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Geophysical Study of the Subsurface Electrical Conductivity at Sahl El Qaa area, Southern Sinai Peninsula, Egypt

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The area under investigation is located in the southern Sinai Peninsula, Egypt, which is considered one of the most promising regions for oil resources. Three different tectonic forces affect this area in the triple junction structures associated with the opening of the Gulf of Suez and the strike slip movement along the Gulf of Aqaba. The present study is mainly dealing with evaluation of the tectonic position and subsurface structures of the study area. To achieve this, a high-resolution land magnetic survey has been acquired over an area of bout 250 km^2. Two hundred seventy eight land magnetic stations were measured over a mesh like area with 500m spacing interval. The necessary reduction concerning daily variation, the regional gradient and time variation observation were applied, and then the total intensity anomaly map was constructed and transformed to the reduced to the pole magnetic map (RTP). This step was followed by application of the analytical signal, low and high pass filleting techniques to process the magnetic data. As well as, Six MT soundings have been performed at Sahl El Qaa area. The fluxgate magnetometer and telluric amplifiers allow recording the field variations in the period range from 5 to 1000s. The sampling rate for digital recordings used in the field measurements varied between 2 and 5 s. In the telluric profiles of about 100 m length, unpolarised electrodes were used. The MT data have been processed to yield the TE and TM mode responses and then corrected for static shift. Robust estimation of the impedance tensor for every station has been made using different methods. Apparent resistivity (ρa) and phase (ϕ) for transverse electric (TE) and transverse magnetic (TM) modes at all MT stations have been processed and inverted using advanced techniques including 2-D inversions to investigate the conductive zones at the study area. The study of the dimensionality and directionality of the regional electrical structures is based on the analysis of the induction arrows. The resulting regional strike direction is N–S, N35º–N45º west and E–W directions, in accordance with regional geological features. Moreover, interpretation of tipper magnitude has been presented for the MT soundings. The 2-D inversion has been employed on both TE and TM modes. The main features obtained from the inversion elucidate high conductive zones at different levels of the resistivity sections with various thicknesses from west to east**.** The depth to the basement rocks ranges from 1 km to more than 2 km below sea level.