SCIENTIFIC TASKS ACCOMPLISHED

A. ATMOSPHERIC SCIENCES

A-1. India Meteorology Department

UNDERWAY OBSERVATIONS

A-1a. Surface Observations—Parameters like clouds, visibility, wind velocity/direction, temperature (dry/wet bulb), pressure, sea surface temperature and sea swells/waves were recorded on real time basis from 30th Nov. 1986 to 23 Dec. 1986 and again from 22nd Feb. 1987 to 18th Mar. 1987.

A-1b. Upper Air-Observations—Radiosonde and Omegasonde were taken on regular basis as part of onboard observations.

A-1c. Turbidity Measurements—Two hourly sunphotometer observations were recorded on routine basis throughout the sailing schedules.

ANTARCTIC METEOROLOGY

A-1d. Ozone Measurements—Essential infrastructure like Dobson spectrophotometer and a hut to house it was created at Dakshin Gangotri permanent station, for carrying out the internationally celebrated "Ozone Hole" programme, on round the year basis. Four ozonesonde ascents were taken successfully.

A-1.e Radiometer Sonde Ascents—To study the radiation balance RMS ascents were taken soon after the cessation of a blizzard.

A-1.f Upper Air Observations—Four balloon ascents were carried out.

A-1.g Surface Observations—Three hourly observations were taken on regular basis from 2nd Jan. 1987 to 17th Feb. 1987.

A-1.h Fascimile Charts Reception—Daily 6 charts on an average, were received and analysis helped in forecasting the weather for helicopter and other ligistic operations.

A-2. Indian Institute of Technology (Delhi)

UNDERWAY OBSERVATIONS

A-2.a Conventional Surface Meteoroiogical Observatons—136 sets at six hourly intervals were recorded alongwith continuous record of surface pressure.

A-2.b Aitken Nuclei For Surface Condensation—239 sets at two hourly intervals were recorded.

A-2.C Aerosols—31 samples were collected.

A-2.d Solar Radiation—42 sets of intensity of direct solar radiation at four selected wavelengths were record-ed.

A-2.e Temperature Scanner—8 Channel microprocessor based scanner was installed at DG permanent station for recording micrometeorological parameters.

A-2.f Vertical Temperature Profiles—770 profiles, at one hour interval, from three different levels within the snow and three in the air, were collected for studies on Cryosphere-Atmosphere energy exchange processes.

A-2.g Conventional Surface Meteorological Observations—110 sets of observations were recorded at Maitri field camp from 14th Jan. 1987 to 11th Feb. 1987.

A-2.h Aitken Nuclei Concentrations—9 vertical profiles (from surface to 2 kms.) over Dakshin Gangotri, Maitri and Wolthat-Peterman range were recorded through helicopter flights.

A-2.i Special Measurements—92 sets of observations on intensity of direct solar radiation in selected wave length bands were carried out in the Maitri range.

A-2.j Water Chemistry of Polar Region—6 (1 lit. each) samples of air and 12 (1 lit. each) samples of snow, have been collected for chemical analysis.

A-3. National Physical Laboratory

IONOSPHERIC STUDIES—All studies were conducted from Maitri field camp and extended from 28th Dec. 1986 to 15th Feb. 1987.

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A-3.a Riometer-Cosmic noise at 30 MHz was monitored continuously. Periods of intense ionospheric absorptions coinciding with geomagnetic storms, were observed.

A.3.b VLF Studies—Propagation at 12.0, 12.3 and 12.9 KHz from Omega stations of Liberia, La Reunion and Argentina were studied for proper understanding of ionospheric D-region.

A.3.C Lower Atmospheric Studies by Microbarograph—Infrasonic pressure fluctuations were recorded on continuous basis as these recordings help in locating natural or man-made explosions as also for recording the gravity waves.

A.3.d Ozone Studies—UV photometric recordings for measuring ground level ultraviolet B at 4 different wavelengths were carried out and are to be continued during winter and spring.

A.3.e Sun Photometer—Turbidity measurements at 360, 500, 675 and 778 mm were taken on clear sky days for studying aerosol contents and ultraviolet scattering.

A.3.f Gas Chromatograph—For analyzing methane and carbon monoxide in Antarctic atmosphere, a gas chromatograph was installed, caliberated and test runs carried out, Instrument which will be operated

through Antarctic winter will generate qualitative data on the probable causes of ozone depletion.

A.4. Indian Institute, of Geomagnetism

A.4.a A permanent geophysical laboratory was set up in the campus of Dakshin Gangotri permanent station for carrying out the following studies on round the year basis.

