Magnetic Characteristics of Princess Astrid Coast of Antarctica 70°S, 12°E, North of *Dakshin Gangotri*

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ABSTRACT

Eight magnetic profiles recorded on the coast of Antarctica towards Indian Ocean side around 70°S 12°E during the second Indian expedition are analysed to obtain the magnetic characteristics of the bed rock beneath the ice cover in this region. A magnetic anomaly of the order of 180 200 approximately 5-6 km from the coast has been consistently recorded in all these profiles The causative source appears to be approximately 3 km wide and lying at depth of 2 5 km magnetised with a feeble intensity of 80 100 nT which could either be a metamorphosed basic intrusion extending deep into the crust or a depression in the bed rock

INTRODUCTION

Owing to its pivotal position, Antarctica holds the key to the understanding of dynamics of evolution of southern continents which once formed the *Gondwanaland.* Since the discovery of this concept, it has been the constant endeavour of workers to study the subsurface structures and their evolution in the framework of this hypothesis and correlate the significant features from these continents with those found in the counterpart portion of Antarctica. From this view point, northern coast of eastern Antarctica assumes special importance due to its presumed attachment with east coast of India. However, due to ice cover, most of this continent is inaccessible and thereby geophysical surveys have special significance in deciphering the bed rock topography and subsurface structures. Magnetic method of geophysical exploration has been used considerably for this purpose (Wellman, 1982; Mishra, 1983). During the second expedition of Antarctica from India (December, 1982 - March, 1983) eight magnetic profiles were therefore recorded across Princess Astrid coast which have provided the magnetic characteristics and structures below the ice cover in this region.

Bed rock below ice cover

The region (Fig. 1) characterised by an ice cover of the order of 500 m (Geological World Atlas, 1976) is probably underlain by high grade metamorphic granites and gneisses of Precambrian period which are exposed south of this region in the hills of Hofmann mountains near *Dakshin Gangotri* (70°44'75"S, 11°36'49"E) surveyed and named by the Indian expedition. The only and most significant geophysical work in this region to-date are two deep sounding profiles recorded by Russians (Kogan, 1972). According to the results of this investigation, basement rocks referred to above are expected immediately below the ice cover and are characterised by deep fractures extending almost upto Moho and filled with basic intrusive rocks. These fractures are 2-3 km wide and are reported to have coincided with high magnetic and gravity anomalies. In case of any sediment being present under the ice cover, it should be thin (Bentley, 1974) in this region.

DATA COLLECTION AND REDUCTION

Fig. 1 presents the area covered by the profiles recorded in the present programme. Eight profiles totalling 65 line kilometres are laid approximately 500 m apart along which the total intensity

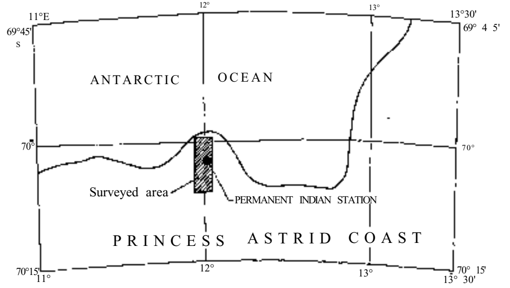

Fig 1 Coverage of the surveyed area

of the earth's magnetic field was recorded at 200 m intervals using a specially designed proton precision magnetometer. This magnetometer can be operated in the low temperature range upto -40°C with a reasonable sensitivity of 1 gamma. Base station was occupied twice daily at the start and end of the day's survey. Another magnetometer of similar type was operated continuously at the base station to correct for the diurnal variation in the earth's magnetic field. A daily variation of approximately 30-100 gamma was recorded during the period of this survey, a typical record of which is presented in Fig. 2. This also provided a check on the magnetic storms during which the intensity of earth's magnetic field depicted considerable variation and the survey was abandoned. The observed total intensity, along these profiles corrected for the diurnal variation is further corrected for the regional variation in the earth's magnetic field which is approximately 8/km in this region and are plotted in Fig. 3 (a, b, c).

INTERPRETATION AND DISCUSSION

As apparent from the corrected magnetic profiles plotted in Fig 3 (a,b,c), all the profiles are characterised by a rise in the magnetic values as one goes from the coast towards the interior of the continent, *i.e.,* from north to south. However, due to limitations of logistics, these profiles could not be extended further beyond in order to record the total magnetic picture which would have been ideal for the quantitative interpretation of large magnetic anomaly recorded in these profiles.

