REPORT

PETRAD – CCOP – PETROVIETNAM - VASI

Workshop
on
GAS HYDRATES

1-3 March 2011

Halong Pearl Hotel,

Halong Bay, Vietnam

CONTENTS

Page

INTRODUCTION

The seminar will discuss gas hydrates, understanding on how they are formed, where and how they can be located, and what are the benefits and impacts in exploiting gas hydrates. The challenges for identifying and exploitation of gas hydrates would also be discussed as well as future capacity building activities in CCOP related to gas hydrates. Experts from US, Russia, India and from the CCOP Member Countries are invited as speakers and resource persons for the seminar.

The request for the seminar was jointly made by Dr. Sc. Phung DinhThuc, President and CEO of PetroVietnam, Permanent Representative of Vietnam to CCOP, and Ass. Prof. Dr. Sc. Nguyen Van Cu, Director-General of VASI. The main objective is to conduct a seminar that will enhance the understanding of the CCOP Member Countries about gas hydrates and its potential as an energy resource.
The seminar will focus on:-

1. Overview of Gas hydrate exploration results in the world and the region.
2. Gas hydrate research program in some CCOP member countries: lessons learned.
3. Gas hydrate indicators.
4. How the geographical and geological conditions affect the conservation or destruction of accumulated Gas hydrate, illustrative examples.
5. The role of stratigraphy and geological structure to the distribution of Gas hydrate zone, illustrative examples.
6. Gas hydrate exploration tools, methods and technologies; reserves/potential assessment methodology of Gas hydrate.
7. Exploration drilling for Gas hydrate, coring program and monitoring/ and core analyses, Logging program and Logging interpretation.
8. Gas hydrate production methods and technologies.
9. What is needed for a special laboratory for Gas hydrate studies (Lab equipments: Physical properties, sedimentology, PVT…).
10. Environment Impacts and Policies.
11. Experiences in development in human resources for Gas hydrate exploration.
12. Success stories and lessons learned.

Summary Report

Project number: 200485	**Title of workshop:** Workshop on Gas Hydrates	**Date:** 1-3 March 2011
Total number of participants: 45	**From which countries:** Vietnam, Malaysia, Korea and CCOP T/S	**Number of female participants:** 7
Venue: Halong Pearl Hotel, Halong Bay, Vietnam		
Organisers: PETROVIETNAM, Vietnam Administration of Sea and Islands (VASI), PETRAD, and CCOP Technical Secretariat	**Sponsors:** Cost Sharing by PETROVIETNAM, VASI and PETRAD	
Involvement of Norwegian institutions (Embassies, Innovation Norway, Intsok etc.): University of Bergen, Norway		

Goal achievement:

The workshop was requested by PETROVIETNAM with cost sharing by PETROVIETNAM, VASI, and Norwegian Government through PETRAD, in cooperation and co-organized by CCOP Technical Secretariat. The Official Welcome and Opening Ceremony Address was given by ***Associate Prof. Dr. Sc. Nguyen Van Cu***, Director-General of VASI, ***Dr. Nguyen Van Minh***, Deputy Permanent Representative of Vietnam to CCOP, Vice President of PETROVIETNAM, ***Dr. Øystein Berg***, Managing Director, PETRAD, and ***Prof. Dr. He Qingcheng***, Director, CCOP Technical Secretariat.

The Welcome Speeches from the Distinguished Guests focused on the long and close cooperation between Vietnam, PETRAD-Norway, and CCOP and ASCOPE members. The sharing of knowledge and technology on Gas Hydrates Research Project in different countries was the core of discussions, exchange experiences as well as establishing net working amongst researchers and scientists. The Key Note Address on Overview Research and Investigation of Gas Hydrate Potential in Vietnam was presented by ***Dr. Vu Truong Son***, Director of Marine Geological and Mineral Center (MGMC),VASI with focus on the prospect on Gas Hydrates in the sea of Vietnam, research and investigation on gas hydrate potential.

The Workshop was held at Halong Pearl Hotel, Halong Bay, Vietnam from 1-3 March 2011, with a total of 45 participants. There were 9 Guest Speakers from different countries such as University of Bergen from Norway, Naval Research Laboratory from USA, Chinese Academy of Science from China, Institute for Geo-Resource & Environment, ASIT/GSJ from Japan, Gas Hydrate Department, KIGAM from Korea, Pacific Oceanological Institute Far Eastern Branch of Russian Academy of Sciences from Russia, Hydrocarbons Section of GNS Science from New Zealand, and National Gas Hydrate Programme (NGHP), Directorate General of Hydrocarbons under Ministry of Petroleum & Natural Gas from India.

Through the workshop on Gas Hydrates, participants had the opportunity to share their research experiences with the Guest Speakers. The overview of presentations which provided the predicted methane hydrate deposits in different coastal regions and the advantages of combining different parameters in the evaluation, and also provided an overview of the benefits and issues with the interpretation of deep sediment hydrate deposits by using different approaches for the fields survey.

The research on continental margins and permafrost areas were also presented, the energy trapped in gas hydrates rivals that in all known conventional petroleum and coal fields, and could provide energy power to many parts of the world where conventional petroleum is nonexistent or has been consumed. The offshore hydrate production is today focus of geophysical surveys and drilling operation in India, Japan, Korea, and China and the east coast of USA. The Gas Hydrate Research Development Programme and Exploration was presented and overviewed by Japan, China, Korea, New Zealand and India. The Gas Hydrate indicator and outcomes in Okhotsk Sea, and Extract Methane from Gas Hydrate areas in the sea was presented and emphasized by Russia. The Analysing Sand-Dominated Channel system for Potential Gas Hydrate Reservoir using an AVO Seismic Inversion Technique on the Southern Hikurangi Margin in New Zealand was also presented and sharing experiences.

The last part of the workshop was the Certificate Ceremony presented by Dr. Øystein Berg, Managing Director, PETRAD to representative from each country organizations, and followed by the Words of Appreciation to all Guest Speakers, Organizing Committee and Host Country, Vietnam for the wide range in potential sharing and integration of research plans through the workshop and it will establishing fruitful relationships within CCOP countries as basis for collaborations in further developments in this area of unconventional energy source which receives increasing interest worldwide. The Official Closing Remark was delivered by Dr. Nguyen Van Minh, Deputy Permanent Representative of Vietnam to CCOP, Vice President, PETROVIETNAM. Dr. Minh took this opportunity to express deep appreciation and sincere thanks to PETRAD, Norway to bring Guest speakers to this Workshop, and also congratulated to Dr. Øystein Berg for having developed very comprehensive and fruitful workshop contents.

Comments:

-basic understanding about GH as a new energy for future, very good international overview
-exchange of knowledge and understand more and clear detailed of GH
-understand the basic knowledge of GH and current program of other countries
-the most important, the biggest value of the workshop was net working, meeting scientists & representatives of GH from all over the world
-obtained knowledge is useful and applicable
-a cooperative in future development project on GH between CCOP members and cooperating countries is helpful for capacity building of GH in CCOP and ASCOPE members
-improve capacity in researching and investigation of GH
-very good status of GH programs/research in countries present
-to know the future energy in the hungry status of the energy demand in the world, that's good for the long term infrastructure of big energy supply
-good to understand current GH programs initiated by India, Japan, Korea, China and other
-preparing to apply a national program on GH in Vietnam
-a tailor made workshop should be introduced to local participants who are in a very first step of GH study &research survey

-detailed procedure for GH survey & exploration that can be applicable in Vietnam in the future
-there are a lot of information about GH for a hundred of Vietnam scientists at least
-this kind of workshop will useful for many researcher, scientists and students in many research institutes and universities

Future work:

Suggestions of topics to other PETRAD tailor-made seminars or Workshops:

-Joint Research and Study in GH: "South China Sea and Methodology to Produce GH in practice"
-Standard/Appropriate Procedures for GH Survey & Exploration
-Environmental Challenges and Impact Related to GH Survey, Exploration, Production Activities
-Carbon Capture Storage (CCS)
-Cost Benefit Analysis is GH Production
-Deepwater Exploration and production / E&P Deepwater Zones
-Method to Extract Methane Hydrates from GH, Technology Exploitation GH
-Training on GH Module
-Training the Human Resources
-Climate Change, Energy Focus, National Security and Local Impact

-VASI is taking the lead in implementing a government on GH, including a sub-project on capacity building for this field. It would be much helpful if PETRAD/CCOP can help to arrange a series of seminars and workshops for different target audiences: management, managers, technicians, and researcher of different levels

-Seminars / Workshops should be followed-up and focused on:-

- Hydrate fundamentals, an easy & important area to establish collaboration on and important in education of staff for concerning generation
- More focus on exploitation and technologies for different types of hydrates including clay hydrates
- Mechanism for creating real collaboration

Supporting Documents:

1) Programme
2) Speaker – Short CV
3) List of Distinguished Guests, Speakers, and Participants
4) Summary Evaluation
5) Pictures from Workshop

PROGRAMME

Tuesday 1 March

12:00 Lunch hosted by PVN

13:00 Registration

14:00 Opening Ceremony of Seminar
Introduction by Mr. Pham Van Huy, Secretary of CCOP Vietnam, Deputy General Manager, Science & Technology Division, Vietnam Oil and Gas Group, PETROVIETNAM

Welcoming Address & Remark:
By Associate Prof. Dr. Sc. Nguyen Van Cu, Director-General, VASI-Vietnam Administration of Seas and Islands
By Dr. Øystein Berg, Managing Director, PETRAD
By Prof. Dr. He Qingcheng, Director, CCOP Technical Secretariat
Official Opening Address:
By: Dr. Nguyen Van Minh, Deputy Permanent Representative of Vietnam to CCOP, Vice President of PETROVIETNAM, Vietnam Oil and Gas Group, PETROVIETNAM

Present Token of Appreciation and Official Group Photo Session

14:30 Overview on the Research and Investigation of Gas Hydrates in Vietnam
Speaker: Dr. Vu Truong Son, Director of Marine Geological and Mineral Center, VASI

15:00 Shallow Sediment Geochemical Surveys of Deep Sediment Methane Hydrate Deposits
Speaker: Dr. Richard B. Coffin, USA

16:00 Coffee/Tea

16:30 Multi-scale nature of hydrate dynamics and implications for hydrate production and geo-mechanical stability
Speaker: Prof. Bjørn Kvamme, Norway

17:15 Gas Hydrate System and Numerical Investigation of Gas Production Strategy in Shenhu Area, South China Sea
Speaker: Dr. Nengyou WU, China

18:00 Close of day

18:30 Welcome Dinner hosted by Petrovietnam

Wednesday 2 March

08:30 Present status of Japanese methane gas hydrate research and development program
Speaker: Dr. Manabu Tanahashi, Japan

09:00 Korea Gas Hydrate R&D Progam
Speaker: Dr. Jong-Hwa Chun (KIGAM)

PROGRAMME

10:00 Coffee/Tea

10:30 Gas Hydrate is Indicator to Search Oil-Gas Deposit in the Okhotsk Sea
Speaker: Professor Anatoly Obzhirov, Russia

11:15 Gas Hydrates in the Sea of Okhotsk 1998-2010: Outcomes of Geological, Geophysical and Ecological Research
Speaker: Dr. Renat Shakirov, Russia

12:00 Lunch hosted by PVN

13:30 Natural Gas Hydrates as an Energy Resource and New Developments in Gas Hydrate Exploration
Speaker: Dr. Miko Fohrmann, New Zealand

14:15 Overview of the Gas Hydrate Exploration Program in India
Speaker: Mr. Malcolm V. Lall, India

15:00 Coffee/Tea

15:30 One of the methods to extract methane from gas hydrate area in the Sea
Speaker: Professor Anatoly Obzhirov, Russia

16:15 Analysing sand-dominated channel systems for potential gas-hydrate-reservoirs using an AVO seismic inversion technique on the Southern Hikurangi Margin, New Zealand
Speaker: Dr. Miko Fohrmann, New Zealand

17:00 Certificate Ceremony
By Dr. Øystein Berg, Managing Director, PETRAD

Closing Remark
By Dr. Nguyen Van Minh, Deputy Permanent Representative of Vietnam to CCOP, Vice President of PETROVIETNAM, Vietnam Oil and Gas Group, PETROVIETNAM

17:30 End of day

18:30 Farewell Dinner hosted by VASI

Thursday 3 March

Excursion by boat in Halong Bay and Lunch on boat hosted by VASI

07:30 Check-out and Assembly at hotel main lobby
08:00 Leave hotel for boat berth
08:30 – 12:30 Halong Gulf tour by boat (duration 4 hour), visit of Sung sot cave, Titov Island, Lucnh on board. There will be English speaking tour guide.
14:00 End of excursion and leave for Hanoi.

