September 22−26, 2013
Szczecin, Poland

The Tenth (2013) ISOPE
Ocean Mining & Gas Hydrates Symposium

ISOPE
OMS-2013
Szczecin, Poland, September 22–26, 2013

Final Program
Invited and Peer-reviewed Papers

Nodules, Crusts, Sulphide Exploration & Environment
Mineral Processing Gas Hydrates and Engineering
Mining Systems and Technology
Underwater and Subsea Systems

Organized by:
International Organizing Committee

Sponsored by:
International Society of Offshore and Polar Engineers (ISOPE)
Interoceanmetal Joint Organization (IOM)
with cooperating organizations (listed inside)

ISOPE OMS-2013 Local Secretariat
Attn.: Dr. Jozef Franzen, Interoceanmetal Joint Organization,
Ul. Cyryla i Metodego 9, 71-541 Szczecin, Poland
Fax: 48 +91-4539399 Telephone: +48-91-4256813 ; E-mail:
j.franzen@iom.gov.pl

ISOPE
P.O. Box 189
Cupertino, Calif. 95015-0189, USA
Fax 1–650–254–2038: www.isope.org
info@isope.org ;
Welcome to 10th ISOPE OMS-2013

We greatly appreciate the excellent responses and help we have received from colleagues around the world in the successful organization of the 10th ISOPE Ocean Mining & Gas Hydrates Symposium (ISOPE OMS-2013), Szczecin, Poland, September 22–26, 2013. The symposium features 14 sessions of 53 peer-reviewed papers and 5 additional oral presentations from 16 countries. This year the symposium continues to introduce gas hydrates in ocean and permafrost in addition to deep-ocean exploration, environment, mining systems, and processing systems.

The 1st (1995) ISOPE Ocean Mining Symposium (ISOPE OMS-95) was held on November 22, 1995 in Tsukuba, Japan as an informal organizational meeting of the Ocean Mining Working Group (OMWG). At the meeting, representatives from 7 countries agreed to establish the group for close international cooperation and continued exchange of the individuals’ progress, which could also act as an informal channel between governments. The group concept received the blessing of directors general of the participating governments: U.S., Germany, IOM, Japan, Korea, India, and China (joined later).

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 professions.
• to facilitate opportunities for the members to interact with their governments. The International Society of Offshore and Polar Engineers (ISOPE) facilitates the group activities.


On behalf of the International Organizing Committee, it is our pleasure to welcome all participants to the ISOPE OMS-2013 Symposium in Szczecin.

<table>
<thead>
<tr>
<th>Co-chairmen of the ISOPE OMS-2013 Symposium</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Prof. Jin S. Chung, USA</td>
<td>Dr. T Abramowski, Poland</td>
</tr>
</tbody>
</table>
**SUNDAY September 22**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Location</th>
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<tbody>
<tr>
<td>14:00</td>
<td>OMS-2013 Registration and badge pickup</td>
<td>Foyer, 11 Fl</td>
</tr>
<tr>
<td>17:00</td>
<td>OMS-2013 IOC</td>
<td>Copernicus 2, 11 F</td>
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<tr>
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<td>For Tour Information</td>
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<td>(see the bulletin board in the foyer)</td>
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</tbody>
</table>

**All sessions will be held in Copernicus 2, 11th Floor of Radisson Blu Hotel**

**MONDAY September 23**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Location</th>
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</thead>
<tbody>
<tr>
<td>07:30–08:30</td>
<td>Symposium Registration</td>
<td>Foyer, 11 Fl</td>
</tr>
<tr>
<td>09:00</td>
<td><strong>1. OPENING SESSION</strong></td>
<td>Copernicus 2</td>
</tr>
<tr>
<td>10:35</td>
<td><strong>2. EXPLORATION &amp; ENVIRONMENT I</strong></td>
<td>Copernicus 2</td>
</tr>
<tr>
<td>13:00–14:00</td>
<td>OMS Lunch</td>
<td>Europa, Ground Fl</td>
</tr>
<tr>
<td>14:00</td>
<td><strong>3. EXPLORATION &amp; ENVIRONMENT II</strong></td>
<td>Copernicus 2</td>
</tr>
<tr>
<td>15:30</td>
<td><strong>4. GAS HYDRATES I: Fundamentals</strong></td>
<td>Copernicus 2</td>
</tr>
<tr>
<td>19:00–21:00</td>
<td>Banquet Dinner and Polish Cultural Evening</td>
<td>Hall Vivaldi’s, Ground Fl</td>
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</tbody>
</table>

