as 0.4 g/cc and h as 33 km for standard crustal column thickness at sea level are taken as assumed earlier. Considering 2.84 g/cc as normal density of the crust, the dense crust has 2.92 g/cc as its density.

Zero gravity field (Figure 5) over SW part of Cuddapah basin suggests isostatic equilibrium probably for dense sediments. In this region, the crustal thickness is 37 km as shown by the DSS profile and a value of 34.5 km only for T is expected for regional topography compensated here. This crustal thickness difference of 2.5 km can be equated with a positive density contrast of 0.1 g/cc for 10 km thickness sediments based on Airy's theory. Here ΔR is 2.5 km, $\Delta\sigma$ is 0.4 g/cc assumed earlier, lc is density contrast of sediments and h, its thickness is 10 km. Considering a density of 2.7 g/cc for crystallines, the density of sediments is 2.8 g/cc. This estimated density of 2.8 g/cc as well as 10 km thickness for sediments are well within geological estimates. This high-density sediment causes regional compensation similar to the dense crust with the mobile belt as explained earlier, by which downwarp of the crust extends beyond limits of this basin. This is reflected by negative gravity values observed along margins of the southwestern part of the basin (Figure 5).

Thus ZFb anomaly map reflects essentially the state of isostasy with different tectonic units in the study area with Airy's theory of isostasy operative and that the standard crustal column thickness and densities assumed for the crustal model are reasonable.

Using the zero-free air value concept of Subba Rao[1], ZFb anomaly map prepared for the southern part of India has brought out the real nature of gravity field over this region, which is otherwise not evident from Bouguer gravity map due to negative bias. The ZFb anomaly map has helped to understand better the tectonics of the region by indicating isostatic equilibrium with the Western Ghat mountains and isostatic instability with plateaus, the region of major earthquakes. In granulite terrain, the regions of mobile belts (Kerala, Madurai and the Eastern Ghats) along the east and west coasts are with anomalous crust, while the rest of the region is with normal crust. The regional topography and negative bias maps obtained now for the southern part of India can be utilized for any local and regional data sets to obtain ZFb anomaly map.

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Basement structure of the southwestern part of the Cuddapah Basin from aeromagnetic anomalies

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The basement configuration of the southwestern part of the Cuddapah Basin was derived from aeromagnetic data by transforming it into pseudo-gravity anomalies with a low-pass filter. The inferred picture shows a general depression of the basement elongated in a NW-SE direction and reaching a maximum depth of about 10 km near Muddanuru. The steep dip of the basement in the southern and southwestern part suggests that the sediments were derived from the southern and southwestern sides of the basin.

THE Cuddapah Basin (Figure 1) is one of the well-studied Proterozoic basins of India. The basin, filled with Precambrian rocks of the Cuddapah and Kurnool super groups, comprises mainly shales, limestones and quartzites, with basic sills in the southwestern part. The Archean granites, gneisses and schists surrounding the basin might constitute the basement[1–4]. In the last three decades, extensive geophysical studies over the Cuddapah Basin have been carried out to understand its structure and evolution. These include detailed studies

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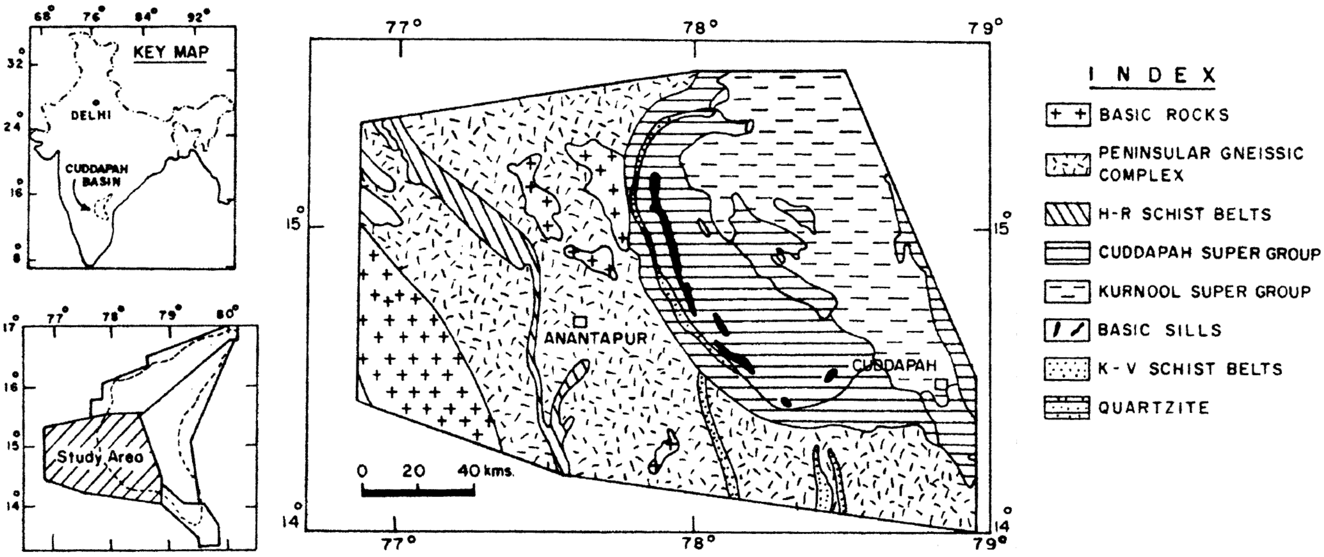

