

November 8–10, 1999  
**Goa, India**

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**The Third (1999) ISOPE  
Ocean Mining  
Symposium &  
Workshop**

**ISOPE OMS-99**

**National Institute of Oceanography  
Dona Paula, Goa, India  
November 8–10, 1999**

**Technical Program**

**Invited and Refereed Papers**

**Environment  
Exploration & Survey**

**Mining Systems & Technology  
Materials and Processing**

*Organized by:*

International Organizing Committee

*Sponsored by:*

International Society of Offshore and Polar Engineers (ISOPE)

with cooperating organizations (list inside)

Department of Ocean Development, Government of India

National Institute of Oceanography, Goa, India

ISOPE OMS-99 secretariat

Attn.: Dr. Rahul Sharma

**National Institute of Oceanography**

**Dona Paula, Goa 403 004, India**

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**NIO**

## Welcome to ISOPE OMS-99

We greatly appreciate the excellent responses and help we have received from colleagues around the world in the successful organization of the 3rd ISOPE Ocean Mining Symposium (ISOPE-OMS-99), Goa, India, November 8-10, 1999. The symposium features **10 sessions of refereed papers** and **1 workshop on environment** from 10 countries.

The 1st (1995) ISOPE Ocean Mining Symposium (ISOPE OMS-95) was held in Tsukuba. An informal organizational meeting of **Ocean Mining Working Group (OMWG)** was held in Tsukuba, Japan, on November 22, 1995. At the meeting, representatives from 7 countries desired to have a close international cooperation and more exchange of the individuals' progress. It was agreed to establish a non-governmental body, OMWG, which can also act as an informal channel among the governments: The OMWG concept got blessing from director generals of the participating governments: US, France (Ifremer joined later), Germany, Japan, IOM, Korea, India, and China (joined later). The OMWG covers exploration and survey, environment, mining systems, and processing systems.

The primary objectives of the OMWG are:

- to advance at an international level technological progress in the interdisciplinary field of ocean resources, environment and mining and related technologies, through international cooperation and participation;
- to disseminate scientific knowledge and provide timely exchange of technical knowledge and information;
- to provide opportunities through its programs for interested individuals to maintain and expand their knowledge in these fields for the benefit of engineering and scientific profession.

to facilitate opportunities or the members to interact with their governments. The International Society of Offshore and Polar Engineers (ISOPE) facilitates the OMWG activities.

On behalf of the International Organizing Committee, it is our pleasure to welcome participants to the ISOPE OMS-99 Symposium in Goa.

*Co-chairmen of the ISOPE OMS-99 Symposium*

Jin S. Chung, USA  
A.E. Muthunayagam and E. Desa, India  
Tetsuo Yamazaki, Japan

**SUNDAY November 7**

15:00  
OMS-99 Executive Committee Meeting                      Conference room

16:00  
Ocean Mining Working Group (OMWG) Meeting                      Conference room

For Tour Information                      (see the Bulletin board at the Lobby)

**MONDAY November 8**

9.00 -10.00  
Symposium Registration                      Lobby

10.00 -11.00  
**1. Opening Session**                      Seminar Hall

11.30-13.00  
**2. MINING TECHNOLOGY & SYSTEMS I**                      Seminar Hall

13.00-14.00  
Group Lunch                      NIO Canteen

14.00-15.30  
**3. MINING TECHNOLOGY & SYSTEMS II**                      Seminar Hall

16.00-18.00  
**4. EXPLORATION & SURVEY**                      Seminar Hall

19.30-21.30  
**SYMPOSIUM RECEPTION**                      Cidade-de-Goa

**TUESDAY November 9**

09.00 -11.00  
**5. ENVIRONMENT I**                      Seminar Hall

11.30-13.00  
**6. ENVIRONMENT II**                      Seminar Hall

13.00-14.00  
Group Lunch                      NIO Canteen

14.00-15.30  
**7. ENVIRONMENT III**                      Seminar Hall

16.00-19.00  
**8. ENGINEERING AND ENVIRONMENT  
ASSESSMENT WORKSHOP**                      Seminar Hall

Monday - Wednesday                      Training Hall

Audio/Visual Practice  
On-site Registration

**WEDNESDAY NOVEMBER 10**

09.00-10:00		
<b>9. ENVIRONMENT IV</b>		Seminar Hall
10.30-13.00		
<b>10. PROCESSING TECHNOLOGY</b>		Seminar Hall
13.00-14.00		
Group Lunch		NIO Canteen
14.00-15.30		
<b>CLOSING SESSION</b>		Seminar Hall
16.00-20.00		Old Goa Churches and city tour
<b>EXCURSION</b>		
Technical and Optional Tours	see program and bulletin board	

