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BEOWAWE GEOTHERMAL AREA EVALUATION PROGRAM

FINAL REPORT

J. L. IOVENITTI

WITH SHORT-TERM FLOW TEST SUMMARY BY I. J. EPPERSON, JR.

MARCH 1981

WORK PERFORMED UNDER CONTRACT

DE-AC08-78ET-27101

CHEVRON RESOURCES COMPANY
595 Market Street
San Francisco, CA 94105

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FOR THE PERIOD 1 NOV 1978 - 31 JULY, 1980

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Prepared for the
U.S. Department of Energy
Division of Geothermal Energy
Under Contract DE-AC08-78ET-27101

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ABSTRACT

As part of the U.S. Department of Energy's Northern Basin and Range Geothermal Reservoir Assessment Program, Chevron Resources Company conducted several varied exploration programs at the Beowawe Geothermal Prospect, Lander and Eureka County, Nevada under Contract No. DE-AC08-78ET-27101. The exploration effort was divided into two parts. Part I, Preliminary Studies, consisting of a shallow temperature hole program, a mercury soil samplling survey, and a self-potential survey were conducted in order to select the optimum site for an exploratory well. Part II, Beowawe 85-18 Exploratory Well, consisted of drilling a 5,927-foot exploratory well, running geophysical logs, conducting a drill stem test (2937-3208 feet), and a short-term (3-day) flow test (1655 - 2188 feet).*

This report summarizes all basic data collected by Chevron Resources Company from these studies.

*Results from the 3-day flow test were not available during the writing of this report, however, the data has been subsequently obtained and incorporated in Appendix 6 and 7.

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INTRODUCTION

Location

The Beowawe Geothermal Area (herein referred to as BGA) is located in north-central Nevada along the Lander-Eureka County line, approximately 190 miles northeast of Reno (Figure 1).

Geothermal Evaluation of Prospect

BGA is probably one of the most spectacular geothermal areas (for its size) in the western United States. Within a very limited area, there are prolific geothermal surface manifestations (such as geysers, hot springs, fumaroles, etc.). Several attempts at commerical development have occurred in the last twenty years which can be categorized into four phases.

Phase 1 took place between 1959 and 1964 when Magma Power Company, followed by Sierra Pacific Company, drilled eleven exploratory wells in the "Geysers" Area (N1/2, Sec. 17, T31N, R48E) of BGA (Figure 2). At least four of these wells reportedly encountered temperatures in excess of 400°F at depths between 700-900 feet.

Phase 2 occurred between 1972 and 1978 when Chevron Resources Company conducted numerous geologic and geophysical studies, and drilled two exploratory wells. These wells, Ginn 1-13 (1974) and Rossi 21-19 (1976), were drilled approximately 2-1/2 miles southeast of the "Geysers" Area (Figure 2). The Ginn 1-13 was drilled to 9563 feet and encountered a maximum stabilized temperature of 414°F. The Rossi 21-19 was drilled to 5686 feet and encountered a maximum stabilized temperature of 399°F. During this same period, Magma Power Company, in conjunction with Dow Chemical, drilled the Batz #1 to 6000 feet in the "Geysers" Area (Figure 2). The temperature data for this well have not been released.

Phase 3 occurred in 1979 and evaluated the geothermal potential of the area between Chevron's Ginn 1-13 and Rossi 21-19, and the "Geysers" Area. This phase encompasses a portion of the Chevron/DOE study which was designed to select the optimum site for an exploratory well.

Phase 4 consisted of (1) deepening the Rossi 21-19 an additional 1500 feet, (2) drilling an exploratory well in the "Geysers" Area (Beowawe 33-17) and (3) drilling of the Chevron/DOE well (Beowawe 85-18). This activity took place between late 1979 and mid-1980.

Chevron/DOE Study

During the period from June 1979 to July 1980, Chevron Resources Company undertook numerous and varied geothermal studies at Beowawe. This work was conducted as part of the U.S. Department of Energy, Northern Basin and Range Geothermal Reservoir Assessment Program. The study was done under contract DE-AC08-78ET-27101 with subsequent modification.

The original contract specified data acquisition on 8-line miles of reflection seismic in the vicinity of the proposed exploratory well and drilling a 4000-foot exploratory well in the area of Section 17 or 18, T31N, R48S (Figure 2).

The ultimate purpose of the DOE-sponsored program was to gather information on the geothermal reservoir through the drilling of the exploratory well. When it became apparent that additional work was necessary to select an optimum well site location, the original contact was modified to include:

1) a shallow temperature hole program;
2) a mercury-in-soil survey; and
3) a self-potential (SP) survey.

Plate 1 summarizes the exploration program done at Beowawe under the DOE/Chevron contract.

This report summarizes all basic data collected by Chevron Resources Company under the programs described above with the exception of the reflection seismic data which has already been presented (April/79). To facilitate data presentation, the work is presented in two parts: Part I, Preliminary Studies; and Part II, Beowawe 85-18 Exploratory Well. Part I covers the shallow temperature hole program, mercury-in-soil survey, and self-potential survey. The exploratory well data are discussed in Part II.

Reproduction of geophysical logs may be obtained from:

Rocky Mountain Well Log Service
P.O. Box 3150
Denver, CO 80201
Tel. (303) 825-2181

Other basic data such as detailed lithogic and temperature information for shallow gradient holes are available from:

Publications
Earth Science Laboratory Division (ESLD)
University of Utah Research Institute
420 Chipeta Way, Suite 120
Salt Lake City, Utah 84108

In addition, physical samples such as drill cuttings and cores are available for study at the ESLD.

PART I: PRELIMINARY STUDIES

The surveys discussed in this section (shallow temperature holes, mercury-in-soil, and self-potential) were designed to cover the Beowawe area with a regional grid, and specifically the area between Chevron's exploratory wells, Ginn 1-13 and Rossi 21-19, and the "Geysers" area, in detail.

Shallow Temperature Hole Program

Twenty-six shallow temperature holes* were drilled in BGA between June and August, 1979 (Plate 1 and Table 1). The temperature holes were to be drilled for 2 days or 500 feet with the exception of those located on the low-lying hill in Section 18, T31N, R48E which was designated for 750 feet total depth. This program was modified as a result of problems with lost circulation, slow drilling, and critical location. Table 2 presents a drilling summary for each hole. Given are the time required to drill, total depth, the amount of pipe set, and comments on drilling problems. Completion was done by running one-inch steel pipe to total depth, cementing outside the pipe from 10 feet to 8 inches below the surface and filling the pipe with water. Lithologic samples (ditch cuttings) were collected over five feet intervals every twenty feet (i.e., 15-20', 35-40', 55-60', etc.) before drill pipe connections. Each hole was logged for temperature at least twice to check for stabilized conditions. Once thermal equilibrium was established, the hole was abandoned by filling the top 10 feet of the one-inch pipe with cement, and cleaning up the drill site. Detailed lithologic descriptions, a complete set of cuttings, and all temperature data collected have been transmitted to the University of Utah Research Institute. Appendix 1 contains lithologic descriptions of two shallow temperature holes (#29 and 35) which represent the range of lithologic types encountered during drilling. Given in Appendix 2 are the stabilized temperature data for the three shallow holes illustrating the general types of thermal profiles observed.

Mercury-In-Soil Survey

A mercury-in-soil survey was conducted at Beowawe to detect any near-surface expression of the geothermal system outside the "Geysers" Area (Figure 2). An area approximately six miles square (see Plate 1) was surveyed by collecting 155 soil samples. Sample locations are shown on Plate 2 along with the Hg concentrations (in ppb) at each sampling station. Tabulated data are presented in Table 3. Soil samples were collected at 500 to 1000-foot intervals (1000-foot interval spacing occurred at margins of survey area) from a depth of 4-6 inches. The survey was conducted over an one week period (from July 19, 1979 to July 25, 1979). Dry samples were sieved in a minus 80-mesh stainless steel sieve and immediately stored in air-tight screw top glass vials. Wet samples were dried at room temperature for 2-3 days and then sieved and sealed. The dried samples were analyzed by Microgeophysics Corporation using the Jerome Instrument - Gold Film Mercury Detector.

* Contract only called for twenty-five holes with a possible extension to 35 holes.

Self-Potential Survey

A detailed, self-potential (SP) survey was conducted at Beowawe to determine if any electrical anomalies existed outside of the "Geysers" Area. The survey was intended to augment an earlier, less detailed survey released to DOE in the initial Chevron Beowawe (existing) data package. An area approximately three miles square was examined. Plate 3 shows the location of individual stations along with the measured SP-response. A total of twenty-seven line miles were run. Cross-profiles lines were tied to a base line running NE-SW along the road at the base of the Mal Pais Rim, in Whirlwind Valley. In addition, cross-profiles were tied every 200 meters with profiles parallel to the base-line.

PART II: BEOWAWE 85-18 EXPLORATORY WELL

Part II of this report discusses all data collected on the Chevron/DOE well, Beowawe 85-18. To facilitate data presentation, the well information has been subdivided into the following sections:

(I) Drilling History,
(II) Lithology,
(III) Directional Survey,
(IV) Schlumberger Logging Operations,
(V) Temperature Surveys, and
(VI) Drill Stem Test

Section I: Drilling History

The Beowawe 85-18 was spudded on February 23, 1980. The program was to drill to 4000 feet total depth, run Schlumberger geophysical logs at three depths (shallow, intermediate and deep) prior to running casing, and conduct a short-term flow test, if warranted. The well was scheduled for 30 days of drilling. Analysis of well data as the drilling proceeded prompted deepening beyond the programmed depth. As a result of (1) drilling beyond the programmed depth, (2) encountering one (possibly two) severe lost circulation zones, (3) running geophysical logs (on four occasions), (4) coring and (5) conducting a short-term drill stem test, the well required 105 days to complete. The Beowawe 85-18 was completed on June 3, 1980, at a total depth of 5,927 feet. Plate 4 presents the actual time and cost versus depth curves for the well along with the proposed drilling curve. The completion report is given in Appendix 3. Detailed daily drilling reports have been transmitted to UURI/ESL.

Section II: Lithology

The mud log (R. F. Smith Corp.) is available through the ESLD, Salt Lake City, Utah and includes: drilling rate (ft/hr), bulk rock density, lithology, mud in/out temperature, mud report, fluid loss/gain volumes, concentration of CO_2, methane and H_2S, hole deviation and lithologic summary. In addition to the mud log, a detailed lithologic description (10-foot intervals) was prepared by the mud loggers (Appendix 4). Note that a complete set of cuttings has been transmitted to the University of Utah Research Institute.

Section III: Directional Survey

The directional survey data are given in Table 4.

Section IV: Schlumberger Logging Operations

Four logging operations took place in this well at depths of 1008, 3208, 4543 and 5927 feet. These operations are referred to as shallow, intermediate, deep #1 and deep #2, respectively. The pertinent aspects of each are discussed below. Final copies of the Schlumberger geophysical logs are available from the Rocky Mountain Well Log Service, Denver, CO.

Shallow logging operation occurred during the period from March 7-8, 1980. The operation was scheduled to obtain open-hole logs to approximately 1000 feet prior to surface casing emplacement. The original well program called for the following logs: Dual Induction Laterlog* with SP, and a sonic log with gamma-ray, caliper and SP. Because of the minimum remote charge, an additional log (HDT/FIL) was added to the program (Table 5).

The following conditions should be noted when examining the logs:

(1) The caliper response on the BHC log was over-saturated. Maximum opening of this caliper is 16 inches and the borehole size was 17-1/2 inches.

(2) No SP curve was recorded on the BHC log because the SP response was extremely variable (variations exceeding 40 millivolts occurred over less than one foot intervals). This is a common phenomena when dealing with a high resistivity borehole environment.

(3) The validity of the dipmeter log is questionable in places due to the over-saturation of the caliper.

(4) The Schlumberger Rmf bridge calibration is satisfactory (Figure 3 and Table 6).

Intermediate Logging Operation occurred during the period April 4-7, 1980. The purpose of this operation was to obtain open-hole logs (1008-3208 feet) prior to the setting intermediate depth casing. Two lost circulation zones (1842-2150 feet and 2972-3208 feet) were of specific interest. Table 7 summarizes the planned intermediate logging program.

As a result of difficulty maintaining the hole open, logging operations were cancelled prior to completion. The completed logging program is shown in Table 8. The sequence of events which took place during the operation are given in Table 9. A brief discussion of the events which transpired during this program follows. The reader is referred to the completion report (Appendix 3) for details.

The initial logging trip (HTT/DISFL) on April 4, 1980 encountered a bridge at 1924 feet. Logging was suspended and a clean-out run made to remove the bridge and condition the hole. Logging was re-attempted on April 5. This logging trip (HTT/DISFL) encountered a bridge at 1350 feet. A larger tool configuration (HTT/Gamma-Ray/BHC/Caliper/DISFL) was then attempted in the hopes that the additional weight would break through the bridge. This also failed. Logging was again suspended and another clean-out operation began.

April 5-7 were spent conditioning the hole. Several mud chemistry, viscosity, and lost circulation material additives were tried in hope of regaining

* Dual Induction Spherically Focused Log (DISFL) was run instead of the Dual Induction Laterolog.

circulation. The objective was to circulate all debris out of hole and build up a stable mud cake prior to logging. Circulation was regained for brief periods of time, but never maintained.

Late April 7, it was decided to abandon further efforts to run open-hole logs and to run casing blind. The only logs obtained were three incomplete temperature logs (132-1400 feet, 87-1324 feet, and 87-1282 feet) and an incomplete induction log (1006-1918 feet).

Deep Logging Operation #1 occurred during the period from May 27-28, 1980. It was programmed to evaluate the interval from 2937 feet (bottom of shoe) to about 4543 feet (total depth at the time). Its purpose was to gather wireline geophysical data to evaluate the existing well-bore and to determine whether or not to drill ahead. As a result of equipment breakdown, inexperienced Schlumberger crew hands and logging engineers who were not totally familiar with the computerized logging equipment, the logging operation required 68 hours to complete. In spite of this, a complete suite of logs were run (temperature, dual induction, sonic, density, neutron, caliper, gamma ray and SP). In addition, a cement bond log (CBL) was run of the cased interval. This log was scheduled to be run after the BHC log for it only required a minor command change on the CSU equipment. A chronological summary of events which occurred during the logging operation is given in Table 10. Table 11 summarizes the types of logs run along with the number of trips made, interval logged, and time required to run each trip. A total of seven logging trips were made. Given below is a brief discussion of the logging operation by trip.

Trip 1

The first logging run was the HRT (High Resolution Temperature) tool. This temperature run was the only run able to nearly touch the bottom of the well bore (4542 feet). Upon reaching the total depth, 269^{o}F was measured and a 1/2-hour build-up was attempted. The build-up was terminated after two minutes because the temperature measured reached 354^{o}F (tool limitation is 350^{o}F). The tool was pulled off bottom and allowed to stabilize before it was pulled out of the hole. The three maximum registering thermometers (MRT) each recorded temperatures of 230^{o}F.

Trip 2

The DISFL/SP was the second trip into the hole. No problems were encountered. The Rmf calibration was checked with brines of known resistivity (Figure 4 and Table 12) and found adequate. MRTs recorded temperature of 235^{o}, 236^{o} and 240^{o}F.

Trip 3

The third logging trip was conducted in three parts: (1) BHC/Caliper/Gamma-Ray from about 4530 to 2936 feet, (2) CBL/Gamma-Ray from 750 to 2990 feet, and (3) BHC/Caliper/Gamma-Ray/SP from about 2960 to about 100 feet. This trip was only programmed for only two parts, but the third part was added when the logging engineer failed to obtain a gamma-ray response to surface during part (1), Table 10. Initially, the BHC was receiving a weak casing signal and the

caliper was reading 8.3 inches in 9-5/8 inch casing with an I.D. of 8.84 inches. This necessitated pulling the tool out of the hole for re-examination, re-calibrating the caliper tool, and running back into the hole. The subsequent logging proceeded smoothly except for having to do part (3). Note part (2) was done with the analog truck, not the CSU van due to the engineers' inability to switch from the BHC mode to the CBL mode on the CSU (see Table 9). The three MRTs each recorded temperatures of 250°F.

Trip 4

In the second HRT run the log could not be run to total depth because the tool could not pass below 4200 feet. This tool is very light and was most likely caught on a ledge (the hole is out of gauge in this interval). MRTs recorded temperatures of 260°, 262°, and 262°F.

Trip 5

Because the second HRT run failed to reach total depth, the high temperature sub-assembly (HTT) was used in conjunction with other tools. Trip 5 consisted of logging temperature (with HTT) going into the hole and logging the dipmeter (HDT) coming out.

Several problems were encountered during this trip. The first was not being able to retrieve data for the HTT from the tape in the CSU van, necessitating running the HTT with the analog truck. The HDT run on the CSU coming out of the hole had too much current going down-hole and the caliper would not close once opened. The tool was examined once out of hole and a badwire in the cable-head was found to be the problem. The Schlumberger logging engineer (Mr. J. Anderson) stated, however, that the data obtained was probably valid. Unfortunately, this could not be verified because the HDT tool could not re-enter the hole (caliper would not close) and the hostile environment HDT was not on location (it was not available for this job). MRTs recorded temperatures of 276°, 278° and 278°F.

Trip 6

HTT was logged going into the hole (4th temperature run) with the analog truck and FDC/CNL/Caliper/Gamma-Ray were logged coming out of hole with the CSU van. The neutron log at about 4030 feet stopped recording and the Schlumberger engineers were not able to determine the cause of the failure. MRTs recorded temperatures of 276°, 278°, and 278°F.

Trip 7

A re-run of the previous trip was necessary because of failure of the neutron log. This run was successful. MRTs recorded temperatures of 290°, 290° and 291°F.

Temperature Data

A total of five temperature logs were run in this hole (Table 11). The first two logs were run with the HRT tool (HIGH RESOLUTION TEMPERATURE) and the last three runs were with the HTT tool (HIGH TEMPERATURE SUB-ASSEMBLY). Figure 5 is a temperature-depth profile of these data; also given are the MRT values for each run. The data indicate that the two tools have different temperature response; that is, run #2 is higher than #1, but the subsequent HTT runs are all lower than #2. Because the temperature should increase at a somewhat predictable rate, the discrepancy of tools is attributable to varying tool response. MRT correlation with each temperature run is different for each tool, but internally consistent (Figure 5). The HTT read about 7°F lower than the MRT while the HRT read about 38°F higher than the MRT.

The highest measured temperature in the hole was on the first temperature run at 4542 feet where the temperature rose from 269° to 354°F with only two minutes of build-up time. The cause for this rapid build-up is explained by the fact that the bottom 18 feet of the hole was not cooled down by circulation at all.

Deep Logging Operation #2 occurred during the period May 27-28, 1980, the fourth and last operation. It was programmed to evaluate the unlogged portion of the well from 4543 to 5927 feet (total depth), a total of about 1400 feet. Since each log run has a minimum 2000-foot depth charge, the logs were run from 4100 to total depth. A complete suite of logs were obtained (temperature, dual induction, sonic, density, neutron, caliper, gamma-ray, and SP). No major problems were encountered during this operation. A chronological summary of events is given in Table 13. Table 14 summarizes the types of logs run, together with the number of trips made, the interval logged, and the maximum registering thermometer (MRT) values for each trip. Given below is a brief description of the operation by trip.

Trip 1

The first logging trip was a combined HTT/DISFL/SP/Gamma-ray. HTT recorded a maximum temperature of 222°F at 5300 feet (Figure 7). The Rmf bridge calibration was checked with brines of known resistivity (Figure 6 and Table 15) and found acceptable. The three MRTs each recorded temperatures of 258°F.

Trip 2

The BHC/Gamma-Ray/Caliper logging run encountered a minor problem with the sonic signal (Table 12) which was immediately corrected. It should be noted that the Caliper registered too high on this run. Three MRTs each recorded temperatures of 266°F.

Trip 3

The nuclear logs (FDC/CNL) constituted the third logging run. MRT recorded temperatures of 276°, 276° and 273°F.

Trip 4

The final logging run was a combined HTT and HDT. Difficulty was encountered in calibrating the HTT at the surface. Once a satisfactory calibration was achieved on both tools, they were run in the hole. The after-survey calibration on the HTT indicated a significant amount of drift. The temperatures recorded on this run were also very questionable (see discussion below). As a result, the well-site geologist decided not to purchase this log. The Schlumberger logging engineer concurred. MRT recorded temperatures of 248^{o}, 234^{o}, and 274^{o}F.

Temperature Data

Two temperature logs were run in the hole (Table 14). The temperature-depth profiles along with the respective MRT values are presented in Figure 7. As mentioned above, run #2 was not accepted by the well-site geologist. In a "normal" well bore situation, the temperature should increase at a somewhat predictable rate with time. Run #2 measured lower temperatures relative to run #1 and one of the survey calibrations showed significant drift. Because of these factors, it was concluded that the validity of this log was very questionable.

Section V: Temperature Surveys

A total of 25 separate temperature surveys (both partial and complete with respect to total depth at the time) were run in the Beowawe 85-18 during the course of drilling. Four additional surveys have been conducted since completion. Table 16 presents a summary of the surveys run. Given is the data, contractor, and number of surveys conducted. All temperature data is available through the UURI/ESL.

Section VI: Drill Stem Test (DST)

As a result of rapid drilling rates and apparent lost circulation, a drill stem test (DST) was conducted of the interval 2937-3208 feet. The data collected during this test are summarized below.

Pre-Test Temperature Logging

On April 21, Agnew and Sweet Wireline Services ran four temperature surveys from 1500 to 2435 feet at 100-foot stations.

Mechanical Set-up

A schematic of the well and surface test equipment along with the data collection points is shown in Figure 8. Bottomhole pressure and temperature recorders were located at 2920 to 2931 feet (point A in Figure 8). Two Halliburton pressure chart recorders and one Agnew and Sweet temperature recorder were used. During the test one of the pressure recorders failed. Wellhead temperature and pressure were determined with a thermocouple taped to the outside of the drill pipe and with a Halliburton pressure gauge, respectively. Fluid samples were taken principally from the end of the blooie line (point E in Figure 8). One sample was taken from a small valve connected

to the blooie line (point C in Figure 8). Brine flow rates were determined by fluid level difference in a 400 bbl Baker tank. Note that flow rates reported herein have not been corrected for flash.

Test Procedure

Test tools were run on drill pipe and hung above the 9-5/8 inch casing shoe with the packer set at 2866 feet. NOWSCO tubing was run to 100 feet, where nitrogen was pumped at low rates into the drill pipe, and the tubing slowly lowered to 500 feet. Using nitrogen to maintain the brine production, flow rates were determined while lifting from 500, 1000, 1500 and 2500 feet. The well was then shut-in for a pressure build-up. Table 19 is a detailed test chronology.

Surface Measurements

Wellhead pressure and temperature, flow rates, as well as pH, specific conductance and fluid temperature of water samples were recorded at the surface. Wellhead measurements and flow rates are given in Table 20. Nine water samples (which appeared contaminated with drilling mud) were collected during the flow test. The pH, specific conductance and temperature of these samples were measured. Table 21 presents these data in both real and flow time along with the pH and specific conductance of distilled water used in the collection procedure and make-up water for the drilling fluids; and comments on validity of the various measurements. Note, the specific conductance measurements are questionable because of a faulty conductivity meter. The measurement given was the highest value obtained as soon as the conductivity probe was placed within the sample. Drift in readings towards lower values occurred within seconds after the initial reading was taken. Chemical analysis of these samples were done by Skyline Labs, Inc. and the data is presented in Appendix 5. Initial rat-hole volume was about 80 barrels and approximately 158 barrels of fluid were produced during the test.

Bottomhole Measurements

Bottomhole temperature and pressure measurements recorded during the DST are available through the UURI/ESL. Figure 9 presents the annotated pressure chart along with a summary of the test procedure.

Post-Test Temperature Log

Two temperature logs on April 23, 1980, by Geothermal Services (GTS) obtained post-test temperature data. GTS was used because the decal thermister temperature tool with digital read-out at the surface provided real time data. The time, depth and temperature for each run are reported in Tables 17 and 18.

CONCLUDING REMARKS

The Department of Energy Industry Coupled Program has allowed for the acquisition of varied geothermal data on the Beowawe Geothermal Area. A shallow temperature hole program, mercury-in-soil survey and self-potential survey were conducted to select the optimum location for an exploratory well. A 5929-foot exploratory well was drilled. Lithologic, temperature, and wireline geophysical data were collected along with conducting a drill stem test (2437-3208 feet), and a short-term flow test (1655-2188 feet), Appendix 6. In addition, chemical data has been obtained on water samples collected during the drill stem test and short-term flow test, Appendix 7. The data gathered in this study has been useful in defining various aspects of the active geothermal system at Beowawe. The program is considered by Chevron to be a success.

