Vol. 3, Iss. 2

Fire in the Ice

THE NATIONAL ENERGY TECHNOLOGY LABORATORY METHANE HYDRATE NEWSLETTER

NETL

CONTENTS

Hot Ice #1: First Dedicated Hydrate Research Well In Alaska

Anadarko Petroleum, Maurer Technology, and the U.S. Department of Energy began drilling the first dedicated hydrate research well in Alaska on March 31, 2003.

The Hot Ice #1 well is the culmination of a year of intensive planning, preparation, development and testing of special tools and facilities. The purpose of the well is to evaluate the subsurface hydrate occurrence and to demonstrate novel drilling technologies that protect the tundra environment while solving some of the problems associated with operations in permafrost regions.

Hot Ice #1

Hot Ice #1 is located approximately 20 miles by air south of the Kuparuk River Oil Field Center and about 40 air miles southwest of Prudhoe Bay. The completed well will be approximately 2,600 feet (792 meters) deep. Based on nearby offsets (the Cirque and Tarn wells), hydrates are expected to occur in sands near the base of the permafrost.

Aerial view of Anadarko's Arctic Platform, set up and fully operational at Hot Ice #1. Photo courtesy of the Anadarko Petroleum Corporation.

This is Your Newsletter
Fire in the Ice is the newsletter for the entire hydrate community. It is challenging to bring together such a diverse group of researchers and devise a newsletter that will be interesting to all of you. If you have or know of something you'd like to see published in *Fire in the Ice*, or have ideas for how to improve the newsletter, please contact us.

CONTACT POINT

Brad Tomer
Gas Exploration
Production & Storage
Product Manager
National Energy
Technology Laboratory
(304) 285-4692
(304) 285-4216 fax
brad.tomer@netl.doe.gov

Be sure to visit our website at http://www.netl.doe.gov/scng/hydrate

Drilling of Hot Ice #1 proceeded smoothly through the first weeks in April. However, in mid-April, unseasonably warm weather conditions set in over the Arctic. With the warm weather and thawing permafrost, Anadarko decided on April 21 to suspend drilling. Drilling operations will begin again in the fall as temperatures decrease and conditions improve. According to Keith Millheim, Technology Manager for Anadarko, "our company is committed to completing the well, despite this delay."

Hot Ice #1 currently stands at 1,403 feet (425 meters) deep. The base of the permafrost was crossed at about 1,250 ft, and intermediate casing was set in the thick shale that forms the boundary between the Ugnu and West Sak formations. Comparison to West Sak 20 suggests there is a sand accumulation at the top of the West Sak formation, and this zone should provide the best chance to encounter hydrates.

The entire interval was cored, with core recovery of over 90 percent. During the coring process, a Sandia Lab tool was used to monitor the downhole hydrostatic pressures and mud temperatures. Open-hole wire line logs were acquired, and 7-inch casing was set and cemented.

On the bright side, the break in drilling activity will provide time to evaluate the acquired core and log data. The suspension of activity will also provide an excellent opportunity to test the Arctic Platform. When operations resume, there should be ample time to finish coring and completion, to perform well testing, and to run vertical seismic profiling (VSP).

The Arctic Platform

The drilling of Hot Ice #1 marks the debut of Anadarko's new patent pending Arctic Platform as the Arctic drilling facility of the future. The drilling platform is specially designed to reduce the environmental footprint of drilling operations in ecologically sensitive regions, and to extend the drilling season by several months.

Conventional drilling in the Arctic is limited to the months in which the surface is frozen—typically late December through April.

The Arctic Platform consists of 16 lightweight aluminum modules fitted together. Each segment is mounted on steel legs that are frozen into the ground. Five additional interlocking modules form an adjacent platform for the rig camp. The legs position the platform 12 feet above the ground. This design allows adequate air circulation and should allow sunlight to reach the tundra grass during summer months.

Once the legs are frozen in place, the platform is easily assembled, and it is subsequently taken apart and removed after drilling. The relatively small and

Rolligon all-terrain vehicles, photo courtesy of the Anadarko Petroleum Corporation.

shallow leg holes can then be filled, thus leaving much of the area undisturbed. The Arctic Platform eliminates the need for either temporary ice pads that melt away each summer, or large gravel drilling pads that can impact the tundra landscape.

The platform modules and drilling components were delivered to the site by Rolligon all-terrain vehicles. The Rolligons have large, cylindrical pillow tires that do not sink into the tundra and can move effectively over ice. The Arctic Platform modules are also light enough for helicopter transport.

