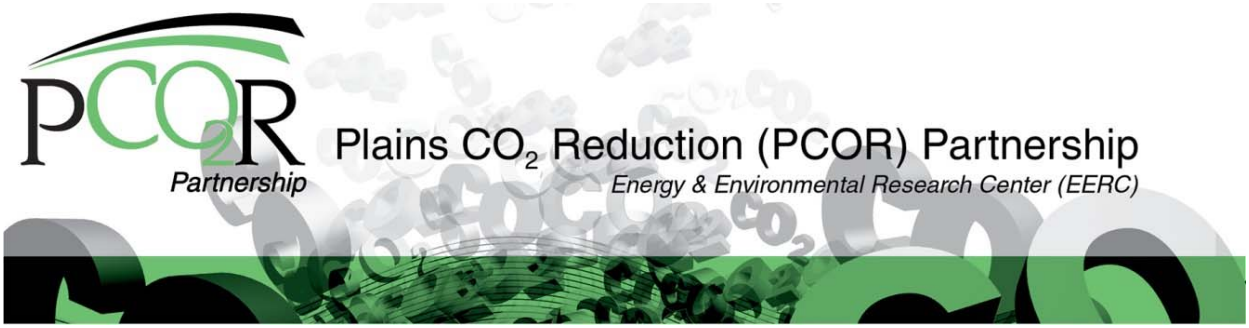

PETROPHYSICAL EVALUATION OF BAKKEN FORMATION CORE FROM THE AQUISTORE CO_2 INJECTION SITE

Plains CO_2 Reduction (PCOR) Partnership Phase III
Value-Added Report

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DOE Cooperative Agreement No. DE-FC26-05NT42592

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January 2015
2015-EERC-04-05
Approved

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ACKNOWLEDGMENT

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EXECUTIVE SUMMARY

One of the goals of the Plains CO_2 Reduction (PCOR) Partnership is to develop a first-order, reconnaissance-level estimate of the potential carbon dioxide (CO_2) storage resource of a wide variety of geologic formations in the region. To date, research efforts to better understand and estimate CO_2 storage capacity/resource have been largely focused on relatively permeable targets, such as saline formations and conventional oil reservoirs. However, as development of unconventional oil and gas reservoirs throughout North America continues to expand, there is increasing interest from stakeholders regarding the feasibility of CO_2 storage and/or simultaneous CO_2 storage and enhanced oil recovery (EOR) within these types of formations. To determine the role that a tight oil formation, such as the Bakken, may play in carbon capture and storage (CCS), it is critical to understand its petrophysical characteristics that would make it amenable to CO_2 injection. In 2014, the EERC received samples from the upper and middle members of the Bakken Formation that were collected from the Petroleum Technology Research Centre (PTRC) Aquistore Project CO_2 injection well in southern Saskatchewan, Canada. Laboratory activities were conducted, including petrographic analysis, capillary entry pressure determinations, total organic carbon analysis, porosity and permeability analyses, and mineralogical analyses.

In all, ten samples were collected and tested over the course of this evaluation: nine middle member and one upper shale sample. Test results indicate that the Middle Bakken in this area is composed of three unique members, labeled from bottom to top Units A, B, and C. This correlates well with existing published literature. The average porosity and bulk density of nine middle member samples was determined to be 6.75% and 2.54 g/cm^3, respectively. The relationship indicates a quartz sandstone-to-limestone-dominated system, which is confirmed through optical thin-section analysis. Mineralogically, the middle member was determined through x-ray diffraction, x-ray fluorescence, and scanning electron microscopy to be dominated by quartz, illite clay, and potassium feldspar. While the samples contain the minerals dolomite and calcite, they are in lower percentages than the rocks of the central Williston Basin. Total organic carbon was found to be less than 1 wt% in each middle member sample tested and about 15 wt% in the upper shale. The evaluation indicated that this area is not likely capable of economically producing oil because the quality of organic carbon was not considered mature.

Regarding the CO_2 storage potential, samples were evaluated to determine their effective porosity, pore throat distribution, and relative permeability to brine and CO_2. Results of the mercury injection capillary pressure work indicated that the shale and stratigraphically adjacent upper Unit C have a pore throat size distribution of less than 0.25 µm, typically of rocks considered "geologic seals," or good barriers to fluid flow. The middle unit (B) and lower unit (A), while still small in scale, have a wider size distribution of less than 7.5 µm that may aid in the injection and movement of fluids away from a wellbore during CO_2 storage.

Relative permeability tests were conducted on two samples from Unit B. Results indicate the potential to move CO_2 through core plugs saturated with 286,000 ppm brine. The relatively high porosity (13.9%), laminated, fine grained sandstone had a permeability to brine of 1.17 mD, an irreducible brine saturation value of 44.1%, and a permeability to CO_2 of 1.17 mD. The sample with tighter-grained fabric (4.7% porosity) had a permeability to brine of 0.007 mD, an irreducible brine saturation of 58.6%, and a permeability to CO_2 of 0.003 mD. It was noted during testing that as the brine was mobilized and "pushed" out of the way, CO_2 flow became more efficient and pressure across the sample decreased. This is not a surprising result considering the large viscosity differences between the two fluids. However, this indicates that the formation may be amenable to use as a secondary CO_2 storage reservoir should the need arise. Further evaluation of this formation is needed regarding injection testing and modeling and simulation of the reservoir prior to making a complete determination. It is anticipated that this may be an area of focus for future evaluations.

PETROPHYSICAL EVALUATION OF BAKKEN FORMATION CORE FROM THE AQUISTORE CO_2 INJECTION SITE

INTRODUCTION

In mid-2012, the Petroleum Technology Research Centre (PTRC) drilled and completed the PTRC_INJ_5-6-2-8 W2M well in southwestern Saskatchewan near Estevan (Figure 1). The well was developed as part of PTRC's Aquistore Project and is to be used for injection of carbon dioxide (CO_2) captured from SaskPower's Boundary Dam Station into the Cambrian Deadwood Formation. During the drilling of the well, a decision was made by PTRC to core the Bakken Formation interval to gain insight regarding its resource potential and/or viability as an alternate CO_2 storage horizon. In March 2014, representatives of the Energy & Environmental Research Center (EERC), through the Plains CO_2 Reduction (PCOR) Partnership, were invited to collect samples from this core in support of both PTRC's and the EERC's CO_2 storage research programs.

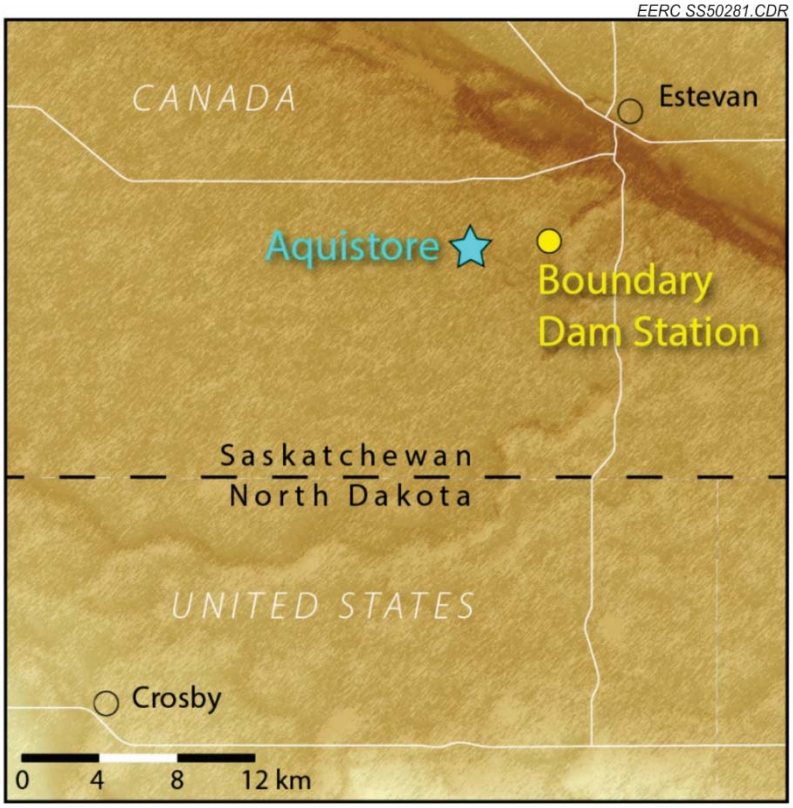


Figure 1. Location map of PTRC_INJ_5-6-2-8 W2M well.

One of the goals of the PCOR Partnership is to develop a first-order, reconnaissance-level estimate of the potential CO_2 storage capacity of a wide variety of geologic formations in the region. To date, research efforts to better understand and estimate CO_2 storage capacity in geologic formations have been largely focused on relatively permeable targets, such as saline formations and conventional oil reservoirs. However, as development of unconventional oil and gas reservoirs throughout North America continues to expand, there is increasing interest from stakeholders regarding the feasibility of CO_2 storage and/or simultaneous CO_2 storage and enhanced oil recovery (EOR) within these types of formations. In particular there are questions as to whether tight, organic-rich oil- and gas-producing formations (e.g., "tight oil" formations) can serve as CO_2 sinks or seals. One example is the Bakken Formation (Bakken), a tight (<10-mD), naturally fractured oil and gas reservoir in the Williston Basin. The Bakken Formation contains geology that represents a fractured reservoir or storage system that contains brine and hydrocarbons (Middle Bakken) which is sandwiched between tight, organic-rich, oil-wet black shales (Upper and Lower Bakken) that may be representative of sealing formations in this area.

To determine the role that a tight oil formation, such as the Bakken, may play in carbon capture and storage (CCS), it is critical to understand the petrophysical characteristics of the formation. It is of particular importance to develop an understanding and contribute data sets that can be used to estimate the CO_2 injectivity and long-term storage potential of the reservoir. This study has focused on laboratory activities including petrographic analysis, pore throat size determination, total organic carbon analysis, porosity, and CO_2/brine relative permeability. It is anticipated that results of this work could be used in modeling and simulation efforts to determine storage efficiency that might be expected if CO_2 was injected into the Bakken at the Aquistore site.

SAMPLE SELECTION AND METHODS OF ANALYSIS

Sample Selection

The core from the Aquistore well is housed in Regina, Saskatchewan, and was unboxed for its initial viewing with PTRC, Saskatchewan Geological Survey, and EERC representatives present. At the time of viewing, the core was in the process of being slabbed, which provided an opportunity to observe sedimentary structures and relevant contacts with ease (Figure 2). Upon viewing, the core was divided into three units based on small changes in lithologic character, grain size, grain sorting, mineral content, and observed sedimentary structures. These divisions were previously established and described by Kohlruss and Nickel (2013) of the Saskatchewan Geological Survey (Figure 3). These units also served as the basis for selecting sampling points for the laboratory work in order to provide information on zones of distinct lithologic character.

A total of nine core plugs were sampled from the middle member of the Bakken Formation, and three shale samples were taken from the upper member of the formation. Depth correlation and unit designations are shown in Table 1. Samples were subsequently shipped to the EERC. All core plugs were cut to have a diameter of 30 mm, with various lengths appropriate for the analytical techniques scheduled.

Figure 2. Example of slabbed core viewed and described prior to sampling.

Methods of Analysis

The samples were characterized in detail for petrophysical attributes, including mineralogy, porosity, relative permeability, total organic carbon (TOC), and pore-size distribution. A brief description of each technique is provided under each activity.

Sample Preparation

All samples were photographed for reference and to document their as-received condition. Plug samples were cut into multiple parts in an effort to maximize the characterization opportunity. Plug ends were trimmed and distributed for x-ray diffraction (XRD), x-ray fluorescence (XRF), and thin-section creation. Additional material was allocated to Core Laboratories for mercury injection capillary pressure (MICP) and Rock-Eval/TOC work. Finally, 25.4-mm-long by 30-mm-diameter samples were prepared for flow-through experimentation.

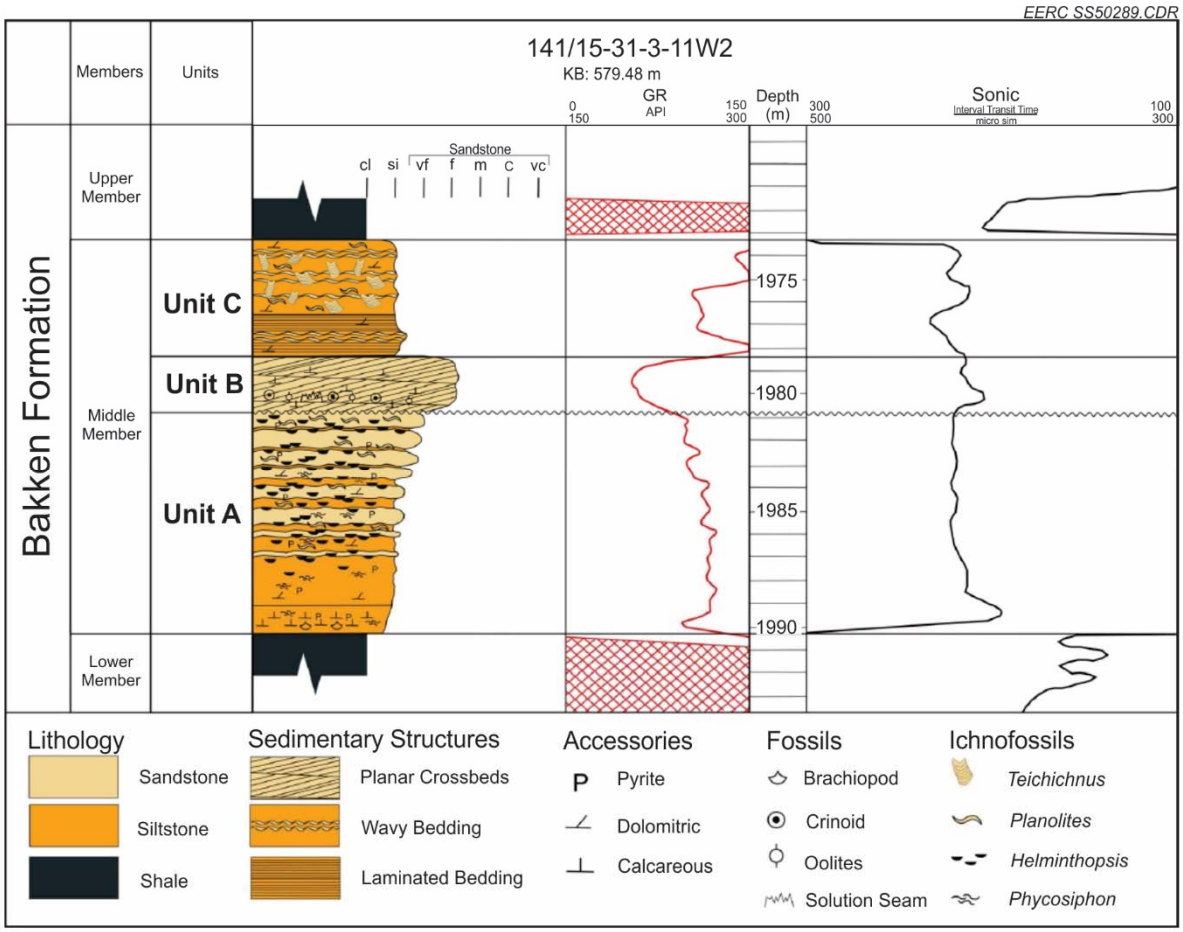


Figure 3. Lithofacie designation of the Bakken Formation in southern Saskatchewan (modified from Kohlruss and Nickel, 2013).

Table 1. Summary of Sampled Depths and Corresponding Unit Designations

Sample Number	Depth, m	Lithofacie
118645	2098.5	Unit C
118646	2100.0	Unit C
118647	2100.6	Unit B
118648	2102.1	Unit B
118649	2103.4	Unit B
118652	2104.7	Unit B
118653	2105.2	Unit A
118654	2108.1	Unit A
118655	2111.4	Unit A
118656	2095.9	Upper shale
118657	2096.1	Upper shale
118658	2097.2	Upper shale

Petrographic Analysis

Several petrographic techniques were used to evaluate the mineralogy of the rocks. One end trim was cut (retaining orientation) and sent to Wagner Petrographics for thin-section preparation. Thin sections were ground to a 30-µm thickness and emplaced with blue-dyed epoxy using a vacuum. Alizarin red dye was applied to aid in the distinction between calcite and dolomite.

The EERC used optical microscopy with plane and cross-polarized light to analyze and describe the thin sections. Microscale mineralogical interpretations from the thin sections included rock fabric (grain size and shape distribution, cementation, and/or mineral overgrowth), description of microstructure, and mineral presence. Additional petrographic techniques, including XRD and clay typing as well as scanning electron microscopy (SEM), were performed on one sample from each middle member lithofacies identified in the core and one shale sample.

Bulk Volume, Grain Density, and Porosity

The bulk volume of each sample was determined using a 3-D laser scanner. This technique provides results comparable to those obtained by the conventionally used immersion and Archimedes techniques, but it has the advantage of being noninvasive. The bulk density, skeletal/grain density, and porosity of each core were determined utilizing a commercial-grade helium porosimeter. The technique utilizes Boyle's law equations to determine the grain volume, which is subtracted from the bulk volume to yield the pore volume of the sample. These results were used further in relative permeability test calculations.

SEM and XRD Analysis

Thin sections were analyzed by SEM, and core pieces from the remaining thin-section billets were ground for analysis by XRD and XRF. These analyses were used in conjunction with the thin-section analyses to provide additional information on characteristics such as the bulk mineralogy and textural, elemental, and mineralogical composition of the samples. Specific information obtained includes the identification of the major mineral phases and clay types present (i.e., illite, muscovite, smectite, glauconite, etc.). The results from the techniques were interpreted as a package to provide a concise characterization of the rocks.

- **SEM techniques –** SEM techniques were used to evaluate the textural, elemental, and mineralogical composition of the samples using backscattered electron (BSE) imaging and energy-dispersive spectrometry (EDS). EDS was used to create maps showing the mineralogical composition of the samples.

- **XRD analysis –** XRD is the standard method for determining bulk mineralogy of materials. The complementary use of SEM data enhances bulk mineral identification. Rietveld refinement was used to quantify the mineralogical composition of the samples.

- **XRF analysis –** XRF is used to determine the bulk chemistry of the samples, reported as elemental oxide weight percent. The results are used as a guide to improve mineral characterization by the XRD technique.

CO_2–Brine Relative Permeability Determination

Relative permeability testing was conducted on two of the selected core samples and included the determination of a drainage curve using CO_2 and brine. The testing utilized the steady-state method where predetermined ratios of CO_2 and brine are set at a known flow rate and pumped through the core plug until a constant pressure drop is achieved. The brine used was a synthetic mixture of salts similar to the chemistry of the actual formation brine and prepared according to data provided by the Saskatchewan Geological Survey to match existing relative permeability tests.

Mercury Injection Capillary Pressure, TOC, and Rock-Eval Tests

Samples were sent to Core Laboratories (Houston, Texas) to perform MICP, TOC, and Rock-Eval tests. In all, nine middle member samples and one upper shale sample were sent to the lab for this testing. The overall goal of this activity was to provide a comparison of pore throat sizes, potential for hydrocarbon production, and kerogen type encountered. The following is a brief description of each test:

- **MICP –** This test determines the pore-size distribution, size classification, and a permeability distribution of samples tested and provides direct inputs for calculated threshold, or breakthrough, pressure testing.

- **TOC and Rock-Eval –** This test is commonly performed to judge a rock formation's potential as a petroleum reservoir. Data associated with TOC testing provide information regarding the weight percent of organic carbon in each sample. Rock-Eval gives an indication of the quality of the organic material encountered and relates it to the overall reservoir potential.

SUMMARY OF KEY OBSERVATIONS

Within the Williston Basin, the Bakken Formation has been explored as a potential hydrocarbon resource for decades. Recent advances in technology coupled with a favorable price environment have allowed field operators to sustain production at economical levels. This has provided a renewed motivation to explore the previously defined boundaries of areas known to be thermally mature, a key criterion for evaluating a hydrocarbon resource. While the well sampled in this report is thought to be outside of the zone of thermal maturity, a program was put in place to determine the petrographic and petrophysical properties of the formation that may indicate whether a hydrocarbon resource exists. However, the investigation goes beyond evaluating the hydrocarbon resource potential because the ultimate purpose of the well is CO_2 injection into the Cambrian-age Deadwood Formation for long-term storage. As such, analytical data are being considered in the context of whether or not the Bakken Formation,

stratigraphically above the Deadwood, in this area could potentially store CO_2 or provide yet another barrier to flow. The following provides a brief summary of key observations made during the evaluation. Sample-specific data from all characterization activities are provided as a series of data sheets in Appendix A.

Porosity and Mineralogy

The porosity and mineralogy of a potential CO_2 storage reservoir are important parameters to understand from the context of long-term injection operations, determinations of plume extent, cap rock integrity, and reporting and regulatory compliance. Because geologic systems are typically heterogeneous with respect to both mineralogical composition and fluid chemistry within available pore space, CO_2–water–rock interactions are complex and thus not easily determined. Modeling and simulation are generally the mechanisms that can provide a visual explanation of the results of potential injection scenarios. While modeling has not been conducted here, the topic of CO_2 injection-related geochemical reactions has been an area of focus in the research community. The addition of CO_2 into a geologic reservoir has the potential to alter the geochemical stability of fluids and minerals within the reservoir matrix. In its most basic form, CO_2 will dissolve into water and form a weak solution of carbonic acid, which will lower the local pH and potentially dissolve acid-soluble materials such as carbonate or metal oxides. To a much lesser effect, injection activities may cause a local temperature and/or pressure flux or localized "drying," which may alter specific aspects of reservoir geochemistry. This has the potential to affect the way CO_2 is distributed within a reservoir and dictate how CO_2 is stored in the long-term.

The mineral constituents of a formation that may lead to specific geochemical interactions are highly reservoir-specific and are difficult to generalize, especially without detailed geochemical modeling. The data generated in this study are being used for correlating lithofacies, evaluating hydrocarbon resource potential, and developing cursory evaluations of the CO_2 storage resource of the formation. While modeling is beyond the scope of this current work, the porosity and mineralogy of samples are provided in an effort to create data sets that may be used for contributed to future geochemical and geologic modeling studies. The results of these analyses are provided in the following discussion.

Table 2 provides a summary of the porosity tests conducted on nine middle member samples. Included are the sample depths and laboratory-derived bulk density, pore volume, and porosity. The average porosity and bulk density for all samples was determined to be 6.75% and 2.54 g/cm^3, respectively. When looking at each unit individually, the average porosities are 6.83%, 8.57%, and 2.97% for Units A, B, and C, respectively. These data are not out of the ordinary for the Bakken, a mixture of well-consolidated clastic and carbonate sedimentary rocks. Figure 4 shows a plot illustrating the relationship between wireline log-based neutron porosity and the bulk density of the formation. The samples tested throughout this project plot consistently in the quartz sandstone-to-limestone-dominated systems.

The relationship between porosity and bulk density-based observation of lithology is confirmed through optical thin-section analysis. Figure 5 shows the results of three samples

Table 2. Summary of Porosity Results

Sample Number	Depth, m	Formation	Unit	Length, cm	Diameter, cm	Scanned Bulk Volume, cm^3	Bulk Density, g/cm^3	Average Pore Volume, cm^3	Average Porosity, %
118645	2098.5	M. Bakken	C	1.872	3.012	13.34	2.641	0.35	2.63
118646	2100.0	M. Bakken	C	1.723	3.002	12.24	2.643	0.40	3.31
118647	2100.6	M. Bakken	B	1.819	3.007	41.04	2.559	1.41	4.70
118648	2102.1	M. Bakken	B	1.670	3.002	11.80	2.348	1.64	13.90
118649	2103.4	M. Bakken	B	1.728	3.015	12.39	2.536	0.90	7.26
118652	2104.7	M. Bakken	B	1.857	3.007	13.25	2.477	1.12	8.42
118653	2105.2	M. Bakken	A	1.789	3.007	12.64	2.579	0.73	5.74
118654	2108.1	M. Bakken	A	1.776	3.010	12.92	2.483	1.15	8.90
118655	2111.4	M. Bakken	A	1.787	3.010	12.94	2.549	0.76	5.86

representing Units A, B, and C from left to right. Each image shows a quartz-dominated system (white grains) with sporadic calcite grains (red) present. The dark brown material shown in each sample is clay, and the black is pyrite. While grain size changes from stratigraphic bottom to top throughout the Bakken interval are evident, what is noteworthy is a general lack of visible porosity (represented by blue color between grains) in the samples at the base and top of the unit (118654 and 118645, respectively). Each of these samples was tested for porosity, with the results showing values of 2.6% and 5.8%, respectively. Sample 118648 was determined to have a porosity of 13.9%, which is confirmed in the thin section shown in the middle of Figure 5.

Figure 6 shows the same three samples in a larger field of view. In this collection of images, the entire thin section is shown to better illustrate the textural differences of each unit within the Middle Bakken. At the basal Unit A, Sample 118654 shows a relatively structureless siltstone with minor fossil inclusions. The sample is dominated by quartz, feldspars, dolomite/iron–dolomite, and clays with minor calcite as fossil fragments rather than pore filling. Grains are moderately sorted, angular to subangular, and range in size from 10 to 60 µm. The sample from Unit B, 118648, shows a coarse siltstone to very fine sandstone with coarse laminations. Calcite fill is common, and intergranular porosity is visible. Dolomite and iron–dolomite are common, along with quartz, feldspars, and clays. Grains are poorly rounded and moderately sorted, ranging in size from 10 to 100 µm, with a majority of grains larger than 60 µm. Finally, Sample 118645, representing the upper most Unit C, shows a siltstone with a stronger bioturbated texture. Fossil fragments are present within the mixed quartz, feldspars, dolomite, and clay matrix. Intergranular calcite was found likely filling available pore space. Dolomite often shows zoning with iron-rich overgrowths. Quartz grains show some overgrowths as well. The grains are angular and moderately well sorted from 30 to 100 µm.

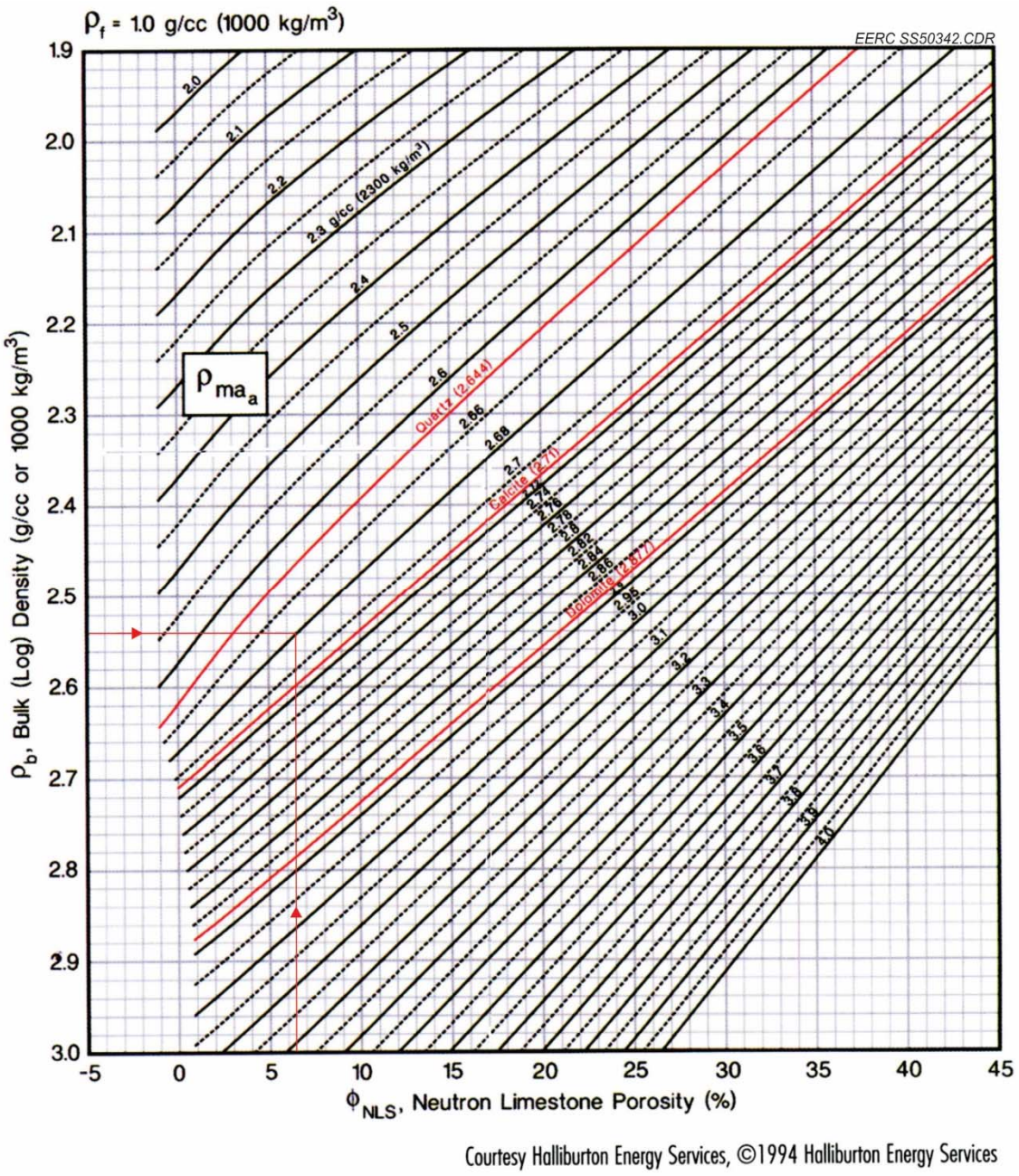


Figure 4. Chart illustrating the relationship between porosity and bulk density of rock samples. The average value (red arrow line) of the rocks evaluated for this project plot within the quartz sandstone–limestone windows.

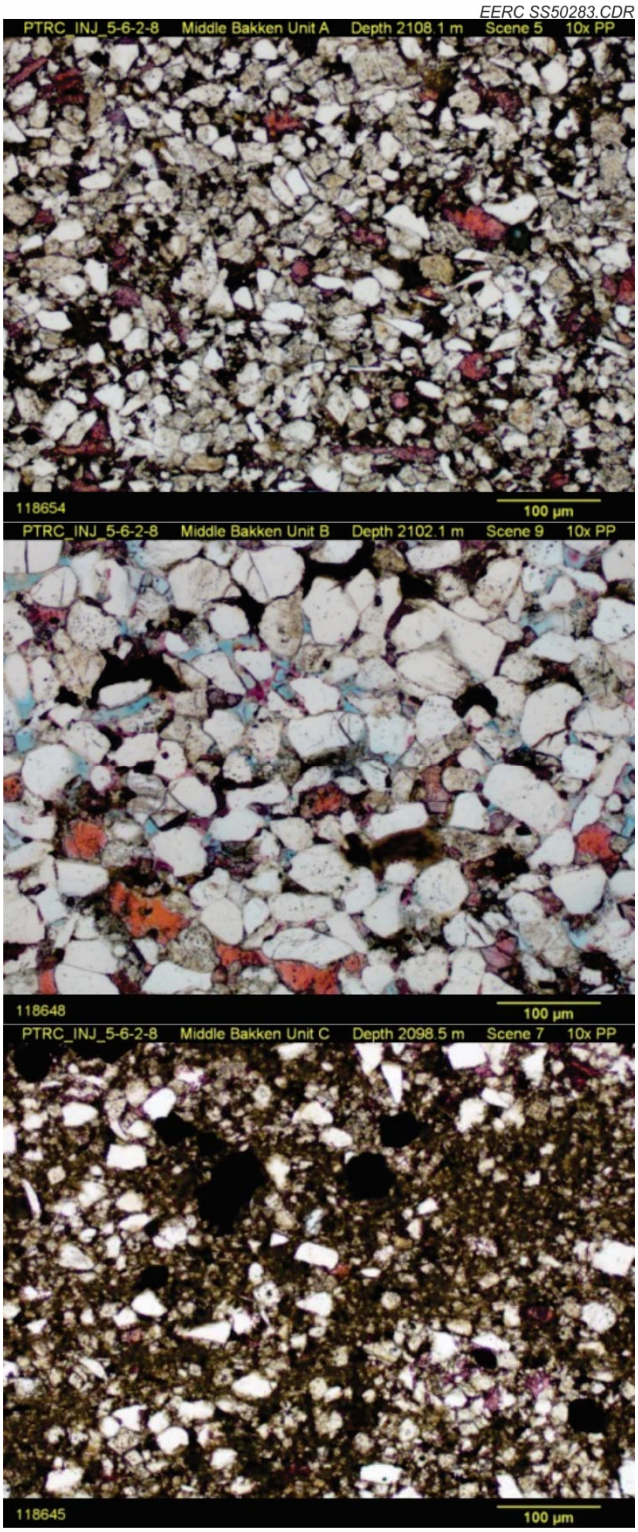


Figure 5. Thin-section images from Units A, B, and C, shown from left to right.

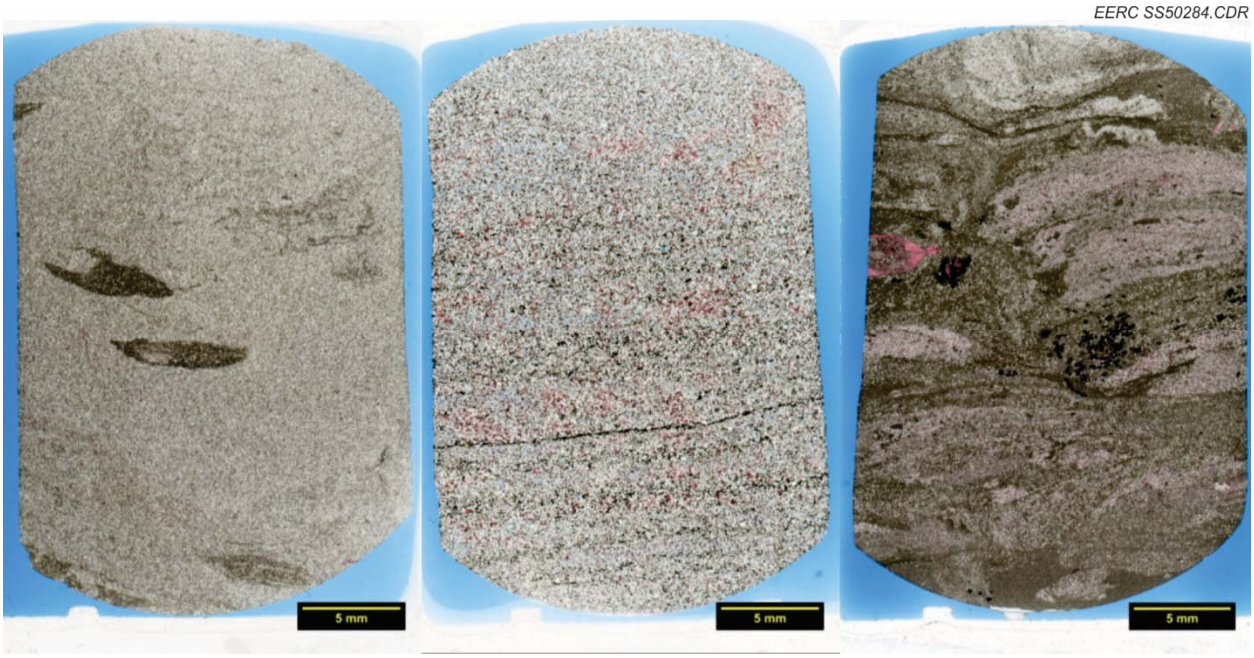


Figure 6. Whole thin-section scan demonstrating textural differences throughout the three Middle Bakken units observed in this well. Units A, B, and C are shown from left to right.

SEM, XRD, and XRF Mineralogy

SEM, XRD, and XRF were used in conjunction with one another to determine the bulk mineralogical content of four samples, three from the middle member and one from the upper shale. Two methods of SEM were employed on thin-section samples, BSE imaging and EDS. BSE imaging provides a scan of the sample surface in an effort to understand the chemistry of each point analyzed. The second technique, EDS, uses software to aid in the interpretation of the chemistry and assign the most likely mineral type. EDS was used to create maps showing the mineralogical distribution and composition of the samples.

Figure 7 provides two images of the same areal extent of Sample 118648 (Unit B). While the image on the top has data regarding the chemistry of multiple points within the sample, there is still much left to the imagination regarding the mineralogy of the sample, grain-to-grain relationships, cements, etc. The lower image begins to bring clarity to the complex heterogeneity found at a relatively small scale. For instance, the sample is dominated by quartz and feldspar grains. Where feldspars exist, it becomes clear that the perimeter of these particles has begun breaking down to form new clay particles, in this case illite. Likewise, the calcite shows evidence of dolomitization. The quartz remains unaltered because of its chemical resistivity. Another added benefit of this type of analysis is the ease at which one can quantify the mineral species in each sample in 2-D area percent. Specifically, this scan was determined to contain 49.4% quartz, 12.3% illite, 12.1% potassium–feldspar, 10.6% organic-filled pores, 7.1% dolomite, 5.1% calcite, and a minor amount of albite.

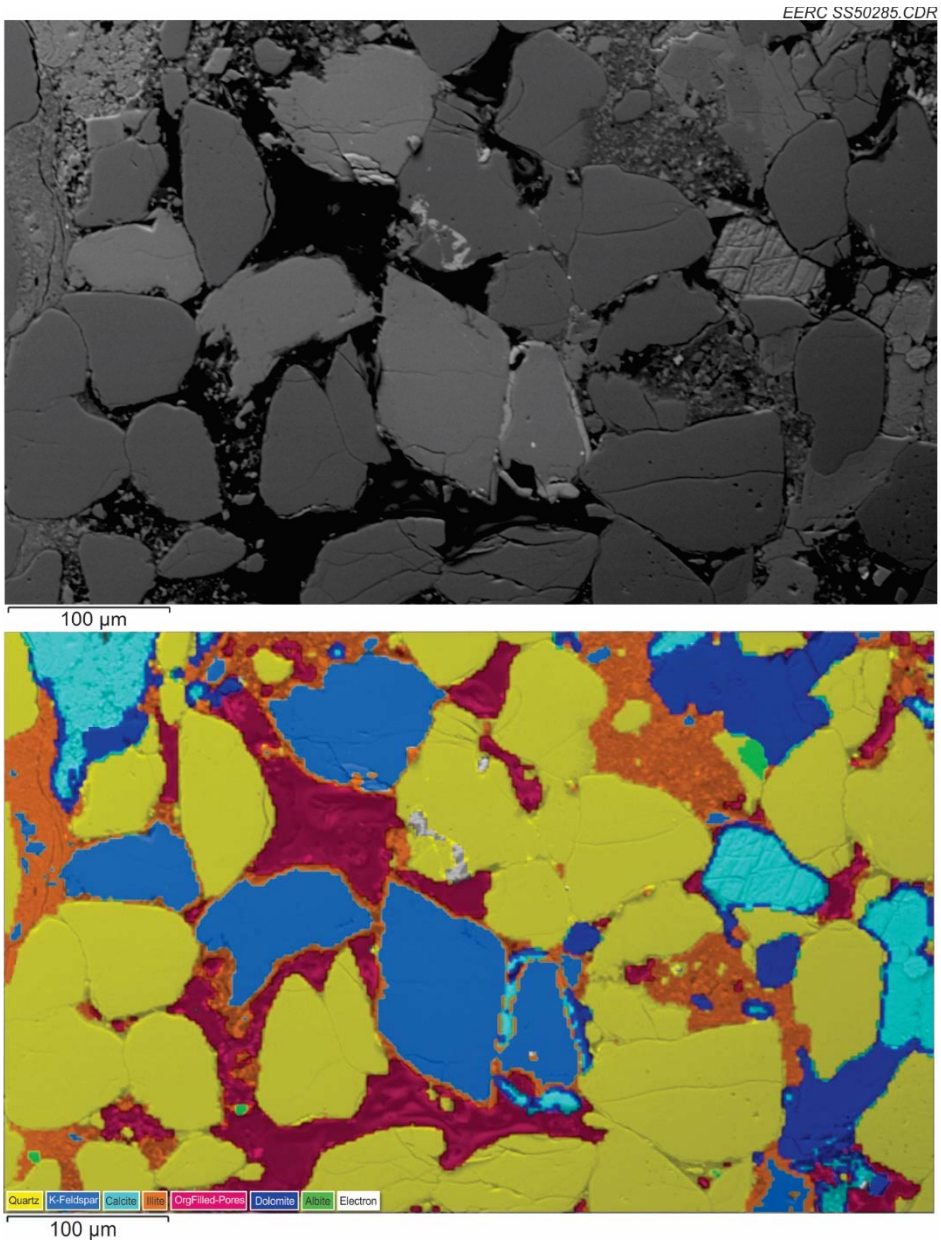


Figure 7. The mineral map (bottom) allows full sorting of mineral phases and mineral associations that are indistinguishable in a conventional BSE image (top). The colors on the image are altered from the legend because of the overlay on the BSE image.

To further understand the mineralogy of these samples, XRD and XRF analyses were conducted. Three middle member samples and one upper shale sample were selected based on their representative character in each lithofacie. The three middle member samples represent each unit throughout the interval. Figure 8 shows the distribution of mineralogy for each sample tested. The upper shale sample is composed primarily of quartz and illite clay with relative weight percent values of 36.4% and 31.5%, respectively. Potassium–feldspar was the next largest component at 19.5% and minor amounts of accessory minerals. The three middle member samples are generally similar in composition, with quartz dominating each zone. The remaining minerals in each sample are distributed between ankerite, dolomite, illite, calcite, feldspars, and anhydrite. Additional accessory minerals and relative weight percents obtained are detailed for each sample in Appendix A of this report.

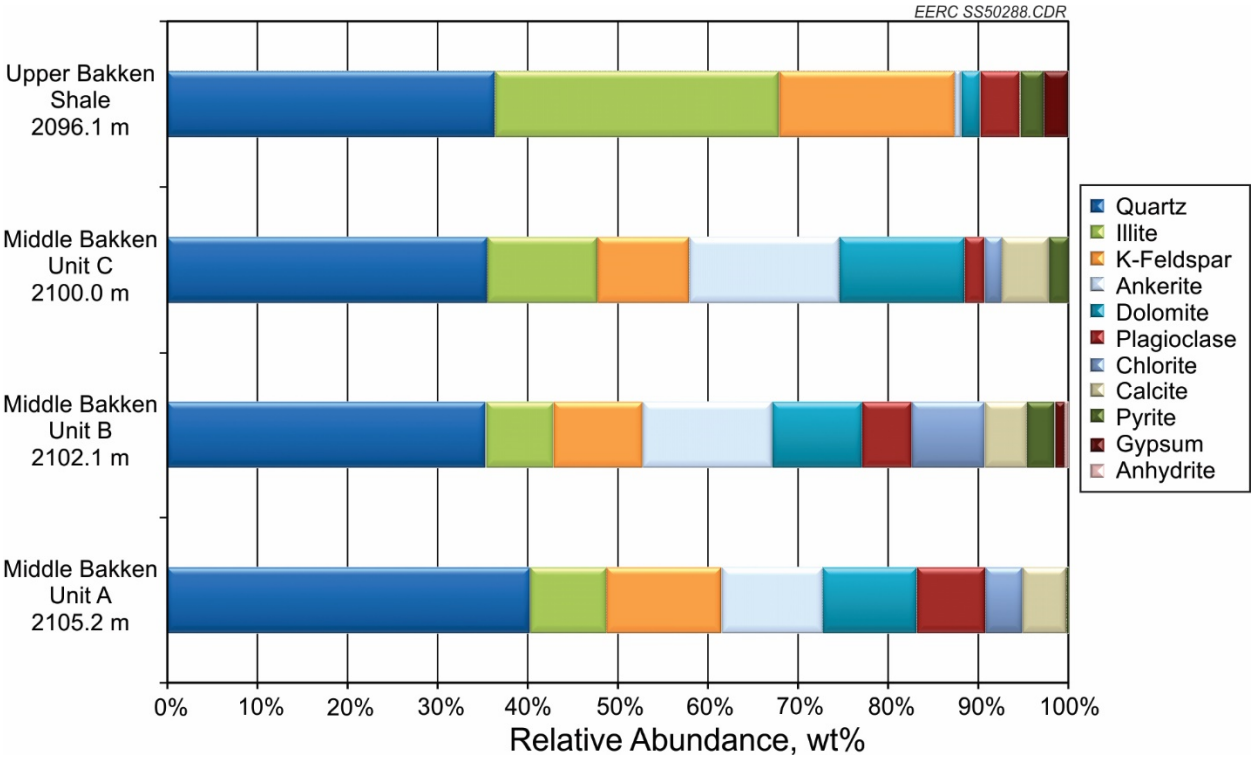


Figure 8. Results of XRD on the upper shale and Middle Bakken interval. It can be seen that the mineralogy of the middle member is very similar throughout, with unit boundaries identified primarily through textural changes.

Capillary Pressure

High-pressure mercury injection (HPMI) tests were performed on nine middle member samples and one upper shale sample. The goal of the test was to compare and contrast the pore throat sizes observed over the three units and, ultimately, compare them to the upper shale. These data help inform the flow-through experimentation and provide insight regarding the sink-versus-seal quality of this reservoir. This has specific implications to CO_2 injection and storage evaluation purposes in that the test provides a level of understanding for potential injectivity and the size of the available pores within the rock package being considered. Capillary entry pressures can be estimated using the pore throat radius obtained in this test. Along with the interfacial tension and wetting angle of CO_2 in the presence of brine, an estimate of the pressure needed to overcome and displace the in-place wetting phase (brine) can be made. At time of reporting, evaluation of capillary entry pressure and its relationship to CO_2 storage estimation is ongoing and will be published in subsequent documents. A brief summary of HPMI testing results follows. All sample data are provided in a summary report in Appendix B of this document.

Figure 9 shows the distribution of pore throat sizes encountered for all samples tested. The pore throats of each of the samples tested are similar to rocks considered geologic barriers to flow. In certain cases, like Sample 118645, Middle Bakken Unit C, 2098.5 m, the pore throats fall within the range of a geologic seal, between 10 and 100 nm. The samples tested for Unit B have the largest pore throats and are generally bimodal in their distribution. The evaluation of this reservoir for CO_2 storage will be dictated by how well-connected these pores are and whether the calculated entry pressures fall below acceptable fracture gradients.

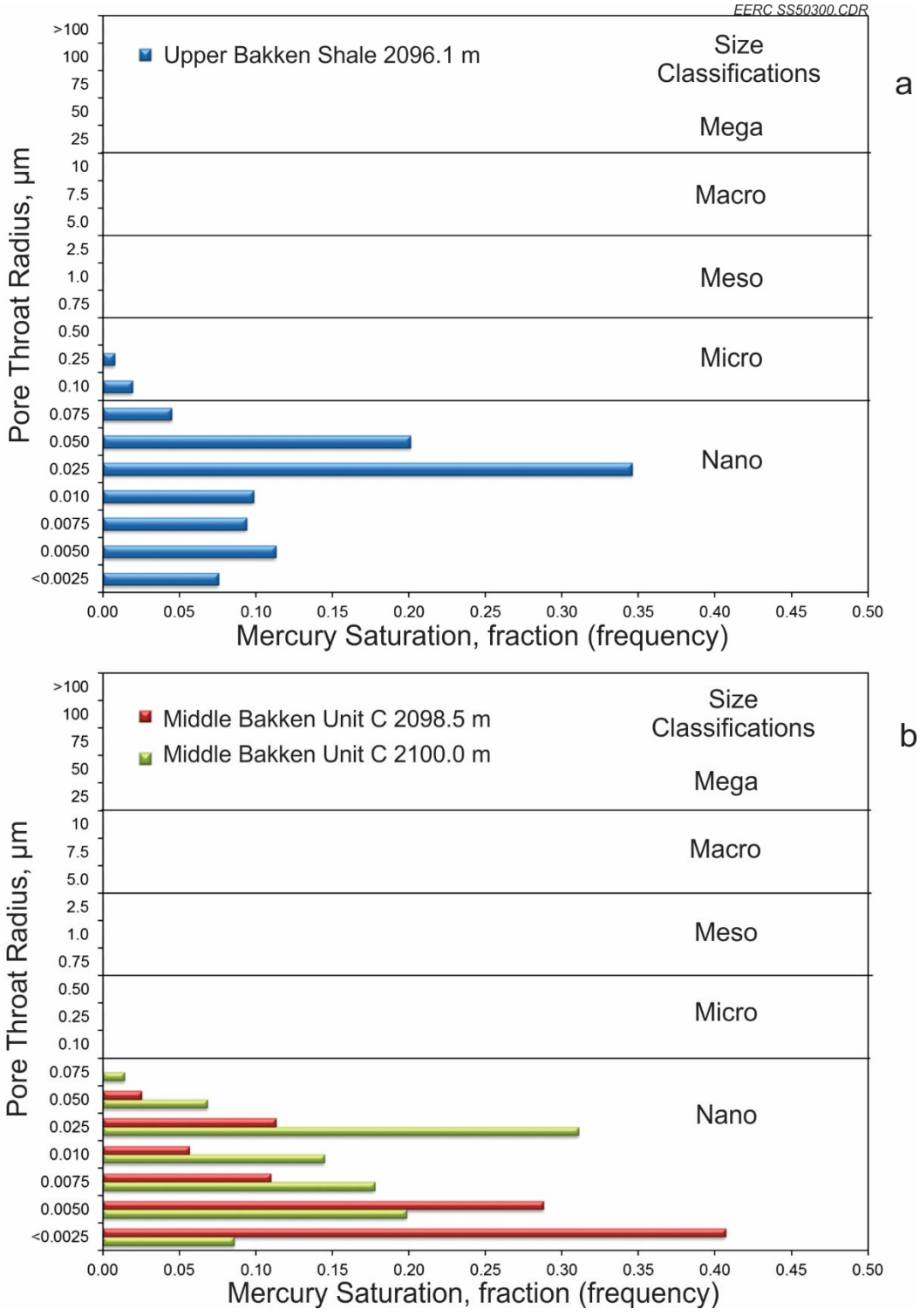


Figure 9. Pore throat distribution of one upper shale sample (a) and nine Middle Bakken samples (b–d) (continued).

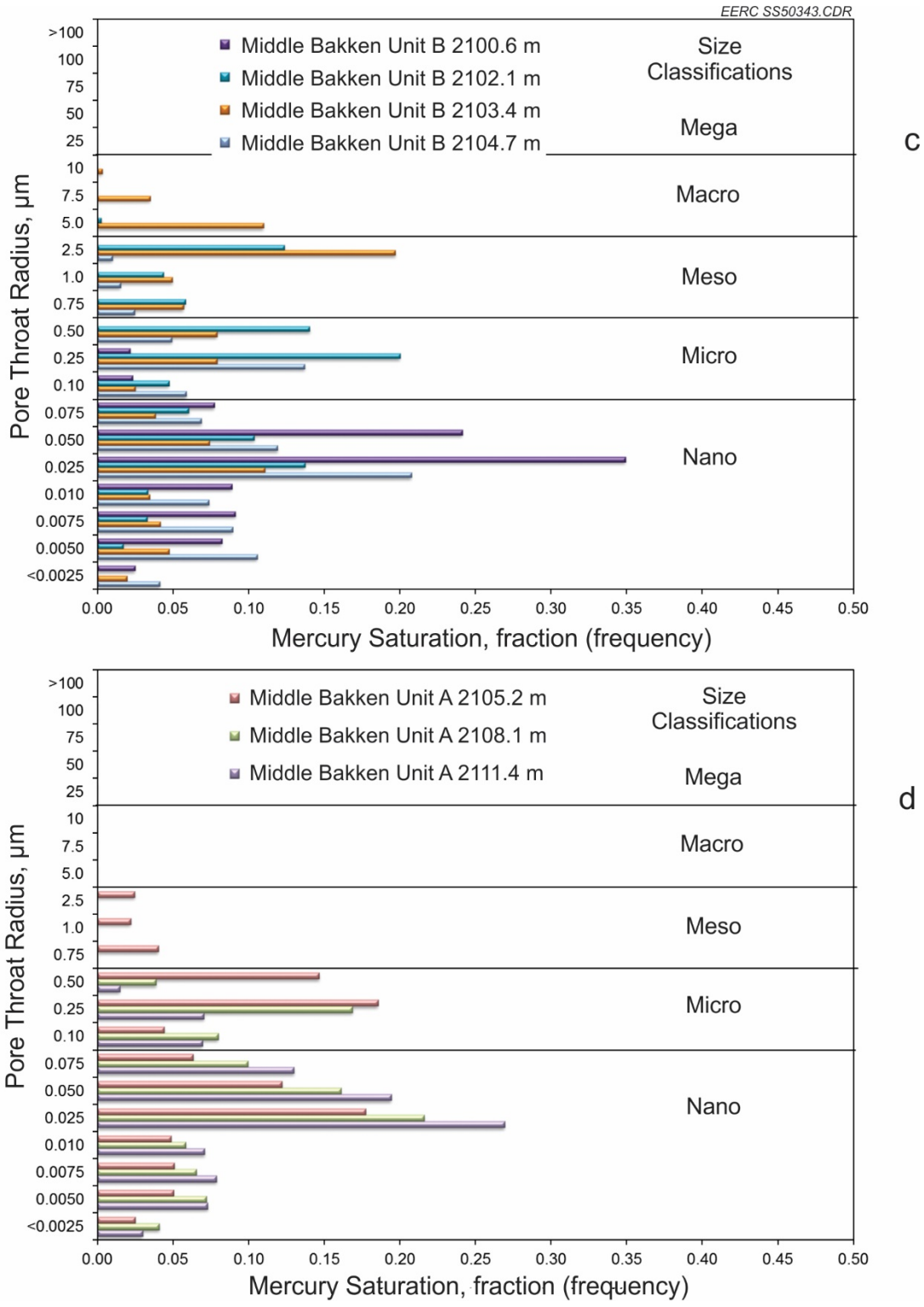


Figure 9 (continued). Pore throat distribution of one upper shale sample (a) and nine Middle Bakken samples (b–d) (continued).

TOC and Rock-Eval

In an effort to determine the petroleum potential of this reservoir, TOC and Rock-Eval tests were conducted on nine middle member samples and one upper shale sample. TOC analysis provides the organic carbon present in samples as an indicator of a hydrocarbon resource potentially present. Rock-Eval indicates the overall quality of carbon, from an oil-generating perspective, if it is present. Figure 10 provides the data plotted as free hydrocarbon content (mg HC/g rock) versus TOC (wt%). It is evident that there is very little organic carbon present in the middle member samples (all nine clustered around zero), while the upper shale contains just over 15%. While much higher than the middle member, the upper shale is still in the lower portion of the free hydrocarbon range and, thus, is shown to have little or no potential for oil production. All sample data are provided in a summary report in Appendix C of this document.

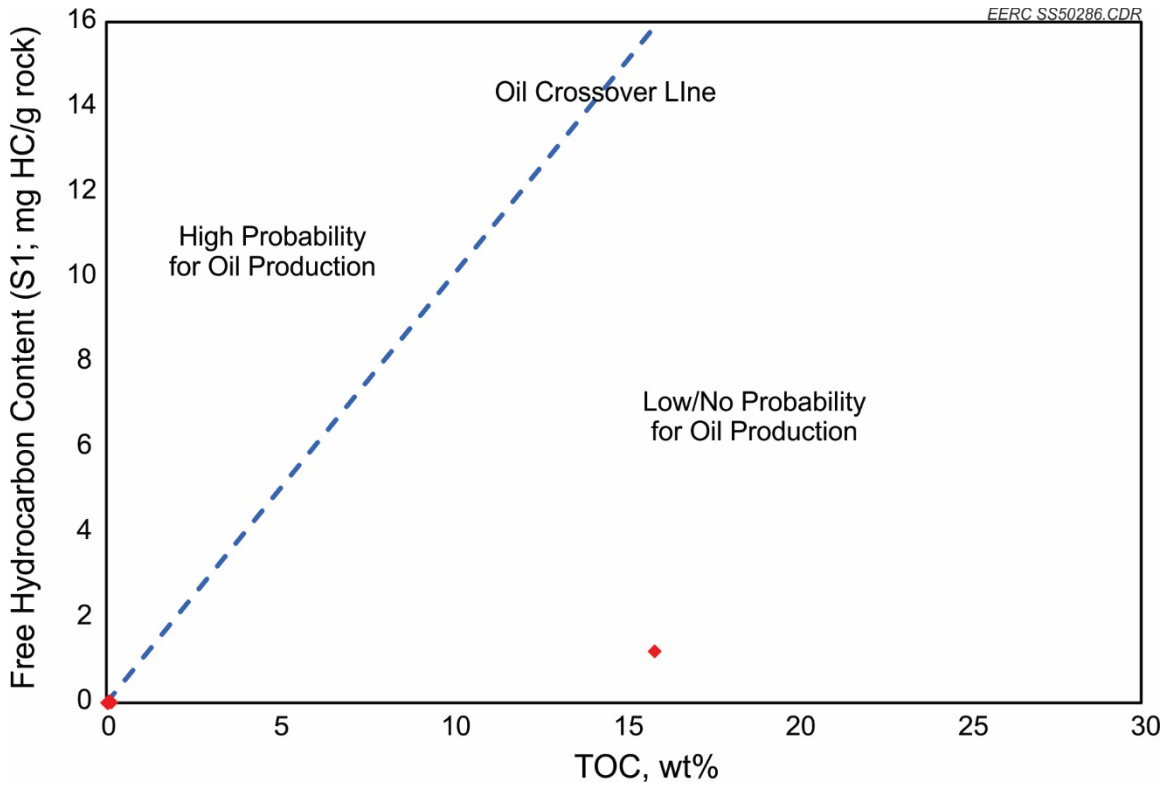


Figure 10. Results of TOC analysis and Rock-Eval data. This figure illustrates the low overall organic content found in these samples. It further illustrates that the organic content found has little potential for oil production.

Relative Permeability Evaluation

Relative permeability is a specialized flow experiment that calculates the relative rate at which supercritical CO_2 flows through brine-saturated rock. The test identifies the reservoir condition permeability of each fluid and provides an indication of the irreducible water saturation present in the sample tested. The steady-state relative permeability testing conducted at the EERC used a representative formation brine with a total dissolved solids content of 286,000 parts per million and pure CO_2. Test results for Sample 118648 (porosity 13.9%, pore volume 1.64 cm^3) show a permeability to brine of 1.17 mD and an irreducible brine saturation value of 44.1% (Figure 11). The permeability to CO_2 was 0.421 mD for this sample. This is a reasonable flow condition for this relatively high porosity, laminated, fine grained sandstone. The second sample tested was from the same interval (Unit B) but observed to be composed of a tighter-grained fabric manifested in a reduced porosity of 4.7% and a pore volume of 1.41 cm^3. The test data show a relatively high irreducible water saturation of 58.6% and brine permeability of 0.007 mD. Permeability to CO_2 was determined to be 0.003 mD at the irreducible brine condition (Figure 12).

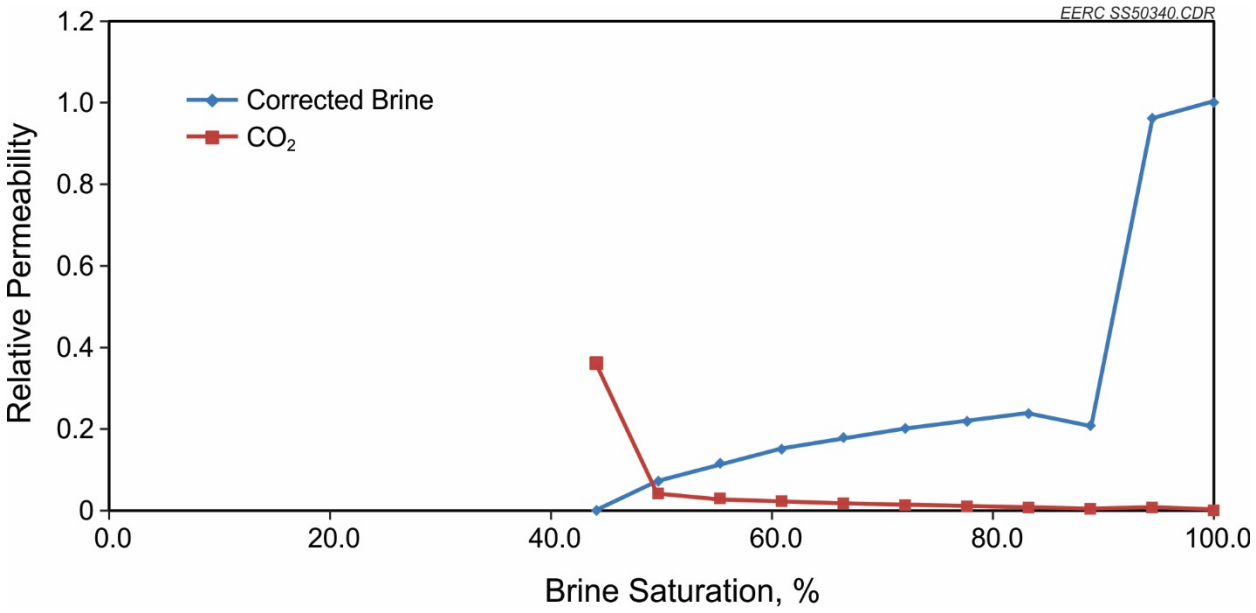


Figure 11. Graph of relative permeability for simulated formation brine (k_{rw}) and CO_2 (k_{rg}), Sample 118648, 2102.1 m.

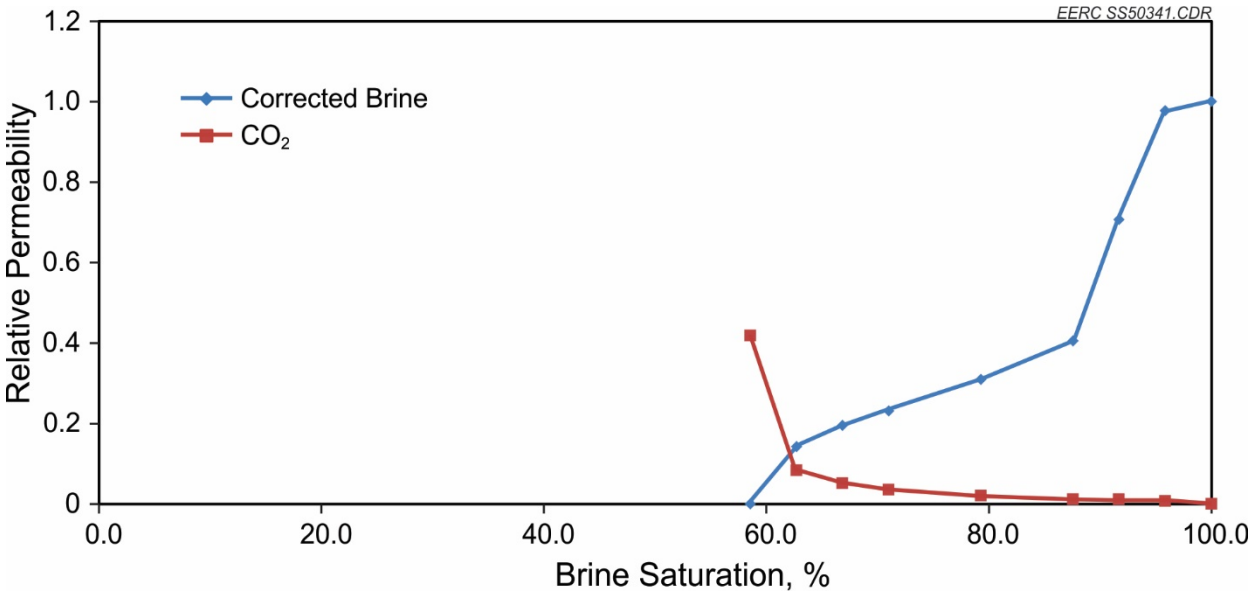


Figure 12. Graph of relative permeability for simulated formation brine (k_{rw}) and CO_2 (k_{rg}), Sample 118647, 2100.6 m.

CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE WORK

In all, ten samples were collected and tested over the course of this evaluation: nine middle member and one upper shale sample. Test results indicate that the Middle Bakken in this area is composed of three unique members, labeled from bottom to top Units A, B, and C. This correlates well with existing published literature. The average porosity and bulk density of nine middle member samples was determined to be 6.75% and 2.54 g/cm^3, respectively. The relationship indicates a quartz sandstone-to-limestone-dominated system, which is confirmed through optical thin-section analyses. Mineralogically, the middle member was determined through XRD, XRF, and SEM to be dominated by quartz, illite clay, and potassium feldspar. While the samples contain the minerals dolomite and calcite, they are in lower percentages than the rocks of the central Williston Basin. Total organic carbon was found to be less than 1 wt% in each middle member sample tested and about 15 wt% in the upper shale. The evaluation indicated that this area is not likely capable of economically producing hydrocarbon because the quality of organic carbon was not considered mature.

Regarding the CO_2 storage potential, samples were evaluated to determine their pore throat distribution, effective porosity, and relative permeability to brine and CO_2. Results of the mercury injection capillary pressure work indicated that the shale and stratigraphically adjacent upper Unit C have a pore throat size distribution generally found in rocks considered “geologic seals,” or good barriers to fluid flow. The middle unit (B) and lower unit (A), while still small in scale, have a wider size distribution which may aid in the injection and movement of fluids away from a wellbore.

Relative permeability tests were conducted on two samples from Unit B. Results indicate the potential to move CO_2 through core plugs saturated with 286,000 ppm brine. The relatively

high porosity (13.9%), laminated, fine-grained sandstone had a permeability to brine of 1.17 mD, an irreducible brine saturation value of 44.1%, and a permeability to CO_2 of 1.17 mD. The sample with a tighter-grained fabric (4.7% porosity) had a permeability to brine of 0.007 mD, an irreducible brine saturation of 58.6%, and a permeability to CO_2 of 0.003 mD. It was noted during testing that as the brine was mobilized and "pushed" out of the way, CO_2 flow became more efficient and pressure across the sample decreased. This is not a surprising result considering the large viscosity differences between the two fluids. However, this indicates that the formation may be amenable to use as a secondary CO_2 storage reservoir should the need arise. Further evaluation regarding injection testing, static and dynamic modeling and simulation of the reservoir, and geochemical modeling are needed prior to making a complete determination. It is anticipated that this may be an area of focus for future evaluations.

The following are recommendations for future work:

- Geomechanical evaluations to determine strength parameters of each lithofacies and cap rock.
- Additional relative permeability work to better understand the CO_2 storage potential of this reservoir.
- Collection of additional core to determine the heterogeneity of this reservoir laterally adjacent to the injection zone.
- Further mineralogical and flow-through testing to determine similarities and differences.
- Local-scale modeling and simulation of the Bakken reservoir interval to determine injectivity of CO_2.
- Geochemical modeling to determine the potential reactivity of the potential injection zone and cap rock.

REFERENCES

Gunter, W.D., Bachu, S., and Benson, S.M., 2004, The role of hydrogeological and geochemical trapping in sedimentary basins for secure geological storage for carbon dioxide, In Baines, S.J., and Worden, R.H. eds., Geological storage of carbon dioxide: London, United Kingdom, Geological Society, Special Publication 233, p. 129–145.

Kohlruss, D., and Nickel, E., 2013, Bakken Formation of southeastern Saskatchewan—selected stratigraphy and production maps: Saskatchewan Ministry of the Economy, Saskatchewan Geological Survey Open File 2013-1.

APPENDIX A

APPLIED GEOLOGY LABORATORY DATA SHEETS

EERC Energy & Environmental Research Center® Putting Research into Practice UND THE UNIVERSITY OF NORTH DAKOTA	**Applied Geology Laboratory**	ID: 118657/658
		Upper Bakken Shale
	Well Name: PTRC_INJ_5-6-2-8 W2M	Depth: 2096.1 m

SAMPLE PHOTOGRAPH

PHYSICAL PROPERTIES

Porosity

Pycnometer Effective Porosity Average, vol%
Pending

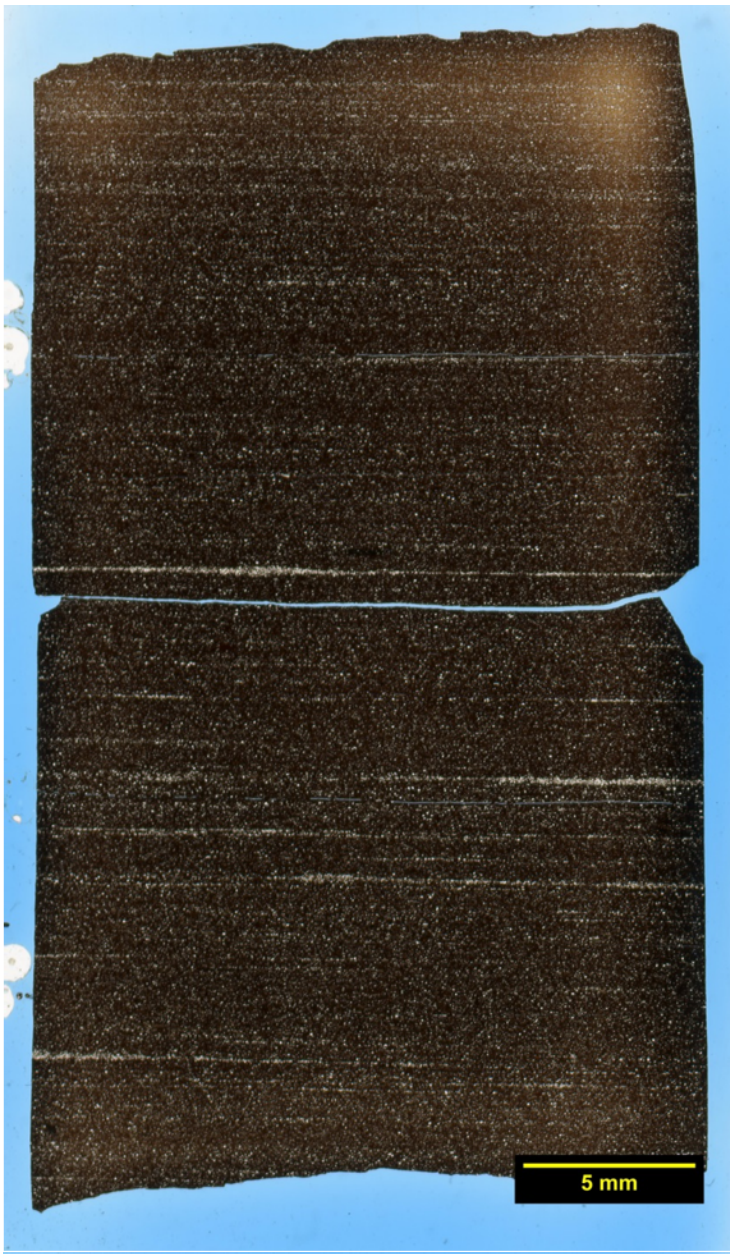
Volume and Density

Bulk Volume, cm^3	Bulk Density, g/cm^3	Grain Volume, cm^3	Grain Density, g/cm^3
Pending	Pending	Pending	Pending

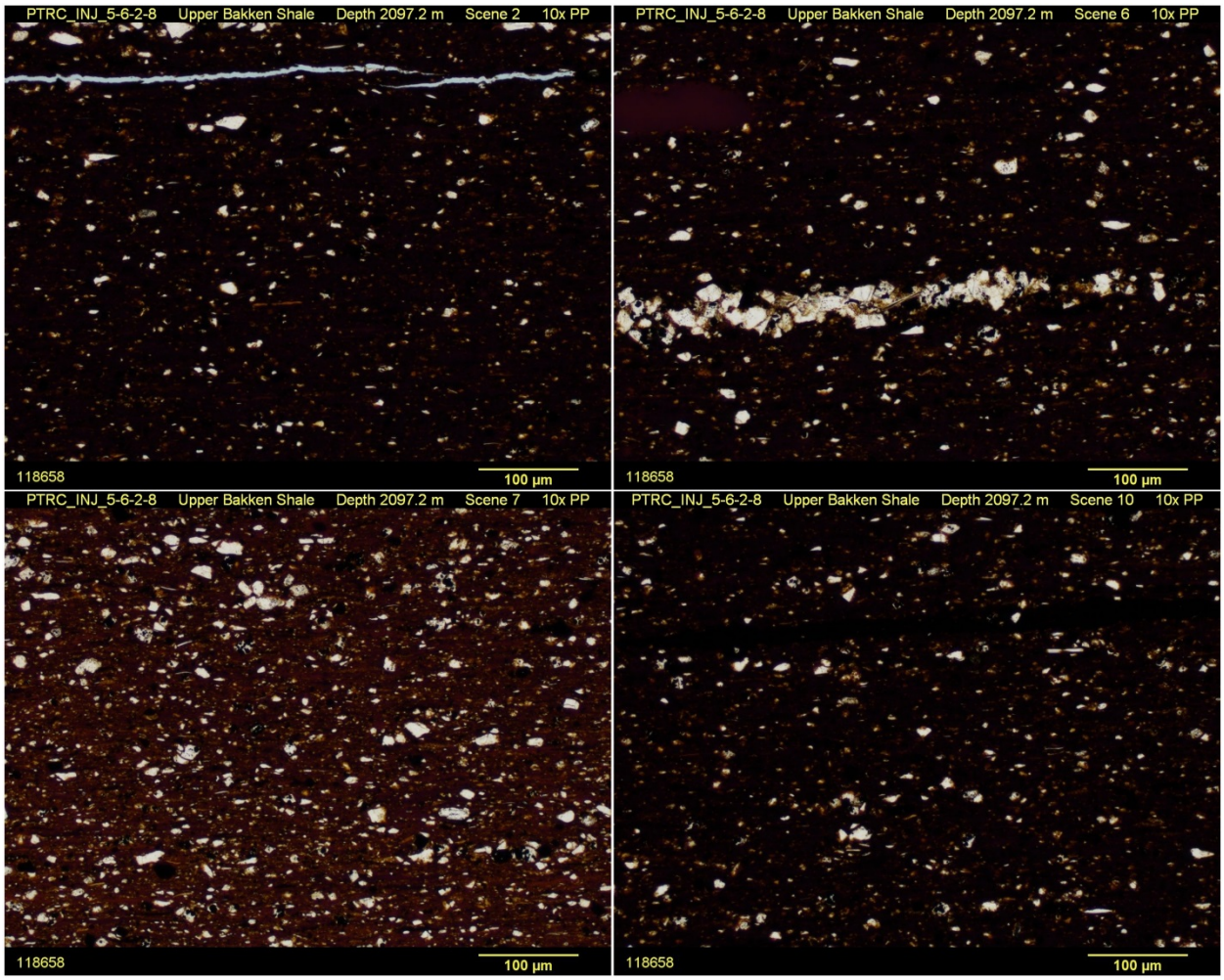
Permeability

Gas Permeability, mD
Pending

FULL THIN-SECTION SLIDE

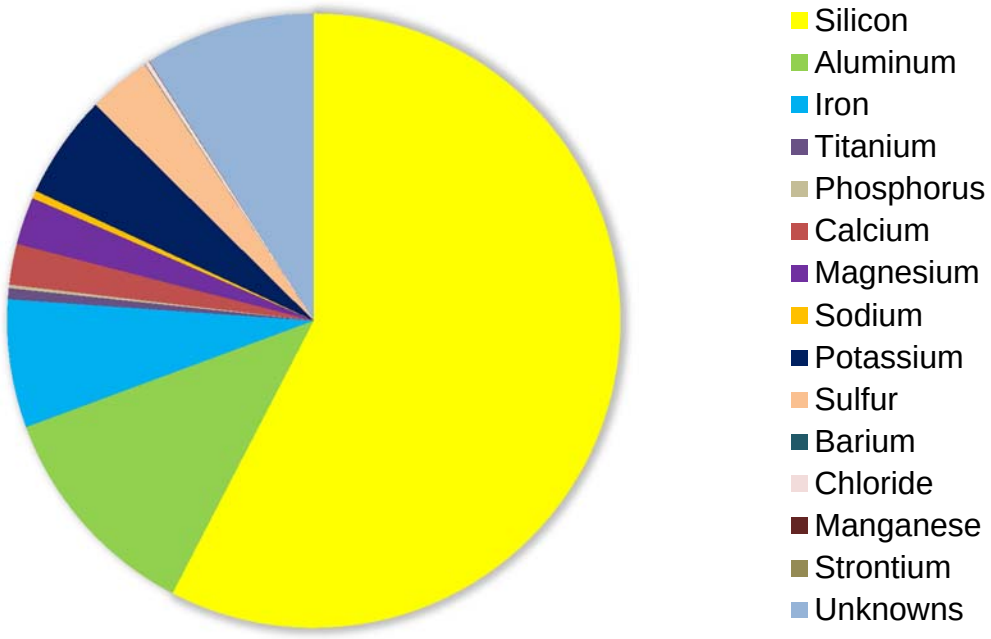


PLANE POLAR PHOTOMICROGRAPHS



The 2097.2-m Upper Bakken Shale thin section shows dark, silty shale. Very fine laminations of silt grains are found in the very dark shale consisting of mostly quartz and some dolomite.

