METHANE HYDRATE NEWS

FIRE IN THE ICE

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CONTENTS

CONTACT

Jared Ciferno

Technology Manager—Oil and Natural Gas Program, including the Methane Hydrate R&D Program

(412) 386-5862

jared.ciferno@netl.doe.gov

U.S. DEPARTMENT OF ENERGY

FORMATION OF MASSIVE HYDRATE DEPOSITS IN GULF OF MEXICO SAND LAYERS

Hugh Daigle[1], Ann Cook[2], and Alberto Malinverno[3]

[1] Hildebrand Department of Petroleum and Geosystems Engineering, University of Texas at Austin, Austin, TX
[2] School of Earth Sciences, Ohio State University, Columbus, OH
[3] Lamont-Doherty Earth Observatory, Columbia University, Palisades, NY

Thick accumulations of methane hydrate at high saturations in pore space—termed massive methane hydrate deposits—have attracted significant attention recently as targets for resource exploitation. For a better understanding of the origins and evolution of such deposits, we studied migration mechanisms and associated methane hydrate accumulation rates in coarse-grained sands of the Terrebonne Basin, located in Walker Ridge Block 313 in the northern Gulf of Mexico (WR313) (Figure 1).

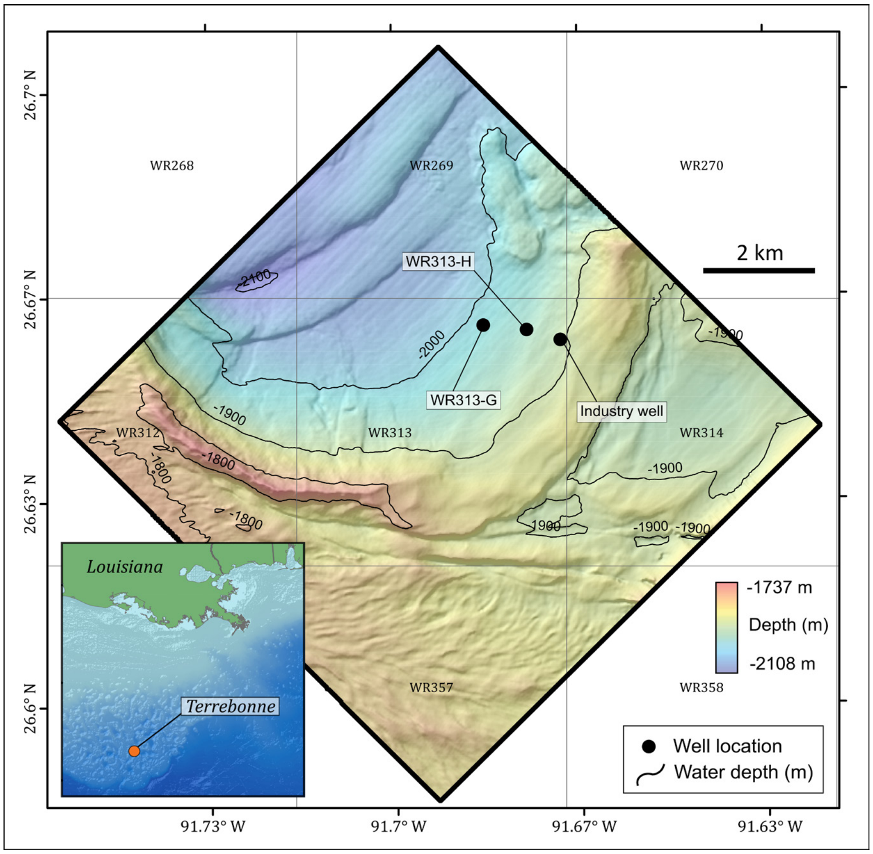

Figure 1. Location of the Terrebonne Basin and Walker Ridge Block 313.

National Energy Technology Laboratory

1450 Queen Avenue SW
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Interested in contributing an article to *Fire in the Ice*?

This methane hydrate newsletter now reaches 1600 individuals, representing 20 countries. If you would like to submit an article on research results likely to be of interest to the methane hydrate R&D community, please contact Fran Toro at frances.toro@netl.doe.gov or Karl Lang at klang@keylogic.com. We look forward to hearing from you.

We considered three different methane migration mechanisms for the formation of high-saturation hydrate-bearing sand layers: (1) short migration, in which methane is generated microbially in finer-grained sediments and diffuses over short distances into adjacent sand layers, where capillary effects favor precipitation of hydrate; (2) long migration, in which methane is supplied by long-distance advective flow along permeable layers into the methane hydrate stability zone (MHSZ); and (3) short advection, where dissolved microbial methane is focused into more permeable layers by compaction-driven fluid flow.

Based on prior knowledge of sedimentation rates, rock properties, and rates of microbial methanogenesis in the Terrebonne Basin, we modeled the growth of hydrate in a 3.6 m-thick sand layer, with methane supplied only by short migration as the sand is buried (Figure 2). At about 220 meters below seafloor (mbsf), the sand achieves a hydrate saturation of about 60%, which is similar to the interpreted hydrate saturation in a comparable sand found at this depth in the WR313-H hole drilled in 2009.

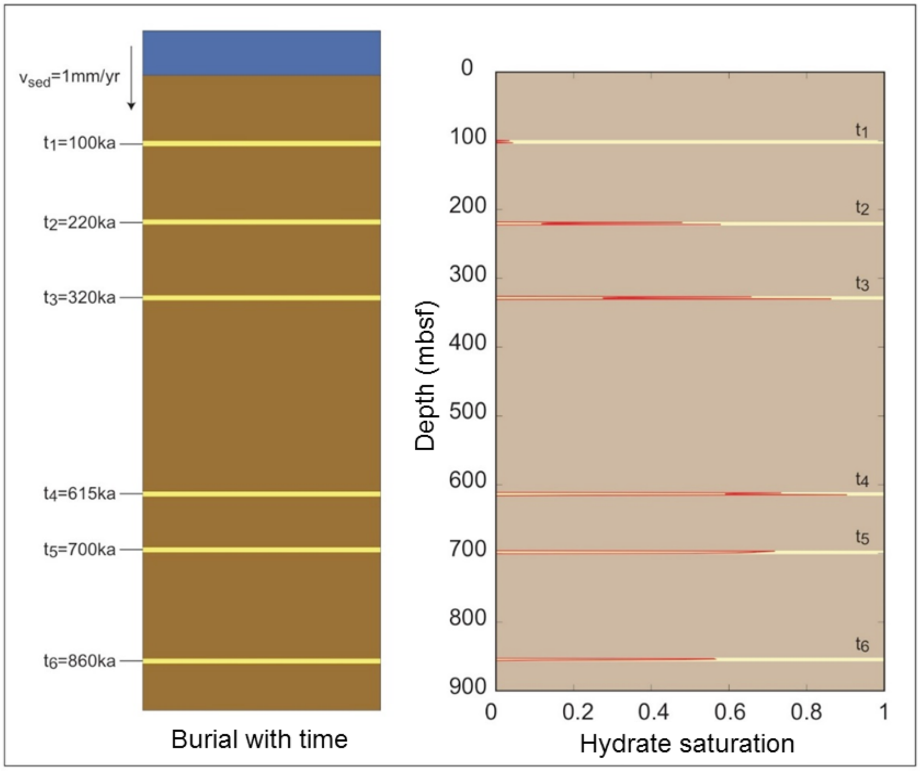

Figure 2. Hydrate saturation formed from microbial methane at various points in time in a thin, subsiding sand layer.

