PRELIMINARY DATA FROM ARBUCKLE TEST WELLS, MIAMI, DOUGLAS, SALINE, AND LABETTE COUNTIES, KANSAS

U.S. GEOLOGICAL SURVEY

Open-File Report 81-1112

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GEOLOGICAL SURVEY

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H. E. McGovern
Publications Section

Enc.

CONVERSION TABLE

The inch-pound units of measurement used in this report may be converted to the International System (SI) of Units using the following factors:

Inch-pound unit	Multiply by	To obtain SI unit
inch	25.4	millimeter
foot	0.3048	meter
mile	1.609	kilometer
gallon per minute (gal/min)	0.06309	liter per second
pound per foot	1.488	kilogram per meter
pound-force per square inch (lbf/in^2)	6.895	kilopascal
degree Fahrenheit (°F)	(1)	degree Celsius (°C)

1 Temperature °C = (temperature °F - 32)/1.8.

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PRELIMINARY DATA FROM ARBUCKLE TEST WELLS, MIAMI, DOUGLAS, SALINE, AND LABETTE COUNTIES, KANSAS

By

Tony Gogel

ABSTRACT

Preliminary data are presented for test wells in Kansas that were completed in Cambrian and Ordovician rocks of the Arbuckle Group in late 1979 and early 1980. Included in the report are hole history, electrical logs, geology (sample descriptions and cores), hydrologic testing, and geochemistry. These wells were drilled as part of a cooperative investigation between the U.S. Geological Survey and the Kansas Geological Survey, the Kansas Department of Health and Environment, and the U.S. Army Corps of Engineers to determine the regional hydrology of the Arbuckle Group and to investigate the hydraulic characteristics of the formation at site-specific areas.

The test wells were drilled in Miami (site 1), Douglas (site 2), Saline (site 3), and Labette (site 4) Counties, Kansas. Depths of the wells ranged from 1,816 feet in Labette County to 3,665 feet in Saline County. All wells have surface casing installed to depths well below the base of freshwater. The wells were cased from land surface to near the top of the Arbuckle Group; the remainder of the hole was left open so that additional hydrologic tests could be made.

Cores of rocks in the Arbuckle Group were collected at sites 2, 3, and 4. Results of core analyses are presented for vertical and horizontal permeability to air, porosity, fluid saturation, accoustic velocity, resistivity indices, and formation factor. Gamma-ray logs of the core were run for correlation with electrical logs. A series of electrical logs was run at each site, consisting of dual-induction laterolog, sonic, and compensated neutron-formation density logs for correlating geologic and hydrologic data. Flow logs and temperature logs also were run at some sites.

Formation data from drill-stem tests are presented for use in calculating transmissivity, hydraulic conductivity, and hydraulic head. Complete analyses of water samples from wells at sites 2, 3, and 4, and a partial analysis at site 1, are presented to indicate water quality in the aquifers.

INTRODUCTION

In 1976, the U.S. Geological Survey and the Kansas Geological Survey began a cooperative investigation to determine the regional hydrology of rocks in the Arbuckle Group of Upper Cambrian and Lower Ordovician age in Kansas. In the extreme southeastern part of the State, rocks of the Arbuckle Group yield freshwater to wells used for municipal and industrial supplies. In the remainder of the State, the aquifer generally contains saltwater. Moreover, the Arbuckle is reported to be a prolific producer of oil and gas, especially in the area of the Central Kansas Uplift and in south-central Kansas near the State line. Because of this fact, most of the data used in the investigation were procured from the petroleum industry. Much of this data are useful for determining hydrologic characteristics, as well as for defining the geologic framework.

In 1978, the investigation was expanded to include determination of hydraulic characteristics of the Arbuckle and related rocks and to determine the ability of the Arbuckle rocks to accept fluid at site-specific areas. Test holes were drilled with the cooperation of the Kansas Department of Health and Environment and the U.S. Army Corps of Engineers, and monitor wells were installed in Miami (site 1), Douglas (site 2), Saline (site 3), and Labette (site 4) Counties (fig. 1). Drilling and testing were designed to yield the maximum amount of stratigraphic, structural, geophysical, and hydrologic information possible consistent with available funds. Analyses of drill cuttings, cores, and geophysical logs provided information for use in reconstructing the stratigraphic and structural conditions and in determination of the existing geologic framework.

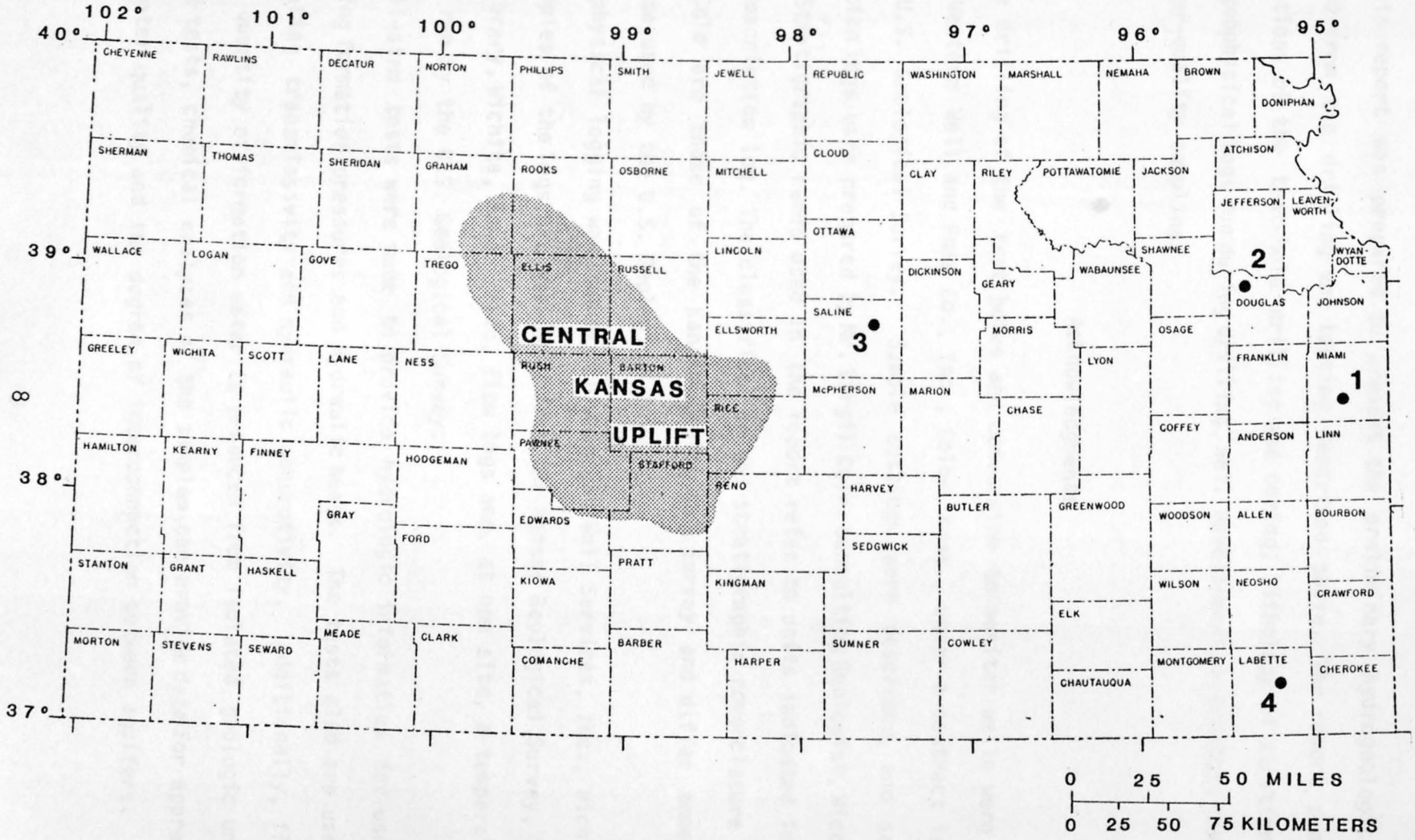

Figure 1.--Location of test holes.

This report was prepared to present the preliminary hydrogeologic data obtained from the drilling and testing described above. The report provides descriptions of the test-hole drilling and coring, lithology of stratigraphic units, geophysical logs run during drilling, well development, hydrologic testing, and water-quality sampling.

Acknowledgments

The drilling of the test holes and conversion to monitor wells were done by the Western Well and Pump Co., Inc., Colby, Kans., under a contract issued by the U.S. Geological Survey. Sample cuttings were described, and sample description logs were prepared by Mr. Virgil Cole, Consulting Geologist, Wichita, Kans. Stratigraphic names used in the report refer to units indicated in the sample description log. The classification and stratigraphic nomenclature used by Mr. Cole are those of the Kansas Geological Survey and differ somewhat from those used by the U.S. Geological Survey.

Geophysical logging was done by Schlumberger Well Services, Inc., Wichita, Kans. Copies of the logs are available from the Kansas Geological Survey, Well Sample Library, Wichita, Kans. Also, flow logs and, at one site, a temperature log were run by the U.S. Geological Survey.

Drill-stem tests were made to provide hydrologic information for use in determining formation pressures and hydraulic heads. The tests also are useful in estimating transmissivity and hydraulic conductivity. Additionally, if an adequate quantity of formation water is produced from isolated geologic units during the tests, chemical analyses of the samples can provide data for appraising the water quality and the degree of interconnection between aquifers.

Seventeen drill-stem tests were run by Halliburton Sources, Inc., Wichita, Kans., during the drilling and testing program. Fourteen tests were successful in that pressures were obtained and calculations of transmissivity, hydraulic conductivity, and hydraulic head were possible. Three of the tests were judged to be misruns because results were questionable or inadequate. Formation test data and reproductions of the pressure graphs provided by the contractor are given in Appendix A.

The Arbuckle Group was cored in test holes 2, 3, and 4. Coring was done by Christensen Diamond Products Co., Oklahoma City, Okla., and the core recovered from each hole was analyzed by Core Laboratories, Inc., Oklahoma City, Okla. Analyses of each core consisted of photographing the core and testing for horizontal and vertical permeability to air, porosity, fluid saturation, and grain density. A gamma-ray log was made of the entire core to allow exact correlation with electrical logs. One-inch plugs were taken at selected intervals in order to complete some special analyses, including determinations of accoustic velocity, resistivity indices, and formation factor. These data may be useful in appraising some of the rock properties of the Arbuckle Group and in electrical-log interpretations. The "Core Analysis Report" provided by Core Laboratories, Inc. is given in Appendix B.

In addition to the Arbuckle coring, cores of the basement rock were collected at sites 2 and 4. These cores were collected as part of an investigation between the Kansas Geological Survey and the Department of Geology, University of Kansas, Lawrence, Kans. Cores are being interpreted by Dr. Patrick Bickford of the Department of Geology, University of Kansas, to investigate a magnetic anomally that has been mapped in the basement rock.

Drill-Stem Testing

One of the primary purposes of the test drilling and monitor-well installation was to appraise the hydrologic conditions at each site. This was accomplished principally through the use of drill-stem tests, which are commonly used by the petroleum industry to measure pressures and to collect formation water samples from isolated geologic intervals.

The typical drill-stem test may consist of six phases that are discussed here in general as related to the pressure graph in figure 2. A detailed discussion of the phases in a drill-stem test is given by Bredehoeft (1965).

The first phase of the test, as indicated by segment A-B of the trace in figure 2, is represented by the increase in hydrostatic pressure when the test tool and drill stem are lowered into the borehole. At a predetermined depth, the packers are seated to isolate a stratigraphic interval so that the gages can measure the pressure changes in that interval. The second phase of the test, as indicated by segment C-D, occurs when the tester valve is opened to atmospheric pressure and fluid enters the tool from the formation. The main purpose of this "initial flow" period is to remove the effects of abnormal pressure buildup in the formation, which may be caused by drilling and completion operations. The third phase of the test, as indicated by segment D-E, occurs when the tester valve is closed. During this "initial shut-in" period, the continued movement of fluid from the formation into the borehole causes an increase in pressure. In fact, if the drill-stem test tool is "shut-in" long enough, the static pressure of the aquifer will be attained.

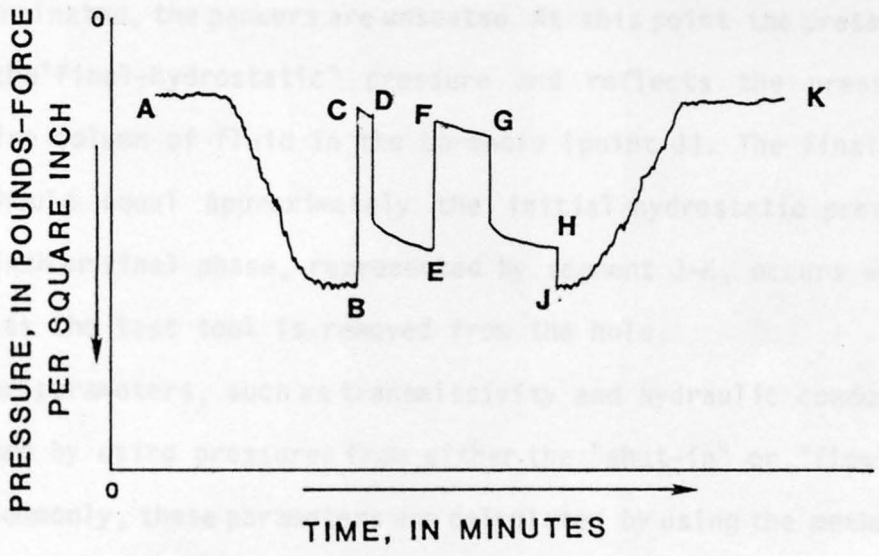

Figure 2.--Typical pressure graph from drill-stem test.

After the initial flow and shut-in periods are completed, the tester valve is reopened for the "second-flow" period (segment F-G). The pressure will decrease instantaneously toward atmospheric. Fluid again enters the drill pipe from the isolated interval and head buildup occurs. Subsequent to this phase, the tester valve is again closed and the "second shut-in" period is traced (segment G-H) as the formation pressure builds toward static pressure. When this fifth phase is terminated, the packers are unseated. At this point the pressure recorded is termed the"final-hydrostatic" pressure and reflects the pressure exerted by the entire column of fluid in the borehole (point J). The final hydrostatic pressure should equal approximately the initial hydrostatic pressure (point B). The sixth or final phase, represented by segment J-K, occurs with pressure decreasing as the test tool is removed from the hole.

Aquifer parameters, such as transmissivity and hydraulic conductivity, may be calculated by using pressures from either the "shut-in" or "flow" periods of the test. Commonly, these parameters are calculated by using the method described by Horner (1951) that utilizes pressures during the "shut-in" periods. However, the extremely rapid increase in pressure during the "shut-in" periods of several tests performed during this program, as shown by segments D-E and G-H in figure 2, indicates that static reservoir pressures probably had been attained during the "flow" periods. Thus, it would be necessary in these tests to use the pressures recorded during the "flow" periods to calculate the aquifer parameters. This is accomplished by using a method described by Ramey, Agarwal, and Martin (1975).

TEST HOLE 1, WATSON NO. 1

Drilling, Logging, and Well Development

Test hole 1, also designated as Watson no. 1, was located in the SE1/4 SW1/4SE1/4 sec. 18, T. 18 S., R. 23 E., about 1.5 miles southeast of Osawatomie in Miami County (fig. 3). Operations at this site consisted of reentering and deepening a previous minerals-exploration test.

The initial test was drilled by the Houston Oil and Minerals Co., Denver, Colo., to obtain information on a magnetic anomally that occurs in this area. This test was drilled to a total depth of 2,158 feet, about 63 feet below the top of the Precambrian basement rocks. A 7 7/8-inch diameter hole was drilled, and a 6 1/4-inch diameter surface casing was installed to a depth of 150 feet below land surface. The remainder of the hole was drilled 5 5/8 inches in diameter (table 1). A sample description log, shown in figure 4, was determined from rock cuttings that had been collected during the original drilling.

The Houston Oil and Minerals Co. had intended to plug the hole. However, arrangements were made for the U.S. and Kansas Geological Surveys to utilize the hole for obtaining information on the hydrology of the Arbuckle Group. The original hole was reopened by washing to a depth of 2,158 feet. A 4 3/4-inch diameter core of the Precambrian rock was taken from 2,158 to 2,184.5 feet. Dual-induction laterolog, sonic, and compensated neutron-formation density logs were run as listed in table 2. Two drill-stem tests were completed in the test hole (see "Hydrologic Testing," p. 21). Subsequent to completion of drill-stem testing, a 4 1/2-inch diameter casing was installed in the drill hole from land surface to a depth of 1,253 feet. Centralizers were placed at the top of alternate joints (at about 80-foot intervals), and the annular space was cemented from the base of the casing to land surface. The final well-construction details are shown in figure 5.

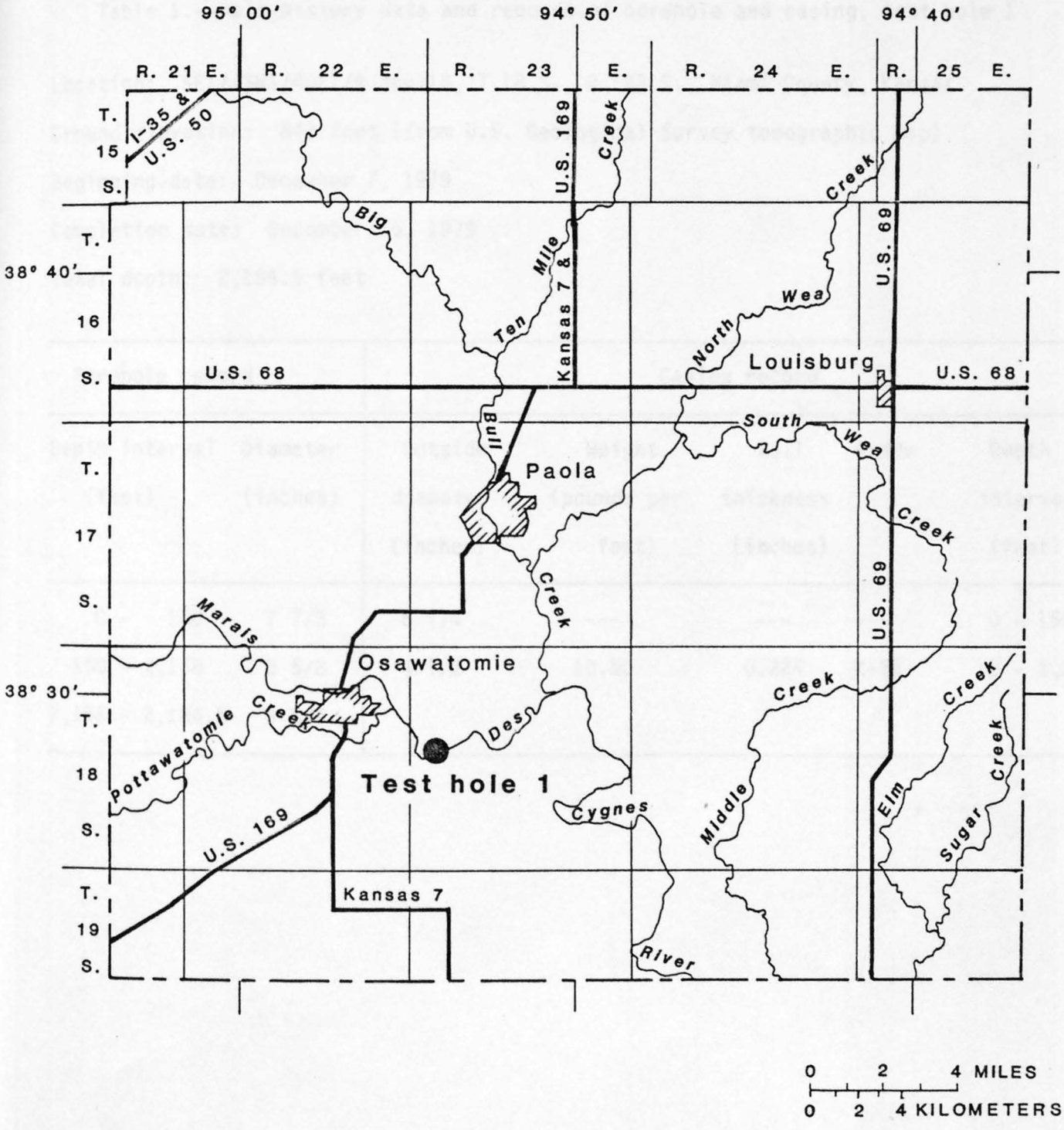

Figure 3.--Location of test hole 1, Miami County.

Table 1.--Hole-history data and records of borehole and casing, test hole 1

Location: SE1/4SW1/4SE1/4 sec.18, T.18 S., R. 23 E., Miami County, Kansas

Ground elevation: 843 feet (from U.S. Geological Survey topographic map)

Beginning date: December 7, 1979

Completion date: December 15, 1979

Total depth: 2,184.5 feet

Borehole record		Casing record				
Depth interval (feet)	Diameter (inches)	Outside diameter (inches)	Weight (pounds per foot)	Wall thickness (inches)	Grade	Depth interval (feet)
0 - 150	7 7/8	6 1/4	---	---	---	0 - 150
150 - 2,158	5 5/8	4 1/2	10.50	0.224	K-55	0 - 1,253
2,158 - 2,184.5	4 3/4					

STATE: Kansas
COUNTY: Miami
BLOCK:
SEC. 18
T 18 R 23E
ALTITUDE: 843 Gr. (topo)
PRODUCTION:

COMPANY: U.S. Geol. Survey
FARM: Watson
WELL NO.: 1
SURVEY: SE SW SE
TOTAL DEPTH: 2185 ft
COMMENCED: 12-7-79
COMPLETED: 12-15-79
REMARKS:

CASING RECORD
6 1/4" @ 150 ft
4 1/2" @ 1253 ft

Samples, Virgil B. Cole Jan. 1980

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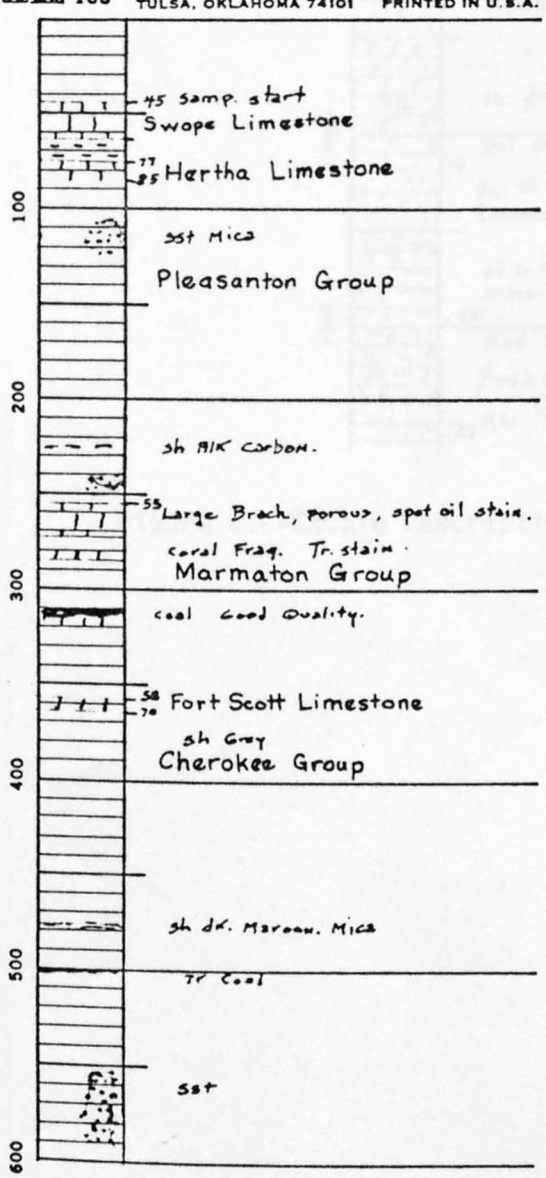

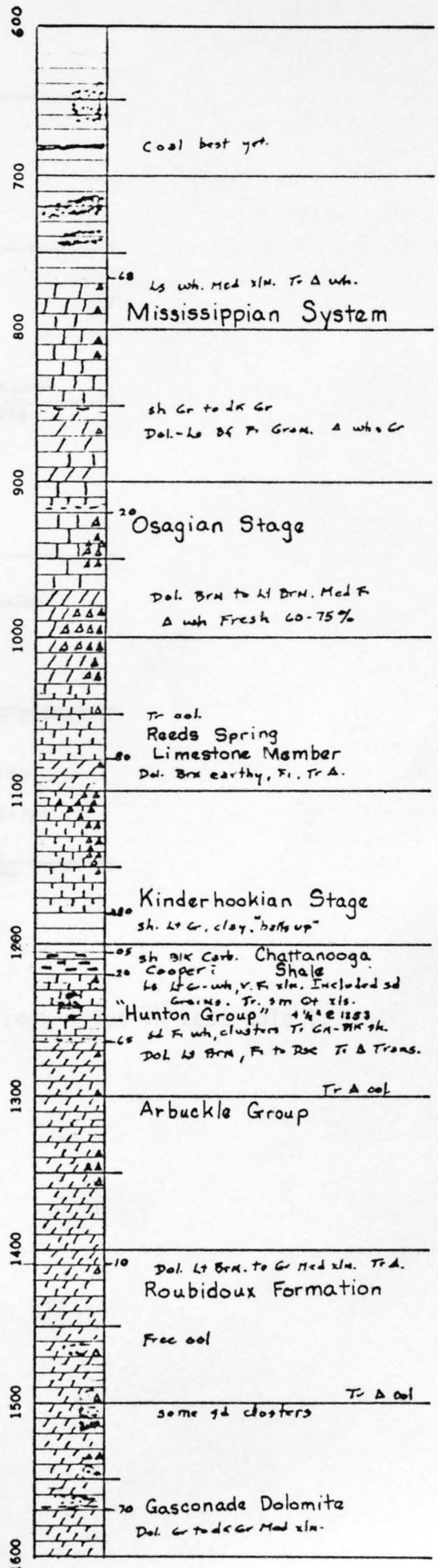

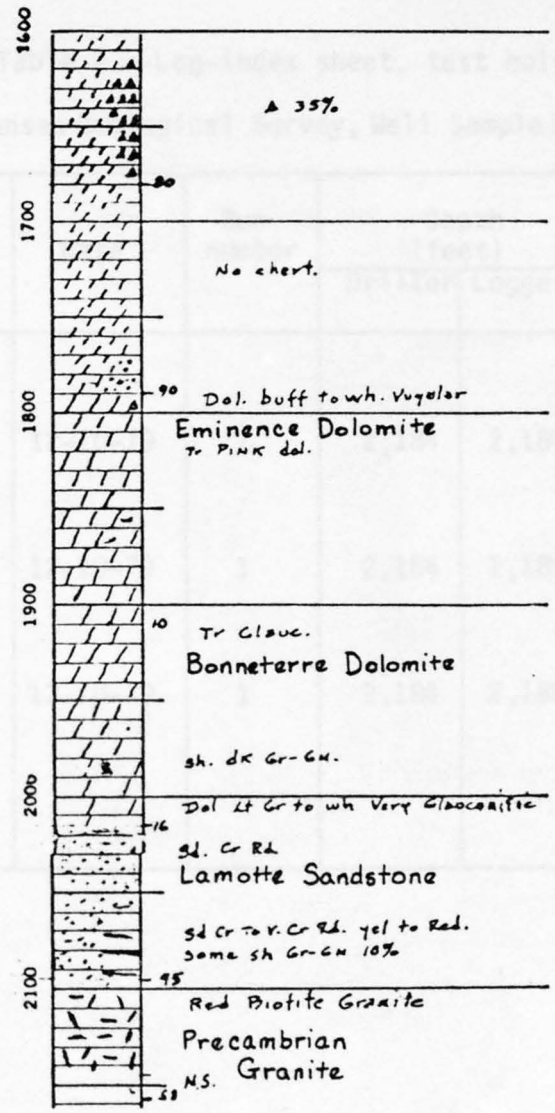

Figure 4.--Sample description log of rock types in test hole 1.

