AIN SHAMS UNIVERSITY
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AIRBORNE GAMMA RAY SPECTROMETRY AND MAGNETIC DATA EVALUATION OVER THE EAST WADI LIGAN AREA, EASTERN DESERT, EGYPT

A THESIS
Submitted for the partial fulfillment for the requirements of the M.Sc. degree in Geophysics

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Abstract

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ABSTRACT

The studied Wadi Ligan area is located in the Central Eastern Desert of Egypt between latitudes 27°50' N- 28°05' N and longitudes 32°10' E- 32° 40' E and approximated 2052 km2. The geology of this area consists, for the most part of exposures, of Upper Cretaceous, Eocene and Quaternary Wadi sediments. Precambrian metavolcanics, metagabbro-diorite complex and younger granites are exposed in the east of the area.

The purpose of this study is the analysis, evaluation and interpretation of the aerial radiospectrometric and magnetometric survey data acquired over East Wadi Ligan area. The interpretation is mainly devoted towards the achievement of three main objectives namely: geological (lithological and tectonical) mapping, mineral exploration especially uranium anomalous zones and environmental radiospectrometric monitoring of the area under consideration.

The area under consideration has been involved in the aerial multi-channel gamma-ray and magnetic survey conducted by Aero- service Division, Western Geophysical Company of America, in 1983, over a large segment of the Eastern Desert of Egypt, as a part of the Mineral, Petroleum and Ground Water Assessment Program (MPGAP). Conversion of the gridded data of the aerial magnetic and multi-channel gamma-ray survey - conducted over the studied area- to a common image format made it possible to display and manipulate these originally non-image data by standard digital image processing technique. In this way some interesting false colour composite images were produced for some selected combinations from the various radiometric parameters. These radiometric composite images offered much in terms of lithologic discrimination based on colour differences and showed distinct efficiency in defining areas where different lithofacies occur.

Applications of univariate, bivariate and multivariate statistical methods of analysis have been developed to interpret quantitatively aerial gamma-ray spectrometric survey data. The integrated results gained from

these analyses were presented on interpreted radio-lithologic unit map (IRLU). These map enabled the identification of some significant modifications on the mapped surface geology of the studied area. Five locations of anomalously high U abundance were outlined. There represent exploration targets of high priority for ground geological, geophysical and geochemical follow-up investigations.

The natural radiation (exposure rate) of the study area is frequently referred as a standard for comparing additional sources of man-made radiation such as atomic weapon fallout, nuclear power generation, radioactive waste disposal, etc. Furthermore, the dose rate of the study area remains in the safe side and for under the maximum permissible safe radiation dose without harm to the individual, with continuous external irradiation of the whole body except the eastern sides that should be subjected for further follow up investigations.

2D-frequency domain filtering techniques were applied on the aerial magnetic data. There included: reduction to the north magnetic pole, isolation of regional and residual magnetic components. Depth calculations were applied on some selected magnetic anomalies to determine the depths to their causative geological sources. Results obtained from these interpretation techniques were used in integrated manner to construct the basement tectonic map of the study area. It shows that structurally, the predominant direction in the study area is the NW-SE and the basement highs exposed at eastern part. This interpreted tectonic map has been quantified through the application of the 2D-magnetic modeling technique.

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