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Report on Mapping in Antarctica
(During 18th Indian Scientific Expedition to Antarctica)

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Abstract

The paper describes the various steps involved in the detail and contour *(i.e. Original Plane Tabling)* survey on scale 1:1,000 with 1 m contour interval for the proposed summer camp site which is North West of Indian station Maitri. It also narrates as to how the precise ground control network was formed which is a basic need for geographical field work and how Survey of India extended survey facilities to Geological Survey of India and Scientist of various participant organizations for carrying out their scientific activities in an efficient manner.

1. Introduction

Survey of India is the National Survey and Mapping Organisation of our country under the Ministry of Science and Technology and is the oldest scientific department of Government of India. It was setup in 1767.

Maps are a means of communication in graphical form and provide basis for developments in every country. In the past, primary maps were mainly prepared for use by defence forces. But, after Independence with the rapid development of our country, the demand of maps has been increased considerably and the number of map users has multiplied several times.

The developments due to the scientific activities carried out during the first nine Indian Scientific Expedition to Antarctica (ISEA) necessitated the provision of geographical control and mapping in the surroundings of Indian station Maitri located in east Antarctica. Survey of India was identified by the Department of Ocean Development to carryout mapping task from tenth ISEA onward.

The ground control points were provided for the geographical fieldwork and the topographical maps on scale 1:5,000 with 5 m contour interval and also on scale 1:1,000 with 1 m contour interval have already been published as shown in Fig. 1.

The maps of Antarctica series, published so far, have been proved to be very useful for scientific community in planning their activities.

2. Objectives:

2.1 To provide precise ground control points for geographical and geophysical field work and densification of the topographical (i.e. horizontal and vertical) control in the area covering additional base stations for carrying out contoured mapping at 1 m vertical interval.

2.2 To carryout detail and contour survey on scale 1: 1,000 with I m contour interval for the proposed summer campsite in Maitri region (i.e. NW of Maitri)

2.3 To study of glacial dynamics with Geological Survey of India and provide survey aids to other organizations as per their requirements.

3. PROVISION OF GROUND CONTROL POINTS:

3.1 Verification:

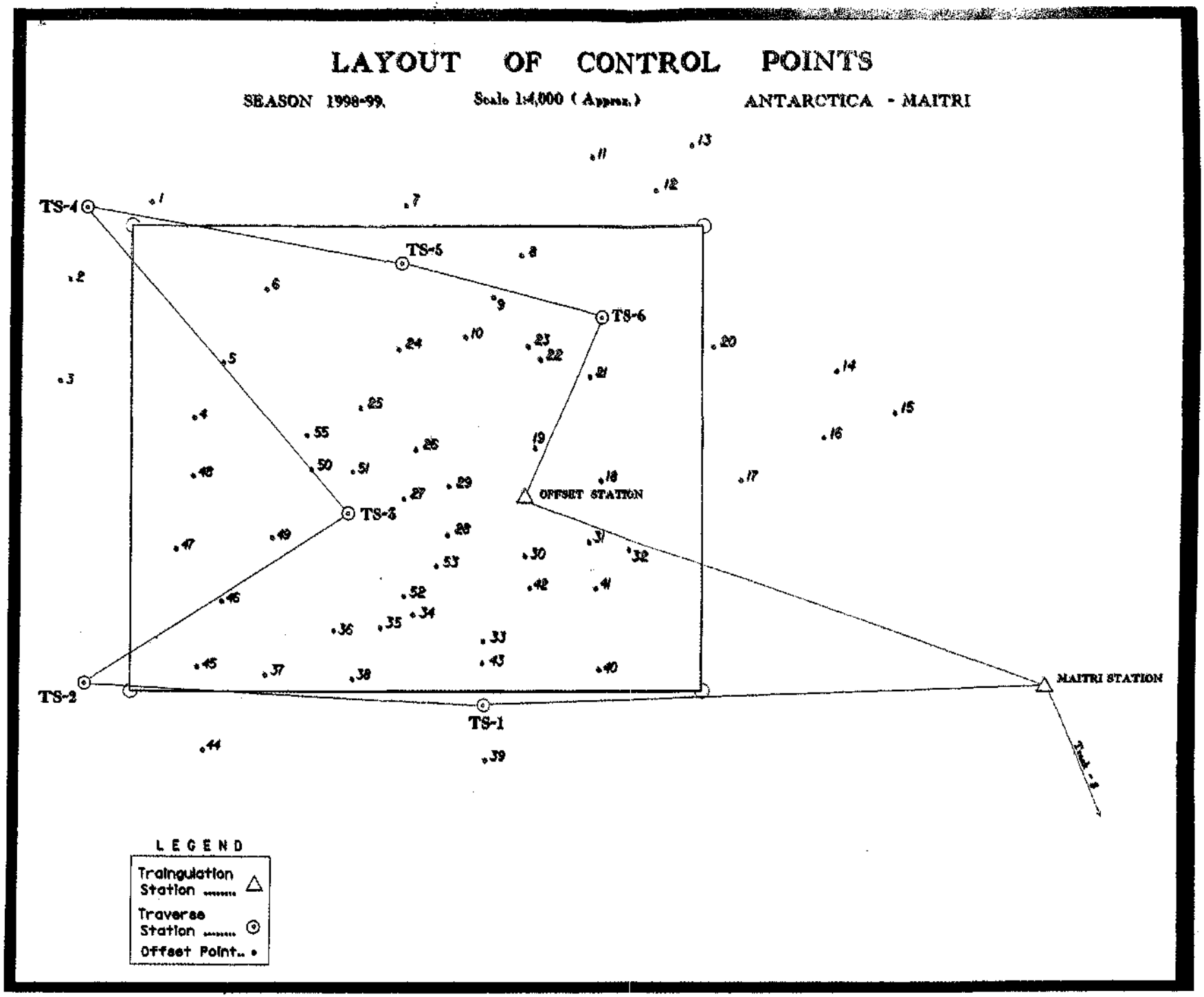
The ground control points (i.e. MAITRI-S, TRACK-S and OFFSET-STN) already provided in previous expeditions have been verified, found intact and these points were used for the extension of ground control points in the area, after checking their stability.