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***Cosponsored by:***

**International Society of Offshore and Polar Engineers (ISOPE)  
Department of Ocean Development, Government of India  
National Institute of Oceanography, India**

***Cooperated by:***

Korea Committee for Ocean and Resources Engineering (KCORE)  
International Society of Offshore and Polar Engineers (ISOPE)  
U.S. National Science Foundation (NSF)  
Mining and Materials Processing Institute of Japan (MMIJ)  
Korea Association for Deep Ocean Minerals Development (KADOM)  
Kansai Society of Naval Architects of Japan (KSNAJ)  
Ifremer (France)  
National Institute of Oceanography (NIO, India)  
InterOceanMetal (Poland)  
China Ocean Mineral Resources R&D Association (COMRA)

***Secretariat:***

Dr. Rahul Sharma, National Institute of Oceanography, India

***Technical Executive Committee:***

Prof. Jin S. Chung, Colorado School of Mines, Golden, USA  
Dr. Rahul Sharma, National Institute of Oceanography, Goa, India  
Dr. Tetsuo Yamazaki, NIRE, Tsukuba, Japan

***International Organizing Committee***

Prof. Jin S. Chung (**Chairman**), Colorado School of Mines, Colorado, USA  
Dr. E. Desa, National Institute of Oceanography, Goa, India  
Dr. Ning Yang, Changsha Research Inst. of Mining and Metallurgy,  
Changsha, China  
Dr. Seok Won Hong, Korea Research Inst. of Ship and Ocean Engineering,  
Korea  
Prof. Kun Mo Han, Dong-A University, Pusan, Korea

Mr. Myungjae Yoon, KADOM, Seoul, Korea  
ir. M. Olagnon, Ifremer, France  
Dr. K. Otsuka, Osaka Prefecture University, Osaka, Japan  
Dr. Y. Okano, University of Tokyo, Tokyo, Japan  
Dr. G. Schriever, BIOLAB Forschungsinstitut, Germany  
Dr. T. Yamazaki, National Inst. for Resources and Environment, Japan

**Conference Co-chairmen**

Jin S. Chung, Colorado School of Mines, USA  
A.E. Muthunayagam, Department of Ocean Development, Government of India  
E. Desa, National Institute of Oceanography, India  
Dr. Tetsuo Yamazaki, National Institute for Resources and Environment, Japan

# TECHNICAL PROGRAM

## 1. OPENING SESSION

Monday 10:00 Seminar Hall

**Coordinator:** Rahul Sharma, National Institute of Oceanography, India

**Development of Manganese Nodule Resources in Indian Ocean**

Dr. A.E. Muthunayagam, S.K. Das, Department of Ocean Development, New Delhi, India

**Opportunity for Offshore Minerals Exploration in Indian Ocean**

Dr. E. Desa, National Institute of Oceanography, India

**Deep-Ocean Mining and Ocean Mining Working Group (OMWG)**

Prof. Jin S. Chung, Colorado School of Mines, USA

## 2. MINING TECHNOLOGY & SYSTEMS I

Monday 11:30 Seminar Hall

**Chair:** Jin S. Chung, Colorado School of Mines, USA

**Co-chair:** Sup Hong, Korea Research Inst. of Ship and Ocean Engineering, Korea

**Mining System with Free Swimming Pick-Up Device and Dose Test of Environment Assessment (Oral Presentation Only)**

Ning Yang, Changsha Research Inst of Mining & Metallurgy, Hunan, China

**Non-Linear Dynamic Response of Ocean Mining Pipe**

R.R. Babu and Suhail Ahmad, Indian Institute of Technology, New Delhi, India

**Effects of Internal Flow on Dynamics of Deep Seawater Risers**

Koji Otsuka, Akiyoshi Bando and Yoshiho Ikeda, Osaka Prefecture University, Sakai, Japan

