



# Japan's National Methane Hydrate R&D Program -Overview and Status-

11<sup>th</sup> November, 2009

Technology & Research Center  
Japan Oil, Gas and Metals National Corporation



**MH21** *Research Consortium for Methane Hydrate Resources in Japan*

## Outlines

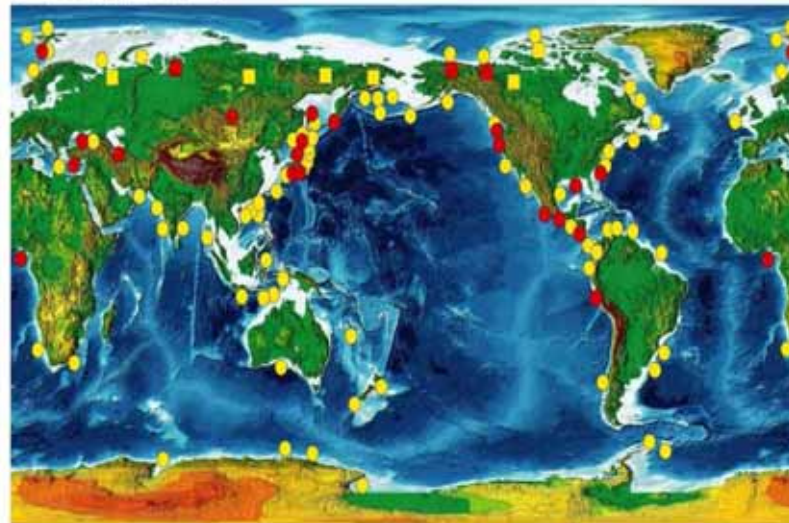
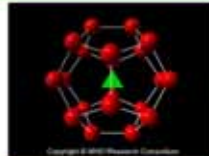
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- ◆ Overview of the Japan's National Methane Hydrate R&D Program
  - Background
  - Objectives and Goals
  - Road Map of the Research and Development Program
- ◆ Key accomplishments of Phase- I Research
- ◆ Future Challenges
- ◆ References



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## Distribution of Methane Hydrate around the World



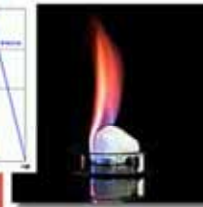
- Ocean and Lakes
- Land (Permafrost)
- Methane Hydrate Sample
- Inferred Methane Hydrate

Kvenvolden,  
Mikio Sato (2001)

- Methane hydrate is stable under the conditions of low temperature and high pressure. (Ex. at 40 atm, at 5deg. or lower )

- Where on earth meet the conditions.

- Onshore: Polar region (Permafrost)
- Offshore: Deep sea (> 400~500m) shallow layers (less than 500m) from the sea bottom



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## Background

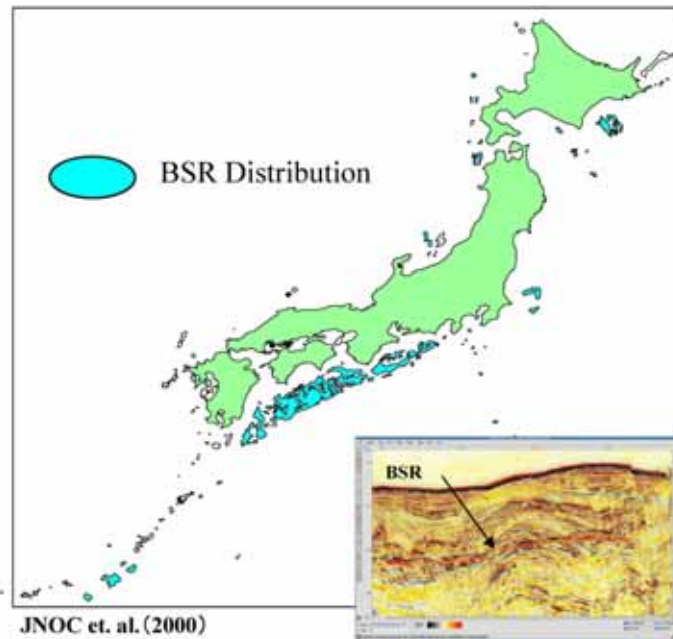
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- ◆ METI-Test-Well-1999 “ Nankai Trough” has revealed and confirmed the occurrence of methane hydrate filling pore spaces of sand layers in the marine environment. This finding was accomplished base on the lessons and learns of METI-3D seismic survey conducted in 1996 and the Experimental Well in Mackenzie Delta in 1998.
  - The Agency for Natural Resources and Energy of the Ministry of Economy , Trade and Industry( METI) has been conducting “Oil and Gas Domestic Survey Program”, which intend to accumulate fundamental data sets of seismic surveys and test drillings for evaluating hydrocarbon potentials in Japan and to promote E&P activities by the private sector.
  
