GRAVITY SURVEY OF PARTS OF SOUTHWESTERN NIGERIA

BY

ADEJUWON, Benjamin Bukola ***(B.Sc., Ado-Ekiti; M.Sc., Ibadan)***

REG NO: 20154988598

A DISSERTATION SUBMITTED TO THE POSTGRADUATE SCHOOL

FEDERAL UNIVERSITY OF TECHNOLOGY, OWERRI.

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF DOCTOR OF PHILOSOPHY (PH.D.) IN GEOPHYSICS

December, 2021.

CERTIFICATION

This is to certify that this work "Gravity Survey of Parts of Southwestern Nigeria" was carried out by "ADEJUWON, Benjamin Bukola" (Reg No: 20154988598) in partial fulfilment of the requirements for the award of the degree of Doctor of Philosophy (Ph.D) in Geophysics in the Department of Geology, Federal University of Technology Owerri.

Prof. K.K Ibe (Principal Supervisor)	08-03-2022 Date
Prof. C.C.Z. Akaolisa (Co-Supervisor)	8/11/22 Date
Dr. S.I. Ibeneme (Co-Supervisor)	08/11/2022 Date
Prof. A.I. Opara (Head, Geology Department)	24/09/21 Date
Prof. C.C.Z. Akaolisa (Dean, School of Physical Sciences)	23/11/22 Date
Prof. C.C. Eze (Dean, Postgraduate School)	Date
Prof. H.O. Aboh (External Examiner)	16/12/21 Date

ii

DEDICATION

This PhD dissertation is dedicated to my father Chief Oluwole Adejuwon for setting my feet on the right path early in life. He lives on. Rest in Peace.

To the most peaceful and loving person that ever liveth my mother Mrs. C.Y. Adejuwon, this work is equally dedicated.

AKNOWLEDGEMENTS

I thank the maker of the universe for his abundant Grace and Mercy for the success of this PhD thesis. All glory be unto Him.

The support, dedication and guidance of my supervisors (Prof. C.C.Z. Akaolisa, Prof K.K. Ibe and Dr. S.I. Ibeneme) are appreciated for making the work a success. Also, the H.O.D (Prof. A.I. Opara), the PG coordinator (Prof. C.N. Okereke) and all members of staff of the Department of Geology, Federal University of Technology, Owerri are appreciated for their guidance, direction and corrections. I thank the Dean (Prof. C.C. Eze) and all members of staff of Post Graduate School, Federal University of Technology, Owerri. Also, the unalloyed support, direction and guidance of my Previous Principal supervisor Prof. A.I.O Selemo is appreciated.

I appreciate the effort of the management of Nigerian Geological Survey Agency for providing most of the geophysical equipment and field vehicle used for the field exercise through the leadership of the former DG (Mr. Alex Nwegbu) and the full support of the current DG (Dr. A.A. Garba). Also, the agency staff that assisted during the data acquisition are appreciated (Mr. Abba Adamu Usman, Kaka Imam, Tunde Adeyemo, Dickson Johnson, Oni Bolaji, Okorie Mary, Fashae Dele, Uche Kelvin, Iliya Jonathan, Fabusiwa Ayodeji, Ojo Tolu and Stephen). The assistance from Olufemi Olasehinde, Adekeye Moses, Afolabi Adewale, Okoye Ekene, Okoye Jerry, Fasae Dele and Rukayat (NYSC) in rock density determination is commendable.

I appreciate the care, prayer and the extra love from my best friend and wife Obiageli, my mum and my children (Adewale, Adeleye, Ericcole, Jeffrey, Busola and Ifeanyi) for the success of this PhD Thesis. The support from the entire Adejuwon family is also appreciated especially Temilade, Adebanjo, Aderotimi, Adeniyi, Adekunle, Adetoye, Bolanle, Anita, Mummy Tolani and Mummy Shina.

The positive word of encouragement from AGSI 96 sets is appreciated especially Madam Mary, Iranola Niyi, Madam Janet, Prince Busuyi Ajoloko, Ajayi Oladimeji, SP, Omolola Bisi, Obe Dare, Egba A. Egba and Kosomolate Busola. The support from the entire KBAB Geoscience Consult Staff is highly appreciated (Tony, Pascal, Festus, Mike, Timbee, Shina, Solomon, Samuel, Victor, Segun, Peter, Akpa, Favour etc.).

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF PLATES

LIST OF APPENDICES

ABSTRACT

Ground gravity survey was carried out in the southwestern part of Nigeria within the areas underlain mainly by the Basement Complex rocks. The study area is precisely bounded by Latitudes $7^0$00'N – $8^0$00'N and Longitudes $4^0$30'E – $6^0$00'E. The work is aimed at producing a comprehensive interpreted structural and geological models and maps from the gravity data as an aid to mineral investigation, structural and crustal studies. One thousand and ninety-three (1,093) gravity data points were established in an area of 18,150km^2 giving a density of 1/16.6km^2. This is a positive improvement on the existing 1/9,075km^{2}gravity density in the area. Seventy-five (75) evenly distributed gravity base stations were established in the study area. These were tied to IGSN 71 through the PGNN Base station at Oshogbo and Akure base stations. This gives a gravity station density of 1/242km^2 as against the existing density of 1/9,075km^2. The database was also saved in GIS platform for proper management and archiving. One hundred and forty-eight (148) rock samples were collected and their densities determined using a standard density determination procedure. The density values ranged from 2.526 to 2.871g/cm^3. The amphibolites have the highest mean density of 2.765g/cm^3, followed by the charnockites with 2.755g/cm^3. The processed data were presented as 2D maps with both contour and colour shaded maps. The maps include absolute gravity value map, Free-air anomaly map, Bouguer anomaly map, Regional anomaly map, residual anomaly map and rock density anomaly map of the area. The Bouguer anomaly field values range from about -19.087 to 16.914mGal, the free-air anomaly values range from 16.026 to 68.274mGal/m while the residual Bouguer Anomaly values range from about -10.577 to 19.805mGal. There is mostly a general NE/SW and few N/S trends in all the anomaly fields. Four gravity profiles across the study area were chosen for modelling and interpretation. Six major bouguer anomalies with unique characteristic features were identified. These maybe related to the contrasting lithological and structural features. These include the Ifewara-Ilesha-Ilaorogun High, Akure-Ikere-Igbaraoke High, Ikare-Ogbagi-Ajowa High, Ute-Uzebba High, IjeshaIsu-Ikole-Ponyan Low and Ondo-Bagbe Low. The elongated NE/SW trending bouguer anomaly at the western part of the study area termed the Ifewara-Ilesha-Ilaorogun High coincide with the geologically established shear zone associated with Ifewara-Zungeru fault system in orientation and location. Hence, the gravity data have confirmed the existence of the mega fault system which is related to gold mineralization within the Ilesha Schist belt. In the same vein, the relatively high oval shaped bouguer anomaly "Ikare–Ogbagi-Ajowa high" at the NE part of the study area can be a new frontier for mineral exploration. Such anomaly needs further exploration using other geophysical and geochemical techniques to determine its mineral potential.

Keywords: Gravity Survey, Basement Complex, Base Stations, Bouguer Anomaly, Rock Density, Fault, Mineral, Orientation.

CHAPTER I

1.0 INTRODUCTION

1.1 Background Information

The efficacy of geophysical data as an aid to structural and lithological mapping as well as mineral exploration cannot be over-emphasized. Most rocks have unique physical properties which give different responses to geophysical measurements; hence obscure structural and lithological features from the traditional surface geological mapping are better resolved with the aid of geophysical data such as gravity, magnetic, radiometrics etc. A well interpreted geophysical dataset can provide the third dimension to surface mapping and sampling, it maps rocks, structure, alteration, etc. under a surface cover of overburden or water, it aid to detect changes in mineralogy, alteration, etc. that are not readily observable visually, and it accelerate mapping and exploration by rapid and cost-effective airborne or ground measurements.

An interpretation is an attempt to reconstruct from the image(s) the geological framework and composition of the earth itself. A good interpretation must be compatible with known geology or geological theory and must be consistent with all of the observed geophysical phenomena.

Gravity is useful prospecting tool because the density of rocks varies laterally, causing the gravitational attraction of the Earth to vary laterally (Adejuwon, Ujubuonu, Alo, Megwara, Arobasalu & Nwegbu, 2013). With a gravity meter also known as gravimeter it is possible to map surface variations in density. The maps derived from accurately located discrete points, allow the interpretation of density variations and consequently the lithology of the Earth.

Changes in the force of gravity at the surface are caused by lateral density changes in the subsurface. The intensity of the gravitational force due to a buried mass difference (concentration or void) is superimposed on a larger gravitational force due to the total mass of the Earth. Thus, two components of gravitational forces are measured at the Earth's surface: (1) a general and relatively uniform component due to the total Earth, and (2) a component of much smaller size which moves due to lateral density changes (gravity anomaly (Wightman, Jalinoos, Sirles and Hanna (2003)).

In mineral exploration, gravity method focuses on the relative change in gravity rather than the absolute value of the Earth's gravitational field. The Earth's gravitational field is approximately 9.8 m/s^2 or 980,000 mGal (Telford, Geldart, Sheriff & Keys, 1990). Anomalies in the range of one part per million or 1 mGal of the Earth's field often have significance in exploration. Gravity meters can more accurately determine differential changes in gravity than absolute magnitude of gravity. They provide great precision in the observation of gravity at a point but the measurement is of a local nature. Many lithologies have specific densities and are thus distinguishable from other rock types; therefore, lateral density changes are useful in prospecting. In early 20^{th} century, gravity method was used successfully to distinguish between large lateral density contrasts, such as anticlines and fault offsets. Even though the diapers may appear identical on seismic data, a salt dome can be recognized from an igneous intrusion based on density (Adejuwon *et al*., 2013).

Measurement of an absolute gravity value is difficult and requires complex apparatus and a lengthy period of observation. Such a measurement is classically made using large pendulums or falling body techniques (Nettleton, 1976). The measurement of relative values of gravity, i.e. the difference of gravity between locations, is simpler and is therefore, the standard procedure for gravity surveying. Absolute gravity values at a survey station may be obtained by tiring the value to the nearest International Gravity Standardization Network (IGSN) station (Morelli,

Ganter, Honkasalo, McConnel, Tanner, Szabo, Uotila & Whalen, 1974). This is a network of stations at which the absolute values of gravity have been determined by reference to sites of absolute gravity measurements. By using a gravimeter to determine the difference in gravity between an International Gravity Standardization Network (IGSN) station and a field location, the absolute value of gravity at that location can be obtained.

Gravity data have consistently been a valuable tool in geological mapping (both structural and lithological features), mineral exploration, mapping underlying basement topography in sedimentary areas, delineation of crustal weakness and mass imbalances within the lithosphere and in the preliminary stages of oil and gas exploration (Basin Analyses) (Choi, Kumar & Kim, 1999).

1.1.1 Location, physiography and drainage of the study area

The study area is in Southwestern part of Nigeria and lies between latitudes 7º00'N and 8º00'N and longitudes 4º30'E and 6º00'E with an approximate area extent of 18,150km^2. It covers Ekiti State, parts of Ondo, Osun, Kogi and Edo States (Figure 1.1). The area is accessible through network of major road, minor roads, footpaths and waterways (Figure 1.2).

Elevation in the study area varies from 93m from the southern part to about 1037m in the north-central part (Figure 1.3). The northern part is generally an upland zone, with elevations being generally above 450m. The elevations drop to around 360m at the central part. The landscape is dotted with rugged hills, the most notable of which are the Olosunta hills of Ikere-Ekiti in the south, the Effon ridge which runs longitudinally around Efon-Alaiye on the western boundary, and the Ado Hills in the center (Figure 1.3).

The study area is principally drained by six major river systems: Owena, Ofosu, Ogbese, Oni, Oshun and Osse (Figure 1.2). The drainage system shows a dendritic pattern. The dendritic drainage implies numerous tributaries and high drainage density.

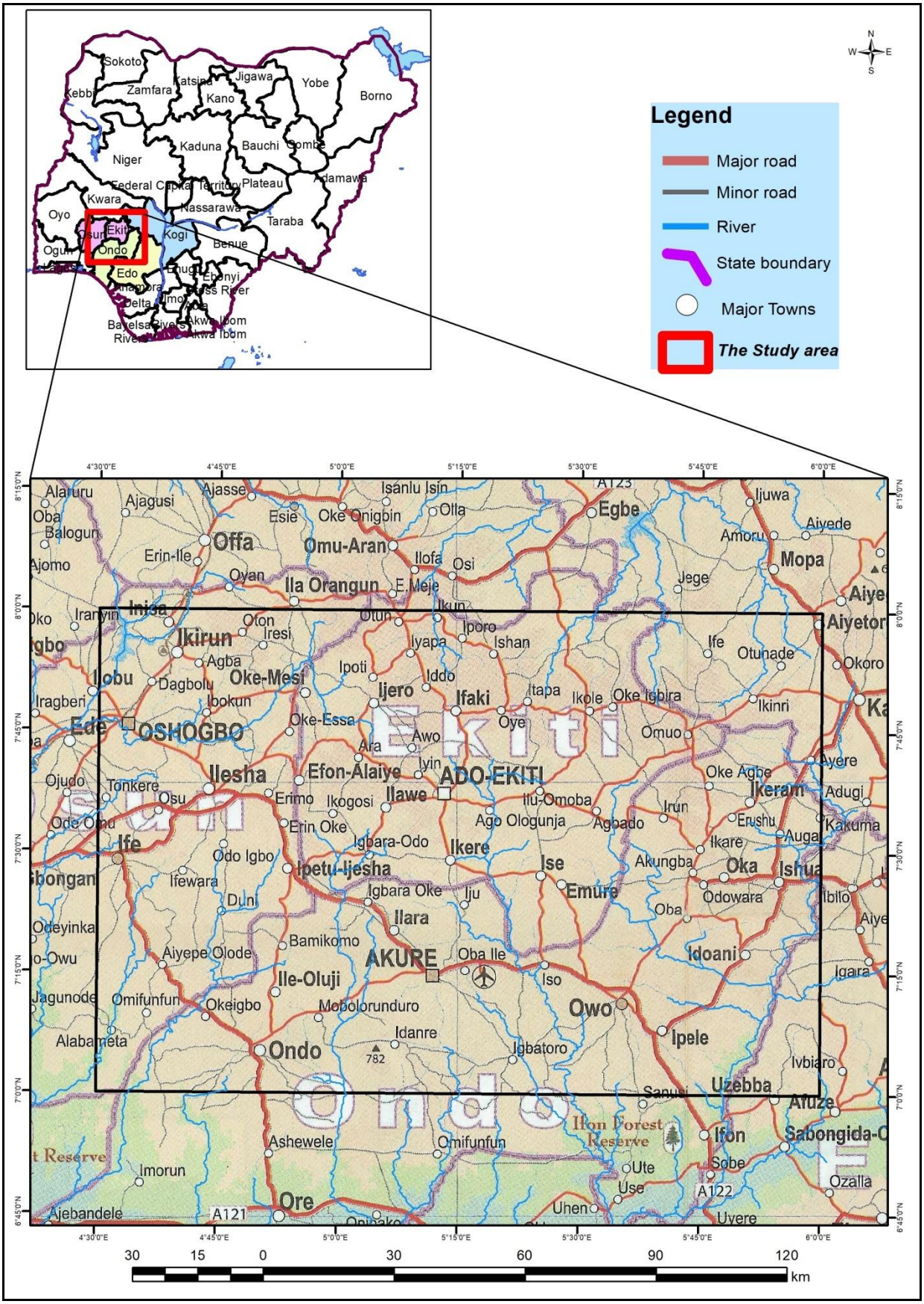


Figure 7.1: Location Map of the Study Area (MDZ Multimedia, 2006)

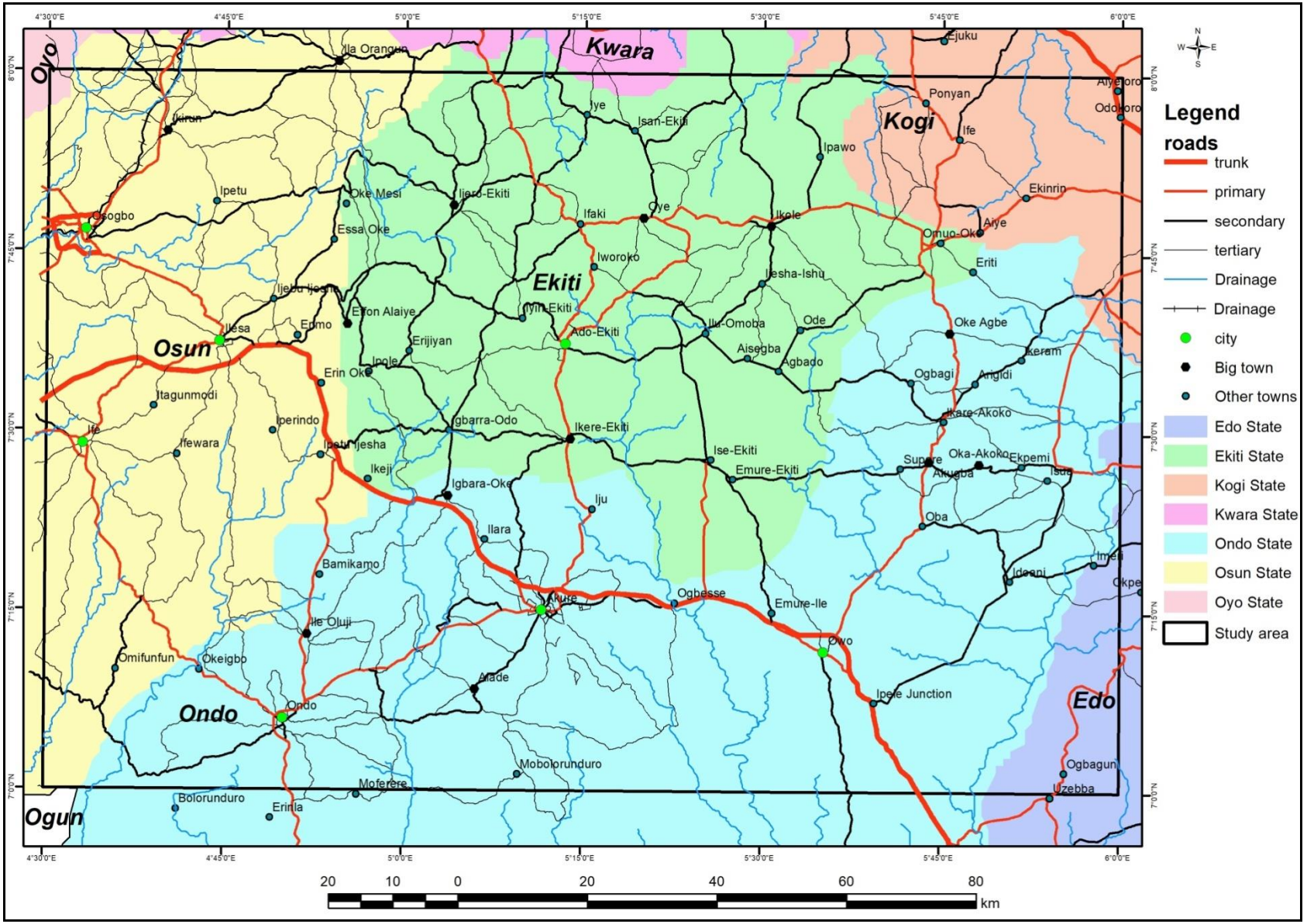


Figure 1.8: Accessibility Map of the Study Area (Modified after MDZ Multimedia, 2006)

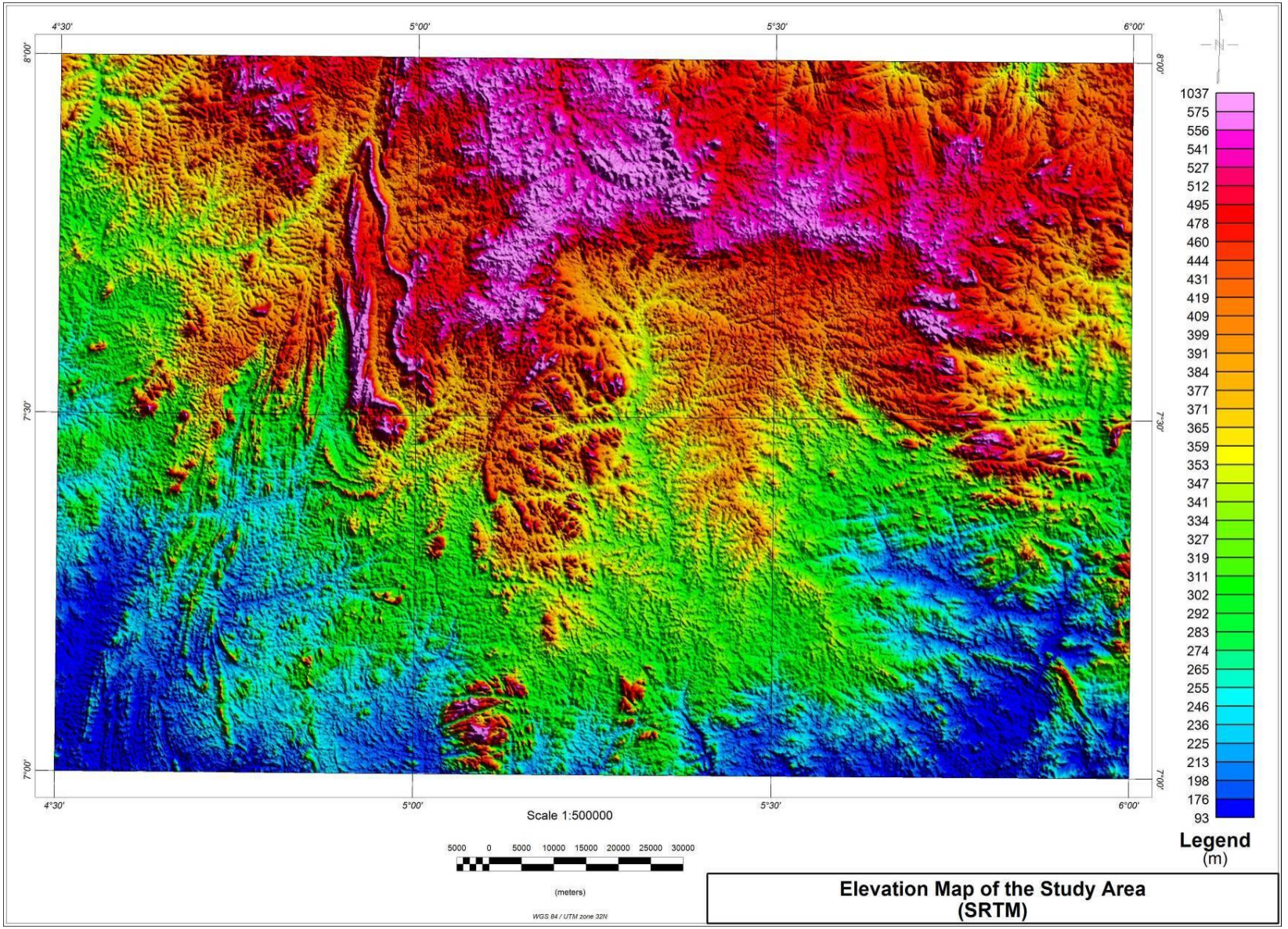


Figure 1.9: Elevation Map of the Study Area (SRTM, 2009)

1.1.2 Vegetation and climate

The study area is in tropical climate zone with alternating dry and wet seasons. It is characterized by aggressive climatic elements such as high temperatures, scorching insolation, high relative humidity and heavy precipitation in the form of large battering raindrops. The rainy season starts in April and ends in October while the dry season exists between November and March. This area of the tropical rainforest enjoys high annual rainfall of about 1700mm, high humidity of over 80% and a mean annual temperature of about 27°C. The rainfall ranges between 50.8 mm during the driest months to 2413.3 mm in the wettest period with a mean annual rainfall of about 1500 mm (Babatunde, Olorunsanya, Orebiyi & Falola, 2007).

The climate is controlled by moist southwest monsoon winds, dry northeast trade winds and high equatorial eastern tides (Ayoade, 1975). This climatic belt favours the growth of a dense forest characterized by tall trees, herbs, shrubs, palm trees etc. observable in the study area. The soil cover is made up of greyish dark loamy soil and few clayey soils. The major land use is farming with notable crops like Cocoa, Kolanut, Oil Palm, plantain and Cassava.

1.2 Statement of the Problem

Despite the usefulness of gravity data in mapping structural and lithologic features, distribution and configuration of the underlying basement rocks, geometry of the sedimentary basin, zones of crustal weakness and mass imbalances within the lithosphere but paucity of such gravity data in this part of Southwestern Nigeria has made such research and mineral exploration difficult, hence there is urgent need for this research.

There are only two gravity stations/base stations in an area of over 18,000km^2. The paucity of gravity data for mapping, mineral exploration and research in this part of Southwestern Nigeria

needs attention. For this study, gravity survey of the parts of Southwestern Nigeria (covering parts of Ekiti, Ondo, Osun, Kogi and Edo states) will be carried out.

1.3 Aim and Objectives of the Research

This work is aimed at producing an interpreted structural and geological models and maps from the gravity data and integration of all relevant geo-information as an aid to mineral investigation, structural and crustal studies.

The objectives are:

i) Generation of the gravity database for the study area.
ii) Densification of the existing two gravity base stations in the area.
iii) Establishment of easily accessible and evenly distributed base stations in the study area that are properly tied to International gravity Standardization Net, 1971 (IGSN ’71).
iv) Density determination of rock samples from the study area.
v) Unification of any previous gravity data in the study area.
vi) Production of reduced height map, Absolute Gravity value map, Free Air anomaly map and Bouguer anomaly map of the area.
vii) Determination of the thickness of the sedimentary basin i.e. depth to the basement and establishment of the basement topography in the sedimentary part.
viii) Mapping of major structural elements that may be related to mineralization.
ix) Delineation and confirmation of the continuation of some trans-oceanic mega fracture systems into the Nigerian continental shelf and beyond.
x) Production of comprehensive interpreted structural maps, models of geologic structures and lithological map of the area based on integration of all relevant geophysical and geological information as an aid to mineral investigation, crustal and other structural studies.

1.4 Justification of the Study

There have been quite a number of efforts at producing gravity anomaly maps in Nigeria by eminent scholars and researchers aimed at identifying areas of interest for mineral exploration and for general understanding of geology (Hospers, 1965, Ajakaiye, 1968 and 1970, Ajakaiye & Burke, 1973). Ofrey (1978) established a preliminary gravity network for Nigeria comprising of 11 gravity stations. However, most of the earlier gravity studies in Nigeria had no common datum. They were simply tied to datum established by Du Claux, Martin, Blot & Remiot (1954) or Woolard & Rose (1963).

The need to have a common reference datum for unifying gravimetric studies in Nigeria led to the establishment of a Primary Gravity Network for Nigeria (PGNN) by Osazuwa (1985). The PGNN consists of 59 base stations which are uniformly distributed throughout Nigeria at an average interval of 200 km.

The establishment of the PGNN is a big step towards reducing error in gravity survey as well as unifying all gravimetric activities in the Country. However, the PGNN cannot be used solely in producing gravity anomaly maps because of the large separation of 200 km between stations. Osazuwa, Onwuasor, Azubike. & Okafor (1994) in their report on Regional Gravity Survey of Kaduna and Katsina States recommended further densification of the Network by locating at least one gravity station within an area of $25km^2$ grid or at every 5km along motorable roads and paths in Nigeria. Based on this, some state in Nigeria especially parts of the Benue Trough and Anambra basin has been covered with the ground gravity by Nigerian Geological Survey agency (Adejuwon *et al.*, 2013, Abba, Alo & Adejuwon, 2013 and Alo, Adejuwon & Abba, 2013).

Most of the recent gravity work in Nigeria are concentrated on the Niger Delta region and part of Lower Benue Trough using majorly aero-gravity data to determine sedimentary sequence (Ugbor & Okeke (2010), Ezekiel, Onu, Akaolisa & Opara (2013), Eke, Okeke & Ezema (2016), Mbah, Obiora, Oha, Terhemba, Ossai & Igwe (2017), Ekpa, Okeke, Ibuot, Obiora &

Abangwu (2018), Igwe, Yakubu, & Idike (2018), Eteje, Oduyebo & Oluyori (2019), Ngozi, Okeke & Orji (2020) and Johnson, Mfoniso, Amarachukwu, Bethrand & Azuanamibebi (2021)). While the present study area in the south-western part of the country received little or no attention in term of gravity research.

To this end, due to the paucity of gravity data; the present study is borne out of the desire to densify the PGNN station and making gravity data accessible for research and mineral exploration in this part of South-western Nigeria because just two (2) PGNN base station in an area of over 18,150km^2 is grossly inadequate for any exploration or geoscience research.

1.5 Scope of the Study

This research will be carried out in stages, which are:

Stage 1 (literature review): This will involve consultation of texts, journals, articles, monographs, conference papers, seminar paper, theses etc. on this gravity studies or related works.

Stage 2 (Data acquisition): This will involve:

i) Calibration of the gravimeter prior to data acquisition using the Gravity Calibration line established by Osazuwa (1992B and 1992C).
ii) Monitoring of the gravimeter and altimeter for two days before the actual survey at a known base station.
iii) Collection of gravity data at 2km interval on all available roads in the study area.
iv) Collection of altimetry data (Altimeter reading, wet temperature and dry temperature) at 2km interval on all available roads in the study area.
v) Taking GPS coordinates and height of all the data collected at 2km interval on all available roads in the study area.

vi) Collection of rocks samples for density determination.

vii) Collection of geologic information and samples from deposits and outcrops.

Stage 3 (Data processing and presentation)

i) The altimetric data will be processed in order to get reduced height.

ii) This will involve temperature correction using relative humidity table and psychometric chart, drift correction etc.

iii) Gravity data processing involved identifying and removing all factors not relating to local geologic bodies.

iv) The corrections to be carried out in this gravity survey include: latitude, drift, free air, Bouguer, and terrain corrections.

Stage 4 (Interpretation and Inference): This will involve integration of all the results in order to produce a comprehensive geophysical interpretation and report for the study area.

1.6 Regional Geologic Setting of Africa and West Africa

The continent of Africa is made up of vast stable crystalline basement of very old rocks, mainly of Precambrian age. Superimposed on this basement are later, largely flat-lying covering successions; along the east, west and north coasts there are sediments of Mesozoic and Tertiary age, deposited in marginal marine basins.

The Precambrian basement can be divided into three cratons; these are the Kalahari, Congo, and the West Africa cratons. These cratons are separated from each other by a number of mobile belts (Sun, Wei-dong, Li-peng, Jia, Cong-ying, Yu-hang, Robert & Zhao-feng, 2016) active in late Precambrian and early Paleozoic times (Figure 1.4).

The Kalahari Craton is an old and stable part of the continental lithosphere, that occupies large portions of South Africa, Botswana, Namibia and Zimbabwe. It consists of two cratons separated by the Limpopo Belt: the larger Kaapvaal Craton to the south and the smaller Zimbabwe Craton to the north (Nguuri, Gore, James, Webb, Wright, Zengeni, Gwavava, Snoke & Kaapvaal Seismic Group, 2001). The Kalahari craton occupies much of southern Africa and contains some of the oldest known rocks and microfossils in the world. The oldest rocks occur in the Transvaal province; in this area the basement consists of granites, gneiss and migmatites around 3.4 billion years old.

The Congo craton occupies a large part of central Africa; its oldest rocks occur in the Tanzania province, an area of granitic basement and greenstone belts similar in structure to the Rhodesian province of the Kalahari craton.

The West Africa craton comprises practically the whole of western Africa from the Gulf of Guinea to the Anti-Atlas Mountains of Morocco. It is bounded east, west and north by much younger mobile belts, while in the Sahara area it is often covered by later Phanerozoic sediments. The oldest rocks occur as scattered masses of highly metamorphosed rocks, metamorphosed during the period 2.9 billion-2.5 billion years ago (Begg *et al.,* 2009).

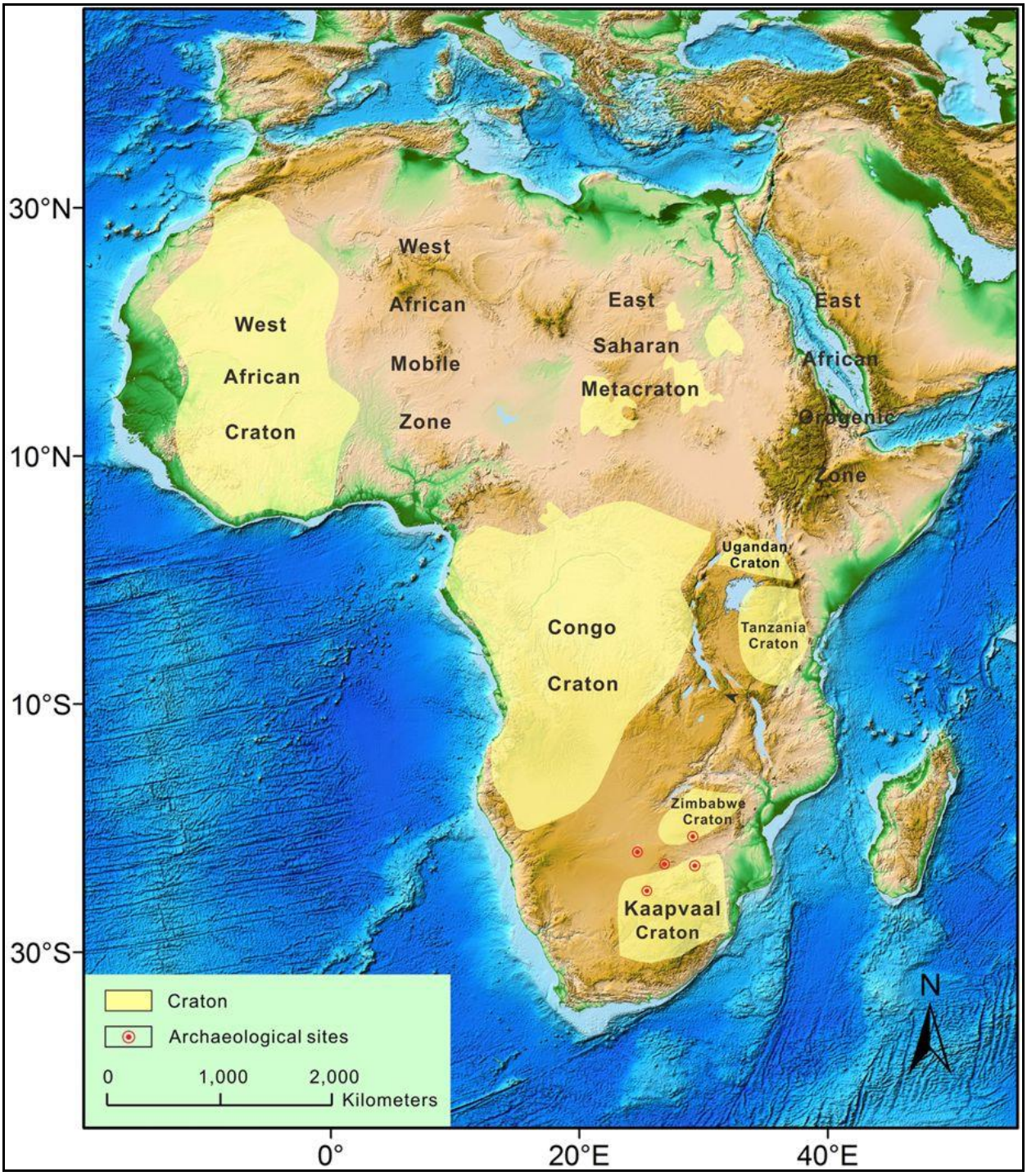


Figure 1.10: Sketched Geologic Map of Africa Showing the Distributions of Archean Cratons (Sun *et al.*, 2016)

1.9 Regional Geologic Setting of Nigeria

Nigerian lies within Pan-Africa mobile belt. This Pan-Africa Province of West Africa lies between two cratons of Achaean to Lower Proterozoic age: the West Africa craton to the west

and the Congo craton to the southeast (Figure 1.4). Eastward, the Pan-Africa Province probably continues across the whole width of Africa to link with the Mozambique belt of East Africa; northward it extends through the Hoggar massif in the central Sahara to be truncated by the Alphine fold belt in North Africa (Turner, 1983).

Nigeria is subdivided into two broad groups in term of geology which are: the crystalline basement rocks and the sedimentary rocks, which occur in about equal proportions as shown in Figure 1.5.

The crystalline basement rocks in Nigeria are subdivided into two namely: the Precambrian rocks and the Phanerozoic rocks. The Precambrian basement rocks are the oldest and most stable rocks of Cambrian to Pre-Cambrian age. These rocks occupy about 40% of the total surface area of Nigeria (Figure 1.5). These rocks have been affected and altered by orogenic events of Liberian (2800±200 Ma), Eburnean (2000±200Ma), Kibarian (1100±200 Ma) and Pan-African (600±150 Ma) orogenies (Turner, 1983).

The Phanerozoic rocks on the other hand are rocks of Cambrian to Recent in age. Some have been referred to as the Younger granites and their associated volcanic rocks by various authors. These rocks are high-level intrusions into the basement complex and it occupies about 9% of the total surface area of Nigeria. They are limited to the Jos Plateau in the north and Benue trough in the eastern part of the country. It consists of basalts, trachytes, rhyolites, amphibolites-rhyolite, granite etc.

The sedimentary rocks in Nigeria are confined to seven major sedimentary basins of Cretaceous to recent ages. These are: Dahomey basin, Niger Delta, Anambra basin, Bida (Middle Niger) basin, Benue Trough, Bornu (Chad) basin and Sokoto basin.

The Basement Complex terrain as a whole has been classified into six major groups by Rahaman (1976), viz:

- Migmatite-gneiss-quartzite complex;
- Younger metasediments, commonly referred to as the schist belt;
- Charnokitic, gabbroic and dioritic rocks;
- Older Granites;
- Volcanics and hypabyssal rocks; and
- Unmetamorphosed dolerite dykes, basic dykes and syenite dykes.

The younger metasediments commonly referred to as the schist belt consist of schistose rocks of Achaean to Late Proterozoic in age. They occur mostly in the western half of the country but are more pronounced in the northern basement complex than the south-western basement complex.

A number of north-south trending Proterozoic schist belts occur conspicuously within the western part of Nigeria with few in the eastern parts and show distinctive petrological and structural features. Fourteen of such belts have been delineated (Rahaman, 1976; Odeyemi, 1977; Ekwueme & Shing1987; Elueze, 1991; Okunlola, 2001; Elueze & Okunlola, 2003). Belts in the southwest include Iseyin, Igarra, Egbe, Isanlu, Ife-Ilesha, Lokoja -Jakura, and Toto-Gadabuike.

The Achaean, Early Proterozoic (Birimian) and Late Proterozoic (Pan-African) shield of Nigeria all have the following features in common:

1. A basement complex dominated by mainly amphibolites-grade gneisses and migmatites and layers and lenses of other rock types such as quartzite, and amphibolites, is made up of rocks that mostly experienced the effects of more than one thermotectonic events.

2. Elongated supracrustal belts of mainly green-schist to amphibolite facies phyllites, schist and greenstones. The Achaean and the Pan-African both have occurrences of meta-conglomerates. These supracrustal are generally believed to have been deformed and metamorphosed during the last of the thermotectonic events which reactivated their basement; i.e., Liberian, Eburnean and Pan-African thermotectonic events for the Archaean, Birimian and Pan-African supracrustal belts, respectively.
3. Syntectonic to late-tectonic plutonic intrusions which are mainly granites to granodiorites in composition but also include smaller masses of diorites, gabbros, syenites and related rocks. They intrude both basement and supracrustal. They were emplaced during the last episode of reactivation that affected the basement, i.e., during the deformation and metamorphism of the supracrustal.
4. Throughout most of the sub-region, the structural grain of the Precambrian rocks generally lies between the N-S and NE-SW trends. This again is defined by the strike of foliation in the schist and gneisses.

In general, the regional geological setting of Nigeria belongs to the Pan African mobile belt and indicates about 50% of its landmass to be underlain by Pre Cambrian basement complex rocks of variable types and composition ranging from meta-igneous rocks and meta-sedimentary rocks, igneous rocks of the older granite suite, which was intruded by younger granites in the Mesozoic and unconformably underlain by younger cretaceous to recent sediments of the five sedimentary basins (Figure 1.5). Thus, Nigeria is underlain by basement complex rocks as well as sedimentary rocks.

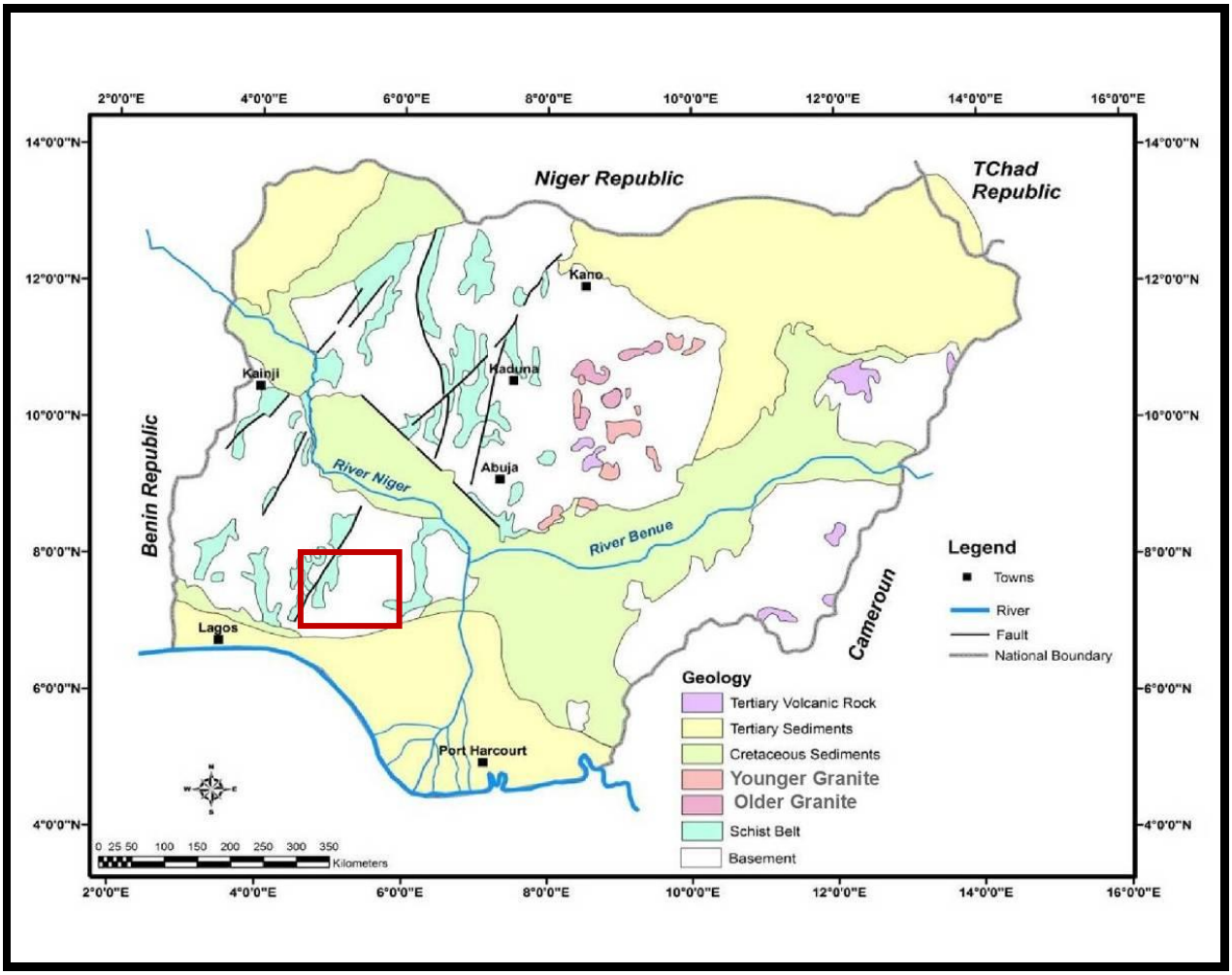


Figure 1.11: Generalized geological map of Nigeria with the Study Area in red Rectangle (Modified after Geological Map of Nigeria, 1996)

1.10 Geology of the Study Area

The study area is underlain mainly by the Precambrian Basement rocks. From the regional geological map of the area, the basement rocks which are mainly migmatites, schists, charnokites, and granites cover over 95% of the study area while the sedimentary rocks covers the extreme southeastern part (Figure 1.6).

According to Rahaman (1978) and Olarewaju (1982), about six lithologies are known in this region: -

- The migmatite – gneiss complex

- The slightly migmatised to unmigmatised paraschists and meta-igneous rocks
- The charnockitic rocks
- The older granites
- The un-metamorphosed granitic rocks composed mainly of microcline and quartz
- The dolerite dykes which are composed of mainly mafic minerals.

The geological setting of the area involves a suite of Pan-African (600±150 Ma) orogenic granitoids, known as the 'Older Granites'. The granitoids were emplaced into migmatites, gneisses and schists of ages varying from Liberian (2,700 Ma), Eburnean (2,000 – 2,700 Ma) and Kibaran (1,100 Ma; Holt, Egbuniwe, Fitches & Wright, 1978; Ogezi, 1977) or the Pan-African time (Ajibade, Woakes, & Rahaman, 1986) but are now reduced to synclinorial remnants by subsequent erosion (Russ, 1957).

The Ilesha schist belt which is known for gold mineralization falls within the study area. The Proterozoic Ilesha schist belt of Southwestern Nigeria has been mapped in various degrees of details by workers, such as, Deswardt (1953), Hubbard (1966, 1975), Elueze (1982 and 1986), Ajayi (1980), Klemm, Schneider & Wagner (1984), Kehinde-Phillips (1991), Bolarinwa & Adeleye (2015), Bolarinwa & Adepoju (2017), Bamisaiye & Ajala (2021) etc. This was largely due to the discovery of gold in the Ilesha area in 1940.

Ilesha schist belt host Ifewara fault system which is an integral part of the Ifewara – Zungeru mega fault. This Shear Zone hosts the 250 km, NNE-SSW trending Ifewara fault. The Ifewara fault is a mega lineament that is connected to the Atlantic fracture system (Hubbard, 1975). Ilesha schist belt rocks on adjacent sides of the fault shows pronounced age difference. The western part consists of volcano sedimentary suites/amphibolite complex of Archean to early Proterozoic age (Bolarinwa & Adepoju, 2017); the eastern section is made up of metasediments of post Archean age (Okunlola & Okoroafor, 2009).

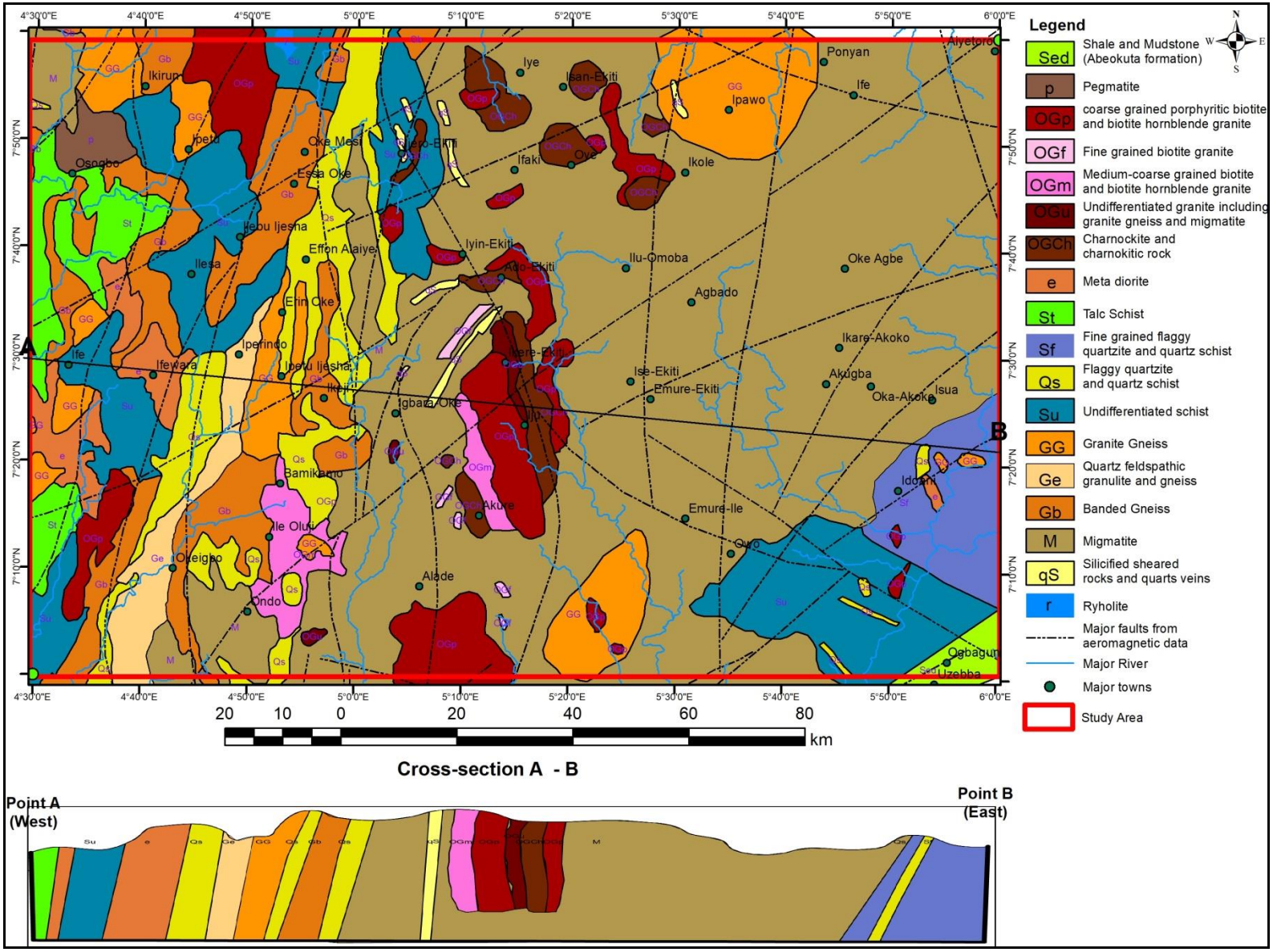


Figure 1.12: Regional Geological Map of Study Area (Modified at NGSA, 2006).

The sedimentary part at the southern region falls within the Dahomey basin. Dahomey basin is generally long with a total length of about 800 km, narrow and parallel to the coastline (Adejato, Adeyeri & Salubi, 2018). The Benin basin (Dahomey Embayment) is bounded in the west by the Ghana Ridge which is an extension of the Romanche Fracture Zone and the east by the Benin Hinge line, a basin escarpment which separates the Okitipupa structure from the Niger delta basin and marks the continental extension of the Chain Fracture Zone (Opara, Ekwe, Okereke, Oha & Nosiri, 2012). The Benin basin is a sedimentary basin that was initiated during the Mesozoic in response to the separation of the African–South American landmasses and the subsequent opening of the Atlantic. The basin forms the onshore part of the West African miogeocline in eastern Ghana, Togo, Benin and western Nigeria.

Dahomey basin contains extensive wedge of Cretaceous to recent sediments, which thicken towards the offshore. Six lithostratigraphic units have been identified by Adegoke &Omatsola (1981). The formation from the oldest to the youngest includes: Abeokuta group (Cretaceous), Ewekoro Formation (Paleocene), Akinbo Formation (Paleocene-Eocene), Oshosun Formation (Eocene), Ilaro Formation (Eocene) and Benin Formation (Oligocene-Recent).

This part of Dahomey basin that outcrop in the study area consists of Cretaceous Abeokuta formation (lying uncomformably on the basement complex), Tertiary Ewekoro formation, followed by Ilaro formation and Quaternary Benin formation (Figure 1.6). This basin has been a major source for both developed and underdeveloped energy fuels and minerals such as petroleum, coal (Ehinola, Oluwajana & Adekoya, 2012), bitumen (tar sand), limestone, phosphate and gypsum.

CHAPTER II

2.0 LITERATURE REVIEW

2.1 Literature Review

Most of the earlier gravity works in Nigeria are concentrated at the North central Nigerian Basement complex especially within the Ring Complex (Ajakaiye (1968, 1970, 1974, 1975, 1976), Ajakaiye & Burke (1973), Ajakaiye & Sweeney (1974), Ibe (1982)) and the Benue Trough (Cratchey & Jones (1965), Adighije (1981)). They were simply tied to datum0 established by Duclaux *et al.* (1954) and Woolard & Rose, (1963).

Hospers (1965) observed the gravity field of Niger Delta region of Nigeria using data from 73 gravity stations situated in the land area of the Niger Delta. Hospers (1965) revealed a sediment thickness of about 8 km in the Niger Delta Basin using the gravity data and showed negative values of low magnitude, called the 'Niger Delta Minimum' which is a gentle gravity minimum reaching -40 mgal covering most part of the Niger Delta.

Cratchey & Jones (1965) attempted to resolve the two contradictory hypotheses on the origin of the Benue Trough has a buried rift valley from tensional forces or a minor geosynclinals furrows formed by comprehension using gravity data. From their research, the initial tension and infilling of the Benue Trough with sediments were followed by intrusion and a later period of folding due to compression.

Ajakaiye & Burke (1973) attempted in producing the gravity map of Nigeria by compiling the existing regional Bouguer gravity map of Nigeria with data mainly from the Ring Complex, Benue Trough and Niger Delta.

Ofrey (1978 and 1980) established a preliminary gravity network for Nigeria comprising of eleven (11) gravity stations (Figure 2.1) which are connected to Lagos or Kano airport gravity stations. The absolute gravity values range from 977889.99mGal in Jos to 987211.55mGal at

Sokoto. The gravity data were acquired with Worden gravimeter and the station were tied to Potsdam datum.

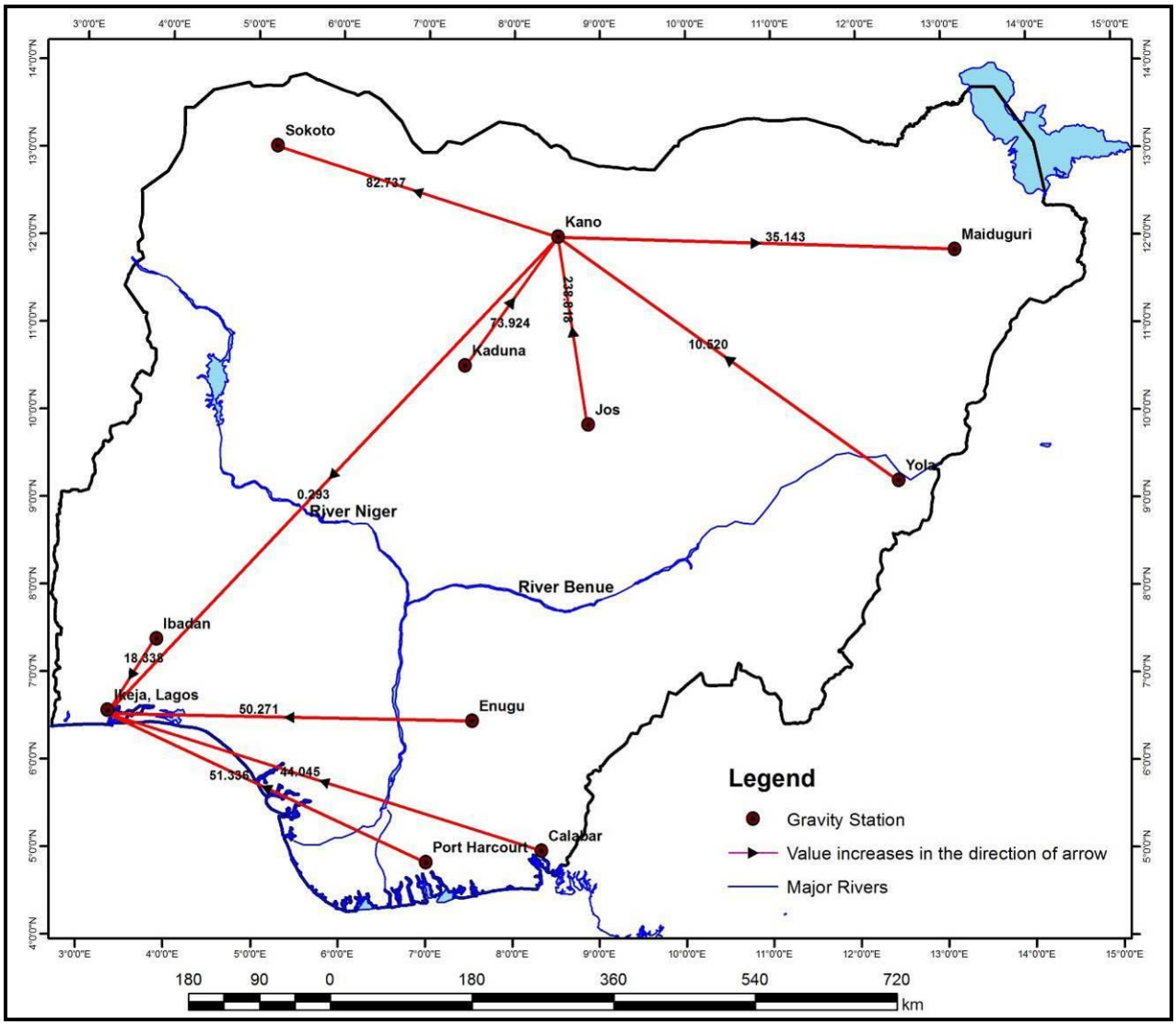


Figure 2.1: Preliminary Gravity Network for Nigeria (Modified from Ofrey, 1980)

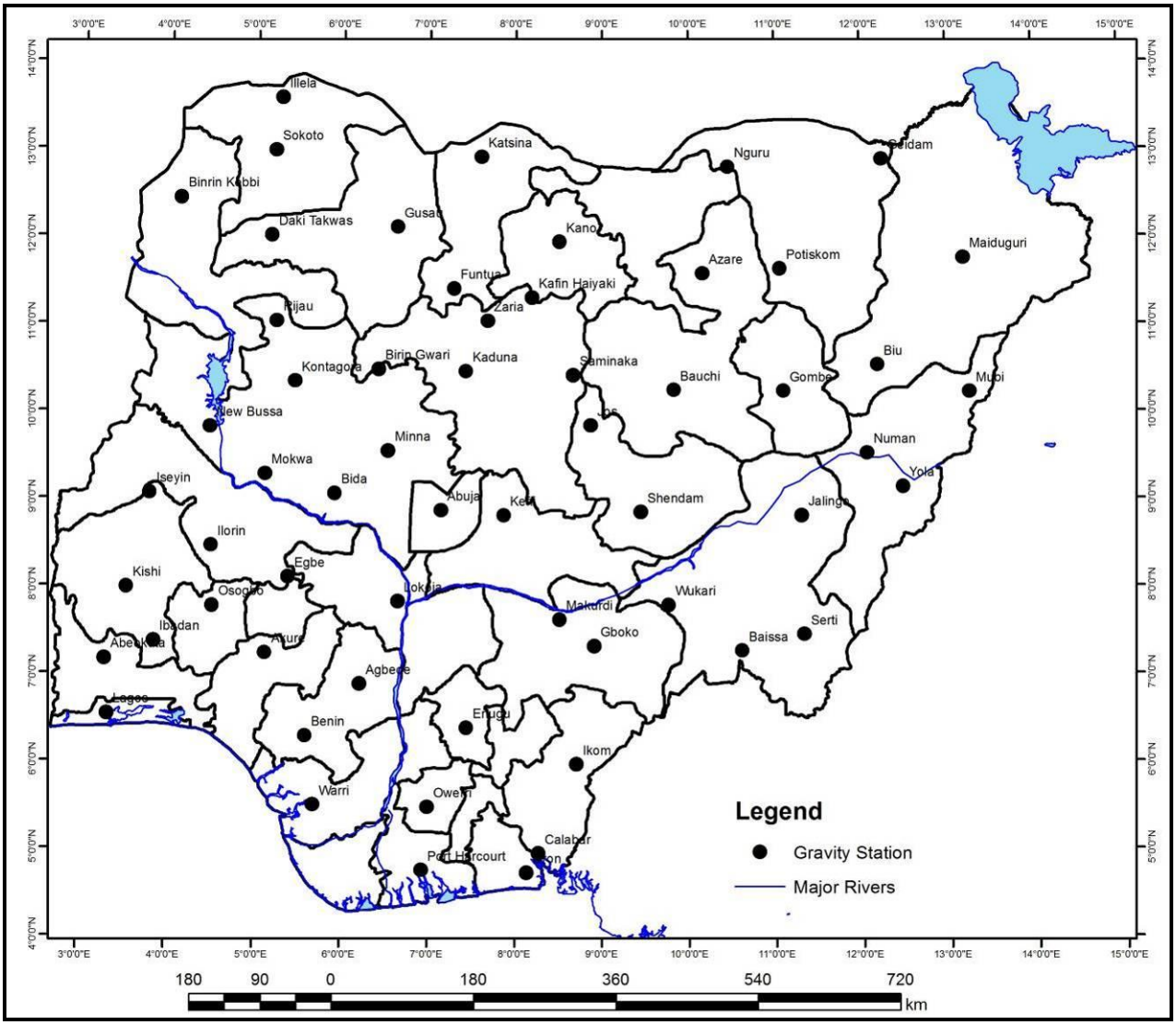


Figure 2.2: Primary Gravity Network of Nigeria (Modified after Osazuwa, 1985)

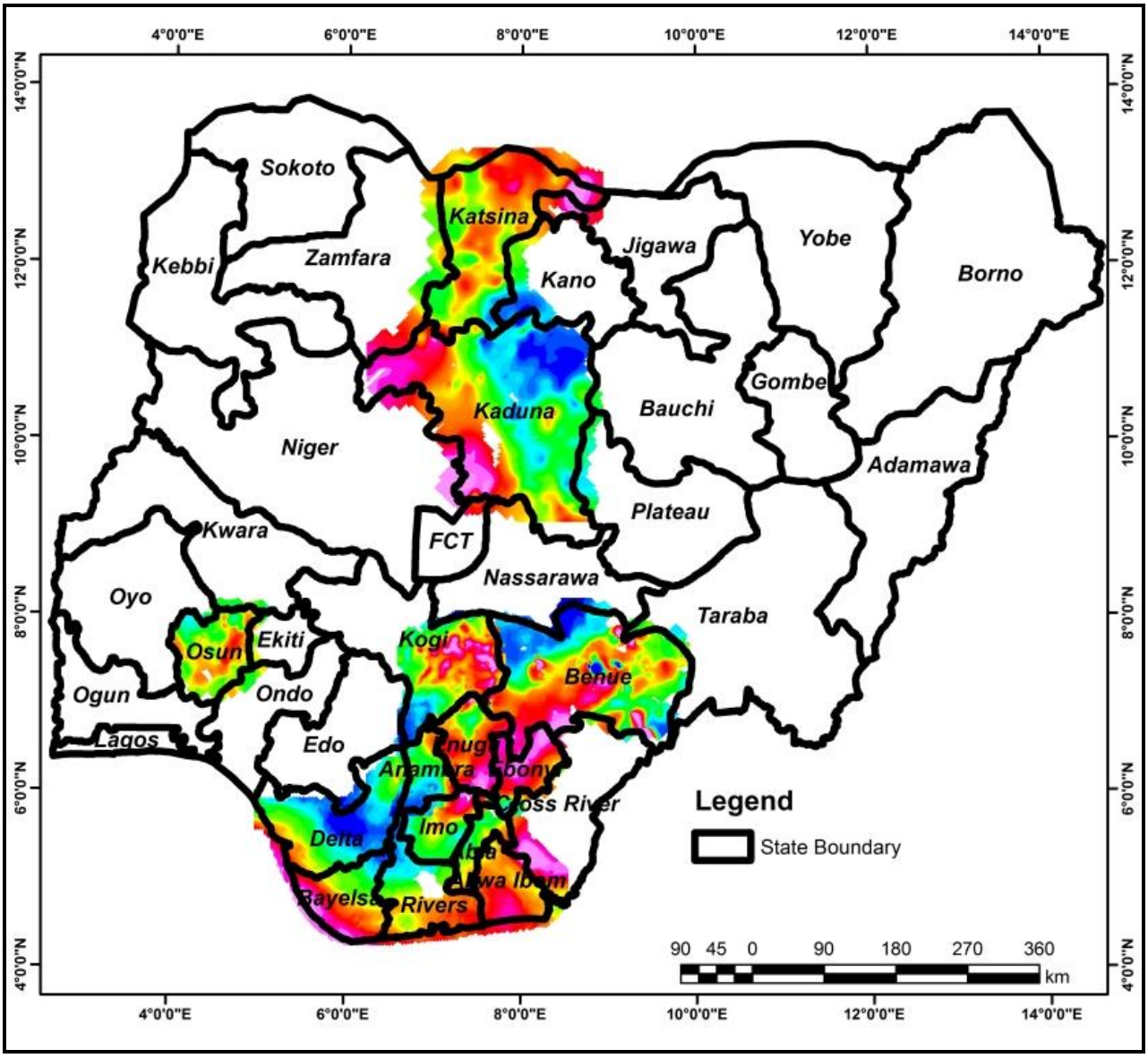


Figure 2.3: Nigeria Gravity Coverage by NGSA (Niger Delta Region is covered with Aero-gravity Survey)

Fairhead & Okereke (1987, 1988 and 1990) use gravity method to map the crustal structures in Lower Benue Trough and Mamfe basin. The results of simple three dimensional gravity modelling indicate the crust beneath the lower and middle Benue is approximately 20 km thick while beneath the Gongola rift the crust is approximately 25 km thick relative to a normal crustal thickness of 34 km away from the rift.

Okereke (1988) used Bouguer gravity and available geological data to show the contrasting mode of rifting in the Benue Trough and the Cameroon volcanic line. The trough indicates that its formation was probably due to the result of regional horizontal stresses in the lithosphere,

causing crustal extension and surface subsidence. By contrast, the data for the adjoining Cameroon volcanic line suggests that the associated tensional stresses relate to mantle upwarp causing thinning of the lithosphere and regional crustal uplift.

The need to have a common reference datum for unifying gravimetric studies in Nigeria led to the establishment of a Primary Gravity Network for Nigeria (PGNN) by Osazuwa (1985). The PGNN consists of 59 base stations which are uniformly distributed throughout Nigeria at an average interval of 200 km (Figure 2.2). The PGNN is also tied to IGSN 71 (Morelli *et al.*, 1974) via a base station established at Mallam Aminu Kano International Airport by Verheijen & Ajakaiye (1978).

The establishment of the PGNN is a big step towards reducing error in gravity survey as well as unifying all gravimetric activities in the Country. However, the PGNN cannot be used solely in producing gravity anomaly maps because of the large separation of 200 km between stations. Osazuwa *et al.* (1994) in their report on Regional Gravity Survey of Kaduna and Katsina States recommended further densification of the Network by locating at least one gravity station within an area of 25km^2 grid or at every 5km along motorable roads and paths in Nigeria.

