Lithosphere resistivity structure across the Marwar terrane and Aravalli-Delhi Mobile Belt in NW India using magnetotelluric data

K. K. Abdul Azeez*, K. Veeraswamy, Prasanta K. Patro, Arvind K. Gupta, Narendra Babu
MT Group, CSIR - National Geophysical Research Institute, Hyderabad, India
azeez@ngri.res.in/azeez.kk@gmail.com

SUMMARY

The lithospheric resistivity structure of the Marwar terrane and Aravalli-Delhi Mobile Belt (ADMB) in the NW Indian shield is studied using magnetotelluric (MT) data acquired along a 600 km long traverse across these Precambrian geologic domains that experienced major Proterozoic tectonothermal events. Detailed dimensionality analysis of the data was performed, and accordingly lithospheric resistivity models were generated using 2D and 3D approaches. The subsurface resistivity models generated through the two different inversion approaches showed a broad concurrence since most of the major resistivity features (resistive and conductive) can be identified in both inversion models. However, there are notable differences in spatial occurrence and geometry of some of these resistivity structures. The lithospheric resistivity section obtained through 3D inversion is preferred to make inferences on the subsurface geology and shed light on to the tectonic setting and evolution of the region. The conductive and resistive structures imaged by the MT study show good agreement with the geological markers of the Precambrian collisional tectonics and magmatism envisaged for the region. The resistivity model shows a moderately resistive (about 200 Ωm) upper mantle structure under the ADMB, surrounded by conductive zones (50 – 100 Ωm), indicating anhydrous, cold sub-continental lithospheric mantle and deformed lithosphere zones. This is explained as the remnant of the Archean Aravalli craton that resulted from the metacratonization of the Archean lithosphere through the tectonic processes related to the Aravalli-Delhi orogeny. A low resistive upper mantle anomaly characterizes the Marwar lithosphere with a few conductive “fingers” penetrating through a resistive uppermost mantle and crust in the area. This is considered as the vestiges of intense deformation and partial melting associated with the Neoproterozoic tectonothermal events experienced during the Delhi orogeny and pathways of magma outpour.

Keywords: Aravalli, Marwar, magnetotelluric, resistivity, metacratonization