DOE Award No.: DE-FE0023919

Quarterly Research Performance Progress Report (Period Ending 12/31/19)

Deepwater Methane Hydrate Characterization & Scientific Assessment

Project Period 4: 10/01/19 - 09/30/20

Submitted by:

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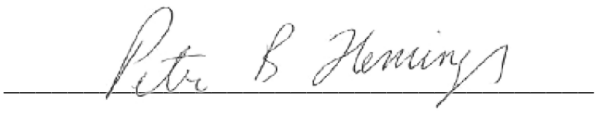

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U.S. DEPARTMENT OF ENERGY | NATIONAL ENERGY TECHNOLOGY LABORATORY

Office of Fossil Energy

DISCLAIMER

1 ACCOMPLISHMENTS

This report outlines the progress of the first quarter of the sixth fiscal year of the project (Budget Period 4, Year 1). Highlights from this period include:

- **AAPG Volume 1 Publication in final phases:** A dedicated volume will be published in 2020 that captures the initial results from the UT-GOM2-1 expedition with 6 papers. This is the start of a multi-volume commitment by AAPG to this project. It will be an exciting demonstration of the project's achievements.

- **UT-GOM2-2 Planning**: UT, with Ohio State University and Pettigrew Engineering, completed updating the UT-GOM2-2 Operations Plan. The plan was distributed to the project sponsor and the GOM2 Advisory Team in December, 2019. UT also completed the UT-GOM2-2 Science and Sample Distribution Plan. It was distributed to the GOM2 Core Analysis Team in December, 2019. UT and Ohio State University initiated permitting tasks for the UT-GOM2-2 Scientific Drilling Program.

- **PCTB Modifications and Bench Test**: UT executed a contract amendment with Geotek to complete modifications to the PCTB based on results of the Bench Test I, which was conducted in 2019. Engineering modifications/upgrades to the PCTB were initiated in December, 2019. UT also executed a contract amendment with Geotek to conduct a supplemental post-modification Bench Test (Bench Test II) so that the final PCTB design can be vetted prior to the PCTB Land Test.

- **Pressure Core Transfer:** UT completed the transfer of all pressure core sections per the recommended allocation from the Science and Sample Distribution Technical Advisory group.

1.1 Major Project Goals

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 Table 1-1, Table 1-2, and Table 1-3.

Table 1-1. Previous Milestones

Budget Period	Milestone	Milestone Description	Estimated Completion	Actual Completion	Verification Method
1	M1A	Project Management Plan	Mar-15	Mar-15	Project Management Plan
	M1B	Project Kick-off Meeting	Jan-15	Dec-14	Presentation
	M1C	Site Location and Ranking Report	Sep-15	Sep-15	Phase 1 Report
	M1D	Preliminary Field Program Operational Plan Report	Sep-15	Sep-15	Phase 1 Report
	M1E	Updated CPP Proposal Submitted	May-15	Oct-15	Phase 1 Report
	M1F	Demonstration of a Viable Pressure Coring Tool: Lab Test	Sep-15	Sep-15	Phase 1 Report
2	M2A	Document Results of BP1/Phase 1 Activities	Dec-15	Jan-16	Phase 1 Report
	M2B	Complete Updated CPP Proposal Submitted	Nov-15	Nov-15	QRPPR
	M2C	Scheduling of Hydrate Drilling Leg by IODP	May-16	May-17	Report directly to DOE PM
	M2D	Demonstration of a Viable Pressure Coring Tool: Land Test	Dec-15	Dec-15	PCTB Land Test Report, in QRPPR
	M2E	Demonstration of a Viable Pressure Coring Tool: Marine Test	Jan-17	May-17	QRPPR
	M2F	Update UT-GOM2-2 Operational Plan	Feb-18	Apr-18	Phase 2 Report
3	M3A	Document results of BP2 Activities	Apr-18	Apr-18	Phase 2 Report
	M3B	Update UT-GOM2-2 Operational Plan	Sep-19	Jan-19	Phase 3 Report

Table 1-2. Current Milestones

Budget Period	Milestone	Milestone Description	Estimated Completion	Actual Completion	Verification Method
4	M4A	Document results of BP3 Activities	Jan-20	In progress	Phase 3 Report
	M4B	Demonstration of a Viable Pressure Coring Tool: Lab Test	Feb-20	-	PCTB Lab Test Report, in QRPPR
	M4C	Demonstration of a Viable Pressure Coring Tool: Land Test	Mar-20	-	PCTB Land Test Report, in QRPPR

Table 1-3. Future Milestones

Budget Period	Milestone	Milestone Description	Estimated Completion	Actual Completion	Verification Method
5	M5A	Document Results of BP4 Activities	Dec-20	-	Phase 4 Report
	M5B	Complete Contracting of UT-GOM2-2 with Drilling Vessel	May-21	-	QRPPR
	M5C	Complete Project Sample and Data Distribution Plan	Jul-22	-	Report directly to DOE PM
	M5D	Complete Pre-Expedition Permitting Requirements for UT-GOM2-2	Dec-21	-	QRPPR
	M5E	Complete UT-GOM2-2 Operational Plan Report	May-21	-	QRPPR
	M5F	Complete UT-GOM2-2 Field Operations	Jul-22	-	QRPPR
6	M6A	Document Results of BP5 Activities	Dec-22	-	Phase 5 Report
	M6B	Complete Preliminary Expedition Summary	Dec-22	-	Report directly to DOE PM
	M6C	Initiate comprehensive Scientific Results Volume	Jun-23	-	Report directly to DOE PM
	M6D	Submit set of manuscripts for comprehensive Scientific Results Volume	Sep-24	-	Report directly to DOE PM

1.2 What Was Accomplishments Under These Goals

1.2.1 Previous Project Periods

Tasks accomplished in previous project periods (Phase 1, 2, and 3) are summarized in Table 1-4, Table 1-5, and Table 1-6.

Table 1-4. Tasks Accomplished in Phase 1.

PHASE 1/BUDGET PERIOD 1	
Task 1.0	**Project Management and Planning**
Task 2.0	**Site Analysis and Selection**
Subtask 2.1	*Site Analysis*
Subtask 2.2	*Site Ranking / Recommendation*
Task 3.0	**Develop Operational Plan for UT-GOM2-2 Scientific Drilling Program**
Task 4.0	**Complete IODP Complimentary Project Proposal**
Task 5.0	**Pressure Coring and Core Analysis System Modifications and Testing**
Subtask 5.1	*PCTB Scientific Planning Workshop*
Subtask 5.2	*PCTB Lab Test*
Subtask 5.3	*PCTB Land Test Prep*

Table 1-5. Tasks Accomplished in Phase 2.