However, the situation is considerably saved as the anomaly has already started falling and the area is located in high magnetic latitudes where a simple high or low is expected in Total Intensity depending on the nature of the causative sources. Three of these profiles Nos. 4, 5 and 6 are interpreted using some well known characteristic points and curve-matching techniques (Gay Jr., 1963) the results from which are summarised in Table I.

The average depth of the causative source for the large anomaly (Table I) appears to be of the order of 2.5 km out of which approximately 0.5 km can be accounted by the ice cover. The causative source could either be a fracture filled with basic intrusive rock as deciphered from D.S.S. studies in the surrounding region referred to above or a depression in the basement filled with sediment as the

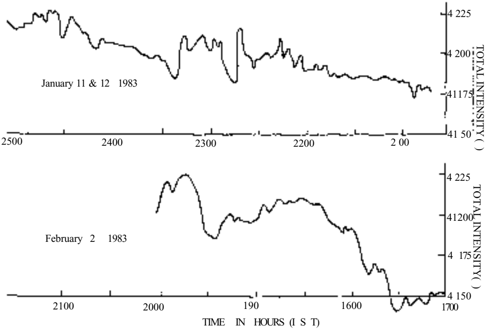

fig 2 A typical diurnal curve for the period of survey

TABLE I

Quantitative interpretation of magnetic profiles

Profile Number	Depth (*d*)= straight slope (S) X 1 25 (Atchuti Rao & Ram Babu 1984)	Depth *(d)* Half width where T=1/2 T $_x$ and magnetization (*m*) = T $_x$/2 *(d/w)* for cases *(d/w)* =1 m = T/2	Curve matching Gay Jr (1963) *d* = depth *w* = width
4	S = 2 2 km *d* = 2 75 km	*d* = 2 5 km *m*= 100 nT	*d* = 2 5 km *w* = 2 5-3 5 km
5	S = 2 1 km *d* = 2 62 km	*d* = 2 6 km *m* = 96 5 nT	*d* = 2 5 km *w* = 2 5 3 5 km
6	S = 1 8 km *d* = 2 25 km	*d* = 2 2 km *m* = 83 nT	*d* = 2 5 km *w* = 2 5 3 5 km

region is very close to the present coastline. In any case, the intensity of magnetization is quite low which usually corresponds to basement as suggested above. However, if it is caused by basic intrusive rocks it must have been considerably metamorphosed to account for the low order of magnetization

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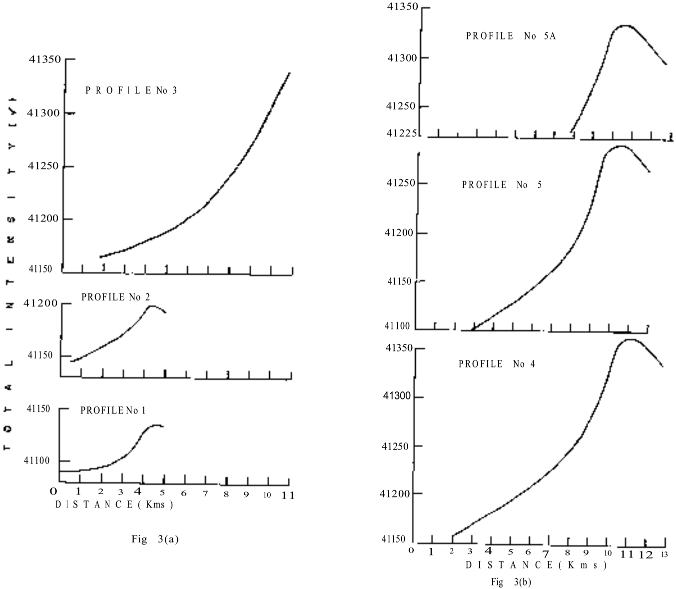

Fig 3 (a b) Magnetic profiles 15A corrected for diurnal variation and regional variations in earth s magnetic field

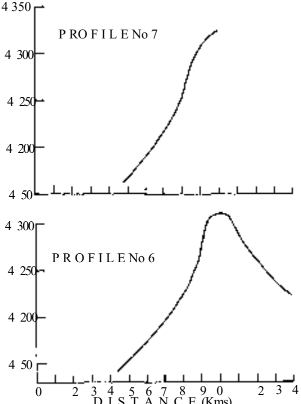

Fig 3(c) Magnetic profiles 6 and 7 corrected for diurnal variation and regional variation in earth s magnetic field

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