Integrated interpretation of the magnetotelluric and magnetic data from Mahallat geothermal field, Iran

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ABSTRACT

Magnetotelluric (MT) and ground magnetic surveys were conducted on the Mahallat geothermal field situated in Markazi province, central Iran, as a primary part of the explorations and developments of a geothermal energy investigation program in the region. Mahallat region has the greatest geothermal fields in Iran. MT survey was performed in November 2011 on an 8 km profile crossing the hot springs with a total of 17 stations. The 2D inversion of the determinant MT data was performed using a 2D inversion routine based on the Occam approach. The 2D resistivity model obtained from the determinant data shows a low resistivity zone at 800–2000 m depth and a higher resistivity zone above the low resistivity zone, interpreted as geothermal reservoir and cap rock, respectively. It also revealed two major concealed faults which are acting as preferential paths for the circulation of hydrothermal fluids. To obtain more geophysical evidence, a ground magnetic survey with 5000 stations was also performed over an area of 200 km² around the MT profile. Magnetic measurements show a main positive anomaly of about +1000 nT over the study area, which could be interpreted as an intrusive body with the high magnetic susceptibility (i.e. mafic and ultramafic rocks) into the sedimentary host rocks. We interpret the body as the heat source of the geothermal system. Structural index and depth estimation of the anomaly indicate that the intrusive body is similar to a cylinder extending from about one kilometer depth down to greater depths. The results of MT and magnetic investigations indicate a geothermal reservoir which proves the preliminary geological observations to a great extent.

Keywords: geothermal field, inversion, Iran, magnetic, magnetotelluric, Mahallat
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References


