Geoelectric Characterization of Igbo Oritaa Archaeological Site, Iwo, Southwestern Nigeria

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ABSTRACT

Electrical resistivity survey was carried out at Igbo Oritaa archaeological site in Iwo, Southwest Nigeria, with a view to providing information on the locations of buried artifacts that will aid follow-up excavation works and subsequent recreation of the historical activities at the ancient settlement. Within the upper 1.5 m, thirty-one (31) anomalous zones suspected to be of archaeological interest were identified from depth slice resistivity maps. Twenty-one (21) of these were high resistivity zones while ten (10) were low resistivity zones.

Suspected archaeological artifacts include collapsed huts, iron smelting site, tomb, ancient dumpsites, and collapsed ancient wall. These artifacts were identified based on their geoelectric characteristics. Clustered high resistivity anomalous zones C, D, and E characterized by resistivity values greater than 120 ohm-m, were interpreted as suspected mini settlements. The low resistivity anomalous zones iii, iv, v, vii, viii, ix, and x within or close to the suspected settlements were attributed to ancient dumpsites. The elongated high resistivity anomalous zone F with resistivity values ranging from 120 – 200 ohm-m was attributed to tomb. High resistivity (200 – 400 ohm-m) anomalous zones C_5, C_6, D_3, D_4, F, and G aligned parallel to the delineated ancient trench were attributed to relics of a collapsed ancient wall.

Two of the recommended eight sites, sites 4 (Pit 1) and 5 (Pit 2), characterized by high resistivity closures were excavated. Artifacts recovered from these sites were pottery sherds, snail shell, animal jaw bone, cowries, flute, iron objects, glass beads, bones fragments, bone bead, metallic and bronze objects, oyster shells, finger like clay cylinder, and relics of a structure (hut) foundation. The recovered artifacts confirmed Igbo Oritaa as an ancient settlement occupied by people whose social, economic, dietary, and cultural activities were reflected by the archaeological finds.

(Keywords: geoelectric characteristics, anomalous zones, archaeological artifacts, cultural resources, Igbo Oritaa)

INTRODUCTION

Archaeology is the systematic or scientific study of past (ancient and recent) human activities, which include their existence, culture and behavior, through the retrieval and examination of material remains such as fossils (preserved bones) of humans and animals, food relics, buried relics of ancient structures, and human artifacts which include tools, pottery, and jewelry left behind by past human societies. In most cases, artifacts at these sites are often buried (concealed) and when exposed, sometimes have subsurface extension. An archaeological project begins with a field survey, one of which is a geophysical survey, which is about the most effective way to see beneath the ground.

Geophysics has found useful applications as a reconnaissance tool in archaeological prospection (Eluyemi *et al.,* 2012; Olorunfemi *et al.,* 2015; Oyeyemi *et al.,* 2015 and Mohamed, 2017). It is commonly used for the identification of prospective sites for excavation and to estimate archaeologically significant depth.

The relevance of geophysical methods in archaeological prospection is based on the fact that detectable contrasts in physical properties such as resistivity or conductivity, magnetic susceptibility, density, elasticity and dielectric constant exist between archaeological remains (artifacts and structures) and the surrounding earth materials (Aspinall *et al*., 2008; Ekinci, *et al*., 2012; Olorunfemi *et al*., 2015). These make the electrical resistivity, electromagnetic, magnetic, microgravity, Ground Penetrating Radar (GPR) and even seismic method of geophysical prospecting relevant (Clark, 1990; Gaffney and Gater, 2003; Witten, 2006; Oswin, 2009; Dolphin 2011 and Dalan, 2012).

The choice of the geophysical method depends on the physical properties of the targets relative to the environment and the geological setting which are used in selecting the optimum prospecting method(s) and technique(s) while factors such as size and geometry of the interested artifacts or structures and the extent of the site, are important in the survey design.

The main application of geophysics in archaeological prospection is to provide information on artifacts laden zones that will guide the location of excavation work (Olorunfemi *et al*., 2015). Resistivity method is one of the earliest geophysical methods used in archaeological prospection (Dahlin *et al*., 2002; Papadopoulos *et al*., 2006; Tonkov *et al*., 2006; Drahor *et al*., 2008; Luigia *et al*., 2009; Ortega *et al*., 2010). In archaeological prospection, the resistivity method is used to map potsherd, charcoal, collapse hut, iron slag, buried stone concretion and tomb, relevant in the reconstruction of the history of an ancient historical site.

Documented history (Ladipo and Amoo, 2017) has it that the present-day Iwo township in Osun State, relocated from Igbo Oritaa, an ancient settlement located SW of Iwo. However, there is no archaeological record of the ancient settlement save an ancient Peregun (*Dracaena*) tree, small fragments of pottery, iron slag, and relics of an ancient wall (*Oodi*). There is therefore the need to carry out archaeogeophysical investigation of Igbo Oritaa ancient settlement as a means of identifying buried artifacts and structure architecture that will guide and complement subsequent archaeological excavation works, whose results will enable a recreation of the historical activities at the ancient settlement.

Description of the Study Area

The Igbo Oritaa archaeological site is located S60º W of the Iwo town in Iwo Local Government Area, of Osun State, Nigeria (Figure 1). It lies within geographic coordinates of Latitudes 7º37′13″-7º37′16″ N and Longitudes 4º09′13″-4º09′22″ E or Northings 842600 mN to 842780 mN and Eastings 627400 mE to 627600 mE in the Universal Traverse Mercator (UTM) Zone 31, Minna Datum (Figure 2).

The site is located within the tropical rain forest characterized by dry and rainy seasons. The study area is underlain by the Precambrian Basement rocks of Southwest Nigeria. Igbo Oritaa archaeological site is located within migmatite gneiss characterized by lateritic clay topsoil overlying a clay/sandy clay/clayey sand weathered basement (Figure 3). The structural features in the gneisses include lineation, folds, faults and joints.