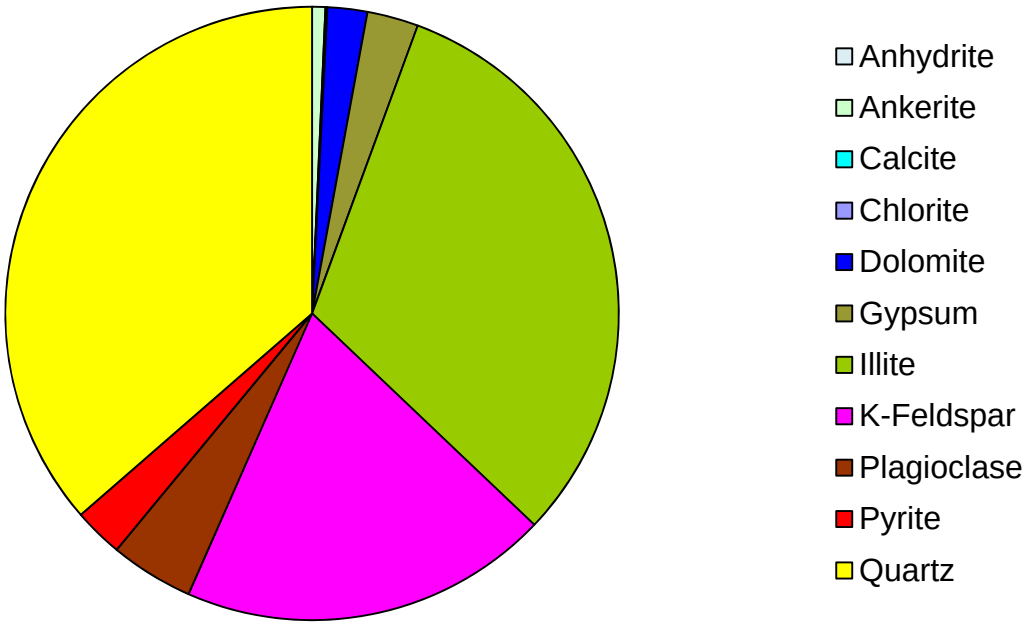
X-RAY FLUORESCENCE (XRF) BULK CHEMICAL COMPOSITION



Element	Reporting Convention (oxide)	wt%
Si (silicon)	SiO_2	57.62
Al (aluminum)	Al_2O_3	11.75
Fe (iron)	Fe_2O_3	6.75
Ti (titanium)	TiO_2	0.58
P (phosphorus)	P_2O_5	0.18
Ca (calcium)	CaO	2.15
Mg (magnesium)	MgO	2.51
Na (sodium)	Na_2O	0.41
K (potassium)	K_2O	5.46
S (sulfur)	SO_3	3.31
Ba (barium)	BaO	0.03
Cl (chloride)	Cl	0.23
Mn (manganese)	MnO	0.02
Sr (strontium)	SrO	0.01
Unknowns	Due to the presence of carbonates*	9.00
Total		100.01

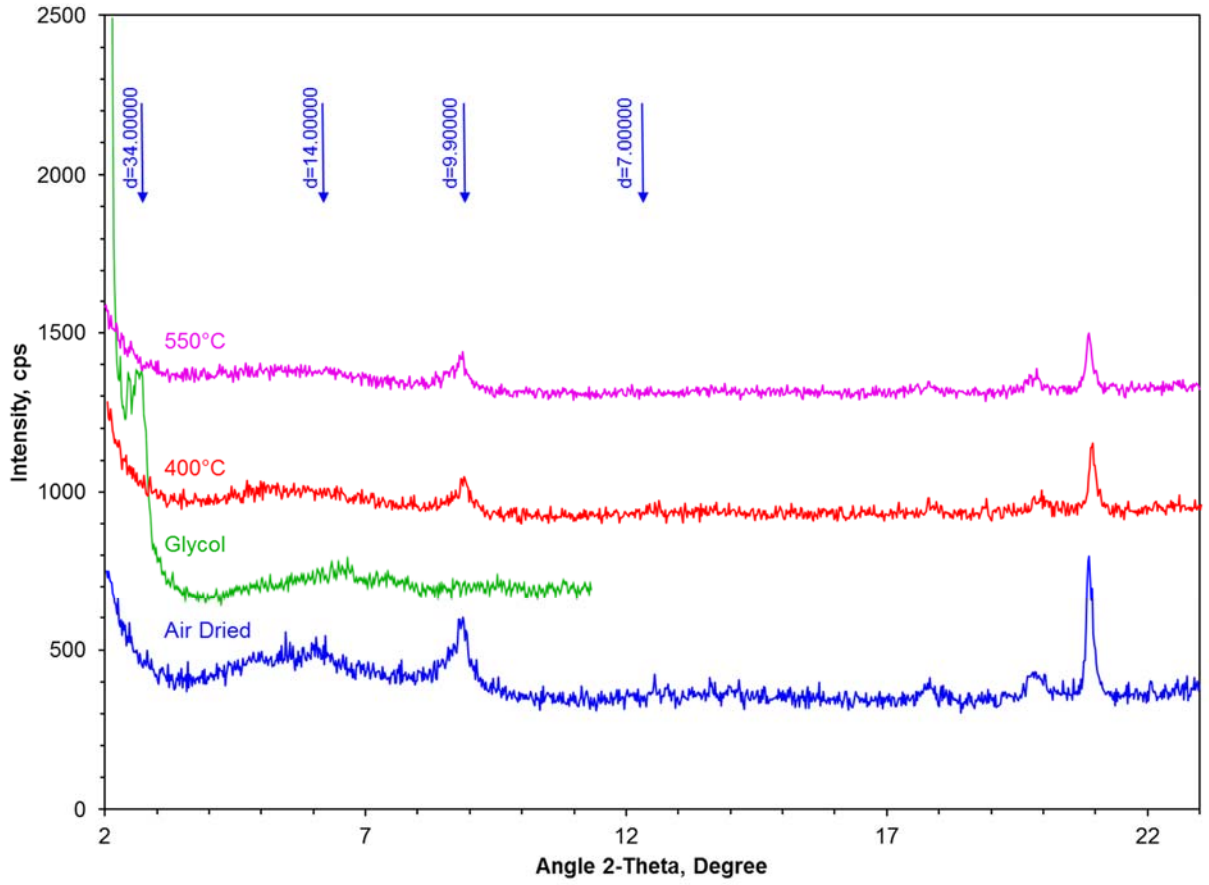
* Sample effervesced in the presence of dilute HCl, verifying the presence of carbonates.

X-RAY DIFFRACTION (XRD) MINERAL-PHASE DISTRIBUTION



Mineral Phase	Formula	Relative wt%
Quartz	SiO_2	36.4
Pyrite	FeS_2	2.6
K-Feldspar	$KAlSi_3O_8$	19.5
Plagioclase	$Na_{0.5}Ca_{0.5}Al_{1.5}Si_{2.5}O_8$	4.4
Calcite		0.1
Dolomite	$CaMg(CO_3)_2$	2.1
Ankerite	$CaMg_{0.45}Fe_{0.55}(CO_3)_2$	0.7
Illite	$(K,H_3O)(Al,Mg,Fe)_2(Si,Al)_4O_{10}[(OH)_2,(H_2O)]$	31.5
Chlorite	$(Mg,Fe)_3(Si,Al)_4O_{10}$- $(OH)_2$ • $(Mg, Fe)_3(OH)_6$	0.0
Gypsum	$CaSO_4$ • $2(H_2O)$	2.7
Anhydrite	$CaSO_4$	0.0
Total		100.0
Total Carbonates		2.9
Total Clay		31.5

XRD CLAY TYPING



Clays Identified
High Amount of Smectite
Some Illite/Smectite

CORE LABORATORIES, INC., HIGH-PRESSURE MERCURY INJECTION (HPMI) SUMMARY DATA

See Appendix B for full Core Labs report.

Core Labs Sample ID S11 #118657m
Depth 2096.10 m

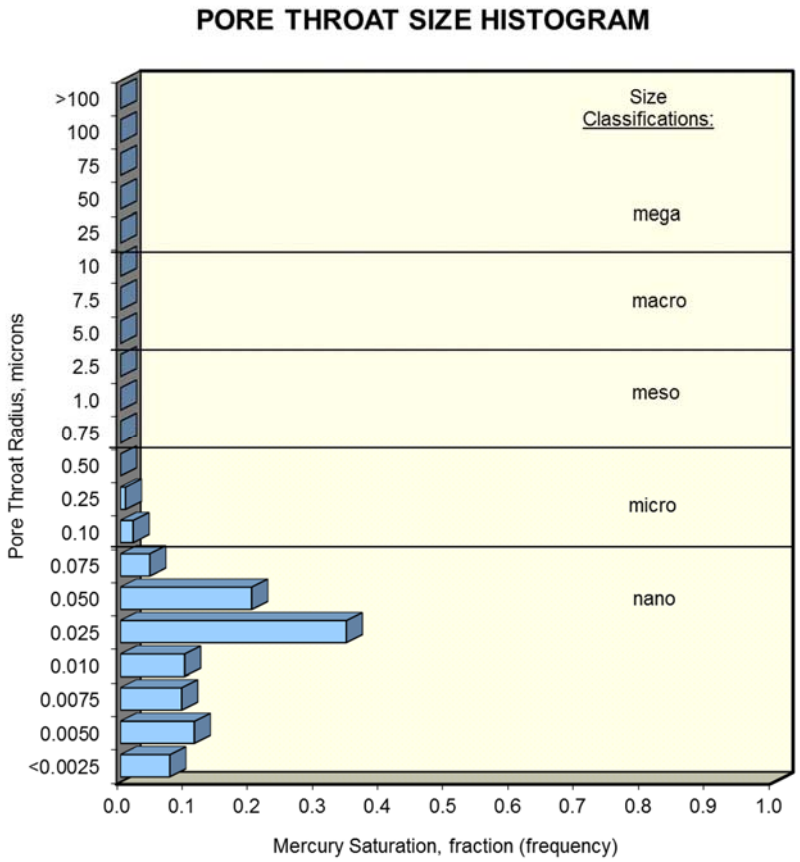
Mercury Injection Data Summary

Maximum S_b/P_c*, fraction	Pore Throat Radius at 35% Mercury Saturation (R35), µm	Median Pore Throat Radius, µm
0.00036	0.0199	0.0135

* Volume of mercury (S_b)-to-capillary pressure (P_c) ratio. The maximum S_b/P_c is used to represent the point on a capillary pressure curve where all of the major connected pore spaces controlling permeability have been intruded with mercury.

Sample Parameters

Weight, g	Pore Volume, cm^3	Grain Volume, cm^3	Bulk Volume, cm^3	Grain Density, g/cm^3	Bulk Density, g/cm^3
9.724	0.212	3.610	3.823	2.694	2.543



CORE LABORATORIES, INC., TOTAL ORGANIC CARBON (TOC) AND ROCK EVALUATION (ROCK-EVAL) SUMMARY DATA

See Appendix C for full Core Labs Report.

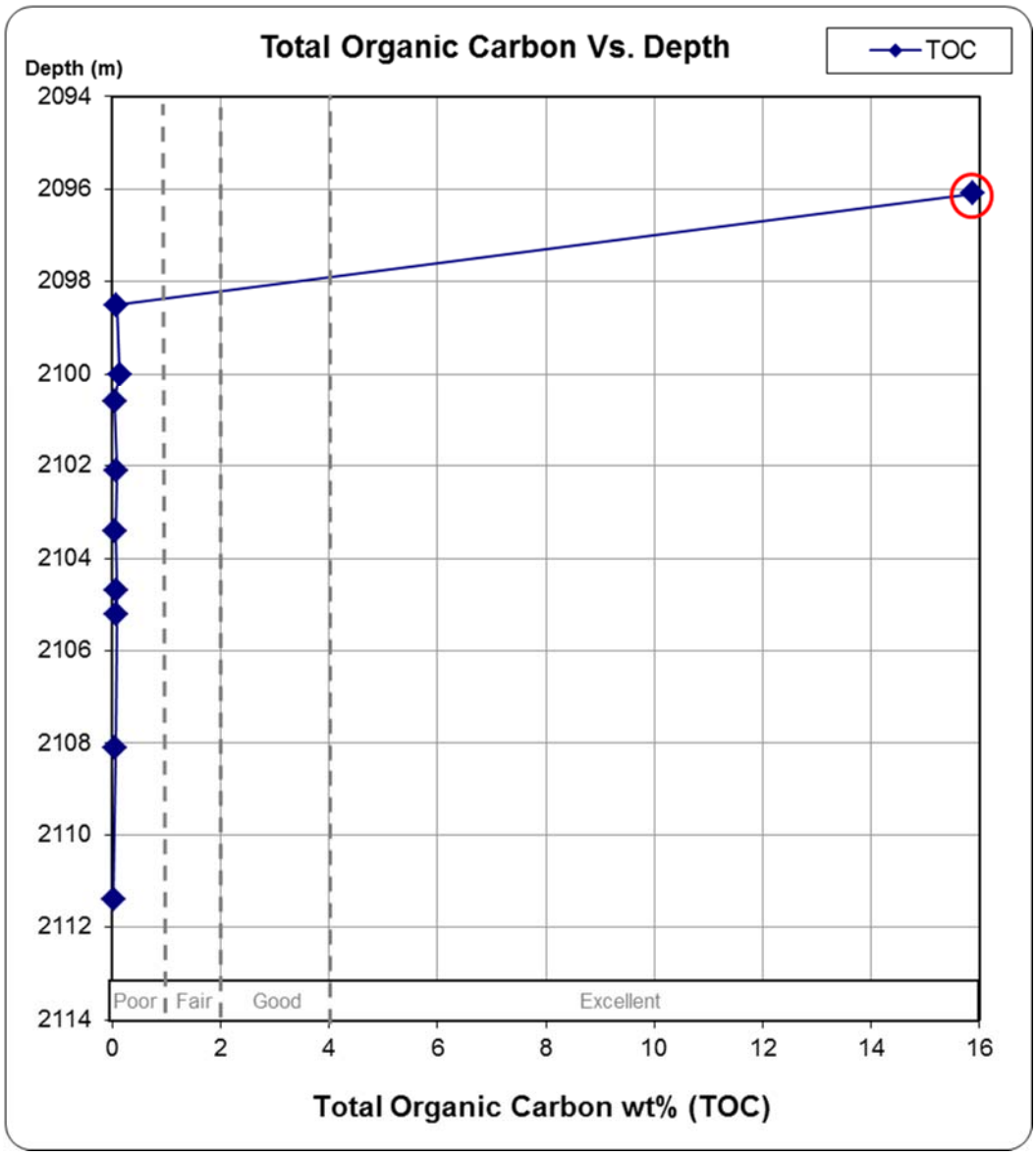
Core Labs Sample ID S11-118657

Depth 2096.1 m

TOC and ROCK-EVAL Data Summary

Sample Weight, mg	TOC, wt%	T_{max}*, °C
20.8	15.89	436

* Pyrolysis oven temperature during maximum generation of hydrocarbons.



SAMPLE PHOTOGRAPH

PHYSICAL PROPERTIES

Porosity

Pycnometer Effective Porosity Average, vol%
2.63

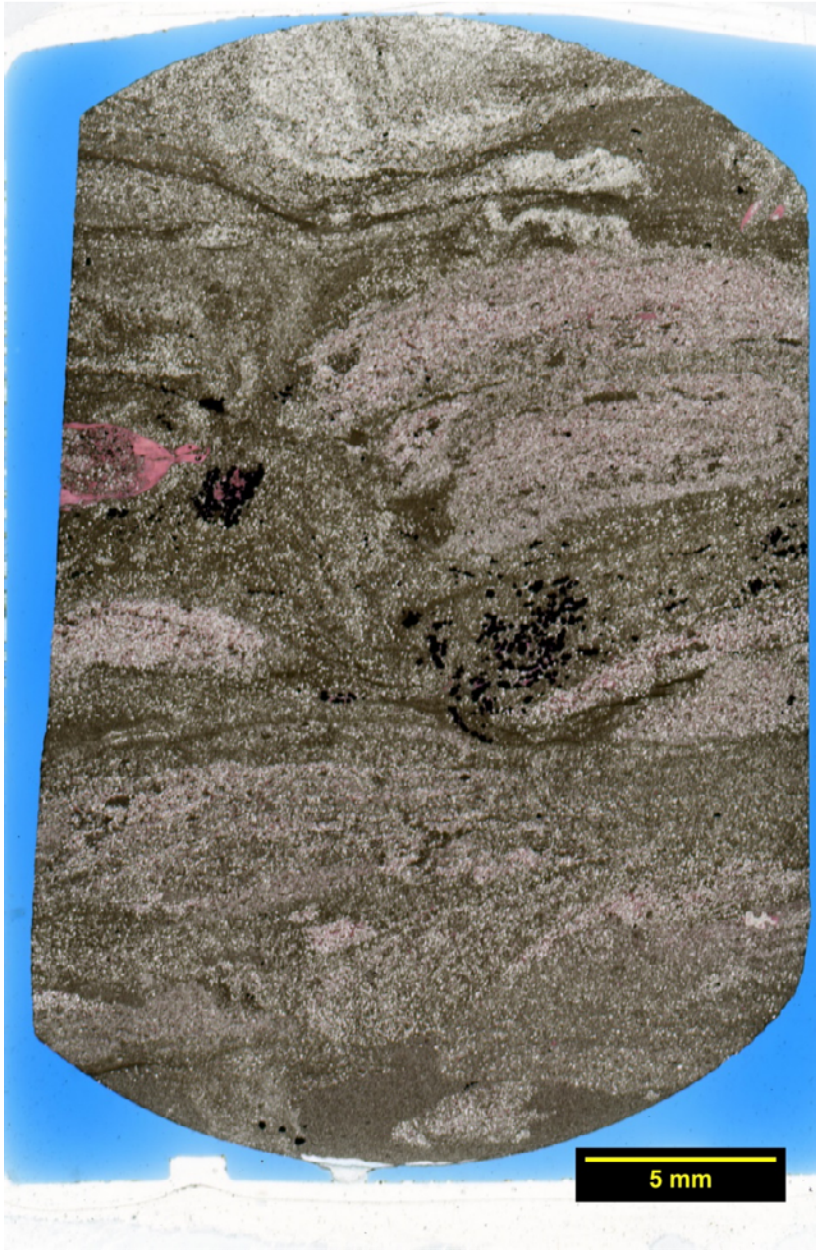
Volume and Density

Bulk Volume, cm^3	Bulk Density, g/cm^3	Grain Volume, cm^3	Grain Density, g/cm^3
13.34	2.641	12.989	2.712

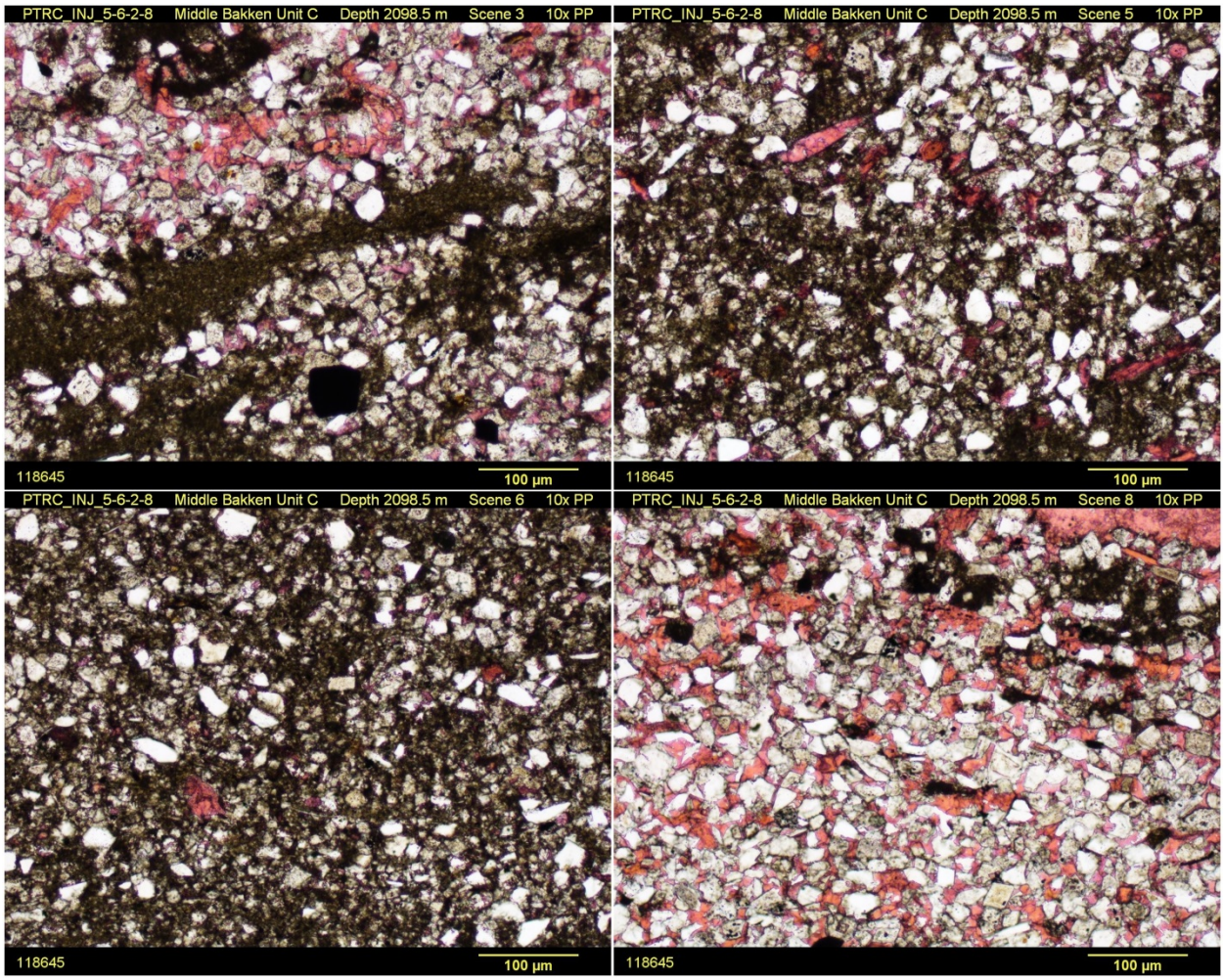
Permeability

Gas Permeability, mD
Pending

FULL THIN-SECTION SLIDE



PLANE POLAR PHOTOMICROGRAPHS



The 2098.5-m Middle Bakken sample is siltstone containing quartz, feldspars, dolomite, and clays, with intergranular calcite. Dolomite often shows zoning with iron-rich overgrowths. Quartz grains show some overgrowths as well. Some zones show no calcite. It is very fine sand to coarse silt in size, angular, and moderately well sorted (30 to 100 µm).

CORE LABORATORIES, INC., HPMI SUMMARY DATA

See Appendix B for full Core Labs report.

Core Labs Sample ID S1 #118645-2m

Depth 2098.50 m

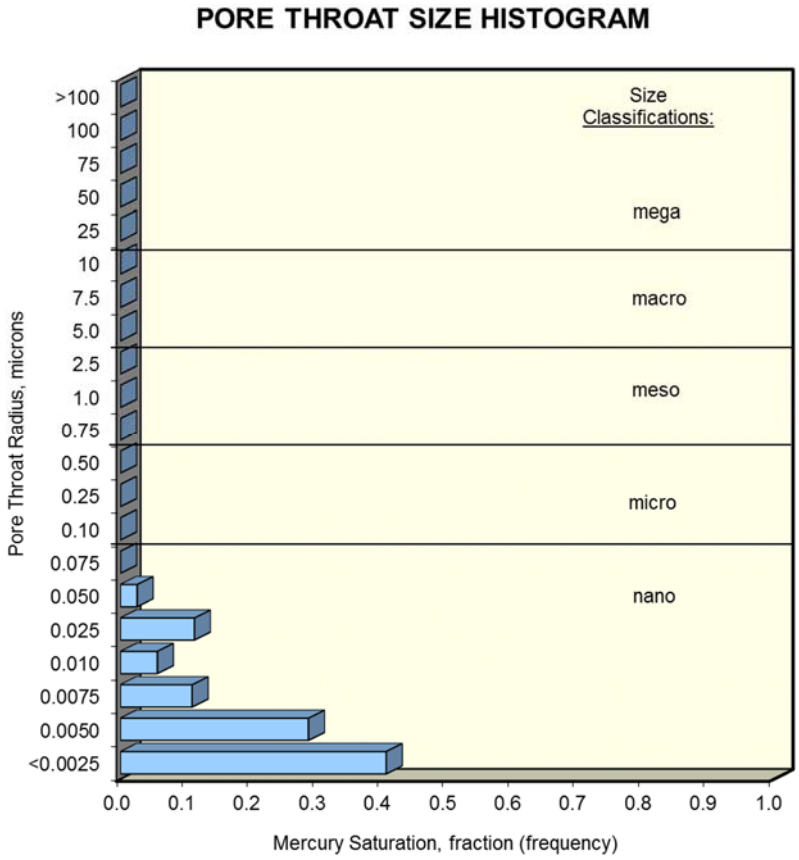
Mercury Injection Data Summary

Maximum S_b/P_c*, fraction	Pore Throat Radius at 35% Mercury Saturation (R35), µm	Median Pore Throat Radius, µm
0.00005	0.00432	0.00299

* Volume of mercury (S_b)-to-capillary pressure (P_c) ratio. The maximum S_b/P_c is used to represent the point on a capillary pressure curve where all of the major connected pore spaces controlling permeability have been intruded with mercury.

Sample Parameters

Weight, g	Pore Volume, cm^3	Grain Volume, cm^3	Bulk Volume, cm^3	Grain Density, g/cm^3	Bulk Density, g/cm^3
10.947	0.176	5.015	5.194	2.183	2.108



CORE LABORATORIES, INC., TOC AND ROCK-EVAL SUMMARY DATA

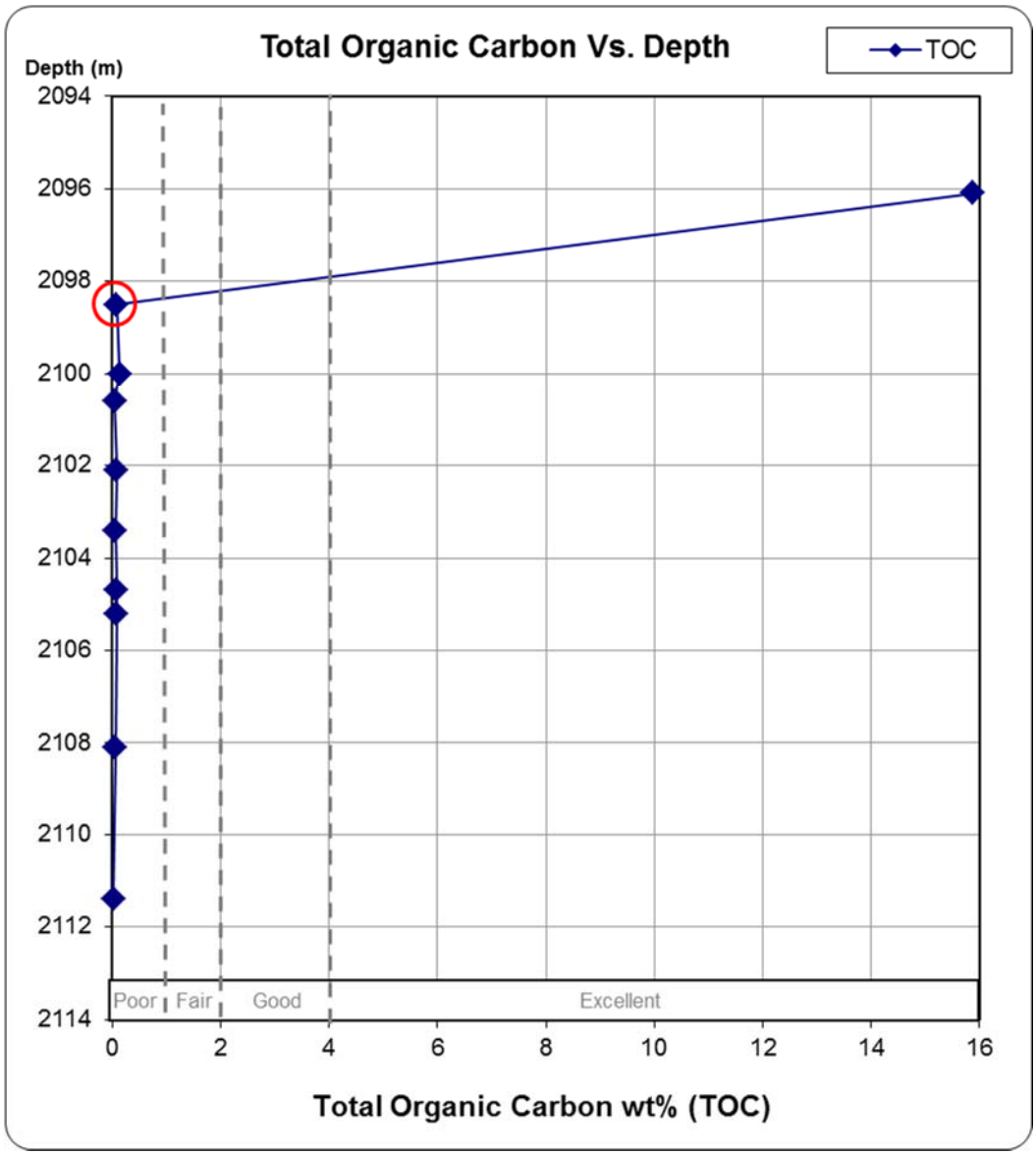
See Appendix C for full Core Labs report.

Core Labs Sample ID S1-118645-2

Depth 2098.5 m

TOC and ROCK-EVAL Data Summary

Sample Weight, mg	TOC, wt%	T_{max}, °C
60.7	0.08	423



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SAMPLE PHOTOGRAPH

PHYSICAL PROPERTIES

Porosity

Pycnometer Effective Porosity Average, vol%
3.31

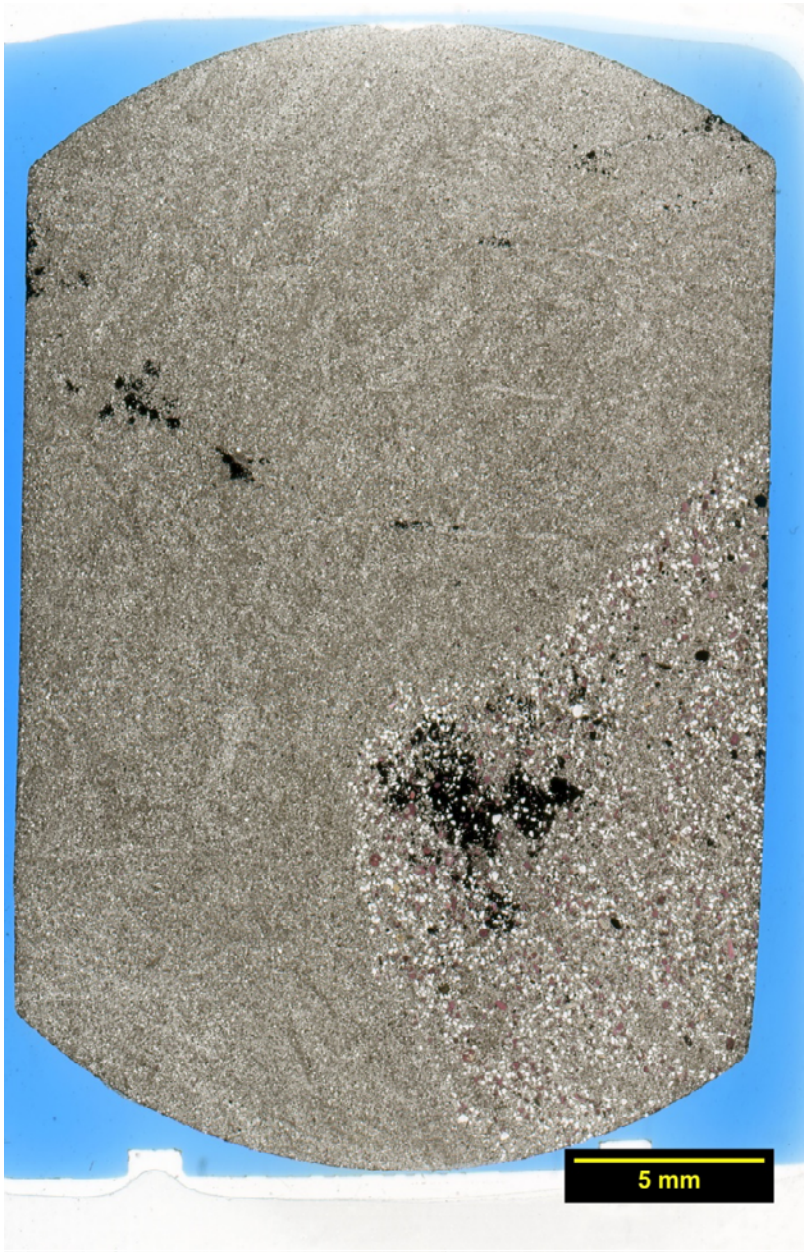
Volume and Density

Bulk Volume, cm^3	Bulk Density, g/cm^3	Grain Volume, cm^3	Grain Density, g/cm^3
12.24	2.643	11.835	2.733

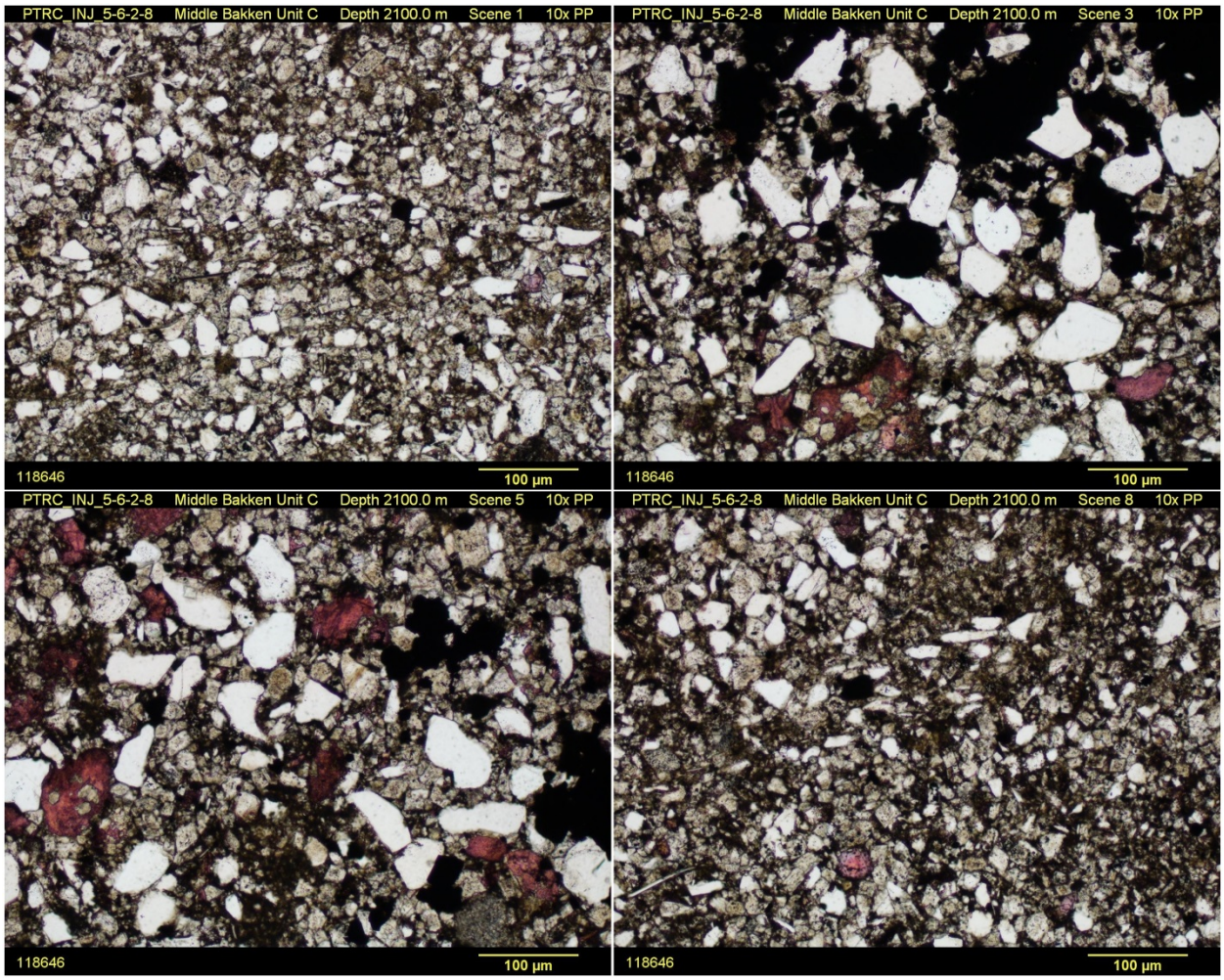
Permeability

Gas Permeability, mD
Pending

FULL THIN-SECTION SLIDE

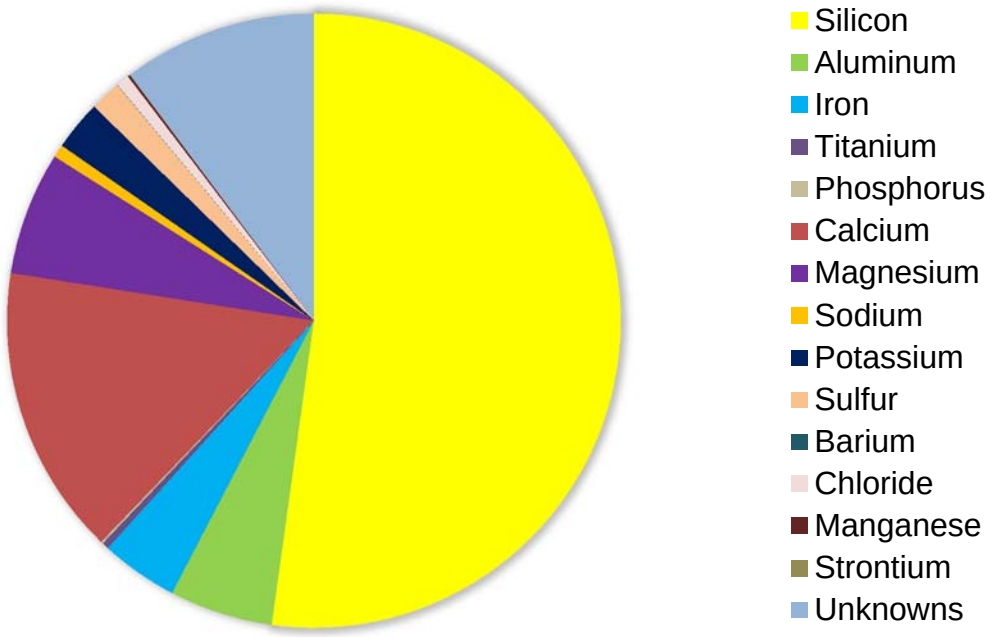


PLANE POLAR PHOTOMICROGRAPHS



The 2100.0-m Middle Bakken sample is burrowed siltstone containing quartz, feldspars, dolomite/Fe-dolomite, and clays, with calcite fill in some areas. It contains large, coarser-grained lens with calcite fill; however, most of the sample is silty quartz and dolomite, with some clays. Grains are angular and poorly sorted (10 to 80 µm), with a majority of grains less than 40 µm.

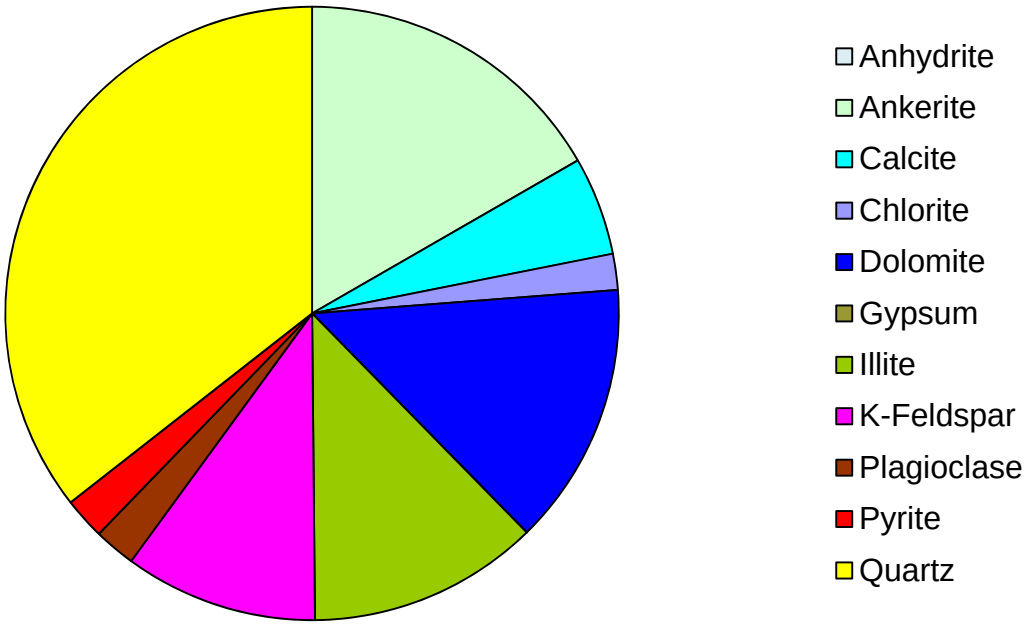
XRF BULK CHEMICAL COMPOSITION



Element	Reporting Convention (oxide)	wt%
Si (silicon)	SiO_2	52.20
Al (aluminum)	Al_2O_3	5.45
Fe (iron)	Fe_2O_3	4.08
Ti (titanium)	TiO_2	0.36
P (phosphorus)	P_2O_5	0.11
Ca (calcium)	CaO	15.29
Mg (magnesium)	MgO	6.49
Na (sodium)	Na_2O	0.68
K (potassium)	K_2O	2.63
S (sulfur)	SO_3	1.64
Ba (barium)	BaO	0.02
Cl (chloride)	Cl	0.69
Mn (manganese)	MnO	0.13
Sr (strontium)	SrO	0.01
Unknowns	Due to the presence of carbonates*	10.23
Total		100.01

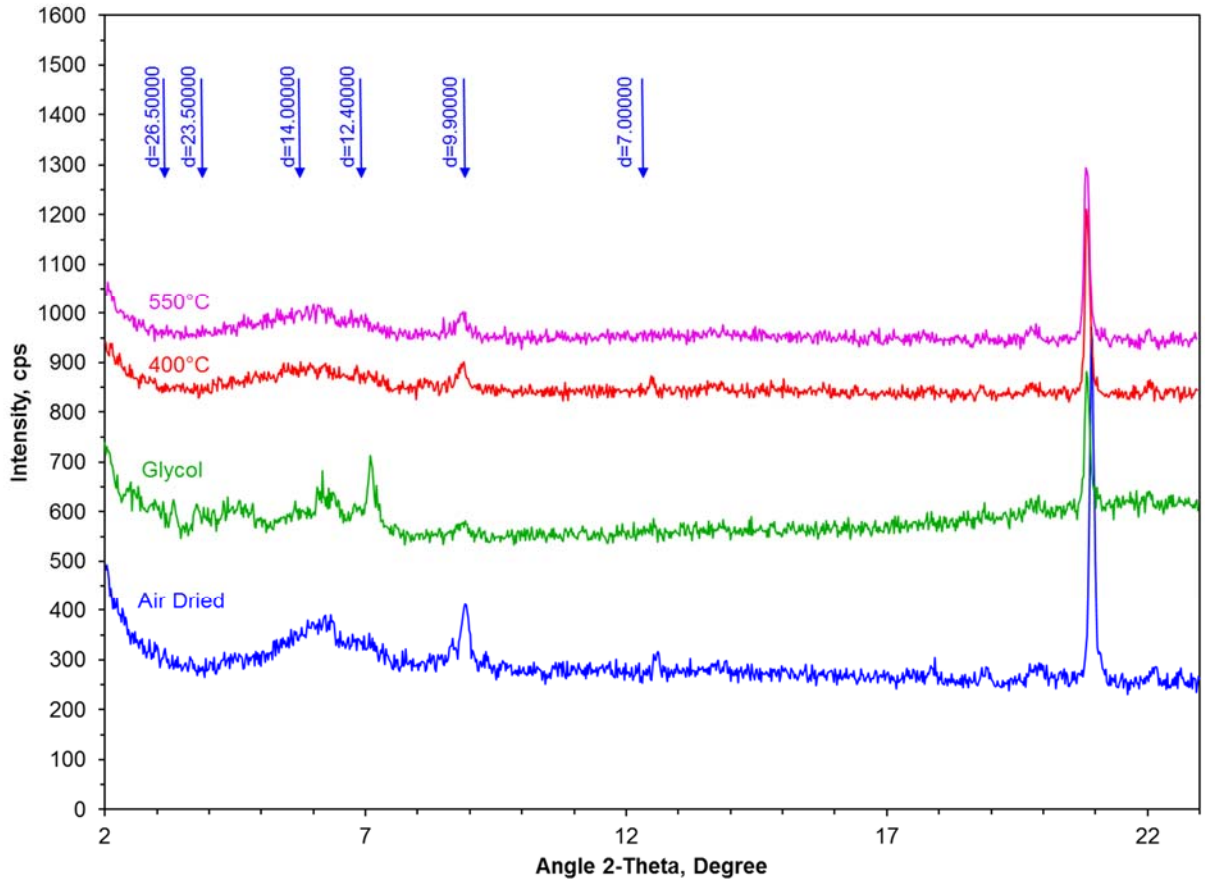
* Sample effervesced in the presence of dilute HCl, verifying the presence of carbonates.

XRD MINERAL-PHASE DISTRIBUTION



Mineral Phase	Formula	Relative wt%
Quartz	SiO_2	35.6
Pyrite	FeS_2	2.2
K-Feldspar	$KAlSi_3O_8$	10.2
Plagioclase	$Na_{0.5}Ca_{0.5}Al_{1.5}Si_{2.5}O_8$	2.2
Calcite		5.2
Dolomite	$CaMg(CO_3)_2$	13.9
Ankerite	$CaMg_{0.45}Fe_{0.55}(CO_3)_2$	16.7
Illite	$(K,H_3O)(Al,Mg,Fe)_2(Si,Al)_4O_{10}[(OH)_2,(H_2O)]$	12.2
Chlorite	$(Mg,Fe)_3(Si,Al)_4O_{10}$- $(OH)_2$ • $(Mg, Fe)_3(OH)_6$	1.9
Gypsum	$CaSO_4$ • $2(H_2O)$	0.0
Anhydrite	$CaSO_4$	0.0
Total		100.1
Total Carbonates		35.8
Total Clay		14.0

XRD CLAY TYPING



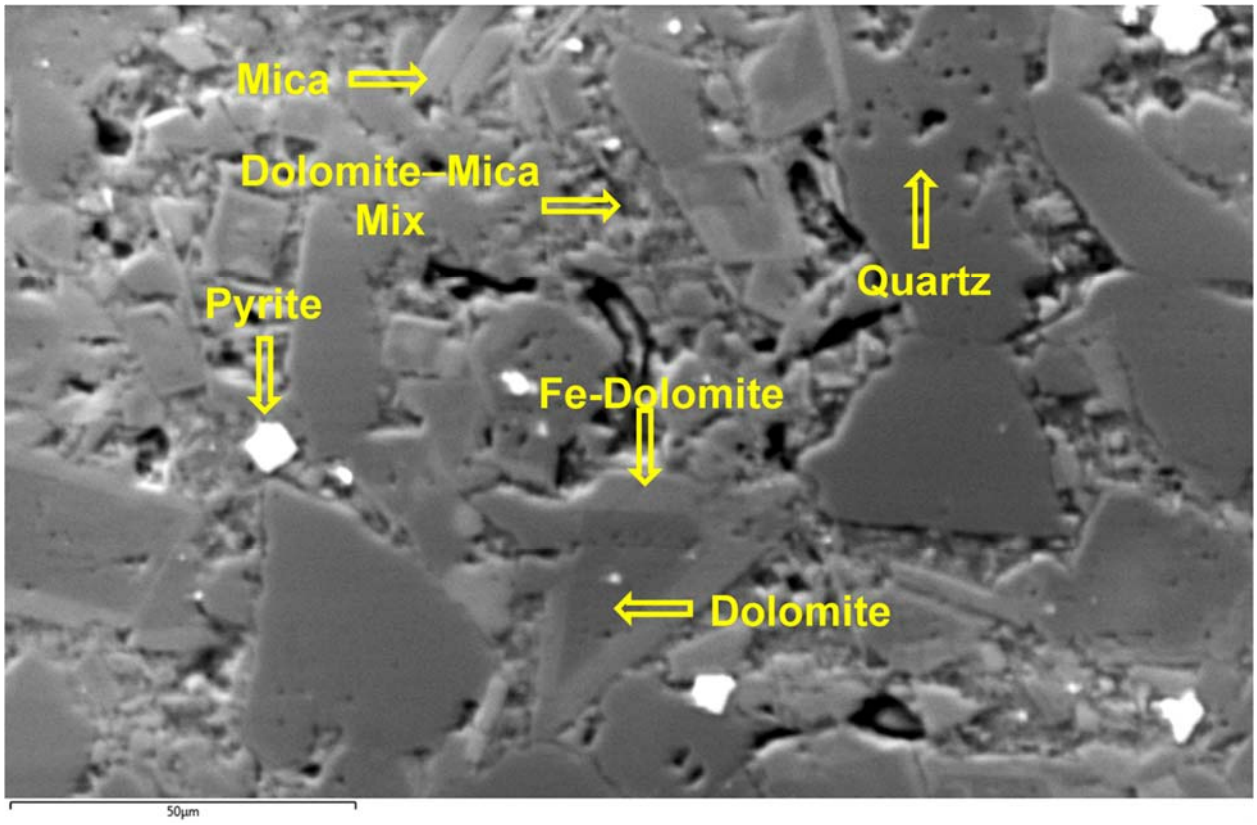
Clays Identified
Interstatified Illite/Smectite and Illite/Chlorite Possibly Sepiolite

SCANNING ELECTRON MICROSCOPY (SEM)

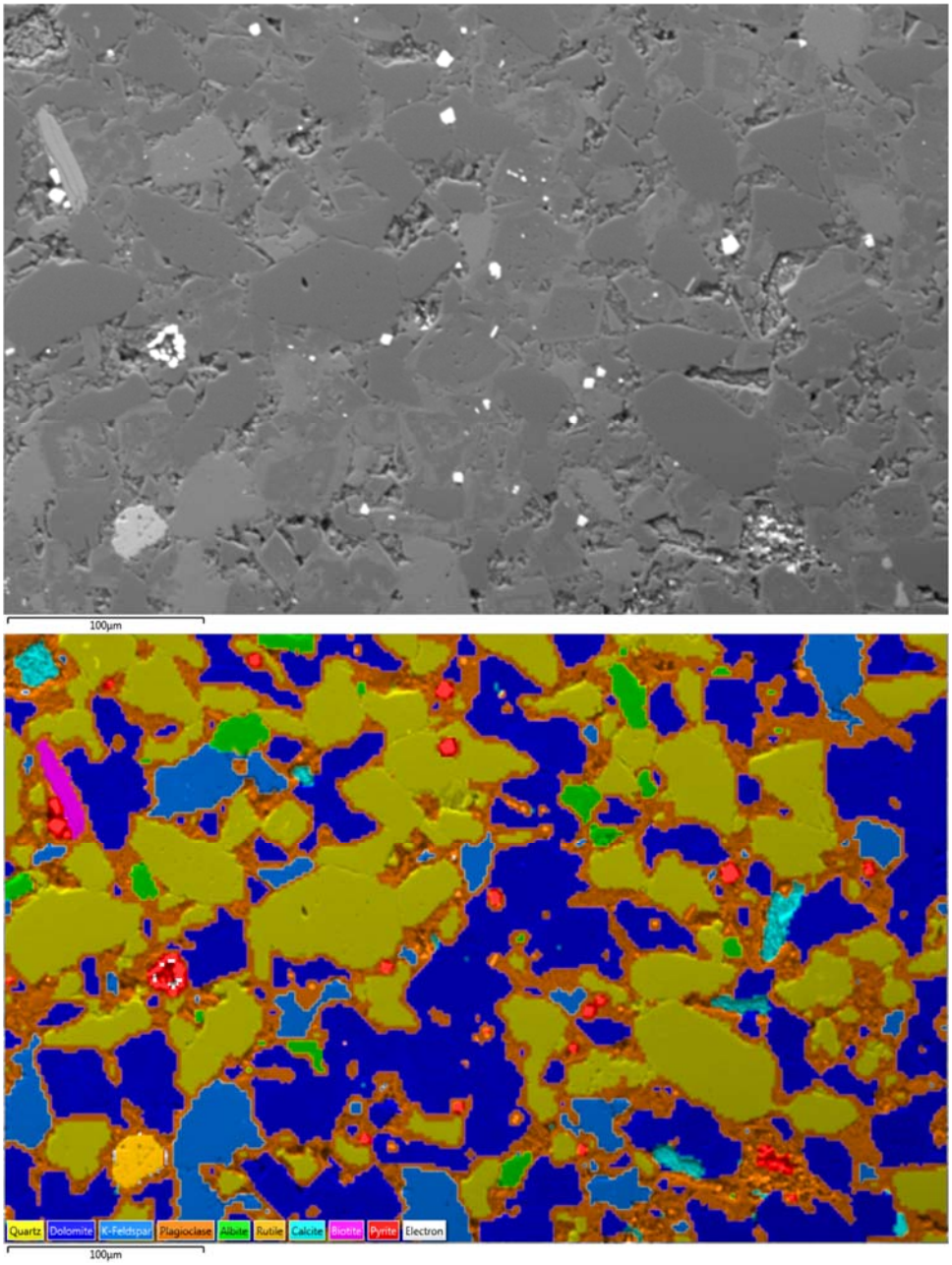
Observed Mineral Phases

Mineral Phase	Mineral Phase
Quartz	Mica
Dolomite	Albite
K-Feldspar	Zircon
Calcite	Apatite
Plagioclase	Biotite
Fe-Dolomite	Clays
Pyrite	

High-Magnification Backscattered Electron (BSE) Image Annotated with Examples of Mineral Phases Identified



SEM BSE Image and Corresponding Digital Mineral Map Overlaid on BSE Image with Mineral-Phase 2-D Area Percentages



Phase	2-D area%
Quartz	28.3
Dolomite	30.7
K-Feldspar	6.4
Plagioclase	28.2
Albite	1.5
Rutile	0.3
Calcite	1.0
Biotite	0.3
Pyrite	0.7

The mineral map (bottom) allows full sorting of mineral phases and mineral associations that are indistinguishable in a conventional BSE image (top). The colors on the image are altered from the legend because of the overlay on the BSE image.

CORE LABORATORIES, INC., HPMI SUMMARY DATA

See Appendix B for full Core Labs report.

Core Labs Sample ID S2 #118646-2m

Depth 2100.00 m

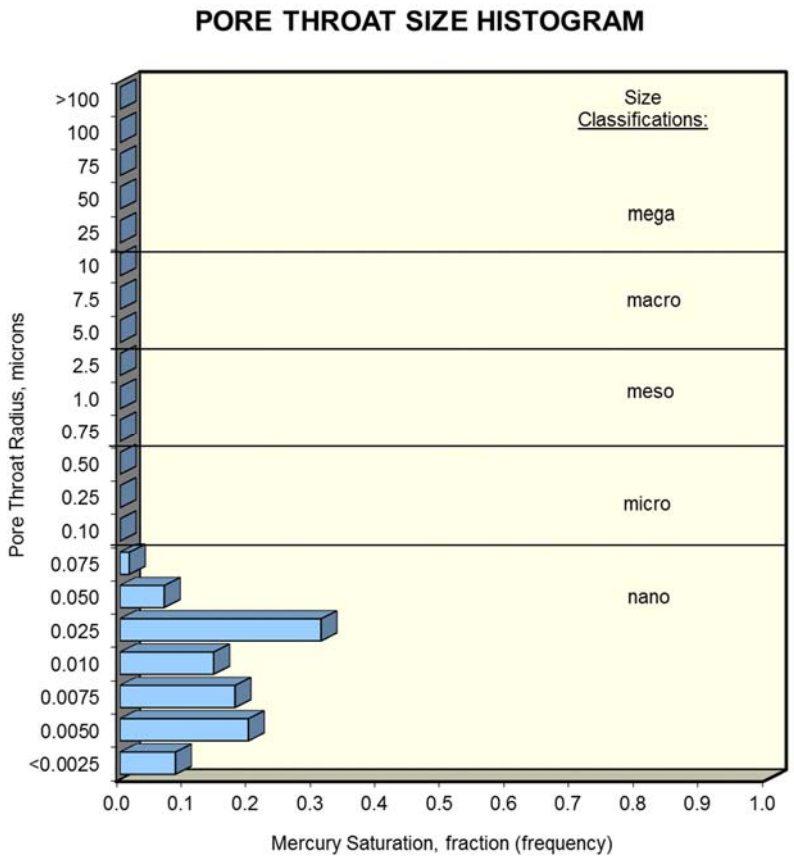
Mercury Injection Data Summary

Maximum S_b/P_c*, fraction	Pore Throat Radius at 35% Mercury Saturation (R35), µm	Median Pore Throat Radius, µm
0.00022	0.0109	0.00809

* Volume of mercury (S_b)-to-capillary pressure (P_c) ratio. The maximum S_b/P_c is used to represent the point on a capillary pressure curve where all of the major connected pore spaces controlling permeability have been intruded with mercury.

Sample Parameters

Weight, g	Pore Volume, cm^3	Grain Volume, cm^3	Bulk Volume, cm^3	Grain Density, g/cm^3	Bulk Density, g/cm^3
10.942	0.251	4.009	4.264	2.729	2.566



CORE LABORATORIES, INC., TOC AND ROCK-EVAL SUMMARY DATA

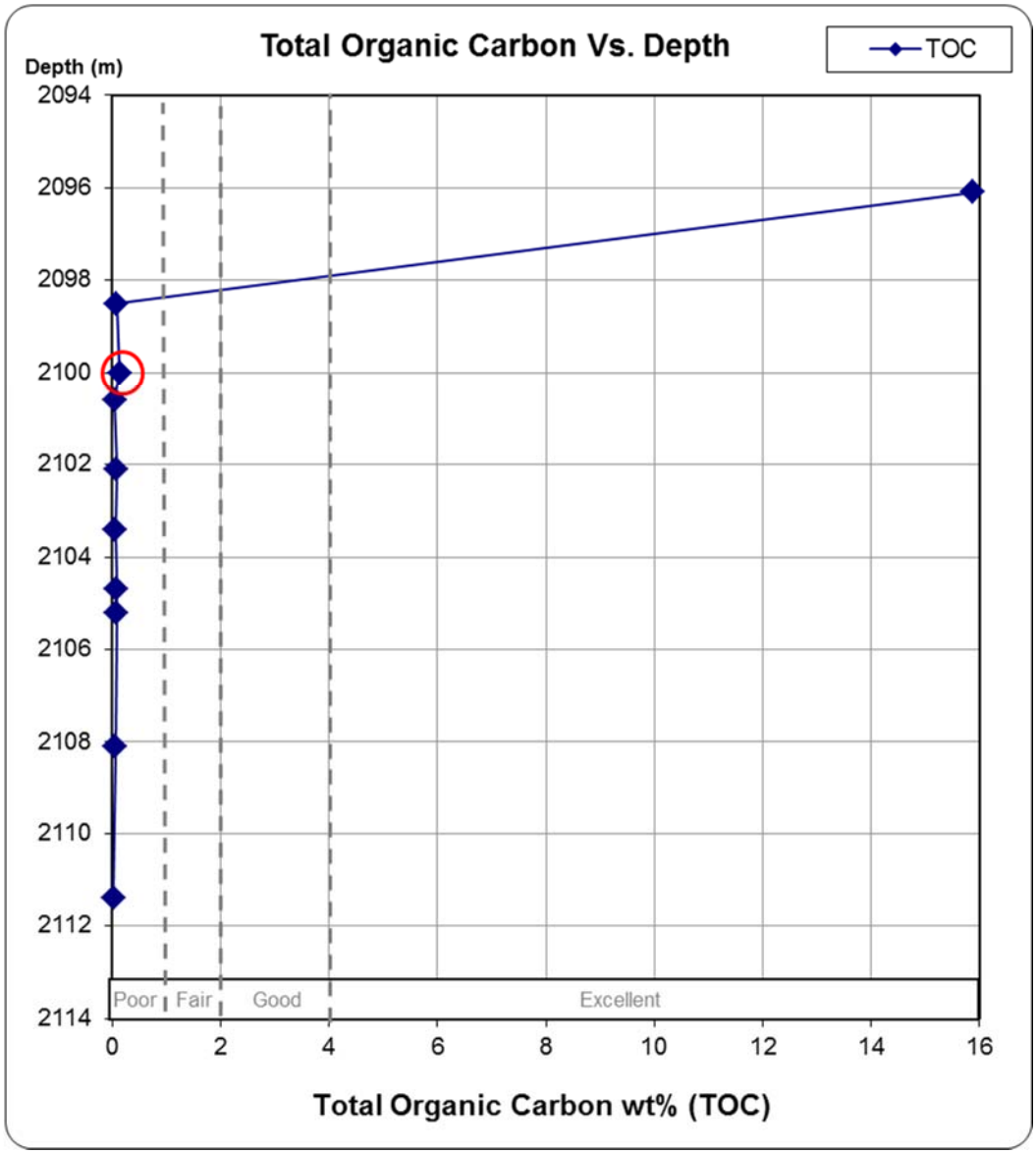
See Appendix C for full Core Labs report.

Core Labs Sample ID S2-118646-2

Depth 2100 m

TOC and ROCK-EVAL Data Summary

Sample Weight, mg	TOC, wt%	T_{max}, °C
60.3	0.14	410



SAMPLE PHOTOGRAPH

PHYSICAL PROPERTIES

Porosity

Pycnometer Effective Porosity Average, vol%
4.70

Volume and Density

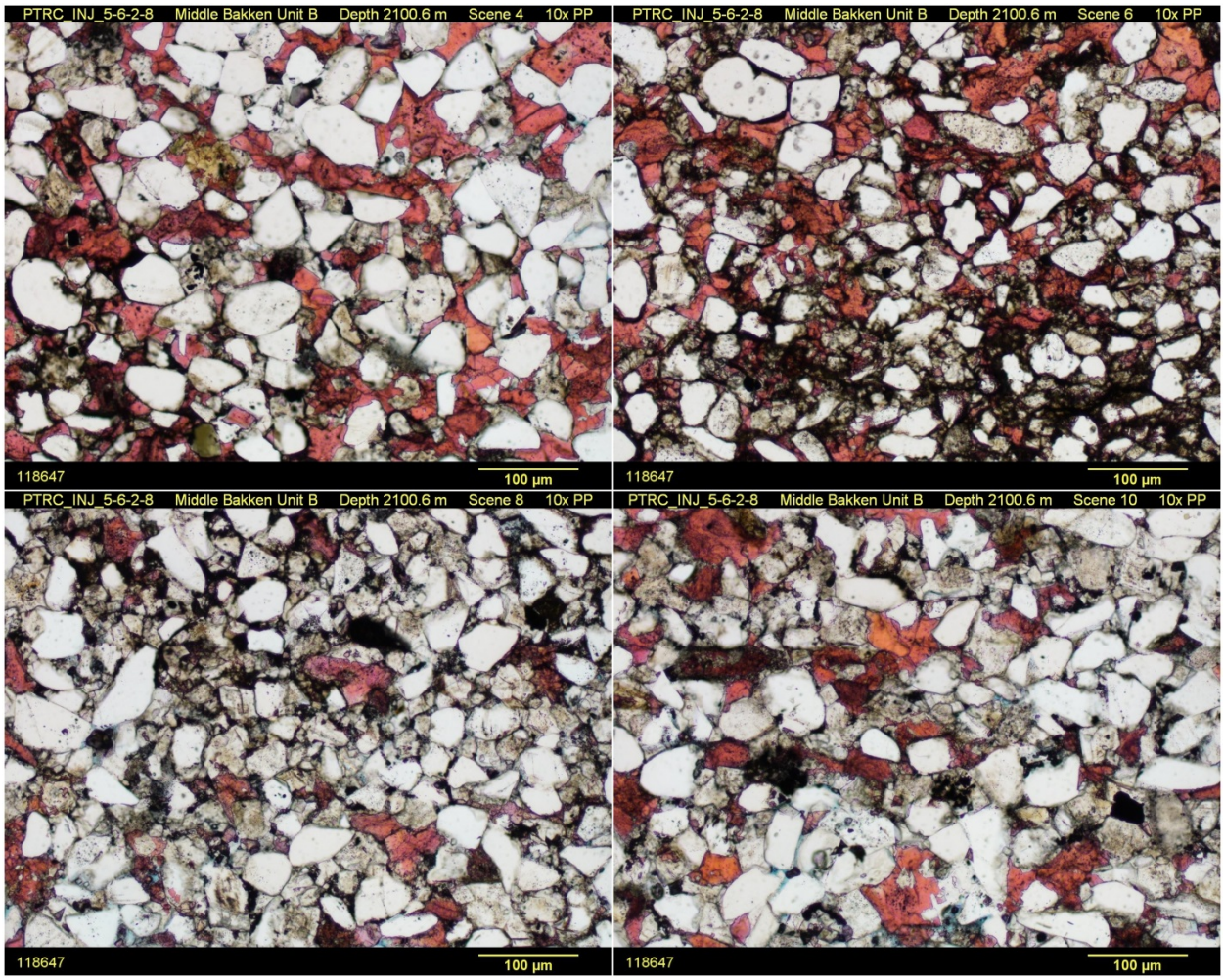
Bulk Volume, cm^3	Bulk Density, g/cm^3	Grain Volume, cm^3	Grain Density, g/cm^3
41.04	2.559	39.111	2.686

Permeability

Gas Permeability, mD
Pending

FULL THIN-SECTION SLIDE

PLANE POLAR PHOTOMICROGRAPHS



This Middle Bakken Unit B sample is very fine sandstone to coarse siltstone. Quartz, feldspars, dolomite/Fe-dolomite, and minor clays with calcite fill and grain replacement are present. Finer-grained areas have less calcite and are more dolomitic. Grains are poorly rounded and moderately sorted, ranging from 10 to 100 µm, with most grains larger than 60 µm.

CORE LABORATORIES, INC., HPMI SUMMARY DATA

See Appendix B for full Core Labs report.

