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A Further Application of Coefficient of Anisotropy and Reflection Coefficient as Indices in Delineating Groundwater Potential in Basement Complex of Ado Ekiti, Southwestern Nigeria

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Abstract:
One index might not be enough in geophysical investigation of underground water potentials in basement terrain, there is a need to look into other indices for an improved investigation, the combination of some indices will lead credence to the result hence this work is a further application of coefficient of anisotropy, reflection coefficient and fracture coefficient on spatial distribution of underground water in Ado Ekiti basement complex. This work examined the thickness of aquifer, its resistivity spread and other hydro geological parameters such as total longitudinal conductance, total transverse resistances, coefficient of Anisotropy, reflection coefficient and fracture contract to determine water potentials in the study area. Resistivity and thickness are linearly related for high productive Aquifer formation, thus these indices generated from thickness and resistivity have been examined in other to determine the porosity and permeability and hence transmissivity of the aquiferous zone in the study area. Aquifer resistivity ranges from 7.7Ωm to 545Ωm in weather zone and between 9.5Ωm to 1902.6Ωm in fracture zone these values are within productive range in basement complex environment. Shallow basement of less water potential have been found in part of North west and north east of the study area, total transverse resistance also discovered low porosity at Aiyedun quarters, Elemi housing Estate and Ita Eku these are hard rock zone, this area has also been identified through their coefficient of anisotropy as low or none productive zone the coefficient of anisotropy is higher than 1.5. Area of promising water bearing zone are with the North west, west, south west and south east of the study area.

Keywords: *Anisotropy, resistivity, reflection coefficient, fracture, aquifer, longitudinal conductance*

1. Introduction

Water is essential in our daily activities, it is required for drinking, domestic and industrial use, the quality of water needed depend on the use hence availability of water in quality and quantity is essential for human existent. Water is unique, a combination of hydrogen and oxygen when put together in billons form liquid water. It weight, density and energy provide comfort for human existence on the planet Earth. There are various sources of underground water, easy access to the source depend on the geological formation of the environment and it potentials. In basement complex environment weathered and fractured zones are known to be the sources of groundwater potentials unlike sedimentary area where ground water is in confined aquifer.

The increase in demand for water due to the rapid growth in urban development necessitated more research into ground water exploitation in basement complex of Ado-Ekiti and consequently the deployment of various methods. Vertical electrical method developed in 1900s has brought about more improved method and approach to underground water exploration. One method seems not to be enough in geophysical investigation there is a need to look into other index for an improved investigation, the combination of all indices will lead credence to the result hence this work is a further application of coefficient of anisotropy, reflection coefficient and fracture coefficient on spatial distribution of underground water in Ado Ekiti basement complex

The study of anisotropy is important in basement complex, the direction of current flow and the influence of the geological formation is important in determining waterpotentialin this environment. Electrical resistivity survey technique has proved to be an effective and reliable tool in locating viable aquifer for continuous and regular water supply [1][2]. Vertical electrical resistivity sounding have been carried out in the study area with the aim of delineatingaquifer potential in form of high, moderate and low ground water with the aid of guiding the public in ground water planning, development and exploration in Ado-Ekiti basement complex of south west Nigeria.This further approach is to correlate with other parameters used in similar environment. There can be no single index that determines groundwater potential but combination of some factors are necessary for optimum mapping of ground water productivity mostly in weathered and fracture zones.

It is difficult to source out underground water in the study area even through the hand dug well. Hard rock, intrusive rock is easily encountered during the process. Problem of non-productive hand-dug wells, fail boreholes and erratic supply from the state government water supply agency prevailed in the study area. Basement complex topology is known to be associated with faults, joints and lithological contracts.

[2] combined Dar zarouk parameters of transverse resistance and coefficient of anisotropy in Bwari basement area of central Nigeria so also [3] used VES to obtain resistivity indices in evaluating ground water potential in Ajana area south western Nigeria. [4]Also examined application of Dar zarrrouk parameter and coefficient of Anisotropy to groundwater potential evaluation in Ado Ekiti southwest Nigeria.

2. Study Area and Its Geological Formation

The study area is Ado Ekiti municipality, Ekiti state Nigeria. It covers Ado local Government and part of Ifelodun/Irrepodun local Government area toward the north. It is within 733000mE to 765000mE and between 835000mN to 855000Mn (Figure 1) covering approximately 640km^2. Ado Ekiti is situated at the centre of Ekiti region of western Nigeria. It is bounded in the south and East by Ondo state through IkereEkiti Local Government area in the North by kwara state and Kogi State in the west by Osun State. The population is about 427700 according to 2016 population censor; the elevation is between 334m to 510m.

Ado Ekiti is surrounded with hills and ridges of basement complex topography, it lies in tropical section of western Nigeria, average rainfall is about 1400mm per annual, and two seasons exist in the area, a period between April to October as rainy seasons and between November to March known as dry season. The vegetation is of thick evergreen forest now being depleted through urban encroachments.

