GEOPHYSICAL STUDIES TO EVALUATE THE DEEP GROUNDWATER AQUIFERS IN THE SOUTHWESTERN PART OF SINAI

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ABSTRACT

The study area lies in the southwestern part of Sinai Peninsula and is defined between Latitudes 27° 45' and 28° 45' N and Longitudes 33° 10' 40" and 34° 15' E.

The objective of this work is to make use of integrated geophysical data (aeromagnetic, deep seismic, well logging and geoelectrical resistivity sounding) to evaluate the characteristics of the deep and shallow formations as well as their vertical and horizontal extension in the study area in terms of groundwater potential. A special emphasis is given to the structural pattern affecting these formations and its impact on the groundwater occurrence.

To fulfill these tasks the available magnetic and deep seismic data were interpreted to delineate the subsurface structural pattern, while the wireline electrical well logging and geoelectrical well logging data were tools to study the characteristics of the groundwater aquifers. The geoelectrical resistivity sounding data were used to delineate the shallow formations and to detect groundwater occurrence within these formations.

The total intensity aeromagnetic field map has been qualitatively analyzed and quantitatively interpreted to delineate the structural elements at different depths using various methods of separations (Griffin's and Filtering techniques) and to estimate the average depths applying the spectral analysis.

The parameters of acquisition and processing of deep seismic data have been discussed in terms of velocity analysis and construction of velocity maps. The subsurface structural elements have been delineated by constructing

structure contour maps of Nubia, Lower Rudies, Upper Rudies, Kareem, Belayim and Zeit Formations.

Well logging data were used to determine the general characteristics of the water bearing formation in terms of shale volume, effective porosity, water saturation, and water salinity.

The geoelectrical resistivity sounding data have been quantitatively interpreted and the deduced geoelectrical parameters were used to delineate the near surface lithologic succession and the water bearing formations.

The statistical analysis of the tectonic trends inferred from the separation of the aeromagnetic data showed the presence of five tectonic trends. The Suez or Clysmic trend (N 30°- 40° W) is the major one while the Aqaba trend (N 5°- 15° E) is the minor one. In a decreasing order the Syrian Arc trend (N 30°- 50° E), Najd trend (N 40°- 60° W), Tethyan trend (E-W), East African trend (N-S) have also been detected.

The interpretation of velocity maps constructed for the top of the different formations (Nubia, Lower Rudies, Upper Rudies, Kareem, Belayim and Zeit Formations), revealed that the velocity values increase in the northeast, east and southwest part of the area and decrease towards the northwest and southeast directions.

The seismic velocity of each formation and their isochronous reflected data were used to construct structure contour maps in terms of depth. In additional, azimuth length distribution was carried out to enhance the structural interpretation. The thickness distribution of each formation has been presented in the form of isopach maps.

The structural pattern inferred from both magnetic and seismic interpretation was found to be more or less conformable to each other.

The interpretation of the well logging data revealed that the formations are moderately to highly porous and saturated with saline to highly saline water.

The results of geoelectrical resistivity sounding revealed that the lithologic succession consists of a number of layers that can be grouped in four main zones. The geoelectrical characteristics of the third and fourth zones suggest water saturation with downward increasing salinity. Locations for drilling water wells have been recommended.

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