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Research Paper

Determination of Mineral Potential Zones of Sokoto Basin Northwestern Nigeria Using Enhancement Magnetic Techniques (EMT).

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ABSTRACT
Rock magnetization of Sokoto Basin Northwestern, Nigeria was determined to study the mineralization potentials of the basin for mineral exploration using enhancement techniques which includes first vertical derivative (FVD), second vertical derivative (SVD) and horizontal gradient (HGRAD). Digital elevation map was also modelled to give the value above sea level of the study area in a pictorial form. The result obtained from the first vertical derivative revealed values ranged from -5.81817 to 6.89227nT/km, the result of the second vertical derivative revealed values ranged from 0.039815 to 0.0528083nT/km and horizontal gradient result showed values ranged -2.33617 to 3.14636nT/km. the digital elevation map (DEM) indicated that some parts of south and southeastern zones have high elevation of 637m and parts of southwestern and northwestern regions have low elevation of 175km above sea level. The south and southeastern parts of the study area have very low magnetic minerals while north and northwestern parts of the study area have high magnetic minerals. The study has identified the north and northwestern parts of the research interest to have mineral potentials.

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I. INTRODUCTION

The traditional role of aeromagnetic studies over an area has been in establishing geologic and tectonic framework in exploring for minerals and other commodities. Magnetic anomalies can be defined by aeromagnetic surveys and interpreted in terms of the depth to the basement rock surface and consequently the thickness of overlying sedimentary rocks (Adekeye et al., 2019). The magnetic data can also be used to determine relief on the basement surface that may be directly related to structures favorable for accumulation of gas and oil in overlying sedimentary rocks (Ekwok et al., 2021). Thus, with magnetic data it is possible to identify areas with potential for occurrence of petroleum and to provide information on thickness of sedimentary rocks plus some information on possible structures in sedimentary rocks. Presence of igneous extrusive rocks inter-bedded with sedimentary rocks or igneous rocks intrusive into sedimentary rocks may be important in the exploration for oil or gas. Magnetic data are very effective in indicating the presence, delineating the boundaries, and in determining the depth of igneous rocks (Opara, et al., 2018; Eshnibli, et al., 2021).

An aeromagnetic survey is a common type of geophysical survey carried out using a magnetometer aboard or towed behind an aircraft. It is the oldest potential field method used for hydrocarbon exploration. The aeromagnetic geophysical method plays a distinguished role when compared with other geophysical methods in its rapid rate of coverage and low cost per unit area explored. The principle is similar to a magnetic survey carried out with a hand-held magnetometer, but allows much larger areas of the earth's surface to be covered quickly for regional reconnaissance (Dentith et al., 2000). The aircraft typically flies in a grid-like pattern with height and line spacing determining the resolution of the data (and cost of the survey per unit area).

As the aircraft flies, the magnetometer records tiny variations in the intensity of the ambient magnetic field due to the temporal effects of the constantly varying solar wind and spatial variations in the earth's magnetic field, the latter being due both to the regional magnetic field, and the local effect of magnetic minerals in the earth's crust. By subtracting the solar and regional effects, the resulting aeromagnetic map shows the spatial distribution and relative abundance of magnetic minerals in the upper levels of the crust. Different rock types differ in their content of magnetic minerals; hence, the magnetic map allows a visualization of the geological structure of the upper crust in the subsurface, particularly the spatial geometry of bodies of rock and the presence of faults and folds. Aeromagnetic data was once presented as contour plots, but now is more commonly exposed as colored and shaded computer generated pseudo-topography images. The apparent hills, ridges and valleys are referred to as aeromagnetic anomalies, while the differences between actual measurements and theoretical values indicate anomalies in the magnetic field. These anomalies in turn represent changes in rock type or in thickness of rock units (Olawale et al., 2020; Okoro et al., 2021).

In rock magnetization: aeromagnetic maps represent magnetic-field variations caused by differences in the total magnetization of underlying sources. Total magnetization, is the vector sum of induced and remanant components. The induced component of the magnetization of a rock is the product between the Earths present-day magnetic field vector and the magnetic susceptibility. Magnetic susceptibility is a scalar measure of the quantity and type of magnetic minerals (commonly titanomagnetites) in the rock. The remanent component (also a vector) is based on the permanent alignment of magnetic domains within magnetic minerals and is measured using Paleomagnetic methods (Butler, 1992).

Igneous and crystalline metamorphic rocks commonly have high total magnetizations compared to other rock types, whereas sedimentary rocks and poorly consolidated sediments have much lower magnetizations (Reynolds et al., 1990; Hudson et al., 1999). Total magnetizations of volcanic rocks are normally dominated by the remanent component, whereas those for all other rock types are dominated by the induced component, with the exception of some mafic metamorphic rocks (Reynolds et al., 1990; Clark, 1997). Aeromagnetic anomalies over volcanic rocks commonly produce high-amplitude positive or negative anomalies. Where a correspondence between volcanic edifices and anomaly shape can be demonstrated, positive and negative anomalies indicate normal and reversed-polarity remanent polarities of the rocks respectively.

In the search for mineral deposits aeromagnetic data have both direct and indirect application. Aeromagnetic surveys provide a direct indication of ore bodies containing substantial amounts of magnetite or other magnetic minerals. Numerous iron-ore bodies have been found through magnetic surveys. Aeromagnetic surveys are effective means of mapping and evaluating the economic potential of Precambrian iron formations. One of the greatest values of the aeromagnetic analysis in the exploration for mineral deposits is in the study of magnetic features related to mineral deposits but not produced directly by ore bodies. Regional magnetic surveys are useful in establishing regional Lithologic setting, character of mineral districts, intrusive provinces, and in delineating batholiths and major structural trends and crustal features, all of which are important for developing the framework for detailed mineral exploration. Considerable effort is being devoted to recognizing regional patterns in the distribution of mineral deposits and regional magnetic surveys provide the best continuous and uniform set of data over large areas to aid in this recognition (Emberga et al., 2016).

TABLE 1. SOLID MINERAL IN NIGERIA WITH STATES OCCURRED (Lar, 2018)

