DOE Award No.: DE-FE0023919

Quarterly Research Performance Progress Report

(Period Ending 06/30/21)

Deepwater Methane Hydrate Characterization & Scientific Assessment

Project Period 5: 10/01/20 - 09/30/22

Submitted by:

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DISCLAIMER

1 ACCOMPLISHMENTS

This report outlines the progress of the third quarter of the seventh fiscal year of the project (Budget Period 5, Year 1). Highlights from this period include:

- **PCTB MK V Land Test**:
  UT conducted a full-function land-based coring test of the Mk. 5 pressure coring tool with ball valve (PCTB) at the Catoosa Geophysical and Drilling Technology Testing and Evaluation Facility. Previously, we identified that the primary cause of seal failure was ingress of silt-sized particles into the ball valve assembly with the result that the ball valve did not to seal. Sixteen out of nineteen tests were successful (84% success). None of the unsuccessful tests were caused by ingress of grit causing ball valve failure. This test demonstrates that modifications to the PCTB successfully prevent silt-sized particles from causing the ball valve to not seal without introducing other performance issues. The tool is ready for deployment at sea.

- **UT-GOM2-2 permits submitted to BOEM**:
  UT submitted a right-of-use and easement (RUE) application to the Bureau of Ocean Energy Management (BOEM), and was granted RUE control number OCS-G30392. UT submitted the UT-GOM2-2 Initial Exploration Plan and Shallow Hazard Assessment reports for each proposed well to BOEM. The Exploration Plan and Shallow Hazard Assessment reports have received preliminary approval from BOEM with regard to geological/geophysical content. UT also emplaced a $200,000 general lease bond, which was accepted by BOEM.

- **Pressure core testing improvements:**
  As a result of upgraded protocols and equipment, UT can now run tests in the K0 permeameter at high effective stresses (See Section 1.2.2.5.2 Subtask 13.2). These developments increased the capacity of our tool. A benchmark study validates our measurements by comparing properties obtained using the K0 permeameter and conventional geotechnical devices. Results suggest the K0 accurately estimates geomechanical and petrophysical properties of geomaterials.

- **Data and Reports:**
  https://ig.utexas.edu/energy/gom2-methane-hydrates-at-the-university-of-texas/project-reports/

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

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
4	M4A	Document results of BP3 Activities	Jan-20	Apr-20	Phase 3 Report
	M4B	Demonstration of a Viable Pressure Coring Tool: Lab Test	Feb-20	Jan-20	PCTB Lab Test Report, in QRPPR
	M4C	Demonstration of a Viable Pressure Coring Tool: Land Test	Mar-20	Mar-20	PCTB Land Test Report, in QRPPR

Table 1-2: Current Milestones

Budget Period	Milestone	Milestone Description	Estimated Completion	Actual Completion	Verification Method
5	M5A	Document Results of BP4 Activities	Dec-20	Mar-21	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

Table 1-3: Future Milestones

Budget Period	Milestone	Milestone Description	Estimated Completion	Actual Completion	Verification Method
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, 3, and 4) are summarized in Table 1-4, Table 1-5, Table 1-6, and Table 1-7.

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 Science and Operational Plans 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 Science and Operational Plans 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*

Table 1-7: Tasks Accomplished in Phase 4

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 Science and Operational Plans 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 Current Project Period

Current project period tasks are shown in Table 1-8.

Table 1-8: Current Project Tasks

PHASE 5/BUDGET PERIOD 5	
Task 1.0	**Project Management and Planning**
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*
Subtask 10.7	*Hydrate Modeling*
Subtask 10.8	*Routine Core Analysis (UT-GOM2-2)*
Subtask 10.9	*Pressure Core Analysis (UT-GOM2-2)*
Subtask 10.10	*Core-log-seismic Integration (UT-GOM2-2)*
Task 11.0	**Update Science and Operational Plans 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 Maintenance and Storage of Hydrate Pressure Cores from UT-GOM2-1*
Subtask 13.7	*Maintain X-ray CT*
Subtask 13.8	*Maintain Preconsolidation System*
Subtask 13.9	*Transportation of Hydrate Core from UT-GOM2-2 Scientific Drilling Program*
Subtask 13.10	*Storage of Hydrate Cores from UT-GOM2-2 Scientific Drilling Program*
Subtask 13.11	*Hydrate Core Distribution*
Task 14.0	**Performance Assessment, Modifications, and Testing of PCTB**
Subtask 14.4	*PCTB Modifications/Upgrades*
Subtask 14.5	*PCTB Land Test III*
Task 15.0	**UT-GOM2-2 Scientific Drilling Program Preparations**
Subtask 15.3	*Permitting for UT-GOM2-2 Scientific Drilling Program*
Subtask 15.4	*Review and Complete NEPA Requirements*
Subtask 15.5	*Finalize Operational Plan for UT-GOM2-2 Scientific Drilling Program*
Task 16.0	**UT-GOM2-2 Scientific Drilling Program Field Operations**
Subtask 16.1	*Mobilization of a Scientific Ocean Drilling and Pressure Coring Capability*
Subtask 16.2	*Field Project Management, Operations and Research*
Subtask 16.3	*Demobilization of Staff, Labs, and Equipment*

1.2.2.1 Task 1.0 – Project Management & Planning

Status: Ongoing

1. **Coordinate the overall scientific progress, administration and finances of the project:**
   - Monitored and controlled project scope, costs, and schedule.

2. **Communicate with project team and sponsors:**
   - Organized sponsor and stakeholder meetings.
   - Organized task-specific working meetings to plan and execute project tasks per the Project Management Plan and Statement of Project Objectives (e.g. PCTB development, UT-GOM2-2 operations planning, UT-GOM2-2 science and sample distribution planning, UT-GOM2-2 permitting, and UT-GOM2-2 vessel access).
   - Managed SharePoint sites, email lists, and archive/website.

3. **Coordinate and supervise subcontractors and service agreements:**
   - A new subcontract was fully executed between UT and Dr. John Germaine of Tufts University. Tufts will fill the role of the physical/petrophysical properties lead.
     1. Obtained DOE authorization
     2. Completed NEPA Environmental Questionnaire
     3. Negotiated scope of work, budget, and contract
   - Held operational planning and contractual discussions with Geotek regarding continued performance assessment, modification, and testing of the PCTB (Task 14).
   - Managed planning, execution, and closeout of the PCTB Land Test III.
   - Procured ANCO Insurance to broker a $200,000 general lease bond with RLI Insurance Company. This bond meets a regulatory requirement of the Bureau of Ocean Energy Management (BOEM) for the UT-GOM2-2 research permit.
   - Organized recurring technical/science meetings with Geotek to identify and address science and engineering challenges pertaining to UT Pressure Core Center and field science program for the UT-GOM2-2 Scientific Drilling Program.

4. **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:**
   - UT identified a schedule/resource conflict that has significant implications for the UT-GOM2-2 field program schedule. It came to UT's attention that DOE Alaska North Slope program closely intersects and could possibly overlap the UT-GOM2-2 schedule. As a result, it is unlikely that Geotek would be able to participate in the Alaska North Slope program and also be available to perform the UT-GOM2-2 drilling program within the contracted drilling window of February 1 to June 1, 2022.
   - UT notified DOE that the schedule conflict presented unacceptable risk to the UT-GOM2-2 program and requested clarification on how to proceed. DOE informed UT that in addition to

the schedule conflict, there were also budget conflicts presented by the overlap of both programs occurring in the same fiscal year. DOE informed UT that UT-GOM2-2 may have to be postponed until 2023. A final decision will be made in late summer, 2021.

- UT and DOE agreed that until a delay is confirmed, UT will proceed with planning the 2022 UT-GOM2-2 field program so that a possible 2022 effort is not compromised. However, UT will not yet commit funding or execute contracts that commit to a 2022 schedule. For further discussion, see section 3.2.

1.2.2.2 Task 10.0 – Core Analysis

Status: Ongoing

1.2.2.2.1 Subtask 10.4 – Continued Pressure Core Analysis (UT-GOM2-1)

A. Pressurized Core Analysis

A1. Relative permeability of pressure core

- UT analyzed relative permeability of UT-GOM2-1 hydrate-bearing pressure core measured in a long-term hydrate dissolution test.
    - UT found that at high hydrate saturations (e.g., S_h > 80), the relative permeabilities are greater than predicted by a grain-coating model (Figure 1-1).
    - UT found that when the core sample's bulk volume is fixed, the relative permeability evolution follows a trend between a pore-filling and grain-coating model. ('Hydrate Dissolution', Figure 1-1).
    - UT found that the stress ratio (K_0) of the core in absence of hydrate is lower than the same core in presence of hydrate (Figure 1-1).

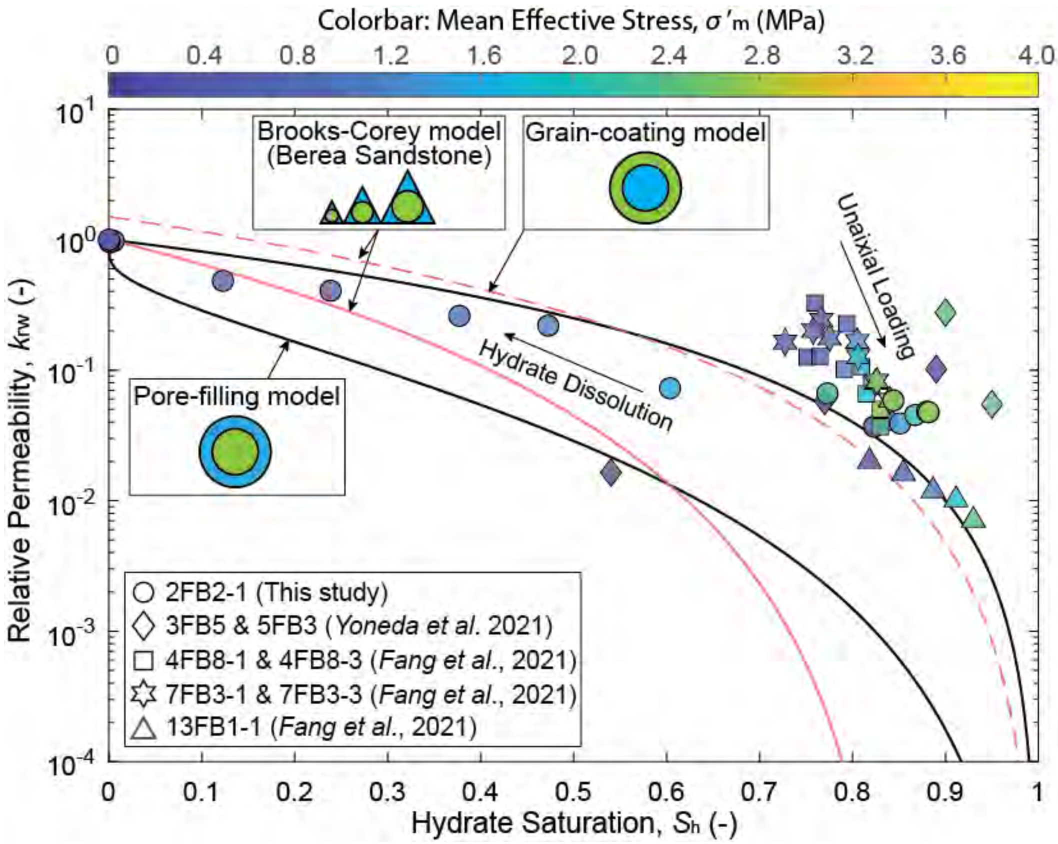

Figure 1-1: Dependence of log-scale relative permeability (k_{rw}) on hydrate saturation (S_h) and mean effective stress (σ'_m). The relative permeability is a dimensionless parameter calculated as a ratio of effective permeability to intrinsic permeability. The effective permeabilities are measured in pressure core samples in presence of hydrate. The intrinsic permeability is measured in absence of hydrate. When the pressure cores are uniaxially loaded up to their in-situ effective stress at 3.8 MPa, the intrinsic permeability are changing with stress. Thus, the intrinsic permeability corresponding to its paired effective permeability during the loading is estimated from the log-linear porosity-permeability relationship identified in (Fang et al., 2020). During hydrate dissolution, as the sands frame (or bulk volume) is fixed, all effective permeability values just have a single paired intrinsic permeability, which is measured at the end of the dissolution. Two solid black curves show the empirical log-linear relationship between k_{rw} and S_h based on hydrate morphology in porous media: the lower solid black curve represents a hydrate pore-filling model and S_h the upper solid black curve represents a hydrate grain-coating model (Kleinberg et al., 2003). The capillary pressure-derived Brooks-Corey model (Brooks and Corey, 1964), if hydrate is non-wetting or pore-filling, is plotted as the dashed black line using a water fitting parameter and a residual water saturation obtained from the relative permeability relationship in a Berea Sandstone (Murphy et al., 2020). If hydrate is wetting or grain-coating, the Brooks-Corey model is plotted in a dashed red line using a gas fitting parameter and a residual gas saturation in the same Berea Sandstone (Murphy et al., 2020). The mean effective stress of each specimen at each hydrate saturation is color-coded.

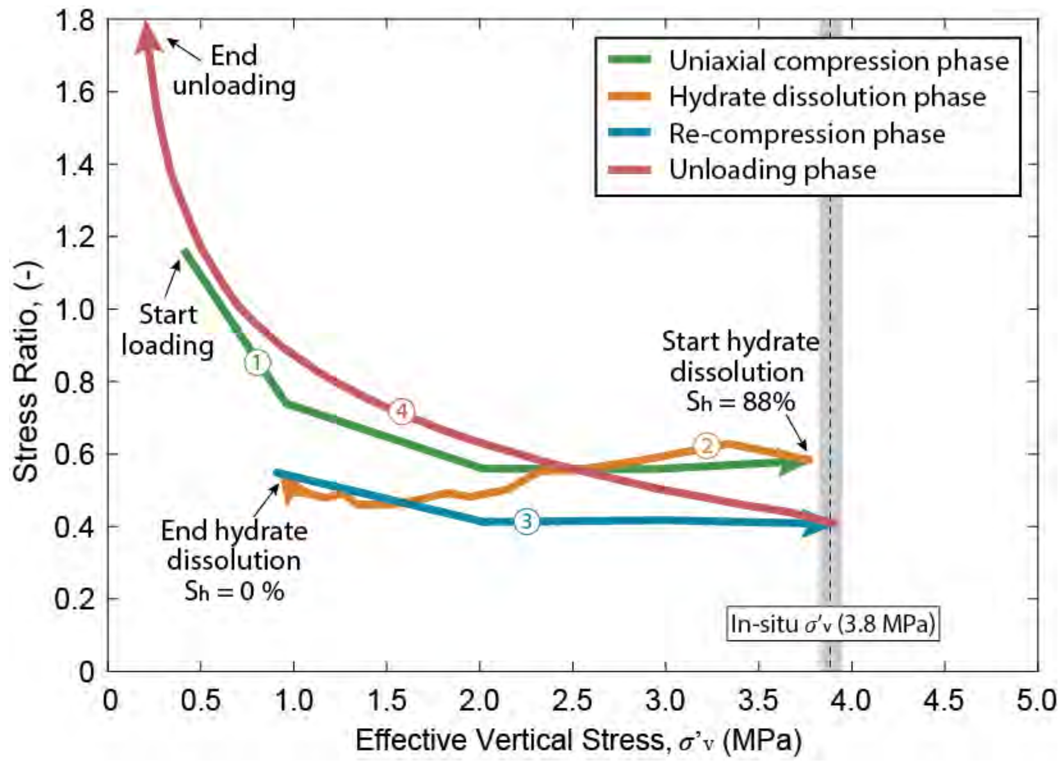

Figure 1-2. The evolution of stress ratio in hydrate-bearing pressure cores measured during the uniaxial-strain compression and hydrate dissolution. Step 1 (green curve): uniaxial-strain compression; step 2 (orange curve): hydrate dissolution under fixed bulk volume (i.e., no volumetric strain); step 3 (blue curve): reload the sample under uniaxial-strain condition; step 4 (red curve): unload the sample under uniaxial-strain condition.

<u>A2. Hydrogen and Carbon Isotope Data of Methane and Ethane</u>

- In Q3, Ohio State (Gus Wulsin and Tom Darrah) were able to measure hydrogen and carbon isotopes of methane on four samples from Hole H005 (2FB-2 and 7FB-3) and one sample from Hole H002 (04CS-2) that were previously analyzed for major, hydrocarbon and noble gas geochemistry. Previously, in 6 of the 8 samples from Hole H005 (each were run twice), we observed principally methane with low concentrations of ethane and propane (Table 1-9, Table 1-10, Table 1-11). These data are consistent with the occurrence of predominantly microbial methane throughout Hole H005. An important and notable derivation from these data were found in the two gas samples from the **H005-7FB-3 A** (highlighted green in Table 1-9, Table 1-10, Table 1-11). In these two samples, a notable increase in the proportion of thermogenic (i.e., wet natural gases such as ethane, propane) natural gas was observed. This interpretation is supported by marked decreases in the C_1/C_2+, increased concentrations of wet gases (C_2+), marked increasing in radiogenic concentrations of ^4He and other crustal noble gases, and associated decreases in the helium isotopic values toward a crustal/radiogenic endmember ($0.02R_A$). In summary, these data are consistent with the presence of a marked increase in the proportion of natural gas derived from a thermogenic natural gas source (likely of exogenous origin) associated with core segment **H005-7FB-3 A.** It is challenging to determine the proportions without knowing the true composition of the endmember, but the thermogenic component appears to be an early thermal maturity (e.g., oil-associated gas) endmember.

- Because of the unique result in H005-7FB-3 A, we measured hydrogen and carbon isotopes on both of these samples as well as hydrogen and carbon isotopes on one of each of the other three sample pairs from H005 (Table 1-12). We found that the signatures for all samples were very similar, again suggesting predominately microbial methane. But unlike the noble gas and hydrocarbon results, H005-7FB-3 A is no longer unique and has the same signature as the other samples. In addition, we were able to measure δ13C2 and δ13C3 in one sample from H005-7FB-3 A, and found: δ13C2 of -33.3 and δ13C3 of -28.8. A small amount of early thermal maturity hydrocarbon (oil phase wet gas) could certainly occur in and still produce the hydrogen and carbon isotopes and molecular hydrocarbon composition that we observe, and this would agree with what we observe in the noble gas results. The hydrocarbon data does suggest that more heavy hydrocarbons are occurring in samples from H005-7FB-3 A, however.

Table 1-9: Bulk Gas Geochemistry and BTU Content. Gas samples from H005-7FB-3 A, in which an increase in the proportion of thermogenic natural gas was observed, are highlighted green.

Samples	CH_4 ccSTP/cc	N_2 ccSTP/cc	CO_2 ccSTP/cc	O_2 ccSTP/cc	H_2 ccSTP/cc	Ar ccSTP/cc	GROSS BTU	NET BTU
H005-2FB-2 A 7172020	0.769	0.191	1.40E-02	2.30E-02	1.34E-03	2.98E-03	778.79	701.07
H005-2FB-2 A 842020	0.877	0.106	8.17E-03	6.21E-03	1.57E-03	1.43E-03	888.69	800.01
H005-2FB-2 B 7172020	0.862	0.120	8.67E-03	6.87E-03	1.99E-03	1.81E-03	872.98	785.87
H005-2FB-2 B 842020	0.878	0.102	1.15E-02	7.07E-03	1.42E-04	1.36E-03	889.47	800.71
H005-7FB-3 A 6262020	0.882	0.167	9.29E-03	1.74E-02	1.41E-03	2.05E-03	814.59	733.31
H005-7FB-3 A 842020	0.966	0.028	4.37E-03	b.d.l.	1.71E-03	5.28E-04	979.05	881.35
H005-7FB-3 B 6262020	0.804	0.167	9.29E-03	1.74E-02	1.41E-03	2.05E-03	814.59	733.31
H005-7FB-3 B 742020	0.972	0.022	4.07E-03	b.d.l.	1.68E-03	3.94E-04	984.83	886.56
H002-04CS-2	0.976	0.016	6.18E-03	b.d.l.	2.17E-03	3.22E-04	987.87	889.28

Table 1-10: Hydrocarbon Data. Gas samples from H005-7FB-3 A, in which an increase in the proportion of thermogenic natural gas was observed, are highlighted green.

Samples	$\frac{CH_4}{C_2H_6+}$	CH_4 ccSTP/cc	C_2H_6 ccSTP/cc	C3 ccSTP/cc	Ci-4 ccSTP/cc	Cn-4 ccSTP/cc	Ci-5 ccSTP/cc	C-5 ccSTP/cc	C-6 ccSTP/cc
H005-2FB-2 A 7172020	2586	0.769	2.90E-04	3.97E-06	9.53E-07	8.70E-07	2.00E-06	b.d.l.	b.d.l.
H005-2FB-2 A 842020	1422	0.877	5.99E-04	9.28E-06	2.75E-06	1.88E-06	3.36E-06	1.16E-06	b.d.l.
H005-2FB-2 B 7172020	2243	0.862	3.76E-04	4.80E-06	1.05E-06	b.d.l.	2.64E-06	b.d.l.	b.d.l.
H005-2FB-2 B 842020	2378	0.878	3.55E-04	8.75E-06	2.41E-06	1.34E-06	2.14E-06	b.d.l.	b.d.l.
H005-7FB-3 A 6262020	366	0.882	1.62E-03	4.13E-04	7.40E-05	1.49E-04	6.05E-05	6.78E-05	2.54E-05
H005-7FB-3 A 842020	1409	0.966	6.69E-04	9.02E-06	6.00E-06	1.54E-06	b.d.l.	b.d.l.	b.d.l.
H005-7FB-3 B 6262020	2116	0.804	3.68E-04	6.69E-06	1.47E-06	1.35E-06	2.94E-06	b.d.l.	b.d.l.
H005-7FB-3 B 742020	1311	0.972	7.26E-04	9.13E-06	2.08E-06	1.64E-06	2.26E-06	b.d.l.	b.d.l.
H002-04CS-2	2922	0.976	3.34E-04	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.

Table 1-11: Noble Gas Data. Gas samples from H005-7FB-3 A, in which an increase in the proportion of thermogenic natural gas was observed, are highlighted green.

Samples	^{3}He pcc/cc	^{4}He µcc/cc	^{20}Ne µcc/cc	^{36}Ar µcc/cc	^{40}Ar µcc/cc	R/R_A	$\frac{^{4}He}{^{20}Ne}$	$\frac{^{20}Ne}{^{36}Ar}$	$\frac{N_2}{Ar}$
H005-2FB-2 A 7172020	3.19	2.76	3.421	10.12	2984.18	0.8351	0.81	0.338	63.92
H005-2FB-2 A 842020	1.33	1.14	1.884	4.83	1429.24	0.8430	0.61	0.390	74.39
H005-2FB-2 B 7172020	1.12	0.91	1.689	6.13	1813.36	0.8933	0.54	0.275	66.14
H005-2FB-2 B 842020	1.17	0.98	2.154	4.59	1358.48	0.8607	0.46	0.469	75.18
H005-7FB-3 A 6262020	30.22	223.57	2.645	5.45	1619.22	0.0977	84.53	0.485	64.76
H005-7FB-3 A 842020	6.04	23.28	1.134	1.78	528.36	0.1874	20.52	0.636	52.44
H005-7FB-3 B 6262020	1.82	1.57	0.719	6.92	2046.57	0.8354	2.19	0.104	81.48
H005-7FB-3 B 742020	0.68	0.61	0.577	1.33	393.84	0.7989	1.06	0.433	56.50
H002-04CS-2	0.37	0.26	0.502	1.08	322.16	1.0126	0.53	0.467	50.17

Table 1-12: Carbon Isotope Data. Gas samples from H005-7FB-3 A, in which an increase in the proportion of thermogenic natural gas was observed, are highlighted green.

Samples	$\delta^{13}C_1$ ‰	δDC_1 ‰
H005-2FB-2 A 7172020	-73.2	-188.0
H005-2FB-2 B 842020	-73.1	-191.0
H005-7FB-3 A 842020	-73.1	-194.0
H005-7FB-3 B 6262020	-72.2	-188.0
H005-7FB-3 B 742020	-73.0	-196.00

B. Pressure Core Degradation

- UT continues to make progress on understanding the mechanisms and extent of core degradation during high pressure storage in fresh water.
  - Work was started on developing a new method for extracting samples of storage fluid from high pressure chambers. Previous simulations of core degradation have modeled a change in storage fluid salinity and dissolved methane concentration as a function of time and space (see Y7Q1 (Flemings, 2021a) or Y7Q2 (Flemings, 2021b)). These modeled changes are a result of salt diffusion and advection from the pore space into the fresh storage fluid, and loss of hydrate in the pore space of the exposed surfaces of the core. Being able to extract samples of storage fluid from the high-pressure storage chambers would allow us to measure salinity and dissolved methane content of the fluid which would then be used to confirm the extent of degradation over time and compare lab and simulation results. Figure 1-2 shows a photo of the initial 5 mL sampling device.
  - The new high-pressure sampling device described above (Figure 1-2) was used to extract several samples from UT-GOM2-1-H005-02FB-3, 03FB-4. These initial extractions produced very low volumes of gas and had a much lower salinity than expected. The result was more indicative of extracted water vapor than of storage fluid. As a result, our method was modified and much longer equilibrations times were used. The device was also modified to lower the volume of trapped fluid between the sample chamber and syringe.
  - Two addition samples were extracted from UT-GOM2-1-H005-08FB-1. These samples produced 1.7 mL of gas from 6.8 grams of fluid and 2.7 mL of gas from 3.8 g of fluid, respectively. The gas was measured on a gas chromatograph for C1-CX, O2, and N2. Analysis of the results is underway.
  - Work continued on developing a method for storing pressure cores in methane-charged water. Extraction of high-pressure fluid with measurements of dissolved methane concentration will also be required to confirm the dissolved methane concentration before and after addition of the fluid to the storage chamber.
  - Extraction and measurement of fluid concentrations will also aid in the interpretation of pressure core degassing and other experiments were hydrate-bearing cores are exposed to fresh and charged fluids.

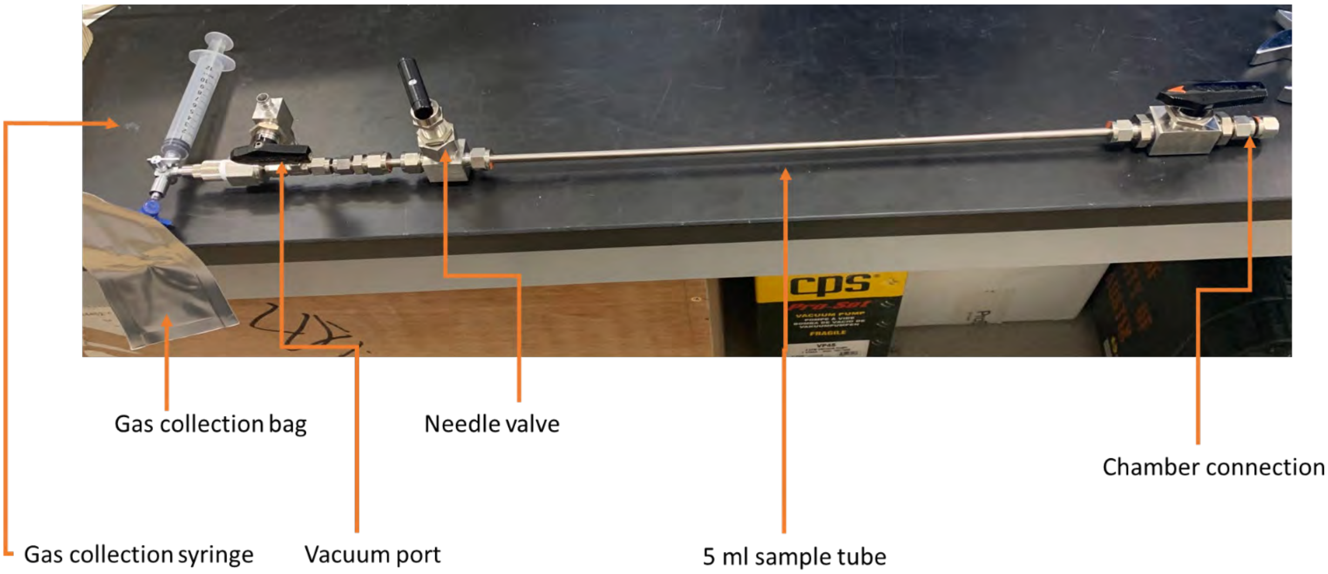

Figure 1-2: High-pressure 5mL fluid sampling device for extracting fluid samples from pressure core storage and dissolve methane mixing chambers.

C. Conventional Core Analysis

C.1 Bulk sediment CHNS elemental analysis, Bulk sediment TOC, N, and S isotopes and Grain size using a laser particle size analyzer

- UNH completed the full data analyses/interpretations for all of the UNH derived UT-GOM2-1 samples. This work included integration of the GOM2-1 data with existing data sets in the Gulf of Mexico that document the provenance of the GOM2-1-sediments is similar to the Mississippi and Rio Grande river deposits (Figure 1-3A). The predominance of carbonate lithics within the GOM2-1 sediments (Figure 1-3B) and reworked calcareous nannofossils of Cretaceous age throughout the reservoir suggest these grains are likely derived from the Cretaceous age carbonate rocks of the Mississippi embayment onshore.

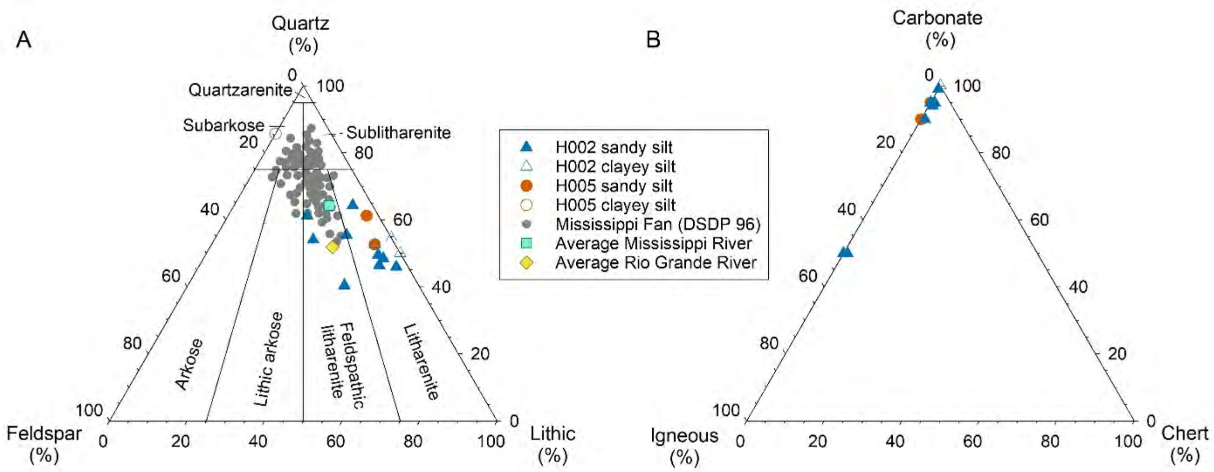

Figure 1-3: (A) Summary QFL ternary plot of sediment compositions from DSDP Leg 96 (Thayer et al., 1985), Mississippi and Rio Grande River deposits (Potter, 1978), and GOM² sediments. GOM² normalized % estimates of quartz, total feldspar, and total lithics grains obtained from smear slide descriptions. (B) Lithic ternary plot for GOM2-2 sediments; notice detrital carbonates with a small admixture of igneous lithics dominate the overall lithic fraction.

1.2.2.2.2 Subtask 10.5 – Continued Hydrate Core-Log-Seismic Synthesis (UT-GOM2-1)

- Ohio State is edited logging-while-drilling (LWD) curves and developing reference hydrate saturation curves for WR313-H and WR313-G from the 2009 LWD data to provide to UT-GOM2-2 participants before, during and after the expedition. These curves will allow non-logging experts to have quality reference curves with depth to compare to new datasets as they are generated during UT-GOM2-2. We plan to publish these curves in the Expedition Proceedings.

1.2.2.2.3 Subtask 10.6 – Additional Analysis Capabilities

- UT increased the K0 permeameter (i.e., effective stress chamber) capacity from ~4 to 20 MPa of effective vertical stress. The load is now applied using a hydraulic loading scheme instead of the screw-drive system. To accomplish this procedural change, engineering testing conducted at UT identified optimal protocols and hydraulic seals that resulted in higher effective stresses while monitoring sample compression under zero-lateral strain condition (see section 1.2.2.5.2 for details)
- UNH began running calibration and internal lab standards on the new Elementar CHNS Elemental Analyzer. This instrument will be utilized extensively on samples collected during the GOM2-2 expedition.

1.2.2.2.4 Subtask 10.7 – Hydrate Modeling

- UT developed a model that systematically describes the generation, migration, phase partitioning and accumulation of methane as the sediment is deposited from the seafloor and buried through the base of hydrate stability zone (Figure 1-4) (You et al., In Review).

- With three-dimensional focused free gas flow, microbial methane that is generated from a much larger fetch area of the entire basin, both above and below the BHSZ, is concentrated into coarse-grained layers at structural closures to form high-concentration methane hydrate reservoirs (Figure 1-4).
- This model can well explain the formation of many observed highly-concentrated hydrate reservoirs along the continental margins, such as the concentrated hydrate reservoirs at Green Canyon 955 and Walker Ridge 313 of northern Gulf of Mexico, the first offshore gas production site of eastern Nankai Trough, Area B and Area C of NGHPE-02, and New Zealand's southern Hikurangi subduction margin.

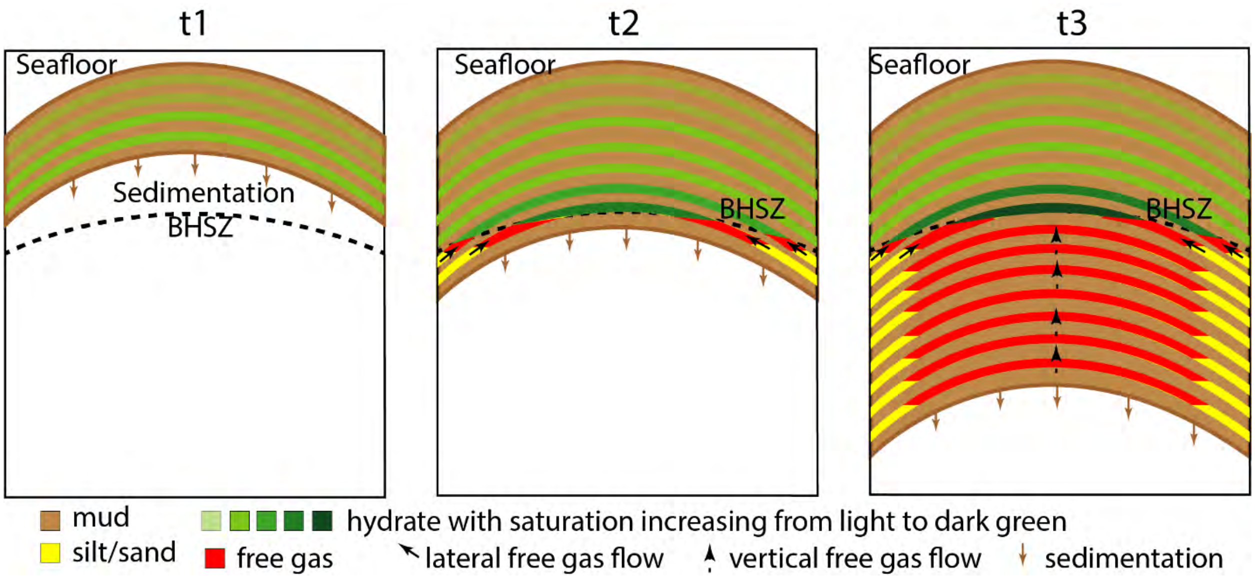

Figure 1-4: A schematic of the generation, migration, phase partitioning and accumulation of microbial methane in an evolving sedimentary system from t1 to t2 and then to t3. Methane is generated in muds, focused into sands/silts and forms concentrated methane hydrate as a sand-mud interbedded system is deposited from the seafloor and passes through the BHSZ from t1 to t2 and t3. In this model, methane is generated by biodegradation of organic carbon in muds. Hydrate does not form and methane is not trapped until a coarse-grained layer is deposited, because the nm-scale pores prevent hydrate formation in muds. Instead, methane diffuses into sands/silts where methane solidifies into hydrate. As hydrate-bearing sands/silts pass through the base of hydrate stability zone (BHSZ) during sediment burial, methane hydrate dissociates and releases free gas. The released and the newly generated free gas below the BHSZ concentrates into a vertical/dipping zone with low capillary entry pressure and high permeability and flows upward driven its buoyancy. When free gas reaches the hydrate stability zone (HSZ), capillary forces drive free gas to flow laterally, preferentially enter sands/silts, feed hydrate growth and elevate hydrate saturation

1.2.2.2.5 Subtask 10.8 – Routine Core Analysis (UT-GOM2-2)

- Future Task.

1.2.2.2.6 Subtask 10.9 – Pressure Core Analysis (UT-GOM2-2)

- Future Task.

1.2.2.2.7 Subtask 10.10 – Core-log-seismic Integration (UT-GOM2-2)

- Future Task.

1.2.2.2.8 Other – Publication and Presentation Work

- AAPG Editors continued working on the AAPG Bulletin GC 955 dedicated Volume 2
- GOM2 participants continued working on their AAPG Vol 2 submissions. Table 1-13 shows the current status. Four papers are now available on-line (ahead of print).
- UNH is preparing a submission to Marine Geology on GC 955 titled "Primary Deposition and Early Diagenetic Effects on the High Saturation Accumulation of Gas Hydrate in a Silt Dominated Reservoir in the Gulf of Mexico"
- UT submitted the paper "Three-dimensional free gas flow focuses basin-wide microbial methane to concentrated methane hydrate reservoirs in geological system" to the Journal of Geophysical Research: Solid Earth (You, In Review).

Table 1-13: AAPG Vol 2 submissions

Primary Author	Working Title	Status
Oti	Using X-ray Computed Tomography (XCT) to Estimate Hydrate Saturation in Sediment Cores from Green Canyon 955, northern Gulf of Mexico	Ahead of Print
Moore	Integrated geochemical approach to determine the source of methane in gas hydrate from Green Canyon Block 955 in the Gulf of Mexico	Ahead of Print
Daigle	Pore structure of sediments from Green Canyon 955 determined by mercury intrusion	Accepted
Wei	Methane migration mechanisms for the Green Canyon Block 955 gas hydrate reservoir, northern Gulf of Mexico	Ahead of Print
Santra	Occurrence of High-Saturation Gas Hydrate in a Fault-Compartmentalized Anticline and the Role of Seal- Green Canyon, Abyssal Gulf of Mexico	Accepted
Yoneda	Comprehensive pressure core analysis for hydrate-bearing sediments from Gulf of Mexico Green Canyon Block 955, including assessments of geomechanical viscous behavior and NMR permeability	Ahead of Print
Fang	Permeability of methane hydrate-bearing sandy silts in the deepwater Gulf of Mexico (Green Canyon block 955)	Accepted
Fang	Compression behaviors of hydrate-bearing sediments	In Review
Phillips	Thermodynamic insights into the production of methane hydrate reservoirs from depressurization of pressure cores	Accepted, pending revisions

1.2.2.3 Task 11.0 – Update Science and Operations Plans for UT-GOM2-2 Scientific Drilling Program

Status: Ongoing

Operations Plan

No update this period.

Science and Sample Distribution Plan

Work continued on version 2 of the UT-GOM2-2 Science and Sampling Plan. Additional planning included:

- The GOM2 Lead PIs (Flemings, Cook, Malinverno, Johnson, Germaine, Solomon, Colwell) and key UT (Thomas, Portnov, Price) and USGS staff (Collett and Phillips) have been meeting weekly to work through the details of the science plan. The group assessed the on-board Conventional Core flow and made several updates (see Figure 1-5). The cutting of whole-round samples from pore water, microbiology, and moisture and density (MAD) as well as hand-held vane/penetrometer measurements and headspace gas sampling will now be done in the Geotek Core Receiving Lab. After whole round cutting, conventional cores will be thermally imaged a second time in order to identify additional developing thermal anomalies. The additional thermal scan also provides a backup record of where whole round samples have been removed from the core since the initial IR scan conducted upon recovery and before sampling and cutting into archived sections. Discussions with Geotek concerning staffing, equipment, and container space are on-going.
- The group also assessed the dockside Conventional Core flow and made several updates (see Figure 1-6). We will now cut a whole round sample for geomechanical testing after CT imaging but before core splitting. Thermal conductivity and Vane Strength measurements will also be made at that time. Discussions with Geotek concerning staffing, equipment, and container space are on-going.
- The group also assessed the Pressure Core flow which has been divided into a hydrate-bearing pressure core flow (see Figure 1-7), a background mud pressure core flow (see Figure 1-8), and a flow for pressure cores with fall-in (see Figure 1-9). These cores need to be handled differently due to limitations of PCATS time on-board. The Science planning team is also assessing how to better calibrate PCATS logging and imaging data, and preparing a proposal for possible dockside LN2 freezing before depressurization.

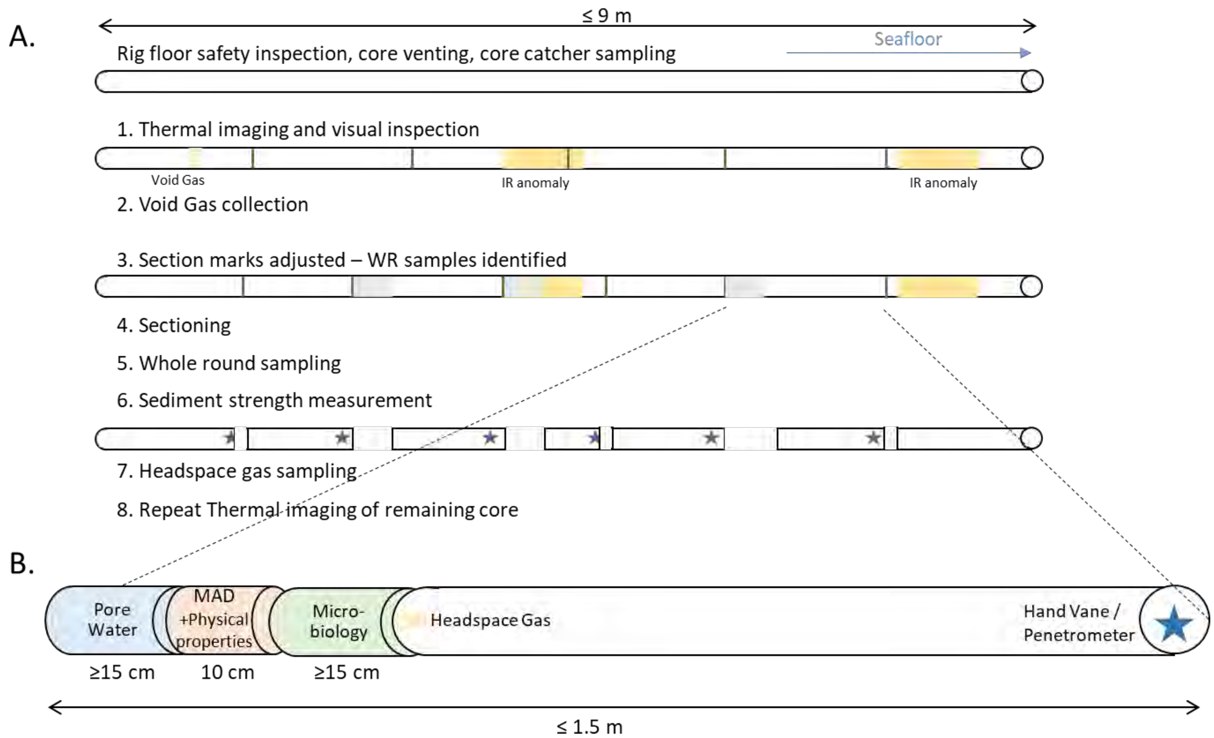

Figure 1-5. On-board Conventional Core Flow. A. ~ 9 m conventional core processing steps for a hypothetical APC/XCB core below the sulfate-methane transition zone (SMT). B. Detailed Section noting whole round sampling, headspace gas sampling, and hand-held vane and penetrometer measurement locations.

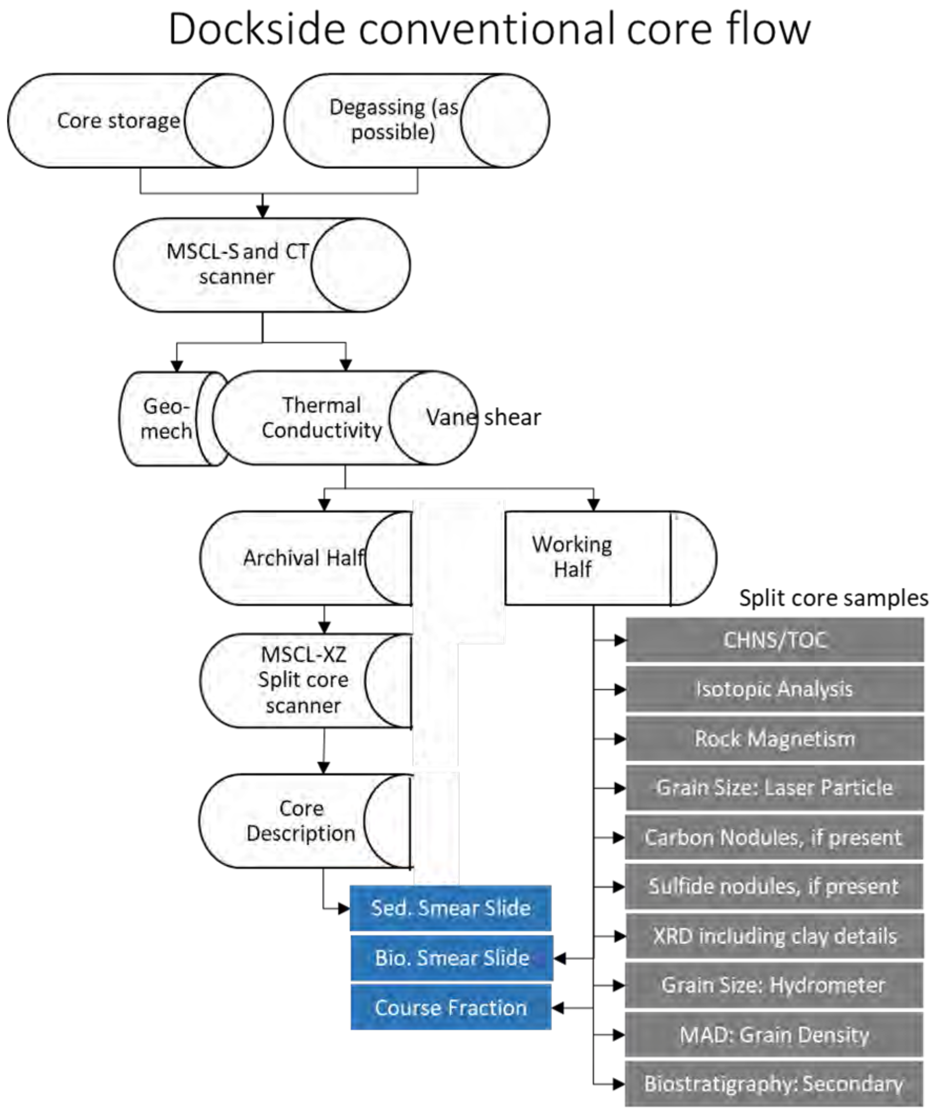

Figure 1-6. Dockside Conventional Core Flow. As available, conventional and depressurized cores will be brought to the Geotek MSCL-S and CT scanner for whole core logging and imaging. After logging sections of whole round will be cut and shipped to Tufts for geomechanical testing, thermal conductivity measurements will be made and measurements of sediment strength made. Cores will then be split and scans of the split core acquired. The split will be laid-out, described, and flagged for sampling. Microscopes will be available for sediment description, biostratigraphy, and course fraction work. Finally, flag samples will be taken from the working half and shipping to UNH and other institutions. Archival and working halves will be shipped to UT for cold storage.

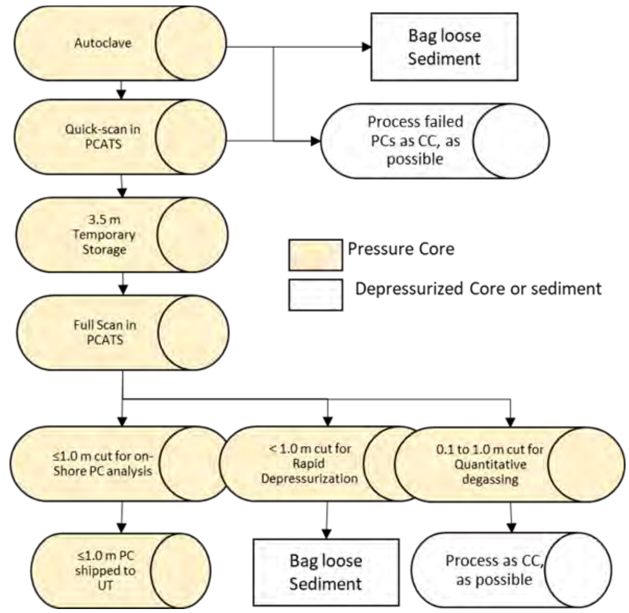

Figure 1-7. Hydrate-bearing Pressure Core Flow. As hydrate-bearing pressure cores arrive at the Geotek Pressure Core Analysis and Transfer System (PCATs), they will be removed from the Autoclave, an initial core log and image is generated (Quick-scan), and the full core is transferred to a long (3.5 m) storage chamber. As time permits, the long storage chamber is brought back to PCATS and the core is imaged and scanned at high resolution (Full-Scan). From the quick and full scan data, a core sectioning plan is made. The core is then sectioned and sections are moved into smaller storage and analysis chambers. 1.0 m sections of pressure core will be cut and transferred to UT. 0.1 to 1.0 m sections will be quantitatively degassed (6-12 hour depressurization measuring the amount of gas produced and collecting gas samples for Gas chromatography). Core from slow degassing will be processed as conventional core as possible. Remaining sections of core including any fall-in will be rapidly depressurized. We currently plan to bring 40 sections of core to UT and most of them will be sections of reservoir material (mainly hydrate-bearing sand).

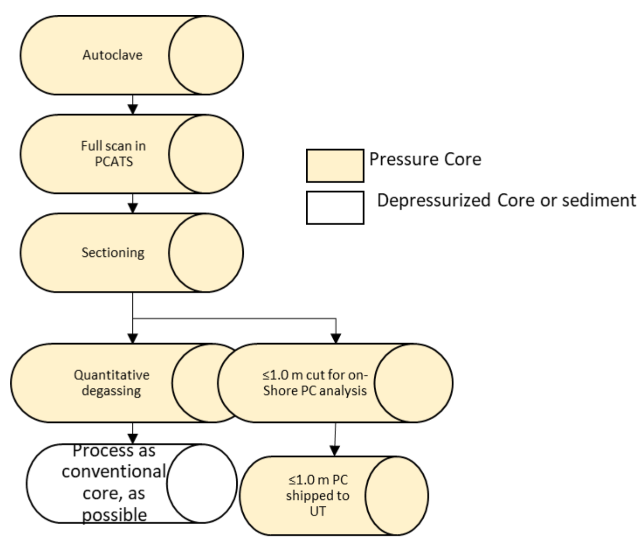

Figure 1-8. Background Mud Pressure Core Flow. As Background mud pressure cores arrive at the Geotek Pressure Core Analysis and Transfer System (PCATs), they will be removed from the Autoclave, and the core will be imaged and scanned at high resolution (Full-Scan). From the full scan data, a core sectioning plan will be made. These cores are likely to be cut into three equal sections of about 1.0 m. 1.0 m sections will be quantitatively degassed (6-12 hour depressurization measuring the amount of gas produced and collecting gas samples for Gas chromatography). Core from slow degassing will be processed as conventional core as possible. A small number (~2) 1.0 m sections of pressure core will be cut and transferred to UT.

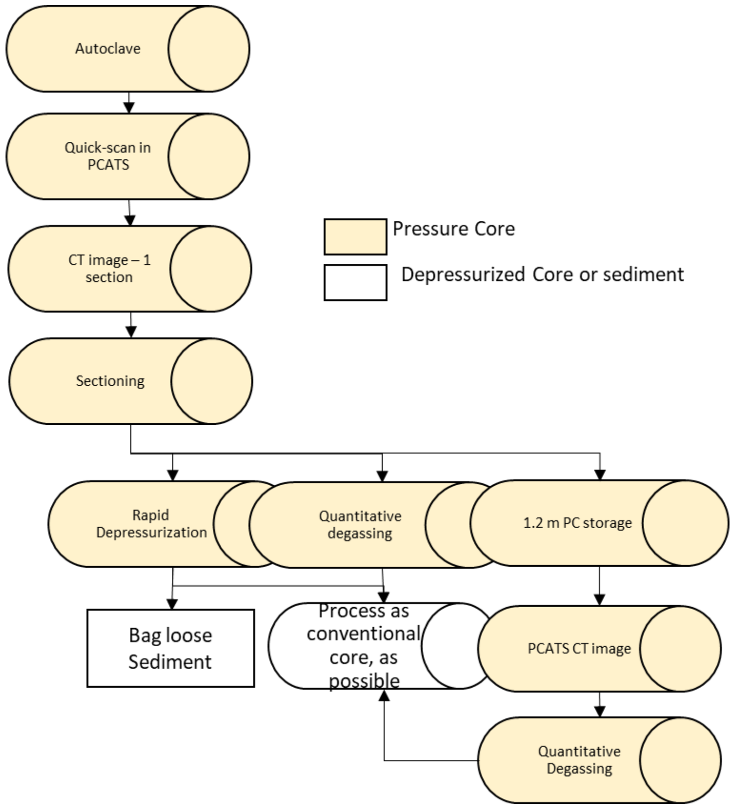

Figure 1-9. Pressure Cores with Fall-in material (cutting and other material from the borehole). Fall-in is sometimes seen in the first core of every group of cores. These cores are including in the coring plan to ensure that we acquire enough high-quality material for our analyses. As pressure cores with fall-in material arrive at the Geotek Pressure Core Analysis and Transfer System (PCATs), they will be removed from the Autoclave, an initial core log and image is generated (Quick-scan). From the quick scan data, a core sectioning plan is made. Most of these cores will be taken from units of background mud or will have a high percentage of bounding mud. For planning purposes, we are assuming that one 1.0 m section will be fall-in, and the rest good core for analysis. Before the core is sectioned, we will have time to image and scan about half of the good core at high resolution (full scan). The core is then sectioned and sections are moved into smaller storage and analysis chambers. The 1.0 m section with full scan data will be quantitatively degassed (6-12 hour depressurization measuring the amount of gas produced and collecting gas samples for Gas chromatography). Core from slow degassing will be processed as conventional core as possible. The remaining section of good core will be storage and brought back to PCATS when there is time for full scanning and possibly more cutting. The section with fall-in material will be rapidly degassed (~ 1 hour). If fall-in material is not seen in the first couple of cores, the coring plan will be modified as these cores will no longer be needed to ensure we obtain enough high quality sediment with each group of cores.

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

Status: Ongoing

- UT identified three possible vessel contracting paths:
    1. Best value determination through UT
    2. Competitive bid through UT
    3. Competitive bid through Geotek

- We have made a preliminary decision which contracting strategy we will pursue, and are taking steps to pursue this strategy. However, this does imply we have made a final decision
- In this quarter, we completed internal reviews for UT's proposed contractual terms and conditions, determined how to actively addressing the schedule uncertainty in our contracting plans, requested bids from prospective vessel contractor(s), and began working towards obtaining independent (3rd party) assessment of drilling rig rates, utilization, and availability.

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

Status: Ongoing

- In the two previous quarters, UT made a dedicated effort to evaluate and identify the failure modes that were preventing the loading of higher effective stresses in the K0 Permeameter (i.e., Effective Stress Chamber). Through a detailed series of engineering tests, it was determined that silty sand from the pressure cores was infiltrating around the O-rings seals of the bottom platen and causing failures. This led to leaking between the actuator pressure and sample pore pressure, thereby preventing higher effective stresses. Through a series of steps involving procedural changes to limit sediment interactions and instituting hydraulic points seals (instead of O-rings), we believe we have corrected the sealing issue.
- UT now routinely conducts tests at vertical effective stresses up to 20 MPa. Our motor-driven actuator limited our maximum effective stress due to the leaking seals. By solving the sealing issue, UT can now conduct loading with a hydraulically driven system. Further validation of the effective stress chamber was conducted by a benchmark study. Results indicate the effective stress chamber can accurately measures geomaterial properties of pressure cores at high stresses. See section 1.2.2.5.2 (Subtask 13.2 – Hydrate Core Effective Stress Chamber).

1.2.2.5.1 Subtask 13.1 – Hydrate Core Manipulator and Cutter Tool

- System underwent a cutter mechanism maintenance teardown with replacement of seals and bearings. In addition to the cleaning of mini-PCATS sediment traps.
- The x-ray system underwent a quarterly calibration.
- In the previous quarter, shims were added to the pipe cutter wheel and the cutting wheel was sharpened to help create better stabilized cuts of the core liner during K0 subsampling of pressure cores. These have proven to be effective modifications to provide clean edges on the core liners during pressure core sub-samplings in mPCATS.

1.2.2.5.2 Subtask 13.2 – Hydrate Core Effective Stress Chamber

- We were limited to a vertical effective stress to ~4 MPa using a motor-driven actuator. The transition to a higher capacity hydraulic loading system needed an adequate sealing between the sample and actuator pressures across the bottom cap (Figure 1-10). UT conducted engineering tests in the effective stress and acrylic chambers that identified silty sand as the primary culprit for O-rings to fail.
    - We implemented procedural changes that minimize sealing failure: horizontal extrusion to reduce gravitational sediment infiltration, retraction of the bottom cap to help position the seals properly, sharpening cutting wheels to provide smoother core liner cuts (Flemings, 2021b).
    - We now routinely use hydraulic point-seals coated in lanolin rather than O-rings covered in Molykote 55 as they provide additional sealing points and effectively wipe sediments away from sealing surfaces.

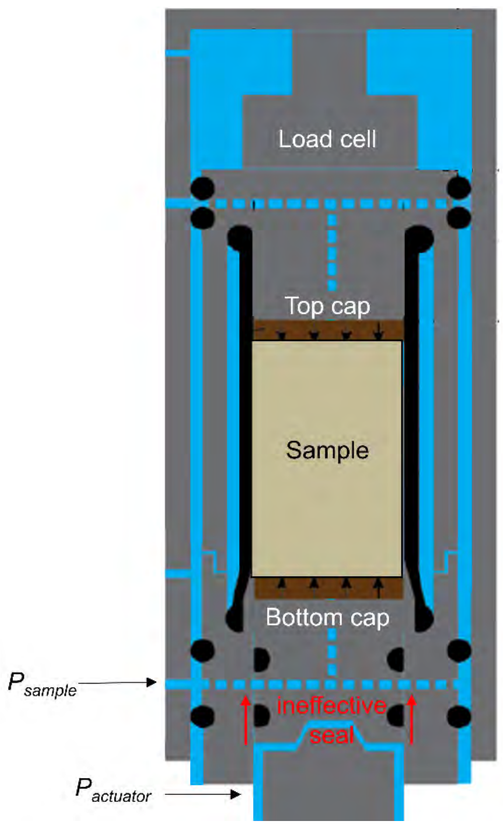

Figure 1-10. Simplified schematic of the effective stress chamber. Red arrows indicate the location of the sealing problem, where actuator and sample pressures communicate.

- We are now confident we can apply effective vertical stresses equivalent to in-situ conditions of the sands targeted in our next expedition using a hydraulic loading system. However, the position of the actuator can no longer be used to measure displacements. We used the following protocols to track sample location:

- Use the injected pump volumes V_{inj} to derive displacements continuously $\delta_v = 4V_{inj}/\pi D$, where D is the sample diameter. Fluid compressibility, trapped air inside the chamber, and equipment compressibility add uncertainty to the measurements. Therefore, we performed calibration tests using steel samples to correct for these effects.
- Use the actuator to contact the bottom cap in an "undrained" fashion. Figure 1-11 shows the sequence of events. The sample, from an initial isostatic condition (point A), compresses a distance δ_v under zero-lateral strain (point B). With the system hydraulically locked (i.e., no flow allowed), the actuator is moved (point C) until it reaches the bottom cap (point D). At this point, the confining and sample pressure increase whereas the actuator pressure slightly decreases. This displacement is recorded using the actuator displacement sensor.
- The volumetrically-derived displacements provide a continuous monitoring of the sample compression. Conversely, the hydraulically-locked displacement of the actuator results in discrete points. These two methodologies combine to have reliable and accurate estimates of sample deformation.

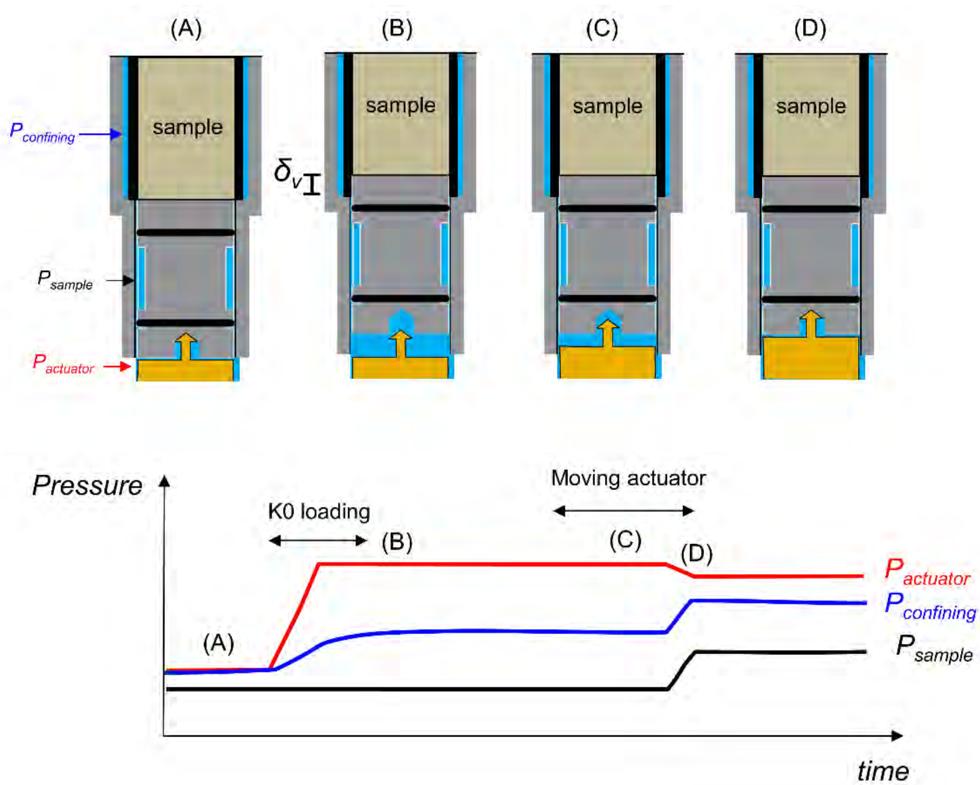

Figure 1-11. Measurement of displacements with the effective stress chamber hydraulically locked. The sample from an initial isostatic condition (A) is compressed a distance δ_v by increasing the actuator pressure (B). The system is hydraulically locked (i.e., no flow allowed) and the actuator is moved (C) until it contacts the bottom cap (D). This results in an increase of the confining and sample pressures that indicates the location of the bottom cap, and therefore, the sample.

- UT conducted calibration tests using steel samples to correct for equipment deformation. This guarantees the zero-lateral strain condition during future tests using pressure cores. We automated these corrections by creating new pump modes.
- UT validated and tested two higher scale load cells from Geotek. Results indicate a linear and non-hysteretic performance.
- These developments have increased the effective stress capacity and provide more reliable measurements. To test the accuracy of our approach, we conducted a benchmark study to compare properties obtained in the effective stress chamber against classical geotechnical devices.
    - We selected resedimented Boston Blue clay (RBBC) as testing material. Large published properties databases and similar geomaterial behavior to GOM sediments make this sample an adequate reference point for validation studies.
    - Comparison data sets used triaxial devices and instrumented oedometers (i.e., consolidometers) to estimate compression, permeability, and effective stress ratio evolution with vertical effective stress (Casey, 2014).
    - Figure 1-12 compares data obtained from the effective stress chamber with the existing database. Data overlap in all cases (i.e., compression, permeability, and effective stress ratio), which suggests the effective stress chamber is able to measure correctly geomechanical and petrophysical properties in conventional cores. We anticipate this behavior also applies to pressure cores.

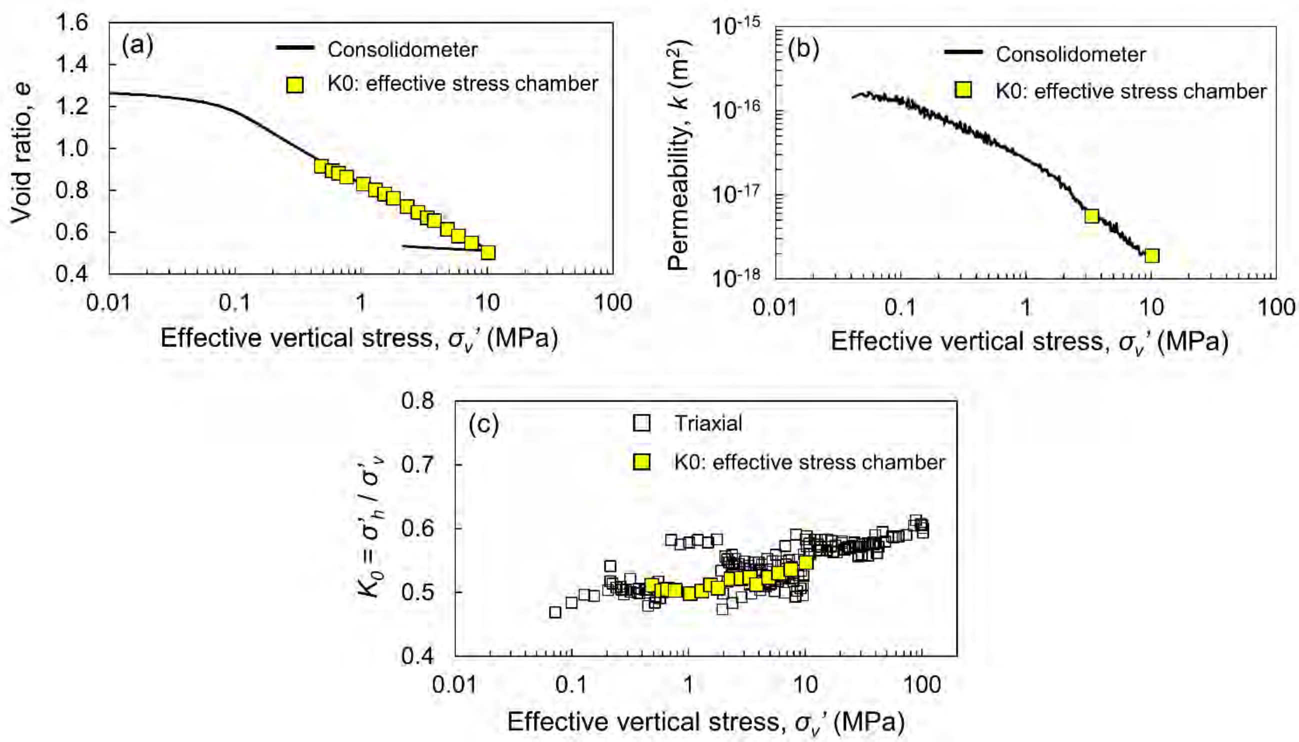

Figure 1-12. (a) Compression, (b) permeability, and (c) effective stress ratio data for a resedimented Boston Blue Clay sample obtained from the effective stress chamber and conventional geotechnical devices. Data sources in (Casey, 2014).

1.2.2.5.3 Subtask 13.3 – Hydrate Core Depressurization Chamber

- The system was used to quantify dissociated methane hydrate small remainder samples of pressure cores.
- The system underwent maintenance 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

- UT has obtained a quote to manufacture new core chamber orientation support bases. Before purchasing the necessary support bases, a single quad configuration base has been ordered for operational evaluation.
- Expansion of pressure maintenance system is required to increase storage capability sufficient to receive UT-GOM2-2 cores. UT is revising the quote for additional pressure maintenance manifolds to include additional components and pressure testing at the manufacturer's facility.
- Expansion of pressure safety venting system will also be required. UT is revising the quote for additional venting lines to include additional components and pressure testing at manufacturer's facility.

- Evaluation and maintenance testing of methane monitoring system and possible expansion being explored.

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, even when additional cores are collected during UT-GOM2-2 and transferred to the PCC.

1.2.2.5.7 Subtask 13.7 – X-ray Computed Tomography

- Improvements were made for processing 2D X-Ray and 3D CT scans. UT image quality is now on par with Geotek. See Figure 1-13.
    - The new version of Geotek imaging software continues to operate well on the new image processing computer.
- The X-Ray CT continues to operate as designed.
- During this period, the system was calibrated.

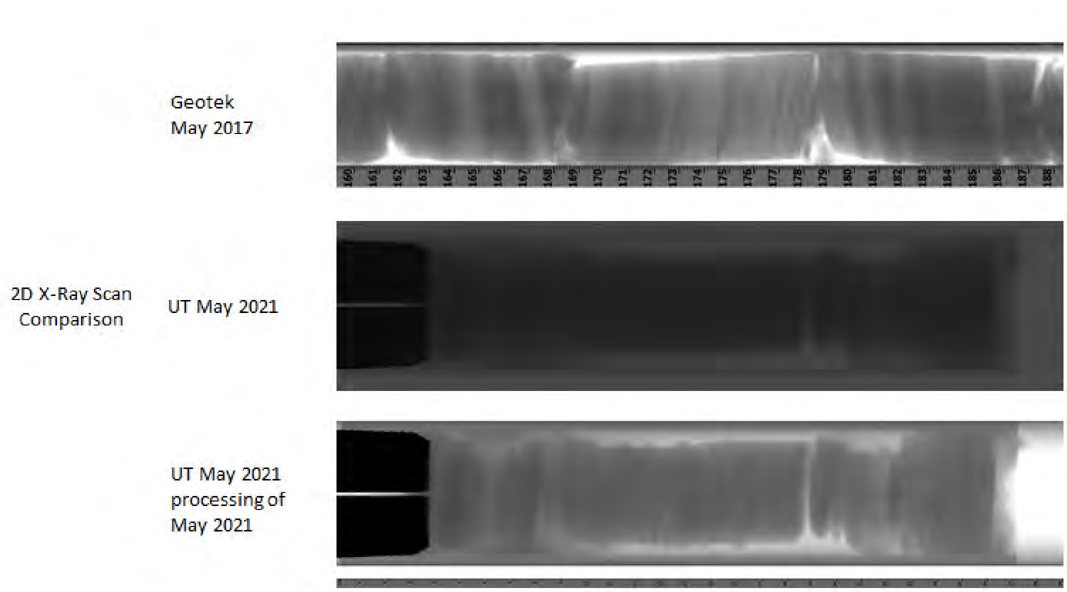

Figure 1-13: Comparison of Geotek and UT X-ray imaging capability. 2-D x-ray comparison. The top image shows the original 2D X-ray image of UT-GOM2-1 H005-3FB-4 taken by Geotek using PCATS in May of 2017. The middle image shows the original processing of the raw data from a scan of 3FB-4 taken in May of 2021 using mini-PCATS at UT. The bottom image shows the reprocessed image of the May 2021 scan utilizing the new Geotek imaging software and new processing computer. The top and bottom image are of equal resolution.

1.2.2.5.8 Subtask 13.8 – Pre-Consolidation System

- Replacement parts for a leaking Pre-Consolidation System hydraulic accumulator were installed and tested in Q1, 2021. Long-term nitrogen leak test was postponed during Q2 and Q3. Long-term nitrogen leak test of accumulators to assess replacement parts will be done in Q4, 2021.

1.2.2.5.9 Subtask 13.9 – Transportation of Hydrate Core from UT-GOM2-2 Scientific Drilling Program

Future Task.

1.2.2.5.10 Subtask 13.10 – Storage of Hydrate Cores from UT-GOM2-2 Scientific Drilling Program

Future Task.

1.2.2.5.11 Subtask 13.11 – Hydrate Core Distribution

Future Task.

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

Status: Complete

1.2.2.6.1 Subtask 14.4 – PCTB Modifications/Upgrades

Status: Complete

1.2.2.6.2 Subtask 14.5 – PCTB Land Test III

UT, Pettigrew Engineering, and Geotek performed a field test of the Mk. 5 Pressure Core Tool with Ball Valve (PCTB) at the Catoosa Geophysical and Drilling Technology Testing and Evaluation Facility (CTF) near Jennings, Oklahoma on April 12-23 (Table 1-14) (PCTB Land Test III). In the previous quarter, the PCTB was upgraded to Mk. 5 ball-valve specifications. The Mk. 5 design improvements focused on diverting grit and cleaning the sliding surfaces with wiper rings, improving centralization throughout actuation, and improving flow paths throughout the tool to route drilling fluids away from the sliding surfaces. The purpose of the PCTB Land Test III was to test the Mk. 5 ball valve functionality in a borehole environment and determine if the ball valve assembly's sensitivity to grit had been fully resolved. The PCTB Land Test III report is provided as **APPENDIX A**.

Table 1-14: Summary of PCTB Land Test III Daily Events

Date	Activity
Monday, April 12, 2021	Catoosa Test Facility (CTF) initial drilling completed; Geotek arrived and mobilized; ball valve successfully tested with mud from site
Tuesday, April 13, 2021	Drill pipe arrived and made up; BHA made up and run to the casing shoe; PCTB spaced out
Wednesday, April 14, 2021	Wireline arrived and rigged up; COK-01CS, COK-02CS, COK-03CS (full function actuation tests with drilling fluid in the borehole)
Thursday, April 15, 2021	COK-04CS, COK-05CS, COK-06CS
Friday, April 16, 2021	COK-07CS, COK-08CS, COK-09CS
Saturday, April 17, 2021	COK-10CS, COK-11CS
Sunday, April 18, 2021	COK-12FB, COK-13FB, COK-14FB
Monday, April 19, 2021	COK-15FB, COK-16FB, COK-17FB
Tuesday, April 20, 2021	COK-18FB, COK-19FB, Demobilization begins
Wednesday, April 21, 2021	Demobilization
Thursday, April 22, 2021	Demobilization
Friday, April 23, 2021	Demobilization

19 coring and full-function actuation tests of the PCTB were performed: 11 tests were performed with the cutting shoe (PCTB-CS) and 8 tests were performed with the face-bit (PCTB-FB). Of the 19 coring tests, 16 recorded a pressure boost, sealed successfully, and maintained pressure until retrieval (84% success) (Figure 1-14).

3 coring attempts failed to seal. However, none of the 3 failed coring attempts were due to ingress of grit jamming the ball valve. Of the three failed coring tests, one was due to the hard lithology of the testing site which prevented the core from retracting into the inner barrel upon actuation. Another was due to pre-deployment damage to an upper seal. The final instance was due to the PCTB landing incorrectly in the Bottom Hole Assembly (BHA). Recommendations were made to address the reasons for the failed deployments.

In two tests, we observed a gradual pressure drop of approximately 125 psi that occurred approximately 3 minutes after coring ended but before the boost fired. This has been interpreted in two ways: as slow actuation at coring depth due atypically slow wireline actuation, or a partial seal at coring depth as a result of an incomplete upper seal followed by a delayed pressure boost. Remedial recommendations were made to address both possibilities.

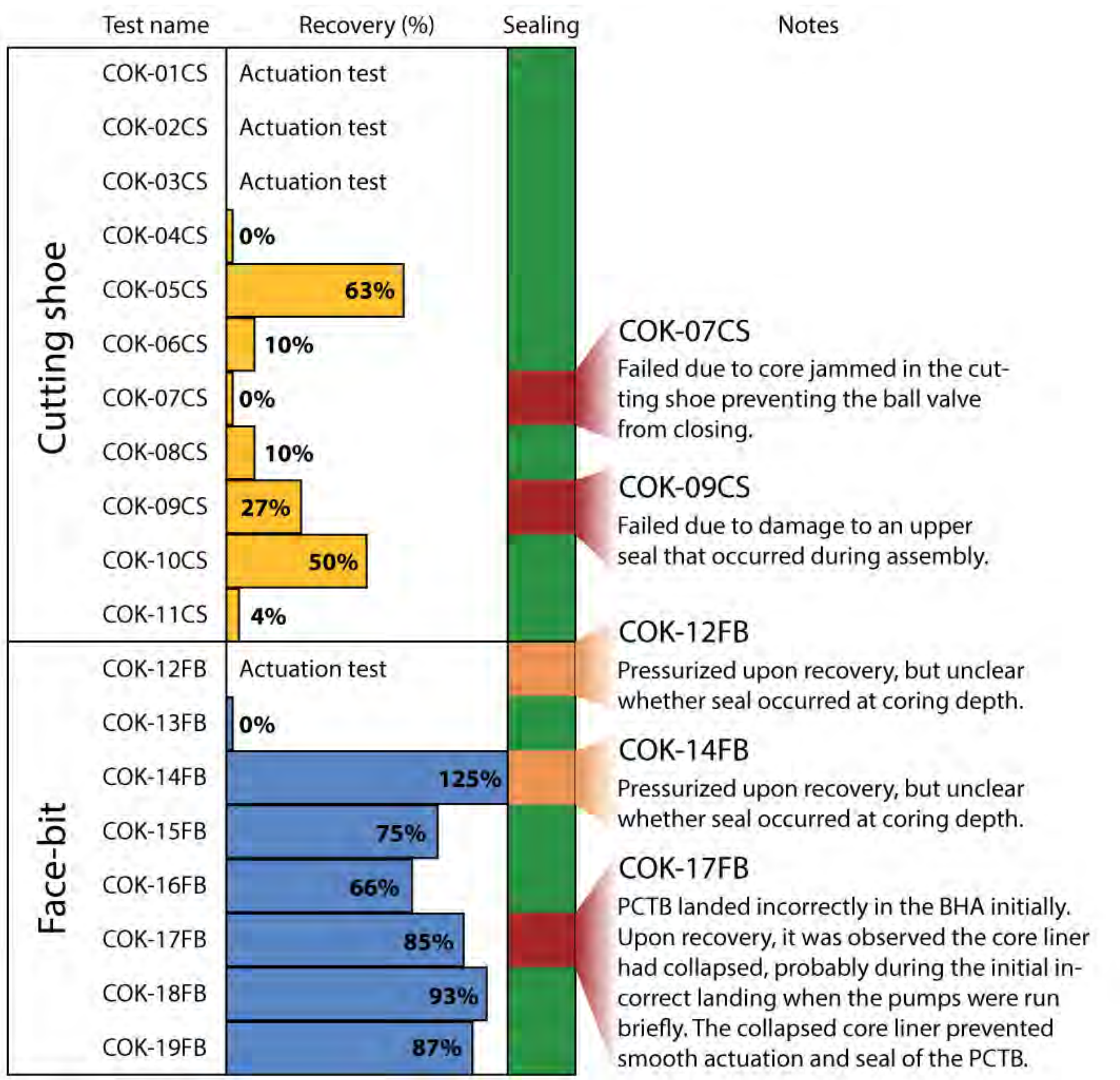

Figure 1-14: Recovery colored by configuration and seal success. The Face-bit configuration demonstrated higher recovery than the Cutting shoe configuration. Rate of successful sealing was 84%. In two tests, COK-12FB and COK-14FB, the pressure chamber was sealed and pressurized upon recover, but it is unclear whether seal occurred at coring depth.

