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Quarterly Research Performance Progress Report

Period Ending 6/30/2019

Deepwater Methane Hydrate Characterization and Scientific Assessment

Project Period 3: 01/15/2018-09/30/2019

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1 ACCOMPLISHMENTS

What was done? What was learned?

This report outlines the progress of the third quarter of the fifth fiscal year in the third budget period. Highlights from this period include:

- **UT-GOM2-2 Path Forward:** In Y5Q3, UT, the GOM2 Advisory Team, and technical experts from Oregon State University, University of New Hampshire, and University of Washington came to a consensus recommendation for the revised UT-GOM2-2 Scientific Drilling Program. UT is currently developing the revised operational plan and will propose the plan to DOE in the next quarter. UT presented this plan to NETL and DOE headquarters in a web conference in April, 2019, along with timelines and budgets for executing the drilling program in 2021 and 2022. DOE subsequently instructed UT to plan the drilling program in 2022, to allow for accrual of required funding and availability of vessels.

- **Vessel of Opportunity**: At the request of DOE, UT approached Equinor ASA (Equinor) to explore the feasibility of a logging-while-drilling (LWD) program in February 2020 aboard the Pacific Drilling Pacific Khamsin drillship at a reduced cost while under long-term lease to Equinor. UT met with Equinor multiple times to discuss this opportunity. In discussions, Equinor is broadly interested but is unable to commit resources to assisting UT with cost estimates until ongoing negotiations are complete. UT requires a decision by mid-July in order to complete necessary contracting and permitting for an early 2020 program to be possible.

- **PCTB Development**: Geotek performed bench-testing of the Pressure Coring Tool with Ball-Valve (PCTB) at their facility in Salt Lake City, Utah. The test took place at a new purpose-built testing facility that allows latching, drilling simulation, and retrieval to be tested at field pressures. Geotek performed pressure function tests, pressure actuation tests, and latch tests. The testing program assessed a single-trigger mechanism designed to ensure complete autoclave closure before boost, further vetting of the flow diverter, and defined an autoclave compliance issue that was previously not understood. Failure of autoclave top seal, late ball-valve sealing, and boost failure did not occur throughout the testing program.

1.1 WHAT ARE THE MAJOR GOALS OF THE PROJECT?

The primary objective of this project is to gain insight into the nature, formation, occurrence and physical properties of methane hydrate-bearing sediments for the purpose of methane hydrate resource appraisal. This will be accomplished through the planning and execution of a state-of-the-art drilling, coring, logging, testing and analytical program that assess the geologic occurrence, regional context, and characteristics of marine methane hydrate deposits in the Gulf of Mexico Continental Shelf. Project Milestones are listed in Tables 1-1, 1-2, and 1-3.

Table 1-1: Previous Milestones

Project Phase	Milestone	Task	Milestone Description	Planned Completion	Actual Completion	Verification Method
Phase 1	M1A	1.0	Project Management Plan	03/2015	03/2015	Project Mgmt. Plan
	M1B	1.0	Project Kick-off Meeting	01/2015	12/2014	Presentation
	M1C	2.0	Site Location and Ranking Report	09/2015	09/2015	Phase 1 Report
	M1D	3.0	Preliminary Field Program Operational Plan Report	09/2015	09/2015	Phase 1 Report
	M1E	4.0	Updated CPP Proposal Submitted	05/2015	10/2015	Phase 1 Report
	M1F	2.0	Demonstration of a viable PCS Tool: Lab Test	09/2015	09/2015	Phase 1 Report
	M1G	--	Document results of BP1/Phase 1 Activities	12/2015	01/2016	Phase 1 Report
Phase 2	M2A	6.0	Complete Updated CPP Proposal Submitted	11/2015	11/2015	QRPPR
	M2B	6.0	Scheduling of Hydrate Drilling Leg by IODP	05/2016	05/2017	Report status to DOE PM
	M2C	7.0	Demonstration of a viable PCS tool for hydrate drilling through completion of land-based testing	12/2015	12/2015	PCTB Land Test Report (in QRPPR)
	M2D	8.0	Demonstration of a viable PCS tool for hydrate drilling through completion of a deepwater marine field test	01/2017	05/2017	QRPPR
	M2E	11.0	Update Field Program Operational Plan	02/2018	04/2018	Phase 2 Report
	M2F	--	Document results of BP2/Phase 2 Activities	04/2018	04/2018	Phase 2 Report

Table 1-2: Current Milestones

Project Phase	Milestone	Task	Milestone Description	Planned Completion	Actual Completion	Verification Method
Phase 3	M3A	14.0	Demonstration of a viable PCS tool for hydrate drilling: Lab Test	12/2018	--	PCTB Lab Test Report (in QRPPR)
	M3B	14.0	Demonstration of a viable PCS tool for hydrate drilling: Land Test	03/2019	--	PCTB Land Test Report (in QRPPR)
	M3C	15.0	Complete Refined Field Program Operational Plan Report	12/2018	--	QRPPR
	M3D	15.0	Completion of required Field Program Permit(s)	12/2018	--	QRPPR
	M3E	--	Document results of BP3/Phase 3 Activities	12/2019	--	Phase 3 Report

Table 1-3: Future Milestones

Project Phase	Milestone	Task	Milestone Description	Planned Completion	Actual Completion	Verification Method
Phase 4	M4A	16.0	Completion of planned field Research Expedition operations	03/2020	--	QRPPR
	M4B	17.0	Complete Preliminary Expedition Summary	09/2020	--	Report directly to DOE PM
	M4C	17.0	Complete Project Sample and Data Distribution Plan	05/2020	--	Report directly to DOE PM
	M4D	17.0	Contribute to IODP Proceedings Volume	09/2021	--	Report directly to DOE PM
	M4E	17.0	Initiate comprehensive Scientific Results Volume with appropriate scientific journal	09/2021	--	Report directly to DOE PM

1.2 WHAT WAS ACCOMPLISHED UNDER THESE GOALS?

1.2.1 PREVIOUS PROJECT PERIODS

Tasks accomplished in previous project phases (Phase 1 and Phase 2) are summarized in Table 1-4.

Table 1-4: Tasks completed during Phase 1 and Phase 2

Project Phase	Task	Description	QRPPR with Task Information
Phase 1	**Task 1.0**	**Project Management and Planning**	Y1Q1 - Y1Q4
	Task 2.0 *Subtask 2.1* *Subtask 2.2*	**Site Analysis and Selection** *Site Analysis* *Site Ranking / Recommendation*	Y1Q1 - Y1Q4
	Task 3.0	**Develop Pre-Expedition Operational Plan**	Y1Q3 - Y1Q4
	Task 4.0	**Complete IODP CPP Proposal**	Y1Q2 - Y1Q4
	Task 5.0 *Subtask 5.1* *Subtask 5.2* *Subtask 5.3*	**Pressure Coring and Core Analysis System Modifications and Testing** *Pressure Coring Tool with Ball Scientific Planning Workshop* *Pressure Coring Tool with Ball Lab Test* *Pressure Coring Tool with Ball Land Test Prep*	Y1Q2 - Y1Q4
Phase 2	**Task 1.0**	**Project Management and Planning *(Cont'd)***	Y2Q1 - Y4Q1
	Task 6.0	**Technical and Operational Support of CPP Proposal**	Y2Q1 - Y4Q1
	Task 7.0 *Subtask 7.1* *Subtask 7.2* *Subtask 7.3* *Subtask 7.4*	**Cont'd. Pressure Coring and Core Analysis System Mods. and Testing** *Review and Complete NEPA Requirements (PCTB Land Test)* *Pressure Coring Tool with Ball Land Test* *PCTB Land Test Report* *PCTB Tool Modification*	Y2Q1 - Y3Q2
	Task 8.0 *Subtask 8.1* *Subtask 8.2* *Subtask 8.3* *Subtask 8.4* *Subtask 8.5*	**Pressure Coring Tool with Ball Marine Field Test** *Review and Complete NEPA Requirements* *Marine Field Test Operational Plan* *Marine Field Test Documentation and Permitting* *Marine Field Test of Pressure Coring System* *Marine Field Test Report*	Y2Q1 - Y4Q1
	Task 9.0 *Subtask 9.1* *Subtask 9.2* *Subtask 9.3* *Subtask 9.4* *Subtask 9.5* *Subtask 9.6* *Subtask 9.7*	**Pressure Core Transport, Storage, and Manipulation** *Review and Complete NEPA Requirements* *Hydrate Core Transport* *Storage of Hydrate Pressure Cores* *Refrigerated Container for Storage of Hydrate Pressure Cores* *Hydrate Core Manipulator and Cutter Tool* *Hydrate Core Effective Stress Chamber* *Hydrate Core Depressurization Chamber*	Y2Q2 - Y3Q3

	Task 10.0 *Subtask 10.1* *Subtask 10.2* *Subtask 10.3*	**Pressure Core Analysis** *Routine Core Analysis* *Pressure Core Analysis* *Hydrate Core-Log-Seismic Synthesis*	Y3Q3 - Y4Q1
	Task 11.0	**Update Pre-Expedition Operational Plan**	Y3Q3 - Y4Q1
	Task 12.0	**Field Program / Research Expedition Vessel Access**	Y3Q3

1.2.2 CURRENT PROJECT PERIOD

TASK 1.0 - PROJECT MANAGEMENT AND PLANNING

Status: Ongoing

Objective 1: Assemble teams according to project needs.

