Geomagnetic anomalies and regional geology in India along 18° N parallel

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MS received 5 June 1981; revised 24 September 1981

Abstract. The mobile geomagnetic measurements made during 1970-73 by NGRI across the Indian Peninsula between Alibag and Kalingapatnam have been examined. It is noticed that the mean Z values after normal correction and the long period Zr/Hr ratio reveal different levels on the three different geological provinces viz., the Deccan traps, peninsular granites and the eastern ghat metamorphics.

Keywords. Geomagnetic anomalies; regional geology.

Geomagnetic elements measured through mobile observatories help to improve the geomagnetic picture of the globe and also inferring deep conductivity inhomogeneities within the earth. While relatively stable field values or mean values over a certain period at each spot are needed for the former aspect, in the latter case, time dependent variations are studied. The observations made by Srivastava *et al* (1974) at 21 sites between Alibag and Kalingapatnam are of interest as the measurements were made for Z and H fields continuously for a week at each site and that these observation sites are distributed nearly about 18°N parallel traversing the Deccan traps, the peninsular granites and the eastern ghat metamorphics. In addition this profile also covers the proposed Koyna and Kurdwadi rift valleys in the Deccan trap region and the Godavari rift valley between Kothagudam and Bhadrachalam. From the long and short period time variations of the Z and H fields Srivastava *et al* (1974) inferred deep conducting structures in Koyna and Bhadrachalam regions as also the normal ocean effects at the respective coastal regions.

It is possible, as had been attempted by Murty and Swamy (1978) and Murty and Rao (1979) in other areas of the Indian peninsula that from the relatively stable mean geomagnetic field values magnetic anomalies could be estimated for inferring the contribution of geology and crustal structure. Therefore the Z field mean values of one week observations at each site along the profile are subjected to normal correction using the charts of Sankaranarayan (1967) and are projected onto 18°N parallel (figure 1). These values can be considered to be free from the daily and short period variations and thus represent the stable main field (ignoring secular variation correction which is small for the period of observations 1970-73) which appears mostly as the regional and the intra-crustal and the surface regional geological influences. Also the mean Zr/Hr ratios (Zr is the daily range in Z determined from early morning maximum and noon time minimum and Hr is the daily range in H determined for

Figure 1. Profile from Alibag to Kalingapatnam, (a) Plan view of location of geomagnetic stations (NGRI) and geology (after GSI, 1963, 1975) (b) Geomagnetic variation Z_r/H_r and vertical magnetic component projected along 18° N Parallel, (c) Bouguer anomaly (after Qureshy 1971) projected on to 18° N Parallel, (d) Elevation profile projected on to 18° N Parallel along with schematic view of regional geology inferred from geophysical anomalies.

noon time maximum and night minimum) from the observations for a week at each site are plotted along the profile in figure 1.

It is clear that these Z_r/H_r ratios being time dependent would represent the induction components from deeper layers of the crust.

An examination of these two profiles in comparison with the surface geology, regional gravity anomaly taken from Qureshy (1971) and the schematic probable geological section (figure 1) reveals that the corrected Z field values and the Z_r/H_r values are corresponding to the extent of distinguishing among the three geological provinces by means of significant changes in the levels of the intensity values. It is conspicuous that there is a sudden change in Z as also in Z_r/H_r values between Sastapur and Homnabad (stations 8 and 9) again around Kothagudem. Surface geology indicates that the zone between Homnabad and Kothagudem is marked by Peninsular granites while to the west it is occupied by Deccan traps and on the east easternghat series (metamorphics) appear. The average levels of corrected Z field for the three zones are found to be 15738 nT for the Deccan trap region 15515 nT for the Peninsular granites and 15065 nT for the eastern ghat region. While in Koyana and Kurdwadi regions within the Deccan trap country there appear to be same response in the geomagnetic field characteristics for the deep structural patterns like the rift valleys proposed by Krishna Brahman and Negi (1973) it is to be ascertained from further analysis whether the variation around Kothagudem reveals the Godavari rift influence or the deep seated fault proposed by Murty *et al* (1978).

Further the prominent level changes in Z_r/H_r values at the boundary zones of Deccan traps and granites and granites and metamorphics could be due to deep conductivity inhomogeneity associated with the regional geological situation or could be due to the possible effect of the regional geology screening the deep conductivity features. Further studies in this direction can help in ascertaining the exact reasons for such a variation of Z_r/H_r values.

A comparison of geomagnetic dips estimated from the Z and H values and the values read from the normal geomagnetic dip chart of Sankaranarayanan (1967) also revealed a decrease in the former over the granitic region.

Acknowledgements

The authors thank the Head of the Dept. of Geophysics for providing research facilities and to Prof. V L S Bhimasankaram for encouragement. Financial help from CSIR is thankfully acknowledged.

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