- ◆ These findings have encouraged Japan a potential of methane hydrate as one of the future energy resources. METI compiled in 2001 a long term national plan called “ National Methane Hydrate R&D Program”, which intended to find and clarify challenges and to develop technologies for possible production of methane from hydrate.
  
- ◆ Implementation of the program, a research consortium “ MH21” was established and conducted the first phase of the three staged R&D program.

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## Japan's National Methane Hydrate R&D Program

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Preliminary surveys and researches suggested that Methane hydrate is expected to exist in large amount offshore Japan from BSR distribution in seismic data.

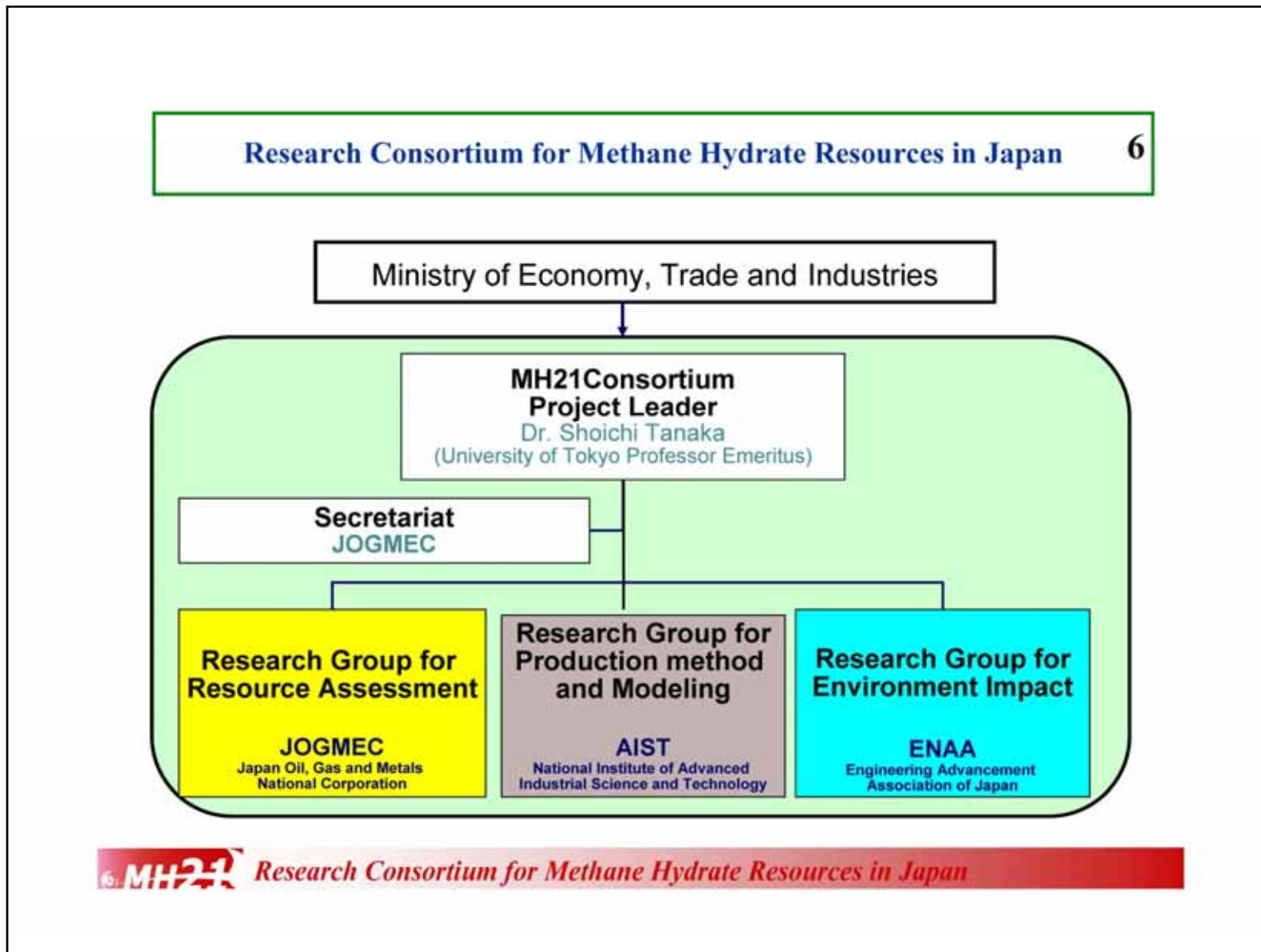


Methane hydrate is expected to be future domestic energy which contributes to Japan's energy security.



**National Methane Hydrate R&D Program** started under the Ministry of Economy, Trade and Industry (METI) in July 2001





## Objectives and Goals of the Program

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### Objectives