3.2 Reconnaissance:

A thorough reconnaissance was carried out for providing ground control points uniformly distributed in the area of work in such a way that detail survey and contour chasing can be done with required accuracy. Cairons were made for correct identification of control points. The configuration of the control points is shown in Fig. 2.

3.3 Traversing

A main Traverse line was run between known points, established during the previous expeditions by survey of India, by using Wild -T2 Theodolite with E D M instrument DI-3000S. Six Traverse stations and fifty four subsidiary ground control points (Offset Points) were provided to densify the ground control covering the entire working area.


LAYOUT OF CONTROL POINTS
SEASON 1998-99. Scale 1:4,000 (Approx.) ANTARCTICA - MAITRI
TS-4
TS-5
TS-6
TS-3
TS-2
TS-1
OFFSET STATION
MAITRI STATION
1
2
3
4
5
6
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8
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LEGEND
Traingulation Station
Traverse Station
Offset Point

Fig No. 2

Known Co-ordinate used for Traverse:-

STATIONS	EASTING	NORTHING	HEIGHTS
MAITRI-S	10,00,000.00	5,00,000.00	117.0m
TRACK-S	10,00,131.92	4,99^30.64	126.1m
OFFSET-STATION	9,99,544.38	5,00,167.98	134.5 m

The normal departmental procedure was adopted to carryout the work and maintain the accuracy.

3.4 Computation:

The computed mutual grid bearing at Maitri Station of Track Station has been taken as initial bearing and computed mutual grid bearing at Offset Station of Maitri Station has been taken as closing bearing. Thus the Maitri Station and Offset Station were taken as base for the computation of co-ordinates of Traverse Stations. Co-ordinates of offset points were computed using angle and distance measurement during the course of traversing. Heights of the stations have been computed in datum of Maitri-S only.

4. Detail and contour survey:

The plane table section was divided in regular grids, each grid of size 2 cm X 2cm (20m X 20m). The ground control points (main station as well as offset points) were plotted on Plane Table Section. A mesh of well distributed control points were provided. A total number of 47 fixings (plane table position) and 49 nos. of clinometers heights were made to cover an area of 0.22 Sq. km. The Plane Table position (fixings) was made on control points only and computed heights of these control points were used, no deduced height was used for chasing the contours. This has added the accuracy of the contours, and care has been taken to survey the overlap area 1 cm for edge matching in future survey. The south edge is adjusted with the already surveyed map in 14th IAE.

5. Technical Assistance to other scientific teams:

5.1 Geological Survey of India (GSI)

GSI team requested for the survey of Dakshin Gangotri Glacier Snout in order to monitor its movement. The survey was carried out with respect to already existing GSI points, 21 offset points have been fixed along the snout limit by theodolite and E D M instruments. The survey of snout is shown in Fig. 3. This has enabled GSI scientists to continue their study.

