THE GEOLOGY OF THE DISTRICT AROUND KARUMO, PAIPE AND JIDU IN THE FEDERAL CAPITAL TERRITORY.

A B.SC, THESIS
PRESENTED TO THE
DEPARTMENT OF GEOLOGY
A.B.U. ZARIA.

BY
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"Read, in the Name of thy Lord
who created,
Created man from a clot of blood.
Read, And thy Lord is Most Generous,
Who taught man by the pen,
Taught man what he knew not."

Q (96: 2 - 6)

DEDICATED TO,

MUMMY AND DADDY.

A C K N O W L E D G E M E N T S

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DEDICATION

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A B S T R A C T

The area is made up of mig matites, migmatitic gneisses, granite gneisses nnd parphyrablastic granite gneisses, forming part of the migmatitic complex belonging to the Nigerian Precambrian basement complex. These rocks represent various stages of homogenisatinn in the process of migmatisation. They could have been formed by the migmatizotion of the reactivated gneisses and ether supracrustal rocks of the Oaho meyan successions (with ages of about 2,800 - 2,500 million years.)

CHAPTER ONE

GENERAL INFORMATION

1.1. AIM OF PROJECT.

The aim of this project is to acquaint the student with the basic methods of geological investigation This is an independent project and contributes in the considerations for the award of the Bachelors of Science degree in Geology.

1.2. LOCATION AND ACCESSIBILITY.

The area covered is part of the proposed New Federal Capital territory about 27km east of Abuja (now Suleija), along the road to Keffi in Plateau State. The work covers the vicinities of Kafumo, Paipe, Jidu and Mulumi villages. The area is fairly accessible on account of a few motorable roads and foot-paths. However, as to be expected, most of the out crops are remote to such available roads and foot-paths. During the period of mapping, which was at the end of the rainy season, most streams were either, dry or shallow and therefore crossable to four wheel driven Vehicles.

1.3. DURATION.

The basic field work lasted from 12th to 22nd of December 1978, and during this period the village of Karumo was used as the main base station.

1.4. RELIEF.

The areas consists of two distinct geomorphic unit, the plains and the hills. The plains are extensive and undulating, few hundred metres above sea level, while the hills are generally less extensive and several hundred metres above sea level.

1.5. DRAINAGE.

The plains and the hills have been largely dissected by many streams that drain the area. The area is fairly well drained by the rivers Wupa, Usuman and a number of their tributaries.

1.6. VEGETATION

As this area belongs to the Nigerian middle belt, it is typically made up of the Guinea savannah to the north, and forest land to the South, with tall grasses and medium height trees. Elephant grass, shrubs, creepers and teak plantations characterise the area.

1.7. CLIMATE.

The area climatically belongs to the, wet and dry cycle, humid tropical zone, with at least four month of relatively dry season, during which the North-easterly trade winds, known as Harmattan, blows towards the sea. The wet or 'rainy' season, lasts at least for five months, depending on the south - westerly monsoon winds that blow inland from the sea.

1.8. METHODOLOGY

As no aerial photographs were available at the time of execution of this project, no photogeological methods could be applied. Therefore geological mapping techniques were applied to the area using a working seale of 1:25,000. Both the outcrop and interpretation maps are attached to this volume.

1.9. PREVIOUS WORK.

Prior to the establishment of the F.C.D.A., no previous work of this nature has been done in this particular area. However the United states Geological did a reconnaisance survey
survey of the whole area (U.S.G.S 1978) geoscience consultancy investigations of the area was also

undertaken by the Ahmadu Bello University department of Geology (A. B. U.), 1970), Both unpublished reports were available to the author.

CHAPTER TWO

GENERAL GEOLOGY.

2.1. INTRODUCTION

The rocks of the area under consideration fall within the group of rocks known as the migmatitic complex of the basement. These consist of:-

a. Migmatites

b. Migmatitic gneisses

c. Granite gneisses (equigranular) and

d. Porphyroblastic granite gneisses, as indicated on the geological maps attached (Maps 1 and 2).

where these rocks do not outcrop, they are overlain by undifferentiated alluvial cover, soils and laterites.

2.2. NATURE OF OUTCROPS.

Field observation has shown that, most outcrops occur either as blocks and boulders, flat - lying outcrops, whale backs or as small inselbergs. The inselbergs may or may not be covered with vegetation. Often outcrops occur along stream channels. Some outcrops of migmatites occur as elongated rock masses several metres in size (e.g. locality 16.S.E. Karumo).

Most bigger hills are built of granite gneisses and porphyroblas granite gneisse.

ROCK TYPES.

Although the migmatites are areally, the most abundant rocks in the area, the other rocks of the migmatitic complex also occur abundantly. The migmatites are described first, followed by the other rocks as described above (2.1.) Also see maps.

2.3. MIGMATITES

The migmatites are grey rocks, generally ranging from leucocratic to melanocratic but also some that are intermediate (eg. sample AH 16). They range compositionally and texturally from very heterogenous (eg. A H 20) to slightly homogenous (e.g AH 11^{C}). Most of the handspecimen samples exhibit the two distinct part of the migmatite textures, ie. paleosome and leusosome.

2.3.1. PALEOSOME.

The paleosome is usually the darker, supposedly unaltered portion of the original rocks or the parent rock that is usually enclosed in the neosome. It is found to be rich in mafics notably, biotite and some opaque minerals.

In the paleosome the biotite plates may or may not be oriented directionally. The palesome also may contain some felsic minerals, like microline and plagioclase and quartz (e.g. AH 3) see appendix. The plagioclase composition in the paleosome is about An 33%, determined in the section perpendicular to (a) crystallographic axis, in rock slide AH3.