S/N	Mineral	States involved
1	Marble	Edo, Kogi, Nasarawa, Kwara, Oyo, FCT
2	Baryte	Cross River, Zamfara, Nasarawa, Taraba, Benue, Plateau
3	Tantalite	Nasarawa, Ekiti, Cross River, Kwara, Kogi
4	Mica	Kogi, Ekiti, Kwara, Oyo, Nasarawa
5	Gemstones	Kaduna, Taraba, Ogun, Bauchi, Kwara, Plateau, Nasarawa, Kogi, Niger, Oyo
6	Manganese	Kebbi, Zamfara, Katsina
7	Columbite	Cross River, Bauchi, Kano, Plateau, Kaduna, Kwara, Nasarawa,
8	Limestone	Sokoto, Cross River, Benue, Edo, Gombe, Ebonyi, Kogi, Ogun,
9	Gold	Niger, Kaduna, Katsina, Kano, Kogi, Kebbi, Kwara, Osun, FCT, Zamfara
10	Feldspar	Bauchi, Borno, Abuja, Kaduna, Kogi,
11	Ilmenite	Plateau, Cross River, Bauchi, Kaduna,
12	Cassiterite	Plateau, Cross River, Kwara, Kaduna, Bauchi, Kano, Nasarawa
13	Diatomite	Borno and Yobe
14	Clay	All states
15	Gypsum	Edo, Yobe, Sokoto, Gombe, Adamawa, Ogun
16	Bismuth	Kaduna only
17	Silver	Ebonyi and Kano
18	Lead	Ebonyi, Cross River, Zamfara, Abuja, Plateau,
19	Zinc	Abuja, Cross River, Plateau, Ebonyi, Zamfara
20	Fluorite	Bauchi, Ebonyi, Plateau, Taraba
21	Benonite	Ogun, Borno, Kogi, , Ondo, Edo,
22	Silica sand	Jigawa, Delta, Kano, Lagos, Rivers, Ondo
23	Bitumen	Lagos, Ogun, Edo, Ondo,
24	Molybdenite	Plateau only
25	Iron ore	Abuja, Kaduna, Enugu, Kogi, Zamfara, Nasarawa,

26	Phosphate	Ogun and Sokoto
27	Coal	Adamawa, Bauchi, Edo, Benue, Anambra, Cross River, Ebonyi, Abia, Enugu, Plateau, Gombe, Imo, Delta, Kogi, Nasarawa
28	Lithium	Zamfara, Kaduna, Niger, Nasarawa,
29	Magnesite	Adamawa and Zamfara
30	Wolframite	Bauchi, Nasarawa, Kaduna, Kwara, Kano, Niger, Zamfara
31	Kaolin	Anambra, Kogi, Bauchi, Ekiti, Katsina,Imo, Bayelsa, Kebbi, Ogun, Akwa Ibom, Ondo, Plateau, Rivers
32	Kyanite	Kaduna and Niger
33	Ta l c	Kaduna, Niger, Ekiti, Kogi
34	Rutile	Plateau, Cross River, Bauchi, Kaduna,

TABLE 2. TYPES OF MINERAL RESOURCES AND THEIR USES (Lar, 2018)

S/No.	Mineral Type/Metal	Characteristics	Use(s)
	ENERGY/FISSIONABLE		
1	Fuel/Crude oil	a mixture of naturally occurring hydrocarbons; Refined into heating oil, diesel, gasoline, jet fuel and kerosene	Used for energy, petrochemical industry, fertilizer, plastic etc.
2	Coal	accumulation of organic matter from plants (peat, lignite, bituminous coal, anthracite, graphite)	Energy generation
3	Natural gas	natural gas is derived from marine plants and animals	Energy generation
4	Uranium	Uranium is a radioactive material	used in nuclear defence systems; nuclear generation of electricity; in x-ray machines, atomic dating, and electronic instruments.
5	Zircon	Zirconium metal is recovered from zircon	Used as refractory products that will withstand high temperature of 2,550°C. Also used in nuclear reactors
6	Gold	gold is a rare, valuable and durable precious metal with a versatile use	jewellery, dentistry, medicine, coins, and applications for the aerospace industry; commonly alloyed with other metals to increase its strength and durability
7	Silver	a light precious substance	used for making jewellery, cell phone covers, fine silverware, coins and photography
8	Platinum	the most precious and durable of all metals (it is very pure and it is rarer, denser and stronger than gold or silver)	used in jewellery industry
	BASE METALS		
9	Galena	Main ore for Lead; a bluish-white soft malleable ductile plastic, or inelastic heavy metallic element	used especially in X-ray and gamma radiation shielding, pipes, cable sheaths, batteries, solder, and shields against radioactivity, ceramics, weights, and ammunition
10	Chalcopyrite	Ore for Copper; a soft shiny and malleable metal	used as an alloy (bronze and brass); used to make coins, brass instruments, pipes and fungicides, electrical wiring etc
11	Sphalerite	Sulfide of Zinc (for zinc metal)	used as protective coating on steel, alloying metal with copper (brass). Also used in galvanizing iron, electroplating, metal spraying, automotive parts, electrical fuses, anodes, dry-cell batteries, nutrition, chemicals, roof gutters, cable wrapping, and pennies.
12	Iron Ore	Fe metal (the fourth most abundant element in the crust)	used to manufacture steels of various types; magnets, auto parts, and catalysts.
13	Nickel	Associated with Ultramafic rocks	A vital alloy for stainless steel, use in the chemical and aerospace industries
14	Chromium	Obtained from the ore mineral Chromite $(Mg,Fe)(Cr,Al,Fe)_2O_4$	used in the production of stainless and heat-resistant steel, full-alloy steel, super alloys and other alloys.
15	Cassiterite	Tin ore; Tin is a soft silvery-white, ductile and malleable metal	used in containers, as a protective coating, in tinfoil, and in soft solders and alloys.
16	Molybdenite	Principal ore of molybdenum (MoS) found in pegmatites	used in stainless steels (21%), tool steels (9%), cast irons (7%), and chemical lubricants (8%); commonly used to make automotive parts, construction equipment, gas transmission pipes, and as a pure metal molybdenum is used as filament supports in light bulbs, metalworking dies, and furnace parts because of its high melting temperature (2,623°C).
17	Wolframite	(Ore of Tungsten)	used in steel production, metalworking, cutting applications, construction electrical machinery, light

