GEOPHYSICAL STUDIES OF AL -HAMMA AREA
AS A POTENTIAL SOURCE OF GEOTHERMAL
ENERGY

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ABSTRACT

The geothermal area of the northwestern corner of Jordan has been investigated by gravity, magnetic and electrical methods. Extended Bouguer and total magnetic field data show the presence of several anomalies with different shapes, amplitudes and lengths. These anomalies are interpreted to be caused by a combination of sources at different depths.

Low gravity values in the study area are attributed to the presence of low density marly limestone of Cenozoic age. While high Bouguer values particularly those observed between Umm Qeis and Al-Hamma are interpreted to have been caused by local igneous intrusions of gabbroic type with a density of 3.03 gm/cm³. The source of the high density materials is probably the upper mantle. The upper surface of these intrusions lay at depths ranging from 0.8-1.6 km. These intrusions are probably the source of heat observed in the springs of this area. Regional and local faults facilitate the water circulation causing elevated local water temperatures in the aquifer as well as the local springs and wells. Normal depth-temperature gradient may only be a second or third order contributor to this heating.

The magnetic map is characterized by two different types of anomalies; the first extends in the NE-SW direction and is characterized by high amplitude and gradient, suggesting that the causative source, mainly of basaltic type, ranges in depth from the surface to about 1.5 km. The second type is characterized by low
amplitude and gradient. The causative source seems to be basement rocks or deeper.

Both gravity and magnetic lineaments do not correlate with the surface geological lineaments. This suggests that the anomalies are caused by subsurface structures which are not related to the topography or surface geology.

Modelling of gravity data indicates the depth to the crystalline basement ranges from 3-4.8 km, while the total thickness for the crust beneath the study area is 35.5 km. This is in agreement with the results obtained from deep seismic soundings experiment (El-Isa et al., 1987 a,b).

Based on electrical resistivity data, two types of aquifers are distinguished, where the first, west of the transform, which has a resistivity ranging from 3-55Ω.m, is characterized by high salinity and is composed of gravel and fractured basalt at shallow depths, the second type, east of the transform, which has a resistivity ranging from 3-586Ω.m, is characterized by moderate, less salinity and composed of limestone and marly limestone, the transform acts as a semi-barrier to the water flowing westward.