5.2 Botanical Survey of India (BSI)

The scientist from Botanical Survey of India (BSI) had request to give the co-ordinate of all the lakes of Schirmarcher oasis and its surroundings. The co-ordinates have been supplied from Russian map on 1:25000 scales. These co-ordinates have enabled BSI to know actual position of lakes for their present and future experiments

5.3 Scientist from Republic of Iran

Scientist Md. Raja Shokhri from Republic of Iran had request to supply the co-ordinates of some lakes in Schirmarcher oasis and a prominent highest top in the area.

6. Conclusion

Inspite of late arrival at Maitri and under extremely hostile weather condition, the targeted assignment i.e. detailed contour mapping on scale of 1:1000 with 1 m contour interval for an area covering 400m X 500m located to the NW of "Maitri", as completed successfully. This became possible by the planning of the whole days work made in advance and the best possible efforts of the team members and utilizing every bit of their available time at the station. It will not be out of place to mention that ground survey is a challenging out door task, which needs day trodding in difficult terrain of Schirmarcher, where mapping work was to be done at sub zero temperature, without use of Gloves and some times without sun-glasses also.

After completion of the post fieldwork fair drawing of surveyed map will be done resulting in a map on scale 1:1,000 with 1 m contour interval, as shown in Fig. 4. Which will be available from Officer -in-charge, Map record and issue office, Map Publication, Survey of India Dehradun- 248001.