PHASE 2/BUDGET PERIOD 2	
Task 1.0	**Project Management and Planning**
Task 6.0	**Technical and Operational Support of Complimentary Project Proposal**
Task 7.0	**Continued Pressure Coring and Core Analysis System Modifications and Testing**
Subtask 7.1	*Review and Complete NEPA Requirements for PCTB Land Test*
Subtask 7.2	*PCTB Land Test*
Subtask 7.3	*PCTB Land Test Report*
Subtask 7.4	*PCTB Modification*
Task 8.0	**UT-GOM2-1 Marine Field Test**
Subtask 8.1	*Review and Complete NEPA Requirements for UT-GOM2-1*
Subtask 8.2	*UT-GOM2-1 Operational Plan*
Subtask 8.3	*UT-GOM2-1 Documentation and Permitting*
Subtask 8.4	*UT-GOM2-1 Marine Field Test of Pressure Coring System*
Subtask 8.5	*UT-GOM2-1 Marine Field Test Report*
Task 9.0	**Develop Pressure Core Transport, Storage, and Manipulation Capability**
Subtask 9.1	*Review and Complete NEPA Requirements for Core Storage and Manipulation*
Subtask 9.2	*Hydrate Core Transport*
Subtask 9.3	*Storage of Hydrate Pressure Cores*

Subtask 9.4	*Refrigerated Container for Storage of Hydrate Pressure Cores*
Subtask 9.5	*Hydrate Core Manipulator and Cutter Tool*
Subtask 9.6	*Hydrate Core Effective Stress Chamber*
Subtask 9.7	*Hydrate Core Depressurization Chamber*
Task 10.0	**Core Analysis**
Subtask 10.1	*Routine Core Analysis (UT-GOM2-1)*
Subtask 10.2	*Pressure Core Analysis (UT-GOM2-1)*
Subtask 10.3	*Hydrate Core-Log-Seismic Synthesis (UT-GOM2-1)*
Task 11.0	**Update Operational Plan for UT-GOM2-2 Scientific Drilling Program**
Task 12.0	**UT-GOM2-2 Scientific Drilling Program Vessel Access**

Table 1-6. Tasks Accomplished in Phase 3.

PHASE 3/BUDGET PERIOD 3	
Task 1.0	**Project Management and Planning**
Task 6.0	**Technical and Operational Support of CPP Proposal**
Task 9.0	**Develop Pressure Core Transport, Storage, and Manipulation Capability**
Subtask 9.8	*X-ray Computed Tomography*
Subtask 9.9	*Pre-Consolidation System*
Task 10.0	**Core Analysis**
Subtask 10.4	*Continued Pressure Core Analysis (UT-GOM2-1)*
Subtask 10.5	*Continued Hydrate Core-Log-Seismic Synthesis (UT-GOM2-1)*
Subtask 10.6	*Additional Core Analysis Capabilities*
Task 11.0	**Update Operational Plan for UT-GOM2-2 Scientific Drilling Program**
Task 12.0	**UT-GOM2-2 Scientific Drilling Program Vessel Access**
Task 13.0	**Maintenance and Refinement of Pressure Core Transport, Storage, and Manipulation Capability**
Subtask 13.1	*Hydrate Core Manipulator and Cutter Tool*
Subtask 13.2	*Hydrate Core Effective Stress Chamber*
Subtask 13.3	*Hydrate Core Depressurization Chamber*
Subtask 13.4	*Develop Hydrate Core Transport Capability for UT-GOM2-2 Scientific Drilling Program*
Subtask 13.5	*Expansion of Pressure Core Storage Capability for UT-GOM2-2 Scientific Drilling Program*
Subtask 13.6	*Continued Storage of Hydrate Cores from UT-GOM2-1*
Task 14.0	**Performance Assessment, Modifications, and Testing of PCTB**
Subtask 14.1	*PCTB Lab Test*
Subtask 14.2	*PCTB Modifications/Upgrades*
Task 15.0	**UT-GOM2-2 Scientific Drilling Program Preparations**
Subtask 15.1	*Assemble and Contract Pressure Coring Team Leads for UT-GOM2-2 Scientific Drilling Program*
Subtask 15.2	*Contract Project Scientists and Establish Project Science Team for UT-GOM2-2 Scientific Drilling Program*

1.2.2 Current Project Period

Current project period tasks are shown in Table 1-7.

Table 1-7. Current Project Tasks.

PHASE 4/BUDGET PERIOD 4	
Task 1.0	**Project Management and Planning**
Task 10.0	**Core Analysis**
Subtask 10.4	*Continued Pressure Core Analysis (GOM2-1)*
Subtask 10.5	*Continued Hydrate Core-Log-Seismic Synthesis (UT-GOM2-1)*
Subtask 10.6	*Additional Core Analysis Capabilities*
Subtask 10.7	*Hydrate Modeling*
Task 11.0	**Update Operational Plan for UT-GOM2-2 Scientific Drilling Program**
Task 12.0	**UT-GOM2-2 Scientific Drilling Program Vessel Access**
Task 13.0	**Maintenance and Refinement of Pressure Core Transport, Storage, and Manipulation Capability**
Subtask 13.1	*Hydrate Core Manipulator and Cutter Tool*
Subtask 13.2	*Hydrate Core Effective Stress Chamber*
Subtask 13.3	*Hydrate Core Depressurization Chamber*
Subtask 13.4	*Develop Hydrate Core Transport Capability for UT-GOM2-2 Scientific Drilling Program*
Subtask 13.5	*Expansion of Pressure Core Storage Capability for UT-GOM2-2 Scientific Drilling Program*
Subtask 13.6	*Continued Storage of Hydrate Cores from UT-GOM2-1*
Subtask 13.7	*X-ray Computed Tomography*
Subtask 13.8	*Pre-Consolidation System*
Task 14.0	**Performance Assessment, Modifications, and Testing of PCTB**
Subtask 14.1	*PCTB Lab Test*
Subtask 14.2	*PCTB Modifications/Upgrades*
Subtask 14.3	*PCTB Land Test*
Task 15.0	**UT-GOM2-2 Scientific Drilling Program Preparations**
Subtask 15.3	*Permitting for UT-GOM2-2 Scientific Drilling Program*

1.2.2.1 Task 1.0 – Project Management & Planning

Status: Ongoing

- **Coordinated the overall scientific progress, administration and finances of the project:**
  - Monitored and controlled project scope, cost, and schedule.

- **Communicated with project team and sponsors:**
  - Organized and coordinated project team and stakeholder meetings.
  - Organized task-specific team working meetings to plan and execute project tasks (e.g. PCTB development, PCTB Bench Test, PCTB Land Test, UT-GOM2-2 Operations Plan, & UT-GOM2-2 permits).
  - Organized sponsor meetings.
  - Managed SharePoint sites, email lists, and archive/website.
  - Provided updated UT-GOM2-2 Operations Plan to sponsors, team, and stakeholders for review and comment.

- **Coordinated and supervised subcontractors and service agreements:**
  - Actively managed all active subcontractors.
  - Monitored progress and schedules, and ensured that contractual obligations were being met.
  - Developed new scope of work and executed contract amendment with Geotek for PCTB modifications based on the results of the Bench Test I, conducted in BP3.
  - Developed new scope of work and executed contract amendment with Geotek for a post-modification Bench Test (Bench Test II).
  - Developed scope of work and executed contract amendment with Schlumberger for use of the Cameron Test and Training Facility (CTTF) during the PCTB Land Test.

- **Compared identified risks with those documented in the Project Management Plan to ensure all risks are identified and monitored. Communicated risks and possible outcomes to project team and stakeholders:**
  - Actively monitored project risks and reported identified risks to project team and stakeholders.

1.2.2.2 Task 10.0 – Core Analysis

Status: Ongoing

1.2.2.2.1 Subtask 10.4 – Continued Pressure Core Analysis

A. Pressurized Core Analysis

- AAPG Editors, including UT and Ohio State, and the GC 955 Petrophysics Working group, hosted an on-line workshop to review the status of all petrophysical and geomechanical experiments on GC 955 pressure core. Each group reviewed their completed or anticipated results and possible submissions to the AAPG Special Bulletin Volume 2.
- One pressure core section (H002-04CS-2) was quantitatively degassed at the UT pressure core center. This was a special degassing in which the core was depressurized over several hours as one gas collection step by expanding 6 L of gas through the bubbling chamber and into a large gas bag. This approach was used to collect a bulk gas sample that represents the average composition of the sample. This gas sample was shipped to Caltech for clumped methane isotope analysis to be compared to the 4 stepwise samples collected offshore during the UT-GOM2-1 expedition.

