

## NOTES

### INTERNATIONAL WORKSHOP ON BIOGEOCHEMICAL PROCESSES IN THE NORTHERN INDIAN OCEAN

An International Workshop on Biogeochemical Processes in the Northern Indian Ocean was jointly organized by the National Institute of Oceanography (NIO, CSIR), India and the Center for Tropical Marine Ecology (ZMT), University of Bremen, Germany at the National Institute of Oceanography, Goa during 24-25 February 2003.

At the outset, Dr. Ehrlich Desa, Chairman of the workshop and the Director, National Institute of Oceanography while welcoming the delegates, stated that the global ocean community was interested in the study of biogeochemical processes operating in the Arabian Sea. He further briefed that this workshop would review the impact of voluminous data and knowledge generated by the research carried out by the scientists of India and Germany. Prof. G. Hempel, former Director of the Center for Tropical Marine Ecology, University of Bremen,

Germany inaugurated the workshop by lighting the traditional lamp. In his inaugural address, Prof. Hempel mentioned that the rampant extraction of oil from ocean bed has adversely affected the processes regulating the biological driven marine carbon-dioxide uptake, also known as Biological Pump. Hence, ocean as a carbon sink cannot swallow all the CO<sub>2</sub>. The workshop abstract volume was later released by Prof. Hempel. Prof. V. Ittekkot, Co-chairman of the workshop and the Director of the Center for Tropical Marine Ecology, University of Bremen, delivered the introductory remarks and hoped that this workshop would form a base for future Indo-German collaborative programs. Dr. B. N. Desai, former Director of NIO, while recollecting his experiences during the Indo-German Bilateral Program, said that since the launching of this program many oceanographic cruises onboard German and Indian research vessels were undertaken to carry out



A memorable get-together at NIO, Dona Paula, Goa.

mooring operations to collect particle flux. Dr. Desai also shared his experiences associated with this program with the others. Later, the collected reprint volumes published under the Indo-German bilateral program were formally released by Dr. Desai, Dr. M.V.S. Gupta, Convener of the workshop, highlighted the seventeen long-years of Indo-German collaborative program on particle flux research in the northern Indian Ocean and mentioned some significant milestones during the course of this joint venture. Dr. Birgit Gaye-Haake, University of Hamburg, Germany briefed the delegates on the scope and structure of the workshop. Finally, Dr. R. Nigam proposed vote of thanks.

#### Background

In 1984 a German delegation from the then Federal Ministry for Research and Technology visited India to attend a bilateral Indo-German Workshop on Marine Geology and Oceanography at Goa. Among the many proposals discussed at the Workshop was one which was conceived by the late Dr. H.N. Siddiquie, Director, National Institute of Oceanography (NIO), Goa, India and Prof. E. T. Degens, Director, Geological Paleontological Institute and Museum of the University of Hamburg, Germany was approved. This project entitled, "Quaternary Upwelling Climate in the Northern Indian Ocean related to Monsoon Events" was aimed at the study of time-varying biogeochemical processes triggered by monsoonal upwelling in the Arabian Sea and the Bay of Bengal. Subsequently, a project proposal was submitted for approval by both the government agencies, the Council of Scientific & Industrial Research (CSIR), India and Bundesministerium für Forschung und Technologie, Germany.

The project was launched in 1986 with the cruise of the German Research Vessel SONNE on which three moorings consisting of two sediment traps each were deployed at three locations in the western (WAST), central (CAST) and eastern Arabian Sea (EAST) by a team of Indian and German scientists and also several sediment cores were collected. These sediment traps are devices that can be programmed to collect settling material at intervals of days to months and that can be moored at various depths in the sea. This collaborative project was aimed at quantifying the flux of material to the interior of the oceans by moored time series sediment traps. In this effort, 24 research cruises have been undertaken jointly in the northern Indian Ocean (Bay of Bengal and Arabian Sea) on board the Indian Research Vessel SAGAR KANYA and chartered vessel M. V. NAND RACHIT and German Research Vessels METEOR and SONNE and for carrying out sediment trap mooring operations.

The three preselected mooring stations - WAST, CAST and EAST, have become the centerpiece of investigations during the years by many nations around the world. The results have contributed significantly to the development of international programs such as the IGBP-JGOFS and its Arabian Sea Process Study which started in 1995. JGOFS in turn changed the focus of the project and processes regulating the biological driven marine CO<sub>2</sub> uptake known as the biological pump have been emphasized. This topic is of special interest at a time when the anthropogenically increased atmospheric CO<sub>2</sub> is leading to global warming. The efficiency of the biological pump depends on the rain ratio which is the ratio between the export of organic carbon and inorganic carbon (calcium carbonate carbon). Since the production of calcium carbonate unlike that of organic carbon enhances the PCO<sub>2</sub> in surface waters, lowering the carbonate production or enhancing the organic carbon export increases the efficiency of the biological pump.