Ado Ekiti and its environment are underlain by Precambrian crystalline rocks of the western Nigeria Basement complex. CharnokiteBauchite rocks migrate from the southern part of the study area piecing into the centre and tending to the North. This rock is enclosed east to west segment with older Granite, the extreme East and west is underlain with migmatite Gneiss.

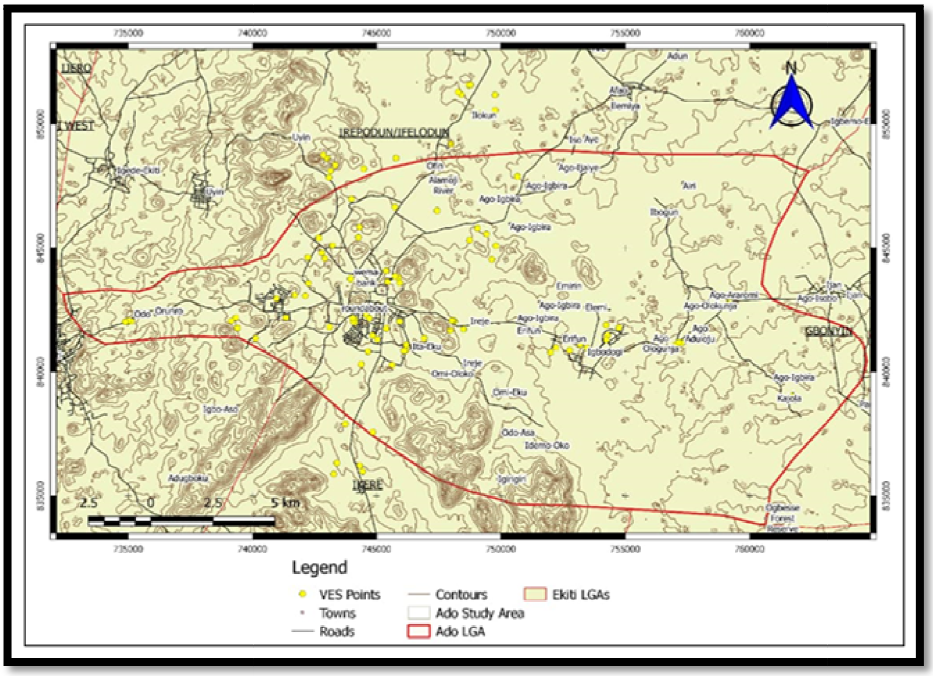

Figure 1: Topographical Map of the Study Area Showing the VES Stations

3. Materials and methods

Ohmega campus Terrameter and its accessories were used for electrical sounding with Garmin 12 GPS Equipment for geospatial information of all vertical electrical sounding points. The work considered the Schlumberger model array for its deeper penetrating power with half electrode spacing of $\frac{AB}{2}$to maximum of 150m Figure 2.Apparent resistivity was computed based on Ohm's law on current flowing through a material using equation 1.

$$\rho_a = \frac{\Delta V}{I}\pi[\frac{s2}{a} - \frac{a}{4}] \quad 1$$

Where Pa is apparent resistivity

$\pi\,[\frac{s2}{a}-\frac{a}{4}]$ is the arrangement of Electrodes also express as K(Figure 2)

$\frac{\Delta V}{I}$ as R (Resistance)

Therefore $\rho_a = RK$ 2

R is measured with Ohmega Campus Terrameter

K is computed as constant at every AB/2

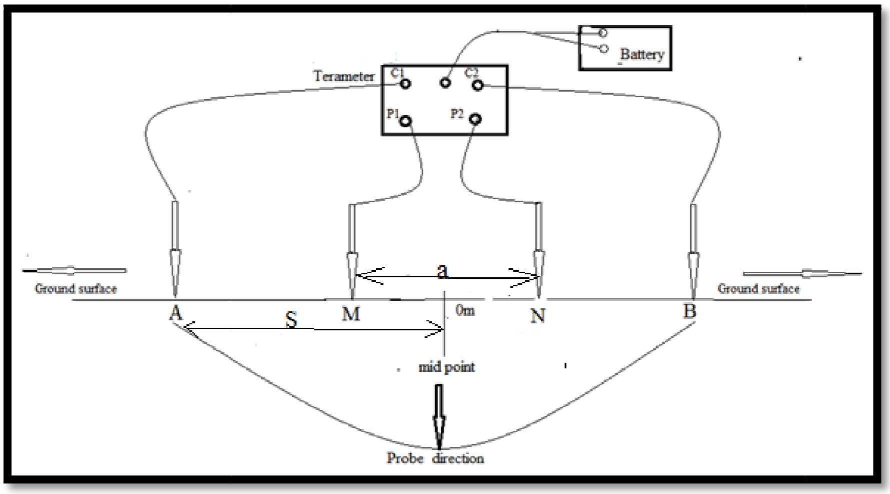

Figure 2: Sketch Diagram of Schlumberger Array for Vertical Electrical Sounding

The computed apparent resistivity and AB/2 values were processed with WIN Resist Geophysical computational iterative software and presented as depth sounding curves with layers resistivity and thickness respectively. From the two primary parameters all other Aquifer indices such as Longitudinal conductance (S),Transverse resistance (T), Longitudinal resistivity(P_L), Transverse resistivity(P_T) and Coefficient of anisotropy (λ) were computed using the following mathematical equations.