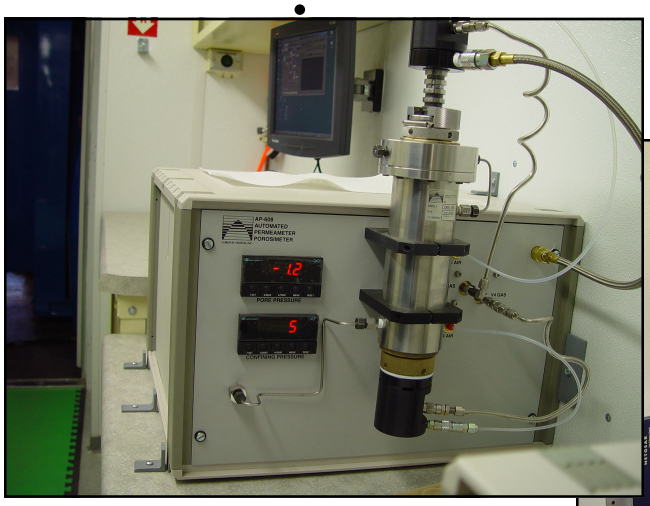
Housed on the platform is the small, hard-rock, Dynatec 1500 mining rig that is drilling and coring the well. The two platforms are large enough to contain the rig, mud tanks, living quarters for 40 people, an on-site core analysis laboratory, and all other auxiliary equipment. A channel surrounds the perimeter of the platform, which reduces complications in case of an accidental spill.

Mobile Core Laboratory

The Hot Ice #1 well is being continuously cored using a wire-line coring system and drilling mud chilled to 23 ºF (-5 ºC). The chilled drilling mud helps to preserve the 3.3-inch diameter (8.5 cm) core and to prevent the hydrate from dissociating during core recovery.

Core samples are analyzed on site in the specialized Anadarko Mobile Core Laboratory, which is also situated on the drilling platform, in close proximity to the drill rig. Measurements in the lab are made on whole core and on one inch plugs. The whole core measurements and the taking of plugs are done in a module that is kept at about 23 ºF (–5 ºC). The whole core measurements consist of a core gamma log, white light photography, IR temperature, and a velocity measurement. Schlumberger has supplied a CMR tool which is used to make an NMR measurement on six inches from each section of whole core. A geologic description is also done in the cold module. An additional whole core measurement is provided by a high resolution CT scanner provided built and provided by Lawrence Berkeley National Lab.

Plug measurements are made on fresh samples, and cleaned and dried samples and, where appropriate, re-saturated samples. Measurements are made of bulk volume and grain density. Helium porosity and permeability are measured at confining stress. P and S wave velocity, resistivity, and thermal conductivity are made at specified confining stress, specified temperature, and specified pore pressure. For hydrate samples, methane can be used for pressure control.



Interior of Anadarko's Mobile Core Lab, showing the pressurized system for measuring porosity and permeability of core samples. Photos courtesy of the Anadarko Petroleum Corporation.

The Mobile Core Lab also includes automated instruments for measuring gamma ray emissions and infrared temperatures.

HOT ICE #1 GOALS

1. Develop and test the best tools and methods for drilling and recovering hydrates.

2. Determine the amount of gas that can be recovered from the reservoir and potential production rates.

There is a core NMR system in which confining stress, pore pressure, and temperature are controlled. The NMR system measures the fluid volume in the sample. For hydrate samples it forms part of the dissociation experimental apparatus. NMR measurements are made at various steps in the dissociation process. The gas released is collected and its volume measured as a function of time during the collection process thus providing the dissociation rate. A quadrupole mass analyzer provides the gas composition. All cores are identified by bar code and test data are collected by computer and automatically stored in a database for further analysis.

During the drilling, newly developed logging techniques combined with conventional logs will provide porosity and water saturation data to help characterize gas hydrate reservoir properties.

Smart Drilling

Using Noble Engineering and Development's "DrillSmart" and "DrillGraph" technologies, the drilling data that are collected from various sensors are digitally recorded and transmitted to the network and made accessible to project participants located off site in places like Houston, Texas.

Post Drilling

After drilling has been completed, a high resolution 3D Vertical Seismic Profile (VSP) survey will be conducted to delineate lateral variations of hydrate occurrence within the hydrate-bearing zones. Also, a limited production test is planned to test the viability of producing methane gas from the hydrate zone.