As the sand is more deeply buried, the rate of microbial methanogenesis decreases, and eventually the hydrate starts to dissolve, as the solubility of methane increases. This suggests that at least shallow, thin sands at Terrebonne can be charged entirely by microbial methane and reach very high hydrate saturations.

We also considered advective transport of methane into a dipping sand layer, as it is buried. A simulation was run in 3D, starting with a 36.6 m-thick sand unit. Figure 3 shows 2D cross sections through the sand after about

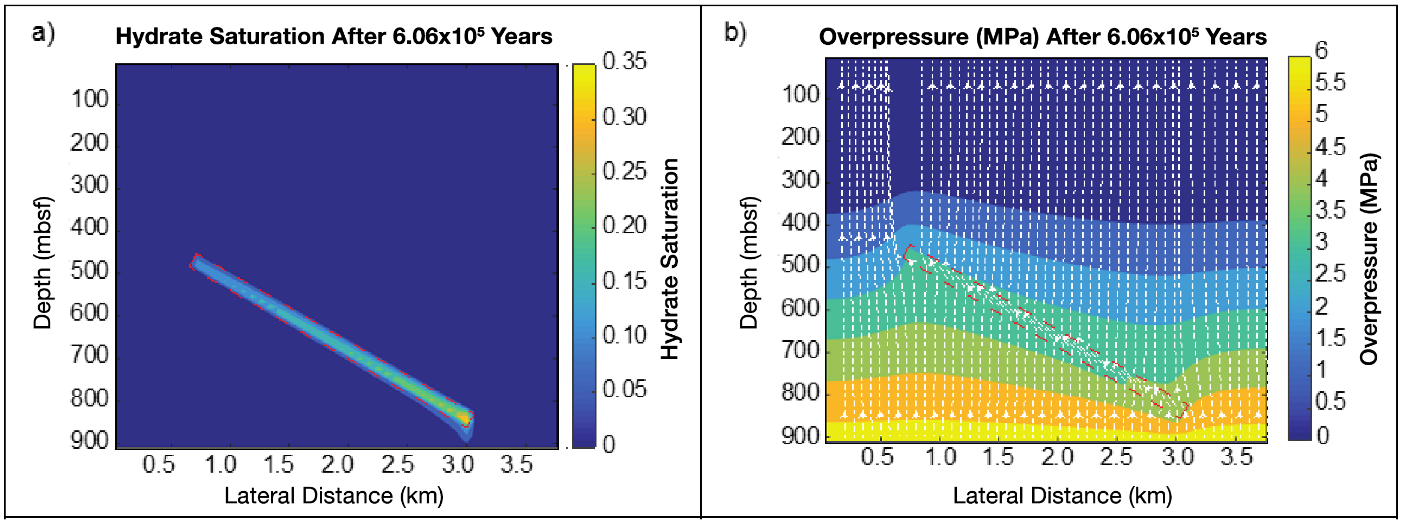

Figure 3. (A) Hydrate saturation in a dipping sand after 606,000 years of burial; (B) Flow streamlines showing direction of fluid transport.

600,000 years of burial. The maximum hydrate saturation reaches about 35% near the downdip end of the sand (Figure 3A), and the higher permeability of the sand (initially about 6 orders of magnitude higher permeability than the surrounding clay) causes compaction-driven flow to be focused through the sand layer. This advective process drives methane into the sand to form hydrate (Figure 3B). This represents a means of forming massive hydrate deposits deeper within the hydrate stability zone while preserving hydrate against dissolution during burial.

Overall, our work has illustrated that microbial methane is probably a significant methane source for the hydrate deposits at WR313, and the ages of observed features are consistent with predicted rates of hydrate formation. Short migration is favored for forming high hydrate saturations in thin sands that are relatively shallow in the MHSZ. Hydrate-bearing sands that occur at greater depths, e.g., approaching the base of the MHSZ, require an additional methane source to counteract decreased rates of microbial methanogenesis and increased rates of hydrate dissolution in more deeply buried sediments. Advective transport is likely to play a more important role in such cases.

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EXPLORING IMPACTS OF WIDESPREAD SEAFLOOR METHANE SEEPAGE ON OCEAN CHEMISTRY AND ATMOSPHERIC METHANE EMISSIONS ALONG THE U.S. MID-ATLANTIC MARGIN

John D. Kessler[1], Carolyn D. Ruppel[2], DongJoo Joung[1], Fenix Garcia-Tigreros[1], and Mihai Leonte[1]

[1] Department of Earth and Environmental Sciences, University of Rochester, Rochester, NY
[2] US Geological Survey, Woods Hole, MA

Since 2011, hundreds of previously unknown seafloor methane (CH_4) seeps have been discovered on the U.S. mid-Atlantic margin. While seeps have been found at depths spanning the entire continental slope, many of these newly discovered seeps are positioned just shallower than the contemporary landward limit of gas hydrate stability, which occurs at 550-575 meters water depth in this region. These seeps are ideal for investigating the potential fate of CH_4 released from the seafloor due to gas hydrate degradation or escape from shallow, subseafloor free gas accumulations.

In general, most CH_4 emitted from the seafloor at depths greater than ~100 m is expected to diffuse out of rising bubbles, dissolve in ocean water, and then oxidize to carbon dioxide (CO_2) by bacteria or escape to the atmosphere (Figure 1). In August and September 2017, the University of Rochester and the US Geological Survey's Gas Hydrates Project set out to directly measure the impact and fate of seafloor CH_4 release on oceanic CO_2 concentrations and atmospheric CH_4 emission along the U.S. mid-Atlantic margin. During a 14-day oceanographic research expedition aboard the *R/V Hugh R. Sharp*, we collected water samples and digital data along ~260 km of the path of the southward-flowing shelf-break current that traverses hundreds of seeps on the U.S. mid-Atlantic margin between Baltimore Canyon and Cape Hatteras (Figure 2).

