Oil and Natural Gas Technology

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1Q2007 Quarterly Progress Report

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Resource Characterization and Quantification of Natural Gas-Hydrate and Associated Free-Gas Accumulations in the Prudhoe Bay – Kuparuk River Area on the North Slope of Alaska

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Office of Fossil Energy

PROJECT ABSTRACT

Methane hydrate may contain significant offshore and onshore arctic gas resources. The appraisal phases of this study are designed to help determine whether or not gas hydrate can become a technically and economically recoverable gas resource. The Phase 1-2 reservoir characterization, development scenario modeling, and associated studies indicated that 0-12 TCF gas may be technically recoverable from 33 TCF gas-in-place (GIP) Eileen trend gas hydrate beneath industry infrastructure within the Milne Point Unit (MPU), Prudhoe Bay Unit (PBU), and Kuparuk River Unit (KRU) areas on the Alaska North Slope (ANS). Modeled production methods involve subsurface depressurization and/or thermal stimulation of pore-filling gas hydrate into gas and water components.

Phase 2 studies included rate forecasts and hypothetical well scheduling, methods typically employed to evaluate the development potential of conventional large gas accumulations. This work helped quantify: 1. Potential to technically produce gas from the 33 TCF GIP Eileen trend gas hydrate resource using conventional petroleum technologies and 2. Range of 0-12 TCF possible recoverable resource based on potential future development schemes. Phase 2 studies culminated in recommendations to acquire Phase 3a stratigraphic test static data including 400-600 feet core, extensive wireline logs, and MDT wireline tests within the Mt Elbert intra-hydrate MPU prospect interpreted from the Milne 3D seismic survey. Phase 3b studies, if approved, would acquire additional static data and include production testing, likely from a gravel pad within production infrastructure.

Phase 2 production forecast and regional schematic modeling studies included downside, reference, and upside cases. Reference case forecasts with type-well depressurization-induced production rates of 0.4-2.0 MMSCF/D predict that 2.5 TCF of gas might be produced in 20 years, with 10 TCF ultimate recovery after 100 years; it is important to note that typical industry forecasts would not exceed 50 years. Downside cases envision research pilot failure and economic or technical infeasibility. Upside cases identify additional potential if Phase 3 data acquisition would confirm upside modeling results of pressure-induced, thermally enhanced, or chemically stimulated gas hydrate dissociation into movable gas. Phase 3a field studies initiated in early 2007 and acquired data to help mitigate uncertainty in potential gas hydrate productivity. Successful Phase 3a MtElbert-01 stratigraphic test drilling and data acquisition was completed between February 3-19, 2007. Although potential Phase 3b production test planning is underway with Phase 3a data evaluation, a Phase 3b production test is not currently approved by BP.

ACKNOWLEDGEMENTS

This cooperative DOE-BPXA research project has helped facilitate and maintain industry interest in the resource potential of shallow natural gas hydrate accumulations. This research could help determine whether or not methane hydrate may become an additional unconventional gas resource and DOE and BPXA support of these studies is gratefully acknowledged.

Efforts of DOE National Energy Technology Lab staff Brad Tomer, Ray Boswell, Richard Baker, Tom Mroz, Kelly Rose, Eilis Rosenbaum, and others have enabled continuation of this and associated research projects. Scott Digert and others at BPXA continue to promote the importance of this cooperative research within industry. BPXA staff support and stratigraphic test well planning efforts of Micaela Weeks, Larry Vendl, Dennis Urban, and others led to successful Phase 3a well operations and data acquisition. The State of Alaska Department of Natural Resources through the efforts and leadership of Dr. Mark Myers, Bob Swenson, Paul Decker, and others has consistently recognized the contribution of this research toward identifying a possible additional unconventional gas resource and actively supported the Methane Hydrate Act of 2005 to enable continued funding of these studies.

The USGS has led ANS gas hydrate research for nearly 3 decades. Dr. Tim Collett coordinates USGS partnership in this Alaska gas hydrate research and potential future development. Seismic studies accomplished by Tanya Inks at Interpretation Services and by USGS scientists Tim Collett, Myung Lee, Warren Agena, and David Taylor identified multiple MPU gas hydrate prospects. Support by USGS staff Bill Winters, Bill Waite, and Tom Lorenson and Oregon State University staff Marta Torres and Rick Colwell is gratefully acknowledged. Steve Hancock at APA (RPS Energy) and Peter Weinheber at Schlumberger have helped design the Phase 3a wireline testing program. Scott Wilson at Ryder Scott has progressed reservoir models from initial studies by the University of Calgary (Dr. Pooladi-Darvish) and the University of Alaska Fairbanks (UAF). The Canadian Modeling Group (CMG) STARS program was adapted to an industry-standard production model of gas hydrate-bearing reservoir behavior and has helped assess the regional development potential of Alaska North Slope gas hydrate (if proven as a resource). Dr. Shirish Patil and Dr. Abhijit Dandekar have helped redevelop the UAF School of Mining and Engineering into an arctic regions gas hydrate research center. The University of Arizona reservoir characterization studies led by Dr. Bob Casavant with Dr. Karl Glass, Ken Mallon, Dr. Roy Johnson, and Dr. Mary Poulton have described the structural and stratigraphic architecture of the ANS Sagavanirktok formation gas hydrate-bearing reservoir sands.

Current related studies of gas hydrate resource potential are too numerous to mention here. National Labs studies include Dr. Pete McGrail, CO_2 Injection, and Dr. Mark White, reservoir modeling, at Pacific Northwest National Lab and Dr. George Moridis, reservoir modeling, at Lawrence Berkeley National Lab. The Colorado School of Mines under the leadership of Dr. Dendy Sloan continues to progress laboratory and associated studies of gas hydrate. The significant efforts of international gas hydrate research projects such as those supported by the Directorate General of Hydrocarbons by the government of India and by the Japan Oil, Gas, and Metals National Corporation (JOGMEC) with the government of Japan are contributing significantly to a better understanding of the resource potential of natural methane hydrate. JOGMEC and the government of Canada support of the 2002 and current Mallik project gas hydrate studies in Northwest Territories, Canada are gratefully acknowledged. This cooperative DOE-BPXA research project builds upon the accomplishments of many prior government, academic, and industry studies.

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2.0 PROJECT INTRODUCTION

The cooperative research between BP Exploration (Alaska), Inc. (BPXA) and the U.S. Department of Energy (DOE) is helping to characterize and assess Alaska North Slope (ANS) methane hydrate resource and is helping to identify technical and commercial factors that could enable government and industry to understand the future development potential of this possible unconventional energy resource. Results of Phase 1-2 reservoir characterization, reservoir modeling, regional schematic modeling, and associated studies culminated in approval to proceed into a 2007 Phase 3a stratigraphic test to acquire data designed to help mitigate potential recoverable resource uncertainty. Future Phase 3b production testing is a key goal of the Federal Research and Development program and may follow, but this remains to be evaluated. Collaborative research partners include U.S. Geological Survey (USGS), Arctic Slope Regional Corporation Energy Services, Ryder Scott Company, APA RPS Engineering, University of Arizona, University of Alaska Fairbanks, Oregon State University, Pacific Northwest National Lab, Lawrence Berkeley National Lab, and others.

Methane hydrate may contain a significant portion of world gas resources within offshore and onshore arctic regions petroleum systems. In the United States, accumulations of gas hydrate occur within pressure-temperature stability regions in both offshore and also onshore near-permafrost regions. USGS probabilistic estimates indicate that clathrate hydrate may contain a mean of 590 TCF in-place ANS gas resources (Figure 1). Over 33 TCF in-place potential gas hydrate resources are interpreted within shallow sand reservoirs beneath ANS production infrastructure within the Eileen trend (Figure 2). Gas hydrate accumulations require the presence of all petroleum system components (source, migration, trap, seal, charge, and reservoir). Future exploitation of gas hydrate would require developing feasible, safe, and environmentally-benign production technology, initially within areas of industry infrastructure. In the United States, the ANS onshore and Gulf of Mexico (GOM) offshore are currently known to favorably combine these factors. The information and technology being developed in this onshore ANS program will be an important component to assessing the possible productivity of the potentially much larger marine hydrate resource. The resource potential of gas hydrate remains unproven, but if proven, could increase ANS gas resources and could lead to greater U.S. energy independence.

In 1972, the existence of natural methane hydrate within ANS shallow sand reservoirs was confirmed by data acquired in the Northwest Eileen State-02 well. Although up to 100 TCF in-place gas may be trapped within the gas hydrate-bearing formations beneath existing ANS infrastructure, it has been primarily known as a shallow gas drilling hazard to the hundreds of well penetrations targeting deeper oil-bearing formations and has drawn little resource attention due to no ANS gas export infrastructure and unknown potential productivity. Characterization of ANS gas hydrate-bearing reservoirs and improved modeling of potential gas hydrate dissociation processes led to increasing interest to study gas hydrate resource and production feasibility.

If gas can be technically produced from gas hydrate and if studies help prove production capability at economically viable rates, then methane dissociated from ANS gas hydrate could help supplement fuel-gas, provide additional lean-gas for reservoir energy pressure support, sustain long-term production of portions of the geographically-coincident 20-25 billion barrels viscous oil resource, and/or potentially supplement conventional export-gas in the longer term.

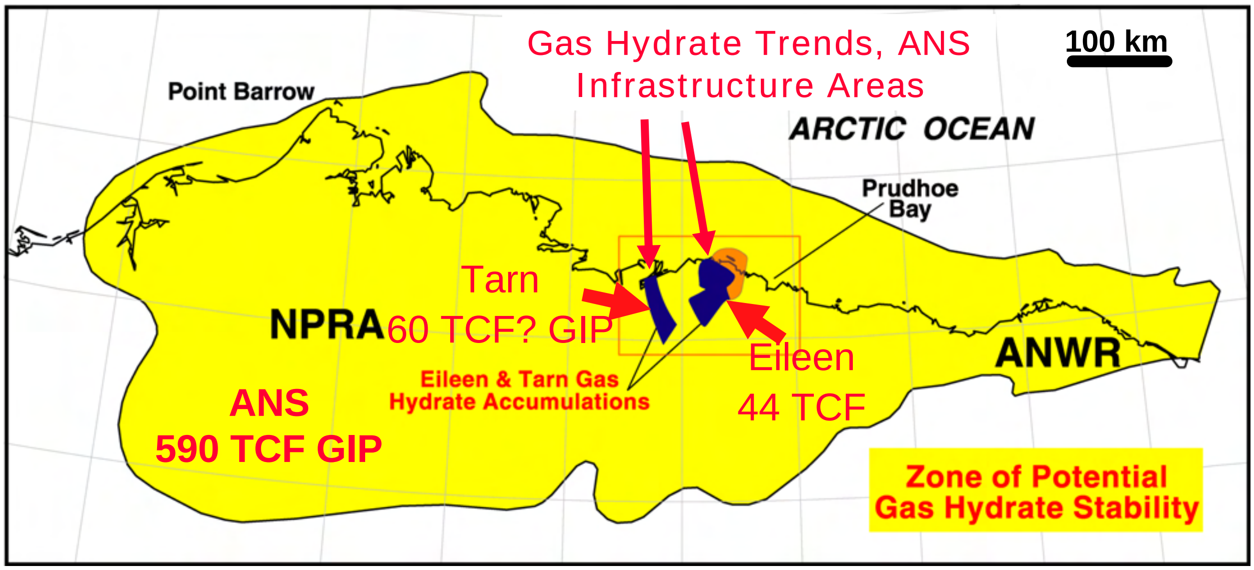


Figure 1: ANS Gas Hydrate Stability Zone Extent. The USGS has estimated 590 TCF methane in place in hydrate form in this region (Courtesy USGS).

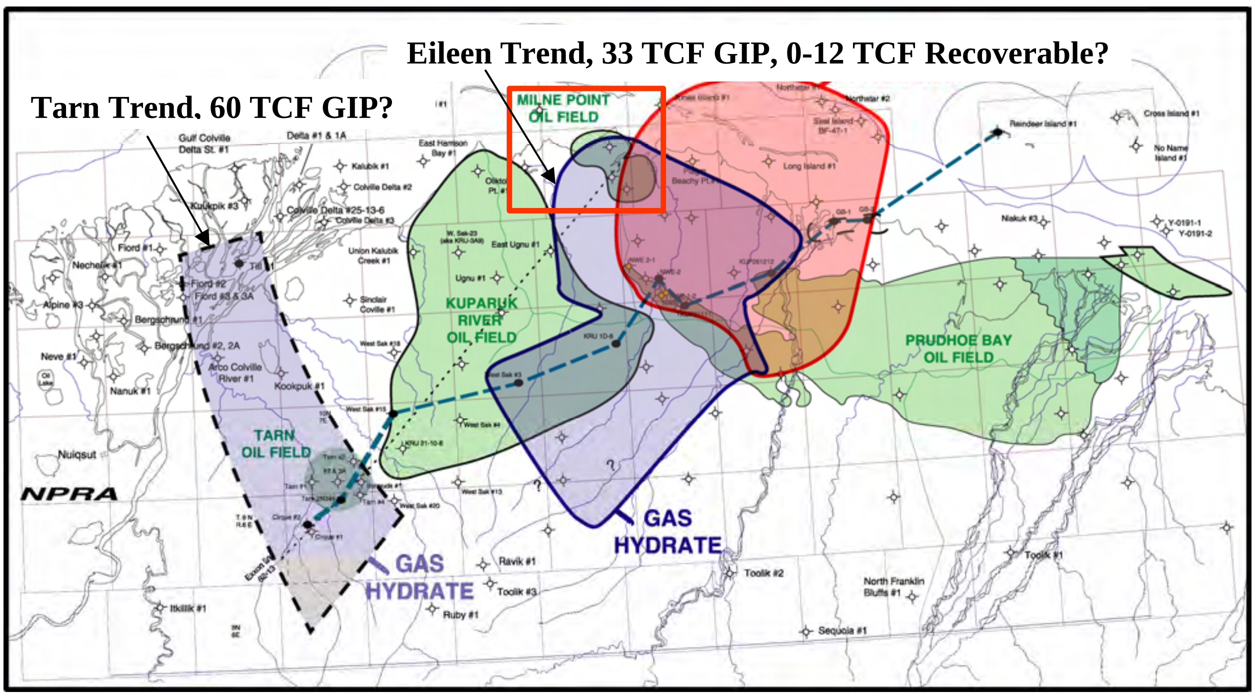


Figure 2: Eileen and Tarn Gas Hydrate Trends and ANS Field Infrastructure (modified after Collett, 1998) and including potential gas-in-place (GIP).

As part of a multi-year effort to encourage these feasibility studies, the DOE also supports significant laboratory and numerical modeling efforts focused on the small scale behaviors of gas hydrate. Concurrently, the USGS has assessed the potential in-place resource potential and participated in field operations with DOE and others to acquire data within many naturally occurring gas hydrate accumulations throughout the world. There remain significant challenges in quantifying the fraction of these in-place resources that might eventually become a technically-feasible or possibly a commercial natural gas reserve. This study estimates this potential ANS prize within the Eileen trend and recommends additional research, data acquisition, and field operations.

A “chicken and egg” problem has hindered unproven resource research and development in the past; an “unconventional” resource commonly requires a few positive examples before it can generate stand-alone interest from industry. This was true for tight gas resources in the 1950-1960’s, Coal-Bed-Methane plays in the 1970-1980’s and the shale gas resources in the 1990-2000’s. In each case, the resource was thought to be technically infeasible and uneconomic until the combination of market, technology (new or newly applied), and positive field experience helped motivate widespread adoption of unconventional recovery techniques in an effort to prove whether or not the resource could be technically and commercially produced. In an attempt to bridge this gap, Phase 2 gas hydrate reservoir modeling efforts were coupled with a series of possible regional schematic models to quantify a suite of potential recoverable reserve outcomes.

These regional schematic modeling scenarios indicated that 0-12 TCF gas may be technically recoverable from 33 TCF in-place Eileen trend gas hydrate beneath ANS industry infrastructure within the Milne Point Unit (MPU), Prudhoe Bay Unit (PBU), and Kuparuk River Unit (KRU) areas. Production forecast and regional schematic modeling studies included downside, reference, and upside cases. Reference case forecasts with type-well depressurization-induced production rates of 0.4-2.0 MMSCF/D predict that 2.5 TCF of gas might be produced in 20 years, with 10 TCF ultimate recovery after 100 years (typical industry forecasts would not exceed 50 years). The downside case envisions research pilot failure and economic or technical infeasibility. Upside cases identify additional potential recoverable resource. Additional static data acquisition and possible future production testing could help validate whether or not these upside model results might occur in a future potential development using depressurization-induced, thermally enhanced, and/or chemically stimulated dissociation of gas hydrate into movable gas. Modeled production methods involve subsurface depressurization and/or thermal stimulation of pore-filling gas hydrate into gas and water components. Phase 2 studies included rate forecasts and hypothetical well scheduling, methods typically employed to evaluate potential conventional large gas development projects. This work helped quantify: 1. Potential to technically produce gas from the 33 TCF GIP Eileen trend gas hydrate resource using conventional petroleum technologies and 2. Range of 0-12 TCF possible recoverable resource based on potential future development schemes. Phase 2 studies culminated in recommendations to acquire Phase 3a stratigraphic test static data including 400-600 feet core, extensive wireline logs, and MDT wireline tests within the Mt Elbert intra-hydrate MPU prospect interpreted from the Milne 3D seismic survey (Figure 3). Phase 3a field studies led to successful acquisition of critical data to help mitigate uncertainty in potential gas hydrate productivity. Successful Phase 3a MtElbert-01 stratigraphic test drilling and data acquisition was completed between February 3-19, 2007. Although potential Phase 3b production test planning is underway with Phase 3a data evaluation, a Phase 3b production test is not currently approved by BP. Phase 3b studies, if approved, would acquire additional static data and include production testing, likely from a gravel pad within production infrastructure.

3.0 EXECUTIVE SUMMARY

This Quarterly report encompasses project work from January 1, 2007 through end-March 2007. This research program is designed to determine whether the currently unproven gas hydrate resource may become a new unconventional gas reserve Major research objectives accomplished during this reporting period included all recommended Phase 3a stratigraphic test well drilling and data acquisition. Acquired data included 430 feet core (100 feet gas hydrate-bearing), extensive wireline logging, and wireline production testing operations using the Modular Dynamic Testing (MDT) downhole tool. Significant pre-well planning, inclusion of world hydrate experts, and onsite vigilance were key elements to safely drilling and acquiring this data in February 2007 on an ANS Milne Point Unit exploration ice pad. Chilled oil-based drilling fluid mitigated operational safety concerns and enhanced core and data acquisition by maintaining gas hydrate and borehole stability during openhole drilling and operations.

Significant project accomplishments during the reporting period included:

- Finalized project scope, budget, and contracts for Phase 3a Stratigraphic Test Well
    - Implemented Phase 3a stratigraphic test well operations and data acquisition plans
    - Finalized Authority-for-Expenditure (AFE) consistent with budget categories
    - Rationalized budget and updated drilling/data acquisition cost estimates
    - Established cost-cutting tiers to maintain project within budget
        - Implemented Tier 1 cut to TD well at 3000 feet (versus 4000 feet)
- Maintained project reports, electronic and hardcopy files, documentation, and backups
- Rejected addition of short-term Drill-stem testing (DST) to data acquisition program
    - High ice-pad operations cost and abandonment concern regarding downhole Electrical Submersible Pump (ESP) cable/equipment
    - Phase 3b production test (currently not approved) gravel-based operations would provide more cost-effective and better integrity operations.
- Safely implemented well operations and data acquisition plans
    - Forwarded safety, policy, training, and procedure documents to all subcontractors
    - Switched to oil-based (versus water-based) chilled mud for operations and safety
    - Finalized staff roster, assignments, and shift schedules
    - Finalized plans and contracts, permits, and materials acquisition
    - Implemented detailed core acquisition, onsite sampling, and preservation program
    - Implemented logging-during-drilling, wireline, and MDT program plans
    - Implemented mud program and incorporated DrillCool, Inc. mudchilling system

Significant stratigraphic test well data acquisition accomplishments included:

- Successfully demonstrated ability to safely and effectively acquire data within shallow gas hydrate-bearing reservoirs over 7-10 days (versus the normal approach to drill and case within a maximum 2-4 days).
- Validated seismic interpretation of gas hydrate-bearing MtElbert prospect within MPU
- Acquired 430 feet of 3-inch diameter core, 100 feet of which were gas hydrate-bearing
    - Collected 261 onsite subsamples for preservation and analyses at various labs
        - 4 samples preserved in methane-charged pressure vessels (later converted to liquid nitrogen)
        - 7 samples preserved in liquid nitrogen

  - 52 samples for physical property analyses
  - 46 samples for interstitial water geochemistry
  - 5 samples for thermal property study
  - 86 samples for microbiological study
  - 46 samples for organic geochemistry study
  - 15 samples for detailed petrophysical analyses
- Acquired extensive open-hole wireline logs including gamma-ray, resistivity, neutron-density porosity, Dipole Sonic Acoustic porosity, Nuclear Magnetic Resonance, Formation Imaging, Electromagnetic Propagation, caliper
- Acquired 4 extensive, long shut-in period MDT within 2 gas hydrate-bearing reservoirs
  - MDT analyses improving understanding of gas hydrate dissociation, gas production, formation cooling, and long-term production potential
  - MDT analyses providing calibration of reservoir simulation models
  - Obtained 4 gas samples from each test interval
  - Obtained 1 pre-dissociation formation water sample and demonstrated ability to flow mobile connate formation water from hydrate-saturated interval
  - Observed rapid formation cooling during gas hydrate dissociation and gas flow and demonstrated gas dissociation from hydrate with pressure drawdown

The 2007 Alaska North Slope MtElbert-01 Gas Hydrate Stratigraphic Test accomplished several ”firsts”, including:

- First significant ANS gas hydrate bearing core (100 feet of 430 feet acquired)
- First wireline retrievable coring system application on ANS with conventional drilling rig
- First extensive ANS open hole multi-day data acquisition program in gas hydrate section
- First in world open-hole dual packer MDT program in gas hydrate bearing sections
- First ANS MDT sampling of both gas and water in gas hydrate-bearing reservoirs
- First in world sand face temperature data tracking during MDT flow and shut-in periods

The acquired data has helped calibrate reservoir simulation models and greatly improved understanding of gas hydrate dissociation, gas production, formation cooling, and possible future long-term production test design.

4.0 QUARTERLY RESULTS

The primary task accomplished during the reporting time period from January 2007 through end-March 2007 was planning, execution, and preliminary analyses of drilling and data acquisition in the Phase 3a Stratigraphic Test well (Project Task 8.0).

4.1 Stratigraphic Test Well Approach

Amendment 11 of the BP-DOE Cooperative Agreement defines Task 8.0 as follows:

“Task 8.0 - Plan and Implement Drilling of Stratigraphic Test Well:

Recipient will implement appropriate data acquisition consisting of a drilling and evaluation program based on a single vertical stratigraphic test well with appropriate logging, coring and MDT testing of the previously documented "Mt. Elbert" or comparable prospect within the Milne

Point Unit. The field activity will be designed to determine the validity of pre-drill seismically-based predictions of gas hydrate occurrence and reservoir quality and to collect other data as necessary to enable a decision whether or not to conduct future dedicated gas hydrate reservoir production testing on the Alaska North Slope. Recipient will maximize synergies with existing and planned ANS developments. Recipient will either plug and abandon the well before moving off or suspend the well with or without instrumentation for future use as an observation well".

4.1.1 Stratigraphic Test Engineering, Data Acquisition, and Operations Planning

The well plan engineering and operations procedures were reviewed and modified with the rig assignment to Doyon 14. The priority of data acquisition objectives were: 1. Wireline Logging, 2. MDT Pressure Testing, and 3. Core Acquisition. Core acquisition, processing, and transportation plans were prepared as additional well planning documents. Lessons learned from previous gas hydrate-bearing cored wells, such as the Mallik 1998 and Mallik 2002 onshore and certain offshore research programs were incorporated into the well planning, where applicable.

The program was designed to deliver the primary objectives identified by the Gas Hydrate project research team and the MPU development team and it was reviewed and refined through a number of meetings leading up to well spud in early February 2007. In addition, Job Risk Assessments (JRA) and dry-run pre-operations onsite training were executed prior to and during the wireline coring, logging, and MDT operations.

MtElbert-01 was the first of three (2 were non-hydrate) planned appraisal wells drilled in MPU during the 2007 ice-pad exploration season. The primary objectives of this well included acquisition of approximately 400 to 600 feet of low invasion 3-inch whole wireline-retrievable core, extensive open-hole wireline logging, and extensive MDT testing within interpreted gas hydrate-bearing Sagavanirktok reservoirs beneath the Permafrost within the Eileen gas hydrate trend (Figures 1 and 2) to improve reservoir characterization and resource determination. This program acquired the first conventional rig wireline core on the Alaska North Slope using an improved version of the ReedHycalog (Corion) Wireline Express tool that successfully retrieved, via wireline, the inner core barrel through the drill string in the Mallik 2002 gas hydrate project. A separate coring protocol document was prepared as Appendix B of the December 2006 Quarterly report and provided detailed technical justifications and methods for acquiring, subsampling, transporting, and storing core to meet the project objectives.

Core, logs, and MDT data will help determine the resource potential of methane hydrate within the study area. The determination of locally derived rock and reservoir properties data is considered critical for properly characterizing the Sagavanirktok formation for potential future production test and reservoir development planning. Only a few feet of conventional core were acquired within the Eileen gas hydrate trend in the 1972 Northwest Eileen State #2 well, only very few full-suite wireline logs are available, and no MDT pressure testing has occurred within these intervals on the ANS.

The MtElbert prospect is one of 14 gas hydrate prospects interpreted from 3D seismic interpretation and mapping within the MPU (Figure 3). The MtElbert prospect is mapped as a 3-way fault-bounded structural trap within the northwestern portion of the Eileen gas hydrate trend and may contain up to 90 BCF gas in-place out of a total of 600-700 BCF gas in-place for all 14 mapped prospects (Figure 3). Figure 4 illustrates the surface location for the MtElbert-01 stratigraphic test well and ice pad.

Total pre-drilling cost estimates of the MtElbert-01 Sagavanirktok drilling and core, log, and MDT data acquisition was estimated to be $4.1-4.8 MM, depending on operations contingency costs.

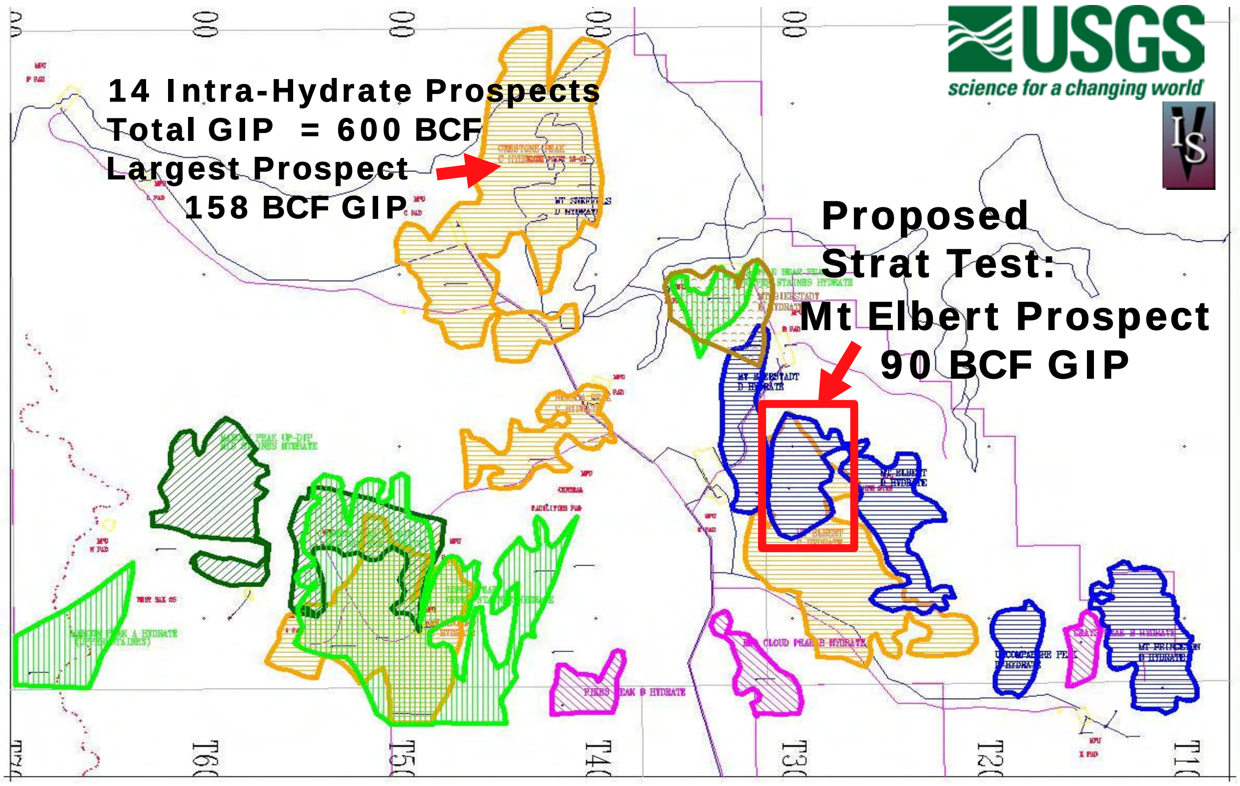


Figure 3: Gas Hydrate prospects within MPU, including the Mt Elbert prospect

4.1.1.1 Drilling Requirements

The layout of core processing areas on Doyon-14 and the ice pad were reviewed and agreed by the MPU technical staff, project leaders from ASRC Energy and USGS, lead coring engineer, and drilling supervisor. The diagram in Figure 5 shows the planned layout to indicate the scale of operations for general guidance.

