iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 Issue: I Month of publication: January 2019

DOI: http://doi.org/10.22214/ijraset.2019.1128

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 7 Issue I, Jan 2019- Available at www.ijraset.com

Assessment of Mineral Resources in Federal Capital Territory (FCT) Abuja, Nigeria

Aduojo Atakpa[1], Dr. G.M. Argungu [2], Sani Muawiya[3], Muhammad M. Wase[4], Labaran Mohammed Shuaibu [5], Abdu Abdullahi[6], Shehu Mohammed Fatima[7], Muhammad Ibrahim M [8]
[1]Advanced Space Technology Applications Laboratory (ASTAL), BUK, Kano
[2]Department of physics, Usman Danfodio University, Sokoto, Nigeria
[3]Center for Atmospheric research (CAR) Anyigba, Kogi State, Nigeria
[4, 5, 6, 7, 8]ASTAL, BUK, Kano

Abstract: The mineral resources of the federal republic of Nigeria (FCT), Abuja were investigated using remote sensing and geographic information system. In this research, landsat TM image was processed and analyzed to unravel the mineralized zones of the study area using ArcGIS, Erdas Imagine and PCI Geomatica. Pixels for vegetation which could introduce errors to the results were removed before further analysis were carried out. Band ratios for landsat band 5/7, 3/1, and 5/4 were used to detect the mineralized zones in the red, green, and blue colour combination respectively. Clay-carbonate-sulfate-Mica minerals, ferric iron minerals and the ferrous mineral groups were detected in the study area. The Clay-carbonate-sulfate-Mica mineral group were found in Southern part of the study area. The ferric iron mineral group were more dominant in the north eastern part of the study area while the ferrous minerals were observed in southern part of Gwagwalada, Kwali as well Abaji area. The lineaments which serve as conduit for mineralization were also analyzed and found to have N-E and S-W Orientation. This research could be useful in management of the mineral resources for sustainable development of FCT, Nigeria and provision of raw materials for both local and foreign industries.

Keywords: remote sensing, mineral resources, Composite band rationing, and lineaments.

I. INTRODUCTION

Band ratio combination has been proven to be one of the most useful image processing methods for lithological discrimination, as discussed by many researchers in the past. [1]. Remote sensing provides information on the properties of the surface of exploration targets that is potentially of value in mapping alteration zones and lithology units [2]. Ratio technique provide distinctive information that may not be gotten using a single band analysis which is useful in separating surface materials [3]. The use of satellite images for mineral exploration has been very successful in pointing out the presence of minerals such as alunite, pyrophyllite, kaolinite, sericite, illite, muscovite, smectite, and carbonate which are important in the identification of hydrothermal alterations [4]. Lineament mapping is an important part of structural geology and they reveal the architecture of the underlying rock basement [5]-[6].

II. THE STUDY AREA

The Federal Capital Territory, Abuja is located in the central part of Nigeria, between latitudes 8° 25' and 9° 25'North and longitudes 6° 47' and 7° 40' East. It is bounded in the north by Kaduna State, in the west by Niger State, in the east by Nasarawa State and Kogi State in the south-west [7].