METHODOLOGY

Following a review of the oral and documented history of the Igbo Oritaa archaeological site, an area extent of 45 m x 160 m and 20 m x 40 m were investigated. The geophysical investigation involved the electrical resistivity method. Fifty three (53) traverses were established, forty (TR 1 – 40) of which were each 45 m long and trend N70ºE, while ten traverses (TR 41 – 50) trending N38ºE were each 20 m long and three crossed traverses (TR 51 – 53), each 40 m long, were established orthogonal to the N70ºE traverses (Figure 2).

The traverses were established at regular interval of 4 m while the station interval along each traverse was 1 m. Dipole-Dipole profiling was carried out along all the traverses. The 2D Dipole-Dipole data were acquired at 1 m inter-electrode spacing while the inter-dipole separation factor (n) was varied from 1 – 5. The Dipole-Dipole data were inverted into 2D resistivity structures using the DIPRO version 4.01 software (Jung-Ho Kim, 2001).

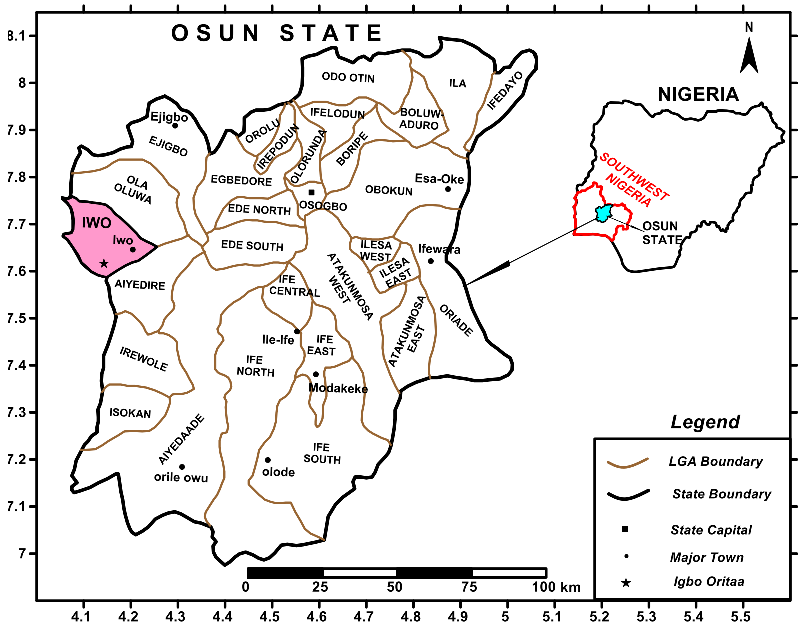

Figure 1: Map of Osun State Showing Iwo Local Government Area (LGA) and Igbo Oritaa Archaeological Site.

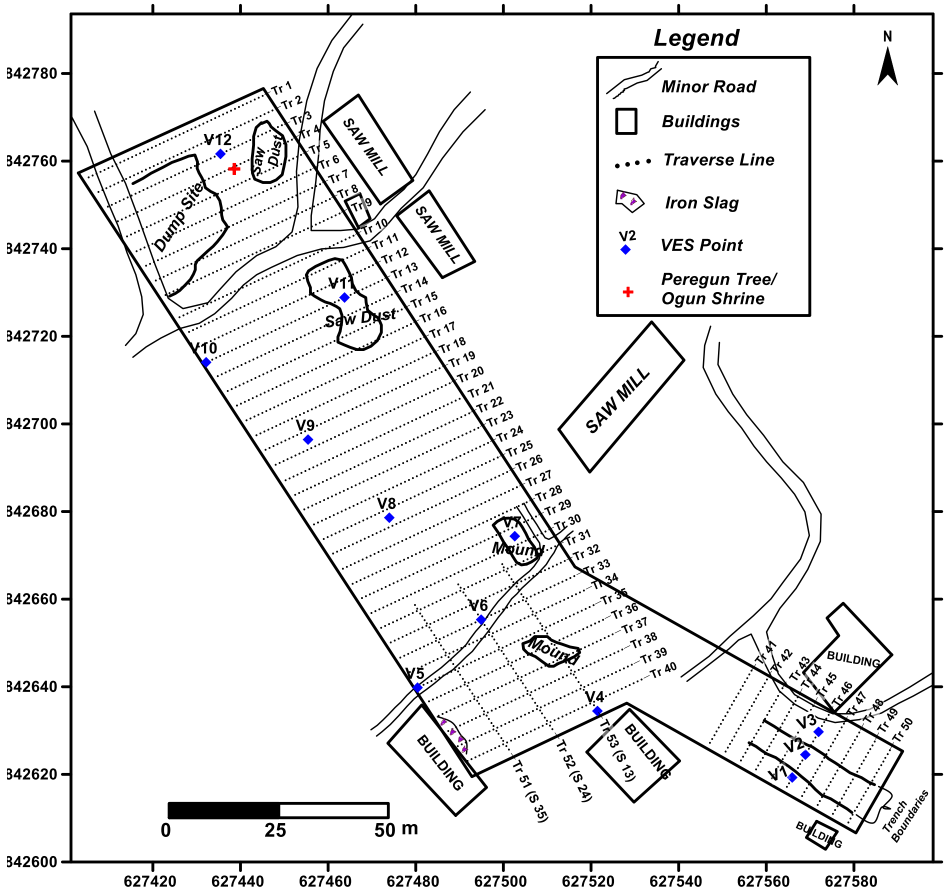

Figure 2: Data Acquisition Map Showing Traverse Lines and VES Locations.