The project is intended to promote technical development for economical exploration and production of methane from hydrate, and to facilitate its utilization and contribution to the long-term stable energy supply.

Target should solely be the methane hydrate filling pore spaces of sand layers in the marine environment.

### Goals

1. Clarification of the features of methane hydrate resources offshore Japan
2. Assessment of methane gas amounts in promising methane hydrate bearing offshore area
3. Selection of methane hydrate resource fields from promising methane hydrate bearing offshore area and study of their economic potential
4. Implementation of production test in the selected methane hydrate resources fields
5. Improvement of technologies for commercial gas production
6. Establishment of an exploitation system complying with environment



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## Road map of the Program

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### Schedule

● **Phase 1 [FY2001~FY2008]**

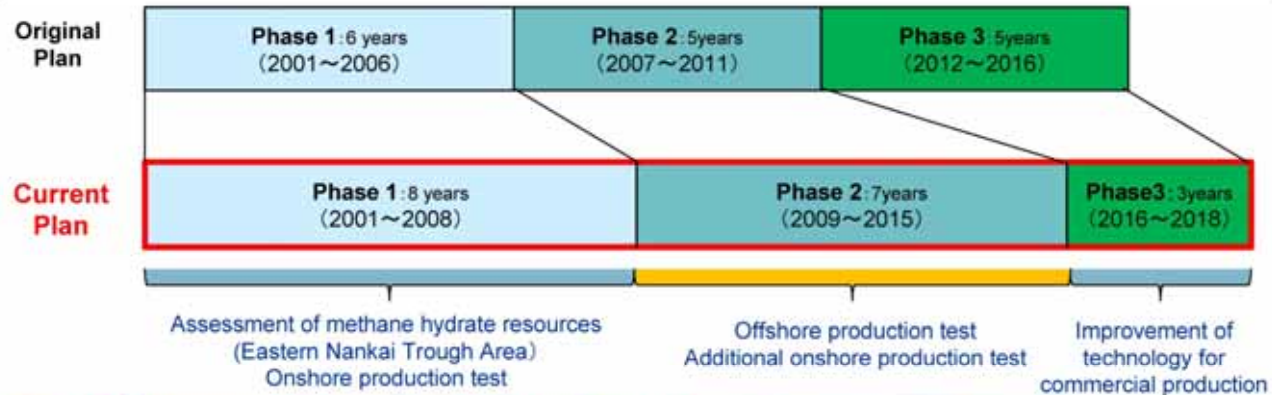
2/3D seismic survey and Exploratory drilling offshore Japan, Onshore production test, Basic research (exploration techniques, dissociation methods, production technologies, simulator development, environmental impact assessment)