- No new hires this period.

Objective 2: Coordinate the overall scientific progress, administration and finances of the project.

- Managed current project phase tasks.
- Monitored project costs.
- Managed ongoing experimental analysis of pressure cores.
- Continued planning and preparing alternate path forward for the UT-GOM2-2 expedition.
- Responded to DOE request to explore the feasibility of a logging-while-drilling (LWD) program in early 2020 aboard the Pacific Drilling Pacific Khamsin drillship. Met with Equinor in-person on May 16, June 5, and June 20. Prepared draft operational planning documents and developed framework and timeline for possible LWD expedition.
- Initiated discussions with DOE to plan and prepare for BP3 to BP4 budget period transition.
- Initiated development of refined scope of work and cost estimate in preparation for BP3 to BP4 budget period transition.
- Engaged stakeholders and subcontractors to begin development of refined costs and detailed scopes of work for future budget period transitions.
- Provided a formal *Letter of Indication*, informing DOE of UT's intent to initiate a budget period continuation request from BP3 to BP4 by the current BP3 end date of September 30, 2019.

Objective 3: Communicate with project team and sponsors.

- Organized and coordinated regular project team meetings:
    - Monthly sponsor meetings
    - UT-GOM2-2 Advisory Team meetings
    - PCTB development team meetings
- Communicated development of a new expedition plan to the Sponsors, sub awards, and project team
- Managed SharePoint sites, email lists, and archive/website.

Objective 4: Coordinate and supervise subcontractors and service agreements to realize deliverables and milestones according to the work plan.

- Actively managed subcontractors and service agreements.
- Monitored progress and schedule of PCTB bench testing program.

Objective 5: Compare identified risks with project risks to ensure all risks are identified and monitored. Communicate risks and possible outcomes to project team and stakeholders.

- Actively monitored project risks as needed and reported identified risks to project team and stakeholders.

TASK 6.0 - TECHNICAL AND OPERATIONAL SUPPORT OF COMPLIMENTARY PROJECT PROPOSAL

Status: Closed (See *Task 15: Field Program / Research Expedition Preparation* for UT-GOM2-2 plan forward).

A timeline of tasks associated with the Complimentary Project Proposal is provided in Table 1-5.

Table 1-5: Timing of Complimentary Project Proposal Submission

DATE	ACTIVITY
Apr 1, 2015	First Submittal of CPP
May 1, 2015	Upload data to IODP SSDB
Oct 1, 2015	Revised Submittal of CPP
Jan 8, 2016	Upload data to IODP SSDB
Jan 12-14, 2016	SEP Review Meeting
Apr 1, 2016	CPP Addendum Submittal
May 2, 2016	Upload data to IODP SSDB
May 15, 2016	Proponent Response Letter Submitted
Jun 21-23, 2016	SEP Review Meeting
June 2016	Safety Review Report Submitted
July 2016	Safety Presentation PowerPoint
July 11 – 13, 2016	Environmental Protection and Safety Panel Meeting
March 2, 2017	Submit CPP Addendum2
March 10, 2017	Upload Revised Site Survey Data
April 2017	Submit EPSP Safety Review Report V2
May 3, 2017	EPSP Safety Review Presentation V2

May 24, 2017	Scheduling of CPP-887 Hydrate Drilling Leg by JR Facility Board: Exp. 386, Jan-March 2020
May 15-16, 2018	Expedition 386 removed from *JR* schedule
September 10, 2018	EFB recommends that ESO support an MSP expedition based on Plan B-3 for implementation in 2021
November 7-8, 2018	ECORD Council and ESSAC determine that it is not possible to implement CPP2-887 as an MSP.

TASK 9.0 - PRESSURE CORE TRANSPORT, STORAGE, AND MANIPULATION

Status: Complete (See Task 13 for continued UT Pressure Core Center (PCC) activities).

TASK 10.0 - PRESSURE CORE ANALYSIS

Status: Ongoing

Subtask 10.4 - Continued Pressure Core Analysis

A. Pressurized Core Analysis

A.1. Quantitative Degassing and Gas Analysis

- UT continued quantitative depressurization of pressure core and analysis of the resultant gases. Samples were selected to fill in the gaps and increase the resolution of estimated variation in hydrate saturation downhole. During this quarter, we degassed intervals from core sections UT-GOM2-1-H005-04FB-8 and UT-GOM2-1-H005-13FB-1; these cores had hydrate saturations of ~75% and 86% respectively.

A2. Permeability measurement of pressure core

- UT continued permeability measurement of UT-GOM2-1 pressure cores. During this quarter, we measured pressure core section UT-GOM2-1-H005-04FB-8-3 and UT UT-GOM2-1-H005-13FB-1. The effective permeability of 4FB-8-3 is 0.46 mD and its intrinsic permeability is 0.28 mD after hydrate dissociation. The effective permeability of 13FB-1 is 0.08 mD. After hydrate dissociation, the intrinsic permeability is 0.24 mD (Figure 1-1).

A3. Capillary behaviors of GC 995 lithofacies, intact cores and compromised cores

- UT continued studying the capillary behavior of the reconstituted lithofacies, intact cores, and compromised cores in the UT-GOM2-1 pressure cores (Figure 1-2).
- The capillary behavior of intact cores, reconstituted sandy silts, and compromised cores are similar.
- At the observed 90% hydrate saturation in lithofacies 2, the methane solubility is defined by the smallest pores filled with hydrate (*e.g.*, red filled circle in Figure 1-3 where S_w = 10%, d_p = ~ 0.35µm). This solubility is less than that necessary to form hydrate in the very largest pores of lithofacies 3 (*e.g.*, green filled circle in Figure 1-3 where S_w = 100%, d_p = 0.18 µm).

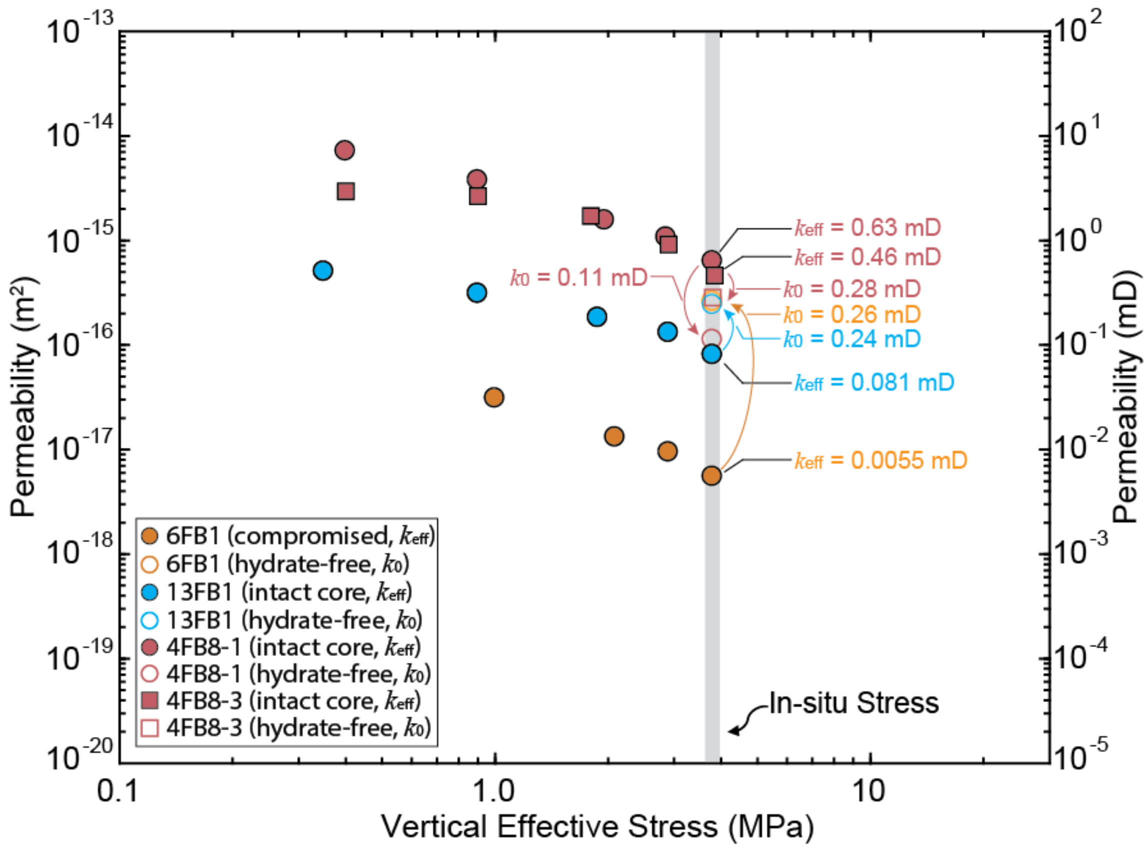

Figure 1-1. Effective(k_{eff}) *and intrinsic*(k_o) *permeabilities of pressure cores. The filled symbols show effective permeabilities with vertical effective stress. The empty symbols represent the measured permeability after hydrate dissociation while maintaining a constant effective stress of 3.8 MPa.*

