



**GEOPHYSICAL CHARACTERISTICS OF THE
SUBSURFACE STRUCTURES IN NORTHEASTERN AL-
MADINAH AL-MUNAWARAH (HARRAT AL-AQUL)
CENTRAL ARABIAN SHIELD**

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ABSTRACT

An integrated geological, hydrogeological and geophysical investigation was conducted in Al-Aqul area, northeastern Al-Madinah Al-Munawarah to determine subsurface structural characteristics and volcanic layer (basalt) sequences. Magnetic data were used to show the variations between volcanic layer sequences and to locate subsurface structures, while resistivity measurements were used to delineate hydrostratigraphy.

The study consists of six magnetic profiles, eight Vertical Electrical Soundings (VES) and eighteen Horizontal Electrical Profiling (HEP). The total magnetic intensity map was reduced to the pole (RTP), which was then processed to smooth out field variations caused by various noise sources and to facilitate the qualitative and quantitative interpretations. The data acquired from resistivity method were used to construct three geoelectrical cross-sections, four HEP contour maps and 3D geoelectrical models.

The structural elements, deduced from the magnetic maps, show the same structural trends of the study area. The geoelectrical cross-sections revealed six layers with different physical characteristics. The upper layer consists of weathered basalt, associated with high resistivity ($\rho > 1000$ Ohm-m). The second layer consists of wet fresh basalt associated with resistivity ranging from 500 – 1000 Ohm-m. The third layer has an average thickness of 48m and consists of fractured basalt with gravelly sand associated with resistivity ranging from 100-300 Ohm-m. This layer probably indicates the main water bearing layer in the study area. The fourth layer consists of fractured basalt with clay which is associated with resistivity ranging from 10-100 Ohm-m. The low resistivity in the fourth layer is probably attributed to the clay content and saline water. The fifth layer consists of weathered basement associated with resistivity ranging from 280-500 Ohm-m. The lower layer consists of fresh basement with resistivity $\rho > 1000$ Ohm-m and depth range from 121m to ∞ .

Analysis of magnetic and horizontal electrical profiling (HEP) suggests that the middle segment of Wadi Al-Ehileene is existing buried under lava sill. The average thickness estimated from magnetic and resistivity data of the basaltic lava flow is about 184 and 166m respectively.