

The crisis in Kashmir valley like tsunami is of a delayed reaction. Difficulty seems communication between SASE (Snow and Avalanche Studies Establishment) and the users i.e. army and local population. All avalanche-prone spots are now computable through simulations on the GIS for different rates and volumes of precipitation.

We are systematically under prepared in the war against natural hazards. System needs a psychological adjustment to become receptive to scientists and scientific matters. Science managers in our country need to be more effective and vocal about potential hazards. Scientific methods can retard the avalanches and the susceptible slopes can be managed regularly. Local hill folks would gladly help themselves if guided. Extra preparation should not be deemed a waste. In moments of truth the economics of the efforts makes sense. We had opted out of tsunami warning system against the scientific advice looking at huge costs. Now we know what was cheaper. Prevention is always better. Onus of preparation should be on hazard mitigating agencies. Governments would then be more understanding to warnings. These can turn out to be exaggerations. Erring to save lives is the wiser option. Infrastructure of hazard fighting technical and human resources takes decades to build and is a long term asset. For India to be an advanced nation in 2020, it has to be capable of standing up to all hazards with dignity. Nice to hear admission by Kapil Sibal that India is today unprepared for a major quake or a tsunami. He should know preparation is also based on

prolonged popular awakening and management of information at Panchayat as well as district and higher levels. Safety focus must spread across the country at village level. All deaths and losses due to natural hazards should be audited and responsibility fixed. Hazards never come without a brief or a protracted warning. Wasting that reaction period is at the root of our failure. This reaction time must be catalogued and valued. The clock of Parechu Lake in Tibet ticked last year in July. The lake is now frozen so is the alarm. Are we any better than we were last summer with daily red alerts? Diplomatic initiatives in advance to get the dam breached in phases can bear fruit if initiated now. Our system needs to monitor advance action against hazards rather than be always engaging in relief with our back to the wall and foredoomed defeat on our minds. Good management of natural hazards makes economic sense. People must be educated and involved in this management with maturity and sensitivity. Alert populations in villages and cities are certainly better than governmental machinery on tenterhooks. Hazard museums across the country are the need of the hour. If lessons need to be imported, there is no better example than Italy with a galaxy of natural miseries (flash floods, landslides, and volcanoes) well managed.

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PROCEEDINGS OF THE HEDBERG RESEARCH CONFERENCE 'GAS HYDRATES: ENERGY RESOURCE POTENTIAL AND ASSOCIATED GEOLOGIC HAZARDS'

The Hedberg Research Conference on 'Gas Hydrates: Energy Resource Potential and Associated Geologic Hazards', hosted by the American Association of Petroleum Geologists (AAPG), was convened in Vancouver, British Columbia, Canada, from 12-16 September, 2004. Dr. Tim Collett, U.S. Geological Survey, Denver, CO, USA and Dr. A Johnson (Hydrate Energy International, New Orleans, LA, USA) have organized this conference.

Natural gas hydrate (clathrate) is a solid, ice-like substance composed of rigid cages of water molecules that enclose molecules of gas, mainly methane. These clathrates have been found in sediments worldwide where low temperature, high pressure, water, and natural gas concentrations are conducive to their formation. Gas hydrates are present in many arctic regions and offshore

areas around the world. Hydrates represent the Earth's largest untapped energy resource (Sloan, 1998). By all estimates the volume of gas trapped in hydrates likely exceeds that trapped in all other conventional (non-gas hydrate) accumulations (Collett and Johnson, 2004). There is enormous potential to produce natural gas from gas hydrate deposits in the coming decades (Makogon et al. 2004).

Gas Hydrate Research is still a very young field with many unanswered questions/issues viz., energy potential, geological hazards and the possible relationship to global climate change.

Conference Goals

This Hedberg Research Conference has been organized to examine the rapidly emerging field of gas hydrates.

Scientists from various disciplines, including geology, geophysics, and reservoir engineering, have participated in this conference and discussed the state-of-the-art concepts, methodologies, case histories, and the future direction of gas hydrates as an energy resource.

The primary goals of the conference were to critically examine the geologic parameters that control the occurrence and stability of gas hydrates, assess the volume of natural gas stored within known gas hydrate accumulations, assess exploration methods for identifying gas hydrate prospects, identify the technologies needed to economically produce gas from hydrate, assess possible marine slope stability hazards that can be attributed to the occurrence of gas hydrate, and analyze the effects of gas hydrate on drilling safety.