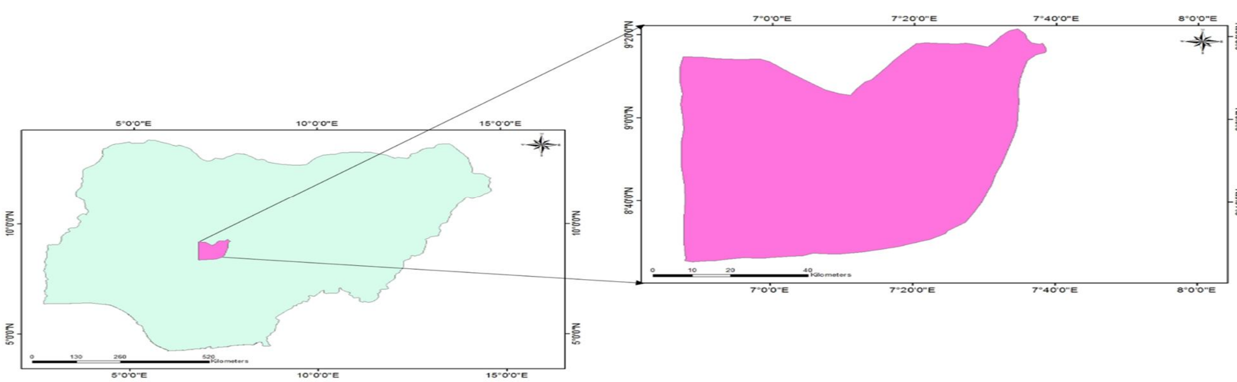


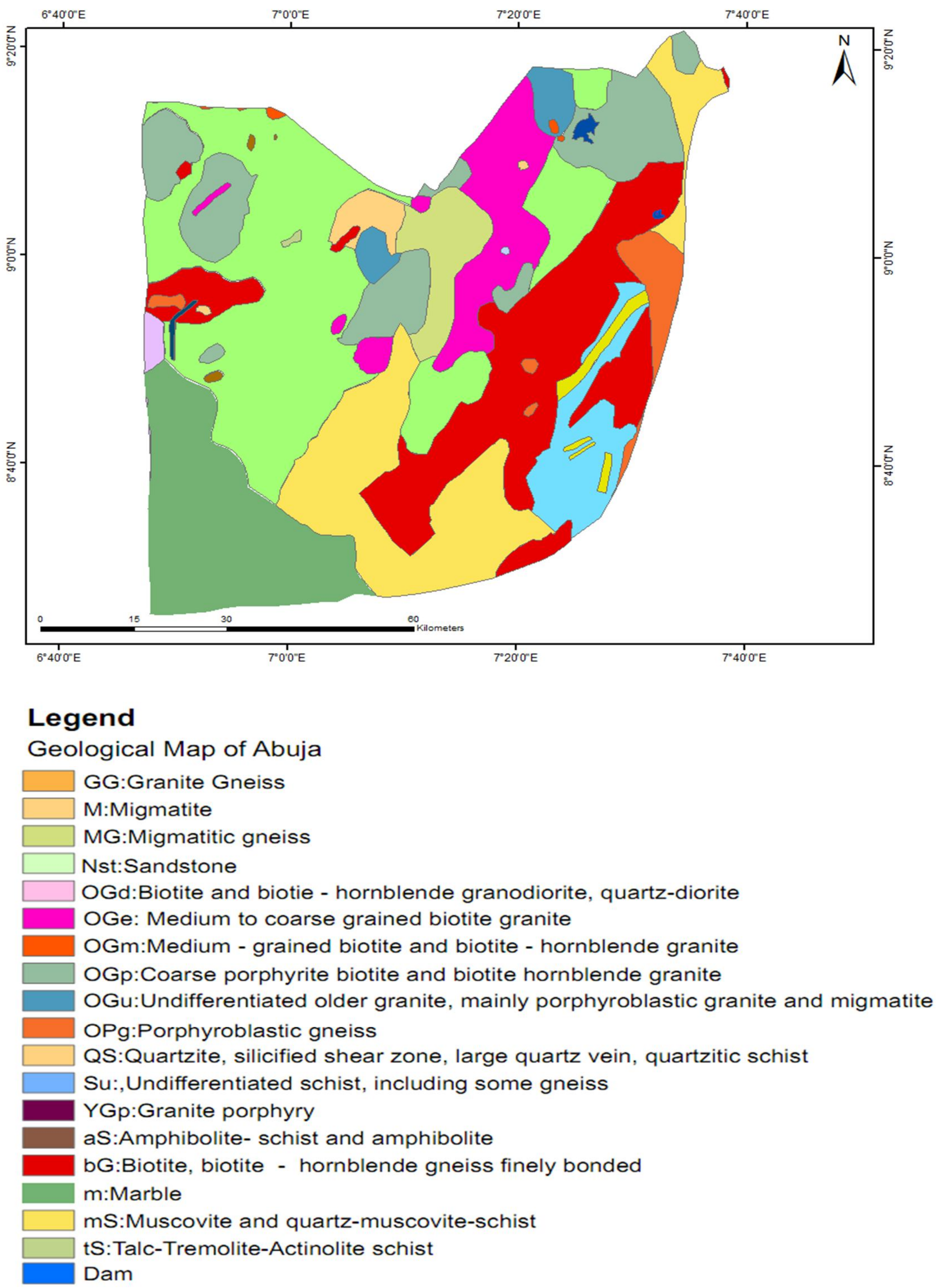
Fig1. The Study Area

©IJRASET: All Rights are Reserved

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 7 Issue I, Jan 2019- Available at www.ijraset.com

III. GEOLOGY OF THE FCT, ABUJA

The Federal Capital Territory, Abuja is mainly underlain by crystalline rocks of north-central basement complex. The Nigerian basement complex lies in the Pan-African mobile belt which has been affected by Pan-African events through the ages of orogenic, tectonic and metamorphic cycles [8],[7]. Geologically, the lithological units in the FCT, Abuja include migmatite, granite gneiss, Quartzo-fedspathic gneiss, undifferentiated schist, porphyritic biotite, marble and Nupe sandstone of lower Turonian age covering less than 5% within the FCT, Abuja [7].



©IJRASET: All Rights are Reserved

IV. MATERIALS AND METHODS

Landsat TM was acquired on the 2nd of January, 1987. It has 7 bands which cover the visible and the infrared region of the electromagnetic spectrum. The path and row covering the study area are path 189 and row 054. The software used in this research include: ArcGIS, Erdas Imagine and PCI Geomatica.

Table 1.The properties landsat 5TM bands are shown in the table below:

Landsat 5 (TM)	Wavelength	Resolution
Band 1	0.45 – 0.52 µm	30 m
Band 2	0.52 – 0.60 µm	30 m
Band 3	0.63 – 0.69 µm	30 m
Band 4	0.76 – 0.90 µm	30 m
Band 5	1.55 – 1.75 µm	30 m
Band 6	10.40 – 12.50 µm	30 m
Band 7	2.08 – 2.35 µm	30 m

A. *Data Masking*