The analysis and synthesis of core, log, seismic, and other well data, such as data from downhole hydrostatic pressure and temperature transducers, will be useful for evaluating the hydrate reservoir quality and the potential for production from future hydrate wells. The reservoir data will also be entered into Lawrence Berkeley National Lab's hydrate reservoir simulation and production model to test possible scenarios for producing gas from hydrates in geological settings similar to what is found at the Hot Ice #1 site.

Participants

- U.S. Department of Energy, National Energy Technology Laboratory
- Maurer Technology Inc., a subsidiary of Noble Drilling Corporation
- Anadarko Petroleum Corporation
- Noble Engineering and Development, a subsidiary of Noble Drilling Corporation
- University of Alaska, Anchorage
- U.S. Geological Survey
- Lawrence Berkeley National Laboratory
- Schlumberger
- Paulsson Geophysical Services

For more information, contact:

Frances Toro at frances.toro@netl.doe.gov (304) 285-4107

Tom Williams at twilliams@noblecorp.com (281) 276-6713

Anne Vincent at anne_vincent@anadarko.com (832) 636-8368

Worldwide Search for Affordable Gas

by Tim Collett, United States Geological Survey

Many countries with little indigenous energy resources pay a high price for imported liquefied natural gas and oil. The high cost of imported hydrocarbon resources is one reason why, in the last five years, government agencies in numerous countries have launched research programs to recover gas from oceanic and terrestrial Arctic gas hydrate accumulations.

One of the most notable gas hydrate projects is under way in Japan. Early in 2000, the Japan National Oil Corporation (JNOC), with funding from the Ministry of International Trade and Industry (MITI), drilled a series of gas hydrate test wells in the Nankai Trough off the southeastern coast of Japan.

The Government of Canada, through Natural Resources Canada, also supports a national level research program to assess the resource potential of both marine and permafrost-associated gas hydrates. The Canada program also deals with the evaluation of the potential geologic hazards associated with gas hydrates and the assessment of the possible relation between climate change and destabilized gas hydrates.

In this issue of *Fire in the Ice*, we have compiled reports from the managers of the national gas hydrate research programs in Japan and Canada. These reports describe the history of their respective programs and provide an overview of ongoing and planned gas hydrate research activities.

Natural Gas Hydrates in Canada: An Economically Attractive Energy Alternative?

by Kirk Osadetz, Geological Survey of Canada

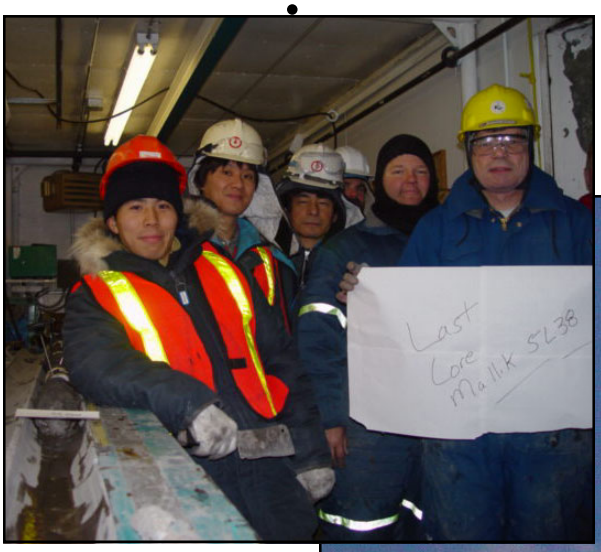
Canada is a northern nation, bordered by the world's longest marine coastline, with 50 percent of its land mass underlain by permafrost. These characteristics endow Canada with an immense petroleum potential in natural gas hydrates. If a future global supply of energy is stored in gas hydrates, then a significant portion of it occurs in Canada.

Currently, Canada provides over 94 percent of the natural gas imports of the United States, or about 15 percent of the U.S. domestic natural gas market. These exports are an important engine of the Canadian economy—$25.6 billion (Canadian dollars) annually. It is strategically important for both Canada and the United States to maintain this trade and to exploit opportunities to double export volumes during the coming decade. While Canada has significant conventional natural gas reserves and resources, the future assurance of abundant, environmentally friendly fuel for North America may ultimately rest with gas hydrates.

Canada has a long history of gas hydrate research, with early pioneering work in the 1970s by Canadian industry. Milestone contributions were made in the 1980s by Canadians in geothermics, molecular science, and geophysical properties of gas hydrates. In 1992, a scientific research well drilled by the Geological Survey of Canada (GSC), Imperial Oil, and Shell Canada collected the first intrapermafrost gas hydrates from an Arctic location. In 1993, Ocean Drilling Program Leg 146 characterized gas hydrates offshore of Vancouver Island. Research on the west coast has continued with geophysical research cruises to map the offshore distribution of gas hydrates, and an exciting remotely operated vehicle (ROV) survey of gas hydrate outcrops on the sea floor, led in the summer of 2002 by the University of Victoria.