			bulbs, carbide drilling equipment etc.
18	bismuthinite	Major ores of bismuth	Majority is consumed in bismuth alloys, and in pharmaceuticals and chemicals; remainder is used in ceramics, paints, catalysts, and a variety of minor Applications
	INDUSTRIAL MINERALS		
19	Gypsum	a soft white or grey mineral consisting of hydrated calcium sulphateused	for making cement, plaster of Paris, fertilizer, wallboard, and glass. used in industrial or building plaster, prefabricated wallboard, cement manufacture, and for agriculture
20	Aluminium (Bauxite)	a silvery-white lightweight metal with malleable and durable property; it is soft and malleable	used in smartphones, tablets, laptops, and flat screen TV.
21	Natural aggregates	Aggregates are composed of rock fragments (sand, gravel, and crushed stone); formed by weathering of igneous rocks like granite, it comes in various sizes of grain	used for making construction materials such as concrete blocks, bricks, pipes, mixing with asphalt and as construction fill
22	Baryte	Sulphate of Barium	used as a heavy additive in oil-well-drilling mud, paints, rubber, plastic and paper; production of barium chemicals; and glass manufacturing.
23	Dolomite	Dolomite is the near twin-sister rock to limestone	used in agriculture, chemical and industrial applications, cement construction, refractories, and environmental industries.
24	Diatomite	A rock composed of the skeletons of diatoms, single-celled organisms with skeletons made of silica which are found in fresh and salt water	Used mainly for filtration of drinks, such as juices and wines, others include being used as filler in paints and pharmaceuticals and environmental cleanup technologies
25	Clay	Weathering products of rocks	used in the manufacturing of paper, refractories, rubber, ball clay, dinnerware and pottery, floor and wall tile, sanitary wear, fire clay, firebricks, foundry sands, drilling mud, iron-ore pelletizing, absorbent and filtering materials, construction materials, and cosmetics
26	Feldspars	A rock-forming mineral.	used in glass and ceramic industries; pottery, porcelain and enamelware; soaps; bond for abrasive wheels; cement; glues; fertilizer; and tarred roofing materials and as a sizing, or filler, in textiles and paper applications.
27	Fluorite	Compound of Fluorine	used in production of hydrofluoric acid, which is used in the pottery, ceramics, optical, electroplating, and plastics industries; as a flux in steel furnaces, and in metal smelting, carbon electrodes, emery wheels, electric arc welders, and toothpaste as a source of fluorine.
28	Lithium carbonate	Source for lithium	For making lithium Batteries used in smoke alarms, pacemakers, defibrillator machines, many other types of portable medical equipment, and in emergency communications equipment, including computers and cell phones.
29	Mica	Mica minerals commonly occur as flakes, scales, or shreds in granitic rocks	used in electronic insulators, paints, as joint cement, as a dusting agent, in well drilling mud and lubricants, and in plastics, roofing, rubber, and welding rods
30	Phosphate Rock	A Sedimentary Rock	used to produce phosphoric acid and ammoniated phosphate fertilizers, feed additives for livestock, elemental phosphorus, and phosphate chemicals.
31	Pyrite	Pyrite (fool’s gold)	used in the manufacture of sulfur, sulfuric acid, and sulfur dioxide; pellets of pressed pyrite dust are used to recover iron, gold, copper, cobalt, and nickel
32	Silica Sand		used in the manufacture of computer chips, glass and refractory materials, ceramics, abrasives, and water filtration, a filler in cosmetics, pharmaceuticals, paper, and insecticides; as a thermal insulator etc.
33	Manganese	Obtained from the ore minerals of Braunite $(Mn,Si)_2O_3$, Pyrolusite MnO_2, and Psilomelane BaMn9O18*$2H_2O$.	Used in iron and steel production.
34	Talc	Alteration product of Ultramafic rocks	Primary use, the production of paper. Ground talc is used as filler in ceramics, paint, paper, roofing,

			plastics, cosmetics, and in agriculture. Also used as baby (talcum) powder, deodorant, and makeup; used to carve figurines etc.

Isolate magnetic anomalies, generally are circular or oval in plane and several hundred metres across and with amplitude of tens to hundreds of nano-teslas may give rise from accumulation of magnetite and /or pyrrhortite which may be associated with economic grades of copper, lead, zinc, silver and gold. Such deposits which precipitate from mineral bearing solution are frequently located within or adjacent to major faults. Gunn & Dentith, (1997) reviewed the characteristics of such deposits which are much more numerous than most people realized and likely to occur at depth in many unexhumed sedimentary basins.

Most sedimentary rocks are nearly non-magnetic but the overlying Igneous or basement rocks usually are to a great extent magnetic. Note, the magnetic method makes use of the potential field seeking anomalous bodies caused by the changes in physical properties of the subsurface rocks. Most times, it is used as a reconnaissance tool.

The variations in the magnetic field may be caused by the inhomogeneity in the composition of the basement rocks, structural or topographic relief of the basement surface. These variations may be measured at the surface or from the air (Aeromagnetic survey). The measured variations are interpreted in terms of distribution of magnetic bodies below the surface which indirectly gives a better explanation to the geologic condition of the subsurface. Generally, the magnetic surveys are chiefly done for two reasons:

- Detailed determination of anomalous bodies which could be for economic interest; and
- Detailed studies of the deeper parts of the earth's crust, mantle or core.

In Nigeria where oil and various minerals have been discovered in commercial quantities, and reserve potentials are believed to be\high over the sedimentary basins which cover approximately half of the country and within the granitic rock types in many other places.

The Sokoto sedimentary basin were accumulated in four depositional phases (Ofoha et al., 2016). The principal rock formations of the study area includes; Gamba and Dange Formation, Dukamaje Formation which separates the Rima group comprising of mudstones and friable sandstones (Wurno and Taloka Formations).

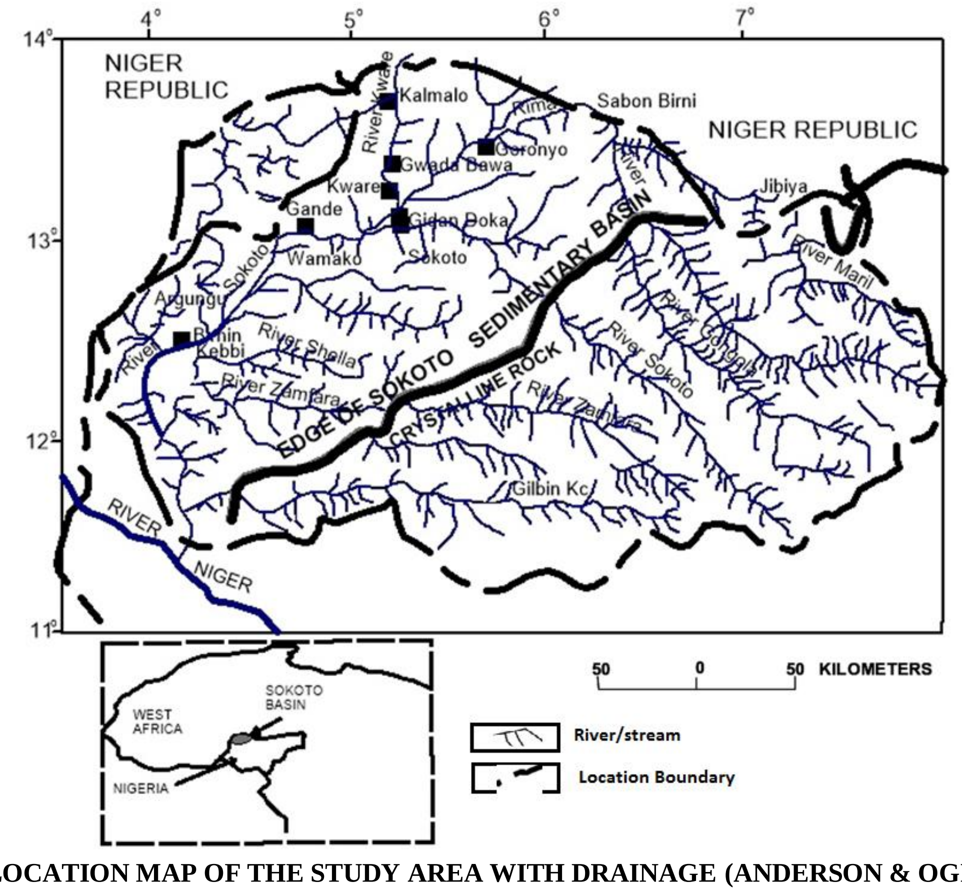

FIG.1 LOCATION MAP OF THE STUDY AREA WITH DRAINAGE (ANDERSON & OGILBEE, 1973)