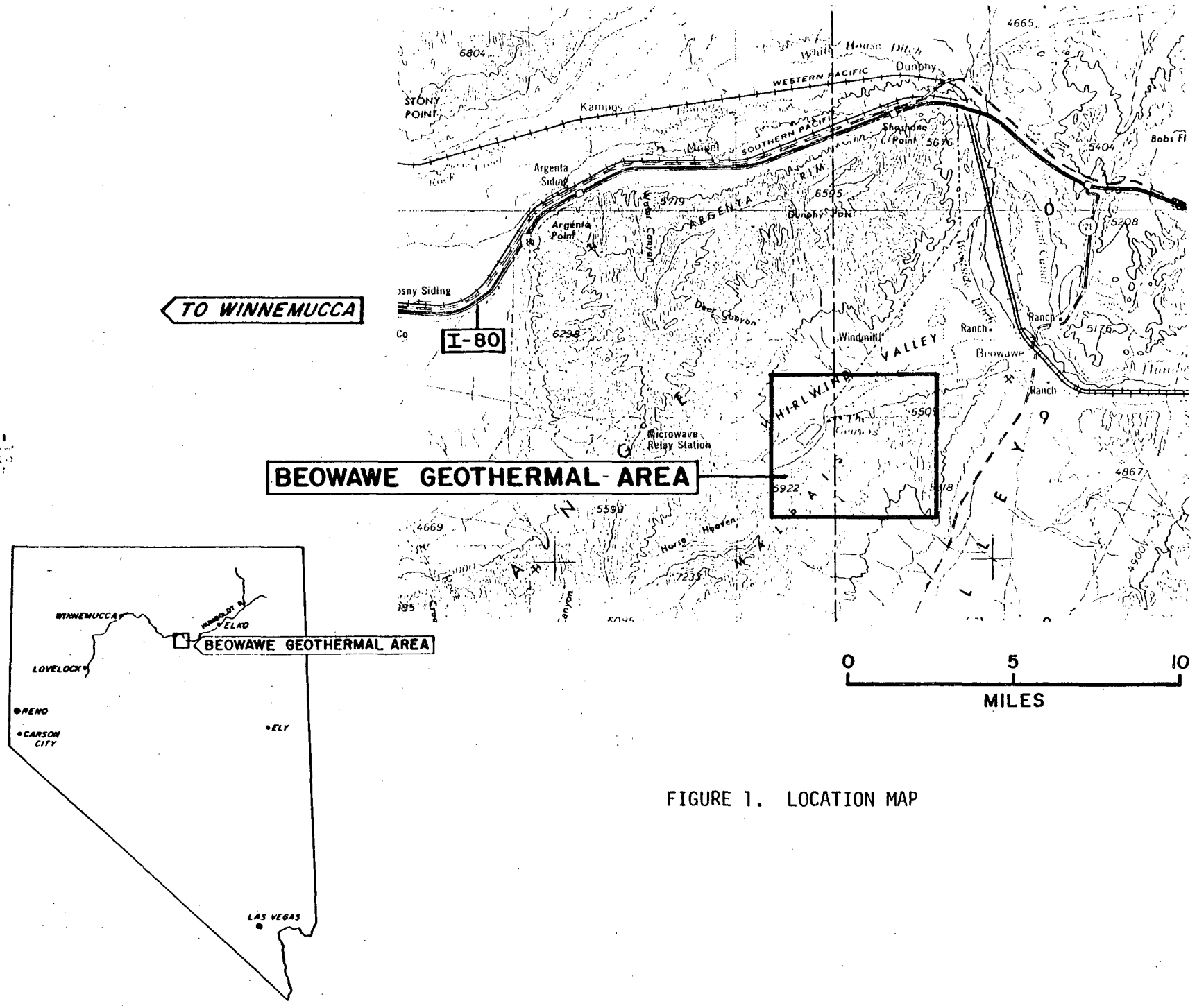


FIGURE 1. LOCATION MAP

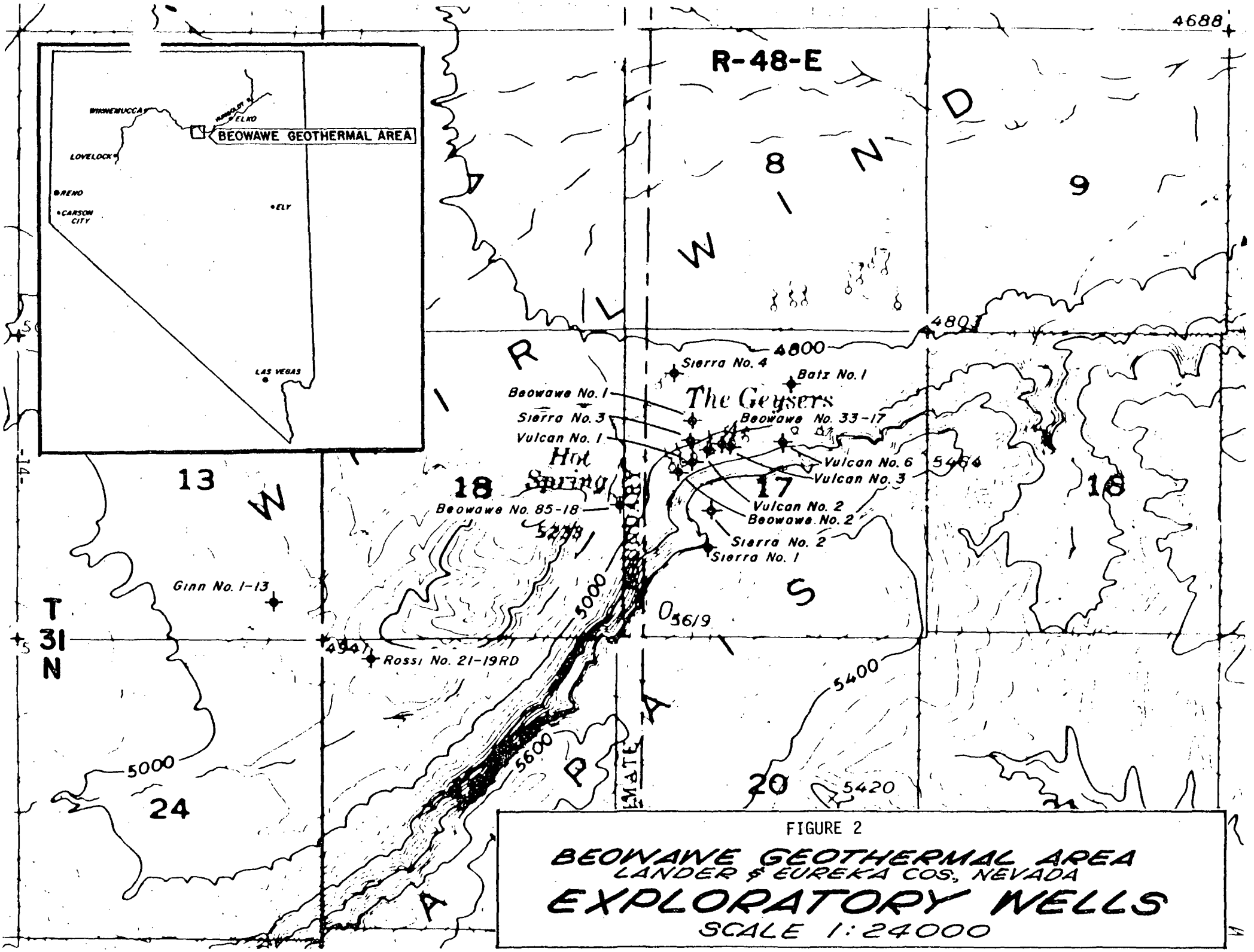


FIGURE 2

BEOWAWE GEOTHERMAL AREA
LANDER & EUREKA COS., NEVADA

EXPLORATORY WELLS

SCALE 1:24000

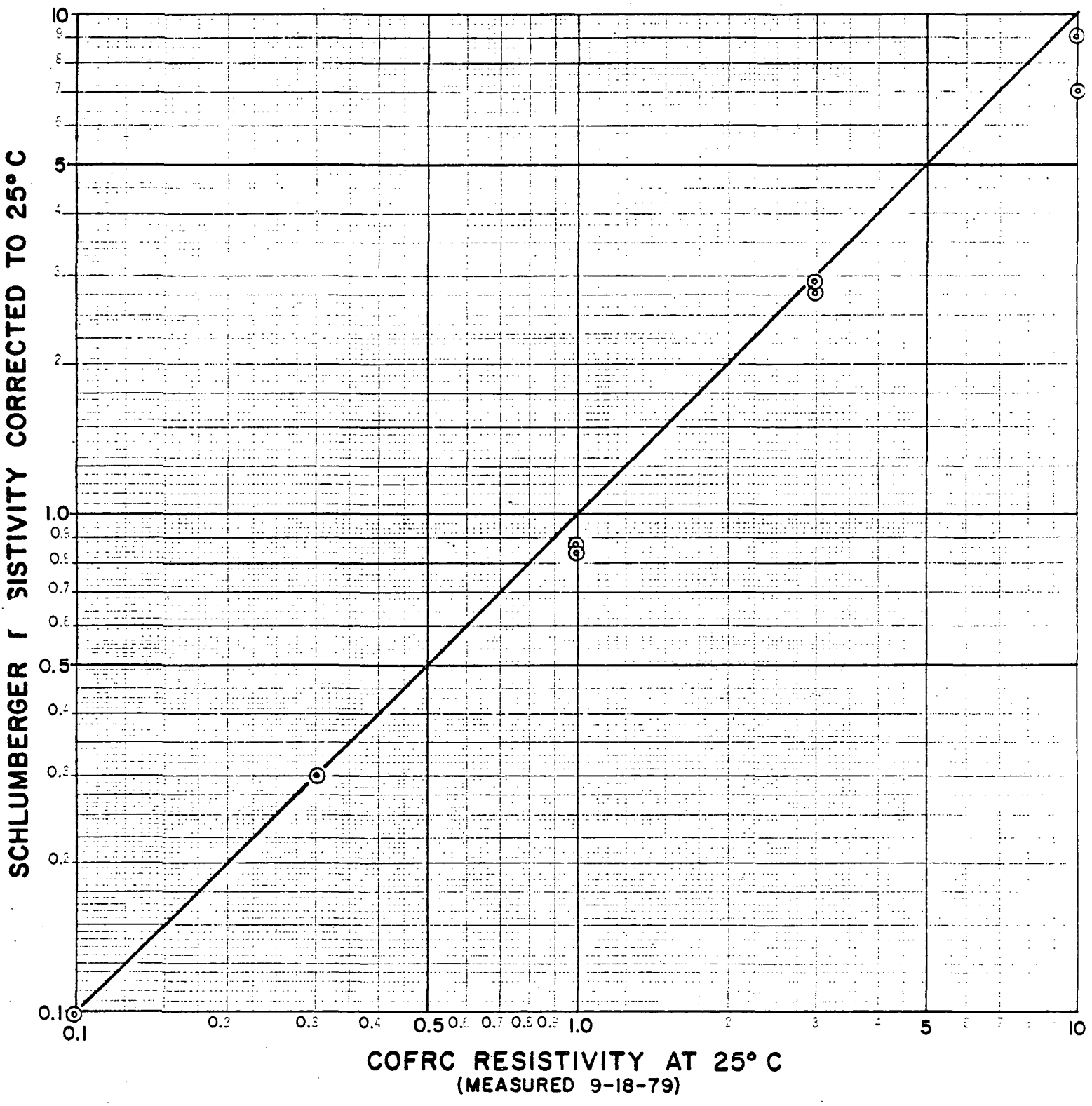


Figure 3. Schlumberger Rmf bridge calibration plot for the shallow logging operation (see Table 6).

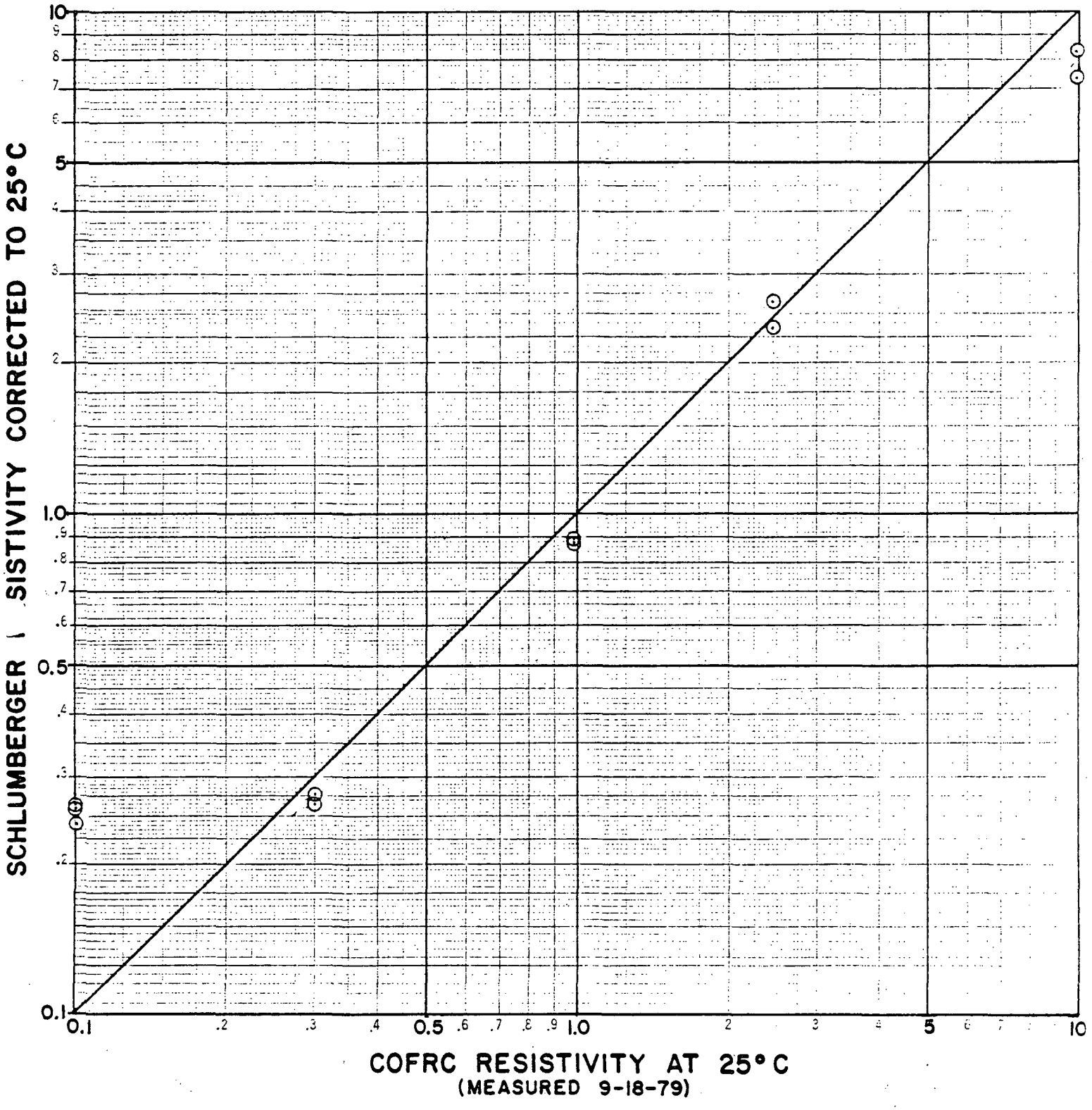


Figure 4. Schlumberger Rmf bridge calibration for logging operation #1 (see Table 12).

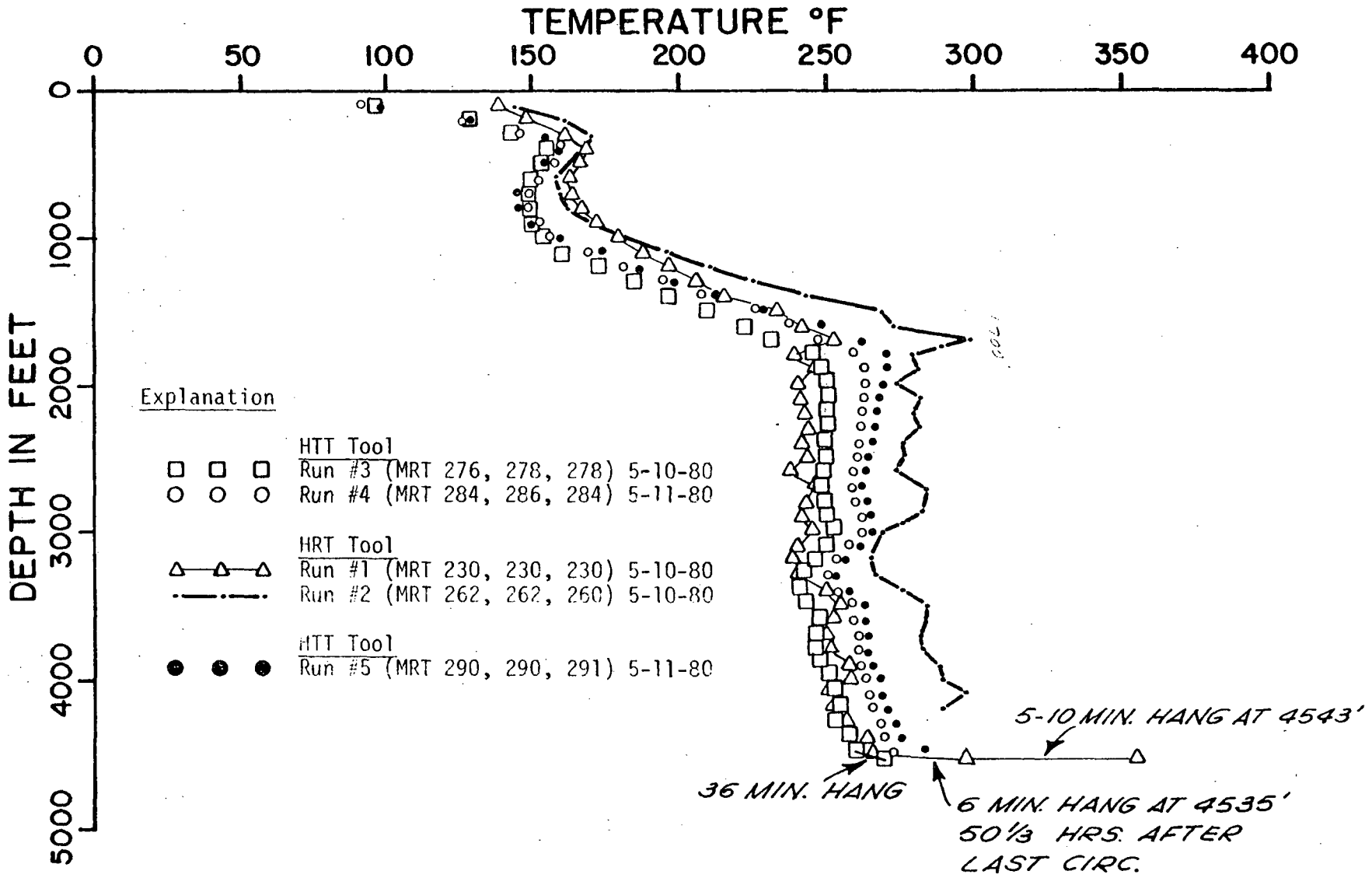


Figure 5. Temperature-depth profile (at 100 foot increments) for Schlumberger temperature runs conducted during the deep logging operation #1. Also given are the MRT values for each respective run. Note: $T_{HTT} < T_{MRT} << T_{HRT}$, where T is the maximum temperature recorded.

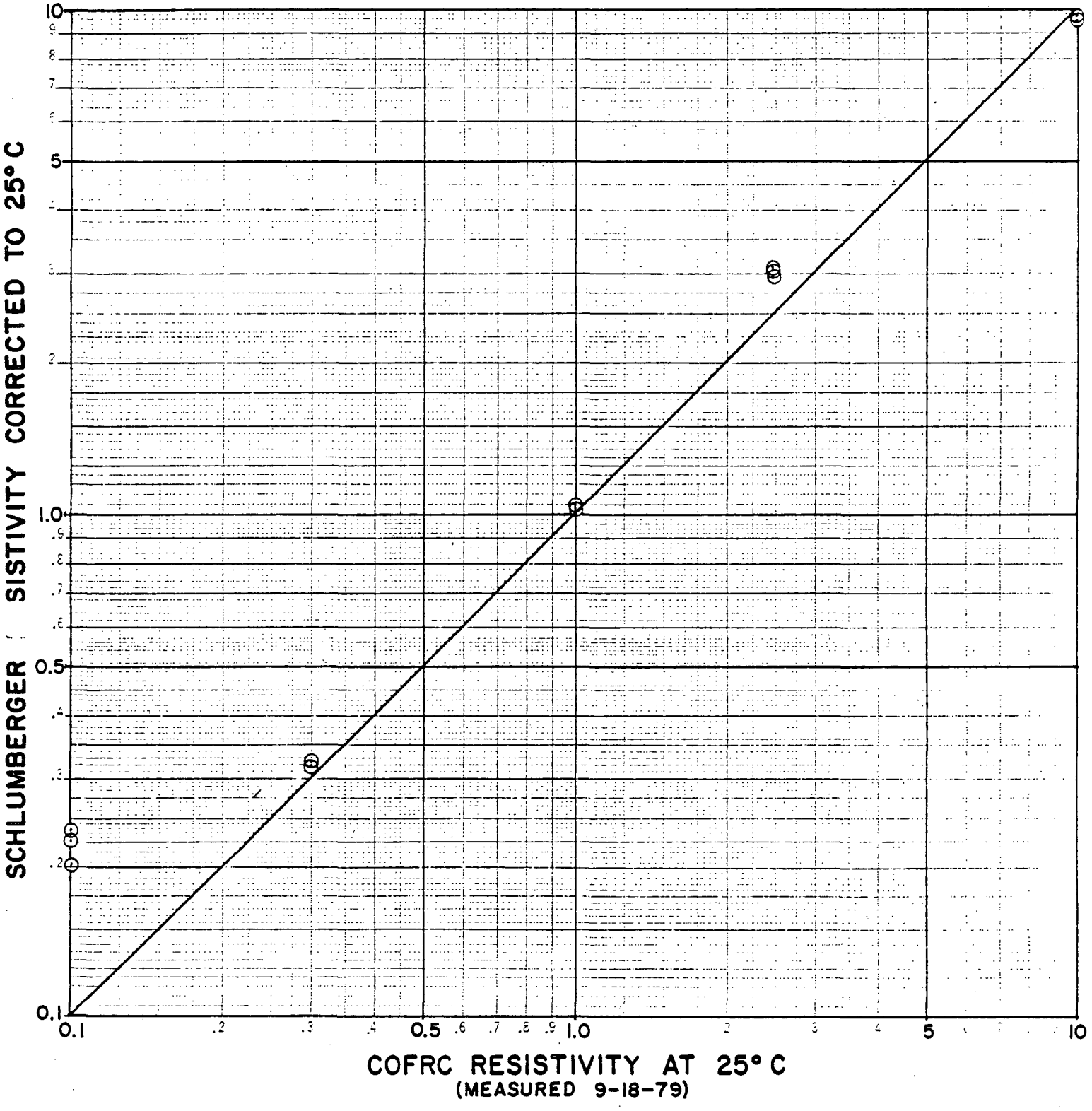


Figure 6. Schlumberger Rmf bridge calibration for deep logging operation #2 (see Table 15).

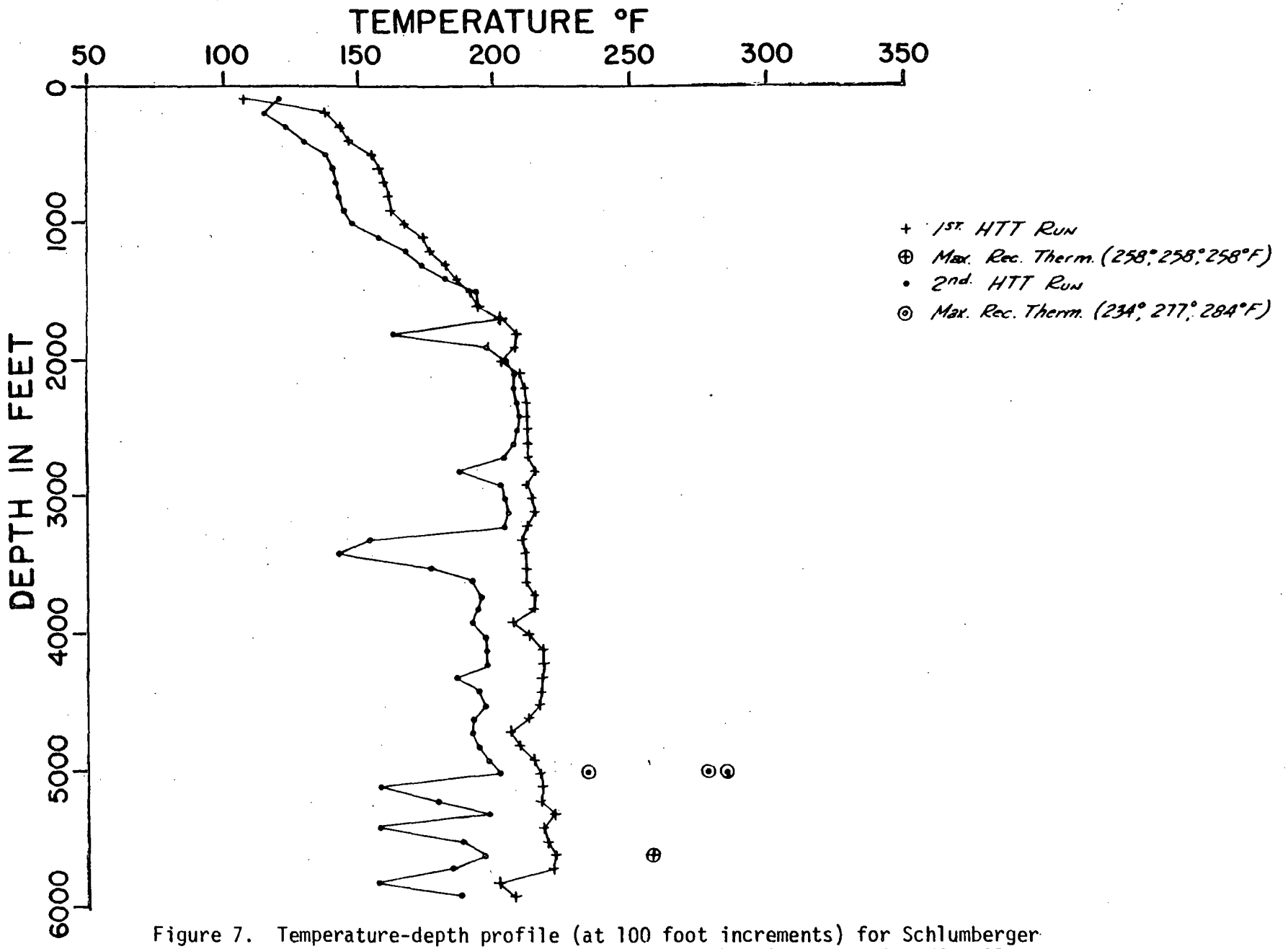


Figure 7. Temperature-depth profile (at 100 foot increments) for Schlumberger temperature runs conducted during deep logging operation #2. Also shown are the MRT values for each run. These data are plotted at the depth of the maximum temperature recorded in each log.

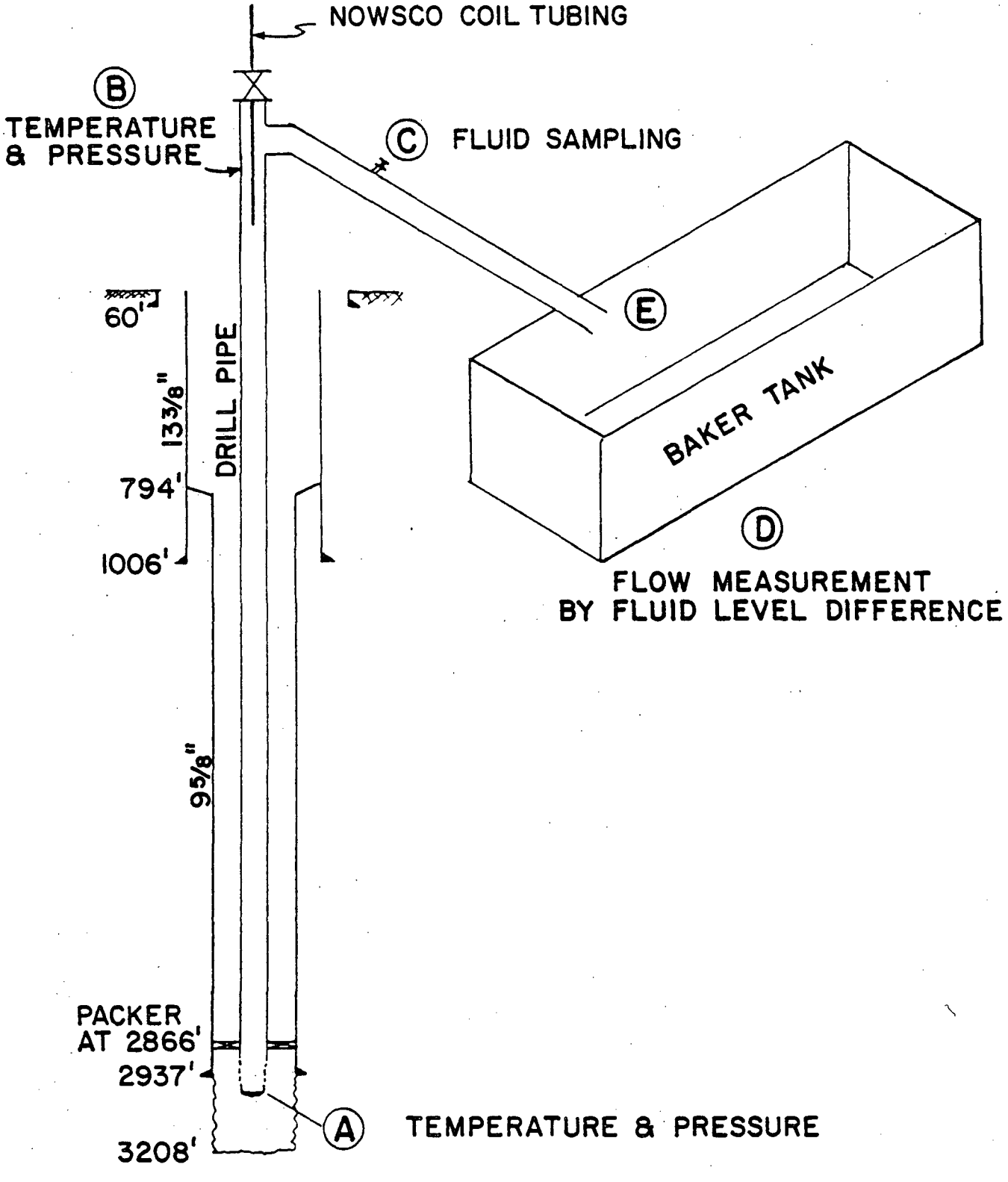
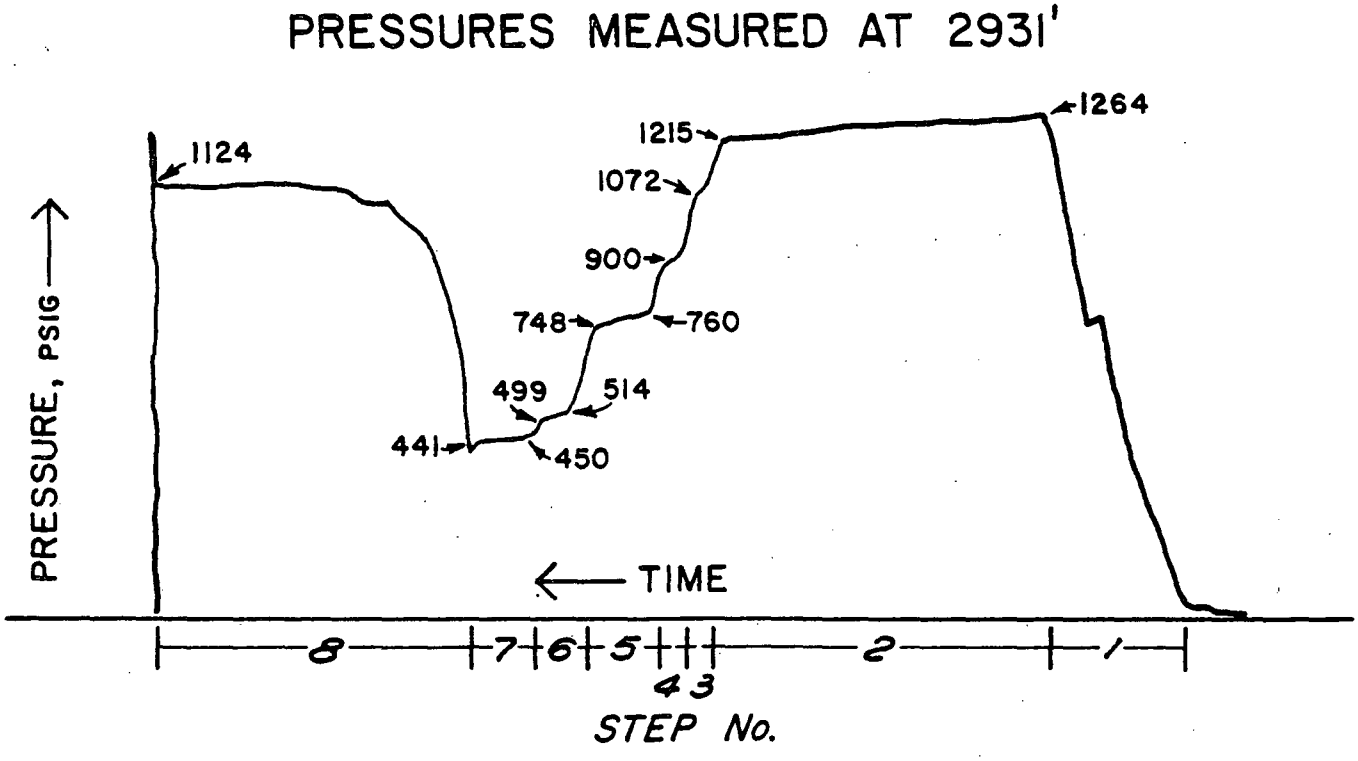


Figure 8. Schematic of well and surface test equipment utilized during the DST on April 22, 1980. Also given are the data collection points.



STEPS:

1. RUN IN HOLE. SET PACKER AT 2867'.
2. RIG UP AND RUN NOWSCO TUBING.
3. NOWSCO TUBING AT 500'. INJECT N_2 AT 300 CFM.
4. LOWER NOWSCO TUBING TO 1000'.
5. LOWER NOWSCO TUBING TO 1500'.
6. LOWER NOWSCO TUBING TO 2500'.
7. INCREASE N_2 RATE TO 500 CFM.
8. STOP N_2; WELL DIED. SHUT-IN AT SURFACE.

Figure 9. Summary of annotated pressure chart.

Table 1. Shallow Temperature hole locations.

