https://acjpas.acu.edu.ng

ACJPAS
VOL. 4, NO. 2
2025

Ajayi Crowther Journal of Pure and Applied Sciences

A publication of the Faculty of Natural Sciences, Ajayi Crowther University

Ajayi Crowther Journal of Pure and Applied Sciences
https://acjpas.acu.edu.ng

Ajayi Crowther J. Pure Appl. Sci. 2025, 4(2), pp. 49-60.
https://doi.org/10.56534/acjpas.2025.04.02.06

Article

Hydrogeological Evaluation and Lithological Characterization of Crystalline Bedrock Terrain of Ilora and Environs, Southwestern Nigeria

Olanrewaju Akinfemiwa Akanbi* and Princewill Anne Kingba

Department of Earth Sciences, Faculty of Natural Sciences, Ajayi Crowther University, Oyo, Nigeria

* Correspondence: O.A.A (oa.akanbi@acu.edu.ng; 08055606353)

Article history: *received, Mar. 2, 2025; revised, Apr. 2, 2025; accepted, Apr. 4, 2025; published, Apr. 9, 2025*

Abstract

In order to delineate possible water-bearing zones in area underlain by crystalline basement area of Ilora and its environs; hydrogeological attributes were inferred from the lithological characterization of geo-electric parameters interpreted from seventeen vertical electrical soundings (VES) conducted across the study area. The results of the geo-electric parameters showed that the saprolite resistivity was between 19 – 1677 Ωm with the lithologies varying from clayey, sandy gravelly and compacted lateritic clay across the study area. The regolith thickness varies widely from 5 to 99 m while the topsoil thickness was between 0.1 and 6.2m. The bedrock resistivity was between 326 – 22589 Ωm with areas underlain by migmatite having more resistive bedrock. The bedrock resistivities of areas underlain by quartzites and schist are less resistive, and are characterized by fractures and weathered basement with higher potential for groundwater occurrence. The hydrogeological inference from the lithological interpretation obtained from the geo-electric results revealed that the lithology of the weathered middle layer (saprolite) at north-center and south-east locations is more of compacted to loose clayey soils while that of the western half is sandy. There are generally have thick regolith development and the center region is underlain by fresh crystalline bedrock, which is not capable of storing and transmitting water. The results established the heterogeneity of the crustal units in areas underlain by typical basement rocks. Notwithstanding, locations with sandy/coarse saprolite and those with clayey overburden underlain by fractured bedrocks in the southwestern parts showed greater potential for groundwater prospecting in the study area.

Keywords: Basement-crust, Geo-electric-parameters, Lithology, Saprolite, Bedrock, Water-bearing zones.

1. Introduction

Though there are other sources of water such as streams, rivers, ponds, etc., none is as hygienic as groundwater because groundwater has an excellent natural microbiological quality and generally adequate chemical quality for most uses [1]. Groundwater exploration has continued to remain an important issue due to its unalloyed needs. However, crystalline basement complex rocks typical of the study area in this research are relatively impermeable and have no storage capacity [2,3]. Thus, the ground water resource in such terrains, which are widespread in Africa, is limited. However, a good number of wells have been successfully developed in this area. To ensure maximum and perennial yields it is essential that a borehole be located where it can penetrate the greatest possible thickness of both the regolith and the fractured zone, before hitting the fresh bed rock.

To locate aquifer accurately, geophysical survey is often carried out and the most commonly used geophysical technique for groundwater exploration is the electrical resistivity. Electrical resistivity is aimed at identifying high conductivity anomalies, normally thought to be as a result of deep weathering and bedrock fracturing. Such anomalies are often further investigated by sounding in order to provide a more quantitative information on the geo-electrical profile and hydrogeological evaluation of the subsurface environment are inferred for well construction [4,5,6,7,8,9,10].

The purpose of the present work is to evaluate the hydrogeological attributes of Ilora and environs underlain by intrusive basement rocks for areas for possible groundwater occurrence from geo-electric interpretation using vertical electrical resistivity (VES) methods. VES is used to reveal the extent of weathering development, bedrock fracturing and lithologic attributes of the weathered regolith from the resistivity values, thereby delineating and locating the position of the permeable zones within the subsurface environment.

Areas underlain by the intrusive Basement Complex rocks such as Ilora town and its environs commonly have problem of groundwater supply due to the nature of the underlying rocks which lack primary porosity. Groundwater storage capacity in those areas is dependent on depth of weathering and intensity of fracturing of the underlying rocks and water-bearing zones normally occur in localized discontinuous ponds within the subsurface environment [10,11]. This discontinuous nature of the basement aquifer systems makes detailed knowledge and application of the geological, hydrogeological and geophysical investigations inevitable [6] for effective siting of boreholes [12,13].

1.1 The Study Area

The study area is situated in Afijio Local Government Area of Oyo state, southwestern Nigeria. The major township is Ilora with other adjoining areas such as Taiwo, Alade, Jinno, Falansa. It lies within latitude 7º 51′N and 07˚ 48′ N longitude 3º 52′ E and 3˚56′ E (Figure 1). The topography of Ilora and its environs is a gentle rolling low land. The area is fairly well drained with drainage converging in lowlands and in valleys. The drainage pattern is trellis. Surface water bodies fluctuate with seasons and some of their tributaries get dried up during the dry season and the water is used often for irrigation purpose. For domestic water utilization, groundwater is the only reliable and available water due to lack of piped- borne water supply in the area as typical of most towns and rural settings in developing nations of the world.