● **Phase 2 [FY2009~FY2015 (original plan:FY2011)]**

Offshore production tests,

● **Phase 3 [FY2016 (FY2012) ~FY2018 (FY2016)]**

Improvement of technology for commercial production, evaluation of economic feasibility and environmental impact of a large scale development



**6. MH21 Research Consortium for Methane Hydrate Resources in Japan**



**Key Accomplishments of the eight years of the Phase-1 R&D  
Methane Hydrate Research in Japan**

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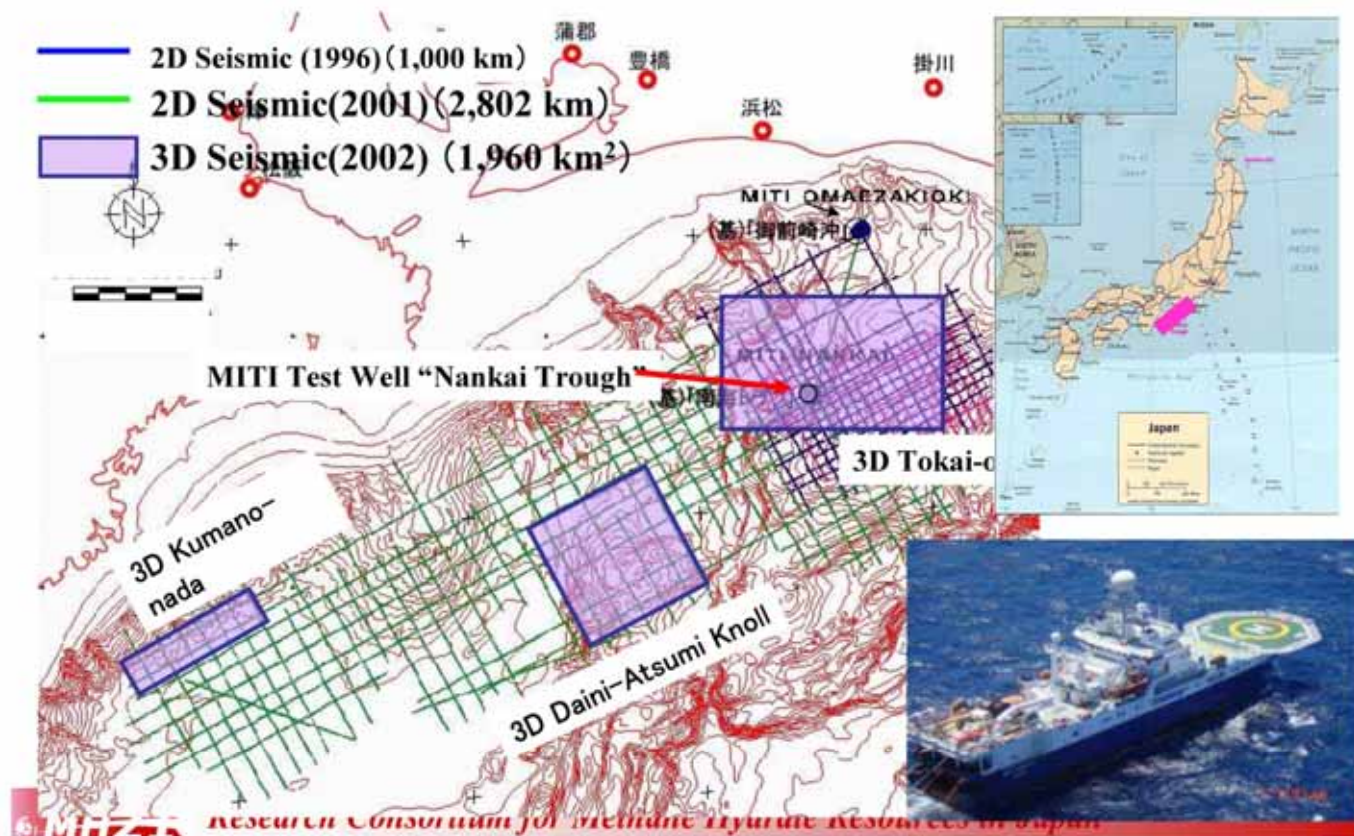
1. Revealed and confirmed the occurrence of methane hydrate filling pore spaces of sand layers in the marine environment for the first time in the eastern Nankai Trough area through the drilling of the METI exploratory test wells in 1999 and 2004.
2. Established methodology to delineate the thick methane hydrate concentrated zones composed of alternations of highly hydrate-saturated turbidite sand mainly by geophysical measures.
3. Evaluated the amount of gas trapped in the Eastern Nankai Trough area, applied a probabilistic method based on the borehole data and seismic data, contained in methane hydrate-bearing layers.



