

Management Plan for Antarctic Specially Protected Area No. 163

DAKSHIN GANGOTRI GLACIER, DRONNING MAUD LAND

Introduction

In accordance with the provisions to Annex V of the Protocol on Environmental Protection to the Antarctica on Treaty Area Protection and Management, India initiated a review of the management plans for the Antarctic Specially Protected Area: Dakshin Gangotri Glacier, Dronning Maud Land. This ASPA is renamed from the previous Specially Protected Area and Site of Special Scientific Interest (SSSI) in accordance with Decision 1 (2002) of the XXV ATCM at Warsaw.

1. Description of values to be protected

Historic Value

Dakshin Gangotri Glacier is a small tongue of polar continental ice sheet, overriding the Schirmacher Oasis of central Dronning Maud Land (CDML). It was identified by the second Indian Antarctic Expedition in 1983 and since then its snout is being monitored continuously.

Scientific Value

With the availability of this vast amount of data for the past two decades, it has become a valuable site for observing the changes in the movement of the Antarctic ice sheet under the impact of global warming. The area has primary scientific importance for glaciologists and environmental scientists. Due to the scientific values of the Area and the nature of the research, it is protected as an Antarctic Specially Protected Area consistent with Articles 2, 3, 5 and 6 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty, to prevent interference with ongoing planned scientific investigations.

Environmental Value

In the designated Area exploration shows the faunal diversity and ecology of the moss-inhabiting terrestrial invertebrate fauna and it is also extensively explored lichenologically. Schirmacher Oasis is also an important area for the algal and cyanobacterial flora diversity. Terrestrial mosses are quite widespread in the Schirmacher Oasis colonizing a range of habitats. The bryophytes, because of their poikilohydric nature and alternative strategy of adaptation, are one of the very few plant groups which grow in Antarctica. As such their role in habitat modification, nutrient cycling, primary production and providing shelter and security to associated invertebrate animals, for example the bryobionts, bryophiles, bryoxenes assume a particular significance. Bryophytes have been reported in Schirmacher Oasis (divided in Eastern, Central and Western Schirmacher). Lichens, fungi, algae and bacteria have also been reported in the Area. Distribution of algae and cyanobacteria flora of fresh water streams of the Oasis at the designated area are studied. Examination of algae and cyanobacteria is conducted in the glacier-melt water stream. The species reported are *G. magma*, *Chaemosiphon subglobosus*, *Oscillatoria limosa*, *O. limnetica*, *P. frigidum*, *P. autumnale*, *Nostoc commune*, *N. punctiforme*, *Calothrix gracilis*, *C. brevissima*, *Uronema sp.*, and *Cosmarium leave*. Among the cyanobacteria encountered in the stream of Schirmacher Oasis, contribution by N₂-fixing species might play a significant role in nitrogen economy of the ecosystem through N₂-fixation. Studies on polar Skuas are also conducted at Schirmacher Oasis and their nesting and breeding success is reported around the designated place.

2. Aims and Objectives

Management at Dakshin Gangotri Glacier aims to:

- Avoid degradation of values of the Area by preventing undue human disturbance;

II. Measures

- Allow glaciological and environmental scientific research, while ensuring protection of observational accuracy from any sort of man-made inputs;
- Ensure that peripheral points along the snout are not adversely affected by human activity in the Area;
- Maintain the Area as a reference marker for studying the movement patterns of this part of the Antarctic ice-sheet under the influence of global warming;
- Allow visits for management purposes in support of the aims of the Management Plan for the Area.

3. Management Activities

The following management activities will be undertaken to protect the values of the Area:

- A detailed map showing the location & boundaries of the Area and stating the special restrictions that apply will be displayed prominently at Maitri (India) and Novolazarevskaya (Russia) research stations; copies of this management plan shall also be made available at both the stations.
- Two signs displaying the location and boundaries of the Area with clear statements of entry restrictions shall be placed on prominent rocks near both the entrance points to the valley, the eastern end and the south-eastern end; to help avoid inadvertent entry.
- Copies of this management plan along with location and boundary maps of the Area will be provided to all the visiting ships/aircraft.
- Markers, signs, cairns and other structures erected within the Area for scientific and management purposes will be secured and maintained in good condition, and will be removed when no longer necessary.
- Visits shall be made as necessary (at least once every year) to assess whether the Area continues to serve the purposes for which it was designated and to ensure that maintenance and management are adequate.
- The management plan shall be reviewed no less than once every five years and updated as required.