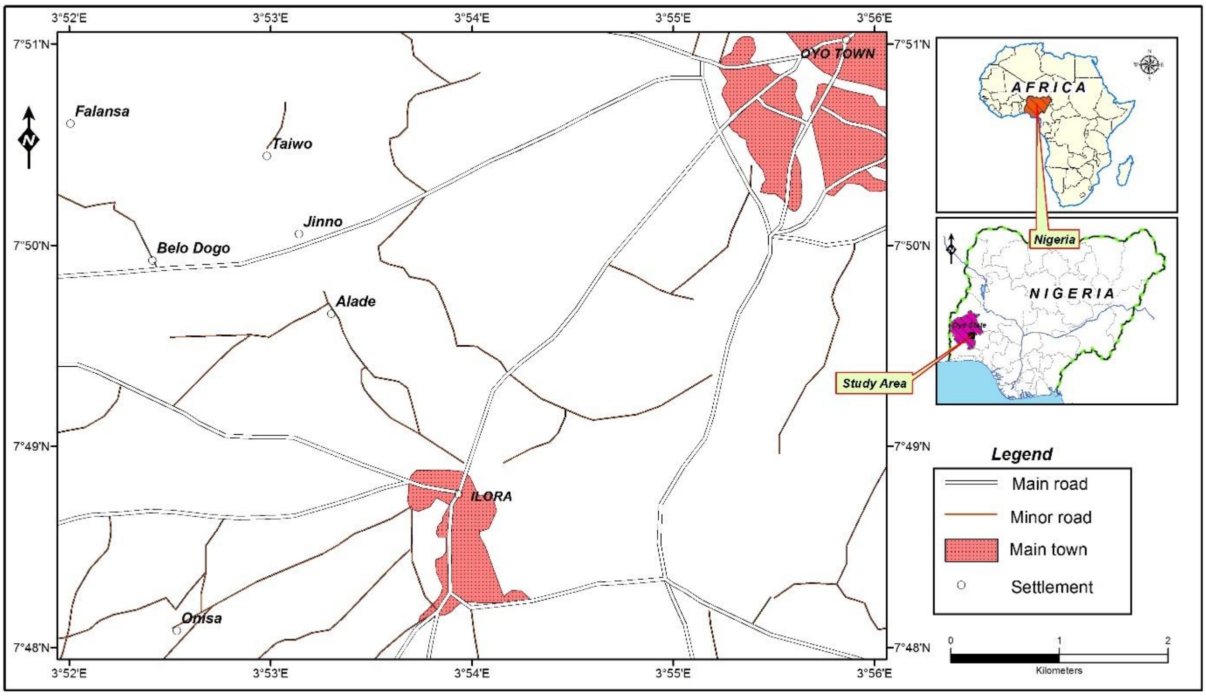

Figure 1: Location and Accessibility Map of the Study Area

1.2 Geological setting

Ilora lies within the basement complex of southwest Nigeria and has rocks that belong to the Precambrian crystalline basement complex rock suite of Nigeria (Fig. 2) namely; banded gneiss, granite gneiss and migmatite, with intrusions of pegmatite and quartzite veins. Over 70% of the mapped area was covered by migmatite. Most of the outcrops were isolated and majority of the outcrops in this region are covered by vegetation. The availability of groundwater in areas underlain by crystalline basement rocks depends on the development of thick soil overburden (overburden aquifers) or the presence of fractures that are capable of holding water (fractured crystalline aquifers). The storage of groundwater is confined to fractures and fissures in the weathered zone of the igneous and metamorphic rocks.

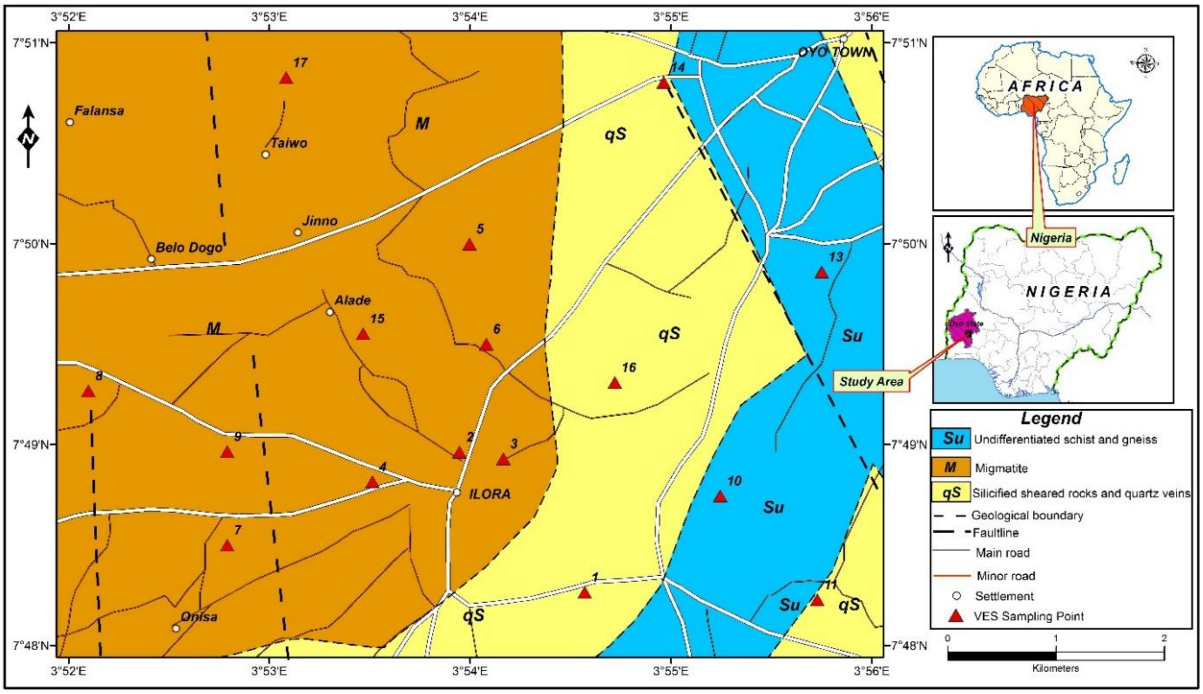

Figure 2: Geological map of the study area with VES points

2. Methodology

The study area is located in Oyo town, Oyo state. The area includes Ajayi Crowther University campus, Oke-ebo, Ameji Ogbe, Basorun, Akede, Idi-Ose, Alaodi, Alojo, Agbuo, and Akujo. The area falls within the basement complex terrain of south-western Nigeria and bounded by latitude $7^0 50'$N to $7^0 52'$N and longitude $003^0 56'$E to $003^0 57'$E (Figure 1). Average daily temperature ranges between 27^0C and 35^0C, almost throughout the year [8]. The area typically receives about 1200 millimeters of precipitation and has 208.28 rainy days (57.06% of the time) annually [9]. The vegetation pattern is that of rain forest. Cocoa and palm produce are mostly grown in the area. The topography of the area ranges from medium to low terrain above the sea level and ranges from 264m to 326m. The northwestern part of the area is a low lying area of which its elevation is about 264m. The peak of the topography is located at the southeastern part of the area which is about 326m high (Figure 1). The area is well drained. Majority of the rivers flows in a northwestern direction. The drainage pattern is the rectangular drainage pattern (Figure 2).