Table 2.--Log-index sheet, test hole 1

[Logs available in Kansas Geological Survey, Well Sample Library, Wichita, Kans.]

Type log	Date	Run number	Depth (feet)		Logged interval (feet)
			Driller	Logger	
Schlumberger logs					
Dual-induction laterolog	12-10-79	1	2,184	2,189	154 - 2,183
Sonic, borehole compensated	12-10-79	1	2,184	2,189	370 - 2,182
Compensated neutron-formation density log	12-10-79	1	2,184	2,189	154 - 2,188

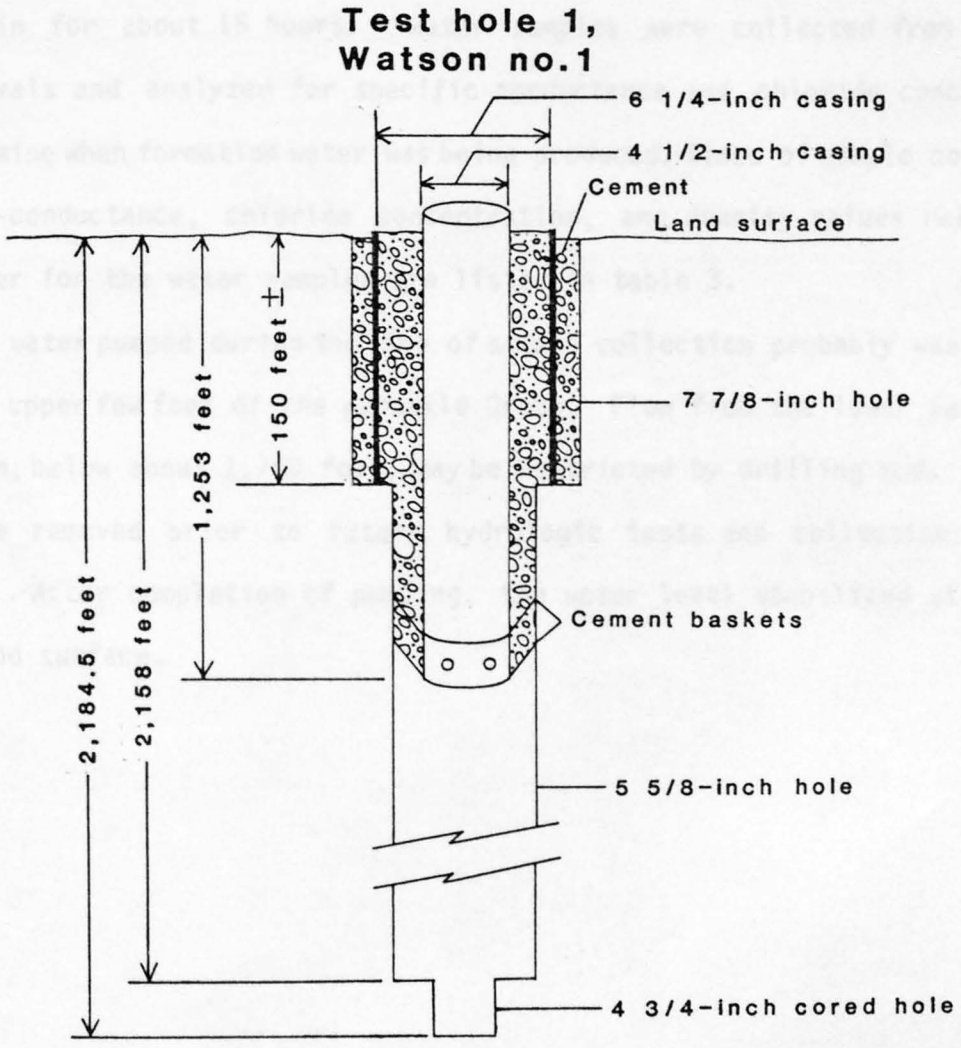

Figure 5.--Final well-construction details for test hole 1.

The well was partially developed with air by surging and pumping until the discharge water was clear. Pumping with air then continued at a rate of 42 gal/min for about 15 hours. Water samples were collected from the well at intervals and analyzed for specific conductance and chloride concentration to determine when formation water was being produced. Times of sample collection, specific-conductance, chloride concentration, and density values relative to freshwater for the water samples are listed in table 3.

The water pumped during the time of sample collection probably was produced from the upper few feet of the Arbuckle Group. Flow from the lower part of the formation, below about 1,760 feet, may be restricted by drilling mud. This mud should be removed prior to future hydrologic tests and collection of water samples. After completion of pumping, the water level stabilized at 175 feet below land surface.

Table 3.--Results of partial chemical analyses of water produced from the Arbuckle Group, test hole 1

Time (hours)	Specific conductance (micromhos per centimeter at 25°C)	Chloride concentration (milligrams per liter)	Density (relative to freshwater)
December 14, 1979			
1930	18,000	18,000	1.02
2000	40,400	20,000	1.02
2030	44,300	20,000	1.02
2100	46,700	20,000	1.02
2200	51,600	20,000	1.02
2300	51,200	20,000	1.02
2400	51,700	20,000	1.02
December 15, 1979			
0100	51,800	20,000	1.02
0200	52,700	21,000	1.02
0300	51,800	21,000	1.02
0400	52,200	21,000	1.02
0500	51,900	21,000	1.02
0600	52,300	20,000	1.01
0700	51,200	21,000	1.02
0845	52,100	21,000	1.02

Hydrologic Testing

Drill-stem tests were made at two depth intervals in test hole 1 to determine hydrologic properties for parts of the Arbuckle Group. Both tests were considered to be successful because the packers were well seated and stabilized pressures were recorded.

Drill-stem test 1, a standard double-packer test, was run in the depth interval from 1,760 to 2,179 feet to determine pressures in the Lamotte Sandstone and the lower part of the Arbuckle Group (as indicated by Virgil Cole, Consulting Geologist, Wichita, Kans.). Although the Precambrian rocks were included in the interval, the granite probably did not yield significant amounts of fluid in this area. Drill-stem test 2, a straddle-packer test, was run in the depth interval from 1,245 to 1,735 feet to determine pressures in the upper part of the Arbuckle Group and the lower part of the "Hunton Group" (as indicated by Cole, fig. 4). A summary of the pressure data from the tests is given in table 4. Also given are the amounts of fluid recovered at the end of each test, expressed in feet of the drill stem and described in general proportions of mud and water. Data provided by the contractor and reproductions of the pressure graphs for each test are given in Appendix A.

Table 4.--Summary of drill-stem test data, test hole 1

[All depths are measured from ground level, 843 feet above National Geodetic Vertical Datum of 1929. Pressures are reported in pounds-force per square inch (lbf/in^2).]

Test number	Formation	Interval tested (feet)	Gage depth (feet)	Flow pressures (lbf/in^2)				Shut-in pressure (lbf/in^2)		Hydrostatic pressure (lbf/in^2)		Remarks
				First period		Second period		Inital	Final	Initial	Final	
				Initial	Final	Initial	Final					
1	Arbuckle Group - Lamotte Sandstone	1,760-2,179	1,740	1,115.8	698.4	699.4	699.4	699.4	699.4	728.8	701.3	1,247 feet water-cut mud,
			2,175	373.0	894.4	896.4	896.4	896.4	896.4	927.0	901.3	300 feet water
2	"Hunton" - Arbuckle Groups	1,245-1,735	1,229	154.4	470.2	470.2	470.2	470.2	470.2	495.0	481.1	865 feet mud, 120 feet water

TEST HOLE 2, DCL AND FA NO. 1

Drilling, Logging, and Well Development

Test hole 2, also designated as DCL and FA no. 1, was located in the SE1/4NW1/4NW1/4 sec. 13, T. 12 S. R. 17 E., at Big Springs in Douglas County (fig. 6).

An 8 1/2-inch diameter pilot hole was drilled to a depth of 292 feet. The hole was reamed with a 13 3/4-inch bit, and a 10 3/4-inch surface casing was installed to a depth of 238 feet and cemented to land surface. Information on well construction is given in figure 7 and listed in table 5. A 9 7/8-inch diameter hole was drilled from 238 to 2,408 feet. Drill-stem tests were run at three intervals during drilling of this part of the hole (see "Hydrologic Testing", p. 30). The locations of packer seats were selected on the basis of sample cuttings and drilling time. Dual-induction laterolog, sonic, and compensated neutron-formation density logs were run in the hole, as listed in table 6.

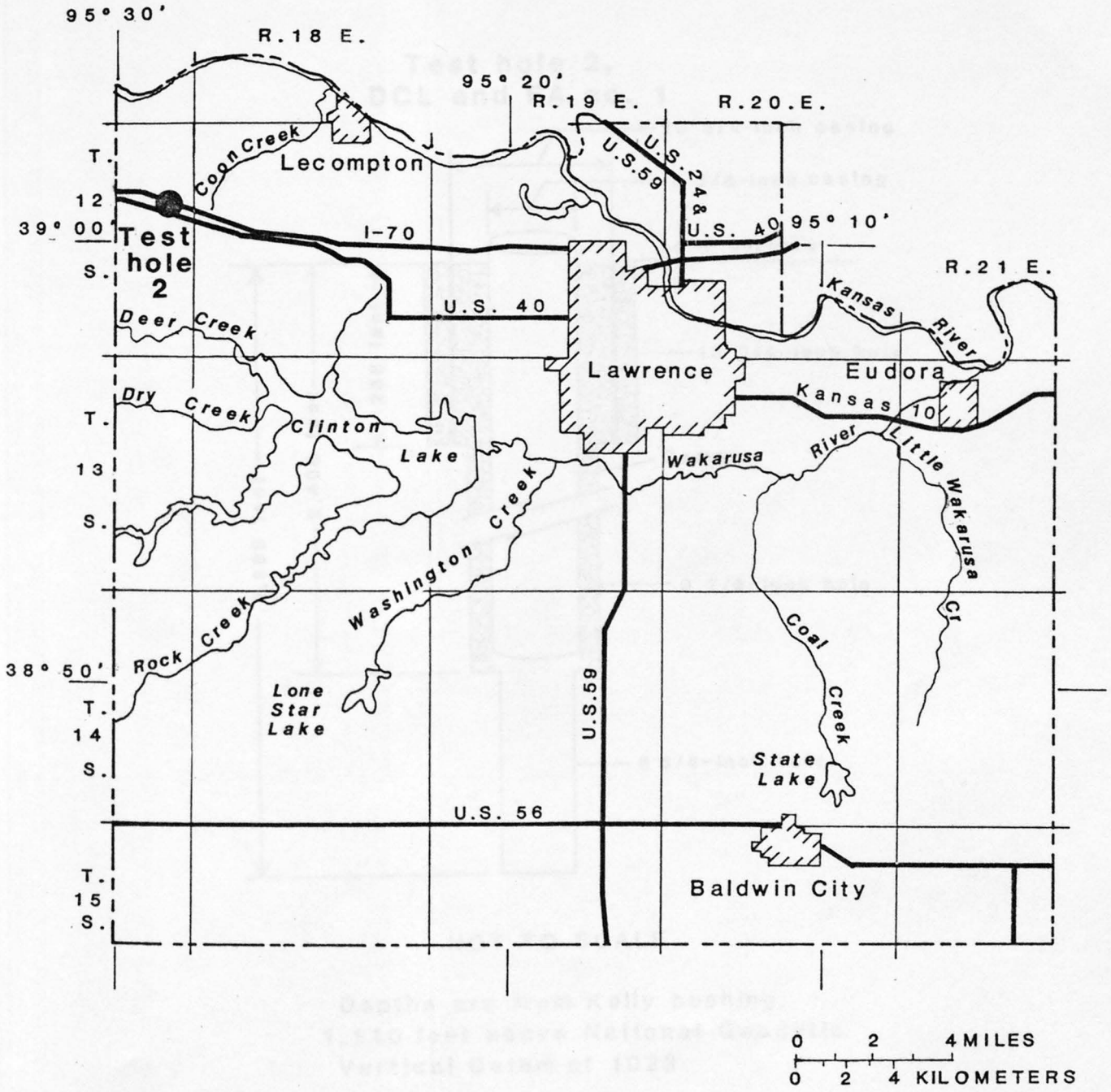

Figure 6.--Location of test hole 2, Douglas County.

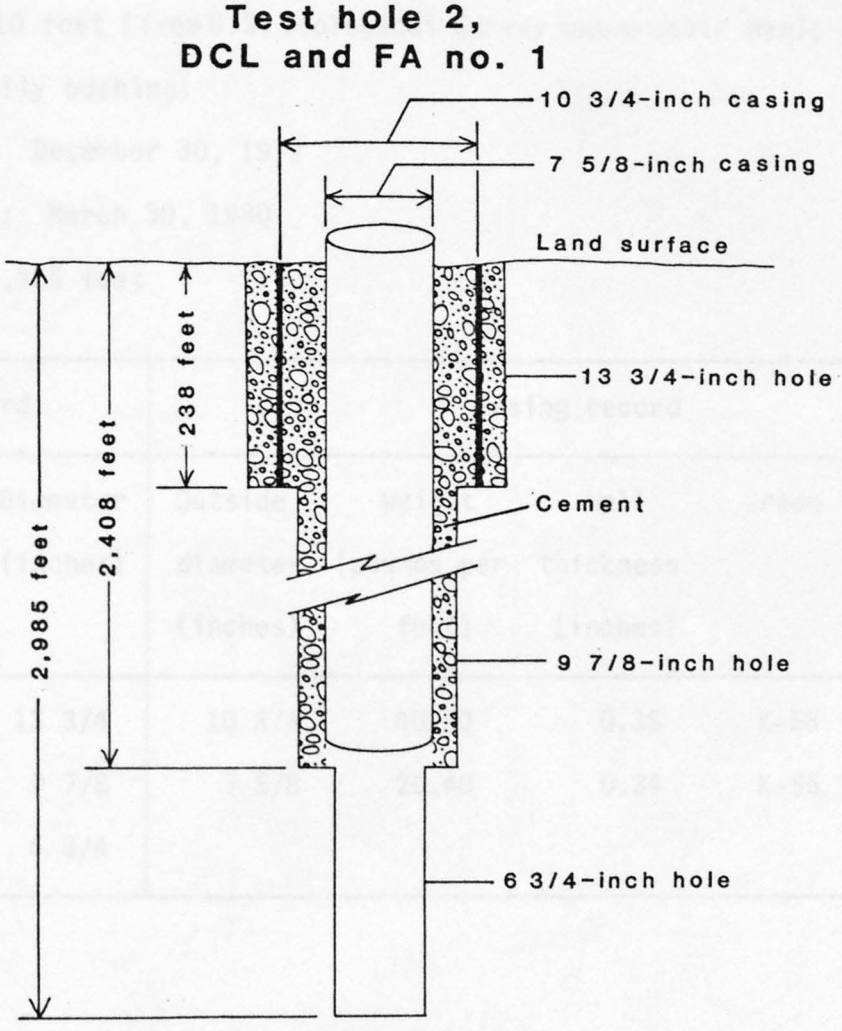

Figure 7.--Final well-construction details for test hole 2.

Table 5.--Hole-history data and records of borehole and casing, test hole 2

Location: SE1/4NW1/4NW1/4 sec.13, T.12 S., R.17 E., Douglas County, Kansas

Elevation: 1,110 feet (from U.S. Geological Survey topographic map); 1,115 feet (Kelly bushing)

Beginning date: December 30, 1979

Completion date: March 30, 1980

Total depth: 2,985 feet

Borehole record		Casing record				
Depth interval (feet)	Diameter (inches)	Outside diameter (inches)	Weight (pounds per foot)	Wall thickness (inches)	Grade	Depth interval (feet)
0 - 238	13 3/4	10 3/4	40.50	0.35	K-55	0 - 238
238 - 2,408	9 7/8	7 5/8	26.40	0.34	K-55	0 - 2,398
2,408 - 2,985	6 3/4					

Table 6.--Log-index sheet, test hole 2

[Logs available in Kansas Geological Survey, Well Sample Library, Wichita, Kans.]

Type log	Date	Run number	Depth (feet)		Logged interval (feet)
			Driller	Logger	
Schlumberger logs					
Dual-induction laterolog	2-19-80	1	2,406	2,406	237 - 2,400
	3-20-80	2	2,985	2,979	2,399 - 2,973
Sonic, borehole compensated	2-19-80	1	2,406	2,405	237 - 2,403
	3-20-80	2	2,985	2,977	2,398 - 2,972
Compensated neutron-formation	2-19-80	1	2,406	2,406	237 - 2,405
density log	3-20-80	2	2,985	2,979	2,398 - 2,978
Cement bond log	3-20-80	1	2,394	2,397	208 - 2,397
U.S. Geological Survey logs					
Flow logs, spinner and brine ejection types	7-10-80	1	2,985	2,978	2,300 - 2,900

A 7 5/8-inch diameter casing was installed to a depth of 2,398 feet and cemented in place. Subsequent to casing installation, a 6 3/4-inch diameter hole was drilled to 2,420 feet. A core was collected of the Arbuckle rocks between 2,420 and 2,444 feet (Appendix B). Subsequent to coring, drilling continued to 2,968 feet, about 6 feet below the top of the Precambrian basement rock. A sample description log of rock cuttings obtained in test hole 2 is shown in figure 8. A core was taken of the basement rock from 2,968 feet to 2,985 feet as part of the cooperative project with the Kansas Geological Survey mentioned previously. Another series of electrical logs, identical to those mentioned above, was run on the part between 2,398 feet and the bottom of the hole (table 6). Two drill-stem tests were run on the lower part of the hole (see "Hydrologic Testing," p. 30).

The well was cleared of drilling mud by lowering the drill stem to bottom and flushing the well with freshwater. Subsequently, the drill stem was pulled back to 370 feet, and the well was pumped with air for 8 hours until the stabilization of specific conductance in water samples indicated that formation water was being produced. Then, a submersible pump was installed, and the well was pumped for about 56 hours. Final water samples then were collected. Analyses of the samples are listed in table 7. Prior to capping the well, depth to the stabilized water level was measured at 450 feet below land surface.

STATE: KANSAS
COMPANY: U.S. Geol. Survey
COUNTY: Douglas
FARM: D C L and F A
WELL NO.: 1
BLOCK:
SURVEY:
SEC.: 13
SE NW NW
T.: 12S
R.: 17E
TOTAL DEPTH: 2985 ft
COMMENCED: 12-30-79
COMPLETED: 3-30-80
REMARKS:
ALTITUDE: 1110 Gr (topo)
PRODUCTION:

CASING RECORD
10 3/4" @ 238 ft
7 5/8" @ 2,398 ft

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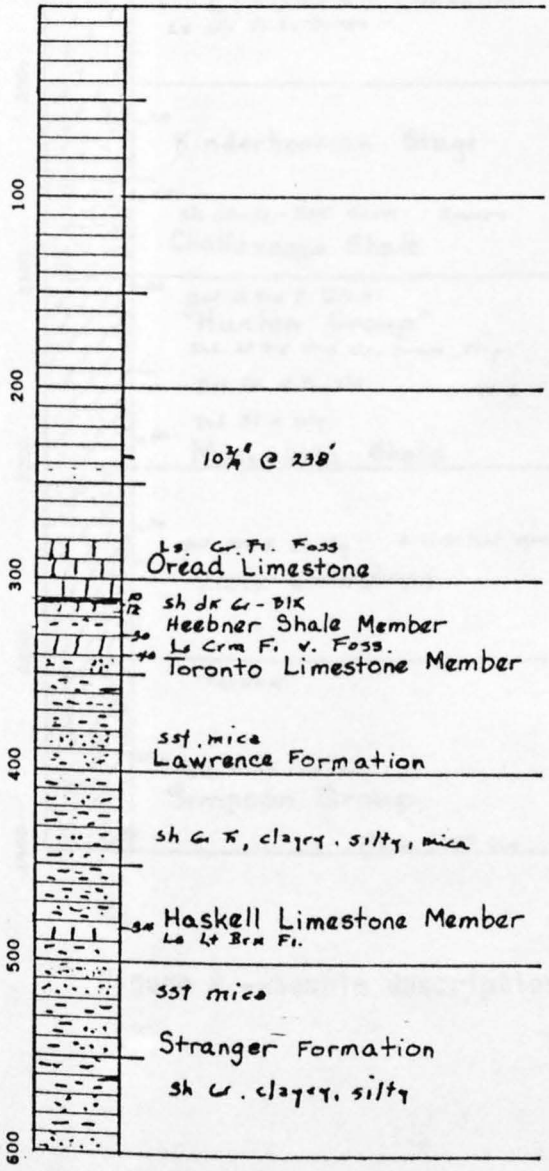
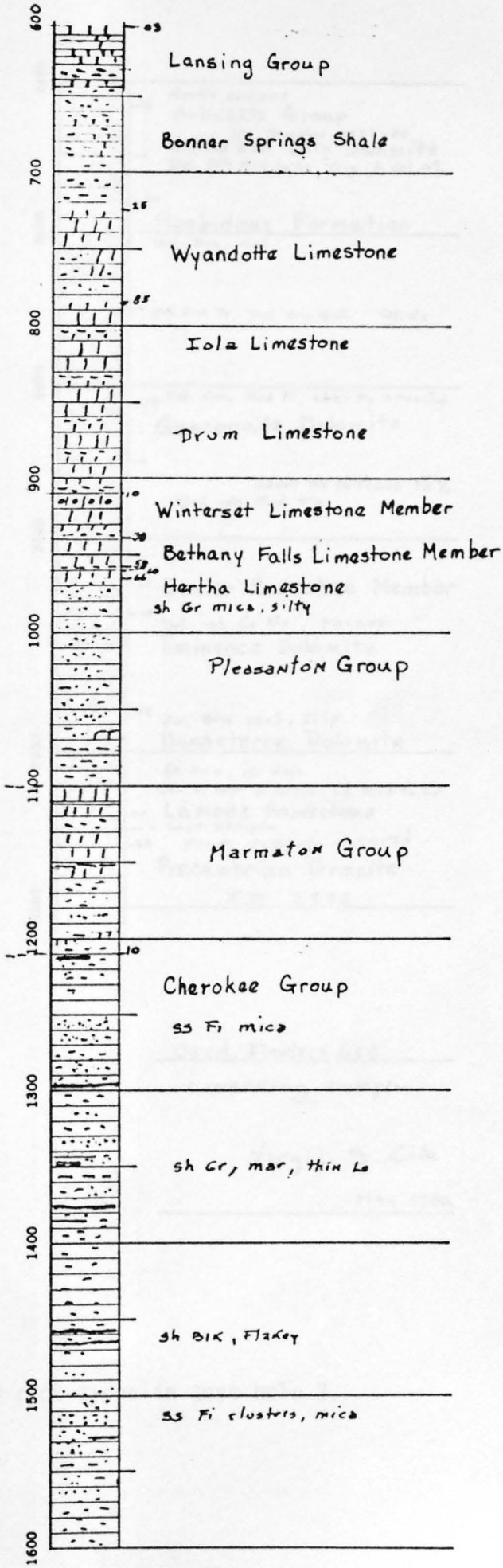