(after the excursion at 14:00, a big coach will going direct Noi Bai Int'l Airport / Hanoi downtown / Hilton Hanoi Opera Hotel)

LIST OF DOCUMENTS

Document No. 1	**Overview on the Research and Investigation of Gas Hydrates in Vietnam** *Speaker: Dr. Vu Truong Son, Director of Marine Geological and Mineral Center, VASI*
Document No. 2	**Shallow Sediment Geochemical Surveys of Deep Sediment Methane Hydrate Deposits** *Speaker: Dr. Richard B. Coffin, USA*
Document No. 3	**Multi-scale nature of hydrate dynamics and implications for hydrate production and geo- mechanical stability** *Speaker: Prof. Bjørn Kvamme, Norway*
Document No. 4	**Gas Hydrate System and Numerical Investigation of Gas Production Strategy in Shenhu Area, South China Sea** *Speaker: Dr. Nengyou WU, China*
Document No. 5	**Present status of Japanese methane gas hydrate research and development program** *Speaker: Dr. Manabu Tanahashi, Japan*
Document No. 6	**Korea Gas Hydrate R&D Progam** *Speaker: Dr. Jong-Hwa Chun (KIGAM)*
Document No. 7	**Gas hydrate indicators to search gas hydrate and oil-gas in the Okhotsk Sea** *Speaker: Professor Anatoly Obzhirov*
Document No. 8	**Gas Hydrates in the Sea of Okhotsk 1998-2010: Outcomes of Geological, Geophysical and Ecological Research** *Speaker: Dr. Renat Shakirov, Russia*
Document No. 9	**Natural Gas Hydrates as an Energy Resource and New Developments in Gas Hydrate Exploration** *Speaker: Dr. Miko Fohrmann, New Zealand*
Document No. 10	**Overview of the Gas Hydrate Exploration Program in India** *Speaker: Mr. Malcolm V. Lall, India*
Document No. 11	**One of the methods to extract methane from gas hydrate area in the Sea** *Speaker: Professor Anatoly Obzhirov, Russia*
Document No. 12	**Analysing sand-dominated channel systems for potential gas-hydrate reservoirs using an AVO seismic inversion technique on the Southern Hikurangi Margin, New Zealand** *Speaker: Dr. Miko Fohrmann, New Zealand*

GUEST SPEAKERS SHORT BIODATA & ABSTRACT

NAME: DR. VU TRUONG SON
POSITION: Director
COMPANY: Marine Geological and Mineral Center (MGMC)
VASI – Vietnam Administration of Seas and Islands, Ha Noi, Viet Nam
ADDRESS: 125 Trung Kinh Str, Cau Giay Dist, Ha Noi, Viet Nam
E-MAIL: vts_mgu@yahoo.com.vn

Presentation: Overview research and investigation of gas hydrate potential in Viet Nam

Short Bio Data:

Dr. Vu Truong Son is a doctor of Geochemistry. He received B.Eng. degree in Geochemistry from Ivan Franko National University of Lvov in 1985 in Ukraine and Dr. degree in Geochemistry at Viet Nam National University in 2004. Now, he is the leader of Marine Geology and Mineral Resources Center (MGMC), VASI, MONRE. He is the author/co-author of dozens reviewed publications and proceedings contributions. Topics include sea tin prospects, environment geology characteristic, geochemical environment characteristic, geology and minerals, Holocene evolution and so on. He is also the chief editor of projects; subject matters; programs on marine geology - minerals, environmental geology, geo-hazards and environmental geochemistry.

Abstract: Overview research and investigation of gas hydrate potential in Viet Nam

Gas hydrate has been aware and noticed since the last years of the 20th century by Vietnamese scientists. However investment in research and investigation on this resource has just been strengthened in recent years. The mission of research and preparation for investigation of gas hydrate was assigned for two main agencies, i.e. Vietnam Administration of Seas and Islands (VASI) of MONRE and Vietnam National Oil and Gas Group (PVN). These agencies have early conducted several researches on gas hydrate, with focus on enhancement of human capacity and equipment capacity to serve the research, investigation and exploration of gas hydrate resource. Spontaneously, they are active to collect and synthesize available publications over the world on gas hydrate world.

Through these studies, some prerequisites, indications and conditions of gas hydrate have revealed as to scientific base to valuate generally on the prospects on gas hydrate in the sea of Viet Nam.

Research and investigation on gas hydrate potential is an important mission of Vietnam. Vietnamese scientists determined that programs of research and investigation are generally conducted via three main steps as follows:

- Step 1: Basic research and investigation on gas hydrates in potential areas.
- Step 2: Zoning of areas with high potential of gas hydrate; Drilling test.
- Step 3: Studying and developing techniques of gas hydrate exploration and production test.

Major methods used in investigation of gas hydrate include:

* Collecting and processing of available documents on the researched, investigated or explored gas hydrate.

* Geological methods: Studies on structure and tectonic; Studies on geodynamics; Studies on geological stratigraphy; Studies on sedimentology; Studies on lithology; Sampling methods.

* Geochemical methods: Aquatic geochemistry; Pore water geochemistry ; Sedimentary geochemistry; gas geochemistry.

* Geophysics: Sub-bottom high-resolution seismic; Multimeam Echosounder; Side Scan Sonar; Marine Magnetic Surveys; Electro- Magnetic Surveys.

* Analytical methods

* Informatics

* Deep sea drilling

In sum, the above mentioned methods have been used in research and investigation of gas hydrate in many countries over the world for more than 40 years. These manifest scientific advance, effectiveness and feasibility in research of gas hydrate in Viet Nam.

NAME: DR. RICHARD B. COFFIN
POSITION: Section Head, Marine Biogeochemistry, Code 6114
COMPANY: Naval Research Laboratory
ADDRESS: 4555 Overlook Ave. SW, Washington, DC, 20375, USA
E-MAIL: richard.coffin@nrl.navy.mil

Short Bio Data:

Richard Coffin is the Marine Biogeochemistry Section Head at the Naval Research Laboratory in Washington DC. Rick is a NRL leader for international development of methane hydrate research. His primary research focus is biogeochemistry related to sediment and water column methane cycling. There is strong experience in applying geophysics and geochemical approaches to studying the flux of sediment methane to shallow sediment and water column carbon cycling. Field work, as a chief and co-chief scientist, has been conducted off the mid Chilean Margin, Hikurangi Margin off New Zealand, Cascadia Margin, along the mid-Norwegian coast, on the Texas-Louisiana Shelf in the Gulf of Mexico, and most recently, off the coast of Alaska in the Beaufort Sea. Currently plans are being set for the Kara Sea during August 2011. This research addresses climate change and alternate energy exploration. Rick received his Ph.D. in oceanography in 1986 from the University of Delaware.

Abstract: Shallow Sediment Geochemical Surveys of Deep Sediment Methane Hydrate Deposits

Methane hydrates are recognized to exist in high concentrations in coastal oceans around the world. The Japanese are exploring the potential for hydrates in the Nankai Trough, off the coast of Tokyo Japan, for development as a dominant national energy source. This investigation has lead to Arctic tundra hydrate energy evaluation in the Mackenzie Delta and Prudhoe Bay by international governments, universities and industry. Exploration of for the hydrates depends on data from seismic profiling and deep sediment drilling. This approach to hydrate exploration is expensive. Recent studies have combined seismic profiles, shallow sediment geochemistry, heatflow and controlled source electromagnetics to predict deep sediment hydrate deposits. This approach provides a more thorough, less expensive, investigation prior to deep sediment drilling.

NRL has been involved in methane hydrate exploration of the coasts of New Zealand, Chile, Canada, in the Beaufort Sea and the Gulf of Mexico. These studies have shown a wide variation in the prediction of deep sediment methane hydrate deposits within and between the locations. General findings of these studies are the need for a thorough geochemical evaluation.

Strong seismic blanking indicative of high vertical methane migration off the coast of Chile was observed to have a low vertical methane flux through the deep sediment. High vertical methane migration on Atwater Valley in the Gulf of Mexico was observed to be coupled with a high vertical chloride flux in the porewaters, which suggest deep sediment salt diapirs caused unstable sediment methane hydrate deposits. Bottom simulating reflection, coupled with seismic blanking were believe to indicate high vertical methane fluxes on the Hikurangi Margin off the coast of New Zealand. However, shallow sediment geochemical data taken through this region suggested very low deep sediment hydrate deposits.

This presentation will provide an overview of predicted methane hydrate deposits in different coastal regions and the advantages of combining different parameters in the evaluation. Work will include data from expeditions in the Gulf of Mexico at Atwater Valley and Alaminos Canyon, on the mid Chilean Margin, west of Concepion, on the Alaskan coast in the Beaufort Sea and on the Hikurangi Margin, northeast of New Zealand**.** The approach will provide an overview of the benefits and issues with the interpretation of deep sediment hydrate deposits using different approaches for the field survey. This presentation supports combining a variety of parameters for these surveys.

NAME: PROF. BJØRN KVAMME
Professor,
Department of Physics and Technology,
University of Bergen,
Allegt. 55, N-5007 Bergen, Norway
Tel. +47 55 583310, Mobile. +47 93 451956
E-mail: bjorn.kvamme@ift.uib.no

Short Bio Data:

Professor Bjørn Kvamme, Department of Physics and Technology obtained his M.Sc. in Chemical Engineering (1981) and Ph.D. in Chemical Engineering (1984) from the Norwegian University of Technology and Natural Sciences. He has been with SINTEF in Trondheim. In 1987 he was appointed as a full Professor and was a pioneer in starting up education of M.Sc. as well as initiating a doctoral program in Process Engineering in Telemark, Norway, now implemented as a part of Telemark University College. He has been affiliated with UoB, Department of Chemistry, since 1998 and entered a position as Professor in Gas Processing at Department of Physics March 2000. He is the author/coauthor of more than 100 reviewed publications plus several book chapters and proceedings contributions. His main research effort has been in thermodynamics and statistical thermodynamics. Topics include natural gas hydrates, equilibrium, stability and kinetics, polar solutions and electrolyte solutions, kinetics of phase transitions, oil in water emulsions, separation, gas cleaning, and seawater chemistry. During the later years the main funding has been related to natural gas hydrate in general, with the main funding sources being related to hydrate as energy source. Different aspects of CO_2 capture and storage have been heavily funded research since 2002 and in addition to some large ongoing projects Kvamme is part of the FME SUCCESS. Development of a new reactive transport simulator for CO_2 storage with implicit geo-mechanical analyses is currently an important issue. He is currently the leader of a research group containing 1 additional Professor, 1 post.doc., 12 PhD students, 14 MSc students and a varying number of international guest researchers and guest students.