Maintaining an in-gauge borehole with no to minimal washout is critical to maintaining safe operations and to acquiring high-quality core, log, and MDT data. In support of these safety and data acquisition objectives, a special mineral oil-based mud (MOBM) drilling fluid was selected and will be cooled in a special heat-transfer chilling unit connected to the mud system on Doyon-14. The chilled MOBM is expected to maintain both borehole and gas hydrate stability during drilling, coring, logging, and MDT operations. Surface casing is planned to be set in a shaly section just below base permafrost to maintain permafrost stability (Figure 6).

4.1.1.2 Coring Requirements

Appendix B of the December 2006 Quarterly report contains a complete summary of the core procedure documentation. The MtElbert-01 well is planned to acquire 400-600 feet of wireline-retrievable core from 2-3 major reservoir sand intervals that are interpreted from the seismic data to contain gas hydrate within the Sagavanirktok intervals shown in Figure 6. The reservoir properties and lateral continuity of the Sagavanirktok zones are relatively unknown. The core point in this well will occur just below the surface casing point set in the shalier section below Zone E just prior to penetrating the top of Zone D (Figure 6). The projected core point is 2000 feet TVDss, but may be subject to change if the well plan requires a final modification following correlations from the MWD logs in the surface hole.

Once the Sagavanirktok zone D and C-sands have been cored, the coring in the Sagavanirktok formation is planned to continue through the Zone B reservoir interval, if time permits (Figure 6). Zones D and C are currently interpreted to be fluvial-deltaic sands and Zone B is interpreted to be marine. These zones are interpreted to contain gas hydrate, water, and possibly free gas as pore-filling fluid phases.

The core point for the MtElbert-01 well will be picked by the wellsite geologists based on MWD log correlations from the adjacent MPU E-26 and B-01, B-02, B-22, and other E-pad offset penetrations. The MtElbert-01 well LWD logging tool will be placed as close to the bit as possible in the surface hole to minimize core depth point prediction uncertainty.

The criteria for ending the planned Sagavanirktok formation core program are as follows:

1. The full 600 feet of Zone D and Zone C through base Zone B interval core has been recovered as illustrated in Figure 6, or
2. If coring across the targeted Sagavanirktok intervals have not been completed but the core acquisition AFE limit has been reached (i.e. 48 hours in base-plan, with up to 24 hour contingency time)

The well track is planned to be vertical throughout this interval. The purpose of obtaining the core is to characterize the following reservoir properties to help reduce subsurface uncertainties from which an appropriate understanding of gas hydrate-bearing reservoir properties can be ascertained.

The MtElbert-01 core onsite subsampling analysis objectives are:

1. Confirm gas hydrate and reservoir characterization interpretation
2. Obtain whole-round cores for porosity, permeability, and fluid saturations determination for log calibration, and potential resource assessments.
3. Sample mineralogy and lithology for log calibration, and understanding formation physical and mechanical properties
4. Sample gas hydrate and pore water geochemical and microbiological properties to understand the origin of gas hydrate and implications for vertical and lateral compartmentalization within variable lithologies.
5. Sample biostratigraphic markers, which will aid in constraining and/or defining regional stratigraphic correlation horizons.

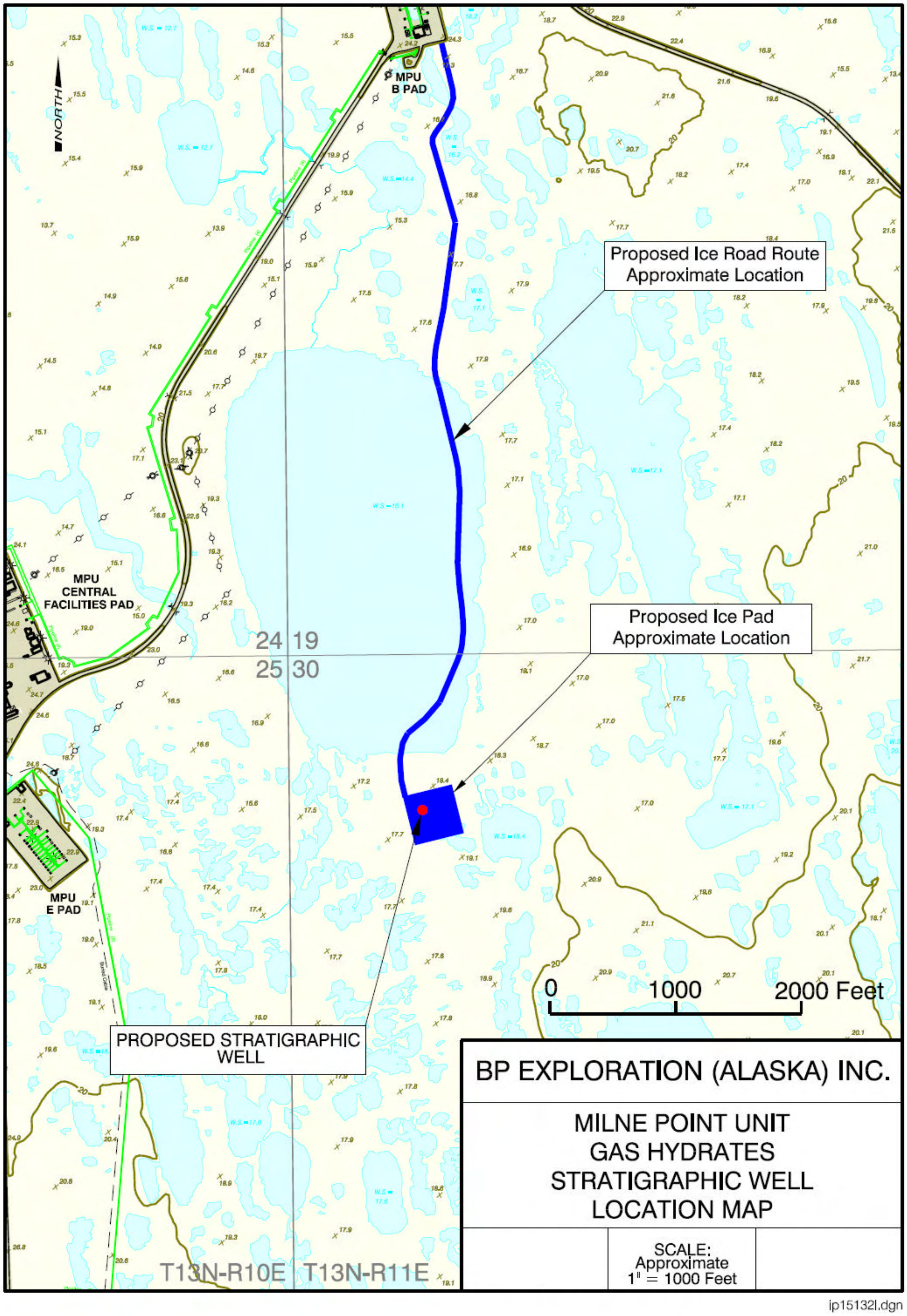


Figure 4: Surface Location Map Showing Ice Road and Pad within MPU Field Area

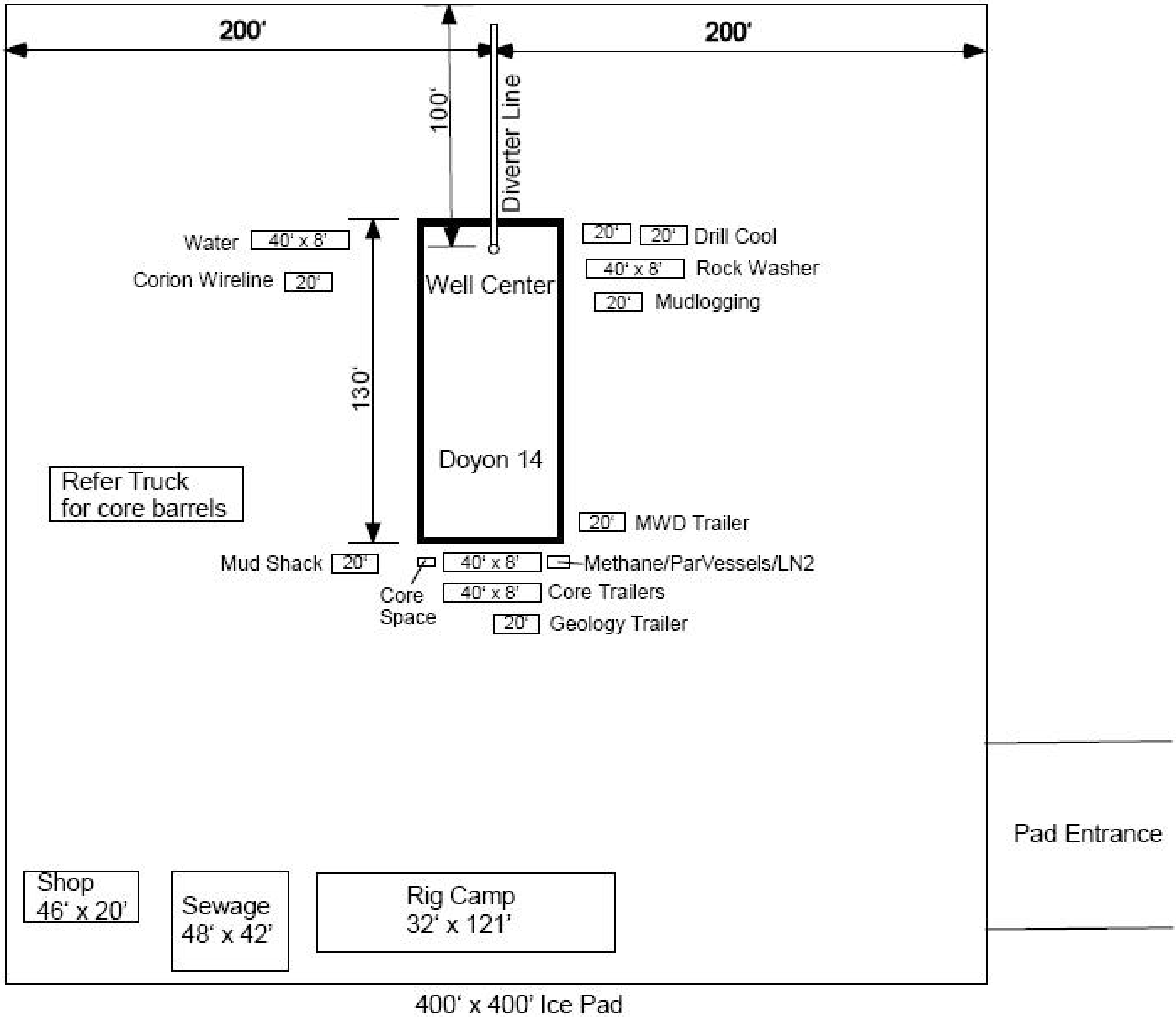


Figure 5: Ice Pad and Rigsite pre-drill layout diagram.

Core will also provide critical information on reservoir quality, interpreted reservoir lateral continuity, reservoir fluids, hydrocarbon in-place, resources, potential deliverability, well placement and drillability. Specific post-well core studies will include the following (subject to budget availability):

- Core-derived Rw/Sw (gas-hydrate-in-place)
- Sedimentology (well placement, reserves)
- Poroperm (reserves, well productivity)
- Reservoir quality (well placement)
- High resolution biostratigraphy (drilling)
- Vertical and horizontal heterogeneity description (reservoir compartmentalization, potential reservoir depletion plan)
- Coreflood tests (relative permeability)
- Petrophysical tests

Primary Risks / Impacts / Mitigations to good coring performance and the overall well objectives on MtElbert-01 are detailed in the Core Risk Register. The top 6 include:

1. **Stage:** Planning and preparation / **Risk**: Coring equipment and personnel not available when needed (Corion's wireline system, Drill Cool mud chilling system, USGS/DOE equipment and supplies, Core trailers) / **Impact**: Unable to core well, possible rig standby waiting on equipment / **Mitigation**: Prepare detailed coring plan. Work with vendors to confirm equipment and personnel are available (and properly certified and trained for slope). Prepare checklist and distribute. Prepare checklist for training and slope clearance.

2. **Stage:** Planning and preparation / **Risk**: Coring procedure and processes and core handling procedure poorly understood leading to HSE incident / **Impact**: Cannot proceed with work or HSE impact / **Mitigation**: Proper FEL planning and documentation, proper ATP. Proper JSA/JRA at rigsite pre-core with dress rehearsal. Detailed coring pre-spud on rig with rig and coring crews.

3. **Stage:** Operations **/ Risk:** Mud chiller fails / **Impact:** Cannot proceed with drilling/coring well, poor data acquisition, poor borehole conditions, loss of borehole, potential well control issue / **Mitigation**: DrillCool equipment must be checked out and working ahead of time, and working at Doyon14. On location when Doyon14 moves on ice pad for spud anticipated by February 2, 2007.

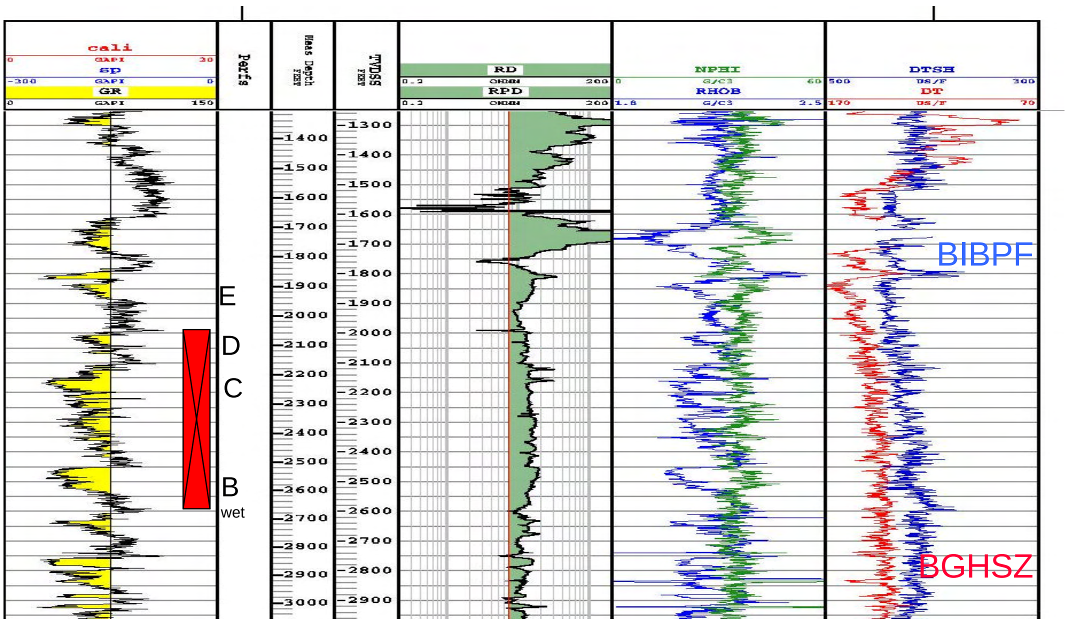
4. **Stage:** Operations **/ Risk:** Core point picked too shallow or too deep (core point based on isopach ahead from casing shoe) / **Impact:** Core the wrong interval. Pick too shallow and not enough time to obtain 600 feet of cored interval. Pick too deep and drill up main cored interval. Do not have enough contingency in timing to have mis-picked core point / **Mitigation**: Have rig geologists and USGS/DOE in agreement for core point.

5. **Stage**: Operations / **Risk**: Swabbing during POOH / **Impact**: Well control incident / **Mitigation**: Prepare tripping guidelines to include maximum speed per wireline run, pump out of open hole. Model swab prior to coring and develop tripping schedule. There is a great deal of flexibility here. If the top valve on the diverter sub is closed, wireline can be pulled at up to 200 feet per minute and likely not swab the well. If the valve is left open, approximately 10 gallons may be swabbed. There is no perceived downside to the leaving the valve closed and pulling at the above rate. The rates are dealing with gas expansion in the core, if no free gas is expected, then pulling at 200 feet per minute could occur with minimal to no swabbing.

6. **Stage**: Operations / **Risk**: Gas liberation at rig floor / **Impact**: HSE incident, poor core quality / **Mitigation**: Prepare tripping guidelines to include maximum speed per stand and per #5 Corion input. Chilled MOBM.

Additional concerns include, but are not limited to:

- Jamming of semi-consolidated water-bearing Sagavanirktok reservoir sands during coring,
- Poor recovery of gas hydrate-bearing reservoir intervals during coring,
- Poor displacement of water based with oil-based drilling fluid or excess water in MOBM,
- Borehole problems due to mud-chilling difficulties or gas dissolution from gas hydrate or associated free gas-bearing formations,
- Core face obscured by opaque oil-based mud with black Gilsenite additive causing difficulty in subsampling



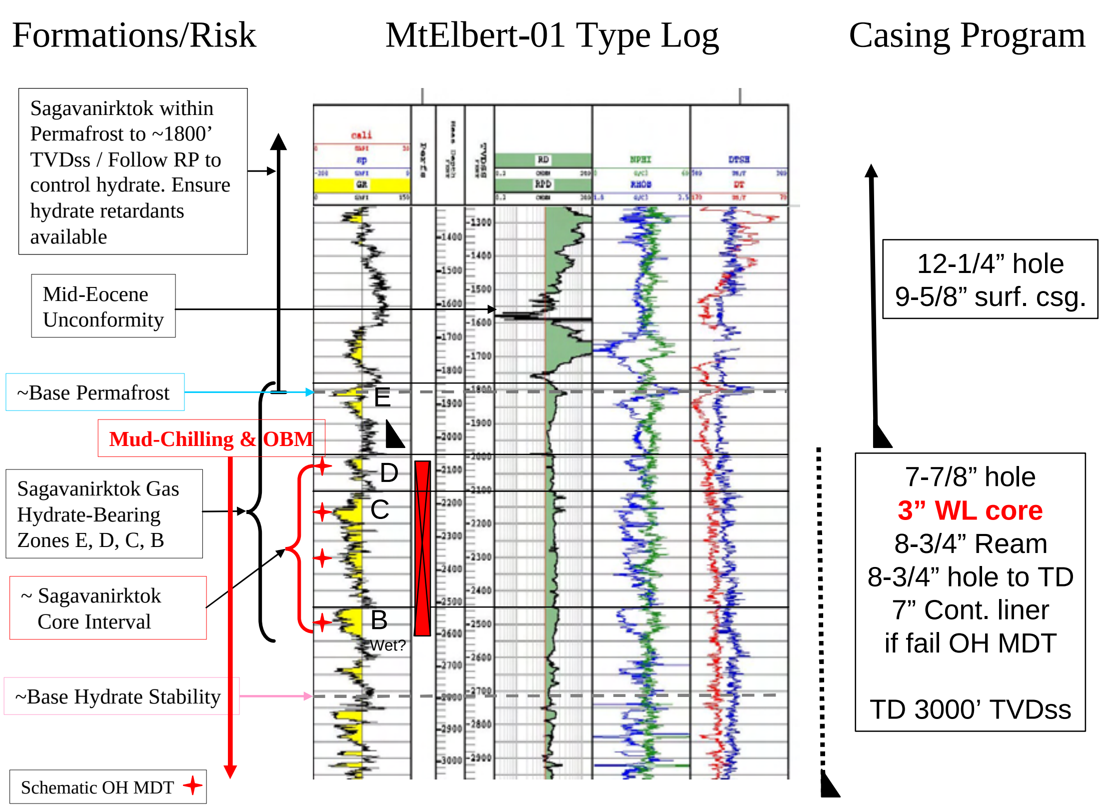


Figure 6: MPE-26 Type Log showing planned intervals of wireline log and core data acquisition between Base of Ice-Bearing Permafrost (BIBPF) and Base Gas Hydrate Stability Zone (BGHSZ) and planned drilling/casing program.

All Risks to coring performance will be examined in detail and prevention/mitigation agreed with the operations team during the pre-coring risk register assessment. Above all, MtElbert-01 coring operations must be done without hurting people or damaging the environment in any way. BP HSE practices will be rigorously followed at all times and if anyone sees any cause for concern regarding procedures described in this or the primary core plan document, they should let the authors or BP management know immediately.

4.1.1.3 Logging Requirements

A primary objective of the stratigraphic test is to acquire high-quality wireline logging across the interpreted gas hydrate-bearing intervals of the shallow Sagavanirktok reservoir sands and shales. Since the well is planned to be near-vertical, wireline logs are planned to acquire high-quality gas hydrate-bearing reservoir petrophysical data, provided that the mud-chilling operations maintain adequate borehole stability and in-situ conditions (preventing borehole washouts and gas hydrate dissociation during drilling, coring, and data acquisition operations). Wireline logs would be run from approximately 1,950 to 3,000 feet (or TD) in the “production” hole below surface casing below BIBPF as shown in Figure 6. The MPE-26 type log shown in Figure 6 is directly beneath MPU E-pad within the shallow zones of interest. MPE-26 is on MPE-pad approximately 1,500 feet west of the proposed Mt Elbert-01 well location (Figure 4). Wireline logs planned would include gamma-ray, resistivity, neutron-density in the “platform-express” along with dipole sonic (with shear wave data), nuclear magnetic resonance (NMR), RtScanner, and oil-based formation micro-imager (OBMI) to help determine gas hydrate-bearing reservoir properties. Planned data acquisition is summarized in Table 1.

Wireline Logging Runs from Surface Casing to TD
Run-1
PEX - Platform Express
AIT - Array Induction-SP Log
RtScanner (AIT or RtScanner)
Electromagnetic Propagation Tool Log
Run-2
DSI - Dipole Shear Imager Log - expert mode; stonely
GR - Gamma Ray Log
OBMI - Formation MicroImager for oil-based mud
Run-3
CMR - Combinable Magnetic Resonance Tool
NGT - Spectral Gamma Ray Log
ECS - Elemental Capture Sonde
Run-4
MDT Open Hole – 2 test points per sand (2 sands expected) – up 10 hrs/each; cased hole MDT contingency

Table 1: Planned Wireline Logging Runs

4.1.1.4 MDT Pressure Testing Requirements

During the 2002 Mallik gas hydrate program, Modular Dynamic Test (MDT) data provided valuable insights into the potential productivity of gas hydrate-bearing reservoir sands (Figure 7; Courtesy GSC, Bulletin 585). These tests revealed for the first time that movable connate waters could be produced through the MDT tool within gas hydrate-saturated reservoir sand intervals. This revelation may importantly indicate an ability of the gas hydrate-saturated reservoir to transmit a pressure pulse with offtake of mobile connate waters. The MtElbert-01 MDT tests are expected to yield important data regarding gas hydrate-bearing reservoir connate water mobility, permeability, relative permeability, dynamic permeability (changing during dissociation of gas hydrate), and other data in combination with core and wireline logs. Analysis of this data is anticipated to help promote a better understanding of the potential productivity and potential production methods of these gas hydrate-bearing reservoirs. Three to four separate MDT sites within 2-3 interpreted gas hydrate-bearing reservoir sands are anticipated to be tested for up to 10 hours per test (Figure 6).

The MDT plan will be flexible to account for onsite interpretations and an ability to conduct pressure tests both within and outside of gas hydrate equilibrium conditions. The MDT tool basically allows a limited down-hole production test, which can yield this very important data. The MDT testing is planned for a dual-packer, open-hole approach. This approach is commonly run on the North Slope, but has never before been attempted within a gas hydrate-bearing interval in an open hole. A contingency 7" liner is planned to allow running of MDT in cased hole should the preferred open hole method have unacceptable operational difficulties. Planning meetings have been held with Schlumberger MDT experts in Houston and have included the team that designed and implemented the Mallik 2002 MDT program. The head of the Mallik 2002 MDT testing program, Steve Hancock, APA Engineering, will also be onsite to enable maximum data acquisition and flexibility. MDT results will be applied to reservoir model calibration and will help understand the important gas hydrate-bearing reservoir relative and dynamic dissociating permeabilities, all very important parameters to model production potential.

4.1.1.5 MDT Testing Procedure

The onsite criteria evaluated for selection of MDT test intervals included:

- MDT tool packer section 9 ft overall length (2 x 3 ft packer elements with 3 ft spacing in between packers)
- Do not set packer in previous disturbed area
- Uniform sand quality and reservoir saturation preferable
- Sufficient separation of test intervals so all tests conducted in undisturbed hydrate
- Packer set 3 feet minimum away from water zone (tool inlet 6 feet from water)

The sequence of MDT test procedure will include:

1) **Safety Meeting**: Review wireline logging operations, job responsibilities, and job hazards.

2) Setup MDT logging tool, stub lubricator, and wireline BOP's. Pressure test to 2,000 psi with 40/60% water/MEG. Run-In-Hole on Drillpipe and log on depth using GR at first MDT test interval.

3) Monitor MDT tool temperature read-out until rate of tool temperature change <1 ^{o}F/hour Expected duration: 1-2 hrs.

4) **First MDT Packer test Procedure**: Move MDT tool to the first straddle packer hydrate test interval. Set packers and test seal. Initiate flow using Pump-out sub (POS) to remove mud, filtrate (if any) and reservoir fluids.

- First flow period planned for 10 minutes or until gas and/or formation water has been detected. Maintain pressure at or below stability pressure while pumping. Shut in if pressure drops below 300 psi while pumping. The first build-up period will be 3-times the flow period duration.

- Second flow period planned for 50 minutes. Maintain pressure at or below gas hydrate stability pressure while pumping, and at a lower pressure than during flow period 1 if pump control allows. Shut in if pressure drops below 300 psi while pumping. The second build-up period is planned for 100 minutes.

- Gas and/or water samples will be taken early in the second flow period when near steady state flow conditions have been obtained, or as directed.

5) **Subsequent MDT Packer test Procedure**: Move MDT tool to the next straddle packer hydrate test interval. Set packers and test seal. Initiate flow using POS to remove mud, filtrate (if any) and reservoir fluids. Note that the second and subsequent MDT straddle tests may include optional fluid mobility and fracture (pump-in/break-down) testing

- Optional: Conduct a mobile fluids test by pumping slowly (or on-off operation) keeping the sandface pressure <u>**above**</u> the stability point. Continue pumping well until reservoir fluids are identified. Mobile formation water sample(s) may be taken and followed by a build-up period depending upon reservoir response

- First flow period planned for 10-15 minutes or until gas and/or formation water has been detected. Maintain pressure at or below hydrate stability pressure while pumping. Shut in if pressure drops below 300 psi while pumping. The first build-up period planned for 6-times the flow period duration.

- Second flow period planned for 60-120 minutes. Maintain pressure at or below hydrate stability pressure while pumping, and at a lower pressure than during flow period 1 if pump control allows. Shut in if pressure drops below 300 psi while pumping. The second build-up period will be 2-times the flow period or as directed.

