The Use of Vertical Electrical Sounding (VES) in the Evaluation of Erosion in Abia State University, Uturu and Environs.

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ABSTRACT

In this study, Vertical Electrical Sounding (VES) method of Geophysics is applied in the evaluation of erosion in Abia State University, Uturu and environs. Twenty resistivity sounding points are carried out using the Schlumberger configuration. Data are collected using a current electrode separation of AB/2= 500m. Data analysis and Interpretation are done using the Resist software to obtain the layer parameters. Thereafter some geo-electrical sections are drawn and hence the geologic units of the area obtained. Results show that the resistivity range is between 2291.8-100,000Ωm at a maximum depth of between 350m and 400m. Three geologic Formations have equally been identified in the study area: the Lower Coal Measures (Mamu Formation), the Ajali Formation (false-bedded sandstones) and the Upper Coal Measures (Nsukka Formation). The Ajali Formation, which is most predominant, is essentially Cretaceous and consists of friable, false-bedded poorly sorted sandstones. Given the friable, erosion-prone geology, it is therefore strongly recommended that some water harvesting technologies, such as roof water harvesting, be employed to control runoff in the study area under threat. Spillways, culverts, terraces, barriers, diversion ditches, catchment ponds and gutters must be designed to accommodate runoff amounts around the study area up to Isukwuato community.

(Keywords: Ajali formation, VES, resistivity, Schlumberger, erosion)

INTRODUCTION

The vertical electrical sounding (VES) is a geophysical tool for the determination of the subsurface geology of a place. It has been used extensively for the determination of the aquifer potential in the drilling of boreholes (Igboekwe, 2005; Igboekwe *et al.,* 2006). These days it is being used for in-depth geotechnical studies to determine the suitability or otherwise of a site for the building of heavy structures including high rise buildings, bridges and stadia.

Because current trends in VES studies have been used successfully in the determination of subsurface geology, this technology is used in this work to evaluate the erosion menace at a site near Abia State University, Uturu. This is because the major cause of erosion in the area is essentially geological.

Soil erosion has been defined by Ofomata (1985) as a geomorphological process whereby the surface layer of weathering rock is loosened and carried away by wind or running water and a lower horizon in the soil is exposed. Egboka (2000) further defines it as the gradual or quick removal of sediments (soil, clays and sand pieces of blocks of minerals) by agents of denudation such as running water (streams, rivers, floods,) wind, man, animals, and the consequent transport or removal of weathered sedimentary materials along varied distances to various and distant location and eventual deposition elsewhere. Attah (2000) summaries erosion types into four classes namely: Rain splash Erosion, Sheet Erosion, Rill Erosion and Gully Erosion.

Egboka (2000) broadly split causes of erosion into two namely: natural cause, man-made (or anthropogenic) cause. The natural negative causes include: nature of soil, geology of the area, earth movement and earth quakes, climate conditions which include rainfall, temperature, pressure, topography and slope stability problems. Nature of vegetation cover, water quality and quantity, flowing water, physiochemical weathering and other agents of natural mass washing are also causes of erosion. On the other hand anthropogenic causes include man and other destructive mayhem such as deforestation.

As a result of urbanization, agriculture and social development, deforestation is increasing, causing erosion in the southern and desertification in the northern parts of Nigeria. Flood disaster, soil and gully erosion as well as landslides are major environmental problems that have caused a lot of hazards in parts of Nigeria year in year out, causing extensive havoc and massive socio-economic losses. According to a FAO/UNEP (1983) report, about 80% of lands in Nigeria are affected by soil erosion. About 70% of lands are devastated by gully erosion in the south-east and south-south, while about 10% of lands are equally lost to landslides annually, particularly, during the rainy season.

In other to solve this endemic problem, Vertical Electrical Sounding method of Geophysics is used to evaluate the erosion in Abia state University Uturu (ABSU) and its environs and deduce the geological factors supporting erosion in the area under study. We believe that such a study as this could inform the government, corporate bodies and industries on where to build structures in the study area and the possible control measures to be applied where necessary.

LOCATION, GEOLOGY AND LITHOLOGY OF THE AREA

Figure1 shows the location map of the study area. It is located within latitudes $5^{0}46.742^{/}$N and $5^{0}49.542^{/}$N and longitudes $7^{0}23.159^{/}$E and $7^{0}25.319^{/}$E within Isuikwuato area of southeastern Nigeria. It is bounded by Ihube and Leru on the North, Umuahia and Bende on the South, Uturu on the east and Okigwe on the West.

The Geology of the area (Figure 2) consists of Ajali Formation (false-bedded sandstones) as well as Lower Coal Measures which Reyment (1965) called “Mamu” Formation. The coal-bearing part of the formations is predominantly mudstone and sandy clay (Simpson, 1955). The formation sediments were deposited during the late Tertiary-Early Createaceous period. The false-bedded sandstones consist of thick, friable, poorly sorted sandstones typically white in color, but sometimes iron-stained, often marked by repetitive banding of coarse and fine-grained layers. The sand grains, especially the longer ones are sometimes sub-angular in shape.