Abstract:

Multiscale couplings of hydrate dynamics in porous media and implications for hydrate instability

Research on continental margins and in permafrost areas have shown that the energy trapped in gas hydrates rivals that in all known conventional petroleum and coal fields, and could provide energy power to many parts of the world where conventional petroleum is nonexistent or has been consumed. Previous opinions were that methane clathrates are unreliable as reservoirs and

uneconomical to exploit, but feasibility studies at the Mallik test well in Arctic permafrost and drilling offshore Gulf of Mexico and India are changing this conservative attitude.

Recent drilling by an US governmental agency and industry consortium in the Gulf of Mexico confirmed gas hydrate energy targets with potential for gas production. Commercially viable offshore production is considered achievable within 5-10 years depending on reservoir assessments and technology developments [1].

Onshore hydrate production has existed since the seventies [e.g. Messoyakha field] while offshore hydrate production is today the focus of geophysical surveys and drilling operations in India, Japan, Korea and China and the east coast of USA. These geophysical surveys have successfully predicted the location and concentration of gas hydrate deposits using reprocessed industry 3-D seismic data and multi-component seismics [2, 3]. Despite these efforts, offshore production demonstration sites are lacking behind by several years testing at land-based production sites in the Arctic [US Department of Energy]. The U.S. Department of Energy (2008) signed agreements for cooperative research efforts with representatives from three countries with gas hydrate research programs: India, Korea and Japan.

There are essentially four classes of exploitation methods for hydrates: 1) Pressure reduction, 2) Thermal stimulations, 3) Injection of chemical like inhibitors or salt solutions and 4) Injection of CO2. Injection of salt or inhibitors is generally expensive due to price of chemicals and extra processing of the produced water that follows along with the production of hydrocarbons. Limiting heating, at least locally, is required with option 2) but option 3) as separate alternative is expensive and involves useless heat losses to minerals. Options 1), 2) and 3) all involve roughly 10% reduction in volume and at seems un likely that the released pore space can be replaced sufficiently rapid to avoid rearrangement of sand and corresponding geo mechanical implications, at least for options 1) and 2). In addition to the rearrangement and compaction of unconsolidated sand there is always the risk of producing sand with the fluid flow, which may have even more severe implications for geo mechanical instability. Since 1970 roughly 6 billion cuft of gas have been produced from the Messoyakha field and the Tundra above have indeed been sinking substantially during these years.

Despite the above pressure reduction have been the primary method in Mallik and Mallik II test productions. It is also the primary method for the Nankai Through test planned for 2012. ConocoPhillips and DOE is planning a test on CO2 injection in Alaska in 2012. The wells are yet being drilled and will be plugged until 2012. The advantages of this option is of course the win-win situation by simultaneous storage of CO2 and release of natural gas as well as the fact that the net volume change is practically zero and as such geo mechanically feasible.
The kinetics rates of hydrate dissociation involved in options 1), 2) and 3) are implicit coupled functions of mass transport, heat transport and kinetics of the phase transition itself. Pressure reduction is often limited by heat transport since the heat for dissociation have to be supported from the surroundings after the pressure have been reduced to outside stability for the hydrate front. Heat addition obviously also requires understanding of the heat transport kinetics involved. The degree of thermodynamic control of the kinetics of phase transition itself is not adequately described in any simulators today. Mots of the relate to some empirically fitted data from PVT cell experiments of Kim and Bishnoi in the 1980's and have no relevance for realistic reservoir conditions. Injection of CO2 is a mass transport controlled process in which the entropy changes dominate the thermodynamics of the phase transition.

Another challenge is that practically all hydrate systems in nature are non equilibrium systems. Many of them even as given by Gibbs phase rule and other simply because only a number of the theoretically possible number of phases are stable at the given temperature and pressure locally

in the reservoir. The typical situation is therefore that one phase or at least some few phases dominate the progress of the system inside the pores at any time. Solid mineral surfaces have a dual effect as the water adsorbed directly on the surface have lower chemical potential than "bulk" pore water and as such might dissociate hydrate. On the other hand the solid mineral surfaces with adsorbed water may serve as adsorption sites for hydrate formers so hydrate formation slightly outside the mineral surfaces can be facilitated. In addition hydrate will dissociate towards any phase which is under saturated with respect to water or hydrate formers. Hydrates can reform on hydrate former/interfaces are even form solutions of hydrate formers in water. Hydrate formation from water in gas is less important due to the low content of water in gas.

Existing hydrate simulators are normally using pressure versus temperature stability curve and neglecting kinetics of phase transition, or use the aforementioned equation due to Kim and Bishnoi. The incorporated equation for heat transport contains different sets of approximations that makes them rather questionable for the complex system of phase transitions subject to varying fluid flow inside pores.

In view of the above there is a need for a new type of hydrate simulator which is capable of handling competing phase transitions under varying regimes of flow surrounding the hydrate (and corresponding rates of dilution of surrounding fluids). Reactive transport simulators do have the logistics in place for this. RetrasoCodeBright (RCB) [4 - 8] is to our knowledge the only reactive transport simulator which also offers the implicit description of geo mechanics for every element of a grid system at any time step. Another advantage of a reactive transport simulator is the couplings between different reactions which open up for couplings between CO2 hydrate phase transitions and mineral reactions with CO2 when all hydrate phase transitions (formation and dissociation) are treated as "pseudo" reactions.

References

1.Research Consortium for Methane Hydrate Resources in Japan:
http://www.mh21japan.gr.jp/english/index.html

2. Hustoft, S., Bünz, S., Mienert, J. and Chand, S., 2009. Gas hydrate reservoir and active methane-venting province in sediments on < 20 Ma young oceanic crust in the Fram Strait, offshore NW-Svalbard, Earth Planetary Science Letters, 284, 1-2, pp 12-24

3. Bünz, S., Mienert, J., Andreassen, K., 2009. Multi-component seismic studies of the gas hydrate system at the Storegga Slide,AAPG Memoir 89, pp. 451-466.

4. Liu, S., Kvamme, B., “Simulating CO2 Storage in Saline Aquifers with Improved code RCB”, INTERNATIONAL JOURNAL of ENERGY and ENVIRONMENT, 2007, 1, 21-2

5. Kvamme, B., Liu, S., *"Reactive Transport of CO2 in Saline Aquifers with implicit geomechanical analysis"*, 2009, Energy Procedia, 1, 3267–3274

6. Kvamme, B., Liu, S., 2009, "*A new reactive transport reservoir simulator for aquifer storage of* co_2 *- with implicit geomechanical analysis*" in "Carbon Dioxide Capture for Storage in Deep Geologic Formations", Volume 3, L.I. Eide (Ed.), CPL Press and BP, in press

7. Kvamme, B., Liu, S., *"Sensitivity study on storage of CO2 in saline aquifer formation with fracture using reactive transport reservoir simulator RCB"*, 2009, Basin Research, submitted

8. Kvamme, B., Liu, S., *"Reactive Transport of CO2 in Saline Aquifers with implicit geomechanical analysis"*, 2008, Proceedings from GHGT-9, Energy Procedia, 9 pages

NAME: PROF. NENGOU WU

POSITION: Vice Director, Professor

COMPANY: Guangzhou Institute of Energy Conversion, Chinese Academy of Sciences

Guangzhou Center for Gas Hydrate Research, Chinese Academy of Sciences

ADDRESS: No.2 Nengyuan R., Wushan, Tianhe District, Guangzhou 510640, China

E-MAIL: wuny@ms.giec.ac.cn

Presentation: Gas Hydrate System and Numerical Investigation of Gas Production Strategy in Shenhu Area, South China Sea

Short Bio Data:

Dr. Nengyou WU is a professor of Marine Geology. He received M.Sc. degree in Tectonics from the Department of Earth Sciences, Zhejiang University in 1991 and Ph.D degree in Geochemistry at Guangzhou Institute of Geochemistry, Chinese Academy of Sciences (CAS) in 1999. He was employed by Guangzhou Marine Geological Survey, Ministry of Land and Resources and conducted the investigation and research on the topics of regional tectonics, marine sedimentation and paleoenvironmental evolution, offshore petroleum and gas hydrate from March 1991 to April 2008. In 2008, Nengyou WU was selected as one researcher of 100 Talents Program of CAS. He has been a professor, Vice Director of Guangzhou Institute of Energy Conversion (GIEC), CAS; Managing Director of Guangzhou Center for Gas Hydrate Research, CAS; Managing Director of Key Laboratory of Renewable Energy and Gas Hydrate, CAS since May 2008. At GIEC, he is in charge of the GIEC research programs on gas hydrates. He is the author and co-author of over 180 papers, of over 20 reports and book articles, and of 3 patents.

Abstract:

Gas Hydrate System and Numerical Investigation of Gas Production Strategy in Shenhu Area, South China Sea

Nengyou WU [1,2,3], Shengxiong YANG[3], Haiqi ZHANG[4],
Zheng SU[1,2], Keni ZHANG[5], George J. MORIDIS[5]
(1. Key Lab of Renewable Energy and Gas Hydrate, Guangzhou Institute of Energy Conversion, CAS,China; 2. Guangzhou Center for Gas Hydrate Research, CAS, Guangzhou 510640, China; 3. Guangzhou Marine Geological Survey Guangzhou 510075, China; 4. China Geological Survey, Beijing 100011, China; 5.Lawrence Berkeley National Laboratory, Berkeley, CA 94702, USA)

ABSTRACT

Shenhu Area, one of the most favorable locations for gas hydrates in the north slope of South China Sea, is located in the Pearl River Mouth Basin. The geological setting, temperature and pressure conditions are favorable for the formation of gas hydrate. Analysis of the geochemistry of sediments from large piston cores showed that the sulfate-methane interface (SMI) is from 10 to 27 mbsf in the research area. Methane was the dominant hydrocarbon gas in all gas analyses. The $\delta^{13}C_{CH4}$ values of headspace gases from the gravity piston core sediments ranged from -74.3‰ to -46.2‰, with the majority being less than -55‰. It is likely that the methane of gas hydrate originated from in-situ microbial activity.

The drilling recovered high concentrations of hydrate (maximum 26-48%, with the gas composition of >99% CH_4) in a disseminated form in foram-rich clay sediments. The wire-line log showed a very distinctive positive anomaly in resistivity and sonic velocity in the interval of the hydrate layer. It was also interesting that the caliper log was smoother through this interval and the density log also showed a small decrease. From the combined well-log and geochemical data, the hydrate-bearing sediments were determined to range from 10 meters to 25 meters in thickness, and to concentrate just above the base of the gas hydrate stability zone (BGHSZ).