**A Proposal of the Deep Ocean Water Upwelling Machine Using Density Current**

Kazuyuki Ouchi, Nakashima Propeller Co., Tokyo, Japan

**To the Problem of Application of New Technologies of Mining Coal Seams in the Shelf of the Sea of Japan**

Yuriy N. Niskovskiy, Elena V. Niskovskaya, Far Eastern State Technical University, Anatoliy M. Vasiyanovitch, Alexander G. Shakhirzanov, JSC "Primorskogol," Vladivostok; Russia

**An Experimental Study on the Flow Characteristics of Two Phase Solid-Liquid Mixture in a Vertical Tube** (Proceedings Only)

Chi Ho Yoon, In Kee Kim, Kwang Soo Kwon, Seok Ki Kwon, Jung Seock Kang, Ou Kwang Kwon and Chi Won Seo, Korea Institute of Geology, Mining and Materials, Taejon, Korea

**3. MINING TECHNOLOGY & SYSTEMS II**

Monday 14:00 Seminar Hall

**Chair:** *T. Yamazaki*, National Inst. for Resources and Environment, Japan

**Co-chair:** *M.S. Nagar*, Indian Rare Earth Limited, India

**Deepsea Core Boring by BMS in Northern Mariana Area**

Katsutoki Matsumoto, Metal Mining Agency of Japan, Tokyo; Shigeru Sarata, National Inst for Resources and Environment, Tsukuba, Japan

**Tracing Collector Passes and Preliminary Analysis of Collector Operation**

Tetsuo Yamazaki, National Inst. for Resources and Environment, Japan

**Track-Keeping Control of Seafloor Miner by Successive Learning of Unknown Velocity and Soil Properties**

Jin S. Chung, Colorado School of Mines, Golden, Colorado, USA

**Experimental Study on Performance of Waterjet Pickup Device of Manganese Nodule Collector**

Sup Hong, Jong-Su Choi, Jin-Ha Kim and Chan-Kyu Yang, Korea Research Inst of Ships and Ocean Engineering, Taejon, Korea

**Underwater Sand Mining System for Shallow Waters**

C.R. Deepak, M. Pugazhaandi, S. Paul, M.A. Shajahan, M.A. Atmanand, R. Jeyamani, M. Ravindran, E. Schulte, Nat. Inst. of Ocean Technology, Chennai, India

**4. EXPLORATION & SURVEY**

Monday 16:00 Seminar Hall

**Chair:** *T R P Singh*, Engineers India Ltd., India

**Co-chair:** *G P Glasby*, University of Sheffield, UK

**The First Phase of the IOM Survey Program According to Plan of Work for Exploration in the Area**

R. Kotlinski and V. Stoyanova, Interoceanmetal Joint Organization, Szczecin, Poland

**Mode of Occurrence of Ferromanganese Crusts on Inactive Seamounts in the Northwestern Pacific**

Akira Usui, Osamu Ishizuka and Makoto Yuasa, Geological Survey of Japan, Tsukuba, Japan

Multibeam Echosounder Pseudo Sidescan Images as a Tool for Manganese Nodule Exploration  
V.N. Kodagali, B. Chakraborty, National Institute Of Oceanography, Goa, India

**The Implementation Agreement and Indian Interests**  
B. Vijay Kumar, National Institute of Oceanography, Goa, India

**Hydrothermal Processes in the Manus Basin, Papua New Guinea, Southwest Pacific**  
Jean-Marie Auzende, IFREMER, Noumea cedex, New Caledonia;  
Tetsuro Urabe, Geological Survey of Japan, Tsukuba, Japan

## 5. ENVIRONMENT I

Tuesday 09.00 Seminar Hall  
**Chair:** *Gerd Schriever*, BIOLAB Forschungsstitut, Germany  
**Co-chair:** *Z A Ansari*, National Institute Of Oceanography, India

**Summary of the Japanese Environmental Study for Deep-sea Mining**  
Satoru Okubo, Metal Mining Agency of Japan, Tokyo, Japan

**Indian Deepsea Environment Experiment (INDEX): Achievements and Applications**  
Rahul Sharma, National Institute Of Oceanography, Goa, India

**Vertical Distribution of Meiobenthos in Relation to Geotechnical Properties of Deep-Sea Sediment in the IOM Pioneer Area (Clarion-Clipperton Fracture Zone, NE Pacific)**  
Teresa Radziejewska and Igor Modlitba, Interoceanmetal Joint Organization, Szczecin, Poland

