Chapter VI

SUMMARY AND CONCLUSIONS

1. According to the views of earlier workers, the Mysore plateau is considered as an integral southern part of the Indian shield made up largely of Archaean gneissose and schistose rocks with a variety of associated intrusive rocks. The grade of metamorphism of the Dharwar schistose rocks increases southwards in the Karnataka region. Adjoining and surrounding these rocks are gneisses, called Peninsular gneiss and granites, which occupy a large part of the area. The other rock formations in this region are banded ferruginous quartzites, metabasalts and patches of ultramafics, etc. Prevalent types of dyke rocks appearing in this area are of epidiorite, dolerite, quartz-dolerite and olivine-dolerite. It is believed that some of the younger granites like the Closepet granites were derived from the country rock (Peninsular gneiss) by palingenesis and metasomatism.

2. Dharwar Iron-ore bearing region of Mysore Province forms one of important tectonic subdivisions of Peninsular India. The Iron-ore Province occur as sub-parallel linear belts within the peninsular gneisses and granites. The strike of these belts varies from NNE-SSW to NNE-SSW. The dominant structural elements
in these belts are the northward plunging isoclinal synforms whose axes are steeply over-turned to the east or west. In general, the N-S, NNW-SSW and NNE-SSW axes of Dharwar folding pass into or are parallel to the northerly trending cross-fold axes within the other tectonic provinces. The Closepet granite forms a N-S trending linear belt between the Chitaldurg schist belt in the west and the detached Kolar belt in the east. Deformation and orogenic uplift of the Dharwar geosyncline about a N-S axial trend by forces dominantly from east and west not only resulted in several N-S trending Dharwar fold mountains, but it has also cross-folded the rocks occurring in other belts on the north and south of the area.

3. Gravity data collected by N.C.R.I. and other agencies such as Survey of India, O.N.C.C., Hawaii Institute, were standardised to a common datum and the standardised data has been utilised in the preparation of Free-Air, Bouguer and isostatic (Airy-Heiskanen) anomaly maps of the Karnataka area. Gravity and also magnetic data were collected from the area along three profiles taken from west to east of the area: (1) Goa (Panaji) to Bellary, (2) Bhatkal to Pavagada and (3) Mangalore to Betmangala. Density and susceptibility measurements of the rock samples such as gneisses, schists, granites, dyke and trap rocks, etc., collected at certain intervals along the three profiles, were made in the laboratory. Further one gravity profile, taken in NW-SE direction on the plateau, was constructed from the three gravity maps,
viz., free-air, Bouguer and isostatic anomaly maps.

4. Analysis of the free-air map showed that the plateau is approximately in a state of isostatic equilibrium. The Bouguer anomaly map of the region consists of negative anomalies which, of course, is to be expected in the continental zones. However, the indication of strong negative anomalies over the denser Precambrian rocks of Karnataka can perhaps be explained by some deeper source as neither the topography nor surface geology of the region could satisfactorily explain totally these anomalies. Various suggestions were put forward to explain the gravity 'low' over the Deccan traps whose thickness is small. The consistently negative Bouguer anomalies over the Archaean rocks such as Dharwar schists and charnockites of this area suggest that the anomalies are comprised of two effects, viz., deep-seated (regional) and local.

5. The Airy-Heisnanen anomaly with a crustal thickness 'T' equal to 30 km, also shows negative bias but the order of values is less. Isostatic anomalies, can be treated as residual anomalies which reflect the gravity effects of local geologic bodies. The gravity 'lows' over the schistose formations may be due to the pressure of some subsurface granite bodies underlying the schists.

6. Quantitative estimate of the causative geologic bodies was made from the gravity data obtained from the three East-West
and one North-West to South-East gravity profiles. Making use of the density values of the rocks measured in the laboratory, structure of the upper part of the crust was determined from the four different profiles.