**TUESDAY September 24**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Location</th>
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<tbody>
<tr>
<td>07:30–08:30</td>
<td>Symposium Registration</td>
<td>Foyer, 11 Fl</td>
</tr>
<tr>
<td>09:00</td>
<td><strong>5. GAS HYDRATES II: Properties 1</strong></td>
<td>Copernicus 2</td>
</tr>
<tr>
<td>10:30</td>
<td><strong>6. GAS HYDRATES III: Properties 2</strong></td>
<td>Copernicus 2</td>
</tr>
<tr>
<td>13:00–14:00</td>
<td>OMS Lunch</td>
<td>Europa, Ground Fl</td>
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<tr>
<td>14:00</td>
<td><strong>7. GAS HYDRATES IV: Development</strong></td>
<td>Copernicus 2</td>
</tr>
<tr>
<td>16:30</td>
<td><strong>8. MINERAL PROCESSING</strong></td>
<td>Copernicus 2</td>
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<tr>
<td>20:00–21:00</td>
<td>Dinner</td>
<td>Restaurant Europa,  Ground FL</td>
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**Monday – Wednesday**

<table>
<thead>
<tr>
<th>Time</th>
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<tbody>
<tr>
<td></td>
<td>Author Practice</td>
<td>Copernicus Bar, 11 F</td>
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<tr>
<td></td>
<td>On-site Registration</td>
<td>Foyer, 11 Fl</td>
</tr>
</tbody>
</table>
WEDNESDAY September 25

09:00
9. DEEP-OCEAN MINING SYSTEMS & TECHNOLOGY I: Mining System

10:30
10. DEEP-OCEAN MINING SYSTEMS & TECHNOLOGY II: Pipe & Lift 1

13:00-14:00
OMS Lunch

14:00
11. DEEP-OCEAN MINING SYSTEMS & TECHNOLOGY III: Pipe & Lift 2

15:20
12. DEEP-OCEAN MINING SYSTEMS & TECHNOLOGY V: Miner 1

17:20
13. DEEP-OCEAN MINING SYSTEMS & TECHNOLOGY V: Miner 2

18:00
14. Closing Session

Co-sponsored by:
International Society of Offshore and Polar Engineers (ISOPE)
Interoceanmetal Joint Organization (IOM)

Co-operated by:
International Society of Offshore and Polar Engineers (ISOPE)
U.S. National Science Foundation (NSF)
Mining and Materials Processing Institute of Japan (MMJ)
Korea Association for Deep Ocean Minerals Development (KADOM)
Korea Society of Ocean Engineers (KSOE, formerly KCORE)
National Institute of Ocean Technology (NIOT)
National Institute of Oceanography (NI, India)
Interoceanmetal Joint Organization (IOM, Poland)
Japan Society of Naval Architects and Ocean Engineers (JSNAOE)
China Ocean Mineral Resources R&D Association (COMRA)

Supported by:
IOM
ISOPE

Local Secretariat:
Dr. Jozef Franzen, Interoceanmetal Joint Organization, Szczecin, Poland

Technical Executive Committee:
Prof. Jin S. Chung, ISOPE, Cupertino, California, USA
Dr. T Abramowski, IOM, Szczecin, Poland
Dr. Takeshi Komai, Tohoku University, Sendai, Japan

International Organizing Committee
Prof. Jin S. Chung (Chairman), ISOPE, Cupertino, California, USA
Dr. T Abramowski (Co-chairman), IOM, Szczecin, Poland
Dr. M.A. Atmanand, National Institute of Ocean Technology, Chennai, India
Dr. Sup Hong, Korea Research Institute of Ship and Ocean Engineering, Daejeon, Korea
Dr. Takeshi Komai, Tohoku University, Sendai, Japan
Plan to Attend Coming ISOPE Meetings

24th ISOPE–2014 Busan Conference, Korea
at BEXCO, Busan, June 15–20, 2014

Ocean and Arctic
including
Ocean Mining, Gas Hydrates, Shale Gas, Clean Coal and Clean Energy

Abstract Deadline: October 12, 2013

For Call For Papers, visit www.isope.org and submit online or Email an abstract to meetings@isope.org

11th PACOMS-2014 Shanghai Symposium
Shanghai Jiao Tong University, China
October 12-16, 2014
www.isope.org >PACOMS-2014 Shanghai

25th ISOPE-2015 Kona Conference, Hawaii, USA
Big Island, Hawaii, USA, June 21-26, 2015
www.isope.org or www.isope2015.org

Submit abstracts online or to meetings@isope.org

International Society of Offshore and Polar Engineers (ISOPE)
P.O. Box 189
Cupertino, California 95015-0189, USA
info@isope.org; www.isope.org
ISOPE OMS-2013 Szczecin
Radisson Blu Hotel, Szczecin, Poland
September 22–26, 2013

TECHNICAL PROGRAM

All sessions will be held in Copernicus 2, 11th Floor.