Hole #	Sec.	Tnship	Rge	Approx. Location
B-2-79	5	31N	48E	150 ft N & 950 ft E of SW cor of sec 5
B-7-79	7	31N	48E	2200 ft S & 700 ft W of NE cor of sec 7
B-9-79	9	31N	48E	2250 ft N & 2625 ft E of SW cor of sec 9
B-11-79	7	31N	48E	750 ft N & 2200 ft E of SW cor of sec 7
B-14-79	13	31N	48E	1450 ft S & 1400 ft W of NE cor of sec 13
B-19-79	18	31N	48E	1775 ft S & 1125 ft W of NE cor of sec 18
B-20-79	18	31N	48E	2550 ft N & 175 ft E of SW cor of sec 18
B-22-79	18	31N	48E	2450 ft S & 2150 ft W of NE cor of sec 18
B-24-79	18	31N	48E	1750 ft N & 725 ft E of SW cor of sec 18
B-25-79	18	31N	48E	2100 ft N & 2000 ft E of SW cor of sec 18
B-27-79	18	31N	48E	2450 ft N & 150 ft W of SE cor of sec 18
B-29-79	13	31N	47E	1150 ft N & 2400 ft W of SE cor of sec 13
B-31-79	18	31N	48E	1300 ft N & 2075 ft W of SE cor of sec 18
B-32-79	18	31N	48E	1425 ft N & 600 ft W of SE cor of sec 18
B-33-79	17	31N	48E	1925 ft N & 1800 ft E of SW cor of sec 17
B-35-79	16	31N	48E	2450 ft N & 525 ft E of SW cor of sec 16
B-37-79	18	31N	48E	250 ft N & 2450 ft E of SW cor of sec 18
B-38-79	18	31N	48E	275 ft N & 1475 ft W of SE cor of sec 18
B-39-79	17	31N	48E	800 ft N & 875 ft E of SW cor of sec 17
B-46-79	19	31N	48E	500 ft S & 2175 ft W of NE cor of sec 19
B-47-79	20	31N	48E	1600 ft S & 700 ft E of NW cor of sec 20
B-48-79	21	31N	48E	5000 ft N & 250 ft E of SW cor of sec 21
B-49-79	24	31N	47E	2600 ft S & 675 ft W of NE cor of sec 24
B-50-79	19	31N	48E	2175 ft S & 1105 ft E of NW cor of sec 19
B-51-79	19	31N	48E	1200 ft S & 2300 ft E of NW cor of sec 19
B-54-79	24	31N	48E	1150 ft N & 900 ft E of SW cor of sec 24

Table 2. Shallow temperature hole program drilling summary.

Temperature Hole	Date (1979) Spudded/Completed	Hours Drilled	Total Depth (ft)	Pipe Set (ft)	Comment(s)
B-2-79	June 5/7	16	500	484	
B-7-79	August 4/5	18	500	494	Worked 12.5 hrs. to re-set pipe when well began to flow (8-6-79).
B-9-79	June 4/5	15	500	494	
B-11-79	August 2/3	20	500	494	
B-14-79	August 2/3	21.75	350	346	Two-day drilling limit.
B-19-79	June 7/8	24.75	500	494	Spent an additional 8 hrs. spent on fishing of 500 feet of drill stem on June 13.
B-20-79	June 27/30	24.25	360	335	
B-22-79	July 26/28	24	500	494	
B-24-79	June 26/27	20.75	450	441	
B-25-79	July 27/28	37.75	430	420	
B-27-74	June 9/10	14	240	237	Drilling terminated because mud temperature reached 125°F.
B-29-79	August 4/5	22.5	460	452	
B-31-79	July 19/26	62	460	438	Severe loss circulation from 340 to TD.
B-32-79	June 11/12	21.25	220	210	Two-day drilling limit.
B-32-79	August 28/31	43.25	510	504	Due to high temprature in first 220 hole was twinned and drilled to 500 feet. Old hole could not be re-entered because of severe dog leg.
B-33-79	August 22/23	20.5	200	196	Two-day drilling limit.
B-35-79	August 21/23	32	500	494	
B-37-79	August 12/21	97.75	740	714	Severe loss circulation problems. No returns from 270-290, 300-600, and 620-740 feet.
B-38-79	June 14/14	11.75	500	494	
B-39-79	August 17/20	42.75	420	410	
B-46-79	June 19/20	27.75	175	170	Severe loss circulation at 170 feet. Tried to cement off flow, but failed. Cement pulled off and then pulled back on August 28.
B-47-79	August 10/12	33	390	388	
B-48-79	August 6/9	42.75	490	483	
B-49-79	June 21/23	23.25	500	494	
B-50-79	July 26/28	24.5	330	323	
B-51-79	July 19/22	48	425	420	Hole was initially drilled on June 21 to 140 feet (9 hrs.), then suspended and deepened on July 19.
B-54-79	June 23/25	22.5	450	441	

Table 3. Mercury-in-soil data. Sample notation (e.g., A-01) describes the traverse line (01,02,03,...). Sampling points are shown in Plate 4 along with Hg concentration at that station.

MERCURY-IN-SOIL RESULTS

Sample #	Hg (ppb)	Sample #	Hg (ppb)	Sample #	Hg (ppb)	Sample #	Hg (ppb)
A-01	No Sample	A-18	4	A-35	11	C-01	8
A-02	30	A-19	64			C-02	No Sample
A-03	18	A-20	35	B-01	No Sample	C-03	21
A-04	24	A-21	22	B-02	33	C-04	No Sample
A-05	20	A-22	25	B-03	20	C-05	24
A-06	20	A-23	19	B-04	16	C-06	No Sample
A-07	12	A-24	39	B-05	22	C-07	17
A-08	9	A-25	No Sample	B-06	14	C-08	No Sample
A-09	22	A-26	19	B-07	26	C-09	10
A-10	26	A-27	No Sample	B-08	21	C-10	20
A-11	10	A-28	5	B-09	21	C-11	12
A-12	14	A-29	No Sample	B-10	9	C-12	19
A-13	7	A-30	11	B-11	35	C-12	19
A-14	13	A-31	No Sample	B-12	20	C-13	29
A-15	10	A-32	19	B-13	18	C-14	14
A-16	8	A-33	15	B-14	11	C-15	21
A-17	8	A-34	11	B-15	13	C-16	44

Table 3. (Cont'd)

MERCURY-IN-SOIL RESULTS

Sample #	Hg (ppb)	Sample #	Hg (ppb)	Sample #	Hg (ppb)	Sample #	Hg (ppb)
C-17	29	E-04	20	G-07	58	I-01	12
C-18	25	E-05	30	G-08	28	I-02	30
		E-06	10	G-09	17	I-03	6
D-01	22	E-07	13	G-10	20	I-04	34
D-02	17	E-08	15			I-05	29
D-03	14			H-01	11	I-06	9
D-04	12	F-01	31	H-02	13		
D-05	22	F-02	41	H-03	12	J-01	No Sample
D-06	14	F-03	52	H-04	18	J-02	15
D-07	29	F-04	32	H-05	20	J-03	16
D-08	44			H-06	17	J-03	42
D-09	48	G-01	58	H-07	22	J-04	20
D-10	107	G-02	144	H-08	30	J-05	11
		G-03	22	H-09	14	J-06	15
E-01	34	G-04	11	H-10	11	J-07	12
E-02	17	G-05	20	H-11	28	J-08	5
E-03	37	G-06	16			J-09	21

Table 3. (Cont'd)

MERCURY-IN-SOIL RESULTS

Sample #	Hg (ppb)	Sample #	Hg (ppb)	Sample #	Hg (ppb)	Sample #	Hg (ppb)
K-01	No Sample	L-05	32	N-04	27		
K-02	45	L-06	29	N-05	51		
K-03	No Sample	L-07	308				
K-04	19			O-01	11		
K-05	38	M-01	No Sample	O-02	9		
K-06	15	M-02	No Sample	O-03	30		
K-07	16	M-03	No Sample	O-04	54		
K-08	36	M-04	No Sample				
K-09	33	M-05	20	P-01	No Sample		
K-10	84	M-06	33	P-02	97		
K-11	156	M-07	28				
K-12	29	M-08	57	Q-01	62		
		M-09	38	Q-02	40		
L-01	8			Q-03	78		
L-02	7	N-01	15	Q-04	35		
L-03	22	N-02	8	Q-05	42		
L-04	12	N-03	29	Q-06	41		

Table 4. Directional survey data.

DEPTH (ft)	DRIFT (degree-minute/direction)
120	1°45'/S75W
241	1°30'/S57W
284	2°/S77W
354	1°15'/S84W
468	1°15'/S16W
700	1°15'/S30W
1088	1°15'/S15W
1226	1°/S33W
1339	0°
1447	1°/S49W
1565	1°45'/N72E
1668	0°45'/N72E
1984	0°45'/S35W
2257	2°30'/S59W
2301	1°45'/S71W
2376	1°/N43W
2418	1°/N8W
2478	1°/N12W
2539	1°/N2W
2613	1°30'/N41E
2701	1°30'/N34E
2794	1°15'/N40E
3427	1°15'/N82E
3940	2°/S67E
5370	2°/N30E
5916	4°/N32E

Table 5. Approximate* Schlumberger logging operation charges for the shallow logging operation (see text).

PLANNED PROGRAM COST BREAKDOWN

Individual Components		Cost ($)
DISFL/SP		1180**
BHC/Caliper/SP	Logs	1240**
Gamma Ray		300**
Round Trip Mileage		2145
Field Tape Purge	Services	240
		5105
10% Remote Location Charge		510
	Cumulative Total	5615

MINIMUM CHARGE FOR A REMOTE LOCATION

Individual Components		Cost ($)
Minimum Charge		4870
Mileage		2145
	Total	7015

Since the minimum charge incurred by the logging operation exceeded the actual program rendered a HDT/FIL log was added.

COMPLETED LOGGING OPERATION COST BREAKDOWN

Individual Components		Cost ($)
DISFL/SP		1180**
BHC/Caliper/SP	Logs	1240**
Gamma Ray		300**
HDT/FIL		2710**
Round Trip Mileage		2145
Field Tape Purge	Services	240
FIL Presentation		680
		8495
10% Remote Location Charge		850
	Cumulative Total	9345

Effective additional cost for HDT/FIl log is $2330.
HDT/FIL ($2710 + FIL Presentation ($680) + 10% Remote Location Differential ($850 - $510) - Minimum Charge ($7015) - Planned Program Cost (5615) = Effective cost for HDT/FIL ($2330)

*Charges are approximate, actual field cost may vary slightly.

**Minimum charge for log is based on 2000-foot total depth.

Table 6. Schlumberger R_{mf} bridge calibration data for the shallow logging operation.

BRINE	COFRC Resistivity Measurement* (ohm-m) @ 25°C	Schlumberger R_{mf} bridge Resistivity Measurement**(ohm-m) @ 56°F	Schlumberger values (ohm-m) converted to 25°C
A-3	9.889	12.3, 11.9, 12.3	9, 8, 9
B-3	2.962	3.81, 3.79, 3.79	2.9, 2.8, 2.8
C-3	0.999	1.30, 1.29, 1.29	0.85, 0.87, 0.87
D-3	0.302	0.41, 0.41, 0.41	0.3
E-3	0.102	0.16, 0.16, 0.16	0.095

*Resistivity measurement made on 9-18-79.

**Schlumberger conducted three replicate measurements.

Table 7. Planned intermediate logging program.

Trip	Log	Depth (feet)
1	HTT (Temperature) logging into hole	0 - 3208
	DISFL (Induction) logging out of hole	3208 - 1006
2	BHC (Sonic)/Caliper/Gamma Ray	3208 - 906
3	FDC (Density)/CNL(Neutron)/Caliper/Gamma-Ray	3208 - 906
4	HTT (Temperature) logging into hole	0 - 3208
	HDT (Dipmeter) logging out of hole	3208 - 1006

Table 8. Actual intermediate logging program.

Date	Trip	Log
4-4-80	1	HTT (temperature) logging into hole: 132-1900 feet (bridge at 1924 feet). DISFL (induction) logging out of hole: 1918-1006 feet
4-5-80	2	HTT (temperature) logging into hole: 87-1324 feet (bridge at 1350 feet). DISFL (induction) on tool configuration, but not used.
	2	HTT (temperature) logging into hole: 87-1282 feet (bridge at 1350 feet). DISFL (induction) on tool configuration, but not used. BHC (sonic)/Caliper/Gamma Ray on tool configuration, but not used.

Table 9. Intermediate depth logging operations summary of events.

Date	Time	Event
4-4-80:	02:30	Schlumberger on location.
	10:55	Reached TD.
	12:30	PØH (to stands).
	13:20	PØH.
	17:30	Schlumberger back to rig up.
	19:00	Bit out of hole.
	19:30	HTT/DISFL, RIH; logging temperature bridge at 1900 ft RØH, logging induction SP. Schlumberger on standby, RIH with bit to clear bridges.
4-5-80:	06:00	Schlumberger on location.
	03:00	Bit on bottom.
	07:00	PØH.
	14:30	Bit out of hole.
	15:00	RIH with HTT/DISFL, logging temperature.
	16:10	Bridge @ 1350 ft.
	17:00	RØH - no log.
	18:30	Rig up for HTT/DISFL/BHC (heavier tool).
	19:30	RIH with HTT/DISFL/BHC, logging temperature.
	20:00	Bridge @ 1350 ft.
	20:30	RØH - no log.
	22:00	Schlumberger on standby, RIH with bit to clear bridges and condition hole.

Table 10: Chronological summary of events which occurred during deep logging operation #1.

Date	Time	Event
May 9	1800	Arrive at B-85-18 location.
	1815	Schlumberger calls location from Winnemucca, POH.
	1830	Circulation stops.
	2050	Schlumberger arrives on location with a CSU van and an analog truck and proceeds to set up.
	2125	JLI discusses logging program with Schlumberger engineers: Jack Anderson and Ed Boratko.
	2225	Still POH; Schlumberger rigging up.
	2338	Schlumberger having difficulty calibrating temperature tool (HRT).
May 10	0015	Start in hole with HRT.
	0030	Having difficulty running HRT, power is being switched off. Appears that there is trouble with line continuity.
	0114	Determine problem to be in connection between cable and tool; attempting to correct
	0125	Started in hole.
	0410	Temperature survey approximately 4430 feet, T=263^{o}F. Jack Anderson is concerned about sticking the tool at bottom if we have a long build-up time.
	0413	Reached T.D. hanging tool for about five minutes.
	0415	Pulled off bottom because temperature are too high, 354^{o}F, after 2 minutes.
	0417	At 4500' and waiting for HRT tool to stabilize.
	0435	POH
	0611	Rigging up for DISFL/SP.
	0630	RIH with DISFL/SP.
	0645	DISFL/SP tool on bottom.

Date	Time	Event
	0930	RIH with BHC tool; getting a week casing signal; and caliper is off (reading 8.3" in 9-5/8" casing with a 8.84" I.D.). POH
	0935	BHC tool out of hole, will attempt to recalibrate caliper.
	1030	RIH with BHC tool.
	1130	Near completion with BHC tool; will run CBL as soon as figure out how to on CSU.
	1300	Discovered gamma-log has not been run to surface. Have to re-do. In addition, Jack Anderson will be running CBL on analog truck because of difficulty switching from BHC to CBL on the CSU.
	1315	After CBL is completed and will go back in-hole to get rest of gamma-ray with the CSU.
	1330	Going in hole to run CBL in 9-5/8" casing.
	1500	Breaking down BHC tool.
	1530	Calibrating temperature tool (HRT).
	1647	RIH with HRT.
	1935	HRT tool stuck @ 4258' trying to get pass this point.
	2007	Cannot get pass approximately 4200'; will POH and try to run the HTT tool in combination.
	2037	Having difficulty with HTT tape in CSU. Cannot retrieve all necessary information.
	2206	Still having problems with HTT tape. Asked engineers to run HTT with analog truck.
	2250	Switching from CSU to analog truck for HTT run.
May 11	0100	RIH with HTT.
	0210	Finished temperature survey; will wait on bottom for 1/2 hour.
	0230	Start off bottom; logging HDT coming out of hole.

Date	Time	Event
	0245	Having problem with HDT logging run. J. Anderson states that too much electrical current is going down-hole and having difficulty closing caliper.
	0353	POH with open caliper open.
	0500	Out of hole.
	0645	Problem with logging cable. Attempting to fix. Have a bad wire in cable-head.
	0830	Cable-head fixed. J. Anderson believes dipmeter data is good. Cannot verify because HDT tool not functioning properly (caliper does not close) and hostile environment HDT is not on location.
	0935	Calibrating FDC/CNL and HTT.
	1000	RIH with FDC/CNL and HTT.
	1014	Using analog truck for HTT (see above).
	1515	Coming out of hole, logging Gamma-Ray to surface.
	2000	Have to re-run FDC/CNL because neutron log ceased recording at approximately 4030 feet.
	2200	HTT out of hole, setting up FDC/CNL on the CSU.
May 12	0100	Out of hole; running after survey calibration.
	0800	Processing logs.
	0945	Schlumberger having difficulty running FIL.
	1123	FIL very bad as a result of not being able to apply pressure to the pads (see above).
	1400	Schlumberger leaves location.

Table 11: Summary of logging trips, logs run, interval logged, and time required to run each trip. Also given are the maximum registering thermometer (MRT) values for each trip.

Trip	Type of Log	Interval Logged (feet)	Date: Time started/ended	MRT Values (^{o}F)
1	HRT	50 - 4542	5-10-80: 0125/0400	230,230,230
2	DISFL/SP BHC/Caliper/	2936 - 4536 2936 - 4530	5-10-80: 0645/0830	235,236,240
3	CBL/Gamma-Ray* BHC/Caliper/ SP/Gamma-Ray	750 - 2990 1240 - 2960	5-10-80: 0930/1500	250,250,250
4	HRT	50 - 4240	5-10-80: 1700/1925	260,262,262
5	HTT* HDT	0 - 4525 2937-4318	5-10-11-80: 1700/1925	276,278,278
6	HTT FDC/CNL Caliper/ Gamma-Ray	0 - 4530 2936 - 4524	5-11-80: 0958/1640	284,284,286
7	HTT* FDC/CNL/ Caliper/ Gamma-Ray	0 - 4532 2936 - 4542	5-11-12-80: 1819/2058	290,290,291

* Logged using analog truck instead of CSU van.

Table 12. Schlumberger Rmf bridge calibration data, for deep logging operation #1.

Brine	Resistivity Measurements* (ohm-m) at 25°C	Schlumberger Rmf Bridge Resistivity Measurements (ohm-m)	Temperature of Measurement (°F)	Schlumberger Values (ohm-m) Converted to 25°C
A-3	9.889	122, 13.0, 13.0	44, 47, 47	7.39, 8.34, 8.34
B-3	2.462	4.02, 4.01, 4.01	42, 48, 48	2.34, 2.62, 2.62
C-3	0.992	1.43, 1.40, 1.43	45, 45, 45	.884, .865, .884
D-3	0.302	.438, .438, .437	44, 46, 46	.265, .276, .275
E-3	0.102	.40, .41, .42	44, 46, 46	.242, .258, .264

* Resistivity measurements were made on 9-18-79.

Table 13. Chronological summary of events which occurred during deep logging operation #2.

Date	Time	Event
May 27	1130	Arrive on location; mud loggers rigging down; POH.
	1435	POH.
	1550	Calibrating HTT.
	1700	Logging.
	2000	POH.
	2035	Preparing to RIH with BHC.
	2208	Having problems with sonic tool, losing signal. Checking line continuity.
	2345	RIH with sonic. Responding properly in casing. Caliper is reading low, however.
	2350	Check caliper. Works well coming up hole, and not functioning properly going down.
May 28	0300	Out of hole with sonic. Running after survey calibration.
	0430	Logging FDC/CNL.
	0700	Calibrating HTT/HDT.
	0755	Having some problems with the HTT calibration.
	1130	Logging HTT.
	1215	Logging HDT.
	1430	Schlumberger leaves location. Operation completed.

Table 14. Summary of logging trips, logs run, interval logged and MRT values for each trip.

Trip	Type of Log	Interval Logged (ft)	MRT Values (^{o}F)
1	HTT DISFL/SP Gamma-Ray	100-5894 4100-5924	258, 258, 258
2	BHC Gamma-Ray/Caliper	4100-5915	266, 266, 266
3	FDC/CNL Gamma-Ray/Caliper	4100-5930	276, 276, 273
4	HTT HDT	100-5900 4100-5932	284, 234, 274

Table 15: Schlumberger Rmf bridge calibration data for deep logging operation #2.

Brine #	COFRC Resistivity* Measurements (ohm-m) at 25°C	Schlumberger Rmf Bridge Resistivity Measurements (ohm-m)	Temperature of Schlumberger Measurements (°F)	Schlumberger Values Corrected (ohm-m) to 25°C
A-3	9.889	11.2, 11.4, 11.4	64, 64, 64	9.46, 9.63, 9.63
B-3	2.462	3.66, 3.46, 3.63	64, 65, 66	3.09, 2.92, 3.067
C-3	0.992	1.23, 1.23, 1.25	65, 65, 65	1.053, 1.053, 1.071
D-3	0.302	0.376, 0.370, 0.371	66, 66, 66	.326, .321, 1322
E-3	0.102	0.278, 0.236, 0.265	65, 65, 65	.238, .202, .227

* Resistivity measurements were made on September 18, 1979

Table 16. Summary of temperature surveys conducted.

Date	Contractor(s)	No. of Surveys
4-4-80	Schlumberger Wireline	1
4-21-80	Agnew & Sweet Wireline Services	4
4-23-80	Geothermal Services	2
4-29-30-80	Pruitt Wireline Services	6
5-7-8-80	Pruitt Wireline Services	6
5-9-11-80	Schlumberger Wireline Services	5
5-27-28-80	Schlumberger Wireline Services	1*
6-6-80	Triangle Services, Inc.	1
6-11-80	Triangle Services, Inc.	1
6-17-80	Pruitt Wireline Services	1
7-17-80	Pruitt Wireline Services	1

* Two surveys were conducted, but only one accepted (see p. 10).

Table 17. Run #1, Geothermal Testing Services (GTS) temperature data. Log was tun on April 23, 1980, with total depth being 3208 feet. Note that maximum registering thermometer measured 300°F.

Real Time (Hrs:mins)	Depth (ft)	Temperature (°F)
0645	500	162.0
0654	1000	172.2
0703	1500	213.9
0715	2000	215.5
0730	2500	230.5
0740	2800	232.9
0742	2850	235.4
0744	2900	233.1
0746	2950	249.7
0748	3000	265.3
0750	3050	279.5
0751	3100	290.3
0753	3150	297.0
0756	3200	294.1
0800	3208	292.3
0810	3208	291.4
0820	3208	291.4

Table 18. Run #2, GTS temperature data. Log was run on April 23, 1980, with total depth being 3208 feet. Note that a maximum registering thermometer measured 299°F.

Time (Hrs:Mins)	Depth (Ft.)	Temperature (°F)	Time (Hrs:Mins)	Depth (Ft.)	Temperature (°F)
09:30	50	119.8	10:43	1100	175.4
09:35	100	132.4	10:45	1150	179.9
09:40	150	139.9	10:46	1200	182.2
09:45	200	145.0	10:48	1250	189.4
09:50	250	151.7	10:52	1300	192.9
09:53	300	161.5	10:53	1350	202.5
09:55	350	165.7	10:56	1400	204.9
09:56	400	166.5	10:57	1450	208.0
09:58	450	164.9	11:59	1500	217.2
10:00	500	162.7	11:02	1550	232.8
10:02	550	160.7	11:09	1600	234.4
10:04	600	157.9	11:11	1650	241.4
10:06	650	156.8	11:16	1700	239.4
10:08	700	156.8	11:18	1750	247.3
10:10	750	157.8	11:21	1800	246.5
10:12	800	158.8	11:23	1850	243.1
10:15	850	159.7	11:25	1900	237.6
10:18	900	162.5	11:27	1950	239.0
10:21	950	165.1	11:33	2000	238.6
10:24	1000	167.1	11:36	2050	239.7
10:39	1050	170.8	11:39	2100	242.8

Time (Hrs:Mins)	Depth (Ft.)	Temperature (°F)	Time (Hrs:Mins)	Depth (Ft.)	Temperature (°F)
11:42	2150	246.7	12:41	3050	274.9
11:46	2200	249.4	12:44	3100	281.7
11:49	2250	253.1	12:45	3150	290.6
11:57	2300	255.7	12:47	3200	291.5
11:55	2350	255.1	12:50	3208	294.6
12:03	2400	249.7	13:00	3208	296.5
12:06	2450	249.2	13:10	3208	296.9
12:10	2500	250.0	13:20	3208	297.1
12:13	2550	248.7			
12:15	2600	246.7			
12:20	2650	246.9			
12:22	2700	248.3			
12:23	2750	249.4			
12:25	2800	250.2			
12:27	2850	251.4			
12:30	2900	251.6			
12:36	2950	255.2			
12:39	3000	265.2			

Table 19. Chronology of events during drill stem test (DST).

Date	Time	Event
4-20-80		Clean out cement 2980-2937 feet. Clean out sand plug 2937-3208 feet. Circulate and condition mud.
4-21-80		Circulate.
	10:30	Stop circulation POH, rig up Agnew and Sweet. Run 4 temperature profiles.
4-22-80		Pick up DST tools.
	05:35	RIH, set pocker at 2867 feet. Tail is at 2,935 feet. Total Depth is 3208. Rat hole volume is 76 bbls.
	01:00	Clocks on downhill recorder starts.
	11:12	Temp and press recorders and sampling ready.
	11:15	Start NOWSCO into hole.
	11:20	Stop tbg at 100'.
	11:22	Start N_2 at < 200 cfm.
	11:27	Increase N_2 200 cfm.
	11:30	Increase N_2 300 cfm.
	11:44	N_2 to gage tank.
	11:45	Start lowering tbg at min rate (N_2 at 300 cfm).
	11:46	Fluid to surface.
	12:01	Stop tbg at 500'.
	12:10	Start tbg in hole.
	12:27	Stop tbg at 1,000'.
	12:47	Start in hole (flow had decreased N_2 press decl).
	13:10	Stop tbg at 1,500'.
	13:40	Checked annular fluid level - OK - pkr OK.
	14:10	Start tbg in hole.
	14:43	Stop at 2,500'.
	15:25	Increase N_2 rate to 475-500 cfm. Draining Baker tank.
	15:30	Fluid in annulus starting to boil.
	15:53	Stop draining Baker tank.
	16:47	SI N_2 and bled off pressure to 40 $\pm$ psig.
	17:00	Shut-in.

Table 20. Flowrate and wellhead temperature and pressure data DST conducted on April 22, 1980.

FLOWRATE			WELLHEAD			
Time	Bbls/Day	Cum. (bbls.)	Time	Temp. (^{o}F)	Press (psig)	Remarks
			11:35	61	0	
			11:45	68	0	Fluid to surface at 11:46
			11:48	86	0	
			11:49	101	0	
			11:58	122	3	
			12:06	132	0	Tubing at 500'
			12:41	158	3	Tubing at 1000'
12:58		22	12:59	170	5	
1:09	916	29	1:04	176	5	Tubing at 1500'
1:19	864	35	1:23	180	18	Nitrogen = 300 cfm
1:29	576	39	1:35	184	18	
1:39	648	44	2:04	184	18	
1:49	720	48				
1:59	648	54				
2:09	720	58				
2:50	1080	88	2:42	200	24	Tubing at 2500'
3:00	1080	95	2:48	203	28	Nitrogen = 300 cfm
3:10	936	102	3:00	204	25	
3:20	1008	109	3:11	204	22	
			3:14	204	24	
Drained tank			3:26	205	26	
4:07	864	127	4:12	210	39	Tubing @ 2500'
4:17	864	139	4:34	210	38	Nitrogen = 500 cfm
4:27	720	-	4:45	210	37	
4:37	792	149				
4:47	720	-				
4:52	576	-				Shut-in Nitrogen
4:57	432	158				
5:00	0	158	5:06	192	4	Shut-in at surface

Table 21. Field measurements on water samples collected during DST.

TIME		SAMPLE	WATER SAMPLE FIELD PARAMETERS			
Real Time (Hr:min)	Flow Period Time (Hr:min)	I.D.#	pH**	Specific* Conductance (Umhos)	Temperature (^{o}F)	Remarks***
11:50	:04	1	8.5	4250	90	Sample very dirty
1:14	:28	2	8.0	4500	118	
2:15	1:29	3	8.0	4250	158	
2:55	2:09	4	8.0	1450	156	
3:30	2:44	5	8.0	1350	148	Sample cleaning up somewhat
4:20	3:34	6	8.0	1150	140	
4:37	3:51	7	8.0	1150	146	
4:51	4:05	8	8.0	1050	152	
5:00	4:14	9	8.0	850	190	

* Specific conductance measurements are in question because of possible conductivity-meter malfunction.

** Measurements for pH were made with pH paper which is suspect, as a result of difficulty in duplicating measurements with different pH paper within overlapping ranges.

*** All collected samples were contaminated to varying degrees and unfilterable with field appartus.

Appendix 1. Lithologic descriptions of shallow temperature holes #29 and 35 which are representative of the stratigraphy encountered during drilling.