A2. Permeability measurement of pressure core

- UT continued permeability measurement of UT-GOM2-1 pressure cores. During this quarter, we cut two pressure core sections from UT-GOM2-1-H005-7FB-3. We finish the measurements of effective permeability of two 7FB-3 cores (7FB-3-01 and 7FB-3-02) with brine. Only one core (7FB-3-01) was successfully measured and compared to previous measurements from 4FB-8 and 13FB-1 (Figure 1-1). We measured and compared the grain size distribution of 7FB-3-01 (Figure 1-2).

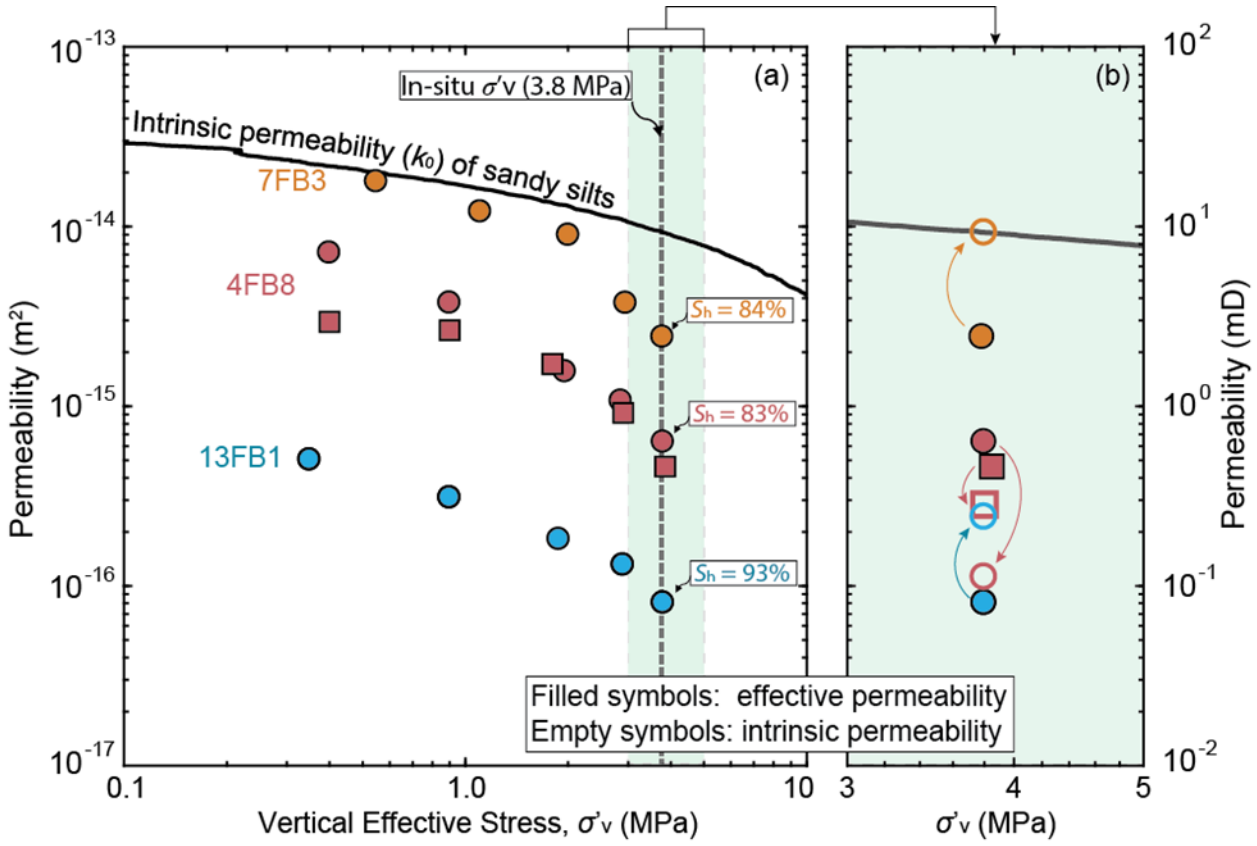

Figure 1-1. Permeability of UT-GOM2-1 Sandy silt sediment from three pressure core sections as a function of vertical effective stress before (effective permeability) and after (intrinsic permeability) depressurization under in-situ effective stress. The intrinsic permeability is altered (decreased) due to fines migration in the K0 permeability during the measurement and possible compaction of the sediment after hydrate dissociation.

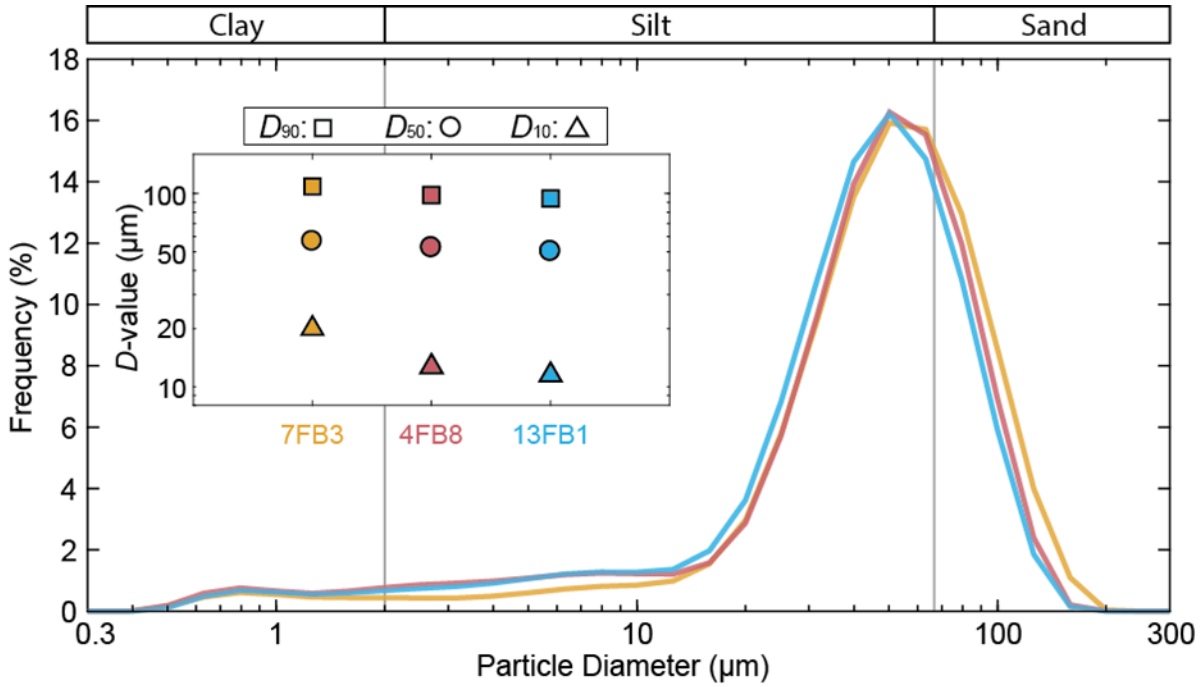

Figure 1-2. Bulk grain size measurements of the UT-GOM2-1 sandy silt sediment from three pressure core sections (4FB8, 7FB3, and 13FB1) measured by laser diffraction technique.

A4. Pressure Core Distribution

- Pressure Core sections in AIST (Japan) pressure chambers were picked up by Geotek, Ltd. Geotek will transport the samples to Japan using their pressure core overpack system. This transfer completes the distribution of GC 955 pressure core to the hydrate community from UT-GOM2-1 as recommended by the Technical Advisory Group.

B. Depressurized Pressure Core Analysis

- The University of New Hampshire continued working on Total Organic Carbon (TOC) measurements of sediment samples from UT-GOM2-1.

1.2.2.2.2 Subtask 10.5 – Continued Hydrate Core-Log-Seismic Synthesis

- No update this period.

