

Estimation of Source Parameters using Source Parameters Imaging (SPI) Method on Digitised High Resolution Airborne Magnetic Data of a Basement Complex

O. T. Olurin¹, S. A. Ganiyu¹, G. O. Layade¹, I. C. Okeyode¹ and O. A. Idowu²

¹Department of Physics, Federal University of Agriculture, P. M. B 2240.
Abeokuta Ogun State Nigeria

²Department of Water Resources Management and Agro-Meteorology,
Federal University of Agriculture, P. M. B. 2240. Abeokuta. Ogun State Nigeria.

Abstract

This study was carried out using aeromagnetic data which record variation in the magnitude of the earth magnetic field in order to detect local changes in the properties of the underlying geology. The aeromagnetic data (Sheet No. 261) was acquired from the archives of Nigeria Geological Survey Agency, obtained in 2009. The study present estimation of source parameters within an area of about 3,025square kilometres on geographic latitude 7°00'N to 7°30'N and longitude 3°30'E to 4°00'E within Ibadan and it's environs in Oyo State, southwestern Nigeria. The area under study belongs to part of basement complex in southwestern Nigeria. Estimation of source parameters of aeromagnetic data was achieve through the application of source imaging parameters (SPI) techniques which delineation; depth, dip contact, susceptibility contrast and mineral potentials of magnetic signatures within the region. The depth to the magnetic sources in the area ranges from 0.675 km to 4.48 km. The estimated depth limit to shallow sources is 0.695 km and depth to deep sources is 4.48 km. The apparent susceptibility values of the entire study area obtained ranges from - 0.01 to 0.005 [SI]. This study has shown that the magnetic susceptibility within study area is controlled mainly by super paramagnetic minerals.

Keywords: Aeromagnetic, basement complex, metasediment, Precambrian

1.0 Introduction

The main source of the magnetic field and the cause of the circular variation remained a mystery since rapid fluctuations seemed to be the odds with the rigidity of the Earth, and until this century an external origin of the field was seriously considered. In 1839, Gauss [1] was able to prove that the entire field has to be of internal origin. Gauss used spherical harmonics and showed that the coefficients of the expansion, which he determined by fitting the surface harmonic to the available to the magnetic data at that time. To acquire the variation in the earth magnetic field, there is need to carry out magnetic survey. Magnetic method is a geophysical technique that exploits the appreciable differences in the magnetic properties of minerals within the main objective of characterizing the earths subsurface. In order to cover a large expanse of land, airborne magnetic survey is required. Aeromagnetic data allow fast coverage of large and inaccessible areas for subsurface reconnaissance, which makes magnetic data analysis an essential tools in geophysical exploration. Airborne magnetic data is the gathering of magnetic data by small aircraft over a large expanse of land (which may be or not accessible) and interpreting the data using several interpretation techniques. It is a means of arriving at ore deposit within a geographic area [2]. Aeromagnetic data records variation in the magnitude of the earth's magnetic field in order to detect local changes in the properties of the underlying geology. Airborne magnetic data collected over region under study becomes a potential source of valuable information containing signal related to hidden magnetic lithology and subsurface structure of area under consideration. The crystalline basement complex in some parts of West Africa has direct correlation between the yield of bore wells and their

Corresponding author: O. T. Olurin, E-mail: olurin@physics.unaab.edu.ng, Tel.: +2348066600703