- Gas and/or water samples will be taken early in the second flow period when near steady state flow conditions have been obtained, or as directed.

- Optional: Conduct fracture stimulation test. Release and re-set packer elements (to release free gas in the near wellbore area). Reverse POS and pump into the hydrate interval to initiate a fracture. Step up pressure slowly in 250 psi increments. Shut-in and monitor fluid loss for approximately 10 minutes at each step. Continue until fracture initiation is observed. After the fracture is initiated, pump approximately 0.5 gallons at maximum rate to extend the fracture and Shut-in. Monitor pressure falloff for approximately 15 minutes or until fracture closure is not observed (or as directed).

6) **MDT Probe test Procedure (Optional):** Move MDT tool to the first probe hydrate test interval. Set probe and test seal. Initiate flow using POS to remove filtrate (if any) and reservoir fluids. Flow until gas and/or water is detected and temperature trend has been established (or as directed depending upon formation response). No samples will be taken during probe tests. Shut-in will be for approximately 30 minutes or as directed. Release probe and move tool down to next interval and repeat as directed if time permits.

4.1.1.6 Operations Safety

Chilled (0 to 4 degrees Centigrade) mineral oil-based mud drilling fluid is critical to maintaining borehole stability, safe operations, and high-quality data acquisition. Coring is a non-routine activity; most of the below safety considerations, therefore, apply primarily to the coring operations and associated activities.

- Core point will be picked within the interpreted gas hydrate-bearing reservoir section: geologists, mudloggers, and driller should work closely together to ensure effective well control.
- During wireline retrieval of core, care must be taken to not "swab" excessive pore fluids up the drill-string. This interval has not been penetrated at this location and the exact nature of the pore fluids, while interpreted to contain gas hydrate, is not known; pore fluids may include water, gas hydrate, and/or free gas.
- Well control and assurance of delivery of the total objectives of the well will take precedence over geological core acquisition and termination criteria.

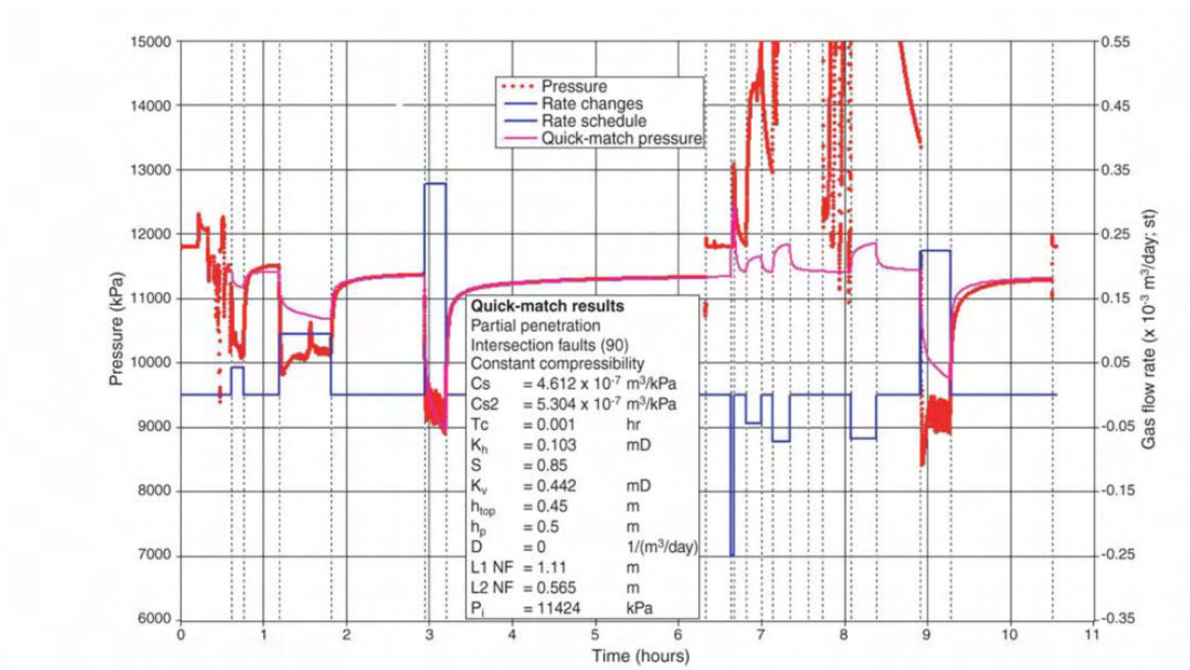


Figure 7: Simulation of pressure history using the interpreted formation parameters from the third (i.e. the longest) pre-minifrac buildup period, MDT-2 test (gas hydrate zone at 1089.8 m KB). JAPEX/JNOC/GSC et al. Mallik 5L-38 gas hydrate production research well. Abbreviations: Cs, wellbore-storage coefficient (initial); Cs2, wellbore-storage coefficient (final); D, turbulent-skin coefficient; h_p, perforated interval; h_{top}, distance from top of formation to top of perforation; L2 NF, distance to second no-flow boundary; m(p), pseudo-pressure; Pi, initial reservoir pressure; S, skin damage; st, standard conditions; Tc, time to end of initial wellbore-storage calculation.

1. Coring will commence in open reservoir and well control requirements take precedent over technical recommendations made for improved coring practice.
2. Coring is not a routine activity, the coring engineer, core specialist, core shift team leads, and BP Operations Geologist will lead Job Risk Assessments (JRA's) and discussions with the rig crew involved to ensure that safe and effective procedures are used before picking up the core barrel and beginning coring.
3. JRAs will be reviewed with each crew as program and shift changes occur.

- The core barrel will be large diameter within drillpipe; calculate the wireline-retrievable tripping rates to prevent swabbing.
- Normal drillfloor procedure for safe tripping and wire-lining is required.
- The reservoir sections may be cored with moderate overbalance so the adoption of procedures to avoid differential sticking of the coring assembly is essential until BHA is safely tripped into the surface casing.
- All core handling presents a manual handling risk. Core handling operations will be carefully reviewed with the team, and all risks eliminated or minimized. Manual handling refresher training will be performed with the team before the first core is handled, and then will be refreshed as required.
  1. Core laydown is not a routine activity. The coring engineer will lead a Job Risk Assessment and discussion with the rig crew involved to ensure that safe and effective procedures are used before beginning the core lay-down.
  2. Any misalignment of the inner tube during the cutting and the application of the shear boot may result in dropping the core onto the drill floor. This activity must therefore be conducted with great care.
  3. Stringent precautions for heavy lifting must be followed with care – this is one of the most potentially dangerous parts of the whole coring operation.
- Gas monitoring (sniffers) will be provided by BP HSE in the core processing trailer(s) to provide assurance for electrical or non-intrinsically safe equipment operations during hot-work permitted operations; detailed protocols will be developed onsite during JRA's.
- The core handling will involve cleaning the oil-based mud from the outside surface of the core. Proper PPE, wiping rags, and rag disposal must be followed to eliminate any environmental impacts of this operation.
- The core will be cut with chisel and hammer; proper PPE and precaution must be used to avoid rock chipping hazard and potential eye damage.
- Certain subsamples will be removed from the Corion processing trailer, marked with Styrofoam insert, and destroyed in the Core Press to obtain pore water samples. The Press operation, while simple, must be properly used and adequately cleaned between samples.
- Appropriate caution should be applied to the required compressed air line for the presses in the geo trailer. Note that if air line is needed to the cold trailer that it will not last very long in cold environment (i.e. pneumatic saw to cut inner barrel tabs). This issue will need to be worked out onsite.
- Appropriate caution should be applied to the required outdoor methane station and a nitrogen station near the core trailer. The methane and nitrogen bottles should be stabilized using a

standard bottle rack assembly and protected from the elements by placing them on the leeward side of the trailer and possibly constructing a temporary shelter, if needed.

- Core barrels have tabs which require cutting using a small abrasion air saw which must only be used by qualified operators (suppliers) with appropriate personal protective equipment including gloves, goggles, dust mask and earplugs. All non-essential staff should stand clear. A hot-work permit must be maintained for electrical equipment in the presence of potential out-gassing from hydrate dissociation of the core.
- Core processing is a non-routine activity. Pre-job briefings and training will be given to any staff that temporarily assist (e.g. rig crew, mudloggers).
- Team work hours will be monitored and a 12-hour shift system implemented. The baseplan is that no one should need to work longer than 12 hour days with a maximum of 16 hours. The baseplan for 24-foot core acquisition requires a 12 man team for processing within this framework (2 12-hour 6-man shifts) as documented in the below time estimate. This team of 12 is needed to maintain safe work hours for 2-3 days of successive 24 foot cores with approximately 90 minutes between cores. A 30-90 minute shift change-over time will be required during each shift change, depending on operations and difficulties.
- Core acquisition turn-around is expected to take 75 to 90 minutes per 24 foot core with the Corion system at optimum usage. Core processing and subsampling is estimated to require 60 minutes per 24 foot core.
- The planned MtElbert-01 core operation will be the longest yet in MPU experience with up to 600 feet of core (25 24-foot cores). Change out of team members over the anticipated 2-3 day coring time will be managed to minimize loss of learning and impact of handover.
- A number of air-lines and power cables will be routed to the core processing area and these must be properly located and connected. They must not constitute a trip hazard.
- All core processing activities must be discussed with and approved by the BP Drilling Supervisor before work begins. Proper permits must be obtained for any specialized procedures and equipment. Proper BP authorization is required for special required equipment such as power saws, centrifuge, rock press, etc.

4.1.1.7 Mudlogging Requirements

- Mud-logging interval is from surface to TD (~3000' TVDss)
- Gas-detection is required from surface to TD
- Gas chromatograph from surface to TD
- Catch and describe samples at the following intervals:
    - 60 foot spacing from 0 to 1,900' TVDss (Surface Casing Point)
    - 30 foot spacing from 1,900' TVDss to TD – see also below Special Sampling Requirements for this interval
- Head space gas samples
- Reporting requirements include regular morning report and lithology/gas logging
- Washed cuttings for the State per State AOGCC requirements for new pad

- Aerosol cans and isotubes, production hole, only where gas shows 5 times over background and additional samples every 10 feet in the anomaly; Some of these may go through later ARMIS analyses, to be determined
- Recommend paired samples (i.e., one aerosol cans and one isotube together) on every gas (total gas) anomaly about 5 times over background. Take additional paired samples in a thick anomaly about every 10 feet

- Canned Sample Cuttings: 60 foot spacing from 60 to 1900 feet (surface hole)
  30 foot spacing from bottom surface hole (1900 feet to TD
- Procedure: Obtain drill cutting samples for geochemical analysis and preserve the samples in pint or quart size paint cans as described below. The cuttings should be collected directly from the shaker table with a trowel. The sample should be collected as a single "grab" sample not a composite of the entire interval.

- Sampling Description:
  1. Collect cuttings directly from the shaker table using trowel.
  2. Place the cuttings in a pint size can (provided) and fill the can to half full (do not add water).
  3. Add a teaspoon of table salt, which is as bactericide (provided), to cuttings.
  4. Wipe can rim clean.
  5. Seal can with lid.
  6. Label can (depth and well name), both on the side and the bottom of the can.
  7. Turn the cans upside down and freeze. The samples will be shipped in provided coolers. During storage the samples should be frozen if possible.

4.2 Stratigraphic Test Well Results and Discussion

4.2.1 Summary Stratigraphic Test Well Results

Major research objectives accomplished during this reporting period included safely drilling and acquiring all recommended Phase 3a stratigraphic test well data. Acquired data included 430 feet core (100 feet gas hydrate-bearing), extensive wireline logging, and wireline production testing operations using the Modular Dynamic Testing (MDT) downhole tool. Significant pre-well planning, inclusion of world hydrate experts, and onsite vigilance were key elements to safely drilling and acquiring this data in February 2007 at MtElbert-01 on the Milne Point Unit exploration ice pad (Figure 8). Chilled oil-based drilling fluid mitigated operational safety concerns and enhanced core and data acquisition by maintaining gas hydrate and borehole stability during openhole drilling and operations.

Figure 8: Doyon 14 rig and pipeshed during early drilling operations on MtElbert-01, Milne Point Unit, Alaska North Slope, February 2007.

Significant Stratigraphic Test Well results during the reporting period included:

- Safely implemented well operations and data acquisition plans
    - Forwarded safety, policy, training, and procedure documents to all subcontractors
    - Switched to oil-based (versus water-based) chilled mud for operations and safety
    - Finalized staff roster, assignments, and shift schedules
    - Finalized plans and contracts, permits, and materials acquisition
    - Implemented detailed core acquisition, onsite sampling, and preservation program
    - Implemented logging-during-drilling, wireline, and MDT program plans
    - Implemented mud program and incorporated DrillCool, Inc. mudchilling system

- Successfully demonstrated ability to safely and effectively acquire data within shallow gas hydrate-bearing reservoirs over 7-10 days (versus the normal approach to drill and case within a maximum 2-4 days).

- Validated seismic interpretation of gas hydrate-bearing MtElbert prospect within MPU

- Acquired 430 feet of 3-inch diameter core, 100 feet of which were gas hydrate-bearing
    - Collected 261 onsite subsamples for preservation and analyses at various labs
        - 4 samples preserved in methane-charged pressure vessels (later converted to liquid nitrogen)
        - 7 samples preserved in liquid nitrogen
        - 52 samples for physical property analyses
        - 46 samples for interstitial water geochemistry
        - 5 samples for thermal property study
        - 86 samples for microbiological study
        - 46 samples for organic geochemistry study
        - 15 samples for detailed petrophysical analyses

- Acquired extensive open-hole wireline logs including gamma-ray, resistivity, neutron-density porosity, Dipole Sonic Acoustic porosity, Nuclear Magnetic Resonance, Formation Imaging, Electromagnetic Propagation, caliper.

- Acquired 4 extensive, long shut-in period MDT within 2 gas hydrate-bearing reservoirs
    - MDT analyses improving understanding of gas hydrate dissociation, gas production, formation cooling, and long-term production potential
    - MDT analyses providing calibration of reservoir simulation models
    - Obtained 4 gas samples from each test interval
    - Obtained 1 pre-dissociation formation water sample and demonstrated ability to flow mobile connate formation water from hydrate-saturated interval
    - Observed rapid formation cooling during gas hydrate dissociation and gas flow and demonstrated gas dissociation from hydrate with pressure drawdown

The 2007 Alaska North Slope MtElbert-01 Gas Hydrate Stratigraphic Test accomplished several ”firsts”, including:

- First significant ANS gas hydrate bearing core (100 feet of 430 feet acquired)
- First wireline retrievable coring system application using conventional ANS drilling rig
- First extensive ANS open hole multi-day data acquisition program in gas hydrate section
- First in world open-hole dual packer MDT program in gas hydrate bearing sections
- First ANS MDT sampling of both gas and water in gas hydrate-bearing reservoirs
- First in world sand face temperature data tracking during MDT flow and shut-in periods

The acquired data has helped calibrate reservoir simulation models and greatly improved understanding of gas hydrate dissociation, gas production, formation cooling, and possible future long-term production test design.

4.2.2 Gas Hydrate Saturation Results

Figure 9 illustrates a gas hydrate saturation log based on the Combinable Magnetic Resonance (CMR) log acquired in the MtElbert-01 Stratigraphic Test Well. Based on geophysical interpretations, the well was predicted to encounter 2 gas hydrate-bearing sands from 25-75' thickness within an upper zone (D) and a lower zone (C). Actual well results show these 2 sands to contain a combined 100' thickness of gas hydrate (Figure 9). Gas hydrate saturation varies primarily as a function of sand quality and silt/clay interbeds. In the cleanest sand zones, saturation reaches a maximum of 75% within the pore volume. The remaining 25% saturation is likely split between a mobile water phase and an irreducible water phase (bound to sand grains and clays) within the tight, hydrate-cemented sands.

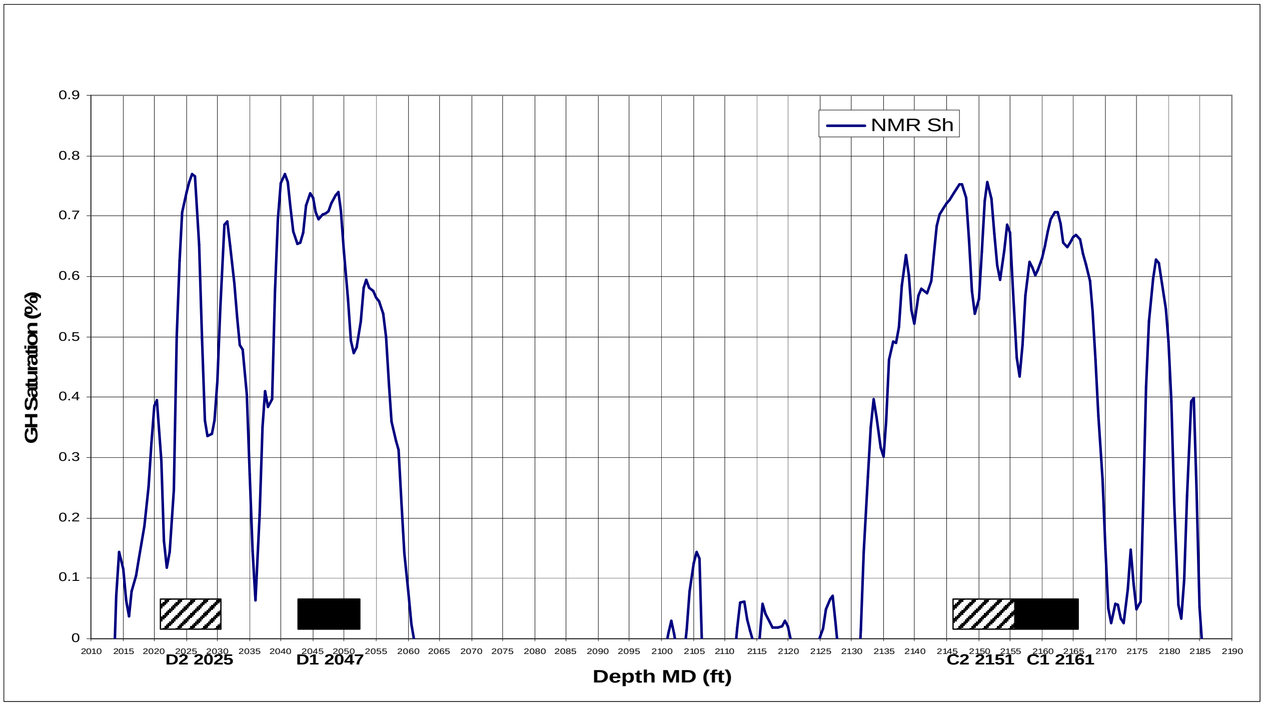


Figure 9: Gas Hydrate saturation based on Combinable Magnetic Resonance Log for MtElbert-01. Zones shown in stippled and block patterns were proposed sites for MDT logging during onsite evaluation of CMR by T. Collett, S. Hancock, R. Boswell, and R. Hunter.

4.2.3 Gas Hydrate Core Results

Application of the heat-exchange mud chilling unit operated by DrillCool, Inc. (Figure 10) was a key element to the successful acquisition of both core and log data. The chilled oil-based drilling fluid helped maintain stability of both gas hydrate and water-bearing sediments during drilling and extensive data acquisition operations. Over the 2.5 day coring program, 504 feet of mixed gas hydrate and water-bearing sediments were cored in 23 core runs. A total of 430 feet core was recovered, yielding an approximately 85% core recovery efficiency, similar to that recovered by similar methods in the 2002 Mallik gas hydrate core as reported in GSC Bulletin 585. The wireline core recovery enabled quick drilling and recovery of each core. Maximum core recovery possible per core run was up to 24 feet plus a few inches in core-catcher.

Figure 10: DrillCool, Inc. Heat Exchange Mud Chilling Unit onsite at MtElbert-01.

Approximately 100 feet of 503 feet cored was gas hydrate-bearing as shown in Figure 9. These results validated the 3D seismic interpretation of the MtElbert prospect (Figures 11 and 12). During core retrieval to the surface, the core passes through the upper limit of the gas hydrate stability zone and any gas hydrate-bearing sediment begins to dissociate into gas and water. Therefore, rapid processing of the core from the wireline retrieval from reservoir to surface at the rig floor, to the pipe shed, and to the processing and subsampling area helps preserve remaining gas hydrate within the core. From the rig floor (Figure 13), the core is moved into the cold pipeshed (Figure 14) where the inner barrel is separated and cut into 3-foot sections (Figure 15) prior to transport to the core processing "cold" trailer (Figures 16 and 17) for core description (Appendix A) and core subsampling (Figures 18-22).

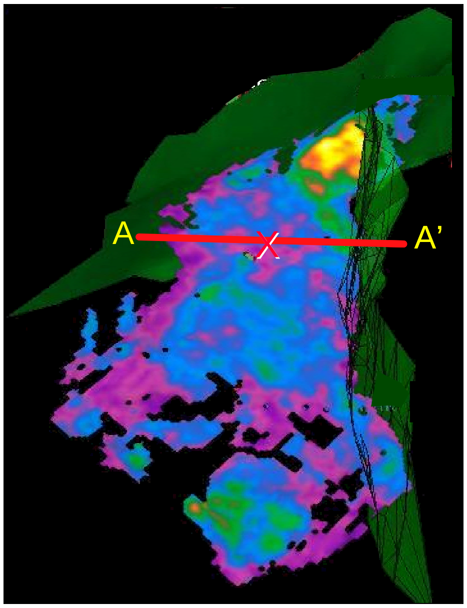


Figure 11: Seismic Amplitude map of MtElbert prospect within 3-way fault-bounded closure. The X marks the approximate MtElbert-01 location.

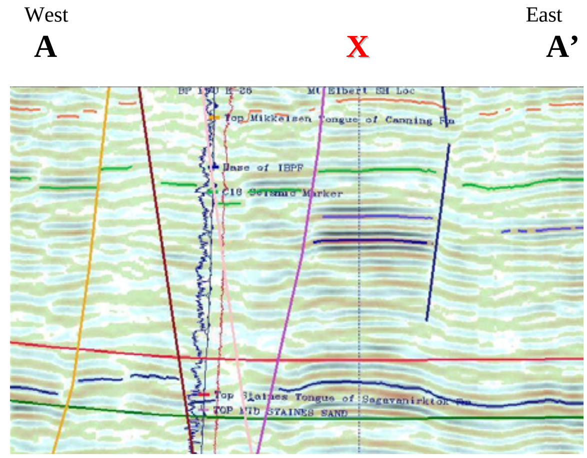


Figure 12: Seismic traverse A-A' (Figure 11) From West to East illustrates interpreted zone C and D gas hydrate-bearing intervals used for thickness and saturation calculations. The X marks the approximate location of the MtElbert-01 well. The double arrows mark the range of base gas hydrate stability. Note corroborating evidence of gas hydrate within zones C and D in the prominent velocity pull-up directly beneath these zones.

Figure 13: Core barrel being lowered from rig floor to pipeshed.

Figure 14: Core barrel inner liner separation in cold pipeshed processing area. Rig mats placed on pipe racks provided working surface.

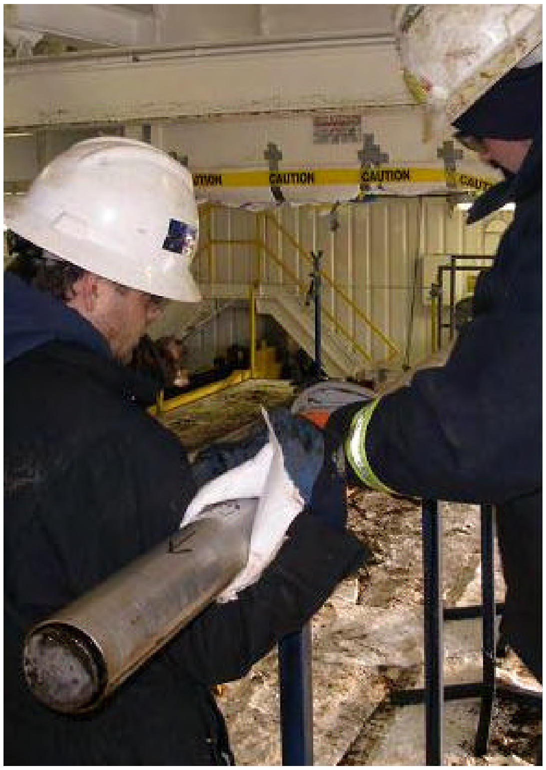


Figure 15: Core inner barrel cutting into 3 foot segments in pipeshed. Core end is visible on lower left side of photo.

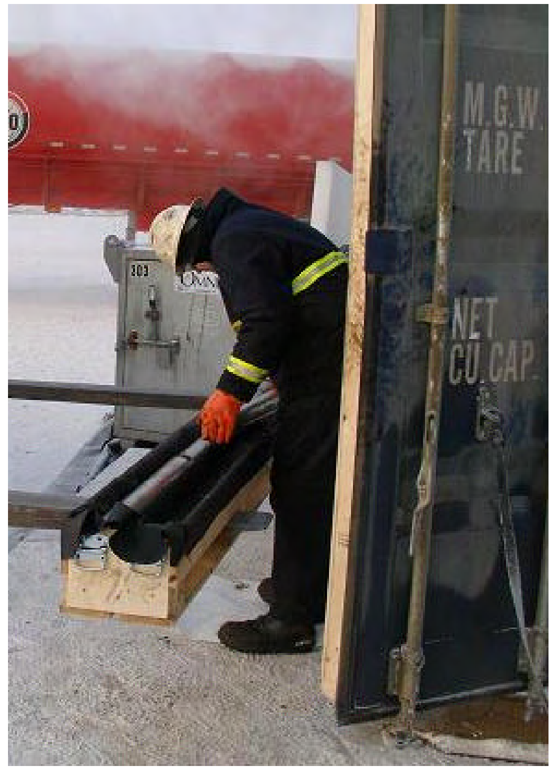


Figure 16: Transport of 3 foot core segments in lined box via forklift from pipeshed to core processing "cold" trailer.

Figure 17: Dr. Timothy Collett (USGS) describes initial gas hydrate-bearing core in core processing "cold" trailer, February 2007.

Figure 18: Robert Hunter (ASRC Energy) subsamples gas hydrate-bearing core in core processing trailer, February 2007.

Initial core processing was accomplished onsite, primarily to ensure that time and temperature-dependent measurements and subsamples were obtained before gas hydrate completely dissociated from the core. The core is scraped to reveal sediment beneath the rind of oil-based mud (Figure 17) to allow onsite description and choosing intervals for subsampling. Various subsamples are taken (Figure 18) for both time/temperature-dependent onsite analyses and for later offsite analyses.

Core temperature provides an indicator of gas hydrate presence (Figure 20). Over the first several minutes of onsite core processing, gas and water are actively dissociating from gas hydrate. This endothermic reaction cools the core and freezes the pore water. Both smaller and larger samples of gas hydrate were placed into water (Figure 21); where gas hydrate is present, the water causes the gas to more actively dissociate from the hydrate. Headspace gas evolves and can be studied qualitatively in cans (Figure 21) and syringes (Figure 22). During and following subsampling, an onsite description of the core was also completed (Appendix A).

Figure 19: Foam inserts mark where core was subsampled for headspace gas, microbiology, interstitial water and physical properties Appendix A details onsite description/subsamples.

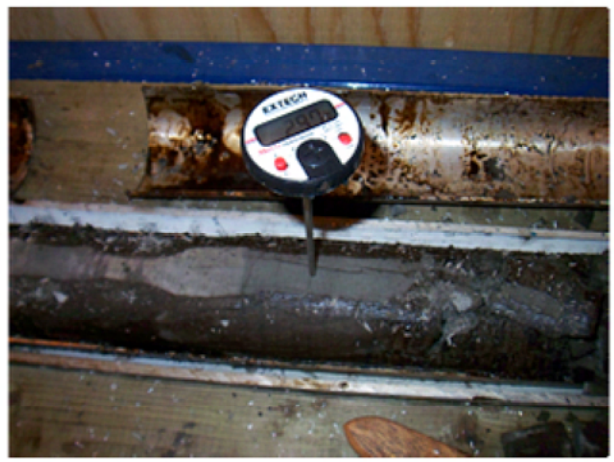


Figure 20: Temperature probe testing used to show decreasing temperature with time during gas hydrate dissociation in hydrate-bearing core samples during onsite subsampling.