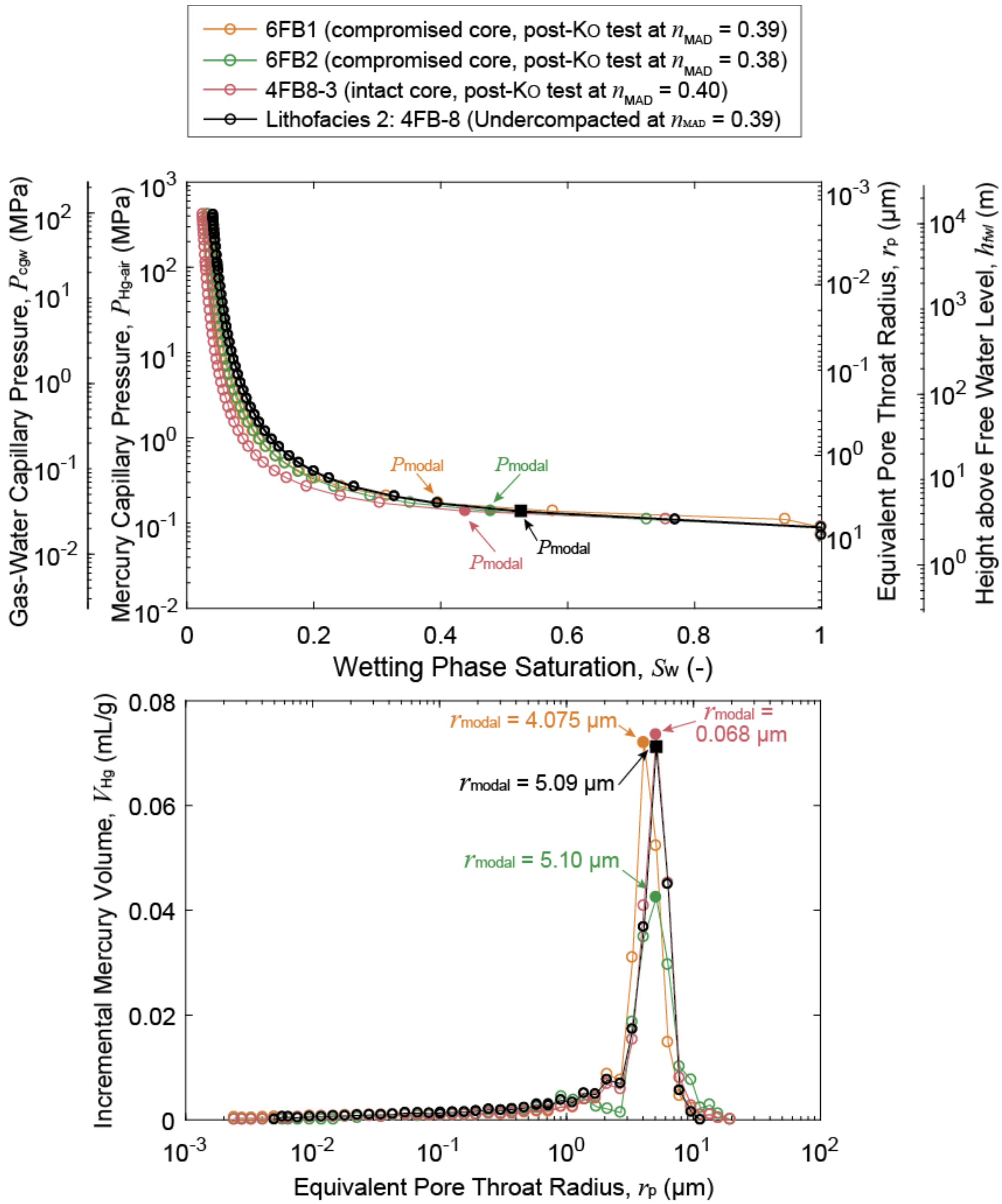

Figure 1-2. Results of Mercury injection capillary pressure measurement of reconstituted sandy silts from 4FB8, intact pressure core 4FB8-3, compromised core 6FB1 and 6FB2. (a) Hg-air entry pressure curves. (b) Incremental Mercury injection volume with pore throat diameter. The 'post Ko' tests were pressure core samples measured after dissociation at a constant effective stress of 3.8 MPa.

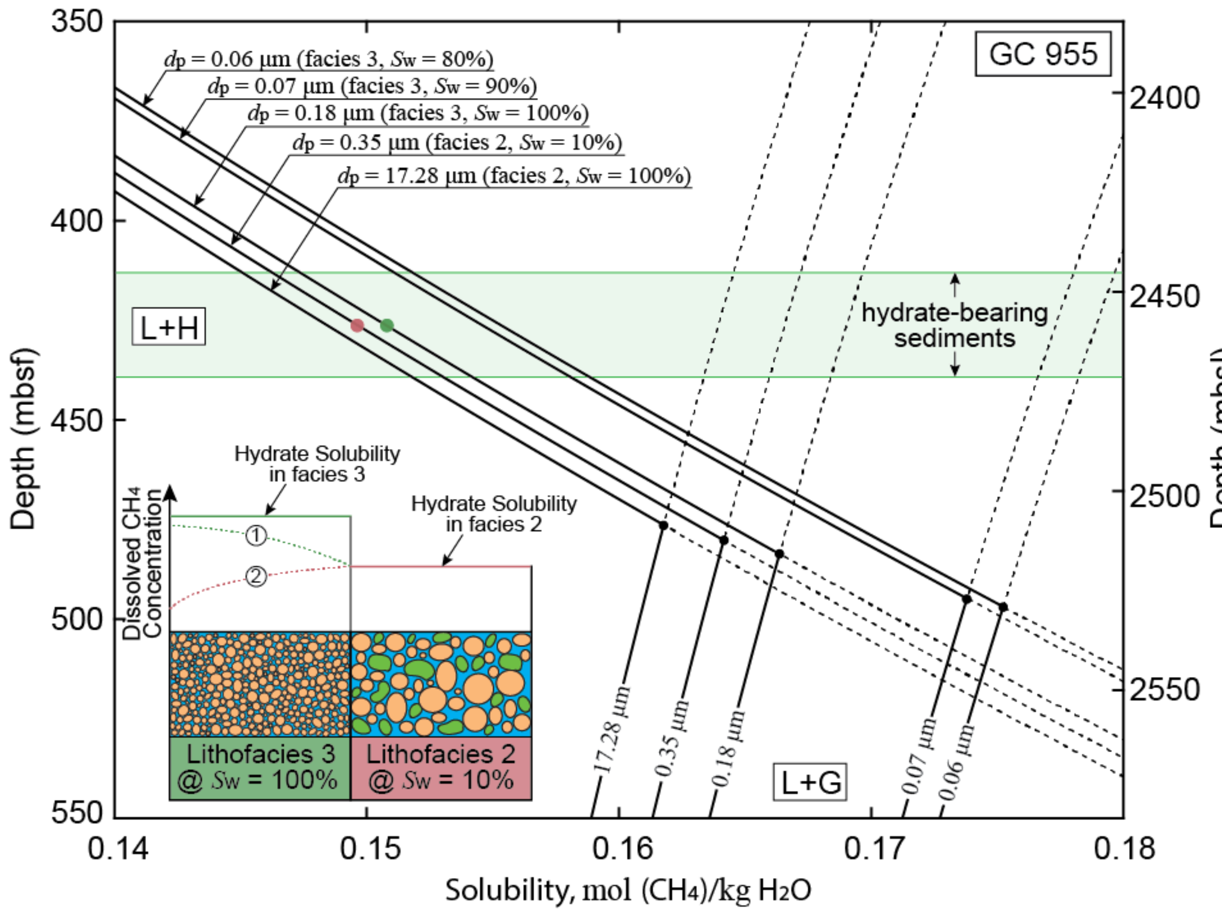

Figure 1-3: The L(liquid) + G(gas) and L + H(hydrate) solubilities (black lines) in fine pores (d_p = 17.28, 0.35, 0.18, 0.07, 0.06 μm). At any depth in hydrate-bearing sediment zone (light green zone), the hydrate solubility in fine pores of lithofacies 2 (red filed circle, S_w = 10%, d_p = 0.35 μm) is always less than that in the largest pore of lithofacies 3 (green filled circle, S_w = 100%, d_p = 0.18 μm).