It is located within the Basement Complex of South Western Nigeria. Major lithological units are basically crystalline basement rocks. These rocks include undifferentiated schist, quartzite and migmatite (Figure 3). The extreme deformational structures of these rocks allow sufficient aquifer properties needed to generate the well water. Eighteen (18) water samples were collected randomly from hand-dug wells. The samples were collected in 1lilter capacity plastic bottles after rinsing with the sample and preserved airtight in order to avoid evaporation. Physical parameters such as temperature, EC, TDS, and pH of the sampled water were determined in situ using pH/EC/TDS/temp Hannan H19812-5 multi-meter. Samples were kept under air-condition prior to analysis. Major ions' concentrations (Na^+, K^+, Mg^{2+}, Ca^{2+}) were determined by ion exchange chromatography at TEMSOL Consulting Ltd Ibadan, while the major anions (Cl^-, NO_3^-, HCO_3^-, SO_4^{2-} and CO_3^-) were determined by flame photometry emission. Alkalinity measurements were carried out by acid titration with 0.02N H_2SO_4 added to each sample to reach its titration end point marked by a pH of 4.5. For quality control of the chemical measurements, standards and blanks were used in between runs to provide a measured of background noise, accuracy and precision.

For this present investigation, reconnaissance geological field work was carried out and geological and structural elements were identified and measured in the field. A total of seventeen (17) VES stations were surveyed in the study area (Fig. 2). Apparent resistivities were measured with Terameter and the Schlumberger electrode configuration was used. The principle of electrical resistivity method is based on Ohm's law empirical relationship between the current (I) flowing through a wire, of resistance (R) and the voltage potential (V) required to propagate the current, which is ; $V=IR$ and $R = \varrho L/A$ Where R is the resistance in ohms, A is cross-sectional area of the wire in square meter, L is the length in meter and ϱ is the resistivity in ohms meter.

Interpretation of VES Data

In depicting logical subsurface hydrogeological conclusions from the field VES data, quantitative and qualitative methods of interpretation were employed. The quantitative methods involved originating values for the primary geo-electric parameters that include the layers' resistivities and thicknesses either by curve matching or computer techniques. For the present work, integration of partial curve matching and computer iteration was employed. This was done by plotting the apparent resistivities values obtained from the field against the electrode spacing on a log-log chart. The curves obtained were then compared with those of auxiliary curve charts of Orellana-Mooney [14] to derive the true layer's resistivity and thickness for each geo-electric layer. These were employed as model values in computer iteration using Winresist VES software application.

Qualitative interpretation of VES data normally reveals reasonable hydrogeological deductions. These include curve type, basement topography and isopach of resistivity and thickness from which both the sub-surface lithological mapping and spatial variations across the study area were studied. For the present study, the qualitative interpretation approach of VES data is provided mainly in form of maps using Surfer 12 software. The lithology of the geo-electric layer was interpreted from the resistivities of the saprolite/overburden units [10] in Table 1.

Table 1: Subsoil and bedrock suitability as dumpsite liner based on the lithology [10]

Resistivity range (Saprolite) (Ωm)	**Lithology of saprolite**	**Suitability as Dumpsite Liner**
>400	Compacted clay/ hardpan	Excellent
< 50	Predominantly clay	Good
50 - 120	Sand and clay mixture	Fair
> 150	Predominantly sand to gravel	Poor
Resistivity range (Bedrock) (Ωm)	**Bedrock status**	
>1800	Fresh	Good/suitable
601 - 1800	Weakly/slightly weathered	Fair
<600	Fractured	Poor/Unsuitable

3. Results and Discussion

3.1 VES Curves

VES curve types obtained from the study area are; HKHK, H, QH and HA. Typical VES curves obtained are presented in Figure 3. The three layer H-type curve has the highest occurrence with 6 locations representing 35% occurrence in VES003, VES008, VES012, VES014, VES015, VES017. Curve type H is a 3-layer curve, characterized by a top soil, relatively more conductive middle layer that terminates on more resistive infinite layer. The resistivity of the top soil ranged from 5288.0 to 173.6 Ωm. The regolith thickness was 6.5 in VES017 to 98.9 m in VES014. The saprolite is largely sandy clayey soil and the bedrock resistivity ranged from 326 to 3966.3 Ωm and mostly weathered to fractured basement.

Curve type HA- type is a 4-layer geo-electric sequence that are found in 5 locations namely; VES002, VES005, VES007, VES009 and VES011. The resistivity of the top soil ranged from 3416.4 to 165.3Ωm. The thickness of the middle layer was between 3.7 and 29.5 m while the regolith thickness ranged from 5.1 - 45.7 m correspondingly for locations VES002 and VES007. The saprolite units are largely clayey and compacted laterites. The bedrock resistivities are mostly high and fresh and spanned from 3166 to as high as 22589 Ωm.

Curve type QH is also a 4-layer sequence that occurred in 5 locations namely; VES004, VES006, VES010, VES013 and VES016. The resistivity of the top soil ranged from 1451.7 to 261.2Ωm. The middle layer ranged from 6.9 to 21.3 m while the regolith thickness was between 10.1 and 30.4 m. The basement resistivities was 342.1 - 3679.0 Ωm. The bedrocks were comparatively lower to other curve types and are largely weathered basement. The lowest bedrock resistivity was found at VES004 in Ilora and it is interpreted as a fractured basement. Lastly, the six layer HKHK type curve has one occurrence in VES001. The regolith thickness was 17.9 m and the bedrock was 457.0 Ωm.