A DST and rig parameter plot of a representative successful deployment (COK-05CS) is annotated with coring events in Figure 1-15.

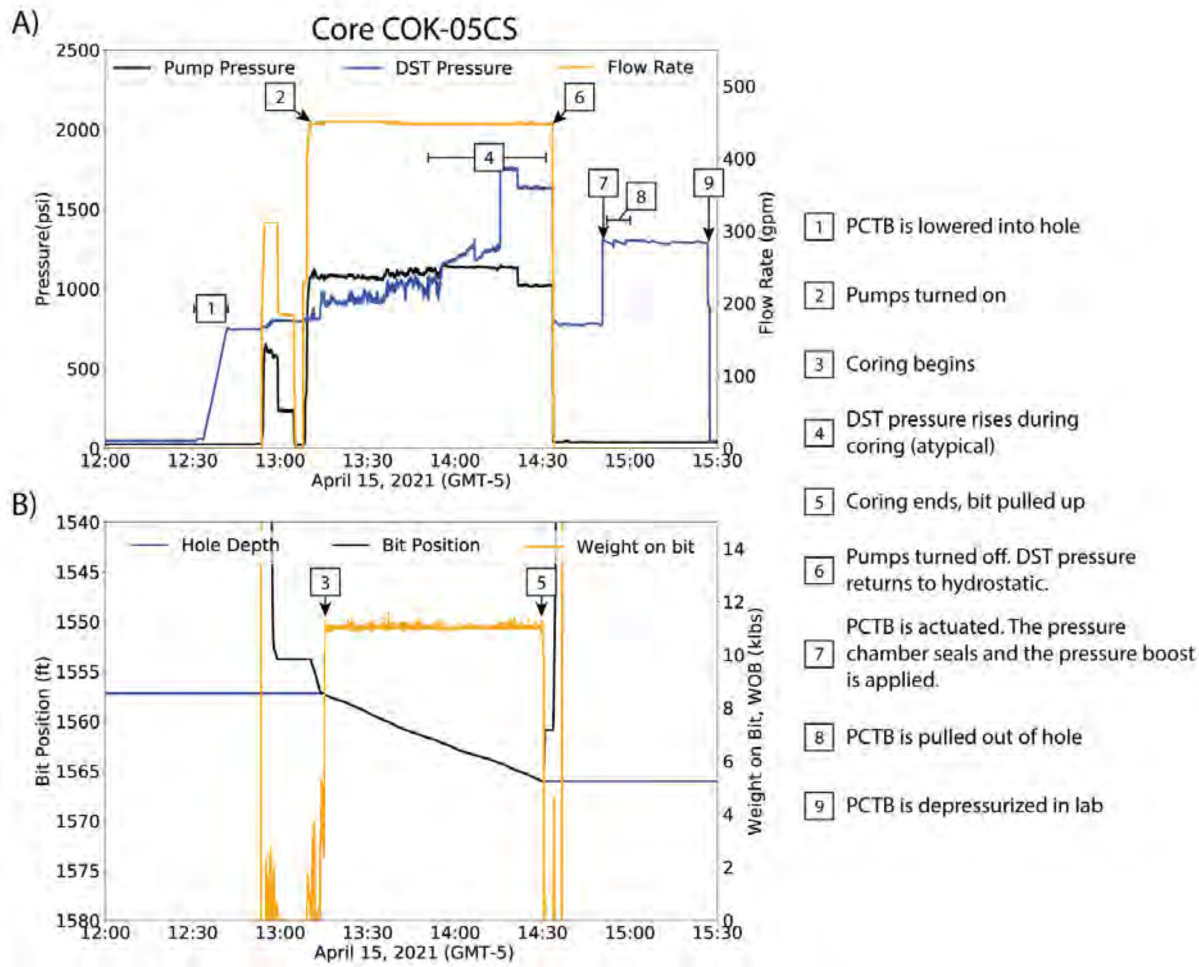

Figure 1-15: Annotated DST and rig parameter plot of representative successful deployment (COK-05CS).

The drilling mud used in the PCTB Land Test III was characterized to determine if it contained the critical range of grit size (53-125 µm) and minimum concentration (≥0.24%) that resulted in failure during the Land Test II and subsequent bench tests. Laser diffraction analysis of mud samples indicated that target range of particulates were present in concentrations approximately three times greater than that needed to cause failure (0.7%). The high concentration of grit in the critical range indicate that the PCTB Land Test III appropriately tested the modifications intended to remove sensitivity of the ball valve actuation to grit.

Maximizing core recovery not the objective of this test and drilling parameters were selected to maximize rate of penetration and minimize test duration rather than maximize core quality. However, the core quality and recovery from both configurations was good, particularly considering that the test conducted in a very hard formation that is not representative of softer marine sediments. Core recovery appeared to be higher with the PCTB-FB configuration (median of 49.7%) than with the PCTB-CS configuration (median of 10%).

The high rate of successful sealing and ball valve actuation, the high core quality and recovery indicate that the modifications included in the current version of the PCTB (the 'Mk. 5') have removed sensitivity of ball valve actuation to grit, without introducing other tool performance issues.

The PCTB Land Test III demonstrated the ability of the PCTB Mk. 5 to reliably capture pressure core at depth. The issue of grit preventing ball valve closure appears to be resolved. Out of 19 tests, 16 resulted in a captured pressure boost and a complete seal of the pressure chamber, which is a significant improvement over the results of Land Test II and the UT-GOM2-1 Marine Field Test. None of the failures to seal were a result of grit in the ball valve assembly, and each provided actionable information on how to avoid these failure modes in future deployments. Good core quality and an excellent record of recovering core at pressure shows that the modifications worked well to resolve existing issues and avoided introducing new issues.

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

UT completed and submitted numerous UT-GOM2-2 permit requirements to the Bureau of Ocean Energy Management (BOEM):

- UT submitted a Right of Use and Easement (RUE) request (30 CFR 550.160 & 550.161) to BOEM Plans Section. BOEM Plans Section confirmed receipt of the RUE application and assigned control number OCS-G30392.
- UT submitted the following permit application documents to BOEM Plan Section, along with required cover letters, proof of payment, and public versions and proprietary versions as required:
    - Initial Exploration Plan (30 CFR 550.211-235; 30 CFR 550.125-126; NTL No. 2008-G04)
    - Coastal Zone Management (CZM) Consistency Certification (NTL No. 2008-G04)
    - Shallow Hazard Assessment Reports (NTL No. 2008-G05)
- BOEM has since indicated that preliminary approval has been granted to the Initial Exploration Plan and Shallow Hazard Reports with regard to geological and geophysical content.
- On May 20, BOEM Leasing and Financial Responsibility Section indicated that bonding requirements had been determined based on preliminary review of the UT-GOM2-2 Exploration Plan. BOEM requested a RUE-specific bond amount of $200,000. UT procured the services of ANCO Insurance to broker the required $200,000 bond with RLI Insurance Company. The bond was submitted to BOEM Leasing and Financial Responsibility Section, and subsequently approved.

1.2.2.7.2 Subtask 15.4 – Review and Complete NEPA Requirements

Future Task.

1.2.2.7.3 Subtask 15.5 – Finalize Operational Plan for UT-GOM2-2 Scientific Drilling Program
Future Task.

1.2.2.8 Task 16.0 – UT-GOM2-2 Scientific Drilling Program Field Operations

Status: Future Task

1.2.2.8.1 Subtask 16.1 – Mobilization of Scientific Ocean Drilling and Pressure Coring Capability
Future Task.

1.2.2.8.2 Subtask 16.2 – Field Project Management, Operations, and Research
Future Task.

1.2.2.8.3 Subtask 16.3 – Demobilization of Staff, Labs, and Equipment
Future Task.

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 Project Management Plan and Statement of Project Objectives.
- 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 Project Management Plan.
- UT will continue to manage the risk introduced to the project by the UT-GOM2-2 schedule uncertainty. We will proceed with planning and preparation for the UT-GOM2-2 program to the extent that is possible without committing funds or contracts that lock us into a spring 2022 field program.

1.3.2 Task 10.0 – Core Analysis

- Petrophysical and geomechanical properties of pressure cores (core 2FB-2) using the UT K0 permeameter will be determined at high vertical effective stresses ~20MPa.
- UT will simulate production of gas using the K0 permeameter. While samples are being dissociated at constant total stress (i.e., similar to field conditions), we will quantify volume of produced gas, sample compression, and horizontal effective stress. New capabilities and modifications to measure temperature inside the K0 will be tested.
- UT will explore the petrophysical and geomechanical behavior of UT-GOM2-1 reservoir by conducting experiments on reconstituted sandy silt lithofacies samples. We will use traditional geotechnical systems to determine effective stress ratios.

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

- UT will update the Operations Plan, as required.
- UT will continue to develop the UT-GOM2-2 Science and Sample Distribution Plan focusing on the details of sampling protocols, equipment and supply needs, and staffing levels.

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

- In late July, UT will receive cost estimate(s), statement(s) of rig availability, response(s) to our proposed contractual terms and conditions and contract schedules from potential vessel contractor(s).
- UT will evaluate cost estimate(s) and benchmark to an independent, third-party, source of vessel rates, utilization, and schedules.
- Based on review of the above criteria, UT will decide to pursue or not pursue the currently proposed contractual approach and formally initiate the contracting strategy to the extent possible without committing funding towards a 2022 field program.

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

- The Mini-PCATS, PMRS, analytical equipment, and storage chambers will undergo continued observation and maintenance at regularly scheduled intervals and on an as-needed basis. Installation of new or replacement parts will continue to ensure operational readiness.
- Work with Geotek to evaluate the possibility of monitoring the temperature of a sample in the Effective Stress Chamber.
- Long-term nitrogen leak test of Pre-Consolidation hydraulic accumulators to assess replacement parts will be done in Q4, 2021.
- Conduct an operational evaluation of the single, quad configuration support base has been ordered for core storage expansion.
- Obtain and evaluate revised quotes for the expansion of the PMRS pressure core storage system.
- Continue to evaluate the new pump modes developed to compensate for K0 apparatus compressibility.

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

- Task complete.

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

- UT will complete the BOEM permit application for Geological and Geophysical (G&G) research in the Outer Continental Shelf (OCS)
- UT will work on NEPA Environmental Questionnaire for UT-GOM2-2

1.3.8 Task 16.0 – UT-GOM2-2 Scientific Drilling Program Field Operations

- No update.

2 PRODUCTS

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

2.1 Publications

Boswell, R., Collet, T.C., Cook, A.E., Flemings, P.B., 2020, Introduction to Special Issue: Gas Hydrates in Green Canyon Block 955, deep-water Gulf of Mexico: Part I: AAPG Bulletin, v. 104, no. 9, p. 1844-1846, http://dx.doi.org/10.1306/bltnintro062320.

Chen, X., and Espinoza, D. N., 2018a, Ostwald ripening changes the pore habit and spatial variability of clathrate hydrate: Fuel, v. 214, p. 614-622. https://doi.org/10.1016/j.fuel.2017.11.065

Chen, X., Verma, R., Espinoza, D. N., and Prodanović, M., 2018, Pore-Scale Determination of Gas Relative Permeability in Hydrate-Bearing Sediments Using X-Ray Computed Micro-Tomography and Lattice Boltzmann Method: Water Resources Research, v. 54, no. 1, p. 600-608. https://doi.org/10.1002/2017wr021851

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

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Cook, A. E., and Sawyer, D. E., 2015, The mud-sand crossover on marine seismic data: Geophysics, v. 80, no. 6, p. A109-A114. https://doi.org/10.1190/geo2015-0291.1

Cook, A. E., and Waite, W. F., 2018, Archie's Saturation Exponent for Natural Gas Hydrate in Coarse-Grained Reservoirs, v. 123, no. 3, p. 2069-2089. https://doi.org/10.1002/2017jb015138

Darnell, K. N., and Flemings, P. B., 2015, Transient seafloor venting on continental slopes from warming-induced methane hydrate dissociation: Geophysical Research Letters, p. n/a-n/a. https://doi.org/10.1002/2015GL067012

Darnell, K. N., Flemings, P. B., and DiCarlo, D., 2019, Nitrogen-Driven Chromatographic Separation During Gas Injection Into Hydrate-Bearing Sediments: Water Resources Research. https://doi.org/10.1029/2018wr023414

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Flemings, P. B., Phillips, S. C., Boswell, R., Collett, T. S., Cook, A. E., Dong, T., Frye, M., Guerin, G., Goldberg, D. S., Holland, M. E., Jang, J., Meazell, K., Morrison, J., O'Connell, J., Pettigrew, T., Petrou, E., Polito, P. J., Portnov, A., Santra, M., Schultheiss, P. J., Seol, Y., Shedd, W., Solomon, E. A., Thomas, C., Waite, W. F., and You, K., 2020, Pressure coring a Gulf of Mexico Deepwater Turbidite Gas Hydrate Reservoir: Initial results from the UT-GOM2-1 hydrate pressure coring expedition: AAPG Bulletin, v. 104, no. 9, p. 1847-1876. https://doi.org/10.1306/05212019052

Flemings, P. B., Phillips, S. C., Collett, T., Cook, A., Boswell, R., and Scientists, U.-G.-E., 2018, UT-GOM2-1 Hydrate Pressure Coring Expedition Summary, *in* Flemings, P. B., Phillips, S. C., Collett, T., Cook, A., Boswell, R., and Scientists, U.-G.-E., eds., UT-GOM2-1 Hydrate Pressure Coring Expedition Report: Austin, TX, University of Texas Institute for Geophysics.

Hillman, J. I. T., Cook, A. E., Daigle, H., Nole, M., Malinverno, A., Meazell, K., and Flemings, P. B., 2017a, Gas hydrate reservoirs and gas migration mechanisms in the Terrebonne Basin, Gulf of Mexico: Marine and Petroleum Geology, v. 86, no. Supplement C, p. 1357-1373. https://doi.org/10.1016/j.marpetgeo.2017.07.029

Hillman, J. I. T., Cook, A. E., Sawyer, D. E., Küçük, H. M., and Goldberg, D. S., 2017b, The character and amplitude of 'discontinuous' bottom-simulating reflections in marine seismic data: Earth and Planetary Science Letters, v. 459, p. 157-169. https://doi.org/10.1016/j.epsl.2016.10.058

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Meazell, K., Flemings, P., Santra, M., and Johnson, J. E., 2020, Sedimentology and stratigraphy of a deepwater gas hydrate reservoir in the northern Gulf of Mexico: AAPG Bulletin, v. 104, no. 9, p. 1945–1969, https://doi.org/10.1306/05212019027

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Meyer, D. W., Flemings, P. B., DiCarlo, D., You, K. H., Phillips, S. C., and Kneafsey, T. J., 2018b, Experimental Investigation of Gas Flow and Hydrate Formation Within the Hydrate Stability Zone: Journal of Geophysical Research-Solid Earth, v. 123, no. 7, p. 5350-5371. https://doi.org/10.1029/2018jb015748

Moore, M., Phillips, S., Cook, A.E. and Darrah, T., (2020) Improved sampling technique to collect natural gas from hydrate-bearing pressure cores. Applied Geochemistry, Volume 122, November 2020, p. 104773, https://doi.org/10.1016/j.apgeochem.2020.104773.

Phillips, S. C., Flemings, P. B., Holland, M. E., Schulthiss, P. J., Waite, W. F., Jang, J., Petrou, E. G., and H., H., 2020, High concentration methane hydrate in a silt reservoir from the deep-water Gulf of Mexico: AAPG Bulletin, v. 104, no. 9, p. 1971–1995. https://doi.org/10.1306/01062018280

Phillips, S. C., Flemings, P. B., You, K., 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, v. 109, p. 128-144. https://doi.org/10.1016/j.marpetgeo.2019.06.015

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Sawyer, D. E., Mason, R. A., Cook, A. E., and Portnov, A., 2019, Submarine Landslides Induce Massive Waves in Subsea Brine Pools: Scientific Reports, v. 9, no. 1, p. 128. https://doi.org/10.1038/s41598-018-36781-7

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2.2 Conference Presentations/Abstracts

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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.

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.

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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

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2.3 Proceeding of the UT-GOM2-1 Hydrate Pressure Coring Expedition

Volume contents are published on the UT-GOM2-1 Expedition website and on OSTI.gov.

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2.3.2 Prospectus

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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

UT has identified a schedule and resource conflict with significant implications to the UT-GOM2-2 field program schedule. DOE is directing a methane hydrate production test on the Alaska North Slope in which Geotek a key participant. It came to UT's attention that the commencement date for the Alaska North Slope program is February 1, 2022, which intersects and may possibly overlap with the UT-GOM2-2 schedule. Common contractors, equipment, and resources specific to hydrates research are required for both of these programs.

UT communicated to DOE that the schedule conflict presented unacceptable risk to the UT-GOM2-2 program and requested clarification on how to proceed. UT was informed that in addition to the schedule and resource conflict, there is also a budget conflict presented by the overlap of both programs occurring in the same fiscal year. DOE informed UT that due to these combined factors, UT-GOM2-2 may have to be postponed until 2023, when additional funding is expected and further schedule/resource conflicts are not presented by the concurrent programs. DOE indicated that a final decision would be made in late summer, 2021.

UT and DOE have agreed that until a delay is officially confirmed, UT will proceed with planning the 2022 UT-GOM2-2 field program, so that a possible 2022 effort is not compromised. However, UT will not commit funding or execute contracts that lock in a 2022 schedule unless the existing schedule is confirmed and approved by DOE.

3.3 Changes That Have A Significant Impact On Expenditures

UT is proceeding with planning a 2022 UT-GOM2-2 field program. However, we have agreed to postpone committing funds towards UT-GOM2-2 contracts until the UT-GOM2-2 field program schedule is approved by DOE.

If the project is postponed until 2023, there will be numerous financial impacts to the current budget and spending projections:

- Anticipated expenditures planned for 2021-2022 will be shifted to 2022-2023.
- UT will be unable to lock in vessel rates until a future time; it is likely that vessel rates will increase during this period.
- A delay would require expanding the GOM2 program by an additional year.

- A budget modification would be required to maintain continued administration, project planning, science planning, ongoing science/engineering developments and personnel required for the continuation of the GOM2 project

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 15.5 – Final UT-GOM2-2 Scientific Drilling Program Operations 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 – UT-GOM2-2 Scientific Drilling Program Scientific Results Volume

5 BUDGETARY INFORMATION

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

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

Baseline Reporting Quarter	Budget Period 5							
	Y1Q1		Y1Q2		Y1Q3		Y1Q4	
	10/01/20-12/31/20		01/01/21-03/31/21		04/01/21-06/30/21		07/01/21-09/30/21	
	Y1Q1	Cumulative Total	Y1Q2	Cumulative Total	Y1Q3	Cumulative Total	Y1Q4	Cumulative Total
Baseline Cost Plan								
Federal Share	$ 587,651	$ 31,973,595	$ 581,151	$ 32,554,746	$ 5,466,306	$ 38,021,052	$ 581,151	$ 38,602,203
Non-Federal Share	$ 150,293	$ 23,871,255	$ 148,630	$ 24,019,885	$ 1,398,018	$ 25,417,903	$ 148,630	$ 25,566,533
Total Planned	$ 737,944	$ 55,844,850	$ 729,781	$ 56,574,631	$ 6,864,324	$ 63,438,955	$ 729,781	$ 64,168,736
Actual Incurred Cost								
Federal Share	$ 589,548	$ 589,548	$ 426,667	$ 1,016,215	$ 2,072,269	$ 3,088,485		
Non-Federal Share	$ 220,056	$ 220,056	$ 374,124	$ 594,180	$ 623,736	$ 1,217,916		
Total Incurred Cost	$ 809,604	$ 809,604	$ 800,791	$ 1,610,395	$ 2,696,006	$ 4,306,401		
Variance								
Federal Share	$ 1,897	$ 1,897	$ (154,484)	$ (152,587)	$ (3,394,037)	$ (3,546,623)		
Non-Federal Share	$ 69,763	$ 69,763	$ 225,493	$ 295,257	$ (774,281)	$ (479,025)		
Total Variance	$ 71,661	$ 71,661	$ 71,010	$ 142,670	$ (4,168,318)	$ (4,025,648)		
Baseline Reporting Quarter	**Budget Period 5**							
	Y2Q1		**Y2Q2**		**Y2Q3**		**Y2Q4**	
	10/01/21-12/31/21		**01/01/22-03/31/22**		**04/01/22-06/30/22**		**07/01/22-09/30/22**	
	Y2Q1	**Cumulative Total**	**Y2Q2**	**Cumulative Total**	**Y2Q3**	**Cumulative Total**	**Y2Q4**	**Cumulative Total**
Baseline Cost Plan								
Federal Share	$ 4,433,883	$ 43,036,085	$ 749,973	$ 43,786,058	$ 20,274,089	$ 64,060,147	$ 710,837	$ 64,770,984
Non-Federal Share	$ 700,232	$ 26,266,765	$ 118,441	$ 26,385,206	$ 3,201,835	$ 29,587,040	$ 112,261	$ 29,699,301
Total Planned	$ 5,134,114	$ 69,302,850	$ 868,414	$ 70,171,264	$ 23,475,924	$ 93,647,188	$ 823,097	$ 94,470,285
Actual Incurred Cost								
Federal Share								
Non-Federal Share								
Total Incurred Cost								
Variance								
Federal Share								
Non-Federal Share								
Total Variance								

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7 ACRONYMS

Table 7-1: List of Acronyms

ACRONYM	DEFINITION
AAPG	American Association of Petroleum Geologists
APC	Advanced Piston Corer
BOEM	Bureau of Ocean Energy Management
BHSZ	Base of Hydrate Stability Zone
BSEE	Bureau of Safety and Environmental Enforcement
CFR	Code of Federal Regulation
CHNS	Carbon, Hydrogen, Nitrogen, Sulfur
CPP	Complimentary Project Proposal
CT	Computed Tomography
CTF	Catoosa Test Facility
CZM	Coastal Zone Management
DST	Data Storage Tag
DOE	U.S. Department of Energy
DSDP	Deep Sea Drilling Program
EP	Exploration Plan
G&G	Geologic and Geophysical
GC	Green Canyon
HSZ	Hydrate Stability Zone
IODP	International Ocean Discovery Program
MAD	Moisture and Density
NEPA	National Environmental Policy Act
NETL	National Energy Technology Laboratory
NTL	Notice to Lessees
OCS	Outer Continental Shelf
PCATS	Pressure Core Analysis and Transfer System
PCC	Pressure Core Center
PCTB	Pressure Core Tool with Ball Valve
PCTB-CS	Pressure Core Tool with Ball Valve - Cutting Shoe
PCTB-FB	Pressure Core Tool with Ball Valve - Face Bit
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
RUE	Right-of-Use-and-Easement

SMT	Sulfate-Methane Transition
SOPO	Statement of Project Objectives
T2P	Temperature to Pressure Probe
TOC	Total Organic Carbon
TN	Total Nitrogen
UNH	University of New Hampshire
UT	University of Texas at Austin
UW	University of Washington
XCB	eXtended Core Barrel

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APPENDIX A

GOM2 PCTB Land Test III Report

GOM2 PRESSURE CORING TOOL WITH BALL VALVE (PCTB) LAND TEST III REPORT

06/17/2021

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Disclaimer

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2 Executive Summary

The Deepwater Methane Hydrate Characterization and Scientific Assessment or Genesis of Methane Hydrates in the Gulf of Mexico (GOM2) research project (DOE award no. DE-FE0023919) performed a field test of the Pressure Core Tool with Ball Valve (PCTB) in April 2021 at the Catoosa Geophysical and Drilling Technology Testing and Evaluation Facility (CTF) (PCTB Land Test III). A total of 19 coring and full-function actuation tests of the PCTB were performed: 11 tests were performed with the cutting shoe version (PCTB-CS), and 8 tests were performed with the face-bit version (PCTB-FB).

16 out of 19 tests successfully resulted in the pressure chamber sealing, boosting, and maintaining pressure until retrieval. It was interpreted that, prior to this test, the major cause of seal failure was the presence of silt-sized particles that prevented the ball valve from sealing both at sea (Flemings et al., 2020; Flemings et al., 2018; Thomas et al., 2020) and in the previous land test, PCTB Land Test II (Flemings, 2020c). None of the seal failures in this test were due to grit causing the ball valve not to seal. Furthermore, analysis of drilling mud from this land test showed that it had a high concentration of grit of the size that previously caused the ball valve to fail.

Of the three coring tests that did not seal, one was due to the hard lithology of the testing site which prevented the core from retracting into the inner barrel upon actuation, one was due to pre-deployment damage to an upper seal, and one was due to the PCTB landing incorrectly in the Bottom Hole Assembly.

Core recovery was higher with the PCTB-FB than with the PCTB-CS, and the quality of core from both configurations was good.

The high rate of successful sealing and ball valve actuation, the high core quality, and the good core recovery indicate that the modifications included in the current version of the PCTB (the ‘Mk 5’) have removed sensitivity of ball valve actuation to grit, without introducing other tool performance issues.

3 Introduction

The PCTB Land Test III occurred from Monday 4/12/2021 to Wednesday 4/21/2021. The test was performed at Catoosa Geophysical and Drilling Technology Testing and Evaluation Facility (CTF), near Jennings, OK. Representatives from Geotek Coring Inc., Pettigrew Engineering, and The University of Texas at Austin participated in the test. PCTB Land Test III served primarily to vet the latest modifications made to the tool after an unsuccessful land test performed in 2020 (Flemings, 2020c). At that test, grit in the ball valve assembly consistently prevented the ball valve from sealing correctly.

Two configurations of the tool were tested: the face-bit (PCTB-FB) and cutting shoe (PCTB-CS) (Thomas et al., 2020b). The test plan included full function actuation tests in the borehole with drilling fluid but without coring, and coring tests where the bit was advanced and coring was attempted. Since the tool's ability to seal correctly and on time was the focus of the latest modifications, coring runs were designed to maximize the number of downhole tests in the allotted amount of time rather than maximize core quality/core recovery. Thus, coring parameters were chosen to prioritize rate of penetration in CTF's harder lithology, rather than core quality, and mostly short cores were attempted rather than full length cores.

4 PCTB Development History

The PCTB is a very complex tool with over 200 parts. It is challenging to find the root cause (or causes) for problems in tool performance. For example, failure of the pressure barrel to seal could stem from issues with the triggering mechanism, flow issues within the tool, hydraulic delays, failed seals at multiple locations, ball valve issues, fluidized sediment, core liner jamming, or other causes. The complexity of the tool combined with an initial lack of laboratory testing equipment and methods made the source of various failures difficult to identify. Nonetheless, continuous improvements were made with the goal of eradicating different possible sources of tool error. Table 4-1 provides a summary of the PCTB tests with links to detailed reports.

PCTB performance prior to 2014 demonstrated poor ability of the PCTB to hold pressure and capture a pressure boost (Flemings, 2016a). Since 2014, the PCTB, under the direction of UT and the DOE with Geotek, has undergone a series of revisions to improve the function and reliability of the tool. In 2015, modifications were made to improve ball valve closure rates by improving the ball valve speed. Lab tests of the revisions confirmed significant improvement (Flemings, 2016a). The first UT PCTB land test, Land Test I, was conducted in late 2015 (Flemings, 2016b). The rate of sealing was 50% and problems were encountered with ball valve closure and late pressure boost. Modifications were made to the tool to divert flow away from the inner barrel subassembly. These modifications were considered minor, and appeared to perform well in a 2016 lab test (Flemings, 2016c), but coring tests were not performed before heading to sea, and they caused unforeseen problems in the first hole of the 2017 GOM2-1 marine expedition, UT-GOM2-1.

UT-GOM2-1 was the first opportunity for UT to test the efficacy of the revised PCTB in deepwater sediments. The expedition was largely successful. However, on the first deployment of the PCTB, a hydraulic lock attributed to the recent modifications to the tool's flow paths occurred and prevented the tool from sealing (Thomas et al., 2020b). The problem was resolved by removing the new parts that enabled flow diversion. Other coring runs in the first hole failed due to damage of loose ball valve seals, a broken core liner, core jamming the ball valve, and silt and sand packed into the ball valve. (Some of these problems may be been exacerbated by the removal of the flow diversion components.) Ultimately only 1 out of 8 coring attempts (13%) in the first hole successfully returned pressure core within the hydrate stability zone. Several changes were made to the PCTB between the first and second hole, including modification and replacement of the flow diversion components, which dramatically improved pressure core recovery in the second hole—11 out of 13 cores (85%) were recovered in the hydrate stability zone) Analysis of the coring data showed that in nearly all cases the tool sealed much shallower than coring depth, and a pressure boost was recorded in only one test (Thomas et al., 2020b). Initially, these late sealing events and failure to capture the pressure boost were thought to be linked. It was hypothesized that the boost may be firing before a seal in the upper part of the tool was in place, causing the boost to be lost and preventing the upper seal from being fully seated by the boost (Flemings, 2020a). A redesign that combined the components that trigger the seal at the top of the tool and the pressure boost into a simpler "single trigger mechanism" that guaranteed a top seal before pressure boost and eliminated several potential leak paths was proposed and executed (Flemings, 2020a).

A key advance in our ability to understand tool behavior came in 2018 when Geotek upgraded their lab facility by adding a pressure chamber and pneumatic actuator large enough to test the fully assembled PCTB and BHA at close to downhole conditions. Lab tests demonstrated that the single trigger mechanism worked as designed at borehole pressures (Flemings, 2020a). Several minor changes were introduced after that test, and were vetted at the upgraded facility in early 2020 in preparation for the PCTB Land Test II (Flemings, 2020c).

In the PCTB Land Test II, March 2020, core recovery was greatly improved, but 6 out of 7 coring tests failed to seal. During this land test, it was clearly observed for the first time that the ball valve itself was not fully closing or sealing properly. It was hypothesized that very fine sand-sized grit was jamming in the ball valve assembly, preventing the ball valve from closing completely or on time (Flemings, 2020c). Observations that physical jarring of the partially closed ball valve would trigger complete closure also lead us to hypothesize that the late sealing observed in UT-GOM2-1 was also a result of temporary jamming of the ball valve.

In 2020, Geotek modified their ball valve assembly testing method to test the assembly in the presence of grit. With this change, they were able to reproduce the ball valve closure and late sealing problem in the lab. Subsequent 2020 lab tests confirmed that grit was indeed causing canting and jamming of sliding mechanisms in the ball valve assembly producing incomplete ball valve closure and the inability to seal the tool and hold core at elevated pressure (Flemings, 2020c). The new testing method also enabled Geotek to design, test, and redesign modifications to the ball valve assembly to account for the presence of grit. The two critical changes were modifications to eliminate the possibility of canting during actuation and modifications to keep grit from getting into the housing and around the ball seal ring. Specific modifications to the ball valve assembly included extending shoulders and sleeves, adding wiper rings/wiper ring grooves, modifying flow paths to divert grit and avoid hydraulic locking, shortening the ball valve return spring, and adding a mesh screen over some fluid compensation ports

(Flemings, 2021a, b). Additional bench tests confirmed feasibility, showing 100% successful ball valve closure in the presence of grit at concentrations found at the second land test, and 100% successful actuation tests of the whole tool at borehole pressures (Flemings, 2021b).

PCTB Land Test III (this report) was planned primarily to test the recent modifications in a borehole environment and determine whether the ball valve assembly's sensitivity to grit was fully resolved.

Table 4-1. Summary of PCTB tests and design modifications since 2015.

Design Modifications	Test	Test Date	Report
Improved ball valve closing speed	Lab Test	March-April 2015	Phase 1 Report (Flemings, 2016a) Appendix D
	Land Test I	December 2015	Y2Q1 RPPR (Flemings, 2016b) Appendix A
Flow diverted away from inner core barrel	Lab Test/"pre sea" trial	July 2016	Y2Q4 RPPR (Flemings, 2016c) Appendices A and B
	UT-GOM2-1 Hydrate Pressure Coring Expedition	May-June 2017	Proceedings of GOM2-1 (Flemings et al., 2018); Overview paper (Flemings et al., 2020); Pressure coring paper (Thomas et al., 2020a)
Converted upper section of tool to a Single Trigger Mechanism, shear pin added	Lab Test	April-May 2019	Phase 3 Report (Flemings, 2020a) Appendix G
	Lab Test	February 2020	Y6Q2 RPPR (Flemings, 2020b) Appendix A
	Land Test II	March 2020	Y6Q3 RPPR (Flemings, 2020c) Appendix A
Modifications to prevent grit from jamming ball valve assembly	Lab Test	September 2020	Y7Q1 RPPR (Flemings, 2021a) Appendix B
	Lab Test	February 2021	Y7Q2 RPPR (Flemings, 2021b) Appendix A
	Land Test III	April 2021	This report

5 Hole Description

The testing was done in the T-BIRD 9J hole (36°13'15.81161"N 96°34'45.92330"W). There are no well logs for this hole, but the T-Bird 5E2 hole (36°13'5.69654"N 96°34'45.5545"W), 32 ft to the SE, was logged from the same rig and has well log data.

A lithology interpretation was performed using well logs from the T-Bird 5E2 hole and it was determined that the lithology at the test site is comprised of interbedded clastic and carbonate sedimentary rocks including shale, siltstone, sandstone, limestone and marl (Figure 5-1, Figure 5-2). Some degree of uncertainty exists in the lithology interpretation, especially in distinguishing between thin sand / silt beds and porous limestone horizons (e.g., intervals 1870-1905 ft and 2290-2350 ft). All coring tests were performed in the Osage Formation.

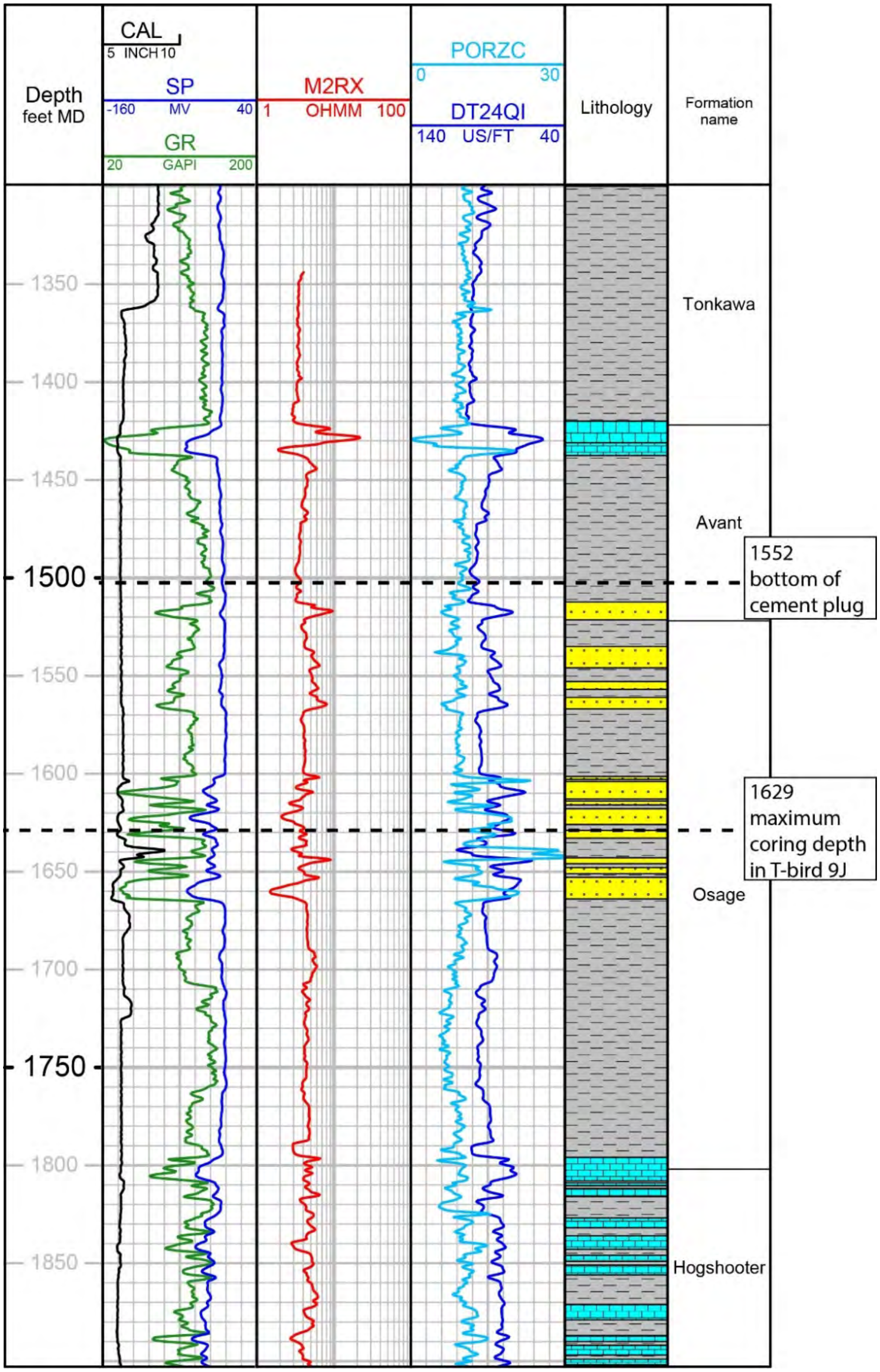

Figure 5-1. Log data and lithology interpretation in the interval of the T-BIRD 5E2 well cored in this study. Gray represents mudstone, yellow represents sandstone, and blue represents limestone. Logs used: gamma ray (GR), caliper (CAL), spontaneous potential (SP), electric resistivity (M2RX), porosity (PORZC), and sonic velocity (DT24QI) Pressure coring occurred beneath the cement plug up to a depth of 1629' MD.

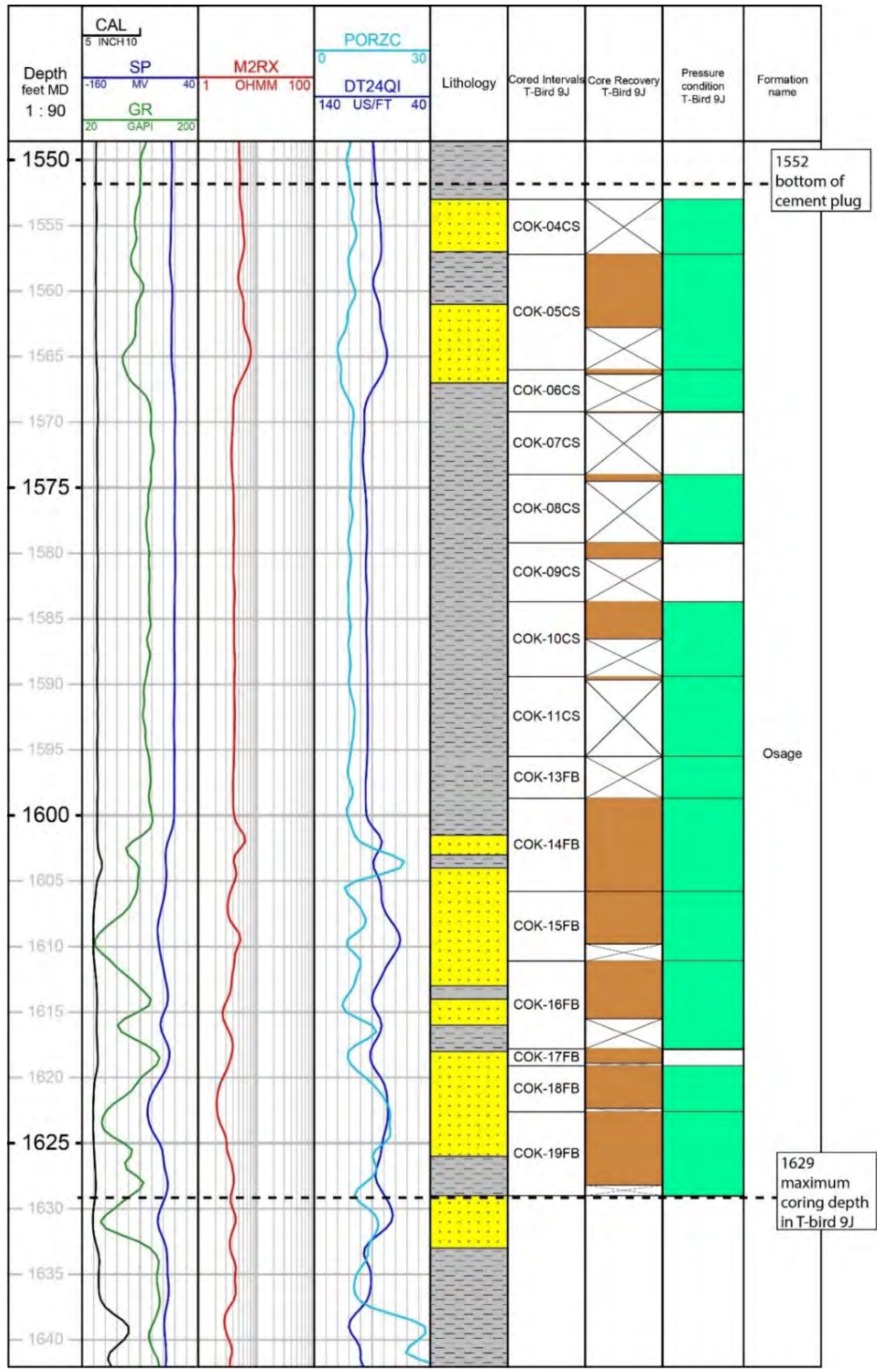

Figure 5-2. Coring intervals, core recovery, and pressure determination. (a) Measured depth. (b) gamma ray (GR), caliper (CAL), spontaneous potential (SP). (c) electric resistivity (M2RX). (d) porosity (PORZC), sonic velocity (DT24QI) (e) Lithology: gray represents mudrock and yellow represents sandstone. (f) Cored interval and core name. (g) Core Recovery: length of recovered core shown in orange. Non recovered interval shown with X. (h) Pressure Condition: green indicates that the PCTB returned to the rig floor sealed and with a boosted core barrel pressure, white indicates no seal.

6 Operations

6.1 Operational Summary

Table 6-1 summarizes daily activities and the details are provided below.

Table 6-1. Summary of daily Events

Date	Activity
Monday, April 12, 2021	Catoosa Test Facility (CTF) initial drilling completed; Geotek arrived and mobilized; ball valve successfully tested with mud from site
Tuesday, April 13, 2021	Drill pipe arrived and made up; BHA made up and run to the casing shoe; PCTB spaced out
Wednesday, April 14, 2021	Wireline arrived and rigged up; COK-01CS, COK-02CS, COK-03CS (full function actuation tests with drilling fluid in the borehole)
Thursday, April 15, 2021	COK-04CS, COK-05CS, COK-06CS
Friday, April 16, 2021	COK-07CS, COK-08CS, COK-09CS
Saturday, April 17, 2021	COK-10CS, COK-11CS
Sunday, April 18, 2021	COK-12FB, COK-13FB, COK-14FB
Monday, April 19, 2021	COK-15FB, COK-16FB, COK-17FB
Tuesday, April 20, 2021	COK-18FB, COK-19FB, Demobilization begins
Wednesday, April 21, 2021	Demobilization
Thursday, April 22, 2021	Demobilization
Friday, April 23, 2021	Demobilization

6.2 Mobilization

Mobilization was organized by UT Austin and Geotek Coring Inc. (Geotek), with assistance from Pettigrew Engineering.

Geotek (Peter Schultheiss, Mike Mimitz, Matt Selman, Alex Burrows, and Dan Minarich) and Pettigrew Engineering (Tom Pettigrew) arrived at CTF on April 12. UT mobilized in two stages: the first team (Zach Murphy and Addison Savage) arrived onsite April 14; the second team arrived on April 17 (Aaron Price and Alejandro Cardona). Peter Flemings, Jesse Houghton, and Carla Thomas were onsite April 14-15, and April 19, respectively.

Geotek shipped the PCTB Service Conex and Heavy Tools Conex from Salt Lake City, Utah to CTF by flatbed trucks. The conexes were offloaded and staged by crane on April 12. UT leased 80 joints of 5” drill pipe from the International Ocean Discovery Program (IODP) in College Station, TX. The pipe was shipped to CTF by flatbed and arrived on April 13. Wireline service operators arrived on April 14.

6.3 PCTB-CS

The PCTB was first assembled using the cutting shoe configuration (PCTB-CS) and 11 tests were run. 3 tests, COK-01CS, COK-02CS, and COK-03CS, were full-function actuation tests performed at 1482 ft MD with drilling mud in the borehole but without coring. (These are referred to as “mud cores” in some daily reports, Appendix D) The remaining tests, COK-04CS to COK-11CS, were coring tests where the bit was advanced and coring was attempted.

6.4 PCTB-FB

The PCTB was then tested in the face-bit configuration (PCTB-FB). 8 tests were run in the PCTB-FB configuration. The first test, COK-12FB, was a full function actuation test performed 1574 ft downhole with drilling fluid. The remaining tests were coring tests where the bit was advanced and coring was attempted.

During retrieval of COK-16FB, the wireline broke at the terminal connection and the PCTB was dropped an estimated 10 ft. A pipe trip was required to recover the tool.

During COK-17FB, the PCTB landed high in the BHA and became stuck. The tool was successfully retrieved using the emergency pulling tool and redeployed.

6.5 Demobilization

Operations were completed on Tuesday, April 20. UT demobilized on April 20. Pettigrew Engineering demobilized on April 21. Geotek remained onsite through April 23 to disassemble, clean, and pack PCTB toolsets and oversee demobilization of the drill pipe, conexes and wireline service operator.

The drill pipe was loaded onto flatbeds and transported to TexFlow in Alvin, TX on April 23. There, the pipe was pressure washed and the threads were ‘doped’, prior to being returned to IODP.

The BHA was broken down and moved to the Heavy Tools Conex, where it was disassembled and washed. The coring tools were rinsed and stowed in the Heavy Tools Conex and PCTB Service Conex, for transport to Geotek in Salt Lake City, Utah.

Upon arrival in Salt Lake City, Geotek conducted a detailed inventory and inspection of the PCTB toolsets and prepared them for long-term storage until the UT-GOM2-2 Scientific Drilling Program in 2022.

7 Test Results

Table 7-1 summarizes the coring test results. They are also summarized graphically in Figure 7-1.

Table 7-1. Coring summary. Depths in MD from rig floor. Tests COK-01CS, COK-02CS, COK-03CS, and COK-12FB were full-function actuation tests performed in the borehole with drilling mud but without coring. In tests COK-12FB and COK-14FB, the PCTB was sealed and pressurized upon recovery, but it is unclear whether sealing occurred at coring *depth. See Section 8.2.*

Coring Test	Configuration	Core Name	Pressure chamber sealed?	Coring begin depth (ft)	Coring stop depth (ft)	Penetration (ft)	Core recovered (ft)	Recovery (%)	Flow Rate (gal/min)	Date	Coring start time	Coring end time
1	Cutting shoe	COK-01CS	Y	Act. test	1482	-	-	-	0	4/14/2021	13:15	14:20
2	Cutting shoe	COK-02CS	Y	Act. test	1482	-	-	-	0	4/14/2021	14:30	15:20
3	Cutting shoe	COK-03CS	Y	Act. test	1482	-	-	-	180, 320	4/14/2021	15:30	17:20
4	Cutting shoe	COK-04CS	Y	1553	1557.2	4.2	0	0.0%	230, 310	4/15/2021	10:48	11:44
5	Cutting shoe	COK-05CS	Y	1557.2	1566	8.8	5.58	63.4%	450	4/15/2021	1:17	2:32
6	Cutting shoe	COK-06CS	Y	1566	1569.2	3.2	0.33	10.3%	450	4/15/2021	15:46	16:26
7	Cutting shoe	COK-07CS	N	1569.2	1574	4.8	0	0.0%	450, 500, 550	4/16/2021	9:10	10:26
8	Cutting shoe	COK-08CS	Y	1574	1579.2	5.2	0.5	9.6%	450, 500	4/16/2021	11:47	12:48
9	Cutting shoe	COK-09CS	N	1579.2	1583.7	4.5	1.2	26.7%	450, 500	4/16/2021	14:05	14:57
10	Cutting shoe	COK-10CS	Y	1583.7	1589.4	5.7	2.83	49.6%	315	4/17/2021	10:51	12:13
11	Cutting shoe	COK-11CS	Y	1589.4	1595.5	6.1	0.25	4.1%	315	4/17/2021	13:25	14:40
12	Face bit	COK-12FB	Y	Act. test	1574	-	-	-	320	4/18/2021	10:00	10:50
13	Face bit	COK-13FB	Y	1595.5	1598.7	3.2	0	0.0%	320	4/18/2021	11:42	12:42
14	Face bit	COK-14FB	Y	1598.7	1605.8	7.1	8.9	125.4%	310, 200	4/18/2021	13:46	14:51
15	Face bit	COK-15FB	Y	1605.8	1611.1	5.3	4	75.5%	300	4/19/2021	9:02	9:48
16	Face bit	COK-16FB	Y	1611.1	1617.8	6.7	4.4	65.7%	300	4/19/2021	10:55	11:43
17	Face bit	COK-17FB	N	1617.8	1619.1	1.3	1.1	84.6%	320	4/19/2021	17:11	17:31
18	Face bit	COK-18FB	Y	1619.1	1622.6	3.5	3.25	92.9%	310	4/20/2021	9:06	9:34
19	Face bit	COK-19FB	Y	1622.6	1629	6.4	5.6	87.5%	310, 285	4/20/2021	10:37	11:32

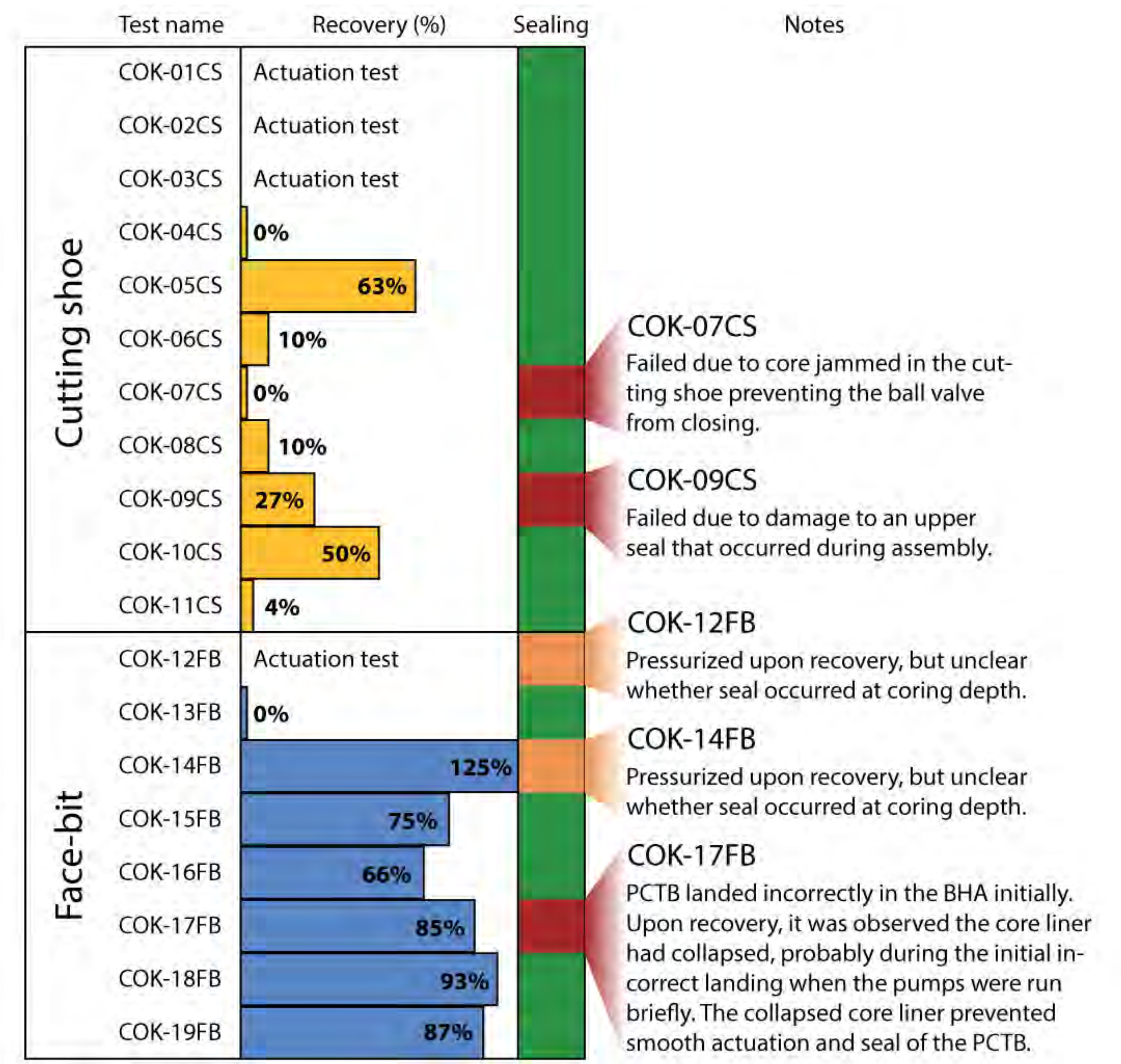

Figure 7-1. Recovery colored by configuration and seal success. The Face-bit configuration demonstrated higher recovery than the Cutting shoe configuration. Rate of successful sealing was 84%. In two tests, COK-12FB and COK-14FB, the pressure chamber was sealed and pressurized upon recover, but it is unclear whether seal occurred at coring depth. See Section 8.2.

7.1 PCTB Deployment, Sealing, and Boost

Of the 19 coring tests, 16 recorded a pressure boost and sealed successfully (84% success) in the borehole environment with drilling fluid and grit present (Table 7-1). 9 out of 11 PCTB-CS tests boosted and sealed successfully (82%), and 7 out of 8 PCTB-FB tests boosted and sealed successfully (88%).

Three cores failed to seal. COK-07FB had core protruding through the ball valve. COK-09FB was deployed with a damaged seal. COK-17FB initially landed in the BHA incorrectly and had to be retrieved with the emergency tool. After redeployment, the ball valve was open and the core liner had collapsed. These failures are examined in detail in section 8.1.

In two tests, COK-12FB and COK-14FB, it is unclear whether the pressure chamber sealed at coring depth or several hundred feet above coring depth. However, in either case the pressure chamber sealed at very close to in-situ pressure, and the boost was successfully applied. See Section 8.2 for detail.

Detailed summaries of all coring tests are presented in the daily reports in Appendix D. All DST plots and rig instrumentation plots are presented in Appendices A and B. Raw data from this land test can be found on the GOM2 Land Test Data page.

7.1.1 DST and Rig Plots for a Successful test (COK-05CS on April 15, 2021):

For this land test the PCTB was deployed with one Star-Oddi Data Storage Tag (DST, compact temperature and pressure logger) in the pressure chamber section of the PCTB. The DST pressure data clearly shows if the tool sealed successfully and if the pressure boost was properly deployed. We plot

DST pressure alongside several relevant rig parameters to describe a successful deployment of the PCTB (Figure 7-2).

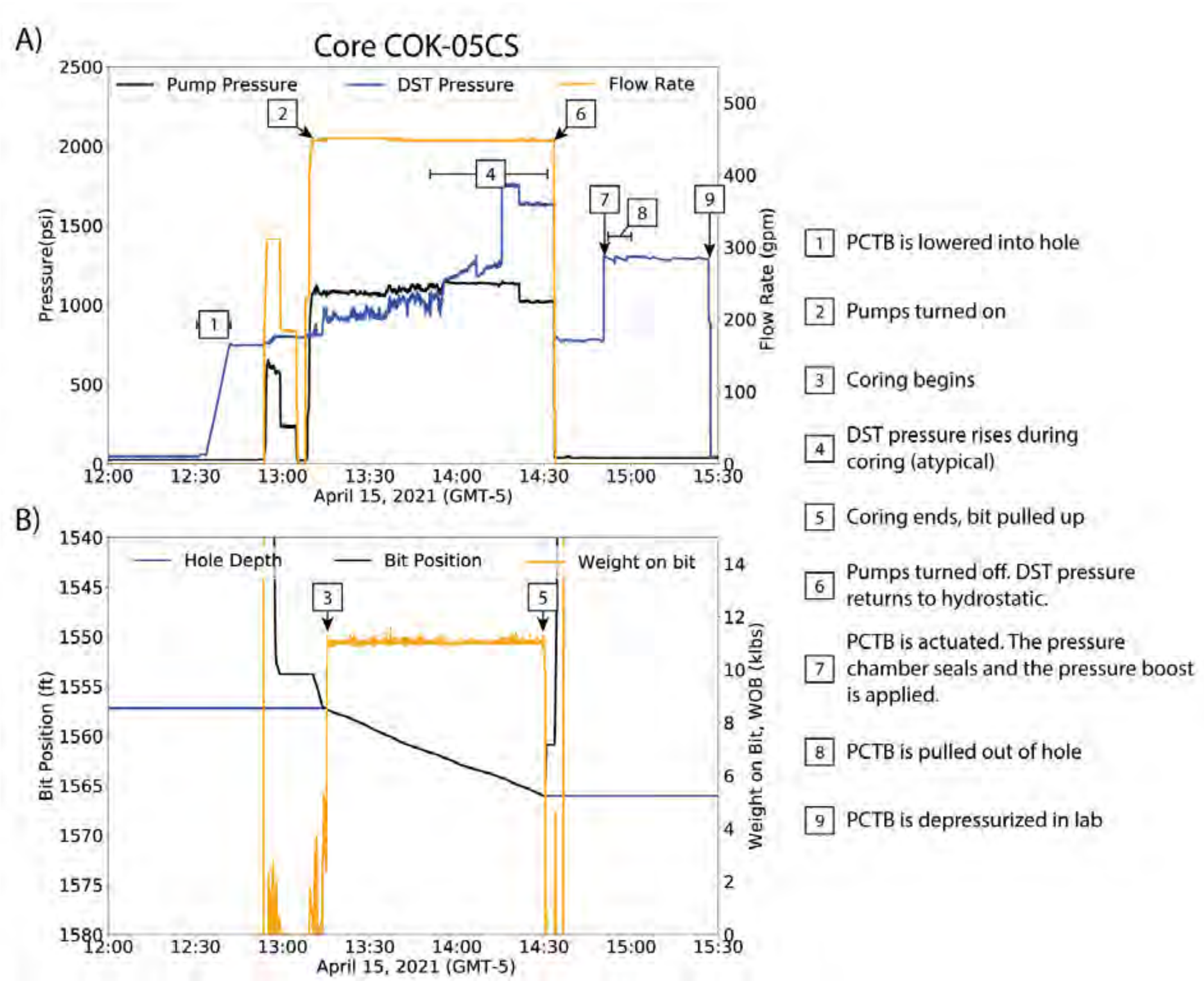

Figure 7-2. DST and rig instrumentation plots for core COK-05CS. The PCTB tool boosted and sealed correctly, and 5.58' of pressurized core was recovered (63% recovery). See also Table 7-2. DST data timestamps were shifted +3.5 minutes to match to rig instrumentation timestamps. A) Pump Pressure (psi), DST Pressure (psi), and Flow Rate (gpm). B) Hole depth (ft), Bit Position (ft), and Weight on Bit (klbs).

Table 7-2. Significant events for core COK-05CS.

COK-05CS		
Event #	Time	Event description
1	12:33-12:41	PCTB is lowered into hole
2	13:12	Pumps turned on
3	13:18	Coring begins
4	~14:00-14:30	DST pressure rises during coring (atypical)
5	14:30	Coring ends, bit pulled up
6	14:33	Pumps turned off. DST pressure returns to hydrostatic.
7	14:49	PCTB is actuated. The pressure chamber seals and the pressure boost is applied.

8	14:49-15:00	PCTB is pulled out of hole
9	15:25	PCTB is depressurized in lab

7.1.2 DST and Rig Plots for an Unsuccessful Test (COK-07CS):

We plot DST pressure alongside several relevant rig parameters to describe an unsuccessful deployment of the PCTB (Figure 7-3).

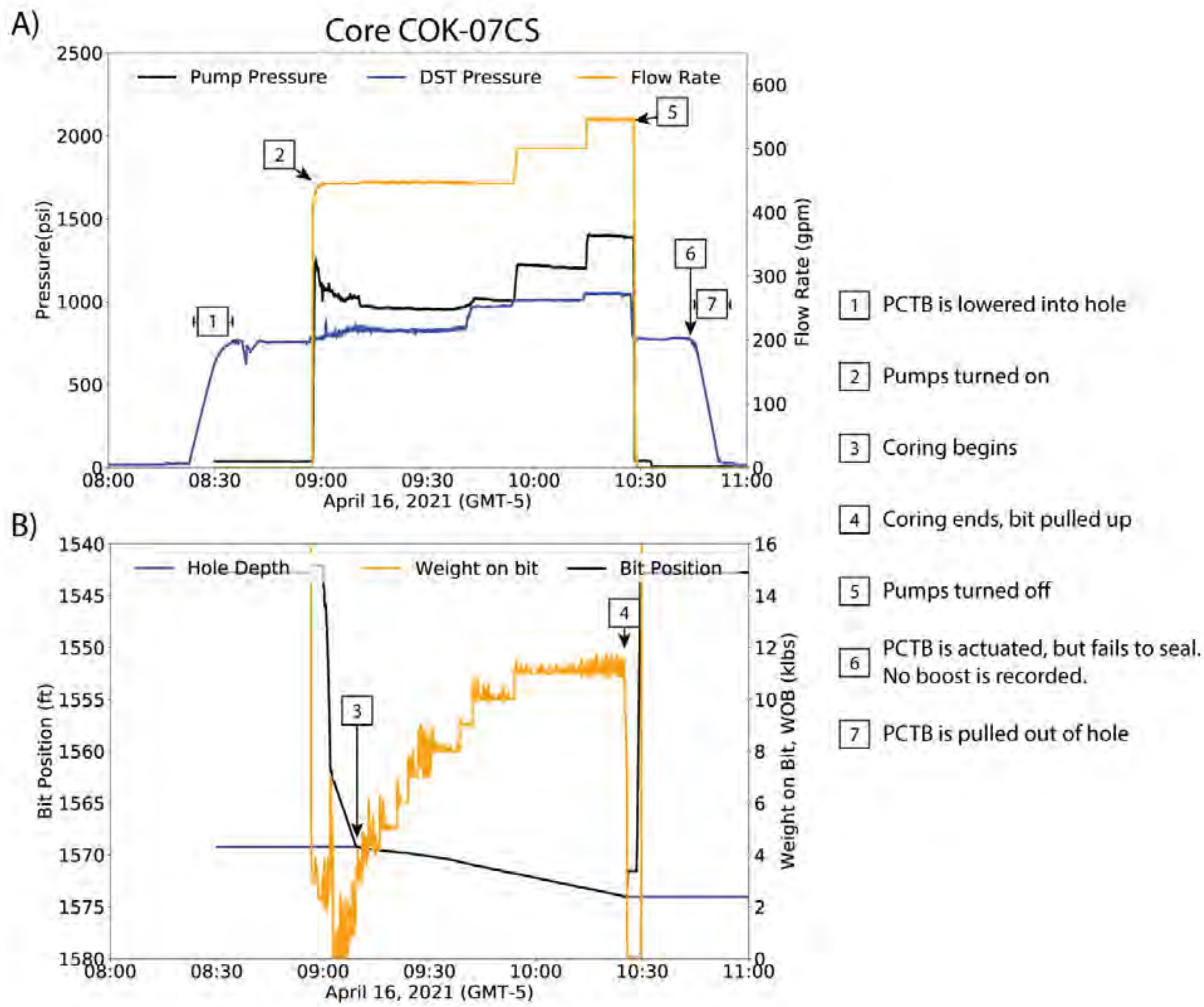

Figure 7-3. DST and rig instrumentation plots for core COK-07CS. The PCTB failed to seal due to a damaged upper seal. See also Table 7-7-3. DST data timestamps were shifted +3.5 minutes to match rig instrumentation timestamps. A) Pump Pressure (psi), DST Pressure (psi), and Flow Rate (gpm). B) Hole depth (ft), Bit Position (ft), and Weight on Bit (klbs).

Table 7-7-3. Significant events for core COK-07CS.

COK-07CS		
Event #	Time	Event description
1	8:22 - 8:35	PCTB is lowered into hole

2	8:57	Pumps turned on
3	9:10	Coring begins
4	10:26	Coring ends, bit pulled up
5	10:27	Pumps turned off
6	10:43	PCTB is actuated, but fails to seal. No boost is recorded.
7	10:56	PCTB is pulled out of hole

7.1.3 Pressure Drop Prior to Boost

In several tests, a brief drop in pressure of up to ~125 psi is observed immediately before the boost is recorded. This behavior has been frequently observed in this previous land tests and the UT-GOM2-1 marine expedition. In this land test, 8 tests showed pressure drops of greater than 50 psi. The pressure drop usually occurs over a few seconds, then the boost fires after <30s (e.g. COK-18FB, Figure 7-4).

However, in two tests, COK-12FB and COK-14FB, DST pressure data recorded a gradual drop in core barrel pressure for several minutes, rather than several seconds, before the pressure boost was recorded. In COK-12FB, a pressure drop of 125 psi occurred over 3m40s before the boost clearly fires and pressure is maintained (Figure 7-5). In COK-14FB, a pressure drop of 119 psi occurred over 2m55s before the boost fired and pressure was maintained (Figure 7-6). The bit was not moved during either pressure drop. There is no wireline depth data or wireline pressure data to explicitly delineate the wireline trip through the borehole. However, the rate of pressure loss (the slope of the pressure curve) is less than would be expected if the PCTB was unsealed and moving up through the borehole at a normal wireline speed. However, the rate of pressure loss is much less than would be expected from an unsealed PCTB moving upwards through the borehole.

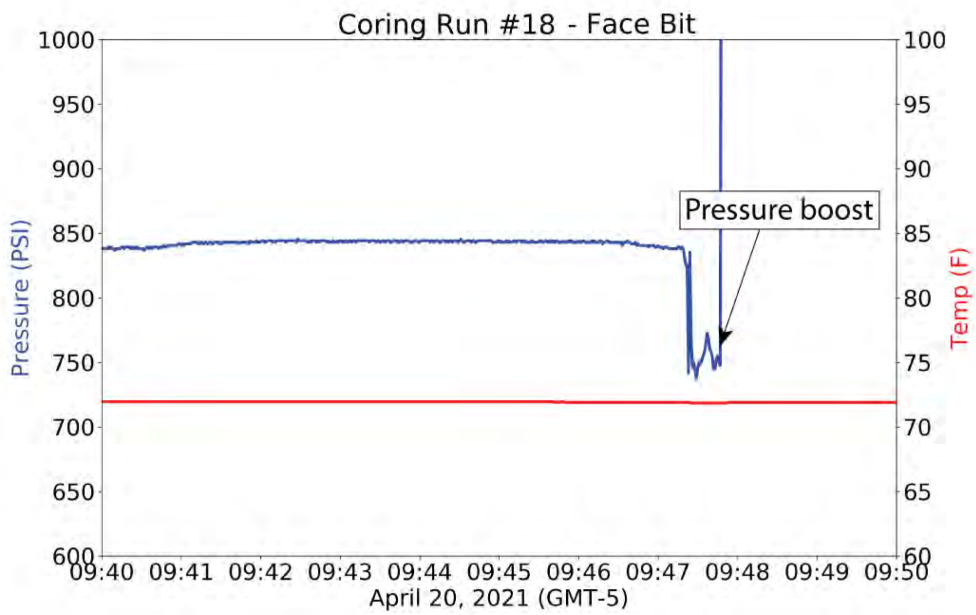

Figure 7-4. DST pressure and temperature data for COK-18FB, showing an on-time pressure boost. The plot is zoomed in to show a decrease in DST pressure similar in magnitude to those seen in COK-12FB and COK-14FB, but occurring over seconds instead of minutes prior to the boost. This drop in pressure prior to boost is not always observed, but has frequently occurred in this land test, the previous land test, and the GOM2-1 marine test.

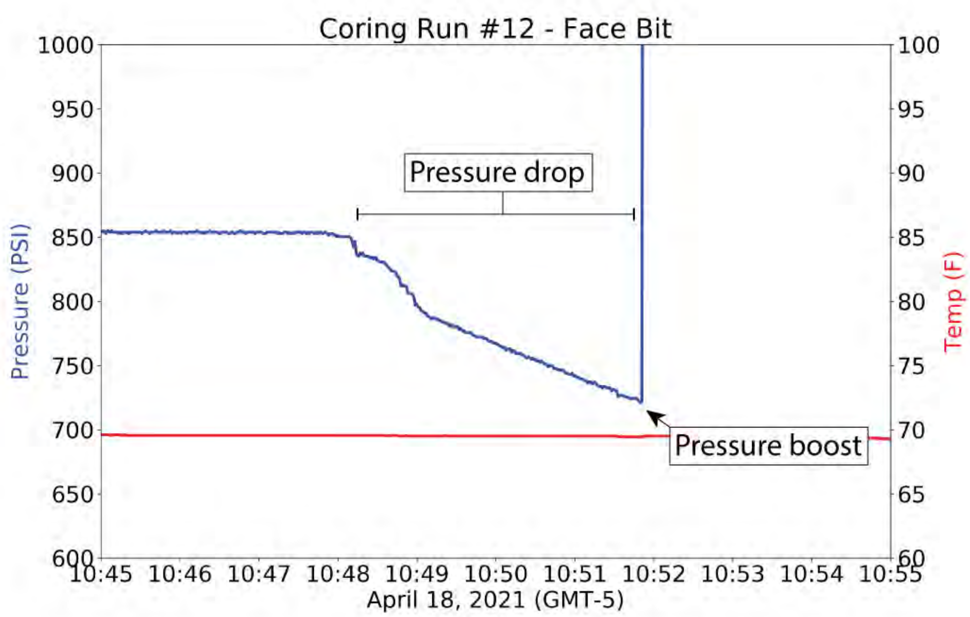

Figure 7-5. DST pressure and temperature data for COK-12FB, zoomed in to show a decrease in pressure lasting 3m40s just before the pressure boost is recorded.

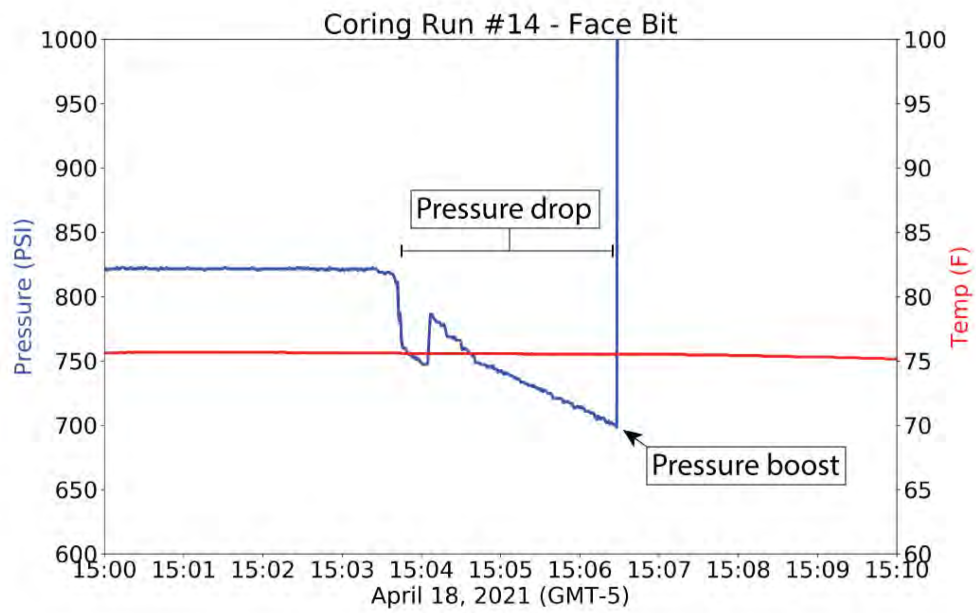

Figure 7-6. DST pressure and temperature data for COK-14FB, zoomed in to show a decrease in pressure lasting 2m55s just before the pressure boost is recorded.

7.2 Core Quality

Core target lengths varied from approximately 1 to 9 ft, and the core recovery rate (% of length of core recovered versus cored) varied from 0% to 125%, with a median recovery of 49.7%. The PCTB-CS demonstrated recoveries of 0% to 63% with a median recovery of 10%. The PCTB-FB demonstrated recoveries of 0% to 125%, with a median recovery of 84.6%.

Cores taken with both configurations were not intact and were comprised of pieces 1-15" long, with occasional rubble/smaller fragments. In many cases, fractures between pieces were sharp with matching features on both ends of the break (eg, COK-10CS, COK-14FB), while in other cases there are rounded edges that clearly demonstrate biscuiting (eg, COK-15FB, COK-16FB).

Except where edges were worn down by occasional biscuiting, the core diameter appeared consistent within each core and between cores.

Core scraping was not noted and the cores were not imaged or logged.

A collection of core photos is presented in Appendix C.

Figure 7-7. Core COK-05CS contained 5.58 ft (63.4% recovery) of interbedded shale. There are breaks in the core section, but the breaks are sharp and unrounded.

Figure 7-8. Clear evidence of biscuiting in core COK-15FB. The lithology of this core is sandier than most of the other cores.

7.3 Mud and Cuttings properties

1. Methods

The drilling mud was characterized on site to determine the grain size distribution of suspended particles in the drilling fluid. The sieved grain analysis procedure consisted of four main steps: (1) daily sample collection of mud from both the returning mud prior to the shale shakers and the supply tank mud that has been filtered, (2) weight measurement of the mud for gravimetric analyses, (3) filtering the mud through sieve sizes 5 to 230 mesh (4000 –62 µm), (4) rinsing, drying, and weighing of the retained material in each mesh. Weight measurements are normalized with respect to total weight of the drilling fluid. Additional rheological (i.e., Fann viscometer), API fluid loss, and pH measurements were also obtained during the land test (See Appendix E for details).

We found that particles were lost during rinsing and drying at the CTF site. Therefore, a complementary study was performed at The University of Texas using a laser diffractometer (Mastersizer 3000) to determine more reliably the particle size distribution of the smaller particles. The test starts by diluting 1 g of mud in 0.5 wt.% sodium hexametaphosphate solution to hinder particle aggregation. The diluted solution is placed inside the laser diffractometer to obtain a volumetric particle size distribution. These results are equivalent to the gravimetric distribution if all particles have the same density. We measured the total solids concentration by drying a mud sample to normalize our particle size distribution with respect to the total mass of bulk fluid.

2. Mud properties

Appendix E contains the laser diffraction data obtained at the University of Texas as well as data gathered at the CTF site: the particle size distribution of samples prior to the shale shakers and the supply mud tank, and mud properties (e.g., rheology, fluid loss, pH) collected by the test facility personnel.

The characterization at CTF indicates that the mud properties did not change considerably during the land test (See Appendix E for details). The increase in pH during later days of the test is caused by the addition of caustic soda to the drilling fluid. There is a slight decrease of rheological properties (e.g, plastic viscosity = 8 to 5 cP) and an increase in API fluid loss (49 to 70 cm^3) as the land test progresses.

3. Cuttings properties

Sieve data gathered on site shows that pre-shaker mud samples had larger and more grains retained on each sieve than the filtered mud (i.e., blue and green markers in Figure 7-9). Large grains (>4000 µm) had the largest weight percent in comparison with other grain sizes during the sieve analysis (0.15-1.5% of the total weight). These larger grains were mostly rounded.

Results from laser diffraction suggests the presence of grains between 50 to 125 µm before and after the shakers (note Figure 7-9 only shows one dataset for clarity - see Appendix E for details). The particle concentration within this range ≈0.7% is obtained by subtracting the cumulative values between 125 and 50 µm (See dashed lines in Figure 7-9 inset). To further validate these concentration values, we conducted a sedimentation test (i.e., Stokes law) that segregates particles larger than 50 µm. The concentration obtained corresponds to 0.45%, which agrees with the laser diffraction data.

The sieve analysis on site indicate that the filtered mud had less material in comparison with the pre-shaker mud. This implies that the shakers effectively prevent larger grains from entering the recirculating mud.

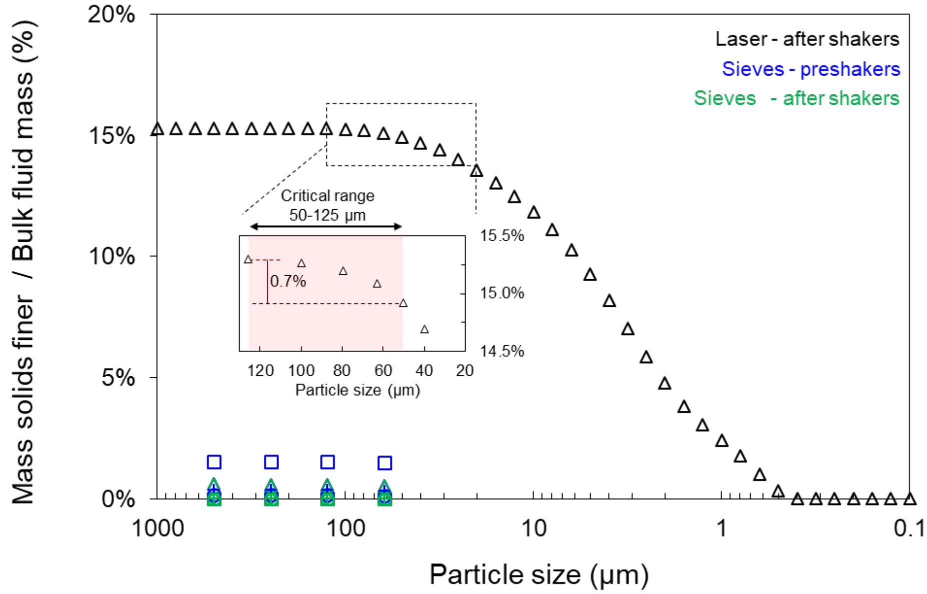

Figure 7-9. Cumulative particle size distribution of the suspended particles in the mud normalized with respect to mass of mud. Marker type represent test day (squares 4/16, diamonds 4/17, circles 4/18, triangles 4/19, cross 4/20). Inset is a zoomed in region for the particle range for failure.

8 Discussion

8.1 PCTB Sealing

Of the 19 coring tests, 16 sealed correctly and recorded a pressure boost (84%). A typical successful deployment is annotated in Figure 7-2. The 3 cores which failed to seal or record a boost, COK-07CS and COK-17FB, are described and discussed below. These errors are not a result of any modification made to the tool nor a result of the main issue encountered in the last land test—jamming of the ball valve assembly due to the presence of grit in and around the assembly sliding parts and/or seal ring. These failures also appear to be unrelated to configuration differences.