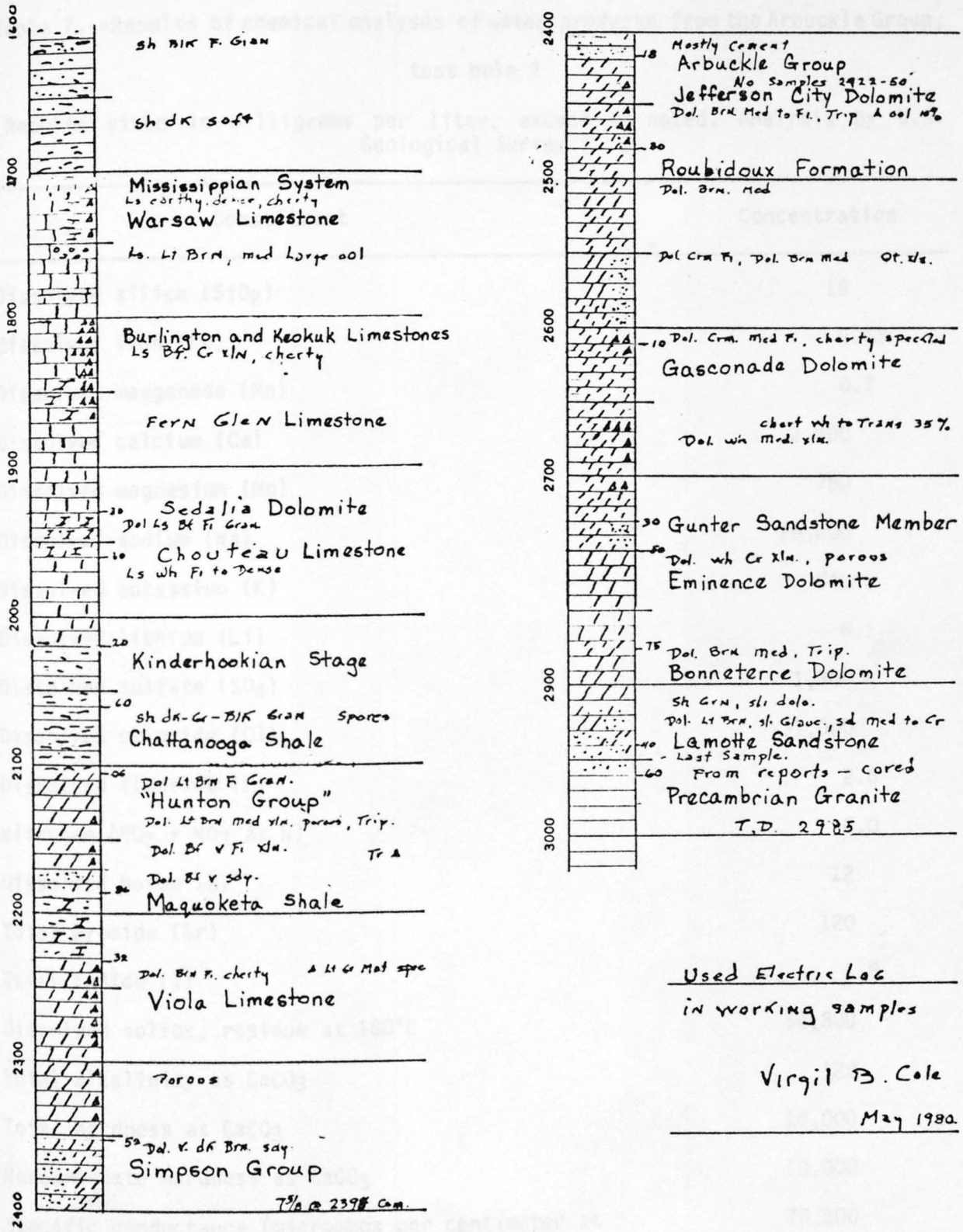


Figure 8.--Sample description log of rock types in test hole 2.

Table 7.--Results of chemical analyses of water produced from the Arbuckle Group, test hole 2

[Results given in milligrams per liter, except as noted. Analysis by U.S. Geological Survey.]

Constituent	Concentration
Dissolved silica (SiO_2)	18
Dissolved iron (Fe)	0.42
Dissolved manganese (Mn)	0.3
Dissolved calcium (Ca)	2,900
Dissolved magnesium (Mg)	780
Dissolved sodium (Na)	16,000
Dissolved potassium (K)	240
Dissolved lithium (Li)	6.1
Dissolved sulfate (SO_4)	1,300
Dissolved chloride (Cl)	31,000
Dissolved fluoride (F)	2.6
Nitrogen (NO_2 + NO_3 as N)	0.0
Dissolved boron (B)	12
Total bromide (Br)	120
Total iodide (I)	1.8
Dissolved solids, residue at 180°C	54,800
Total alkalinity as $CaCO_3$	120
Total hardness as $CaCO_3$	10,000
Noncarbonate hardness as $CaCO_3$	10,000
Specific conductance (micromhos per centimeter at 25°C)	70,200
pH, units	6.7
Radium 226 (Ra_{226}) (picocuries per liter)	160

Hydrologic Testing

Standard double-packer drill-stem tests were run on five different intervals in the hole to determine hydrologic properties. Because the packers were well seated and stabilized pressures were recorded, all tests were considered to be successful. Tests were made (according to Cole's log, fig. 8) in the Lansing-Kansas City Groups between 612 and 955 feet, in Mississippian rocks between 1,715 and 1,896 feet, in the Viola Limestone between 2,240 and 2,335 feet, in the Simpson and upper part of the Arbuckle Groups between 2,398 and 2,508 feet, and in the Lamotte Sandstone between 2,934 and 2,985 feet. A summary of the pressure data from these tests and the amount of fluid recovered at the end of each test are given in table 8. Data provided by the contractor and the reproductions of pressure graphs are given in Appendix A.

Table 8.--Summary of drill-stem test data, test hole 2

[All depths are measured from the Kelly bushing, 1,110 feet above National Geodetic Vertical Datum of 1929. Pressures are reported in pounds-force per square inch (lbf/in^2).]

Test number	Formation	Interval tested (feet)	Gage depth (feet)	Flow pressure (lbf/in^2)				Shut-in pressure (lbf/in^2)		Hydrostatic pressure (lbf/in^2)		Remarks
				First period		Second period						
				Initial	Final	Initial	Final	Initial	Final	Initial	Final	
1	Lansing - Kansas City Groups	612-955	589	15.0	20.0	24.0	39.0	161.3	160.3	309.6	310.6	60 feet mud.
			951	214.8	221.8	223.8	238.9	360.4	356.4	508.0	510.0	
2	Mississippian System	1,715-1,896	1,634	161.3	311.8	298.0	336.6	543.2	537.3	945.9	941.0	540 feet mud.
			1,892	573.8	674.2	622.0	668.3	691.9	684.0	1,089.9	1,087.9	
3	Viola Limestone	2,240-2,335	2,217	356.2	796.9	799.9	799.9	798.9	799.9	1,238.7	1,231.6	400 feet mud, 500 feet mud-cut saltwater, 660 feet saltwater.
4	Simpson-Arbuckle Groups	2,398-2,508	2,372	678.0	866.1	866.1	866.1	866.1	866.1	1,077.3	1,040.1	268 feet mud, 2,000 feet saltwater; possible leak in drill stem.
5	Lamotte Sandstone	2,934-2,985	2,910	61.3	338.6	351.4	610.9	1,067.1	1,065.2	1,305.3	1,186.7	1,385 feet saltwater.

TEST HOLE 3, GEIS NO. 1

Drilling, Logging, and Well Development

Test hole 3, also designated as Geis no. 1, was located in the SW1/4 SW1/4SW1/4 sec. 32, T. 13 S., R. 2 W., Saline County (fig 9).

A 9 7/8-inch pilot hole was drilled to a depth of 296 feet. The hole was reamed with a 14 1/2-inch bit, and a 10 3/4-inch surface casing was installed to a depth of 280 feet and cemented to land surface. Information on well construction is given in figure 10 and listed in table 9. Then, a 9 7/8-inch diameter hole was drilled to a depth of 3,345 feet. Drill-stem tests were run at three intervals during drilling of this part of the hole (see "Hydrologic Testing," p. 39). The locations of packer seats were selected on the basis of sample cuttings and drilling time. Dual-induction laterolog, sonic, and compensated neutron-formation density logs were run in the hole, as listed in table 10.

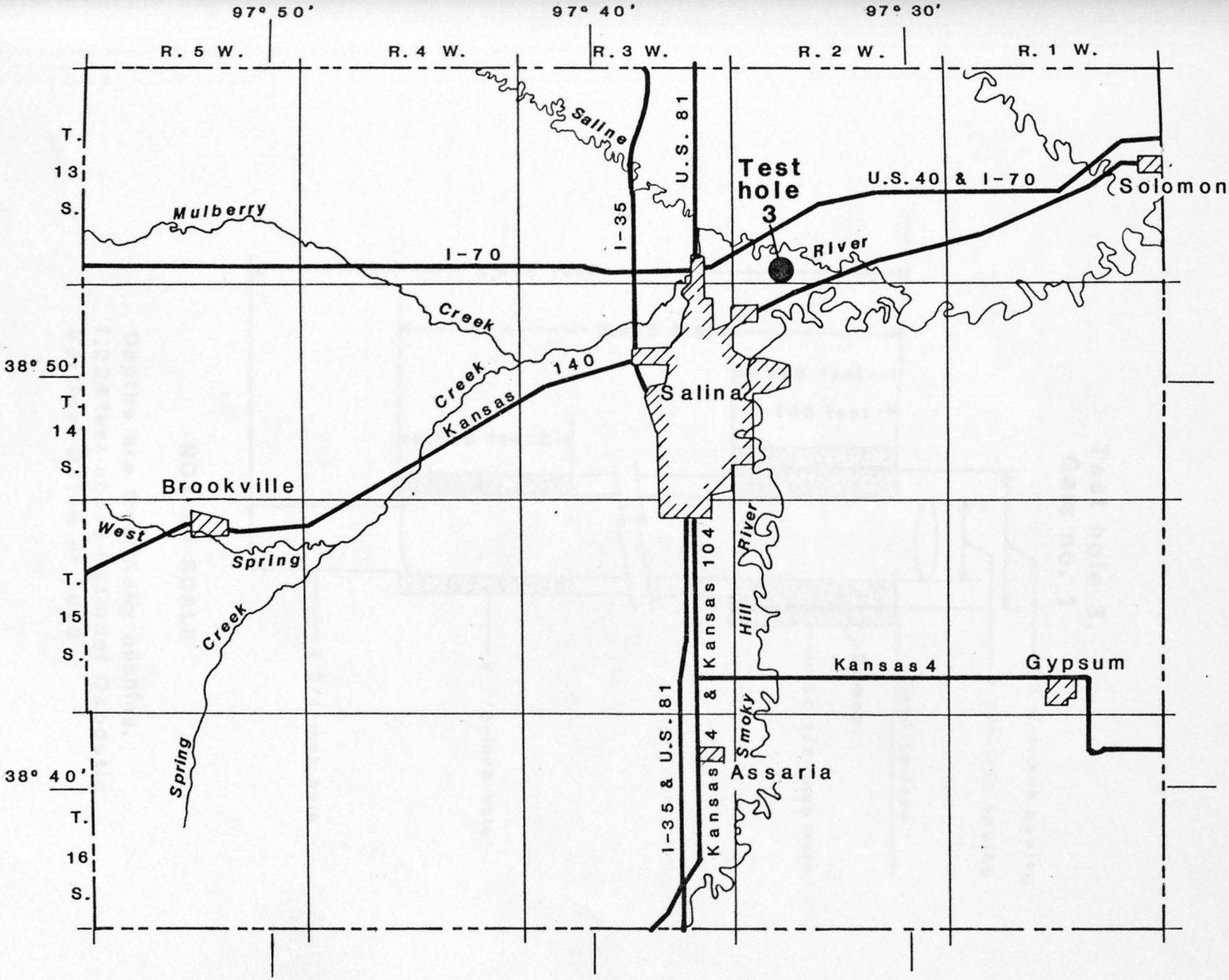


Figure 9.--Location of test hole 3, Saline County.

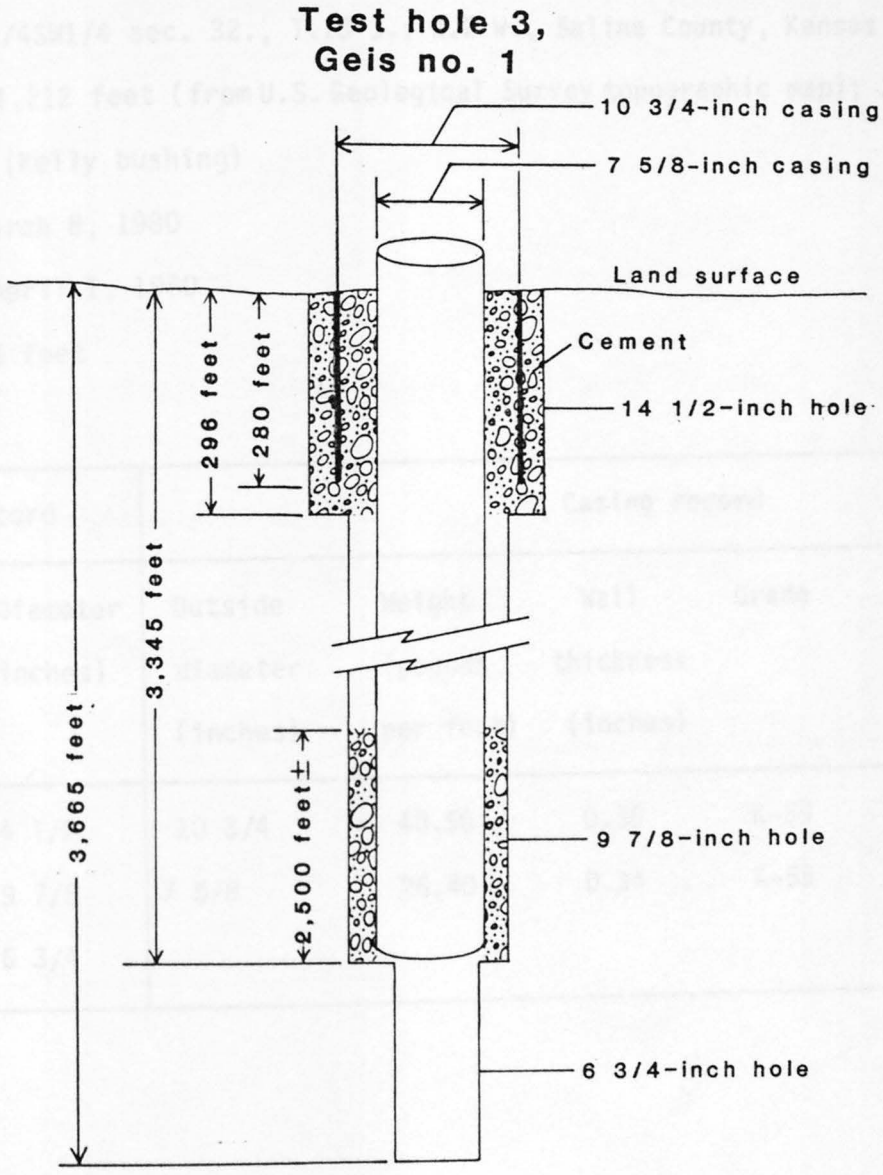


Figure 10.--Final well-construction details for test hole 3.

Table 9.--Hole-history data and records of borehole and casing, test hole 3

Location: SW1/4SW1/4SW1/4 sec. 32., T.13 S., R.2 W., Saline County, Kansas

Ground elevation: 1,212 feet (from U.S. Geological Survey topographic map); 1,224 feet (Kelly bushing)

Beginning date: March 8, 1980

Completion date: April 1, 1980

Total depth: 3,665 feet

Borehole record		Casing record				
Depth interval (feet)	Diameter (inches)	Outside diameter (inches)	Weight (pounds per foot)	Wall thickness (inches)	Grade	Depth interval (feet)
0 - 296	14 1/2	10 3/4	40.50	0.35	K-55	0 - 280
296 - 3,345	9 7/8	7 5/8	26.40	0.34	K-55	0 - 3,343
3,345 - 3,665	6 3/4					

Table 10.--Log-index sheet, test hole 3

[Logs available in Kansas Geological Survey, Well Sample Library, Wichita, Kans.]

Type log	Date	Run number	Depth (feet)		Logged interval (feet)
			Driller	Logger	
Schlumberger logs					
Dual-induction laterolog	3-23-80	1	3,345	3,346	280 - 3,340
	3-29-80	2	3,665	3,657	3,344 - 3,651
Sonic, borehole compensated	3-23-80	1	3,345	3,346	280 - 3,344
	3-29-80	2	3,665	3,657	3,344 - 3,655
Compensated neutron-formation density log	3-23-80	1	3,345	3,346	280 - 3,345
	3-29-80	2	3,665	3,657	3,344 - 3,656
U.S. Geological Survey logs					
Flow log, spinner and brine ejection types	7-9-80	1	3,665	3,665	3,330 - 3,525

A 7 5/8-inch diameter casing was installed to a depth of 3,343 feet and cemented in place. Subsequent to casing installation, a 6 3/4-inch diameter hole was drilled to 3,481 feet. A core of the rocks in the Arbuckle Group was collected from the interval 3,481 to 3,494 feet (Appendix B). Subsequently, drilling continued to 3,665 feet where circulation was lost. Repeated efforts to regain circulation were unsuccessful, and the decision was made to complete the hole at that depth. The sample description log of rock cuttings in test hole 3 by Virgil B. Cole indicates that drilling ended in the Gasconade Dolomite of the Arbuckle Group (fig. 11). Another series of electrical logs, identical to those mentioned above, was run on the part of the hole between 3,344 feet and the total depth (table 10). Two drill-stem tests were run on the lower part of the hole (see "Hydrologic Testing," p. 39). Again, locations of packer seats were selected on the basis of sample cuttings, drilling time, and electrical-log inspection.

The well was cleared of mud and developed by surging and pumping with air and then removing mud through the drill stem until clear formation water was produced based on stabilization of the chloride concentration in water samples. This procedure was repeated in stages at successively lower depths to the total depth. Subsequently, a submersible pump was installed in the well. The well then was pumped for 5 hours at a rate of 37 gal/min to insure that formation water was being produced. Samples were collected for analyses at the end of this period. The results of these analyses are listed in table 11.

STATE: KANSAS
COUNTY: Saline
BLOCK:
SEC.: 32
T.: 13S
R.: 2W
COMPANY: U.S. Geol. Survey
FARM: Geis
WELL NO.: 1
SURVEY:
SW SW SW
TOTAL DEPTH: 3665 ft
COMMENCED: 3-8-80
COMPLETED: 4-1-80
REMARKS:
ALTITUDE: 1210 Gr. (Topo)
PRODUCTION:

CASING RECORD
10 3/4" @ 280 ft
7 5/8" @ 3343 ft

SHOT | QUARTS | BETWEEN

Kraftsman 186 TULSA, OKLAHOMA 74101 PRINTED IN U.S.A.

Samples generally poor
Electric Log used extensively

Virgil B. Cole
May 1920

100
200
300
400
500
600

84 10% @ 280'
Winfield Limestone
1st Sample
Dol Gr Fi to dense, Anh.

sh red
Anhydrite
70
Dol. Gr Fi to earthy.
Fort Riley Limestone Member

Anh.
Ls - Dol. porosity

Ls. Lt Gr. Fi Foss. Δ Gr Foss Fossil
Barneston Limestone
sh red & Grey

60
Ls Gr Fi earthy. Foss. cherty.
Wreford Limestone

600
700
800
900
1000
1100
1200
1300
1400
1500
1600

25 Cottonwood Limestone Member
Ls Bf mod F. Vuggy Fossiliferous

78 sh red.
Ls. wh. Fi.
Neva Limestone Member

sh Red - Gray

sh G Gr-Gr, Mor, Thin Ls.
Pennsylvanian System

Anh. wh. poss. cave?

36 Tarkio Limestone Member
sh sdy

70 Ls Bf - Mottled impure
Emporia Limestone

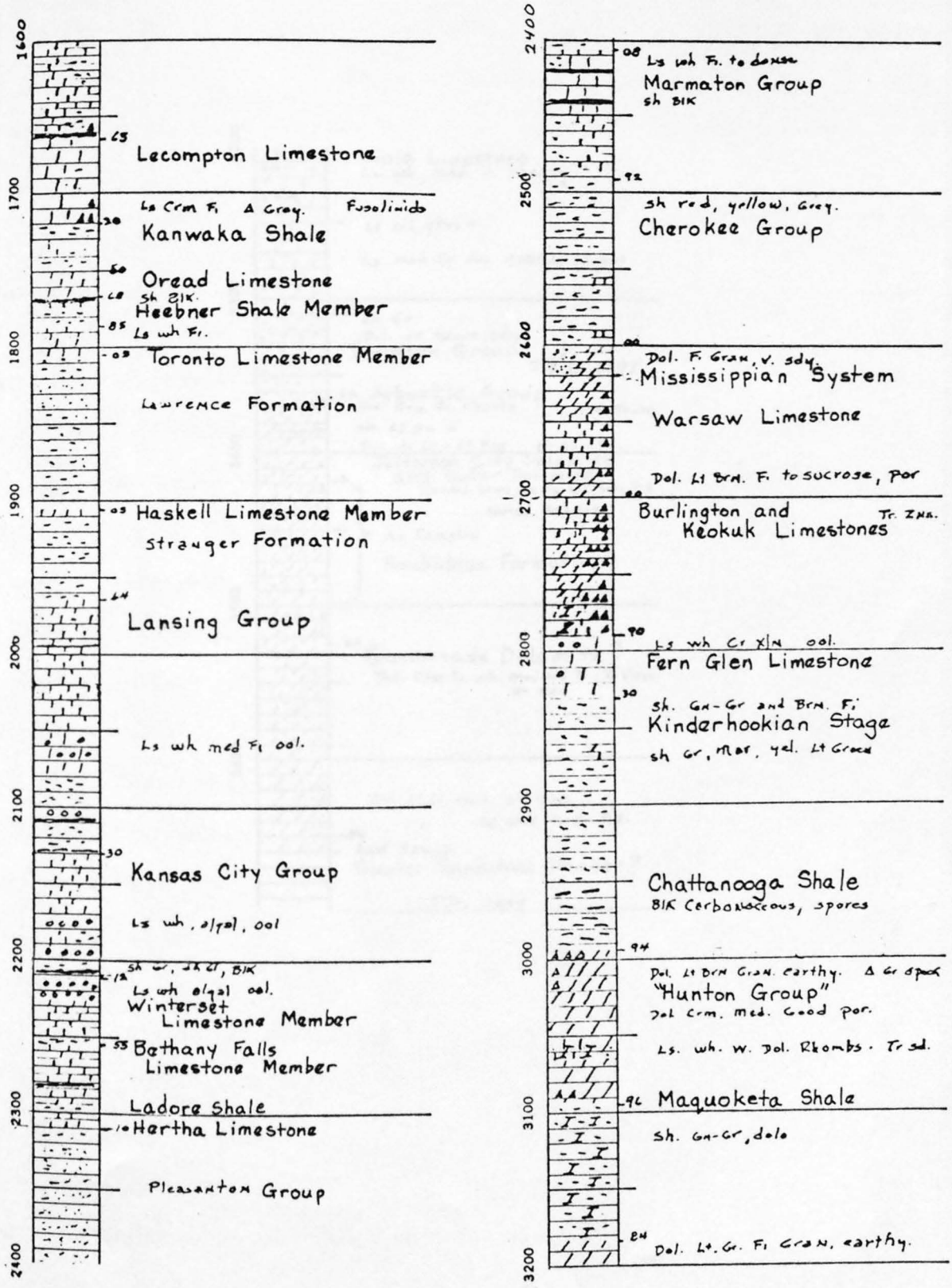
65 Ls thin bedded
Bern Limestone
sh. Red. Fi silty

Happy Hollow Limestone Member
sh red Grey, Mica Tr Ls

26 Ls Bf. Fi. cherty Δ Grey, spick.
Howard Limestone

72 Topeka Limestone

68
Deer Creek Limestone


1600
1700
1800
1900
2000
2100
2200
2300
2400
Lecompton Limestone
Ls Crm Fi Δ Gray. Fusolinids
Kanwaka Shale
Oread Limestone
sh Blk.
Heebner Shale Member
Ls wh Fi.
Toronto Limestone Member
Lawrence Formation
Haskell Limestone Member
Stranger Formation
Lansing Group
Ls wh med Fi ool.
Kansas City Group
Ls wh, algal, ool
sh gr, sk cl, Blk
Ls wh algal ool.
Winterset Limestone Member
Bethany Falls Limestone Member
Ladore Shale
Hertha Limestone
Pleasanton Group
2400
2500
2600
2700
2800
2900
3000
3100
3200
Ls wh Fi. to dense
Marmaton Group
sh Blk
sh red, yellow, Grey.
Cherokee Group
Dol. Fi Gran, v. sdy.
Mississippian System
Warsaw Limestone
Dol. Lt Brn. Fi to sucrose, por
Burlington and Keokuk Limestones
Tr. Znd.
Ls wh Cr X|N ool.
Fern Glen Limestone
sh. Gn-Gr and Brn. Fi
Kinderhookian Stage
sh Gr, Mar, yel. Lt Green
Chattanooga Shale
Blk Carbonaceous, spores
Dol. Lt Brn Gran. earthy. Δ Gr speck
"Hunton Group"
Dol Crm. med. Good por.
Ls. wh. w. Dol. Rhombs. Tr sd.
Maquoketa Shale
sh. Gn-Gr, dolo
Dol. Lt. Gr. Fi Gran, earthy.