Longitudinal conductance. $S=\sum_{i=1}^{n}(\frac{h_i}{\rho_i})$ 2

Transverse Resistance $T=\sum_{i=1}^{n}(h_i\rho_i)$ 3

Longitudinal Resistivity $P_L=\frac{H}{S}$ 4

Transverse Resistivity $P_T=\frac{T}{H}$ 5

Coefficient of anisotropy $\lambda=\sqrt{\frac{PT}{PL}}$ 6

Where '*H*' is the total thickness of all layers in each sounding point.

h_i= thickness of aquifer

ρ_i = resistivity value of the aquifer

The reflection coefficient (R_C) and Fracture contrast (F_C) were then calculated from [5] formula as follows;

$Rc=\frac{Pn-Pn-1}{Pn+Pn-1}$ **7**

$Fc=\frac{Pn}{Pn-1}$ 8

P_n is the layer resistivity of the nth layer

P_{n-1} is the layer resistivity overlying the nth layer

4. Results and Discussion

4.1. Aquifer Thickness

Aquifer thickness is important as the volume of water depends on the thickness of the water body, aquifer of a considerable thickness would transmit water in a water filled weather basement or fracture basement. The result show minimum thickness of 3.1m at Kajola and Egbewa, 4.9m at Agric Training centre and Kajola respectively. 6.0m at Owode off Nover Road, Aiyedun, and 6.1m at FM Iworoko road these are shallow aquifer that might be due to clay content and clayed sand in the weather zone. The highest thickness is 82.9m found at Fagbohun.Figure 3 shows the spatial distribution map of aquifer thickness.

4.2. Aquifer Resistivity

Aquifer resistivity is a function of the composition; the fluid flowing through, the amount of water present and the lithology of the aquifer, in clay formation the resistivity is low. The aquifer resistivity in the study area ranges between 7.7Ωm -Egbewa area to 1902.6Ωm-Elemi housing estate both weather and fracture area but aquifer resistivity ranges from 7.7Ωm to 545.6Ωm in weather zone and between 9.5Ωm and 1902.6Ωm i fracture basement as in figure 4.