Based on this, some states in Nigeria especially parts of the Benue Trough and Anambra basin (Figure 2.3) had been covered with the ground gravity by Nigerian Geological Survey agency (Adejuwon *et al.*, 2013, Abba *et al.*, 2013 and Alo *et al.*, 2013).

There are other localized and regional gravity surveys in various part of the country which include: Adighije (1981), Ibe (1982), Ibe, Ajakaiye & Ojo (1983), Gandu, Ojo & Ajakaiye (1986), Okereke & Fairhead (1987, 1988, and 1990), Akaolisa (1997), Shemang, Jacoby & Ajayi (2005), Lawal & Akaolisa (2006), Okiwelu, Okwueze, & Akpabio (2009), Ugbor & Okeke (2010), Oladapo & Oladapo (2011), Ezekiel *et al.* (2013), Eke *et al.* (2016), Mbah *et al.* (2017), Igwe *et al.* (2018), Adejuwon, Salami, Omatola, Ashien, Adeyemo & Ujubuonu (2018), Ekpa *et al.* (2018), Eteje *et al* (2019), Ngozi *et al* (2020) and Johnson *et al* (2021) targeted at mineral exploration, aids to geological mapping, basins analysis and crustal studies.

Okiwelu *et al.* (2009) produced Bouguer gravity anomaly map of the Calabar flank. The results from these analyses showed a close relationship between the Bouguer and free air anomaly data; which is compatible with mid-continental results. Calabar Flank is largely not in isostatic equilibrium judging from the dominance of short-wavelength free-air anomaly patterns. The circular, elliptical contours in the Bouguer and free air anomaly maps are lineaments with distinctive trends. These trends indicate structural features that pre-date exposed geology and that have probably controlled the tectonic expressions of the geological province.

Ugbor & Okeke (2010) determine the geometry of the buried body from the interpretation of residual anomaly data using data from Ninety-eight gravity stations in parts of the Lower Benue Trough. The residualized and interpreted gravity profiles yielded results that reveal low Bouguer gravity anomalies with magnitudes ranging from –2.5 to 3.8 mgals and with abrupt changes at intervals thereby suggesting a fault. The low-density anomalous body suspected to be salt deposit was buried at depths of between 868 and 2618 m. The low Bouguer gravity anomaly over the area suggests a zone of basic to intermediate igneous intrusions, deep basement and crustal thinning.

Oladapo & Oladapo (2011) combined Gravity and electromagnetic methods to characterize known veins and possibly unveil other concealed veins in Tunga, North-eastern Nigeria. In the area, zones of high gravity values exhibit very low conductivity values and are presumed underlain by dense materials of low conductivity to which barite mineralization can be associated.

Ezekiel *et al.* (2013) used ground gravity data to determine the thickness (depth) of the sedimentary basin, establish the basement topography and produce a geologic model over the Njaba sub-basin of south-eastern Nigeria which is in the Northern (oldest) depobelt of Niger Delta. The interpretation of the observed gravity shows an estimated sedimentary thickness of about 7 km in the mapped basin and the observed structural features such as faults which may have serious implications for hydrocarbon accumulation.

Eke *et al.* (2016) carried out qualitative and quantitative interpretation of the airborne gravity anomaly over parts of Niger delta basin. The qualitative interpretation of the gridded data reveals NS, EW and NE-SW trending subsurface structures. The inverse and forward modelling results show spherical and dyke-like anomaly structures at depths of between 1,090 m to 3,538 m, while the density contrast of formations identifies areas of possible hydrocarbon occupation. The work reveals that the maximum depth to basement in the study area is 10,600 m.

Mbah *et al.* (2017) investigated the possible cause of gravity anomalies in parts of the Niger Delta region. Their research revealed a maximum depth of 9.4 km from the gravity data which is quite similar to sediment thickness of about 8km by Hospers (1965).

Ekpa *et al.* (2018) used aero-gravity data to investigate gravity anomalies in the Niger Delta region of Nigeria. The Bouguer anomaly of their study area varied from -20.0 to 37.7 mGal, while the residual Bouguer anomaly varied from -19.6 to 25.7 mGal which give depth values ranging from 539m to 4276m for shallow and deep lying gravity anomalous bodies.

Adejuwon *et al.* (2018) mapped mineralised dense structures in parts of Benue Trough using gravity data and EM-VLF data while Igwe *et al.* (2018) mapped the Nsukka area of Anambra Basin for potential mineral deposit using aerogravity data. With the depth range of over 9km, the authors suggested that the area is suitable for hydrocarbon generation if other conditions for hydrocarbon accumulation are favourable.

Eteje *et al.* (2019) used twenty gravity stations to model local gravity anomalies in Benin City and its environs for geodetic applications. Ngozi *et al.* (2020) qualitatively and quantitatively interpreted the airborne gravity data of the Lafia and Akiri area of Benue Trough of Nigeria. The bouguer gravity anomaly map varies from -66.0 mGal to 28.4 mGal while residual Bouguer anomaly map varies from -30.5 to 27.7 mGal with minimum depth to basement of 5600m.

Recently, Johnson *et al.* (2021) used aerogravity data to delineate faults and cavities using gravity techniques in order to aid in better roads construction in the Niger Delta region of Nigeria.

2.2 Theory of Gravity Method

Gravimetry is the geophysical measurement of the acceleration of gravity and has as its basis two well-known laws of elementary physics. The law of Universal Gravitation states that the mutual force (F) of attraction between any two particles (or bodies) is directly proportional to the product of their masses and inversely proportional to the square of the distance between them. Thus

$$F=G\frac{m_1 m_2}{r^2} \qquad 2.1$$

Where G is a constant of proportionality (the gravitational constant), m_1 and m_2 are the particle masses and r is the distance between the particles. The other law is the Newton's second law of motion which states that when a force is applied to a body, the body experiences an acceleration that is directly proportional to the force and inversely proportional to the body's mass. Thus,

$$a = F/m \qquad 2.2$$

$$F = ma = mg \qquad 2.3$$

Equating (1) and (iii) with m_1 and m_2 as m_e and m_o

$$m_0 g=G\frac{M_E m_0}{r^2} \qquad 2.4$$

$$g= F/m_o \approx \frac{Gm_e}{} \qquad 2.5$$

In term of unit, $g = \frac{R}{\underline{m^3 kg^{-1} s^{-2} kg}}{m^2}$

Where 'a' is the acceleration of the body in the direction in which the force is acting.

Where m_o is the mass of the object and m_e is the mass of the earth.

Because the Earth is approximately spherical and because the mass of a sphere can be treated as though all of it were concentrated at a point to the centre, any object with mass m_o, resting on the Earth's surface, will be attracted to the Earth. If the object is lifted a short distance above the Earth and allowed to fall, it will do so with a gravitational acceleration 'g'. The acceleration is the force per unit mass acting on the object. It is a function of both the mass of the Earth, m_e and the distance, R, to its centre. The principle is the same, however, when the attracting body is something other than the Earth as a whole, and it is on this principle that gravimetry, as a geophysical method is based.

Most gravity variations associated with geologic bodies in the outer several kilometers of the Earth's crust are measured in mgals (1 gal is equivalent to an acceleration of 1cm/sec/sec). The maximum gravity difference between the Earth's normal field (the main gravity field of the reference spheroid) and that actually observed on the surface and corrected for latitude and altitude is of the order of several hundred mgals. The difference known as gravity anomaly reflects lateral density variations in rocks extending to a depth of several tens of kilometers.

In real sense, the 'g' described above is not the total magnitude of gravity. It is only the measurable component of gravity. The other component is the normalized centrifugal force due to rotation of the Earth about its polar axis. Gravity can therefore be defined as the resultant of gravitational force and centrifugal force per unit mass.

g is commonly expressed in ms^{-2} (SI units) or cm s^{-2} (c.g.s.)

In geophysics the conventional units of g are the Gal (in honour of Galileo)

1 Gal = 1 cms^{-2}

1 mGal = 10^{-3} cms^{-2}

1 μGal = 10^{-6} cms^{-2}

The other SI unit is the 'gravity unit' g.u.

1 g.u. = 10^{-6} ms^{-2}

1 g.u. = 0.1 mGal

2.3 Mode and medium of Gravity Data Acquisition

Gravity data can be acquired on land, sea and air. The survey design, resolution, procedure and makes of the instruments used in the various media varied. The development of gravity measuring equipment 'Gravimeter' has evolved over the years. There are two types of gravity instruments: an absolute and a relative gravimeter. An absolute gravimeter is a highly precise instrument for measurement. The commonly used gravimeter in geophysical exploration applications is the relative gravimeter. Absolute gravimeters measure the local gravity in absolute units (Gal). Absolute gravimeters work by directly measuring the acceleration of a mass during free-fall in a vacuum. An accelerometer is rigidly attached to the ground.

Relative gravimeters are extremely sensitive, specially assembled, spring-based instruments carrying a fixed mass (m). The principle is that the changes in gravity will result in a change in weight of fixed mass g(m + δg) with change of location (See figure 2.4). Thus the length of the spring will differ slightly with change of location. The spring extension is recorded by suitable optical, mechanical, or electrical amplifications with high precision. The gravimeter is

calibrated at regular intervals at a base station where the absolute value of gravity is known. Absolute gravity values at survey stations are obtained with reference to the International Gravity Standardization Network.

Gravity measuring instruments are classified into three types:

- Pendulums - where the period of the pendulum is inversely proportional to g
- Sensitive spring balances - where the spring extension is proportional to g
- Falling bodies timed over a fixed distance of fall in a vacuum tube

Within each class, there are several variants. The spring balances are relative instruments, which mean that they can only be used to measure the difference in gravity between two or more points. Pendulums can be used for relative and absolute measurements by calculating the ratio of periods measured at two points or the exact period at a particular point. The falling body class measures the absolute gravity. The LaCoste and Romberg and Scintrex instruments are the most commonly used gravimeters. The survey design is based on the anticipated depth of investigation, density contrast and structure of the geological feature. Additional parameters to take into account for the survey design are the accuracy of the gravimeter, accuracy of the measurement station in location and elevation, the accuracy of the topography in the vicinity of the station, and the frequency of the re-occupation of the base station.

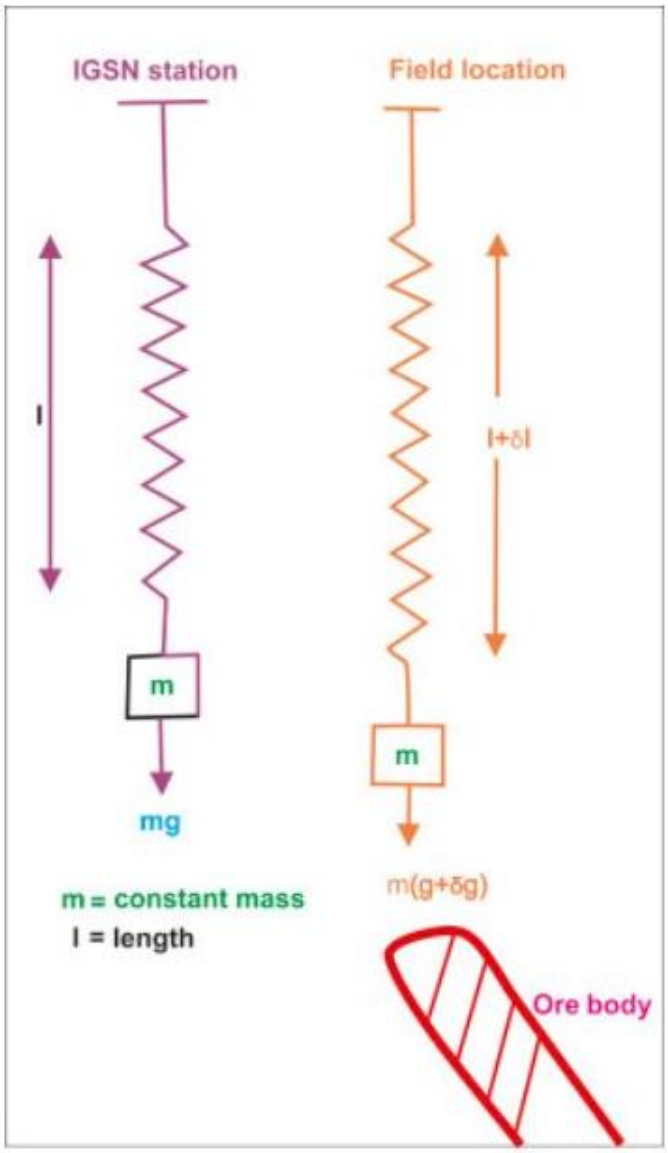


Figure 2.4: Schematic Diagram Showing the Principle of a Stable Relative Gravimeter Survey in the Field.

Gravity has been measured from aircraft in flight since the late 1950s (Thompson & LaCoste 1960). Recent improvements in GPS processing and a new airborne gravity measuring instruments such as GT-1A, AIRGrav, FALCON, Air-FTG etc. have resulted in significantly increase in resolution of airborne gravity data. Some of these instruments were capable of reproducing existing ground data accurately, with the added benefit of quick data acquisition and uniform sampling of an area that was difficult or impossible to access on the ground (Elieff & Sander, 2004, Studinger, Michael, Bell, Robin & Frearson 2008).

Depending on the nature of the survey, airborne gravity and gravity gradiometer surveys are typically conducted at a terrain clearance of 80 to 150 m, with survey lines spaced from 100 m to several kilometers apart. A magnetometer and sometimes radiometric equipment are carried on the aircraft. Both helicopters and fixed-wing aircraft are used but the gravity sensors are sensitive to 'strong' aircraft manoeuvres, so the tight turns at the end of flight-lines and the rapid elevation changes common in low-level aeromagnetic surveys are generally to be avoided in gravity work. The survey heights are chosen to suit the gravity data and are usually greater than ideal for the magnetic and radiometric measurements.

Submarine - ship Seaborne gravity surveys face similar stability issues as airborne gravity surveys, but to a lesser extent. On a calm day, the movements of the sea in deep water are slower and more predictable than air currents, and a large ship will not be greatly affected by chop and swell. Hence, submarine – ship seaborne gravity surveying in rough or bad weather will give poor gravity results. Elevation of the observation points which is critical in calculating the gravity anomaly is reasonably well defined for ship/seaborne gravity measurements. Before GPS positioning became the standard the accuracy of marine gravity surveys was 5 - 10μms^{-2} or worse. New gravity surveys appear to have an accuracy of 1 - 5μms^{-2} which is an order of magnitude less accurate than land gravity surveys. Submarine gravity surveys are less accurate still and have been only a curiosity. Submarine or sea bottom gravity surveys may be useful in the future for pinpointing high-grade mineral deposits on the sea floor. In shallow water, underwater gravity meters have been employed and can provide readings that are comparable to those obtained on land.

2.4 Gravity Data Reduction

Gravity data processing entailed identifying and eliminating all factors that were unrelated to local geologic bodies. As a result, the challenge is to determine what portion of the gravity

differences between locations is relevant to the interpretation and what portion is a systematic change unrelated to the geologic target. The gravity correction process is given by:

Bouguer Anomaly = Observed Gravity – Theoretical Gravity + Free Air correction – Bouguer correction.

i.e. $BA = g_{obs}-g_{th}+FAC-BC$ 2.6

While the complete bouguer anomaly is given as:

Complete Bouguer Anomaly = Observed Gravity – Theoretical Gravity + Free Air Correction – Bouguer correction + Terrain correction

i.e. $BA = g_{obs}-g_{th}+FAC-BC+TC$ 2.7

The common corrections carried out in a gravity survey include: latitude, tidal, altitude, free air, Bouguer, terrain and drift corrections. These corrections are necessary to remove the effect of irregular shape and non-static nature of the Earth, the force or pull exerted by both the sun and moon on the gravimeter known as tide, the difference in elevation as you move between hills and valleys. The topographic excess masses and voids contribution on the observed gravity values must all be resolved before a final refined data could be analysed for interpretation (Telford *et al.*, 1990).

The corrections carried out on the gravity data are as follow:

2.4.1 Tidal Correction

The tidal correction is a factor applied to station gravity that compensates for the Sun's and Moon's gravitational attraction. This external temporal variation is determined by the Sun's and Moon's positions in relation to Earth. The tidal correction is a complex function with peaks at

approximately every twelve hours. The waveform is complex because it contains components that peak with periods of 12 hours, 24 hours, 14 days, and six months. The maximum peak-to-trough variation is about 0.3 mGal or 300 microGals (Geotools, 2004). This amplitude change can occur in times as short as six hours, meaning sustained gradients of 50 microGals per hour. Maximum gradients are found during the full or new Moon (Heiskanen & Meinesz, 1958; Nettleton, 1976).

Several formulae for the tides have been derived over the years and the equations allow reliable calculation of tidal accelerations. The tidal correction implemented in GravMaster software is based on the published program of Warren Dewhurst. The mathematical underpinnings for the Dewhurst program are spherical harmonics as supplied by Eden. For reasons of accuracy, the spherical harmonics approach has been selected over the widely used method published by Longman (1959).

For this survey, the correction was carried out using the 'correct for tides' function in the process observation spreadsheet of the GravMaster software. The tide correction is required because the Sun and Moon add components directly to acceleration measured at a gravity station due to gravitational attraction on the spring of the meter and due to the secondary effect of flexure of the Crust. The GravMaster software extracts the time and location of the gravity reading from the Observation Table and then calculates the tidal effect using spherical harmonics. The correction will then be added to the height-corrected raw gravity value.

2.4.2 Drift Correction

A drift correction is required because, over time, the components within the gravity meter sensor change their basic response slightly; for instance, the spring may stretch. Although these effects are very small, they should be removed whenever possible by re-measuring the gravity at the same location at different times. The difference in the gravity observations (after

removing known effects such as tides) was used to estimate the drift correction. The drift correction was carried out using the correction for meter drift function; by tying to a specified base station for each loop in the process observation spreadsheet.

2.4.3 Free Air Correction

The Earth model assumes a theoretical gravity at sea level that is based upon Newton's inverse square law:

$$g = \frac{GM}{R^2} \qquad 2.8$$

Where:

g = Acceleration due to gravity,

G = Universal gravity constant,

M = Mass of the Earth,

R = Distance between the observation and the center of the Earth.

Free-Air accounts for the fact that measurements were not taken at sea level by using a correction based on the station's elevation. The free-air gravity gradient, or correction, is the derivative of g with respect to the station elevation h and it's given as:

$$\delta_{FA} = -2G_E h/R_E(1-3h/2R_E) \qquad 2.9$$

Where G_E = average Earth gravity,

R_E = average Earth radius,

and h = Elevation of station

The first order term gives a gravity gradient for the Earth's surface that can be simplified to -0.3086 mGal per meter. The free air correction is positive if the gravity station is above the datum and negative if the gravity station is below the datum.

Free Air Correction (FAC) = 0.3086 mgal/meter 2.10

Free air gravity is the Absolute Gravity, corrected for the height above mean sea level, while Free Air Anomaly is given by:

Free Air Anomaly (FAA) =Absolute Gravity-Theoretical Gravity + FAC 2.11

2.4.4 Latitude Correction (g_{th})

Latitude correction (g_{th}) accounts for Earth's elliptical shape and rotation and it's subtracted from observed gravity. The gravity value that would be observed if Earth were a perfect (no geologic or topographic complexities), rotating ellipsoid is referred to as the *normal/ theoretical gravity*. This is a mathematical model of the Earth's worldwide gravity field. There are several different formulae that have been used over time. These include:

1. 1967b Geodetic International Reference System (GRS67b) [International Assoc. of Geodesy, 1971] given as:

   $g_{th} = 978031.846(1.0+0.0053024sin^2(lat)-0.0000058sin^4(lat))(mGal)$ 2.12

   where *lat* is latitude.

2. 1967a Geodetic International Reference System (GRS67a) [International Assoc. of Geodesy, 1971] given as:

$g_{th} = 978031.846(1.0+0.005278895\sin^2(lat)+0.000023462\sin^4(lat))(mGal)$ 2.13

Note: GRS67b is an approximation of GRS67a but is the more widely used of the two so when only the year is given (GRS67) it is assumed that version b was applied. For this survey, the 1967b gravity formula will be used because the base station in the state was processed with this formula. The formula has a maximum error of 0.04 g.u (Lowrie, 2002). The formula reproduces the actual measured absolute values of gravity at sea level within 1 g.u.

2.4.5 Bouguer Correction

The free-air correction makes an incorrect assumption, namely that there is nothing (except air) between the observation point and sea level. Of course, this is not the case. The goal of the Bouguer correction is to replace the previous correction's "air" with an infinite horizontal slab of rock. Bouguer correction for any given gravity station requires specific density for calculation and the formula is given as:

$$\text{Bouguer Correction} = \frac{2\pi G \rho h}{g^2}, \quad 2.14$$

Where

G = 6.673×10^{-8},

ρ = Density in g/cm^3

h = Elevation in m,

g = Acceleration due to gravity in m/s^2.

Thus,

$$\text{Bouguer Correction} = 0.04191\ \rho\ h \quad 2.15$$

It can be expressed in differential form as:

$$\delta g = 0.04193\ \rho \text{ (mGal/meter)} \qquad 2.16$$

Nettleton (1942) proposed an indirect approach of densities estimation that operates on a scale comparable to actual gravity surveys. From his study, the gravity data is corrected for bouguer several times using different density values. The density with the least correlation to the observed topography is thought to be the best estimate of the surface material's density and this is called the Nettleton density.

The Free-Air Anomaly (FAA) and the Bouguer Anomaly (BA) can be computed as follows:

$$FAA = g - \gamma + FAC \qquad 2.17$$

$$BA = FAA - BC \qquad 2.18$$

Where: g is the observed absolute gravity, γ is the normal gravity at the reference ellipsoid, FAC is the Free Air Correction and BC is the Bouguer Correction.

The formula based on satellite information used a flattening value of 1/298.247 in the Geodetic Reference System 1967 (Morrelli, 1976, Wright, 1981).

The crustal density value of 2.67 g/cm^3 was used for processing the gravity data while the rock density determine from fresh rock samples during the data acquisition was used for modelling.

2.4.6 Terrain Correction

When Bouguer correction is inadequate, terrain correction is also used. Since the publication of Hayford and Bowie's method (1912) and Hammer's detailed tables (1939), the terrain correction problem for gravity stations continues to attract perennial interest.

Terrain corrections for this research work were calculated using a hybrid of Nagy's (1966) and Kane's (1962) methods, as well as new grid-mesh interpolation, zoning, and de-sampling techniques (Dai & Hollyer, 2004). This is necessary because of the rugged and uneven terrain of the study area especially at the Northcentral part.

2.5 Rock Density Determination

Density is a basic property of a material and is defined as mass divided by volume. While the definition is straightforward, the determination of an accurate and reliable value of a material's density can be difficult to achieve in some circumstances. For example, objects that consist of irregular shapes that are highly fractured and made up of many pieces can cause difficulties in determining an accurate volume and thus the density. In most cases, it is not the determination of the mass of the object, but the volume, which poses a significant challenge in obtaining an accurate density.

In principle, interpretation of gravity data depends directly on density contrast of the adjacent rock units, hence, density of rocks become an important factor in gravity survey. There are several standard methods and procedures in determining the density of materials be it rock, soil etc. The density of fresh rock samples collected in course of the gravity data acquisition was determined in the laboratory using immersion principle given by:

$$\rho_d = \frac{W_a}{W_a - W_w} \qquad 2.19$$

Where:

ρ_d = Dry density of a given sample

W_a = Weight of sample (dry or saturated) in air

W_w = Weight of sample (dry or saturated) in water

Assuming the water is pure and at 25^0C.

After the determination of the dry density using equation (vi) above, the samples were then soaked in water for 48hours. Then, their wet densities were determined using the same procedure as the dry density with equation (vii) below:

$$þ_w = \frac{W_a}{W_a - W_w} \qquad 2.20$$

Where:

$þ_d$ = Wet density of a given sample

W_a = Weight of sample (dry or saturated) in air

W_w = Weight of sample (dry or saturated) in water

Then, the density of the samples (mean density) is calculated by:

$$þ = \frac{þ_a + þ_w}{2} \qquad 2.21$$

This method is somewhat restricted to samples that are non-porous and will not absorb any of the water in which they are immersed, in practice, igneous and metamorphic rocks, and some limestones (Balco & Stone, 2003). Hence, the use of the method is appropriate here since samples are crystalline rocks.

One hundred and eighty-four (148) fresh rock samples were systematically collected for density determination during the field exercise using the above procedure at National Geoscience Research Laboratory, Kaduna.

CHAPTER III

3.0 MATERIALS AND METHODS

3.1 Instrumentation

A Lacoste and Romberg gravimeter (G-512) licensed to Nigerian Geological Survey Agency was used for this gravity data acquisition in the study area (Plate 3.1). Its temperature controlled and the heater circuit powered by a 12V battery with a reading line of 2.4 operating at a temperature of 52.4^{o}C. This is relative gravity measuring equipment with a precision of 0.01mGal.

Heights of the gravity stations were measured with Three Wallace and Tiernan altimeters (Plate 3.2). The Psychro-Dyne thermometer (Plate 3.2) was used to measure the wet and dry temperatures from which the relative humidity was derived using the psychrometric chart (Plate 3.3). The altitude correction chart (Plate 3.4) which combines the correction factors for air temperature and relative humidity was used for the correction of altimeter readings.

Bench marks of known heights were obtained from the Office of Surveyor General of Ondo state. These were used as controls in the determination of elevations. Even though, these benchmarks are not necessarily gravity stations, however the altimeters were read at all the known heights with the points looped into the survey for proper monitoring of drift of the Altimeters. Also, the administrative map of the study area showing all the available roads from the Office of Surveyor General of Ondo state was used as the base map (Figure 3.1) with other maps such as the accessibility map (Figure 1.2) and geological map (Figure 1.6).

The Global Positioning System (Garmin 76CSx) with an accuracy of ± 2m was used to record the coordinates of each gravity station using WGS 84 as the datum. Also, the GPS coordinates and height of some of the base stations were recorded using differential GPS (DGPS) S320.

S320 is an integrated GNSS survey and mapping device for mobile data collection providing differential GPS (DGPS) accuracy in a rugged and all-in-one enclosure. It is powered by Hemisphere GPS' powerful dual-frequency Eclipse™ II OEM board. The S320 is two units (base/rover setup) GPS (Plate 3.5).

Plate 3.1: Lacoste and Romberg Gravimeter (G512) used for Data Acquisition

Plate 3.2: Wallace and Tiernan Altimeter and Psychro-Dyne Thermometer

WET BULB TEMPERATURE ^{0}F (columns) / **DRY BULB TEMPERATURE °F** (rows)

Dry bulb °F	34	36	38	40	42	44	45	48	50	52	54	56	58
50	5	16	27	33	49	61	74	87	100				
52		9	19	29	40	51	63	75	87	100			
54		3	12	22	32	42	53	64	76	88	100		
56			7	16	25	34	44	55	65	76	88	100	
58			1	10	18	27	37	46	56	66	77	89	100
60				5	13	21	30	39	48	58	68	78	89
62					8	16	24	32	41	50	59	69	79
64					4	11	18	26	34	43	51	60	70
66						7	14	21	29	36	44	53	61
68						3	10	16	23	31	38	46	54
70							5	12	19	25	33	40	48
72							3	9	15	21	28	34	42
74								5	11	17	23	29	36
76								3	8	13	19	25	31
78									5	10	16	21	27
80									3	7	12	18	23
82										4	10	14	20
84										1	7	12	16
86											5	9	14
88											3	7	11
90											1	5	9
92												3	7
94													5
96													3
98													1
100													
102													
104													
106													
108													
110													
112													
114													
116													
118													
120													
122													
124													
126													

Dry bulb °F	60	62	64	66	68	70	72	74	76	78	80	82	84
50													
52													
54													
56													
58													
60	100												
62	89	100											
64	79	90	100										
66	71	80	90	100									
68	62	71	80	90	100								
70	55	64	72	81	90	100							
72	49	57	65	73	82	91	100						
74	43	50	58	65	74	82	91	100					
76	38	44	51	59	66	74	82	91	100				
78	33	39	46	53	60	67	75	83	91	100			
80	29	35	41	47	54	61	68	75	83	91	100		
82	25	30	36	42	48	55	61	69	76	84	92	100	
84	21	26	32	37	43	49	56	62	69	76	84	92	100
86	18	23	28	33	39	44	50	57	63	70	77	84	92
88	15	20	25	30	35	40	46	51	57	64	70	77	85
90	13	17	22	26	31	36	41	47	52	58	65	71	78
92	11	15	19	23	28	32	37	42	48	53	59	65	72
94	9	12	16	20	24	29	33	38	43	49	54	60	66
96	7	10	14	18	22	26	30	35	39	44	50	55	61
98	5	8	12	15	19	23	27	32	36	40	45	50	55
100	3	7	10	13	17	21	24	28	33	37	41	46	51
102	1	5	8	11	15	18	22	25	30	34	38	42	47
104		3	7	10	13	16	20	23	27	31	35	39	43
106			5	8	11	14	17	21	24	28	32	36	40
108			3	7	10	12	16	19	22	25	29	33	37
110				5	8	11	14	17	20	23	26	30	34
112				4	7	9	12	15	18	21	24	27	31
114					6	8	11	13	16	19	22	25	28
116						7	9	12	14	17	20	23	26
118						6	8	11	13	16	18	21	24
120							6	9	12	14	17	19	22
122								8	10	13	15	18	20
124								7	9	11	14	16	18
126									8	10	12	15	17

Dry bulb °F	86	88	90	92	94	96	98	100	102	104	106	108	110
50													
52													
54													
56													
58													
60													
62													
64													
66													
68													
70													
72													
74													
76													
78													
80													
82													
84													
86	100												
88	92	100											
90	85	92	100										
92	78	85	92	100									
94	72	79	85	93	100								
96	66	73	79	86	93	100							
98	61	67	73	79	86	93	100						
100	56	52	68	73	80	85	93	100					
102	52	57	62	68	74	80	85	93	100				
104	48	53	58	63	69	74	80	87	93	100			
106	44	49	53	58	64	69	75	81	87	93	100		
108	41	45	49	54	59	64	70	75	81	87	93	100	
110	38	42	46	50	55	60	65	70	75	81	87	93	100
112	35	38	42	47	51	55	60	65	70	76	81	87	94
114	32	35	39	43	47	52	56	61	66	71	76	82	88
116	29	33	36	40	44	48	52	57	61	66	71	76	82
118	27	30	34	37	41	45	49	53	57	62	67	72	77
120	25	28	31	34	38	41	45	49	53	58	62	67	72
122	23	26	29	32	35	39	42	46	50	54	58	63	67
124	21	24	27	30	33	36	39	43	47	50	54	59	63
126	19	22	25	27	30	33	37	40	44	47	51	55	59

Plate 3.3: Percentage Relative Humidity Table (Psychrometric Chart)

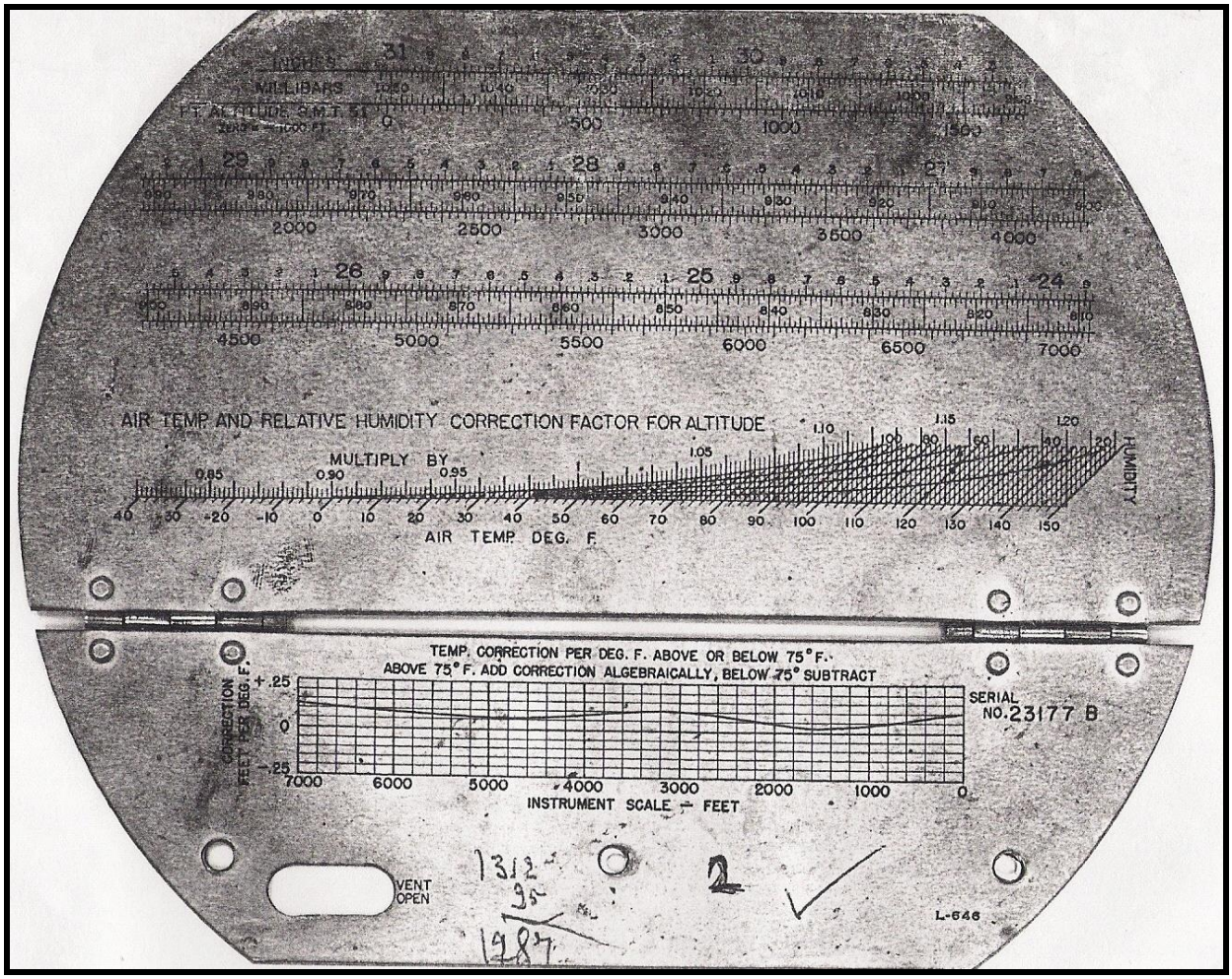


Plate 3.4: Altitude Correction Chart

Plate 3.5: Hemisphere DGPS Data Acquisition

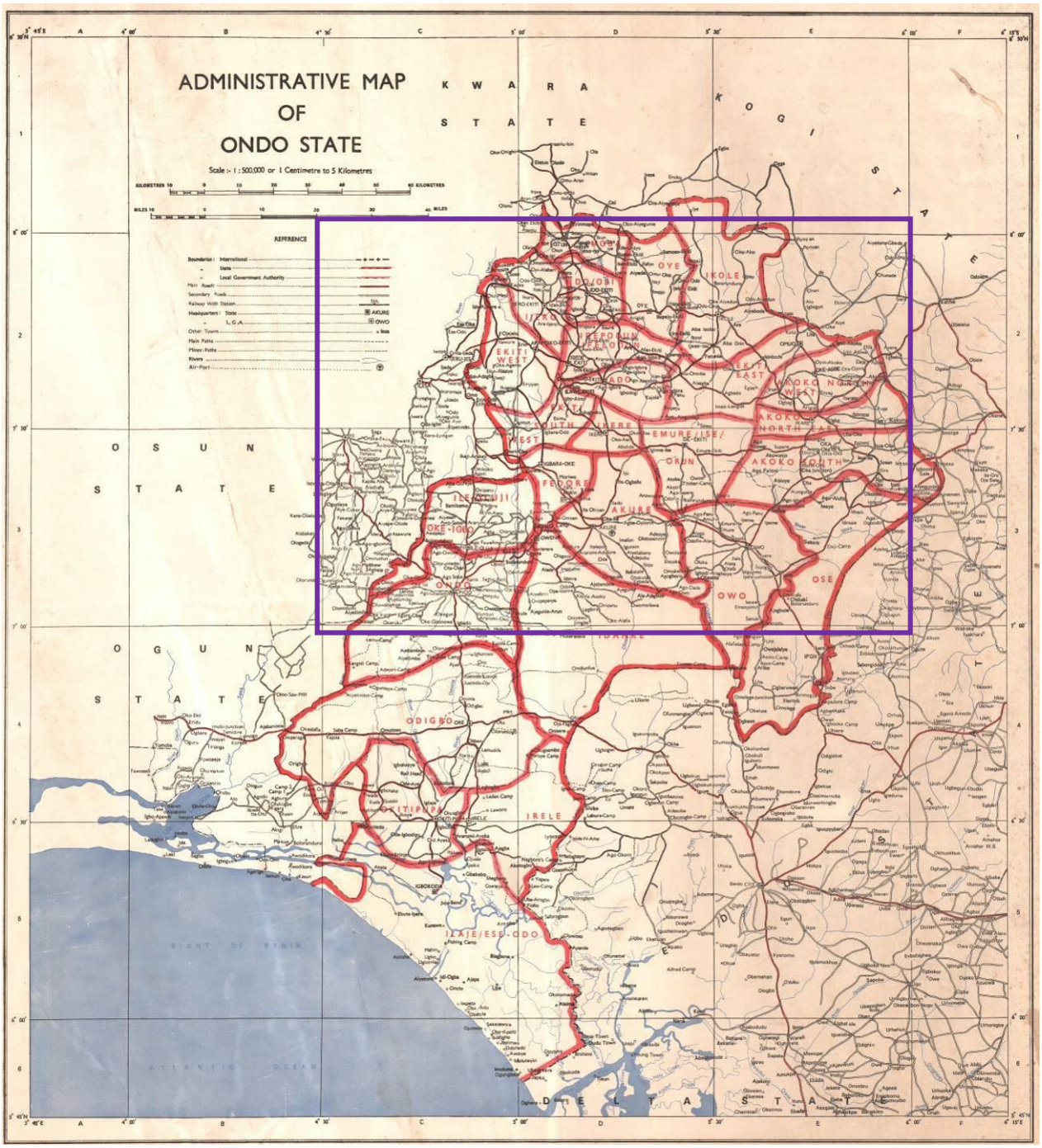


Figure 3.1: Administrative Map of the Study Area (Source: OSGOF, Ondo state)

3.3 Pre-Data Acquisition

3.3.1 Calibration of Gravimeter

Prior to the actual field data acquisition, the gravimeter used was calibrated using parts of the Northern Gravity Calibration line (Figure 3.2a) established by Osazuwa (1992B and 199C). The Northern Gravity Calibration Line extent from Jos to Ilella passing through Saminaka, Kaduna, Suleja, Minna, Kotangora, Rijau, Daki Tawkas, Binrin Kebbi and Sokoto. Part of this calibration line was used for the calibration of the gravimeter (Jos, Saminaka, Kaduna, Suleja, Minna and Kontagora (Figure 3.2b)). Measurements were taken at these already established base stations using a closed loop system. The summary of the data from the calibration is shown Table 3.1 below.

When the gravity reading is compared with some of the already established absolute values of these gravity base stations on the calibration lines a perfect positive correlation coefficient exists (0.99976) (Table 3.2). This is a confirmation of a good working condition of the gravimeter used for the data acquisition. Also, the closure error for the closed loop system is very minimal which also confirm the zero-length spring of the gravimeter.

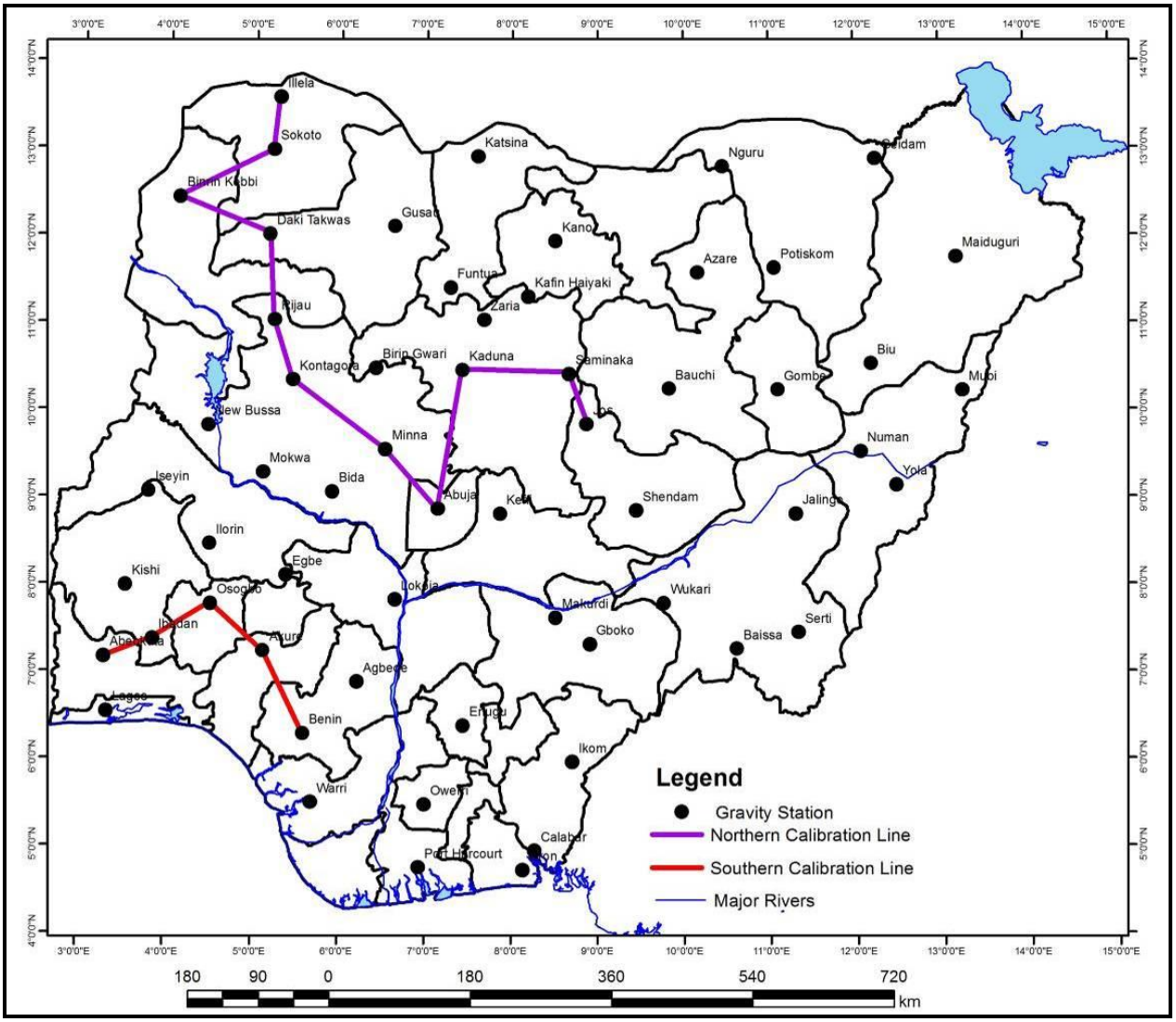


Figure 3.2a: Gravity Calibration Line (Southern line in pink (Adapted from Osazuwa 1992))

Figure 3.2b: Gravity Calibration Line used for Calibration

Table 3.1: Gravimeter Calibration Value

Date	Latitude	Longitude	Elevation (m)	Station ID	Station Description	Local Time	Gravimeter Reading
18/09/17	09°54′51N	008°53′25E	1256	A	Jos Post Office (NPJ1)	7:40	1458.82
18/09/17	10°25′22N	008°41′42E	781	B	Saminaika, Govt Coll. Sch (GMSK11)	9:35	1579.98
18/09/17	09°54′51N	008°53′25E	1256	A	Jos Post Office (NPJ1)	10:54	1458.70
18/09/17	10°25′22N	008°41′42E	781	B	Saminaika, Govt Coll. Sch (GMSK11)	12:05	1578.86
18/09/17	10°35′30N	007°26′40E	645	C	Old Airport Kaduna (GMSJ1B)	15:15	1620.15
18/09/17	09°54′51N	008°53′25E	1256	A	Jos Post Office (NPJ1)	19:08	1458.75
19/09/17	09°54′51N	008°53′25E	1218	A	Jos Post Office (NPJ1)	6:28	1458.83
19/09/17	09°10′39N	007°10′49E	414	D	Suleja Post Office (GMSK25B)	11:12	1637.24
19/09/17	10°35′30N	007°26′40E	647	C	Old Airport Kaduna (GMSJ1B)	13:34	1619.91
19/09/17	09°10′39N	007°10′49E	414	D	Suleja Post Office (GMSK25B)	15:27	1637.33
19/09/17	09°54′51N	008°53′25E	1218	A	Jos Post Office (NPJ1)	19:12	1458.54
21/09/17	09°10′39N	007°10′49E	414	D	Suleja Post Office (GMSK25B)	7:16	1637.28
21/09/17	09°37′13N	006°32′17E	260	E	Old Airport Minna (GMSJ11)	10:20	1674.78
21/09/17	10°23′52N	005°26′45E	346	F	Kontagora Govt. Sec. Sch. (GMS11A)	13:30	1697.33
21/09/17	09°37′13N	006°32′17E	260	E	Old Airport Minna (GMSJ11)	16:39	1674.76
21/09/17	09°10′39N	007°10′49E	414	D	Suleja Post Office (GMSK25B)	18:18	1637.24

Table 3.2: Correlation Coefficient between Gravimeter Reading during Calibration and the Absolute Gravity Value

Station ID	Station Description	Gravimeter Reading	Absolute Gravity value (mGal)
A	Jos Post Office (NPJ1)	1458.82	977866.058
B	Saminaika, Govt Coll. Sch (GMSK11)	1579.91	977984.609
C	Old Airport Kaduna (GMSJ1B)	1620.12	978029.737
D	Suleja Post Office (GMSK25B)	1637.35	978048.390
E	Old Airport Minna (GMSJ11)	1674.79	978085.890
F	Kontagora Govt. Sec. Sch. (GMS11A)	1697.35	978108.799
Correlation coefficient = 0.99976			

3.3.2 Gravimeter Monitoring at known Base Station

Also, the gravity was monitored at one of the already established base station within the study area for two days. This was monitored at the base station in St Peters' College, Akure. This is necessary to study the drift pattern of the gravimeter and to determine the time for the linear drift window. The plot of the two days gravity monitoring at the station is plotted as figures 3.3 and 3.4. From the plot, uniform linear slopes are observed between 7:55 – 9am, 9:30am and 2:30pm and 3:30pm to 6:30pm which are indicative of linear drift pattern. This linear time window was used for the data acquisition.

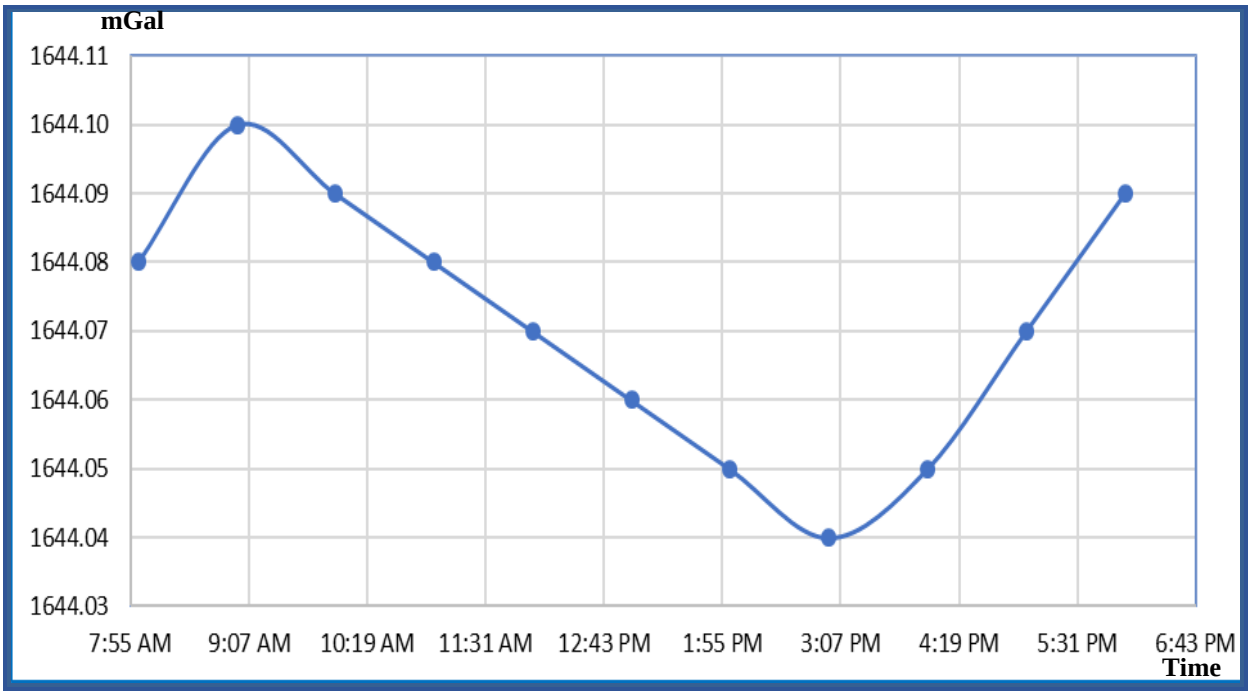


Figure 3.3: Gravimeter Drift Monitoring for Day 1 (15/11/2017)

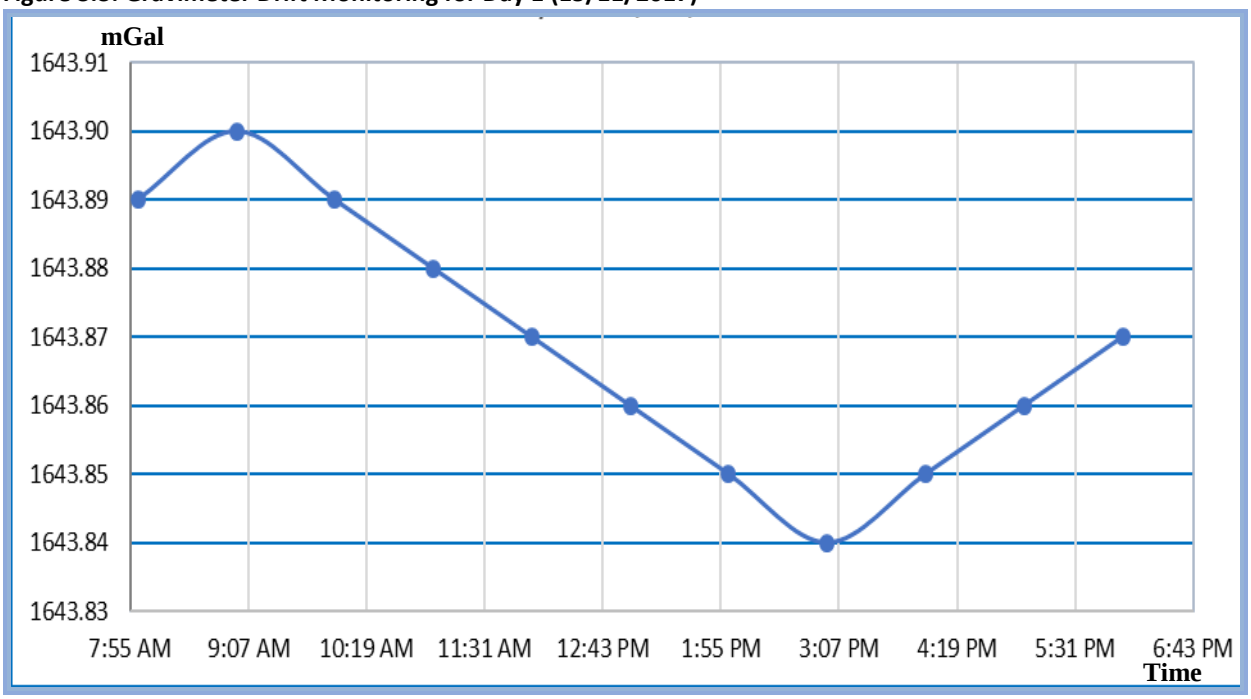


Figure 3.4: Gravimeter Drift Monitoring for Day 2 (16/11/2017)

3.4 Data Acquisition

The gravity data acquisition in the study area started at an existing gravity base station established by Osazuwa (1985) at St Peters' College, Akure (Figure 3.5). Base stations are stations with known absolute gravity values. In the study area, the two base stations: St Peters'

College, Akure and General Post Office Oshogbo (Figure 3.6) have absolute gravity values of 978055.275mGal and 978060.58mGal respectively.

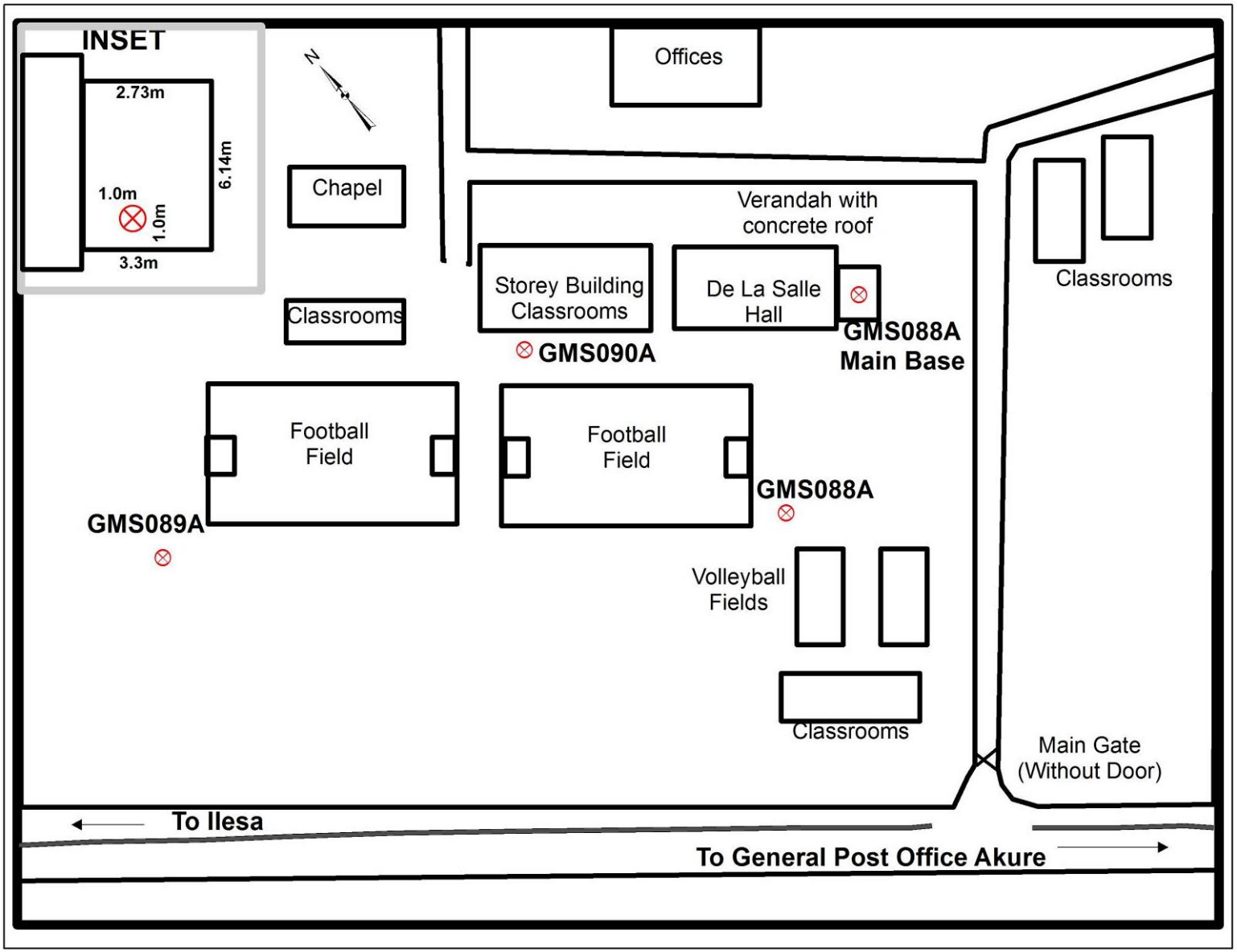


Figure 3.5: Synopsis of PGNN Base Station at St Peter's College, Akure.

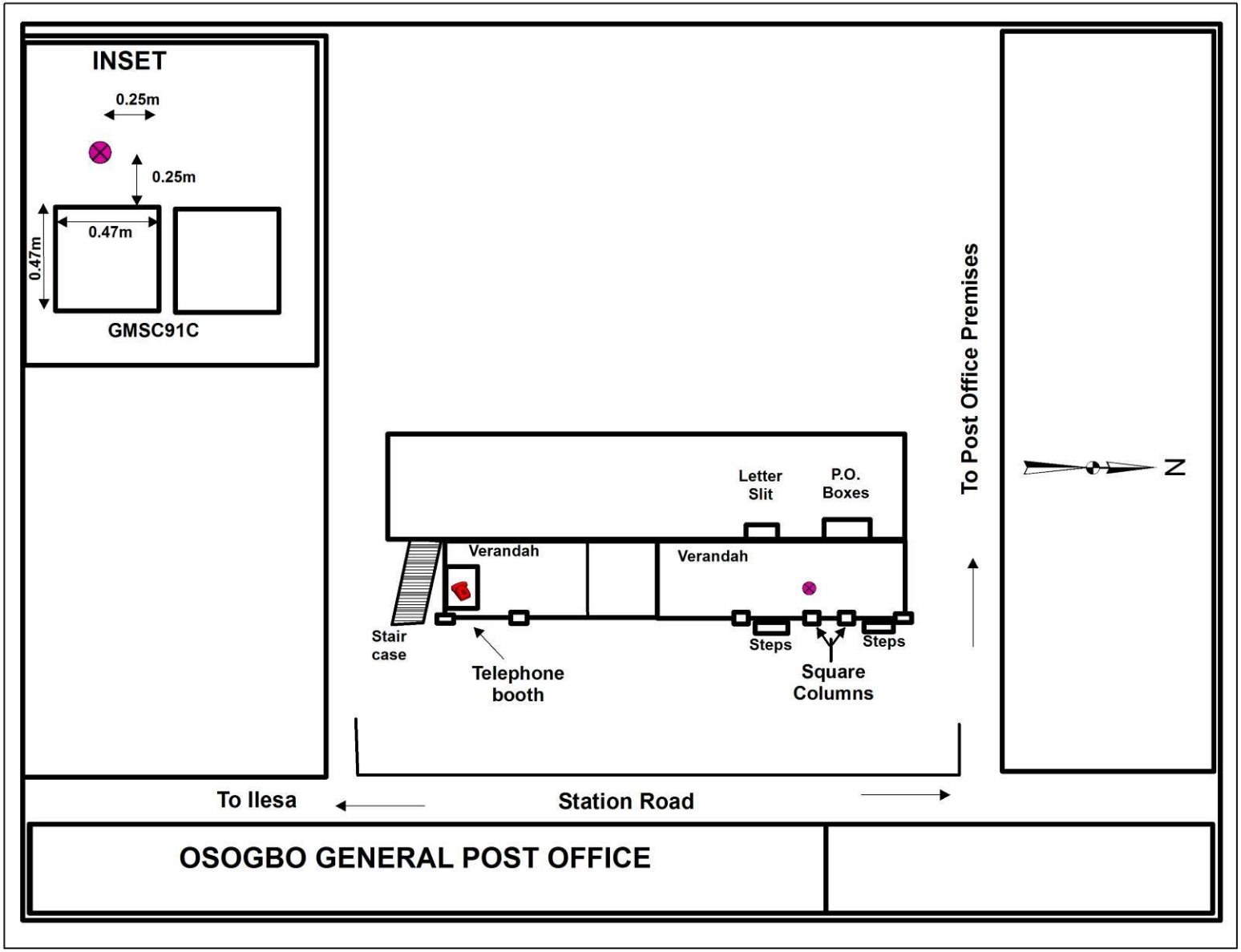


Figure 3.6: Synopsis of PGNN Base station at General Post Office Oshogbo.

Gravity measurements were taken at 2.0 km intervals along motorable roads and footpaths through-out the study area. The pattern of movement adopted for this survey is the closed loop sequence in which all the loops for a particular day were either chained or looped into one another in a kind of cascade and the first reading for the day always started from a base station (Osazuwa, 1985, 1992). The result of every day's work was sketched on the field to make sure that the loop was properly run and that there were no redundant data. This kind of sequence is compatible with most gravity data processing software such as Geotools (GravMaster), Geosoft (Oasis Montaj) etc. Schematic diagram illustration of the looping sequence used are shown in Figure 3.7 and appendix 1in which A, B and C are successive base stations and S_{01}, S_{02}, $S_{03,}$ …., S_n are detail stations. Gravity differences due to instrumental drift and tidal effects were monitored together by a repeated reading taken at the base station every two hours. About one hundred and twenty-five (125) loops were carried out during the survey.

Several base stations were established at chosen locations throughout the study area. The choice of these base stations depends largely on the distribution of the detail stations. However, care was taken in choosing the location of a base station because of easy identification and preservation. Schools, churches, post offices and major road junctions were used as base stations.

The vehicle's odometer was relied upon in getting the intervals between stations. At each station; the station number, station description, latitude, longitude, GPS elevation, altimeter reading, air temperature, gravity meter reading, date, and observation of time etc. were recorded. A remark column also kept for recording the station description and observations on surface geology, vegetation and other physical features.

To prevent the gravimeter from thermal shock, it was shielded with a large umbrella throughout the field survey (Plate 3.6).

Plate 3.6: Data Acquistion under a protective umbrella to prevent thermal shock

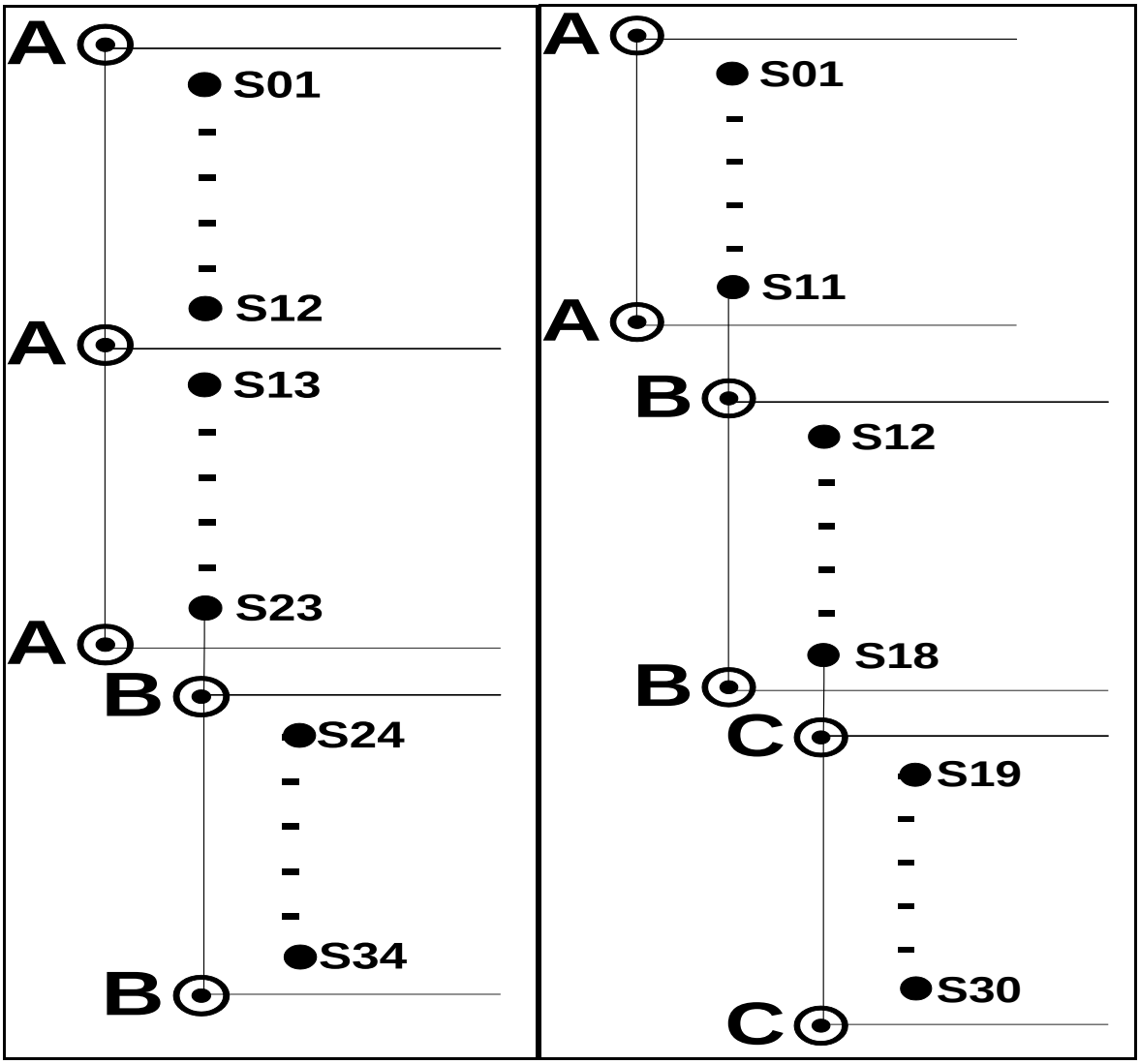


Figure 3.7: Closed Loop sequence of Gravity Data collection for 01-12-2017 and **07-12-2017**

3.5 Precautions and Field challenges

The secret of consistent and accurate gravity meter reading is following a routine. If the same procedure is followed for each reading the sources of difference are reduced. Some of the precautions adopted for a good reading with Lacoste and Romberg gravimeter (G-512) are:

- Level the bubble on the base plate
- Level the meter before unclamping
- Do not turn the dial while the meter is clamped

- Be familiar with the reading line on the graticule and where the beam should be placed as shown in Figure 3.8 (e.g., just touching the left of the line)
- Always turn the dial in the same direction when approaching the reading line to prevent seesaw data effect.
- Always use the same eye for reading

The field challenges encountered during the exercise include:

1. Accessibility (Bad and un-motorable road)
2. Road location problem
3. Gravimeter Battery
4. Security
5. Local communities non cooperation

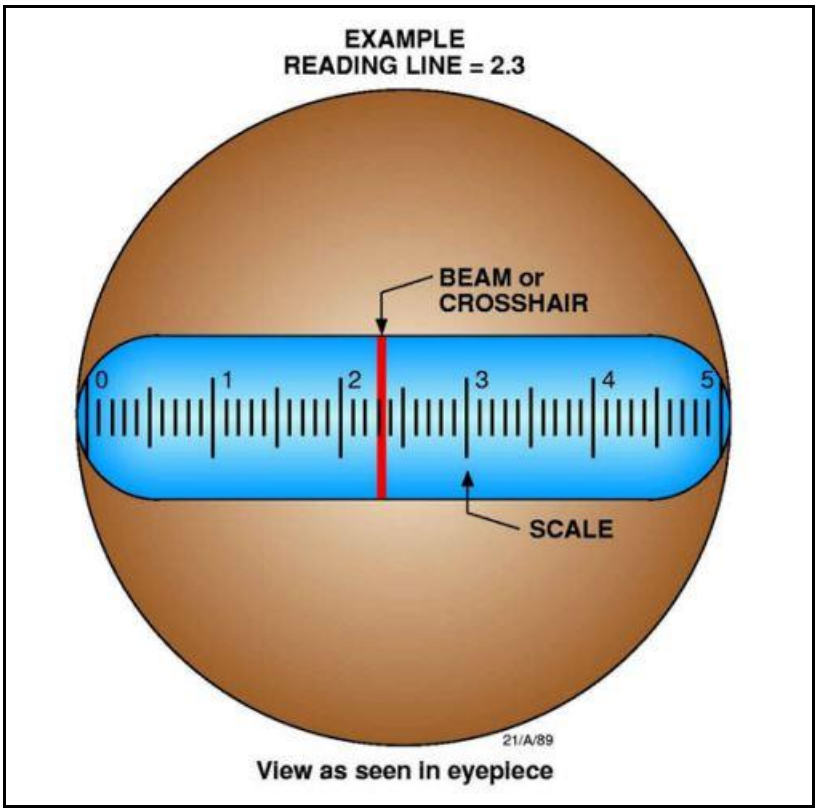


Figure 3.8: Reading Line of a Typical Lacoste and Romberg Gravimeter

CHAPTER IV

4.0 RESULTS AND DISCUSSION

4.1 Established Base Station

From the study, a total of one thousand and ninety-three (1,093) detail stations was established from about one hundred and twenty-five (125) closed loops. The loops were kept at an average of 2hours. The error analyses were shown in Table 4.1 below with the summary in Table 4.2. From the analysis, the time for the loops varied between 34mins to 153min with an average of 114 ± 22mins. The close repeatability of data at the close of every loop due to the low drift rate of the gravimeter used is worthy of mentioning. It ranges from 0.01 to maximum of 0.38meter reading with an average of 0.0792 ± 0.0744.