COK-07CS failed due to core protruding through the ball valve during actuation, blocking the ball valve from closing (Figure 8-1). A small length of core entered into the cutting shoe and barely into the inner core barrel, before the cutting shoe became jammed (Figure 8-2). When the tool actuated, the core was jammed too tightly to be pulled into the inner core barrel by the core catcher or to fall out through the cutting shoe, and the ball valve could not close. The hard lithology of the CTF site may have contributed to this failure, first by jamming the cutting shoe more easily, and then by being too hard for the “basket” style core catchers more suitable to softer lithologies to pull up once it was jammed. Additionally, it was observed that the basket catcher was causing some damage to the core. For the remainder of the tests, the basket catcher was removed and only a slip catcher was used. This failure mode is unlikely occur in future marine tests, but using just the slip catcher, or switching to a flapper catcher may be considered in future deployments if core damage is observed.

Core COK-09CS did not seal due to damage to a seal on the upper end of the inner core barrel (Figure 8-3). It is probable that the damage occurred after the pre-deployment pressure tests while resetting a section of the tool for deployment (Appendix G, Geotek's report). This is an exceedingly rare occurrence and is unrelated to revisions to the ball valve assembly. Extra care taken in this stage of the deployment protocol will lower the chance of this happening again.

Core COK-17FB did not actuate and seal properly due to a collapsed core liner that occurred during an aborted first attempt at latching the PCTB into the BHA. On the first deployment, the PCTB appeared to land at the BHA some 30 ft higher than expected. Attempts were made to dislodge the tool, including running the pumps at 200 GPM, at which point a much higher than expected standpipe pressure was observed. The PCTB was retrieved with the emergency pulling tool, and was sent back down without being rebuilt. Upon tool recovery, the ball valve was observed to be partially open (Figure 8-4), and upon disassembly it was observed that the core liner had partially collapsed at the lower end (Figure 8-5). It is thought that running the pumps with the PCTB resting high near the BHA landing shoulder caused flow paths in that area to be constrained, which in turn caused the high standpipe pressure and the core liner collapse. On the second attempt to deploy the PCTB, the BHA was vigorously cleaned and the PCTB landed as normal in the BHA. However, after coring, the collapsed core liner prevented full and smooth actuation. The core liner was also partially ruptured which may have allowed debris from the captured core to prevent ball valve closure. Geotek inspected the BHA after the conclusion of the land test, and discovered that the drill collars were manufactured to an incorrect specification that allowed the PCTB to unlatch at the higher location (Appendix G, Geotek's report). These parts will be corrected to prevent this sort of incorrect release. If the PCTB lands high in future, a lower flow rate might be used to try to dislodge or reseat the tool. Additionally, if a spike in standpipe pressure is observed prior to a coring run, the core liner may be inspected at the rig floor to ensure it has not collapsed.

It is possible, but not certain, that two other cores, COK-12FB and COK-14FB did not seal at coring depth, even though they were pressurized when recovered, and a boost was recorded. See Section 8.2.

Figure 8-1. In test COK-07CS, a small length of core was jammed in the cutting shoe and protruded up through the ball valve, preventing it from closing.

Figure 8-2. The jammed cutting shoe of test COK-07CS, seen from the bottom.

Figure 8-3. COK-09CS failed to seal and actuate properly due to a damaged plug seal on the upper end of the inner core barrel. The damaged seal is shown here after post-deployment disassembly.

Figure 8-4. Upon retrieval of COK-17FB, the ball valve was visibly open.

Figure 8-5. Collapsed core liner of COK-17FB. Despite the collapsed core liner, 1.1 ft of core entered the inner core barrel and was captured.

8.2 Pressure Drop Prior to Boost

In two tests, COK-12FB and COK-14FB, there was a gradual pressure drop of ~125 psi that occurred over ~3 minutes after coring ended but before the boost fired. We have two possible interpretations of this behavior.

8.2.1 Interpretation A: Slow Actuation at Coring Depth

One interpretation is that the pressure decrease results from slow tool actuation due to atypical wireline operation. In this interpretation, the tool actuated slowly, but correctly, at coring depth, and the pressure decrease is attributed to volume expansion of the pressure chamber as the tool is actuated. A characteristic tool behavior is that there is frequently a brief drop in pressure when the PCTB is actuated, before the boost fires. This behavior has frequently been observed in past marine and land tests, and in this land test (e.g. COK-18FB, Figure 7-4), and has been attributed to slight volume changes occurring in the pressure chamber as the tool is actuated. The pressure drops observed in COK-12FB and COK-14FB (described in section 7.1.3) are of similar magnitude to these common pressure drops, but occurred over minutes instead of seconds. It is interpreted that atypical wireline operation caused slow, but otherwise normal, actuation of the PCTB during which the PCTB sealed and boosted at coring depth.

8.2.2 Interpretation B: Partial Seal at Coring Depth, Followed by Late Boost

A second interpretation is that the PCTB detached from the BHA without the upper assembly completing its stroke during actuation, which resulted in an incomplete upper seal and delay of the pressure boost.

In this interpretation, the pressure decrease is attributed to a slow leak due to incomplete seal as the PCTB rose through the borehole, followed by a late boost and complete seal several hundred feet above coring depth (Appendix G, Geotek's report). In this interpretation, the sleeve that fully seats the tool's upper seals and fires the pressure boost did not stroke completely at coring depth, possibly due to a combination of high static friction and slightly lower-than-usual actuation force. Only a partial seal was established before the PCTB unlatched from the BHA and began to rise through the borehole. The pressure drop is attributed to gradual equalization of pressure between the pressure chamber and the borehole through restricted flow paths. Approximately 3 minutes later, the sleeve finished its stroke, the pressure chamber sealed completely, and the boost was applied.

It is possible that the maximum delay could be reduced by reducing the static friction in the sleeve with the use of different sleeve seal rings. However, it is important to ensure that a reduction in static friction does compromise the primary function of the sleeve in preventing premature firing of the boost.

8.2.3 Summary

In this land test, wireline depth data was not recorded and a DST was not placed in the pulling tool. Wireline depth data or pulling tool pressure data would clearly corroborate one interpretation over the other. In the absence of that data, both interpretations are presented.

Importantly, the pressure drops observed in COK-12FB and COK-14FB were similar in magnitude and duration. In both cases, regardless of interpretation, the pressure boost and complete seal of the pressure chamber occurred at or very near to in-situ pressure. It is unlikely that this effect is large enough to take hydrate-bearing sand pressure core to, or over, the hydrate stability boundary.

8.3 PCTB Core Quality

The main objective of PCTB Land Test III was to determine if the modifications made to the PCTB improved the sealing success of the ball valve assembly in the presence of grit and debris without introducing any other performance issues. Therefore, drilling parameters were chosen to maximize rate of penetration and minimize test duration, rather than maximize core quality. Furthermore, the lithology at the CTF site differs significantly from the marine sediments the PCTB will be deployed in during the marine test. Thus, quality of core from this land test may not reflect the quality of core in the marine test, or indicate the superiority of either configuration with respect to core recovery or core quality.

With that caveat, core recovery appeared to be higher with the PCTB-FB configuration (median of 49.7%) than with the PCTB-CS configuration (median of 10%). This could support the hypothesis of superior core recovery with the PCTB-FB configuration.

Although the cores with the most biscuiting (COK-15FB and COK-16FB) were acquired with the PCTB-FB configuration, the lithology of those cores also clearly differs from the rest of the cores taken with either configuration, and other PCTB-FB cores show little to no signs of biscuiting. It cannot be determined from the results of this land test if configuration affected the tendency of biscuits to form during coring.

8.4 PCTB Mud Analysis

Critical range size: land vs. bench tests

PCTB Land Test II and follow-up lab tests identified a critical range of grit size (53-125 µm) in the drilling fluid that, at a concentration of 0.24%, was interpreted to be the main cause of ball valve seal failures (Flemings, 2020c). These particle sizes are present in the drilling fluid of Land Test III at concentrations approximately three times greater (0.7%). The high concentration of grit in the critical size range indicates that this land test serves as an appropriate test of the modifications intended to remove sensitivity of the ball valve assembly to grit.

Roundness of larger grains

Larger and rounded cuttings present in the drilling mud may imply inadequate hole cleaning. Stagnant cuttings at the bottom of the hole are constantly reground, which promotes roundness. The large number of cuttings observed on 4/16/2021 (i.e., 1.52%) correlates with an increase in pump flow rate to ≈ 550 GPM

Optimal pump flow rate

Lower pump flow rate values are required to minimize likelihood of core liner collapse and reduce abrasive jetting or erosion in the cores, especially hydrate-bearing sand cores. However, low flow rates may cause insufficient cleaning of the cuttings. A comprehensive optimization of drilling fluid parameters will provide an optimal flow rate that guarantees a successful coring operation.

8.5 PCTB Ball Valve Actuation in the Presence of Grit

In Land Test II, the ball valve did not fully close due to 50-125 µm grit in the ball valve assembly in 6 out of 7 tests (Flemings, 2020c). Analysis of the drilling mud at Catoosa showed that sediment of that size range was also present during this land test, and at greater concentration (section 8.4). In this land test, the ball valve did not close in 2 tests (COK-07CS and COK-17FB). However, these ball valve failures were not a result of fine grit in the ball valve assembly.

As a result of the high percentage of successful ball valve actuations, we are confident that the recent modifications made by Geotek have successfully removed sensitivity of ball valve actuation to grit.

8.6 PCTB-CS vs. PCTB-FB

Figure 7-1 compares core recovery and seal success of the two configurations. The PCTB-FB demonstrated significantly higher recovery than the PCTB-CS configuration. There was not significant evidence that either configuration collected higher-quality core. The lithology at CTF makes it difficult to make statements about superiority of either configuration in terms of core quality when the PCTB is deployed in the Gulf of Mexico.

The PCTB-CS failed to seal twice during this land test (18% failure), while the PCTB-FB failed to seal only once (13% failure). However, the modes of failure are not related to differences between the configurations. Thus, this land test does not demonstrate superiority of either configuration in successful sealing.

9 Recommendations for future tests

We have now done three expensive land tests and we keep learning new and better ways to do these tests. The following are some recommendations we would make for any further testing.

1. Consider alternate core catcher types for use in different lithologies.
2. As lithology changes, consider whether different core catcher types could be more effective at retracting the core into the inner core barrel.
3. After the tool is assembled and pressure-tested in the lab, reset the tool more carefully before deployment to avoid inadvertent damage to seals.
4. Monitor wireline depth when latching the PCTB into the BHA to ensure correct landing.
5. If the PCTB lands too high in the BHA, do not run the pumps until the tool is removed from the BHA—restricted flow paths could cause core liner collapse.
6. If there are any problems with tool deployment, swap out the tool before going in a second time.
7. Ensure that the wireline operator has the ability to record, at a minimum, the time and position of the wireline. It would be extremely favorable to also record the tension. This was not done in this test, but would have been extremely helpful.
8. Ensure that the pressure and temperature in the running tool and pulling tool are monitored with a DST. This was not done in this test but would have been helpful.
9. Analyze the mud composition and do a careful size analysis both entering and exiting the borehole. This was done on this field test.

10 Conclusions

The extensive testing and modifications performed by Geotek since the last land test appear to have greatly improved the ability of the PCTB to reliably capture pressure core at depth. Specifically, the issue of grit preventing ball valve closure appears to be resolved. Out of 19 tests, 16 resulted in a captured pressure boost and a complete seal of the pressure chamber, which is an excellent improvement over the results of Land Test II and the GOM2-1 marine expedition. None of the failures to seal were a result of grit in the ball valve assembly, and each provided actionable information on how to avoid these failure modes in future deployments.

Both the cutting shoe and the face-bit configurations of the PCTB were tested in this land test. The PCTB-FB demonstrated significantly higher core recovery than the PCTB-CS, but due to the lithology of the CTF site and the aggressive drilling parameters chosen for these tests, we cannot say for certain whether either configuration would demonstrate superior core recovery in the soft sediment marine environment. Each configuration produced high quality core with a high rate of pressure boost and seal success.

The PCTB Land Test III provided additional operational experience with the PCTB in a wellbore environment and a way to vet recent modifications to the PCTB. Good core quality and an excellent record of recovering core at pressure shows that the modifications worked well to resolve existing issues, and didn't introduce new problems. We are confident that the sealing problems encountered on the GOM2-1 expedition have been resolved, and that the PCTB technology is more robust than it has ever been.

11 References

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Thomas, C., Phillips, S. C., Flemings, P. B., Santra, M., Hammon, H., Collett, T. S., Cook, A. E., Pettigrew, T., Mimitz, M., Holland, M., and Schultheiss, P., 2020, Pressure coring operations during The University of Texas-Gulf of Mexico 2-1 (UT-GOM2-1) Hydrate Pressure Coring Expedition in Green Canyon Block 955, northern Gulf of Mexico: AAPG Bulletin, v. 104, no. 9, p. 1877-1901.

PCTB Land Test III 2021 Report

Appendix A: DST Plots

See Appendix D, Daily Reports, for a detailed discussion of each coring run.

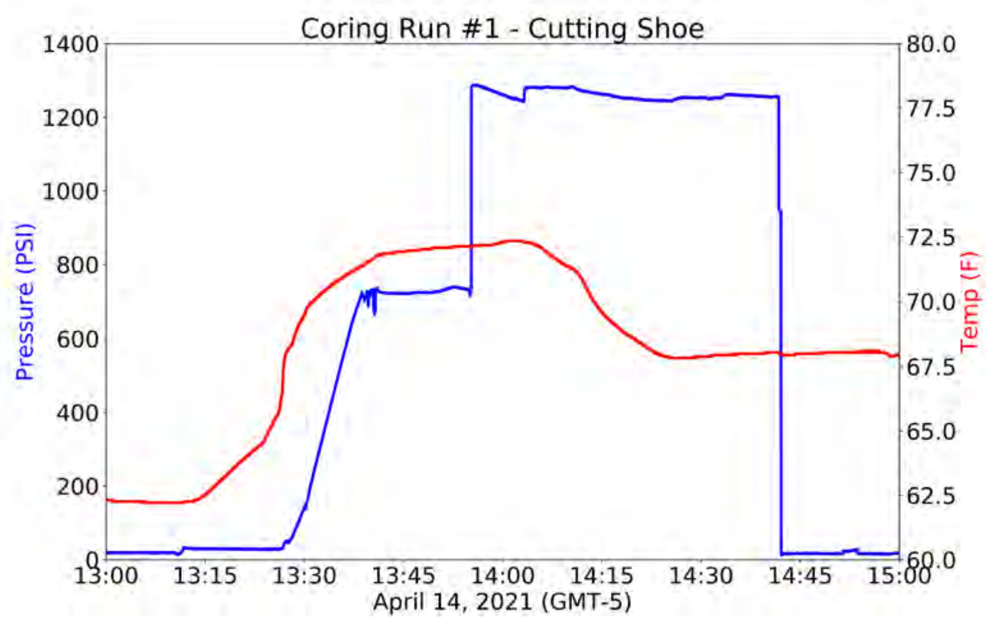

Figure 1. DST data for COK-01CS

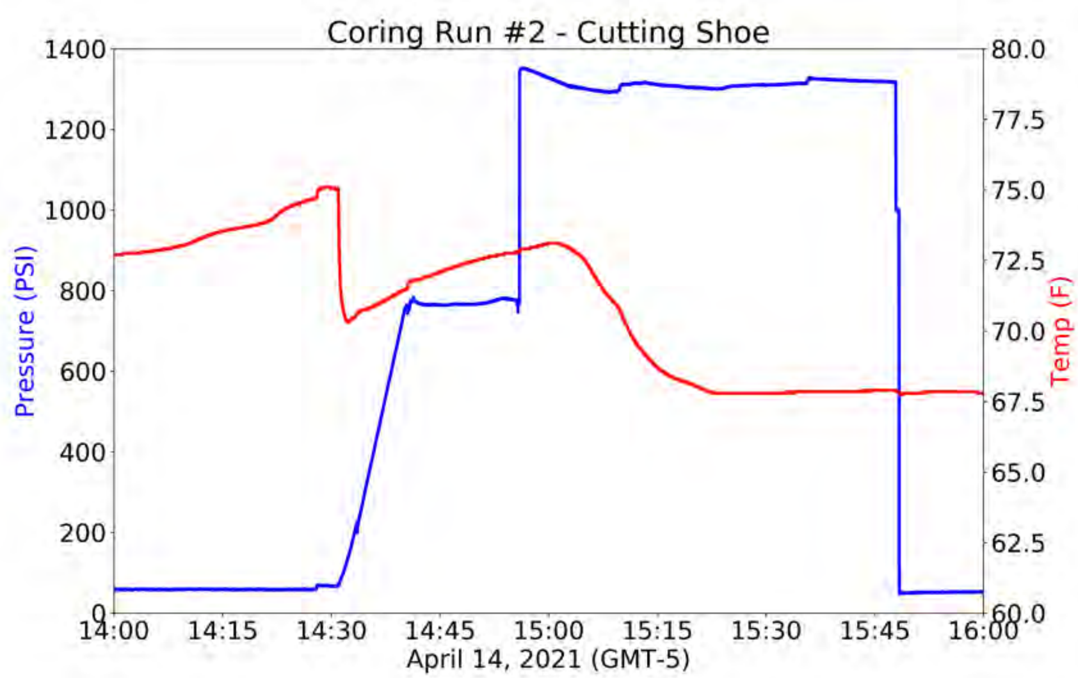

Figure 2. DST data for COK-02CS

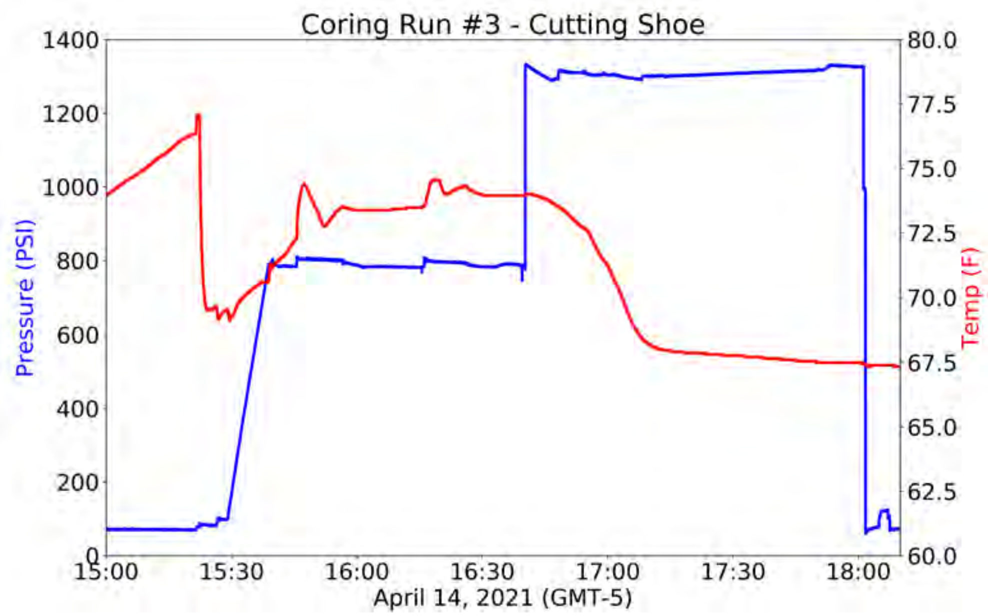

Figure 3. DST data for COK-03CS

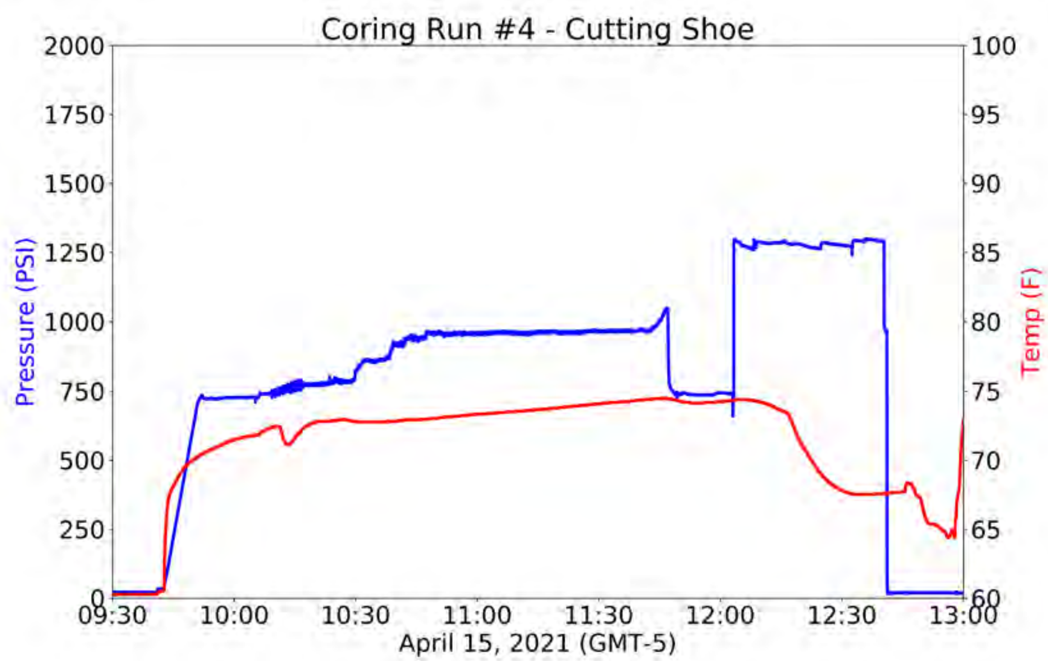

Figure 4. DST data for COK-04CS

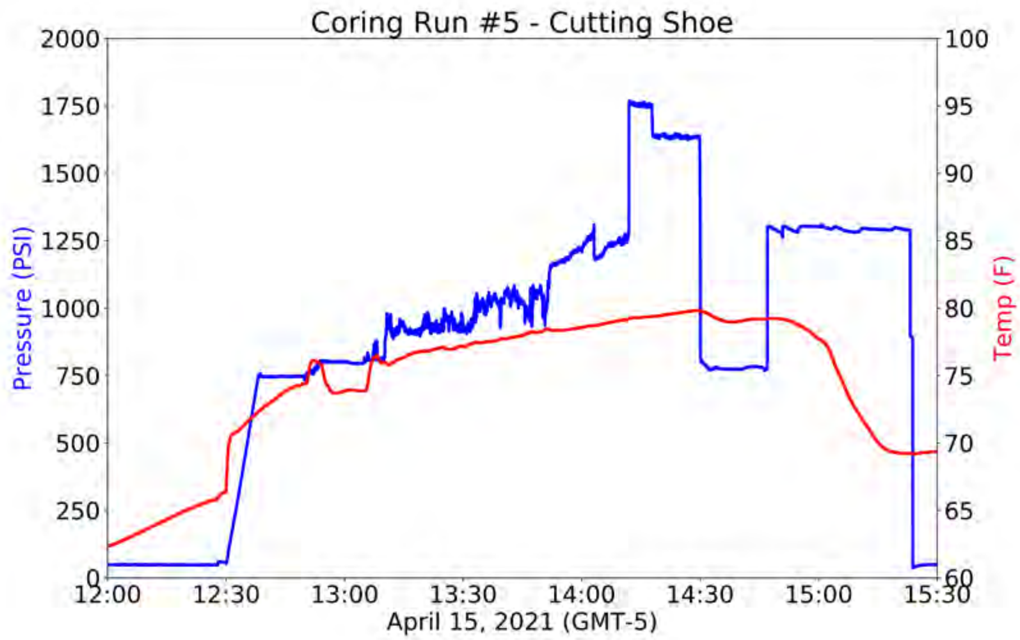

Figure 5. DST data for COK-05CS

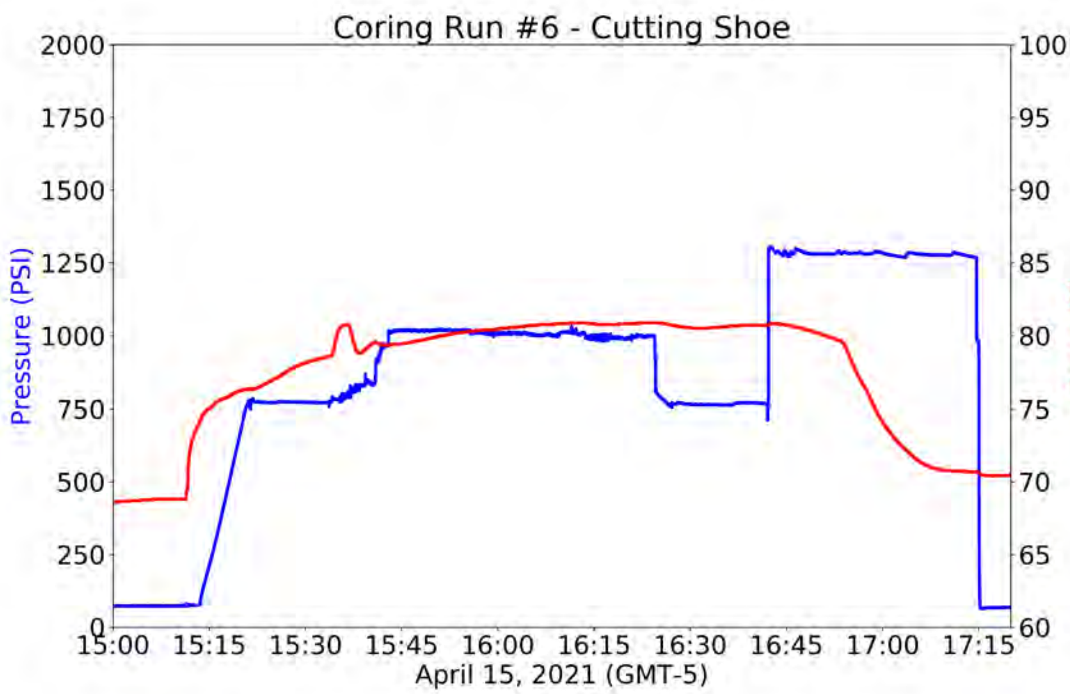

Figure 6. DST data for COK-06CS

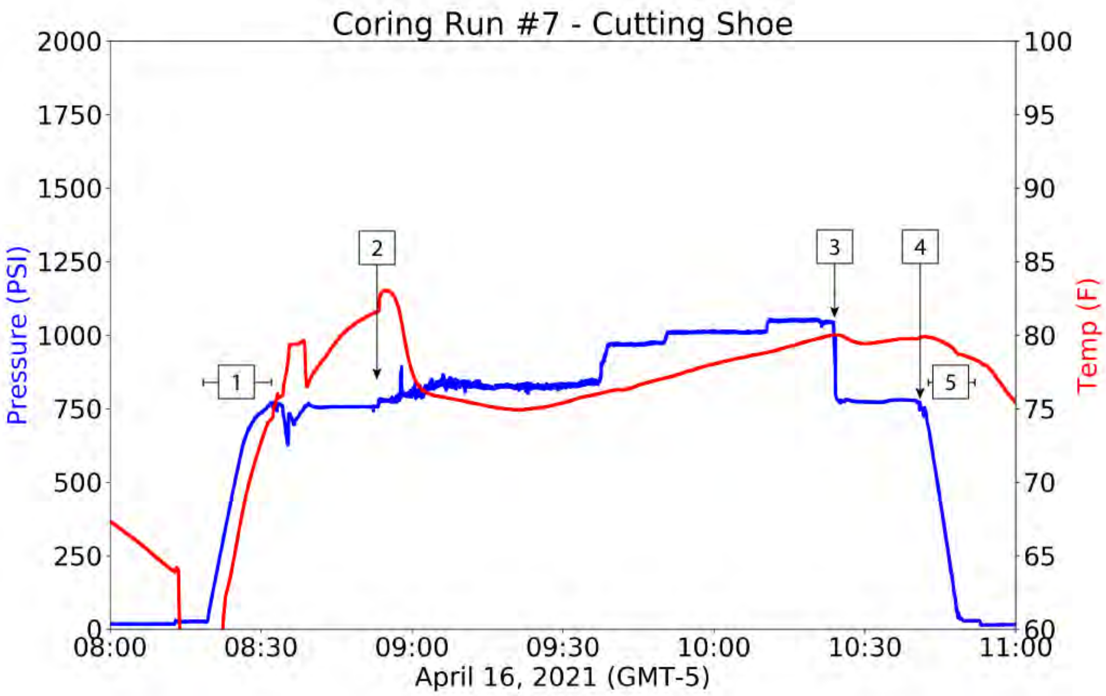

Figure 7. DST data for COK-07CS

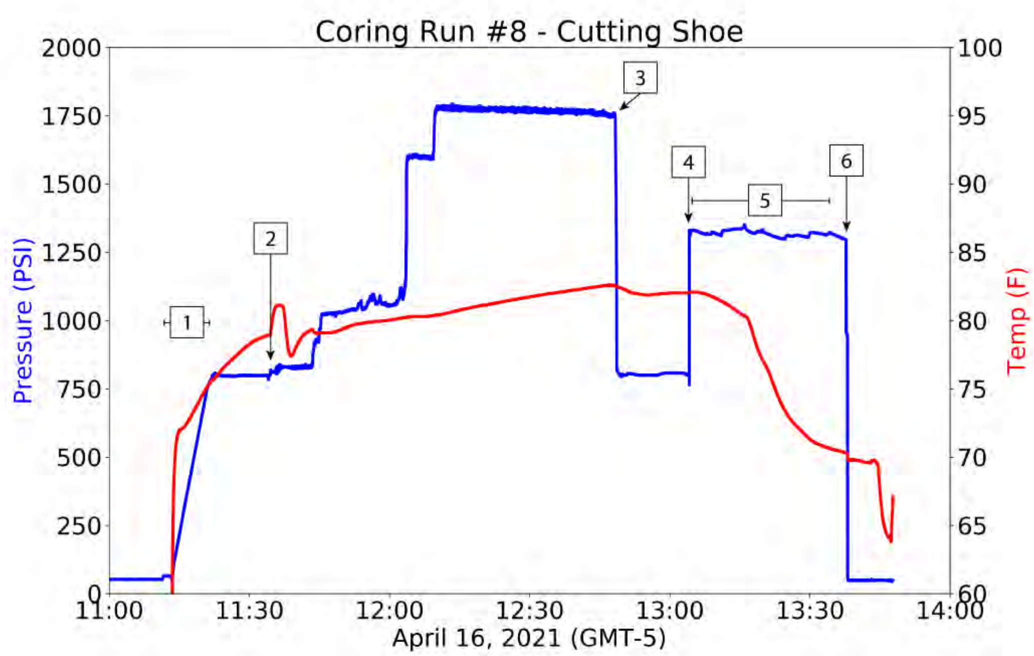

Figure 8. DST data for COK-08CS

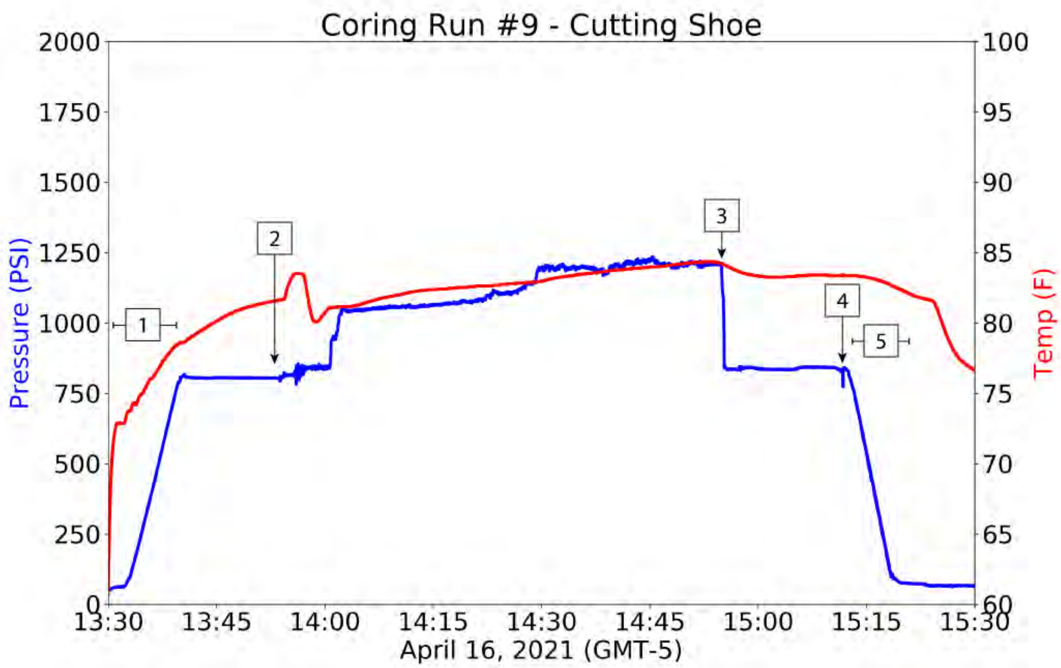

Figure 9. DST data for COK-09CS

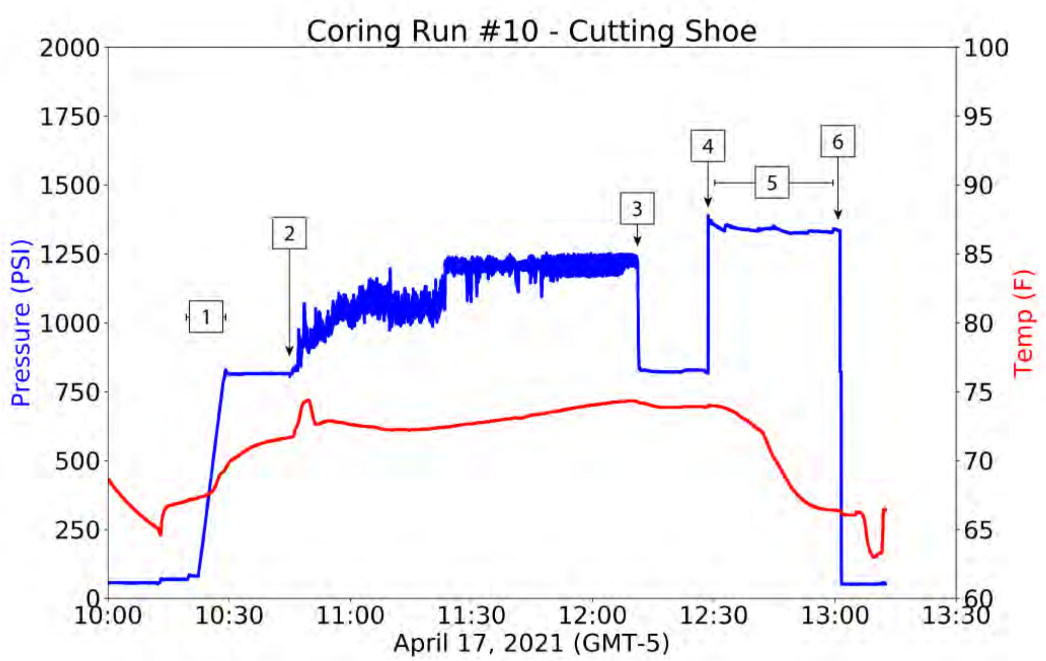

Figure 10. DST data for COK-10CS

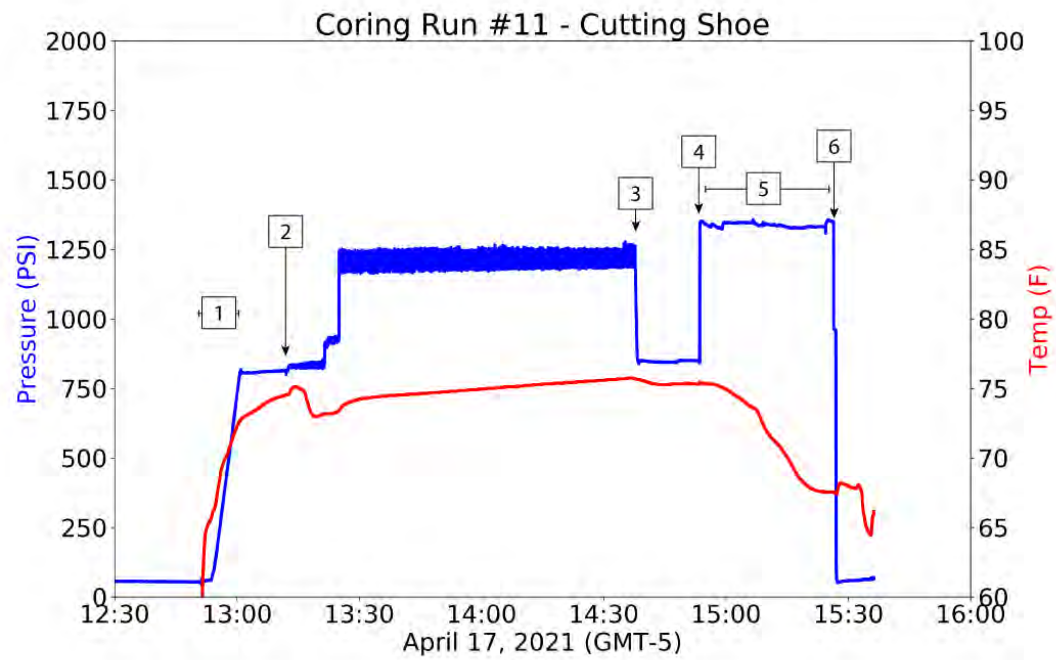

Figure 11. DST data for COK-11CS

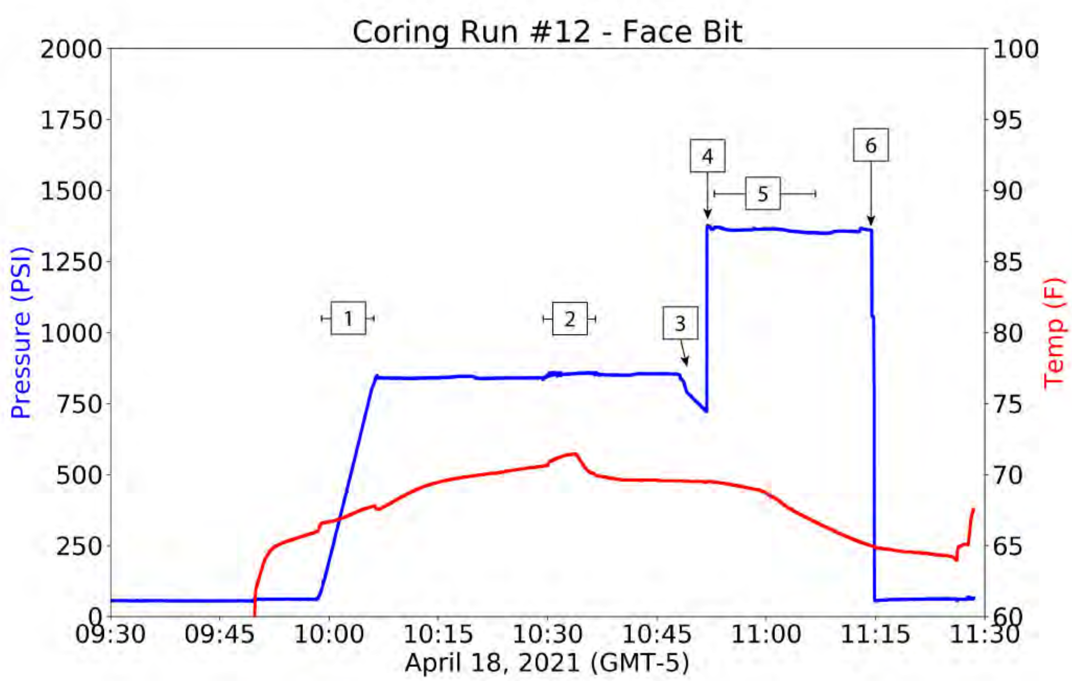

Figure 12. DST data for COK-12FB

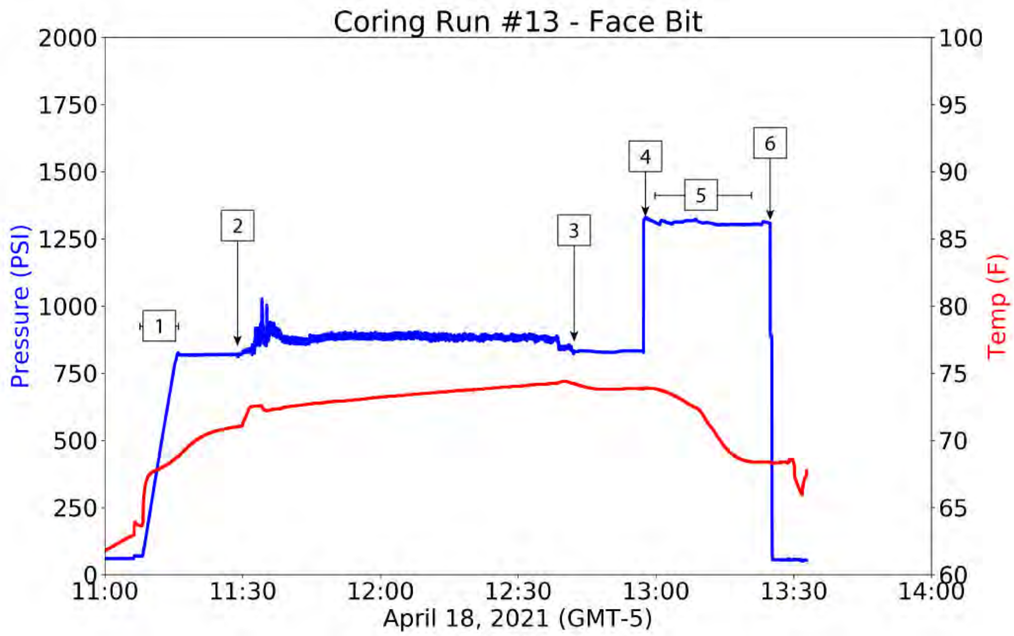

Figure 13. DST data for COK-13FB

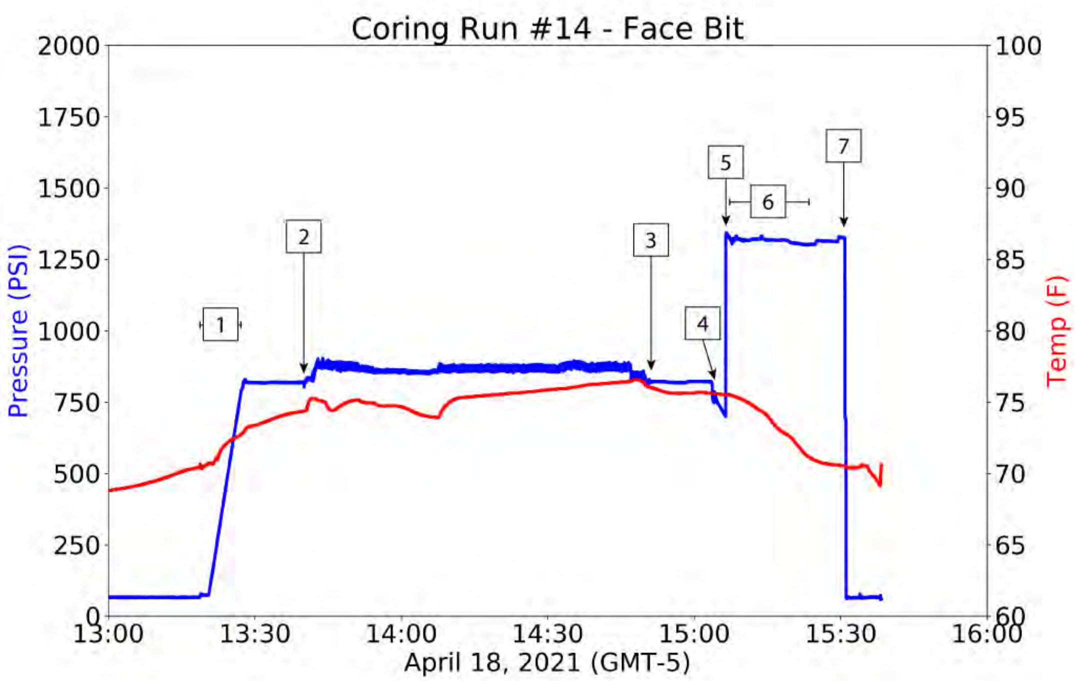

Figure 14. DST data for COK-14FB

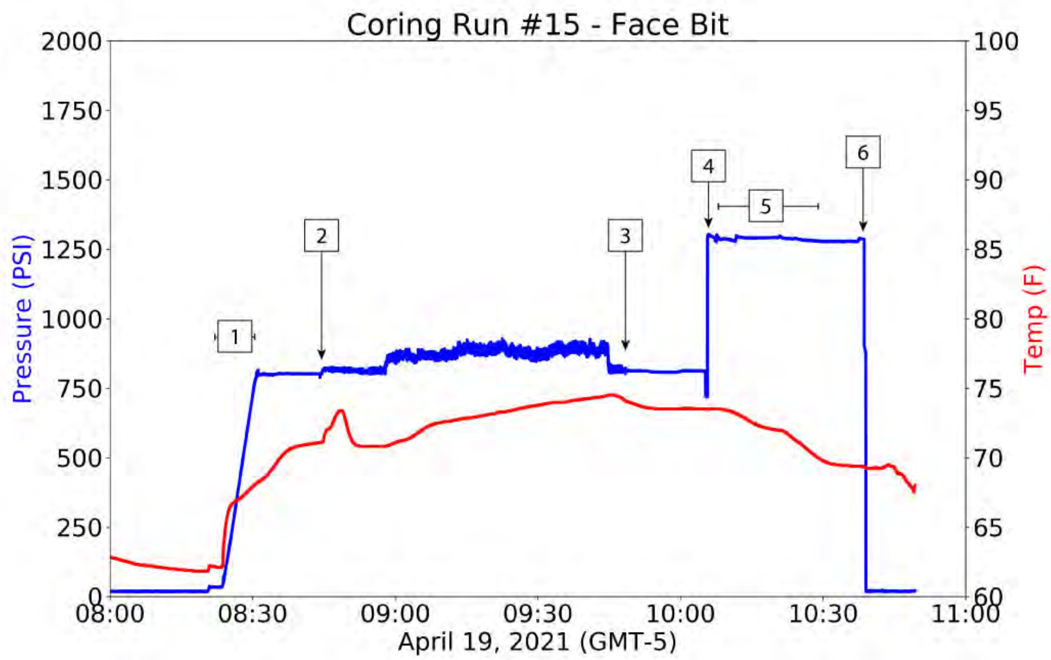

Figure 15. DST data for COK-15FB

Note: There is no DST data for COK-16FB because the DST was damaged during deployment. COK-16FB boosted and sealed successfully.

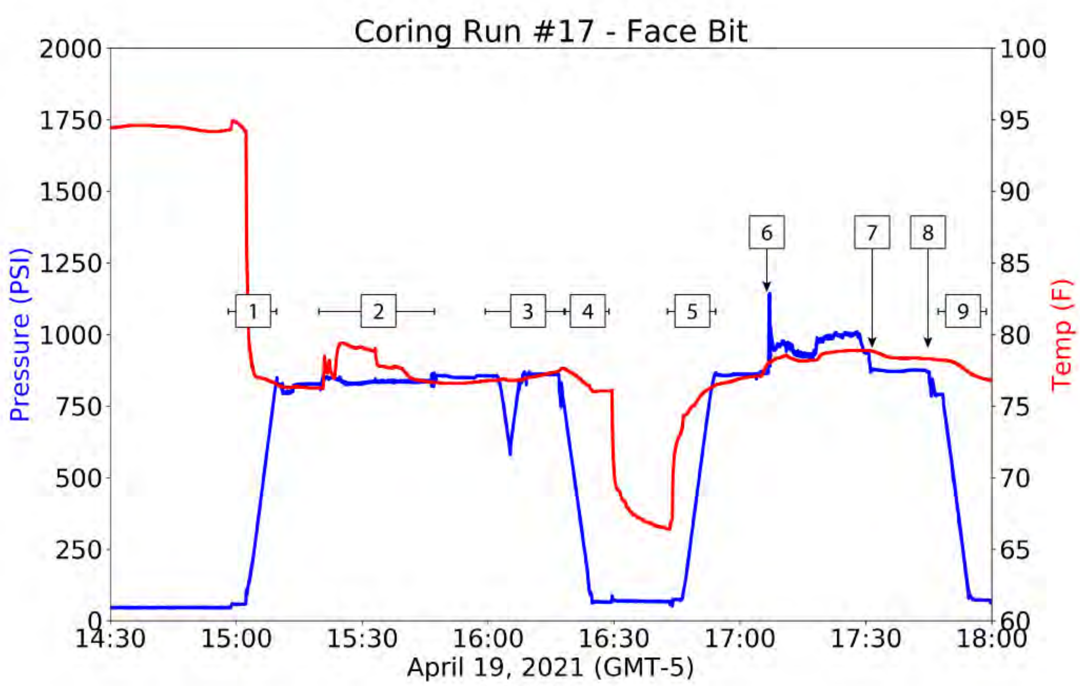

Figure 16. DST data for COK-17FB

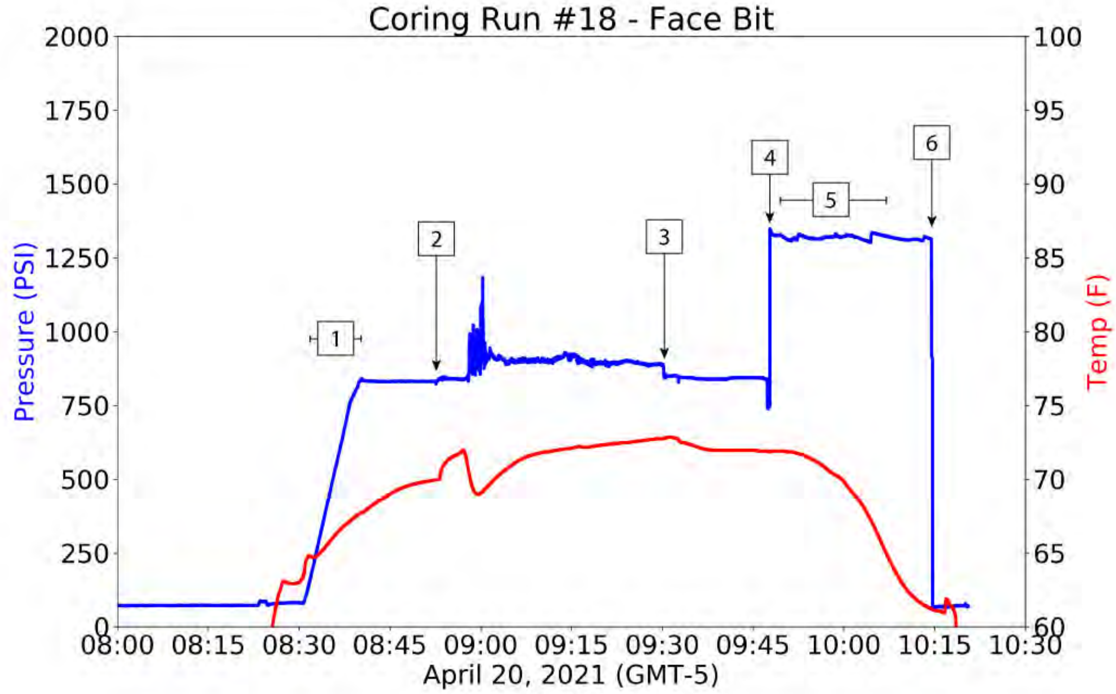

Figure 17. DST data for COK-18FB

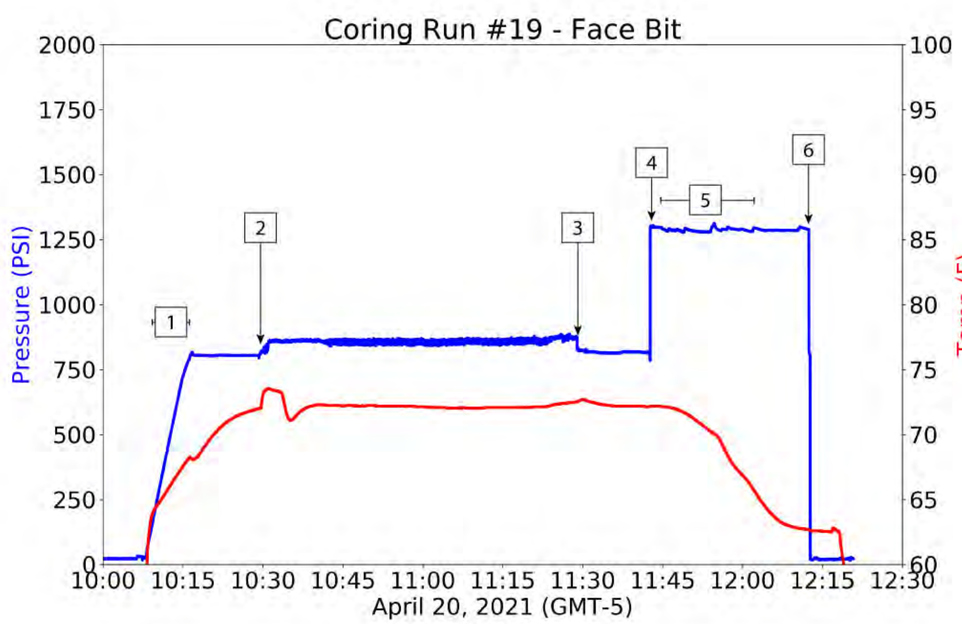

Figure 18. DST data for COK-19FB

PCTB Land Test III 2021 Report

Appendix B: Rig Instrumentation Plots

See Appendix D, Daily Reports, for a detailed discussion of each coring run.

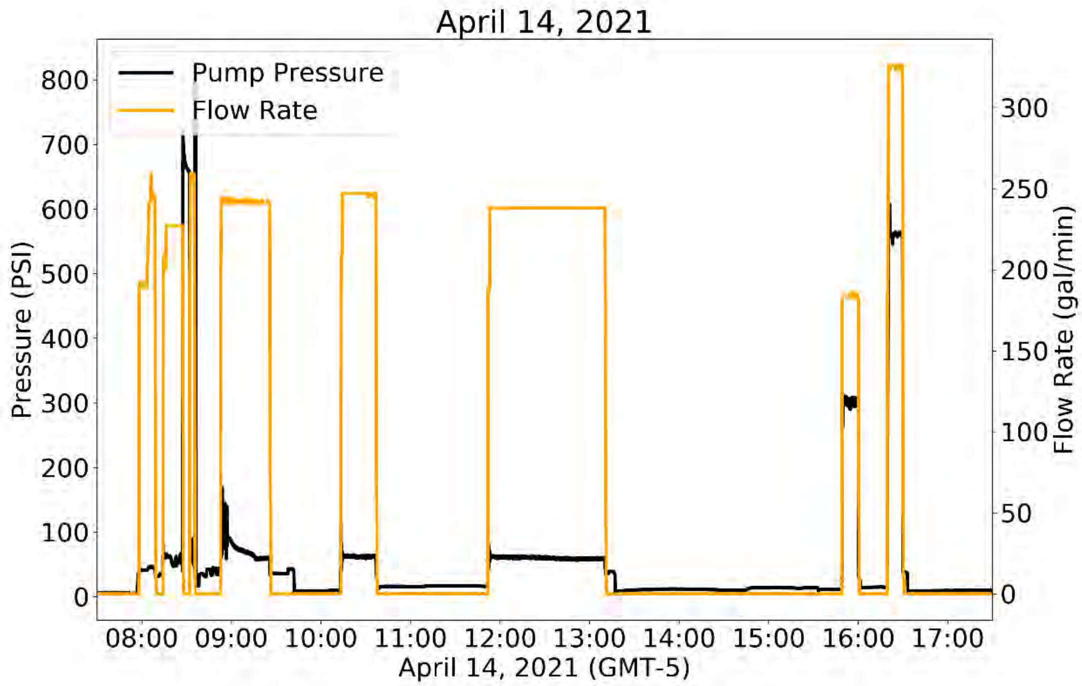

Figure 1. Weight on bit data for 4-14-21.

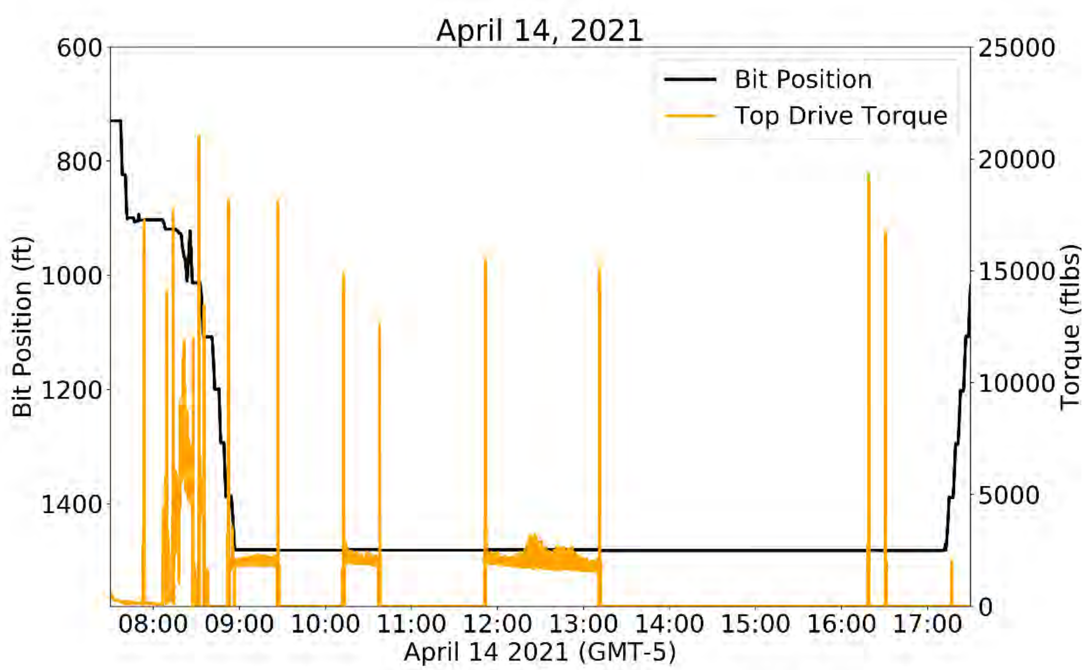

Figure 2. Top drive torque data for 4-14-21.

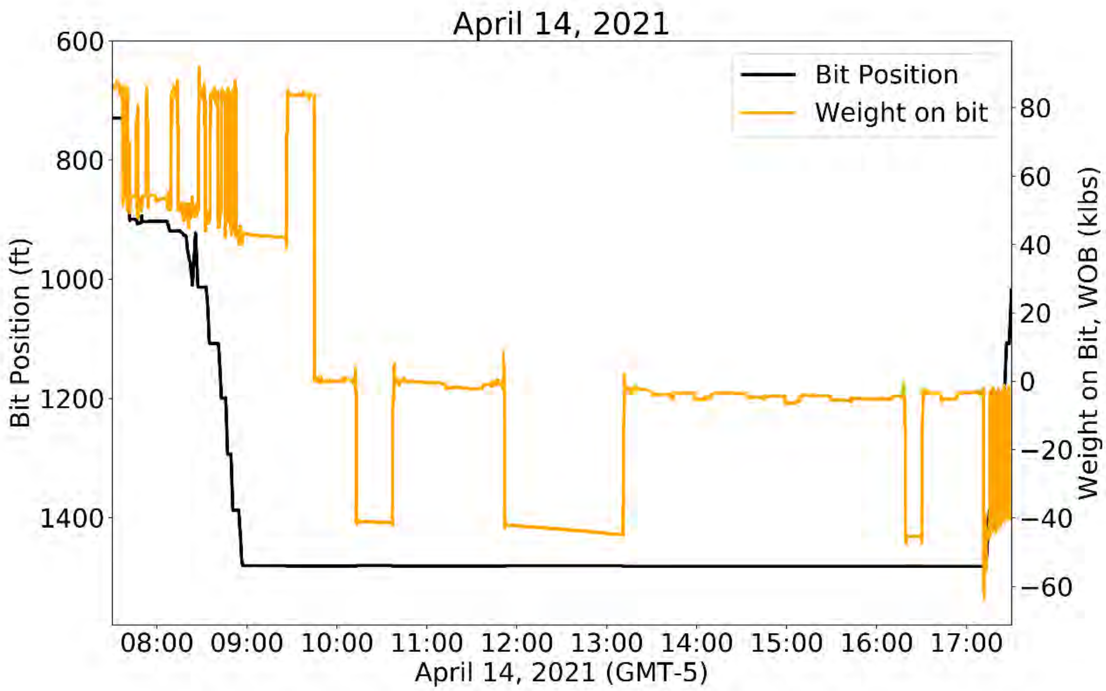

Figure 3. Pump data for 4-14-2021.F

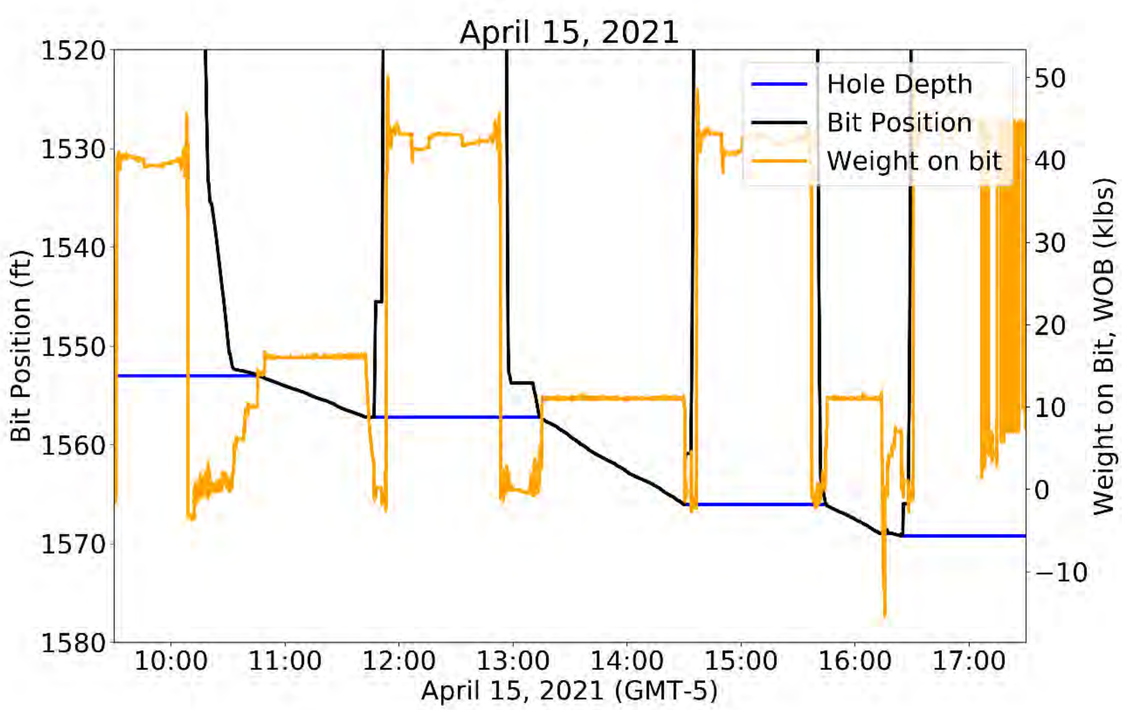

Figure 4. Weight on bit data for 4-15-2021.

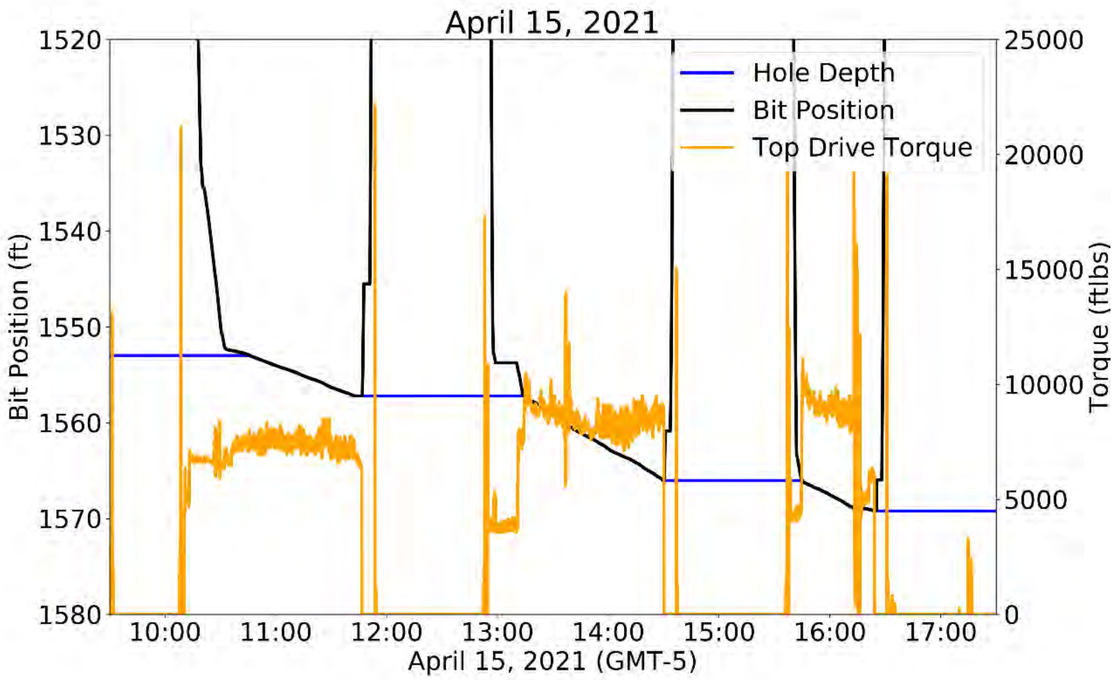

Figure 5. Top drive torque data for 4-15-2021.

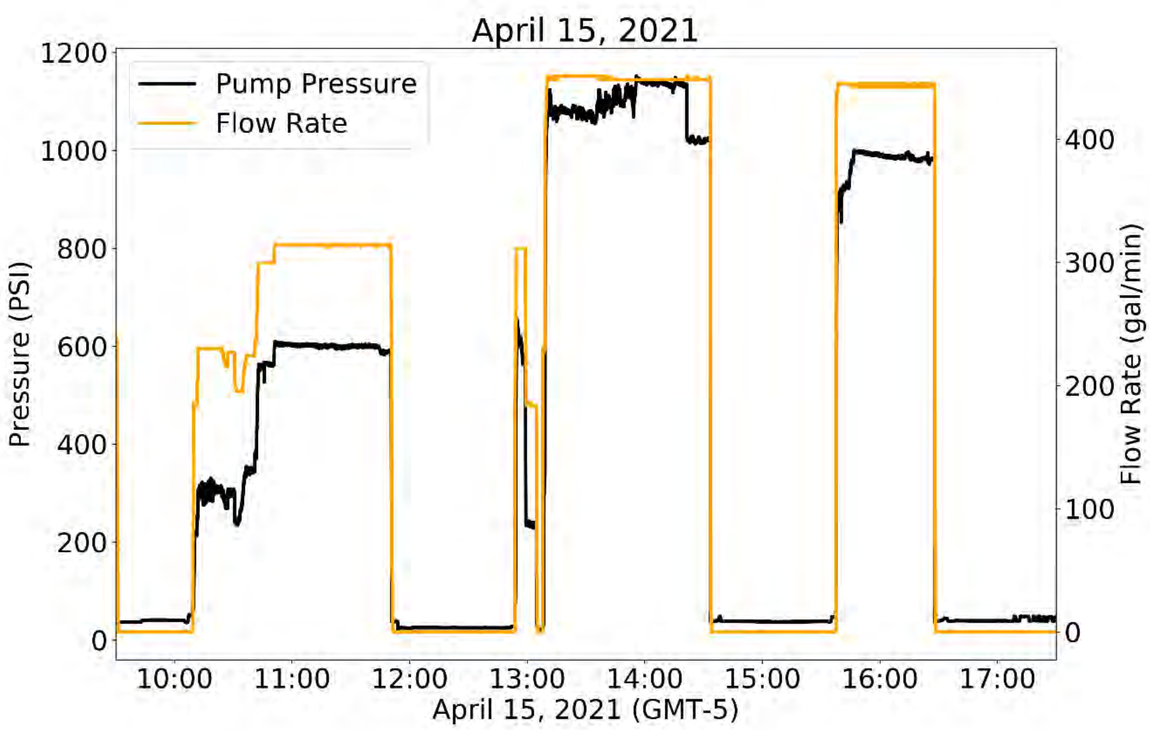

Figure 6. Pump data for 4-15-2021.

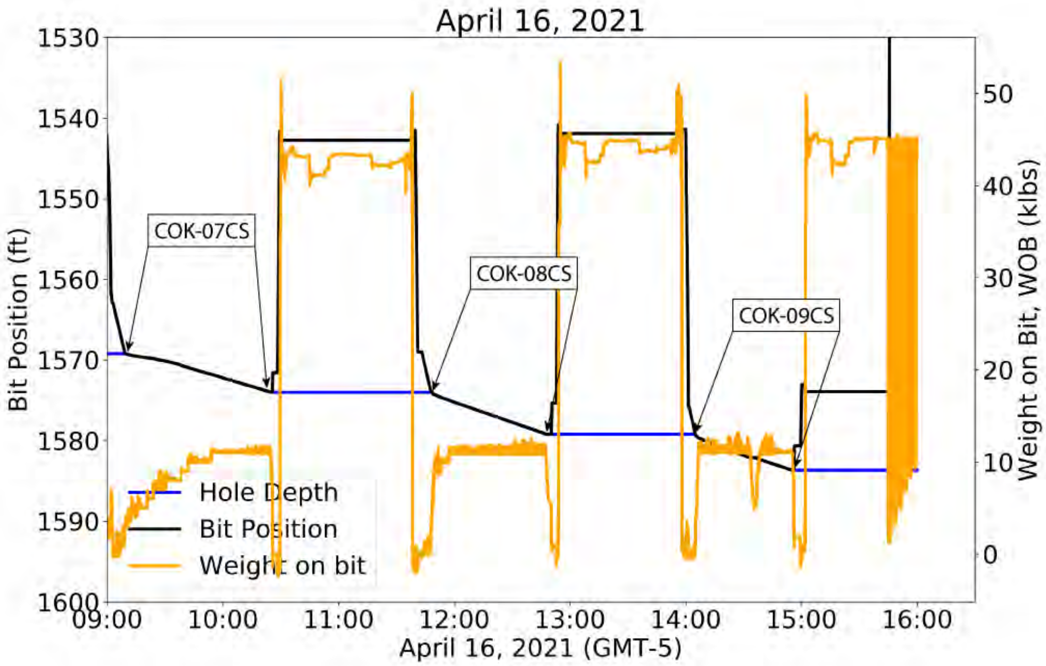

Figure 7. Weight on bit data for 4-16-21.

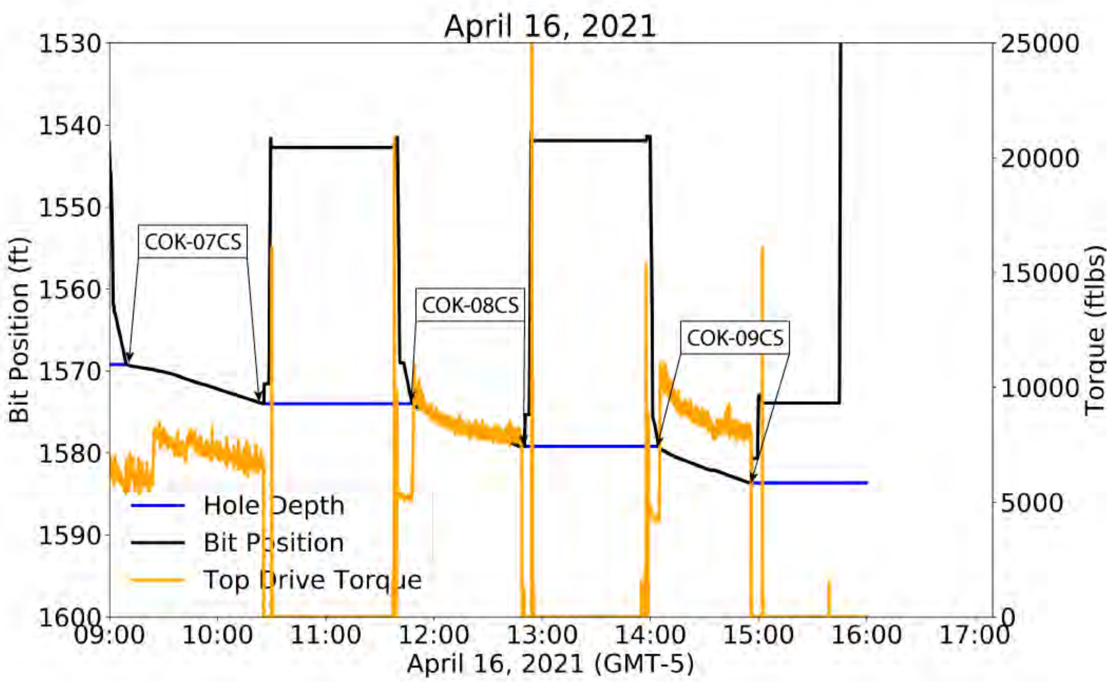

Figure 10. Top drive torque data for 4-16-21.

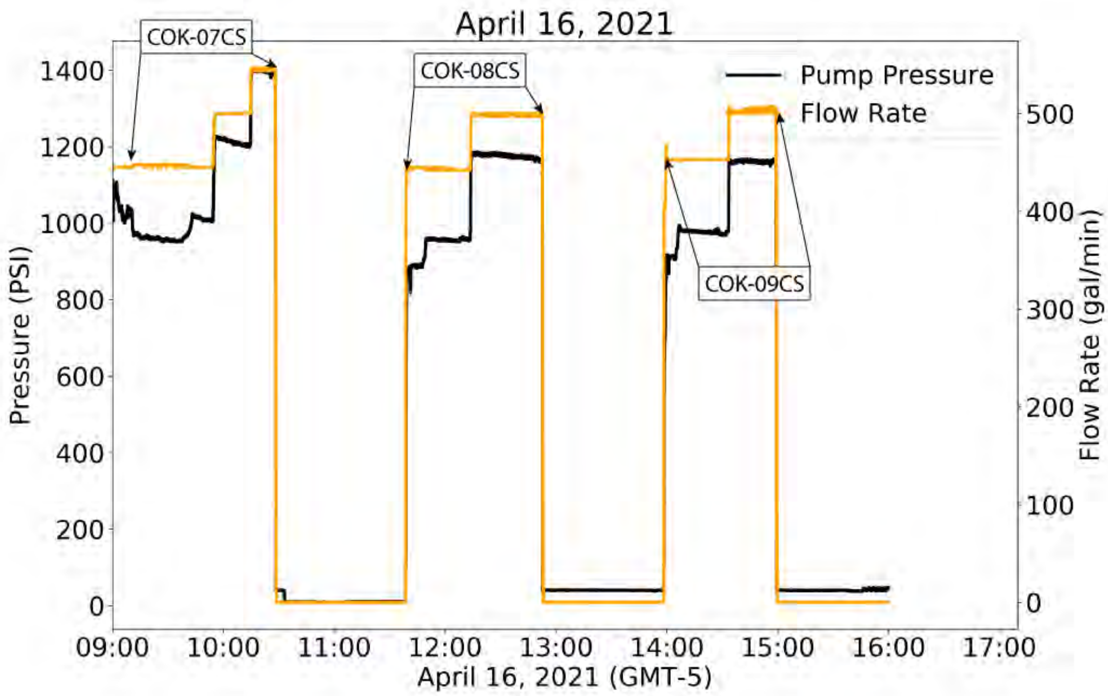

Figure 9. Pump data for 4-16-21.

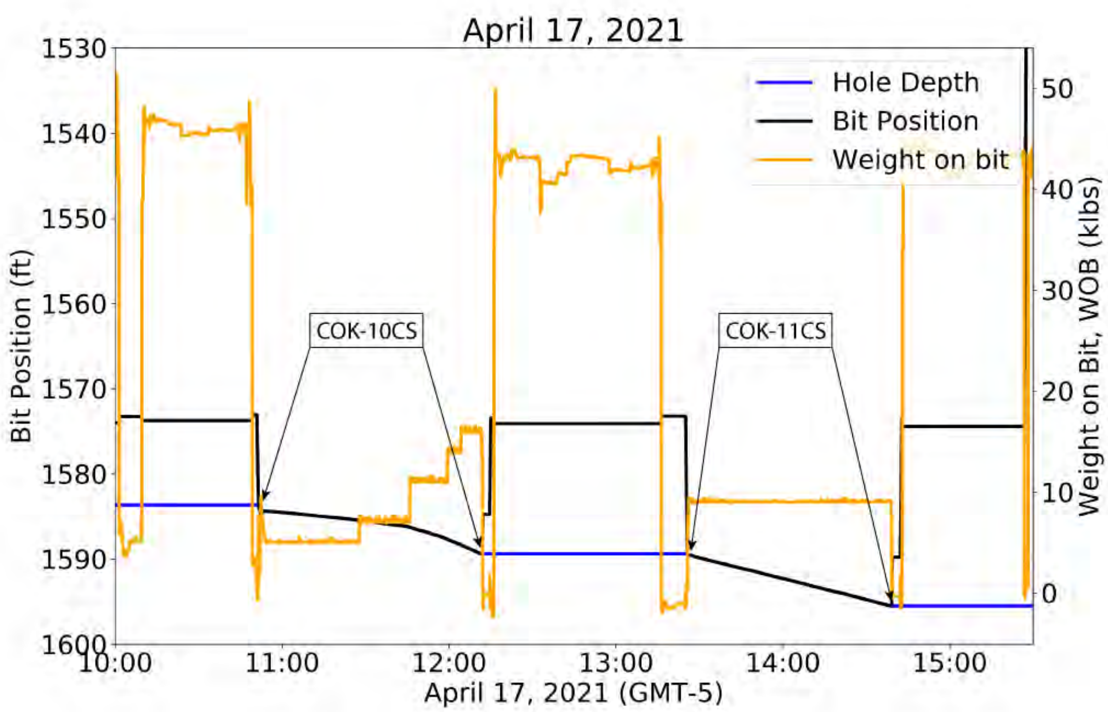

Figure 10. Weight on bit data for 4-17-21.