The Conference Program

The conference started at 08.00 am on Monday 13th September 2004 at the Coast Plaza Hotel in Vancouver, B.C. Canada with welcoming remarks by Dr. Debbi Boonstra, AAPG Education Department, on behalf of the AAPG, after which the Hedberg Research Conference Theme was highlighted with welcoming speech by the Conference Convener Dr. Timothy Collett, US Geological Survey, Denver Colorado, USA who, besides Dr. Arthur Johnson Hydrate Energy International, New Orleans, LA, USA have played a key role in organizing this conference. This was followed by several technical Oral and Poster Sessions, covering various aspects of gas hydrates, the main themes being:

Technical Oral Sessions: (1) Challenges of Unconventional Resources; (2) Gas Hydrate Resources Development Research; (3) Resource Potential and Geology of Marine Gas Hydrates; (4) Resource Potential and Geology of Terrestrial Arctic Gas Hydrates; (5) Geologic Controls on the Occurrence of Gas Hydrate; (6) Gas Hydrate Resource Production Testing and Modeling.

Further, poster sessions, topical group discussions and panel discussions were also held.

- More than 120 participants from 13 different countries (USA-75; Canada-20; Japan-7; China-3; India-3; U.K.-3; Norway-2; Australia-2; Russia-2; Taiwan-2; one each from Germany, New Zealand and Trinidad) reflecting multi-national interest in gas hydrates attended the Conference.
- In all, 89 Research Papers were presented (43 research papers in oral sessions and 46 research papers in poster sessions).
- Dr. M. W. Downey delivered a banquet keynote address

titled 'Boulders in the Path, Problems on the Way Towards the Gas Hydrate Rainbow' and elaborated on gas hydrate economics.

- Also, Topical Group Discussions were held at the end of regular sessions on 14th and 15th September, 2004.
- The Conference provided an effective forum for communication among Scientists, Engineers and Administrators from government agencies, academia and from industry from the above mentioned countries. It was also a unique opportunity for geoscientists to learn about the recent research work that has been carried out in the realm of Gas hydrates.
- The Conference concluded with a panel discussion on Geology and Energy Resource Potential of Gas Hydrates, besides production techniques and the role of gas hydrates in seafloor stability.
- Attending this unique and important conference has been very fruitful and useful to the on-going studies on gas hydrates along the continental margins of India. Such studies would provide a platform for greater involvement of R&D activities from Indian Ocean Rim countries in their endeavor to explore and possibly exploit gas from gas hydrates from the continental margins, in the near future.

Highlights of the Conference

The presentations at the conference covered various geological, geophysical and geochemical aspects of gas hydrates in the Pacific, Atlantic and Indian Ocean areas, besides those in the Arctic regions.

At the commencement of each session, the Conference Conveners introduced the session's theme. A brief outline of the sessions' presentation is as follows:

- In the Session on 'Challenges of Unconventional Resources' the importance of gas hydrates, how to explore the resources, and basics for the development of gas hydrate deposits have been presented.
- The Session on 'Gas Hydrate Resources Development Research' discussed the results of drilling for methane hydrate evaluation in the Nankai Trough; coring in the Gulf of Mexico; the lessons learned from the past three decades of Gas Hydrate exploration at the Mallik Gas Hydrate Field; well planning operations in the Arctic Alaska; and economic viability of gas hydrates in the North Slope Alaska.
- In the Session on 'Resource Potential and Geology of Marine Gas Hydrates' - an exhaustive account of geological, geophysical, geochemical aspects and physical properties of Gas Hydrates have been presented. The areas studied included Nankai Trough;