Core Labs Sample ID S3 #118647-2

Depth 2100.60 m

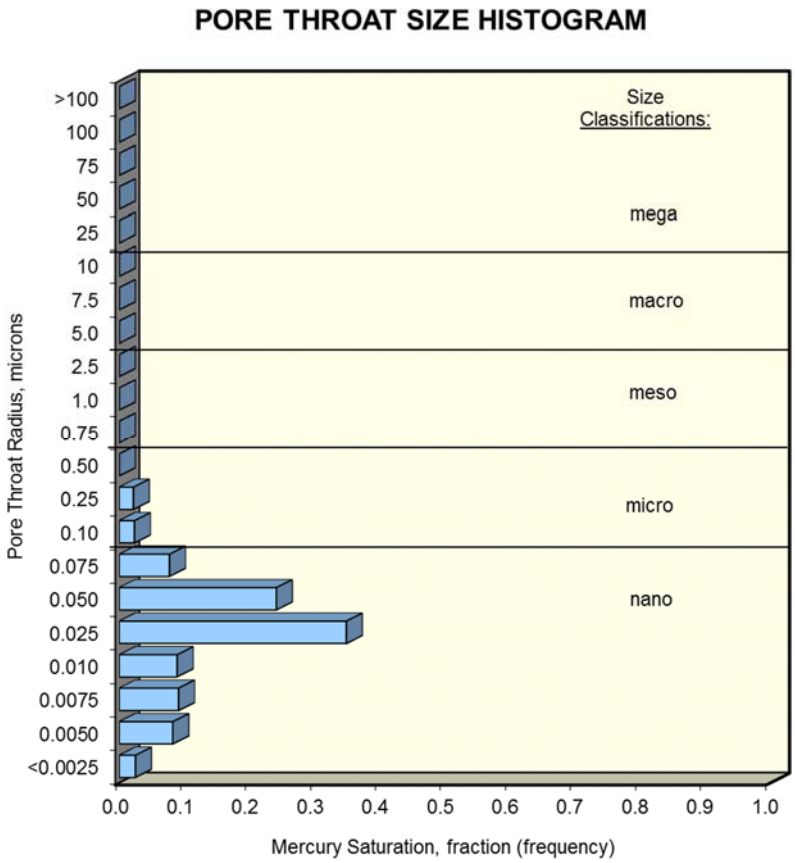
Mercury Injection Data Summary

Maximum S_b/P_c*, fraction	Pore Throat Radius at 35% Mercury Saturation (R35), µm	Median Pore Throat Radius, µm
0.00046	0.0259	0.0175

* Volume of mercury (S_b)-to-capillary pressure (P_c) ratio. The maximum S_b/P_c is used to represent the point on a capillary pressure curve where all of the major connected pore spaces controlling permeability have been intruded with mercury.

Sample Parameters

Weight, g	Pore Volume, cm^3	Grain Volume, cm^3	Bulk Volume, cm^3	Grain Density, g/cm^3	Bulk Density, g/cm^3
8.786	0.180	3.137	3.318	2.801	2.648



CORE LABORATORIES, INC., TOC AND ROCK-EVAL SUMMARY DATA

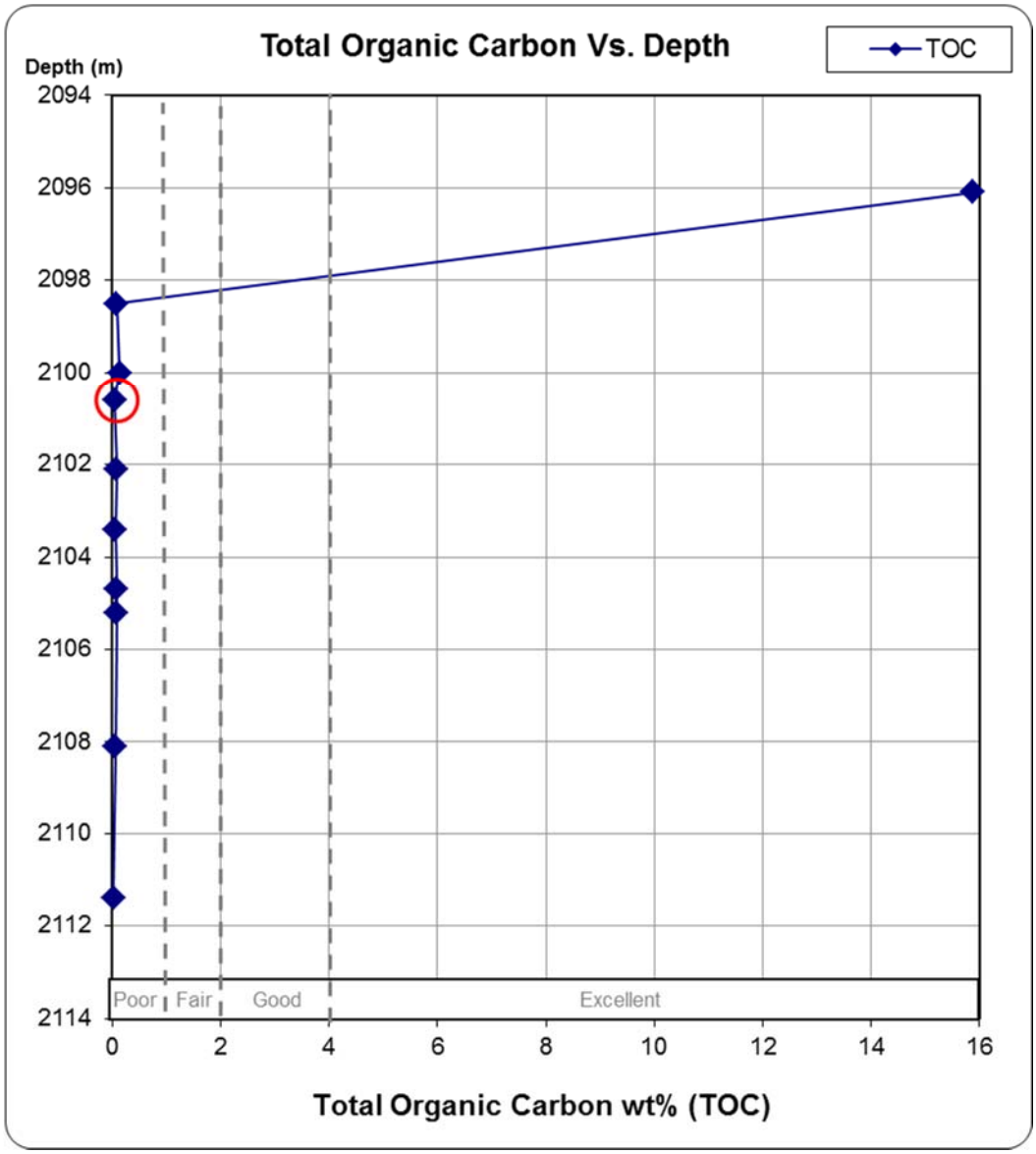
See Appendix C for full Core Labs report.

Core Labs Sample ID S3-118647-2

Depth 2100.6 m

TOC and ROCK-EVAL Data Summary

Sample Weight, mg	TOC, wt%	T_{max}, °C
60.7	0.04	426



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SAMPLE PHOTOGRAPH

PHYSICAL PROPERTIES

Porosity

Pycnometer Effective Porosity Average, vol%
13.90

Volume and Density

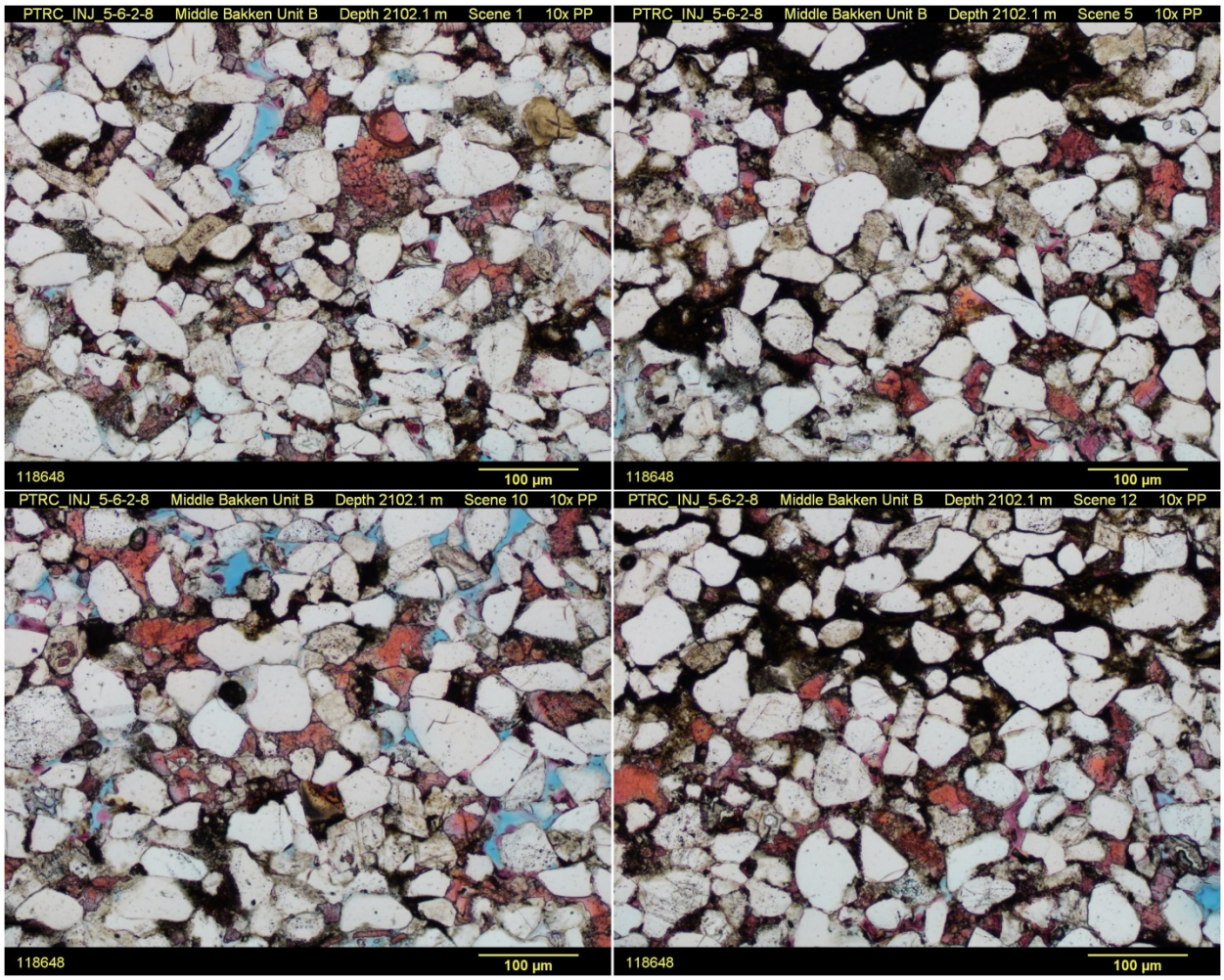
Bulk Volume, cm^3	Bulk Density, g/cm^3	Grain Volume, cm^3	Grain Density, g/cm^3
11.801	2.348	10.161	2.727

Permeability

Gas Permeability, mD
Pending

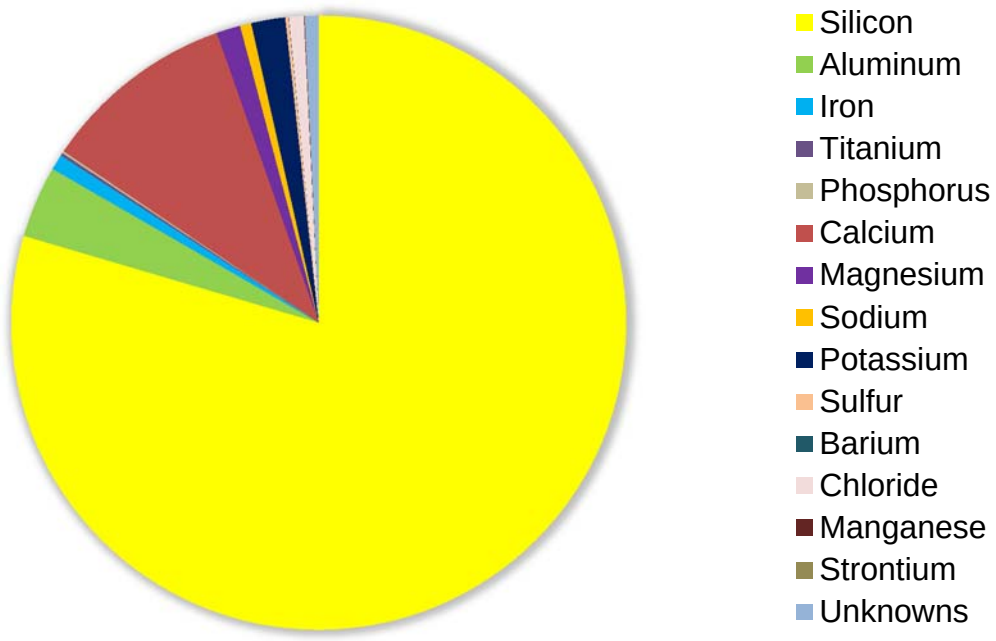
FULL THIN-SECTION SLIDE

PLANE POLAR PHOTOMICROGRAPHS



The 2102.1-m Middle Bakken sample can be described as coarse siltstone to very fine sandstone, with coarse laminations. Calcite fill is common, and a few pores are visible. Some areas show some porosity that are non-calcite-filled. Dolomite and Fe-dolomite are common. The thin section shows quartz, feldspars, dolomite/Fe-dolomite, and clays. Some intergranular porosity is visible. Grains are poorly rounded and moderately sorted, ranging in size from 10 to 100 µm, with a majority of grains larger than 60 µm.

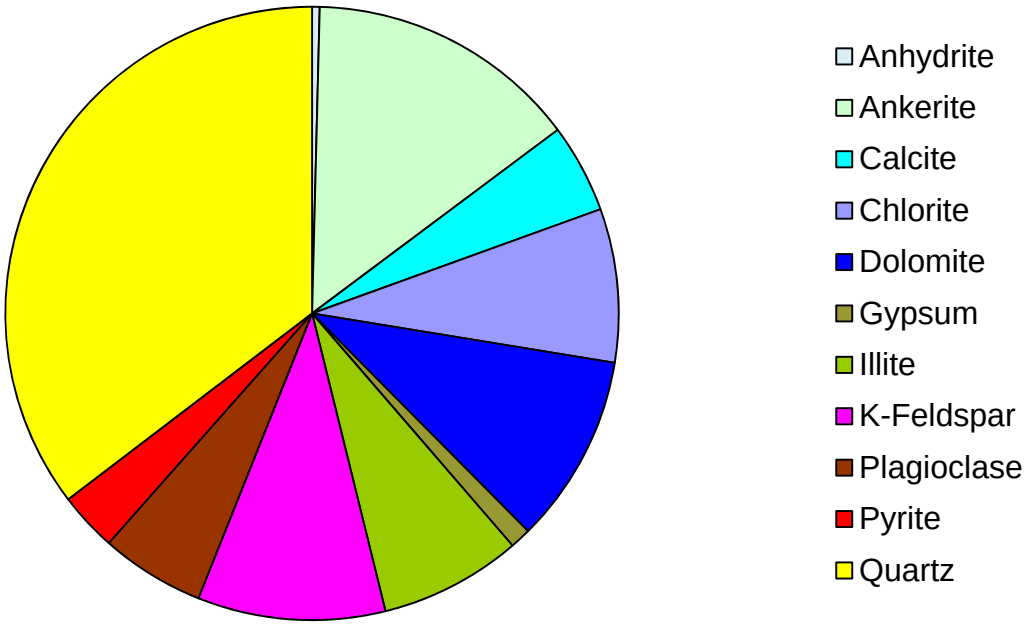
XRF BULK CHEMICAL COMPOSITION



Element	Reporting Convention (oxide)	wt%
Si (silicon)	SiO_2	79.55
Al (aluminum)	Al_2O_3	3.78
Fe (iron)	Fe_2O_3	0.82
Ti (titanium)	TiO_2	0.15
P (phosphorus)	P_2O_5	0.11
Ca (calcium)	CaO	10.20
Mg (magnesium)	MgO	1.26
Na (sodium)	Na_2O	0.59
K (potassium)	K_2O	1.79
S (sulfur)	SO_3	0.17
Ba (barium)	BaO	0.02
Cl (chloride)	Cl	0.78
Mn (manganese)	MnO	0.03
Sr (strontium)	SrO	0.01
Unknowns	Due to the presence of carbonates*	0.73
Total		99.99

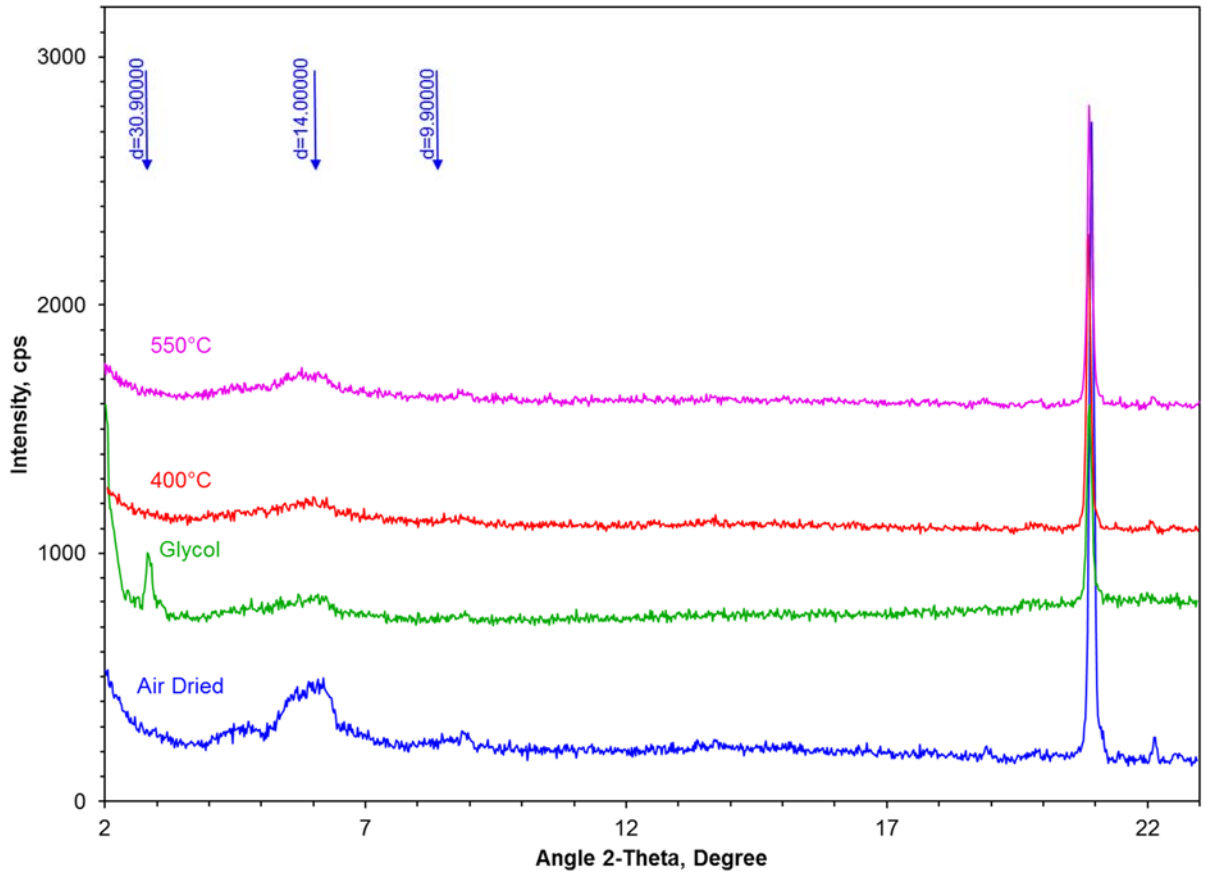
* Sample effervesced in the presence of dilute HCl, verifying the presence of carbonates.

XRD MINERAL-PHASE DISTRIBUTION



Mineral Phase	Formula	Relative wt%
Quartz	SiO_2	35.4
Pyrite	FeS_2	3.1
K-Feldspar	$KAlSi_3O_8$	9.9
Plagioclase	$Na_{0.5}Ca_{0.5}Al_{1.5}Si_{2.5}O_8$	5.5
Calcite		4.7
Dolomite	$CaMg(CO_3)_2$	10.0
Ankerite	$CaMg_{0.45}Fe_{0.55}(CO_3)_2$	14.4
Illite	$(K,H_3O)(Al,Mg,Fe)_2(Si,Al)_4O_{10}[(OH)_2,(H_2O)]$	7.5
Chlorite	$(Mg,Fe)_3(Si,Al)_4O_{10}$- $(OH)_2$ • $(Mg, Fe)_3(OH)_6$	8.1
Gypsum	$CaSO_4$ • $2(H_2O)$	1.1
Anhydrite	$CaSO_4$	0.4
Total		100.1
Total Carbonates		29.1
Total Clay		15.6

XRD CLAY TYPING



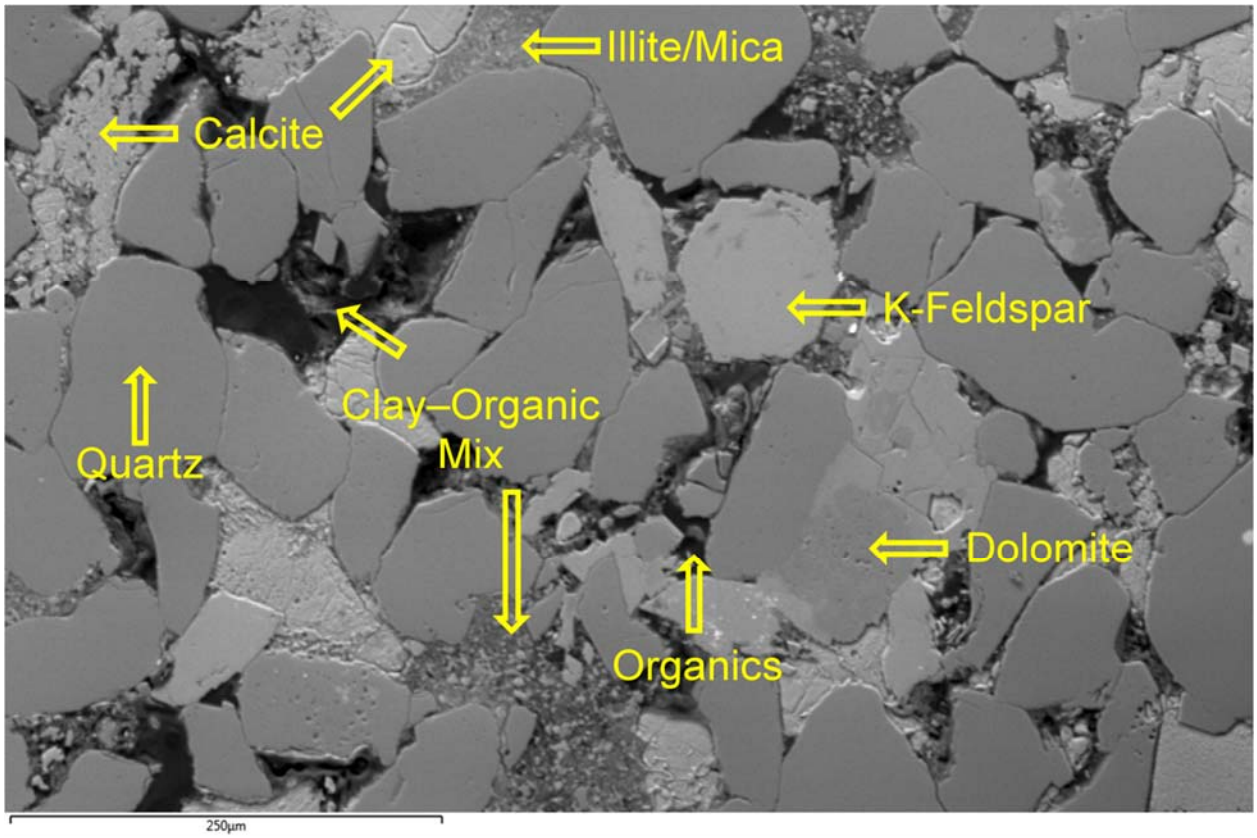
Clays Identified
Interstratified Chlorite–Montmorillonite or Chlorite–Vermiculite (corrensite)
Illite

SEM

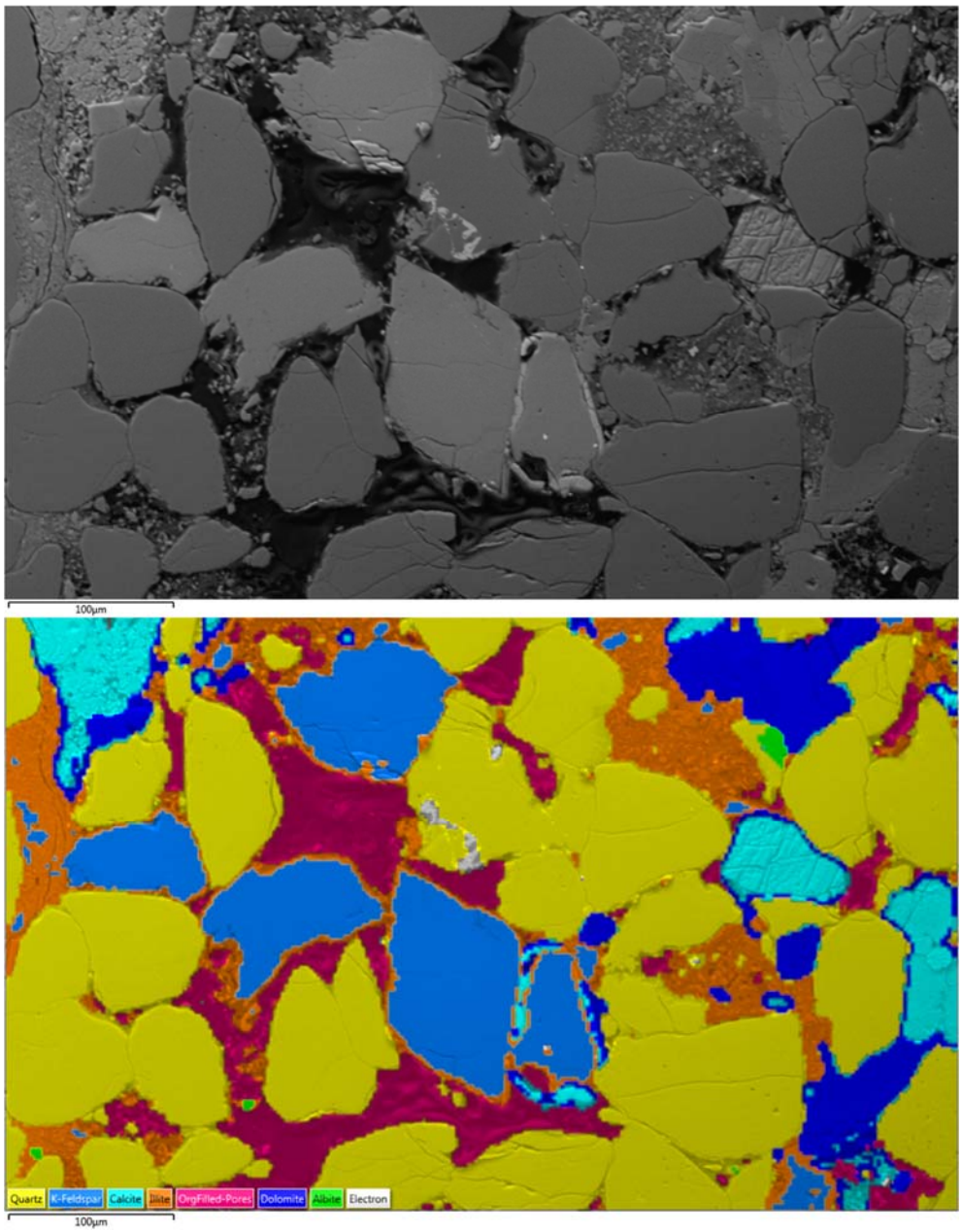
Observed Mineral Phases

Mineral Phase	Mineral Phase
Calcite	Fe-Dolomite
Quartz	Illite
K-Feldspar	Mica
Dolomite	Albite
Organics	Clays
Apatite	

High-Magnification BSE Image Annotated with Examples of Mineral Phases Identified



SEM BSE Image and Corresponding Digital Mineral Map Overlaid on BSE Image with Mineral-Phase 2-D Area Percentages

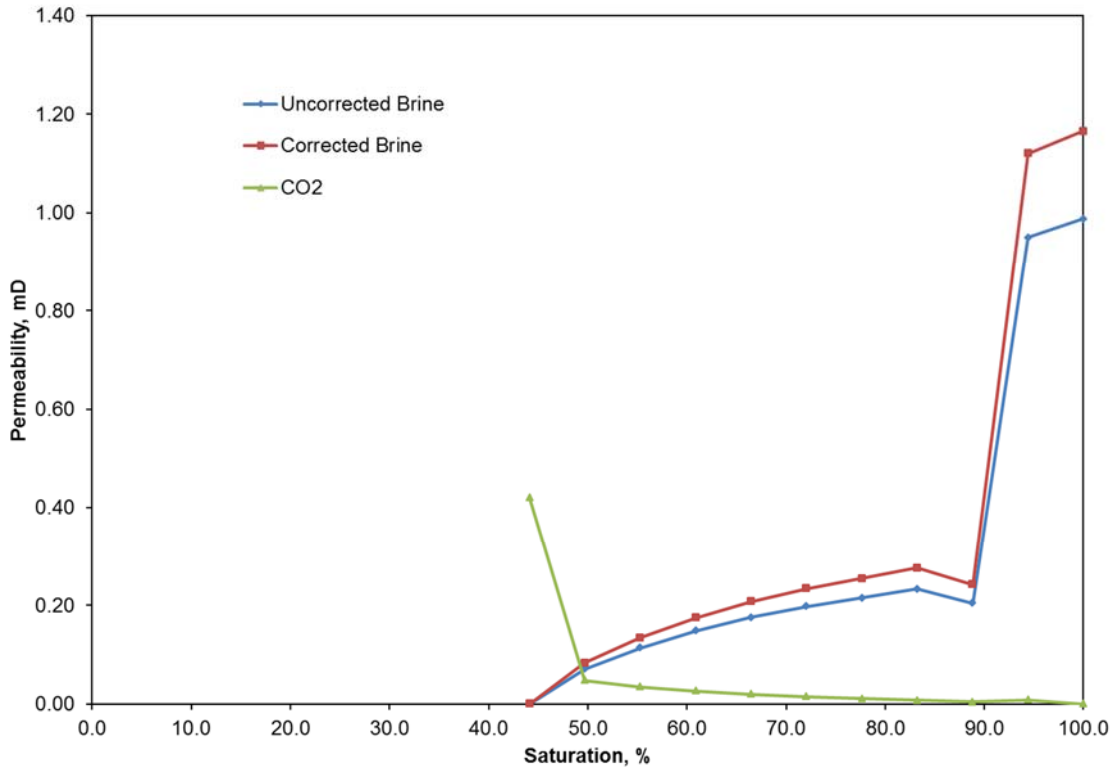


Phase	2-D area%
Quartz	49.4
K-Feldspar	12.1
Calcite	5.7
Illite	12.3
Organic-Filled Pores	10.6
Dolomite	7.1
Albite	0.2

The mineral map (bottom) allows full sorting of mineral phases and mineral associations that are indistinguishable in a conventional BSE image (top). The colors on the image are altered from the legend because of the overlay on the BSE image.

RELATIVE PERMEABILITY

Parameter	Value		Brine Chemistry
Length	1.67	cm	238,000 mg/L NaCl
Diameter	3.00	cm	8210 mg/L KCl
Cross-Sectional Area	7.073	cm^2	42,600 mg/L $CaCl_2 \cdot 2H_2O$
Pore Volume	1.64	cm^3	10,200 mg/L $MgCl_2 \cdot 6H_2O$
Drainage Mass, dry	27.64	g	
Drainage Mass, end	28.48	g	283,000 mg/L TDS
Drainage Mass, end imbibition	NA	g	(total dissolved solids)
Brine Density	1.16	g/mL	
Brine Viscosity, uncorrected	0.905	cp	
Brine Viscosity, corrected	1.07	cp	
Water in Sample	0.84	g	
Water in Sample	0.72	mL	
Brine Saturation	44.13	% Pore Volume	
Brine Saturation	2.95	% Mass	



Permeability vs. Brine Saturation at 140°F

CORE LABORATORIES, INC., HPMI SUMMARY DATA

See Appendix B for full Core Labs report.

Core Labs Sample ID S4 #118648-2m

Depth 2102.10 m

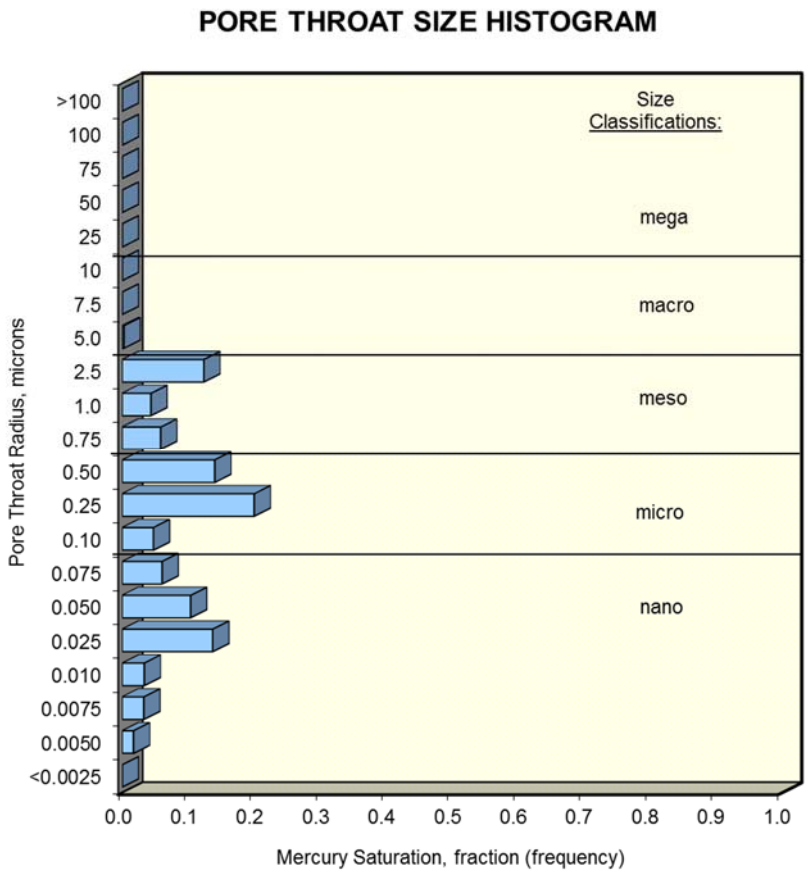
Mercury Injection Data Summary

Maximum S_b/P_c*, fraction	Pore Throat Radius at 35% Mercury Saturation (R35), µm	Median Pore Throat Radius, µm
0.00646	0.269	0.144

* Volume of mercury (S_b)-to-capillary pressure (P_c) ratio. The maximum S_b/P_c is used to represent the point on a capillary pressure curve where all of the major connected pore spaces controlling permeability have been intruded with mercury.

Sample Parameters

Weight, g	Pore Volume, cm^3	Grain Volume, cm^3	Bulk Volume, cm^3	Grain Density, g/cm^3	Bulk Density, g/cm^3
4.401	0.093	1.617	1.710	2.722	2.573



CORE LABORATORIES, INC., TOC AND ROCK-EVAL SUMMARY DATA

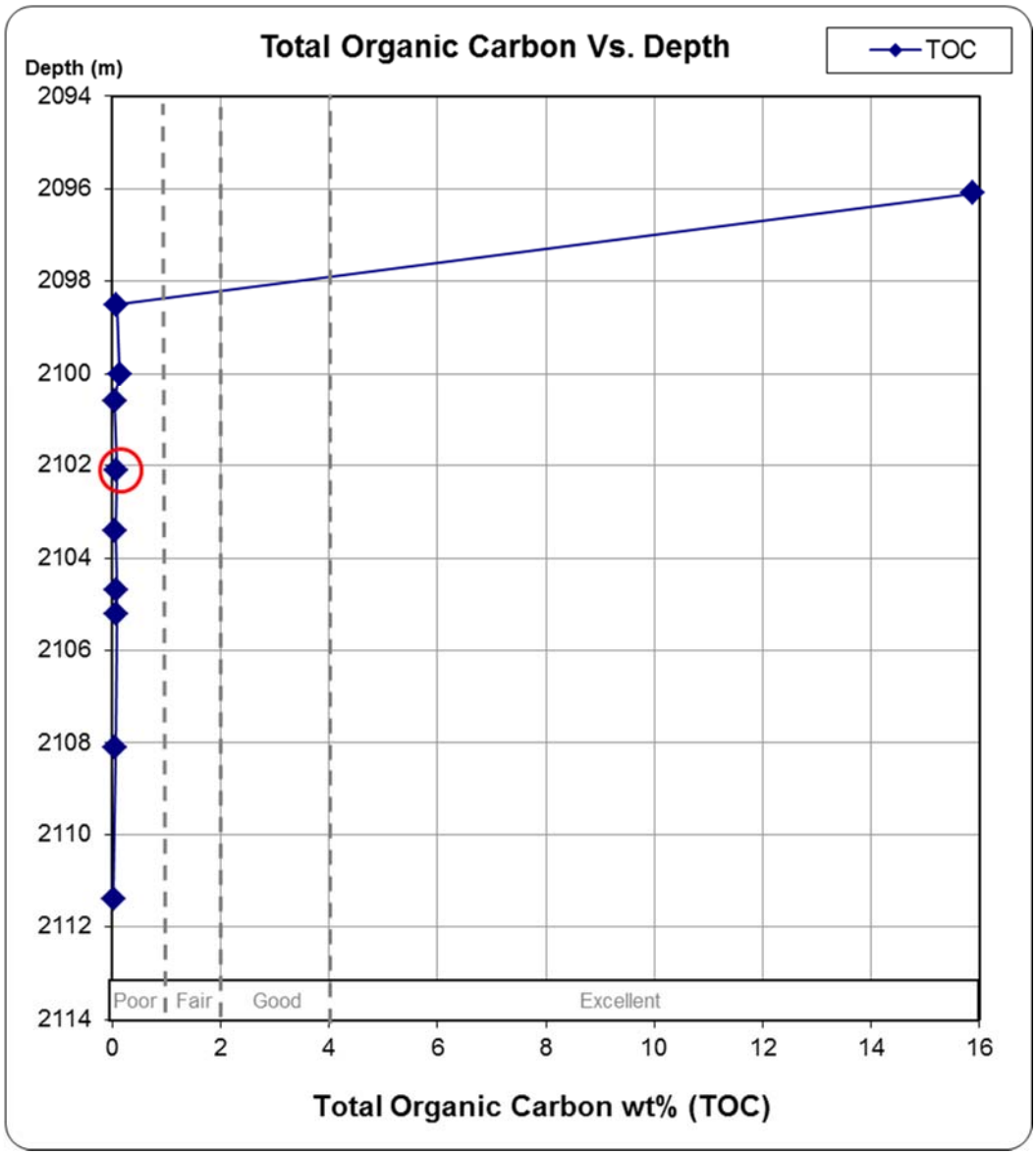
See Appendix C for full Core Labs report.

Core Labs Sample ID S4-118648-2

Depth 2102.1 m

TOC and ROCK-EVAL Data Summary

Sample Weight, mg	TOC, wt%	T_{max}, °C
60.6	0.08	435



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SAMPLE PHOTOGRAPH

PHYSICAL PROPERTIES

Porosity

Pycnometer Effective Porosity Average, vol%
7.26

Volume and Density

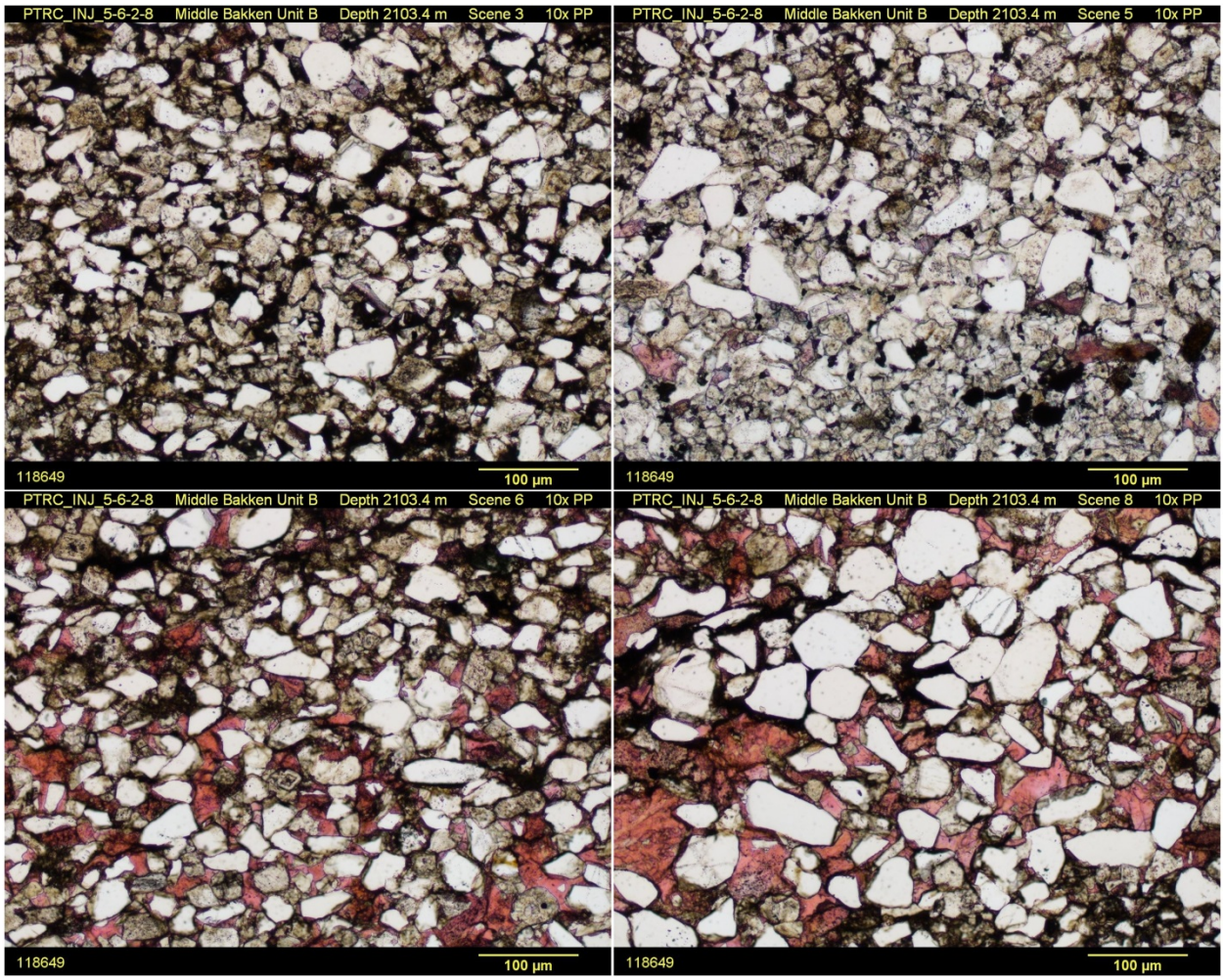
Bulk Volume, cm^3	Bulk Density, g/cm^3	Grain Volume, cm^3	Grain Density, g/cm^3
12.389	2.536	11.490	2.734

Permeability

Gas Permeability, mD
Pending

FULL THIN-SECTION SLIDE

PLANE POLAR PHOTOMICROGRAPHS



This Middle Bakken sample is coarsely laminated, sandy siltstone. Laminations are separated by clay layers and appear to be coarser grained at the bottom of the thin section. Calcite fill is common in some areas. Quartz, feldspars, dolomite/Fe-dolomite, and clays with minor calcite are present. Grains are subangular and poorly sorted, ranging in size from 5 to 90 µm. Overgrowths are common.

CORE LABORATORIES, INC., HPMI SUMMARY DATA

See Appendix B for full Core Labs report.

Core Labs Sample ID S5 #118649-2m

Depth 2103.40 m

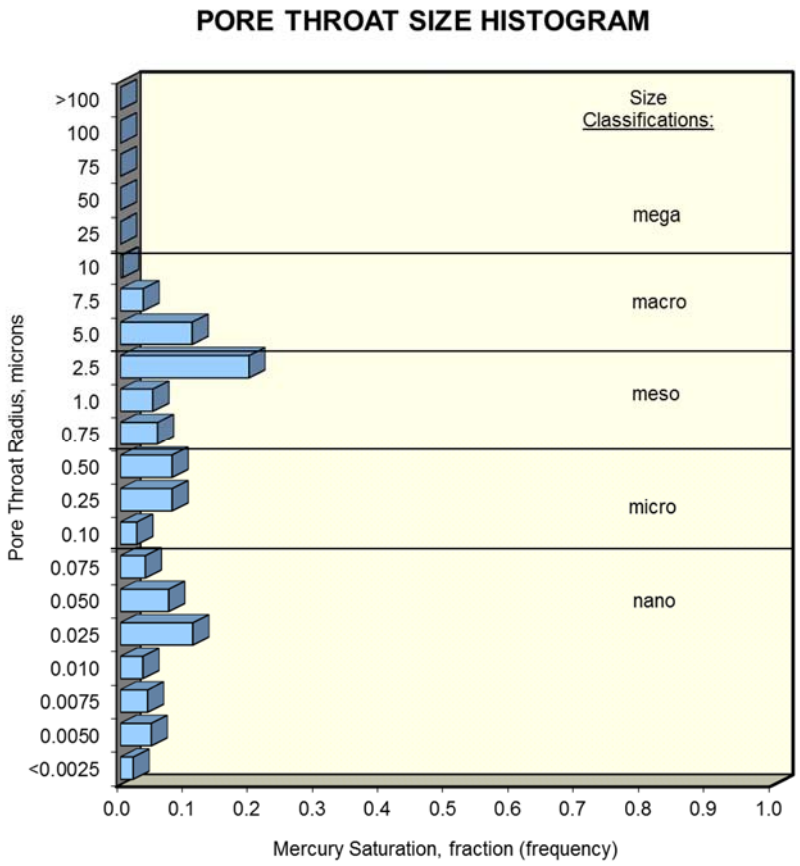
Mercury Injection Data Summary

Maximum S_b/P_c*, fraction	Pore Throat Radius at 35% Mercury Saturation (R35), µm	Median Pore Throat Radius, µm
0.0426	0.973	0.334

* Volume of mercury (S_b)-to-capillary pressure (P_c) ratio. The maximum S_b/P_c is used to represent the point on a capillary pressure curve where all of the major connected pore spaces controlling permeability have been intruded with mercury.

Sample Parameters

Weight, g	Pore Volume, cm^3	Grain Volume, cm^3	Bulk Volume, cm^3	Grain Density, g/cm^3	Bulk Density, g/cm^3
6.050	0.294	2.221	2.514	2.724	2.406



CORE LABORATORIES, INC., TOC AND ROCK-EVAL SUMMARY DATA

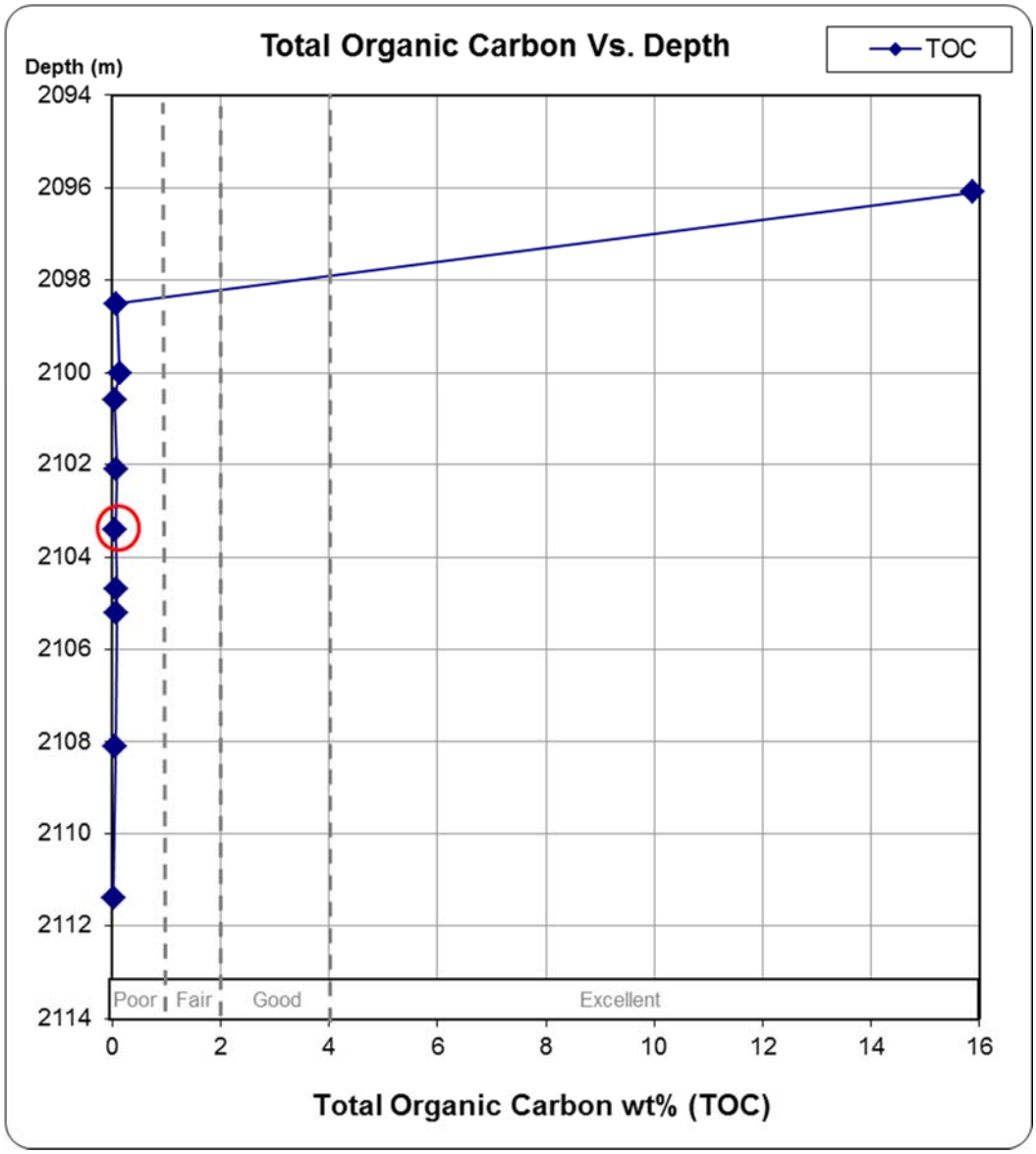
See Appendix C for full Core Labs report.

Core Labs Sample ID S5-118649-2

Depth 2103.4 m

TOC and ROCK-EVAL Data Summary

Sample Weight, mg	TOC, wt%	T_{max}, °C
60.5	0.05	436



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SAMPLE PHOTOGRAPH

PHYSICAL PROPERTIES

Porosity

Pycnometer Effective Porosity Average, vol%
8.42

Volume and Density

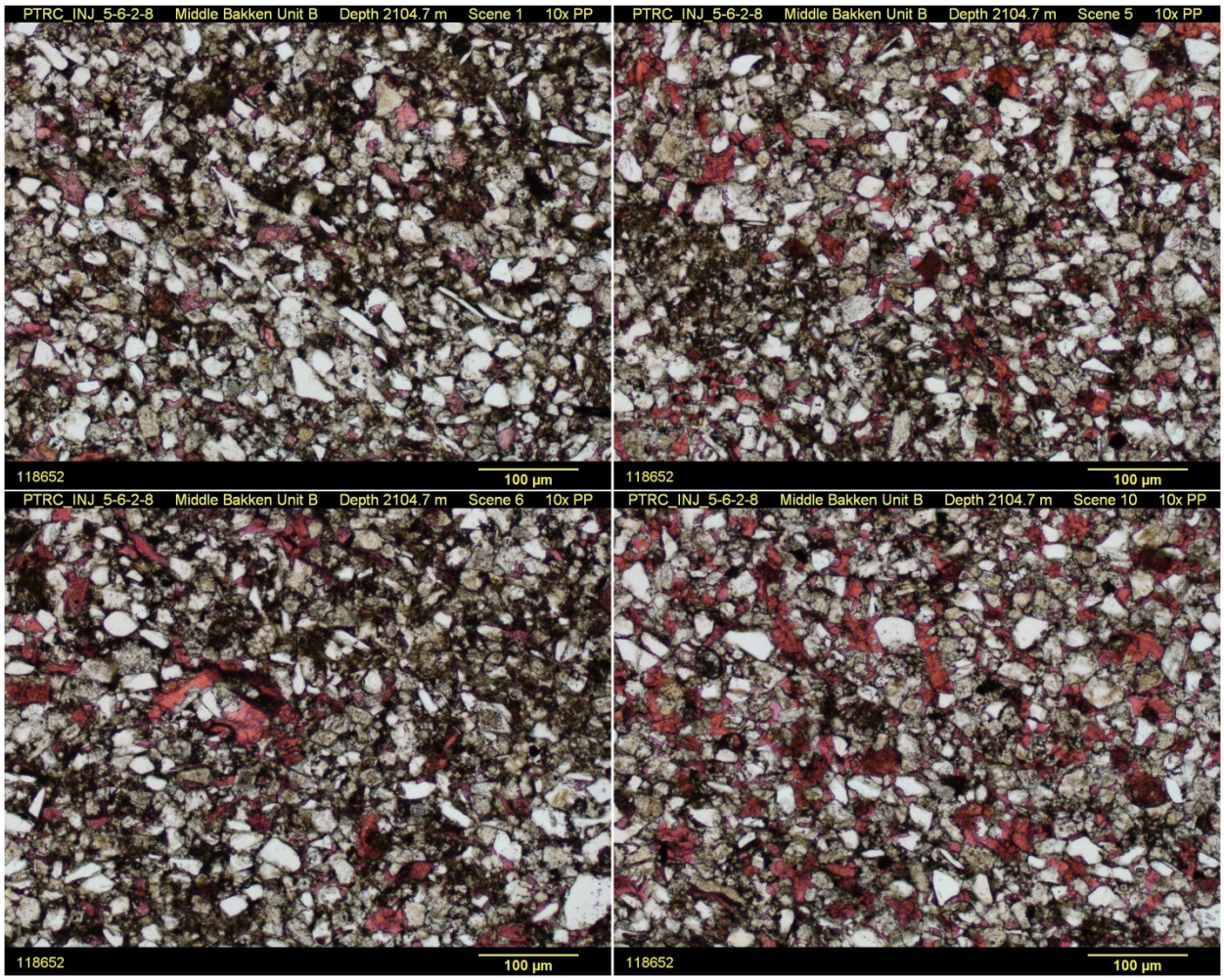
Bulk Volume, cm^3	Bulk Density, g/cm^3	Grain Volume, cm^3	Grain Density, g/cm^3
13.245	2.477	12.130	2.705

Permeability

Gas Permeability, mD
Pending

FULL THIN-SECTION SLIDE

PLANE POLAR PHOTOMICROGRAPHS



The Middle Bakken Unit B sample at 2104.7 m is burrowed siltstone consisting of quartz, feldspars, dolomite/Fe-dolomite, and clays. Calcite fill is common; no bedding or laminations are visible. Grains are angular to subrounded and moderately sorted, ranging in size from 5 to 50 µm.

CORE LABORATORIES, INC., HPMI SUMMARY DATA

See Appendix B for full Core Labs report.

Core Labs Sample ID S6 #118652-2m

Depth 2104.70 m

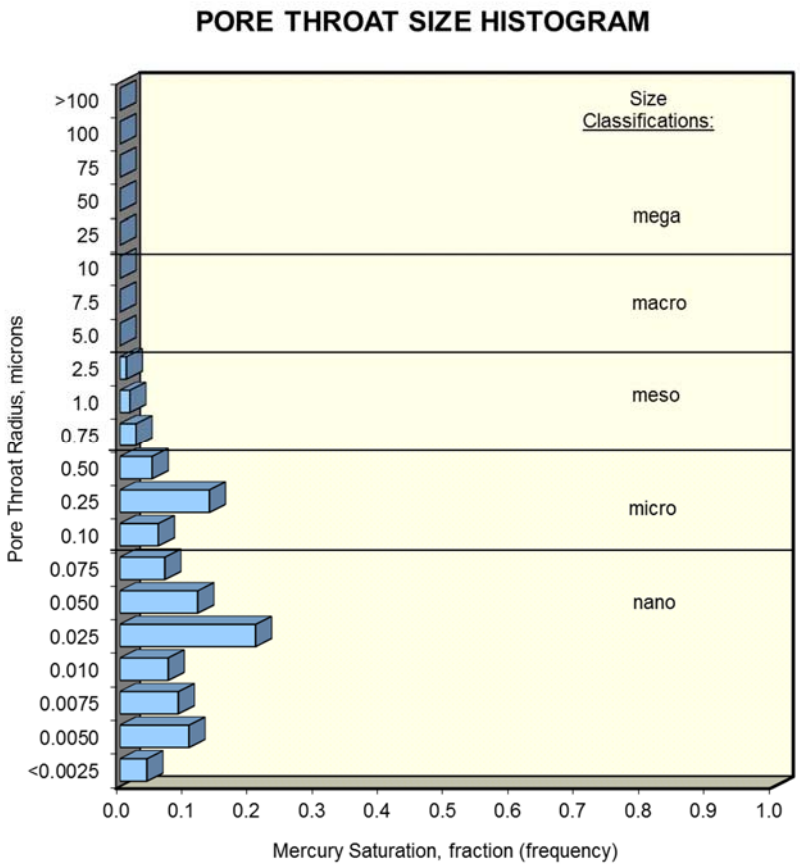
Mercury Injection Data Summary

Maximum S_b/P_c*, fraction	Pore Throat Radius at 35% Mercury Saturation (R35), µm	Median Pore Throat Radius, µm
0.00122	0.0542	0.0228

* Volume of mercury (S_b)-to-capillary pressure (P_c) ratio. The maximum S_b/P_c is used to represent the point on a capillary pressure curve where all of the major connected pore spaces controlling permeability have been intruded with mercury.

Sample Parameters

Weight, g	Pore Volume, cm^3	Grain Volume, cm^3	Bulk Volume, cm^3	Grain Density, g/cm^3	Bulk Density, g/cm^3
10.219	0.208	3.805	4.012	2.686	2.547



CORE LABORATORIES, INC., TOC AND ROCK-EVAL SUMMARY DATA

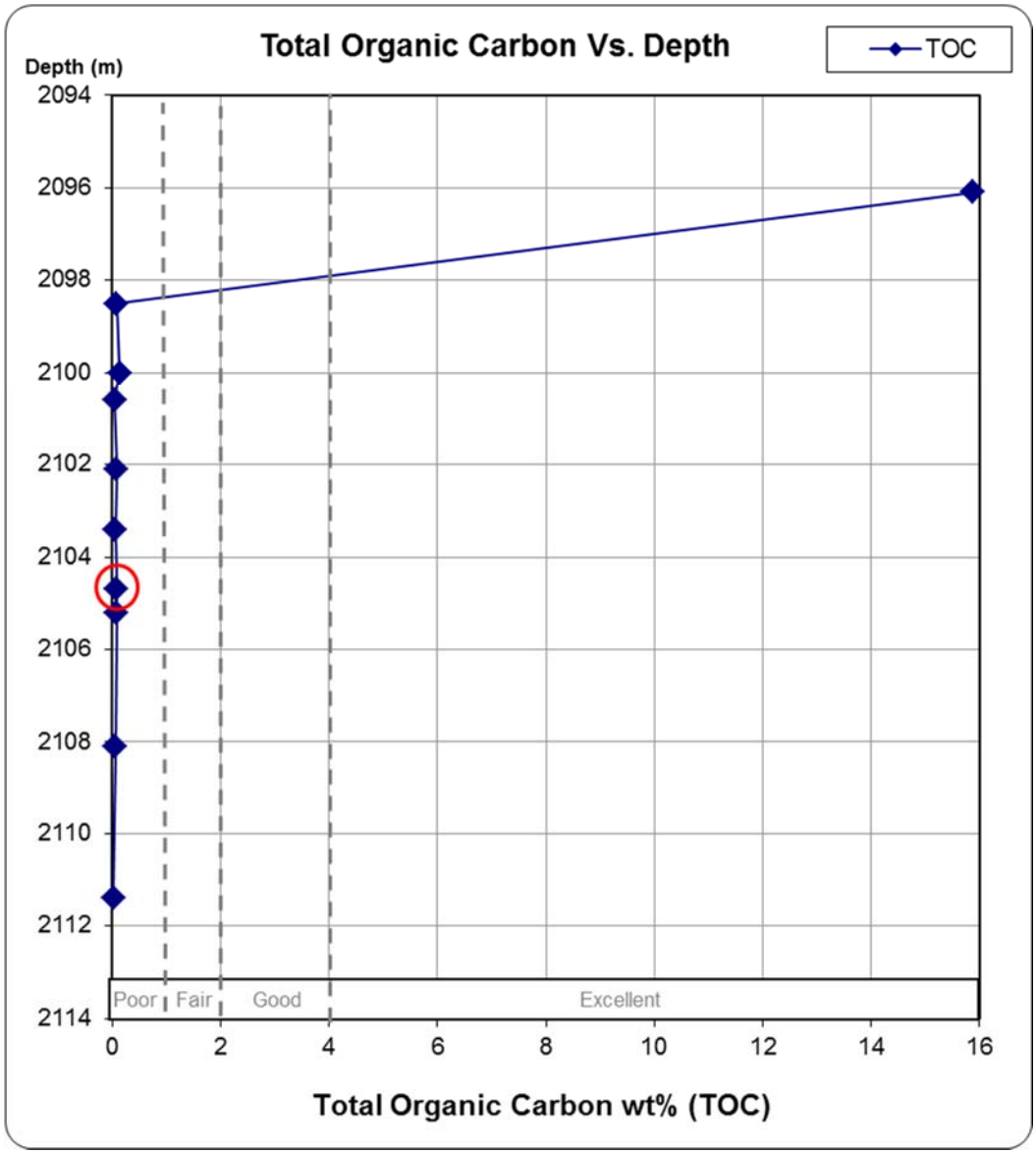
See Appendix C for full Core Labs report.

Core Labs Sample ID S6-118649-2 *(should be S6-118652-2)*

Depth 2104.7 m

TOC and ROCK-EVAL Data Summary

Sample Weight, mg	TOC, wt%	T_{max}, °C
60.8	0.08	442



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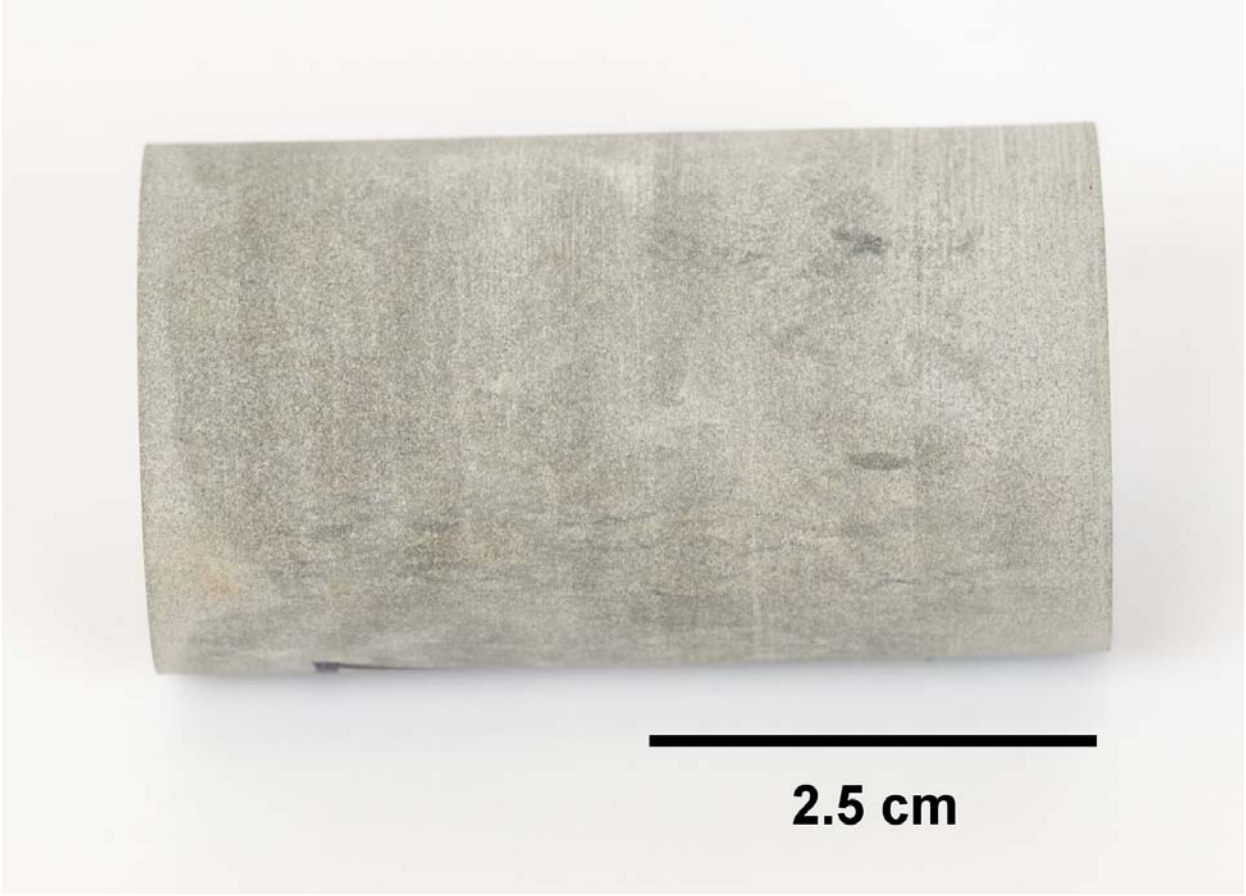
SAMPLE PHOTOGRAPH



PHYSICAL PROPERTIES

Porosity

Pycnometer Effective Porosity Average, vol%
5.74

Volume and Density

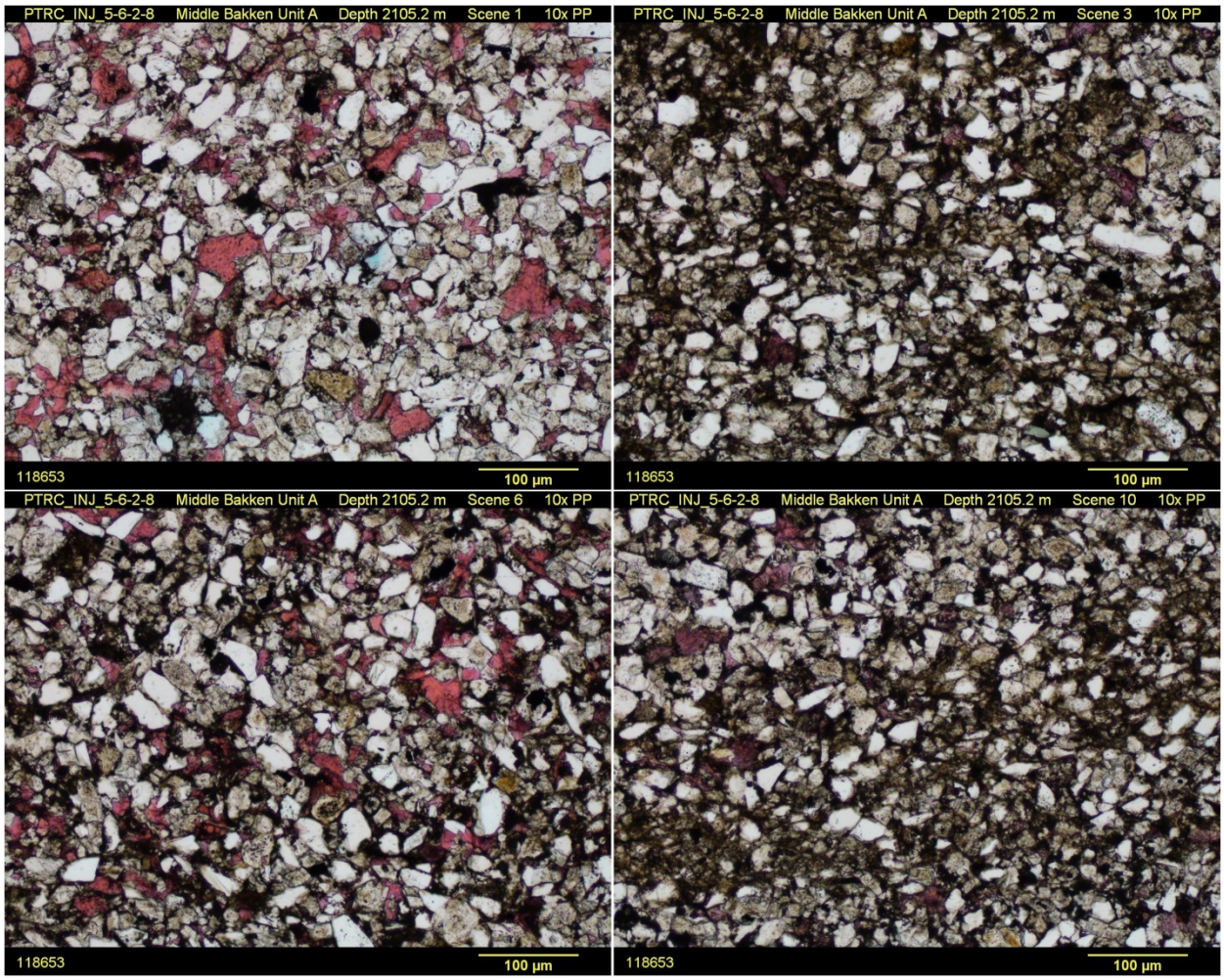
Bulk Volume, cm^3	Bulk Density, g/cm^3	Grain Volume, cm^3	Grain Density, g/cm^3
12.64	2.579	11.914	2.736

Permeability

Gas Permeability, mD
Pending

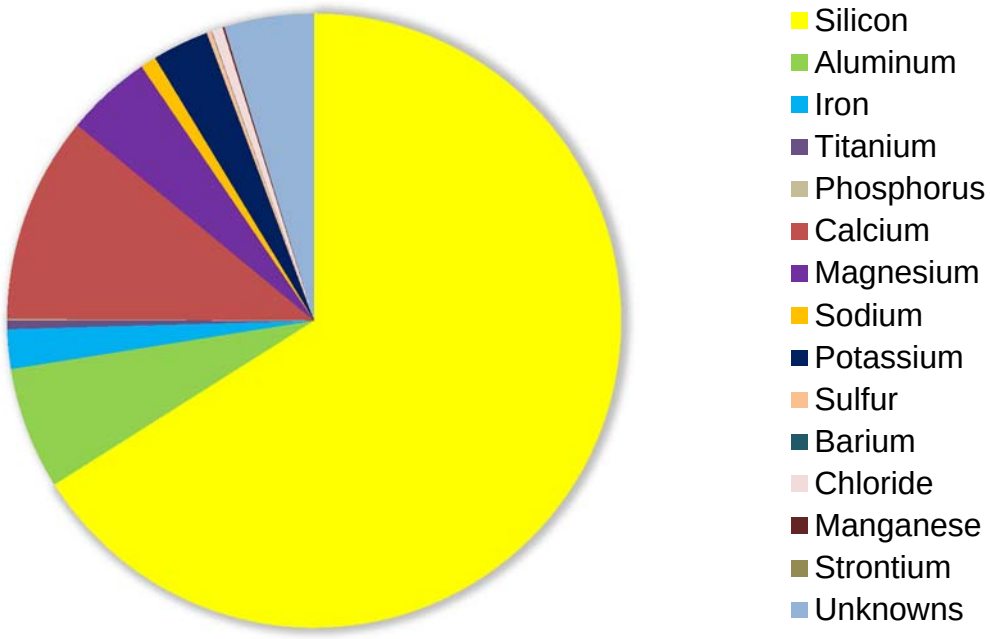
FULL THIN-SECTION SLIDE

PLANE POLAR PHOTOMICROGRAPHS



The 2105.2-m Middle Bakken Unit A sample is burrowed siltstone consisting of quartz, feldspars, dolomite/Fe-dolomite, and clays. A portion of the thin-section slide is finer-grained, with little or no calcite fill between grains. Coarser-grained areas show calcite fill. Grains are angular to subangular and range in size from 5 to 60 µm, with moderate sorting.