1.2.2.2.3 Subtask 10.6 – Additional Analysis Capabilities

- No update this period.

1.2.2.2.4 Subtask 10.7 – Hydrate Modeling

- No update this period.

1.2.2.2.5 Other – Publications

- UT, Ohio State, Oregon State, University of Washington, Columbia, and University of New Hampshire all continued preparing UT-GOM2-1 Data Reports. Data Report archive of experimental or observational data that is not captured in publications. The reports highlight methods and results but do not include any interpretation of the results. When finalized, Data Reports will reside on the UT-GOM2-1 Expedition Report Electronic Volume (https://ig.utexas.edu/energy/genesis-of-methane-hydrate-in-coarse-grained-systems/expedition-ut-gom2-1/reports/) and in the UT-GOM2-1 Data Directory (http://www-udc.ig.utexas.edu/gom2/).
- UT continued working on contributions to Vol. 1 of the AAPG Bulletin special issue dedicated to UT-GOM2-1. Paper include:
    - *Portnov et al. (2018, DOI:10.1306/10151818125) Salt-driven evolution of a gas hydrate reservoir in Green Canyon, Gulf of Mexico, American Association of Petroleum Geologist Bulletin*
    - *Santra et al. (2019, DOI:10.1306/04251918177) Evolution of gas-hydrate-bearing deep-water channel-levee system in abyssal Gulf of Mexico – levee growth and deformation, American Association of Petroleum Geologist Bulletin*
    - *Flemings et al. (accepted, in press) Concentrated hydrate in a deepwater Gulf of Mexico turbidite reservoir: initial results from the UT-GOM2-1 Hydrate Pressure Coring Expedition, American Association of Petroleum Geologist Bulletin*
    - *Phillips et al. (accepted, online, DOI: 10.1306/01062018280) High concentration methane hydrate in a silt reservoir from the deep water Gulf of Mexico, American Association of Petroleum Geologist Bulletin*
    - *Meazell et al., (accepted), Silt-rich channel-levee hydrate reservoirs of Green Canyon 955, American Association of Petroleum Geologist Bulletin*
    - *Thomas (accepted, in press) Pressure-coring operations during Expedition UT-GOM2-1 in Green Canyon Block 955, northern Gulf of Mexico, American Association of Petroleum Geologist Bulletin*
    - *Fang et al. (accepted, online, DOI:10.1306/01062019165) Petrophysical Properties of the GC 955 Hydrate Reservoir Inferred from Reconstituted Sediments: Implications for Hydrate Formation and Production, American Association of Petroleum Geologist Bulletin*
- Ohio State continued working on three AAPG submissions covering XCT saturation, gas sampling, and the effects of degassing on gas geochemistry

1.2.2.3 Task 11.0 – Update Operations Plan for UT-GOM2-2 Scientific Drilling Program

Status: Ongoing

- UT completed the updated UT-GOM2-2 Operations Plan and distributed the plan to the project sponsor and the GOM2 Advisory Team. The UT-GOM2-2 Operations Plan was distributed for review and incorporated feedback from Geotek Coring, the project sponsor, and the GOM2 Advisory Team.
- UT also completed the UT-GOM2-2 Science and Sample Distribution Plan, which includes detailed science objectives, core types and coring locations, core cutting and preservation, core analyses and methodology, and distribution of cores and other samples. The UT-GOM2-2 Science and Sample Distribution Plan was distributed to the GOM2 Core Analysis Team for review in December, 2019. The UT-GOM2-2 Science and Sample Distribution Plan is scheduled to be distributed to the Technical Advisory Group in April, 2020.

1.2.2.4 Task 12.0 – UT-GOM2-2 Scientific Drilling Program Vessel Access

Status: Ongoing

- No update this period.

1.2.2.5 Task 13.0 – Maintenance & Refinement of Pressure Core Transport, Storage, & Manipulation Capability

Status: Ongoing

1.2.2.5.1 Subtask 13.1 – Hydrate Core Manipulator and Cutter Tool

- Two cores scanned and subsampled with the aid of the new CT scanner system:
  - Core H005-7FB-3 – Two K0 samples
  - Core H002-4CS-2 –Degas sample
- AIST Storage Chambers:
  - Two storage chambers held at pressure.
  - Two chambers with samples were picked up by Geotek Coring and placed into the Overpack Reefer Unit for shipment to Japan on December 20, 2019.
- System cleaned and cutter blades replaced after each sampling.
- System underwent maintenance teardown and cleaning. All seals replaced.

1.2.2.5.2 Subtask 13.2 – Hydrate Core Effective Stress Chamber

- Two pressure core samples underwent K0 testing:
  - H005-7FB-3-1
  - H005-7FB-3-2
- System underwent full maintenance teardown and cleaning. All seals were replaced.

1.2.2.5.3 Subtask 13.3 – Hydrate Core Depressurization Chamber

- UT completed one degassing test during this period:
    - H002-4CS-2
- The system underwent maintenance teardown and cleaning.

1.2.2.5.4 Subtask 13.4 – Develop Hydrate Core Transport Capability for UT-GOM2-2

- No update this period.

1.2.2.5.5 Subtask 13.5 – Expansion of Pressure Core Storage Capability for UT-GOM2-2

- New core chamber orientation is being designed that will require manufacturing new chamber supports.
- Expansion of pressure maintenance system is required to increase storage capability sufficient to receive UT-GOM2-2 cores. UT is obtaining quotes for additional pressure lines.
- Expansion of pressure safety venting system will also be required. UT is obtaining quotes for additional venting lines.

1.2.2.5.6 Subtask 13.6 – Continued Storage of Hydrate Cores from UT-GOM2-1

- Core storage expansion in the PCC is anticipated to accommodate any remaining pressure cores acquired from UT-GOM2-1.

1.2.2.5.7 Subtask 13.7 – X-ray Computed Tomography

- The X-Ray CT continues to operate as designed. No updates this period.

1.2.2.5.8 Subtask 13.8 – Pre-Consolidation System

- The Pre-Consolidation System functions as designed. No updates this period.

1.2.2.6 Task 14.0 – Performance Assessment, Modifications, And Testing Of PCTB

Status: Ongoing

1.2.2.6.1 Subtask 14.1 – PCTB Lab Test

- UT, Geotek, and Pettigrew Engineering held web-conferences on October 16 and November 21, 2019 to resolve scope, schedule, and cost of numerous tasks, including a supplemental bench test of the PCTB (Bench Test II) to vet the final tool design in a controlled environment prior to the PCTB Land Test.
- The supplemental PCTB bench test (PCTB Bench Test II) testing procedure was finalized and approved in this reporting period. The PCTB Bench Test II will accomplish pressure actuation testing (PAT) of the final PCTB design that will be tested during the PCTB Land Test at Schlumberger CTTF, using both seawater

and drilling mud. Additionally, Geotek will test the Temperature-to-Pressure Probe (T2P) and Probe Deployment Tool (PDT).