MONDAY 09:00

1. OPENING SESSION

Chair: T Abramowski, Interoceanmetal Joining Organization (IOM), Szczecin, Poland
Co-Chair: T Komai, Tohoku University, Sendai, Japan

Welcome to Interoceanmetal and Szczecin
Tomasz Abramowski, Co-chair, ISOPE OMS-2013 Symposium, Interoceanmetal Joining Organization, Szczecin, Poland

Symposium Opening Address
Jin S Chung, Chair, ISOPE OMS-2013 Symposium, ISOPE, Cupertino, California, USA

Commercial Mining System Development for Manganese Nodules: Take Direct-to- or Incremental-to-5,000-m Approach? (Invited)
Jin S Chung, ISOPE, Cupertino, California, USA

Tailings and their Disposal in Deep-Sea Mining (Invited)
Gerd Schriever, Hjalmar Thiel, BIOLAB Forschungsinstitut, Germany

Baselines Data Support for Developing of Environmentally Sound Nodule Mining Systems
Valcana Stoyanova, Interoceanmetal Joint Organization, Poland

2. EXPLORATION & ENVIRONMENT 1

Chair: R Kotlinski, Szczecin University, Poland
Co-Chair: Thomas Kuhn, Federal Institute for Geosciences and Natural Resources (BGR), Germany

Cook Islands Nodules Revisited: An Updated Resource Assessment [Oral Presentation]
David S. Cronan, Imperial College, UK

Seamount and Cobalt-Platinum rich Fe-Mn Crust Resources in the Indian Ocean
G S Roonwal, AMS Group, Inter Univ. Accelerator Center, India

Variability and Accuracy of Polymetallic Nodules Abundance Estimations in the IOM Area – Statistical and Geostatistical Approach
Jacek Mucha, Monika Wasilewska-Blaszczyk, AGH Univ of Science and Tech; Ryszard Andrzej Kotliński, Łukasz Maciąg, Univ of Szczecin, Poland

Application of Hydro-Acoustic and Video Data for the Exploration of Manganese Nodule Fields [Oral Presentation]
Thomas Kuhn, Carsten Rühlemann, Michael Wiediecke-Hombach, Federal Institute for Geosciences and Natural Resources (BGR); Timm Schöning(2), Tim Nattkemper, Bielefeld University, Germany
Exploration of Polymetallic Nodule Using AUV in the Central Equatorial Pacific
Masatsugu Okazaki, Akira Tsune, Deep Ocean Resources Development, Japan

3. EXPLORATION & ENVIRONMENT 2
Monday 14:00  Copernicus 2
Chair: David S. Cronan, Imperial College, UK
Co-Chair: Masatsugu Okazaki, Deep Ocean Resources Development, Japan

Deep Sea Exploration and Exploitation of Minerals in PNG – An Update [Oral Presentation]
Mohan Singh, Mineral Resources Authority, Papua New Guinea

Geochemistry of Molybdenum Element in Co-rich Crusts from the Magellan Seamounts and Tracing of Paleoceanographic Environment
Guoqing You, Jiahua Pan, Wenhong Sun, Shuqin Liu, Chinese Academy of Geological Sciences, China

Grain Size of the Seabed Sediments Underlying Polymetallic Nodules in the Exploration Area of Interoceanmetal
Ivo Dreiseitl, Interoceanmetal Joint Organization; Roman Bednarek, Cyprian Seul, West Pomeranian Univ of Tech, Poland

The Contouring Accuracy of Polymetallic Nodules Ore Fields in the Interoceanmetal (IOM) Area, East Pacific Ocean
Jacek Mucha, Monika Wasilewska-Blaszczuk, AGH Univ of Science and Tech, Poland

4. GAS HYDRATES I: Fundamentals
Monday 15:30  Copernicus 2
Chair: Werner F. Kuhs, Universität Göttingen, Germany
Co-Chair: Zhengquan Lu, Chinese Academy of Geological Sciences; China

Influence of Cation for Cage Occupancy from Small Cage Competition with Methane at Natural Gas Hydrates in Real sediments
Juwoon Park, KAIST; Sun-Hwa Yeon, Korea Inst of Energy Research; Jiwoong Seol, Dong-Yeun Koh, KAIST; Young-ju Seo, Keun-Pil Park, Dae-Gee Huh, Jaehyoung Lee, KIGAM; Huen Lee, KAIST; Korea

Axial Symmetrical Thermal Conduction and Phase Transformations in THF Hydrate-Bearing Sediments
Xu Hui Zhang, Xiao Bing Lu, Chinese Academy of Sciences; Shi Yao Hong, Xia Zhen, Guangzhou Marine Geological Survey, China

Origin of Gases from Gas Hydrate in the Qilian Mountain Permafrost, Qinghai: Comparison of Gas Composition and Carbon Isotopes
Zhengquan Lu, Xiaohua Xue, Chinese Academy of Geological Sciences; Zewen Liao, Chinese Academy of Sciences; Hui Liu, China Geological Survey, China

Spectroscopic Explanation of Metastability in Gas Hydrate Formation
Dongwook Lim, Woongchul Shin, Seongmin Park, Hyeyoon Ro, Dong-Yeun Koh, Jiwoong Seol, KAIST; Se-Joon Kim, Jaehyoung Lee, KIGAM; Huen Lee, KAIST, Korea