The one thousand and ninety-three (1,093) detail stations give a gravity data density of 1/16.6km^2 i.e. an approximate of one detail gravity station in 2.3km radius. This is a considerable improvement on the existing station density of 1/4538km^2.

Seventy-five (75) base stations were established in the study area (Figure 4.1) giving a base station density of 1/242km^2 i.e. an approximate of one gravity base station in 8.7km radius. This is a considerable improvement on the existing base station density of 1/9,075km^2.

These base stations were evenly distributed in the study area. The base stations were carefully established (for preservation purposes) at Post office, Local Government secretariats, customary courts, orthodox churches and important road junctions. Table 4.3 shows the summary of the Seventy-five (75) base stations established during the survey. The photographs of some of the base stations are shown in plate 4.1 below while the others are placed in appendix 2. The synopsis of some of the base stations are displayed in appendix 3. This description of each gravity base stations which include the coordinates, photographs, synopsis

etc. will allow future use and reoccupation with a high level of accuracy within the shortest time.

Table 4.1: Error Analysis for the Loops

No	Date	Base Station Used	Base Station Description	Change in value at Base	Time interval (minutes)	Route for the loop
1	11/17/2017	GMS088B	St Peter's Unity, Akure	0.02	118	Along Idanre Road
2	11/17/2017	GMS088B	St Peter's Unity, Akure	0.03	107	Aule Road
3	11/17/2017	GMS088B	St Peter's Unity, Akure	0.03	94	Ijoka Road
4	11/18/2017	GMS088B	St Peters Unity Akure	0.02	133	Akure-Ilesha Road
5	11/18/2017	AKR/ILH/013	Post Office Igbara Oke	0.04	79	Igbara Oke-Igbara Odo
6	11/19/2017	AKR/ILH/013	Post Office Igbara Oke	0.05	136	Owena Dam Road
7	11/19/2017	AKR/ILH/005	Ipogun Junction, Ilara	0.01	50	Ilara-Ipogun Road
8	11/19/2017	GPSA72S	Mobil F/S, Ilesha Garage	0.01	113	Akure-Ijare Road
9	11/20/2017	GMS088B	St Peters Unity Sch Akure	0.04	112	Akure Ogbese Road
10	11/20/2017	AKR/OWO/002	Ado-Owo-Akure Junction	0.02	85	Akure/Ikere Road
11	11/20/2017	AKR/OGB/001	Opp Chicken Repubic Akure	0.04	98	Oda Road
12	11/21/2017	AKR/IKR/008	Roundabout	0.03	131	Iju-Ikere Road
13	11/21/2017	AKR/IKR/014	Ikere Post Office	0.1	112	Ikere-Ise Road
14	11/21/2017	AKR/IKR/014	Ikere Post Office	0.12	102	Ikere-Igbara Odo Road
15	11/21/2017	AKR/IKR/014	Ikere Post Office	0.01	99	Ikere-Ilawe Road
16	11/22/2017	IGB/IGB/005	Ikere-Igbara Odo Junction	0.03	113	Igbara Odo-Ilawe-Ado Road
17	11/22/2017	IGB/IGB/005	Igbara Odo-Ikere Junction	0.02	115	Igbara Odo-Ikogosi Road
18	11/22/2017	IGB/IGB/005	Igbara Odo-Ikere Junction	0.07	120	Ogotun-Ipole Road
19	11/23/2017	AKR/OGB/010	Ogbese Road Beside F/S	0.01	131	Ogbese-Owo Road
20	11/23/2017	OGB/OWO/008	Emure Ile Junction	0.04	118	Emure Ile-Emure Ekiti Road
21	11/23/2017	OGB/OWO/013	Ikare Junction, Owo	0.09	110	Owo-Ifon Benin Road
22	11/24/2017	AKR/OGB/001	Opp Chicken Republic Akure	0.18	115	Akr-Igbatoro Road
23	11/25/2017	IGB/IKG/007	Ikogosi Ekiti	0.08	131	Ipole-Efon Road
24	11/25/2017	IGB/IKG/007	Ikogosi Ekiti	0.03	120	Erijiyam-Aramoko Road
25	11/25/2017	IGB/ILW/006	Ilawe Post Office	0.24	112	Ilawe Igede Road

26	11/25/2017	IGB/ILW/006	Ilawe Post Office	0.02	117	Ikere Ilawe Road
27	11/27/2017	GMS088B	St. Peter Unity College Akure	0.03	129	Akure Ondo Road
28	11/27/2017	AKR/OND/010	Local Govt. Sec., Owena	0.01	94	Owena Idanre Road
29	11/27/2017	AKR/OND/015	Bolorunduro	0.08	134	Akure Ondo Ore Road
30	11/28/2017	AKR/OND/024	Ondo Town	0.01	96	Ondo Ife Road
31	11/28/2017	AKR/OND/024	Ondo Town	0.05	116	Ondo Egbure Oba Road
32	11/28/2017	AKR/OND/024	Ondo Town	0.01	34	Ondo Town
33	11/28/2017	AKR/OND/024	Ondo Town	0.03	137	Ondo-Ile Oluji Road
34	11/28/2017	AKR/OND/015	Bolorunduro	0.05	71	Bolorunduro-Fagbohun Road
35	11/29/2017	OWN/IDR/005	Post Office Idanre	0.05	128	Alade Idanre Atosin Idanre Road
36	11/29/2017	OWN/IDR/005	Post Office Idanre	0.06	142	Idanre Onifunfun Road
37	11/29/2017	OWN/IDR/005	Post Office Idanre	0.02	124	Idanre Ala Road
38	11/30/2017	OGB/OWO/003	Uso Grammer School	0.01	118	Uso-Ise Road
39	11/30/2017	AKR/OGB/010	Ogbese Beside F/S	0.04	96	Ogbese Ala Road
40	11/30/2017	GPSA23S	Pillar Beside Winners Oda	0.01	104	Oda-Ala Road
41	12/1/2017	IGD/ARA/005	Aramoko Post Office	0.02	128	Aramoko-Itawure-Okemesi Road
42	12/1/2017	IGD/ARA/005	Aramoko Post Office	0.08	117	Aramoko-Ijero Road
43	12/1/2017	ARA/IJE/007	Ijero Post Office	0.02	87	Ijero Okemesi Road
44	12/2/2017	OND/ILO/014	Bamikemo	0.03	96	Bamikemo Olusola Road
45	12/4/2017	ARA/IJE/007	Ijero Post Office	0.11	135	Ijero Ifakai Road
46	12/4/2017	IJE/IFK/008	Ido Post Office	0.02	70	Ijero Ifakai Road
47	12/4/2017	IJE/IFK/014	Ifaki Post Office	0.19	115	Ado/Ifaki Road
48	12/4/2017	IFK/ADO/010	Ado-Ekiti Post Office	0.02	80	Ado-Iyin Road
49	12/5/2017	ILW/IGD/004	Ekiti Baptist High Schl, Igede	0.01	100	Igede-Awo-Iropora Road
50	12/5/2017	IJE/IFK/008	Ido Post Office	0.13	131	Ido-Otun Road
51	12/5/2017	IDO/OTN/008	Otun Post Office	0.03	126	Otun-Isan Road
52	12/6/2017	OGB/OWO/014	Owo Post Office	0.02	126	Owo-Isi Jogun

53	12/6/2017	OGB/OWO/014	Owo Post Office	0.06	145	Owo-Oba-Sooto Road
54	12/6/2017	OGB/OWO/013	Ikare Junction, Owo	0.05	120	Owo-Ikare Road
55	12/7/2017	IJE/IFK/014	Ifaki Post Office	0.04	114	Ifaki-Oye Road
56	12/7/2017	IFK/OYE/011	Outskirt Of Osin-Ekiti	0.06	87	Oye-Ikole Road
57	12/7/2017	IFK/OYE/017	Oja Odo Oro Junction	0.05	127	Ikole-Omuo Road
58	12/8/2017	IFK/ADO/010	Ado Ekiti Post Office	0.09	123	Ado-Poly-Ijan Road
59	12/8/2017	ADO/IJA/012	Ilu Omo Oba Post Office	0.31	110	Iluomooba-Ise Road
60	12/8/2017	ADO/IJA/012	Ilu Omo Oba Post Office	0.19	123	Ijan-Igbimo Road Iworoko Road
61	12/9/2017	IFK/OYE/005	Oye Ekiti Town	0.13	128	Oye-Isan Road
62	12/9/2017	IFK/OYE/005	Oye Ekiti Town	0.12	97	Oye-Ire Road
63	12/9/2017	IFK/OYE/005	Oye Ekiti Town	0.1	87	Ilupeju-Ire Road
64	12/10/2017	OWO/IKA/011	Oba Akoko Post Office	0.1	117	Owo-Ikare Road
65	12/11/2017	OWO/IKA/017	Akungba Post Office	0.08	138	Akungba-Supare-Emure Road
66	12/11/2017	OWO/IKA/017	Akungba Post Office	0.07	125	Akungba Oka Road
67	12/11/2017	OWO/IKA/011	Oba Akoko Post Office	0.03	123	Oba-Idoani Road
68	12/11/2017	OWO/IKA/011	Oba Akoko Post Office	0.05	87	Ise Oba Iwoye Road
69	12/12/2017	OWO/IKA/021	Post Office Ikare	0.14	150	Ikare-Oke Agbe Omuo Road
70	12/12/2017	OWO/IKA/021	Post Office Ikare	0.01	129	Ikare-Erusu-Ajowa Road
71	12/12/2017	IKA/AJW/011	Ajowa Akoko	0.02	118	Ajowa-Omuo-Road
72	12/12/2017	OWO/IKA/021	Post Office Ikare	0.38	62	Ikare-Irun-Aisegba
73	12/13/2017	IKA/IRU/005	Ogbagi Post Office	0.03	133	Ogbagi-Iluomoba-Road
74	12/13/2017	IKA/IRU/017	Agbado Ekiti	0.09	135	Agbado-Ode Road
75	12/13/2017	ADO/IJA/012	Ilu Omo Oba Post Office	0.09	119	Ilu-Omo Oba Ikole Road
76	12/13/2017	ILU/IKL/007	Ijesha Isu Post Office	0.07	37	Ijesha Isu Ode Road
77	12/14/2017	OWO/AGB/021	Ikare Post Office	0.12	123	Ikare-Ugbe_Iboropa Road
78	12/14/2017	IKR/IBU/009	Ayegbe Comp. High Schl,Ise	0.2	83	Ise-Akoko-Kabba Road
79	12/14/2017	IKR/IBU/012	Information Centre, Isua	0.06	123	Isua-Ido-Ani Road
80	12/14/2017	IKR/IBU/012	Information Centre, Isua	0.03	113	Ifira-Ipesin Road

81	12/15/2017	OBA/IDN/010	Idoani Post Office	0.16	121	Ido-Ani-Ipele Road
82	12/15/2017	OBA/IDN/010	Idoani Post Office	0.04	93	Idoani-Idogun Road
83	12/15/2017	IDN/IPE/016	Hamel Filling Station, Ipele	0.06	99	Ifon-Ijagba-Road
84	12/15/2017	GPO/IFON	General Post Office Ifon	0.05	138	Uzebba-Otuo, Road
85	12/16/2017	IFK/OYE/017	Oja Odo Oro Junction	0.34	131	Ikole-Itapaji Road
86	12/16/2017	IFK/OYE/017	Oja Odo Oro Junction	0.03	51	Ikole Post Office
87	12/16/2017	IFK/OYE/017	Oja Odo Oro Junction	0.03	111	Oke Ayedun-Ipao Road
88	9/16/2018	LKJ/OKN/036	Kabba Junction, Ogaminna	0.14	151	Oga - Ogale Road
89	9/17/2018	OGA/KAB/016	Kabba Post Office	0.05	118	Kabba - Iyara Road
90	9/17/2018	OGA/KAB/016	Kabba Post Office	0.1	159	Kabba - Omuo Road
91	9/18/2018	KAB/OMU/006	Kabba-Omuo Road	0.35	137	Iyara-Ogidi Road
92	9/19/2018	OGA/KAB/016	Kabba Post Office	0.05	116	Kabba-Egbe Road
93	9/19/2018	KAB/EGB/008	Kabba-Egbe Road	0.18	128	Kabba-Egbe Road
94	9/23/2018	KAB/OMU/016	Iyamoye Post Office	0.05	123	Iyamoye - Odo-Eri Road
95	9/23/2018	IYM/ODR/011	Iyamoye - Odo-Eri Road	0.07	107	Iyamoye - Odo-Eri Road
96	9/24/2018	KAB/EGB/010	Kabba-Egbe Road	0.31	97	Aiyetoro - Ekinrin Ade Road
97	9/24/2018	MPA/IML/002	Mopa - Imela Road	0.11	124	Mopa - Ife-Olukotun Road
98	9/25/2018	KAB/OMU/012	Kabba-Omuo Road	0.14	102	Aiyetoro - Ekinrin Ade Road
99	9/25/2018	KAB/OMU/012	Kabba-Omuo Road	0.14	102	Ekinrin Ade - Ife Olukotun Road
100	9/25/2018	IYM/ODR/011	Iyamoye - Odo-Eri Road	0.19	75	Ife Olukotun -Mopa Road
101	9/26/2018	IYM/ODR/006	Iyamoye - Odo-Eri Road	0.07	89	Alu - Igbo Ero Road
102	9/26/2018	IYM/ODR/006	Iyamoye - Odo-Eri Road	0.03	103	Alu - Odo Amu Road
103	9/26/2018	IYM/ODR/016	Iyamoye - Odo-Eri Road	0.02	104	Ponyan - Ogbe Road
104	7/9/2008	GMSO91B	Osogbo Post Office	0.2	126	Oshogbo Ilobu-Erin-Ede road
105	7/18/2008	OSB/IKR07	Ikirun Town	0.18	147	Ikirun - Okuku road
106	7/18/2008	GMSO91B	Osogbo Post Office	0.26	139	Oshogbo - Ikirun road
107	7/21/2008	OSB/IKR07	Ikirun Town	0.11	124	Ikirun - Ilaorangun road
108	7/21/2008	IKR/OA10	Ila Grammar School, Ila	0.05	119	Ilaorogun - Imesiile road

109	7/21/2008	IKR/OA10	Ila Grammar School, Ila	0.08	138	Ilaorogun - Okeila road
110	7/22/2008	ILS/IBK04	Ibokun	0.02	111	Ibokun - Ikirun road
111	7/22/2008	ILS/IBK04	Ibokun	0.01	96	Ibokun-Imesiile road
112	7/22/2008	GMSO91B	Osogbo Post Office	0.08	122	Oshogbo - Ilesha road
113	7/23/2008	OSB/ILS09	Ilesha	0.02	125	Ijebujesa -EsaOdo road
114	7/23/2008	OSB/ILS09	Ilesha	0.01	123	Ilesha - Ijebujesa road
115	7/23/2008	OSB/ILS09	Ilesha	0.18	142	Ilesha - Erinmo road
116	7/24/2008	ILS/ERM08	Ipetu	0.08	125	Ipetu - IleOluji road
117	7/24/2008	ILS/ERM08	Ipetu	0.08	107	Ipetu - Akure road
118	7/24/2008	OSB/ILS09	Ilesha	0.15	153	ILS/AS01
119	7/25/2008	OSB/ILS09	Ilesha	0.04	125	Ifewara road
120	7/25/2008	OSB/ILS09	Ilesha	0.03	147	Ilesha-Omifunfun road
121	7/25/2008	OSB/ILS09	Ilesha	0.02	115	Ife-Ilesha road
122	7/28/2008	IFE/OD09	Olode Town	0.05	141	Olode - Omifunfun road
123	7/28/2008	IFE/OD01	Ife	0.01	116	Ife Olode Road
124	7/30/2008	GMSO91B	Osogbo Post Office	0.18	148	Ede-Osu road
125	7/30/2008	GMSO91B	Osogbo Post Office	0.06	127	Oshogbo -Ede road

Table 4.2: Summary of the Error Analysis

	Change in value at Base	Time interval (minutes)
Minimum	0.01	34
Maximum	0.38	153
Mean	0.0792	114
Standard deviation	0.0744	22

Table 4.3: Summary of the Gravity Base Stations newly established

S/No	Station ID	Longitude	Latitude	Elevation	Absolute Gravity	Station Description	No of Observation
1	IGB/IGB/005	5.06679	7.50229	357.50	978050.220	Ikere Junction, Igbara-Odo Ekiti	8
2	IGB/IKG/007	4.99211	7.59026	471.12	978020.980	Ikogosi Ekiti at major Roundabout	4
3	AKR/IKR/014	5.23013	7.48989	356.79	978054.780	Post Office Ikere-Ekiti	5
4	IGB/ILW/006	5.10536	7.59977	427.24	978034.070	Post Office Ilawe-Ekiti	4
5	IKG/ARA/006	5.04105	7.70661	457.42	978032.150	Post Office Aramoko-Ekiti	6
6	IPL/EFY/007	4.92155	7.65191	534.69	978012.598	Effon Alaye Post Office	2
7	ARA/IJE/007	5.06888	7.81740	494.39	978026.610	Post Office Ijero-Ekiti	5
8	IJE/IFK/008	5.18227	7.84602	575.21	978008.800	Post Office Ido –Ekiti	5
9	IJE/IFK/014	5.24231	7.78890	565.67	978008.020	Post Office Ifaki-Ekiti	5
10	AKR/IKR/022	5.22203	7.62178	436.12	978039.610	General Post Office Ado-ekiti	6
11	ILW/IGD/004	5.12621	7.66863	574.18	978004.920	Ekiti Baptist High School, Igede	3
12	IDO/OTN/008	5.12135	7.98845	538.19	978013.812	Post Office Otun-Ekiti	3
13	IFK/OYE/005	5.32950	7.80013	543.96	978016.730	Oye Ekiti Town	5
14	IFK/OYE/011	5.42330	7.80360	510.49	978013.730	Osin-Ekiti(Ikole road)	3
15	IFK/OYE/017	5.52070	7.80274	578.94	977997.820	Ikole at Oja Odo Oro Junction	7
16	ADO/IJA/012	5.41716	7.63876	394.31	978033.760	Post Office IluOmooba-Ekiti	6
17	IKA/IRU/017	5.51416	7.59178	389.06	978043.400	Agbado-Ekiti (Aisegba road)	3
18	ILU/IKL/007	5.49972	7.71230	442.08	978023.980	Post Office IjeshaIsu-Ekiti	3

19	IKR/ISE/012	5.42337	7.46484	378.26	978042.000	Post Office Ise-Ekiti	2
20	GMS088B	5.18462	7.25886	345.97	978055.280	St Peter's College, Akure	11
21	GPSA72S	5.16710	7.27075	363.60	978055.330	GPS Pillar, Ilesha Garage, Akure	4
22	AKR/ILH/005	5.10439	7.33582	344.97	978052.870	Ilara-Mokin/Ipogun Junction	3
23	AKR/ILH/013	5.05515	7.41077	353.30	978050.550	Post Office Igbara-Oke	9
24	AKR/OGB/010	5.36373	7.26108	324.45	978053.810	Ogbese Beside F/S filling station	6
25	OGB/OWO/003	5.42248	7.27242	321.88	978052.350	Uso Grammer School	3
26	AKR/OND/010	5.02792	7.19048	268.41	978065.090	Owena Town, By Local Govt. Sec.	3
27	AKR/OND/015	4.95848	7.16864	268.31	978060.990	Bolorunduro, Akure Ondo RD	6
28	AKR/OND/024	4.82136	7.09148	245.63	978059.110	Ondo Town at Ore road	10
29	OND/ILO/014	4.89269	7.37820	287.29	978053.160	Ileoluji/Ipetu road, Bamikemo	3
30	OWN/IDN/005	5.10071	7.14050	292.38	978056.460	Post Office Idanre	5
31	GPSA23S	5.23387	7.17275	337.05	978052.600	GPS Pillar by Winners church Oda	3
32	GMS088C	5.19412	7.25365	349.42	978054.690	General Post Office Akure	2
33	AKR/OGB/001	5.21185	7.25112	349.95	978052.470	Alagbaka Akure	3
34	AKR/OWO/002	5.22153	7.28160	374.79	978045.530	Total Station Ado Junction, Akure	5
35	AKR/IKR/008	5.25922	7.39434	369.21	978050.860	Iju Round-about	5
36	GPSA715	5.14759	7.17830	309.71	978057.120	GPS Pillar Alade Idanre	2
37	OWO/IKA/011	5.72725	7.37121	299.13	978055.040	Gate of Oba Akoko Post Office	6

38	OWO/IKA/017	5.73621	7.46796	322.55	978056.600	Post Office Akungba	7
39	OWO/IKA/021	5.75172	7.52390	431.96	978041.620	Post Office Ikare	11
40	IKA/OMU/013	5.723710	7.732640	553.023	978014.106	Omuo Post Office	2
41	IKA/AJW/011	5.89729	7.67652	407.90	978046.110	Ajowa Akoko	3
42	IKA/IRU/005	5.70133	7.57521	520.04	978024.730	Post Office Ogbagi	3
43	IKR/IBU/009	5.91675	7.51524	310.24	978059.240	Ayegbe High Schl, Ise-Akoko	3
44	AKG/OKA/011	5.91073	7.45435	358.52	978045.490	Information Centre Junction, Isua.	5
45	OBA/IDN/010	5.84612	7.30374	323.18	978053.240	Post Office Idoani	4
46	AGB/ODE/004	5.549580	7.647680	414.385	978036.206	Ode Post Office	2
47	AGB/ODE/009	5.625050	7.682960	438.188	978032.972	Isinbode Post Office	2
48	OWO/IFO/006	5.65338	7.12925	276.48	978059.530	Hamel Filling Station, Ipele	4
49	GPO/IFON	5.76369	6.93230	159.16	978081.030	Post Office Ifon	6
50	OGB/OWO/008	5.51384	7.23755	317.19	978051.700	Emure Junction, at Emure Ile	3
51	OGB/OWO/013	5.60269	7.21895	295.42	978054.820	Ikare Junction at Owo-Ifon Road	5
52	OGB/OWO/014	5.58505	7.19840	347.89	978043.430	Post-Office Owo	4
53	IFON/OKL 014	5.60926	6.84721	119.07	978086.140	Customary court Ute	5
54	IKLPOST	5.51035	7.79193	571.16	977999.495	Ikole Post Office	2
55	OND/ORE/007	4.84824	6.98015	230.08	978064.190	Bagbe Town, Ondo	3
56	IYM/ODR/006	5.73931	7.83990	538.00	978009.921	Alu Town	5

57	IYM/ODR/011	5.76135	7.91362	482.00	978023.061	Wesley High School, Ife-Olukotun	5
58	IYM/ODR/016	5.70918	7.99041	406.00	978038.960	Oke-Oyi Sc. Sec. Sch., Ponyan	3
59	KAB/EGB/008	6.00107	7.94317	456.00	978028.015	Iyara Junction, Odokoro-Gbede	3
60	KAB/EGB/010	5.99028	7.97748	435.00	978033.229	CAC Church Ayetoro-Gbede	5
61	KAB/OMU/006	5.96498	7.84297	465.00	978027.125	Iyara-Ijumu Village	3
62	KAB/OMU/012	5.85791	7.82959	507.00	978019.000	Ekinrin-Adde Ijumu Town	5
63	KAB/OMU/016	5.79766	7.78186	520.00	978017.371	Post Office Iyamoye	3
64	OGA/KAB/016	6.07282	7.82950	450.00	978030.783	Kabba Post Office	12
65	GMSO91B	4.55000	7.77972	320.57	978060.580	Osogbo Post Office	26
66	OSB/IKR 07	4.65630	7.91605	370.01	978055.777	Ikirun Town	6
67	IKR/OA10	4.87812	8.00455	508.26	978034.889	Ila Grammar School, Ila-Orangun	5
68	IOG/II09	4.84335	7.83237	517.80	978023.058	Imesi Ile Town Roundabout	2
69	OSB/ILS 09	4.74570	7.64380	376.01	978061.978	Ilesha	15
70	ILS/IBK 04	4.72785	7.78532	375.59	978056.900	Ibokun	5
71	ILS/ERM 08	4.89637	7.48543	283.29	978065.350	Ipetu	5
72	IFE/ILS 01	4.57607	7.50688	278.06	978070.431	Ife	3
73	IFE/ILS 07	4.67737	7.58272	372.34	978064.588	Osu	3
74	IFE/OD01	4.55677	7.45247	308.35	978058.032	Ife	3
75	IFE/OD09	4.62765	7.26860	234.42	978065.299	Olode Town	3

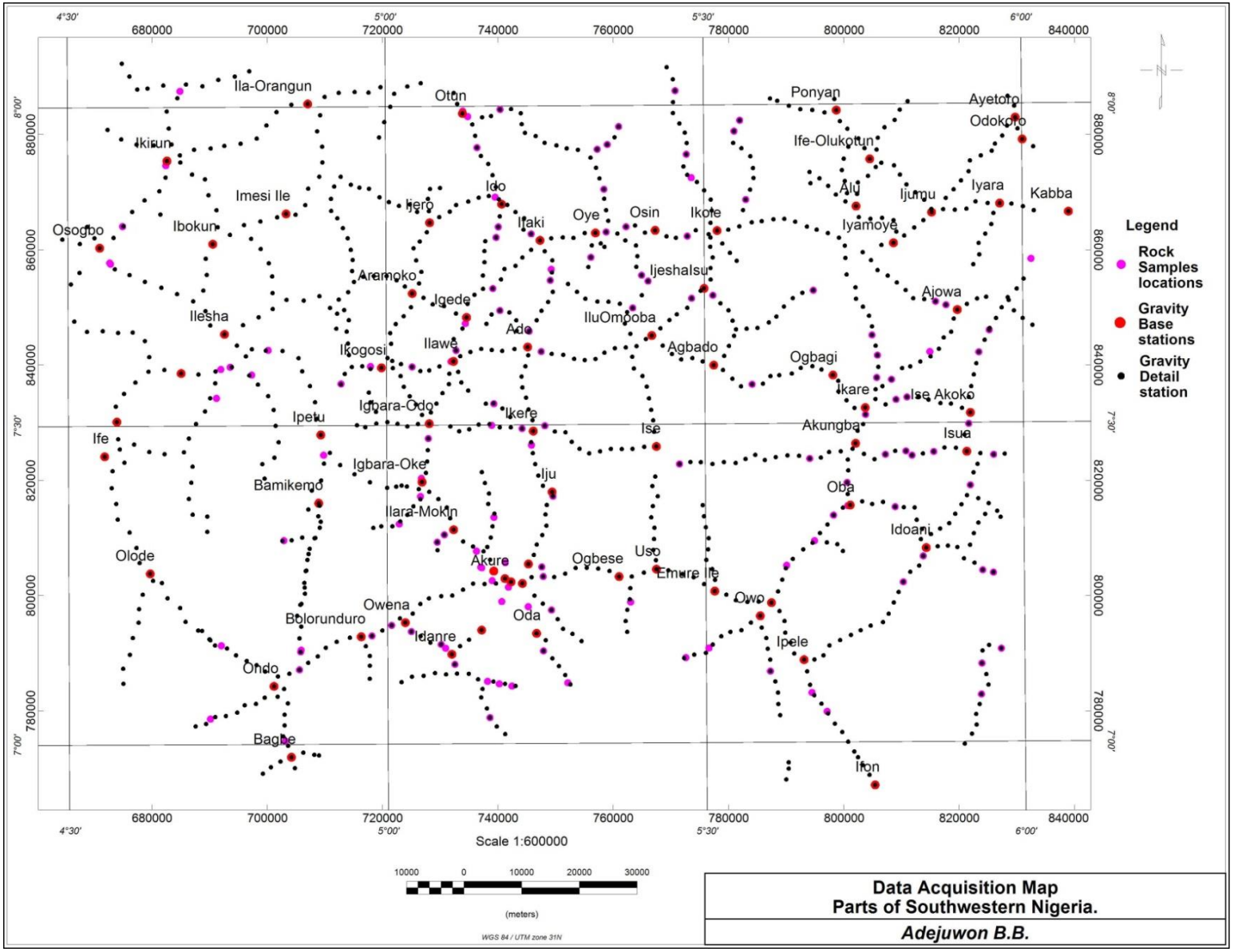


Figure 4.1: Data Acquisition Map

Plate 4.1: Some of the Established Base Stations

4.2 Determination of Rock Samples Densities

During the gravity data acquisition, some of the encountered lithologies were mapped and sampled (plates 4.2 to 4.6). The rocks samples were used for density determination.

A total of One hundred and fourth-eight (148) fresh rock samples were collected during the gravity data acquisition in the study area (figure 4.1). The rocks samples were grouped into 8 major groups which are:

- Charnockite
- Migmatite
- Gneiss
- Quartzite
- Schist
- Amphibolite
- Granite
- Diorite/Granodiorite

Gneissic rocks here are composed of granite gneisses, banded gneisses and some biotite gneiss while the encountered schistose rocks are mainly quartz schist and mica schist. The gneisses rocks are migmatite in parts. The granites are made up the major granite classes which are porphyritic granite, coarse grained biotite granite and medium to coarse grained granite.

The lithological and density parameters of the rock samples are presented in Table 4.4 below. Also, the summary of density range for each rock units are shown table 4.5, figures 4.2 and 4.3. A 2D map of the density distribution is shown in figure 4.4. The density values range from 2.526 to 2.871g/cm^3. The amphibolites have the highest mean density of 2.765g/cm^3, followed by the charnockites with 2.755g/cm^3. This may be related to the presence of ferromagnesian

minerals in the composition. The schists and quartzites have the lowest mean density value (Figure 4.3). From field observation, most of the schistose rocks are highly weathered.

Plate 4.2: Quartzite Outcrop (N7.59245, E4.97497)

Plate 4.3: Migmatite Gneiss (close to N7.45435, E5.91073)

Plate 4.4: Coarse Grained Granite (N 07 45 23.0, E 04 33 56.8, 333m)

Plate 4.5: Quartz Schist (N07 45 16.5, E04 34 01.1, 338m)

Plate 4.6: Gneiss (Granitic/Migmatitic) (N 07 5048.3, E 0555 54.3, 481m)

Table 4.4: Lithological and Density Parameters of the Rock Samples

Rock ID	Latitude	Longitude	Elevation	Lithology	Wet (g/cm^3)	Dry (g/cm^3)	Density (g/cm^3)
BB001	7.24540	5.18997	337	Charnockite	2.763	2.783	2.773
BB002	7.22291	5.17945	343	Medium Grained Granite	2.698	2.718	2.708
BB003	7.27075	5.16710	359	Charnockite	2.782	2.792	2.787
BB004	7.27593	5.14820	368	Charnockite	2.844	2.854	2.849
BB005	7.27694	5.14666	357	Migmatite Gneiss	2.679	2.699	2.689
BB006	7.25569	5.16448	362	Charnockite	2.857	2.869	2.863
BB007	7.33582	5.10439	334	Medium Grained Granite	2.736	2.746	2.741
BB008	7.30202	5.14009	375	Medium Grained Granite	2.729	2.749	2.739
BB009	7.47903	5.06527	374	Medium Grained Granite	2.861	2.881	2.871
BB010	7.34523	5.01898	357	Quartzite	2.575	2.585	2.580
BB011	7.38828	5.05257	331	Migmatite Gneiss	2.707	2.727	2.717
BB012	7.41663	5.05411	345	Granite	2.650	2.674	2.662
BB013	7.32799	5.08975	403	Migmatite Gneiss	2.766	2.786	2.776
BB014	7.31636	5.07852	326	Gneiss (Banded/Granite)	2.629	2.639	2.634
BB015	7.35501	5.16776	407	Gneiss (Banded/Granite)	2.565	2.581	2.573
BB016	7.25365	5.19412	341	Porphyritic Granite	2.582	2.592	2.587
BB017	7.26186	5.24469	331	Porphyritic Granite	2.608	2.622	2.615
BB018	7.27686	5.24248	346	Porphyritic Granite	2.595	2.615	2.605
BB019	7.28160	5.22153	371	Granite Gneiss	2.609	2.629	2.619
BB020	7.28381	5.18510	375	Porphyritic Granite	2.547	2.557	2.552
BB021	7.38760	5.26060	377	Porphyritic Granite	2.646	2.668	2.657
BB022	7.21465	5.22088	351	Charnockite	2.664	2.685	2.675
BB023	7.17275	5.23387	339	Gneiss (Banded/Granite)	2.620	2.642	2.631
BB024	7.46793	5.22731	370	Porphyritic Granite	2.595	2.605	2.600
BB025	7.49819	5.24840	375	Porphyritic Granite	2.567	2.587	2.577
BB026	7.49393	5.21262	372	Porphyritic Granite	2.606	2.626	2.616
BB027	7.49920	5.16491	390	Porphyritic Granite	2.584	2.594	2.589
BB028	7.53310	5.16851	388	Porphyritic Granite	2.605	2.615	2.610
BB029	7.59150	5.04030	405	Medium Grained Granite	2.624	2.644	2.634
BB030	7.59966	5.10156	431	Migmatite Gneiss	2.676	2.704	2.690

BB031	7.04803	5.68913	234	Migmatite Gneiss	2.701	2.721	2.711
BB032	7.07777	5.66546	235	Gneiss (Banded/Granite)	2.837	2.857	2.847
BB033	7.20922	5.25741	332	Migmatite Gneiss	2.688	2.698	2.693
BB034	7.59245	4.97497	538	Migmatite Gneiss	2.702	2.712	2.707
BB035	7.56534	4.92853	435	Quartzite	2.584	2.604	2.594
BB036	7.61690	5.10956	485	Quartzite	2.591	2.605	2.598
BB037	7.65917	5.12439	562	Migmatite Gneiss	2.619	2.639	2.629
BB038	7.18632	5.00632	245	Gneiss (Banded/Granite)	2.707	2.727	2.717
BB039	7.16990	4.97542	272	Gneiss (Banded/Granite)	2.673	2.696	2.685
BB040	7.17643	5.03730	263	Gneiss (Banded/Granite)	2.612	2.632	2.622
BB041	7.15605	5.08408	284	Gneiss (Banded/Granite)	2.647	2.659	2.653
BB042	7.15009	5.09103	285	Gneiss (Banded/Granite)	2.812	2.822	2.817
BB043	7.14050	5.10071	297	Gneiss (Banded/Granite)	2.692	2.702	2.697
BB044	7.11717	4.86142	235	Migmatite	2.647	2.667	2.657
BB045	7.00541	4.83878	189	Medium Grained Granite	2.573	2.593	2.583
BB046	7.15533	4.73887	227	Coarse Grained Granite	2.679	2.699	2.689
BB047	7.04042	4.72133	238	Coarse Grained biotite Granite	2.757	2.767	2.762
BB048	7.14529	4.86335	275	Porphyritic Granite	2.720	2.730	2.725
BB049	7.14808	4.86420	271	Porphyritic Granite	2.720	2.730	2.725
BB050	7.12473	5.10540	327	Coarse Grained Granite	2.800	2.820	2.810
BB051	7.04094	5.16004	301	Porphyritic Granite	2.659	2.680	2.669
BB052	7.09032	5.19475	282	Porphyritic Granite	2.641	2.661	2.651
BB053	7.09391	5.17485	293	Granite Gneiss	2.743	2.763	2.753
BB054	7.09784	5.15651	310	Granite Gneiss	2.770	2.780	2.775
BB055	7.22109	5.38170	324	Porphyritic Granite	2.636	2.646	2.641
BB056	7.14518	5.24453	318	Medium Grained Granite	2.730	2.740	2.735
BB057	7.09501	5.28248	283	Gneiss (Banded/Granite)	2.692	2.702	2.697
BB058	7.31997	4.83765	258	Gneiss (Banded/Granite)	2.635	2.645	2.640
BB059	7.38003	4.89217	290	Medium Grained Granite	2.652	2.672	2.662
BB060	7.45364	4.90070	285	Migmatite	2.671	2.677	2.674
BB061	7.85714	5.17204	560	Coarse Grained Granite	2.712	2.732	2.722
BB062	7.79915	5.22846	563	Biotite Gneiss	2.804	2.824	2.814

BB063	7.81040	5.17683	581	Coarse Grained Biotite Granite	2.695	2.715	2.705
BB064	7.79383	5.17329	562	Porphyritic Granite	2.667	2.677	2.672
BB065	7.72614	5.25815	421	Charnockite	2.572	2.592	2.582
BB066	7.64662	5.22448	423	Gneiss (Banded/Granite)	2.663	2.683	2.673
BB067	7.74337	5.25973	449	Porphyritic Granite	2.540	2.560	2.550
BB068	7.67926	5.17873	510	Gneiss (Banded/Granite)	2.609	2.629	2.619
BBA01	7.67926	5.17873	510	Gneiss (Granite/migmatite)	2.667	2.690	2.678
BB069	7.71376	5.16771	546	Charnockite	2.677	2.702	2.689
BB070	7.93485	5.14395	561	Charnockite	2.671	2.691	2.681
BB071	7.98368	5.12960	565	Coarse Grained Biotite Granite	2.745	2.765	2.755
BB072	7.99238	5.12180	568	Charnockite	2.792	2.802	2.797
BB073	7.99456	5.18060	533	Coarse Grained Granite	2.702	2.722	2.712
BB074	7.11165	5.60044	265	Migmatite Gneiss	2.587	2.607	2.597
BB075	7.13355	5.46787	268	Migmatite Gneiss	2.622	2.632	2.627
BB076	7.14837	5.50423		Migmatite Gneiss	2.565	2.575	2.570
BB077	7.35559	5.70097	280	Granite Gneiss	2.568	2.593	2.580
BB078	7.37026	5.72330	305	Migmatite Gneiss	2.674	2.694	2.684
BB079	7.31572	5.67089	221	Migmatite Gneiss	2.686	2.706	2.696
BB080	7.27745	5.62688	239	Migmatite Gneiss	2.691	2.701	2.696
BB081	7.80013	5.32950	537	Charnockite	2.804	2.814	2.809
BB082	7.80151	5.34630	549	Charnockite	2.836	2.856	2.846
BB083	7.80956	5.37756	611	Porphyritic Granite	2.620	2.640	2.630
BB084	7.79428	5.47384	531	Granite Gneiss	2.588	2.608	2.598
BBA02	7.79713	5.50743	554	Quartzite	2.600	2.620	2.610
BBA03	7.75860	5.75501	535	Schist (Weathered)	2.617	2.643	2.630
BB085	7.61453	5.24330	410	Charnockite	2.670	2.690	2.680
BB086	7.68214	5.38740	390	Migmatite Gneiss	2.690	2.710	2.700
BB087	7.86849	5.34313	579	Charnockite	2.759	2.780	2.770
BB088	7.93126	5.33293	511	Granite	2.590	2.600	2.595
BB089	7.93862	5.34881	492	Granite	2.615	2.625	2.620

BB090	7.96670	5.36690	463	Granite	2.603	2.623	2.613
BB091	7.76193	5.32210	483	Gneiss (Banded/Granite)	2.618	2.638	2.628
BB092	7.73345	5.40168	547	Biotite Gneiss	2.654	2.674	2.664
BB093	7.72418	5.41175	481	Biotite Gneiss	2.657	2.677	2.667
BB094	7.40675	5.72257	301	Granite Gneiss	2.672	2.692	2.682
BB095	7.51313	5.75216	425	Migmatite Gneiss	2.683	2.705	2.694
BB096	7.44459	5.66406	324	Migmatite Gneiss	2.699	2.709	2.704
BB097	7.43714	5.45960	366	Migmatite Gneiss	2.682	2.692	2.687
BB098	7.45045	5.78291	470	Migmatite Gneiss	2.675	2.685	2.680
BB099	7.45549	5.81521	529	Biotite Granite	2.759	2.773	2.766
BB100	7.44879	5.82472	474	Migmatite	2.744	2.764	2.754
BB101	7.45438	5.85885	402	Migmatite	2.656	2.676	2.666
BB102	7.36819	5.79776	276	Migmatite Gneiss	2.643	2.653	2.648
BB103	7.57094	5.77003	392	Gneiss (Banded/Granite)	2.662	2.672	2.667
BB104	7.60590	5.77142	406	Gneiss (Banded/Granite)	2.617	2.637	2.627
BB105	7.63771	5.76308	483	Gneiss (Banded/Granite)	2.622	2.642	2.632
BB106	7.56789	5.79319	367	Charnockite	2.759	2.783	2.771
BB107	7.61103	5.85374		Gneiss (Banded/Granite)	2.578	2.602	2.590
BB108	7.68420	5.87953	380	Granite Gneiss	2.686	2.702	2.694
BB109	7.68969	5.86315	404	Gneiss (Banded/Granite)	2.672	2.692	2.682
BB110	7.56147	5.57432	362	Gneiss (Banded/Granite)	2.606	2.616	2.611
BB111	7.70826	5.67122	461	Gneiss (Banded/Granite)	2.572	2.592	2.582
BB112	7.70132	5.51348	441	Migmatite Gneiss	2.789	2.809	2.799
BB113	7.69686	5.48003	424	Migmatite Gneiss	2.553	2.565	2.559
BB114	7.53633	5.80011	363	Granite Gneiss	2.610	2.620	2.615
BB114b	7.53633	5.80011	363	Granite Gneiss	2.761	2.781	2.771
BB115	7.54011	5.81737	376	Granite Gneiss	2.689	2.711	2.700
BB116	7.49800	5.91412	342	Medium Grained Granite	2.771	2.781	2.776
BB117	7.61013	5.93063	354	Banded Gneiss	2.652	2.672	2.662
BB118	7.64459	5.94718	356	Granite Gneiss	2.671	2.691	2.681
BB119	7.45435	5.91073	349	Migmatite Gneiss	2.647	2.657	2.652
BB120	7.40163	5.91601	292	Granite Gneiss	2.555	2.565	2.560
BB121	7.44934	5.95284	288	Migmatite Gneiss	2.632	2.652	2.642

BB122	7.29081	5.84138	264	Granite Gneiss	2.567	2.589	2.578
BB123	7.25035	5.80979	188	Gneiss (Banded/Granite)	2.552	2.562	2.557
BB124	7.26848	5.93457	258	Banded Gneiss	2.521	2.531	2.526
BB125	7.26472	5.95134	277	Banded Gneiss	2.616	2.626	2.621
BB126	7.07378	5.93137	202	Quartzite	2.595	2.615	2.605
BB127	7.12226	5.93245	257	Granite	2.779	2.794	2.787
BB128	7.14546	5.96297	272	Granodiorite	2.758	2.776	2.767
BB129	7.88590	5.48061	512	Diorite	2.668	2.678	2.673
BB130	7.92267	5.47294	497	Coarse Grained Granite	2.785	2.805	2.795
BB131	8.02242	5.45588	432	Granite Gneiss	2.616	2.626	2.621
BB132	7.85103	5.56600	540	Migmatite Gneiss	2.664	2.684	2.674
BB133	7.95848	5.54813	430	Migmatite Gneiss	2.708	2.716	2.712
BB134	7.97539	5.55717	425	Gneiss (Banded/Granite)	2.689	2.699	2.694
ILS001	7.58878	4.73971	408	Quartzite	2.680	2.700	2.690
ILS047	7.61841	4.81422	415	Amphibolite	2.760	2.780	2.770
ILS053	7.57981	4.78821	347	Amphibolite (weathered)	2.755	2.765	2.760
IL058	7.59218	4.75447	422	Schist (Weathered)	2.670	2.690	2.680
ILS065	7.54344	4.73270	394	Quartzite	2.675	2.695	2.685
KG01	7.75598	6.01353	426	Porphyritic Granite	2.670	2.690	2.680
IKR01	7.90883	4.65453	356	Mica Schist	2.643	2.657	2.650
OKK01	8.02531	4.67725	362	Migmatite	2.679	2.689	2.684
OSG01	7.75458	4.56697	338	Quartz schist	2.640	2.660	2.650
OSG02	7.75639	4.56578	333	Coarse Grained Granite	2.699	2.721	2.710
OSG03	7.81350	4.58617	367	Pegmatite in Schist	2.640	2.650	2.645

Table 4.5: Summary of Rock Samples Density Parameters

Statistical Parameters	All Samples	Charnockite	Gneiss	Migmatite	Quartzite	Schist	Amphibolite	Granite	Diorite/Granodiorite
Number of samples	148	14	45	31	7	5	2	42	2
Minimum density (g/cm^3)	2.526	2.582	2.526	2.559	2.580	2.630	2.760	2.550	2.673
Maximum density (g/cm^3)	2.871	2.863	2.847	2.799	2.690	2.680	2.770	2.871	2.767
Mean density (g/cm^3)	2.677	2.755	2.659	2.680	2.623	2.651	2.765	2.676	2.720
Standard deviation	0.07334	0.08184	0.07087	0.05110	0.04496	0.01817	0.00707	0.07691	0.06661

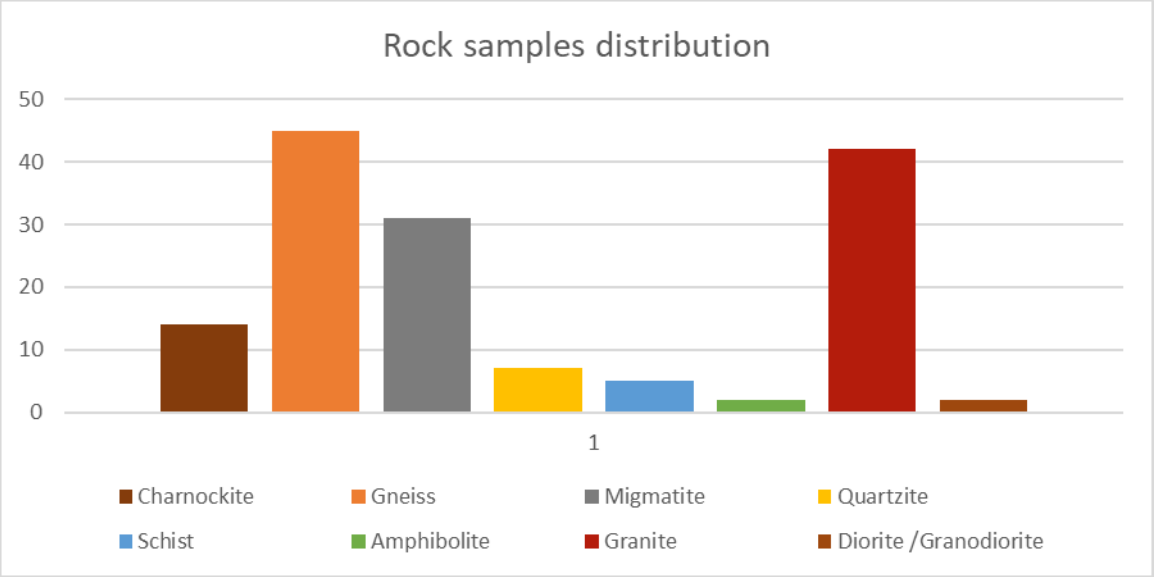


Figure 4.2: Rock Samples Distribution

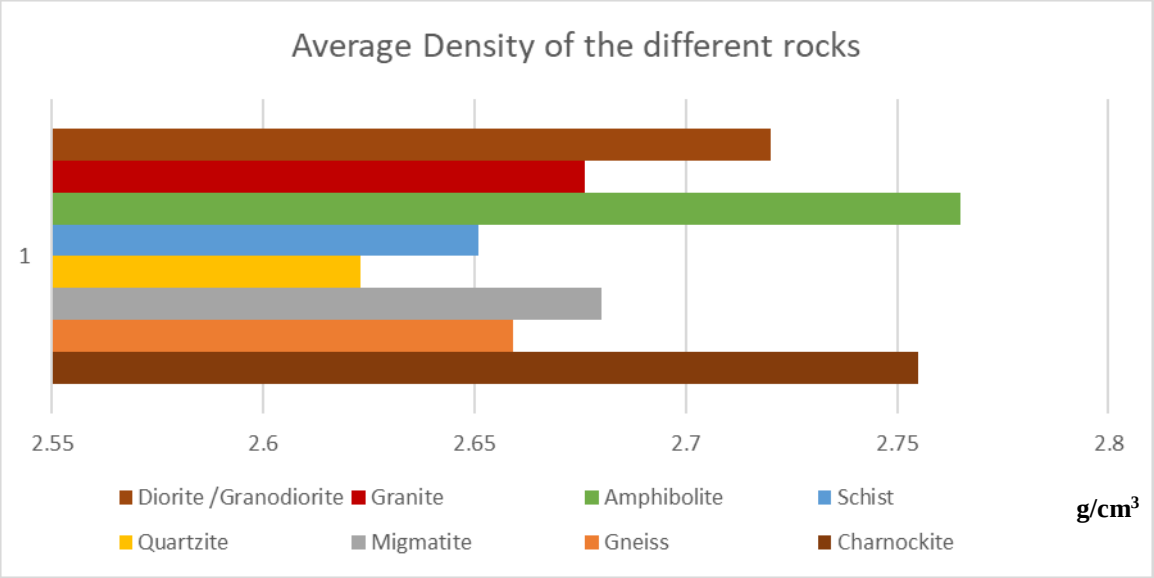


Figure 4.3: Average Density Values of Various Rock Classes

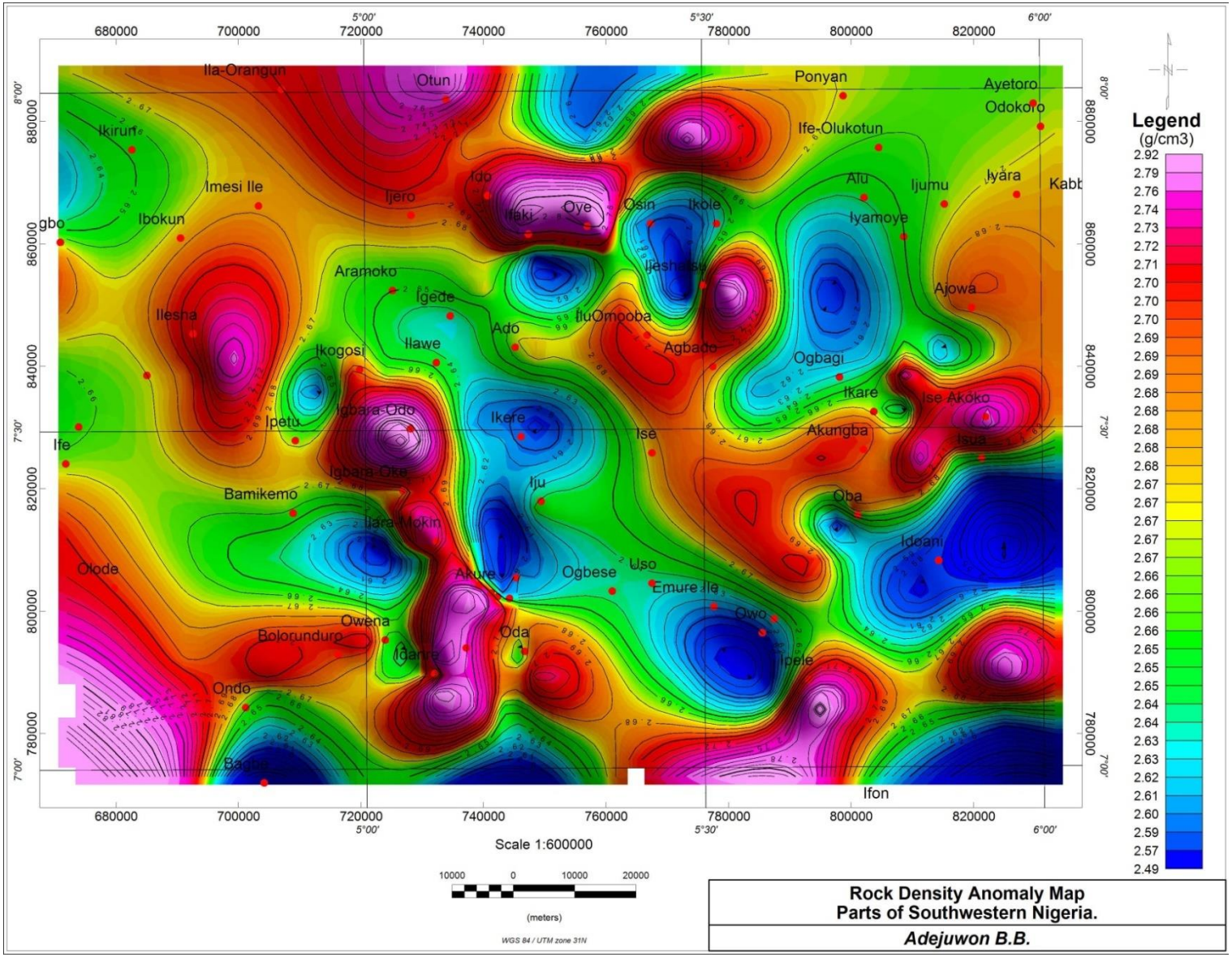


Figure 4.4: Rock Density Distribution Map

4.3 Reduced Height of the Study Area

Elevation is a critical factor in the measurement of gravity. The acceleration of gravity is highly dependent upon the distance from center of mass of the Earth. Small elevation variations result in relatively large deviations in gravity compared to the gravity anomalies of interest. As the gravity field is so strongly influenced by elevation, it is not normally mapped until the elevation corrections have been made. A simple experiment to show the effect of elevation on gravity conducted by measuring acceleration due to gravity from on top of and underneath a desk by the Geological Survey of South Australia offices shows a difference in height of about 1m results in change in gravity of ~0.30 mGal (Heath, 2017).

The three Wallace and Tiernan altimeters were used to measure the altitude of all the gravity stations with pycho-dyne thermometer which measures the wet and dry air temperature. This is an aneroid barometer that responds to air pressure variation with elevation changes.

The major parameter that usually affects atmospheric pressure is Humidity; hence, humidity correction was carried out on the altimeter data using the measured wet and dry temperature readings. The percentage relative humidity obtained from the psychometric chart (plate 3.3) is plotted against the average temperature to get the correction factor. This correction factor (plate 3.4) was used to multiply the altimeter reading to get the final corrected altimeter reading. This was later processed for drift correction and reduced with known height to get the reduced height for each station.

The elevation values obtained for this study range from about 158m to 622m above sea level from the south to the northcentral part. In the northcentral part of the study area, the elevation is higher, averagely 600m above sea level (Figure 4.5). The major towns around this area are Igede, Ifaki, Ido, Otun, Isan, Oye. Geologically, the area is mostly underlain by the older

granite suite. The lowest elevations are recorded in the southeastern part of the study area. These areas are of within the sedimentary parts around Ifon-Ute area with Cretaceous Abeokuta formation (lying uncomformably on the basement complex) and Tertiary Ewekoro formation.

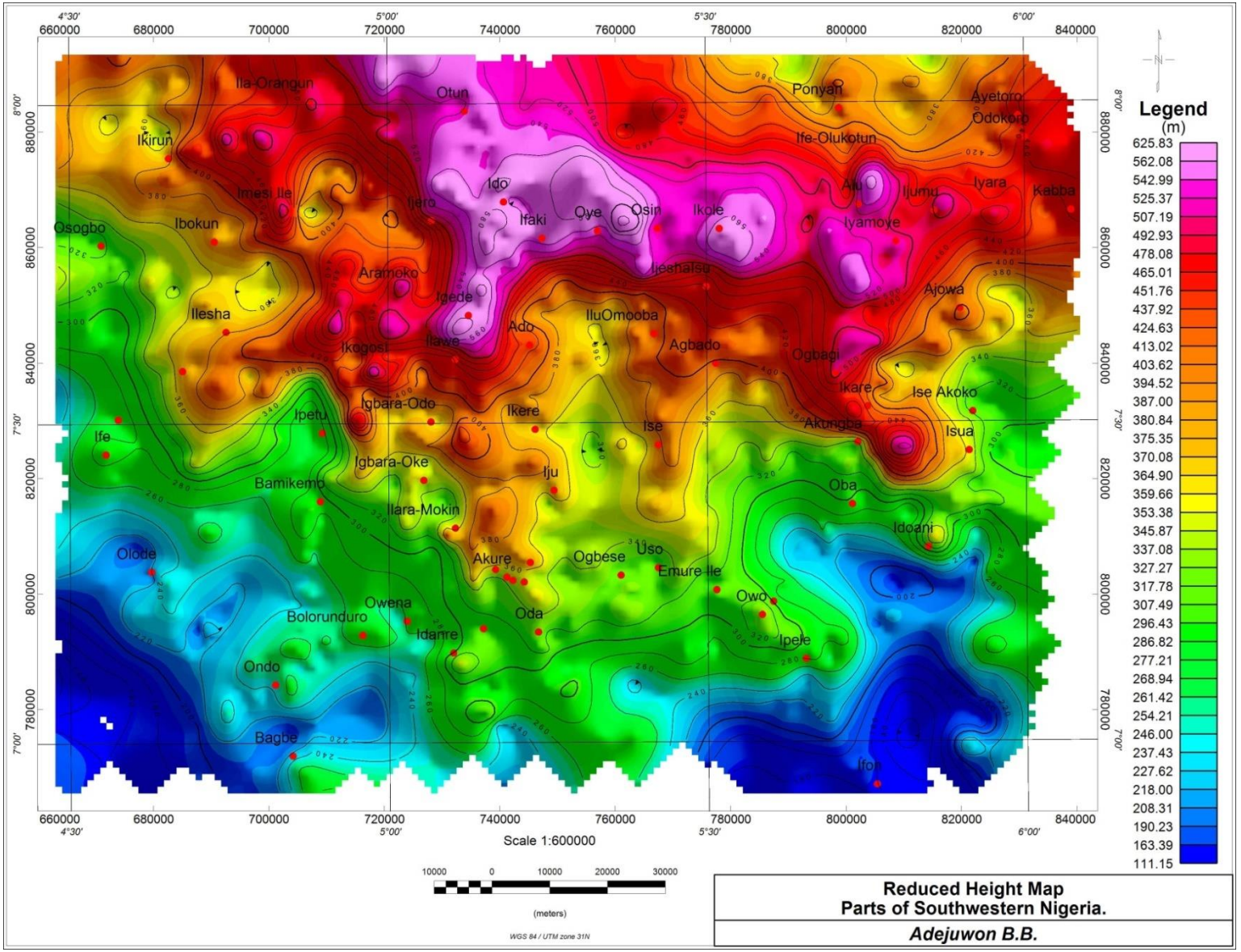


Figure 4.5: Reduced Height Map

4.4 Gravity Anomaly Maps

Gravity values are transformed into Free Air anomaly and Bouguer Anomaly. The processed gravity data were presented as 2D maps in both contour and colour-shaded maps. The maps include Absolute gravity value map, Bouguer anomaly map, Free-air anomaly map, Regional anomaly map and Residual anomaly map. The Bouguer anomalies represent the subsurface mass distribution with the aid of geological interpretation.

4.4.1 Absolute Gravity Value Map

Figure 4.6 shows the absolute gravity value map of the study area. It ranges from 977996.665mGal to 978087.438mGal i.e. from the northcentral part to the southeastern part with an average value of 978043.535 ±19.156 mGal. Within the 1093 detail gravity stations, absolute gravity value range is about 90.773mgal while it's 88.32mGal across the 75 base stations. The lowest value at base station was recorded at IFK/OYE/017 (Ikole) with a value of 977997.82mGal while the highest value at a base station was recorded at IFON/OKL/014 (Customary court, Ute) with value 978086.14mGal.

The very low absolute gravity value was recorded in the northcentral part of the Ekiti state around Igede, Ido, Oye, Ikole etc. This corresponds to the area with high elevation, thereby confirming the relationship between elevation and gravity i.e. they are inversely proportional to each other (figure 4.5). Other areas show a little variation in gravity. The highest absolute gravity values were recorded in the southeastern part (sedimentary basin) with corresponding low elevation values around Ifon as shown in figures 4.5 and 4.6.

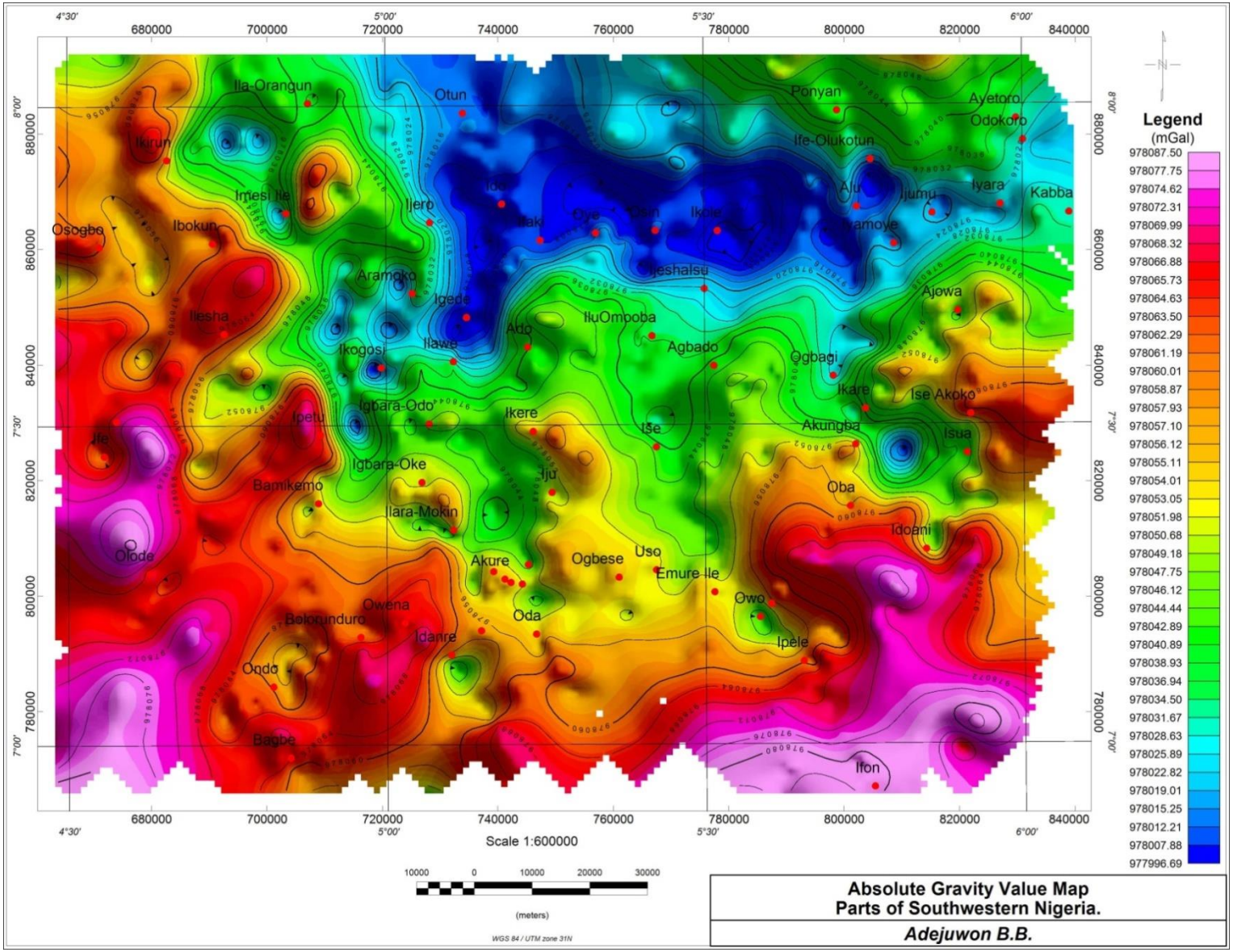


Figure 4.6: Absolute Gravity Value Map

4.4.2 Bouguer Anomaly Map

Bouguer anomaly field is devoid from the effect of geological materials lying between the observation point and the datum. The observed gravity values were reduced to bouguer anomaly. Figures 4.7a and 4.7b are the Bouguer Anomaly maps of the study area. The Bouguer anomaly values range from about -19.087 to 16.914mGal with mean value of -2.01 ±6.713 mGal. The northcentral/northeastern parts of the study area (Ijesa-isu, Ikole, Ipao, Itapaji, Iye, Ponyan, Ijumu, ayetoro area) map show negative gravity values probably indicating low-density bodies. The western and southern parts of the study area (Ilesha, Ife, Akure, Ikere, Ifon area) map show positive gravity values probably indicating high-density bodies. It is noteworthy that positive gravity anomalies are associated with shallow high-density bodies whereas gravity lows are associated with shallow low-density bodies (Wright, 1981).

High bouguer values are associated with Ilesha schist belt to the west of the study area, the charnockite of Oye, Ado, Akure and Idanre area and the Akoko high.

The bouguer anomaly map is characterized by several closures with varied amplitudes and gradients. This may be related to the litho-structural features of the underline rocks in the study area which varied widely both in composition, mineralogy, orientation, depth of emplacement and density.