1.2.2.6.2 Subtask 14.2 – PCTB Modifications/Upgrades

- UT, Geotek, and Pettigrew Engineering held web-conferences on October 16 and November 21, 2019 to resolve scope, schedule, and cost of numerous tasks, including PCTB modifications/upgrades.
- The scope of work for PCTB modifications/upgrades as a result of the PCTB Bench Test I was approved in this reporting period. Geotek initiated PCTB upgrades in December, 2019:
    - Permanently incorporate "single-trigger mechanism" design
    - Coat all sliding parts with friction-reducing coating
    - Design and produce low-strength shear pin for inner tube plug
    - Replace point seals with lip seals
    - Modify components to run prototype diverter seal
    - Modify regulator sub so seal cannot cause hydraulic lock

1.2.2.6.3 Subtask 14.3 – PCTB Land Test

- In this reporting period, UT and Pettigrew Engineering continued planning activities for the PCTB Land Test. Test procedures and time estimates were updated and distributed to Geotek, Schlumberger, and other stakeholders, including the project sponsor.
    - The PCTB Land Test at the Schlumberger CTTF will occur in March, 2020. The PCTB Land Test is projected to occur over 8-10, 12-to-16-hour days at Schlumberger CTTF in Cameron, Texas. The testing procedure requires 3 coring runs of the PCTB-FB and 3 coring runs of the PCTB-CS to be carried out to test core recovery capability in simulated field conditions. The PDT and T2P will also be tested to characterize the overall PDT and T2P function under simulated field conditions. The testing procedure requires two tests of the PDT and T2P.
- In this reporting period, UT and Schlumberger agreed upon the final scope of services, and executed a contract amendment for drill-testing at Schlumberger CTTF during the PCTB Land Test

1.2.2.7 Task 15.0 – UT-GOM2-2 Scientific Drilling Program Preparations

Status: In Progress

1.2.2.7.1 Subtask 15.3 – Permitting for UT-GOM2-2 Scientific Drilling Program

- The UT-GOM2-2 Permit Team (consisting of UT and Ohio State) held a web-conference in November, 2019. The purpose of this web-conference was to define action items and delegate responsibilities for the UT-GOM2-2 permitting task.

- With current funding, UT-GOM2-2 will core two wells at two locations in the Gulf of Mexico. The decision was made to permit two additional wells: a logging-while-drilling (LWD) well, and cored well at an up-dip location. This approach will position the project with the ability to drill additional wells and complete more of the original science objectives if additional funding become available prior to execution of the UT-GOM2-2 Scientific Drilling Program.
- UT and Ohio State began to develop a contingency operations plan for the two up-dip wells (4-well program), required in order to permit these locations.
- In December, 2019, UT sent UT-GOM2-2 Scientific Drilling Program operations information to M-I SWACO with a request for a drilling fluids proposal, required for permitting purposes. An incremental drilling fluids proposal for the additional up-dip wells will be requested in early 2020.

1.3 What Will Be Done In The Next Reporting Period To Accomplish These Goals

1.3.1 Task 1.0 – Project Management & Planning

UT will continue to execute the project in accordance with the approved PMP. UT will continue to 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.

1.3.2 Task 10.0 – Core Analysis

- Work will continue on measuring the petrophysical and geomechanical properties of pressure core using the UT K0 Permeameter. Quantitative degassing will continue as needed in support of the permeability measurements.
- Work will continue on finalizing and posting Data Reports
- UT, Ohio State, University of New Hampshire, and Oregon State continue working on contributions to the AAPG Special Bulletin Volumes (1,2, and 3).
- UT, Ohio State, University of New Hampshire, Oregon State, Columbia University, and University of Washington will all participate in the Gordon Research Conference on Gas Hydrates.

1.3.3 Task 11.0 – Update Operations Plan for UT-GOM2-2 Scientific Drilling Program

- The updated UT-GOM2-2 Scientific Drilling Program Operations Plan was distributed to the project sponsor and the project team in December, 2019. In the next reporting period, UT Austin will develop an operations plan for the additional up-dip drilling location. This will be used for the purpose of permitting.
- UT will continue to develop the UT-GOM2-2 Science and Sample Distribution Plan, which will be reviewed with subcontractors, the Core Analysis Team, and the Technical Advisory Group.

1.3.4 Task 12.0 – UT-GOM2-2 Scientific Drilling Program Vessel Access

- UT will develop vessel requirements and scope of services that will be used as the basis for vessel acquisition.
- UT will determine and initiate the vessel acquisition approach.

1.3.5 Task 13.0 – Maintenance And Refinement Of Pressure Core Transport, Storage, & Manipulation Capability

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

1.3.6 Task 14.0 – Performance Assessment, Modifications, And Testing Of PCTB

- UT will control and monitor the completion of approved PCTB modifications/upgrades by Geotek.
- UT will control and monitor the completion of the post-modification PCTB Bench Test (Bench Test II), to vet the final PCTB design that will be land-tested and deployed at sea during the UT-GOM2-2 Scientific Drilling Program.
- UT will continue to plan and execute the PCTB Land Test at Schlumberger CTTF.

1.3.7 Task 15.0 – UT-GOM2-2 Scientific Drilling Program Preparations

- The UT-GOM2-2 Permitting Team will hold regular web-conferences to work through permit-related geology and geophysics issues.
- The UT-GOM2-2 will continue to develop the permits for the approved 2-well program, as well as for the third, up-dip, location (4-well program).
- The initial permits to be completed are the Bureau of Ocean Energy Management (BOEM) Exploration Plan (EP), and the BOEM Application for Permit to Conduct Geological or Geophysical (G&G) Exploration for Mineral Resources or Scientific Research on the Outer Continental Shelf.

2 PRODUCTS

Project publications webpage: https://ig.utexas.edu/energy/gom2-methane-hydrates-at-the-university-of-texas/gom2-publications/

2.1 Publications

Fang, Y., Flemings, P.B., Daigle, H., Phillips, S.C., Meazell, K. (**in review**). Petrophysical Properties of the GC 955 Hydrate Reservoir Inferred from Reconstituted Sediments: Implications for Hydrate Formation and Production, AAPG Bulletin.

Flemings, P.B., Phillips, S.C., Boswell, R., Collett, T.S., Cook, A.E., Dong, T., et al. (**in review**). Pressure coring a Gulf of Mexico deepwater turbidite gas hydrate reservoir: initial results from the UT-GOM2-1 hydrate pressure coring expedition, AAPG Bulletin.

Meazell, K., Flemings, P.B., Santra, M., Johnson, J.E. (**in review**). Sedimentology and stratigraphy of deepwater methane hydrate reservoir in Green Canyon 955, AAPG Bulletin.

Meazell, K., Flemings, P.B., Santra, M. (**in review**). Silt-rich channel-levee hydrate reservoirs of Green Canyon 955: AAPG Bulletin.

Phillips, S. C., Flemings, P. B., Holland, M. E., Schulthiss, P. J., Waite, W. F., Jang, J., et al. (**in press**). High concentration methane hydrate in a silt reservoir from the deep-water Gulf of Mexico. AAPG Bulletin. https://doi.org/10.1306/01062018280 (pending)

Portnov, A., Cook, A. E., Heidari, M., Sawyer, D.E., Santra, M., Nikolinakou, M. (**in press**). Salt-driven evolution of a gas hydrate reservoir in Green Canyon, Gulf of Mexico. AAPG Bulletin. https://doi.org/10.1306/10151818125

Santra, M., Flemings, P. B., Scott, E., Meazell, P. K. (**in press**). Evolution of Gas Hydrate Bearing Deepwater Channel-Levee System in Abyssal Gulf of Mexico – Levee Growth and Deformation. AAPG Bulletin. https://doi.org/10.1306/04251918177

Thomas, C. M., Flemings, P.B., Santra, M., Hammond, H., Collet T.S., Pettigrew, T., et al. (**in press**). Pressure-coring operations during Expedition UT-GOM2-1 in Green Canyon Block 955, northern Gulf of Mexico. AAPG Bulletin.