18:00 – 21.00
Banquet Dinner  Hall Vivaldi’s, Ground Fl

TUESDAY 09:00

5. GAS HYDRATES II: Properties 1
Tuesday 09:00  Copernicus 2
Chair: Takeshi Komai, Tohoku Univ, Japan
Co-Chair:
Development of Ring Shear Apparatus with Permeability Measurement System for Hydrate Bearing Sediments
Hideki Minagawa, Hiroaki Kaneko, Sho Kimura, Takuma Ito, Hideo Narita, National Inst of Advanced Industrial Science and Tech, Japan

Basic Study on the Permeability of Sand during Direct Shear Test
Masayo Kakumoto, Jun Yoneda, Jun Katagiri, Kuniyuki Miyazaki, Norio Tenma, Kazuo Aoki, National Institute of Advance Industrial Science and Technology (AIST), Japan

Geotechnical Properties of Soil Samples Recovered from Eastern Nankai Trough Offshore Japan
Shin’ya Nishio, Eiji Ogisako, Atsushi Denda, Shimizu Corp; Hiroyuki Tanaka, Hokkaido Univ; Hiroyuki Hirakawa, Oyo Corp, Japan

Geochemical Characteristics of the Soil above Muli Gas Hydrate Reservoir
Zhongjun Sun, Mingcai Xu, Zhibin Yang, Aihua Qin, Chinese Academy of Geological Sciences, China

An Experimental Study of Natural Gas Hydrate in Permafrost by the Electromagnetic Method
Meixing He, Hui Fang, Qing Zhong, Chinese Academy of Geological Sciences; Yao Zhang, Guangzhou Marine Geological Survey; Yongzhen Yuan, Genggeng Qu, Chinese Academy of Geological Sciences; Yixin Ye, East China Inst of Tech, China

6. GAS HYDRATES III: Properties 2
Tuesday 10:30 Copernicus 2
Chair: Hideki Minagawa, National Inst of Advanced Industrial Science and Tech, Japan
Co-Chair: Taewoong Ahn, Korea Inst of Geoscience and Mineral Resources, Korea

Using Alcohol Vapor as Catalyst for Synthesizing Methane Hydrate
Po-Chun Chen, MOEA; Wuu-Liang Huang, National Taiwan Univ; San-Hsiung Chung, MOEA; Li-Jen Chen, National Taiwan Univ, Taiwan, China

Gas replacement in clathrate hydrates during CO2 injection – kinetics and micro-structural mechanism
Andrzej Falenty, M. Mangir Murshed, Universität Göttingen, Germany; Andrey N. Salamatin, Kazan State Univ, Russia; Werner F. Kuhs, Universität Göttingen, Germany

Quantitative Raman Scattering of Guest Molecules in Gas Hydrates and Its Relevance to Gas Exchange Processes Involving N2
Junfeng Qin, Werner F. Kuhs, Universität Göttingen, Germany

Validation of Seismic Methods to Detect Natural Gas Hydrates in Permafrost
Mingcai Xu, Zhongjun Sun, Jianxun Liu, Baowei Zhang, Xiaojiang Wang, Guangke Wang, Chinese Academy of Geological Sciences, China

Triaxial Behaviour of Mathance Hydrate Bearing Sand
Masayuki Hyodo, Shintaro Kajiyama, Norimasa Yoshimoto, Yukio Nakata, Yamaguchi Univ, Japan

7. GAS HYDRATES IV: Development
Tuesday 14:00 Copernicus 2
Chair: Huen Lee, KAIST, Korea
Co-Chair: Ganpat S.Roonwal, AMS Group, Inter Univ. Accelerator Center, India

Monitoring System for Seafloor Deformation during Methane Hydrate Production Test
Tatsuya Yokoyama, Mio Shimoyama, Shinji Matsuda, Koichi Tago, Junya Takeshima, OYO Corp, Japan

Research on Marine Gas Hydrate Drilling Sampler of China
Hong Ren, Laiju Han, Junliang Xu, Zhonghua Wu, Sinopec, China

Development of Large Scale Production System for Methane Hydrates
8. MINERAL PROCESSING

Tuesday 16:30 Copernicus 2
Chair: Yanqing Fan, Beijing General Research Inst. of Mining and Metallurgy, China
Co-Chair: Kyoun Ho Park KIGAM,

Recovery of Total Rare Earth Metal from The Deep Sea Nodule Leach Liquor by Solvent Extraction Process
Chul Woo Nam, Pankaj Ku Parhi, Kyung Ho Park, Smruti Pra Barik, Jean Tae Park, Korea Inst of Geosciences & Mineral Resources, Korea

Leaching of Rare Earth Metals from Deepsea Nodule by Dilute Sulfuric Acid Solution
Kyung Ho Park, Pankaj Ku Parhi, Chul Woo Nam, Smruti Pra Barik, Jean Tae Park, Korea Inst of Geosciences & Mineral Resources, Korea

