



Global Advanced Research Journal of Geology and Mining Research Vol. 1(1) pp. 007-013, October, 2012  
Available online <http://garj.org/garjgmr/index.htm>  
Copyright © 2012 Global Advanced Research Journals

*Full Length Research Paper*

# The Geology and Geotourism Potential of the Mayes Water Fall, North Central Nigeria.

Aga, T<sup>1</sup>, Atane, G<sup>1</sup>. and Baba, J<sup>2</sup>

<sup>1</sup>Department of Geology and Mining, University of Jos, Jos-Nigeria.

<sup>2</sup>National Metallurgical Development Centre. Jos-Nigeria.

Accepted 08 October, 2012

Detailed geological mapping was carried out on some parts of the Sha-Kaleri Younger Granite Complex which lies between latitudes 09° 3.5'N and 09° 8.5'N and longitudes 08° 43'E and 08° 45'E and forms part of Kurra Sheet 189SW. The area designated for the research project is underlain by the Basement Complex in the western part and extends to the southeastern part of the study area. These Basement Complex rocks were emplaced during the Pan African Orogeny before the Jurassic Younger Granites intruded through peripheral ring structures. Within the confines of the research project the gabbros are well represented occurring within the migmatite-gneiss of the Basement Complex and along river channels. They also occur as dykes intruding the Basement Complex. This depicts the end of the Pan-African Orogeny as they cross-cut the Basement Complex. Petrographic examination and laboratory assay showed the presence of the dominant rock forming minerals which include plagioclase and alkali feldspars, quartz, biotite and olivine as observed within the field of view under a polarized light when plane and crossed. Structural study carried out within the confines of the project area reveal the presence of dykes, veins, foliations, xenoliths and joints. The field tectonic studies and analyses of these structures were simply descriptive, that is done as a sequence of recognizing and describing their attitudes which are essentially defined by strike and dip. With the use of a circular histogram which displays directional data a consistent dominant structural trend of NE-SW was envisaged. Geologically, this essentially suggests that all the rocks underwent a uniform post emplacement tectonic episode as revealed from the relationship to other processes and geologic history of the project area. The geotourism potentials of the study area as keenly observed show the presence of a colossal waterfall known as the Mayes water fall, captivating hills, scenic environment and an alluring vegetation which can be developed into a tourism haven.

**Keywords:** Geology and Geotourism, Mayes Water Fall, North Central Nigeria.

## INTRODUCTION

The location of the study area which cover an estimated areal extent of approximately 20 km<sup>2</sup> is along the southeastern part of the Younger Granites of the Sha-Kaleri Complex situated in the western fringe of Jos

Plateau, located in Wamba Local Government Area of Nassarawa State, North-Central Nigeria (Figure.1).The area lies within the bounds of latitudes 09° 3.5'N and 09° 8.5'N and longitudes 08° 43'E and 08° 45'E.

The geotourism potential of the Sha-Kaleri Younger Granite Complex, north central Nigeria which the project area is situated deals with the tourism of the geology and landscape which provide insight and comprehensively