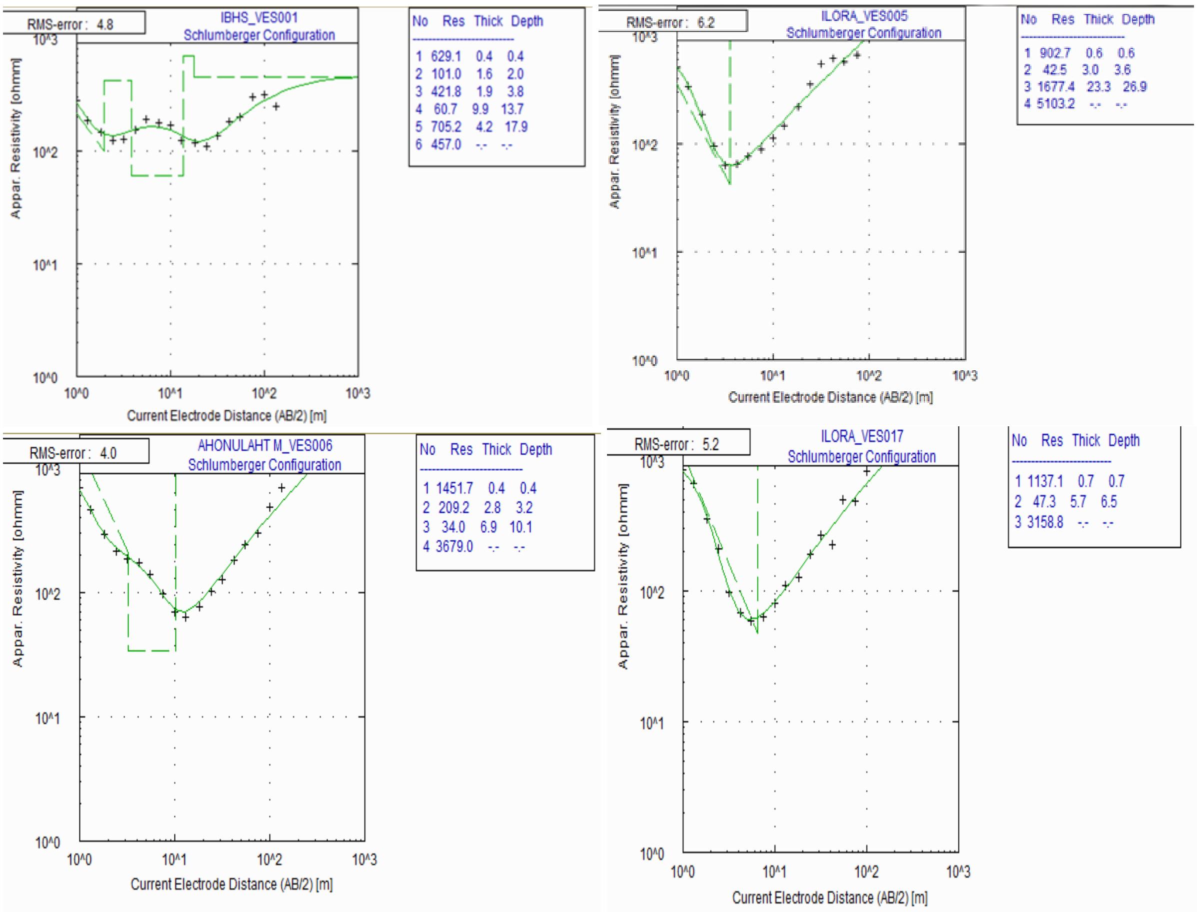

Figure 3: Typical VES curves obtained in the study area

3.2 Lithologic Interpretation

The lithological interpretation from the geo-electric parameters obtained from VES surveys is presented in Table 2. VES 001 is a 6-layer geo-electric curve type HKHK. The total regolith thickness is 17.9 m and it terminate on fractured bedrock of 457 Ωm. The saprolite layers ranged from sandy to lateritic clayey soils. VES 002 is a 4-layer HA curve with regolith thickness of 5.1 m. the saprolite is largely clayey and lateritic. This fine-grained overburden unit terminate on fresh bedrock with 9198.2 Ωm.

VES 003 has total regolith thickness of 22.1 m and it is 3-layer H type curve geo-electric section. The middle saprolite unit is less resistive with 115.9 Ωm that terminates on slightly weathered bedrock. VES004 is a 4-layer QH geo-electric section with total regolith thickness of 23.5 m that is largely clayey. The sequence terminates on fractured bedrocks with 342 Ωm. VES005 is 4-layer HA curve type geo-electric section with a total regolith thickness of 26.9 m. It has an impermeable bedrock overlain by thick clayey and compacted lateritic weathered layer.

Table 2: Geo-electric Parameters and Lithological interpretation obtained from interpreted VES survey

VES POINT	CURVE TYPE	LAYER NO	THICKNESS (m)	Resistivity	Lithology	Regolith Thickness (m)
VES001	HKHK	1	0.4	629	Top soil	
		2	1.6	101	Sandy	
		3	1.9	421	Lateritic clay	
		4	9.9	60.7	Sandy clay	
		5	4.2	705	Compacted clay	
		6		457	Fractured bedrock	17.9
VES002	HA	1	0.9	1985	Top soil	
		2	3.7	19.3	Clay	
		3	0.6	1988	Compacted Lateritic clay	
		4		9189	Fresh bedrock	5.1
VES003	H	1	0.9	5288	Topsoil	
		2	21.8	115.9	Sandy	
		3		1105.7	Weathered basement	22.7
VES004	QH	1	0.2	1158	Topsoil	
		2	2.7	446	Gravelly	
		3	20.7	44.7	Clayey	
		4		342	Fractured bedrock	23.5
VES005	HA	1	0.6	902.7	Topsoil	
		2	3	42.5	Clayey	
		3	23.3	1677.4	Compacted lateritic clay	
				5103.2	Fresh bedrock	26.9
VES006	QH	1	0.4	1451.7	Top soil	
		2	2.8	209.2	Sandy	
		3	6.9	34.0	Clayey	
		4		3679.0	Fresh basement	10.1
VES007	HA	1	0.7	953.0	Top soil	
		2	29.5	129.3	Sandy Clayey	
		3	15.5	329.8	Compacted lateritic clay	
		4		6502.1	Fresh basement	45.7
VES008	H	1	1.9	2665.1	Top soil	
		2	18.1	65.9	Sandy Clayey	
		3		326.0	Fractured basement	20.0
VES009	HA	1	0.6	3416.4	Top soil	
		2	12.3	94.4	Sandy Clayey	
		3	16.3	554.4	Compacted lateritic clay	
		4		22589.7	Fresh basement	29.2