Pixels dominated by vegetation were masked before calculating the TM band ratios because of their obscureness to the ground surface so that the compositional characteristics of rocks and soils can be evaluated from the Landsat data. This masking was essential to reduce image spectral variability arising from different land covers and to focus attention on the bare earth surface. The Normalized Difference Vegetation Index (NDVI) was generated and used to identify the vegetation pixels in order to eliminate them from further analysis.

B. *Band Ratios*

Landsat band 5/7, 3/1, and 5/4 ratio was used to generate the colour composites for the mineral groups in study area. The red, green, and blue colour combination were used to highlight the ratio images

V. RESULTS AND DISCUSSION

A. *Mineral Composite*

The use of remote sensing data such as landsat images to detect mineral anomalies is very important in the exploration and management of mineral resources of any area. The band rationing of landsat 5 TM was carried out to detect the mineral groups in the federal capital territory of Nigeria, Abuja. The mineral groups detected are: Clay-carbonate-sulfate-mica mineral group which were dominant in southern part of study area which include: Kwali and Abaji local Government areas. They were also observed in the eastern part of Gwagwalada, Kuje and Kwali areas. The ferric iron mineral groups were found mainly in Gwaska, Gwagwa, Idogwari, Kubwa, Kuchbuni,Tafa,Bwari, Idu Industrial District, Gwarinpa Estate, Kuje, Kwali, which are located in the north eastern part of the study area while the ferrous minerals were found to be more dominant in the southern part of Gwagwalada, Kwali as well Abaji area.