2.3.2. NEOSOME

The leucosome, usually regarded as the neosome is the predominantly lighter coloured constituent of these rocks - It was found to be mineralogically quartzo-feldspathic, containing felsic minerals mainly both microdine and plagioclase. The leucosome also contain, but is poor, in matics like biotite. Plagioclase composition is about An35% (+ a), (slide AH 20). Most of the outcrops seen in the field show about the same amount of paleosome and leucosome, while some handspecmens are entirely made up of either leucosome or paleosome (as indicated in the appendix)

Some samples, however, show both eg. AH 20, in which leucosome measures about 3 cm, while paleosome measures about 4 - 5 cm. In others, like AH 3, the paleosome and neosome are about the same in width ie. about 1.5 cm each.

In sample AH 16, the leucosome measures about 1 - 2cm while the paleosome is a few millimetres thick.

While essential minerals consist of microcline, plagioclase (andesine mainly) quartz and biotite, the migmatites were found to contain many accessories such as muscovite, chlorite, epidote (e.g. AH 20) and sphene. Others include apatite and opaque Iron oxides, most likely ilmenite, since it is associated with sphene in most thin sections. The chlorite most probably are due to secondary chloritisation of biotite. Muscovite is also probably secondary.

Detailed petrographic description is given as apart of the appendix.

2.4 MIGMATITIC GNEISSES

In some localities (eg 21 on map 2), the migmatite grades into migmatitic gneisses which are transitional (ABU report). The distinction of these rocks into paleosome and leucosome in some places is not all too apparent. They retain the plastic nature of migmatites and show directional texture. They do not significantly differ in mineralogical composition to the gronite gneisses. These rocks therefore occupy a position between the migmatites on one hand and granite gneisses

on the other, since they show characteristics of both. When observed, the handspecimen shows the major Minerals to be quartz, feldspar, and biotite . Although no thin section has been made by the author, it has been reported that(A BU - Geoscience Report, 1978), the rock consists of quartz, plagioclade (andesine range), microcline, brown biotite as major minerals, while accessories include apatite, sphene, and opaque mineral, most probably ilmenite.

2.5. GRANITE GNEISSES.

A considerable proportion of the area is made up of granite gneisses. These rocks are grey in colour and are equigranular. They are medium to course grained rocks and in some localities, show directional texture though not always. These rocks were found to characterise the area East of Karumo, from localities, 4 - 10 as indicated on the map(1) and appendix where they show directional fabric, it was found that mainly, biotite plates are aligned in some preferred orientation.

In relation to migmatites and migmatitic gneisses, these rocks are characterised by abundance of xenoliths, the more homogenous, the better is the occurrence of these xenoliths. They range in size from a few millimetres to about a metre in size (ABU report 1978), generally

generally being oval or lenticular in shape. They are rich in biotite and could have been amplibolites prior to migmatitzation.

The granite gneisses are composed of quartz, about 30 - 40%, but varying from place to place, plagioclase (An 28% (L. A),+AH 6), show albite, Rericline and carlsbad twinning. Plagioclase also show myrmekite intergrowth with quartz. Microcline also occur in these rocks sometime in equal amount to plagioclases. Biotite occurs in most of these rocks and is brown in some, in others olive. Muscovite, thought to be secondary accompanies the biotite in some thin sections (e.g AH 6). Accessory minerals include Zircon (AH 7), apatite, calcite (AH 6) chlorite, epidote and allanite, while some contain ilmenite (AH 6).

2.6. PORPHYROBLASTIC GRANITE GNEISSES.

There rocks are the porphyroblastic cousins of the variety described above. They have been found to be characteristic in the area around Jidu, paipe and Kulumi villages, found mostly as hills and massive bodies, but also occur as boulders.

In loc. 11 and 20, they make up the whole hills while they occur as blocks in loc. 17, 18 and 19. (see map 1).

These rocks are distinctive in that they are characterized by the development of porphyroblasts of white feldspar. These crystals locally measure up to 4cm but mainly about 2cm by 1cm in size/ (Loc. 17). The porphyroblasts were later found to be microcline. These are mostly Euhedral, and most often show preferred orientation giving the rock a directional fabric. The blasts may either be randomly or evenly distributed throughout the outcrop, and some show carlsbad twins on hand specimen.

In thin section, these rocks are found to consist of microcline, plagioclase (An16 (1 a), eg in slide AH $11^{A)}$ shows carlsbad, pericline and albite twinning. It also shows some myrmekite (inclusions of quartz rods in plagioclase). Quartz is commonly about one - third of the rock but also varies from outcrop to outcrop. Biotite occurs as the major mafic mineral, but in some slides it is slightly altered to chlorite, while it is associated with musecovite in some (eg AH 11A).

Accessories include apatite, as inclusions in plagioclase, Zircon in biotite and some opaque ores of Fe, while sphene is also an accessory in these rocks.

2.7. CALC - SILICATE ROCK

These rocks occurs about 1.5km East of Karumo along the road to Kuse. It consists of few boulders by the road side in an area made up of predominantly granite gneisses to the South and migmatite to the North. (refer to map 1 and 2 Loc AH 15). They are mesocratic and medium grained and seem to contain some red minerals thought to be garnets. Although no thin section has been made, the rock contains diopside and garnet chiefly (ASU report W.S. 112)

2.8. CONTACT RELATIONS:

It was observed in the field the migmatites, except on rare occasions, (eg, loc. 3). do not show sharp boundaries with other rock types. In some, contacts are characterised by the presence of porphyroblasts in migmatites. Contacts between the equigranular and the porphyroblastic granite gneisses are not sharp usually, but some localities (eg loc. 17) display sharp boundaries.

2.9. MINOR FORMATIONS

Few occurrences of formations, geologically minor, have been observed in the field, the most notable of these being andesite - looking dykes, pegmatoids

in migmatite leucosomes or quartzo - feldspathic dykes

2.9.1. RHYOLITE.

This is a grey rock, that is very fine grained. At least two such occurences have been observed in the field, one found just east of Mulumi village occuring as altered reddish grey rock. The second occurs along the road to paipe about 0.25km to the east. The fresh handspecimen shows black and white spoyd in a grey glassy matrixe. However, the rock was found to be riebeeckite bearing alkali rhyolite (Alagba, personal communication).