Figure 1. Generalized geological map of the study area, showing its location.

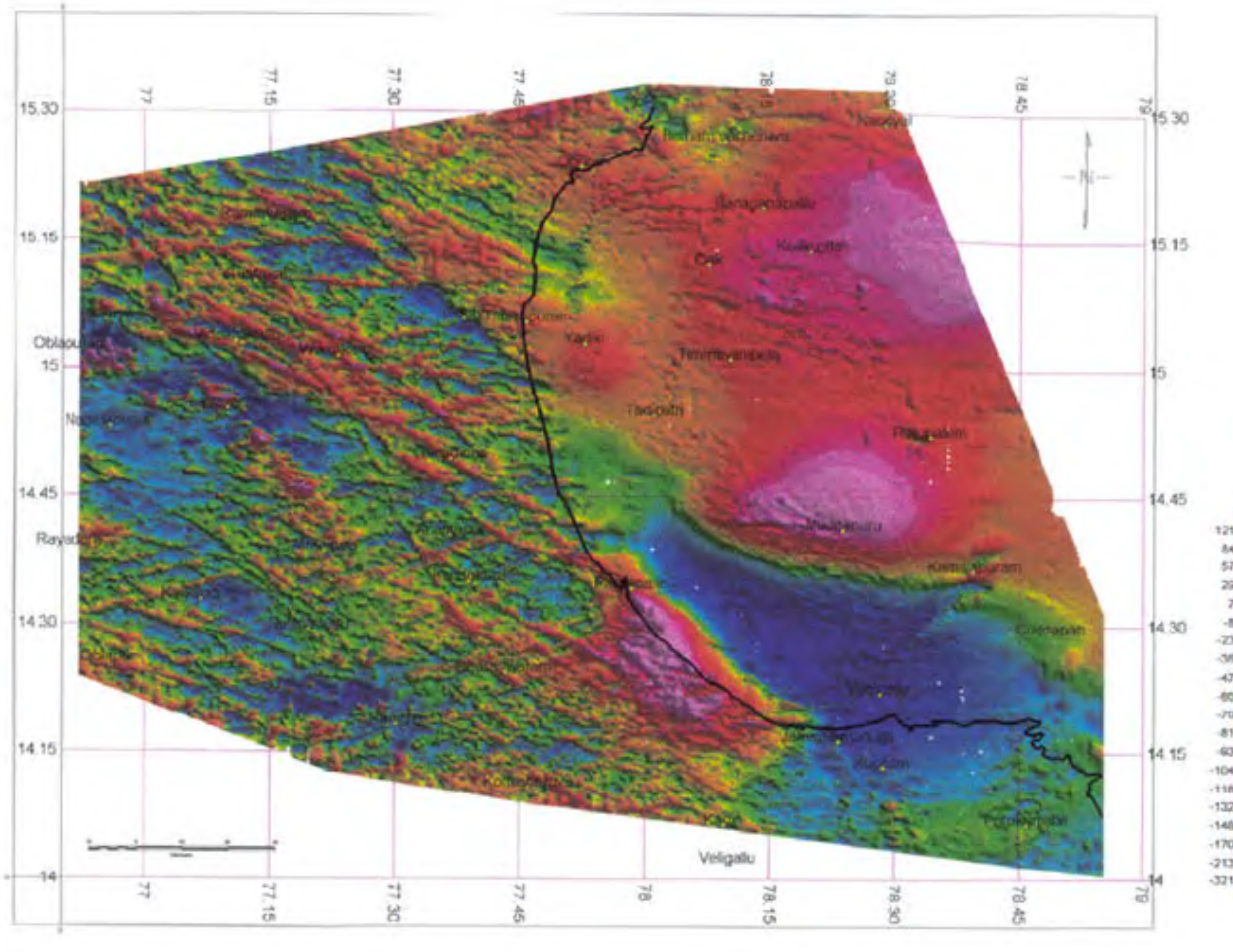

Figure 2. Aeromagnetic image of a part of the southwestern region of Cuddapah Basin.

using aeromagnetics[5–7], gravity[8–13] and deep seismic sounding[14,15].