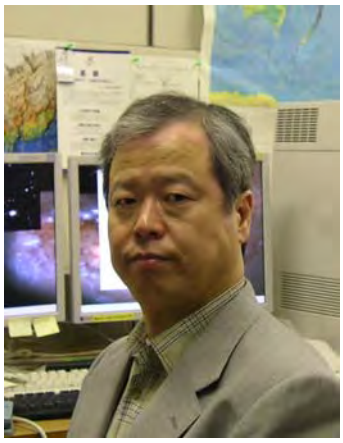
The estimate of the total amount of methane trapped in the drilling-confirmed 15 km^2 extent of the Shenhu hydrate deposit is about $160\times10^8 m^3$. Given the size of this accumulation, the Chinese government and industry have a keen interest in the commercial development potential of the resource.

By means of numerical simulation, we assess the production potential of hydrate accumulations at the SH2 drilling site of the Shenhu area. We simulate the hydrate dissociation and the corresponding gas production induced by depressurization at a single vertical well. We also test the gas production potential by alternately producing fluid and injecting hot water (huff-and-puff) at the well. To minimize gas losses through the overburden and excessive water production through proximity to the permeable, water-saturated zones, the production (perforated) interval is limited to the middle 1/3 section of the well within the hydrate layer.

Production from depressurization-induced dissociation based on a constant well pressure does not appear to be a promising approach in deposits characterized by the low hydraulic diffusion. This approach allows the production of hydrate-originating gas at decreasing rates (<463m^3/d for the permeability k=10D) in the reference case. The production is invariably lower than would have been attainable in the presence of impermeable boundaries. The intrinsic permeability of the HBL is considered as the most insensitive parameter to enhance the gas production from the deposits. Huff-and-puff results in very low production rates (50-140m^3/d) that are orders of magnitude much lower than generally acceptable standards of commercial viability of gas production from oceanic reservoirs. The study provides a first insight into the production potential of the Shenhu hydrate accumulations, and a basis for the analysis of the economic feasibility of gas production from that area.

Acknowledgements

This study is financially supported by the National Natural Science Foundation of China (No.U0933004), Knowledge Innovation Program of Chinese Academy of Sciences (No.KGCX2-YW-805) and National Basic Research Program of China (973 Program) (No.2009CB219506).



NAME: **DR. MANABU TANAHASHI**
POSITION: **Deputy Director of Institute for Geo-Resources and Environment**
COMPANY: **National Institute of Advanced Science and Technology, Geological Survey of Japan**
ADDRESS: **Tsukuba Centaral 7, AIST, Higashi 1-1-1, Tsukuba, Ibaraki, Japan**
E-MAIL: **tanahashi-m@aist.go.jp**

Presentation: Present status of Japanese methane gas hydrate research and development program

Short Bio Data:

I joined Geological Survey of Japan in 1978 and have worked in the marine geology field using the seismic reflection method for the manganese nodule exploration, geological mapping around Japanese Islands, hydrothermal activity and tectonic studies of North Fiji Basin, geological survey in Antarctic offshore basins, methane gas hydrate and other hydrocarbon resource potential in Japan.
I received doctor of science degree in 1994 from Nagoya University for the study of the active marginal basin.
I worked for JNOC (Japan National Oil Corporation, present JOGMEC) during 1983-4 and 1996-7.

Abstract:

Present status of Japanese methane gas hydrate research and development program

Present activities of methane gas hydrate research and development in Japan will be presented.

Agency of Natural Resources and Energy of the Ministry of Economy, Trade and Industry (ANRE/METI) organized MH21 (Research Consortium for Methane Hydrate Resources in Japan) comprising JOGMEC, AIST, ENAA, and many industrial and scientific organizations for the research and development of natural gas hydrate as natural gas resources in 2001.

MH21 program completed its 8 years Phase 1 activities in March 2009. Main research results of Phase 1 are 1) Success of gas production from natural hydrate deposit with reservoir depressurization technique in Canadian Arctic, 2) Discovery of pore-space filling type hydrate deposits in sand layer which is controlled sedimentologicaly, 3) Petrophysical understanding of hydrate deposit by seismic and well logging analysis, 4) Understanding of dynamic physical properties of hydrate deposits in-situ and production conditions with laboratory measurement and computer simulation. The resource potential of the pore-space filling type hydrate deposits, which is developed within the sand interval of turbidite sedimentary sequences in Nankai Trough forearc basin area, is assessed and confirmed by JOGMEC hydrate research team.

MH21 program moved in present 7 years Phase 2 (FY2009-15) in April 2009. New Project Leader of MH21 is Associate Professor Yoshihiro Masuda, Tokyo University. JOGMEC and AIST are the main components of the MH21 R&D in Phase 2. Main research objective of Phase 2 is the R&D for the gas production in offshore methane hydrate field in Eastern Nankai Trough region. Two production tests in offshore area are planned during Phase 2. First test will be carried out in fiscal year 2012. JOGMEC is planning to start drilling for production test well and some monitoring wells in fiscal year 2011 and completed the shallow part of the test well. They will re-drilled and test the productivity of the gas from the methane hydrate deposits in fiscal year 2012.

Tokyo University and AIST/GSJ have surveyed the fracture filling shallow methane gas hydrate deposits in eastern margin of Japan Sea with the conventional surface core sampling and geophysical methods for ten years. As the geological character and the resource potential of this type of methane gas hydrate are still not well known, we conducted the deep piston coring in 2010 as a part of MH21. The recent progress with the deep piston core sample analysis will be presented.

This research is supported by MH21 Research Consortium JAPAN.

NAME: DR. JONG HWA CHUN
POSITION: Senior Researcher, Gas Hydrate Department/KIGAM
COMPANY Korea Institute of Geoscience and Mineral Resources (KIGAM)
ADDRESS: 92 Gwahang-no, Yuseong-gu, Daejeon, 305-350, Korea
E-MAIL: jhchun@kigam.re.kr

Co-Authors:
NAME: Dr. Byong Jae Ryu
POSITION: Director, Gas Hydrate Department/KIGAM
COMPANY Korea Institute of Geoscience and Mineral Resources (KIGAM)
ADDRESS: 92 Gwahang-no, Yuseong-gu, Daejeon, 305-350, Korea
E-MAIL: bjryu@kigam.re.kr

NAME: Dr. Sung Rock Lee
POSITION: Director, GHDO
COMPANY Gas Hydrate R&D Organization (GHDO)
ADDRESS: 92 Gwahang-no, Yuseong-gu, Daejeon, 305-350, Korea
E-MAIL: srlee@gashydrate.or.kr

Presentation: Korea Gas Hydrate R&D Program

Short Bio Data (Jong Hwa Chun)

1990 B.Sc. at Department of Applied Geology, Pukyong National University
1992 M. Sc. at Department of Applied Geology, Pukyong National University
2000 PhD. Sc. at Department of Geology, Kangwon National University
2006-present Senior Researcher, Gas Hydrate Department, Petroleum & Marine Research Div., Korea Institute of Geoscience and Mineral Resources

Abstract:
In 2007, natural gas hydrates was successfully recovered in the Ulleung Basin during the Ulleung Basin Gas Hydrate Expedition 1 (UBGH1). UBGH1 was funded by Ministry of Knowledge Economy of Korea (MKE), Korea National Oil Corporation (KNOC), and Korea Gas Corporation (KOGAS). The scientific aspects and technical decisions were made by the Korea Institute of Geoscience and Mineral Resources (KIGAM) and the Korea Gas Hydrate R&D Organization (GHDO). Conventional and pressure coring confirmed gas hydrates within a "fracture-filling" type clay-dominated sediments up to 150 meters below seafloor. The thick gas hydrate accumulation within a "pore-filling" type sand-dominated sediments was discovered in the Ulleung Basin during the Ulleung Basin Gas Hydrate Expedition 2 (UBGH2) in 2010. Post-expedition gas hydrates studies are ongoing for the research and potential resources from the Ulleung Basin, East Sea, Korea.

NAME: PROF. OBZHIROV ANATOLY
POSITION: Chief Department of Geolo gy and Geophysics, Chief Laboratory Gas Geochemistry
COMPANY V.I.Il'ichev Pacific Oceanolo gical Institute Far Eastern Bra nch Russian Academy of Science
ADDRESS: 690041, Vladivostok, Baltiyskay St. 43, POI DVO RAS
E-MAIL: obzhirov@poi.dvo.ru

Presentation: 1) Gas hydrate is indicator to search oil-gas deposit in the Okhotsk Sea

2) One of the method to extract methane from gas hydrate area in the Sea

Short Bio Data:

Date and place of birth: February 11, 1940, Uste-Katav, Ural, Russia **Nationality:** Russia

Education (*degrees, dates, universities)*

Oil-Gas Engineer-Geologist, 1963, Tomsk Politekhnical Institute, Tomsk
Kandidat of Sciences (PhD), 1974, Moscow Geologo-Survey Institute, Moscow
Doctor of Sciences, 1996, Moscow, Moscow Geoinform Institute, GEOS, Moscow
Professor, 2009, High Certificate Committee of Moscow, Russia

Career/Employment (*employers, positions and dates)*

1963-68 Geologist Primorye Geological Survey
1968-74 Chief of gas Survey on mining deposits Far East Russia
1974-77 Chief of Chukotka Geological Survey
1977-79 Scientist of Pacific Oceanological Institute Far Eastern Branch of the Russia Academia of Sciences
1979-present Chief of the Laboratory of Gas Geochemistry POI FEB RAS
2005-present Head of Department Geology and Geophysics POI FEB RAS
2003-present Head chair of Geology Oil and Gas Institute Oil and Gas of the Far Eastern State

И **Specialization (*specify)***

(i) main field

Searching oil-gas deposits in the marine and land using gas geochemical indicators

(ii) other fields

Marine geology, Earthquake prognoses, Gas Hydrate study, Global climate change

(iii) current research interest

Gas hydrate, Oil and gas seeps, distribution of gas across water columns in Sea and Ocean, environmental gas geochemistry

Honours, Awards, Fellowships, Membership of Professional Societies

Membership of Professor Club of Russian Academy of Sciences, Vladivostok, 1996

Medal of the Geological Survey, 1999

Publications (*list selected publications on page 2 of curriculum vitae)*

Number of papers in refereed journals and monographs: 91

Number of communications to scientific meetings: 107

Abstract:

1) <u>Gas hydrate is indicator to search oil-gas deposit in the Okhotsk Sea</u>

Anatoly Obzhirov and Renat Shakirov

V.I.Il'ichev Pacific oceanological institute FEB RAS

Laboratory Gas Geochemistry POI FEB RAS is studying natural gas distribution on the sediment, column water in the Okhotsk Sea and atmosphere since 1984. Gas (mostly methane) used like indicators to search oil-gas deposit, gas hydrate, prognosis seismo-tectonic activity (including earthquake and tsunami) and examine local and global ecology. In Okhotsk Sea methane and heavy hydrocarbon anomalies are formed in sediment and bottom water over oil-gas structures and gas hydrate area in zone fault. Gas hydrate was discovered due to flux of gas is formed where gas hydrate destroyed in zone fault. Bubbles of gas (mostly methane) from decomposition gas hydrate is going from surface sediment to up to water column and to atmosphere. They created hydro-acoustic anomaly in echogram like flare 200-300 m long (fig. 1). Methane concentration inside flare was more than 10000 nl/l. It sharply decreased outside flare and zone fault. Over gas hydrate field without fault methane concentration in bottom water was like background about 40-50 nl/l. It is because layer of gas hydrate is good cap that keep gas to go out from oil-gas deposit and support to form oil-gas deposit in geological period when sediment thickness grows and gas hydrate layers is going down in the warmer zone unstable gas hydrate. So, gas hydrate and oil-gas deposit relationship and gas hydrate can help to search oil-gas deposit.

