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Pre- Earthquake Deccan Trap Thickness Estimation By Aeromagnetics in Latur Earthquake Zone

The multi-level aeromagnetic survey conducted over the Deccan traps in 1974 reflects a tectonic fault and thrust faulting environment near the Latur earthquake zone. The matching aeromagnetic thickness estimate with the drilling results calibrates thickness estimates at other places of aeromagnetic profiles and surveys and calls for a detailed future coverage of randomly magnetized Deccan traps by aeromagnetic surveys.

A collaborative project between National Geophysical Research Institute (NGRI), Hyderabad and National Oceanographic and Atmospheric Administration (NOAA), U.S.A. was launched in November 1970 for integrated studies of Deccan Traps by intensive geological, geochemical and geophysical methods. Under this programme, NGRI had planned and conducted multi-level aeromagnetic surveys at flight heights of 1220 m and 1524 m above mean sea level in March, 1974 (Negi and Agrawal, 1978, 1983). The objective of the survey was to study subsurface tectonic features and estimate the Deccan Trap thickness variation in the area.

The rare geophysical investigation before the earthquake assumes special importance now. One of the aeromagnetic profiles, extending from Goa to Parbhani (GP), runs close to the Latur earthquake zone (Fig.1.). The other profile running from Hyderabad to Surat (HS) is approximately perpendicular to the Goa-Parbhani profile. The GP profile, interestingly, reflects a fault F5 near the drilling site (Fig.1). Interestingly, the axis of this fault runs in the NW direction as the HS profile (bearing NW) is aeromagnetically quiet. Both these profiles were spectrally analysed to estimate the thickness of the traps from the surface (Fig.2). The G8 section of GP profile containing the Latur earthquake fault zone (F5- f4) (Pandey *et al.* 1995) shows the trap thickness of 330 m. (Figs. 1,2). Further, the average thickness of the trap rocks within a 50 km radius of the Latur region (shown by the dashed circle in Fig.1) works out to be 324 m.

Recently, Gupta and Dwivedy (1996) reported the drilling results in the surface repture zone, ~ 2Km NW of Killari (coordinates 18° 03' 07"N; 76° 33'20"E). The base of the trap rocks was encountered at 338 m. The paper also refers to the estimated thickness of about 350 m by magnetotelluric sounding (Sarma *et al.* 1994). Mishra *et al.* (1994) estimate the thickness as 600 m by gravity studies. It is gratifying to note that aeromagnetic results submitted to NOAA in 1978 and published in 1986 (Negi *et al.* 1986) is the closest to the drilling results. The comparative results of the various estimates are summarised in Table I.

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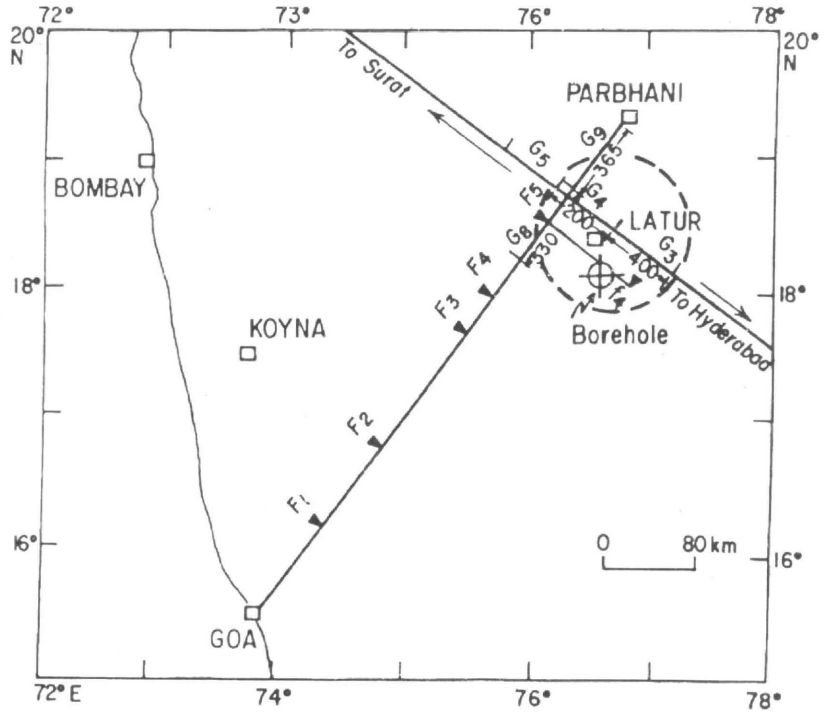