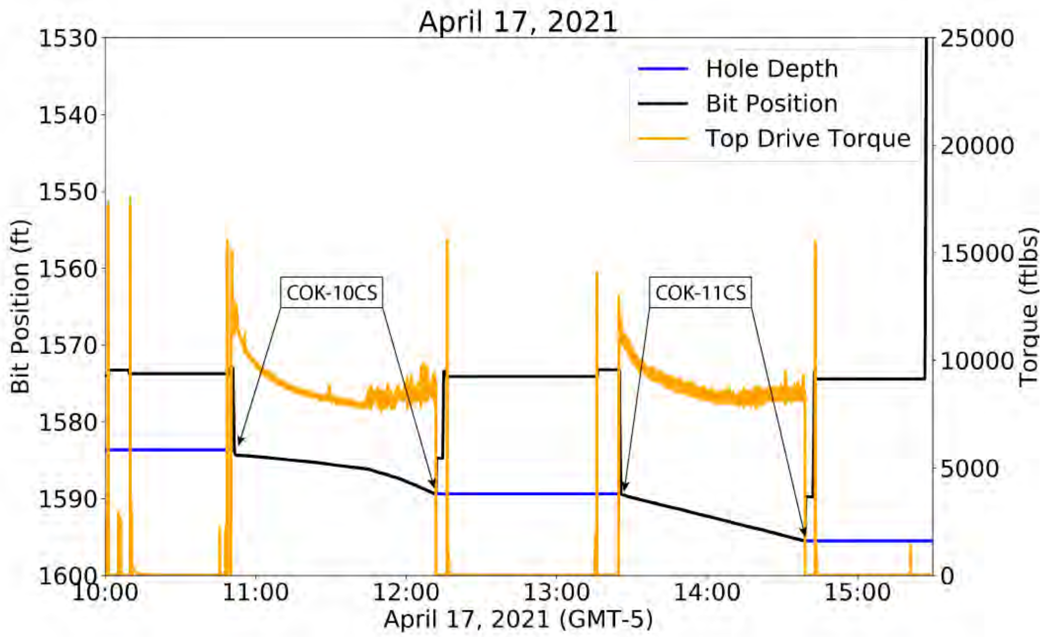

Figure 11. Top drive torque data for 4-17-21.

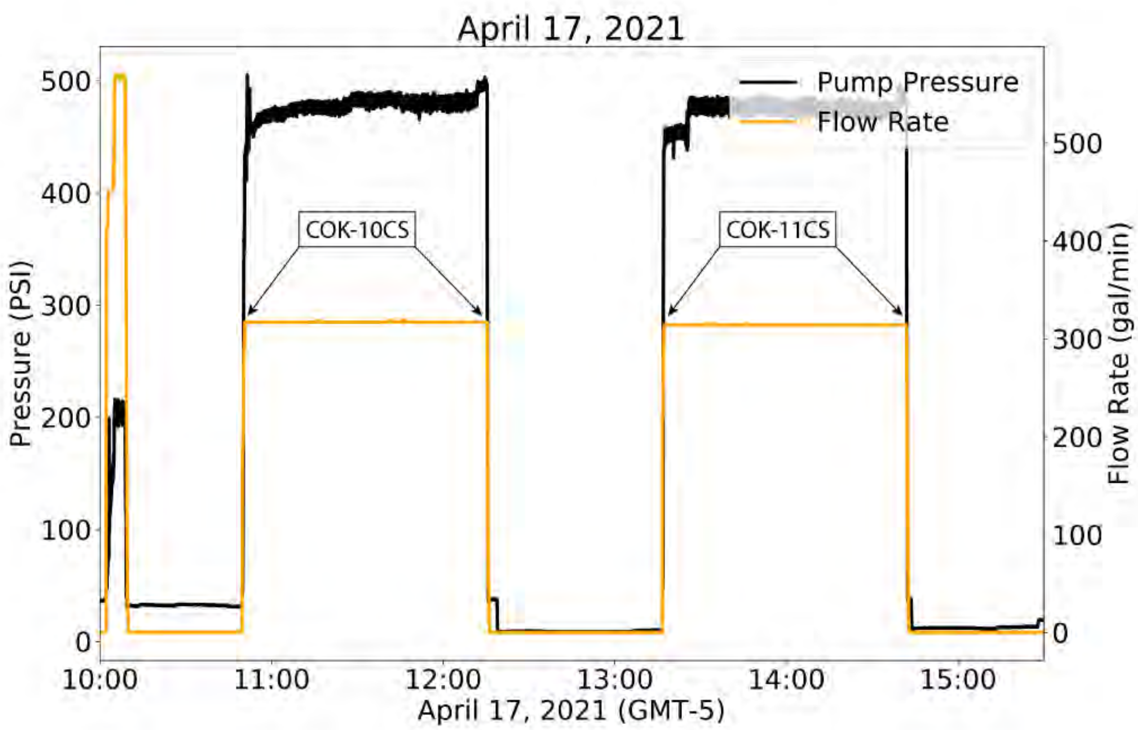

Figure 12. Pump data for 4-17-21.

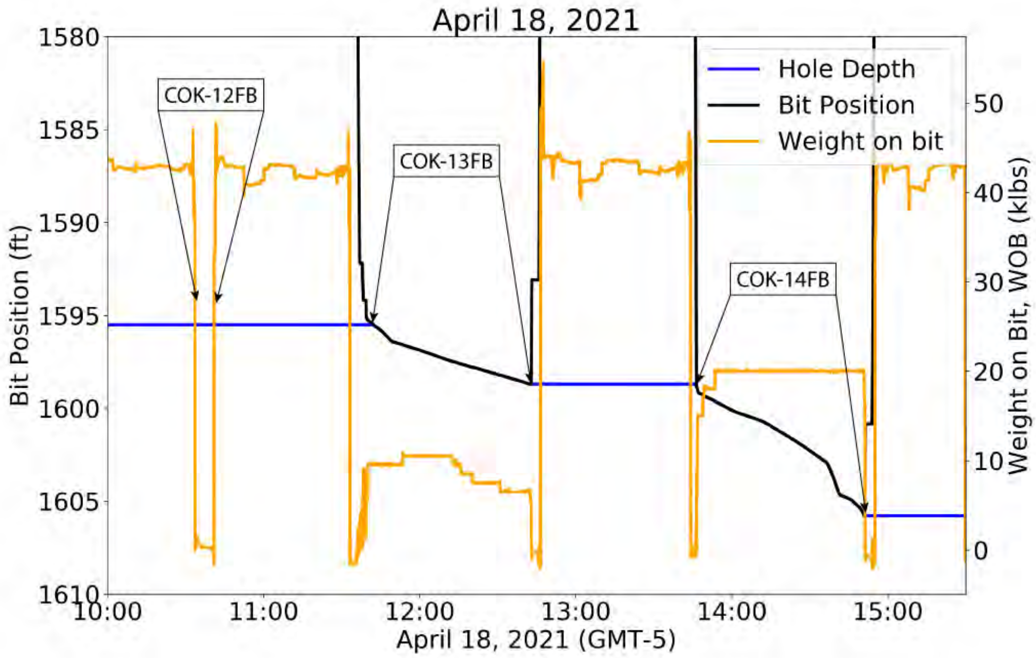

Figure 13. Weight on bit for 4-18-21.

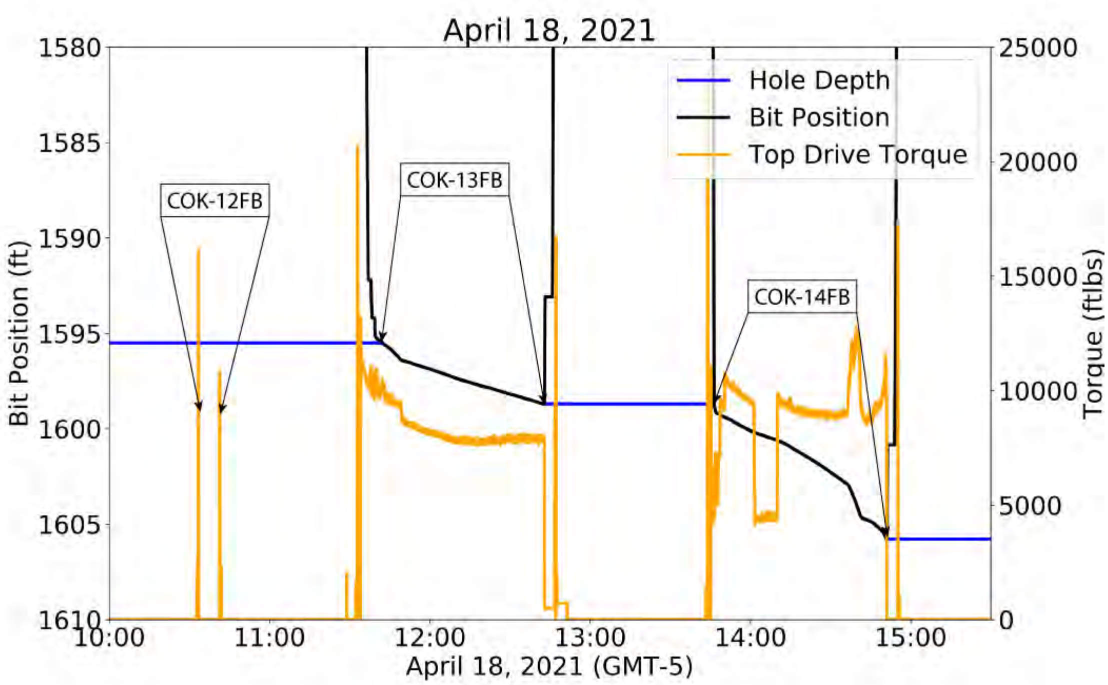

Figure 14. Top drive torque data for 4-18-21.

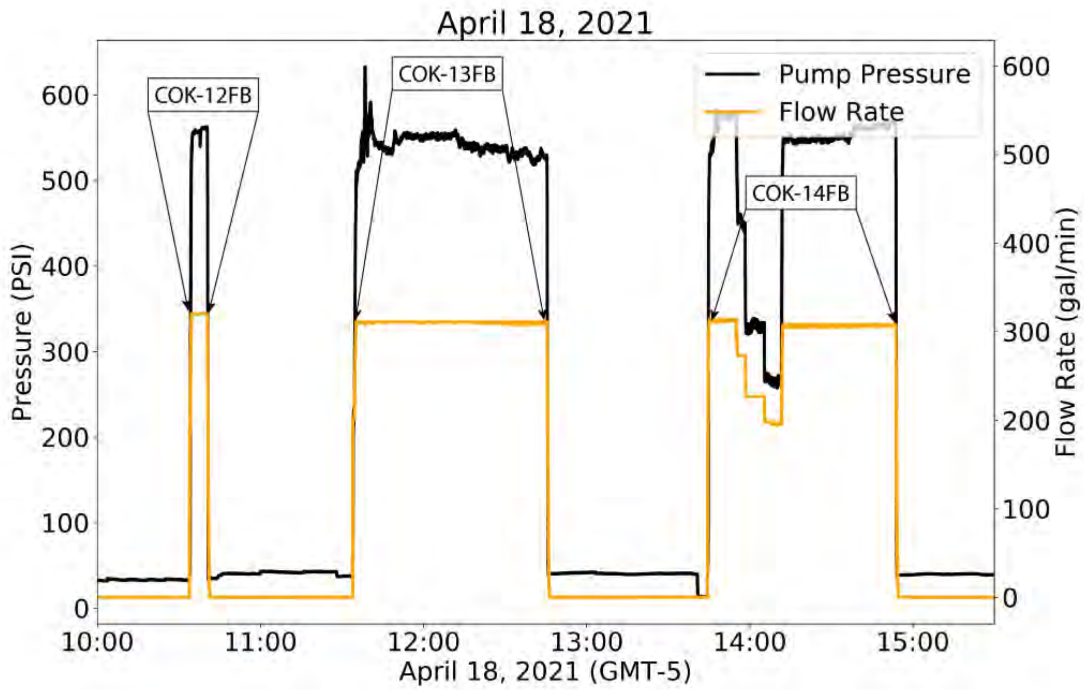

Figure 15. Pump data for 4-18-21.

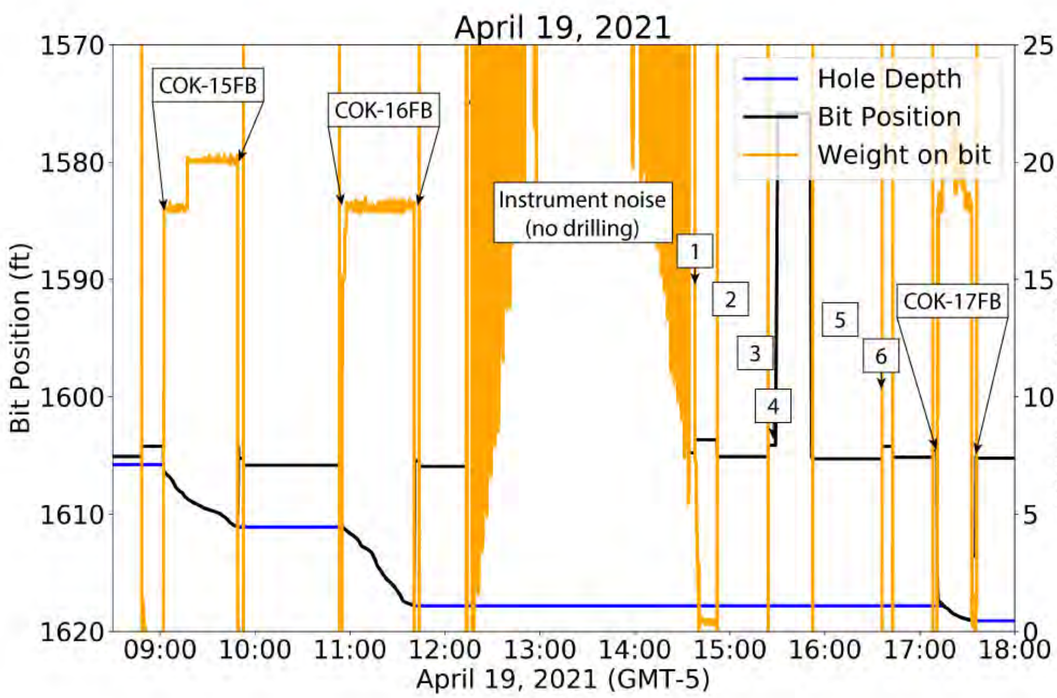

Figure 16. Weight on bit data for 4-19-21.

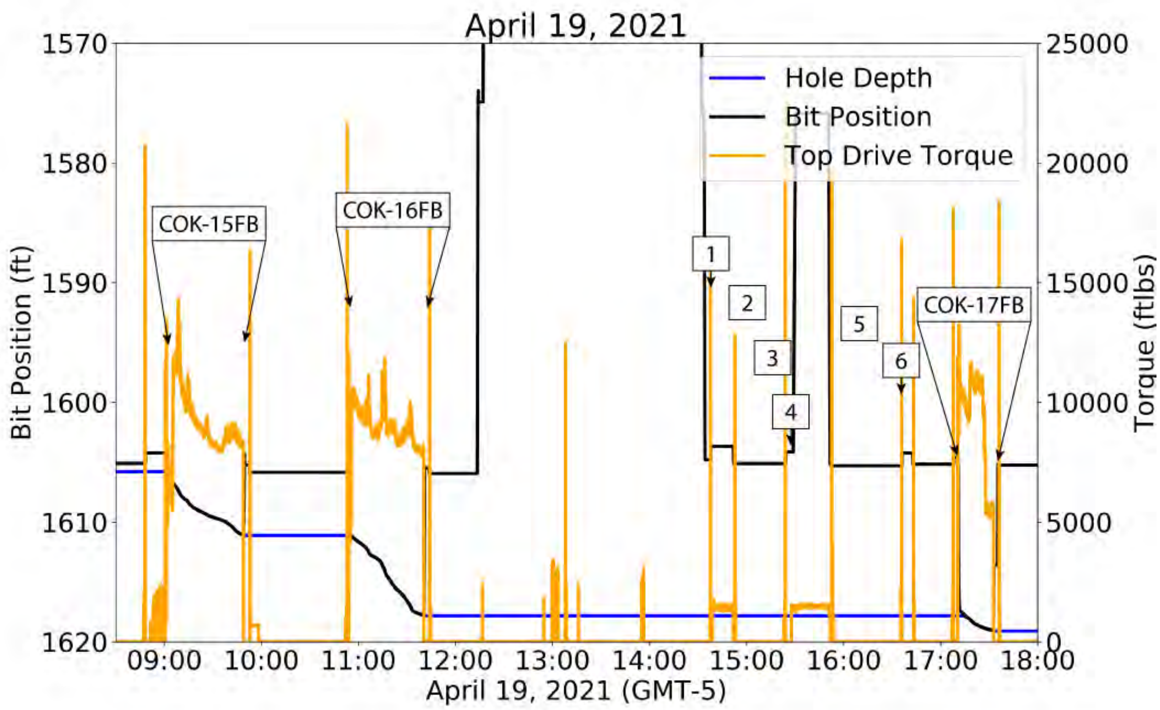

Figure 17. Top drive torque data for 4-19-21.

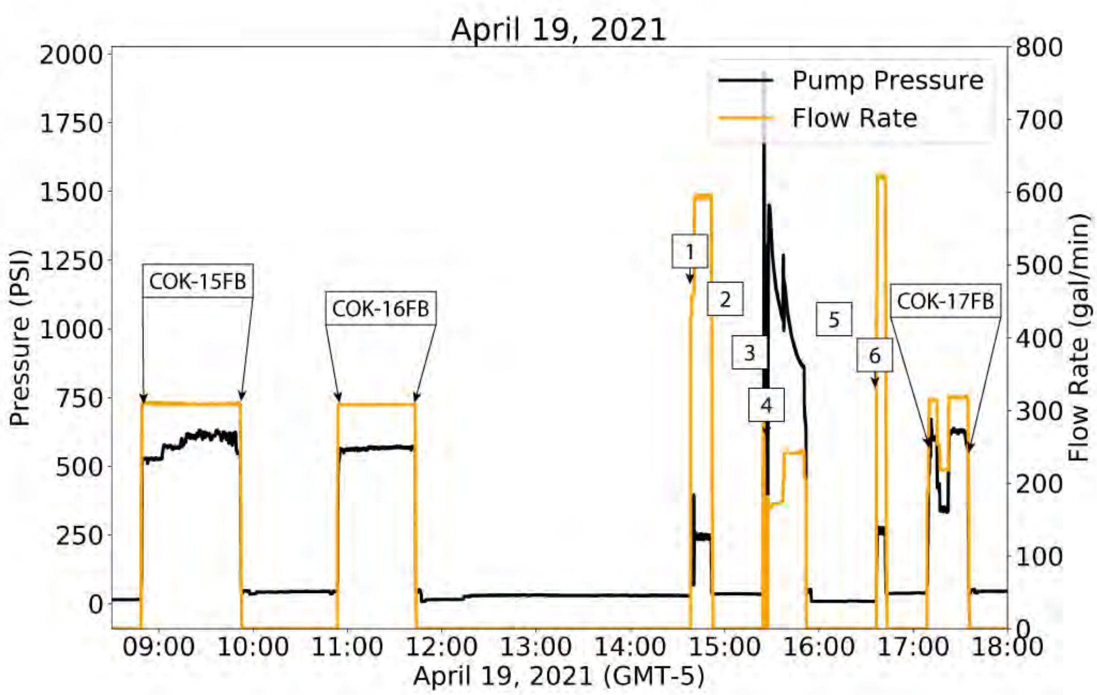

Figure 18. Pump data for 4-19-21.

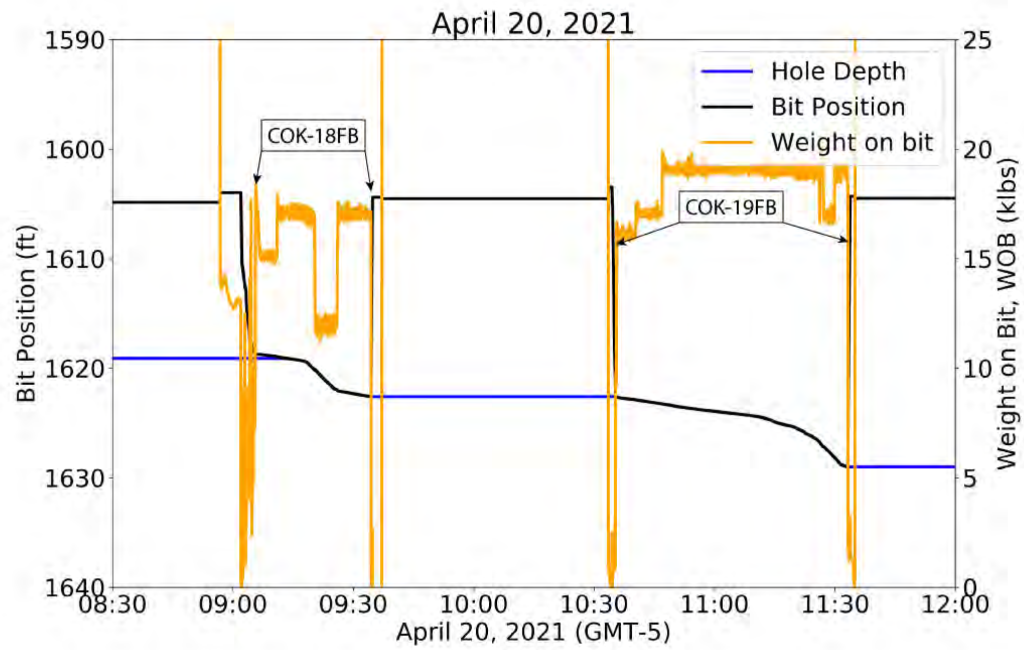

Figure 19. Weight on bit data for 4-20-21.

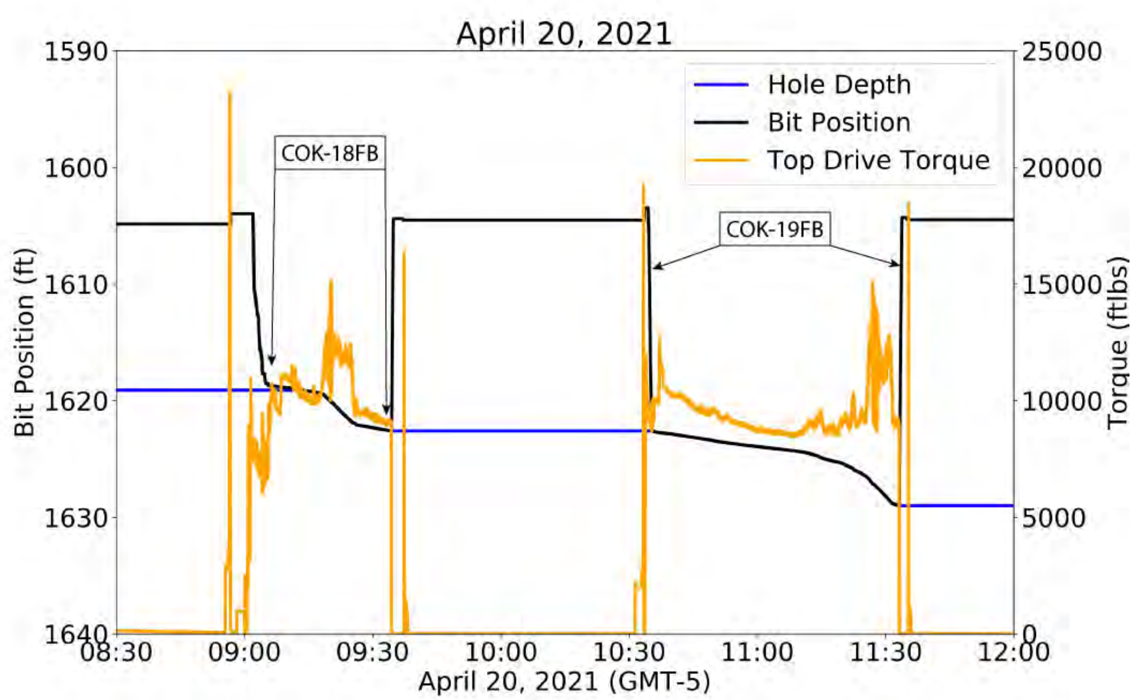

Figure 20. Top drive torque data for 4-20-21.

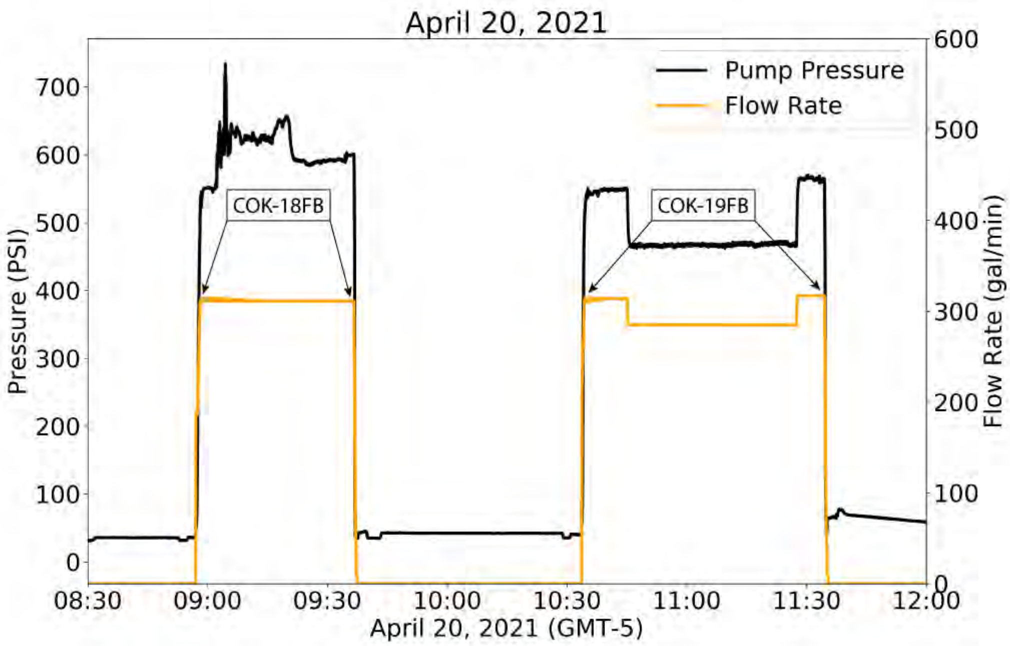

Figure 20. Pump data for 4-20-21.

PCTB Land Test III 2021 Report

Appendix C: Core Photos

Figure 1. COK-04CS

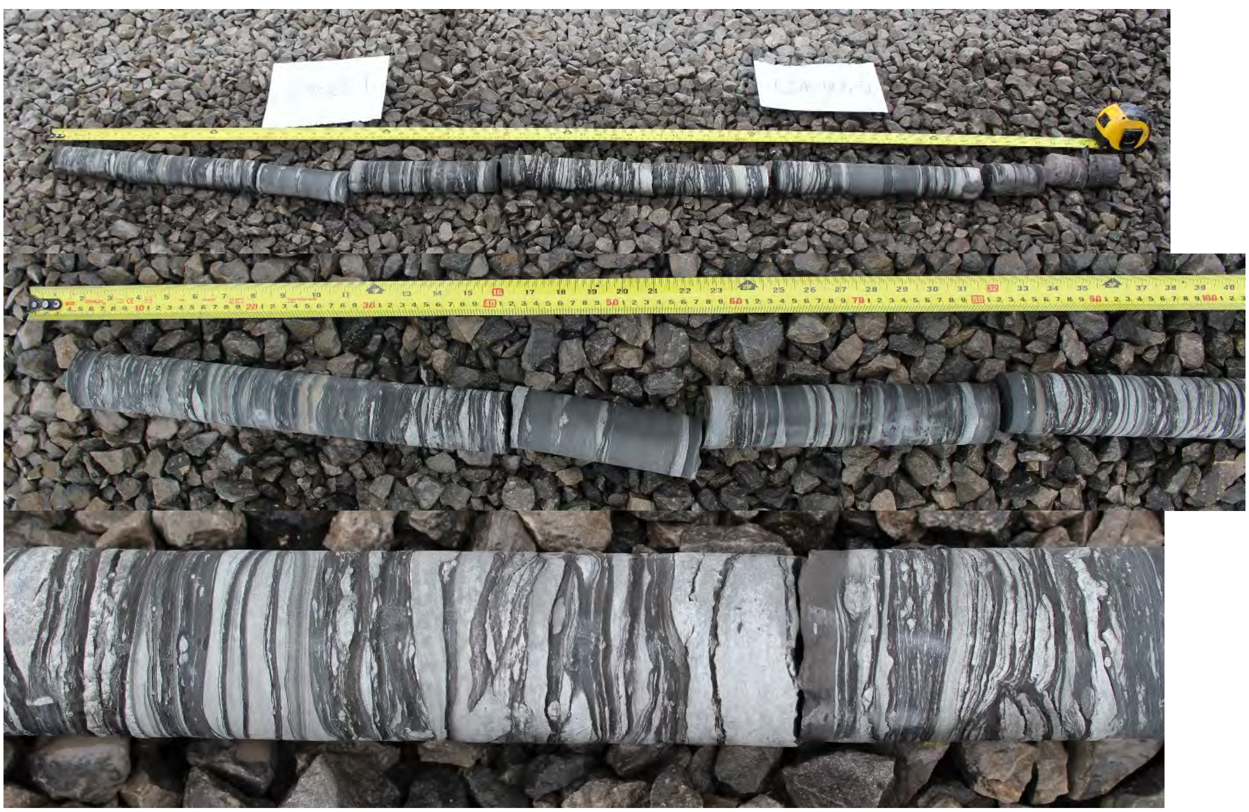
Figure 2. COK-05CS

Figure 3. COK-06CS

Figure 4. COK-08CS

Figure 5. COK-09CS

Figure 6. COK-10CS

Figure 7. COK-11CS

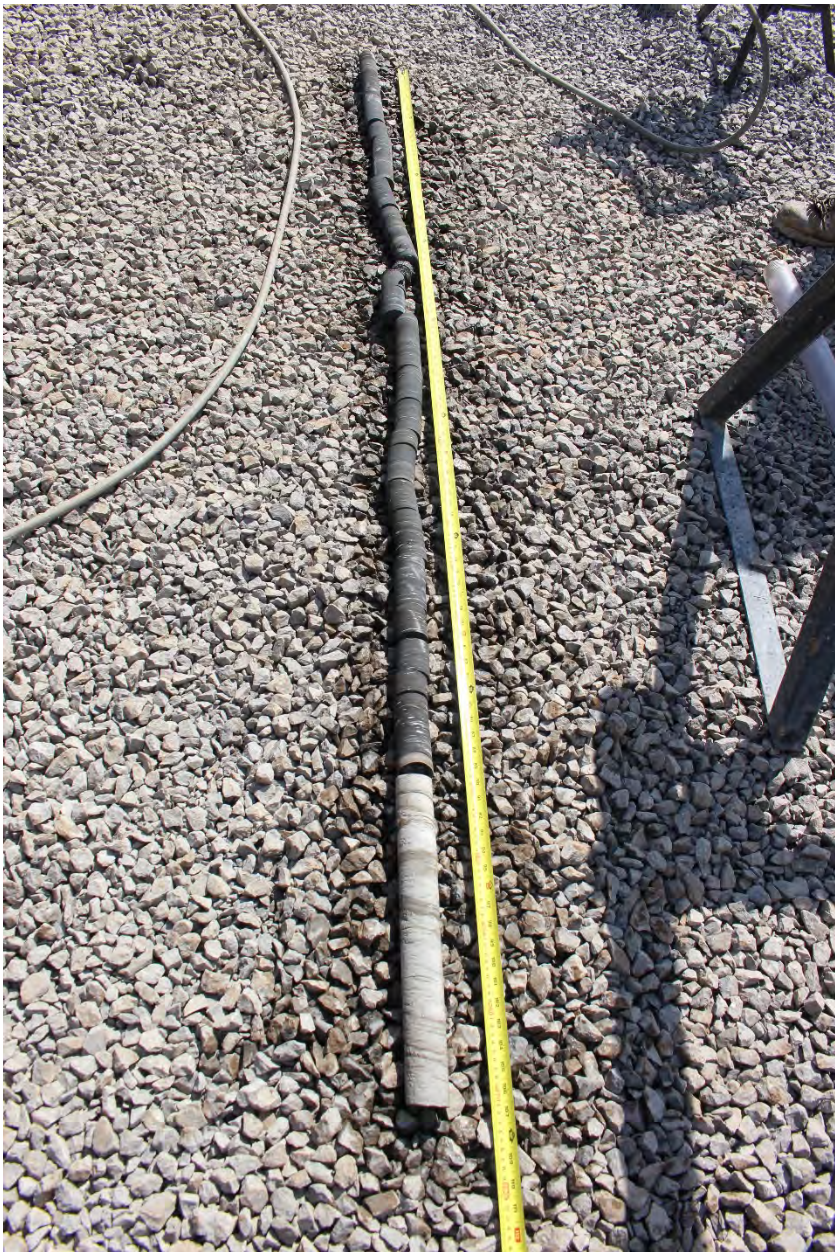
Figure 8. COK-14FB in total. Total core length of 8.9 ft

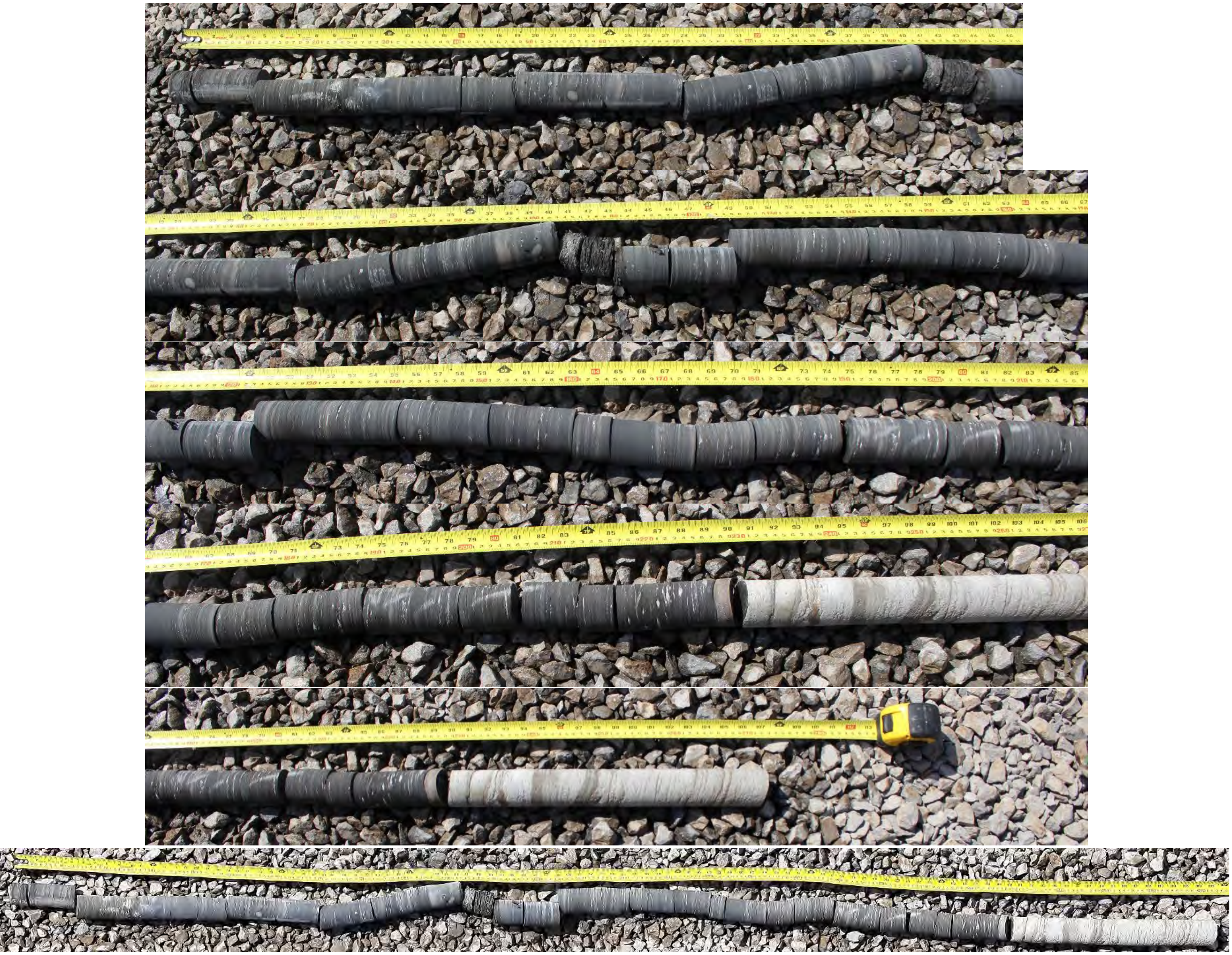

Figure 9. COK-14FB

Figure 10. COK-15FB

Figure 11. COK-16FB

Figure 12. COK-17FB

Figure 13. COK-18FB

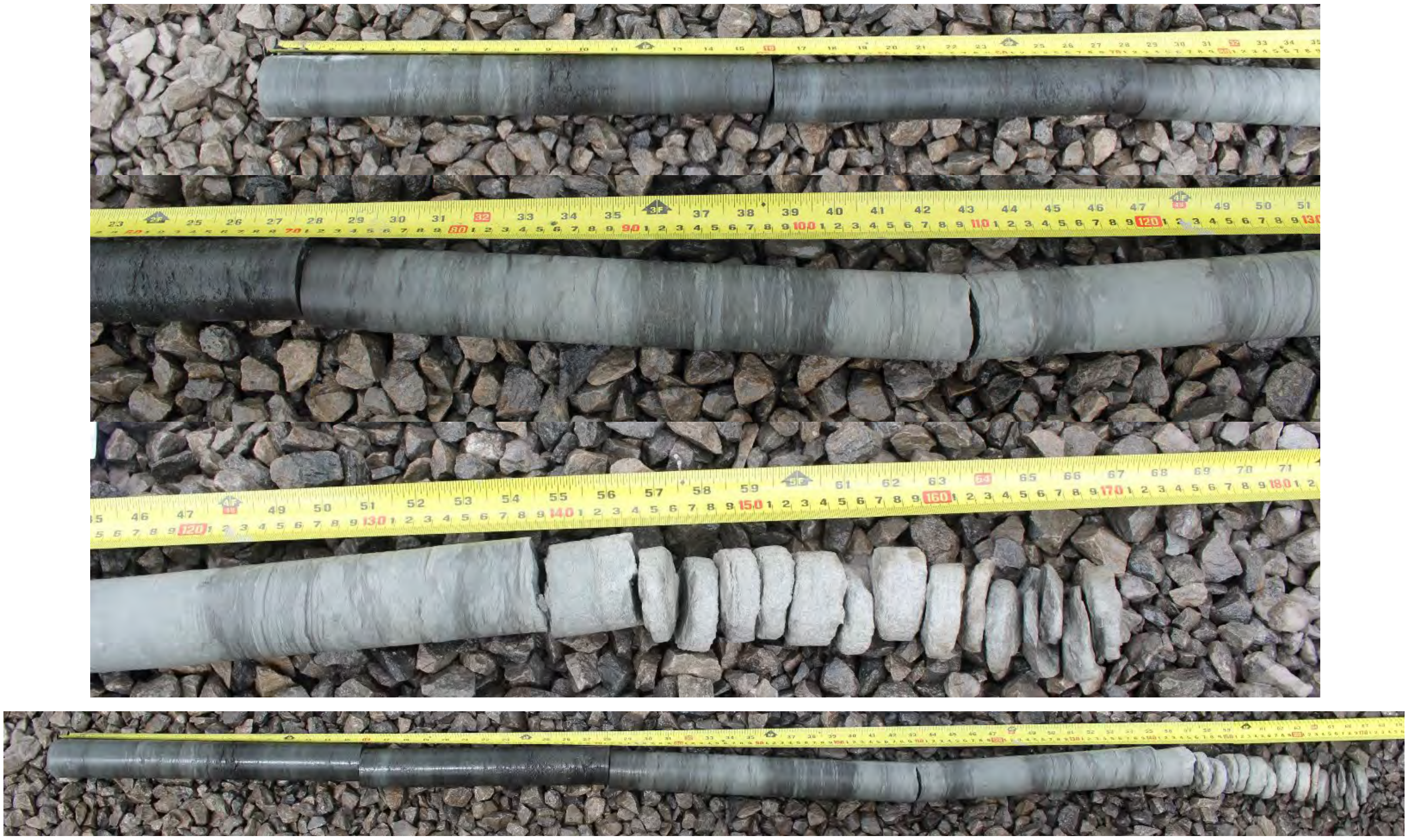

Figure 14. COK-19FB

PCTB Land Test III 2021 Report

Appendix D: Daily Reports

PCTB Land Test 3: Daily Report

Date: Monday, 12 April 2021

Summary: This was the first day of mobilization. The ball valve subassembly was tested in the mud retrieved from the test facility mud pit. 5 of 5 tests were successful.

Structure of Report: Each daily report will include a summary of results, and then two event logs: 1) as recorded by Tom Pettigrew and 2) as recorded by GeoTek Inc.

Pettigrew Report:

0700 All GCI personnel present for sign-in and safety briefing.

0830 Mobile crane on site, begin unloading conexes from trucks and spotting.

1045 Conexes unloaded from trucks and spotted, mobile crane released.

1300 Heavy tools conex unloaded.

All utilities connect to service conex.

Begin assembling PCTB parts for “flip test” (non-pressurized ball valve subassembly test using Lexan test fixture).

1445 Begin flip testing PCTB ball valve sub assembly in mud retrieved from rig pit.

1630 4/4 successful flip tests completed without changing seals.

Notes:

1. CTF – Hole has been drilled out to 1553 ft, 2 ft below existing cement plug.

2. CTF – 200 micron shaker screen installed.

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Daily Progress Report

DPR 1
Date: 2021-04-12
Location: Catoosa Test Facility (CTF), Hallett, Oklahoma
Staff: M. Mimitz, M. Selman, A. Burrows, D. Minarich, J. Mariani, J.P. Riley, C. Sandusky

WEEKEND REVIEW

Geotek Coring staff arrived in Tulsa. All staff underwent rapid testing for COVID-19 and received negative results. The PCTB coring van and heavy BHA van arrived by truck from Salt Lake City. Geotek Coring staff took up residence onsite in the CTF guesthouse and trailer.

2021-04-12

All staff attended morning briefing and orientation at CTF. The PCTB coring and heavy BHA vans were offloaded and landed by crane. All BHA components were removed from the heavy van and staged for assembly. The PCTB coring van was connected to utilities and powered up.

A mud sample from the coring well was obtained and used to submerge the ball valve for function testing. A battery of five ball valve function tests were performed with full immediate closure in each instance.

The PCTB upper sections were assembled and inspected. A pressure washing area was set up for tool cleaning; the dirt staging area outside the coring van is becoming very muddy. CTF staff have arranged to have a load of gravel delivered tomorrow to mitigate the mud.

PCTB Land Test 3: Daily Report

Date: Tuesday, 13 April 2021

Summary: The day was dedicated to preparing for downhole tests on Wed. 4/14/2021. Drill pipe was made up and stood back in the derrick. The BHA (bottom hole assembly) was made up. The PCTB (pressure coring tool with ball) was spaced out. The PCTB was dry-fired on the rig floor and successfully sealed. The BHA was run in the hole to the casing shoe.

Structure of Report: Each daily report will include a summary of results, and then two event logs: 1) as recorded by Tom Pettigrew and 2) as recorded by GeoTek Inc.

Pettigrew Report:

0700 Sign in, safety meeting.

1000 2nd truck unloaded of drill pipe, 80 joints total.

1230 Making up ~1500 ft of drill pipe in triples and standing back in derrick.

Pressure test PCTB assemblies.

1400 Make up BHA and stand back in derrick.

Make up outer core barrel assembly.

1500 Spacing out PCTB.

Dry fire – complete ball closure.

Run in the hole to casing shoe for the night.

Assemble 2x PCTBs for morning deployment.

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Daily Progress Report

DPR 2
Date: 2021-04-13
Location: Catoosa Test Facility (CTF), Hallett, Oklahoma
Staff: M. Mimitz, M. Selman, A. Burrows, D. Minarich, J. Mariani, J.P. Riley, C. Sandusky

Drill pipe was delivered and unloaded mid-morning. Pipe was moved to the drill floor, made up into stands of three (Triples), and racked into the derrick. BHA components were hoisted to the drill floor and assembled.

PCTB cutting shoe space-out was completed and the tool was actuated in the BHA while suspended in the slips. The tool functioned as intended in dry actuation and was removed to the coring service unit for rebuild.

Drill collars were hoisted to the drill floor, assembled to the BHA, and run into the hole, after which drill pipe was tripped in to a depth of 729 ft., the approximate depth of the well casing.

The wireline service operators arrived, given an initial safety briefing, and taken to the drill floor to plan the wireline installation. Wireline configuration and crossovers were confirmed and initial rig-up will take place tomorrow morning.

PCTB Land Test 3: Daily Report

Date: Wednesday, 14 April 2021

Structure of Report: Each daily report will include a summary of results, and then two event logs: 1) as recorded by Tom Pettigrew and 2) as recorded by GeoTek Inc.

Summary: The wireline arrived and was rigged up. The PCTB was deployed for three 'mud' tests where the tool was actuated while hanging in the borehole (no drilling/coring). The first 2 tests were run without circulation. The third test was run while circulating. The PCTB successfully sealed during all three tests.

Core Results:

Coring Test 1: No core was taken (mud core). The PCTB sealed successfully.

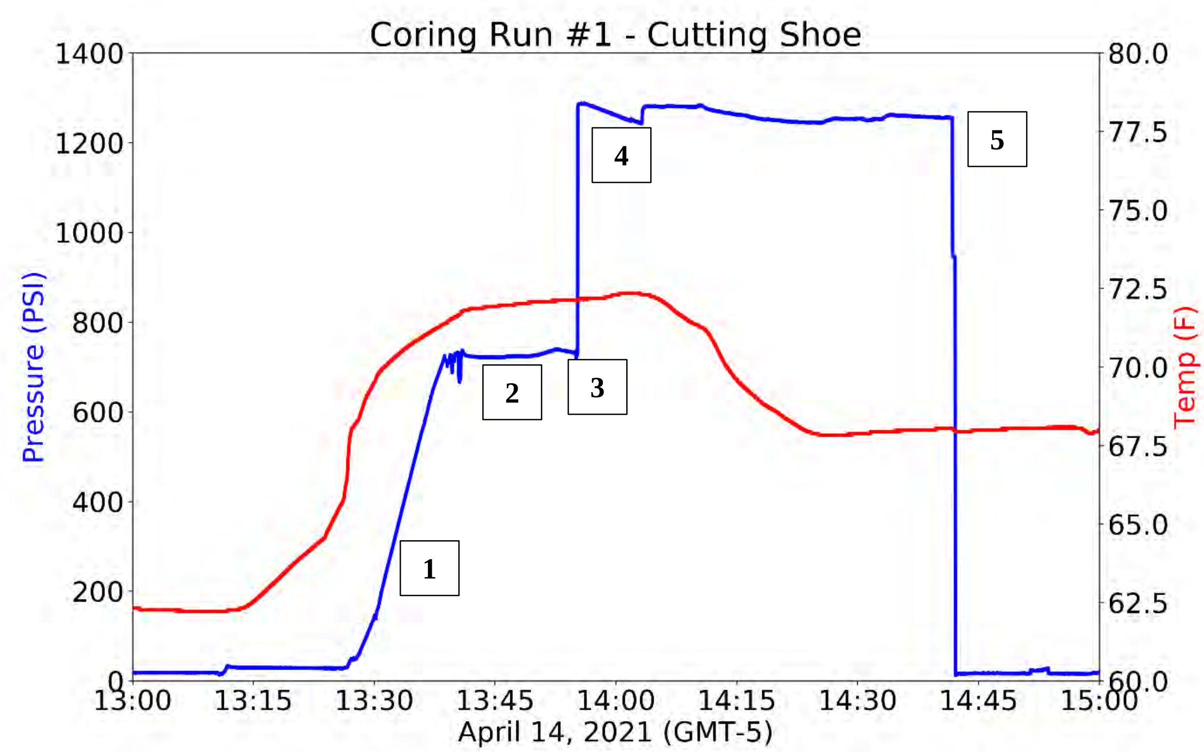

Figure 1: **Coring Test 1 (COK-01CS).** DST pressure and temperature data. This was a water core with no circulation. Summary of events: **1:** Tool lowered down hole to 1400 ft.; **2:** PCTB latched into BHA at 1400 ft. **3:** Inner core barrel retrieved, ball valve seals, and pressure boost is preserved; **4:** Pressure held as tool is removed from hole. **5:** Depressurized in lab.

Coring Test 2: No core was taken (mud core). The PCTB was sealed successfully.

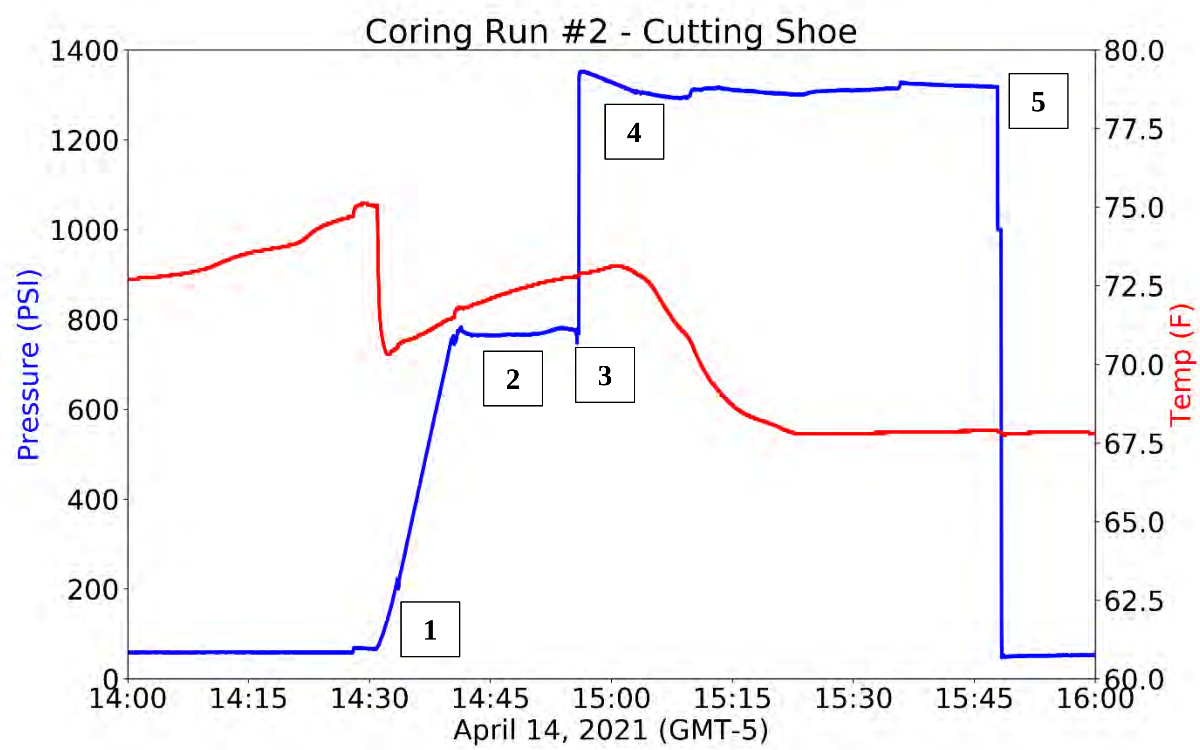

Figure 2: **Coring Test 2 (COK-02CS).** DST pressure and temperature data. Water core (no core taken), no circulation. **1:** Inner core barrel lowered down hole to latch into BHA at 1400 ft. **2:** PCTB at BHA while running tool is recovered and pulling tool is deployed. **3:** PCTB is actuated. **4:** Inner core barrel is removed from hole. **5:** Depressurized in lab.

Coring Test 3 (COK-03CS): No core was taken (water core). The objective of Test 3 was to confirm PCTB would seal in downhole conditions after pumping mud at 300 GPM to replicate drilling conditions. The PCTB sealed successfully.

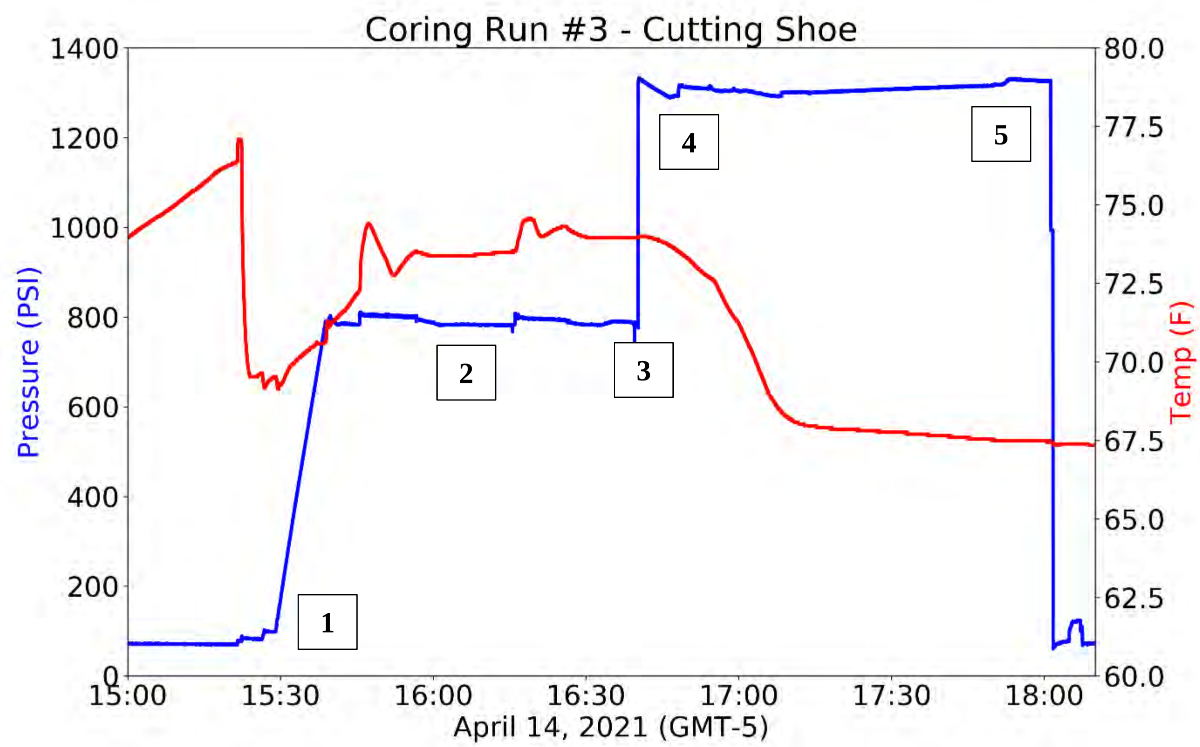

Figure 3: **Coring Test 3 (COK-03CS):** DST pressure and temperature data, no core taken (water core) dynamic fluid with pump flow for ten minutes at 300 GPM. **1:** Inner core barrel lowered down hole to latch into BHA; **2:** PCTB at BHA while running tool is recovered and pulling tool is deployed. **3:** PCTB is actuated. **4:** Inner core barrel is removed from hole. **5:** Depressurized in lab.**1**.

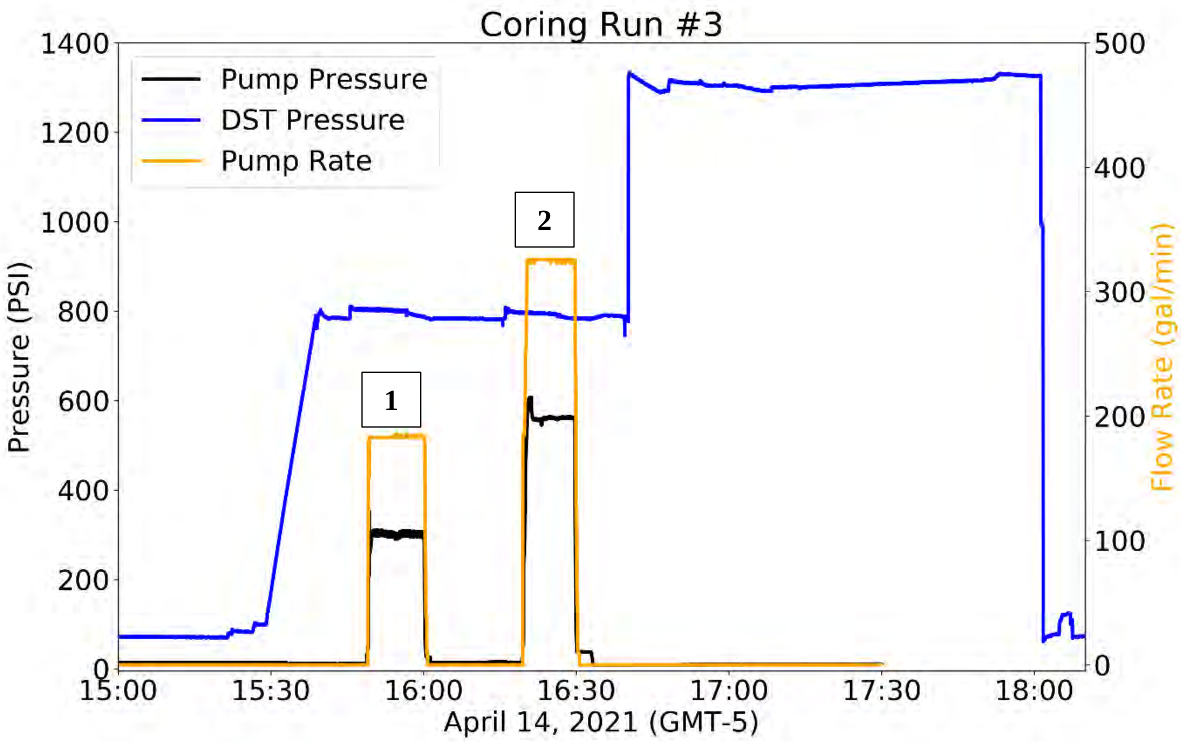

Figure 4: **Coring Test 3 (COK-03CS):** DST pressure, and rig instrumentation (pressure and flow rate). **1:** circulation while the inner core barrel was hung on the wireline (180 GPM). **2:** circulation while the inner core barrel was locked into the BHA (315 GPM). The pressure boost is clearly recorded, and pressure was maintained as the PCTB was brought to the surface.

Pettigrew Report:

0700 Sign in and safety briefing.

0745 RIH from casing shoe to near TD at 1553 ft.

Tight hole at ~923 ft.

Reaming and cleaning hole.

1000 Drill pipe hung off at ~1493 ft.

Rigging up wireline.

Problem with wireline sheave.

Remove sheave to onsite machine shop for repair.

1030 Back to rigging up wireline.

1115 RIH with #1 PCTB-CS water core.

Problem with wireline winch slipping while lowering.

1145 POOH and rig down wireline unit in preparation for replacement unit.

1300 Replacement wireline unit arrive.

Rigging up wireline.

RIH with #1 PCTB-CS water core

Actuate PCTB, POOH.

Ball closed, trapped pressure ~1174 psi, calculated hydrostatic pressure ~680 psi, release overpull ~600 lbs., good run.

1510 #2 PCTB-CS water core on deck.

Ball closed, trapped pressure ~1160 psi, calculated hydrostatic pressure ~680 psi, release overpull ~800 lbs., good run.

1700 #3 PCTB-CS water core with circulation on deck.

Ball closed, trapped pressure ~1140 psi, calculated hydrostatic pressure ~680 psi, release overpull ~500 lbs., good run.

1730 LO PCTB for service and ready for next day deployment.

POOH to casing shoe.

Shut down for the night.

Note: All times, depths, and pressures reported are preliminary and approximate.

Daily Progress Report

DPR 3
Date: 2021-04-14
Location: Catoosa Test Facility (CTF), Hallett, Oklahoma
Staff: P. Schultheiss, M. Mimitz, M. Selman, A. Burrows, D. Minarich, J. Mariani, J.P. Riley, C. Sandusky

A coring tool was moved to the drill floor in the morning and the wireline was rigged up. As the tool was being lowered into the drill pipe, a malfunction was discovered in the wireline unit's gearbox which required that it be immediately removed from service. Operations were suspended until a replacement wireline unit could be brought to the work site.

After the new wireline unit arrived and was rigged up, tests 1CS, 2CS, and 3CS were performed near bottom-hole depth (1,481 ft.) and without rotation or weight on bit. Both 1CS and 2CS were successful in capturing full boost (approximately 600 psi over in situ pressure). Test 3CS was then landed in the BHA, after which rig pumps were tested through both the flow tee and the top drive. A maximum flow of 325 gpm was maintained for 10 minutes. Test 3CS was also successful with full boost captured.

PCTB Land Test 3: Daily Report

Date: Thursday, 15 April 2021

Structure of Report: Each daily report will include a summary of results, and then two event logs: 1) as recorded by Tom Pettigrew and 2) as recorded by Geotek Inc.

Summary: The PCTB-CS was deployed three times while coring. Pressure sealing mechanism and boost functioned properly on each test. The first test was plugged by cement and no core was recovered. The second attempt had 85% recovery. The last test sealed and maintained pressure but had limited core recovery which has been attributed to sections of hard formation that inhibit proper function of core grabber and bit.

Drilling Operations:

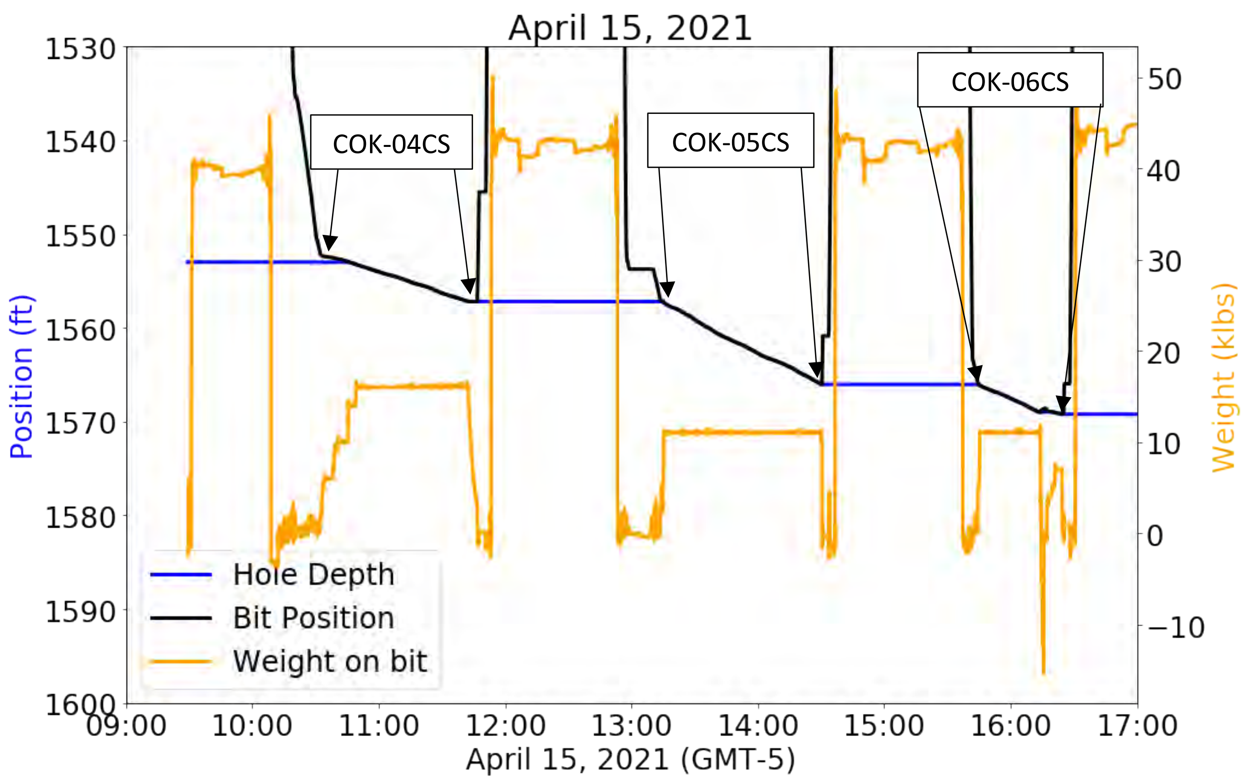

Figure 1: **Drilling Summary for April 15, 2021.** Bit position, hole depth, and weight on bit for three coring runs (COK-04CS, COK-05CS, and COK-06CS). The rate of penetration for COK-04CS was approximately 4 ft/hr, whereas the rate of penetration for COK-05CS increased to approx. 7 ft/hr. The interval from 1553'-1568.3' was drilled while these three cores were taken.

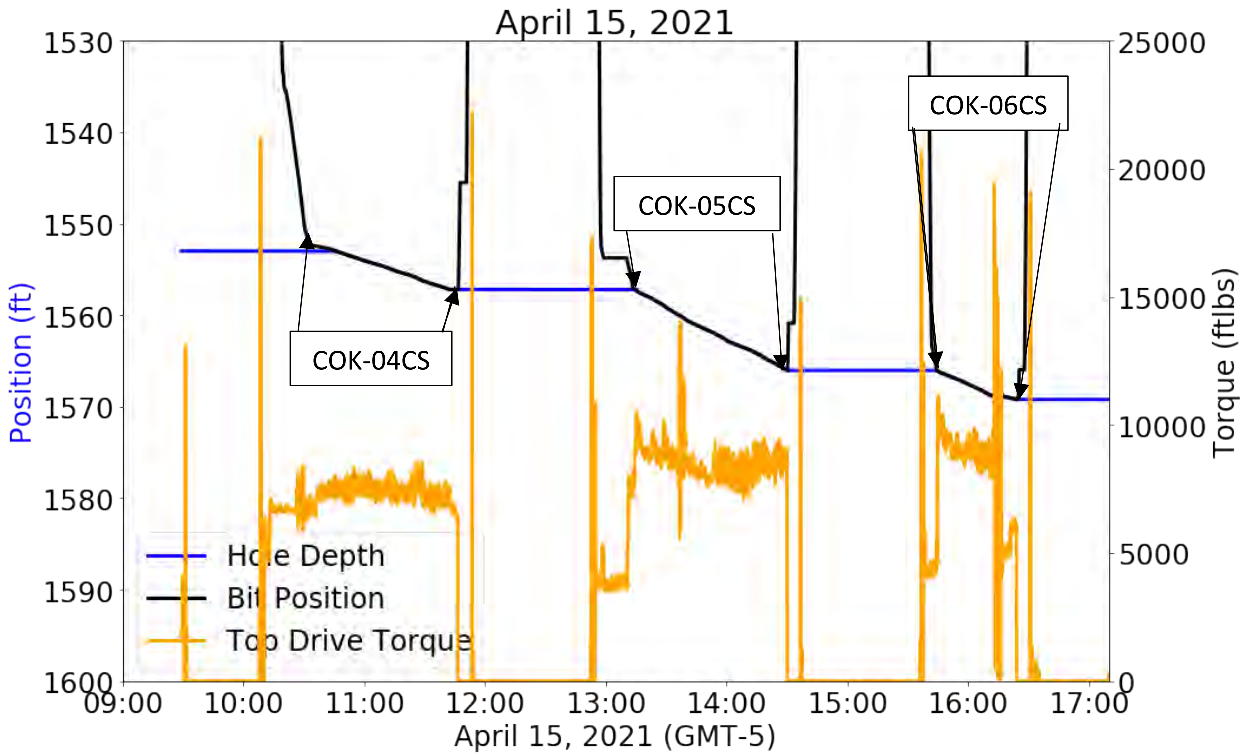

Figure 2: **Drilling Summary for April 15, 2021.** Bit position, hole depth, and top drive torque for coring runs COK-04CS, COK-05CS, and COK-06CS. Coring run COK-06CS was cut short because torque exceeded 20,000 ft-lbs. In response, the driller raised the bit. Once the bit is lifted off bottom, it is exceedingly difficult to collect more core. For this reason, the test was ended.

Core Results:

Coring Test 4 (COK-04CS): No core was recovered. Small pieces of cement recovered in core liner that were likely leftover debris from cement plug. Small piece of formation was stuck in cutting shoe when disassembled. Despite no recovery, the PCTB sealed successfully (Figure 3).

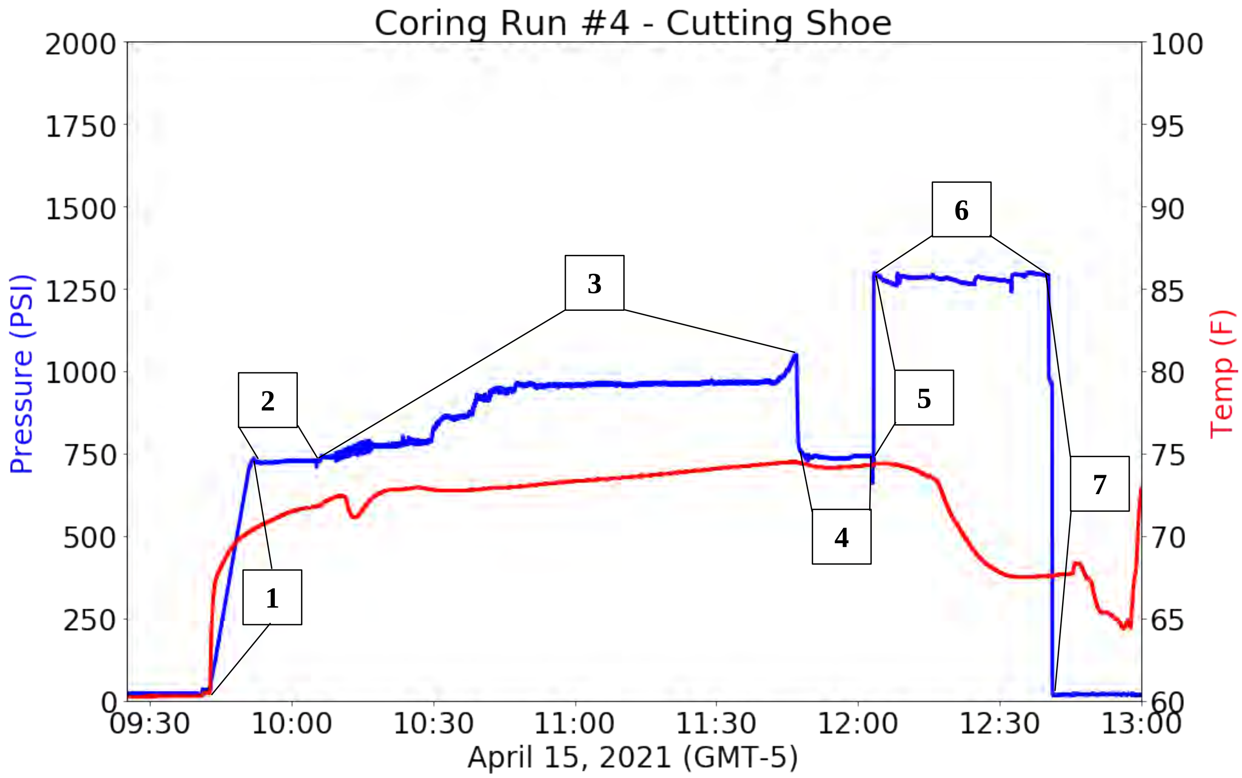

Figure 3: **Coring Test 4 (COK-04CS).** DST pressure and temperature data. No core recovered. Small pieces of debris or cement were collected in core liner. PCTB sealed successfully. Summary of events: **1:** Core barrel lowered down hole and latched into BHA at 1552.8 ft. **2:** Core barrel at BHA and running tool released. **3:** Coring begins with flow at 240 GPM. Pressure builds up as pump pressure increases. **4:** Coring ends and pulling tool is deployed. Pressure returns to in situ. **5:** PCTB is actuated. **6:** Wireline pulled out core barrel. **7:** Depressurized in lab.

Coring Test 5 (COK-05CS): Core recovery was 65 percent (5.58 feet recovered of 8.5 feet drilled). The PCTB sealed successfully.

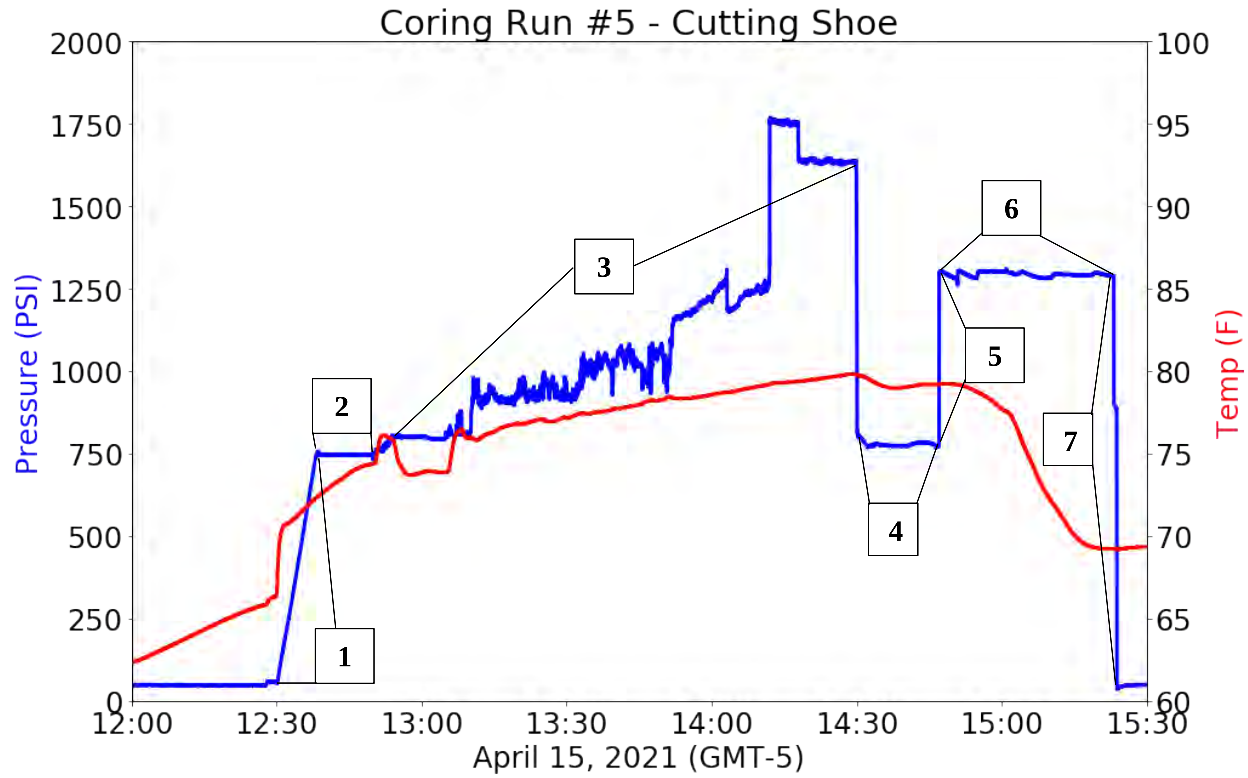

Figure 3: **Coring Test 5 (COK-05CS).** DST pressure and temperature data. 67" of core recovered. PCTB sealed successfully and pressure maintained as tool retrieved and brought to lab. Summary of events: **1:** Core barrel lowered down hole and latched into BHA at 1557.5 ft. **2:** Core barrel at BHA and running tool released. **3:** Coring begins with flow at 240 GPM. Pressure builds up as pump pressure increases. **4:** Coring ends and pulling tool is deployed. Pressure returns to in situ. **5:** PCTB is actuated. **6:** Wireline pulled out core barrel. **7:** Depressurized in lab.

Figure 4: **Coring Test 5 (COK-05CS).** 5.58 feet (67 inches) of core recovered. Good quality core with few fractures and smooth edges. Fractures appear to be from removal from core liner. Some biscuiting/fractures at bottom of core near ball valve.

Coring Test 6 (COK-06CS): The recovery was 14.3 percent (4 inches recovered of 2.3 feet drilled). High torque on the drill string required the driller to pick up off bottom, coring ended since no more core could be collected. The PCTB was sealed successfully.

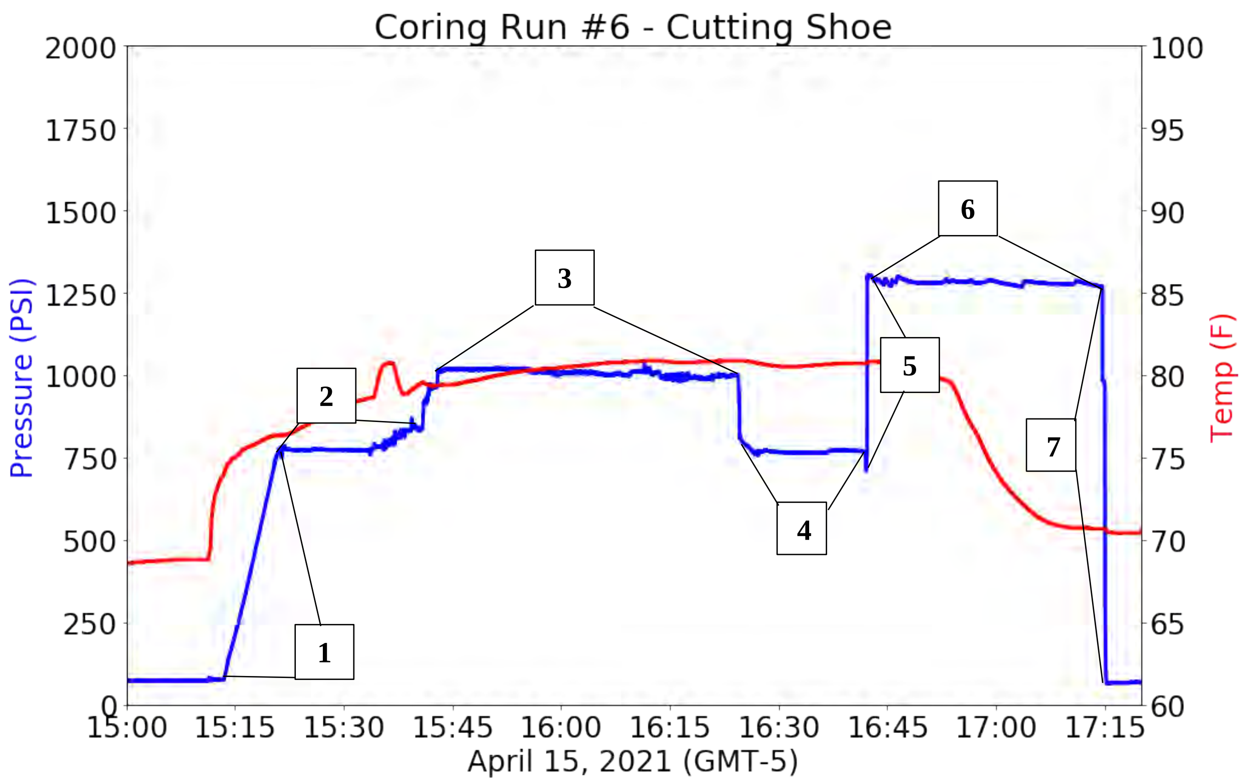

Figure 5: **Coring Test 6 (COK-06CS).** DST pressure and temperature data. 4" of core recovered. PCTB sealed successfully and pressure maintained as tool retrieved and brought to lab. Summary of events: **1:** Core barrel lowered down hole and latched into BHA at 1566 ft. **2:** Core barrel at BHA and running tool released. **3:** Coring begins with flow at 240 GPM. Pressure builds up as pump pressure increases. **4:** Coring ends and pulling tool is deployed. Pressure returns to in situ. **5:** PCTB is actuated. **6:** Wireline pulled out core barrel. **7:** Depressurized in lab.