4. Period of Designation

The ASPA is designated for an indefinite period.

5. Maps

The following maps and photographs are enclosed for illustrating the Area and the Management Plan:

- Map 1: Location of Schirmacher Oasis in central Dronning Maud Land, East Antarctica.
- Map 2: Map of Schirmacher Oasis, showing locations of Maitri Research Station (India) and Novolazarevskaya Research Station (Russia).
- Map 3: Classification and Numbering of Lakes of Schirmacher Oasis (after Ravindra et al, 2001).
- Map 4: Topographic map of the Area (contour interval 10 m).
- Map 5: Paths of Fossil Glaciers in Schirmacher Oasis (after Beg et al, 2000).
- Map 6: Aerial view of the Dakshin Gangotri Glacier Snout.

6. Description of the Area

6(i) Geographical coordinates, boundary markers and natural features

Schirmacher Oasis is a rocky hill range, about 17 km long in E-W trend (bounded by Eastern longitudes 11° 22' 40" and 11° 54' 20") and about 0.7 km to 3.3 km wide (bounded by Southern latitudes 70° 43' 50" and 70° 46' 40"). Its elevation varies from 0 to 228 m above the msl. It is a

part of central Dronning Maud Land in Eastern Antarctica. The Area is a fragment of the western part of Schirmacher Oasis.

The Area is bounded by the Eastern longitudes 11° 33' 30" and 11° 36' 30" and by the Southern latitudes 70° 44' 10" and 70° 45' 30". The Area is 4.53 sq. km in aerial extent. The northeastern and northwestern corners of the Area are on shelf-ice, while the southwestern extremity is on polar ice-sheet. The southeastern end lies on a rocky outcrop.

Topographically, the Area can be divided into four distinct units - the southern continental ice-sheet, rocky hill slopes, a vast central proglacial lake (Lake-B7, Sbrosovoye Lake) and northern undulatory shelf ice.

The southernmost ice-sheet is bare 'blue ice', descending from 180 m contour to 10 m contour at the snout of the Glacier. It is crevassed and crisscrossed by NE-SW to NNE-SSW trending fractures. Two small and ephemeral supraglacial streams flow over the snout in a NNE direction.

The rocky terrain is uneven and has the minimum width of the Schirmacher Oasis at the snout point; less than 50 m only. The eastern and western sides of the hills slope towards the snout, making a wide valley. The contours descend from 150 m to msl at the northern margin of the rock outcrops.

The central part of the Area is occupied by Lake B7. It is a lake of glacial origin. The dimensions of the lake are about 500 m x 300 m.

The northernmost part of the Area comprises shelf ice with pressure ridges, fractures and crevasses. The contact between shelf ice and eastern rocky slopes is marked by a prominent 3-km long, NNE-SSW trending lineament. The fractures in the ice are also aligned parallel to this lineament.

Schirmacher Oasis exposes a granulite to amphibolite facies metamorphic terrain. The rock types are represented by charnockites, enderbites, garnet-sillimanite, gneisses, garnet-biotite gneisses, quartzofeldspathic augen gneisses with some foliated lamprophyres, amphibolites, dolerite, metagabbro and metabasalt. The rock suites dominantly fall under Grenvillean (1000 Ma) and Pan-African (550 Ma) events. Three phases of deformation are distinct.

The Area comprises mostly charnockite-Khondalite type of rocks (quartz-garnet-sillimanite-perthite±graphite gneisses) with some interlayering of garnet-sillimanite quartzites, calc silicate gneisses and mafic granulites. Two sets of faults (N30E and N50E) are quite prominent. One such major fault runs from the north-eastern corner of the Area; cutting all the three geomorphological units-shelf ice, rocks and continental ice-sheet.

Meteorological data from the nearby Indian Research Station Maitri shows that the Area has a dry polar climate. The extreme temperatures for the warmest and the coldest months range between 7.4 to -34.8°C. The mean annual temperature is -10.2°C. December is the warmest month of the year and August is the coldest. The blizzards touch a gale speed of 90 to 95 knots; the mean annual wind speed is 18 knots. The dominant wind direction is E-SE. Snowfall is quite frequent during the winter months, but gale force winds scrub the rocky surfaces clean and snow deposition is widespread on the leeward side of the hillocks.

Glaciological observations from 1983 to 1996 were carried out by surveys from two fixed points ('G' and 'H') using EDM or theodolite. The results showed that the Glacier is steadily receding every year at an average recession rate of 70 cm per annum.