Fig.1. Map showing the location of Goa- Parbhani and Hyderabad- Surat aeromagnetic profiles. F1-F5 are the faults indicated by aeromagnetic study and f4 from geotectonic study (Ravi Shanker, 1993). G3-G4 and G8-G9 are the sections along which thickness of traps has been estimated by spectral technique.

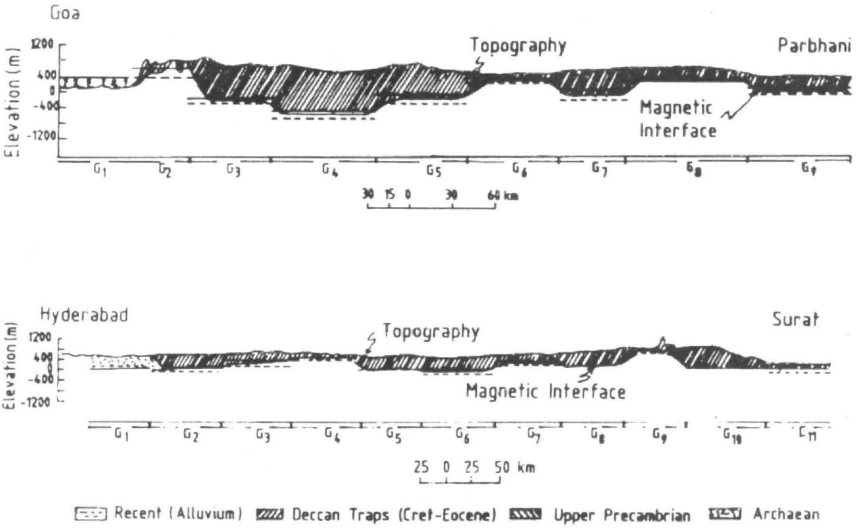

Fig.2. Estimated thickness of the trap rocks from the surface along Goa-Parbhani and Hyderabad-Surat aeromagnetic profiles (Negi *et al.* 1986).

Table I. Comparison of Deccan trap thickness estimates near the borehole site in the Latur earthquake region by various geophysical methods

Sl. No.	Method used	Thickness estimates (in meters)	Reference
1.	Aeromagnetics	330	Negi *et al.* 1986
2.	Gravity	600	Mishra *et al.* 1994
3.	Magnetotellurics	350	Sarma *et al.* 1994
4.	Drilled borehole	338	Gupta and Dwivedy, 1996

The drilling result also calibrates thickness estimates from aeromagnetic profiles at other places (G3: Trap thickness 400 m, and G4: trap thickness 200 m, both of HS) which are also close to the drilling site. Also, the section G8 of GP indicates thrust faulting environment of upwarped basement (Fig. 2) (Negi *et al.* 1986). The paper very well estimates depth distribution of Trap rocks in a radius of about 50 km around the Latur region.

Thus, the pre-earthquake multi-level aeromagnetic surveys with profiles chosen on the basis of available gravity data in 1974 (Krishna Brahmam and Negi, 1973) has proved quite fruitful in delineating the structural and tectonic patterns below the surveyed area. The success of such multi-level aeromagnetic surveys clearly demands a wider coverage of Deccan traps which are characterised by high and random surface susceptibility variations and Königsberger (Qn) ratio. Also, the spectral technique emerges as a reliable tool even in the magnetically Complex area like Deccan Traps where forward or inverse modelling generally fails owing to a number of uncertainties involved.

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