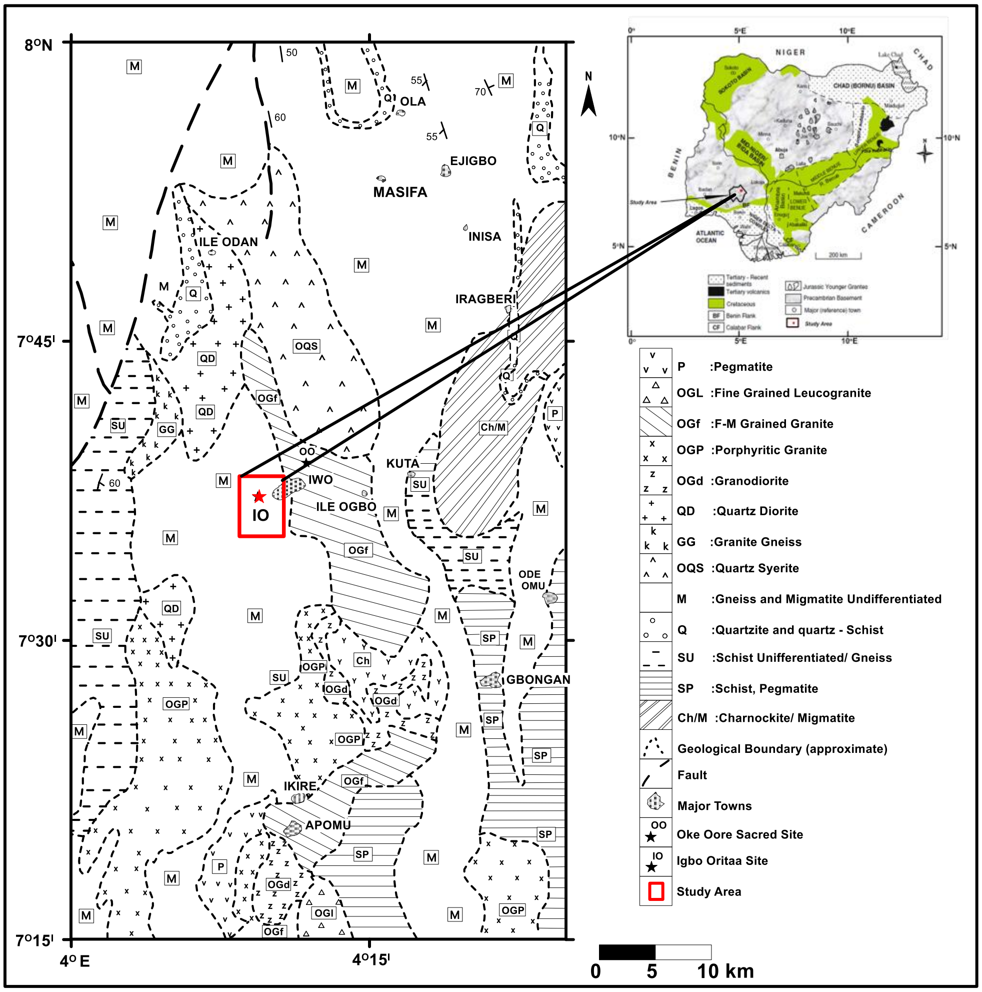

Figure 3: Generalized Geological Map of the Study Area (Adapted from Iwo Sheet 1:25,000 Geological Map, Compiled by the Geological Survey of Nigeria, 2006).

From the 2D resistivity structures, true resistivity values were extracted at different depth levels of 0.25 m (0-0.5 m); 0.75 m (0.5-1.0 m); 1.50 m (1.0-1.2.0 m) and 2.50 m (2.0-3.0 m) and subsequently used to generate 2D resistivity depth slice maps. Comprehensive base map showing positions, shape and pattern of visible artifacts and features were generated. The base map was superimposed on all the resistivity maps generated and used to constrain the interpretation of the geophysical anomalies.

Twelve (12) Schlumberger VES stations were distributed along the fifty-three (53) traverses. The electrode spacings (AB/2) were increased from 1 m to a maximum of 40 m. Measurements of ground resistance were made with the ABEM Terameter SAS 300C Resistivity Meter. The VES data were displayed as sounding curves and interpreted quantitatively by partial curve matching and computer assisted 1D forward modelling with WinRESIST version 1.0 software (Vander Velpen, 1988). The VES interpretation results (resistivities and thicknesses) were used to constrain the 2D modelling and also to generate 2D geoelectric sections.

RESULTS AND DISCUSSION

Characteristic VES Curves and the Subsurface Sequence

The VES type curves vary from QH to H, KH and HKH type with the QH type predominating (66.7%) (Figure 4). The delineated subsurface sequence varies from 3 to 5 layers in the upper 26.8 m.

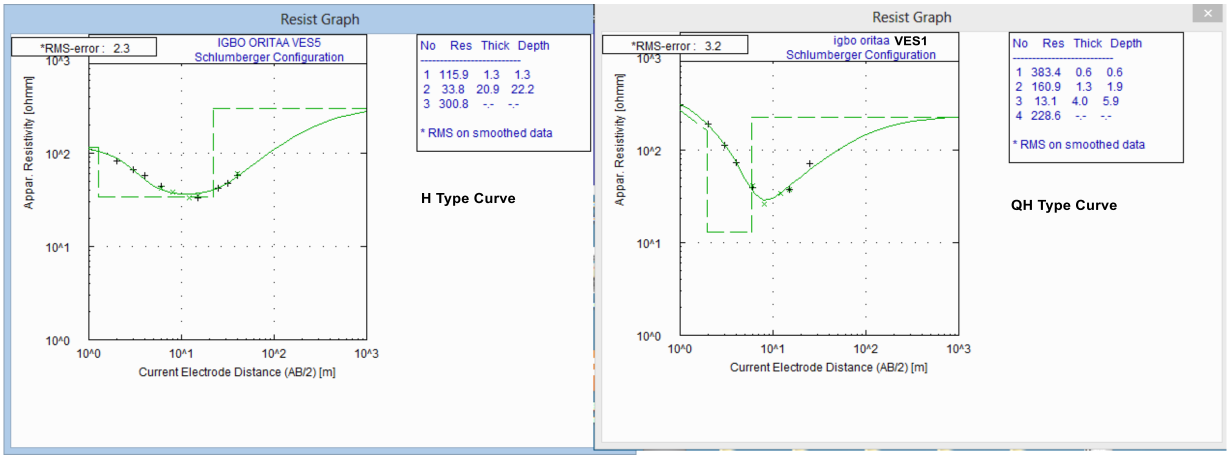

Figure 4: Typical VES Type Curves.