A.4.b Continuous monitoring of magnetic field fluctuations in the three orthogonal components X, Y and Z through fluxgate magnetometer using

- normal run (30 mm/hr) analog record.
- high gain and rapid run (120 mm/hr) analog record for magnetic pulsations by using appropriate filters.
- continuous monitoring of total magnetic field using proton precision magnetometer (0.1 nT) accuracy at 1 minute sampling time.

A.4.c Cosmic Noise Absorption Data—Using a 20 MHz Riometer, data generated can be used to study absorption events caused by electron precipitation (auroral absorption), solar protons (polar cap absorption) and solar flare X-rays.

A.4.d Daily variation data, total magnetic field variation data and magnetic pulsation data are recorded continuously on digital cassettes through Analog to Digital convertors at 1 min. and 10 sec. sampling intervals respectively.

B. EARTH SCIENCES

B.1. Geological Survey of India

B.1. Geological Mapping of peterman, I, II and III Range—An area of around 1600 sq. km. between Lat. 71 18°— 72°38'S and Long. 11°50'—13°00'E was surveyed. Rock types encountered include gneisses of various types which are intruded by amorthosites, presumably of two types, charnockite, granodiorite and quartzofelsparic dykes and veins besides several dykes of gabbroic basic bodies.

B.1.b Check Traverses in Schirmacher Range—Samples were collected for geochronological and paleomagnetic studies. Fresh assessment was made of the metamorphic grade and minerological characters of litho units in the area.

B.1.c Glaciological Studies—Four new stakes have been-fixed on the cap ice south of Maitri field camp. Both the newly fixed as well as old stakes were monitored for obtaining flow movement data. The snout of Dakshin Gangotri glacier was monitored through 'DISTOMAT survey.

B.1.d Iceberg Studies—Type, expanse and movement of icebergs was studied from 20th Dec. 1986 to 29th Dec. 1986 and again from 19th Feb. 1987 to March 1st 1987.

B.2. National Geophysical Research Institute

B .2. a Geology structural features and inter-relationship of different rock formations in Schirmacher oasis was investigated 85 representative samples from different lithological unit have been collected for geochemical studies

B. 2. b Wohlthat—Petermen Range—5 grano-syenite and 5 garnet biotite samples besides a few interesting rock samples from moraine were also collected

C ENVIRONMENTAL SCIENCES

C.1 National Institute of Oceanography

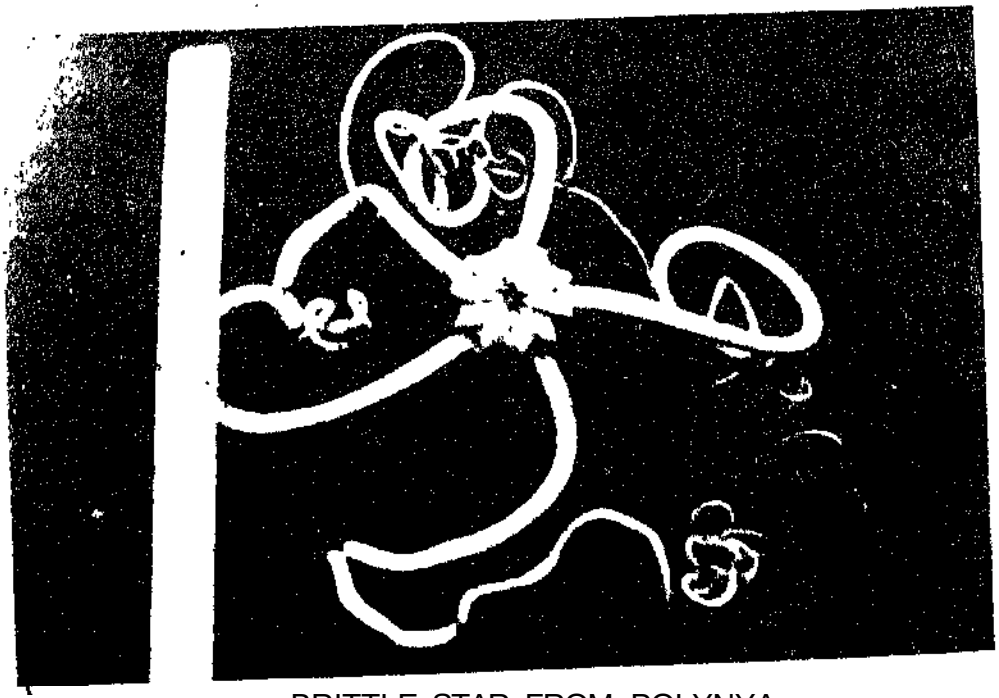
C. 1. a Oceanography—UNDERWAY OBSERVATIONS