In 1996, to enhance the accuracy of the observations, 19 peripheral points were marked encircling the snout of the Glacier. The average annual recession in the years 1997 to 2002 was 48.7 cm, 74.9 cm, 69.5 cm, 65.8 cm and 62.7 cm, respectively.

This translates into an overall average recession of 65.3 per annum for the period 1996-2002; which is in conformity with the observations for the previous period (1983 – 1996) of a recession rate of 7 meters per decade.

II. Measures

6(ii) Restricted and managed zones within the Area

Along the periphery of the Dakshin Gangotri Glacier, 19 observation points have been marked in February 1996. With reference to these points it has become possible to record the movement of the Glacier within an accuracy of 1 cm. Precise monitoring on cm-scale is also available for the years 1996-2002. Access to this zone should be restricted. It is proposed that a 100m radius all along the periphery of the Glacier should have limited admittance to protect the accuracy of scientific observations.

6(iii) Structures within and near the Area

There are no structures present in the Area, apart from two cairns ('G' and 'H') marking the sites used for glaciological and topographical surveys.

In future, some signs and cairns will be erected notifying the protected status of the Area.

6(iv) Location of other Protected Areas within close proximity of the Area

In the entire Schirmacher Oasis, there are no other protected areas.

7. Permit Conditions

7(i) Access to and movement within the Area

Entry into the Area shall be prohibited except in accordance with a permit issued by an appropriate national authority as designated under Article 7 of Annex V to the Protocol on Environmental Protection to the Antarctic Treaty.

A permit to enter the Area may only be issued for scientific research, or for essential management purposes consistent with the Management Plan's objectives and provisions; with the condition that the actions permitted will not jeopardize the scientific and environmental values of the Area and will not interfere with ongoing scientific studies.

7(ii) Activities that are or may be conducted within the Area, including restrictions on time or place

The following activities may be conducted within the Area:

- Scientific research programmes consistent with the Management Plan for the Area, including the values for which the Area has been designated; which cannot be carried out elsewhere and which will not jeopardize the ecosystem of the Area.
- Essential management activities, including monitoring.

7(iii) Installation, modification or removal of structures

No structures are to be erected within the Area except as specified in a permit. Any equipment should not be installed if it is not essential for scientific research or for management activities, and it must be authorized in a permit. All scientific equipment installed in the Area must be clearly identified by country, name of principal investigator, year of installation and expected date of completion of the study. Details are to be included in the visit report. All such equipment should be made of materials that pose minimum risk of contamination and must be removed at the completion of the study. Removal of specific equipment for which the permit has expired shall be a condition of the permit.

7(iv) Location of field camps

Camping is not allowed in the Area. The field parties can camp either east of "Lake Kalika" at "VK-Ground" or beyond the western limit of the Area.

7(v) Restriction on materials and organisms which can be brought into the Area

No living animals, plant material or microorganism shall be deliberately introduced into the Area and precautions shall be taken against accidental introductions.

No pesticides, herbicides, chemicals, radio-isotopes shall be brought into the Area, other than those permitted for scientific or management purposes. And these authorized agents shall be removed from the Area at the conclusion of the activity.

Fuel is not to be stored in the Area unless connected with authorized activity. Permanent depots are not to be built in the Area.

All material taken into the Area shall be for a stated period only and shall be removed at or before the conclusion of that stated period.

7(vi) Taking or harmful interference with native flora and fauna

Any interference with the native flora and fauna of the Area shall be in accordance with the requirements of the Protocol on Environmental Protection to the Antarctic Treaty, 1991, Annex II, Article 3. Where taking or harmful interference with animals is involved, SCAR Code of Conduct for Use of Animals for Scientific Purposes in Antarctica should be used as a minimum standard.

7(vii) Collection or removal of anything not brought into the Area by the Permit holder

Material may only be collected or removed from the Area as specified in the permit and should be limited to the minimum necessary to meet scientific or management requirements.

7(viii) Disposal of Waste

All waste, including human wastes, shall be removed from the Area.

7(ix) Measures that are necessary to ensure that the aims and objectives of the management plan can continue to be met

Permits may be granted to enter the Area to carry out biological monitoring and area inspection activities.

Specific sites of long-term monitoring shall be appropriately marked and GPS positions will be obtained for records with the Antarctic Data Directory System through the appropriate national authority.