Meyer, D. W., Flemings, P. B., You, K., DiCarlo, D. A. (**2020**). Gas flow by invasion percolation through the hydrate stability zone, Geophysical Research Letters. https://doi.org/10.1029/2019GL084380

Portnov, A., Santra, M., Cook, A.E., Sawyer, D.E. (**2020**). The Jackalope gas hydrate system in the northeastern Gulf of Mexico, Marine and Petroleum Geology, 111, 261–278. https://doi.org/10.1016/j.marpetgeo.2019.08.036

Cook, A.E., and Portnov, A. (**2019**). Gas hydrates in coarse-grained reservoirs interpreted from velocity pull up: Mississippi Fan, Gulf of Mexico. Comment. Geology. doi: 10.1130/G45609C.1

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Phillips, S.C., You, K., Flemings, P.B., Meyer, D.W., and Dong, T. (**2019**). Investigation of in situ salinity and methane hydrate dissociation in coarse-grained sediments by slow, stepwise depressurization. Marine and Petroleum Geology 109, 128-144, https://doi.org/10.1016/j.marpetgeo.2019.06.015

Portnov, A., Cook, A.E., Sawyer, D.E., Yang, C., Hillman, J.I.T., & Waite, W.F. (**2019**). Clustered BSRs: Evidence for gas hydrate-bearing turbidite complexes in folded regions, example from the Perdido Fold Belt, northern Gulf of Mexico. Earth and Planetary Science Letters, 528. https://doi.org/10.1016/j.epsl.2019.115843

Sawyer, D.E, Mason, R.A., Cook, A.E., and Portnov, A., (**2019**). Submarine landsides induce massive waves in subsea brine pools. Scientific Reports, 9, 128. doi: 10.1038/s41598-018-36781-7

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Ewton, E., (**2019**)**.** The effects of X-ray CT scanning on microbial communities in sediment cores. Honors thesis, Oregon State University.

Chen, X., & Espinoza, D. N. (**2018**)**.** Ostwald ripening changes the pore habit and spatial variability of clathrate hydrate. Fuel, 214, 614–622. https://doi.org/10.1016/j.fuel.2017.11.065

Chen, X., and Espinoza, D. N. (**2018**)**.** Surface area controls gas hydrate dissociation kinetics in porous media, Fuel, 234, 358-363. https://doi.org/10.1016/j.fuel.2018.07.030

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Cook. A. E., and Waite, W. F., (**2018**). Archie's saturation exponent for natural gas hydrate in coarse-grained reservoirs. Journal of Geophysical Research. DOI: 10.1002/2017JB015138

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Majumdar, U., & Cook, A.E. (**2018**). The Volume of Gas Hydrate-Bound Gas in the Northern Gulf of Mexico. Geochemistry, Geophysics, Geosystems, 19(11), 4313-4328. https://doi.org/10.1029/2018GC007865

Meyer, Dylan Whitney, (**2018**). Dynamics of Gas Flow and Hydrate Formation within the Hydrate Stability Zone, Department of Geological Sciences, doctoral dissertation, The University of Texas at Austin, Austin, TX. http://doi.org/10.15781/T2M03ZG8H

Meyer, D. W., Flemings, P. B., DiCarlo, D., (**2018**). Effect of Gas Flow Rate on Hydrate Formation Within the Hydrate Stability Zone, Journal of Geophysical Research – Solid Earth, 123, 6263–6276. https://doi.org/10.1029/2018JB015878

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Sheik, C., Reese, B., Twing, K., Sylvan, J., Grim, S., Schrenk, M., Sogin, M., and Colwell, F. (**2018**). Identification and removal of contaminant sequences from ribosomal gene databases: lessons from the census of deep life. Frontiers in Microbiology. doi: 10.3389/fmicb.2018.00840

Smart, K (**2018**). Modeling Well Log Responses in Hydrate Bearing Silts. Ohio State University. Undergraduate Thesis.

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.

Hillman, J, Cook, A.E., Sawyer, D., Küçük, H.M., and Goldberg, D.S. (**2017**). The character and amplitude of bottom-simulating reflectors in marine seismic data. Earth & Planetary Science Letters. doi: http://dx.doi.org/10.1016/j.epsl.2016.10.058

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Majumdar, U., Cook, A. E., Shedd, W., and Frye, M. (**2016**). The connection between natural gas hydrate and bottom-simulating reflectors. Geophysical Research Letters, DOI: 10.1002/2016GL069443

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2.2 Conference Papers

Fortin, W., Goldberg, D.S., Küçük, H. M. (2017). Prestack Waveform Inversion and Well Log Examination at GC955 and WR313 in the Gulf of Mexico for Estimation of Methane Hydrate Concentrations. EOS Trans. American Geophysical Union, Fall Meeting, New Orleans, LA.

Fortin, W., Goldberg, D.S., Küçük, H.M. (2016). Methane Hydrate Concentrations at GC955 and WR313 Drilling Sites in the Gulf of Mexico Determined from Seismic Prestack Waveform Inversion. EOS Trans. American Geophysical Union, Fall Meeting, San Francisco, CA.

Malinverno, A., Cook, A. E., Daigle, H., Oryan, B. (2017). Methane Hydrate Formation from Enhanced Organic Carbon Burial During Glacial Lowstands: Examples from the Gulf of Mexico. EOS Trans. American Geophysical Union, Fall Meeting, New Orleans, LA.

Oryan, B., Malinverno, A., Goldberg, D., Fortin, W. (2017). Do Pleistocene glacial-interglacial cycles control methane hydrate formation? An example from Green Canyon, Gulf of Mexico. EOS Trans. American Geophysical Union, Fall Meeting, New Orleans, LA.

2.3 Presentations

Espinoza D.N., Chen X., Luo J.S., Tisato N., Flemings P.B. (**2019**). X-Ray Micro-CT Observation of Methane Hydrate Growth and Dissociation in Sandy Sediments. Presented to the *Engineering Mechanics Institute Conference 2019*, Pasadena, CA, 19 June.

Ewton, E., Klasek, S., Peck, E., Wiest, J. Colwell F. (**2019**). The effects of X-ray computed tomography scanning on microbial communities in sediment cores. Poster presented at *AGU Fall Meeting*.

Oti, E., Cook, A., Phillips, S., and Holland, M. (**2019**). Using X-ray Computed Tomography (XCT) to Estimate Hydrate Saturation in Sediment Cores from UT-GOM2-1 H005, Green Canyon 955 (Invited talk, U11C-17). Presented to the *AGU Fall Meeting*, San Francisco, CA.

Phillips, S.C. (**2019**). Pressure coring in marine sediments: Insights into gas hydrate systems and future directions. Presented to the *GSA Annual Meeting 2019*, Phoenix, Arizona, 22-25 September. https://gsa.confex.com/gsa/2019AM/meetingapp.cgi/Paper/338173

Wei, L. and Cook, A. (**2019**). Methane Migration Mechanisms and Hydrate Formation at GC955, Northern Gulf of Mexico. Abstract OS41B-1668 presented to the *AGU Fall Meeting*, San Francisco, CA.

Cook. A., Waite, W. F., Spangenberg, E., and Heeschen, K.U. (**2018**). Petrophysics in the lab and the field: how can we understand gas hydrate pore morphology and saturation? Invited talk presented at the American Geophysical Union Fall Meeting, Washington D.C.

Chen X., Espinoza, D.N., Tisato, N., and Flemings, P.B. (**2018**). X-Ray Micro-CT Observation of Methane Hydrate Growth in Sandy Sediments. Presented at the *AGU Fall Meeting 2018*, Dec. 10–14, in Washington D.C.

Dong, T., Lin, J. -F., Flemings, P. B., Gu, J. T., Polito, P. J., O'Connell, J. (**2018**). Pore-Scale Methane Hydrate Formation under Pressure and Temperature Conditions of Natural Reservoirs. Presented to the *AGU Fall Meeting 2018*, Washington D.C., 10-14 December.