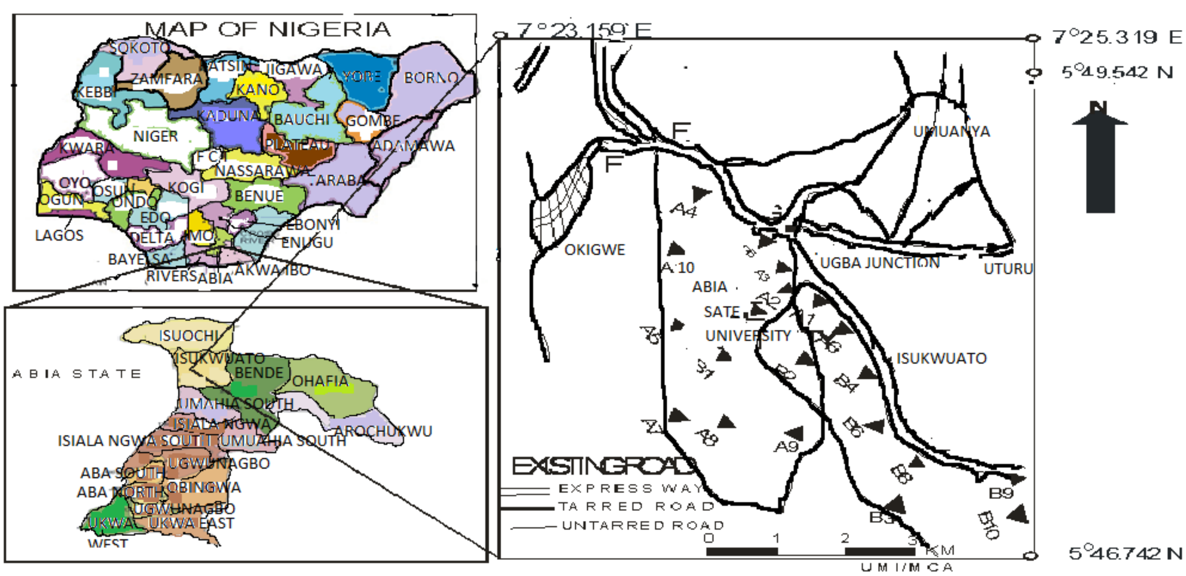


Figure 1: Location Map of the Study Area Showing VES Points.

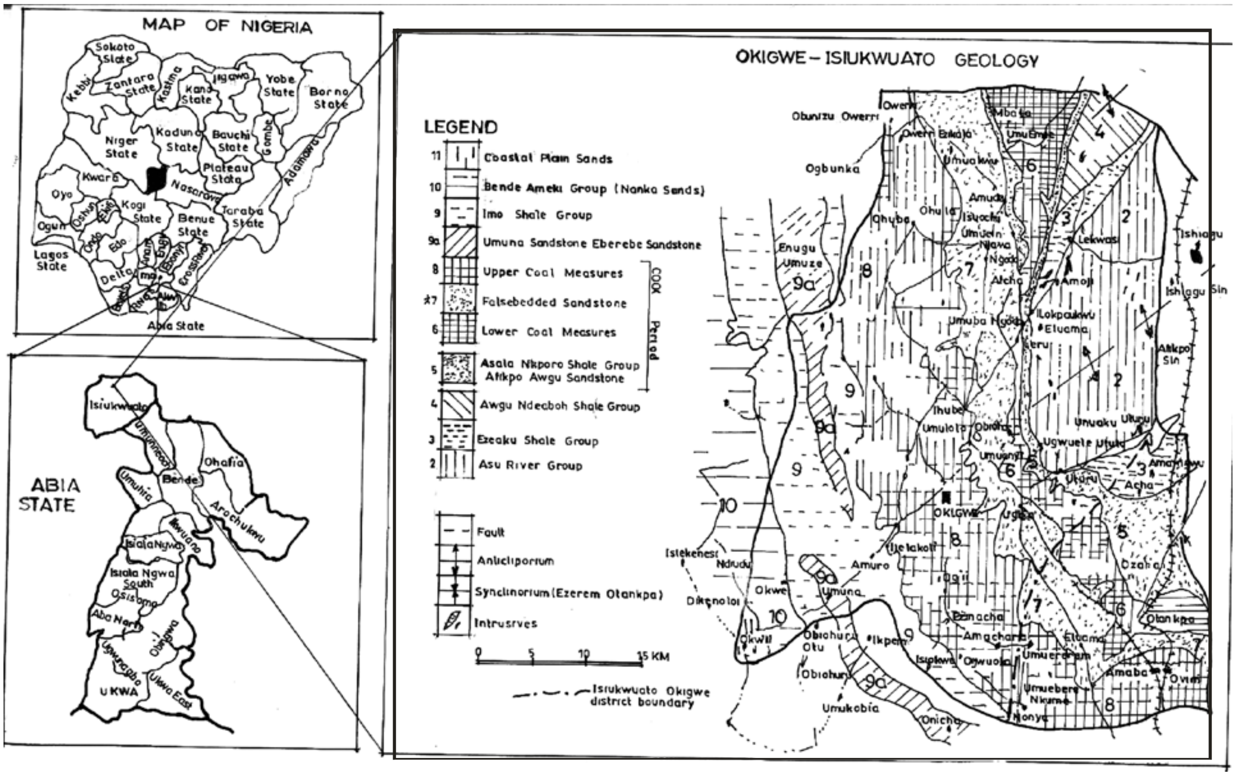


Figure 2: A Geologic Map of the Area.

Because of these characteristics, the formation is highly porous (Igbozurike, 1986). The Lower Coal Measures is the largest geological formation in the Isuikwuato region. It comprises mainly of coarse-grained, alternating sediments of grey sand, dark, sandy shale and carbonaceous shale containing thin brand of impure coal in place at various horizons. Estimated thickness is 300-350m (Igbozurike, 1986). These formations give rise to the line of prominent hills along the eastern margins of the escarpment including those found on the old Okigwe-Enugu road through Ihube.

The geological setting of southeastern Nigeria varies from place to place. There has been a notable variation in the rock formation. The alluvial deposit consists of clay, silt, sand, gravel, shale, pebble and unconsolidated sediment whose thickness ranges between 10m to 15m toward Isuikwuato. The youngest cretaceous rocks of the escarpment constitute an important aquifer, effectively underlying some 17% of the study area, Ebillah (1993).