Pettigrew Report:

0700	Sign in and safety briefing 0720 Run in the hole to TD at 1530 ft.
	Stage #4 PCTB-CS in mouse hole.
0800	Delay due to wireline crew not having proper crossover sub.
0915	Proper crossover sub acquired, rig up wireline.
0945	Run in the hole with #4 PCTB-CS.
1000	Pull out of hole with running tool.

Rig down wireline.

Begin coring, 300 gpm, 8k wob, 80 rpm.

1200 Rig up wireline.

1800 lbs to release PCTB.

1230 #4 PCTB on deck, 1177 psi trapped, core jammed in core catcher.

Run in the hole with #5 PCTB-CS

1300 On bottom, begin coring, 450 gpm, 8k wob, 100 rpm.

1500 #5 PCTB on deck, 2800 lbs to release, 1140 psi trapped, 70” of core recovered.

1539 Run in hole with #6 PCTB-CS.

At 2 ft of penetration drill string torqued up and driller picked up off bottom.

Drill string free, decision made to recover PCTB.

1650 #6 PCTB-CS on deck, 1140 psi trapped, 4” of core recovered jammed in core catcher.

1700 Rig down wireline.

Pull out of hole to casing shoe for the night.

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Daily Progress Report

DPR 4
Date: 2021-04-15
Location: Catoosa Test Facility (CTF), Hallett, Oklahoma
Staff: P. Schultheiss, M. Mimitz, M. Selman, A. Burrows, D. Minarich, J. Mariani, J.P. Riley, C. Sandusky

Testing while drilling commenced today with the cutting shoe (CS) configuration of the PCTB. Test 4CS was successful, with full boost captured and a small amount of core retained. The recovered core proved to be chunks of cement, suggesting that advancement had been at least partially through infill form the drill-out.

Test 5CS advanced 9 feet and was returned to the surface with full boost and 5.5 feet of competent rock core.

Test 6CS encountered a high-torque event at 2.97 feet which required the bit to be lifted off bottom while coring. Because of the risk of core jam, advancement was stopped at this point and the tool was retrieved. Full boost was captured and a small amount of rock core was retrieved.

PCTB Land Test 3: Daily Report

Date: Friday, 16 April 2021

Structure of Report: Each daily report will include a summary of results, and then two event logs: 1) as recorded by Tom Pettigrew and 2) as recorded by Geotek Inc.

Summary: The PCTB-CS was deployed three times while coring. One of these 3 tests sealed successfully. In the first test, core protruding through the ball valve prevented it from closing. The second test recovered 6" of core and boosted and sealed successfully. In the third test, the core barrel did not seal due to a damaged upper seal. It is presumed the damage to the seal occurred prior to deployment.

Drilling/Coring Operations:

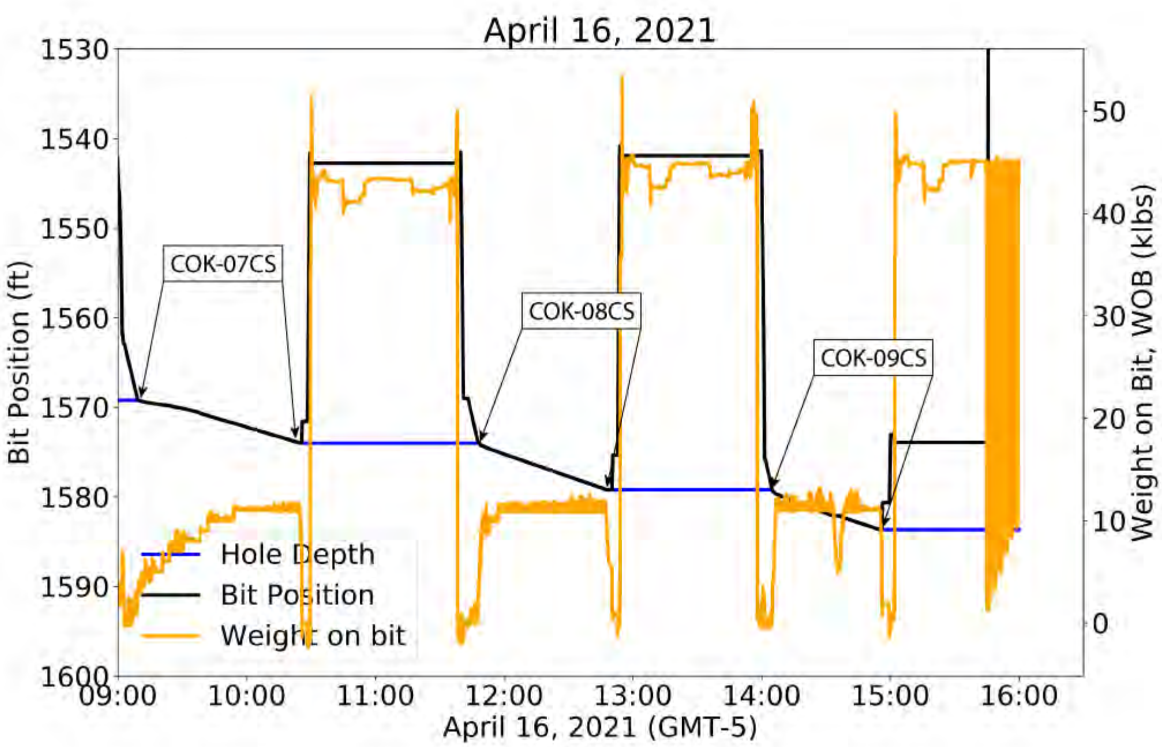

Figure 1: **Drilling Summary for April 16, 2021.** Bit position, hole depth, and weight on bit for three coring runs (COK-07CS, COK-08CS, and COK-09CS). The rate of penetration for COK-07CS was approximately 4 ft/hr, whereas the rate of penetration for COK-08CS and COK-09CS increased to approx. 5 ft/hr. The interval from 1568.3'-1583.7' was drilled while these three cores were taken.

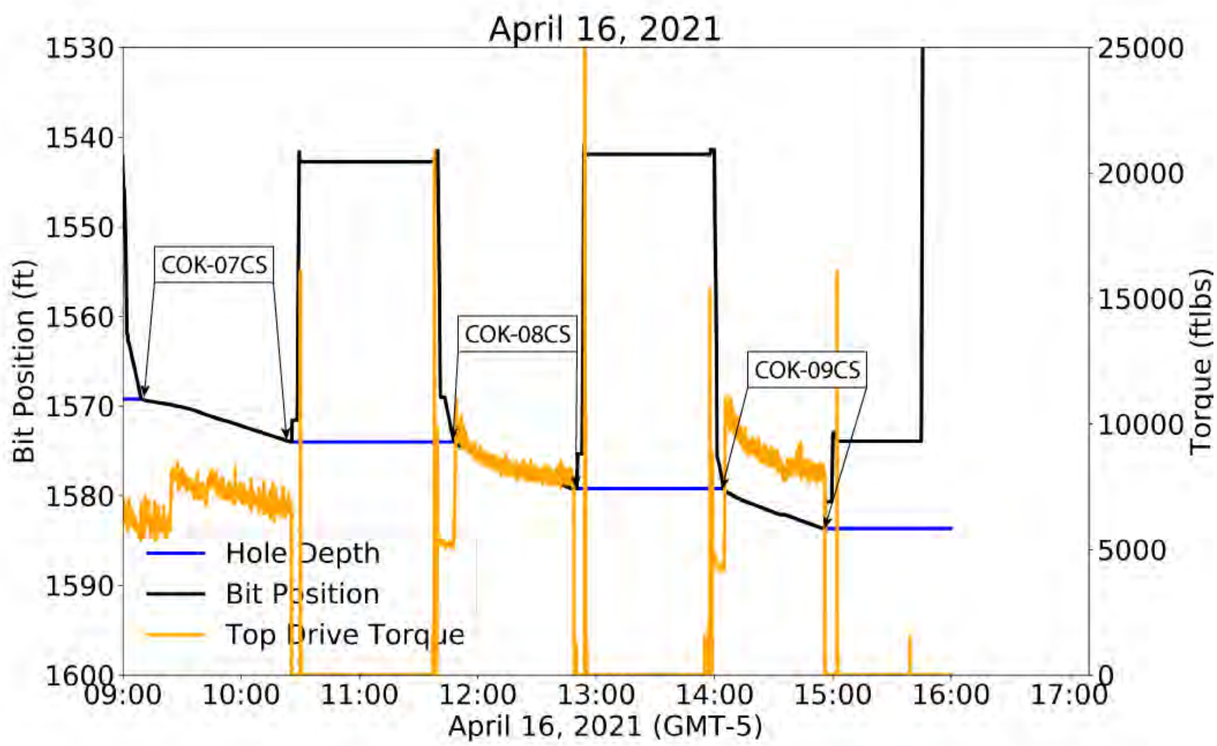

Figure 2: **Drilling Summary for April 16, 2021.** Bit position, hole depth, and top drive torque for coring runs COK-07CS, COK-08CS, and COK-09CS.

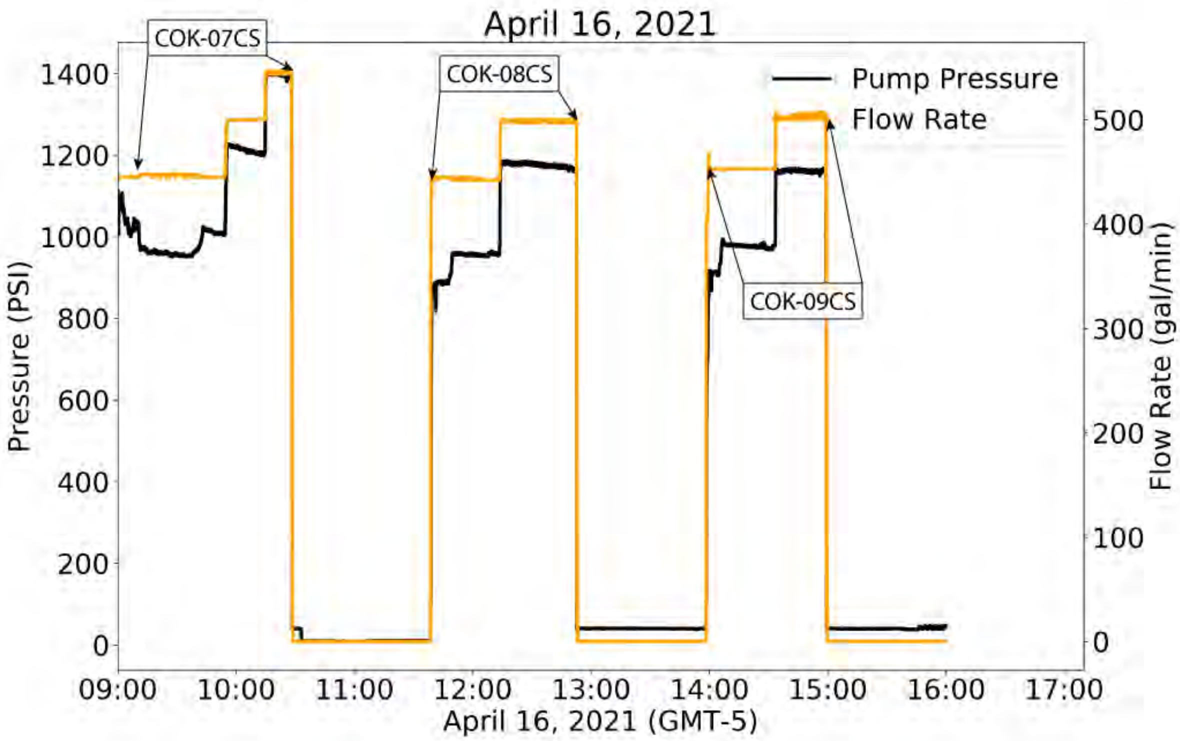

Figure 3: **Drilling Summary for April 16, 2021.** Pump Pressure and Flow Rate for coring runs COK-07CS, COK-08CS, and COK-09CS.

Coring Results:

Coring Test 7 (COK-07CS): Core jammed during coring and was not pulled up with the core liner when the tool actuated. As a result, some core was still protruding through the ball valve during actuation preventing ball closure. As such, no boost was recorded.

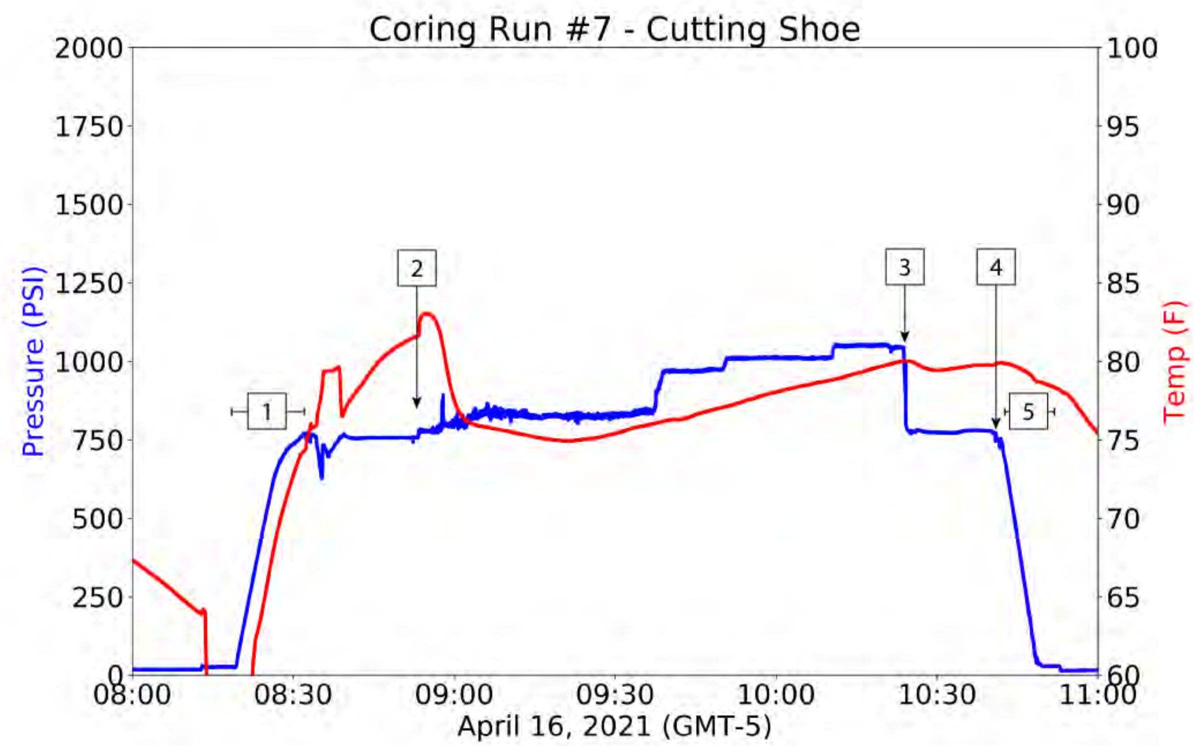

Figure 3: **Coring Test 7 (COK-07CS).** DST pressure and temperature data. Summary of events: **1:** Core barrel lowered down hole and latched into BHA at 1569.4ft. **2:** Pumps turn on at 450 GPM. **3:** Pumps turn off. **4:** PCTB is actuated. Core extending through the ball prevented ball closure; no boost or seal is recorded. **5:** PCTB is brought back to rig floor.

Figure 4: **Coring Test 7 (COK-07CS).** Core that was not pulled up when the PCTB actuated blocked the ball from closing.

Coring Test 8 (COK-08CS): 6” of jammed core recovered. The PCTB sealed successfully.

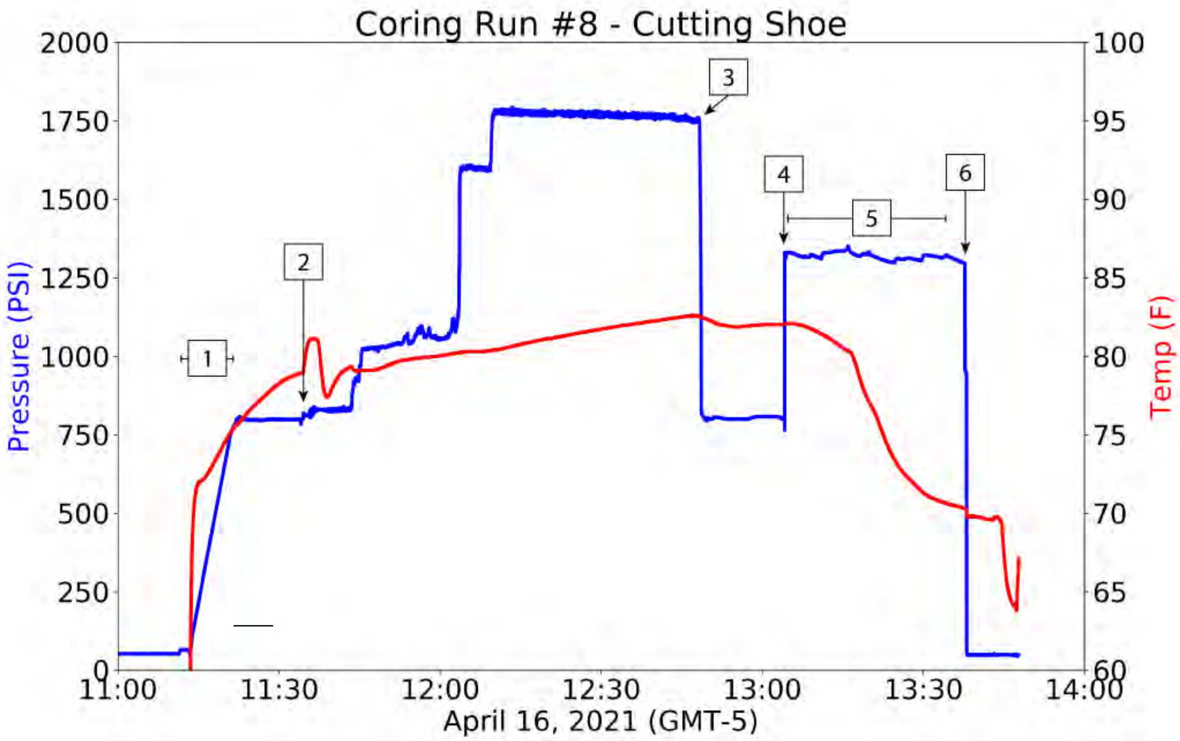

Figure 3: **Coring Test 8 (COK-08CS).** DST pressure and temperature data. Summary of events: **1:** Core barrel lowered down hole and latched into BHA at 1574 ft. **2:** Pumps turned on with flow at 450 GPM. **3:** Pumps turned off. Pressure returns to in situ. **5:** PCTB is actuated, and a pressure boost and seal is recorded. **5:** PCTB returns to rig floor. **6:** Depressurized in lab.

Figure 4: **Coring Test 8 (COK-08CS).** 6" of jammed core.

Coring Test 9 (COK-09CS): 14" of core recovered, similar quality to COK-08CS. The PCTB did not seal. Upon disassembly, it was found that an upper seal was damaged. It is hypothesized that the seal was damaged right before deployment, after assembly and pressure test.

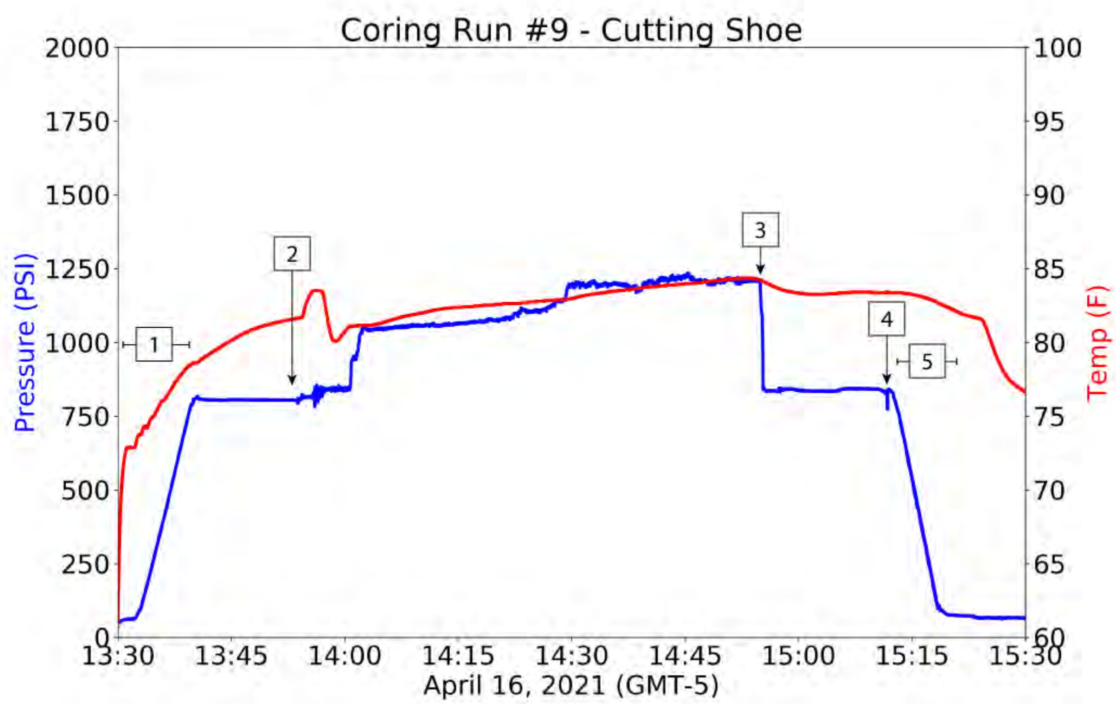

Figure 5: **Coring Test 9 (COK-09CS).** DST pressure and temperature data. Summary of events: **1:** Core barrel lowered down hole and latched into BHA at 1579.2 ft. **2:** Pumps turned on with flow at 450 GPM. **4:** Pumps turned off. Pressure returns to in situ. **5:** PCTB is actuated, but did not seal due to damaged upper seal. **6:** PCTB returns to rig floor.

Pettigrew Report:

0700 Sign in and safety briefing.

0720 Run in the hole with bit to TD.

0800 Pickup #7 PCTB-CS.

Rig up wireline. Run in the hole with PCTB 0900 On bottom coring.

No drill string torqueing as experienced at end of hole yesterday.

1050 #7 PCTB-CS on deck.

Ball did not close, no pressure trapped.

Core jam in cutting shoe and ball (see comment 1).

1115 Run in the hole with #8 PCTB-CS.

1315 #8 PCTB-CS on deck.

Ball close, 1161 psi trapped pressure, 4” of jammed core.

Run in the hole with #9 PCTB-CS.

1520 #9 PCTB-CS on deck.

Ball closed, no trapped pressure (see comment 2).

1600 Pull out of the hole with the bit to the casing shoe for the night.

Release the rig and wireline unit.

Service PCTB tools.

1. It appears the core began to enter the core tube and then jammed in the cutting shoe. The core was jammed tight enough and was strong enough that upon actuation of the PCTB the liner and integral core catcher moved upward without pulling the core with it. A short section of core was left behind that extended up through the ball and could not fall out the end of the core barrel due to the jammed cutting shoe. The result was that the PCTB actuated properly but the ball was prevented from closing due to the trapped core extending through the ball. This is not considered a tool failure.

2. Upon disassembly of #9 PCTB-CS the plug seals (autoclave upper seals) were found to be damaged. It was also observed that the shear pin had sheared and the pressure section (boost) had not fired. It appears that the damaged seals did not allow the plug to fully enter the seal sub to complete the autoclave seal and fire the boost. The over-travel feature of the tool allowed the latch to be released without firing the boost as designed. The plug seals appeared to be partially extruded and have some of the lip sheared off due to a force applied in the upward direction. The damage to the seals may have occurred while sliding the inner tube release collet back in the run-in-the-hole position, covering the plug seals, after the pre-deployment pressure test just prior to deployment.

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Daily Progress Report

DPR 5
Date: 2021-04-16
Location: Catoosa Test Facility (CTF), Hallett, Oklahoma
Staff: P. Schultheiss, M. Mimitz, M. Selman, A. Burrows, D. Minarich, J. Mariani, J.P. Riley, C. Sandusky

Testing while drilling continued with the cutting shoe (CS) configuration of the PCTB. Test 7CS advanced 4.79 feet. The tool arrived at the drill floor with a partially open ball valve. A section of core was found inside the ball valve, suggesting that rock core had fallen through the ball valve prior to closing. The tool appeared to have actuated properly otherwise. After the piece of rock was removed the ball valve actuated fully.

Test 8CS advanced 4.98 feet. The tool captured full boost and a small amount of rock core was retrieved.

Test 9CS advanced 4.29 feet. The tool arrived at the drill floor with a closed ball valve but no pressure. Examination of the tool during disassembly revealed that the inner tube plug seals had extruded around the inside diameter of the seal sub, potentially preventing full extension of the inner tube plug.

PCTB Land Test 3: Daily Report

Date: Saturday, 17 April 2021

Structure of Report: Each daily report will include a summary of results, and then two event logs: 1) as recorded by Tom Pettigrew and 2) as recorded by Geotek Inc.

Summary: The PCTB-CS was deployed two times while coring. The two tests sealed successfully. The first test recovered 2.8 ft relative to 5.7 ft drilled of a predominantly shale core. The second test recovered 0.25 ft out of 6.1 ft drilled. The limited core recovery in the second test is attributed to very friable cored material.

Drilling/Coring Operations:

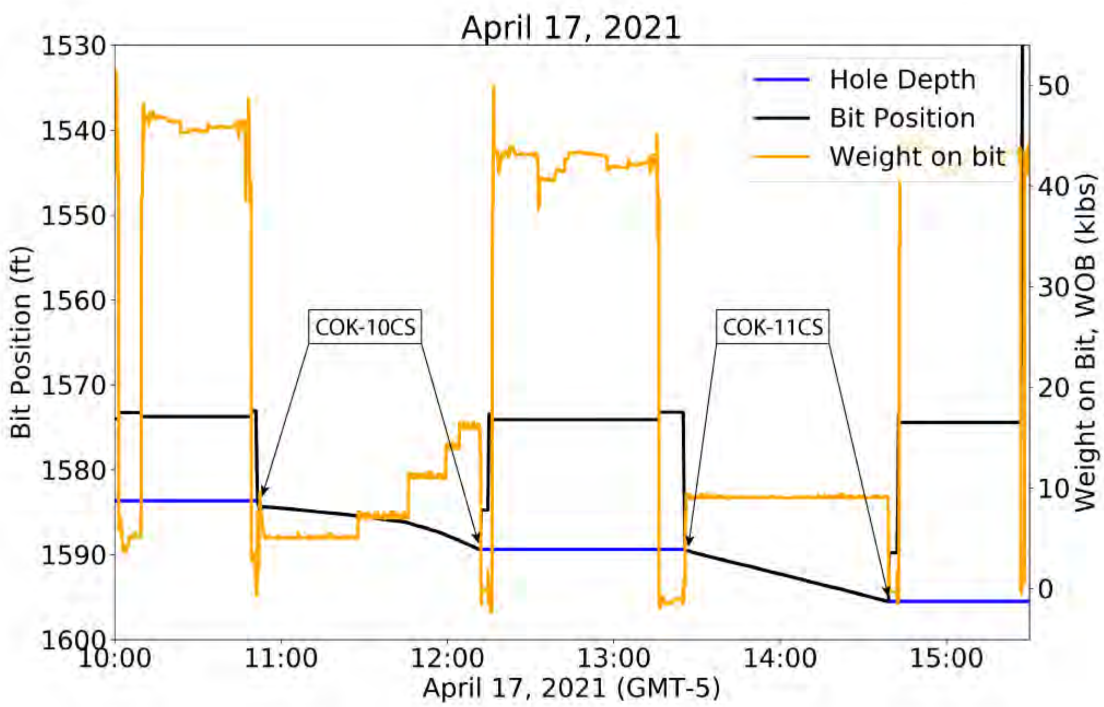

Figure 1: **Drilling Summary for April 17, 2021.** Bit position, hole depth, and weight on bit for three coring runs (COK-10CS, and COK-11CS). The rate of penetration for COK-10CS ranged from 2 to 8 ft/hr, whereas the rate of penetration for COK-11CS was 5 ft/hr. The interval from 1583.7'-1595.5' was drilled while these two cores were taken.

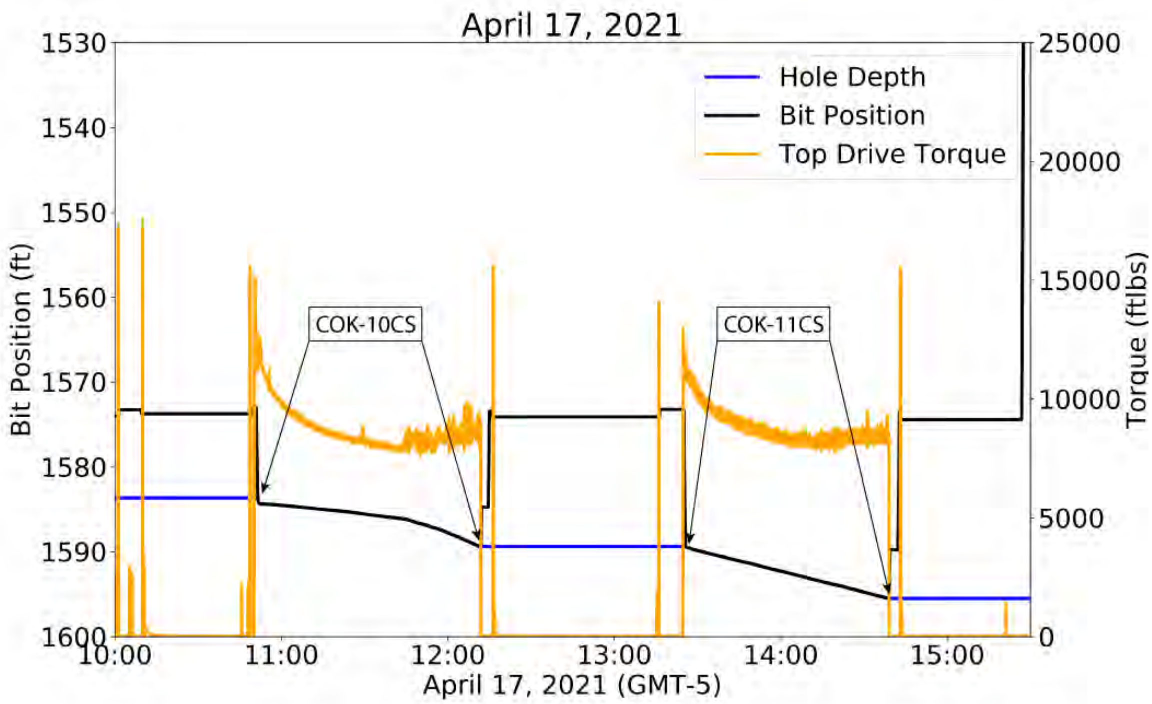

Figure 2: **Drilling Summary for April 17, 2021.** Bit position, hole depth, and top drive torque for coring runs COK-10CS, and COK-11CS.

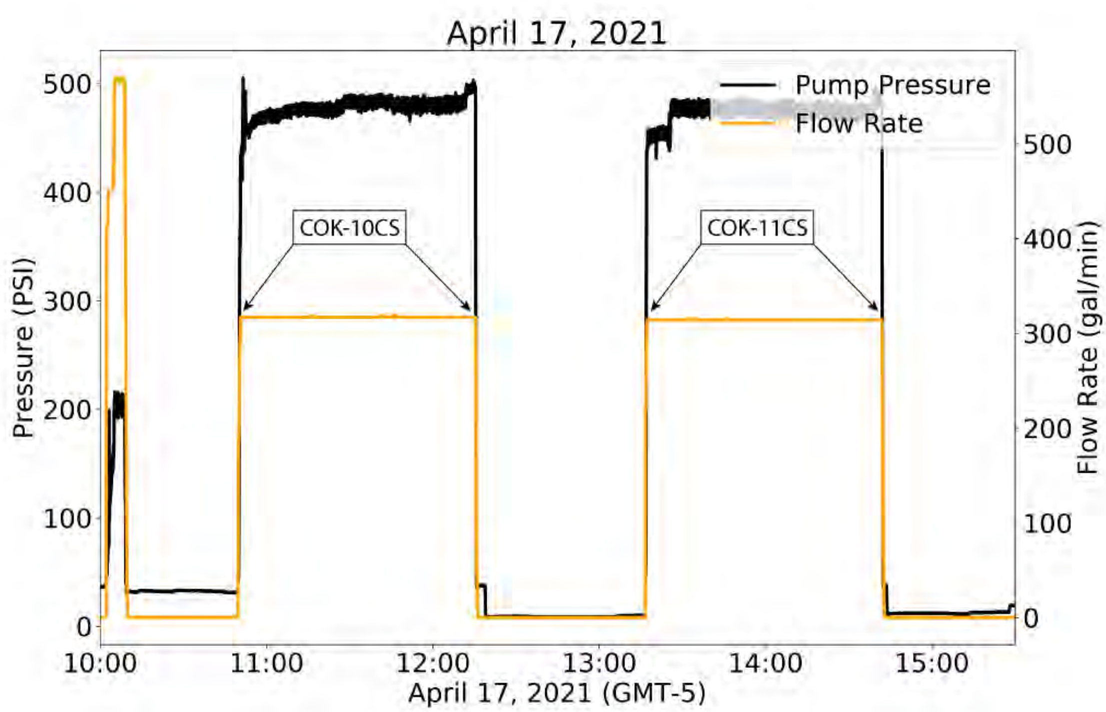

Figure 3: **Drilling Summary for April 17, 2021.** Pump Pressure and Flow Rate for coring runs COK-10CS, and COK-11CS.

Coring Results:

Coring Test 10 (COK-10CS): The coring operation advanced 5.7 ft and recovered 2.8 ft, which results in a recovery rate of 49.7%. The PCTB successfully sealed and maintained the pressure until disassembly. The core exhibits shale laminations, and was very fragile upon closer examination.

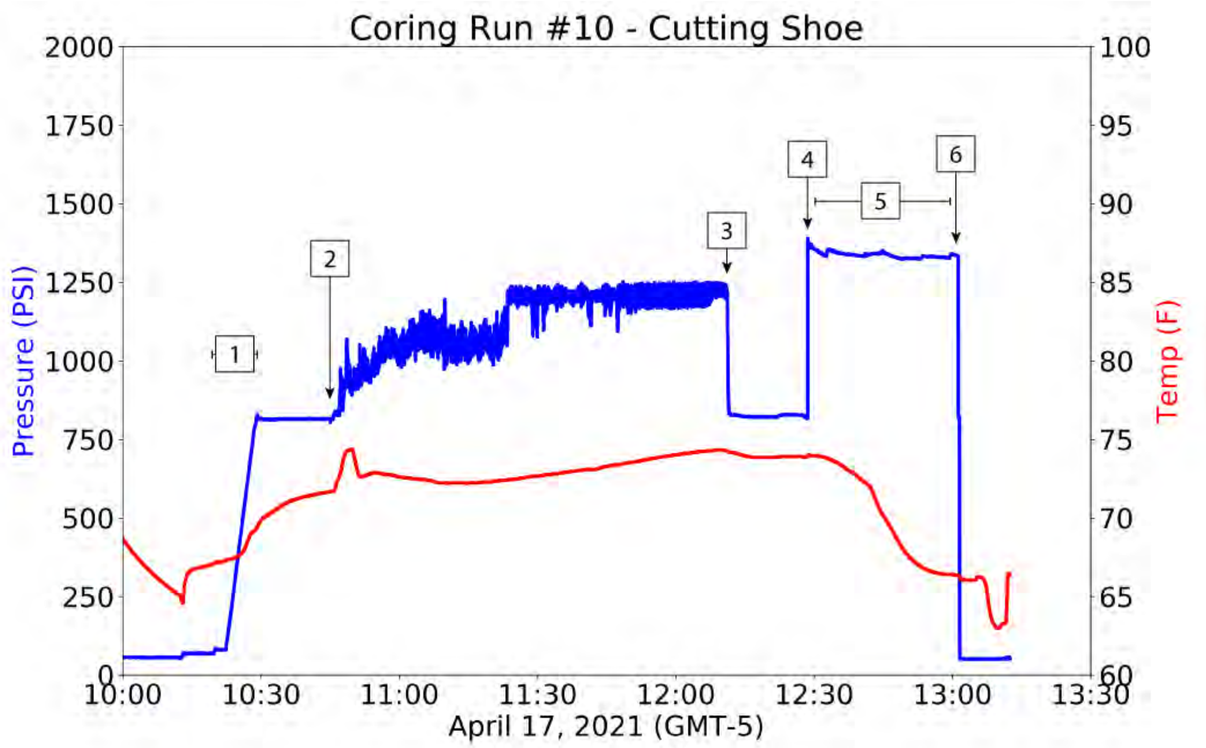

Figure 4: **Coring Test 10 (COK-10CS).** DST pressure and temperature data. Summary of events: **1:** Core barrel lowered down hole and latched into BHA at 1583.7ft. **2:** Pumps turn on at 315 GPM. **3:** Pumps turn off. **4:** PCTB is actuated. **5:** PCTB is brought back to rig floor. **6:** PCTB is depressurized in the lab.

Figure 5: **Coring Test 10 (COK-10CS).** The 34" of recovered core was very fragile upon inspection. Shale is the predominant lithology.

Coring Test 11 (COK-11CS): The coring operation advanced 6.1 ft. The tool sealed and boosted successfully. The recovered was 0.25 ft, resulting in a recovery rate of 4.1%. Core quality is similar to COK-10CS, with primarily shale laminations.

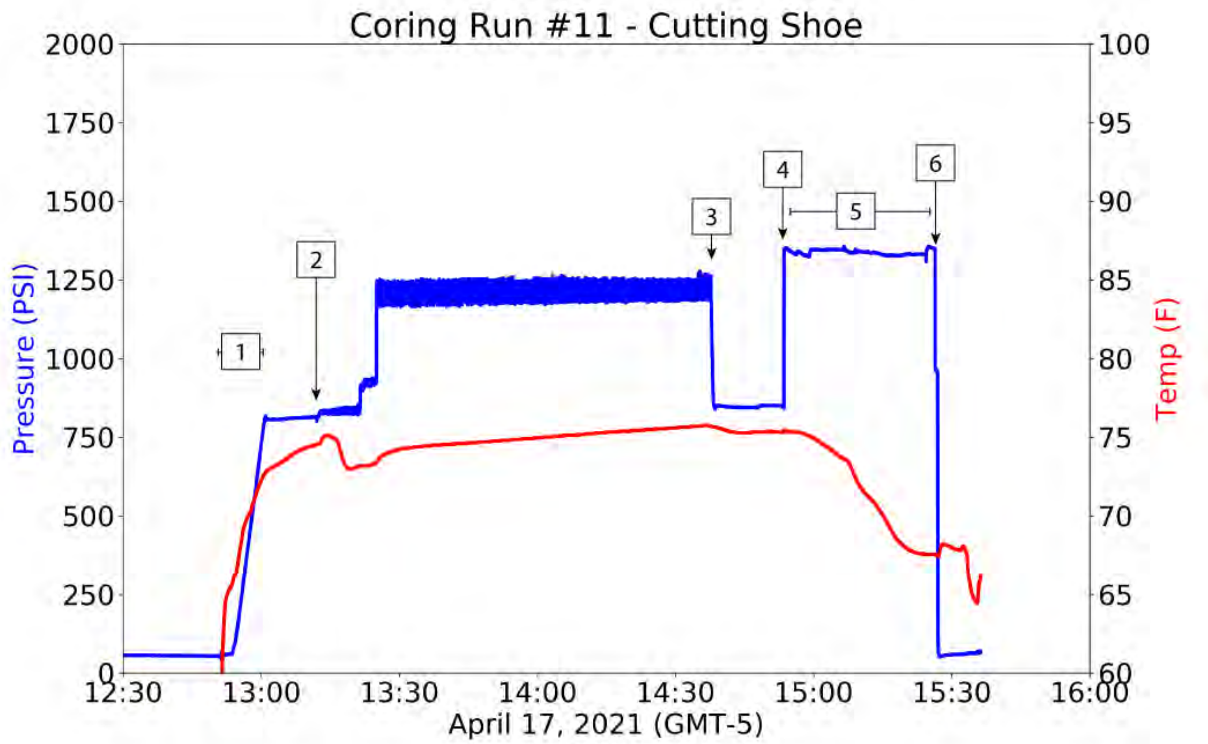

Figure 6: **Coring Test 11 (COK-11CS).** DST pressure and temperature data. Summary of events: **1:** Core barrel lowered down hole and latched into BHA at 1589.4ft. **2:** Pumps turn on at 315 GPM. **3:** Pumps turn off. **4:** PCTB is actuated. **5:** PCTB is brought back to rig floor. **6:** PCTB is depressurized in the lab.

Figure 7: **Coring Test 11 (COK-11CS).** 3” of recovered core. The core was very fragile upon inspection.

Pettigrew Report:

Saturday 17 April 2021

0700 Sign in, safety briefing.

0730 Pull out of hole with bit for inspection . . . OK.

0845 Move #10 PCTB-CS to cat walk.

0900 Rig up wireline

Run in hole with #10 PCTB

0940 PCTB would not land.

Pull out of hole with PCTB.

Circulate pipe/BHA clean.

1020 Run in hole with #10 PCTB.

1045 On bottom coring #10 PCTB.

1240 #10 PCTB on deck.

1170 psi trapped pressure, 12” of core.

Run in hole with #11 PCTB-CS.

1320 On bottom coring #11 PCTB.

1500 #11 PCTB on deck.

1143 psi trapped, 8” of core.

Pull out of hole with bit for BHA change.

1615 Bit on deck

Reconfigure BHA for face bit.

Hang off face bit outer core barrel assembly.

Space out PCTB-FB.

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Daily Progress Report

DPR 6
Date: 2021-04-17
Location: Catoosa Test Facility (CTF), Hallett, Oklahoma
Staff: P. Schultheiss, M. Mimitz, M. Selman, A. Burrows, D. Minarich, J. Mariani, J.P. Riley, C. Sandusky

Testing while drilling continued today with the cutting shoe (CS) configuration of the PCTB. Test 10CS advanced 5.0 feet. The tool captured full boost and recovered 3.0 feet of rock core.

Test 11CS advanced 6.0 feet. The tool captured full boost and 0.33 feet of rock core was retrieved.

Test 11CS concluded testing using the cutting shoe configuration. Pipe was tripped to the surface and the BHA was reconfigured for face bit testing. Space-out was completed and the tool was actuated in the BHA while suspended in the slips. The tool functioned as intended in dry actuation and was removed to the coring service unit for rebuild.

PCTB Land Test 3: Daily Report

Date: Sunday, 18 April 2021

Structure of Report: Each daily report will include a summary of results, and then two event logs: 1) as recorded by Tom Pettigrew and 2) as recorded by Geotek Inc.

Summary: The PCTB-FB was deployed three times (COK-12FB, COK-13FB, and COK-14FB). The first "mud core" test successfully closed the ball valve and sealed. The second test drilled 3.2 ft without retrieving any recovered core but sealed successfully. The third test sealed successfully. The recovered core was 8.9 ft relative to 7.1 ft drilled. The 125% core recovery rate is attributed to core from COK-13FB being captured in the core barrel of COK-14FB.

Drilling/Coring Operations:

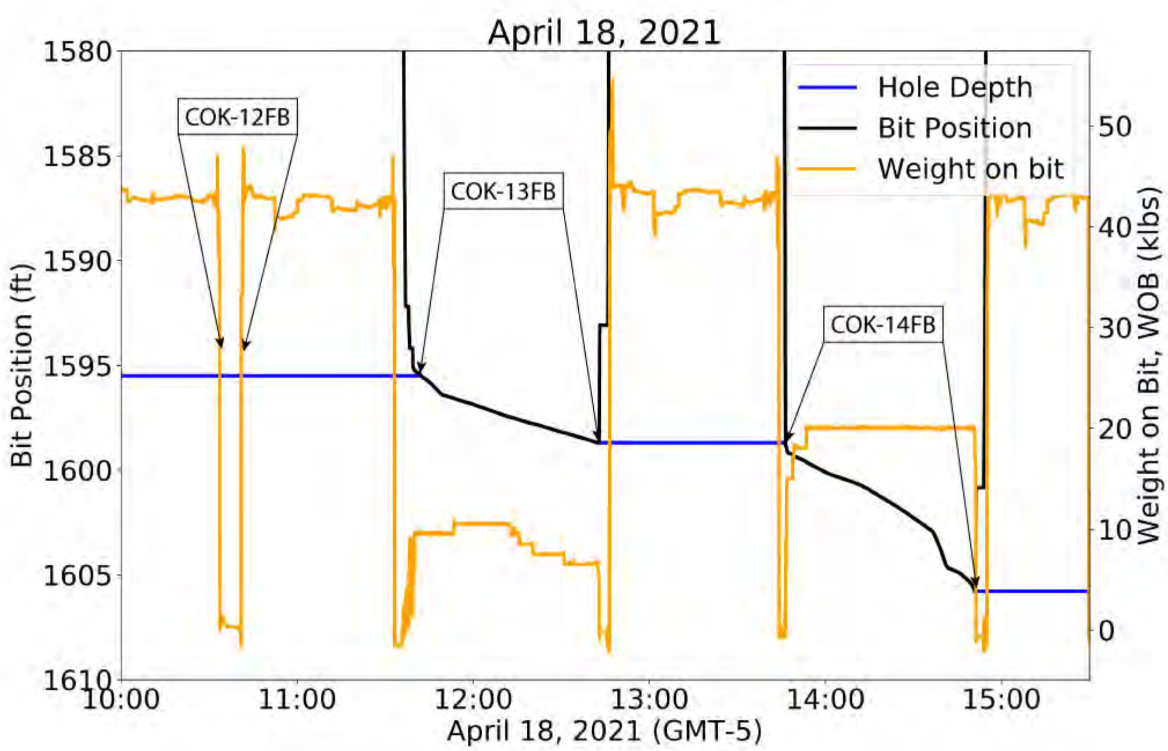

Figure 1: **Drilling Summary for April 18, 2021.** Bit position, hole depth, and weight on bit for three coring runs (COK-12FB, COK-13FB, and COK-14FB). The rate of penetration for COK-13FB started at 5 ft/hr and declined to 2.5 ft/hr, whereas the rate of penetration for COK-14FB ranged from 3.5 to 6 ft/hr with a peak of 22 ft/hr. The interval from 1595.5'-1605.8' was drilled

while these cores were taken. No drilling occurred during run COK-12FB, which was a mud test conducted at 1574 ft.

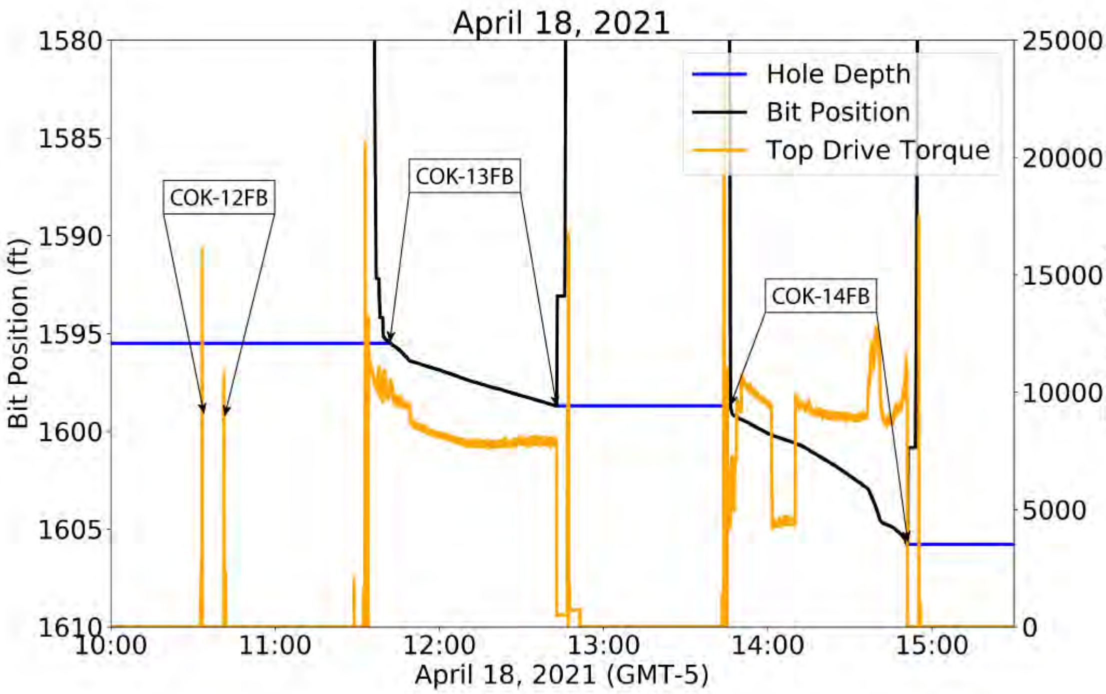

Figure 2: **Drilling Summary for April 18, 2021.** Bit position, hole depth, and top drive torque for coring runs COK-12FB, COK-13FB, and COK-14FB. No drilling occurred during run COK-12FB, which was a mud test conducted at 1574 ft.

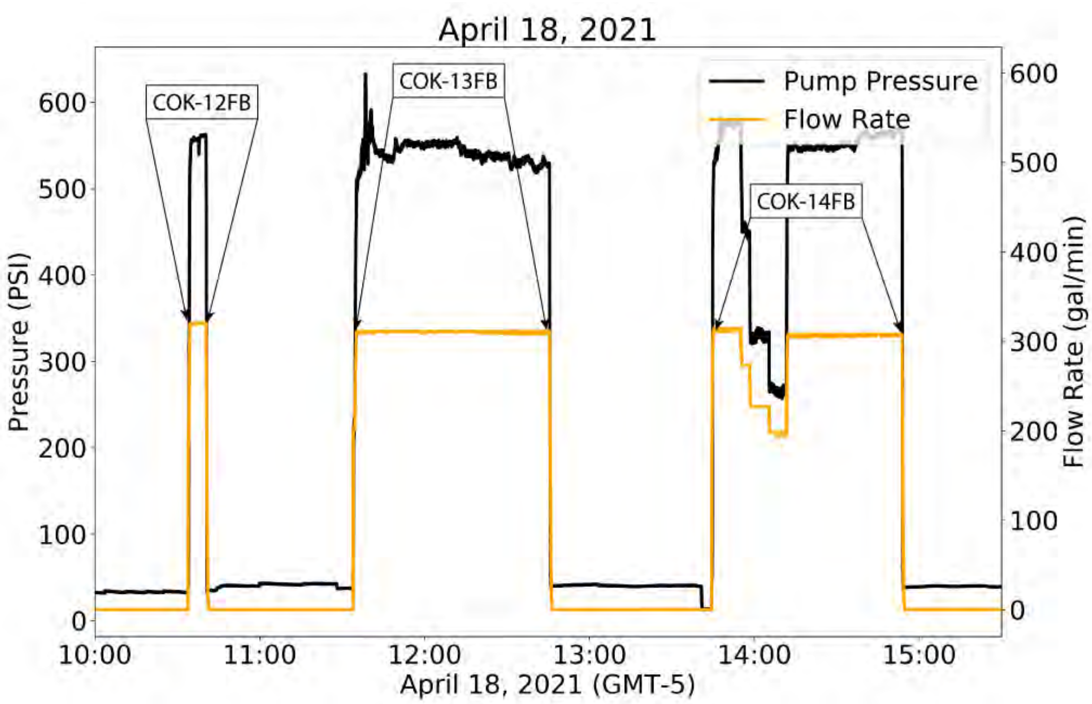

Figure 3: **Drilling Summary for April 18, 2021.** Pump Pressure and Flow Rate for coring runs COK-12FB, COK-13FB, and COK-14FB. No drilling occurred during run COK-12FB, but there was a brief period of circulation.

Coring Results:

Coring Test 12 (COK-12FB): The BHA was changed to start the testing program for the PCTB-FB. The tool was run in the hole and no core was taken (mud core) The test was conducted at 1574', and the pumps were run briefly at 320 GPM. The ball valve closed, successfully sealed, and maintained pressure until disassembly.

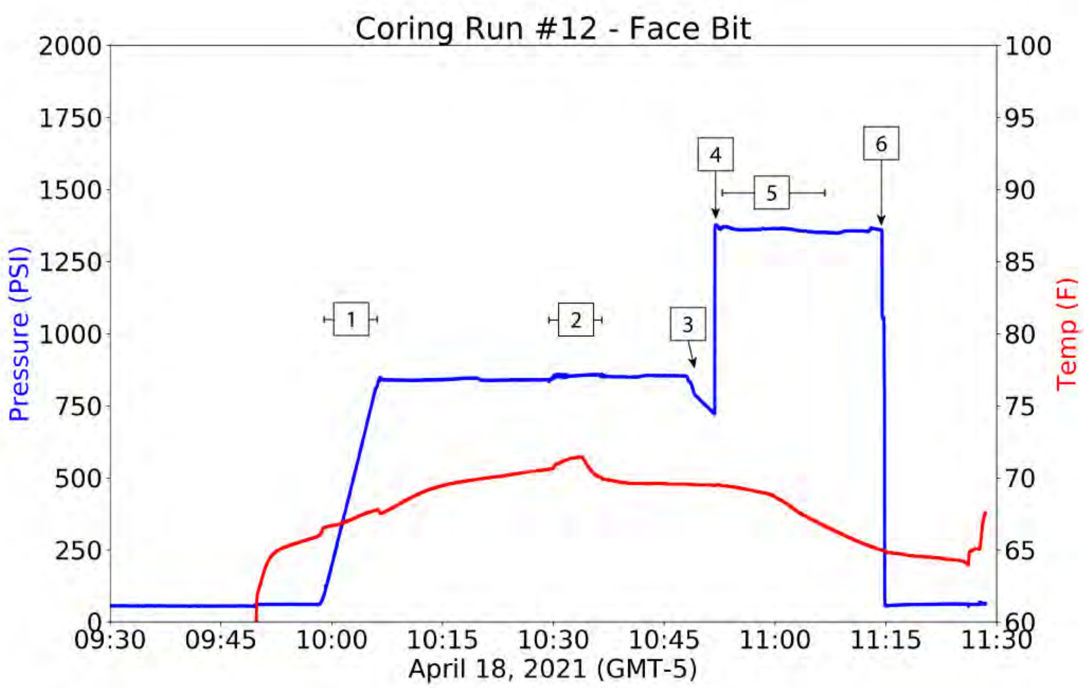

Figure 4: **Coring Test 12 (COK-12FB).** DST pressure and temperature data. Summary of events: **1:** Core barrel lowered down hole and latched into BHA at 1583.7ft. **2:** Pumps run for short time at 320 GPM. **3:** A decrease in DST pressure for ~5 minutes prior to pressure boost. The reason for the dip is being investigated by UT and Geotek. **4:** Pressure boost is recorded. **5:** PCTB is brought back to rig floor. **6:** PCTB is depressurized in the lab.

Coring Test 13 (COK-13FB): The coring operation drilled 3.2 ft. The tool sealed and boosted successfully. Upon disassembly of the tool, no core was present inside the core liner.

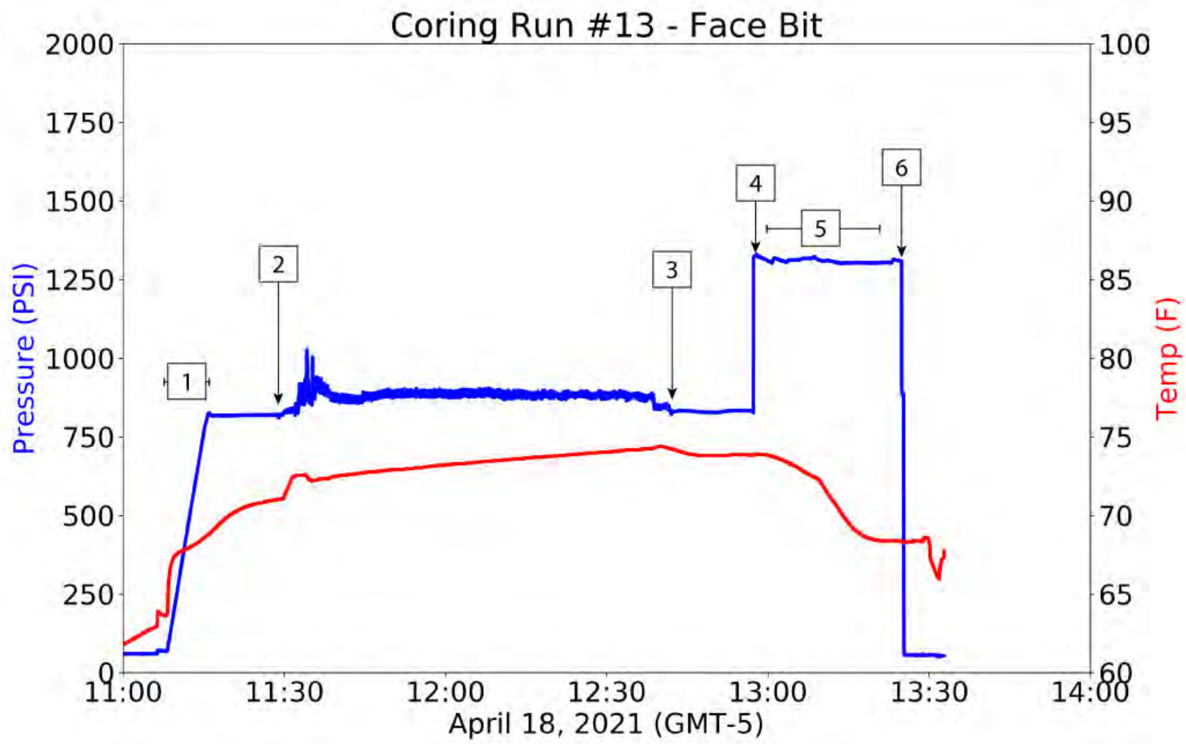

Figure 6: **Coring Test 13 (COK-13FB).** DST pressure and temperature data. Summary of events: **1:** Core barrel lowered down hole and latched into BHA at 1595.5 ft. **2:** Pumps turn on at 310 GPM. **3:** Pumps turn off. **4:** PCTB is actuated. **5:** PCTB is brought back to rig floor. **6:** PCTB is depressurized in the lab.

Coring Test 14 (COK-14FB): The coring operation advanced 7.1 ft. The tool sealed and boosted successfully. The recovered core was 8.9 ft, resulting in a recovery rate of approximately 125%. Presumably, the core from the previous run (COK-13CS) stayed in the bottom of the hole, and was captured while the PCTB FB entered the hole. Upon closer examination, the core indicates a lithological change from a shale to sand dominated lithology.

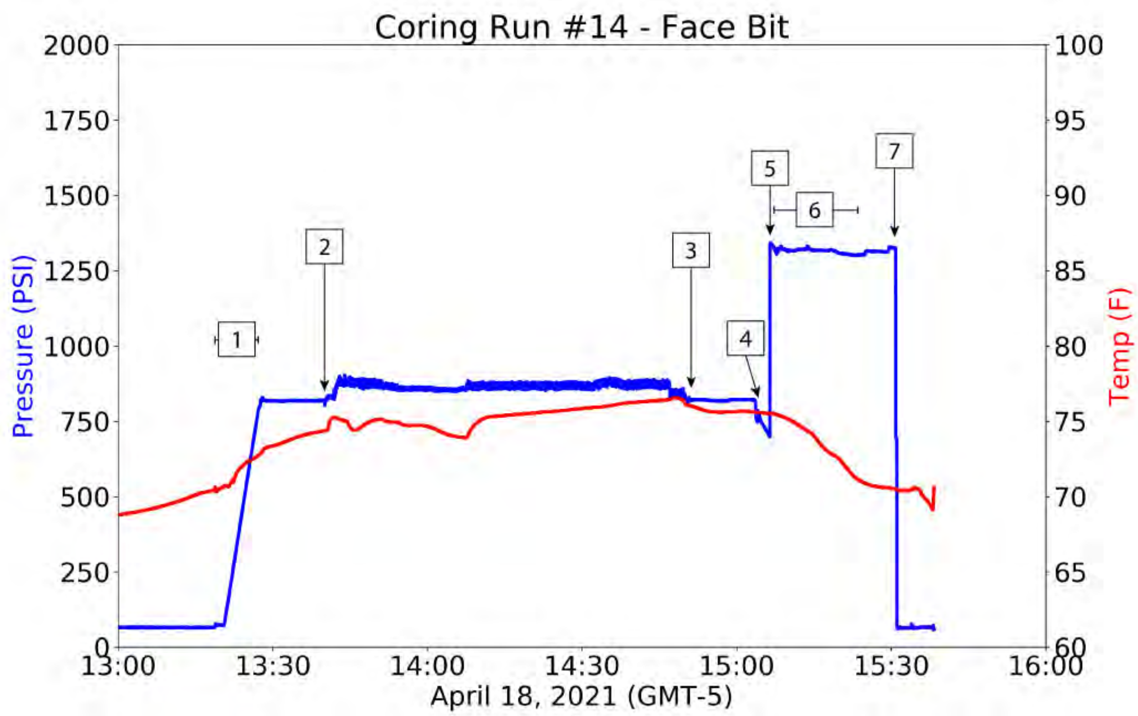

Figure 6: **Coring Test 14 (COK-14FB).** DST pressure and temperature data. Summary of events: **1:** Core barrel lowered down hole and latched into BHA at 1598.7 ft. **2:** Pumps turn on at 310 GPM. **3:** Pumps turn off. **4:** A decrease in DST pressure for ~5 minutes prior to pressure boost. The reason for the dip is being investigated by UT and Geotek. **5:** Pressure boost is recorded. **6:** PCTB is brought back to rig floor. **7:** PCTB is depressurized in the lab.

Figure 7: **Coring Test 14 (COK-14FB).** 8.9 ft of recovered core, with the top being on the left. The shale section was very fragile upon inspection, whereas the sand dominated section at the bottom of the core showed a more rigid behavior.

Pettigrew Report:

Sunday 18 April 2021

0700 Sign in, safety briefing.

0720 Run in hole with bit to TD.

0730 Iron roughneck broke.

0800 Run in hole with bit using manual tongs.

0915 Bit on bottom, circulating hole clean.

0945 Stage 12FB on rig floor.

1000 Rig up wireline.

Run in hole with 12FB.

Rig down wireline.

Circulate.

1050 Rig up wireline.

12FB (water core with circulation) on deck.

Ball closed, 1140 psi trapped.

1100 Run in hole with 13FB.

Rig down wireline.

1245 Rig up wireline.

Pull out of hole with 13FB.

Ball closed, 1140 psi trapped, no core recovered.

Run in hole with 14FB.

Rig down wireline.

1500 Rig up wireline.

Pull out of hole with 14FB.

Ball closed, 1175 psi trapped, 9 ft of core recovered.

1530 Rig down wireline.

Release wireline crew.

Pull out of hole with bit to casing shoe.

Release rig crew.

1600 Clean and service PCTB tools

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Daily Progress Report

DPR 7
Date: 2021-04-18
Location: Catoosa Test Facility (CTF), Hallett, Oklahoma
Staff: P. Schultheiss, M. Mimitz, M. Selman, A. Burrows, D. Minarich, J. Mariani, J.P. Riley, C. Sandusky

Testing continued today on the face bit configuration of the PCTB. Tripping from the casing to bottom in the morning was interrupted by a mechanical malfunction in the iron roughneck on the drill floor. Tripping in was completed using manual tongs.

Test 12FB was performed at bottom-hole depth after pumping drilling fluid at normal circulation rates. This test was retrieved and captured full boost.

Test 13FB was performed while drilling. The main bit advanced 3.35 feet. The tool was retrieved and captured no core, but was successful in capturing full boost.

Test 14FB advanced 6.92 feet. The tool was retrieved containing approximately 9 feet of competent rock core, suggesting that a core stick-up from test 13FB had been captured along with 14FB.

PCTB Land Test 3: Daily Report

Date: Monday, 19 April 2021

Structure of Report: Each daily report will include a summary of results, and then two event logs: 1) as recorded by Tom Pettigrew and 2) as recorded by Geotek Inc.

Summary: The PCTB-FB was deployed three times (COK-15FB, COK-16FB, and COK-17FB). The first test successfully sealed and recovered 4 ft out of 5.3 ft drilled. During tool retrieval of the second test, the wireline failed and the tool was dropped approximately 10 ft back to the BHA. The PCTB-FB was pulled out with a pipe trip. The ball valve closed and sealed. The recovered core was 4.4 ft relative to 6.7 ft drilled. In the third test, the PCTB-FB landed 30 ft above previous deployment depths, and was interpreted to have not latched into the BHA correctly. Pumps were run and a high standpipe pressure was observed. The tool was retrieved using the emergency pulling tool and redeployed. Coring continued to drill 1.3 ft. Upon retrieval and disassembly it was observed that the ball valve was partially open and the core liner had collapsed. It is possible that the high standpipe pressure observed contributed to core liner collapse, and probably the core liner collapse prevented a smooth, complete tool actuation, resulting in the open ball valve. 1.1 ft of core was recovered.

Drilling/Coring Operations:

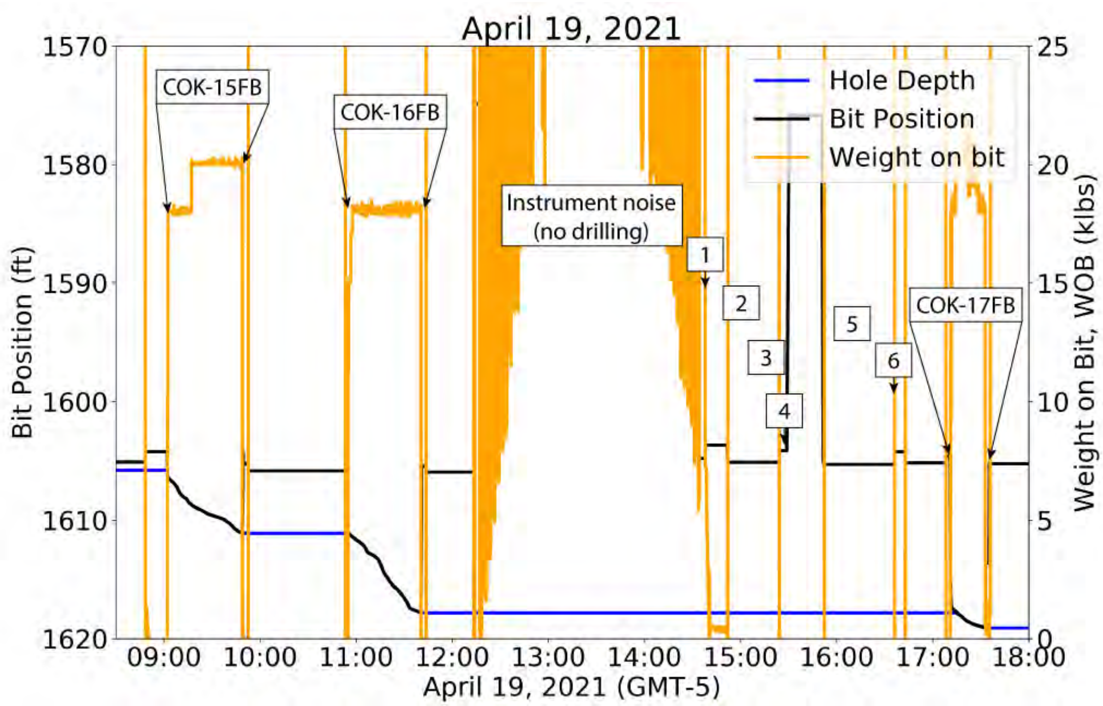

Figure 1: **Drilling Summary for April 18, 2021.** Bit position, hole depth, and weight on bit for three coring runs (COK-15FB, COK-16FB, and COK-17FB). The rate of penetration for COK-

15FB and COK-16FB was 5 to 10 ft/hr, whereas the rate of penetration for COK-17FB was 5 ft/hr. The interval from 1605.8'-1619.1' was drilled while these cores were taken. The instrument noise is related to the pipe trip needed to remove the tool in COK-16FB. Special events marked: 1. Circulation begins to clean BHA. 2. PCTB is sent downhole for test COK-17FB the first time. 3. PCTB lands too high and does not latch into BHA correctly. 4. Pumps are run, high standpipe pressure observed. 5. Emergency pulling tool retrieved PCTB. 6. Circulation begins to clean BHA.

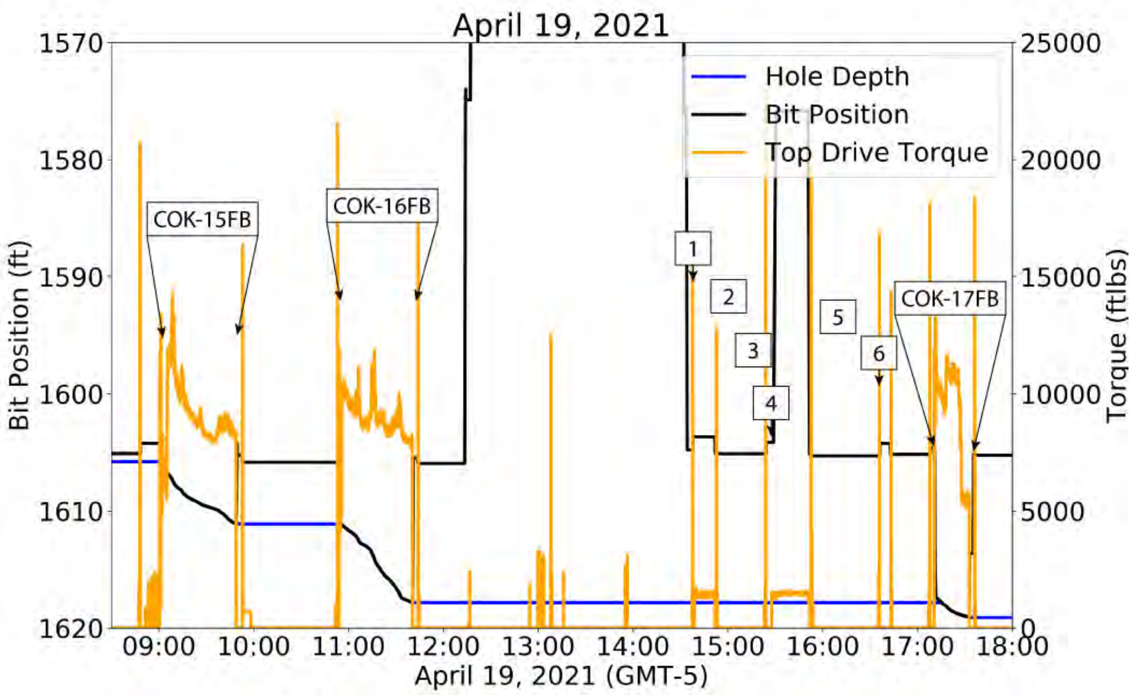

Figure 2: **Drilling Summary for April 18, 2021.** Bit position, hole depth, and top drive torque for coring runs COK-15FB, COK-16FB, and COK-17FB. Special events marked: 1. Circulation begins to clean BHA. 2. PCTB is sent downhole for test COK-17FB the first time. 3. PCTB lands too high and does not latch into BHA correctly. 4. Pumps are run, high standpipe pressure observed. 5. Emergency pulling tool retrieved PCTB. 6. Circulation begins to clean BHA.

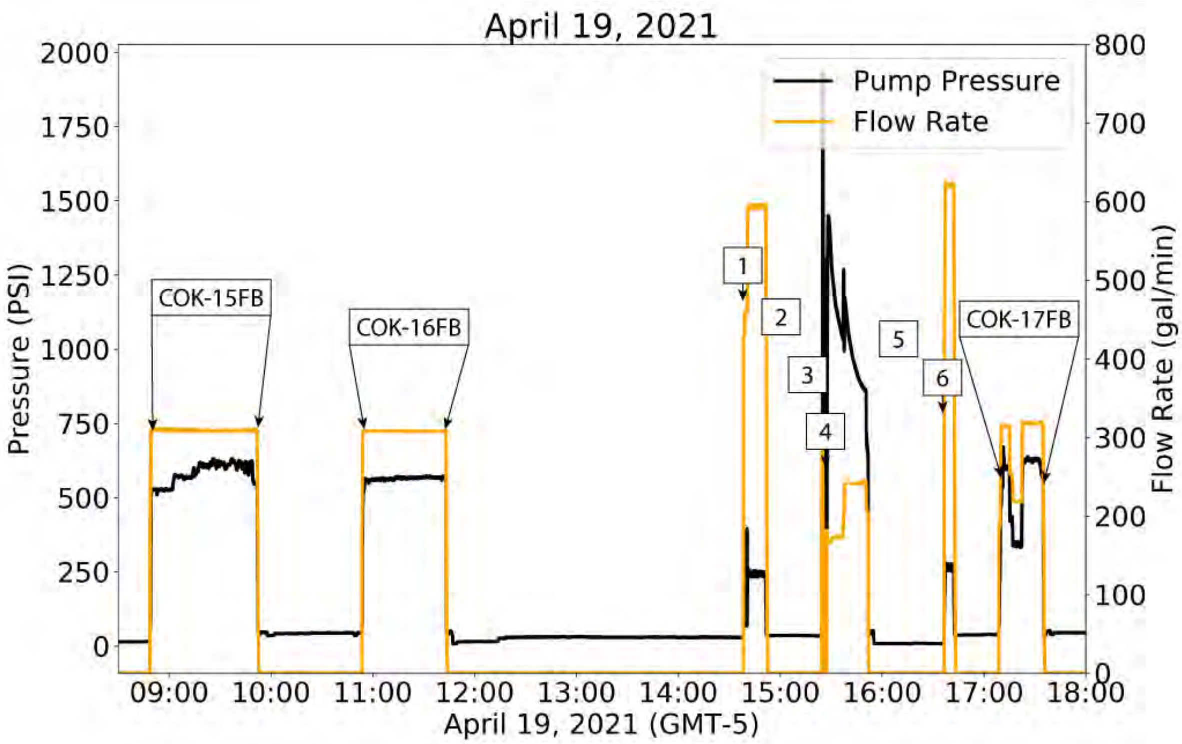

Figure 3: **Drilling Summary for April 18, 2021.** Pump Pressure and Flow Rate for coring runs COK-15FB, COK-16FB, and COK-17FB. Special events marked: 1. Circulation begins to clean BHA. 2. PCTB is sent downhole for test COK-17FB the first time. 3. PCTB lands too high and does not latch into BHA correctly. 4. Pumps are run, high standpipe pressure observed. 5. Emergency pulling tool retrieved PCTB. 6. Circulation begins to clean BHA.

Coring Results:

Coring Test 15 (COK-15FB): The testing program continued for the PCTB-FB at 1605.8 ft. The tool was run into the hole and drilled 5.3 ft. The tool sealed and boosted successfully. The recovered core was 4 ft, resulting in a 75% recovery rate. Upon closer examination of the core, there is evidence of interbedded shale/sandstone.

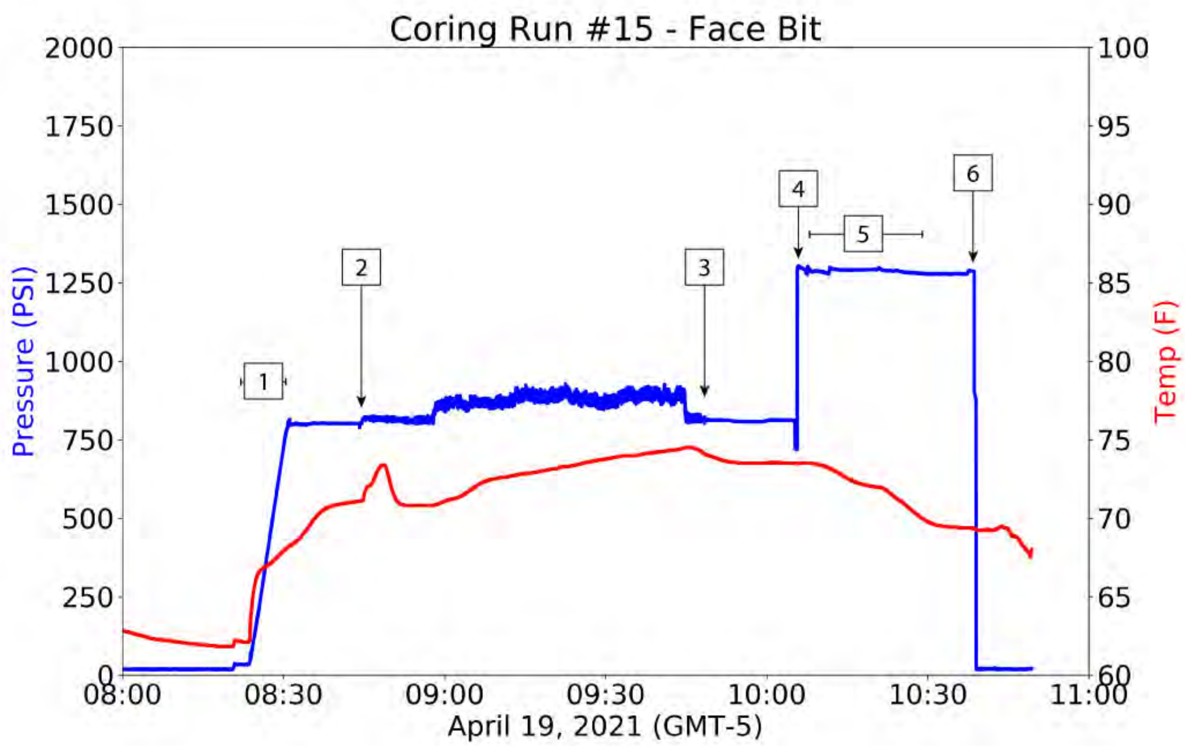

Figure 4: **Coring Test 15 (COK-15FB).** DST pressure and temperature data. Summary of events: **1:** Core barrel lowered down hole and latched into BHA at 1605.8. **2:** Pumps turn on at 300 GPM. **2:** Pumps turn off. **4:** PCTB is actuated an a boost is recorded. **5:** PCTB is brought back to rig floor. **6:** PCTB is depressurized in the lab.

Figure 5: **Coring Test 15 (COK-15FB).** 4 ft of recovered core, with the top being on the left. Interbedded shale and sand are present in the core, with the shale sections being more fragile.