1998 Mallik Gas Hydrate Research Well Program. Perhaps of greatest significance in the quest to assess the energy potential of gas hydrates are the 1998 and 2002 Mallik gas hydrate research well programs, which were undertaken as collaborations with leading international gas hydrate research programs. The 1998 program, led by the GSC and the Japan National Oil Corporation (JNOC), established the Mallik gas hydrate field in Canada's Mackenzie Delta as one of the most concentrated gas hydrate occurrences in the world. The concept was developed that cost effective research and development could be carried out on terrestrial gas hydrates with direct application to the more challenging offshore environment. The 1998 program included scientific contributions from the U.S. Geological Survey (USGS), the U.S. Department of Energy (DOE), and a number of industry, academia and government research agencies. The GSC *Bulletin* published on the 1998 drilling included 32 contributions with new core, well log, modeling, and molecular science studies, in addition to engineering contributions on drilling, coring, and cementing of gas hydrates.

2002 Mallik Gas Hydrate Research Well Program. The 1998 program was considered extraordinarily successful, but the elusive goal of producing from gas hydrates was not accomplished. Stimulated by this goal, GSC and JNOC established a wider partnership to return to Mallik in 2002. The program participants include eight partners; the GSC, JNOC, USGS, DOE, GeoForschungsZentrum Potsdam (GFZ), India Ministry of Petroleum and Natural Gas (MOPNG)/Gas Authority of India (GAIL), and the Chevron-British Petroleum-Burlington joint venture group. In addition, the project was accepted as part of the International Scientific Continental Drilling Program, which allowed a broadening of the scientific research goals to include fundamental climate change studies and geohazard research.



Mallik science team celebrate last core from Mallik 5L 38 well retrieved from 1150m. From left to right scientists: Kato san (JNOC), Tomaru san (U of Tokyo), Uchida san (JNOC), Collett san (USGS) and Nixon san. Photos courtesy of the Mallik Project.

Again, the GSC coordinated the science activities. JAPEX Canada Ltd. acted as the designated operator for the fieldwork. The primary objectives were to advance fundamental geological, geophysical, and geochemical studies of the Mallik gas hydrate field and to undertake the first modern production testing of gas hydrates. Full-scale field experiments in the production well monitored the physical behavior of the hydrate deposits in response to depressurization and thermal stimulation. Two observation wells facilitated cross-hole tomography and vertical seismic profile experiments (before and after production) as well as the measurement of in-situ formation conditions. A wide-ranging science and engineering program included the collection of gas-hydrate-bearing core samples and downhole geophysical logging. Laboratory and modeling studies undertaken during the field program, and subsequently as part of a post-field research program, will document the sedimentology, physical/petrophysical properties, geochemistry, geophysics, reservoir characteristics, and production behavior of the Mallik gas hydrate accumulation. The research team, including some 100 participant scientists from over 20 institutes in seven countries, expects to publish the scientific results in 2004.

New Canadian Research Program to be Led by GSC. The GSC recently established a new gas hydrate research and development program as part of Natural Resources Canada's Earth Sciences Sector (ESS). The new ESS science program consolidates the efforts of talented and energetic GSC scientists with established gas hydrate research activities. The focus is on gas hydrates as an environmentally friendly source of petroleum for Canada and North America. A special emphasis is placed on the potential benefits of gas hydrate exploitation as a basis for sustainable economies in Canada's northern and coastal communities.

A basic tenet of the new ESS program is the implicit understanding that much more research is required to constrain exploration models, to quantify the physical properties of gas hydrates, and to develop appropriate production methods. Advancement of fundamental and applied science is, therefore, a cornerstone of the new program, which currently has two regional projects (marine and northern environments) and one that focuses on research and development specific to improving geophysical survey techniques, the science of gas hydrates in porous media, and gas hydrate production.

Achieving these goals is a major undertaking, and the continuation of active and meaningful international collaborations with agencies such as DOE and other participants in the recent drilling campaigns is part of the new program. While the current ESS program focuses on petroleum fuel potential, the role of gas hydrates in other issues, particularly climate change and geohazards, is strongly acknowledged. Important linkages with Canadian academic research networks and other federal government departments, such as the National Research Council of Canada, will be strengthened to advance this research.