The lithology reflects its influence on the type of soil formed by affecting the following soil parameters: detachability, transportability, infiltration, permeability of different horizons, aggregate stability, surface scaling, top soil depth and water holding capacity, (Akamigbo, 1986). The underlying lithology of the study area comprises of unconsolidated sediments of Quaternary alluvium and Coastal Plain Sands, weakly consolidated sediments of Tertiary to Cretaceous Formations and crystalline rocks of the Basement Complex and associated younger intrusives.

The areas underlain by the basement complex rocks have moderate potential to erosion. On the other hand, the greater part of the study area which lie between these two extremes, and whose subsurface lithology comprises unconsolidated and weakly consolidated sediments have high potential to soil erosion. Soils resulting from this group of lithological material are highly weathered, very deep, highly leached and acidic with loose sandy textures. To this type of soil, the name “acidic sand” has been given. Acidic sands are naturally very fragile and their loose nature makes them very susceptible to erosion.

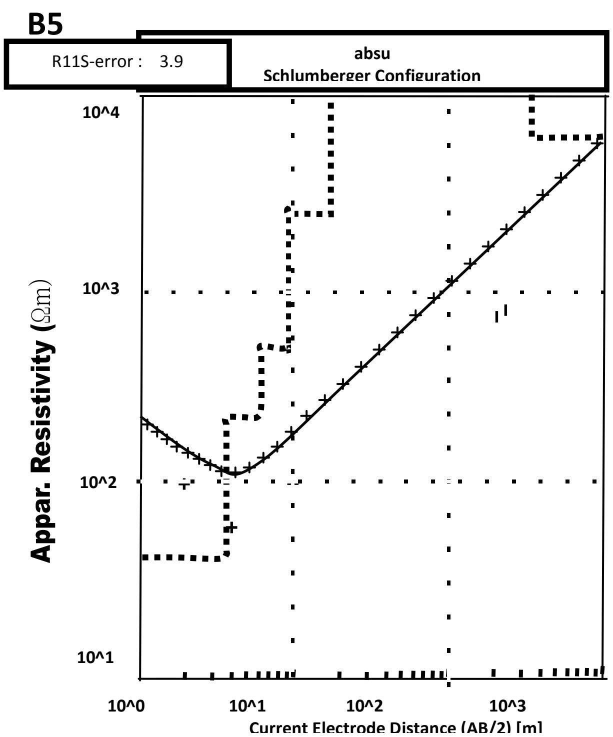
METHODS OF STUDY

Variations of electrical conductivity from which different subsurface strata are inferred are investigated with the help of electrical resistivity soundings. Twenty Schlumberger Vertical Electrical Soundings (VES) are acquired in the entire area using a maximum current electrode separation AB/2 = 500m. A_Digital averaging instrument, ABEM SAS 4000 Terrametter is used.

Data are collected and the apparent resistivity values are plotted against half the current electrode spacing on a double logarithmic graph for manual interpretation. These later served as input for a fast computer assisted interpretation. The computer program of Resist (designed and used at National Geophysical Research Institute (NGRI), India is employed in the modeling of the VES data. (Jupp and Vazoff, 1975). The data from the sounding points are collected in two different days: Group A for the first ten points on the first day and Group B for the next ten points on the second day.

The result of this computer VES curves are presented partly in Figures 3 and 4 and fully in Tables 1 and 2. Most of the sounding curves in Abia State University Uturu (ABSU) reflect the presence of four or five geoelectric layers with resistivity increasing ($\rho_1 < \rho_2 < \rho_3 < \rho_4 < \rho_5$) or decreasing ($\rho_1 > \rho_2 > \rho_3 > \rho_4$) with depth (Zohdy et al, 1966, Okwueze, 1996). An example of the latter is the QQ-type curve shown in Figure 4. However, a few other sounding curves reflect the presence of eight geoelectric layers with results of most of them being the HAAAKQ-type curves.

Four other figures showing the geological/lithological units of the area have been developed from a sample of the VES points A9, B5, A4 and B2 and are displayed in Figures 4b, 5, 6, and 7. The geology of the area is generally evident from these lithologs and the geo-electrical sections hereunder discussed.



No	Res	Thick	Depth
1	156.7	1.0	1.0
2	40.7	2.8	3.7
3	221.6	2.5	6.2
4	497.4	3.0	9.2
5	2465.9	8.1	17.3
6	23285.0	106.1	123.4
7	10624.0	109.6	333.0
8	5999.5	-.-	-.-

Figure 3: Computer Modeled Curve of VES B5.

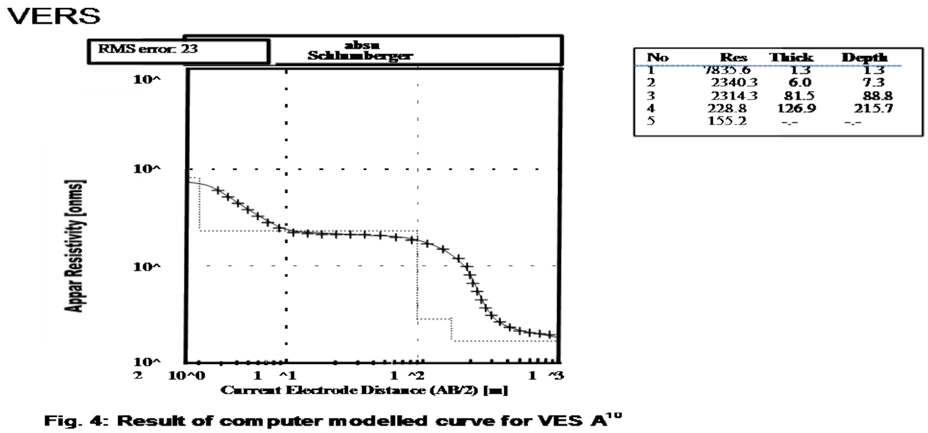


Figure 4: Result of Computer Modeled Curve for VES A^{10}

Table 1: Results of Geo-electrical Survey (Group A).