Coring Test 16 (COK-16FB): The coring operation drilled 6.7 ft. Upon retrieval of the tool, the wireline socket failed and dropped the tool. The BHA was pulled out of the hole to recover the PCTB-FB. The recovered core was 4.4 ft, resulting in a recovery rate of approximately 65%. The DST was broken, presumably from the tool drop, so there is no DST pressure or temperature data for this test.

Figure 6: **Coring Test 16 (COK-16FB).** 4.4 ft of recovered core, with the top being on the left. Shale is the predominant lithology throughout the entire core.

Coring Test 17 (COK-17FB): The PCTB-FB was run in the hole. The tool landed approximately 30 ft before previous deployment depths, and was interpreted to not have latched into the BHA correctly. Pumps were run and a high standpipe pressure was observed. The tool was retrieved using the emergency pulling tool and redeployed. The coring tool was pulled out using the emergency pulling tool. Upon retrieval and disassembly it was observed that the ball valve was partially open and the core liner had collapsed. It is possible that the high standpipe pressure observed contributed to core liner collapse, and probably the core liner collapse prevented a smooth, complete tool actuation, resulting in the open ball valve. 1.1 ft of core was recovered from the undamaged core liner, which results in a recovery rate of 89%.

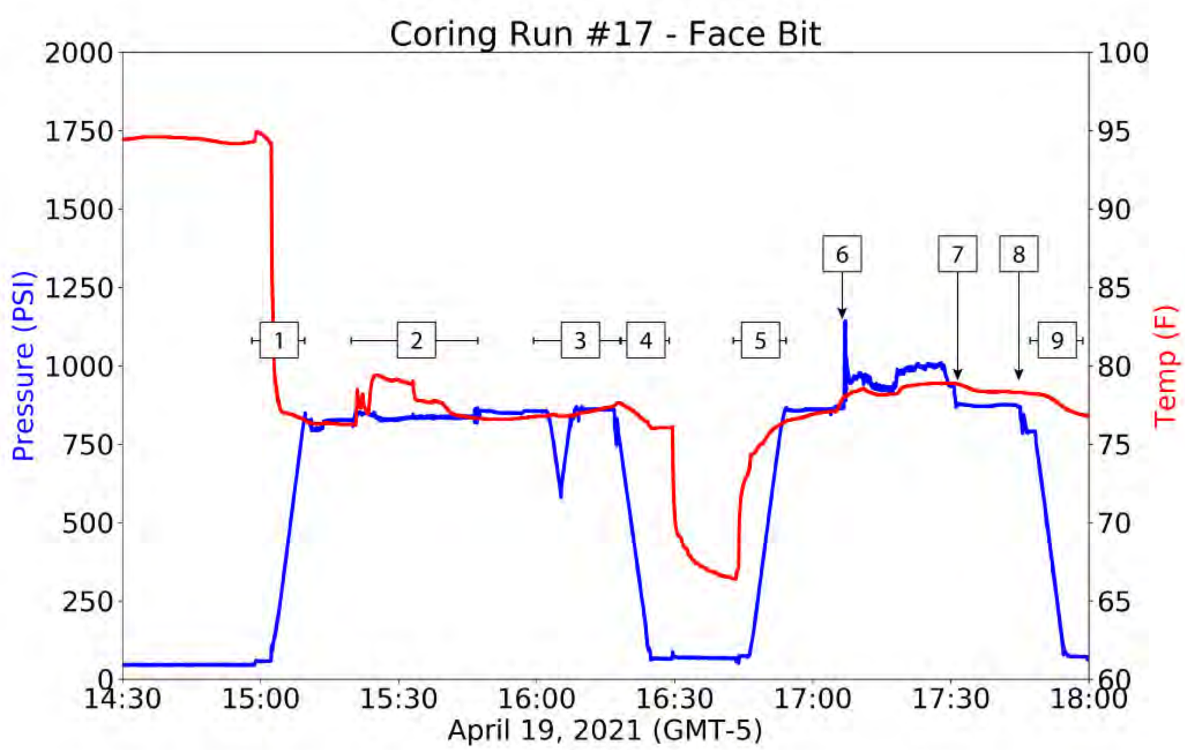

Figure 7: **Coring Test 17 (COK-17FB).** DST pressure and temperature data. Summary of events: **1:** Core barrel lowered down hole and lands an estimated ~30 ft above the BHA. **2:** Circulation at 200-250 GPM. **3:** Attempts to retrieve the tool with emergency pulling tool. **4:** PCTB is pulled out of hole with emergency pulling tool. **5:** The same PCTB is run in hole. **6:** Pumps turned on at 310

GPM. **7.** Pumps turned off. **8.** PCTB actuated. No pressure boost recorded. **9.** PCTB is pulled out of hole.

Figure 9: **Coring Test 17 (COK-17FB).** Partial ball valve closure observed at the drilling floor (left) and collapsed core liner.

Figure 10: **Coring Test 17 (COK-17FB).** 1.16 ft of recovered core from the core liner, despite partial collapse.

Pettigrew Report:

Monday 19 April 2021

0700 Sign in, safety briefing.

0720 Run in hole with bit to TD.

0820 Rig up wireline.

Run in hole with 15FB.

Rig down wireline.

Cut core.

0950 Rig up wireline.

Iron roughneck back in service.

1020 15FB on deck.

Ball closed, 1220 psi captured, 4 ft of core.

1030 Run in hole with 16FB.

Rig down wireline.

Cut core.

1145 Rig up wireline.

1200 Wireline parted at weak link while recovering 16FB.

Rig down wireline.

Pull out of hole with bit to recover 16FB.

1300 16FB at rig floor.

Pulling tool stuck in core barrel (see comment 1).

Ball closed, 1340 psi trapped, 4 feet of core.

Run in the hole with bit to TD.

Circulate drill string/BHA clean.

1445 Free pulling tool from core barrel and repair core barrel upper subassembly.

1500 Rig up wireline.

Run in the hole with 17FB.

17FB landed ~30 ft high releasing running tool.

Pull out of hole with running tool.

Rig down wireline.

Circulation indicated pressure 3x normal.

Rig up wireline.

Run in the hole with emergency pulling tool.

Engage core barrel, work core barrel up and down.

Core barrel moved down landing in BHA.

Attempt to shear release emergency pulling tool failed.

1615 Pull out of hole with core barrel.

Rig down wireline.

1630 Circulate drill string/BHA vigorously.

1645 Rig up wireline.

Run in the hole with 17FB.

Rig down wireline.

Cut core.

1735 Rig up wireline.

Run in the hole to recover 17FB.

1755 17FB at rig floor

Ball valve failed to close completely, no pressure trapped (see comment 2).

Rig down wireline.

Pull out of hole with bit to casing shoe.

Clean and service coring tools.

Comments:

1. Speculation . . . When the wireline parted the core barrel was ~10 feet above the landing shoulder in the BHA. The core barrel dropped back down the BHA landing once again. When the core barrel landed the wireline sinker bar jar closed driving the pulling tool down into the inner latch mechanism where it became stuck.

2. Speculation . . . Debris may have been pushed up inside the BHA while running in the hole with the bit after the first recovery of 17FB. Possibly all of the debris was not flushed out of the BHA during the initial circulation exercise. The remaining debris caused the core barrel to land high and infiltrated the ball valve mechanism preventing it from functioning properly. Prior to further deployments the BHA will be pulled out of the hole are fully inspected.

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Daily Progress Report

DPR 8
Date: 2021-04-19
Location: Catoosa Test Facility (CTF), Hallett, Oklahoma
Staff: P. Schultheiss, M. Mimitz, M. Selman, A. Burrows, D. Minarich, J. Mariani, J.P. Riley, C. Sandusky

Testing continued today on the face bit configuration of the PCTB. Repair of the iron roughneck was completed early in the morning allowing for more efficient tripping times throughout the day.

Test 15FB was performed while drilling. The main bit advanced 4.79 feet. The tool was retrieved containing approximately 4 feet of rock core. Full boost was captured.

Test 16FB was performed while drilling. The main bit advanced 6.65 feet. During retrieval, the wireline termination failed. The sinker bar, link jar, pulling tool, and coring tool were dropped a short distance onto the replaceable seat. A pipe trip was required to recover the tool and sinker bar assembly. The autoclave contained approximately 4.5 feet of rock core. Full boost was captured.

During deployment of test 17FB, the wireline appeared to land the tool at a point above previous deployment depths. Pump pressure was applied to the string and high standpipe pressure was observed. The coring tool was retrieved using the emergency pulling tool and immediately redeployed, reaching the correct landing depth before releasing. The hole was advanced 1.6 feet. The coring tool was brought to the surface where a half-open ball valve was observed. Disassembly in the coring service unit revealed that the lower portion of the core liner had collapsed, which in turn did not allow a full and rapid stroke of the ball valve release sleeve. Furthermore, the core liner had ruptured, allowing debris from the captured core to fall into the ball valve seal carrier which further retarded ball valve closure.

PCTB Land Test 3: Daily Report

Date: Tuesday, 20 April 2021

Structure of Report: Each daily report will include a summary of results, and then two event logs: 1) as recorded by Tom Pettigrew and 2) as recorded by Geotek Inc.

Summary: The PCTB-FB was deployed two times (COK-18FB and COK-19FB). The first test successfully sealed and recovered 3.1 ft out of 3.5 ft drilled. During the second test, coring continued to drill 6.4 ft. The PCTB-FB successfully sealed and boosted. The recovered core was 5.5 ft.

Drilling/Coring Operations:

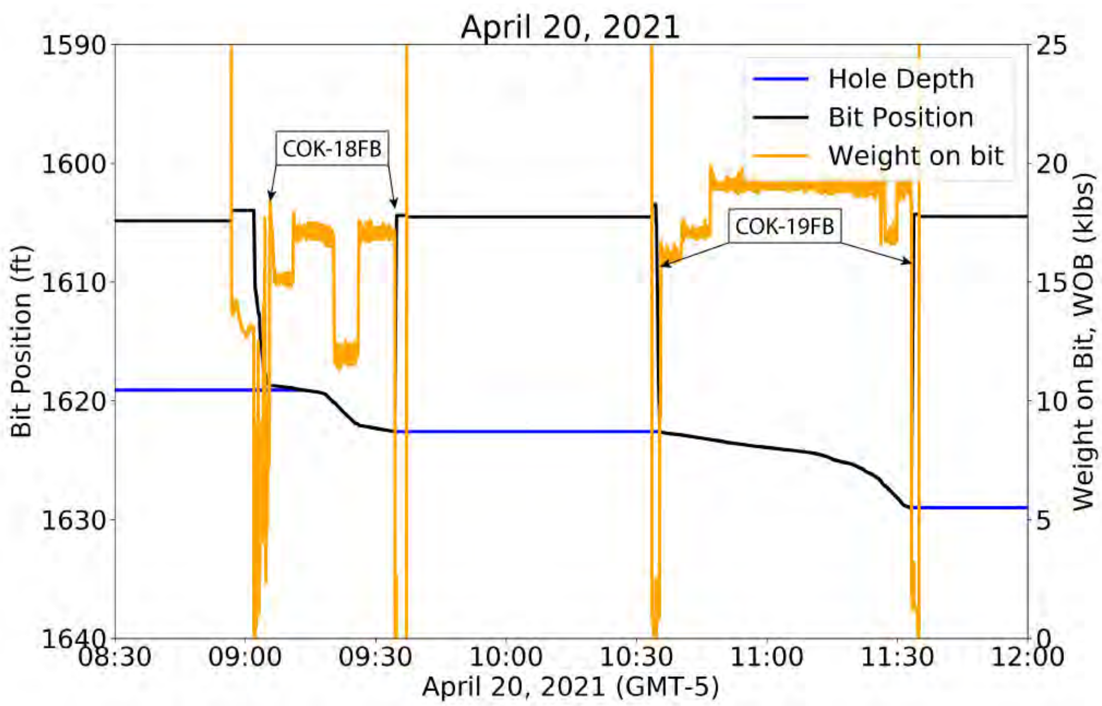

Figure 1: **Drilling Summary for April 20, 2021.** Bit position, hole depth, and weight on bit for the two coring runs (COK-18FB and COK-19FB). The rate of penetration for COK-18FB and COK-19FB ranged from 2.5 to 20 ft/hr. The interval from 1619.1' - 1629' was drilled while these cores were taken.

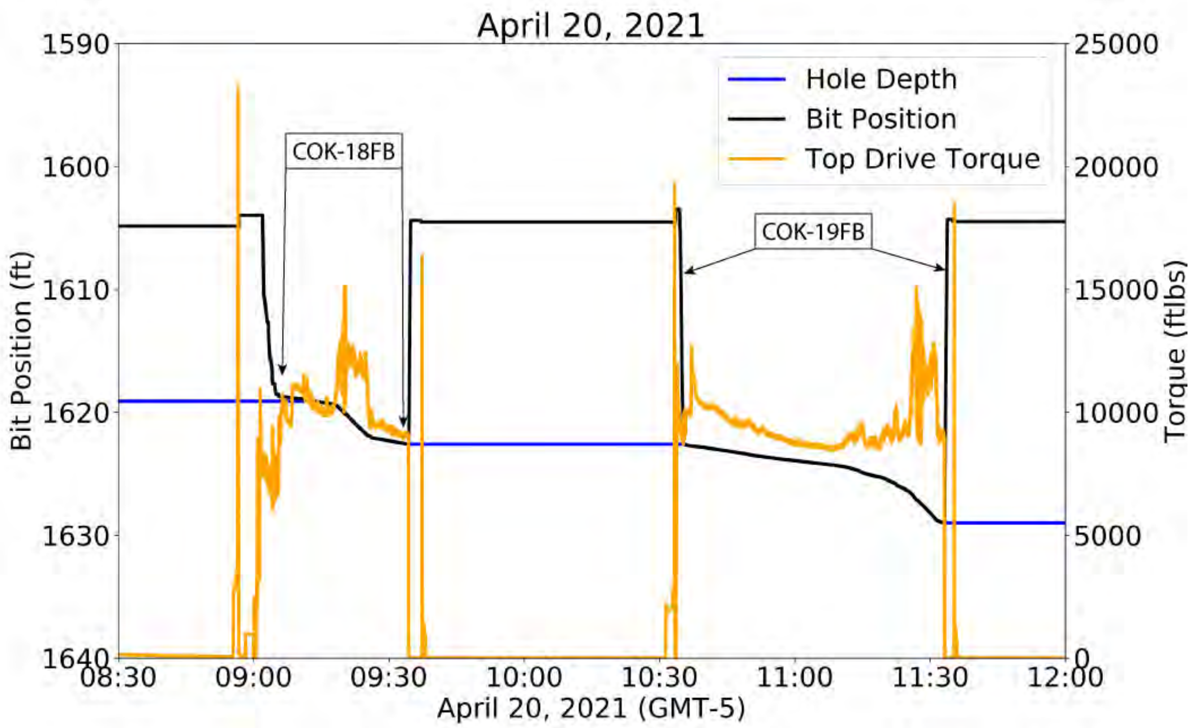

Figure 2: **Drilling Summary for April 20, 2021.** Bit position, hole depth, and top drive torque for coring runs COK-18FB, and COK-19FB.

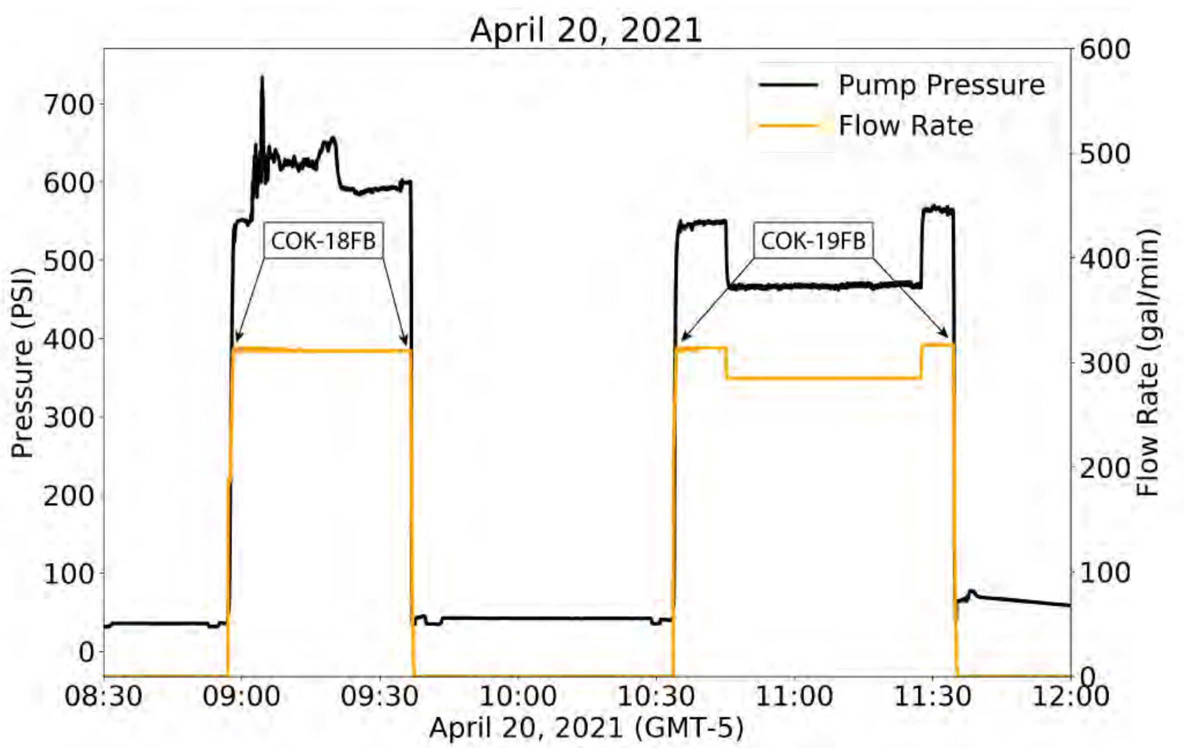

Figure 3: **Drilling Summary for April 20, 2021.** Pump Pressure and Flow Rate for coring runs COK-18FB, and COK-19FB.

Coring Results:

Coring Test 18 (COK-18FB): The testing program continued for the PCTB-FB at 1619.1 ft. The tool was run into the hole and drilled 3.5 ft. The tool sealed and boosted successfully. The recovered core was 3.1 ft, which results in an 88% recovery rate. Upon closer examination of the core, there is evidence of interbedded shale/sandstone.

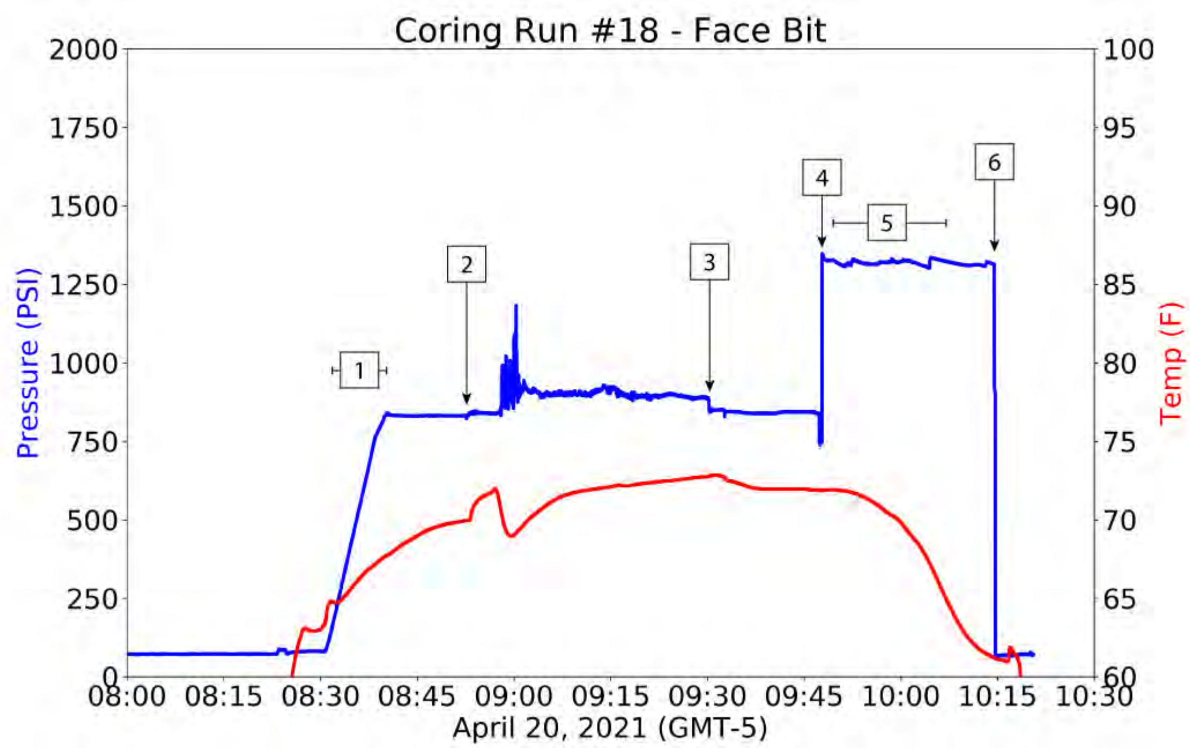

Figure 4: **Coring Test 18 (COK-18FB).** DST pressure and temperature data. Summary of events: **1:** Core barrel lowered down hole and latched into BHA at 1619.1 ft **2:** Pumps turn on at 311 GPM. **3:** Pumps turn off. **4:** PCTB is actuated and a boost is recorded. **5:** PCTB is brought back to rig floor. **6:** PCTB is depressurized in the lab.

Figure 5: **Coring Test 18 (COK-18FB).** 3.1 ft of recovered core, with the top being on the left. Interbedded shale and sand are present in the core, with the shale sections being more fragile.

Coring Test 19 (COK-19FB): The coring operation continued to drill 6.4 ft. The tool actuated the ball valve, sealed and boosted successfully. The recovered core was 5.5 ft, resulting in a recovery rate of approximately 86%.

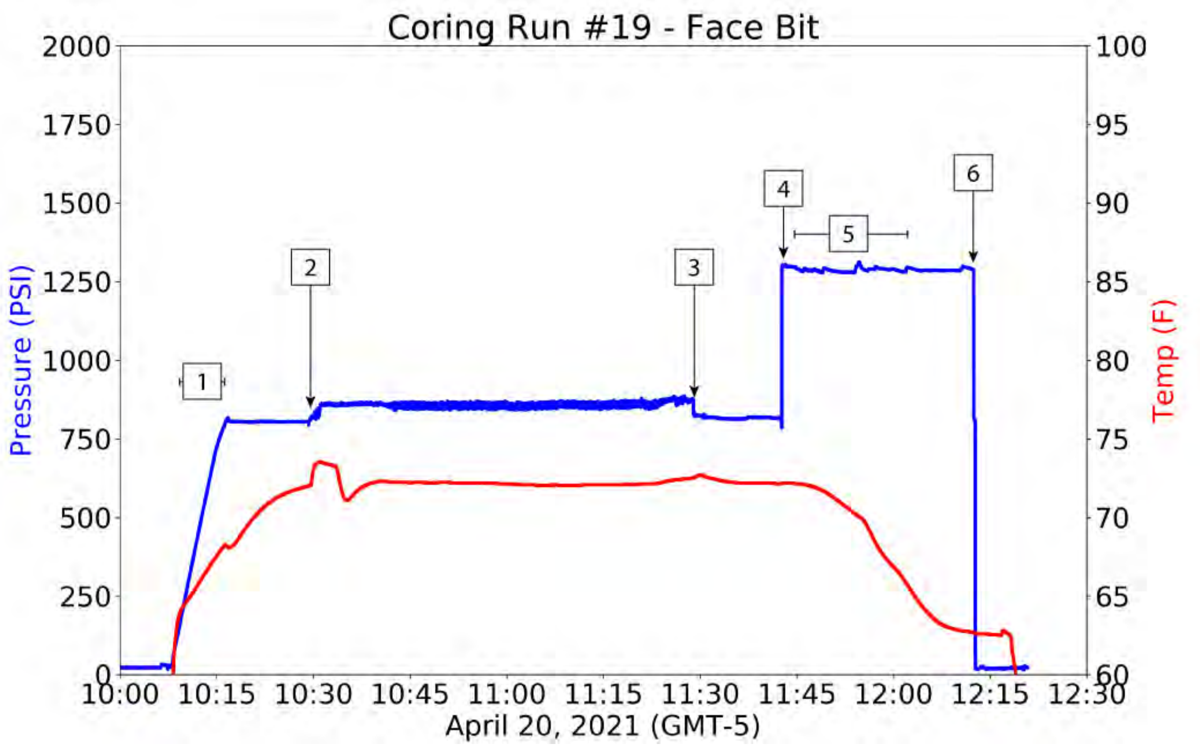

Figure 4: **Coring Test 19 (COK-19FB).** DST pressure and temperature data. Summary of events: **1:** Core barrel lowered down hole and latched into BHA at 1622.6. **2:** Pumps turn on at 285-313 GPM. **2:** Pumps turn off. **4:** PCTB is actuated and a boost is recorded. **5:** PCTB is brought back to rig floor. **6:** PCTB is depressurized in the lab.

Figure 6: **Coring Test 19 (COK-19FB).** 5.5 ft of recovered core, with the top being on the left. Interbedded shale and limestone are present in the core.

Pettigrew Report:

Tuesday 20 April 2021

0700 Sign in, safety briefing.

0720 Run in hole with bit to TD.

0825 Rig up wireline.

Run in hole with 18FB.

Rig down wireline.

Cut core.

1000 Rig up wireline.

Recover 18FB, 1222 psi trapped, 3 ft core.

Run in hole with 19FB.

Rig down wireline.

Cut core.

1134 Rig up wireline.

Recover 19FB, 1216 psi trapped, 5.5 ft core.

Rig down wireline.

Pull out of hole with bit laying down singles.

1215 Release wireline unit.

Demob.

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Daily Progress Report

DPR 9
Date: 2021-04-20
Location: Catoosa Test Facility (CTF), Hallett, Oklahoma
Staff: P. Schultheiss, M. Mimitz, M. Selman, A. Burrows, D. Minarich, J. Mariani, J.P. Riley, C. Sandusky

Testing of the PCTB concluded today with tests 18FB and 19FB. In test 18FB, the main bit advanced 3.86 feet, and recovered approximately 3.25 feet of rock core. Full boost was captured. During test 19FB, the main bit advanced 6.35 feet, recovering 6.5 feet of rock core at full boost pressure.

Following completion of testing the pipe trip to surface was completed, with each joint of pipe flushed and washed as it was broken. The BHA was broken and removed to the coring van where it was disassembled and washed prior to packing.

The coring tools were rinsed and stowed for transport, with inventory and inspection and preparation for storage to take place in Salt Lake City. Trucking to Salt Lake City is slightly delayed due to current demand for flatbed carriage in the area. Current outlook is for the service vans to be loaded out on Friday, April 22nd. Geotek staff will be onsite at Catoosa Test Facility for rigging and loading of the containers.

PCTB Land Test III 2021 Report

Appendix E: Drilling Mud

Mud Report

Particle size distribution: sieve data gathered on site

Date	Time	Sample	Weight (lb)	Volume (gal)	Density (ppg)	Retained Mesh 5 (4 mm)	Retained Mesh 10 (2 mm)	Retained Mesh 35 (0.5 mm)	Retained Mesh 60 (0.25 mm)	Retained Mesh 120 (0.125 mm)	Retained Mesh 230 (0.062 mm)
4/16	10:30 AM	Before shaker	NA	2.5	NA	1.520%	0.005%	0.008%	0.001%	0.000%	NA
4/16	12:00 PM	After shaker	NA	1	NA	0.000%	0.000%	0.000%	0.001%	0.002%	NA
4/17	11:20 AM	After shaker	8.87	0.997	8.90	NA	NA	NA	NA	0.000%	0.018%
4/18	11:40 AM	Before shaker	15.22	1.659	9.17	0.155%	0.016%	NA	0.004%	0.000%	0.022%
4/18	11:40 AM	After shaker	6.21	0.693	8.95	NA	NA	NA	NA	0.000%	0.016%
4/19	10:30 AM	Before shaker	11.63	1.376	8.46	0.526%	0.034%	0.034%	0.005%	0.002%	0.022%
4/19	10:30 AM	After shaker	4.79	0.529	9.04	NA	NA	NA	NA	0.000%	0.008%
4/20	10:30 AM	Before shaker	18.90	2.108	8.97	0.348%	0.022%	0.019%	0.007%	0.003%	0.026%
4/20	10:30 AM	After shaker	7.51	0.825	9.10	NA	NA	NA	NA	0.000%	0.011%

Note: particle concentration in percentage is normalized with respect to the total mass of mud

Mud properties obtained on site

Date	4/13/2021	4/15/2021	4/16/2021	4/18/2021	4/19/2021	4/19/2021	4/20/2021
Time	5:00 PM	9:45 AM	9:30 AM	3:30 PM	10:00 AM	5:30 PM	9:30 AM
Mud type	WB	WB	WB	WB	WB	WB	WB
Mud weight (ppg)	9.3	9	8.9	9.1	9.04	9.04	9.04
Fann Reading 600 rpm (lb/100 ft^2)	26	30	25	21	21	21	20
Fan Reading 300 rpm (lb/100 ft^2)	19	22	18	15	16	16	14
Viscosity (cP)	38	37	34	35	34	34	32
Plastic viscosity (cP)	7	8	7	6	5	5	6
Yield point (lb/100 ft^2)	12	14	11	9	11	11	8
API fluid loss 30 min (cm^3)	49	55	68	70	68	68	62
pH	7.2	7.4	7.1	8.5	9.4	9.4	8.3

Particle size distribution: laser diffraction data obtained at The University of Texas

	Volumetric concentration with respect to total volume of solids (%)			
Particle Size (μm)	**4/18/2021 After shaker**	**4/18/2021 Before shaker**	**4/19/2021 After shaker**	**4/19/2021 Before shaker**
0.1	0.000	0.000	0.000	0.000
0.126	0.000	0.000	0.000	0.000
0.159	0.000	0.000	0.000	0.000
0.2	0.000	0.000	0.000	0.000
0.251	0.000	0.000	0.000	0.000
0.316	0.000	0.000	0.000	0.000
0.398	0.240	0.240	0.232	0.234
0.501	2.160	2.150	2.100	2.102
0.631	4.506	4.480	4.406	4.396
0.795	5.072	5.040	4.966	4.946
1	4.220	4.208	4.158	4.142
1.26	4.038	4.070	4.066	4.052
1.59	4.912	5.004	5.054	5.022
2	6.038	6.174	6.264	6.196
2.51	6.992	7.124	7.222	7.108
3.16	7.478	7.534	7.608	7.442
3.98	7.546	7.472	7.514	7.320
5.01	7.286	7.084	7.104	6.914
6.31	6.674	6.414	6.416	6.256
7.95	5.790	5.554	5.556	5.448
10	4.942	4.776	4.814	4.760
12.6	4.218	4.124	4.210	4.204
15.9	3.610	3.572	3.682	3.716
20	3.154	3.156	3.252	3.320
25.1	2.846	2.896	2.940	3.048
31.7	2.384	2.486	2.468	2.604
39.9	1.914	2.054	1.980	2.142
50.2	1.468	1.620	1.522	1.686
63.2	1.052	1.186	1.088	1.240
79.5	0.716	0.806	0.726	0.846
100	0.448	0.482	0.432	0.522
126	0.232	0.232	0.204	0.258
159	0.058	0.062	0.020	0.066
200	0.000	0.000	0.000	0.000
252	0.000	0.000	0.000	0.000
317	0.000	0.000	0.000	0.000
399	0.000	0.000	0.000	0.000
502	0.000	0.000	0.000	0.000
632	0.000	0.000	0.000	0.000
796	0.000	0.000	0.000	0.000
1000	0.000	0.000	0.000	0.000
1260	0.000	0.000	0.000	0.000
1590	0.000	0.000	0.000	0.000
2000	0.000	0.000	0.000	0.000

Note: the report shows the cumulative particle size distribution normalized with respect to the total solids concentration.

Total solids concentration data obtained at The University of Texas

Sample	**Total solids concentration (%)**
4/18 after shakers	16.6
4/18 before shakers	17.3
4/19 after shakers	15.3
4/19 before shakers	17.9

PCTB Land Test III 2021 Report

Appendix F: IADC Reports

LEASE	WELL NO.	API WELL NUMBER	WATER DEPTH	DATE
Hallett	T-Bird 9J			22-Mar-2021

OPERATOR	CONTRACTOR	RIG NO.
GEOTEK	Catoosa Test Facility	1T

SIGNATURE OF OPERATOR'S REPRESENTATIVE	SIGNATURE OF CONTRACTOR'S TOOL PUSHER
Justin Tanner	Justin Tanner

DP SIZE	WEIGHT	GRADE	TOOL JT O.D.	TYPE THREAD	STRING NO.	PUMP NO.	PUMP MANUFACTURER	TYPE	STROKE LENGTH
						1	emsco	tri	12.000
						2	emsco	tri	12.000
						3			
						4			

TIME DISTRIBUTION HOURS

CODE NO.	OPERATION	TOUR 1	TOUR 2
1	RIG UP AND TEAR DOWN		
2	DRILL ACTUAL	8:45	
3	REAMING		
4	CORING		
5	CONDITION MUD & CIRCULATE	0:15	
6	TRIPS	3:15	
7	LUBRICATE RIG		
8	REPAIR RIG		
9	CUT OFF DRILLING LINE		
10	DEVIATION SURVEY		
11	WIRELINE LOGS		
12	RUN CASING & CEMENT		
13	WAIT ON CEMENT		
14	NIPPLE UP B.O.P.		
15	TEST B.O.P.		
16	DRILL STEM TEST		
17	PLUG BACK		
18	SQUEEZE CEMENT		
19	FISHING		
20	DIR. WORK		
21	customer meet	0:15	
22			
23			
COMPLETION	A. PERFORATING		
	B. TUBING TRIPS		
	C. TREATING		
	D. SWABBING		
	E. TESTING		
	F.		
	G.		
	H.		
TOTALS		12:30	

DAYWORK TIME SUMMARY (OFFICE USE ONLY)

HOURS W/CONTR D.P.		
HOURS W/OPR D.P.		
HOURS WITHOUT D.P.		
HOURS STANDBY		
TOTAL DAYWORK		
NO. OF DAYS FROM SPUD		
CUMULATIVE ROTATING HOURS		
DAILY MUD COST		
TOTAL MUD COST		

TOUR 1

DRILLING ASSEMBLY (AT END OF TOUR)

NO.	ITEM	O.D.	LENGTH
1	bit	12.25	0.9
1	bit sub		2
1	cross over		3.41
1	crossover		3.6
34	STANDS D.P.	4.5	3187.79
0	SINGLES D.P.	4.5	0
	KELLY DOWN		0
	TOTAL		3197.7
	WT. OF STRING		

REMARKS
fuel 29 inches

DRILLER
Andy Brown

BIT RECORD

BIT NO.	
SIZE	
IADC CODE	
MFG	
TYPE	
SERIAL NO.	
JETS	
TFA	
DEPTH OUT	
DEPTH IN	
TOT DRILLED	
TOT HOURS	

CUTTING STRUCTURE

INNER	OUTER	DULL CHAR	LOCATION	BEARINGS/ SEALS	GAGE	OTHER DULL CHAR	REASON PULLED

MUD RECORD

TIME	11:00		15:00		17:00	
WEIGHT	8.5		8.7		8.8	
PRESSURE GRADIENT	0.44115		0.45153		0.45672	
FUNNEL VISCOSITY	32		36		37	
PV/YP	7	5	16	2	11	11
GEL STRENGTH	19	12	34	18	33	22
FLUID LOSS	120		120		55	
pH	10		12.3		12.2	
SOLIDS	0.25		0.25		0.5	

MUD & CHEMICAL ADDED

TYPE	AMOUNT	TYPE	AMOUNT
Gel	55	Starch	50

TOUR 2

DRILLING ASSEMBLY (AT END OF TOUR)

NO.	ITEM	O.D.	LENGTH
	STANDS D.P.		
	SINGLES D.P.		
	KELLY DOWN		
	TOTAL		
	WT. OF STRING		

REMARKS

DRILLER
Justin Tanner

BIT RECORD

BIT NO.	
SIZE	
IADC CODE	
MFG	
TYPE	
SERIAL NO.	
JETS	
TFA	
DEPTH OUT	
DEPTH IN	
TOT DRILLED	
TOT HOURS	

CUTTING STRUCTURE

INNER	OUTER	DULL CHAR	LOCATION	BEARINGS/ SEALS	GAGE	OTHER DULL CHAR	REASON PULLED

MUD RECORD

TIME			
WEIGHT			
PRESSURE GRADIENT			
FUNNEL VISCOSITY			
PV/YP			
GEL STRENGTH			
FLUID LOSS			
pH			
SOLIDS			

MUD & CHEMICAL ADDED

TYPE	AMOUNT	TYPE	AMOUNT

IADC

DAILY DRILLING REPORT

WELL T-Bird 9J REPORT NO. 1 DATE 22-Mar-2021

FIELD OR DISTRICT	COUNTY	STATE / COUNTRY
Hallett	Pawnee	OK / United States

LAST CASING TUBING OR LINER	SIZE	MAKE	WEIGHT GRADE	NO. JOINTS	LENGTH	RKB. TO CSG. HD.	SET AT

WIRE LINE RECORD REEL NO.

SIZE	NO LINES	LENGTH SLIPPED
LENGTH CUT OFF	PRESENT LENGTH	
WEAR OR TRIPS SINCE LAST CUT		
CUMULATIVE WEAR OR TRIPS		

TOUR 1

DEPTH INTERVAL FROM	DEPTH INTERVAL TO	DRILL..D REAM..R CORE..C	CORE NO.	FORMATION (SHOW CORE RECOVERY)	ROTARY TABLE SPEED	WT. ON BIT	PUMP PRESSURE	PUMP NO. 1 LINER SIZE	PUMP NO. 1 S.P.M.	PUMP NO. 2 LINER SIZE	PUMP NO. 2 S.P.M.	PUMP NO. 3 LINER SIZE	PUMP NO. 3 S.P.M.	PUMP NO. 4 LINER SIZE	PUMP NO. 4 S.P.M.	TOTAL PUMP OUTPUT

DEVIATION RECORD

DEPTH	DEV	DIR.	TVD	HORZ. DISP.	DEPTH	DEV	DIR.	TVD	HORZ. DISP.	DEPTH	DEV	DIR.	TVD	HORZ. DISP.

From	To	Elapsed Time	CodeNo	Details Of Operations In Sequence And Remarks
7:00	7:15	0:15	21	customer meeting
7:15	9:15	2:00	6	make up bit and pick up heavy weights
9:15	10:00	0:45	6	trip to bottom
10:00	18:45	8:45	2	drilling from 750-1006
18:45	19:00	0:15	5	circulate hole clean
19:00	19:30	0:30	6	trip up to casing

TOUR 2

DEPTH INTERVAL FROM	DEPTH INTERVAL TO	DRILL..D REAM..R CORE..C	CORE NO.	FORMATION (SHOW CORE RECOVERY)	ROTARY TABLE SPEED	WT. ON BIT	PUMP PRESSURE	PUMP NO. 1 LINER SIZE	PUMP NO. 1 S.P.M.	PUMP NO. 2 LINER SIZE	PUMP NO. 2 S.P.M.	PUMP NO. 3 LINER SIZE	PUMP NO. 3 S.P.M.	PUMP NO. 4 LINER SIZE	PUMP NO. 4 S.P.M.	TOTAL PUMP OUTPUT

DEVIATION RECORD

DEPTH	DEV	DIR.	TVD	HORZ. DISP.	DEPTH	DEV	DIR.	TVD	HORZ. DISP.	DEPTH	DEV	DIR.	TVD	HORZ. DISP.

From	To	Elapsed Time	CodeNo	Details Of Operations In Sequence And Remarks

IADC

DRILLING CREW PAYROLL DATA

DATE

WELL NAME & NO.

COMPANY

TOOLPUSHER Justin Tanner

TOUR 1 CREW	EMPL. ID NO.	FROM
Driller		A
Derrickman		B
Derrickman		L
Floorman		C
Floorman		E

NO. DAYS SINCE LAST LOST TIME ACCIDENT

TOUR 2 CREW	EMPL. ID NO.	FROM

NO. DAYS SINCE LAST LOST TIME ACCIDENT

IADC

LEASE	WELL NO.	API WELL NUMBER	WATER DEPTH	DATE
Hallett	T-Bird 9J			23-Mar-2021

OPERATOR	CONTRACTOR	RIG NO.
GEOTEK	Catoosa Test Facility	1T

SIGNATURE OF OPERATOR'S REPRESENTATIVE	SIGNATURE OF CONTRACTOR'S TOOL PUSHER
Justin Tanner	Justin Tanner

DP SIZE	WEIGHT	GRADE	TOOL JT O.D.	TYPE THREAD	STRING NO.	PUMP NO.	PUMP MANUFACTURER	TYPE	STROKE LENGTH
						1	emsco	tri	12.000
						2	emsco	tri	12.000
						3			
						4			

TIME DISTRIBUTION HOURS

CODE NO.	OPERATION	TOUR 1	TOUR 2
1	RIG UP AND TEAR DOWN		
2	DRILL ACTUAL	10:15	
3	REAMING		
4	CORING		
5	CONDITION MUD & CIRCULATE	0:15	
6	TRIPS	1:30	
7	LUBRICATE RIG		
8	REPAIR RIG		
9	CUT OFF DRILLING LINE		
10	DEVIATION SURVEY		
11	WIRELINE LOGS		
12	RUN CASING & CEMENT		
13	WAIT ON CEMENT		
14	NIPPLE UP B.O.P.		
15	TEST B.O.P.		
16	DRILL STEM TEST		
17	PLUG BACK		
18	SQUEEZE CEMENT		
19	FISHING		
20	DIR. WORK		
21	customer meet	0:15	
22	shut down rig	0:15	
23			
COMPLETION	A. PERFORATING		
	B. TUBING TRIPS		
	C. TREATING		
	D. SWABBING		
	E. TESTING		
	F.		
	G.		
	H.		
TOTALS		12:30	
DAYWORK TIME SUMMARY (OFFICE USE ONLY)			
HOURS W/CONTR D.P.			
HOURS W/OPR D.P.			
HOURS WITHOUT D.P.			
HOURS STANDBY			
TOTAL DAYWORK			
NO. OF DAYS FROM SPUD			
CUMULATIVE ROTATING HOURS			
DAILY MUD COST			
TOTAL MUD COST			

TOUR 1

DRILLING ASSEMBLY (AT END OF TOUR)

NO.	ITEM	O.D.	LENGTH
1	bit	12.25	0.9
1	bit sub		2
1	cross over		3.41
1	crossover		3.6
34	STANDS D.P.	4.5	3187.79
0	SINGLES D.P.	4.5	0
	KELLY DOWN		0
	TOTAL		3197.7
	WT. OF STRING		

REMARKS
fuel 26 inches

DRILLER
Andy Brown

BIT RECORD

BIT NO.	
SIZE	
IADC CODE	
MFG	
TYPE	
SERIAL NO.	
JETS	
TFA	
DEPTH OUT	
DEPTH IN	
TOT DRILLED	
TOT HOURS	

CUTTING STRUCTURE

INNER	OUTER	DULL CHAR	LOCATION

BEARINGS/SEALS	GAGE	OTHER DULL CHAR	REASON PULLED

MUD RECORD

TIME	09:00	14:00	16:00
WEIGHT	8.9	9.3	9.3
PRESSURE GRADIENT	0.46191	0.48267	0.48267
FUNNEL VISCOSITY	32	36	35
PV/YP	7 / 0	7 / 6	10 / 3
GEL STRENGTH	14 / 7	23 / 13	23 / 13
FLUID LOSS	15	16	8
pH	12	12	11.4
SOLIDS	0.25	0.25	0.25

MUD & CHEMICAL ADDED

TYPE	AMOUNT	TYPE	AMOUNT
Starch	35	Gel	70
Drispac	2	flozan	2

TOUR 2

DRILLING ASSEMBLY (AT END OF TOUR)

NO.	ITEM	O.D.	LENGTH
	STANDS D.P.		
	SINGLES D.P.		
	KELLY DOWN		
	TOTAL		
	WT. OF STRING		

REMARKS

DRILLER
Justin Tanner

BIT RECORD

BIT NO.	
SIZE	
IADC CODE	
MFG	
TYPE	
SERIAL NO.	
JETS	
TFA	
DEPTH OUT	
DEPTH IN	
TOT DRILLED	
TOT HOURS	

CUTTING STRUCTURE

INNER	OUTER	DULL CHAR	LOCATION

BEARINGS/SEALS	GAGE	OTHER DULL CHAR	REASON PULLED

MUD RECORD

TIME	
WEIGHT	
PRESSURE GRADIENT	
FUNNEL VISCOSITY	
PV/YP	
GEL STRENGTH	
FLUID LOSS	
pH	
SOLIDS	

MUD & CHEMICAL ADDED

TYPE	AMOUNT	TYPE	AMOUNT

IADC

DAILY DRILLING REPORT WELL T-Bird 9J REPORT NO. 2 DATE 23-Mar-2021

FIELD OR DISTRICT	COUNTY	STATE / COUNTRY
Hallett	Pawnee	OK / United States

	SIZE	MAKE	WEIGHT GRADE	NO. JOINTS	LENGTH	RKB. TO CSG. HD.	SET AT
LAST CASING							
TUBING							
OR LINER							

WIRE LINE RECORD REEL NO.

SIZE	NO LINES	LENGTH SLIPPED

LENGTH CUT OFF / PRESENT LENGTH
WEAR OR TRIPS SINCE LAST CUT
CUMULATIVE WEAR OR TRIPS

TOUR 1

DEPTH INTERVAL FROM	TO	DRILL..D REAM...R CORE...C	CORE NO.	FORMATION (SHOW CORE RECOVERY)	ROTARY TABLE SPEED	WT. ON BIT	PUMP PRESSURE	PUMP NO. 1 LINER SIZE	S.P.M.	PUMP NO. 2 LINER SIZE	S.P.M.	PUMP NO. 3 LINER SIZE	S.P.M.	PUMP NO. 4 LINER SIZE	S.P.M.	TOTAL PUMP OUTPUT

DEVIATION RECORD

DEPTH	DEV	DIR.	TVD	HORZ. DISP.	DEPTH	DEV	DIR.	TVD	HORZ. DISP.	DEPTH	DEV	DIR.	TVD	HORZ. DISP.

From	To	Elapsed Time	CodeNo	Details Of Operations In Sequence And Remarks
7:00	7:15	0:15	21	customer meeting
7:15	8:00	0:45	6	start up rig and ream in hole
8:00	18:15	10:15	2	drill from 1006-1262
18:15	18:30	0:15	5	circulate hole clean
18:30	19:15	0:45	6	trip up to casing
19:15	19:30	0:15	22	shut down rig

TOUR 2

DEPTH INTERVAL FROM	TO	DRILL..D REAM...R CORE...C	CORE NO.	FORMATION (SHOW CORE RECOVERY)	ROTARY TABLE SPEED	WT. ON BIT	PUMP PRESSURE	PUMP NO. 1 LINER SIZE	S.P.M.	PUMP NO. 2 LINER SIZE	S.P.M.	PUMP NO. 3 LINER SIZE	S.P.M.	PUMP NO. 4 LINER SIZE	S.P.M.	TOTAL PUMP OUTPUT

DEVIATION RECORD

DEPTH	DEV	DIR.	TVD	HORZ. DISP.	DEPTH	DEV	DIR.	TVD	HORZ. DISP.	DEPTH	DEV	DIR.	TVD	HORZ. DISP.

From	To	Elapsed Time	CodeNo	Details Of Operations In Sequence And Remarks

IADC

DRILLING CREW PAYROLL DATA

DATE
WELL NAME & NO.
COMPANY
TOOLPUSHER Justin Tanner

TOUR 1 CREW	EMPL.ID NO.	FROM
Driller		A
Derrickman		B
Derrickman		L
Floorman		C
Floorman		E

NO. DAYS SINCE LAST LOST TIME ACCIDENT

TOUR 2 CREW	EMPL.ID NO.	FROM

NO. DAYS SINCE LAST LOST TIME ACCIDENT

IADC

LEASE	WELL NO.	API WELL NUMBER	WATER DEPTH	DATE
Hallett	T-Bird 9J			25-Mar-2021

OPERATOR	CONTRACTOR	RIG NO.
GEOTEK	Catoosa Test Facility	1T

SIGNATURE OF OPERATOR'S REPRESENTATIVE	SIGNATURE OF CONTRACTOR'S TOOL PUSHER
Justin Tanner	Justin Tanner

DP SIZE	WEIGHT	GRADE	TOOL JT O.D.	TYPE THREAD	STRING NO.	PUMP NO.	PUMP MANUFACTURER	TYPE	STROKE LENGTH
						1	emsco	tri	12.000
						2	emsco	tri	12.000
						3			
						4			

TIME DISTRIBUTION HOURS

CODE NO.	OPERATION	TOUR 1	TOUR 2
1	RIG UP AND TEAR DOWN		
2	DRILL ACTUAL	12:35	
3	REAMING		
4	CORING		
5	CONDITION MUD & CIRCULATE	0:25	
6	TRIPS	2:00	
7	LUBRICATE RIG		
8	REPAIR RIG		
9	CUT OFF DRILLING LINE		
10	DEVIATION SURVEY		
11	WIRELINE LOGS		
12	RUN CASING & CEMENT		
13	WAIT ON CEMENT		
14	NIPPLE UP B.O.P.		
15	TEST B.O.P.		
16	DRILL STEM TEST		
17	PLUG BACK		
18	SQUEEZE CEMENT		
19	FISHING		
20	DIR. WORK		
21	customer meet	0:15	
22	start up rig	0:15	
23	shut down rig	0:15	
COMPLETION	A. PERFORATING		
	B. TUBING TRIPS		
	C. TREATING		
	D. SWABBING		
	E. TESTING		
	F.		
	G.		
	H.		
TOTALS		15:45	
DAYWORK TIME SUMMARY (OFFICE USE ONLY)			
HOURS W/CONTR D.P.			
HOURS W/OPR D.P.			
HOURS WITHOUT D.P.			
HOURS STANDBY			
TOTAL DAYWORK			
NO. OF DAYS FROM SPUD			
CUMULATIVE ROTATING HOURS			
DAILY MUD COST			
TOTAL MUD COST			

TOUR 1

DRILLING ASSEMBLY (AT END OF TOUR)

NO.	ITEM	O.D.	LENGTH
1	bit	12.25	0.9
1	bit sub		2
1	cross over		3.41
1	crossover		3.6
34	STANDS D.P.	4.5	3187.79
0	SINGLES D.P.	4.5	0
	KELLY DOWN		0
	TOTAL		3197.7
	WT. OF STRING		

BIT RECORD

BIT NO.	
SIZE	
IADC CODE	
MFG	
TYPE	
SERIAL NO.	
JETS	
TFA	
DEPTH OUT	
DEPTH IN	
TOT DRILLED	
TOT HOURS	

CUTTING STRUCTURE

INNER	OUTER	DULL CHAR	LOCATION	BEARINGS/SEALS	GAGE	OTHER DULL CHAR	REASON PULLED

MUD RECORD

TIME	09:30	11:30	16:00
WEIGHT	9.4	9.5	9.4
PRESSURE GRADIENT	0.48786	0.49305	0.48786
FUNNEL VISCOSITY	46	40	40
PV/YP	14 / 6	13 / 6	12 / 12
GEL STRENGTH	34 / 20	32 / 19	36 / 24
FLUID LOSS	7	5	6
pH	10.1	9.9	10
SOLIDS	0.5	1	0.25

MUD & CHEMICAL ADDED

TYPE	AMOUNT	TYPE	AMOUNT
Gel	30	Starch	27

REMARKS
fuel 20 inches

DRILLER
Andy Brown

TOUR 2

DRILLING ASSEMBLY (AT END OF TOUR)

NO.	ITEM	O.D.	LENGTH
	STANDS D.P.		
	SINGLES D.P.		
	KELLY DOWN		
	TOTAL		
	WT. OF STRING		

BIT RECORD

BIT NO. / SIZE / IADC CODE / MFG / TYPE / SERIAL NO. / JETS / TFA / DEPTH OUT / DEPTH IN / TOT DRILLED / TOT HOURS

CUTTING STRUCTURE: INNER / OUTER / DULL CHAR / LOCATION / BEARINGS/SEALS / GAGE / OTHER DULL CHAR / REASON PULLED

MUD RECORD

TIME / WEIGHT / PRESSURE GRADIENT / FUNNEL VISCOSITY / PV/YP / GEL STRENGTH / FLUID LOSS / pH / SOLIDS

MUD & CHEMICAL ADDED: TYPE / AMOUNT / TYPE / AMOUNT

REMARKS

DRILLER
Justin Tanner

IADC

DAILY DRILLING REPORT

WELL T-Bird 9J REPORT NO. 3 DATE 25-Mar-2021

FIELD OR DISTRICT	COUNTY	STATE / COUNTRY	WIRE LINE RECORD REEL NO.
Hallett	Pawnee	OK / United States	

LAST CASING / TUBING / OR LINER	SIZE	MAKE	WEIGHT GRADE	NO. JOINTS	LENGTH	RKB. TO CSG. HD.	SET AT

SIZE / NO LINES / LENGTH SLIPPED / LENGTH CUT OFF / PRESENT LENGTH / WEAR OR TRIPS SINCE LAST CUT / CUMULATIVE WEAR OR TRIPS

TOUR 1

DEPTH INTERVAL FROM	TO	DRILL..D REAM..R CORE..C	CORE NO.	FORMATION (SHOW CORE RECOVERY)	ROTARY TABLE SPEED	WT. ON BIT	PUMP PRESSURE	PUMP NO. 1 LINER SIZE	S.P.M.	PUMP NO. 2 LINER SIZE	S.P.M.	PUMP NO. 3 LINER SIZE	S.P.M.	PUMP NO. 4 LINER SIZE	S.P.M.	TOTAL PUMP OUTPUT

DEVIATION RECORD: DEPTH / DEV / DIR. / TVD / HORZ. DISP.

From	To	Elapsed Time	CodeNo	Details Of Operations In Sequence And Remarks
7:00	7:15	0:15	21	customer meeting
7:15	7:30	0:15	22	start up rig
7:30	8:15	0:45	6	trip and ream to bottom
8:15	20:50	12:35	2	drill from 1262-1553
20:50	21:15	0:25	5	circulate hole clean
21:15	22:30	1:15	6	trip out of hole
22:30	22:45	0:15	23	shut down rig
22:45				

TOUR 2

DEPTH INTERVAL FROM	TO	DRILL..D REAM..R CORE..C	CORE NO.	FORMATION (SHOW CORE RECOVERY)	ROTARY TABLE SPEED	WT. ON BIT	PUMP PRESSURE	PUMP NO. 1 LINER SIZE	S.P.M.	PUMP NO. 2 LINER SIZE	S.P.M.	PUMP NO. 3 LINER SIZE	S.P.M.	PUMP NO. 4 LINER SIZE	S.P.M.	TOTAL PUMP OUTPUT

DEVIATION RECORD: DEPTH / DEV / DIR. / TVD / HORZ. DISP.

From	To	Elapsed Time	CodeNo	Details Of Operations In Sequence And Remarks

IADC

DRILLING CREW PAYROLL DATA

DATE
WELL NAME & NO.
COMPANY
TOOLPUSHER Justin Tanner

TOUR 1 CREW	EMPL.ID NO.	FROM
Driller		A
Derrickman		B
Derrickman		L
Floorman		C
Floorman		E

NO. DAYS SINCE LAST LOST TIME ACCIDENT

TOUR 2 CREW	EMPL.ID NO.	FROM

NO. DAYS SINCE LAST LOST TIME ACCIDENT

IADC

DAILY DRILLING REPORT

REPORT NO. 4

LEASE	WELL NO.	API WELL NUMBER	WATER DEPTH	DATE
Hallett	T-Bird 9J			12-Apr-2021

OPERATOR	CONTRACTOR	RIG NO.
GeoTech	Catoosa Test Facility	1T

SIGNATURE OF OPERATOR'S REPRESENTATIVE	SIGNATURE OF CONTRACTOR'S TOOL PUSHER
Customer Signature	Justin Tanner

DP SIZE	WEIGHT	GRADE	TOOL JT O.D.	TYPE THREAD	STRING NO.	PUMP NO.	PUMP MANUFACTURER	TYPE	STROKE LENGTH
						1	emsco	tri	12.000
						2	emsco	tri	12.000
						3			
						4			

TIME DISTRIBUTION HOURS

CODE NO.	OPERATION	TOUR 1	TOUR 2
1	RIG UP AND TEAR DOWN		
2	DRILL ACTUAL		
3	REAMING		
4	CORING		
5	CONDITION MUD & CIRCULATE		
6	TRIPS		
7	LUBRICATE RIG		
8	REPAIR RIG		
9	CUT OFF DRILLING LINE		
10	DEVIATION SURVEY		
11	WIRELINE LOGS		
12	RUN CASING & CEMENT		
13	WAIT ON CEMENT		
14	NIPPLE UP B.O.P.		
15	TEST B.O.P.		
16	DRILL STEM TEST		
17	PLUG BACK		
18	SQUEEZE CEMENT		
19	FISHING		
20	DIR. WORK		
21	customer meet	0:15	
22	unload custom	7:45	
23			
COMPLETION	A. PERFORATING		
	B. TUBING TRIPS		
	C. TREATING		
	D. SWABBING		
	E. TESTING		
	F.		
	G.		
	H.		
TOTALS		8:00	

DAYWORK TIME SUMMARY (OFFICE USE ONLY)

HOURS W/CONTR D.P.	
HOURS W/OPR D.P.	
HOURS WITHOUT D.P.	
HOURS STANDBY	
TOTAL DAYWORK	
NO. OF DAYS FROM SPUD	
CUMULATIVE ROTATING HOURS	
DAILY MUD COST	
TOTAL MUD COST	

TOUR 1

DRILLING ASSEMBLY (AT END OF TOUR)

NO.	ITEM	O.D.	LENGTH
	STANDS D.P.		
	SINGLES D.P.		
	KELLY DOWN		
	TOTAL		
	WT. OF STRING		

BIT RECORD: BIT NO., SIZE, IADC CODE, MFG, TYPE, SERIAL NO., JETS, TFA, DEPTH OUT, DEPTH IN, TOT DRILLED, TOT HOURS

CUTTING STRUCTURE: INNER, OUTER, DULL CHAR, LOCATION, BEARINGS/SEALS, GAGE, OTHER DULL CHAR, REASON PULLED

MUD RECORD: TIME, WEIGHT, PRESSURE GRADIENT, FUNNEL VISCOSITY, PV/YP, GEL STRENGTH, FLUID LOSS, pH, SOLIDS

MUD & CHEMICAL ADDED: TYPE, AMOUNT, TYPE, AMOUNT

REMARKS
fuel 52 inches

DRILLER
Andy Brown

TOUR 2

DRILLING ASSEMBLY (AT END OF TOUR)

NO.	ITEM	O.D.	LENGTH
	STANDS D.P.		
	SINGLES D.P.		
	KELLY DOWN		
	TOTAL		
	WT. OF STRING		

BIT RECORD: BIT NO., SIZE, IADC CODE, MFG, TYPE, SERIAL NO., JETS, TFA, DEPTH OUT, DEPTH IN, TOT DRILLED, TOT HOURS

CUTTING STRUCTURE: INNER, OUTER, DULL CHAR, LOCATION, BEARINGS/SEALS, GAGE, OTHER DULL CHAR, REASON PULLED

MUD RECORD: TIME, WEIGHT, PRESSURE GRADIENT, FUNNEL VISCOSITY, PV/YP, GEL STRENGTH, FLUID LOSS, pH, SOLIDS

MUD & CHEMICAL ADDED: TYPE, AMOUNT, TYPE, AMOUNT

REMARKS

DRILLER
Justin Tanner

IADC

DAILY DRILLING REPORT

WELL T-Bird 9J REPORT NO. 4 DATE 12-Apr-2021

FIELD OR DISTRICT	COUNTY	STATE / COUNTRY
Hallett	Pawnee	OK / United States

LAST CASING TUBING OR LINER	SIZE	MAKE	WEIGHT GRADE	NO. JOINTS	LENGTH	RKB. TO CSG. HD.	SET AT

WIRE LINE RECORD REEL NO.

SIZE	NO LINES	LENGTH SLIPPED

LENGTH CUT OFF / PRESENT LENGTH / WEAR OR TRIPS SINCE LAST CUT / CUMULATIVE WEAR OR TRIPS

TOUR 1

DEPTH INTERVAL FROM	TO	DRILL..D REAM...R CORE...C	CORE NO.	FORMATION (SHOW CORE RECOVERY)	ROTARY TABLE SPEED	WT. ON BIT	PUMP PRESSURE	PUMP NO. 1 LINER SIZE	S.P.M.	PUMP NO. 2 LINER SIZE	S.P.M.	PUMP NO. 3 LINER SIZE	S.P.M.	PUMP NO. 4 LINER SIZE	S.P.M.	TOTAL PUMP OUTPUT

DEVIATION RECORD: DEPTH, DEV, DIR., TVD, HORZ. DISP. (×3)

From	To	Elapsed Time	CodeNo	Details Of Operations In Sequence And Remarks
7:00	7:15	0:15	21	customer meeting
7:15	15:00	7:45	22	unload customers conex, change liners in both pumps, change out saver sub, move collars and make wedding bands for them, modify elevators,

TOUR 2

DEPTH INTERVAL FROM	TO	DRILL..D REAM...R CORE...C	CORE NO.	FORMATION (SHOW CORE RECOVERY)	ROTARY TABLE SPEED	WT. ON BIT	PUMP PRESSURE	PUMP NO. 1 LINER SIZE	S.P.M.	PUMP NO. 2 LINER SIZE	S.P.M.	PUMP NO. 3 LINER SIZE	S.P.M.	PUMP NO. 4 LINER SIZE	S.P.M.	TOTAL PUMP OUTPUT

DEVIATION RECORD: DEPTH, DEV, DIR., TVD, HORZ. DISP. (×3)

From	To	Elapsed Time	CodeNo	Details Of Operations In Sequence And Remarks

IADC

DRILLING CREW PAYROLL DATA

DATE

WELL NAME & NO.

COMPANY

TOOLPUSHER Justin Tanner

TOUR 1 CREW	EMPL.ID NO.	FROM
Driller		A
Derrickman		B
Derrickman		L
Floorman		J
Floorman		C
Floorman		E

NO. DAYS SINCE LAST LOST TIME ACCIDENT

TOUR 2 CREW	EMPL.ID NO.	FROM

NO. DAYS SINCE LAST LOST TIME ACCIDENT

IADC

LEASE	WELL NO.	API WELL NUMBER	WATER DEPTH	DATE
Hallett	T-Bird 9J			13-Apr-2021

OPERATOR	CONTRACTOR	RIG NO.
GEOTEK	Catoosa Test Facility	1T

SIGNATURE OF OPERATOR'S REPRESENTATIVE	SIGNATURE OF CONTRACTOR'S TOOL PUSHER
Customer Signature	Justin Tanner

DP SIZE	WEIGHT	GRADE	TOOL JT O.D.	TYPE THREAD	STRING NO.	PUMP NO.	PUMP MANUFACTURER	TYPE	STROKE LENGTH
						1	emsco	tri	12.000
						2	emsco	tri	12.000
						3			
						4			

TIME DISTRIBUTION HOURS

CODE NO.	OPERATION	TOUR 1	TOUR 2
1	RIG UP AND TEAR DOWN	0:45	
2	DRILL ACTUAL		
3	REAMING		
4	CORING		
5	CONDITION MUD & CIRCULATE		
6	TRIPS	7:00	
7	LUBRICATE RIG		
8	REPAIR RIG		
9	CUT OFF DRILLING LINE		
10	DEVIATION SURVEY		
11	WIRELINE LOGS		
12	RUN CASING & CEMENT		
13	WAIT ON CEMENT		
14	NIPPLE UP B.O.P.		
15	TEST B.O.P.		
16	DRILL STEM TEST		
17	PLUG BACK		
18	SQUEEZE CEMENT		
19	FISHING		
20	DIR. WORK		
21	Customer meet	0:15	
22	move collars,	1:15	
23	space out cus	1:15	
COMPLETION	A. PERFORATING		
	B. TUBING TRIPS		
	C. TREATING		
	D. SWABBING		
	E. TESTING		
	F.		
	G.		
	H.		
TOTALS		10:30	
DAYWORK TIME SUMMARY (OFFICE USE ONLY)			
HOURS W/CONTR D.P.			
HOURS W/OPR D.P.			
HOURS WITHOUT D.P.			
HOURS STANDBY			
TOTAL DAYWORK			
NO. OF DAYS FROM SPUD			
CUMULATIVE ROTATING HOURS			
DAILY MUD COST			
TOTAL MUD COST			

TOUR 1

DRILLING ASSEMBLY (AT END OF TOUR): NO. | ITEM | O.D. | LENGTH — STANDS D.P. / SINGLES D.P. / KELLY DOWN / TOTAL / WT. OF STRING

BIT RECORD: BIT NO. / SIZE / IADC CODE / MFG / TYPE / SERIAL NO. / JETS / TFA / DEPTH OUT / DEPTH IN / TOT DRILLED / TOT HOURS — CUTTING STRUCTURE: INNER / OUTER / DULL CHAR / LOCATION / BEARINGS/SEALS / GAGE / OTHER DULL CHAR / REASON PULLED

MUD RECORD: TIME / WEIGHT / PRESSURE GRADIENT / FUNNEL VISCOSITY / PV/YP / GEL STRENGTH / FLUID LOSS / pH / SOLIDS — MUD & CHEMICAL ADDED: TYPE / AMOUNT / TYPE / AMOUNT

REMARKS
fuel 52 inches

DRILLER
Andy Brown

TOUR 2

DRILLING ASSEMBLY (AT END OF TOUR): NO. | ITEM | O.D. | LENGTH — STANDS D.P. / SINGLES D.P. / KELLY DOWN / TOTAL / WT. OF STRING

BIT RECORD: BIT NO. / SIZE / IADC CODE / MFG / TYPE / SERIAL NO. / JETS / TFA / DEPTH OUT / DEPTH IN / TOT DRILLED / TOT HOURS — CUTTING STRUCTURE: INNER / OUTER / DULL CHAR / LOCATION / BEARINGS/SEALS / GAGE / OTHER DULL CHAR / REASON PULLED

MUD RECORD: TIME / WEIGHT / PRESSURE GRADIENT / FUNNEL VISCOSITY / PV/YP / GEL STRENGTH / FLUID LOSS / pH / SOLIDS — MUD & CHEMICAL ADDED: TYPE / AMOUNT / TYPE / AMOUNT

REMARKS

DRILLER
Justin Tanner

DAILY DRILLING REPORT

WELL T-Bird 9J REPORT NO. 5 DATE 13-Apr-2021

FIELD OR DISTRICT	COUNTY	STATE / COUNTRY
Hallett	Pawnee	OK / United States

LAST CASING / TUBING / OR LINER: SIZE | MAKE | WEIGHT GRADE | NO. JOINTS | LENGTH | RKB. TO CSG. HD. | SET AT

WIRE LINE RECORD REEL NO. — SIZE / NO LINES / LENGTH SLIPPED / LENGTH CUT OFF / PRESENT LENGTH / WEAR OR TRIPS SINCE LAST CUT / CUMULATIVE WEAR OR TRIPS

Tour 1

DEPTH INTERVAL FROM / TO | DRILL...D REAM...R CORE...C | CORE NO. | FORMATION (SHOW CORE RECOVERY) | ROTARY TABLE SPEED | WT. ON BIT | PUMP PRESSURE | PUMP NO. 1–4 LINER SIZE / S.P.M. | TOTAL PUMP OUTPUT

DEVIATION RECORD: DEPTH | DEV | DIR. | TVD | HORZ. DISP.

From	To	Elapsed Time	CodeNo	Details Of Operations In Sequence And Remarks
7:00	7:15	0:15	21	Customer meeting
7:15	8:30	1:15	22	move collars, stage bha and fix pipe racks
8:30	9:15	0:45	1	unload pipe and tally
9:15	13:15	4:00	6	pick up drill pipe
13:15	15:00	1:45	6	make up bha
15:00	16:15	1:15	23	space out customer tool
16:15	16:45	0:30	6	finish picking up bha
16:45	17:30	0:45	6	pick up collar and trip to the base of the shoe

Tour 2

DEPTH INTERVAL FROM / TO | DRILL...D REAM...R CORE...C | CORE NO. | FORMATION (SHOW CORE RECOVERY) | ROTARY TABLE SPEED | WT. ON BIT | PUMP PRESSURE | PUMP NO. 1–4 LINER SIZE / S.P.M. | TOTAL PUMP OUTPUT

DEVIATION RECORD: DEPTH | DEV | DIR. | TVD | HORZ. DISP.

From	To	Elapsed Time	CodeNo	Details Of Operations In Sequence And Remarks

DRILLING CREW PAYROLL DATA

DATE / WELL NAME & NO. / COMPANY / TOOLPUSHER Justin Tanner

TOUR 1 CREW	EMPL.ID NO.	FROM
Driller		A
Derrickman		B
Derrickman		L
Floorman		J
Floorman		C
Floorman		E

NO. DAYS SINCE LAST LOST TIME ACCIDENT

TOUR 2 CREW	EMPL.ID NO.	FROM

NO. DAYS SINCE LAST LOST TIME ACCIDENT

DAILY DRILLING REPORT

REPORT NO. 6

LEASE	WELL NO.	API WELL NUMBER	WATER DEPTH	DATE
Hallett	T-Bird 9J			14-Apr-2021

OPERATOR	CONTRACTOR	RIG NO.
GEOTEK	Catoosa Test Facility	1T

SIGNATURE OF OPERATOR'S REPRESENTATIVE	SIGNATURE OF CONTRACTOR'S TOOL PUSHER
Customer Signature	Justin Tanner

DP SIZE	WEIGHT	GRADE	TOOL JT O.D.	TYPE THREAD	STRING NO.	PUMP NO.	PUMP MANUFACTURER	TYPE	STROKE LENGTH
						1	emsco	tri	12.000
						2	emsco	tri	12.000
						3			
						4			

TIME DISTRIBUTION HOURS

CODE NO.	OPERATION	TOUR 1	TOUR 2
1	RIG UP AND TEAR DOWN		
2	DRILL ACTUAL		
3	REAMING		
4	CORING		
5	CONDITION MUD & CIRCULATE	2:30	
6	TRIPS	2:45	
7	LUBRICATE RIG		
8	REPAIR RIG		
9	CUT OFF DRILLING LINE		
10	DEVIATION SURVEY		
11	WIRELINE LOGS	5:00	
12	RUN CASING & CEMENT		
13	WAIT ON CEMENT		
14	NIPPLE UP B.O.P.		
15	TEST B.O.P.		
16	DRILL STEM TEST		
17	PLUG BACK		
18	SQUEEZE CEMENT		
19	FISHING		
20	DIR. WORK		
21	customer meti	0:15	
22	start up rig	0:15	
23	shut down rig	0:15	
COMPLETION	A. PERFORATING		
	B. TUBING TRIPS		
	C. TREATING		
	D. SWABBING		
	E. TESTING		
	F.		
	G.		
	H.		
TOTALS		11:00	

DAYWORK TIME SUMMARY (OFFICE USE ONLY)

HOURS W/CONTR D.P.		
HOURS W/OPR D.P.		
HOURS WITHOUT D.P.		
HOURS STANDBY		
TOTAL DAYWORK		
NO. OF DAYS FROM SPUD		
CUMULATIVE ROTATING HOURS		
DAILY MUD COST		
TOTAL MUD COST		

TOUR 1

DRILLING ASSEMBLY (AT END OF TOUR): NO. | ITEM | O.D. | LENGTH — STANDS D.P. / SINGLES D.P. / KELLY DOWN / TOTAL / WT. OF STRING

BIT RECORD: BIT NO. / SIZE / IADC CODE / MFG / TYPE / SERIAL NO. / JETS / TFA / DEPTH OUT / DEPTH IN / TOT DRILLED / TOT HOURS

CUTTING STRUCTURE: INNER / OUTER / DULL CHAR / LOCATION / BEARINGS/SEALS / GAGE / OTHER DULL CHAR / REASON PULLED

MUD RECORD: TIME / WEIGHT / PRESSURE GRADIENT / FUNNEL VISCOSITY / PV/YP / GEL STRENGTH / FLUID LOSS / pH / SOLIDS

MUD & CHEMICAL ADDED: TYPE | AMOUNT | TYPE | AMOUNT

REMARKS
fuel 51 1/2 inches

DRILLER
Andy Brown

TOUR 2

DRILLING ASSEMBLY (AT END OF TOUR): NO. | ITEM | O.D. | LENGTH — STANDS D.P. / SINGLES D.P. / KELLY DOWN / TOTAL / WT. OF STRING

BIT RECORD: BIT NO. / SIZE / IADC CODE / MFG / TYPE / SERIAL NO. / JETS / TFA / DEPTH OUT / DEPTH IN / TOT DRILLED / TOT HOURS

CUTTING STRUCTURE: INNER / OUTER / DULL CHAR / LOCATION / BEARINGS/SEALS / GAGE / OTHER DULL CHAR / REASON PULLED

MUD RECORD: TIME / WEIGHT / PRESSURE GRADIENT / FUNNEL VISCOSITY / PV/YP / GEL STRENGTH / FLUID LOSS / pH / SOLIDS

MUD & CHEMICAL ADDED: TYPE | AMOUNT | TYPE | AMOUNT

REMARKS

DRILLER
Justin Tanner

IADC

DAILY DRILLING REPORT

WELL T-Bird 9J REPORT NO. 6 DATE 14-Apr-2021

FIELD OR DISTRICT	COUNTY	STATE / COUNTRY
Hallett	Pawnee	OK / United States

	SIZE	MAKE	WEIGHT GRADE	NO. JOINTS	LENGTH	RKB. TO CSG. HD.	SET AT
LAST CASING TUBING OR LINER							

WIRE LINE RECORD REEL NO.: SIZE / NO LINES / LENGTH SLIPPED / LENGTH CUT OFF / PRESENT LENGTH / WEAR OR TRIPS SINCE LAST CUT / CUMULATIVE WEAR OR TRIPS

DEPTH INTERVAL (FROM / TO) | DRILL..D REAM...R CORE...C | CORE NO. | FORMATION (SHOW CORE RECOVERY) | ROTARY TABLE SPEED | WT. ON BIT | PUMP PRESSURE | PUMP NO. 1–4 (LINER SIZE, S.P.M.) | TOTAL PUMP OUTPUT

DEVIATION RECORD: DEPTH | DEV | DIR. | TVD | HORZ. DISP.

Tour 1

From	To	Elapsed Time	CodeNo	Details Of Operations In Sequence And Remarks
7:00	7:15	0:15	21	customer meting
7:15	7:30	0:15	22	start up rig
7:30	9:00	1:30	6	trip and ream in hole
9:00	9:30	0:30	5	circulate
9:30	10:15	0:45	6	pick up tools and run in hole with wire line
10:15	10:45	0:30	5	circulate hole while waiting on sheive
10:45	11:15	0:30	11	rig up wire line
11:15	11:45	0:30	11	run tool in hole truck broke, rig wire line down
11:45	13:15	1:30	5	circulate hole while waiting on wire line truck
13:15	17:15	4:00	11	rig up wire line and test
17:15	17:45	0:30	6	trip up to casing
17:45	18:00	0:15	23	shut down rig
18:00				

Tour 2

From	To	Elapsed Time	CodeNo	Details Of Operations In Sequence And Remarks
18:00				

IADC

DRILLING CREW PAYROLL DATA

DATE / WELL NAME & NO. / COMPANY

TOOLPUSHER Justin Tanner

TOUR 1 CREW	EMPL.ID NO.
Driller	A
Derrickman	B
Derrickman	L
Floorman	J
Floorman	C
Floorman	E

NO. DAYS SINCE LAST LOST TIME ACCIDENT

TOUR 2 CREW	EMPL.ID NO.

NO. DAYS SINCE LAST LOST TIME ACCIDENT

IADC

LEASE	WELL NO.	API WELL NUMBER	WATER DEPTH	DATE
Hallett	T-Bird 9J		0.00	15-Apr-2021

OPERATOR	CONTRACTOR	RIG NO.
GEOTEK	Catoosa Test Facility	1T

SIGNATURE OF OPERATOR'S REPRESENTATIVE	SIGNATURE OF CONTRACTOR'S TOOL PUSHER
Customer Signature	Justin Tanner

DP SIZE	WEIGHT	GRADE	TOOL JT O.D.	TYPE THREAD	STRING NO.	PUMP NO.	PUMP MANUFACTURER	TYPE	STROKE LENGTH
						1	Emsco	Triplex	12.000
						2	Emsco	Triplex	12.000
						3			
						4			

TIME DISTRIBUTION HOURS

CODE NO.	OPERATION	TOUR 1	TOUR 2
1	RIG UP AND TEAR DOWN		
2	DRILL ACTUAL		
3	REAMING	0:30	
4	CORING	3:15	
5	CONDITION MUD & CIRCULATE	1:30	
6	TRIPS	2:05	
7	LUBRICATE RIG		
8	REPAIR RIG		
9	CUT OFF DRILLING LINE		
10	DEVIATION SURVEY		
11	WIRELINE LOGS	2:40	
12	RUN CASING & CEMENT		
13	WAIT ON CEMENT		
14	NIPPLE UP B.O.P.		
15	TEST B.O.P.		
16	DRILL STEM TEST		
17	PLUG BACK		
18	SQUEEZE CEMENT		
19	FISHING		
20	DIR. WORK		
21	customer meet	0:15	
22	shut down rig	0:30	
23			
COMPLETION	A. PERFORATING		
	B. TUBING TRIPS		
	C. TREATING		
	D. SWABBING		
	E. TESTING		
	F.		
	G.		
	H.		
TOTALS		10:45	

DAYWORK TIME SUMMARY (OFFICE USE ONLY)

HOURS W/CONTR D.P.		
HOURS W/OPR D.P.		
HOURS WITHOUT D.P.		
HOURS STANDBY		
TOTAL DAYWORK		
NO. OF DAYS FROM SPUD		
CUMULATIVE ROTATING HOURS		
DAILY MUD COST		
TOTAL MUD COST		

TOUR 1

DRILLING ASSEMBLY (AT END OF TOUR): NO. | ITEM | O.D. | LENGTH — STANDS D.P. / SINGLES D.P. / KELLY DOWN / TOTAL / WT. OF STRING

BIT RECORD: BIT NO. / SIZE / IADC CODE / MFG / TYPE / SERIAL NO. / JETS / TFA / DEPTH OUT / DEPTH IN / TOT DRILLED / TOT HOURS

CUTTING STRUCTURE: INNER / OUTER / DULL CHAR / LOCATION / BEARINGS/SEALS / GAGE / OTHER DULL CHAR / REASON PULLED

MUD RECORD: TIME / WEIGHT / PRESSURE GRADIENT / FUNNEL VISCOSITY / PV/YP / GEL STRENGTH / FLUID LOSS / pH / SOLIDS

MUD & CHEMICAL ADDED

TYPE	AMOUNT	TYPE	AMOUNT
Caustic	2		

REMARKS
fuel 50 inches

DRILLER
Andy Brown

TOUR 2

DRILLING ASSEMBLY (AT END OF TOUR): NO. | ITEM | O.D. | LENGTH — STANDS D.P. / SINGLES D.P. / KELLY DOWN / TOTAL / WT. OF STRING

BIT RECORD: BIT NO. / SIZE / IADC CODE / MFG / TYPE / SERIAL NO. / JETS / TFA / DEPTH OUT / DEPTH IN / TOT DRILLED / TOT HOURS

CUTTING STRUCTURE: INNER / OUTER / DULL CHAR / LOCATION / BEARINGS/SEALS / GAGE / OTHER DULL CHAR / REASON PULLED

MUD RECORD: TIME / WEIGHT / PRESSURE GRADIENT / FUNNEL VISCOSITY / PV/YP / GEL STRENGTH / FLUID LOSS / pH / SOLIDS

MUD & CHEMICAL ADDED: TYPE | AMOUNT | TYPE | AMOUNT

REMARKS

DRILLER
Justin Tanner

DAILY DRILLING REPORT

WELL T-Bird 9J REPORT NO. 2 DATE 15-Apr-2021

FIELD OR DISTRICT	COUNTY	STATE / COUNTRY
Hallett	Pawnee	OK / United States

	SIZE	MAKE	WEIGHT GRADE	NO. JOINTS	LENGTH	RKB. TO CSG. HD.	SET AT
LAST CASING TUBING OR LINER							

WIRE LINE RECORD REEL NO. / SIZE / NO LINES / LENGTH SLIPPED / LENGTH CUT OFF / PRESENT LENGTH / WEAR OR TRIPS SINCE LAST CUT / CUMULATIVE WEAR OR TRIPS

TOUR 1

DEPTH INTERVAL (FROM / TO) | DRILL..D REAM...R CORE...C | CORE NO. | FORMATION (SHOW CORE RECOVERY) | ROTARY TABLE SPEED | WT. ON BIT | PUMP PRESSURE | PUMP NO. 1–4 (LINER SIZE, S.P.M.) | TOTAL PUMP OUTPUT

DEVIATION RECORD: DEPTH / DEV / DIR. / TVD / HORZ. DISP.