C .1. a. i Sea Surface Temperature & Air Sea Interaction Studies—Expandable bathythermograph (XBT) probing upto 450 m depth was undertaken from Lat 7°44 N to Lat 43° 48 S during the onward journey and again on return sailing from Lat 46° 00 S to equator A total of 80 temperature profiles were recorded Surface meteorological parameters viz sea surface temperature wind speed wind direction air temperature total cloud amount sea state sea level pressure and visibility were recorded whenever XBT probes were launched

C. 1 .a .ii Pollutants in Aerosols—Measurements of aerosols along a section between the equator and 67°47 S Lat and from 43°02 S to the equator was carried out A total of 30 samples have been collected

C .1. b Oceanography—Pre-selected Points—43 stations

C.1.b.i Physical Oceanography—8 hydrographic stations in the polynya and 27 stations along the ship's track were occupied and physical processes in the Southern Ocean were studied.



BRITTLE STAR FROM POLYNYA

c.1.b.ii Chemical Oceanography—Water samples from different depths (8 on an average) at 35 stations were collected and analyzed on board the ship for pH, dissolved oxygen, nutrient salts of nitrogen, phosphorous and silica, dissolved and Particulate carbohydrates and suspended matter. For the analysis of fluorides, bromides, iodides, calcium,

magnesium and sulphate, water samples were preserved for detailed analysis in the shore' laboratory.

c.1.b.iii Biological Oceanography

- Primary Productivity & Phytoplankton—In situ incubation of more than 150 water samples drawn from discrete depths within the euphotic zone was carried out on board, for estimating the rate and magnitude of organic production in an expansive area between Lat. 70°S to 57°S and Long. 11°E to 27°E. Qualitative and quantitative distribution of phytoplankton, primary and extracellular production and the nature of photosynthetic and extracellular products was investigated. Biomass estimates on the basis of chlorophyll' a, adenosine triphosphate and Particulate oxidisable carbon measurements were carried out. Temporal variability and growth rates of phytoplankters were measured in the polynya.

- Epontic Algae—Measurement of photosynthesis, nutrient uptake, growth rates and generation time by sea-ice bound algal forms was carried out.

- Secondary Production & Zooplankton—A total of 49 zooplankton samples were collected from 200 m to surface and studies relating to qualitative and quantitative distribution, abundance and production were undertaken.

- Sea floor life—Benthic productivity

measurements were carried out at 4 stations. Sediment samples have been collected for biological and geological characterization.

C.i.b.iv Marine Biomass

- Krill Resources—A total of 30 krill samples were collected from an area bounded between 70-43 S and 11-37 E. Biomass measurements, growth rate, distribution pattern, migration and ecology were studied.

- Sea birds and marine mammals—672 observations were recorded from an area extending to and fro between the equator and the ice-shelf. 40 species of seabirds and 12 species of marine mammals were observed. Ecological parameters along with distributional characteristics were studied. Emperor Penguin rookery/moulting ground on fast ice was studied, through weekly sampling for understanding ecology, energetics and behaviour of pack ice habitats.

C.1.c. Limnology, Glacial Studies and Terrestial Zoology

C.1 .c.i Limnology—8 lakes in the Schirmacher ranges were studied on fortnightly sampling basis, from Dec. 1986 to Feb. 1987. Physical, chemical, geological and biological characterization of water column and lake floor in relation to diurnal variations was also carried out at Zub lake. Some of the studies carried out were as follows :

- Diving survey (7th Jan. 1987) of Priyadarshani Lake for bathymetry, installation and servicing of sediment traps.

- Energy fluxes in Antarctic Lakes through sediment trap assay.

- Photosynthesis and metabolites—freshwater algae.

- Benthic survey of Zub lake.