Erica Ewton et al. (**2018**). The effects of X-ray CT scanning on microbial communities in sediment cores. Poster presented at American Geophysical Union, Fall Meeting, Washington, D.C. OS23D-1657

Fang, Y., et al. (**2018**). Permeability, compression behavior, and lateral stress ration of hydrate-bearing siltstone from UT-GOM2-1 pressure core (GC-955 – northern Gulf of Mexico): Initial Results. Poster presented at American Geophysical Union, Fall Meeting, Washington, D.C. OS23D-1650

Fang, Y., Flemings, P.B., Daigle, H., O'Connell, J., Polito, P., (**2018**). Measure permeability of natural hydrate-bearing sediments using K_0 permeameter. Presented at Gordon Research Conference on Gas Hydrate, Galveston, TX. Feb 24- Mar 02, 2018.

Flemings, P., Phillips, S., and the UT-GOM2-1 Expedition Scientists, (**2018**). Recent results of pressure coring hydrate-bearing sands in the deepwater Gulf of Mexico: Implications for formation and production. Talk presented at the 2018 Gordon Research Conference on Natural Gas Hydrate Systems, Galveston, TX, February 24-March 2, 2018.

Fortin, W. (**2018**). Waveform Inversion and Well Log Examination at GC955 and WR313 in the Gulf of Mexico for Estimation of Methane Hydrate Concentrations. Presented at Gordon Research Conference on Natural Gas Hydrate Systems, Galveston, TX.

Hammon, H., Phillips, S., Flemings, P., and the UT-GOM2-1 Expedition Scientists, (**2018**). Drilling-induced disturbance within methane hydrate pressure cores in the northern Gulf of Mexico. Poster presented at the 2018 Gordon Research Conference and Seminar on Natural Gas Hydrate Systems, Galveston, TX, February 24-March 2, 2018.

Johnson, J. (**2018**). High Porosity and Permeability Gas Hydrate Reservoirs: A Sedimentary Perspective. Presented at Gordon Research Conference on Natural Gas Hydrate Systems, Galveston, TX.

Liu, J. et al. (**2018**). Pore-scale CH4-C2H6 hydrate formation and dissociation under relevant pressure-temperature conditions of natural reservoirs. Poster presented at American Geophysical Union, Fall Meeting, Washington, D.C. OS23D-2824

Meazell, K., Flemings, P. B., Santra, M., and the UT-GOM2-01 Scientists (**2018**). Sedimentology of the clastic hydrate reservoir at GC 955, Gulf of Mexico. Presented at Gordon Research Conference on Natural Gas Hydrate Systems, Galveston, TX.

Morrison, J., Flemings, P., and the UT-GOM2-1 Expedition Scientists (**2018**). Hydrate Coring in Deepwater Gulf of Mexico, USA. Poster presented at the 2018 Gordon Research Conference on Natural Gas Hydrate Systems, Galveston, TX.

Murphy, Z., et al. (**2018**). Three phase relative permeability of hydrate bearing sediments. Poster presented at American Geophysical Union, Fall Meeting, Washington, D.C. OS23D-1647

Oti, E., Cook. A., Phillips, S., Holland, M., Flemings, P., (**2018**). Using X-ray computed tomography to estimate hydrate saturation in sediment cores from Green Canyon 955 Gulf of Mexico. Talk presented at the American Geophysical Union Fall Meeting, Washington D.C.

Oti, E., Cook, A. (**2018**). Non-Destructive X-ray Computed Tomography (XCT) of Previous Gas Hydrate Bearing Fractures in Marine Sediment. Presented at Gordon Research Conference on Natural Gas Hydrate Systems, Galveston, TX.

Phillips et al. (**2018**). High saturation of methane hydrate in a coarse-grained reservoir in the northern Gulf of Mexico from quantitative depressurization of pressure cores. Poster presented at American Geophysical Union, Fall Meeting, Washington, D.C. OS23D-1654

Portnov A., et al. (**2018**). Underexplored gas hydrate reservoirs associated with salt diapirism and turbidite deposition in the Northern Gulf of Mexico. Poster presented at American Geophysical Union, Fall Meeting, Washington, D.C. OS51F-1326

Portnov, A., Cook, A., Heidari, M., Sawyer, D., Santra, M., Nikolinakou, M. (**2018**). Salt-driven Evolution of Gas Hydrate Reservoirs in the Deep-sea Gulf of Mexico. Presented at Gordon Research Conference on Natural Gas Hydrate Systems, Galveston, TX.

Santra, M., et al, (**2018**). Channel-levee hosted hydrate accumulation controlled by a faulted anticline: Green Canyon, Gulf of Mexico. Poster presented at American Geophysical Union, Fall Meeting, Washington, D.C. OS51F-1324

Santra, M., Flemings, P., Scott, E., Meazell, K. (**2018**). Evolution of Gas Hydrate Bearing Deepwater Channel-Levee System in Green Canyon Area in Northern Gulf of Mexico. Presented at Gordon Research Conference and Gordon Research Seminar on Natural Gas Hydrates, Galveston, TX.

Kehua You et al. (**2018**). Formation of lithology-dependent hydrate distribution by capillary-controlled gas flow sourced from faults. Poster presented at American Geophysical Union, Fall Meeting, Washington, D.C. OS31F-1864

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.

Heber, R., Kinash, N., Cook, A., Sawyer, D., Sheets, J., and Johnson, J.E. (2017). Mineralogy of Gas Hydrate Bearing Sediment in Green Canyon Block 955 Northern Gulf of Mexico. Abstract OS53B-1206 presented at American Geophysical Union, Fall Meeting, New Orleans, LA.

Kinash, N. Cook, A., Sawyer, D. and Heber, R. (**2017**). Recovery and Lithologic Analysis of Sediment from Hole UT-GOM2-1-H002, Green Canyon 955, Northern Gulf of Mexico. Abstract OS53B-1207 presented at American Geophysical Union, Fall Meeting, New Orleans, LA.

Moore, M., Darrah, T., Cook, A., Sawyer, D., Phillips, S., Whyte, C., Lary, B., and UT-GOM2-01 Scientists (**2017**). The genetic source and timing of hydrocarbon formation in gas hydrate reservoirs in Green Canyon, Block GC955. Abstract OS44A-03 presented at American Geophysical Union, Fall Meeting, New Orleans, LA.

Oti, E., Cook, A., Buchwalter, E., and Crandall, D. (**2017**). Non-Destructive X-ray Computed Tomography (XCT) of Gas Hydrate Bearing Fractures in Marine Sediment. Abstract OS44A-05 presented at American Geophysical Union, Fall Meeting, New Orleans, LA.

Phillips, S.C., Flemings, P.B., Holland, M.E., Schultheiss, P.J., Waite, W.F., Petrou, E.G., Jang, J., Polito, P.J., O'Connell, J., Dong, T., Meazell, K., and Expedition UT-GOM2-1 Scientists, (**2017**). Quantitative degassing of gas hydrate-bearing pressure cores from Green Canyon 955. Gulf of Mexico. Talk and poster presented at the 2018 Gordon Research Conference and Seminar on Natural Gas Hydrate Systems, Galveston, TX, February 24-March 2, 2018.

Cook, A.E., and Waite, B. (**2016**). Archie's saturation exponent for natural gas hydrate in coarse-grained reservoir. Presented at Gordon Research Conference, Galveston, TX.

Cook, A.E., Hillman, J., Sawyer, D., Treiber, K., Yang, C., Frye, M., Shedd, W., Palmes, S. (**2016**). Prospecting for Natural Gas Hydrate in the Orca & Choctaw Basins in the Northern Gulf of Mexico. Poster presented at American Geophysical Union, Fall Meeting, San Francisco, CA.

Darnell, K., Flemings, P.B., DiCarlo, D.A. (**2016**). Nitrogen-assisted Three-phase Equilibrium in Hydrate Systems Composed of Water, Methane, Carbon Dioxide, and Nitrogen. Presented at American Geophysical Union, Fall Meeting, San Francisco, CA.