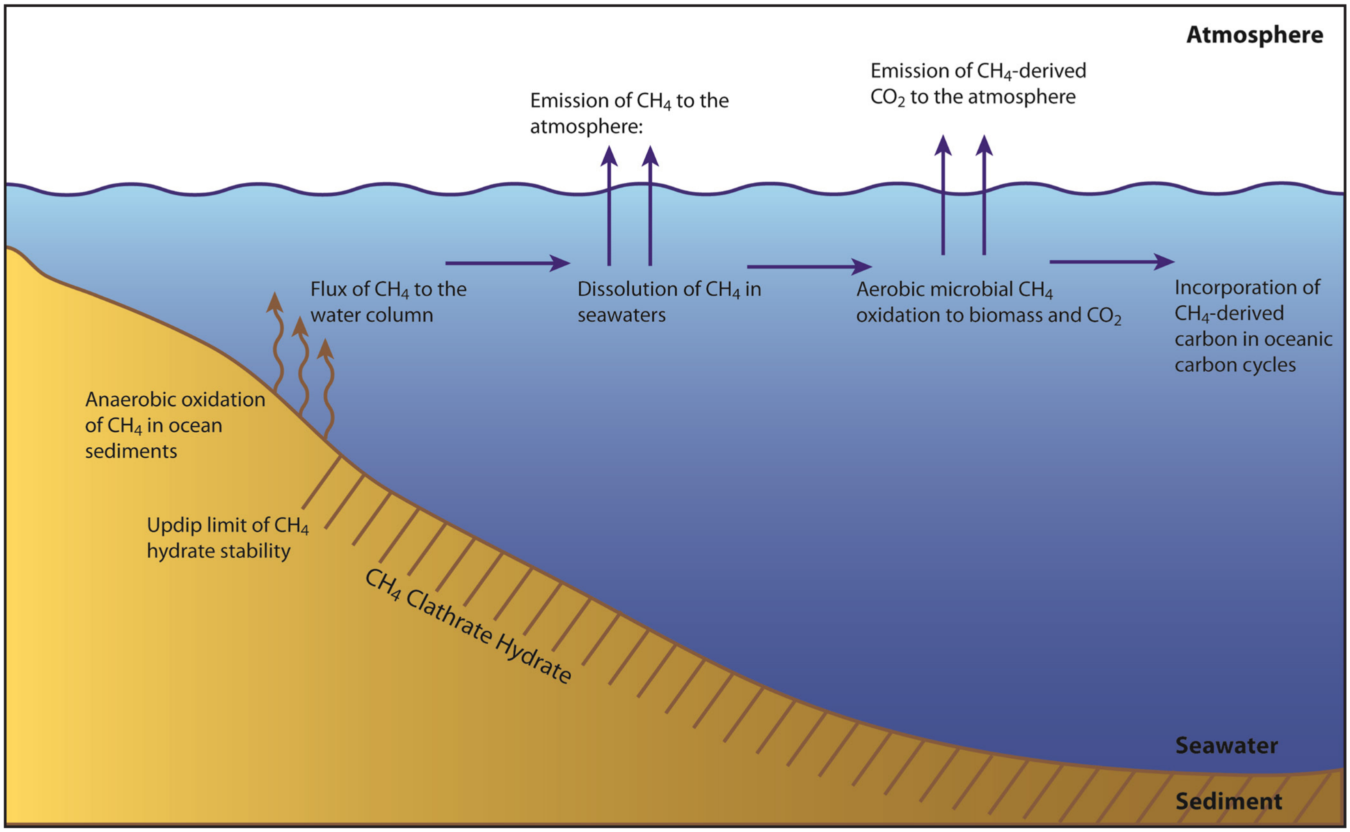

Figure 1. Fate of methane following release from gas hydrates. Each of these potential impacts was investigated here. Figure adapted from Kessler, J.D., 2014, Atlantic Bubble Bath. Nature: Geoscience, https://doi.org/10.1038/ngeo2238

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The main challenges with this research program were to detect changes in seawater composition; and then determine whether those changes resulted from seafloor CH_4 release. The first challenge was overcome using cutting edge analytical techniques, while the second challenge was addressed using the natural radiocarbon content of CH_4 as a way of identifying the CH_4 source. Previously published measurements have shown hydrate and seep CH_4 released from the seafloor to be devoid of natural radiocarbon, a signature which we confirmed here and used to follow this CH_4-derived carbon in the ocean.

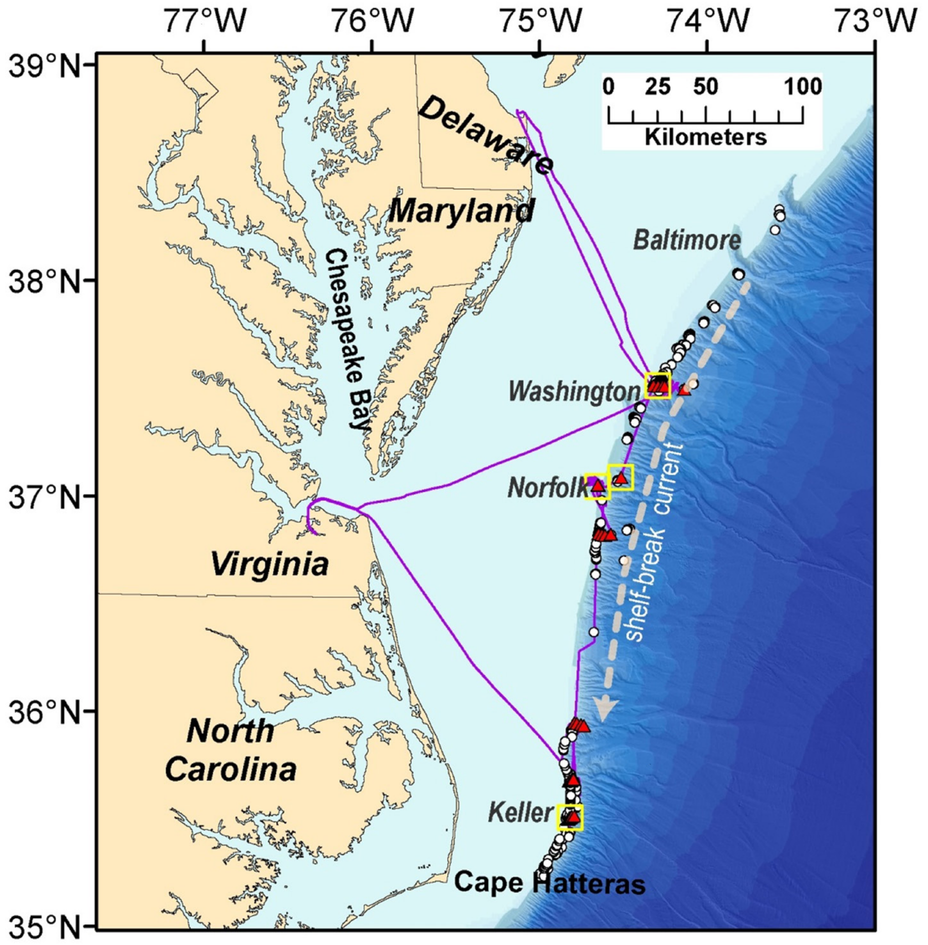

Figure 2. Map showing the U.S. mid-Atlantic margin and locations of methane seeps (white circles), the ship track for the 2017 research cruise (purple lines), CTD casts (red triangles), and large volume sampling for methane radiocarbon isotopes (yellow squares). Names in italics refer to major shelf-break canyons, and the gray arrow indicates the southward flowing shelf-break current.

Despite an active hurricane season in the Atlantic Ocean, we conducted 26 conductivity-temperature-depth (CTD) casts along five upper continental slope transects, some directly within water column CH_4 plumes. The CTD casts collected discrete seawater samples to help constrain the source of CH_4, the extent of aerobic CH_4 oxidation, and the influence that aerobic CH_4 oxidation has on oceanic CO_2 concentration and acidification.