Ves Nos	Locations	Longitude	Latitude	Alt (amsl) ft	No of Layers		$\rho_1 h_1$	$\rho_2 h_2$	$\rho_3 h_3$	$\rho_4 h_4$	$\rho_5 h_5$	$\rho_6 h_6$	$\rho_7 h_7$	$\rho_8 h_8$	Thickness (m)	Error%
Ves A_1	Erosion spot along Isiukwu-ato Rd	07°23.754′E	05°42.892′ N	164	8	ρ(Ωm)	605.6	920.9	2611.6	6298.0	10325. 7	8864.4	8439.0	8881.5	266.3	2.4
						h(m)	0.5	2.3	5.0	14.8	46.4	78.0	1193	………..		
						Geology	Top soil	Lateritic earth	Lateritic earth	Lateritic earth	Sand stone	Fine sand	Fine sand	Conductive layer		
Ves A_2	Before erosion spot along Isiukwuato Rd	07°24.775′E	05°48.913′ N	625	8	ρ(Ωm)	4040. 5	2017.1	3142.2	9535.2	35814. 6	36635.1	28258.8	28589.0	224.7	2.3
						h(m)	0.5	2.1	3.4	7.6	29.5	64.1	117.5	………		
						Geology	Top Soil	Lateritic earth	Lateritic earth	Coarse sand	Sand stone	Fine sand	Fine sand	Conductive layer		
Ves A_3	Near the University along Isiukwuato Rd	07°24.027′E	05°49.363′ N	787	8	ρ(Ωm)	81.4	445.4	2035.3	7209.7	44305. 0	100000.0	13445.8	20267.5	363.9	4.8
						h(m)	0.4	0.5	0.7	1.4	5.6	64.5	290.8	…..		
						Geology	Top Soil	Top Soil	Lateritic earth	Lateritetic earth	Coars e sand	Stand Stone	Conductive layer			
Ves A_4	Beside ABSU gate (120m) to the gate	07°23.848′E	05°49.56′N	782	6	ρ(Ωm)	1799. 1	5900.0	2291.8	13157.1	18348. 2	14298.8	………	……	268.7	1.9
						h(m)	0.5	3.9	20.4	66.8	177.1	……	………			
						Geology	Top Soil	Lateritetic Soil	Sand	Coarse Sand	Sand stone	Stand Stone	Conductive layer			
Ves A_5	Beyond the erosion spot along Isiukwuato Rd	07°23.198′E	05°.48.664′ N	876	8	ρ(Ωm)	300.2	1499.5	4900.4	7535.9	13448. 7	11805.5	10785.3	10345.4	216.7	2.1
						h(m)	0.5	1.2	2.9	6.7	27.3	58.4	119.7	……		
						Geology	Top Soil	Lateritic earth	Lateritetic earth	Coarse Sand	Sand Stone	Stand Stone	Conductive layer			
Ves A_6	Beyond the Erosion spot along Isiukwuato Rd	07°25.319′E	05°48.451′ N	868	8	ρ(Ωm)	378.9	971.0	5019.8	13267.4	30236. 9	40378.9	29320.9	17435.1	134.4	2.1
						h(m)	0.5	0.9	1.7	4.0	11.6	31.3	84.4	…………		
						Geology	Top Soil	Lateritic earth	Lateritic earth	Lateritic earth	Coars e Sand	Coarse sand	Fine sand	Conductive layer		
Ves A_7	Inside ABSU Opposite Dept of Foreign Languages	07°23.666′E	05°49.386′ N	707	5	ρ(Ωm)	3478. 0	4239.0	4141.3	14431.4	14735. 4	1157.0	……	……	117.4	2.1
						h(m)	0.5	2.5	26.0	88.4	….	……	………	……		

Table 1 (continued): Results of Geo-electrical Survey (Group A).

						Geology	Top Soil	Lateritic earth	sand	sandstone	Sand stone	Stand stone `````````````	Stand stone			
Ves A_8	Along Hostel Lane	$07^{0}23.550^{/}$E	$05^{0}49.168^{/}$ N	573	7	ρ(Ωm)	209.8	770.2	246.2	724.8	4741.4	9853.0	11572.4	…….	128.9	2.5
						h(m)	0.6	3.2	8.3	10.3	29.3	77.2	………	……		
						Geology	Top Soil	Lateritic earth	Shale	Caly	Fine sand	Fine sand	Conductive layer			
Ves A_9	Opposite Dept of Comm. Rd	$07^{0}23.814^{/}$E	$05^{0}49.168^{/}$ N	620	6	ρ(Ωm)	4566.5	152.4	1489.1	2748.7	8010.7	1661.4	37090.9	100000.0	94.4	2.5
						h(m)	0.6	1.7	3.3	6.8	13.5	20.8	47.7			
						Geology	Top Soil	Lateritic earth	Sand	Sand	Sand stone	Fine Sand	Conductive layer			
Ves A_{10}	At ABSU's Pavillion	$07^{0}23.770^{/}$E	$05^{0}49.542^{/}$ N	651	5	ρ(Ωm)	7885.6	2340.3	2314.3	228.8	155.2	……	………	……	215.7	2.3
						h(m)	1.3	6.0	81.5	126.9	….	……	………	……		
						Geology	Top Soil	Coarse Sand	Coarse sand	Fine Sand	Cond layer					