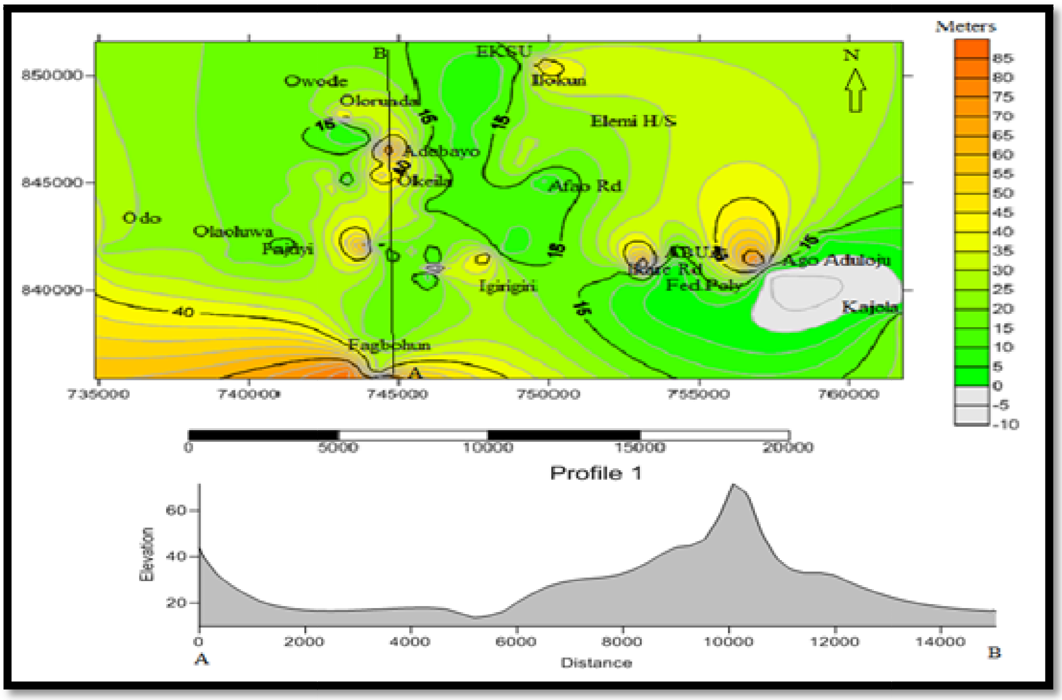

Figure 3: Isopach Map of Aquifer in the Study Area

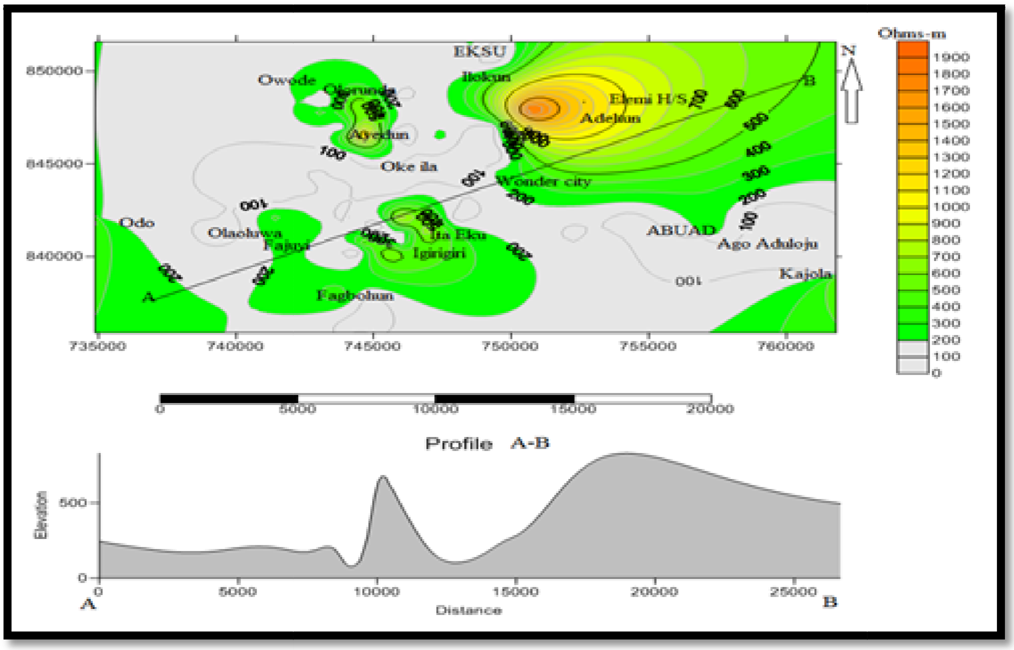

Figure 4: Aquifer Resistivity Map and a Profile along A-B in the Study Area

4.3. Longitudinal conductance

Longitudinal conductance in the study area varies from one VES station to the other. This is due to the difference in the underline rock formation. Increase from one point to the next indicates increase in thickness of the low-resistivity materials the range is between 0.0023mhs to 2.3mhs. The low longitudinal area represent low thickness and high resistivity this indicates shallow basement environment with less water potential this is found in North west and north east. Area with moderate thickness and resistivity occupies 60% of the study area these are found in the west, south and centre of the study area as seen in figure 5.

4.4. Transverse Resistance

This is significant for current flows normal to the bed; high values of transverse resistance indicate high resistivity formation or high thickness of formation hence low porosity. The range is between 43.8 Ωm² to 3165333.13Ωm². Higher record was recorded at Aiyedun quarters (340174 Ωm²), Elemi housing Estate (563059.55Ωm²) and ItaEku (3165333.12 Ωm²) these areas are hard rock zone of low porosity. Area with low total transverse resistance means area of shallow aquifer; figure 6 show the distribution of transverse resistance in the study area the map also correlate with the coefficient of anisotropy map. The green/red portions in the map are low productive zone.

4.5. Coefficient of Anisotropy

Formation anisotropy is an index good to be study in groundwater exploration in basement complex it gives a clue to the direction of electrical conductivity in subsurface it depends on the interconnectivity of the interstices. Anisotropy in resistivity is the square root of the ratio of the measured transverse resistivity to longitudinal resistivity and it is usually between 1 and 2 and it indicates area of most prolific to explore. The coefficient of anisotropy in the study area ranges from 0.98-7.74 figure7. Area suggest to be promising water bearing zone are within the North west, West, South west and south east of the study area and these area are within 0.98 to 1.6. The value is high at north east towards Afao road, Elemi housing Estate and centre of the study area, Ita Eku and OlopeIdofin.

This map is almost the same as Total transverse resistance map. The high value in the two maps indicated high resistivity of formation at this zone and consequently a low or none productive zone. The zone is not good for water exploration. High resistivity means low porosity and permeability. [6]says that porosity is the major control of the resistivity of rocks and that resistivity generally increases as porosity decreases. Area with less than 1.5 value of coefficient of Anisotropy lies within North, North West, West and South east these are area with high porosity and permeability hence good for groundwater development.VES 104 at Apata Nathaniel in Aiyedun quarters value is 1.67 it was drilled to 81metres without appreciable yield. [7] Suggested a range of 1.39 to 1.66 as good for borehole well development. A further extension of drilling depth to 100m could have entered the favourable fracture zone and hence an appreciable result, only drops of water was seen on the suite coming from the well.

4.6. Reflection Coefficient (Rc)

Reflection coefficient is one of the indices that give insight to verifiable aquifer zone in hard rock environment, low reflection coefficient value indicate fracture zone of the basement rock and hence underground water zone while high value of reflection coefficient indicate basement. From figure 8 and result in the study area, reflection coefficient values ranges from -0.98 to 0.91 which indicate high percentage of fracture zone the result are presented in table 1.