8. Requirements for Reports

The principal permit holder for the permit issued shall submit to the appropriate national authority a visit report describing the activities undertaken. Reports are due and shall be submitted as soon as possible after the expiration of the permit, and include the types of information contained in SCAR visit report form or as required by national laws. The authority will maintain a record of such activities and make this accessible to interested Parties.

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II. Measures

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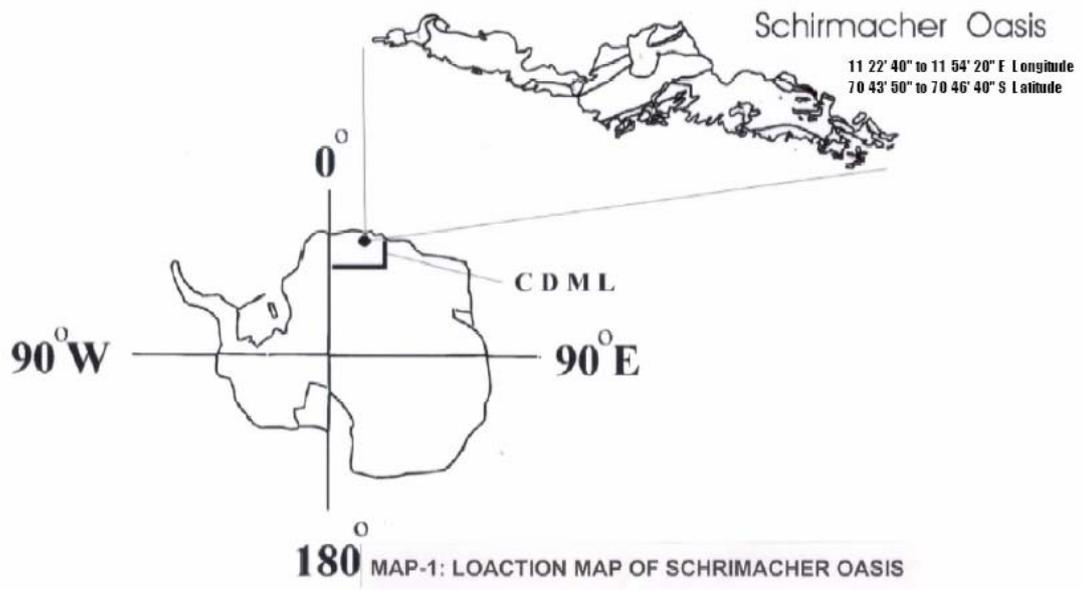
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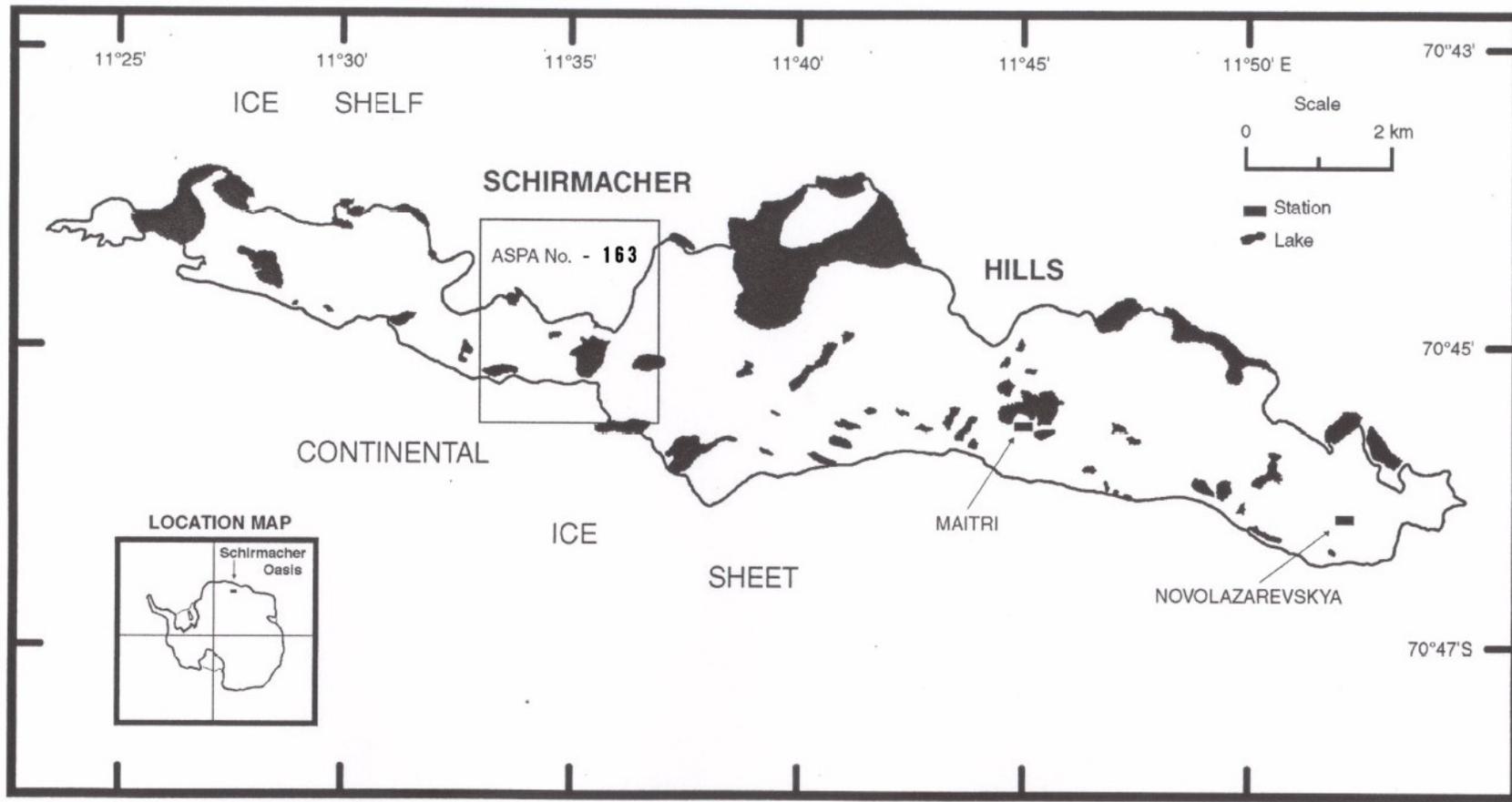
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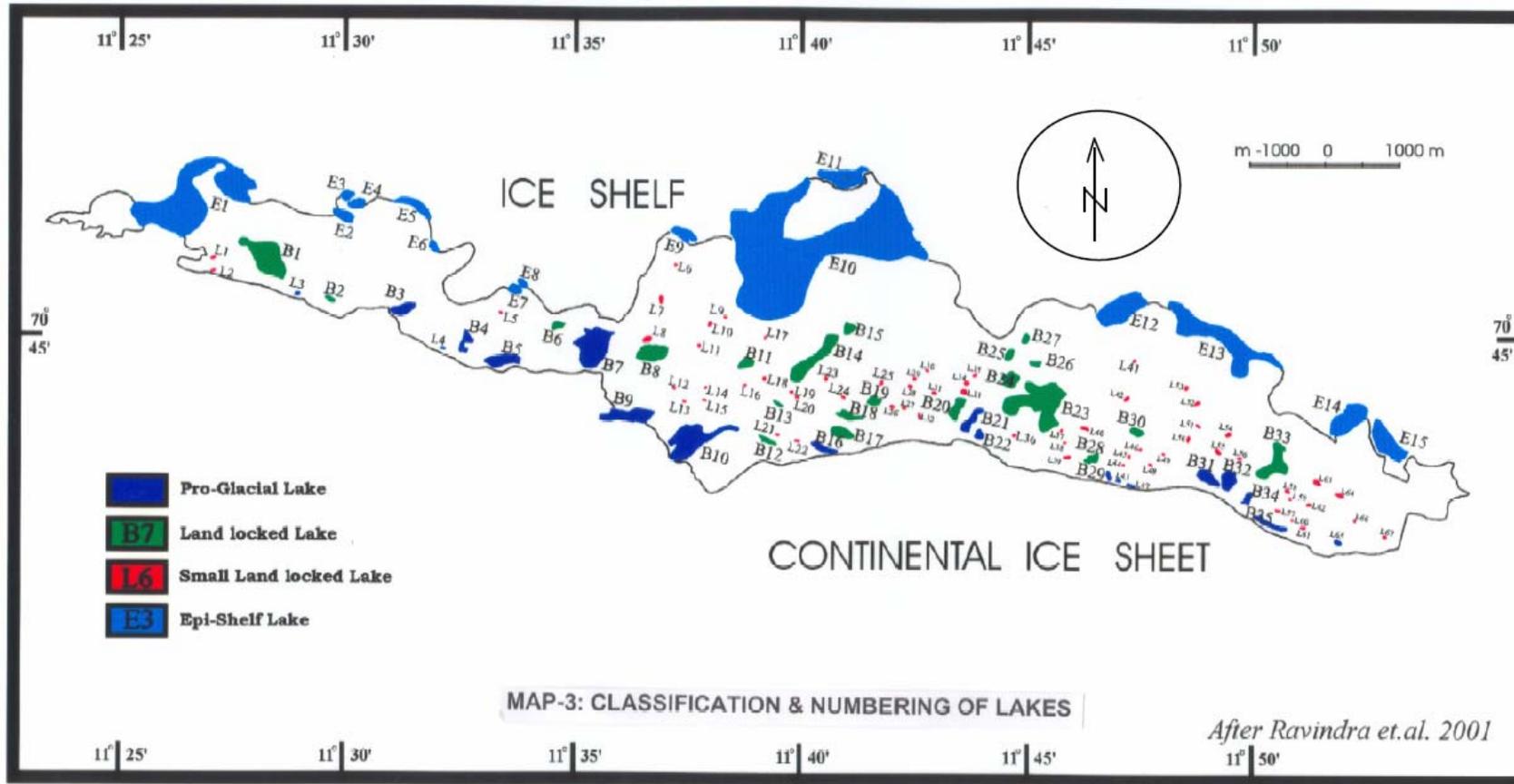
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MAP-2: MAP SHOWING LOCATION OF MAITRI (INDIA) & NOVOLAZAREVSKAYA RUSSIA