We also acquired continuous near-surface gas concentration and

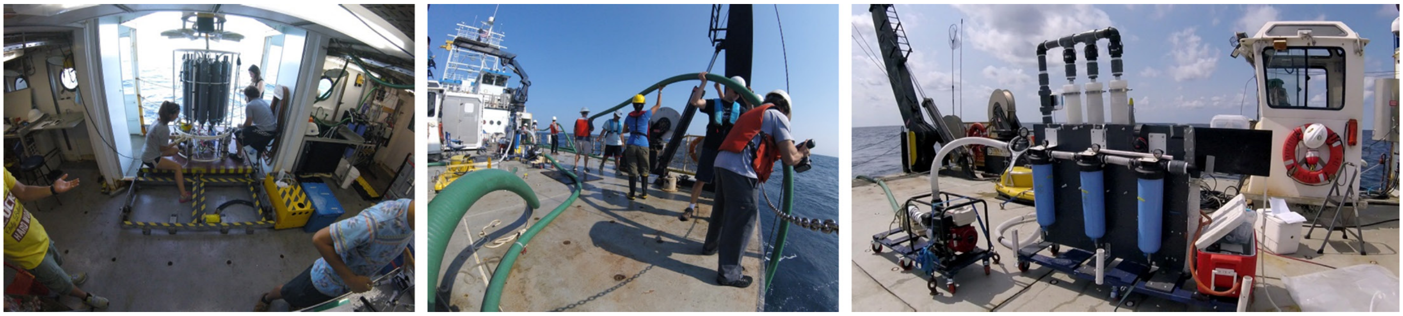

Figure 3. Sampling activities during August and September 2017 on the R/V Hugh R. Sharp. Left: collecting water column samples for seawater chemistry analyses. Middle: deploying approximately 400 m of suction hose to sample methane dissolved in water for its natural radiocarbon content. Right: apparatus used to extract methane from seawater for natural radiocarbon analysis.

isotope data to constrain the sea-to-air CH_4 flux. This was accomplished using newly developed techniques with ultra-high response time and spatial resolution. Synchronously, we collected over 1100 line-km of geophysical data to verify known seeps, locate new CH_4 emission sites, and correlate seafloor and sea surface emissions.

Finally, we collected samples to measure the natural radiocarbon content of CH_4 carbon dissolved in seawater. This collection process required CH_4 to be extracted from over 30,000 liters of seawater per sample, which we conducted at four different geographical locations and throughout the water column at each site. This analysis was used to determine the fraction of the CH_4 sourced from the seafloor (Figure 3). The large volume sample was necessary for obtaining a high fidelity measurement of a trace isotope (radiocarbon) of a trace gas (CH_4) dissolved at low concentrations in seawater.

The data collected from this expedition are being interpreted to determine if oceanic CH_4 emission to the atmosphere can be isotopically connected with a seafloor source, and if those emissions are enhanced above active seafloor seeps. Also, the extent of aerobic CH_4 oxidation is being assessed, as is any ocean acidification resulting from the CO_2 produced from the aerobic oxidation of CH_4. The results of these experiments will help to determine how much, if any, CH_4 released from the seafloor at these depths is transmitted to the atmosphere. Our results will also help determine if changes in CO_2 concentrations resulting from CH_4 oxidation in deep seawater are significant, and if these changes are enhancing current trends in seawater acidification and shifts in the marine carbonate cycle.

Acknowledgments

We thank the crew of the *R/V Hugh R. Sharp*, the marine operations staff of the University of Delaware, and operational and technical personnel at the USGS for outstanding support that resulted in a successful research cruise. This work was supported by US Department of Energy award DE-FE0028980 to University of Rochester and DOE-USGS interagency agreement DE-FE0026195. Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

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ELECTRICAL CONDUCTIVITY OF METHANE HYDRATE WITH PORE FLUIDS: NEW RESULTS FROM THE LAB

Ryan Lu[1], Laura A. Stern[2], Wyatt L. Du Frane[1], John C. Pinkston[2], and Steven Constable[3]

[1] Lawrence Livermore National Laboratory, Livermore, CA
[2] U.S. Geological Survey, Menlo Park, CA
[3] Scripps Institution of Oceanography, San Diego, CA

With renewed U.S. Department of Energy (DOE) support to characterize the evolution of gas hydrate systems using marine electromagnetic (EM) methods paired with laboratory studies, we extended previous electrical conductivity measurements on methane hydrate, with and without sediment, to include a liquid component. Here we report the pronounced effects of adding pure H_2O water or NaCl-bearing brine, and we track the development of the fluid phase within samples.

Pure H_2O pore water, generated in situ through partial dissociation of methane hydrate at 5°C, increases conductivity by at least a factor of 3 (0.5 on a log scale), as water accumulates in roughly 15 ± 5 vol.% of the sample. Brine, generated by adding NaCl to sample reactants prior to methane hydrate synthesis, elicited a considerably stronger effect; at 5°C, the addition of 2.5wt% NaCl increases conductivity by over 2 orders of magnitude (log-scale) relative to pure methane hydrate. Cryogenic scanning electron microscopy (cryo-SEM) imaging of quenched samples revealed the distribution of the liquid component within samples, thus allowing evaluation of conduction mechanisms and pathways.

Background

Controlled source electromagnetic (CSEM) sounding is emerging as an effective tool for gas hydrate exploration. CSEM measures amplitude and phase of EM energy through the seafloor, and the data can be inverted to resistivity and combined with seismic reflection data to further resolve total volume and peak subsurface gas hydrate saturations. Field studies provide baselines for assessing the ability of EM methods to detect changes in hydrate volume associated with environmental change. Complementary lab tests provide insight into factors affecting hydrate/sediment/water conductivity and their petrophysical mixing relationships, in turn aiding modeling efforts and interpretation of borehole resistivity measurements.

In previous work, we designed a high-pressure cell to synthesize methane hydrate while simultaneously measuring electrical impedance spectra (Figure 1A). In that study, we used the apparatus to measure electrical properties of pure polycrystalline methane hydrate as well as methane hydrate mixed with quartz sand or silica beads.

Samples were quenched in liquid nitrogen for analysis by cryo-SEM to assess grain characteristics and component distribution. USGS recently upgraded both the SEM and the cryo-stage attachments, and our new system (Figure 1B) has variable-pressure capabilities that improve stabilization of gas hydrates and minimize damage to sample surfaces during imaging. The next step has been to add pore fluids to hydrate samples in a controlled manner.