2.9.2. PEGMATOIDS.

Associated with migmatites and granite gneisses are pegmatoidal dykes , of not too certain origin, which have been observed to be quartzo - feldspathic in quantitative composition. They are generally, very light coloured parts with shapes of dykes and are about few millimetres to few centimetres in thickness. Since they are quartzo - feldspathic they are thought to represent, more volatile constituents in the leucosome.

2.9.3. QUARTZ AND FELDSPAR VEINS.

Quartz veins occur in all the major rocks, but, they are never thicker than 1.5 cm some are found to fill joints in migmatites (e.g around loc. 22). Within the migmatites, they sometimes occur as faulted, by minor dislocations (e.g loc. 18).

In some joint, however, the infilling is done by thin feldspar veins generally less than 1 cm in thickness, and meet with vertical dips. These minor formations are probably emplaced as a result of concentration of more volatile components resulting from the recrystallization of the complex.

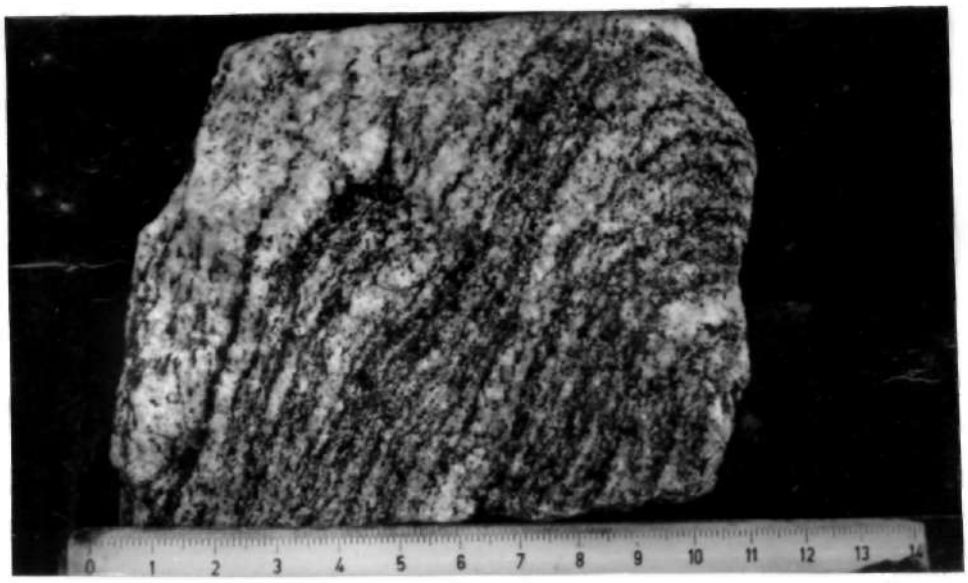


PLATE 1

A photograph of migmatite showing both Paleosome and neosome (Sample AH 16)



PLATE 2

A Photograph or migmatite Paleosome (sample AH 11b).



PLATE 3

A medium grained Pgg (sample AH 11a)

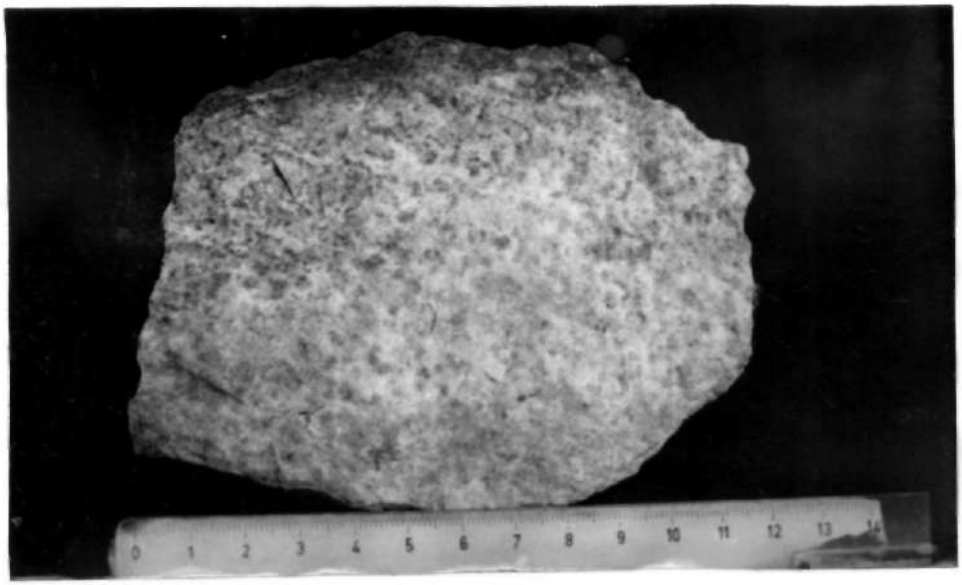


PLATE 4

A Calc - silicate rock (sample AH 15)

note dark garnetiferous sports.



PLATE 5

A Photomicrograph of biotite - rich Paleosome (slide AH 3).

Rock type?

Magnification?