Table 2: Results of Geo-Electric Survey (Group B)

Ves Nos	Locations	Longitude	Latitude	No of Layers		ρ_1h_1	ρ_2h_2	ρ_3h_3	ρ_4h_4	ρ_5h_5	ρ_6h_6	ρ_7h_7	ρ_8h_8	ρ_9h_9	Total Thickness (m)	Fitting Error%
Ves B_1	Along Isiukwu-ato Rd	$7^{0}23.5450^{/}$E	$05^{0}49.422^{/}$ N	8	ρ(Ωm)	3356.5	2993.0	11033.0	7666.6	6930.5	13301.2	13968.4	13775.7	…	176.7	2.4
					h(m)	0.4	1.1	5.0	3.8	9.8	19.5	46.1	96.0			
					Geology	Top soil	Lateritic earth	Lateritic earth	Coarse Sand	Coarse Sand	Coarse Sand	Fine sand	Conductive layer	…..		
Ves B_2	Inside ABSU Pavillion	$7^{0}23.4173^{/}$E	$05^{0}49.243^{/}$ N	9	ρ(Ωm)	1243.2	1649.3	3164.9	1872.5	2247.0	258.0	5078.4	1118.1	2762.0	357.8	3.6
					h(m)	0.5	1.8	5.2	9.7	16.8	57.9	176.6	89.3	………		
					Geology	Top Soil	Lateritic earth	Sand	Sand	Coarse sand	Fine sand	Fine sand	Fine sand	Conductive layer		
Ves B_3	Near the Ugba Junction	$7^{0}.23.558^{/}$E	$05^{0}49.436^{/}$ N	7	ρ(Ωm)	2069.3	3239.0	2091.3	8405.8	17470.4	2919.7	1490.6	………	…	121.3	2.9
					h(m)	0.6	4.6	8.7	10.4	35.7	61.3	………	………..	…….		
					Geology	Top Soil	Lateritic earth	Lateritic earth	Lateritetic earth	Lateritic earth	Fine sand	Conductive layer	………			
Ves B_4	Along Isiukwuato Rd before the Gully Spot	$7^{0}23.5379^{/}$E.	$05^{0}49.528^{/}$ N	8	ρ(Ωm)	242.5	246.3	1557.8	2749.9	14791.7	21999.2	10658.6	7688.9	…	343.4	2.9
					h(m)	0.5	1.3	3.2	14.2	33.5	91.8	199.1	……..	…		
					Geology	Top Soil	Lateritic earth	Lateritic earth	Sand	Coarse sand	Coarse sand	Fine sand	Conductive layer	…		
Ves B_5	Along Isiukwuato Rd at Ugba Junction	$7^{0}23.8925^{/}$E	$05^{0}49.7185^{/}$N	8	ρ(Ωm)	156.7	40.7	221.6	497.4	2465.9	23285.0	10624.0	5998.5	…	333.0	3.9
					h(m)	0.5	2.8	2.5	3.0	8.1	106.1	209.6	………	…		
					Geology	Top Soil	Lateritic Soil	Lateritetic siol	Lateritic earth	Coarse sand	Fine sand	Fine sand	Conductive layer	…		
Ves B_6	Beyond the Erosion spot along Isiukwuato Rd	$7^{0}23.5355^{/}$E	$05^{0}49.4129^{/}$N	8	ρ(Ωm)	2218.5	4588.2	97471.0	14212.0	26810.9	7295.0	1333.3	….	……	427.8	2.4
					h(m)	0.5	4.9	12.8	34.1	116.6	252.5	……	………	…		
					Geology	Top Soil	Lateritic earth	Coarse sand	Coarse sand	Fine sand	Fine sand	Con layer	…….	…	…..	
Ves B_7	Inside ABSU	$7^{0}23.5564^{/}$E	$05^{0}49.3824^{/}$N	8	ρ(Ωm)	1299.8	1614.8	3351.1	1456.1	3198.0	1411.5	141.4	3527.5	…	118.7	4.7
					h(m)	0.5	1.8	4.6	9.6	18.0	5.8	78.4	………	…….		

					h(m)	0.5	1.8	4.6	9.6	18.0	5.8	78.4	....	....		
					Geology	Top Soil	Lateritic eart	Lateritic earth	Fine sand	Fine sand	Fine sand	Conductive lsayer	......	...	.....	
Ves B_8	Along Isiukwuato Rd after the Erosion Spot	7⁰23.5323/E	05⁰49.4097/N	7	ρ(Ωm)	2667.9	856.9	4225.2	13756.7	31440.4	100000.0	100000.0	......	...	160.2	3.7
					h(m)	0.5	3.0	3.2	8.5	25.1	119.9	......	......	...		
					Geology	Top S	Lateritic earth	Lateritic earth	Coarse sand	Fine sand	Fine sand	Conductive layer				
Ves B_9	Along Isiukwuato Rd near the L.G.H/Q	7⁰23.1506/E	05⁰48.767/N	8	ρ(Ωm)	772.8	2989.4	802	2743.8	54635.8	6043.3	764.2	2357.0		386.0	4.5
					h(m)	0.6	1.8	3.9	3.2	23.7	29.4	323.4	......			
					Geology	Top Soil	Lateritic earth	Lateritic earth	Lateritic earth	Coarse sand	Fine sand	Fine sand	Conductive layer			
Ves B_{10}	At the Isiukwuato L.G.H/Q	7⁰23.153/E	05⁰46.7709/N	8	ρ(Ωm)	7885.6	99.3	405.2	172.1	212.9	29.5	26.7	16.3	312.8	151.2	2.5
					h(m)	0.5	1.3	2.0	6.5	11.1	17.6	39.9	73.7	...		
					Geology	Top Soil	Lateritic earth	Lateritic earth	Shale	Shale	Fine sand	Fine sand	Conductive layers			