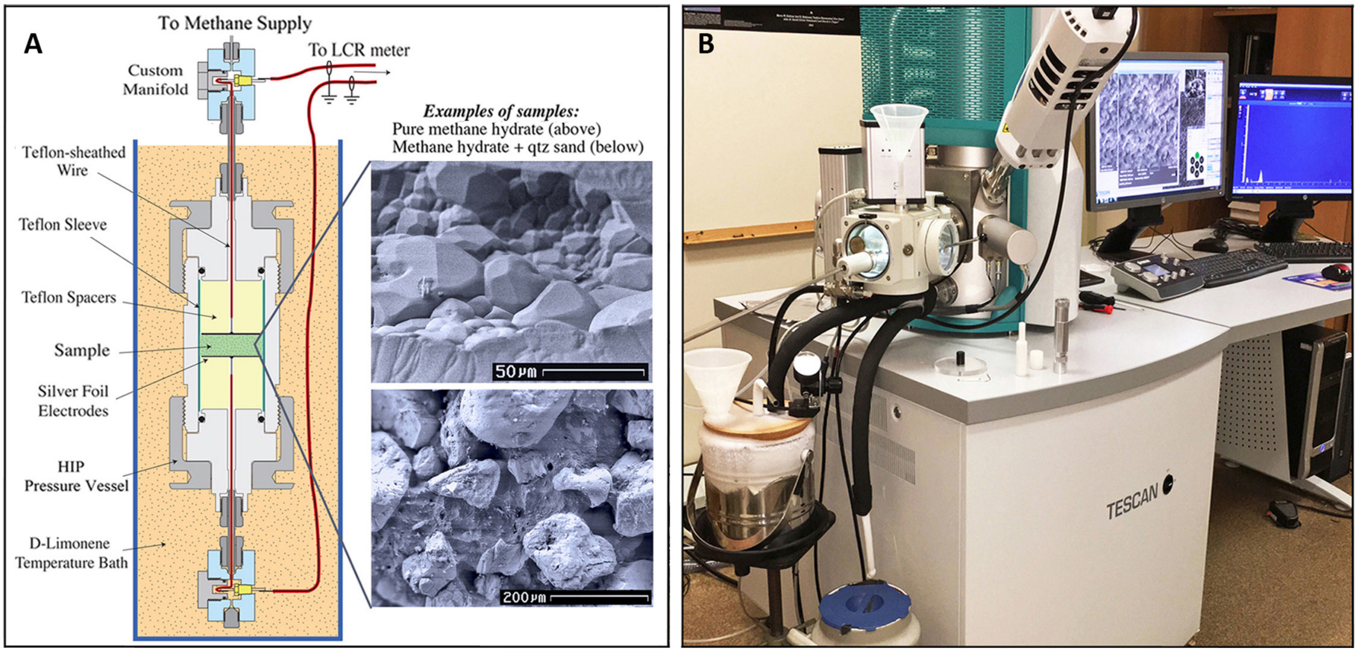

Figure 1. (A) Schematic of electrical resistivity apparatus showing sample chamber configuration and examples of pure methane hydrate and hydrate + sand samples. (B) Cryo-SEM facility in use at the USGS.

Sample Synthesis

Pure methane hydrate was synthesized at the USGS using a temperature-cycling technique to react granular H_2O ice and pressurized methane (CH_4) gas into polycrystalline methane hydrate with ~ 20% pore volume. Samples with NaCl were prepared by mixing powdered NaCl with the ice grains in a low-temperature freezer prior to packing the reactants into the cell. Impurities are typically excluded during methane hydrate formation, so our premise was to uniformly distribute NaCl along ice grain boundaries and junctions, to react with melting ice and form brine, while the bulk sample undergoes hydrate synthesis.

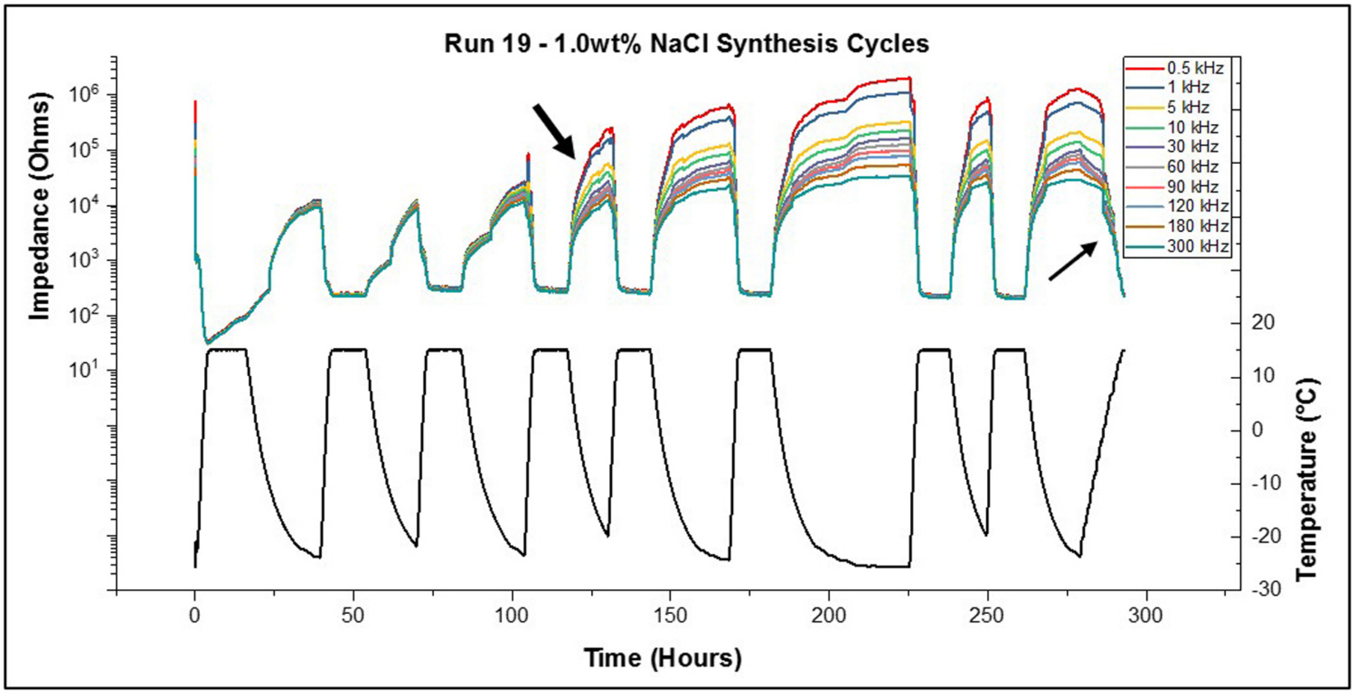

Figure 2. Example run data. Electrical impedance (top graph) and temperature (bottom graph) vs. time during synthesis of methane hydrate with 1.0wt% NaCl. Several heating cycles are needed before the reaction stabilizes, as indicated by bold black arrow. Measurements of electrical conductivity are established during the final step-dwell temperature sweep, indicated by the thin black arrow.

All samples underwent at least 8 thermal cycles to ensure maximum reaction and concluded with a slow step-dwell temperature sweep (1 hour hold per 3-4 °C increments) for final impedance data collection (Figure 2). We have measured methane hydrate samples with bulk NaCl concentrations of 0.25wt%, 1.0wt%, 1.75wt%, and 2.5wt%.

Generating Pore Water

Gas hydrate in nature often occurs near its stability limit, and measuring conductivity changes associated with dissociation and pore water formation is central to our goal of understanding the electrical properties of naturally occurring hydrate. For an initial test, we chose a depressurization pathway across the phase stability boundary (Figure 3A, "induced") to avoid heat flow gradient effects and preferential dissociation along outer portions of the sample. We first synthesized pure methane hydrate and then released pressure to ~ 90 psi below the equilibrium boundary at 5°C to induce in-situ water production (Figure 3B).

After pressure rebounded and impedance approached a new plateau, the sample was quenched in liquid nitrogen. Cryo-SEM shows clear development of the quenched liquid water ("melt") component forming partially interconnected accumulations that are distributed throughout the sample (Figure 4). Methane hydrate grains commonly show rounding or receding of crystal surfaces in regions bordering the liquid component, as they destabilize and partially dissociate.