VES010	QH	1	0.5	112.5	Top soil	
		2	3.4	75.5	Sandy Clayey	
		3	21.3	52.4	Clayey	
		4		644.7	Weathered basement	25.2
VES011	HA	1	0.1	165.3	Top soil	
		2	13.9	87.3	Sandy clay	
		3	1.0	243.4	Sandy	
		4		3166.2	Fresh basement	15.0
VES012	H	1	0.5	1549.4	Top soil	
		2	29.6	160.8	Sandy	
		3		3966.3	Fresh basement	30.1
VES013	QH	1	0.8	261.2	Top soil	
		2	10.3	173.9	Sandy	
		3	19.3	79.9	Sandy clay	
		4		1140.3	Weathered bedrock	30.4
VES014	H	1	3.8	173.8	Top soil	
		2	95.1	46.7	Clayey	
		3		1747.4	Weathered bedrock	98.9
VES015	H	1	6.2	207.8	Top soil	
		2	29.9	105.3	Sandy clayey	
		3		944.6	Weathered bedrock	36.1
VES016	QH	1	0.4	833.0	Top soil	
		2	3.0	261.6	Sandy	
		3	20.5	64.0	Clayey	
		4		704.3	Weathered bedrock	23.9
VES017	H	1	0.7	1137.1	Top soil	
		2	5.7	47.3	Clayey	6.5
		3		3158.8	Fresh basement	

VES 006 has fresh basement and a clayey layer of 6.9 m thickness; it is a 4-layer geo-section and total regolith thickness is 10.1m and a HK curve type was obtained. VES 007 indicates a 4-layer geo-electric section with total regolith thickness of 45.7m having a clayey layer which forms weathered zone with a thickness of 15.5m and a fresh basement and an HA curve type. VES 008 has a resistivity ranging from 2665.1 (top soil) – fractured basement of 326 and a H curve type, an aquifer can be explored from the fractured basement, a clayey soil of 18.1m thickness and it also has a total regolith thickness of 20.0m. VES 009 indicates a 4-layer geo-electric section with total regolith thickness of 29.2m having a clayey layer which forms the weathered zone with a thickness of 12.3m and a fresh basement and an HA curve type.

VES 010 has a fractured basement resistivity of 644.7 and above it is a thick clayey layer of 21.3m thickness which serves as an aquiclude for the fractured basement and has a total regolith thickness of 25.2m and a QH curve type was obtained. VES 011 indicates a 4-layer geo-electric section with total regolith thickness of 15.0m having a thick clayey layer which forms the weathered zone with a thickness of 13.9m and a fresh basement and an HA curve type. VES 012 indicates a 3-layer geo-electric layer of total; regolith layer of 30.1m and top-soil resistivity of 1549.4Ωm, the weathered zone has a total thickness of 29.6m and a fresh basement at the last layer and a H type curve was obtained. VES 013 showed a fresh basement and a thick clayey layer of 19.3m thicknesses, it also has a total regolith thickness of 30.4m and 4- layer of geo-electric layers with curve type QH.

VES 014 has a curve type H with 3-layer geo-electric section, the weathered layer is clayey with thickness of 96.1m which can serve as an aquifer and total regolith layer of 98.9m and the fresh basement follows. VES 015 has a fractured basement; weathered zone has a thickness of 29.9m and thick regolith thickness of 36.1m and a curve type H with 3-layer geo-electric layers. VES 016 shows a fractured basement and has a thick clayey layer of 20.5m thickness with total regolith thickness 23.8m and has a curve type QH with 4 geo-electric layers. VES 017 indicates a fresh basement and the weathered zone is clayey with 5.7m with total regolith thickness of 6.5m, it has a curve type H with 3 geo-electric layers.

3.3 Hydrogeological evaluation: Topsoil

Figure 4 showed the variation in thicknesses of the top soil in Ilora area. The top soil is mostly an alluvium which comprises of clay, sand and laterites. Generally, the thickness varies from 0.1 – 6.2 m. Thick topsoil is localized in the north-western terrain of the study area while the southern part is characterized by thin soil. Thick topsoil layer act as natural sieve for filtering water percolating into the subsurface.