4.7. Fracture Contract (Fc)

The highest value of fracture contract is 23.57 found in part of EKSU, Fajuyi Housing estate, Ajebandele (19.25),Ago Aduloju (18.22) while the lowest value is 0.011 at ItaEku road.

Consequently, the highest value occurs in southwest centre of the study area while the lowest value is noticeable at south east and northwest this area (lower value) is good for water prospecting. Fracture contrast gives evident of water fill fracture. [8] says that reflection coefficient value of <0.9 and resistivity contract value of <19 may indicate high-density water-filled fractures [9]. Thus in the study area the fracture zone is adjudged to have high-density water fill aquiferous zone, hence region of Northwest, south east, north, northwest and south east of the study are good for water prospect as in figure 9.

Eastings (m)	Northings (m)	Resistivity P	Thickness (m)	Long. Lc	Transverse Tr	Coefficient of Anisotropy	Reflection coefficient	Fracture Coefficient
745736.97	846658.3	12.4	17.3	1.61	770.78	1.57	-0.59	0.26
747995.86	849198.39	237.9	6.1	0.30	2364.03	1.55	0.23	1.59
745777.93	848631.79	86.8	13.7	0.24	1679.68	1.06	0.21	1.55
744483.31	848202.84	640.5	35	0.06	54005.80	1.49	-0.41	0.41
743085.29	847847.46	352.5	8.7	0.08	5855.43	1.03	0.29	1.84
743984.64	846983.31	128.3	6	0.09	1626.29	1	-0.05	0.89
744317.65	845842.74	336.8	33.1	0.17	13870.21	1.03	0.2	1.51
742676.81	845412.38	63	30	0.32	16228.38	1.3	-0.74	0.15
743947.28	843752.64	119.6	33.3	0.49	8520.73	1.01	-0.13	0.76
742234.75	844618.81	74.5	20	0.04	11019.69	1.5	-0.87	0.06
741352.68	842195.81	330.6	11.5	0.26	3841.90	2.18	0.91	23.61
743107.59	841806.76	208	36.9	0.45	13495.50	1.09	0.3	1.86
744654.65	840820.81	545.6	18.4	0.09	11152.16	1.23	0.63	4.53
744378.22	840312.33	13.6	20	0.07	21145.14	1.64	-0.97	0.011

Eastings (m)	Northings (m)	Resistivity P	Thickness (m)	Long. Lc	Transverse Tr	Coefficient of Anisotropy	Reflection coefficient	Fracture Coefficient
743740.43	837902.82	369.6	20.9	0.53	8304.00	1.99	0.9	19.25
744846.06	837570.41	41.2	20	0.29	13181.25	1.07	-0.65	0.2
745626.39	840278.78	648.8	16.3	0.15	10762.21	1.92	0.87	14.29
745930.11	842035.11	812.9	15	0.80	69650.84	3.66	-0.19	0.67
746914.79	841364.1	681.4	30	0.26	3165333.12	7.74	-0.95	0.03
748498.21	841722.66	167.3	8.9	0.40	1774.13	1.45	0.75	7.12
753454.4	840968.11	141.6	12.2	0.12	4233.96	1.07	-0.31	0.52
744582.62	842310.91	103.7	20	0.16	3915.02	1.12	-0.37	0.45
745887.36	843783.52	64.7	6.2	0.16	759.89	1.13	-0.31	0.52
749633.28	844546.75	254	11.6	0.52	3236.23	1.95	0.88	16.18
750658.14	847886.62	1902.6	20	0.18	563059.55	2.95	-0.48	0.35
747430.76	846511.3	247.6	7.6	0.09	2988.92	1.11	0.42	2.46
749310.99	846948.32	25.7	26.8	1.28	2213.16	1.4	-0.71	0.16
734974.91	842007.54	479.2	15	0.28	502.84	1.32	0.9	20.3
735124.38	842039.01	186.5	24.5	0.36	4698.77	1.39	0.81	9.51
735011.39	842071.64	287.2	21.1	0.52	1942.75	1.25	0.52	3.24
734881.03	842019.37	404.1	40	0.54	32200.90	1.59	-0.02	0.95
757261.26	841177.17	215.7	19.3	0.21	4613.27	1.2	0.67	5.1
757037.09	841006.93	70.7	11.8	0.58	1595.64	1.15	0.03	1.07
757136.67	841191.87	322.5	79.9	0.55	26485.14	1.38	0.89	18.22
756979.74	841063.79	99.3	67.7	1.25	6939.85	1.22	0.78	8.28