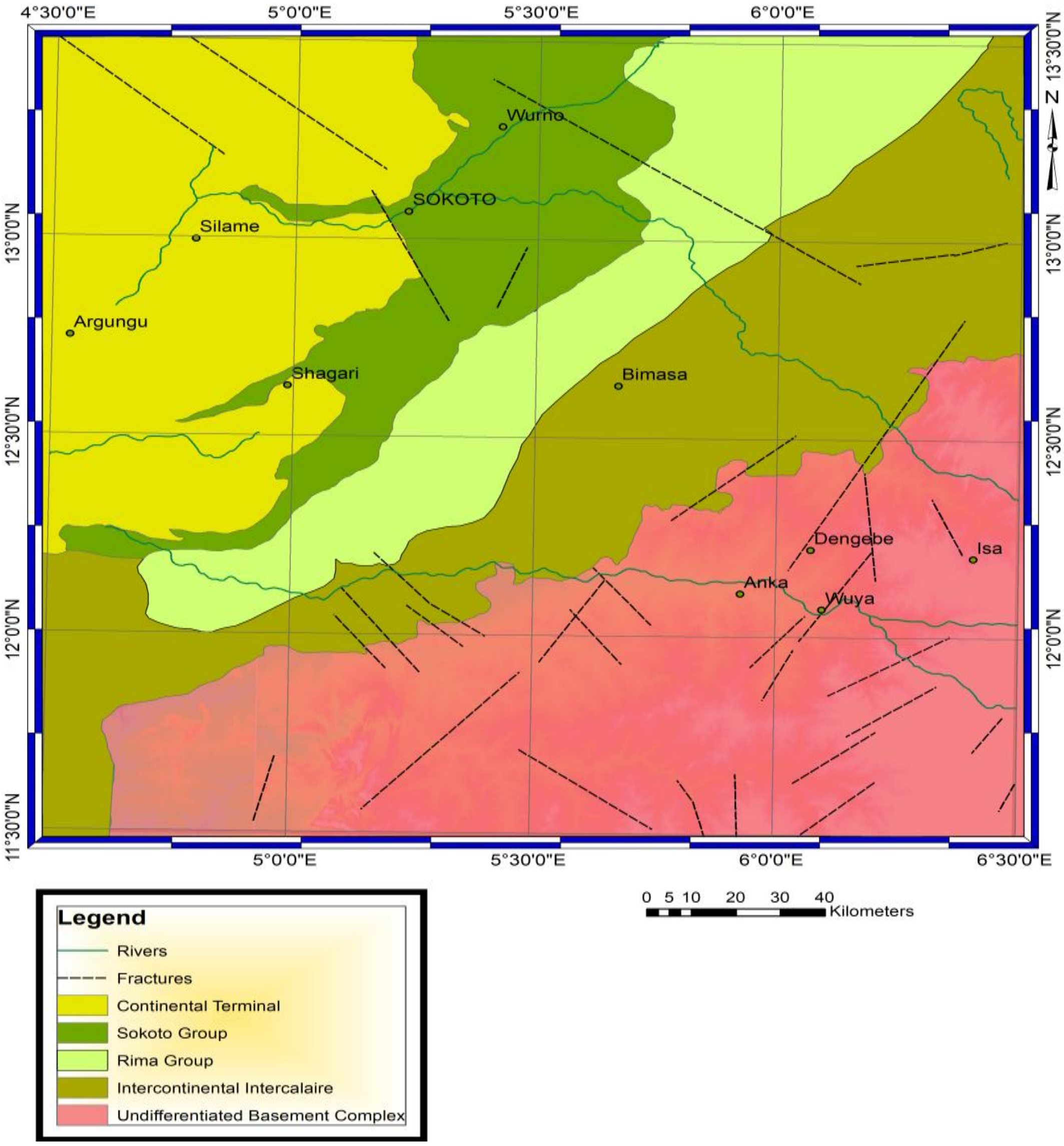

FIG.2 GEOLOGIC MAP OF THE STUDY AREA

II. METHOD

Sixteen sheets of aeromagnetic data of Sokoto basin were used to study the rock magnetization of the research area. The enhancement techniques were applied which includes; first vertical derivative (FVD), second vertical derivative (SVD) and horizontal gradient (HGARD).

Vertical Derivative transforms were intended to facilitate the interpretation of magnetic RTP (or RTE) maps. They were enhancement techniques which amplify the shorter wavelength features relatively to those with longer wavelengths.

The second vertical derivative (SVD) transform is a mathematical transform based on Laplace`s equation. It has the effect of accentuating the shorter wavelength (shallower source) components at the expense of longer wavelength (generally deeper) features. Vertical derivatives of any order may be prescribed. The higher the order the greater is the relative amplification of higher frequencies and greater too is the risk of accentuating noise to an unacceptable degree. For this reason, vertical derivatives of order three and above are hardly ever calculated. Thus the First Vertical Derivative (FVD) and second vertical Derivative (SVD) transforms are the only transforms of this type that are routinely generated. The primary property of the SVD transform is that the zero contour represents the point of inflexion on the original anomaly curve which approximates the locations of edges of the causative bodies, provided that the bodies are shallow and have vertical sides. The first vertical derivative can be used as an alternative to a residual display. The SVD or FVD is calculated using a filtered and unmasked grid of the RTP/RTE magnetic anomaly (Airo &Wennerstrom, 2010; Aitken & Betts, 2009; Di Massa et al., 2018).

The operation requires knowledge of the values of inclination and declination of the Earth's magnetic field appropriate to the survey. This is obtained by inputting the location and period during which the data were acquired. The height above sea level is also required, e.g. for a marine survey height = 0 and for an airborne survey typically height = 305m (1000ft).

In relatively low magnetic latitudes (up to 30-40° north or south of the magnetic equator), the RTP operator can become unstable, amplifying high frequency noise. Also beware of RTP calculations that cover large areas. Currently there is no option within the program to compote a variable latitude correction. This problem may be resolved by Reduction to the Equator (RTE). Reduction to the Equator was used in this study and digital elevation map was produced.

NOTE: Magnetic latitude does not correspond to geographic latitude (Bansal et al., 2013; Alagbe, 2015). Any RTE requirement should be discussed for projects within 20° of the magnetic equator as the analytic signal transform might be more appropriate. The RTP operation should be performed on the filtered magnetic anomaly grid. Gradient transforms are non-linear (so their order in relation to other processing steps such as frequency filtering will affect the final result) and are of two kinds. The Horizontal Gradient H[F] of an anomaly field F is calculated as the Pythagorean sum of the gradients in the orthogonal directions. Choosing the directions to be along the ones of the grids, the calculation becomes:

$$\sqrt{GxZ^2 + GyZ^2} \quad = \quad H\,(F) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ 1$$

This is thus the absolute value of the horizontal gradient (HGRAD) at x, y, i.e. the value of the horizontal gradient in the direction of greatest increase.

Generally, when calculating the Horizontal Gradient, the primary option is to calculate H[F], though options also exist to calculate the direction of the greatest rate of change and the trend.