From	To	Elapsed Time	CodeNo	Details Of Operations In Sequence And Remarks
7:00	7:15	0:15	21	customer meeting
7:15	7:30	0:15	22	start up rig
7:30	8:00	0:30	6	trip in hole
8:00	9:30	1:30	5	circulate while waiting on wireline
9:30	10:00	0:30	11	rig up wireline and put tool in pipe
10:00	10:30	0:30	3	ream to bottom
10:30	11:45	1:15	4	core from 1552 ft to 1557 ft (5 ft)
11:45	12:00	0:15	6	pull one stand
12:00	12:20	0:20	11	rig up wireline and remove tool from pipe
12:20	12:55	0:35	11	pick up new tool and put in pipe
12:55	13:15	0:20	6	pick up one stand and trip to bottom
13:15	14:30	1:15	4	core from 1557 ft to 1566 ft (9 ft)
14:30	14:40	0:10	6	pull one stand
14:40	15:10	0:30	11	rig up wireline and remove tool from pipe
15:10	15:30	0:20	11	pick up new tool and put in pipe
15:30	15:45	0:15	6	pick up one stand and trip to bottom
15:45	16:30	0:45	4	core from 1566 ft to 1569 ft (3 ft) top drive stalled out and had to pick up off bottom
16:30	16:40	0:10	6	pull one stand
16:40	17:05	0:25	11	rig up wireline and remove tool from pie and lay down
17:05	17:30	0:25	6	trip up to casing
17:30	17:45	0:15	22	shut down rig

TOUR 2

DEPTH INTERVAL (FROM / TO) | DRILL..D REAM...R CORE...C | CORE NO. | FORMATION (SHOW CORE RECOVERY) | ROTARY TABLE SPEED | WT. ON BIT | PUMP PRESSURE | PUMP NO. 1–4 (LINER SIZE, S.P.M.) | TOTAL PUMP OUTPUT

DEVIATION RECORD: DEPTH / DEV / DIR. / TVD / HORZ. DISP.

From	To	Elapsed Time	CodeNo	Details Of Operations In Sequence And Remarks

DRILLING CREW PAYROLL DATA

DATE / WELL NAME & NO. / COMPANY

TOOLPUSHER Justin Tanner

TOUR 1 FROM

CREW	EMPL.ID NO.
Driller	A
Derrickman	C
Derrickman	B
Derrickman	L
Floorman	J
Floorman	E

NO. DAYS SINCE LAST LOST TIME ACCIDENT

TOUR 2 FROM

CREW	EMPL.ID NO.

NO. DAYS SINCE LAST LOST TIME ACCIDENT

No. 7 DAILY DRILLING REPORT REPORT NO. 1

LEASE	WELL NO.	API WELL NUMBER	WATER DEPTH	DATE
Hallett	T-Bird 9J		0.00	16-Apr-2021

OPERATOR	CONTRACTOR	RIG NO.
GEOTEK	Catoosa Test Facility	1T

SIGNATURE OF OPERATOR'S REPRESENTATIVE	SIGNATURE OF CONTRACTOR'S TOOL PUSHER
Customer Signature	Justin Tanner

DP SIZE	WEIGHT	GRADE	TOOL JT O.D.	TYPE THREAD	STRING NO.	PUMP NO.	PUMP MANUFACTURER	TYPE	STROKE LENGTH
						1	Emsco	triplex	12.000
						2	Emsco	triplex	12.000
						3			
						4			

TIME DISTRIBUTION HOURS

CODE NO.	OPERATION	TOUR 1	TOUR 2
1	RIG UP AND TEAR DOWN		
2	DRILL ACTUAL		
3	REAMING		
4	CORING	3:05	
5	CONDITION MUD & CIRCULATE		
6	TRIPS	2:00	
7	LUBRICATE RIG		
8	REPAIR RIG		
9	CUT OFF DRILLING LINE		
10	DEVIATION SURVEY		
11	WIRELINE LOGS	3:30	
12	RUN CASING & CEMENT		
13	WAIT ON CEMENT		
14	NIPPLE UP B.O.P.		
15	TEST B.O.P.		
16	DRILL STEM TEST		
17	PLUG BACK		
18	SQUEEZE CEMENT		
19	FISHING		
20	DIR. WORK		
21	customer meet	0:15	
22	start up rig	0:15	
23	shut down rig	0:10	
COMPLETION	A. PERFORATING		
	B. TUBING TRIPS		
	C. TREATING		
	D. SWABBING		
	E. TESTING		
	F.		
	G.		
	H.		
TOTALS		9:15	

DAYWORK TIME SUMMARY (OFFICE USE ONLY)

HOURS W/CONTR D.P.		
HOURS W/OPR D.P.		
HOURS WITHOUT D.P.		
HOURS STANDBY		
TOTAL DAYWORK		
NO. OF DAYS FROM SPUD		
CUMULATIVE ROTATING HOURS		
DAILY MUD COST		
TOTAL MUD COST		

TOUR 1

DRILLING ASSEMBLY (AT END OF TOUR)

NO.	ITEM	O.D.	LENGTH
	STANDS D.P.		
	SINGLES D.P.		
	KELLY DOWN		
	TOTAL		
WT. OF STRING			

BIT RECORD: BIT NO. / SIZE / IADC CODE / MFG / TYPE / SERIAL NO. / JETS / TFA / DEPTH OUT / DEPTH IN / TOT DRILLED / TOT HOURS

CUTTING STRUCTURE: INNER / OUTER / DULL CHAR / LOCATION / BEARINGS/SEALS / GAGE / OTHER DULL CHAR / REASON PULLED

MUD RECORD: TIME / WEIGHT / PRESSURE GRADIENT / FUNNEL VISCOSITY / PV/YP / GEL STRENGTH / FLUID LOSS / pH / SOLIDS

MUD & CHEMICAL ADDED

TYPE	AMOUNT	TYPE	AMOUNT
Caustic	2		

REMARKS
fuel 48 1/2 inches of fuel

DRILLER
Andy Brown

TOUR 2

DRILLING ASSEMBLY (AT END OF TOUR)

NO.	ITEM	O.D.	LENGTH
	STANDS D.P.		
	SINGLES D.P.		
	KELLY DOWN		
	TOTAL		
WT. OF STRING			

BIT RECORD: BIT NO. / SIZE / IADC CODE / MFG / TYPE / SERIAL NO. / JETS / TFA / DEPTH OUT / DEPTH IN / TOT DRILLED / TOT HOURS

CUTTING STRUCTURE: INNER / OUTER / DULL CHAR / LOCATION / BEARINGS/SEALS / GAGE / OTHER DULL CHAR / REASON PULLED

MUD RECORD: TIME / WEIGHT / PRESSURE GRADIENT / FUNNEL VISCOSITY / PV/YP / GEL STRENGTH / FLUID LOSS / pH / SOLIDS

MUD & CHEMICAL ADDED: TYPE / AMOUNT / TYPE / AMOUNT

REMARKS

DRILLER
Justin Tanner

No. 7 Rev. B

IADC

DAILY DRILLING REPORT WELL T-Bird 9J REPORT NO. 1 DATE 16-Apr-2021

FIELD OR DISTRICT	COUNTY	STATE / COUNTRY
Hallett	Pawnee	OK / United States

LAST CASING, TUBING OR LINER: SIZE / MAKE / WEIGHT GRADE / NO. JOINTS / LENGTH / RKB. TO CSG. HD. / SET AT

WIRE LINE RECORD REEL NO.: SIZE / NO LINES / LENGTH SLIPPED / LENGTH CUT OFF / PRESENT LENGTH / WEAR OR TRIPS SINCE LAST CUT / CUMULATIVE WEAR OR TRIPS

TOUR 1

DEPTH INTERVAL FROM / TO / DRILL..D REAM..R CORE..C / CORE NO. / FORMATION (SHOW CORE RECOVERY) / ROTARY TABLE SPEED / WT. ON BIT / PUMP PRESSURE / PUMP NO. 1–4 LINER SIZE, S.P.M. / TOTAL PUMP OUTPUT

DEVIATION RECORD: DEPTH / DEV / DIR. / TVD / HORZ. DISP.

From	To	Elapsed Time	CodeNo	Details Of Operations In Sequence And Remarks
7:00	7:15	0:15	21	customer meeting
7:15	7:30	0:15	22	start up rig
7:30	8:10	0:40	6	trip in hole
8:10	8:50	0:40	11	rig up wire line and run tool to bottom
8:50	9:10	0:20	6	pick up 2 joints and ream to bottom
9:10	10:25	1:15	4	core from 1569-1574
10:25	10:35	0:10	6	pull 2 joints of pipe
10:35	11:05	0:30	11	retrieve tool and lay down
11:05	11:35	0:30	11	pick up new tool and run to bottom
11:35	11:50	0:15	6	pick up 2 joints of pipe and ream to bottom
11:50	12:50	1:00	4	core from 1574-1579
12:50	13:00	0:10	6	pull 2 joints of pipe
13:00	13:30	0:30	11	retrieve tool and lay down
13:30	14:05	0:35	11	run new tool to bottom
14:05	14:55	0:50	4	core from 1579-1583
14:55	15:00	0:05	6	pull 1 joint of pipe
15:00	15:45	0:45	11	retrieve tool and lay down
15:45	16:05	0:20	6	trip out of hole
16:05	16:15	0:10	23	shut down rig
16:15				

TOUR 2

DEPTH INTERVAL FROM / TO / DRILL..D REAM..R CORE..C / CORE NO. / FORMATION (SHOW CORE RECOVERY) / ROTARY TABLE SPEED / WT. ON BIT / PUMP PRESSURE / PUMP NO. 1–4 LINER SIZE, S.P.M. / TOTAL PUMP OUTPUT

DEVIATION RECORD: DEPTH / DEV / DIR. / TVD / HORZ. DISP.

From	To	Elapsed Time	CodeNo	Details Of Operations In Sequence And Remarks

No. 7 Rev. B

IADC

DRILLING CREW PAYROLL DATA

DATE

WELL NAME & NO.

COMPANY

TOOLPUSHER Justin Tanner

TOUR 1 FROM

CREW	EMPL.ID NO.
Driller	A
Derrickman	C
Derrickman	B
Derrickman	L
Floorman	J
Floorman	E

NO. DAYS SINCE LAST LOST TIME ACCIDENT

TOUR 2 FROM

CREW	EMPL.ID NO.

NO. DAYS SINCE LAST LOST TIME ACCIDENT

IADC

DAILY DRILLING REPORT

REPORT NO. 3

LEASE	WELL NO.	API WELL NUMBER	WATER DEPTH	DATE
Hallett	T-Bird 9J		0.00	17-Apr-2021

OPERATOR	CONTRACTOR	RIG NO.
GEOTEK	Catoosa Test Facility	1T

SIGNATURE OF OPERATOR'S REPRESENTATIVE	SIGNATURE OF CONTRACTOR'S TOOL PUSHER
Customer Signature	Justin Tanner

DP SIZE	WEIGHT	GRADE	TOOL JT O.D.	TYPE THREAD	STRING NO.	PUMP NO.	PUMP MANUFACTURER	TYPE	STROKE LENGTH
						1	Emsco	triplex	12.000
						2	Emsco	triplex	12.000
						3			
						4			

TIME DISTRIBUTION HOURS

CODE NO.	OPERATION	TOUR 1	TOUR 2
1	RIG UP AND TEAR DOWN		
2	DRILL ACTUAL		
3	REAMING		
4	CORING	2:35	
5	CONDITION MUD & CIRCULATE	0:35	
6	TRIPS	2:55	
7	LUBRICATE RIG		
8	REPAIR RIG		
9	CUT OFF DRILLING LINE		
10	DEVIATION SURVEY		
11	WIRELINE LOGS	3:10	
12	RUN CASING & CEMENT		
13	WAIT ON CEMENT		
14	NIPPLE UP B.O.P.		
15	TEST B.O.P.		
16	DRILL STEM TEST		
17	PLUG BACK		
18	SQUEEZE CEMENT		
19	FISHING		
20	DIR. WORK		
21	customer meet	0:15	
22	shut down rig	0:25	
23	pick up tool	1:35	
COMPLETION	A. PERFORATING		
	B. TUBING TRIPS		
	C. TREATING		
	D. SWABBING		
	E. TESTING		
	F.		
	G.		
	H.		
TOTALS		11:30	

DAYWORK TIME SUMMARY (OFFICE USE ONLY)

HOURS W/CONTR D.P.		
HOURS W/OPR D.P.		
HOURS WITHOUT D.P.		
HOURS STANDBY		
TOTAL DAYWORK		
NO. OF DAYS FROM SPUD		
CUMULATIVE ROTATING HOURS		
DAILY MUD COST		
TOTAL MUD COST		

TOUR 1

DRILLING ASSEMBLY (AT END OF TOUR)

NO.	ITEM	O.D.	LENGTH
	STANDS D.P.		
	SINGLES D.P.		
	KELLY DOWN		
	TOTAL		
	WT. OF STRING		

BIT RECORD: BIT NO., SIZE, IADC CODE, MFG, TYPE, SERIAL NO., JETS, TFA, DEPTH OUT, DEPTH IN, TOT DRILLED, TOT HOURS

CUTTING STRUCTURE: INNER, OUTER, DULL CHAR, LOCATION, BEARINGS/SEALS, GAGE, OTHER DULL CHAR, REASON PULLED

MUD RECORD: TIME, WEIGHT, PRESSURE GRADIENT, FUNNEL VISCOSITY, PV/YP, GEL STRENGTH, FLUID LOSS, pH, SOLIDS

MUD & CHEMICAL ADDED

TYPE	AMOUNT	TYPE	AMOUNT
Caustic	2		

REMARKS
fuel 47 inches

DRILLER
Andy Brown

TOUR 2

DRILLING ASSEMBLY (AT END OF TOUR)

NO.	ITEM	O.D.	LENGTH
	STANDS D.P.		
	SINGLES D.P.		
	KELLY DOWN		
	TOTAL		
	WT. OF STRING		

BIT RECORD: BIT NO., SIZE, IADC CODE, MFG, TYPE, SERIAL NO., JETS, TFA, DEPTH OUT, DEPTH IN, TOT DRILLED, TOT HOURS

CUTTING STRUCTURE: INNER, OUTER, DULL CHAR, LOCATION, BEARINGS/SEALS, GAGE, OTHER DULL CHAR, REASON PULLED

MUD RECORD: TIME, WEIGHT, PRESSURE GRADIENT, FUNNEL VISCOSITY, PV/YP, GEL STRENGTH, FLUID LOSS, pH, SOLIDS

MUD & CHEMICAL ADDED

TYPE	AMOUNT	TYPE	AMOUNT

REMARKS

DRILLER
Justin Tanner

IADC

DAILY DRILLING REPORT

WELL T-Bird 9J REPORT NO. 3 DATE 17-Apr-2021

FIELD OR DISTRICT	COUNTY	STATE / COUNTRY
Hallett	Pawnee	OK / United States

LAST CASING TUBING OR LINER	SIZE	MAKE	WEIGHT GRADE	NO. JOINTS	LENGTH	RKB. TO CSG. HD.	SET AT

WIRE LINE RECORD REEL NO.: SIZE, NO LINES, LENGTH SLIPPED, LENGTH CUT OFF, PRESENT LENGTH, WEAR OR TRIPS SINCE LAST CUT, CUMULATIVE WEAR OR TRIPS

TOUR 1

DEPTH INTERVAL (FROM, TO), DRILL.D REAM..R CORE..C, CORE NO., FORMATION (SHOW CORE RECOVERY), ROTARY TABLE SPEED, WT. ON BIT, PUMP PRESSURE, PUMP NO. 1–4 (LINER SIZE, S.P.M.), TOTAL PUMP OUTPUT

DEVIATION RECORD: DEPTH, DEV, DIR., TVD, HORZ. DISP.

From	To	Elapsed Time	CodeNo	Details Of Operations In Sequence And Remarks
7:00	7:15	0:15	21	customer meeting
7:15	7:30	0:15	22	start up rig
7:30	8:00	0:30	6	trip out of hole to look at bit
8:00	9:00	1:00	6	trip in hole to bottom
9:00	9:45	0:45	11	pick up tool and try to run to bottom come back out
9:45	10:10	0:25	5	screw top drive in and circulate
10:10	10:50	0:40	11	pick up tool and run to bottom
10:50	12:10	1:20	4	core from 1584-1589
12:10	12:20	0:10	6	pull 1 joint of pipe
12:20	12:45	0:25	11	rig up wire line and retrieve tool
12:45	13:15	0:30	11	run new tool to bottom
13:15	13:25	0:10	5	circulate
13:25	14:40	1:15	4	core from 1589-1595
14:40	14:50	0:10	11	pull 1 joint of pipe
14:50	15:30	0:40	11	rig up wire line and retrieve tool, lay tool down and rig down wire line
15:30	16:45	1:15	6	trip out of hole and change out bits
16:45	18:20	1:35	23	pick up tool and space out
18:20	18:30	0:10	22	shut down rig
18:30				

TOUR 2

DEPTH INTERVAL (FROM, TO), DRILL.D REAM..R CORE..C, CORE NO., FORMATION (SHOW CORE RECOVERY), ROTARY TABLE SPEED, WT. ON BIT, PUMP PRESSURE, PUMP NO. 1–4 (LINER SIZE, S.P.M.), TOTAL PUMP OUTPUT

DEVIATION RECORD: DEPTH, DEV, DIR., TVD, HORZ. DISP.

From	To	Elapsed Time	CodeNo	Details Of Operations In Sequence And Remarks

IADC

DRILLING CREW PAYROLL DATA

DATE
WELL NAME & NO.
COMPANY
TOOLPUSHER Justin Tanner

TOUR 1

CREW	EMPL.ID NO.	FROM
Driller	A	
Derrickman	C	
Derrickman	B	
Derrickman	L	
Floorman	J	
Floorman	E	

NO. DAYS SINCE LAST LOST TIME ACCIDENT

TOUR 2

CREW	EMPL.ID NO.	FROM

NO. DAYS SINCE LAST LOST TIME ACCIDENT

IADC

LEASE	WELL NO.	API WELL NUMBER	WATER DEPTH	DATE
Hallett	T-Bird 9J		0.00	18-Apr-2021

OPERATOR	CONTRACTOR	RIG NO.
GEOTEK	Catoosa Test Facility	1T

SIGNATURE OF OPERATOR'S REPRESENTATIVE	SIGNATURE OF CONTRACTOR'S TOOL PUSHER
Customer Signature	Justin Tanner

DP SIZE	WEIGHT	GRADE	TOOL JT O.D.	TYPE THREAD	STRING NO.	PUMP NO.	PUMP MANUFACTURER	TYPE	STROKE LENGTH
						1	Emsco	triplex	12.000
						2	Emsco	triplex	12.000
						3			
						4			

TIME DISTRIBUTION HOURS

CODE NO.	OPERATION	TOUR 1	TOUR 2
1	RIG UP AND TEAR DOWN		
2	DRILL ACTUAL		
3	REAMING		
4	CORING	2:15	
5	CONDITION MUD & CIRCULATE	0:25	
6	TRIPS	1:00	
7	LUBRICATE RIG		
8	REPAIR RIG	1:00	
9	CUT OFF DRILLING LINE		
10	DEVIATION SURVEY		
11	WIRELINE LOGS	3:05	
12	RUN CASING & CEMENT		
13	WAIT ON CEMENT		
14	NIPPLE UP B.O.P.		
15	TEST B.O.P.		
16	DRILL STEM TEST		
17	PLUG BACK		
18	SQUEEZE CEMENT		
19	FISHING		
20	DIR. WORK		
21	customer meet	0:15	
22	start up rig	0:15	
23	shut down rig	0:15	
COMPLETION	A. PERFORATING		
	B. TUBING TRIPS		
	C. TREATING		
	D. SWABBING		
	E. TESTING		
	F.		
	G.		
	H.		
TOTALS		9:30	

DAYWORK TIME SUMMARY (OFFICE USE ONLY)

HOURS W/CONTR D.P.		
HOURS W/OPR D.P.		
HOURS WITHOUT D.P.		
HOURS STANDBY		
TOTAL DAYWORK		
NO. OF DAYS FROM SPUD		
CUMULATIVE ROTATING HOURS		
DAILY MUD COST		
TOTAL MUD COST		

TOUR 1

DRILLING ASSEMBLY (AT END OF TOUR): NO. | ITEM | O.D. | LENGTH — STANDS D.P., SINGLES D.P., KELLY DOWN, TOTAL, WT. OF STRING

BIT RECORD: BIT NO., SIZE, IADC CODE, MFG, TYPE, SERIAL NO., JETS, TFA, DEPTH OUT, DEPTH IN, TOT DRILLED, TOT HOURS

CUTTING STRUCTURE: INNER, OUTER, DULL CHAR, LOCATION, BEARINGS/SEALS, GAGE, OTHER DULL CHAR, REASON PULLED

MUD RECORD: TIME, WEIGHT, PRESSURE GRADIENT, FUNNEL VISCOSITY, PV/YP, GEL STRENGTH, FLUID LOSS, pH, SOLIDS

MUD & CHEMICAL ADDED

TYPE	AMOUNT	TYPE	AMOUNT
Caustic	2		

REMARKS
fuel 46 inches

DRILLER
Andy Brown

TOUR 2

DRILLING ASSEMBLY (AT END OF TOUR): NO. | ITEM | O.D. | LENGTH — STANDS D.P., SINGLES D.P., KELLY DOWN, TOTAL, WT. OF STRING

BIT RECORD: BIT NO., SIZE, IADC CODE, MFG, TYPE, SERIAL NO., JETS, TFA, DEPTH OUT, DEPTH IN, TOT DRILLED, TOT HOURS

CUTTING STRUCTURE: INNER, OUTER, DULL CHAR, LOCATION, BEARINGS/SEALS, GAGE, OTHER DULL CHAR, REASON PULLED

MUD RECORD: TIME, WEIGHT, PRESSURE GRADIENT, FUNNEL VISCOSITY, PV/YP, GEL STRENGTH, FLUID LOSS, pH, SOLIDS

MUD & CHEMICAL ADDED: TYPE | AMOUNT | TYPE | AMOUNT

REMARKS

DRILLER
Justin Tanner

IADC

DAILY DRILLING REPORT

WELL T-Bird 9J REPORT NO. 4 DATE 18-Apr-2021

FIELD OR DISTRICT	COUNTY	STATE / COUNTRY
Hallett	Pawnee	OK / United States

LAST CASING / TUBING OR LINER: SIZE | MAKE | WEIGHT GRADE | NO. JOINTS | LENGTH | RKB. TO CSG. HD. | SET AT

WIRE LINE RECORD REEL NO.: SIZE | NO LINES | LENGTH SLIPPED | LENGTH CUT OFF | PRESENT LENGTH | WEAR OR TRIPS SINCE LAST CUT | CUMULATIVE WEAR OR TRIPS

TOUR 1

DEPTH INTERVAL (FROM, TO) | DRILL..D REAM...R CORE...C | CORE NO. | FORMATION (SHOW CORE RECOVERY) | ROTARY TABLE SPEED | WT. ON BIT | PUMP PRESSURE | PUMP NO. 1–4 (LINER SIZE, S.P.M.) | TOTAL PUMP OUTPUT

DEVIATION RECORD: DEPTH | DEV | DIR. | TVD | HORZ. DISP.

From	To	Elapsed Time	CodeNo	Details Of Operations In Sequence And Remarks
7:00	7:15	0:15	21	customer meeting
7:15	7:30	0:15	22	start up rig
7:30	8:30	1:00	8	work on st80
8:30	9:25	0:55	6	trip in the hole
9:25	9:40	0:15	5	circulate pipe
9:40	10:30	0:50	11	rig up wire line and put tool in hole
10:30	10:40	0:10	5	screw in top drive and circulate
10:40	11:10	0:30	11	rig up wire line and retrieve tool
11:10	11:30	0:20	11	run in new tool
11:30	11:40	0:10	6	pick up one joint of dp
11:40	12:45	1:05	4	core from 1595-1598
12:45	12:50	0:05	6	pull 1 joint of drill pipe
12:50	13:20	0:30	11	rig up wire line and retrieve tool
13:20	13:45	0:25	11	run new tool in to bottom
13:45	14:55	1:10	4	core from 1598 1605
14:55	15:00	0:05	6	pull 1 joint of drill pipe
15:00	15:30	0:30	11	rig up wire line and retrieve tool
15:30	16:15	0:45	6	trip up to the shoe
16:15	16:30	0:15	23	shut down rig
16:30				

TOUR 2

DEPTH INTERVAL (FROM, TO) | DRILL..D REAM...R CORE...C | CORE NO. | FORMATION (SHOW CORE RECOVERY) | ROTARY TABLE SPEED | WT. ON BIT | PUMP PRESSURE | PUMP NO. 1–4 (LINER SIZE, S.P.M.) | TOTAL PUMP OUTPUT

DEVIATION RECORD: DEPTH | DEV | DIR. | TVD | HORZ. DISP.

From	To	Elapsed Time	CodeNo	Details Of Operations In Sequence And Remarks

IADC

DRILLING CREW PAYROLL DATA

DATE

WELL NAME & NO.

COMPANY

TOOLPUSHER Justin Tanner

TOUR 1 CREW	EMPL.ID NO.
Driller	
Derrickman	
Derrickman	
Derrickman	
Floorman	
Floorman	

NO. DAYS SINCE LAST LOST TIME ACCIDENT

TOUR 2 CREW	EMPL.ID NO.

NO. DAYS SINCE LAST LOST TIME ACCIDENT

IADC

LEASE	WELL NO.	API WELL NUMBER	WATER DEPTH	DATE
Hallett	T-Bird 9J		0.00	19-Apr-2021

OPERATOR	CONTRACTOR	RIG NO.
GEOTEK	Catoosa Test Facility	1T

SIGNATURE OF OPERATOR'S REPRESENTATIVE	SIGNATURE OF CONTRACTOR'S TOOL PUSHER
Customer Signature	Justin Tanner

DP SIZE	WEIGHT	GRADE	TOOL JT O.D.	TYPE THREAD	STRING NO.	PUMP NO.	PUMP MANUFACTURER	TYPE	STROKE LENGTH
						1	Emsco	triplex	12.000
						2	Emsco	triplex	12.000
						3			
						4			

TIME DISTRIBUTION HOURS

CODE NO.	OPERATION	TOUR 1	TOUR 2
1	RIG UP AND TEAR DOWN		
2	DRILL ACTUAL		
3	REAMING		
4	CORING	2:10	
5	CONDITION MUD & CIRCULATE	1:10	
6	TRIPS	3:40	
7	LUBRICATE RIG		
8	REPAIR RIG		
9	CUT OFF DRILLING LINE		
10	DEVIATION SURVEY		
11	WIRELINE LOGS	4:15	
12	RUN CASING & CEMENT		
13	WAIT ON CEMENT		
14	NIPPLE UP B.O.P.		
15	TEST B.O.P.		
16	DRILL STEM TEST		
17	PLUG BACK		
18	SQUEEZE CEMENT		
19	FISHING		
20	DIR. WORK		
21	customer meet	0:15	
22	start up rig	0:15	
23	shut down rig	0:15	
COMPLETION	A. PERFORATING		
	B. TUBING TRIPS		
	C. TREATING		
	D. SWABBING		
	E. TESTING		
	F.		
	G.		
	H.		
TOTALS		12:00	

DAYWORK TIME SUMMARY (OFFICE USE ONLY)

HOURS W/CONTR D.P.		
HOURS W/OPR D.P.		
HOURS WITHOUT D.P.		
HOURS STANDBY		
TOTAL DAYWORK		
NO. OF DAYS FROM SPUD		
CUMULATIVE ROTATING HOURS		
DAILY MUD COST		
TOTAL MUD COST		

TOUR 1

DRILLING ASSEMBLY (AT END OF TOUR)

NO.	ITEM	O.D.	LENGTH
	STANDS D.P.		
	SINGLES D.P.		
	KELLY DOWN		
	TOTAL		
	WT. OF STRING		

BIT RECORD

BIT NO.	
SIZE	
IADC CODE	
MFG	
TYPE	
SERIAL NO.	
JETS	
TFA	
DEPTH OUT	
DEPTH IN	
TOT DRILLED	
TOT HOURS	

CUTTING STRUCTURE

INNER	OUTER	DULL CHAR	LOCATION
BEARINGS/SEALS	GAGE	OTHER DULL CHAR	REASON PULLED

MUD RECORD

TIME	10:00		
WEIGHT	9		
PRESSURE GRADIENT	0.4671		
FUNNEL VISCOSITY	34		
PV/YP	5 / 11		
GEL STRENGTH	21 / 16		
FLUID LOSS	63		
pH	9.4		
SOLIDS	0.25		

MUD & CHEMICAL ADDED

TYPE	AMOUNT	TYPE	AMOUNT
Caustic	2		

REMARKS
fuel 45 inches

DRILLER
Andy Brown

TOUR 2

DRILLING ASSEMBLY (AT END OF TOUR)

NO.	ITEM	O.D.	LENGTH
	STANDS D.P.		
	SINGLES D.P.		
	KELLY DOWN		
	TOTAL		
	WT. OF STRING		

BIT RECORD: BIT NO., SIZE, IADC CODE, MFG, TYPE, SERIAL NO., JETS, TFA, DEPTH OUT, DEPTH IN, TOT DRILLED, TOT HOURS

CUTTING STRUCTURE: INNER, OUTER, DULL CHAR, LOCATION, BEARINGS/SEALS, GAGE, OTHER DULL CHAR, REASON PULLED

MUD RECORD: TIME, WEIGHT, PRESSURE GRADIENT, FUNNEL VISCOSITY, PV/YP, GEL STRENGTH, FLUID LOSS, pH, SOLIDS

MUD & CHEMICAL ADDED: TYPE, AMOUNT, TYPE, AMOUNT

REMARKS

DRILLER
Justin Tanner

IADC

DAILY DRILLING REPORT

WELL T-Bird 9J REPORT NO. 5 DATE 19-Apr-2021

FIELD OR DISTRICT	COUNTY	STATE / COUNTRY
Hallett	Pawnee	OK / United States

LAST CASING / TUBING / OR LINER	SIZE	MAKE	WEIGHT GRADE	NO. JOINTS	LENGTH	RKB. TO CSG. HD.	SET AT

WIRE LINE RECORD REEL NO.

SIZE	NO LINES	LENGTH SLIPPED
LENGTH CUT OFF	PRESENT LENGTH	
WEAR OR TRIPS SINCE LAST CUT		
CUMULATIVE WEAR OR TRIPS		

TOUR 1

DEPTH INTERVAL FROM	TO	DRILL..D REAM...R CORE...C	CORE NO.	FORMATION (SHOW CORE RECOVERY)	ROTARY TABLE SPEED	WT. ON BIT	PUMP PRESSURE	PUMP NO. 1 LINER SIZE	S.P.M.	PUMP NO. 2 LINER SIZE	S.P.M.	PUMP NO. 3 LINER SIZE	S.P.M.	PUMP NO. 4 LINER SIZE	S.P.M.	TOTAL PUMP OUTPUT

DEVIATION RECORD

DEPTH	DEV	DIR.	TVD	HORZ. DISP.	DEPTH	DEV	DIR.	TVD	HORZ. DISP.	DEPTH	DEV	DIR.	TVD	HORZ. DISP.

From	To	Elapsed Time	CodeNo	Details Of Operations In Sequence And Remarks
7:00	7:15	0:15	21	customer meeting
7:15	7:30	0:15	22	start up rig
7:30	8:00	0:30	6	trip in hole
8:00	8:15	0:15	5	circulate hole
8:15	9:00	0:45	11	rig up wire line and run tool to bottom
9:00	9:55	0:55	4	core from 1606-1611
9:55	10:05	0:10	6	pull 2 joint of drill pipe
10:05	10:30	0:25	11	rig up wire line and retrieve tool
10:30	10:55	0:25	11	run new tool to bottom
10:55	11:45	0:50	4	core from 1611-1617
11:45	11:50	0:05	6	pull 2 joints of drill pipe
11:50	12:15	0:25	11	rig up wire line retrieve tool wire line parted
12:15	13:15	1:00	6	trip out of hole
13:15	13:45	0:30	6	pull tool and lay down
13:45	14:40	0:55	6	trip in hole
14:40	14:50	0:10	5	circulate hole
14:50	15:25	0:35	11	rig up wire line and run tool to bottom
15:25	15:55	0:30	5	circulate on hole
15:55	16:30	0:35	11	retrieve tool
16:30	16:45	0:15	5	circulate hole
16:45	17:10	0:25	11	rig up wire line and run tool to bottom

TOUR 2

DEPTH INTERVAL FROM	TO	DRILL..D REAM...R CORE...C	CORE NO.	FORMATION (SHOW CORE RECOVERY)	ROTARY TABLE SPEED	WT. ON BIT	PUMP PRESSURE	PUMP NO. 1 LINER SIZE	S.P.M.	PUMP NO. 2 LINER SIZE	S.P.M.	PUMP NO. 3 LINER SIZE	S.P.M.	PUMP NO. 4 LINER SIZE	S.P.M.	TOTAL PUMP OUTPUT

DEVIATION RECORD

DEPTH	DEV	DIR.	TVD	HORZ. DISP.	DEPTH	DEV	DIR.	TVD	HORZ. DISP.	DEPTH	DEV	DIR.	TVD	HORZ. DISP.

From	To	Elapsed Time	CodeNo	Details Of Operations In Sequence And Remarks

IADC

DRILLING CREW PAYROLL DATA

DATE

WELL NAME & NO.

COMPANY

TOOLPUSHER Justin Tanner

TOUR 1 FROM

CREW	EMPL.ID NO.
Driller	A
Derrickman	C
Derrickman	B
Derrickman	L
Floorman	J
Floorman	E

NO. DAYS SINCE LAST LOST TIME ACCIDENT

TOUR 2 FROM

CREW	EMPL.ID NO.

NO. DAYS SINCE LAST LOST TIME ACCIDENT

IADC

LEASE	WELL NO.	API WELL NUMBER	WATER DEPTH	DATE
Hallett	T-Bird 9J		0.00	19-Apr-2021

OPERATOR	CONTRACTOR	RIG NO.
GEOTEK	Catoosa Test Facility	1T

SIGNATURE OF OPERATOR'S REPRESENTATIVE	SIGNATURE OF CONTRACTOR'S TOOL PUSHER
Customer Signature	Justin Tanner

DP SIZE	WEIGHT	GRADE	TOOL JT O.D.	TYPE THREAD	STRING NO.	PUMP NO.	PUMP MANUFACTURER	TYPE	STROKE LENGTH
						1	Emsco	triplex	12.000
						2	Emsco	triplex	12.000
						3			
						4			

TIME DISTRIBUTION HOURS

CODE NO.	OPERATION	TOUR 1	TOUR 2
1	RIG UP AND TEAR DOWN		
2	DRILL ACTUAL		
3	REAMING		
4	CORING	2:10	
5	CONDITION MUD & CIRCULATE	1:10	
6	TRIPS	3:40	
7	LUBRICATE RIG		
8	REPAIR RIG		
9	CUT OFF DRILLING LINE		
10	DEVIATION SURVEY		
11	WIRELINE LOGS	4:15	
12	RUN CASING & CEMENT		
13	WAIT ON CEMENT		
14	NIPPLE UP B.O.P.		
15	TEST B.O.P.		
16	DRILL STEM TEST		
17	PLUG BACK		
18	SQUEEZE CEMENT		
19	FISHING		
20	DIR. WORK		
21	customer meet	0:15	
22	start up rig	0:15	
23	shut down rig	0:15	
COMPLETION	A. PERFORATING		
	B. TUBING TRIPS		
	C. TREATING		
	D. SWABBING		
	E. TESTING		
	F.		
	G.		
	H.		
TOTALS		12:00	

DAYWORK TIME SUMMARY (OFFICE USE ONLY)

HOURS W/CONTR D.P.		
HOURS W/OPR D.P.		
HOURS WITHOUT D.P.		
HOURS STANDBY		
TOTAL DAYWORK		
NO. OF DAYS FROM SPUD		
CUMULATIVE ROTATING HOURS		
DAILY MUD COST		
TOTAL MUD COST		

TOUR 1

DRILLING ASSEMBLY (AT END OF TOUR)

NO.	ITEM	O.D.	LENGTH
	STANDS D.P.		
	SINGLES D.P.		
	KELLY DOWN		
	TOTAL		
	WT. OF STRING		

REMARKS
fuel 45 inches

DRILLER
Andy Brown

BIT RECORD

BIT NO.	
SIZE	
IADC CODE	
MFG	
TYPE	
SERIAL NO.	
JETS	
TFA	
DEPTH OUT	
DEPTH IN	
TOT DRILLED	
TOT HOURS	

CUTTING STRUCTURE

INNER	OUTER	DULL CHAR	LOCATION

BEARINGS/SEALS	GAGE	OTHER DULL CHAR	REASON PULLED

MUD RECORD

TIME	10:00		
WEIGHT	9		
PRESSURE GRADIENT	0.4671		
FUNNEL VISCOSITY	34		
PV/YP	5 11		
GEL STRENGTH	21 16		
FLUID LOSS	63		
pH	9.4		
SOLIDS	0.25		

MUD & CHEMICAL ADDED

TYPE	AMOUNT	TYPE	AMOUNT
Caustic	2		

TOUR 2

DRILLING ASSEMBLY (AT END OF TOUR)

NO.	ITEM	O.D.	LENGTH
	STANDS D.P.		
	SINGLES D.P.		
	KELLY DOWN		
	TOTAL		
	WT. OF STRING		

REMARKS

DRILLER
Justin Tanner

BIT RECORD

BIT NO.	
SIZE	
IADC CODE	
MFG	
TYPE	
SERIAL NO.	
JETS	
TFA	
DEPTH OUT	
DEPTH IN	
TOT DRILLED	
TOT HOURS	

CUTTING STRUCTURE

INNER	OUTER	DULL CHAR	LOCATION

BEARINGS/SEALS	GAGE	OTHER DULL CHAR	REASON PULLED

MUD RECORD

TIME	
WEIGHT	
PRESSURE GRADIENT	
FUNNEL VISCOSITY	
PV/YP	
GEL STRENGTH	
FLUID LOSS	
pH	
SOLIDS	

MUD & CHEMICAL ADDED

TYPE	AMOUNT	TYPE	AMOUNT

DAILY DRILLING REPORT

WELL T-Bird 9J REPORT NO. 5 DATE 19-Apr-2021

FIELD OR DISTRICT	COUNTY	STATE / COUNTRY
Hallett	Pawnee	OK / United States

	SIZE	MAKE	WEIGHT GRADE	NO. JOINTS	LENGTH	RKB. TO CSG. HD.	SET AT
LAST CASING							
TUBING							
OR LINER							

WIRE LINE RECORD REEL NO.

SIZE	NO LINES	LENGTH SLIPPED

LENGTH CUT OFF	PRESENT LENGTH

WEAR OR TRIPS SINCE LAST CUT

CUMULATIVE WEAR OR TRIPS

TOUR 1

DEPTH INTERVAL FROM	TO	DRILL..D REAM...R CORE...C	CORE NO.	FORMATION (SHOW CORE RECOVERY)	ROTARY TABLE SPEED	WT. ON BIT	PUMP PRESSURE	PUMP NO. 1 LINER SIZE	S.P.M.	PUMP NO. 2 LINER SIZE	S.P.M.	PUMP NO. 3 LINER SIZE	S.P.M.	PUMP NO. 4 LINER SIZE	S.P.M.	TOTAL PUMP OUTPUT

DEVIATION RECORD

DEPTH	DEV	DIR.	TVD	HORZ. DISP.	DEPTH	DEV	DIR.	TVD	HORZ. DISP.	DEPTH	DEV	DIR.	TVD	HORZ. DISP.

From	To	Elapsed Time	CodeNo	Details Of Operations In Sequence And Remarks
17:10	17:35	0:25	4	core from 1617-1619
17:35	18:15	0:40	11	rig up wire line and retrieve tool, lay tool down
18:15	18:45	0:30	6	trip up to casing
18:45	19:00	0:15	23	shut down rig

TOUR 2

DEPTH INTERVAL FROM	TO	DRILL..D REAM...R CORE...C	CORE NO.	FORMATION (SHOW CORE RECOVERY)	ROTARY TABLE SPEED	WT. ON BIT	PUMP PRESSURE	PUMP NO. 1 LINER SIZE	S.P.M.	PUMP NO. 2 LINER SIZE	S.P.M.	PUMP NO. 3 LINER SIZE	S.P.M.	PUMP NO. 4 LINER SIZE	S.P.M.	TOTAL PUMP OUTPUT

DEVIATION RECORD

DEPTH	DEV	DIR.	TVD	HORZ. DISP.	DEPTH	DEV	DIR.	TVD	HORZ. DISP.	DEPTH	DEV	DIR.	TVD	HORZ. DISP.

From	To	Elapsed Time	CodeNo	Details Of Operations In Sequence And Remarks

DRILLING CREW PAYROLL DATA

DATE

WELL NAME & NO.

COMPANY

TOOLPUSHER Justin Tanner

TOUR 1	FROM
CREW	EMPL.ID NO.

NO. DAYS SINCE LAST LOST TIME ACCIDENT

TOUR 2	FROM
CREW	EMPL.ID NO.

NO. DAYS SINCE LAST LOST TIME ACCIDENT

PCTB Land Test III 2021 Report

Appendix G: Geotek Report

2021 PCTB V

FIELD TEST REPORT

UT/DOE

GEOTEK LTD DOCUMENT NO. UT2021 (R1)

PREPARED FOR:

UT/DOE

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ISSUE	REPORT STATUS	PREPARED	APPROVED	DATE
1	FINAL	AB/PS	MM	06/03/2021

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EXECUTIVE SUMMARY

2020 Cameron Field Testing
In March 2020, a PCTB field test project at the Cameron Test and Training Facility (CTTF) led to the discovery of a problematic ball valve mechanism. The ball valve jammed upon actuation and failed to seal in-situ autoclave pressure on 6/7 coring runs.

2020 Geotek Coring Test Facility
Geotek Coring staff then shifted efforts into reproducing the ball valve actuation failures observed in CTTF at the Geotek Test Facility. Failures were reproduced by actuating the ball valve in a similar concentration of fine grit particles determined from a CTTF mud sample.

The ball valve sub-assembly was redesigned to reduce friction and eliminate potential jamming points throughout the stroke. The redesigned sub-assembly was thoroughly tested in aggressive conditions to prove its functionality before being deployed in the next field test.

2021 Catoosa Field Testing
19 downhole tests were performed on the upgraded PCTB V at the Catoosa Test Facility in Jennings, Oklahoma. 16/19 tests successfully sealed, boosted, and maintained pressure throughout the coring run. The three tests that did not produce a sealed autoclave were for reasons that were immediately identifiable. The details of these three tests are as follows:

- 7CS – Solid length of core stuck from the bottom of the cutting shoe up into the autoclave interfered with ball valve closure
- 9CS – Extruded inner tube plug seal jammed up and prevented tool from fully actuating before unlatching out of the BHA
- 17FB – Tool landed in a position above the latch causing the core liner to collapse when pumps were turned on, collapsed liner also prevented proper stroke of release sleeve

Overall, the ball valve sub-assembly redesign greatly improved the functionality of the PCTB. With this improvement we are confident that the PCTB will consistently retrieve fully sealed pressure cores in the upcoming offshore operation.

1 PREVIOUS FIELD TEST SUMMARY

In March 2020, a group of PCTB modifications were set to be tested at the Cameron Test and Training Facility (CTTF) in a downhole drilling environment. The modifications included the following:

- Low-friction coatings for latch parts
- Single trigger mechanism
- IT plug shear pin
- Flow diversion lip seal
- Higher-volume pressure section

A group of seven downhole tests were performed and 6/7 failed to seal the bottom-hole pressure. The group of testing revealed a problematic ball valve mechanism that failed to fully close and seal throughout six of the tests.

A noticeable amount of fine grit had accumulated around the ball valve mechanism upon each coring run. The ball valve would finish the stroke with a small amount of pressure applied downward on the ball, showing that with enough peripheral force coming up the drill string the mechanism may have been working intermittently in past projects.

1.1 BALL VALVE TESTING AND UPGRADES

Mud samples from the facility were analyzed post-field test and revealed 0.24% solids by weight of fine grit particles around 125 µm in size. This information was used to try to reproduce ball valve actuation failures in a custom Geotek designed test fixture. Ball valve actuation failures were successfully reproduced by actuating the mechanism in concentrations of fine-grit particles. The failure method matched up closely with what was observed in CTTF.

An upgraded ball valve sub-assembly was then designed to reduce friction throughout the stroke of the system and eliminate potential jamming points. Wiper ring seals were added to the ball valve housing to help reduce build-up of fine-grit particles between the sliding surfaces of the seal carrier and ball follower. Diversion seals and seal positions were changed to improve the flow path and divert flow away from the sliding mechanisms. A new ball valve return spring was designed to reduce the total number of coils and reduce the counteracting force on the ball valve.

The upgraded assembly was then tested thoroughly at the Geotek Test Facility in fine-grit solutions in preparation for the next field test.

1.2 CATOOSA FIELD TEST GOALS & PURPOSE

The primary goal of the Catoosa field test is to validate that the ball valve sub-assembly redesign fully actuates and seals consistently in a downhole drilling environment. Proving the functionality of this mechanism is critical before running the PCTB in an offshore project.

2 FIELD TEST RESULTS

2.1 FIELD TEST RUN DATA

Test results for the 11, PCTB Cutting Shoe configuration tests are shown in table 1 below. 9/11 tests of this configuration successfully sealed, boosted, and maintained pressure throughout the duration of the test.

TEST	SET (PSI)	FILL (PSI)	BOTTOM HOLE DEPTH (FT)	BOTTOM HOLE PRESSURE (PSI)	PCTB SEAL PRESSURE (PSI)	CORE RECOVERY (FT)	CORE RECOVERY (%)
1CS	1,202	2,960	1,481	657	1,143	N/A	N/A
2CS	1,182	3,084	1,481	657	1,155	N/A	N/A
3CS	1,170	3,155	1,481	657	1,135	N/A	N/A
4CS	1,202	3,085	1,557	690	1,177	0.50	10
5CS	1,190	3,090	1,566	694	1,137	5.50	61
6CS	1,194	3,125	1,569	696	1,140	0.33	11
7CS	1,200	3,140	1,575	698	0	1.92	40
8CS	1,189	3,080	1,579	700	1,161	0.58	12
9CS	1,173	3,057	1,583	702	0	1.17	27
10CS	1,215	3,024	1,585	703	1,165	3.00	60
11CS	1,175	3,055	1,590	705	1,146	0.25	4

Table 1. PCTB cutting shoe configuration test data

Results for the eight, PCTB Face Bit configuration tests are shown in table 2 below. 8/9 tests of this configuration successfully sealed, boosted, and maintained pressure throughout the duration of the test.

TEST	SET (PSI)	FILL (PSI)	BOTTOM HOLE DEPTH (FT)	BOTTOM HOLE PRESSURE (PSI)	PCTB SEAL PRESSURE (PSI)	CORE RECOVERY (FT)	CORE RECOVERY (%)
12FB	1,165	3,099	1,55	687	1,164	N/A	N/A
13FB	1,225	3,130	1,595	707	1,145	0	0
14FB	1,167	3,062	1,605	712	1,175	8.90	129
15FB	1,168	3,070	1,612	715	1,220	0.50	84
16FB	1,233	3,023	1,620	718	1,344	4.40	66
17FB	1,250	3,316	1,618	717	0	1.10	69
18FB	1,275	3,256	1,620	718	1,222	3.25	84
19FB	1,234	3,045	1,625	721	1,216	6.50	102

Table 2. PCTB face bit configuration test data

2.1.1 *1CS*

The PCTB Cutting Shoe configuration was run into the hole and latched into the BHA smoothly at a depth of 1,481 ft. The tool was then pulled from the BHA with no drilling or pumping performed. The tool unlatched smoothly at a maximum wireline weight of 2,300 lbs.

The tool was sent to the service van and the internal pressure of the tool registered 1,143 psi. The tool sealed and captured full boost within ~5% of the regulator set pressure. The autoclave pressure was then reduced, and the mud was drained from the tool.

Result: Successful test

Failure mode: None

Corrective action: None

2.1.2 *2CS*

Like 1CS, the tool was run into the hole and latched into the BHA smoothly at a depth of 1,481 ft. The tool was then pulled from the BHA with no drilling or pumping performed. The tool unlatched smoothly at a maximum wireline weight of 2,500 lbs.

The tool was sent to the service van and the internal pressure of the tool registered 1,155 psi. The tool sealed and captured full boost within ~6% of the regulator set pressure. The autoclave pressure was then reduced, and the mud was drained from the tool.

Result: Successful test

Failure mode: None

Corrective action: None

2.1.3 *3CS*

The tool was run into the hole and latched into the BHA smoothly at a depth of 1,481 ft. Drilling fluid was then circulated at 325 gpm for ~30 minutes with no drilling. The tool was then pulled from the BHA, unlatching smoothly at a maximum wireline weight of 2,100 lbs.

The tool was sent to the service van and the internal pressure of the tool registered 1,135 psi. The tool sealed and captured full boost within ~3% of the regulator set pressure. The autoclave pressure was then reduced, and the mud was drained from the tool.

Result: Successful test

Failure mode: None

Corrective action: None

2.1.4 *4CS*

The tool was run into the hole and latched into the BHA smoothly. The tool began coring at a depth of 1,552 ft with a weight on bit of 16,000 lbs. Drilling fluid was circulated at 314 gpm with a rate of penetration of 4 ft/hr. The final depth of the coring run was 1,557 ft. The tool was then retrieved from the BHA and unlatched smoothly with a maximum wireline weight of 3,000 lbs.

The tool was sent to the service van and the internal pressure of the tool registered 1,177 psi. The tool sealed and captured full boost within ~2% of the regulator set pressure.

The core sample was depressurized and removed from the core barrel to show a recovery of 0.5 ft.

Result: Successful test

Failure mode: None

Corrective action: None

2.1.5 *5CS*

The tool was run into the hole and latched into the BHA smoothly. The tool began coring at a depth of 1,557 ft with a weight on bit of 11,000 lbs. Drilling fluid was circulated at 450 gpm with a rate of penetration of 12 ft/hr. The final depth of the coring run was 1,566 ft. The tool was then retrieved from the BHA and unlatched smoothly with a maximum wireline weight of 3,800 lbs.

The tool was sent to the service van and the internal pressure of the tool registered 1,137 psi. The tool sealed and captured full boost within ~4% of the regulator set pressure.

The core sample was depressurized and removed from the core barrel to show a recovery of 5.50 ft.

Result: Successful test

Failure mode: None

Corrective action: None

2.1.6 *6CS*

The tool was run into the hole and latched into the BHA smoothly. The tool began coring at a depth of 1,566 ft with a weight on bit of 11,000 lbs. Drilling fluid was circulated at 445 gpm with a rate of penetration of 6 ft/hr. The final depth of the coring run was 1,569 ft. The tool was then retrieved from the BHA and unlatched smoothly with a maximum wireline weight of 2,300 lbs.

The tool was sent to the service van and the internal pressure of the tool registered 1,140 psi. The tool sealed and captured full boost within ~5% of the regulator set pressure.

The core sample was depressurized and removed from the core barrel to show a recovery of 0.33 ft.

Result: Successful test

Failure mode: None

Corrective action: None

2.1.7 *7CS*

The tool was run into the hole and latched into the BHA smoothly. The tool began coring at a depth of 1,569 ft with a weight on bit of 11,000 lbs. Drilling fluid was circulated at 445 gpm with a rate of penetration of 6 ft/hr. The final depth of the coring run was 1,574 ft. The tool was then retrieved from the BHA and unlatched smoothly with a maximum wireline weight of 2,500 lbs.

It was apparent after the tool was retrieved to the drill floor that the ball valve had not closed due to a jammed section of core that ran from the bottom of the cutting shoe up into the core barrel. Figure’s 1 and 2 below show the core interfering with the ball valve mechanism.

Figure 1. Jammed core on test run 7CS causing ball valve to not close

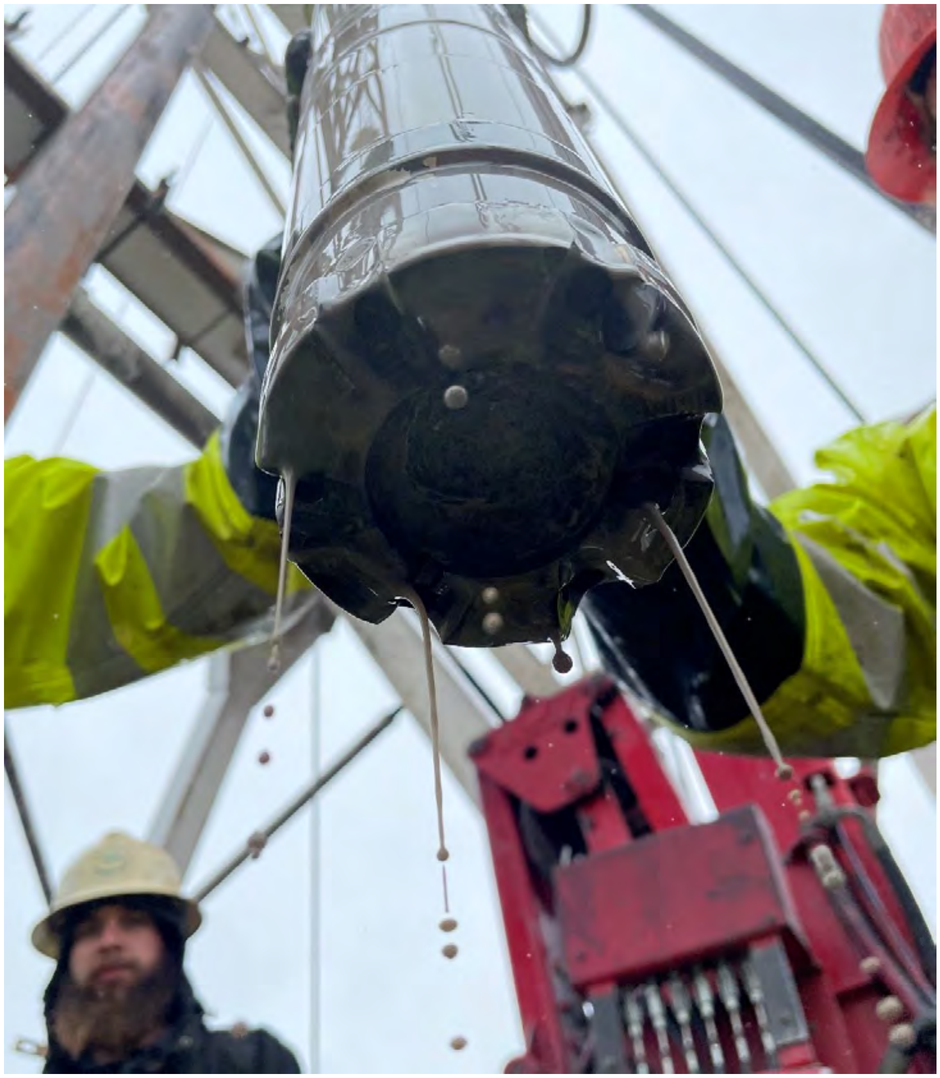

Figure 2. Cutting shoe view of coring run 7CS

The core liner failed to break the core at the base of the formation and pull it into the core barrel past the ball valve, resulting in the jamming shown above. The initial configuration of basket catcher and slip catcher was changed to a slip catcher only due to damage done to the core by the spinning basket catcher. This could be considered in future operational (marine sediment) deployments, as it suggests that the fingers of the basket catcher can do damage to even hard core.

1.92 ft of core was retrieved from this test.

Result: Failed test

Failure mode: Core jamming ball valve mechanism

Corrective action: Close inspection of slip catcher and core lifter skirt upon future deployments, change from core basket catchers to blank liner ends. It may be worth considering use of a flapper catcher in place of the basket catcher when coring in softer sediments

2.1.8 *8CS*

The tool was run into the hole and latched into the BHA smoothly. The tool began coring at a depth of 1,574 ft with a weight on bit of 11,000 lbs. Drilling fluid was circulated at 445 gpm with a rate of penetration of 5 ft/hr. The final depth of the coring run was 1,579 ft. The tool was then retrieved from the BHA and unlatched smoothly with a maximum wireline weight of 3,000 lbs.

The tool was sent to the service van and the internal pressure of the tool registered 1,161 psi. The tool sealed and captured full boost within ~2% of the regulator set pressure.

The core sample was depressurized and removed from the core barrel to show a recovery of 0.58 ft.

Result: Successful test

Failure mode: None

Corrective action: None

2.1.9 *9CS*

The tool was run into the hole and latched into the BHA smoothly. The tool began coring at a depth of 1,579 ft with a weight on bit of 11,000 lbs. Drilling fluid was circulated at 501 gpm with a rate of penetration of 4 ft/hr. The final depth of the coring run was 1,584 ft. The tool was then retrieved from the BHA and unlatched smoothly with a maximum wireline weight of 2,850 lbs.

The tool was sent to the service van and registered 0 psi internal pressure. Upon further investigation it was determined that an IT plug polypak seal had extruded during actuation preventing the IT plug from pulling into the seal sub. This additional force allowed for the tool to unlatch out of the BHA before finishing the full tool actuation by compressing the over-travel feature in the upper assembly.

A core sample of 1.17 ft was retrieved from the core barrel following the disassembly of the tool.

The seal was likely damaged when resetting the collet release sleeve after pressure testing and before downhole deployment. The seal damage is shown below in figure 3.

Figure 3. Damaged IT plug polypak seal causing jamming of the tool during actuation

Result: Failed test

Failure mode: IT plug seal damage

Corrective action: More careful assembly procedure of collet release sleeve post-pressure testing

2.1.10 ***10CS***

The tool was run into the hole and latched into the BHA smoothly. The tool began coring at a depth of 1,584 ft with a weight on bit of 16,000 lbs. Drilling fluid was circulated at 315 gpm with a rate of penetration of 5 ft/hr. The final depth of the coring run was 1,589 ft. The tool was then retrieved from the BHA and unlatched smoothly with a maximum wireline weight of 4,000 lbs.

The tool was sent to the service van and the internal pressure of the tool registered 1,165 psi. The tool sealed and captured full boost within ~4% of the regulator set pressure.

The core sample was depressurized and removed from the core barrel to show a recovery of 3 ft.

Result: Successful test

Failure mode: None

Corrective action: None

2.1.11 ***11CS***

The tool was run into the hole and latched into the BHA smoothly. The tool began coring at a depth of 1,589 ft with a weight on bit of 9,000 lbs. Drilling fluid was circulated at 314 gpm with a rate of penetration of 6 ft/hr. The final depth of the coring run was 1,595 ft. The tool was then retrieved from the BHA and unlatched smoothly with a maximum wireline weight of 2,000 lbs.

The tool was sent to the service van and the internal pressure of the tool registered 1,165 psi. The tool sealed and captured full boost within ~4% of the regulator set pressure.

The core sample was depressurized and removed from the core barrel to show a recovery of 3 ft.

Result: Successful test

Failure mode: None

Corrective action: None

2.1.12 ***12FB***

The BHA was pulled up to the drill floor and a main bit change was made in anticipation of PCTB Face Bit configuration testing. After the bit change, we tripped back into the well. The tool was then run into the hole and latched into the BHA smoothly at a depth of 1,550 ft. Drilling fluids were circulated through at a rate of 315 gpm for about 30 minutes with no drilling. The tool was then pulled from the BHA and unlatched smoothly at a maximum wireline weight of 2,700 lbs.

The tool was sent to the service van and the internal pressure of the tool registered 1,164 psi. The tool sealed and captured full boost within less than 1% of the regulator set pressure. The autoclave pressure was then reduced, and the mud was drained from the tool. However, it was noted from the DST data that the pressure boost had occurred some 3m 40s after the tool was removed from the BHA which implies that the boost occurred during the wireline trip up the hole. Geotek interprets this DST record as a successful ball valve closure just prior to unlatching from the BHA but without the upper assembly completely stroking out to either fully seal the inside of the tool or fire the pressure boost. We interpret the decreasing pressure on the inside of the tool for 3m 40s as occurring during the early part of a normal fast wireline trip up the hole. We are confident that there were no delays in starting the wireline trip immediately after unlatching from the BHA and hence the tool must be coming up the hole. The observation that the rate of pressure drop measured in the tool is lower than the normal pressure drop rate if the tool were fully open to the outside well pressure during tool tripping we believe is being caused by; a) the very restricted flow of drilling mud through the compensation ports for pressure equalization and b) the fact that there is always/often a residual trapped gas volume in the upper part of the tool that acts as an accumulator/compensator slowing the rate of pressure change. Note that this behaviour was also noted in deployment 14FB (see below)

Result: Successful test (ball valve closed but pressure boost was 'late')

Failure mode: None

Corrective action: None

2.1.13 ***13FB***

The tool was run into the hole and latched into the BHA smoothly. The tool began coring at a depth of 1,595 ft with a weight on bit of 6,500 lbs. Drilling fluid was circulated at 311 gpm with a rate of penetration of 4 ft/hr. The final depth of the coring run was 1,599 ft. The tool was then retrieved from the BHA and unlatched smoothly with a maximum wireline weight of 3,100 lbs.

The tool was sent to the service van and the internal pressure of the tool registered 1,145 psi. The tool sealed and captured full boost within ~6% of the regulator set pressure.

No core sample was recovered during this test.

Result: Successful test

Failure mode: None

Corrective action: None

2.1.14 ***14FB***

The tool was run into the hole and latched into the BHA smoothly. The tool began coring at a depth of 1,599 ft with a weight on bit of 20,000 lbs. Drilling fluid was circulated at 306 gpm with a rate of penetration of 7 ft/hr. The final depth of the coring run was 1,606 ft. The tool was then retrieved from the BHA and unlatched smoothly with a maximum wireline weight of 3,900 lbs.

The tool was sent to the service van and the internal pressure of the tool registered 1,175 psi. The tool sealed and captured full boost within ~1% of the regulator set pressure.

However, it was noted from the DST data that the pressure boost had occured late (some 2m 55s after the tool was removed from the BHA which as with deployment 12FB implies that the boost occured during the wireline trip up the hole. See deployment 12 FB for further discussion.

The core sample was depressurized and removed from the core barrel to show a recovery of 8.90 ft.

Result: Successful test (ball valve closed but pressure boost was 'late')

Failure mode: None

Corrective action: None

2.1.15 *15FB*

The tool was run into the hole and latched into the BHA smoothly. The tool began coring at a depth of 1,606 ft with a weight on bit of 20,000 lbs. Drilling fluid was circulated at 311 gpm with a rate of penetration of 6 ft/hr. The final depth of the coring run was 1,612 ft. The tool was then retrieved from the BHA and unlatched smoothly with a maximum wireline weight of 2,300 lbs.

The tool was sent to the service van and the internal pressure of the tool registered 1,220 psi. The tool sealed and captured full boost within ~4% of the regulator set pressure.

The core sample was depressurized and removed from the core barrel to show a recovery of 4.00 ft.

Result: Successful test

Failure mode: None

Corrective action: None

2.1.16 *16FB*

The tool was run into the hole and latched into the BHA smoothly. The tool began coring at a depth of 1,612 ft with a weight on bit of 18,000 lbs. Drilling fluid was circulated at 308 gpm with a rate of penetration of 7 ft/hr. The final depth of the coring run was 1,618 ft.

When retrieving the tool from the BHA the wireline underwent a heavy overpull causing the wireline connection to separate from the wireline tool shortly after unlatching out of the BHA. This required us to trip out of the hole and remove the tool from the BHA at the drill floor.

The tool was then sent to the service van and the internal pressure of the tool registered 1,344 psi. The tool sealed and captured full boost; the internal pressure had increased ~150 psi over the regulator set pressure due to the increase in temperature of the core barrel from the extra time it spent outside.

The DST inside of the core barrel was damaged during the coring run, no DST data for this run was collected.

A core sample of 4.40 ft was recovered from this test.

Result: Successful test

Failure mode: None

Corrective action: None

2.1.17 ***17FB***

The tool was run into the hole and released from the running tool 30 ft above the bottom. The pumps were turned on and a standpipe pressure of ~2,000 psi was observed. The tool was retrieved with the emergency wireline tool and redeployed.

The tool then latched into the BHA smoothly and we began coring at a depth of 1,618 ft. Drilling fluids were circulated at 220 gpm with a weight on bit of 18,000 lbs and a rate of penetration of 4 ft/hr. The final depth of the coring run was 1,619 ft.

The tool was retrieved to the drill floor with an open ball valve. The tool was then disassembled in the service van to reveal that the core liner had been collapsed during the initial run. The core liner was firmly jammed inside of the inner tube, along with the release sleeve responsible for firing the ball valve mechanism. The jammed core liner also did not allow the pressure section sleeve valve to fire.

Figure 4 below shows the collapsed liner section along with the jammed release sleeve on the inner tube.

Figure 4. Collapsed core liner on test 17FB

The collapsed core liner was split, and 1.10 ft of core was recovered from this test.

It should be noted that when the tool was landed by wireline, a depth discrepancy of less than 30 feet was noted. The 9m BHA as currently designed does not allow the coring tool to release from the wireline tool at this location in the BHA; as such it was presumed that a bad wireline “zero” had been obtained prior to deploying the tool. The pumps were turned on as normal and an immediate pressure spike was noted, beginning the troubleshooting process. The pumps were maintained for a few minutes in an attempt to “seat” the coring tool into proper position.

Inspection of the BHA on return to Salt Lake City revealed that the drill collars were manufactured to a different specification than the existing standard. This unknown specification allows a large thread relief, which provides sufficient space for the latch dogs to extend and the wireline tool to release, mimicking a proper landing of the tool.

The root cause of this failed run is the excessive thread relief space in the drill collars. Geotek recommends manufacturing bushings to fill this space, making it impossible to inadvertently release in this manner.

On a typical offshore job in soft sediment, with finer control of pump flow rates, pumping at a low rate should be kept on the table as a possible remedy to a tool failing to land in the BHA.

Result: Failed test

Failure mode: Tool released from running tool above latch point, position of the tool created pressure differential around low end core liner when pumps turned on collapsing liner

Corrective action: Run tool into BHA slower and verify with wireline operator the unlatching depth is in the proper position before turning on pumps. In case of observed standpipe pressure spikes prior to the coring run in the future the tool should be retrieved where inspection of the core liner can be completed on the drill floor prior to redeployment.

2.1.18 ***18FB***

The tool was run into the hole and latched into the BHA smoothly. The tool began coring at a depth of 1,618 ft with a weight on bit of 18,000 lbs. Drilling fluid was circulated at 311 gpm with a rate of penetration of 10 ft/hr. The final depth of the coring run was 1,623 ft. The tool was then retrieved from the BHA and unlatched smoothly with a maximum wireline weight of 2,500 lbs.

The tool was sent to the service van and the internal pressure of the tool registered 1,222 psi. The tool sealed and captured full boost within ~4% of the regulator set pressure.

The core sample was depressurized and removed from the core barrel to show a recovery of 3.25 ft.

Result: Successful test

Failure mode: None

Corrective action: None

2.1.19 *19FB*

The tool was run into the hole and latched into the BHA smoothly. The tool began coring at a depth of 1,623 ft with a weight on bit of 19,000 lbs. Drilling fluid was circulated at 285 gpm with a rate of penetration of 7 ft/hr. The final depth of the coring run was 1,629 ft. The tool was then retrieved from the BHA and unlatched smoothly with a maximum wireline weight of 2,400 lbs.

The tool was sent to the service van and the internal pressure of the tool registered 1,216 psi. The tool sealed and captured full boost within ~2% of the regulator set pressure.

The core sample was depressurized and removed from the core barrel to show a recovery of 6.50 ft.

Result: Successful test

Failure mode: None

Corrective action: None

3 CONCLUSION

Upgrading the ball valve sub-assembly design led to significant improvements of the functionality of the PCTB. The previous field test at the Cameron Test and Training Facility in March 2020 yielded 6/7 tool failures due to the ball valve mechanism failing to close and seal. We were able to complete 16/19 successful tests at the Catoosa Test Facility after upgrading the ball valve assembly design. It should be noted that 2 of these successful ball valve closure tests did exhibit late pressure boosts. All three run failures were easily identifiable and correctable with minor adjustments. Most importantly, none of the three failures were at the fault of a problematic ball valve mechanism. The three failures leave us room to fine-tune assembly and drilling protocols before the upcoming offshore operation to further improve our downhole success rates.

APPENDICES

- **APPENDIX 1: RUN REPORTS**

1CS RUN REPORT

GEOTEK CORING Inc
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Salt Lake City, Utah, 84104 USA
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REVISION NO.: 0

PCTB V CORING RUN REPORT
CATOOSA TEST FACILITY 2021

DATE:	2021-04-14	CORE:	1CS
TOOL ASSEMBLY TEAM:		Burrows, Mariani, Riley, Sandusky	
BOTTOM CORE DEPTH (BELOW RIG FLOOR):	1,481.00 ft	BOTTOM HOLE PRESSURE:	657 psi
DST SERIAL NUMBERS: LINER LENGTH ADJUSTER:		C9500 RABBIT:	N/A
NOTES:			

TOOL ASSEMBLY

BUILD CHECKLIST		AUTOCLAVE PRESSURE TEST			
LINER/IT PLUG LENGTH (156.75")	☑	To test, pressurize assembled autoclave to 3000 psi (+/- 100 psi). Record this *INITIAL* pressure below. Wait five minutes to allow for acclimitization. During this time inspect for gross leakage of water or significant pressure drop. If leaks or pressure loss are observed, rectify and retest. At five minutes, record *START* pressure. Wait 10 minutes, then observe and record *END* pressure. If pressure loss >60 psi is observed, the test is considered a failure and should be repeated.			
SET PRESSURE (CONFIRM WITH 3 TESTS):	1,202 psi				
RESERVOIR PRESSURE:	2,960 psi				
SUPPLY VALVE OPEN	☑				
FILL VALVE CLOSED/PORT PLUGGED	☑	TEST 1			
SET VALVE CLOSED/PORT PLUGGED	☑	DATE:	2021-04-13	INITIAL:	2,983 psi
DRAIN VALVE CLOSED/PORT PLUGGED	☑	START TIME:	14:48	START:	2,983 psi
SHUTOFF VALVE OPEN	☑			END:	3,040 psi
SAMPLE PORT CLOSED/PORT PLUGGED	☑	TEST 2 (IF REQUIRED)			
IT PLUG SHEAR PIN INSTALLED	☑	DATE:		INITIAL:	
		START TIME:		START:	
				END:	

TOOL READY FOR RIG FLOOR	DATE: 2021-04-14	TIME: 8:07	TOOL SENT TO RIG FLOOR	DATE: 2021-04-14	TIME: 9:18
NOTES:					

CORING RUN

DATE:	2021-04-14		TOOL DEPLOYMENT TIME:		13:28
START DEPTH: 1,481.00 ft	END DEPTH: 1,481.00 ft		ANTICIPATED RECOVERY:		0.00 ft
CORING START TIME:	N/A		CORING END TIME:		N/A
FLOW RATES — RUNNING IN:	0 gpm	DRILL PARAMETERS			
CORING:	0 gpm	W.O.B.:	R.P.M.:	R.O.P.:	WEIGHT (MAX): 2,300.0 lbs
PULLING:	0 gpm	N/A	N/A	N/A	SPEED: 300 ft/min
P.O.O.H.:	0 gpm	COLD SHUCK:	TIME IN: N/A		TIME OUT: N/A
			TIME ON DECK:		14:19
TOTAL TIME IN HOLE:	0:51		TOTAL TIME CORING:		N/A
NOTES:					

CORE TRANSFER & RECOVERY

RECEIVED FROM RIG FLOOR	DATE: 2021-04-14	TRANSDUCER PRESSURE:	1,143 psi
	TIME: 14:45		
		TOTAL CORE RECOVERY:	N/A
		RECOVERY PERCENTAGE:	
NOTES:			

POST-CORING TOOL ANALYSIS & REBUILD

NOTES:

2CS RUN REPORT

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PCTB V CORING RUN REPORT
CATOOSA TEST FACILITY 2021

DATE:	2021-04-14	CORE:	2CS
TOOL ASSEMBLY TEAM:		Burrows, Mariani, Riley, Sandusky	
BOTTOM CORE DEPTH (BELOW RIG FLOOR):	1,481.00 ft	BOTTOM HOLE PRESSURE:	657 psi
DST SERIAL NUMBERS: LINER LENGTH ADJUSTER:	C9492	RABBIT:	N/A
NOTES:	Autoclave 2; 1000 lbf shear pin		

TOOL ASSEMBLY

BUILD CHECKLIST	
LINER/IT PLUG LENGTH (156.75")	☑
SET PRESSURE (CONFIRM WITH 3 TESTS):	1,182 psi
RESERVOIR PRESSURE:	3,084 psi
SUPPLY VALVE OPEN	☑
FILL VALVE CLOSED/PORT PLUGGED	☑
SET VALVE CLOSED/PORT PLUGGED	☑
DRAIN VALVE CLOSED/PORT PLUGGED	☑
SHUTOFF VALVE OPEN	☑
SAMPLE PORT CLOSED/PORT PLUGGED	☑
IT PLUG SHEAR PIN INSTALLED	☑

AUTOCLAVE PRESSURE TEST

To test, pressurize assembled autoclave to 3000 psi (+/- 100 psi). Record this *INITIAL* pressure below. Wait five minutes to allow for acclimitization. During this time inspect for gross leakage of water or significant pressure drop. If leaks or pressure loss are observed, rectify and retest. At five minutes, record *START* pressure. Wait 10 minutes, then observe and record *END* pressure. If pressure loss >60 psi is observed, the test is considered a failure and should be repeated.

TEST 1			
DATE:	2021-04-13	INITIAL:	3,048 psi
START TIME:	16:28	START:	3,040 psi
		END:	3,020 psi

TEST 2 (IF REQUIRED)			
DATE:		INITIAL:	
START TIME:		START:	
		END:	

TOOL READY FOR RIG FLOOR	DATE: 2021-04-14	TIME: 9:39	TOOL SENT TO RIG FLOOR	DATE: 2021-04-14	TIME: 12:30

NOTES:

CORING RUN

DATE:	2021-04-14	TOOL DEPLOYMENT TIME:	14:31
START DEPTH: 1,481.00 ft	END DEPTH: 1,481.00 ft	ANTICIPATED RECOVERY:	0.00 ft
CORING START TIME:	N/A	CORING END TIME:	N/A

FLOW RATES		DRILL PARAMETERS			WIRELINE PULLOUT	
RUNNING IN:	0 gpm					
CORING:	0 gpm	W.O.B.:	R.P.M.:	R.O.P.:	WEIGHT (MAX):	2,500.0 lbs
PULLING:	0 gpm	N/A	N/A	N/A	SPEED:	300 ft/min
P.O.O.H.:	0 gpm	COLD SHUCK:	TIME IN:	N/A	TIME OUT:	N/A

		TIME ON DECK:	15:10
TOTAL TIME IN HOLE:	0:39	TOTAL TIME CORING:	N/A

NOTES:

CORE TRANSFER & RECOVERY

RECEIVED FROM RIG FLOOR	DATE: 2021-04-14	TRANSDUCER PRESSURE:	1,155 psi
	TIME: 15:25		
		TOTAL CORE RECOVERY:	N/A
		RECOVERY PERCENTAGE:	

NOTES:

POST-CORING TOOL ANALYSIS & REBUILD

NOTES:

3CS RUN REPORT

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PCTB V CORING RUN REPORT
CATOOSA TEST FACILITY 2021

DATE:	2021-04-14	CORE:	3CS
TOOL ASSEMBLY TEAM:		Burrows, Mariani, Riley, Sandusky	
BOTTOM CORE DEPTH (BELOW RIG FLOOR):	1,481.00 ft	BOTTOM HOLE PRESSURE:	657 psi
DST SERIAL NUMBERS: LINER LENGTH ADJUSTER:	C9481	RABBIT:	NA
NOTES: Autoclave 1, 600 lbf shear pin			

TOOL ASSEMBLY

BUILD CHECKLIST	
LINER/IT PLUG LENGTH (156.75")	☑
SET PRESSURE (CONFIRM WITH 3 TESTS):	1,170 psi
RESERVOIR PRESSURE:	3,155 psi
SUPPLY VALVE OPEN	☑
FILL VALVE CLOSED/PORT PLUGGED	☑
SET VALVE CLOSED/PORT PLUGGED	☑
DRAIN VALVE CLOSED/PORT PLUGGED	☑
SHUTOFF VALVE OPEN	☑
SAMPLE PORT CLOSED/PORT PLUGGED	☑
IT PLUG SHEAR PIN INSTALLED	☑

AUTOCLAVE PRESSURE TEST

To test, pressurize assembled autoclave to 3000 psi (+/- 100 psi). Record this *INITIAL* pressure below. Wait five minutes to allow for acclimitization. During this time inspect for gross leakage of water or significant pressure drop. If leaks or pressure loss are observed, rectify and retest. At five minutes, record *START* pressure. Wait 10 minutes, then observe and record *END* pressure. If pressure loss >60 psi is observed, the test is considered a failure and should be repeated.