The Indo-German bilateral program was the first to show the link between monsoons and sedimentation of material including carbon from the ocean surface to the deep sea—a much needed information to validate the use of sediment record to decipher past monsoons. The long term continuous record of particle fluxes in the Arabian Sea obtained since 1986 has shown that particle fluxes are governed by upwelling and wind mixing during the SW monsoon and winter cooling during the NE monsoon. Especially in the northern Bay of Bengal (NBBT), the fluxes are largely affected by river inputs. Towards the south (SBBT), the river influence diminishes and upwelling signals advected by currents from the Kerala coast can be seen in the southern Bay of Bengal. Moreover, the sediment trap experiment! could show that the biological pump is more efficient in the river dominated Bay of Bengal than in the Arabian Sea although the latter is among the areas in the ocean which experiences the highest eolian inputs. In both these areas monsoonal processes cause a shift in the biological community structure and in the amount of material, including organic carbon sinking out of the euphotic zone.

The results generated from this project were jointly presented at several national and international conferences and meetings and in 75 papers published in peer-reviewed international scientific journals. Within the framework of the joint Indo/German project, several International Conferences were conducted, among them ICSU (International Council of Scientific Unions) - SCOPE (Scientific Committee on Problems of the Environment) Workshops on "Particle flux in the Oceans" in 1991 (Goa) and 1993 (Hamburg) and bilateral Indo-German Workshops in 1988 (Hamburg), 1996 (Goa) and 1997 (Cochin). The

German research vessel visited Indian ports twice: in 1991 (Goa) and 1997 (Cochin).

#### The Workshop

The main purpose of this Workshop was to highlight the achievements in the area of Biogeochemical Processes in the northern Indian Ocean carried out over the last 17 years of our collaborative work and also to mark the culmination of this long joint venture.

There were several delegates from abroad (Germany and USA) representing the Universities of Maryland, Washington (USA) and Universities of Bremen, Hamburg, Kiel and Bonn (Germany) who attended the workshop. About seventy Indian scientists from various research institutions; INCOIS, Hyderabad; NCAOR, Goa; PRL, Ahmedabad; HTM, Pune; SAC, Ahmedabad and CMMACS, Bangalore and Universities of Kochi, Andhra, Mangalore, IIT Guwahati participated in the workshop. There were five different themes in the workshop viz., 1) Particle fluxes; 2) Ocean Dynamics; 3) Remote Sensing; 4) Biological fluxes to the ocean; 5) Chemical fluxes to the ocean. First two sessions were conducted on the first day

with about 30 presentations and followed by about 25 presentations on the second day. Besides, four thematic lectures were also organized during the workshop.

Wide range of topics such as long term variability of particle fluxes and marine carbon cycle in the northern Indian Ocean, fluctuations in productivity and denitrification intensity along the southwestern continental margin of India, oceanic proxies for the late Quaternary monsoon reconstruction, dynamics and thermodynamics of the Indian Ocean warm pool, ocean ecosystem coupling suspended sediment dispersal observed from IRS P4 OCM data, phytoplankton biomass and production etc. were discussed.

The workshop was concluded with a special session on the discussion to explore future scope for collaboration between India and Germany. Furthermore, it was emphasized that multi-laboratory and university involvement in such collaborative programmes was essential to promote participation of universities in bilateral programmes.

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## Geological Society of India

### POPULARIZING GEOLOGICAL SCIENCES

The Geological Society of India has launched on a new line of activity of popularization of science with the object of fulfilling one of its main objectives of educating the public. It proposes to issue a series of illustrated booklets aimed at informing an average high school student about aspects of geological science which are of great interest like geological hazards, groundwater availability, energy resources, fossils, extinctions and similar other related scientific topics. There is an obligation cast on every geologist to educate the public on matters of geological interest. If we fail to do so we run the risk of being neglected as a science in preference to other contenders like television, and other communication technologies which are making rapid headway. There is an urgent need for emphasizing the importance of earth in all its aspects and in understanding the way it has changed in the past.

As a beginning it is proposed to issue short booklets (20-25 pages), well illustrated aimed at informing an average student taking science as a course. These will be low priced, accessible to all and translated into other Indian languages. Language should be simple and free from jargon. The subject chosen should emphasize some important aspect of earth science, preferably of current scientific interest. These booklets can be written in any of the following languages. English, Hindi, Kannada, Tamil, Telugu, Bengali and Marathi. The Society undertakes to translate the text into other languages. Those interested in taking part in this effort are requested to get in touch with Dr.M.S.Rao, Editor who will coordinate this line of activity.