LITHOLOGIC WELL LOG

CHEVRON RESOURCES COMPANY

PROSPECT Beowawe
COUNTY _____ STATE Nevada
DATE _____ SECTION 13
TOWNSHIP 31N
WELL No. B-29-79 RANGE 47E

TIME	DEPTH	LITHOLOGY	COMMENTS
	0-10	#1 95% grey fine grained basalt-3% cream fine grained lithic calcareous tuff?-2% subrded pebbles.	Mud Temp. = 70°F
	10-20	#2 98% subround to subang pebbles (mostly grey basalt)-2% ang. frags of basalt off larger fraction?-a trace of cream fine grained, lithic, calcareous tuff?	MT = 70°F
	20-30	#3 Subrounded to subang. pebbles with a trace of ang. frags, alluvium.	MT = 70°F
	30-40	#4 Alluvium-subrounded to subang pebbles & a trace of sand-~ 5% ang. frags off larger fraction.	MT = 65°F
	40-50	#5 Alluvium-95% subrded to subang pebbles, a trace of sand & granules - 5% ang. frags.	MT = 68°F
	50-60	#6 Same as #5.	MT = 68°F
	60-70	#7 Alluvium-98% subrounded to subang pebbles-1-2% ang. frags, a trace of sand & granules-a trace of silica (tan) cemented sandst.	MT = 68°F
	70-80	#8 Alluvium-subrded to subang pebbles w/trace of ang. frags sand & granules-trace of silica cemented sandst. as #7.	MT = 68°F
	80-90	#9 Alluvium 95% as above-5% buff silicified? lithic tuff? a trace of qtz sandst. (very hard & clean).	
	90-100	#10 Med. grey diktytaxitic olivine basalt-a trace of alluvium.	MT = 68°F

LITHOLOGIC WELL LOG

CHEVRON RESOURCES COMPANY

PROSPECT Beowawe
COUNTY _____ STATE Nevada
DATE _____ SECTION 13
TOWNSHIP 31N
WELL No. B-29-79 RANGE 47E

TIME	DEPTH	LITHOLOGY	COMMENTS
	100-110	#11 Med. grey to reddish diktytaxitic olivine basalt with a trace of vesicles-a trace of alluvium.	MT = 70°F
	110-120	#12 50% diktytaxitic basalt as above-48% med. grey to brown massive basalt-2% alluvium.	MT = 70°F Poor sample?
	120-130	#13 99% diktytaxitic basalt as above-1% alluvium-a trace of massive basalt as in #12, qtz, chalcedony & iron oxide staining,	MT = 70°F
	130-140	#14 Med. to dark grey perlitic vesicular basalt-a trace of tan waxy to vitreous mineral, tuff & chalcedony.	MT = 70°F Loss circ. material.
	140-150	#15 Med. to dark grey massive basalt with a trace of vesicles -a trace of basalt altered to pale grey to brown-trace of iron oxide staining.	MT = 70°F
	150-160	#16 85% med. to dark grey vesicular basalt, vesicles lined w/red mineral (trace) green to pale blue chalcedony or green to yellow waxy mineral-15% grey massive basalt-a trace of alteration to pale grey of both types-vesicles tend to be elongated.	MT = 70°F Linings </mm.
	160-170	#17 Med. grey vesicular basalt, vesicles lined w/blue to green chalcedony, or greenish waxy mineral-40% of chips show alteration to pale grey color, especially around vesicles.	MT = 70°F
	170-180	#18 Med. grey basalt as in #16-a trace of alteration.	MT = 70°F Loss circ. material.

LITHOLOGIC WELL LOG

CHEVRON RESOURCES COMPANY

PROSPECT Beowawe
COUNTY _____ STATE Nevada
DATE _____ SECTION 13
TOWNSHIP 31N
RANGE 47E
WELL No. B-29-79

TIME	DEPTH	LITHOLOGY	COMMENTS
	180-190	#19 Med. grey massive basalt with a trace of vesicles-a trace of basalt altered to pale grey or tan-a trace of tan waxy soft mineral (2-3h).	MT = 72°F
	190-200	#20 Med. brown massive basalt with a trace of yellow blotches-a trace of plate or fracture surfaces, smooth surfaces with iron oxide staining-a trace of chalcedony coatings.	MT = 70°F Malpais basalt.
	200-210	#21 95% brown basalt as in #20-5% med. grey vesicular basalt-a trace of pale tan to grey altered basalt-trace of tan waxy mineral-a trace of plate or fracture surfaces as in #20.	MT = 73°F Loss circ. material
	210-220	#22 Brown massive basalt with a trace of yellow blotches & plate or fracture surfaces as in #20-a trace of grey vesicular basalt-a trace of chalcedony & tan waxy mineral-trace of sluff.	MT = 70°F
	220-230	#23 Same as #22 with no chalcedony, waxy mineral or sluff.	MT = 70°F
	230-240	#24 Med. brown massive basalt with a trace of yellow blotches-a trace of plate or fracture surfaces as above-trace of clay? (drilling mud?).	MT = 72°F
	240-250	#25 Basalt as in #24-a trace of dark grey vesicular basalt, basalt altered to tan color, tan waxy mineral & iron oxide staining.	MT = 70°F
	250-260	#26 Same as #25 with a trace of clay.	MT = 70°F

LITHOLOGIC WELL LOG

CHEVRON RESOURCES COMPANY

PROSPECT Beowawe
COUNTY _____ STATE Nevada
DATE _____ SECTION 13
TOWNSHIP 31N
RANGE 47E
WELL No. B-29-79

TIME	DEPTH	LITHOLOGY	COMMENTS
	260-270	#27 Brown massive basalt with yellow blotches-a trace of grey vesicular basalt & grey to whitish altered basalt-a trace of plate or fracture surfaces as above-a trace of sluff.	MT = 69°F
	270-280	#28 Same as #27-no sluff, a trace of tan waxy mineral.	MT = 70°F
	280-290	#29 Same as #28 w/trace of black glassy perlitic basalt w/40% of surface covered with iron oxide staining.	MT = 68°F
	290-300	#30 Same as #29.	MT = 66°F
	300-310	#31 95% med. brown massive basalt with yellow blotches-5% med. to dark grey perlitic basaltic andesite-a trace of med. grey vesicular basalt-a trace of basalt altered to pale grey color.	MT = 68°F
	310-320	#32 35% med. brown massive basalt w/yellow blotches-30% med. grey massive basalt (small chips, may be vesicular) 35% med. grey perlitic porphyritic basaltic andesite-a trace of chalcedony.	MT = 68°F
	320-330	#33 75% med. grey perlitic porphyritic basaltic andesite-20% brown massive basalt-5% altered andesite pale grey-a trace of chalcedony, white, and iron oxide staining.	MT = 70°F
	330-340	#34 85% med. brown massive basalt-15% med. grey perlitic porphyritic basalt-a trace of altered basalt & andesite to white or white, grey or tan-a trace of chalcedony.	MT = 70°F

LITHOLOGIC WELL LOG

..EVRON RESOURCES COMPANY

PROSPECT _____

COUNTY _____ STATE Nev.

DATE _____ SECTION 13

TOWNSHIP 31N

WELL No. B-29-79 RANGE 475

TIME	DEPTH	LITHOLOGY	COMMENTS
	340-350	#35 85% med brown massive b salt-10% grey perlitic porphyritic basaltic andesite - 5% grey vesicular bosalt - trace of tan waxy mineral, chalcedory and altered bosalt as in #34	MT = 70°F
	350-360	#36 20% med brown massive basalt - 60% purplish grey brown porphyritic basaltic andesite 20% grey perlitic porphyritic basaltic andesite	MT = 72°F Tbl.
	360-370	#37 90% purplish grey-brown porphyritic basaltic andesite - 5% grey perutic, porphyritic basaltic andesite - 5% brown massive basalt - trace of iron oxide staining altered andesite & basalt & chalcedony	MT = 64°F
	370-380	#38 Purplish grey porphyritic basaltic andesite - a trace of secondary silica, chalcedony, perlitic porphyritic basaltic andesite & altered (pale grey) andesite	MT = 62°F
	380-390	#39 Same as #38 with some (trace) of sluff	MT = 66°F
	390-400	#40 Grey-brown porphyritic basaltic andesite a trace of chalcedony & iron oxide staining	MT = 63°F
	400-410	#41 Same as #40 with sluff	MT = 69°F
	410-420	#42 Light grey-brown porphyritic basaltic andesite with a trace of alteration to white clay - trace of chalcedony & iron oxide staining	MT = 68°F
	420-430	#43 Same as #42; chips coated with with pale pinkish white clay	MT = 70°F

LITHOLOGIC WELL LOG

CHEVRON RESOURCES COMPANY

PROSPECT Beowawe
COUNTY _____ STATE Nev.
DATE _____ SECTION 13
TOWNSHIP 31N
RANGE 47E
WELL No. B-29-79

TIME	DEPTH	LITHOLOGY	COMMENTS
	430-440	#44 Purplish-grey brown porphyritic basaltic andesite with a trace of vesicles - trace of grey andesite, chalcedony & iron oxide staining	MT = 70°F
	440-450	#45 Pale greyish brown porphyritic basaltic andesite with a trace of vesicles - a trace of dark to med. grey porphyritic andesite - 2 trace of chalcedony	MT = 70°F
	450-460	#46 Same as #45	MT = 69°F

LITHOLOGIC WELL LOG

CHEVRON RESOURCES COMPANY

PROSPECT Beowawe

COUNTY _____ STATE Neveda

DATE _____ SECTION 16

TOWNSHIP 31N

RANGE 48E

WELL No. B-35-79

TIME	DEPTH	LITHOLOGY	COMMENTS
13:15	0-10	#1 Medium brown aphanite basalt w/ yellow splotches - a trace of calcite & 2nd silica	Mud temp = 81°F *malpais bassit*
13:50	10-20	#2 Medium brown aphanitic basalt w/ yellow blotches - 2 trace of iron & manganese oxide staining - a trace of platiness or fractures, flat surfaces with an abundance of iron or manganese oxide	MT = 82°F Malpais basalt
14:15	20-30	#3 Same as #2 w/a trace of calcite some in fractures phenocrysts & alteration to pale yellow color	Drilled w/air
:5	30-40	#4 Same as #3	Drilled w/air
14:55	40-50	#5 50% med brown aphanitic basalt w/yellow blotches & a trace of vesicles a trace of ateration to pale yellow color 25% dark grey, glassy, perlitic aphanitic, vesicular basalt vesicles tend to be filled w/ opaline material or lined - a trace of alteration to pale grey or buff color 5% black glassy vitrophyric basalt? 25% buff lithic tuff? Composed of sand sized frags of rock glass & pumice a trace of chalcedony and Tbuv?	
15:04	50-60	#6 5% med brown basalt as in #5 93% dark grey vesicular basalt as in #5 2% tuff? as in #5 a trace of chalcedony & opal as fracture & visicle fillings	Drilled w/air
:20	60-70	#7 92% med brown aphanitic basalt w/yellow blotches & a trace of vesicles-vesicular chips tend (a trace) to alter to pale grey or buff color - vesicles coated or filled w/chalcedony & opal	Drilled w/air

LITHOLOGIC WELL LOG

PROSPECT Beowawe

COUNTY _____ STATE NV

CHEVRON RESOURCES COMPANY

DATE _____ SECTION 16

TOWNSHIP 31N

WELL No. B-35-79 RANGE 48E

TIME	DEPTH	LITHOLOGY	COMMENTS
9:52	410–420	#42 95% white to greyish white altered basaltic andesite, partial silicia alteration (silicified) a trace of qtz (drusy) & chalcedony in altered rk 5% pale grey to med grey partially altered porphyritic basaltic andesite, more altered areas are found around vesicles? or fractures	
9:58	420–430	#43 60% altered andesite as in #42 w/pink to pale blue waxy mineral hardness of 2.5 lining voids 40% med grey perlitic porphyritic basaltic andesite with a trace of alteration to pale grey perlitic porphyritic basaltic andesite with a trace of alteration to pale grey color	Voids may be vesicles or solution cavities
10:07	430–440	#44 85% buff to white altered basaltic andesite (clay alteration?) - voids lined w/pale blue to yellow green waxy, soft mineral 15% grey perlitic porphyritic basaltic andesite w/a trace of alteration around voids - a trace of qtz & chalcedony	
10:19	440–450	#45 75% altered andesite as in #44 25% grey andesite as in #44 a trace of ang frags of green waxy mineral, drusy qtz & chalcedony	
10:42	450–460	#46 90% med to dark grey perlitic porphyritic basaltic andesite w/pink to pinkish brown phenocryst, a trace of round blobs of brown aphanitic basaltic andesite - a trace of ang frags of porphyritic basaltic andesite 10% altered basaltic andesite as in #45 - a trace of qtz & chalcedony	

LITHOLOGIC WELL LOG

PROSPECT Beowawe

COUNTY _____ STATE NV

..EVRON RESOURCES COMPANY

DATE _____ SECTION 16
TOWNSHIP 31N
RANGE 48E

WELL No. B-35-79

TIME	DEPTH	LITHOLOGY	COMMENTS
11:05	460-470	#47 90% red-brown porphyritic basaltic andesite 10% grey basaltic andesite as in #46, a trace of altered andesite as in #45, green waxy mineral	
11:42	470-480	#48 Same as #47	
12:17	480-490	#49 Red-brown porphyritic basaltic andesite w/nearly aphanitic ground mass - a trace of andesite altered to white or cream color - a trace of grey porphyritic andesite w/trace of brown blobs & perlitic texture trace of green waxy mineral	
:22	490-500	#50 Med grey slightly glassy perlitic porphyritic basaltic andesite & brown porphyritic basaltic andesite with nearly aphanitic ground mass - brown andesite appears as blobs in grey andesite - a trace of obsidian inclusions in grey andesite - trace of altered andesite & chalcedony	

Appendix 2. Stabilized temperature data for three shallow temperature holes illustrating the general types of thermal profiles observed.

CHEVRON RESOURCES COMPANY
GEOTHERMAL DIVISION
SHALLOW TEMPERATURE HOLE LOG

PROSPECT : BEOWAWE
STATE : NEV.
HOLE NO. : B-2-79
S.T.R. :

DATE COMPLETED :
DATE LOGGED : 6-28-79
LOGGED BY : FLEINER
UNIT NO. : 1,000
2 ND LOG

SUMMARY OF LITHOLOGY:

CALIBRATION NOTES: CHECKED WITH RESISTORS.
START-BATT. V = 1168 END- BATT. V = 1140

DEPTH (Ft)	RESISTANCE (ohms)	TEMPERATURE (°C/°F)	DEPTH (Ft)	RESISTANCE (ohms)	TEMPERATURE (°C/°F)
10	4,295	52.3	190	3,455	60.6
20	4,245	52.7	200	3,415	61.1
30	4,165	53.5	220	3,335	62.1
40	4,095	54.2	240	3,255	63.1
0	4,045	54.6	260	3,175	64.1
60	3,995	55.1	280	3,095	65.1
70	3,965	55.4	300	2,932	67.1
80	3,905	56.0	320	2,863	68.0
90	3,865	56.3	340	2,799	69.0
100	3,835	56.6	360	2,734	70.1
110	3,815	56.8	380	2,670	71.1
120	3,785	57.1	400	2,609	72.1
130	3,725	57.7	420	2,549	73.0
140	3,685	58.1	440	2,494	73.9
150	3,655	58.4	460	2,440	74.8
160	3,605	58.8	480	2,384	75.7
170	3,555	59.4	~~484~~ 500	2,372	75.9
180	3,505	60.0			

TIME START: 1020
TIME ON BOTTOM: 1115

CHEVRON RESOURCES COMPANY
GEOTHERMAL DIVISION
SHALLOW TEMPERATURE HOLE LOG

PROSPECT : BEOWAWE
STATE : NEV
HOLE NO. : B-19-79
S.T.R. :

DATE COMPLETED :
DATE LOGGED : 6-26-79
LOGGED BY : FLEINER
UNIT NO. : 1,000'
2ND LOG

SUMMARY OF LITHOLOGY:

CALIBRATION NOTES: CHECKED, WITH RESISTORS.
START-BATT.V = 1184 END-BATT.V=1160

DEPTH (Ft)	RESISTANCE (ohms)	TEMPERATURE (°C/°F)	DEPTH (Ft)	RESISTANCE (ohms)	TEMPERATURE (°C/°F)
10	1,120	109.3	190	575	143.3
20	1,058	111.9	200	572	143.6
30	958	116.9	220	567	144.1
40	851	122.6	240	561	144.7
0	769	127.9	260	557	145.1
60	711	131.8	280	549	145.9
70	670	135.1	300	543	146.5
80	613	139.7	320	533	147.5
90	606	140.3	340	524	148.4
100	600	140.9	360	516	149.2
110	599	141.0	380	506	150.4
120	594	141.5	400	494	151.8
130	591	141.7	420	480	153.5
140	587	142.1	440	464	155.5
150	585	142.3	460	453	156.8
160	582	142.6	480	448	157.4
170	579	142.9	~~500~~ 495	446	157.6
180	577	143.1			

TIME START: 1415 TIME ON BOTTOM: 1505

CHEVRON RESOURCES COMPANY
GEOTHERMAL DIVISION
SHALLOW TEMPERATURE HOLE LOG

PROSPECT : BEOWAWE
STATE : NEV.
HOLE NO. : B-32A-79
S.T.R. :

DATE COMPLETED :
DATE LOGGED : 9-20-79
LOGGED BY : FLEINER
UNIT NO. : 1,000'
2ND LOG

SUMMARY OF LITHOLOGY:

CALIBRATION NOTES: CHECKED, WITH RESISTORS.
START- BATT. V = 1228 END- BATT. V = 1204

DEPTH (Ft)	RESISTANCE (ohms)	TEMPERATURE (°C/°F)	DEPTH (Ft)	RESISTANCE (ohms)	TEMPERATURE (°C/°F)
10	2,483	74.1	190	629	138.4
20	2,176	79.6	200	617	139.3
30	1,843	86.5	220	604	140.5
40	1,521	94.9	240	597	141.2
0	1,251	103.9	260	593	141.6
60	1,167	107.4	280	586	142.2
70	1,095	110.4	300	586	142.2
80	1,016	113.8	320	591	141.7
90	950	117.3	340	601	140.8
100	897	120.1	360	606	140.3
110	771	127.8	380	621	139.0
120	745	129.4	400	645	137.1
130	726	130.7	420	688	133.6
140	710	131.9	440	733	130.2
150	680	134.3	460	771	127.8
160	662	135.7	480	804	125.6
170	650	136.7	500	833	123.7
80	641	137.4	501	833	123.7

TIME START: 0945 TIME ON BOTTOM: 1040

Appendix 3. Completion report.

Completion Report
New Well PRO-318

Field Beowawe

Property:

Well No. 85-18 (Proj x 20811)

Sec. 18 T. 31N R. 48E MD B.&M.

Location 2960'S and 80'W NE cor Sect 18

Elevation 4920' GL Derrick Floor

D.F. is _____' above mat.

Date 7-10-80

Chevron Resources Company

B. D. GARRETT/R. B. MURRAY
(For Operations Manager, Producing Dept.)

Drilled By KENAI DRILLING

Date Commenced Drilling 2-22-80

Date Completed Drilling 6-2-80

Date of Initial Production - -

Production:

Daily Average, 1st _____ Days		Gravity _____ °API		Pump _____	
Oil _____	Bbls.	T.P. _____	PSI	Flowing _____	
Water _____	Bbls.	C.P. _____	PSI	Gas Lift _____	
Gas _____	Mcf.	Bean _____	/64"		

Summary

TD : 5927'

Logs : DISFL, CNL-FNC-GR, Sonic, Dipmeter
Temperature Surveys.

Casing : 20" conductor at 60'.
13-3/8" 25 Jts 54.5# K-55 Buttress surface to 1006'.
9-5/8" 51 Jts 40# N-80 Buttress 758' to 2937'.
2-7/8" 187 Jts 6-1/2# Atlas-Bradford N-80 DSS surface to 5922'.

PRO-318 (CD-10-73)
Printed in U.S.A.

Note: Day called 2-23 starts at 0600 hrs. 2-22 and ends at 0600 hrs. 2-23.

Feb. 23, 1980	Rig up. Winterized rig. Spud in rathole 12 AM. Dyna drill 15 to 31'.
24	Dyna drill rathole 31'to 55'. Drill 17-1/2" 15' to 65'.
25	Dyna drill 17-1/2" to 80'. Boulders falling in hole. POOH, lay down Dyna drill. RIH. Drilled 17-1/2' to 94'.
26	Drill 17-1/2" to 106'. Circulate and condition mud. POOH. Open hole to 26" 15' to 45'.
27	Open hole to 26" to 106'.
28	Circulate and condition hole. Ran 20" conductor to 60'. POOH w/casing. Lay down casing. Ream 17' to 106'. Drill ahead 26" to 110'. Circulate and condition hole.
29	POOH run 20" conductor pipe to 60'. Stopped USGS approved 60' cmt depth. BJ cmtd conductor w/200 cu. ft. Class "G" cmt w/ 3% $CaCL_2$ through 1" tubing in annulus, set at 50'. Welded on head and diverter line.
Mar. 1	Work on picture nipple and flowline. Nipple up 20" hydril. Unload csg. Make up 17-1/2" bit.
2	RIH with 17-1/2" bit. Tag cement at 51'. Drill out cement to 110'. Drill ahead to 131'. POOH. Pick up 6 point and 3 point reamer and monel.
3	RIH drill ahead 17-1/2" to 180' circulate, survey, drill ahead 17-1/2" to 248'.
4	Drill ahead 17-1/2" to 253'. Rig down 3 hrs. for repairs to Kelly. Drill ahead 17-1/2" to 314'. Circulate and survey. Drill ahead 17-1/2" to 343'.
5	Drill ahead 17-1/2" to 365' (rig down for repairs). Drill ahead 17-1/2" to 371' (rig down for repairs). Drill ahead 17-1/2" to 400'.
6	Drill ahead 17-1/2" to 468'. Problems with fill on each connection. Circulate out 15' fill and survey. Drill ahead 17-1/2" to 653'.
7	Drill ahead 17-1/2" to 770' circulate and survey. Drill ahead 17-1/2" to 857'.
8	Drill ahead 17-1/2" to 1008'. Circulate and condition hole. Wipe to collars. POOH. Rig up Schlumberger. Run DIL, Sonic, Dipmeter. Rig down Schlumberger.

Mar. 9	RIH to 1008'. Circulate for csg. POOH. Run 25 Jts 13-3/8" 54.5# K-55 Buttress csg. B. J. Hughes cmtd with 100 cu. ft. water, 1200 cu. ft. 1:1 Pozz : Class "G" cement w/33#/sack silica flour, 200 cu. ft. Class "G" cmt w/33#/sack silica flour. Displaced with 850 cu. ft. mud. Had 250 cu. ft. returns to surface. Bumped plug, float held.
10	WOC. Remove 20" Hydril. Cut off 20" conductor attach 13-3/8" csg head. Install 12" gate valve. Start on BOPE.
11	Finish BOPE installation.
12	Test BOPE - rams and hydril, to 1000 PSI. RIH, tag cement at 954'. Drill out cement to shoe at 1006'. Drill ahead 12-1/4" to 1120' POOH for locked in drilling assembly.
13	RIH to 1006'. Ream 1007 to 1120. Drill ahead 12-1/4" to 1239'. Lost circulation (10 bbls.) POOH to shoe. Test BOPE. Regain circulation, drill ahead to 1240'.
14	Drill ahead 12-1/4" to 1450'. POOH to change bit.
15	RIH, break circulation @ 1058'. RIH drilled ahead 12-1/4" to 1671'.
16	Drilled ahead 12-1/4" to 1838'.
17	Drilled ahead 12-1/4" to 1842'. Lost circulation. Pull to shoe. RIH to spot gel pill. Pull to shoe, mix mud. Pumped away 3 pits mud.
18	RIH, drill ahead 12-1/4" blind to 2034' spotting gel pill @ each connection.
19	Drill 12-/1/4" blind to 2154' with water. Sweep hole w/ gel pills.
20	Drill 12-1/4" blind to 2156' w/ water. Regained circulation. Drill ahead 12-1/4" to 2208'.
21	Drill ahead 12-1/4" to 2287'. Circulated and surveyed. POOH.
22	Make up Dyna drill. Twisted off 1 DC pin while making up string. RIH, Dyna drill to 2345'. Dyna drill failed. POOH.
23	Pick up new BHA. RIH, reamed 2287' to 2345'. Dyna drilled to 2437'.
24	Drill ahead 12-1/4" to 2569.

Mar.	25	RIH drill ahead to 2603′. POOH. Changed BHA. Staged in hole @ 1000′ and 2000′. Ream 2569′ to 2603′.
	26	Drilled ahead 12-1/4" to 2791′. Survey: 2613′; 1°30′ N41°E 2701′; 1°30′ N34°E.
	27	Repair rig engine. RIH, drilled 12-1/4" to 2903′. Survey @ 2794′ 1°15′ N40°E.
	28	Drill ahead 12-1/4" to 2974′. Circulate and survey. POOH. Shock sub broke apart @ mandril. Left bit, 3 pt reamer, bottom of sub in hole. Top of fish @ 2962′. RIH w/ overshot, extension, bumper sub, jars, 4DC, 20 jts HW DP.
	29	Lost circulation at 2950′. POOH w/ fish. Recovered bit, 3 pt reamer, bottom of shock sub. Lay down fishing tools. Pick-up bit. Stage in hole to 1500′, no circulation (lost 250 bbls.). RIH to 2000′ no circulation (lost 500 bbls.). POOH to 320′ RIH to 2000′, no circulation (lost 400 bbls.).
	30	Unable to gain circulation after approximately 1150 bbls. mud. POOH. Changed BHA. Set-up to drill blind. RIH to 850′. Ran temp survey - obtained 480°F, believed wrong. RIH to 2974′.
	31	Attempt to fill hole from top. Pump in 150 bbl water. Drill ahead blind 12-1/4" to 2995′. Circulate down 250 bbls gal. Make connection. Drill blind 2995′ to 3025′. Circulate down 250 bbls gel. Pumped down 500 bbls gel/LCM. Drill ahead blind to 3149′. At each 30′ pumped gel/LCM. POOH 10 stands.
Apr.	1	Mix pit of LCM. Want to core 3149′ to 3179′. Pumped 250 bbls gel/LCM @ 2500′. Mix hi-visc mud. RIH to 3079′. Found 70′ fill. Circulate out fill to 3149′ with 250 bbls. mud. Pull 3 stands, wait 45 min. RIH to 3107′, found 42′ fill. Pull 3 stands wait 45 min. RIH to 3094′ found 55′ fill.
	2	Mix hi-visc gel pill. Pumped pill (400 bbls.) while circulating out fill to 3149′. POOH 10 stands. Wait on pill 5 hrs. RIH to 3149′. No fill. POOH, pick-up core barrel.
	3	RIH to 3149′. Core to 3179′. Pumping gel while coring blind. (approx. 1500 bbls.) Strapped out of hole. Corrected depth to 3188′. Lay down core barrel, pick-up drilling rig.
	4	Repair seal in hydril. RIH to 1935′. Ream thru bridge to 1965′. RIH to 2118′. Ream thru bridge to 2145′. RIH to 3045′. Found 142′ fill.

Apr. 5	Circulate out fill, mix gel pill. Circulate, POOH 5 stands, wait 1 hr. RIH to 3208′ no fill. POOH to 2145′, hit bridge. Work thru 100′ of tight hole. Ream back thru 2045′ to 2145′. POOH. Rig up Schlumberger. Ran temp survey, hit bridge at 1932′. Log indicates lost circulation zone @ 1850′. Fluid level at 200′. Log DIL out of hole. RIH w/ drilling assy. to 1909′. Ream to 1949′. RIH to 2219′. Ream to 2259′. RIH to 3133′. Circulate out 75′ of fill.
6	Circulate out fill to 3208′, mix gel pill, spot on bottom. POOH. No bridges. Rig up Schlumberger. Run temp survey, hit bridge at 1355′. POOH. Run sonic log, stopped at 1355′. Rig down loggers. RIH, hit bridge at 1350′. Circulate, mixed LCM. Spot pill at 1350′. POOH 5 stands, wait 1 hr. Unable to fill hole from surface. Spot LCM pill at 1350′. Pull up 5 stands, wait 1 hr. Unable to fill hole from surface. RIH, ream thru plug at 1350′.
7	Hit bridge at 1852′ mix LCM. Spot at 1852′. Regained circulation. Circulate and condition mud, lost circulation after 6 hrs. Spot LCM @ 1852′. POOH 5 stands, wait 2 hrs. Regained circulation at 1852′.
8	Lost circulation, spot LCM pill at 1850′. Wait 3 hrs. Mix LCM, spot @ 1850′. Wait 3 hrs. Unable to fill hole thru kill line. Water pump broke down.
9	Mix LCM pill and spot @ 972′. Regain circulation. Stage in hole @ 1032′, 1092′, 1451′, 1757′, 2152′, 2227′, 2516′, 2819′, 2950′. Bridges @ 1850′ to 1870′, 2152′ to 2162′, 2222′ to 2232′. Reamed thru all bridges. Lost approx. 250 bbls. mud. Circulate @ 2950′ with full returns.
10	Circulate and condition @ 2850′. RIH, tag fill @ 3164′. POOH to shoe, wait 5 hrs. Stage in hole 300′ intervals. Hit bridge at 1350′. Circulate and condition mud @ 2950′.
11	Lay down drill collars. RIH with open end drill pipe to 3093′. Circulate and condition mud. Rig up B. J. Hughes. Pump down 59 sx of 6 x 12 gravel. B. J. Hughes pump broke down. Pull 5 stands. Wait 2 hrs. RIH to 3197′. No plug. POOH to shoe.
12	Stage in hole from shoe to 3197′. Rig up gravel packers. Pump 234 sx 6 x 12 gravel (28% xs). Tag top of gravel @ 2947′. POOH. Pick-up 12-1/4" bit.
13	Stage in hole with 12-1/4" bit. Circulate up gravel left on site walls etc. Tag sand plug @ 2947′. Circulate and condition mud. POOH. Rig up casing tongs. Run 51 jts 9-5/8" 40# N80 Buttress casing. Make up 9-5/8" x 13-3/8" Baker liner hanger with tie back connection.

Apr. 14 Baker had wrong xover sub. Make up packer. Could not work liner hanger past complete shut-off valve. One slip die off liner hanger fell in hole. POOH, lay down csg.

15 Set Halliburton 13-3/8" BP @ 60'. Remove BOPE, gate valve. Dress internal casing to well head weld and nipple up BOPE.

16 Installed BOPE and test. B. P. pumped down hole with 200 PSI. Staged in hole to 2947'. Circulate and condition mud. POOH.