Table 1: Summary of Vertical Electrical Sounding Results VES 1-35

Eastings (m)	Northings (m)	Resistivity P	Thickness t	Long. Lc	Transverse Tr	Coefficient of Anisotropy	Reflection coefficient	Fracture Coefficient
748132.88	842043.45	23.7	12.4	0.63	617.72	1.07	-0.4	0.43
748076.55	842083.6	65.7	26.8	0.63	2123.98	1.02	0.25	1.69
748024.17	842073.62	26.6	10.7	0.43	505.09	1.11	-0.54	0.29
747964.79	841673.79	222.4	49.1	0.65	11379.65	1.37	0.76	7.54
744133.53	841990.24	129.9	28	0.32	5327.76	1.04	-0.09	0.83
744120.53	842133.38	221.8	16.4	0.10	6295.50	1.01	-0.03	0.93
744055.4	842037.78	80.8	73.9	1.31	7620.53	1.01	0.12	1.28
744036.29	842177.81	60.2	52.7	0.93	7868.46	1.28	-0.74	0.15
746189.69	841049.97	348.4	141	0.11	5880.70	1.21	0.62	4.26
746159.98	840865.42	301.6	12.2	0.09	10768.72	1.03	-0.17	0.71
746196.16	841104.7	25.6	5.1	0.22	472.43	1.32	-0.67	0.2
746105.5	840846.09	21.2	4.9	0.24	489.32	1.54	-0.78	0.12
754222.85	841891.12	31.4	9.2	0.40	762.66	1.1	-0.42	0.4
754734.96	841772.76	53.3	19.5	0.40	1744.26	1.07	-0.46	0.36
754283.93	841476.55	45.9	15.2	0.36	985.75	1.06	-0.5	0.33
754227.83	841301.68	77.8	3.4	0.24	1877.52	1.01	-0.09	0.83
743152.28	848114.24	128.7	56.5	0.37	22137.08	1.07	-0.29	0.54
743336.85	848351.2	159.3	33.7	0.24	7390.37	1.06	-0.12	0.77
743024.66	848609.58	114.4	30	0.35	18522.58	1.11	-0.42	0.4
742856.56	848747.01	220.8	22.7	0.30	13729.77	1.07	-0.06	0.87
741706.23	843098.93	59.5	24.5	0.62	2640.42	1.02	-0.012	0.97

Eastings (m)	Northings (m)	Resistivity P	Thickness t	Long. Lc	Transverse Tr	Coefficient of Anisotropy	Reflection coefficient	Fracture Coefficient
740972.93	842955.09	79.4	20	0.11	1792.95	1.01	-0.18	0.68
742133.17	843071.6	141.1	25	1.58	1723.28	1.09	0.66	4.96
742257.51	843581.14	29.2	24.6	0.18	4299.15	1.01	-0.67	0.19
761797.43	838974.79	221	10.7	0.11	2379.80	1.41	0.87	14.63
761708.72	838876.57	517.8	24.3	0.24	19326.88	1.26	0.34	2.04
761592.91	838968.14	126.4	4.9	0.28	1137.27	1.19	0.37	2.17
761745.26	839037.21	135.4	3.1	0.10	1035.02	1.15	0.03	1.07
745749.65	843850.42	19.7	22.1	1.30	605.60	1.02	-0.24	0.6
745382.35	844083.93	24.3	24.1	1.28	705.72	1	0.05	1.1
745441.66	843641.7	17.9	27.3	1.64	820.36	1.09	-0.52	0.31
745936.75	843600	29.7	23.2	0.15	4251.47	1	-0.7	0.17
759225.04	842649.51	9.4	6.1	0.70	165.49	1.33	-0.75	0.14
759224.95	842666.11	70.7	14.2	0.54	2777.25	1.04	-0.06	0.88
759200.35	842792.6	132.6	20.6	0.29	8351.61	1.73	-0.37	0.45
759180.41	842737.17	112.1	15	0.47	43.80	1.1	0.87	14.94
744443.21	835985.7	109.6	82.2	0.72	16351.86	1.08	-0.24	0.61

Table 2: Summary of Vertical Electrical Sounding Results VES 36-72

Eastings (m)	Northings (m)	Resistivity P	Thickness t	Long. Lc	Transverse Tr	Coefficient of Anisotropy	Reflection coefficient	Fracture Coefficient
743398.22	836329.5	111.6	82.9	0.75	17211.27	1.12	-0.25	0.58
743273.5	835887.57	112.2	79.8	0.63	35501.08	1.44	-0.58	0.26
744318.76	836216.17	35.4	22.4	0.64	1675.16	1.32	-0.83	0.08
751989.91	840784.57	157.3	18.3	0.74	538.03	1.02	0.72	6.14
752203.21	840983	28	15	0.57	542.97	1.03	-0.44	0.38
753180.77	841101.89	117	97	1.15	16712.02	1.3	-0.19	0.68
752758.22	840869.15	159.7	16.6	0.26	2849.42	1.22	0.64	4.53
749416.39	845562.85	22.7	19	0.88	871.70	1.19	-0.67	0.19
749052.73	845799.42	23.3	26.9	1.18	1068.86	1.18	-0.77	0.12
748743.12	845319.6	17.5	19.6	1.14	909.85	1.4	-0.84	0.08
749792.29	845095.23	137.3	3.4	0.06	302.34	0.98	0.34	2.01
739319.23	842194.47	107.4	17.9	1.21	1246.99	1.85	0.76	7.2
739135.32	842060.79	113.4	25	1.67	1367.56	1.65	0.75	7.31
739380.24	841768.24	9.5	16.5	1.89	470.78	1.23	-0.67	0.19
740134.74	841357.17	91.8	20	0.35	101.79	1.01	0.67	5.1
742912.23	844580.16	147.7	30.8	0.21	7182.58	1.18	-0.98	0.01
742797.63	844808.21	32.7	35	1.34	1621.37	1.01	-0.17	0.7
743225.34	845106.65	7.7	3.1	0.41	319.51	2.5	-0.94	0.03
744266.1	845434.67	120.7	50	0.94	18465.53	1.28	-0.22	0.63
744842.03	841473.28	83.4	10.6	1.90	210.62	1.22	0.85	13.03
745028.65	841316.28	82.5	17.1	2.36	243.53	1.16	0.83	10.85
744712.15	842164.68	102.1	17	1.71	337.37	1.2	0.81	10.01
745394.35	841753.31	96.2	23.1	0.62	1984.65	1.23	0.07	1.17
748405.64	851203.05	157.1	12.4	0.29	1967.24	1.65	0.88	16.36
748282.53	851294.6	106.9	11.9	0.32	1302.11	1.41	0.79	8.9