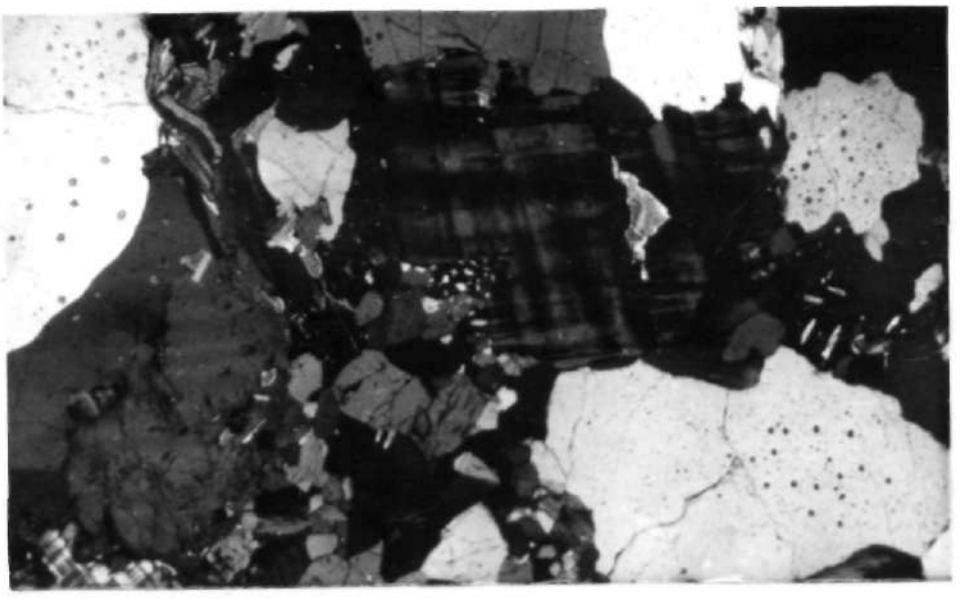


PLATE 6

A Photomicrograph of quartzo - feldsparthic neosome slide AH 8

Rock type?

Magnification?

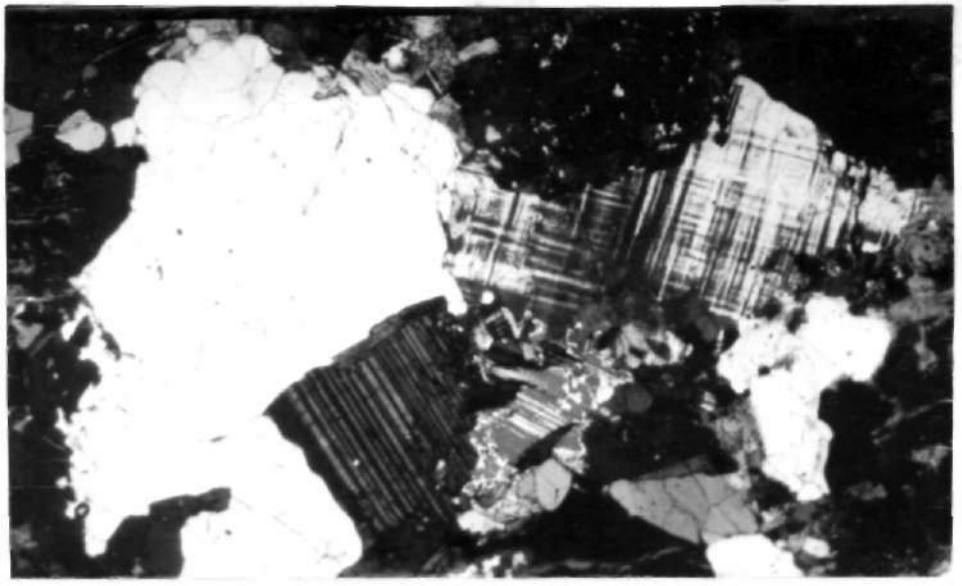


PLATE 7

A Photomicrograph of granite gneiss (AH 6a)

note quartz - feldspar intergrowth (centre).

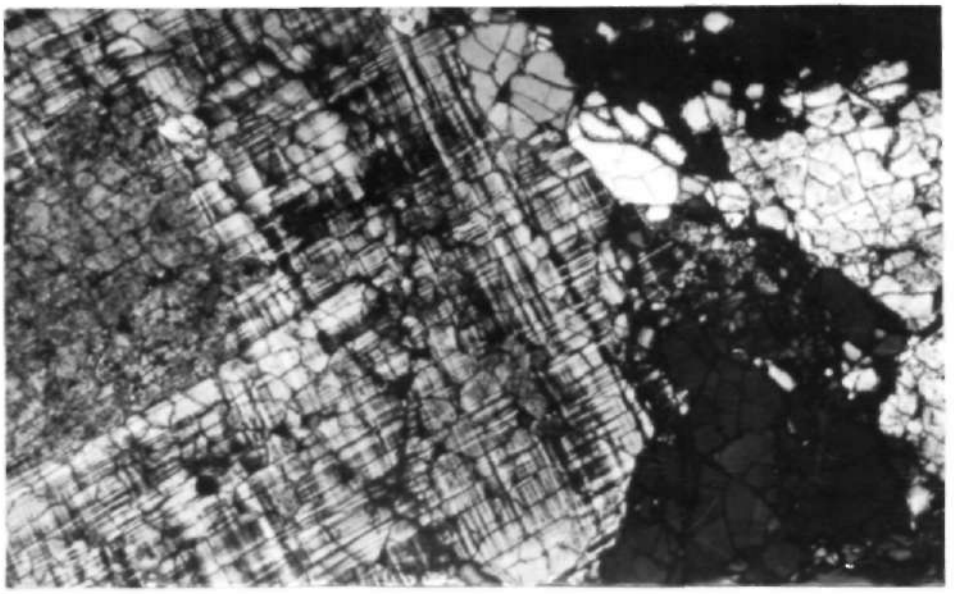


PLATE 8

A Photomicrograph of Pgg showing apatite in microcline

(AH 11 a).

CHAPTER THREE

STRUCTURES

In this area of migmatitic complex, certain structures have been observed to be associated with the rocks. The most important ones are described below.

4.1. FOLIATION.

Foliation is defined as the parallel orientation of platy minerals in rocks. Foliation is a planar structure. Many such foliation has been noted in the field, to be characteristic to the rocks of the complex. The minerals, feldspar and biotite show the maximum ability to form parallel alignment. Majority of foliation planes trend.
NNW - SSE (Fig ?).

4.2. LINEATION

This is a linear feature and therefore one - dimensional. The mineral aggregates of quartz and feldpar and Biotite sometimes show elongation (lineation) in migmatites, migmatitic gneisses, Most common Lineation direction observed in the field fall within NNW - SSE.