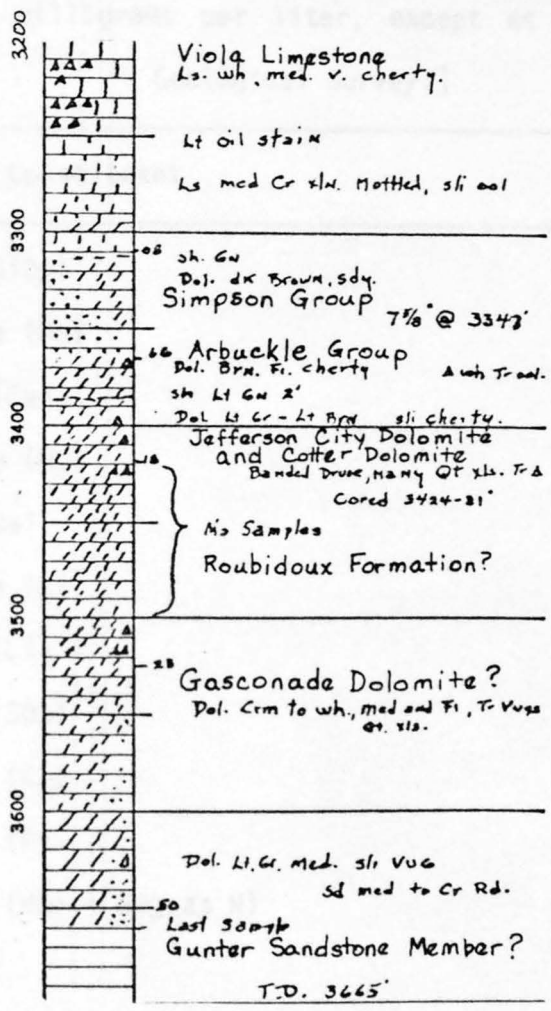


Figure 11.--Sample description log of rock types in test hole 3.

Table 11.--Results of chemical analyses of water produced from the Arbuckle Group, test hole 3

[Results given in milligrams per liter, except as noted. Analyses by U.S. Geological Survey.]

Constituent	Concentration
Dissolved silica (SiO_2)	22
Dissolved manganese (Mn)	0.16
Dissolved calcium (Ca)	260
Dissolved magnesium (Mg)	80
Dissolved sodium (Na)	2,300
Dissolved potassium (K)	50
Dissolved lithium (Li)	0.93
Dissolved sulfate (SO_4)	980
Dissolved chloride (Cl)	3,500
Dissolved fluoride (F)	3.6
Dissolved nitrogen (NO_2 + NO_3 as N)	0.03
Dissolved boron (B)	3.3
Total bromide (Br)	14
Total iodide (I)	0.18
Dissolved solids, residue at 180°C	7,510
Total alkalinity as $CaCO_3$	200
Total hardness as $CaCO_3$	980
Noncarbonate hardness as $CaCO_3$	780
Specific conductance (micromhos per centimeter at 25°C)	11,400
pH, units	7.4
Temperature (°C)	32

Hydrologic Testing

Standard double-packer drill-stem tests were run on five different intervals in the well to determine hydrologic properties. Because the packers were well seated and stabilized pressures were recorded, all of the tests were considered successful. Tests were made, according to Cole's log (fig. 11), in the Lansing-Kansas City Groups between 1,980 and 2,200 feet, in Mississippian rocks between 2,616 and 2,804 feet, in the "Hunton Group" between 2,970 and 3,070 feet, in the Viola Limestone between 3,132 and 3,200 feet, and in the upper part of the Arbuckle Group between 3,384 and 3,498 feet. A summary of pressure data from these tests and the amount of fluid recovered at the end of each test are given in table 12. Data provided by the contractor and the reproduction of pressure graphs are given in Appendix A.

Table 12.--Summary of drill-stem test data, test hole 3

[All depths are measured from Kelly bushing, 1,224 feet above National Geodetic Vertical Datum of 1929. Pressures are reported in pounds-force per square inch (lbf/in^2).]

Test number	Formation	Interval tested (feet)	Gage depth (feet)	Flow pressures (lbf/in^2)				Shut-in pressure (lbf/in^2)		Hydrostatic pressure (lbf/in^2)		Remarks
				First period		Second period						
				Initial	Final	Initial	Final	Initial	Final	Initial	Final	
1	Lansing - Kansas City Groups	1,980-2,200	1,954	40.5	280.1	293.0	667.9	907.6	900.7	1,012.8	999.0	424 feet mud, 1,530 feet saltwater.
			2,197	117.5	521.6	424.6	790.9	1,032.5	1,022.6	1,143.9	1,126.2	
2	Mississippian System	2,616-2,804	2,593	200.9	933.1	937.1	959.7	956.7	960.6	1,388.3	1,365.5	500 feet muddy saltwater, 1,500 feet saltwater.
			2,801	346.2	1,035.5	1,044.1	1,062.1	1,061.1	1,064.1	1,498.0	1,466.4	
3	"Hunton Group"	2,970-3,070	2,954	190.6	1,057.3	1,114.6	1,201.0	1,201.0	1,201.0	1,536.6	1,511.5	458 feet mud, 122 feet water-cut mud, 2,125 feet muddy saltwater.
4	Viola Limestone	3,132-3,200	3,110	11.4	23.9	28.1	52.0	987.5	957.3	1,568.1	1,547.1	85 feet mud.
5	Arbuckle Group	3,384-3,498	3,369	739.4	1,392.5	1,397.5	1,397.5	1,397.5	1,397.5	1,516.0	1,480.9	3,046 feet saltwater.

TEST HOLE 4, KANSAS ORD. NO. 1

Drilling, Logging, and Well Development

Test hole 4, also designated as Kansas Ord. no. 1, was located in the center of the SW1/4 sec. 22, T. 31 S., R. 20 E.. Labette County (fig. 12). A 9 7/8-inch diameter pilot hole was drilled to a depth of 237 feet. The hole was reamed to 14 1/2 inches in diameter, and a 10 3/4-inch diameter surface casing was installed to a depth of 220 feet and cemented to land surface. Information on well construction is given in figure 13 and listed in table 13. Then, a 9 7/8-inch diameter hole was drilled to a depth of 875 feet. Two drill-stem tests were attempted on the Mississippian rocks. The locations of packer seats were selected on the basis of sample cuttings, drilling time, and electrical-log inspection. However, mechanical problems were encountered in both tests, and the results probably are not reliable (see "Hydrologic Testing," p. 49). Dual-induction laterolog, sonic, and compensated neutron-formation density logs were run in the hole as listed in table 14.

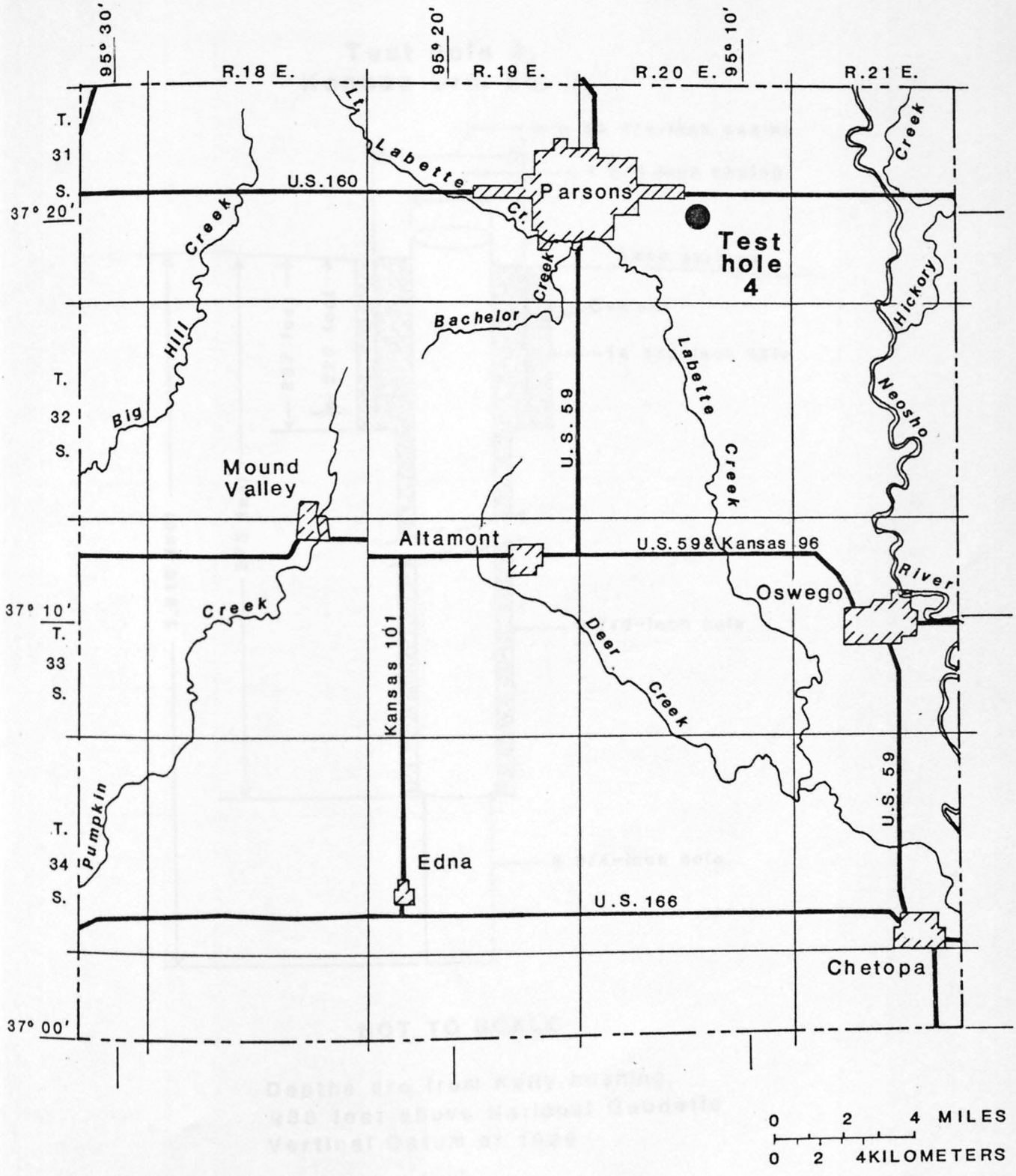


Figure 12.--Location of test hole 4, Labette County.

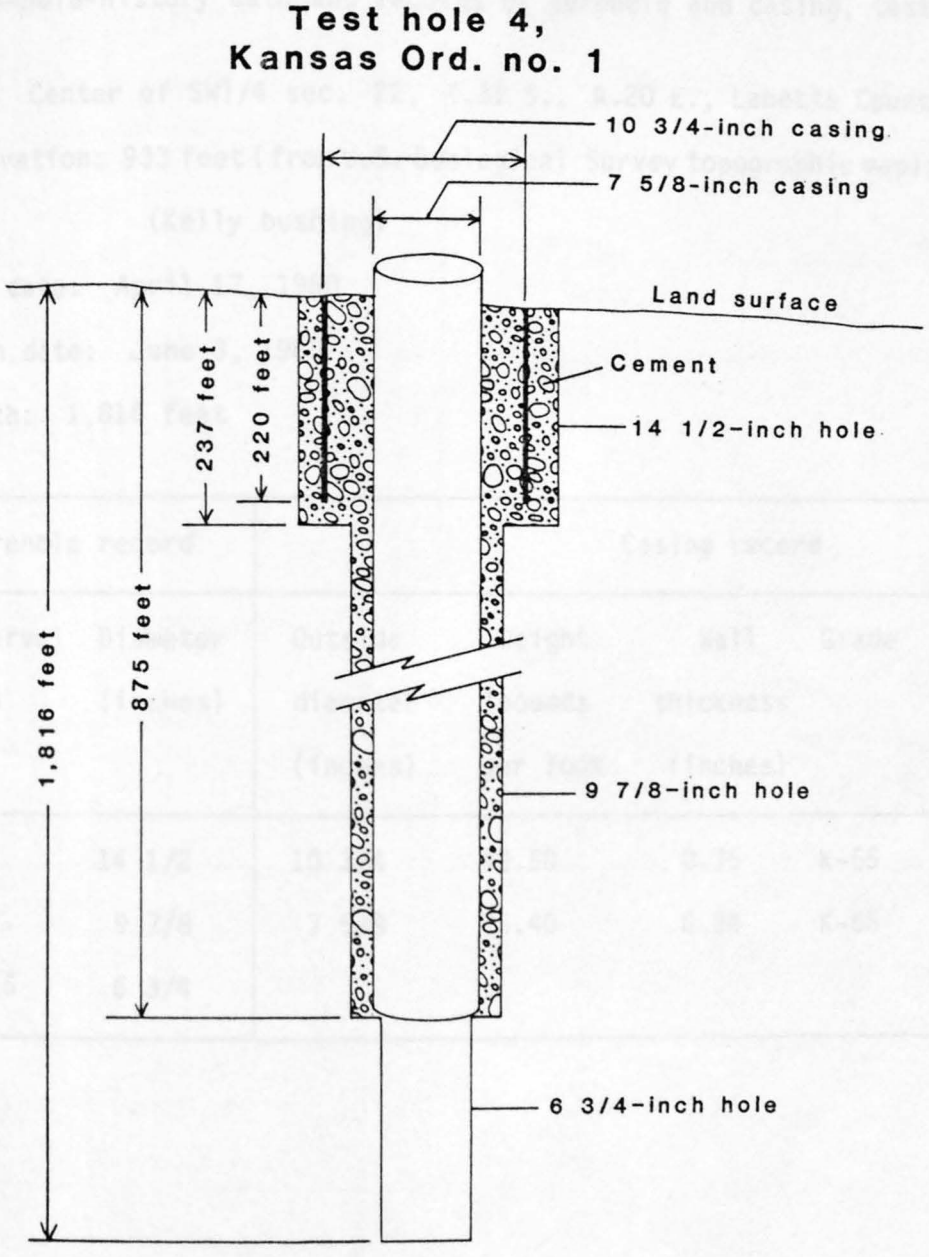


Figure 13.--Final well-construction details for test hole 4.

Table 13.--Hole-history data and records of borehole and casing, test hole 4

Location: Center of SW1/4 sec. 22, T.31 S., R.20 E., Labette County, Kansas

Ground elevation: 933 feet (from U.S. Geological Survey topographic map); 938 feet (Kelly bushing)

Beginning date: April 17, 1980

Completion date: June 3, 1980

Total depth: 1,816 feet

Borehole record		Casing record				
Depth interval (feet)	Diameter (inches)	Outside diameter (inches)	Weight (pounds per foot	Wall thickness (inches)	Grade	Depth interval (feet)
0 - 237	14 1/2	10 3/4	40.50	0.35	K-55	0 - 220
237 - 875	9 7/8	7 5/8	26.40	0.34	K-55	0 - 875
875 - 1,816	6 3/4					

Table 14.--Log-index sheet, test hole 4

[Logs available in Kansas Geological Survey, Well Sample Library, Wichita, Kans.]

Type log	Date	Run number	Depth (feet)		Logged interval (feet)
			Driller	Logger	
Schlumberger logs					
Dual-induction laterolog	4-22-80	1	875	876	220 - 870
	5-14-80	2	1,816	1,816	874 - 1,800
Sonic, borehole compensated	4-22-80	1	875	876	220 - 863
	5-14-80	2	1,815	1,815	873 - 1,813
Compensated neutron-formation density log	4-22-80	1	875	876	220 - 875
	5-14-80	2	1,816	1,815	875 - 1,814
U.S. Geological Survey logs					
Temperature	6-12-80	1	1,816	1,816	850 - 1,800
Flow logs, spinner and brine ejection types	7-14-80	1	1,816	1,816	950 - 1,600

A 7 5/8-inch diameter casing was installed to a depth of 875 feet and cemented in place to land surface. Subsequent to casing installation, a 6 3/4-inch diameter hole was drilled to a depth of 1,419 feet where a core was collected of the Arbuckle rocks from 1,419 to 1,434 feet (Appendix B). Then, drilling continued to a depth of 1,816 feet where circulation was lost. Repeated efforts to regain circulation were unsuccessful, and the decision was made to complete the hole at that depth. The sample description log of rock cuttings in test hole 4 by Virgil B. Cole indicates that drilling ended in the Gasconade Dolomite of the Arbuckle Group (fig. 14). Another identical series of electrical logs was run on the part of the hole between 873 feet and the total depth (table 14). Three drill-stem tests were run on Arbuckle intervals in the lower part of the hole. Mechanical problems were encountered in one of the tests (see "Hydrologic Testing," p. 49). The locations of packer seats for these tests were selected on the basis of sample cuttings, drilling time, and electrical-log inspection.

The well was cleared of drilling mud and developed by surging and pumping with air in three stages, similar to the method used in test hole 3. Water samples were collected at regular intervals at each stage until specific-conductance analyses indicated that formation water was being produced. After development a submersible pump was installed. The well then was pumped for 4 hours at a rate of 34 gal/min. Samples were collected for analyses at the end of this period. Results of these analyses are listed in table 15.

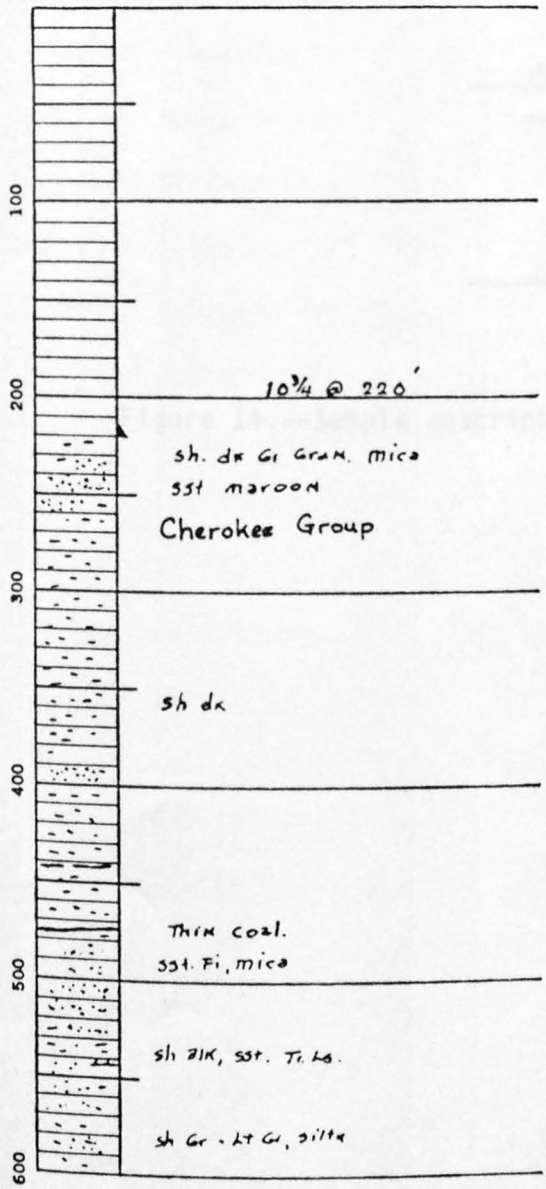
STATE: KANSAS
COUNTY: Labette
BLOCK:
SEC. 22
T 31S R 20E

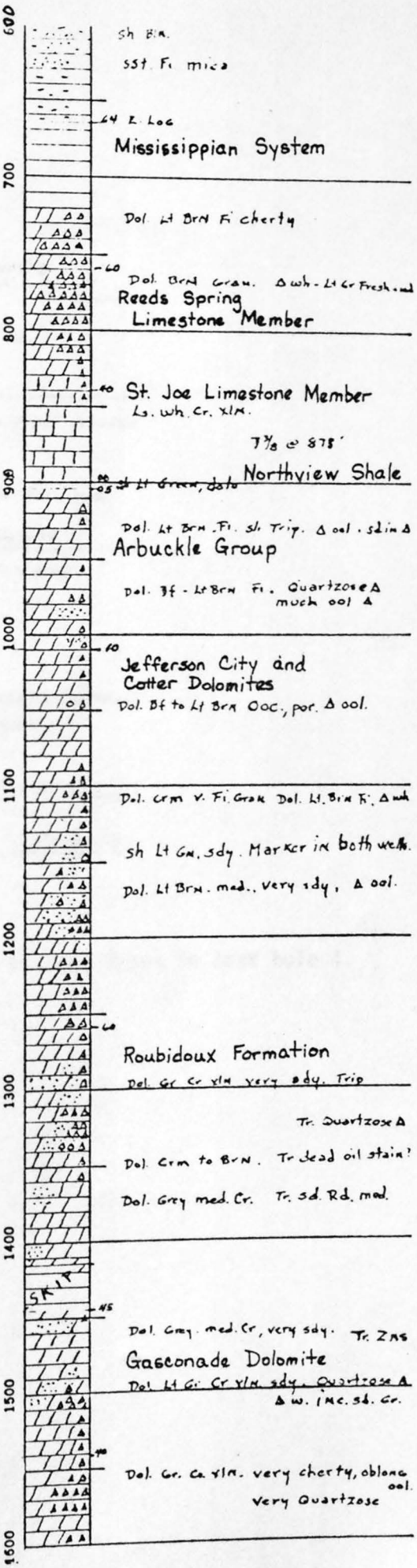
COMPANY U.S. Geol. Survey
FARM Kansas Ord. WELL NO. 1
SURVEY Approx Center SW/4
TOTAL DEPTH 1,816 ft
COMMENCED 4-17-80
COMPLETED 6-3-80
REMARKS
ALTITUDE 933 Gr (topo)
PRODUCTION

CASING RECORD
10 3/4" @ 220'
7 5/8" @ 875'

SHOT QUARTS BETWEEN

FORM 186 - In stock and for sale by Ross-Martin Co., Tulsa





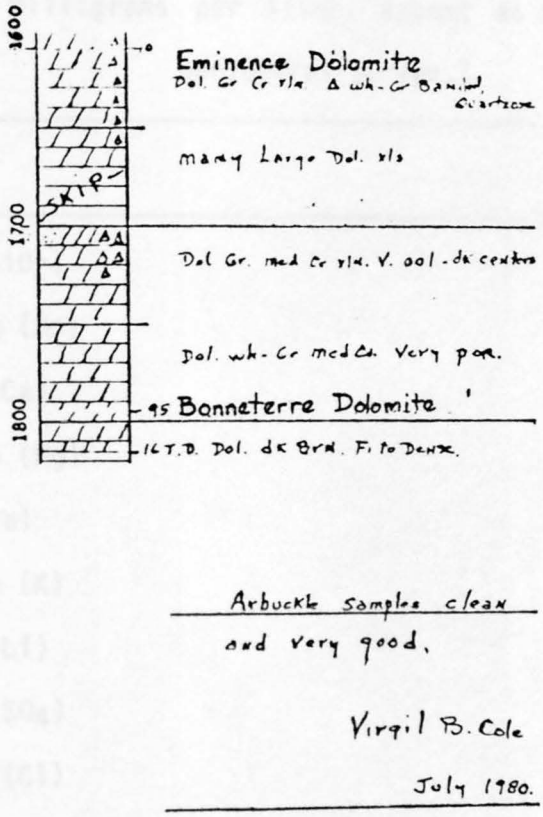


Figure 14.--Sample description log of rock types in test hole 4.

Table 15.--Results of chemical analyses of water produced from the Arbuckle Group, test hole 4

[Results given in milligrams per liter, except as noted. Analyses by U.S. Geological Survey.]

Constituent	Concentration
Dissolved silica (SiO_2)	22
Dissolved manganese (Mn)	0.48
Dissolved calcium (Ca)	857
Dissolved magnesium (Mg)	260
Dissolved sodium (Na)	5,500
Dissolved potassium (K)	90
Dissolved lithium (Li)	3.6
Dissolved sulfate (SO_4)	110
Dissolved chloride (Cl)	11,000
Dissolved fluoride (F)	2.7
Dissolved nitrogen (NO_2 + NO_3 as N)	0.06
Dissolved boron (B)	4.6
Total bromide (Br)	4.6
Total iodide (I)	0.68
Dissolved solids, residue at 180°C	18,400
Total alkalinity as $CaCO_3$	290
Total hardness as $CaCO_3$	< 3,200
Noncarbonate hardness as $CaCO_3$	2,900
Specific conductance (micromhos per centimeter at 25°C)	30,000
pH, units	7.3
Temperature (°C)	30

Table 15.--Results of chemical analyses of water produced from the Arbuckle Group, test hole 4 -- Continued

Constituent	Concentration
Dissolved aluminum (Al)	0.03
Dissolved antimony (Sb)	0.001
Dissolved arsenic (As)	0.012
Dissolved barium (Ba)	< 0.5
Dissolved beryllium (Be)	< 0.003
Dissolved cadmium (Cd)	0.022
Dissolved chromium (Cr)	0.020
Dissolved cobalt (Co)	< 0.008
Dissolved copper (Cu)	< 0.025
Dissolved lead (Pb)	0.110
Dissolved mercury (Hg)	0.0006
Dissolved molybdenium (Mo)	< 0.025
Dissolved nickel (Ni)	0.002
Dissolved selenium (Se)	0.001
Dissolved silver (Ag)	0.0
Dissolved strontium (Sr)	< 250
Dissolved vanadium (V)	< 0.008
Dissolved zinc (Zn)	0.013
Radium 226 (Ra_{226}) (picocuries per liter)	120

Hydrologic Testing

Five standard double-packer drill-stem tests were run on parts of the Mississippian and Arbuckle sections. Test 1 (Mississippian) was a misrun and not useful. Test 2 (Mississippian) was questionable because the packer seat may have been lost when the tool was shut-in. A better estimate of the true shut-in pressure is indicated by the flow pressure at the end of the first flow period. The results of drill-stem test 3, which was run on the lower part of the Mississippian and the upper part of the Arbuckle also show that the best estimate of shut-in pressure is indicated by the flow pressure at the end of the first flow period. For these reasons, the reproductions of the drill-stem charts are not included in Appendix A. Drill-stem test 4, according to Cole's log (fig. 14), was run on the Arbuckle between 1,230 and 1,443 feet. Test 5 was run on the Arbuckle between 1,516 and 1,816 feet. A summary of pressure data from the results of all tests and the amount of fluid recovered are given in table 16. The reproduction of pressure graphs and data provided by the contractor for drill-stem tests 4 and 5 are given in Appendix A.