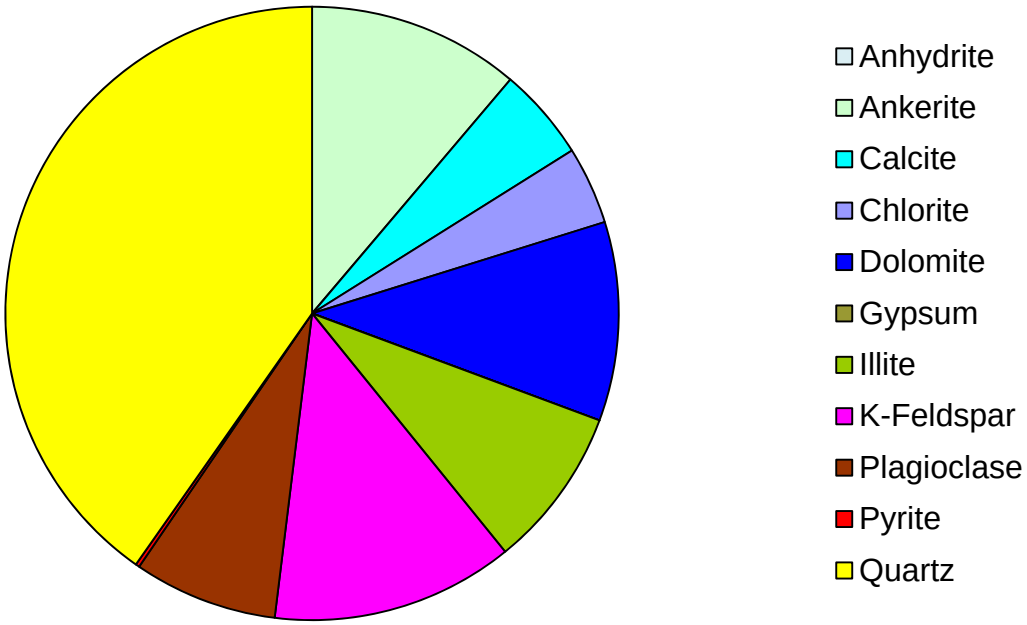
XRF BULK CHEMICAL COMPOSITION



Element	Reporting Convention (oxide)	wt%
Si (silicon)	SiO_2	66.05
Al (aluminum)	Al_2O_3	6.44
Fe (iron)	Fe_2O_3	2.08
Ti (titanium)	TiO_2	0.45
P (phosphorus)	P_2O_5	0.08
Ca (calcium)	CaO	10.90
Mg (magnesium)	MgO	4.52
Na (sodium)	Na_2O	0.83
K (potassium)	K_2O	2.98
S (sulfur)	SO_3	0.25
Ba (barium)	BaO	0.03
Cl (chloride)	Cl	0.59
Mn (manganese)	MnO	0.09
Sr (strontium)	SrO	0.01
Unknowns	Due to the presence of carbonates*	4.72
Total		100.02

* Sample effervesced in the presence of dilute HCl, verifying the presence of carbonates.

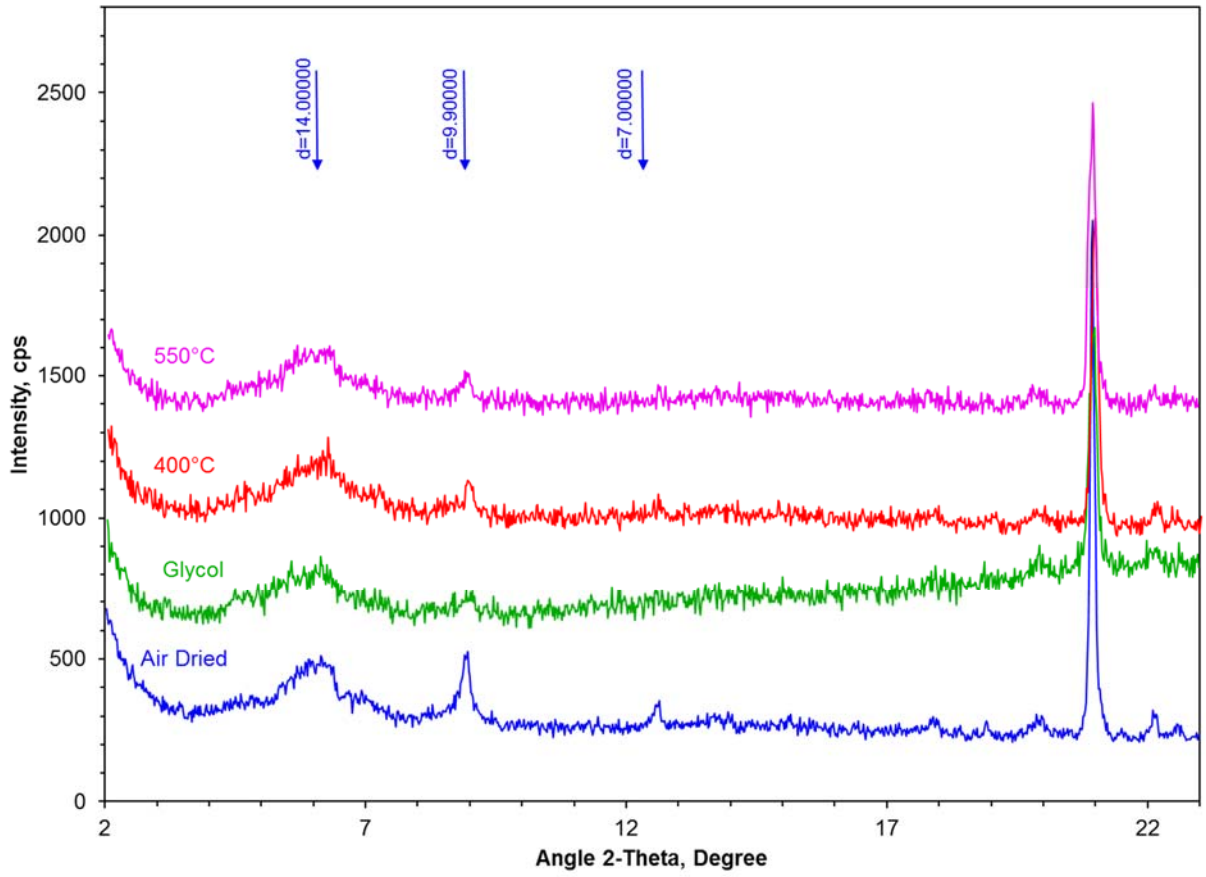
XRD MINERAL-PHASE DISTRIBUTION



Mineral Phase	Formula	Relative wt%
Quartz	SiO_2	40.3
Pyrite	FeS_2	0.2
K-Feldspar	$KAlSi_3O_8$	12.8
Plagioclase	$Na_{0.5}Ca_{0.5}Al_{1.5}Si_{2.5}O_8$	7.6
Calcite		4.9
Dolomite	$CaMg(CO_3)_2$	10.5
Ankerite	$CaMg_{0.45}Fe_{0.55}(CO_3)_2$	11.2
Illite	$(K,H_3O)(Al,Mg,Fe)_2(Si,Al)_4O_{10}[(OH)_2,(H_2O)]$	8.5
Chlorite	$(Mg,Fe)_3(Si,Al)_4O_{10}$- $(OH)_2$ • $(Mg, Fe)_3(OH)_6$	4.1
Gypsum	$CaSO_4$ • $2(H_2O)$	0.0
Anhydrite	$CaSO_4$	0.0
Total		100.1
Total Carbonates		26.6
Total Clay		12.6

	Applied Geology Laboratory	ID: 118653
		Middle Bakken Unit A
	Well Name: PTRC_INJ_5-6-2-8 W2M	Depth: 2105.2 m

XRD CLAY TYPING



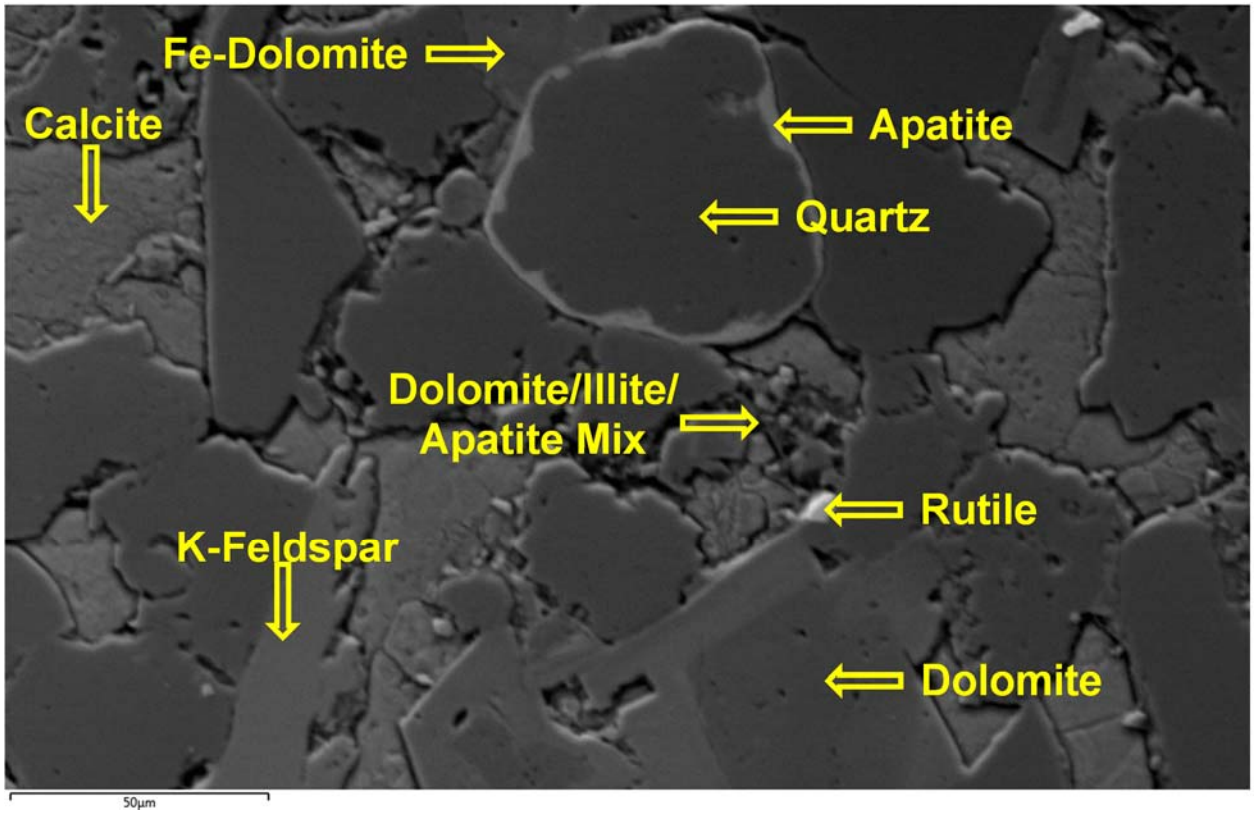
Clays Identified
Illite with Some Smectite Layers
Chlorite

SEM

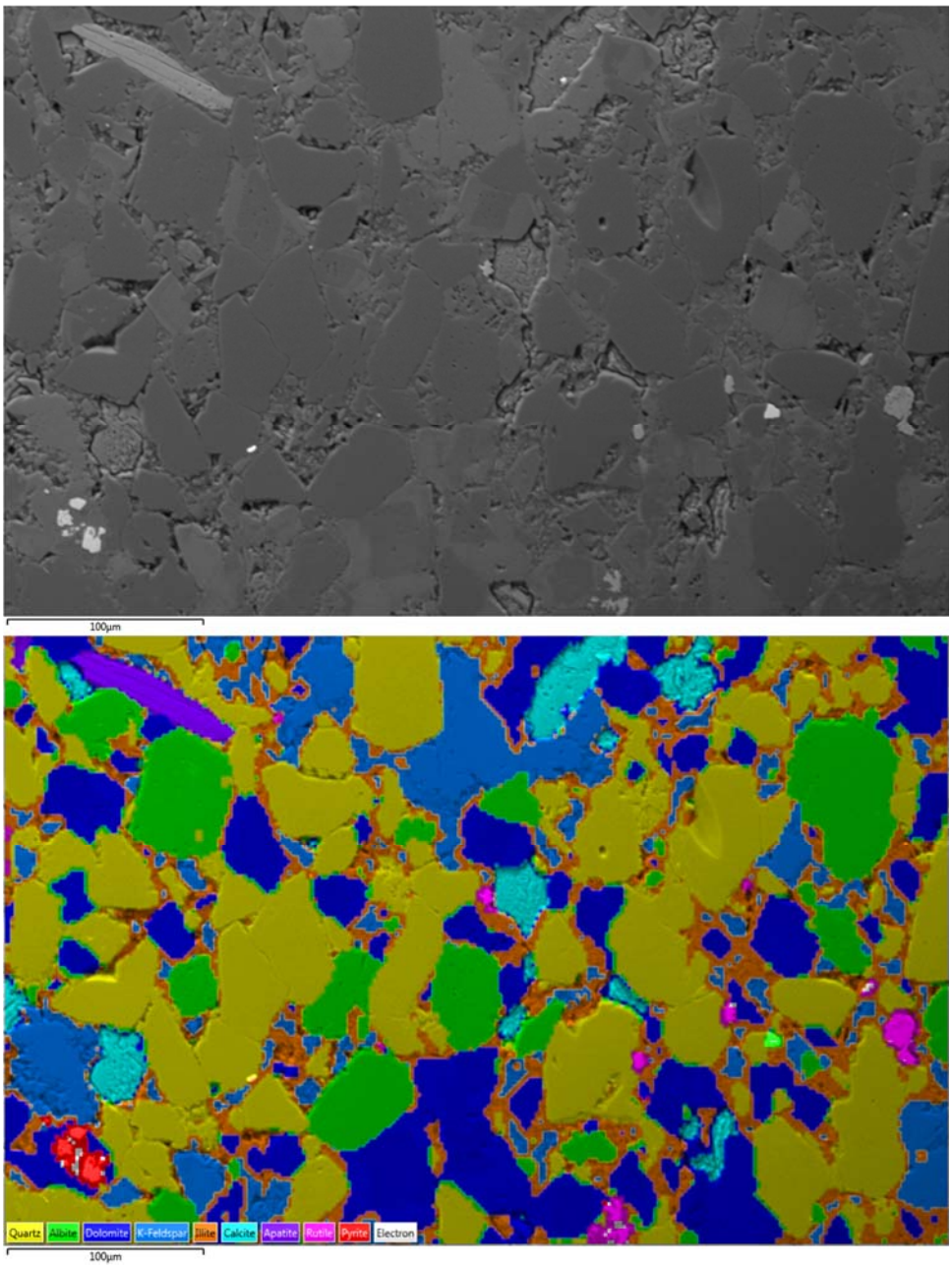
Observed Mineral Phases

Mineral Phase	Mineral Phase
Quartz	Zircon
Dolomite	Pyrite
K-Feldspar	Ankerite
Calcite	Illite
Apatite	Muscovite
Albite	Fe-Dolomite
Rutile	Monazite

High-Magnification BSE Image Annotated with Examples of Mineral Phases Identified



SEM BSE Image and Corresponding Digital Mineral Map Overlaid on BSE Image with Mineral-Phase 2-D Area Percentages



Phase	2-D area%
Quartz	35.2
Albite	12.4
Dolomite	18.5
K-Feldspar	11.3
Illite	15.2
Calcite	3.1
Apatite	0.9
Rutile	0.5
Pyrite	0.2

The mineral map (bottom) allows full sorting of mineral phases and mineral associations that are indistinguishable in a conventional BSE image (top). The colors on the image are altered from the legend because of the overlay on the BSE image.

CORE LABORATORIES, INC., HPMI SUMMARY DATA

See Appendix B for full Core Labs report.

Core Labs Sample ID S7 #118653m

Depth 2105.20 m

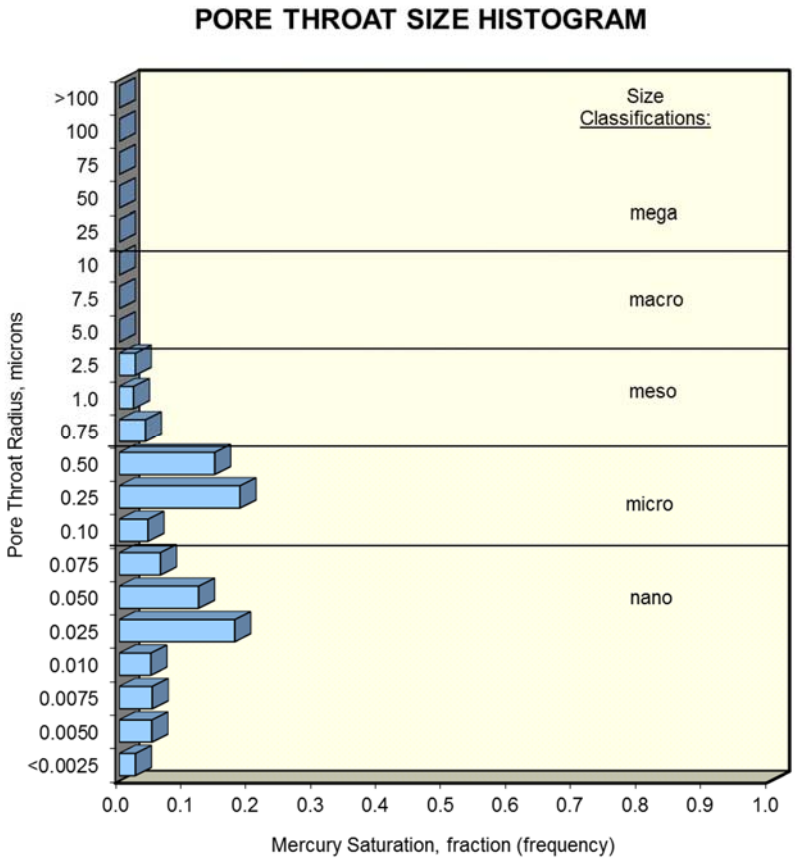
Mercury Injection Data Summary

Maximum S_b/P_c*, fraction	Pore Throat Radius at 35% Mercury Saturation (R35), µm	Median Pore Throat Radius, µm
0.00483	0.152	0.0590

* Volume of mercury (S_b)-to-capillary pressure (P_c) ratio. The maximum S_b/P_c is used to represent the point on a capillary pressure curve where all of the major connected pore spaces controlling permeability have been intruded with mercury.

Sample Parameters

Weight, g	Pore Volume, cm^3	Grain Volume, cm^3	Bulk Volume, cm^3	Grain Density, g/cm^3	Bulk Density, g/cm^3
9.703	0.348	3.629	3.977	2.674	2.440



CORE LABORATORIES, INC., TOC AND ROCK-EVAL SUMMARY DATA

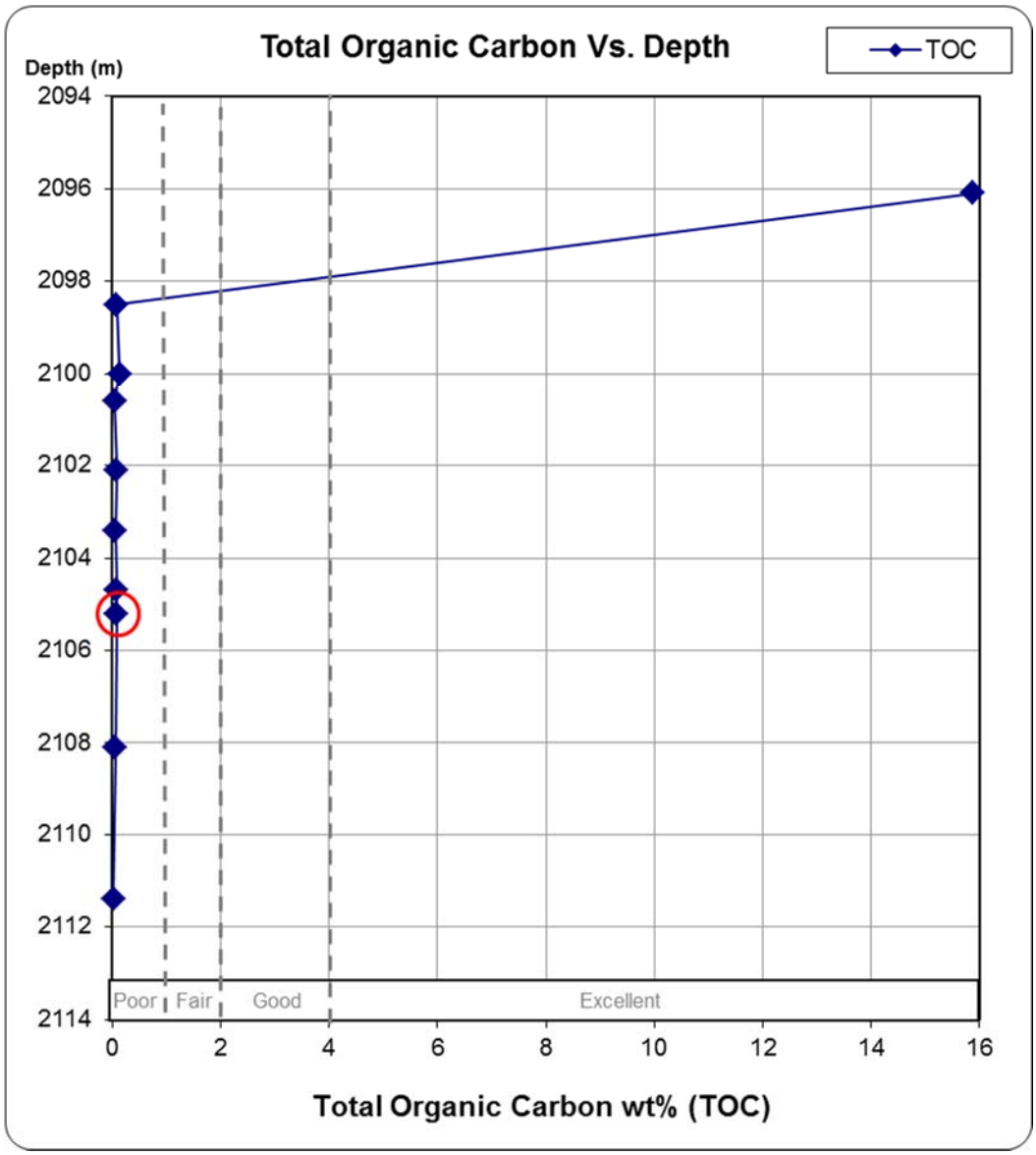
See Appendix C for full Core Labs report.

Core Labs Sample ID S7-118653

Depth 2105.2 m

TOC and ROCK-EVAL Data Summary

Sample Weight, mg	TOC, wt%	T_{max}, °C
60.1	0.08	432



SAMPLE PHOTOGRAPH

PHYSICAL PROPERTIES

Porosity

Pycnometer Effective Porosity Average, vol%
8.90

Volume and Density

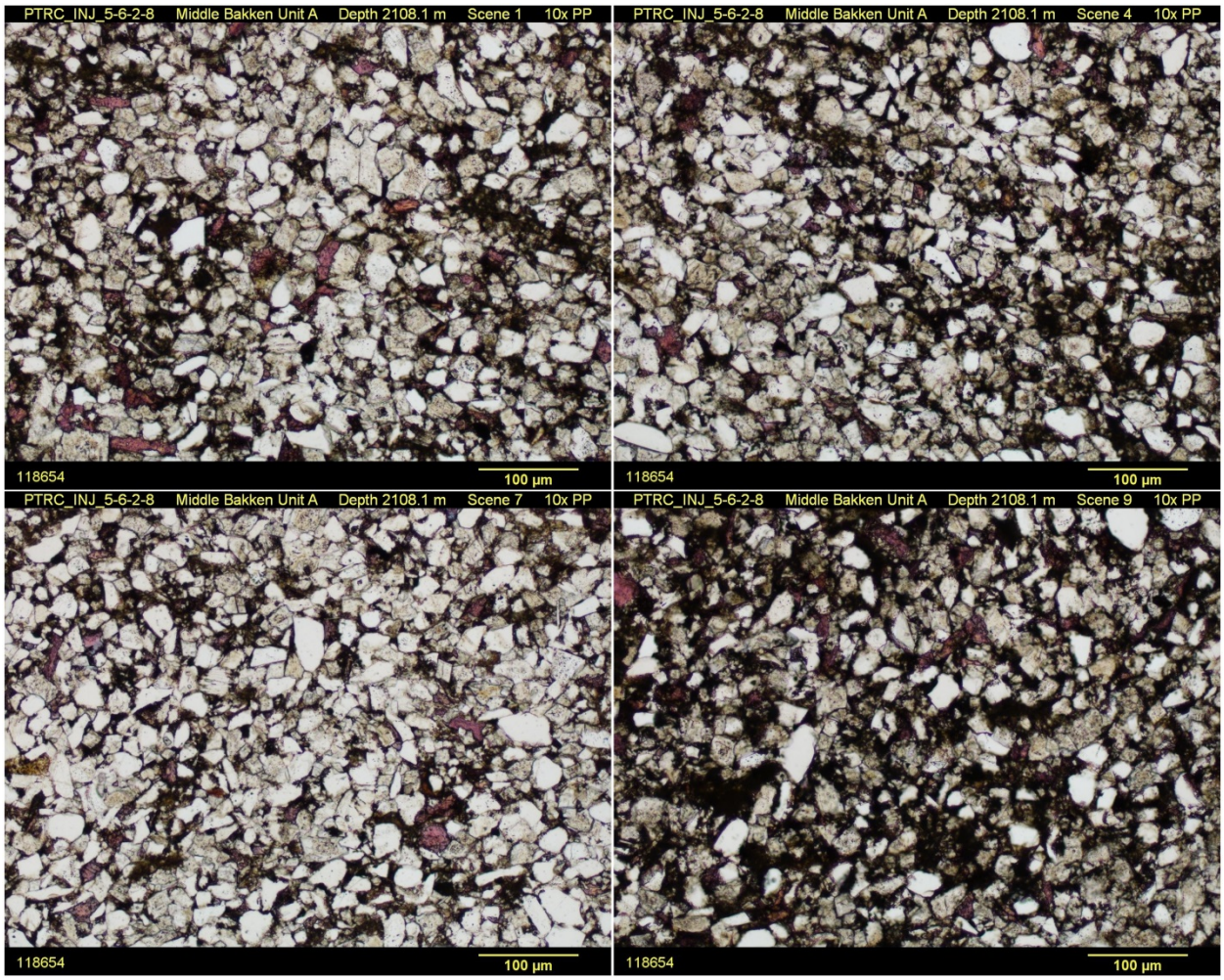
Bulk Volume, cm^3	Bulk Density, g/cm^3	Grain Volume, cm^3	Grain Density, g/cm^3
12.924	2.483	11.774	2.726

Permeability

Gas Permeability, mD
Pending

FULL THIN-SECTION SLIDE

PLANE POLAR PHOTOMICROGRAPHS



This Middle Bakken sample is siltstone containing quartz, feldspars, dolomite/Fe-dolomite, and clays, with minor calcite as fossil fragments rather than pore filling. Grains are moderately sorted, are angular to subangular, and range in size from 10 to 60 µm.

CORE LABORATORIES, INC., HPMI SUMMARY DATA

See Appendix B for full Core Labs report.

Core Labs Sample ID S8 #118654-2m

Depth 2108.10 m

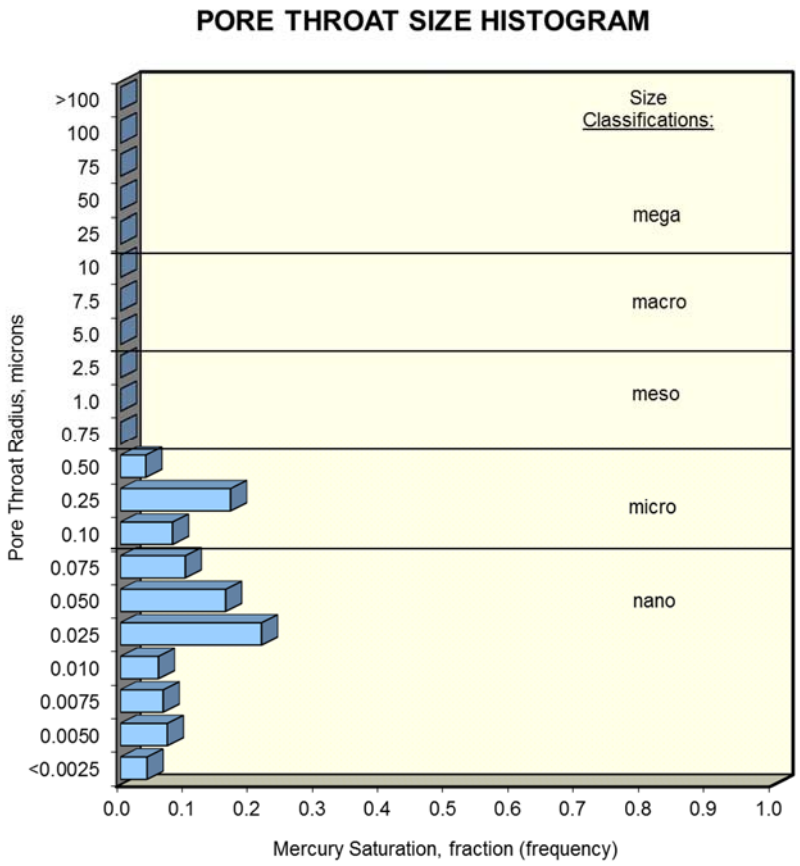
Mercury Injection Data Summary

Maximum S_b/P_c*, fraction	Pore Throat Radius at 35% Mercury Saturation (R35), µm	Median Pore Throat Radius, µm
0.00135	0.0583	0.0306

* Volume of mercury (S_b)-to-capillary pressure (P_c) ratio. The maximum S_b/P_c is used to represent the point on a capillary pressure curve where all of the major connected pore spaces controlling permeability have been intruded with mercury.

Sample Parameters

Weight, g	Pore Volume, cm^3	Grain Volume, cm^3	Bulk Volume, cm^3	Grain Density, g/cm^3	Bulk Density, g/cm^3
9.293	0.248	3.420	3.669	2.717	2.533



CORE LABORATORIES, INC., TOC AND ROCK-EVAL SUMMARY DATA

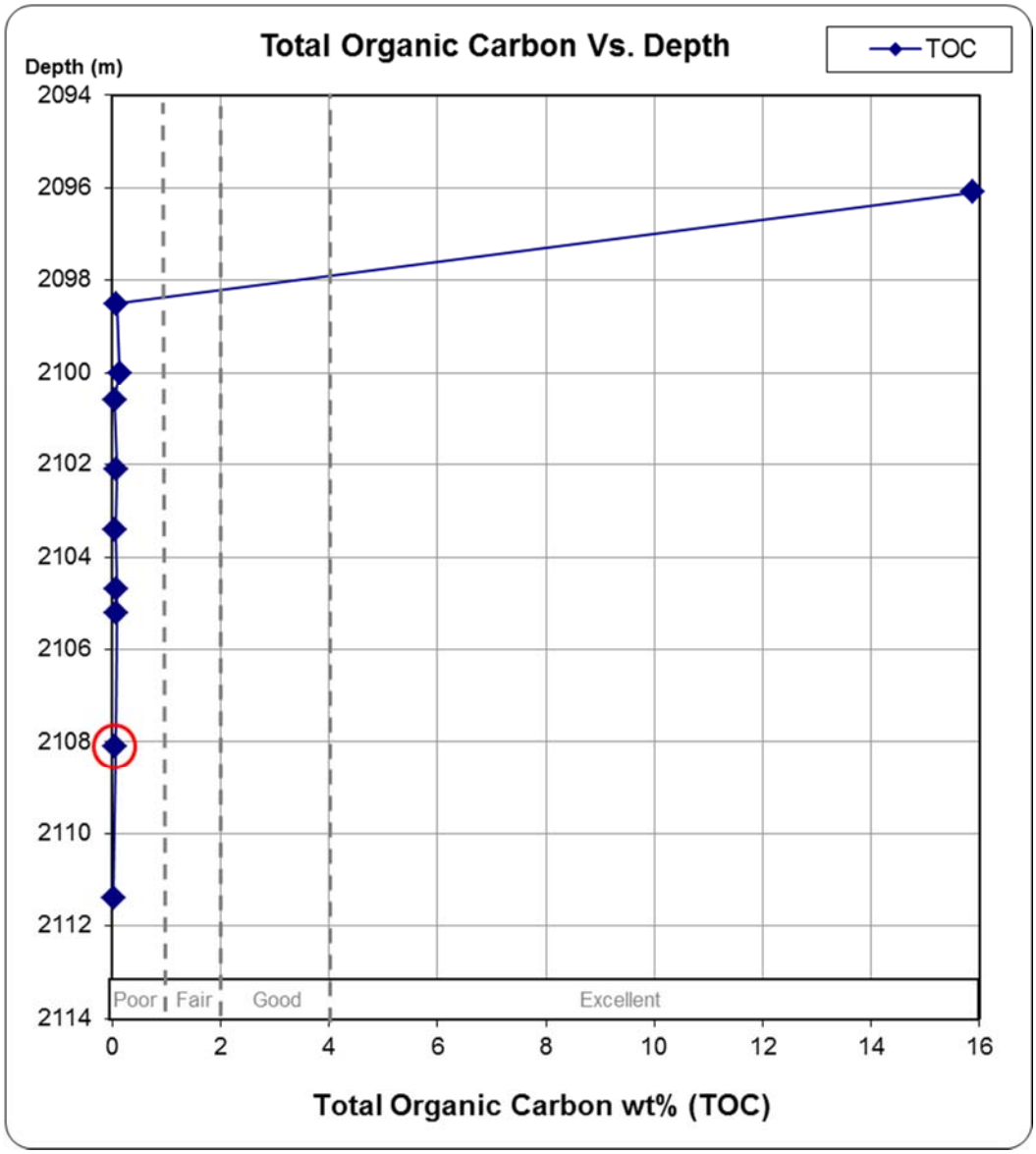
See Appendix C for full Core Labs report.

Core Labs Sample ID S8-118654-2

Depth 2108.1 m

TOC and ROCK-EVAL Data Summary

Sample Weight, mg	TOC, wt%	T_{max}, °C
60.4	0.05	442



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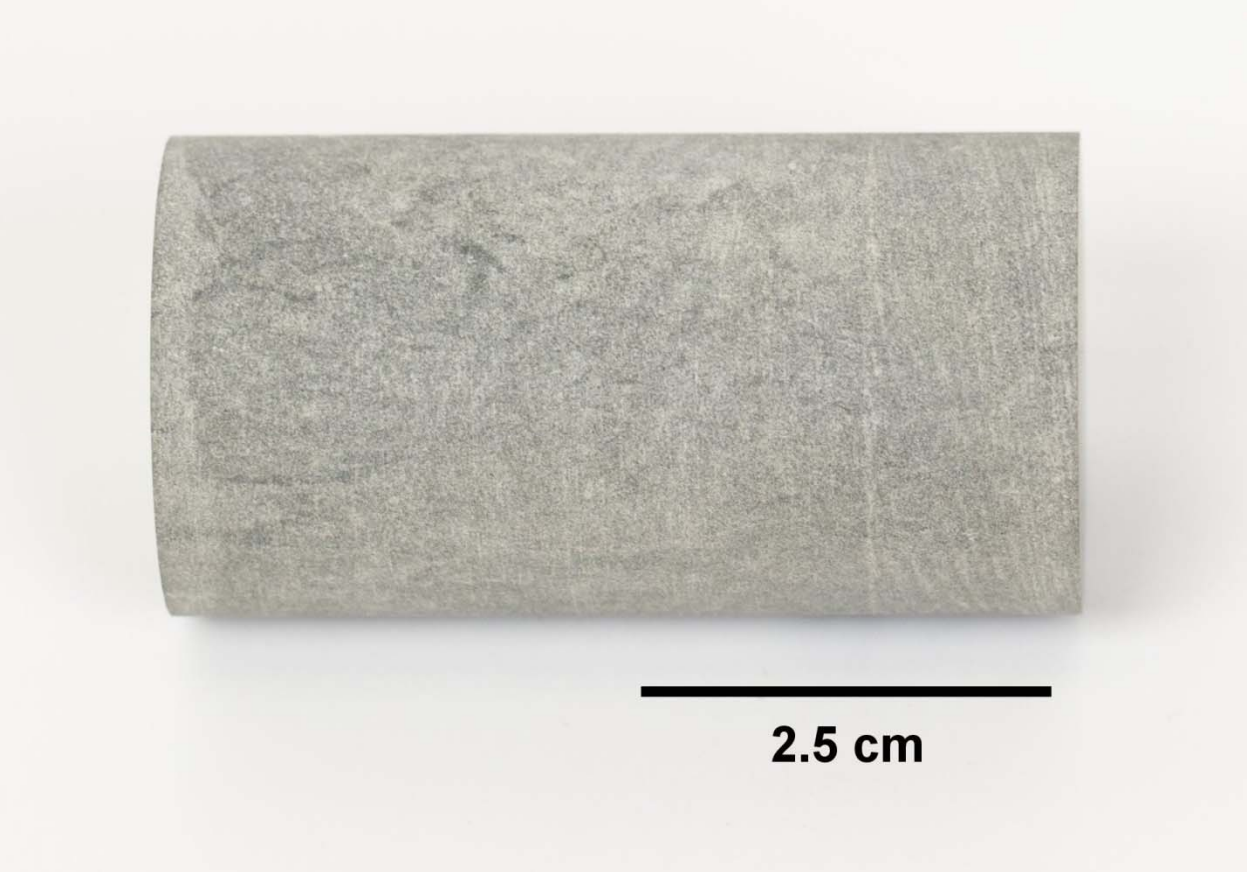
SAMPLE PHOTOGRAPH



PHYSICAL PROPERTIES

Porosity

Pycnometer Effective Porosity Average, vol%
5.86

Volume and Density

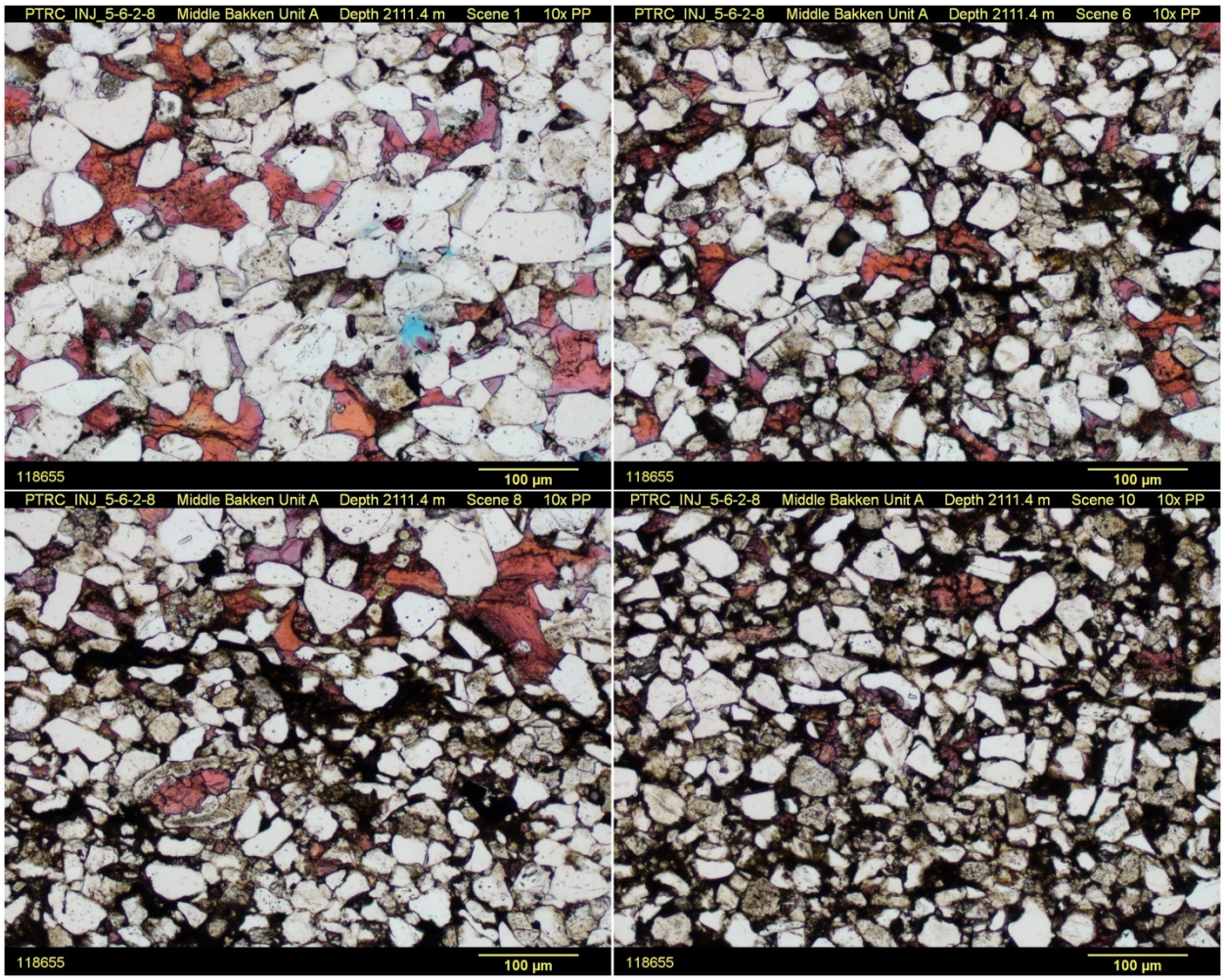
Bulk Volume, cm^3	Bulk Density, g/cm^3	Grain Volume, cm^3	Grain Density, g/cm^3
12.943	2.549	12.184	2.708

Permeability

Gas Permeability, mD
Pending

FULL THIN-SECTION SLIDE

PLANE POLAR PHOTOMICROGRAPHS



The lowest Middle Bakken Unit A sample analyzed is laminated, very fine sandstone to coarse siltstone. Quartz, feldspars, dolomite/Fe-dolomite, and clays are present. Quartz overgrowths and areas of calcite pore filling are common, but not in all layers. These are mostly associated with coarser grains where there is little clay and some porosity visible. Grains are subrounded and moderately sorted, ranging in size from 30 to 100 µm.

CORE LABORATORIES, INC., HPMI SUMMARY DATA

See Appendix B for full Core Labs report.

Core Labs Sample ID S9 #118655m

Depth 2111.40 m

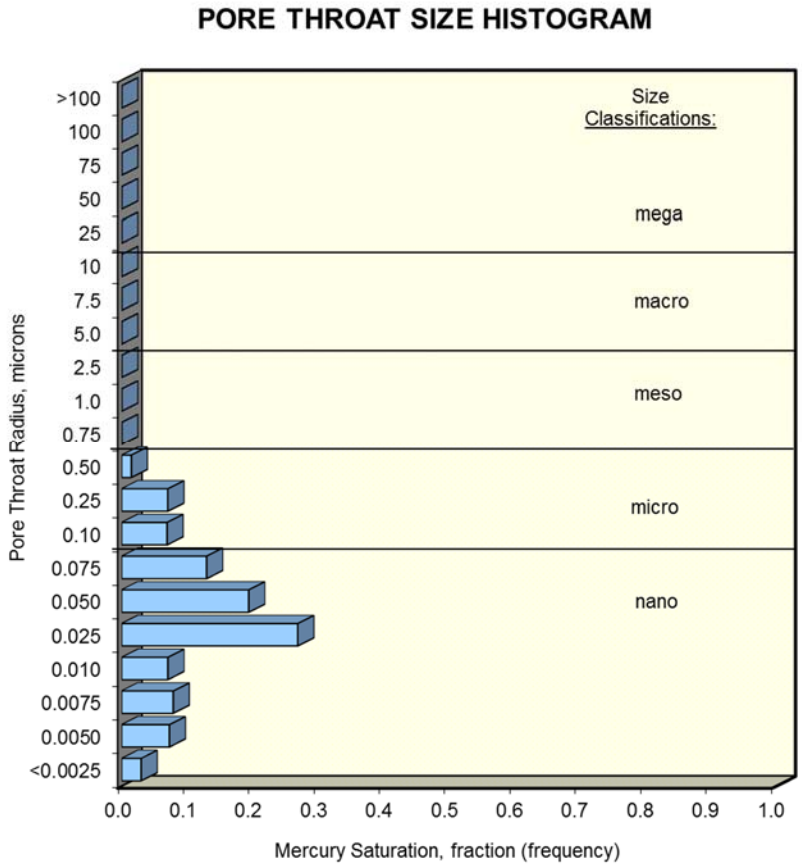
Mercury Injection Data Summary

Maximum S_b/P_c*, fraction	Pore Throat Radius at 35% Mercury Saturation (R35), µm	Median Pore Throat Radius, µm
0.00090	0.0394	0.0232

* Volume of mercury (S_b)-to-capillary pressure (P_c) ratio. The maximum S_b/P_c is used to represent the point on a capillary pressure curve where all of the major connected pore spaces controlling permeability have been intruded with mercury.

Sample Parameters

Weight, g	Pore Volume, cm^3	Grain Volume, cm^3	Bulk Volume, cm^3	Grain Density, g/cm^3	Bulk Density, g/cm^3
12.655	0.343	4.687	5.030	2.700	2.516



CORE LABORATORIES, INC., TOC AND ROCK-EVAL SUMMARY DATA

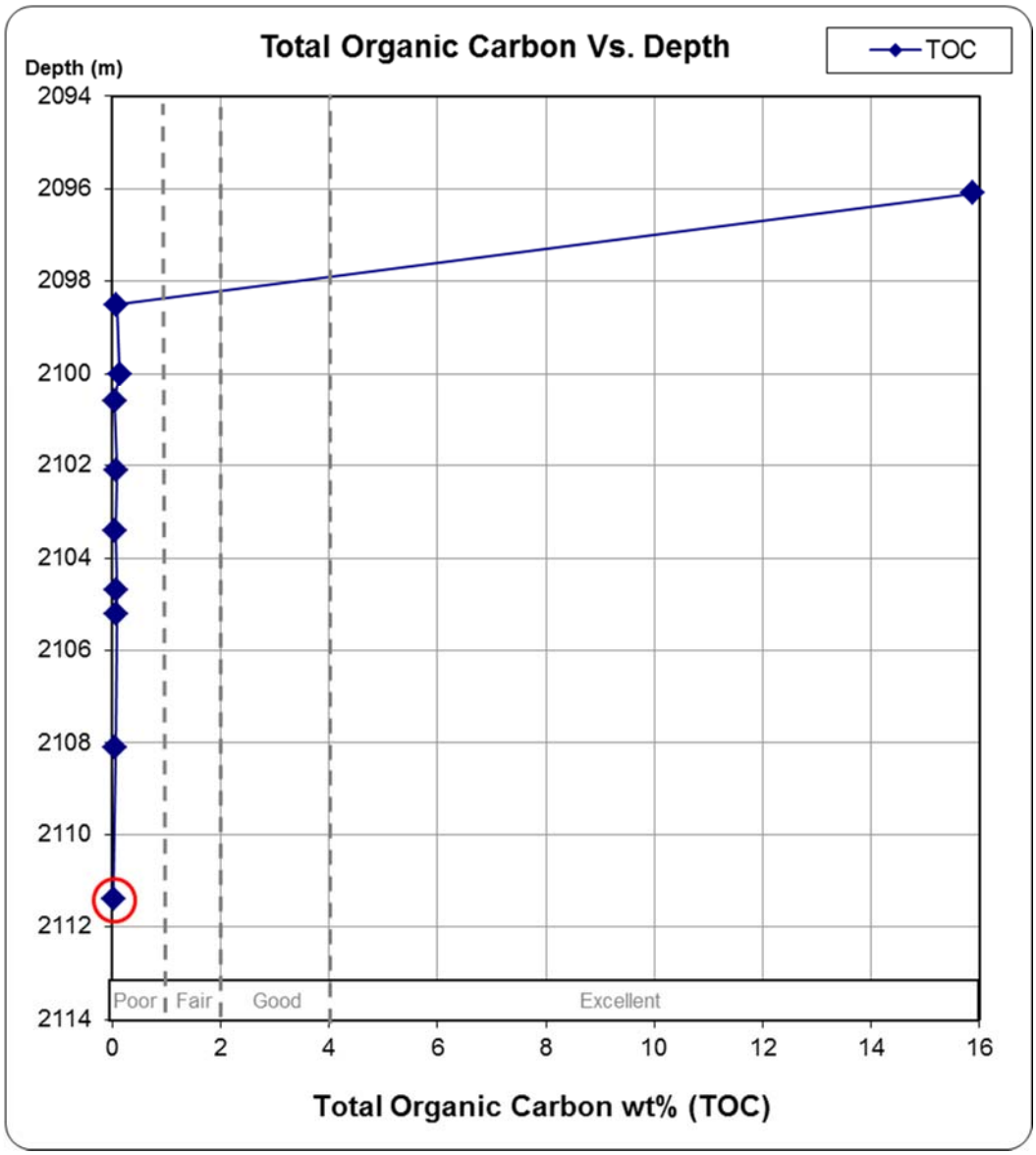
See Appendix C for full Core Labs report.

Core Labs Sample ID S9-118655

Depth 2111.4 m

TOC and ROCK-EVAL Data Summary

Sample Weight, mg	TOC, wt%	T_{max}, °C
60.7	0.02	440



APPENDIX B

CORE LABORATORIES
HIGH-PRESSURE MERCURY INJECTION
SUMMARY REPORT

ADVANCED CORE ANALYSIS STUDY

University of North Dakota
Aquistore

INTERIM DATA

Submitted to:

University of North Dakota

August 18, 2014

Performed by:

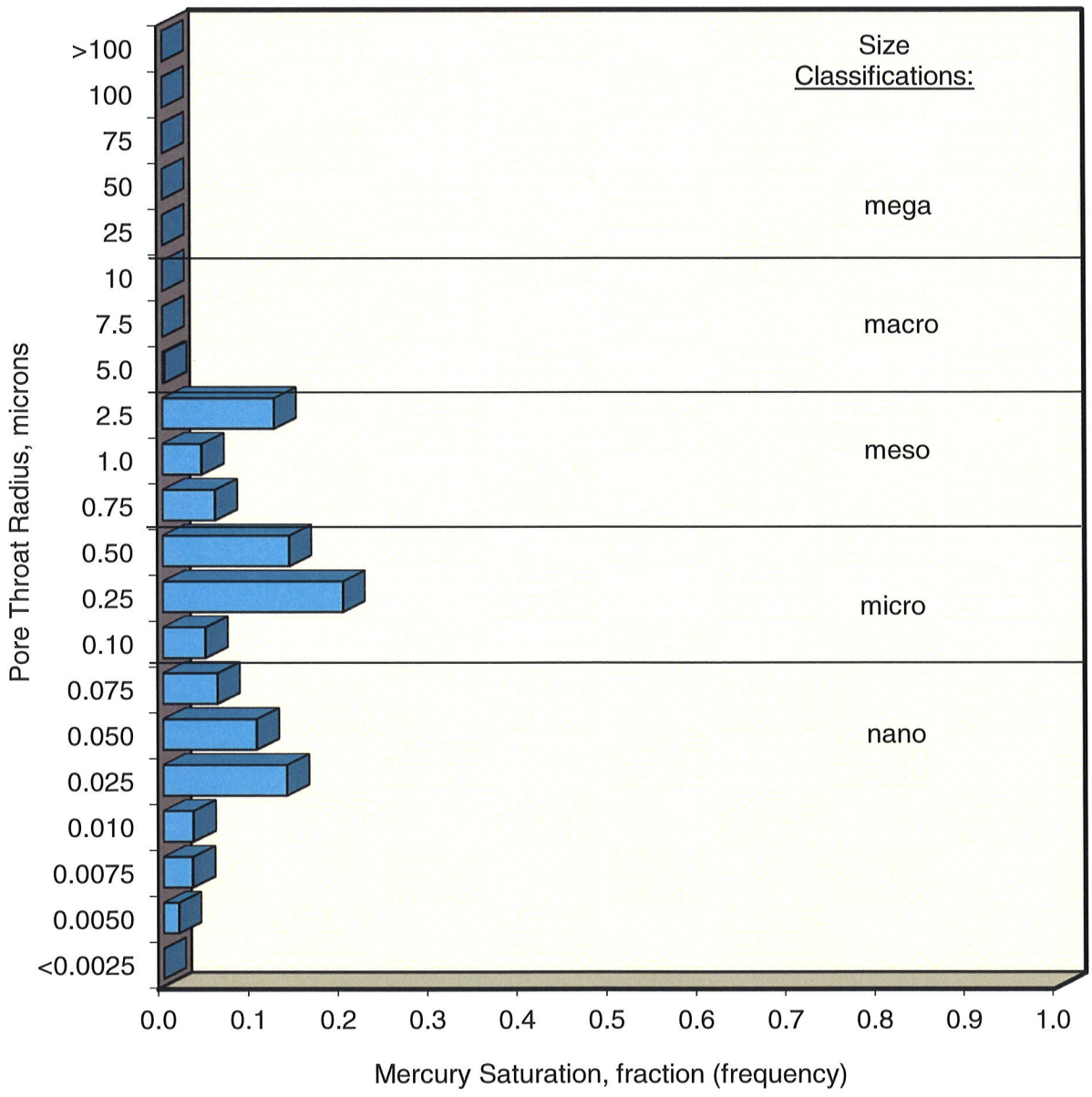
Core Laboratories
Petroleum Services Division
6316 Windfern
Houston, Texas 77040

HOU-140757

Company:	University of North Dakota
Well:	Aquistore
File:	HOU-140757

Sample:	S4 #118648-2m	un-	Host Plug	
Depth, meters:	2102.10	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.0790	-	-
Porosity, fraction:		0.055	-	-
maximum Sb/Pc, fraction:		0.00646		
R35, microns:		0.269		
R50 (median pore throat radius):		0.144		

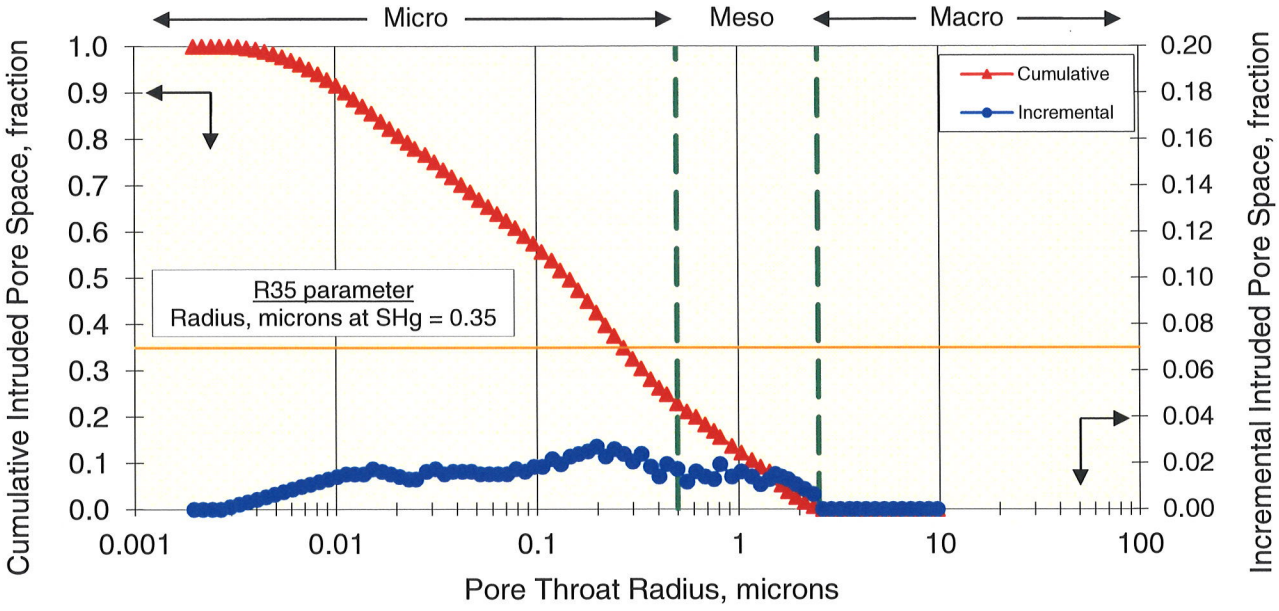
PORE THROAT SIZE HISTOGRAM



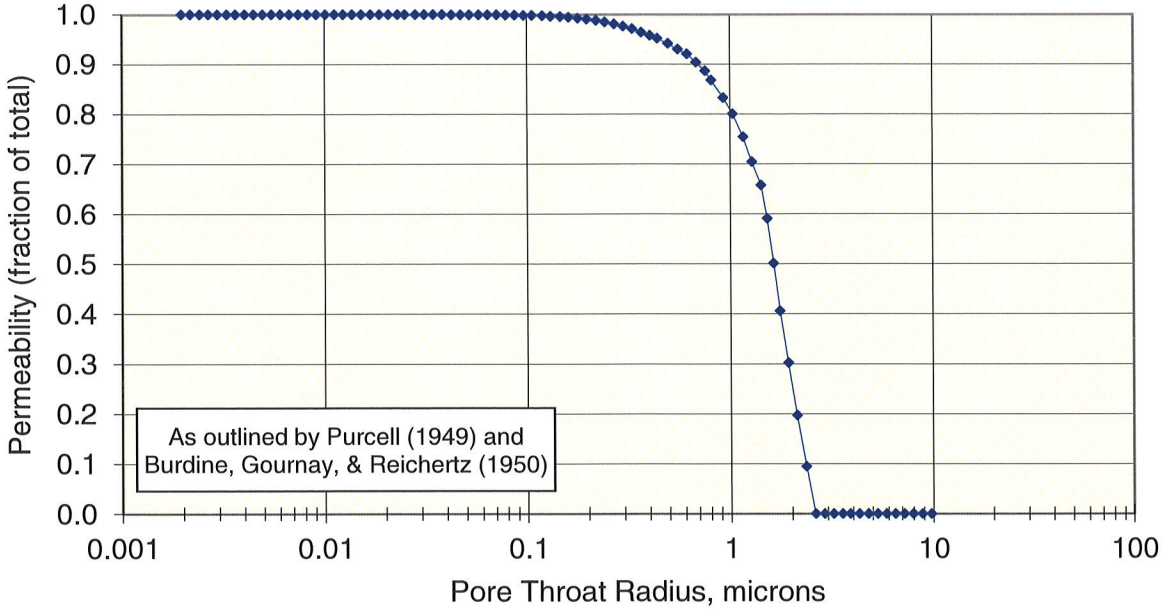
Company:	University of North Dakota
Well:	Aquistore
File:	HOU-140757

Sample: S4 #118648-2m	un-	Host Plug	
Depth, meters: 2102.10	stressed	n/a	n/a
Klinkenberg Permeability, md:	N/A	-	-
Permeability to Air, md:	N/A	-	-
Swanson Permeability, md:	0.0790	-	-
Porosity, fraction:	0.055	-	-
maximum Sb/Pc, fraction:	0.00646		
R35, microns:	0.269		
R50 (median pore throat radius):	0.144		

PORE THROAT RADIUS DISTRIBUTION



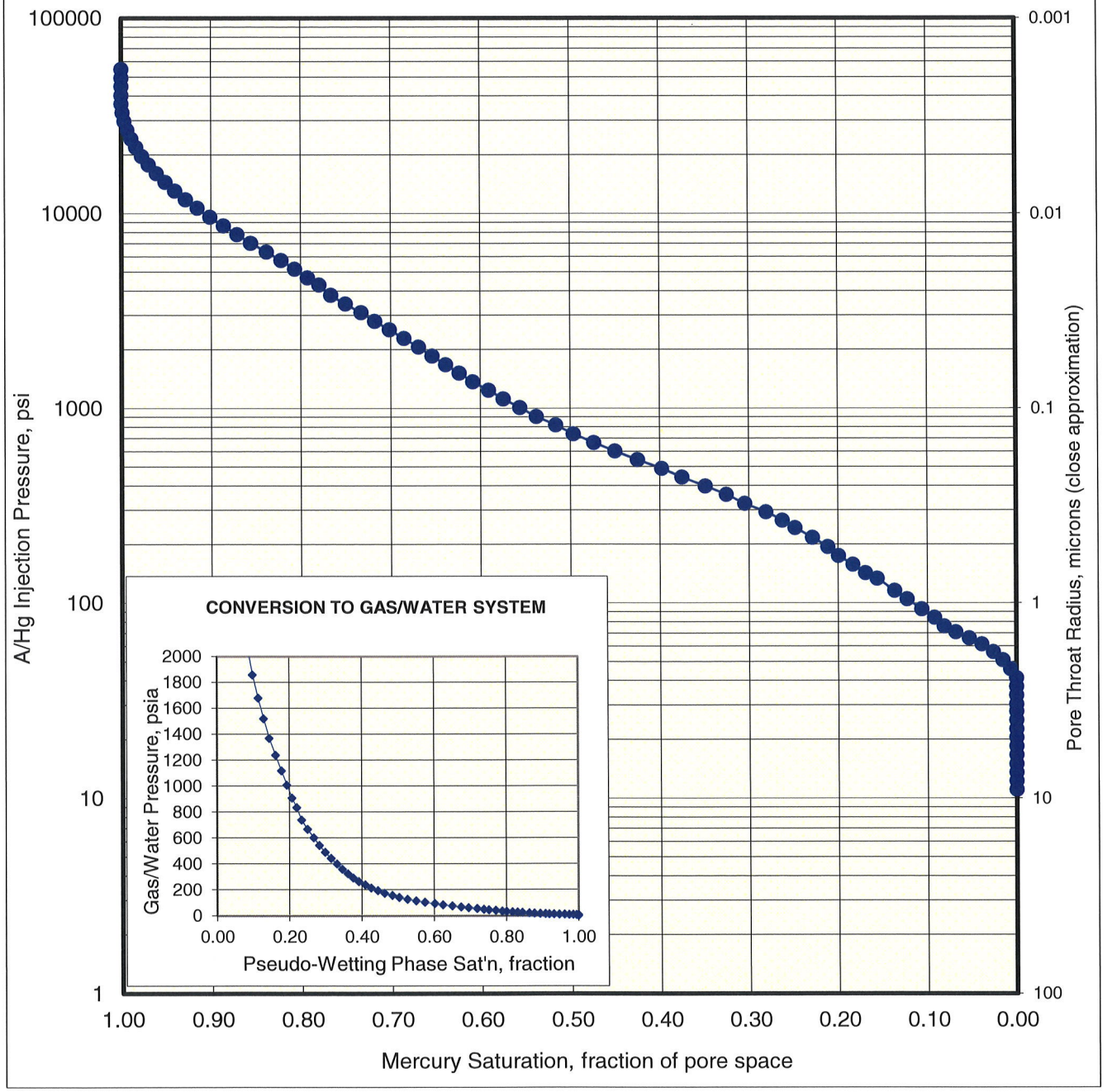
PERMEABILITY DISTRIBUTION



Company:	University of North Dakota
Well:	Aquistore
File:	HOU-140757

Sample: S4 #118648-2m	un-stressed	Host Plug	
Depth, meters: 2102.10		n/a	n/a
Klinkenberg Permeability, md:	N/A	-	-
Permeability to Air, md:	N/A	-	-
Swanson Permeability, md:	0.0790	-	-
Porosity, fraction:	0.055	-	-
maximum Sb/Pc, fraction:	0.00646		
R35, microns:	0.269		
R50 (median pore throat radius):	0.144		

MERCURY INJECTION



Core Laboratories

MERCURY INJECTION DATA SUMMARY

Company: University of North Dakota
Well: Aquistore
File: HOU-140757

Sample:	**S4 #118648-2m**	un-	Host Plug	
Depth, meters:	2102.10	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.0790	-	-
Porosity, fraction:		0.055	-	-
maximum Sb/Pc, fraction:		0.00646		
R35, microns:		0.269		
R50 (median pore throat radius):		0.144		

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
11.1	0.000	1.000	9.72	0.00777	2.15	0.716	1.24	4.49	8.92
12.3	0.000	1.000	8.79	0.00860	2.38	0.792	1.37	4.97	9.89
13.6	0.000	1.000	7.93	0.00952	2.63	0.877	1.52	5.50	10.9
15.0	0.000	1.000	7.16	0.0105	2.91	0.972	1.68	6.06	12.1
16.7	0.000	1.000	6.46	0.0117	3.23	1.08	1.87	6.75	13.4
18.5	0.000	1.000	5.84	0.0129	3.58	1.19	2.07	7.48	14.9
20.5	0.000	1.000	5.27	0.0143	3.96	1.32	2.29	8.28	16.5
22.7	0.000	1.000	4.74	0.0159	4.41	1.47	2.54	9.17	18.2
25.2	0.000	1.000	4.28	0.0177	4.88	1.63	2.82	10.2	20.3
27.9	0.000	1.000	3.86	0.0196	5.41	1.80	3.12	11.3	22.4
30.4	0.000	1.000	3.54	0.0213	5.89	1.96	3.40	12.3	24.4
33.8	0.000	1.000	3.19	0.0237	6.54	2.18	3.78	13.7	27.2
37.4	0.000	1.000	2.88	0.0262	7.25	2.42	4.19	15.1	30.1
41.4	0.000	1.000	2.60	0.0290	8.02	2.67	4.63	16.7	33.3
46.0	0.007	0.993	2.34	0.0322	8.91	2.97	5.14	18.6	37.0
51.1	0.015	0.985	2.11	0.0358	9.90	3.30	5.71	20.7	41.1
56.3	0.026	0.974	1.92	0.0394	10.9	3.63	6.29	22.8	45.3
61.7	0.039	0.961	1.75	0.0433	12.0	3.99	6.90	24.9	49.6
66.3	0.053	0.947	1.63	0.0465	12.8	4.28	7.42	26.8	53.3
71.1	0.068	0.932	1.52	0.0499	13.8	4.59	7.96	28.7	57.1
76.1	0.081	0.919	1.42	0.0534	14.7	4.92	8.51	30.8	61.2
84.4	0.092	0.908	1.28	0.0592	16.4	5.45	9.44	34.1	67.8
93.2	0.106	0.894	1.16	0.0653	18.1	6.02	10.4	37.7	74.9
105	0.123	0.877	1.03	0.0736	20.3	6.78	11.7	42.4	84.4
116	0.137	0.863	0.926	0.0816	22.6	7.52	13.0	46.9	93.2
134	0.156	0.844	0.807	0.0936	25.9	8.63	14.9	54.2	108
143	0.169	0.831	0.753	0.100	27.7	9.24	16.0	57.8	115
158	0.183	0.817	0.681	0.111	30.7	10.2	17.7	63.9	127
175	0.200	0.800	0.615	0.123	34.0	11.3	19.6	70.7	141
195	0.211	0.789	0.554	0.136	37.7	12.6	21.8	78.8	157
217	0.229	0.771	0.497	0.152	42.0	14.0	24.3	87.7	174
244	0.248	0.752	0.441	0.171	47.3	15.8	27.3	98.6	196
266	0.262	0.738	0.405	0.186	51.5	17.2	29.7	108	214
294	0.281	0.719	0.367	0.206	56.9	19.0	32.9	119	236

MERCURY INJECTION DATA SUMMARY

Company: University of North Dakota
Well: Aquistore
File: HOU-140757

Sample:	**S4 #118648-2m**	un-	Host Plug	
Depth, meters:	2102.10	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.0790	-	-
Porosity, fraction:		0.055	-	-
maximum Sb/Pc, fraction:		0.00646		
R35, microns:		0.269		
R50 (median pore throat radius):		0.144		

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
325	0.305	0.695	0.331	0.228	63.0	21.0	36.4	131	261
361	0.325	0.675	0.299	0.253	69.9	23.3	40.4	146	290
399	0.349	0.651	0.270	0.280	77.4	25.8	44.7	161	321
444	0.375	0.625	0.243	0.311	86.1	28.7	49.7	179	357
491	0.398	0.602	0.220	0.344	95.1	31.7	54.9	198	395
545	0.425	0.575	0.198	0.382	106	35.2	60.9	220	438
603	0.450	0.550	0.179	0.423	117	38.9	67.4	244	485
668	0.474	0.526	0.161	0.468	129	43.2	74.7	270	537
740	0.497	0.503	0.146	0.519	143	47.8	82.8	299	595
821	0.516	0.484	0.131	0.576	159	53.1	91.9	332	660
909	0.538	0.462	0.119	0.637	176	58.7	102	367	731
1010	0.556	0.444	0.106	0.710	196	65.4	113	408	812
1120	0.575	0.425	0.0965	0.783	216	72.1	125	453	900
1240	0.591	0.409	0.0871	0.867	240	79.9	138	501	997
1370	0.608	0.392	0.0786	0.961	266	88.6	153	554	1100
1520	0.624	0.376	0.0709	1.06	294	98.1	170	614	1220
1680	0.639	0.361	0.0640	1.18	326	109	188	679	1350
1860	0.654	0.346	0.0578	1.31	361	120	209	752	1500
2070	0.669	0.331	0.0521	1.45	401	134	231	837	1660
2290	0.685	0.315	0.0471	1.61	444	148	256	925	1840
2540	0.702	0.298	0.0425	1.78	492	164	284	1030	2040
2810	0.718	0.282	0.0383	1.97	545	182	314	1140	2260
3110	0.733	0.267	0.0346	2.18	603	201	348	1260	2500
3450	0.751	0.249	0.0312	2.42	669	223	386	1390	2770
3820	0.767	0.233	0.0282	2.68	741	247	428	1540	3070
4320	0.780	0.220	0.0250	3.03	837	279	483	1750	3470
4690	0.793	0.207	0.0230	3.29	909	303	525	1900	3770
5200	0.807	0.193	0.0207	3.65	1010	336	582	2100	4180
5760	0.822	0.178	0.0187	4.04	1120	372	645	2330	4630
6380	0.838	0.162	0.0169	4.48	1240	412	714	2580	5130
7070	0.856	0.144	0.0152	4.96	1370	457	791	2860	5680
7840	0.871	0.129	0.0137	5.50	1520	506	877	3170	6300
8680	0.886	0.114	0.0124	6.09	1680	561	972	3510	6980
9620	0.901	0.099	0.0112	6.75	1860	621	1080	3890	7730

MERCURY INJECTION DATA SUMMARY

Company: University of North Dakota
Well: Aquistore
File: HOU-140757

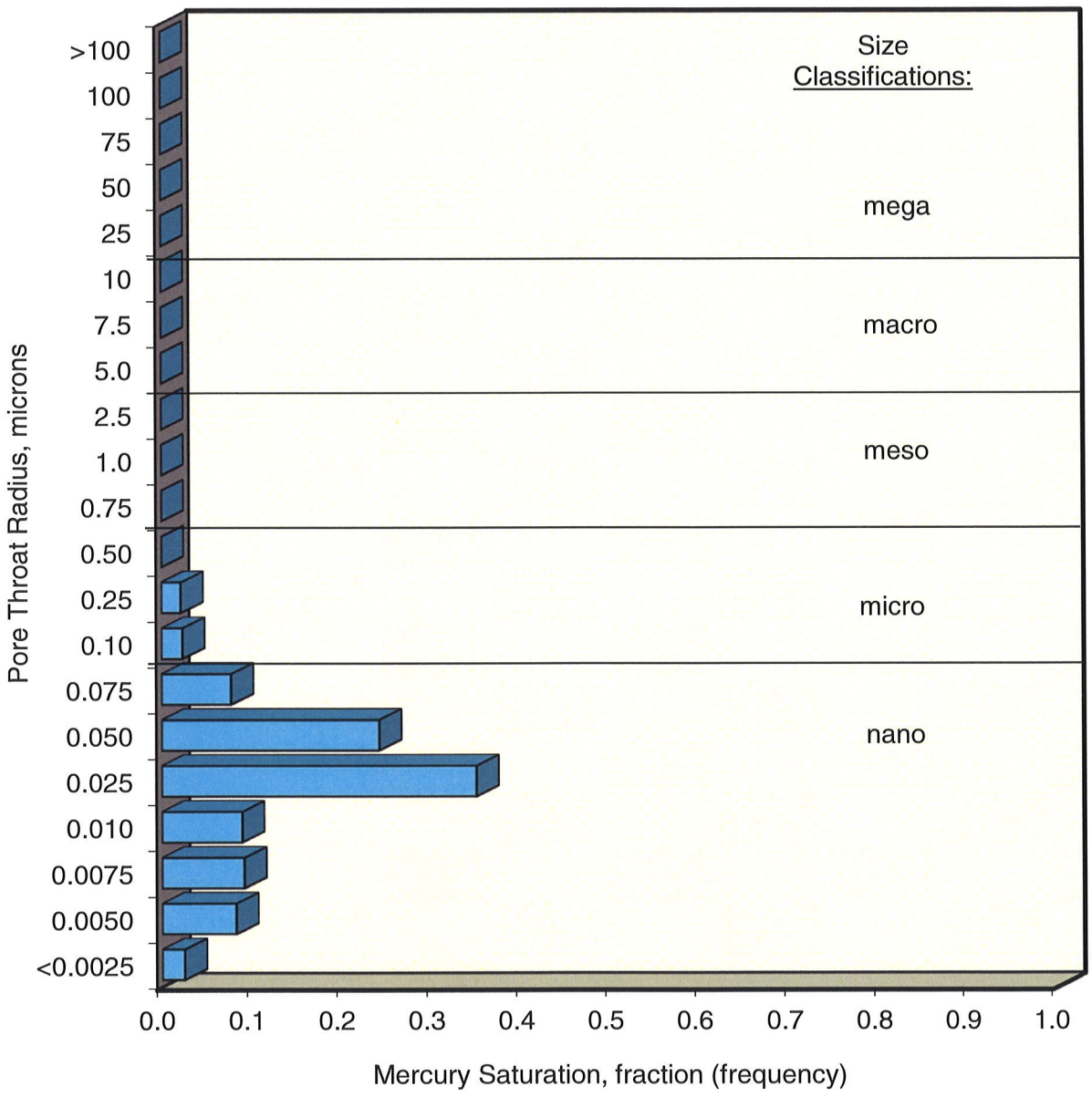
Sample:	**S4 #118648-2m**	un-	Host Plug	
Depth, meters:	2102.10	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.0790	-	-
Porosity, fraction:		0.055	-	-
maximum Sb/Pc, fraction:		0.00646		
R35, microns:		0.269		
R50 (median pore throat radius):		0.144		