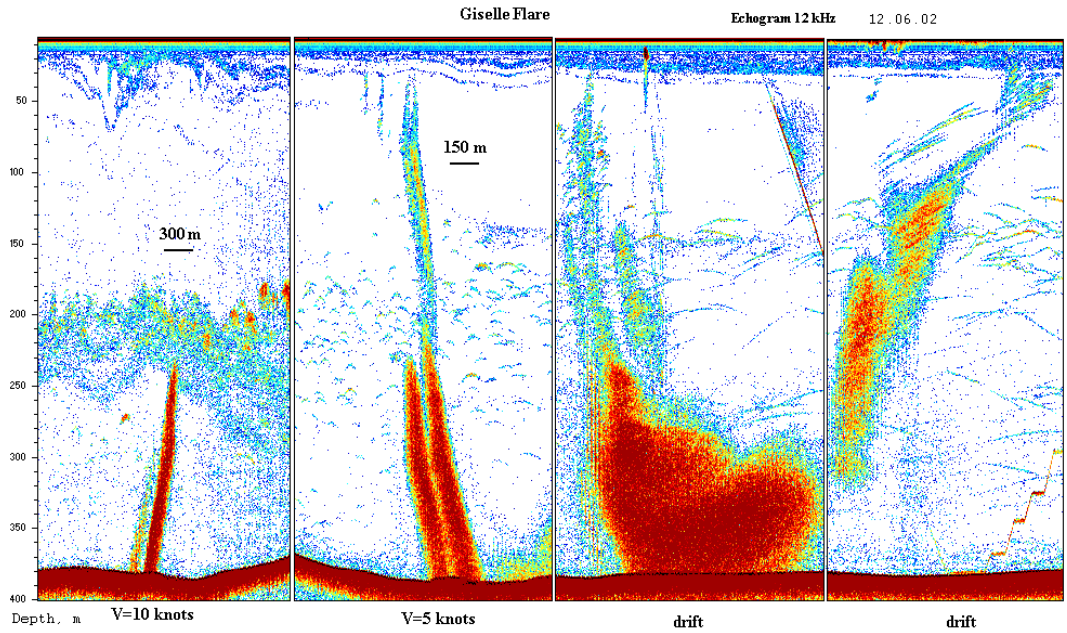


Fig. 1. Hydroacoustic image (echogram) in gas hydrate area of Gizella Flare in Okhotsk Sea. Almost vertical structure is flux of methane bubbles from sediment to water column and atmosphere like flare.

Abstract:

2) **<u>One of the method to extract methane from gas hydrate area in the Sea</u>**

Anatoly Obzhirov

To extract methane from gas hydrate and methane flux we will be use methane for commerce and reduce to put it in atmosphere. One of the possible to extract methane from gas hydrate and methane flux we proposal the next model (fig. 1). Bubbles of methane are covering many traps and gas is going up by special gas-storage device. When it will be full device with gas come up in ship. Ship will be take gas in order each trap (for example 50 traps) and come back in first after last trap. It will be continue. So, untraditional sources hydrocarbon (methane) that may use in the national economy and to decrease prolusion of environment and atmosphere are gas hydrate with methane flux in the Okhotsk Sea. It is important to take methane from its to use in commerce and preserve ecology.

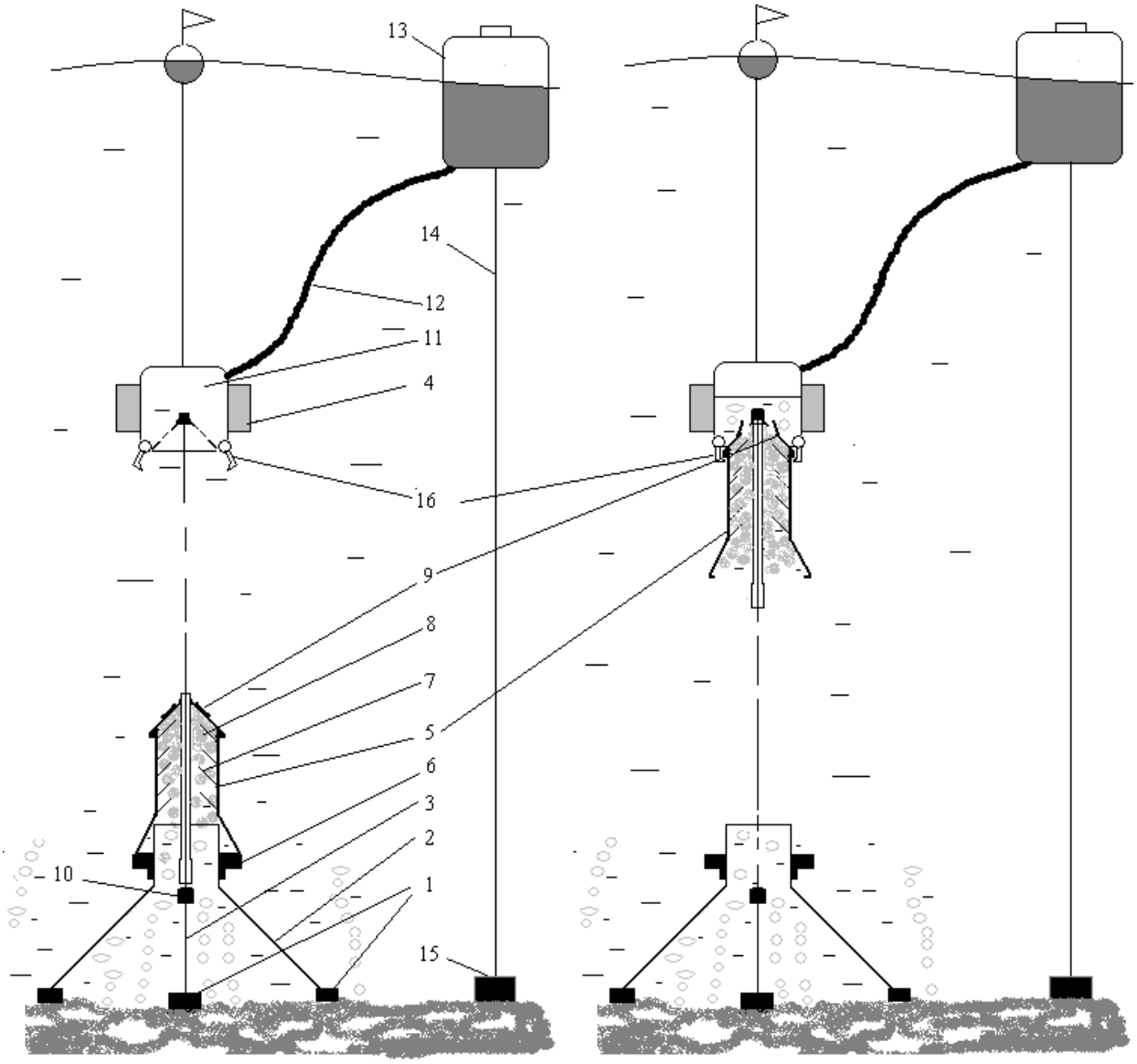


Fig. 1. Gas-extracted device of bubbles methane in the gas hydrate field.

NAME: DR. RENAT SHAKIROV
POSITION: Senior Researcher, POI FEB RAS
Address: 43 Baltiyskaya Str., Vladivostok, 690041, Russian Federation
E-MAIL: ren@poi.dvo.ru

Presentation: Gas hydrates in the Sea of Okhotsk 1998-2010: outcomes of geological, geophysical and ecological research

Short Bio Data:

School education: 1982-1992, Primorye, Russia.
•June 1997 — Diploma of "Geological Mapping and Minerals Forecast",
•Geological Faculty of Far Eastern State Technical University (FESTU, 1992-1997), Vladivostok, Russia
•Oct. 1997-October 2000—post-graduate student, junior scientific researcher, POI FEB RAS;
•Oct. 2000-2003 — scientific researcher, Gasgeochemistry lab., POI FEB RAS;
•Oct. 2003 – 31 march 2005 – post-doctoral fellow at New Energy Resources Research Center (NER), Kitami Institute of Technology (KIT), Japan;
•1 April 2005 – 16 November 2005 – scientific researcher, POI FEB RAS;
•16 November 2005 - present – senior researcher, POI FEB RAS;
•2005 - present – senior researcher, POI FEB RAS;
•20 June 2008 – present - assistant professor.

Abstract:

Our research aim is to investigate methane hydrates induced by different geological conditions in the second largest marginal sub arctic sea of the Pacific Ocean - Okhotsk Sea. Coring, hydroacoustic, seismic profiling, GC and MS technologies et cet. were applied. Methane hydrates was explored for 1998-2010. Active methane emission within the thick Cenozoic sediment basins (up to 10 km thickness) are linked to multiple hydrocarbon accumulations: mainly oil and gas deposits, and gas (methane) hydrates – proved for the Okhotsk Sea. The distribution of gas hydrates on NE Sakhalin slope (7000 sq. km) are related genetically with hydrocarbon accumulations, spatially with local structures, and controlled particularly by active faulting belongs to transform plates border. Modern high seismic activity cause fault's activities that break through the sea floor and create a favourable gas-permeable state along shear zones. Anomalously ambient methane concentrations in the water column (up to 30.000 nl/l above gas hydrates) and in sediments reflect that situation geochemically. For the Okhotsk Sea we classified when gas saturated fluids migrate through the upper sediments and penetrate the sea floor, particularly via the fault systems, deformations of the BSR, mud volcanoes, gas-geothermal springs, and pockmark-like structures are originates. Mineralogical and biological features are brightly marks the gas hydrates in sediments also. Submarine gas seepage usually accompanied by contrast acoustic anomalies in the sediments and water column (up to 500 gas "flares" prior to 2010 indicates gas hydrate accumulation off NE Sakhalin). High hydrocarbons were found as well, but methane is dominated. We recovered gas hydrates up to 35 cm thick pieces by coring. Lithology and stratigraphy, presumably have a less significance comparably to active tectonic mode. Methane origin discussed as mixture of thermogenic and biogenic. Methane resources trapped in gas hydrates estimated up to 2×10*12 cubic meters.

NAME: DR. MIKO FOHRMANN
POSITION: Seismic Interpreter
COMPANY GNS Science
ADDRESS: GNS Science, 1 Fairway Drive, PO Box 30368, Lower Hutt, New Zealand 5010
E-MAIL: m.fohrmann@gns.cri.nz

Presentation:
1)Natural Gas Hydrates as an Energy Resource and New Developments in gas Hydrate Exploration

2)Analysing sand-dominated channel systems for potential gas-hydrate-reservoirs using an AVO seismic inversion technique on the Southern Hikurangi Margin, New Zealand

Short Bio Data:

Miko Fohrmann is a geologist at GNS Science where he works as a seismic interpreter. His research interest focuses on marine gas hydrates deposits, AVO analysis, and basin evolution. He received his PhD from the University of Otago, New Zealand, where he studied the Fiordland-Puysegur gas hydrate province.