- Hydrate Ridge; Cascadia margin; Scotian Slope, eastern Canada; and the Storegga Slide along the Norwegian Margin.
- An exclusive Session was devoted to Gas Hydrate investigations in the Gulf of Mexico.
 - The Session on 'Resource Potential and Geology of Terrestrial Arctic Gas Hydrates*' covered topics viz., Prospecting for Gas Hydrates using seismic techniques in North Slope, Alaska; P/T Salinity influences on Gas Hydrate stability in sediments, Mallik Gas Hydrate Reservoir; the origin of gases in permafrost associated gas hydrate, Arctic Alaska, and gas hydrates occurrences in the region north of West Siberia.
 - In the Session on 'Geologic Controls on the Occurrence of Gas Hydrate' factors for the lack of gas flux from the Blake Ridge Depression, and the formation, occurrence and dissociation of gas hydrates in marine environment have been discussed. Numerical models of well-characterized gas hydrate reservoirs in a range of geological settings, and potential natural gas hydrate resources in Indian offshore areas have also been dealt with.
 - In the last Session 'Gas Hydrate Resource Production Testing and Modeling', an overview of production test results from JAPEX/JNOC/GSC Mallik 5L-38 Gas Hydrate Research Well, numerical studies of gas production from oceanic hydrates, and economics of gas production from Alaska north slope and onshore gas hydrate production from Mallik Gas Hydrate Field have been presented.
 - A series of poster presentations described the methodologies and provided new perspectives on Gas Hydrate Production techniques.
 - The Topical Discussion was devoted to:
 - i) Gas Hydrate 'Assessments' [Resources vs Reserves differences]:
 Estimation of the amount of gas hydrate and associated free gas within a given gas hydrate accumulation;
 Lessons learnt from Gulf of Mexico & Mallik 5L-38 Gas Hydrate Research Field.
 Gas Hydrate 'Resource' assessments on National/Regional scale.
 - ii) The nature of Gas Hydrates Occurrence
 - iii) Gulf of Mexico Gas Hydrate Occurrences,
 - iv) Gas Hydrate Petroleum System: Passive vs Active margin settings and the factors controlling the formation and occurrence of Gas Hydrates, and
 - v) Experimental investigations reg. cementing characteristics of Gas Hydrates.
 - The Panel Discussions dealt with Geology and Resource Potential of Gas Hydrates viz. occurrence, distribution, geological controls; differences between marine and permafrost hydrate deposits, refinement of field and laboratory techniques, development of gas hydrate petroleum system model, exploration, drilling and production technology development and economic assessment of resources.
 - The conference participants expressed that we need an improved understanding of:
 - o Characteristics of gas hydrate occurrences,
 - o Geological, geophysical and geochemical variations in oceanic and permafrost gas hydrates.
 - o Physical properties of gas hydrates in different settings, including the effect of gas hydrates on sediments, and potential hazards associated with gas hydrates, especially slope stability issues (both natural and human induced).
 - o Identification of viable prospects/sites the world over, including their geometry in space and time.
 - o Gas Hydrate Resource characterization (Proven resources/in-place resources and how much gas is present?)
 - o Gas Hydrate Petroleum System Concept, as it compares to conventional oil and gas petroleum system, involving components such as source, migration, reservoir, trap, seal, and stability
 - o Coupling geological observations to complex numerical models as a predictive tool for evaluating the evolution of gas hydrate reservoirs at multiple spatial and temporal scales.
 - o The linkages between processes and observations, which hold key to further advancement of our understanding of the formation of gas hydrates.
 - o These goals may be achieved through collaborative research, involving Govt., industry and academic institutions.
- Although significant progress has been made in understanding the geological aspects of gas hydrates, the conference participants were of the opinion that there is much more work to be done specially in the acquisition of data using better geophysical methods that would allow for the direct detection and evaluation of gas hydrate accumulations, besides analyses and synthesis of data on gas hydrates. It was noted that none of the existing assessments have predicted how much gas can be produced from the world's gas hydrate accumulations, and it was concluded that much more work is needed to go beyond the existing in-place gas hydrate volumetric estimates. Industry representatives

expressed the importance of relatively small, well-defined, gas hydrate accumulations in the 1 to 5 trillion cubic feet (TCF) range that can be drilled, tested, and possibly produced. Marian Downey challenged the audience to "think bigger" and view gas hydrate production as a potential paradigm shift of global importance (Collett and Johnson, 2004). The conference participants concluded that a key goal of industry should be to document that commercial rates of gas production from hydrates are possible, and we need more dedicated and expanded field production testing to assess the ultimate resource potential of natural gas hydrates, besides the documentation of case histories of actual gas hydrate-induced drilling and completion problems.

However, the Conference provided a wealth of scientific information to resource managers, planners and scientific community, which could contribute to the development and evaluation of natural gas hydrates resource potential in marine as well as in Permafrost environments. Finally, it has been felt that one can take the present understanding forward as a viable testing concept through pilot study, under certain conditions.

From the presentations at the conference as well as the inspiring discussions among the participants, the Conveners prepared a write up (pl. see <http://www.netl.doe.gov/scngo/> natural gas hydrates, for details), which outlines the

importance of gas hydrates as an unconventional resource, and presents recommendations for future research and technology development for gas hydrate exploration and exploitation from the world oceans, besides the permafrost environment, in the near future

The abstracts published in the Conference proceedings volume are available on the AAPG website (<http://www.aapg.org>) under the Education/Hedberg section. A review of this Hedberg Conference was published in the Fall Issue of DOE Methane Hydrates Newsletter- Fire In the Ice, available on the above website.

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DISCUSSION GROUP ON EARTH SCIENCE EDUCATION IN INDIA

As of now there is no common forum for articulation to those interested in Earth Science Education in India. Many teachers, geoscientists and professional geologists have been doing their bit in isolation to improve Earth Science education. Often, their ideas and activities have not received the attention they deserve.

This group has been started to form a circle of all those who have an interest and commitment to Earth Science education at the school/college/university level and popularization of Earth Sciences among children and common man in India. Through this group, one can share ideas, experiences, reports and activities, information on

forthcoming meetings / seminar/ symposia in Earth Science education.

Interested scientists and teachers can join the group by sending a message to Earth_Sci_Edn_India-subscribe@yahoogroups.com. The group's website is http://groups.yahoo.com/group/Earth_Sci_Edn_India/

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