(ii)

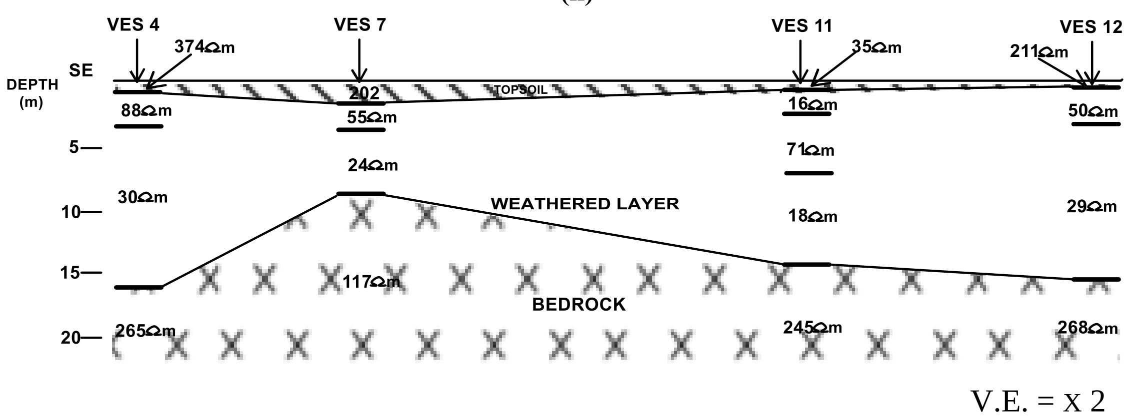

Figure 5: Typical Geoelectric Section Relating VES 4, 7, 11, and 12

Table 1: Geoelectric Characteristics of the Archaeological Site.

Geoelectric Layer	Resistivity Range (ohm-m)	Thickness Range (m)	Lithological Description
Layer 1	35 - 723	0.3 – 1.5	Topsoil: Clay, sandy clay and clayey sand (Archaeologically relevant layer)
Layer 2	16 – 162	0.9 - 4.8	Clay/sandy clay (Archaeologically relevant layer)
Layer 3	13 - 70	2.3 – 23.2	Clay (Weathered Basement)
Layer 4	167 - 544	DRH: 5.7 – 26.8	Basement Bedrock

DRH: Depth to Rock Head

The subsurface layers include the topsoil, weathered layer and the basement bedrock (Figures 5). The geoelectric characteristics of the survey area are contained in Table 1. The upper two geoelectric layers constitute the archaeologically significant unit with total thickness of between 0.3 and 3.8 m. The depth to basement rock head varies from 5.7 – 26.8 m.

2D Dipole-Dipole Subsurface Imaging

Figures 6 a and b display typical 2D resistivity structures (2D images) with superimposed VES 4 interpretation model along Traverses TR 40. The 2D structures imaged the upper 3.0 m of the subsurface sequence – the topsoil and the upper segment of the weathered layer.

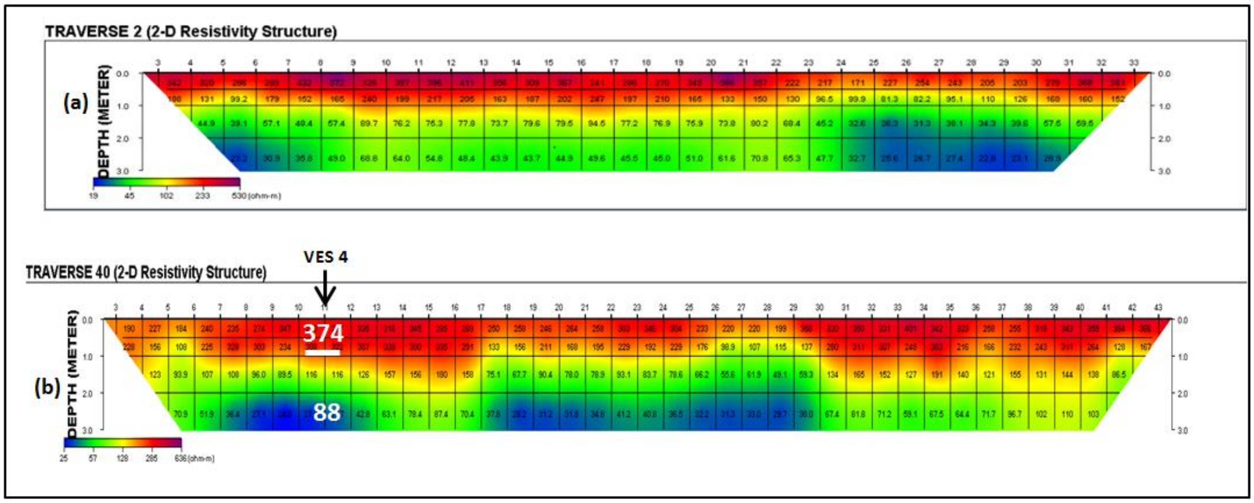

Figure 6: Resistivity Structure along (a) Traverse 2 and (b) Traverse 40.

The topsoil in purple to reddish brown/yellowish color varies in resistivity from 100 – 580 ohm-m and thickness of up to 2.0 m. The upper segment of the weathered layer (in green/blue color) has resistivity values of 19 – 110 ohm-m. The 2D structures correlate significantly with the upper segment (0 – 3 m) of the geoelectric section.

Resistivity Depth Slice Maps

Figures 7(a-d) present the resistivity maps at depth levels 0.25 m – 2.5 m. At 0.25 m, thirty two (32) anomalous zones were identified, twenty (20) of which are high resistivity zones, labelled A, B, C_1, C_2, C_3, C_4, C_5, C_6, C_7, D_1, D_2, D_3, D_4, E_1, E_2, E_3, E_4, E_5, F, G and twelve (12) are low resistivity zones coded i, ii, iii, iv, v, vi, vii, viii, ix, x, xi, and xii.

Twenty-seven (27) of these anomalous zones (A, B, C_3, C_4, C_5, C_6, C_7, D_2, D_3, D_4, E_1, E_2, E_4, E_5, F, G, i, ii, iii, v, vi, vii, viii ix x, xi, and xii) manifest at 0.75 m depth while three (3) new anomalous zones (two (2) high resistivity anomalous zones D_5, H and one low resistivity anomalous zone xiii) were identified. The remaining four (4) anomalous zones C_1, C_2, E_2, iv have disappeared.