The ridges of maxima on the Horizontal Gradient of Bouguer gravity are recognised by the industry generally as being good locators of shallow, vertical body edges. The same is true of magnetic data which has been transformed to pseudogravity. The Total Gradient T[F(x,y)] of the field extends the Horizontal Gradient concept to three dimensions and were calculated thus:

For magnetic data the Total Gradient is the absolute value of a complex quantity known as the Analytic Signal and maxima also are indicators of body edges, independent of the Earth's magnetic field and direction of magnetisation in bodies.

III. RESULTS AND INTERPRETATION

The first vertical derivative (FVD) of the regional field of the data revealed a NW-SW trend indicating that the regional trend of the study area is dominantly in this direction. The residual magnetic field intensity values as seen in fig.4 of the study showed a range of values between -770.25 to 1385.95nT. Areas with high values of residual anomaly represented with red, pink, and purple colours are seen in the following sheets; Shagari, Silame and Wurno while the low values were represented with black and blue colours as seen in these sheets; Anka, Dengebe, Wuya and Isa.

Residual magnetic low areas generally reflect zones of low magnetization while the areas with high residual magnetic values reflects zones of high magnetization implying that the areas are associated with intense tectonic/magmatic activities. Similarly, several clusters of circular anomaly closures with various amplitudes which were delineated especially in the northwestern and southwestern areas as seen in fig.3, fig.4 and fig.5 respectively were interpreted to be lithological variations of mafic-ultramafic inclusions. (Opara et al., 2018, Gazala, 1993). The first vertical derivative map revealed values ranged from -5.81817-6.89227nT/km (fig.6). The second vertical derivative (SVD) map as represented in fig.7 of the study area, the zero magnetic contours coincides with lithologic boundaries while positive and negative anomalies generally match surface exposures of mafic and felsic rock respectively. (Opara et al., 2018, Gupta & Ramani, 1982). The observed value of the second derivative analysis revealed values which ranged from -0.039815 to 0.0528083nT/km. The light colours denote areas with high values while dark colours denote areas with low values.