Methane Hydrate Research in Japan

by Tetsuo Yonezawa, Japan National Oil Corporation

In Japan, integrated studies encompassing both basic research and field surveys targeting methane hydrates as a commercial energy resource began in 1995 under the leadership of the Ministry of International Trade and Industry (the current Ministry of Economy, Trade and Industry, METI). The METI initiative was rooted in the key aims of (1) increasing the share of energy supplied by natural gas, and (2) augmenting the supply of domestically produced natural gas.

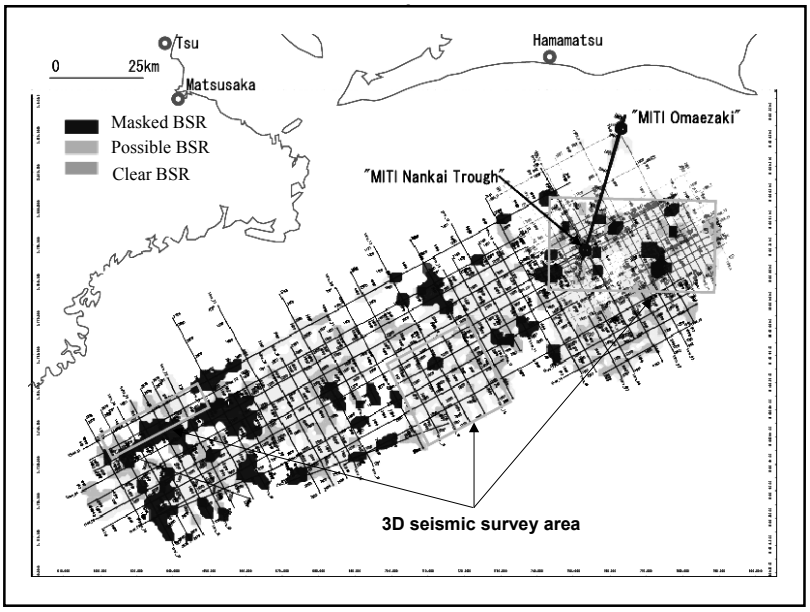
Various approaches are currently being advanced in Japan to make methane hydrates a viable energy resource. These include the Nankai Trough METI Exploratory Test Well program carried out from 1999 to 2000, the Collaborative R&D for Methane Hydrate program that advanced technical development of the METI Exploratory Test Well project, and drill testing in the Mackenzie Delta of Canada in support of the METI led collaborative research project. Based on the results of these efforts, the new Methane Hydrate Exploitation Program was announced in 2001, together with the Research for Methane Hydrate Resources in Japan project, as a means of putting the new plan into force.

The onshore Mackenzie Delta production testing program was expanded into a joint international research project under the METI plan. METI also conducted offshore 2D seismic surveys in the Tokai area of the Sea of Kumano: in an area about 200 km east to west and 30 miles (50 kilometers) north to south and stretching from the Izu Peninsula to Cape Ushio, at water depths ranging from 1,600 to 6,550 feet (500 to 2,000 meters). The total length of the measured lines is about 1,750 miles (2,800 km).

Based on the results of this 2D seismic survey, three sites were selected in fiscal year 2002 for additional geophysical surveys: the Tokai offshore area (survey area 473 mi^2/1,225 km^2), the Atsumi Sea Knoll (survey area 241 mi^2 , 625 km^2), and Kumano Basin (survey area 81 mi^2 ,210 km^2). In each of these areas, high-resolution 3D seismic surveys were conducted to gain a more detailed understanding of the bottom simulating reflector (BSR) distribution.

These seismic surveys will be used to select well locations for a 2004 drilling/coring campaign. About 30 to 40 wells will be drilled, including (1) logging while drilling (LWD) wells to confirm the methane hydrate distribution; (2) coring wells for use in comparing the methane hydrate occurrence against the wireline logging data, and the recovery of core for the various research projects; and (3) wireline logging wells for use in LWD data calibration and comparison with the core.

A drill ship with a dynamic positioning system will be mobilized for this project. The research will be conducted over a period of approximately 110 days beginning in early January 2004. Also planned is the testing of hydrate drilling technologies, completion technologies necessary for offshore production testing, and a high resolution formation temperature measurement system that will be deployed in the wells and used to monitor borehole temperatures.



Map of BSRs interpreted from seismic data. Closed green rectangles show areas of 3D seismic survey. Map courtesy of the Japan National Oil Corporation.

