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Original Article

Application of geophysical method as a reconnaissance tool for pre-excavation archaeological investigation

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ABSTRACT

An electrical resistivity geophysical survey was conducted as a preliminary survey for archeological study, the survey was conducted at Laniba Ajibode prehistoric stone age archeological site. The aim of this research is to show that geophysical methods can serve as a non-invasive and non-destructive reconnaissance tool for archeological studies. Wenner configuration with electrode spacing ranging from 1.0 to 7.0 m was employed for the two dimensional (2D) electrical resistivity survey, the points and the profile were selected far away from sources of contaminants this is to avoid uncertainty or ambiguity in the interpretation, the resistivity data were processed and analyzed using RES 2D inversion software. Anomalous zones that are possible archeological remains were delineated at depth range 3.19–3.96 m. The research shows that application of geophysical methods is an effective, non-invasive, non-destructive and environmental friendly preliminary method for locating subsurface archeological artefacts.

Keywords: Ajibode, artefacts, potsherd, prehistoric, stone age, Wenner array

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INTRODUCTION

Archeology is the study of the lives of human past using material remains, these material remains are known as artefacts,[1] they are what prehistoric and historic people made or used and left behind, they provide information and give a better understanding of their life and lifestyle, they also provide historical information on past societies when there are no written documents, archeologists can reconstruct extinct culture from these remains. Examples of archeological artefacts are ceramic materials such as tiles, plates, clay pots and potsherd, potsherd pavement, furnace fragments, pottery kilns, bricks or brick walls tomb, skulls, human bones.[2-4] Anthropogenic activities such as farming has often altered the surface of archeological site and masked the location and depth to which artefacts are buried, thereby given rise to test pitting and wild cats excavation which may be invasive and destructive to the environment and in general the ecosystem. Geophysical methods are generally economical, non invasive, non destructive and effective reconnaissance techniques that can aid the archeologists in pre-excavation survey.[5,6] Several geophysical methods such as electrical resistivity, Magnetic survey, ground-penetrating radar have been successfully used in archaeological prospection.[4,7-12] The aim of this research is to apply electrical resistivity survey as a non invasive, non destructive reconnaissance tool for archeological studies.

The Study Area

The study area is Laniba village, Ajibode, Ibadan, Oyo State, Southwestern Nigeria. It is bounded by latitudes 7.482520N–7.48280N and longitudes 3.880760E–3.880760E. The Ajibode area is located within the tropical rain forest vegetation area which has now been turned into a derived savanna as a result of persistent human activities.[13] The area is regarded as prehistoric archeological site because of the evidence of occupation when water levels were low which suggests that Ajibode area was intensively occupied throughout historic and prehistoric era.[13] Geologically, Laniba village falls within the crystalline basement complex of Southwestern Nigeria and lies in the region of late Precambrian to early Proterozoic orogenesis. The basement complex of Southwestern Nigeria predominantly composed of migmatite

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and granitic gneiss, quartzite;, the rocks of this region are generally igneous and metamorphic.[14] Most of these rocks are mechanically weathered, and material derived from them forms fertile soil and lateritic deposits [Figure 1].[15]

MATERIALS AND METHODS

The materials used for this survey consist of the OHMEGA Ohm Terrameter E0506, four steal electrodes, field hammers, measuring tape and reels of wire. The OHMEGA Ohm Terrameter E0506 measures the resistance and displays on its screen board. Two dimensional (2D) electrical resistivity survey was conducted using Wenner array, the points and the profile were selected far away from sources of contaminants this is to avoid uncertainty or ambiguity in the interpretation. Wenner array Method was employed in this research work because it gives a clearer picture and among other common arrays and it has the strongest signal strength.[17] The data were obtained using an "a" spacing of 1, 2, 3, 4, 5, 6 and 7 m and the distance between adjacent soundings was 1m. RES 2D inversion software was used to generate pseudo sections from the resistivity data, 2D inversion software is a computer programme that automatically determines a 2D resistivity model for the subsurface data obtained from the electrical survey.[18] The pseudo sections for Wenner were then constructed by plotting each reading in accordance with its spacing and sounding location centre.

RESULTS AND DISCUSSION

Figures 2-4 shows the pseudosections generated from the 2D inversion of the field data. Figure 2 is the pseudosection for profile 1, it reveals a compacted lateritic layer from the surface to a depth of 1.85 m and an anomalous region was observed