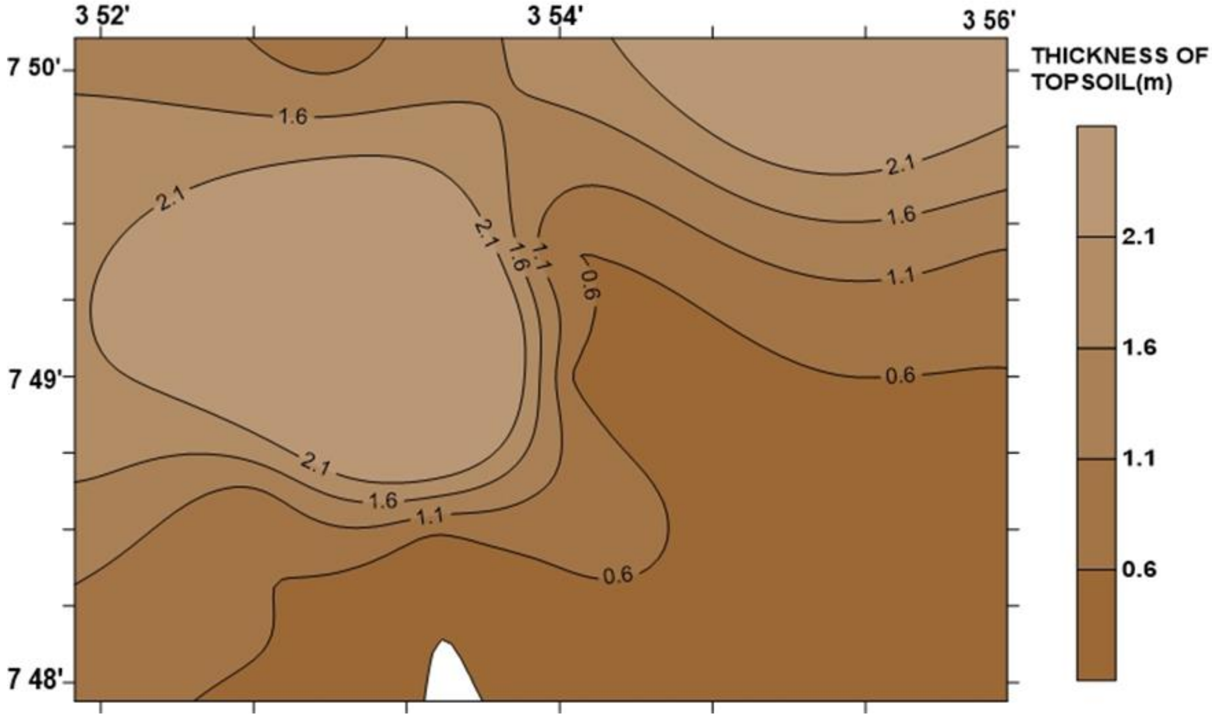

Figure 4: Isopach-topsoil thickness map across the study area

3.4 Saprolite Resistivity

The iso-resistivity map of the saprolite unit of the surveyed area is represented in figure 5. The saprolite layer is the soft, friable, weathered zone and the resistivity ranges from 34.0-1988.4Ωm. The resistivity is highest at VES002 and VES005. Regions which have the highest resistivity values are localized at the north-central. Lower resistivity values in the southern area of investigation are indicative of clayey fractions which are highly conductive. Low resistive areas is also an indication of water occurrence. Locations with sandy lithology will be more suitable to generate prolific water-bearing zones due to expected good porosity and excellent water transmitting capacity.

3.5 Saprolite Thickness

The thickness of the middle layer/saprolite across the study area is presented in Figures 6. The middle layer is the weathered/regolith unit that develop upon the crystalline bedrock. The saprolite is an important layer capable of storing and transmitting water. The thickness of the saprolite varies across the area. The thickness is more at the north-eastern areas and it ranges from 25 - 40 m and decrease generally towards the south with thicknesses of about 10-20m. the thickness of the saprolite is lowest at the central locations. Generally, the weathered unit is quite well developed in the area and it is capable of furnishing water to nearby wells provided that there is recurrent recharge [15].

