

TECHNICAL PUBLICATION NO. 19



Scientific Report
TWENTY FIRST

INDIAN EXPEDITION TO

ANTARCTICA

2007



MINISTRY OF EARTH SCIENCES
NEW DELHI



सत्यमेव जयते

SCIENTIFIC REPORT OF TWENTY FIRST INDIAN ANTARCTIC EXPEDITION

TECHNICAL PUBLICATION No. 19



सत्यमेव जयते

NATIONAL CENTRE FOR ANTARCTIC & OCEAN RESEARCH
(MINISTRY OF EARTH SCIENCES)
HEADLAND SADA, VASCO, GOA-403804

2007

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Leader & Station Commander
Maitri, Antarctica

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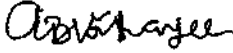
Prime Minister

MESSAGE

[For Shri R.P. Lal, Station Commander and
all the Members of XIX Winter Team, 'Maitri'
Antarctica]

I felicitate you and all the team members at the Indian Station 'Maitri' on the occasion of Antarctic Mid Winter Day. The National Antarctic programme has been achieving continuous success on account of the diligent efforts made by you and your colleagues. I have no doubt that your sincere and fearless work in such trying conditions will achieve fruition. The people of India admire the courage and determination shown by all of you.

I wish all of you a happy and successful stay in Antarctica and a safe return home.


(A.B. VAJPAYEE)

New Delhi
May 23. 2002



डा. मुरली मनोहर जोशी
DR. MURLI MANOHAR JOSHI

विज्ञान एवं प्रौद्योगिकी तथा
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NEW DELHI-110 001

May, 2002

Dear **Shri Lal**,

My warm greetings to you all on the occasion of the Antarctic Mid Winter Day. Your courage and perseverance makes the Indian Antarctic programme a success.

We are all proud of you who have volunteered to brave the Antarctic winter and complete the tasks assigned.

Best wishes for a successful stay and safe return home.

With best wishes,

Yours sincerely,

(MURLI MANOHAR JOSHI)

Shri R.P. Lal
Station Commander and
all the members of XIX winter
team, 'Maitri'
Antartica



डॉ. प्रेम शंकर गोयल
DR. P. S. GOEL



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FOREWORD

Since its inception in 1981, the Indian Antarctic Programme has evolved into a sustained scientific campaign with a clear cut focus to understand the mysteries of nature which are preserved in Antarctica. For the last forty years, the Antarctic Treaty has provided a stable framework for human activities in Antarctica, thus making available scientific information for the benefit of posterity. The Antarctic atmosphere has been subject to changes in recent decade due to global pollution, long-range transport from other continents, and local pollution from stations and other activities like tourism.

The successful conclusion of the 21st Indian Antarctic Expedition and scientific results generated, as reflected in this Report, have further consolidated our knowledge in various domains of polar science. The Expedition has been remarkable in many ways. A Gas Chromatograph was installed to study Green house gases such as methane, CO₂, and water vapour. Environmental cleaning of station, installation of incinerator to incinerate kitchen waste and relocation of fuel dump was also given equal importance. The station cleanliness was well appreciated by visitors from several countries.

The present Report is an outcome of an excellent scientific work by a multidisciplinary team under the capable leadership of Shri R.P. Lai from India Meteorological Department. I am sure that this Technical Report will serve as a valuable source of data and information in the field of Polar Sciences and logistics.


(P.S. Goel)

राष्ट्रीय अंटार्कटिक एवं
समुद्री अनुसंधान केन्द्र
पृथ्वी विज्ञान मंत्रालय
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PREFACE

Indian Scientific Expedition to Antarctica has been the National Mission with lots of challenges, adventures and prestige. Science has been the main currency of all these expedition. India has long been committed to Antarctic Programme as a result of which National Centre for Antarctic and Ocean Research (NCAOR) was established to co-ordinate the entire gamut of the activities related to Polar Logistics & Sciences. True to the spirit of the National Programme more than 60 National Laboratories / Departments/ Organizations are involved to carry out various scientific experiments in Antarctica.

The XXI Indian Scientific Expedition to Antarctica comprised 49 members drawn from 20 scientific institutions/organizations was set to achieve yet another goal of our National Antarctic Programme. The main task of the expedition was continuation of efforts for further advancement of multidisciplinary scientific research. A state of the art equipment namely, Gas Chromatograph was installed along with many other innovative projects such as Bio-potentialities of snow dwelling and epiphytic bacteria of Antarctica.

The completion of the XXI Indian Antarctic Expedition is a reflection of fulfilling the above goal in appreciating and understanding the various enigmas of nature controlled by this remote continent. It is most heartening to note that this expedition has successfully completed its assigned scientific and logistics task as reflected in this report.

Shri R. P. Lai of India Meteorological Department, the Leader of this expedition deserves all our deep appreciation for concerted efforts made by the entire team under his able guidance for achieving the targets of this mission and bringing out this report.

The publication of this technical report heralds the completion of yet another scientific mission of the country paving way for new challenges.