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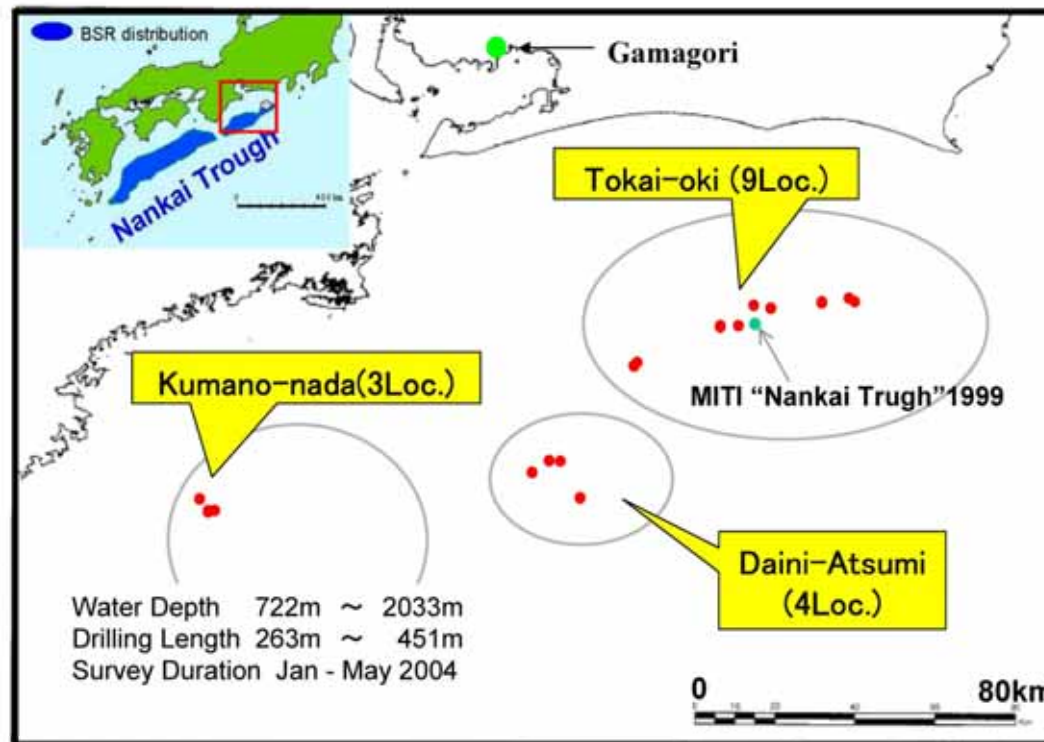
## Seismic Campaign in the eastern Nankai Trough

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### Drilling Campaign in the eastern Nankai Trough

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## Occurrence of Methane Hydrate and Target for MH21 Research

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1) Sand (pore space)



2) Mud (massive)



3) Massive Surface



1) METI Well "Tokai-oki to Kumano-nada" Core. Water depth:720m, Depth from sea floor:164m