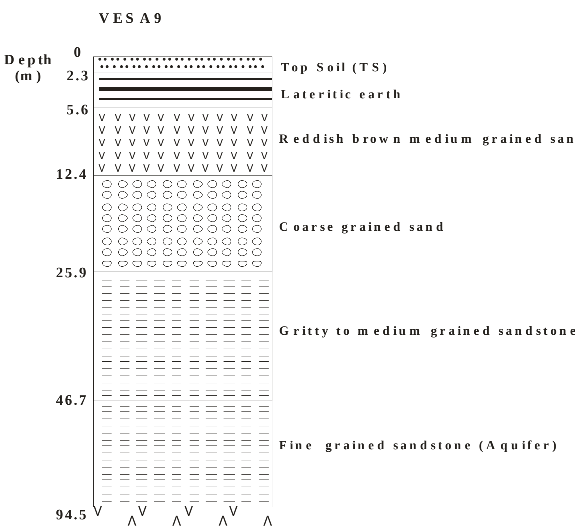


Figure 4b: Litholog of VES A9.

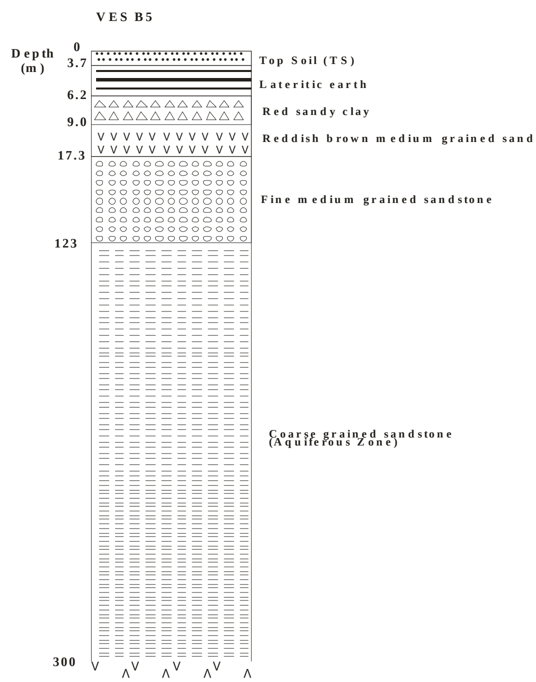


Figure 5: Litholog of VES B5.

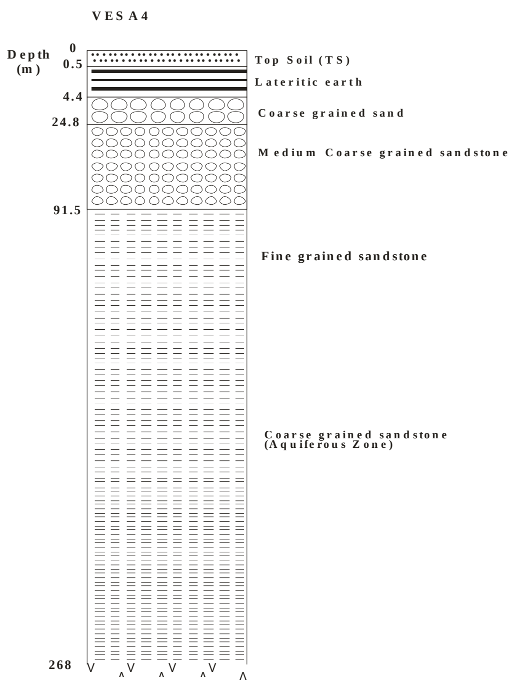


Figure 6: Litholog of VES A4.

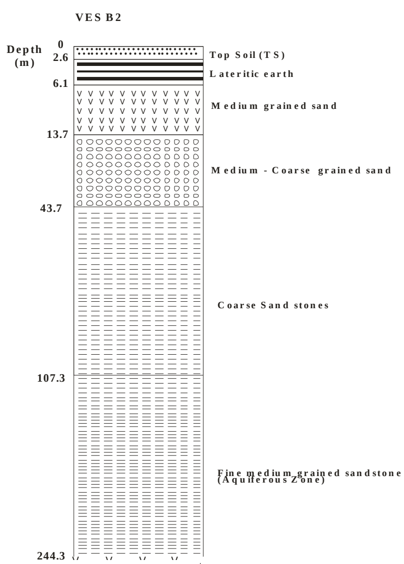


Figure 7: Litholog of VES B2.

Geo-Electrical Sections

A number of the sounding points that were found to be along the same line of sight were joined to produce the geo-electrical sections. Three of such sections namely: AA/, BB/ and CC/ are shown in Figures 7b, 8, and 9.

RESULTS AND DISCUSSION

In the foregoing study, Vertical Electrical Sounding (VES) method of Geophysics has been to collect data at twenty (20) sounding points using the Schlumberger configuration.with a current electrode separation of AB/2= 500m. Data analysis and Interpretation have been done using the Resist software to obtain the layer parameters. Results of these interpretations show that the resistivity range from the surface to about 400m or less is between 2291.8-100,000Ωm. This is the erosion prone zone.

Physical Inspection

Physical inspection also shows that the textural properties of this zone, the surficial deposits and horizontal to gently inclined bedrock make it susceptible to erosion. In this area, gully processes are localized in the fine- to medium-grained Coastal Plain Sands (Pliocene-Recent), the Nanka Sands (Eocene) and the medium- to coarse-grained Nsukka Sandstone and Ajali Sandstone (Cretaceous) characteristic of the Anambra-Imo basin region.