17 Test BOPE to 1000 PSI. Run 51 jts 9-5/8" 40# N80. Buttress Casing with Baker liner hanger with tie back connection. Shoe @ 2937'. Top liner 785'. Circulate casing 3 hrs. @ 2948'. Halliburton cmtd. 100 cu. ft. water, 100 cu. ft. $CaCl_2$, 100 cu. ft. water, 100 cu. ft. sodium silica, 100 cu. ft. water, 1800 cu. ft. cmt (200% xs) Class "G", 1:1 perlite, 35% silica flour, 3% gel, 1/2% CFR-2. Displaced with 938 cu. ft. mud. Lost circulation with 50 cu. ft. left to displace. RIH with 12-1/4" bit.

18 POOH. Test lap form surface. No good. Would pump away with 250 PSI. P. U. 5-3/4" D.C. Prep location for DST. Make up RTTS tool.

19 RIH with RTTS tool to 728'. Tool would not hold pressure. POOH. Packer OK. RIH with HW DP to 723'. Halliburton squeezed: 50 cu. ft. water, 58 cu. ft. $CaCl_2$, 100 cu. ft. water, 58 cu. ft. Flo-check, 50 cu. ft. water. Init. press 500 PSI. Preflush broke press to 0. Pumped 650 cu. ft. Class "G" cement with 1:1 perlite, 40% silica flour, 3% gel, 3/4% CFR-2. Pumped @ 2 bbl/min. Press increase after 500 cu. ft. Displaced DP with 80 cu. ft. mud @ 1 bbl/min. Final squeeze press 600 PSI. POOH, lay down RTTS. RIH with 12-1/4" bit. Circulate out xs cmt. Test lap @ 500 PSI for 15 mins. OK. Remove BOPE.

20 Install master gate valve, install BOPE and test blind rams to 1000 PSI. RIH with 8-3/4" bit to 785'. CO cmt 785'-805'. RIH to 2809'. Tagged cmt. Tested csg and BOPE to 1000 PSI. Drill on cmt to 2890'.

21 CO cmt to shoe @ 2937'. CO sand plug to 3208' circulate and condition mud. POOH. DST tools stranded. RIH with 8-3/4" bit. Circulate and condition mud.

22 Circulate and condition mud. Wait on DST tools. POOH. Rig up Agnew and Sweet. Ran 4 temp surveys. 1500' to 2935'. Pick-up DST tools RIH with and set packer @ 2865'.

23 Make-up surface lines for DST. Rig up NOWSCO. RIH with tubing to 2500'. Unload well. Would not flow when N_2 off. Test and shut in @ surface 6 hrs. Rig down NOWSCO.

		Circ. bottoms-up. POOH, lay down packer. Rig up Geothermal Testing Service.
Apr.	24	Ran GTS temp surveys 2800′-3208′ and 0-3208′. Rig down GTS. PU 8-3/4" bit RIH. Drill ahead to 3281′.
	25	Trip for bit. PU monel. RIH breaking circ. @ 2000′ and 2600′. Drill ahead 8-3/4" to 3442′. Survey @ 3305′ 1°, 3427′ 1°15′.
	26	Drill ahead 8-3/4" to 3744′.
	27	Drill ahead 8-3/4" to 3834′. Wipe hole.
	28	POOH. Left 1 cone and inserts in hole. Rig up GTS. Ran temp survey 0-2900′, could not get tool below 2900′.
	29	Rig down GTS. RIH. Break circ. @ 1000′. RIH to 2500′. Circ. bottoms up. RIH to 3500′.
	30	Ream 3663′ to 3826′. Circ. Rig up Pruett. Ran 6 temp surveys 2900′-3810′. Rig down Pruett. Ream 3826′ to 3834′.
May	1	Drill ahead to 3836′. Work on junk @ 3836′. POOH. Retrieved various junk. PU magnet. RIH. Break circ. at 1000′ and 2500′. Work magnet.
	2	POOH with magnet. Recovered cone and assorted junk. RIH, break circ. @ 1500′ and 3000′. Drill ahead 8-3/4" to 3964′. Survey: 3940′ 2° S67°E.
	3	Drill ahead 8-3/4" to 4039′.
	4	POOH for new equipment and rig repairs. RIH to 2500′.
	5	RIH to 3836′. Reamed tight hole 3836′ to 4039′. Drill ahead 8-3/4" to 4128′.
	6	Drill ahead 8-3/4" to 4224′. Trip for bit.
	7	Drill ahead 8-3/4" to 4400′.
	8	Drill ahead 8-3/4" to 4543′. Rig up Pruett, run temp surveys.
	9	Complete surveys. Rig down Pruett. Wipe hole to shoe. Break circ. @ 2900′. RIH to 4540′. Circ. and wait for Schlumberger.
	10	Rig up Schlumberger. Run temp surveys and DISFL.
	11	Run temp survey CBL, Sonic.

May	12	Run Dipmeter with temp, FDC, CNL/GR with temp. Rig down loggers.
	13	RIH. Break circ @ 1500', 2900', 3700', 4540'. Drill ahead 8-3/4" to 4653'.
	14	Drill ahead 8-3/4" to 4849'.
	15	Drill ahead 8-3/4" to 4860'. Trip for bit, stage in @ 2900', 3900', 4860'. Drill ahead 8-3/4" to 4985'.
	16	Drill ahead 8-3/4" to 5111'.
	17 to 20	Rig down for rig repairs to drawworks.
	21	Drill ahead 8-3/4" to 5318'. Bit plugged. POOH to 4400' bit cleared. Work on pumps. RIH to 5318'.
	22	Test BOPE. Circ. @ 3000', 4000', 4500', 5111'. Drill ahead 8-3/4" to 5227'.
	23	Drill ahead 8-3/4" to 5502'. Survey: 5370' 2°N30°E.
	24	Drill ahead 8-3/4" to 5528'. POOH to check equipment. Lay down 1 cracked DC 2 stbs. and junk sub. RIH.
	25	Drill ahead 8-3/4" to 5672'.
	26	Drill ahead 8-3/4" to 5850'.
	27	Drill ahead 8-3/4" to 5927'. Circ. survey. Wipe hole to shoe.
	28	Rig up Schlumberger. Run DISFL/temp., Sonic, Caliper, FDC-CNL-GR.
	29	Run dipmeter. Rig down loggers. Lay down drill pipe.
	30	Continue lay down DP, collars, kelly. Remove BOPE. Replace mud cross with tubing head.
	31	Replace BOPE with 2-7/8" tubing rams.
June	1	Test BOPE. Run 187 jts 2-7/8" 6-1/2# N-80 Atlas-Bradford DSS tubing. Change over to formation water at 3000' and 5900'. Circ. bottoms up. Land tbg in tbg head. B and W float shoe at 5922'.
	2	Remove BOPE. Install 3" Pow-R-Seal gate valve on tbg head. Release rig.

Appendix 4. Detailed lithologic descriptions of Beowawe 85-18 well at 10-foot intervals.

17-1/2" drilled to 110' then opened to 26" to 106' bridging problems encountered while try to set 20" conductor pipe to bottom (106'). So conductor pipe was set @ 47'.

Mud logging unit was rigged and samples were collected beginning @ 110' per "Mud Logging Instructions."

Depth	Description*
110/20	Andesite: pred. reddish brown micro x'ln aroundmass with 3-4% phenos., relic weathered out phenos with iron ox staining adjacent appears to be a clinopyroxene (probably augite) other phenos. were in abundance clear to shiney bin lath shape mineral probably a Ca rich plag. 5% bg cuttings have white, powdery coating (kaolinite). Cuttings commonly display red and yellow iron ox staining. Whitish to light grey material with black specks is cement from casing job. Trc amount of 3 different looking cryto x'ln qtz clear - white chalcedony, a milky creamy white opal? And a banded agate appearing variety.
120/30	Generally, A/A but <3% is a light grey andesite that is V. hard and appears to have been silicified with a sugary texture. Contains dark reddish brown to dark amber phenos. lath shaped. Trc pyroclucite in white clay minerals. Cement in sample.
130/40	Cuttings much finer, last lith described (120/30) absent. Trc of v. light gel powdery clay minerals. Generally A/A.
140/50	Majority of cuttings are fine grain - 0, with approximately 20% larger grain. Generally as above minor amount <5% of is a mottled reddish brown and grey. Grey doesn't appear to be volcanic? Some light grey mottling also occ. striated plag lath visible fresh looking white powdery clay increase to + 3-4%, cement present in sample.

* Descriptions provided by R. F. Smith mud loggers.

Depth	Description
150/60	A/A yellow staining more prev. Some pieces approximately 15% are light grey speckled rock either silicified or mafics nearly all leached out (no Iron ox. staining) of groundmass or poss a more acidic rx inclusions. Increase chalcedony 3-5%.
160/70	A/A trc crypto x'ln qtz-trc last described grey speckled lith-trc green staining on some plag grains, some clay minerals have light green cast.
170/80	Andesite A/A 15-20% yellowish brown. Some rectangular phenos probably plag appear to have integrown x'ln qtz (concoidal fracs. vis) poss trc included glass. Black in groundmass.
180/90	Cutting much finer. Overall color changes to pred a light reddish brown with a purple cast, red Iron ox staining increase to 20-25%. Phenos less common. Cutting are light purple with red specks.
190/200	A/A decrease red Iron ox staining 15-20% clay min and crypto. qtz A/A pred light purple andesite.

Summary: 110 - 200'

Andesite - pred reddish brown, some light reddish brown with purple cast with depth, porphyritic. Micro x'ln groundmass with plag. and pyroxene phenos, invarious stages of alteration abund. relic phenos of pyroxene, common red and yellow Iron ox. staining. Trc - approximately 5% crypto x'ln qtz, trc silicified lith frags trc - 4% clay minerals.

200/10	Andesite 30% generally A/A. Breccia 70% varies rounded to angular volcanic with frags set in an in an buff-pinkish - whitish clay matrix.
210/20	Andesite reddish brown - brown with mottling of light yellow and green - ang. and red. Some with light purple cast. Porphryritic - <3% phenos. pred. plag micro x'ln groundmass. About 10% have a honey yellow, vitreous mineral on them, possibly adamite(?) trc white clay min. Iron ox staining yellow and red.
220/30	Andesite A/A light grey material in sample is cement sloughed from cement job on conductor pipe.
230/40	As above-abundance of cement in sample-color red-brown with purple cast overall - trc with clay minerals, trc crypto x'ln qtz.
240/50	Andesite A/A. Still abundant cement increase crypto x'ln qtz from trc - 1%.

Depth	Description
250/60	A/A 5-7% dark reddish brown andesite with twinned plag phenos has sugary texture to groundmass. Trc cement. Trc white clay minerals.
260/70	Generally as above some possible red encrustations of realgar? Could be Iron ox staining-xls. of vitreous light green minerals-yellow Iron ox staining.
270/80	A/A.
280/90	A/A
290/300	Color has less purple cast changes more to brown - reddish brown. Trc white clay.

Summary: 200 - 300'

Andesite; maroon - red-brown (brick) light green, canary yellow and occassional white mottling, cryptoxln - aphanitic-larger cuttings, devitrified - smaller cuttings, hyaline, white, kaolin clay in relic felds cast and in prox of partly alt felds; amber, x'ls/conchod - sbcon. fracture, translucent adamine dull black metallic mineral diseminated thru matrix.

310/20	A/A except smaller cuttings and matrix more hyaline (glassy)
320/30	A/A.
330/40	A/A vis twinned plag phenos. Trc crypto qtz with included segregated Iron oxides.
340/50	A/A - some pieces have rounded surfaces.
350/60	A/A mottled varied - common, clear plag phenos "fresh" looking overall rock reddish brown with purple cast, cuttings much finer.
360/70	A/A.
370/80	A/A.
380/90	A/A but with dark red brown mottling and banding.
390/400	Trc poss incrustations of Realgar.
400/10	A/A cutting are much larger. Some pieces have light yellow and light green soft coating.
410/20	Cutting are finer. A/A. Trc white crumbly clay - Kaolinite.
420/30	A/A.

Depth	Description
430/40	A/A but with aphanitic yellowish brown andesite? 7-10?
440/50	A/A brown above decreases. Trc light green hd min.

Summary: 300 - 450'

Andesite: Varied color - maroon - red brown brick. Light green and yellow and light grey mottled hard and brit. porph. micro x'ln groundmass with clear and glassy twinned plag and pyrox phenos and sdc phenos. Common amber colored x'ls with concoidal-subconcoidal frac; trc white clay, trc crypto x'ln qtz.

450/60	Andesite varied color-maroon-dark light reddish brown, 40% light reddish brown with purple cast 60% mott. dark and reddish brown and dark reddish brown banding 15%; and some yellowish brown. All with light yellow and green colors desem. thruout in patches common near relic phenos porh - relic plag and pyrox phenos A/A common amber color x'ls trc white and yellow clay minerals.
460/70	Andesite A/A. Tarc calcite rhombs clear iceland spr, less than 1% pistachio green clay with pyrolusite dendrites.
470/90	(20' composite sample due to increased rate of penetration.) Andesite A/A, trc dark olive green porph. andesite, clear plag phenos fresh and glassy.
490/500	A/A 4-5% have light yellow - light-green coating. Less dark reddish brown banding and mott.
500/10	A/A small % of cuttings have yellow vitreous needlelike x'ls to massive mineral on surface.
510/20	A/A 2% white Kaolinite in sample.
520/30	Andesite 30% dark reddish brown 70% as above but with different color distribution, i.e., different "style" of mottling. Trc Kaolinite.
530/40	A/A trc of dark brown - black dusty rusty looking mineral.
540/50	Trc silica clear with orange flockulate looking material inside.
550/60	50% A/A/. 50% Andesite dark grey - black with brown cast occ. green cast porh. micro x'ln groundmass and glassy plag phenos and slightly altered pyroxene phenos - relics.
560/70	30%-40% new dark-grey lith, 60-70% reddish brown and varying color A/A.

Depth	Description
570/80	Black andesite not present. Reddish brown varying color - mott as last described trc pistachio green clay.
580/90	Andesite A/A. Trc yellow reinform silica. Trc pistachio green - yellow clay minerals.
590/600	A/A trc yellow vitreous x'ls: cuttings; much larger black rx is sluff.

Summary: 450 - 600'

Andesite varying color - maroon, dark and light reddish brown some mott, some reddish banding and mott light yellow and green mineral yellow, dark grey - black 550 - 70'. Porph aphanitic groundmass with abundant clear glassy plag phenos. Com pyroxene phenos and relics. Common vitreous amber color x'ls, trc yellow vit. x'ls.

Trc - 1% clay mineral: red white Kaolinite and pistachio green with pyrolusite dendrites. Trc crypto x'ln qtz and calcite rhumbs.

600/10	Andesite-pred. light reddish brown - brown porph. A/A 15% dark reddish brown - maroon, trc yellow vitreous x'ls aggregates on frac. surfs.
610/20	Generally A/A trc reddish amber and yellow vitreous x'ls, pyrolusite dendrites and clay mineral like coatings on some pieces.
620/30	A/A.
630/40	Color change, Andesite red - reddish brown porph pred plag phenos - some alt to amber color.
640/50	Andesite predominates - red and reddish brown. A/A com pistachio green clay mineral trc yellow silica? - 1% light grey siliceous materials.
650/60	Andesite - color change from pred pk - red and reddish brown to brown and light brown with 20% above color. Light brown - 40% could poss. be a more siliceous rx type? Yellow vitreous x'ls poss. sulfur? Trc yellow silica? Trc light grey siliceous material trc yellow green soft and waxy and fiberous mineral.
660/70	Reddish brown 40% andesite 60% light grey with glassy vis. twinned plag phenos.
	Altered rx Andesite (?) light grey - grey with light brown cast, hd - com red; brown porph - groundmass aphanitic - glassy, with bleached out app. abundant tiny black specks, com clear vis. twinned plag phenos and mafic phenos.

Depth	Description
670/80	50% light grey - 50% reddish brown - brown A/A A/A.
680/90	Grey - 10-20% reddish brown - brown 70% - 10% dark grey - black andesite (glassy in app.) similar in app. to 550 - 70. Some light grey has bands of silica thru it, some appearance layered, some with poss. inclusions of?
690/700	20% light grey A/A. 20% reddish brown - brown A/A. 60% dark grey to black glassy porph A/A.

Summary: 600 - 700'

Andesite: red, light reddish-brown - brown dark-grey - black and glassy, some red pk, purple A/A. Abundant to 60% light-grey - grey with brown cast andesite(?) hd, porph - groundmass aphanitic - glassy with bleached appearance abundant tiny black specks common clear vis. twinned plag phenos and black maf. trc free yellow silica and other red amber and yellow x'ls.

710/20	80% brown andesite 20% prob. sluff. Basalt - very dark grey - black hd and britt porph. micro x'ln groundmass with plag. phenos and pyrox-amygdoloidal: com brown, blue green and white amygdules.
720/30	A/A 85% black basalt 15% brown andesite.
730/40	A/A.
740/50	50% black, 30% brown A/A. 20% - 25% crypto silica/opal. look like (magnesite?) White cream some light green - some tan - buff.
750/60	Cutting much larger 70% bassalt, 30% andesite.
760/70	50% basalt A/A, 50% andesite. Andesite mott red brown and black - reddish brown from Fe ox. porph amyg.
770/80	70% basalt A/A. 30% reddish brown - brown andesite. A/A, but not as last sample.
780/90	75% basalt A/A, 25% reddish brown - brown andesite.
790/800	Basalt 50% andesite 50%, some has green cast, some slightly calc. trc calc un/frac fill.
800/10	10% basalt andesite varying color and abundant clay.

Depth	Description

Basalt vdk grey - black, some with minor green cast, hd and britt, porph - micro x'ln ground mass with v fn plag - phenos and pyrox phenos. Amygdaloidal - common bin, white and blue green. Amyg. trc to 25% crypt silica/opal. White cream, some light green and tan-buff, hd and brit subconcoidal frac. Andesite pred red brown generally A/A.

950/60	(Basalt) Andesite - 80% black, 15% reddish brown. Iron ox 1% qtz veining trc calc veining - black proxene phenos sl alt 1-3%.
960/70	A/A mnr 3% qtz vesicle fill in red brown andesite.
970/80	Andesite A/A cutting much finer 70% black 10-15% dark grey, <5% red brown trc mott grey and red brown varying color flags prob sluff from 820' - 940' interval.
980/90	A/A.
990/1000	(Basalt) A/A Andesite black 1-3% calc vein and vesicle fill >1% calc rhombs >1% qtz vein fill >1% powdery white clay mineral (prob. Kaolinite).
1000/08	Basalt/Andesite-60% black approximately 40% red brown maroon mott varying color-trc fiberous in appearance, chloritized, slight calcite vein fill.

1st Casing Point

1010/20	Dark brown - black aphanitic andesite (basalt)/varicolored poss zeolites amygdules - pred green and white; occ chalcedony veins, and unknown soft canary yellow mineral and green mineral.
1020/30	A/A cuttings larger.
1030/40	A/A cuttings larger.
1040/50	Clay 50%, light brown - brown, sandy and silty v. slightly calc. Soft and sticky - easily washed away. Andesite - 15-20% brown andesite. Andesite/Basalt 25-30% black. (Cutting are pred angular.)
1050/60	Clay A/A 40-45% - washes away. Andesite - reddish brown - brown 35-40%. Andesite/Basalt - black 10/20%. Approximately 5% light yellowish green clay mineral frac fill veining and vesicle fill.
1060/70	A/A.
1070/80	35-40% A/A clay becomes reddish brown: andesite Hl 30% reddish brown - brown. Basalt/andesite 30% black. Light yellowish green clay mineral A/A. Trc element in sample.

Depth	Description
1080/90	Andesite 65% reddish brown. 35-40% red - reddish brown clay soft sticky sandy calc frags in sample. Soft waxy yellowish green mineral filling vesicles.
1090/1100	A/A.
1100/10	A/A.
1110/20	A/A.
1120/30	Andesite hyaline, aphnatic, crypotoxln. 75% med - dark grey/green and red mottling and streaks. 25% red brown (brick) /clear-white, green, yellow, mottling 1 to 2% chalcedony and other vein and drusy fillings. (No calc mineral.)
1130/40	Andesite 100% med - dark gray/brick, mottling, hyaline - aphanitic, porphyritic plag alt to chlorite soft green mineral devitrified: Amygdules, pred, white chalcedony/green rim or core, possibly chlorite. No calc mineral.
1140/50	A/A except less amygdule material. No calc mineral.
1150/60	A/A.
1160/70	Basaltic (andesite) med - dark gray/green cast, aphanitic - microxln, hyaline and porph: soft, translucent green mineral.
1170/80	Color change: 70% reddish brown andesite - varying color 5% amygdules. 25% dark grey - black (basalt?) red Iron ox staining. Clay like or colloidal silica, commonly green to yellow. 5% sticky clay.
1180/90	Andesite dark reddish brown - grey with red brown cast. >5% soft green, waxy mineral filling voids and cavities in rock - poss alt mafic? Trc qtz vn/frac fill.

100 Feet Summary

Basalt: v dark grey - black, hd, porph - micro x'ln groundmass, with pyroxene phenos. Com varying color amygdules.

Andesite: Brown - reddish brown hd.

Clay. Light brown - dark reddish brown, silty and sticky sandy.

Depth	Description
1190/1200	Basalt. Light grey, tan and green - pred. green; pred plag, some shows play of clors - prob. labradorite sec. mafics at x'l intersitices, some drawn in to needlelike prisms.
	Light brown material with dark specks is cement - sample had some aluminum shaving - probably from shoe.
1200/10	A/A needlelike mafic less well developed. White to light grey crumbly clay decrease.
1210/20	Andesite pred mottled light grey and red brown - 30% Iron oxide staining finer grain than above; abundant - 10% soft and waxy green - green and whitish mottled mineral.
1220/30	A/A Iron oxide staining decreases.
1230/40	Generally A/A but pred coarser texture. Trace clear subhed x'l qtz (very rare) trc crypto silica? with suspended flockulants: red and yellow from oxides and some green material.
1240/50	Andesite.
1250/60	Sand and clay varying color; 20% clay, 80% sand poorly sort pred. v. fine - fine.
1260/70	Sand occ. med grain pred subang., - at least 50% qtz and occ subrounded to rounded.
1270/80	Andesite A/A 50% basalt A/A 50%.
1280/90	Andesite A/A 50% basalt A/A 50%.
1290/1300	40% basalt: Med grey green to white mottling, porph, hyaline - devitrified euhedral - anhed xl's of prep flds/alt to chlorite. 30% andesite A/A/Tr amounts silver mica 30% red brown clay/angular slt - f sd.
1300/10	30% A/A basalt 30% A/A andesite.
	40% slt - clay, red brown/occ pieces of siltstone, bone - white, ang., clear - white qtz, occ. varicolored lith frags.
1310/20	A/A.
1320/30	Basalt 40% pred anhedral firm green grains, plag alt to Kaolin.
	60% brown/10% white - bone Kaolin clay.
1330/40	A/A.
1340/50	A/A.
1350/60	A/A.

Depth	Description
1360/70	A/A. Well hydrating clays.
1370/80	A/A.
1380/90	A/A.
1390/1400	? Rhyolite Tuff. Devit glass: Light gray - white, mottled white - pink/phenocryst flds? And occ clear anhed. qtz/dism, pyrite.
1400/10	A/A.
1410/20	A/A except light brown tuff.
1420/30	A/A.
1430/40	A/A.
1440/50	A/A.
1450/60	A/A? Light brown tuff dacite. Light brown - light - light med. gray aphanitic - cryptoxln, occ porph, devit/dism pyrite. (euhedral).
1460/70	Light brown bone (dacite?) A/A except Ang fragment of phenocryst. Plag), relic shards (?) welded.
1470/80	A/A.
1480/90	A/A except rhyolite very light gray green - whitsh green. Chlorizatioin in streaks and in relic phenocryst.
1490/1500	Dacite - rhyolite A/A. Clay A/A. Drusy - Dolomite Fillings - 1-5 mm ang cuttings of pyrite crypto - microxln A/A vein material <u>Note</u>: There are a lot of stabilizers in BHA

Summary: 1400 - 1500'

Rhyolite Tuff: devitrified, hyaline aphanitic.
Porph, becomming welded/matrix less altered to clay (or this may imply clay size minerals associate mud properties), secondary minerals.

White bone smaller qtz, anhed phenocryst flds pink. plag white, rhyolite.
Light brown larger phenocrysts dacite.

Depth	Description
1500/10	Welded tuff A/A.
1510/20	? A/A? (Look at later in detail.)
1520/30	Crumy sample!
1530/40	Clay - slt. Light grey - bone - light brown/mot white, pred clay? sz minerals/abundant vf 0 slt, ang.
1540/50	A/A blocky, clear, qtz, sd, abundant tuff frags.
1550/60	A/A except abundant green cast tuff hd, - brit.
1560/70	A/A pred clay.
1570/80	A/A pred clay.
1580/90	A/A green cast, white, ang. and blocky cutting of rhyolite. Slightly - mod. calc.
1590/1600	?
1600/10	Welded Tuff: Light med. grey/green cast, aphanitic - devitrified/spherulites, occ porph/minor euhed-anhed, qtz, and broken white flds. Tr Mica.
1620/30	Tuff - devitrified and welded - rhyolitic as above 35% light grey - white; 55 - 60% aqua - blue green vitric 15-20% dark brown - black welded tuff, obsidian? and a vitrophere of sorts hd - v. hd. sl calc. >1% vn and disem pyrite trc biotite.
*1630/40	Tuff blue green - aqua A/A 25-30% light grey - white 50% light brown - brown 25% trc dark brown obsidian and vitrophere smelt brown - brown is banded v hard and brit. - type #1 volcanic vitrophere approximately 5%.
1640/50	Tuff A/A - 5% vitrophere light brown - light grey 30% brown and gray vitrophere - with disem euhed pyrite trc of clear qtz with disem pyrite trc micro qtz veining v hard! appears silicified.
1650/60	Welded tuff A/A 50%. 50% brown - light brown vitrophere? or vitric weld tuff? Sub com-hackly frac., some looks "cherty" or poss. silicified v hd and brit grds to obsid, some flow banding.
1660/70	Welded tuff/rhyolite med gray and white mott. Aqua, light brown and brown 25-30% clay-gray hd - v hd. Rhyolitic spherulitic, poss broken hornblend and fels frags sl calc. Pyrite trc chalcedony.
1670/80	Trachytic A/A. Subparallel ali. Perlitic. 45% vitrophere flow banding pyrite.

Depth	Description
1680/90	Light grey - brown 75-80% vitrophere flagy frac. Subcond. fracture - v hard, divitrified. 20% rhyodacite.

Summary: 1600 - 1700'

Rhyodacite: 80% - med gray - brown - bone, buff, vitrophyre, trachyic, perlitic and flow band occ vesicules; fabric broken phenox'ls/dism crypt-micro pyr.

1700/10	Light grey - light brown vitrophere? 80-90% appears grainy dull - devitrified v hd. 10-15% rhyodacite A/A common pyr ves fill.
1710/20	A/A.
1720/30	50% Rhyodacite trc. 50% vitrophere chal. vning/frac.
1730/40	A/A, nice flow banding occ perlitic surfaces covered/chalcedony or vf-f e/o pyr xls.
1740/50	A/A. Trc qtz vning with euhed x'l on top.
1750/60	35% Rhyodacite A/A. 35% vitrophere A/A. 30% of sample is a green and white mottled tuffeceous? rx mod hd poss from up hole! and friable.
1760/70	Green rx above gone. 50% Rhyodacite 50% vitrophere light grey with abundant sec disem pyrite.
80/90	35% clay A/A. 30% Rhyodacite. 30% vitrophere A/A.
1790/1800	Lith change. Vitrophere and rhyodacite from above sluff. 25-30% clay in sample. Dominant rx type. Basalt?/andesite dark grey, black with green cast poss saussuritzation of plag. hd-vhd. Abundant visible plag laths micro play of colors (poss olivine)? Rock is coarsely micro x'ln. (Poss retrograde alt of mafics to biotite?) Abundant disem pyrite.
1800/10	40% basalt A/A some appears to be altered to chlorite. 20% grey clay: well hydrated sticky, silty and contains volcanic lith frags. 40% rhyodacite and rhyolitic tuffaceous materials A/A.

Depth	Description
1810/20	Lith change. Tuff - light grey - aqua and blue green - pred fine and devitrified abundant clay firm - mod hd. trc clearly flakey material. Lith change. Approximately 50% light gray tuffaceous appearing rx v hd. brit some are dark, some has disem pyr, some which appears to have been silicified in part. Light blue clay coating. 50% light green and white mottled ang rx sf - hard. Trc white clay with green laths of? Trc mother of pearl? Trc quartz lining with euhedral x'ls and reniform. Some of the green and rx has bubbles lined with blue clay.
1820/30	

FROM STABILIZERS

244' off bottom - soft black with green cast blocky firm waxy texture g 2.3 abundant blue grey clay. Free calc. Trc, Trc pyr, disem.

87' off bottom - 1 piece light med. brown silty claystone, hard v, some volcanic ash? Contained sl calc: disem micro specks pyr? 1 piece light grey v hd volcanic? rx pyr vn. non cal. g 2.6 abundant disem - sl calc. - silicified bluish green clay lining cavities rim pyr outside arreole, blue gray clay calc.

55' off bottom - blue green clay - calc.

14' off bottom - blue green clay - calc.

Bit - blue green clay - calc.

1830 - 2150	No returns.
2150/60	Med Basalt? - dark grey green - brown occ green, occ red, white mottling, porphyritic with vf flds and f mafic mineral? Hyaline - aphanitic/devitrified. Olivine/alt rims. Banded silica vein material attached to basalt. Veins/dolomite and some calc and qtz. Occ, dism, pyrite. Calcite/(alt to) green mineral. Filled drusys/chalcedony.
2160/70	A/A.
2170/80	Basalt?/Andesite - A/A Mott is light purple pred micro x'ln.