Study on Self-Catalysis Reduction Leaching of Ocean Co-Mn Polymetallic Ores in Ammonia Solution
Kaixi Jiang, Xunxiong Jiang, Linyong Feng, Wei Jiang, Shengdong Wang, Lei Zhao, Yanqing Fan, Beijing General Research Inst of Mining & Metallurgy, China

Optimization of the Existing Methods for Recovery of Basic Metals from Polymetallic Nodules
M. Pelegrin Rodriguez, CEDINIQ; Ruben Aja, CIPIMM, Cuba; R. Causse Miyaes, Interocceanmetal Joint Organization, Poland

Copper, Nickel and Cobalt Extraction from FeCuNiCoMn Alloy Obtained after Pyrometallurgical Processing of Deep Sea Nodules
Vladislava Przebinda Stefanova, Peter Kostadinov Iliev, Boris Stoilov Stefanov, Univ of Chemical Tech and Metallurgy, Bulgaria

Study on the Ammonia-Nitrogen Wastewater Treatment by Ocean Manganese Nodules
Denggao Zhang, Yanqing Fan, Rengjian Wang, Xunxiong Jiang, Beijing General Research Inst of Mining & Metallurgy, China

9. DEEP-OCEAN MINING SYSTEMS & TECHNOLOGY I: Mining System

Wednesday 09:00 Copernicus 2
Chair: Tomasz Abramowski, Interocceanmetal Joint Organization; Poland
Co-Chair: M Singh, Mineral Resources Authority, Papua New Guinea

In-Situ Soil testing in the Central Indian Ocean Basin at 5462-m Water Depth

Preliminary Design Considerations for a Ship to Mine Polymetallic Nodules in the Clarion-Clipperton Zone

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Jiro Nagao, Yoshihiro Konno, National Inst of Advanced Science and Tech, Japan

Experimental Investigation on Controlling the Depressurization-Induced Production Behavior from Hydrate-Bearing Sediments in 10-Meter-Scale
Taewoong Ahn, Jaehyoung Lee, Joo Yong Lee, Se Joon Kim, Korea Inst of Geoscience and Mineral Resources, Korea

Laboratory Test to Evaluate the Performance of Sand Control Screens during Hydrate Dissociation Process by Depressurization
Jaehyoung Lee, Taewoong Ahn, Joo Yong Lee, Se Joon Kim, Korea Inst of Geoscience and Mineral Resources, Korea

The Lab-Scale Evaluation of Geomechanical Safety during the Production from Marine Gas Hydrate Deposits
Joo Yong Lee, Jaehyung Lee, Se Joon Kim, Taewoong Ahn, Korea Inst of Geoscience and Mineral Resources, Korea
Tomasz Abramowski, Interoceanmetal Joint Organization; Tomasz Cepowski, Maritime Academy of Szczecin, Poland

Suspension Principle of Deep-Sea Miner and Drag Tests
Hao Zheng, Qiong Hu, Ning Yang, Yangrui Chen, Bing Yang, Changsha Research Inst of Mining and Metallurgy, China

A Study on Dynamic Behaviors of Pilot Mining Robot According to Extremely Cohesive Soft Soil Properties
Chang-Ho Lee, Hyung-Woo Kim, Sup Hong, MOERI/KIOST, Korea

Design Analysis of a Deep-sea Manganese Nodule Mining System using Axiomatic Design [Oral Presentation]
Minuk Lee, Sup Hong, Jong-Su Choi, Hyung-Woo Kim, Tae-Kyeong Yeu, KIOST; Su-gil Cho, Tae Hee Lee, Hanyang Univ, Korea

10. DEEP-OCEAN MINING SYSTEMS & TECHNOLOGY II: Pipe & Nodule Lift I

Wednesday 10:30 Copernicus 2
Chair: Pavel Vlasak, Inst of Hydrodynamics, Czech Republic
Co-Chair: Josef Franzen, IOM, Poland

Conveying of Coarse-Grained Particles in Pipes
Pavel Vlasak, Zdenek Chara, Jiri Konfrst, Inst of Hydrodynamics, Czech Republic; Jerzy Sobota, Wroclaw Univ of Environmental and Life Sciences, Poland; Bohus Kysela, Inst of Hydrodynamics, Czech Republic

Slip Velocities in Mixture Vertical Pipe Flow
Jerzy Sobota, Wroclaw University of Environmental and Life Sciences, Poland; Pavel Vlasak, Institute of Hydrodynamics AS CR, Czech Republic; Leszek Petryka, Marcin Zych, AGH University of Science and Technology, Poland

Consideration of Seafloor Ore Separation by Slurry Flushing for Seafloor Massive Sulfide Mining
T. Yamazaki, Y. Yamamoto, R. Arai, N. Nakatani, Osaka Prefecture Univ, Japan

Application of the Cross-Correlation Method to Determine Solid and Liquid Velocities during Flow in a Vertical Pipeline
Leszek Petryka, Marcin Zych, AGH Univ of Science & Tech; Robert Hanus, Rzeszow Univ of Tech; Jerzy Sobota, Wroclaw Univ of Environmental and Life Sciences, Poland; Pavel Vlasak, Inst of Hydrodynamics, Czech Republic