Certain subsamples were acquired for further onsite processing to determine the saturation and composition of pore waters (Figures 23-26). Coring with the oil-based drilling fluid also ensured that only natural pore waters were present within the core. Samples were scraped to obtain a cleaner sediment from the innermost portion of the core and placed into a press to squeeze pure pore waters from the sample for later laboratory analyses.

Figure 21: Gas hydrate-bearing samples in water bubble with gas escape during gas dissociation onsite testing for gas hydrate bearing presence in core samples.

Figure 22: Gas hydrate-bearing sediment placed in syringe to monitor gas escape over time from gas hydrate dissociation in hydrate-bearing core samples during onsite analyses.

Figure 23: Whole core sample is scraped to remove oil-based drilling mud contamination.

Figure 24: Cleaner innermost portion of core prior to placement into drill-press to remove formation water for later laboratory analyses.

Figure 25: Marta Torres (Oregon State University) during subsampling of core for interstitial water for later analyses.

Figure 26: Warren Agena (USGS) and Kelly Rose (USDOE) work the drill-press to obtain pure interstitial water samples.

Subsampling studies collected 261 total subsamples processed onsite, primarily to preserve time and temperature dependent data. Eleven of these samples were preserved, four in methane-charged pressure vessels and seven in liquid nitrogen. Other samples were obtained for physical property measurements, petrophysics, water chemistry, thermal properties, and microbiological and organic geochemistry studies (Appendix A). Subsamples of the core will be analyzed at various laboratories in North America.

4.2.4 Gas Hydrate Wireline Logging Preliminary Results

Figure 27: Wireline logging operations at MtElbert-01 Gas Hydrate Strat Test.

Obtaining high-quality open hole logs was a primary data acquisition priority. Analyses of wireline logs are still underway. Excellent open hole logs were obtained, due in large part to the chilled, oil-based drilling fluids maintaining gas hydrate and borehole stability. A full suite of wireline logs were obtained, some with initial difficulties due to the cold (30 degree F) temperatures in the wellbore. Major logs included Platform Express (GR, Resistivity, neutron/density porosity, dipole sonic/acoustic porosity), ElectroMagnetic Propagation Tool (EPT), and Nuclear/Combinable Magnetic Resonance (NMR or CMR). As shown in Figure 9, the CMR logs were a direct indicator of gas hydrate saturation and helped in planning the Modular Dynamic Testing (MDT) wireline production test data acquisition. Figure 27 illustrates the logging unit onsite at MtElbert-01 and the Doyon 14 rig.

4.2.5 Gas Hydrate Wireline Modular Dynamic Testing (MDT)

Following the major logging runs, the second major data priority was to perform extensive wireline production testing using the MDT tool. Even though the MDT tests are small-scale, the results of these tests within two major gas hydrate-bearing zones (Figure 9) are enabling a better understanding of the nature of gas hydrate dissociation, gas production, formation cooling, and long-term production test potential.

The MDT tests were the first in the world open-hole, dual packer tests within gas hydrate bearing sediments. The extensive data acquired also included the first temperature measurements at the tool inlet or sand-face using a tiny programmable capsule to measure time, temperature, and pressure (Figure 28) mounted to the tool within a screen welded to the tool (Figure 29). The MDT program also obtained four gas samples and one pore water sample. Recorded observations indicated major formation cooling during gas hydrate dissociation and gas production during pressure draw-down. The response of the formation during shut-in and pressure build-up following production indicated that gas production during gas hydrate dissociation caused a choke in the formation, possibly due to the reformation of gas hydrate or formation of ice during the testing. Analyses and modeling of these test results are underway.

Figure 28: DSTmicro capsule data logger used to record time, temperature, and pressure during coring and during MDT logging operations. Data logger on right was destroyed during operations outside the pressure rating of the capsule.

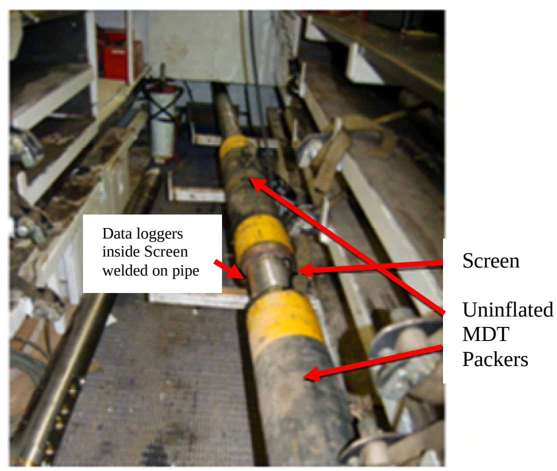


Figure 29: Photo of MDT tool with screen-mounted DSTmicro capsules welded to tool . (Photo courtesy Ray Boswell).

Table 2 shows the four major zones in which MDT testing occurred. Figure 9 shows these zones on the CMR log. Primary MDT test intervals were selected after evaluation of CMR log (Figure 9) and based on criteria outlined in Section 4.2.5.1. Figures 30-33 illustrate preliminary MDT results from onsite analyses by Steve Hancock, RPS APA Engineering. MDT analyses and reservoir modeling history match studies are underway.

Test Zone	Test Type	MDT Intake Depth (Ft)	Pressure Mud Column	Pore Pressure	Hydrate Stability Pressure	Temperature (Degrees F)
C1	Packer	2161	1045	938	547	38.8
C2	Packer	2151	1040	934	535	38.4
D1	Packer	2047	990	889	484	36.5
D2	Packer	2025	979	879	474	36.1

Table 2: MDT testing in major gas hydrate-bearing reservoir zones, MtElbert-01.

4.2.5.1 MDT Interval Selection Criteria

Onsite core description and wireline log analyses indicated the following interval selection for MDT testing:

1. Zone C sand: available test interval 2146-2166 feet (18 feet net); caution due to log and core indicating water below and poor reservoir quality above proposed test interval.
2. Zone C1, test interval 2156-2166 feet; proposed duration 3 hours or as-directed.
3. Zone C2, test interval 2146-2156 feet; proposed duration up to 12 hours or as-directed
4. Zone D sand; available test interval 2022-2053 feet (31 feet net); caution due to water above and below proposed test interval and 1-foot thick conglomerate at 2026.
5. Zone D1, test interval 2042-2052 feet; proposed duration up to 12 hours or as-directed.
6. Zone D2, test interval 2020-2030; proposed duration up to 12 hours, or as-directed.
7. Optional possible probe tests in water intervals at 2175 feet and 2015 feet, and/or various gas hydrate intervals to be determined and only if time permits; caution in water-bearing intervals due to potential for tool to plug with very fine grained sand.

4.2.5.2 MDT Preliminary Results

The preliminary results of MDT data acquisition are presented in this section of the report as data analyses were still underway at end quarter. Reservoir modeling and history matching of MDT results are also planned.

Zone C1 MDT testing:

- Planned short duration test
- First flow conducted with Flowing Bottom-hole Pressure (FBHP) below hydrate stability zone pressure
- First build up appeared to include non porous media affects
- Second flow conducted with FBHP below hydrate stability pressure
- Acquired gas sample
- Second build-up severely dampened
- Uncertain cause (freezing?), continued to second test
- No overpull on tool movement after 5-hour testing at station

Figure 30 illustrates the 5-hour Zone C1 MDT test profiles with flow and build-up periods.

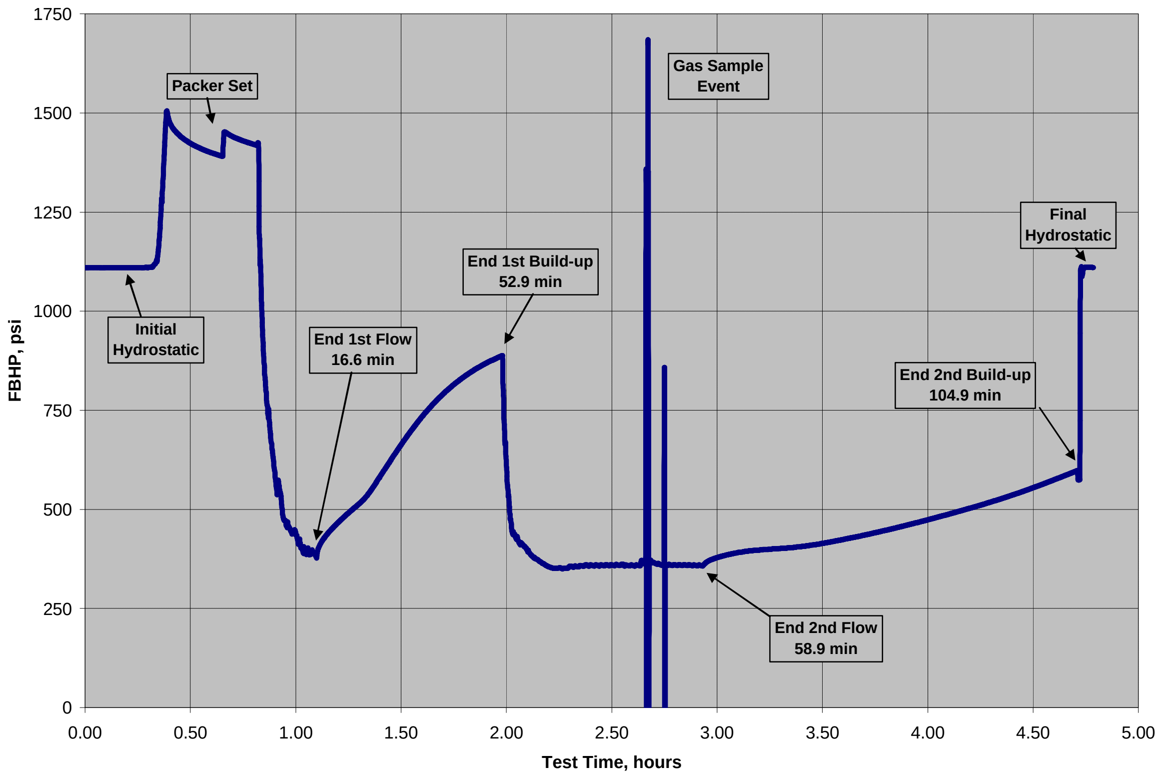


Figure 30a: MDT test pressures, flow, and build-up periods in gas hydrate-bearing zone C1

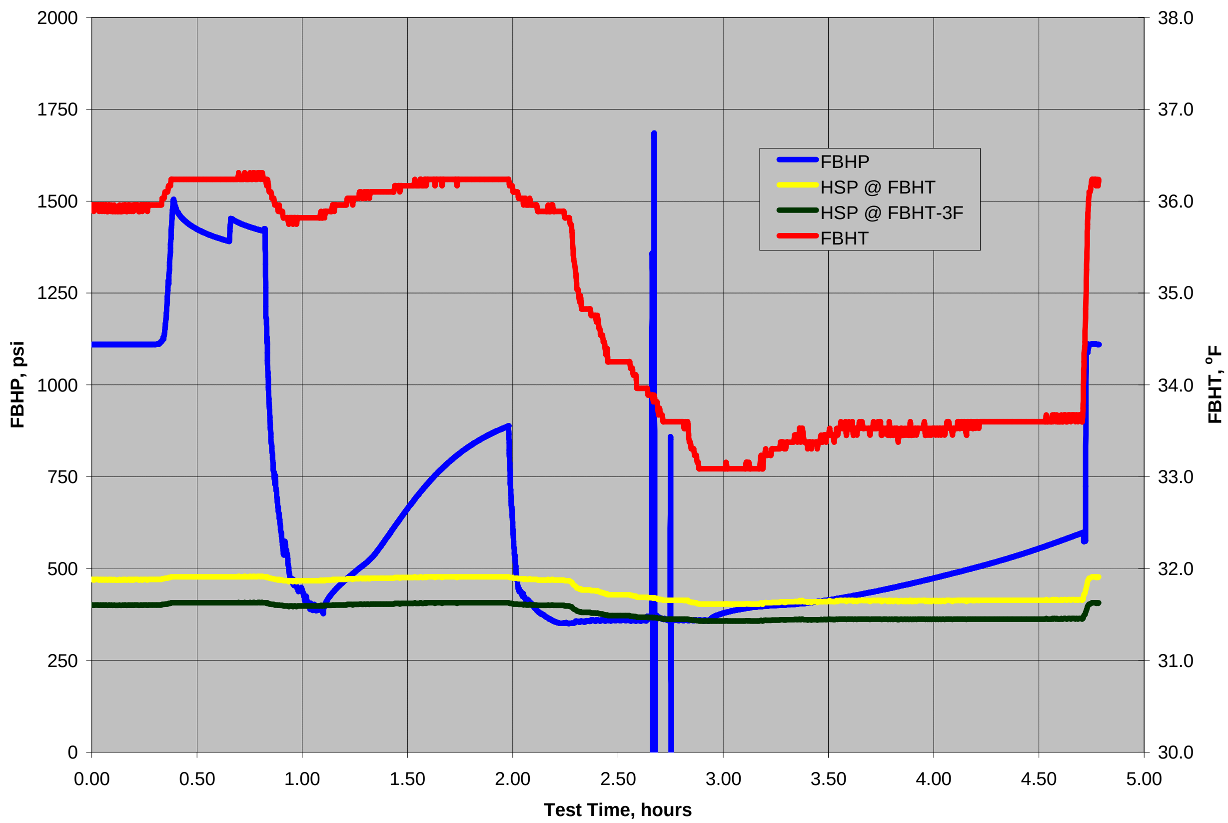


Figure 30b: MDT test pressures and temperatures in gas hydrate-bearing zone C1

Zone C2 MDT testing:

- First flow conducted with FBHP above hydrate stability pressure
- Classic porous media response observed on first build-up
- Second flow conducted with FBHP below hydrate stability pressure
- Second build-up distinctly different from first build-up
- Extended third flow with FBHP below hydrate stability pressure
- Pressure purposely maintained near 400 psi during third flow period
- Acquired gas sample
- Third build-up severely dampened;
- Uncertain cause (freezing effects?) still present after 4 hour shut-in
- Fourth flow ended with no inflow

Figure 31 illustrates the 11-hour Zone C2 MDT test profiles with flow and build-up periods.

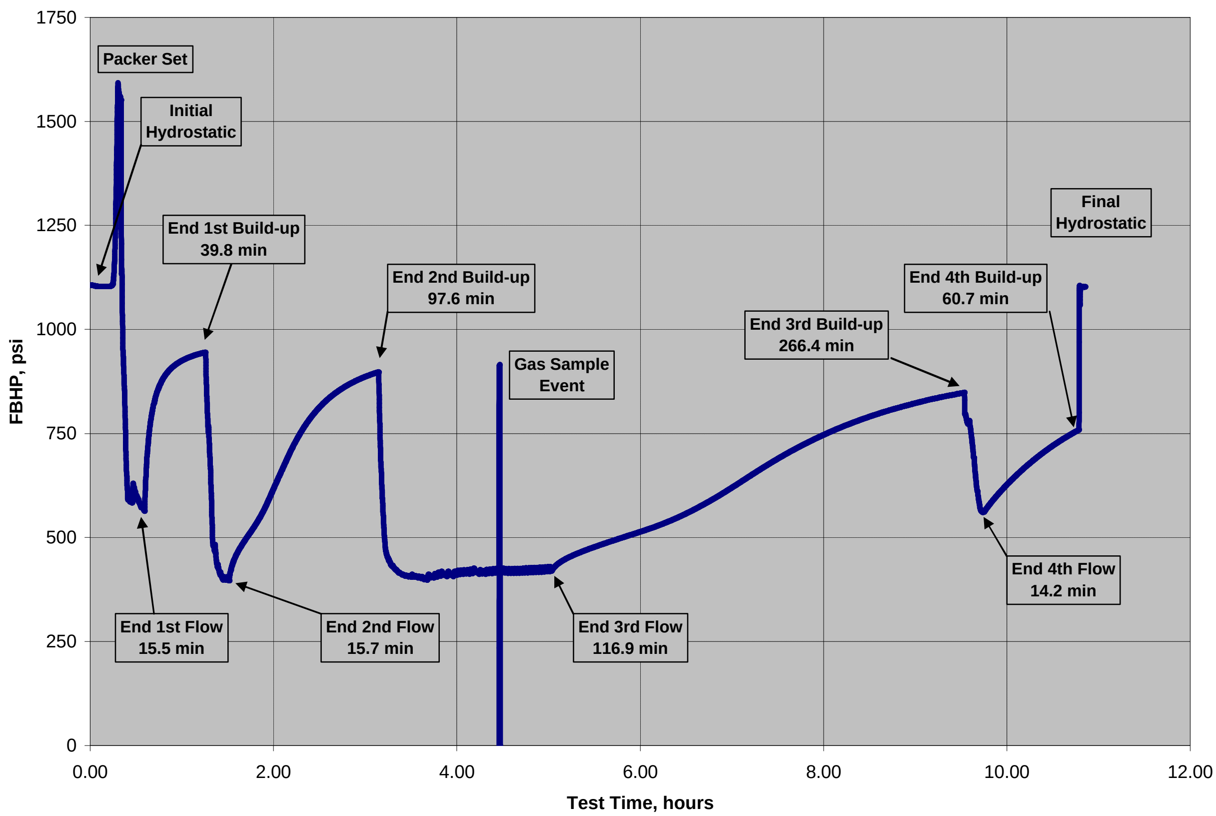


Figure 31a: MDT test pressures, flow, and build-up periods in gas hydrate-bearing zone C2

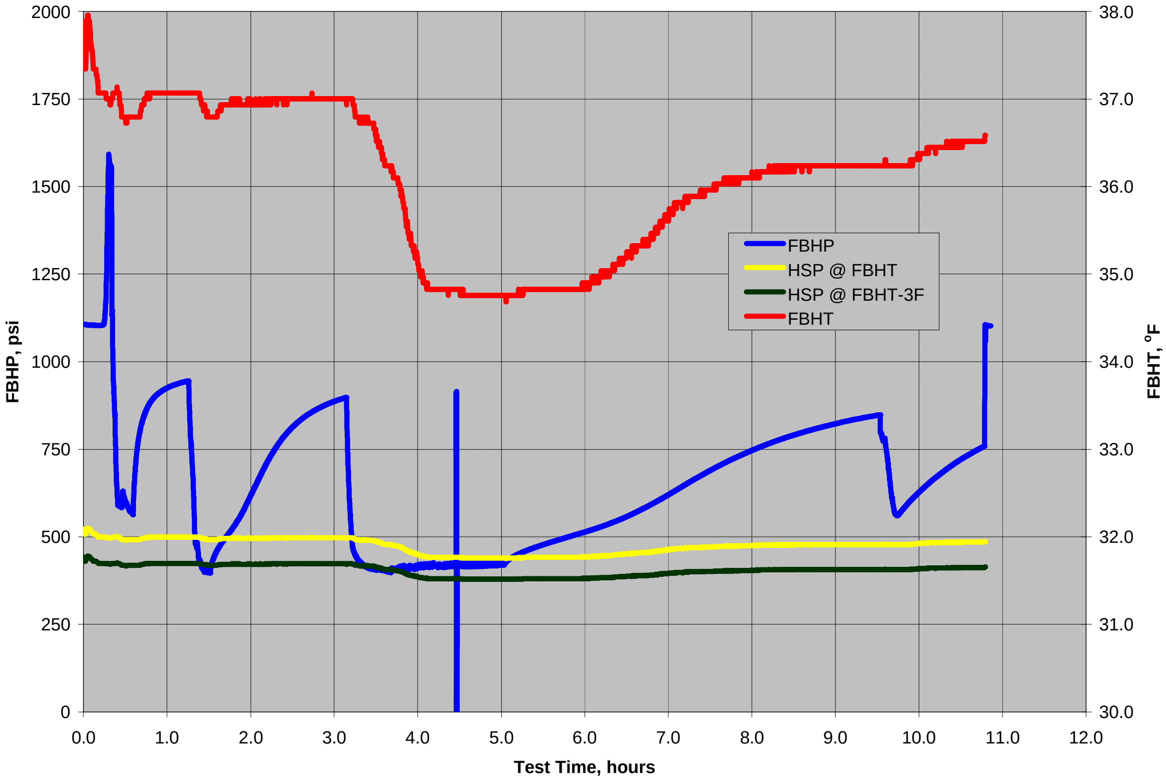


Figure 31b: MDT test pressures and temperatures in gas hydrate-bearing zone C2

Zone D1 MDT testing:

- First flow and extended second flow conducted with FBHP > hydrate stability pressure
- Pore water sample and Pressure Transient Analyses (PTA) data obtained with for formation water; gas hydrate undisturbed (no dissociation)
- Third flow conducted with FBHP < hydrate stability pressure
- Obtained gas sample during third flow period
- Detected decreasing pump performance due to extended pumping times and wear due to fine sediments in flow stream
- Third build-up ended prematurely due to packer seal failure

Figure 32 illustrates the 11-hour Zone D1 MDT test profiles with flow and build-up periods.

Zone D2 MDT testing:

- First flow conducted with FBHP > hydrate stability pressure
- Classic porous media response observed on first build-up
- Second flow conducted with FBHP < hydrate stability pressure – pump wear impeded ability to compress therefore flow test cut short – gas sample obtained (volume in bottle uncertain)
- Second build-up affected by similar effects as previous test

Figure 33 illustrates the 3-hour Zone D2 MDT test profiles with flow and build-up periods.

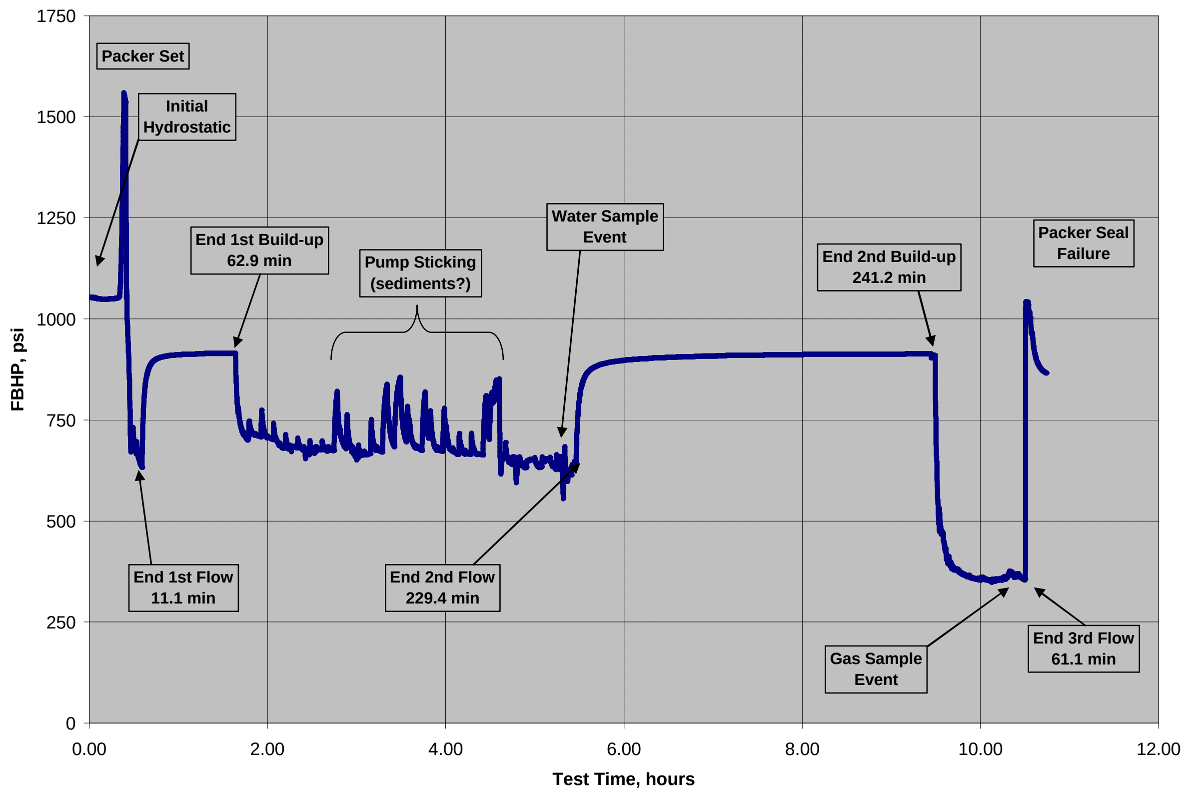


Figure 32a: MDT test pressures, flow, and build-up periods in gas hydrate-bearing zone D1

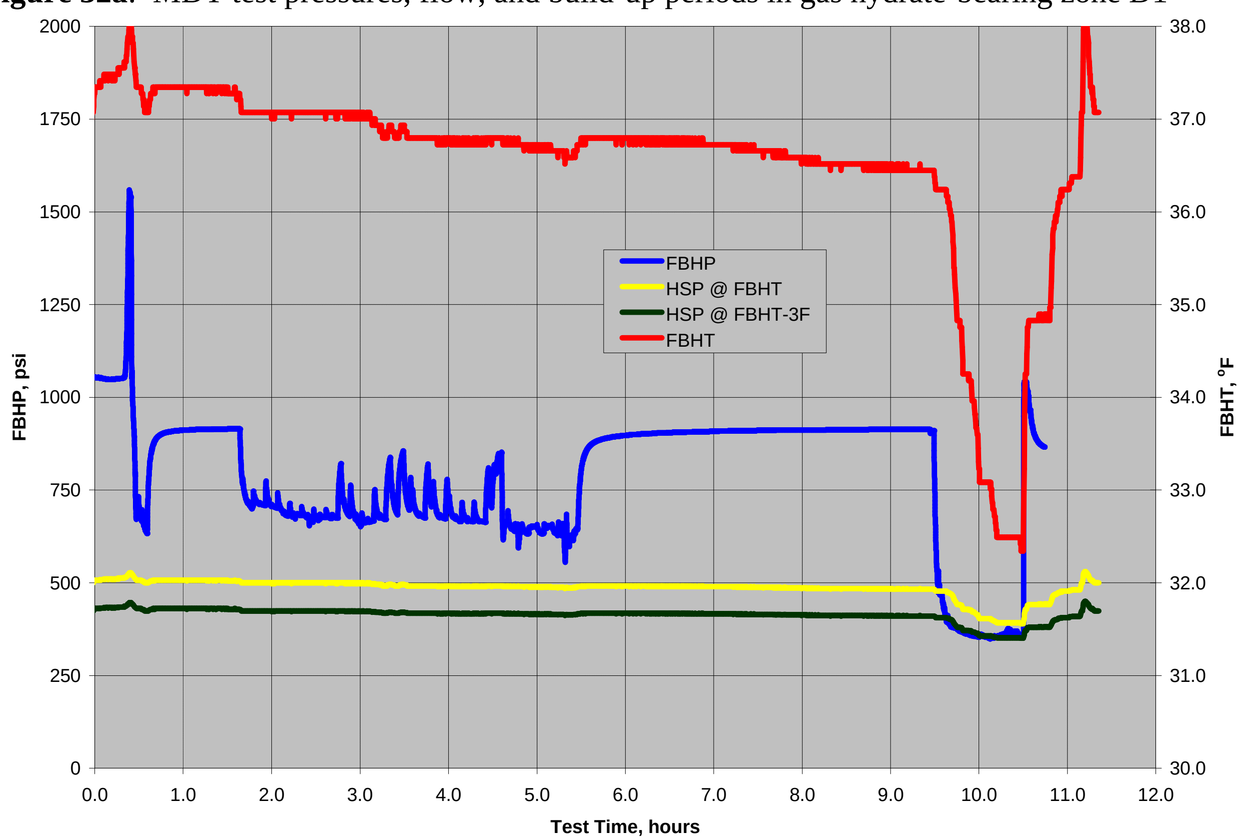


Figure 32b: MDT test pressures and temperatures in gas hydrate-bearing zone D1

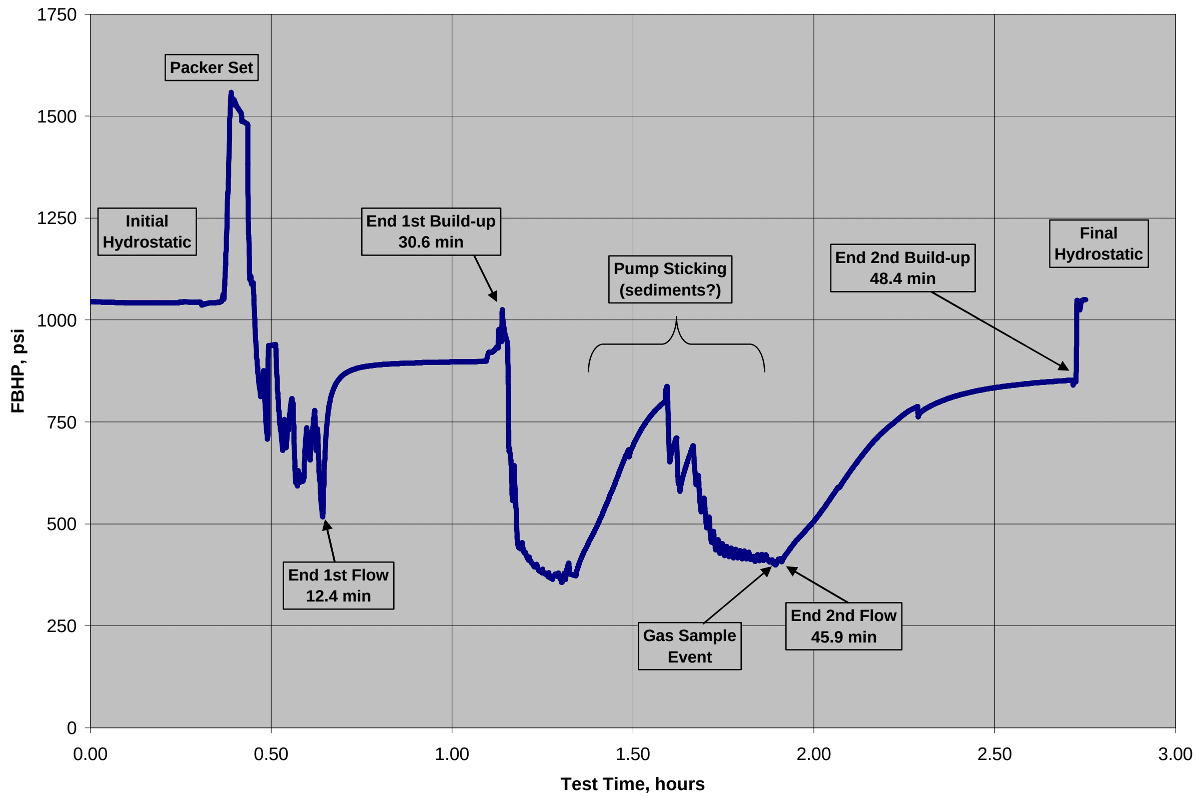


Figure 33a: MDT test pressures, flow, and build-up periods in gas hydrate-bearing zone D2