**Sedimentological Impacts of INDEX Experiment**  
A.B. Valsangkar, N.V. Ambre, Maria Rodrigues, National Institute Of Oceanography, Goa, India

**Effect of Benthic Disturbance on Geotechnical Characteristics of Sediments from Nodule Mining Area in the Central Indian Basin**  
N.H. Khadge, National Institute Of Oceanography, Goa, India

**Baseline Studies and Evaluation of Effects of Surface Discharge of Deepsea Mining -INDEX Area**  
S.N. De Souza, S.D. Sardesai, National Institute of Oceanography, Goa, India

## 6. ENVIRONMENT II

Tuesday 11.30 Seminar Hall  
**Chair:** *R. Kotlinski*, Interoceanmetal Joint Organization, Szczecin, Poland  
**Co-chair:** *Rahul Sharma*, National Institute of Oceanography, India

**Environmental Impact of Suspended Tailings Discharge During Mining Nodules**

Jianxin Xia and Ning Yang, Changsha Research Inst of Mining & Metallurgy, Hunan, China

**Long-Term Propagation of Tailings from Deep-Sea Mining - Numerical Simulations Under Variable Conditions**  
Susanne Rolinski, Universitat Hamburg, Hamburg, Germany

**Environmental Study on the Deepsea Mining of Manganese Nodules in the Northeastern Tropical Pacific: Modeling the Sediment-Laden Negative Buoyant Flow**  
Toshimasa Doi, Koichi Taguchi, Computer Tech. Integrator Co, Nagoya; Kisaburo Nakata and Masahisa Kubota, Tokai University, Shimizu; Shigeaki Aoki, National Inst for Resources and Environment, Tsukuba, Japan

**Intercomparison Between Aanderaa and Potok Current Meters Deployed During Phase II of PMN EIA Programme.**  
A.A. Fernandes, Shailesh Pednekar, P. Vethamony, National Institute of Oceanography, Goa, India

### 7. ENVIRONMENT III

Wednesday 14.00 Seminar Hall  
**Chair:** *Yoshihisa Shirayama*, Kyoto University, Japan  
**Co-chair:** *Nagender Nath*, National Institute Of Oceanography, India

**Mapping the Megabenthos as an Essential Part of Environmental Studies Related to Anthropogenic Impact in the Deep-Sea**  
Hartmut Bluhm, Alfred-Wegener-Institute for Polar and Marine Research, Bremerhaven, Germany

**Biological Results of JET Project: An Overview**  
Yoshihisa Shirayama, Kyoto University, Wakayama, Japan

**Immediate Response of Meio and Macrobenthos to Disturbance Caused by Benthic Disturber.**  
B.S. Ingole, Z.A. Ansari, S.G.P. Matondkar, National Institute Of Oceanography, Goa, India.

**Validation of EIA Sampling Methods—Bacterial and Biochemical Analyses**  
Sheelu G., P.A. Loka Bharati, Shanta Nair, C. Raghukumar, C. Mohandass, National Institute of Oceanography, Goa, India

### 8. ENGINEERING AND ENVIRONMENT ASSESSMENT OF DEEP-SEA MINING WORKSHOP

Tuesday 16:00 Seminar Hall  
**Chair:** *Prof. H. Thiel*, AWI für Polar- und Meeresforschung, Germany  
**Co-chair:** *Jin S. Chung*, Colorado School of Mines, USA

**Engineering Assessment**  
Tetsuo Yamazaki, National Inst of Resources and Environment, Japan

**Scientific Assessment**  
G. Schriever, BIOLAB Forschungsstitut, Germany



## 9. ENVIRONMENT IV

Wednesday 09:00 Seminar Hall  
Chair: Ning Yang, Changsha Research Inst of Mining & Metallurgy,  
China  
Co-chair: V. Ramesh Babu, National Inst. of Oceanography, India

### **Surface Meteorological Conditions at Benthic Disturbance Site - INDEX Area During Austral Winter 1997**

A. Suryanarayana, V.S.N. Murty, V. Ramesh Babu, B.S. Beena,  
National Institute of Oceanography, Goa, India

### **Watermass Structure at Benthic Disturbance Site (INDEX Area) and Anticipated Mining Effects On Hydrophysical Properties**