4.3. MINOR FOLDING AND FOLD AXES

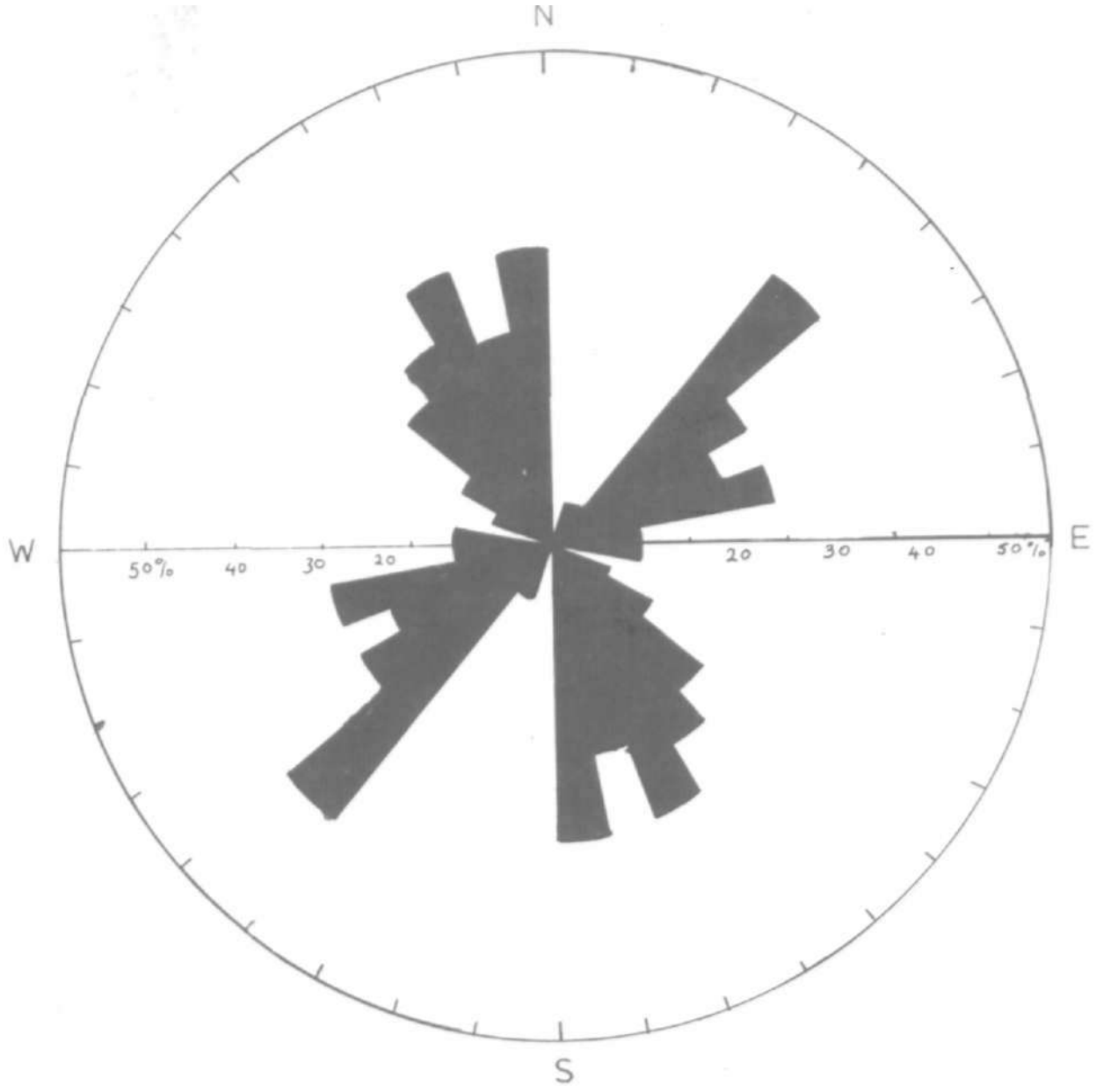
Minor folding structures have been noticed in the field and observation shows that they occur mostly in migmatites and migmatitic gneisses. (Plate ?). The folds are of disharmonic nature, probably due to differences in competance of the folded rock components. Some axial plane regions appear to be more homogenised.

4.4. JOINTS (Fig ?).

The most common structural features in the migmatitic complex are joints. They are also the most abundant. At least two generations of joints have been observed in the field. These joints may be gaping or partly filled with quartz or feldspar veins. The joints mostly trend NE - SW and NNW -SSE, or slight variations of these. Other minor ones show different directions. About 81 mensurments were plotted on rosette a diagram.

4.5. MINOR FRACTURES.

Fracturing and faulting on small scale, usually less than 20 cm, has been observed in the field, especially in connection with migmatites and migmatitic gneisses.



JOINTS/A ROSE PLOT OF 81 MEASUREMENTS.

Only the N part should be given as S is mirror image.

These are usually found to truncate minor formations and migmatitic layers (e.g. Fig). Faulting tends to produce some slickensides effect in some places.

CHAPTER FOUR

METAMORPHISM AND MIGMATIZATION.

4.1. INTRODUCTION

The rocks of the migmatitic complex belong to the Nigerian basement complex in which at least two different episodes of migmatisation and deformation have been reported (Mc Curry, 1976). Many Author have reported that, there were two orogenic cycles that affected the h basement rocks and have suggested that the migmatites are products of migmatisation associated with these pan-African thermo-tectonic events.

4.2. METAMORPHISM

The rocks of the migmatitic complex originated from probable supracrustal cover of various types and compositions from pelitic and psammitic rocks to carbonate sediments and basic volcanics (USGS 1978 ABU 1978).

In this area, occurence of a calc-silicate rock may indicate a carbonate sedimentary relic, while amphibolite to the east (jidda, E.B. personal comm.) and to the South (A.B.U. 1978), in most probably indicates a basic volcanic relic.

The mineral compositions of these amphibolite and calc - silicate occurences, correspond to the amphibolite facies.