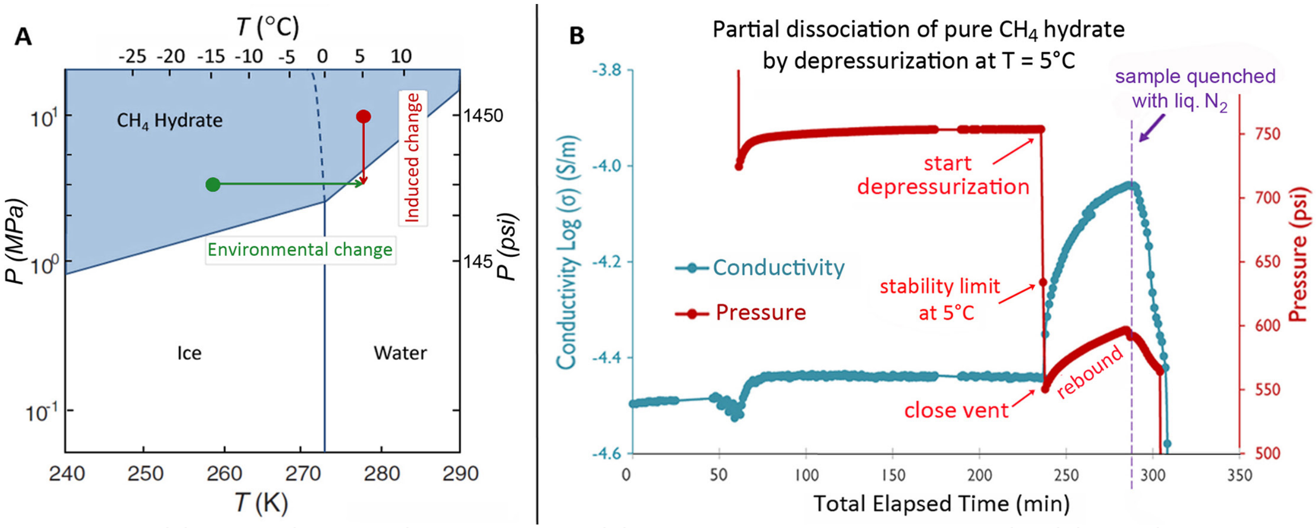

Figure 3. (A) Destabilization pathways simulating environmental change (increasing Temperature, T) vs. induced change (decreasing Pressure, P). (B) Conductivity response to decreasing pressure at 5°C to induce pore water formation.

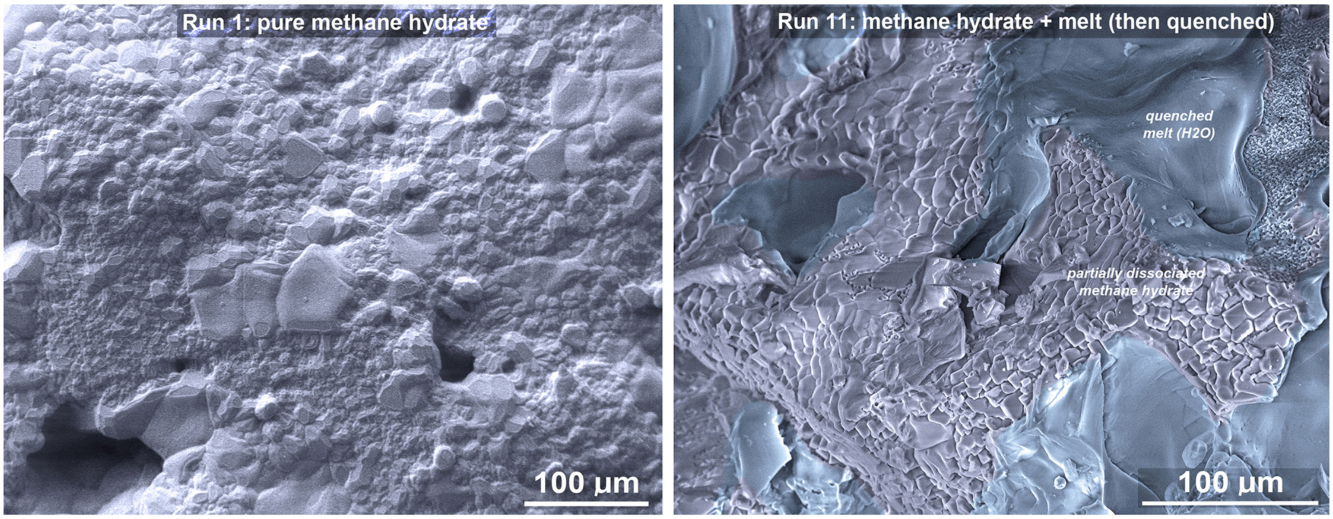

Figure 4. Cryo-SEM images of pure methane hydrate (left), and methane hydrate after brief depressurization at 5°C prior to quenching via the path in Figure 3B (right). False color indicates regions of accumulated water.

Electrical Conductivity Measurements

Impedance spectra (0.5-300 kHz) were collected using an Inductance-Capacitance-Resistance (LCR) meter and two silver-foil electrodes throughout each run. Impedance measurements with the lowest phase angle were isolated and used to calculate conductivity while excluding external contributions. Conductivity exhibited typical exponential dependence on temperature.

Figure 5A compares pure methane hydrate, methane hydrate with pore water, and methane hydrate with 0.25 and 1.0 wt% NaCl. Current measurements on pure methane hydrate match well with prior data. Adding pore water increased conductivity by about a 0.5 log unit at 5°C (Figure 5A, blue arrow to open circle) after dissociating roughly 20% of the sample. This is likely a conservative measurement, as pressure and conductivity continued to stabilize at the conclusion of the test. NaCl had a markedly greater effect; adding even 0.25wt% NaCl increased conductivity by an order of magnitude.

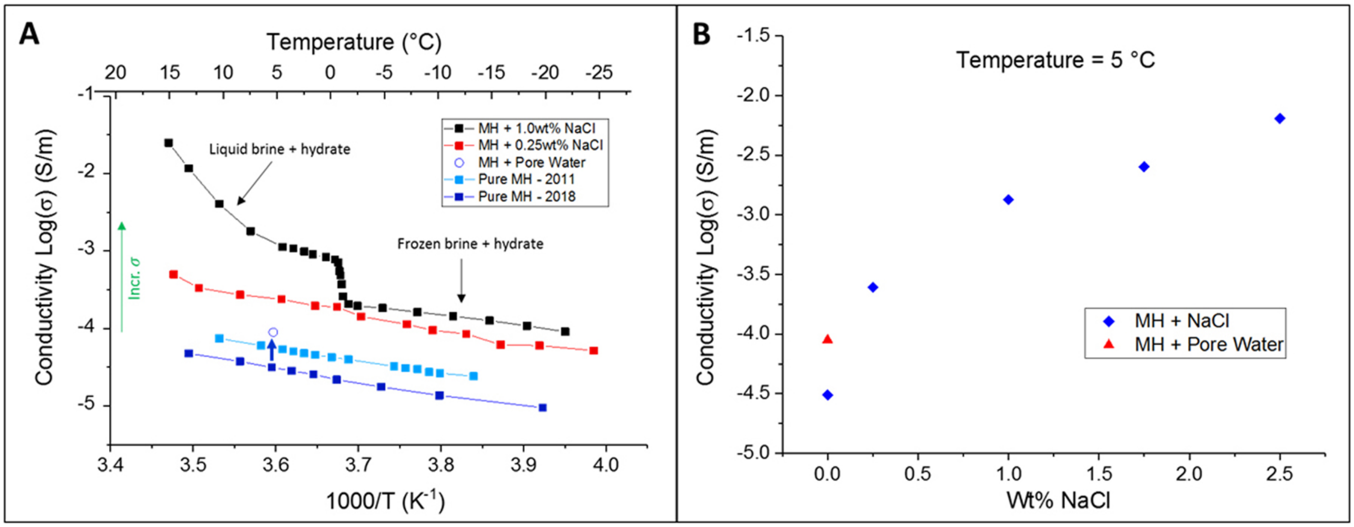

Figure 5. (A) Conductivity (σ) of pure methane hydrate, methane hydrate with H_2O pore water (5°C data point only), methane hydrate with 0.25wt% NaCl and 1.0wt% NaCl; (B) Conductivity of all tests (0-2.5wt% NaCl) compared at 5°C.