V. Ramesh Babu, V.S.N. Murty, A. Suryanarayana, B.S. Beena ,  
National Institute of Oceanography, Goa, India

### **Current Structure and Kinetic Energy of The Abyssal Waters in the Central Indian Basin**

V.S.N. Murty, V. Ramesh Babu, A. Suryanarayana, B.S. Beena,  
National Institute Of Oceanography, Goa, India

## 10. PROCESSING TECHNOLOGY

Wednesday 10:30 Seminar Hall  
Chair: *R P Das*, Regional Research Lab, Bhubaneswar, India  
Co-chair: *Yasuhiko Okano*, Univ of Tokyo, Tokyo, Japan

### **The Smelting-Rusting-Solvent Extracting Process to Recover Valuable Metals from Polymetallic Nodules**

Xiang Zhong, Zequan He, Yujin Shen, Yongjun Mao, Shuguang Qu  
and Xianbai Li, Changsha Research Inst of Mining & Metallurgy,  
Hunan, China

### **An Evaluation of Mineral Processing Experimental Data for Cobalt-Rich Crust Development**

Se Hun Park, Sohei Shimada and Yasuhiko Okano, Univ of Tokyo,  
Tokyo, Japan

### **Processing of Polymetallic Sea Nodules : An Overview**

Premchand and R.K. Jana, National Metallurgical Lab., Jamshedpur,  
India

### **Manganese Recovery from Manganese Nodules**

K. Sanjay, T. Subbaiah, S. Anand, R.P. Das, Regional Research Lab,  
Bhubaneswar, India

### **Design of Flexible Configuration Nodule Processing Pilot Plants In The Context Of Evolving Metal Markets**

P.K. Sen, T.R.P. Singh, Engineers India Limited, New Delhi, India

### **Studies on Removal of Impurities from Ocean Nodules Leach Liquor by Solvent Extraction**

K. Bhattacharya, M.F. Fonseca, R. Sadanandam, S.K. Tangri, A.K.  
Suri, Bhabha Atomic Research Centre, Mumbai, India

### **Simultaneous Spectrophotometric Estimation of Iron, Copper, Cobalt and Nickel in Ocean Nodule Leach Liquor**

M.V. Rane, K. Srikant, N.K. Menon, R. Sadanandam, S.K. Tangri,  
A.K. Suri, Bhabha Atomic Research Centre, Mumbai, India

**Recovery of Nickel and Cobalt Values from Various Sources**

I.G. Sharma, A. C. Bidaye, P.R. Menon, P.P.Shukla, A.K. Suri,  
Bhabha Atomic Research Centre, Mumbai, India

**11. CLOSING SESSION**

Wednesday 14:00 Seminar Hall  
**Chair:** *E. Desa*, National Institute of Oceanography, India  
**Co-chair:** *Prof. H. Thiel*, AWI für Polar- und Meeresforschung, Germany

**Excursion**

Wednesday 16:00

Visit to Old Goa churches and Panjim city.

**GENERAL INFORMATION**

**PLACE AND DATE:** Dona Paula, Goa, India; November 8–10, 1999

**ISOPE OMS-99**

**National Institute of Oceanography (NIO)**

**Dona Paula, Goa 403 004, India**

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**Tel +91-832-226253/221322**

**Gram : Oceanology, Panaji, India**

**E-mail rsharma@csnio.ren.nic.in or rsharma@darya.nio.org**

NIO is located in Dona Paula area, a suburb about 6 km away from Panaji (also called as Panjim), the capital city of Goa state.

**ACCESS TO GOA**

By Air

Goa is well connected by Air with all international airports at Mumbai, Delhi, Chennai and Cochin. All flights to Goa arrive at the Dabolim Airport (close to Vasco-da-Gama city) about 30 kms from Panjim. Airport coaches and prepaid taxis can be taken to come to Panjim and Dona Paula. Book in advance during this tourist season.

By Rail

Train services are available from New Delhi, Mumbai (Bombay), Bangalore, Hyderabad and Cochin. Public transport and hired taxis are available to come to NIO (Dona Paula) from the nearest railway stations.

By Road

Panjim is connected by road with the major cities in western India. There are many private and government luxury and semi-luxury buses from these cities to Panjim.

**PARKING:** Free parking.

### **LANGUAGE**

The language for the conference is English. No translation service will be arranged. English is fluently spoken in Goa in addition to Hindi and Konkani.