11. DEEP-OCEAN MINING SYSTEMS & TECHNOLOGY III: Pipe & Nodule Lift II

Wednesday 14:00 Copernicus 2
Chair: Jerzy Sobota, Wroclaw Univ. of Environmental and Life Science, Poland
Co-Chair: Qingjue Han, Central South Univ, China

Identification of Vertical Deep-Ocean Pipe End-Point Position
Peter Hubinský, Jozef Rodina, Jaroslav Hanzel, Boris Rudolf, Slovak Univ of Tech, Slovakia

Computer simulations of the water flow around the ocean mining pipe
Tomasz Abramowski, Interoceanmetal Joint Organization; Tadeusz Szelańciewicz, Katarzyna Zelazny, West Pomeranian Univ of Tech, Poland

Structural Health Monitoring for Top-tensioned Riser with Response Data of Damaged Model
Cheon-Hong Min, Sup Hong, Hyung-Woo Kim, Jong-Su Choi, Tae-Kyeong Yeu, MOERI/KIOST, Korea

Experimental and Computational Investigation of Turbulent Pulsatile Flow through a Flexible Hose
12. DEEP-OCEAN MINING SYSTEMS & TECHNOLOGY IV: Miner1

Wednesday 15:20 Copernicus 2

Chair: Valcana Stoyanova, Interocceanmetal Joint Organization, Poland
Co-Chair: Enno Schulte, Germany

Multi-objective Design Optimization for Manganese Nodule Pilot Miner Considering Collecting Performance and Maneuver of Vehicle
Su-gil Cho, Sanghyun Park, Sung Sik Choi, Tae Hee Lee, Hanyang Univ; Minuk Lee, Jong-Su Choi, Hyung Woo Kim, Chang-Ho Lee, Sup Hong, Korea Inst of Ocean Science and Tech, Korea

Performance Tests of a Manganese Nodule Crusher
Cheon-Hong Min, Sup Hong, Hyung-Woo Kim, Chang-Ho Lee, Min-Uk Lee, Jong-Su Choi, Tae-Kyeong Yeu, Ki-Young Sung, MOERI/KIOST, Korea

Operating System of KIOST Pilot Mining Robot in Inshore Test
Tae-Kyeong Yeu, Suk-Min Yoon, Sup Hong, Jin-Ho Kim, Hyung-Woo Kim, Jong-Su Choi, Cheon-Hong Min, Korea Inst of Ocean Science and Tech, Korea

Electric-Electronic System of Pilot Mining Robot, MineRo-II
Jin-Ho Kim, Tae-Kyeong Yeu, Suk-Min Yoon, Hyung-Woo Kim, Jong-Su Choi, Cheon-Hong Min, Sup Hong, Korea Institute of Ocean Science and Technology (KIOST), Korea

A Study on Dynamic Behaviors of Pilot Mining Robot According to Extremely Cohesive Soft Soil Properties
Chang-Ho Lee, Hyung-Woo Kim, Sup Hong, MOERI/KIOST, Korea

13. DEEP-OCEAN MINING SYSTEMS & TECHNOLOGY V: Miner2

Wednesday 17:20 Copernicus 2

Chair: S Hong, Korea Institute of Ocean Science and Technology (KIOST), Korea
Co-Chair: N R Ramesh, National Inst of Ocean Tech, India

A New Path Tracking Control Algorithm of Deepsea Tracked Miner
Qingjue Han, Shaojun Liu, Central South Univ, China

Dynamic Analysis of a Tracked Vehicle Based on a Subsystem Synthesis Method
Hyung-Woo Kim, Chang-Ho Lee, Sup Hong, KIOST; Jae-Won Oh, Hanyang Univ; Cheon-Hong Min, Tae-Kyeong Yeu, Jongsu Choi, KIOST, Korea

Study on Geometric Path Tracking Algorithm for Tracked Vehicle Model
Suk-Min Yoon, Tae-Kyeong Yeu, Sup Hong, Hyung-Woo Kim, Jong-Su Choi, Cheon-Hong Min, Korea Inst of Ocean Science and Tech; Sang-Bong Kim, Pukyong National Univ, Korea

14. CLOSING SESSION

Wednesday 18:00 Copernicus 2, FL 11

Chair: Jin S Chung, ISOPE, USA
Co-Chair: Takeshi Komai, Tohoku Univ, Japan
PLACE AND DATE:
Radisson Blu hotel, Szczecin, Poland
September 22-26, 2013

All sessions of ISOPE OMS-2013 symposium will take place at:

Radisson Blu Hotel
Plac Rodla 10, PL
70-419 Szczecin, Poland
Phone: +48-91-3595595

HOW TO REACH SZCZECIN? Click Google for flights, transportation, and tours

1. Flights to International Airport Szczecin (Poland) via International Airport Warszawa (Poland), or

2. Flights to Berlin-Tegel or Berlin-Schoenefeld (Germany).

For the participants arriving on September 22, Sunday at Berlin airports above, a special shuttle is being organized:
Contact j.franzen@iom.gov.pl

Otherwise:
From Berlin-Tegel Airport or Berlin-Schoenefeld Airport to Szczecin we recommend a shuttle.