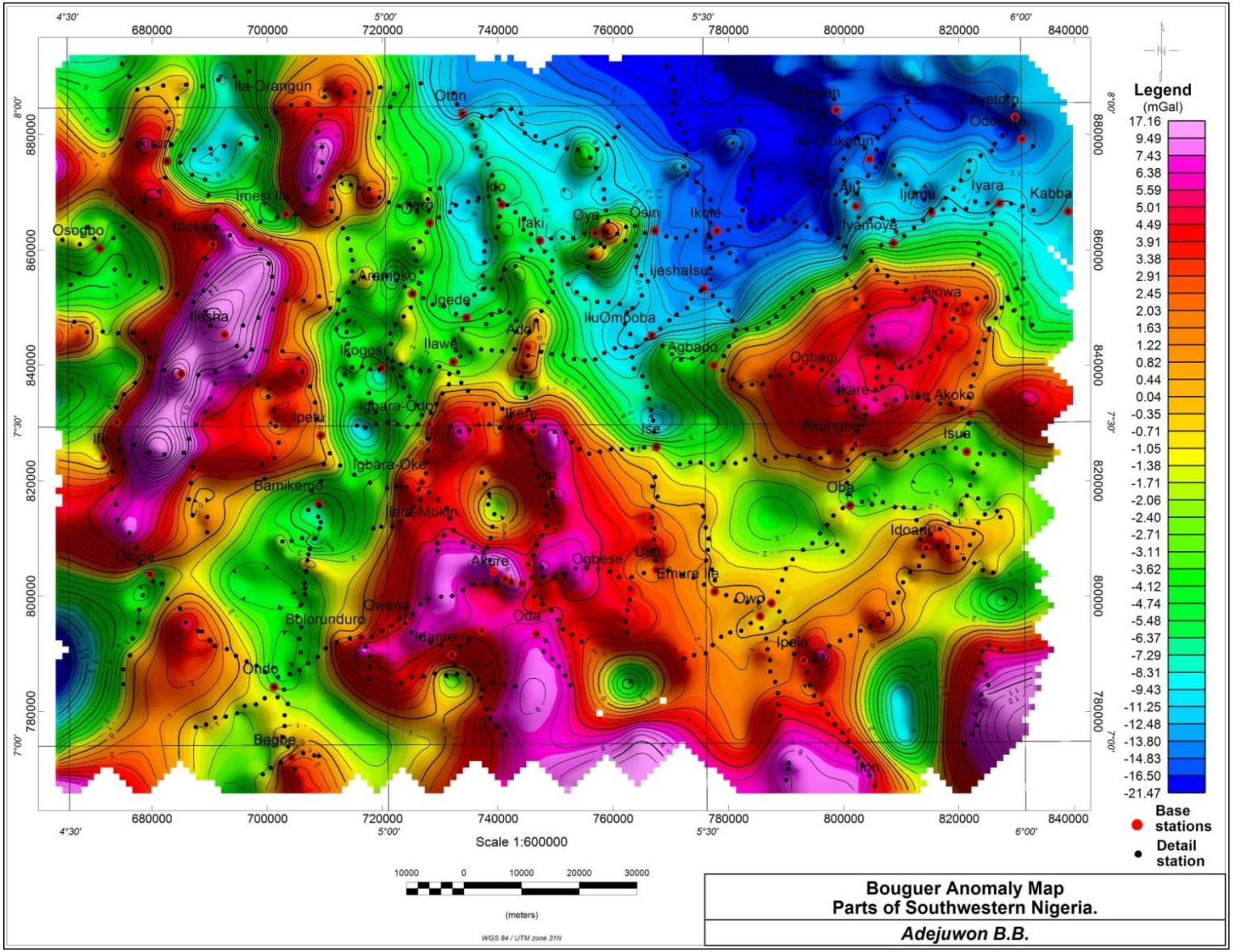


Figure 4.7a: Bouguer Anomaly Map

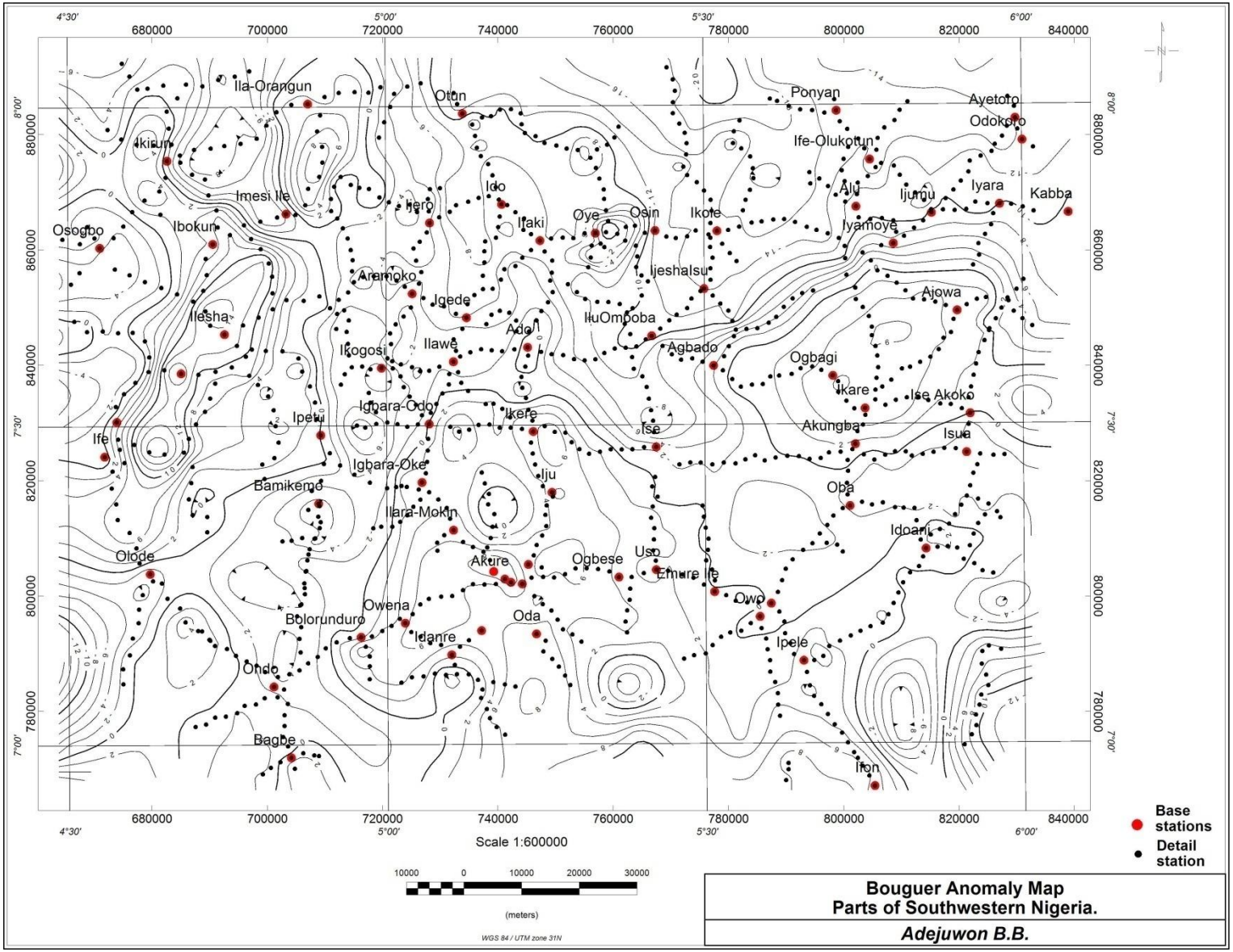


Figure 4.7b: Bouguer Anomaly Map (Contoured)

4.4.3 Free Air Anomaly Map

The free-air anomaly map of the study area is shown in figure 4.8. The free-air anomaly values range from 16.026mGal/m to 68.274mGal/m with mean value 40.778 ± 9.759 mGal. It shows the highest value around the north-eastern part (around Omuo, Ikare and Ajowa Akoko area) and northcentral part (Ilaorogun-Igede-Ifaki-Ido-Oye area) of the study area. The lowest free-air anomaly value is recorded around the southeastern and southwestern part of the study area e.g. Ifon and Bagbe. Geologically, the southeastern section of the study area falls within the sedimentary formation. There is seemingly direct relationship between the Free Air Anomaly map and the Elevation map (Figure 4.6) in some parts of the study area. The positive high free Air Anomaly values area correspond to the high elevation areas.

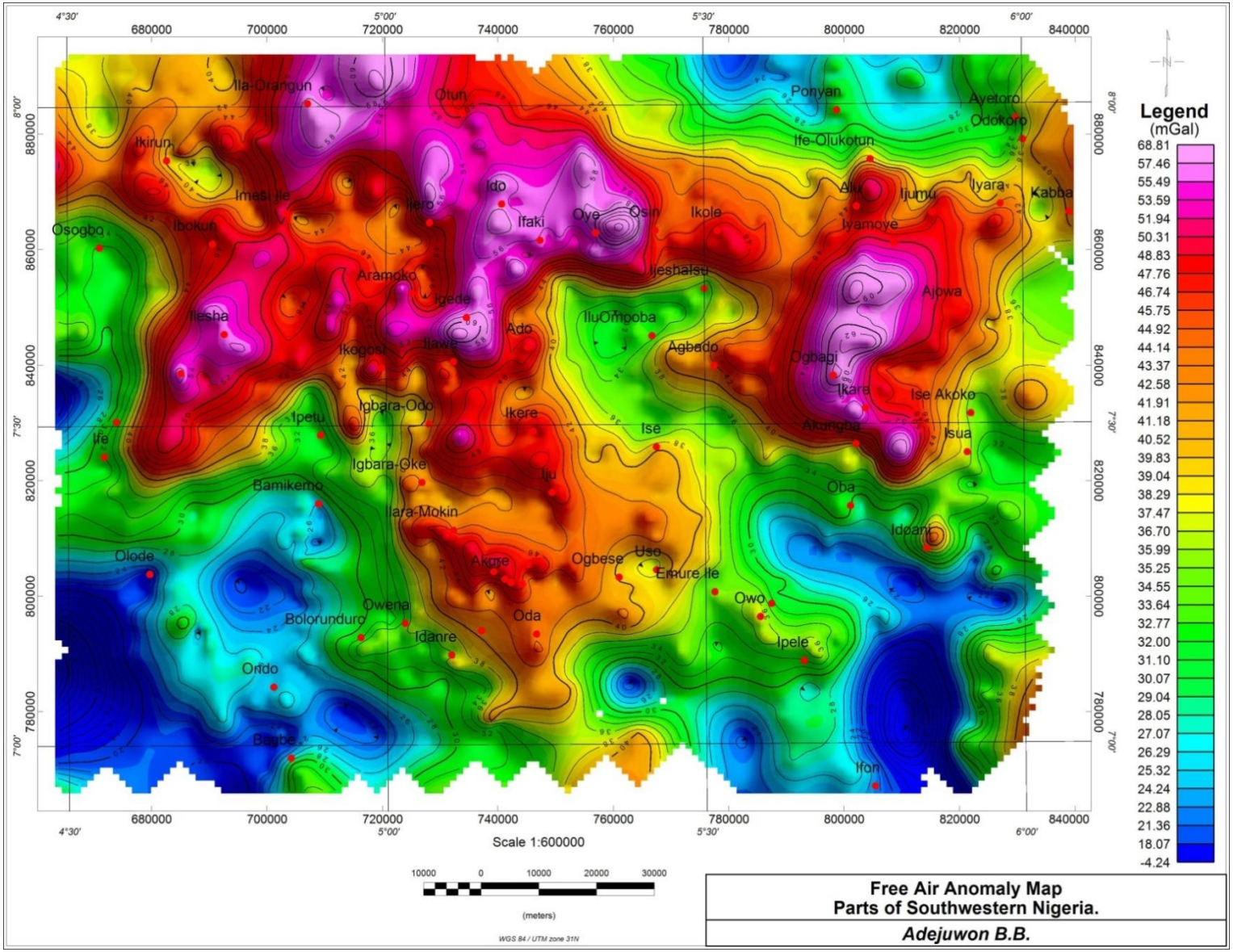


Figure 4.8: Free-Air Anomaly Map

4.5 Regional and Residual Anomalies

For meaningful geological inferences and deductions from the gravity data, it is imperative to separate the effects which are associated with geologic features of interest from the total gravity field. The observed gravity field at every point is a vector sum of various components, such as the regional field and the local field components. The regional field was assumed to be a first order polynomial plane. The regional field was calculated with the aid of Geosoft MAGMAP software which is based on least square (best-fit polynomial) algorithm. The computed regional anomaly (figure 4.9) was subtracted from the Bouguer anomaly map (Figure 4.7a) to obtain the field due to local geological events i.e. residual bouguer map (figure 4.10).

The regional field represents a large wavelength anomaly at relatively deeper level than the residual anomaly which is characterized by short wavelength. This regional field varies from -10.628mGal in the north to 3.841mGal in the south and dipping slightly to the east (Figure 4.7a).

The residual Bouguer Anomaly map of the study area is presented as Figure 4.10. The residual Bouguer Anomaly values range from about -10.577 to 19.805mGal with a mean value 1.479 ± 5.319 mGal. The northcentral/northeastern parts of the study area (Ijesa-isu, Ikole, Ipao, Itapaji, Iye, Ponyan, Ijumu, ayetoro area) map show negative gravity values probably indicating low-density bodies. The western and southern parts of the study area (Ilesha, Ife, Akure, Ikere, Ifon area) map show positive gravity values probably indicating high-density bodies.

The residual bouguer anomaly map is characterized by several closures with varied amplitude and gradient similar to the bouguer anomaly map but the anomaly here are more distinct.

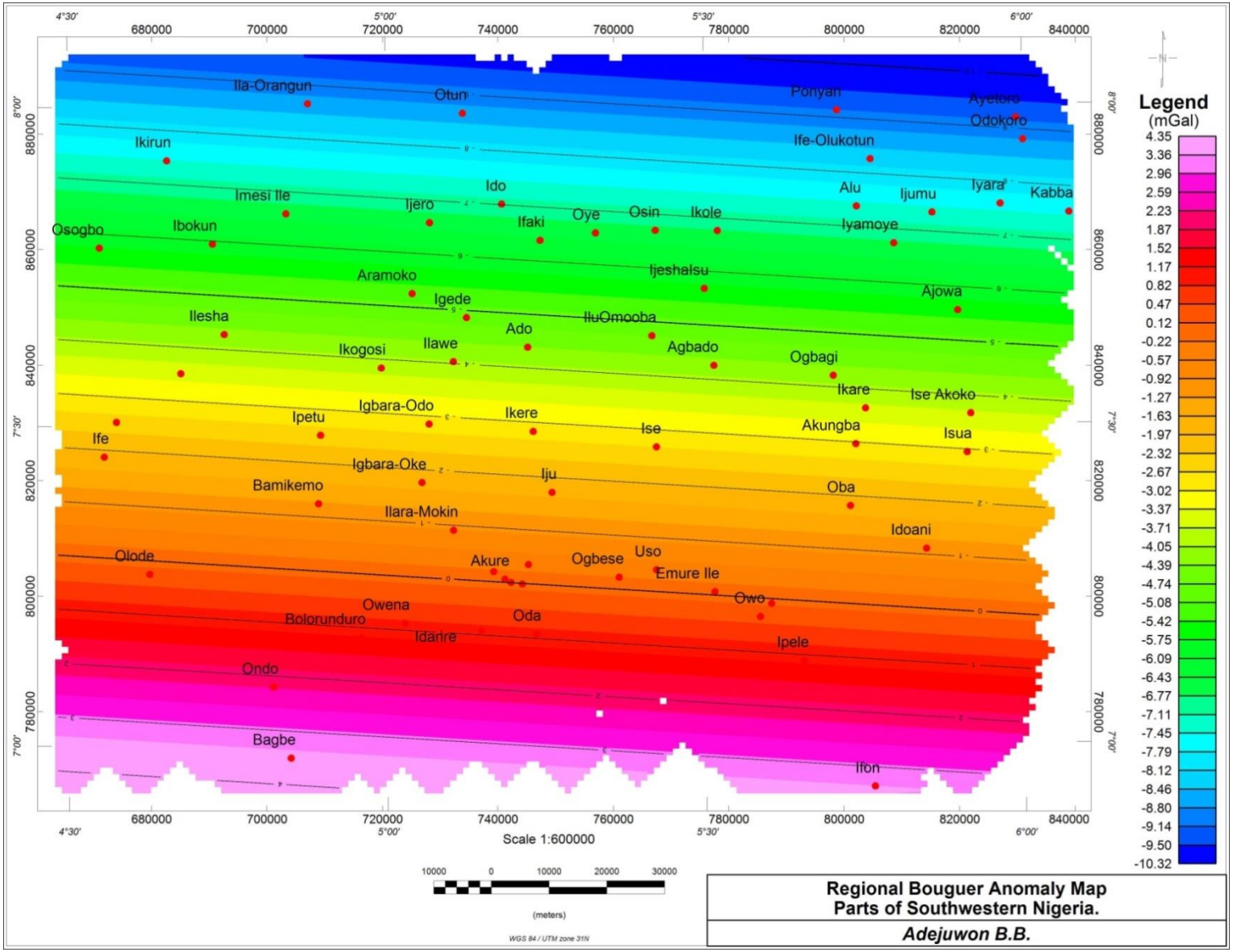


Figure 4.9: Regional Bouguer Map

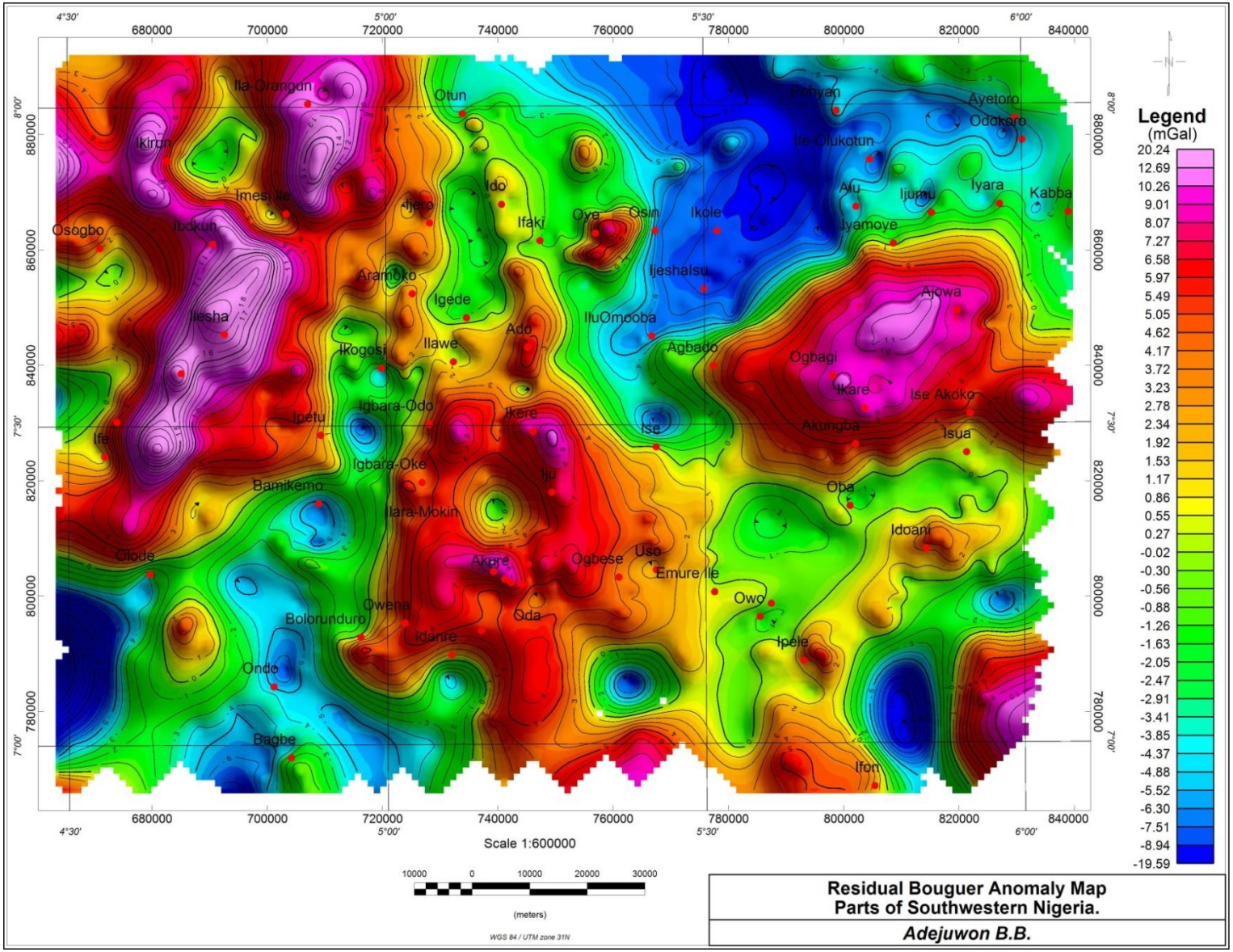


Figure 4.10: Residual Bouguer Anomaly Map

4.6 Qualitative Interpretation

The gravity field is characterized by low amplitude anomaly of varied lateral extent and closures. The trend of the Bouguer anomaly map (figure 4.7a) is generally NE/SW to N/S around the western-half of the study area. Correlation of the Geology and Bouguer anomaly maps indicates that high Bouguer anomaly running NE/SW corresponds to the Ilesha Schist belt at the western part of study area (Ife, Ifewara, Ilesha, Obokun and Ila-orangun area) termed 'Ifewara-Ilesha-Ilaorogun High' (Figure 4.11). These are areas with well-known and established belt for mineralization such as gold. The highest recorded Bouguer anomaly is 17mGal over the belt. This dominant positive elliptical Bouguer anomaly trends in the NE/SW direction depicting a linear structure that could be a fault and this may be related to the well-known Ifewara-Zungeru fault system. This positive bouguer around this schist belt is in agreement with the findings of some other authors in other schist belt in Nigeria e.g. Birnin Gwari Schist belt (Udensi, Ojo & Ajakaiye, 1986).

Also, the sedimentary part in the southeastern end of the study area is characterized by high Positive Bouguer anomaly running approximately N/S around Uzebba, Uroe, Ute etc. termed "Ute-Uzebba High" (Figure 4.11).

A relatively high oval shape bouguer anomaly (between 0 to 6mGal) termed "Ikare–Ogbagi-Ajowa high" running linearly ENE/SWS was observed at the NE part of the study area (figure 4.11). The area is underlain by migmatite, Charnockitic rocks and granite gneiss around Ikare, Ogbagi, Ajowa, Ise-Akoko area. From the mineral map of the area, Semi precious minerals e.g. Corundum and metallic mineral e.g. iron ore are documented, hence these dense ferromagnesian minerals and rocks maybe responsible for the positive bouguer in the area.

Another interesting observation is seemingly higher bouguer value of charnockite (hypersthene bearing granite) area compared with the pure granitic rock area as observed around Idanre, Akure, Ikere, Ado, Oye etc. This positive bouguer anomaly around Akure is termed "Akure-Ikere-Igbaraoke anomaly".

The lowest Bouguer anomaly of -19.5mGal occurs at northern part of the study area within the older granite suite of Ijesha-Isu, Ikole, Ponyan, Ayetoro and Iyara area. This broad and laterally extensive negative gravity closure almost elliptical but irregular in shape in value between -6 and -19.5 mGal is termed "IjeshaIsu-Ikole-Ponyan low". This closure is mainly underlain by granite gneiss and biotite granite (compare Figures 1.6, 4.10 and 4.11).

Also, another major negative bouguer anomaly zone can be identified at the south western part of the study area. This includes areas around Bamikemo, Ile-Oluji, Ondo, Bagbe etc. This N/S trending irregular shape low gravity closure with value between -7 and -1mGal is termed "Ondo-Bagbe Low". This area is underlain mainly by granite gneiss, quartz schist and fine to medium grained granite (compare Figures 1.6, 4.9 and 4.10).

The Free-Air anomaly map (Figure 4.8) shows a general NE-SW and N/S trends which are consistent with the general structural setting of the area. The Free-Air anomaly map mirrors the Elevation map to some extent (figure 4.5). The map indicates a rising Free-Air anomaly of between -4mGal from the south and 68mGal at North part of the study area. This seemingly partial agreement between the Free-Air anomaly and the Elevation suggest that study area is not too from the Coast. Except in few places, the correlation between the Free-Air anomaly map and the Bouguer anomaly map (Figure 4.12) are not perfect. This suggests isostatic in-equilibrium typical of a basement complex.

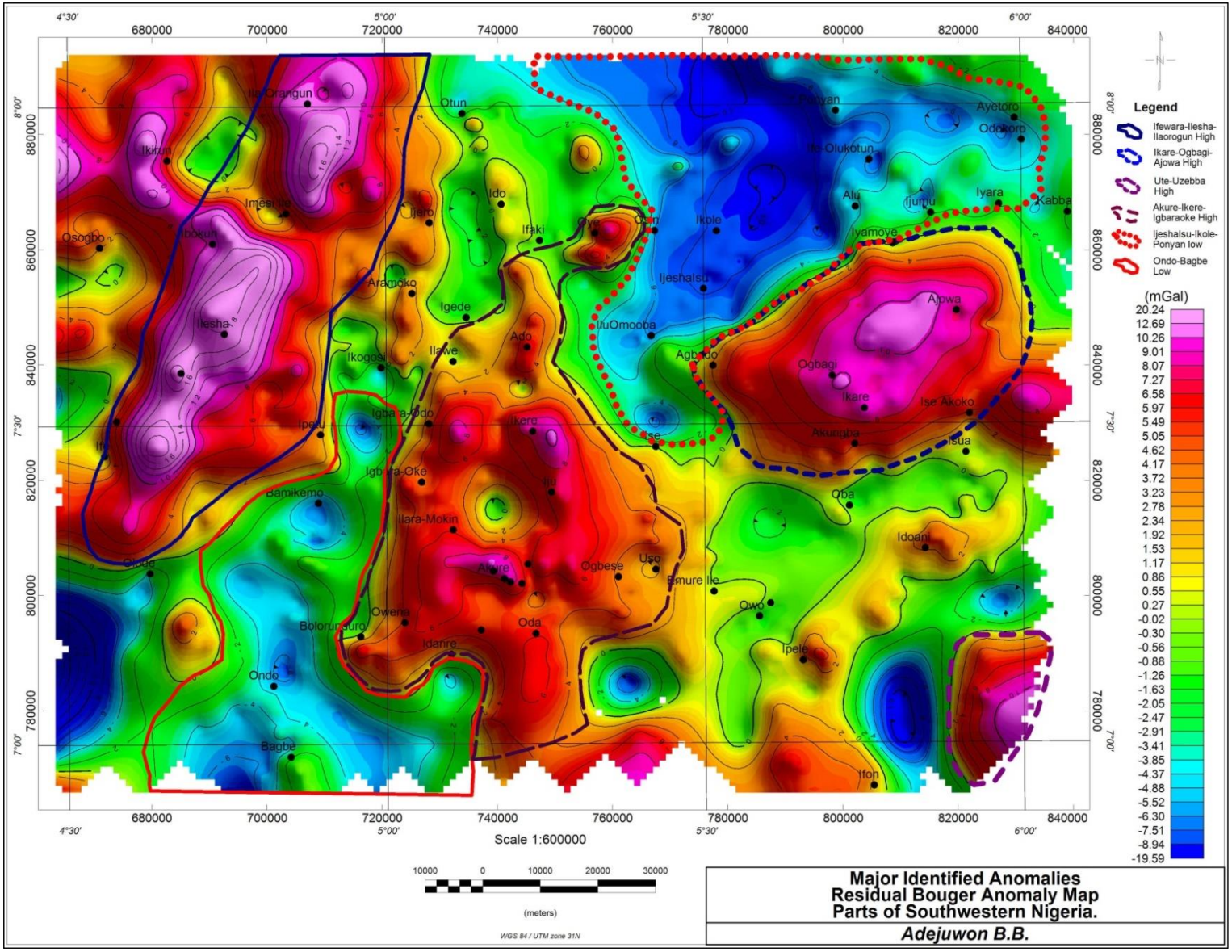


Figure 4.1: Major Anomalies of Interest

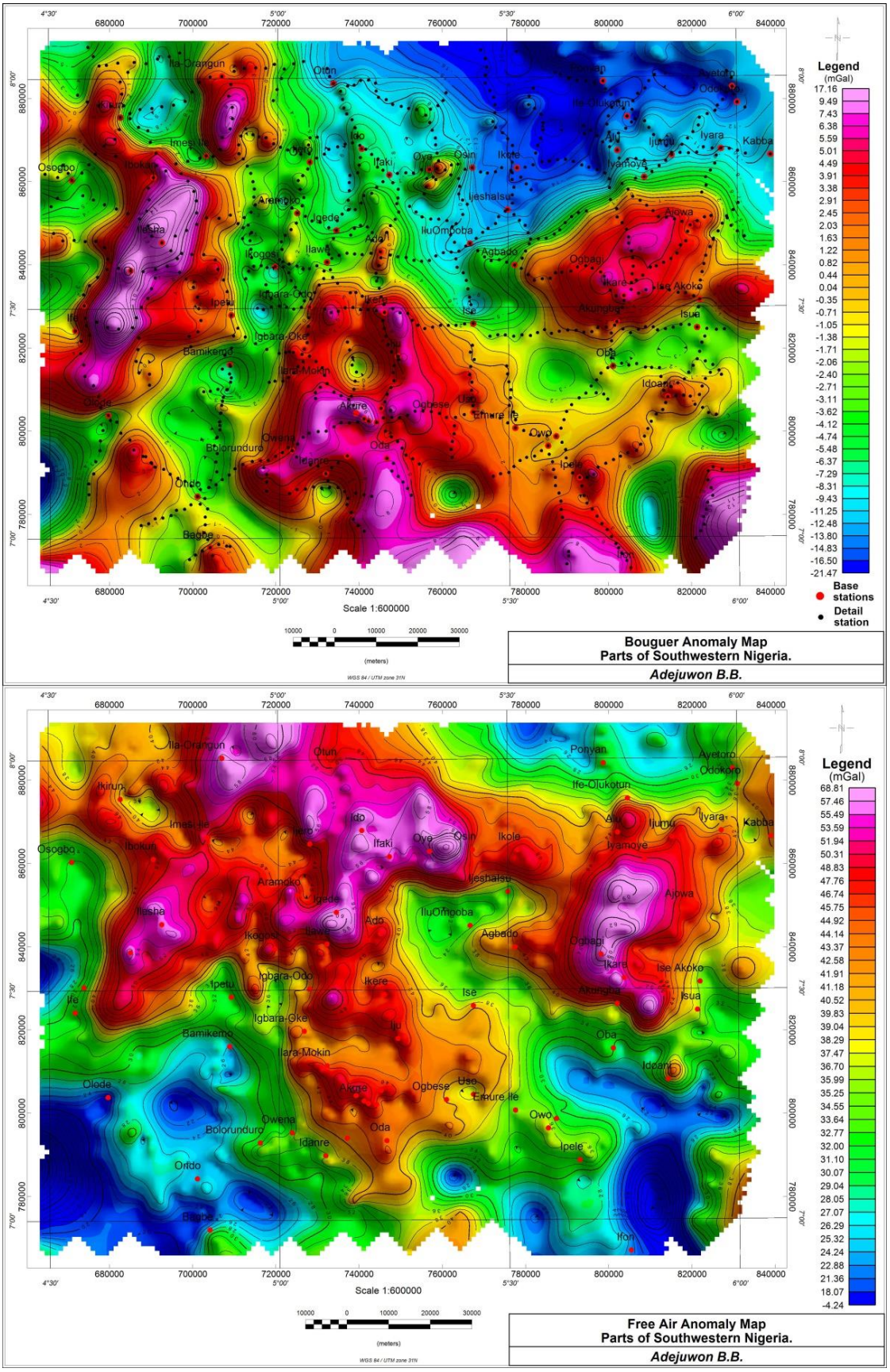


Figure 4.12: Comparing Free Air Anomaly Map with Bouguer Anomaly Map

4.7 Quantitative Interpretation and Models

In order to determine the geometry of the causative bodies, quantitative interpretation was carried out on the data. This involves inverse modeling which is the determination of the mass distribution and extent of the subsurface causative bodies from the gravity field effect observed at the surface. This modeling assumes an hypothetical regular body of known densities to have intruded into the host rocks. The residual gravity obtained is then compared with that calculated for the hypothetical body. The calculated value is then adjusted until the difference between it and the observed gravity is as small as possible. Also, the surface geological information as observed during the field exercise guided the modelling.

Modelling of some profiles across the study area to determine the length, width, shape and depth of such bodies were carried out. A GM-SYS extension of the Oasis Montaj software by developed by Geosoft Inc. was used for the modeling. The profiles were chosen in such a way that they are almost perpendicular to the observed bouguer anomalies. Four profiles were modeled for the quantitative interpretation (Figure 4.13). These are Profiles L0001, L0002, L0003 and L0004.

Profile L001 is 189km long approximate running in the NW/SE direction with an azimuth of 122^0cutting the NE/SW trending Ifewara-Ilesha-Ilaorogun High, the Akure-Ikere-Igbaraoke High and the sedimentary High (Ute-Uzebba High) at the southeastern end of the study area (Figure 4.14). The shear zone (Ifewara-Ilesha-Ilaorogun High) runs dip to about 9km into the migmatite gneiss host.

Profile L002 is 178km long in WSW/ENE direction (76^0 azimuth) cutting the NE/SW trending Ifewara-Ilesha-Ilaorogun High and IjeshaIsu-Ikole-Ponyan low bouguer anomalies (Figure 4.15).

Profile L003 is about 142km long runs in NW/SE direction with an azimuth of 122^0across the NE/SW trending Ifewara-Ilesha Ilaorogun High, the IjeshaIsu-Ikole-Ponyan low and the Ikare-Ogbagi-Ajowa high anomalies (Figure 4.16). The hypersthene bearing granite (Charnockite) is responsible for the gravity high at the centre of the profile around Oye-Ekiti.

Profile L004 is 172km long SW/NE trending profile (46^0 azimuths). It cuts across the low negative bouguer "Ondo-Bagbe Low", the positive bouguer "Akure-Ikere-Igbaraoke high" and the IjeshaIsu-Ikole-Ponyan low (Figure 4.17). The hypersthene bearing granite (Charnockite) is responsible for the gravity high at the centre of the profile around Ikere-Ekiti and Akure area.

From the model, the granitic rocks marked by low bouguer value compared with other surrounding crystalline rocks occur as dyke-like intrusions within the host. The shear zone of Ifewara-Zungeru fault system which consist of gneisses, schists and amphibolites are clearly defined by high than average bouguer value (Figures 4.14 to to 4.16) while the host (migmatite-gneiss) has background gravity value.

4.10 Sediment Thickness in Sedimentary Part of the Study Area

Gravity data are veritable tools in sedimentary thickness determination using any of the known established depth determination algorithms such as Standard Euler de-convolution, Source parameter imaging etc. The depth to the causative bodies were determined from the gravity using standard Euler deconvolution method. The Standard Euler de-convolution map for the study area using the bouguer anomaly data was produced using structural index of '0' typical of dyke/sill and '1' typical of cylinder/pipe (Figures 4.18 and 4.19 (Appendix 5)).

Quantitatively, the results from Standard Euler deconvolution showed a depth range of 348m to 10233m to the anomalous body using a structural index of 0 and a depth range of 1399m to 12133m to the anomalous body using structural index of 1.

In the study area only few datapoints falls within the Sedimentary part, therefore calculation of the thickness of the sedimentary part using such gridded data based method is subject to too much error. Hence, the modelled data was relied upon in sedimentary basin thickness (Figure 4.14). The depth to the sedimentary basin in the south-eastern part of the study area varies from 0m to less than 50m; hence the area is just a transition part separating the South-western Nigerian Basement Complex and the sedimentary basin.

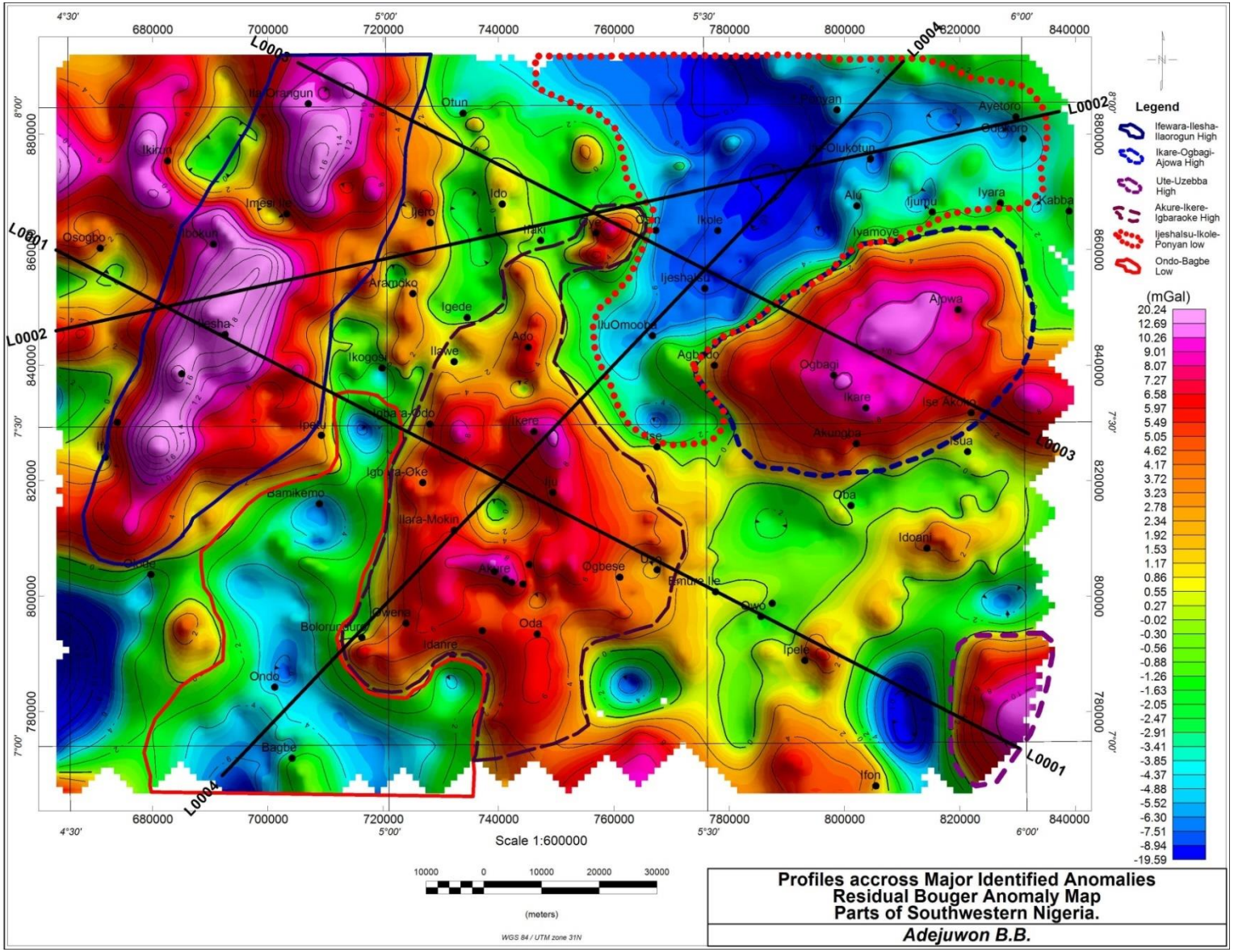


Figure 4.13: Model Profiles on Residual Bouguer Anomaly map

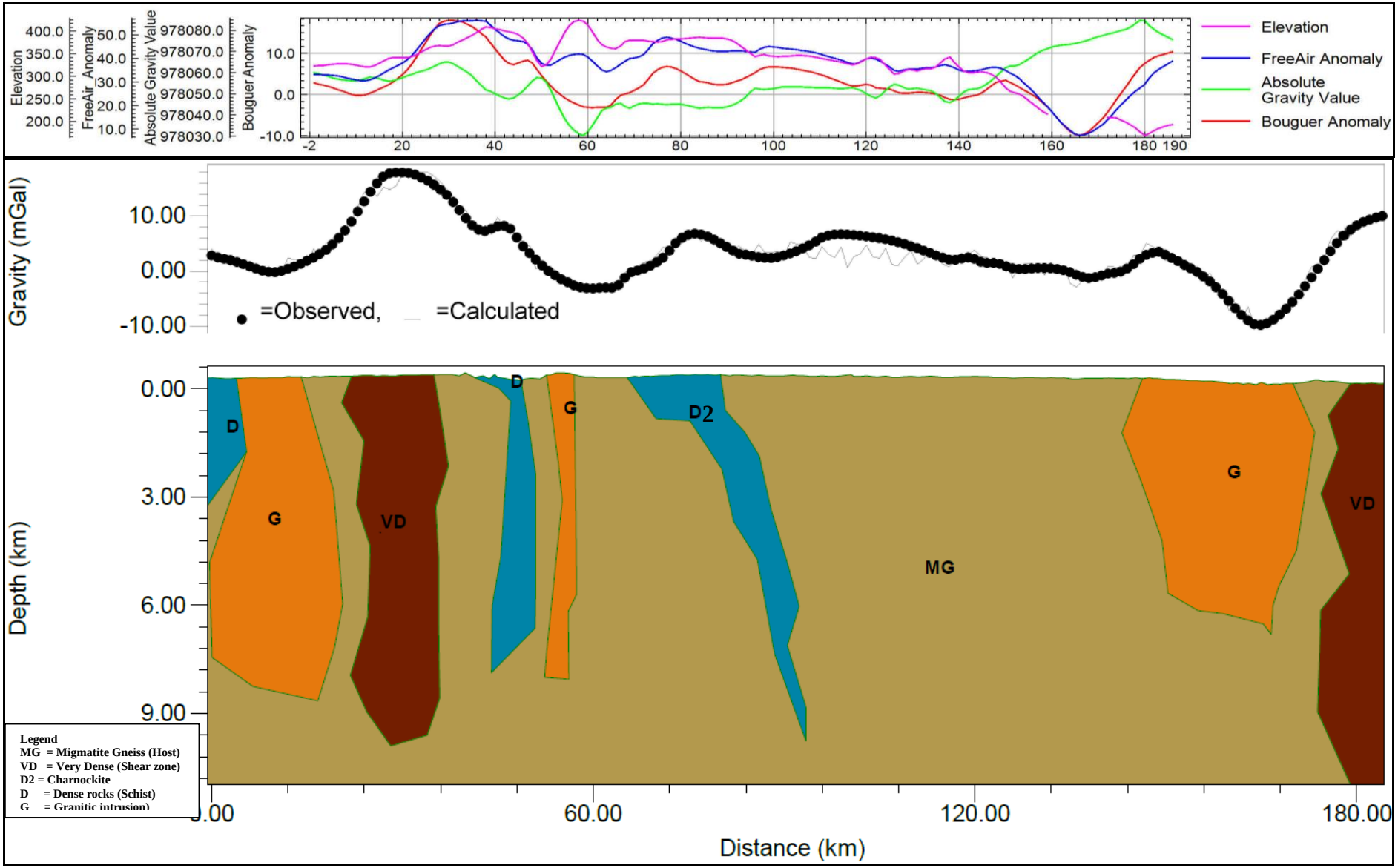


Figure 4.14: Gravity Model along Profile L0001

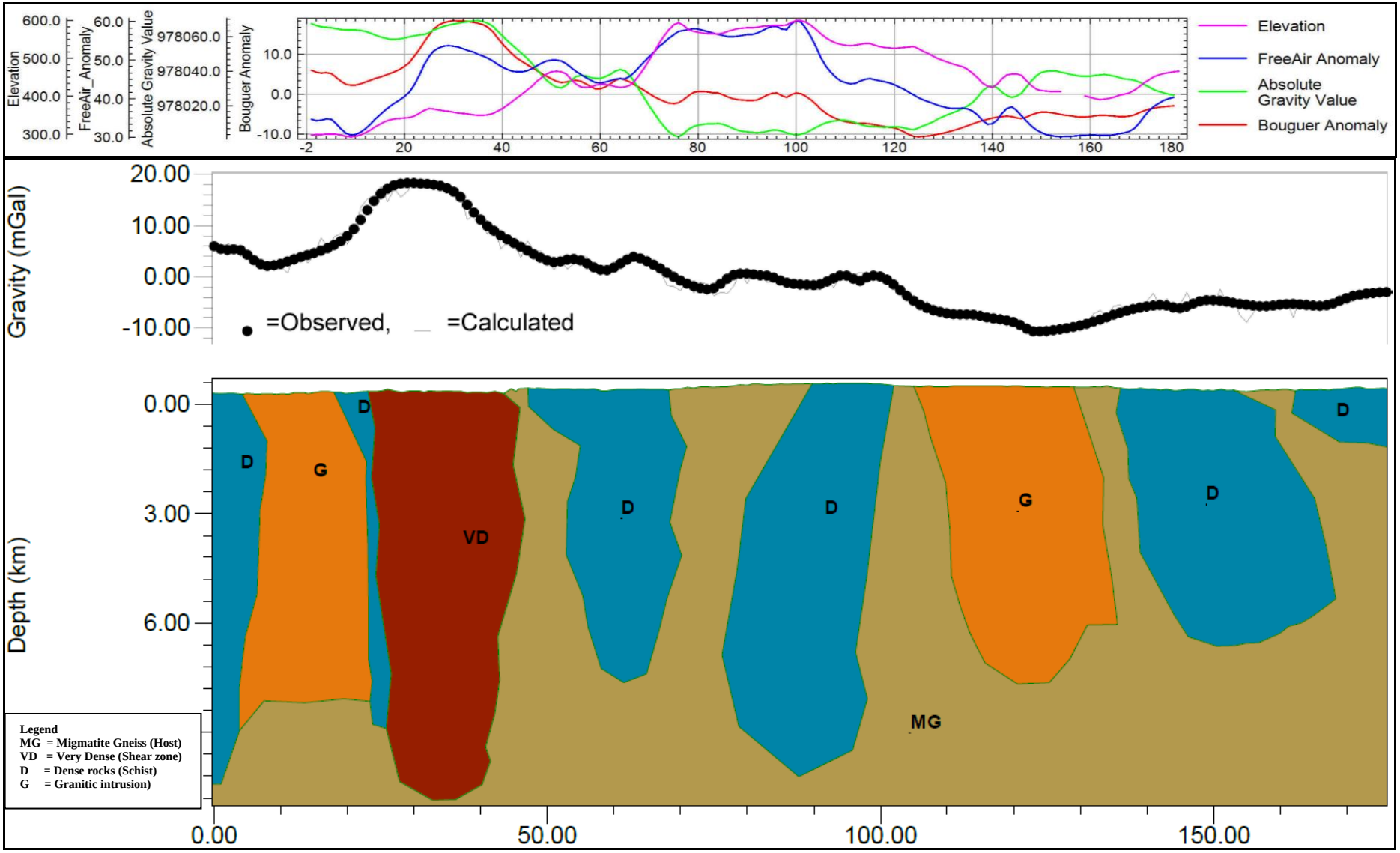


Figure 4.15: Gravity Model along Profile L0002

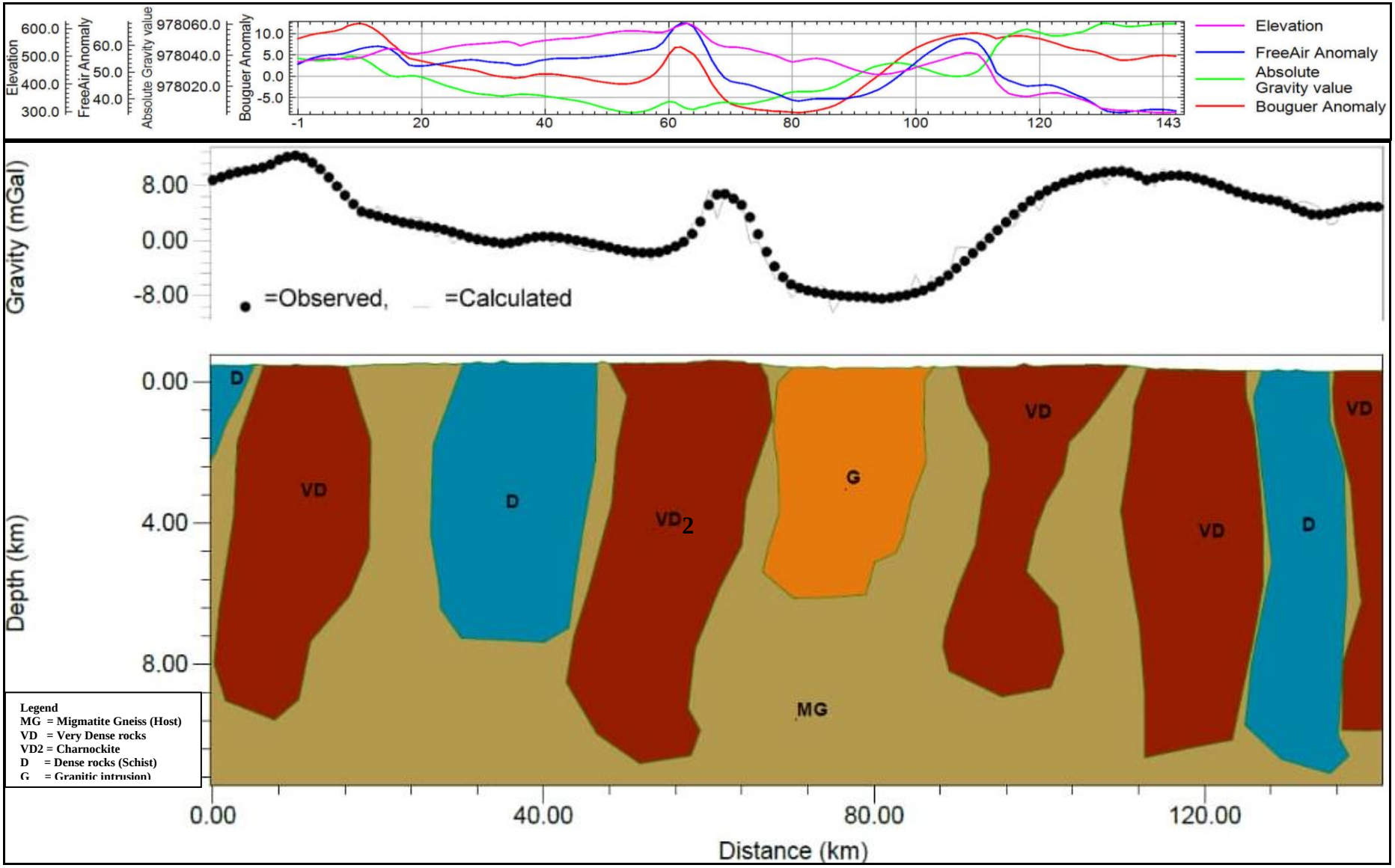


Figure 4.16: Gravity Model along Profile L0003

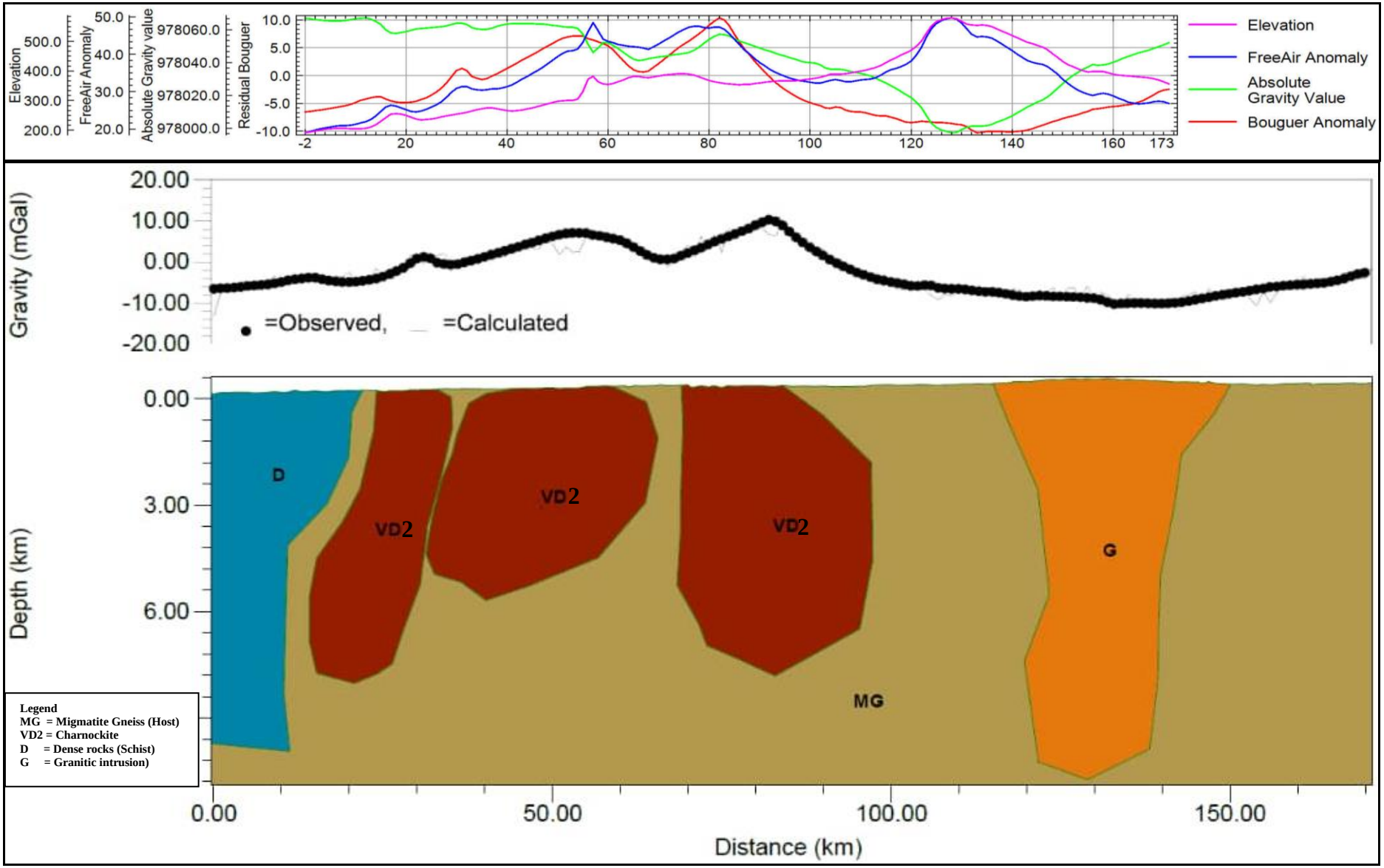


Figure 4.17: Gravity Model along Profile L0004

4.11 Structural implications

The bouguer anomaly maps were compared with the existing aeromagnetic data from the study area. The aeromagnetic data (Figure 4.20) with their several derivatives such as analytic signal (Figure 4.21 (Appendix 6)) and first vertical derivative (Figure 4.22 (Appendix 6)) provides value-added products for delineation of the structural features in the area. Analytic signal map is useful in locating the edges of magnetic source bodies, particularly where remanence and/or low magnetic latitude complicates interpretation. The analytic signal map from the aeromagnetic data compares well in parts with the bouguer anomalies especially the Ikare-Ajowa-Ogbagi high, Akure-Ikere-Igbaraoke High, Ikole-Ponyan low and parts of Ifewara-Ilesha-Ilaorangun High (Figure 4.23) which is an indication that most of the bouguer anomaly were equally magnetic.

The identified structures from Bouguer Anomaly map were overlain on the major Bouguer anomaly to produce the structural map from gravity data (Figure 4.24). Similarly, the identified structures from the aeromagnetic data were used to produce the structural map from Magnetic data (Figure 4.25). These two maps i.e. structures from gravity data as well as data from the aeromagnetic data were combined to produce structural map for the study area (Figure 4.26). From the structural map, there are conjugate faults i.e. two intersecting sets of fault with opposite shear sense (Davatzes and Aydin, 2003). Most of the identified structures from the gravity anomaly map coincide with structures from the aeromagnetic data in term of position and orientation. From this map, the delineated Ifewara-Ilesha-Ilaorangun High coincides with the already known NNE/SSW Ifewara fault which is an integral part of the Ifewara-Zungeru fault. This shear zone is marked by major fault trending in same direction from both the magnetic data as well as the gravity data (Figures 4.24 to 4.26). Fault zones are often associated with enhanced, focused, repeated fluid circulations in the earth's crust (Micklethwaite et al

(2010) and Grara et al 2018). These fluids may have different origins and possibly transport minerals to a favorable area of deposition; that will ultimately allow for the formation of potential economic ore deposits.

The high bouguer value observed at this western part of the study area is attributed to the Ifewara shear zone. The Ifewara fault system is a typical tectonic setting where there is a relative movement causing shearing trending NNE/SSW (Figures 4.25). This shear zone produces mylonitised rock. This mylonitization creates a density contrast with the surrounding rocks. Also, the high bouguer anomaly value can be attributed to the fault zone acting as pathway for upward movement of mineralising fluid with the emplacement of gold among other minerals. This is in agreement with the findings of previous geochemical research in the area such as Bolarinwa & Adepoju (2017) that "the observed shearing of the amphibolites is not unconnected with the Ifewara fault which provided the pathway for the magma. The fault could have been responsible for magma upwelling from the mantle and subsequent contamination and emplacement of the magma in a Within-plate tectonic setting".

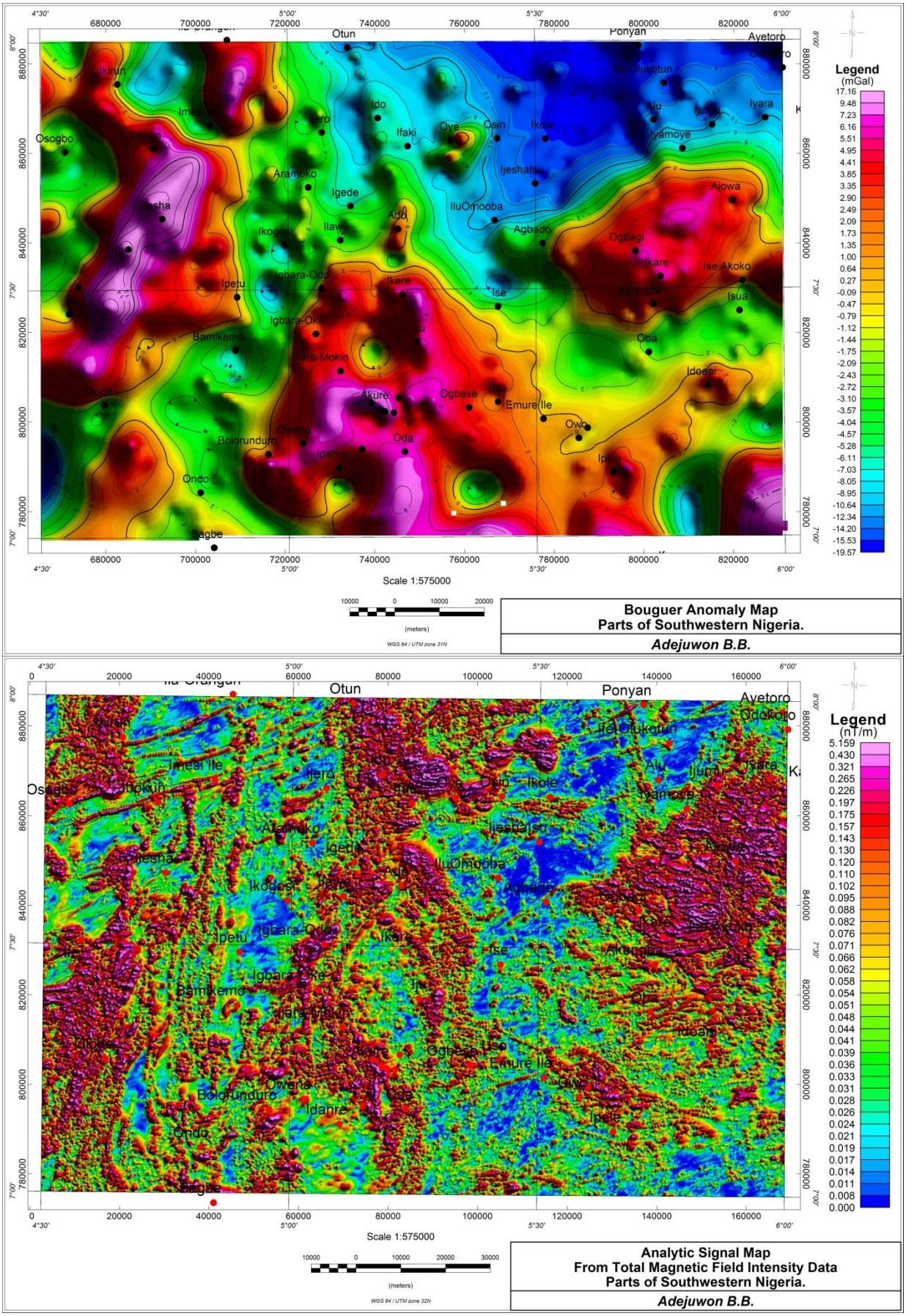


Figure 4.23: Comparing Gravity Bouguer Anomaly Map with the Analytic Signal Map from Aeromagnetic Data

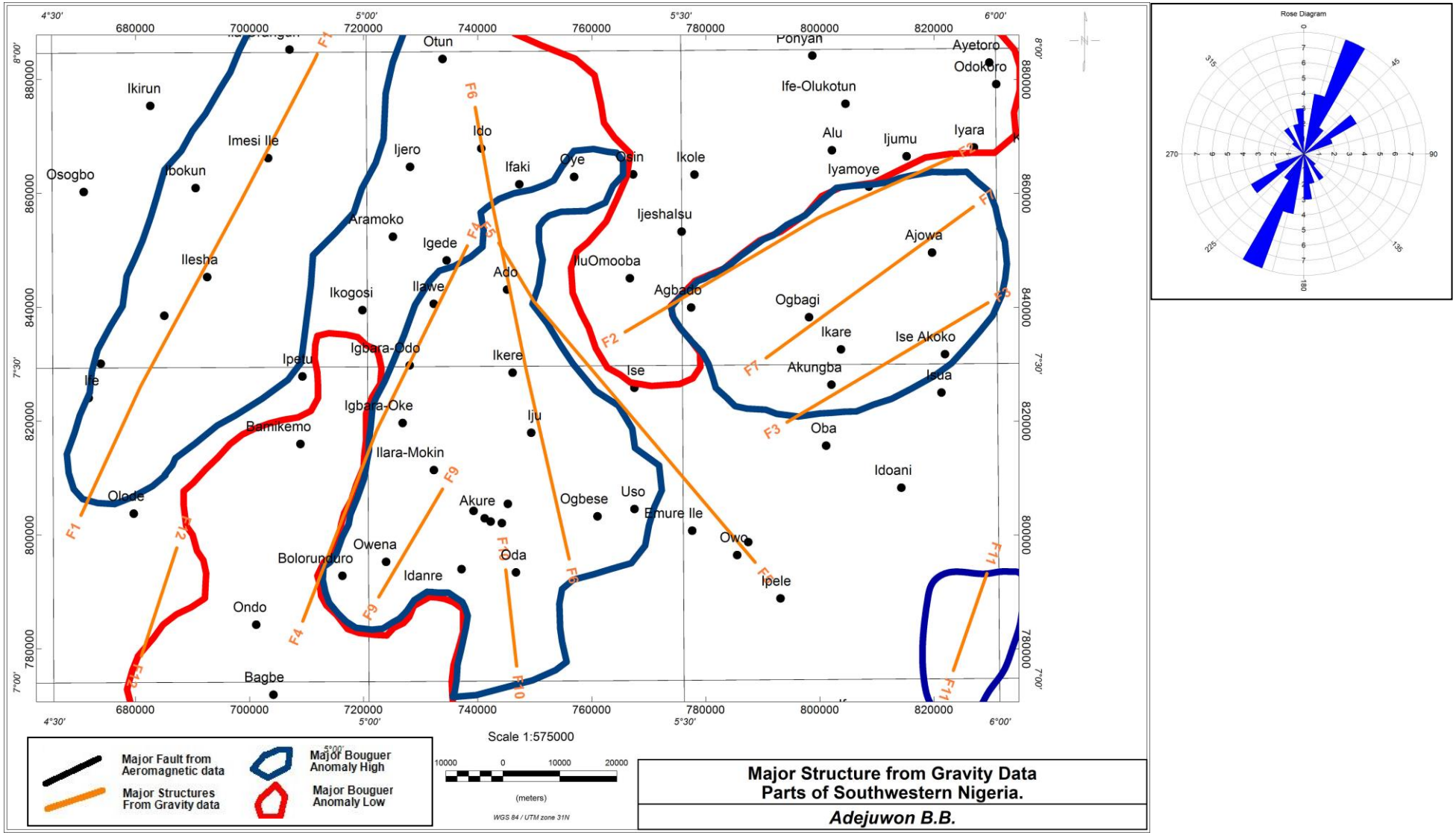
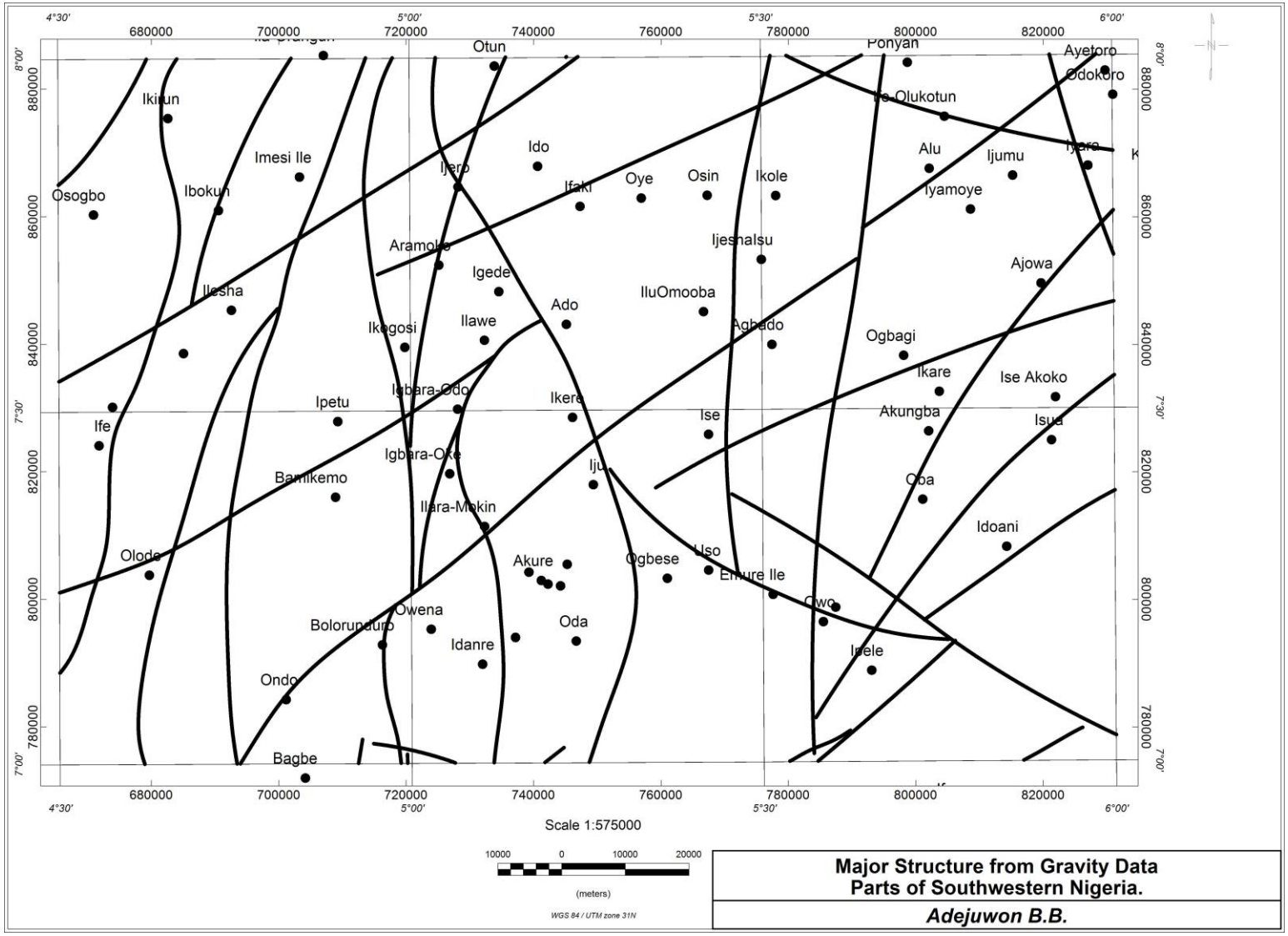


Figure 4.24: Structural Map from Gravity Data with Rose diagram



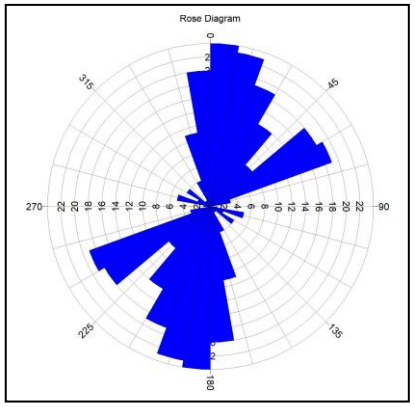


Figure 4.25: Structural Map from Aeromagnetic Data with Rose diagram

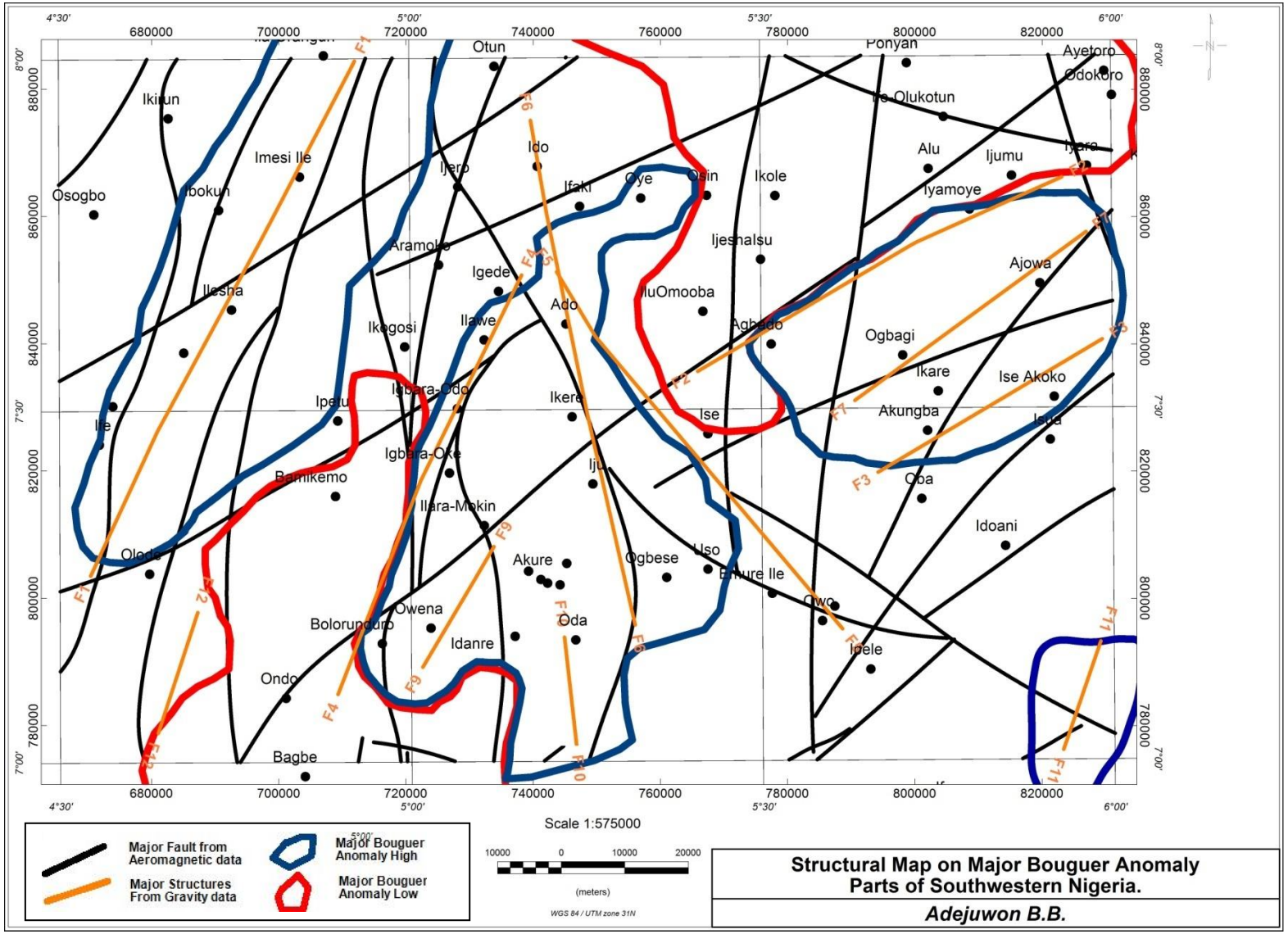


Figure 4.26: Structural Map of the Study Area

CHAPTER V

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Summary of Findings

Ground gravity survey of parts of Southwestern Nigeria was carried with Lacoste and Romberge Gravimeter (G512) licenced to Nigeria Geological survey agency in order to establish easily accessible second order gravity base stations, generate gravity database and produce the bouguer anomaly map of the area.