### **CURRENCY EXCHANGE**

Bank with foreign exchange counter is located in the NIO campus. The approximate exchange rates as of July 1999: 1 US\$ = Rs.43, 1 UK£= Rs. 68, 1 Euro = Rs. 45, 100 Yen = Rs. 35.

### **AIRPORT to Hotels and NIO (see the map in this program)**

Airport to Hotel Cidade-de-Goa by Hotel courtesy coach.  
To go to other hotels or to come to NIO, take a pre-paid Taxi (~Rs. 400).

### **HOTEL ACCOMMODATION: Guaranteed reservation by AUGUST 30 only (must use the Reservation Form in this program.)**

Accommodation is arranged at 2 hotels close to the venue for the delegates. Transport will be available between hotels and seminar venue for the convenience of the participants. The choice for accommodation is as follows:

- a) Cidade-de-Goa Beach Resort : Located at Vainguinim Beach, only 1.5 km from NIO, this luxury hotel has offered single rooms (with CTV, refrigerator) at the rates of US \$ 150 per night (including breakfast and taxes).
- b) Prainha Cottages: Located at Dona Paula beach and adjacent to the symposium venue, this hotel has offered a single / double bed room at Rs. 1800 (US \$ 45)+ 15% taxes (including breakfast).

Both the hotels have a beach, restaurants, swimming pools and taxi facilities.

**Voltage**: The voltage for electrical power supply is 220 V.

### **CITY TRANSPORTATION**

Pick up a local tourist information booklet at the registration desk. Local buses run regularly to all points of the city. Taxis are also available at Dona Paula.

### **EXCURSION, November 10**

A short excursion will be organized on 10 November, to the Basilica of Bom Jesus and Se Cathedral. On the return, participants will get a chance to visit the shopping areas of Panjim city.

### **OTHER TOURS**

Full day sight seeing tours can be booked from the hotels.

### **ADVANCE SYMPOSIUM REGISTRATION BY MAIL OR FAX (use the Registration Form)**

All persons attending the symposium are required to register, pay the appropriate fee, and get a conference badge. Remember to send via airmail the Advance Registration (*and Invoice*) Form in this Program or a copy to reach **before OCTOBER 8**:

The fee includes Proceedings, Reception and 3 Lunch tickets.

**Foreign Participants: ISOPE OMS-99, ISOPE, P.O. Box 189, Cupertino, California 95015-0189, USA: Fax 1-408-980-1787.** In case one charges to a credit card via FAX, the card number should be typed in bold face or written clearly to be readable in the transmitted fax copy.

Registration fees (note **US\$50 surcharge after October 8** for on-site registration) are as follows:

Category	Registration Fee* (US Dollars)	
	Before October 08	After October 08
Author, Co-authors, Panelist	200	250
Session or Symposium Chair, Co-Chair	200	250
New ISOPE member application (incl. Yr. 2000 membership fee and one year journal issues)	290	340
Spouses (no proceedings/no luncheon ticket)	N/C	N/C
Full-time Student with 1999 ID Card	100	100

**Domestic Participants: ISOPE OMS-99, NIO, Goa, India :**

The advance payment should be made by cheque/draft drawn in favour of ISOPE-Ocean Mining Symposium, NIO, Goa and sent to **Dr. V.N. Kodagali, ISOPE-OMS Secretariat, National Institute of Oceanography, Dona Paula, Goa 403 004, India (Fax +91-832-223340 / 2291102 or contact on email: kodagali@csnio.ren.nic.in, kodagali@darya.nio.org).**

Late payment can also be made at the registration desk in cash: Rs.8,000.

Category	Registration Fee (Rs)*	
	Before October 08	After October 08
Author, Co-authors, Panelist	6,000	8,000
Session or Symposium Chair, Co-Chair	6,000	8,000
Spouses (no proceedings/no luncheon)	No charge	No charge
Full-time Student with 1999 ID Card	2,000	3,000
Banquet and Three lunch tickets	1,000	1,000

\* The Symposium registration fee includes the symposium reception, daily group lunch, tea breaks, and a symposium proceedings.

**REGISTRATION CANCELLATIONS**

Request for cancellation of registration must be received in writing by **October 12, 1999** to be granted a refund minus US\$50 (Rs. 2000) processing charge.