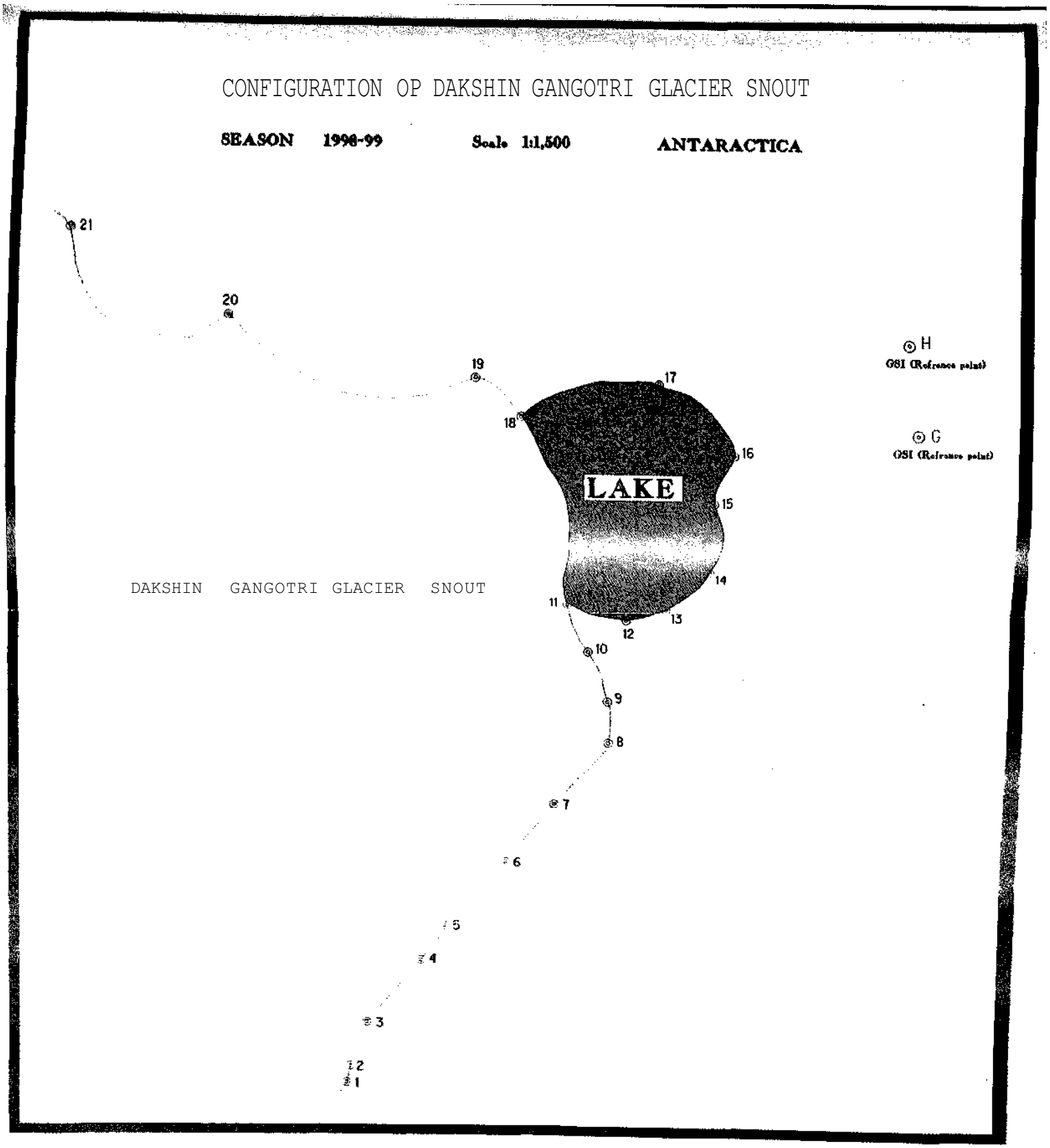

CONFIGURATION OP DAKSHIN GANGOTRI GLACIER SNOUT
SEASON 1998-99
Scale 1:1,500
ANTARACTICA
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
H
GSI (Refrance point)
G
GSI (Refrance point)
LAKE
DAKSHIN GANGOTRI GLACIER SNOUT

Fig. N. 3

Future Recommendation

a) Aerial Photography for the whole strip ofSchirmarcher Oasis area about 4 km X 20 km on scale 1:10,000 should be flown. Aerial Photography of the whole Schirmarcher Oasis is also available with Germany, which can be procured on request for mapping purpose.

b) Ground Control Points should be established on the whole Schirmarcher range and the post pointing on the aerial photographs should be done.

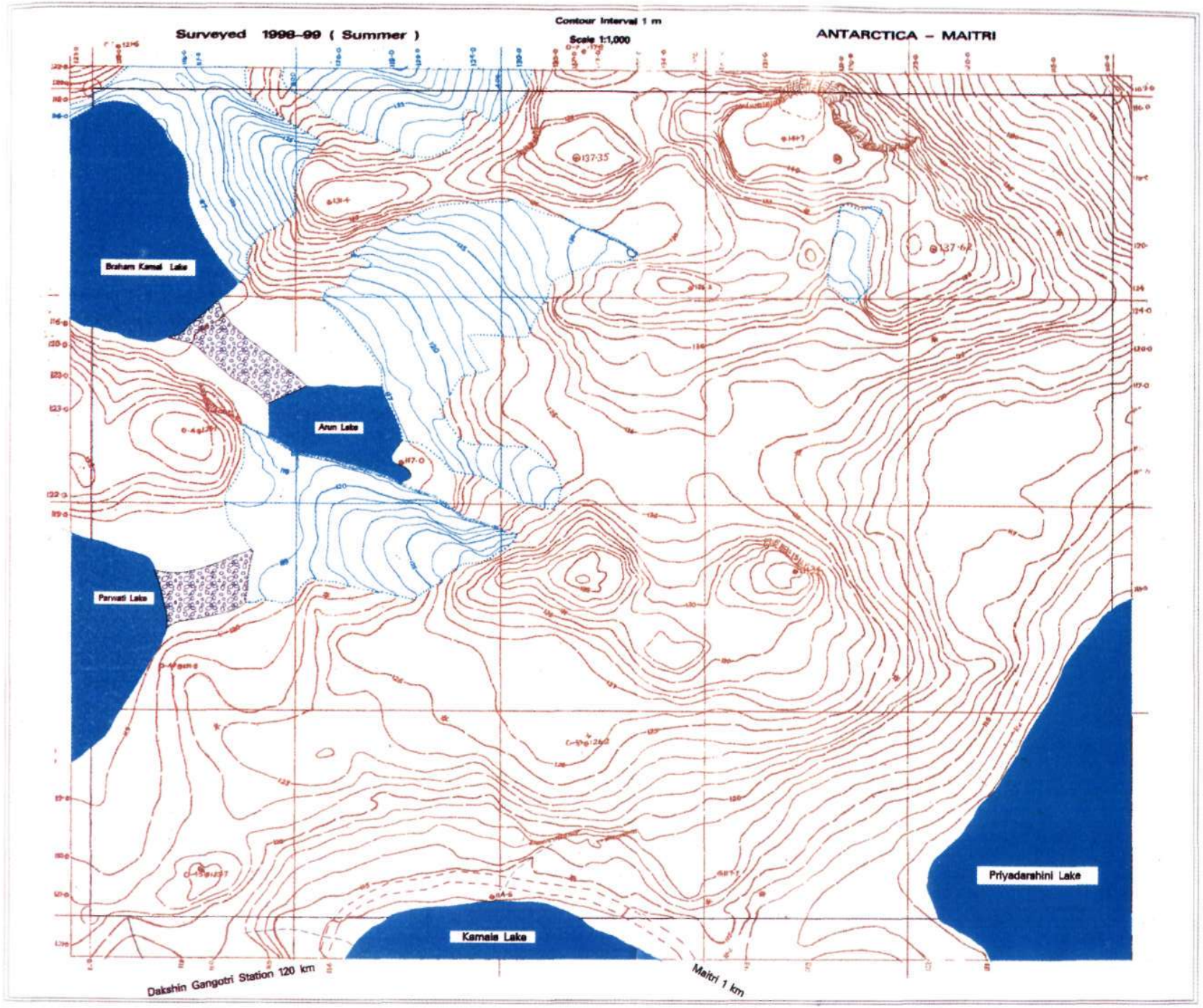
c) Initially actual ground survey should be carried out on scale 1:25,000 with 10 m vertical interval on photogrammetrically plotted Air Survey Section and later on in any larger scale as per the requirements.