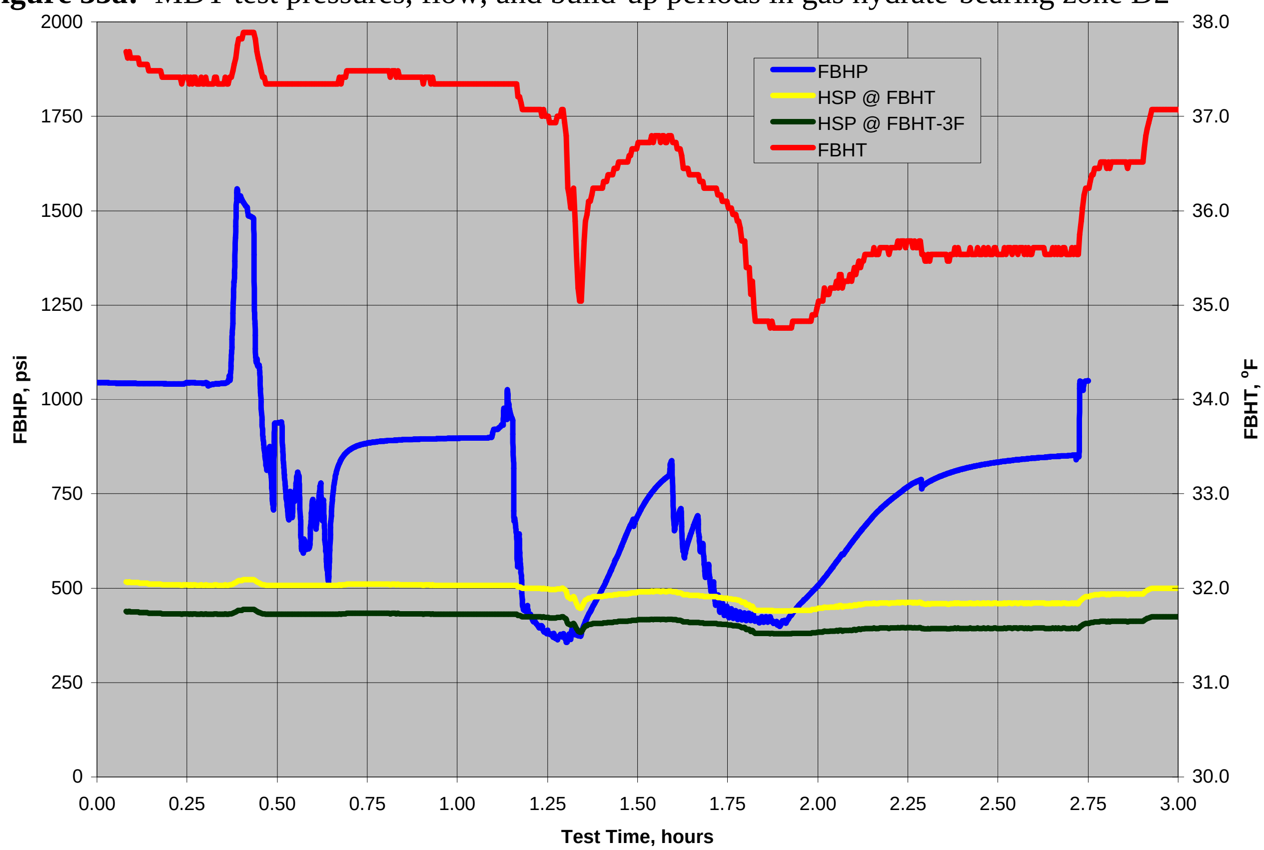


Figure 33b: MDT test pressures and temperatures in gas hydrate-bearing zone D2

Miscellaneous MDT testing results:

- Star-Oddi pressure and temperature logger data at MDT inlet to facilitate pressure match
- MDT probe tests of hydrate zones 2039 feet and 2032 feet failed due to lack of seal (soft water-bearing sediments)
- MDT packer test of water zone 2036 feet failed due to inlet plugging (fines migration); noted continued declining pump performance
- MDT packer test of water zone 2012 feet failed due to pump failure (sediment wear and plugging)
- MDT testing terminated (note extended initial testing in gas hydrate bearing zones enabled MDT tool to remain in-hole until testing terminated by probe and pump failures due primarily to anticipated fines migration

4.3 Stratigraphic Test Well Preliminary Conclusions and Relevancy

4.3.1 Gas Hydrate Saturation and Fluid Mobility

The maximum gas hydrate saturation as calculated by the CMR and associated logs is approximately 75% (Figure 9). Data is still being analyzed, but preliminary results indicate that although there is some mobile water in the hydrate-bearing formation, it might not be enough to maintain dissociation of gas hydrate through depressurization by producing the mobile water component. The pressure build-up periods during MDT testing were extensive (up to 12 hours total) and the abnormal build-ups after drawdown below gas hydrate stability pressure indicates that gas production from gas hydrate at these temperatures closer to the base permafrost may also require thermal or chemical stimulation to maintain gas flow during potential future production test operations. However, it needs to be emphasized that this is only a single well location and that an alternate case could still be found at higher temperatures and/or where more of the gas hydrate exists at lower saturations within a matrix of more pressure conductive and higher free water saturations and rock/sediment. Although lower saturations may seem detrimental to production practices, it could potentially provide a means of propagating a low pressure front farther into the formation than does the higher gas hydrate saturation case. This effect would favor the use of the counter-intuitive premise that a better gas rate might be achievable in a well with a more moderate hydrate saturation, while those with the higher hydrate saturation and lower movable water saturation (such as interpreted within MtElbert-01) may require thermal and/or chemical stimulation to achieve higher gas production rates. This production characteristic was also predicted in reservoir modeling efforts (documented in the June 2006 and prior quarterly reports) which compared gas hydrate production responses for several different water saturations and multiple reservoir permeabilities.

The C2 MDT test shown in the detailed graph (Figure 34) demonstrates that the formation response to initial drawdown is typical of porous media (albeit tight formation) response when pressures were maintained above the gas hydrate stability zone. However, once pressures were allowed to draw-down below the gas hydrate stability zone to induce gas (and water) dissociation, the following shut-in period shows an abnormal pressure rebound. Causes of this abnormality remain under investigation, but may be associated with reformation of hydrate or possibly the formation of ice within the porous media, acting as a formation choke to pressure recovery.

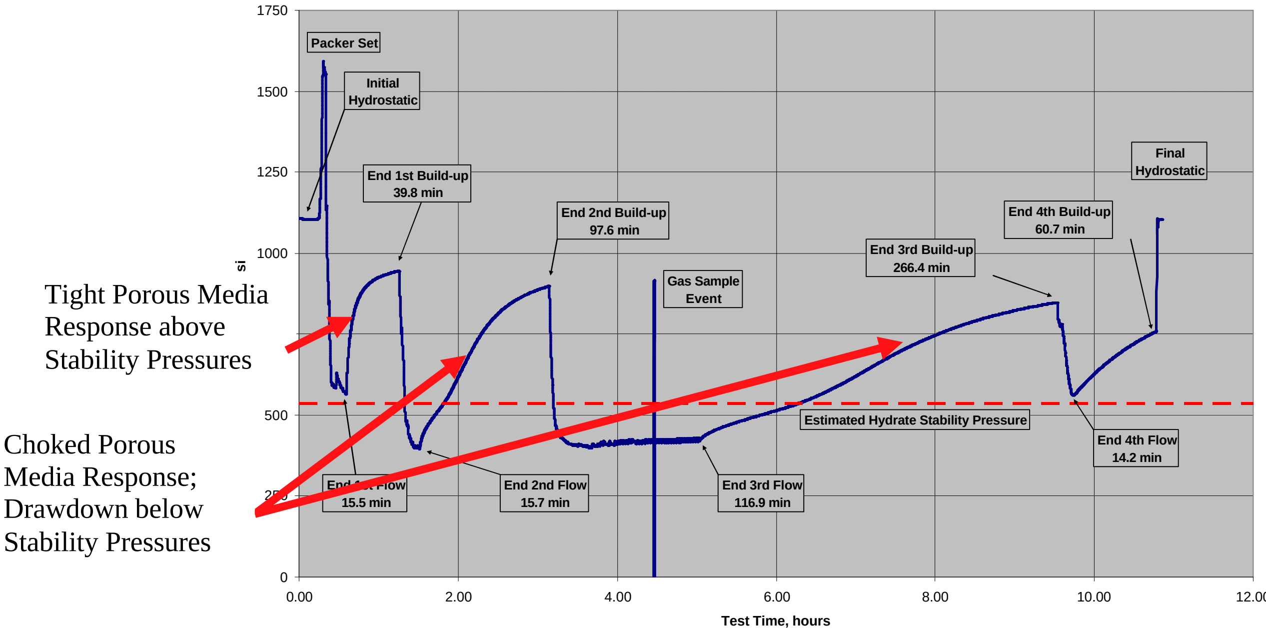


Figure 34: C2 MDT test preliminary interpretations.

Importantly, analyses of the stratigraphic test core, log, and MDT data will also help us better understand reservoir properties, permeabilities and saturations. These variables are very leveraging to understanding potential gas producibility from gas hydrate-bearing reservoirs and to design and planning of potential future Phase 3b production test operations.

5.0 STATUS REPORT

5.1 Cost Status

Costs for the Phase 3a Stratigraphic Test Well drilling, data acquisition, and associated studies were re-estimated and definitized in September 2006 following program deferral due to third party drilling rig delays in March 2006. Costs were budgeted based on project task and cost estimates for required contractual services associated with drilling, data acquisition, data evaluation, and Phase 3b planning and feasibility studies.

Comparison of budgeted versus actual cost by task is underway at the time of the writing of this report. Preliminary comparison indicates that certain task categories exceeded budget estimated; an internal study is underway to ensure that any cost overruns are clearly documented with reasons for any overrun, benefits of the additional cost, consequences of overrun on remaining budget, and identification of items outside scope of original budget. Table 3 illustrates the preliminary analyses indicating possible major cost overruns by category.

Task Category	Budgeted Cost ($ thousands)	Apparent Invoiced Cost* ($ thousands)	Final Contractor-Supplied Cost ($ thousands)	Invoiced (I) or Final (F) vs. Budgeted Cost ($ thousands)
Ice Road / Pad	$272	$640	$423	$146 (F) or $368 (I)
Well Logging	$632	$881	$881	$249
OBM Drilling Fluid	$120	$303	$303	$183
Abandon Charge	$80	$337	$80	$0 (F) or $257 (I)
TOTALS	**$1,104**	**$2,161**	**$1,687**	**$583 (F) or $1,057 (I)**

Table 3: Preliminary Comparison of Major Potential Cost Overruns by Task

* "Apparent Invoice Cost" that exceed Contractor-supplied cost may require reallocation into proper cost code category, which may resolve certain budget versus invoice discrepancies

Certain costs were recognized and agreed by BP and DOE to exceed the September 2006 budget prior to drilling of the well, including the switch to oil-based mud (OBM) to improve safety, borehole stability, and data acquisition; this switch to OBM also contributed to some of the increased logging costs.

Actions underway to further compare and contrast actual versus budgeted costs include:

1. Detailed study of "Central Dispatch" road equipment records for pre-drill and drilling costs to compare/contrast apparent overruns on ice road/pad and to recategorize charges, if necessary. Some of the apparent ice road/pad "overrun" indicated in the "Apparent Invoice Cost" of Table 3 may be misallocation of drilling-related equipment to the ice road/pad; this will be corrected using the dates of charges that correspond to dates of ice road/pad construction. For example, final ice road/pad costs are $640K according to categorized invoices, but are $423K according to vendor correspondence (Table 3). This work will include verification of contract versus fleet rates for equipment. Certain equipment was invoiced at variable rates; these rates will be verified with the vendor and corrected to final costs, if necessary.

2. Certain detailed invoice records from several vendors were identified as having potential to exceed budgeted costs and will be compared/contrasted to the original budget estimates. This work will clearly document reasons for any overruns or identify if required tasks were authorized outside of original scope. Additional documentation may be required from specific contractors.

3. Capital Wells Allocations may have been directed to the Drilling AFE for shared North Slope services from January-June 2007. If these expenditures are not directly related to drilling and data acquisition (including ice road/pad construction and abandonment), then they should be disallowed or recategorized.

4. Per pre-drill agreement with DOE, BP staff time is not billable, but will continue to be tracked for cost-share calculations.

5. Core analyses by Oregon State University, OMNI, and by GeoTech has been suspended pending resolution of budget and remaining funds. Limited reservoir modeling work and Phase 3b planning efforts continue.

5.2 Project Task Schedules and Milestones

5.2.1 U.S. Department of Energy Milestone Log, Phase 1, 2002-2004

Note that SOPO in contract amendments 1-8 for Phase 1.

Program/Project Title: DE-FC26-01NT41332: Resource Characterization and Quantification of Natural Gas-Hydrate and Associated Free-Gas Accumulations in the Prudhoe Bay - Kuparuk River Area on the North Slope of Alaska.

Identification Number	Description	Planned Completion Date	Actual Completion Date	Comments
Task 1.0	Research Management Plan	12/02 – 12/04	12/02 and Ongoing	Subcontracts Completed
Task 2.0	Provide Technical Data and Expertise	MPU: 12/02 PBU: * KRU: *	MPU: 12/02 PBU: * KRU: *	See Technical Progress Reports
Task 3.0	Wells of Opportunity Data Acquisition	Ongoing	Ongoing	See Technical Progress Reports
Task 4.0	Research Collaboration Link	Ongoing	Ongoing	See Technical Progress Reports
Subtask 4.1	Research Continuity	Ongoing	Ongoing	
Task 5.0	Logging and Seismic Technology Advances	Ongoing		See Technical Progress Reports
Task 6.0	Reservoir and Fluids Characterization Study	12/04	Ongoing to Phases 2 and 3	Interim Results presented, 2004 Hedberg Conference
Subtask 6.1	Characterization and Visualization	12/04	Ongoing to Phases 2 and 3	Interim Results presented, 2004 Hedberg Conference
Subtask 6.2	Seismic Attributes and Calibration	12/04	Ongoing to Phases 2 and 3	Interim Results presented, 2004 Hedberg Conference
Subtask 6.3	Petrophysics and Artificial Neural Net	12/04	Ongoing to Phases 2 and 3	Interim Results presented, 2004 Hedberg Conference
Task 7.0	Laboratory Studies for Drilling, Completion, Production Support	6/04	6/04	
Subtask 7.1	Characterize Gas Hydrate Equilibrium	6/04	6/04	Results presented, 2004 Hedberg Conference
Subtask 7.2	Measure Gas-Water Relative Permeabilities	6/04	6/04	Results presented, 2004 Hedberg Conference
Task 8.0	Evaluate Drilling Fluids	12/04		
Subtask 8.1	Design Mud System	11/03		
Subtask 8.2	Assess Formation Damage	9/05	Into Phase 2	
Task 9.0	Design Cement Program	12/04		
Task 10.0	Study Coring Technology	2/04	2/04	
Task 11.0	Reservoir Modeling	12/04	Ongoing task	Interim Results presented, 2004 Hedberg Conference
Task 12.0	Select Drilling Location and Candidate	9/05		Topical Report submitted, June 2005
Task 13.0	Project Commerciality & Phase 2 Progression Assessment	9/05	Redesigned 2005 Phase 2	BPXA and DOE decision

* Date dependent upon industry partner agreement for seismic data release

5.2.2 U.S. Department of Energy Milestone Log, Phase 2, 2006

Note that SOPO in contract Amendment 9 for Phase 2.

Program/Project Title: DE-FC26-01NT41332: Resource Characterization and Quantification of Natural Gas-Hydrate and Associated Free-Gas Accumulations in the Prudhoe Bay - Kuparuk River Area on the North Slope of Alaska.

Identification Number	Description	Planned Completion Date	Actual Completion Date	Comments
Task 1.0	Research Management Plan	1/05 – 1/06	Ongoing	Subcontracts Completed
Task 2.0	Provide Technical Data and Expertise	MPU: 12/02 PBU: * KRU: *	MPU: 12/02 PBU: * KRU: *	See Technical Progress Reports
Task 3.0	Wells of Opportunity Data Acquisition	Ongoing	Ongoing	See Technical Progress Reports
Task 4.0	Research Collaboration Link	Ongoing	Ongoing	See Technical Progress Reports
Subtask 4.1	Research Continuity	Ongoing	Ongoing	
Task 5.0	Logging and Seismic Technology Development and Advances	Ongoing		See Technical Progress/Topical Reports
Task 6.0	Reservoir and Fluids Characterization Study	12/06	Ongoing into Phases 2 and 3	
Subtask 6.1	Structural Characterization	12/06	Ongoing into Phases 2 and 3	
Subtask 6.2	Resource Visualization	12/06	Ongoing into Phases 2 and 3	
Subtask 6.3	Stratigraphic Reservoir Model	12/06	Ongoing into Phases 2 and 3	
Task 7.0	Laboratory Studies for Drilling, Completion, Production Support	12/06		Some Hiatus; Phase 2-3a design, studies, & decision
Subtask 7.1	Design Mud System	12/05		
Subtask 7.2	Assess Formation Damage	1/06		
Subtask 7.3	Measure Petrophysical and Other Physical Properties	9/06	Phase 3a	No Samples Acquired; await Phase 3a acquisition
Task 8.0	Design Completion / Production Test for Gas Hydrate Well	4/06	Mt Elbert-01 strat test only	Design of Phase 3a Strat Test operation Complete
Task 9.0	Field Operations and Data Acquisition Program Planning	4/06	Mt Elbert-01 strat test only	Planning for Potential operations underway
Task 10.0	Reservoir Modeling and Project Commercial Evaluation	1/06		Regional Resource Review & Development Planning
Subtask 10.1	Task 5-6 Reservoir models	Ongoing		
Subtask 10.2	Hydrate Production Feasibility	1/06		
Subtask 10.3	Project Commerciality & Phase 3a Progression Assessment	1/06		January 2006 approval for Phase 3a Stratigraphic Test

* Date dependent upon industry partner agreement for seismic data release

5.2.3 U.S. Department of Energy Milestone Log, Phase 3a, 2006-2007

Note that SOPO in contract Amendment 11 for Phase 3a.
Program/Project Title: DE-FC26-01NT41332: Resource Characterization and Quantification of Natural Gas-Hydrate and Associated Free-Gas Accumulations in the Prudhoe Bay - Kuparuk River Area on the North Slope of Alaska

Identification Number	Description	Planned Completion Date	Actual Completion Date	Comments
Task 1.0	Research Management Plan	1/06 – 12/07	Ongoing	Subcontracts Completed
Task 2.0	Provide Technical Data and Expertise	MPU: 12/02 PBU: * KRU: *	MPU: 12/02 PBU: * KRU: *	See Technical Progress Reports
Task 3.0	Wells of Opportunity Data Acquisition	Ongoing	As-identified	See Technical Progress Reports
Task 4.0	Research Collaboration Link	Ongoing	Ongoing	See Technical Progress Reports
Subtask 4.1	Research Continuity	Ongoing	Ongoing	
Task 5.0	Logging and Seismic Technology Development and Advances	Ongoing	As-needed	See Technical Progress/Topical Reports
Task 6.0	Reservoir and Fluids Characterization Study	12/07		Under No-cost Extension
Subtask 6.1	Structural Characterization	12/07		
Subtask 6.2	Resource Visualization	12/07		
Subtask 6.3	Stratigraphic Reservoir Model	12/07		
Task 7.0	Laboratory Studies for Drilling, Completion, Production Support	12/07		Under No-cost Extension
Subtask 7.1	Design Mud System	9/07		
Subtask 7.2	Assess Formation Damage	9/07		
Subtask 7.3	Measure Petrophysical and Other Physical Properties	9/07		
Task 8.0	Implement completion/production Test for gas hydrate well	3/07	3/07	Stratigraphic Test Well Drilled February 3-19, 2007
Task 9.0	Reservoir Modeling and Project Commercial Evaluation	12/07	Ongoing	Regional Resource Review & Development Planning
Subtask 9.1	Task 5-6 Reservoir models	12/07	As-needed	
Subtask 9.2	Project Commerciality & Phase 3b Production Test Decision	12/07	Early decision possible	Phase 3a Stratigraphic Test to mitigate uncertainties

* Date dependent upon industry partner agreement for seismic data release

5.2.4 U.S. Department of Energy Milestone Plans

(DOE F4600.3)

DOE F 4600.3#

U.S. DEPARTMENT OF ENERGY FEDERAL ASSISTANCE MILESTONE PLAN: PHASE 1

1. Program/Project Identification No. DE-FC26-01NT41332	2. Program/Project Title Resource Characterization and Quantification of Natural Gas-Hydrate and Associated Free-Gas Accumulations in the Prudhoe Bay - Kuparuk River Area on the North Slope of Alaska
3. Performer (Name, Address) BP Exploration (Alaska), Inc., 900 East Benson Blvd, P.O. Box 196612, Anchorage, Alaska 99519-6612	4. Program/Project Start Date 10/22/02* 5. Program/Project Completion Date 12/31/07 (through Phase 3a)

6. Identification Number	7. Planning Category (Work Breakdown Structure Tasks)	8. Program/Project Duration (Currently illustrates 2002-2004) O N D J F M A M J J A S O N D J F M A M J J A S-D	9. Comments (Primary work Performer)
Task 1.0	Research Management Plan	>>!>	BPXA
Task 2.0	Technical Data and Expertise	>>>>>>----->>>>------>>>>>>>>------------->>>>>>>>--------->>>>>>>>-->>>>>>>>--!-	BPXA
Task 3.0	Wells of Opportunity - Data	------>>>>>-------------->>>>>--------->>>>>>>>>>>>>>>---------->>>>>>>>>>>>>>>!-	BPXA
Task 4.0	Research Collaboration Link	>>!>	BPXA, USGS, UAF, UA
Task 5.0	Logging/Seismic Technology	>>>!	USGS, BPXA
Task 6.0	Characterize Reservoir/Fluid	------->>!>>	UA
Task 7.0	Lab Studies: Ph Behav, Rel k	-- ----->>!----------	UAF
Task 8.0	Evaluate Drilling Fluids	------->>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>--->>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>	UAF
Task 9.0	Design Cementing Program	------->>>>>>>>>>>>>>>>>>>>>>>>>>>	UAF
Task 10.0	Study Coring Techniques	-------->>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>- --	UAF
Task 11.0	Reservoir Modeling	>>>>------------------------>>>>>>>>>----------------->>>>>>>>>>>>>>>>>>>>>>!>>>	UAF, RyderScott
Task 12.0	Drilling Candidate Selection	>>>------ ----->>>>>>------->>>>>>>>>>>>---->>>>>>>>>>>>>!	BPXA, UA, USGS, RyderScott
Task 13.0	Commerciality Assessment	>>>>>>-------------------------------->>>>>>>>-------------->>>>>>>----->>>>>>>>>	BPXA, UAF, Ryder Scott

10. Remarks * Official Contract Date 10/22/02; Funded reduced-cost pre-Phase 1 from 10/01-10/02. Phase 1 project from 10/02 through 12/04.
Explanation of Symbols: (> = Major Task Work); (- = Minor Task Work); (! = Milestones).
Additional significant milestones presented in Quarterly Technical Progress Reports.

DOE F 4600.3#

U.S. DEPARTMENT OF ENERGY FEDERAL ASSISTANCE MILESTONE PLAN: PHASE 2-3a (2005-2006)

1. Program/Project Identification No. DE-FC26-01NT41332		2. Program/Project Title Resource Characterization and Quantification of Natural Gas-Hydrate and Associated Free-Gas Accumulations in the Prudhoe Bay - Kuparuk River Area on the North Slope of Alaska	
3. Performer (Name, Address) BP Exploration (Alaska), Inc., 900 East Benson Blvd, P.O. Box 196612, Anchorage, Alaska 99519-6612			4. Program/Project Start Date 10/22/02* 5. Program/Project Completion Date 12/31/07 (through Phase 3a)
6. Identification Task Number	7. Planning Category (Work Breakdown Structure Tasks)	8. Program/Project Duration (Currently illustrates Phases 2-3, 2005 - 2006) ← Planning/Analysis → ← DECISION---→ ←Planning--------→← IMPLEMENTATION deferred to 2007→ J F M A M J J A S O N D J F M A M J J A S O N D	9. Comments (Primary work Performer)
Task 1.0	Contracts and Research Management Planning	>>>>>>>!>>>--->>>>>!-->>>>>>>>>>>>>>>>>>!----------------------->>---->>-->>>>>>>	BPXA, AES
Task 2.0	Technical Data and Expertise	-->>>>>>----->>>>--!---->>>>>>>>>-------!--->>>>>>>>-------->>>>>>>-->>>>>>>>>--	BPXA, AES
Task 3.0	Wells of Opportunity - Data	------------->>>>>-!------------->>>>>---!----->>>>>>>>>>>>>>>------------>>>>>>>>	BPXA, AES
Task 4.0	Research Collaboration Link	---------->>>>>>>>>!---------->>>>>>>>>>!>>	BPXA, USGS, AES, UAF,UA
Task 5.0	Logging/Seismic Technology	>>>>>>>>>>>>>>>>>>>!>>>>>>>>>>>>>>>>>>>>!>>>>>>>>>>---------------------------->>	USGS, BPXA
Task 6.0	Characterize Reservoir/Fluid	------->>>>>>>>>>>>>!---------->>>>>>>>>>!>>>>>>>>>>>>>>>>---------->>>>>>>>>>>>>>	UA, USGS
Task 7.0**	Lab Studies: Drilling, Completion, Production	------------>>>>>>>!---------->>>>>>>>>>!>>>>>>>------------------>----->>>>>>>>>	UAF
Task 8.0**	Stratigraphic Test Decision, Design, and Implementation	-->>>>>>>>>>>!>>>----->>>>>>>>>>>>!>>>>>>>----------------------->>>>>>>>>>>	APA, BPXA, AES, UAF
Task 9.0**	Field Operations Planning and Implementation	---->>>>>>>>>!>>>-------->>>>>>>>>>!>>>>>>>----------------------->>>>>>>>>>>	APA, BPXA, AES, UAF
Task 10.0**	Reservoir Modeling and Commercial Evaluation	----->>>>>>>>>>>>>>!>>>>>>>>>>>>>>>>>---!---------------------------------------	RS, AES, BPXA, UAF

10. Remarks * Schedule shows Phases 2-3a from 2005 through end-2006. Phase 2 project from 1/05 through 12/05. Phase 3a stratigraphic test initiated 6/05 and included 9/05 Continuation Application culminating in 1/06 decision to Drill. . Explanation of Symbols: >> Major Task Work; -- Minor Task Work; ! Milestone. Significant technical work and milestones presented in Technical Progress and Topical Reports. **Note new (Phase 2-3a) Task numbers.