**REGISTRATION BADGE**

Registration badges are required for admittance to all the symposium activities, including the reception and lunch.

**ON-SITE SYMPOSIUM REGISTRATION**

Participants who miss the advance registration may register at the Symposium Registration Desk, but there is a US\$50 (Rs. 2000) surcharge. The registration desk will be open during the following hours:

Monday, Nov. 8    09:00-16:00    Tuesday, Nov. 9    09:00-14:00

#### **ISOPE PUBLICATION ORDER**

A copy of **ISOPE OMS-99 Symposium Proceedings** is included in the symposium registration fees. The proceedings volumes (250 pp. est.) can be ordered by mail at the rates of:

Mail order at \$100 (ISOPE Member \$80) including shipping charge.

**All ISOPE PUBLICATIONS can be ordered from ISOPE, P.O. Box 189, Cupertino, California 95015-0189, USA: Fax 1-408-980-1787.** Advance payment is required. MasterCard or VISA card, international money order or U.S. bank checks in US dollars *payable to ISOPE* will be accepted. Shipping and handling charges are included (also see the ISOPE Publication Order Information.)

**PRESS** - The press is invited to register at: Registration Desk

**SYMPOSIUM HEADQUARTERS** Registration Desk

#### **SYMPOSIUM RECEPTION**

19:30-21:30 MONDAY Cidade-de-Goa-Beach Resort

**AUDIO VISUAL PRACTICE ROOM** Session Room

An overhead projector, 35 mm slide projector and screen will be set up from 08:00-17:00 (Monday and Tuesday) in the session room.

An overhead projector, 35 mm slide projector and screen will be set up in the session rooms. For any specific requirements for presentations, participants may contact **Dr. B. Nagender Nath, ISOPE-OMS Secretariat, NIO, Goa, India (Fax : +91-832-223340 / 229102 or on e-mail nagender@csnio.ren.nic.in, nagender@darya.nio.org).**

#### **INTERNATIONAL PARTICIPANTS AND VISA APPLICATION**

International authors, participants or attendees who need help (except financial) can contact: **Dr. Rahul Sharma, OMS-99 Secretariat, NIO, Dona Paula, Goa, India (Fax: +91-832-223340 / 229102 or email : rsharma@csnio.ren.nic.in, rsharma@darya.nio.org).**

**Entry Visa.** Some authors may be required to apply for an entry visa. Please get an application form at the Embassy/ Consulate of India in your country. If the Consulate requires you to submit an official letter of invitation, please contact OMS-99 Secretariat, India.

#### **About GOA**

Goa is popular among domestic as well as foreign tourists for its enchanting beaches, and magnificent churches and temples. Located on the central west coast of India, Goa is famous for its natural beauty and cultural heritage. Its subtropical weather makes it an ideal place for swimming and water sports.

Being an international tourist destination, Goa has adequate facilities, such as domestic flights to all international airports in India, luxury hotels, conference, banking and telecom facilities.

**Climate And Clothes.** The weather in Goa during November will be warm (~30°C). Occasional rains may occur during this period.

#### **About NIO**

NIO, a national research laboratory under the Council of Scientific and Industrial Research, was established in 1966. The Institute is a premier

organization in the South East Asian region, conducting oceanographic research and developmental activities.

- Research is carried out under the major disciplines of Geological, Geophysics, Biological, Chemical and Physical Oceanography, Ocean Engineering, Marine Instrumentation, Marine Corrosion and Biofouling, and Marine Archaeology.
- Currently, it is the nodal agency for 2 of the major activities connected with *Ocean Mining*, that is (i) delineation of mine sites in the Indian Pioneer area, and (ii) environmental impact assessment studies for nodule mining.

### **Goa, Airport and Train to Dona Paula**

Take domestic flights from New Delhi, Mumbai (Bombay), Chennai (Madras) and Cochin to Dabolim Airport 30 km from Dona Paula, Goa. Take the pre-paid Taxi (~ Rs. 400) to reach your hotel or NIO.

Train connections to Goa from New Delhi, Mumbai, Chennai, Cochi. Get off at Karmali, Margao or Vasco-da-Gama stations, and take local bus or hired taxi to come to Dona Paula or to your hotel.