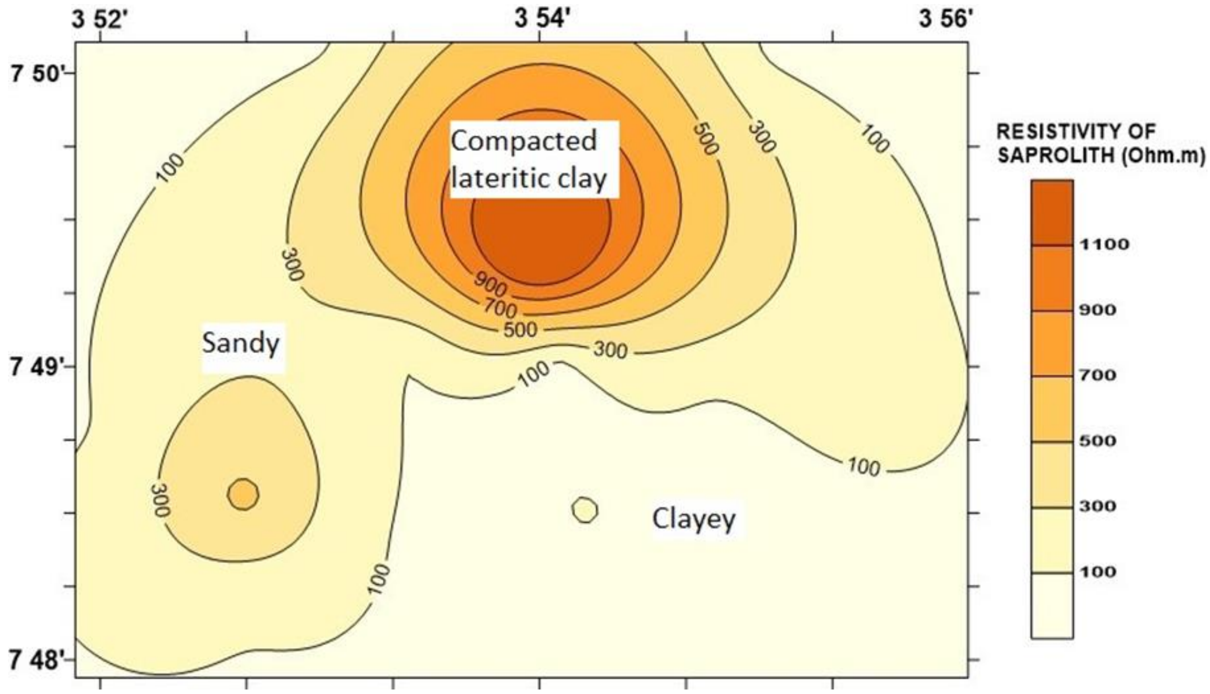

Figure 5: Iso-Resistivity map of Saprolite layer

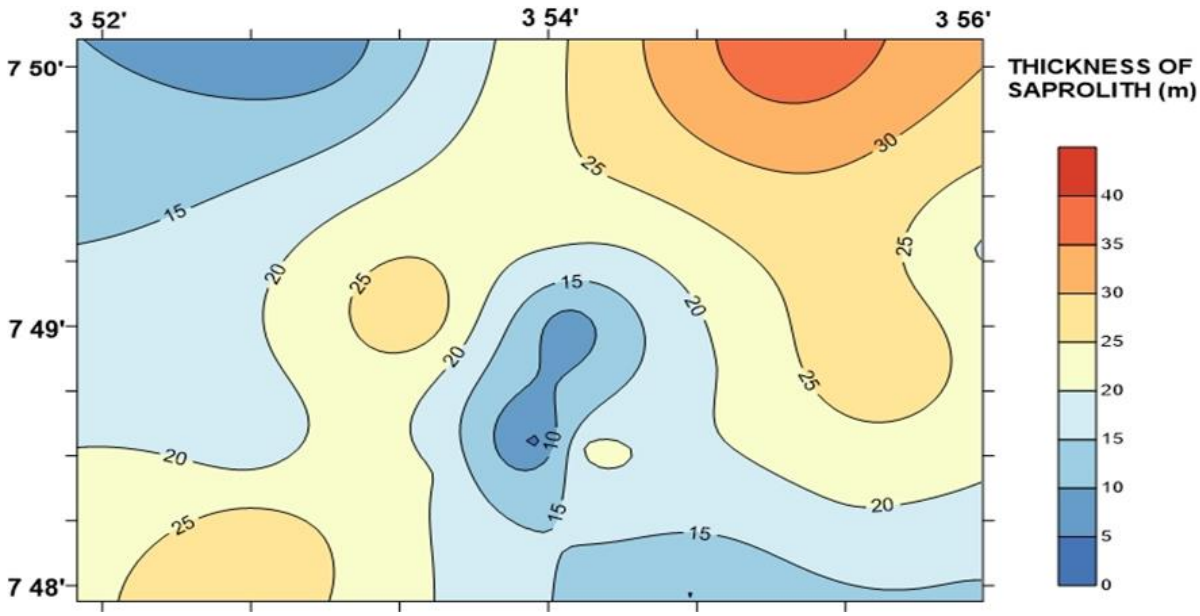

Figure 6: Isopach-saprolite thickness map across the area

3.6 Total Regolith Thickness

The total regolith thickness is the combination of all layers' thicknesses from the topsoil to the infinite layer. The spatial spread of regolith thickness across the surveyed area is presented in Figure 7. Weathering development is most pronounced at the south-west and north-east region with weathering thickness exceeding 20 m. Good weathering development is panacea to groundwater storage.

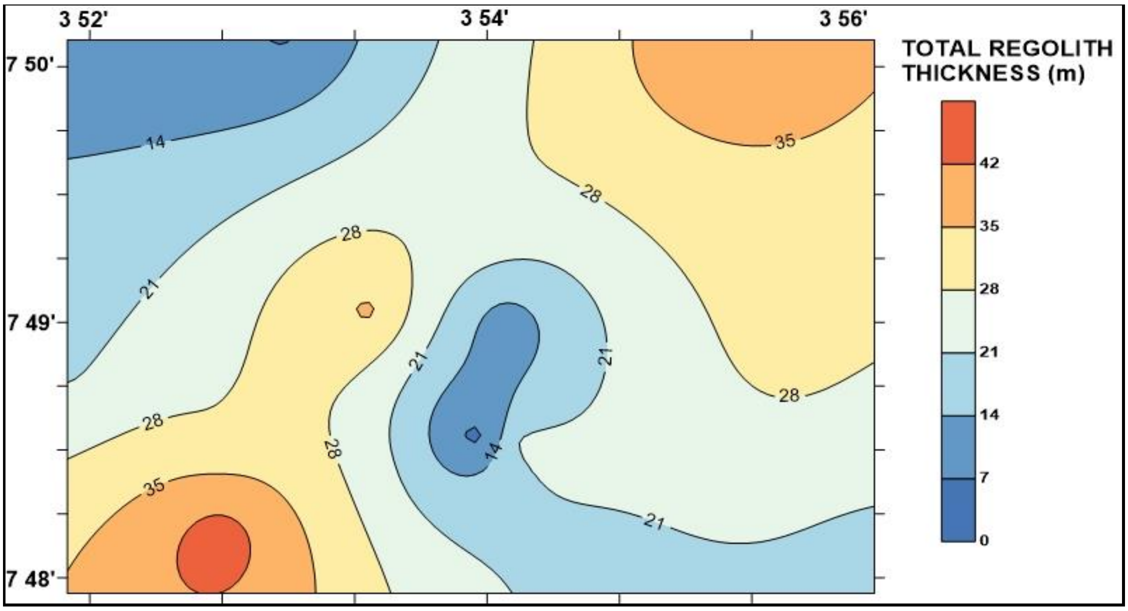

Figure 7: Isopach map of the total regolith

3.7 Basement Resistivity

The bedrock resistivity spread across the area is presented in Figure 8. Basement resistivity in the study area generally ranges from 326.0-22589.7Ωm. from the bedrock/basement resistivity, bedrock lithology can be inferred. Bedrock resistivity below 500 Ωm are regarded as fractured, and when between 500-2000 Ωm the bedrocks are weathered and above the limit of 2000 Ωm, it is taken to be a fresh basement [10]. North- central areas of towns southwestern regions of the study area have high resistive bedrocks and are fresh. This means that the potential for water occurrence is low. The only alternative water occurrence is the saprolite, the middle layer provided the lithology is sandy or gravelly. Areas underlain by migmatite at the southeastern part are the most resistive with resistivity exceeding 400 Ωm and represent location with the lowest potential for groundwater occurrence. In contrast, location underlain by schist and quartzites are characterized by less resistive bedrock and more likely to have good to excellent water-bearing potential.

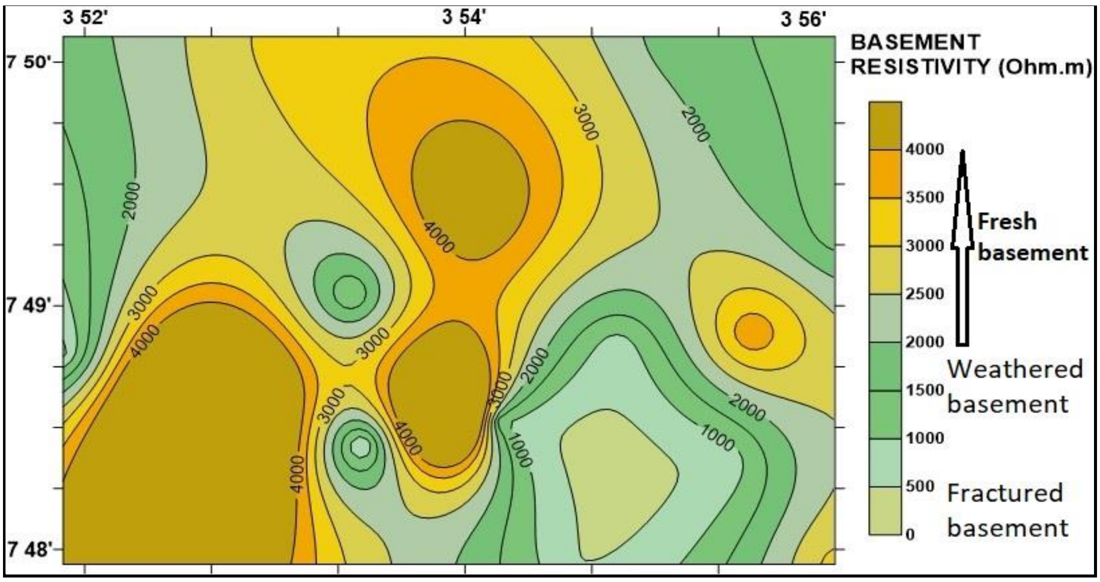

Figure 8: Bedrock resistivity across the study area

Areas with fractured bedrocks in the SW region (Figure 8) is overlayed by clayey or fine-grained regolith/saprolite (Fig. 5); and with lithological sequence, this location can provide artesian aquifer (free=flowing water bearing zones). Artesian aquifers are confined aquifers that are under pressure and when drilled, the water level in the well has capacity to rise above the aquifer level.