Depth	Description
2180/90	A/A color become slighter shades, com perlitic structure. Vis plag lath - very tiny ground mass micro x'l - glassy looking abundant walnut hulls in this sample.
2190/2200	A/A <5% off sample is sky blue alt? V rich in plag - this rx could be a dark colored andesite.
2200/10	50% + Basalt/Andesite. 30-40% bluish grey tuffeceous material, some banded dark and light green. 5-10% reddish brown vesicular andesite/basalt ves fill with silica.
2210/20	A/A Reddish brown vesicular rx - trc.
2220/30	Basalt med - dark grey/green cast hd and ang. cuttings occ grading to propylite, light green - gray green, soft blocky cuttings, hyaline - aphanitic, porph/euhed flds and occ mafic minerals, slightly mod devitrified. Dism pyr x'ls in propylite sl calc and vn dark green - black minerals. SL phenoxls alt to green mineral occ flds to Kaolin.
2230/40	A/A less propylite.
2240/50	A/A.
2250/60	A/A.
2260/70	A/A.
2270/80	Becoming lighter gray - brown less porph, hyaline, aphan.
2280/90	As in 2270/80.

Summary: 2200 - 2300'

Basaltic andesite:
Medium - dark grey/green and brown cast and mot, hyaline (Mod-V Devit) - aphan/mod - sl porph, vf, phenoxls flds and mafic/sddc alt to KAO, and mafic minerals dism pyr, occ silica and calc vns.

2290/2300	A/A except propylitic.
2300/10	A/A increasingly propylitic.
2310/20	A/A.
2320/30	Andesitic basalt: Light - dark grey green/white, brown mottling, altering to brick, green/mott white - brown, hyaline - aphan. porph, propylitic/open fractures, terminated qtz xls and other frac fillings approximately 20%.

Depth	Description
2340/50	Andesite light - med. gray - gray green - green, hyaline - devitrified, porph/flds.
2350/60	A/A VF - crs, euhed, light green amphibole (?). VF - crs, anhed, qtz.
2360/70	A/A vein and fracture minerals; light green soft/translucent blue opal.
2370/80	AA brown becomming predominantly propylitic. Light brown - brick/white and green, occ magnetitie: dolomite? VF pred mico, (?) muscovite dism pyr. Globular Reinform
2380/90	Brown andesite? - pred (80%) reddish bronw with white and green mott: color due to reddish bronw FeOx alt matics relic needlelike x'ls inside oxidation product, poss amphibole green and white is prob. alt plag. 20% gray with green cast propylitic 5% light grey - green with white specks. 2% cryptoxlline qtz.
2390/2400	50% andesite? more propylitic reddish brown, 50% green - grey. Trc green tuff prob. sluff. Trc green crypt qtz. Trc grey siliceious material crypt qtz? calc.
2400/10	50% green - 50% greenish gray. More propylitic com 3% rounded free siliceous pieces appear to have filled vessicles at one time. Calc.
2410/20	Andesite 90% green largely alt to? 5% calc pred. green and white mott with some grey mott. Abundant siliceous un/frac/amyg. filling (5%).
2420/30	Pred reddish brown - grey; 5% alt green and white mott propylitic. 3% crypto qtz., com free amyg., filling calc.
2430/40	Pred A/A light grey andesite alt to green and white and gray mott rx some black and blue mott. Some looks like greenstone but density is off; 40% prop.

Summary: 2340 - 2450'

Andesite. Light - medium grey, grey green - green, light brown- reddish brown - brick, green, white and gray mott, hd md - intense propylitic alter. porph - relic mafics surrounded by abundant FeOx - some feld. amyg. com free siliceous amyg. fill - abundant arg. alt prods. disem pyr com disem calc. thru out: Trc - crypto qtz.

Depth	Description
2440/50	50% light grey 50% alt green calc, com silica veining, trc clear, rhombohedral mineral (dolomite). Propylitic.
2450/60	A/A increase crypto qtz.
2460/70	A/A but more intensely alt.
	70-80% green to green-grey, com green/white/grey mott.
	Disem calc. decreasing.
2470/80	A/A amydules white/green rims, brown.
2480/90	Andesitic Basalt, dark grey, cryptoxln, with grain vn material, occ, porph, light grey/green and brown mott v calc. Amydule/opal and dolomite.
2490/2500	Light grey green/brick brown - white mottle hyaline - aphan, porph, sl - v calc, devit, tr, pyr./brittle pistachio mineral, hd honey yellow mineral.
2500/10	A/A.
2510/20	A/A except more propylitic.
2520/30	A/A except more propylitic.
2530/40	A/A except more propylitic.
2540/50	Increasingly propylitic light green/white, brown, red mottling, increasing pyr.

Summary: 2550 - 2600'

No description?
Pred 90% sluff.

2600/10	Andesite (abundant sluff from trip?) Varying color propylitic; 90% (cannot decipher notation). Trc poor sort rd qtz grains in siliceous matrix. 10-20% ss. 5-10% chert.
2610/20	Abundant aqua? Light blue and mott A/A varying color trc (ss and chert)? Something is happening; looks conglometric but no rounded pieces. 10-20% ss. 5-10% chert.
2610/30	Approximately 50% propylitic andesite? 50% sedimentary?, 20% ss; Approximately 30% chert
2630/40	40% ss, 30% chert.
2640/50	Pred ss and crypto x'l qtz. 50% ss 50% chert/sluff.

Depth	Description
2650/60	A/A less ss 40% ss; 60% sluff.
2660/70	A/A and sluff.
2670/80	90% qtzite. White - light brown - light blue green/occ black-brown streak and s & p text, closed fracture/black - brown shinny streaks. Hornfelsic qtzite/Ang-pressure solu. (suturing & pitted) relic sandstone textures white - tan VF-F sub rd-ditted.
2680/90	A/A 40% ss. 60% chert.
2690/2700	Sandstone and siltstone: A/A except light tan - brown. 50/50
2700/10	1-2% brown, micro mila silt st. Sandstone/iron oxide staining. 1-2% uncon sd vf-f, ang subrd. pitted, etc., prolate - blocky - elip - oblate. Note: Altered volc rx in samples are sluff!
2730/40	SS/orthoquartzite: 50%-60% varying color ÷ white - cream, light brown and tan - buff occ with pinkish cast. mod hd and fri - v hd, and well cemented with silica - pled fn - med w/occ med - coarse, pred subround - round w/occ sub ang and ang. - good - fair sort. - pred qtz sand in a siliceous matrix. Some rex'lized in part to Quartzite. Mnr secondary bronze col. mineral (sericite) on some rock surfs. New trc FeOx calc. Chert/crypto x'ln qtz: varying color 40-50% white cream, light brown, flesh grey, occ, with pk cast occ pk, pk-red ornge. occ light green-v hd and brit, hacly splintery, sub con-con, frac. com dark disem min along internal micro freacs. mnr sec bronze col. min on some surfs.
2740/50	60% ss A/A slightly more quartzite. 40% chert A/A with more light green.
2750/60	Becoming more quartzitic. Trc siltstone ss trc light green and light orange. 80-90% ss/orthoqtzite/quartzite.
2760/70	10% chert. Hematite x'ln turned mud a brick red. Some pieces of x'ln hem calc.
2770/80	90% sandstone and orthoqtzite. Light brown - tan - bone - white vf - med, mod - w srt, ang - sb rd, blocky - prolate, ellip - oblate, pressure suturing/cleaving across grains, occ not, hd and brit/silica cement. Pred clear - white qtz occ, alt, white, pink flds, occ hematite matrix/chlorite.

Depth	Description
2780/90	A/A.
2790/2800	A/A. 10% chert sluffing material?
2800/10	A/A soft yellow mineral. 20% chert, black metallic mineral, clear soft brit mineral.
2810/20	A/A.
2820/30	A/A trc light brown - light grey - grey siltstone arg. silicified pyr vng trc calc. 90% ss, 10% chert Trc x'ln Hematite stuck to rx surf prob vn/or frac fill.
2830/40	SS gen A/A varying color 85%. Chert 15% continue free hem.
2840/50	SS varicol A/A 50-60%. Chert varying color 40-50% trc light grey silstone.
2850/60	A/A.
2860/70	SS A/A 40-50%. Chert 50-60%. Trc brown silicified? Gen A/A.
2870/80	A/A trc amber col stained optical qtz brown ss becoming darker shade or brown.
2880/90	SS-45% - abundant brown and white mott. Chert - 55% poss alteration of ss or quartzite?
2890/2900	Gen as above, varicolor, chert and crypto qtz.

Summary: 2850 - 2900'

Chert: Varicol - white - cream.

Chert/crypto qtz - varicol' white - cream, light brown, brn, some pk cast, light green, light yellow, grey, orange and red, opaq - transluc. v hd and brit, sub con-con frac, mnr hackly, grds to trac. amounts of silty chert com x'ln hem on surfs.

2900/10	Approx. 30% chert A/A. SS 40% A/A s/w dirty looking matrix. Quartzite? 30% dark brown and white mott in app.; v. hard.
2910/20	No description provided.
2920/30	No description provided.
2930/40	Lost circulation.

Depth	Description

CORED
3159' - 3187'

When removing core from barrel 1-1/2 feet of argillite came out followed by approximately 4" of clay and lith frags and a bucket full of drilling fluid containing lith frags as described below:

Argillite: Black, mod hd and brit, com sub con-con frac, shiney graphitic luster, com calc micro frac fill.

Clays and Lith Frags: Pred. light brown claystone? or prob a totally devitrified volc glass or vitrophere? soft and fri - sl firm and fri into com-blocky pieces, sl calc some with poss proto auhed phenos of qtz in place, some tuffeceous in app. Com large pieces of free calc vn fill to 1/4" thick with intergrown x'ls, mnr light grey tuff.

Sample from Fluid above core:

Pred (90%) black argillite A/A, mnr <5% dark grey and black banded chert, com 5-7% was a brite green rock/min - v hd, earthy luster, com black soft and sticky substance or sufs trc black and green serpentine trc large pieces of free calc vn fill.

3210/20 Garbage

3220/30 Phylite shiny surfaces.

3230/40 Phylite shinny surfaces.

3240/50 Phylite med - dark grey - grey brown argillaceous/fine - M sd, well indurated occ, gn chl stn, pyr/ang-block cutting/vns and fracture surfs.

Qtzite? bone - white - light brown materials/hornfels (relic) textures of sd gns, flds.

3250/60 A/A.

3260/70 Argillite (Phyllite): Pred med - dark grey with more grey brown and black, mod hd - hd, earthy, blocky - hackly, occ conch fracs with v shiney frac surfaces, tr chlor staining, tr silicia and calc veining, tr dism pyrite trace amts (1) quartzite: white, tan red, hd, (2) microcrystalline qtz: grey, white, light brown w/dism pyp vng.

3270/80 A/A.

Summary: 3280 - 3350'

A/A.
Except increasing amounts of microxln qtz (which appears to be filling fracture i.d., veins) light grey - grey/box work outlines of dark gray dism pyr, "Jigsaw puzzle text."

Depth	Description
3350/80	Argillite: Med pred - dark grey with mnr blck, mod hd - hd, earthy, blocky - hackly, tr silic vng, tr - mnr calc vng, tr disem pyr, microxln qtz: (10/20%) A/A, but with com dism pyrite.
3380/3400	A/A Argillite 80-90%. Microxln qtz 10-20%.
3400/20	Argillite (75-80%) A/A but with mnr white calc vng. Microxln Qtz (20-25%): light grey, white, light blue grey, com dark grey to black dism and veined pyr which gives a framework appearance, opaq-transluc, v hd, brittle, conch fracs, some hackly.
3420/30	Argillite (50%) A/A. Microxln qtz (50%) A/A with mnr pale green, tr white calc vng.
3430/40	Micro crystalline silica (70%) - den 2.53. - Amorphous silica, white - light grey, slight granular, durable, small-hackly fract. - "Chickenwire" texture, micro vening by magnetite, macro veining/patchy by pyrite (some jasperoid matrix orange). Siltstone (25%) - 2.50. Meta/white (granular) black - light grey, durable, hackly, mnr calc. Sandstone (5%) den 2.48. Meta granite, bleached light brown, v fine grained. Minor sec quartz (limonitic staining?)
3440/50	As above.
3450/60	Micro crystalline silica (90%) - Amorphous silica light grey, blue grey, totally amorphous, durable smooth flat fracture. - "Chickenwire" texture, microveining, infill. magnetite, patchy chalcopyrite some pyrite. - Siltstone (5%) as above. - Sandstone (5%) q. sublith arenite as above. - Sec mnr chalc, pyr, mag and, Jasper, limontic Q.
3450/70	Lithology as above Am silic 2.45 50% "Chickenwire" texture facting. White 2.42 30% Arenite 2.57 10% Friday 25/4/80

Depth	Description
3380/90	AM silica 20% Meta siltstone (according to Gilbert-Graywacke) 70% "Argillite" 10% - caught after pumps down 6 hours.
3390/3500	"Argillite" (phylite) 85% Meta siltsone 10% Meta Arewite > 5% AM silica Tr Argillite A/A except brown grey and micromica
3500/10	A/A.
3510/20	(Caught after connection.) A/A except. 5% AM silica.
3520/30	A/A. Fracture surfaces apparent.
3530/40	A/A.
3540/50	Argillite: Med-dark grey with grey brown and black shiny conch surfaces or planar frac.
3550/60	50% Meta Quartzite: white - bone, light grey. hd v. w. indurated pred, white - clear, qtz/suturing and silica cmt,/occ dism pyr; grading to meta siltstone.
3560/70	A/A.
3570/80	20% microxln qtz. 85% "meta siltstone" (graywacke) light brown/white black spec, hd, ang pred, brown mtx/white - clear vf-slt, micro mica, sl calc./concr and dism pyr. 5% microxln qtz. white - clear brown occ yellow, lighter green/white, green mottled tr, banded opal/sphereulites.
3580/90	A/A.
3590/3600	A/A.
3600/10	Increasing, 30 to 40%, microxln qtz.
3610/20	Increasing, 30 to 40%, microxln qtz.
3620/30	50% Argillite. 30% microxln qtz. 20% meta siltstone.
3630/40	A/A.
3640/50	Fubar by connection.

Depth	Description
3650/60	A/A.
3660/70	Argillite: (40%) Pred med grey - black with occ grey brown, hd, earthy, developing granular tex in pts, blocky - hackly, tr calc veing, mnr dism and veined pyrite, some shiny surfaces. Micro crystalline qtz 30-40% pred light medium grey, with occ dark grey v hd, opaque - transluc, gd conch fracs, com framework micro and macro veining of dism pyrite and chacopyrite? developing dark grey - black bndrs, poss micro veining of magnetite, tr calc veining, tr agg and euhedral x'ls of pyrite. Sandstone (10/20%) light grey - grey white fine - medium grey, hd.
3670/80	A/A Argilite 40% Qtz 40% SS 20%
3680/90	Argillite 10% Qtz 20% Sandstone: (70%) pred light medium grey with occ grey white, dark grey and gray brown, pred fn - med gray, pred sub rd - rd with mnr sub ang due to silica over growths with occ vfn, well srtd, hd, some silty matrix mat., tr calc veining, com dism and veined pyrite, ma=nr intercolated pyrite with occ euhedral x'ls, Tr intercalated hemitite.
3690/3710	A/A Argillite 30-40% SS 40-50% Qtz 20%
3710/20	Argillite (75-80%): Pred dark grey - black with occ light to medium gray, hd, earthy, blocky-hackly, some gd conch fracs, tr calc vng, tr dism and veined pyr, in pts developing a granular text similar to siltstone. (25%) microcrystalline qtz: light grey - white with occ green cast, vhd, gd conch frac, mnr dism and micro veined pyrite, poss microveining magnetite.
3720/40	Argillite (60-70%) A/A. Sandstone (15-20%) A/A, but with only tr-mnr pyrite both veined and dism. Microxln qtz: (15-20%): Pred, light grey - grey white with occ green cast, some medium dark grey, vhd, gd conch frac; mnr dism and micro veined pyrite.
3830/40	Pred sluff from hole being circulated. Clean fter trip. 30-40% Ortho - Meta - Qtz 50% Argillite Meta Siltstone 10% Micro Qtz.
3840/50	Hole cleaning.

Depth	Description
3840/60	70% qtzite. 255 Argillite. 5% Other micro qtz.
3870/80	A/A.
3880/90	A/A.
3890/90	A/A.
3900/10	25% metaqtzite grading to 40% meta sandy siltstone (Graywacke) to 25% argillite and 10% micro xln qtz.
3910/20	A/A vn pyrite in Argillite.
3920/30	A/A.
3930/40	Metaquartzite (60-70%): Light dark grey, some grey-white, pred fn-medium grain with occ crs sub ang-sub rd, mod srtd, hd - vhd, in pts. slightly foliated (schistose?), com clear white qtz veining, mnr biotite in pts, trc pyrite and poss magnetite tr of euhedral qtz xls, pred mosaic text with relic rd qtz grs, tr calc vng, generally breaks across grains, possibly qtz: (10%) light grey - grey white, hd, mnr micro veining of magnetite. Argillite: pred dark grey - black, with occ grey brown and light grey, hd, occ gd conch fractures with shiny surfaces, poss micromicaeous, locally mnr clr - white silic veining hackly - blocky, occ silty text (metasiltstone), tr dism pyr.
3940/50	Metaquartzite (20-30%) A/A. Microxln qtz (10%) A/A. Argillite (60-70%) A/A.
3950/60	Metaquartzite (25%): A/A but increase in dark grey - black, pred fn med. w/occ vfn. Microxln Qtz (15%): Light grey - white with occ pale green cast. Microveining of magnetite and dism pyr. Argillite: 10%.
3960/70	Metaquartzite/Qtzschist: 80% Microxln qtz: 10% Argillite: 10%
3970/80	Metaquartzite/Qtzschist: 80% A/A some qtz grains blue-white cast. Argillite: 20% A/A Qtz: Tr
3980/90	Qtz: 15% Argillite: 355 Metaquartzite: 50%

Depth	Description
3990/4000	Metaquartzite A/A 50% Argillite A/A 40% Qtz: 10%
4040/50	70-80% Argillite: Grading to metasiltstone black/shinny conch surfs, (cannot decipher word) and calc vn, pyr. 20% micro qtz; light grey - bone, banded.
4050/60	A/A. Argillite/Anamostosing Silica vns.
4060/70	A/A.
4070/80	Very poor sample.
4090/4100	Metaquartzite 70% Argillite 20% Qtz 10%
4100/10	70% Metaquartzite: Pred med - dark grey with occ black, light grey, and grey white, pred fn - med grain with occ vfn, pred sub ang. sb rd with occ relic rd, pred mosaic text with interlocking grs, pred hd with some friable when locally grading to Ortho-quartzite, com microbiotitic, tr dism pyr and magnetite veining, mnr silica veining in pts, locally sl foliated, tr interstitital pyrite. 20% argillite: Pred med-dark grey with occ black, blocky - hackly, occ shinny surface, dense, pred hd, with occ firm friable when black, com micromica, earthy, grading to metasiltstone, in pts, tr-mnr dism pyr, mnr white silica veining. Microcrystalline Qtz: (10%) pred light grey - grey white with occ white with green cast on some, vhd, gd conch fract., opaque, mnr dism pyr and micro veining of magnetite.
4110/20	Argillite: 70% A/A - Metaquartzite: 20% A/A. Qtz: 10% A/A but with tr clay: gray white, soft, calc, mnr dism pyr and magnetite microveining.
4120/30	Argillite: 40% A/A, but with com white, blue white silica vng. com dism pyr. Qtz: 20% Meta Qtz: 40%
4130/40	Metqtz 30% Qtz: 30%; Argillite: 40%.

Depth	Description
4140/50	(50%) Argillite: Light grey - black, blocky - hackly, hd abundant dism and veined pyr, mnr silic veining, earthy, grade to metasiltstone. Qtz: 30% A/A but with some dark banding. Meta Quartzite: 20% A/A.
4150/60	A/A.
4160/70	A/A.
4170/80	A/A with terminate qtz in vugs on qtz.
4180/90 & 4190/4200	By passed shaker.
4200/10	70-80% Argillite black - dark grey; grading to metasiltstone: 10% Quartzite. 10-20% Microxln qtz.
4210/20	70-80% Argillite/clear opal banded drusy vug fillings. 10% microxln qtz/pyr. Metasiltstone/terminate euhed qtz and pyr metaqtzite cmt/pyr.
4210/20	A/A. Argillite: Dark grey - black, grading to metasiltstone, dark grey - black/white specs, grading to qtz. light grey - white/abundant silica vns and tr term qtz xls, dism and euhed pyr.
4220/30	A/A. 80% Argillite: dark grey - black, black, shinny, conch surfs earthy/dism pyr. 15-20% qtzite A/A. Tr microxln qtz "Framework" dark vns.
4230/40	A/A Argillite grading to metasiltstone.
4240/50	A/A.
4250/60	A/A 3-5% micro qtz light grey/darker framework vns of magnetite.
4260/70	A/A.
4270/80	Argillite: 30% Microxln Qtz: 40% Qtzite: 30%
4280/90	A/A.

Depth	Description
4290/4300	A/A. Increasing qtz veins. Log description. Qtzite - Metasiltstone: Light grey - bone, hd, with ind, parting across gns, slt; occ med, ang-sb ang, interlock mosaic text/silica veins, dism euhed pyr.
4300/10	Qtzite: 40% Argillite: 30% Microxln Qtz 30%
4310/20	Qtzite: 20% Qtz: 20% Argillite: 60% Argillite: dark grey black, hd, pred blocky - hackly with mnr gd conch fracture surfaces that are shiny, phyllitic sheen common, mnr dism pyrite, com white silica veining grading to metasltstn. Microxln Qtz: White - light grey, hd, conch frac, com dism and veined pyrite, com micro veining of magnetite, occ granular some of white silica secondary in nature of veins in Argillite and Qtzite. Qtzite: A/A, but with increase in vfn gr. com dism pyr, light grey - grey white.
4320/40	Argillite: 85% pred med - dark grey, grading to metasltstn. Qtz: 10% A/A/ Meta Qtzite: 5% A/A.
4340/50	A/A. Tr dism pyrite.
4350/60	Metaqtzite: 0-5% Argillite 90-% Qtz: 10%
4360/70	Argillite (90%): Pred med - dark grey with occ black, hd, pred blocky - hackly, with occ conch fracs, earthy, dense, micromicas com, mnr dism pyr and white silica veining, massive, grading to metasltstn in pts. Qtz: white - light grey A/A. Tr Metaquartzite.
4370/80	A/A.
4380/90	Argillite: (40%) dark grey - black, mnr dism pyr and tr euhedral xlts. Microxln qtz (60%): Pred white - light grey clear with occ med grey, brittle, hd, conch freac, some xltn, mnr dism pyr, tr euhdra pyr xlts, tr microveining of magnetite, pred transparent - translucent with occ opaque, sharp edges, massive.

Depth	Description
4390/4400	Argillite: 60% Qtz: 30% Metaquartzite: (10%) light med grey, vfn-fn gr.
4400/10	Argillite: 60% A/A.
4410/30	Argillite: 40% A/A, but with increase in veined and dism pyr. Qtz: 40% A/A. Metaquartzite: 20% light grey - med grey, vfn-fn gr.
4430/40	Argillite: 50% A/A with micro veining pyrite. Qtz: 40% with abundant framework magnetite micro veining. Metaquartzite: 10%.
4440/50	Argillite: (80%): Dark grey, black, hd, blocky-hackly, com dism and veined pyr, mnr silica vng, some with phyllitic sheen, earthy, grading to metasltstn. Qtz: 20% A/A.
4450/60	A/A.
4460/70	A/A.
4470/80	A/A.
4480/90	Increasing microxln qtz.
4490/4500	Argillite: dark grey - black, shiny conch surf, earthy, micro mica, dism pyr and silica vns.
4500/10	Microxln qtz: light grey - white/black framework veins magnetite cross cut by white - clear silica veins, pyr.
4510/20	A/A.
4520/30	A/A.
4530/40	A/A.
BREAK	NO SAMPLE DESCRIPTION
4600/10	Microxln Qtz: (80%) white - light grey, hd, good conch fracs, translucent - transparent, brittle, mnr dism pyr, com magnetite "framework" microveining, tr macro veining of pyrite with rare euhedral xlts. Metaquartzite (10%): gray white - light grey, vfn - fn gr, com interlocking mosaic text, breaks across grs, hd, tr dism pyr, com mafic minerals - biotite? Argillite: 10% dark grey - black, hd, blocky, dense, micro, mica, earthy, tr dism pyr and silica vng.

Depth	Description
4610/20	A/A Qtz: A/A occ dark grey.
4620/30	Qtz: 60% but with tr granular. Metaquartzite: 20% A/A. Argillite: 20%
4630/40	A/A.
4640/50	Microxln Qtz: (70%) Pred light grey - grey white with mnr med grey and white dism pyr, magnetite "framework" vng, 20% secondary silica vng, occ granular. Argillite: (20%) A/A, grading to metasltstn. Meta Qtzite: (10%) A/A.
4650/60	Qtz: 60% A/A. Argillite: 40% A/A.
4660/80	Qtz: 60% A/A with increase of dism pyr, rare trace terminated qtz xls. Argillite: 40% A/A but with increase in dism pyrite and veined silica, mnr macro veined pyr, grading to metasltstn.
4680/90	Argiillite: 85% C 10% (C = chert?, SQ 5% and SQ - secondary quartz?)
4690/4700	Argillite: 85% C 5% SQ 5%
4710/20	Argillite 75% C 5% CSQ 5% SQ 15%
4720/30	A/A.
4740/50	Argillite 75% C 5% CSQ 10% SQ 10%
4750/60	A/A
4760/70	A/A.
4770/80	A/A.

Depth	Description
4780/4800	Argillite: (50%) dark grey - black, hd, blocky - hackly with occ phyllitic scheen, earthy, dense, mnr dism and macro veined pyr, occ siliceous, mnr silic vng, grading to metasltstn. Microxln Qtz: (40%) - primary 10% primary with secondary 10%, secondary 20%. pred light-dark grey with occ white and ?, hd, brittle, conch frac, occ granular, com dism and mnr euhdral pyr, com magnetite "framework" microvng., mnr macro vng pyr, occ silica vng. Metaquartzite: (10%) light grey - dark grey, vfn - fn, hd, mnr biottite, mnr dism pyr and some veined pyr, com mosaic text.
4800/10	Qtz: 40% A/A. Argillite: 60% A/A.
4810/30	Qtz: 30% Secondary 20% Primary 10% Argillite: 70% A/A.
4830/40	Qtz: 40% (secondary 30%) A/A. Argillite: 60% A/A micromica.
4840/50	Qtz: (90%) primary 10% primary with secondary 40% secondary 30% A/A but increase in granular. Argillite 10%
4850/60	Argillite: 60% Qtz: 40%
4860/70	40% Argillite: dark grey/shiny surfs, micro mica, dism euhed pyr, silica vns. with elliptical clr qtz grns. 60% microxln qtz: light grey - clr/abundant dism pyr magnetite vns, occ clr silica vns "sucrosic" granular text.
4870/80	30% Argillite. 70% Microxln qtz.
4880/90	20% Argillite 80% Micro Qtz.
4900/20	Argillite: 80% Qtz: 20% A/A
4920/30	Argillite: 50% Qtz: 50%
4930/40	Argillite: (60%) black - dark grey, blocky-hackly, pred hd with occ firm friable when v micromiceous with graphitic sheen, siliceous in part, manr dism and euhedral pyr, occ silica veining, mass, dense, grading to metasltstn in part. Microxln Qtz (40%): Pred with light grey with occ clr, hd, conch frac, about dism pyr, com magnetite micro vng, granular tex in part, occ banded, pred massive, approx 30% secondary.

Depth	Description
	Microxln Qtz: Pred white - light grey w/occ clr and dark grey, hd, brittle, pred mass w/occ banding dark grey, opaque - translucent. about dism pyr and mnr euhedral xlts and macro veining pyr and silica, com magnetite micro veining, granular text inpt, approx 60% of qtz secondary. Argillite: Pred black - dark grey with occ med. grey, pred hd with occ firm friable when very micromicaeous with graphitic sheen (carbonaceous) dense, pred mass with micro lams inpts, occ siliceous, mnr dism and euhdral pyr, (?), mnr silic and pyr macro vng, grading to Metasltstn.
	Depth @ 7:30 4,993'
	Ave 14 ft/hr.
	Breaks 4880-90 25' 4915-25 25 No gains or loss. 4955-65 22
	Mud in/out
	4860-8000 139/168 4880-4900 141/167 4900-2000 140/166 4920-4000 140/168 4940-6000 140/168 4860-8000 141/170
	Lith Argillite 70-80% Qtz 20-30% 40% @ 4870-90 4930-40
4940/50	Argillite (80%) A/A but with poss mag vng. Qtz: (20%)
4950/60	A/A.
4960/70	Argillite: 70% mnr white silica vng. Qtz: 30% A/A with increase in white (secondary and macro vnd pyrite.
4970/80	Argillite: 80% pred mass with thin lams inpts. Qtz: 20% Qtzite Tr gneissic?
4980/90	A/A.
4990/500	A/A.
5000/10	Qtz 805 (40% secondary) Argillite 20%
5010/20	By passed shaker.

Depth	Description
5020/30	By passed shaker.
5030/40	70% Argillite. 30% Microxln Qtz.
5040/50	80% Argillite. 20% Micro qtz.
5050/60	80% Argillite: Med - dark grey, black/shiny conch surfs, micromica, pyr, silica vns. 20% microxln qtz.
5060/70	50% Argillite. 50% MQ.
5070/80	
5080/90	Lith Change. Qtz Monzonite. ? light grey - buff, tan - white/spec white, white-pink, tan occ, brown and green. Brown square mica, occ pyr, occ? Light green mineral abundant white prismatic SQ euhed flds. SL-V calc hypidiomorphic granite. Idiomorphic - SB flds id mica.
5090/5100	A/A.
5100/10	A/A with com altn of felds - KAO (white laths) com bronze brown biotite. 40% qtz monz, 30% Argillite, 30% qtz.
5110/20	30% qtz Monzonite - light grey - light green, white high silicic altn. 50% Argillite: dark grey - black - hd blocky, aphanitic (pred) with some sucrosic tex tr silicic vening, tr vn pyritic. 20% qtzite, vt gr, light grey, microxln, occ.
5120/30	20% Mon qtz. 60% Argillite. 20% qtz (secondary).
5130/40	10% Mon qtz. 80% Argillite. 10% and secondary qtz.
5140/50	80% Argillite 20% secondary qtz - occ white, mgr, tr un pyr.
5150/60	60% Argillite - fr green black - dark grey 30% qtzite 10% secondary qtz.
5160/70	Meta quartzite (70%): White and dark grey - black, pred fn with mnr med gr, sub ang-sub rd with relic rd, com mosaic text, breaks across grs, rare - mnr dism pyr, white pred pure in upper pt, tr magnetite and silica vening, grey micromicaeous, hd.