(Rasik Ravindra)

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THE TEAM

XXI Indian Antarctic Expedition 2002-2003 Winter Team



Sh R P LAL, IMD
Leader & Station Commander



Maj RK Sharma,
EME, Dy. Leader



Dr Govind Acharya
BSACS, Station Doctor



Sh Misha Bajpai
BSNL



Sh SVRR Rao
NGRI



Sh Sudesh Jamwal
SASE



Sh P N Machnurkar
IMD



Capt Amit Atri
ENGR



Dr Ghanshyam Singh
NCAOR



Sh Rajendra Kumar
DEAL



Sh Mohendra Doiphode
IIG



Sh Sachin Gude
NPL



Sh Bhupendra Singh
DEAL

XXI Indian Antarctic Expedition 2002-2003 Winter Team



Nb/Sub Rattan Singh
EME



HMT Lalit Sanklan
EME



Nk M Narute
EME



Nk Dalbir Singh
EME



Nk M Ramesh
ENGRS



Ct Manjit Kumar
ITBP



HMT Sita Ram
EME



HMT V V Gangadharan
EME



Hav L R Joshi
ENGRS



Spr Surender Singh
ENGRS



Spr Sanjay Bist
ENGRS



Hav P Chettiannan
EME

XXI Indian Antarctic Expedition 2002-2003 Summer Team



N . Sub. Gurbachan
Singh, EME



HMT P.K. Awasthi,
EME



Dr P.C. Pandey
DOD Observer



Dr S.L. Jain,
NPL



Lt Cdr Indu Prakash
Indian Navy



S.P. Kestwal
SOI



M.P. Gaur,
GSI



Dr Pawan K Sharma
KUK



Dr Kailash Chandra
ZSI



Dr Natwar Sharma
MSU



Dr A.K. Srivastava
AU



Abhay Mishra
DEAL



R.K. Das
SASE



Dr A.V.K. Prasad
GSI

XXI Indian Antarctic Expedition 2002-2003 Summer Team



Dr V. Wilsanand
RGCB



Arun Kumar
SOI



Lt Cdr N. Thapliyal
Indian Navy



S.K. Rai, POSR I
Indian Navy



G. Srinivas
NGRI



I. Rajshekhar
NAL



B.S. Ashoka
NAL



B.T. Rokade
VSNL



Sachin Labde
IIG



L/Nk Chandra Shekhar
Indian Army



Hav J.K. Verma
Indian Army



H.CT Dikar Singh
ITBP

THE TEAM

THE WINTER TEAM

Sr. No.	Name	Organization
1.	Sri R.P.Lal Leader & Station Commander	IMD
2.	Sri P.N.Machnurkar	IMD
3.	Sri Misha Bajpayee	BSNL
4.	Sri S.V.R.Rao	NGRI
5.	Sri Sudesh Kumar Jamwal	SASE
6.	Sri Mahendra Doiphode	IIG
7.	Sri Sachin Dinkar Gudhe	NPL
8.	Sri Rajendra Kumar	DEAL
9.	Sri Bhupinder Singh	DEAL
10.	Dr. Govind Acharya	BMS
11.	Dr. Ghanshyam Singh	NCAOR
12.	Sri Manjit Kumar	ITBP
13.	Maj.R.K.Sharma Dy. Leader	Indian Army EME
14.	Capt. Amit Atri	Indian Army ENGINEERS
15.	Nb.Sub. Ratan Singh	Indian Army EME
16.	HMT Sita Ram	Indian Army EME
17.	HMT Lalit Kumar Sankalan	Indian Army EME
18.	HMT V.V. Gangadharan	Indian Army EME
19.	Hav. R Chettiannan	Indian Army EME
20.	Nk. M.Narute	Indian Army EME
21.	Nk. Dalbir Singh	Indian Army EME
22.	Hav. Lok Raj Joshi	Indian Army ENGINEERS
23.	Spr. Surinder Singh Rawat	Indian Army ENGINEERS
24.	Spr Sanjay Singh Bist	Indian Army ENGINEERS
25.	L/Nk M.Ramesh	Indian Army ENGINEERS

THE SUMMER TEAM

Sr. No.	Name	Organization
1.	Sri M.P.Gaur	GSI
2.	Dr. A.V.K. Prasad	GSI
3.	Dr. S.L. Jain Dy. Leader	NPL
4.	Dr. Pawan Kumar Sharma	Kurushetra University
5.	Dr. Kailash Chandra	ZSI
6.	Dr. N.Sharma	M.S.University, Baroda
7.	Dr. A.K.Srivastava	Amravati University
8.	Dr. V.Wilasanand	RGCB
9.	Sri Abhay Mishra	DEAL
10.	Sri Sachin Labade	IIG
11.	Sri GSrinivas	NGRI
12.	Sri R.K.Das	SASE
13.	Sri I.Rajshekhar	NAL
14.	Sri B.S.Ashok	NAL
15.	Sri S.P.Kestwal	SOI
16.	Sri Arun Kumar	SOI
17.	Sri R.T.Rokade	VSNL
18.	Sri Dikar Singh	ITBP
19.	Lt. Cdr. Indu Prakash	NHO
20.	Lt. Cdr. N.Thapaliyal	NHO
21.	Sailor S.K.Rai	NHO
22.	Hav. J.K.Verma	Indian Army Engineers
23.	L/Nk. Chandra Shekhar	Indian Army Engineers
24.	Nb.Sub. Gurbachan Singh *	Indian Army EME
25.	HMT. Prem Kumar Awasthi *	Indian Army EME
26.	Dr. P.C. Pandey	DOD Observer

* These two members returned to India due to medical problem as per decision taken by Government of India communicated through National Centre for Antarctic & Ocean Research, Goa vide their Fax no. NCAOR/14(161)/01 dated 8 March 2002. Two substitutes HMT V.V. Gangadharan and HMT P.Chettiannan joined the winter team on 29th May 2002.