Aeromagnetic surveys over the Cuddapah Basin were carried out by the National Geophysical Research Institute (NGRI) for the Geological Survey of India. The entire basin was covered with a one-kilometre line spacing at a mean terrain clearance of 150 m. The aeromagnetic data available as contour maps of total intensity were redigitized to obtain data in digital form. The total intensity aeromagnetic anomaly image prepared using GEOSOFT[16] is shown in Figure 2. The grid interval used is 200 m. This image typifies two major aeromagnetic provinces, one to the west with high frequency, high gradient anomalies with criss-cross patterns (occupied by the granite greenstone terrain) and the other to the east with low gradient and relatively smoother field over the Cuddapah Basin. At some places within the basin, the anomalies are superimposed with high frequency anomalies due to dikes and sills. As the present objective is to understand the basement structure, the total intensity anomaly field is filtered to reject the high frequency (20 km) component and to retain its low-frequency component. The 20 km filter was found to be most suitable for this purpose, by trial and error. The low-pass filtered aeromagnetic data are then transformed into pseudo-gravity data using Poisson's relation between gravity and magnetic fields. The main assumption involved here is that the magnetic anomalies are caused by induction. Under the assumption that the basement is magnetized uniformly by induction, the pseudo-gravity field can be attributed to the basement topography. The pseudo-gravity field over the western half where the basement is exposed, can be imagined to be a mere representation of the density (susceptibility) variations within the exposed gneissic complex. Under ideal conditions, the pseudo-gravity field provides an accurate representation of the basement domains when the sediments are nonmagnetic, whereas the original gravity field may also include the effects of the sedimentary column due to variation of density within the sedimentary pile.

The pseudo-gravity data were assumed to be generated due to a series of juxtaposed vertical prisms placed at each corner of a 200 m square grid. The top of each prism is located at the basement surface, while the bottom of all the prisms is kept at the same depth, usually much greater than the deepest prism. The depth to the top of each prism is evaluated iteratively, by calculating the anomalies of all prisms of influence at each grid corner, until