Electrical current is dependent on the concentration and mobility of charge carriers, such as Na+ and Cl- solutes in brine. Clean fracture surfaces through all but the 0.25wt% NaCl sample showed thin but increasingly prominent rims of frozen brine surrounding grains or clusters of methane hydrate (Figure 6). The brine becomes increasingly interconnected with higher NaCl content, resulting in increased contribution to the overall conductivity. These results are consistent with work by You et al. (2015) on hydrate-bearing sediments with brine.

All samples that we tested with ≥1.0wt% NaCl exhibited two slopes, such as the 1.0wt% NaCl sample shown in Figure 5A. The steeper slope at higher temperature reflects conductivity mechanisms through the interconnected brine, whereas at lower temperatures where the brine freezes, the primary current path is presumably through hydrate and possibly in combination with frozen brine.

This is also evident during the synthesis of methane hydrate with 1.0wt% NaCl (Figure 2). At higher temperatures, impedance has very little frequency dependence between 0.5-300kHz indicating current is flowing through a resistor-like medium (brine). At lower temperatures, the impedance decreases with corresponding higher frequencies indicating current is primarily flowing through a dielectric medium (hydrate/frozen brine).

Future Work

These preliminary results provide proof-of-concept that we can successfully produce methane hydrate samples with well-distributed pore fluids while concurrently measuring electrical conductivity, even in an evolving system. Now that our group has some grasp of the individual effects of sand, pore water, and

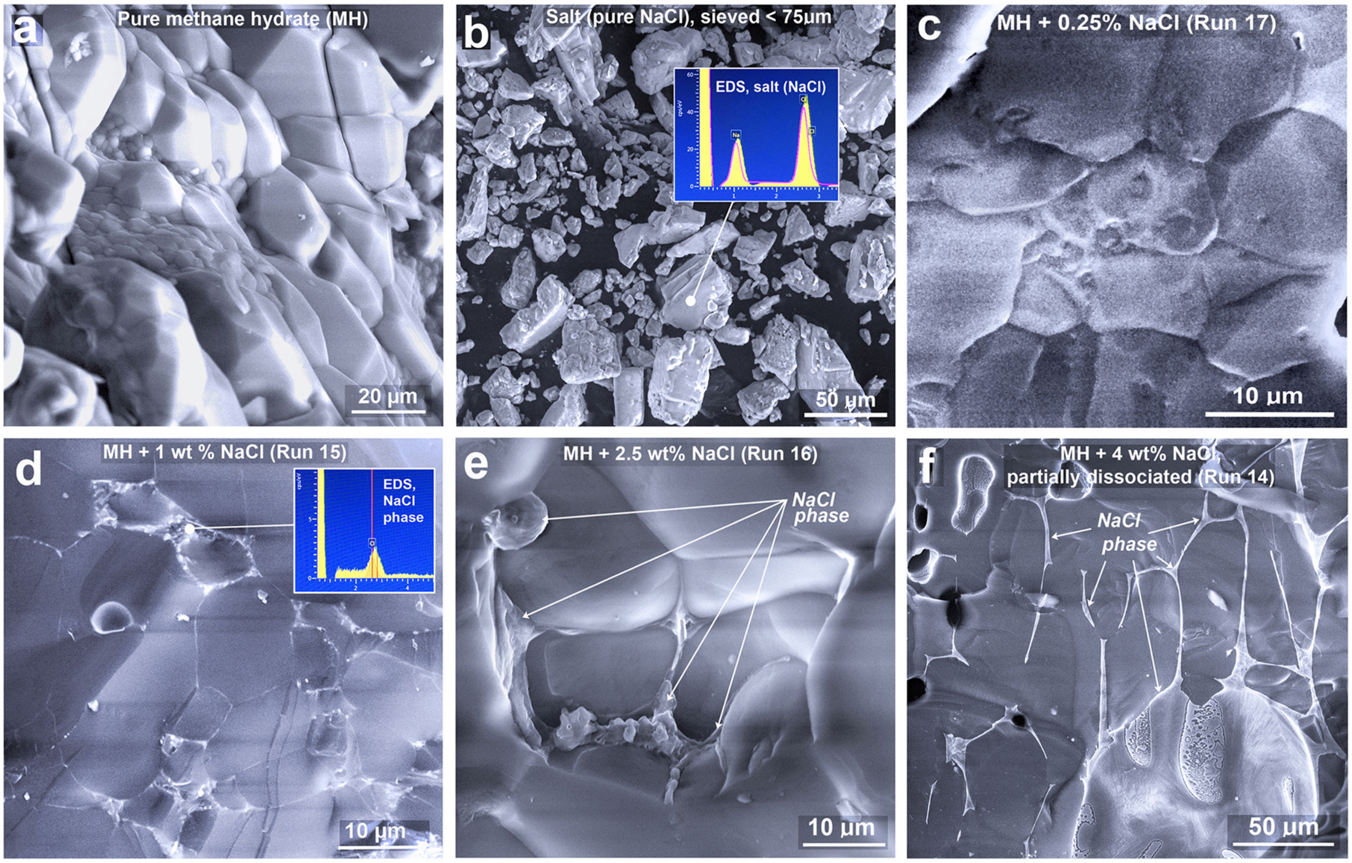

Figure 6. Cryo-SEM images of (A) pure methane hydrate (MH), (B) sieved NaCl particles <75µm, (C) MH + 0.25wt% NaCl, (D) MH + 1wt% NaCl, (E) MH + 2.5wt% NaCl, and (F) MH + 4 wt% NaCl that also underwent partial dissociation. Energy Dispersive Spectroscopy (EDS) spectra shown here as insets confirm identification of elemental components.

brine on methane hydrate, we endeavor to synthesize multi-component mixtures of methane hydrate to better mimic natural systems. Upcoming plans involve the addition of other chemical impurities to better simulate true seawater composition, and synthesizing samples with varying sedimentary grain sizes.

Acknowledgments

Support for this work was provided by U.S. Department of Energy contract DE-FE0028972 and Interagency Agreement DE-FE0026382 between the USGS Gas Hydrate Project and DOE/NETL. We thank J. Roberts (LLNL) and D. Lockner (USGS) for helpful discussion and advice, and W. Waite (USGS) and P. Kannberg (SIO) for helpful reviews of this report. Prepared by LLNL under contract DE-AC52-07NA27344.

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AAPG to Hold Gas Hydrates Workshop

April 16-17, 2019

Auckland, New Zealand

As part of the AAPG's Asia Pacific Geosciences Technology Workshops 2019, a workshop will be held on "Gas Hydrates - From Potential Geohazard to Carbon-Efficient Fuel?"

The workshop takes place April 16-17, 2019 in Auckland, New Zealand.

Natural gas hydrates have been studied extensively in the past three decades, in the context of geohazards, future energy resources, and climate change. While the latter is the topic of significant environmental science research, the petroleum industry is largely focused on possible hazards to offshore installations from gas hydrates. Government-led research, meanwhile, is aimed at investigating the potential of hydrates as an energy resource.