DOE F 4600.3#

U.S. DEPARTMENT OF ENERGY FEDERAL ASSISTANCE MILESTONE PLAN: PHASE 3a and 3b

1. Program/Project Identification No. DE-FC26-01NT41332	2. Program/Project Title Resource Characterization and Quantification of Natural Gas-Hydrate and Associated Free-Gas Accumulations in the Prudhoe Bay - Kuparuk River Area on the North Slope of Alaska
3. Performer (Name, Address) BP Exploration (Alaska), Inc., 900 East Benson Blvd, P.O. Box 196612, Anchorage, Alaska 99519-6612	4. Program/Project Start Date 10/22/02* 5. Program/Project Completion Date 12/31/07 (through Phase 3a)

6. Identification Task Number	7. Planning Category (Work Breakdown Structure Tasks)	8. Program/Project Duration (Currently illustrates Phases 3a-3b, 2007-2008 projection) ←Phase 3a Strat Test→ ←3b Planning →← 3b Decision →← IMPLEMENTATION→ J F M A M J J A S O N D J F M A M J J A S O N D	9. Comments (Primary work Performer)
Task 1.0	Contracts and Research Management Planning	!>>>>>>!>>>--->>>>>--->>>>>>>>>>>>>>>>>>>!------------------!---------->>!>>>>>>>>	BPXA, AES
Task 2.0	Technical Data and Expertise	!->>>>>>----->>>>------->>>>>>>>>-------!--->>>>>>>>-------!>>>>>>>>-->!>>>>>>--	BPXA, AES
Task 3.0	Wells of Opportunity - Data	!------------>>>>>--------------->>>>---!----->>>>>>>>>>>>>!>-----------!>>>>>>>>	BPXA, AES
Task 4.0	Research Collaboration Link	!>>>>>>>>>>>>>>>>>>------------>>>>>>>>>>!>>>>>>>>>>>>>>>>>>>!>>>>>>>>>>>>!>>>>>>>>	BPXA, USGS, AES, UAF,UA
Task 5.0	Logging/Seismic Technology	!>>>>>>>>>>>>>>>>>>->>>>>>>>>>>>>>>>>>>>!>>>>>>>>>>>>>>>>>>>!>>>>>>>>>>>>!>>>>>>>>	USGS, BPXA
Task 6.0	Characterize Reservoir/Fluid	!------>>>>>>>>>>>>-------------->>>>>>>>>>!>>>>>>>>>>>>>>>>---!------>>>>>!>>>>>>>>	UA, USGS
Task 7.0	Lab Studies: Drilling, Completion, Production	!------------>>>>>>>------------->>>>>>>>>>!>>>>>>>>>>>>>>>>>>>!>>>>>>>>>>>>!>>>>>>>>	UAF
Task 8.0	Implement 2007 Strat Test Evaluate/Design Production Test & Phase 3b progression	! -->>>>>>>>>>>>->>>>------>>>>>>>>>>>>>!>>>>>>>>>>>>>>>>>>>!>>>>>>>>>>>>!>>>>>>>>	APA, BPXA, AES, UAF
Task 9.0	Reservoir Modeling and Commercial Evaluation	!---->>>>>>>>>>>>>>->>>>>>>>>>>>>>>>>>>>>!>>>>>>>>>>>>>>>>>>>!>>>>>>>>>>>>!>>>>>>>>	RS, AES, BPXA, UAF

10. Remarks * Schedule shows Phases 3a-3b (3b not approved-indicated in red) from 2007 projected through end-2008. Phase 3a stratigraphic test deferred until early 2007 by 3rd party rig delay. Explanation of Symbols: >> Major Task Work; -- Minor Task Work; ! Milestone. Significant technical work and milestones presented in Technical Progress and Topical Reports. Note that 2008 Drilling Schedule apparently fully dedicated; additional drilling rigs under construction; 2009 Implementation possible.

5.3 1Q07 Reporting Period Significant Accomplishments

Approval to proceed into Phase 3a well operations resulted in drilling and data acquisition in the MtElbert-01 Stratigraphic Test during the reporting period from January through end-March 2007. These operations were safely accomplished and all recommended data was successfully acquired, including extensive wireline core, logging, and production testing. Data acquired is under evaluation in preparation for planning, site selection, budgeting, and seeking industry/government approval to proceed into Phase 3b long-term gas hydrate production test operations. Successful Phase 3a operations also proved the ability to safely, effectively, and cost-efficiently acquire data within the shallow gas hydrate-bearing Alaska North Slope reservoir zones. The Phase 3a data analyses will help narrow the significant uncertainties in reservoir properties and productivity potential in preparation for Phase 3b planning activities and operations decision.

5.4 Actual or Anticipated problems, delays, and resolution

Phase 3a Stratigraphic Test definitization documents and budgets were approved in late 2006. Contract amendments were completed in December 2006 to better define operations liabilities and extend Phase 3a data analyses and Phase 3b planning activities through end-December 2007. Apparent increases in well costs as detailed in Table 3 may lead to expenditure of budgeted funds before end-2007. Some of these increases were known and agreed prior to drilling and data acquisition operations:

1. Change to oil-based drilling fluid was agreed in early 2007 to increase borehole and gas hydrate stability and to enable higher quality assurance of core, log, and MDT data acquisition.
2. Moderate increase in wireline logging cost was needed to run logs compatible with change to oil-based drilling fluid.

Additional funding, if available, is sought to enable completion of Phase 3a data analyses and Phase 3b planning activities.

5.5 Project Research Products, Collaborations, and Technology Transfer

5.5.1 Project Research Collaborations and Networks

Project objectives significantly benefit from DOE awareness, support, and/or funding of the following associated collaborations, projects, and proposals.

1. **Reservoir Model studies:** DOE NETL and University of Akron coordination of reservoir modeling significantly increased collaborative reservoir modeling efforts with Japan, Lawrence Berkeley National Lab (LBNL), Pacific Northwest National Lab (PNNL), and University of Calgary and Fekete. This important work should continue into simulation of field-scale gas hydrate bearing reservoirs. The studies to-date have facilitated a common understanding of how these different gas hydrate reservoir models handle the basic physics of gas hydrate dissociation processes within gas hydrate-bearing formations and extend into analyses of Phase 3a data. Contributors to this effort include: Masanori Kurihara (Japan Oil Engineering Co., Ltd.), Yoshihiro Masuda (The University of Tokyo), Pete McGrail (Pacific Northwest National Laboratory), George Moridis

(Lawrence Berkeley National Laboratory, University of California), Hideo Narita (National Institute of Advanced Industrial Science and Technology), Mark White (Pacific Northwest National Laboratory), Joseph W. Wilder and Brian Anderson (University of Akron), Scott Wilson (Ryder Scott Company, Consultant to BP-DOE project), Mehran Pooladi-Darvish and Huifang Hong (University of Calgary and Fekete), Timothy Collett (U.S. Geological Survey), and Robert Hunter (ASRC Energy Services; BP Exploration (Alaska), Inc.).

2. **DE-FC26-01NT41248:** UAF/PNNL/BPXA studies to investigate the effectiveness of CO_2 as a potential enhanced recovery mechanism for gas dissociation from methane hydrate. DOE currently supports this associated project research which may help facilitate a future field test of this technology. If Phase 3b production testing proceeds, an Alaskan source of CO_2 for latter stage testing may be available.
3. **UAF/Argonne National Lab project:** This associated project was approved for funding by the Arctic Energy and Technology Development Lab (AETDL), forwarded to NETL for review, and was funded in mid-2004. The project is designed to determine the efficacy of Ceramicrete cold temperature cement for possible future gas hydrate drilling and completion operations. Evaluating the stability and use of an alternative cold temperature cement may enhance the ability to maintain the low temperatures of the gas hydrate stability field during drilling and completion operations and help ensure safer and more cost-effective operations. In early 2006, the Ceramicrete material was approved for field testing at the BJ Services yard in Texas (primary contact Lee Dillenbeck). Although Ceramicrete was not yet field tested in time to be evaluated for use in 2007 Alaska operations, successful future yard testing of the material may enable limited testing in Alaska project operations.
4. **Precision Combustion, Inc. (PCI) – DOE collaborative research project:** Potential synergies from this DOE-supported research project with the BPXA – DOE gas hydrate research program were recognized in December 2003 by Edie Allison (DOE). Communications with Precision Combustion researchers indicate possible synergies, particularly regarding potential in-situ reservoir heating. Successful modeling and lab work could potentially proceed into field applications in future gas hydrate operations. BPXA provided a letter in April 2004 in support of progression of PCI's project into their phase 2: prototype tool design and possible surface testing. If the project proceeds into Phase 3b operations, a thermal component of production testing may be necessary and a delivery mechanism may incorporate this technology.
5. **UAF shallow resource (gas hydrate and viscous oil) research initiatives:** UAF proposed that AETDL fund Alaska shallow resource research initiatives. This associated research could provide benefits to this project. It should be noted that industry could take a leadership role in these initiatives, similar to the approach taken in this project.
6. **Japan gas hydrate research:** Progress toward completing the objectives of this project remain aligned with gas hydrate research by Japan Oil, Gas, and Metals National Corporation (JOGMEC), formerly Japan National Oil Corporation (JNOC). JOGMEC remains interested in research collaboration, particularly if this project proceeds into production testing operations. Communications with JOGMEC were limited during the reporting period, but were renewed in June 2006, to inform JOGMEC that the BP-DOE project is proceeding into Phase 3a stratigraphic test field operations. JOGMEC may proceed into future (2007-2008?) production test operations at the Mallik field site.

7. **India gas hydrate research:** India's Institute of Oil and Gas Production Technology (IOGPT) indicates a continued interest in participating with the BPXA – DOE research program in correspondence/discussion with DOE. Dr. Tim Collett, partner in the BPXA-DOE research team, and Ray Boswell, DOE gas hydrate program, led and participated in, respectively, certain aspects of the data acquisition at multiple offshore India field sites. India sent a technical observer to view ANS Phase 3a operations and data acquisition. The value of international research collaboration is recognized.
8. **Korea gas hydrate research:** Korea may be developing a gas hydrate research program. Korea has discussed potential participation in future Alaska gas hydrate research with USGS. BPXA has not initiated contact with Korea.
9. **China gas hydrate research:** China may be developing a gas hydrate research program. BPXA has not initiated contact with China.
10. **U.S. Department of Interior, USGS, BLM, State of Alaska DGGS:** An additional collaborative research project under the Department of Interior (DOI) may provide significant benefits to this project. The BLM, USGS, and the State of Alaska recognize that gas hydrate is potentially a large untapped ANS onshore energy resource. To develop a more complete regional understanding of this potential energy resource, the BLM, USGS and State of Alaska Division of Geological and Geophysical Surveys (DGGS) have entered into an Assistance Agreement to assess regional gas hydrate energy resource potential in northern Alaska. This agreement combines the resource assessment responsibilities of the USGS and the DGGS with the surface management and permitting responsibilities of the BLM. Information generated from this agreement will help guide these agencies to promote responsible development if this potential arctic energy resource becomes proven. The DOI project is working with the BPXA – DOE project to assess the regional recoverable resource potential of onshore natural gas hydrate and associated free-gas accumulations in northern Alaska, initially within current industry infrastructure.

5.5.2 Project Research Technologies/Techniques/Other Products

Multiple technologies are under evaluation in association with this project. With research progression into Phase 3 operations, technologies under evaluation include gas hydrate production techniques such as thermal and/or chemical stimulation to enhance gas dissociation during future Phase 3b production testing, if approved.

5.5.3 Project Research Inventions/Patent Applications

DOE granted an advance patent waiver to the project in 2003. No patents are currently recorded in association with the project.

5.5.4 Project Research Publications

5.5.4.1 General Project References

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5.5.4.2 University of Arizona Research Publications and Presentations

5.5.4.2.1 Professional Presentations

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5.5.4.8 Short Courses

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5.5.4.9 Websites

There are currently no external project-sponsored websites. Project information is available on the DOE website: http://www.fossil.energy.gov/programs/oilgas/hydrates/index.html. A project internal website has been developed for storage, transfer, and organization of project-related files, results, and studies. This website is available to project participants only; information contained on this working website will be finalized and released at project final reporting.

6.0 CONCLUSIONS

The first dedicated gas hydrate coring and production testing well, NW Eileen State-02, was drilled in 1972 within the Eileen gas hydrate trend by Arco and Exxon. Since that time, ANS methane hydrates have been known primarily as a drilling hazard. Industry has only recently considered the resource potential of conventional ANS gas during industry and government efforts in working toward an ANS gas pipeline. Consideration of the resource potential of conventional ANS gas helped create industry - government alignment necessary to reconsider the resource potential of the potentially large (44 – 100 TCF in-place) unconventional ANS methane hydrate accumulations beneath or near existing production infrastructure. Studies show this in-place resource is compartmentalized both stratigraphically and structurally within the petroleum system.

The BPXA – DOE collaborative research project enables a better understanding of the resource potential of this ANS methane hydrate petroleum system through comprehensive regional shallow reservoir and fluid characterization utilizing well and 3D seismic data, implementation of methane hydrate experiments, and design of techniques to support potential methane hydrate drilling, completion, and production operations.

Following discovery of natural gas hydrate in the 1960-1970's, significant time and resources have been devoted over the past 40 years to study and quantify natural gas hydrate occurrence. However, only in the past decade have there been significant attempts to understand the potential recoverability of methane from hydrate. Although significant in-place natural gas hydrate deposits have been identified and inferred, estimation of potential recoverable gas from these deposits is difficult due to the lack of empirical or even anecdotal evidence.

The potential to induce gas hydrate dissociation across a broad regional contact from adjacent free gas depressurization is demonstrated by the results of the collaborative BPXA-LBNL pre-Phase 1 scoping reservoir model (presented in the March 2003 Quarterly report and technical conferences) and corroborated by the results of continued UAF and Ryder Scott reservoir model research as presented in Section 5.9 of the December 2003 Quarterly report.

The possibility to induce in-situ gas hydrate dissociation through producing mobile connate waters from within an under-saturated gas hydrate-bearing reservoir establishes saturation and permeability as key variables which, when better understood, could help mitigate productivity uncertainty. A schematic potential development screening study was undertaken to set ranges on the potential resources that might one day be recovered (if production is technically and economically feasible) given various possible production scenarios of the ANS Eileen gas hydrate trend, which may contain up to 33 TCF gas-in-place. Type-well production rates modeled at 0.4-2 MMSCF/d yield potential future peak field-wide development forecast rates of up to 350-450 MMSCF/d and cumulative production of 0-12 TCF gas. Individual wells would exhibit a long production character with flat declines, potentially analogous to Coalbed Methane production.

Results from the various scenarios show a wide range of potential development outcomes. None of these forecasts would qualify for Proved, Probable, or even Possible reserve categories using the SPE/WPC definitions since there has yet to be a fully documented case of economic production from hydrate-derived gas. Each of these categories would, by definition, require a positive economic prediction, supported by historical analogies, prudent engineering judgment, and rigorous geological characterization of the potential resource before a decision on an actual development could proceed.

Phase 3a stratigraphic test field operations enabled acquisition of critical gas hydrate-bearing reservoir data. Key data acquired included wireline cores, logs, and production (MDT) testing of gas hydrate-bearing reservoir sands and associated sediments. Analyses of the core, log, and MDT results is underway and should help reduce the uncertainty regarding gas hydrate-bearing reservoir productivity and improve planning of Phase 3b gas hydrate production test studies, although Phase 3b operations are not currently approved.

7.0 LIST OF ACRONYMS AND ABBREVIATIONS

Acronym	Denotation
2D	Two Dimensional (seismic or reservoir data)
3D	Three Dimensional (seismic or reservoir data)
AAPG	American Association of Petroleum Geologists
AAT	Alaska Arctic Terrane (plate tectonics)
AETDL	Alaska Energy Technology Development Laboratory
ADEC	Alaska Department of Environmental Conservation
ANL	Argonne National Laboratory
ANN	Artificial Neural Network
ANS	Alaska North Slope
AOGCC	Alaska Oil and Gas Conservation Commission
AOI	Area of Interest
AVO	Amplitude versus Offset (seismic data analysis technique)
ASTM	American Society for Testing and Materials
BGHSZ	Base of Gas Hydrate Stability Zone
BHA	Bottom Hole Assembly; equipment at bottom hole during drilling operations
BIBPF	Base of Ice-Bearing Permafrost
BLM	U.S. Bureau of Land Management
BMSL	Base Mean Sea Level
BP	BP or BPXA
BPXA	BP Exploration (Alaska), Inc.
CMR	Combinable Magnetic Resonance log (wireline logging tool – see also NMR)
DOI	U.S. Department of Interior
DGGS	Alaska Division of Geological and Geophysical Surveys
DNR	Alaska Department of Natural Resources
EM	Electromagnetic (referencing potential in-situ thermal stimulation technology)

ERD	Extended Reach Drilling (commonly horizontal and/or multilateral drilling)
FBHP	Flowing Bottom-Hole Pressure (during MDT wireline production testing)
FEL	Front-End Loading, reference to effective pre-project operations planning
FG	Free Gas (commonly referenced in association with and below gas hydrate)
GEOS	UA Department of Geology and Geophysics
GH	Gas Hydrate
GOM	Gulf of Mexico (typically referring to Chevron Gas Hydrate project JIP)
GR	Gamma Ray (well log)
GTL	Gas to Liquid
GSA	Geophysical Society of Alaska
HP	Hewlett Packard
HSE	Health, Safety, and Environment (typically pertaining to field operations)
JBN	Johnson-Bossler-Naumann method (of gas-water relative permeabilities)
JIP	Joint Industry Participating (group/agreement), ex. Chevron GOM project
JNOC	Japan National Oil Corporation
JOGMEC	Japan Oil, Gas, and Metals National Corporation (reorganized from JNOC 1/04)
JSA/JRA	Job Safety Assessment/Job Risk Assessment; part of BP HSE operations protocol
KRU	Kuparuk River Unit
LBNL	Lawrence Berkeley National Laboratory
LDD	Generic term referencing Logging During Drilling (also LWD and MWD)
LNG	Liquefied Natural Gas
MDT	Modular Dynamic Testing wireline tool for downhole production testing data
MGE	UA Department of Mining and Geological Engineering
MOBM	Mineral Oil-Based Mud drilling fluid used to improve safety and data acquisition
MPU	Milne Point Unit
MSFL	Micro-spherically focused log (wireline log indication of formation permeability)
NETL	National Energy Technology Laboratory
NMR	Natural Magnetic Resonance (wireline or LDD tool – see also CMR)
ONGC	Oil and Natural Gas Corporation Limited (India)
PBU	Prudhoe Bay Unit
PNNL	Pacific Northwest National Laboratory
POOH	Pull out of Hole; pulling drillpipe or wireline from borehole during operations
POS	Pump-out Sub (pertaining to MDT tool)
Sag	Sagavanirktok formation
SPE	Society of Petroleum Engineers
TCF	Trillion Cubic Feet of Gas at Standard Conditions
TCM	Trillion Cubic Meters of Gas at Standard Conditions
T-D	Time-Depth (referencing time to depth conversion of seismic data)
UA	University of Arizona (or Arizona Board of Regents)
UAF	University of Alaska, Fairbanks
USGS	United States Geological Survey
USDOE	United States Department of Energy
Vp	Velocity of primary seismic wave component
Vs	Velocity of shear seismic wave component (commonly useful to identify GH)
VSP	Vertical Seismic Profile
WOO	Well-of-Opportunity

8.0 APPENDICES

8.1 Appendix A: Onsite Core Description and Subsampling

The following pages were scanned from onsite core subsampling and description forms. Some discrepancies between these field sheets and the actual core subsamples are annotated in red. Most of these were resolved during the quarter and a final spreadsheet is in development.

DRILLING AND CORING DATA SHEET - BPXA MPU Mt. Elbert #1

Page 1 of 1

Core Run: 01

Date: 10/02/2007

Logger: Collett

Start Time: 03:28

End Time: 04:26

DRILLING

Initial rod depth: 1990 ft.

Final rod depth: 2014 ft. 24ft

Mud temp In: °F

Mud temp out: °F

Core temp logger #:

CORING

Section	Section Length
1	20.0 in.
2	34.5 in.
3	38.0 in.
4	36.0 in.
5	36.0 in.
6	34.0 in.
7	X in.
8	X in.
9	X in.
shoe	6.5 in.

Core in tube: 198.5 in.

Core in shoe: 6.5 in.

Total Recovery: 205.0 in.

Core Disturbance: mostly intact

Core entry time: (?)

% Recovery: 71.2 %

Comments: Uniform core, few cracks; problem w/ tabs; + tape (cold)

SUBSAMPLING

Gas Hydrate (HYLN, HYPV): NA ✓

Interstitial Water (IW)

Sec	Top	Base	
3	27	33	X
5	27	33	X

Headspace (HS)

Sec	Top	Base	
3	18	21	X
5	18	21	X

Microbio (MBRF, MBLN)

Sec	Top	Base		
3	21	24	LN	X
3	24	27	RF	X
5	21	24	LN	X
5	24	27	RF	X

Phys Props (PPMA)

Sec	Top	Base	
3	33	36	X
5	33	36	X

Phys Props (PPOM, THERMAL): NA ✓

GH Dissociation (SYRINGE, DEVICE, DISPLACEMENT): NA ✓

FIELD LOGGING SHEET Page 1 of 1

Borehole: BPXA MPU Mt. Elbert #1 **Date:** /02/2007

Core Run: 01 **Logger:** Collett

Sec.	Top	Base	Description	Temp Data ~~Depth~~ ~~T1/°F T2/°F T3/°F~~
				NA
			– Entire core -> silty claystone,	
			dark gray to black, well consolidated,	
			hard; no apparent bedding;	
			frozen by arrival into	
			core lab.	

DRILLING AND CORING DATA SHEET - BPXA MPU Mt. Elbert #1 Page 1 of ___

Core Run: 02 Date: 10/02/2007

Logger: Colle H / Boswell Start Time: 07:21 End Time: 08:30

DRILLING

Initial rod depth: 2014.0 ft.
Final rod depth: 2038.0 ft.

Mud temp In: ___ °F
Mud temp out: ___ °F
Core temp logger #: ___

CORING

Section	Section Length
1	29.0 in.
2	36.5 in.
3	34.5 in.
4	35.5 in.
5	33.5 in.
6	35.0 in.
7	36.0 in.
8	36.0 in.
9	X in.
shoe	7.0 in.

Core in tube: 276 in.
Core in shoe: 7 in.
Total Recovery: 283.0

Core Disturbance: ___
Core entry time: ___
% Recovery: ___ %

Comments: Lower 1/2 of core drilled quickly & ROP increase

SUBSAMPLING

Gas Hydrate (HYLN, HYPV)

Sec	Top	Base
8	31	36 LN X
8	26	31 LN X
7	20	30 PV ← (?)

Phys Props (PPMA)

Sec	Top	Base
7	33	36 X (TSC)
6	33	~~36~~ (35) X
2	33	36 X

Interstitial Water (IW)

Sec	Top	Base
7	27	33 X
6	24	30 X
2	27	33 X

Phys Props (PPOM, THERMAL)

	Sec	Top	Base	
PPOM	X 2	21	27	shale
thermal	8	20	26	Core GH
PPOM X	8	14	20	(GH)

Headspace (HS)

Sec	Top	Base
7	18	21 X
6	30	33 X

Microbio (MBRF, MBLN)

Sec	Top	Base	
7	24	27	RF X
7	21	25	LN X TSC
2	14	17	LN - A00 X
2	18	21	RF - A00 X TSC

GH Dissociation (SYRINGE DEVICE, DISPLACEMENT)

S.7 15 inch X
S.8 20 inch X

FIELD LOGGING SHEET

Page 1 of 2

Borehole: BPXA MPU Mt. Elbert #1
Date: 10 /02/2007
Core Run: 02
Logger: Collett

Sec	Top	Base	Description	Depth	Temp Data T1°F T2°F T3°F
1	0	25	→ Gray siltstone to claystone, finely laminated, with interbeds of silty shale, high organic contact; lower contact gradational		
2	0	7			
2049 2	7	36	- Very fine grained SS, X-beds graded top - Top of GH, marked by contact w/ overlying siltstone section GH- bubble in watch glass w/water well cemented w/ GH - cold bubbles in mud coating	GAS H2O Contact	
4	—	—			
3	—	34.5	→ same as above, very fine grained ss, well sorted, grey to dark gray.	GH	
4	—	35.5			
5	0	13	→ Cong section, rounded pebbles, uniform grain size, little to no matrix, sharp upper + lower contact, pebble to 1/2 in.	GH	
5	13	~~36~~ 33.5	- very fine sandstone, alternating laminae, grey dark to medium (same as upper SS - Sect - 2-4)	Sand	
6		35	- Very fine sandstone, thinly bedded grey dark to light in color, good bubbly → GH, bubbles in watch glass!	GH	
7		36			
8		36			

FIELD LOGGING SHEET

Page 2 of 2

Borehole: BPXA MPU Mt. Elbert #1
Core Run: 02
Date: 10 /02/2007
Logger: Collett

Sec.	Top	Base	Description	Depth	Temp Data T°F	[illegible]	[illegible]
			Section 8	7"	19.1	19.9	
				16"	21.9	15.0	18.1
				17"	22.5		
			Section 7	11"	20.9	16.5	
				4"	23.1		

DRILLING AND CORING DATA SHEET - BPXA MPU Mt. Elbert #1

Page __ of __

Core Run: 3

Date: /02/2007

Logger: Hunter

Processing Time only

Start Time: 1:15pm

End Time: 2:30pm

DRILLING

Initial rod depth: 2038 ft.

Final rod depth: 2062 ft.

Mud temp In: __ °F

Mud temp out: __ °F

Core temp logger #:

CORING

Section	Section Length	
1	19 in.	19
2	39 in.	39
3	33 in.	33
4	39 in.	39
5	33.5 in.	33.5
6	36 in.	36
7	39 in.	39
8	36 in.	36
9	in.	274.5"
shoe	6" in.	6 280.5 ✓

Core in tube: 274.5 in.

Core in shoe: 6.0 in.

Total Recovery: 280.5 in.