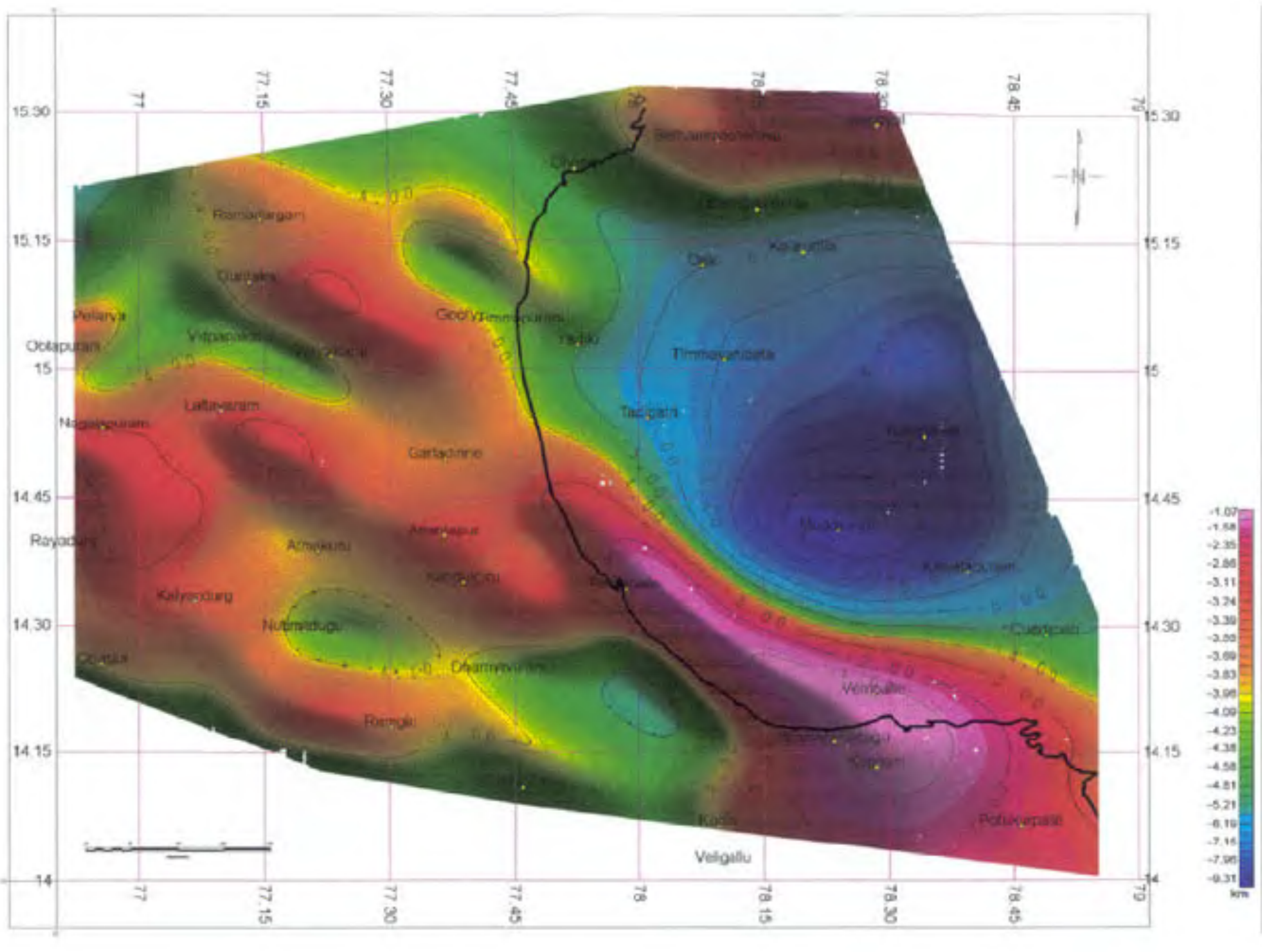

Figure 3. Basement depth map of a part of the southwestern region of the Cuddapah Basin derived from aeromagnetic data.

an acceptable match between the observed and the calculated anomalies is obtained. The FIT-3D[17] software for performing this inversion was used. The basement picture (Figure 3) thus evolved provides a synoptic view of major basement domains and associated structural features. It is a clear representation of the Papaghni sub-basin. This shows a bulging in the southwestern part of the basin, more or less coinciding with the boundary of the Cuddapah Basin in the south and southwestern part of the basin. The basement attains a maximum depth of about 10 km near Muddanuru.

The central depression in basement is observed to be elongated in NW-SE direction with steep dips in the southern and southwestern sides, suggesting that the sediment filling the depression was derived from the southern and southwestern side of the basin. An east-west elongation was observed over a part of the depression (clearly seen in contour pattern) nearly along and below 15°N parallel and above Tadipatri, where the Kunder river followed the same direction and thereafter took a turn towards the basin centre. And in the northern side, the depression boundary is truncated in E-W direction, which might be the representation of the E-W Banganpalle Fault. The basement high further north to the Banganpalle Fault may be a transition zone between Papaghni Basin and the northern Kurnool sub-basin. It seems from this basement map that the western sub-basin is bounded by faults in the north and the southwest directions. The maximum thickness of the sediment in this area is observed to be about 10 km near Muddanuru.

A part of the Kavali–Udupi Deep Seismic Sounding (DSS) survey carried out by NGRI[14,15] reveals the structure and tectonics of the south Indian peninsula along this profile. A part of this profile passes through the present study area and the basement depths inferred from the DSS are comparable to those obtained in the present analysis.

It may be mentioned here that the basement picture derived by pseudo-gravity transformation of aeromagnetic data is based on the assumption that the magnetization is solely by induction. If remanance is present in any other direction than the present field, then the picture will be different. However, as the results of the present analysis are in general agreement with the geological understanding and other geophysical information such as DSS, the basement picture provided here may be considered to present a qualitative description of the basement in this part of the area.

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Variations in nearshore processes along Nagapattinam coast, India

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Directional wave data collected at 10 m water depth, at 2 km distance off Nagore from March 1998 to February 1999, were used to estimate the longshore currents and longshore sediment transport rate considering the sea and swell waves separately using the CERC formula. Daily littoral environmental parameters were observed at three stations and longshore sediment transport rate was estimated using Walton's equation. A comparative study was carried out on theoretical and measured longshore currents. The ratio of spectral energy at the first and second spectral peaks shows that energy at the second peak was more than 50% of the energy at the first peak in 43% of the data collected, due to the presence of sea and swell waves. The difference between the sediment transport rate estimated based on the two methods is around 3.5%. The sediment transport using CERC formula shows that average annual gross transport was 0.448×10^6 m^3 and the average annual net transport (towards south) was 0.098×10^6 m^3 and this contributes to the supply of sediment to the Palk Bay.

THE Nagapattinam–Poompuhar coastline (Figure 1) consists of long, narrow and low sandy beaches. The nearshore bathymetry is relatively steep, straight and parallel

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