## ISOPE MEMBERSHIP APPLICATION

Please send me an ISOPE membership application form:

Name \_\_\_\_\_  
Organization \_\_\_\_\_  
Dept. \_\_\_\_\_  
Address \_\_\_\_\_  
Postal Code \_\_\_\_\_, Country \_\_\_\_\_  
Fax No. \_\_\_\_\_

Send to:

ISOPE Membership Department  
ISOPE, P.O. Box 189, Cupertino, California 95015-0189, USA:  
Fax 1-408-980-1787.

*Prospective authors are invited to submit abstract to:*

## ISOPE-2000 Seattle

The 10th (2000) International  
**Offshore and Polar Engineering  
Conference**  
**Seattle, USA, May 28–June 2, 2000**

**ABSTRACT DEADLINE: August 30, 1999**

**Send 2 copies of your abstract in 300-400 words to:** (1) One of the TPC members (session organizers) or (2) **ISOPE-2000 TPC**, ISOPE, P.O. Box 189, Cupertino, California 95015-0189, USA: Fax 1-408-980-1787.



NOTE

**HOTEL RESERVATION FORM (must use this form)**

**NIO, Goa, India  
November 8-10, 1999**

Rooms in two hotels are blocked for the Symposium. For **guaranteed reservation**, this form must be received **via either fax or mail** only and no later than **AUGUST 30** by:

**Dr. V. Ramesh Babu**  
(email : rbabu@csnio.ren.nic.in, rbabu@darya.nio.org)  
**ISOPE OMS-99 Secretariat**  
**National Institute of Oceanography**  
**Dona Paula, Goa 403 004, India**  
**Fax +91-832-223340 / 2229102**

First (Fore)  
Surname: \_\_\_\_\_ & Middle: \_\_\_\_\_  
Circle: Male Female; Title Mr. Ms. Mrs. Prof. Dr.  
Company: \_\_\_\_\_  
Address \_\_\_\_\_  
\_\_\_\_\_

Country \_\_\_\_\_ Postal (ZIP) Code \_\_\_\_\_  
Fax No. \_\_\_\_\_

Arrival: November \_\_ Time \_\_\_\_; Depart.: \_\_\_\_ , Time \_\_\_\_

Hotel Choice:	Check	Rate Per Night
Cidade-de-Goa <sup>a</sup>	Single	US \$ 150
	Double	
Prahna Cottages <sup>b</sup>	Single	Rs. 1800
	Double	(US \$ 45)

- a) includes breakfast and taxes.
- b) includes breakfast but add 15%.

Name of the person to share: \_\_\_\_\_

\* Rates include gratuity and tax. If your 1st choice is consumed, you will be automatically moved to next available category room.

Note: Exchange rate is about Rs. 43 to 1 US dollars as of July 1999.

**Methods of Payment.** No advance deposit is required. Pay directly to the Hotel as you check in. Credit cards (Visa, MasterCard only) or cash payments are accepted. Cancellation must be notified in advance in writing to ISOPE OMS-99 Secretariat so that the room can be released to others on the waiting list.

Signature: \_\_\_\_\_ Date: \_\_\_\_\_, 1999

**Photocopy, Complete, and Send This Form**  
Reservation after **AUGUST 30** is subject to room availability.

## **TECHNICAL PROGRAM**

### **ISOPE OMS-99 Goa Dona Paula, Goa, India November 8–10, 1999**

*Find Forms for the Hotel Reservation and Advance Registration inside this program.*

*Venue Address:*  
**ISOPE OMS-99  
National Institute of Oceanography  
Dona Paula, Goa 403 004, India  
Fax +91-832-223340  
E-mail rsharma@darya.nio.org**

#### ***Plan to Attend Other ISOPE Meetings***

**ISOPE–2000 Seattle, USA  
May 28–June 2, 2000  
Abstract Deadline: August 15, 1999  
For Call For Papers, Fax to 1-408-980-1787 USA**

**ISOPE–2001 Stavanger, Norway  
June 17–22, 2001**

**ISOPE PACOMS-2000 to be announced.**

**ISOPE EUROMS-2001 Europe  
Venue and date to be announced.**



**International Society of  
Offshore and Polar Engineers (ISOPE)  
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# **ISOPE-2001 Stavanger**

**The 11th (2001) International  
Offshore and Polar Engineering  
Conference  
Stavanger, Norway, June 17-22, 2001**

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