At 1.5 m depth level, twenty (20) anomalous zones (A, B, C_1, C_2, C_3, C_4, C_7, D_1, D_3, D_4, D_5, E_1, E_2, G, H, ii, iii, viii, ix, x, and xii) have disappeared into the low resistivity background while few anomalous zones C_5, C_6, D_2, E_3, E_4, E_5, F, i, vi, xiii still occur at this depth.

Anomalous zones D_2, E_3, F, i, vi, xiii disappeared at 2.5 m depth while other anomalous zones C_5, C_6, E_5, E_6 still occur. Near surface (high resistivity) anomalous zones A, B, C_1, C_2, C_3, C_4, C_7, D_1, D_2, D_3, D_4, D_5, E_1, E_2, E_3 which occur at depth of up to 0.75 m with resistivity values greater than 120 ohm-m and are clustered near circular or oval in shape are suspected to be collapsed huts/structures, built with fired bricks and masonry with characteristic relatively high resistivity values.

The different geometries (shapes) displayed by these anomalies may suggest different architecture of the suspected structure (huts). The clustered arrangements of the high resistivity anomalous are typical of mini settlements. Three (3) mini settlements labelled C, D, and E are revealed on the resistivity map.

The mini settlements fall on both sides of the ancient trench characterized by low resistivity anomaly (xii). Low resistivity anomalies iii, iv, v, vii, viii, ix, x, xi which also occur within or close to the clustered high resistivity anomalous zones and at the same depth range, with resistivity values ranging from 40 – 100 ohm-m are attributed to suspected dumpsites created by the identified mini settlements.

Low resistivity anomalies are expected over biodegraded domestic refuse dumpsite with generated conductive effluent. Domestic wastes are in the ancient past disposed within the living surrounding.

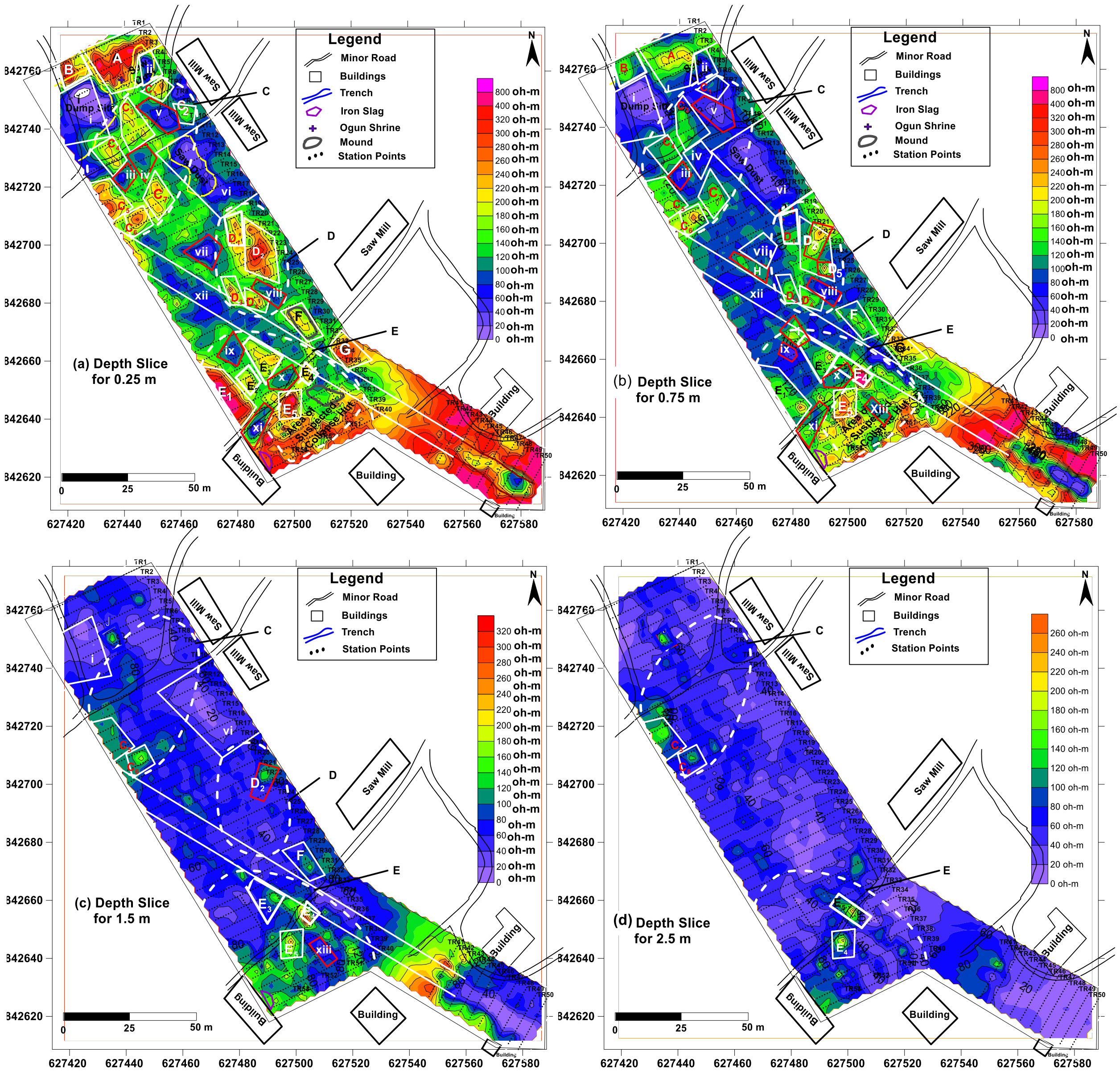

Figure 7 (a-d): Composite Resistivity Maps at (a) 0.25, (b) 0.75, (c) 1.5, and (d) 2.5 m Depth Levels.