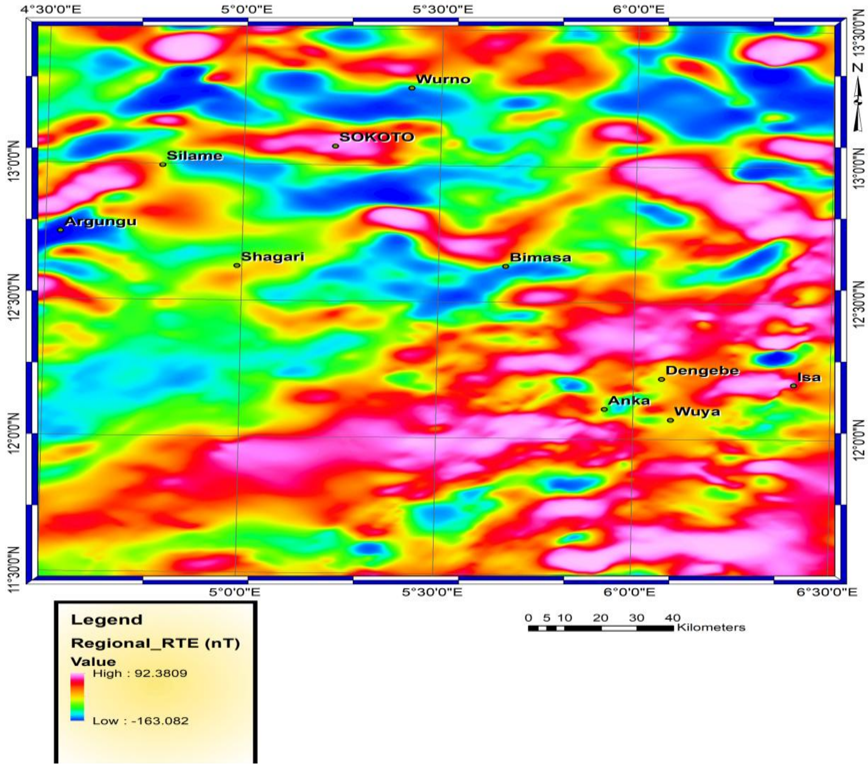

FIG. 3 REGIONAL ANOMALY MAP

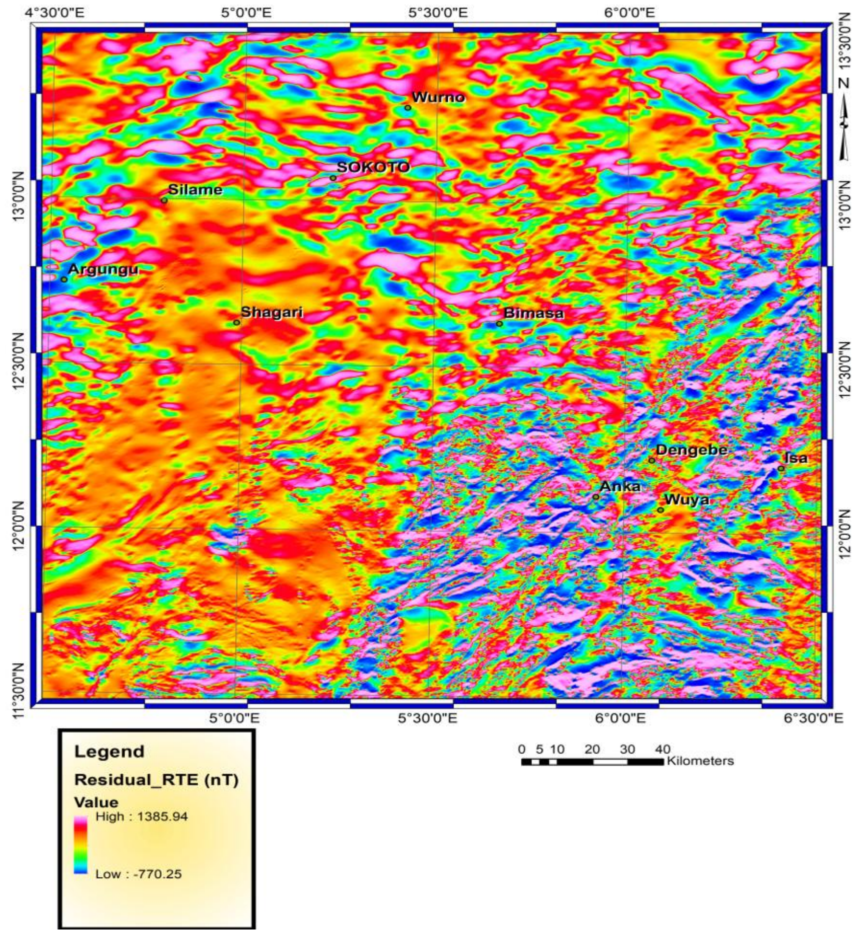

FIG. 4 RESIDUAL ANOMALY MAP

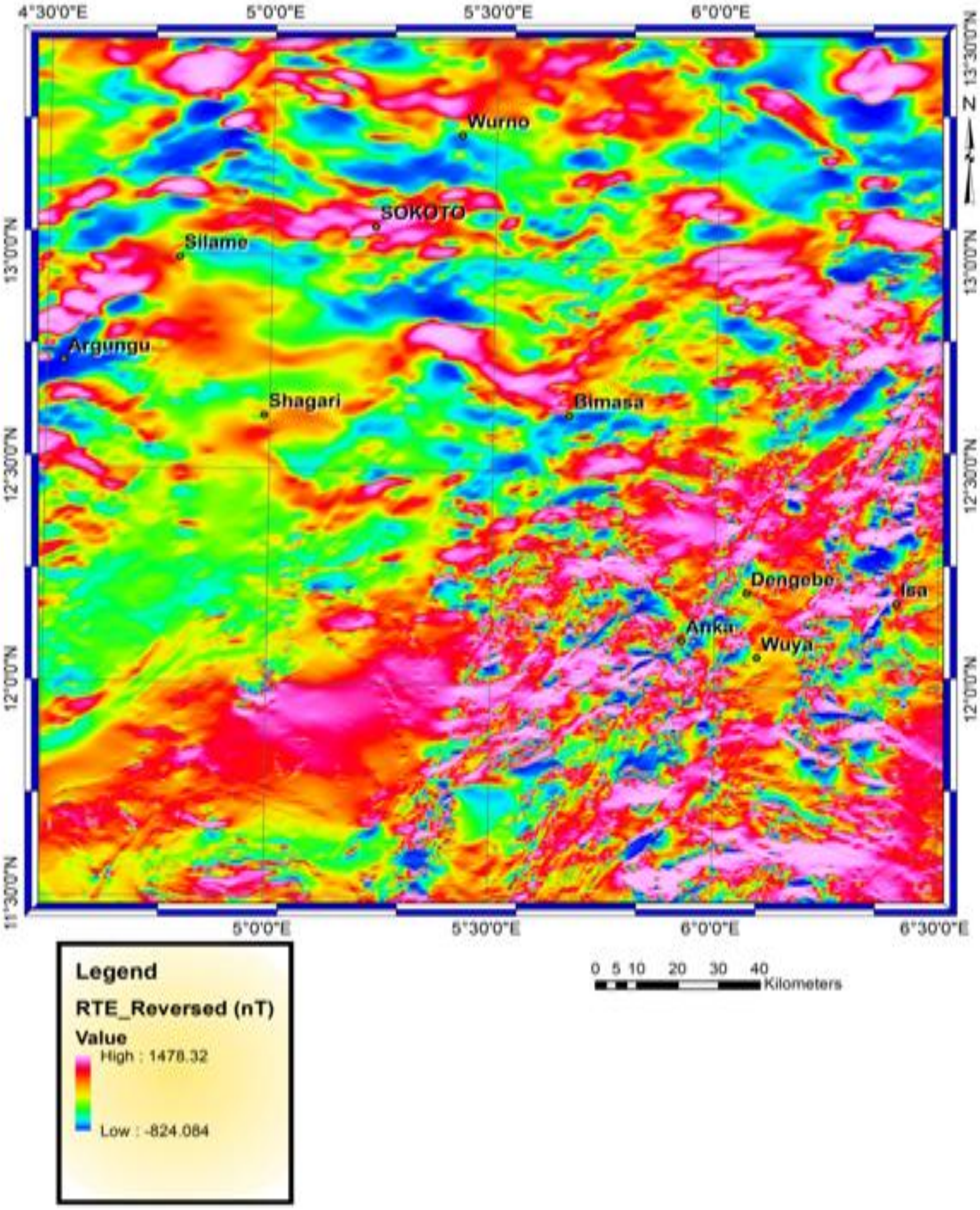

FIG. 5 REVERSED ANOMALY MAP

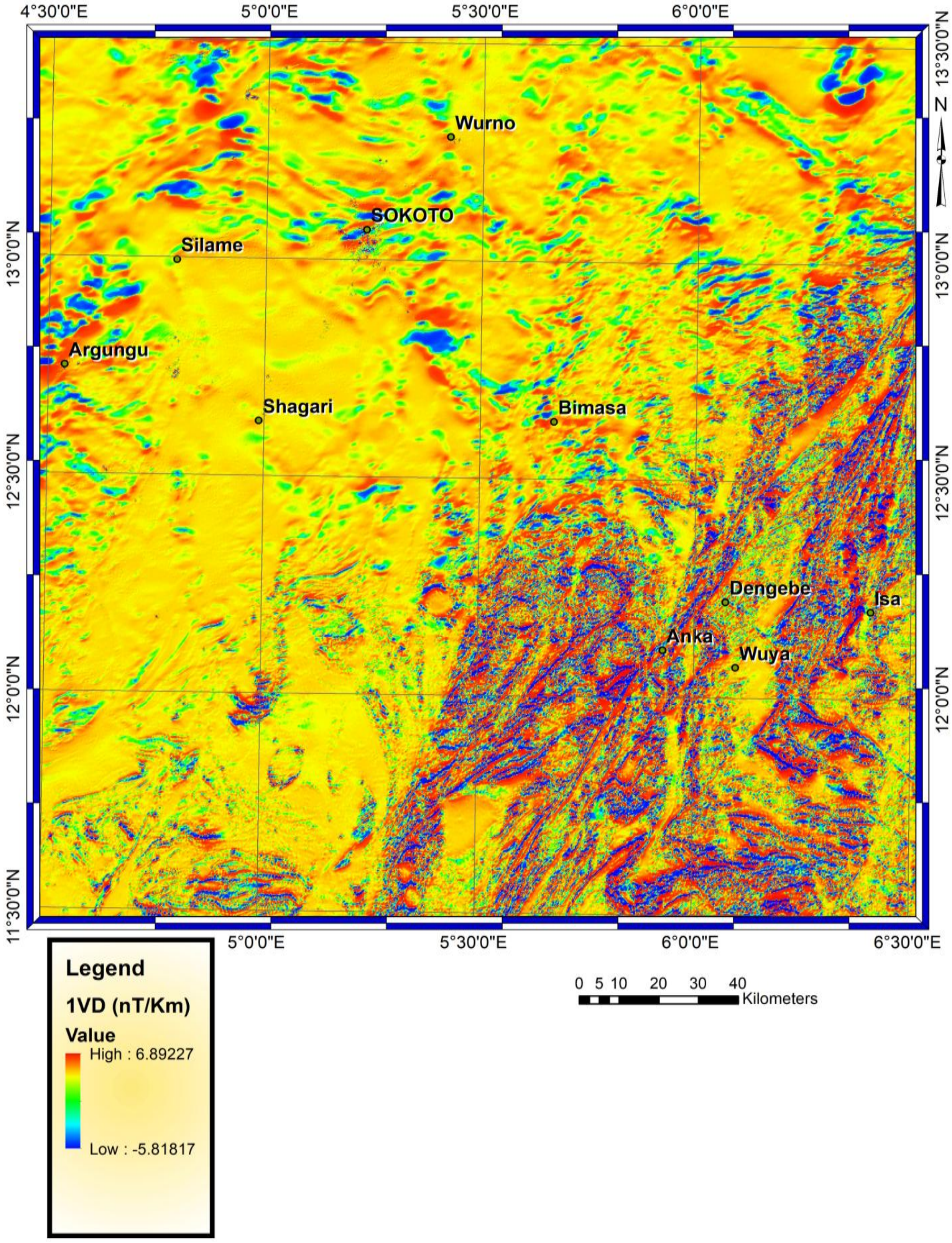

FIG. 6 FIRST VERTICAL DERIVATIVE

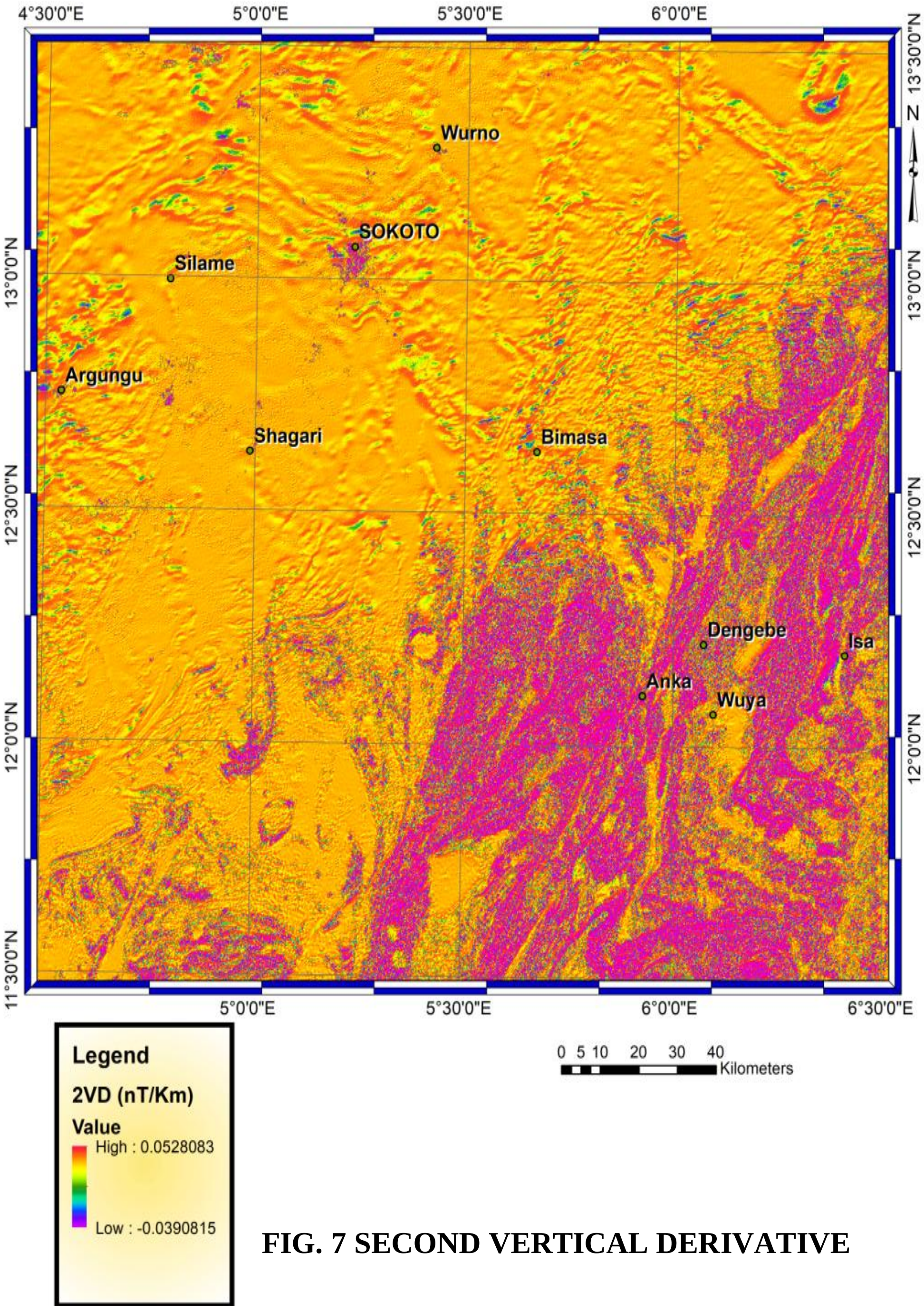

FIG. 7 SECOND VERTICAL DERIVATIVE

Digital Elevation Model (DEM) showed that the study area has an altitude ranging from 175m to a peak of about 637m above sea level. The area seems to have lowest elevation above sea level at Argungu and Shagari, intermediate level at Silame, Bimasa and Anka areas while Isa, Wuya and Dengebe areas have the highest elevation. The highest elevation occurred towards the South-East part of the study area with 637m value while the lowest elevation occurred towards the South-West part of the study area with the value 175m above sea level.