Depth	Description
	Argillite: (10%) grey - balck, hd dense, micrmiceous, mnr dism pyr, tr silica vng.
	Qtz Monzonite: Pred light grey - grey white with occ light green, pink, buff, fn - med xln, pred hypidiomorphic text, with idiomorphic - phenocrysts of possible plag, occ brm brit, tr dism pyr.
5170/80	Metaquartzite 30% A/A. Monzonite 70% A/A.
5180/90	Qtz Monzonite? - 100%: Pred light grey - pale green with occ grey white, pred med gr with occ fn, pred hypidiomorphic granular text with idiomorphic plagioclase, in a finer alkali locally groundmass tr of plag phenocrysts, striations of cleav surfaces of plag, qtz white - grey (10%), tr biot, pyr, sphene (?), and hornblende, pale green color due to alteration of mafics?
5190/5200	A/A 100% Monzonite.
5200/20	A/A.
5220/30	Qtz Monzonite A/A but with fhgr, white tan inpts.
5230/40	A/A.
5240/50	Qtz Monzonite (altered): pale green - light grey, chloritized, med gr, pink, white, light grey aphite veinings in lower pt.
	AP = aplite vn
5250/60	70% Qtz Monz. 20% Ap, 10% qtzite.
5260/70	50% qtzite: white - light grey, aphanitic, tr 2nd qtz veining, tr pyr. 20% AP 30% Qtz Monz
5270/80	A/A 70% qtzite 20% AP
5280/90	80% qtzite (B) light grey (A) white microcrystalline granular mod rextal rare remgr, bndrys, abundant silicic overgrowth. (A) White - occ light grey microxtln sl vitreous abundant 2nd silicic vning with occ dark grey bands, mass, opaque, tr dism trm pyrite, tr black mag veining. (B) M - dark grey, pred clear vf gr qtz with com gr bndry's some 2nd silicic overgrowths, rd, dirty appears.

Depth	Description
	Microxln 20% qtz. Qtzite 80%.
5290/5300	75% Qtzt A/A. 25% Microxln qtz.
5300/10	30% qtzt. 70% microxln qtz.
5310/20	A/A.
5320/30	A/A.
5330/40	20% Argillite. 20% qtz. 50% Microxln qtz.
5340/50	10% qtzt. 35% Argillite. 55% Microxln qtz.
5350/60	10% qtzt. 45% Microxln qtz. 45% Argillite.
5360/70	50% Argillite. 40% Microxln qtz. 10% qtz.
5370/80	30% Argillite. 60% qtz. 10% qtzt.
5380/90	90% Microxln qtz: clear, white, light grey, occ vitreous text, opaque-transparent, hd, brit, mass tr dark grey vns, com - abundant agg and vn pyr. 10% Argillite: black, very dark grey, sucroci, micromic, hd, abundant clear and white secondary silicic veining tr agg and vn pyr.
5390/5900	A/A (80/90).
5400/10	A/A (80/90).
5410/20	A/A (80/90).
5420/30	80% M qtz. 20% Argillite.
5430/40	80% M qtz. 20% Argillite.
5440/50	Argillite 50% Microxln Qtz 50% Metaquartzite Tr

Depth	Description
5450/60	Argillite: (60%): black - dark grey, hd, dense, blocky-hackly, earthy, occ micromiceous, com graphitic sheen in pts (carbonaceous?), mnr dism and euhedral xls pyr, com white silica macro veining, mass, grading to metasltstn inpts. Microxln qtz (30%): white - med grey with occ dark grey bands, hd, conch frac, brittle, opaque-translucent, tr dism pyr and microveined magnite, occ silica vng, 70% of qtz secondary, granular inpt. Metaquartzite (10%) pred grey white - light grey with occ dark grey, hd, vfn - fn, gr, relic rd grs, com mosaic text, breaks across grs, tr dism pyr and silica vng.
5460/70	Argillite: 40% A/A. Qtz: 50% (80% secondary) Qztitic: 10% A/A
5470/80	Microxln qtz: 60% increase in white and granular Argillite: 30% Metaquartzite: 10%
5480/90	Microxln qtz: 60% A/A Argillite: 10% Metaquartzite: 30% A/A, but with sl tr of foliation of micro miceous material.
5490/5500	Microxln qtz: 70% Argillite: 20% Metaquartzite: 10%
5500/10	Metaquartzite: 20% A/A but with occ med gr, occ micromiceous. Argillite: 60% A/A. Qtz: 20% (60% secondary)
5510/30	Metaquartzite: 10-15% Argillite: 60% A/A Qtz: 15-20%
5530/50	A/A.
5550/60	Metaquartzite: 70% light grey - m. grey, hd, brit, irreg frag. opque, tr vn mag and pyr. Argillite: 10% Qtzite: 20%
5560/70	A/A (50-60).
5570/80	Qtzite: 50% very dark grey and clear, pred clear, rounded firm grain qtz grains, with dark grey argillic type matrix hd. 30% Microxln; qtz tr vn pyrite, tr vn silica. 20% Argillite
5580/90	60% dark grey qtzt. 20% qtz. 20% Argillite

Depth	Description
5590/5600	85% dark grey black clear qtzite. 5% M qtz. 10% Argillite.
5600/10	Argillite 70% Micro qtz 20% Qtzite 10%

5/25/80 - SUMMARY

Depth @ 0800	5690'	
Ave Drill Rate	9-1/2 ft/hr.	
Breaks	None	
Temps.	In/Out	BU 190°
5530/40	139/173	
5540/60	136/167	
5560/80	136/170	Cooler on
5580/5600	135/168	
5600/20	130/163	
	126/173	
5620/40	128/163	
5640/60	135/165	
5660/80	134/163	

Lith	Arg.	Meta Qztzite	Qtz
5530-50	50	10	40
5550-70	25	10	70
5570-90	30	50	20
5590-5600	10	85	5
5600-10	60	10	30
5610-50	60	30	10
5650-60	80	20	0
5660-70	60	20	20

5610/20 Microxln qtz (10%): Pred grey white - light grey with occ white - clear, hd, brittle, conch fracs, tr dism pyr and microveined magnetite, 20% secondary.
Argillite (50%): Pred med - dark grey with occ black, hd, dense, mass, blocky-hackly, mnr dism pyr, tr macro veining of pyr and silica, micromiceous in pts, earthy, occ graphitic scheen, mnr clear rd relic qtz grs in pts.
Metaquartzite (40%): Pred med - dark grey with occ black, fn - med gr, com clear rd qtz grs, com mosaic text, breaks across grs, generally distinct gr boundaries, micromicaeous, tr dism and und pyr.

5620/30 A/A.

5630/40 Argillite: 60%.
Qtz: 10% A/A.
Metaquartzite: 30%

Depth	Description
5640/50	Argillite 65% but with increase in black Metaquartzite 30% A/A Qtz 5% A/A
5650/60	Argillite 80% A/A Metaquartzite 20% A/A
5660/70	Qtz: 20% A/A but with dark grey and mnr dism and macro vn pyrite, 20% secondary. Metaquartzite: 20% A/A but with sub ang - sub rd and relic rd due to silica overgrowths, tr intersitial pyr with euhedral xltls. Argillite: 60%
5670/80	Argillite: 70% Metaquartzite: 20% Qtz: 10% Sluff? Tr white - grey white. Intrusive body: fn gr plag laths, tr biot, tr dism pyr, qtz poor (?).
5680/90	Argillite: 60% A/A Metaquartzite: 20% Qtz: 20% light - dark grey
5690/5700	Argillite 70% A/A Metaquartzite 30% A/A
5700/10	Argillite 60% v sdy. Metaquartzite 40%
5710/20	80% Argillite 20% M qtz
5720/30	60% Argillite 40% M qtz
5730/40	20% Argillite 60% Microxln qtz, white - light grey. 20% qtzite.
5740/50	35% Argillite 30% M qtz 35% qtzite
5750/60	60% Argillite 30% Microxln qtz 10% qtzite
5760/70	60% Argillite: m - dark grey, hd, brit, occ splintery parting, sucrosic - granular tex, occ phyllitic sheen, micro mic in pts, occ clear qtz grns, com white - light grey silicic vning, tr bagg vn pyrite.

Depth	Description
	30% Meta Qtzite: white, light and m grey f-m gr clear to dirty, mod srtd, rnd clear qtz with com 2nd silica overgrowths, occ argillitic matrix tr vn and dism pyrite.
5770/80	80% Metaqtzite: clear and dark grey, vhd, mod srtd, well rd clear qtz grain, interstitital argillite, abundant secondary clear silica with some white vns. 20% Argillite
5780/90	Metaquartzite 60% A/A com mosaic text, tr dism: interstitial pyr. Argillite 30% A/A occ graphitic scheen Microxln qtz 10% (50% secondary): pred light - dark grey with occ white, brittle, conch frac, tr magnetite vng, tr dism pyr, mass, opaque
5790/5800	A/A.
5800/10	Metaquartzite (90%): Pred med - dark grey with occ grey white, vhd, fn - med gr, sub rd - rd relic alr qtz due to qtz overworths, well-mod sorted, argillitic type matrix material in pts, trc dism pyr and vnd silica, com mosaic text, breaks across grs. Argillite 10% A/A
5810/20	Metaquartzite 50% A/A Argillite 50% A/A
5820/30	Argillite (80%): dark grey - black, hd, dense, brittle, blocky-hackly, micromicaeous, occ sucrosic - granular, mass, sl tr dism pyr, occ phyllitic and graphitic scheen, mnr clear rd qtz grs inpts, mnr white silica vng. Metaquartzite 20% A/A
5830/40	Argillite 80% A/A Meta Qtz 20% A/A

5/26/80 - Summary

Depth @ 0800 5860
8 ft/hr

No breaks

Temp.	In/Out	
5680-5700	130/169	
5700/2000	122/156	
5720/4000	128/161	Cooler on
5740/6000	127/159	
5760/8000	131/162	
5780/5800	125/160	
5800/2000	128/162	
20/40	128/170	

Depth	Description		
Lith	Arg	Meta	Qtz
5690-5730	60	40	0
5730-5000	40	30	30
5750-7000	60	20	20
5770-5820	30	70	0-10
5820-4000	70	30	0
5840-5000	90	10	0

5840/50
Argillite 90% A/A
Metaqtzite 10% A/A

5850/60
Argillite 30% A/A
Intrusive Dike (70%): white, grey white - light grey with occ green cast, pred fn gr with mnr med, pre hypidiomorphic text with mnr allotriomorphic text, abundant clear - white plag felds with some subidiomorphic to idiomorphic, poss mnr clear - white qtz, mnr brown biotite, poss mnr black - gray pyroxenes, tr dism pyr, sl altered, sl - mod calc, mnr amounts buff - pink aplite veining with porphoritic qtz.

5860/70
Intrusive: 10% A/A
Argillite: Dark grey - black, pred aphanitc, mass, dense, micromicaeous, phyllitic scheen, tr dism pyr, tr secondary silica vning.

5870/80
100% Argillite

5880/90
85% Argillite
15% Meta Qtzite.

5890/5900
85% Argillite
15% Meta Qtzite

5900/10
85% Argillite
15% Microxln Qtz

5910/20
80% Argillite
20% Microxln qtz

5920/27
80% Argillite
20% Microxln qtz.

Appendix 5. Skyline Labs, Inc. report of analysis of water samples collected during the Beowawe 85-18 DST.

SKYLINE LABS, INC.
SPECIALISTS IN EXPLORATION GEOCHEMISTRY
12090 WEST 50TH PLACE • WHEAT RIDGE, COLORADO 80033 • TEL.: (303) 424-7718

REPORT OF ANALYSIS

JOB NO. DEY 023
MAY 22, 1980
SHIPMENT NO. 1

Chevron Resources Company
Attn: Joe Iovenetti
P.O. Box 3722
San Francisco, California 94119

Analysis of 22 Water Samples

ITEM	SAMPLE NUMBER	As (mg/l)	B (mg/l)	F (mg/l)	Cl (mg/l)
1	BEOWAWE 85-18 #1-RAW	.04	I/S	5.9	1900.
3	BEOWAWE 85-18 #2-RAW	<.05	I/S	5.9	2300.
5	BEOWAWE 85-18 #3-RAW	.14	I/S	5.5	1575.
7	BEOWAWE 85-18 #4-RAW	I/S 0	I/S	8.7	475.
9	BEOWAWE 85-18 #5-RAW	I/S 0	I/S	9.5	215.
11	BEOWAWE 85-18 #6-RAW	I/S 0	I/S	10.3	135.
14	BEOWAWE 85-18 #7-RAW	I/S 0	I/S	9.9	120.
17	BEOWAWE 85-18 #8-RAW	I/S 0	I/S	9.9	115.
19	BEOWAWE 85-18 #9-RAW	I/S 0	I/S	9.5	120.

ITEM	SAMPLE NUMBER	SO4 (mg/l)	CO3 (mg/l)	HCO3 (mg/l)
1	BEOWAWE 85-18 #1-RAW	615.	20.0	67.
3	BEOWAWE 85-18 #2-RAW	530.	<2.0	145.
5	BEOWAWE 85-18 #3-RAW	555.	65.6	30.
7	BEOWAWE 85-18 #4-RAW	205.	46.0	190.
9	BEOWAWE 85-18 #5-RAW	135.	49.0	240.
11	BEOWAWE 85-18 #6-RAW	100.	49.0	275.
14	BEOWAWE 85-18 #7-RAW	115.	56.0	270.
17	BEOWAWE 85-18 #8-RAW	90.	22.0	250.
19	BEOWAWE 85-18 #9-RAW	80.	110.0	83.

ITEM	SAMPLE NUMBER	pH	TDS (mg/l)	Specific Cond. (micromhos/cm)
1	BEOWAWE 85-18 #1-RAW	9.0	3800.	4070.
3	BEOWAWE 85-18 #2-RAW	8.2	4400.	4390.
5	BEOWAWE 85-18 #3-RAW	9.2	3300.	3710.
7	BEOWAWE 85-18 #4-RAW	8.8	I/S	1940.
9	BEOWAWE 85-18 #5-RAW	8.8	1900.	1430.
11	BEOWAWE 85-18 #6-RAW	8.8	1300.	1210.
14	BEOWAWE 85-18 #7-RAW	8.8	1300.	1100.
17	BEOWAWE 85-18 #8-RAW	8.8	1250.	1150.
19	BEOWAWE 85-18 #9-RAW	9.2	1100.	1020.

ITEM	SAMPLE NUMBER	Ag (mg/l)	Mo (mg/l)	Cd (mg/l)	Na (mg/l)	K (mg/l)
1	BEOWAWE 85-18 #1-RAW	<.01	I/S	.001	I/S	I/S
3	BEOWAWE 85-18 #2-RAW	<.01	I/S	.001	1100.	83.
5	BEOWAWE 85-18 #3-RAW	<.01	I/S	.001	950.	68.
7	BEOWAWE 85-18 #4-RAW	<.01	I/S	.001	430.	41.
9	BEOWAWE 85-18 #5-RAW	<.01	I/S	.001	300.	30.
11	BEOWAWE 85-18 #6-RAW	<.01	I/S	<.001	250.	27.
14	BEOWAWE 85-18 #7-RAW	<.01	I/S	<.001	260.	27.
17	BEOWAWE 85-18 #8-RAW	<.01	I/S	<.001	250.	27.
19	BEOWAWE 85-18 #9-RAW	<.01	I/S	.001	220.	22.

ITEM	SAMPLE NUMBER	Ca (mg/l)	Mg (mg/l)	Mn (mg/l)	Fe (mg/l)
1	BEOWAWE 85-18 #1-RAW	I/S	I/S	I/S	I/S
3	BEOWAWE 85-18 #2-RAW	340.0	.6	.03	.1
5	BEOWAWE 85-18 #3-RAW	110.0	.2	<.01	<.1
7	BEOWAWE 85-18 #4-RAW	43.0	49.0	.24	18.0
9	BEOWAWE 85-18 #5-RAW	21.0	21.0	.11	20.0
11	BEOWAWE 85-18 #6-RAW	12.0	12.0	.08	10.0
14	BEOWAWE 85-18 #7-RAW	10.0	9.9	.07	8.1
17	BEOWAWE 85-18 #8-RAW	9.4	8.8	.05	7.5
19	BEOWAWE 85-18 #9-RAW	6.8	7.9	.06	6.8

ITEM	SAMPLE NUMBER	U (ppb)	Al (mg/l)	Li (mg/l)
1	BEOWAWE 85-18 #1-RAW	11.	I/S	I/S
3	BEOWAWE 85-18 #2-RAW	11.	.2	2.0
5	BEOWAWE 85-18 #3-RAW	<2.	<.1	1.9
7	BEOWAWE 85-18 #4-RAW	22.	150.0	1.7
9	BEOWAWE 85-18 #5-RAW	11.	72.0	1.4
11	BEOWAWE 85-18 #6-RAW	5.	44.0	1.3
14	BEOWAWE 85-18 #7-RAW	9.	35.0	1.3
17	BEOWAWE 85-18 #8-RAW	<2.	30.0	1.3
19	BEOWAWE 85-18 #9-RAW	7.	27.0	1.1

ITEM	SAMPLE NUMBER	SiO2 (mg/l)
2	BEOWAWE 85-18 #1-DILUTE	540.
4	BEOWAWE 85-18 #2-DILUTE	870.
6	BEOWAWE 85-18 #3-DILUTE	400.
8	BEOWAWE 85-18 #4-DILUTE	220.
10	BEOWAWE 85-18 #5-DILUTE	130.
12	BEOWAWE 85-18 #6-DILUTE	67.
13	BEOWAWE 85-18 #6-DIL-FIL	61.
15	BEOWAWE 85-18 #7-DILUTE	52.
16	BEOWAWE 85-18 #7-DIL-FIL	72.
18	BEOWAWE 85-18 #8-DILUTE	50.
20	BEOWAWE 85-18 #9-DILUTE	48.
21	BEOWAWE 85-18 #9-DIL-FIL	46.

NOTES: N/R = Analysis not requested.

I/S = Insufficient sample for analysis.

Gordon H. VanSickle
Manager

SKYLINE LABS, INC.
SPECIALISTS IN EXPLORATION GEOCHEMISTRY

Appendix 6. Summary of Beowawe 85-18
Short-Term Flow Test: 1655-2188 feet
by Mr. I. J. Epperson, Jr.

Introduction

A short-term flow test at 1655-2188 feet was conducted on the Beowave 85-18 during the period December 17-21, 1981. To prepare the well for testing a bridge plug was set in 9 5/8" casing at 2500 feet and then fifteen zones, listed below (from bottom to top) were perforated.

2188-2150'	2059-2024'	1854-1840'
2144-2124'	2018-1982'	1800-1780'
2122-2104'	1976-1941'	1773-1738'
2100-2080'	1935-1900'	1732-1697'
2078-2068'	1895-1860'	1641-1655'

Figure 1 is a schematic of the mechanical set-up of the well during the test. Discussion of the salient aspects of this tests follows.

Flow Test Procedure

The flow test consisted of running NOWSCO coil tubing with capillary tubing inside to 500'. The caplillary tubing was filled with nitrogen and connected a quartz pressure transducer. Static pressures were recorded overnight. Nitrogen was injected down the NOWSCO tubing to kick the well off. After the flowrate stabilized, the nitrogen injection was stopped and the NOWSCO tubing lowered to 1678' to record pressures. From the wellhead, the fluid flowed through about 20' of 10" line pipe and a 4 1/2" blooie line.

The test chronology is reported in Table 1. The surface data is recorded in Table 2. Figures 2 and 3 present plots of the surface and subsurface data recorded. The subsurface and wellhead pressure data is presented in Table 3.

Flowing Bottomhole Temperature

The flowing bottomhole temperature was not measured during the short-term flow test. After a second, 12-day flow test on January 22, 1981 a partial flowing temperature survey was obtained (tool failed after logging from 800 to 1100 feet) which indicated a flowing temperature of 362°F. The flowing temperature during the short-term test was probably lower than 362°F due to residual cooling affects from drilling. Using a proprietary computer simulator, it is estimated the flowing temperature during the short-term test was about 343°F. (173°C

Flowrate Calculation

The flowrate was determined by measuring the blooie line lip pressure and by using the James Method of calculation.

$$\text{Flowrate} = \frac{223838\ d^2\ p^{0.96}}{h_o^{1.102}}$$

where:
- d = blooie line ID = 4.026"
- P = lip pressure, psia
- h_o = stagnation enthalpy (at flowing temperature)

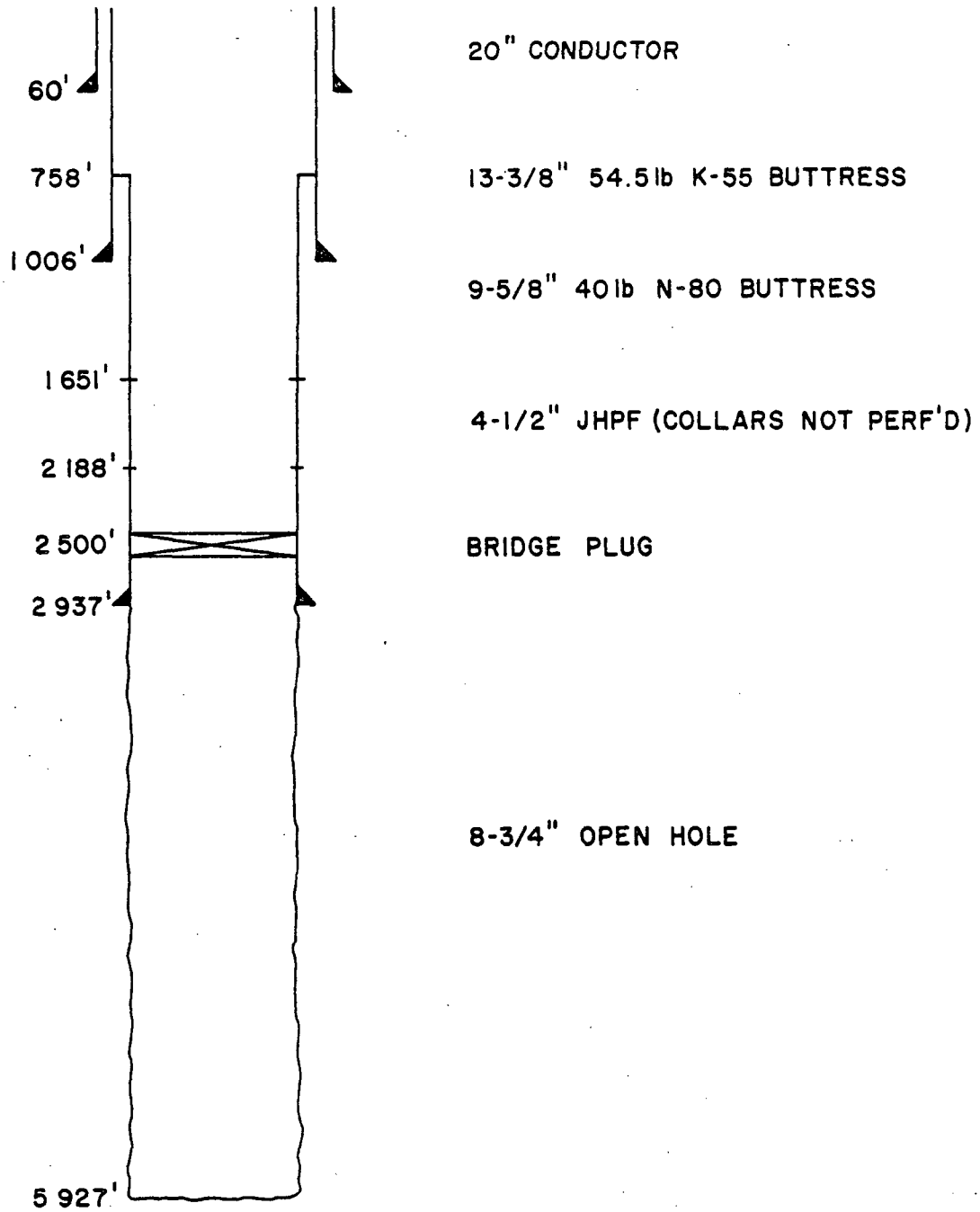


FIGURE 1

MECHANICAL SCHEMATIC OF WELL

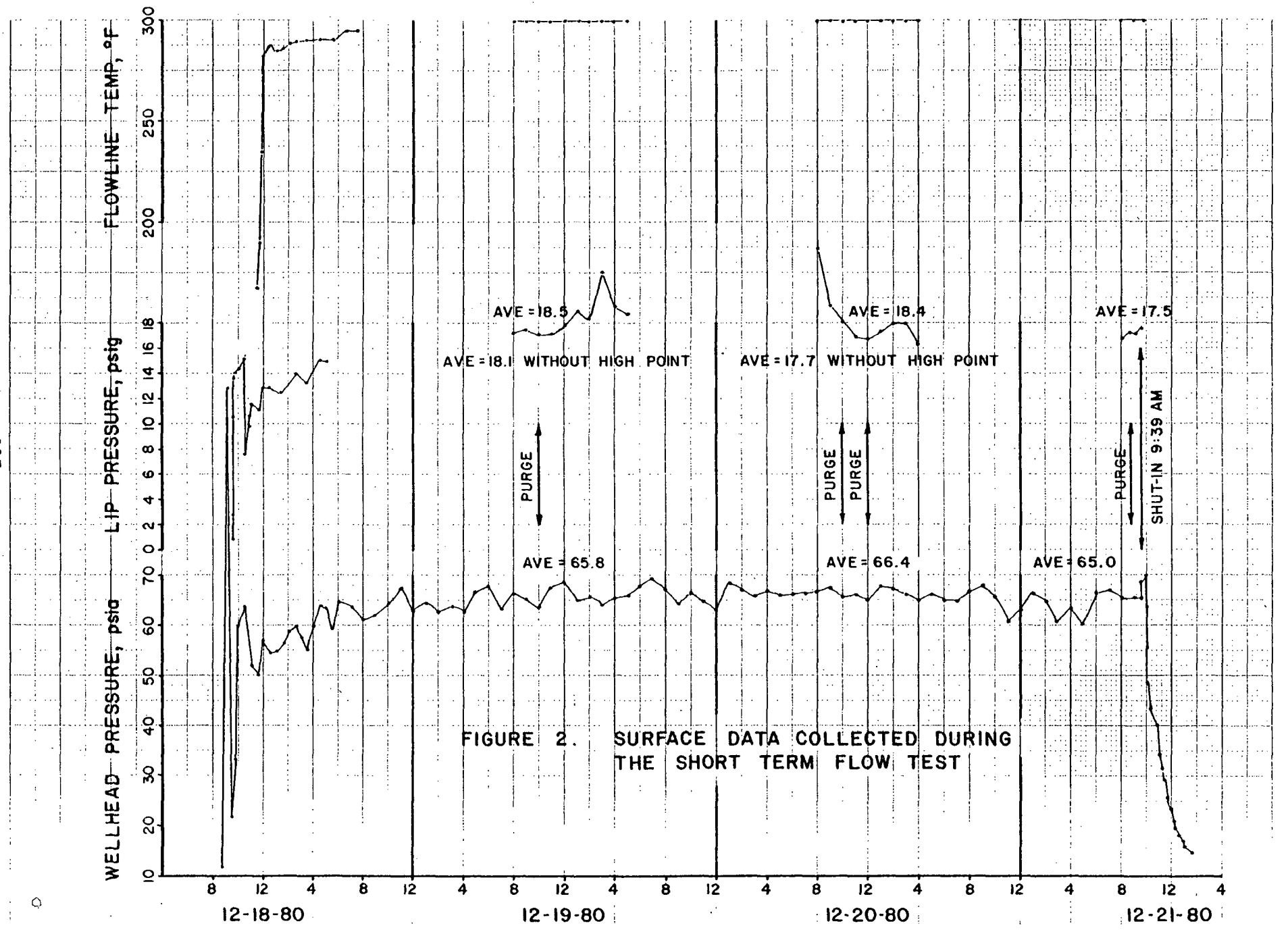


FIGURE 2. SURFACE DATA COLLECTED DURING THE SHORT TERM FLOW TEST

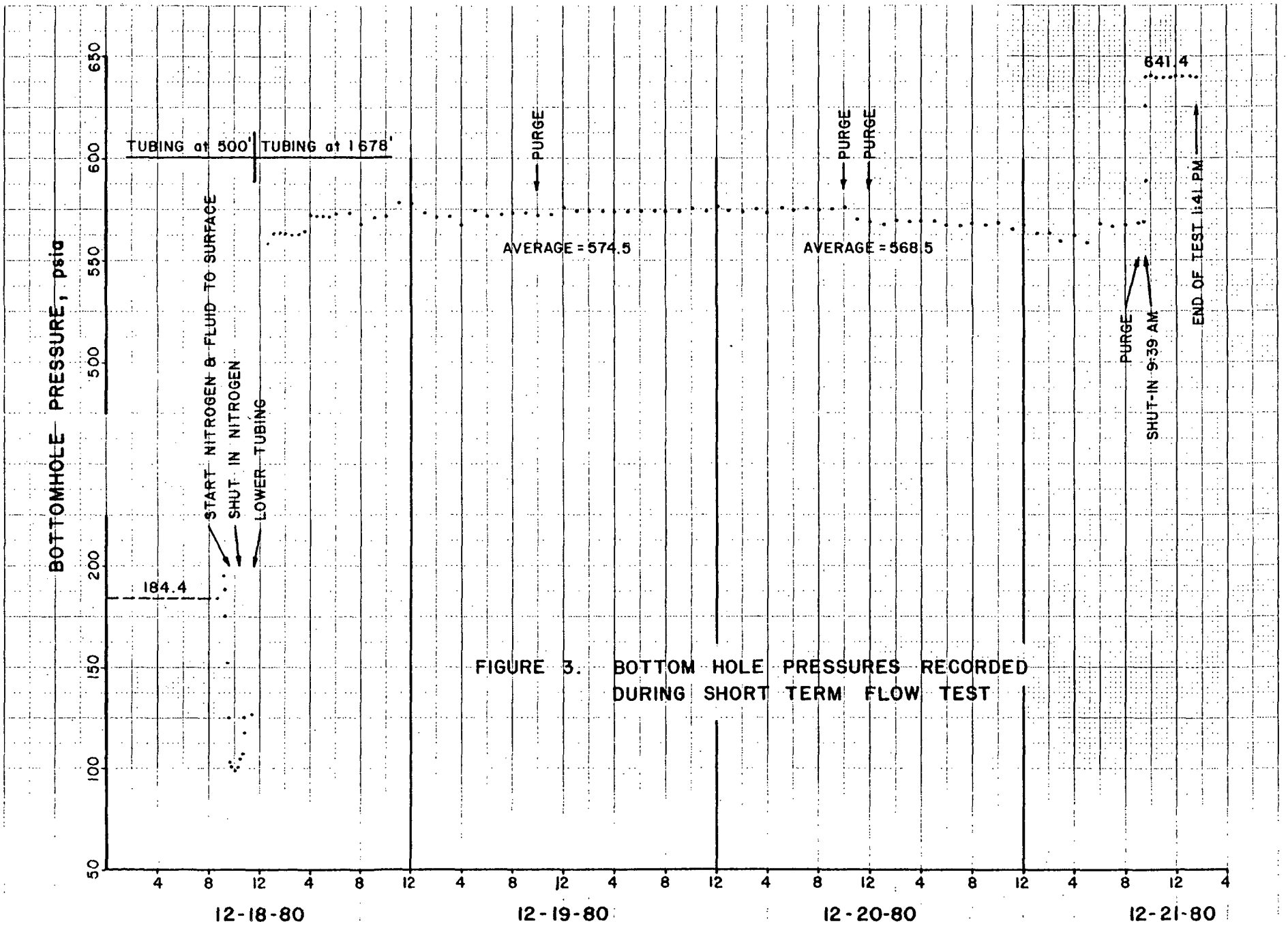


FIGURE 3. BOTTOM HOLE PRESSURES RECORDED DURING SHORT TERM FLOW TEST

Table 1. Short-term flow test chronology of events.