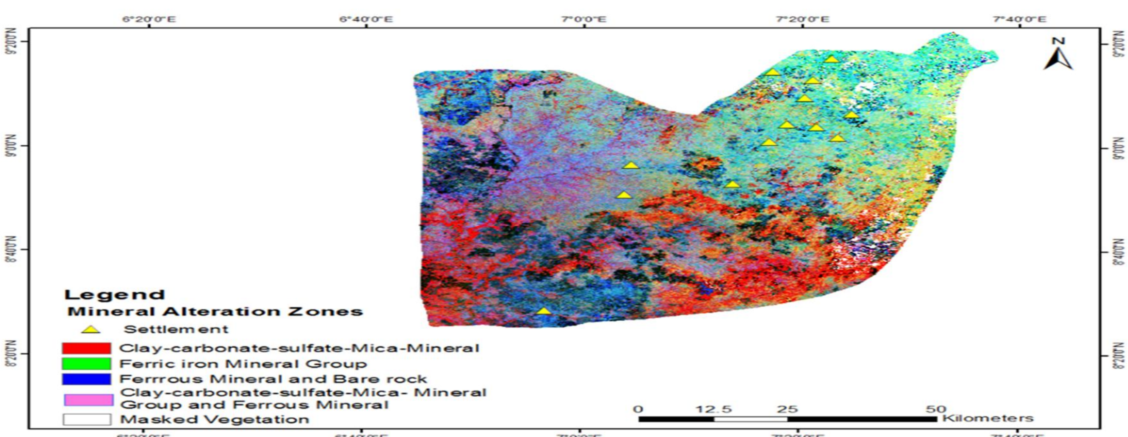


Fig 3. Mineral Composite of the Study Area

B. Lineaments Mapping

Principal components analysis was carried out for Landsat5 TM image in order to compress most of the information in the original bands into fewer bands which represents the useful information. In this analysis the first three bands contains most of the information making up to 99.89% of the entire image (Table 2). The lineaments were extracted from the bands containing the useful information using PCI Geomatica software (Fig4).

Table 2.Eigen Values of PCA Analysis

	Eigen Values	%Eigen Values	Cumulative Eigen Values
PCA1	4353.28	96.85	96.85
PCA2	118.34	2.63	99.48
PCA3	18.53	0.41	99.89
PCA4	3.46	0.08	99.97
PCA5	1.16	0.03	99.99
PCA6	0.29	0.01	100.00

C. Lineament and the Rose Diagram

The mapping of Lineaments is very essential in mineral resources exploration because they are permeable zones for hydrothermal fluids were base and precious metal ores could concentrate to form deposits. The rose diagram indicates the overall trend of the lineaments in the study area. The lineaments observed from the analysis are characterized by N-E and S-W orientation (Fig 5).