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
10700	0.915	0.085	0.0101	7.47	2070	689	1190	4320	8600
11800	0.928	0.072	0.00912	8.28	2290	763	1320	4770	9480
13100	0.940	0.060	0.00823	9.18	2540	845	1460	5290	10500
14500	0.951	0.049	0.00743	10.2	2810	937	1620	5860	11700
16100	0.961	0.039	0.00671	11.3	3110	1040	1800	6510	12900
17800	0.970	0.030	0.00605	12.5	3450	1150	1990	7190	14300
19700	0.977	0.023	0.00546	13.8	3820	1270	2210	7960	15800
21900	0.984	0.016	0.00493	15.3	4240	1410	2450	8850	17600
24200	0.989	0.011	0.00445	17.0	4690	1560	2710	9780	19500
26800	0.993	0.007	0.00402	18.8	5200	1730	3000	10800	21500
29700	0.997	0.003	0.00362	20.8	5760	1920	3330	12000	23900
32900	0.999	0.001	0.00327	23.1	6380	2130	3680	13300	26400
36500	1.000	0.000	0.00295	25.6	7070	2360	4080	14800	29300
40400	1.000	0.000	0.00266	28.3	7840	2610	4520	16300	32500
44800	1.000	0.000	0.00241	31.4	8680	2890	5010	18100	36000
49600	1.000	0.000	0.00217	34.8	9620	3210	5550	20000	39900
55000	1.000	0.000	0.00196	38.6	10700	3550	6150	22200	44200

Company:	University of North Dakota
Well:	Aquistore
File:	HOU-140757

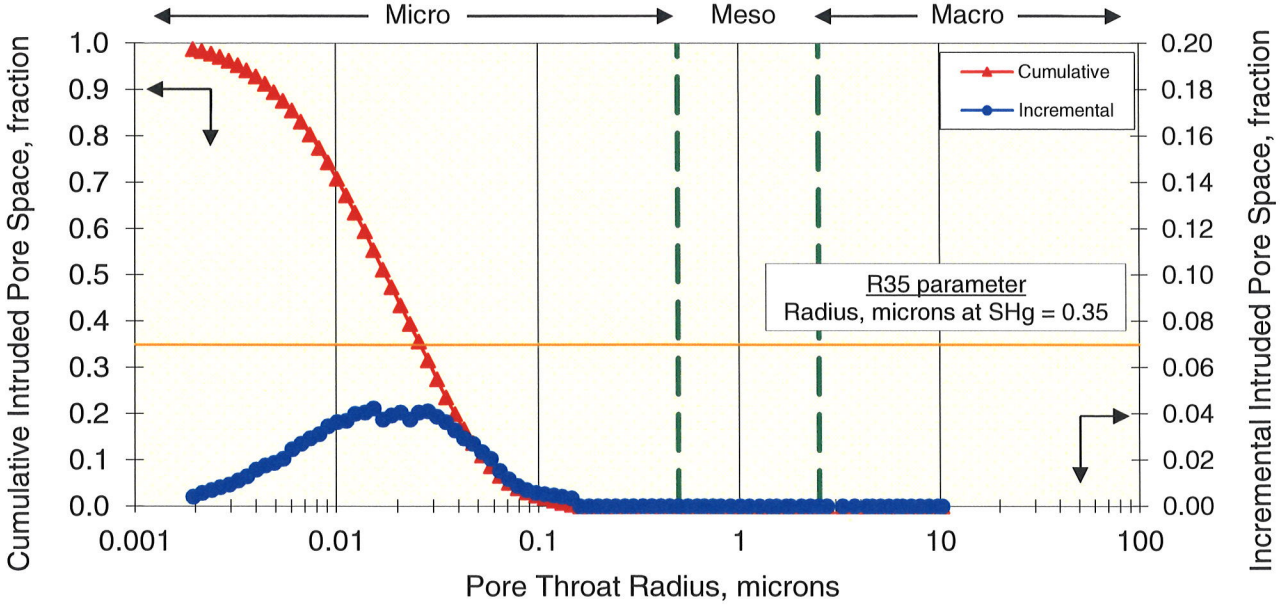
Sample:	S3 #118647-2	un-	Host Plug	
Depth, meters:	2100.60	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.000899	-	-
Porosity, fraction:		0.054	-	-
maximum Sb/Pc, fraction:		0.00046		
R35, microns:		0.0259		
R50 (median pore throat radius):		0.0175		

PORE THROAT SIZE HISTOGRAM

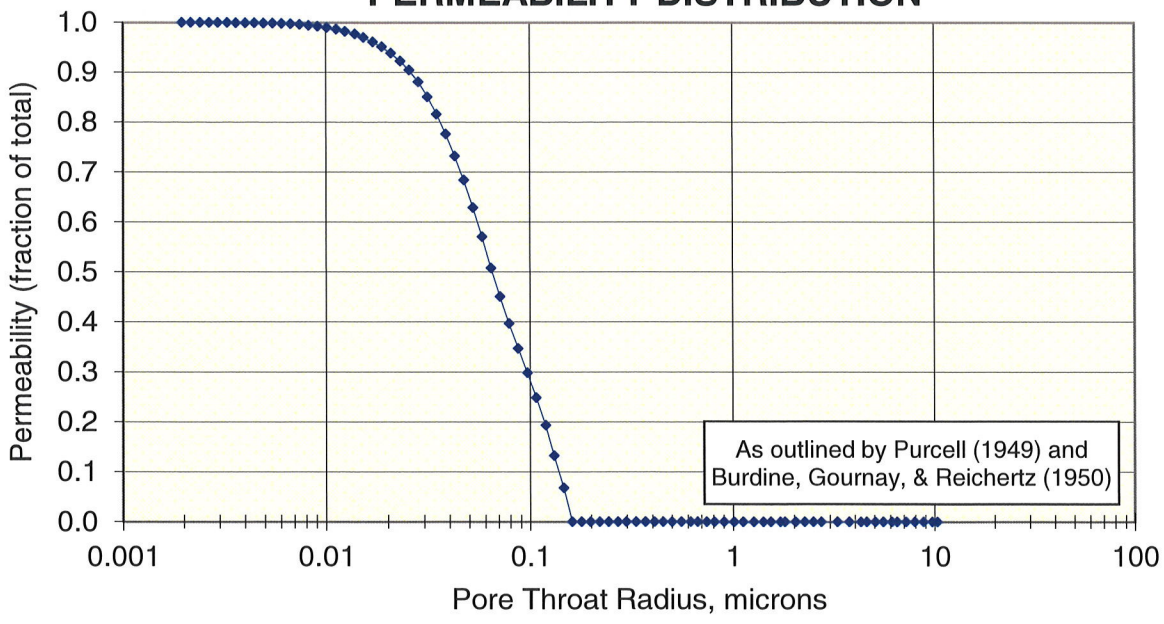


Company:	University of North Dakota	**Sample:**	**S3 #118647-2**	un-	Host Plug
Well:	Aquistore	Depth, meters:	2100.60	stressed	n/a n/a
File:	HOU-140757	Klinkenberg Permeability, md:		N/A	- -
		Permeability to Air, md:		N/A	- -
		Swanson Permeability, md:		0.000899	- -
		Porosity, fraction:		0.054	- -
		maximum Sb/Pc, fraction:		0.00046	
		R35, microns:		0.0259	
		R50 (median pore throat radius):		0.0175	

PORE THROAT RADIUS DISTRIBUTION



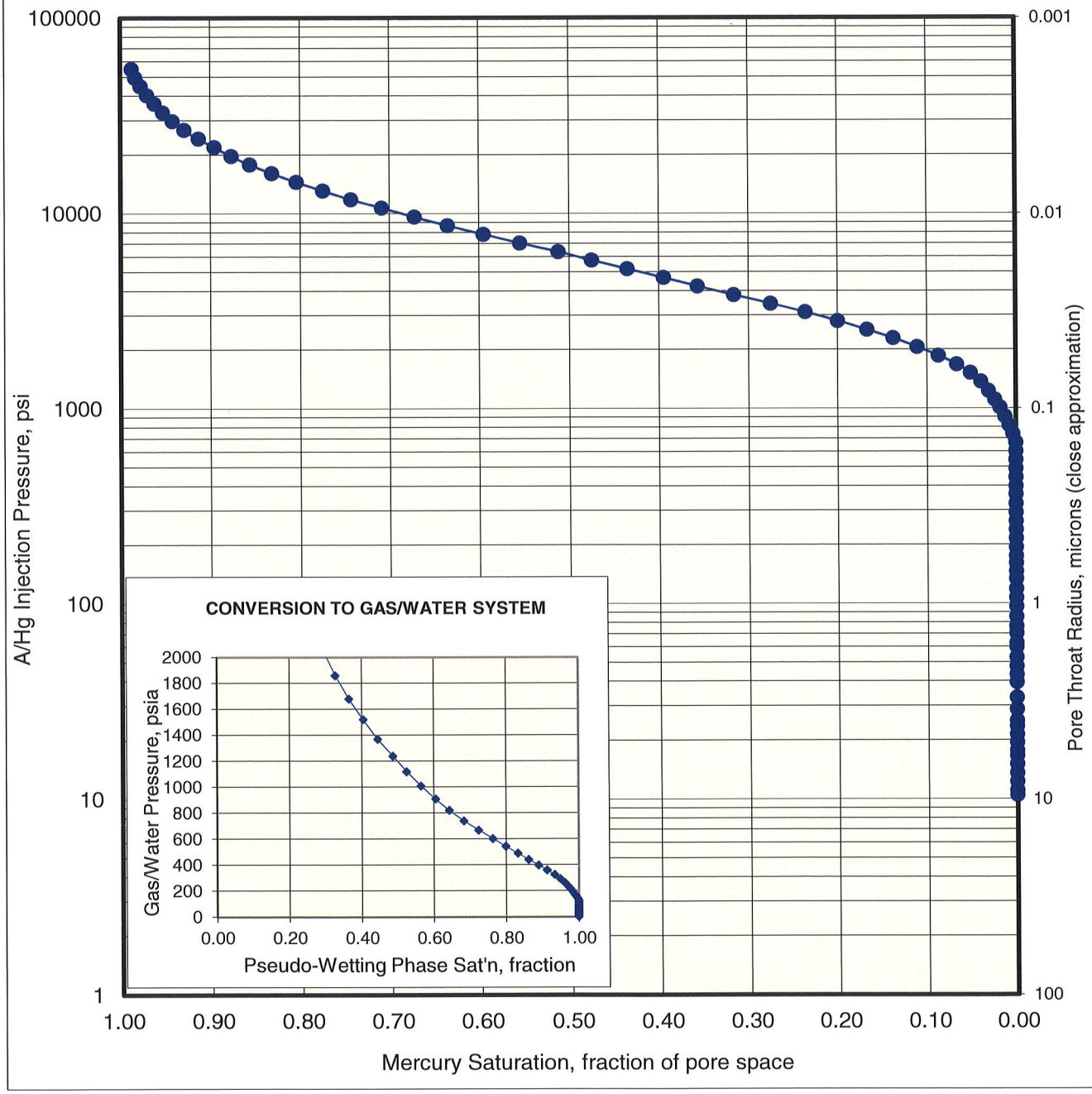
PERMEABILITY DISTRIBUTION



Company:	University of North Dakota
Well:	Aquistore
File:	HOU-140757

Sample:	**S3 #118647-2**	un-	Host Plug	
Depth, meters:	2100.60	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.000899	-	-
Porosity, fraction:		0.054	-	-
maximum Sb/Pc, fraction:		0.00046		
R35, microns:		0.0259		
R50 (median pore throat radius):		0.0175		

MERCURY INJECTION



Core Laboratories

MERCURY INJECTION DATA SUMMARY

Company: University of North Dakota
Well: Aquistore
File: HOU-140757

Sample:	**S3 #118647-2**	un-	Host Plug	
Depth, meters:	2100.60	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.000899	-	-
Porosity, fraction:		0.054	-	-
maximum Sb/Pc, fraction:		0.00046		
R35, microns:		0.0259		
R50 (median pore throat radius):		0.0175		

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
10.5	0.000	1.000	10.3	0.000788	2.03	0.678	1.17	4.24	8.44
11.1	0.000	1.000	9.74	0.000830	2.14	0.714	1.24	4.49	8.92
12.3	0.000	1.000	8.79	0.000920	2.38	0.792	1.37	4.97	9.89
13.6	0.000	1.000	7.93	0.00102	2.63	0.878	1.52	5.50	10.9
15.1	0.000	1.000	7.16	0.00113	2.92	0.972	1.68	6.10	12.1
16.7	0.000	1.000	6.47	0.00125	3.23	1.08	1.86	6.75	13.4
17.7	0.000	1.000	6.09	0.00133	3.43	1.14	1.98	7.15	14.2
19.5	0.000	1.000	5.53	0.00146	3.78	1.26	2.18	7.88	15.7
21.4	0.000	1.000	5.03	0.00161	4.15	1.38	2.39	8.65	17.2
23.6	0.000	1.000	4.57	0.00177	4.57	1.52	2.64	9.54	19.0
25.2	0.000	1.000	4.28	0.00189	4.88	1.63	2.82	10.2	20.3
28.8	0.000	1.000	3.74	0.00216	5.58	1.86	3.22	11.6	23.1
33.1	0.000	1.000	3.26	0.00248	6.41	2.14	3.70	13.4	26.6
39.6	0.000	1.000	2.72	0.00297	7.66	2.55	4.43	16.0	31.8
43.4	0.000	1.000	2.48	0.00326	8.41	2.80	4.86	17.5	34.9
47.8	0.000	1.000	2.25	0.00359	9.26	3.09	5.35	19.3	38.4
53.1	0.000	1.000	2.03	0.00398	10.3	3.43	5.94	21.5	42.7
59.9	0.000	1.000	1.80	0.00449	11.6	3.87	6.70	24.2	48.1
62.9	0.000	1.000	1.71	0.00472	12.2	4.06	7.04	25.4	50.6
70.6	0.000	1.000	1.53	0.00529	13.7	4.56	7.89	28.5	56.7
76.5	0.000	1.000	1.41	0.00574	14.8	4.94	8.56	30.9	61.5
85.4	0.000	1.000	1.26	0.00640	16.5	5.51	9.55	34.5	68.6
96.5	0.000	1.000	1.12	0.00723	18.7	6.23	10.8	39.0	77.6
107	0.000	1.000	1.01	0.00802	20.7	6.91	12.0	43.2	86.0
119	0.000	1.000	0.903	0.00895	23.1	7.71	13.4	48.1	95.6
134	0.000	1.000	0.807	0.0100	25.9	8.63	14.9	54.2	108
146	0.000	1.000	0.740	0.0109	28.2	9.41	16.3	59.0	117
161	0.000	1.000	0.668	0.0121	31.2	10.4	18.0	65.1	129
175	0.000	1.000	0.616	0.0131	33.9	11.3	19.6	70.7	141
194	0.000	1.000	0.555	0.0146	37.6	12.5	21.7	78.4	156
216	0.000	1.000	0.499	0.0162	41.8	13.9	24.1	87.3	174
239	0.000	1.000	0.450	0.0179	46.4	15.5	26.8	96.6	192
264	0.000	1.000	0.408	0.0198	51.2	17.1	29.6	107	212
293	0.000	1.000	0.368	0.0220	56.7	18.9	32.8	118	236

MERCURY INJECTION DATA SUMMARY

Company: University of North Dakota
Well: Aquistore
File: HOU-140757

Sample:	**S3 #118647-2**	un-	Host Plug	
Depth, meters:	2100.60	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.000899	-	-
Porosity, fraction:		0.054	-	-
maximum Sb/Pc, fraction:		0.00046		
R35, microns:		0.0259		
R50 (median pore throat radius):		0.0175		

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
325	0.000	1.000	0.332	0.0244	63.0	21.0	36.4	131	261
363	0.000	1.000	0.297	0.0272	70.4	23.5	40.6	147	292
399	0.000	1.000	0.270	0.0300	77.4	25.8	44.7	161	321
443	0.000	1.000	0.243	0.0332	85.8	28.6	49.5	179	356
491	0.000	1.000	0.219	0.0369	95.2	31.7	55.0	198	395
544	0.000	1.000	0.198	0.0408	106	35.2	60.9	220	437
603	0.000	1.000	0.179	0.0452	117	39.0	67.5	244	485
667	0.000	1.000	0.161	0.0501	129	43.1	74.7	270	536
739	0.004	0.996	0.146	0.0554	143	47.7	82.7	299	594
819	0.008	0.992	0.131	0.0615	159	52.9	91.7	331	658
908	0.012	0.988	0.119	0.0681	176	58.7	102	367	730
1010	0.018	0.982	0.107	0.0756	195	65.1	113	408	812
1110	0.024	0.976	0.0967	0.0835	216	71.9	125	449	892
1230	0.031	0.969	0.0872	0.0926	239	79.8	138	497	989
1370	0.039	0.961	0.0786	0.103	266	88.5	153	554	1100
1520	0.051	0.949	0.0709	0.114	294	98.1	170	614	1220
1680	0.066	0.934	0.0640	0.126	326	109	188	679	1350
1860	0.087	0.913	0.0578	0.140	361	120	208	752	1500
2060	0.111	0.889	0.0522	0.155	400	133	231	833	1660
2290	0.138	0.862	0.0471	0.172	443	148	256	925	1840
2530	0.167	0.833	0.0425	0.190	491	164	283	1020	2030
2810	0.200	0.800	0.0384	0.211	544	181	314	1140	2260
3120	0.236	0.764	0.0346	0.234	604	201	349	1260	2510
3450	0.275	0.725	0.0312	0.259	669	223	386	1390	2770
3820	0.316	0.684	0.0282	0.287	741	247	428	1540	3070
4240	0.357	0.643	0.0254	0.318	821	274	474	1710	3410
4690	0.395	0.605	0.0230	0.352	909	303	525	1900	3770
5200	0.435	0.565	0.0207	0.390	1010	336	582	2100	4180
5760	0.475	0.525	0.0187	0.432	1120	372	644	2330	4630
6380	0.512	0.488	0.0169	0.479	1240	412	714	2580	5130
7070	0.555	0.445	0.0152	0.530	1370	457	791	2860	5680
7840	0.595	0.405	0.0138	0.588	1520	506	877	3170	6300
8680	0.635	0.365	0.0124	0.651	1680	561	972	3510	6980
9620	0.672	0.328	0.0112	0.722	1860	622	1080	3890	7730

MERCURY INJECTION DATA SUMMARY

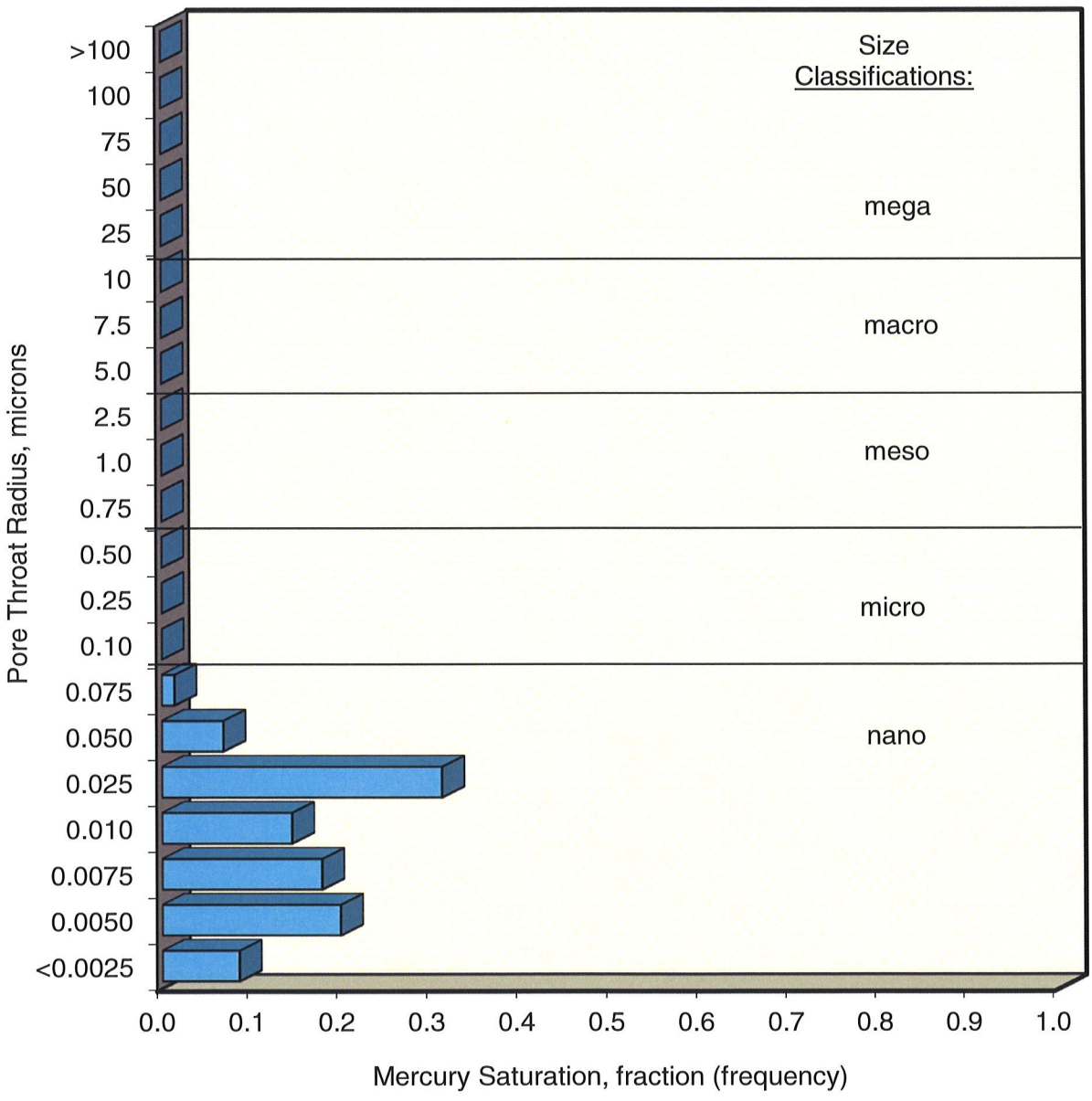
Company: University of North Dakota
Well: Aquistore
File: HOU-140757

Sample:	**S3 #118647-2**	un-	Host Plug	
Depth, meters:	2100.60	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.000899	-	-
Porosity, fraction:		0.054	-	-
maximum Sb/Pc, fraction:		0.00046		
R35, microns:		0.0259		
R50 (median pore throat radius):		0.0175		

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
10700	0.709	0.291	0.0101	0.800	2070	689	1190	4320	8600
11800	0.744	0.256	0.00912	0.886	2290	763	1320	4770	9480
13100	0.775	0.225	0.00823	0.982	2540	845	1460	5290	10500
14500	0.804	0.196	0.00743	1.09	2810	937	1620	5860	11700
16100	0.831	0.169	0.00671	1.21	3110	1040	1800	6510	12900
17800	0.856	0.144	0.00605	1.34	3450	1150	1990	7190	14300
19700	0.876	0.124	0.00546	1.48	3820	1270	2210	7960	15800
21900	0.895	0.105	0.00493	1.64	4240	1410	2450	8850	17600
24200	0.913	0.087	0.00445	1.82	4690	1560	2710	9780	19500
26800	0.929	0.071	0.00402	2.01	5200	1730	3000	10800	21500
29700	0.942	0.058	0.00362	2.23	5760	1920	3330	12000	23900
32900	0.953	0.047	0.00327	2.47	6380	2130	3680	13300	26400
36500	0.962	0.038	0.00295	2.74	7070	2360	4080	14800	29300
40400	0.971	0.029	0.00267	3.03	7830	2610	4520	16300	32500
44800	0.978	0.022	0.00241	3.36	8680	2890	5010	18100	36000
49600	0.984	0.016	0.00217	3.72	9620	3210	5550	20000	39900
55000	0.988	0.012	0.00196	4.12	10700	3550	6150	22200	44200

Company:	University of North Dakota	**Sample:**	**S2 #118646-2m**	un-	Host Plug
Well:	Aquistore	Depth, meters:	2100.00	stressed	n/a n/a
File:	HOU-140757	Klinkenberg Permeability, md:		N/A	- -
		Permeability to Air, md:		N/A	- -
		Swanson Permeability, md:		0.000263	- -
		Porosity, fraction:		0.059	- -
		maximum Sb/Pc, fraction:		0.00022	
		R35, microns:		0.0109	
		R50 (median pore throat radius):		0.00809	

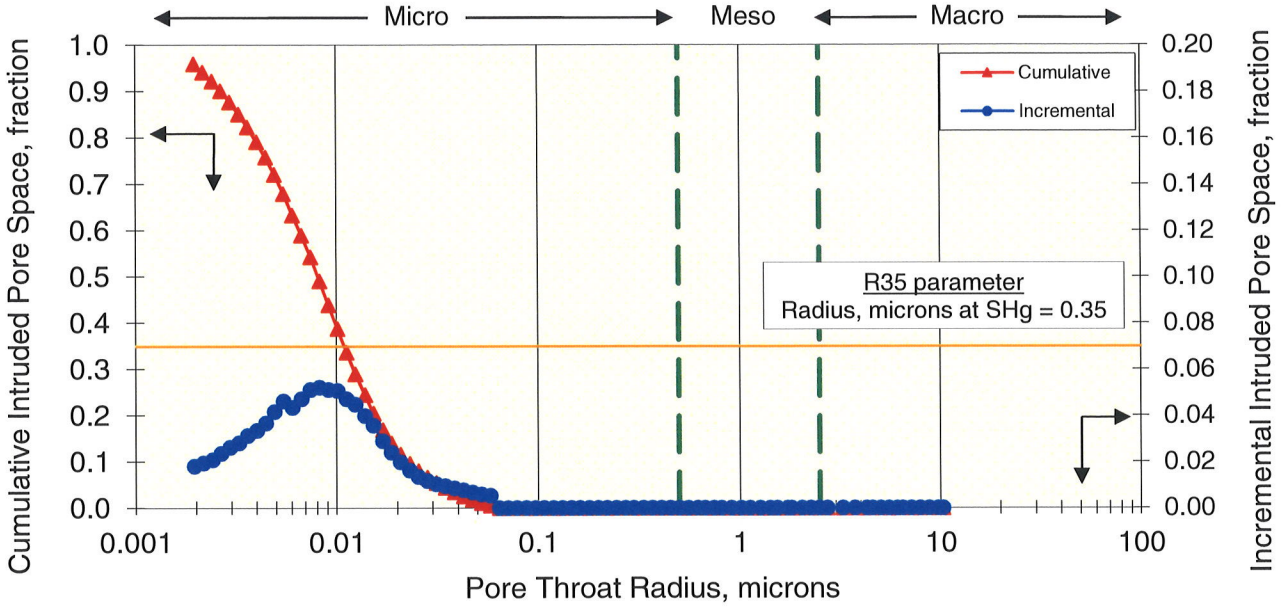
PORE THROAT SIZE HISTOGRAM



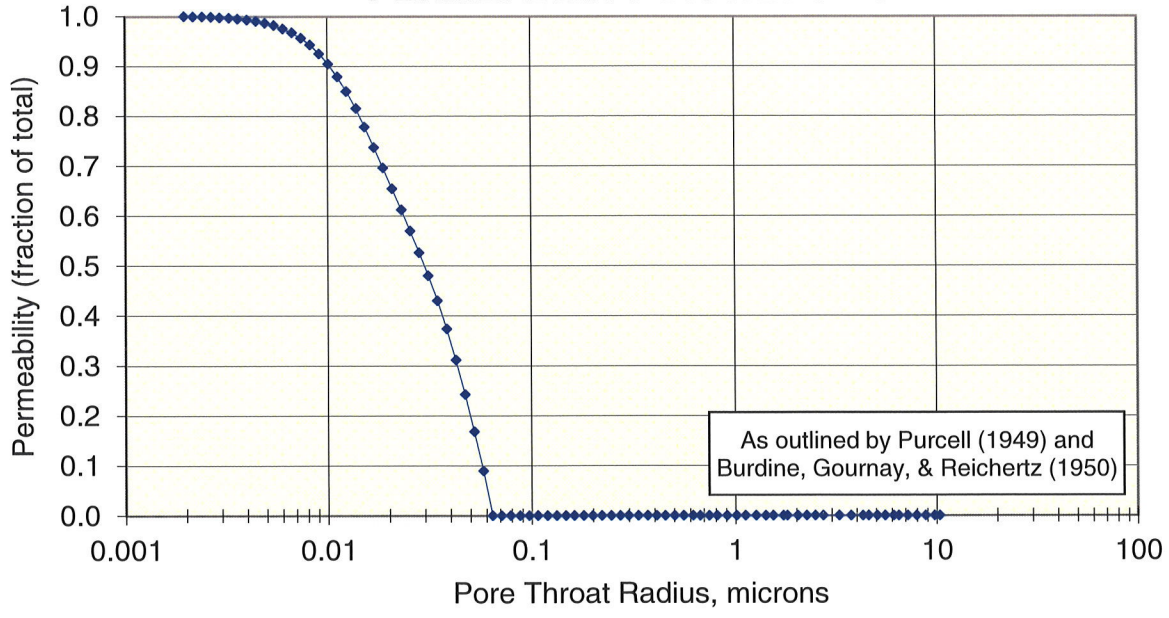
Company:	University of North Dakota
Well:	Aquistore
File:	HOU-140757

Sample:	S2 #118646-2m	un-	Host Plug	
Depth, meters:	2100.00	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.000263	-	-
Porosity, fraction:		0.059	-	-
maximum Sb/Pc, fraction:		0.00022		
R35, microns:		0.0109		
R50 (median pore throat radius):		0.00809		

PORE THROAT RADIUS DISTRIBUTION



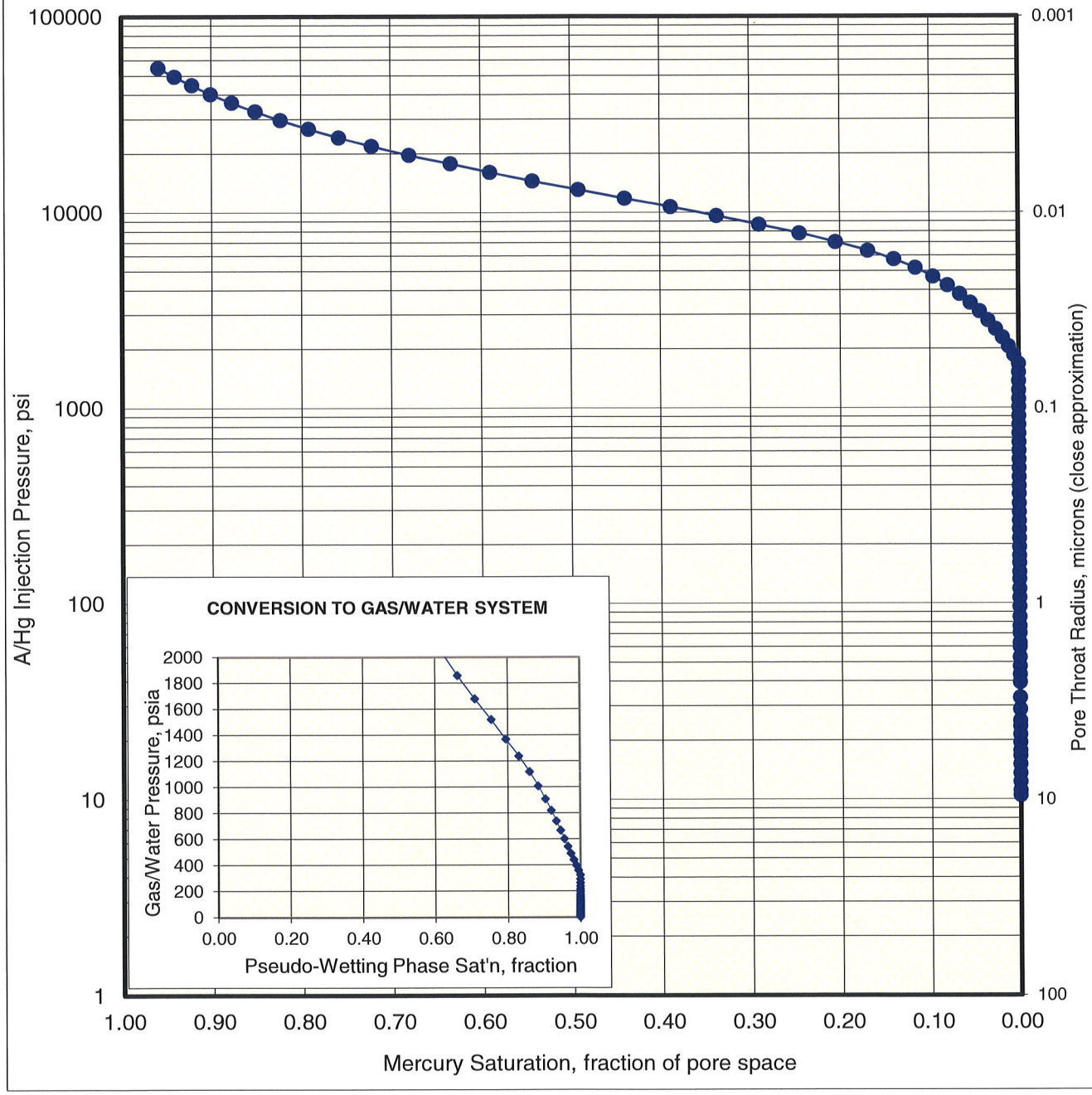
PERMEABILITY DISTRIBUTION



Company:	University of North Dakota
Well:	Aquistore
File:	HOU-140757

Sample:	S2 #118646-2m	un-stressed	Host Plug	
Depth, meters:	2100.00		n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.000263	-	-
Porosity, fraction:		0.059	-	-
maximum Sb/Pc, fraction:		0.00022		
R35, microns:		0.0109		
R50 (median pore throat radius):		0.00809		

MERCURY INJECTION



Core Laboratories

MERCURY INJECTION DATA SUMMARY

Company: University of North Dakota
Well: Aquistore
File: HOU-140757

Sample:	**S2 #118646-2m**	un-	Host Plug	
Depth, meters:	2100.00	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.000263	-	-
Porosity, fraction:		0.059	-	-
maximum Sb/Pc, fraction:		0.00022		
R35, microns:		0.0109		
R50 (median pore throat radius):		0.00809		

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
10.5	0.000	1.000	10.3	0.000409	2.03	0.678	1.17	4.24	8.44
11.1	0.000	1.000	9.74	0.000431	2.14	0.714	1.24	4.49	8.92
12.3	0.000	1.000	8.79	0.000477	2.38	0.792	1.37	4.97	9.89
13.6	0.000	1.000	7.93	0.000529	2.63	0.878	1.52	5.50	10.9
15.1	0.000	1.000	7.16	0.000586	2.92	0.972	1.68	6.10	12.1
16.7	0.000	1.000	6.47	0.000649	3.23	1.08	1.86	6.75	13.4
17.7	0.000	1.000	6.09	0.000689	3.43	1.14	1.98	7.15	14.2
19.5	0.000	1.000	5.53	0.000759	3.78	1.26	2.18	7.88	15.7
21.4	0.000	1.000	5.03	0.000833	4.15	1.38	2.39	8.65	17.2
23.6	0.000	1.000	4.57	0.000919	4.57	1.52	2.64	9.54	19.0
25.2	0.000	1.000	4.28	0.000981	4.88	1.63	2.82	10.2	20.3
28.8	0.000	1.000	3.74	0.00112	5.58	1.86	3.22	11.6	23.1
33.1	0.000	1.000	3.26	0.00129	6.41	2.14	3.70	13.4	26.6
39.6	0.000	1.000	2.72	0.00154	7.66	2.55	4.43	16.0	31.8
43.4	0.000	1.000	2.48	0.00169	8.41	2.80	4.86	17.5	34.9
47.8	0.000	1.000	2.25	0.00186	9.26	3.09	5.35	19.3	38.4
53.1	0.000	1.000	2.03	0.00207	10.3	3.43	5.94	21.5	42.7
59.9	0.000	1.000	1.80	0.00233	11.6	3.87	6.70	24.2	48.1
62.8	0.000	1.000	1.72	0.00245	12.2	4.06	7.03	25.4	50.5
70.4	0.000	1.000	1.53	0.00274	13.6	4.55	7.88	28.5	56.6
76.4	0.000	1.000	1.41	0.00298	14.8	4.93	8.55	30.9	61.4
85.2	0.000	1.000	1.26	0.00332	16.5	5.50	9.53	34.4	68.5
96.3	0.000	1.000	1.12	0.00375	18.7	6.22	10.8	38.9	77.4
107	0.000	1.000	1.01	0.00416	20.7	6.90	11.9	43.2	86.0
119	0.000	1.000	0.904	0.00464	23.1	7.70	13.3	48.1	95.6
133	0.000	1.000	0.808	0.00520	25.9	8.62	14.9	53.8	107
145	0.000	1.000	0.741	0.00567	28.2	9.40	16.3	58.6	117
161	0.000	1.000	0.669	0.00627	31.2	10.4	18.0	65.1	129
175	0.000	1.000	0.617	0.00680	33.9	11.3	19.5	70.7	141
194	0.000	1.000	0.555	0.00756	37.6	12.5	21.7	78.4	156
215	0.000	1.000	0.500	0.00839	41.8	13.9	24.1	86.9	173
239	0.000	1.000	0.451	0.00931	46.3	15.4	26.7	96.6	192
264	0.000	1.000	0.408	0.0103	51.2	17.1	29.5	107	212
293	0.000	1.000	0.368	0.0114	56.7	18.9	32.7	118	236

MERCURY INJECTION DATA SUMMARY

Company: University of North Dakota
Well: Aquistore
File: HOU-140757

Sample:	**S2 #118646-2m**	un-	Host Plug	
Depth, meters:	2100.00	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.000263	-	-
Porosity, fraction:		0.059	-	-
maximum Sb/Pc, fraction:		0.00022		
R35, microns:		0.0109		
R50 (median pore throat radius):		0.00809		

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
325	0.000	1.000	0.332	0.0126	62.9	21.0	36.3	131	261
363	0.000	1.000	0.297	0.0141	70.3	23.4	40.6	147	292
399	0.000	1.000	0.270	0.0155	77.3	25.8	44.7	161	321
442	0.000	1.000	0.244	0.0172	85.7	28.6	49.5	179	355
491	0.000	1.000	0.219	0.0191	95.2	31.7	55.0	198	395
544	0.000	1.000	0.198	0.0212	105	35.2	60.9	220	437
603	0.000	1.000	0.179	0.0235	117	38.9	67.4	244	485
667	0.000	1.000	0.161	0.0260	129	43.1	74.6	270	536
739	0.000	1.000	0.146	0.0288	143	47.7	82.7	299	594
819	0.000	1.000	0.132	0.0319	159	52.9	91.6	331	658
908	0.000	1.000	0.119	0.0354	176	58.7	102	367	730
1010	0.000	1.000	0.107	0.0392	195	65.1	113	408	812
1110	0.000	1.000	0.0968	0.0434	216	71.9	125	449	892
1230	0.000	1.000	0.0873	0.0481	239	79.8	138	497	989
1370	0.000	1.000	0.0786	0.0534	266	88.5	153	554	1100
1520	0.000	1.000	0.0710	0.0591	294	98.1	170	614	1220
1680	0.000	1.000	0.0641	0.0655	326	109	188	679	1350
1860	0.005	0.995	0.0579	0.0725	361	120	208	752	1500
2060	0.011	0.989	0.0522	0.0804	400	133	231	833	1660
2290	0.018	0.982	0.0471	0.0891	443	148	256	925	1840
2530	0.026	0.974	0.0425	0.0987	491	164	283	1020	2030
2810	0.034	0.966	0.0384	0.109	544	181	314	1140	2260
3120	0.044	0.956	0.0346	0.121	604	201	349	1260	2510
3450	0.054	0.946	0.0312	0.134	669	223	386	1390	2770
3820	0.066	0.934	0.0282	0.149	741	247	428	1540	3070
4240	0.080	0.920	0.0254	0.165	821	274	474	1710	3410
4690	0.096	0.904	0.0230	0.183	909	303	525	1900	3770
5200	0.116	0.884	0.0207	0.202	1010	336	582	2100	4180
5760	0.140	0.860	0.0187	0.224	1120	372	644	2330	4630
6380	0.169	0.831	0.0169	0.249	1240	412	714	2580	5130
7070	0.205	0.795	0.0152	0.275	1370	457	791	2860	5680
7840	0.245	0.755	0.0138	0.305	1520	506	877	3170	6300
8680	0.290	0.710	0.0124	0.338	1680	561	971	3510	6980
9620	0.337	0.663	0.0112	0.375	1860	621	1080	3890	7730

MERCURY INJECTION DATA SUMMARY

Company: University of North Dakota
Well: Aquistore
File: HOU-140757

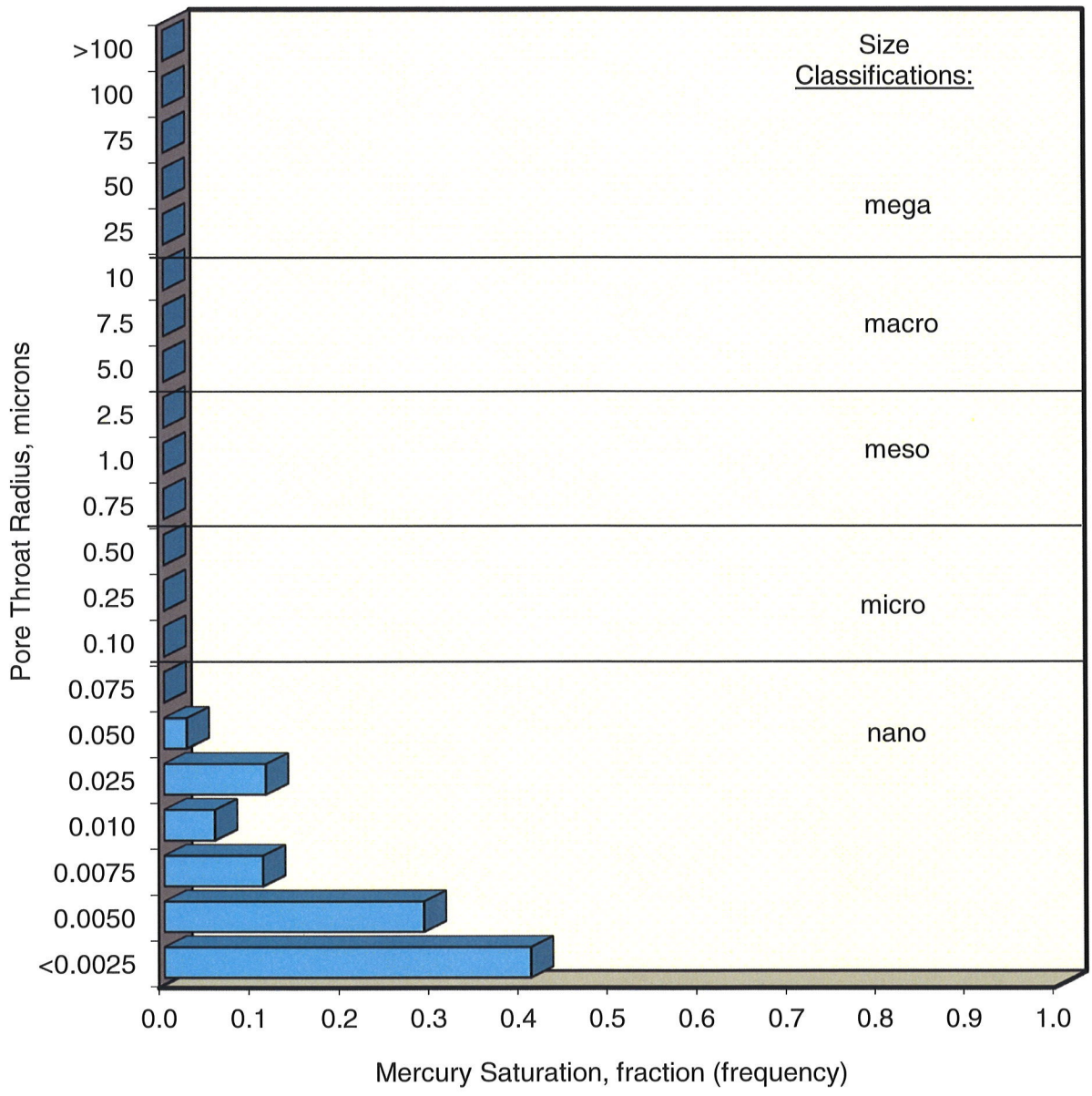
Sample:	**S2 #118646-2m**	un-	Host Plug	
Depth, meters:	2100.00	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.000263	-	-
Porosity, fraction:		0.059	-	-
maximum Sb/Pc, fraction:		0.00022		
R35, microns:		0.0109		
R50 (median pore throat radius):		0.00809		

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
10700	0.388	0.612	0.0101	0.415	2070	689	1190	4320	8600
11800	0.439	0.561	0.00912	0.460	2290	763	1320	4770	9480
13100	0.491	0.509	0.00823	0.510	2540	845	1460	5290	10500
14500	0.543	0.457	0.00743	0.565	2810	937	1620	5860	11700
16100	0.590	0.410	0.00671	0.626	3110	1040	1800	6510	12900
17800	0.633	0.367	0.00605	0.693	3450	1150	1990	7190	14300
19700	0.680	0.320	0.00546	0.768	3820	1270	2210	7960	15800
21900	0.721	0.279	0.00493	0.851	4230	1410	2440	8850	17600
24200	0.758	0.242	0.00445	0.943	4690	1560	2710	9780	19500
26800	0.792	0.208	0.00402	1.04	5200	1730	3000	10800	21500
29700	0.823	0.177	0.00362	1.16	5760	1920	3330	12000	23900
32900	0.851	0.149	0.00327	1.28	6380	2130	3680	13300	26400
36500	0.877	0.123	0.00295	1.42	7070	2360	4080	14800	29300
40400	0.901	0.099	0.00267	1.57	7830	2610	4520	16300	32500
44800	0.922	0.078	0.00241	1.74	8680	2890	5010	18100	36000
49600	0.941	0.059	0.00217	1.93	9620	3210	5550	20000	39900
55000	0.959	0.041	0.00196	2.14	10700	3550	6150	22200	44200

Company:	University of North Dakota
Well:	Aquistore
File:	HOU-140757

Sample: S1 #118645-2m	un-	Host Plug	
Depth, meters: 2098.50	stressed	n/a	n/a
Klinkenberg Permeability, md:	N/A	-	-
Permeability to Air, md:	N/A	-	-
Swanson Permeability, md:	0.000020	-	-
Porosity, fraction:	0.034	-	-
maximum Sb/Pc, fraction:	0.00005		
R35, microns:	0.00432		
R50 (median pore throat radius):	0.00299		

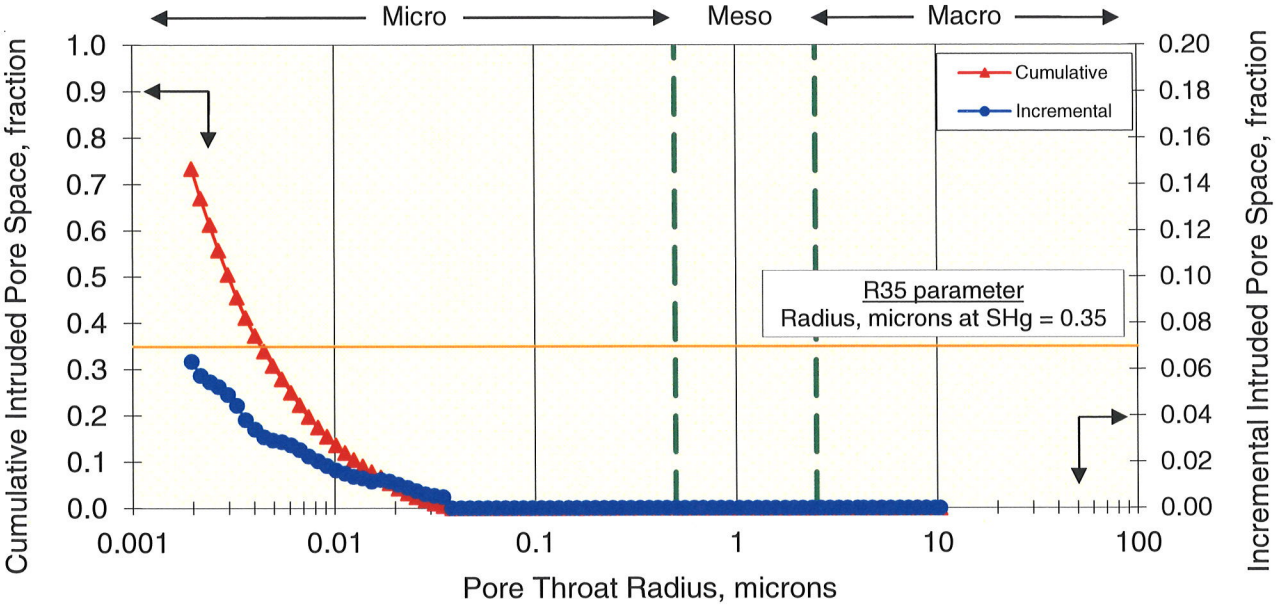
PORE THROAT SIZE HISTOGRAM



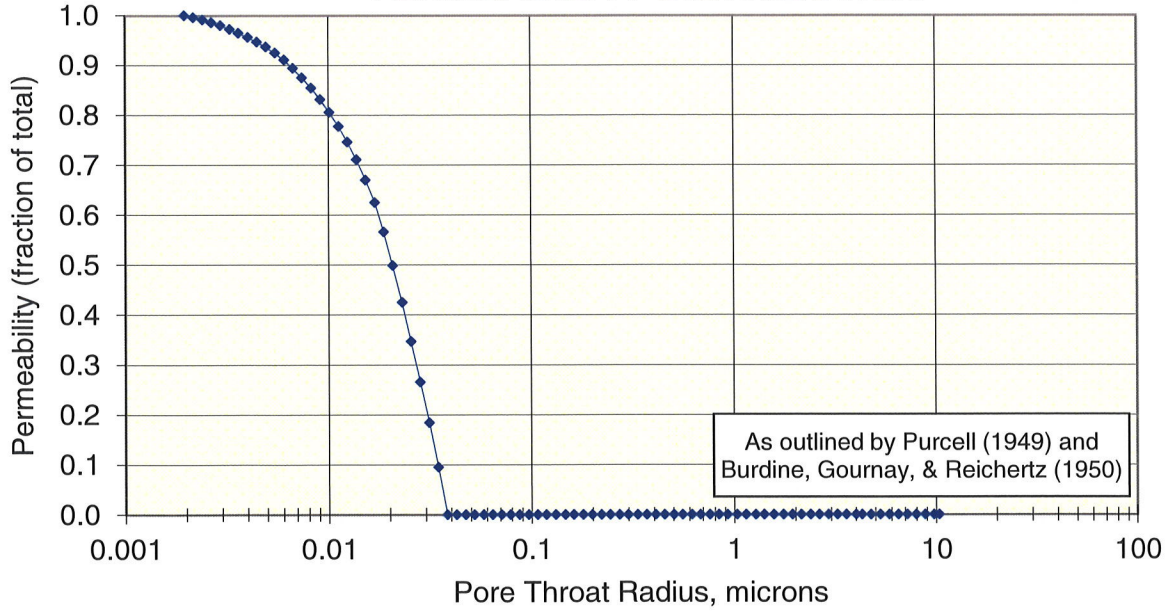
Company:	University of North Dakota
Well:	Aquistore
File:	HOU-140757

Sample:	S1 #118645-2m	un-	Host Plug	
Depth, meters:	2098.50	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.000020	-	-
Porosity, fraction:		0.034	-	-
maximum Sb/Pc, fraction:		0.00005		
R35, microns:		0.00432		
R50 (median pore throat radius):		0.00299		

PORE THROAT RADIUS DISTRIBUTION



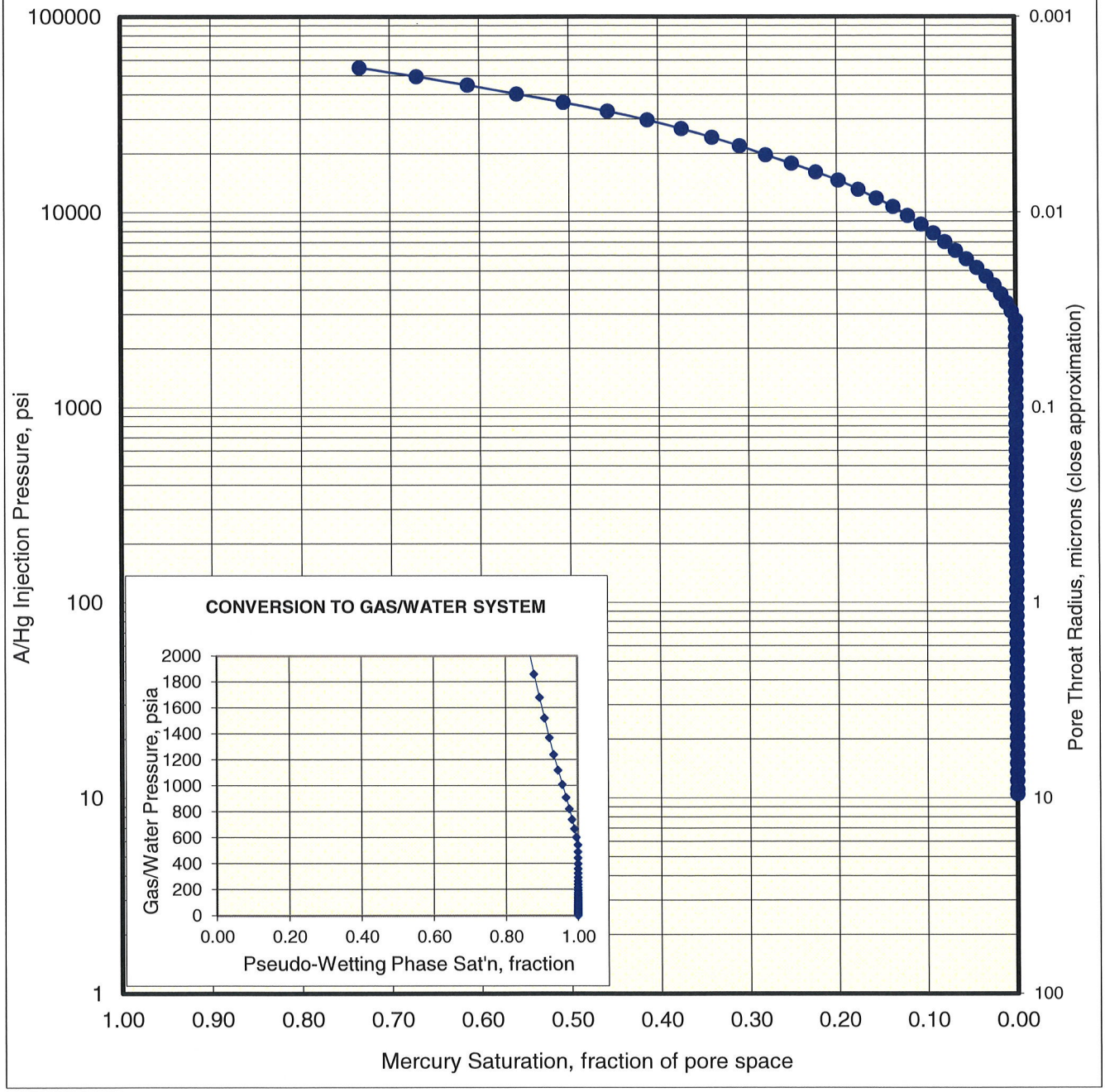
PERMEABILITY DISTRIBUTION



Company:	University of North Dakota
Well:	Aquistore
File:	HOU-140757

Sample:	S1 #118645-2m	un-	Host Plug	
Depth, meters:	2098.50	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.000020	-	-
Porosity, fraction:		0.034	-	-
maximum Sb/Pc, fraction:		0.00005		
R35, microns:		0.00432		
R50 (median pore throat radius):		0.00299		

MERCURY INJECTION



Core Laboratories

MERCURY INJECTION DATA SUMMARY

Company: University of North Dakota
Well: Aquistore
File: HOU-140757

Sample:	**S1 #118645-2m**	un-	Host Plug	
Depth, meters:	2098.50	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.000020	-	-
Porosity, fraction:		0.034	-	-
maximum Sb/Pc, fraction:		0.00005		
R35, microns:		0.00432		
R50 (median pore throat radius):		0.00299		

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
10.5	0.000	1.000	10.3	0.000149	2.03	0.678	1.17	4.24	8.44
11.1	0.000	1.000	9.74	0.000157	2.14	0.714	1.24	4.49	8.92
12.3	0.000	1.000	8.79	0.000174	2.38	0.792	1.37	4.97	9.89
13.6	0.000	1.000	7.93	0.000193	2.63	0.877	1.52	5.50	10.9
15.1	0.000	1.000	7.16	0.000213	2.92	0.972	1.68	6.10	12.1
16.7	0.000	1.000	6.47	0.000236	3.23	1.08	1.86	6.75	13.4
18.5	0.000	1.000	5.84	0.000262	3.58	1.19	2.07	7.48	14.9
20.5	0.000	1.000	5.27	0.000290	3.96	1.32	2.29	8.28	16.5
22.8	0.000	1.000	4.74	0.000323	4.41	1.47	2.55	9.21	18.3
25.2	0.000	1.000	4.28	0.000357	4.88	1.63	2.82	10.2	20.3
27.0	0.000	1.000	3.99	0.000383	5.24	1.75	3.02	10.9	21.7
30.3	0.000	1.000	3.56	0.000429	5.86	1.95	3.38	12.2	24.4
33.5	0.000	1.000	3.21	0.000475	6.50	2.17	3.75	13.5	26.9
37.1	0.000	1.000	2.90	0.000527	7.20	2.40	4.16	15.0	29.8
41.4	0.000	1.000	2.61	0.000586	8.02	2.67	4.63	16.7	33.3
45.6	0.000	1.000	2.37	0.000646	8.83	2.94	5.10	18.4	36.7
50.7	0.000	1.000	2.13	0.000718	9.82	3.27	5.67	20.5	40.8
56.0	0.000	1.000	1.93	0.000794	10.8	3.62	6.26	22.6	45.0
62.0	0.000	1.000	1.74	0.000879	12.0	4.01	6.94	25.1	49.8
69.1	0.000	1.000	1.56	0.000980	13.4	4.46	7.73	27.9	55.5
76.9	0.000	1.000	1.40	0.00109	14.9	4.97	8.60	31.1	61.8
85.2	0.000	1.000	1.27	0.00121	16.5	5.50	9.53	34.4	68.5
94.3	0.000	1.000	1.14	0.00134	18.3	6.09	10.6	38.1	75.8
105	0.000	1.000	1.03	0.00149	20.3	6.77	11.7	42.4	84.4
117	0.000	1.000	0.922	0.00166	22.6	7.55	13.1	47.3	94.0
129	0.000	1.000	0.835	0.00183	25.0	8.33	14.4	52.1	104
143	0.000	1.000	0.754	0.00203	27.7	9.23	16.0	57.8	115
159	0.000	1.000	0.679	0.00225	30.8	10.3	17.8	64.3	128
175	0.000	1.000	0.615	0.00248	33.9	11.3	19.6	70.7	141
195	0.000	1.000	0.553	0.00276	37.7	12.6	21.8	78.8	157
216	0.000	1.000	0.500	0.00306	41.8	13.9	24.1	87.3	174
239	0.000	1.000	0.450	0.00339	46.4	15.5	26.8	96.6	192
265	0.000	1.000	0.406	0.00376	51.4	17.1	29.7	107	213
294	0.000	1.000	0.367	0.00417	57.0	19.0	32.9	119	236

MERCURY INJECTION DATA SUMMARY

Company: University of North Dakota
Well: Aquistore
File: HOU-140757

Sample:	**S1 #118645-2m**	un-	Host Plug	
Depth, meters:	2098.50	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.000020	-	-
Porosity, fraction:		0.034	-	-
maximum Sb/Pc, fraction:		0.00005		
R35, microns:		0.00432		
R50 (median pore throat radius):		0.00299		

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
325	0.000	1.000	0.332	0.00461	63.0	21.0	36.4	131	261
361	0.000	1.000	0.298	0.00512	70.0	23.3	40.4	146	290
400	0.000	1.000	0.270	0.00567	77.4	25.8	44.7	162	322
443	0.000	1.000	0.243	0.00627	85.8	28.6	49.5	179	356
490	0.000	1.000	0.220	0.00695	95.0	31.7	54.9	198	394
544	0.000	1.000	0.198	0.00771	105	35.1	60.8	220	437
603	0.000	1.000	0.179	0.00855	117	38.9	67.4	244	485
669	0.000	1.000	0.161	0.00948	130	43.2	74.8	270	538
740	0.000	1.000	0.146	0.0105	143	47.8	82.8	299	595
821	0.000	1.000	0.131	0.0116	159	53.0	91.8	332	660
909	0.000	1.000	0.118	0.0129	176	58.7	102	367	731
1010	0.000	1.000	0.107	0.0143	195	65.1	113	408	812
1120	0.000	1.000	0.0965	0.0158	216	72.1	125	453	900
1240	0.000	1.000	0.0871	0.0175	240	79.9	138	501	997
1370	0.000	1.000	0.0786	0.0194	266	88.5	153	554	1100
1520	0.000	1.000	0.0709	0.0215	294	98.1	170	614	1220
1680	0.000	1.000	0.0640	0.0239	326	109	188	679	1350
1870	0.000	1.000	0.0578	0.0264	361	120	209	756	1500
2070	0.000	1.000	0.0521	0.0293	400	133	231	837	1660
2290	0.000	1.000	0.0471	0.0325	444	148	256	925	1840
2540	0.000	1.000	0.0425	0.0360	492	164	284	1030	2040
2810	0.000	1.000	0.0383	0.0399	545	182	315	1140	2260
3110	0.005	0.995	0.0346	0.0442	604	201	349	1260	2500
3450	0.010	0.990	0.0312	0.0489	669	223	386	1390	2770
3820	0.016	0.984	0.0282	0.0542	741	247	428	1540	3070
4240	0.024	0.976	0.0254	0.0601	821	274	474	1710	3410
4690	0.033	0.967	0.0230	0.0665	909	303	525	1900	3770
5200	0.043	0.957	0.0207	0.0737	1010	336	582	2100	4180
5760	0.055	0.945	0.0187	0.0817	1120	372	645	2330	4630
6380	0.067	0.933	0.0169	0.0905	1240	412	714	2580	5130
7070	0.079	0.921	0.0152	0.100	1370	457	791	2860	5680
7840	0.092	0.908	0.0137	0.111	1520	506	877	3170	6300
8680	0.105	0.895	0.0124	0.123	1680	561	972	3510	6980
9620	0.120	0.880	0.0112	0.136	1860	622	1080	3890	7730

MERCURY INJECTION DATA SUMMARY

Company: University of North Dakota
Well: Aquistore
File: HOU-140757

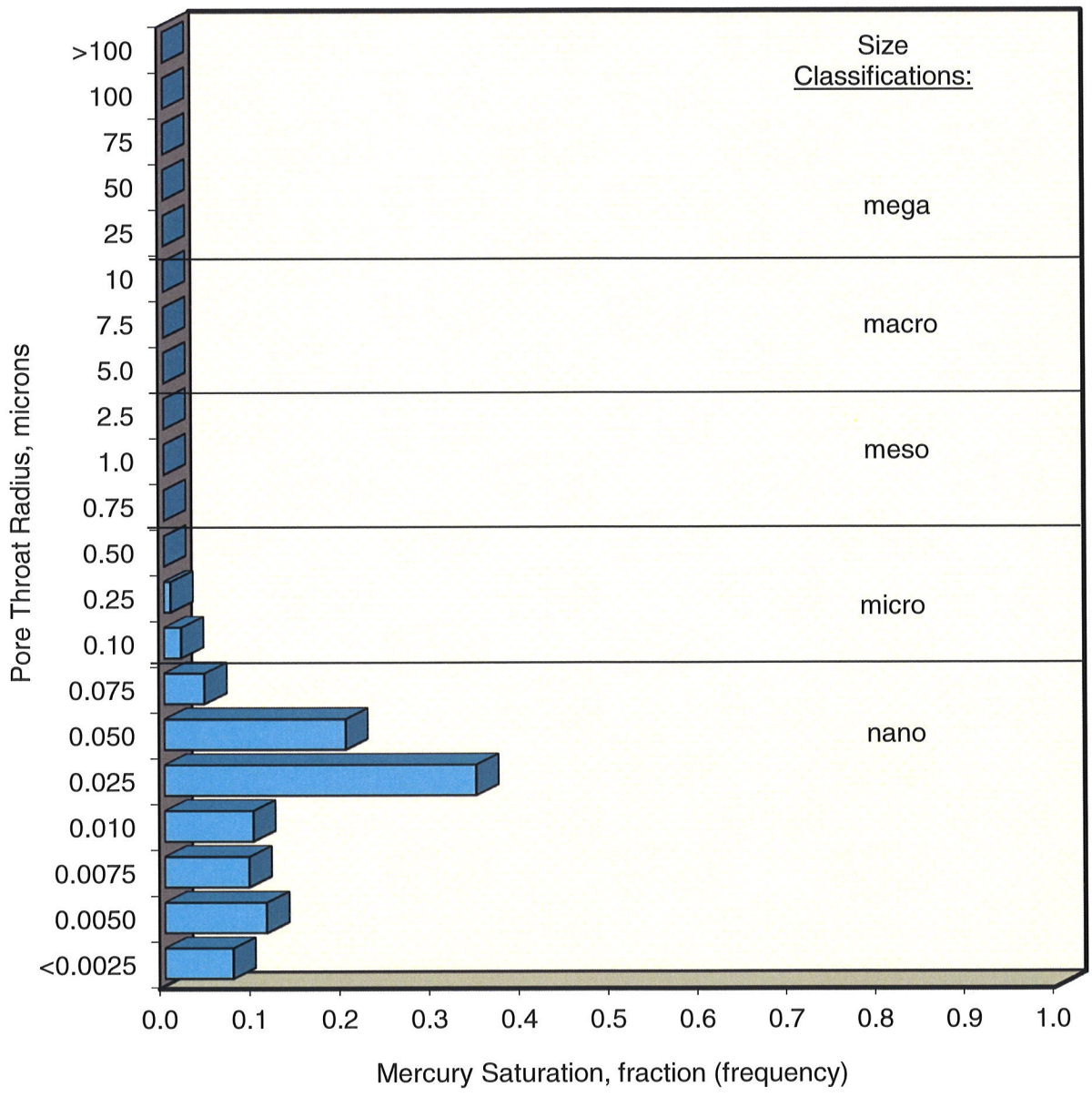
Sample:	**S1 #118645-2m**	un-	Host Plug	
Depth, meters:	2098.50	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.000020	-	-
Porosity, fraction:		0.034	-	-
maximum Sb/Pc, fraction:		0.00005		
R35, microns:		0.00432		
R50 (median pore throat radius):		0.00299		

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
10700	0.137	0.863	0.0101	0.151	2070	689	1190	4320	8600
11800	0.155	0.845	0.00912	0.167	2290	763	1320	4770	9480
13100	0.176	0.824	0.00823	0.186	2540	845	1460	5290	10500
14600	0.198	0.802	0.00739	0.207	2820	941	1630	5900	11700
16100	0.223	0.777	0.00667	0.229	3130	1040	1810	6510	12900
17800	0.251	0.749	0.00605	0.252	3450	1150	1990	7190	14300
19700	0.279	0.721	0.00546	0.280	3820	1270	2210	7960	15800
21900	0.309	0.691	0.00493	0.310	4240	1410	2450	8850	17600
24200	0.340	0.660	0.00445	0.343	4690	1560	2710	9780	19500
26800	0.374	0.626	0.00402	0.380	5200	1730	3000	10800	21500
29700	0.412	0.588	0.00362	0.422	5760	1920	3330	12000	23900
32900	0.456	0.544	0.00327	0.467	6380	2130	3690	13300	26400
36500	0.506	0.494	0.00295	0.517	7070	2360	4080	14800	29300
40400	0.558	0.442	0.00266	0.573	7840	2610	4520	16300	32500
44800	0.613	0.387	0.00241	0.635	8680	2890	5010	18100	36000
49600	0.670	0.330	0.00217	0.704	9620	3210	5550	20000	39900
55000	0.734	0.266	0.00196	0.780	10700	3550	6150	22200	44200

Company:	University of North Dakota
Well:	Aquistore
File:	HOU-140757

Sample:	S11 #118657m	un-	Host Plug	
Depth, meters:	2096.10	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.000599	-	-
Porosity, fraction:		0.055	-	-
maximum Sb/Pc, fraction:		0.00036		
R35, microns:		0.0199		
R50 (median pore throat radius):		0.0135		