For more information see: http://www.berlinia.net/en/ or: www.http://interglobus.pl/. Get off from a shuttle at Szczecin-Glawny (Main Railway Station) and take a taxi from Main Railway Station to Radisson Blu hotel (5 – 10 min., cca 3 USD,

From Airport Szczecin to hotel a shuttle, see http: www.berlinia.net/en/ or http://www.interglobus.pl/.

3. Ryanair operates daily flights between Szczecin and London (Stansted), Two flights per week between Szczecin and both Trondheim and Oslo.

ACCOMMODATIONS: SYMPOSIUM VENUE
Download hotel reservation form www.isope.org > Deep Ocean Mining
Radisson Blu Hotel,
Plac Rodla 10, PL 70-419 Szczecin, Poland
Phone: +48-91-3595595 Fax: +48-91-3594594
E-mail:reservations.szczecin@radissonblu.com or contact local secretariat j.franzen@iom.gov.pl

ACCESS TO Radisson Blu Hotel
Take a taxi from train station or bus station to the hotel (5-10 min., cca 10 PLN = 3 USD. Taxi can take credit card.

PARKING
Hotel parking is free for guests.

LANGUAGE
The language for the symposium is English. No translation service will be arranged.
CURRENCY EXCHANGE
Currency can be exchanged either at the banks or hotel for the most favorable rates. Exchange rate as of June, 2013 is: 1 USD = 3.1 PLN.

HOTEL ACCOMMODATION:
To get the OMS-2013 discount room rate, use the Reservation Form in this program or posted on www.isope.org >Hotel >Ocean Mining. Write ISOPE OMS-2013 on Email Subject line. Only a limited number of rooms at ISOPE OMS-2013 rates are available. Guaranteed reservation must be received by August 15.

Electric Voltage: The electrical power supply voltage is 220 V, 50 Hz, for each room of the Hotel. Adaptor to European 3-prong electric outlet may be needed.

CITY TRANSPORTATION
City bus service and taxi service are also available.

ADVANCE SYMPOSIUM REGISTRATION BY EMAIL OR FAX
(use the Registration Form)
All persons from outside Poland attending the symposium are required to register, pay the appropriate fee, and get a symposium badge. Remember to send via Airmail or Fax the Advance Registration (and Invoice) Form in this Program or a copy to reach isope-5@isope.org before August 20.

Polish participants: Ask for another form from Local Secretariat oms@iom.gov.pl.

Deadline: May 21 for one author per paper, and August 20 for non-authors from outside Poland.

ISOPE OMS-2013 Secretariat, 1674 North Shoreline Blvd, Suite 146, Mountain View, California 94043, USA: isope-5@isope.org.

In case one charges to a credit card via EMAIL or FAX, the card number should be typed in bold face or written clearly to be readable in the transmitted fax copy.

Use the Advance Registration Form [download from www.isope.org >deep ocean mining to reach isope-5@isope.org. Registration fees (note: US$100 surcharge after September 1 for on-site registration) are as follows:

<table>
<thead>
<tr>
<th>Category</th>
<th>Fee (US $)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Author, Co-authors</td>
<td>450</td>
</tr>
<tr>
<td>Session or Symposium Chair, Co-Chair</td>
<td>450</td>
</tr>
<tr>
<td>ISOPE Member</td>
<td>450</td>
</tr>
<tr>
<td>ISOPE member with new application (incl. 2009 membership fee and 1-year journal issues)</td>
<td>540</td>
</tr>
<tr>
<td>Non-Member</td>
<td>540</td>
</tr>
<tr>
<td>Spouses (no proceedings, incl. lunch)</td>
<td>100</td>
</tr>
<tr>
<td>Full-time Student with 2005 student ID Card</td>
<td>350</td>
</tr>
<tr>
<td>OMS Banquet</td>
<td>Free</td>
</tr>
<tr>
<td>Symposium Tour: pending</td>
<td></td>
</tr>
</tbody>
</table>

TOTAL AMOUNT DUE
* The registration fee includes a symposium proceeding CD-ROM, NIOT Reception, OMS Banquet, lunches, Dinners and coffee/tea breaks.
** One author per paper is required to advance-register.

REGISTRATION CANCELLATIONS
Request for cancellation of registration must be received in writing by September 05, 2013 to be granted a refund minus US$50 processing charge. No refunds for the author whose paper is already included in the proceedings.

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

ON-SITE SYMPOSIUM REGISTRATION
Participants who miss the advance registration may register at the Symposium Registration Desk, but there is a US$100 surcharge. The registration desk will be open from 08:30-16:00 hrs.