- UT submitted a manuscript to the AAPG Bulletin special issue summarizing the index properties, intrinsic permeability and compressibility of reconstituted lithofacies. *Fang et al. (in review) Petrophysical properties of the GC 955 Hydrate Reservoir Inferred from Reconstituted Sediments: Implications for Hydrate Formation and Production, American Association of Petroleum Geologist Bulletin.*

- Oregon State, with UT, is helping prepare for the microbial analysis of the UT-GOM2-1 pressure cores at UT, collaborating with Zara Summers (ExxonMobil), Bill Waite, Junbong Jang (both of USGS), and Jenn Glass and Sheng Dai (both of Georgia Tech). Experiments continue to be planned that can be conducted with the preserved cores to determine which microbial communities are stimulated as a result of depressurization in a lab study that would be somewhat analogous to a depressurization in the field aimed at producing methane from hydrates. Among the few samples that are still at pressure is one that is close to a reference sample taken at the time that the cores were collected in 2017. The microbial community in this reference sample has been characterized at ExxonMobil Research by Zara

Summers and Ian Drake and will be a useful comparison for the communities derived from the pressure core.

Along with the pressure core team (Bill Waite, Junbong Jang, Jennifer Glass, Sheng Dai) Oregon State planned the summer 2019 sampling party at UT during July/August. Added to the team were Jessica Buser (OSU graduate student) and Brandi Kiel Reese (TAMU Corpus Christi) to augment the microbiological analysis. In the previous quarter Oregon State provided detail related to the DNA and RNA analysis planned to occur at TAMU-CC in the Reese clean lab. This will incorporate earlier findings from Zara Summers and Ian Drake at Exxon. Oregon State has developed a provisional microbiology sampling plan for the sampling that will occur UT-Austin in late July. This is based on Colwell's past experience in working with deep sediment cores and will be adjusted as needed according to the actual sample at hand when it is used in July at UT. The intent of this sampling plan for GOM2-1 and GOM2-2 microbiological studies is to: 1) reproduce previous sampling approaches for deep sediments that have generated useful results, 2) allow consistency in subsampling sediment cores, and 3) serve as a training plan for scientists new to microbiological sampling.

In addition, Oregon State is planning two summer 2019 tasks that will assist in the evaluation of low biomass samples from the GOM2-2 expedition: 1) determination of best practices for minimizing the effects of polymerase chain reaction inhibitors present in sediment cores (as needed to optimize DNA-based community characterization studies, and 2) determination of primary contaminants in the Colwell Geomicrobiology lab at OSU such that these taxa can be recognized and distinguished from authentic microbes in GoM sample material. Progress related to these efforts will be reported in the next quarter.

A3. Pressure Core Distribution

- UT continued working on the research agreement and material transfer agreement between UT and the National Institute of Advanced Industrial Science and Technology (AIST) (Japan) for the transfer of two 35 cm pressure core sections from UT-GOM2-1-3FB-5 and 5FB-3. The execution of the agreement should begin once AIST has secured funding.
- UT worked to prepare cutting plans for cores H005-06FB-3, H005-01FB-4, H005-05FB-2, and H005-05FB-3 for BIO chamber sampling. This involved coordinating with the USGS, Georgia Tech, and Oregon State to prepare shipping and preparation of equipment, and plan sample transport.

B. Depressurized Pressure Core Analysis

52 samples (of 40 planned) for sediment grain size from holes H002 and H005 using the laser particle size analyzer at UNH were measured twice, (bulk sediment and TOC-free sediment) using the UNH Malvern Mastersizer 2000 Laser Particle Size Analyzer. The TOC-free results are shown in Figure 1-4.

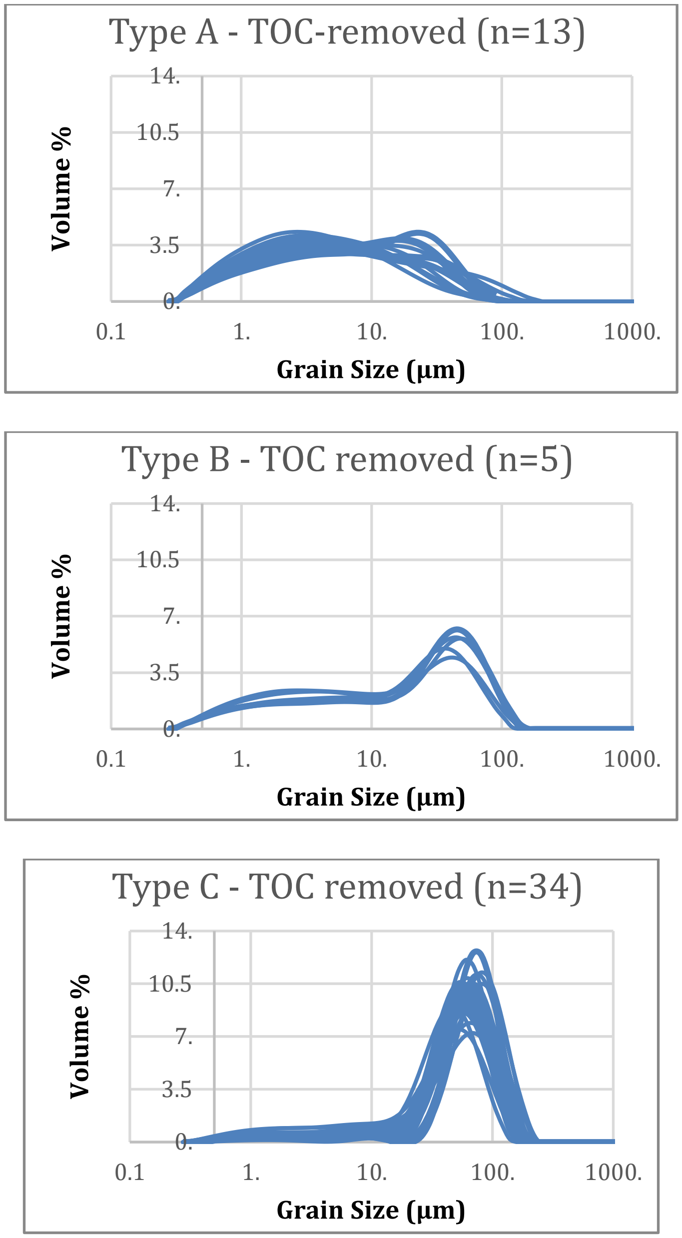

Figure 1-4. Malvern Mastersizer 2000 Laser Particle Size Analyzer Grain Size Distribution Plots by sample. UNH measured 52 samples (shown above) and 18 duplicates (not shown above) and binned the results into three profile types (A, B, and C), reflective of their sorting characteristics and dominant grain size.

Subtask 10.5: Continued Hydrate Core-Log-Seismic Synthesis

- No update

Subtask 10.6: Additional Core Analysis Capabilities

- The X-ray CT system with P-wave attachment for Mini-PCATS, installed and tested during the previous budget period, continues to function as anticipated.
    - CT scans of pressure cores prior to cutting has allowed researchers to adjust cut locations mm to cm ensuring (for example) a lithofacies 2 core in fact contains only lithofacies 2.

- In the previous reporting period UT ordered a pre-consolidation system from Geotek. The system would at a minimum allow for multiple K0 permeameter samples to be cut and stored at applied effective stress in preparation for analysis. The pre-consolidation system can then be loaded directly in to the K0 permeameter to measure permeability and compressibility. This will reduce sample wastage and increase the rate of sample analysis. The pre-consolidation system was delivered to UT in June, 2019.

TASK 13.0 – MAINTENANCE AND REFINEMENT OF PRESSURE CORE TRANSPORT, STORAGE, & MANIPULATION

Status: Ongoing

Continued to store, stabilize, and perform tests on pressure core acquired from UT-GOM2-1 Marine Field Test (May-June 2017). Performed weekly pressure checks on pressure chambers.