Table 16.--Summary of drill-stem test data, test hole 4

[All depths are measured from the Kelly bushing, 938 feet above National Geodetic Vertical Datum of 1929. Pressures are reported in pounds-force per square inch (lbf/in^2).]

Test number	Formation	Interval tested (feet)	Gage depth (feet)	Flow pressures (lbf/in^2)				Shut-in pressure (lbf/in^2)		Hydrostatic pressure (lbf/in^2)		Remarks
				First period		Second period						
				Initial	Final	Initial	Final	Initial	Final	Initial	Final	
1	Mississippian System	680-875	-	Misrun								
2	Mississippian System	626-875	606	69.3	186.1	304.9*	293.0*	349.5*	343.5*	353.4	330.6	725 feet slightly water-cut mud. Questionable test.
			871	166.9	271.1	391.9*	376.2*	432.2*	430.2*	442.0	426.3	
3	Mississippian System - Arbuckle Group	875-1,151	841	82.1	252.4	250.4	257.4	-	-	412.8	411.8	480 feet water-cut mud. Questionable test.
			1,148	256.9	400.8	402.7	407.7	-	-	565.0	562.1	
4	Arbuckle Group	1,230-1,443	1,217	255.4	417.8	415.8	418.8	418.8	418.8	595.2	573.6	1,000 feet muddy water.
			1,440	479.1	522.6	522.6	522.6	522.6	522.6	707.1	679.4	
5	Arbuckle Group	1,516-1,816	1,494	327.0	495.8	496.8	541.5	542.6	541.5	544.6	538.4	1,185 feet muddy water.
			1,812	676.7	675.6	685.0	686.0	685.0	686.0	689.1	682.9	

* Questionable values due to mechanical problems.

REFERENCES

Bredehoeft, J. D., 1965, The drill-stem test--The petroleum industry's deep-well pumping test: Ground Water Journal, v. 3, no. 3, p. 31-36.

Horner, D. R., 1951, Pressure build-up in wells: Leiden, Holland, Proceedings of Third World Petroleum Congress, Section II, p. 503-521.

Ramey, H. J., Agarwal, R. G., and Martin, Ian, 1975, Analysis of "slug test" or DST flow period data: Journal of Canadian Petroleum Technology, July-September, p. 37-47.

Appendix A.--Drill-stem test charts.

CORRECTED COPY

FLUID SAMPLE DATA

Sampler Pressure _____ P.S.I.G. at Surface
Recovery: Cu. Ft. Gas _____
cc. Oil _____
cc. Water _____
cc. Mud _____
Tot. Liquid cc. _____
Gravity _____ ° API @ _____ °F.
Gas/Oil Ratio _____ cu. ft./bbl.

	RESISTIVITY			CHLORIDE CONTENT
Recovery Water	___	@ ___	°F.	___ ppm
Recovery Mud	___	@ ___	°F.	___ ppm
Recovery Mud Filtrate	___	@ ___	°F.	___ ppm
Mud Pit Sample	___	@ ___	°F.	___ ppm
Mud Pit Sample Filtrate	___	@ ___	°F.	___ ppm

Mud Weight 8.4 vis 43 sec.

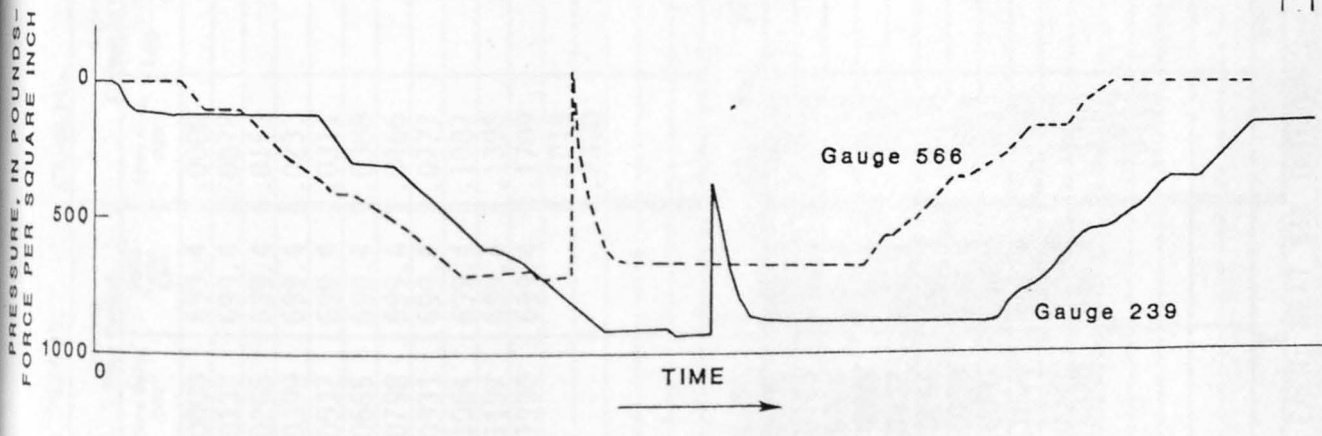
Date 12-10-79 Ticket Number 522592
Kind of D.S.T. OPEN HOLE PACKER DST Halliburton Location EL DORADO
Tester MR. RIEDEL Witness ???
Drilling Contractor COMPANY TOOLS IC-bj - bj

EQUIPMENT & HOLE DATA

Formation Tested	Arbuckle		
Elevation	843'		Ft.
Net Productive Interval	419'		Ft.
All Depths Measured From	Ground Level		
Total Depth	2179'		Ft.
Main Hole/Casing Size	5 5/8"		
Drill Collar Length	-	I.D. -	
Drill Pipe Length	1722'	I.D. 2.151"	
Packer Depth(s)	1755'	1760'	Ft.
Depth Tester Valve	1738'		Ft.

Cushion TYPE AMOUNT Ft. Depth Back Pres. Valve Surface Choke 1/4" Bottom Choke .62"

Recovered 1247 Feet of watery mud
Recovered 300 Feet of water



TEMPERATURE	Gauge No. 566	Gauge No. 239	Gauge No.	TIME (00:00-24:00 hrs.)
	Depth: 1740' Ft.	Depth: 2175' Ft.	Depth: Ft.	
Est. 120 °F.	12 Hour Clock	12 Hour Clock	Hour Clock	Tool Opened 0147
	Blanked Off NO	Blanked Off YES	Blanked Off	Opened Bypass 0425
Actual °F.	Pressures	Pressures	Pressures	

		Field	Office	Field	Office	Field	Office	Reported Minutes	Computed Minutes
Initial Hydrostatic		725	728.8	-	927.0			—	—
First Period	Flow Initial	99	115.8	-	373.0			45	45
	Flow Final	692	698.4	-	894.4			60	60
	Closed in	701	699.4	-	896.4			—	—
Second Period	Flow Initial	701	699.4	-	896.4			20	20
	Flow Final	701	699.4	-	896.4			30	30
	Closed in	701	699.4	-	896.4			—	—
Third Period	Flow Initial								
	Flow Final								
	Closed in							—	—
Final Hydrostatic		701	701.3	-	901.3				

FORM 101-R2 – PRINTED IN U.S.A.

LITTLE'S 11033 75C 2/80

Legal Location Sec. - Twp. - Rng. 18 18 23E
Lease Name WATSON
Well No. 1
Test No. 1
Tested Interval 1760' to 2179'
Field Area
Mea. From
Lease Owner/Company Name UNITED STATES GEOLOGICAL SURVEY & KANSAS GEOLOGICAL SURVEY
MIAMI
State KANSAS

FORMATION TEST DATA

CORRECTED COPY

Gauge No.	566	Depth	1740'	Clock No.	17419	12 hour	Ticket No.	522592

	First Flow Period		First Closed In Pressure			Second Flow Period		Second Closed In Pressure			Third Flow Period		Third Closed In Pressure		
	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.
0	.0000	115.8	.0000		698.4	.0000	699.4	.0000		699.4					
1	.0200	226.7	.0067		698.4	.0133	699.4	.0078		699.4					
2	.0400	338.6	.0133		698.4	.0266	699.4	.0155		699.4					
3	.0600	437.6	.0200		699.4	.0399	699.4	.0233		699.4					
4	.0800	519.6	.0267		699.4	.0532	699.4	.0311		699.4					
5	.1000	580.5	.0333		699.4	.0665	699.4	.0388		699.4					
6	.1200	625.7	.0400		699.4	.0798	699.4	.0466		699.4					
7	.1400	657.1	.1000		699.4	.0931	699.4	.0777		699.4					
8	.1600	677.7	.1600		699.4	.1064	699.4	.1087		699.4					
9	.1800	688.6	.2200		699.4	.1197	699.4	.1398		699.4					
10	.2000	692.5	.2800		699.4	.1330	699.4	.1709		699.4					
11	.2200	694.4	.3400		699.4			.2019		699.4					
12	.2400	696.4	.4000		699.4			.2330		699.4					
13	.2600	697.4													
14	.2800	698.4													
15	.3000	698.4													

Gauge No.	239		Depth	2175'		Clock No.	17418	12 hour						
0	.0000	373.0	.0000		894.4	.0000	896.4	.0000		896.4					
1	.0200	470.2	.0067		894.4	.0133	896.4	.0078		896.4					
2	.0400	570.0	.0133		894.4	.0266	896.4	.0155		896.4					
3	.0600	657.7	.0200		894.4	.0399	896.4	.0233		896.4					
4	.0800	731.7	.0267		894.4	.0532	896.4	.0311		896.4					
5	.1000	788.9	.0333		894.4	.0665	896.4	.0388		896.4					
6	.1200	829.3	.0400		894.4	.0798	896.4	.0466		896.4					
7	.1400	858.9	.1000		895.4	.0931	896.4	.0777		896.4					
8	.1600	876.7	.1600		895.4	.1064	896.4	.1087		896.4					
9	.1800	885.6	.2200		895.4	.1197	896.4	.1398		896.4					
10	.2000	889.5	.2800		895.4	.1330	896.4	.1709		896.4					
11	.2200	891.5	.3400		895.4			.2019		896.4					
12	.2400	892.5	.4000		896.4			.2330		896.4					
13	.2600	893.4													
14	.2800	894.4													
15	.3000	894.4													
Reading Interval	2		*			2		**							Minutes

REMARKS: * FIRST SIX INTERVALS = 1 MINUTE EACH; NEXT SIX INTERVALS = 9 MINUTES EACH; ** FIRST SIX INTERVALS = 1 MINUTE EACH; NEXT SIX INTERVALS = 4 MINUTES EACH....

FORM 183-R1—PRINTED IN U.S.A.

SPECIAL PRESSURE DATA

LITTLE'S 96673 75C 8/74

CORRECTED COPY

FLUID SAMPLE DATA

Sampler Pressure _____ P.S.I.G. at Surface
Recovery: Cu. Ft. Gas _____
cc. Oil _____
cc. Water _____
cc. Mud _____
Tot. Liquid cc. _____
Gravity _____ ° API @ _____ °F.
Gas/Oil Ratio _____ cu. ft./bbl.

	RESISTIVITY		CHLORIDE CONTENT
Recovery Water	____ @ ____	°F.	____ ppm
Recovery Mud	____ @ ____	°F.	____ ppm
Recovery Mud Filtrate	____ @ ____	°F.	____ ppm
Mud Pit Sample	____ @ ____	°F.	____ ppm
Mud Pit Sample Filtrate	____ @ ____	°F.	____ ppm

Mud Weight 8.4 vis 42 sec.

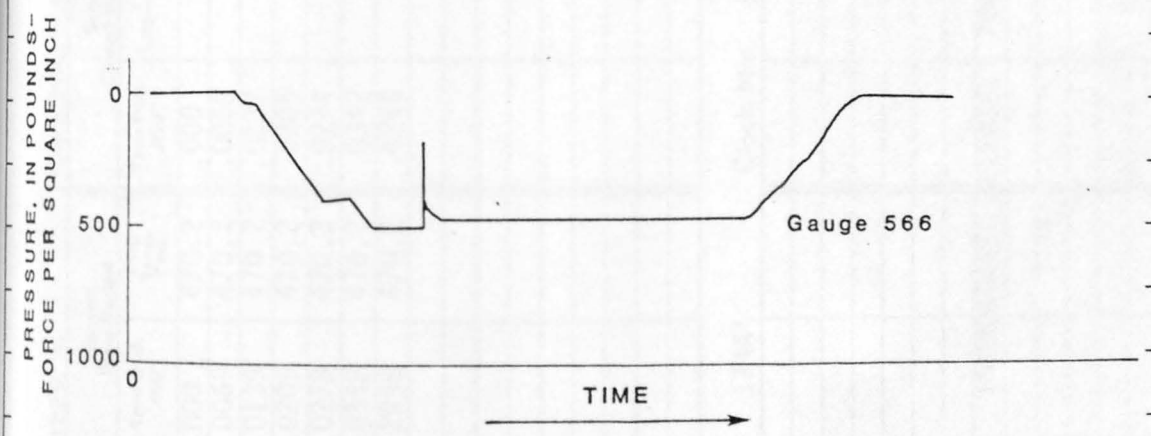
Date 12-11-79 Ticket Number 522593
Kind of D.S.T. OPEN HOLE OFF BOTTOM STRADDLE DST Halliburton Location EL DORADO
Tester MR. RIEDEL Witness ???
Drilling Contractor COMPANY TOOLS IC-DR

EQUIPMENT & HOLE DATA

Formation Tested Arbuckle
Elevation 843' Ft.
Net Productive Interval 490' Ft.
All Depths Measured From Ground Level
Total Depth 2179' Ft.
Main Hole/Casing Size 5 5/8"
Drill Collar Length - I.D. -
Drill Pipe Length 1210' I.D. 2.151"
Packer Depth(s) 1245-1735' Ft.
Depth Tester Valve 1227' Ft.

Cushion TYPE AMOUNT Ft. Depth Back Pres. Valve
Surface Choke 1/4" Bottom Choke .62"

Recovered 865 Feet of mud
Recovered 120 Feet of black water



TEMPERATURE	Gauge No. 566 Depth: 1229' Ft.	Gauge No. 239 Depth: 1744' Ft.	Gauge No. Depth: Ft.	TIME (00:00-24:00 hrs.)
	12 Hour Clock	12 Hour Clock	Hour Clock	Tool Opened 14:50
Est. 120 °F.	Blanked Off No	Blanked Off Yes	Blanked Off	Opened Bypass 17:40
Actual °F.	Pressures	Pressures	Pressures	

		Field	Office	Field	Office	Field	Office	Reported Minutes	Computed Minutes
Initial Hydrostatic		515	495.0		729.3			___	___
First Period Flow	Initial	139	154.4					20	22
	Final	426	470.2					45	43
	Closed in	465	470.2	HYDROSTATIC				___	___
Second Period Flow	Initial	465	470.2	RELEASE:				45	43
	Final	465	470.2					60	62
	Closed in	465	470.2					___	___
Third Period Flow	Initial								
	Final								
	Closed in							___	___
Final Hydrostatic		515	481.1		720.4				

Legal Location Sec. - Twp. - Rng. 18-18-23E
Lease Name WATSON
Well No. 1
Test No. 2
Tested Interval 1245-1735'
Lease Owner/Company Name UNITED STATES GEOLOGICAL SURVEY
Field Area
County MIAMI
State KANSAS
Meas. From Tester Valve

FORM 101-82 — PRINTED IN U.S.A.

FORMATION TEST DATA

LITTLE'S 111033 75C 2/80

CORRECTED COPY

Gauge No.	566	Depth	1229' ft	Clock No.	17419	12 hour	Ticket No.	522593

	First Flow Period		First Closed In Pressure			Second Flow Period		Second Closed In Pressure			Third Flow Period		Third Closed In Pressure		
	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.
0	.000	154.4	.000		470.2	.000	470.2	.000		470.2					
1	.0068	355.4	.0069		470.2	.0069	470.2	.0068		470.2					
2	.0136	384.1	.0139		470.2	.0139	470.2	.0137		470.2					
3	.0205	407.9	.0209		470.2	.0209	470.2	.0205		470.2					
4	.0273	429.7	.0278		470.2	.0278	470.2	.0274		470.2					
5	.0341	445.5	.0348		470.2	.0348	470.2	.0342		470.2					
6	.0409	454.4	.2990		470.2	.2990	470.2	.4240		470.2					
7	.0477	461.3													
8	.0546	465.3													
9	.0614	466.3													
10	.0682	467.3													
11	.0818	468.3													
12	.0955	469.3													
13	.1091	470.2													
14	.1227	470.2													
15	.1364	470.2													
	.1500	470.2													

Gauge No.	239	Depth	1744'	Clock No.	17418	hour	12

0															
1															
2															
3															
4															
5															
6															
7								HYDROSTATIC RELEASE:		704.7					
8															
9															
10															
11															
12															
13															
14															
15															
Reading Interval		*		**			**		****						Minutes

REMARKS: *-First 10 intervals equal to 1minute each; last 6 intervals equal to 2 minutes each. **-First 5 intervals equal 1 minute each; last interval equal to 38 minutes ***-First 5 intervals equal to 1minute each; last interval equal to 57 minutes.

FORM 183-R1—PRINTED IN U.S.A.

SPECIAL PRESSURE DATA

LITTLE'S 96673 75C 8/74

FLUID SAMPLE DATA

Sampler Pressure _____ P.S.I.G. at Surface

Recovery: Cu. Ft. Gas _____

cc. Oil _____

cc. Water _____

cc. Mud _____

Tot. Liquid cc. _____

Gravity _____ ° API @ _____ °F.

Gas/Oil Ratio _____ cu. ft./bbl.

		RESISTIVITY		CHLORIDE CONTENT
Recovery Water	@	°F.		ppm
Recovery Mud	@	°F.		ppm
Recovery Mud Filtrate	@	°F.		ppm
Mud Pit Sample	@	°F.		ppm
Mud Pit Sample Filtrate	@	°F.		ppm

Mud Weight 10.2 vis 44 SEC qt

Date 1-14-80 Ticket Number 708573

Kind of Job OPEN HOLE PACKER DST Halliburton District OBERLIN

Tester H.L. NUTTING Witness F. GREGORY

Drilling Contractor WESTERN WELL AND PUMP DR

EQUIPMENT & HOLE DATA

Formation Tested Lansing – Kansas City

Elevation 1110' Ft.

Net Productive Interval 343' Ft.

All Depths Measured From Kelly Bushing

Total Depth 955' Ft.

Main Hole/Casing Size 9 7/8"

Drill Collar Length 260' I.D. 2.25"

Drill Pipe Length 323' I.D. 2.150"

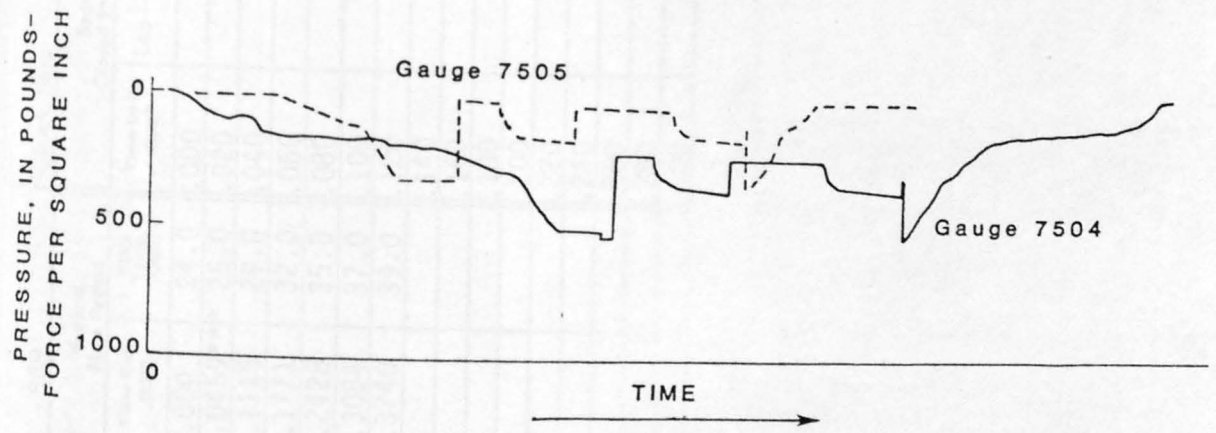
Packer Depth(s) 606-612' Ft.

Depth Tester Valve 587' Ft.

Cushion TYPE AMOUNT Ft. Depth Back Pres. Valve

Surface Choke .25" Bottom Choke .75"

Recovered 60 Feet of mud



TEMPERATURE	Gauge No. 7505	Gauge No. 7504	Gauge No.	TIME
	Depth: 589 Ft.	Depth: 951 Ft.	Depth: Ft.	
Est. °F.	12 Hour Clock	12 Hour Clock	Hour Clock	Tool Opened 1110 A.M. P.M.
Actual 950' 84 °F.	Blanked Off No	Blanked Off Yes	Blanked Off	Opened A.M. Bypass 1400 P.M.

		Pressures		Pressures		Pressures		Reported Minutes	Computed Minutes
		Field	Office	Field	Office	Field	Office		
Initial Hydrostatic		301	309.6		508.0				
First Period Flow	Initial	10	15.0		214.8			———	———
	Final	20	20.0		221.8			35	23
	Closed in	160	161.3		360.4			45	44
Second Period Flow	Initial	20	24.0		223.8			———	———
	Final	30	39.0		238.9			45	(57)
	Closed in	160	160.3		356.4			45	45
Third Period Flow	Initial							———	———
	Final								
	Closed in								
Final Hydrostatic		301	310.6		510.0			———	———

Legal Location Sec. - Twp. - Rng. 13 - 12 S - 17 E

Lease Name BIG SPRINGS

Well No. 1

Test No. 1

Tested Interval 612-955'

Field Area WILDCAT

1 Mea. From Tester Valve

County DOUGLAS

State KANSAS

Lease Owner/Company Name DOUGLAS COUNTY FAIR AND LIVESTOCK ASSOCIATION

FORM 181-R1—PRINTED IN U.S.A.

FORMATION TEST DATA

LITTLE'S 34671 10M 8/74

Gauge No.	7505		Depth	589'		Clock No.	12869		12 hour	Ticket No.	708573					
	First Flow Period		First Closed In Pressure			Second Flow Period			Second Closed In Pressure			Third Flow Period		Third Closed In Pressure		
	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.		Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.
0	.000	15.0	.000		20.0	.000	24.0		.000		39.0					
1	.0202*	13.0	.0133**		76.1	.0459***	25.0		.020		92.1					
2	.0472	14.0	.0332		108.2	.1115	29.0		.040		116.2					
3	.0741	16.0	.0531		126.2	.1771	32.0		.060		130.2					
4	.1011	17.0	.0730		137.2	.2428	35.0		.080		139.2					
5	.1281	18.0	.0929		144.2	.3084	37.0		.100		145.2					
6	.1550	20.0	.1128		149.2	.3740	39.0		.120		148.2					
7			.1327		152.3				.140		151.3					
8			.1526		154.3				.160		153.3					
9			.1725		156.3				.180		155.3					
10			.1925		158.3				.200		156.3					
11			.2124		159.3				.220		157.3					
12			.2323		160.3				.240		158.3					
13			.2522		161.3				.260		159.3					
14			.2721		161.3				.280		160.3					
15			.2920		161.3				.300		160.3					

Gauge No.	7504				Depth	951'		Clock No.	7101		hour	12				
0	.000	214.8	.000		221.8	.000	223.8	.000		238.9						
1	.0202*	214.8	.0132**		276.1	.0464***	225.9	.0201		292.1						
2	.0472	216.8	.0331		308.2	.1127	229.9	.0401		315.2						
3	.0741	217.8	.0529		326.3	.1790	232.9	.0602		328.3						
4	.1011	219.8	.0728		337.3	.2454	234.9	.0802		337.3						
5	.1280	220.8	.0926		344.3	.3117	236.9	.1003		342.3						
6	.1550	221.8	.1124		349.3	.3780	238.9	.1204		346.3						
7			.1323		351.4			.1404		348.3						
8			.1521		353.4			.1605		350.3						
9			.1720		355.4			.1805		351.4						
10			.1918		357.4			.2006		353.4						
11			.2116		358.4			.2207		354.4						
12			.2315		359.4			.2407		355.4						
13			.2513		360.4			.2608		356.4						
14			.2712		360.4			.2808		356.4						
15			.2910		360.4			.3010		356.4						
Reading Interval	4		3			10		3								Minutes

REMARKS: *-3 minutes **-2 minutes ***-7 minutes

67

FORM 188-A1—PRINTED IN U.S.A.