\*Corresponding Author's E-mail:tergaus@yahoo.com

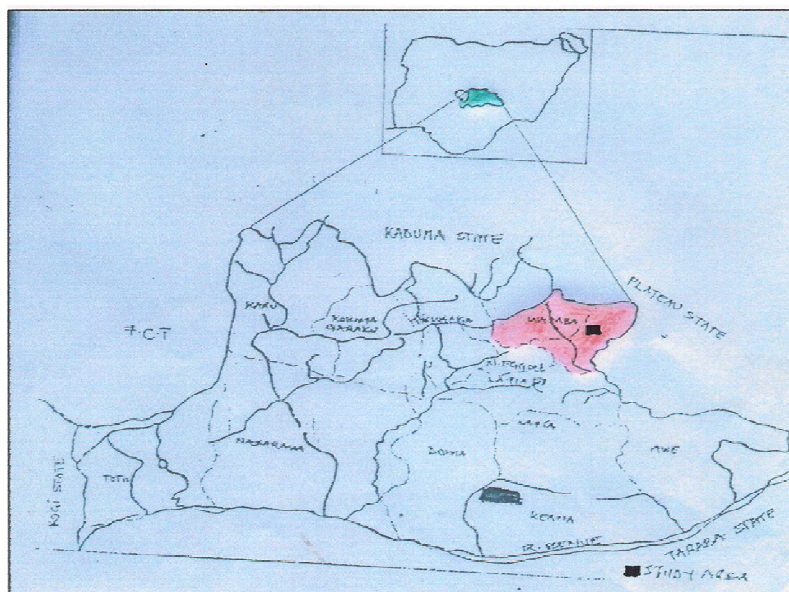


Figure 1. Map of Nassarawa State showing Study Area

Table 1. Characterization of the Geotourism Potentials of Mayes Water Fall.

Name of potential	Level of development	Characteristics	Geotourism according to importance
Mayes Waterfall	Partially developed	Waterfall deep and valley, cliff, whirlpool bath, rocks and vegetation	Site seeing, filming and picnicking
Massenge hills	Not developed	Beautiful rock forms and vegetation	Site seeing, hiking and filming
Ranching	Not developed	Grasses for grazing, scenic environment and alluring vegetation	Site seeing, filming and picnicking

explores the nexus between landscape, geological phenomena and tourism that sustains and enhances the geographical character of a place in relation to its immediate physical environment, culture, aesthetics, heritage and the well being of its residents. The achievement of the geotourism potential of a place with the project area inclusive depends on the incorporation of the concept of sustainable tourism – that destination should remain unspoiled for future generations and posterity while allowing for ways to protect a place's distinctive character.

The paper is significant because it provides information and characterize the existing tourism potentials of the Mayes waterfall. This will in turn benefit stakeholders, investors and tourists alike in making credible decisions as regards investing their resources and also in the planning of their tours. The information this study will provide can also be useful to the Nassarawa state government in the development of the available geotourism potentials in order to increase her revenue base.

## MATERIALS AND METHODS

The sets of principles and methods used to perform this research appropriately deal with the method of data collection and technique of analysis. The instruments used in data collection include field observation and survey, oral interview and voice viva utilizing a digital camera and field note book. Field observations were carried out by visiting the centers of attractions so as to ascertain and confirm their geotourism potentials. Oral interview and voice viva were conducted on the inhabitants of the various places within the project area to obtain first hand information. The field note book and digital camera were used for note taking and capturing shots important for the research project.

The techniques used in the detailed examination of the various data collected for this study is that which aids and conveys the message in its simplest form as shown in Table 1. The Table shows and characterizes the normal



**Figure 2.** A Dyke Intruding Migmatite Gneiss

distribution of the various geotourism potentials of the project area.

## DISCUSSIONS

### Geology

The Younger Granites of the Sha-Kaleri Complex form part of the Jos Plateau which is characterized by high lands and low lands. The high lands and hills cover the northern axis of the complex which consists of preponderant biotite granite, while the distinct lithologies of the pure gabbro and quartz gabbro encountered within the study area all occur as pure gabbroic and quartz gabbroic dykes respectively within the undifferentiated migmatite-gneiss.

The migmatite-gneiss shows a discrete leucocratic component characterized by a crystalloblastic texture showing a concordant alternation of palaeosome and neosome, whose composition would probably bear little relation to the pre-existing rocks envisaged. The biotite granite envisaged can be described to have a coarse to medium grained texture, grey colouration with phaneritic crystals of quartz, feldspars and predominantly biotite. The gabbros observed within the study area all occur as sheet-like, vertical intrusion cutting across horizontal to gently dipping planar structures in the country rocks quintessentially as gabbroic dykes respectively.