Acknowledgement

The Survey Of India team members are grateful to the secretary, Department of Ocean Development, the Surveyor General of India and the Director, Geodetic and Research Branch of Survey of India for providing the unique opportunity to participate in this expedition.

They are thankful to the Deputy Director. G & R B , OC 82 Party, OC 68 Party- and T S O , G & R B for their valuable suggestions.

Thanks are also due to Sh. K.R.Sivan, the station commander of 15 W O T , for initial logistic support during our stay in Antarctica and during return voyage.



Configuration of map surveyed in 18th. Expedition

Fig No 4

Survey of Dakshin Gangotri Glacier Snouts

(As Technical Assistance to other Scientific teams)

Kamal Sharma & Rup Kumar Das

Season: 1998-99

ANTARCTICA - MAITRI

As part of Scientific work, the survey of Dakshin Gangotri Glacier Snout in order to monitor its movement has been carried out with GSI team members. The survey was carried out with respect to already existing GSI points. 21 offset points as recognised by GSI team have been fixed along the snout limit by theodolite and EDM instruments. The computation of the offset points has been done on the basis of arbitrary grid bearing and false origin of the GSI reference points as per the normal departmental procedure. The offset points have been plotted on the graph and verified on the ground and a trace of survey of snout limit is shown in Fig 1 on scale 1:1,000 and in Fig 3 on scale 1:1,500. This has enabled GSI scientists to continue their study for preparation of Geomorphological Glacial map of the area.

SCHIRMARCHER OASIS

The SCHIRMARCHER HILL/OASIS a 30 Sq. km area comparatively low relief bed rock exposure on the Dronning Moud Land coast of East Antarctica, situated between 11^0 20'E to 11°55'E and 70° 43'S to 70^0 46'S. A fair amount of slope appreciation is there in general South to North direction, towards its South high Glacier occupy vast area extended up to South Pole and towards North, the Ice She If extended up to 100 km. There are over 30 fresh water lakes of different sizes within the oasis. The general terrain is boulderous with varying sizes of boulders. The soil is dull gray and of glacial origin. Some organic soil with moss etc. is found near the lake areas. The average height of Schirmarcher Oasis is 100 meters above mean sea level.

Antarctic climate has unique features such as sub-zero temperatures, strong winds, blizzards, rare rain and poor moisture contents. Animal life is lesser than many other desert areas. It consists krill, snow petrels, skuas, whales, seals and penguins. Schirmarcher Oasis being a rock exposure, penguins are occasionally seen around lakes. In addition, the skuas are seen most of the time during summer and snow petrels very rarely.

The Department of Ocean Development has set-up a second permanent station on ground at a logistically good place in the Schirmacher Hills. The station is known as Maitri. It was constructed during 7^{th} and 8^{th} expeditions and commissioned on 26^{th} February, 1990 and has been functioning smoothly.

The first permanent station "Dakshin Gangotri" was established on Ice Shelf during 1983-84. It got covered by bnlowing ice and decommissioned on 25* February, 1990, and converted into a supply base. It is 75 km north west of "Maitri". The another permanent station of "USSR" named "Novolazarevskaya" was already established forty three years back in Schimacher Hill, which is 5 km south east of "Maitri".

Maitri is our farthest outpost and gives the sense of pride to the nation, Survey of India started Scientific study / Mapping since 1990 in Schirmarcher Oasis, with this the meaning of " A S E T U H I M A C H A L A M " has been changed "Antarctica to Himalayas" (Bottom of the world to Top of the world) in-place of " Cape Comorin to Himalayas".