Subtask 13.1: Hydrate Core Manipulator and Cutter Tool

- One core scanned and subsampled with the aid of the new CT scanner system:
    - Core H005-13FB-1 – K0, Degas samples, May 2019.
- Accepted delivery of the Pre-Consolidation System for long term storage of pressure core permeability samples.
- X-ray system continues to function well.
- Installation of vertical PMRS pump stand to accommodate new Pre-Consolidation System.
- Accepted delivery of USGS BIO sampler chamber.
- Accepted delivery of two AIST pressure chambers for BIO sampling transfers.
- System cleaned and cutter blades replaced after each sampling.

Subtask 13.2: Hydrate Core Effective Stress Chamber

- Installation of new K0 software, Version April 2019 from Geotek.
- Completed K0 system maintenance in May, 2019.
- One pressure core sample from core H005-13FB-1 was tested and dissociated in the effective stress chamber from May-June, 2019. Sediments from sample collected for additional analysis.

Subtask 13.3: Hydrate Core Depressurization Chamber

- Ran two degassing tests during Q3:

- H005-4FB-8 - 40-54 cm
- H005-13FB-1 - 33.5-52 cm

Subtask 13.4: Hydrate Core Transport Capability for Field Program

- Future Task (UT-GOM2-2).

Subtask 13.5: Maintenance and Expansion of Pressure Core Storage Capability

- Continued to assess current capabilities and requirements for storing pressure cores that will be acquired in during UT-GOM2-2.

Subtask 13.6: Transportation of Hydrate Core (Field Program)

- Future Task (UT-GOM2-2).

Subtask 13.7: Storage of Hydrate Cores (Field Program)

- Future Task (UT-GOM2-2).

Subtask 13.8: Hydrate Core Distribution

- Future Task (UT-GOM2-2).

TASK 14.0 – PERFORMANCE ASSESSMENT, MODIFICATIONS, AND TESTING OF DOE PRESSURE CORING SYSTEM

Status: Ongoing

Subtask 14.1: PCTB Lab Testing and Analysis

- In April-May, 2019, Geotek performed bench-testing of the Pressure Coring Tool with Ball-Valve (PCTB). The test tool place at a new, purpose-built, facility in Salt Lake City, Utah which allows latching, drilling simulation, and retrieval to be tested at field pressures.
- Seven PCTB failure modes were identified to have occurred in the 2017 UT-GOM2-1 Marine Field Test. Of these, three were resolved during UT-GOM2-1. The four failure modes that were unresolved after the expedition are:
    - Repeated high-tension efforts to unlatch the PCTB from the BHA.
    - With above in-situ boost setting, possible on-time seal of autoclave but no recorded boost.
    - With above in-situ boost setting, very late seal of autoclave with no recorded boost.
    - With below in-situ boost setting, seal of autoclave after sea floor dwell with probable boost recorded.
- Geotek performed the following tests in the Bench Test Program:
    - **Latch Tests**

    - In the UT-GOM2-1 Marine Test, we occasionally encountered significant difficulty unlatching from the BHA. The latch components were tested individually, with the PCTB assembled in a vertical configuration, in attempt to troubleshoot individual components. Twenty-three latch tests were performed in various configurations. No difficulties unlatching were encountered in these tests, however later in the testing program, it was found that a proposed overtravel spring modification resulted in dramatically higher pull weights, some beyond the capability of a typical wireline.
  - **Pressure Function Tests (PFT)**
    - Pressure Function Tests are designed to test proper function of the individual components of the autoclave assembly. In this test the autoclave is suspended vertically in open air, pressurized, and actuated at 1000/4000 psi. Sixteen PFTs were performed.
    - All pressure function tests with diverter seals installed were either aborted due to hydraulic lock, or were successful with manipulation of the actuation pressure. Geotek has stated that the hydraulic lock observed was due to unique parts required by the test fixturing sealing with the diverter and are not indicative of a new hydraulic lock issue. After removing the diverter seals all pressure function tests were successful without having to manipulate the lubricator pressure. A new Point Contact Sleeve Valve Seal did not suffer the damage as seen on the previously used lip seal. The Single-Trigger-Mechanism was tested in PFTs 1-10 and functioned well with no malfunctions or loss of boost.
  - **Pressure Actuation Tests (PAT)**
    - Pressure Actuation Tests are designed to replicate tool performance at pressure conditions similar to those encountered in deep ocean drilling. The entire PCTB assembly is deployed with a mock BHA in a test pressure chamber capable of 5000 psi. The PCTB is then pressurized, actuated, and retrieved. Ten PATs were performed.
    - The PATs revealed an issue with the overtravel spring compressing and allowing the PCTB to unlatch from the BHA prior to full stroke of the PCTB when a slow wireline pull is applied, and the new shear pin is installed. The addition of the shear pin in the IT plug, allowing for a dwell in the stroking process for the ball to have more time to close, has introduced issues associated with the overtravel spring.
- The PCTB Development Team, including members of UT, DOE, USGS, and Pettigrew Engineering are reviewing the results of the PCTB Bench Testing Program. In the next reporting period the PCTB Development Team will conclude their assessment of the testing outcome and make recommendations for additional testing or PCTB modifications/upgrades determined necessary as a result of the tests.

Subtask 14.2 Pressure Coring System Modifications/Upgrades

- Potential modifications that were tested in the Bench Test include the following:
  - A prototype Single-Trigger-Mechanism design was tested that combines the seal on the top of the PCTB and the firing of the boost into a single action. The intent of this design is to increase the reliability and performance of the PCTB by eliminating unnecessary complexity. The Single-Trigger Mechanism behaved as anticipated throughout the testing program.
  - A shear pin was designed to allow a pause in activation after the ball valve is released from the activation spring. The intent of this design is to provide additional time for the ball valve to close before continuing the actuation sequence.
  - Lip seals were replaced with point seals during the testing.
- The PCTB Development Team is reviewing results of the PCTB Bench Test and will make recommendations on upgrades/modifications in the next reporting period.

Subtask 14.3: PCTB Land-Based Testing and Analysis

- UT and Pettigrew Engineering continued planning activities for PCTB Land Test at the Schlumberger Cameron Testing and Training Facility (CTTF). The Land Test has been tentatively re-scheduled for early 2020. This will allow for time needed to assess outcome of PCTB Bench Testing program and perform any additional tests or modifications as determined necessary by UT, Pettigrew Engineering, and DOE.

TASK 15.0 – FIELD PROGRAM / RESEARCH EXPEDITION OPERATIONS

Status: In Progress

Subtask 15.1: Review and Complete NEPA Requirements

Future Task.

Subtask 15.2: Finalize Detailed Operational Plan for Field Program

In this reporting period, UT completed development of a revised UT-GOM2-2 operations plan that meets the science objectives recommended by the GOM2 Advisory Team (composed of members of UT, Ohio State, LDEO, DOE, BOEM, and USGS) and a panel of technical experts from Oregon State, UNH, and UW. This plan has the unanimous approval of the GOM2 Advisory Team. UT presented this plan to NETL and DOE Headquarters in a web conference on April 25, 2019.

In the UT-GOM2-2 Scientific Drilling Program, we will core at the existing logging-while-drilling (LWD) locations of WR313-H (TBONE-01B) and WR313-G (TBONE-03B) in Terrebonne Basin. At TBONE-01B, we will solely acquire pressure cores. At TBONE-03B, we will combine conventional coring, pressure coring, and pressure/temperature measurements.

The UT-GOM2-2 operations plan is summarized below:

TBONE-01B

- We will first drill TBONE-01B at the WR313-H location. TBONE-01B will be drilled with the PCTB-FB bottom-hole assembly (BHA) from seafloor to total depth (3010 fbsf). Pressure cores will be acquired with the PCTB-FB tool. A center bit will be used to advance the borehole where pressure cores are not taken.
- We will acquire continuous pressure-cores in the Red Sand (2 cores, complete interval), the Blue Sand (3 cores, partial interval), and the Orange Sand (7 cores, complete interval). We will acquire intermittent spot pressure-core pairs throughout the borehole to develop a dissolved methane profile and acquire pressure cores above and below the bottom-simulating reflector (BSR) (Figure 1-5).