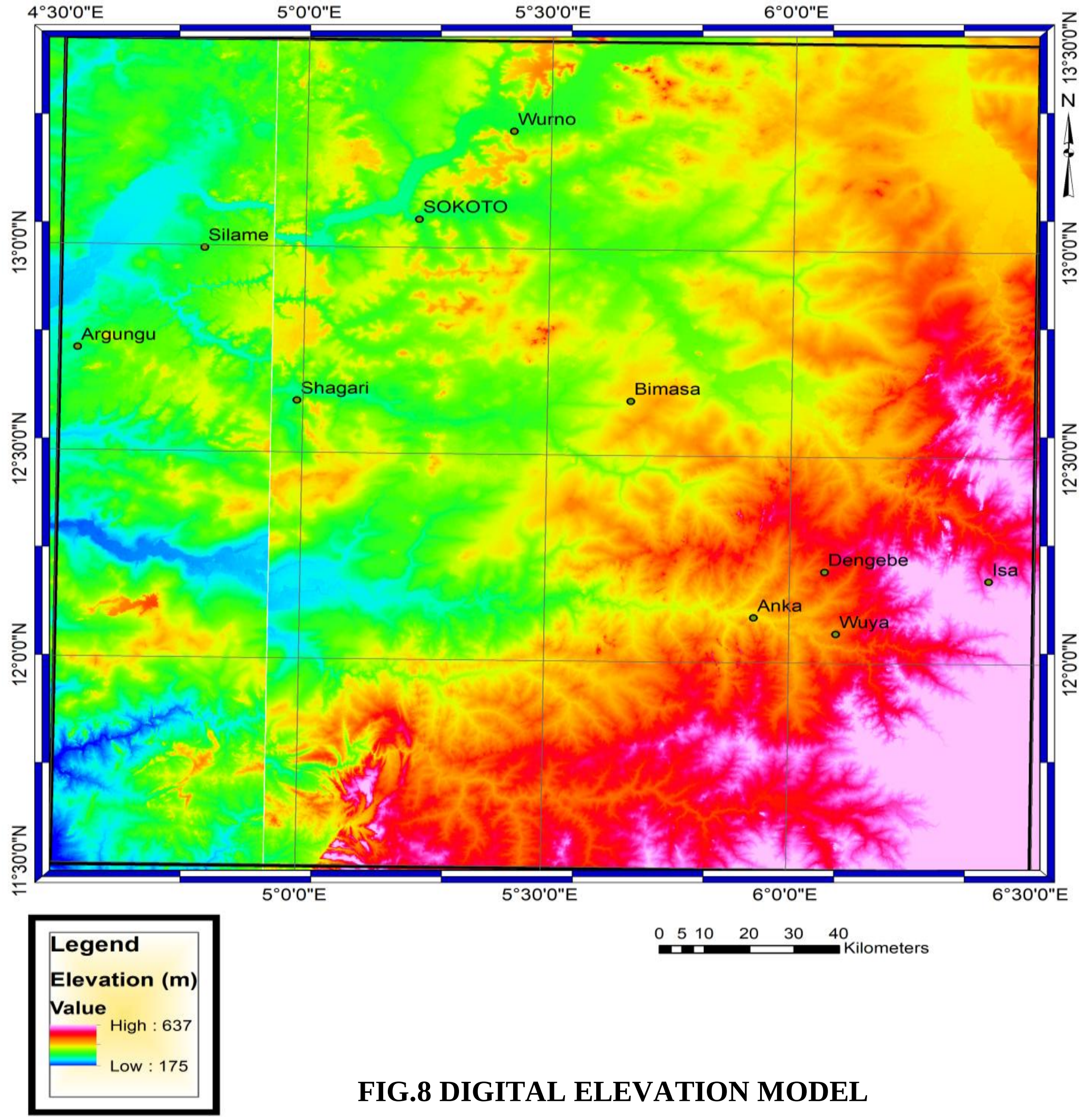

FIG.8 DIGITAL ELEVATION MODEL

The horizontal gradient (HGRAD) result revealed values varying between -2.33617nT/km to 3.14636nT/km (fig. 9) with low linear features around the south and southeastern parts of the study area and major linear features with high magnetic signal amplitude were seen at other parts of the study area. The linear features were traced to correspond with the surface faults from the surface geology of the study area. The northern parts of the study area contain highly magnetized materials which is evidence of mineralization potentials. .

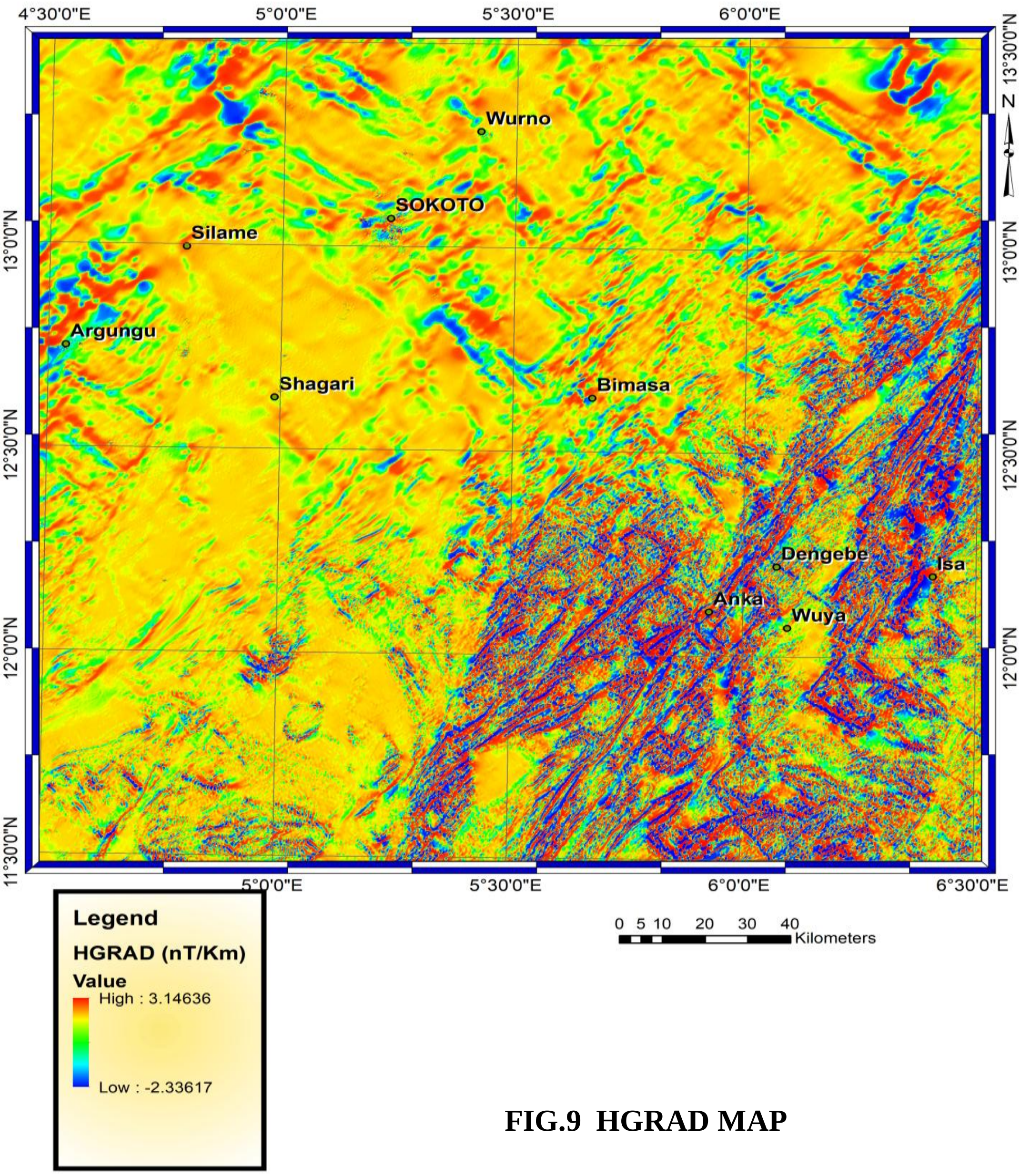

FIG.9 HGRAD MAP

The horizontal gradient (HGRAD) map (fig. 9) really demarcated areas with low magnetic intensity signal (hydrocarbon potential zones) and zones with high/strong magnetic intensity signal which corresponds to mineralization potential zones. It has helped in defining the location of linear features which in turn are related to the trend of the faults in the area. Faults can be traced easily along these linear features which prove the effectiveness of the filter in the interpretation. The result was compared with the available geologic information of the study area and it corresponded according.

IV. CONCLUSION

The qualitative physical principles and quantitative physical measurements applied in the analysis have detected and delineated local features of potential interest of the study area. The regions for mineral and hydrocarbon exploration potentials have been demarcated using magnetic signal amplitudes.

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