

SCIENTIFIC REPORT
TENTH INDIAN EXPEDITION TO
ANTARCTICA

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FOREWORD

Progress in science is a result of sustained effort in its pursuit. The polar science in India has come of age through the tireless efforts of our scientists and thus the Tenth Indian Expedition to Antarctica marks a decade of a magnificent endeavour.

The country has shown immense capabilities by now in the diverse disciplines of Polar Science where dedication and a sense of purpose have been the guiding light. It is in this context that the expedition was able to install and operate the state-of-art experiment on Acoustic Sounder for studies in atmospheric sciences. The scientific papers incorporated in this issue covering atmospheric science, bio-science, earth science, human physiology, oceanography and polar horticulture speak of the multidisciplinary and multiinstitutional nature of the Indian expedition. The hazards and uncertainties of weather notwithstanding, this expedition is credited with establishing a farsoutherly camp at Lat. 71°53'S; Long. 11°30'E, where the G.S.I. team braved the uncertainties of weather and terrain and accomplished their tasks.

I appreciate the painstaking efforts of National Physical Laboratory, New Delhi and Antarctica Division of Geological Survey of India, Faridabad in bringing out this publication.

June, 1995

Dr A.E. Muthunayagam
Secretary
Department of Ocean Development
New Delhi

PREFACE

The 100-member team of the Tenth Indian Antarctic Expedition sailed off Morma-gao on 27th November 1990 on-board *M.V.Thuleland*, the Swedish ship, chartered for the expedition. The team was a combination of members drawn from various defence services and scientific organisations. The tasks, as in every expedition, were enormous, critical and time bound.

Soon after sailing, the members were thoroughly briefed about the tasks of the expedition and the ways in which these were planned to be accomplished. The members started sharing various responsibilities and tasks straightaway. We landed in Antarctica as early as 20th December, mainly due to some excellent sea condition. Throughout the summer period, the weather remained good and all the scientific and logistic tasks scheduled for that period were accomplished as per programme. The summer component of the Tenth Expedition sailed back in the beginning of March 1991, leaving behind the wintering component of 25 members including 5 scientists.

All through the expedition, there was a lot of moral encouragement from various personalities back in India. We had the blessings of the then H'ble Prime Minister, Sh. Chandra Shekhar. I was constantly encouraged and guided in our endeavours by Prof. V.K.Gaur, then Secretary, Department of Ocean Development, who was closely monitoring our activities with interest. I and my team members thank him for his tremendous contribution to our expedition. This interest was continued by the present Secretary, Prof. P.Rama Rao and the Joint Secretary, Sh. J.V.R.Prasada Rao. We are grateful to them for their encouragement. My previous acquaintance with Sh. H.P.Rajan, Director, Deptt. of Ocean Development, resulted in a very fruitful interaction with him for few months before the departure of the expedition. He continued to be in constant touch with us throughout the sixteen month duration of the expedition. I sincerely thank him for his contribution to the expedition.

During the course of our expedition we also received messages of greetings and good wishes from Chief of the Army Staff, Chief of the Naval Staff and Chief of the Air Staff. We also received greetings from Director Generals of Geological Survey of India, Survey of India, Indo-Tibetan Border Police and EME, Directors of National Physical Laboratory, Geological Survey of India, National Geophysical Research Institute, National Institute of Oceanography, India Meteorological Department, Indian Institute of Geomagnetism and many others. We are extremely grateful to them. Our expedition tasks started on a healthy note due to the healthy co-operation we got from the members of the previous wintering team led by Sh.RasikRavindra of Geological Survey of India. We thank all of them.

The members from three Services played important role in the execution of the logistic tasks. Their co-operation, skill and dedication to the tasks was exemplary. The fact that we established a summer camp for earth scientists in the hitherto southern most part of Wohlthat mountains and touched new southern latitudes in search of meteorites,

are some glaring examples of the type of logistic help that the expedition was able to provide to the members due to the support offered by the Services. I thank all of them for their excellent contribution to the expedition. I also thank all the fellow scientists, who apart from executing their own programmes satisfactorily, provided a helping hand to the logistic tasks in their spare time.

I take this opportunity to thank my colleagues at the Time and Frequency Section of NPL, Dr. A. Mitra of D.O.D. and Sh. M.K.Kaul of G.S.I, who helped me in one way or other during the preparation of this manuscript.

The task of processing the manuscript and the pre-print stage monitoring was shared by Sh. Rasik Ravindra, Leader of the previous team due to my involvement in a foreign assignment, March 1994 onwards. I thank him for contributing to the publication of this report.