7. In profile AA', it has been observed from the quantitative study that the schistose rocks vary in thickness from 4 to 9 km and the thickness of the granites vary from 4 to 6 km. The granite near Bellary is found to be in the form of a 'T' shaped batholith. Analysis of the magnetic data along the profile AA' revealed intense magnetic anomalies over the iron ores of Dharwar and colorite dykes between Hospet and Bellary. The magnetic anomalies obtained over the schistose rocks are possibly due to some surrounding or underlying rocks rich in magnetite. Granites gave a comparatively high magnetic relief and the magnetism may be attributed to the magnetic minerals in the Closepet granite.

8. Quantitative estimates along profile BB' showed that the schistose rocks vary in thickness from 2 to 4 km, trap rocks from 0.5 to 4.0 km, and the maximum thickness of Pavagada granite is found to be about 8.5 km. The outline of the granite body is partly 'T' shaped. Analysis of the magnetic anomalies in this profile suggests that the gneisses and schists show high magnetic values. Small susceptibility contrast in the trap rocks yield weak magnetic anomalies. Minor magnetic anomalies obtained over the hematite-quartzite are attributed to weakly magnetic susceptibility of the rocks.
9. In profile CC', charnockites did not indicate significant gravity anomalies due to possible lack of density variation between the charnockites and the gneisses in this region. A rise in anomaly over the gneisses is possibly due to heterogeneity of the rocks at depth. The interpreted geologic section from the gravity data in this profile reveals that schistose rocks occur in indiffrent dome-like patches with their thicknesses varying from 0.5 km to 2 km. The inferred granitic body is dome-shaped with a maximum thickness of about 6 km. Also the gneisses exhibited higher magnetic anomalies in this profile which further indicates that the peninsular gneisses in this area are heterogeneous and more magnetic at depth. Dyke rocks gave weak magnetic anomalies. Moderately intense magnetic anomalies have been observed over the granites.

10. The nature and magnitude of the magnetic anomalies and their variations over the peninsular gneisses suggest that they acquired magnetism under different physico-chemical conditions. Further it may be noticed that the inferred thickness of the schistose rocks decreases as one proceeds in the direction north to south of the region from 9 km to 2 km respectively. This suggests that the depth to the basement decreases from north to south. But since the magnetic anomaly does not indicate shallow basement, either the schistose rocks are gradually replaced by a material which is more magnetic and possibly composed of lighter substance as one proceeds from north to south or the basement
material is brought to a higher level after undergoing changes in its physical properties as a result of changes in pressure-temperature conditions at depth. This suggests that reworked material of the basement with altered physical properties must have been brought from depth as one approaches from north to south of the plateau. This has been corroborated from the combined analysis of heat flow and gravity data at Kolar. Thus, the gravity and magnetic studies provide some understanding of the possible physical changes at depth and the crustal evolution.

11. Fourth gravity profile, DD', extending NW-SE and following more or less the structural trends of the Karnataka rocks, indicated maximum thickness of the trap rock (2.5 km). It further revealed the possible intrusion of a major dyke rock at Nanjangud. Correlation of gravity map (Bouguer anomaly map) with tectonics confirmed the existence of some major faults and grabens.

12. Laboratory measurements indicated that the schistose rocks are generally denser than gneisses and granites. The magnetic susceptibility values of gneisses, schists, and granites indicated that they are moderately high.

13. Although the Deccan Traps which are covered by several geophysical surveys relate to the traps existing on the northern side and beyond/north of the Karnataka region, they provide valuable information on their tectonics. The gravity 'lows' over the Kaladgi in the northern part of the region was interpreted to be
due to the probable pressure of a graben.

14. The metavolcanics of Dharwars are characterised by low heat flow values and negative gravity anomaly values over the schist rocks at some places indicate the possible existence of granites at depth.

The results of geophysical studies carried out over the Precambrians of Karnataka compare well with the results observed over the Precambrian rocks of western Australia as mentioned in earlier chapters. This indicates the possibility that shield areas in the world possess identical characteristics.