Anomalous zones i, ii and vi with low resistivity values ranging from 4 – 80 ohm-m coincide with the locations of an existing refuse and sawdust dumpsites respectively. The elongated high resistivity anomalous zone F with resistivity values ranging from 120 – 200 ohm-m is suspected to be a tomb. An ancient tomb is expected to contain human remains (carcass) with void whose resistivity is supposed to be relatively higher than the immediate environment. The high resistivity anomalous zones C_5, C_6, D_3, D_4, F, G and H aligned parallel to the delineated ancient trench with resistivity values ranging from 200 – 400 ohm-m, are attributed to relics of an ancient wall. Low resistivity anomalous zone xiii, around which iron slag was found and characterized by resistivity values of 60 – 100 ohm-m is attributed to iron smelting site. The occurrence of high resistivity anomalous zones C_5, C_6, E_4 and E_5 beyond the depth range (0 – 2 m) of most archaeological artifacts that are typical of anthropogenic activities could indicate the effect of resistive basement bedrock at shallow depth. Eight (8) sites were selected for follow-up archaeological excavation, as shown in Table 2 and Figure 8.

Table 2: Selected Sites for Archaeological Excavation.

S/N	Anomalous Zone	Resistivity Anomaly	Inferred Suspected Archaeological Artifacts
1	A	High	Collapsed Hut
2	C_3	High	Collapsed Hut
3	iv	Low	Ancient Waste Dumpsite
4	D_1	High	Collapsed Hut
5	D_2	High	Collapsed Hut
6	D_3	High	Relics of Ancient Wall
7	x	Low	Ancient Waste Dumpsite
8	F	High	Suspected Tomb

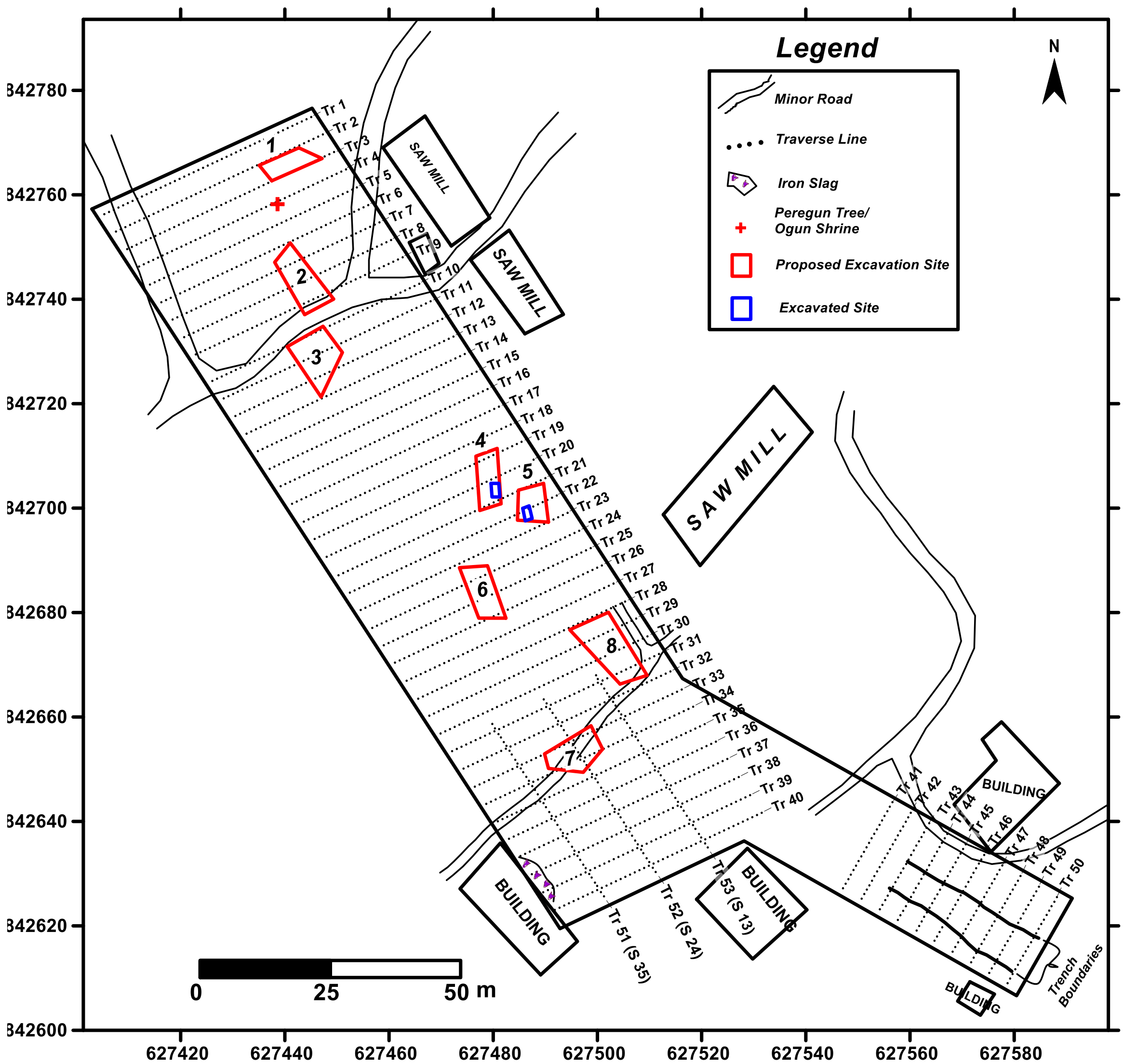

Figure 8: Map Showing Proposed Sites for Archaeological Excavation.

Preliminary Archaeological Excavation

Two of the selected sites (4 and 5) were excavated. The dimension of the excavated sites was 1 m x 2 m x 1.5 m. The excavated sites are discussed below.

Site 4 (Pit 1): This site is characterized by a high resistivity anomaly closure (Figure 7a) suspected to be a collapsed structure (hut). Pit 1 (Figure 9) yielded many pottery sherds, snail shell, animal jaw bone, cowries, flute, iron objects and glass bead (Figure 9b). The pit also identifies a relic of a structure (hut) foundation (Figure 9a).