The study area lies within the Southwestern part of Nigeria and is underlain mainly by the Basement Complex rocks and the Cretaceous/Tertiary to recent sediments in the southeastern. The Basement Complex rocks comprise of charnokites, Migmatites, gneisses, schists, quartzites, amphibolites, granites, granodiorite and diorite assemblages. Structural trends in the crystalline basement complex rocks are dominantly ENE/WSW with significant associated NE/SW and N/S trends.

One thousand and ninety-three (1,093) points were generated in an area of 18,150km^2 giving a density of 1/16.6km^2 which is a positive improvement on the recommendation of 1/25km^2 and also a tremendous improvement on the existing 1/9,075km^2 in the area. Seventy-five (75) gravity base stations were established in the study area which are tied to IGSN 71 through the PGNN Base stations at Oshogbo and Akure. This gives a gravity station density of 1/242km^2 as against the existing density of 1/9,075km^2.

One hundred and forty-eight (148) rocks samples were collected and their densities were determined using a standard density determination procedure. The processed data were presented as 2D map with both contour and colour shaded maps. The map includes Absolute

gravity value map, Bouguer anomaly map, Free-air anomaly map, Regional anomaly map, residual anomaly map and rock density anomaly map of the rock samples. Some gravity profiles across the study area were modeled. Also, the database was saved in GIS platform for proper management and archiving.

Six major bouguer anomalies with unique characteristics features which may be related to the contrasting lithological and structural features were identified. These are: (1) Ifewara-Ilesha-Ilaorogun High (2) Akure-Ikere-Igbaraoke High (3) Ikare-Ogbagi-Ajowa High (4) Ute-Uzebba High (5) IjeshaIsu-Ikole-Ponyan Low and (6) Ondo-Bagbe Low (Figure 4.1).

5.2 Conclusion and Recommendations

From the analysis of the various data sets, the data and maps from this research work clearly show the gravity distribution within the study area which is vital tool for researchers, mineral exploration and Surveying (geodesy). Researchers carrying out gravity survey in any part of the study area will find the data useful since they can tie their surveys to IGSN (1971) through any of the established Base Stations. Hence, the Seventy-five (75) base stations established here are recommended as second order gravity base stations for any future gravity studies in this part of Southwestern Nigeria.

Conclusively, the research has confirmed the existence of Ifewara shear zone marked by Ifewara-Ilesha-Ilaorogun High which is connected with the Atlantic fracture system according to Bamisaye and Ajala (2021). For mineral exploration, a common feature of mineralized veins in Nigeria is their proximity to major and subsidiary fault structures which has been properly delineated and mapped with the gravity data. The elongated NNE/SSW trending bouguer anomaly at the western part of the study area termed the Ifewara-Ilesha-Ilaorogun High coincide with the geologically established shear zone associated with Ifewara-Zungeru fault system in orientation and location, hence, the gravity data has confirmed the existence such

mega fault system which is related to gold mineralization within the Ilesha Schist belt. Also in the same vein, the relatively high oval shape bouguer anomaly (between 0 to 6mGal) termed "Ikare–Ogbagi-Ajowa high" running linearly ENE/SWS is observed at the NE part of the study area (Figure 4.24) and can be another new frontier for mineral exploration. Hence, this research is recommended as a valuable tools and baseline data for mineral exploration for the mining industry.

With the recent threat and possible menace of geo-hazard in the country such as earth tremor whose frequency of occurrence has been on annual increase in several parts of the basement complex region of Nigeria (the study area inclusive); continuous monitoring of the deformed areas with gravimeter and seismometers for their geo-hazard potentials is recommended.

Northern and southern continuity of the identified Ifewara system outside the study area i.e. into parts of Kwara state and Ogun state should be investigated. More Gravimetery research at detailed scale or microgravity should be carried out around most of the identified major anomalies here for further mineral potential, geodesy and crustal studies.

In general, the result from this research is a valuable document for researchers, government, investors, geoscientists, geodesists etc. because the Bouguer gravity anomaly maps has been useful in mapping geographic distribution and configuration of the underlying basement crystalline rocks, structural and lithological provinces, zones of crustal weakness, mass imbalances within the lithosphere, and geometry of the sedimentary basin (O'Hara & Lyons, 1985).

5.3 Contribution to Knowledge

Establishment of seventy-five (75) easily accessible and fairly distributed base stations in the study area would facilitate easy access to gravity base stations leading to more and improved

gravimetric research in the study area. Production of Bouguer Anomaly maps, Free-air anomaly maps and Absolute gravity value map (previously not existing) in this part of Southwestern Nigeria would be a future referral data, map and documents for further gravity study. Also, confirmation of the Trans-oceanic fault system using gravity data has helped to resolve the misgiving and corroborate the existence of transoceanic or regional Ifewara fault system from geophysical data perspective using gravimetric information because most previous advocacy of the fault system are from geological evidences devoid of geophysical data.

References

Abba, A.U., Alo, G.A, & Adejuwon, B.B. (2013): Regional Gravity Survey of Enugu State. *Published by Nigerian Geological Survey Agency,* Occasional paper No 21.

Abba, A.U., Alo, G. A., Adejuwon, B. B. & Osazuwa, I. B. (2013): Regional Gravity Survey of Parts of South-eastern Nigeria, *3rd International Workshop on Geosciences Information in Africa (GIRAF 2013), Accra Ghana*.

Adegoke, O.S & Omatsola M.E. (1981): The Tectonic Evolution and Cretaceous Stratigraphy of the Dahomey Basin. *Journal in Geology,* 18(1), 130-137.

Adejato, K.O., Adeyeri, O.E. & Salubi, O. (2018): Use of Remote Sensing and Geographic Information System in Accessing the Spatial Distribution of Bitumen in Dahomey Sub-Basin, Southwestern Nigeria." *IOSR Journal of Applied Geology and Geophysics (IOSR-JAGG) 6.1 (2018):*20-31.

Adejuwon, B. B., Salami, A.A., Omatola, P.S., Ashien, S.O., Adeyemo, B.K., & Ujubuonu, E.G. (2018): Integrated EM (VLF) and Gravity Survey for Delineation of Mineralized Veins in Touzuwa Area of Benue State, Nigeria. *International Journal of Engineering Research & Technology*, 7(2), 49-53.

Adejuwon, B.B., Ujubuonu, G.E, Alo, G.A, Megwara, U.J, Arobasalu, O.T. & Nwegbu, A.N. (2013): Regional Gravity Survey of Anambra State. *Published by Nigerian Geological Survey Agency,* Occasional paper No 21.

Adejuwon, B.B., Ujubuonu, G.E, Alo, G.A, Megwara, U.J, & Arobasalu, O.T. (2013):

Regional Gravity and Aeromagnetic data of Anambra State; Implications for Basin Analysis. *49th Annual International Conference, Nigeria Mining and Geosciences' Society (NMGS), Ibadan. Conference presentation and Expanded Abstract.*

Adighije, C.I (1981): A gravity interpretation of the Benue trough, Nigeria. *Tectonophysics*, 79(1), 109-128.

Ajakaiye, D.E. (1968): A gravity investigation of the Liruei Younger Granite Ring Complex of Northern Nigeria. *Geol. Mag, 105*, 256-263.

Ajakaiye, D.E. (1970): Gravity measurements over the Nigerian Younger Granite Province. *Nature, 252, 50-52*.

Ajakaiye, D.E. (1974): A gravity profile across the Banke ring complex, Nigeria. *Geoexploration*, 12, 59-60.

Ajakaiye, D.E. (1975): Densities of Rocks in the Nigerian Younger Granite Province. *Jour. Min. Geol.*, 11, 34-43.

Ajakaiye, D.E. (1976): Negative gravity anomalies in the Younger Granite Northern Nigeria. *Geology of Nigeria, C.A. Kogbe (Ed.), 207-224.*

Ajakaiye, D.E. & Burke, K. (1973): A Bouguer gravity map of Nigeria. *Tectonophysics*, 16 (1), 103–115.

Ajakaiye, D.E. & Sweeney, J.F. (1974): Three-dimensional Gravity Interpretation of Dutse-Wai Complex, Nigerian Younger Granite Province. *Tectonophysics*, 24, 331–344.

Ajayi, T.R. (1980): On the origin and Geochemistry of amphibolites of Ife-Ilesha area, southwestern Nigeria. *Journ. Min. and Geol,* 17, 170-195.

Ajibade, A. C., Woakes, M. & Rahaman, M. A. (1986): Proterozoic crustal development in Pan-African Regime of Nigeria. *Amer. Geophy. Union*, 259-271.

Alo, G.A, Adejuwon, B.B., & Abba, A.U. (2013): Regional Gravity Survey of Ebonyi State. *Published by Nigerian Geological Survey Agency,* Occasional paper No 21,

Alo, G.A, Adejuwon, B.B., & Abba, A.U. (2013): Gravity and Airborne data of Ebonyi State; Implications for Regional and Structural interpretation. *49th Annual International Conference, Nigeria Mining and Geosciences' Society (NMGS), Ibadan. Conference presentation and Expanded Abstract.*

Akaolisa, C. Z. (1997): A Detailed Gravity Investigation of the Kwello Anomaly In the North Central Area of Nigeria. *Unpublished M.Sc Thesis. Ahmadu Bello University, Zaria, Nigeria.*

Ayoade, J. O. (1975): Water Resources and their Development in Nigeria. *Hydrogeological Sciences Bulletin, Des Sciences Hydrologiques*, 2 (4), 581 – 589.

Babatunde, R.O., Olorunsanya, E.O., Orebiyi J.S. & Falola, A. (2007): Optimal farm plan in

sweet potato cropping systems: the case of Offa and Oyun local government areas of Kwara State, North-Central Nigeria. *Agricultural Journals.* 2(2). 285 –289.

Balco, G. & Stone, J.O. (2003): Measuring the density of rock, sand, till, etc. UW Cosmogenic Nuclide Laboratory, methods and procedures. http://depts.washington.edu/cosmolab/chem.html

Bamisaiye, O.A & Ajala, P.T. (2021): Pan African Nappe system: evidence of thrust structures from Okemesi, southwestern Nigeria. *Research Article*, 7(6), E07171, https://doi.org/10.1016/j.heliyon.2021.e07174.

Begg G.C., Griffin W.L., Natapov L.M., Suzanne Y. O'Reilly, Grand S.P., O'Neill C.J., Hronsky J.M.A., Y. Poudjom Djomani, Swain C.J., Deen T. & Bowden P. (2009): The lithospheric architecture of Africa: Seismic tomography, mantle petrology, and tectonic evolution. *Geosphere* 5(1):23-50. DOI: 10.1130/GES00179.1

Bolarinwa, A.T. & Adeleye, M.A. (2015): Nature and Origin of the Amphibolites in the Precambrian Basement Complex of Iseyin and Ilesha Schist Belts, Southwestern Nigeria. *Journal of Geography and Geology*, 2015, 7(2), 6-17.

Bolarinwa, A.T. & Adepoju, A.A. (2017): Geochemical Characteristics and Tectonic Setting of Amphibolites in Ifewara Area, Ife-Ilesha Schist Belt, Southwestern Nigeria. *Earth Science Research*, 6 (1), 2017.

Choi, K.S., Kumar, G.V.R. & Kim, K.Y. (1999): Qualitative interpretation of Bouguer anomaly in the southern part of the Korean peninsula. *Geosciences Journal*, 3(1), 49-54.

Cratchely, C.R. & Jones, G.P. (1965): An interpretation of the geology and gravity anomalies of Benue valley, Nigeria. *Overseas Geo. Svy. Lond. Geoph.* Paper1, 1-26

Dai, T.F. & Hollyer, G.M., (2004). An Optimized Gravity Terrain Correction Algorithm and Test Results from the Rio Tinto Valley, Spain. Geosoft Inc, Toronto, Canada.

Davatzes, N. C., & A. Aydin (2003): The formation of conjugate normal fault systems in folded sandstone by sequential jointing and shearing, Waterpocket monocline, Utah, *J. Geophys. Res., 108(B10), 2478, doi:10.1029/2002JB002289, 2003.*

De Swardt, A. M. J. (1953): The geology of the county around Ilesa. *Geological Survey of Nigeria Bulletin* 23, 54p.

Du Claux, F., Martin, J., Blot, C. & Remiot, R. (1954): Establishment doun Reseau General de Stations Gravimetriques en Afrique a Madagascar a la Reunion, et al'ile Maurice' ORSTOM, Paris 50 pp.

Ehinola, O. A.; Oluwajana A. & Adekoya, A. T. (2012): Geophysical investigation and reserve estimation of a coal seam in Ute area, Southwestern Nigeria. *Petroleum & Coal* 54 (3), 252-259.

Eke, P. O, Okeke, F.N & Ezema, P.O (2016): Improving the geological understanding of the Niger Delta basin of Nigeria using airborne gravity data. *International Journal of Geography and Geology*. 5(5), 97-103.

Ekpa, M. M. M., Okeke, F. N., Ibuot, J. C., Obiora, D. N. & Abangwu, U. J. (2018):

Investigation of gravity anomalies in parts of Niger Delta Region in Nigeria using aerogravity data. *International Journal of Physical Sciences,*13(4), 54-65.

Ekweme, B.N., & Shing, R. (1987): Occurrence, Geochemistry and Geochronology of the Mafic-Ultramafic rock in the Obudu Plateau, south eastern Nigeria in Srivasta, R.K. and Chadta, R., (eds) Magmatism in relation to diverse tectonic settings pp42-57.

Elieff, S., & Sander, S., (2004): AIRGrav Airborne Gravity Survey in Timmins, Ontario: In R.J.L. Lane, editor, Airborne Gravity 2004 - *Abstracts from the ASEG-PESA Airborne Gravity 2004 Workshop: Geoscience Australia Record 2004/18*, 111-119

Elueze, A. A. (1982): Metallographic studies of ore-minerals in the amphibolites of Ilesa schist belt, southwestern Nigeria. *Journal of Mining and Geology*, 18(2), 53 – 58.

Elueze, A. A. (1986): Petrology and gold mineralization of the amphibolites belt, Ilesa area, southwestern Nigeria.*Geol. Mijnbouw*, 65, 189 – 195.

Elueze, A.A. (1991): Rift system for proterozoic schist belt in Nigeria. *Tectonophysics*, 209, 167-169.

Elueze, A.A. & Okunlola, O.A. (2003): Petrochemical and Petrogenetic Characteristics of Metasedimentary rocks of Lokoja-Jakura Schist Belt, Central Nigeria in Elueze A. A (ed.), *Journal of Mining and Geology*, 39(1), 21-27.

Eteje, S. O., Oduyebo, O. F. & Oluyori P. D. (2019): Modelling Local Gravity Anomalies

from Processed Observed Gravity Measurements for Geodetic Applications. *International Journal of Scientific Research in Science and Technology,* 6 (5), 144-162. ff10.32628/IJSRST196515ff. ffhal-02412702

Ezekiel, J. C., Onu, N. N., Akaolisa, C. Z. & Opara, A. I. (2013): Preliminary Interpretation of gravity mapping over the Njaba sub-basin of southeastern Nigeria: An implication to petroleum potential. *Journal of Geology and Mining Research*, 5(3), 75-87.

Fairhead, J.D. & Okereke, C.S. (1987): A regional gravity study of the West African Rift System in Nigeria and Cameroon and its tectonic interpretation. *Tectonophysics*, 143 (1-3). 141-159.

Fairhead, J.D. & Okereke, C.S. (1988): Depths to major density contrast beneath the West African rift system in Nigeria and Cameroon based on the spectral analysis of gravity data. *Journal of African Earth Sciences*, 7(5), 769-777.

Fairhead, J.D. & Okereke, C.S. (1990): Crustal thinning and extension beneath the Benue Trough based on gravity studies. *Journal of African Earth Sciences*, 11(314), 329-355.

Fairhead, J.D., Okereke, C.S. & Nnange, J.M. (1991): Crustal structures of the Mamfe Basin, West African based on gravity data. *Tectonophysics*, 186(3-4), 351-358.

Gandu, A.H., Ojo, S.B. & Ajakaiye, D.E. (1986): A gravity study of Precambrian Rocks in Malumfashi Area of Kaduna state, Nigeria. *Tectonophysics*, 126, 181–194.

Geological Survey of Nigeria (1996): Geological map of Nigeria. A map prepared by Geological Survey of Nigeria.

Geotools Corporation (2004): GravMaster User's Guide/Manual. Pp 92.

Grare, A., Lacombe, O., Mercadier, J., Benedicto, A., Guilcher, M., Trave, A., Ledru, P., & Robbins, J (2018): Fault Zone Evolution and Development of a Structural and Hydrological Barrier: The Quartz Breccia in the Kiggavik Area (Nunavut, Canada) and Its Control on Uranium Mineralization. *Minerals, 8(8), 319. MDPI AG.*

Haldar, S. K., (2018): Exploration Geophysics, Editor(s): Swapan Kumar Haldar, Mineral Exploration (Second Edition), Elsevier, 2018, Pages 103-122, ISBN 9780128140222,

Hammer, S., (1939): Terrain corrections for gravimeter stations: *Geo-physics,* 4, 184-194.

Hayford, J. F. & Bowie, W., (1912): The effect of topography and isostatic compensation upon the intensity of gravity: *USC and GS Spec.pub.* 10.

Heath Philip (2017): Quantifying the differences between gravity reduction techniques. *Exploration Geophysics*, 49(5), 735-743.

Heiskanen, W. & Meinesz, V. (1958): The Earth and Its Gravity Field, McGraw-Hill

Hospers, J. (1965): Gravity Field and Structure of the Niger-Delta, Nigeria, West Africa. *Geological Society of America Bulletin*, 76, 407-422.

Holt, R., Egbuniwe, I. G., Fitches, W. R. & Wright, J. B. (1978). The relationship between

low grade metasedimentary belts, calc-alkaline volcanism and the Pan-African Orogeny in N.W. Nigeria. *41 Geol. Rundsch.Ed. 67. Heft 2, Seite, 631-646.*

Hubbard, F. H. (1966). A provisional report on the geology of sheet 262 (Apomu) and parts of sheet 263 (Ondo). *Geological Survey of Nigeria Report* 1341.

Hubbard, F. H. (1975). Precambrian crustal development in western Nigeria: indications from Iwo Region. *Geological Society of America Bulletin,* 86, 548 – 554.

Ibe, K.K. (1982): Gravity and Geological Investigation over the Zaranda Younger Granite Ring Complex of Northern, Nigeria. *Unpublished M.Sc Thesis, Ahmadu Bello University, Zaria, Nigeria.*

Ibe, K.K., Ajakaiye, D.E, & Ojo, S.B. (1983): Gravity interpretation of the Zaranda Younger Granite ring complex, Nigeria. *Journal of African Earth Sciences,* 3(1-2), 253-259.

Igwe, E. A., Yakubu, J.A. & Idike, J.I. (2018): Investigation of Nsukka Area, South-Eastern Nigeria for Mineral Exploration Using Gravity Method.*Journal of Applied Physics (IOSR-JAP).* 10 (2), 22-32.

International Assoc. of Geodesy, (1971): Geodetic Reference System 1967, *Bureau Central de l'Association Internationale de Geodesie, Special Publication* No. 3, Paris.

Johnson C. Ibout, Mfoniso U. Aka, Amarachukwu A. Ibe, Bethrand E. Oguama &

Azuanamibebi D. Osu (2021): Delineation of Faults and Cavities Using Gravity Techniques: An Implication for Road Construction, South-South Nigeria. *Malaysian Journal of Geosciences*, 5(1): 31-34.

Kane, M.F., (1962): A Comprehensive System of Terrain Corrections Using a Digital Computer. *Geophysics*, 27(4), 455–462.

Kehinde-Phillips, O. O. (1991): Compositional variations in lateritic profiles over mafic and ultramafic rock units of Ilesa schist belt, southwestern Nigeria. Unpublished Ph.D. Thesis, University of Ibadan, Ibadan, Nigeria. 201p.

Klemm, D. D., Schneider, W., & Wagner, B. (1984): The Precambrian meta- volcano – sedimentary sequence east of Ife-Ilesa, southwestern Nigeria. A Nigerian "greenstore belt" *Journal of African Earth Sciences*, 2(2), 161-176.

Lawal, K. M. & Akaolisa, C. Z. (2006): Bouguer correction density determination from fractual analysis using data from part of the Nigerian Basement Complex. *Nigerian Journal of Physics* 2006, 18(2), 251-254.

Longman, I. M., (1959): Formulas for Computing the Tidal Acceleration due to the Moon and Sun, *JGR*, 64, 2351-2355.

Lowrie, W. (2002): Fundamentals of Geophysics. Cambridge Univ. Press, UK.

Mbah, D., Obiora, D.N., Oha, A.I, Terhemba, B.S, Ossai, C.O. & Igwe, E.A. (2017):

Investigation of possible cause of gravity anomalies in parts of the Niger Delta Basin, Nigeria. *International journal of physical sciences*. 12(9), 103-117.

MDZ Multimedia (2006): Brunel Nigeria Roap Map, published by MDZ Multimedia (Nig) Ltd.

Micklethwaite, S.; Sheldon, H.A.; & Baker, T. (2010): Active fault and shear processes and their implications for mineral deposit formation and discovery. *Journal of Structural Geology. 2010, 32(2), 151–165.*

Morelli, C., Ganter, C., Honkasalo, T., McConnel, R.K., Tanner, J.G., Szabo, G., Uotila, U. & Whalen, C.T. (1974): The International gravity standardization Net 1974 (IGSN 71).

Morelli, C., (1976): Short Notes: Mordern standards for Gravity Surveys. *Geophysics*, 41, 1051

Nagy D., (1966): The Prism Method for Terrain Corrections Using Digital Computers. Pure Appl. Geophys. 63, 31–39.

Nettleton, L. L., (1942): Gravity and Magnetic Calculations, *Geophysics*, 7, 293-310.

Nettleton, L. L., (1976): Gravity and Magnetics in Oil Prospecting, McGraw-Hill.

Ngozi Agatha Okwesili, Okeke Francisca Nneka & Orji Prince Orji (2020): Geophysical survey of aerogravity anomalies over Lafia and Akiri regions of middle Benue trough, Nigeria, employing Power Spectrum and Source Parameter Imaging technique. *IOSR Journal of Applied Physics (IOSR-JAP)*, 12(5), 2020, 58-68.

Nguuri, T.K., Gore, J., James, D. E., Webb, S. J., Wright, C., Zengeni, T. G., Gwavava, O.,

Snoke, J. A., & Kaapvaal Seismic Group (2001): Crustal structure beneath southern Africa and its implications for the formation and evolution of the Kaapvaal and Zimbabwe cratons. *Geophysical Research Letters*, 28, 2501–2504.

Odeyemi, I.B., (1977): The Basement rocks of Bendel state of Nigeria. Unpublished Phd Thesis. University of Ibadan, Nigeria.

OSGOF (1993): Adminstartive map of Ondo state *published by Office of Surveyor General.*

Ofrey, O., (1978): Fundamental Gravity Network for Nigeria and the Gravity Field of Southwestern Nigeria. Ph.D. Thesis., University of Ibadan, Ibadan, Nigeria.

Ofrey, O., (1980): A Preliminary Gravity Network for Nigeria. *Journ. Min. Geol.,* 17(2), 159-161.

Ogezi, A. E. O. (1977). Geochemistry and Geochronology of basement rocks from north western Nigeria (Unpublished Ph.D. thesis). University of Leeds, England. 295pp. 144

O'Hara, N.W. & Lyons, P.L. (1985): Preparation and Overview of the Gravity Anomaly Map of the United States. In: W.J. Hinze (ed.). The Utility of Regional Gravity and Magnetic Anomaly Maps. Society of Exploration Geophysicists: Tulsa, OK.

Okereke, C. S. (1988): Contrasting modes of rifting: The Benue and Cameroon volcanic line, West Africa. *Tectonophysics*, 7(4), 775-784.

Okiwelu, A.A., Okwueze, E.E. & Akpabio I.O. (2009): The Bouguer Gravity Anomaly Map

of the Calabar Flank, Southeastern, Nigeria. *The Pacific Journal of Science and Technology,* 10(1), *656 – 662.*

Okunlola, O.A. (2001): Geological and compositional investigation of Precambrian marble bodies and associated rocks in the Burum and Jakura areas, Central Nigeria.PhD thesis, University of Ibadan, Nigeria. 193p.

Okunlola, O.A**.** & Okoroafor R.E., (2009): Geochemical and petrogenetic features of schistose rocks of the Okemesi fold belt, Southwestern Nigeria. *RMZ Materials and Geoenvironment*, 56 (2), 148-162.

Oladapo, M.I. & Oladapo, O.O. (2011): Geophysical investigation of barite deposit in Tunga, Northeastern Nigeria. *International Journal of the Physical Sciences*. 6(20), 4760-4774.

Olarewaju, V.O; (1982): Review of the petrology and Geochemistry of the charnockitic and associated granitic rocks of Ado-Ekiti- Akure area, Southwestern Nigeria. In Geology of Nigeria edited by Kogbe C. pp 125 – 144.

Opara, A.I.; Ekwe, A.C.; Okereke, C.N.; Oha, I.A. & Nosiri, O.P. (2012): Integrating Airborne Magnetic and Landsat Data for Geologic Interpretation over part of the Benin Basin, Nigeria.*Pacific Journal of Science and Technology. 13(1):556-571.*

Osazuwa, I.B. (1985): The Establishment of primary gravity Network forstudies in Nigeria, Unpublished Ph.D. Thesis. A.B.U., Zaria, Nigeria.

Osazuwa, I.B., (1988): Cascade Model for the removal of Drift from Gravimetric data. *Survey*

Review. U.K. 29, 295-303.

Osazuwa, I.B., (1992A), Logistics and Operational Techniques in Gravimetric Studies. In: Proceeding of the First International Conference on Surveying and Mapping, National Cartographic Centre, Tehran, Iran, (Editor: tatavus Ghazarian), II, 15-41.

Osazuwa, I.B., (1992B): The Nigerian Standard Gravimeter Calibration Line. *Survey Review*. U.K. 31(245), 397-408.

Osazuwa, I.B., (1992C): The Southern Nigerian Standard Gravimeter Calibration Line. *BOLLETTINO DI TEORICA ED APPLICATA*. XXXIV (133), 21-28.

Osazuwa, I.B., & Ajakaiye, D.E. (1992): Gravity meter calibration ranges in Nigera. *Journal of African Earth Sciences*, 14(4), 519-525.

Osazuwa, I.B., Onwuasor, E.O., Azubike, O.C. & Okafor, B.J.O. (1994): Regional Gravity Survey of Kaduna and Katsina States, *Geological Survey of Nigeria Gravity Map Series* No. 1, 9pp.

Rahaman, M.A., (1978): Review of the Basement geology of Southwestern Nigeria. In: Geology of Nigeria. *Elizabethan Publishing Company*. Nigeria. pp 41-58

Russ, W. (1957): The geology of parts of Niger, Zaria and Sokoto Provinces with Special Reference to the Occurrence of Gold.*Geological Survey of Nigeria, Bulletin No. 27.*

Shemang, E.M, Jacoby, W.R. & Ajayi, C.O. (2005): Gravity Anomalies over the Gongola arm,

Upper Benue Trough, Nigeria.*Global Journal of Geological Sciences,* 3(1), 61-69.

Shuttle Radar Topographic Mission (2009): Digital Elevation Model by U.S. National Geospatial-Intelligence Agency (NGA) and the U.S. National Aeronautics and Space Administration (NASA).

Studinger, Michael & Bell, Robin & Frearson, N. (2008): Comparison of AIRGrav and GT-1A Airborne Gravimeters for Research Applications. *Geophysics, 73. 10.1190/1.2969664.*

Sun, Wei-dong ,Li-peng Zhang, Jia Guo, Cong-ying Li, Yu-hang Jiang, Robert E. Zartman & Zhao-feng Zhang (2016): Origin of the mysterious Yin-Shang bronzes in China indicated by lead isotopes. *Sci. Rep.*, 6, 23304; doi: 10.1038/srep23304 (2016).

Telford, V.M., Geldart, L.P., Sheriff, R.E. & Keys, D.A. (1990): Applied Geophysics, *Cambridge Univ. Press, London*. 860pp

Thompson, L. & LaCoste, L. [1960] Aerial gravity measurements. *Journal of Geophysical Research, 65, 305–322.*

Turner, D.C. (1983): Upper Proterozoic Schist Belts in the Nigerian Sector of the Pan-African Province of West Africa.*Precambrian Research, 21, 55-79.*

Udensi, E.E., Ojo, S.B. & Ajakaiye, D.E. (1986): A three-dimensional interpretation of the bouguer anomalies over the Minna Batholith in Central Nigeria. *Precambrian Research*, 32(1986) 1-15.

Ugbor, D. O. & Okeke, F. N (2010): Geophysical investigation in the Lower Benue trough of Nigeria using gravity method. *International Journal of the Physical Sciences*, 5(11), 1757-1769.

Verheijen, P.J.T. & Ajakaiye, D.E. (1978): A Gravimeter Calibration line, Nigeria. *Survey Review*, 24(190), 373-380.

Wightman, W. E., Jalinoos, F., Sirles, P., & Hanna, K. (2003): Application of Geophysical Methods to Highway Related Problems." Federal Highway Administration, Central Federal Lands Highway Division, Lakewood, CO, Publication No. FHWA-IF-04-021, September 2003. *http://www.cflhd.gov/resources/agm/*

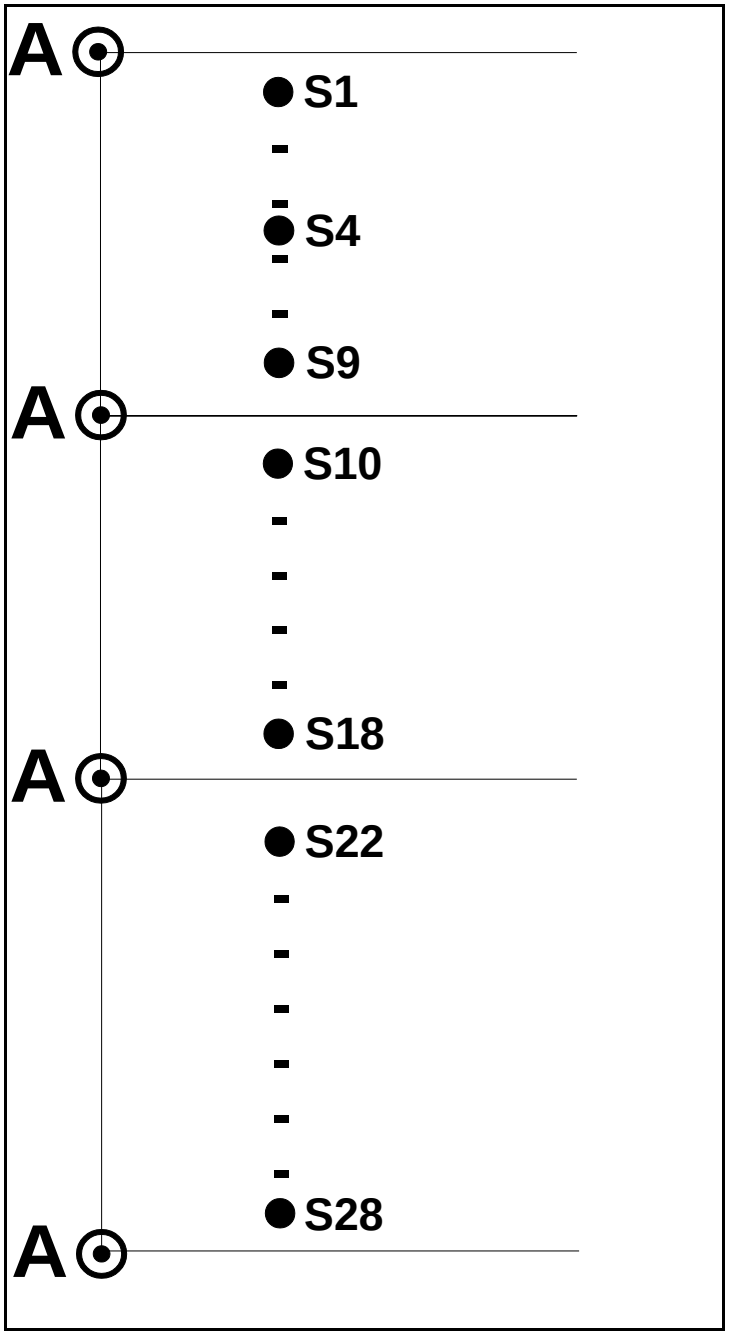
Woolard, G.P. & Rose, J.C. (1963): International Gravity Measurements. Suppl.Publ., *S.E.G.*, Tulsa, P. 518.

Woolard, George P., (1979): The New Gravity System - Changes in International Gravity Base Values and Anomaly Values, *Geophysics*, 44, 1352-1366.

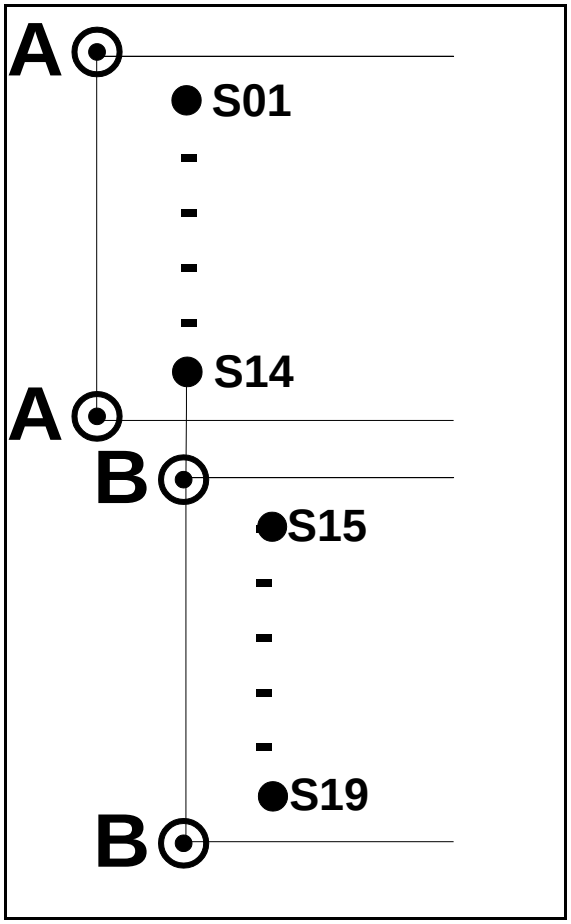
Wright, P.M., 1981, Gravity and Magnetic methods in mineral exploration. In Skinner, B.J., ed., *Economic Geology*, 7th Anniversary volume, 829-839.

Appendix 1

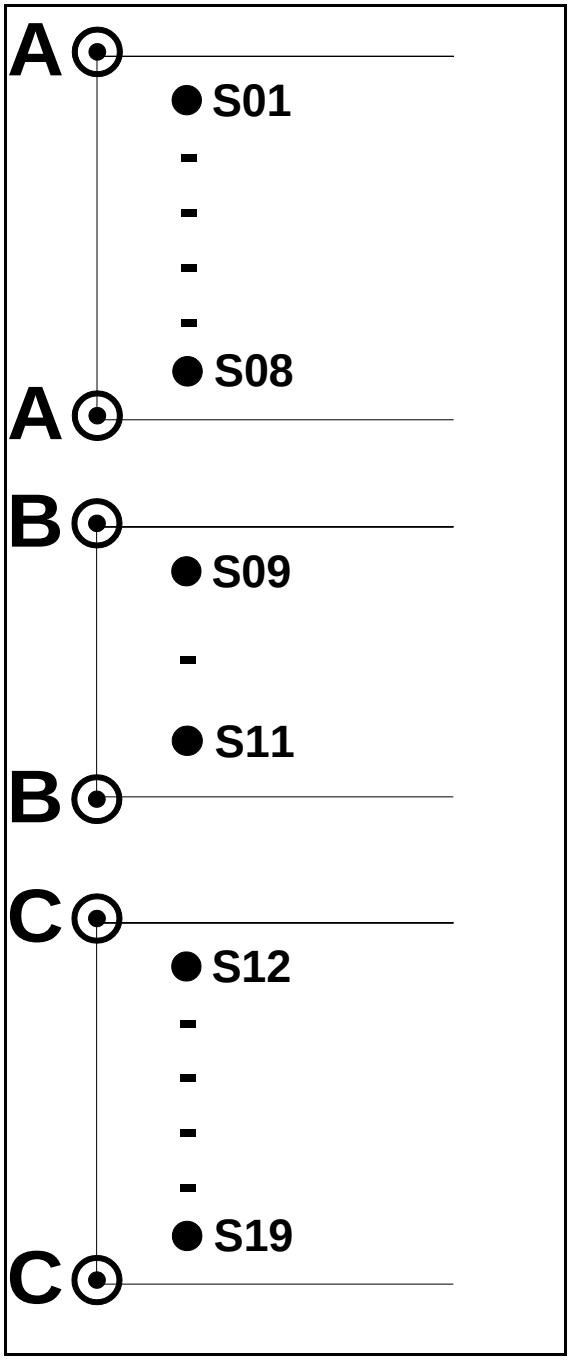
Loop Plots



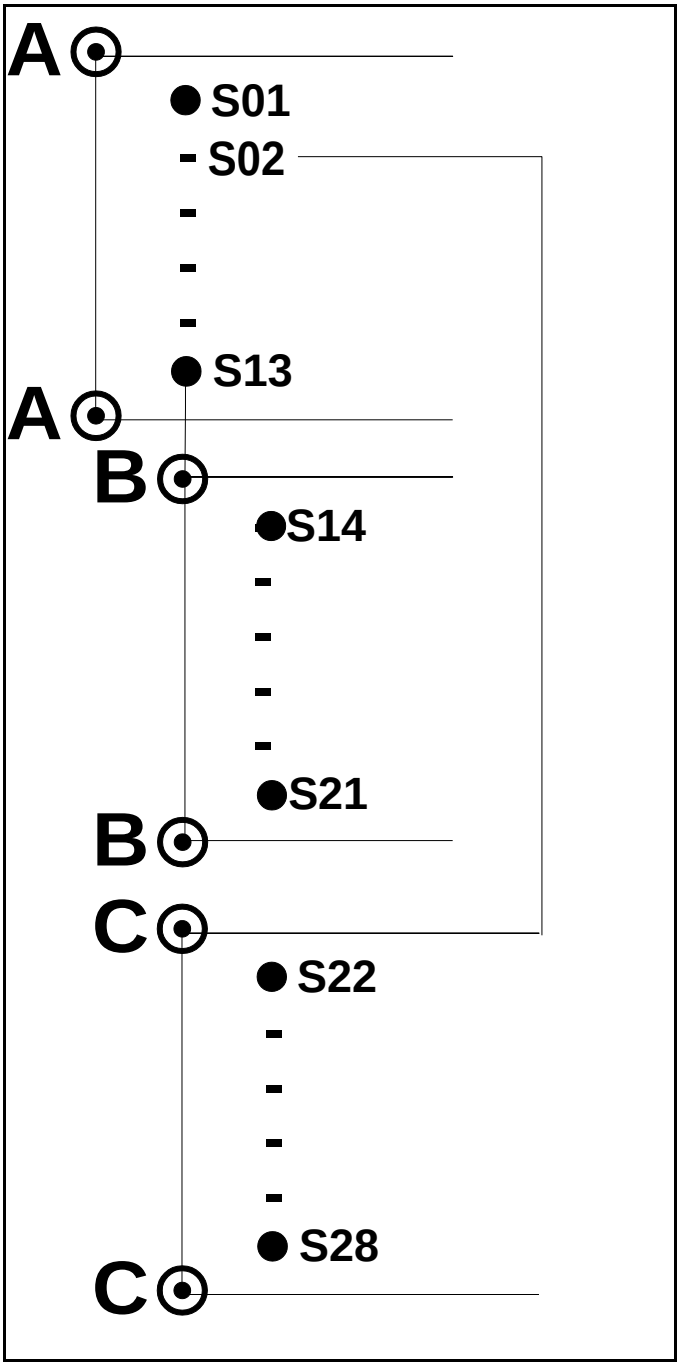
17-11-2017 (Base station A = St Peters College Akure)



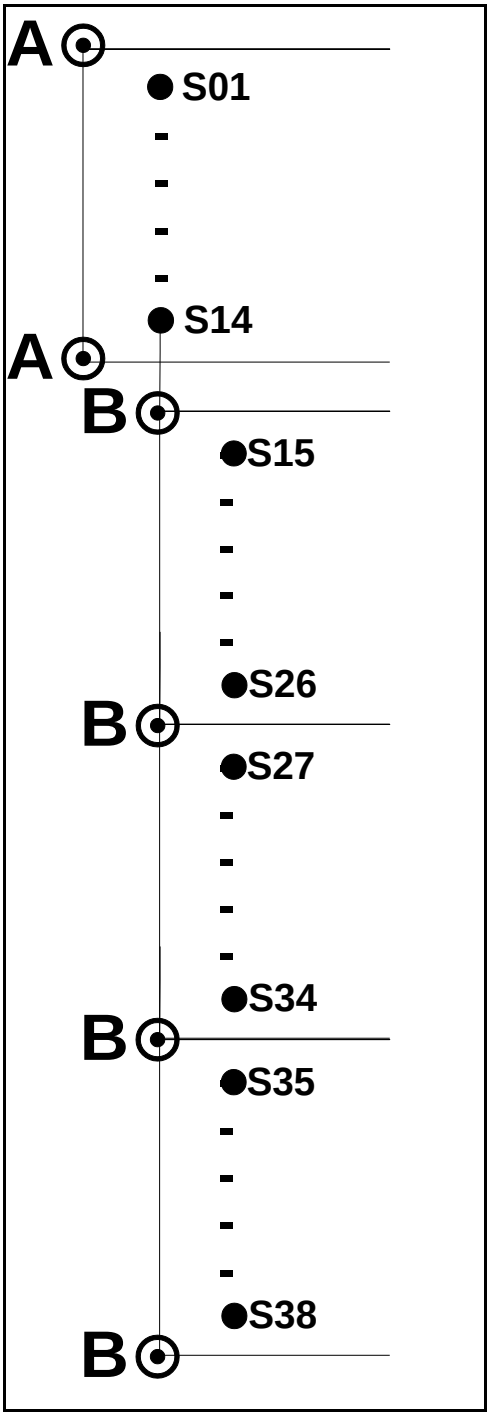
18-11-2017 (Base station A = St Peters College Akure, Base station B = General Post Office Igbara-Oke)



19-11-2017 (Base station A = General Post Office Igbara-Oke, Base station B = AKL/ILH/005 (Ilara), Base station C = GPSA72S (Akure))

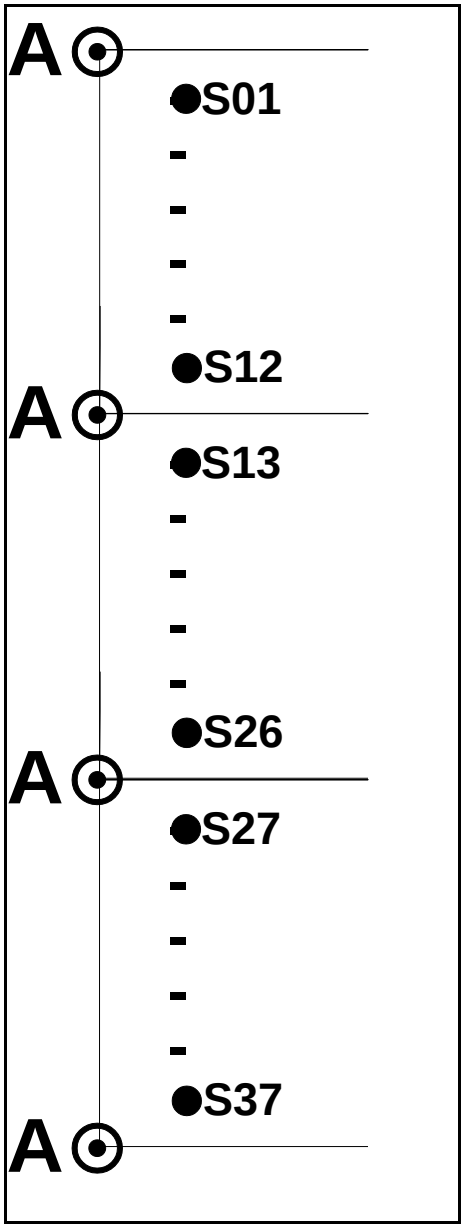


20-11-2017 (Base station A = St Peters College Akure, Base station B = AKR/OWO/002 (Akure), Base station C = AKR/OGB/001 (Akure))

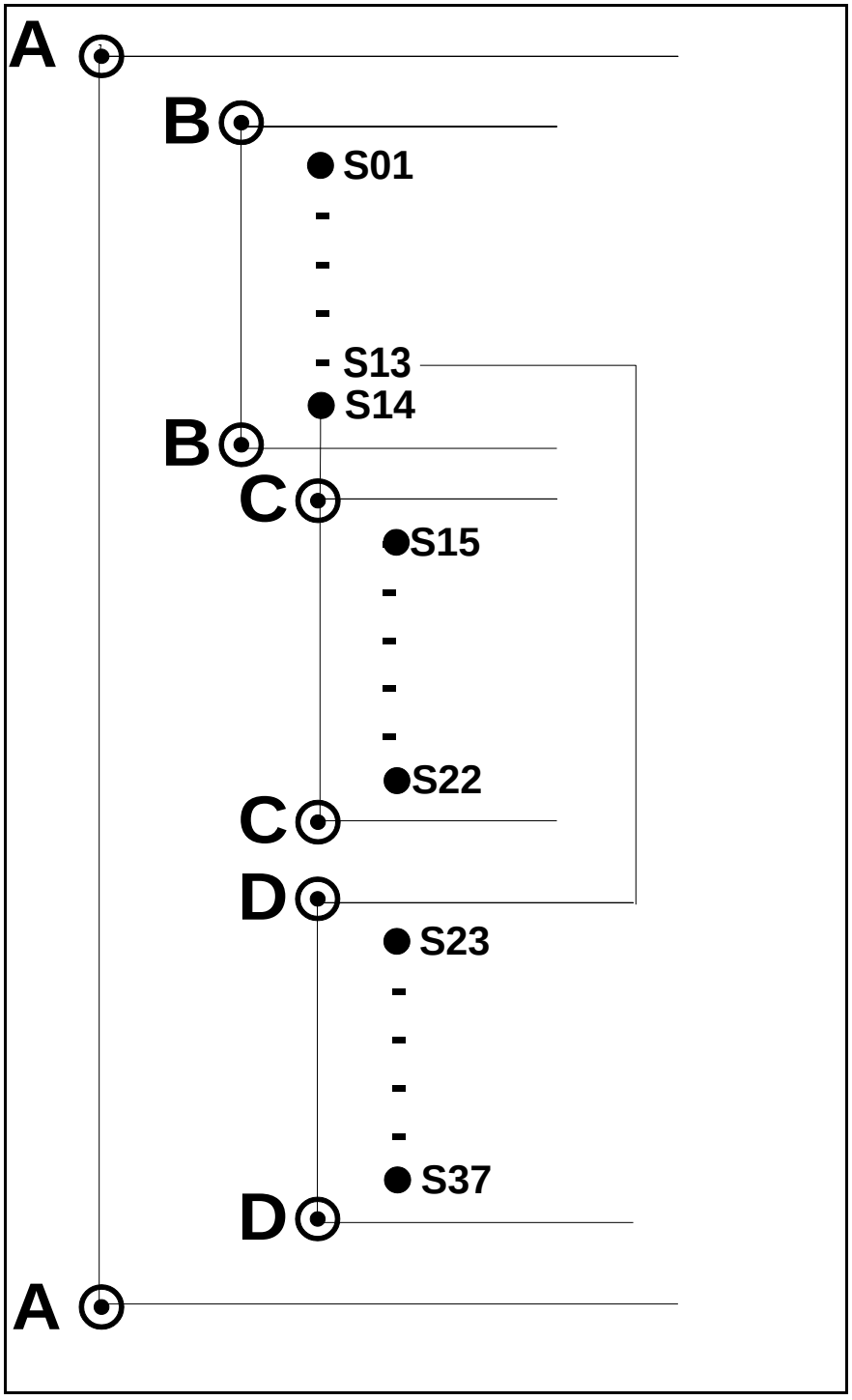


21-11-2017 (Base station A = AKR/IKR/008 (Iju), Base station B = AKR/IKR/014

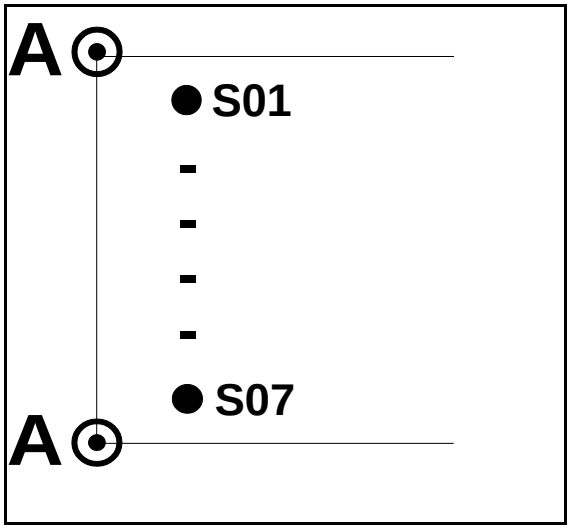
(General Post office Ikere))



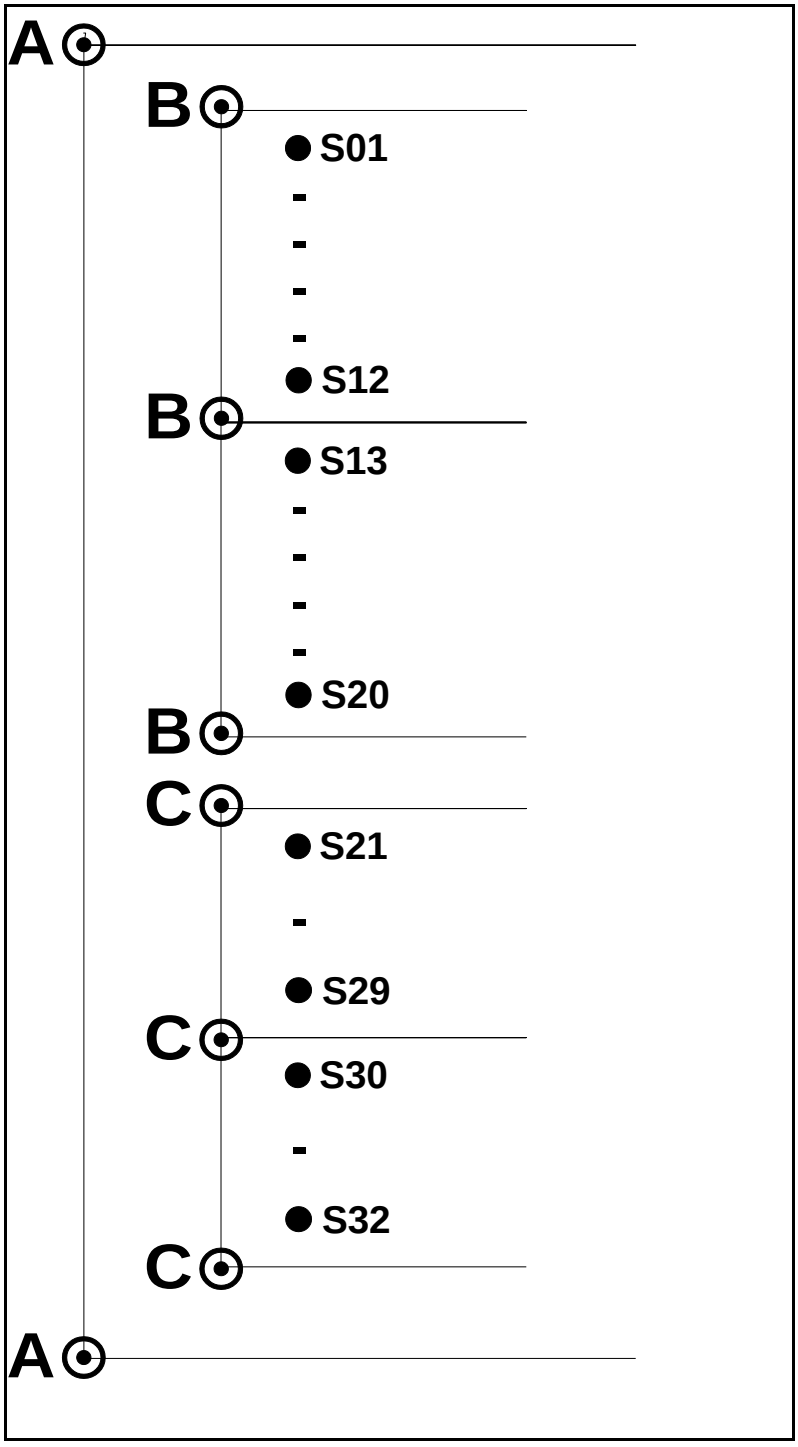
22-11-2017 (Base station A = IGB/IGB/005 (Igbara-Odo))



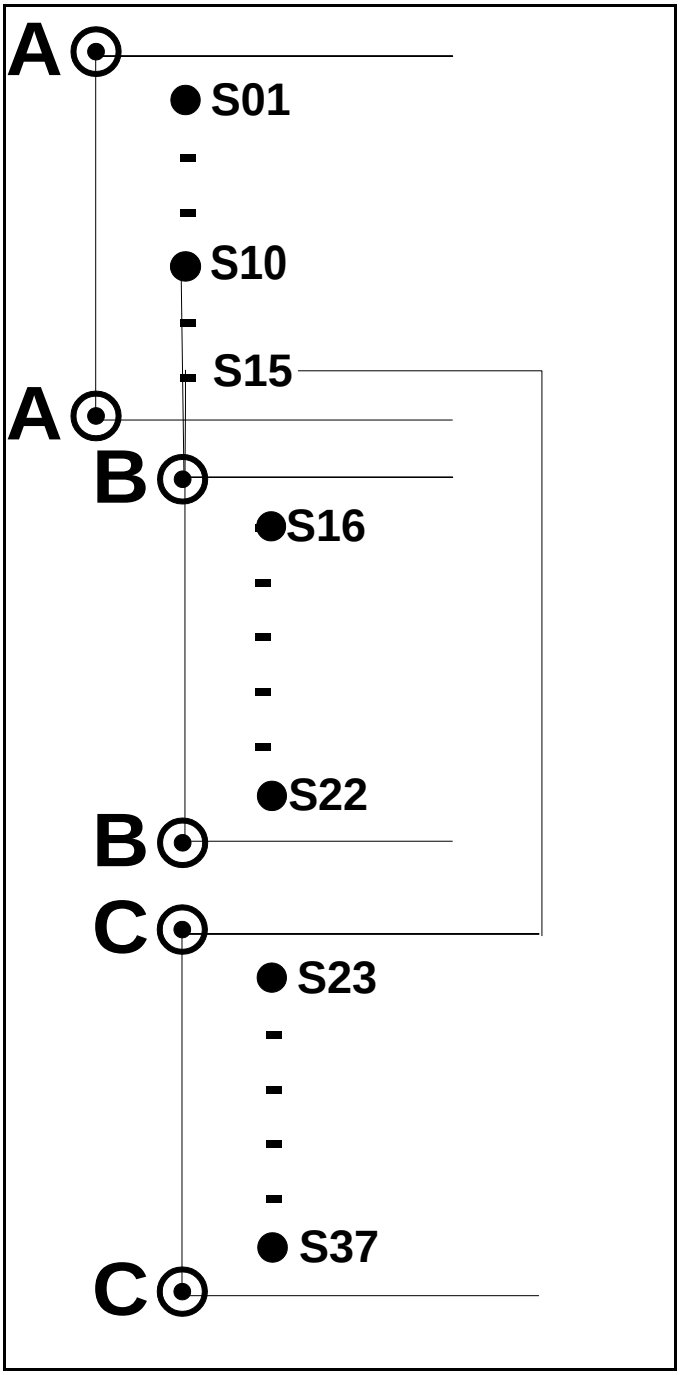
23-11-2017 (Base station A = AKR/OWO/002 (Akure), Base station B = AKR/OGB/010 (Ogbese), Base station C = OGB/OWO/008 (Emure-Ile), Base station D = OGB/OWO/013 (Owo))



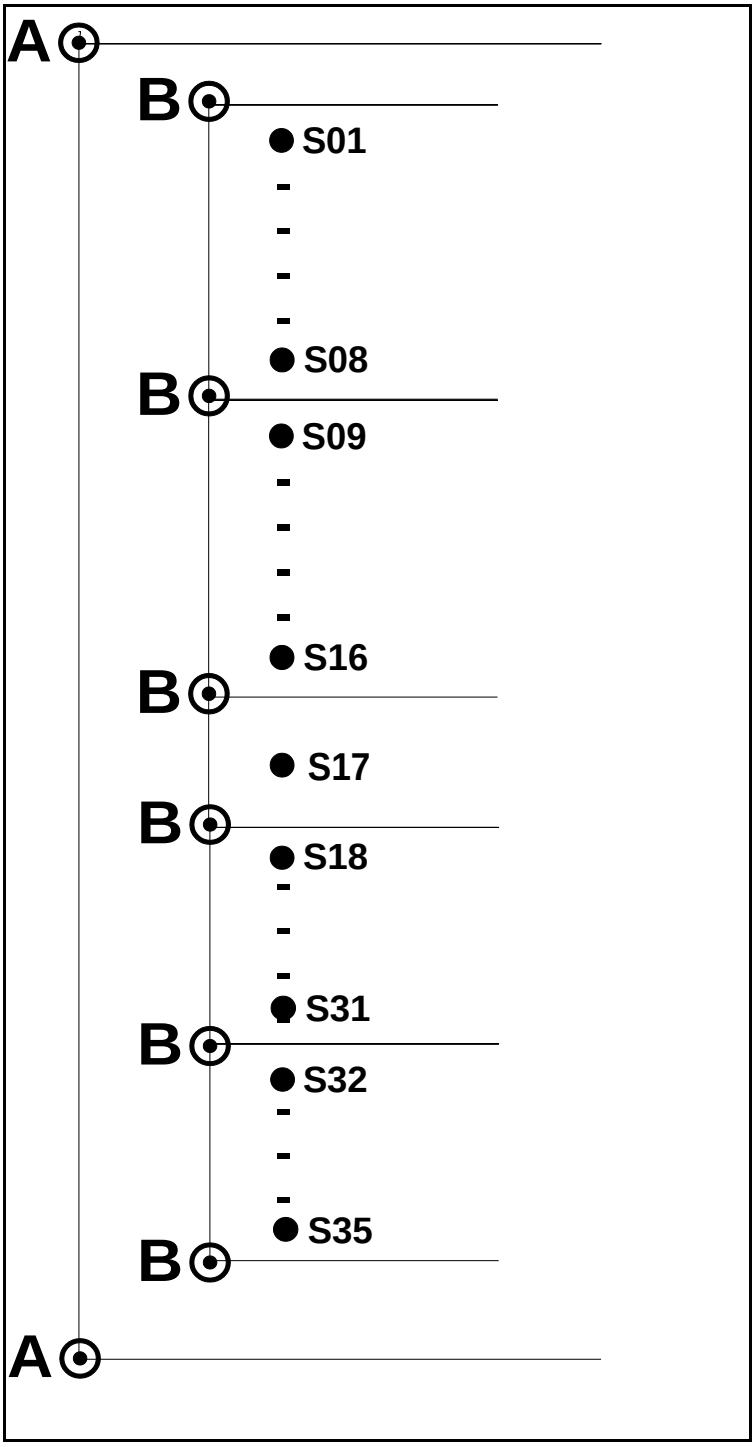
24-11-2017 (Base station A = AKR/OGB/001 (Akure))