Eastings (m)	Northings (m)	Resistivity P	Thickness t	Long. Lc	Transverse Tr	Coefficient of Anisotropy	Reflection coefficient	Fracture Coefficient
749760.2	851179.47	101	12.7	0.20	1425.95	1.054	0.45	2.69
749167.71	850411.71	89	15	0.04	3125.01	1.2	-0.64	0.22
749764.09	850560.54	103.7	52.9	0.56	8006.01	1.05	-0.44	0.38
748771.5	851586.06	117.2	28.2	0.29	5485.05	1.04	-0.33	0.5
749760.2	851179.47	381.3	30	0.15	58958.95	1.08	-0.32	0.51
744597.56	846560.53	1288	80	0.00	340174.40	1.67	-0.91	0.05

Table 3: Summary of Vertical Electrical Sounding Results VES 72-104
Long. Lc =Longitudinal Conductance. Transverse Tr= Transverse Resistance

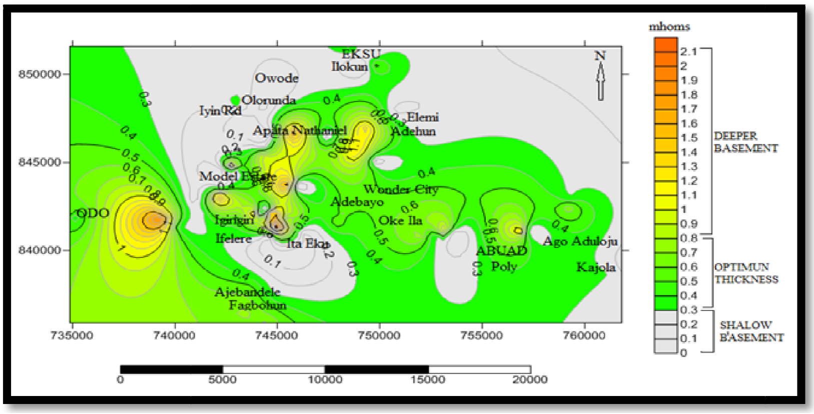

Figure 5: Longitudinal Conductance

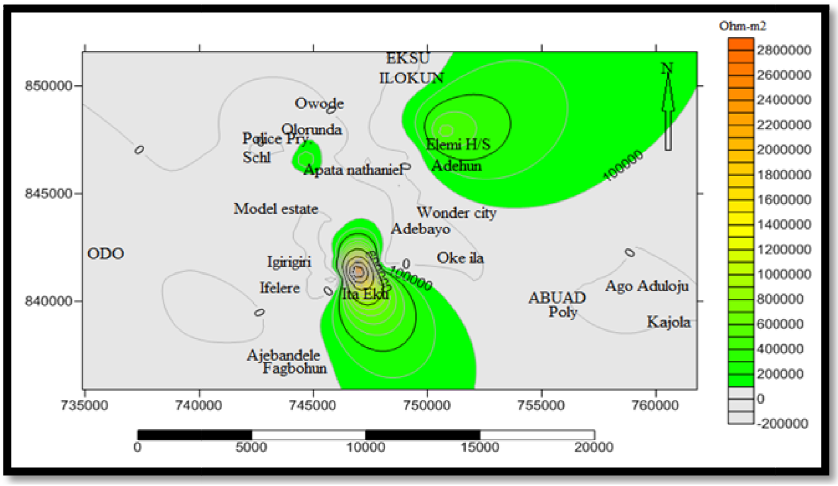

Figure 6: Transverse Resistance Map

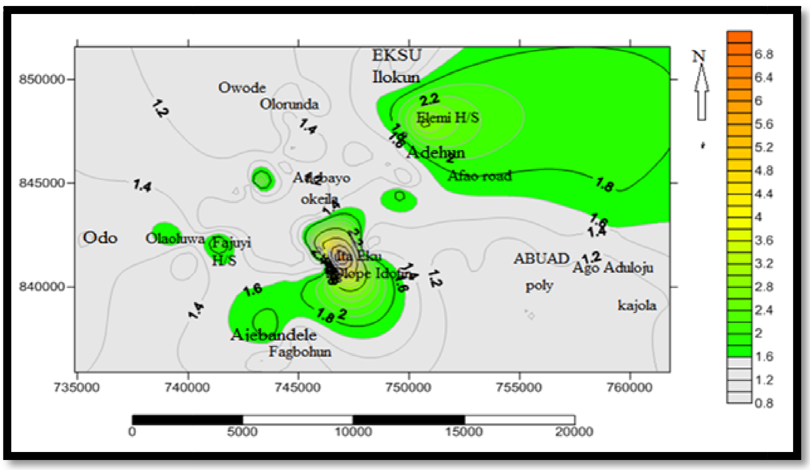

Figure 7: Coefficient of Anisotropy Map of the Study Area

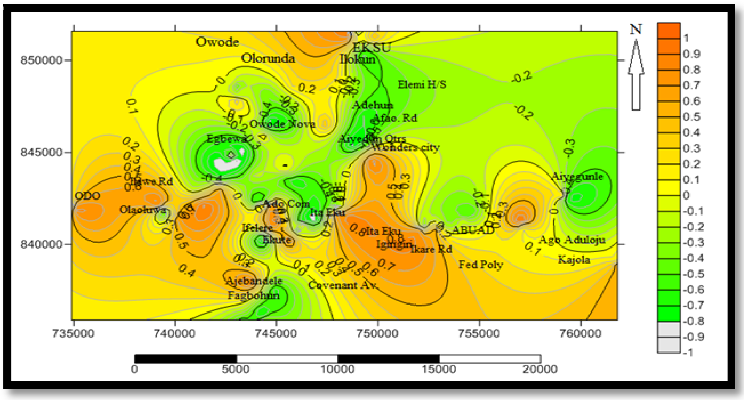

Figure 8: Reflection Coefficient Distribution Map

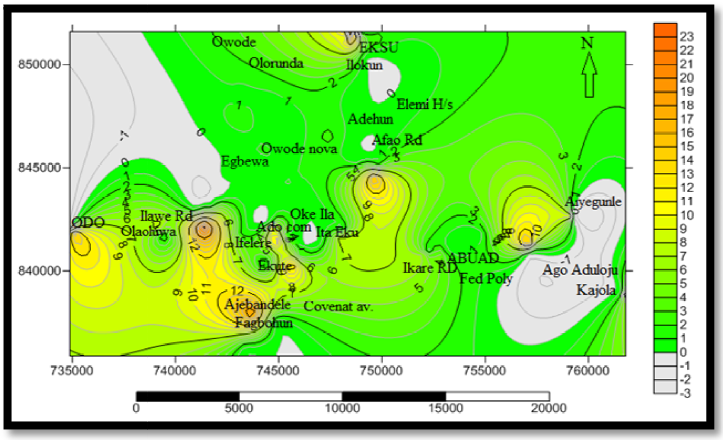

Figure 9: Fracture Contrast Distribution Map

5. Conclusion

This work examined the thickness of aquifer,its resistivity spread and other hydrogeological parameters such as total longitudinal conductance, total transverse resistances, coefficient of Anisotropy, reflection coefficient and fracture contract to determine water potentials in this study area. Resistivity and thickness are linearly related for high productive Aquifer formation, thusthese indices generated from thickness and resistivity have been examined in other to determine the porosity and permeability and hence transmissivity of the aquiferous zone. Aquifer is discovered in weather and fracture zone, aquifer resistivity ranges from 7.7Ωmto 545Ωm in weather zone and between 9.5Ωm to 1902.6Ωm in fracture zone these values are within productive