The most affected deposits are unconsolidated to poorly consolidated and with short dispersion times. The cleaner, more porous and weakly cemented sands are the most prone to gully advance, which increases directly with an increase in the proportion of grains, more than 1 mm in diameter. Gully formation is enhanced by sliding and by the rapid dispersion of clays in the inter-bedded shales. Gully initiation is the result of localized erosion by surface runoff, associated with rainfall events of high intensity.

Erosion is frequently focused, where the forest cover has been removed for agricultural purposes and also at the sites of uneven compaction of surface soils by foot (human and livestock) and wheeled traffic, in off-road locations.

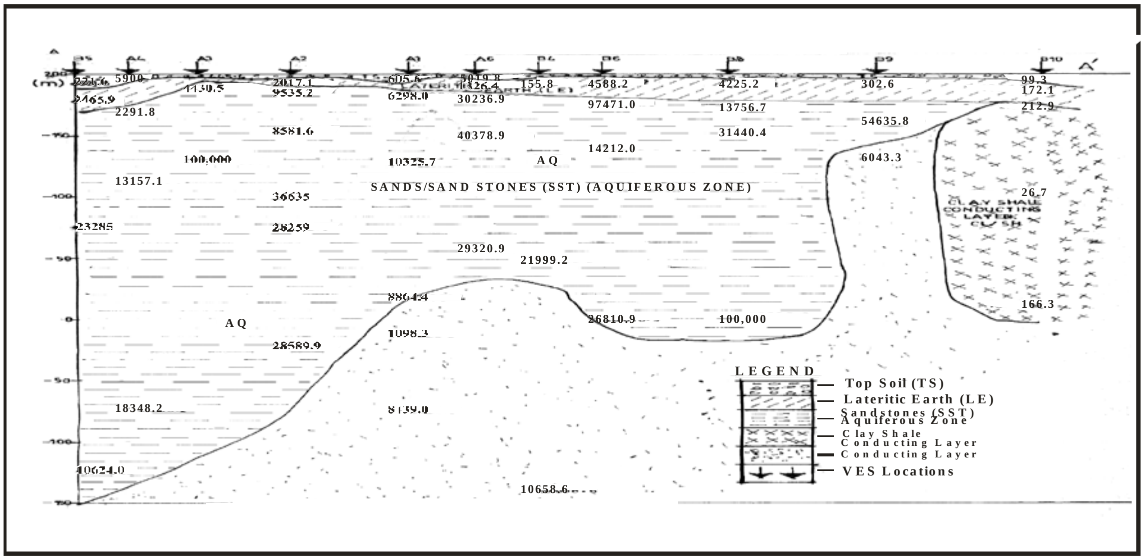


Figure 7b: Geoelectric Section along AA' (5490m).

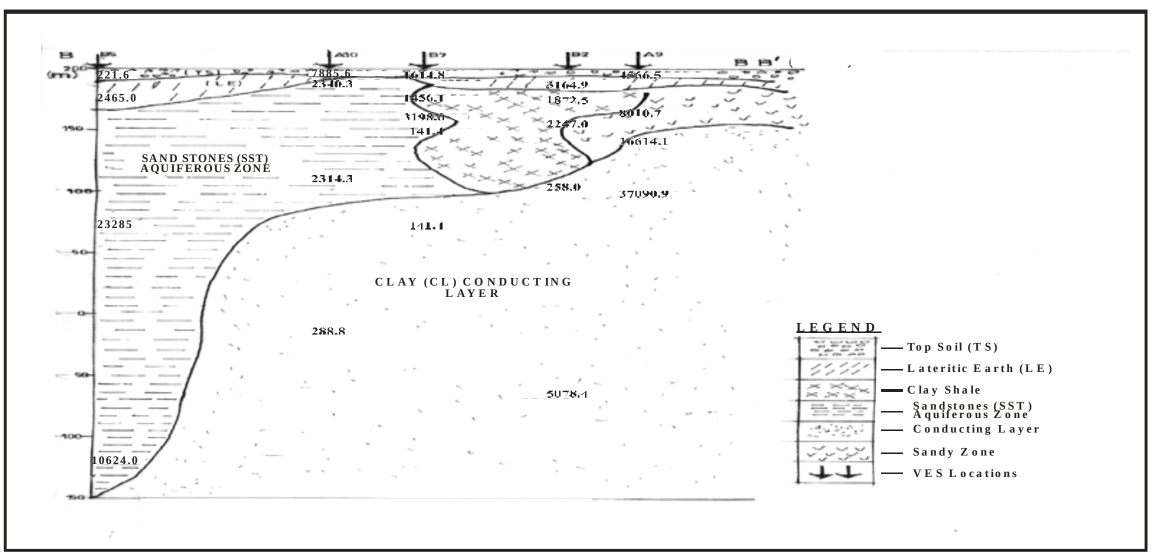


Figure 8: Geoelectric Section along BB' (2400m).