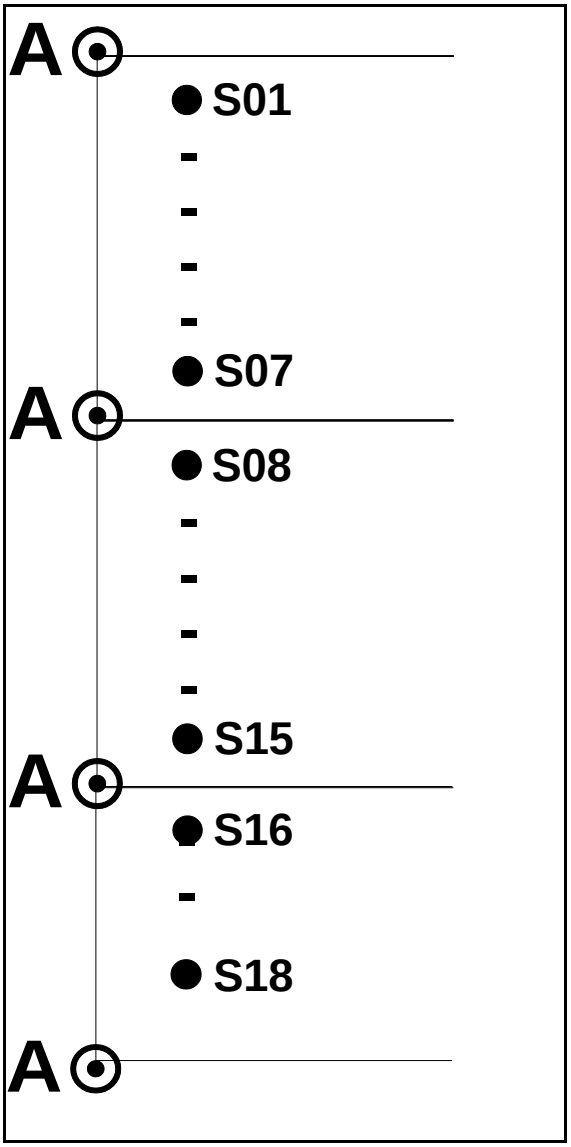
25-11-2017 (Base station A = IGB/IGB/005 (Igbara-odo), Base station B = IGB/IKG/007 (Ikogosi) and Base station C = IGB/ILW/006 (Ilawe Post office))



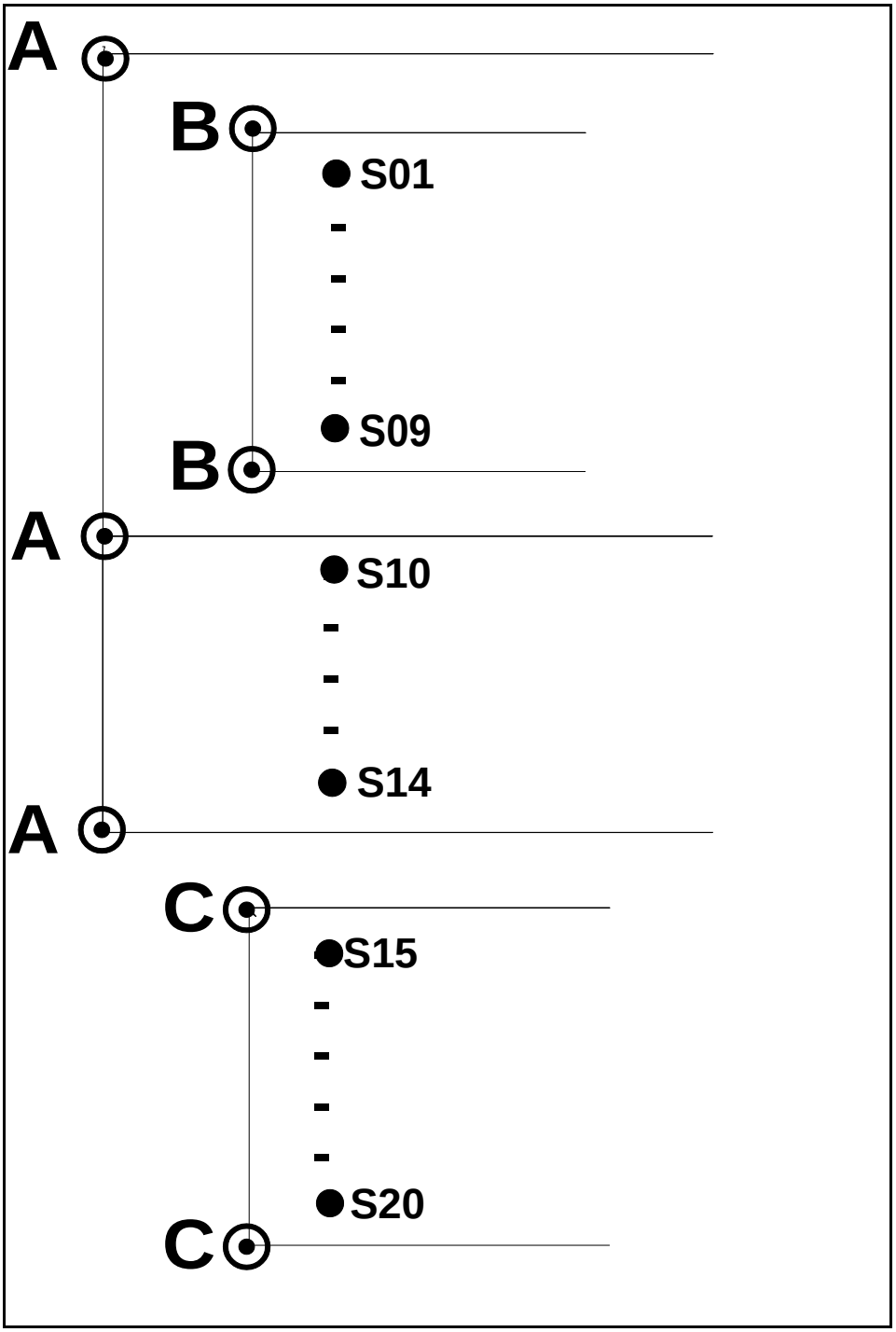
27-11-2017 (Base station A = GMS088B (Akure), Base station B = AKR/OND/010 (Owena) and Base station C = AKR/OND/015 (Bolorunduro))



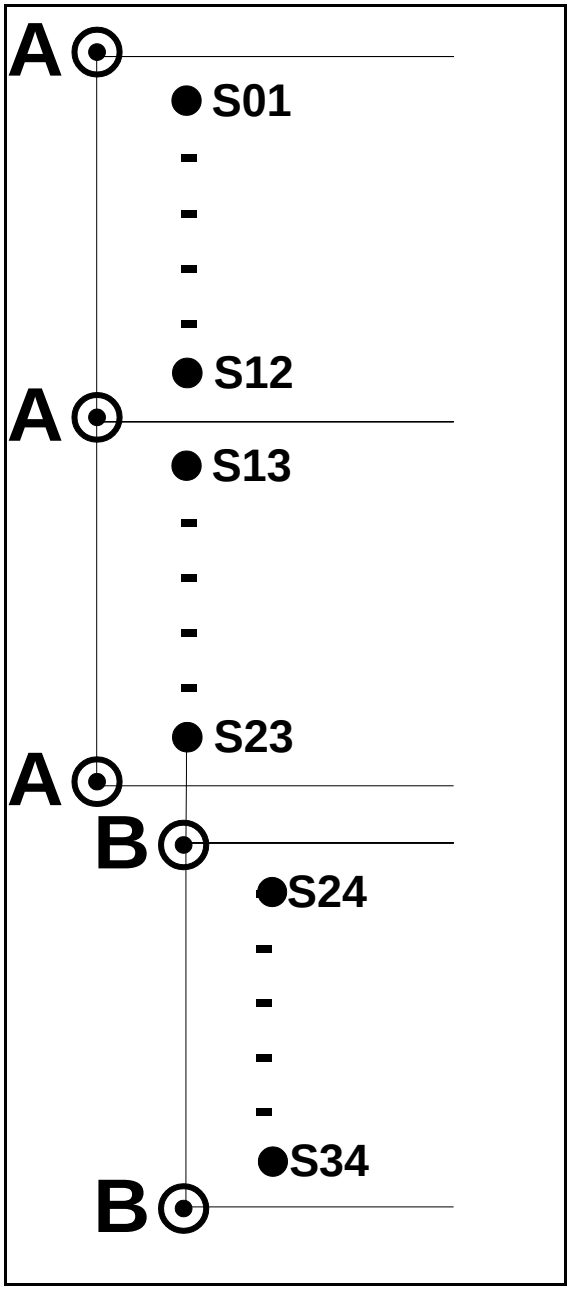
28-11-2017 (Base station A = AKR/OND/015 (Bolorunduro) and Base station B = AKR/OND/024 (Bolorunduro))



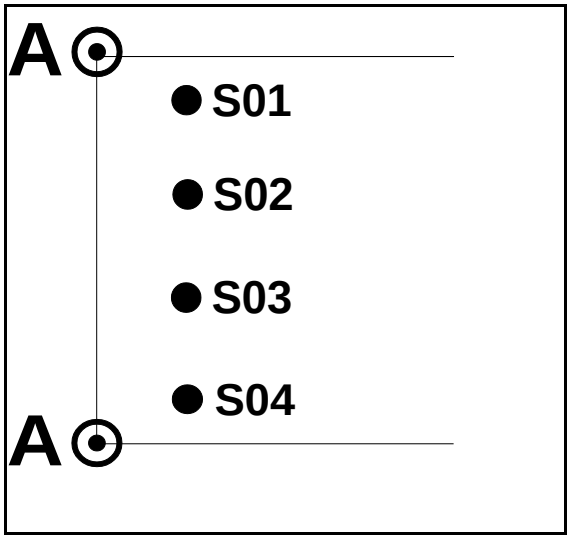
29-11-2017 (Base station A = OWN/IDR/005 (Post Office, Idanre)



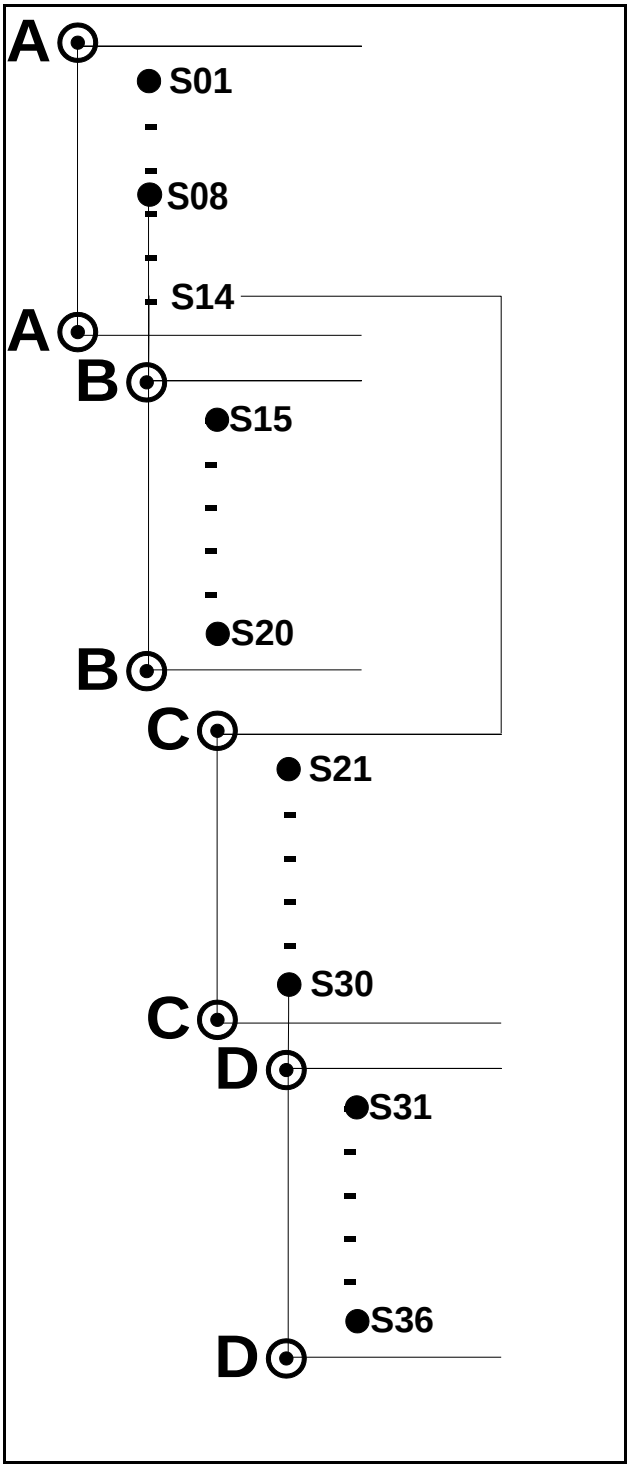
30-11-2017 (Base station A = AKR/OGB/010 (Ogbese), Base station B = OGB/OWO/003 (Uso) and Base station C = GPSA23S (Oda))



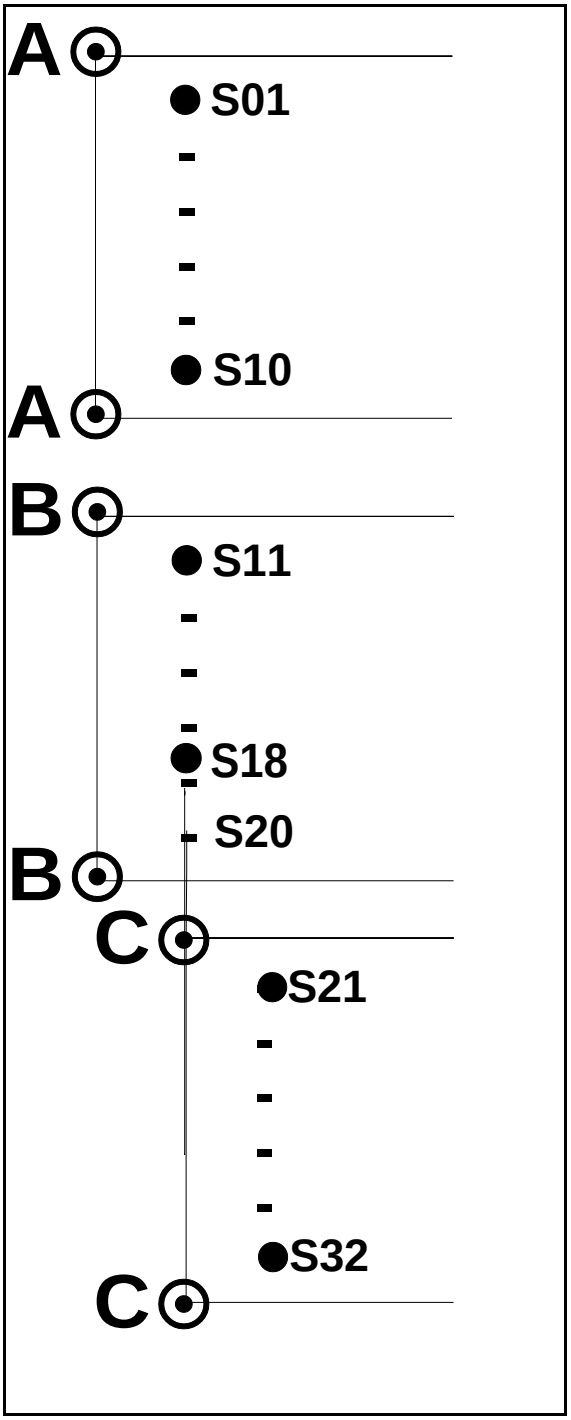
01-12-2017 (Base station A =IGD/ARA/005 (Aramoko Post Office) and Base station B = ARA/IJE/007 (Ijero Post Office)



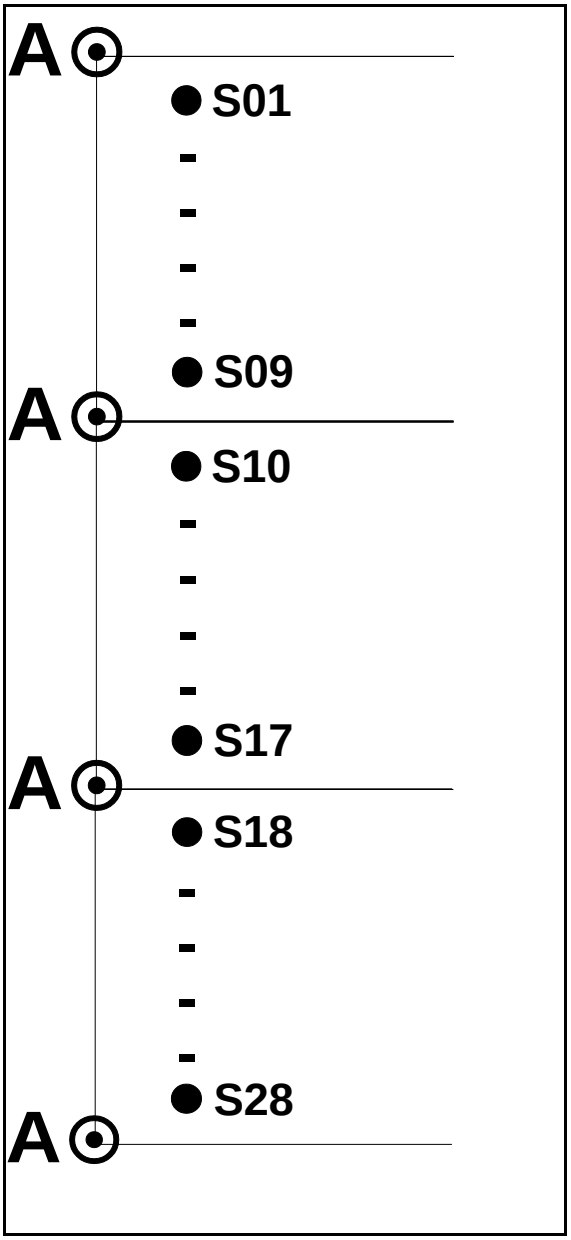
02-12-2017 (Base station A =OND/ILO/014)



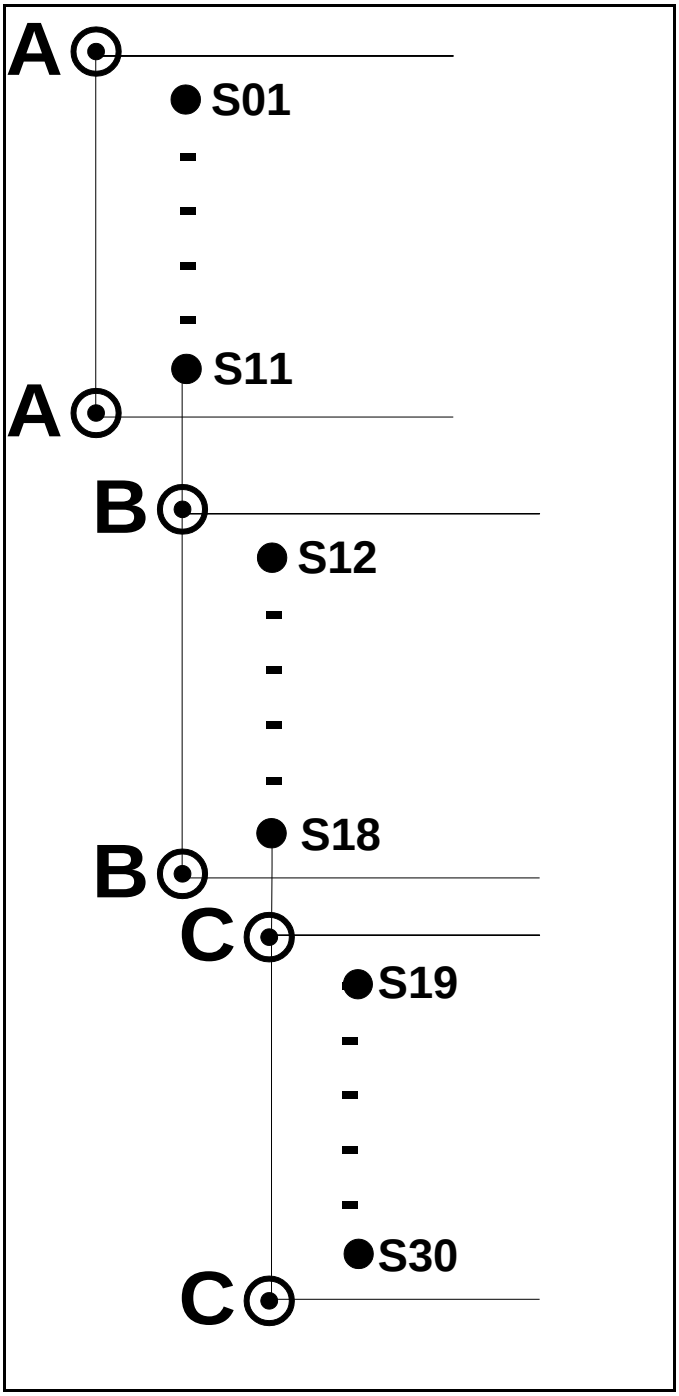
04-12-2017 (Base station A = ARA/IJE/007 (Ijero Post Office), Base station B = IJE/IFK/008 (Ido Post Office), Base station C = IJE/IFK/014 (Ifaki Post Office) and Base station D = IFK/ADO/010 (Ado-Ekiti Post Office).



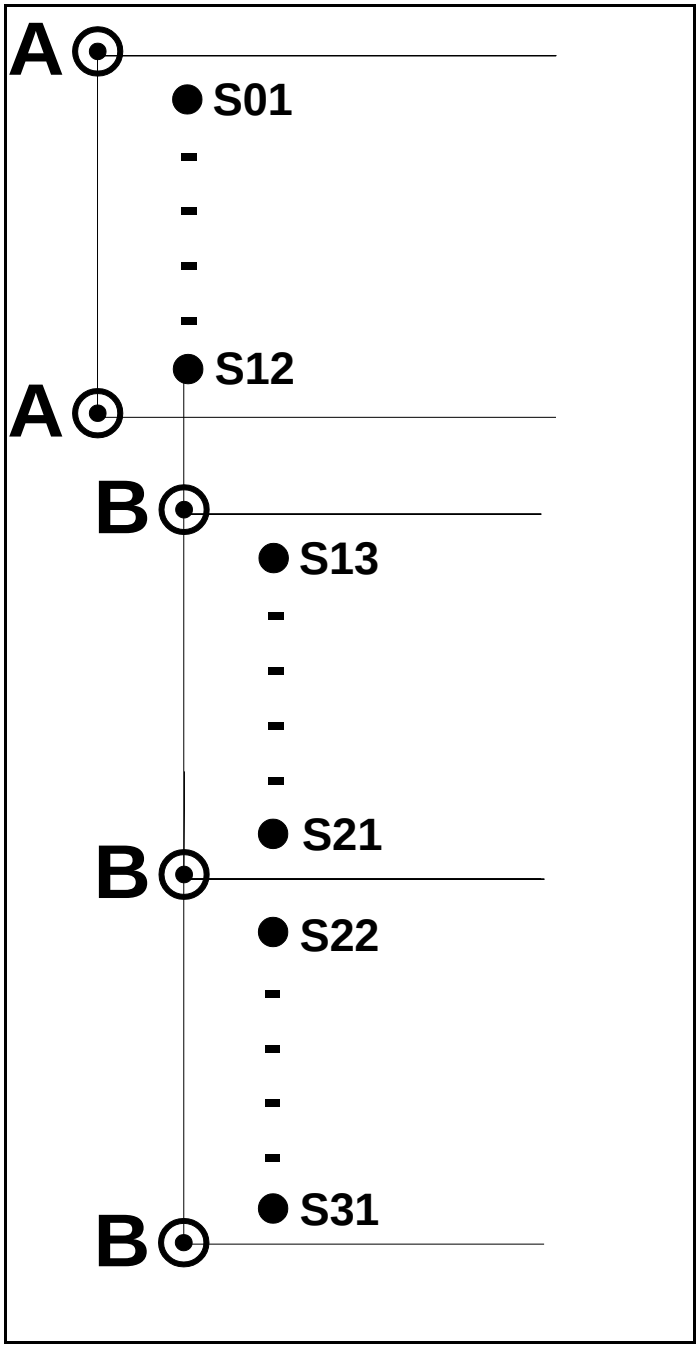
05-12-2017 (Base station A = ILW/IGD/004 (Igede), Base station B = IJE/IFK/008 (Ido Post Office) and Base station C = IDO/OTN/008 (Otun Post Office).



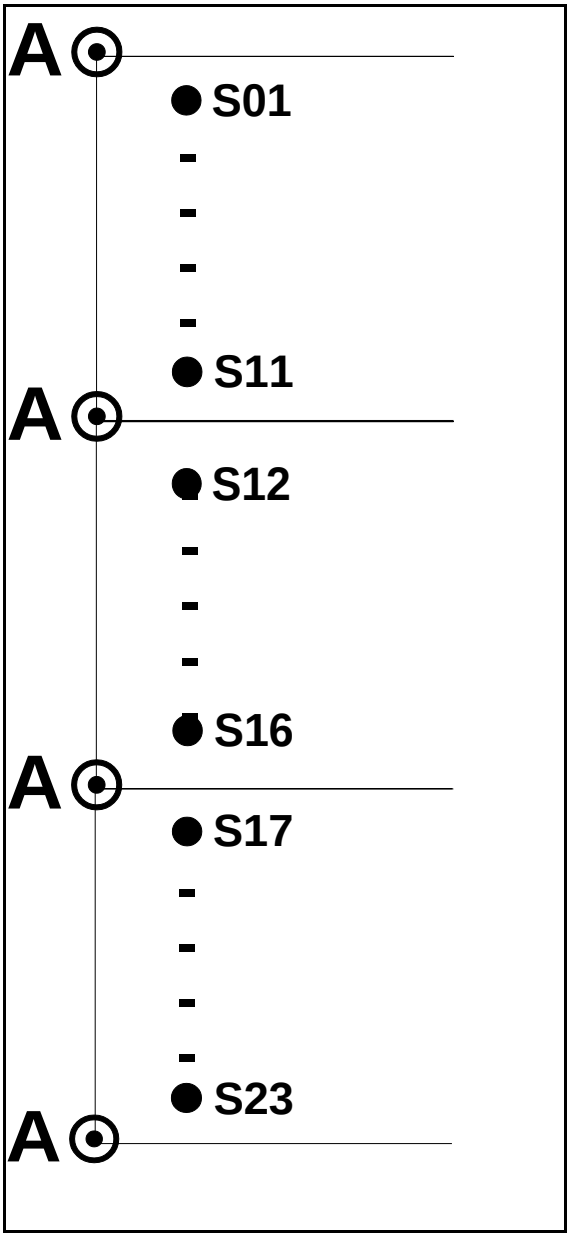
06-12-2017 (Base station A = OGB/OWO/014 (Owo Post Office).



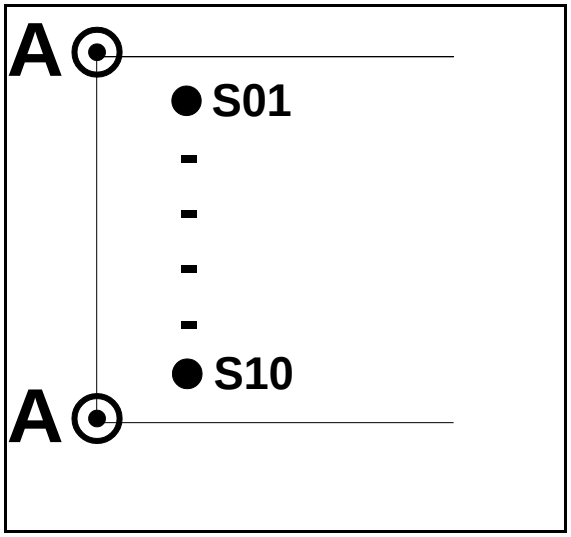
07-12-2017 (Base station A = IJE/IFK/014 (Ifaki Post Office), Base station B = IFK/OYE/011 and Base station C = IFK/OYE/030 (Ikole).



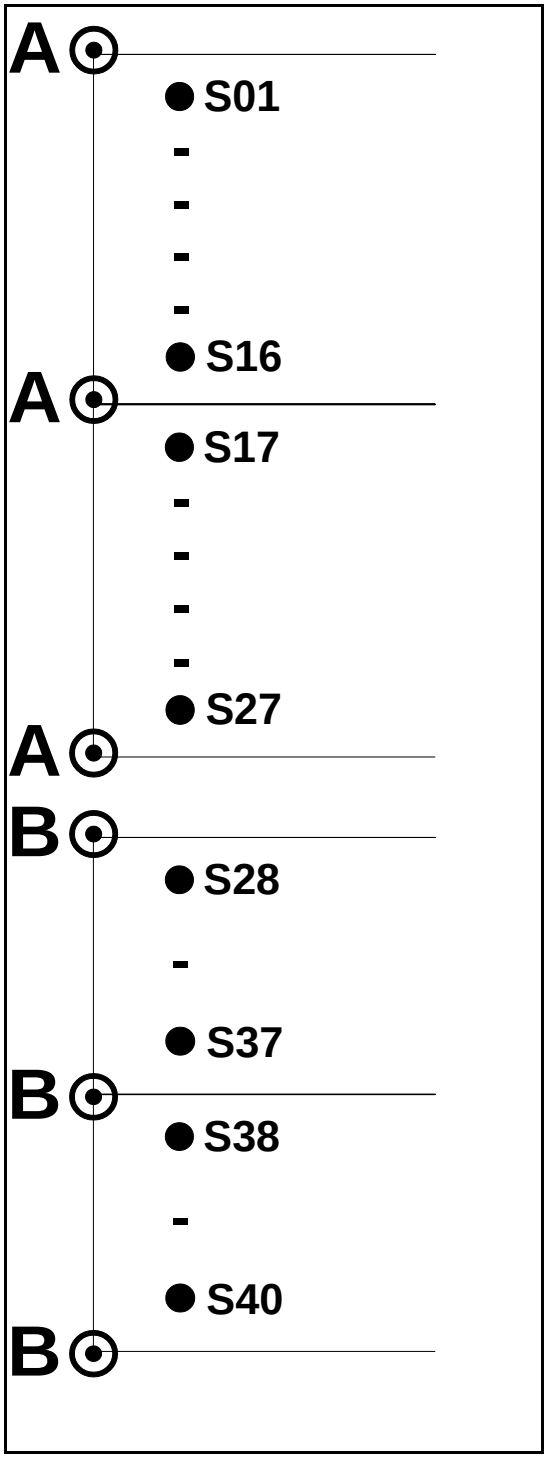
08-12-2017 (Base station A = IFK/ADO/010 (Ado-Ekiti Post Office) and Base station B = ADO/IJA/012 (Iluomooba Post Office)).



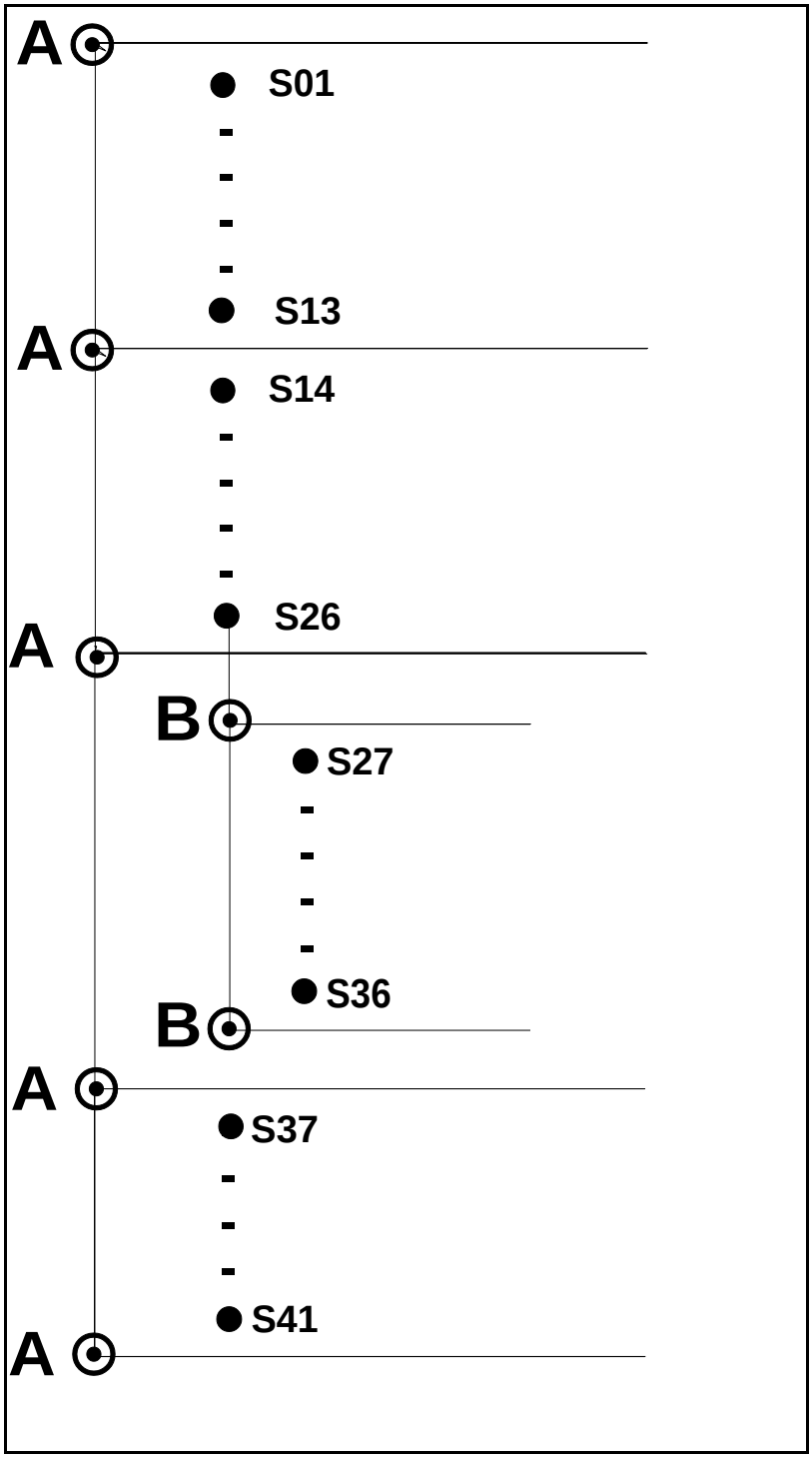
09-12-2017 (Base station A = IFK/OYE/005 (Oye-Ekiti)



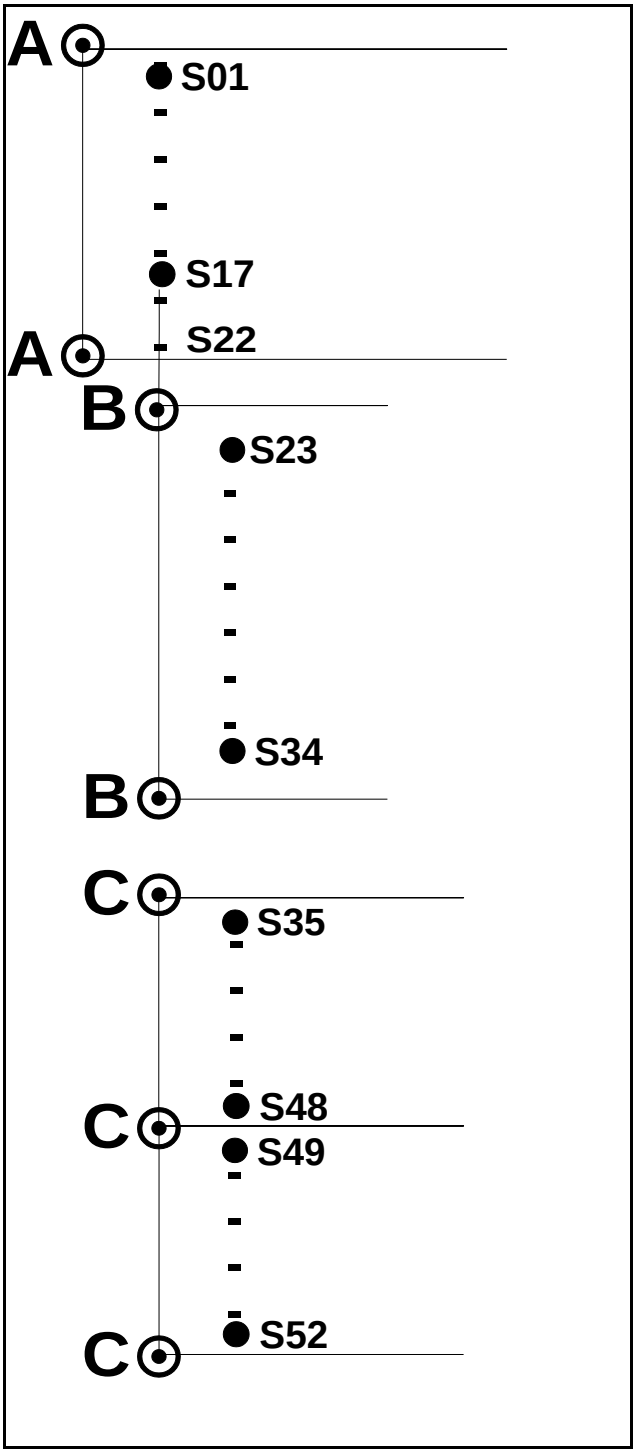
10-12-2017 (Base station A = OWO/IKA/011 (Oba Akoko, Post office))



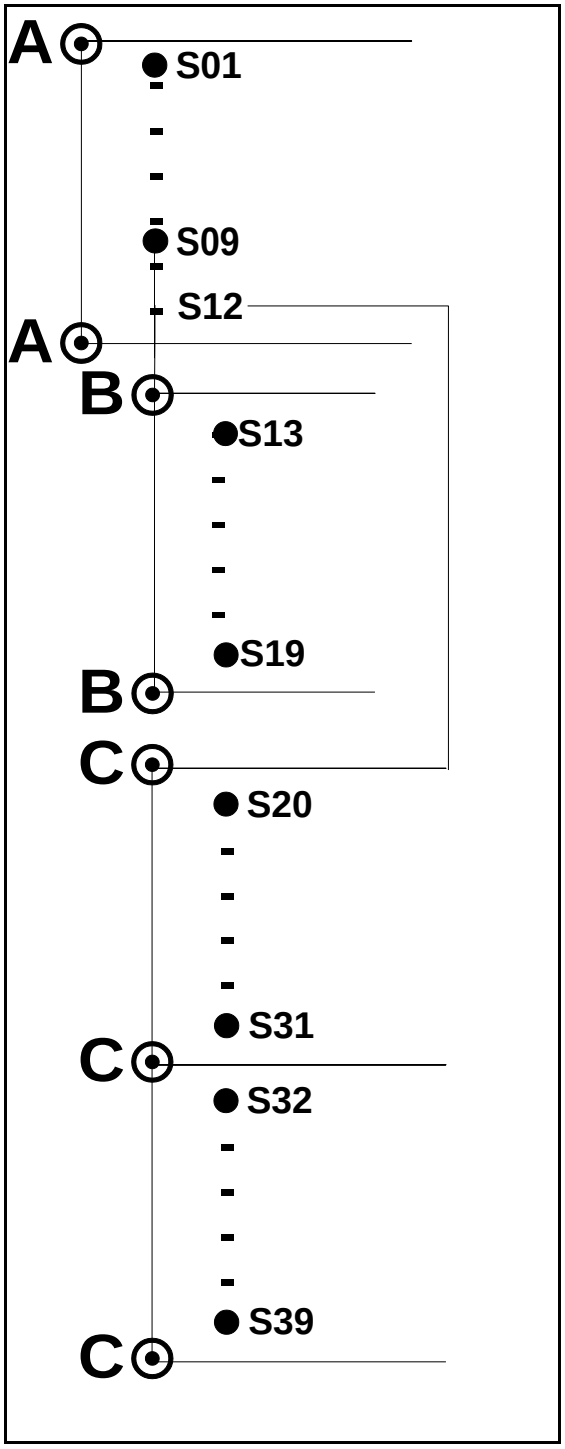
11-12-2017 (Base station A = OWO/IKA/017 (Akungba Post Office) and Base station B = OWO/IKA/011 (Oba Akoko, Post office))



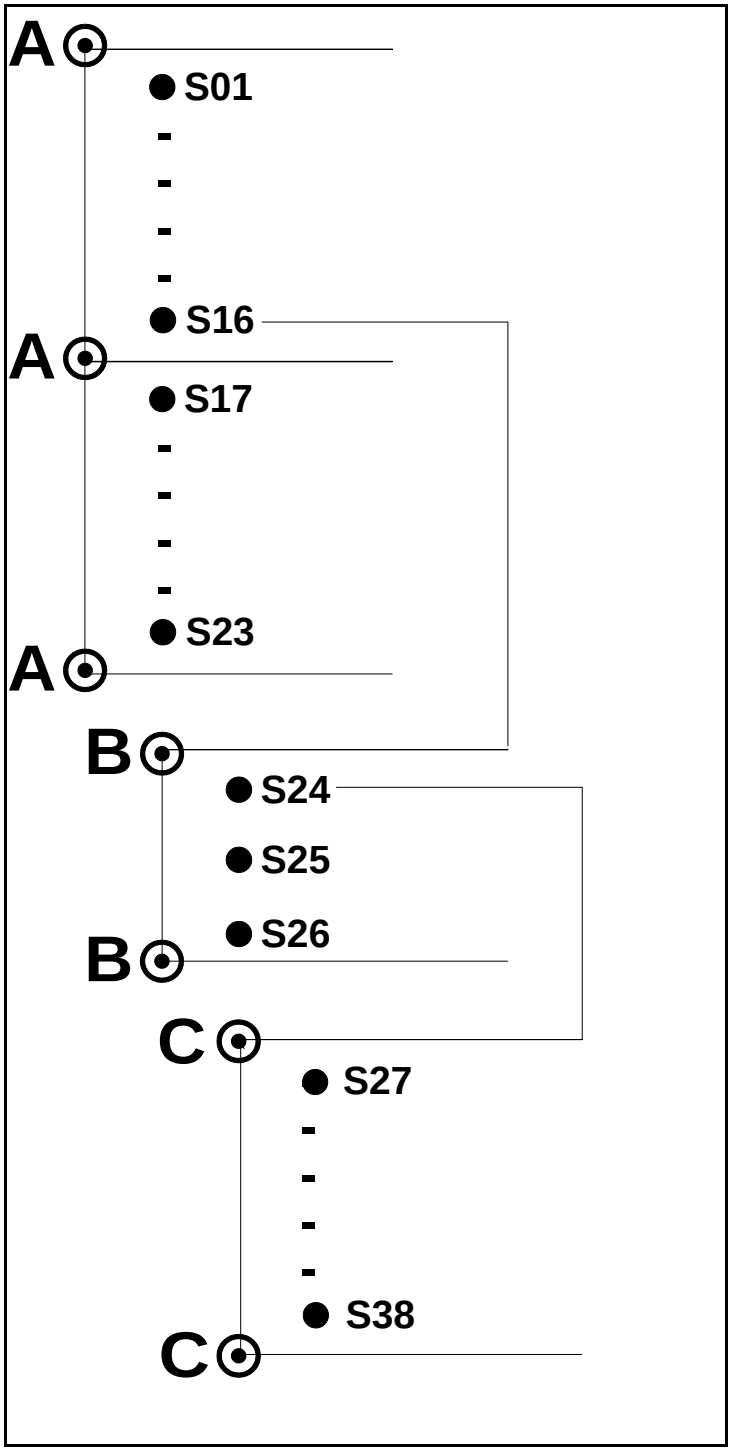
12-12-2017 (Base station A = OWO/IKA/021 (Ikare Post Office) and Base station B = IKA//AJW/011 (Ajowa Akoko))



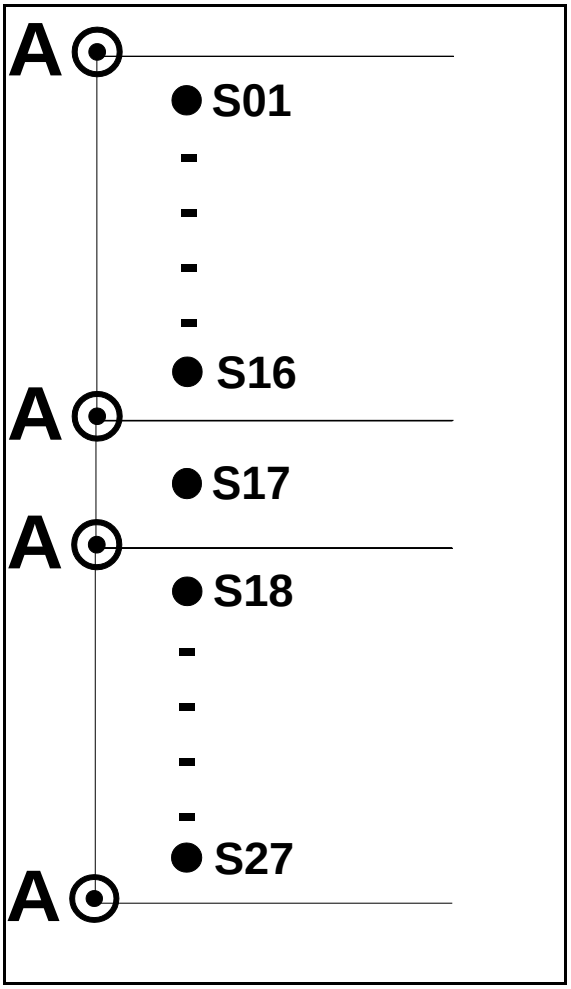
13-12-2017 (Base station A = IKA/IRU/005 (Ogbagi Post Office), Base station B = IKA/IRU/017 (Agbado) and Base station C = ADO/IJA/012 (Iluomooba Post Office))



14-12-2017 (Base station A = OWO/IKA/021 (Ikare Post Office), Base station B = IKR/IBU/009 (Ise Akoko) and Base station C = IKR/IBU/012 (Isua))



15-12-2017 (Base station A = OBA/IDN/010 (IDO-Ani Post Office), Base station B = IDN/IPE/016 (Ipele) and Base station C = GPO/IFON (Ifon Post Office))



16-12-2017 (Base station A = IFK/OYE/017 (Oye-Ekiti)).

Appendix 2

Photographs of the Base Stations showing their position

Akungba Post Office

Ifaki Post Office

Emure Post office

Ogbagi Post office

Idoani Post Office

Omuo Post office

Ode Post office

Isinbode post office

Ijesha-Isu Post office

Idanre Local Government secretariat, Owena

Alade Idanre Post office

Aramoko Post office

Ijero post office

Efon-alaye post office

Igbara-oke post office

Ayegbe Comprehensive High School, Ise-Akoko

Ijagba Anglican church

Ikole Post office

Ise Post office

Ikere post office

Iju round-about, Ondo State.

Iwaro-Oka post office

General Post Office Ado-Ekiti

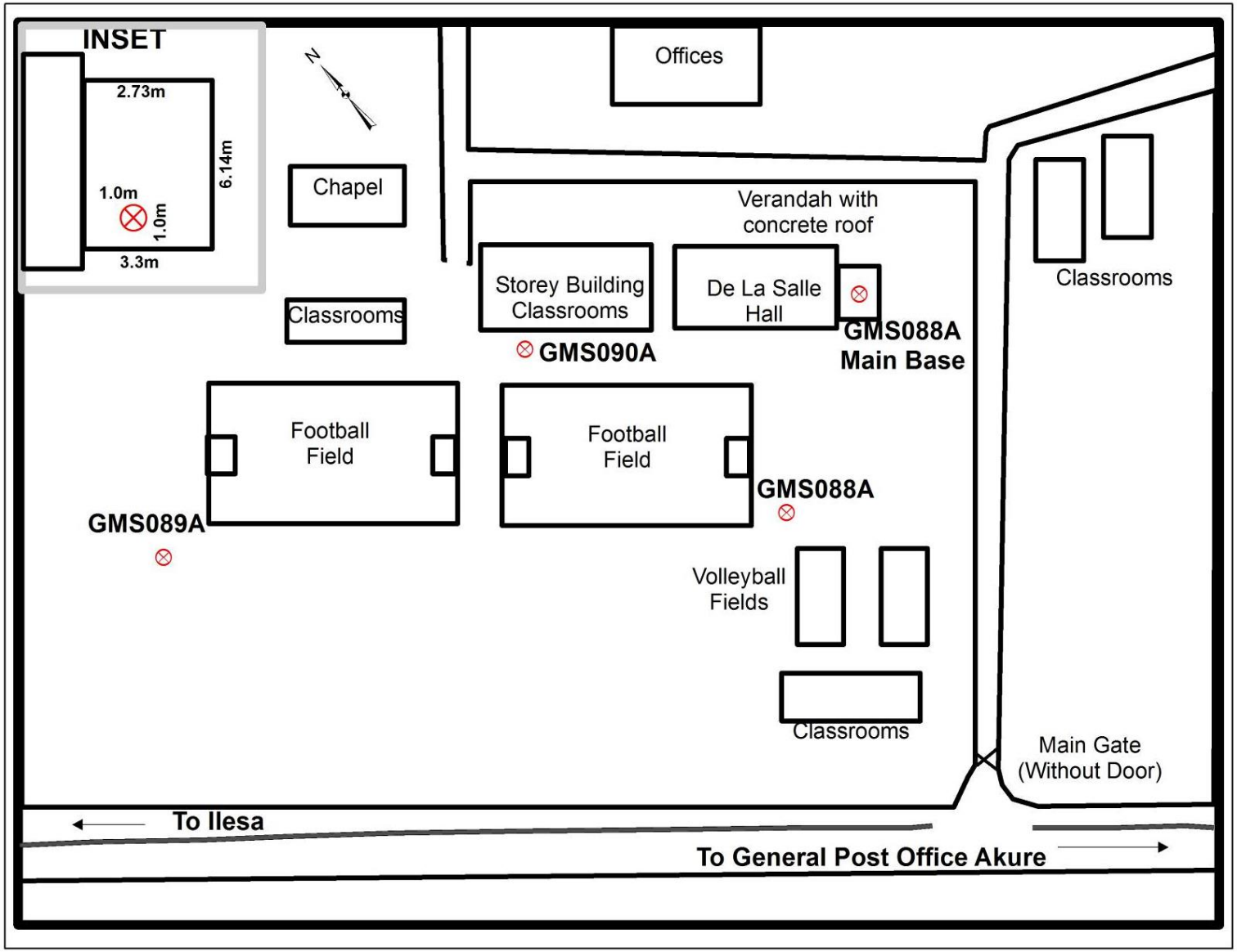
Ilawe Post Office

Ikere Juction at Igbara-Odo Ekiti

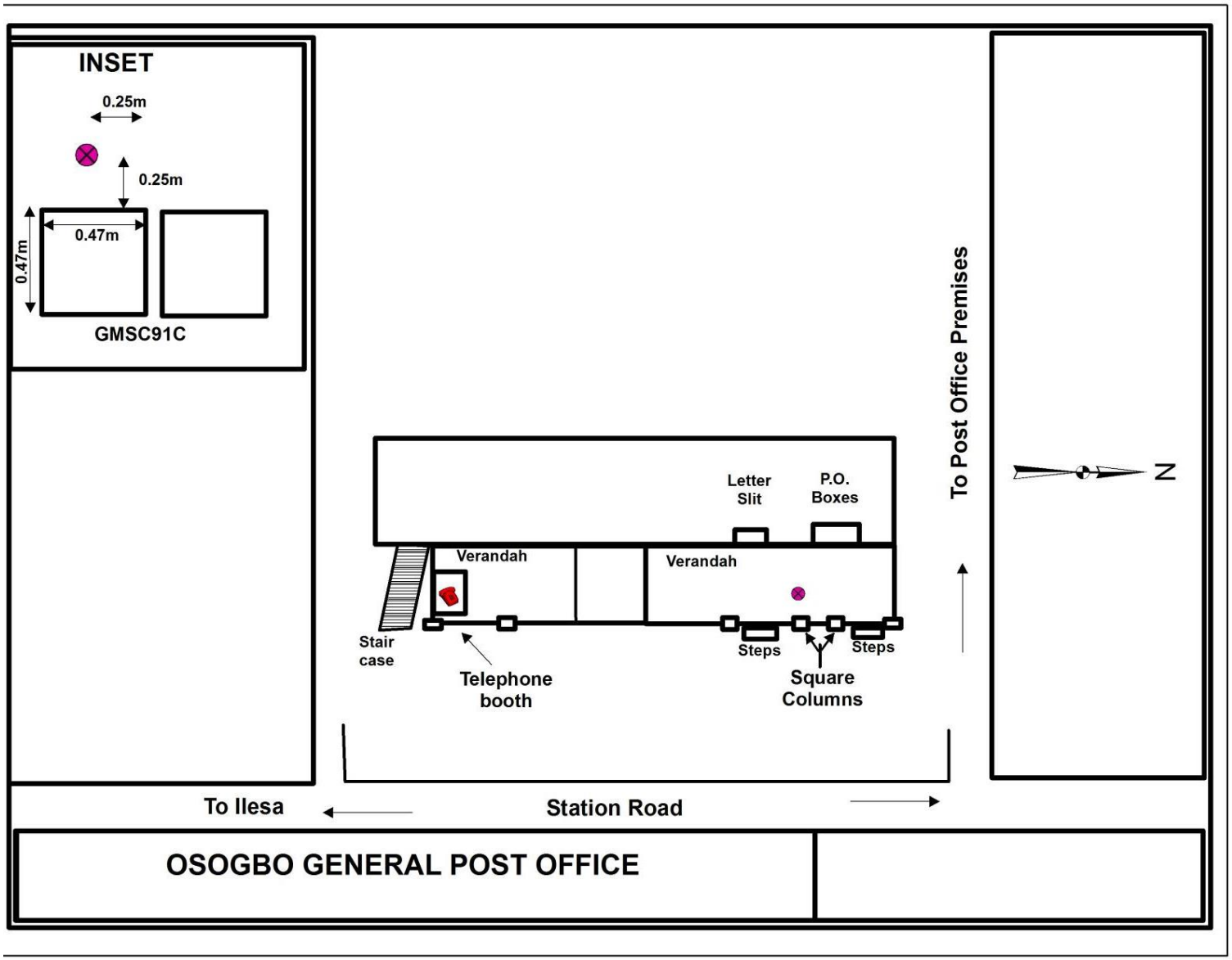
General Post Office Owo

Appendix 3

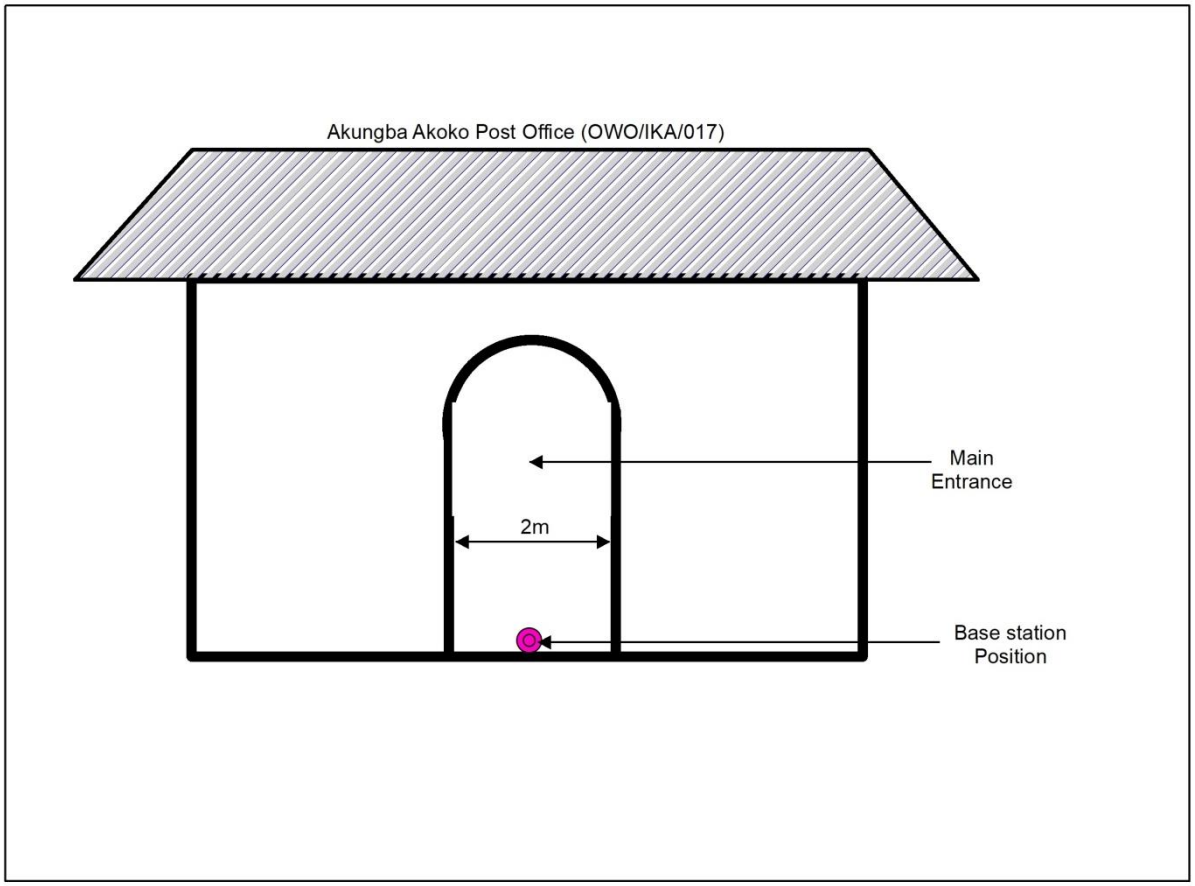
Synopsis of Base Stations



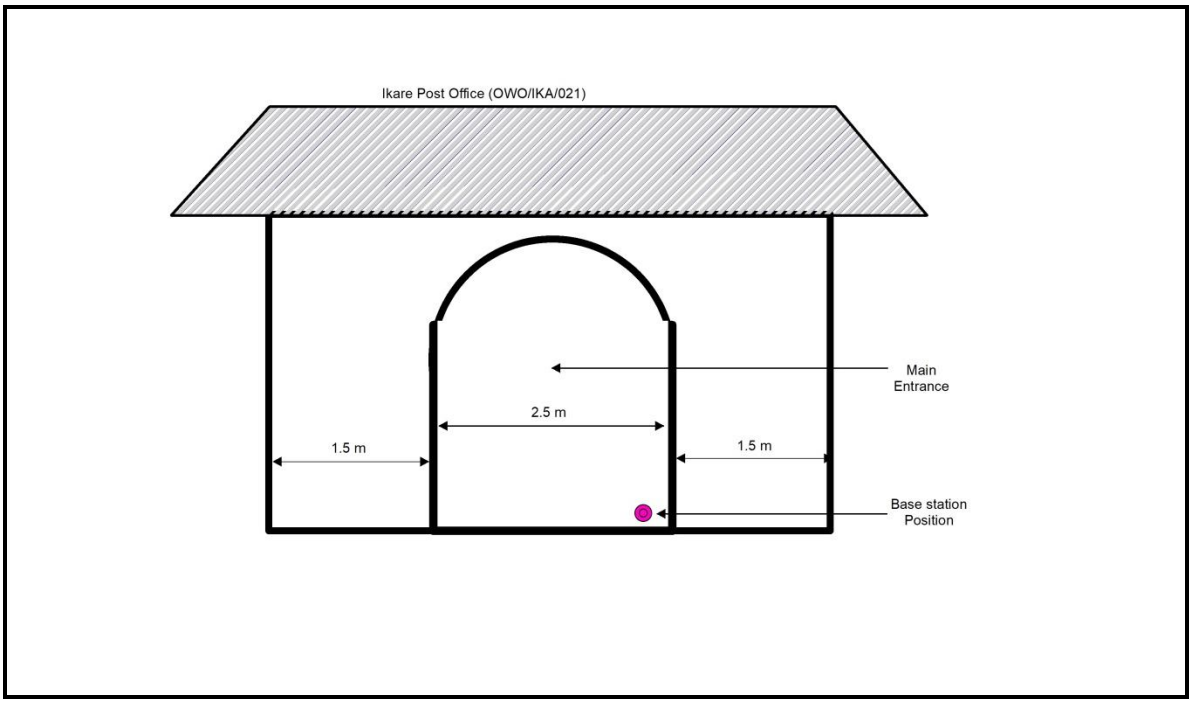
Synopsis of PGNN Base Station at St Peter's College, Akure.



