Groundwater for Sustainable Development
Volume 9, October 2019, 100264
https://www.sciencedirect.com/science/article/pii/S2352801X1830167X

Groundwater for Sustainable Development 9 (2019) 100264
Available online 22 August 2019

Research paper

# Integration of aeromagnetic and electrical resistivity imaging for groundwater potential assessments of coastal plain sands area of Ado-Odo/Ota in southwest Nigeria

E.S. Joel [a,*], P.I. Olasehinde [b], T.A. Adagunodo [a], M. Omeje [a], M.L. Akinyemi [a], J.S. Ojo [c]

[a] Department of Physics, Covenant University Ota, Nigeria
[b] Department of Geophysics, University of Ilorin Kwara State, Nigeria
[c] Department of Applied Geophysics, Federal University of Technology Akure, Ondo State, Nigeria

**ARTICLEINFO**

*Keywords:*

Groundwater potential; Aeromagnetic technique; Sedimentary rock; Borehole drillers; Electrical resistivity imaging; Nigeria

**ABSTRACT**

This study aims to investigate the groundwater potential of Coastal Plain Sands area of Ado-Odo/Ota within Dahomey Basin using the integration of aeromagnetic method and electrical resistivity imaging. The aeromagnetic method is applied to reveal the possible hydrogeological structures (such as lineament or fracture) buried in the subsurface. The lineaments which are interconnected are observed in the eastern part of the study area while the western part is void of the interconnectivity of lineaments. Resistivity technique is applied in regions where there are interconnectivity and non-interconnectivity of lineament to delineate occurrence of groundwater about the observed lineament. The depths to magnetic sources range between 102.6 and 1965.2 m. Furthermore, the result of resistivity technique shows that the depth to aquifer ranges from 40 to 100 m with corresponding resistivity values that range between 150.0 and 350.0 Ωm in the region of the interconnectivity of lineament, which is the eastern part of the study area (Igboloye-Covenant University area) and had high groundwater potential. The western part which is void of the interconnectivity of lineaments (Alapoti area) ranges from 80 to 130 m with resistivity values that range between 250.0 and 450.0 Ωm suggesting that the area has low groundwater potential. The study, therefore, shows that the occurrence of groundwater in Ado-Odo/Ota community is a function of hydrogeological structures such as lineaments or fractures, and as a result, this information could serve as guide for borehole drillers, civil engineers and resident of the study area for proper planning before siting borehole either for domestic or industrial use.

## 1. Introduction

It has been confirmed that groundwater exists in the three main rocks types that are found in the earth crust namely the igneous, sedimentary and metamorphic rocks, and each of these rocks that host the groundwater needs to be carefully studied to derive maximum benefit (Vouillamoz et al., 2015). Exploration of groundwater is usually a hydrogeological and hydro-geophysical inference operation and depends on the analysis of the hydrological indicators and assurance (Anthony, 2012). As a result, groundwater has been adjudged to offer an abundance of water to a man (Olasehinde, 2010; Omole, 2013; Omole and Ndambuki, 2014; Adagunodo et al., 2018a) which is a reliable and most constant source of water supply in terms of quantity and quality. Due to its invisibility on the earth subsurface and probable misinformation about its existence, many have not placed value on groundwater as the only source of sustainable water supply. However, the occurrence of groundwater in any part of the surface of the earth is not a matter of chance but as a result of the interaction of physiographical, ecological, hydrological, geological, and climatic factors (Biswas et al., 2012; McLachlan et al., 2017). Therefore, exploring groundwater resource requires the use of certain geophysical techniques to derive its benefits. Various geophysical methods have been employed in exploring groundwater resources ranging from traditional methods (such as fracture trace method) to sophisticated ones (which include electrical, electromagnetic, seismic methods, etc.). However, recently, it has been observed that using any geophysical techniques alone for groundwater investigation might not yield desired result (Omole, 2013; Descloitres et al., 2013; Ojo et al., 2015) and this is due to the heterogeneous nature of the subsurface. It is often possible to determine the depth to basement and under the favourable situation, quantitatively map basement structures, such as host blocks and faults (Prieto and Morton, 2003; Barbara et al., 2016) using the magnetic technique. After all, structure in the shallower segment often lies comfortably atop the basement, at minimal depth. Furthermore, faulting in the shallower segment is often dominated through the revival of basement faults, it is often feasible to discern formation favourable to groundwater occurrence from the interpretation of basement (Goussev et al., 2003), while the use of electrical resistivity method can estimate the contents of groundwater host by hydrogeological structure.

The state water corporations make use of some rivers in Ogun State as a means of water supply to the populace; this water is insufficient for domestic uses to let alone its availability for industrial uses. Groundwater has been the only source of water for all

activities in the study area. The reconnaissance survey revealed some failed hand-dug wells in the study area, which has been as a result of inadequate use of the proper geophysical tool(s) to explore the promising aquiferous zones in the subsurface. Therefore, this research aims to investigate the potential assessment of groundwater in Coastal Plain Sand area of Ado-Odo/Ota using the integration of aeromagnetic and electrical resistivity imaging in order to ascertain the level of availability of this resource in Ado-Odo/Ota being an industrialized environment, which has impact on the population growth in the study area. Also, due to the insufficient geophysical information and topographic nature of the subsurface of the area, access to groundwater for the domestic purpose has been problematic.

* Corresponding author.
*E-mail address:* emmanuel.joel@covenantuniversity.edu.ng (E.S. Joel).
Contents lists available at ScienceDirect

Groundwater for Sustainable Development

journal homepage: http://www.elsevier.com/locate/gsd
https://doi.org/10.1016/j.gsd.2019.100264
Received 1 August 2018; Received in revised form 16 August 2019; Accepted 19 August 2019