range in basement complex environment. Shallow basement of less water potential have been found in part of Northwest and north east of the study area as in figure 5.Total transverse resistance also discovered low porosity at Aiyedun quarters, Elemi housing Estate and ItaEku these are hard rock zone .this area has also been identified through their coefficient of anisotropy as low or none productive zone the coefficient of anisotropy is higher than 1.5. Area of promising water bearing zone are with the North west, west, south west and south east of the study area (Figure7).

79.8% of the study area have coefficient of anisotropy (λ) less than 1.5 but aquifer depth is low 70% fell within low aquifer this underline the fact that other index have to be considered before generalizing aquifer potentials in basement complex. [9]proffers that fractured bedrock resistivity of less than 750Ωm is indication of high fracture and permeability hence high aquifer potential and that 750Ωm to 1500Ωm indicate low aquifer potential in Ado Ekiti. However, a sample well at Aiyedun quarters Apata Nathaniel of resistivity 1288Ωm was drilled to low aquifer zone it coefficient of anisotropy is 1.67, it reflection coefficient (-0.91) and fracture coefficient (0.05) are within acceptable figure of fracture basement. It was drilled to 81 metres depth without appreciable result, however its traverse resistance is very high 340174.40Ωm^2 an indication of low porosity hence the result. Aquifer indices must therefore be considered before recommending a well for drilling in basement complex one index might not be adequate.

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One needs to appreciate to Mr. O. Ayodele; his well was used as case study in the course of the research work.

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