SPECIAL PRESSURE DATA

LITTLE'S P6673 75C 4/74

FLUID SAMPLE DATA

Sampler Pressure _____ P.S.I.G. at Surface
Recovery: Cu. Ft. Gas _____
cc. Oil _____
cc. Water _____
cc. Mud _____
Tot. Liquid cc. _____
Gravity _____ ° API @ _____ °F.
Gas/Oil Ratio _____ cu. ft./bbl.

	RESISTIVITY		CHLORIDE CONTENT
Recovery Water	____ @ ____	°F.	____ ppm
Recovery Mud	____ @ ____	°F.	____ ppm
Recovery Mud Filtrate	____ @ ____	°F.	____ ppm
Mud Pit Sample	____ @ ____	°F.	____ ppm
Mud Pit Sample Filtrate	____ @ ____	°F.	____ ppm

Mud Weight 11 vis 47 sec.

Date 2-7-80 Ticket Number 521706
Kind of D.S.T. OPEN HOLE PACKER Halliburton Location EL DORADO
Tester MR. RIEDEL Witness MR. GOGEL
Drilling Contractor WESTERN WELL AND PUMP, INCORPORATED

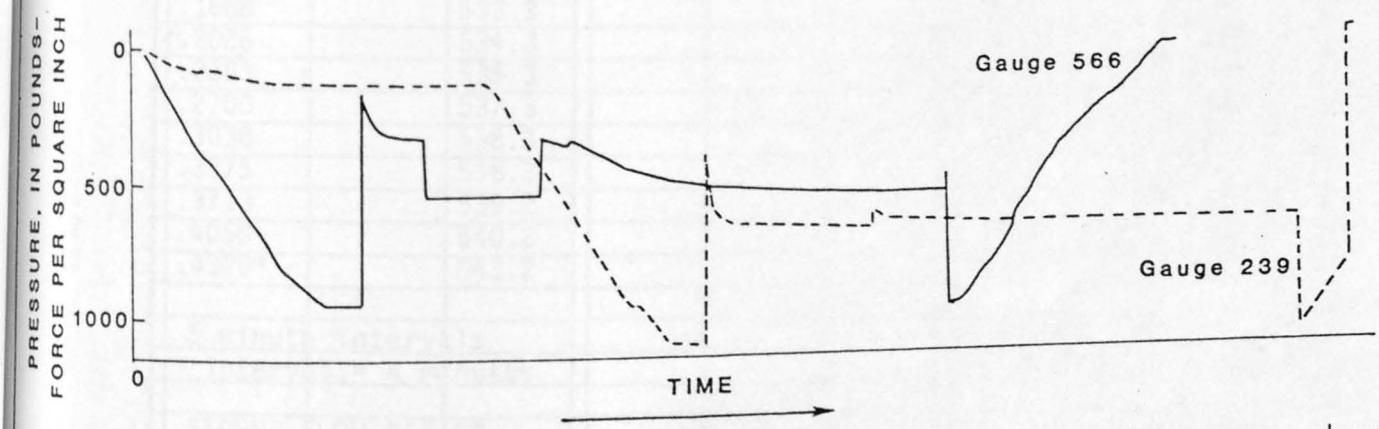
EQUIPMENT & HOLE DATA

Formation Tested	Mississippi	
Elevation	1110'	Ft.
Net Productive Interval	181'	Ft.
All Depths Measured From	Kelly Bushing	
Total Depth	1896'	Ft.
Main Hole/Casing Size	9 5/8"	
Drill Collar Length	- I.D. -	
Drill Pipe Length	1623' I.D. 2.15"	
Packer Depth(s)	1650' - 1715'	Ft.
Depth Tester Valve	1632'	Ft.

Cushion TYPE AMOUNT Ft. Depth Back Pres. Valve Surface Choke 1/4" Bottom Choke 3/4"

Recovered 540 Feet of Mud

Remarks Charts indicate severe plugging of anchor perforations.



TEMPERATURE	Gauge No. 566	Gauge No. 239	Gauge No.	TIME (00:00-24:00 hrs.)
Calc.	Depth: 1634' Ft.	Depth: 1892' Ft.	Depth: Ft.	Tool Opened 1256
Est. 100 °F.	12 Hour Clock	12 Hour Clock	Hour Clock	
	Blanked Off -	Blanked Off Yes	Blanked Off	Opened Bypass 1830
Actual °F.	Pressures	Pressures	Pressures	

		Field	Office	Field	Office	Field	Office	Reported Minutes	Computed Minutes
Initial Hydrostatic		957	945.9		1089.9			—	—
First Period Flow	Initial	158	161.3		573.8			34	33
	Final	327	311.8		674.2			60	64
	Closed in	544	543.2		691.9			—	—
Second Period Flow	Initial	327	298.0		622.0			20	18
	Final	317	336.6		668.3			220	219
	Closed in	529	537.3		684.0			—	—
Third Period Flow	Initial								
	Final								
	Closed in							—	—
Final Hydrostatic		937	941.0		1087.9				

FORM 101-82 — PRINTED IN U.S.A.

LITTLE'S 111033 75C 2/80

FORMATION TEST DATA

Legal Location Sec. Twp. Rng. 13 - 12S - 17E
Lease Name LIVESTOCK DCL
Well No. 1
Test No. 2
Field Area
Meas. From
Tested Interval 1715' - 1896'
Lease Owner/Company Name UNITED STATES GEOLOGICAL SURVEY
DOUGLAS
State KANSAS

Re-read for CIP pressure breakdown readings as per customer request

UNITED STATES GEOLOGICAL SURVEY
Lease Owner/Company Name

521706
Ticket Number

B.T. 566 | B.T. | B.T. 239

Depth 1634' | Depth | Depth 1892'

HOUR 12 - 17419 | HOUR 12 - 17418

	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.
	FIRST FLOW PERIOD						FIRST FLOW PERIOD		
0	.0000		161.3				.0000		573.8
1	.2260		311.8				.2300		674.2
	FIRST CLOSED IN PERIOD						FIRST CLOSED IN PERIOD		
0	.0000		311.8				.0000		674.2
1.	.0338		524.5				.0341		680.1
2	.0675		527.5				.0683		684.0
3	.1013		529.4				.1024		686.0
4	.1350		531.4				.1366		687.0
5	.1688		533.3				.1707		687.0
6	.2025		534.3				.2048		688.0
7	.2363		535.3				.2390		688.9
8	.2700		537.3				.2731		688.9
9	.3038		538.3				.3073		688.9
10	.3375		538.3				.3414		688.9
11	.3713		539.2				.3755		689.9
12	.4050		540.2				.4097		690.9
13	.4320*		543.2				.4370*		691.9
	5 minute intervals						5 minute intervals		
	* interval = 4 minutes						* interval = 4 minutes		
	SECOND FLOW PERIOD						SECOND FLOW PERIOD		
0	.0000		298.0				.0000		622.0
1	.1210		336.6				.1220		668.3
	SECOND CLOSED IN PERIOD						SECOND CLOSED IN PERIOD		
0	.0000		336.6				.0000		668.3
1	.0673		361.3				.0673		675.2
2	.1345		398.0				.1345		678.1
3	.2018		426.7				.2018		679.1
4	.2690		450.4				.2690		679.1
5	.3363		468.3				.3363		680.1
6	.4036		483.1				.4036		680.1
7	.4708		494.0				.4708		681.1
8	.5381		501.9				.5381		682.0
9	.6053		508.8				.6053		682.0
10	.6726		513.7				.6726		682.0
	(CONTINUED)						(CONTINUED)		

Remarks:

Re-read for CIP pressure breakdown readings as per customer request

UNITED STATES GEOLOGICAL SURVEY — Lease Owner/Company Name

521706 — Ticket Number

B.T. 566	B.T.	B.T. 239
Depth 1634'	Depth	Depth 1892'
HOUR 12 - 17419		HOUR 12 - 17418

	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.
11	.7399		518.6				.7399		682.0
12	.8071		527.5				.8071		682.0
13	.8744		533.3				.8744		683.0
14	.9416		534.3				.9416		683.0
15	1.0089		534.3				1.0089		683.0
16	1.0762		534.3				1.0762		683.0
17	1.1434		534.3				1.1434		683.0
18	1.2107		534.3				1.2107		683.0
19	1.2779		534.3				1.2779		684.0
20	1.3452		534.3				1.3452		684.0
21	1.4125		535.3				1.4125		684.0
22	1.4730		537.3				1.4730		684.0
	10 minute intervals						10 minute intervals		
	** interval = 9 minutes						** interval = 9 minutes		

Remarks:

FLUID SAMPLE DATA

Sampler Pressure _____ P.S.I.G. at Surface
Recovery: Cu. Ft. Gas _____
cc. Oil _____
cc. Water _____
cc. Mud _____
Tot. Liquid cc. _____
Gravity _____ ° API @ _____ °F.
Gas/Oil Ratio _____ cu. ft./bbl.

	RESISTIVITY		CHLORIDE CONTENT
Recovery Water	____ @ ____	°F.	____ ppm
Recovery Mud	____ @ ____	°F.	____ ppm
Recovery Mud Filtrate	____ @ ____	°F.	____ ppm
Mud Pit Sample	____ @ ____	°F.	____ ppm
Mud Pit Sample Filtrate	____ @ ____	°F.	____ ppm

Mud Weight 9.3 vis 44 sec.

Date 2-16-80 Ticket Number 521708
Kind of D.S.T. OPEN HOLE Halliburton Location EL DORADO
Tester E. L. RIEDEL Witness TONY GOGEL
Drilling Contractor WESTERN WELL & PUMP, INCORPORATED bj

EQUIPMENT & HOLE DATA

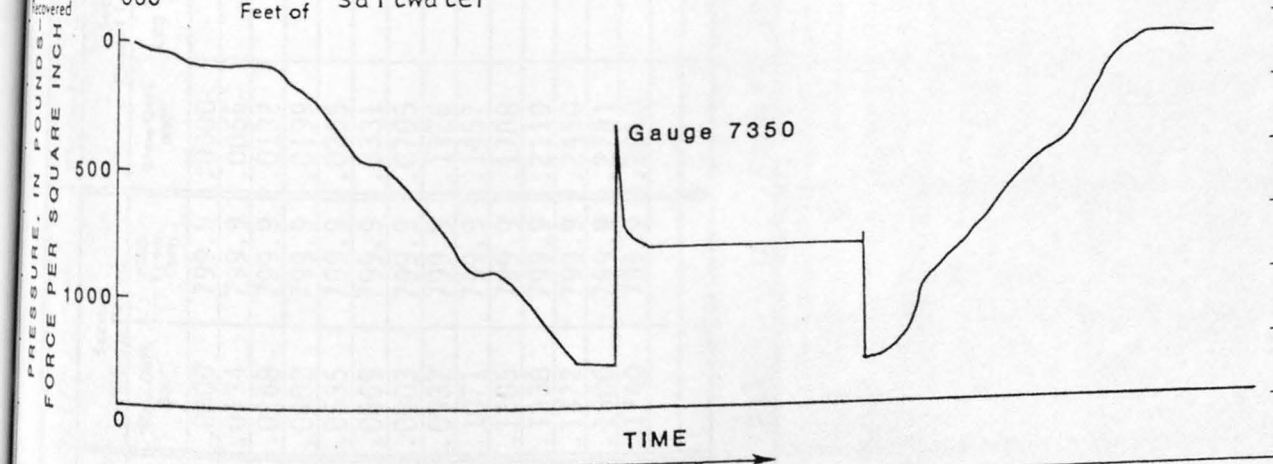
Formation Tested Viola
Elevation 1110' Ft.
Net Productive Interval 95' Ft.
All Depths Measured From Kelly Bushing
Total Depth 2335' Ft.
Main Hole/Casing Size 9 7/8"
Drill Collar Length 173' I.D. 2.25"
Drill Pipe Length 2027' I.D. 2.15"
Packer Depth(s) 2233' 2240' Ft.
Depth Tester Valve 2215' Ft.

Cushion TYPE AMOUNT Ft. Depth Back Pres. Valve Surface Choke 1/4" Bottom Choke 3/4"

Recovered 400 Feet of mud Remarks

Recovered 500 Feet of muddy saltwater UTR = UNABLE TO READ....

Recovered 660 Feet of saltwater



TEMPERATURE	Gauge No. 7350 Depth: 2217' Ft.	Gauge No. 7349 Depth: 2332' Ft.	Gauge No. Depth: Ft.	TIME (00:00-24:00 hrs.)
Calc. Est. 100 °F.	12 Hour Clock	12 Hour Clock	Hour Clock	Tool Opened 1355
Actual °F.	Blanked Off NO	Blanked Off YES	Blanked Off	Opened Bypass 1620

		Pressures Field	Pressures Office	Pressures Field	Pressures Office	Pressures Field	Pressures Office	Reported Minutes	Computed Minutes
Initial Hydrostatic		1258	1238.7		UTR			—	—
Initial Flow Period	Initial	349	356.2					30	30
	Final	799	796.9					45	45
	Closed in	799	798.9		Clock			—	—
Final Flow Period	Initial	799	799.9		Stopped			25	26
	Final	799	799.9					45	45
	Closed in	799	799.9					—	—
Initial Flow Period	Initial								
	Final								
	Closed in							—	—
Final Hydrostatic		1258	1231.6		UTR				

Legal Location Sec. - Twp. - Rng. 13 12S 17E
Lease Name LIVESTOCK DCC
Well No. FA #1
Test No. 3
Tested Interval 2240' to 2335'
Lease Owner/Company Name UNITED STATES GEOLOGICAL SURVEY
Field Area
County DOUGLAS
State KANSAS
Meas. From Tester Valve

FORM 101-82 — PRINTED IN U.S.A.

FORMATION TEST DATA

CORRECTED COPY

Gauge No. 7350	Depth 2217'	Clock No. 17419	12 hour	Ticket No. 521708

	First Flow Period		First Closed In Pressure			Second Flow Period		Second Closed In Pressure			Third Flow Period		Third Closed In Pressure		
	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.
0	.0000	356.2	.0000		796.9	.0000	799.9	.0000		799.9					
1	.0134	523.4	.0067		797.9	.0134	799.9	.0066		799.9					
2	.0268	647.9	.0134		797.9	.0268	799.9	.0132		799.9					
3	.0402	731.6	.0201		797.9	.0402	799.9	.0199		799.9					
4	.0536	772.4	.0268		798.9	.0535	799.9	.0265		799.9					
5	.0670	787.7	.0334		798.9	.0669	799.9	.0331		799.9					
6	.0804	792.8	.0669		798.9	.0803	799.9	.0795		799.9					
7	.0938	793.8	.1003		798.9	.0937	799.9	.1126		799.9					
8	.1072	794.8	.1338		798.9	.1071	799.9	.1457		799.9					
9	.1206	794.8	.1672		798.9	.1205	799.9	.1788		799.9					
10	.1340	795.9	.2007		798.9	.1338	799.9	.2119		799.9					
11	.1474	795.9	.2341		798.9	.1472	799.9	.2450		799.9					
12	.1608	796.9	.2676		798.9	.1606	799.9	.2781		799.9					
13	.1742	796.9	.3010		798.9	.1740	799.9	.2980		799.9					
14	.1876	796.9													
15	.2010	796.9													

Gauge No. 7349	Depth 2332'	Clock No. 17418	12 hour

No readings available....clock stopped....

0															
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															

Reading Interval 2	*	2	*	Minutes

REMARKS: * FIRST FIVE INTERVALS = 1 MINUTE EACH; LAST EIGHT INTERVALS = 5 MINUTES EACH

FORM 193-RI—PRINTED IN U.S.A.

SPECIAL PRESSURE DATA

LITTLE'S 84433 INC 8/74

LIVESTOCK
Lease Name

13 12 17E
Legal Location Sec. - Twp. - Rng.

1
Well No.

4
Test No.

2379' to 2508' * setnote
Tested Interval

WESTERN WELL & PUMP, INCORPORATED
Lease Owner/Company Name

DOUGLAS
County

KANSAS
State

FLUID SAMPLE DATA

Sampler Pressure ________ P.S.I.G. at Surface
Recovery: Cu. Ft. Gas ________
cc. Oil ________
cc. Water ________
cc. Mud ________
Tot. Liquid cc. ________
Gravity ________ ° API @ ________ °F.
Gas/Oil Ratio ________ cu. ft./bbl.

	RESISTIVITY	CHLORIDE CONTENT
Recovery Water	___ @ ___ °F.	___ ppm
Recovery Mud	___ @ ___ °F.	___ ppm
Recovery Mud Filtrate	___ @ ___ °F.	___ ppm
Mud Pit Sample	___ @ ___ °F.	___ ppm
Mud Pit Sample Filtrate	___ @ ___ °F.	___ ppm

Mud Weight 9.2 vis 42 sec.

Date 3-6-80 Ticket Number 521717
Kind of D.S.T. OPEN HOLE Halliburton Location EL DORADO
Tester MR. RIEDEL Witness MR. MITCHELL
Drilling Contractor WESTERN WELL & PUMP INCORPORATED

EQUIPMENT & HOLE DATA

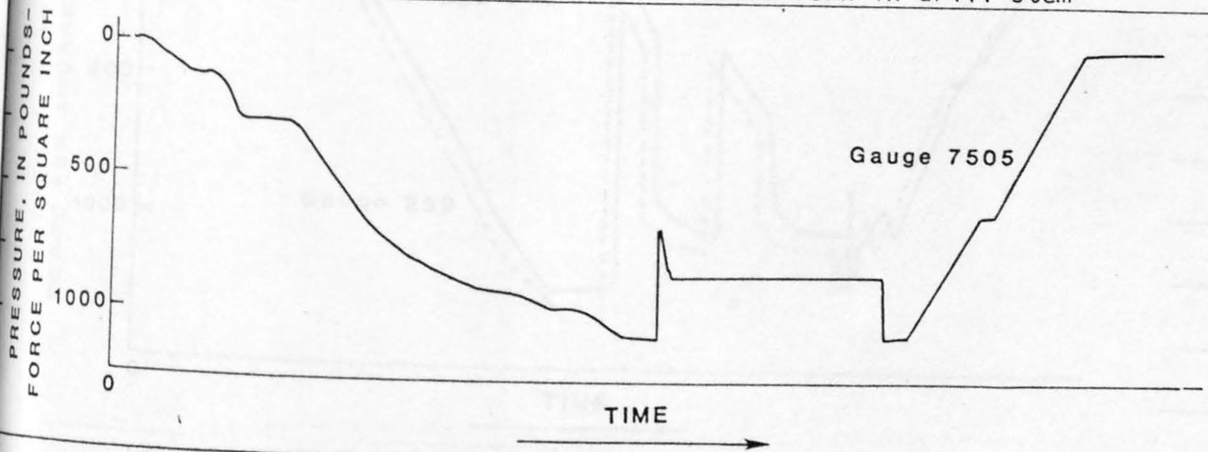
bj

Formation Tested Arbuckle
Elevation 1110' Ft.
Net Productive Interval 110' (2398' to 2508') Ft.
All Depths Measured From Kelly Bushing
Total Depth 2508' Ft.
Main Hole/Casing Size 6 3/4"
Drill Collar Length 135' I.D. 2.25"
Drill Pipe Length 2221' I.D. 2.15"
Packer Depth(s) 2379' Ft.
Depth Tester Valve 2370' Ft.

TYPE	AMOUNT		
Cushion	Ft.	Depth Back Pres. Valve	Surface Choke 1/4"	Bottom Choke 3/4"

Recovered 268 Feet of muddy saltwater
Recovered 2000 Feet of saltwater
Recovered Feet of

Remarks Packers set in casing - actual test interval 2,398 - 2,508 ft
Possible leak in drill stem



TEMPERATURE	Gauge No. 7505		Gauge No. 7504		Gauge No.		TIME (00:00-24:00 hrs.)	
Calc. Est. 100 °F.	Depth: 2372' Ft.		Depth: 2505' Ft.		Depth: Ft.			
	12 Hour Clock		12 Hour Clock		Hour Clock		Tool	
	Blanked Off NO		Blanked Off YES		Blanked Off		Opened 0530	
Actual °F.	Pressures		Pressures		Pressures		Opened Bypass 0745	
	Field	Office	Field	Office	Field	Office	Reported Minutes	Computed Minutes
Initial Hydrostatic	1094	1077.3		1137.2				
First Period Flow Initial	662	678.0		765.5			___	___
First Period Flow Final	863	866.1		(924.8)CS			30	
First Period Closed in	883	866.1		CS			45	
Second Period Flow Initial	883	866.1		CS			___	___
Second Period Flow Final	883	866.1		CS			15	
Second Period Closed in	883	866.1		CS			45	
Third Period Flow Initial							___	___
Third Period Flow Final								
Third Period Closed in								
Final Hydrostatic	1094	1040.1		1099.1			___	___

CS = CLOCK STOPPED

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FORMATION TEST DATA

LITTLE'S 111033 75C 2/80

Lease Name: LIVESTOCK | Well No.: 1 | Test No.: 5 | Tested Interval: 2934' - 2985' | Lease Owner/Company Name: WESTERN WELL & PUMP, INCORPORATED

Legal Location Sec. - Twp. - Rng.: 13 - 12S - 17E | Field Area: | County: DOUGLAS | State: KANSAS

FLUID SAMPLE DATA

Sampler Pressure ______ P.S.I.G. at Surface

Recovery: Cu. Ft. Gas ______
cc. Oil ______
cc. Water ______
cc. Mud ______
Tot. Liquid cc. ______

Gravity ______ ° API @ ______ °F.

Gas/Oil Ratio ______ cu. ft./bbl.

	RESISTIVITY		CHLORIDE CONTENT
Recovery Water	____ @ ____ °F.		____ ppm
Recovery Mud	____ @ ____ °F.		____ ppm
Recovery Mud Filtrate	____ @ ____ °F.		____ ppm
Mud Pit Sample	____ @ ____ °F.		____ ppm
Mud Pit Sample Filtrate	____ @ ____ °F.		____ ppm

Mud Weight 8.8 vis 34 sec.

Date 3-24-80 | Ticket Number 521725

Kind of D.S.T. OPEN HOLE | Halliburton Location ELDORADO

Tester E. L. RIEDEL | Witness TONY GOEL

Drilling Contractor WESTERN WELL & PUMP INCORPORATED

EQUIPMENT & HOLE DATA TJH S

Formation Tested Reagan

Elevation 1110' Ft.

Net Productive Interval ______ Ft.

All Depths Measured From Kelly Bushing

Total Depth 2985' Ft.

Main Hole/Casing Size 6 3/4"

Drill Collar Length 211.30' I.D. 2.25"

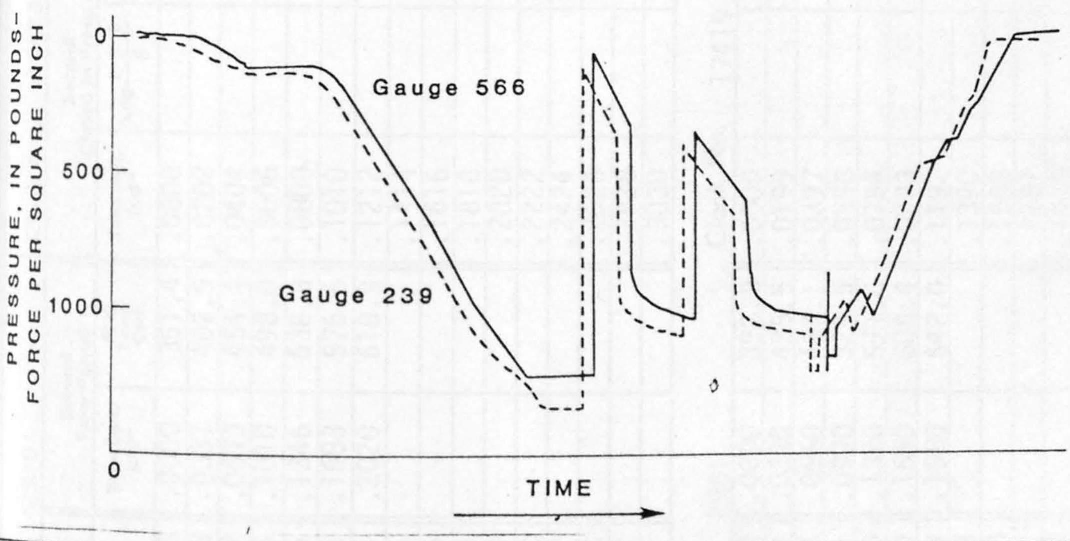
Drill Pipe Length 2683.01' I.D. 2.15"

Packer Depth(s) 2926' - 2934' Ft.

Depth Tester Valve 2908' Ft.

Cushion TYPE ______ AMOUNT ______ Ft. Depth Back Pres. Valve ______ Surface Choke 1/4" Bottom Choke .62"

Recovered 1385 Feet of saltwater.