->Target

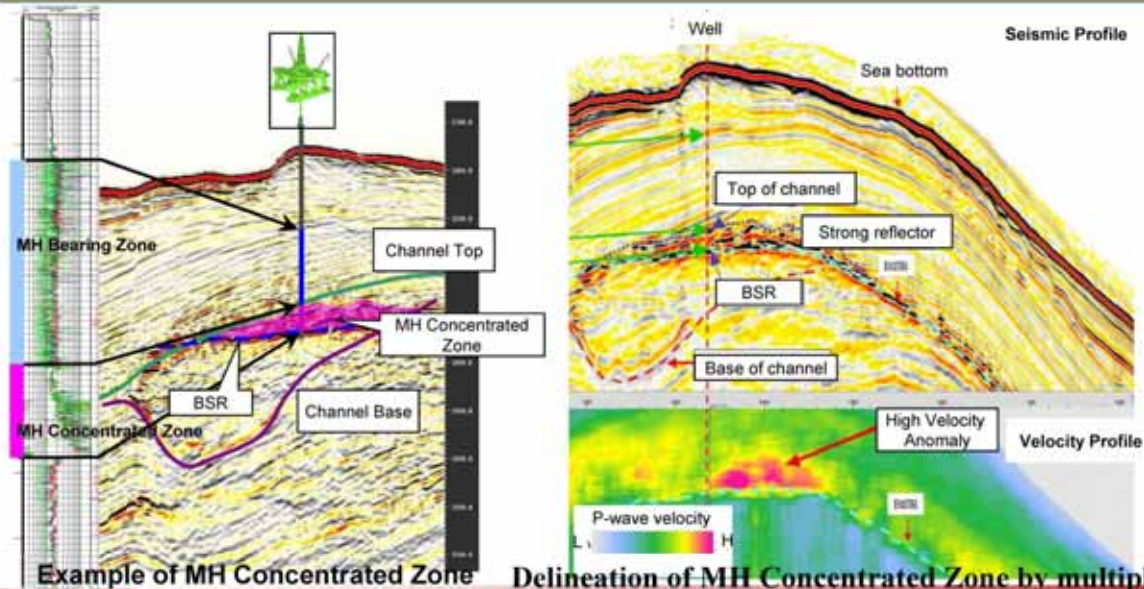
2) METI Well "Tokai-oki to Kumano-nada" Core. Water depth:1862m, Depth from sea floor:126m

3) Gulf of Mexico. Water depth:545m, Sea floor (ref. Fire in the Ice, Winter 2004)



### Delineation of Methane Hydrate Concentrated Zone

● JOGMEC developed workflow to extract methane hydrate concentrated zone with the multiple indicators in the seismic data:



Example of MH Concentrated Zone      Delineation of MH Concentrated Zone by multiple indicators

**MIHRS** Research Consortium for Methane Hydrate Resources in Japan



**Key Accomplishments of the eight- years of the Phase-1  
Methane Hydrate Research in Japan(2)**

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4. Tested and achieved substantial methane gas production through the wellbore from subsurface hydrate-bearing layers by dissociating hydrates in Canadian arctic area under international collaboration.

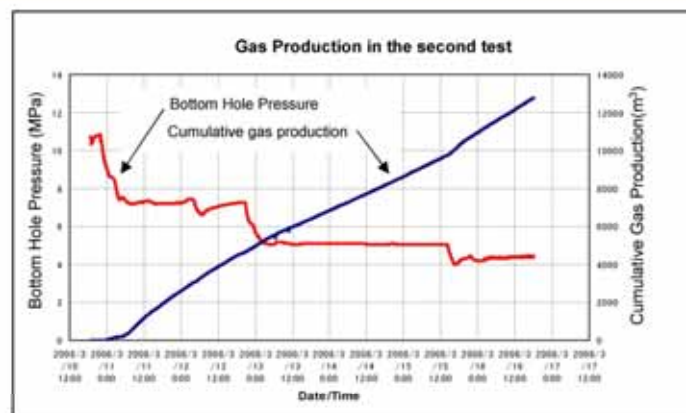
Both depressurization method (2007 and 2008) and hot water circulation method (2002) were successfully conducted to produce methane gas, and the depressurization method was proved to be effective as a production method that could be utilized in the future.