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A. K. HANJURA

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<i>S. Bhatia</i>	

THE TEAM

S.No.	Organization	SummerMember	Winter Member
1.	National Physical Laboratory	Sh. Vijaya Bhaskar Rao Sh.K. Krishna Reddy	Dr. A.K. Hanjura, Leader & Stn. Cdr.
2.	Geological Survey of India	Sh. M.J. Beg Sh. M.J. D'Souza Sh. Aran Chaturvedi	
3.	National Geophysical Research Institute	Sh. V.N. Sarma Dr. P. Rama Rao Dr. A.V. Ramana Rao	
4.	Survey of India	Maj. V.P. Srivastava Sh. H.B. Madhwal Sh. B.K. Gairola Sh. Virendra Dutt	
5.	BhabhaAtomic Research Centre	Sh. M.C. Balani Dr. T.V. Ramachandran	
6.	University of Calcutta	Mrs. Meenakshi Chatterji	
7.	All India Institute of Medical Sciences	Dr. (Mrs.) Usha Sachdeva	
8.	National Institute of Oceanography	Sh. R.A. Sreepada	
9.	Banaras Hindu University	Dr. K.D. Pandey	
10.	India Meteorological Department	Sh. R.K. Sharma	Sh. P.M. Gulhane Sh. S.S. Katariya
11.	Indian Institute of Geomagnetism		Sh. Unnikrishnan Nair
12.	Defence Agricultural Research Laboratory	Sh. A.B. Dhaulakhandi	Sh. R.P. Joshi

Contd.

THE TEAM — *Contd.*

S.No.	Organization	Summer Member	Winter Member
13.	Defence Institute of Fire Research	Sh. P. Chatterjee	
14.	Research & Development Establishment(Engrs.)	Maj. S. Bhatia Sh. V. Shinde Sh. S.V. Gowd	
	Indian Army	Maj. P.R. Sangam Maj. V.C. Bhatt L/Nk Sampat Nb. Sub. D.S. Subba Sub. U.B. Khattri L/Nk Gurmit Singh L/Nk P.C. Suresh L/Nk S.B. Shivanand L/Nk S.B. Gangadharan Hav Shiv Dayal Hav Jayachandran	Lt Col R. Pathania Maj Ravendra Kumar Maj Mahesh Patel Maj Sudhir Rai Sub G. Velliangiri Nb Sub Bhuwan Singh Sub G. Neelakandan Hav A. Raman Hav Navinder Singh HMT R.S. Dahiya HMTH.S. Dadhwal
15.		Hav Sundravadivelu Nk Beg Bahadur Thapa Nk K.M. Kutty Nk Anthony Crus Nk Anand Ballabh Joshi Nk R.S. Pandian	HMT Rameshwar Prasad Nk T. Manoj Kumar Nk M.C. Chauhan Nk H.L. Tiwary
	Indian Navy	Cdr. H.S. Oberoi Lt, Cdr. K. Vijay Kumar Lt. A. Vaideeswaran Lt. A.K. Kinoo Lt. P. Rajkumar Lt. Cdr. P. Elangovan P.P. Paul MCAA II T.D. Lalan EAAR 3 VKM Madhusoodhanan CHMECH(AL) S.S. Singh AA3	Lt. P.M. Mathew K.S. Girijavallaban P. Singh POELR P.P. Joseph POCK(O)
16.		M. Jayapalan CPOR(TEL) V.S.RawatLCK'O' A.K. Babu'LCK'O' A. Singh LCK 'O'	

THE TEAM— *Contd.*

S.No.	Organization	Summer Member	Winter Member
17.	Indian Air Force	Wg. Cdr. Jagdip Singh Sqn. Ldr. Ravi Shankar Sqn. Ldr. S.K. Bassi Sqn. Ldr. M.P.Sharma Fit. Lt. T.V.K.K. Babu Fit. Lt. Joe Emmamuel Fit. Lt. M.M. Samuel Sgt. A. Singh Sgt. S.N. Sharma Sgt. H. Singh Sgt. V.B. Singh Sgt. J. Singh JWO Vishwakarma JWO S.P.S. Sihag JWO Pvajagopalan WO G.O.K. Pillai Cpl. Bora Cpl. S. Kumar	
18.	Indo-Tibetan Border Police	Thakur Shyam Singh Dr. S.C. Panda	Dr. Balraj Begra