Abstract:

1) Gas hydrates have the potential to become an economically viable source of energy within a decade. As a result, significant effort is being spent internationally on developing techniques for gas hydrate exploration. Similar to conventional hydrocarbon exploration, gas hydrates are increasingly being investigated as part of a petroleum system, including gas sources, migration paths, emplacement mechanisms, and reservoir rocks. Such a petroleum-system approach currently appears to be most promising for discovering and characterising gas hydrate fields. In the absence of borehole information, gas hydrate exploration is largely based on analysis of seismic data in particular for seismic velocity and amplitude anomalies caused by gas hydrates and the character of bottom simulating reflections. Resistivity anomalies from electromagnetic surveys appear to be another promising geophysical indicator for gas hydrates. Results from geophysical data are often augmented by geochemical data from sediment cores to determine possible sources of gas (e.g. thermogenic vs. biogenic) and methane flux rates. It also appears that many concentrated gas hydrate deposits are associated with seafloor vent sites that can be detected from multibeam data. Gas hydrate exploration is guided by potential exploitation of gas hydrate reservoirs. It is currently thought that gas will be produced most economically from hydrates by depressurization, in which case production of hydrates is most efficient from deeper layers close to the base of gas hydrate stability. However, flushing out CH_4 from hydrates by sequestering CO_2 may become a viable production method. In that case, reservoirs need to be located within the stability range of both CH_4 and CO_2 hydrates.

2) The Hikurangi Margin, a subduction-zone margin east of New Zealand's North Island, contains gas hydrates in a very variable geologic environment. Significant gas hydrate saturations have been inferred in particular from controlled-source electromagnetic data collected in 2007. However, little is known so far about the quality of the host rock for gas hydrates. Like conventional hydrocarbon fields, gas hydrate need to be hosted by high-quality reservoir rocks, usually high-permeability sands. Identification of sand layers is therefore an important first step for discovering commercially viable gas hydrate fields. On the Hikurangi margin, sands may be deposited through submarine channel systems in slope basins on the accretionary wedge and in the Pegasus Basin.

Extensive canyons are present in the southern part of the margin. We have identified high-amplitude reflections in 2-D seismic data that cross bottom simulating reflections with a polarity reversal.

We suggest these reflections may be caused by high-permeability layers, probably sand-dominated, containing a significant gas column beneath the gas hydrate stability zone and gas hydrates within it. Results from high-resolution velocity analysis on a 2D seismic dataset in combination with AVO attribute analysis and AVO inversion supports our interpretation and facilitates the delineation of the gas hydrate zone.

NAME: MR. MALCOLM V. LALL

Coordinator National Gas Hydrate Program of India and Chief Geologist, Directorate General of Hydrocarbons (DGH)
C-139, Sector 63 Noida -201 301, India
Tel : 91-120-4029499
Mobile No : 9818188837
E-Mail : mvlall@dghindia.org

Presentation: Overview of the Gas Hydrate Exploration Program in India

Short Bio Data:
Malcolm is basically a petroleum Geologist with 22 years of experience in the Hydrocarbon sector. He joined ONGC in 1988 and has been with the DGH since August 2003

He coordinates the National Gas hydrate program of India, is the regional expert for Gas hydrates for the SAARC energy center and is the member of the Steering Committee for Gas hydrate assessment for the UNEP. Additionally he is also responsible for National & International cooperation, identifying R&D Projects of relevance to Upstream Hydrocarbon Sector in India and project planning for these projects. He has been a member of the National Working committee to suggest a strategy to encourage Service providers in Upstream Hydrocarbon Industry to set up a base in India. He is also in the core team to develop regulatory framework for the Exploitation of shale gas in India.

He has a very positive outlook, strong technical knowledge and sound management values.

Abstract:

India Gas Hydrate Program: An overview & Future plans

Malcolm V Lall, Coordinator National Gas Hydrate Program of India & Chief Geologist, Directorate General of Hydrocarbons, Ministry of Petroleum & Natural Gas Government of India

India is an energy hungry country and with the rapid progress and Industrialization the gap between the Demand and Supply of the Conventional Hydrocarbons in the country is ever increasing. The best efforts to reduce the gap through a very aggressing New Exploration & Licensing policy have yielded positive results by way of the spurt in the E&P activity in the Country in the last few years but has this has not been able to curtail the gap. Understandably therefore, India is keen to explore the possible unconventional hydrocarbon resources to help meet its demand and therefore the very optimistic Gas hydrate program has been launched with the sole objective of utilizing the same as an energy fuel in the years to come

In was with this objective that the National Gas Hydrate program (NGHP) of India was launched. With the Secretary Petroleum & Natural Gas himself steering the body and Director General, Directorate General of Hydrocarbons as its Technical Head, the primary goal of the NGHP is to explore and establish the Gas Hydrate potential of the country and explore the appropriate technology for commercial exploitation of these resources With this objective in mind the NGHP carried out the Expedition 01 the results of which were released in the International Conference on Gas hydrates held in February '08 at Noida India. It was through this expedition that the presence of Methane hydrates was established in the Krishna Godavari, Mahanadi and the Andaman offshore. Many scientific studies ranging from Structural, Geochemical, Sedimentological, Microbiological, Paleontological, cavity occupancy, dissociation characteristics, X-ray CT, permeability, Flow properties, etc. were carried out.

The studies revealed that Gas hydrates occur in grayish green fine sediments, gray medium sands, and white volcanic ash as pore-filling hydrate, while visible gas hydrates developed in black fine sediments, especially at Site NGHP 1-10. The structures of the gas hydrates in the studied samples are all S1, with methane as the dominant guest.

The occupancy of methane in large cage is almost complete, while it is variable in the small cage (0.75 to 0.99). The hydration number is 6.10 ± 0.15 for most of the hydrates in the samples studied. The SEM studies suggest a near perfect crystalline form of these hydrates at Site 10 a feature which is not readily available in field conditions. India now boasts of the presence of the World's Richest (Krishna Godavari – 132m of massive hydrate) and the world's deepest (Andaman 613 mbsf) occurrence of Methane Hydrates. Having reached thus far the 2nd NGHP Expedition in 2011-12 would focus on locating sand bodies within the Gas Hydrate Stability Zone in an already established Gas Hydrate area particularly the Krishna Godavari and Mahanadi deep water areas on the east coast of India. The objective of this expedition would be to locate not only the sand bodies but also the occurrence of free gas below the hydrate if any. Three areas in the Krishna Godavari and Mahanadi deep waters have been identified from the sand providence point of view and evaluation of the 30 odd locations is ongoing. These locations after prioritization would be taken up for drilling in the last quarter of 2011-12. Finally the 3rd NGHP Expedition would commence the Pilot Production testing Plan and schedule of which would largely depend on the results of the Expedition-02.

PETRAD Representative

DR. ØYSTEIN BERG, Managing, Director, PETRAD
Address:
PETRAD
Prof. Olav Hanssens vei 10,
P.O. Box 598, N-4003, Stavanger, Norway
Tel. +47 51 876139,
Mob. +47 48 050750
E-mail: oystein.berg@petrad.no
Web : www.petrad.no

Dr. Øystein Berg: Dr. Berg holds a BSc in Civil Engineering from Queens University of Belfast, Northern Ireland, as well as a Postgraduate Diploma in Industrial Administration and PhD in Business Administration from The Management Centre, Bradford, England.
In 1978 Dr. Berg was appointed by the Norwegian Petroleum Directorate as Project Manager for 1/3 of the largest Safety Research Programme ever undertaken in Norway, 'Safety on the Norwegian Continental Shelf'. Dr. Berg was responsible for a total of 51 R&D projects from 1978 until 1981. Between 1981 and 1986, Dr. Berg held various positions such as Director for the Department of Marine Technology, Director of the Strategy Department of the Safety Division and deputized as Director of Safety Division of the Norwegian Petroleum Directorate in the period 1986-89.
In 1989 Dr. Berg was called upon by the Norwegian Government to develop the Petrad Programme (International Programme for Petroleum Management and Administration). Currently Dr. Berg serves as Managing Director for Petrad. Dr. Berg has participated in a large number of national and international advisory committees in the petroleum sector and within R&D. He has since 1984 been Advisor to Government Agencies and National Oil Companies in Asia through the CCOP and ASCOPE Organizations. Prior to establishing Petrad, Dr. Berg also lectured on topics related to industrial maintenance, risk and reliability and safety in the offshore petroleum industry in USA, Asia and Europe. Dr. Berg received in 2004 the "Friendship Award" from the Chinese Government for long standing cooperation on knowledge transfer in the petroleum sector. This is the highest award given to foreigners by the Chinese Government.

Dr. Berg was in May 2006 appointed to the Academic Advisory Board of University Teknologi Petronas, Malaysia, under the Chairmanship of former Prime Minister of Malaysia, Dr. Mahathir Mohamed. Dr. Berg is also a member of the 3 man nominations committee for the Malaysian 'Merdeka Award' – Health, Science and Technology category.

Company profile: Petrad became a non-for-profit Government Foundation on January 1, 1994. Being able to draw on the combined expertise of the Norwegian oil and gas industry puts Petrad in the front rank for expertise and experience transfer between present and future leaders of the petroleum sector worldwide. The Petrad Programme has become internationally known for its 8-week courses in the Norwegian "oil capital" Stavanger, and its tailor made seminars and workshops arranged in Africa, Asia, Latin America and the former Soviet Union.

VIP

Associate Prof. Dr. Sc. Nguyen Van Cu Director-General	Vietnam Administration of Seas and Islands – (VASI) Hanoi, Socialist Republic of Vietnam E-mail: nvcu@monre.gov.vn
Dr. Nguyen Van Minh Deputy Permanent Representative of Vietnam to CCOP Vice President of PETROVIETNAM	Vietnam Oil and Gas Group, PETROVIETNAM No. 18, Lang Ha Street, Ba Dinh District Hanoi, Socialist Republic of Vietnam Tel. +84 4 3825 9143 E-mail: minhnv@pvn.vn
Dr. Øystein Berg Managing Director	PETRAD- International Programme for Petroleum and Administration, Prof. Olav Hanssens vei 10, PO Box 598 4003 Stavanger, Norway Tel.: +47 51 87 61 39, Mobile: +47 48 05 07 50 Telefax: +47 51 87 64 28 E-mail: oystein.berg@petrad.no
Prof. Dr. He Qingcheng Director	CCOP Technical Secretariat CCOP Building 75/10 Rama VI Rd., Phayathai, Ratchathewi, Bangkok 10400, Thailand Tel. +66(0) 2644 5468 Ext. 401, Mobile: +66(08) 1839 8488 E-mail: heqc@ccop.or.th
Ass. Prof. Dr. Nguyen Chu Hoi Deputy Director-General	Vietnam Administration of Seas and Islands (VASI), MONRE Hanoi, Socialist Republic of Vietnam E-mail: nchoi52@gmail.com