Site 5 (Pit 2): This site is characterized by a high resistivity anomaly closure (Figure 7a) suspected to be a collapsed structure (hut). Pit 2 (Figure 10) also yielded several pottery sherds, bones fragments, animal jaw bone, cowries, bone bead, metallic and bronze objects, oyster shells and finger like clay cylinder (Figure 10b). The dry and low porosity pottery sherds, bones, snail and oyster shells, glass and bone beads must be responsible for the observed high resistivity at the two sites excavated. The identified relics of a structure (hut) foundation (Figure 9a) within Pit 1 corroborates the inference of a collapse structure. The identification of oyster shells indicates that the area or part of it was once flooded or underwater or located close to a river.

The recovered artifacts confirmed Igbo Oritaa as an ancient settlement occupied by people whose social, economic, dietary and cultural activities are reflected by the archaeological finds.

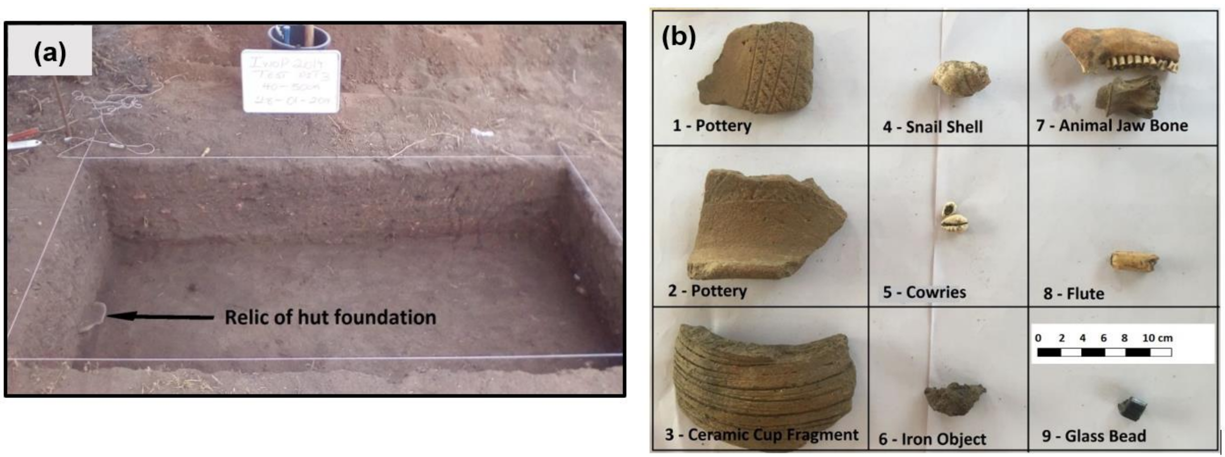

Figure 9: (a) Excavated Pit 1 Showing Relic of Structure Foundation and (b) Archaeological Finds.

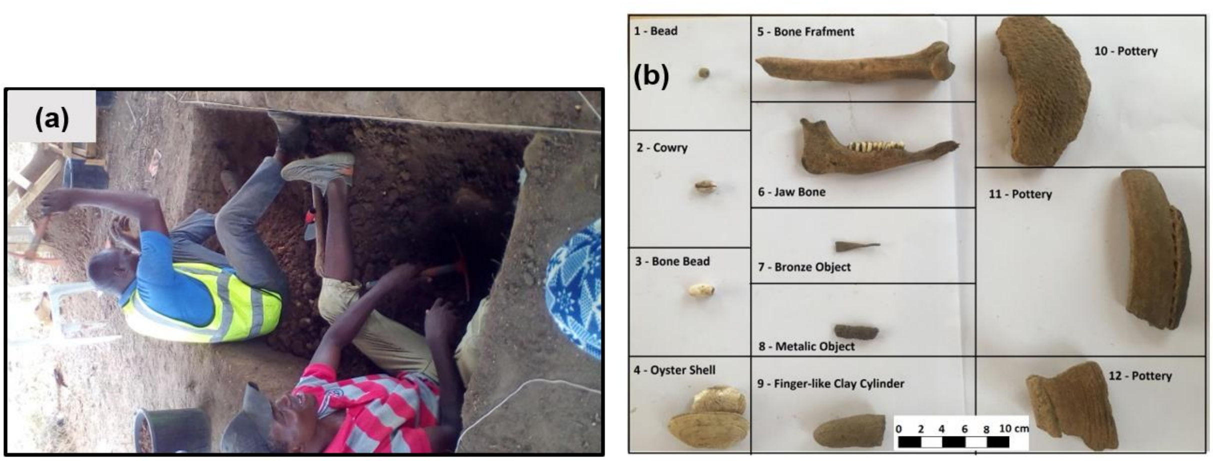

Figure 10: (a) Excavated Pit 2 and (b) Archaeological Finds.

CONCLUSIONS

Geoelectric characterization involving the electrical resistivity method was carried out at Igbo Oritaa archaeological site in Iwo, Southwest Nigeria with the view to providing information on the locations of buried artifacts and structure architecture that will aid follow-up excavation works and subsequent recreation of the historical activities at the ancient settlement.

From the 2-D depth slice maps, thirty-one (31) anomalous zones suspected to be of archaeological interest were identified, twenty-one (21) of which are high resistivity zones and ten (10) low resistivity zones within the upper 1.5 m depth level. Suspected archaeological artifacts included collapsed huts, iron smelting site, tomb, ancient dumpsites and collapsed ancient wall.

These artifact were identified based on geoelectric characteristics. Clustered high resistivity anomalous zones C, D and E, characterized by resistivity values greater than 120 ohm-m, were interpreted as suspected mini settlements. The low resistivity anomalous zones iii, iv, v, vii, viii, ix, x, xi within or close to the suspected settlements were attributed to ancient dumpsites. The elongated high resistivity anomalous zone F with resistivity values ranging from 120 – 200 was attributed to tomb.

High resistivity (200 – 400 ohm-m) anomalous zones C5, C6, D3, D4, F and G aligned parallel to the delineated ancient trench were attributed to relics of a collapsed ancient wall. Based on literature review, oral and documented history, field observations and geoelectric characteristics, eight (8) sites were recommended for follow-up archaeological excavation.