The dominant structural trends of joints show N-S for migmatite-gneiss, NNW-SSE for biotite granite, E-W for quartz gabbro and NE-SW for the pure gabbro respectively. Quite a good number of dykes, specifically

gabbroic dykes of quartz and pure compositions were observed in the study area, with majority of them occurring within the Basement Complex. They range in width between 1.2 and 3.1 meters (Figure. 2). These dykes have geological significance to the study area, as they depict the end of the Pan-African Orogeny. Granitic net veins observed within the confines of the area under study are leucocratic intrusions, with visible crystallinity being phaneritic, degree of crystallinity essentially holocrystalline, exhibiting a coarse grained texture, formed by the infilling of a fracture by fluids, and essentially granitic in composition. The foliations observed were predominantly in the central and western half of the study area which hosts the migmatite-gneiss of the Basement Complex. Xenoliths also occur.

### Geotourism Potentials

The geotourism potentials of the study area lies in the presence of geological and environmental phenomena which suitably cover information on landscape appreciation and geoheritage in relation to its management, interpretation, education and the future of geotourism, as it sets the scene and provides a clear definition of geotourism as well as information on its characteristics. The features with geotourism potentials that were identified within the confines of the study area are the Mayes waterfall, Massenge hills, scenic environment and alluring vegetation that have the propensity to promote the development of a ranch for ranching purpose (Table 1).



Figure 3. Mayes Waterfall.

### Mayes Waterfall

The Mayes waterfall situated in Massenge lies within the adjoining highlands and hilly massifs of the Sha-Kaleri Younger Granite Complex. The fall which is a place where flowing water rapidly drops in elevation as it flows over a steep region or cliff rises to a height of about 400meters (1312ft) into the clouds and the valleys descends at strategic points around the massifs and it is located in the northeastern end of the area under study. Geologically, the genesis of the Mayes waterfall like some others is most commonly formed when a river is young when the channel is seldom narrow and deep. When the river courses over resistant bedrock, erosion happens slowly, while downstream the erosion occurs more rapidly. As the watercourse increases its velocity at the edge of the waterfall, it plucks material from the river bed. Whirlpools created in the turbulence as well as sand and stones carried by the water course increase the erosion capacity. This causes the waterfall to carve deeper into the bed and to recede upstream. Often over time, the waterfall will recede back to form a canyon or gorge downstream as it recedes upstream, and it will carve deeper into the ridge above it. At the top section of the waterfall where the fall derives its source from rivers in Sha, the drainage pattern envisaged is morphologically controlled, typical of crystalline geological environments, which develops on uniformly erodible rocks and characterized by the branching of tributary streams in a model having the resemblance of tree branches or nerve dendrites, hence a dendritic drainage pattern. Although as obvious at the middle section of the fall, it is structurally controlled, as an almost linear trend with some network of fractures and joints (master, simple and cross-cut) meeting at varying

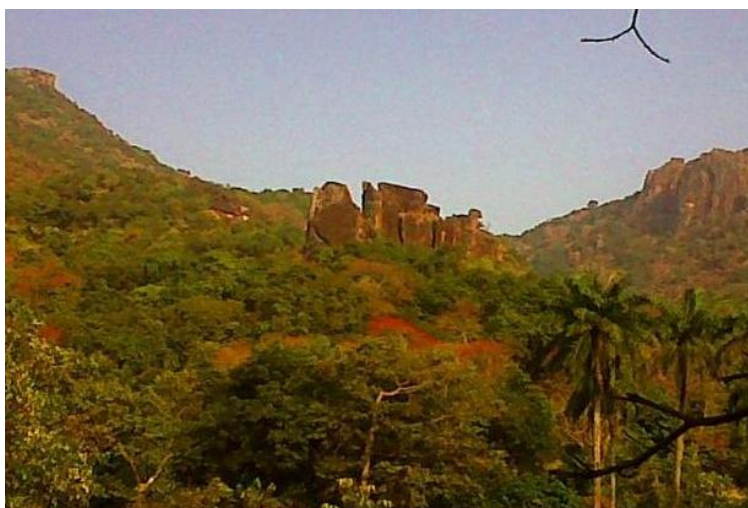
angles from the fall's paths, hence a trellis drainage pattern. Descriptively as observed the fall can best be described as a cascade – horsetail fall – one whose waters descend a series of rock steps though still maintain some contact with the bedrock (Figure 3). If properly harnessed the fall could be a source of locally generated revenue and a foreign exchange earner.