This workshop aims to capture the current state of the art in gas hydrates research and to project a path forward for (1) mitigation of this potential geohazard and (2) extraction of gas from hydrates as a possible low-carbon energy resource. The workshop will start with the latest developments in hydrate resource evaluation and exploration methods and include lessons learned from gas hydrate production tests. Geomechanical models and results from laboratory experiments will be examined in terms of potential hazards of gas hydrates to offshore installations. Finally, novel production methods involving CO_2 sequestration, will be introduced to assess the possible role of gas hydrates as an energy resource in a carbon-constrained future.

For further information, please visit:

https://www.aapg.org/global/asiapacific/events/workshop/Articleid/47012/gas-hydrates-%E2%80%93-from-potential-geohazard-to-carbon-efficient-fuel

For instructions on submitting abstracts, please visit:

https://www.aapg.org/global/asiapacific/events/workshop/Articleid/47012/gas-hydrates-%E2%80%93-from-potential-geohazard-to-carbon-efficient-fuel#152582144-program

Questions regarding the technical program may be directed to Ingo Pecher, Convener, University of Auckland:

i.pecher@auckland.ac.nz

AGU100 ADVANCING EARTH AND SPACE SCIENCE
FALL MEETING
Washington, D.C. | 10-14 Dec 2018

Gas Hydrate Sessions Planned for AGU Fall Meeting 2018

Five technical sessions on gas hydrates are planned for the upcoming AGU Fall Meeting, to be held December 10-14, 2018, in Washington, D.C.:

OS013: Gas hydrates: Major Unconventional Energy Resource, when will they be produced

Conveners: Kalachand Sain, Richard B Coffin, and Ingo Andreas Pecher

OS019 Geomechanics and their implications for long term reservoir stability in a producing Natural Gas Hydrate Reservoir

Conveners: Michael Max, Seth Haines, and Shun Uchida

OS016: Geological and Geophysical Characterization of Marine Gas-Hydrate Reservoirs

Conveners: Manasij Santra, Ann Cook, Alexey Portnov, and Stefan Bunz

OS030: Modeling of Gas-Hydrate-Related Systems

Conveners: Kehua You, Ewa Burwicz, Yoshihiro Konno, and Michael Nole

OS012: Gas-Hydrate-Bearing Sediments: Recent Advances in Characterization, Experiments, and Modeling

Conveners: Stephen C Phillips, Xiaojing Fu, Yi Fang, and Junbong Jang

For further information on the Fall 2018 meeting, please visit:

https://fallmeeting.agu.org/2018/

Fire in the Ice Seeks Articles on Recent International Field Programs

Several notable international field programs were carried out during 2017 and 2018, by methane hydrate research organizations in China (China Geological Survey/CGS), Japan (Ministry of Economy, Technology, and Industry/METI), Germany (GEOMAR), and New Zealand (International Ocean Discovery Program/IODP and University of Auckland). Scientists are currently processing and analyzing data acquired from these field efforts.

Fire in the Ice is seeking articles reporting preliminary findings of these expeditions for future issues of this newsletter. Authors are invited to email Frances Toro (frances.toro@netl.doe.gov) or Karl Lang (karl.lang@netl.doe.gov) by September 30, 2018 with potential titles.

Recently completed international field programs are summarized below.

Researchers in China continue to pursue an active field program in the South China Sea. In July 2017, scientists from the CGS completed their first methane hydrate production test in the Shenhu area of the South China Sea. In April 2018, two submersibles were deployed to gather additional data and samples. A logging-while-drilling, pressure-coring, and geotechnical-sampling expedition is planned for the fall of 2018, using the *R/V Fugro Voyager*, and a second marine production test is planned for 2019. For further information on the production test, please visit http://en.cgs.gov.cn/news1/201707/t20170718_435857.html. For background information on prior field programs in the South China Sea, please refer to FITI vol. 17, issue 1.

Researchers in Japan, representing METI, completed their second offshore methane hydrate production test from April through June of 2017, in the Daini Atsumi Knoll area, between the Atsumi Peninsula and the Shima Peninsula. The expedition was carried out using the *D/V Chikyu* and represents Japan's second offshore methane hydrate production test. For more information on the expedition, please refer to http://www.meti.go.jp/english/press/2017/0629_001.html. For information on prior field programs in the Japan Sea, see FITI vol. 17, issue 1.

International Field Programs Continued

Germany's SUGAR Phase III project included a field program, carried out in April to September of 2017, to sample hydrate prospects in the Black Sea, using the *R/V METEOR*. Gas hydrate reservoir characterization studies were carried out in sand-rich deposits of the Danube Deep-sea Fan. For more information, please visit https://www.marum.de/en/about-us/General-Geology-Marine-Geology/SUGAR-III.html and https://www.marum.de/en/Research/M142.html

In addition, the IODP and University of Auckland completed Expedition 372 on the Hikurangi Margin, east coast of New Zealand, from November 26th, 2017 through January 4th, 2018. The expedition was aimed at studying slow slip events and gas hydrate-related submarine landslides in this active subduction zone. For more information, please see http://publications.iodp.org/preliminary_report/372.

Spotlight on Research

JARED CIFERNO

Technology Manager
NETL Methane Hydrate R&D Program

There is a new name and face on the *Fire in the Ice* newsletter. Meet Jared Ciferno. Jared is the Technology Manager for NETL's Oil and Natural Gas Program, including the Methane Hydrates R&D Program. In this role, he interfaces with executive-level government officials to establish near- and long-term R&D program objectives, oversee project development, and ensure technology integration. In addition, he manages an R&D portfolio that ranges from basic energy science to large-scale field demonstrations.

We thought you would enjoy a glimpse at Jared's background and interests. Jared was born and raised in southwestern Pennsylvania. As a boy, he enjoyed BMX racing—riding fast on 20-inch BMX bicycles around a dirt track punctuated by jumps and rollers and tight corners. When he was about 10, his neighborhood track was sold to a housing developer. A tenacious boy, unwilling to give up his BMX riding, he raised the money needed and worked with a neighbor and a bulldozer to build a new track!

During summers, Jared worked as a cement finisher and block layer in support of his father's cement contracting business. It was during those summers that he and his brothers learned to work hard, guided by their father's strict work ethic, which was essentially "keep your head down, and work hard until the job is done."

Jared considered staying in the cement contracting trade but decided, instead, to pursue engineering. He studied chemical engineering, following a lifelong interest in science and math—and encouraged by an uncle, who told him that engineering skills would open doors to a multitude of career opportunities. Jared received his B.S. and M.S. degrees in Chemical Engineering from the University of Pittsburgh in 1999 and 2005. From 1999-2004, he worked for private industry, and in 2004, he joined NETL in Pittsburgh, first as an Engineering Systems Analyst, then managing fossil energy technology programs.

Jared is enthusiastic about overseeing the *Fire in the Ice* newsletter. He would like to see it continue its longstanding mission of fostering international collaboration and information exchange among scientists and engineers engaged in methane hydrate R&D around the world. At the same time, he would like to see the newsletter employed to publicize achievements emanating from NETL's hydrate program, including highlights of NETL-funded projects and inhouse research activities. In this way, the newsletter can continue to promote international collaboration and technology integration, while also serving as an effective outreach tool for NETL's Methane Hydrates Program.

If you or someone you know would like to be the subject of the newsletter's next "Spotlight on Research," please contact Karl Lang (klang@keylogic.com) or Fran Toro (frances.toro@netl.doe.gov). Thank you!