TEST 1			
DATE:	2021-04-14	INITIAL:	3,135 psi
START TIME:	11:00	START:	3,136 psi
		END:	3,150 psi

TEST 2 (IF REQUIRED)			
DATE:		INITIAL:	
START TIME:		START:	
		END:	

TOOL READY FOR RIG FLOOR	DATE: 2021-04-14	TIME: 13:00	TOOL SENT TO RIG FLOOR	DATE: 2021-04-14	TIME: 14:00

NOTES:

CORING RUN

DATE:	2021-04-14		TOOL DEPLOYMENT TIME:	15:28
START DEPTH: 1,481.00 ft	END DEPTH: 1,481.00 ft		ANTICIPATED RECOVERY:	0.00 ft
CORING START TIME:	N/A		CORING END TIME:	N/A

FLOW RATES	
RUNNING IN:	0 gpm
CORING:	325 gpm
PULLING:	0 gpm
P.O.O.H.:	0 gpm

DRILL PARAMETERS		
W.O.B.:	R.P.M.:	R.O.P.:
N/A	N/A	N/A
COLD SHUCK:	TIME IN: N/A	

WIRELINE PULLOUT	
WEIGHT (MAX):	2,100.0 lbs
SPEED:	300 ft/min
TIME OUT:	N/A

		TIME ON DECK:	17:03
TOTAL TIME IN HOLE:	1:35	TOTAL TIME CORING:	N/A

NOTES:

CORE TRANSFER & RECOVERY

RECEIVED FROM RIG FLOOR	DATE: 2021-04-14	TRANSDUCER PRESSURE:	1,135 psi
	TIME: 17:08		
		TOTAL CORE RECOVERY:	N/A
		RECOVERY PERCENTAGE:	

NOTES:

POST-CORING TOOL ANALYSIS & REBUILD

NOTES:

4CS RUN REPORT

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PCTB V CORING RUN REPORT
CATOOSA TEST FACILITY 2021

DATE:	2021-04-14	CORE:	4CS
TOOL ASSEMBLY TEAM:		Burrows, Selman	
BOTTOM CORE DEPTH (BELOW RIG FLOOR):	1,557.20 ft	BOTTOM HOLE PRESSURE:	690 psi
DST SERIAL NUMBERS: LINER LENGTH ADJUSTER:		C9500 RABBIT:	N/A
NOTES:			

TOOL ASSEMBLY

BUILD CHECKLIST		AUTOCLAVE PRESSURE TEST			
LINER/IT PLUG LENGTH (156.75")	☑	To test, pressurize assembled autoclave to 3000 psi (+/- 100 psi). Record this *INITIAL* pressure below. Wait five minutes to allow for acclimitization. During this time inspect for gross leakage of water or significant pressure drop. If leaks or pressure loss are observed, rectify and retest. At five minutes, record *START* pressure. Wait 10 minutes, then observe and record *END* pressure. If pressure loss >60 psi is observed, the test is considered a failure and should be repeated.			
SET PRESSURE (CONFIRM WITH 3 TESTS):	1,202 psi				
RESERVOIR PRESSURE:	3,085 psi				
SUPPLY VALVE OPEN	☑				
FILL VALVE CLOSED/PORT PLUGGED	☑	TEST 1			
SET VALVE CLOSED/PORT PLUGGED	☑	DATE:	2021-04-14	INITIAL:	3,041 psi
DRAIN VALVE CLOSED/PORT PLUGGED	☑	START TIME:	19:15	START:	3,035 psi
SHUTOFF VALVE OPEN	☑			END:	3,045 psi
SAMPLE PORT CLOSED/PORT PLUGGED	☑	TEST 2 (IF REQUIRED)			
IT PLUG SHEAR PIN INSTALLED	☑	DATE:		INITIAL:	
		START TIME:		START:	
				END:	

TOOL READY FOR RIG FLOOR	DATE:	2021-04-15	TOOL SENT TO RIG FLOOR	DATE:	2021-04-15
	TIME:	7:57		TIME:	802
NOTES:					

CORING RUN

DATE:		2021-04-15	TOOL DEPLOYMENT TIME:		10:35
START DEPTH: 1,552.20 ft	END DEPTH:	1,557.20 ft		ANTICIPATED R	5.00 ft
CORING START TIME:		10:30	CORING END TIME:		11:48

FLOW RATES			DRILL PARAMETERS			WIRELINE PULLOUT	
	RUNNING IN:	0 gpm	W.O.B.:	R.P.M.:	R.O.P.:	WEIGHT (MAX):	3,000.0 lbs
	CORING:	314 gpm	16,000 lbs	91 rpm	4 ft/hr	SPEED:	300 ft/min
	PULLING:	0 gpm	COLD SHUCK:	TIME IN:	N/A	TIME OUT:	N/A
	P.O.O.H.:	0 gpm					

		TIME ON DECK:	12:10
TOTAL TIME IN HOLE:	1:35	TOTAL TIME CORING:	1:18
NOTES:			

CORE TRANSFER & RECOVERY

RECEIVED FROM RIG FLOOR	DATE:	2021-04-15	TRANSDUCER PRESSURE:	1,177 psi
	TIME:	12:25		
			TOTAL CORE RECOVERY:	0.50 ft
			RECOVERY PERCENTAGE:	10%
NOTES:				

POST-CORING TOOL ANALYSIS & REBUILD

NOTES:

5CS RUN REPORT

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PCTB V CORING RUN REPORT
CATOOSA TEST FACILITY 2021

DATE:	2021-04-15	CORE:	5CS
TOOL ASSEMBLY TEAM:		Burrows, Mariani, Riley, Sandusky	
BOTTOM CORE DEPTH (BELOW RIG FLOOR):	1,566.00 ft	BOTTOM HOLE PRESSURE:	694 psi
DST SERIAL NUMBERS: LINER LENGTH ADJUSTER:	C9489	RABBIT:	NA
NOTES:			

TOOL ASSEMBLY

BUILD CHECKLIST		AUTOCLAVE PRESSURE TEST			
LINER/IT PLUG LENGTH (156.75")	☑	To test, pressurize assembled autoclave to 3000 psi (+/- 100 psi). Record this *INITIAL* pressure below. Wait five minutes to allow for acclimitization. During this time inspect for gross leakage of water or significant pressure drop. If leaks or pressure loss are observed, rectify and retest. At five minutes, record *START* pressure. Wait 10 minutes, then observe and record *END* pressure. If pressure loss >60 psi is observed, the test is considered a failure and should be repeated.			
SET PRESSURE (CONFIRM WITH 3 TESTS):	1,190 psi				
RESERVOIR PRESSURE:	3,090 psi				
SUPPLY VALVE OPEN	☑				
FILL VALVE CLOSED/PORT PLUGGED	☑	TEST 1			
SET VALVE CLOSED/PORT PLUGGED	☑	DATE:	2021-04-15	INITIAL:	3,060 psi
DRAIN VALVE CLOSED/PORT PLUGGED	☑	START TIME:	09:46	START:	3,064 psi
SHUTOFF VALVE OPEN	☑			END:	3,079 psi
SAMPLE PORT CLOSED/PORT PLUGGED	☑	TEST 2 (IF REQUIRED)			
IT PLUG SHEAR PIN INSTALLED	☑	DATE:		INITIAL:	
		START TIME:		START:	
				END:	
TOOL READY FOR RIG FLOOR	DATE: 2021-04-15	TOOL SENT TO RIG FLOOR		DATE:	2021-04-15
	TIME: 10:32			TIME:	11:52
NOTES:					

CORING RUN

DATE:		2021-04-15	TOOL DEPLOYMENT TIME:			12:20
START DEPTH: 1,557.10 ft	END DEPTH:	1,566.10 ft		ANTICIPATED RECOVERY:		9.00 ft
CORING START TIME:		13:14	CORING END TIME:			15:00
FLOW RATES	RUNNING IN:	0 gpm	DRILL PARAMETERS		WIRELINE PULLOUT	
	CORING:	450 gpm	W.O.B.:	R.P.M.: / R.O.P.:	WEIGHT (MAX):	3,800.0 lbs
	PULLING:	0 gpm	11,000 lbs	100 rpm / 12 ft/hr	SPEED:	180 ft/min
	P.O.O.H.:	0 gpm	COLD SHUCK:	TIME IN: N/A	TIME OUT:	N/A
			TIME ON DECK:			15:05
TOTAL TIME IN HOLE:		2:45	TOTAL TIME CORING:			1:46
NOTES:						

CORE TRANSFER & RECOVERY

RECEIVED FROM RIG FLOOR	DATE: 2021-04-15	TRANSDUCER PRESSURE:	1,137 psi
	TIME: 15:13		
		TOTAL CORE RECOVERY:	5.50 ft
		RECOVERY PERCENTAGE:	61%
NOTES:			

POST-CORING TOOL ANALYSIS & REBUILD

NOTES:

6CS RUN REPORT

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PCTB V CORING RUN REPORT
CATOOSA TEST FACILITY 2021

DATE:	2021-04-15	CORE:	6CS
TOOL ASSEMBLY TEAM:	Burrows, Mariani, Minarich, Riley, Sandusky		
BOTTOM CORE DEPTH (BELOW RIG FLOOR):	1,568.98 ft	BOTTOM HOLE PRESSURE:	696 psi
DST SERIAL NUMBERS: LINER LENGTH ADJUSTER:	C9481	RABBIT:	NA
NOTES:			

TOOL ASSEMBLY

BUILD CHECKLIST	
LINER/IT PLUG LENGTH (156.75")	☑
SET PRESSURE (CONFIRM WITH 3 TESTS):	1,194 psi
RESERVOIR PRESSURE:	3,125 psi
SUPPLY VALVE OPEN	☑
FILL VALVE CLOSED/PORT PLUGGED	☑
SET VALVE CLOSED/PORT PLUGGED	☑
DRAIN VALVE CLOSED/PORT PLUGGED	☑
SHUTOFF VALVE OPEN	☑
SAMPLE PORT CLOSED/PORT PLUGGED	☑
IT PLUG SHEAR PIN INSTALLED	☑

AUTOCLAVE PRESSURE TEST

To test, pressurize assembled autoclave to 3000 psi (+/- 100 psi). Record this *INITIAL* pressure below. Wait five minutes to allow for acclimitization. During this time inspect for gross leakage of water or significant pressure drop. If leaks or pressure loss are observed, rectify and retest. At five minutes, record *START* pressure. Wait 10 minutes, then observe and record *END* pressure. If pressure loss >60 psi is observed, the test is considered a failure and should be repeated.

TEST 1			
DATE:	2021-04-15	INITIAL:	3,005 psi
START TIME:	13:49	START:	3,000 psi
		END:	2,997 psi
TEST 2 (IF REQUIRED)			
DATE:		INITIAL:	
START TIME:		START:	
		END:	

TOOL READY FOR RIG FLOOR	DATE: 2021-04-15 TIME: 14:25		TOOL SENT TO RIG FLOOR	DATE: 2021-04-15 TIME: 14:30	
NOTES:					

CORING RUN

DATE:	2021-04-15	TOOL DEPLOYMENT TIME:	15:21
START DEPTH: 1,566.01 ft	END DEPTH: 1,568.98 ft	ANTICIPATED RECOVERY:	2.97 ft
CORING START TIME:	15:45	CORING END TIME:	16:25

FLOW RATES		DRILL PARAMETERS				WIRELINE PULLOUT	
RUNNING IN:	0 gpm						
CORING:	445 gpm	W.O.B.:	R.P.M.:	R.O.P.:		WEIGHT (MAX):	2,300.0 lbs
PULLING:	0 gpm	11,000 lbs	100 rpm	8 ft/hr		SPEED:	300 ft/min
P.O.O.H.:	0 gpm	COLD SHUCK:	TIME IN:	N/A		TIME OUT:	N/A

		TIME ON DECK:	16:40
TOTAL TIME IN HOLE:	1:19	TOTAL TIME CORING:	0:40
NOTES:			

RECEIVED FROM RIG FLOOR	DATE: 2021-04-15 TIME: 17:07	TRANSDUCER PRESSURE:	1,140 psi
		TOTAL CORE RECOVERY:	0.33 ft
		RECOVERY PERCENTAGE:	11%
NOTES:			

POST-CORING TOOL ANALYSIS & REBUILD

NOTES:

7CS RUN REPORT

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PCTB V CORING RUN REPORT
CATOOSA TEST FACILITY 2021

DATE:	2021-04-15	CORE:	7CS
TOOL ASSEMBLY TEAM:	Mariani, Burrows		
BOTTOM CORE DEPTH (BELOW RIG FLOOR):	1,575.00 ft	BOTTOM HOLE PRESSURE:	698 psi
DST SERIAL NUMBERS: LINER LENGTH ADJUSTER:	C9500	RABBIT:	NA
NOTES:			

TOOL ASSEMBLY

BUILD CHECKLIST	
LINER/IT PLUG LENGTH (156.75")	☑
SET PRESSURE (CONFIRM WITH 3 TESTS):	1,200 psi
RESERVOIR PRESSURE:	3,140 psi
SUPPLY VALVE OPEN	☑
FILL VALVE CLOSED/PORT PLUGGED	☑
SET VALVE CLOSED/PORT PLUGGED	☑
DRAIN VALVE CLOSED/PORT PLUGGED	☑
SHUTOFF VALVE OPEN	☑
SAMPLE PORT CLOSED/PORT PLUGGED	☑
IT PLUG SHEAR PIN INSTALLED	☑

AUTOCLAVE PRESSURE TEST

To test, pressurize assembled autoclave to 3000 psi (+/-100 psi). Record this *INITIAL* pressure below. Wait five minutes to allow for acclimitization. During this time inspect for gross leakage of water or significant pressure drop. If leaks or pressure loss are observed, rectify and retest. At five minutes, record *START* pressure. Wait 10 minutes, then observe and record *END* pressure. If pressure loss >50 psi is observed, the test is considered a failure and should be repeated.

TEST 1			
DATE:	2021-04-15	INITIAL:	3,004 psi
START TIME:	17:45	START:	2,999 psi
		END:	3,017 psi

TEST 2 (IF REQUIRED)			
DATE:		INITIAL:	
START TIME:		START:	
		END:	

TOOL READY FOR RIG FLOOR	DATE: 2021-04-16	TIME: 07:47	TOOL SENT TO RIG FLOOR	DATE: 2021-04-16	TIME: 07:53
NOTES:					

CORING RUN

DATE:	2021-04-16	TOOL DEPLOYMENT TIME:	08:15
START DEPTH: 1,569.22 ft	END DEPTH: 1,574.01 ft	ANTICIPATED RECOVERY:	4.79 ft
CORING START TIME:	9:09	CORING END TIME:	10:25

FLOW RATES	
RUNNING IN:	0 gpm
CORING:	445 gpm
PULLING:	0 gpm
P.O.O.H.:	0 gpm

DRILL PARAMETERS		
W.O.B.:	R.P.M.:	R.O.P.:
11,000 lbs	90 rpm	6 ft/hr
COLD SHUCK:	TIME IN:	N/A

WIRELINE PULLOUT	
WEIGHT (MAX):	2,500.0 lbs
SPEED:	300 ft/min
TIME OUT:	N/A

		TIME ON DECK:	10:45
TOTAL TIME IN HOLE:	2:30	TOTAL TIME CORING:	1:16
NOTES:			

CORE TRANSFER & RECOVERY

RECEIVED FROM RIG FLOOR	DATE: 2021-04-16	TRANSDUCER PRESSURE:	0 psi
	TIME: 11:02		
		TOTAL CORE RECOVERY:	1.92 ft
		RECOVERY PERCENTAGE:	40%
NOTES:			

POST-CORING TOOL ANALYSIS & REBUILD

NOTES:

8CS RUN REPORT

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PCTB V CORING RUN REPORT
CATOOSA TEST FACILITY 2021

DATE:	2021-04-16	CORE:	8CS
TOOL ASSEMBLY TEAM:		Mariani, Burrows, Riley	
BOTTOM CORE DEPTH (BELOW RIG FLOOR):	1,579.00 ft	BOTTOM HOLE PRESSURE:	700 psi
DST SERIAL NUMBERS:	LINER LENGTH ADJUSTER: C9492	RABBIT:	NA
NOTES:			

TOOL ASSEMBLY

BUILD CHECKLIST	
LINER/IT PLUG LENGTH (156.75")	☑
SET PRESSURE (CONFIRM WITH 3 TESTS):	1,189 psi
RESERVOIR PRESSURE:	3,080 psi
SUPPLY VALVE OPEN	☑
FILL VALVE CLOSED/PORT PLUGGED	☑
SET VALVE CLOSED/PORT PLUGGED	☑
DRAIN VALVE CLOSED/PORT PLUGGED	☑
SHUTOFF VALVE OPEN	☑
SAMPLE PORT CLOSED/PORT PLUGGED	☑
IT PLUG SHEAR PIN INSTALLED	☑

AUTOCLAVE PRESSURE TEST

To test, pressurize assembled autoclave to 3000 psi (+/- 100 psi). Record this *INITIAL* pressure below. Wait five minutes to allow for acclimitization. During this time inspect for gross leakage of water or significant pressure drop. If leaks or pressure loss are observed, rectify and retest. At five minutes, record *START* pressure. Wait 10 minutes, then observe and record *END* pressure. If pressure loss >50 psi is observed, the test is considered a failure and should be repeated.

TEST 1			
DATE:	2021-04-16	INITIAL:	3,000 psi
START TIME:	09:07	START:	3,007 psi
		END:	3,045 psi
TEST 2 (IF REQUIRED)			
DATE:		INITIAL:	
START TIME:		START:	
		END:	

TOOL READY FOR RIG FLOOR	DATE: 2021-04-16	TIME: 09:50	TOOL SENT TO RIG FLOOR	DATE: 2021-04-16	TIME: 10:57
NOTES:					

CORING RUN

DATE:	2021-04-16	TOOL DEPLOYMENT TIME:	11:12
START DEPTH: 1,574.03 ft	END DEPTH: 1,579.01 ft	ANTICIPATED RECOVERY:	4.98 ft
CORING START TIME:	11:48	CORING END TIME:	12:50

FLOW RATES		DRILL PARAMETERS			WIRELINE PULLOUT	
RUNNING IN:	0 gpm					
CORING:	445 gpm	W.O.B.:	R.P.M.:	R.O.P.:	WEIGHT (MAX):	3,000.0 lbs
PULLING:	0 gpm	11,000 lbs	100 rpm	5 ft/hr	SPEED:	300 ft/min
P.O.O.H.:	0 gpm	COLD SHUCK:	TIME IN:	N/A	TIME OUT:	N/A

		TIME ON DECK:	13:13
TOTAL TIME IN HOLE:	2:01	TOTAL TIME CORING:	1:02
NOTES:			

CORE TRANSFER & RECOVERY

RECEIVED FROM RIG FLOOR	DATE: 2021-04-16	TRANSDUCER PRESSURE:	1,161 psi
	TIME: 13:27		
		TOTAL CORE RECOVERY:	0.58 ft
		RECOVERY PERCENTAGE:	12%
NOTES:			

POST-CORING TOOL ANALYSIS & REBUILD

NOTES:

9CS RUN REPORT

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PCTB V CORING RUN REPORT
CATOOSA TEST FACILITY 2021

DATE:	2021-04-16	CORE:	9CS
TOOL ASSEMBLY TEAM:		Burrows, Mariani, Riley	
BOTTOM CORE DEPTH (BELOW RIG FLOOR):	1,583.00 ft	BOTTOM HOLE PRESSURE:	702 psi
DST SERIAL NUMBERS: LINER LENGTH ADJUSTER:	C9489	RABBIT:	NA
NOTES:			

TOOL ASSEMBLY

BUILD CHECKLIST	
LINER/IT PLUG LENGTH (156.75")	☑
SET PRESSURE (CONFIRM WITH 3 TESTS):	1,173 psi
RESERVOIR PRESSURE:	3,067 psi
SUPPLY VALVE OPEN	☑
FILL VALVE CLOSED/PORT PLUGGED	☑
SET VALVE CLOSED/PORT PLUGGED	☑
DRAIN VALVE CLOSED/PORT PLUGGED	☑
SHUTOFF VALVE OPEN	☑
SAMPLE PORT CLOSED/PORT PLUGGED	☑
IT PLUG SHEAR PIN INSTALLED	☑

AUTOCLAVE PRESSURE TEST

To test, pressurize assembled autoclave to 3000 psi (+/- 100 psi). Record this *INITIAL* pressure below. Wait five minutes to allow for acclimitization. During this time inspect for gross leakage of water or significant pressure drop. If leaks or pressure loss are observed, rectify and retest. At five minutes, record *START* pressure. Wait 10 minutes, then observe and record *END* pressure. If pressure loss >60 psi is observed, the test is considered a failure and should be repeated.

TEST 1			
DATE:	2021-04-16	INITIAL:	3,012 psi
START TIME:	12:38	START:	3,016 psi
		END:	3,023 psi

TEST 2 (IF REQUIRED)			
DATE:		INITIAL:	
START TIME:		START:	
		END:	

TOOL READY FOR RIG FLOOR	DATE: 4/16/2021	TIME: 13:01	TOOL SENT TO RIG FLOOR	DATE: 2021-04-16	TIME: 13:05

NOTES:

CORING RUN

DATE:	2021-04-16	TOOL DEPLOYMENT TIME:	13:32
START DEPTH: 1,579.38 ft	END DEPTH: 1,583.67 ft	ANTICIPATED RECOVERY:	4.29 ft
CORING START TIME:	14:05	CORING END TIME:	14:56

FLOW RATES		DRILL PARAMETERS			WIRELINE PULLOUT	
RUNNING IN:	0 gpm					
CORING:	501 gpm	W.O.B.: 11 lbs	R.P.M.: 100 rpm	R.O.P.: 4 ft/hr	WEIGHT (MAX):	2,850.0 lbs
PULLING:	0 gpm				SPEED:	300 ft/min
P.O.O.H.:	0 gpm	COLD SHUCK:	TIME IN: N/A		TIME OUT:	N/A

		TIME ON DECK:	15:30
TOTAL TIME IN HOLE:	1:58	TOTAL TIME CORING:	0:51

NOTES:

CORE TRANSFER & RECOVERY

RECEIVED FROM RIG FLOOR	DATE: 2021-04-16	TRANSDUCER PRESSURE:	0 psi
	TIME: 15:43		
		TOTAL CORE RECOVERY:	1.17 ft
		RECOVERY PERCENTAGE:	27%

NOTES:

POST-CORING TOOL ANALYSIS & REBUILD

NOTES:

10CS RUN REPORT

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REVISION NO.: 0

PCTB V CORING RUN REPORT
CATOOSA TEST FACILITY 2021

DATE:	2021-04-16	CORE:	10CS
TOOL ASSEMBLY TEAM:	Burrows, Mariani, Selman, Mimitz, Riley		
BOTTOM CORE DEPTH (BELOW RIG FLOOR):	1,585.00 ft	BOTTOM HOLE PRESSURE:	703 psi
DST SERIAL NUMBERS: LINER LENGTH ADJUSTER:	C9492	RABBIT:	NA
NOTES:			

TOOL ASSEMBLY

BUILD CHECKLIST	
LINER/IT PLUG LENGTH (156.75")	☑
SET PRESSURE (CONFIRM WITH 3 TESTS):	1,215 psi
RESERVOIR PRESSURE:	3,024 psi
SUPPLY VALVE OPEN	☑
FILL VALVE CLOSED/PORT PLUGGED	☑
SET VALVE CLOSED/PORT PLUGGED	☑
DRAIN VALVE CLOSED/PORT PLUGGED	☑
SHUTOFF VALVE OPEN	☑
SAMPLE PORT CLOSED/PORT PLUGGED	☑
IT PLUG SHEAR PIN INSTALLED	☑

AUTOCLAVE PRESSURE TEST

To test, pressurize assembled autoclave to 3000 psi (+/- 100 psi). Record this *INITIAL* pressure below. Wait five minutes to allow for acclimitization. During this time inspect for gross leakage of water or significant pressure drop. If leaks or pressure loss are observed, rectify and retest. At five minutes, record *START* pressure. Wait 10 minutes, then observe and record *END* pressure. If pressure loss >60 psi is observed, the test is considered a failure and should be repeated.

TEST 1			
DATE:	2021-04-16	INITIAL:	3,025 psi
START TIME:	17:52	START:	3,022 psi
		END:	3,040 psi

TEST 2 (IF REQUIRED)			
DATE:		INITIAL:	
START TIME:		START:	
		END:	

TOOL READY FOR RIG FLOOR	DATE: 2021-04-17	TIME: 08:37	TOOL SENT TO RIG FLOOR	DATE: 2021-04-17	TIME: 08:42
NOTES:					

CORING RUN

DATE:		2021-04-17	TOOL DEPLOYMENT TIME:		10:21
START DEPTH: 1,584.39 ft	END DEPTH:	1,589.39 ft	ANTICIPATED RECOVERY:		5.00 ft
CORING START TIME:		10:51	CORING END TIME:		12:09

FLOW RATES		DRILL PARAMETERS			WIRELINE PULLOUT	
RUNNING IN:	0 gpm	W.O.B.:	R.P.M.:	R.O.P.:	WEIGHT (MAX):	4,000.0 lbs
CORING:	315 gpm	16,000 lbs	104 rpm	-	SPEED:	300 ft/min
PULLING:	0 gpm	COLD SHUCK:	TIME IN:	N/A	TIME OUT:	N/A
P.O.O.H.:	0 gpm					

		TIME ON DECK:	12:35
TOTAL TIME IN HOLE:	2:14	TOTAL TIME CORING:	1:18
NOTES:			

CORE TRANSFER & RECOVERY

RECEIVED FROM RIG FLOOR	DATE: 2021-04-17	TIME: 12:51	TRANSDUCER PRESSURE:	1,165 psi
			TOTAL CORE RECOVERY:	3.00 ft
			RECOVERY PERCENTAGE:	60%
NOTES:				

POST-CORING TOOL ANALYSIS & REBUILD

NOTES:

11CS RUN REPORT

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PCTB V CORING RUN REPORT
CATOOSA TEST FACILITY 2021

DATE:	2021-04-17	CORE:	11CS
TOOL ASSEMBLY TEAM:		Burrows, Mariani, Riley, Sandusky	
BOTTOM CORE DEPTH (BELOW RIG FLOOR):	1,590.00 ft	BOTTOM HOLE PRESSURE:	705 psi
DST SERIAL NUMBERS:	LINER LENGTH ADJUSTER: C9489	RABBIT:	NA
NOTES:			

TOOL ASSEMBLY

BUILD CHECKLIST		AUTOCLAVE PRESSURE TEST			
LINER/IT PLUG LENGTH (156.75")	☑	To test, pressurize assembled autoclave to 3000 psi (+/- 100 psi). Record this *INITIAL* pressure below. Wait five minutes to allow for acclimitization. During this time inspect for gross leakage of water or significant pressure drop. If leaks or pressure loss are observed, rectify and retest. At five minutes, record *START* pressure. Wait 10 minutes, then observe and record *END* pressure. If pressure loss >50 psi is observed, the test is considered a failure and should be repeated.			
SET PRESSURE (CONFIRM WITH 3 TESTS):	1,175 psi				
RESERVOIR PRESSURE:	3,055 psi				
SUPPLY VALVE OPEN	☑				
FILL VALVE CLOSED/PORT PLUGGED	☑	TEST 1			
SET VALVE CLOSED/PORT PLUGGED	☑	DATE:	2021-04-17	INITIAL:	2,998 psi
DRAIN VALVE CLOSED/PORT PLUGGED	☑	START TIME:	09:17	START:	2,992 psi
SHUTOFF VALVE OPEN	☑			END:	2,981 psi
SAMPLE PORT CLOSED/PORT PLUGGED	☑	TEST 2 (IF REQUIRED)			
IT PLUG SHEAR PIN INSTALLED	☑	DATE:		INITIAL:	
		START TIME:		START:	
				END:	
TOOL READY FOR RIG FLOOR	DATE: 2021-04-17	TOOL SENT TO RIG FLOOR		DATE:	2021-04-17
	TIME: 09:45			TIME:	10:00
NOTES:					

CORING RUN

DATE:		2021-04-17	TOOL DEPLOYMENT TIME:			12:52
START DEPTH: 1,589.50 ft	END DEPTH:	1,595.50 ft	ANTICIPATED RECOVERY:			6.00 ft
CORING START TIME:		13:25	CORING END TIME:			14:38
FLOW RATES	RUNNING IN:	0 gpm	DRILL PARAMETERS		WIRELINE PULLOUT	
	CORING:	314 gpm	W.O.B.:	R.P.M.: / R.O.P.:	WEIGHT (MAX):	2,000.0 lbs
	PULLING:	0 gpm	9,000 lbs	106 rpm / -	SPEED:	300 ft/min
	P.O.O.H.:	0 gpm	COLD SHUCK:	TIME IN: N/A	TIME OUT:	N/A
			TIME ON DECK:			15:02
TOTAL TIME IN HOLE:		2:10	TOTAL TIME CORING:			1:13
NOTES:						

CORE TRANSFER & RECOVERY

RECEIVED FROM RIG FLOOR	DATE:	2021-04-17	TRANSDUCER PRESSURE:	1,146 psi
	TIME:	15:16		
			TOTAL CORE RECOVERY:	0.25 ft
			RECOVERY PERCENTAGE:	4%
NOTES:				

POST-CORING TOOL ANALYSIS & REBUILD

NOTES:

12FB RUN REPORT

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PCTB V CORING RUN REPORT
CATOOSA TEST FACILITY 2021

DATE:	2021-04-17	CORE:	12FB
TOOL ASSEMBLY TEAM:		Burrows, Mariani, Riley, Sandusky	
BOTTOM CORE DEPTH (BELOW RIG FLOOR):	1,550.00 ft	BOTTOM HOLE PRESSURE:	687 psi
DST SERIAL NUMBERS:	LINER LENGTH ADJUSTER: C9489	RABBIT:	NA
NOTES:			

TOOL ASSEMBLY

BUILD CHECKLIST	
LINER/IT PLUG LENGTH (156.75")	☑
SET PRESSURE (CONFIRM WITH 3 TESTS):	1,165 psi
RESERVOIR PRESSURE:	3,099 psi
SUPPLY VALVE OPEN	☑
FILL VALVE CLOSED/PORT PLUGGED	☑
SET VALVE CLOSED/PORT PLUGGED	☑
DRAIN VALVE CLOSED/PORT PLUGGED	☑
SHUTOFF VALVE OPEN	☑
SAMPLE PORT CLOSED/PORT PLUGGED	☑
IT PLUG SHEAR PIN INSTALLED	☑

AUTOCLAVE PRESSURE TEST

To test, pressurize assembled autoclave to 3000 psi (+/- 100 psi). Record this *INITIAL* pressure below. Wait five minutes to allow for acclimitization. During this time inspect for gross leakage of water or significant pressure drop. If leaks or pressure loss are observed, rectify and retest. At five minutes, record *START* pressure. Wait 10 minutes, then observe and record *END* pressure. If pressure loss >60 psi is observed, the test is considered a failure and should be repeated.

TEST 1			
DATE:	2021-04-17	INITIAL:	3,092 psi
START TIME:	17:58	START:	3,089 psi
		END:	3,091 psi
TEST 2 (IF REQUIRED)			
DATE:		INITIAL:	
START TIME:		START:	
		END:	

TOOL READY FOR RIG FLOOR	DATE: 2021-04-18 TIME: 07:38		TOOL SENT TO RIG FLOOR	DATE: 2021-04-18 TIME: 09:14	
NOTES:					

CORING RUN

DATE:	2021-04-18	TOOL DEPLOYMENT TIME:	09:58
START DEPTH: -	END DEPTH: -	ANTICIPATED RECOVERY: -	
CORING START TIME:	-	CORING END TIME:	-

FLOW RATES		DRILL PARAMETERS			WIRELINE PULLOUT	
RUNNING IN:	0 gpm					
CORING:	315 gpm	W.O.B.:	R.P.M.:	R.O.P.:	WEIGHT (MAX):	2,700.0 lbs
PULLING:	0 gpm	-	-	-	SPEED:	300 ft/min
P.O.O.H.:	0 gpm	COLD SHUCK:	TIME IN: N/A		TIME OUT:	N/A

		TIME ON DECK:	10:32
TOTAL TIME IN HOLE:	0:34	TOTAL TIME CORING:	-
NOTES:	Mud core with flow over tool		

CORE TRANSFER & RECOVERY

RECEIVED FROM RIG FLOOR	DATE: 2021-04-18 TIME: 11:07	TRANSDUCER PRESSURE:	1,164 psi
		TOTAL CORE RECOVERY:	N/A
		RECOVERY PERCENTAGE:	
NOTES:			

POST-CORING TOOL ANALYSIS & REBUILD

NOTES:

13FB RUN REPORT

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PCTB V CORING RUN REPORT
CATOOSA TEST FACILITY 2021

DATE:	2021-04-18	CORE:	13FB
TOOL ASSEMBLY TEAM:		Burrows, Mariani, Riley, Sandusky	
BOTTOM CORE DEPTH (BELOW RIG FLOOR):	1,595.00 ft	BOTTOM HOLE PRESSURE:	707 psi
DST SERIAL NUMBERS: LINER LENGTH ADJUSTER:	C9492	RABBIT:	NA
NOTES:			

TOOL ASSEMBLY

BUILD CHECKLIST	
LINER/IT PLUG LENGTH (156.75")	☑
SET PRESSURE (CONFIRM WITH 3 TESTS):	1,225 psi
RESERVOIR PRESSURE:	3,130 psi
SUPPLY VALVE OPEN	☑
FILL VALVE CLOSED/PORT PLUGGED	☑
SET VALVE CLOSED/PORT PLUGGED	☑
DRAIN VALVE CLOSED/PORT PLUGGED	☑
SHUTOFF VALVE OPEN	☑
SAMPLE PORT CLOSED/PORT PLUGGED	☑
IT PLUG SHEAR PIN INSTALLED	☑

AUTOCLAVE PRESSURE TEST

To test, pressurize assembled autoclave to 3000 psi (+/- 100 psi). Record this *INITIAL* pressure below. Wait five minutes to allow for acclimitization. During this time inspect for gross leakage of water or significant pressure drop. If leaks or pressure loss are observed, rectify and retest. At five minutes, record *START* pressure. Wait 10 minutes, then observe and record *END* pressure. If pressure loss >60 psi is observed, the test is considered a failure and should be repeated.

TEST 1			
DATE:	2021-04-18	INITIAL:	3,113 psi
START TIME:	07:58	START:	3,118 psi
		END:	3,127 psi
TEST 2 (IF REQUIRED)			
DATE:		INITIAL:	
START TIME:		START:	
		END:	

TOOL READY FOR RIG FLOOR	DATE: 2021-04-18	TIME: 08:22	TOOL SENT TO RIG FLOOR	DATE: 2021-04-18	TIME: 10:43
NOTES:					

CORING RUN

DATE:	2021-04-18	TOOL DEPLOYMENT TIME:	11:05
START DEPTH: 1,595.35 ft	END DEPTH: 1,598.70 ft	ANTICIPATED RECOVERY:	3.35 ft
CORING START TIME:	11:41	CORING END TIME:	12:43

FLOW RATES		DRILL PARAMETERS			WIRELINE PULLOUT	
RUNNING IN:	0 gpm	W.O.B.:	R.P.M.:	R.O.P.:	WEIGHT (MAX):	3,100.0 lbs
CORING:	311 gpm	6,500 lbs	105 rpm	–	SPEED:	300 ft/min
PULLING:	0 gpm	COLD SHUCK:	TIME IN:	N/A	TIME OUT:	N/A
P.O.O.H.:	0 gpm					

		TIME ON DECK:	13:01
TOTAL TIME IN HOLE:	1:56	TOTAL TIME CORING:	1:02
NOTES:			

CORE TRANSFER & RECOVERY

RECEIVED FROM RIG FLOOR	DATE: 2021-04-18	TRANSDUCER PRESSURE:	1,145 psi
	TIME: 13:15		
		TOTAL CORE RECOVERY:	0.00 ft
		RECOVERY PERCENTAGE:	0%
NOTES:			

POST-CORING TOOL ANALYSIS & REBUILD

NOTES:

14FB RUN REPORT

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PCTB V CORING RUN REPORT
CATOOSA TEST FACILITY 2021

DATE:	2021-04-18	CORE:	14FB
TOOL ASSEMBLY TEAM:		Burrows, Mariani, Riley, Sandusky	
BOTTOM CORE DEPTH (BELOW RIG FLOOR):	1,605.00 ft	BOTTOM HOLE PRESSURE:	712 psi
DST SERIAL NUMBERS:	LINER LENGTH ADJUSTER: C9484	RABBIT:	NA
NOTES:			

TOOL ASSEMBLY

BUILD CHECKLIST		AUTOCLAVE PRESSURE TEST			
LINER/IT PLUG LENGTH (156.75")	☑	To test, pressurize assembled autoclave to 3000 psi (+/- 100 psi). Record this *INITIAL* pressure below. Wait five minutes to allow for acclimitization. During this time inspect for gross leakage of water or significant pressure drop. If leaks or pressure loss are observed, rectify and retest. At five minutes, record *START* pressure. Wait 10 minutes, then observe and record *END* pressure. If pressure loss >60 psi is observed, the test is considered a failure and should be repeated.			
SET PRESSURE (CONFIRM WITH 3 TESTS):	1,167 psi				
RESERVOIR PRESSURE:	3,062 psi				
SUPPLY VALVE OPEN	☑				
FILL VALVE CLOSED/PORT PLUGGED	☑	TEST 1			
SET VALVE CLOSED/PORT PLUGGED	☑	DATE:	2021-04-18	INITIAL:	3,100 psi
DRAIN VALVE CLOSED/PORT PLUGGED	☑	START TIME:	08:45	START:	3,105 psi
SHUTOFF VALVE OPEN	☑			END:	3,145 psi
SAMPLE PORT CLOSED/PORT PLUGGED	☑	TEST 2 (IF REQUIRED)			
IT PLUG SHEAR PIN INSTALLED	☑	DATE:		INITIAL:	
		START TIME:		START:	
				END:	
TOOL READY FOR RIG FLOOR	DATE: 2021-04-18	TOOL SENT TO RIG FLOOR		DATE:	2021-04-18
	TIME: 10:44			TIME:	12:47
NOTES:					

CORING RUN

DATE:		2021-04-18	TOOL DEPLOYMENT TIME:			13:18
START DEPTH: 1,598.86 ft	END DEPTH:	1,605.78 ft		ANTICIPATED RECOVERY:		6.92 ft
CORING START TIME:		13:45	CORING END TIME:			14:51
FLOW RATES	RUNNING IN:	0 gpm	DRILL PARAMETERS		WIRELINE PULLOUT	
	CORING:	308 gpm	W.O.B.: 20,000 lbs	R.P.M.: 111 rpm / R.O.P.: –	WEIGHT (MAX):	3,900.0 lbs
	PULLING:	0 gpm			SPEED:	300 ft/min
	P.O.O.H.:	0 gpm	COLD SHUCK:	TIME IN: N/A	TIME OUT:	N/A
			TIME ON DECK:			15:25
TOTAL TIME IN HOLE:		2:07	TOTAL TIME CORING:			1:06
NOTES:						

CORE TRANSFER & RECOVERY

RECEIVED FROM RIG FLOOR	DATE: 2021-04-18	TRANSDUCER PRESSURE:	1,175 psi
	TIME: 15:19		
		TOTAL CORE RECOVERY:	8.90 ft
		RECOVERY PERCENTAGE:	129%
NOTES:	More core than advancement suggests a core stick-up from 13FB was drilled over.		

POST-CORING TOOL ANALYSIS & REBUILD

NOTES:	1000 lbs shear pin in IT plug

15FB RUN REPORT

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PCTB V CORING RUN REPORT
CATOOSA TEST FACILITY 2021

DATE:	2021-04-18	CORE:	15FB
TOOL ASSEMBLY TEAM:	Burrows, Mariani		
BOTTOM CORE DEPTH (BELOW RIG FLOOR):	1,612.00 ft	BOTTOM HOLE PRESSURE:	715 psi
DST SERIAL NUMBERS:	LINER LENGTH ADJUSTER: C9500	RABBIT:	NA
NOTES:			

TOOL ASSEMBLY

BUILD CHECKLIST	
LINER/IT PLUG LENGTH (156.75")	☑
SET PRESSURE (CONFIRM WITH 3 TESTS):	1,168 psi
RESERVOIR PRESSURE:	3,070 psi
SUPPLY VALVE OPEN	☑
FILL VALVE CLOSED/PORT PLUGGED	☑
SET VALVE CLOSED/PORT PLUGGED	☑
DRAIN VALVE CLOSED/PORT PLUGGED	☑
SHUTOFF VALVE OPEN	☑
SAMPLE PORT CLOSED/PORT PLUGGED	☑
IT PLUG SHEAR PIN INSTALLED	☑

AUTOCLAVE PRESSURE TEST

To test, pressurize assembled autoclave to 3000 psi (+/- 100 psi). Record this *INITIAL* pressure below. Wait five minutes to allow for acclimatization. During this time inspect for gross leakage of water or significant pressure drop. If leaks or pressure loss are observed, rectify and retest. At five minutes, record *START* pressure. Wait 10 minutes, then observe and record *END* pressure. If pressure loss >60 psi is observed, the test is considered a failure and should be repeated.

TEST 1			
DATE:	2021-04-18	INITIAL:	2,915 psi
START TIME:	13:03:25 PM	START:	2,910 psi
		END:	2,909 psi
TEST 2 (IF REQUIRED)			
DATE:		INITIAL:	
START TIME:		START:	
		END:	

TOOL READY FOR RIG FLOOR	DATE: 2021-04-18	TIME: 14:23	TOOL SENT TO RIG FLOOR	DATE: 2021-04-19	TIME: 07:24
NOTES:					

CORING RUN

DATE:	2021-04-19	TOOL DEPLOYMENT TIME:	08:24
START DEPTH: 1,606.21 ft	END DEPTH: 1,611.00 ft	ANTICIPATED RECOVERY:	4.79 ft
CORING START TIME:	9:02	CORING END TIME:	09:50

FLOW RATES		DRILL PARAMETERS			WIRELINE PULLOUT	
RUNNING IN:	0 gpm	W.O.B.:	R.P.M.:	R.O.P.:	WEIGHT (MAX):	2,300.0 lbs
CORING:	311 gpm	20 lbs	106 rpm	-	SPEED:	300 ft/min
PULLING:	0 gpm	COLD SHUCK:	TIME IN: N/A		TIME OUT:	N/A
P.O.O.H.:	0 gpm					

		TIME ON DECK:	10:15
TOTAL TIME IN HOLE:	1:51	TOTAL TIME CORING:	0:48
NOTES:			

CORE TRANSFER & RECOVERY

RECEIVED FROM RIG FLOOR	DATE: 2021-04-19	TRANSDUCER PRESSURE:	1,220 psi
	TIME: 10:30		
		TOTAL CORE RECOVERY:	4.00 ft
		RECOVERY PERCENTAGE:	84%
NOTES:			

POST-CORING TOOL ANALYSIS & REBUILD

NOTES:

16FB RUN REPORT

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PCTB V CORING RUN REPORT
CATOOSA TEST FACILITY 2021

DATE:	2021-04-19	CORE:	16FB
TOOL ASSEMBLY TEAM:		Burrows, Mariani, Riley, Sandusky	
BOTTOM CORE DEPTH (BELOW RIG FLOOR):	1,620.00 ft	BOTTOM HOLE PRESSURE:	718 psi
DST SERIAL NUMBERS: LINER LENGTH ADJUSTER:	C9484	RABBIT:	NA
NOTES:			

TOOL ASSEMBLY

BUILD CHECKLIST		AUTOCLAVE PRESSURE TEST			
LINER/IT PLUG LENGTH (156.75")	☑	To test, pressurize assembled autoclave to 3000 psi (+/- 100 psi). Record this *INITIAL* pressure below. Wait five minutes to allow for accimilization. During this time inspect for gross leakage of water or significant pressure drop. If leaks or pressure loss are observed, rectify and retest. At five minutes, record *START* pressure. Wait 10 minutes, then observe and record *END* pressure. If pressure loss >60 psi is observed, the test is considered a failure and should be repeated.			
SET PRESSURE (CONFIRM WITH 3 TESTS):	1,233 psi				
RESERVOIR PRESSURE:	3,023 psi				
SUPPLY VALVE OPEN	☑				
FILL VALVE CLOSED/PORT PLUGGED	☑	TEST 1			
SET VALVE CLOSED/PORT PLUGGED	☑	DATE:	2021-04-19	INITIAL:	3,057 psi
DRAIN VALVE CLOSED/PORT PLUGGED	☑	START TIME:	07:25	START:	3,060 psi
SHUTOFF VALVE OPEN	☑			END:	3,060 psi
SAMPLE PORT CLOSED/PORT PLUGGED	☑	TEST 2 (IF REQUIRED)			
IT PLUG SHEAR PIN INSTALLED	☑	DATE:		INITIAL:	
		START TIME:		START:	
				END:	

TOOL READY FOR RIG FLOOR	DATE: 2021-04-19	TIME: 08:12	TOOL SENT TO RIG FLOOR	DATE: 2021-04-19	TIME: 08:41
NOTES:					

CORING RUN

DATE:	2021-04-19	TOOL DEPLOYMENT TIME:	10:30
START DEPTH: 1,611.17 ft	END DEPTH: 1,617.82 ft	ANTICIPATED RECOVERY:	6.65 ft
CORING START TIME:	10:54	CORING END TIME:	11:40

FLOW RATES			DRILL PARAMETERS			WIRELINE PULLOUT	
	RUNNING IN:	0 gpm					
	CORING:	308 gpm	W.O.B.:	R.P.M.:	R.O.P.:	WEIGHT (MAX):	3,000.0 lbs
	PULLING:	0 gpm	18,000 lbs	108 rpm	-	SPEED:	300 ft/min
	P.O.O.H.:	0 gpm	COLD SHUCK:	TIME IN: N/A		TIME OUT:	N/A

		TIME ON DECK:	13:15
TOTAL TIME IN HOLE:	2:45	TOTAL TIME CORING:	0:46
NOTES:	Heavy overpull while pulling resulted in breaking the wireline connection at the crossover. A pipe trip was required to retrieve the tool and sinker bar assembly.		

CORE TRANSFER & RECOVERY

RECEIVED FROM RIG FLOOR	DATE: 2021-04-19 / TIME: 12:35	TRANSDUCER PRESSURE:	1,344 psi
		TOTAL CORE RECOVERY:	4.40 ft
		RECOVERY PERCENTAGE:	66%
NOTES:			

POST-CORING TOOL ANALYSIS & REBUILD

NOTES:

17FB RUN REPORT

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REVISION NO.: 0

PCTB V CORING RUN REPORT
CATOOSA TEST FACILITY 2021

DATE:	2021-04-19	CORE:	17FB
TOOL ASSEMBLY TEAM:		Burrows, Mariani, Riley, Sandusky	
BOTTOM CORE DEPTH (BELOW RIG FLOOR):	1,618.00 ft	BOTTOM HOLE PRESSURE:	717 psi
DST SERIAL NUMBERS: LINER LENGTH ADJUSTER:	C9489	RABBIT:	NA
NOTES:			

TOOL ASSEMBLY

BUILD CHECKLIST	
LINER/IT PLUG LENGTH (156.75")	☑
SET PRESSURE (CONFIRM WITH 3 TESTS):	1,250 psi
RESERVOIR PRESSURE:	3,316 psi
SUPPLY VALVE OPEN	☑
FILL VALVE CLOSED/PORT PLUGGED	☑
SET VALVE CLOSED/PORT PLUGGED	☑
DRAIN VALVE CLOSED/PORT PLUGGED	☑
SHUTOFF VALVE OPEN	☑
SAMPLE PORT CLOSED/PORT PLUGGED	☑
IT PLUG SHEAR PIN INSTALLED	☑

AUTOCLAVE PRESSURE TEST

To test, pressurize assembled autoclave to 3000 psi (+/- 100 psi). Record this *INITIAL* pressure below. Wait five minutes to allow for acclimatization. During this time inspect for gross leakage of water or significant pressure drop. If leaks or pressure loss are observed, rectify and retest. At five minutes, record *START* pressure. Wait 10 minutes, then observe and record *END* pressure. If pressure loss >50 psi is observed, the test is considered a failure and should be repeated.

TEST 1			
DATE:	2021-04-19	INITIAL:	3,114 psi
START TIME:	08:47	START:	3,117 psi
		END:	3,132 psi
TEST 2 (IF REQUIRED)			
DATE:		INITIAL:	
START TIME:		START:	
		END:	

TOOL READY FOR RIG FLOOR	DATE: 2021-04-19	TIME: 09:17	TOOL SENT TO RIG FLOOR	DATE: 2021-04-19	TIME: 10:32
NOTES:					

CORING RUN

DATE:	2021-04-19	TOOL DEPLOYMENT TIME:	15:00
START DEPTH: 1,617.50 ft	END DEPTH: 1,619.10 ft	ANTICIPATED RECOVERY:	1.60 ft
CORING START TIME:	17:11	CORING END TIME:	17:32

FLOW RATES		DRILL PARAMETERS			WIRELINE PULLOUT	
RUNNING IN:	0 gpm					
CORING:	220 gpm	W.O.B.:	R.P.M.:	R.O.P.:	WEIGHT (MAX):	2,300.0 lbs
PULLING:	0 gpm	18 lbs	120 rpm	-	SPEED:	300 ft/min
P.O.O.H.:	0 gpm	COLD SHUCK:	TIME IN: N/A		TIME OUT:	N/A

		TIME ON DECK:	17:55
TOTAL TIME IN HOLE:	2:55	TOTAL TIME CORING:	0:21

NOTES: The tool was run into the hole and inadvertently released from the running tool at a point 30 feet above bottom. When the pumps were turned on standpipe pressures of up to 2,000 psi were observed. The tool was retrieved using the emergency pulling tool and redeployed. The tool arrived at the surface with a partially open ball. Disassembly of the autoclave revealed the the high standpipe pressure event had collapsed the bottom portion of the core liner, preventing proper cycling of the release sleeve.

CORE TRANSFER & RECOVERY

RECEIVED FROM RIG FLOOR	DATE: 2021-04-19	TRANSDUCER PRESSURE:	0 psi
	TIME: 18:13		
		TOTAL CORE RECOVERY:	1.10 ft
		RECOVERY PERCENTAGE:	69%
NOTES:			

POST-CORING TOOL ANALYSIS & REBUILD

NOTES:

18FB RUN REPORT

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REVISION NO.: 0

PCTB V CORING RUN REPORT
CATOOSA TEST FACILITY 2021

DATE:	2021-04-19	CORE:	18FB
TOOL ASSEMBLY TEAM:		Burrows, Mariani, Riley, Sandsuky	
BOTTOM CORE DEPTH (BELOW RIG FLOOR):	1,620.00 ft	BOTTOM HOLE PRESSURE:	718 psi
DST SERIAL NUMBERS:	LINER LENGTH ADJUSTER: C9484	RABBIT:	NA
NOTES:			

TOOL ASSEMBLY

BUILD CHECKLIST	
LINER/IT PLUG LENGTH (156.75")	☑
SET PRESSURE (CONFIRM WITH 3 TESTS):	1,275 psi
RESERVOIR PRESSURE:	3,256 psi
SUPPLY VALVE OPEN	☑
FILL VALVE CLOSED/PORT PLUGGED	☑
SET VALVE CLOSED/PORT PLUGGED	☑
DRAIN VALVE CLOSED/PORT PLUGGED	☑
SHUTOFF VALVE OPEN	☑
SAMPLE PORT CLOSED/PORT PLUGGED	☑
IT PLUG SHEAR PIN INSTALLED	☑

AUTOCLAVE PRESSURE TEST

To test, pressurize assembled autoclave to 3000 psi (+/- 100 psi). Record this *INITIAL* pressure below. Wait five minutes to allow for acclimitization. During this time inspect for gross leakage of water or significant pressure drop. If leaks or pressure loss are observed, rectify and retest. At five minutes, record *START* pressure. Wait 10 minutes, then observe and record *END* pressure. If pressure loss >60 psi is observed, the test is considered a failure and should be repeated.

TEST 1			
DATE:	2021-04-19	INITIAL:	2,909 psi
START TIME:	11:44	START:	2,904 psi
		END:	2,895 psi

TEST 2 (IF REQUIRED)			
DATE:		INITIAL:	
START TIME:		START:	
		END:	

TOOL READY FOR RIG FLOOR	DATE:	2021-04-18	TOOL SENT TO RIG FLOOR	DATE:	2021-04-20
	TIME:	15:00		TIME:	07:25
NOTES:					

CORING RUN

DATE:		2021-04-20	TOOL DEPLOYMENT TIME:		08:30
START DEPTH: 1,618.74 ft	END DEPTH:	1,622.60 ft	ANTICIPATED RECOVERY:		3.86 ft
CORING START TIME:		9:04	CORING END TIME:		9:34

FLOW RATES		DRILL PARAMETERS			WIRELINE PULLOUT	
RUNNING IN:	0 gpm					
CORING:	311 gpm	W.O.B.:	R.P.M.:	R.O.P.:	WEIGHT (MAX):	2,500.0 lbs
PULLING:	0 gpm	18 lbs	100 rpm	-	SPEED:	300 ft/min
P.O.O.H.:	0 gpm	COLD SHUCK:	TIME IN:	N/A	TIME OUT:	NA

		TIME ON DECK:	10:01
TOTAL TIME IN HOLE:	1:31	TOTAL TIME CORING:	0:30
NOTES:			

CORE TRANSFER & RECOVERY

RECEIVED FROM RIG FLOOR	DATE:	2021-04-20	TRANSDUCER PRESSURE:	1,222 psi
	TIME:	10:07		
			TOTAL CORE RECOVERY:	3.25 ft
			RECOVERY PERCENTAGE:	84%
NOTES:				

POST-CORING TOOL ANALYSIS & REBUILD

NOTES:

19FB RUN REPORT

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REVISION NO.: 0

PCTB V CORING RUN REPORT
CATOOSA TEST FACILITY 2021

DATE:	2021-04-19	CORE:	19FB
TOOL ASSEMBLY TEAM:		Burrows, Mariani, Riley, Sandusky	
BOTTOM CORE DEPTH (BELOW RIG FLOOR):	1,625.00 ft	BOTTOM HOLE PRESSURE:	721 psi
DST SERIAL NUMBERS:	LINER LENGTH ADJUSTER: C9500	RABBIT:	NA
NOTES:			

TOOL ASSEMBLY

BUILD CHECKLIST	
LINER/IT PLUG LENGTH (156.75")	☑
SET PRESSURE (CONFIRM WITH 3 TESTS):	1,234 psi
RESERVOIR PRESSURE:	3,045 psi
SUPPLY VALVE OPEN	☑
FILL VALVE CLOSED/PORT PLUGGED	☑
SET VALVE CLOSED/PORT PLUGGED	☑
DRAIN VALVE CLOSED/PORT PLUGGED	☑
SHUTOFF VALVE OPEN	☑
SAMPLE PORT CLOSED/PORT PLUGGED	☑
IT PLUG SHEAR PIN INSTALLED	☑

AUTOCLAVE PRESSURE TEST

To test, pressurize assembled autoclave to 3000 psi (+/- 100 psi). Record this *INITIAL* pressure below. Wait five minutes to allow for acclimitization. During this time inspect for gross leakage of water or significant pressure drop. If leaks or pressure loss are observed, rectify and retest. At five minutes, record *START* pressure. Wait 10 minutes, then observe and record *END* pressure. If pressure loss >60 psi is observed, the test is considered a failure and should be repeated.

TEST 1			
DATE:	2021-04-19	INITIAL:	3,240 psi
START TIME:	16:36	START:	3,230 psi
		END:	3,197 psi

TEST 2 (IF REQUIRED)			
DATE:		INITIAL:	
START TIME:		START:	
		END:	

TOOL READY FOR RIG FLOOR	DATE: 2021-04-20	TIME: 07:57	TOOL SENT TO RIG FLOOR	DATE: 2021-04-20	TIME: 09:45

NOTES:

CORING RUN

DATE:	2021-04-20	TOOL DEPLOYMENT TIME:	10:05
START DEPTH: 1,622.65 ft	END DEPTH: 1,629.00 ft	ANTICIPATED RECOVERY:	6.35 ft
CORING START TIME:	10:35	CORING END TIME:	11:33

FLOW RATES			
RUNNING IN:	0 gpm		
CORING:	285 gpm		
PULLING:	0 gpm		
P.O.O.H.:	0 gpm		

DRILL PARAMETERS		
W.O.B.:	R.P.M.:	R.O.P.:
19,000 lbs	100 rpm	7 ft/hr
COLD SHUCK:	TIME IN: N/A	

WIRELINE PULLOUT	
WEIGHT (MAX):	2,400.0 lbs
SPEED:	300 ft/min
TIME OUT:	NA

		TIME ON DECK:	12:03
TOTAL TIME IN HOLE:	1:58	TOTAL TIME CORING:	0:58

NOTES:

CORE TRANSFER & RECOVERY

RECEIVED FROM RIG FLOOR	DATE: 2021-04-20	TRANSDUCER PRESSURE:	1,218 psi
	TIME: 12:07		
		TOTAL CORE RECOVERY:	6.50 ft
		RECOVERY PERCENTAGE:	102%

NOTES:

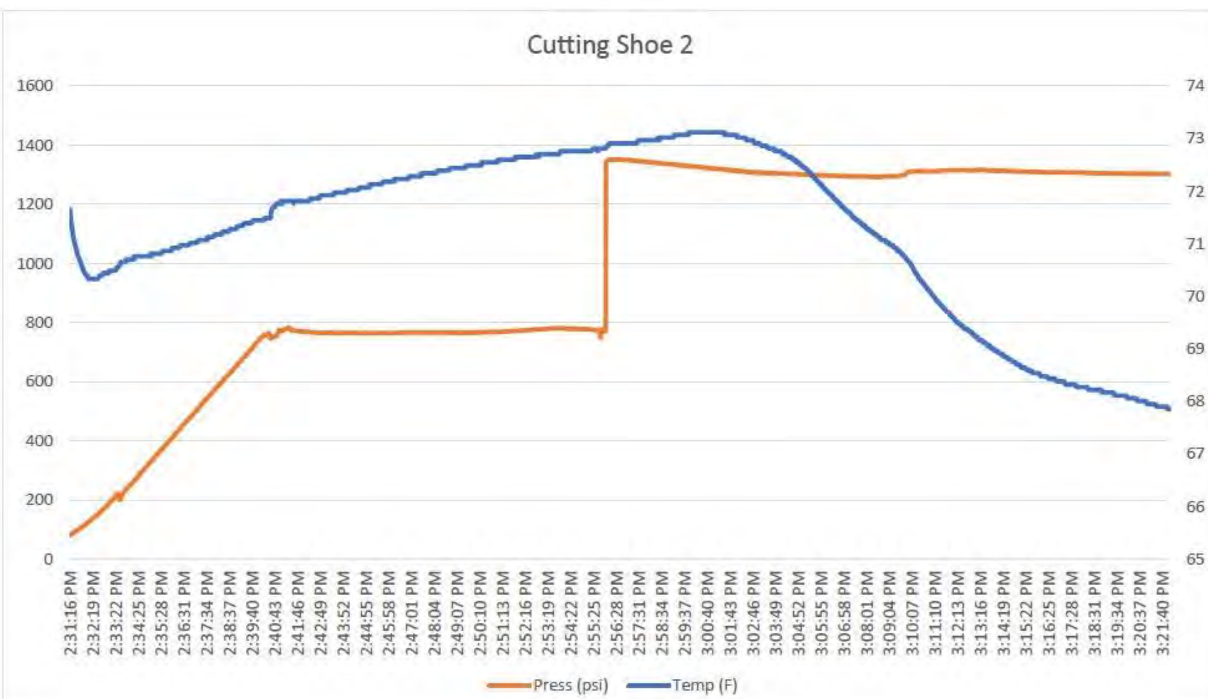
POST-CORING TOOL ANALYSIS & REBUILD

NOTES:

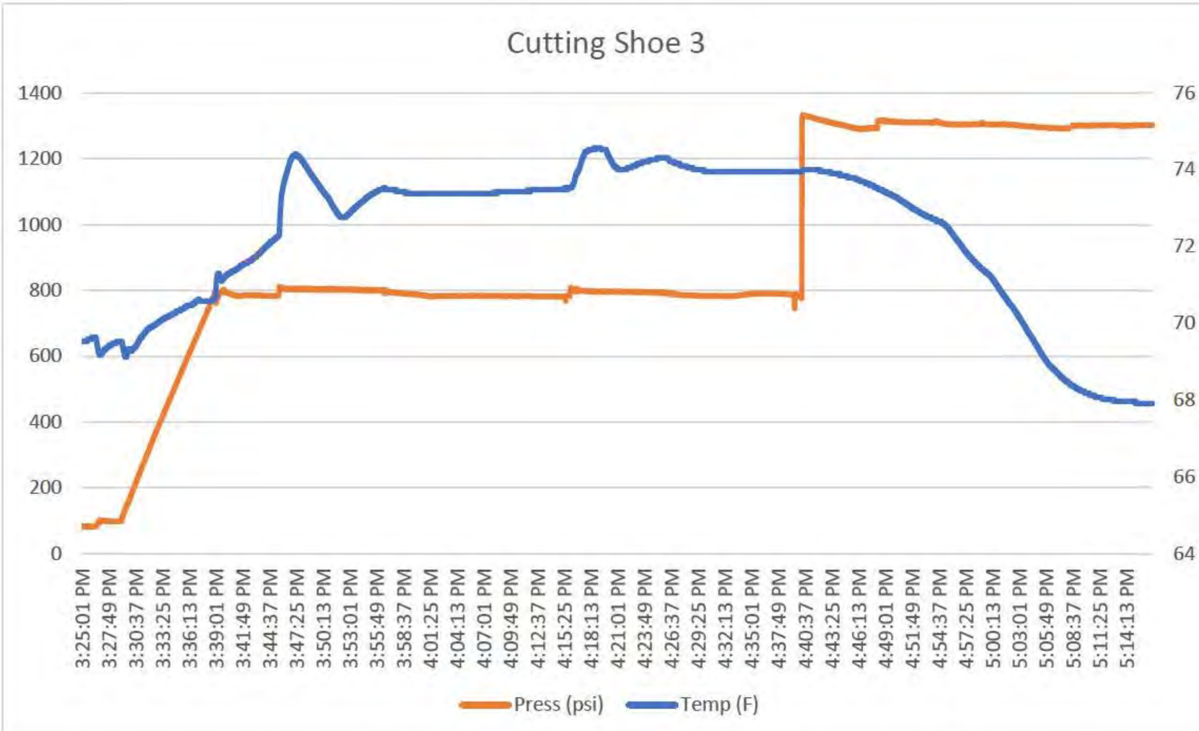
- **APPENDIX 2: DATA STORAGE TAG ANALSYS**

1CS DST DATA

2CS DST DATA



3CS DST DATA

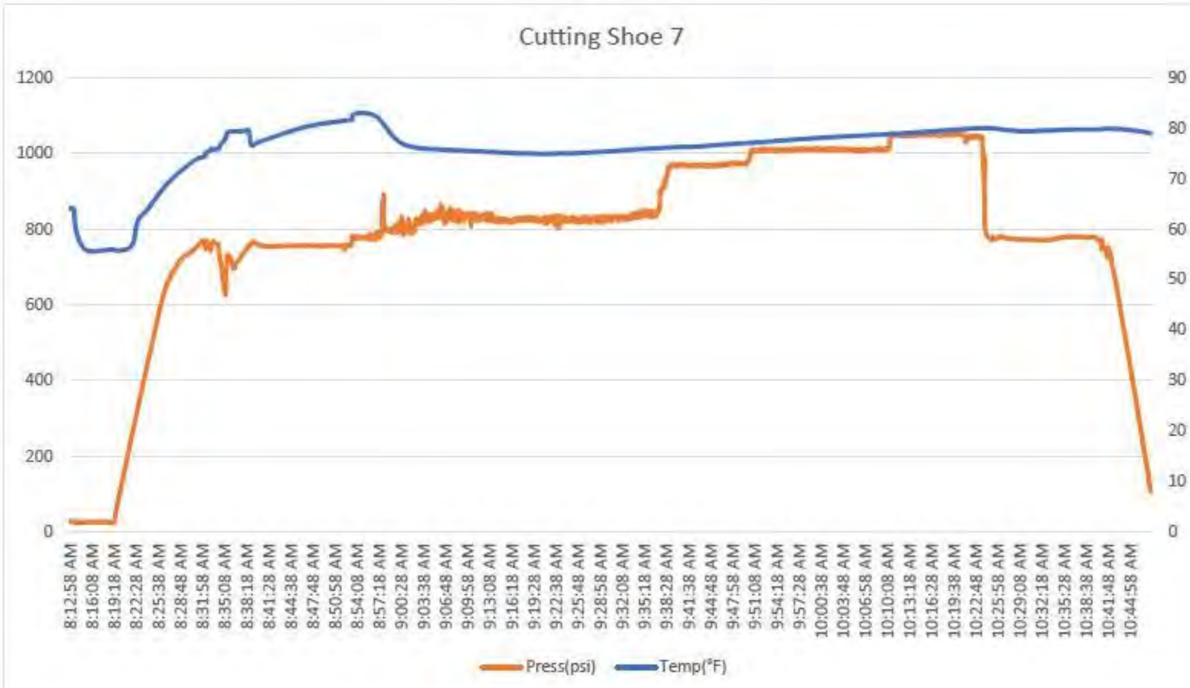


4CS DST DATA

5CS DST DATA

6CS DST DATA

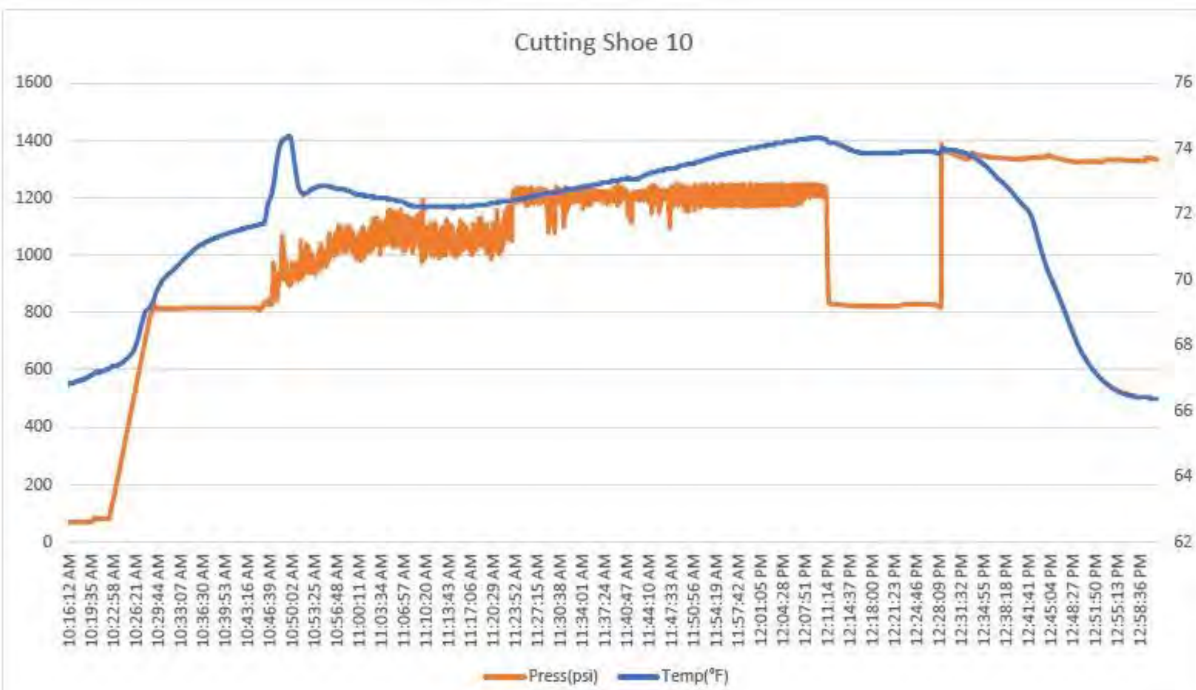
7CS DST DATA



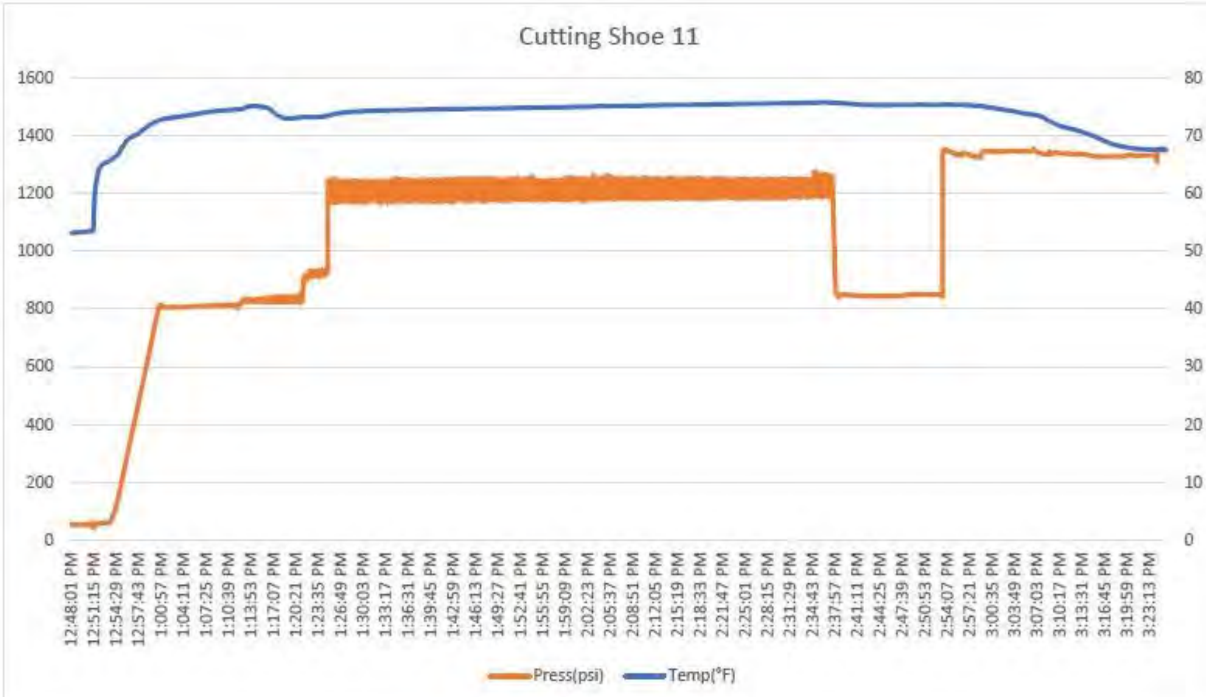
8CS DST DATA

9CS DST DATA

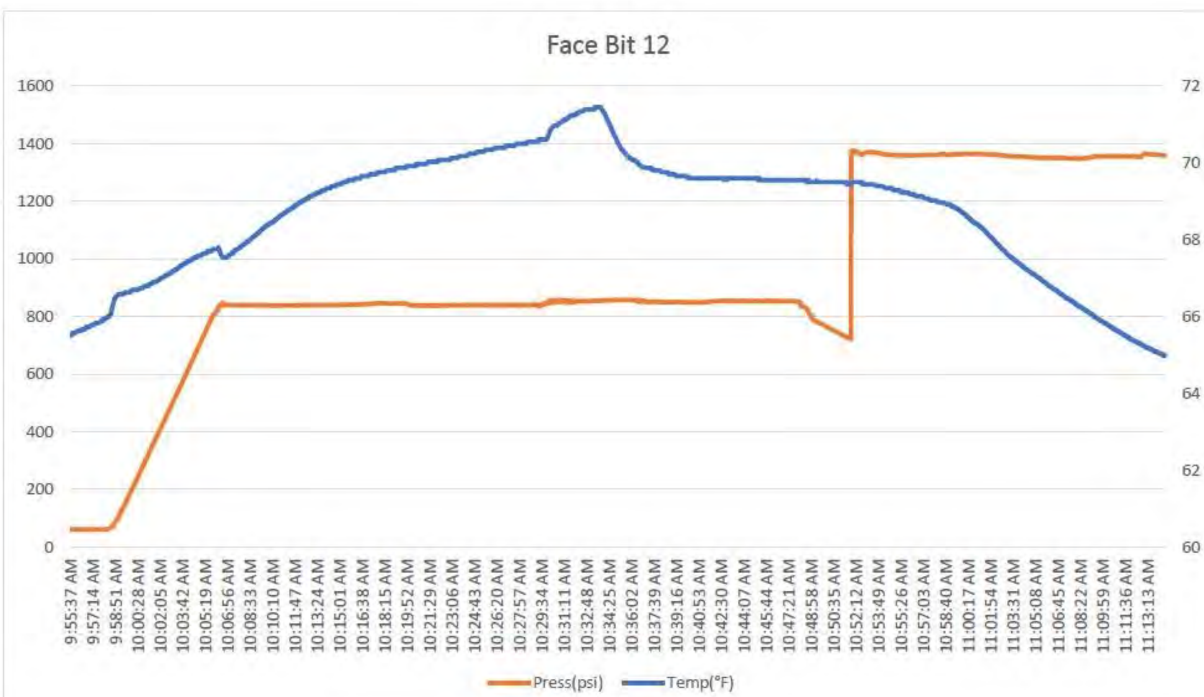
10CS DST DATA



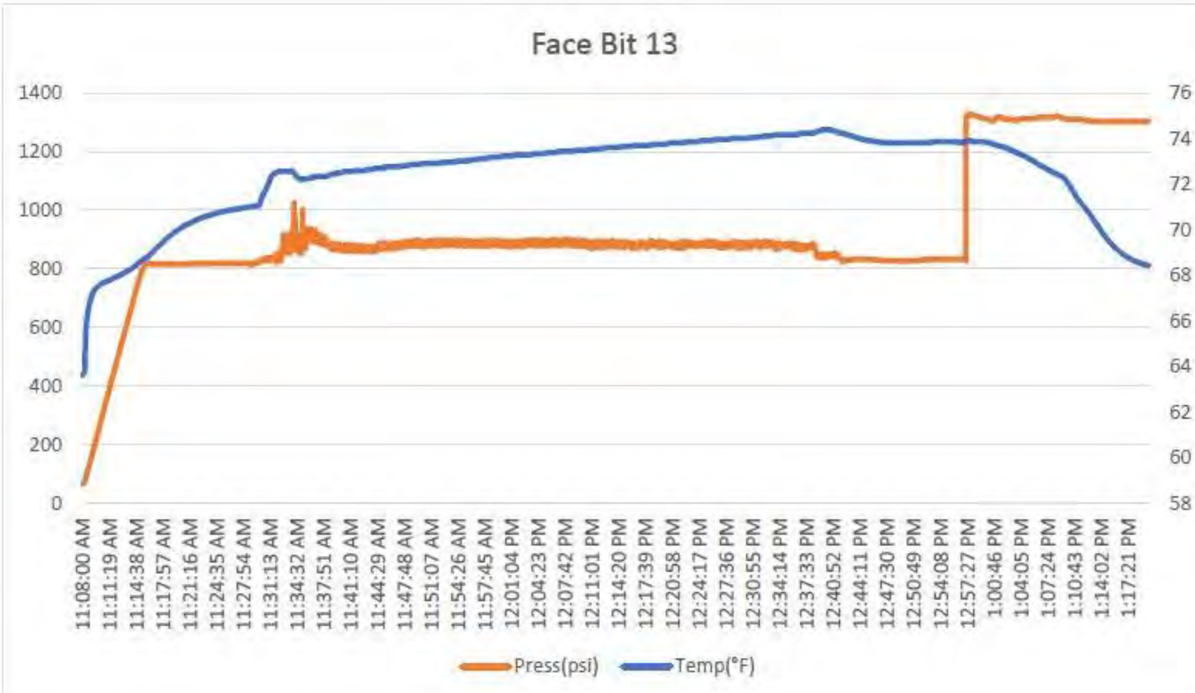
11CS DST DATA



12FB DST DATA



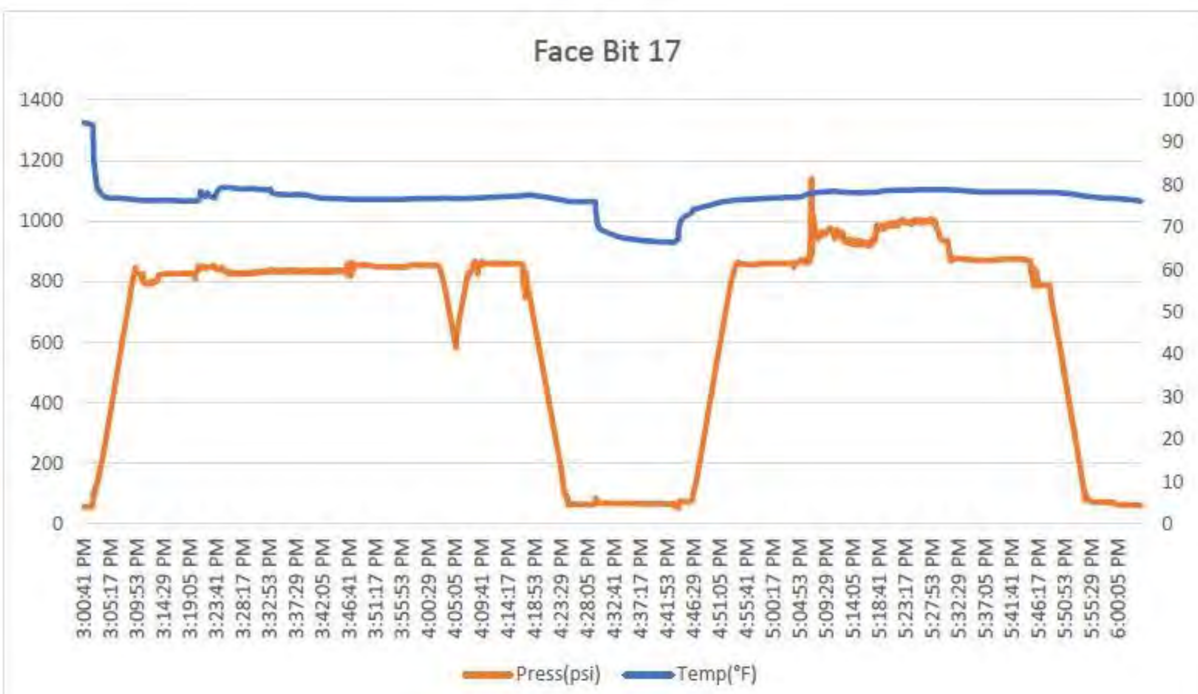
13FB DST DATA



14FB DST DATA

15FB DST DATA

17FB DST DATA



18FB DST DATA

19FB DST DATA