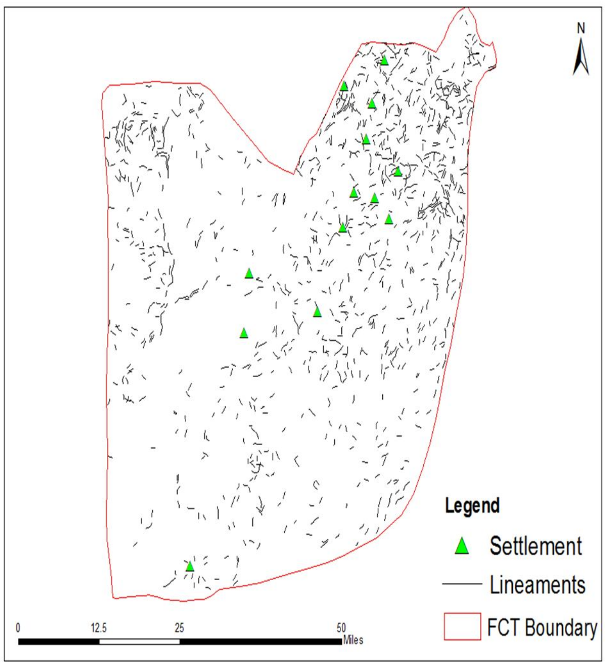


Fig 4. Lineament Map of the study Area

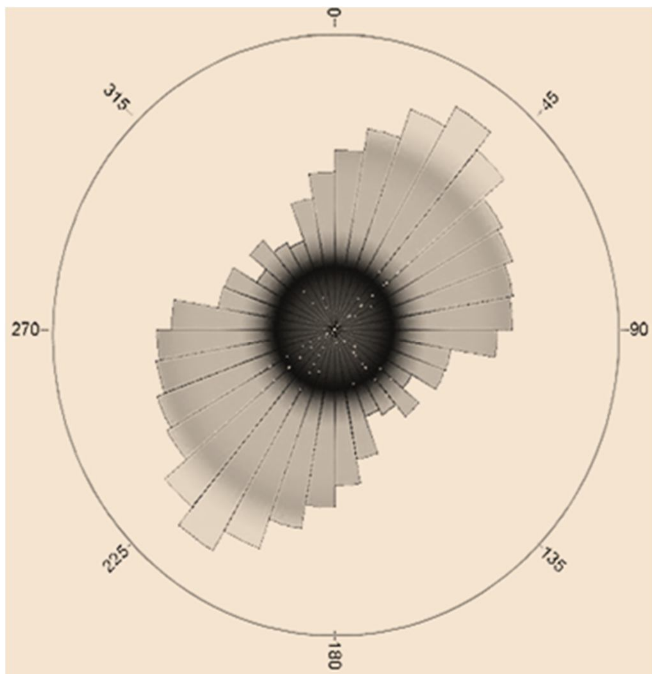


Fig 5. The Rose Diagram

VI. CONCLUSION

The multispectral nature of landsat images and availability of robust software for remote sensing and Geographic Information Systems (GIS) have made prospecting and exploration of mineral resources a lot easier. This research has revealed the enormous occurrence of Clay-carbonate-sulfate-Mica mineral, ferric iron mineral and the ferrous mineral groups by using remote sensing and GIS techniques to process and analyze the data. Proper management and harnessing of these mineral resources could improve the livelihood of the people. Furthermore, the economic minerals in the study area could serve as raw materials for both local and foreign industries in the manufacturing of electronic and other useful products.

©IJRASET: All Rights are Reserved

REFERENCES

[1] Norbert Simon*, Che Aziz Ali, Kamal Soslan Mohamed and Kamilia Sharir2016: Best Band Ratio Combinations for the Lithological Discrimination of the Dayang Bunting and Tuba Islands, Langkawi, Malaysia Sains Malaysiana 45(5)(2016): 659–667

[2] Artimes Ghassemi Dehnavi, Ramin Sarikhani and D. Nagaraju, 2010: Image Processing and Analysis of Mapping Alteration Zones In environmental research, East of Kurdistan, Iran World Applied Sciences Journal 11 (3): 278-283, 2010ISSN 1818-4952© IDOSI Publications, 2010

[3] Adegoke Kayode Martins and Bulus Luka Gadiga: 2015. Satellite Remote Sensing for Mineral Deposit Assessment of Clay in Mubi Local Government Area of Adamawa State, Nigeria Geosciences 2015, 5(1): 26-30 DOI: 10.5923/j.geo.20150501.03

[4] Faranak Feizi and Edris Mansouri, 2013: Introducing the Iron Potential Zones Using Remote Sensing Studies in South of Qom Province, Iran Open Journal of Geology, 2013, 3, 278-286 doi:10.4236/ojg.2013.34032.