TBONE-03B

- We will then drill TBONE-03B at the WR313-G location. TBONE-03B will be drilled using the PCTB-CS BHA from the seafloor until refusal (estimated at 1640 fbsf) and the PCTB-FB BHA to total depth (3065 fbsf).
- Using the Geotek Advanced Piston Corer (G-APC), we will continuously conventional-core from the seafloor to approximately 250 fbsf, to maximize recovery over 1) the sulfate-methane transition (SMT), 2) the depth at which methane reaches saturation, and 3) at least one glacial-interglacial cycle. (Figure 1-5). Within this interval, we will acquire a PCTB-CS spot core just below the SMT, followed immediately by a temperature and pressure penetrometer deployment (T2P) (Figure 1-5).
- We will continue drilling with the PCTB-CS and a center bit to approximately 1640 fbsf. In this interval, we will take five intermittent spot core sequences consisting of one each of G-XCB conventional-core (Geotek Extended Core Barrel), PCTB-CS pressure-core, and a T2P deployment (Figure 1-5). One of these five deployments will be in the thin Aqua Sand, with the four additional spot-deployments evenly distributed to develop the dissolved gas and geochemical profile (Figure 1-5).
- After encountering refusal with the PCTB-CS BHA, we will trip pipe, perform a BHA change, and reenter to continue drilling with the PCTB-FB with center bit. Between ~1640 fbsf and the top of the Blue Sand we will complete three intermittent spot core sequences consisting of one each of G-RCB conventional core (Geotek Rotary Core Barrel) and PCTB-FB spot pressure-core to develop the dissolved gas and geochemical profile (Figure 1-5).
- We will also acquire continuous pressure-cores in the Blue Sand (10 cores) and Kiwi sand (3 cores, at the BSR) (Figure 1-5). These cores will not cover the full thickness of these sands, but will aim to collect representative intervals.

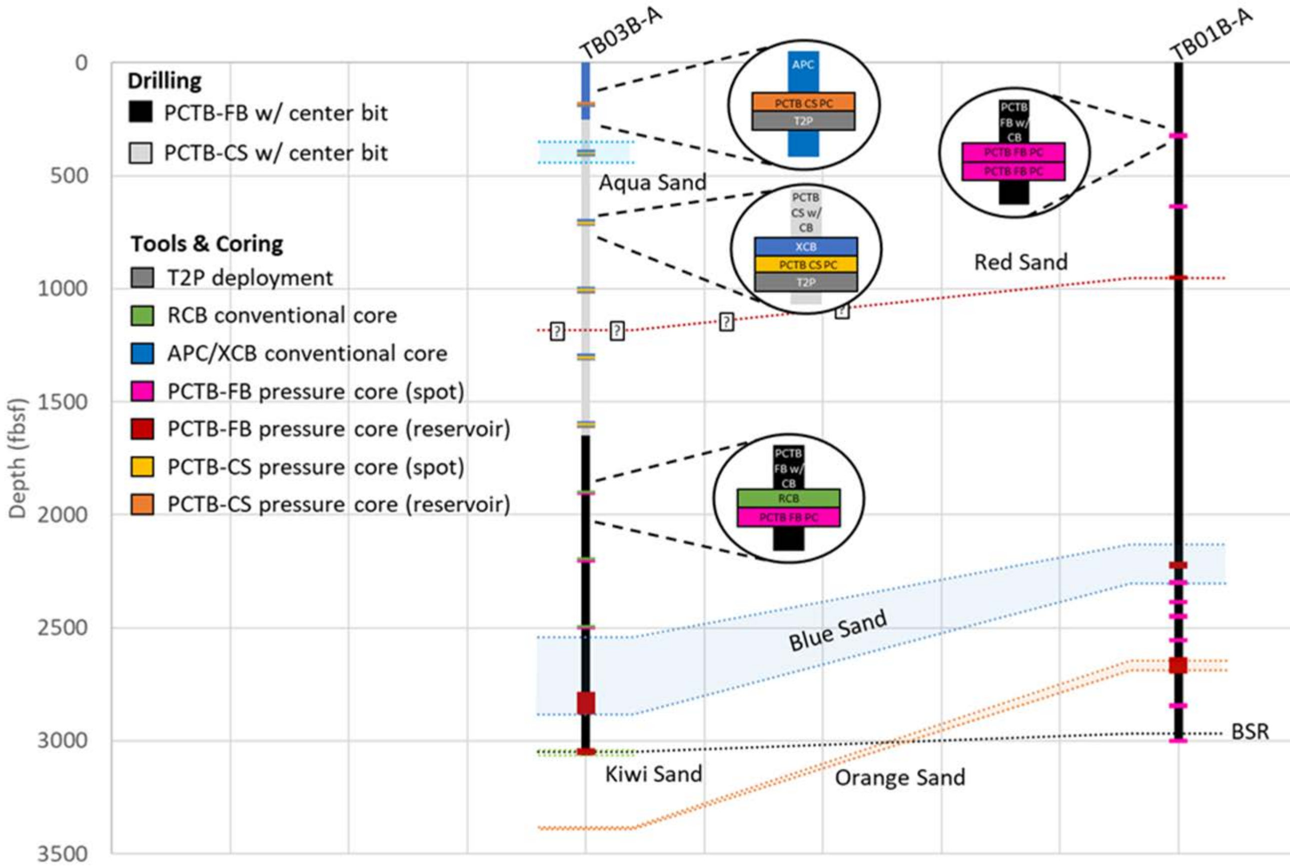

Figure 1-5. UT-GOM2-2 drilling and coring plan at TBONE-01B and TBONE-03B. Dashed lines represent approximate sand locations as described in Hillman et al., 2017 and Boswell et al., 2012. Connectivity of Red and Blue Sands are subject to interpretation. Not to scale.

The UT-GOM^2-2 drilling program will occur in spring 2022, with the ideal weather window being in May. We estimate the drilling/coring program will last approximately 30 days. Following the drilling program, a 30-day pressure-core and conventional core analysis program will take place at Port Fourchon, Louisiana. This is required because there will be insufficient time on the vessel to analyze the acquired pressure cores.

Subtask 15.3: Permitting for Field Program

- OSU and UT G&G permitting has been put on hold pending input from the GOM2 Advisory Team and DOE concerning UT-GOM2-2. All files have been archived on the GOM2 SharePoint site.

Subtask 15.4: Assemble and Contract Pressure Coring Team Leads for Field Program

- No activity this period.

Subtask 15.5: Contract Project Scientists and Establish Project Science Team for Field Program

- Future Task.

New Subtask: Vessel of Opportunity for 2020 LWD Program

In May, 2019, DOE requested that UT assess the potential of subcontracting the Pacific Drilling S.A. (Pacific Drilling) Khamsin drillship through a subcontract to Equinor ASA (Equinor) for a logging-while-drilling (LWD) and well-test program in the deepwater Gulf of Mexico in early 2020. The earliest the program could be run is in February 2020.

UT has taken numerous steps towards exploring this potential, including developing a draft operations plan, developing a draft cost estimate, developing lists of issues that need to be vetted, and engaging Equinor in preliminary discussions. UT has also met with Equinor twice in-person, on May 16 and June 5, 2019. As a result of the most recent meeting, we have determined the following parameters:

1. If the project proceeds, the service agreement would be between UT and Equinor.
2. Pacific Drilling would have to approve any contract between UT and Equinor.
3. UT would be the operator, responsible for all permitting, etc. The situation would be analogous to GOM2-1, wherein UT contracted with Helix.
4. The window for the UT project is February, 2020. This is the soonest it could occur. If Equinor has a discovery at their prospect, the 'success case', then the project would be delayed by 50 days.
5. The current negotiated rate on the Khamsin is $175/day. This is public information. The rate is subject to escalation.
6. It appears that it may be possible for UT to use Equinor's subcontractors (e.g. mud, cement, etc.), as applicable, and would not have to negotiate separately with each third party. This would need to be confirmed with discussions with Equinor. If confirmed, UT would be charged cost-plus administration fees.
7. It may also be possible to use Equinor's logistics (e.g. helicopters, boats, onshore supply base, etc.). This, too, would need to be confirmed with Equinor and would be charged on a cost-plus administrative fee basis.
8. Equinor thinks UT can get questions related to subcontractors answered fairly quickly, as these individuals are not engaged with Total negotiations. UT will receive limited feedback regarding the form of the UT-Equinor service agreement until the Total contracting is complete.

UT provided Equinor with a list of succinct questions on June 11, 2019, for Equinor's consideration. Equinor has requested a meeting to pursue these questions. We are now at the point where we have developed a draft operations plan and a preliminary estimate of total costs. UT requires a decision by mid-July in order to complete necessary contracting and permitting for an early 2020 program to be possible.

1.3 WHAT DO YOU PLAN TO DO DURING THE NEXT REPORTING PERIOD TO ACCOMPLISH THE GOALS?

TASK 1.0: PROJECT MANAGEMENT AND PLANNING (CONT'D FROM PRIOR PHASE)

UT will continue to execute the project in accordance with the approved PMP, manage and control project activities in accordance with their established processes and procedures to ensure subtasks and tasks are completed within schedule and budget constraints defined by the PMP.