TIME	EVENT
12-17-80	NOWSCO & Pruett rigged up. Ran NOWSCO tubing to 500'. Well shut-in. Record bottom hole pressures overnight.
12-18-80	
0730	Crews on location. Rig up nitrogen truck.
0800	Well open. No flow. Still rigging up.
0854	Shut-in well. Start nitrogen: 300 cfm @ 500 psig.
0905	Stop nitrogen to fix leaks in line.
0908	Bleed off WHP. Some fluid to surface. SI.
0925	Open well. Bled off 96 psi WHP. No fluid.
0930	Start nitrogen: 300 cfm @ 500 psig. Well open.
0932	Fluid to surface (very dirty).
0934	Start of sonic flow.
0946	Starting to head.
1032	Shut-in nitrogen.
1140	Start lowering NOWSCO. Well flowing.
1200	Fluid Sample #2.
1225	NOWSCO tubing to 1678'.
1600	Fluid Sample #3.
12-19-80	
1000	Purge. No sign of leaks. Before: BHP = 572.548, after: BHP = 572.339. Fluid Sample #4.
12-20-80	
1000	Purge: BHP Before 575.900 After 570.2; WHP Before 65.9 After 66.5
1200	Purge: BHP 569.1 568.7; WHP 65.2 68.0
	Fluid Sample #5.
12-21-80	
0900	Purge. No problems. Fluid Sample #6.
0939	Shut-in well for build-up.
1340	End of test. Rig down and secure well.

Table 2. Surface data.

Time	Blooie Line Press. psig	Flowline Temp. °F	Time	Blooie Line Press. psig	Flowline Temp. °F
12-18-80					
0934	1.0	167	1630	15.0	295
0945	1.1	190	1700	15.0	295
0947	2.4	235			
0950	10.5	274	12-19-80		
0953	13.6	278	0800	17.2	300
0955	14.1	280	0900	17.5	300
1000	14.4	283	1000	17.2	300
1005	14.4	284	1100	17.2	300
1010	14.3	284	1200	17.8	300
1015	14.1	285	1300	19.0	300
1020	14.5	286	1400	18.5	300
1025	14.5	286	1500	22.4	300
1030	15.3	287	1600	19.5	300
1033	12.3	284	1700	18.8	300
1034	9.0	279	12-20-80		
1035	7.7	276	0800	24.1	300
1037	7.6	276	0900	19.4	300
1040	9.9	281	1000	18.2	300
1045	10.6	284	1100	17.0	300
1050	11.3	285	1200	16.9	300
1055	11.5	285	1300	17.5	300
1105	11.6	285	1400	18.0	300
1115	11.4	286	1500	18.0	300
1125	11.4	286	1600	16.4	300
1130	11.2	286			
1140	11.2	286	12-21-80		
1150	12.5	287	0800	17.0	300
1200	13.0	288	0830	17.5	300
1230	13.0	289	0900	17.5	300
1330	12.5	290	0930	17.8	300
1430	14.0	291	0939	Shut-in	
1530	13.5	291			

Table 3. Subsurface and wellhead pressure field data.

```
 RT    04:14:37

7       P2=   12.0507
7       P1=   184.842
 RT    04:14:22

7       P2=   12.0507
7       P1=   185.044
 RT    04:14:07

7       P2=   12.0507
7       P1=   185.332
 RT    04:13:52

7       P2=   12.0546
7       P1=   185.699
 RT    04:13:37

 IT    00:00:15
 HD           0

 IT    00:00:15

 IT    00:00:00

       STOP

7       P2=   12.0546
7       P1=   186.824

 HD           0
 RT    04:13:10

 RT    04:13:02

 ET    00:00:12

       STOP

7       P2=   12.0546
7       P1=   109.643

 HD           0
 ET    00:00:00

       STOP

7       P2=   12.0585
7       P1=   194.406

 HD           0
 ET    00:00:00

       STOP
```

P1 = pressure @ 500'
P2 = atmospheric pressure

```
       STOP

7       P2=   12.0624
7       P1=   12.5057

 HD           0
 ET    00:00:00
```

```
7       P2=   12.0507
7       P1=   184.363
 RT    16:19:33

7       P2=   12.0469
7       P1=   184.360
 RT    16:19:14

 IT    00:00:20
 HD           0

 IT    00:00:20

 IT    00:00:15

7       P2=   12.0507
7       P1=   184.353
 RT    16:18:44

7       P2=   12.0469
7       P1=   184.353
 RT    16:18:30

 IT    00:00:15
 HD           0

 IT    00:00:15

       STOP

7       P2=   12.0507
7       P1=   184.349

 HD           0
 RT    16:18:03

       STOP

7       P2=   12.0469
7       P1=   184.381

 HD           0
 RT    16:17:17

 RT    16:16:04

7       P2=   12.0507
7       P1=   184.471
 RT    16:15:49

7       P2=   12.0507
7       P1=   184.489
 RT    16:15:34

7       P2=   12.0507
7       P1=   184.533
 RT    16:15:19

 IT    00:00:15
 HD           0

 IT    00:00:15

 RT    16:15:00

 RT    04:14:41
```

BEOWAWE 85-18

Static Press. 12-17-85
P1 @ 500' P2 = atm

```
       STOP (1)
       CALIBRATION

7       P2=   12.0507
7       P1=   184.353
 RT    16:21:52

7       P2=   12.0507
7       P1=   184.353
 RT    16:21:42

7       P2=   12.0469
7       P1=   184.356
 RT    16:21:33

 IT    00:00:10
 HD           0

 IT    00:00:10

 IT    00:00:20

       STOP

 RT    16:21:10

7       P2=   12.0507
7       P1=   184.353
 RT    16:20:50

 IT    00:00:20
 HD           0

 IT    00:00:20

       STOP

7       P2=   12.0507
7       P1=   184.356
 RT    16:20:28

7       P2=   12.0507
7       P1=   184.360
 RT    16:20:09

 IT    00:00:20
 HD           0

       STOP

7       P2=   12.0507
7       P1=   184.363

 HD           0
 RT    16:19:45

       STOP
```

BEOWAWE 85-18

INITIAL FLOW TEST

P1 @ 500' (psia), P2 = Wellhead (psia)

```
7        P2=   33.6077
7        P1=   101.108
 RT    09:45:04

7        P2=   19.5275
7        P1=   103.659
 RT    09:40:04

7        P2=   22.3918
7        P1=   125.181
 RT    09:35:04
      Fluid to surface
7        P2=   19.9385
7        P1=   153.094
 RT    09:30:04
      OPEN WELL
7        P2=   96.9980
7        P1=   177.451
 RT    09:25:07
        9:25 AM, 12-18-80
 IT    00:05:00
 HD          0

       STOP
  P1 = pressure @ 500', psia
  P2 = wellhead pressure, psia
 HD          0
 RT    09:25:03

       STOP


7        P2=   11.9574
7        P1=   177.545
 RT    09:21:50

7        P2=   11.9808
7        P1=   177.823
 RT    09:16:50

7        P2=   11.9652
7        P1=   174.397
 RT    09:11:50
   STATIC
7        P2=   11.9769
7        P1=   188.058
 RT    09:06:50

7        P2=   12.0118
7        P1=   195.328
 RT    09:01:50
      Valve @ P2 closed
7        P2=   12.0157
7        P1=   185.465
 RT    08:56:50
      Start N2
7        P2=   12.0352
7        P1=   184.464
 RT    08:51:50
  (12-18-80)
7        P2=   12.0819
7        P1=   184.443
 RT    08:46:51

7        P2=   51.8686
7        P1=   128.060
 RT    11:00:04

7        P2=   52.2332
7        P1=   127.616
 RT    10:55:04

7        P2=   52.1949
7        P1=   126.184
 RT    10:50:04

7        P2=   54.4782
7        P1=   123.972
 RT    10:45:04

7        P2=   51.3617
7        P1=   118.420
 RT    10:40:04

7        P2=   44.4772
7        P1=   107.074
 RT    10:35:04
      * SI Nitrogen
7        P2=   64.3069
7        P1=   107.536
 RT    10:30:04

7        P2=   61.7473
7        P1=   104.981
 RT    10:25:04

7        P2=   58.8562
7        P1=   104.074
 RT    10:20:04

7        P2=   60.0704
7        P1=   102.704
 RT    10:15:04
   FLOWING
7        P2=   58.5267
7        P1=   101.145
 RT    10:10:04

7        P2=   58.3811
7        P1=   100.356
 RT    10:05:04

7        P2=   60.0091
7        P1=   98.6883
 RT    10:00:04

7        P2=   58.5842
7        P1=   96.5816
 RT    09:55:04

7        P2=   52.3445
7        P1=   94.1911
 RT    09:50:04
```

STOP
Disconnect P1 & lower tbg to 1678'

```
7        P2=   53.5766
7        P1=   12.5897,
 RT    11:55:04

7        P2=   53.8836
7        P1=   12.6012
 RT    11:50:04

7        P2=   53.4998
7        P1=   12.6088
 RT    11:45:04

7        P2=   51.7188
7        P1=   12.6088
 RT    11:40:04

7        P2=   52.1641
7        P1=   12.6088
 RT    11:35:04

7        P2=   49.9407
7        P1=   129.895
 RT    11:30:04

7        P2=   54.0601
7        P1=   129.341
 RT    11:25:04

7        P2=   54.4245
7        P1=   128.846
 RT    11:20:04
   FLOWING
7        P2=   54.2173
7        P1=   129.128
 RT    11:15:04

7        P2=   53.5651
7        P1=   128.585
 RT    11:10:04

7        P2=   52.1795
7        P1=   128.174
 RT    11:05:04
```

BEOWAWF 85-18
INITIAL FLOW TEST

7	P2=	56.4916
7	P1=	564.634
RT	13:10:02	
7	P2=	54.8158
7	P1=	565.057
RT	13:05:02	
7	P2=	55.3067
7	P1=	564.086
RT	13:00:02	
	1:00 PM 12-18-80	
7	P2=	54.5281
7	P1=	561.674
RT	12:55:02	
7	P2=	54.3286
7	P1=	561.395
RT	12:50:02	
7	P2=	57.6071
7	P1=	561.242
RT	12:45:02	
7	P2=	54.0639
7	P1=	561.079
RT	12:40:02	
	12:40 PM	
7	P2=	54.1905
7	P1=	559.320
RT	12:35:02	
7	P2=	54.4897
7	P1=	12.5553
RT	12:30:02	
7	P2=	53.6840
7	P1=	12.5630
RT	12:25:02	
7	P2=	54.0907
7	P1=	12.5668
RT	12:20:02	
7	P2=	54.8772
7	P1=	12.5668
RT	12:15:02	
7	P2=	57.0589
7	P1=	12.5744
RT	12:10:02	
7	P2=	56.6487
7	P1=	12.5782
RT	12:05:02	
7	P2=	57.0781
7	P1=	12.5859
RT	12:00:02	

FLOWING

"P1" DISCONNECTED (reading atm. press)

Tbg @ 1678 = P1

7	P2=	57.4690
7	P1=	564.315
RT	14:24:57	
7	P2=	56.1887
7	P1=	564.415
RT	14:19:57	
7	P2=	57.0244
7	P1=	564.080
RT	14:14:58	
7	P2=	55.4524
7	P1=	563.776
RT	14:10:00	
7	P2=	57.1126
7	P1=	564.960
RT	14:05:02	
7	P2=	58.9481
7	P1=	564.183
RT	14:00:02	
7	P2=	58.7565
7	P1=	564.481
RT	13:55:02	
7	P2=	56.1695
7	P1=	563.948
RT	13:50:02	
7	P2=	58.6838
7	P1=	564.759
RT	13:45:02	
7	P2=	56.3344
7	P1=	564.618
RT	13:40:02	
7	P2=	55.9165
7	P1=	564.371
RT	13:35:02	
7	P2=	56.6947
7	P1=	564.540
RT	13:30:02	
7	P2=	56.4340
7	P1=	563.247
RT	13:25:02	
7	P2=	56.3996
7	P1=	563.657
RT	13:20:02	
7	P2=	54.9385
7	P1=	563.663
RT	13:15:02	

7	P2=	63.7294
7	P1=	572.435
RT	19:00:08	
7	P2=	64.9418
7	P1=	572.922
RT	18:00:08	
IT	01:00:00	
HD	0	
IT	01:00:00	
IT	00:30:00	
IT	00:30:00	
	STOP	
7	P2=	60.4571
7	P1=	571.864
HD	0	
RT	17:52:11	
	STOP	
7	P2=	59.5150
7	P1=	572.310
RT	17:29:57	
7	P2=	63.8136
7	P1=	572.123
RT	16:59:57	
7	P2=	64.1234
7	P1=	572.136
RT	16:29:57	
7	P2=	60.2810
7	P1=	572.800
RT	15:59:57	
7	P2=	55.5790
7	P1=	563.792
RT	15:29:57	
7	P2=	57.5687
7	P1=	563.040
RT	14:59:57	
7	P2=	59.7679
7	P1=	562.949
RT	14:29:58	

FLOWING

BEOWAWE 85-18
FLOW TEST #2

7	P2=	68.1331	
7	P1=	572.339	
RT	35:00:08		
	PURG→		
7	P2=	64.1349	
7	P1=	572.548	
RT	34:00:08		
7	P2=	65.8900	
7	P1=	573.075	
RT	33:00:08		
7	P2=	66.4748	
7	P1=	573.084	
RT	32:00:08	8:00 AM	
7	P2=	63.2359	
7	P1=	572.822	
RT	31:00:08		
7	P2=	68.0567	
7	P1=	572.626	
RT	30:00:08		
7	P2=	67.2046	
7	P1=	573.708	
RT	29:00:08		
7	P2=	62.7729	
7	P1=	568.544	
RT	28:00:08	4:00 AM	
7	P2=	64.0125	
7	P1=	571.867	
RT	27:00:08		
7	P2=	62.8303	
7	P1=	572.039	
RT ↑	26:00:08		
7	P2=	64.6932	
7	P1=	573.524	
RT	25:00:08		
12-19-80			
7	P2=	63.1250	
7	P1=	576.875	
RT	24:00:08		
7	P2=	67.5562	
7	P1=	577.461	
RT	23:00:08		
7	P2=	64.7583	
7	P1=	571.752	
RT	22:00:08		
7	P2=	62.3214	
7	P1=	571.208	
RT	21:00:08		
7	P2=	61.1692	
7	P1=	568.538	
RT	20:00:08		
7	P2=	66.9372	
7	P1=	575.152	
RT	51:00:08	3:00 AM	
7	P2=	67.7626	
7	P1=	574.744	
RT	50:00:08		
12-20-80			
7	P2=	68.9084	
7	P1=	575.158	
RT	49:00:08		
7	P2=	63.6606	
7	P1=	575.878	
RT	48:00:08		
7	P2=	65.0794	
7	P1=	574.410	
RT	47:00:08		
7	P2=	66.4595	
7	P1=	575.158	
RT	46:00:08		
7	P2=	64.8692	
7	P1=	574.822	
RT	45:00:08		
7	P2=	67.3728	
7	P1=	574.407	
RT	44:00:08		
7	P2=	69.7944	
7	P1=	574.784	
RT	43:00:08		
FLOWING			
7	P2=	68.1178	
7	P1=	574.656	
RT	42:00:08		
7	P2=	66.4442	
7	P1=	574.354	
RT	41:00:08		
7	P2=	65.8173	
7	P1=	574.295	
RT	40:00:08	4:00 PM	
7	P2=	64.3146	
7	P1=	574.114	
RT	39:00:08		
7	P2=	66.0122	
7	P1=	574.388	
RT	38:00:08		
7	P2=	65.5153	
7	P1=	574.747	
RT	37:00:08		
7	P2=	68.8665	
7	P1=	576.645	
RT	36:00:08	Blow	
7	P2=	66.3027	
7	P1=	569.294	
RT	65:00:08		
	Purg		
7	P2=	65.5000	
7	P1=	568.925	
RT	64:00:08	4:00 PM	
7	P2=	66.3486	
7	P1=	568.966	
RT	63:00:08		
7	P2=	67.8809	
7	P1=	569.478	
RT	62:00:08		
7	P2=	68.0605	
7	P1=	568.675	
RT	61:00:08		
	Purg		
7	P2=	65.1826	
7	P1=	569.103	
RT	60:00:08	Noon	
7	P2=	66.4824	
7	P1=	570.212	
RT	59:00:08		
	PURG→		
7	P2=	65.9014	
7	P1=	575.900	
RT	58:00:08		
12-20-80			
7	P2=	67.6708	
7	P1=	576.109	
RT	57:00:08		
7	P2=	67.3193	
7	P1=	574.837	
RT ↓	56:00:08		
7	P2=	66.7194	
7	P1=	575.221	
RT	55:00:08		
7	P2=	66.6658	
7	P1=	575.607	
RT	54:00:08		
7	P2=	66.6009	
7	P1=	575.520	
RT	53:00:08		
7	P2=	67.3155	
7	P1=	574.494	
RT	52:00:08		

BEOWAWE 85-18
FLOW TEST #2

PURG

7	P2= 66.1117		
7	P1= 568.544		
RT	80:00:08		
7	P2= 67.4530		
7	P1= 567.184		
RT	79:00:08		
7	P2= 66.9142		
7	P1= 568.650		
RT	78:00:08 6:00 AM		
7	P2= 61.0429		
7	P1= 559.050		
RT	77:00:08		
7	P2= 63.8480		
7	P1= 562.777		
RT	76:00:08		
7	P2= 61.3301		
7	P1= 561.624		
RT	75:00:08		
7	P2= 65.0871		
7	P1= 563.297		
RT	74:00:08		
7	P2= 66.8302		
7	P1= 563.973		
RT	73:00:08 1:00 AM		
7	P2= 63.5878		
7	P1= 567.697		
RT	72:00:08		
7	P2= 60.8095		
7	P1= 565.651		
RT	71:00:08		
7	P2= 66.2149		
7	P1= 568.181		
RT	70:00:08		
7	P2= 68.6449		
7	P1= 568.228		
RT	69:00:08		
7	P2= 67.0137		
7	P1= 569.166		
RT	68:00:08		
7	P2= 65.1712		
7	P1= 567.719		
RT	67:00:08		
7	P2= 65.0986		
7	P1= 567.737		
RT	66:00:08 6:00 PM		

→ 12-21-80

7	P2= 69.2865		
7	P1= 631.733		
RT 5	81:43:01 9:43 AM		
7	P2= 69.9700		
7	P1= 625.911		
RT 4	81:42:01		
7	P2= 70.1838		
7	P1= 617.590		
RT 3	81:41:01		
7	P2= 70.0235		
7	P1= 606.247		
RT 2	81:40:01		
7	P2= 69.2522		
7	P1= 589.657		
RT	81:39:01		
7	P2= 63.3316		
7	P1= 569.422		
RT	81:38:01		
7	P2= 65.9473		
7	P1= 568.175		
RT	81:37:01		
7	P2= 66.7194		
7	P1= 568.459		
RT	81:36:01		
7	P2= 66.6353		
7	P1= 568.137		
RT	81:35:01		
7	P2= 67.1168		
7	P1= 568.303		
RT	81:34:02 9:34 AM		
IT	00:01:00		
HD	0		
IT	00:01:00		
IT	00:30:00		
	STOP		
7	P2= 66.3983		
7	P1= 568.484		
RT	81:33:45		
7	P2= 66.6124		
7	P1= 567.309		
RT	81:03:45 9AM		
7	P2= 66.9793		
7	P1= 568.406		
RT	80:33:46		

9:38 AM 12-21-80

SHUT-IN

7	P2= 57.6760		
7	P1= 641.007		
RT	81:57:01		
7	P2= 58.3505		
7	P1= 640.989		
RT	81:56:01		
7	P2= 58.9098		
7	P1= 640.980		
RT	81:55:01 9:55 AM		
7	P2= 59.5687		
7	P1= 640.886		
RT	81:54:01		
7	P2= 60.1700		
7	P1= 640.843		
RT	81:53:01		
7	P2= 60.8745		
7	P1= 640.761		
RT	81:52:01		
7	P2= 61.6899		
7	P1= 640.704		
RT	81:51:01		
7	P2= 62.5739		
7	P1= 640.643		
RT	81:50:01		
7	P2= 63.3047		
7	P1= 640.506		
RT	81:49:01		
7	P2= 64.1540		
7	P1= 640.318		
RT	81:48:01		
7	P2= 65.1597		
7	P1= 639.962		
RT	81:47:01		
7	P2= 66.1881		
7	P1= 639.238		
RT	81:46:01		
7	P2= 67.1703		
7	P1= 637.870		
RT	81:45:01		
7	P2= 68.2783		
7	P1= 635.517		
RT	81:44:01		

SHUT-IN

BEOWAWE 85-18

```
7        P2=   51.3540
7        P1=   641.220
 RT3    82:09:29

 IT     00:05:00
 HD           0

 IT     00:05:00

 IT     00:01:00

        STOP

7        P2=   51.4577
7        P1=   641.253
 RT     82:09:01

7        P2=   51.9185
7        P1=   641.193
 RT     82:08:01

7        P2=   52.4329
7        P1=   641.196
 RT     82:07:01

7        P2=   52.9587
7        P1=   641.199
 RT     82:06:01

7        P2=   53.3540
7        P1=   641.181
 RT     82:05:01

7        P2=   53.8183
7        P1=   641.141
 RT     82:04:01

7        P2=   54.3823
7        P1=   641.159
 RT     82:03:01

7        P2=   54.8312
7        P1=   641.120
 RT     82:02:01

7        P2=   55.3565
7        P1=   641.108
 RT     82:01:01

7        P2=   56.0084
7        P1=   641.083
 RT     82:00:01  10:00 AM

7        P2=   56.3880
7        P1=   641.083
 RT     81:59:01

7        P2=   57.0244
7        P1=   641.041
 RT     81:58:01
```

WELL SHUT-IN

12-21-80

```
7        P2=   26.1940
7        P1=   641.487
 RT     83:40:00

7        P2=   27.7377
7        P1=   641.396
 RT     83:30:00

7        P2=   29.5396
7        P1=   641.414
 RT     83:20:00

7        P2=   32.1325
7        P1=   641.478
 RT     83:10:00

7        P2=   34.9317
7        P1=   641.493
 RT     83:00:00  11:00 AM

7        P2=   37.8056
7        P1=   641.442
 RT     82:50:00

7        P2=   40.8041
7        P1=   641.402
 RT     82:40:01

 IT     00:10:00
 HD           0

 IT     00:10:00

 IT     00:05:00

        STOP

7        P2=   41.0121
7        P1=   641.338
 RT     82:39:29

7        P2=   42.5142
7        P1=   641.402
 RT     82:34:29

7        P2=   43.8999
7        P1=   641.320
 RT     82:29:29

7        P2=   45.5852
7        P1=   641.269
 RT     82:24:29

7        P2=   47.3927
7        P1=   641.290
 RT     82:19:29

7        P2=   49.3221
7        P1=   641.317
 RT     82:14:29
```

End of Test
1:41 PM 12-21-80

```
7        P2=   15.0691
7        P1=   641.299
 RT     85:41:10

7        P2=   15.7370
7        P1=   641.351
 RT     85:26:10

7        P2=   16.2066
7        P1=   641.372
 RT     85:11:11

 IT     00:15:00
 HD           0

 IT     00:15:00

 IT     00:15:00

        STOP

7        P2=   16.1095
7        P1=   641.375

 HD           0
 RT     85:10:55

        STOP

 RT     85:10:28

7        P2=   17.2894
7        P1=   641.332
 RT     84:55:28

7        P2=   18.9225
7        P1=   641.533
 RT     84:40:28

7        P2=   19.9153
7        P1=   641.430
 RT     84:25:28

7        P2=   21.9113
7        P1=   641.399
 RT     84:10:28

7        P2=   23.9914
7        P1=   641.472
 RT     83:55:28

7        P2=   26.1089
7        P1=   641.433
 RT     83:40:28
```

Appendix 7. Skyline Labs, Inc. report of analysis of waters collected during the short-term flow test.

SKYLINE LABS, INC.
SPECIALISTS IN EXPLORATION GEOCHEMISTRY
12090 WEST 50TH PLACE • WHEAT RIDGE, COLORADO 80033 • TEL.: (303) 424-7718

REPORT OF ANALYSIS

JOB NO. DEY 033
January 21, 1981
CUSTOMER NO. LP-7

Chevron Resources Company
Attn: I. J. Epperson
Minerals Staff
595 Market Street, #2433
San Francisco, California 94105

Analysis of 6 Water Samples

ITEM	SAMPLE NO.	Na (mg/l)	K (mg/l)	Ca (mg/l)	Mg (mg/l)	Mn (mg/l)	Fe (mg/l)
1	#1 RAW	320.	40.	2.6	.3	.01	1.6
2	#2 RAW	300.	36.	3.7	.7	.02	1.9
3	#3 RAW	290.	35.	2.1	.1	<.01	.2
4	#4 ACID	280.	36.	2.8	.4	.01	.7
5	#5 ACID	280.	35.	2.8	.2	.01	.4
6	#6 ACID	270.	33.	2.6	.2	.01	.5

ITEM	SAMPLE NO.	U (ppb)	Al (mg/l)	Li (mg/l)	Au (mg/l)	Sb (mg/l)	Mo (mg/l)
1	#1 RAW	<2.	1.9	1.90	<.02	<.001	.010
2	#2 RAW	<2.	3.9	1.95	<.02	.003	.007
3	#3 RAW	<2.	1.0	1.92	<.02	<.001	.006
4	#4 ACID	<2.	1.3	1.97	<.02	<.001	.005
5	#5 ACID	<2.	.9	1.94	<.02	.001	.004
6	#6 ACID	<2.	1.0	1.91	<.02	.001	.004

ITEM	SAMPLE NO.	SiO2 (mg/l)
10	#1 DILUTE	6.
11	#2 DILUTE	49.
12	#3 DILUTE	43.
13	#4 DILUTE	44.
14	#5 DILUTE	42.
15	#6 DILUTE	45.

Gordon H. VanSickle
Manager

ITEM	SAMPLE NO.	As (mg/l)	B (mg/l)	F (mg/l)	Cl (mg/l)	SO4 (mg/l)
1	#1 RAW	.033	1.7	12.7	90.	102.
2	#2 RAW	.071	2.2	13.1	85.	89.
3	#3 RAW	.076	1.9	11.5	80.	74.
7	#4 RAW	.034	2.1	12.3	60.	82.
8	#5 RAW	.055	2.0	12.3	70.	76.
9	#6 RAW	.040	2.0	11.9	70.	71.

ITEM	SAMPLE NO.	CO3 (mg/l)	HCO3 (mg/l)	pH	TDS (mg/l)
1	#1 RAW	100.	180.	9.4	1410.
2	#2 RAW	95.	210.	9.3	1505.
3	#3 RAW	105.	165.	9.3	1264.
7	#4 RAW	85.	200.	9.1	1247.
8	#5 RAW	95.	155.	9.2	1239.
9	#6 RAW	95.	170.	9.2	1233.

ITEM	SAMPLE NO.	Specific Conductance (micromhos/cm)
1	#1 RAW	1240.
2	#2 RAW	1161.
3	#3 RAW	1110.
7	#4 RAW	1140.
8	#5 RAW	1151.
9	#6 RAW	1134.