4.3. MIGMATIZATION.

According to Mehnert, K.R. (1968), all endogenetic rock-forming processes can be achieved in two way, if tempreture is used as the parameter deciding the process (a) subject to falling temperature, the system consolidates progressively, or (b) subject to rising temperature, the system generally proceeds towards increasing mobilization. The former leads to the fixation of geochemically mobile components, whilst the latter process leads to the migration of formerly immobile components.

The processes of mobilization begin, as a rule, from inhomogeneous, differentiated rock material and lead, theoritically at least, finally to homogenisation of all rock components. (Mehnert, pp. 343 (1968).

It has been reported (ABU - 1978), that migmatisation was followed by homogenisation of the rocks of the migmatitic complex.

Migmatites, then, represent lowest degree of homogenisation while granite - gneisses indicate highest stage of being homogenised.

The presence of water in a quartzo - feldspathic system would definitly enchance conditions of partial melting, by lowering of melting temperatures. Since, as mentioned above (4.2) pelitic rocks contain connate water, this would be made available during metamorphism.

4.4. STRATIGRAPHY.

The rocks of the migmatitic complex, belonging to the Nigerian basement, have been assigned various ages, by various workers. An isochronic, RB/Sr age of a migmatite from Kaduna, was given as 2,220 ± 30 m.y. (Hurley, et. al, 1966) and another occurence of similar rocks, near Ibadan, of gneissic - quartzite complexes, has yielded ages of about 2,800±200 m.y. (Grant, 1970). McCurry, P (1971) pursuing other lines of evidences feels that the migmatites and rocks of the migmatitic complex, belong to a later date, i.e, are contempraneous to the Pan - African event, with dates of about 850 -550my.

However various workers have produced a stratigraphic column of the basement, and the migmatitic complex can only be put tentatively into this column (see. table 1) (McCurry, et al 1971), Grant 1970-71 etc.)

Another possibility is that, they may be Eburnian, in which case they correspond to 1900 ± 250m.y. as some authors tend to suggest. (Coory, P.G. 1974.)

CHAPTER FIVE.

HYDROGEOLOGICAL CONSIDERATIONS AND ASPECTS OF ECONOMIC GEOLOGY.

5.1. INTRODUCTION.

No special work, concerning the hydrogeologic s situation of this area has been done during the field work, and the following considerations are just general remarks about the ground water disposition.

5.2. HYDROGEOLOGY.

In this area, as already mentioned, the rocks of the migmatitic complex are overlain by recent superficial deposits. Groundwater movement and storage in these hard rocks would most likely depend on, fissurization or number of open fractures within them. The ease with which water infiltrates into these rocks or their permeability, depends on degree of jointing systems and patterns, the greater the number of open joints, the more permeable are the rocks (see Fig joints).

In this area, geology, climate and hydrologic cycle conditions combine to give favourable groundwater situation.

Any problems related to future disposition of groundwater, would most likely be connected with water development and management.

5.3. ECONOMIC GEOLOGY.

Although this area may not be interesting from the point of view of economic mineralisation, it would be considerably signficant in terms of other human land uses resource exploitation.

There is no doubt that, from practical point of view this area is quite suitable for all foundation engineering purposes, as it is built up of solid hard rock of considerable mechanical strengths and durability. Building stones or raw material for the construction industry are well endowed in this area. Various types of laterites provide material for road fill and surfacing purposes. Loose sand and gravel in the river channels could be promising in the future for various purposes, including possible exploitation for placer minerals, so the area may be economically tenable after all. (ABU report 1978).

A P P E N D I X

DETAILED PETROGRAPHY

The rocks are very similar in mineral composition so they are grouped together for convienience.

MIGMATITES.

SAMPLE AH 3

The rock occurs as a flat outcrop in the Loc. 3, as indicated on the map 1.

MEGASCOPIC DESCRIPTION:

Handspecimen is distinctly sppearable into paleosome and neosome.

In the paleosome it is dark coloured due to black shiny mineral (Biotite). It is fine grained in this layers and flakes are directionally oriented.

The paleosome is about 6mm thick.

The neosome or leucosome, is as the mame implies, light coloured, due to white and yellowish grains of quartzo - feldspathic minerals are not aligned, and have a granitic aspect. The leucosome is about 1 cm thick and is fine to medium grained.

In the thin section: (both neosome and paleosome)
Minerals, in order of abundance are, plagioclase,
which is andesine (An 33) determined in the section perpendicular to the (a) crystallographic axis.
It shows, albite and pericline twinning.
Quartz, shows anhedral or aggregatic grain shapes some grain exhibit undulose extinction while other are cracked.
Biotite is next in abundance. It is olive, and is plecchroic in pale olive colours. The Plates are always elongated, while some are oriented in such a way that they show no perfect cleavage.
Microcline, show characteristic cross-hatched twinning and occurs as small grains, irregular in shape, between plagioclase and larger quartz grain.
Accessories, include sphene, with well - formed sphenoidal habit and also as aggregatic shapeless grains,
Apatite, Occurs as small grains with euhedral shapes in plagioclase and within biotite.
Opaque minerals, most like ilmenite, but may be Magnetite also are present in large grains and small grains, mostly surrounded by sphene.

SAMPLE AH 8

In the field this rock outcrops as elongate one

of several metres length.

The paleosome and leucosome dist inction is not as clear as in the previous migmatite, but some layering is recognisable.

The paleosome is dark and about 2 - 3 mm, thick and consist of biotite oriented flakes.

The leucosome is about 0.5 cm thick and contain quartz and feldspar giving it a light colour/ The rock is fine to medium grained and has directional fabric as indicated.

In the thin section (Both neosome and paleosome).

Quartz, is abundant, in various shapes and sizes, with some grains showing undulose extinction.

Plagioclase, occurs next to quartz and shows polysynthetic, twinning. The grains are subhedral to anhedral, while some are aggregatic.

Microline, cross-hatched twinned is seen in between quartz grains and occurs as mostly anhedral grains, some being large. Biotite is deep brown and olive.

