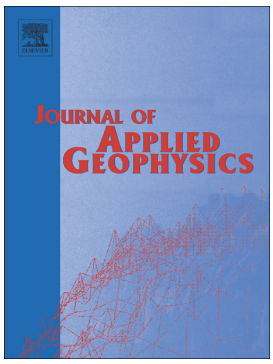

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Imaging subsurface northern Rahat Volcanic Field, Madinah city, Saudi Arabia, using Magnetotelluric study

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Abstract

Rahat volcanic field is one of the basaltic fields in Saudi Arabia that has three major geohazard events; the historical eruption (AD 1256), the fissure eruption (*~4500–1500 BP*), and seismic swarm (1999). These events were studied and evaluated using geophysical and geochemical studies as well as volcanological studies. Geophysical studies include gravity, seismic, and magnetotelluric surveys. In the current research, the magnetotelluric data will be analyzed using 3D inversion technique in order to image the subsurface resistivity setting of the study area.

Results from 3D inversion of the MT data revealed four major resistivity structures. The first is a layer of intermediate resistivity (40-250 ohm-meters) which is thicker (~800 m) to the south-west and thinner to the eastern edge, mostly covered by exposed Precambrian basement. This layer is underlain by resistive (>1000 ohm-metres) granitic basement. Intruding into the resistive basement are two near-vertical conductive (<20 ohm-metres) structures. One is located immediately west of the historic eruption (1256 AD) centre in the north, at a depth of about 15 km. The other intrusive is on the southern end of the survey area, also at a depth of about 15 km. Two conductive “channels” trending NW-SE and NE-SW were observed at depths of about 18 km. The NE-SW aligned “channel” runs through the northern intrusive while the NW-SE trending “channel” runs in the middle of the study area and connects both intrusive. The conductive intrusive and “channels” may be attribute partial melts stored in the pre-existing structures within the lower crust. Although the youngest known trachytic eruptions from the study area are several hundred thousand years old, recent and ongoing seismicity strongly suggest there may be magmatic activities in the lower and probably upper crust.