### Massenge Hills

The Massenge hills which play host to the Mayes waterfall are made up of the extension of the Younger Granites which had a consistent succession of magmatic episodes from plutonic to volcanic associated with the emplacement of mainly granitic rocks at high levels in the crust now partly preserved as a result of the major tectonic controls governing their emplacement – ring faulting and cauldron subsidence. The hills are characterized with some peculiar features that could be of interest to potential tourists and visitors alike. To the north lies the highest Massenge hill measuring about 1,219meters (4,000ft) above Mean Sea Level (MSL), while bounded to the southern axis of the project area lies the lowest Massenge hill with an estimated height of 914meters (3,000ft) above Mean Sea Level (MSL) (Figure. 4)

### Factors Affecting Geotourism Potentials of the Study Area

The factors affecting the geotourism potentials of the project area cannot be over emphasized as it is not peculiar to the geotourism sector but cut across almost all



**Figure 4.** A Section of Massenge Hills.

facets of the Nigerian economy. Scenery that charms, thrills and inspire is a potential asset to the land which it is found. But like other natural resources, it is a potential asset that becomes actual, valued and exploited by a place that has reached a particular cultural and economic level. Several factors might have served as obstacles and broadly speaking can be proportioned into two parts namely: political and human factors. As closely observed the major factors militating against the geotourism potentials of the study area inter alia include the following: lack of political will and presence of political difficulty as regards the ownership of the waterfall, high cost of development, lack of continuity in government's developmental plans, absence of infrastructural facilities, spiritual bigotry and inclination as regards the fall and hills, demographic considerations, social habits and educational consideration.

#### **Lack of Political Will**

The dual geographical and geological characteristics of the Farin Ruwa waterfall have led to the lack of a firm political will concerning the rightful owner. This lies in the fact that the source of the fall characterized by the branching of tributary streams and rivers is situated in the Sha axis of the Sha-Kaleri Younger Granite Complex in Bokkos LGA, northwest Plateau state. Conversely, the fall itself happens to be in Massenge under Farin Ruwa Development Area in Wamba LGA of Nassarawa state. Nature might have caused a debacle as regards the owner of the fall but could be resolved between the sister states of Plateau and Nassarawa respectively. A baseline study embarked during the reconnaissance visit actually led to the discovery of the

disagreement of the Plateau state government to build an accessible road from the Bokkos end to the location of the fall in Nassarawa state (Agisam, 2011).

#### **High Cost of Development**

The financial involvement in making the project area a geotourism hub and haven militate against the geotourism potentials of the project area. Insufficient funds allocated to the state owned ministry of tourism is actually not enough to transform and harness the geotourism potentials of the study area. This trend is prevalent because little interest is shown to the geotourism business of the state. If the interest is lacking there would be no political will, hence no development as regards the development of the area under study. Cue should be taken from countries like Kenya and Namibia that have turned their tourism potentials into actual realities.

#### **Lack of Continuity in Government's Developmental Plans**

Typical in this part of the world is the incessant discontinuity in the development of projects meant for the well being of the state, visitors and residents alike. Reconnaissance visit and oral interviews conducted show the abandonment of certain facilities capable of boosting the geotourism potentials of the area. Accommodation projects which involved the building of chalets and tents for prospective visitors and residents have been abandoned, left to their fates and making them be at the mercies of the elements of weather and marauders (Agisam, 2011).



Figure 5. An Abandoned Chalet

These chalets are now in a moribund state as shown in Figure. 5 Above.

### **Lack of Infrastructural Facilities**

Infrastructural facilities like accessible roads, power, pipe borne water, chalets inter alia hamper the geotourism potentials of the project area. The aforelisted facilitate the attainment of the geotourism potentials of the study area, however they are all conspicuously absent.