Mea. From Tester Valve

TEMPERATURE	Gauge No. 566		Gauge No. 239		Gauge No.		TIME (00:00-24:00 hrs.)	
	Depth: 2910 Ft.		Depth: 2981 Ft.		Depth: Ft.			
Est. °F.	12 Hour Clock		12 Hour Clock		Hour Clock		Tool Opened 1600	
	Blanked Off NO		Blanked Off YES		Blanked Off		Opened Bypass 1815	
Actual °F.	Pressures		Pressures		Pressures		Reported	Computed
	Field	Office	Field	Office	Field	Office	Minutes	Minutes
Initial Hydrostatic		1305.3	1332	1337.2				
First Period Flow Initial		61.3	97	104.1			____	____
First Period Flow Final		338.6	361	370.0			20	22
First Period Closed in		1067.1	1085	1099.6			40	37
Second Period Flow Initial		351.4	366	392.8			____	____
Second Period Flow Final		610.9	642	642.0			30	30
Second Period Closed in		1065.2	1036	1098.6			45	45
Third Period Flow Initial							____	____
Third Period Flow Final								
Third Period Closed in								
Final Hydrostatic		1186.7	1213	1221.8			____	____

FORM 171-R2 — PRINTED IN U.S.A. LITTLE'S 111033 7SC 2/80

FORMATION TEST DATA

Gauge No. 566			Depth 2910			Clock No. 17423			12 hour	Ticket No. 521725				
	First Flow Period		First Closed In Pressure			Second Flow Period		Second Closed In Pressure			Third Flow Period		Third Closed In Pressure		
	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.
0	.0000	61.3	.0000		338.6	.0000	351.4	.0000		610.9					
1	.0134*	75.2	.0608**		1008.8	.0337	402.9	.0202		973.4					
2	.0401	139.6	.0743		1018.7	.0673	454.4	.0404		999.9					
3	.0668	195.0	.0878		1026.6	.1010	498.0	.0606		1013.8					
4	.0935	247.5	.1013		1032.6	.1346	538.3	.0808		1023.7					
5	.1202	295.0	.1149		1038.5	.1683	575.6	.1010		1031.6					
6	.1470	338.6	.1284		1043.4	.2020	610.9	.1212		1037.5					
7			.1419		1047.4			.1414		1043.4					
8			.1554		1050.3			.1616		1047.4					
9			.1689		1053.3			.1818		1050.3					
10			.1824		1056.3			.2020		1053.3					
11			.1959		1059.2			.2222		1056.3					
12			.2094		1061.2			.2424		1058.2					
13			.2229		1063.2			.2626		1061.2					
14			.2364		1065.2			.2828		1063.2					
15			.2500		1067.1			.3030		1065.2					

Gauge No. 239			Depth 2981			Clock No. 17419			12 hour					
0	.0000	104.1	.0000		370.0	.0000	392.8	.0000		642.0					
1	.0133*	109.1	.0591**		1042.4	.0330	435.5	.0199		1001.9					
2	.0398	171.6	.0722		1052.2	.0660	483.1	.0397		1030.5					
3	.0664	227.1	.0854		1059.1	.0990	529.5	.0596		1045.3					
4	.0929	276.7	.0985		1065.0	.1320	571.0	.0794		1055.2					
5	.1194	325.4	.1116		1071.0	.1650	608.4	.0993		1063.1					
6	.1460	370.0	.1248		1074.9	.1980	642.0	.1192		1070.0					
7			.1379		1078.8			.1390		1074.9					
8			.1510		1081.8			.1589		1078.8					
9			.1641		1085.7			.1787		1082.8					
10			.1773		1087.7			.1986		1085.7					
11			.1904		1090.7			.2185		1088.7					
12			.2035		1092.7			.2383		1091.7					
13			.2167		1095.6			.2582		1094.6					
14			.2298		1097.6			.2780		1097.6					
15			.2430		1099.6			.2980		1098.6					
Reading Interval		4		2			5		3					Minutes

REMARKS: * - first interval is equal to 2 minutes, ** - 9 minutes.

75

FORM 183-RI—PRINTED IN U.S.A.

SPECIAL PRESSURE DATA

LITTLE'S 86473 75C 6/74

FLUID SAMPLE DATA

Sampler Pressure _____ P.S.I.G. at Surface
Recovery: Cu. Ft. Gas _____
cc. Oil _____
cc. Water _____
cc. Mud _____
Tot. Liquid cc. _____
Gravity _____ ° API @ _____ °F.
Gas/Oil Ratio _____ cu. ft./bbl.

		RESISTIVITY		CHLORIDE CONTENT
Recovery Water	@	°F.		ppm
Recovery Mud	@	°F.		ppm
Recovery Mud Filtrate	@	°F.		ppm
Mud Pit Sample	@	°F.		ppm
Mud Pit Sample Filtrate	@	°F.		ppm

Mud Weight 9.2 vis 44 sec.

Date 3-16-80 Ticket Number 521723
Kind of D.S.T. OPEN HOLE Halliburton Location EL DORADO
Tester MR. RIEDEL Witness MR. DREILING
Drilling Contractor WESTERN WELL & PUMP INCORPORATED IC

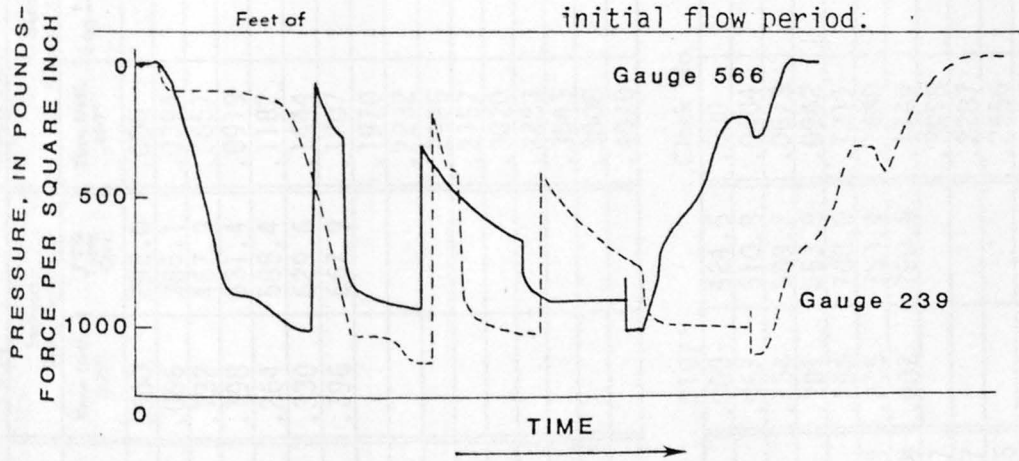
EQUIPMENT & HOLE DATA

Formation Tested Lansing & Kansas City
Elevation 1224' Ft.
Net Productive Interval 220' Ft.
All Depths Measured From Kelly Bushing
Total Depth 2200' Ft.
Main Hole/Casing Size 9 7/8"
Drill Collar Length 117.41' I.D. 2.75"
Drill Pipe Length 1828.51' I.D. 3.826"
Packer Depth(s) 1970' - 1980' Ft.
Depth Tester Valve 1952' Ft.

Cushion TYPE AMOUNT Ft. Depth Back Pres. Valve
Surface Choke 1/4" Bottom Choke 3/4"

Recovered 424 Feet of Mud
Recovered 1530 Feet of Saltwater
Recovered Feet of

Remarks Charts indicate partial (slight) plugging of anchor perforations during initial flow period.



TEMPERATURE	Gauge No. 566 Depth: 1954' Ft.	Gauge No. 239 Depth: 2197' Ft.	Gauge No. Depth: Ft.	TIME (00:00-24:00 hrs.)
	12 Hour Clock	12 Hour Clock	Hour Clock	Tool Opened 03:20
Est. 100 °F.	Blanked Off NO	Blanked Off YES	Blanked Off	Opened Bypass 06:25
Actual °F.	Pressures	Pressures	Pressures	

		Field	Office	Field	Office	Field	Office	Reported Minutes	Computed Minutes
Initial Hydrostatic		-	1012.8	1137	1143.9				
First Period	Flow Initial	-	40.5	169	177.5			—	—
	Flow Final	-	280.1	526	521.6			20	18
	Closed in	-	907.6	1038	1032.5			45	45
Second Period	Flow Initial	-	293.0	427	424.6			—	—
	Flow Final	-	667.9	782	790.9			60	60
	Closed in	-	900.7	1023	1022.6			60	62
Third Period	Flow Initial							—	—
	Flow Final								
	Closed in								
Final Hydrostatic		-	999.0	1137	1126.2			—	—

FORM 101-82 - PRINTED IN U.S.A.

FORMATION TEST DATA

Sec. Twp. - Rng. 32 - 13S - 2W
Field Area ---
Meg. From Tester Valve
County SALINE
State KANSAS

GEIS Lease Name
1 Well No.
1 Test No.
1980' - 2200' Tested Interval
WESTERN WELL & PUMP INCORPORATED Lease Owner/Company Name

Gauge No.	566		Depth	1954'		Clock No.	17419		12 hour	Ticket No.	521723			
	First Flow Period		First Closed In Pressure			Second Flow Period		Second Closed In Pressure			Third Flow Period		Third Closed In Pressure		
	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.
0	.000	40.5	.000		280.1	.000	293.0	.000		667.9					
1	.020	99.0	.020		817.2	.066	385.1	.0394		856.5*					
2	.040	145.5	.040		844.7	.132	467.3	.0657		866.3					
3	.060	184.1	.060		859.5	.198	531.4	.0919		873.2					
4	.080	217.8	.080		868.3	.264	585.4	.1182		879.1					
5	.100	253.4	.100		878.1	.330	629.6	.1444		883.0					
6	.120	280.1	.120		886.0	.396	667.9	.1707		886.0					
7			.140		891.9			.1970		888.0					
8			.160		895.8			.2232		890.9					
9			.180		898.8			.2495		892.9					
10			.200		900.7			.2757		894.8					
11			.220		902.7			.3020		895.8					
12			.240		904.7			.3283		897.8					
13			.260		905.6			.3545		898.8					
14			.280		906.6			.3808		899.7					
15			.300		907.6			.4070		900.7					

Gauge No.	239		Depth	2197'		Clock No.	17423		12hour					
0	.000	177.5	.000		521.6	.000	424.6	.000		790.9					
1	.122	521.6	.0203		941.8	.067	510.8	.0404		979.2*					
2			.0407		971.4	.134	589.7	.0673		990.1					
3	PLUGGING		.0610		987.1	.201	653.8	.0942		997.0					
4			.0813		996.0	.268	708.0	.1211		1001.9					
5			.1017		1004.9	.335	753.4	.1480		1005.9					
6			.1220		1011.8	.402	790.9	.1749		1009.8					
7			.1423		1016.7			.2018		1012.8					
8			.1626		1020.7			.2287		1014.7					
9			.1830		1023.6			.2556		1015.7					
10			.2033		1026.6			.2825		1017.7					
11			.2236		1028.5			.3094		1018.7					
12			.2440		1029.5			.3363		1019.7					
13			.2643		1030.5			.3632		1020.7					
14			.2846		1031.5			.3901		1021.6					
15			.3050		1032.5			.4170		1022.6					
Reading Interval	3		3			10		4							Minutes

REMARKS: *First interval equal to 6 minutes.

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FORM 183-A1—PRINTED IN U.S.A.

SPECIAL PRESSURE DATA

LITTLE'S 36473 75C 9/74

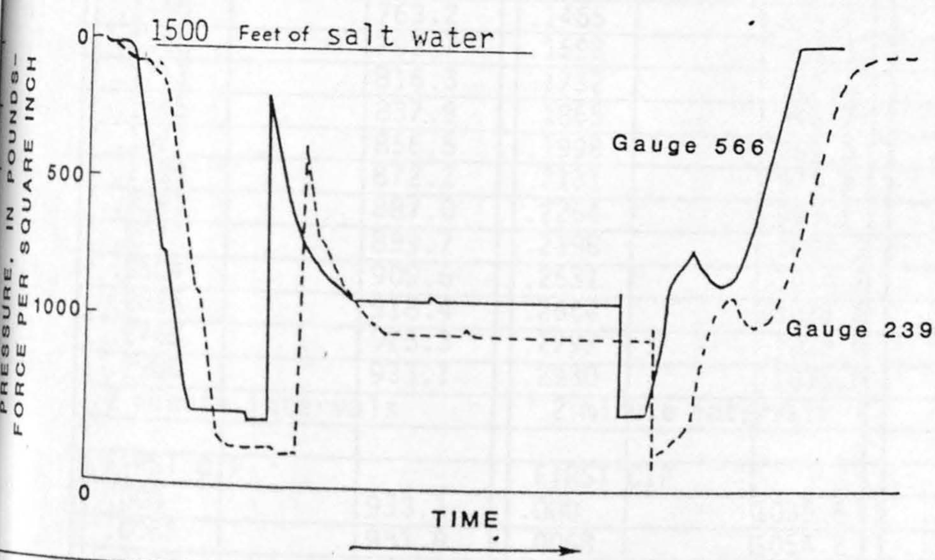
F[illegible] SAMPLE DATA

Sampler Pressure ______ P.S.I.G. at Surface	Date 3-13-80 Ticket Number 521724
Recovery: Cu. Ft. Gas ______	Kind of D.S.T. OPEN HOLE Halliburton Location EL DORADO
cc. Oil ______	
cc. Water ______	Tester EL RIEDEL Witness BOB DIELING
cc. Mud ______	
Tot. Liquid cc. ______	Drilling Contractor WESTERN WELL AND PUMP, INC. DR
Gravity ______ ° API @ ______ °F.	EQUIPMENT & HOLE DATA
Gas/Oil Ratio ______ cu. ft./bbl.	Formation Tested Mississippi
RESISTIVITY / CHLORIDE CONTENT	Elevation 1224' Ft.
Recovery Water ___ @ ___ °F. ___ ppm	Net Productive Interval 188' Ft.
Recovery Mud ___ @ ___ °F. ___ ppm	All Depths Measured From Kelly Bushing
Recovery Mud Filtrate ___ @ ___ °F. ___ ppm	Total Depth 2804' Ft.
Mud Pit Sample ___ @ ___ °F. ___ ppm	Main Hole/Casing Size 9 7/8"
Mud Pit Sample Filtrate ___ @ ___ °F. ___ ppm	Drill Collar Length 117' I.D. 2.75"
	Drill Pipe Length 2462' I.D. 3.826"
Mud Weight 10.1 vis 40 sec.	Packer Depth(s) 2609-2616' Ft.
	Depth Tester Valve 2591' Ft.

Cushion — TYPE ___ AMOUNT ___ Ft. Depth Back Pres. Valve ___ Surface Choke 1/4" Bottom Choke 3/4"

Recovered 500 Feet of muddy salt water

1500 Feet of salt water



TEMPERATURE	Gauge No. 566		Gauge No. 239		Gauge No.		TIME (00:00-24:00 hrs.)	
Calc. Est. 100 °F.	Depth: 2593 Ft.		Depth: 2801 Ft.		Depth: Ft.			
	12 Hour Clock		12 Hour Clock		Hour Clock		Tool	
	Blanked Off No		Blanked Off Yes		Blanked Off		Opened 14:30	
Actual °F.	Pressures		Pressures		Pressures		Opened Bypass 17:45	
	Field	Office	Field	Office	Field	Office	Reported Minutes	Computed Minutes
Initial Hydrostatic	1381	1388.3		1498.0				
Flow Initial	198	200.9		346.2			—	—
Flow Final	937	933.1		1035.5			45	44
Closed in	957	956.7 ✓		1061.1 ✓			45	45
Flow Initial	936	937.1		1044.3			—	—
Flow Final	967	959.7		1062.1			45	44
Closed in	967	960.6 ✓		1064.1 ✓			60	62
Flow Initial							—	—
Flow Final								
Closed in								
Final Hydrostatic	1381	1365.5		1466.4			—	—

Right margin: Lease Name SEIS; Legal Location Sec.-Twp.-Rng. 32-13S-2W; Well No. 1; Test No. 2; Tested Interval 2616-2804'; Field Area; Mea. From Tester Valve; County SALINE; State KANSAS; Lease Owner/Company Name WESTERN WELL AND PUMP, INCORPORATED

-67 – PRINTED IN U.S.A.

FORMATION TEST DATA

LITTLE'S 111033 75C 2/80

WESTERN WELL AND PUMP, INCORPORATED
Lease Owner/Company Name

521724
Ticket Number

B.T. 566 B.T. 239 B.T.

Depth 2593' Depth 2801' Depth

CLOCK: 17419-12 17423' PAGE 1

	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.
	FIRST FLOW			FIRST FLOW					
P-0	.000		200.9	.000		346.2			
1	.0132		273.2	.0133		444.4			
2	.0264		372.2	.0266		548.3			
3	.0395		410.8	.0400		631.1			
4	.0527		479.2	.0533		677.5			
5	.0659		520.6	.0666		717.9			
6	.0791		574.6	.0799		741.6			
7	.0923		619.8	.0932		776.1			
8	.1054		659.1	.1066		809.6			
9	.1186		695.4	.1199		835.3			
10	.1318		730.8	.1332		860.9			
11	.1450		763.2	.1465		884.6			
12	.1582		792.7	.1598		906.3			
13	.1713		816.3	.1732		927.0			
14	.1845		837.9	.1865		946.7			
15	.1977		856.5	.1998		961.5			
16	.2109		872.2	.2131		979.2			
17	.2241		887.0	.2264		993.1			
18	.2372		899.7	.2398		1003.9			
19	.2504		909.6	.2531		1014.7			
20	.2636		918.4	.2664		1021.6			
21	.2768		925.3	.2797		1028.6			
22	.2900		933.1	.2930		1035.5			
	2 minute intervals			2 minute intervals					
	FIRST CIP			FIRST CIP					
P-0	.000		933.1	.000		1035.5			
1	.0066		951.8	.0068		1054.2			
2	.0132		953.8	.0135		1056.2			
3	.0199		953.8	.0203		1057.2			
4	.0265		954.8	.0270		1057.2			
5	.0331		955.7	.0338		1057.2			
6	.0397		955.7	.0406		1057.2			
7	.0463		955.7	.0473		1057.2			
8	.0530		955.7	.0541		1058.1			
9	.0596		955.7	.0608		1058.1			
10	.0662		955.7	.0676		1058.1			
11	.0728		955.7	.0743		1058.1			
12	.0993		956.7	.1013		1058.1			
13	.1655		956.7	.1689		1060.1			
14	.2318		956.7	.2364		1061.1			
15	.2980		956.7	.3040		1061.1			
		*			*				

Remarks: *-First 10 intervals equal to 1 minute each; next interval equal to 4 minutes; last 3 intervals equal to 10 minutes each.

FLUID SAMPLE DATA

Sampler Pressure ____ P.S.I.G. at Surface
Recovery: Cu. Ft. Gas ____
cc. Oil ____
cc. Water ____
cc. Mud ____
Tot. Liqu ____
Gravity ____ °F.
Gas/Oil Ratio ____ cu. ft./bbl.

	RESISTIVITY		CHLORIDE CONTENT
Recovery Water	____ @ ____	°F.	____ ppm
Recovery Mud	____ @ ____	°F.	____ ppm
Recovery Mud Filtrate	____ @ ____	°F.	____ ppm
Mud Pit Sample	____ @ ____	°F.	____ ppm
Mud Pit Sample Filtrate	____ @ ____	°F.	____ ppm

Mud Weight 9.7 vis 60 sec.

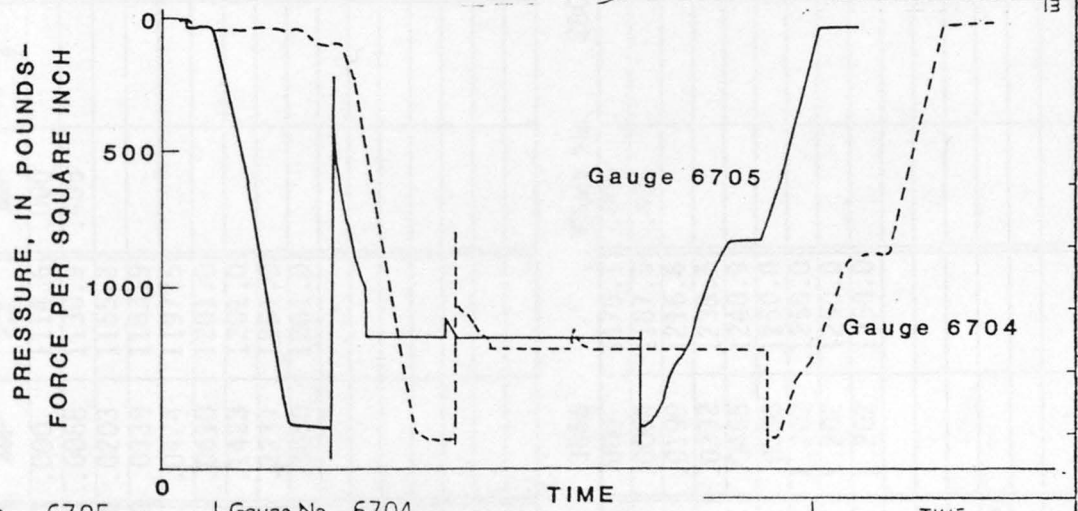
Date 3-20-80 Ticket Number 795125
Kind of D.S.T. OPEN HOLE Halliburton Location WINFIELD
Tester J. DURHAM Witness D.S. FENT
Drilling Contractor WESTERN PETROLEUM DR

EQUIPMENT & HOLE DATA

Formation Tested	Hunton Lime		
Elevation	1224' KB		Ft.
Net Productive Interval	100'		Ft.
All Depths Measured From	Kelly Bushing		
Total Depth	3070'		Ft.
Main Hole/Casing Size	9 3/4"		
Drill Collar Length	117'	I.D. 2.25"	
Drill Pipe Length	2821'	I.D. 3.826"	
Packer Depth(s)	2970'		Ft.
Depth Tester Valve	2950'		Ft.

Cushion TYPE DCIP VALVE AMOUNT ____ Ft. Depth Back Pres. Valve 2945' Surface Choke 1/4" Bottom Choke 3/4"

Recovered 488 Feet of drilling mud
Recovered 122 Feet of Water cut drilling mud 2125 Feet of muddy salt water
Recovered ____ Feet of ____
Recovered ____ Feet of ____
Remarks ____



TEMPERATURE	Gauge No. 6705	Gauge No. 6704	
	Depth: 2954 Ft.	Depth: 3066 Ft.	Depth: Ft.
	12 Hour Clock	12 Hour Clock	Hour Clock
°F.	Blanked Off No	Blanked Off yes	Blanked Off
065'			
Equal 92 °F.	Pressures	Pressures	Pressures

	Field	Office	Field	Office	Field	Office
Initial Hydrostatic	---	1536.6		1595.3		
Flow Initial	333.4	190.6		797.2		
Flow Final	1144.5	1057.3		1217.7		
Closed in	1206.9	1201.0		1250.0		
Flow Initial	1113.4	1114.6		1178.1		
Flow Final	1206.9	1201.0		1250.0		
Closed in	1206.9	1201.0		1250.0		
Flow Initial						
Flow Final						
Closed in						
Final Hydrostatic		1511.5		1569.3		

TIME (00:00-24:00 hrs.)
Tool Opened 11:05
Opened Bypass 13:55

Reported Minutes	Computed Minutes
___	___
20	
45	
___	___
45	
60	
___	___
___	___

FORMATION TEST DATA

LITTLE'S 11033 75C 2/80

Legal Location Sec. - Twp. - Rng. SW-SW-SW-32-13S-2W
Lease Name GEIS
Well No. 1
Test No. 3
Tested Interval 2970-3070'
Lease Owner/Company Name WESTERN PUMP AND SUPPLY
Field Area WILDCAT
County SALINE
State KANSAS

CORRECTED COPY

Gauge No.	6705	Depth	2954'	Clock No.	4197	12 hour	Ticket No.	795125

	First Flow Period		First Closed In Pressure			Second Flow Period		Second Closed In Pressure			Third Flow Period		Third Closed In Pressure		
	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.
0	.000	190.6	.000		1057.3	.000	1114.6	.000		1201.0					
1	.0127*	318.7	Q .0067**		1198.5	.0068	1130.9	.405		1201.0					
2	.0254	557.1	.0133**		1201.6	.0203	1165.2								
3	.0381	660.0	.0301		1201.0	.0339	1183.9								
4	.0508	743.2				.0474	1197.5								
5	.0635	812.8				.0610	1201.0								
6	.0762	869.0				.1423	1201.0								
7	.0889	923.0				.2237	1201.0								
8	.1016	971.9				.3050	1201.0								
9	.1143	1015.5													
10	.1270	1057.3													
11															
12															
13															
14															
15															

Gauge No.	6704	Depth	3066'	Clock No.	2803	hour	12

0	.000	797.2	.000		1217.7	.000	1178.1	.000		1250.0					
1	.0131*	1123.9	.0066**		1250.0	.0064	1187.5	.405		1250.0					
2	.0262	1111.4	.0132**		1250.0	.0199	1216.6								
3	.0393	1113.5	.0298		1250.0	.0332	1238.5								
4	.0524	1128.1				.0465	1248.9								
5	.0655	1144.7				.0598	1250.0								
6	.0786	1171.8				1.202	1250.0								
7	.0917	1192.7				1.202	1250.0								
8	.1048	1204.1				1.202	1250.0								
9	.1179	1211.4													
10	.1310	1217.7													
11															
12															
13															
14															
15															

Reading Interval 2 ***

Minutes

REMARKS: *-2 minute intervals **-1 minute intervals Q-Questionable ***- First interval equal to 1 minute, next four intervals equal to 2 minutes each; last 3 intervals equal 12 minutes each

FLUID SAMPLE DATA

Sampler Pressure _____ P.S.I.G. at Surface
Recovery: Cu. Ft. Gas _____
cc. Oil _____
cc. Water _____
cc. Mud _____
Tot. Liquid cc. _____
Gravity _____ ° API @ _____ °F.
Gas/Oil Ratio _____ cu. ft./bbl.