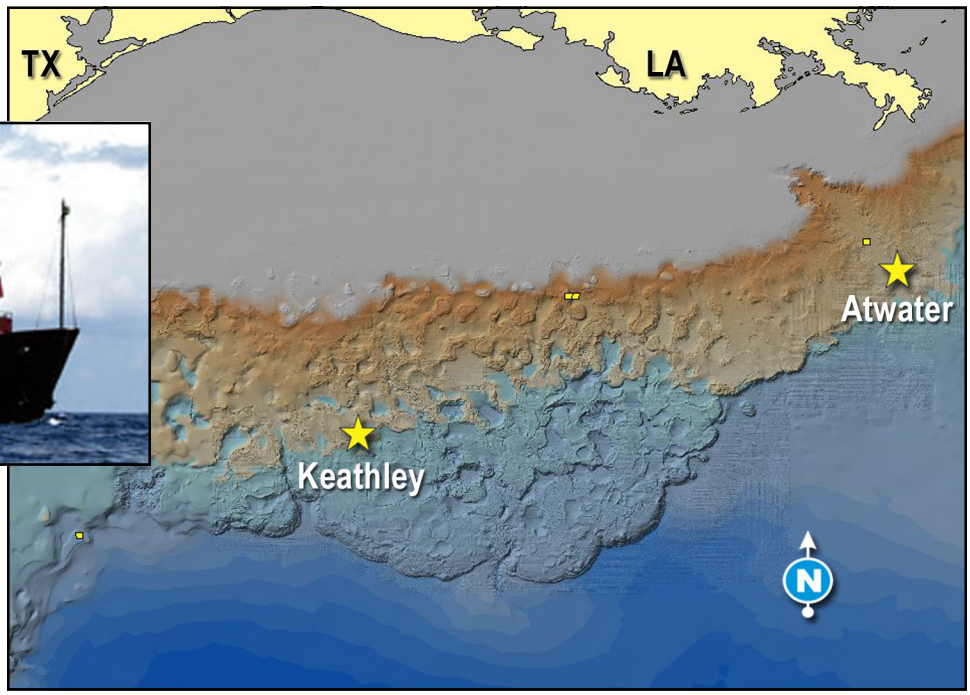
Atwater Valley and Keathley Canyon, Gulf of Mexico: Sites for Further Studies

Scientists on two summer 2003 research cruises, aboard the research vessel (R/V) *Gyre,* will be investigating potential drilling sites for hydrates in the Gulf of Mexico. The Gulf of Mexico Joint Industry Project (JIP) has selected two priority sites, the Keathley Canyon region and the Atwater Valley region, to evaluate and better characterize the area for drilling hydrates in 2004. Both sites are at a water depth of about 4,250 feet (1,300 meters). Drilling at these sites will provide information and facilitate experiments to assess the hazards that hydrates might pose to drilling operations. Of particular concern are disturbances or changes that may destabilize the drilling hole or trigger localized movement of the sea floor.

During the first 2-week cruise, April 26 through May 16, 2003, scientists conducted underwater, high-resolution seismic profiling at each site. This new data will be correlated with more regional data sets. The U.S. Geological Survey (USGS) operated the cruise in partnership with U.S. Department of Energy (DOE) and academic collaborators.

The second leg of the cruise, also aboard the Gyre, is scheduled for August 2003. The purpose of this cruise is to collect high resolution seismic data using the Deep-Towed Acoustics/Geophysics System (DTAGS) of the Naval Research Laboratory (NRL). NRL is operating the cruise in collaboration with DOE and others. Information collected during the May cruise will be used to guide data acquisition on this cruise.

Research Vessel Gyre, photo courtesy of http://www-ocean.tamu.edu/Nav/gyre.html



Bathymetric map of the Gulf of Mexico offshore the Louisiana–Texas coastline. Six lease sites (in yellow) were initially chosen for investigation . The Keathley Canyon and Atwater Valley sites are shown with a star. Map courtesy of Deborah Hutchinson, HSGS Woods Hole Field Center.

Cruisin' for Hydrates

2003 Methane Hydrate Research Cruises

Twelve research cruises devoted to various aspects of the marine hydrate environment are currently scheduled during the spring, summer, and fall of this year. The research will provide information on the physics, chemistry, and biology of hydrates in the marine environment. In addition, newly designed equipment to help monitor and map hydrate deposits will be tested and calibrated.