ISOPE PUBLICATION ORDER
The ISOPE OMS-2013 Symposium Proceedings (ISBN 978-1-880653-92-0) are included in the symposium registration fees: CD-ROM. The proceedings volumes (300 pp. est.) can be ordered by mail at the rates of:

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

All ISOPE PUBLICATIONS (listed on www.isope.org) can be ordered from ISOPE, 1674 North Shoreline Blvd, Suite 146, Mountain View, California 94043, USA: Fax 1-650-254-2038. 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 (surface-mail) and handling charges are included (also see the ISOPE Publication Order Information).

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Proceedings:
Annual ISOPE Conference (1991-present)
ISOPE Ocean Mining and Gas Hydrates Symposium (1995-present)
ISOPE Pacific Asia Offshore Mechanics Symposium (1990-present)
ISOPE European Offshore Mechanics Symposium (1990, 1999)

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Individual papers in PDF file can be emailed upon payment by credit card: Use the order form providing the paper title, first author’s name and publication year.

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PRESS - The press is invited to register at:

Registration Desk,
Corridor, Floor 11

SYMPOSIUM HEADQUARTERS
Registration Desk,
Corridor, Floor 11
SYMPOSIUM BANQUET
September 23, 18:30–20:30
Hall Vivaldi’s, Ground Floor

LCD Projector Test Room
Session Room
LCD projector, PC and screen (and an overhead projector,) will be set up in the session room. For any other specific requirements, the participants should contact:
Dr. Jozef Franzen, OMS-2013 Local Secretariat
E-mail: j.franzen@iom.gov.pl; Fax: +48-91-4256813, Tel.: +48-91-4256813

INTERNATIONAL PARTICIPANTS AND VISA APPLICATION
International authors, participants or attendees who need help (except financial), especially invitation, can contact: Dr. Jozef Franzen, OMS-2013 Local Secretariat.

Entry Visa: Participants from a few countries may be required to apply for an entry visa. Please get an application form at the Consulate of Poland in your country.

ABOUT SZCZECIN
Szczecin, is the capital city of the West Pomeranian Voivodeship in Poland. In the vicinity of the Baltic Sea, it is the country's seventh-largest city and a major seaport in Poland.

City tourist bureaus: cit.szczecin@wp.pl; cikit@zamek.szczecin.pl; www.zamek.szczecin.pl/tourism; cit@mosrir.szczecin.pl;
Page: szczecin.eu – select a language on a front page right above (Polish, English, German)

CLIMATE AND CLOTHES
Weather in Szczecin during September is moderate: 10–24°C. A moderate rain is possible, an umbrella probably not necessary.

For further more Information: cit.szczecin@wp.pl; cikit@zamek.szczecin.pl.

HOTEL RESERVATION FORM (download the form)
Download the form from www.isope.org > deep ocean mining on menu page, or ask from isope-5@isope.org.
Prospective authors are invited to submit abstract to:

**ISOPE–2014 Busan, Korea**

*Ocean and Arctic*


The 24th (2014) International Ocean and Polar Engineering Conference
Busan, Korea, June 15–20, 2014

**First Call For Papers**

**Abstract Deadline** October 20, 2013
**Manuscript (for review) Deadline** January 15, 2014

The International Society of Offshore and Polar Engineers (ISOPE) is organizing about 100 sessions of refereed papers including special sessions of timely topics in cooperation with international technical program committee (TPC) members and cooperating organizations. Delegates from more than 50 countries are expected. All manuscripts will be peer-reviewed prior to the final acceptance. The conference proceedings will be available at the conference. Papers of archival value may be further reviewed for possible publication in the *International Journal of Offshore and Polar Engineering*.

**Main fields of interest are:**

- Frontier/Clean Energy
- Offshore Technology
- Arctic Sci & Tech
- Underwater Systems
- Subsea & Install
- Risers/Pipelines/Cable
- Gas Hydrates, Deep Ocean Resources
- Geotech&Envir Eng
- Hydrodynamics
- LNG Shaloshing
- CFD, NWT & Code
- VIV and Design
- Tsunami, MetOcean
- FPSO, FSRU, SPAR
- LNG, Ship Tech
- Nonlinear Waves
- Coastal Engineering
- Control, Simulation
- Remote Sensing
- Structures
- Environ & Modeling
- High Perform. Mats
- Strain-Based Design
- Nanotechnology
- Materials & Welding
- Arctic Materials
- Manganese Steel
- Asset Integrity
- Earthquake Engineering
- Safety, Risk, Reliability
- Tubular & Linepipe
- Robotic Fish, AUV, ROV
- Emerging Topics

The abstract should stress the originality and the significance of the results, and include the complete names, postal and e-mail addresses and fax numbers of all authors.

**Send (E-mail, online) your abstract in 300–400 words to:**

2. One of the TPC members (session organizers).
3. ISOPE-2014 TPC, ISOPE, 495 North Whisman Road, Suite 300, Mountain View, California 94043-5711, USA:
   - Fax: +1-650-254-2038; meetings@isope.org.

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