Key project management and planning goals for the next quarter include:

- Coordinate evaluation of results of PCTB Bench Testing Program (Task 14.1) and determination of modifications to PCTB (Task 14.2).
- Continue to coordinate and plan Task 14.3: PCTB Land-Based Testing and Analysis.
- Pending DOE approval, of the revised UT-GOM2-2 science and operations plan, UT will update the Operational Plan Report to reflect the current plan.
- Continue to coordinate development of technical requirements and scope of work for a drilling vessel.
- Complete budget and planning documents required for the BP3-BP4 budget period transition. UT intends to deliver the formal packaged of necessary supporting information to DOE by late July, 2019.

TASK 6.0: TECHNICAL AND OPERATIONAL SUPPORT OF COMPLIMENTARY PROJECT PROPOSAL (CONT'D FROM PRIOR PHASE)

- UT will continue to plan and prepare for the UT-GOM2-2 expedition independently. Technical and operational support of the UT-led UT-GOM2-2 field program will be conducted under Task 15 – Field Program Preparation.

TASK 10.0: PRESSURE CORE ANALYSIS (CONT'D FROM PRIOR PHASE)

Subtask 10.4: Continued Pressure Core Analysis

Pressure Core Analysis

A. Quantitative Degassing and Gas Analysis

- We will continue the quantitative depressurization of pressure core and gas analysis:
  - We are now analyzing uncompromised, high quality core, targeting gaps to increase resolution of estimated variation in hydrate saturation downhole. In particular, we will degas 4 samples adjacent to BIO samples and core sections shipped to AIST to provide hydrate saturations for these tests.
  - We will analyze samples with distinct lithologies: lithofacies 2 (sandy silt, high hydrate saturation) and 3 (clayey silt, low hydrate saturation), particularly improving the number of lithofacies 3 samples.

B. Steady-state Permeability Tests

- UT will continue the k0 permeability measurement of pressure core sample 3FB-5.
    - Sample 3FB-5 will be scanned by PCTAS X-CT and cut for K0 permeability measurement. We will perform the pressure core analysis of 3FB-5. This analysis will include (1) measure the effective permeability of pressure core at in-situ stress; (2) measure the intrinsic permeability at in-situ stress; (3) CT-scan of the core after core is taken out of the Ko system; (4) laser grain size distribution; (5) Hg-porosity measurement; (6) Mercury injection capillary measurement.

C. Microbiology of Pressure Cores

- BIO sampling will occur during next quarter (July-August 2019). This effort will involve visits from USGS, Georgia Tech, and Ohio State. For core sections will be sampled using the BIO chamber. Samples will be transported in liquid nitrogen to Texas A&M Corpus Christi.

D. Pressure Core and Data Distribution

- UT will cut two core sections and transfer to 35 cm storage chambers in preparation for transport to AIST Japan.

<u>Depressurized Core Analysis</u>

- Samples analyzed at with the K0 permeameter will be analyzed by X-ray CT, for grain size distribution (laser diffraction and hydrometer methods), mercury injection capillary pressure (MICP), and helium porosimetery.
- Samples quantitatively degassed at UT will be analyzed for grain size (laser diffraction) and grain density.
- Ohio State University will continue work on preparing manuscripts reporting on the gas source at GC 955 and improved gas sampling methods.
- University of New Hampshire will start working Data Reports and an AAPG Special Volume submission.
- Oregon State University will continue discussions with Colwell, Klasek, Summers, and Phillips with the aim to 1) assess the microbial communities collected during the Gulf of Mexico coring, and 2) determine how best to prepare for the upcoming Gulf of Mexico coring in 2020 from a microbiological perspective. We will begin analysis of data and planning the manuscript to be submitted that describes these communities.
- Sediment samples collected by Georgia Tech, USGS, and Oregon State with the BIO chamber and depressurized in an anoxic environment will be shipped frozen in liquid nitrogen to Texas A&M Corpus Christi for RNA and DNA analysis.
- Oregon State University will continue working with ExxonMobil to obtain the best DNA extraction protocols, we will make the plans needed to conduct experiments with pressurized samples that are allocated for microbial analysis. These studies will also be coordinated with researchers at USGS and

Georgia Tech as noted above. As the plan for coring in 2020 develops, we will enlist new microbiology investigators to participate in analysis of expedition samples.

- Oregon State will work with UT and ExxonMobil to produce a UT-GOM2-1 Biogeochemical Report including:
    - Biogeochemical Data
    - Biogeochemical Data Analysis
    - Identification of challenges associated with preliminary studies

- UW will continue to prepare a formal data report summarizing the UT-GOM2-1 pore water geochemical data and results

Subtask 10.5: Continued Hydrate Core-Log-Seismic Synthesis

- OSU will continue work to see if there is significant lateral heterogeneity between holes especially to see if a tie can be done using compressional velocity measurements.

Subtask 10.6: Additional Core Analysis Capabilities

- The Pre-consolidation System will be installed and tested.
    - System will be upgraded from 0.5 L to 3.0 L accumulators once the larger accumulators are sent to UT by Geotek.
- UT will order critical consumable parts to avoid (potential) long Mini-PCATS shut down time.

Other: AAGP Special Publication

- In support of the AAGP Special Publication Vol I and II, Cook and Flemings will continue to participate as Special Volume Editors.

TASK 13.0: MAINTENANCE AND REFINEMENT OF PRESSURE CORE TRANSPORT, STORAGE, & MANIPULATION

- Mini PCATS, the PMRS, and all storage chambers will undergo continued observation and maintenance at regularly scheduled intervals and on an as-needed basis.

TASK 14.0: PERFORMANCE ASSESSMENT, MODIFICATIONS, AND TESTING OF DOE PRESSURE CORING SYSTEM

- In Q4, UT and the PCTB Development Team will review the results of the PCTB Bench Testing Program. A recommendation will be made as to what modifications to the PCTB should be made as a result of the bench tests, and whether further bench testing is required prior to testing the tool at the Schlumberger CTTF.
- UT will continue to coordinate the scope, schedule, and cost of PCTB Land Testing Program at Schlumberger CTTF.

TASK 15.0: FIELD PROGRAM PREPARATIONS

- UT will develop vessel requirements and scope of services that will be used as the basis for vessel acquisition.
- Permitting has currently been put on hold while the revised UT-GOM2-2 science and operations plan is being developed. In the next reporting period OSU and UT will continue working to fulfill permitting requirements for Terrebonne locations as required by the revised operations plan. We assume that UT-GOM2-2 will occur in 2022 as directed by DOE.
- UT will update the UT-GOM2-2 Operations Plan Report.

2 PRODUCTS

2.1 PUBLICATIONS, CONFERENCE PAPERS, AND PRESENTATIONS

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You, K., and Flemings, P. B. (2018). Methane Hydrate Formation in Thick Marine Sands by Free Gas Flow. Presented at Gordon Research Conference on Gas Hydrate, Galveston, TX. Feb 24- Mar 02, 2018.

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You, K., Flemings, P.B. (2016). Methane Hydrate Formation in Thick Sand Reservoirs: Long-range Gas Transport or Short-range Methane Diffusion? Presented at American Geophysical Union, Fall Meeting, San Francisco, CA.

You, K.Y., DiCarlo, D. & Flemings, P.B. (2015), Quantifying methane hydrate formation in gas-rich environments using the method of characteristics. Abstract OS23B-2005 presented at 2015, Fall Meeting, AGU, San Francisco, CA, 14-18 Dec.

You, K.Y., Flemings, P.B., & DiCarlo, D. (2015). Quantifying methane hydrate formation in gas-rich environments using the method of characteristics. Poster presented at 2016 Gordon Research Conference and Gordon Research Seminar on Natural Gas Hydrates, Galveston, TX.

2.2 WEBSITE(S) OR OTHER INTERNET SITE(S)

- Project Website: https://ig.utexas.edu/energy/genesis-of-methane-hydrate-in-coarse-grained-systems/
- UT-GOM2-1 Expedition Website: https://ig.utexas.edu/energy/genesis-of-methane-hydrate-in-coarse-grained-systems/expedition-ut-gom2-1/
- Project SharePoint: https://sps.austin.utexas.edu/sites/GEOMech/doehd/teams/
- Methane Hydrate: Fire, Ice, and Huge Quantities of Potential Energy: https://www.youtube.com/watch?v=f1G302BBX9w
- Fueling the Future: The Search for Methane Hydrate: https://www.youtube.com/watch?v=z1dFc-fdah4
- Pressure Coring Tool Development Video: https://www.youtube.com/watch?v=DXseEbKp5Ak&t=154s

2.3 TECHNOLOGIES OR TECHNIQUES

Nothing to report.