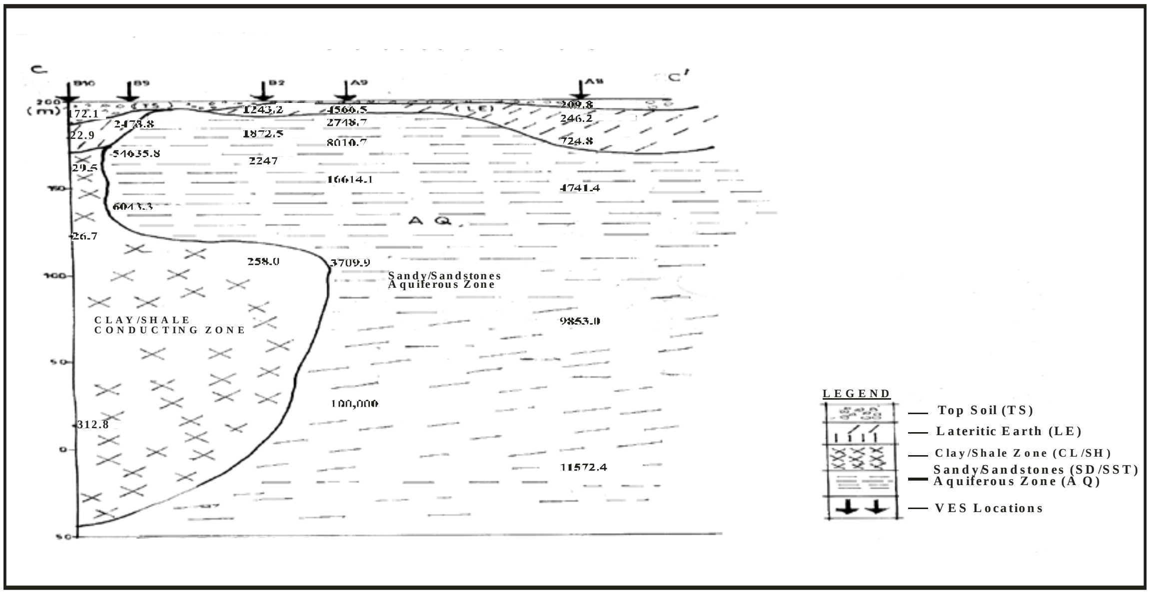


Figure 9: Geoelectric Section along CC' (4662.6m).

Gullies also occur, where springs issue from permeable sands, at contacts with less permeable deposits beneath. In the study area, it is seen that the propagation of gullies is by sapping, caving and sliding at the gully head and sliding along the sides, accompanied by the down-slope transportation of gully-floor debris by storm runoff.

Geologic Characteristics

From the result of the geo-electrical sections we can infer the geologic characteristics favoring erosion in the area. In the geo-electrical section along AA$^{/}$ we see that the top soil and the lateritic earth occupy the first 40 metres depth between VES numbers A4 and B10. From this depth to about 350 metres thereafter, we see sand, clay and sandstone dominating the lithology, the sandstone thickness being maximum between VES A4 and B4. This phenomenon is repeated in the geo-electrical sections BB$^{/}$ and CC$^{/}$. However, the sandstone is only 250 metres thick between B5 and A10 in the geo-electrical section along BB$^{/}$.

The general sequence observed in the geo-electrical sections is that the top soil is underlain by reddish brown laterite. Other layers lying immediately below the laterite are the fine-medium-coarse grained sands. Underlying the sand formation are the conducting layers: the clay and the shale formations.

The resistivities are quite progressively increasing with depth. This could be seen from the layer parameters obtained from the resistivity soundings. However, in few locations, the resistivities decreased with increasing depth.

The resistivity soundings, the geo-electrical sections and the lithologs specifically identified three geologic Formations in the study area namely: the Lower Coal Measures (Mamu Formation), the Ajali Formation (false-bedded sandstones) and the Upper Coal Measures (Nsukka Formation). The Ajali Formation, which is most predominant, is essentially Cretaceous and consists of friable, false-bedded and poorly sorted yellowish-white sandstones. As a result of these characteristics the Formation is porous and structurally unstable. The thickness is between 350 and 400m. As a result of these geologic characteristics, erosion travels along the Formation until a consolidated zone is reached. This is probably why the observed depth of the gully located about 1km southeast of Abia State University, Uturu is about 100 metres deep, see Figure 10.

Figure 10: Deep Gullies Located Near ABSU.

CONCLUSION

This project is a humble attempt to use one of the electrical resistivity methods of Geophysics, the Vertical Electrical Sounding (VES) in the evaluation of erosion at Abia State University, Uturu, (ABSU) and its environs. Twenty Vertical Electrical Sounding (VES) points were carried out using the Schlumberger configuration. Data were collected using a current electrode separation of AB/2= 500m. Data analysis and Interpretation were done using the Resist software to obtain the layer parameters. Thereafter some geo-electrical sections were drawn and hence the lithologic units of the area obtained.

Results of these interpretations show that the resistivity range from the surface to about 400m or less is between 2291.8-100,000Ωm. The results further show from the geo-electrical sections and the lithologic units of the study area that three geologic Formations are evident, namely: the Lower Coal Measures (Mamu Formation), the Ajali Formation (false-bedded sandstones) and the Upper Coal Measures (Nsukka Formation). The Ajali Formation, which is most predominant, is essentially Cretaceous and consists of friable, false-bedded and poorly sorted sandstones of thickness between 350 and 400m. As a result of these characteristics the Formation is porous and structurally unstable, thereby delineating the erosion prone zone.

Given the friable, erosion-prone geology, it is therefore strongly recommended that some water harvesting technologies, such as roof water harvesting, be employed to control runoff in the settlements under threat. Spillways, culverts, terraces, barriers, diversion ditches, catchment ponds and gutters must be designed to accommodate runoff amounts around the study area up to Isukwuato community.

Erosion control requires the integration of water-resource management, soil conservation and re-vegetation on the scale of a drainage basin. The technologies of water harvesting and spreading are necessary on hillsides, cleared for agricultural production. Public education is essential to a sustainable termination strategy. Different levels of government, donor agencies, the private sector and the rural people must work together to engender permanent solutions to erosion threats in the ABSU- Isukwuato area of Abia State.

It is therefore established from this study that it is very possible to use geophysical tools to evaluate and deduce the geological factors affecting erosion in the area under study.

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