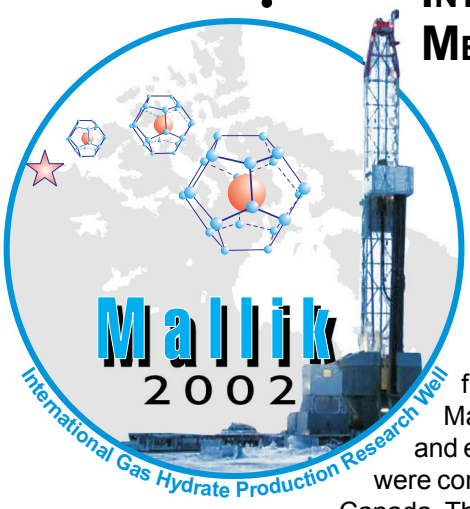
2003 Dates	Institution/s	Chief Scientist/s	Cruise Name	Research Vessel/s	Research Area
3/30-4/9	NRL-Stennis, NRL-DC, VIMS, Catholic University of Valparaiso	Juan Diaz		R/V Vidal Gormaz	Central Chile Coast
5/22-29	CMRET-UM	T. McGee	R/V Pelican	R/V Pelican	MC798 Mississippi Canyon/Atwater Valley-GOM
5/1-14	USGS	D. Hutchinson Pat Hart	Hydrate Gyre 2003 Research Cruise (Leg 1)	R/V Gyre	Keathley Canyon/ Atwater Valley-GOM
6/9-16	CMRET-UM	R. Woolsey	CMRET Seismic System Test	R/V Kit Jones (CMRET vessel)	Offshore Mississippi
6/23-7/1	Canadian Geologic Survey, University of Victoria, NRL, UNC, FSU	Ross Chapman Rick Coffin		R/V J.P. Tully	Cascadia Margin
8/1-22	NRL, FSU, VIMS	J. Gettrust	Hydrate Gyre 2003 Research Cruise (Leg 2)	R/V Gyre	Keathley Canyon/ Atwater Valley-GOM
8/8-21	Penn State Univ., NURP/NOAA, OE/LSU	R. Carney	Biodiversity and Community Function at Deep Sea Seeps	R/V Atlantis; Submersible Alvin	GOM
8/28-9/14	Penn State Univ., NSF/NOAA, OE/NOAA, NURP	C. Fisher	Physiology and Ecology of Cold Seep Systems	R/V Seward Johnson; Submersible Johnson Sea Link	Louisiana Slope-GOM
August	TAMU, CMRET	I. MacDonald R. Woolsey	GHOSTS II	Seward Johnson II	GOM Green Canyon
Early October	GHRC/CMRET-UM	R. Woolsey T. McGhee	R/V Pelican	R/V Pelican	GOM
10/1-24	GEOMAR, TAMU, UNAM	G. Bohrmann	SO-174-1 OTEGA-II (Leg 1)	R/V Sonne	Texas-Louisiana Slope
10/25-11/12	GEOMAR, TAMU, UNAM	G. Bohrmann	SO-174-2 OTEGA-II (Leg 2)	R/V Sonne	Campeche Slope, Mexico

CMRET	Center for Marine Resources and Environmental Technology
DTAGS	Deep-towed Acoustics/Geophysics System
FSU	Florida State University
GEOMAR	GEOMAR Research Center, Kiel, Germany
GHOSTS	Gas Hydrate Observation, Sampling, and Tracer Study
GHRC	Global Hydrology Resource Center
GOM	Gulf of Mexico
LSU	Louisiana State University
MMS	Minerals Management Service
NOAA	National Oceanic and Atmospheric Administration
NRL	National Research Laboratory
NURP	National Underwater Research Program
OMEGA	Oberflächennahe MarinE Gashydrate
ROPOS	Remotely Operated Platform for Ocean Science
TAMU	Texas A&M University
UM	University of Mississippi
UNAM	Universidad Autonoma de Mexico
UNC	University of North Carolina
VIMS	Virginia Institute of Marine Sciences

Announcements

Mallik 2002 Gas Hydrate Production Research Well Program

International Symposium on Methane Hydrates



"From Mallik to the Future"

December 8 to 10, 2003,
Hotel New Otani, Chiba, Japan

The partners of the Mallik 2002 Gas Hydrate Production Research Well Program* are pleased to announce an International Symposium on Methane Hydrates. This meeting will serve as the first public release of the scientific and engineering results from the Mallik program that was undertaken to study the production potential and environmental conditions of gas hydrates. Three research wells were completed during the winter of 2002 in Mackenzie Delta, N.W.T., Canada. The diverse science program included a broad suite of core studies, surface and downhole geophysical surveys, and reservoir simulation modelling. Production testing experiments for the first time monitored formation response and gas flow induced by pressure drawdown and thermal stimulation.

An open session in the symposium will also explore future international gas hydrate science and production research priorities and venues to further collaboration.

