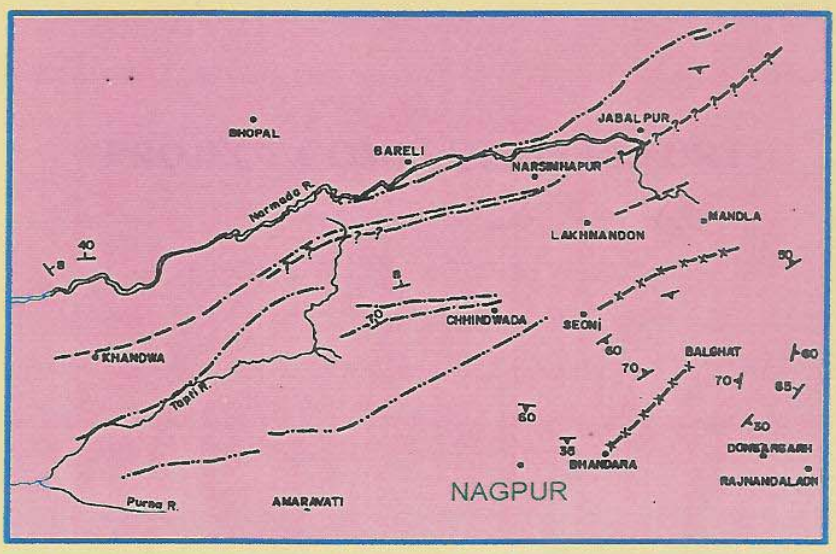
MAGNETOTELLURIC STUDIES ACROSS NARMADA SON LINEAMENT ZONE AND BHANDARA CRATON IN CENTRAL INDIA



PROJECT COMPLETION REPORT

NATIONAL GEOPHYSICAL RESEARCH INSTITUTE
HYDERABAD-500 007, INDIA.
1999

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PROJECT SUMMARY

The Central Indian Craton is one of the important lithospheric units of the Indian peninsula. Presence of important tectonic features like Narmada-Son lineament (NSL), the postulated Central Indian Suture zone (CIS) and several other tectonic features make it all the more important for detailed studies through a multidisciplinary approach. Indeed the CRUMANSONATA project executed by the Geological Survey of India provided very valuable information on the geology, structure, and tectonic setting of this region. A characteristic pattern of structural features resembling a graben and horst structure with interfaces trending roughly parallel to the NSL strike namely the ENE-WSW is evident. Earlier Deep Seismic Sounding Studies along select N-S trending traverses, as also detailed gravity studies brought out the general nature of velocity and density structure and the crustal characteristics. Moderate heat flow, anomalous crustal electrical conductivity, significant seismicity along the NSL and the associated fault features and also the distinct differences in the surface geology and the structure across the CIS, have enhanced the tectonic importance of the region.

Keeping in view the geological and tectonic significance of the region between NSL and the postulated Central Indian Suture zone, the present project was formulated to investigate the subsurface electrical structure of the region. A 350 km long NW-SE trending Bareli-Seoni-Rajnandgaon traverse, cutting across the entire Narmada-Son Lineament zone, the Central Indian Suture zone and the Chhattisgarh basin (Rajnandgaon) has been taken up for the present investigation and a magnetotelluric study was carried out to probe to deeper levels of the crust. A total of 38 MT sites were occupied along this traverse with a station spacing of about 10 to 15 km with relatively closely spaced sites at places where the traverse crossed the important structural features for eg. the Central Indian Suture zone.

The data acquisition was accomplished through deployment of the state of the art wide band MT systems. The data have been modeled using several 1-d and 2-d inversion schemes. Results of modeling from the different segments of the traverse clearly brought out the nature of shallow as well as deeper sections of the crust in this region, besides pointing out to a well-defined block structure and the associated structural elements.

The block structure deduced from the Magnetotelluric modeling results clearly indicates that the subsurface resistivity of the crustal section shows a systematic change from southeast to northwest along the traverse. From very high resistive block in the south to a moderately resistive block followed by conductive and more conductive blocks as we go northwards indicating presumably the presence of increasingly reactivated crust towards north.

The CIS manifests itself in the form of a near vertical but shallow conductive interface and does not however show any electrical characteristic typical of a suture zone. The present results indicate that reactivation of the northern block must have continued in the subsequent geological history, with rifting taking place along the east-west direction at places further northwards. The evidence for this is obtained in the occurrence of well-defined vertical electrical discontinuities coincident with the megatectonic elements like Tapti fault, Satpura fault and Narmada South fault. This suggests that the Central Indian block adjacent to the Dharwar craton underwent several cycles of reactivation the most recent events being; neotectonic activity in the Narmada-Son zone which is characterized by elevated heat flow regimes, significant seismic activity and uplift.

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