Comments:

Core Disturbance:

Core entry time:

% Recovery: __ %

SUBSAMPLING

	Sec	Top	Base	
Gas Hydrate (HYLN, HYPV)	4	31	36	X HYLN X
Interstitial Water (IW)	3	28	~~34~~ 33	TSC X
	7	28	34	TSC
Headspace (HS)	3	19	22	X
	7	19	22	TSC
Microbio (MBRF,MBLN)	3	25	28	? FR/LN
	3	22	25	LN
	7	25	28	TSC

	Sec	Top	Base	
Phys Props (PPMA)	~~3~~ 7	34	36	X TSC
	6	34	36	X
Phys Props (PPOM, THERMAL)	5	~~27.5~~	~~33.5~~	
	PPOM	28	34	X
GH Dissociation (SYRINGE, DEVICE, DISPLACEMENT)	~~36~~	~~34~~		
	~~35~~	~~2~~		
	7	1 inch		

FIELD LOGGING SHEET

Page ___ of ___

Borehole: BPXA MPU Mt. Elbert #1 Date: /02/2007

Core Run: 3 Logger:

10 15

Sec.	Top	Base	Description	Depth	Temp Data T1/°F	T2/°F	T3/°F
1			Uniform v. fg ss to sltst, gry				
2			~~appears massive~~, but OBM	32		15.5	12.3
3			finely laminated sequences				
(4)			~flat lam. (Note 2" Pebble Lag				
5		7"	Scn 1, 13"-15")				
5	7"	9"	Pebble lag	8	20°	18.5	
5	9"		uniform v. fg ss - sltst aa				
6				11	18.7		
7							
8		23"					
9	23"						
			-Note GH sample taken-				

DRILLING AND CORING DATA SHEET - BPXA MPU Mt. Elbert #1 Page ___ of ___

Core Run: 4 Date: 10 /02/2007

Logger: Hunter Processing time only Start Time: 4:05 pm End Time: 5:10

DRILLING

Initial rod depth: 2062 ft. Mud temp In: ___ °F

Final rod depth: ~~2085~~ ft. 2086 Mud temp out: ___ °F

Core temp logger #: ___

CORING

Section	Section Length
1	0-33 in.
2	0-36 in.
3	0-36 in.
4	0-35 in.
5	0-36 in.
6	0-36 in.
7	0-36 in.
8	0-34 in.
9	in.
shoe	6 in.

288" ~~258"~~

Core in tube: 282.0 in. Core Disturbance: minimal

Core in shoe: 6.0 in. Core entry time: ___

Total Recovery: 288.0 % Recovery: ___ %

Comments: No Bubbling Likely non reservoir to poor "

SUBSAMPLING

	Sec	Top	Base
Gas Hydrate (HYLN, HYPV)	None		
Interstitial Water (IW)	3	25	31 X
	7	28	34 X
Headspace (HS)	3	18	- 21 X
	7	21	24
	Section 7 or 8		
Microbio (MBRF,MBLN)	3	23	25 X RF
	3	21	23 X LN
	7	26	28 X RF
	7	24	26 X LN

	Sec	Top	Base
Phys Props (PPMA)	3	31	33 X
	7	34	36 X
Phys Props (PPOM, THERMAL)	None		
GH Dissociation (SYRINGE, DEVICE, DISPLACEMENT)	None		

FIELD LOGGING SHEET

Page ___ of ___

Borehole: BPXA MPU Mt. Elbert #1
Date: 10th/02/2007
Core Run: 4 Four
Logger: Hunter

Sec.	Top	Base	Description	Temp Data: Depth, T1/°F, T2/°F, T3/°F
1	1	27	V. finely laminated siltst to v.fgss	
			v. friable, some under gauge	
1	27		silty clay, flat laminated	
				2 13 29.6
				29.4 15 min
3	35		Claystone v. friable, soft sed.	
			minor thin silt interbeds	4 10 29.6
4			to 1"	29.3 15 min
5 ~~4~~	9	22	siltst interbed	
				5 14 29.4
5 ~~4~~	22		silty clay	29.3 15 min
6	3	"	siltst, minor clay interbeds	
			some v. fg sand	7 7 29.4
				29.2 15 min
8		19	AA	
8	19	shoe	clayst, v. soft	
				8 29.7
				29.6 15 min
			-No Gas Hydrate-	

DRILLING AND CORING DATA SHEET - BPXA MPU Mt. Elbert #1

Page ___ of ___

Core Run: 5

Date: 10/02/2007

Logger: Hunter

Start Time: 6:25

End Time: 7:11

DRILLING

Initial rod depth: 2086 ft.

Final rod depth: 2110 ft.

Mud temp In: ___ °F

Mud temp out: ___ °F

Core temp logger #: ___

CORING

Section	Section Length
1	29 in.
2	36 in.
3	34 in.
4	35 in.
5	36 in.
6	36 in.
7	37 in.
8	34 in.
9	in.
shoe	7 in.

~~284~~"

Core in tube: ~~284~~ 2770 in.

Core in shoe: ~~7~~ in. 70

Total Recovery: 2840

% Recovery: ___ %

Core Disturbance: Minimal - unconsol. silt

Core entry time: ___

Comments: ~Non-Reservoir for most part.

SUBSAMPLING

	Sec	Top	Base
Gas Hydrate (HYLN, HYPV)			
Interstitial Water (IW)	1	21	27 X
	7	28	34 X
Headspace (HS)	1	14	17 X
	7	21	24 X
Microbio (MBRF, MBLN) RF	1	19	21 X
LN	1	17	19 X
RF	7	26	28 X
LN	7	24	26 X

Not posted?

	Sec	Top	Base
Phys Props (PPMA)	1	27	29 X
	~~8~~ 7	34	36 ✓ TSC
	2 ~~Not posted by Bill~~		
Phys Props (PPOM, THERMAL)	8	1	6 X
GH Dissociation (SYRINGE, DEVICE, DISPLACEMENT)			

FIELD LOGGING SHEET

Page ___ of ___

Borehole: BPXA MPU Mt. Elbert #1
Date: 10 /02/2007
Core Run: 5
Logger: Hunter

Sec.	Top	Base	Description	Depth	T1/°F	T2/°F	T3/°F
			No visible Hydrate, No Bubbles in wt				
1	1	8	Clay w/ minor silt Interbeds				
1	8	(2-9)	siltst - v.fg ss, uncons.				
2	9		clay & interbedded, finely lam. slt unconsol.				
			~Interbeds to ~1 foot silt/clay				
3	29		f.gr ss - v.fgr ss, massive, fractured, unconsol.				
4		28			T0	T10	
				4 24"	29.6	29.6	
4	28		Mostly clay, finely lam silt interbeds < 1" interbeds				
			laminae mm-cm scale				
			Occassional silt - v.fgr sand to 5" thick		T0	T10	
				5 18"	29.3	28.5	
5	9 to Base		Mostly clay & finely lam silt interbeds on cm-inch range				
			Non-reservoir				

DRILLING AND CORING DATA SHEET - BPXA MPU Mt. Elbert #1

Page ___ of ___

Core Run: 6

Date: 10/02/2007

Logger: Hunter

Start Time: Processing 8:50 pM

End Time: Processing 10:00 pM

DRILLING

Initial rod depth: 2110 ft.

Final rod depth: 2134 ft.

Mud temp In: ___ °F

Mud temp out: ___ °F

Core temp logger #: ___

CORING

Section	Section Length
1	35.5 in.
2	36 in.
3	36 in.
4	37.5 in.
5	35 in.
6	36.5 in.
7	36 in.
8	35 in.
9	in.
shoe	6 in.

288.0

Core in tube: 287.5 in.

Core in shoe: 6.0 in.

Total Recovery: 293.5 in.

Core Disturbance: ___

Core entry time: ___

% Recovery: ___ %

Comments: Gas Alarm on Monitor in Pipeshed at Base Scn 8
No visible bubbling hydrate
No Lith. change at base core

SUBSAMPLING

	Sec	Top	Base
Gas Hydrate (HYLN, HYPV)			
Interstitial Water (IW)	6	28	34 X
	2	28	34 X
Headspace (HS)	6	21	24 X
	2	21	24 X
Microbio (MBRF,MBLN)	6 RF	26	28 X
	6 LN	24	26 X
	2 RF	26	28
	2 LN	24	26

Not posted (2 RF 26 28; 2 LN 24 26)

	Sec	Top	Base
Phys Props (PPMA)	6	34	36 X
	2	34	36 X
Phys Props (PPOM, THERMAL)	5	30	36 X

GH Dissociation (SYRINGE, DEVICE, DISPLACEMENT): None noted in crucibles w/water

FIELD LOGGING SHEET

Page ___ of ___

Borehole: BPXA MPU Mt. Elbert #1
Core Run: 6

Date: 10 /02/2007
Logger: Hunter/Rose

Sec.	Top	Base	Description	Depth	Temp Data T1/°F	T2/°F	T3/°F
1	0	36"	lt. gray, thinnly laminated silt & clay				
2	0	36"	lt gray silty clay, thinnly interbedded layers				
3	0	2"	same as above				
3	2"	3.5"	tan-gray colored layer, siltier?				
3	3.5	17"	lt gray silty clay				
3	17"	21"	lt gray clay with silt laminae & (FeS mottling?)				
3	21"	28"	same as above but more distinct laminae/silt beds				
3	28"	36"	lt gray silty clay with fine laminae				
4	0	36"	thinnly laminated, lt. gray clay with silt laminae & thin beds				
5	0	36"	same as above				
6	0	20.5	same as above but increased frequency of thin silt beds (black in color)				
6	20.5	36"	sampled, but aa				
7	0	36"	increased volume of silt, buff color, interbedded & laminae w/ lt gray clay				
↳ cont.			thicker silty clay beds, up to 1.5 cm thick.				
8	0	36"	increase in lt gray-buff colored sediments. Continued finely				
↳ cont.			interbedded & laminated silt, silty clay & clay.				
Core catcher			As above in fragments, mostly clay				

DRILLING AND CORING DATA SHEET - BPXA MPU Mt. Elbert #1 Page ___ of ___

Core Run: 7 Date: 10 /02/2007

Logger: Hunter Start Time: ________ End Time: ________

DRILLING

Initial rod depth: ~~2133~~ ft. 2134

Final rod depth: 2158 ft.

Mud temp In: ____ °F

Mud temp out: ____ °F

Core temp logger #: ____

CORING

Section	Section Length
1	35.5 in.
2	~~34.5~~ in. 35"
3	36.5 in.
4	37 in.
5	36 in.
6	36.5 in.
7	36 in.
8	35.5 in.
9	in.
shoe	6 in.

294"

Core in tube: 288.0 in.

Core in shoe: 6.0 in.

Total Recovery: 294.0

Core Disturbance: ________

Core entry time: ________

% Recovery: ________ %

Comments: ________

SUBSAMPLING

Gas Hydrate (HYLN, HYPV)

Sec	Top	Base	
5	14	24	HYPV X
6	31	36	HYLN X

Phys Props (PPMA)

Sec	Top	Base	
6	24	26	X
8	34	36	X
7	34	36	X
2	33	35	X

Interstitial Water (IW)

Sec	Top	Base	
6	20	24	(4") X
8	30	34	(4") X

Phys Props (PPOM, THERMAL)

Sec	Top	Base	
5	8	14	PPOM X

Headspace (HS)

Sec	Top	Base	
6	13	16	X
8	~~23~~ 24	26	X

Microbio (MBRF, MBLN)

Sec	Top	Base	
6	18	20	RF X
6	16	18	LN X
8	28	30	RF X
8	26	28	LN X

GH Dissociation (SYRINGE, DEVICE, DISPLACEMENT)

QD Section 5 23inch TSC

QD Section 6 30inch

Temps	Sch-"	Temp1	T2	T3
	6-9"	23.5	20.5	19.5
	7 20"	27.5	29.3	24.8
		0	18min	

FIELD LOGGING SHEET Page 1 of 2

Borehole: BPXA NPU Mt. Elbert #1 Date: 10 [illegible]2007

Core Run: 7 Logger: Hunter / Rose

Sec.	Top	Base	Description	Temp Data Depth	T1°F	T2°F	T3°F
1	0	25	lt tan-gray silty clay, finely laminated				
1	25	27	1" med. grained sand (white-gray) 1/4" clay then				
↳ cont.			grading up into laminated sand + clay (hydrate bearing)				
1	27	36	1/4" clay then laminated, fine grain sand to base (hydrate bearing)				
↳			lt gray in color.				
2	0	2.5	same as above				
2	2.5	5"	med. grained sand w/ clay laminae, lt gray color, (hydrate bearing)				
↳ cont.			possible organic material				
2	5"	15	lt gray silty clay				
2	15	16	lt gray, fine grained sand, hydrate bearing				
2	16	24	lt gray, silty clay				
2	24	28	base is coarse grained sand (white-gray) with hard clay				
cont.			above (1/4") repeat coarse/med. grain sand grading up to				
↳			silty clay (laminae) with black organic material				
			All is hydrate bearing.				
2	28	36	laminated, med grain sand (white-gray) w/ hydrate				
3	0	5	same as above				
3	5	7	laminated silty clay with sharp top & base contacts				
3	7	16	laminated grained sand, hydrate bearing w/ 1" clay in middle				
3	16	21	2" of lam. silty clay w/ organic material grading up hydrate bearing				
↳			med. grained sand (3"+)				
3	21	34	1/4" clay @ top then laminated med. grained ss, hydrate bearing				
3	34	36	silty clay, laminated, lt gray				
4	0	12.5	same as above				
4	12.5	17	color change peach-tan-gray laminated silty clay, abrupt top contact				
4	17	23	interbedded peach-to-gray laminated clay w/ 2" gray-white,				
↳			hydrate bearing sand				
4	23	27	more silty clay same as above				
4	27	29	hydrate bearing med. grained sand				
4	29	36	gray-black to peach-tan silty clay				
5	0	36	med. grained, laminated sand, hydrate bearing, white-gray				
			some 1/4" clay interbeds				

OVER

56 0 - 6" same as above

56 6" to end of core

laminated ss @ top grading into massive med grained ss w/ sub vertical, drilling mud coated fractures, sand is lt gray & hydrate bearing throughout

22" to top massive laminated grading into med grained ss w/ mud coated fractures lt gray hydrate [illegible] sub vertical fractures

56

21

Core total

38.5
35
36.5
37
36
36.5
36
35.5
6 chips

294.0

24.5'

12) 294
24
54
48
6

x 4955

DRILLING AND CORING DATA SHEET - BPXA MPU Mt. Elbert #1

Page 1 of 1

Core Run: 8

Date: 11/02/2007

Logger: Collett/Boswell

Start Time:

End Time: 02:10

DRILLING

Initial rod depth: 2158 ft.

Final rod depth: 2180 ft.

Mud temp In: °F

Mud temp out: °F

Core temp logger #:

CORING

Section	Section Length
1	15.5 in.
2	37.0 in.
3	36.0 in.
4	36.0 in.
5	36.0 in.
6	36.5 in.
7	36.0 in.
8	~~7.5.0~~ in.
9	in.
shoe	6.5 in.

Base HYD @ 28"

Core in tube: 233.0 in.

Core in shoe: ~~X~~ 6.5 in.

Total Recovery: 239.5

Core Disturbance:

Core entry time:

% Recovery: %

Comments: Hydrate sand to 28" of Sec. 6
Non-reservoir below.
Several major fractures

SUBSAMPLING

	Sec	Top	Base	
Gas Hydrate (HYLN, HYPV)	5	31	36	LN (#8) X
	4	31	36	LN (#9) X
	5	21	31	PV (#10 X
Interstitial Water (IW)	4	25	29	X
	7	14	18	X
	2	31	35	X
Headspace (HS)	4	19	21	X
	7	18	20	X
	2	25	27	X
Microbio (MBRF,MBLN)	4	23	25	RF X
	4	21	23	LN X
	2	29	31	RF X
	2	27	29	LN X

	Sec	Top	Base
Phys Props (PPMA)	4	29	31 X
	7	20	22 X
	2	35	37 X
Phys Props (PPOM, THERMAL) THERM	5	15	21 X
PPOM	5	9	15 X

GH Dissociation (SYRINGE DEVICE, DISPLACEMENT)
6 - 2" X
5 - 1" X
4 - 1" X
Section 1 - at 1.0" X

Temp Sec. 5 @ 20" 25.5
Sec 7 @ 8" 29.8
Sec 3 @ 25"
Sec 2 @ 11"

FIELD LOGGING SHEET Page 1 of 1

Borehole: BPXA MPU Mt. Elbert #1 Date: /02/2007

Core Run: 8 Logger: Collett/Boswell

Sec.	Top	Base	Description	Depth	T1/°F	T2/°F	T3/°F
1	0		v. fi sand, gray to dk grey, finely-laminated	2-12"		23.5	-24.8
6	6	24	gradational lower contact	3-25"		25.8	-26.3
			two large fractures (3-31-36) 45°	5-20"		23.5	-23.8
			(4-13-19) 45°	7-8"		29.7	-29.8
6	24		d. grey siltstone, wispy organic layers				

Bubbling in water all along unit 1 (1-0 to 6-24) and observed in pipeshed. No hydrate evident in unit 2

-Summary gas hydrate from top of core until Sec 6-24" - uniform fine grained SS, basal non reservoir siltstone

Top 1
2
3
4
5
6 – 24 in
7
shoe

1 – 6 (24 in): GH

7 – shoe: NO GH

X

DRILLING AND CORING DATA SHEET - BPXA MPU Mt. Elbert #1 Page 1 of 1

Core Run: 09 Date: 11 /02/2007

Logger: Collett/Boswell Start Time: ______ End Time: ______

DRILLING

Initial rod depth: 2180 ft. ✓
Final rod depth: 2190 ft. ✓

Mud temp In: ______ °F
Mud temp out: ______ °F
Core temp logger #: ______

CORING

Section	Section Length
1	31.0 in.
2	in.
3	in.
4	in.
5	in.
6	in.
7	in.
8	in.
9	in.
shoe	0 in.

Core in tube: 31.0 in.
Core in shoe: 0.0 in.
Total Recovery: 31.0 in.
Comments: Short core - high P - jam off 10 ft throw, 3 ft recovery, ~~* Voids possible massive GH =~~

Core Disturbance: Large voids
Core entry time: ______
% Recovery: ______ %

SUBSAMPLING

	Sec	Top	Base	
Gas Hydrate (HYLN, HYPV)	1	17	17 X	PV #17
Interstitial Water (IW)	1	25	29 X	
Headspace (HS)	1	18	20 X	
Microbio (MBRF,MBLN)	1	23	25	RF +
	1	21	23	LN +

	Sec	Top	Base	
Phys Props (PPMA)	1	29	31 X	
Phys Props (PPOM, ~~THERMAL~~)	1	2	7 X	
GH Dissociation (SYRINGE, DEVICE, DISPLACEMENT)	1	17	18	sy X
	1	7	8	sy X

FIELD LOGGING SHEET

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Borehole: BPXA MPU Mt. Elbert #1

Date: /02/2007

Core Run: 09

Logger: Collett/Boswell

Sec.	Top	Base	Description	Depth	Temp Data T1/°F	T2/°F	T3/°F
1	0	31.0	Uniform massive medium grained SS, lightgray to dark grey, bubbling on surface, bubbles in watch glass. — VIP samples !!	NA			
			Larg voids 1-2 inches in size; ~~possible melted GH forms.~~ see photos on Sony !!				
			Note one large pebble 2-1inch, near top of core ? - in trough unknown source ✓ Voids above, possible plucked pebbles				

DRILLING AND CORING DATA SHEET - BPXA MPU Mt. Elbert #1

Page 1 of __

Core Run: 10
Date: 11 /02/2007

Logger: Collett/Boswell
Start Time: 0535
End Time: ______

DRILLING

Initial rod depth: 2190 ft.
Final rod depth: 2200 ft.

Mud temp In: ______ °F
Mud temp out: ______ °F
Core temp logger #: ______

CORING

Section	Section Length
1	36.0 in.
2	36.0 in.
3	in.
4	in.
5	in.
6	in.
7	in.
8	in.
9	in.
shoe	in.

Core in tube: 72.0 in.
Core in shoe: 4.0 in.
Total Recovery: 76.0 in.

Core Disturbance: ______
Core entry time: ______
% Recovery: ______ %

Comments: Very hard cemented SS? at top, two sections recovered - possible drilling problem Problem 10 ft throw, pressure up - pulled

SUBSAMPLING

	Sec	Top	Base
Gas Hydrate (HYLN, HYPV)			
Interstitial Water (IW)	1	30	34 X
Headspace (HS)	1	24	26 X
Microbio (MBRF, MBLN)	MBLN 1	26	28 X
	MBRF 1	28	30 X
	1	1	2 ← composite of both MBLN MBRF

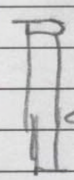
	Sec	Top	Base
Phys Props (PPMA)	1	34	36 X
Phys Props (PPOM, THERMAL)			
GH Dissociation (SYRINGE, DEVICE, DISPLACEMENT)			

FIELD LOGGING SHEET Page 1 of __

Borehole: BPXA MPU Mt. Elbert #1 Date: 11 /02/2007

Core Run: 10 Logger: Collett/Boswell

Sec.	Top	Base	Description	Depth	T1/°F	T2/°F	T3/°F
1	0	2	→ hard, highly cemented siltstone				
1	0	0	stringer 2 inches thick, possible				
			drilling break; tan in color				
			uniform grain size.				
~~1~~	~~0~~	2	↳ possible diagenetic, or simple stringer				
1	2	36					
2	0	36	↳ Poorly cemented (unconsolidated)	1 8"	30.6		
			fine SS, dark gray to black	1 18"	35.5		
			uniform grain size, abrupt	2 11"	30.8		
			contact into overlying cemented	2 29"	34.0		
			siltstone				
			Summary — No gas bubbles, no evidence GH, — ✓✓				



DRILLING AND CORING DATA SHEET - BPXA MPU Mt. Elbert #1

Page 1 of __

Core Run: 11   Date: 11/02/2007

Logger: Collett   Start Time: 08:15   End Time: 9:10

DRILLING

Initial rod depth: 2200 ft.
Final rod depth: 2218 ft.

Mud temp In: ____ °F
Mud temp out: ____ °F
Core temp logger #: ____

CORING

Section	Section Length
1	25.0 in.
2	36.0 in.
3	35.5 in.
4	36.0 in.
5	36.0 in.
6	in.
7	in.
8	in.
9	in.
shoe	4.0 in.

Core in tube: 168.5 in.
Core in shoe: 4.0 in.
Total Recovery: 172.5 in.

Core Disturbance: ____
Core entry time: ____
% Recovery: ____ %

Comments: - Partial throw + recovery silt stringer ? ← cause problem "sand-in-a-trough"

SUBSAMPLING

	Sec	Top	Base
Gas Hydrate (HYLN, HYPV)			
Interstitial Water (IW)	5	30	34 X
	3	30	34 X
Headspace (HS)	5	24	26 X
	3	24	26 X
Microbio (MBRF, MBLN)	MBRF 5-	28	30 X
	MBLN 5	26	28 X
	MBRF 3	28	30 X
	MBLN 3	26	28 X

	Sec	Top	Base
Phys Props (PPMA)	PPMA 5	34	36 X
	PPMA 3	34	36 X
Phys Props (PPOM, THERMAL)			
GH Dissociation (SYRINGE, DEVICE, DISPLACEMENT)			

FIELD LOGGING SHEET

Page 1 of ___

Borehole: BPXA MPU Mt. Elbert #1

Date: 11 /02/2007

Core Run: 11

Logger: Collett

Sec.	Top	Base	Description	Depth	T1/°F	T2/°F	T3/°F
1	0"	2"	- well cemented siltstone stringer 2" thick - possible Carbonate cement NO GH evidence Abrupt lower contact, carb-cemented siltstone				
1	0"	2"	→ Very fine sand to silt, darkgrey to black massive bedded uniform grain size, well sorted abrupt contact into overlying siltstone. - No evidence of GH - check in water ✓				
2				2 11"	32.1°F		
3				3 18"	31.7°F		
4				4 17"	30.7°F		
5				5 18"	31.7°F		
			All Water filled SS - NO GH				

DRILLING AND CORING DATA SHEET - BPXA MPU Mt. Elbert #1

Page 1 of ___

Core Run: 12 Date: 11/02/2007

Logger: Collett Start Time: ___ End Time: ___

DRILLING

Initial rod depth: 2218 ft. Mud temp In: ___ °F

Final rod depth: 2241 ft. Mud temp out: ___ °F

Core temp logger #: ___

CORING

Section	Section Length
1	31.0 in.
2	36.0 in.
3	36.0 in.
4	34.0 in.
5	36.0 in.
6	36.0 in.
7	36.0 in.
8	in.
9	in.
shoe	4.0 in.

245

Core in tube: 245.0 in. Core Disturbance: ___

Core in shoe: 4.0 in. Core entry time: ___

Total Recovery: 249.0 in. % Recovery: ___ %

Comments: ___

SUBSAMPLING

	Sec	Top	Base
Gas Hydrate (HYLN, HYPV)			
Interstitial Water (IW)	5	28	34 X
	7	28	34 X
Headspace (HS)	5	22	24 X
	7	22	24 X
Microbio (MBRF, MBLN)	RF 5	26	28 X
	LN 5	24	26 X
	RF 7	26	28 X
	LN 7	24	26 X

	Sec	Top	Base
Phys Props (PPMA)	5	34	36 X
	7	34	36 X
	3	21	23 X

Phys Props (PPOM, THERMAL): X Thermal 3 0-6.0 special carb, cemented siltstone

X PPOM 3 6-12 fine siltstone

GH Dissociation (SYRINGE, DEVICE, DISPLACEMENT): ___

FIELD LOGGING SHEET

Page 1 of __

Borehole: BPXA MPU Mt. Elbert #1
Core Run: 12
Date: 11/02/2007
Logger: Collett

Sec.	Top	Base	Description	Temp Data Depth T1/°F T2/°F T3/°F
1	0	—	] from 1-0" → 2-30" →	
2	—	30	] uniform gray to black fine sand	
			massive bedded, no evidence GH	
2	30	—	siltstone massive bedded, dark gray	2-13" 36.0
3	—	19	to black, abrubt upper contact	~~DE~~
			at 2-30; NO GH	4-18" 30.9
				6-15" 38.6
3	19	—	carbonate cemented siltstone	
3	—	24	tan to dark green	
3	24	—	siltstone as above abrupt upper	
3	—	31	contact black to dark grey	
3	31	—	Massive unconsolidated ss-fine, dark	
6	—	15	gray to black, abrubt upper contact	
			into siltstone → 2inch carb/silt; sec. 4 (3-5)	
6	15	—	Carbonate cemented siltstone	
6		18	tan to darkgreen	
6	18	—	siltstone, black to dark gray	
6	—	27	abrubt uppercontact	
6	27	—		
7	—	36	very fine sand, dark gray to black,	
			unconsolidated, massive	
			→ Summary: Complex section of fine sand	
			interbedded w/ siltstone - abrupt	
			contacts - several carb/siltstone	

DRILLING AND CORING DATA SHEET - BPXA MPU Mt. Elbert #1

Page ___ of ___

Core Run: 13

Date: /02/2007

Logger: Hunter

Start Time: 1:45 Processing

End Time: ______

DRILLING

Initial rod depth: 2241 ft.

Final rod depth: 2265 ft.

Mud temp In: ______ °F

Mud temp out: ______ °F

Core temp logger #: ______

CORING

Section	Section Length
1	22 in.
2	36 in.
3	36 in.
4	35 in.
5	36 in.
6	36 in.
7	36 in.
8	34 in.
9	in.
shoe	3 in.

274"

Core in tube: 271 in.

Core in shoe: 3 in.

Total Recovery: 274 in.

Core Disturbance: ______

Core entry time: ______

% Recovery: ______ %

Comments: Not gas hydrate-bearing, but good reservoir sand, all unconsolidated. Subsampled to attempt strat. preservation for sedimentology where possible

SUBSAMPLING

	Sec	Top	Base
Gas Hydrate (HYLN, HYPV)			
Interstitial Water (IW)	2	26	34 X
	7	26	34 X
	8	18	26 X
Headspace (HS)	2	19	22 X
	7	19	22 X
Microbio (MBRF, MBLN) RF	2	24	26 X
LN	2	22	24 X
RF	7	24	26 X
LN	7	22	24 X

	Sec	Top	Base
Phys Props (PPMA)	2	34	36 X
	7	34	36 X
	8	26	28 X
Phys Props (PPOM, THERMAL)			
GH Dissociation (SYRINGE, DEVICE, DISPLACEMENT)	No hydrate		

FIELD LOGGING SHEET Page __ of __

Borehole: BPXA MPU Mt. Elbert #1 Date: 11th /02/2007

Core Run: 13 Logger: Hunter

Sec.	Top	Base	Description	Depth	Temp Data T1/°F	T2/°F	T3/°F
1			V.fg snd, unconsol, much OBM invasion				
			Much core-induced fracturing				
			Massive, no obvious bedding/contacts				
2			AA				
		36					
3	0	21	Harder, Poss. Carbonate-cemented layer				
			only 1" thick, appears to be same sand				
	2	vfg	sand, unconsol as in Scn 2				
4			AA, trace black chert "pebbles" → v.coarse gr snd trace				
5			AA w/o tr. v.c.gr snd, completely	14	43°	—	
			invaded by OBM, Poss. laminae, tough				
			to tell in lighting				
6	10	26	Thinly laminated v.fg - f.g. ss, unconsol				
	26	36+	Some massive beds to 1 ft				
7			AA, obvious core-bit "chatter"				
			at 1/4" scale				
8			AA, massive v.fg. snd, likely	20	44°	—	
			bioturbated				
			Photo Scn 8 ~3-10"				
			massive snd & "bit chatter"				

DRILLING AND CORING DATA SHEET - BPXA MPU Mt. Elbert #1 Page ___ of ___

Core Run: 14 Date: 11 /02/2007

Logger: Hunter Start Time: 4 PM End Time: 5 pm

DRILLING

Initial rod depth: 2265 ft. Mud temp In: ___ °F

Final rod depth: 2289 ft. Mud temp out: ___ °F

Core temp logger #: ___

CORING

Section	Section Length
1	15 in.
2	36 in.
3	34 in.
4	36 in.
5	36 in.
6	36 in.
7	35 in.
~~8~~	in.
~~9~~	in.
shoe	4 in.