Two of the recommended sites (sites 4 (Pit 1) and 5 (Pit 2)) characterized by high resistivity closures were excavated. Artifacts recovered from these sites are pottery sherds, snail shell, animal jaw bone, cowries, flute, iron objects and glass beads, bones fragments, bone bead, metallic and bronze objects, oyster shells and finger like clay cylinder. Site 4 (Pit 1) also identifies a relics of a structure (hut) foundation.

The dry and low porosity pottery sherds, bones, snail and oyster shells, glass and bone beads must be responsible for the observed high resistivities at the two sites excavated. The identified relics of a structure (hut) foundation within Pit 1 corroborates the inference of a collapse structure. The identification of oyster shells indicates that the area or part of it was once flooded or underwater or located close to a river.

The recovered artifacts confirmed that Igbo Oritaa is an ancient settlement occupied by people whose social, economic, dietary and cultural activities are reflected by the archaeological finds, listed above.

REFERENCES

1. Clark, A.J. 1990. *Seeing Beneath the Soil. Prospecting Methods in Archaeology. 2nd Edition*. *Geoarchaeology*. B.T. Batsford Ltd.: London, UK. 13, 333-335

2. Dalan, R. 2012. “Defining Archaeological Features with Electromagnetic Surveys at the Cahokia Mounds State Historic Site”. *Retrieved*. 13.

3. Dahlin, T., C. Bernstone, and M.H. Loke. 2002. “A 3-D Resistivity Investigation of a Contaminated Site at Lernacken, Sweden”. *Geophysics*. 67(6): 1692–1700.

4. Dipro for Windows. 2001. *Dipro^{TM} Version 4.0 Processing and Interpretation Software for Dipole – Dipole Electrical Resistivity Data*. KIGAM: Daejon, South Korea.

5. Dolphin, L. 2011. “How Geophysical Methods can help the Archaeologist”. SRI International: Menlapark, CA. lambert@ldolphin.org.

6. Drahor, M.G., M.A. Berge, and M. Hartmann. 2008. “Magnetic Imaging and Electrical Resistivity Tomography Studies in a Roman Military Installation found in Satala Archaeological Site, Northeastern Anatolia, Turkey”. *Journal of Archaeological Science*. 35(4):259-271.

7. Ekinci, Y.L., M.A. Kaya, C. Basaran, H. Kasapoglu, A. Demirci, and C. Durgut. 2012. “Geophysical Imaging Survey in the South Necropolis at the Ancient City of Parion (Kemer-Biga), Northwestern Anatolia, Turkey: Preliminary Results”. *Mediterranean Archaeology and Archaeometry*. 12(2):145-157.

8. Eluyemi, A.A., M.O. Olorunfemi, and M.A. Ogunfolakan. 2012. “Integrated Geophysical Investigation of Orile Oje Archaeological Site, Ogbomosho, Southwest Nigeria”. *The Pacific Journal of Science and Technology*. 13(1): 615-630.

9. Gaffney, C. and J. Gater. 2003. “Revealing the Buried Past”. *Geophysics for Archaeologist. Tempus Publishing*: Stroud. 13(1):73-74.

10. Geological Survey of Nigeria. 2006. “Geological Map of Iwo Sheet 1:25,000”. GSN: Abuja, Nigeria.

11. Jung-Ho K. 2001. “Dipro for Windows, Dipro TM Version 4.0 Processing and Interpretation Software for Dipole-Dipole Electrical Resistivity Data”. Kigam, Daejon, South Korea.

12. Ladipo, O. and A. Amoo. 2017. “Iwo Land and its Untrapped Tourism Potential”. Paper Presented on the Iwo Historical and Cultural Association. 4pp.

13. Luigia, N., L. Giovanni, and N. Sergio. 2009. “GPR, ERT and Magnetic Investigations inside the Martyrium of St Philip, Hierapolis, Turkey”. *Archaeological Prospection*. 16(3): 177-192.

14. Mohammed, A.R. 2017. “Archaeology and Geophysics: Invincible Couple”. *Arch. and Anthropol. Open Access*. 1(3): 1-3. AAOA.000514.2017. Nigeriazipcodes.com

15. Obaje, N.G. 2009. “Geology and Mineral Resources of Nigeria”. Springer Dordrecht: Heidelberg, Germany. 14

16. Olorunfemi, M.O., B.A. Ogunfolakan, G.L. Chouin, A.G. Oni, M.O. Okunubi, and S.A. Akinwumiju. 2015. “Integrated Geophysical Investigation of YEMOO Groove Archaeological Site in Ile-Ife, Osun State, Southwest Nigeria”. *Ife Journal of Science*. 17(3): 553-563.

17. Ortega, A.I., A. Benito-Calvo, and J. Porres. 2010. “Applying Electrical Resistivity Tomography to the Identification of Endokarstic Geometries in the Pleistocene Sites of the Sierra de Atapuerca (Burgos, Spain)”. *Archaeological Prospecting*. 17(4): 233-245.

18. Oswin, J. 2009. *A Field Guide to Geophysics in Archaeology*. Springer-Praxis Books in Geophysical Sciences. Praxis Publishing Ltd.: Chichester, UK. 89 pp.

19. Oyeyemi, K.D., M.A. Oladunjoye, A.P. Aizebeokhai, P.G. Ajekigbe, and B.A. Ogunfolakan. 2015. “Integrated Geophysical Investigations for Imaging Archaeological Structure in Ancient Town of Ile-Ife, Nigeria”. *Asian Journal of Information Technology*. 4(7):246-252.

20. Papadopoulos, N.G., P. Tsourlos, and G.N. Tsokas. 2006. “Two-Dimensional and Three Dimensional Resistivity Imaging in Archaeological Site Investigation”. *Archaeological Prospection*. 13(3):163-181.

21. Tonkov, N., M.H. Loke, J.E. Chambers, and R.D. Ogilvy. 2006. “A Resistivity Survey of a Burial Mound in the 'Valley of the Thracian Kings'”. *Archaeological Prospection*. 13(2):129-136.

22. Vander Velpen, B.P.A. 1988. *Resist Version 1.0.* ITC M.Sc. Research Project.

23. Witten, A. 2006. *Handbook of Geophysics and Archaeology*. Equinox Publishing Ltd.: London, UK.

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