Synopsis of PGNN Base station at General Post Office Oshogbo



Synopsis of PGNN Base station at Post Office Akungba Akoko



Synopsis of PGNN Base station at Post Office Ikare Akoko

Appendix 4

Raw Gravity Field Data

Date	Station ID	Station Description	Latitude	Longitude	GPS Elev	Raw Gravity	Time	Rock ID	Remark
11/17/2017	GMS088B	St Peter's Unity, Akure	7.25886	5.18462	334	1678.85	11:17		Open Loop
11/17/2017	GPSA49S	Along Idaure Road	7.2454	5.18997	337	1678.58	11:37		
11/17/2017	GPSA51S	Along Idaure Road	7.24037	5.18772	349	1678.87	11:44		
11/17/2017	GPSA53S	Along Idaure Road	7.23711	5.18597	357	1676.78	11:53		
11/17/2017	GPSA55S	Along Idaure Road	7.22933	5.18212	347	1678.09	11:59		
11/17/2017	GPSA57S	Along Idaure Road	7.22291	5.17945	343	1678.17	12:05		
11/17/2017	GPS60S	Along Idaure Road	7.21224	5.17329	338	1678.20	12:15		
11/17/2017	GPSA66S	Along Idaure Road	7.1918	5.15847	331	1680.73	12:24		
11/17/2017	GPSA68S	Along Idaure Road	7.18644	5.15599	322	1682.63	12:31		
11/17/2017	GPSA71S	Along Idaure Road	7.1783	5.14759	305	1685.55	12:40		
11/17/2017	GMS088B	St Peter's Unity, Akure	7.25886	5.18462	334	1678.83	13:15		Close/Open Loop
11/17/2017	GPSA72S	Aule Road	7.27075	5.1671	369	1684.01	13:35		
11/17/2017	GPSA75S	Aule Road	7.27223	5.16136	365	1685.28	13:43		
11/17/2017	GPSA77S	Aule Road	7.27364	5.1569	362	1684.19	13:47		
11/17/2017	GPSA79S	Aule Road	7.2743	5.15278	362	1680.26	13:54		
11/17/2017	FG 28	Aule Road	7.27593	5.1482	369	1679.57	14:02		
11/17/2017	FG 29	Aule Road	7.27593	5.14666	357	1680.70	14:09		
11/17/2017	GPSA81S	Agagu Road Off Aule	7.27121	5.16161	354	1685.44	14:26		
11/17/2017	GPSA83S	Agagu Road Off Aule	7.26041	5.16335	368	1678.84	14:31		
11/17/2017	GPSA85S	Agagu Road Off Aule	7.25569	5.16447	362	1679.58	14:41		
11/17/2017	GMS088B	St Peter's Unity, Akure	7.25886	5.18462	334	1678.79	15:02		Close/Open Loop
11/17/2017	GPSA46S		7.24638	5.19348	350	1678.27	15:15		
11/17/2017	GPSA45S	Hospital 1st Round About	7.24312	5.19246	350	1678.21	15:20		
11/17/2017	GPSA25S	Hospital 2nd RoundAbout	7.2399	5.19614	346	1677.78	15:27		
11/17/2017	GPSA29S	Olatuyi Round About	7.23343	5.19917	356	1675.65	15:34		
11/17/2017	GPSA31S	Ijoka Road	7.22975	5.19917	366	1673.85	15:42		
11/17/2017	GPSA33S	Ijoka Road	7.22333	5.19938	364	1673.58	15:49		
11/17/2017	GPSA35S	Ijoka Road	7.21747	5.19856	356	1674.90	15:53		
11/17/2017	GPSA38S	Ijoka Road	7.21227	5.20046	349	1676.27	15:58		
11/17/2017	GPSA40S	Ijoka Road	7.20781	5.20154	349	1675.63	16:05		
11/17/2017	GPSA42S	Ijoka Road	7.20317	5.20045	353	1674.76	16:11		
11/17/2017	GMS088B	St Peter's Unity, Akure	7.25886	5.18462	334	1678.83	16:36		Close Loop
11/18/2017	GMS088B	St Peter’s Unity Akure	7.25886	5.18462	334	1677.78	13:23		Open Loop
11/18/2017	GPSA72S	Mobil F/S, Ilesha Garage	7.27075	5.1671	359	1683.23	13.33		
11/18/2017	AKR/ILH/001	Akure-Ilesha Road	7.28849	5.16141	375	1680.16	13:41		
11/18/2017	AKR/ILH/002	Akure-Ilesha Road	7.30179	5.15114	363	1678.85	13:46		
11/18/2017	AKR/ILH/003	Akure-Ilesha Road	7.3093	5.13472	381	1671.78	13:55		
11/18/2017	AKR/ILH/004	Akure-Ilesha Road	7.31738	5.11925	369	1675.33	14:00		
11/18/2017	AKR/ILH/005	Akure-Ilesha Road	7.33582	5.10439	334	1680.38	14:06		
11/18/2017	AKR/ILH/006	Akure-Ilesha Road	7.35386	5.099	320	1684.05	14:17		
11/18/2017	AKR/ILH/007	Akure-Ilesha Road	7.37063	5.09371	326	1683.61	14:18		
11/18/2017	AKR/ILH/008	Akure-Ilesha Road	7.38405	5.08064	317	1685.26	14:23		
11/18/2017	AKR/ILH/009	Akure-Ilesha Road	7.39545	5.06631	343	1680.14	14:30		
11/18/2017	AKR/ILH/010	Akure-Ilesha Road	7.3998	5.04996	334	1681.69	14:34		
11/18/2017	AKR/ILH/011	Akure-Ilesha Road	7.40395	5.03123	355	1679.10	14:40		
11/18/2017	AKR/ILH/012	Akure-Ilesha Road	7.40384	5.01448	326	1682.06	14:46		
11/18/2017	AKR/ILH/013	Akure-Ilesha Road	7.41077	5.05515	349	1678.07	14:59		

11/18/2017	GMS088B	St Peters Unity Akure	7.25886	5.18462	334	1677.80	15:36		Close Loop
11/18/2017	AKR/ILH/013	Post Office Igbara Oke	7.41077	5.05515	349	1678.13	16:40		Open Loop
11/18/2017	IGB/IGB/001	Igbara Oke-Igbara Odo	7.42522	5.06132	350	1678.52	16:48		
11/18/2017	IGB/IGB/002	Igbara Oke-Igbara Odo	7.44307	5.06331	352	1679.68	16:59		
11/18/2017	IGB/IGB/003	Igbara Oke-Igbara Odo	7.46085	5.06441	378	1673.59	17:10		
11/18/2017	IGB/IGB/004	Igbara Oke-Igbara Odo	7.47903	5.06527	374	1673.19	17:17		
11/18/2017	IGB/IGB/005	Igbara Oke-Igbara Odo	7.50229	5.06679	359	1677.78	17:25		
11/18/2017	AKR/ILH/013	Post Office Igbara Oke	7.41077	5.05515	349	1678.09	17:59		Close Loop
11/19/2017	AKR/ILH/013	Post Office Igbara Oke	7.41077	5.05515	349	1677.34	7:54		Open Loop
11/19/2017	IGB/DAM/001	Owena Dam Rd	7.38389	5.05245	332	1680.38	8:09		
11/19/2017	IGB/DAM/002	Owena Dam Rd	7.37283	5.04141	344	1676.54	8:19		
11/19/2017	IGB/DAM/003	Owena Dam Rd	7.35945	5.03177	331	1677.73	8:28		
11/19/2017	IGB/DAM/004	Owena Dam Rd	7.34924	5.02063	334	1675.35	8:36		
11/19/2017	IGB/DAM/005	Owena Dam Rd	7.34169	5.00821	311	1679.56	8:52		
11/19/2017	IGB/DAM/006	Owena Dam Rd	7.34175	4.9908	304	1679.65	9:03		
11/19/2017	IGB/DAM/007	Owena Dam Rd	7.33933	4.97829	298	1680.27	9:14		
11/19/2017	AKR/ILH/013	Post Office Igbara Oke	7.41077	5.05515	349	1677.29	10:10		Close Loop
11/19/2017	AKR/ILH/005	Akure-Ilesha Rd/Eternal F/S	7.33582	5.10439	334	1679.44	13:30		Open Loop
11/19/2017	ILR/IPG/001	Ilara-Ipogun Rd	7.32799	5.08975	403	1667.93	13:37		
11/19/2017	ILR/IPG/002	Ilara-Ipogun Rd	7.31636	5.07852	326	1685.15	13:46		
11/19/2017	ILR/IPG/003	Ilara-Ipogun Rd	7.30381	5.07892	299	1689.63	13:56		
11/19/2017	AKR/ILH/005	Akure-Ilesha Road/Eternal F/S	7.33582	5.10439	334	1679.43	14:20		Close Loop
11/19/2017	GPSA72S	Mobil F/S, Ilesha Garage	7.27075	5.1671	359	1682.48	14:39		Open Loop
11/19/2017	AKR/IJR001	Akure-Ijare Road	7.30853	5.15711	364	1673.97	14:53		
11/19/2017	AKR/IJR002	Akure-Ijare Road	7.32324	5.16267	380	1668.67	15:04		
11/19/2017	AKR/IJR003	Akure-Ijare Road	7.34087	5.16551	383	1666.49	15:11		
11/19/2017	AKR/IJR004	General Post Office Ijare	7.36074	5.16852	401	1662.94	15:20		
11/19/2017	AKR/IJR005	Ayeson F/S	7.37607	5.15894	397	1664.16	15:28		
11/19/2017	AKR/IJR006	Akure-Ijare Road	7.39239	5.16021	374	1669.78	15:34		
11/19/2017	AKR/IJR007	Akure-Ijare Road	7.40886	5.15386	374	1672.17	15:41		
11/19/2017	AKR/IJR008	Akure-Ijare Road	7.42594	5.1491	383	1670.28	15:50		
11/19/2017	GPSA72S	Mobil F/S, Ilesha Garage	7.27075	5.1671	359	1682.47	16:32		Close Loop
11/20/2017	GMS088B	St Peters Unity Sch Akure	7.25886	5.18462	334	1676.47	12:08		Open Loop
11/20/2017	GMS088C	General Post Office Akure	7.25365	5.19412	341	1675.88	12:17		
11/20/2017	AKR/OGB/001	Akure-Ogbese Road	7.25112	5.21185	348	1673.65	12:25		
11/20/2017	AKR/OGB/002	Free-Man F/S	7.26082	5.22642	341	1672.73	12:30		
11/20/2017	AKR/OGB/003	Akure Ogbese Rd	7.26186	5.24469	331	1675.16	12:35		
11/20/2017	AKR/OGB/004	Akure Ogbese Rd	7.2609	5.26186	330	1675.35	12:43		
11/20/2017	AKR/OGB/005	Akure Ogbese Rd	7.2661	5.27919	333	1676.97	12:48		
11/20/2017	AKR/OGB/006	Akure Airport Gate	7.27505	5.29563	342	1675.45	12:53		
11/20/2017	AKR/OGB/007	New Road	7.27513	5.31308	341	1674.29	12:59		
11/20/2017	AKR/OGB/008		7.2738	5.33107	339	1673.97	13:04		
11/20/2017	AKR/OGB/009	Bolorunduro Junction	7.26999	5.34878	328	1676.14	13:09		
11/20/2017	AKR/OGB/010	Ogbese Road/Ayede	7.26108	5.36373	333	1674.97	13:15		
11/20/2017	AKR/OWO/001	Akure-Owo Road	7.27686	5.24248	346	1672.68	13:32		
11/20/2017	AKR/OWO/002	Ado-Owo-Akure By Total F/S	7.2816	5.22153	371	1666.68	13:43		
11/20/2017	GMS088B	St Peters Unity Sch Akure	7.25886	5.18462	334	1676.43	14:00		Close Loop
11/20/2017	AKR/OWO/002	Ado-Owo-Akure Junction	7.2816	5.22153	371	1666.66	14:27		Open Loop
11/20/2017	AKR/IKR/001	Igoba High Sch Akure	7.29576	5.23013	367	1669.41	14:37		

11/20/2017	AKR/IKR/002		7.31192	5.23479	342	1674.17	14:44		
11/20/2017	AKR/IKR/003		7.32688	5.24351	351	1674.45	14:50		
11/20/2017	AKR/IKR/004		7.34151	5.25007	358	1670.74	14:56		
11/20/2017	AKR/IKR/005	Ita-Gbolu	7.35914	5.24874	360	1671.66	15:01		
11/20/2017	AKR/IKR/006		7.37391	5.25084	339	1675.21	15:08		
11/20/2017	AKR/IKR/007		7.3876	5.2606	377	1670.90	15:15		
11/20/2017	AKR/IKR/008		7.39434	5.25922	368	1671.98	15:21		
11/20/2017	AKR/OWO/002	Ado-Owo-Akure Junction	7.2816	5.22153	371	1666.64	15:52		Close Loop
11/20/2017	AKR/OGB/001	Opp Chicken Repubic Akure	7.25112	5.21185	348	1673.66	16:08		Open Loop
11/20/2017	GPSA06S	Oda Road	7.23448	5.21404	362	1672.64	16:24		
11/20/2017	GPSA08S		7.22739	5.2151	349	1674.29	16:33		
11/20/2017	GPSA10S		7.22221	5.21939	358	1672.56	16:40		
11/20/2017	GPS 13S		7.21465	5.22088	351	1676.25	16:46		
11/20/2017	GPS 16S		7.2043	5.22627	347	1675.24	16:54		
11/20/2017	GPS A20S	Oda Road	7.18432	5.23105	336	1675.17	17:01		
11/20/2017	GPS A23S		7.17275	5.23387	339	1673.83	17:10		
11/20/2017	GPS A03S	Oba Ade	7.25157	5.20353	354	1675.29	17:37		
11/20/2017	AKR/OGB/001	Opp Chicken Repubic Akure	7.25112	5.21185	348	1673.71	17:46		Close Loop
11/21/2017	AKR/IKR/008	Roundabout	7.39434	5.25922	368	1671.69	8:48		Open Loop
11/21/2017	AKR/IKR/009	Iju-Ikere Road	7.40411	5.24495	359	1670.26	8:55		
11/21/2017	AKR/IKR/010	Ikere Road, Ekiti	7.42016	5.23782	374	1668.93	9:01		
11/21/2017	AKR/IKR/011	Gofamint Camp Road	7.43814	5.23296	389	1666.29	9:07		
11/21/2017	AKR/IKR/012	Ikere Road, Ekiti	7.45535	5.22931	381	1668.77	9:12		
11/21/2017	AKR/IKR/013	Ekiti State Rural Water Office	7.4725	5.22676	372	1671.83	9:17		
11/21/2017	AKR/IKR/014	Ikere Post Office	7.48989	5.23013	358	1675.62	9:25		
11/21/2017	AKR/IKR/015	By Fountain Oil Filling Station	7.50697	5.22906	369	1672.99	9:31		
11/21/2017	AKR/IKR/016	Ado Road Ikere	7.5238	5.22288	382	1668.06	9:38		
11/21/2017	AKR/IKR/017	Ado Road Ikere	7.54239	5.21916	372	1665.67	9:42		
11/21/2017	AKR/IKR/018	Ado Road Ikere	7.55844	5.21343	402	1657.51	9:47		
11/21/2017	AKR/IKR/019	Adegbemile Estate Ado Ekiti	7.57549	5.21223	400	1662.07	9:52		
11/21/2017	AKR/IKR/020	Ado Ekiti	7.59163	5.21835	413	1663.01	9:58		
11/21/2017	AKR/IKR/021	Ajilosun Area Ado-Ekiti	7.60879	5.22287	409	1663.82	10:03		
11/21/2017	AKR/IKR/022	Post Office Ado Ekiti	7.62178	5.22203	434	1660.43	10:20		
11/21/2017	AKR/IKR/008	Roundabout	7.39434	5.25922	368	1671.66	10:59		Close Loop
11/21/2017	AKR/IKR/014	Ikere Post Office	7.48989	5.23013	358	1675.53	11:24		Open Loop
11/21/2017	IKR/ISE/001	Ikere-Ise Road	7.49819	5.2484	375	1673.27	11:33		
11/21/2017	IKR/ISE/002	Ikere-Ise Road	7.48905	5.2641	339	1680.51	11:41		
11/21/2017	IKR/ISE/003	Ikere-Ise Road	7.48771	5.28081	347	1675.91	11:47		
11/21/2017	IKR/ISE/004	Ikere-Ise Road	7.47279	5.29056	362	1675.34	11:52		
11/21/2017	IKR/ISE/005	Ikere-Ise Road	7.46179	5.3027	345	1676.13	11:57		
11/21/2017	IKR/ISE/006	Ikere-Ise Road	7.45456	5.31781	326	1677.64	12:02		
11/21/2017	IKR/ISE/007	Ogbese-Ise Area	7.45759	5.33495	335	1674.84	12:07		
11/21/2017	IKR/ISE/008	Obada-Ise Ekiti	7.46137	5.35192	363	1669.45	12:14		
11/21/2017	IKR/ISE/009	Idi-Osan Ise Ekiti	7.46104	5.36905	360	1667.15	12:19		
11/21/2017	IKR/ISE/010	Afolu-Ise Ekiti Area	7.46124	5.38586	352	1668.13	12:25		
11/21/2017	IKR/ISE/011	Ise Ekiti	7.46436	5.40433	360	1667.57	12:29		
11/21/2017	IKR/ISE/012	Post Office Ise Ekiti	7.46484	5.42337	384	1662.68	12:38		
11/21/2017	AKR/IKR/014	Ikere Post Office	7.48989	5.23013	358	1675.43	13:16		Close/Open Loop
11/21/2017	IKR/IGB/001	St Stephen Church Ikere	7.49393	5.21262	372	1674.03	13:29		

11/21/2017	IKR/IGB/002	Ikere-Igbara Odo Road	7.49604	5.19489	366	1672.32	13:36		
11/21/2017	IKR/IGB/003	Opp College Of Education Ikere	7.49604	5.17767	380	1665.67	13:42		
11/21/2017	IKR/IGB/004	Ikere-Igbara Odo Road	7.50108	5.16156	389	1666.47	13:52		
11/21/2017	IKR/IGB/005	Ikere-Igbara Odo Road	7.50061	5.14444	396	1665.09	14:00		
11/21/2017	IKR/IGB/006	Ikere-Igbara Odo Road	7.49318	5.12963	399	1665.47	14:07		
11/21/2017	IKR/IGB/007	Ikere-Igbara Odo Road	7.49018	5.11382	433	1659.76	14:14		
11/21/2017	IKR/IGB/008	Ikere-Igbara Odo Road	7.49783	5.10001	371	1673.66	14:21		
11/21/2017	AKR/IKR/014	Ikere Post Office	7.48989	5.23013	358	1675.31	14:58		Close/Open Loop
11/21/2017	IKR/ILW/001	Ikere-Ilawe Road	7.51222	5.19409	369	1670.45	15:24		
11/21/2017	IKR/ILW/002	Ikere-Ilawe Road	7.52561	5.18189	371	1667.07	15:34		
11/21/2017	IKR/ILW/003	Ikere-Ilawe Road	7.53372	5.168	388	1666.12	15:45		
11/21/2017	IKR/ILW/004	Ikere-Ilawe Road	7.53324	5.15592	409	1661.65	15:51		
11/21/2017	AKR/IKR/014	Ikere Post Office	7.48989	5.23013	358	1675.32	16:37		Close Loop
11/22/2017	AKR/ILH/013	General Post Office Igbara Oke	7.41077	5.05515	349	1675.86	8:04		Open Loop
11/22/2017	IGB/IGB/005	Ikere-Igbara Odo Junction	7.50229	5.06679	359	1675.24	8:37		Open Loop
11/22/2017	IGB/ILW/001	Igbara Odo-Ilawe-Ado Road	7.51986	5.06952	364	1670.19	8:43		
11/22/2017	IGB/ILW/002	Igbara Odo-Ilawe-Ado Road	7.53371	5.07833	373	1669.79	8:49		
11/22/2017	IGB/ILW/003	Igbara Odo-Ilawe-Ado Road	7.55013	5.08791	387	1666.18	8:56		
11/22/2017	IGB/ILW/004	Igbara Odo-Ilawe-Ado Road	7.56422	5.09807	395	1664.28	9:01		
11/22/2017	IGB/ILW/005	Igbara Odo-Ilawe-Ado Road	7.58049	5.09878	431	1658.25	9:07		
11/22/2017	IGB/ILW/006	Ilawe Post Office	7.59977	5.10536	416	1659.10	9:17		
11/22/2017	IGB/ILW/007	Opp Crown Polythecnic Odo	7.60789	5.11611	512	1642.11	9:25		
11/22/2017	IGB/ILW/008	Odo, Ado Ekiti	7.61444	5.13207	521	1640.73	9:32		
11/22/2017	IGB/ILW/009	Odo, Ado Ekiti	7.61915	5.14908	500	1644.71	9:37		
11/22/2017	IGB/ILW/010	Odo, Ado Ekiti	7.61737	5.16562	522	1642.75	9:42		
11/22/2017	IGB/ILW/011	Ita Nla, Ado Ekiti	7.61584	5.18202	452	1654.65	9:48		
11/22/2017	IGB/ILW/012		7.61878	5.20133	441	1658.44	9:55		
11/22/2017	IGB/IGB/005	Igbara Odo-Ikere Junction	7.50229	5.06679	359	1675.27	10:30		Close/Open Loop
11/22/2017	IGB/IKG/001	Igbara Odo-Ikogosi Road	7.51615	5.05559	364	1670.84	10:42		
11/22/2017	IGB/IKG/002	Igbara Odo-Ikogosi Road	7.53248	5.04625	376	1669.57	10:48		
11/22/2017	IGB/IKG/003	Igbara Odo-Ikogosi Road	7.54544	5.03636	378	1666.62	10:53		
11/22/2017	IGB/IKG/004	Igbara Odo-Ikogosi Road	7.56034	5.02718	417	1656.99	10:58		
11/22/2017	IGB/IKG/005	Ikogosi Ekiti	7.57714	5.02215	415	1660.19	11:04		
11/22/2017	IGB/IKG/006	Ikogosi Ekiti	7.58968	5.01005	471	1647.83	11:10		
11/22/2017	IGB/IKG/007	Ikogosi Ekiti	7.59026	4.99211	463	1646.02	11:18		
11/22/2017	IKG/ILW/001	Ikogosi -Erijiyan-Ilawe Road	7.6056	5.00182	436	1657.40	11:26		
11/22/2017	IKG/ILW/002	Ikogosi -Erijiyan-Ilawe Road	7.60098	5.00917	426	1660.06	11:34		
11/22/2017	IKG/ILW/003	Ikogosi -Erijiyan-Ilawe Road	7.59598	5.02286	441	1655.81	11:39		
11/22/2017	IKG/ILW/004	Ikogosi -Erijiyan-Ilawe Road	7.5915	5.0403	405	1661.40	11:44		
11/22/2017	IKG/ILW/005	Ikogosi -Erijiyan-Ilawe Road	7.58494	5.05329	384	1666.52	11:51		
11/22/2017	IKG/ILW/006	Ikogosi -Erijiyan-Ilawe Road	7.58584	5.06726	409	1661.18	11:56		
11/22/2017	IKG/ILW/007	Ikogosi -Erijiyan-Ilawe Road	7.59205	5.08331	420	1659.98	12:02		
11/22/2017	IGB/IGB/005	Igbara Odo-Ikere Junction	7.50229	5.06679	359	1675.25	12:25		Close/Open Loop
11/22/2017	IGB/OGO/001	Ogotun Ekiti	7.50188	5.04918	374	1668.91	12:37		
11/22/2017	IGB/OGO/002	Ogotun Ekiti	7.4982	5.0324	384	1666.79	12:44		
11/22/2017	IGB/OGO/003	Ogotun Ekiti	7.50222	5.01704	351	1672.28	12:50		
11/22/2017	IGB/OGO/004	Ogotun Ekiti	7.50504	5.00111	360	1667.53	12:55		
11/22/2017	IGB/OGO/005	Ogotun Ekiti	7.50284	4.98373	366	1665.63	13:03		

11/22/2017	IGB/OGO/006	Ogotun Ekiti	7.49732	4.96639	427	1651.83	13:10		
11/22/2017	IGB/OGO/007	Osun State	7.50039	4.95335	503	1635.08	13:19		
11/22/2017	OGO/IPO/001	Ogotun-Ipole Road	7.52126	4.98332	365	1667.29	13:38		
11/22/2017	OGO/IPO/002	Ogotun-Ipole Road	7.53619	4.9746	380	1664.33	13:44		
11/22/2017	OGO/IPO/003	Ogotun-Ipole Road	7.55151	4.97219	387	1664.70	13:52		
11/22/2017	IGB/IGB/005	Igbara Odo-Ikere Junction	7.50229	5.06679	359	1675.18	14:25		Close Loop
11/22/2017	AKR/ILH/013	G.O.P Igbara Oke	7.41077	5.05515	349	1675.53	14:59		Close Loop
11/23/2017	AKR/OWO/002	Ado-Owo-Akure Junction Total Filling Station	7.2816	5.22153	371	1665.20	8:24		Open Loop
11/23/2017	AKR/OGB/010	Ogbese Road Beside F/S	7.26108	5.36373	333	1673.73	8:46		Open Loop
11/23/2017	OGB/OWO/001	Ogbese-Owo Road	7.26112	5.38366	306	1673.56	8:49		
11/23/2017	OGB/OWO/002	Ogbese-Owo Road	7.26715	5.40276	313	1672.21	9:03		
11/23/2017	OGB/OWO/003	Ogbese-Owo Road	7.27242	5.42248	315	1672.27	9:08		
11/23/2017	OGB/OWO/004	Ogbese-Owo Road	7.27049	5.44118	323	1670.80	9:13		
11/23/2017	OGB/OWO/005	Ogbese-Owo Road	7.26468	5.46323	331	1667.68	9:18		
11/23/2017	OGB/OWO/006	Ogbese-Owo Road	7.25943	5.48072	311	1672.25	9:22		
11/23/2017	OGB/OWO/007	Ogbese-Owo Road	7.24858	5.49716	299	1675.33	9:27		
11/23/2017	OGB/OWO/008	Ogbese-Owo Road	7.23755	5.51384	310	1671.63	9:33		
11/23/2017	OGB/OWO/009	Ogbese-Owo Road	7.23182	5.532	305	1672.91	9:38		
11/23/2017	OGB/OWO/010	Ogbese-Owo Road	7.22301	5.54688	307	1671.54	9:43		
11/23/2017	OGB/OWO/011	Ogbese-Owo Road	7.22034	5.56489	307	1671.70	9:49		
11/23/2017	OGB/OWO/012	Ogbese-Owo Road	7.22063	5.58259	317	1669.88	9:54		
11/23/2017	OGB/OWO/013	Owo Road	7.21895	5.60269	295	1674.75	10:04		
11/23/2017	OGB/OWO/014	Owo Post Office	7.1984	5.58505	346	1663.36	10:24		
11/23/2017	AKR/OGB/010	Ogbese Road	7.26108	5.36373	333	1673.74	10:55		Close Loop
11/23/2017	OGB/OWO/008	Emure Ile Junction By Judiciary Court Sign Post	7.23755	5.51384	310	1671.71	11:29		Open Loop
11/23/2017	EMU/EMU/001	Emure Ile-Emure Ekiti Rd	7.25514	5.51433	310	1672.52	11:42		
11/23/2017	EMU/EMU/002	Emure Ile-Emure Ekiti Rd	7.27204	5.50997	328	1668.70	11:50		
11/23/2017	EMU/EMU/003	Emure Ile-Emure Ekiti Rd	7.28656	5.50087	324	1670.63	11:59		
11/23/2017	EMU/EMU/004	Emure Ile-Emure Ekiti Rd	7.30301	5.50368	338	1665.71	12:08		
11/23/2017	EMU/EMU/005	Emure Ile-Emure Ekiti Rd	7.32052	5.50471	335	1667.44	12:18		
11/23/2017	EMU/EMU/006	Emure Ile-Emure Ekiti Rd	7.33773	5.5004	340	1665.88	12:28		
11/23/2017	EMU/EMU/007	Emure Ile-Emure Ekiti Rd	7.355	5.49761	341	1667.46	12:33		
11/23/2017	EMU/EMU/008	Emure Ile-Emure Ekiti Rd	7.37236	5.49564	333	1670.13	12:40		
11/23/2017	OGB/OWO/008	Emure Ile Junction By Judiciary Court Sign Post	7.23755	5.51384	310	1671.67	13:27		Close Loop
11/23/2017	OGB/OWO/013	Owo-Ifon Road Junction	7.21895	5.60269	295	1674.63	13:46		Open Loop
11/23/2017	OWO/IFO/001	Owo-Ifon Benin Road	7.20569	5.61517	305	1673.48	13:51		
11/23/2017	OWO/IFO/002	Owo-Ifon Benin Road	7.19002	5.62302	301	1674.08	13:56		
11/23/2017	OWO/IFO/003	Owo-Ifon Benin Road	7.1718	5.62409	314	1670.60	14:00		
11/23/2017	OWO/IFO/004	Owo-Ifon Benin Road	7.15612	5.63221	316	1670.45	14:05		
11/23/2017	OWO/IFO/005	Owo-Ifon Benin Road	7.13905	5.63801	295	1675.49	14:10		
11/23/2017	OWO/IFO/006	Owo-Ifon Benin Road	7.12925	5.65338	276	1679.31	14:15		
11/23/2017	OWO/IFO/007	Owo-Ifon Benin Road	7.11088	5.65811	251	1685.22	14:21		
11/23/2017	OWO/IFO/008	Owo-Ifon Benin Road	7.08986	5.66256	230	1687.85	14:25		
11/23/2017	OWO/IFO/009	Owo-Ifon Benin Road	7.07335	5.669	238	1685.70	14:31		
11/23/2017	OWO/IFO/010	Owo-Ifon Benin Road	7.06012	5.6803	227	1688.71	14:35		
11/23/2017	OWO/IFO/011	Owo-Ifon Benin Road	7.04479	5.6905	225	1688.42	14:39		
11/23/2017	OWO/IFO/012	Owo-Ifon Benin Road	7.02868	5.70114	223	1689.36	14:45		
11/23/2017	OWO/IFO/013	Owo-Ifon Benin Road	7.0155	5.71259	193	1695.08	14:49		

11/23/2017	OWO/IFO/014	Owo-Ifon Benin Road	7.00021	5.72179	191	1695.35	14:54		
11/23/2017	OWO/IFO/015	Owo-Ifon Benin Road	6.98483	5.73129	174	1699.52	14:58		
11/23/2017	OGB/OWO/013	Owo-Ifon Road Junction	7.21895	5.60269	295	1674.53	15:36		Close Loop
11/23/2017	AKR/OWO/002	Ado-Owo-Akure Junction Total Filling Station	7.2816	5.22153	371	1665.03	17:07		Close Loop
11/24/2017	AKR/OGB/001	Opp Chicken Republic Akure	7.25112	5.21185	348	1673.35	10:33		Open Loop
11/24/2017	AKR/IGT/001	Akure-Igbatoro Rd	7.2319	5.23077	353	1666.89	10:45		
11/24/2017	AKR/IGT/002	Akure-Igbatoro Rd	7.21929	5.24391	345	1669.22	10:54		
11/24/2017	AKR/IGT/003	Akure-Igbatoro Rd	7.20922	5.25741	332	1672.03	11:01		
11/24/2017	AKR/IGT/004	Akure-Igbatoro Rd	7.1948	5.26708	315	1675.94	11:10		
11/24/2017	AKR/IGT/005	Akure-Igbatoro Rd	7.17961	5.27543	319	1673.51	11:19		
11/24/2017	AKR/IGT/006	Akure-Igbatoro Rd	7.1716	5.29016	317	1673.96	11:27		
11/24/2017	AKR/IGT/007	Akure-Igbatoro Rd	7.16026	5.30432	301	1676.68	11:37		
11/24/2017	AKR/OGB/001	Opp Chicken Republic Akure	7.25112	5.21185	348	1673.53	12:28		Close Loop
11/25/2017	IGB/IGB/005	Ikere Junction Igbara-Odo	7.50229	5.06679	359	1673.77	8:25		Open Loop
11/25/2017	IGB/IKG/007	Ikogosi Ekiti	7.59026	4.99211	463	1644.61	8:54		Open Loop
11/25/2017	IKG/IPL/001	Ikogosi-Ipole Rd	7.58862	4.97496	539	1629.48	9:03		Weathered Quartzite
11/25/2017	IKG/IPL/002	Ikogosi-Ipole Rd	7.5929	4.96197	430	1657.02	9:16		
11/25/2017	IKG/IPL/003	Ikogosi-Ipole Rd	7.59176	4.9457	394	1665.96	9:22		
11/25/2017	IKG/IPL/004	Ikogosi-Waterfall Rd	7.58097	4.93456	440	1652.57	9:32		
11/25/2017	IKG/IPL/005	Ikogosi-Waterfall Rd	7.56463	4.92846	437	1653.28	9:38		
11/25/2017	IPL/EFY/001	Ipole-Efon Rd	7.61046	4.94118	409	1660.87	9:52		
11/25/2017	IPL/EFY/002	Ipole-Efon Rd	7.62857	4.93972	411	1660.38	9:58		By Iwaji Town Hall
11/25/2017	IPL/EFY/003	Ipole-Efon Rd	7.64733	4.93783	457	1649.66	10:04		
11/25/2017	IPL/EFY/004	Ipole-Efon Rd	7.66521	4.94122	435	1656.82	10:09		
11/25/2017	IPL/EFY/005	Efon Alaye Town	7.68115	4.93404	487	1646.66	10:15		
11/25/2017	IPL/EFY/006	Efon Alaye Town	7.67548	4.92301	498	1644.36	10:22		
11/25/2017	IPL/EFY/007	Post Office Efon Alaye	7.65191	4.92155	532	1636.29	10:33		
11/25/2017	IGB/IKG/007	Ikogosi Ekiti	7.59026	4.99211	463	1644.69	11:05		
11/25/2017	IGB/IKG/007	Ikogosi Ekiti	7.59026	4.99211	463	1644.69	11:05		
11/25/2017	IKG/ARA/001	Erijiyam-Aramoko Rd	7.62792	5.0075	487	1648.08	11:20		
11/25/2017	IKG/ARA/002	Erijiyam-Aramoko Rd	7.64461	5.00616	527	1638.70	11:26		
11/25/2017	IKG/ARA/003	Erijiyam-Aramoko Rd	7.65878	5.01493	508	1644.04	11:35		
11/25/2017	IKG/ARA/004	Erijiyam-Aramoko Rd	7.67109	5.02749	478	1651.62	11:43		
11/25/2017	IKG/ARA/005	Erijiyam-Aramoko Rd	7.68505	5.039	484	1650.32	11:52		
11/25/2017	IKG/ARA/006	Aramoko Post Office	7.70661	5.04105	454	1655.88	12:07		
11/25/2017	ARA/EFY/001	Aramoko Efon Rd	7.71761	5.02957	524	1641.59	12:16		
11/25/2017	ARA/EFY/002	Aramoko Efon Rd	7.72738	5.01669	505	1641.77	12:22		Erio Ekiti
11/25/2017	IGB/IKG/007	Ikogosi Ekiti	7.59026	4.99211	463	1644.72	13:05		
11/25/2017	IGB/ILW/006	Ilawe Post Office	7.59977	5.10536	416	1657.47	14:33		
11/25/2017	ILW/IGD/001	Ilawe Igede Rd	7.6169	5.10956	485	1645.98	14:42	37	
11/25/2017	ILW/IGD/002	Ilawe Igede Rd	7.63484	5.10594	575	1626.25	14:51		
11/25/2017	ILW/IGD/003	Ilawe Igede Rd	7.65124	5.11974	575	1628.86	14:56		
11/25/2017	ILW/IGD/004	Ilawe Ado Jctn/Igede Close To Ekiti Baptist High School	7.66863	5.12621	571	1628.39	15:08		
11/25/2017	IGD/ARA/001	Igede Aramoko Rd	7.67488	5.10969	566	1628.32	15:15		
11/25/2017	IGD/ARA/002	Igede Aramoko Rd	7.68661	5.09098	498	1643.04	15:23		
11/25/2017	IGD/ARA/003	Igede Aramoko Rd	7.68937	5.07312	483	1646.80	15:28		
11/25/2017	IGD/ARA/004	Igede Aramoko Rd	7.69978	5.05877	447	1655.55	15:34		

11/25/2017	IGD/ARA/005 (IKG/ARA/006)	Aramoko Post Office	7.70661	5.04105	454	1655.90	15:44		Tie Point
11/25/2017	IGB/ILW/006	Ilawe Post Office	7.59977	5.10536	416	1657.71	16:25		Close Loop
11/25/2017	IGB/ILW/006	Ilawe Post Office	7.59977	5.10536	416	1657.71	16:25		Close Loop
11/25/2017	IKR/ILW/007	Ikere Ilawe Rd	7.58338	5.11274	428	1658.69	16:36		
11/25/2017	IKR/ILW/006	Ikere Ilawe Rd	7.56673	5.11762	418	1661.14	16:46		
11/25/2017	IKR/ILW/005	Ikere Ilawe Rd	7.55398	5.12831	425	1660.19	16:58		
11/25/2017	IGB/ILW/006	Ilawe Post Office	7.59977	5.10536	416	1657.69	17:22		Close Loop
11/25/2017	IGB/IGB/005	Ikere Jnctn Igbara Odo	7.50229	5.06679	359	1673.82	17:39		Close Loop
11/27/2017	GMS088B	St. Peter Unity College Akure	7.25886	5.18462	334	1673.47	9:46		Open Loop
11/27/2017	AKR/OND/001	Beside Teejay Ass F/S at Akure Ondo Rd	7.25111	5.17052	326	1677.18	9:57		
11/27/2017	AKR/OND/002	Akure Ondo Rd	7.25046	5.15254	324	1678.65	10:03		
11/27/2017	AKR/OND/003	Akure Ondo Rd	7.25118	5.13449	362	1669.15	10:08		
11/27/2017	AKR/OND/004	Close To Prison Service	7.24175	5.1187	313	1679.62	10:13		
11/27/2017	AKR/OND/005	Along Akure Ondo Rd	7.23262	5.10176	304	1682.30	10:18		
11/27/2017	AKR/OND/006	Along Akure Ondo Rd	7.23173	5.08448	285	1685.95	10:22		
11/27/2017	AKR/OND/007	Aponmu Jnct., Akure Ondo Rd	7.22837	5.06509	273	1687.32	10:27		
11/27/2017	AKR/OND/008	Akure Ondo Rd	7.21968	5.05161	265	1688.93	10:32		
11/27/2017	AKR/OND/009	Akure Ondo Rd	7.20458	5.03964	263	1688.65	10:38		
11/27/2017	AKR/OND/010	Offset To Owena Town	7.19048	5.02792	261	1688.27	10:50		
11/27/2017	AKR/OND/011	Akure Ondo Rd	7.19716	5.01947	249	1690.88	10:55		
11/27/2017	AKR/OND/012	Akure Ondo Rd	7.18632	5.00632	245	1690.84	11:04	39	
11/27/2017	AKR/OND/013	Akure Ondo Rd	7.17835	4.99174	272	1684.83	11:11		
11/27/2017	AKR/OND/014	Akure Ondo Rd	7.1699	4.97542	272	1683.70	11:16	40	
11/27/2017	AKR/OND/015	Akure Ondo Rd	7.16864	4.95848	266	1684.16	11:23		
11/27/2017	GMS088B	St. Peter Unity College Akure	7.25886	5.18462	334	1673.44	11:55		Close Loop
11/27/2017	AKR/OND/010	Owena Town Local Govt. Sec.	7.19048	5.02792	261	1688.34	12:31		Open Loop
11/27/2017	OWN/IDN/001	Owena Idanre Rd	7.17643	5.0373	263	1690.14	12:37	41	
11/27/2017	OWN/IDN/002	Owena Idanre Rd	7.16914	5.05171	246	1693.53	12:48		
11/27/2017	OWN/IDN/003	Owena Idanre Rd	7.15902	5.06712	246	1692.87	12:56		
11/27/2017	OWN/IDN/004	Owena Idanre Rd	7.15605	5.08408	284	1683.79	13:02	42	
11/27/2017	OWN/IDN/005	Idanre Town	7.1405	5.10071	297	1679.72	13:20	44	
11/27/2017	IDN/AKR/001	Idanre Akure Rd	7.15329	5.1136	302	1679.83	13:31		
11/27/2017	IDN/AKR/002	Idanre Akure Rd	7.16323	5.12778	308	1678.60	13:38		
11/27/2017	AKR/OND/010	Owena Town Local Govt. Sec.	7.19048	5.02792	261	1688.35	14:05		Close Loop
11/27/2017	AKR/OND/015	CCC Orisun Ibukun	7.16864	4.95848	266	1684.24	14:41		Open Loop
11/27/2017	AKR/OND/016	Akure Ondo Rd	7.16723	4.94072	267	1684.22	14:47		
11/27/2017	AKR/OND/017	Akure Ondo Rd	7.16085	4.92	251	1686.78	14:53		
11/27/2017	AKR/OND/018	Akure Ondo Rd	7.15157	4.90285	261	1681.76	14:59		
11/27/2017	AKR/OND/019	Akure Ondo Rd	7.13806	4.89023	241	1685.08	15:03		
11/27/2017	AKR/OND/020	Ondo Town	7.1281	4.87516	264	1679.64	15:09		
11/27/2017	AKR/OND/021	Ondo Town	7.11717	4.86142	235	1684.62	15:15	45	
11/27/2017	AKR/OND/022	Beside Akiavic Hotel Ondo	7.11109	4.8455	263	1677.58	15:25		
11/27/2017	AKR/OND/023	Ondo Town	7.10687	4.82758	255	1679.38	15:30		Ondo
11/27/2017	AKR/OND/024	Ondo Town	7.09148	4.82136	241	1682.33	15:37		
11/27/2017	OND/ORE/001	Ondo-Ore Rd	7.07517	4.82697	241	1684.23	15:45		
11/27/2017	OND/ORE/002	Ondo-Ore Rd	7.06462	4.84296	256	1680.10	15:52		
11/27/2017	OND/ORE/003	Ondo-Ore Rd	7.04692	4.83772	223	1687.14	15:58		
11/27/2017	OND/ORE/004	Ondo-Ore Rd	7.03009	4.8377	203	1690.80	16:03		

11/27/2017	OND/ORE/005	Ondo-Ore Rd	7.01277	4.83538	190	1693.23	16:07		
11/27/2017	OND/ORE/006	Ondo-Ore Rd	6.99808	4.84305	200	1689.48	16:13		Igbado Village
11/27/2017	AKR/OND/015	Akure Ondo Rd	7.16864	4.95848	266	1684.16	16:54		Close Loop
11/28/2017	AKR/OND/015	Akure Ondo Rd	7.16864	4.95848	266	1683.89	8:04		Open Loop
11/28/2017	AKR/OND/024	200m From 1st Bank, Ore road Ondo	7.09148	4.82136	241	1681.89	9:04		Openloop
11/28/2017	OND/IFE/001	Ondo Ife Rd	7.11465	4.80747	245	1682.15	9:18		
11/28/2017	OND/IFE/002	Ondo Ife Rd	7.12472	4.79407	255	1681.65	9:23		
11/28/2017	OND/IFE/003	Ondo Ife Rd	7.13139	4.77858	251	1683.34	9:28		
11/28/2017	OND/IFE/004	Ondo Ife Rd	7.1403	4.76185	226	1688.71	9:33		
11/28/2017	OND/IFE/005	Ondo Ife Rd	7.15103	4.7478	226	1689.58	9:38		
11/28/2017	OND/IFE/006	Ondo Ife Rd	7.15589	4.72896	214	1693.70	9:44		
11/28/2017	OND/IFE/007	Ondo Ife Rd	7.16562	4.72024	209	1695.99	9:49		
11/28/2017	OND/IFE/008	Ondo Ife Rd	7.17875	4.70877	230	1691.54	9:54		
11/28/2017	AKR/OND/024	200m From 1st Bank, Ore road Ondo	7.09148	4.82136	241	1681.90	10:40		Close Loop/ Open
11/28/2017	OND/EGB/001	Ondo Egbure Oba Rd	7.07367	4.80666	212	1686.25	10:50		
11/28/2017	OND/EGB/002	Ondo Egbure Oba Rd	7.06396	4.79292	232	1684.17	10:57		
11/28/2017	OND/EGB/003	Ondo Egbure Oba Rd	7.06192	4.77519	225	1686.52	11:08		
11/28/2017	OND/EGB/004	Ondo Egbure Oba Rd	7.05047	4.76341	223	1685.71	11:16		
11/28/2017	OND/EGB/005	Ondo Egbure Oba Rd	7.0451	4.74563	246	1680.20	11:26		
11/28/2017	OND/EGB/006	Ondo Egbure Oba Rd	7.04358	4.72887	224	1686.26	11:33		
11/28/2017	OND/EGB/007	Ondo Egbure Oba Rd	7.03278	4.71452	223	1687.40	11:42		
11/28/2017	OND/EGB/008	Ondo Egbure Oba Rd	7.02901	4.69809	200	1691.95	11:49		
11/28/2017	AKR/OND/024	200m From 1st Bank, Ore road Ondo	7.09148	4.82136	241	1681.95	12:36		Close/Open
11/28/2017	OND/OND/001	Ondo Town	7.08723	4.83714	266	1678.90	12:51		
11/28/2017	AKR/OND/024	200m From 1st Bank, Ore road Ondo	7.09148	4.82136	241	1681.96	13:10		Close/Open
11/28/2017	OND/ILO/001	Ondo-Ile Oluji Rd	7.14529	4.86335	275	1677.52	13:29	49	
11/28/2017	OND/ILO/002	Ondo-Ile Oluji Rd	7.16651	4.8616	260	1680.46	13:37		
11/28/2017	OND/ILO/003	Ondo-Ile Oluji Rd	7.1849	4.86444	266	1680.04	13:41		
11/28/2017	OND/ILO/004	Ondo-Ile Oluji Rd	7.20188	4.85804	249	1685.09	13:46		
11/28/2017	OND/ILO/005	Ondo-Ile Oluji Rd	7.21909	4.86315	241	1685.76	13:53		
11/28/2017	OND/ILO/006	Ondo-Ile Oluji Rd	7.23649	4.87056	252	1683.66	13:57		
11/28/2017	OND/ILO/007	Ondo-Ile Oluji Rd	7.2534	4.86965	242	1686.49	14:02		
11/28/2017	OND/ILO/008	Ondo-Ile Oluji Rd	7.27201	4.87175	245	1686.35	14:06		
11/28/2017	OND/ILO/009	Ondo-Ile Oluji Rd	7.28948	4.87452	261	1683.71	14:12		
11/28/2017	OND/ILO/010	Ondo-Ile Oluji Rd	7.30699	4.87818	262	1682.68	14:16		
11/28/2017	OND/ILO/011	Ondo-Ile Oluji Rd	7.32342	4.88588	262	1677.54	14:22		
11/28/2017	OND/ILO/012	Ondo-Ile Oluji Rd	7.33993	4.89416	275	1678.40	14:27		
11/28/2017	OND/ILO/013	Ondo-Ile Oluji Rd	7.35788	4.89195	276	1679.21	14:32		
11/28/2017	OND/ILO/014	Ondo-Ile Oluji Rd	7.3782	4.89269	285	1676.05	14:38		
11/28/2017	AKR/OND/024	200m From 1st Bank, Ore road Ondo	7.09148	4.82136	241	1681.99	15:27		Close Loop
11/28/2017	AKR/OND/015	CCC Orisun Ibukun	7.16864	4.95848	266	1683.99	15:51		Close Loop/Open
11/28/2017	BRD/FAG/001	Bolorunduro	7.15377	4.9657	263	1692.77	16:02		
11/28/2017	BRD/FAG/002	Bolorunduro	7.1385	4.97194	256	1690.69	16:08		
11/28/2017	BRD/FAG/003	Bolorunduro	7.12315	4.97189	243	1691.77	16:22		
11/28/2017	BRD/FAG/004	Fagbohun Town	7.1027	4.97169	229	1693.69	16:32		

11/28/2017	AKR/OND/015	CCC Orisun Ibukun	7.16864	4.95848	266	1683.93	17:02		Close Loop
11/29/2017	GPSA715	Close To Min Of Agric Tree Crop Unit Alade Idanre	7.1783	5.14759	304	1679.43	8:45		Open Loop
11/29/2017	OWN/IDR/005	Post Office Idanre	7.1405	5.10071	297	1678.77	9:06		Open Loop
11/29/2017	IDR/IDR/001	Alade Idanre Atosin Idanre Road	7.12473	5.1054	327	1664.99	9:16	51	
11/29/2017	IDR/IDR/002	Alade Idanre Atosin Idanre Road	7.11022	5.10866	318	1667.40	9:27		
11/29/2017	IDR/IDR/003	Alade Idanre Atosin Idanre Road	7.10908	5.09143	279	1673.84	9:39		
11/29/2017	IDR/IDR/004	Alade Idanre Atosin Idanre Road	7.11119	5.07408	270	1678.74	9:50		
11/29/2017	IDR/IDR/005	Alade Idanre Atosin Idanre Road	7.10692	5.0563	245	1685.53	10:02		
11/29/2017	IDR/IDR/006	Alade Idanre Atosin Idanre Road	7.10562	5.03793	233	1689.62	10:13		
11/29/2017	IDR/IDR/007	Alade Idanre Atosin Idanre Road	7.0972	5.02153	237	1690.13	10:27		
11/29/2017	OWN/IDR/005	Post Office Idanre	7.1405	5.10071	297	1678.83	11:14		Close/Open
11/29/2017	OWN/IDR/005	Post Office Idanre	7.1405	5.10071	297	1678.83	11:14		Close/Open
11/29/2017	IDA/OMI/001	Idanre Onifunfun Rd	7.1098	5.12715	310	1671.09	11:30		
11/29/2017	IDA/OMI/002	Idanre Onifunfun Rd	7.10106	5.14168	302	1674.32	11:40		
11/29/2017	IDA/OMI/003	St James Ang.Church Opasorun Idanre	7.08598	5.14861	283	1678.46	11:49		
11/29/2017	IDA/OMI/004	Idanre Onifunfun Rd	7.0727	5.14639	290	1676.39	12:00		
11/29/2017	IDA/OMI/005	Idanre Onifunfun Rd	7.05534	5.15533	296	1675.48	12:09		
11/29/2017	IDA/OMI/006	Idanre Onifunfun Rd	7.04094	5.16004	301	1675.71	12:18	52	Legbira
11/29/2017	IDA/OMI/007	Idanre Onifunfun Rd	7.02704	5.17063	229	1691.57	12:34		
11/29/2017	IDA/OMI/008	Idanre Onifunfun Rd	7.01502	5.18383	232	1691.16	12:44		
11/29/2017	OWN/IDR/005	Post Office Idanre	7.1405	5.10071	297	1678.89	13:36		Close/Open
11/29/2017	OWN/IDR/005	Post Office Idanre	7.1405	5.10071	297	1678.89	13:36		Close/Open
11/29/2017	IDR/ALA/001	Idanre Ala Rd	7.09747	5.16572	294	1678.60	14:25		
11/29/2017	IDR/ALA/002	Idanre Ala Rd	7.0938	5.18386	289	1682.36	14:36		Ajebandele
11/29/2017	IDR/ALA/003	Idanre Ala Rd	7.09038	5.20038	287	1683.71	14:48		
11/29/2017	OWN/IDR/005	Post Office Idanre	7.1405	5.10071	297	1678.87	15:42		Close/Open
11/30/2017	AKR/OGB/010	Ogbese Beside F/S	7.26108	5.36373	333	1670.82	8:52		Open Loop
11/30/2017	OGB/OWO/003	Uso Grammer School	7.27242	5.42248	315	1669.64	9:03		Open Loop
11/30/2017	USO/ISE/001	Uso-Ise Road	7.28653	5.4217	315	1670.45	9:18		
11/30/2017	USO/ISE/002	Uso-Ise Road	7.30247	5.41766	324	1668.47	9:25		
11/30/2017	USO/ISE/003	Uso-Ise Road	7.31976	5.41893	328	1668.83	9:33		
11/30/2017	USO/ISE/004	Uso-Ise Road	7.33738	5.41969	339	1665.24	9:40		
11/30/2017	USO/ISE/005	Uso-Ise Road	7.35372	5.4147	344	1666.25	9:46		
11/30/2017	USO/ISE/006	Uso-Ise Road	7.37134	5.41738	353	1661.70	9:53		
11/30/2017	USO/ISE/007	Uso-Ise Road	7.38668	5.42519	351	1662.56	10:00		
11/30/2017	USO/ISE/008	Uso-Ise Road	7.40279	5.41674	350	1664.21	10:12		
11/30/2017	USO/ISE/009	Uso-Ise Road	7.41764	5.42134	361	1661.12	10:20		
11/30/2017	OGB/OWO/003	Uso Grammer School	7.27242	5.42248	315	1669.65	11:01		Close Loop
11/30/2017	AKR/OGB/010	Ogbese Beside F/S	7.26108	5.36373	333	1670.87	11:23		Open Loop
11/30/2017	OGB/ALA/001	Ogbese Ala Rd	7.24289	5.38127	315	1670.12	11:38		
11/30/2017	OGB/ALA/002	Ogbese Ala Rd	7.22537	5.38033	316	1670.18	11:48		
11/30/2017	OGB/ALA/003	Ogbese Ala Rd	7.20882	5.37644	324	1668.75	11:56		
11/30/2017	OGB/ALA/004	Ogbese Ala Rd	7.19133	5.37373	324	1668.26	12:08		
11/30/2017	OGB/ALA/005	Ogbese Ala Rd	7.17436	5.37602	308	1672.72	12:16		Elejoka
11/30/2017	AKR/OGB/010	Ogbese Beside F/S	7.26108	5.36373	333	1670.83	12:59		Close Loop
11/30/2017	GPSA23S	Pillar Beside Winners Oda Town	7.17275	5.23387	339	1669.61	15:15		Open Loop
11/30/2017	ODA/ALA/001	Oda-Ala Road	7.16194	5.24815	305	1675.60	15:25		
11/30/2017	ODA/ALA/002	Oda-Ala Road	7.14518	5.24453	318	1670.78	15:39	57	

11/30/2017	ODA/ALA/003	Oda-Ala Road	7.13339	5.25836	282	1677.84	15:48		
11/30/2017	ODA/ALA/004	Oda-Ala Road	7.1212	5.26869	276	1679.05	15:56		
11/30/2017	ODA/ALA/005	By Holy Trinity Church Oda Cocoa Board	7.10717	5.27842	275	1678.31	16:06		
11/30/2017	ODA/ALA/006	Oda-Ala Road	7.0924	5.28652	299	1672.53	16:21		
11/30/2017	GPSA23S	Pillar Beside Winners Oda Town	7.17275	5.23387	339	1669.60	16:59		Close Loop
12/1/2017	IGD/ARA/005	Aramoko Post Office	7.70661	5.04105	454	1653.54	8:48		Open Loop
12/1/2017	ARA/EFY/003	Aramoko-Efon Alaye Rd	7.73405	5.00087	461	1648.88	9:08		
12/1/2017	ARA/EFY/004	Aramoko-Efon Alaye Rd	7.7342	4.98071	431	1661.28	9:14		
12/1/2017	ARA/EFY/005	Aramoko-Efon Alaye Rd	7.73313	4.96423	426	1662.60	9:19		
12/1/2017	ARA/EFY/006	Itawure Jnctn	7.72517	4.94961	435	1658.63	9:25		
12/1/2017	ARA/EFY/007	Outskirt Of Efon Town	7.70915	4.94042	476	1649.49	9:32		
12/1/2017	ITA/OKM/001	Itawure-Okemesi Rd	7.74226	4.94674	474	1650.56	9:41		
12/1/2017	ITA/OKM/002	Itawure-Okemesi Rd	7.7596	4.94774	459	1654.06	9:46		
12/1/2017	ITA/OKM/003	Health Care Service Aladua Community	7.77546	4.94479	435	1660.49	9:51		
12/1/2017	ITA/OKM/004	Itawure-Okemesi Rd	7.7937	4.94008	429	1661.29	9:57		
12/1/2017	ITA/OKM/005	Itawure-Okemesi Rd	7.80959	4.93254	425	1662.67	10:02		
12/1/2017	ITA/OKM/006	St Paul African Church Okemesi	7.82511	4.92387	394	1671.15	10:08		
12/1/2017	ITA/OKM/007	Okemesi Grammar School	7.8367	4.91423	372	1676.14	10:17		
12/1/2017	IGD/ARA/005	Aramoko Post Office	7.70661	5.04105	454	1653.56	10:56		Close Loop
12/1/2017	IGD/ARA/005	Aramoko Post Office	7.70661	5.04105	454	1653.58	11:22		Open Loop
12/1/2017	ARA/IJE/001	Aramoko-Ijero Rd	7.72238	5.05185	441	1655.36	11:30		
12/1/2017	ARA/IJE/002	Aramoko-Ijero Rd	7.74043	5.05563	436	1657.09	11:36		
12/1/2017	ARA/IJE/003	Aramoko-Ijero Rd	7.75847	5.04753	448	1657.29	11:42		
12/1/2017	ARA/IJE/004	Aramoko-Ijero Rd	7.77752	5.04354	415	1664.53	11:48		
12/1/2017	ARA/IJE/005	Near Ade Babade Block Industry Ijero Ekiti	7.78811	5.05338	414	1664.16	11:52		
12/1/2017	ARA/IJE/006	Aramoko-Ijero Rd	7.80253	5.06453	442	1658.48	12:00		
12/1/2017	ARA/IJE/007	Aramoko-Ijero Rd	7.8174	5.06888	496	1647.96	12:10		Ijero Post Office
12/1/2017	IJE/IPT/001	Ijero High Schl Ijero Ekiti	7.83567	5.06793	529	1640.46	12:22		
12/1/2017	IJE/IPT/002	Ijero Ipoti Rd	7.85485	5.06648	527	1643.71	12:29		
12/1/2017	IJE/IPT/003	Ijero Ipoti Rd	7.87036	5.06981	581	1733.77	12:36		Ipoti Ekiti
12/1/2017	IJE/IPT/004	Ipoti High Schl Ipoti Ekiti	7.87177	5.08561	559	1734.33	12:44		
12/1/2017	IGD/ARA/005	Aramoko Post Office	7.70661	5.04105	454	1653.67	13:19		Close Loop
12/1/2017	ARA/IJE/007	Ijero Post Office	7.8174	5.06888	496	1647.98	14:13		Open Loop
12/1/2017	IJE/OKM/001	Ijero – Okeimesi road	7.83459	5.04942	498	1645.61	14:20		Ikoro
12/1/2017	IJE/OKM/002	Ijero – Okeimesi road	7.84631	5.038	442	1656.44	14:26		
12/1/2017	IJE/OKM/003	Ijero – Okeimesi road	7.84415	5.02088	414	1663.52	14:31		
12/1/2017	IJE/OKM/004	Ijero – Okeimesi road	7.85011	5.00504	408	1667.87	14:36		
12/1/2017	IJE/OKM/005	Ijero – Okeimesi road	7.85774	4.99033	427	1666.76	14:41		
12/1/2017	IJE/OKM/006	Ijero – Okeimesi road	7.87113	4.97392	418	1669.87	14:47		
12/1/2017	IJE/OKM/007	Ijero – Okeimesi road	7.87299	4.95887	422	1666.13	14:52		
12/1/2017	IJE/OKM/008	Ijero – Okeimesi road	7.87761	4.94539	379	1674.43	14:57		
12/1/2017	IJE/OKM/009	Ijero – Okeimesi road	7.89023	4.92951	382	1675.75	15:02		
12/1/2017	IJE/OKM/010	Ijero – Okeimesi road	7.8749	4.91918	411	1668.49	15:07		
12/1/2017	IJE/OKM/011	Ijero – Okeimesi road	7.85558	4.91407	408	1671.27	15:13		
12/1/2017	ARA/IJE/007	Ijero Post Office	7.8174	5.06888	496	1647.96	15:40		Close Loop
12/2/2017	OND/ILO/014	Ileoluji/Ipetu Close To Bamikemo	7.3782	4.89269	285	1674.92	8:17		Open Loop
12/2/2017	HEZIEKAI	Heziekai Rd Osun State	7.3686	4.87631	295	1671.05	8:31		

12/2/2017	BMK/OLU/001	Bamikemo Olusola Road	7.32454	4.86653	274	1676.63	8:59		
12/2/2017	BMK/OLU/002		7.32037	4.8499	259	1710.37	9:10		
12/2/2017	BMK/OLU/003	Oluwasola Community	7.31936	4.83552	249	1685.53	9:20		
12/2/2017	OND/ILO/014	Ileoluji/Ipetu Close To Bamikemo	7.3782	4.89269	285	1674.89	9:53		Close Loop
12/4/2017	ARA/IJE/007	Ijero Post Office	7.8174	5.06888	496	1647.20	9:11		Open Loop
12/4/2017	IJE/IFK/001	Okeoro-Ekiti Junction, Ijero Ifaki Road	7.82618	5.08414	518	1638.96	9:20		
12/4/2017	IJE/IFK/002	St. Michael's Catholic Primary Sch Iroko-Ekiti, Ijero Ifaki Road	7.83465	5.10076	535	1632.31	9:28		
12/4/2017	IJE/IFK/003	St. John's Church Anglican Communion Ayegunle-Ekiti	7.84503	5.11079	563	1626.13	9:34		
12/4/2017	IJE/IFK/004	Ijero Ifaki Road	7.85037	5.12987	570	1629.09	9:39		
12/4/2017	IJE/IFK/005	Celestial Church Of Christ Ireti-Ayo, Ilogbo-Ekiti	7.85633	5.14629	553	1629.77	9:45		
12/4/2017	IJE/IFK/006	Ijero Ifakai Road	7.85891	5.16225	567	1630.98	9:50		
12/4/2017	IJE/IFK/007	Ijero Ifakai Road	7.85349	5.17817	556	1631.72	10:03		Ido-Ekiti
12/4/2017	IJE/IFK/008	Ido Post Office	7.84602	5.18227	573	1629.43	10:12		
12/4/2017	IJE/IFK/009	Close To Winners Church Ido	7.84486	5.19121	552	1632.20	10:19		
12/4/2017	IJE/IFK/010	Christ Public College Ido-Ekiti	7.83356	5.20399	558	1631.14	10:24		
12/4/2017	IJE/IFK/011	Ijero Ifakai Road	7.82371	5.21759	553	1632.46	10:29		Ora-Ekiti
12/4/2017	IJE/IFK/012	Ijero Ifakai Road	7.80575	5.21652	563	1630.08	10:34		Aaye-Ekiti
12/4/2017	IJE/IFK/013	Ijero Ifakai Road	7.79915	5.22846	563	1631.27	10:38	63	
12/4/2017	IJE/IFK/014	Post Office Ifaki-Ekiti	7.7889	5.24231	561	1628.69	10:48		
12/4/2017	ARA/IJE/007	Ijero Post Office	7.8174	5.06888	496	1647.31	11:26		Close Loop
12/4/2017	IJE/IFK/008	Ido Post Office	7.84602	5.18227	573	1629.46	11:59		Open Loop
12/4/2017	IDO/IGD/001		7.82696	5.17927	583	1626.85	12:09		
12/4/2017	IDO/IGD/002	Igbole-Ekiti	7.8104	5.17683	581	1626.07	12:15	64	
12/4/2017	IDO/IGD/003	Community Nursery And Primary School Igbole-Ekiti	7.79383	5.17329	562	1629.40	12:24	65	
12/4/2017	IDO/IGD/004		7.78807	5.15625	588	1621.14	12:31		Osi-Ekiti
12/4/2017	IDO/IGD/005		7.77259	5.15485	584	1622.70	12:36		
12/4/2017	IDO/IGD/006	St. Peters Anglican Church Iropora-Ekiti	7.75508	5.15486	571	1624.57	12:41		
12/4/2017	IJE/IFK/008	Ido Post Office	7.84602	5.18227	573	1629.44	13:09		Close Loop
12/4/2017	IJE/IFK/014	Ifaki Post Office	7.7889	5.24231	561	1628.43	14:08		Open Loop
12/4/2017	IFK/ADO/001	Ado/Ifaki Road	7.77185	5.24965	550	1630.95	14:13		
12/4/2017	IFK/ADO/002	Ado/Ifaki Road	7.75752	5.26151	517	1638.31	14:18		
12/4/2017	IFK/ADO/003	Iworoko Community	7.73854	5.26079	436	1654.08	14:24		
12/4/2017	IFK/ADO/004	Iworoko Community	7.72614	5.25815	421	1658.27	14:28	66	
12/4/2017	IFK/ADO/005	Ado/Ifaki Road	7.7081	5.26201	399	1662.73	14:38		
12/4/2017	IFK/ADO/006	Ado/Ifaki Road	7.69221	5.25462	401	1662.52	14:42		
12/4/2017	IFK/ADO/007	Ado/Ifaki Road	7.67846	5.24408	386	1668.13	14:46		Ado-Ekiti
12/4/2017	IFK/ADO/008	Ado/Ifaki Road	7.66367	5.2364	383	1670.41	14:51		Ado-Ekiti
12/4/2017	IFK/ADO/009	Ado/Ifaki Road	7.64662	5.22448	423	1660.45	14:57	67	Ado-Ekiti
12/4/2017	IFK/ADO/010 (AKR/IKR/022)	Post Office Ado-Ekiti	7.62178	5.22203	434	1655.31	15:23		(Tie-Point)
12/4/2017	IJE/IFK/014	Ifaki Post Office	7.7889	5.24231	561	1628.63	16:03		Close Loop
12/4/2017	IFK/ADO/010	Ado-Ekiti Post Office	7.62178	5.22203	434	1655.79	16:38		Open Loop
12/4/2017	ADO/IYN/001	Ado-Iyin Road	7.64719	5.20498	405	1661.68	16:54		
12/4/2017	ADO/IYN/002	Ado-Iyin Road	7.6638	5.20434	400	1662.01	17:01		
12/4/2017	ADO/IYN/003	Ado-Iyin Road	7.67607	5.19362	439	1653.32	17:07		
12/4/2017	ADO/IYN/004	Ado-Iyin Road	7.67926	5.17873	510	1637.17	17:14	69	

12/4/2017	ADO/IYN/005	Babamubonu Memorialm Anglican Church, Iyin-Ekiti	7.67308	5.16562	526	1633.73	17:20		
12/4/2017	ADO/IYN/006	Araromi Local Council Development Area Iyin-Ekiti	7.6585	5.15748	554	1627.69	17:27		
12/4/2017	IFK/ADO/010	Ado-Ekiti Post Office	7.62178	5.22203	434	1655.77	17:58		Close Loop
12/5/2017	ILW/IGD/004	Near Ekiti Baptist High School Ilawe/Ado Junction, Igede	7.66863	5.12621	571	1625.54	8:20		Open Loop
12/5/2017	IGD/IRP/001	Igede-Awo-Iropora Road	7.68987	5.12795	552	1629.16	8:27		
12/5/2017	IGD/IRP/002	Igede-Awo-Iropora Road	7.70408	5.13887	573	1623.31	8:32		
12/5/2017	IGD/IRP/003	Eyio Junction Awo Town	7.71335	5.15244	589	1622.42	8:38		
12/5/2017	IGD/IRP/004	Igede-Awo-Iropora Road	7.73428	5.15231	558	1630.37	8:44		
12/5/2017	AWO/IFK/001	Awo-Eyio-Ifaki Road	7.71376	5.16771	546	1633.36	8:53	69	
12/5/2017	AWO/IFK/002	Awo-Eyio-Ifaki Road	7.72807	5.1807	542	1632.81	9:03		Eyio-Ekiti
12/5/2017	AWO/IFK/003	Awo-Eyio-Ifaki Road	7.74433	5.18629	534	1637.32	9:10		
12/5/2017	AWO/IFK/004	Awo-Eyio-Ifaki Road	7.74917	5.20364	547	1634.59	9:18		
12/5/2017	AWO/IFK/005	Awo-Eyio-Ifaki Road	7.76218	5.21453	534	1637.79	9:24		Esure-Ekiti
12/5/2017	AWO/IFK/006	Awo-Eyio-Ifaki Road	7.77414	5.22832	548	1631.14	9:29		
12/5/2017	ILW/IGD/004	Near Ekiti Baptist High School Ilawe/Ado Junction, Igede	7.66863	5.12621	571	1625.54	10:00		Close Loop
12/5/2017	IJE/IFK/008	Ido Post Office	7.84602	5.18227	573	1629.33	11:06		Open Loop
12/5/2017	IDO/OTN/001	Ido-Otun Road	7.87293	5.17339	584	1626.00	11:17		Usi-Ekiti
12/5/2017	IDO/OTN/002	Harmony Hotels, Usi-Ekiti	7.89152	5.1683	548	1634.70	11:22		
12/5/2017	IDO/OTN/003	Ido-Otun Road	7.90918	5.16159	552	1634.48	11:26		
12/5/2017	IDO/OTN/004	Ekiti State Judiciary Aiyetoro	7.92181	5.15011	533	1636.41	11:31		
12/5/2017	IDO/OTN/005	Ido-Otun Road	7.93485	5.14395	561	1632.38	11:37	70	
12/5/2017	IDO/OTN/006	Ido-Otun Road	7.95342	5.1412	540	1635.24	11:44		
12/5/2017	IDO/OTN/007	Ido-Otun Road	7.97124	5.13683	555	1637.14	11:48		
12/5/2017	IDO/OTN/008	Otun Post Office	7.98845	5.12135	546	1634.26	12:18		
12/5/2017	IDO/OTN/009	Ido-Otun Road	8.00353	5.11324	535	1633.61	12:25		
12/5/2017	IDO/OTN/010	Kwara State	8.02081	5.10784	539	1633.47	12:30		
12/5/2017	IJE/IFK/008	Ido Post Office	7.84602	5.18227	573	1629.19	13:17		
12/5/2017	IDO/OTN/008	Otun Post Office	7.98845	5.12135	546	1634.26	13:46		Open Loop
12/5/2017	OTN/ISN/001	Ifelodun Comprehensive High School Igogo-Ekiti	7.98238	5.15233	556	1631.35	13:51		
12/5/2017	OTN/ISN/002	Otun-Isan Road	7.98421	5.16643	546	1633.64	13:59		
12/5/2017	OTN/ISN/003	Otun-Isan Road	7.99456	5.1806	533	1636.68	14:06	73	Ikosu-Ekiti
12/5/2017	OTN/ISN/004	Otun-Isan Road	7.9951	5.19792	519	1638.49	14:15		Ikun-Ekiti
12/5/2017	OTN/ISN/005	Otun-Isan Road	7.98841	5.21313	513	1637.97	14:23		
12/5/2017	OTN/ISN/006	Otun-Isan Road	7.97134	5.21448	534	1635.94	14:28		
12/5/2017	OTN/ISN/007	Ijesamodu-Ekiti	7.95764	5.2196	545	1633.30	14:33		
12/5/2017	OTN/ISN/008	Otun-Isan Road	7.95253	5.23638	548	1632.45	14:40		Iye-Ekiti
12/5/2017	OTN/ISN/009	Close To St. Paul's Catholic Nursery And Primary School Iludun-Ekiti	7.94189	5.25036	546	1634.46	14:46		
12/5/2017	OTN/ISN/010	Otun-Isan Road	7.93771	5.26899	547	1632.92	14:52		
12/5/2017	OTN/ISN/011	Otun-Isan Road	7.93289	5.28509	555	1631.68	14:57		
12/5/2017	OTN/ISN/012	Govt. Girls Model College Isan	7.93057	5.30273	565	1633.87	15:03		
12/5/2017	IDO/OTN/008	Otun Post Office	7.98845	5.12135	546	1634.29	15:52		Close Loop
12/6/2017	OGB/OWO/014	Owo Post Office	7.1984	5.58505	346	1659.35	8:59		Open Loop
12/6/2017	OWO/ISG/001	Owo-Isi Jogun	7.17995	5.5872	324	1661.79	9:19		
12/6/2017	OWO/ISG/002		7.16353	5.5943	315	1664.32	9:28		
12/6/2017	OWO/ISG/003	Isi Jogun	7.14672	5.59646	294	1672.49	9:36		
12/6/2017	OWO/ISG/004		7.12957	5.6003	276	1672.96	9:42		