Guest Speakers

1	**Dr. Vu Truong Son**	Director Marine Geological and Mineral Center VASI – Vietnam Administration of Seas and Islands Hanoi, Vietnam E-mail: vts_mgu@yahoo.com.vn
2	**Dr. Richard B. Coffin**	Section Head Code 6114 Marine Biogeochemistry Naval Research Laboratory 4555 Overlook Avenue, SW Washington DC, 20375 Tel. 202-767-0065 E-mail: richard.coffin@nrl.navy.mil
3	**Professor Bjørn Kvamme**	Professor - Department of Physics and Technology, University of Bergen, Norway Department of Physics and Technology University of Bergen Allegt. 55, N-5007 Bergen, Norway Phone: (+47)55580000/(+47)55583310 Mobile phone : (+47)93451956 Fax (Dept. of Physics) : (+47)55589440 Fax (My office) : (+47)55583380 E-mail :bjorn.kvamme@ift.uib.no
4	**Dr. Nengyou Wu**	Vice Director Guangzhou Institute of Energy Conversion Guangzhou Center for Gas Hydrate Research Chinese Academy of Sciences No.2 Nengyuan R., Wushan, Tianhe District Guangzhou 510640, China Tel: +86.20.87052746, Mobile: +86 13922774239 E-mail: wuny@ms.giec.ac.cn
5	**Dr. Manabu Tanahashi**	Deputy Director, Institute for Geo-Resources & Environment, AIST/GSJ C-7, Tsukuba, 305-8567, JAPAN Tel: +81-29-861-3938, -3670 Fax: +81-29-861-3666 E-mail: tanahashi-m@aist.go.jp
6	**Dr. Jong-Hwa Chun**	Petroleum & Marine Research Division Korea Institute of Geoscience & Mineral Resources Daejeon 305-350, Korea Tel. : +82-42-868-3328, Fax : +82-42-868-3417 Email: jhchun@kigam.re.kr

Guest Speakers

7	**Prof. Anatoly Obzhirov**	Professor, (POI FEB RAS) - Pacific Oceanological Institute Far Eastern Branch of Russian Academy of Sciences Russia, 690041 E-mail: obzhirov@poi.dvo.ru
8	**Dr. Renat Shakirov**	Candidate of Geologo-Mineralogical Sciences, Senior Researcher, Assistant Professor Laboratory of Gasgeochemistry V.I. Il'ichev Pacific Oceanological Institute Far Eastern Branch of Russian Academy of Sciences Russia, 690041, Vladivostok, Baltiyskaya str., 43 Phone: +7-423-2-31-21-07, Fax: +7-423-2-31-2573 E-mail : ren@poi.dvo.ru http://www.ggc.poi.dvo.ru/
9	**Dr. Miko Fohrmann**	Seismic Interpreter Hydrocarbons Section GNS Science - Te Pu Ao 1 Fairway Drive, Avalon, P O Box 30 368, Lower Hutt 5040, New Zealand Direct: +64 4 570 4397, Tel. +64 4 570 1444, Fax. +64 4 570 4600 E-mail: m.fohrmann@gns.cri.nz Website: www.gns.cri.nz
10	**Dr. Malcolm Lall**	Chief Geologist National Gas Hydrate Programme (NGHP)/ National and International Co-operation Directorate General of Hydrocarbons (Under Ministry of Petroleum & Natural Gas) C-139, Sector 63 Noida -201 301, India Tel : 91-120-4029499 Mobile No : 9818188837 E-Mail : mvlall@dghindia.org

CCOP / ASCOPE Name List of Participants

NO.	NAME	DESINATION / COMPANY / E-MAIL ADDRESS
1	**Mr. Simplicio P. Caluyong**	EPPM Project Coordinator CCOP Technical Secretariat, CCOP Building 75/10 Rama VI Rd., Phayathai, Ratchathewi Bangkok 10400, Thailand Tel: +662 6445468 ext. 503, Fax: +662 6445431 Mobile (66) 81 827 0527 Email: sim@ccop.or.th, scaluyong@gmail.com Website: http://www.ccop.or.th/eppm
2	**Dr. Nguyen Nhu Trung**	Geo-Resources Sector Coordinator CCOP Technical Secretariat, CCOP Building 75/10 Rama VI Rd., Phayathai, Ratchathewi Bangkok 10400, Thailand Tel: +662 6445468 ext. 504, Fax: +662 6445431 E-mail: trungnn@ccop.or.th
3	**Ms. Amni Hidayah Mohd Tauffick**	Industry Analyst, Corporate Information and Research Unit (CIRU) Corporate Strategic Planning (CSP) Executive, PETRONAS Level 72, Tower 1, PETRONAS Twin Towers, KLCC, 50088 Kuala Lumpur, Malaysia. Tel. +603 - 2331 6829, Fax: +603 - 2331 2950 E-mail: amni_hidayah@petronas.com.my
4	**Mr. Tae Gyu Park**	Assistant Director Ministry of Knowledge Economy 88, Gwanmoonro, Gwacheon-Si, Gyeonggi-do, 427-723, Republic of Korea Tel. +82 17 213 9476 E-mail: magnus76@mke.go.kr www.mke.go.kr
5	**Dr. Sung-Rock Lee**	Director, Gas Hydrate R/D Organization 30 Gajeong-dong, Youseong-gu, Daejeon, Korea Tel. +82 42 868 3360, Mobile: +82 10 9240 0290 E-mail: srlee@kigam.re.kr

Local Name List of Participants

PVN

NO.	NAME	DESINATION / COMPANY / E-MAIL ADDRESS
6	**Dr. Phan Tien Vien**	Deputy General Manager, Exploration Division Vietnam Oil and Gas Group, PETROVIETNAM No. 18, Lang Ha Street, Ba Dinh District Hanoi, Socialist Republic of Vietnam Tel. +84 4 3825 2526 ext. 6605 E-mail: vienpt@pvn.vn Website: http://www.petrovietnam.vn
7	**Mr. Nguyen Ngoc Tuan**	Expert, Production Division Vietnam Oil and Gas Group, PETROVIETNAM No. 18, Lang Ha Street, Ba Dinh District Hanoi, Socialist Republic of Vietnam Tel. +84 4 3825 2526, Mobile. 0988555764 E-mail: tuannn@pvn.vn Website: http://www.petrovietnam.vn
8	**Mr. Nguyen Trung Thanh**	Acting Manager, Department of Marine Geochemistry, Institute of Marine Geology and Geophysics A 27 building, 18 Hoang Quoc Viet, Cau Giay District, Hanoi, Vietnam E-mail: Thanhtramtich@yahoo.com
9	**Mr. Ngo Sy Tho**	Expert of Sectoral Economy Department Office of Government No. 01 Hoang Hoa Tham Str., Ba Dinh District, Hanoi, Socialist Republic of Vietnam Tel. +84 90 3 365 757 E-mail: ngosytho@.chinhphu.vn
10	**Dr. Nguyen Tien Long**	Deputy General Director Petrovietnam Exploration Production Coporation (PVEP) Floor 6, 18 Lang Ha Str., Ba Dinh District, Hanoi Tel. +84 4 3772 6001 (Ext. 4869) E-mail: longnt@pvep.com.vn
11	**Mr. Nguyen Van Duc**	Director, Research & Engineering Institute Vietsovpetro J/V 105 Le Loi Str., Vung Tau City, Vietnam Mobile. 0937884009 E-mail: ducnv.hq@vietsov.com.vn
12	**Mr. Trinh Xuan Cuong**	Director Petroleum Exploration and Production Centre, VPI VPI tower, 173 Trung Kinh, Hanoi, Vietnam Mobile. 0983630994 E-mail: cuongtx@vpi.pvn.vn
13	**Mr. Nguyen Thanh Hai**	Senior Development Engineer Petrovietnam Exploration Production Coporation (PVEP) Floor 6, 18 Lang Ha Str., Ba Dinh District, Hanoi, Vietnam Mobile. 0913389980 E-mail: haint@pvep.com.vn

NO.	NAME	DESINATION / COMPANY / E-MAIL ADDRESS
14	**Mr. Tran Thanh Tung**	Deputy Director General, Energy Department, Ministry of Industry and Trade (MOIT) 54 Hai Ba Trung Str., Hoan Kiem Dstrict, Hanoi Tel. +84 913 271 700 E-mail: TungTT@moit.gov.vn
15	**Mr. Do Quoc Anh**	Deputy General Manager, Exploration Department Petrovietnam Exploration Production Coporation (PVEP) Floor 6, 18 Lang Ha Str., Ba Dinh District, Hanoi Tel. +84 4 3772 6001 (Ext. 4936) E-mail: anhdq@pvep.com.vn
16	**Mr. Pham Thanh Liem**	Deputy Manager of Reserves Management Department Exploration Division Vietnam Oil and Gas Group, PETROVIETNAM No. 18, Lang Ha Street, Ba Dinh District Hanoi, Socialist Republic of Vietnam Tel. +84 4 3825 2526 ext. 6617 E-mail: liempt@pvn.vn
17	**Mr. Nguyen Trung Hieu**	Deputy Manager Petroleum Exploration and Production Centre, VPI VPI tower, 173 Trung Kinh, Hanoi, Vietnam Mobile. 0989832666 E-mail: hieunt@vpi.pvn.vn
18	**Mr. Le Hong Lam**	Officer, Petroleum Contract Management Division Vietnam Oil and Gas Group, PETROVIETNAM No. 18, Lang Ha Street, Ba Dinh District Hanoi, Socialist Republic of Vietnam Tel. +84 4 3825 2526, Mobile. 0908089399 E-mail: lamlh@pvn.vn Website: http://www.petrovietnam.vn
19	**Mrs. Tran Chau Giang**	Deputy General Manager of Science and Strategy Division Vietnam Petroleum Institute (VPI) VPI tower, 173 Trung Kinh, Hanoi, Vietnam Mobile. 0912585526 E-mail: giangtc@vpi.pvn.vn
20	**Mr. Vu Ngoc Diep**	Expert, Exploration Division Vietnam Oil and Gas Group, PETROVIETNAM No. 18, Lang Ha Street, Ba Dinh District Hanoi, Socialist Republic of Vietnam Tel. +84 4 3825 2526 ext. 6618 E-mail: diepvn@pvn.vn Website: http://www.petrovietnam.vn
21	**Mr. Le Dang Dung**	Officer, Gas Division Vietnam Oil and Gas Group, PETROVIETNAM No. 18, Lang Ha Street, Ba Dinh District Hanoi, Socialist Republic of Vietnam Tel. +84 4 3825 2526, Mobile. 0983001100 E-mail: dungld@pvn.vn Website: http://www.petrovietnam.vn

VASI

NO.	NAME	DESINATION / COMPANY / E-MAIL ADDRESS
22	**Dr. Vu Truong Son**	Director of Marine Geology and Mineral Resources Center (MGMC), VASI Tel: 84 37842323 Mobile: 0913 506015 Email: vts_mgu@yahoo.com.vn Address: 125 Trung Kinh Str, Cau Giay Dist, Ha Noi, Viet Nam
23	**Dr. Nguyen Minh Trung**	Official of Department of International Cooperation and Science-Technology (DICST), VASI Mobile: 0903433514 Email: nmtrung@monre.gov.vn
24	**ME. Do Huy Thinh**	Deputy Dierector in charge, Bureau of Marine Resources and Environment Servey and Control, VASI Mobile: 0913257127 Email: dhthinh2009@gmail.com
25	**MA. Pham Thi Tuyet Minh**	Head of Division, Management of Planning, Bureau of of Seas and Islands Use Management, VASI Mobile: 0946 449288 Tuyetminh0084@gmail.com
26	**Dr. Đo Tu Chung**	Deputy Director of Marine Geology and Mineral Resources Center (MGMC), VASI Mobile: 0912 072882 Email: dochung@gmail.com
27	**Eng. Ho Quoc Khanh**	Science, Technology and International Relations Division , Marine Geology & Mineral Resources Center (MGMC), VASI Mobile: 0903 296828 Email: hqkhanh62@gmail.com
28	**MA. Ngo Thanh Thuy**	Deputy Leader-Marine Geophysical Union, Marine Geology & Mineral Resources Center (MGMC), VASI Mobile: 0912 586292 Email: ngothanhthuy60@gmail.com
29	**Eng.Van Đuc Nam**	Marine Geology and Minerals Union Marine, Geology & Mineral Resources Center (MGMC), VASI, VASI Mobile: 0912037222 Mail: namvanmgmc@gmail.com
30	**Dr. Nguyen Le Tuan**	Deputy Dierector, Rerseach Institute for the Mannagement of Seas and Islands VASI Mobile: 0912145169 Mail: ngletuan1969@yahoo.com Or nltuan@monre.gov.vn