Conference Chair:	Mr. Noboru Tezuka (JNOC)
Co-Chair:	Dr. Rolf Emmerman (GFZ)
Program Chair:	Mr. Scott R. Dallimore (GSC)
Co-Chairs:	Dr. Timothy S. Collett (USGS)
	Dr. Michael Weber (GFZ)
	Dr. Takashi Uchida (JNOC)
	Mr. Takahisa Inoue (JNOC)
	Mr. Tetsuo Yonezawa (JNOC)

For more information, see the Mallik Project web sites (gashydrate.com; icdp.gfz-potsdam.de) and follow the links to the "From Mallik to the Future" symposium.

* Partners of the Mallik 2002 Gas Hydrate Production Research Well Program: Geological Survey of Canada (GSC), Japan National Oil Corporation (JNOC), GeoForschungsZentrum Potsdam (GFZ), United States Geological Survey (USGS), United States Department of the Energy, India Ministry of Petroleum and Natural Gas (Gas Authority of India/Oil and Natural Gas Corporation), BP-Chevron-Burlington Joint Venture Group. The program was also accepted as a project within the auspices of the International Continental Scientific Drilling Program

HARRY H. ROBERTS

Professor of Oceanography and Coastal Sciences/Coastal Studies Institute
Louisiana State University
Baton Rouge, Louisiana
Hrober3@lsu.edu

No one would have guessed that Professor Harry H. Roberts, born and raised in land-locked West Virginia, would become fascinated by oceans and the secrets beneath them. But his home near coal fields did help him develop an early curiosity about earth sciences while collecting rocks, looking for fossils, and prospecting for uranium.

Color photo of Harry Roberts — by Greig Olivier

Spotlight on Research

From West Virginia to the Gulf of Mexico

Harry Roberts is a Boyd Professor at Louisiana State University (LSU), where he is Director of the Coastal Studies Institute and a member of the Department of Oceanography and Coastal Sciences. He attended Marshall University in Huntington, West Virginia, initially to play basketball to help pay for college. He graduated in physics and took enough geology courses to be offered an assistantship at LSU in the Department of Geology and Geophysics.

While a student at LSU, Harry became interested in marine geology, oceanography, and modern processes that affect the geology and sedimentology of the ocean floor. His initial research years at the Coastal Studies Institute focused on understanding the marine geology of carbonate environments in the Caribbean, Red Sea, and Indonesia. However, Harry always kept a hand in research related to the Mississippi River delta and its adjacent shelf and continental slope.

The northern Gulf of Mexico is the most mature deep-water oil and gas production province in the world. There is a huge data base collected in support of the oil and gas industry which has led to a high level of understanding of the Gulf's incredibly complex geologic framework where hydrocarbon seeps and vents are common.

In 1991, using high resolution seismic and side-scan sonar data, Harry found the first gas hydrate outcrops on the seafloor while studying ^{13}C-depleted carbonates associated with hydrocarbon seep sites. This first exposure of gas hydrates was discovered in Green Canyon Block 232. Now, many other sites of exposed gas hydrates have been found in the Gulf by Harry and other researchers.

Although he still works with high-resolution seismic and side-scan sonar data to geologically characterize sites of fluid and gas expulsion, especially sites of known gas hydrate occurrence, Harry is now working with exploration-scale 3D-seismic through a research project funded by the Minerals Management Service. These high-quality industry-acquired data sets cover over 90 percent of the northern Gulf of Mexico slope.

Because of complex faulting, salt formations, and heat flow anomalies associated with the vertical transport of warm fluids, bottom stimulating reflectors (BSRs) associated with the base of the hydrate stability zone are difficult to image in Gulf of Mexico seismic records. In simpler geologic provinces, the BSR, which results from the acoustic impedance difference between gas hydrates in the hydrate stability zone and free gas beneath it, is much easier to detect. The northern Gulf of Mexico has few undisputed BSRs.

Along with colleagues Bob Hardage from the Bureau of Economic Geology at the University of Texas, and Joe Gettrust and Warren Wood from the Naval Research Lab, Harry is coordinating a project to use newly acquired multicomponent seismic information from which shear wave data can be extracted to produce a subsurface image. He anticipates that shear wave data may be better for imaging the base of the hydrate stability zone than standard compressional wave data.

Harry thinks that we are just beginning to realize the importance of gas hydrates as they affect earth systems. He is hopeful that more financial support will be made available to the scientific community in the near future to further study gas hydrates as a potential energy resource as well as a driver of ocean floor processes and global climate change.