12/6/2017	OWO/ISG/005	Aratokun	7.11165	5.60044	265	1674.36	9:49	74	
12/6/2017	OWO/ISG/006		7.09541	5.60807	254	1677.64	10:00		
12/6/2017	OWO/ISG/007		7.07792	5.61216	245	1681.12	10:06		
12/6/2017	OWO/ISG/008		7.05994	5.61257	206	1688.49	10:14		
12/6/2017	OWO/ISG/009		7.04255	5.61532	205	1687.71	10:22		
12/6/2017	OGB/OWO/014	Owo Post Office	7.1984	5.58505	346	1659.37	11:05		Close Loop/Open
12/6/2017	OWO/OBS/001	Owo-Oba-Sooto Road	7.18788	5.5703	313	1665.39	11:20		
12/6/2017	OWO/OBS/002		7.17605	5.55532	310	1665.19	11:29		
12/6/2017	OWO/OBS/003		7.1734	5.53803	284	1670.88	11:38		
12/6/2017	OWO/OBS/004		7.16665	5.52363	282	1672.17	11:47		
12/6/2017	OWO/OBS/005		7.1538	5.51025	268	1675.44	11:56		
12/6/2017	OWO/OBS/006	Methodist Pry School Ugbeta	7.14078	5.49938	277	1674.14	12:07		
12/6/2017	OWO/OBS/007	Oba-Sooto	7.13806	5.48103	279	1674.35	12:16		
12/6/2017	OWO/OBS/008		7.13284	5.46531	285	1672.99	12:28		
12/6/2017	OGB/OWO/014	Owo Post-Office	7.1984	5.58505	346	1659.31	13:30		Close Loop
12/6/2017	OGB/OWO/013	Owo-Ifon Road, Ikare Junction, Tunji And Tunji Filling Station	7.21895	5.60269	295	1670.19	13:46		Open Loop
12/6/2017	OWO/IKA/001	Owo-Ikare Road	7.23649	5.61314	261	1675.86	13:56		
12/6/2017	OWO/IKA/002		7.25487	5.6198	280	1673.47	14:02		
12/6/2017	OWO/IKA/003		7.27272	5.62564	239	1681.64	14:07		
12/6/2017	OWO/IKA/004		7.28734	5.63664	223	1685.28	14:12		
12/6/2017	OWO/IKA/005		7.30216	5.65309	224	1683.66	14:19		
12/6/2017	OWO/IKA/006		7.31241	5.66777	216	1686.15	14:25		
12/6/2017	OWO/IKA/007		7.32761	5.67943	260	1676.57	14:33		
12/6/2017	OWO/IKA/008		7.34092	5.69131	249	1680.16	14:41	77	
12/6/2017	OWO/IKA/009		7.35559	5.70097	280	1673.76	14:48		
12/6/2017	OWO/IKA/010		7.36718	5.71576	288	1673.03	14:53		
12/6/2017	OWO/IKA/011	Entrance Gate Oba-Akoko Post-Office	7.37121	5.72725	288	1670.37	15:00		
12/6/2017	OGB/OWO/013	Owo-Ifon Road, Ikare Junction, Tunji And Tunji Filling Station	7.21895	5.60269	295	1670.14	15:46		Close Loop
12/7/2017	IJE/IFK/014	Ifaki Post Office	7.7889	5.24231	561	1628.12	9:29		Open Loop
12/7/2017	IFK/OYE/001	Ifaki-Oye Road	7.79209	5.25997	559	1626.59	9:36		
12/7/2017	IFK/OYE/002	Along Oye Road	7.7934	5.27821	549	1628.53	9:42		
12/7/2017	IFK/OYE/003	Ayegbaju Town	7.79247	5.29493	540	1631.93	9:49		
12/7/2017	IFK/OYE/004	Oja's Pleasure Arena Hotel Oye	7.79998	5.31267	554	1629.66	9:56		
12/7/2017	IFK/OYE/005	Opp King's Palace Oye Ekiti	7.80013	5.3295	537	1636.81	10:04	81	
12/7/2017	IFK/OYE/006	Outskirt Of Oye Town	7.80151	5.3463	549	1640.83	10:12	82	
12/7/2017	IFK/OYE/007	Opp Olofi QuartersIlupeju Ekiti	7.79889	5.364	602	1625.19	10:21		
12/7/2017	IFK/OYE/008	Itapa Ekiti	7.80956	5.37756	611	1623.52	10:27		
12/7/2017	IFK/OYE/009	Itapa Ekiti	7.81143	5.39183	601	1624.33	10:34		
12/7/2017	IFK/OYE/010	Osin Ekiti	7.80013	5.40732	538	1631.73	10:41	83	Osin Ekiti
12/7/2017	IFK/OYE/011		7.8036	5.4233	501	1633.80	10:51		
12/7/2017	IJE/IFK/014	Ifaki Post Office	7.7889	5.24231	561	1628.07	11:23		Close Loop
12/7/2017	IFK/OYE/011	Outskirt Of Osin-Ekiti	7.8036	5.4233	501	1633.78	11:57		Open Loop
12/7/2017	IFK/OYE/012		7.79414	5.4412	528	1627.11	12:05		
12/7/2017	IFK/OYE/013		7.79173	5.45593	527	1626.81	12:10		
12/7/2017	IFK/OYE/014	Ikole Junction	7.79428	5.47384	531	1627.17	12:16	84	
12/7/2017	IFK/OYE/015	Fuoye Horticulture Garden Ikole	7.80335	5.48722	527	1627.46	12:27		
12/7/2017	IFK/OYE/016		7.79714	5.50744	554	1621.62	12:37		

12/7/2017	IFK/OYE/017	Ikole	7.80274	5.5207	569	1617.84	12:44		
12/7/2017	IFK/OYE/011	Outskirt Of Osin-Ekiti	7.8036	5.4233	501	1633.71	13:24		Close Loop
12/7/2017	IFK/OYE/017	Oja Odo Oro Junction	7.80274	5.5207	569	1617.75	13:56		Open Loop
12/7/2017	IFK/OYE/018	FGC Ikole Ekiti	7.80396	5.53829	577	1616.60	14:02		
12/7/2017	IFK/OYE/019	Oke-Ayedun Ekiti	7.80907	5.55567	549	1622.31	14:07		
12/7/2017	IFK/OYE/020	Ayedun Ekiti	7.81535	5.57523	546	1620.77	14:13		
12/7/2017	IFK/OYE/021	Odo Ayedun Ekiti	7.81703	5.59094	562	1618.28	14:19		
12/7/2017	IFK/OYE/022	Police Station, Odo Ayedun	7.81995	5.60939	540	1624.59	14:27		
12/7/2017	IFK/OYE/023	St Stephen Pry School Ayebode	7.82044	5.62649	512	1629.91	14:34		
12/7/2017	IFK/OYE/024		7.81586	5.64353	514	1630.38	14:41		
12/7/2017	IFK/OYE/025	Ilasa-Ekiti	7.80816	5.66191	483	1637.29	14:46		
12/7/2017	IFK/OYE/026	Ekamefa Ccg Ilasa Ekiti	7.80318	5.67717	517	1628.97	14:52		
12/7/2017	IFK/OYE/027		7.79771	5.69485	546	1623.71	15:01		
12/7/2017	IFK/OYE/028	Ikun-Oba Ekiti	7.79038	5.71217	525	1630.00	15:06		
12/7/2017	IFK/OYE/029		7.77781	5.72127	514	1634.13	15:12		
12/7/2017	IFK/OYE/030	Kota, Omuo	7.7586	5.72201	535	1628.11	15:25		
12/7/2017	IFK/OYE/017	Oja Odo Oro Junction	7.80274	5.5207	569	1617.81	16:03		Close Loop
12/8/2017	IFK/ADO/010	Ado Ekiti Post Office	7.62178	5.22203	434	1655.72	10:00		Open Loop
12/8/2017	ADO/IJA/001	Ado-Poly-Ijan Road	7.61453	5.2433	410	1660.94	10:15	85	
12/8/2017	ADO/IJA/002	Ado-Poly-Ijan Road	7.61081	5.25976	382	1663.00	10:24		
12/8/2017	ADO/IJA/003	Opposite National Food Reserve	7.60928	5.27793	363	1665.64	10:30		
12/8/2017	ADO/IJA/004		7.60287	5.29499	369	1663.73	10:35		
12/8/2017	ADO/IJA/005	Close To ABUAD Teaching Hospital	7.60085	5.31156	366	1663.08	10:42		
12/8/2017	ADO/IJA/006	Opp St Augustine Catholic Ago Aduloju	7.6025	5.32853	355	1664.82	10:48		
12/8/2017	ADO/IJA/007		7.61226	5.34266	354	1664.09	10:53		
12/8/2017	ADO/IJA/008		7.61913	5.35905	362	1660.52	10:59		
12/8/2017	ADO/IJA/009	Ijan	7.62028	5.37623	363	1660.10	11:04		Ijan
12/8/2017	ADO/IJA/010	Opp St James Catholic Church	7.62224	5.39311	385	1655.39	11:10		Ijan Ekiti
12/8/2017	ADO/IJA/011		7.63331	5.40791	381	1657.44	11:15		
12/8/2017	ADO/IJA/012	Ilu Omo Oba Post Office	7.63876	5.41716	392	1653.94	11:24		
12/8/2017	IFK/ADO/010	Ado Ekiti Post Office	7.62178	5.22203	434	1654.61	12:03		Close Loop
12/8/2017	ADO/IJA/012	Ilu Omo Oba Post Office	7.63876	5.41716	392	1654.05	13:01		Open Loop
12/8/2017	IJA/ISE/001		7.6056	5.38626	375	1657.88	13:17		
12/8/2017	IJA/ISE/002		7.58727	5.3888	380	1656.02	13:24		
12/8/2017	IJA/ISE/003	Ilupeju-Ijan	7.57534	5.40222	372	1657.92	13:31		
12/8/2017	IJA/ISE/004		7.55869	5.40883	358	1660.31	13:38		
12/8/2017	IJA/ISE/005		7.54031	5.41223	366	1659.00	13:46		
12/8/2017	IJA/ISE/006		7.52221	5.41555	369	1656.29	13:52		
12/8/2017	IJA/ISE/007	Odo-Ile Ise Ekiti	7.50577	5.41858	382	1653.74	13:57		
12/8/2017	IJA/ISE/008	Akinluse Comp High School	7.48786	5.41993	373	1656.44	14:02		
12/8/2017	IJA/ISE/009 (IKR/ISE/012)	Ise Post Office	7.46484	5.42337	384	1657.15	14:12		Tie-Point
12/8/2017	ADO/IJA/012	Ilu Omo Oba Post Office	7.63876	5.41716	392	1654.47	14:51		Loop Close/Open
12/8/2017	IJA/IJM/001	Ijan-Igbimo Road Iworoko Road	7.64166	5.38352	389	1656.21	15:11		
12/8/2017	IJA/IJM/002		7.6578	5.37502	364	1661.68	15:19		
12/8/2017	IJA/IJM/003	Igbemo	7.67562	5.37859	381	1658.80	15:27		
12/8/2017	IJA/IJM/004	Igbemo	7.68214	5.3874	390	1657.46	15:34	86	
12/8/2017	IJA/IJM/005	Orun Ekiti	7.68884	5.36724	374	1661.91	15:45		

12/8/2017	IJA/IJM/006		7.69209	5.34939	367	1663.13	15:52		
12/8/2017	IJA/IJM/007	Community Nur/Pry School, Iketun, Afao Ekiti	7.69251	5.33203	382	1659.66	15:58		
12/8/2017	IJA/IJM/008	Afao Town	7.69705	5.3131	382	1661.02	16:05		Afao Town
12/8/2017	IJA/IJM/009	Aree	7.70793	5.30008	390	1658.68	16:13		
12/8/2017	IJA/IJM/010	Aree-Ekiti	7.72038	5.28605	392	1660.17	16:20		
12/8/2017	ADO/IJA/012	Ilu Omo Oba Post Office	7.63876	5.41716	392	1654.28	16:54		CloseLoop
12/9/2017	IFK/OYE/005	Oye Ekiti Town	7.80013	5.3295	537	1636.67	10:04		Open Loop
12/9/2017	OYE/ISN/001	Oye-Isan Road	7.81899	5.34977	580	1629.45	10:14		
12/9/2017	OYE/ISN/002		7.8357	5.34653	577	1624.47	10:19		
12/9/2017	OYE/ISN/003	Imojo-Ekiti	7.85367	5.34356	583	1621.16	10:28		
12/9/2017	OYE/ISN/004		7.86849	5.34313	579	1624.16	10:34	87	Itaji-Ekiti
12/9/2017	OYE/ISN/005	Opp Aud Pry School	7.88548	5.33637	579	1623.74	10:41		Itaji-Ekiti
12/9/2017	OYE/ISN/006	St Peters Ang Nur/Pry School Ayede Ekiti	7.90231	5.33098	582	1625.41	10:48		Ayede Ekiti
12/9/2017	OYE/ISN/007	St Martins Catholic Nur/Pry School, Isan Ekiti	7.91818	5.32244	565	1630.86	10:54		
12/9/2017	ISM/ILM/001	Isan-Ilemeso Ekiti	7.93126	5.33293	511	1640.02	11:12	88	
12/9/2017	ISM/ILM/002		7.93862	5.34881	492	1642.56	11:18	89	
12/9/2017	ISM/ILM/003	Entrance Of Ilemeso-Ekiti	7.94989	5.36036	445	1650.50	11:26		
12/9/2017	ISM/ILM/004	Ilemeso Ekiti	7.9667	5.3669	463	1645.81	11:33	90	
12/9/2017	IFK/OYE/005	Oye Ekiti Town	7.80013	5.3295	537	1636.13	12:12		Close Loop /Open
12/9/2017	OYE/IRE/001	Oye-Ire Road	7.78359	5.33775	522	1637.52	12:25		
12/9/2017	OYE/IRE/002		7.77823	5.34358	511	1641.18	12:33		
12/9/2017	OYE/AFA/001	Federal University Oye Ekiti	7.7806	5.32372	518	1637.65	12:52		
12/9/2017	OYE/AFA/002		7.76193	5.3221	483	1650.47	13:10	91	
12/9/2017	OYE/AFA/003		7.74678	5.31805	469	1645.16	13:24		
12/9/2017	IFK/OYE/005	Oye Ekiti Town	7.80013	5.3295	537	1636.25	13:49		Loop Close /Open
12/9/2017	ILP/IRE/001	Ilupeju-Ire Road	7.78813	5.37642	544	1635.50	14:03		
12/9/2017	ILP/IRE/002		7.78003	5.3931	563	1625.83	14:09		
12/9/2017	ILP/IRE/003	Ire Town	7.7633	5.39519	529	1630.47	14:13		
12/9/2017	ILP/IRE/004	Close To Ogun Onire Grammar School, Ire Town	7.74659	5.39346	544	1626.76	14:19	93	
12/9/2017	ILP/IRE/005	Ire Town	7.73345	5.40168	547	1625.17	14:25	92	
12/9/2017	ILP/IRE/006	Igbemo Road	7.72418	5.41175	481	1637.75	14:32		
12/9/2017	ILP/IRE/007	Igbemo Road	7.70204	5.40189	395	1655.55	14:40		
12/9/2017	IFK/OYE/005	Oye Ekiti Town	7.80013	5.3295	537	1642.28	15:16		Close Loop
12/10/2017	OWO/IKA/011	Entrance Gate Oba Akoko Post Office	7.37121	5.72725	288	1669.70	15:03		Open Loop
12/10/2017	OWO/IKA/012	Owo-Ikare Rd	7.38855	5.72343	298	1668.65	15:12		
12/10/2017	OWO/IKA/013		7.40675	5.72257	301	1670.26	15:18	94	Granite Gneiss
12/10/2017	OWO/IKA/014	Aiyegunle Oka Akoko	7.42561	5.7244	329	1666.40	15:26		
12/10/2017	OWO/IKA/015	Eti Oro Akoko	7.4425	5.72391	329	1668.40	15:31		
12/10/2017	OWO/IKA/016	Akungba Akoko	7.4595	5.73143	315	1671.07	15:36		
12/10/2017	OWO/IKA/017	Akungba Post Office	7.46796	5.73621	315	1671.25	15:42		
12/10/2017	OWO/IKA/018	Outskirt Of Akungba	7.48756	5.73951	411	1653.61	15:52		
12/10/2017	OWO/IKA/019	Outskirt Of Ikare	7.4979	5.74831	440	1649.58	16:03		
12/10/2017	OWO/IKA/020	Ikare	7.51313	5.75216	425	1654.70	16:10	95	GNEISS
12/10/2017	OWO/IKA/021	Post Office Ikare	7.5239	5.75172	427	1656.20	16:28		
12/10/2017	OWO/IKA/011	Entrance Gate Oba Akoko Post Office	7.37121	5.72725	288	1669.60	17:00		Close Loop

12/10/2017	OWO/IKA/017	Akungba Post Office	7.46796	5.73621	315	1671.16	17:21		Repeat Station
12/11/2017	OWO/IKA/017	Akungba Post Office	7.46796	5.73621	315	1671.18	7:03		Open Loop
12/11/2017	AKG/EMU/001	Akungba Supare Emure Road	7.45557	5.71289	311	1673.10	7:11		
12/11/2017	AKG/EMU/002	Supare Akoko	7.4545	5.69452	334	1667.48	7:17		
12/11/2017	AKG/EMU/003	Agbogbo Grammar School	7.44591	5.68159	324	1670.06	7:23		Supare
12/11/2017	AKG/EMU/004		7.44459	5.66406	324	1668.50	7:28	096	Migmatite
12/11/2017	AKG/EMU/005		7.44889	5.64737	313	1670.17	7:35		
12/11/2017	AKG/EMU/006		7.44962	5.62919	299	1671.35	7:41		
12/11/2017	AKG/EMU/007		7.44701	5.61074	314	1667.56	7:47		
12/11/2017	AKG/EMU/008	Akungba Supare Emure Rd	7.44264	5.59357	326	1664.07	7:53		
12/11/2017	AKG/EMU/009	Ondo State	7.45076	5.5786	324	1666.25	7:58		
12/11/2017	AKG/EMU/010	Ekiti State	7.4444	5.56331	311	1667.59	8:02		
12/11/2017	AKG/EMU/011	Fajuyi Camp Emure Ekiti	7.43827	5.54778	321	1664.74	8:06		
12/11/2017	AKG/EMU/012	Owode Emure Ekiti	7.43977	5.52935	320	1663.57	8:11		
12/11/2017	AKG/EMU/013		7.43688	5.51134	339	1661.54	8:16		
12/11/2017	AKG/EMU/014	Opp. Saw Mill	7.43976	5.49306	320	1664.51	8:21		
12/11/2017	AKG/EMU/015	Emu Local Gov't Secetariat	7.44012	5.47673	346	1659.67	8:27		
12/11/2017	AKG/EMU/016	Emure Post Office	7.43714	5.4596	366	1655.48	8:34	097	Migmatite
12/11/2017	OWO/IKA/017	Akungba Post Office	7.46796	5.73621	315	1671.10	9:21		Close Loop
12/11/2017	OWO/IKA/017	Akungba Post Office	7.46796	5.73621	315	1670.97	10:27		Open Loop
12/11/2017	AKG/OKA/001	Outskirt Of Iwaroka	7.45133	5.74931	348	1661.82	10:35		
12/11/2017	AKG/OKA/002	Post Office Iwaroka	7.44287	5.76578	357	1659.38	10:47		
12/11/2017	AKG/OKA/003	Oka Akoko	7.45045	5.78291	470	1636.51	10:55	098	Migmatite
12/11/2017	AKG/OKA/004		7.45572	5.79832	503	1631.54	11:02		
12/11/2017	AKG/OKA/005	Korowa Oka Akoko	7.45549	5.81521	529	1625.49	11:08	099	
12/11/2017	AKG/OKA/006	Okia Oka	7.44879	5.82472	474	1636.70	11:16	100	Migmatite
12/11/2017	AKG/OKA/007		7.45144	5.84188	399	1650.96	11:24		
12/11/2017	AKG/OKA/008	Epinmi Akoko	7.45438	5.85885	402	1650.38	11:30	101	Migmatite
12/11/2017	AKG/OKA/009	Methodist Church Epinmi Akoko	7.46053	5.87571	360	1659.61	11:39		
12/11/2017	AKG/OKA/010	Vision Group Of Schl	7.46001	5.89372	365	1657.81	11:44		Isu Akoko
12/11/2017	AKG/OKA/011	Information Cntre Jnctn	7.45435	5.91073	349	1659.91	11:52		Isu Akoko
12/11/2017	OWO/IKA/017	Akungba Post Office	7.46796	5.73621	315	1671.04	12:33		Close Loop
12/11/2017	OWO/IKA/011	Entrance Gate Oba Akoko Post Office	7.37121	5.72725	288	1669.52	12:54		Open Loop
12/11/2017	OBA/IDN/001		7.37687	5.74603	275	1672.85	13:03		
12/11/2017	OBA/IDN/002	Oba-Ikun-Ido Ani Rd	7.37269	5.76167	287	1671.23	13:10		
12/11/2017	OBA/IDN/003	Ikun Akoko	7.37584	5.77878	303	1667.86	13:17		
12/11/2017	OBA/IDN/004	Ugbe Afo	7.36819	5.79776	276	1673.25	13:24	102	Migmatite
12/11/2017	OBA/IDN/005		7.36736	5.81129	261	1676.59	13:34		
12/11/2017	OBA/IDN/006		7.36681	5.82827	276	1673.80	13:42		
12/11/2017	OBA/IDN/007		7.34752	5.83144	276	1674.69	13:51		
12/11/2017	OBA/IDN/008		7.33314	5.83977	315	1666.70	13:57		
12/11/2017	OBA/IDN/009	Outskirt Of Ido Ani	7.31717	5.83781	319	1667.32	14:03		
12/11/2017	OBA/IDN/010	Ido Ani Post Offfice	7.30374	5.84612	317	1667.70	14:12		
12/11/2017	OWO/IKA/011	Entrance Gate Oba Akoko Post Office	7.37121	5.72725	288	1669.48	14:57		Close Loop /Open
12/11/2017	ISB/IWY/001	Ise Oba Iwoye Road	7.31289	5.69022	241	1679.15	15:24		
12/11/2017	ISB/IWY/002	Catholic Church Iwoye	7.30996	5.70658	217	1684.43	15:37		
12/11/2017	ISB/IWY/003		7.29919	5.71537	214	1684.52	15:48		

12/11/2017	OWO/IKA/011	Entrance Gate Oba Akoko Post Office	7.37121	5.72725	288	1669.43	16:24		Close Loop
12/12/2017	OWO/IKA/017	Akungba Post Office	7.46796	5.73621	315	1670.86	7:13		Loop Open
12/12/2017	OWO/IKA/021	Post Office Ikare	7.5239	5.75172	427	1655.69	7:39		Loop Open
12/12/2017	IKA/OMU/001	Ikare-Oke Agbe Omuo Rd	7.53711	5.76791	364	1665.55	7:49		
12/12/2017	IKA/OMU/002		7.5524	5.76814	379	1663.20	7:57		
12/12/2017	IKA/OMU/003	Arigidi Akoko	7.57094	5.77003	392	1661.24	8:04	103	Gneiss
12/12/2017	IKA/OMU/004		7.58754	5.77266	350	1669.15	8:13		
12/12/2017	IKA/OMU/005		7.6059	5.77142	406	1657.31	8:19	104	Gneiss
12/12/2017	IKA/OMU/006		7.62074	5.76867	507	1640.47	8:28		
12/12/2017	IKA/OMU/007	Ajuwa Grammar Schl Okeagbe	7.63771	5.76308	483	1644.71	8:34	105	Gneiss
12/12/2017	IKA/OMU/008	Okeagbe Akoko	7.65103	5.76317	458	1651.98	8:44		
12/12/2017	IKA/OMU/009	Oyin Akoko	7.6678	5.75859	460	1648.96	8:49		
12/12/2017	IKA/OMU/010	Oyin Akoko	7.68195	5.74914	466	1647.22	8:57		
12/12/2017	IKA/OMU/011		7.69448	5.73832	519	1635.74	9:03		
12/12/2017	IKA/OMU/012	Omu Ekiti	7.71238	5.7376	553	1628.48	9:08		
12/12/2017	IKA/OMU/013	Post Office Omuo Ekiti	7.73264	5.72371	545	1628.26	9:16		
12/12/2017	OWO/IKA/021	Post Office Ikare	7.5239	5.75172	427	1655.83	10:10		Close Loop
12/12/2017	OWO/IKA/021	Post Office Ikare	7.5239	5.75172	427	1655.79	10:44		Open Loop
12/12/2017	IKA/AJW/001	Ikare-Erusu-Ajowa Rd	7.55724	5.77901	408	1658.62	11:02		
12/12/2017	IKA/AJW/002		7.56789	5.79319	367	1667.66	11:08	106	Granite Charnokite
12/12/2017	IKA/AJW/003	Erusu	7.58539	5.81004	352	1671.52	11:17		
12/12/2017	IKA/AJW/004		7.588	5.82282	342	1669.99	11:25		
12/12/2017	IKA/AJW/005	Ikaram-Akoko	7.59549	5.83871	354	1668.73	11:31		
12/12/2017	IKA/AJW/006	Ikaram-Akoko	7.60349	5.85485	367	1665.96	11:35		
12/12/2017	IKA/AJW/007		7.61525	5.86802	401	1659.61	11:40		
12/12/2017	IKA/AJW/008	Opp. Otolomi High Schl Ikaram	7.63293	5.8757	370	1666.83	11:45		
12/12/2017	IKA/AJW/009		7.64192	5.88744	361	1668.57	11:49		
12/12/2017	IKA/AJW/010	Outskirt Of Ajowa Akoko Town	7.66249	5.89158	397	1660.20	11:54		
12/12/2017	IKA/AJW/011	Ajowa-Akoko	7.67652	5.89729	404	1660.29	11:58		
12/12/2017	IKA/AJW/012	Ajowa Akoko	7.68533	5.91243	386	1664.99	12:03		
12/12/2017	IKA/AJW/013		7.69375	5.92842	374	1666.14	12:08		
12/12/2017	IKA/AJW/014	Iyere Kabba Rd	7.6963	5.94277	351	1672.04	12:14		
12/12/2017	OWO/IKA/021	Post Office Ikare	7.5239	5.75172	427	1655.80	12:53		Close Loop
12/12/2017	IKA/AJW/011	Ajowa Akoko	7.67652	5.89729	404	1660.33	13:23		Open Loop
12/12/2017	AJW/OMU/001	Ajowa-Omuo Rd	7.6842	5.87953	380	1667.28	13:33	108	Granite Gneiss
12/12/2017	AJW/OMU/002		7.68969	5.86315	404	1664.06	13:43	109	Gneiss
12/12/2017	AJW/OMU/003		7.69327	5.84549	409	1662.88	13:50		
12/12/2017	AJW/OMU/004		7.69472	5.82824	432	1656.06	13:57		
12/12/2017	AJW/OMU/005		7.70761	5.81639	484	1644.72	14:05		
12/12/2017	AJW/OMU/006	Igasi Akoko	7.71963	5.80259	510	1640.01	14:11		I
12/12/2017	AJW/OMU/007	Eriti Akoko	7.73051	5.78836	509	1638.93	14:17		Eriti Akoko
12/12/2017	AJW/OMU/008		7.73919	5.7725	504	1640.59	14:24		
12/12/2017	AJW/OMU/009		7.75486	5.76232	501	1638.77	14:31		
12/12/2017	AJW/OMU/010	Omuoke Ekiti	7.76743	5.74929	539	1629.19	14:40		
12/12/2017	IKA/AJW/011	Ajowa Akoko	7.67652	5.89729	404	1660.31	15:21		Close Loop
12/12/2017	OWO/IKA/021	Post Office Ikare	7.5239	5.75172	427	1655.70	16:10		Open Loop
12/12/2017	IKA/IRU/001	Ikare-Irun-Aisegba	7.52338	5.73484	476	1643.88	16:20		
12/12/2017	IKA/IRU/002	Ondo State School Of The	7.53545	5.72246	443	1652.45	16:25		

		Physically Impaired Ikare							
12/12/2017	IKA/IRU/003	Nig. Police Stn Ogbagi Akoko	7.54938	5.70982	452	1649.89	16:30		
12/12/2017	IKA/IRU/004	High Schl Ogbagi Akoko	7.566	5.70964	475	1647.00	16:38		
12/12/2017	IKA/IRU/005	Ogbagi Post Office	7.57521	5.70133	508	1639.03	16:45		
12/12/2017	OWO/IKA/021	Post Office Ikare	7.5239	5.75172	427	1656.09	17:12		Close Loop
12/13/2017	OWO/IKA/021	Post Office Ikare	7.5239	5.75172	427	1655.48	7:26		Open Loop
12/13/2017	IKA/IRU/005	Ogbagi Post Office	7.57521	5.70133	508	1638.53	7:54		Open Loop
12/13/2017	IKA/IRU/006		7.58394	5.68338	466	1645.82	8:01		
12/13/2017	IKA/IRU/007	Customary Court Irun Akoko	7.58918	5.66911	441	1650.65	8:07		
12/13/2017	IKA/IRU/008		7.58666	5.65093	432	1651.68	8:13		
12/13/2017	IKA/IRU/009		7.57789	5.63677	419	1653.90	8:19		
12/13/2017	IKA/IRU/010		7.57542	5.61706	377	1662.00	8:25		
12/13/2017	IKA/IRU/011		7.57405	5.60321	399	1656.72	8:30		
12/13/2017	IKA/IRU/012	Close To Ojugbayi Comp. High School Imesi Lasigidi	7.56228	5.5914	359	1664.65	8:35		
12/13/2017	IKA/IRU/013	Imesi Lasigidi	7.56147	5.57432	362	1661.67	8:41	110	Gneiss
12/13/2017	IKA/IRU/014		7.5583	5.55688	375	1659.86	8:49		
12/13/2017	IKA/IRU/015		7.57033	5.54339	361	1664.00	8:53		
12/13/2017	IKA/IRU/016	Ansar-Ud-Deen Pry School Agbado Ekiti	7.58406	5.5287	376	1657.73	8:58		
12/13/2017	IKA/IRU/017	Agbado Ekiti	7.59178	5.51416	371	1657.21	9:02		
12/13/2017	IKA/IRU/018	Close To Comm. Gra. Schl Aisegba	7.59766	5.49687	401	1651.01	9:07		Aisegba Ekiti
12/13/2017	IKA/IRU/019	Aisegba Ekiti	7.60306	5.48069	400	1650.32	9:12		
12/13/2017	IKA/IRU/020	Outskirt Of Aisegba Ekiti	7.60109	5.46321	400	1649.97	9:17		
12/13/2017	IKA/IRU/021		7.60965	5.44864	395	1650.10	9:21		
12/13/2017	IKA/IRU/022	Close To Ilu-Omooba Ekiti	7.62284	5.43425	389	1652.41	9:26		
12/13/2017	IKA/IRU/005	Ogbagi Post Office	7.57521	5.70133	508	1638.56	10:07		Close Loop
12/13/2017	IKA/IRU/017	Agbado Ekiti	7.59178	5.51416	371	1657.15	11:10		Open Loop
12/13/2017	AGB/ODE/001	Agbado-Ode Rd	7.60616	5.53077	400	1653.88	11:18		
12/13/2017	AGB/ODE/002		7.62179	5.53835	404	1652.94	11:23		
12/13/2017	AGB/ODE/003	Cac, Oke Ayo	7.63754	5.54639	394	1654.12	11:28		Ode-Ekiti
12/13/2017	AGB/ODE/004	Ode Post Office	7.64768	5.54958	400	1649.97	11:35		
12/13/2017	AGB/ODE/005	Ode Isinbode Rd	7.64863	5.5662	404	1652.72	11:43		
12/13/2017	AGB/ODE/006		7.64976	5.58326	397	1654.37	11:49		
12/13/2017	AGB/ODE/007		7.65827	5.60119	405	1652.03	11:56		
12/13/2017	AGB/ODE/008		7.66738	5.61308	413	1650.18	12:02		
12/13/2017	AGB/ODE/009	Isin Bode Post Office	7.68296	5.62505	435	1646.76	12:12		
12/13/2017	AGB/ODE/010	Isin Bode Omuo Rd	7.69612	5.63904	442	1644.65	12:22		
12/13/2017	AGB/ODE/011		7.70437	5.65412	448	1645.36	12:29		
12/13/2017	AGB/ODE/012	Omuo Rd	7.70826	5.67122	461	1644.62	12:38	111	Gneiss
12/13/2017	IKA/IRU/017	Agbado Ekiti	7.59178	5.51416	371	1657.24	13:25		Close Loop
12/13/2017	ADO/IJA/012	Ilu Omo Oba Post Office	7.63876	5.41716	392	1653.32	13:42		Open Loop
12/13/2017	ILU/IKL/001	Ilu-Omo Oba Ikole Rd	7.64999	5.43076	397	1652.66	13:52		
12/13/2017	ILU/IKL/002		7.66293	5.44504	404	1651.98	13:55		
12/13/2017	ILU/IKL/003	Opp. Comm. Pry Schl. Fatuila	7.67173	5.4567	409	1651.97	13:59		
12/13/2017	ILU/IKL/004		7.68193	5.47314	414	1649.14	14:06		
12/13/2017	ILU/IKL/005		7.69686	5.48003	424	1647.67	14:11	112	Migmatite
12/13/2017	ILU/IKL/006	Ijesha Isu General Hospital	7.70853	5.49428	426	1645.86	14:17		
12/13/2017	ILU/IKL/007	Ijesha Isu Post Office	7.7123	5.49972	435	1643.58	14:22		
12/13/2017	ILU/IKL/008		7.72605	5.51013	451	1639.76	14:29		

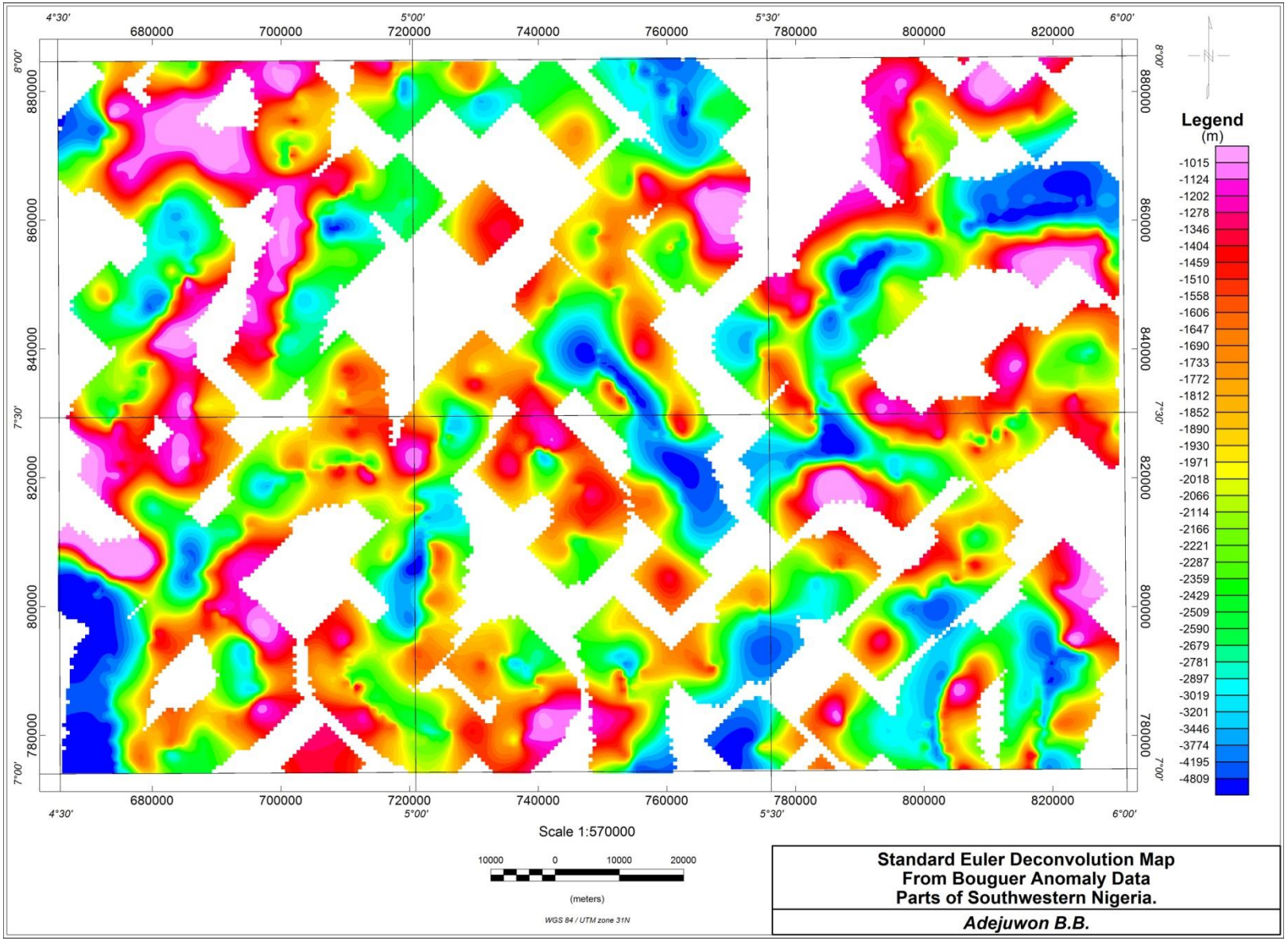
12/13/2017	ILU/IKL/009		7.74397	5.51009	481	1634.12	14:34		
12/13/2017	ILU/IKL/010		7.76065	5.51357	540	1622.17	14:39		
12/13/2017	ILU/IKL/011		7.77742	5.5098	563	1617.85	14:44		
12/13/2017	IKL/ARA/001	Ikole Ara Rd	7.78241	5.52882	566	1618.54	14:53		
12/13/2017	IKL/ARA/002		7.7677	5.54069	558	1619.06	14:58		
12/13/2017	IKL/ARA/003		7.75516	5.55123	560	1617.67	15:03		
12/13/2017	ADO/IJA/012	Ilu Omo Oba Post Office	7.63876	5.41716	392	1653.41	15:39		Close Loop
12/13/2017	ILU/IKL/007	Ijesha Isu Post Office	7.7123	5.49972	435	1643.63	16:23		Loop Open
12/13/2017	IJS/ODE/001	Ijesha Isu Ode Rd	7.70132	5.51348	441	1640.60	16:29	113	Migmatite
12/13/2017	IJS/ODE/002		7.68867	5.52535	429	1644.04	16:37		
12/13/2017	IJS/ODE/003		7.67759	5.53793	429	1644.43	16:42		
12/13/2017	IJS/ODE/004	New Era College Ode Ekiti	7.66124	5.54417	427	1645.90	16:47		
12/13/2017	ILU/IKL/007	Ijesha Isu Post Office	7.7123	5.49972	435	1643.56	17:00		Close Loop
12/13/2017	OWO/AGB/021	Ikare Post Office	7.5239	5.75172	427	1655.54	18:19		Close Loop
12/14/2017	OWO/AGB/021	Ikare Post Office	7.5239	5.75172	427	1654.83	7:41		Open loop
12/14/2017	IKR/IBU/001	Ikare-Ugbe_Iboropa Road	7.5286	5.7837	375	1663.92	7:54		
12/14/2017	IKR/IBU/002	Ikare-Ugbe_Iboropa Road	7.53633	5.80011	363	1667.42	8:00	114	
12/14/2017	IKR/IBU/003	Ikare-Ugbe_Iboropa Road	7.54011	5.81737	376	1664.15	8:09	115	
12/14/2017	IKR/IBU/004	Ikare-Ugbe_Iboropa Road	7.54107	5.83545	381	1661.48	8:14		
12/14/2017	IKR/IBU/005	Opp St Mark's Church, Iboropa	7.53558	5.85116	364	1663.83	8:19		
12/14/2017	IKR/IBU/006		7.53012	5.86991	344	1667.71	8:25		
12/14/2017	IKR/IBU/007		7.52925	5.88636	346	1666.83	8:29		
12/14/2017	IKR/IBU/008		7.52252	5.90365	326	1673.07	8:34		
12/14/2017	IKR/IBU/009	Ayegbe Comprehensive High School	7.51524	5.91675	302	1672.51	8:40		Ise Akoko
12/14/2017	IKR/IBU/010	Ise-Akoko-Isua Road	7.498	5.91412	342	1662.06	8:48	116	
12/14/2017	IKR/IBU/011		7.4806	5.90727	346	1661.99	8:57		
12/14/2017	IKR/IBU/012 (AKG/OKA/11)	Information Centre Junction, Isua Akoko	7.45435	5.91073	349	1659.04	9:06		Tie point
12/14/2017	OWO/IKR/021	Ikare Post Office	7.5239	5.75172	427	1654.95	9:44		Close Loop
12/14/2017	IKR/IBU/009	Ayegbe Comprehensive High School,Ise Akoko	7.51524	5.91675	302	1667.89	11:37		Open loop
12/14/2017	ISK/KAB/001	Ise-Akoko-Kabba Road	7.53945	5.91437	318	1674.95	11:43		
12/14/2017	ISK/KAB/002	Auga Akoko	7.55643	5.91837	335	1670.36	11:50		
12/14/2017	ISK/KAB/003		7.5747	5.92254	330	1673.14	11:57		
12/14/2017	ISK/KAB/004		7.59225	5.92657	337	1672.35	12:03		
12/14/2017	ISK/KAB/005		7.61013	5.93063	354	1669.21	12:08	117	
12/14/2017	ISK/KAB/006	Akunu Akoko	7.62898	5.93996	372	1666.44	12:18		
12/14/2017	ISK/KAB/007		7.64459	5.94718	356	1670.12	12:27	118	
12/14/2017	IKR/IBU/009	Ayegbe Comprehensive High School,Ise Akoko	7.51524	5.91675	302	1672.80	13:00		Close Loop
12/14/2017	IKR/IBU/012	Information Centre Junction, Isua Akoko	7.45435	5.91073	349	1659.09	13:50	119	Open loop
12/14/2017	ISA/IDN/001	Isua-Ido-Ani Road	7.45141	5.93205	309	1667.81	13:56		
12/14/2017	ISA/IDN/002	\	7.43456	5.92746	322	1665.20	14:03		
12/14/2017	ISA/IDN/003	Isua-Ido-Ani Road	7.4213	5.92107	330	1661.82	14:07		
12/14/2017	ISA/IDN/004	Isua-Ido-Ani Road	7.40163	5.91601	292	1670.37	14:14	120	
12/14/2017	ISA/IDN/005	Isua-Ido-Ani Road	7.38558	5.91056	330	1663.20	14:22		
12/14/2017	ISA/IDN/006	Isua-Ido-Ani Road	7.37135	5.90185	329	1663.22	14:29		
12/14/2017	ISA/IDN/007		7.35645	5.89196	334	1661.99	14:36		
12/14/2017	ISA/IDN/008	Okikomo	7.34185	5.8824	288	1671.74	14:48		
12/14/2017	ISA/IDN/009		7.33353	5.86804	336	1663.57	14:55		

12/14/2017	ISA/IDN/010		7.32492	5.85365	353	1660.76	15:02		
12/14/2017	ISA/IBL/001	Isua-Ibillo Road	7.44934	5.95284	288	1673.06	15:36	121	
12/14/2017	ISA/IBL/002	Isua-Ibillo Road	7.45031	5.97021	295	1670.78	15:44		
12/14/2017	IKR/IBU/012	Information Centre Junction, Isua Akoko	7.45435	5.91073	349	1659.15	15:56		Close/ Open Loop
12/14/2017	IFI/IPS/001	Ifira-Ipesin Road	7.38079	5.92826	330	1661.50	16:16		
12/14/2017	IFI/IPS/002		7.37286	5.94456	322	1662.62	16:21		
12/14/2017	IFI/IPS/003		7.36082	5.95784	306	1667.44	16:29		
12/14/2017	IFI/IPS/004		7.35133	5.96317	301	1667.57	16:36		
12/14/2017	IPS/IMR/001	Ipesin-Imeri Road	7.35593	5.93894	276	1672.05	16:48		
12/14/2017	IPS/IMR/002	Ipesin-Imeri Road	7.34252	5.92817	263	1675.24	16:53		
12/14/2017	IPS/IMR/003	Raji Camp	7.32601	5.92098	233	1682.07	17:00		
12/14/2017	IPS/IMR/004		7.30786	5.91493	243	1679.00	17:10		
12/14/2017	IKR/IBU/012	Information Centre Junction, Isua Akoko	7.45435	5.91073	349	1659.12	17:49		Close Loop
12/15/2017	OBA/IDN/010	Idoani Post Office	7.30374	5.84612	317	1666.93	7:52		Open loop
12/15/2017	IDN/IPE/001	Ido-Ani-Ipele Road	7.29081	5.84138	264	1674.31	8:00	122	
12/15/2017	IDN/IPE/002	Ido-Ani-Ipele Road	7.27566	5.83486	195	1686.61	8:11		
12/15/2017	IDN/IPE/003	Basic Health Center, Iwani	7.26595	5.82086	186	1689.19	8:17		
12/15/2017	IDN/IPE/004	About 100m From River Iporo	7.25035	5.80979	188	1688.08	8:21	123	
12/15/2017	IDN/IPE/005	Ido-Ani-Ipele Road	7.23454	5.80231	163	1692.87	8:27		
12/15/2017	IDN/IPE/006	Ido-Ani-Ipele Road	7.21812	5.79472	198	1684.82	8:31		
12/15/2017	IDN/IPE/007	Ido-Ani-Ipele Road	7.2005	5.78655	203	1685.34	8:36		
12/15/2017	IDN/IPE/008	Ido-Ani-Ipele Road	7.18742	5.7775	200	1685.67	8:40		
12/15/2017	IDN/IPE/009	Ido-Ani-Ipele Road	7.18202	5.75819	191	1687.44	8:44		
12/15/2017	IDN/IPE/010	Wese Omosile Camp	7.17491	5.74241	231	1678.92	8:47		
12/15/2017	IDN/IPE/011	Ido-Ani-Ipele Road	7.16761	5.72712	249	1674.88	8:51		
12/15/2017	IDN/IPE/012	Ido-Ani-Ipele Road	7.15962	5.7101	277	1668.96	8:56		
12/15/2017	IDN/IPE/013	Ido-Ani-Ipele Road	7.15139	5.69336	258	1673.15	8:59		
12/15/2017	IDN/IPE/014	Ido-Ani-Ipele Road	7.13585	5.68383	242	1682.58	9:04		
12/15/2017	IDN/IPE/015	Ido-Ani-Ipele Road	7.12949	5.66966	282	1668.52	9:09		
12/15/2017	IDN/IPE/016 (OWO/IFO/006)	Hamel Filling Station, Ipele	7.12925	5.65338	276	1673.23	9:15		Tie point
12/15/2017	OBA/IDN/010	Idoani Post Office	7.30374	5.84612	317	1666.77	9:53		Close/ Open loop
12/15/2017	IDN/IDG/001	Idoani-Idogun Road	7.30572	5.86405	340	1661.17	10:06		
12/15/2017	IDN/IDG/002	Idoani-Idogun Road	7.30668	5.88014	286	1673.41	10:12		
12/15/2017	IDN/IDG/003	Idogun Town	7.30437	5.89498	271	1675.83	10:17		
12/15/2017	IDG/OPE/001	Idogun - Okpe Road	7.28668	5.90524	221	1684.81	10:25		
12/15/2017	IDG/OPE/002	Idogun - Okpe Road	7.27973	5.92172	200	1687.49	10:31		
12/15/2017	IDG/OPE/003	Idogun - Okpe Road	7.26848	5.93457	258	1674.59	10:37	124	
12/15/2017	IDG/OPE/004	Idogun - Okpe Road	7.26472	5.95134	277	1671.94	10:48	125	
12/15/2017	OBA/IDN/010	Idoani Post Office	7.30374	5.84612	317	1666.73	11:26		Close Loop
12/15/2017	IDN/IPE/016	Hamel Filling Station, Ipele	7.12925	5.65338	276	1673.16	13:10		Open loop
12/15/2017	GPO/IFON	General Post Office Ifon	6.9323	5.76369	142	1694.62	13:41		
12/15/2017	PROF/TOWN/1	St Paul Anglican Church, Ijagba	6.85442	5.75354	95	1700.78	14:01		
12/15/2017	PROF/TOWN/2	St Paul Primary School, Ijagba	6.85454	5.75281	98	1700.94	14:07		
12/15/2017	IDN/IPE/016	Hamel Filling Station, Ipele	7.12925	5.65338	276	1673.23	14:49		Close Loop
12/15/2017	GPO/IFON	General Post Office Ifon	6.9323	5.76369	142	1694.58	15:33		Open loop
12/15/2017	UZE/OTO/001	George Junction, Uzebba,	6.99624	5.9047	225	1680.53	16:02		Edo State
12/15/2017	UZE/OTO/002	Uzebba-Otuo, Road	7.01171	5.91605	198	1690.03	16:08		

12/15/2017	UZE/OTO/003	Uzebba-Otuo, Road	7.02599	5.92342	154	1701.02	16:13		
12/15/2017	UZE/OTO/004	Uzebba-Otuo, Road	7.0426	5.92278	165	1698.40	16:17		
12/15/2017	UZE/OTO/005	Oseze Primary School, Eruepe	7.05815	5.92839	184	1694.02	16:22		
12/15/2017	UZE/OTO/006		7.07378	5.93137	202	1689.86	16:27	126	
12/15/2017	UZE/OTO/007		7.08849	5.94243	208	1689.01	16:32		
12/15/2017	UZE/OTO/008	Uroe	7.10499	5.93912	228	1684.57	16:36		
12/15/2017	UZE/OTO/009		7.12226	5.93245	257	1678.50	16:41	127	
12/15/2017	UZE/OTO/010	Ikhin	7.14203	5.9334	268	1675.34	16:47		
12/15/2017	UZE/OTO/011		7.15072	5.94376	279	1673.19	16:52		
12/15/2017	UZE/OTO/012		7.14546	5.96297	272	1674.39	16:58	128	
12/15/2017	GPO/IFON	General Post Office Ifon	6.9323	5.76369	142	1694.63	17:51		Close Loop
12/16/2017	IFK/OYE/017	Oja Odo Oro Junction	7.80274	5.5207	569	1615.56	10:41		Open loop
12/16/2017	IKL/ITP/001	Ikole-Itapaji Road	7.81495	5.51049	545	1621.62	10:49		
12/16/2017	IKL/ITP/002	Ikole-Itapaji Road	7.83412	5.51241	533	1624.66	10:53		
12/16/2017	IKL/ITP/003	Ikole-Itapaji Road	7.85136	5.51097	532	1625.22	10:57		
12/16/2017	IKL/ITP/004	Odo Oro	7.86589	5.50074	532	1625.08	11:03		
12/16/2017	IKL/ITP/005	Ikole-Itapaji Road	7.87904	5.48945	521	1627.06	11:08		
12/16/2017	IKL/ITP/006	Ikole-Itapaji Road	7.89031	5.47438	502	1632.01	11:19		
12/16/2017	IKL/ITP/007	Ikole-Itapaji Road	7.9035	5.46841	484	1639.97	11:22		
12/16/2017	IKL/ITP/008	Ikole-Itapaji Road	7.92267	5.47294	497	1632.97	11:28	130	
12/16/2017	IKL/ITP/009	Ikole-Itapaji Road	7.94025	5.47373	469	1638.19	11:37		
12/16/2017	IKL/ITP/010	Ikole-Itapaji Road	7.95658	5.47085	458	1640.32	11:42		
12/16/2017	IKL/ITP/011	Promise Point, Cassava Mill	7.97094	5.46249	447	1641.89	11:48		
12/16/2017	IKL/ITP/012	Ikole-Itapaji Road	7.98736	5.45242	478	1637.29	11:54		
12/16/2017	IKL/ITP/013	Ikole-Itapaji Road	8.00448	5.45265	486	1634.90	11:58		
12/16/2017	IKL/ITP/014	Ikole-Itapaji Road	8.02242	5.45588	432	1647.60	12:02	131	
12/16/2017	IKL/ITP/015	Ikole-Itapaji Road	8.04031	5.45255	432	1647.09	12:10		
12/16/2017	IKL/ITP/016	Ikole-Itapaji Road	8.05932	5.44292	444	1644.65	12:15		
12/16/2017	IFK/OYE/017	Oja Odo Oro Junction	7.80274	5.5207	569	1615.21	12:52		Close/ Open Loop
12/16/2017	IKOLE POSTOFFICE	Ikole Post Office	7.79193	5.51035	566	1616.88	13:06		
12/16/2017	IFK/OYE/017	Oja Odo Oro Junction	7.80274	5.5207	569	1615.18	13:43		Close/ Open loop
12/16/2017	AYD/IPA/001	Oke Ayedun-Ipao Road	7.83456	5.56169	538	1621.98	13:55		
12/16/2017	AYD/IPA/002	St Luke Anglican Primaryschool, Esun, Ekiti	7.85103	5.566	540	1621.36	14:01	132	
12/16/2017	AYD/IPA/003	Oke Ayedun-Ipao Road	7.8666	5.57296	541	1623.07	14:09		
12/16/2017	AYD/IPA/004	Ipao, Ekiti	7.88482	5.57847	529	1622.95	14:14		
12/16/2017	AYD/IPA/005		7.90039	5.5777	503	1630.32	14:20		
12/16/2017	AYD/IPA/006		7.91896	5.57364	484	1634.25	14:25		
12/16/2017	AYD/IPA/007		7.93157	5.55966	456	1642.49	14:30		
12/16/2017	AYD/IPA/008		7.94001	5.54679	442	1647.68	14:36		
12/16/2017	AYD/IPA/009	Oke Ako Ekiti	7.95848	5.54813	430	1647.67	14:45	133	
12/16/2017	AYD/IPA/010		7.97539	5.55717	425	1647.90	14:54	134	
12/16/2017	IFK/OYE/017	Oja Odo Oro Junction	7.80274	5.5207	569	1615.21	15:32		Close Loop

Appendix 5

(Euler De-convolution maps)



4.18: Euler De-convolution Map with Structural Index "0"

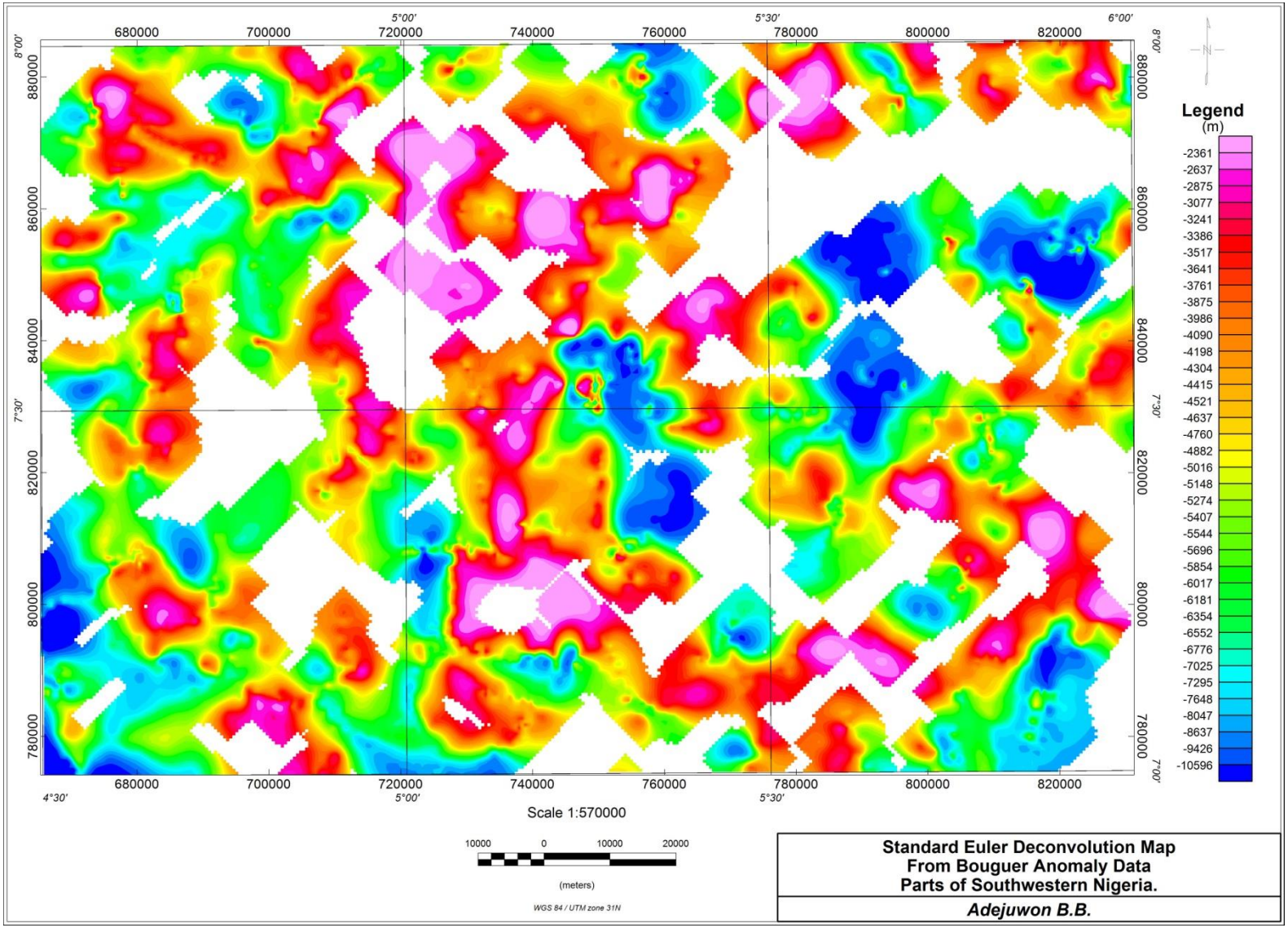


Figure 4.19: Euler De-convolution Map with Structural Index "1"

Appendix 6

(Aero-magnetic data and its derived products)

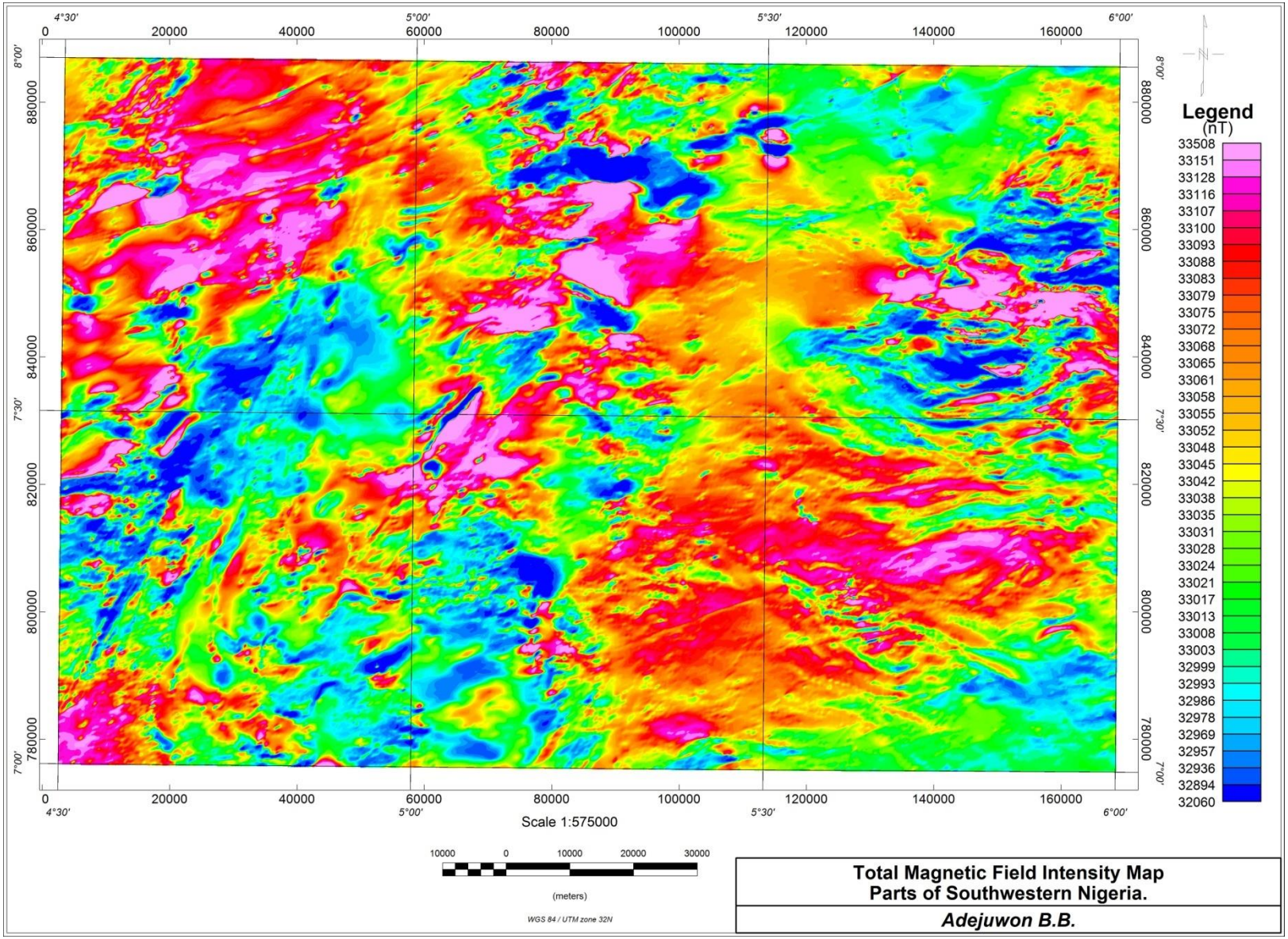


Figure 4.20: Total Magnetic Field Intensity Map

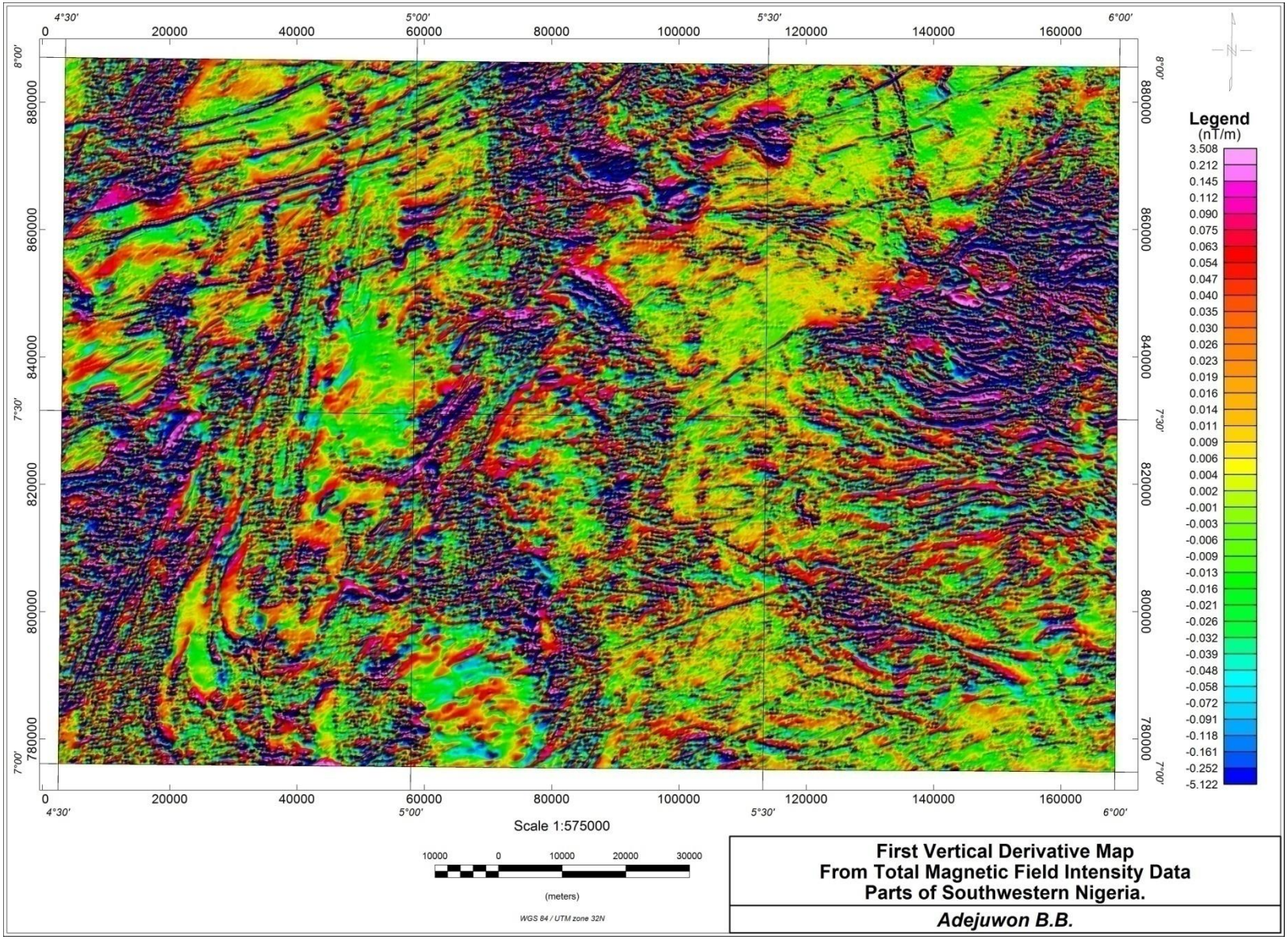


Figure 4.21: First Vertical Derivative Map from Aeromagnetic Data

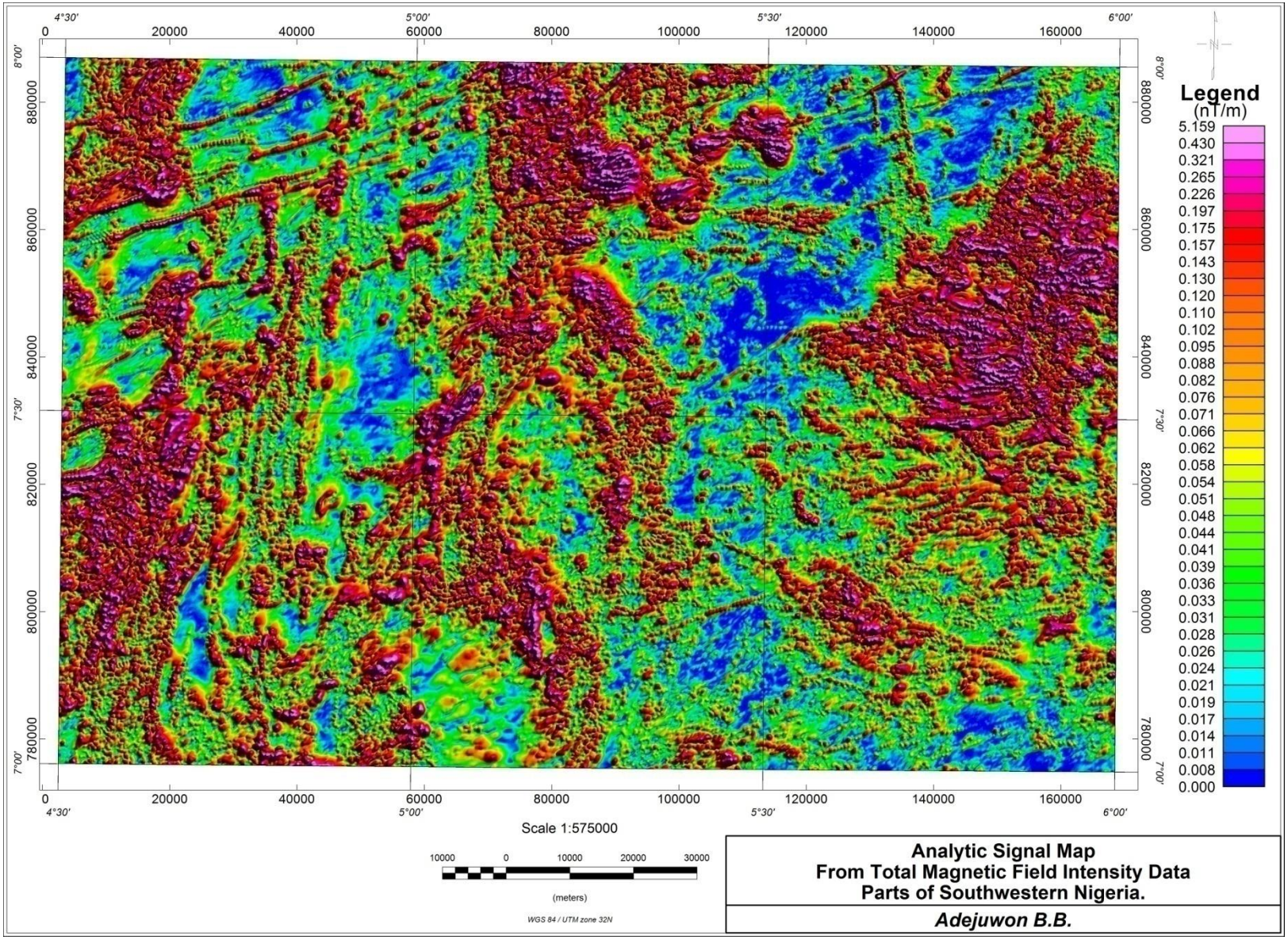


Figure 4.22: Analytic Signal Map from Aeromagnetic Data