NO.	NAME	DESINATION / COMPANY / E-MAIL ADDRESS
31	**Dr. Sc. Nguyen Bieu**	Vietnam General Association of Geology Mobile: 0902112002 Email: nguyenbieu_vn@yahoo.com
32	**MA. Nguyen Dinh Thai**	Center of Marine and Island , Hanoi National University Department of Geology, Hanoi National University Mobile:0982555987 Email: thaind@vnu.edu.vn
33	**Dr. Trinh Hai Son**	Principal Official- Department of Science and Technology, MONRE Mobile: 0904100041 Email:thaison@monre.gov.vn
34	**Mr. Nguyen Khac Tien**	Official of Department of International Cooperation and Science-Technology (DICST), VASI Tel: 084.37736550
35	**Mr. Đo Xuan Truong**	Official of Department of International Cooperation and Science-Technology (DICST), VASI Tel: 084.37736550
36	**Mr. Nguyen Thanh Vinh**	Deputy Chief of VASI Office, in Charge of Program No. 47 Mobile: 0913226386 Email: nguyenthanhvinhvasi@yahoo.com
37	**Mr. Vu Nam Phong**	Director, Center for Monitoring and Environmental Analysis, QN DONRE Mobile: 0912624108 Email: vunamphonghalong@gmail.com

Organizing Committee		
38	**Mr. Pham Tuan Viet**	Senior Officer, Science & Technology Division Vietnam Oil and Gas Group, PETROVIETNAM No. 18, Lang Ha Street, Ba Dinh District Hanoi, Socialist Republic of Vietnam Tel. +84 4 3825 2526 ext. 7513 E-mail: vietpt@pvn.vn
39	**Mr. Pham Van Huy**	Secretary of CCOP Vietnam Deputy General Manager, Science & Technology Division Vietnam Oil and Gas Group, PETROVIETNAM No. 18, Lang Ha Street, Ba Dinh District Hanoi, Socialist Republic of Vietnam Tel. +84 4 3825 2526 ext. 7504 E-mail: huypv@pvn.vn Website: http://www.petrovietnam.vn
40	**Mrs. Nguyen Ha Phuong**	Senior officer, Science & Technology Division Vietnam Oil and Gas Group, PETROVIETNAM No. 18, Lang Ha Street, Ba Dinh District Hanoi, Socialist Republic of Vietnam Tel. +84 4 3825 2526 ext. 7509 E-mail: nhp-adm@pvn.vn Website: http://www.petrovietnam.vn
41	**Mr. Ngo Van Hung**	Officer, Science & Technology Division Vietnam Oil and Gas Group, PETROVIETNAM No. 18, Lang Ha Street, Ba Dinh District Hanoi, Socialist Republic of Vietnam Tel. +84 4 3825 2526 ext. 7512 E-mail: hungnv02@pvn.vn Website: http://www.petrovietnam.vn
42	**Ms. Tong Thi Hong Minh**	Deputy Director, Department of International Cooperation and Science-Technology (DICST) Vietnam Administration of Seas and Islands (VASI) P413 Building A, 83 Nguyen Chi Thanh, Dong Da, Hanoi, Vietnam Tel: + 84 4 37759914, Mobile: + 84 904239255 Email: thminh@monre.gov.vn or hailinhngoc@yahoo.com Website: www.monre.gov.vn
43	**Mr. Tran Van Hung**	Official of Department of International Cooperation and Science-Technology (DICST), VASI E-mail: tranhung1177@yahoo.com Mobile: 0989135699
44	**Ms. Kieu Thị Thanh Loan**	Science, Technology & International Relations Div. Marine Geology & Mineral Resources Center (MGMC), VASI, MONRE Email: dtloan79@gmail.com Mobile: 0904 804 379
45	**Mr. Pham Quang My**	Deputy Chief of Administrative office, VASI Mobile:0913271868 Email: Pqmy@monre.gov.vn
-	**Ms. Petcharat Sarawistura (Fern)**	Program Manager, CCOP Technical Secretariat, Tel: +662 6445468 ext. 501, Fax: +662 6445431 Mobile (66) 81 823 3729 Email: fern@ccop.or.th

WORKSHOP ON GAS HYDRATES
1-3 March 2011, Halong Bay, Vietnam

SUMMARY EVALUATION

Description	Excellent 5	4	3	2	1 Unsatisfactory
1) Were the Lecturers well prepared?	27	18			
2) Were the Lecturers knowledgeable?	32	13			
3) Workshop presentations	29	16			
4) Did the Lecturers, Workshop help you with needs&requirement?	24	17	4		
5) Was there a good mixture of theory and practice?	22	21	2		
6) Were the examples good?	24	18	3		
7) Was the Worksop relevant to your job?	33	12			
8) Overall Workshop assessment.	35	8	2		
9) Did you enjoy the Workshop?	32	13			
10) Did the Workshop meet your expectations?	34	11			

11) Please clarify if you missed something.

-equipments for GH research
-environmental impact and regulations
-posters exhibition area for further discuss
-possible environmental impact related to GH survey, exploration and extraction activities
-analysing 2D, 3D seismic profile, such as how the way to draw bottom simulation reflects and other sequence stratigraphy

12) How many people in your institution/company/organization will benefit from the seminar? (please give an estimate)

-staffs in Research Institutes, Organizations and University students (M.Sc.&Ph.D)
-there are a lot of information about GH for a hundred of Vietnam scientists at least
-this kind of workshop will useful for many researcher, scientists and students in many research institutes and universities

13) What changes do you think could be made to improve the Workshop?
(quality of workshop content , venue, facilities, etc.)?

-workshop is very good, but participants want to have handout before the workshop, if it is possible
-some lectures should talk slowly to make more attractive presentation and participants can capture all important details
-more examples in the term of studying GH in theory as well as in practical
-more time for dedicate discussions in breakout groups could have been very valuable to identify some areas for collaboration
-workshop duration was unfortunately too short time
-more participation from petroleum industry could attend and sharing to make value add to the workshop
-quality of workshop contents, especially in practical aspects

14) Perspectives after the Workshop. How would you put value to the knowledge learned?

-basic understanding about GH as a new energy for future, very good international overview
-exchange of knowledge and understand more and clear detailed of GH
-understand the basic knowledge of GH and current program of other countries
-the most important, the biggest value of the workshop was net working, meeting scientists & representatives of GH from all over the world
-obtained knowledge is useful and applicable
-a cooperative in future development project on GH between CCOP members and cooperating countries is helpful for capacity building of GH in CCOP and ASCOPE members
-improve capacity in researching and investigation of GH
-very good status of GH programs/research in countries present
-to know the future energy in the hungry status of the energy demand in the world, that's good for the long term infrastructure of big energy supply
-good to understand current GH programs initiated by India, Japan, Korea, China and other
-preparing to apply a national program on GH in Vietnam
-a tailor made workshop should be introduced to local participants who are in a very first step of GH study &research survey
-detailed procedure for GH survey & exploration that can be applicable in Vietnam in the future

15) Comments on the food, accommodation and the venue for the Workshop?

-simply excellent but unfortunately unstable internet
-enjoy very much and minor problem in hotel room; noises from the next door (noise prevention needed)
-it could be better if all participants can stay in the same place
-excellent & easy, made workshop focus good

16) Suggestion of topics to other PETRAD Seminars or Workshops.

-Joint Research and Study in GH: "South China Sea and Methodology to Produce GH in practice"
-Standard/Appropriate Procedures for GH Survey & Exploration
-Environmental Challenges and Impact Related to GH Survey, Exploration, Production Activities
-Carbon Capture Storage (CCS)
-Cost Benefit Analysis is GH Production
-Deepwater Exploration and production / E&P Deepwater Zones
-Method to Extract Methane Hydrates from GH, Technology Exploitation GH
-Training on GH Module
-Training the Human Resources
-Climate Change, Energy Focus, National Security and Local Impact
-VASI is taking the lead in implementing a government on GH, including a sub-project on capacity building for this field. It would be much helpful if PETRAD/CCOP can help to arrange a series of seminars and workshops for different target audiences: management, managers, technicians, and researcher of different levels
-Seminars / Workshops should be followed-up and focused on:-

- Hydrate fundamentals, an easy & important area to establish collaboration on and important in education of staff for concerning generation
- More focus on exploitation and technologies for different types of hydrates including clay hydrates
- Mechanism for creating real collaboration

PICTURES FROM WORKSHOP


Korea Gas Hydrate
PETRAD - CCOP - PETROVIETNAM - VAS
Seminar on Gas Hydrates
Halong Bay, Vietnam

PETRAD – INTERNATIONAL PROGRAMME FOR PETROLEUM MANAGEMENT AND ADMINISTRATION

Petrad is a Norwegian Government Foundation established in 1989 to facilitate sharing of knowledge and experience on Petroleum Management, Administration and Technology between managers and experts within Governments and National Oil Companies.

Petrad arranges tailor-made courses and seminars covering a wide range of topics on the management of petroleum resources. The activities are conducted in Norway and abroad lasting from 1 day to 10 weeks. The courses and seminars have a practical focus.

Petrad also conducts Training Needs Assessments and assistance with Institutional Development.

Petrad draw on resource persons and lecturers from the total Norwegian and International petroleum industry. They hold considerable experience from senior managerial and technical positions with Government, Operating-, Engineering- and Service Companies, Consultancies, R&D Institutions and Universities.

Petrad has arranged a total of more than 400 courses and seminars with more than 14.000 participants from 103 countries.

PETRAD PRODUCTS & SERVICES

8-WEEK COURSES (Stavanger, Norway – annually) - Petroleum Policy and Resource Management - Petroleum Development and Operations **TRAINING MODULES** (World wide – on request) - Policy and Management of Petroleum Sector development - Good Governance - Resource management - Revenue management - Environment management - Legislation - Licensing - Contracts for the Petroleum Sector - Local Content - Anti-corruption - Petroleum Sector Understanding for the Civil Society - Fiscal Metering - Data Management - Downstream Petroleum Management - HSE - Health, Safety and Environment Management	**TAILOR MADE SEMINARS** (World Wide – on request) - All topics within petroleum management, administration and technology **TNA – TRAINING NEEDS ASSESSMENT** (World Wide – on request) **INSTITUTIONAL DEVELOPMENT** (World Wide – on request)

For further information please contact: **PETRAD,** Professor Olav Hanssens vei 10, P.O. Box 598, NO-4003 Stavanger, Norway