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## The Onshore Gas Production Test

- The first year winter (2007) operation focused on installing infrastructure and undertaking short production test. Sand production prevented the continuous pumping, and operation was terminated 60 hours. During the most successful 12.5 hours of the test, at least 830m<sup>3</sup> of gas was produced.
- The second year winter (2008) test was conducted with countermeasures to overcome the problems in 2007. Six days of continuous operation of the pumping established stable pressure conditions. Stable gas flow was measured at the surface with a sustainable flare of the hydrate gas (Gas flow: 2000-4000m<sup>3</sup>/d, cumulative production about 13,000m<sup>3</sup>).



**Key Accomplishments of the eight years of the Phase-1 R&D  
Methane Hydrate Research in Japan (3)**

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5. Established experimental testing methods of core samples obtained from methane hydrate-bearing layers and associated formations at the in-situ conditions.
6. Evaluated distributions and physical properties at the in-situ conditions of turbidite sand and mud alternate layers by means of retrieved core samples with the improved PTCS (pressure temperature maintained core sampler) system developed in Japan. Established also a standardized method to make artificial core samples of hydrates in sand pores.
7. Developed a simulator, MH21-HYDRES specifically for methane hydrate production behaviors and utilized for designing of production tests and evaluated the flow behaviors.

## Experiments and Modeling of dissociation behavior

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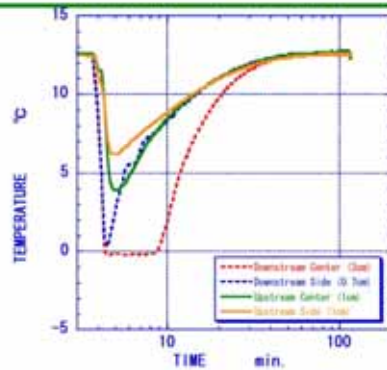
Apparatus for dissociation tests



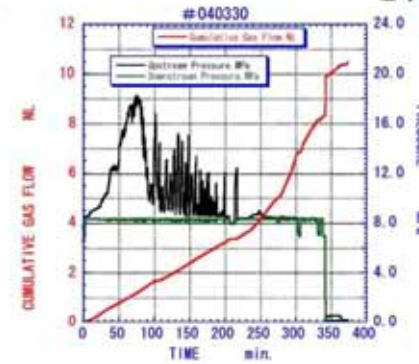
Hi-speed X ray CT



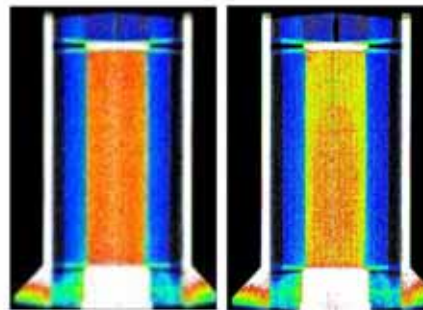
Facility for core dissociation test



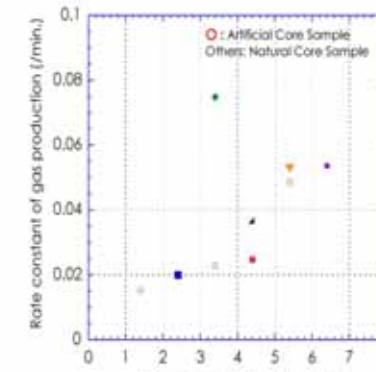
Analysis of depressurization test



Analysis of hot water injection test



Beginning 22 min. after  
Dissociation behavior in depressurization



Depressurization test for natural core



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**Major Technical Challenges in the next Phase****18**

- ◆ Resource assessment of methane hydrate offshore Japan other than the Eastern Nankai Trough,
- ◆ Long term production test to understand long term gas production behavior from methane hydrate under substantial flow rates (onshore),
- ◆ Offshore production tests by depressurization method in the Eastern Nankai Trough,
- ◆ R&D to enhance productivity by injecting external energy of any kind along with depressurization,
- ◆ Assessment of the environmental impact on gas production from methane hydrate in the Eastern Nankai Trough,



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## References

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