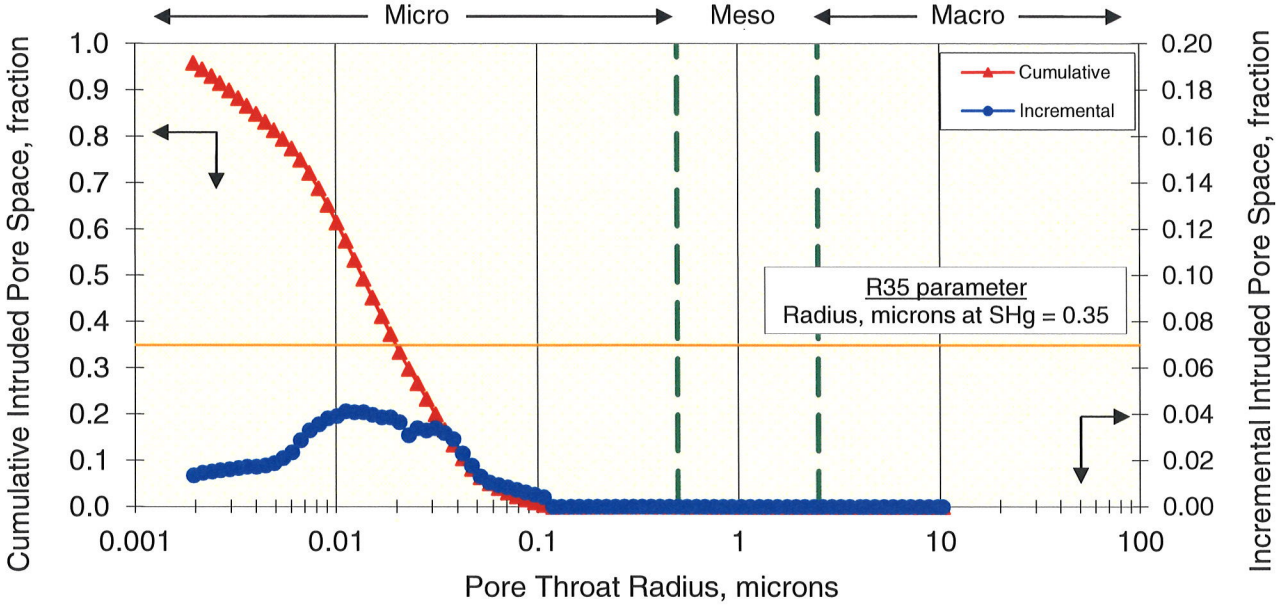
PORE THROAT SIZE HISTOGRAM



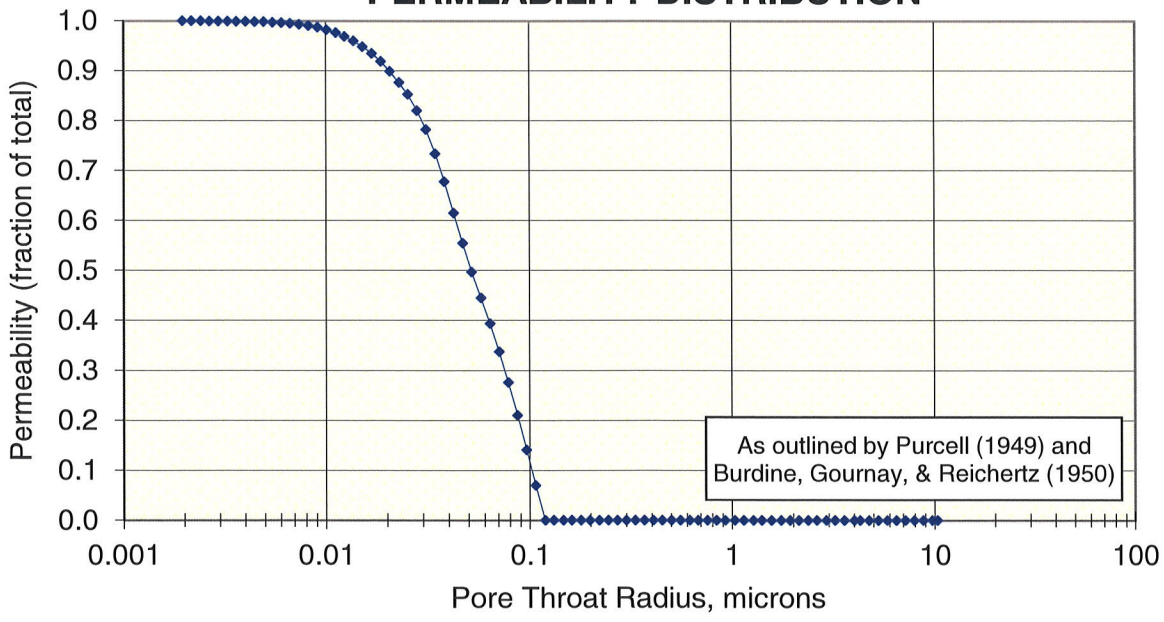
Company:	University of North Dakota
Well:	Aquistore
File:	HOU-140757

Sample: S11 #118657m	un-	Host Plug	
Depth, meters: 2096.10	stressed	n/a	n/a
Klinkenberg Permeability, md:	N/A	-	-
Permeability to Air, md:	N/A	-	-
Swanson Permeability, md:	0.000599	-	-
Porosity, fraction:	0.055	-	-
maximum Sb/Pc, fraction:	0.00036		
R35, microns:	0.0199		
R50 (median pore throat radius):	0.0135		

PORE THROAT RADIUS DISTRIBUTION



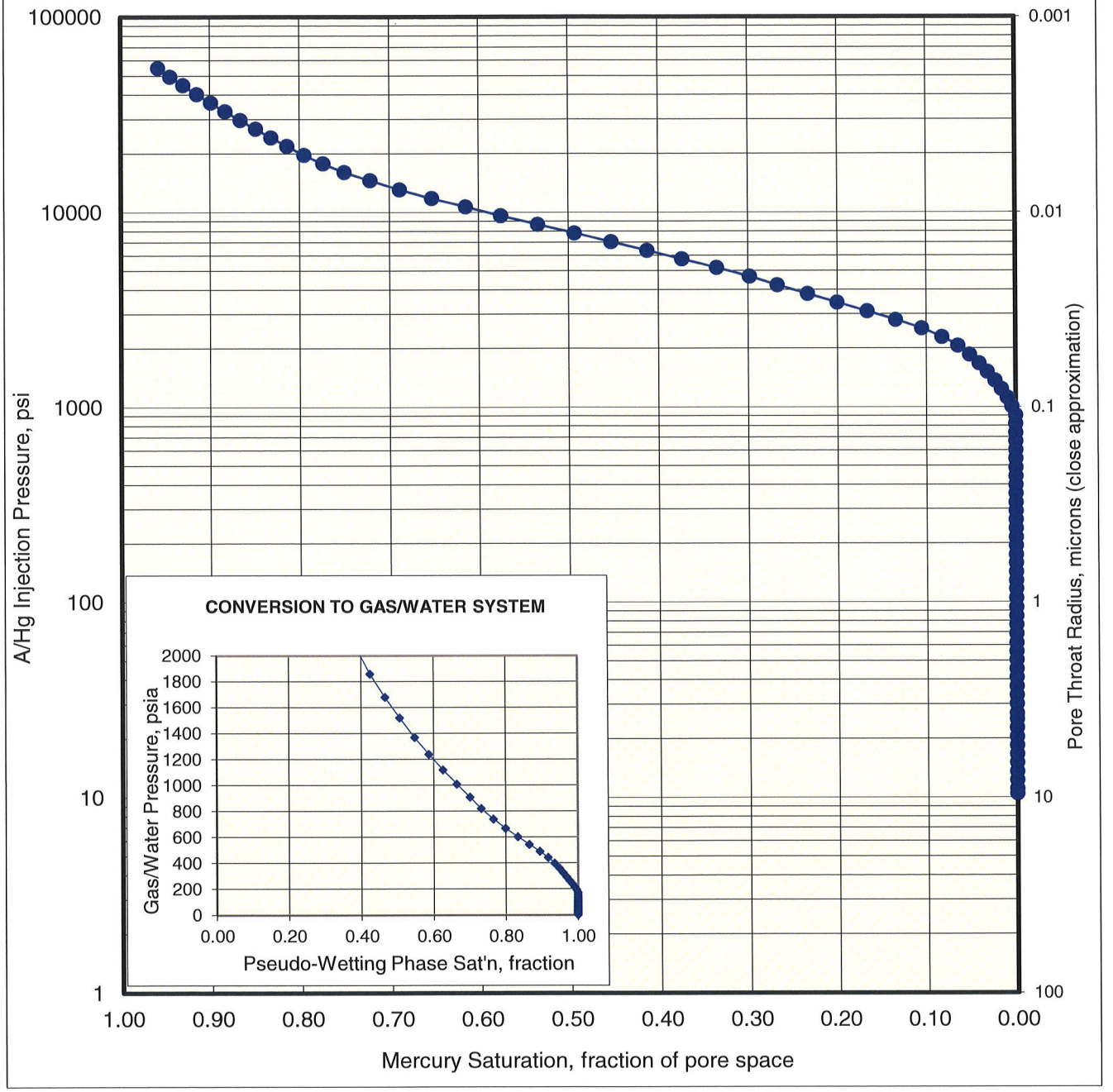
PERMEABILITY DISTRIBUTION



Company:	University of North Dakota
Well:	Aquistore
File:	HOU-140757

Sample:	S11 #118657m	un-	Host Plug	
Depth, meters:	2096.10	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.000599	-	-
Porosity, fraction:		0.055	-	-
maximum Sb/Pc, fraction:		0.00036		
R35, microns:		0.0199		
R50 (median pore throat radius):		0.0135		

MERCURY INJECTION



Core Laboratories

MERCURY INJECTION DATA SUMMARY

Company: University of North Dakota
Well: Aquistore
File: HOU-140757

Sample:	**S11 #118657m**	un-	Host Plug	
Depth, meters:	2096.10	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.000599	-	-
Porosity, fraction:		0.055	-	-
maximum Sb/Pc, fraction:		0.00036		
R35, microns:		0.0199		
R50 (median pore throat radius):		0.0135		

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
10.5	0.000	1.000	10.3	0.000636	2.03	0.678	1.17	4.24	8.44
11.1	0.000	1.000	9.74	0.000670	2.14	0.714	1.24	4.49	8.92
12.3	0.000	1.000	8.79	0.000743	2.38	0.792	1.37	4.97	9.89
13.6	0.000	1.000	7.93	0.000823	2.63	0.877	1.52	5.50	10.9
15.1	0.000	1.000	7.16	0.000912	2.92	0.972	1.68	6.10	12.1
16.7	0.000	1.000	6.47	0.00101	3.23	1.08	1.86	6.75	13.4
18.5	0.000	1.000	5.84	0.00112	3.58	1.19	2.07	7.48	14.9
20.5	0.000	1.000	5.27	0.00124	3.96	1.32	2.29	8.28	16.5
22.8	0.000	1.000	4.74	0.00138	4.41	1.47	2.55	9.21	18.3
25.2	0.000	1.000	4.28	0.00153	4.88	1.63	2.82	10.2	20.3
27.0	0.000	1.000	4.00	0.00163	5.22	1.74	3.02	10.9	21.7
30.2	0.000	1.000	3.57	0.00183	5.85	1.95	3.38	12.2	24.3
33.5	0.000	1.000	3.22	0.00203	6.48	2.16	3.74	13.5	26.9
37.1	0.000	1.000	2.91	0.00225	7.19	2.40	4.15	15.0	29.8
41.3	0.000	1.000	2.61	0.00250	8.00	2.67	4.62	16.7	33.2
45.5	0.000	1.000	2.37	0.00276	8.81	2.94	5.09	18.4	36.6
50.6	0.000	1.000	2.13	0.00306	9.80	3.27	5.66	20.4	40.7
55.9	0.000	1.000	1.93	0.00339	10.8	3.61	6.25	22.6	44.9
61.9	0.000	1.000	1.74	0.00375	12.0	4.00	6.93	25.0	49.8
69.0	0.000	1.000	1.56	0.00418	13.4	4.46	7.72	27.9	55.5
76.8	0.000	1.000	1.40	0.00465	14.9	4.96	8.59	31.0	61.7
85.1	0.000	1.000	1.27	0.00515	16.5	5.49	9.52	34.4	68.4
94.2	0.000	1.000	1.14	0.00571	18.3	6.08	10.5	38.1	75.7
105	0.000	1.000	1.03	0.00635	20.3	6.77	11.7	42.4	84.4
117	0.000	1.000	0.923	0.00707	22.6	7.54	13.1	47.3	94.0
129	0.000	1.000	0.836	0.00781	25.0	8.32	14.4	52.1	104
143	0.000	1.000	0.755	0.00865	27.7	9.22	16.0	57.8	115
159	0.000	1.000	0.679	0.00961	30.7	10.2	17.7	64.3	128
175	0.000	1.000	0.616	0.0106	33.9	11.3	19.6	70.7	141
195	0.000	1.000	0.554	0.0118	37.7	12.6	21.8	78.8	157
215	0.000	1.000	0.500	0.0131	41.7	13.9	24.1	86.9	173
239	0.000	1.000	0.451	0.0145	46.3	15.4	26.7	96.6	192
265	0.000	1.000	0.406	0.0161	51.4	17.1	29.7	107	213
294	0.000	1.000	0.367	0.0178	56.9	19.0	32.9	119	236

MERCURY INJECTION DATA SUMMARY

Company: University of North Dakota
Well: Aquistore
File: HOU-140757

Sample:	**S11 #118657m**	un-	Host Plug	
Depth, meters:	2096.10	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.000599	-	-
Porosity, fraction:		0.055	-	-
maximum Sb/Pc, fraction:		0.00036		
R35, microns:		0.0199		
R50 (median pore throat radius):		0.0135		

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
325	0.000	1.000	0.332	0.0197	62.9	21.0	36.3	131	261
361	0.000	1.000	0.299	0.0219	69.9	23.3	40.4	146	290
399	0.000	1.000	0.270	0.0242	77.4	25.8	44.7	161	321
442	0.000	1.000	0.244	0.0268	85.7	28.6	49.5	179	355
490	0.000	1.000	0.220	0.0297	95.0	31.7	54.8	198	394
544	0.000	1.000	0.198	0.0329	105	35.1	60.8	220	437
603	0.000	1.000	0.179	0.0365	117	38.9	67.4	244	485
669	0.000	1.000	0.161	0.0405	130	43.2	74.8	270	538
740	0.000	1.000	0.146	0.0448	143	47.8	82.8	299	595
821	0.000	1.000	0.131	0.0497	159	53.0	91.8	332	660
909	0.000	1.000	0.119	0.0551	176	58.7	102	367	731
1010	0.004	0.996	0.107	0.0610	195	65.1	113	408	812
1120	0.009	0.991	0.0965	0.0676	216	72.1	125	453	900
1240	0.016	0.984	0.0871	0.0749	240	79.9	138	501	997
1370	0.023	0.977	0.0786	0.0830	266	88.5	153	554	1100
1520	0.031	0.969	0.0709	0.0920	294	98.1	170	614	1220
1680	0.041	0.959	0.0640	0.102	326	109	188	679	1350
1860	0.051	0.949	0.0578	0.113	361	120	209	752	1500
2070	0.064	0.936	0.0521	0.125	400	133	231	837	1660
2290	0.082	0.918	0.0471	0.139	444	148	256	925	1840
2540	0.105	0.895	0.0425	0.154	492	164	284	1030	2040
2810	0.135	0.865	0.0383	0.170	545	182	314	1140	2260
3110	0.167	0.834	0.0346	0.189	604	201	348	1260	2500
3450	0.201	0.799	0.0312	0.209	669	223	386	1390	2770
3820	0.234	0.766	0.0282	0.232	741	247	428	1540	3070
4240	0.268	0.732	0.0254	0.257	821	274	474	1710	3410
4690	0.298	0.702	0.0230	0.284	909	303	525	1900	3770
5200	0.335	0.665	0.0207	0.315	1010	336	582	2100	4180
5760	0.374	0.626	0.0187	0.349	1120	372	644	2330	4630
6380	0.413	0.587	0.0169	0.387	1240	412	714	2580	5130
7070	0.452	0.548	0.0152	0.429	1370	457	791	2860	5680
7840	0.493	0.507	0.0137	0.475	1520	506	877	3170	6300
8680	0.534	0.466	0.0124	0.526	1680	561	972	3510	6980
9620	0.575	0.425	0.0112	0.583	1860	621	1080	3890	7730

MERCURY INJECTION DATA SUMMARY

Company: University of North Dakota
Well: Aquistore
File: HOU-140757

Sample:	**S11 #118657m**	un-	Host Plug	
Depth, meters:	2096.10	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.000599	-	-
Porosity, fraction:		0.055	-	-
maximum Sb/Pc, fraction:		0.00036		
R35, microns:		0.0199		
R50 (median pore throat radius):		0.0135		

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
10700	0.615	0.385	0.0101	0.646	2070	688	1190	4320	8600
11800	0.653	0.347	0.00912	0.716	2290	763	1320	4770	9480
13100	0.689	0.311	0.00823	0.793	2540	845	1460	5290	10500
14600	0.722	0.279	0.00739	0.883	2820	941	1630	5900	11700
16100	0.750	0.250	0.00667	0.978	3130	1040	1810	6510	12900
17800	0.774	0.226	0.00605	1.08	3450	1150	1990	7190	14300
19700	0.795	0.205	0.00546	1.20	3820	1270	2210	7960	15800
21900	0.814	0.186	0.00493	1.32	4240	1410	2450	8850	17600
24200	0.831	0.169	0.00445	1.47	4690	1560	2710	9780	19500
26800	0.849	0.151	0.00402	1.63	5200	1730	3000	10800	21500
29700	0.866	0.134	0.00362	1.80	5760	1920	3330	12000	23900
32900	0.883	0.117	0.00327	2.00	6380	2130	3690	13300	26400
36500	0.899	0.101	0.00295	2.21	7070	2360	4080	14800	29300
40400	0.915	0.085	0.00266	2.45	7840	2610	4520	16300	32500
44800	0.930	0.070	0.00241	2.71	8680	2890	5010	18100	36000
49600	0.945	0.055	0.00217	3.01	9620	3210	5550	20000	39900
55000	0.958	0.042	0.00196	3.33	10700	3550	6150	22200	44200

ADVANCED CORE ANALYSIS STUDY

University of North Dakota
Aquistore

INTERIM DATA

Submitted to:

University of North Dakota

August 18, 2014

Performed by:

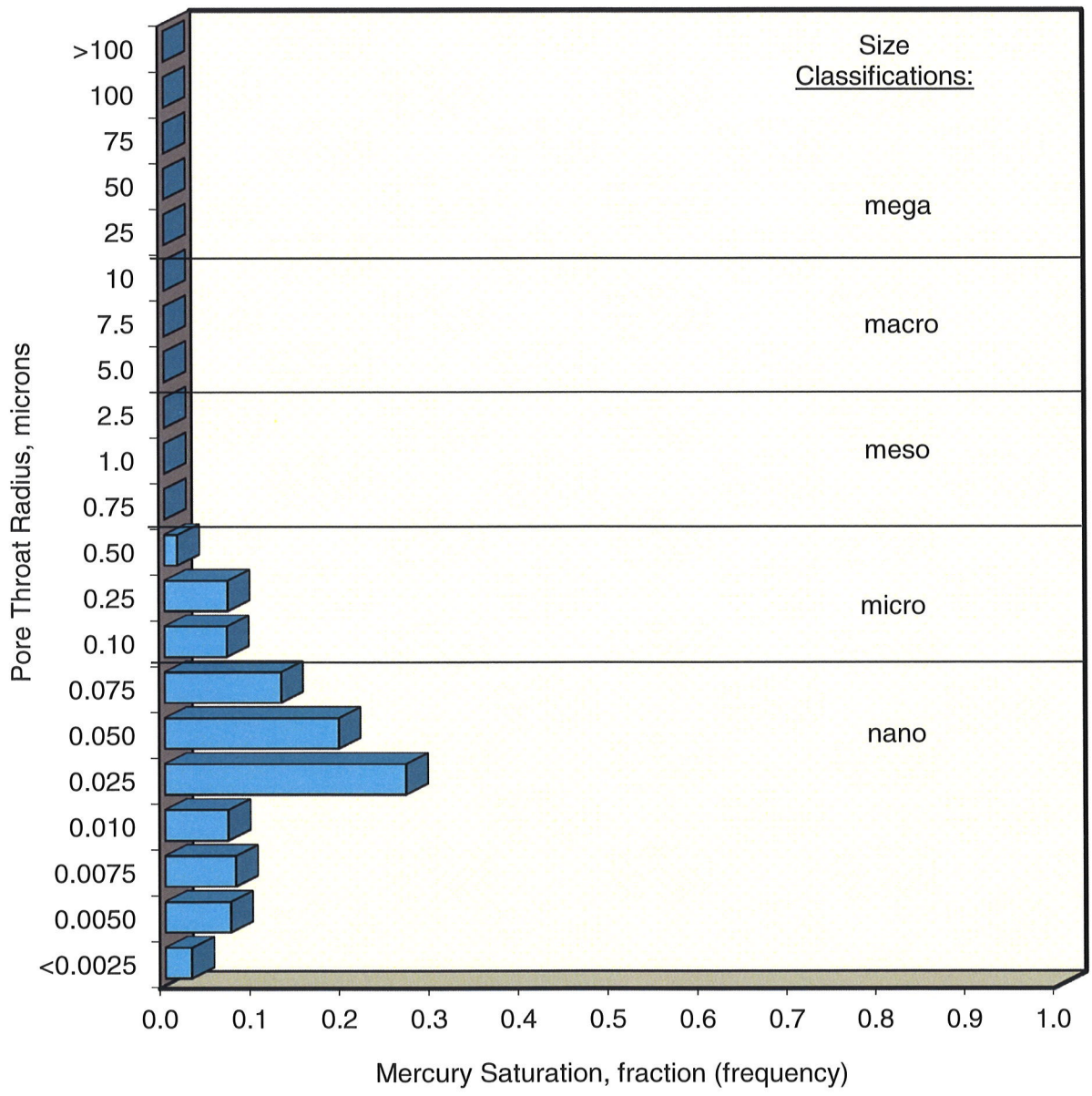
Core Laboratories
Petroleum Services Division
6316 Windfern
Houston, Texas 77040

HOU-140757

Company:	University of North Dakota
Well:	Aquistore
File:	HOU-140757

Sample:	S9 #118655m	un-	Host Plug	
Depth, meters:	2111.40	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.00281	-	-
Porosity, fraction:		0.068	-	-
maximum Sb/Pc, fraction:		0.00090		
R35, microns:		0.0394		
R50 (median pore throat radius):		0.0232		

PORE THROAT SIZE HISTOGRAM



Company:	University of North Dakota
Well:	Aquistore
File:	HOU-140757

Sample:	**S9 #118655m**	un-	Host Plug	
Depth, meters:	2111.40	stressed	n/a	n/a
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Porosity, fraction:		0.068	-	-
maximum Sb/Pc, fraction:		0.00090		
R35, microns:		0.0394		
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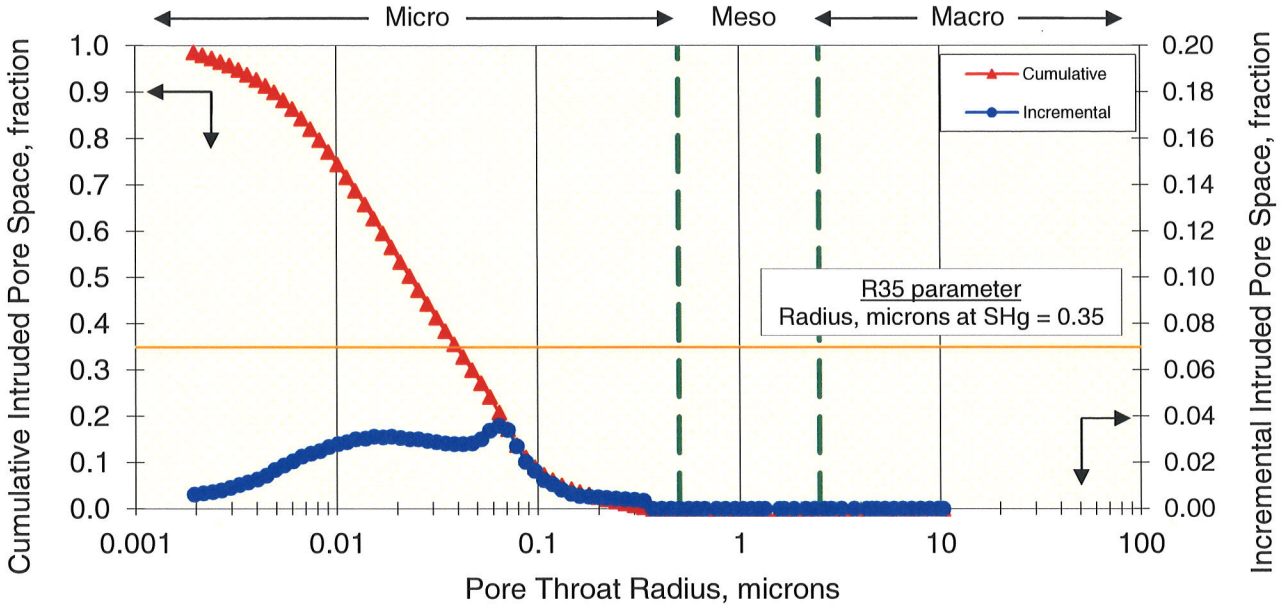
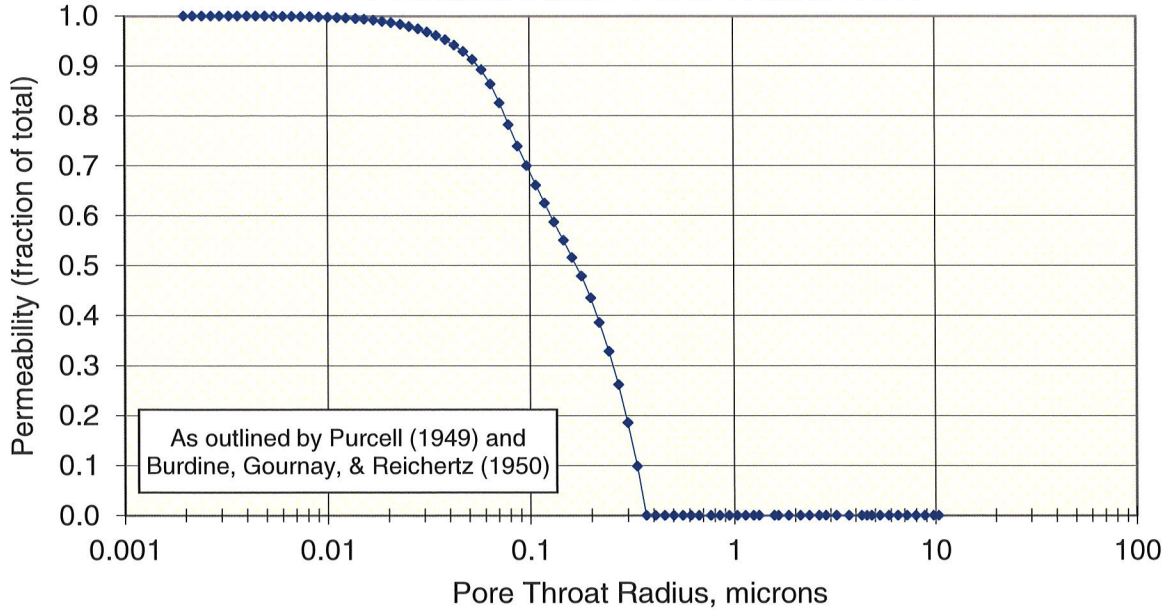
PORE THROAT RADIUS DISTRIBUTION



PERMEABILITY DISTRIBUTION



Company:	University of North Dakota
Well:	Aquistore
File:	HOU-140757

Sample:	**S9 #118655m**	un-	Host Plug	
Depth, meters:	2111.40	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.00281	-	-
Porosity, fraction:		0.068	-	-
maximum Sb/Pc, fraction:		0.00090		
R35, microns:		0.0394		
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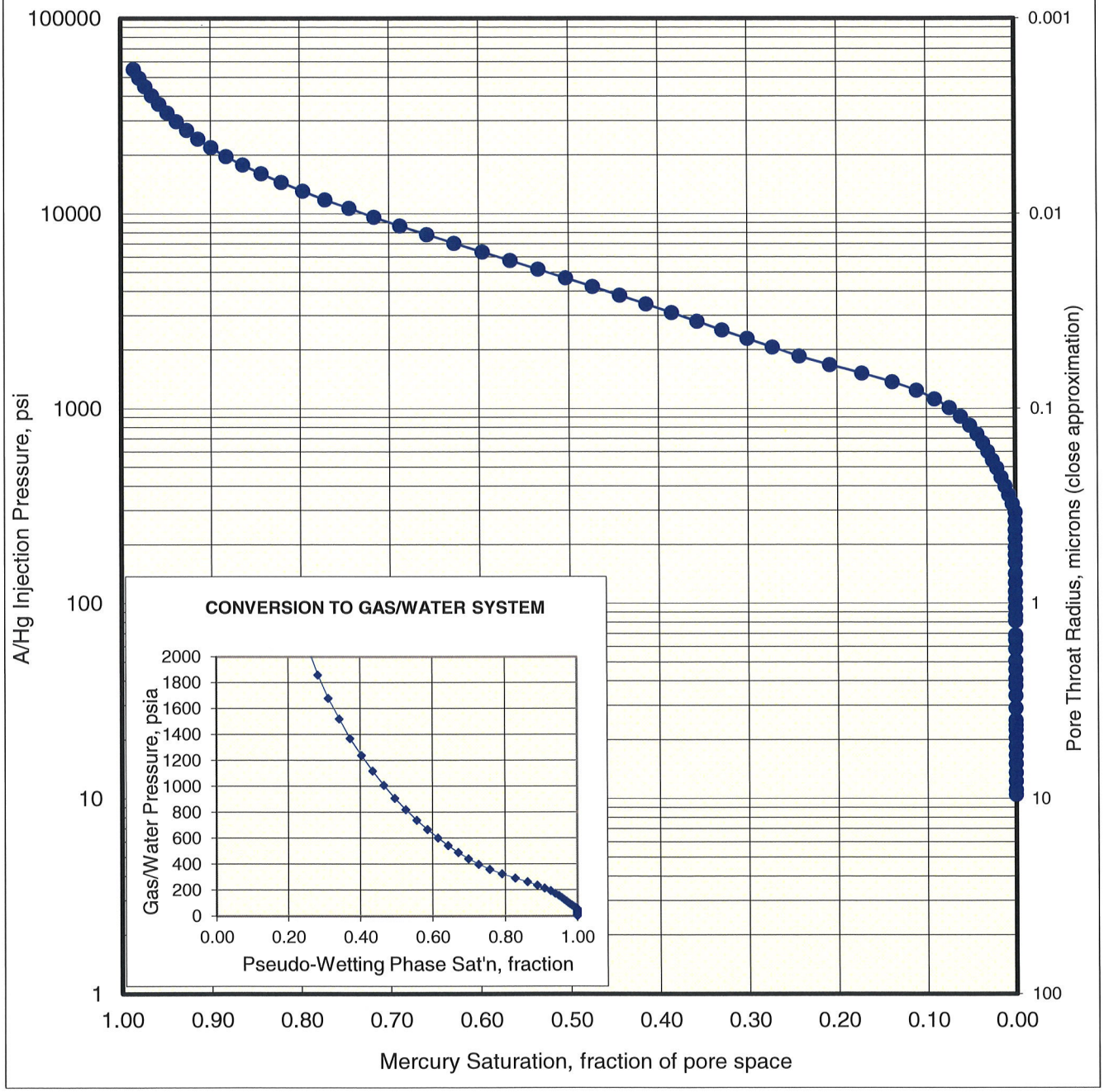
MERCURY INJECTION



Core Laboratories

MERCURY INJECTION DATA SUMMARY

Company: University of North Dakota
Well: Aquistore
File: HOU-140757

Sample:	**S9 #118655m**	un-	Host Plug	
Depth, meters:	2111.40	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
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Porosity, fraction:		0.068	-	-
maximum Sb/Pc, fraction:		0.00090		
R35, microns:		0.0394		
R50 (median pore throat radius):		0.0232		

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
10.5	0.000	1.000	10.3	0.00124	2.03	0.678	1.17	4.24	8.44
11.1	0.000	1.000	9.74	0.00131	2.14	0.714	1.24	4.49	8.92
12.3	0.000	1.000	8.78	0.00145	2.38	0.793	1.37	4.97	9.89
13.6	0.000	1.000	7.93	0.00161	2.63	0.878	1.52	5.50	10.9
15.1	0.000	1.000	7.15	0.00178	2.92	0.973	1.69	6.10	12.1
16.7	0.000	1.000	6.47	0.00197	3.23	1.08	1.86	6.75	13.4
18.5	0.000	1.000	5.84	0.00219	3.58	1.19	2.07	7.48	14.9
20.5	0.000	1.000	5.27	0.00242	3.96	1.32	2.29	8.28	16.5
22.5	0.000	1.000	4.79	0.00266	4.36	1.45	2.52	9.09	18.1
23.8	0.000	1.000	4.54	0.00281	4.60	1.53	2.66	9.62	19.1
25.2	0.000	1.000	4.28	0.00298	4.88	1.63	2.82	10.2	20.3
29.1	0.000	1.000	3.70	0.00345	5.64	1.88	3.26	11.8	23.4
33.7	0.000	1.000	3.20	0.00399	6.53	2.18	3.77	13.6	27.1
37.9	0.000	1.000	2.84	0.00449	7.34	2.45	4.24	15.3	30.5
41.0	0.000	1.000	2.63	0.00485	7.95	2.65	4.59	16.6	33.0
45.8	0.000	1.000	2.35	0.00542	8.88	2.96	5.13	18.5	36.8
50.8	0.000	1.000	2.12	0.00601	9.84	3.28	5.68	20.5	40.8
58.4	0.000	1.000	1.85	0.00691	11.3	3.77	6.53	23.6	46.9
65.1	0.000	1.000	1.65	0.00771	12.6	4.21	7.28	26.3	52.3
68.8	0.000	1.000	1.57	0.00815	13.3	4.45	7.70	27.8	55.3
81.4	0.000	1.000	1.32	0.00964	15.8	5.26	9.11	32.9	65.4
86.7	0.000	1.000	1.24	0.0103	16.8	5.60	9.70	35.0	69.7
95.1	0.000	1.000	1.13	0.0113	18.4	6.15	10.6	38.4	76.4
105	0.000	1.000	1.03	0.0124	20.3	6.77	11.7	42.4	84.4
115	0.000	1.000	0.940	0.0136	22.2	7.41	12.8	46.5	92.4
128	0.000	1.000	0.843	0.0151	24.8	8.26	14.3	51.7	103
142	0.000	1.000	0.761	0.0168	27.4	9.15	15.8	57.4	114
162	0.000	1.000	0.665	0.0192	31.4	10.5	18.1	65.5	130
178	0.000	1.000	0.607	0.0210	34.4	11.5	19.9	71.9	143
194	0.000	1.000	0.555	0.0230	37.6	12.5	21.7	78.4	156
215	0.000	1.000	0.500	0.0255	41.8	13.9	24.1	86.9	173
238	0.000	1.000	0.453	0.0282	46.1	15.4	26.6	96.2	191
265	0.000	1.000	0.407	0.0313	51.3	17.1	29.6	107	213
294	0.000	1.000	0.367	0.0348	56.9	19.0	32.9	119	236

MERCURY INJECTION DATA SUMMARY

Company: University of North Dakota
Well: Aquistore
File: HOU-140757

Sample:	**S9 #118655m**	un-	Host Plug	
Depth, meters:	2111.40	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.00281	-	-
Porosity, fraction:		0.068	-	-
maximum Sb/Pc, fraction:		0.00090		
R35, microns:		0.0394		
R50 (median pore throat radius):		0.0232		

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
325	0.004	0.996	0.332	0.0385	63.0	21.0	36.3	131	261
360	0.007	0.993	0.299	0.0426	69.7	23.2	40.3	145	289
400	0.011	0.989	0.270	0.0473	77.4	25.8	44.7	162	322
443	0.016	0.984	0.243	0.0525	85.9	28.6	49.6	179	356
494	0.021	0.979	0.218	0.0585	95.7	31.9	55.3	200	397
543	0.026	0.974	0.198	0.0643	105	35.1	60.8	219	436
602	0.031	0.969	0.179	0.0713	117	38.9	67.4	243	484
668	0.037	0.963	0.161	0.0790	129	43.1	74.7	270	537
739	0.043	0.957	0.146	0.0875	143	47.7	82.7	299	594
819	0.051	0.949	0.131	0.0970	159	52.9	91.7	331	658
910	0.062	0.938	0.118	0.108	176	58.8	102	368	731
1010	0.074	0.926	0.107	0.119	195	65.1	113	408	812
1120	0.091	0.909	0.0965	0.132	216	72.1	125	453	900
1240	0.111	0.889	0.0872	0.146	239	79.8	138	501	997
1370	0.138	0.862	0.0787	0.162	265	88.5	153	554	1100
1520	0.172	0.828	0.0710	0.180	294	98.0	170	614	1220
1680	0.208	0.792	0.0641	0.199	326	109	188	679	1350
1860	0.242	0.758	0.0578	0.221	361	120	208	752	1500
2070	0.272	0.728	0.0522	0.245	400	133	231	837	1660
2290	0.301	0.699	0.0471	0.271	443	148	256	925	1840
2530	0.329	0.671	0.0425	0.300	491	164	284	1020	2030
2810	0.357	0.643	0.0384	0.333	544	181	314	1140	2260
3110	0.385	0.615	0.0346	0.369	604	201	348	1260	2500
3450	0.414	0.586	0.0312	0.408	669	223	386	1390	2770
3820	0.443	0.557	0.0282	0.452	741	247	428	1540	3070
4240	0.473	0.527	0.0254	0.502	821	274	474	1710	3410
4690	0.503	0.497	0.0230	0.555	909	303	525	1900	3770
5200	0.534	0.466	0.0207	0.615	1010	336	582	2100	4180
5760	0.565	0.435	0.0187	0.682	1120	372	644	2330	4630
6380	0.596	0.404	0.0169	0.756	1240	412	714	2580	5130
7070	0.627	0.373	0.0152	0.837	1370	457	791	2860	5680
7840	0.658	0.342	0.0138	0.928	1520	506	877	3170	6300
8680	0.688	0.312	0.0124	1.03	1680	561	971	3510	6980
9620	0.717	0.283	0.0112	1.14	1860	621	1080	3890	7730

MERCURY INJECTION DATA SUMMARY

Company: University of North Dakota
Well: Aquistore
File: HOU-140757

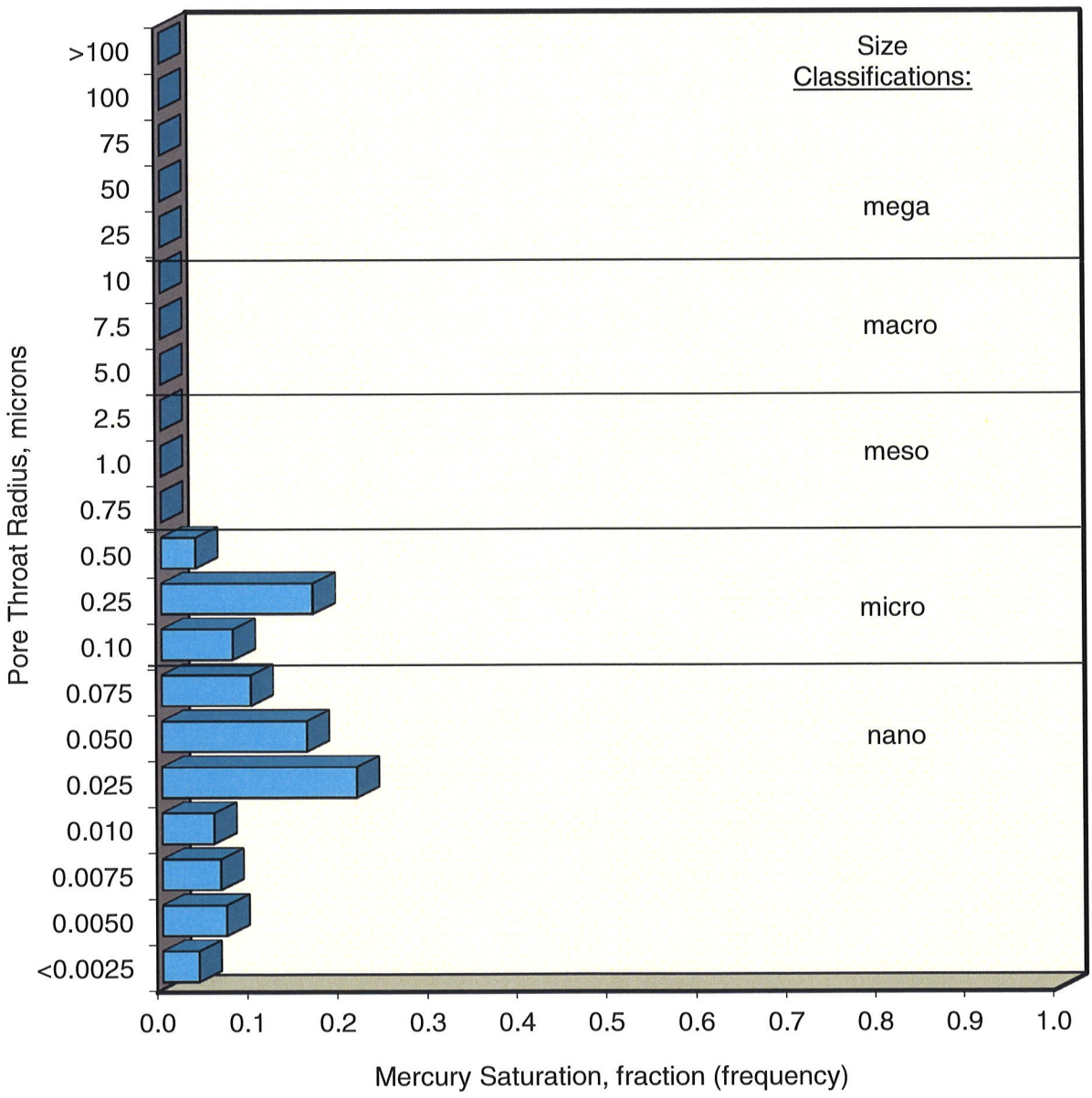
Sample:	**S9 #118655m**	un-	Host Plug	
Depth, meters:	2111.40	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.00281	-	-
Porosity, fraction:		0.068	-	-
maximum Sb/Pc, fraction:		0.00090		
R35, microns:		0.0394		
R50 (median pore throat radius):		0.0232		

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
10700	0.745	0.255	0.0101	1.26	2070	688	1190	4320	8600
11800	0.772	0.228	0.00912	1.40	2290	763	1320	4770	9480
13100	0.797	0.203	0.00823	1.55	2540	845	1460	5290	10500
14500	0.820	0.180	0.00743	1.72	2810	937	1620	5860	11700
16100	0.843	0.157	0.00671	1.90	3110	1040	1800	6510	12900
17800	0.864	0.136	0.00605	2.11	3450	1150	1990	7190	14300
19700	0.883	0.117	0.00546	2.33	3820	1270	2210	7960	15800
21900	0.899	0.101	0.00493	2.59	4230	1410	2450	8850	17600
24200	0.914	0.086	0.00445	2.87	4690	1560	2710	9780	19500
26800	0.927	0.073	0.00402	3.18	5200	1730	3000	10800	21500
29700	0.938	0.062	0.00362	3.52	5760	1920	3330	12000	23900
32900	0.948	0.052	0.00327	3.90	6380	2130	3680	13300	26400
36500	0.958	0.042	0.00295	4.32	7070	2360	4080	14800	29300
40400	0.965	0.035	0.00267	4.79	7830	2610	4520	16300	32500
44800	0.973	0.027	0.00241	5.30	8680	2890	5010	18100	36000
49600	0.980	0.020	0.00217	5.87	9620	3210	5550	20000	39900
55000	0.986	0.014	0.00196	6.51	10700	3550	6150	22200	44200

Company:	University of North Dakota
Well:	Aquistore
File:	HOU-140757

Sample:	S8 #118654-2m	un-	Host Plug	
Depth, meters:	2108.10	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.00563	-	-
Porosity, fraction:		0.068	-	-
maximum Sb/Pc, fraction:		0.00135		
R35, microns:		0.0583		
R50 (median pore throat radius):		0.0306		

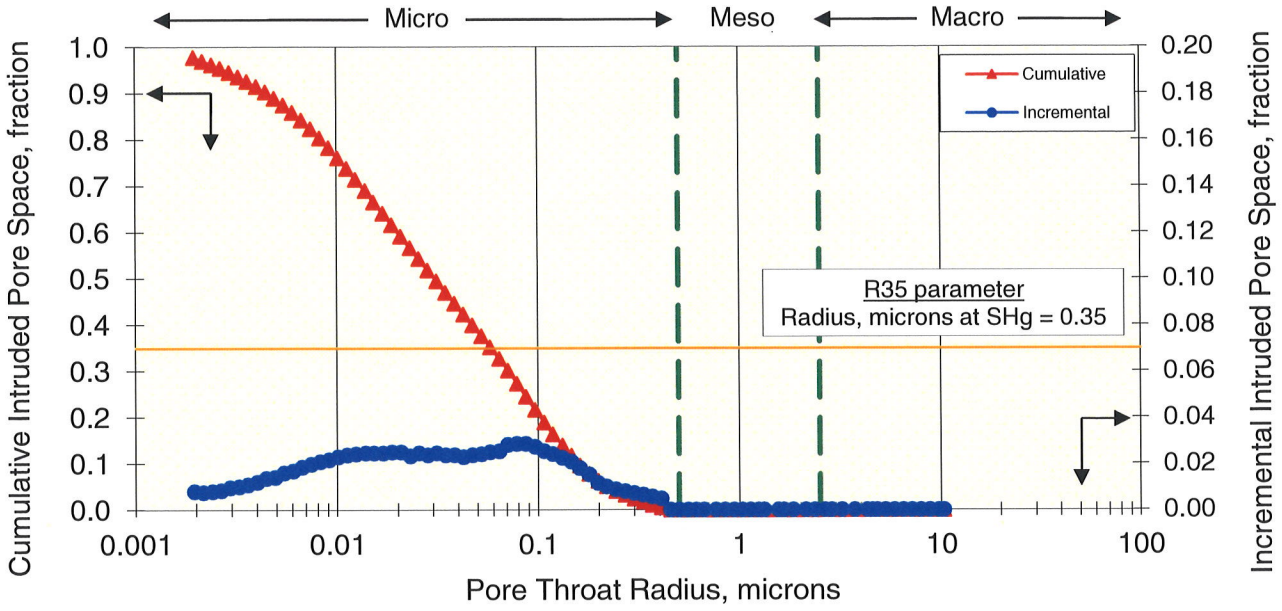
PORE THROAT SIZE HISTOGRAM



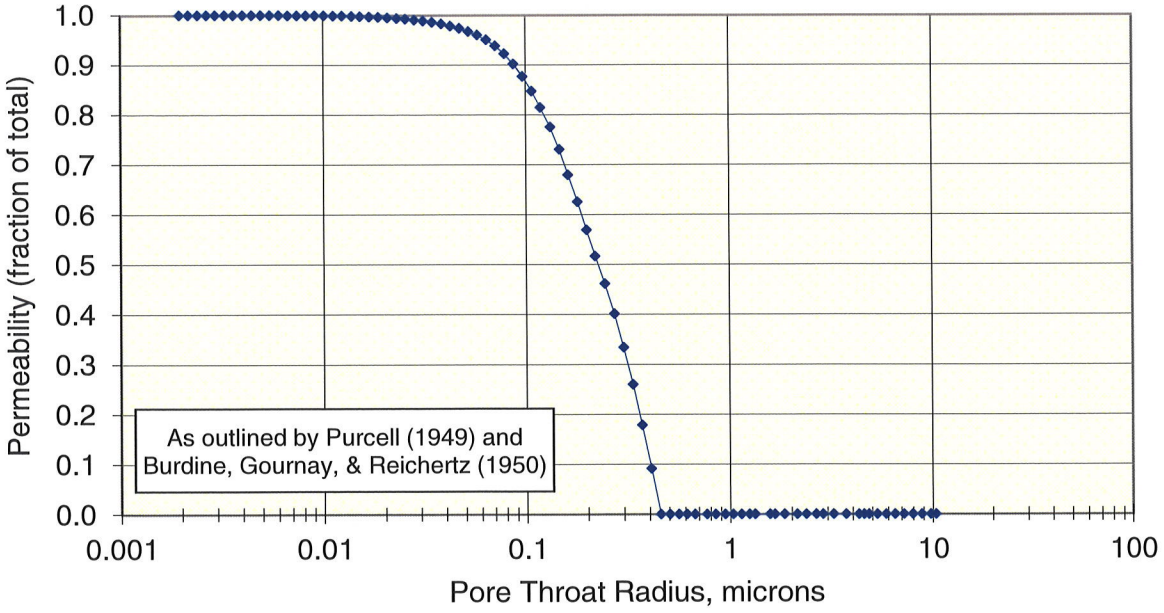
Company:	University of North Dakota
Well:	Aquistore
File:	HOU-140757

Sample:	S8 #118654-2m	un-	Host Plug	
Depth, meters:	2108.10	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.00563	-	-
Porosity, fraction:		0.068	-	-
maximum Sb/Pc, fraction:		0.00135		
R35, microns:		0.0583		
R50 (median pore throat radius):		0.0306		

PORE THROAT RADIUS DISTRIBUTION



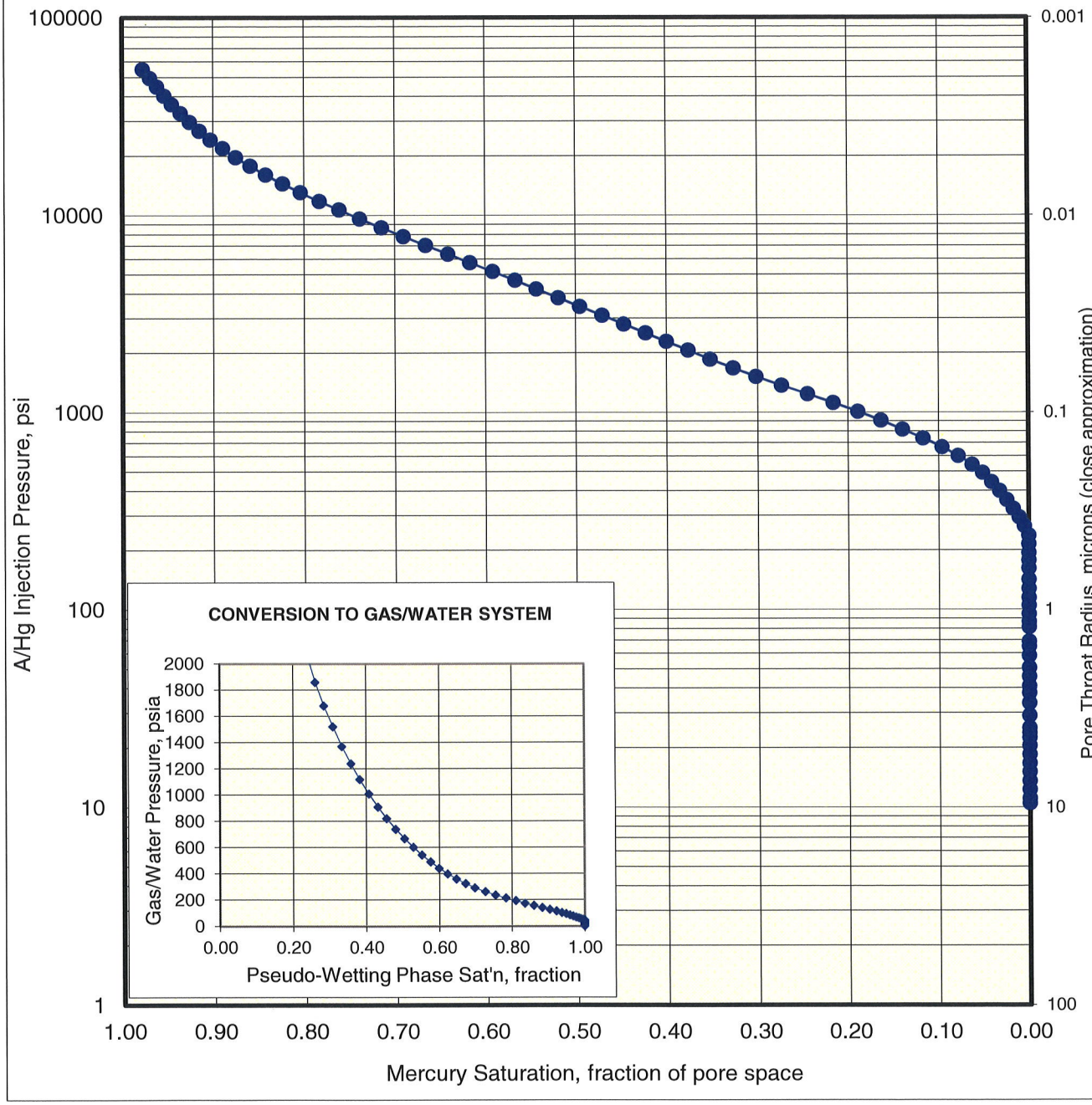
PERMEABILITY DISTRIBUTION



Company:	University of North Dakota
Well:	Aquistore
File:	HOU-140757

Sample:	S8 #118654-2m	un-	Host Plug	
Depth, meters:	2108.10	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.00563	-	-
Porosity, fraction:		0.068	-	-
maximum Sb/Pc, fraction:		0.00135		
R35, microns:		0.0583		
R50 (median pore throat radius):		0.0306		

MERCURY INJECTION



Core Laboratories

MERCURY INJECTION DATA SUMMARY

Company: University of North Dakota
Well: Aquistore
File: HOU-140757

Sample:	**S8 #118654-2m**	un-	Host Plug	
Depth, meters:	2108.10	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.00563	-	-
Porosity, fraction:		0.068	-	-
maximum Sb/Pc, fraction:		0.00135		
R35, microns:		0.0583		
R50 (median pore throat radius):		0.0306		

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
10.5	0.000	1.000	10.3	0.00177	2.03	0.678	1.17	4.24	8.44
11.1	0.000	1.000	9.74	0.00186	2.14	0.714	1.24	4.49	8.92
12.3	0.000	1.000	8.78	0.00206	2.38	0.793	1.37	4.97	9.89
13.6	0.000	1.000	7.93	0.00228	2.63	0.878	1.52	5.50	10.9
15.1	0.000	1.000	7.15	0.00253	2.92	0.973	1.69	6.10	12.1
16.7	0.000	1.000	6.47	0.00280	3.23	1.08	1.86	6.75	13.4
18.5	0.000	1.000	5.84	0.00310	3.58	1.19	2.07	7.48	14.9
20.5	0.000	1.000	5.27	0.00344	3.96	1.32	2.29	8.28	16.5
22.5	0.000	1.000	4.79	0.00378	4.36	1.45	2.52	9.09	18.1
23.8	0.000	1.000	4.54	0.00399	4.60	1.53	2.66	9.62	19.1
25.2	0.000	1.000	4.28	0.00423	4.88	1.63	2.82	10.2	20.3
29.1	0.000	1.000	3.70	0.00489	5.64	1.88	3.26	11.8	23.4
33.7	0.000	1.000	3.20	0.00567	6.53	2.18	3.77	13.6	27.1
37.9	0.000	1.000	2.84	0.00637	7.34	2.45	4.24	15.3	30.5
41.0	0.000	1.000	2.63	0.00689	7.95	2.65	4.59	16.6	33.0
45.8	0.000	1.000	2.35	0.00771	8.88	2.96	5.13	18.5	36.8
50.8	0.000	1.000	2.12	0.00854	9.84	3.28	5.68	20.5	40.8
58.4	0.000	1.000	1.84	0.00982	11.3	3.77	6.53	23.6	46.9
65.2	0.000	1.000	1.65	0.0110	12.6	4.21	7.29	26.3	52.4
68.9	0.000	1.000	1.56	0.0116	13.3	4.45	7.71	27.8	55.4
81.5	0.000	1.000	1.32	0.0137	15.8	5.26	9.11	32.9	65.5
86.8	0.000	1.000	1.24	0.0146	16.8	5.60	9.71	35.1	69.8
95.2	0.000	1.000	1.13	0.0160	18.4	6.15	10.6	38.5	76.5
105	0.000	1.000	1.03	0.0176	20.3	6.78	11.7	42.4	84.4
115	0.000	1.000	0.939	0.0193	22.2	7.41	12.8	46.5	92.4
128	0.000	1.000	0.842	0.0215	24.8	8.26	14.3	51.7	103
142	0.000	1.000	0.761	0.0238	27.4	9.15	15.8	57.4	114
162	0.000	1.000	0.665	0.0273	31.4	10.5	18.1	65.5	130
178	0.000	1.000	0.607	0.0299	34.4	11.5	19.9	71.9	143
194	0.000	1.000	0.555	0.0326	37.6	12.5	21.7	78.4	156
215	0.000	1.000	0.500	0.0362	41.8	13.9	24.1	86.9	173
238	0.000	1.000	0.453	0.0400	46.1	15.4	26.6	96.2	191
265	0.005	0.995	0.407	0.0445	51.3	17.1	29.6	107	213
294	0.010	0.990	0.367	0.0494	56.9	19.0	32.9	119	236

MERCURY INJECTION DATA SUMMARY

Company: University of North Dakota
Well: Aquistore
File: HOU-140757

Sample:	**S8 #118654-2m**	un-	Host Plug	
Depth, meters:	2108.10	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.00563	-	-
Porosity, fraction:		0.068	-	-
maximum Sb/Pc, fraction:		0.00135		
R35, microns:		0.0583		
R50 (median pore throat radius):		0.0306		

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
325	0.017	0.983	0.332	0.0546	63.0	21.0	36.4	131	261
360	0.024	0.976	0.299	0.0605	69.8	23.3	40.3	145	289
400	0.032	0.968	0.270	0.0672	77.4	25.8	44.7	162	322
443	0.041	0.959	0.243	0.0745	85.9	28.6	49.6	179	356
494	0.051	0.949	0.218	0.0830	95.7	31.9	55.3	200	397
543	0.063	0.937	0.198	0.0913	105	35.1	60.8	219	436
602	0.078	0.922	0.179	0.101	117	38.9	67.4	243	484
667	0.096	0.904	0.161	0.112	129	43.1	74.7	270	536
739	0.117	0.883	0.146	0.124	143	47.7	82.7	299	594
819	0.140	0.860	0.132	0.138	159	52.9	91.7	331	658
910	0.164	0.836	0.118	0.153	176	58.8	102	368	731
1010	0.189	0.811	0.107	0.169	195	65.1	113	408	812
1120	0.217	0.783	0.0965	0.188	216	72.1	125	453	900
1240	0.245	0.755	0.0872	0.208	239	79.8	138	501	997
1370	0.274	0.726	0.0787	0.230	265	88.5	153	554	1100
1520	0.302	0.698	0.0710	0.255	294	98.0	170	614	1220
1680	0.327	0.673	0.0641	0.283	326	109	188	679	1350
1860	0.352	0.648	0.0578	0.313	361	120	208	752	1500
2070	0.376	0.624	0.0522	0.347	400	133	231	837	1660
2290	0.400	0.600	0.0471	0.385	443	148	256	925	1840
2530	0.423	0.577	0.0425	0.426	491	164	284	1020	2030
2810	0.447	0.553	0.0384	0.472	544	181	314	1140	2260
3110	0.471	0.529	0.0346	0.524	604	201	348	1260	2500
3450	0.495	0.505	0.0312	0.580	669	223	386	1390	2770
3820	0.519	0.481	0.0282	0.642	741	247	428	1540	3070
4240	0.543	0.457	0.0254	0.712	821	274	474	1710	3410
4690	0.567	0.433	0.0230	0.789	909	303	525	1900	3770
5200	0.592	0.408	0.0207	0.874	1010	336	582	2100	4180
5760	0.617	0.383	0.0187	0.968	1120	372	644	2330	4630
6380	0.641	0.359	0.0169	1.07	1240	412	714	2580	5130
7070	0.666	0.334	0.0152	1.19	1370	457	791	2860	5680
7840	0.690	0.310	0.0138	1.32	1520	506	877	3170	6300
8680	0.715	0.285	0.0124	1.46	1680	561	972	3510	6980
9620	0.738	0.262	0.0112	1.62	1860	621	1080	3890	7730

MERCURY INJECTION DATA SUMMARY

Company: University of North Dakota
Well: Aquistore
File: HOU-140757

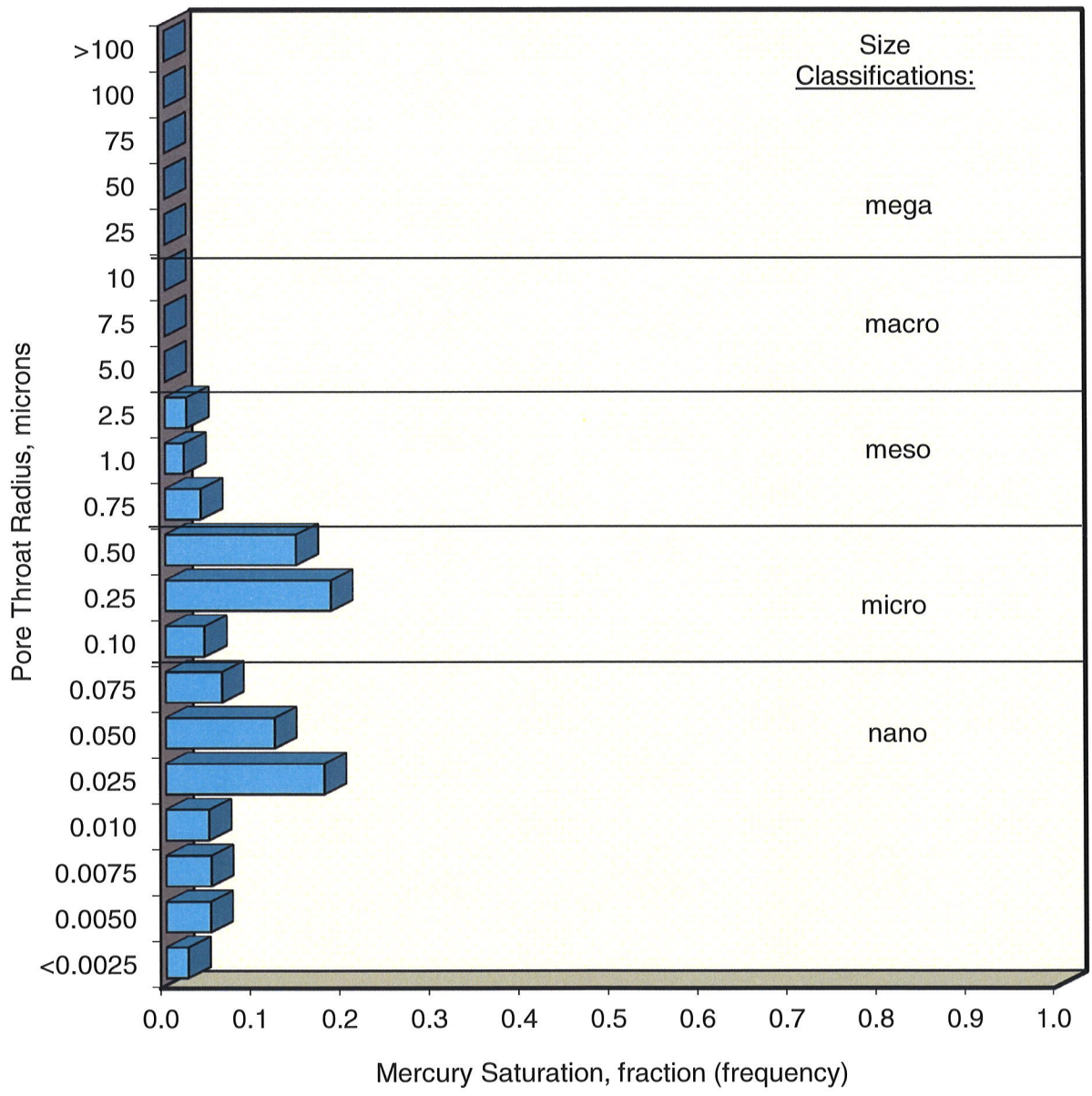
Sample:	**S8 #118654-2m**	un-	Host Plug	
Depth, meters:	2108.10	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.00563	-	-
Porosity, fraction:		0.068	-	-
maximum Sb/Pc, fraction:		0.00135		
R35, microns:		0.0583		
R50 (median pore throat radius):		0.0306		

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
10700	0.761	0.239	0.0101	1.79	2070	689	1190	4320	8600
11800	0.783	0.217	0.00912	1.99	2290	763	1320	4770	9480
13100	0.804	0.196	0.00823	2.20	2540	845	1460	5290	10500
14500	0.824	0.176	0.00743	2.44	2810	937	1620	5860	11700
16100	0.842	0.158	0.00671	2.70	3110	1040	1800	6510	12900
17800	0.859	0.141	0.00605	2.99	3450	1150	1990	7190	14300
19700	0.875	0.125	0.00546	3.32	3820	1270	2210	7960	15800
21900	0.889	0.111	0.00493	3.67	4240	1410	2450	8850	17600
24200	0.903	0.097	0.00445	4.07	4690	1560	2710	9780	19500
26800	0.915	0.085	0.00402	4.51	5200	1730	3000	10800	21500
29700	0.926	0.074	0.00362	5.00	5760	1920	3330	12000	23900
32900	0.936	0.064	0.00327	5.54	6380	2130	3680	13300	26400
36500	0.946	0.054	0.00295	6.13	7070	2360	4080	14800	29300
40400	0.954	0.046	0.00267	6.79	7830	2610	4520	16300	32500
44800	0.962	0.038	0.00241	7.53	8680	2890	5010	18100	36000
49600	0.970	0.030	0.00217	8.34	9620	3210	5550	20000	39900
55000	0.978	0.022	0.00196	9.24	10700	3550	6150	22200	44200

Company:	University of North Dakota
Well:	Aquistore
File:	HOU-140757

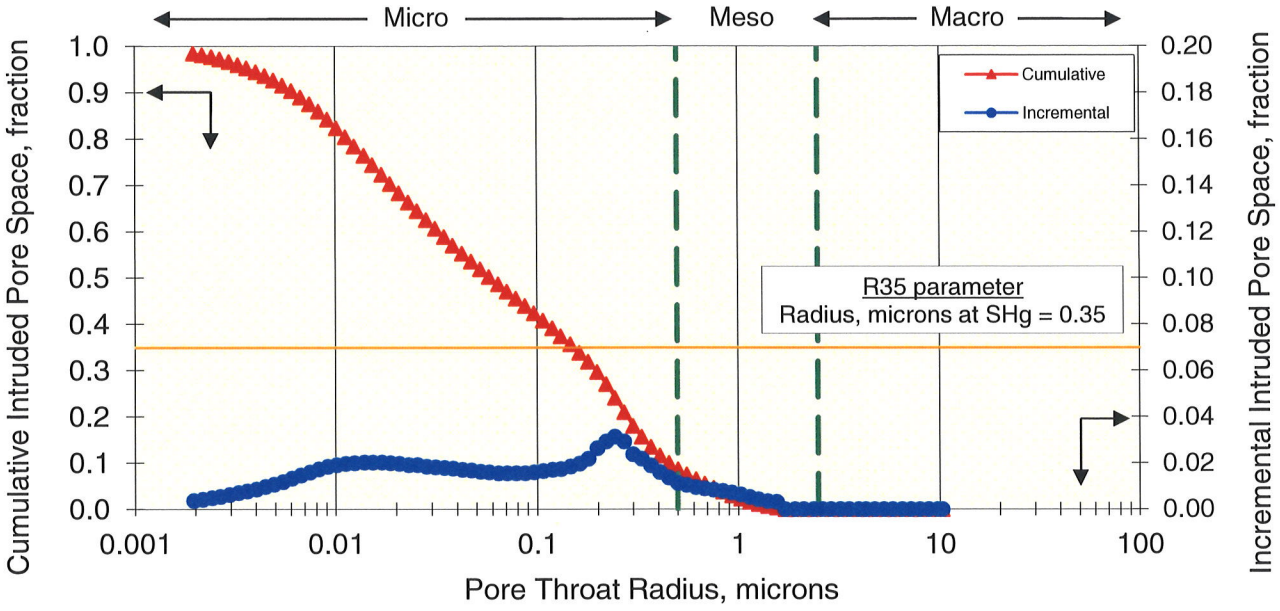
Sample:	S7 #118653m	un-	Host Plug	
Depth, meters:	2105.20	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.0484	-	-
Porosity, fraction:		0.087	-	-
maximum Sb/Pc, fraction:		0.00483		
R35, microns:		0.152		
R50 (median pore throat radius):		0.0590		

PORE THROAT SIZE HISTOGRAM

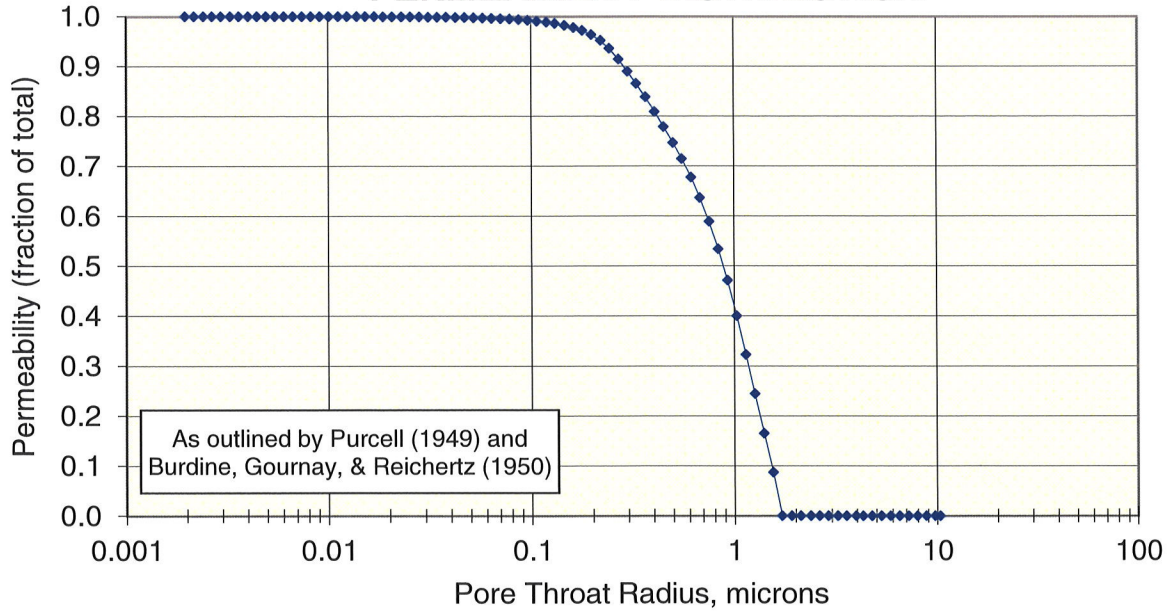


Company:	University of North Dakota	**Sample:**	**S7 #118653m**	un-	Host Plug
Well:	Aquistore	Depth, meters:	2105.20	stressed	n/a n/a
File:	HOU-140757	Klinkenberg Permeability, md:		N/A	- -
		Permeability to Air, md:		N/A	- -
		Swanson Permeability, md:		0.0484	- -
		Porosity, fraction:		0.087	- -
		maximum Sb/Pc, fraction:		0.00483	
		R35, microns:		0.152	
		R50 (median pore throat radius):		0.0590	