Accesories are; muscovite, associated with some biotite plates and generally having smaller plakes,

Magnetite, in small grains and apatite, in small prismatic grains occuring in plagioclase.

SAMPLE AH 16

This rock forms a large flat-lying outcrop in locality

16 of the map.

It is composed of (on hand sample) light coloured parts mostly with thin dark portions.

The paleosome is rich in biotite flakes and shows very fine- grained texture

The leucosome is quartzo-feldspathic and light coloured and is ~~p~~courser - grained then the darker parts. The leucosome is also thicker (about 1 - 2cm) than the paleosome. The rock is medum to ~~9~~ course grained.

In the thin section. (both paleosome and neosome) Microcline occurs as large grains showing crosshatched twinning and is the most abundant mineral, then plagioclase (An 38 (1 a)+), shows polysynthetic twins and grains are anhedral and strongly altered to micaceous laths of sericite, especially along twin planes.

Quartz, occurs as shapeless grains between larger feldspar grains, and exhibit wavy extinction in some grains

Biotite is olive to brown and is associated with muscovite.

Accesories, include muscovite and sericite as plagioclase, alteration product.

SAMPLE AH 20

This rock occurs as a flat outcrop close to a hill of

granite gneiss(pgg)

The rock is mostly leucosome and shows only some light paleosomal parts, and does not show strongly developed foliation on the hand specimen. The rock is fine to course grained.

In the thin section: (Neosome)

Quartz and plagioclase occur in subequal amounts. The grains of both minerals vary in shape and size. Plagioclase is An 35 (la), and shows polysynthetic twinning.

Microcline occurs as large irregular grains, some containing quartz grains. They show the characteristic cross - hatched twinning.

Biotite is olive and is associated with muscovite some biotite is brown in the same slide.

Muscovite, most probably is secondary in origin and forms large flakes.

Accessories are, apatite in tiny grains within plagioclase or between quartz grains, while the alteration product, Sericite is also an accessory.

NOTE:

Most of these mineral observed, in almost all, the thin sections are cracked, this is due to preparation of slides and has nothing to do with the minerals.

GRANITE GNEISSES.

SAMPLE AH 6

This rock forms the whole hill of locality 6. The rock is medium grained, equigranular, grey, granite gneiss showing directional fabric on the hand specimen.

In the thin section

Major minerals are plagioclase showing polysynthetic twinning, albite twins and is also seen in some. The composition determined in the section perpendicular to (a) + gives A28% which is Andesine. Microcline shows cross-hatched twinning and grain size and shape vary greatly.

Quartz, occurs and is about 33% of the thin section (see table (1) modal analysis), and shows variable grain sizes.

Biotite in this section is olive and shows replacement by chlorite. Sometimes in some sections biotite is greenish brown.

Accessories include, epidote in small grains between larger grains of other minerals.

Calcite has been seen in this slide as a small grain.

Allanite is brownish - yellow and occurs as small irregular grain within feldspars.

Apatite occurs as small euhedral grains in felpars while some are quite big and show twinning.

Sphene is seen with the spheroidal shape or as aggreagatic grains around opaque mineral most probably ilmenite, but may also be magnetite.

SAMPLE AH 11

This rock built the whole hill in locality 11, on the map The rock is grey in colour with no observable directional fabric on the hand specimen, but it shows the development of feldspar porphyroblasts that are euhedral in shape and set in medium grained matrix of feldspar, quartz, biotite grains.

The blasts measure 0.5 x 0.5 cm in size.

In the thin section:

Plagioclase is dominant and occurs as small irregular grains showing albite, and poly synthetic twinning while the composition is An 16 (1a +).

Microcline forms large porphyroblasts, typically showing cross - hatched twinning.

Quartz occurs in grains of various shapes and size, some grains showing undulose extinction.

Biotite is brown in this section and it is often chloritized at its margins. It is pleochroic in pale browns.

Muscovite is most likely secondary in origin and it is associated with the biotite.

Accessories are; apatite, included in plagioclase grains. sphene, aggregatic on sphenoidal in shape, and associated ilmenite, which is opaque. Chlorite is seen at margins of biotite.

Quartz occurs in grains of various shapes and size, some grains showing undulose extinction.

Biotite is brown in this section and it is often chloritized at its margins. It is pleochroic in pale browns.

Muscovite is most likely secondary in origin and it is associated with the biotite.

Accessories are; apatite, included in plagioclase grains. sphene, aggregatic on sphenoidal in shppe, and associated ilmenite, which is opaque. Chlorite is seen at margins of biotite.

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TABLE 1

NIGERIAN BASEMENT COMPLEX GEOCHRONOLOGY (AFTER McCurry)

540+40m.y.	Mid-Cambrian	Uplift, cooling fracturing, faulting, high level magmatic activity.	
650-550m.y	L. Cambrian	Granite intrusion Pegmatite and aplite development.	Older granite
650-850m.y	Pan African	Orogenesis: deformation, metamorphism, migmatization, reactivation of preexisting rocks.	4
800-1000m.y.	Katangan	Geosynclinal Intrusion of hypersthene bearing rocks	Katangan metasediments.
1900±250 m.y.	Eburnian	Granite Instrusion Orogenesis: folding, metamorphism and reactivation of preexisting rocks	Eburnian grantes 3
2500 m.y.	Birrimian	Gesynclinal deposition	Birrimian Metasediments.
2800± 200 m.y	Liberian cycle?	Possible formation banded gneiss complex, near Ibadan.	2
2800 m.y.	Dahomeyan	Crystalline Basement Complex	1

Dates adopted from Grant 1970 - 71

Numbers 1, 2, 3 and 4 are probably position of the rocks of the migmatitic complex.

TABLE 2.

A MODAL MINERAL ANALYSIS OF THREE SLIDES.