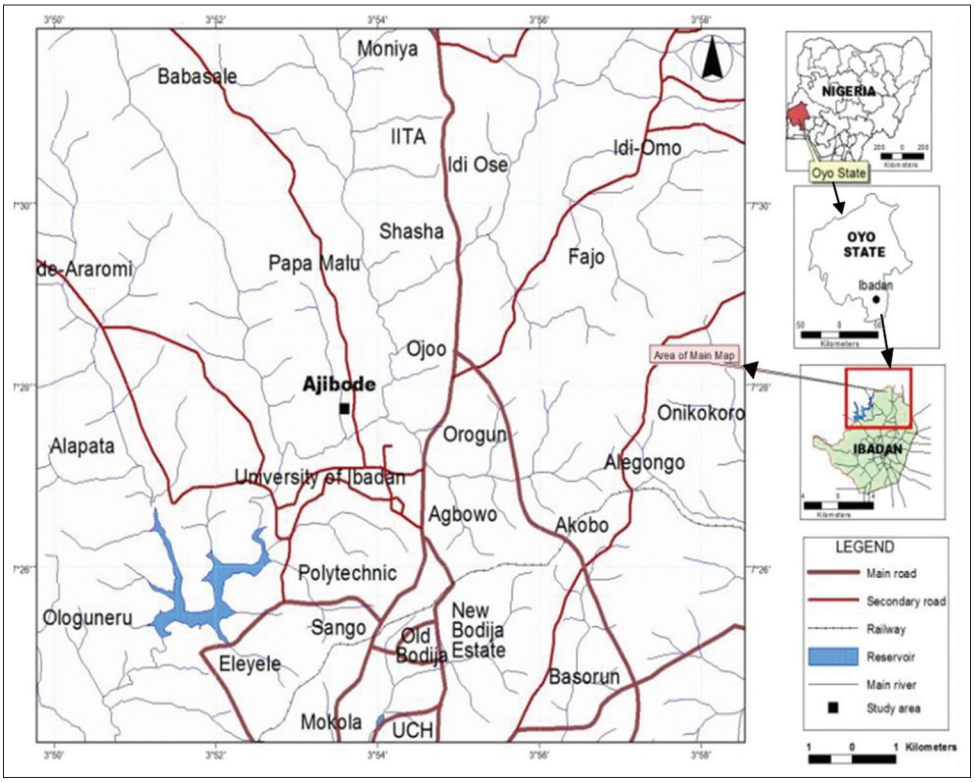

Figure 1: Map of the Study area and its environment after[16]

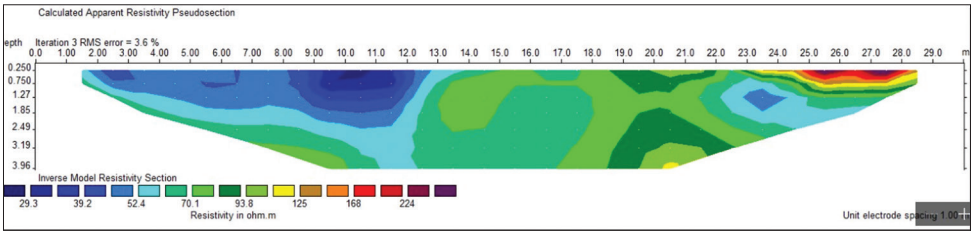

Figure 2: Two dimensional inversion for profile 1

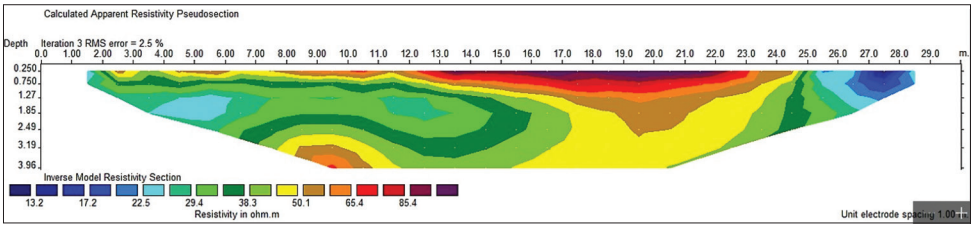

Figure 3: Two dimensional inversion resistivity for profile 2

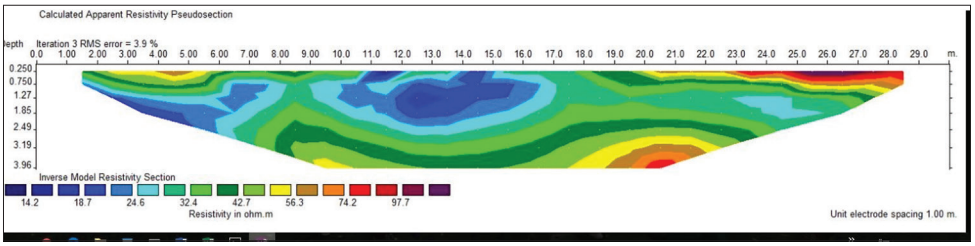

Figure 4: Two dimensional inversion resistivity for profile 3

between distance 20.0 and 21.0 m at depth 3.9–3.95 m this could be relics of artefact because there are possibilities of locating potsherd at this depth.[12] Figure 3 is from Profile 2, the distance covered by this profile is the same as Profile 1 with the same depth, the top layer is compacted laterite delineated between distance 12.0 and 23.0 m with a thickness of about 1.27 m was observed, an anomalous region was observed between distance 9.0 and 10.0 m at depth 3.19–3.96m, this resembles a relics or an artefact. Figure 4 is profile 3, the top soil is compacted lateritic clay, two anomalous zones at distances 9.0–10.0 m and 20.0–21.0 m at depths 3.19–3.96 m and 3.5–3.96 m were observed, respectively. there are possibilities of locating potsherd at this depth and this range is found to be suitable in finding artefact of most archaeological remains when excavated.[12] Based on the existence of some archaeological remains in the vicinity of the surveyed area, these geophysical anomalies were thought to be potsherds or potsherds pavements because of their length, Potsherds are common archeological artefacts in Yoruba, southwestern Nigeria[3,19] the observed geophysical anomalies could be Potsherd or potsherd pavements. This research was able to identify anomalous zones of subsurface archaeological remains at depth 3.19–3.96 m and 3.5–3.96 m Laniba, Ajibode Site using electrical resistivity method, this show that application of geophysical methods is an effective and non destructive preliminary method for locating subsurface archeological artefacts.

CONCLUSION

This research was able to identify anomalous zones of subsurface archaeological remains at Laniba, Ajibode Site using electrical resistivity method, this shows that the application of geophysical methods is an effective and nondestructive preliminary method for locating subsurface archeological artefacts.

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