PORE THROAT RADIUS DISTRIBUTION



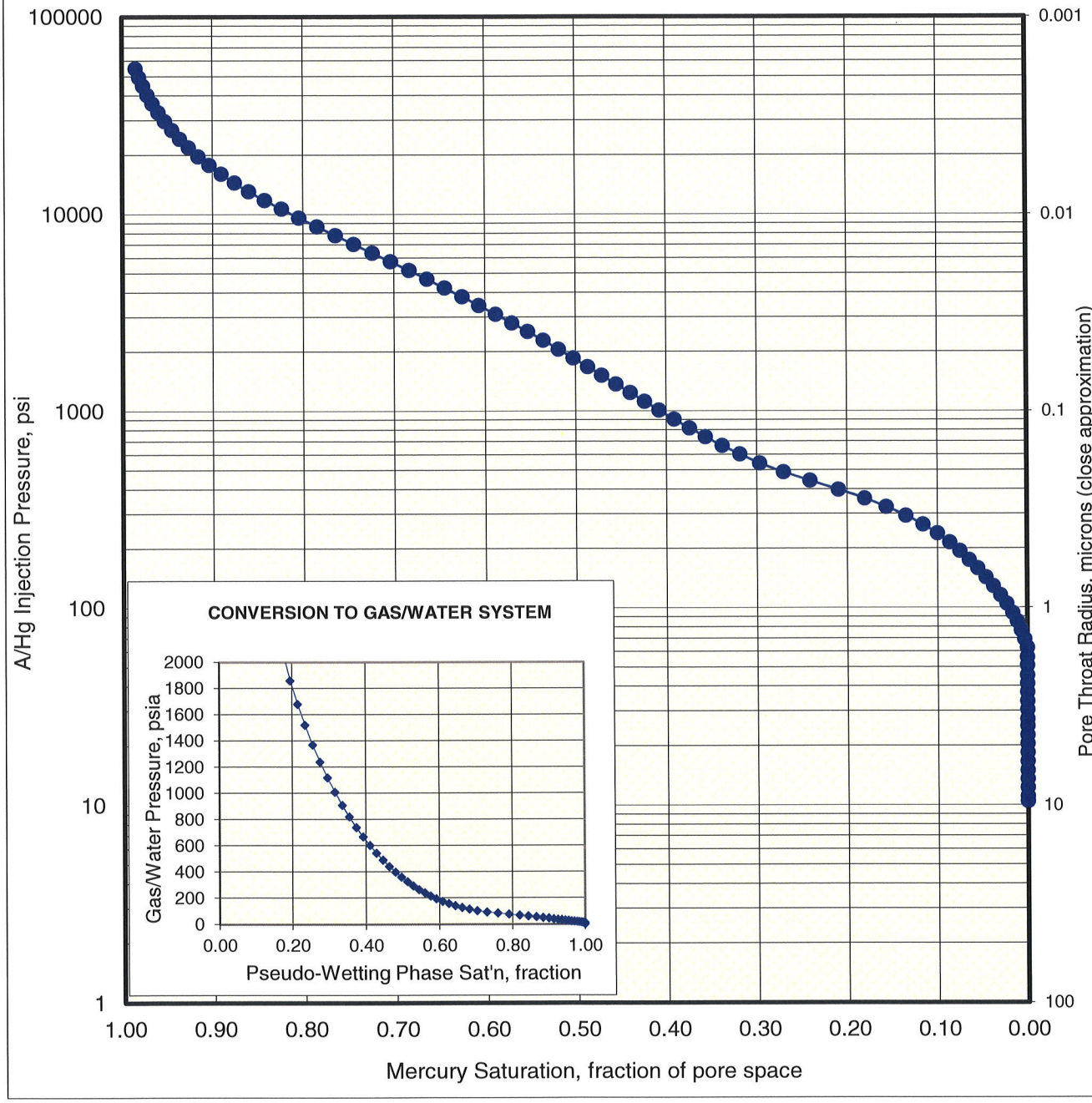
PERMEABILITY DISTRIBUTION



Company: University of North Dakota
Well: Aquistore
File: HOU-140757

Sample:	S7 #118653m	un-	Host Plug	
Depth, meters:	2105.20	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.0484	-	-
Porosity, fraction:		0.087	-	-
maximum Sb/Pc, fraction:		0.00483		
R35, microns:		0.152		
R50 (median pore throat radius):		0.0590		

MERCURY INJECTION



Core Laboratories

MERCURY INJECTION DATA SUMMARY

Company: University of North Dakota
Well: Aquistore
File: HOU-140757

Sample:	**S7 #118653m**	un-	Host Plug	
Depth, meters:	2105.20	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.0484	-	-
Porosity, fraction:		0.087	-	-
maximum Sb/Pc, fraction:		0.00483		
R35, microns:		0.152		
R50 (median pore throat radius):		0.0590		

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
10.5	0.000	1.000	10.3	0.00455	2.03	0.678	1.17	4.24	8.44
11.1	0.000	1.000	9.74	0.00480	2.14	0.714	1.24	4.49	8.92
12.3	0.000	1.000	8.79	0.00532	2.38	0.792	1.37	4.97	9.89
13.6	0.000	1.000	7.93	0.00589	2.63	0.877	1.52	5.50	10.9
15.0	0.000	1.000	7.16	0.00652	2.91	0.972	1.68	6.06	12.1
16.7	0.000	1.000	6.47	0.00722	3.23	1.08	1.86	6.75	13.4
18.5	0.000	1.000	5.83	0.00801	3.58	1.19	2.07	7.48	14.9
20.5	0.000	1.000	5.27	0.00887	3.96	1.32	2.29	8.28	16.5
22.7	0.000	1.000	4.74	0.00986	4.41	1.47	2.54	9.17	18.2
25.2	0.000	1.000	4.28	0.0109	4.88	1.63	2.82	10.2	20.3
27.3	0.000	1.000	3.94	0.0119	5.30	1.77	3.06	11.0	21.9
30.5	0.000	1.000	3.53	0.0132	5.92	1.97	3.42	12.3	24.5
33.7	0.000	1.000	3.20	0.0146	6.52	2.17	3.77	13.6	27.1
37.4	0.000	1.000	2.88	0.0162	7.25	2.42	4.18	15.1	30.1
41.4	0.000	1.000	2.61	0.0179	8.02	2.67	4.63	16.7	33.3
45.5	0.000	1.000	2.37	0.0197	8.81	2.94	5.09	18.4	36.6
51.1	0.000	1.000	2.11	0.0222	9.90	3.30	5.72	20.7	41.1
56.4	0.000	1.000	1.91	0.0244	10.9	3.64	6.31	22.8	45.3
62.9	0.000	1.000	1.71	0.0273	12.2	4.07	7.04	25.4	50.6
69.4	0.003	0.997	1.55	0.0301	13.4	4.48	7.76	28.0	55.8
77.0	0.007	0.993	1.40	0.0334	14.9	4.98	8.62	31.1	61.9
85.4	0.011	0.989	1.26	0.0370	16.6	5.52	9.56	34.5	68.6
94.3	0.016	0.984	1.14	0.0409	18.3	6.09	10.5	38.1	75.8
105	0.023	0.977	1.03	0.0454	20.3	6.77	11.7	42.4	84.4
116	0.030	0.970	0.927	0.0504	22.5	7.51	13.0	46.9	93.2
129	0.038	0.962	0.836	0.0559	25.0	8.32	14.4	52.1	104
143	0.046	0.954	0.753	0.0621	27.7	9.25	16.0	57.8	115
159	0.055	0.945	0.679	0.0688	30.8	10.3	17.8	64.3	128
175	0.065	0.935	0.615	0.0760	34.0	11.3	19.6	70.7	141
195	0.075	0.925	0.553	0.0845	37.8	12.6	21.8	78.8	157
215	0.087	0.913	0.501	0.0933	41.7	13.9	24.1	86.9	173
239	0.100	0.900	0.451	0.103	46.2	15.4	26.7	96.6	192
265	0.116	0.884	0.407	0.115	51.3	17.1	29.6	107	213
294	0.135	0.865	0.367	0.127	56.9	19.0	32.9	119	236

MERCURY INJECTION DATA SUMMARY

Company: University of North Dakota
Well: Aquistore
File: HOU-140757

Sample:	**S7 #118653m**	un-	Host Plug	
Depth, meters:	2105.20	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.0484	-	-
Porosity, fraction:		0.087	-	-
maximum Sb/Pc, fraction:		0.00483		
R35, microns:		0.152		
R50 (median pore throat radius):		0.0590		

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
326	0.157	0.843	0.330	0.141	63.2	21.1	36.5	132	262
360	0.181	0.819	0.299	0.156	69.8	23.3	40.3	145	289
399	0.210	0.790	0.270	0.173	77.3	25.8	44.6	161	321
443	0.241	0.759	0.243	0.192	85.8	28.6	49.5	179	356
490	0.271	0.729	0.220	0.212	94.9	31.6	54.8	198	394
543	0.297	0.703	0.198	0.235	105	35.1	60.7	219	436
603	0.319	0.681	0.179	0.262	117	39.0	67.5	244	485
667	0.339	0.661	0.162	0.289	129	43.1	74.6	270	536
739	0.357	0.643	0.146	0.320	143	47.7	82.7	299	594
820	0.375	0.625	0.131	0.355	159	52.9	91.7	331	659
907	0.392	0.608	0.119	0.393	176	58.6	102	367	729
1010	0.408	0.592	0.107	0.437	195	65.1	113	408	812
1120	0.424	0.576	0.0966	0.484	216	72.0	125	453	900
1240	0.440	0.560	0.0872	0.536	240	79.8	138	501	997
1370	0.456	0.544	0.0787	0.594	265	88.5	153	554	1100
1520	0.471	0.529	0.0710	0.658	294	98.0	170	614	1220
1680	0.487	0.513	0.0641	0.729	326	109	188	679	1350
1860	0.503	0.497	0.0578	0.808	361	120	209	752	1500
2060	0.519	0.481	0.0522	0.895	400	133	231	833	1660
2290	0.536	0.464	0.0471	0.992	443	148	256	925	1840
2540	0.553	0.447	0.0425	1.10	491	164	284	1030	2040
2810	0.571	0.429	0.0383	1.22	544	181	314	1140	2260
3110	0.589	0.411	0.0346	1.35	603	201	348	1260	2500
3450	0.607	0.393	0.0312	1.50	668	223	386	1390	2770
3820	0.626	0.374	0.0282	1.66	741	247	428	1540	3070
4230	0.645	0.355	0.0254	1.84	821	274	474	1710	3400
4690	0.664	0.336	0.0230	2.03	909	303	525	1900	3770
5200	0.684	0.316	0.0207	2.25	1010	336	582	2100	4180
5760	0.704	0.296	0.0187	2.50	1120	372	644	2330	4630
6380	0.724	0.276	0.0169	2.77	1240	412	714	2580	5130
7070	0.744	0.256	0.0152	3.07	1370	457	791	2860	5680
7840	0.765	0.235	0.0138	3.40	1520	506	877	3170	6300
8680	0.785	0.215	0.0124	3.76	1680	561	971	3510	6980
9620	0.804	0.196	0.0112	4.17	1860	621	1080	3890	7730

MERCURY INJECTION DATA SUMMARY

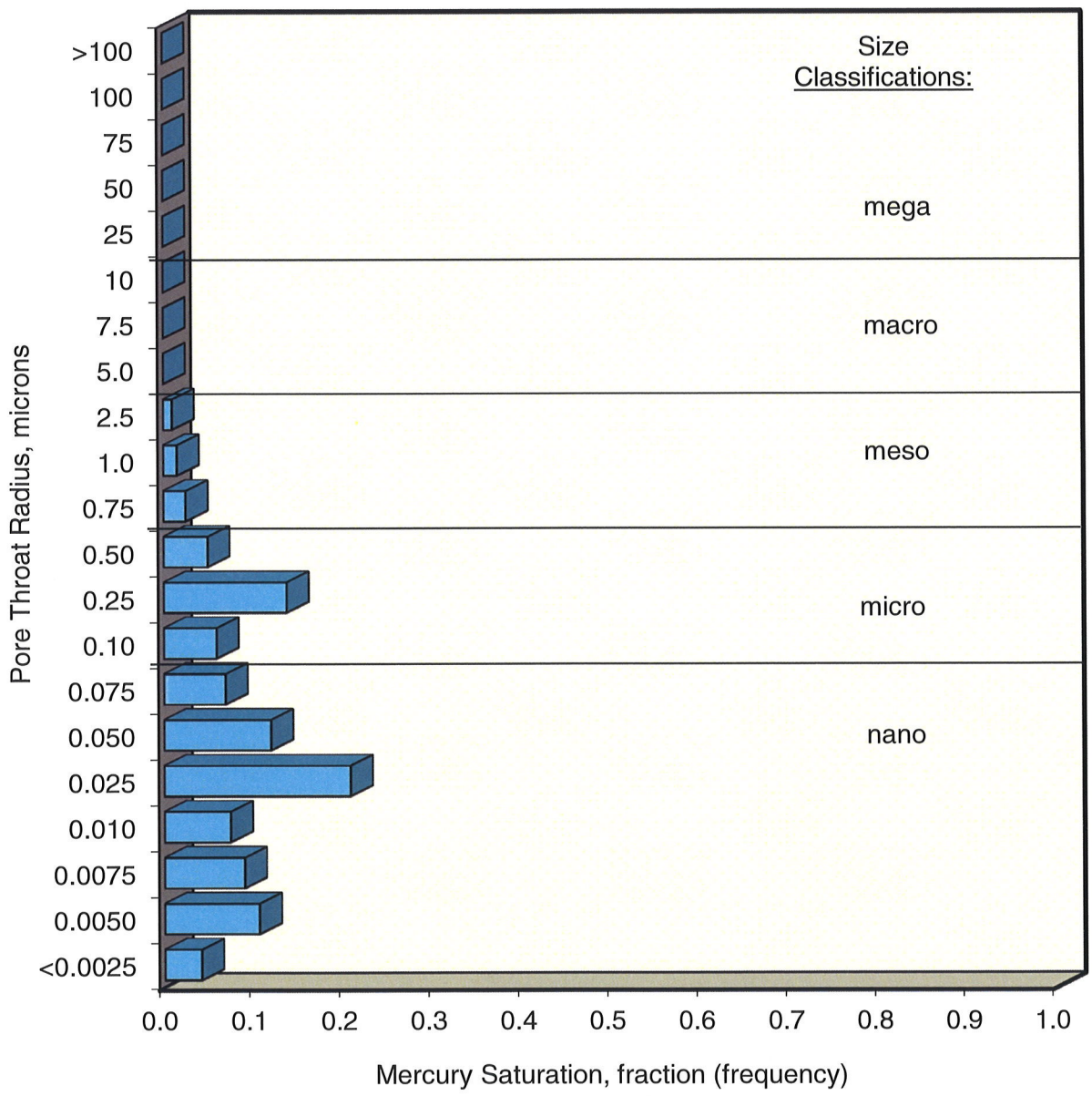
Company: University of North Dakota
Well: Aquistore
File: HOU-140757

Sample:	**S7 #118653m**	un-	Host Plug	
Depth, meters:	2105.20	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.0484	-	-
Porosity, fraction:		0.087	-	-
maximum Sb/Pc, fraction:		0.00483		
R35, microns:		0.152		
R50 (median pore throat radius):		0.0590		

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
10700	0.824	0.176	0.0101	4.62	2070	689	1190	4320	8600
11800	0.842	0.158	0.00912	5.12	2290	763	1320	4770	9480
13100	0.860	0.140	0.00823	5.67	2540	845	1460	5290	10500
14500	0.876	0.124	0.00743	6.29	2810	937	1620	5860	11700
16100	0.890	0.110	0.00671	6.97	3110	1040	1800	6510	12900
17800	0.904	0.096	0.00605	7.72	3450	1150	1990	7190	14300
19700	0.916	0.084	0.00546	8.55	3820	1270	2210	7960	15800
21900	0.926	0.074	0.00493	9.48	4240	1410	2450	8850	17600
24200	0.936	0.064	0.00445	10.5	4690	1560	2710	9780	19500
26800	0.945	0.055	0.00402	11.6	5200	1730	3000	10800	21500
29700	0.953	0.047	0.00362	12.9	5760	1920	3330	12000	23900
32900	0.960	0.040	0.00327	14.3	6380	2130	3680	13300	26400
36500	0.966	0.034	0.00295	15.8	7070	2360	4080	14800	29300
40400	0.972	0.028	0.00266	17.5	7840	2610	4520	16300	32500
44800	0.977	0.023	0.00241	19.4	8680	2890	5010	18100	36000
49600	0.981	0.019	0.00217	21.5	9620	3210	5550	20000	39900
55000	0.985	0.015	0.00196	23.8	10700	3550	6150	22200	44200

Company:	University of North Dakota	**Sample:**	**S6 #118652-2m**	un-	Host Plug
Well:	Aquistore	Depth, meters:	2104.70	stressed	n/a n/a
File:	HOU-140757	Klinkenberg Permeability, md:		N/A	- -
		Permeability to Air, md:		N/A	- -
		Swanson Permeability, md:		0.00473	- -
		Porosity, fraction:		0.052	- -
		maximum Sb/Pc, fraction:		0.00122	
		R35, microns:		0.0542	
		R50 (median pore throat radius):		0.0228	

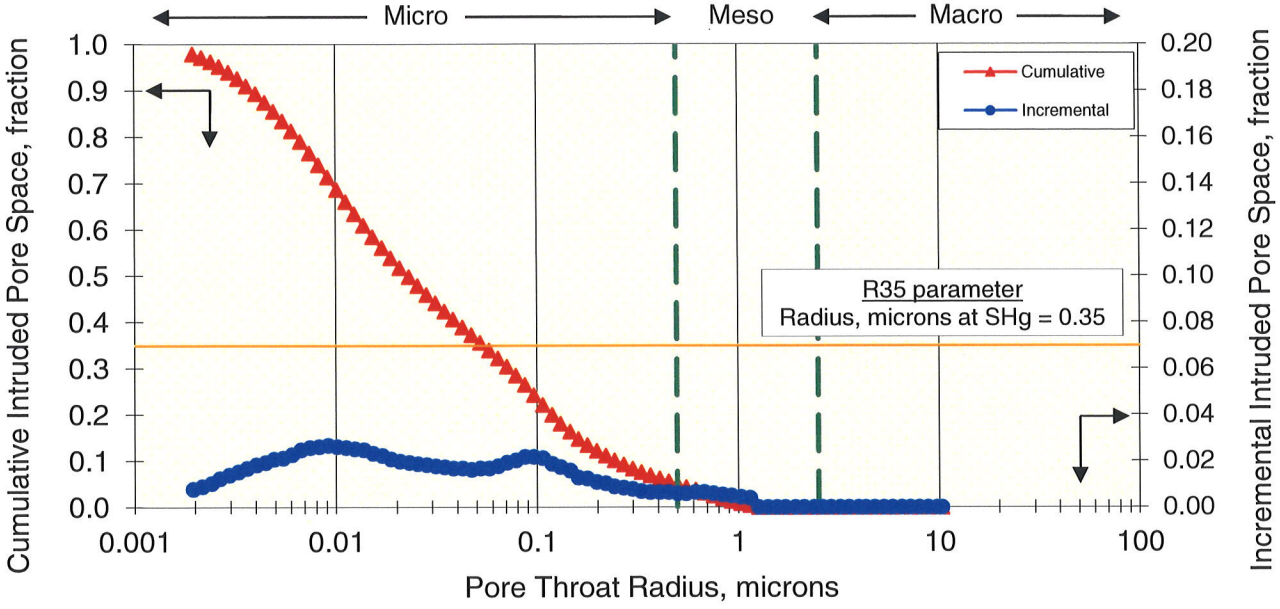
PORE THROAT SIZE HISTOGRAM



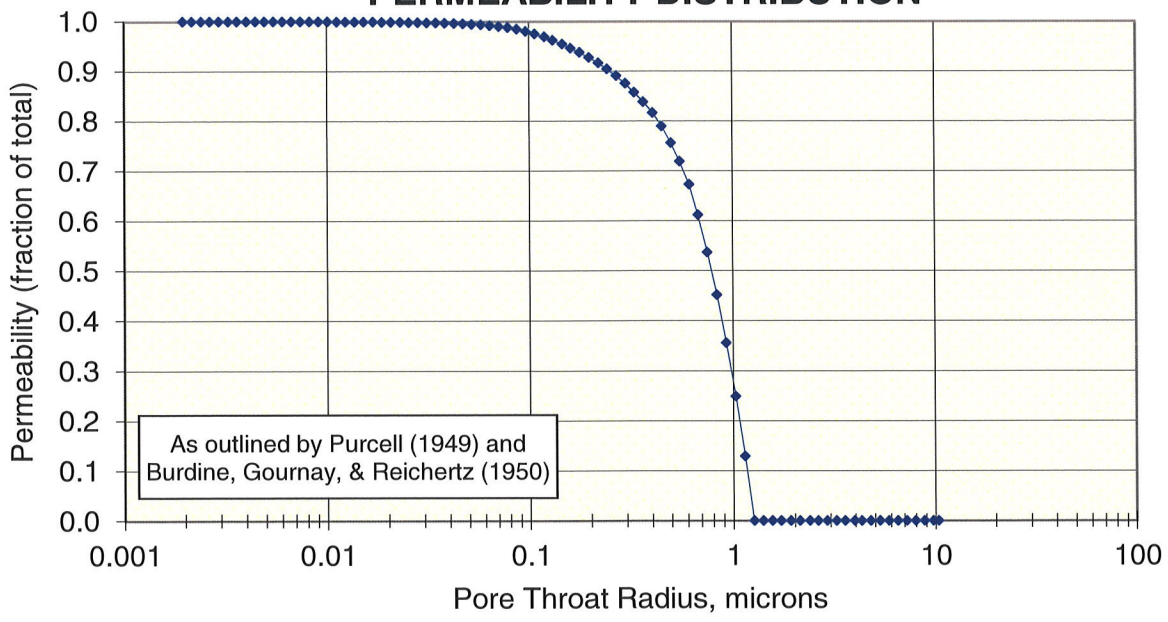
Company:	University of North Dakota
Well:	Aquistore
File:	HOU-140757

Sample:	S6 #118652-2m	un-stressed	Host Plug	
Depth, meters:	2104.70		n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.00473	-	-
Porosity, fraction:		0.052	-	-
maximum Sb/Pc, fraction:		0.00122		
R35, microns:		0.0542		
R50 (median pore throat radius):		0.0228		

PORE THROAT RADIUS DISTRIBUTION



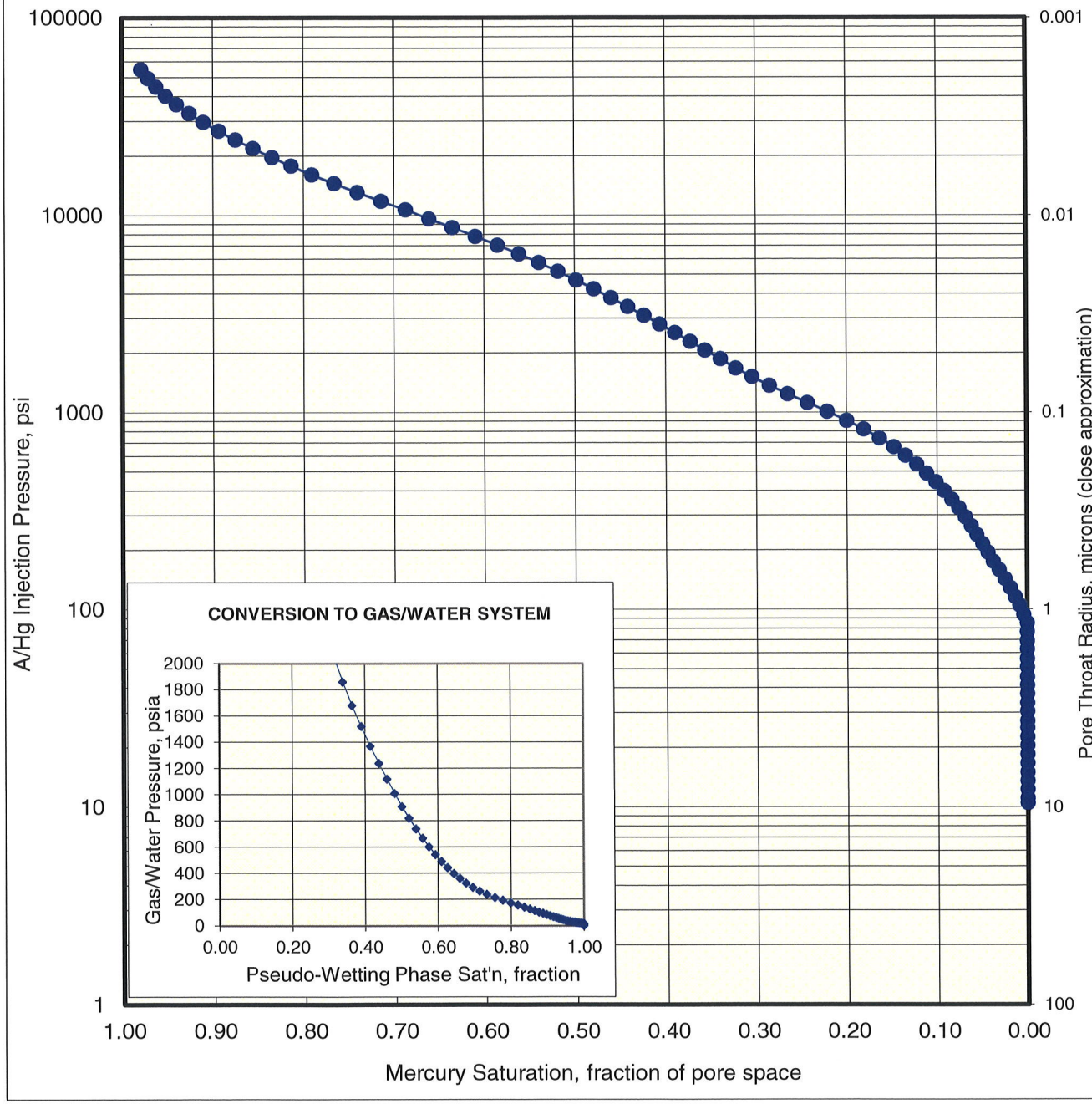
PERMEABILITY DISTRIBUTION



Company:	University of North Dakota
Well:	Aquistore
File:	HOU-140757

Sample:	S6 #118652-2m	un-	Host Plug	
Depth, meters:	2104.70	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.00473	-	-
Porosity, fraction:		0.052	-	-
maximum Sb/Pc, fraction:		0.00122		
R35, microns:		0.0542		
R50 (median pore throat radius):		0.0228		

MERCURY INJECTION



Core Laboratories

MERCURY INJECTION DATA SUMMARY

Company: University of North Dakota
Well: Aquistore
File: HOU-140757

Sample:	**S6 #118652-2m**	un-	Host Plug	
Depth, meters:	2104.70	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.00473	-	-
Porosity, fraction:		0.052	-	-
maximum Sb/Pc, fraction:		0.00122		
R35, microns:		0.0542		
R50 (median pore throat radius):		0.0228		

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
10.5	0.000	1.000	10.3	0.00185	2.03	0.678	1.17	4.24	8.44
11.1	0.000	1.000	9.74	0.00195	2.14	0.714	1.24	4.49	8.92
12.3	0.000	1.000	8.79	0.00216	2.38	0.792	1.37	4.97	9.89
13.6	0.000	1.000	7.93	0.00239	2.63	0.877	1.52	5.50	10.9
15.0	0.000	1.000	7.16	0.00265	2.91	0.972	1.68	6.06	12.1
16.7	0.000	1.000	6.47	0.00294	3.23	1.08	1.86	6.75	13.4
18.5	0.000	1.000	5.83	0.00326	3.58	1.19	2.07	7.48	14.9
20.5	0.000	1.000	5.27	0.00361	3.96	1.32	2.29	8.28	16.5
22.7	0.000	1.000	4.74	0.00401	4.41	1.47	2.54	9.17	18.2
25.2	0.000	1.000	4.28	0.00444	4.88	1.63	2.82	10.2	20.3
27.3	0.000	1.000	3.94	0.00482	5.30	1.77	3.06	11.0	21.9
30.6	0.000	1.000	3.53	0.00539	5.92	1.97	3.42	12.4	24.6
33.7	0.000	1.000	3.20	0.00594	6.53	2.18	3.77	13.6	27.1
37.4	0.000	1.000	2.88	0.00659	7.25	2.42	4.18	15.1	30.1
41.4	0.000	1.000	2.60	0.00729	8.02	2.67	4.63	16.7	33.3
45.5	0.000	1.000	2.37	0.00802	8.82	2.94	5.09	18.4	36.6
51.1	0.000	1.000	2.11	0.00901	9.91	3.30	5.72	20.7	41.1
56.4	0.000	1.000	1.91	0.00994	10.9	3.64	6.31	22.8	45.3
63.0	0.000	1.000	1.71	0.0111	12.2	4.07	7.04	25.5	50.6
69.4	0.000	1.000	1.55	0.0122	13.4	4.48	7.76	28.0	55.8
77.1	0.000	1.000	1.40	0.0136	14.9	4.98	8.62	31.2	62.0
85.5	0.000	1.000	1.26	0.0151	16.6	5.52	9.56	34.6	68.7
94.3	0.004	0.996	1.14	0.0166	18.3	6.09	10.6	38.1	75.8
105	0.008	0.992	1.03	0.0185	20.3	6.77	11.7	42.4	84.4
116	0.013	0.987	0.926	0.0205	22.5	7.51	13.0	46.9	93.2
129	0.019	0.981	0.836	0.0227	25.0	8.33	14.4	52.1	104
143	0.025	0.975	0.752	0.0253	27.8	9.25	16.0	57.8	115
159	0.031	0.969	0.678	0.0280	30.8	10.3	17.8	64.3	128
175	0.038	0.962	0.614	0.0309	34.0	11.3	19.6	70.7	141
195	0.044	0.956	0.552	0.0344	37.8	12.6	21.8	78.8	157
215	0.050	0.950	0.500	0.0380	41.7	13.9	24.1	86.9	173
239	0.056	0.944	0.451	0.0421	46.3	15.4	26.7	96.6	192
265	0.063	0.937	0.407	0.0467	51.3	17.1	29.6	107	213
294	0.069	0.931	0.366	0.0518	57.0	19.0	32.9	119	236

MERCURY INJECTION DATA SUMMARY

Company: University of North Dakota
Well: Aquistore
File: HOU-140757

Sample:	**S6 #118652-2m**	un-	Host Plug	
Depth, meters:	2104.70	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		0.00473	-	-
Porosity, fraction:		0.052	-	-
maximum Sb/Pc, fraction:		0.00122		
R35, microns:		0.0542		
R50 (median pore throat radius):		0.0228		

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
327	0.076	0.924	0.330	0.0576	63.3	21.1	36.5	132	263
361	0.084	0.916	0.299	0.0636	69.9	23.3	40.4	146	290
400	0.092	0.908	0.270	0.0704	77.4	25.8	44.7	162	322
444	0.101	0.899	0.243	0.0782	86.0	28.7	49.6	179	357
490	0.112	0.888	0.220	0.0865	95.0	31.7	54.9	198	394
544	0.123	0.877	0.198	0.0959	105	35.1	60.8	220	437
604	0.135	0.865	0.178	0.107	117	39.0	67.6	244	485
668	0.148	0.852	0.161	0.118	129	43.1	74.7	270	537
740	0.164	0.836	0.146	0.130	143	47.8	82.8	299	595
821	0.181	0.819	0.131	0.145	159	53.0	91.8	332	660
909	0.200	0.800	0.119	0.160	176	58.7	102	367	731
1010	0.221	0.779	0.107	0.178	195	65.1	113	408	812
1120	0.243	0.757	0.0965	0.197	216	72.1	125	453	900
1240	0.265	0.735	0.0871	0.218	240	79.9	138	501	997
1370	0.285	0.715	0.0786	0.242	266	88.5	153	554	1100
1520	0.305	0.695	0.0710	0.268	294	98.1	170	614	1220
1680	0.323	0.677	0.0640	0.297	326	109	188	679	1350
1870	0.340	0.660	0.0578	0.329	362	121	209	756	1500
2070	0.356	0.644	0.0521	0.364	400	133	231	837	1660
2290	0.373	0.627	0.0471	0.404	444	148	256	925	1840
2540	0.390	0.610	0.0425	0.447	492	164	284	1030	2040
2810	0.407	0.593	0.0383	0.496	545	182	315	1140	2260
3110	0.424	0.576	0.0346	0.549	604	201	348	1260	2500
3450	0.442	0.558	0.0312	0.608	669	223	386	1390	2770
3820	0.460	0.540	0.0282	0.674	741	247	428	1540	3070
4240	0.479	0.521	0.0254	0.747	821	274	474	1710	3410
4690	0.498	0.502	0.0230	0.827	909	303	525	1900	3770
5200	0.518	0.482	0.0207	0.917	1010	336	582	2100	4180
5760	0.539	0.461	0.0187	1.02	1120	372	644	2330	4630
6380	0.561	0.439	0.0169	1.13	1240	412	714	2580	5130
7070	0.585	0.415	0.0152	1.25	1370	457	791	2860	5680
7840	0.610	0.390	0.0137	1.38	1520	506	877	3170	6300
8680	0.635	0.365	0.0124	1.53	1680	561	971	3510	6980
9620	0.661	0.339	0.0112	1.70	1860	621	1080	3890	7730

MERCURY INJECTION DATA SUMMARY

Company: University of North Dakota
Well: Aquistore
File: HOU-140757

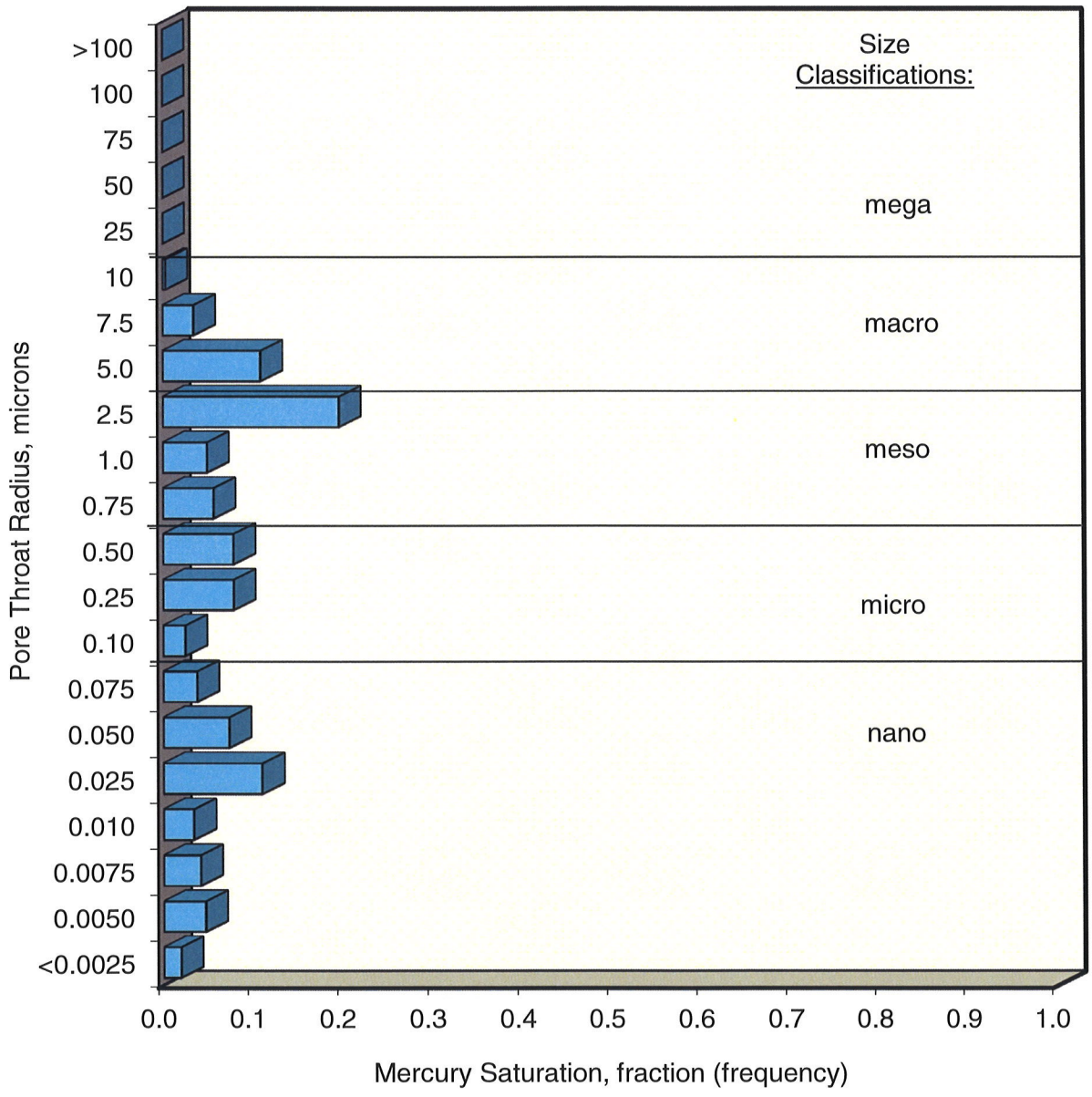
Sample: S6 #118652-2m	un-	Host Plug	
Depth, meters: 2104.70	stressed	n/a	n/a
Klinkenberg Permeability, md:	N/A	-	-
Permeability to Air, md:	N/A	-	-
Swanson Permeability, md:	0.00473	-	-
Porosity, fraction:	0.052	-	-
maximum Sb/Pc, fraction:	0.00122		
R35, microns:	0.0542		
R50 (median pore throat radius):	0.0228		

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
10700	0.687	0.313	0.0101	1.88	2070	689	1190	4320	8600
11800	0.714	0.286	0.00912	2.08	2290	763	1320	4770	9480
13100	0.740	0.260	0.00823	2.31	2540	845	1460	5290	10500
14500	0.766	0.234	0.00743	2.56	2810	937	1620	5860	11700
16100	0.791	0.209	0.00671	2.83	3110	1040	1800	6510	12900
17800	0.814	0.186	0.00605	3.14	3450	1150	1990	7190	14300
19700	0.835	0.165	0.00546	3.48	3820	1270	2210	7960	15800
21900	0.856	0.144	0.00493	3.85	4240	1410	2450	8850	17600
24200	0.875	0.125	0.00445	4.27	4690	1560	2710	9780	19500
26800	0.893	0.107	0.00402	4.73	5200	1730	3000	10800	21500
29700	0.910	0.090	0.00362	5.24	5760	1920	3330	12000	23900
32900	0.926	0.074	0.00327	5.81	6380	2130	3690	13300	26400
36500	0.940	0.060	0.00295	6.43	7070	2360	4080	14800	29300
40400	0.952	0.048	0.00266	7.13	7840	2610	4520	16300	32500
44800	0.962	0.038	0.00241	7.90	8680	2890	5010	18100	36000
49600	0.971	0.029	0.00217	8.75	9620	3210	5550	20000	39900
55000	0.979	0.021	0.00196	9.69	10700	3550	6150	22200	44200

Company:	University of North Dakota
Well:	Aquistore
File:	HOU-140757

Sample:	**S5 #118649-2m**	un-	Host Plug	
Depth, meters:	2103.40	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		1.92	-	-
Porosity, fraction:		0.117	-	-
maximum Sb/Pc, fraction:		0.0426		
R35, microns:		0.973		
R50 (median pore throat radius):		0.334		

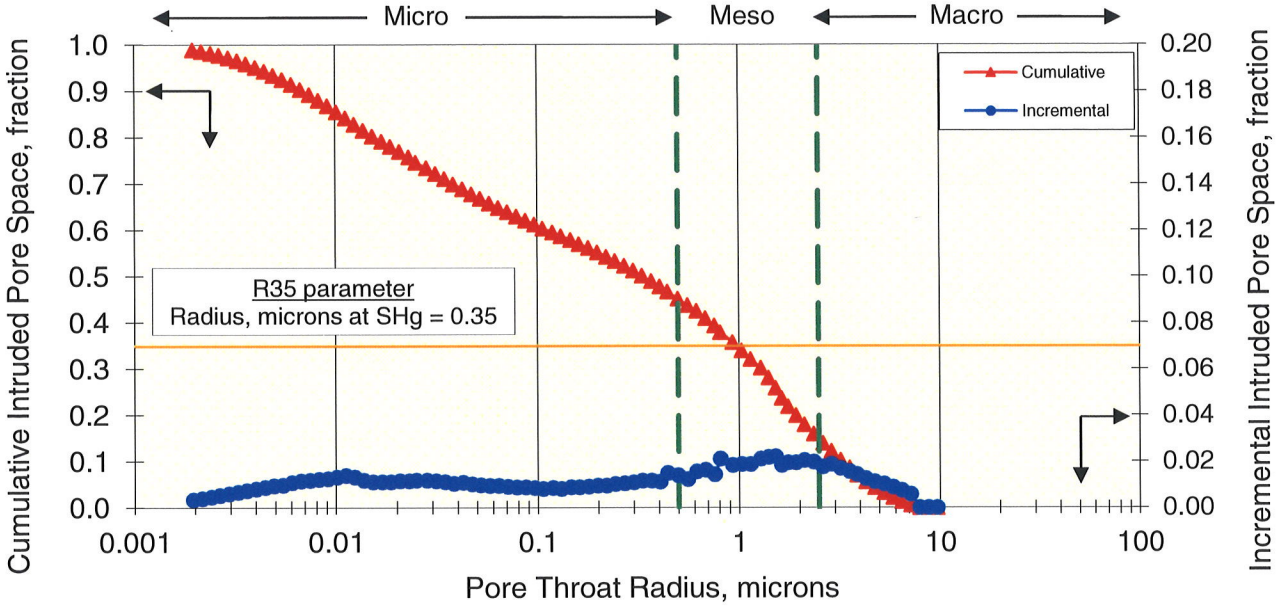
PORE THROAT SIZE HISTOGRAM



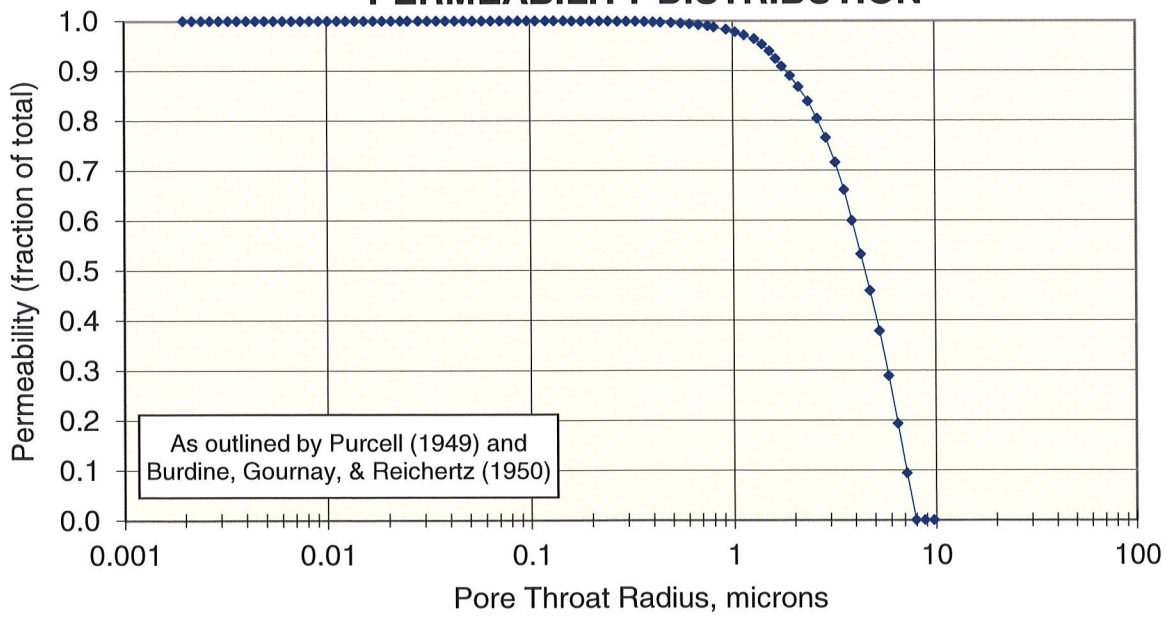
Company:	University of North Dakota
Well:	Aquistore
File:	HOU-140757

Sample:	S5 #118649-2m	un-	Host Plug	
Depth, meters:	2103.40	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		1.92	-	-
Porosity, fraction:		0.117	-	-
maximum Sb/Pc, fraction:		0.0426		
R35, microns:		0.973		
R50 (median pore throat radius):		0.334		

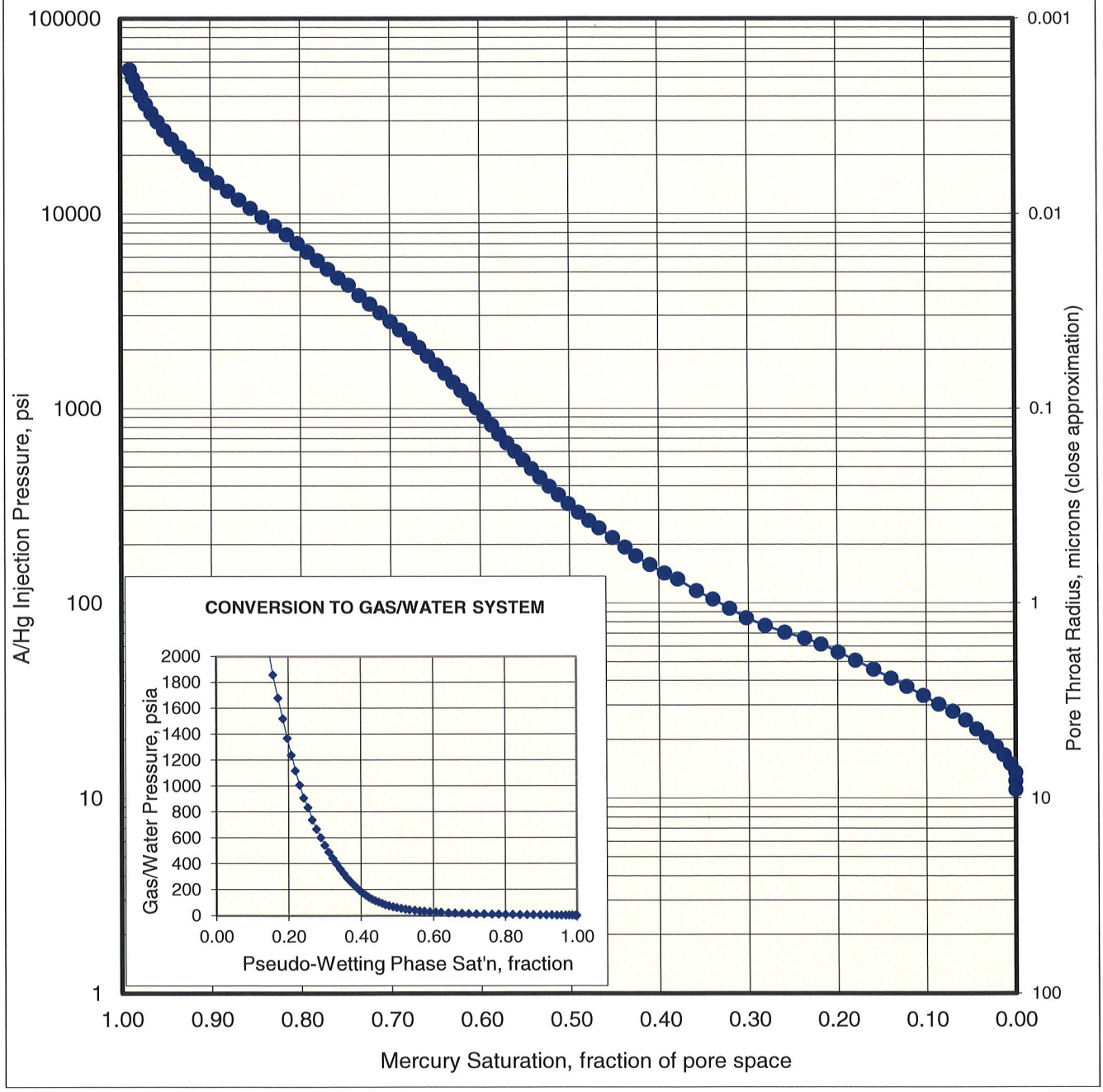
PORE THROAT RADIUS DISTRIBUTION



PERMEABILITY DISTRIBUTION



MERCURY INJECTION



Core Laboratories

MERCURY INJECTION DATA SUMMARY

Company: University of North Dakota
Well: Aquistore
File: HOU-140757

Sample:	**S5 #118649-2m**	un-	Host Plug	
Depth, meters:	2103.40	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		1.92	-	-
Porosity, fraction:		0.117	-	-
maximum Sb/Pc, fraction:		0.0426		
R35, microns:		0.973		
R50 (median pore throat radius):		0.334		

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
11.1	0.000	1.000	9.72	0.0262	2.15	0.716	1.24	4.49	8.92
12.3	0.000	1.000	8.79	0.0290	2.38	0.792	1.37	4.97	9.89
13.6	0.000	1.000	7.93	0.0321	2.63	0.877	1.52	5.50	10.9
15.0	0.006	0.994	7.16	0.0356	2.91	0.972	1.68	6.06	12.1
16.7	0.013	0.987	6.46	0.0394	3.23	1.08	1.87	6.75	13.4
18.5	0.022	0.978	5.84	0.0436	3.58	1.19	2.07	7.48	14.9
20.5	0.032	0.968	5.27	0.0484	3.96	1.32	2.29	8.28	16.5
22.7	0.044	0.956	4.74	0.0538	4.41	1.47	2.54	9.17	18.2
25.2	0.056	0.944	4.28	0.0595	4.88	1.63	2.82	10.2	20.3
27.9	0.071	0.929	3.86	0.0660	5.41	1.80	3.12	11.3	22.4
30.4	0.086	0.914	3.54	0.0719	5.89	1.96	3.40	12.3	24.4
33.7	0.103	0.897	3.20	0.0797	6.53	2.18	3.77	13.6	27.1
37.4	0.122	0.878	2.88	0.0883	7.24	2.41	4.18	15.1	30.1
41.3	0.140	0.860	2.61	0.0977	8.01	2.67	4.62	16.7	33.2
45.9	0.159	0.841	2.35	0.109	8.89	2.96	5.13	18.5	36.9
51.0	0.180	0.820	2.11	0.121	9.88	3.29	5.70	20.6	41.0
56.2	0.199	0.801	1.92	0.133	10.9	3.63	6.28	22.7	45.2
61.7	0.219	0.781	1.75	0.146	12.0	3.99	6.90	24.9	49.6
66.2	0.237	0.763	1.63	0.157	12.8	4.28	7.41	26.8	53.2
71.0	0.259	0.741	1.52	0.168	13.8	4.59	7.94	28.7	57.1
77.0	0.281	0.719	1.40	0.182	14.9	4.97	8.61	31.1	61.9
84.3	0.302	0.698	1.28	0.199	16.3	5.44	9.43	34.1	67.8
94.2	0.321	0.679	1.14	0.223	18.2	6.08	10.5	38.1	75.7
105	0.340	0.660	1.03	0.248	20.3	6.77	11.7	42.4	84.4
116	0.358	0.642	0.927	0.275	22.5	7.51	13.0	46.9	93.2
133	0.379	0.621	0.808	0.315	25.8	8.62	14.9	53.8	107
143	0.394	0.606	0.754	0.338	27.7	9.24	16.0	57.8	115
158	0.410	0.590	0.681	0.374	30.6	10.2	17.7	63.9	127
175	0.426	0.574	0.615	0.414	33.9	11.3	19.6	70.7	141
194	0.438	0.562	0.554	0.460	37.7	12.6	21.8	78.4	156
217	0.452	0.548	0.497	0.512	42.0	14.0	24.2	87.7	174
244	0.467	0.533	0.441	0.577	47.3	15.8	27.3	98.6	196
266	0.478	0.522	0.405	0.628	51.5	17.2	29.7	108	214
293	0.490	0.510	0.367	0.694	56.9	19.0	32.8	118	236

MERCURY INJECTION DATA SUMMARY

Company: University of North Dakota
Well: Aquistore
File: HOU-140757

Sample:	**S5 #118649-2m**	un-	Host Plug	
Depth, meters:	2103.40	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		1.92	-	-
Porosity, fraction:		0.117	-	-
maximum Sb/Pc, fraction:		0.0426		
R35, microns:		0.973		
R50 (median pore throat radius):		0.334		

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
325	0.501	0.499	0.331	0.769	63.0	21.0	36.4	131	261
361	0.512	0.488	0.299	0.853	69.9	23.3	40.4	146	290
399	0.523	0.477	0.270	0.944	77.4	25.8	44.7	161	321
444	0.533	0.467	0.243	1.05	86.0	28.7	49.7	179	357
491	0.542	0.458	0.220	1.16	95.1	31.7	54.9	198	395
544	0.552	0.448	0.198	1.29	106	35.2	60.9	220	437
603	0.561	0.439	0.179	1.42	117	38.9	67.4	244	485
668	0.570	0.430	0.161	1.58	129	43.2	74.7	270	537
740	0.579	0.421	0.146	1.75	143	47.8	82.8	299	595
821	0.587	0.413	0.131	1.94	159	53.1	91.9	332	660
909	0.596	0.404	0.119	2.15	176	58.7	102	367	731
1010	0.604	0.396	0.106	2.39	196	65.4	113	408	812
1120	0.612	0.388	0.0965	2.64	216	72.1	125	453	900
1240	0.621	0.379	0.0871	2.92	240	79.9	138	501	997
1370	0.630	0.370	0.0786	3.24	266	88.6	153	554	1100
1520	0.639	0.361	0.0709	3.59	294	98.1	170	614	1220
1680	0.649	0.351	0.0640	3.98	326	109	188	679	1350
1860	0.658	0.342	0.0578	4.41	361	120	209	752	1500
2070	0.668	0.332	0.0521	4.89	401	134	231	837	1660
2290	0.678	0.322	0.0471	5.41	444	148	256	925	1840
2540	0.689	0.311	0.0425	6.00	492	164	284	1030	2040
2810	0.700	0.300	0.0383	6.65	545	182	314	1140	2260
3110	0.711	0.289	0.0346	7.36	603	201	348	1260	2500
3450	0.723	0.277	0.0312	8.16	669	223	386	1390	2770
3820	0.735	0.265	0.0282	9.04	741	247	428	1540	3070
4320	0.747	0.253	0.0250	10.2	837	279	483	1750	3470
4690	0.758	0.242	0.0230	11.1	909	303	525	1900	3770
5200	0.770	0.230	0.0207	12.3	1010	336	582	2100	4180
5760	0.781	0.219	0.0187	13.6	1120	372	645	2330	4630
6380	0.792	0.208	0.0169	15.1	1240	412	714	2580	5130
7070	0.803	0.197	0.0152	16.7	1370	457	791	2860	5680
7840	0.815	0.185	0.0137	18.5	1520	506	877	3170	6300
8680	0.829	0.171	0.0124	20.5	1680	561	972	3510	6980
9620	0.843	0.157	0.0112	22.7	1860	622	1080	3890	7730

MERCURY INJECTION DATA SUMMARY

Company: University of North Dakota
Well: Aquistore
File: HOU-140757

Sample:	**S5 #118649-2m**	un-	Host Plug	
Depth, meters:	2103.40	stressed	n/a	n/a
Klinkenberg Permeability, md:		N/A	-	-
Permeability to Air, md:		N/A	-	-
Swanson Permeability, md:		1.92	-	-
Porosity, fraction:		0.117	-	-
maximum Sb/Pc, fraction:		0.0426		
R35, microns:		0.973		
R50 (median pore throat radius):		0.334		

Injection Pressure, psia	Mercury Saturation, fraction	Pseudo-Wetting Saturation, fraction	Pore Throat Radius, microns	J Values	Conversion to other Laboratory Fluid Systems, psia			Estimated Height Above Free Water, feet	
					G-W	G-O	O-W	G-W	O-W
10700	0.856	0.144	0.0101	25.2	2070	689	1190	4320	8600
11800	0.868	0.132	0.00912	27.9	2290	763	1320	4770	9480
13100	0.881	0.119	0.00823	30.9	2540	845	1460	5290	10500
14500	0.893	0.107	0.00743	34.3	2810	937	1620	5860	11700
16100	0.904	0.096	0.00671	38.0	3110	1040	1800	6510	12900
17800	0.915	0.085	0.00605	42.1	3450	1150	1990	7190	14300
19700	0.925	0.075	0.00546	46.6	3820	1270	2210	7960	15800
21900	0.935	0.065	0.00493	51.7	4240	1410	2450	8850	17600
24200	0.943	0.057	0.00445	57.3	4690	1560	2710	9780	19500
26800	0.952	0.048	0.00402	63.4	5200	1730	3000	10800	21500
29700	0.959	0.041	0.00362	70.3	5760	1920	3330	12000	23900
32900	0.966	0.034	0.00327	77.9	6380	2130	3680	13300	26400
36500	0.972	0.028	0.00295	86.3	7070	2360	4080	14800	29300
40400	0.978	0.022	0.00266	95.6	7840	2610	4520	16300	32500
44800	0.982	0.018	0.00241	106	8680	2890	5010	18100	36000
49600	0.986	0.014	0.00217	117	9620	3210	5550	20000	39900
55000	0.990	0.010	0.00196	130	10700	3550	6150	22200	44200

APPENDIX C

CORE LABORATORIES
TOC AND ROCK-EVAL
SUMMARY REPORT

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Source Rock Analysis

TOC, Kerogen Quality and Thermal Maturity Testing

Rock Eval 6

Version 4.09

University of North Dakota

Aquistore
Upper & Middle Bakken
North Dakota

140757G-Extracted

9/11/2014

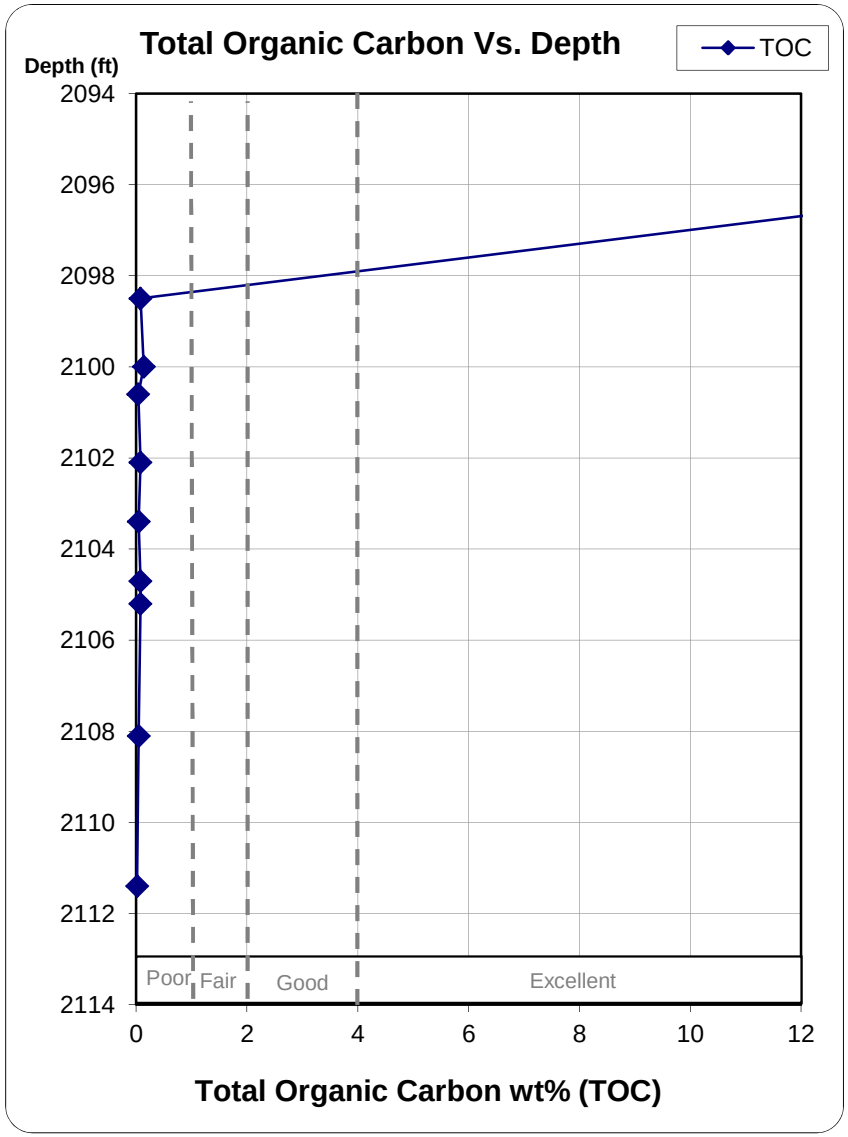
Core Laboratories
6316 Windfern Houston, TX 77040
713-328-2673

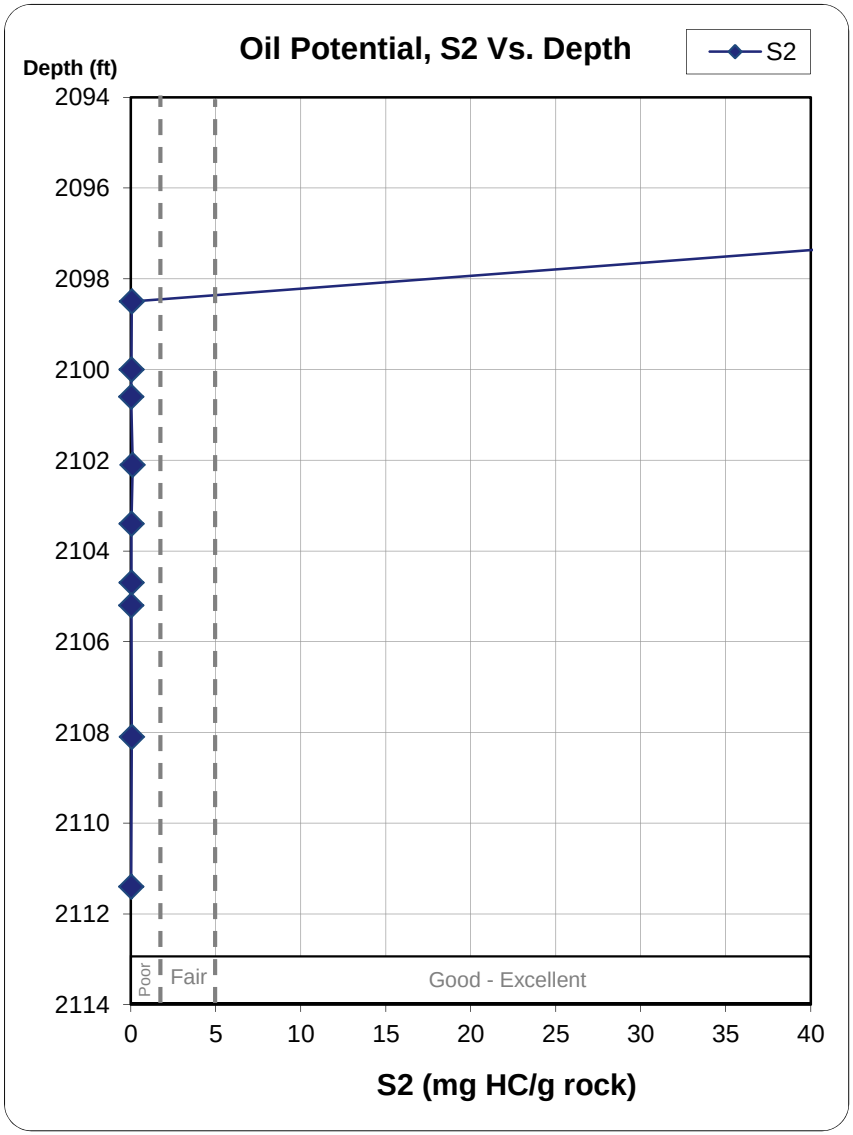
Source Rock Analysis Data Page

Well Name	Formation	Location	Sample ID	Depth ft.	Sample Wt. mg	TOC wt%	S1 mg HC/g	S2 mg HC/g	S3 CO_2 mg CO2/g	S3 CO mg CO/g	Tmax ˚C	HI S2x100/TOC	OI S3x100/TOC	PI S1/(S1+S2)	OSI S1x100/TOC	Oil From Kerogen bbl oil/ac-ft	Gas From Kerogen mcf/ac-ft	VRo-Eq (%) Calculated	Remarks Comments
Aquistore	Upper Bakken	North Dakota	S11-118657	2096.1	20.8	15.89	1.21	84.57	0.06	0.23	436	532.22	0.38	0.01	7.61	1851.24	11107.42	0.69	
Aquistore	Middle Bakken	North Dakota	S1-118645-2	2098.5	60.7	0.08	0.01	0.07	0.01	0	423	87.50	12.50	0.13	12.50	1.53	9.19		*Unreliable Tmax
Aquistore	Middle Bakken	North Dakota	S2-118646-2	2100	60.3	0.14	0.01	0.05	0.02	0.03	410	35.71	14.29	0.17	7.14	1.09	6.57		*Unreliable Tmax
Aquistore	Middle Bakken	North Dakota	S3-118647-2	2100.6	60.7	0.04	0	0.03	0	0	426	75.00	0.00	0.00	0.00	0.66	3.94		*Unreliable Tmax
Aquistore	Middle Bakken	North Dakota	S4-118648-2	2102.1	60.6	0.08	0.03	0.11	0.01	0.01	435	137.50	12.50	0.21	37.50	2.41	14.45	0.67	S2 shoulder (s)
Aquistore	Middle Bakken	North Dakota	S5-118649-2	2103.4	60.5	0.05	0	0.05	0.01	0	436	100.00	20.00	0.00	0.00	1.09	6.57	0.69	S2 shoulder (s)
Aquistore	Middle Bakken	North Dakota	S6-118649-2	2104.7	60.8	0.08	0.01	0.05	0	0.01	442	62.50	0.00	0.17	12.50	1.09	6.57	0.80	S2 shoulder (s)
Aquistore	Middle Bakken	North Dakota	S7-118653	2105.2	60.1	0.08	0.02	0.04	0.01	0	432	50.00	12.50	0.33	25.00	0.88	5.25		*Unreliable Tmax
Aquistore	Middle Bakken	North Dakota	S8-118654-2	2108.1	60.4	0.05	0.01	0.07	0.01	0.02	442	140.00	20.00	0.13	20.00	1.53	9.19	0.80	S2 shoulder (s)
Aquistore	Middle Bakken	North Dakota	S9-118655	2111.4	60.7	0.02	0	0.03	0	0	440	150.00	0.00	0.00	0.00	0.66	3.94	0.76	S2 shoulder (s)

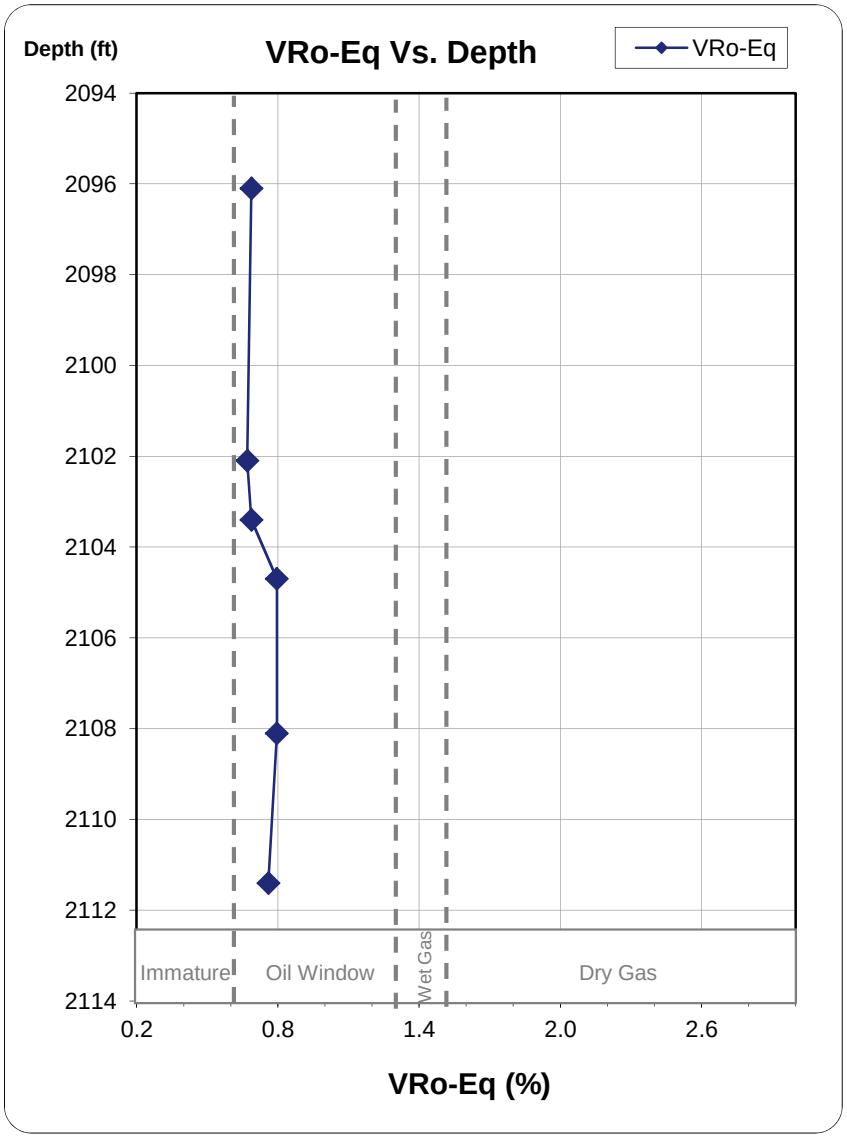
*Unreliable Tmax due to low S2 yields (below reliable detection limit)

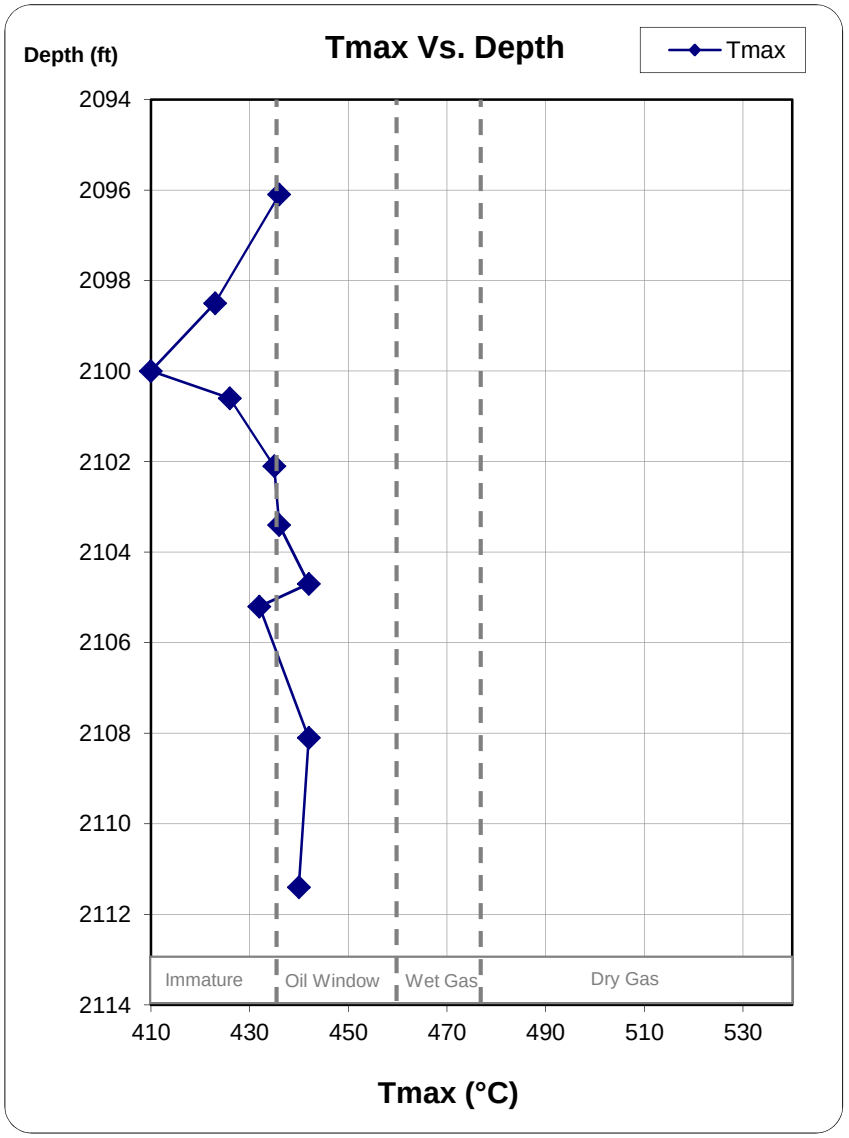
Job Number:	140757G-Extracted	Well Name:	Aquistore