	AH 11a (Pgg)		AH 6 (gg)		AH 7 (gg)	
Minerals	No. of counts	%	No. of counts	%	No. of Counts	%
QUARTZ	1119	34.5	830	33.3	699	39.7
MICROCLINE	1430	44.4	753	30.2	-	-
PLAGIOLCASE	342	10.5	608	24.4	790	44.9
BIOTITE	208	6.4	225	9.0	248	14.1
MUSCOVITE	74	2.2	10	0.4	-	-
ALLANITE	-	-	-	-	2	0.2
EPIDOTE	-	-	10	0.4	-	-
APATITE	23	0.7	15	0.6	5	0.2
SPHENE	4	0.1	5	0.1	8	0.4
ZIRCON	-	-	-	-	2	0.1
CHLORITE	24	0.7	15	0.6	-	-
CALCITE	-	-	4	0.1	-	-
OPAQUES	6	0.1	4	0.1	4	0.2
TOTAL	3230	100.0	2689	100.0	1758	100.0
		99.6		99.2		99.8

LIST OF SAMPLES

Loc.no	LOCALITY	ROCK NAME	GEOLOGICAL SETTING	MAJOR MINERALS	ACCESSORIES	SLIDE
1.	1Km N.E. of Karumo	Migmatite	Massive outcrop on a small hill.	Feldspar (pinksh) Biotite (clark) Quartz; (Hand specimen)	-	None
2.	2Km N.E.of Karumo	Porphyroblastic granite-gneiss	Massive outcrop	White feldspars, Quartz Biotite Hand specimen	-	None
3.	East and very near Karumo	Migmatite (paleosome)	Flat outcrop	Plagioclase, Quartz Biotite, Microcline	Sphene, Apatite, Ilmenite	AH 3
4.	1.5km East of Karumo	Granite gneiss	Outcropping boulders	White feldspars Quartz Biotite (hand specimen)	-	None
5.	About 2km East of Karumo.	Granite gneiss	Massive outcrop of whole hill.	Quartz, plagioclase Microcline, Biotite muscovite.	Epidote chlorite caleite apatite allanite, Ilmenite	AH 6
6.	About 2km slightly	Granite gneiss	Massive boulders	Plagioclasse, a quartz Biotite	Zircon Apatite Allanite Sphene Ilmenite	" AH 7
8.	About 1.5km S.E.of Gidan Nbara	Banded gneiss rock Migmatite	Flate outcrop several metre in lengt in length and width	Quartz,plagioclas microcline biotite	Muscovite apatite magnetite	AH 8

LOC.NO	LOCALITY	ROCKNAME	GEOLOGICAL SETTING	MAJOR MINERALS	ACCESSORIES	SLIDE.
A	0.5km N.E of paipe	Porphyroblastic granite gneiss	Whole Hill	Microcline plagioclase Quartz Biotite Muscovite	Sphene Ilmenite chlorite apatite	BH 11 A
11 B	-	Melanosome in Pgg	As inclusions in Pgg	Biotite plagioclase microcline		None
C	-	Leucosome in Pgg	As inclusion in Pgg	Biotite muscovite plagioclase microcline Quartz		None
13.	About 1.5km North	Alkali rhyolite (grey)	Disintegrated bocks remnabts of a dyke several metres wide	White specks of feldspars Black spots of ferromagnesians Quartz	-	None
14.	close to Karumo	Very fine-grained, dark though to be calc - silicate.	Minor occurence in granite greiss	Not identified	-	None
15.	About 1 km from Karumo along Busa road	Mesocratic Calc - silicate rock	Blocks on road side	Quartz prabable garnet (Red) e.t.c	-	None

LOC.NO	LOCALITY	ROCK NAME	GEOLOGICAL SETTING	MAJOR MINERALS	ACCESSORIES	SLIDE
16.	About 0.5km S.E of Karumo	Migmatite	large flat outcrop	Biotite, Feldspars, Quartz	Museovite Sericite	AH 16
17.	0.8 km S.E of Paipe	Porphyroblastic granite-gneiss	Blocks and boulders	White feldspars Quartz Biotite	-	None
20.	About 1.5km scuth of Jidu	Migmatite	flatlaying outcrop near a hill of Pgg.	Quartz Plagioclase Microcline Biotite Muscovite	Apatite Sericite	AH 20

OUTCROP MAP OF F.C.T. AROUND KARUMO, PAIPE AND JIDU.

(MAP 1)

7°22′ 7°24′ 9°05′ 9°00′

LEGEND

SCALE 1:25,000

0 1 2KM

- MOTORABLE ROADS
- BRIDGES
- CONTOURS (1500)
- STREAMS
- TRAVERSES
- 1,2... LOCALITIES
- Jidu VILLAGES
- mi MIGMATITE
- gg GRANITE GNEISS
- Pgg PORPHYROBLASTIC GRANITE GNEISS
- mgg MIGMATITIC GNEISS
- Rhy RHYOLITE
- cs CALC-SILICATE ROCK

ALIYU AHMED ALIYU
1979

Abuja 26km
Karumo
Gidan Nbora
Rhy
Paipe
Jidu
WS112 AH 15
1450
1400
1350
1300

GEOLOGICAL MAP OF F.C.T. AROUND KARUMO, PAIPE AND JIDU.

(MAP 2)

7°22′ 7°24 9°05′ 9°05′

LEGEND

SCALE 1:25,000

0 1 2KM

- MOTORABLE ROADS
- VILLAGES
- STREAMS
- CONTOURS (1400)
- TRAVERSES
- GEOLOGIC BOUNDARIES (Transitional)
- (Inferred)
- FOLIATION/vertical foliation (20)
- LINEATION (50)
- MIGMATITE
- MIGMATITIC GNEISS
- GRANITE GNEISS
- PORPHYROBLASTIC GRANITE GNEISS
- CS — CALC-SILICATE ROCK
- Rhy — RHYOLITE

ALIYU AHMED ALIYU 1979

Abuja 26km

Karumo

Gidan Nbora

Paipe

Jidu

River Wupa

1500 1450 1400 1350 1300

9°00′ 9°00′

7°22′ 7°24