2.4 INVENTIONS, PATENT APPLICATIONS, AND/OR LICENSES

Nothing to report.

3 CHANGES/PROBLEMS

3.1 CHANGES IN APPROACH AND REASONS FOR CHANGE

Nothing to report.

3.2 ACTUAL OR ANTICIPATED PROBLEMS OR DELAYS AND ACTIONS OR PLANS TO RESOLVE THEM

Now that it has been resolved that UT will independently contract a drilling vessel for GOM2-2, no anticipated problems or delays are envisioned.

3.3 CHANGES THAT HAVE A SIGNIFICANT IMPACT ON EXPENDITURES

UT has been charged with developing a budget around the revised UT-GOM2-2 science and operational plan that keeps the expedition cost more or less equal to the original expedition budget. However, DOE has also given guidance that UT-GOM2-2 should occur in 2022. The decision has also been made to extend the analysis phase from the expedition by one year. Due to the extended duration of the project, the total cost will rise in order to maintain the technical capability to achieve the project objectives.

3.4 CHANGE OF PRIMARY PERFORMANCE SITE LOCATION FROM THAT ORIGINALLY PROPOSED

Nothing to report.

4 SPECIAL REPORTING REQUIREMENTS

4.1 CURRENT PROJECT PERIOD

Task 1.0 – Revised Project Management Plan

Subtask 14.3 – PCTB Land Test Report

Subtask 15.2 – Final Research Expedition Operational Plan

4.2 FUTURE PROJECT PERIODS

Task 1.0 – Revised Project Management Plan

Subtask 17.1 – Project Sample and Data Distribution Plan

Subtask 17.3 – IODP Proceedings Expedition Volume

Subtask 17.4 – Expedition Scientific Results Volume

5 BUDGETARY INFORMATION

Phase 3 (Budget Period 3) cost summary is outlined below (Table 5-1). Note: Y4 in the table is Y5 of the overall project including BP1.

Table 5-1: Phase 3 (Budget Period 3) Cost Profile

Baseline Reporting Quarter		Budget Period 3					
		Y4Q2		Y4Q3		Y4Q4	
		01/01/18-03/31/18		04/01/18-06/30/18		07/01/18-09/30/18	
		Y4Q2	Cumulative Total	Y4Q3	Cumulative Total	Y4Q4	Cumulative Total
Baseline Cost Plan							
Federal Share		$ 1,066,233	$ 22,778,167	$ 788,190	$ 23,566,357	$ 1,270,466	$ 24,836,823
Non-Federal Share		$ 358,558	$ 20,625,085	$ 358,558	$ 20,983,643	$ 358,558	$ 21,342,201
Total Planned	Phase 2 Extension	$ 1,424,791	$ 43,403,252	$ 1,146,748	$ 44,550,000	$ 1,629,024	$ 46,179,024
Actual Incurred Cost							
Federal Share		$ 394,532	$ 21,967,474	$ 433,578	$ 22,401,052	$ 518,480	$ 22,919,532
Non-Federal Share		$ 211,985	$ 20,999,161	$ 207,161	$ 21,206,322	$ 155,856	$ 21,362,178
Total Incurred Cost		$ 606,517	$ 42,966,635	$ 640,739	$ 43,607,374	$ 674,336	$ 44,281,710
Variance							
Federal Share		$ (671,701)	$ (810,693)	$ (354,612)	$ (1,165,305)	$ (751,986)	$ (1,917,291)
Non-Federal Share		$ (146,573)	$ 374,076	$ (151,397)	$ 222,679	$ (202,702)	$ 19,977
Total Variance		$ (818,274)	$ (436,617)	$ (506,009)	$ (942,626)	$ (954,688)	$ (1,897,314)

Baseline Reporting Quarter	Budget Period 3							
	Y5Q1		Y5Q2		Y5Q3		Y5Q4	
	10/01/18-12/31/18		01/01/19-03/31/19		04/01/19-06/30/19		07/01/19-09/30/19	
	Y5Q1	Cumulative Total	Y5Q2	Cumulative Total	Y5Q3	Cumulative Total	Y5Q4	Cumulative Total
Baseline Cost Plan								
Federal Share	$ 5,665,774	$ 30,502,597	$ 458,336	$ 30,960,933	$ 6,464,836	$ 37,425,769	$ 458,336	$ 37,884,105
Non-Federal Share	$ 496,980	$ 21,839,181	$ 496,980	$ 22,336,161	$ 496,980	$ 22,833,140	$ 496,980	$ 23,330,120
Total Planned	$ 6,162,754	$ 52,341,778	$ 955,316	$ 53,297,094	$ 6,961,816	$ 60,258,909	$ 955,316	$ 61,214,225
Actual Incurred Cost								
Federal Share	$ 1,094,173	$ 24,013,705	$ 524,054	$ 24,537,759	$ 904,289	$ 25,442,048		
Non-Federal Share	$ 351,676	$ 21,713,855	$ 116,074	$ 21,829,929	$ 262,542	$ 22,092,471		
Total Incurred Cost	$ 1,445,849	$ 45,727,560	$ 640,128	$ 46,367,688	$ 1,166,831	$ 47,534,519		
Variance								
Federal Share	$ (4,571,601)	$ (6,488,892)	$ 65,718	$ (6,423,174)	$ (5,560,547)	$ (11,983,721)		
Non-Federal Share	$ (145,303)	$ (125,326)	$ (380,906)	$ (506,232)	$ (234,438)	$ (740,670)		
Total Variance	$ (4,716,905)	$ (6,614,218)	$ (315,188)	$ (6,929,406)	$ (5,794,985)	$ (12,724,391)		

*Note: Methodology updated with Y5Q2 report; Cumulative totals now reflect those of overall project

6 REFERENCES

Flemings, P. B., 2016a, Y2Q1 Quarterly Research Performance Progress Report (Period ending 12/31/2015), Deepwater Methane Hydrate Characterization and Scientific Assessment, DOE Award No.: DE-FE0023919.

Flemings, P. B., 2016b, Y2Q2 Quarterly Research Performance Progress Report (Period ending 3/31/2015), Deepwater Methane Hydrate Characterization and Scientific Assessment, DOE Award No.: DE-FE0023919.

7 ACRONYMS

Table 7-1: List of Acronyms

ACRONYM	DEFINITION
AAPG	American Association of Petroleum Geologists
AIST	National Institute of Advanced Industrial Science and Technology
ASW	Air-Saturated Water
BET	Brunauer-Emmett-Teller
BGS	British Geological Survey
BOEM	Bureau of Ocean Energy Management
BSEE	Bureau of Safety and Environmental Enforcement
CFD	Computational Fluid Dynamics
CFR	Code of Federal Regulation
CNPL	Calcareous Nannofossil Plio-Pleistocene
CPP	Complimentary Project Proposal
CT	Computed Tomography
CTTF	Cameron Test Testing Facility
DOE	U.S. Department of Energy
ECORD	European Consortium for Ocean Research Drilling
EFB	ECORD Facility Board
EPSP	Environmental Protection and Safety Panel
ESSAC	ECORD Science Support and Advisory Committee
ESO	European Science Operator
GHSZ	Gas Hydrate Stability Zone
HPTC	High Pressure Temperature Corer
IMO	International Maritime Organization
IODP	International Ocean Discovery Program
JOGMEC	Japanese Oil, Gas, and Metals National Corporation
JR	JOIDES Resolution
JRFB	JOIDES Resolution Facility Board
JRSO	JOIDES Resolution Science Operator
mbsf	meters below sea floor
MODU	Mobile Offshore Drilling Unit
MS	Mass Spectrometry
MSP	Mission Specific Platform
NEPA	National Environmental Policy Act
NETL	National Energy Technology Laboratory
OCS	Outer Continental Shelf
ORCAB	Orca Basin
OSU	Ohio State University
PCATS	Pressure Core Analysis and Transfer System
PCC	Pressure Core Center

ACRONYM	DEFINITION
PCS	Pressure Coring System
PCTB	Pressure Core Tool with Ball Valve
PM	Project Manager
PMP	Project Management Plan
PMRS	Pressure Maintenance and Relief System
QRPPR	Quarterly Research Performance and Progress Report
RFP	Request for Proposal
RFQ	Request for Qualifications
RPPR	Research Performance and Progress Report
SEP	Site Evaluation Panel
SOPO	Scope of Project Objectives
SSDB	Site Survey Data Bank
TBONE	Terrebonne Basin
TOC	Total Organic Carbon
UNH	University of New Hampshire
USCG	United States Coast Guard
USGS	U.S. Geological Survey
USIO	United States Implementing Organization
UT	University of Texas at Austin
UW	University of Washington
XCT	X-ray Computed Tomography
XRD	X-ray Diffraction

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