4. Conclusion

Electrical resistivity survey was carried out using seventeen electrical sounding across Ilora township and its environs in order to characterize the hydrogeological attributes through the lithological interpretation from the geo-electric parameters. The north-central proved to have the lowest potential due to the prominent development of lateritic compacted clayey saprolite overlying largely fresh impermeable bedrocks. Also, fractured bedrocks are not widespread, except reasonable number of locations that were underlain by slightly weathered basement with bedrock resistivity less than 2000 Ωm. The potential for groundwater development is fairly good in areas underlain by schist around Isokun community at the north-east axis of the study area. This is due to the fact that the weathered units are more of sandy formation. However, the groundwater zones may be in unconfined conditions because the weathered saprolite is porous. This hydrogeological framework could lead to surface environment contamination through direct recharge. Lastly, based on lithologic sequence it is likely to site artesian wells in saw-mill and Oko-Oba areas in south-east region, since the overburden clayey unit which is an aquiclude is underlain by fractured bedrock, and this sequence favour the development of confined aquifers.

References

1. Pudentiana O. Luke M., (2012), integration of geophysical techniques for ground water potential investigation in kastina-Ala, Benue state, Nigeria. *The pacific Journal of Science and technology*, 13(16): 11-13.
2. Awomeso A. Orebiyi O. Oyedokun O. (2008). Geophysical investigation exploration in a crystalline basement, *New York Science Journal* 1(14):19-35.
3. Akanbi O.A (2016). Use of vertical electrical geophysical method for spatial characteristics of ground water potential of crystalline crust of Igboora Area, south western Nigeria. *International journal of scientific and research publications*, 6(3):2250-3153.
4. Emenike E.A (2000). Geophysical exploration for gound water in a sedimentary environment a case study from Nanah over Nanka formation Anacubra basin south eastern Nigeria. *Gobal Journal pure and applied sciences*, 7:97-110.
5. Onwuemesi, A.G. and Egboka, B.C.E. (2006). 2-D Polynomial curve fitting techniques on watertable, and hydraulic gradients estimations in parts of Anambra Basin, Southeastern Nigeria. *Natural and Applied Science Journal* 7 (1&2): 6-13
6. Anudu, G. K. ,Onwuemesi, A. G., Ajaegwu, N.E., Onuba , L. N. and Omali, A.O. (2008). Electrical resistivity investigation for groundwater in the basement complex terrain: a case study of idi-ayunre and its environs, Oyo State, southwestern Nigeria. *Natural and Applied Sciences Journal*, 9 (2): 183-193.
7. Oseji, J.O. Ujuanbi, O. (2009). Hydrogeophysical investigation of groundwater potential in Emu kingdom, Ndokwa land of Delta State, Nigeria. *International Journal of Physical Sciences*, 4 (5): 275-284.
8. Akpoborie1, I. A., Nfor, B., Etobro, A.A.I Odagwe S. (2011). Aspects of the geology and groundwater conditions of Asaba, Nigeria; Archives of Applied Science Research, 3 (2):537-550.
9. Anakwuba, E. K., Nwokeabia, C. N., Chinwuko, A. I., and Onyekwelu, C.U. (2014). Hydrogeophysical assessment of some parts of Anambra basin, Nigeria. International Journal of Advanced Geosciences,2(2): 72-81.
10. Akanbi, O.A. (2018a). Hydrogeological characterisation and prospects of basement aquifers of Ibarapa region, SW-Nigeria. *Appl Water Sci* 8(3):89.
11. Akanbi, O.A. (2018b): Groundwater Occurrence from Hydro-geomorphological Study of Hard Rock Terrain of part of SW Nigeria. *RMZ- Material and Geo-environment* 65:131-144.
12. Oyedele K.F., Oladele S. Adedoyin O. (2011). Application of geophysical and geotechnical methods to site characteristics for construction purpose at ikoyi, Lagos, Nigeria. *Journal Of Earth Science And Geotechnical Engineering* 1(1):87-100.
13. Akanbi O.A, and Olukowade O, (2018). Lithologic characterisation of the basement aquifers of Awe and Akinmorin. *Global Journal Of Geological Sciences* 16(1):1-11.
14. Orellana, E. and Mooney, H. M., 1966. Master Tables and curves for vertical electrical sounding over layered structures: Madrid Interciecia, *Geophysics* 28: 99-110.
15. Singhal, B. B. S. and Gupta, R. P. 1999. Applied hydrogeology of fractured rocks. Dordrecht, The Netherlands: *Kluwer Academic Publishers*

Funding
Not applicable.

Institutional Review Board Statement
Not applicable.

Informed Consent Statement
Not applicable.

Acknowledgements
Not applicable

Conflict of Interest
The author declared no conflict of interest in the manuscript.

Authors' Declaration
The author(s) hereby declare that the work presented in this article is original and that any liability for claims relating to the content of this article will be borne by them.

Author Contributions
Conceptualization – O.A.A; Design – O.A.A; Fieldwork and Data collection - OAA, P.A.K. Processing and Interpretation – OAA, P.A.K.; Supervision – O.A.A, P.A.K.; Resources – OAA, P.A.K.; Literature Search OAA, P.A.K., Writing – O.A.A.

Cite article as:
Akanbi, O.A. and Kingba, P.A. Hydrogeological Evaluation and Lithological Characterization of Crystalline Bedrock Terrain of Ilora and Environs, Southwestern Nigeria. *Ajayi Crowther J. Pure Appl. Sci.* **2025**, 4(2), pp. 49--50. | **doi:** https://doi.org/10.56534/acjpas.2025.04.02.06