C.1.c.ii Bathymetry, total water volume & potability of Priyadarshani Lake—by taking depth profiles at

FRESHWATER LAKE IN ANTARCTIC

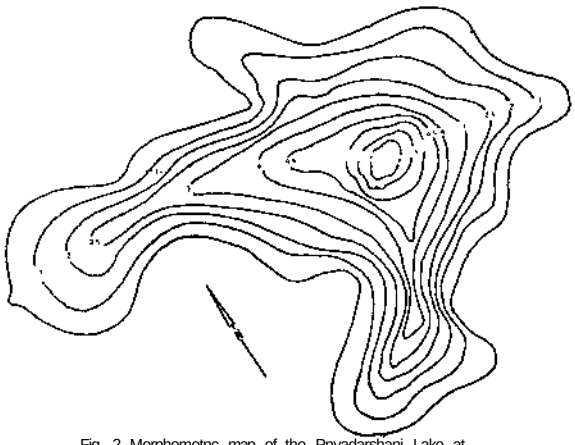


Fig 2 Morphometnc map of the Pnyadarshani Lake at Schirmacher Oasis, Antarctica
(Depth are not compared with M.S.L)

various points, a bathmetry chart has been prepared (Fig. 2). Total volume of water over a submerged area of 0.297 Km^2 in the depth zone of 1 to 6 meter, has been estimated to be 62 million cubic meters. From the water quality analysis (Table II) and after comparing the results with the available International and Indian standards, it is surmised that the water is suitable for human consumption.

C.i.c.iii Glacial Studies—Ice core sampling from two ecologically significant sites, viz. (i) Adelie Penguin Breeding Ground and (ii) Emperor Penguin Moulting Ground was undertaken to study the

MOULTING - EMPEROR PENGUIN

ecology of bacteria, yeast and protozoans in relation to organic enrichment in Penguin habitat.

CONSTRUCTION IN ANTARCTICA

C.1.C.iV Terrestrial Zoology—10 soil traps (8 x 25 cm size each) were fixed at ten different places in the vicinity of Maitri field camp for studying the distribution, abundance, succession and ecology of animal forms in Antarctic Oasis ecosystem—Traps were removed after 4 weeks exposure and the analysis is in progress.

C.2. Benaras Hindu University

C.2.a. Land Biology—268 samples of cyanobacteria were collected from the dry valleys of Schirmacher range and were studied for morphological features. Organisms ranged from unicellular to filamentous heterocystous forms. Nearly 80% of the samples collected contained nitrogen fixing forms. Cyanobacteria growing in association with mosses around lakes or melt water stream as also in association with quartz rocks were also studied.

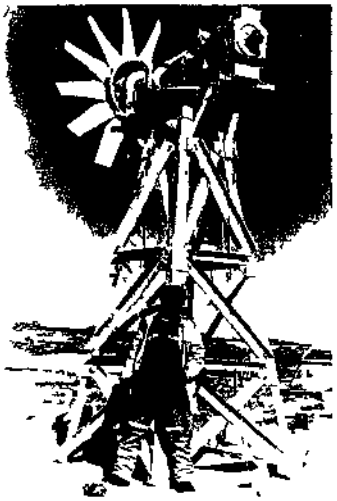
D ENGINEERING SCIENCES

D.1. Corps of Engineers & Defence Research & Development Organisation.

D.1.a. Site reconnaissance for a new permanent manned station—A detailed survey of different sites in the Schirmacher Range was carried out. Parameters like accessibility, source and quantity of waters, substratum, weather conditions, etc. were studied in detail and a lay-out with specifications involving type of habitat, water supply and infrastructural requirement has been proposed.

D.2. Bharat Heavy Electricals Ltd.

D.2.a Wind energy generator—A uni-directional wind mill was installed and tested at Maitri field camp site. Control panels were fixed and connections were given and tested on loads to room heaters.



WIND MILL AT MAITRI FIELD CAMP IN SCHIRMACHER RANGE

D.2.b Solar energy—solar panels installed at DG permanent station campus during the V Antarctic Expedition summer programme were monitored

E. BIOMEDICAL SCIENCES

E.1 Armed Forces Medical Corps

E.1. a Cold pressure response study—Human body response was charted after immersion of right hand in 0°C water for 30 mins. 16 case studies (wintering team members) were recorded.

E.1.b Cardio-pulmonary profiling of 34 team members—17 from the wintering team and 17 from the summer team as controls was carried out.

E.1.c Blood typing of all the team members was carried out.

E.2. Defence Institute for Psychology & Allied Sciences

E.2.a Physiological studies in relation to changes in environmental conditions—from tropical to polar conditions—were carried out. The following parameters were studied :

- Heart rate and blood pressure
- Skin and oral temperature.
- Circadian rhythms.
- Skin fold thickness and body weight.
- ECG profiling.

E.2.b Psychological studies with relevance to changes in human behaviour under conditions of extreme cold and isolation were carried out and the following parameters monitored :

- Security—insecurity test.
- Depression test.
- Ta. M.A. scale.
- Concentration test.
- Attentiveness test.
- Memory test.
- Personal experience test.

The above mentioned studies involving all parameters, will be continued throughout the winter and spring period of Antarctica.