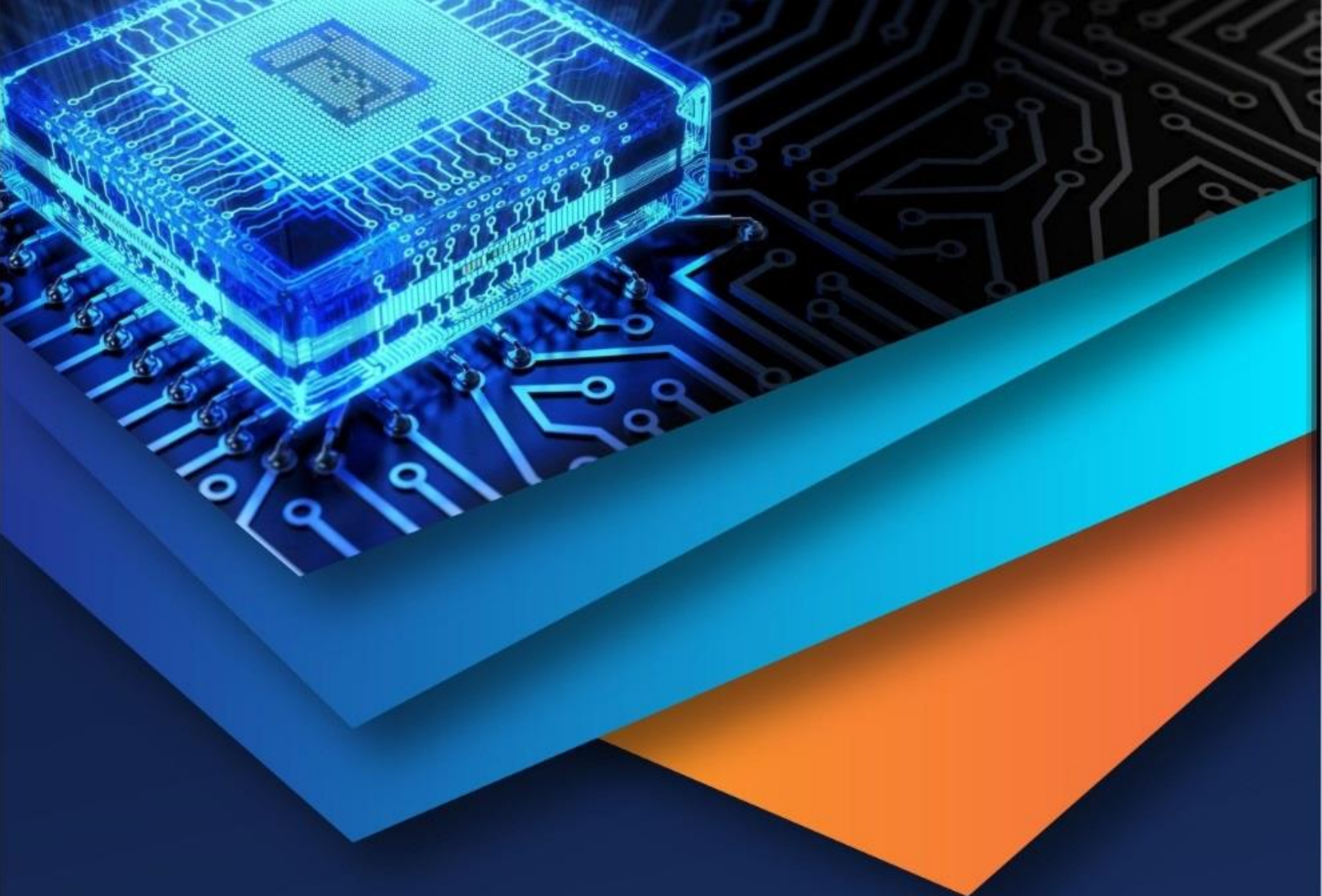
[5] Ramli, M.F., Yusof, N., Yusoff, M.K., Juahir, H., and Shafri, H.Z.M. (2010). Lineament mapping and its application in landslide hazard assessment: a review. Bull. Eng. Geol. Environ. 69, 215–233.

[6] M. W. Mwaniki M. S. Moeller and G. Schellmann 2015: A comparison of Landsat 8 (OLI) and Landsat 7 (ETM+) in mapping geology and visualizing lineaments: A case study of central region Kenya. The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, Volume XL-7/W3, 2015. 36th International Symposium on Remote Sensing of Environment.

[7] Agunleti and Arikawe, 2014: Groundwater Targeting Within The Basement Complex Rocks Of Federal Capital Territory Abuja Using Remotely Sensed And Vertical Electrical Sounding Data international journal of technology enhancements and emerging engineering research, vol 2, issue 12 38 issn 2347-4289

[8] Oyawoye, P. O. (1964) “Geology of Nigerian Basement Complex”. Journal of Mining and Geology, Vol.1, P. 110-121

©IJRASET: All Rights are Reserved



10.22214/IJRASET

INDEX COPERNICUS

45.98

IMPACT FACTOR: 7.129

TOGETHER WE REACH THE GOAL

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)