### **Spiritual Bigotry and Inclination as Regards the Fall and Hills**

Beliefs or opinions concerning the waterfall and hills have overtime hampered the geotourism of the place. Information obtained via social interaction reveal the people's belief in the existence of forces, objects and sites of veneration within the premises of the fall and hills. These have only succeeded in instilling and imbibing fear into potential visitors, thus serve as obstacle in harnessing the geotourism potentials of the project area.

### **Human Factors**

The human problems that affect the geotourism potentials of the project area encompass such factors as demographic consideration, social habits and educational consideration. Demographic consideration deals with the population change in age distribution and increasing urbanization of population. The quest for social organizations to create new desires for different kinds of

leisure activities buttresses the social habits while the relationship between education standards and the desire to travel explains the educational consideration as seen in many travel surveys in recent years.

### **Suggested Solutions**

The identification of a problem only but solves about half of it, as that which remains is dependent on the pragmatic approach in getting the problems solved. A synergy can be politically and economically created between the states of Plateau and Nassarawa. With a good political structure and a strong political will, an economic consensus can be reached at, such that for every income and revenue generated from the activities in and around the fall a certain percentage is legitimately due one state and the other. This makes trade and aids to trade to assume a large scale. Due to the high cost of developing an area for geotourism attraction, the state government should enter into a Public Private Partnership (PPP) with a sincere memorandum of understanding devoid of any form of ignoble objective. There should be continuity as regards the developmental plans of the succeeding government in view of the geotourism potentials of the project area, with these infrastructural facilities in place, commerce thrives leading to high internally generated revenue ultimately causing economic boom. Demographic features should be accorded due consideration, social habits checked and educational standards considered.

As rightly observed by Ogezi et al., (2010) and Aga et al (2011), to facilitate public interest in geotourism, stakeholders must collaborate to sensitize the public, develop and preserve these sites for teaching, training, research, sustainable development, job creation,

environmental conversation and also explores alternative and traditional explanation/uses.

## **CONCLUSION**

The geology and geotourism potentials of the mayes waterfalls are great but grossly underutilized. In the light of the findings of this research project, the government should therefore leave the doors open for individual's participation in developing the geotourism potentials of the project area with appropriate tax rebate and haven coupled with incentives such as easy land acquisition. A strong political will and structure should be put in place to put to an end to the tussle for the actual owner of the waterfall or better still a consensus can be reached on the basis of political and economic considerations.

A comprehensive compendium of the tourist attraction of the project area or better still geotourism gazette or memoir is of paramount importance. The project area could be said to be a sleeping giant in the tourism industry which when revamped should contribute immensely to the overall development of the tourism industry in Nigeria.

## **ACKNOWLEDGEMENT**

The authors gratitudes are expressed to His Royal Highness, Saf Kyobok Agisam, Chief of Massenge for his friendly disposition and insight during the course of this research.

## **REFERENCES**

- Aga T, Zang JJ, Bala DA (2011). Geotourism Potentials in parts of Anaguta Enclaves of Jos, North Central Nigeria. *Pacific J. Sci. and Technol.* Pp 574-579.
- Agisam K (2011). Oral Communication on the Geotourism Potentials of Mayes Waterfalls.
- Macleod WN, Turner DC, Wright EP (1971). The Geology of the Jos Plateau. *Geol. Survey of Nig. Bulletin No. 32, Vol 1.* Pp 8-21.
- Ogezi AEO, Aga T, Okafor I (2010). Geotourism Resources for Sustainable Development and Recreation: Plateau State Case Study. *Pacific J. Sci. and Technol.* Vol. 11, No. 2. Pp 610-616.
- Philip K (2001). *The New Penguin Dictionary of Geology*, 2<sup>nd</sup> Edition.
- Turner DC (1972). Structural and Tectonic Setting of the Younger Granite Ring Complexes of Nigeria and Southern Niger, part 1: In: Ring Complexes and their Component Units. Pp 223 – 226.