Fortin, W. (**2016**). Properties from Seismic Data. Presented at IODP planning workshop, Southern Methodist University, Dallas, TX.

Fortin, W., Goldberg, D.S., Holbrook, W.S., and Küçük, H.M. (**2016**). Velocity analysis of gas hydrate systems using prestack waveform inversion. Presented at Gordon Research Conference on Natural Gas Hydrate Systems, Galveston, TX.

Goldberg, D., Küçük, H.M., Haines, S., Guerin, G. (**2016**). Reprocessing of high resolution multichannel seismic data in the Gulf of Mexico: implications for BSR character in the Walker Ridge and Green Canyon areas. Presented at Gordon Research Conference on Natural Gas Hydrate Systems, Galveston, TX.

Hillman, J., Cook, A. & Sawyer, D. (**2016**). Mapping and characterizing bottom-simulating reflectors in 2D and 3D seismic data to investigate connections to lithology and frequency dependence. Presented at Gordon Research Conference, Galveston, TX.

Küçük, H.M., Goldberg, D.S, Haines, S., Dondurur, D., Guerin, G., and Çifçi, G. (**2016**). Acoustic investigation of shallow gas and gas hydrates: comparison between the Black Sea and Gulf of Mexico. Presented at Gordon Research Conference on Natural Gas Hydrate Systems, Galveston, TX.

Malinverno, A. (**2016**). Modeling gas hydrate formation from microbial methane in the Terrebonne basin, Walker Ridge, Gulf of Mexico. Presented at Gordon Research Conference on Natural Gas Hydrate Systems, Galveston, TX.

Meazell, K., & Flemings, P.B. (**2016**). Heat Flux and Fluid Flow in the Terrebonne Basin, Northern Gulf of Mexico. Presented at American Geophysical Union, Fall Meeting, San Francisco, CA.

Meazell, K., & Flemings, P.B. (**2016**). New insights into hydrate-bearing clastic sediments in the Terrebonne basin, northern Gulf of Mexico. Presented at Gordon Research Conference on Natural Gas Hydrate Systems, Galveston, TX.

Meazell, K., & Flemings, P.B. (**2016**). The depositional evolution of the Terrebonne basin, northern Gulf of Mexico. Presented at 5th Annual Jackson School Research Symposium, University of Texas at Austin, Austin, TX.

Phillips, S.C., Borgfedlt, T., You, K., Meyer, D., and Flemings, P. (**2016**). Dissociation of laboratory-synthesized methane hydrate by depressurization. Poster presented at Gordon Research Conference and Gordon Research Seminar on Natural Gas Hydrates, Galveston, TX.

Phillips, S.C., You, K., Borgfeldt, T., Meyer, D.W., Dong, T., Flemings, P.B. (**2016**). Dissociation of Laboratory-Synthesized Methane Hydrate in Coarse-Grained Sediments by Slow Depressurization. Presented at American Geophysical Union, Fall Meeting, San Francisco, CA.

Treiber, K, Sawyer, D., & Cook, A. (**2016**). Geophysical interpretation of gas hydrates in Green Canyon Block 955, northern Gulf of Mexico, USA. Poster presented at Gordon Research Conference, Galveston, TX.

Worman, S. and, Flemings, P.B. (**2016**). Genesis of Methane Hydrate in Coarse-Grained Systems: Northern Gulf of Mexico Slope (GOM^2). Poster presented at The University of Texas at Austin, GeoFluids Consortia Meeting, Austin, TX.

Yang, C., Cook, A., & Sawyer, D. (**2016**). Geophysical interpretation of the gas hydrate reservoir system at the Perdido Site, northern Gulf of Mexico. Presented at Gordon Research Conference, Galveston, TX, United States.

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.

Cook, A.E., Hillman, J., & Sawyer, D. (**2015**). Gas migration in the Terrebonne Basin gas hydrate system. Abstract OS23D-05 presented at American Geophysical Union, Fall Meeting, San Francisco, CA.

Cook, A. E., & Sawyer, D. (**2015**). Methane migration in the Terrebonne Basin gas hydrate system, Gulf of Mexico. Presented at American Geophysical Union, Fall Meeting, San Francisco, CA.

Meazell, K. (**2015**), Methane hydrate-bearing sediments in the Terrebonne basin, northern Gulf of Mexico. Abstract OS23B-2012 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.

2.4 Websites

- 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

2.5 Technologies Or Techniques

Nothing to report.

2.6 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

Nothing to report.

3.3 Changes That Have A Significant Impact On Expenditures

Nothing to report.

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

Task 11.0 – Refined UT-GOM2-2 Scientific Drilling Program Operations Plan

Subtask 14.3 – PCTB Land Test Report

4.2 Future Project Periods

Task 1.0 – Revised Project Management Plan

Subtask 15.5 – Final UT-GOM2-2 Scientific Drilling Program Operation Plan

Subtask 17.1 – Project Sample and Data Distribution Plan

Subtask 17.3 – UT-GOM2-2 Scientific Drilling Program Scientific Results Volume

5 BUDGETARY INFORMATION

The Budget Period 4 cost summary is provided in Table 5-1.

Table 5-1: Phase 4 / Budget Period 4 Cost Profile

Baseline Reporting Quarter	Budget Period 4							
	Y1Q1		Y1Q2		Y1Q3		Y1Q4	
	10/01/19-12/31/19		01/01/20-03/31/20		04/01/20-06/30/20		07/01/20-09/30/20	
	Y1Q1	Cumulative Total	Y1Q2	Cumulative Total	Y1Q3	Cumulative Total	Y1Q4	Cumulative Total
Baseline Cost Plan								
Federal Share	$ 1,087,357	$ 27,293,955	$ 961,357	$ 28,255,312	$ 2,169,274	$ 30,424,587	$ 961,357	$ 31,385,944
Non-Federal Share	$ 307,598	$ 22,798,170	$ 307,598	$ 23,105,767	$ 307,598	$ 23,413,365	$ 307,598	$ 23,720,962
Total Planned	$ 1,394,955	$ 50,092,125	$ 1,268,955	$ 51,361,079	$ 2,476,872	$ 53,837,951	$ 1,268,955	$ 55,106,906
Actual Incurred Cost								
Federal Share	$ 266,282	$ 26,336,093						
Non-Federal Share	$ 61,210	$ 22,577,153						
Total Incurred Cost	$ 327,492	$ 48,913,245						
Variance								
Federal Share	$ (821,075)	$ (821,075)						
Non-Federal Share	$ (246,388)	$ (246,388)						
Total Variance	$ (1,067,463)	$ (1,067,463)						

6 REFERENCES

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
BOEM	Bureau of Ocean Energy Management
CPP	Complimentary Project Proposal
CRS	Constant Rate Strain
CTTF	Cameron Test Testing Facility
DOE	U.S. Department of Energy
EP	Exploration Plan
G&G	Geologic and Geophysical
GC	Green Canyon
IODP	International Ocean Discovery Program
LWD	Logging While Drilling
NETL	National Energy Technology Laboratory
PCATS	Pressure Core Analysis and Transfer System
PCC	Pressure Core Center
PCTB	Pressure Core Tool with Ball Valve
PDT	Probe Deployment Tool
PM	Project Manager
PMP	Project Management Plan
PMRS	Pressure Maintenance and Relief System
QRPPR	Quarterly Research Performance and Progress Report
RPPR	Research Performance and Progress Report
SOPO	Scope of Project Objectives
T2P	Temperature to Pressure Probe
TOC	Total Organic Carbon
UNH	University of New Hampshire
UT	University of Texas at Austin
UW	University of Washington
XCT	X-ray Computed Tomography

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