AIN SHAMS UNIVERSITY
FACULTY OF SCIENCE
GEOPHYSICS DEPARTMENT

INTEGRATED GEOPHYSICAL PROSPECTING OF THE IRON ORE DEPOSITS AT EAST OF ASWAN, UPPER EGPYT

A Thesis
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By

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بِسْمِ اللَّـهِ الرَّحْمَـٰنِ الرَّحِيمِ

(لَقَدْ أَرْسَلْنَا رُسُلَنَا بِالْبَيِّنَاتِ وَأَنزَلْنَا مَعَهُمُ الْكِتَابَ وَالْمِيزَانَ لِيَقُومَ النَّاسُ بِالْقِسْطِ ۖ وَأَنزَلْنَا الْحَدِيدَ فِيهِ بَأْسٌ شَدِيدٌ وَمَنَافِعُ لِلنَّاسِ وَلِيَعْلَمَ اللَّهُ مَن يَنصُرُهُ وَرُسُلَهُ بِالْغَيْبِ ۚ إِنَّ اللَّهَ قَوِيٌّ عَزِيزٌ)

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ABSTRACT

The main objectives of the current study is to evaluate the area under investigation in terms of iron prospecting. Surface geophysical methods usually used as part of the process of detecting and delineating subsurface geologic conditions.

Shallow geophysical investigations in the form of magnetic, geo-electrical resistivity, self-potential, shallow seismic refraction and very low frequency-electromagnetic techniques were selected and conducted in the area under investigation to attain the purpose of this study and confirmed by field geological observations and a number of boreholes.

Qualitative interpretation of magnetic data was very useful to delineate the presence of iron ore deposits in the study area.

Fifty four vertical electrical soundings in the form of schlumberger configuration were measured along nine profiles arranged on three lines from west to east direction. The Terrameter SAS 300c was used to collect the data of the present study. The interpretation of the obtained geoelectrical resistivity data were executed in detail qualitatively and quantitatively, accordingly, provide subsurface sequence of four geoelectrical units.

Thirty six self-potential profiles were measured along two lines. Self-potential data were interpreted in a qualitative way in the form of profiles and maps.

Three long seismic lines were conducted in the study area for generation of seismic waves. The first seismic line I of about 3860 m length lies in the southern part of the area under study and consists of six (6) seismic profiles. While the second seismic line II lies in the central part of study area of 4388 m length and includes seven (7) seismic profiles. The third seismic line III lies in the northern part of study area of 3869 m length and consists of five (5) seismic profiles. The seismic data has been detected, recorded and collected by OYO McSeis 1500- 24-Channels OYO Seismograph. Two modern computer software packages as ZondST2D and Geogiga Seismic Pro 7.1 were used for processing and filtering these seismic data. The interpretation of seismic data provide the velocity-depth models of four seismic layers.

A total of 684 reliable VLF-EM induction soundings were conducted in the study area along 9 survey profiles with station interval of 20 m using the working frequencies were 20.3 and 26.7 kHz at the measuring azimuths 315º and 340º N, respectively. The measurements were carried out using the commercially available WADITM VLF–EM system. A one-dimensional linear filter-operator (Fraser, 1969) and a two-dimensional linear filter-operator (Karous and Hjelt, 1977 and 1983) were applied to improve both the vertical and lateral resolutions of VLF–EM data and making them easier to identify.

A reconnaissance field trip conducted to the study area to investigate the local geology and recording geological observations

to empower our geological overview of the study area in order to precisely assign the optimum geophysical model.

The integrative use of geophysical techniques was found effective for imaging the typical shallow stratigraphic sequence at the study area. There are some indications for the presence of iron ore accumulations. Where, the locations of some iron ore lenses represented by magnetic anomalies on residual magnetic maps and on self-potential maps. The geo-electrical cross-sections could bulky imaged the relatively conductive ferruginous clay, whereas, the very conductive thin iron ore bands/masses, within such a dominant thick clayey layer, could be imaged from the EM-equivalent current-density cross-sections. The results could approximately differentiate between the target ferruginous clay and its fairly resistive sand/clayey sand background. The thickness of layers correlated to geo-seismic depth-velocity models and drilling data.

Finally, we can conclude that, in the study area, the minable iron ore is concentrated in the eastern part of the study area on the flanks of Wadi Abu Subiera and very rare at the floor of the wadi.

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