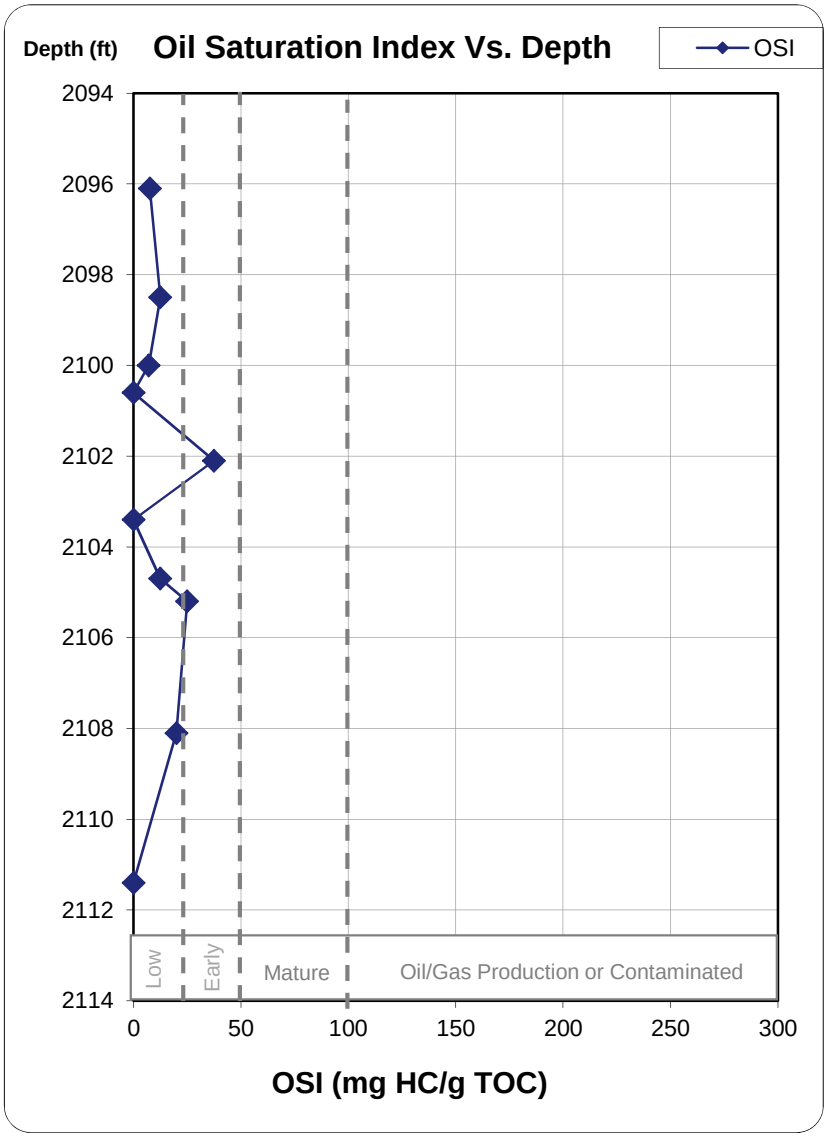


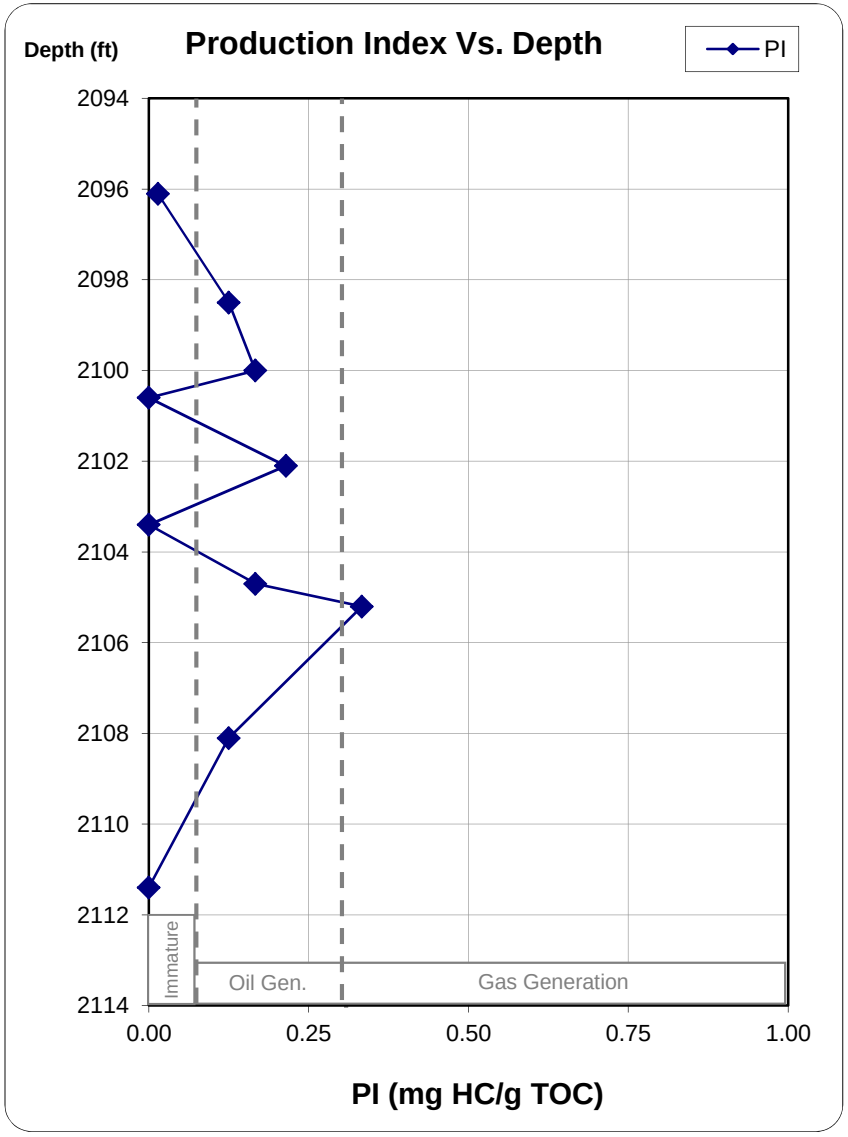
Job Number:	140757G-Extracted	Well Name:	Aquistore



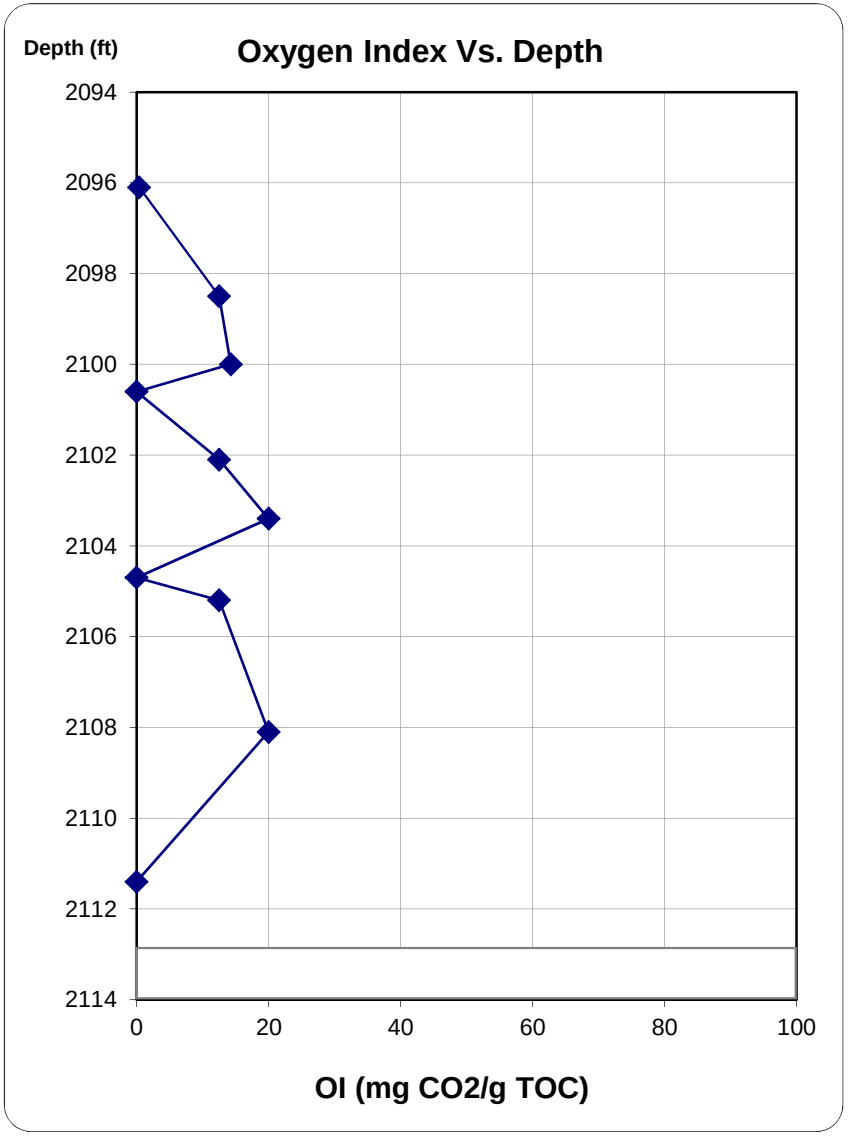


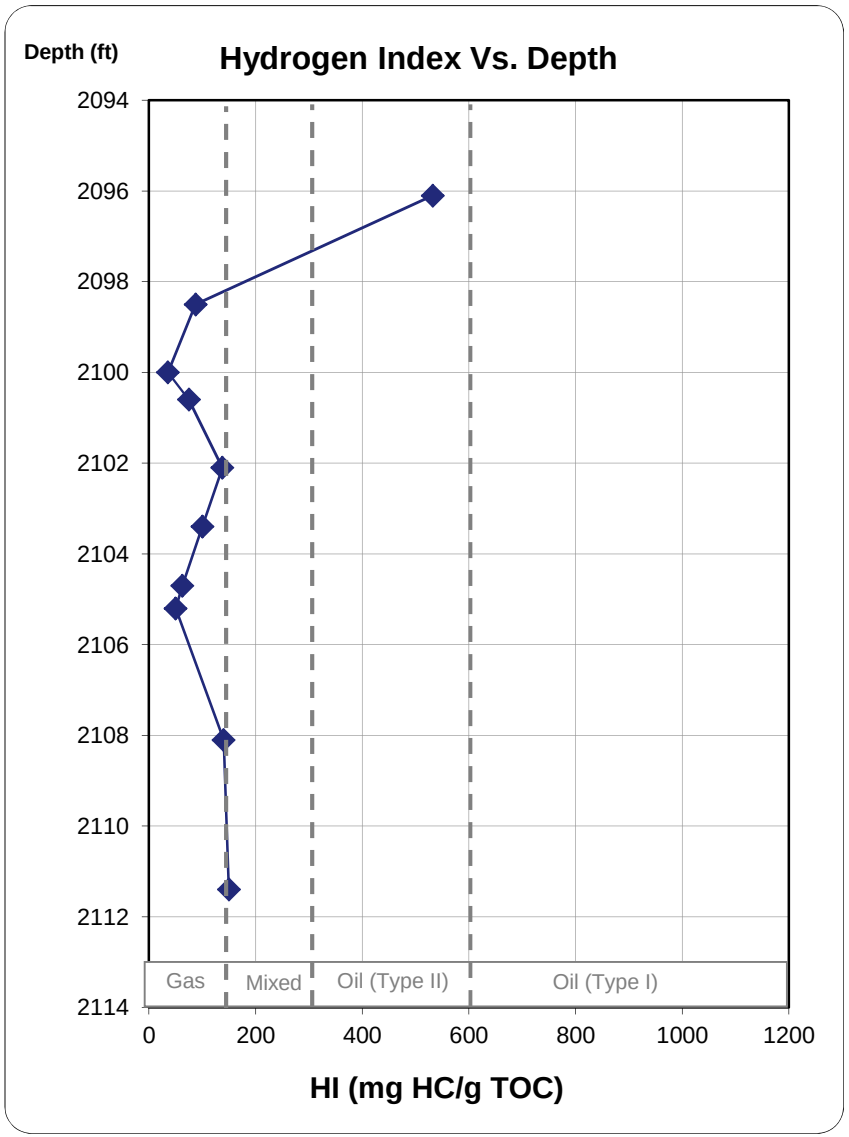
Job Number:	140757G-Extracted	Well Name:	Aquistore





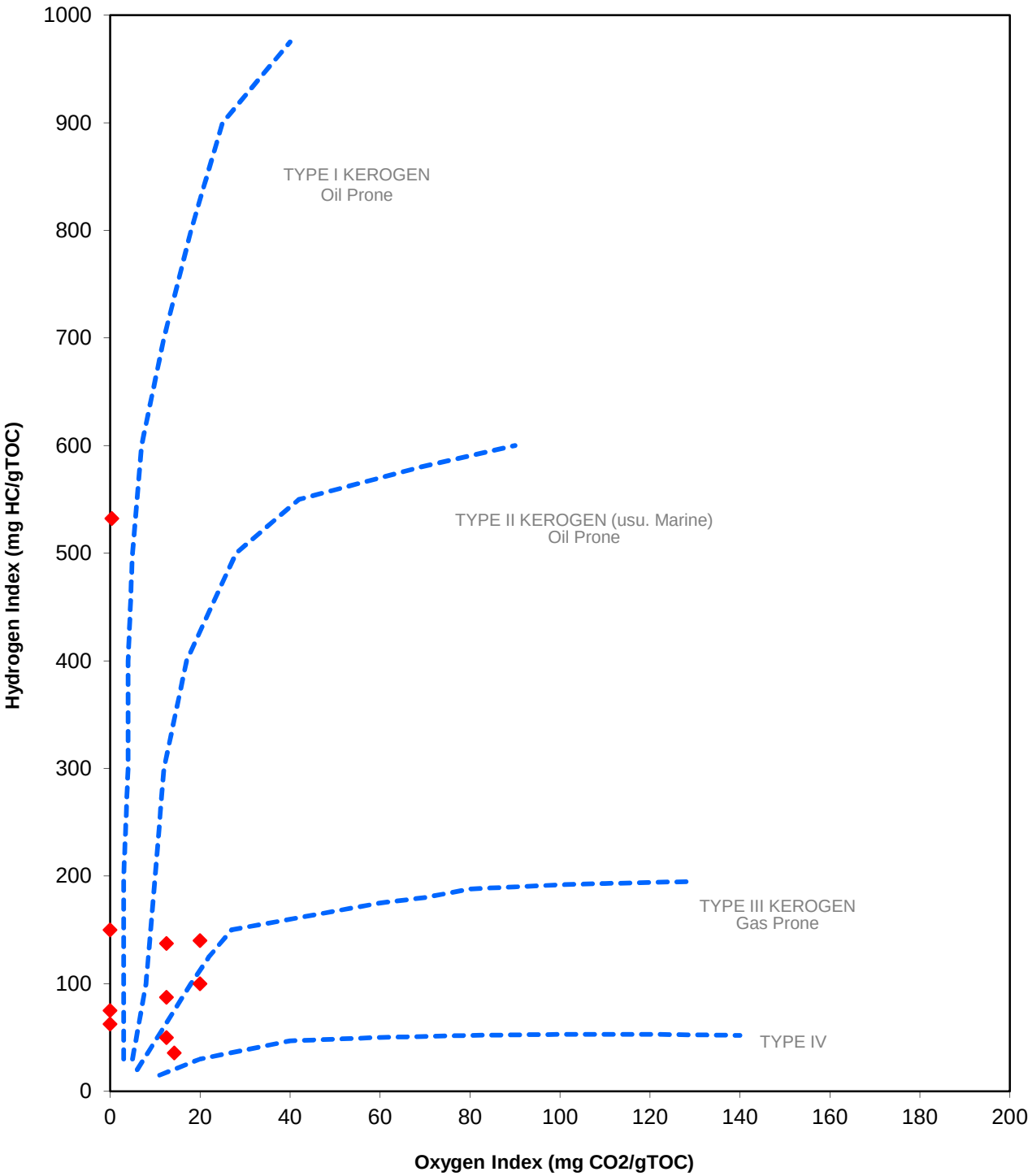
Job Number:	140757G-Extracted	Well Name:	Aquistore



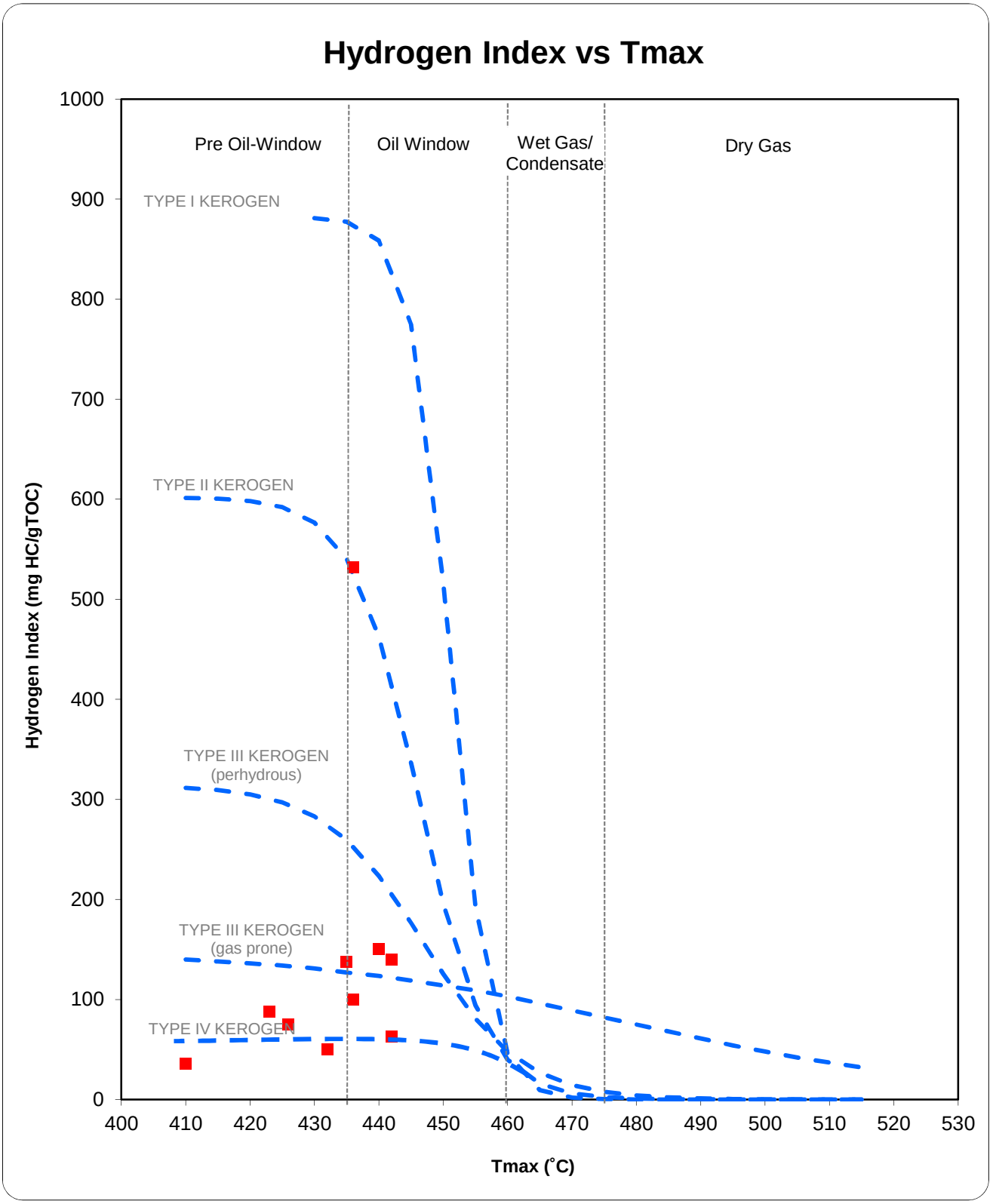


Job Number:	140757G-Extracted	Well Name:	Aquistore

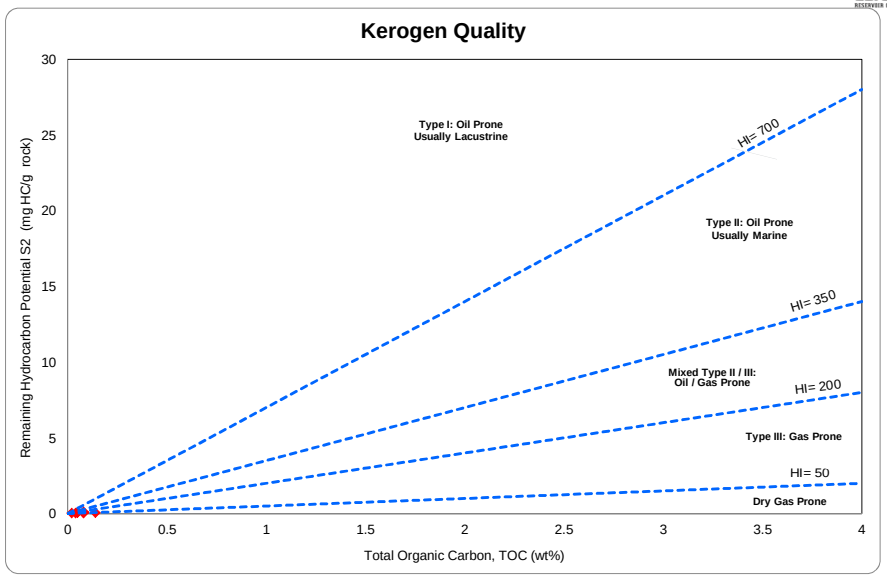
Pseudo Van Krevelen Plot (HI vs OI)

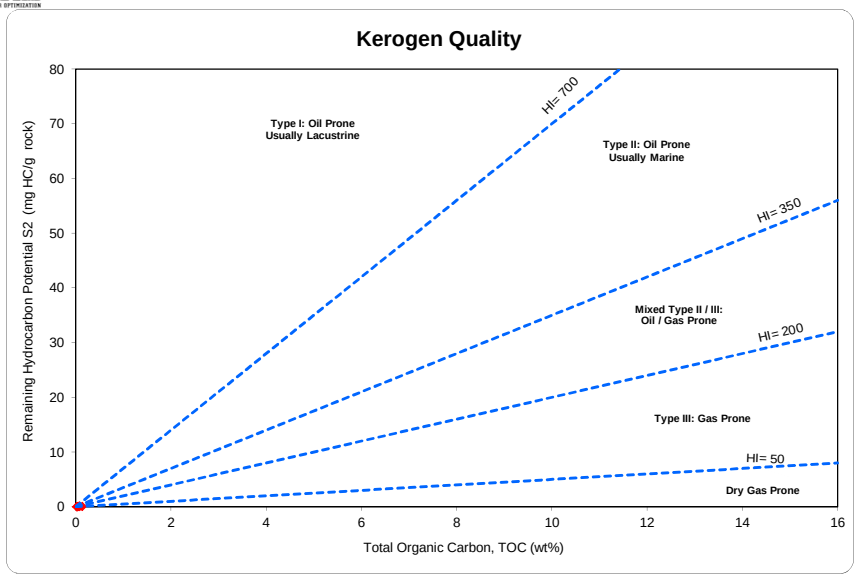


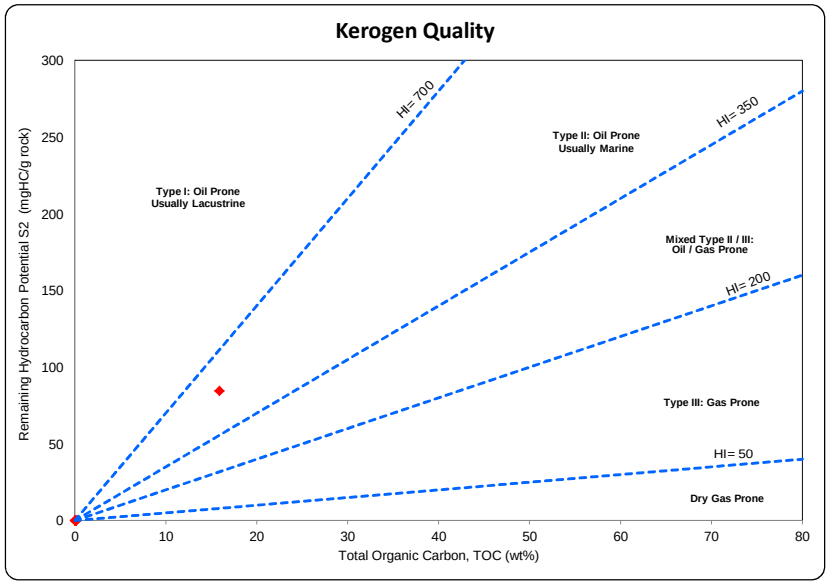
Job Number:	140757G-Extracted	Well Name:	Aquistore



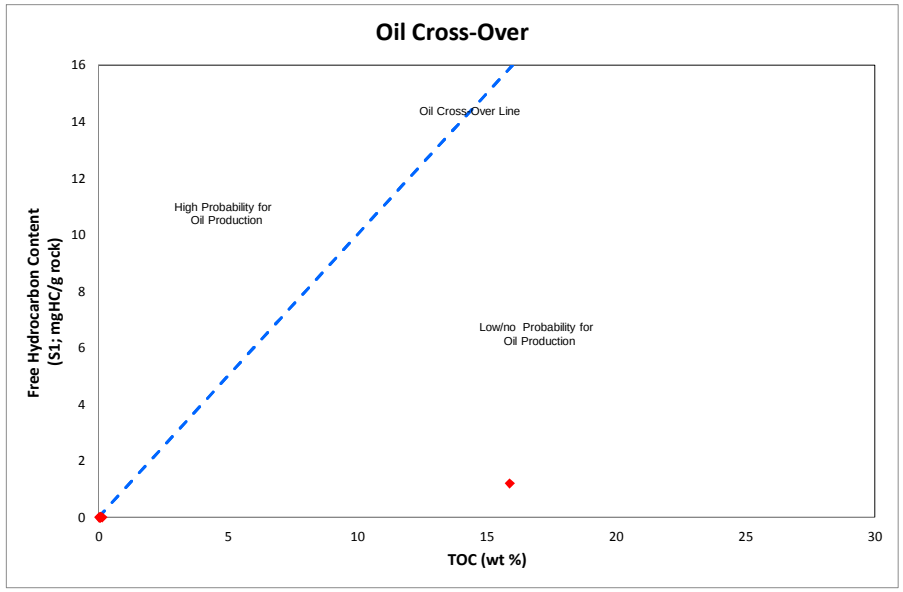
Job Number: 140757G-Extracted **Well Name:** Aquistore

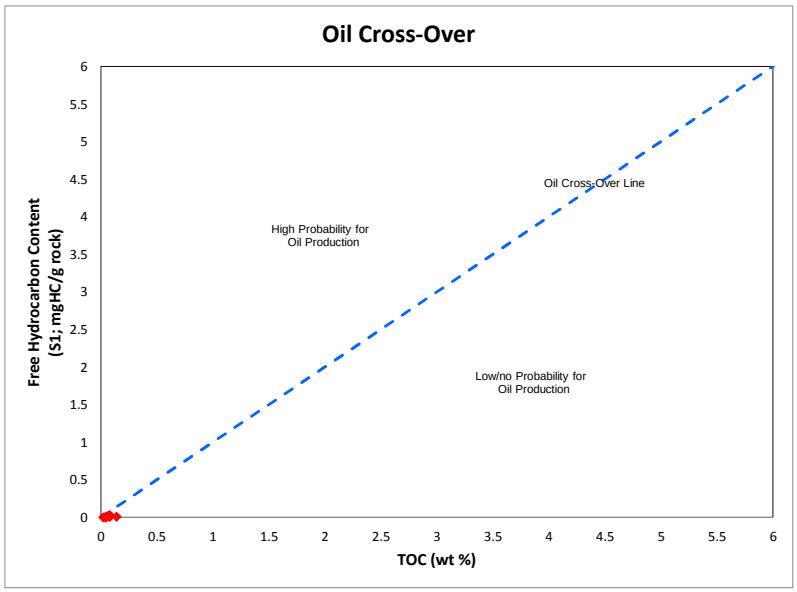






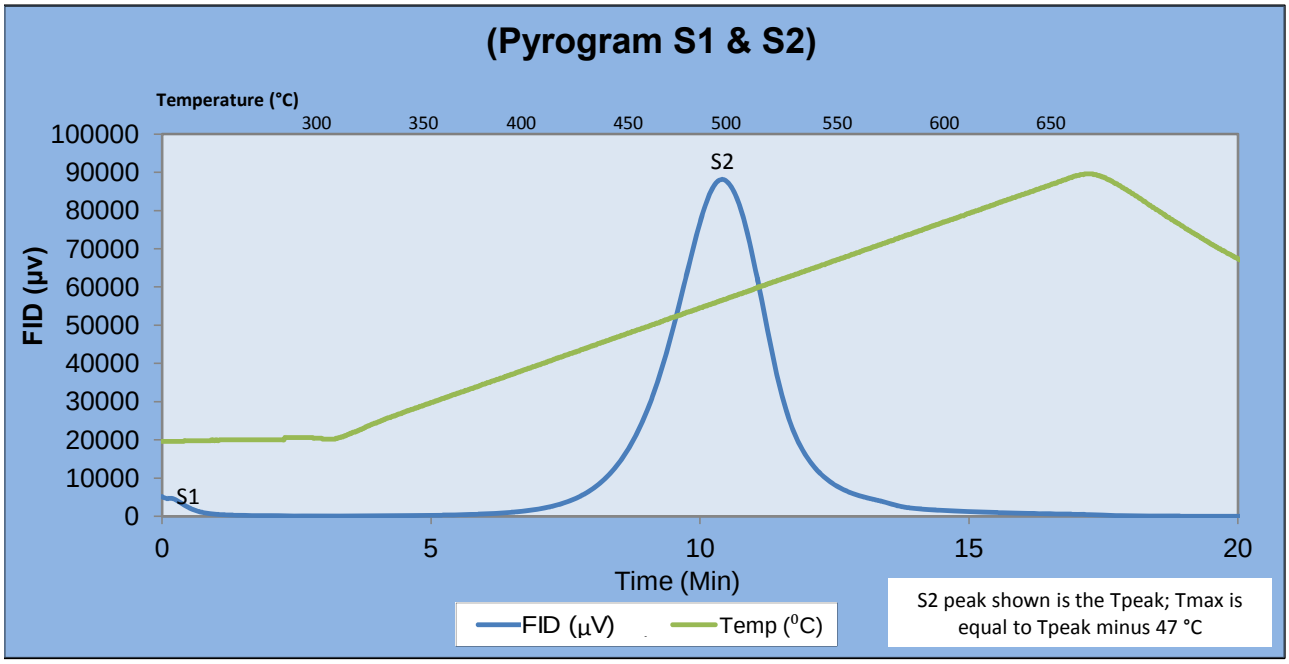
Job Number: 140757G-Extracted **Well Name:** Aquistore

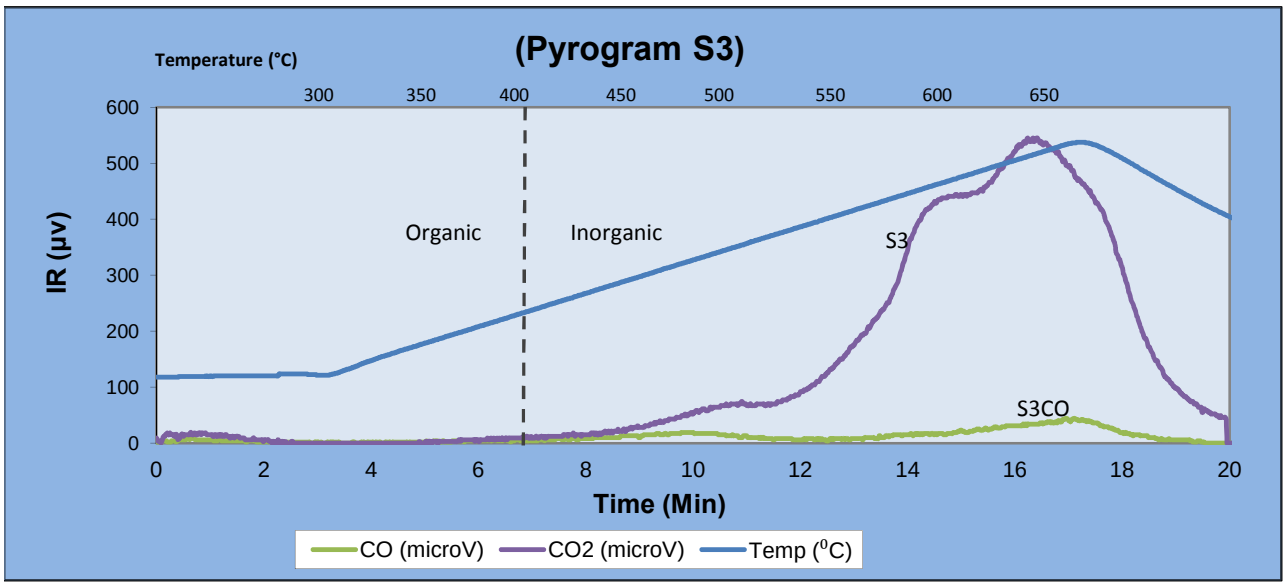




S11-118657

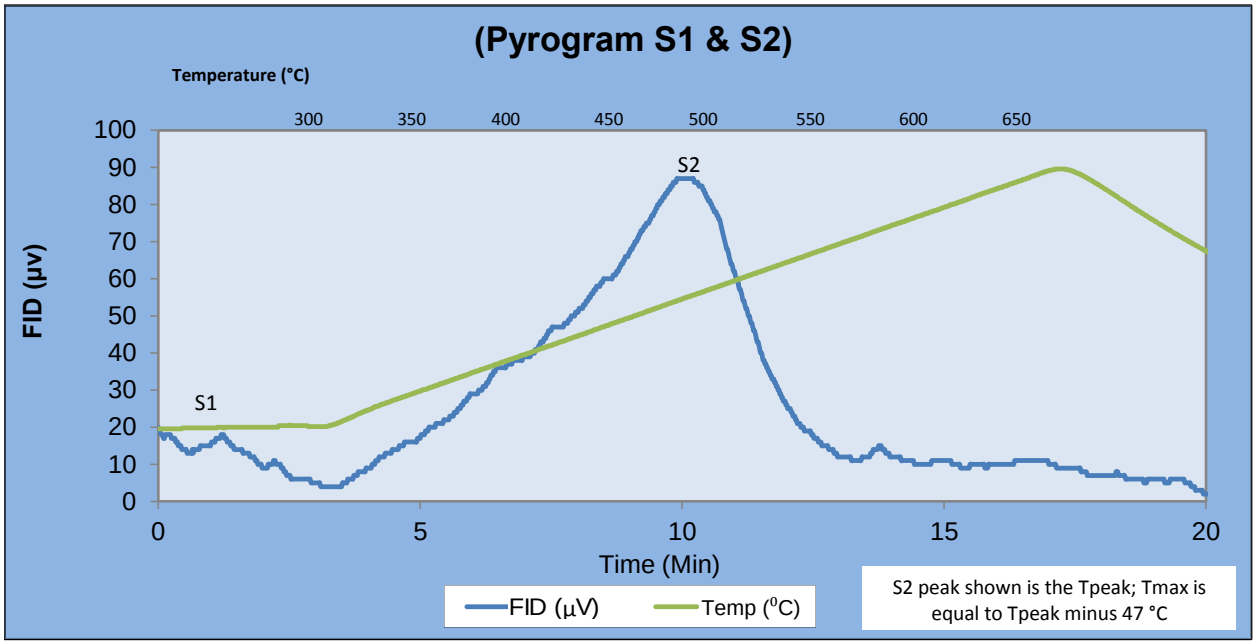
Company:	University of North Dakota	**Job:**	140757G-Extracted
Well:	Aquistore	**Depth:**	2096.10
Location:	North Dakota	**Formation:**	Upper Bakken

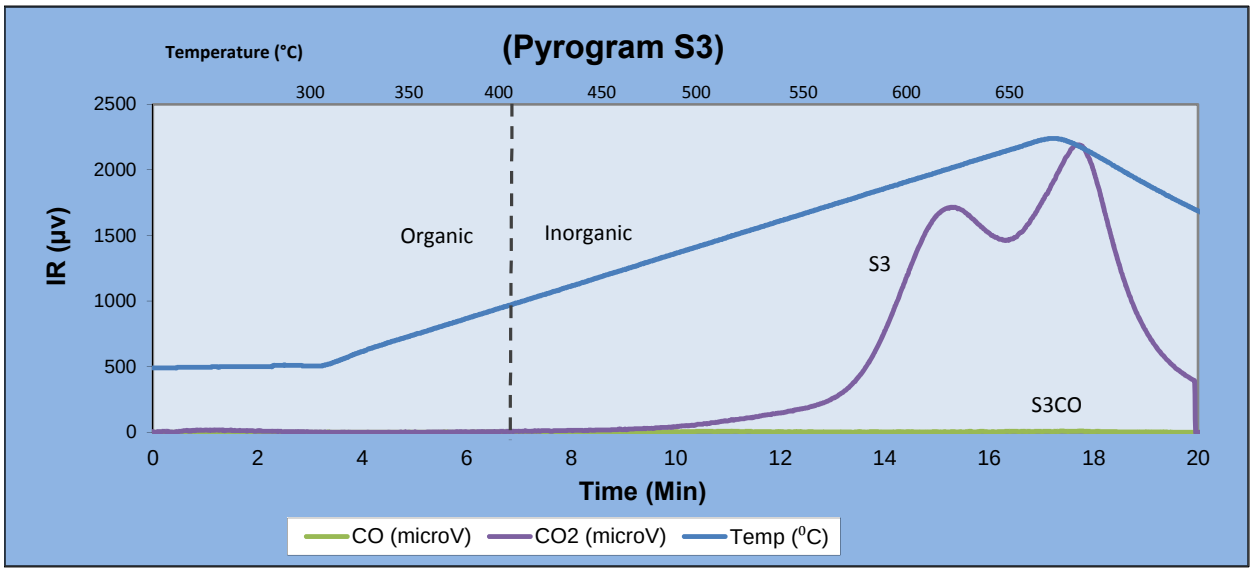




S1-118645-2

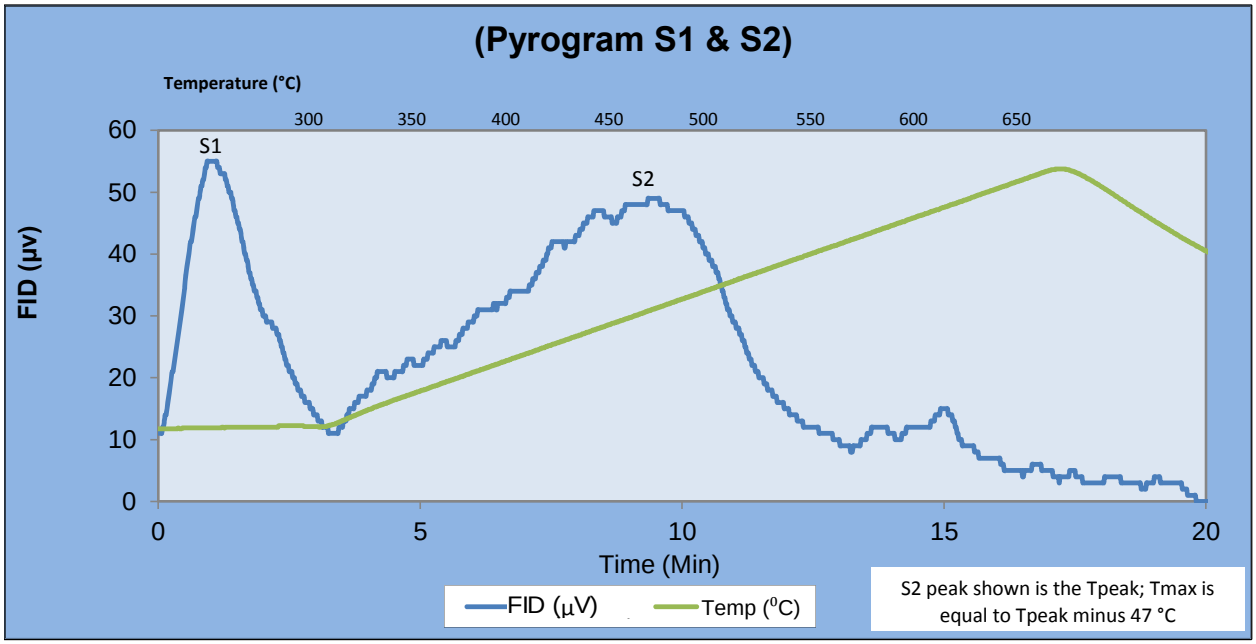
Company:	University of North Dakota	**Job:**	140757G-Extracted
Well:	Aquistore	**Depth:**	2098.50
Location:	North Dakota	**Formation:**	Middle Bakken

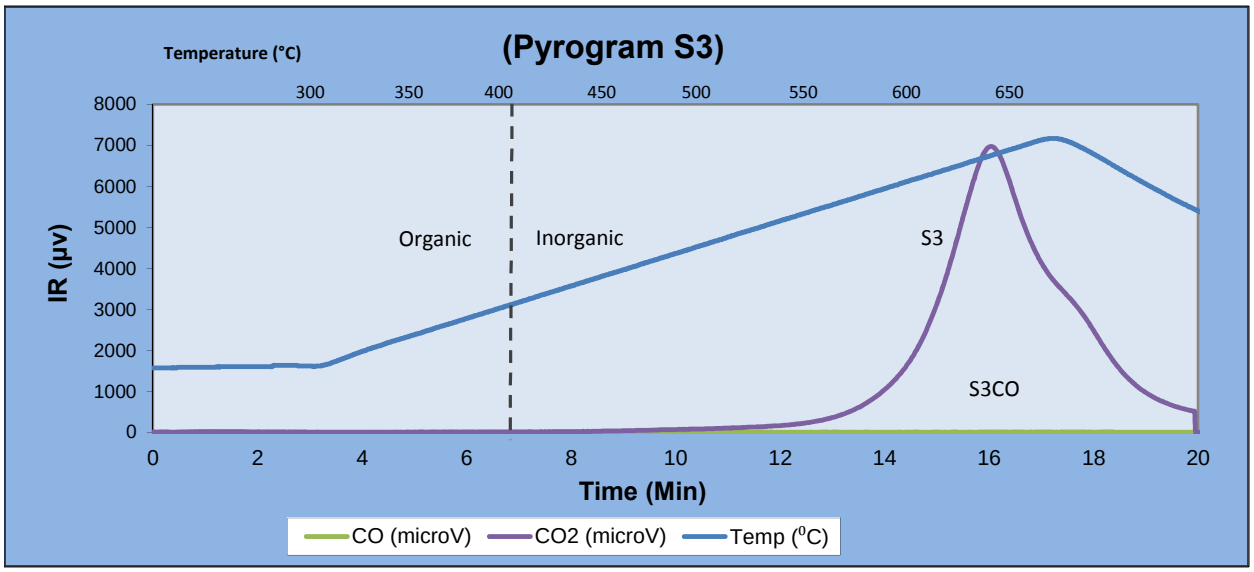




S2-118646-2

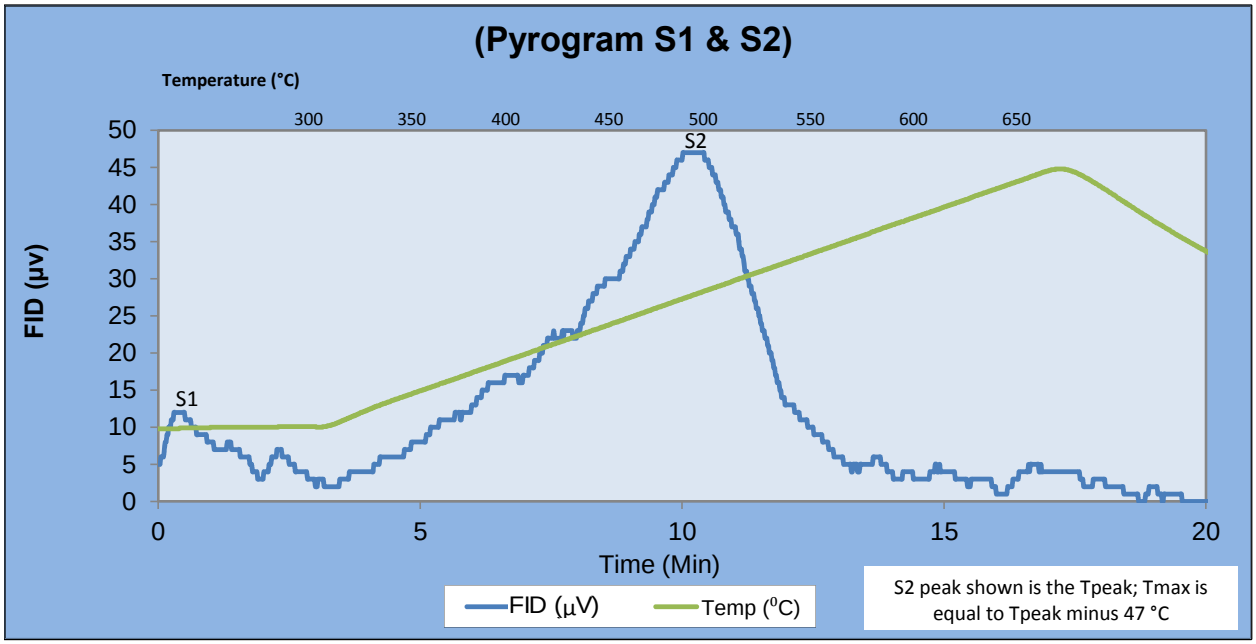
Company:	University of North Dakota	**Job:**	140757G-Extracted
Well:	Aquistore	**Depth:**	2100.00
Location:	North Dakota	**Formation:**	Middle Bakken

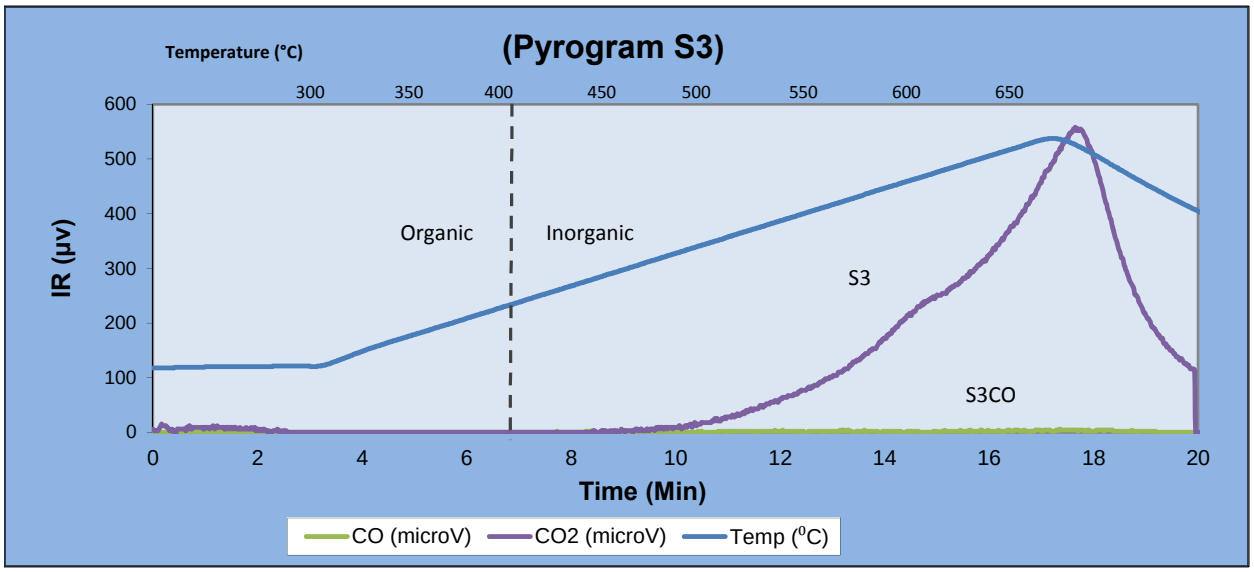




S3-118647-2

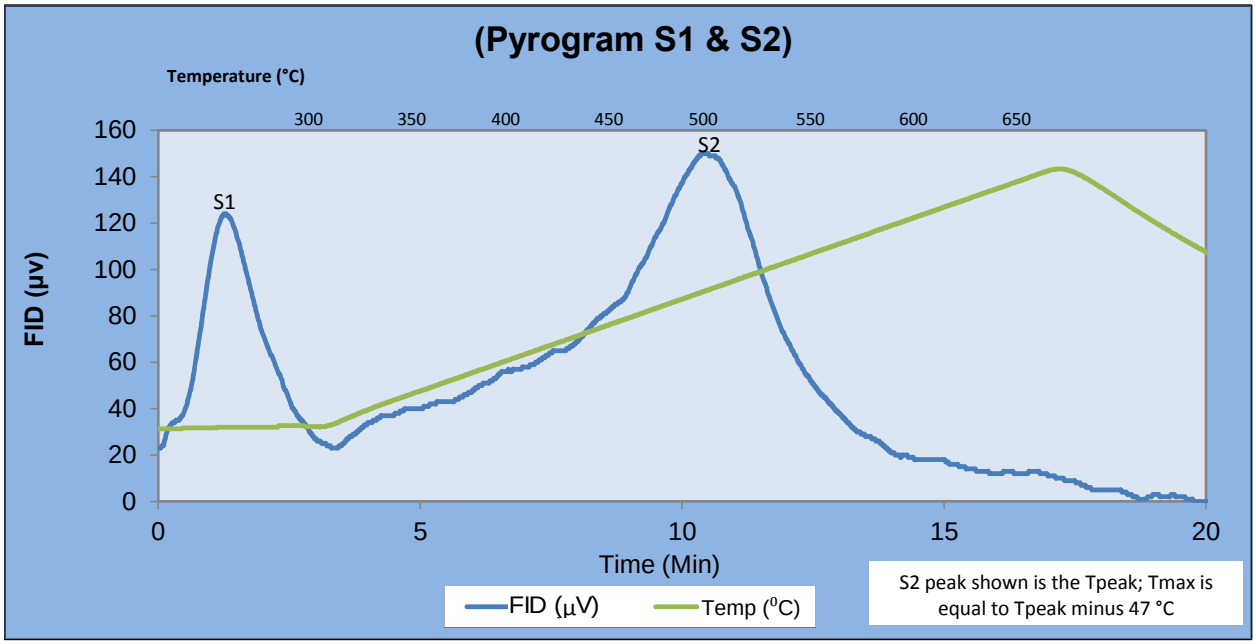
Company:	University of North Dakota	**Job:**	140757G-Extracted
Well:	Aquistore	**Depth:**	2100.60
Location:	North Dakota	**Formation:**	Middle Bakken

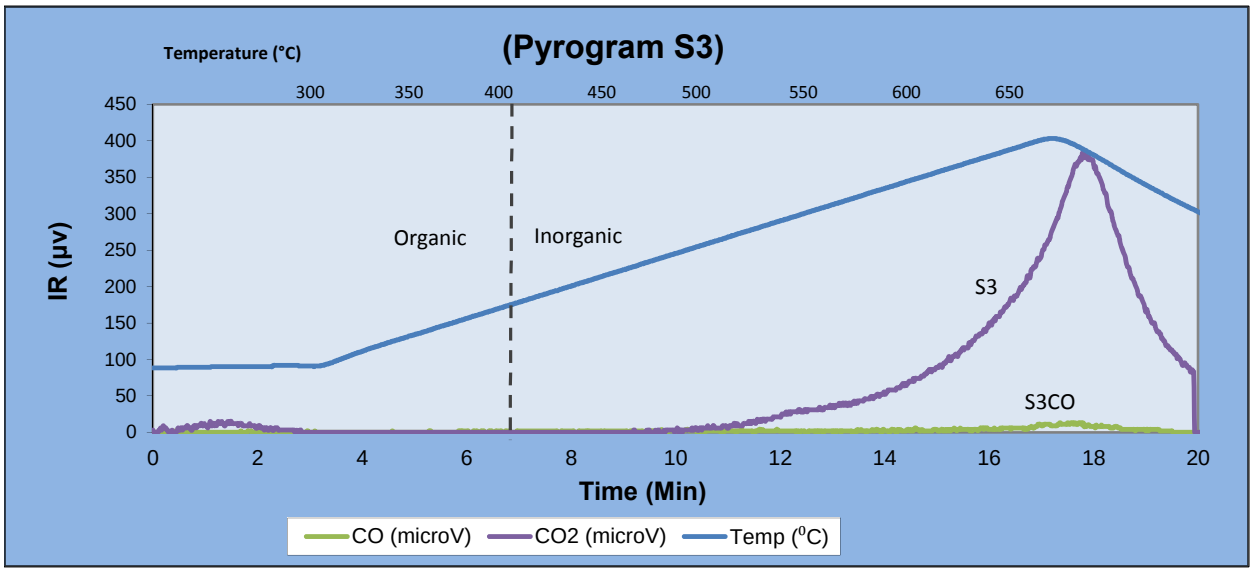




S4-118648-2

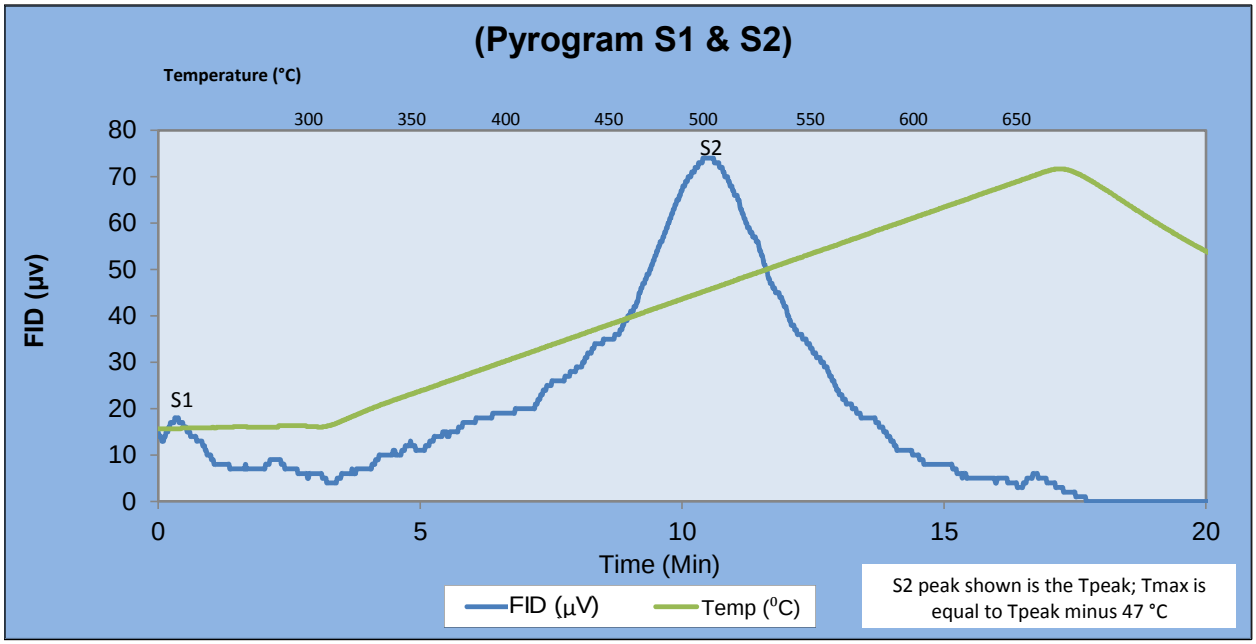
Company:	University of North Dakota	**Job:**	140757G-Extracted
Well:	Aquistore	**Depth:**	2102.10
Location:	North Dakota	**Formation:**	Middle Bakken

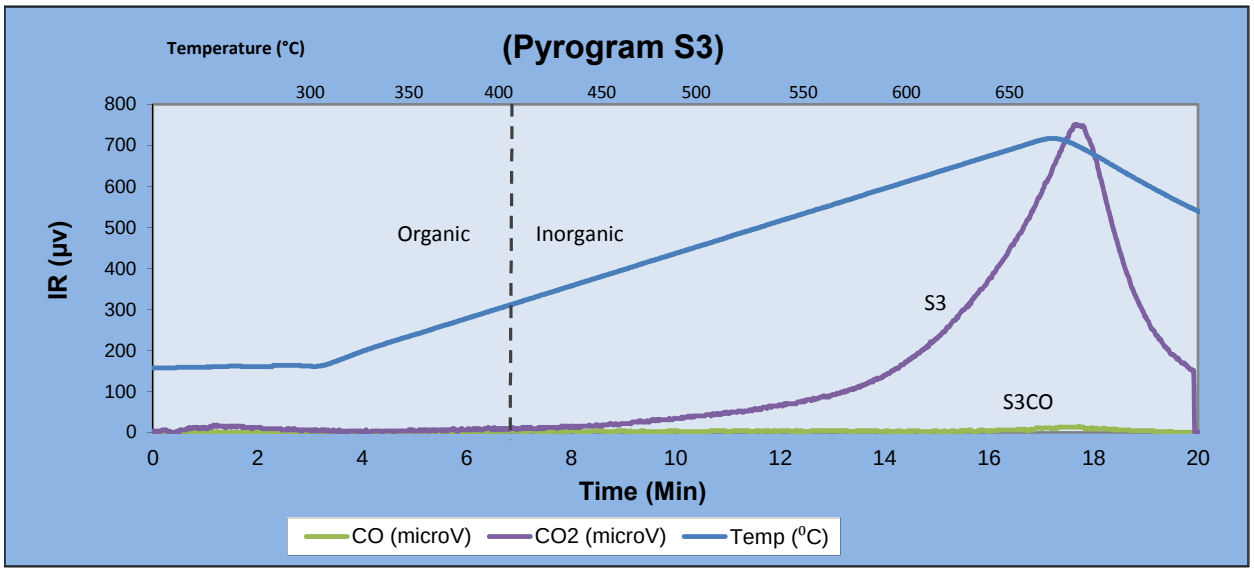




S5-118649-2

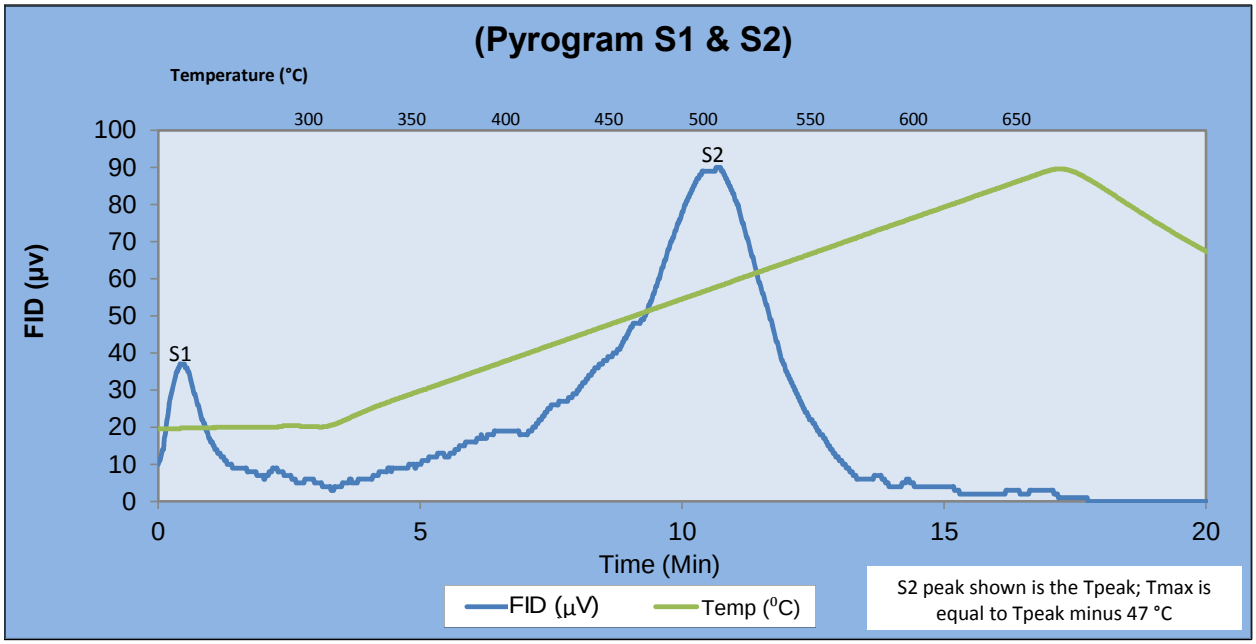
Company:	University of North Dakota	**Job:**	140757G-Extracted
Well:	Aquistore	**Depth:**	2103.40
Location:	North Dakota	**Formation:**	Middle Bakken

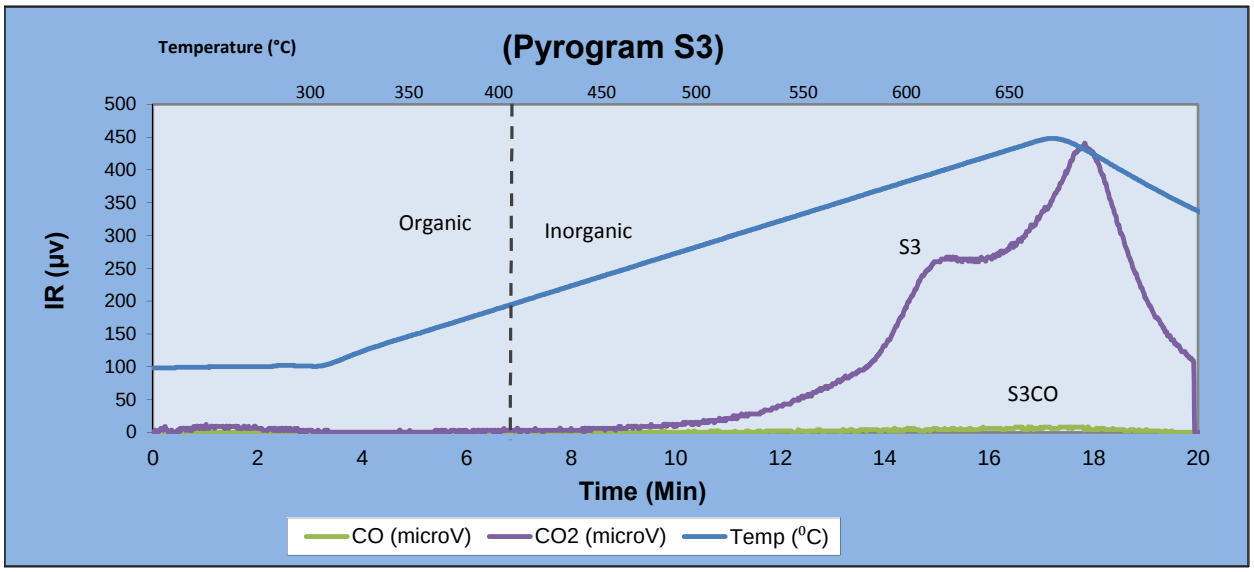




S6-118649-2

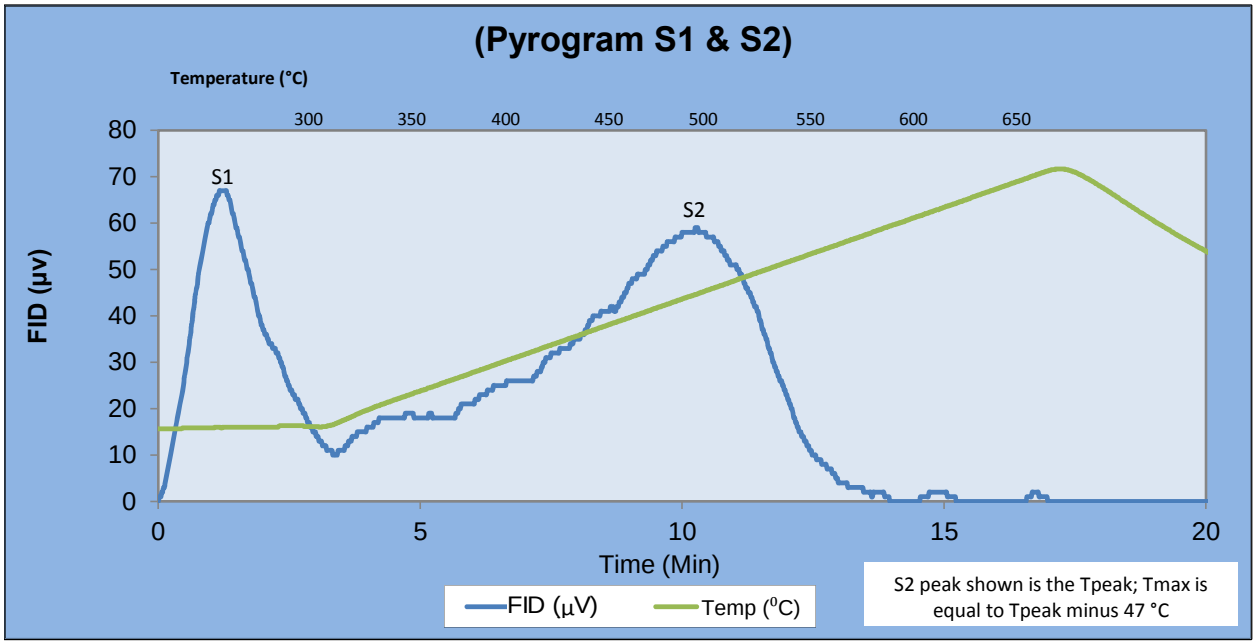
Company:	University of North Dakota	**Job:**	140757G-Extracted
Well:	Aquistore	**Depth:**	2104.70
Location:	North Dakota	**Formation:**	Middle Bakken

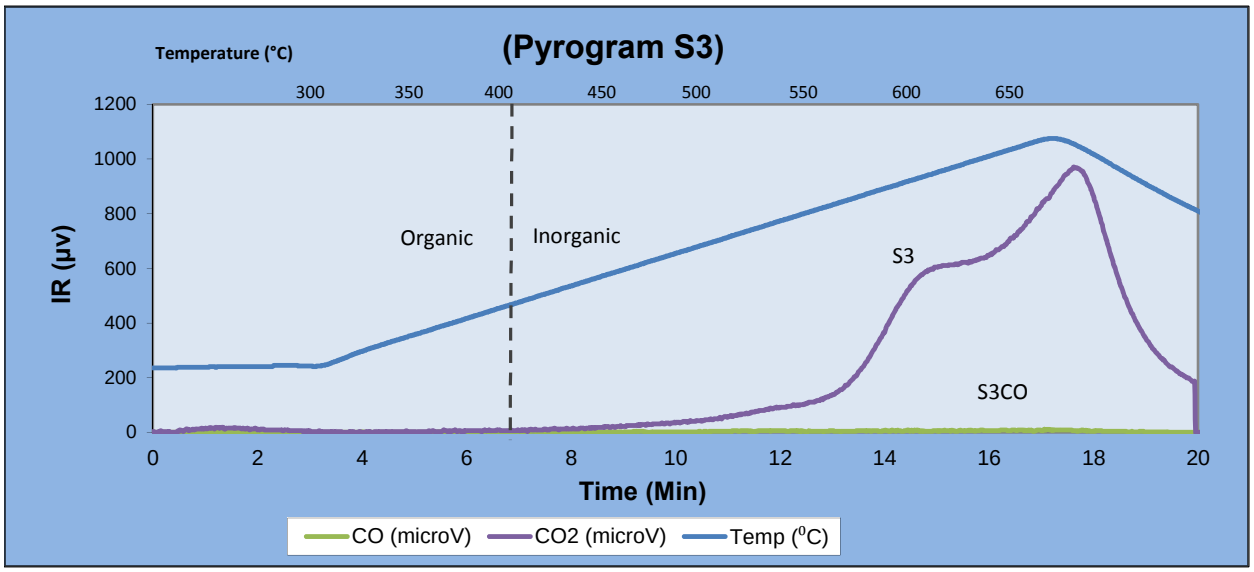




S7-118653

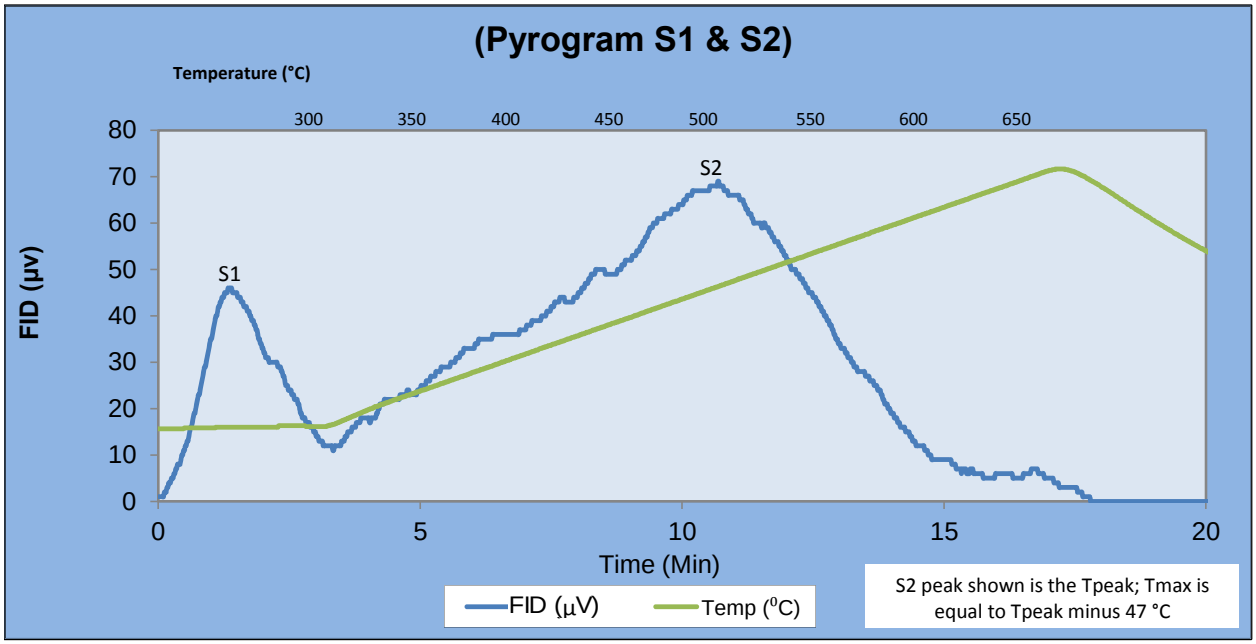
Company:	University of North Dakota	**Job:**	140757G-Extracted
Well:	Aquistore	**Depth:**	2105.20
Location:	North Dakota	**Formation:**	Middle Bakken

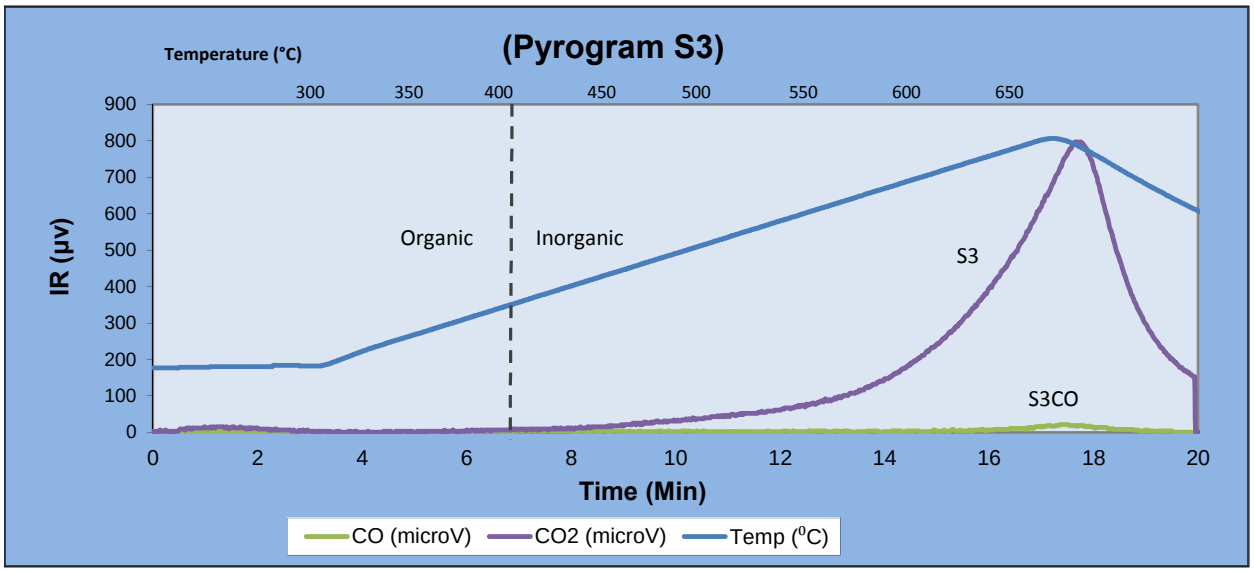




S8-118654-2

Company:	University of North Dakota	**Job:**	140757G-Extracted
Well:	Aquistore	**Depth:**	2108.10
Location:	North Dakota	**Formation:**	Middle Bakken





S9-118655

Company:	University of North Dakota	**Job:**	140757G-Extracted
Well:	Aquistore	**Depth:**	2111.40
Location:	North Dakota	**Formation:**	Middle Bakken