II. Measures

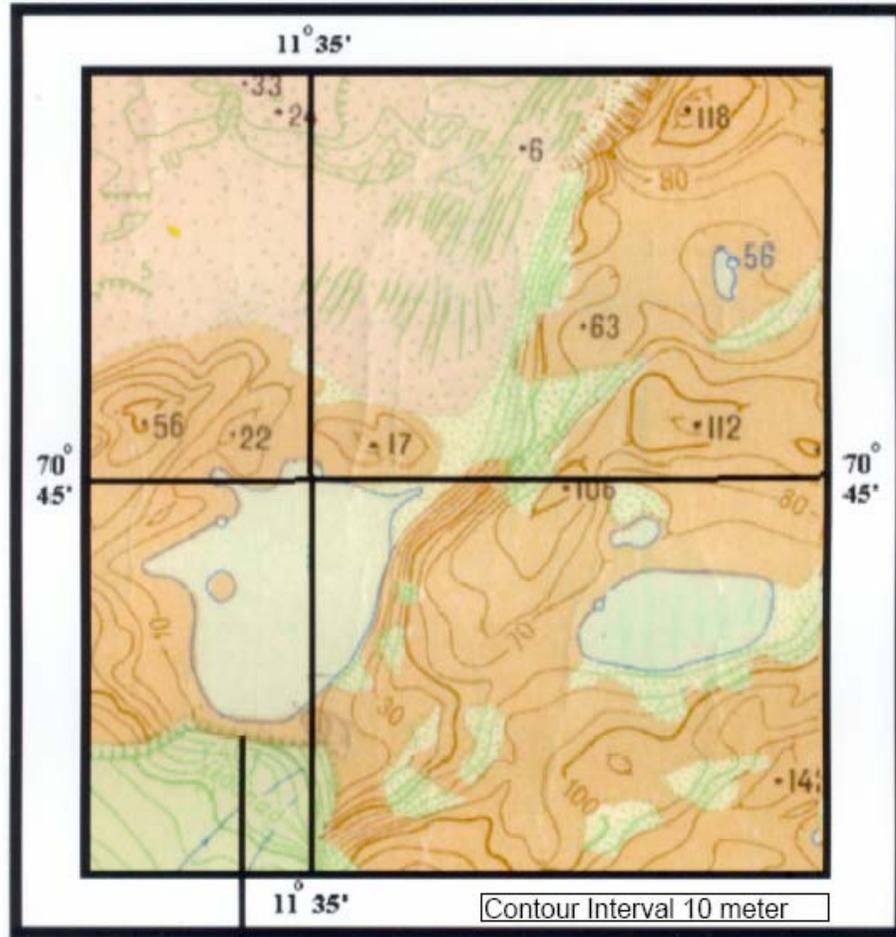


Plate - 4



Dakshin Gangotri Snout
MAP-4: TOPOGRAPHIC MAP OF THE AREA



II. Measures