232"

jammed off in carb: cmtd siltst

Core in tube: 228.0 in. Core Disturbance: ___

Core in shoe: 4.0 in. Core entry time: ___

Total Recovery: 232.0 in. % Recovery: ___ %

Comments: ___

SUBSAMPLING

	Sec	Top	Base
Gas Hydrate (HYLN, HYPV)			
Interstitial Water (IW)	3	24	32 8" X
	7	10	18 ← Not posted
Headspace (HS)	3	17	20 X
	7	3	6 X
Microbio (MBRF,MBLN)	RF 4	33	34
	special in siltst		
RF	3	22	24 X
LN	3	20	22 X
RF	7	8	10] Not posted
LN	7	6	8] Not posted

	Sec	Top	Base
Phys Props (PPMA)	3	32	34 X
	7	18	20 X
Phys Props (PPOM, THERMAL)	~~6~~	~~23~~	~~25~~
	4	30	33 X
	siltstone		

GH Dissociation (SYRINGE, DEVICE, DISPLACEMENT): slight bubbling/gas in fracture, sec 7, 33" in

FIELD LOGGING SHEET

Page ___ of ___

Borehole: BPXA MPU Mt. Elbert #1 Date: 11th /02/2007

Core Run: 14 Logger: Hunter

Sec.	Top	Base	Description	Depth	Temp Data T1/°F	T2/°F	T3/°F
1			Massive vfg ~~siltst~~ ss, unconsol invaded, core-induced fractured Blk-gry, well sorted				
2			AA				
3			Massive vfg ss, core induced frac blk-gry (OBM contam)				
4			aa, slightly siltier qtz & blk lithic or chert composition (aa)				
.	29	36	carb? cmtd siltstone, tan homogenous 3" PPOM for OMNI				
5	0	35	Massive vfg ss contact crumbly aa in scn 3				
.	35	36	siltst, tan				
6	0	22	thinly interbedded tan? sltst & vfgr snd, beds 1/4-1.5 inch				
6	22	27	~~silty sand~~ >cmtd, mostly shale/clay				
.	27	34	vfgr snd, core-induced frac				
	34	36	dk Tan clayst	36.5°			
7	0	22	vfgr ss				
	22	27	inc-upward cmtd silt-clayst				
	27	shoe	interbedded fissile silty clayst & vfgr ss, unconsol ss, >cmtd silty clay				

DRILLING AND CORING DATA SHEET - BPXA MPU Mt. Elbert #1 Page ___ of ___

Core Run: 15 Date: /02/2007

Logger: Hunter/Boswell Start Time: 6:30 End Time: 7:15

DRILLING

Initial rod depth: 2289 ft. Mud temp In: ___ °F

Final rod depth: 2313 ft. Mud temp out: ___ °F

Core temp logger #: ___

CORING

Section	Section Length
1	34 in.
2	36 in.
3	34 in.
4	36 in.
5	36 in.
6	36 in.
7	32 in.
~~8~~	in.
~~9~~	in.
shoe	3" in.

247"

Core in tube: 244 in. Core Disturbance: ___

Core in shoe: 3 in. Core entry time: ___

Total Recovery: 247 in. % Recovery: ___ %

Comments: ___

SUBSAMPLING

	Sec	Top	Base
Gas Hydrate (HYLN, HYPV)			
Interstitial Water (IW)	4	26	34 X
	7	22	~~28~~ 30] Not posted
Headspace (HS)	4	19	22 X
	7	15	18 X
Microbio (MBRF,MBLN) RF	4	24	26 X
LN	4	22	24 X
RF	7	20	22] Not posted
LN	7	18	20] Not posted

	Sec	Top	Base
Phys Props (PPMA)	4	34	36 X
	7	30	32 X
Phys Props (PPOM, THERMAL)			
GH Dissociation (SYRINGE, DEVICE, DISPLACEMENT)			

FIELD LOGGING SHEET

Page ___ of ___

Borehole: BPXA MPU Mt. Elbert #1

Core Run: 15

Date: 11th/02/2007

Logger: Hunter

Sec.	Top	Base	Description	Depth	T1/°F	T2/°F	T3/°F
1	1	31	vfgr ss, OBM, mostly massive, unconsol.				
			likely bioturb? But noticeable v.				
			thin laminations, same vfgss @ 7-9", scnl				
	31	—	Abrupt contact into				
2		4	silty clay, tan-green				
2	4	17	Sharp contact into vfgss, unconsd, aa				
	17	20	sharp contact into silty clay, aa				
	20	—	Sharp contact into silty ss, getting more				
3			clay mixed w/ vfgr silty ss				
3		17					
	17	19	Tan Clay, aa				
	19		silty vfgr ss, fines up into clay,				
			but still sharp contact @ base clay				
4			ss massive, no obvious laminations				
5		6-4	aa				
6	4	15	clay, aa, massive, probably μ laminated				
6	15		ss, aa, vfgr, siltier, fine-up into clay				
7		32	aa, ss, massive, grn-blk				
			Appears generally to be fgr ss				
			sequences that fine upward &				
			terminate in the clays				

DRILLING AND CORING DATA SHEET - BPXA MPU Mt. Elbert #1 Page ___ of ___

Core Run: 16 Date: 11th /02/2007

Logger: Hunter/Boswell/ROSE Start Time: 9 PM - interupt by call to Scott Digert @ MG camp End Time: ______

DRILLING

Initial rod depth: 2313 ft. Mud temp In: ______ °F

Final rod depth: 2337 ft. Mud temp out: ______ °F

Core temp logger #: ______

CORING

Section	Section Length	TEMP	
1	27 in.		
2	36 in.		
3	36 in.	2"	51.3°F
4	24 in.		
5	36 in.		
6	36 in.	26"	51.8°F
7	36 in.	10"	50.1°F
8	34 in.	31"	53.1°F
9	in.		
shoe	4 in.		

Core in tube: 275 in. Core Disturbance: ______

Core in shoe: 4 in. Core entry time: ______

Total Recovery: 279 in. % Recovery: ______ %

Comments: lengthwise vertical fracture thru entire core.

SUBSAMPLING

	Sec	Top	Base
Gas Hydrate (HYLN, HYPV)			
Interstitial Water (IW)	16-6	10-18 X	
	16-3	26-34 X	
Headspace (HS)	16-6 - 3-6 X		
	16-3 - 19-22 X		
Microbio (MBRF,MBLN)	16-6	MBSF 8-10 X	
		MBLN 6-8 X	
	16-3	SF 24-26 X	
		LN 22-24 X	

275

	Sec	Top	Base
Phys Props (PPMA)	16	3	34-36 X
	16	6	18-20 X
Phys Props (PPOM, THERMAL)			
GH Dissociation (SYRINGE, DEVICE, DISPLACEMENT)			

FIELD LOGGING SHEET

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Borehole: BPXA MPU Mt. Elbert #1
Core Run: 16

Date: 11th/02/2007
Logger: ~~Hunter~~ / Rose

Sec.	Top	Base	Description	Temp Data Depth	T1/°F	T2/°F	T3/°F
1	0	36	homogeneous, poorly consolidated very fine grained, gray, well sorted sand, near vertical fractures (coring related?)				
2	0	33	same as above				
2	33	36	buff-gray color, very fine grained sand, cemented (carbonate?)				
3	0	1	same as sec. 2 33-36				
3	1	36	same as sec. 1				
4	0	33	same as sec. 1				
5	0	36	same as sec. 1				
6	0	36	same as sec. 1				
7	0	36	same as sec. 1				
8	0	24	same as sec. 1				
8	24	26	2 1/4" + 1/2" buff-gray colored, moderately cemented bands (carbonate? cement)				
8	26	35	same as sec. 1				

DRILLING AND CORING DATA SHEET - BPXA MPU Mt. Elbert #1 Page 1 of 1

Core Run: 17 Date: /02/2007

Logger: Hunter/Boswell/Rose Start Time: End Time:

DRILLING

Initial rod depth: 2337 ft. Mud temp In: °F

Final rod depth: 2361 ft. Mud temp out: °F

Core temp logger #:

CORING

Section	Section Length
1	15 in.
2	35 in.
3	36 in.
4	36 in.
5	36 in.
6	34 in.
7	in.
8	in.
9	in.
shoe	5.5 in.

Core in tube: 192 in. Core Disturbance:

Core in shoe: 5½ in. Core entry time:

Total Recovery: 197.5 in. % Recovery: %

Comments:

SUBSAMPLING

Sample	Sec	Top	Base	
Gas Hydrate (HYLN, HYPV)				
Interstitial Water (IW)	3	16	24	X
	4	18	26	TSC added
Headspace (HS)	3	9	12	X
Microbio (MBRF,MBLN)	3	14	16	RF X
	3	12	14	LN X
	2	18	19	RF carbonate X

Sample	Sec	Top	Base	
Phys Props (PPMA)	3	24	26	X
	5	34	36	
Phys Props (PPOM, THERMAL)				
GH Dissociation (SYRINGE, DEVICE, DISPLACEMENT)				

FIELD LOGGING SHEET

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Borehole: BPXA MPU Mt. Elbert #1

Core Run: 17

Date: Feb 11, 2007 /02/2007

Logger: Hunter / Rose

Sec.	Top	Base	Description	Temp Data Depth T1°F T2°F T3°F
1	0	14	No core	
1	14	35	gray, well sorted, fine grained sand w/ minor vertical	fractures (drilling?)
2	0	17	Same as above	
2	17	21	fine grained, buff colored ~ 1" layers interbedded w/	sand. Buff layer faint reaction to HCl
2	21	35	Same as Sec. 1	
3	0	31	Same as Sec. 1	
3	31	33	fine grained sand continues but grades to buff color	& more cemented. Slight reaction to HCl
3	33	35	Same as Sec. 1	
4	0	35	Same as sec. 1	
5	0	22	Same as Sec. 1 but w/ more pervasive oil/mud	contamination
5	22	22.5	thin clay layer, light gray color, sharp	contacts
5	22.5	36	Same as Sec. 1	
6	0	5.5	Same as Sec. 1	
6	5.5	15	clay bed, massive, sharp contacts, gray color,	faint fine laminations
6	15	22.5	Same as Sec. 1	
6	22.5	25	light-gray to buff colored clay, consolidated	
6	25	34	basal fine grained gray sand fining upward into gray + well sorted.	clay, semiconsolidated

DRILLING AND CORING DATA SHEET - BPXA MPU Mt. Elbert #1

Page 1 of __

Core Run: 18

Date: /02/2007

Logger: Collett Boswell

Start Time: 01:30

End Time:

DRILLING

Initial rod depth: 2361 ft.

Final rod depth: 2385 ft.

Mud temp in: °F

Mud temp out: °F

Core temp logger #:

CORING

Section	Section Length
1	21.0 in.
2	34.0 in.
3	35.0 in.
4	33.0 in.
5	in.
6	in.
7	in.
8	in.
9	in.
shoe	4.0 in.

123

Core in tube: 123.0 in.

Core in shoe: 4.0 in.

Total Recovery: 127.0 in.

Core Disturbance:

Core entry time:

% Recovery: %

Comments: Highly deformed core, spiral fracture down the core; catcher problem locking up
- Ballseat failure w/ invasion
→ Add more solids

SUBSAMPLING

	Sec	Top	Base
Gas Hydrate (HYLN, HYPV)	X		
Interstitial Water (IW)	4	15	25 X
	2	12	20 X
Headspace (HS)	4	13	15 X
	2	0	2 X
	3	8	10 X TSC
Microbio (MBRF, MBLN)	~~MBRF/MBLN Sec 4 5-8~~		
	MBRF 4	5-6 X	Combo
	MBLN 4	6-8 X	Combo
	MBLN/MBRF Combo 5-8 TSC		

	Sec	Top	Base
Phys Props (PPMA)	4	30	28 X
	2	21	23 X
Phys Props (PPOM, THERMAL)			
GH Dissociation (SYRINGE, DEVICE, DISPLACEMENT)			

FIELD LOGGING SHEET

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Borehole: BPXA MPU Mt. Elbert #1
Core Run: 18

Date: /02/2007
Logger: Collett

Sec.	Top	Base	Description	Temp Data (Depth / T1/°F / T2/°F / T3/°F)
1	0	—	Claystone, dark gray, laminated	Sec 1 - 11" 32°F
1		11		Sec 2 - 25" 32.5
1	11	~~—~~	sand, unconsolidated, light gray	Sec 3 18" 33.0
2	—	0	to black - fine sand, massive	Sec 4 17" 32.5
			abrubt upper contact	
2	0	—	claystone, dark gray, consolidated,	
3	—	22	massive, abrubt upper contact	
3	22	—	siltstone section, dark gry, consolidated,	
4	—	11	uniform,	
4	11	—	v.fine sand, light gray to black	
4	—	33	abrubt upper contact	
			unconsolidated	
			Summary - uniform, interbeds	
			of clay - silt - ss(fine)	
			- no evidence of GH	

DRILLING AND CORING DATA SHEET - BPXA MPU Mt. Elbert #1 Page 1 of 1

Core Run: 19 Date: 12/02/2007

Logger: Collett/Boswell Start Time: 01:57 End Time: 02:41

DRILLING

Initial rod depth: 2385.0 ft.
Final rod depth: ~~2404.0~~ 2391 ? OK

Mud temp in: ____ °F
Mud temp out: ____ °F
Core temp logger #: ____

CORING

Section	Section Length
1	34 in.
2	36 in.
3	33 in.
4	36 in.
5	36 in.
6	38 in.
7	35 in.
8	in.
9	in.
shoe	6 in.

Core in tube: 244.0 in.
Core in shoe: 6.0 in.
Total Recovery: 250.0 in.

Core Disturbance: ____
Core entry time: ____
% Recovery: ____ %

Comments: very disturbed, sand layers washed extensively. Numerous drilling-induced fractures

SUBSAMPLING

	Sec	Top	Base	
Gas Hydrate (HYLN, HYPV)				
Interstitial Water (IW)	7	3	11	X
	4	22	30	X
Headspace (HS)	6	34	36	X
	4	30	32	X
Microbio (MBRF, MBLN)	7	1	2	RF } combo
	7	2	3	LN
	4	21	22	RF } combo
	4	19	21	LN

	Sec	Top	Base	
Phys Props (PPMA)	7	11	13	X
	4	32	34	X
Phys Props (PPOM, THERMAL)	4	13	19	Therm. X
GH Dissociation (SYRINGE, DEVICE, DISPLACEMENT)				

FIELD LOGGING SHEET

Page 1 of 1

Borehole: BPXA MPU Mt. Elbert #1
Core Run: 19

Date: 12/02/2007
Logger: Collett

Sec.	Top	Base	Description	Depth	T1/°F	T2/°F	T3/°F
1	0	→	v. fine-grained grey, massive bedded sandstone	S1	16	29.8	
2	↳	2		S2	23	30.4	
				S3	17	30.3	
2	2	9	dense claystone, abrupt upper contact, pale grey	S4	18	30.6	
				S5	19	30.1	
2	9	→	v. fine-grained, well sorted, massively-bedded	S6	17	30.4	
			sandstone. Grey to lt. grey. 1" dense compacted	S7	17	30.3	
3	↳	4	clay at 23.				
3	4	→	clay-silt. dense massive. v. lt. grey.				
4		↳ 9					
4	9	→	pale grey, claystone, dense, with numerous thin				
5	↳	11	discontinuous black (organic-rich) layers. minor				
			fine-grained sandstone interbeds				
5	11	→	v. fine grained sandstone / siltstone with minor				
7	↳	18	claystone interbedded				
7	18	→	~~vz~~ dense compacted ~~shale~~ claystone, minor dark				
	↳	35	laminations on mm-scale				
			— No evidence of GH —				

DRILLING AND CORING DATA SHEET - BPXA MPU Mt. Elbert #1

Page 1 of __

Core Run: 20 | Date: 12 /02/2007

Logger: Collett | Start Time: 06:45 | End Time: 07:33

DRILLING

Initial rod depth: 2409 ft. (CTS 2394; 13 ft)
Final rod depth: 2422 ft.

Mud temp in: ____ °F
Mud temp out: ____ °F
Core temp logger #: ____

CORING

Section	Section Length
1	39.0 in.
2	36.0 in.
3	36.0 in.
4	in.
5	in.
6	in.
7	in.
8	in.
9	in.
shoe	4.0 in.

(111.0)

Core in tube: 111.0 in.
Core in shoe: 4.0 in.
Total Recovery: 115.0 in
Core Disturbance: ____
Core entry time: ____
% Recovery: ____ %

Comments: Highly disturbed core; vertical fractures, biskets drilling; highly invaded

SUBSAMPLING

	Sec	Top	Base
Gas Hydrate (HYLN, HYPV)			
Interstitial Water (IW)	1	29	36 X
Headspace (HS)	1	23	25 X
	3	30	33 X
Microbio (MBRF,MBLN)	RF	1- 25	27 X
	LN	1- 27	29 X

	Sec	Top	Base
Phys Props (PPMA)	1	36	39 X
	3	33	35 X
Phys Props (PPOM, THERMAL)	~~1~~	~~32~~	~~36~~
	2	32	36 X
GH Dissociation (SYRINGE, DEVICE, DISPLACEMENT)			

FIELD LOGGING SHEET Page 1 of __

Borehole: BPXA MPU Mt. Elbert #1 Date: 12/02/2007

Core Run: 20 Logger: Collett

Sec.	Top	Base	Description	Depth	T1/°F	T2/°F	T3/°F
1	0	–	~~(lightgray to dark gray)~~	1	13	32.8°	
3	–	36	~~Siltstone - massive bedded, thin~~	2	19	32.2°	
			~~lamination; several small~~	3	18	31.3°	
			~~1 inch thick carb shale layers~~				
			~~(alternating layers of black to dark gray)~~				
			~~- No GH -~~				
1	0	–	siltstone to claystone, lightgray				
3	–	36	to dark gray, massive bedded,				
			thin lamination (1/2 inch) alternating				
			layers of black to dark gray;				
			several small 1/2 inch thick				
			carb shale layers				
			- NO GH -				

DRILLING AND CORING DATA SHEET - BPXA MPU Mt. Elbert #1 Page 1 of 1

Core Run: 21
Date: 12/02/2007
Logger: Collett
Start Time: 09:50
End Time: 11:15

DRILLING

Initial rod depth: 2422 ft.
Final rod depth: 2446 ft.
Mud temp in: °F
Mud temp out: °F
Core temp logger #:

CORING

Section	Section Length
1	33.0 in.
2	36.0 in.
3	36.0 in.
4	35.0 in.
5	36.0 in.
6	36.0 in.
7	in.
8	in.
9	in.
shoe	6.0 in.

Core in tube: 212.0 in.
Core in shoe: 6.0 in.
Total Recovery: 218.0 in.
Core Disturbance:
Core entry time:
% Recovery: %
Comments: Highly disturbed core; biskited core; highly; oil invasion vertical fractures

SUBSAMPLING

	Sec	Top	Base
Gas Hydrate (HYLN, HYPV)			
Interstitial Water (IW)	3	26	34 X
	2	20	28 X
Headspace (HS)	3	24	26 X
	2	18	20 X
Microbio (MBRF,MBLN)	MBLN 3	20-22 X	
	MBRF 3	22 24 X	
	MBLN 2	14 16 X	
	MBRF 2	16 18 X	
✓ Special	MBLN 1	- 8-9 X	
	Dolomite silt sample		

	Sec	Top	Base
Phys Props (PPMA)	3	34	36 X
	2	34	36 X
Phys Props (PPOM, THERMAL)	PPOM 4	30-35 X	
	Therm 5	11-16 X	
GH Dissociation (SYRINGE, DEVICE, DISPLACEMENT)			

FIELD LOGGING SHEET

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Borehole: BPXA MPU Mt. Elbert #1
Core Run: 21

Date: /02/2007
Logger: Collett

Sec	Top	Base	Description	Depth	T1/°F	T2/°F	T3/°F
1	0	—	- Very Hard; carbonate cemented	1	16	30.7°	
1	—	10	siltstone - reacted with Acid;	2	16	32.1	
			joined Core 20; abrupt lower	3	15	31.4	
			contact, NO GH - Photo ✓	4	20	30.9	
			[illegible]	5	19	30.3	
1	10	—	Siltstone, gray to dark gray, massive,	6	16	31.1	
6	—	36	thin 1-2mm black laminae; small				
			rip ups of black claystone;				
			two distinct hard layers in				
			Section 4 - (15-16) (20.2)				
			slight reaction to Acid;				
			light tan in color - hard				
			abrupt lower + upper contacts				
			- NO GH -				

FIELD LOGGING SHEET

Page 1 of 2

Borehole: BPXA MPU Mt. Elbert #1
Core Run: 21

Date: /02/2007
Logger: Collett

Sec	Top	Base	Description	Depth	T1/°F	T2/°F	T3/°F
1	0	—	- Very Hard; carbonate cemented	1	16	30.7°	
1	—	10	siltstone - reacted with Acid;	2	16	32.1	
			joined Core 20; abrupt lower	3	15	31.4	
			contact, NO GH - Photo ✓	4	20	30.9	
				5	19	30.3	
1	10	—	Siltstone, gray to dark gray, massive,	6	16	31.1	
6	—	36	thin 1-2mm black laminae; small				
			rip ups of black claystone;				
			two distinct hard layers in				
			Section 4 - (15-16) (20-2)				
			slight reaction to Acid;				
			light tan in color - hard				
			abrupt lower + upper contacts				
			- NO GH -				

DRILLING AND CORING DATA SHEET - BPXA MPU Mt. Elbert #1 Page 1 of 1

Core Run: 22 Date: 12 /02/2007

Logger: Hunter Start Time: 12:15 End Time: ______

DRILLING

Initial rod depth: 2446 ft. Mud temp in: ______ °F

Final rod depth: 2470 ft. Mud temp out: ______ °F

Core temp logger #: ______

CORING

Section	Section Length
1	17 in.
2	36 in.
3	33.5 in.
4	38.5 in.
5	35 in.
6	37 in.
7	35 in.
8	in.
9	in.
shoe	X in.

Core in tube: 232.0 in. Core Disturbance: ______

Core in shoe: 0.0 in. Core entry time: ______

Total Recovery: 232.0 in % Recovery: ______ %

Comments: ______

SUBSAMPLING

	Sec	Top	Base
Gas Hydrate (HYLN, HYPV)			
Interstitial Water (IW)	5	21	30 X
	2	12	19 X
Headspace (HS)	5	11	14 X
	2	27	30 X
Microbio (MBRF, MBLN)	RF 5	16	18 X
	LN 5	14	16 X
	RF 2	32	34 X
	LN 2	30	32 X

2 Pkgs

	Sec	Top	Base
Phys Props (PPMA)	5	34	35 X
	2	19	21 X
Phys Props (PPOM, THERMAL)	4	20	23 X
GH Dissociation (SYRINGE, DEVICE, DISPLACEMENT)			

FIELD LOGGING SHEET Page 1 of 1

Borehole: BPXA MPU Mt. Elbert #1 Date: 12 /02/2007
Core Run: 22 Logger:

Sec	Top	Base	Description	Temp Data Depth T1°F T2°F T3°F
1	1	—	Clay, gray, laminated, mm-cm	
			fresh surf more tan, gray oxidized	
2		9		
2	9	24	~~SS~~, silt, grn-gry, thinly lam	41°
			mm-cm scale	
2	24		Clay, aa	
3		23		
3	23	29	Silt, aa, f-up to the clay contact	
3	29		Clay, aa	
4			(Minor silt interbeds to 2")	
5			Mostly Clay aa, silty clay in part	
6		19	Clay aa, up to 2" silt interbeds	
6	19	24	silt, gry-grn, aa	
6	24	30	Clay, aa	
6	30	33	Silt aa	
~~6~~	~~33~~			
6	33		Clay to silty clay, aa	
7		29	Mostly gry-blk clay	
7	29	30	silt, aa	
7	30	35	Clay	

DRILLING AND CORING DATA SHEET - BPXA MPU Mt. Elbert #1

Page ___ of ___

Core Run: 23

Date: 12th/02/2007

Logger: Hunter

Start Time: 2:50pm

End Time: 4 pm

DRILLING

Initial rod depth: 2470 ft.

Final rod depth: 2494 ft.

Mud temp in: ___ °F

Mud temp out: ___ °F

Core temp logger #: ___

CORING

Section	Section Length
1	35 in.
2	36 in.
3	36 in.
4	36 in.
5	36 in. Contact to SS at 29"
6	36 in.
7	36 in.
8	39 in.
~~9~~	in.
shoe	4 in.

289"

Core in tube: 285.0 in.

Core in shoe: 4.0 in.

Total Recovery: 289.0 in.

Core Disturbance: ___

Core entry time: ___

% Recovery: ___ %

Comments: No hydrate wet - likely poor seal

SUBSAMPLING

	Sec	Top	Base
Gas Hydrate (HYLN, HYPV)			
Interstitial Water (IW)	8	16	25 X
	4	10	17 X
	6	26	34 X
Headspace (HS)	4	3	6 X
	6	22	25 (?)
	4	31	33 X
Microbio (MBRF, MBLN)	4	8	9 RF X
	4	7	8 LN X
	6	18	20 LN
	6	20	22 RF

2-3 ✓ (IW); x2 ✓ (HS) → 3-6 (?); x2 ✓ (Microbio)

	Sec	Top	Base
Phys Props (PPMA)	~~8~~	~~25~~	~~27~~
	8	14	16 X
	6	34	36 X
	4	33	35 X
Phys Props (PPOM, THERMAL)			
PPOM	5	0	5 X
GH Dissociation (SYRINGE, DEVICE, DISPLACEMENT)			

2 +2 → note ~1/8-1/4" siderite cmt nodules cm/g grains → Photo x2

1-2 ★ Take one in scn & once frozen in Anchorage. Use Liq N2 Also

2 sets IW's

PPOM

FIELD LOGGING SHEET

Page ___ of ___

Borehole: BPXA MPU Mt. Elbert #1
Core Run: 23

Date: 12th/02/2007
Logger: Hunter

Sec.	Top	Base	Description	Temp Data Depth T1°F T2°F T3°F
1			Clay, gry-grn, soft	
2			Clay aa	
3			Clay aa	
4		23	Clay aa	coarse sd size
5	23	29	Silty clay, f-up to clay above w/	trace blk chrt pebbles
4			~~Clay aa~~	slightly more
5	29	32	Pebble conglomeratic v.f to coarse gr SS, ~~well~~	cmted
			Pebbles well rnded, but likely immature as up to 1"	
			slightly rounded clay clast; chert pebbles 1"	to coarse snd sized
5			poorly sorted, likely transgressive pebble	lag
5	33		Sharp contact to Zone B SS, v	
			v. friable, v.f - f.gr, well sorted	
			Grayish green, qtz, black grains (chert?)	
			No obvious glauc, but green hue	
		OBM	Invasion rind to ~1" around	
			Sand is massive, v. well sorted	(beach?)
			(Core-induced fracturing spirals downward)	
8			1/2 cu. inch piece @ top scn 8, center weighs	7g, quite
			heavy → very water-saturated	
8	14	16	→ Noted siderite? cmtd? brownish-tan	spots
			w/in the well sorted sands as ~1/4" nodules	
			2 Photos taken, 1 w/ scale - noted when	PPMA sample
			taken	

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