		RESISTIVITY		CHLORIDE CONTENT
Recovery Water	@	°F.		ppm
Recovery Mud	@	°F.		ppm
Recovery Mud Filtrate	@	°F.		ppm
Mud Pit Sample	@	°F.		ppm
Mud Pit Sample Filtrate	@	°F.		ppm

Mud Weight 9.6 vis 47 sec.

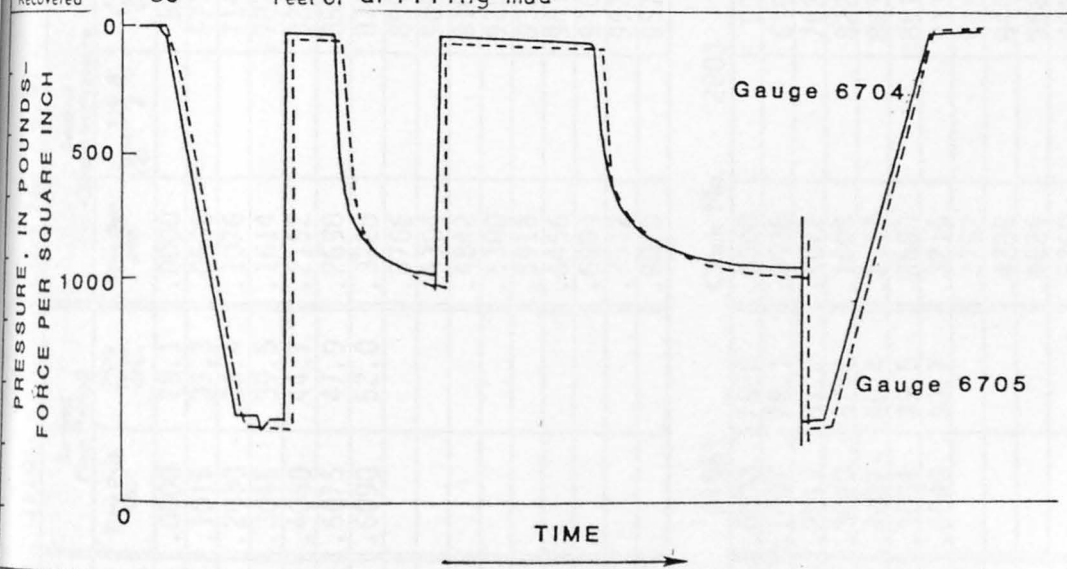
Date 3-21-80 Ticket Number 857051
Kind of D.S.T. OPEN HOLE Halliburton Location WINFIELD
Tester J. DURHAM Witness O.S. FENT
Drilling Contractor WESTERN PETROLEUM INCORPORATED SM

EQUIPMENT & HOLE DATA

Formation Tested Viola Lime
Elevation 1224' Kelly bushing Ft.
Net Productive Interval 68' Ft.
All Depths Measured From Kelly bushing
Total Depth 3200' Ft.
Main Hole/Casing Size 9 7/8"
Drill Collar Length 117' I.D. 2.25"
Drill Pipe Length 2979' I.D. 3.826"
Packer Depth(s) 3126-3132' Ft.
Depth Tester Valve 3106' Ft.

Cushion TYPE AMOUNT Ft. Depth Back Pres. Valve DCIP Valve 3101' Surface Choke 1/4" Bottom Choke 3/4"

Recovered 85 Feet of drilling mud



TEMPERATURE	Gauge No. 6705 Depth: 3110 Ft.	Gauge No. 6704 Depth: 3196 Ft.	Gauge No. Depth: Ft.	TIME (00:00-24:00 hrs.)
	12 Hour Clock	12 Hour Clock	Hour Clock	Tool Opened 1631
Est. °F.	Blanked Off no	Blanked Off yes	Blanked Off	Opened Bypass 2131
3195 Actual 94 °F.	Pressures	Pressures	Pressures	

		Field	Office	Field	Office	Field	Office	Reported Minutes	Computed Minutes
Initial Hydrostatic		1560.8	1568.1		1603.9				
First Period Flow	Initial	10.5	11.4		60.4			—	—
	Final	20.9	23.9		70.8			30	30
Closed in		978.2	987.5		1030.2			60	60
Second Period Flow	Initial	20.9	28.1		76.0			—	—
	Final	41.7	52.0		93.7			90	90
Closed in		957.4	957.3		996.8			120	120
Third Period Flow	Initial							—	—
	Final								
Closed in									
Final Hydrostatic		1560.8	1547.1		1593.4			—	—

Legal Location Sec. - Twp. - Rng. SW/SW/SW 32-13S-2W
Lease Name GEIS
Well No. 1
Test No. 4
Tested Interval 3132 - 3200'
Lease Owner/Company Name WESTERN PUMP & SUPPLY
Field Area WILDCAT
Meas. From Tester Valve
County SALINE
State KANSAS

Gauge No.	6705		Depth	3110'		Clock No.	4197		12 hour	Ticket No.	857051				
	First Flow Period		First Closed In Pressure			Second Flow Period		Second Closed In Pressure			Third Flow Period		Third Closed In Pressure		
	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.
0	.0000	11.4	.0000		23.9	.0000	28.1	.0000		52.0					
1	.0335	14.5	.0267		468.7	.1015	33.3	.0538		571.7					
2	.0670	15.6	.0535		658.0	.2030	36.4	.1076		714.1					
3	.1005	17.7	.0802		756.7	.3045	39.5	.1614		782.7					
4	.1340	19.7	.1069		816.0	.4060	44.7	.2152		823.2					
5	.1675	21.8	.1337		858.6	.5075	47.9	.2690		852.3					
6	.2010	23.9	.1604		887.7	.6090	52.0	.3228		874.2					
7			.1871		909.5			.3766		890.8					
8			.2138		923.0			.4304		905.4					
9			.2406		941.7			.4842		916.8					
10			.2673		952.1			.5380		925.1					
11			.2940		961.5			.5918		933.4					
12			.3208		969.8			.6456		941.7					
13			.3475		977.1			.6994		946.9					
14			.3742		983.3			.7532		952.1					
15			.4010		987.5			.8070		957.3					

Gauge No.	6704		Depth	3196'		Clock No.	2803		12 hour					
0	.0000	60.4	.0000		70.8	.0000	76.0	.0000		93.7				
1	.0332	59.3	.0265		509.3	.1007	78.1	.0536		610.1				
2	.0663	60.4	.0531		699.5	.2013	81.2	.1072		752.5				
3	.0995	62.5	.0796		797.2	.3020	82.2	.1608		822.2				
4	.1327	65.6	.1061		859.6	.4027	86.4	.2144		863.8				
5	.1659	66.6	.1327		900.2	.5034	89.5	.2680		891.8				
6	.1990	70.8	.1592		929.3	.6040	93.7	.3216		913.7				
7			.1857		952.1			.3752		931.3				
8			.2122		970.8			.4288		944.9				
9			.2388		985.4			.4824		956.3				
10			.2653		994.8			.5360		965.6				
11			.2918		1004.1			.5896		974.0				
12			.3184		1012.5			.6432		980.2				
13			.3449		1019.7			.6968		985.4				
14			.3714		1025.0			.7504		991.6				
15			.3980		1030.2			.8040		996.8				
Reading Interval	5		4			15		8						Minutes

REMARKS:

FORM 183-R1—PRINTED IN U.S.A.

SPECIAL PRESSURE DATA

LITTLE'S 84473 35C 8/74

FLUID SAMPLE DATA

Sampler Pressure _____ P.S.I.G. at Surface
Recovery: Cu. Ft. Gas _____
cc. Oil _____
cc. Water _____
cc. Mud _____
Tot. Liquid cc. _____
Gravity _____ ° API @ _____ °F.
Gas/Oil Ratio _____ cu. ft./bbl.

		RESISTIVITY		CHLORIDE CONTENT
Recovery Water	@	°F.		ppm
Recovery Mud	@	°F.		ppm
Recovery Mud Filtrate	@	°F.		ppm
Mud Pit Sample	@	°F.		ppm
Mud Pit Sample Filtrate	@	°F.		ppm

Mud Weight 9 vis 42 sec.

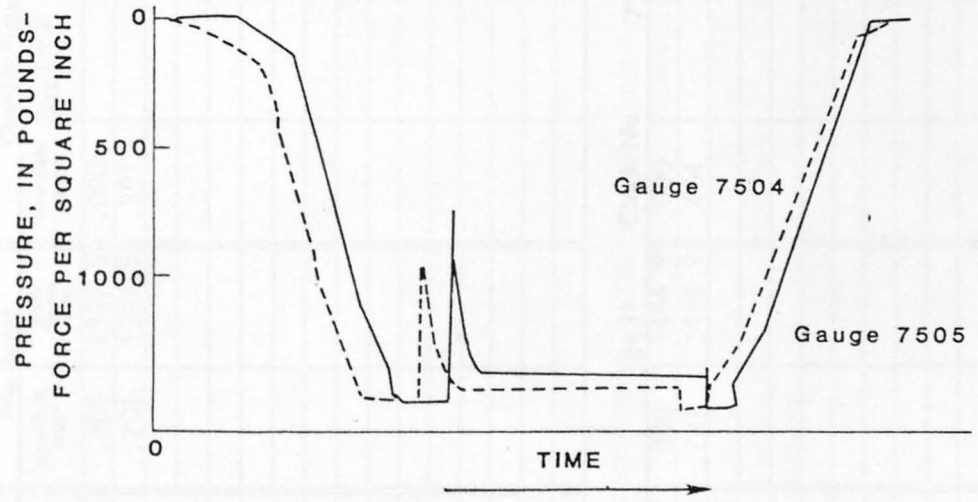
Date 3-28-80 Ticket Number 521576
Kind of D.S.T. OPEN HOLE Halliburton Location EL DORADO
Tester JERRY SEGLEM Witness BOB DRIELING
Drilling Contractor COMPANY TOOLS DR

EQUIPMENT & HOLE DATA

Formation Tested Arbuckle
Elevation 1224' Ft.
Net Productive Interval 114' Ft.
All Depths Measured From Kelly Bushing
Total Depth 3498 Ft.
Main Hole/Casing Size 6 3/4"
Drill Collar Length 385.97' I.D. 2.75"
Drill Pipe Length 2914' I.D. 3.826"
Packer Depth(s) 3332' Ft.
Depth Tester Valve 3315' Ft.

Cushion TYPE AMOUNT Ft. Depth Back Pres. Valve
Surface Choke 1/4" Bottom Choke 3/4"

Recovered 3046' Feet of salt water
Recovered
Recovered
Recovered
Recovered
Remarks



Mea. From Tester Valve

TEMPERATURE	Gauge No. 7505 Depth: 3369 Ft.	Gauge No. 7504 Depth: 3495 Ft.	Gauge No. Depth: Ft.	TIME (00:00-24:00 hrs.)
Calc. Est. 100 °F.	12 Hour Clock	12 Hour Clock	Hour Clock	Tool Opened 0450
Actual °F.	Blanked Off No	Blanked Off Yes	Blanked Off	Opened Bypass 0720

	Pressures Field	Pressures Office	Pressures Field	Pressures Office	Pressures Field	Pressures Office	Reported Minutes	Computed Minutes
Initial Hydrostatic	1504.1	1516.0		1578.1				
First Period Flow Initial	702.5	739.4		958.9			—	—
First Period Flow Final	1383.8	1392.5		1455.9			20	
First Period Closed in	1383.8	1397.5		1456.9			40	
Second Period Flow Initial	1383.8	1397.5		1456.9			—	—
Second Period Flow Final	1383.8	1397.5		1456.9			30	
Second Period Closed in	1383.8	1397.5		1456.9			60	
Third Period Flow Initial							—	—
Third Period Flow Final								
Third Period Closed in								
Final Hydrostatic	1494.0	1480.9		1542.0			—	—

Legal Location Sec. - Twp. - Rng. 32-13S-2W
Field Area
County SALINE
State KANSAS

GEIS Lease Name 1 Well No. 5 Test No. 3384-3498 Tested Interval WESTERN WELL AND PUMP INCORPORATED Lease Owner/Company Name

FORM 181-82 – PRINTED IN U.S.A.

FORMATION TEST DATA

LITTLE'S 111033 75C 2/80

CORRECTED COPY

Gauge No.	7505	Depth	3317'	Clock No.	7407	12 hour	Ticket No.	521576

	First Flow Period		First Closed In Pressure			Second Flow Period		Second Closed In Pressure			Third Flow Period		Third Closed In Pressure		
	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.
0	.000	739.4	.000		1392.5	.000	1397.5	.000		1397.5					
1	.0135	932.5	.007 *		1397.5	.201	1397.5	.391		1397.5					
2	.0270	1021.0	.280		1397.5										
3	.0405	1115.4													
4	.0540	1193.7													
5	.0675	1264.0													
6	.0810	1314.2													
7	.0945	1346.3													
8	.1080	1365.4													
9	.1215	1384.5													
10	.1350	1392.5													
11															
12															
13															
14															
15															

Gauge No.	7504	Depth	3443'	Clock No.	7101	hour	12

0	.000	958.9	.000		1456.9	.000	1456.9	.000		1456.9					
1	.0134	1058.1	.0067*		1456.9	.201	1456.9	.404		1456.9					
2	.0268	1142.2	.269		1456.9										
3	.0402	1223.4													
4	.0536	1290.5													
5	.0670	1345.6													
6	.0804	1386.7													
7	.0838	1410.8													
8	.1072	1431.8													
9	.1206	1446.8													
10	.1340	1456.9													
11															
12															
13															
14															
15															

Reading Interval 2 Minutes

REMARKS: *-1 minute interval

FORM 183 III—PRINTED IN U.S.A.

SPECIAL PRESSURE DATA

LITTLE'S 96673 75C 8/74

FLUID SAMPLE DATA

Sampler Pressure _____ P.S.I.G. at Surface
Recovery: Cu. Ft. Gas _____
cc. Oil _____
cc. Water _____
cc. Mud _____
Tot. Liquid cc. _____
Gravity _____ ° API @ _____ °F.
Gas/Oil Ratio _____ cu. ft./bbl.

		RESISTIVITY		CHLORIDE CONTENT
Recovery Water	@	°F.		ppm
Recovery Mud	@	°F.		ppm
Recovery Mud Filtrate	@	°F.		ppm
Mud Pit Sample	@	°F.		ppm
Mud Pit Sample Filtrate	@	°F.		ppm

Mud Weight 9.2 vis 48 sec.

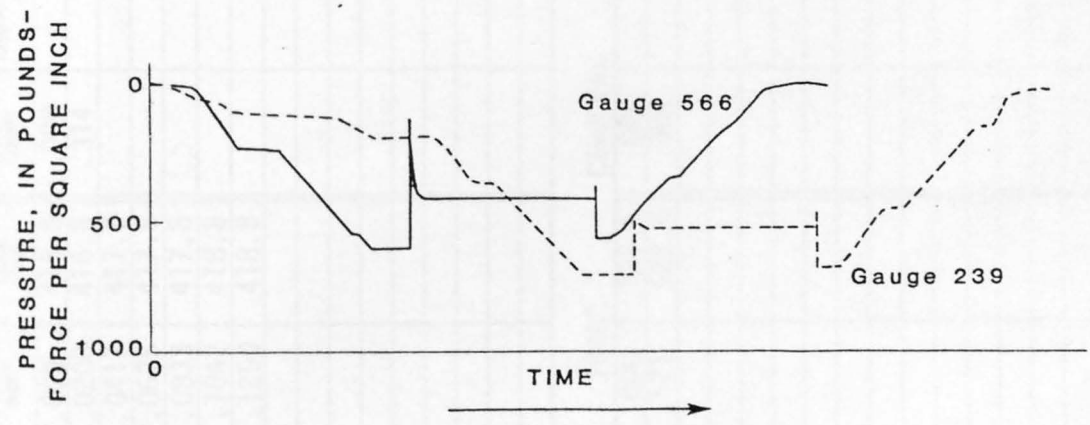
Date 5-10-80 Ticket Number 521765
Kind of D.S.T. OPEN HOLE Halliburton Location EL DORADO
Tester E.L. RIEDEL Witness GOULD
Drilling Contractor WESTERN WELL PUMP, INCORPORATED NM

EQUIPMENT & HOLE DATA

Formation Tested Arbuckle
Elevation 938' KB Ft.
Net Productive Interval 213' Ft.
All Depths Measured From Kelly Bushing
Total Depth 1443' Ft.
Main Hole/Casing Size 6¼"
Drill Collar Length 152' I.D. 2.50"
Drill Pipe Length 1043' I.D. 2.764"
Packer Depth(s) 1230' Ft.
Depth Tester Valve 1215' Ft.

Cushion TYPE NONE AMOUNT Ft. Depth Back Pres. Valve NONE Surface Choke ¼" Bottom Choke .62"

Recovered 1000' Feet of muddy water
Recovered Feet of
Recovered
Recovered
Recovered
Recovered
Remarks



TEMPERATURE	Gauge No. 566 Depth: 1217' Ft.		Gauge No. 239 Depth: 1440' Ft.		Gauge No. Depth: Ft.		TIME (00:00-24:00 hrs.)	
Est. C-100 °F.	12 Hour Clock		12 Hour Clock		Hour Clock		Tool Opened	0135
	Blanked Off	??	Blanked Off	??	Blanked Off			
Actual °F.	Pressures		Pressures		Pressures		Opened Bypass	0320
	Field	Office	Field	Office	Field	Office	Reported Minutes	Computed Minutes
Initial Hydrostatic	593	595.2	-	707.1				
First Period Flow Initial	248	255.4	-	479.1			—	—
First Period Flow Final	406	417.8	-	522.6			12	12
First Period Closed in	526	418.8	-	522.6			33	30
Second Period Flow Initial	526	415.8	-	522.6			—	—
Second Period Flow Final	526	418.8	-	522.6			15	18
Second Period Closed in	526	418.8	-	522.6			45	45
Third Period Flow Initial							—	—
Third Period Flow Final								
Third Period Closed in								
Final Hydrostatic	593	573.6	-	679.4			—	—

KANSAS ORD # 1 4 1230' - 1443'
Lease Name Well No. Test No. Tested Interval
Legal Location Sec. - Twp. - Rng. 22 - 32S - 20E
Field Area -
Meas. From Tester Valve
County LA BETTE
State KANSAS
UNITED STATES GEOLOGICAL SURVEY
Lease Owner/Company Name

FORM 101-82 - PRINTED IN U.S.A.

FORMATION TEST DATA

LITTLE'S 111033 75C 2/80

Gauge No.	566		Depth	1217'		Clock No.	17423		12 hour	Ticket No.	521765					
	First Flow Period		First Closed In Pressure			Second Flow Period		Second Closed In Pressure			Third Flow Period		Third Closed In Pressure			
	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.	
0	.000	255.4	.000		417.8	.000	415.8	.000		418.8						
1	.0068	304.9	.0070		417.8	.0208	416.8	.314		418.8						
2	.0137	334.6	.0139		417.8	.0417	417.8									
3	.0205	361.3	.0209		417.8	.0625	417.8									
4	.0273	384.1	.0279		417.8	.0833	417.8									
5	.0342	399.0	.0348		417.8	.1042	418.8									
6	.0410	409.9	.0418		417.8	.1250	418.8									
7	.0478	412.8	.0488		417.8											
8	.0547	415.8	.0557		417.8											
9	.0615	415.8	.0627		417.8											
10	.0683	417.8	.0697		417.8											
11	.0752	417.8	.0975		417.8											
12	.0820	417.8	.1254		417.8											
13			.1533		417.8											
14			.1811		417.8											
15			.2090		418.8											

Gauge No.	239		Depth	1440'		Clock No.	17419		hour	12						
0	.000	479.1	.000		522.6	.000	522.6	.000		522.6						
1	.007	481.1	.0068		522.6	.121	522.6	.304		522.6						
2	.014	491.0	.0135		522.6											
3	.021	499.0	.0203		522.6											
4	.028	507.8	.0271		522.6											
5	.035	513.8	.0338		522.6											
6	.042	517.7	.0406		522.6											
7	.049	520.7	.0474		522.6											
8	.056	520.7	.0541		522.6											
9	.063	521.6	.0609		522.6											
10	.070	522.6	.0677		522.6											
11	.077	522.6	.0947		522.6											
12	.084	522.6	.1218		522.6											
13			.1489		522.6											
14			.1759		522.6											
15			.2030		522.6											
Reading Interval	1		*			3										Minutes

REMARKS: * FIRST 10 READINGS = 1 MINUTE EACH AND THE LAST 5 READINGS = 4 MINUTES EACH..

FORM 183-R1—PRINTED IN U.S.A.

SPECIAL PRESSURE DATA

LITTLE'S 96673 75C 6/74

FLUID SAMPLE DATA

Sampler Pressure _____ P.S.I.G. at Surface
Recovery: Cu. Ft. Gas _____
cc. Oil _____
cc. Water _____
cc. Mud _____
Tot. Liquid cc. _____
Gravity _____ ° API @ _____ °F.
Gas/Oil Ratio _____ cu. ft./bbl.

		RESISTIVITY		CHLORIDE CONTENT
Recovery Water	@	°F.		ppm
Recovery Mud	@	°F.		ppm
Recovery Mud Filtrate	@	°F.		ppm
Mud Pit Sample	@	°F.		ppm
Mud Pit Sample Filtrate	@	°F.		ppm

Mud Weight 9.1 vis 55 sec.

Date 5-15-80 Ticket Number 857060
Kind of D.S.T. OPEN HOLE Halliburton Location WINFIELD
Tester M. VOSS / J. DURHAM Witness T. GOGEL
Drilling Contractor WESTERN WELL AND PUMP INCORPORATED

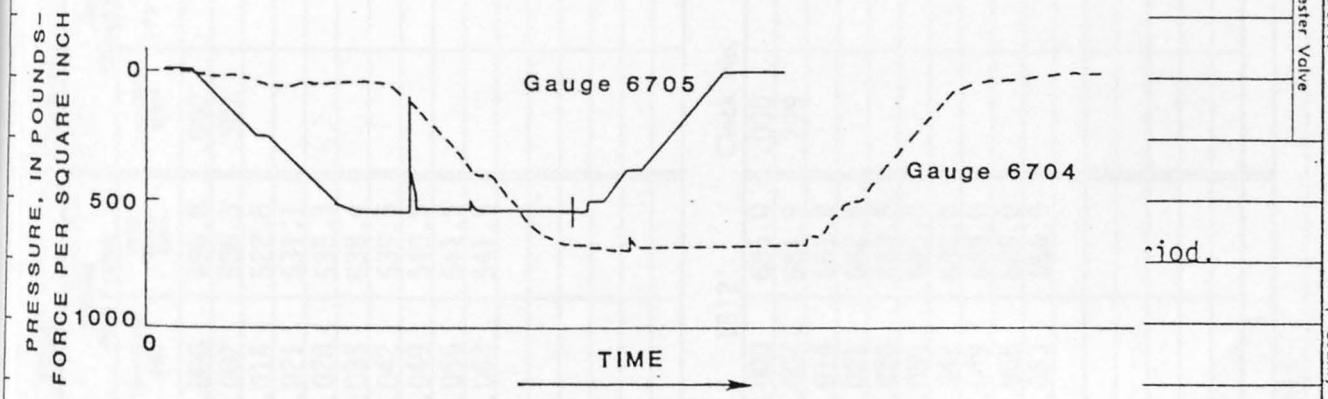
EQUIPMENT & HOLE DATA

Formation Tested Arbuckle
Elevation 938' Kb Ft.
Net Productive Interval 300' Ft.
All Depths Measured From Kelly Bushing
Total Depth 1816' Ft.
Main Hole/Casing Size 6 3/4"
Drill Collar Length 60' I.D. 2.25"
Drill Pipe Length 1423' I.D. 2.151'
Packer Depth(s) 1512-1516' Ft.
Depth Tester Valve 1489' Ft.

Cushion TYPE AMOUNT Ft. Depth Back Pres. Valve
Surface Choke 1/4" Bottom Choke 3/4"

Recovered 1185 Feet of muddy water
Recovered Feet of

Remarks: Unable to calculate due to insufficient curvature of closed in pressure period.



TEMPERATURE	Gauge No. 6705 Depth: 1494 Ft.	Gauge No. 6704 Depth: 1812 Ft.	Gauge No. Depth: Ft.	TIME (00:00-24:00 hrs.)
	12 Hour Clock	12 Hour Clock	Hour Clock	Tool Opened 8:35
Est. 87 °F.	Blanked Off No	Blanked Off Yes	Blanked Off	
Actual °F.	Pressures	Pressures	Pressures	Opened Bypass 10:04

		Field	Office	Field	Office	Field	Office	Reported Minutes	Computed Minutes
Initial Hydrostatic		-	544.6		689.1				
First Period	Flow Initial	395.9	327.0		676.7			—	—
	Flow Final	520.0	495.8		675.6			5	5
	Closed in	541.6	542.6		685.0			30	30
Second Period	Flow Initial	500.0	496.8		685.0			—	—
	Flow Final	541.6	541.5		686.0			9	9
	Closed in	541.6	541.5		686.0			45	45
Third Period	Flow Initial							—	—
	Flow Final								
	Closed in								
Final Hydrostatic			538.4		682.9			—	—

FORM 181-82 - PRINTED IN U.S.A.

FORMATION TEST DATA

LITTLE'S 111033 75C 2/80

Legal Location Sec. - Twp. - Rng. SW 1/4-22-31S-20E
Lease Name KANSAS ORD.
Well No. 1
Test No. 5
Tested Interval 1516-1816'
Lease Owner/Company Name USGS-KGS
Field Area WILDCAT
County LABETTE
State KANSAS
Mea. From Tester Valve

Gauge No.	6705	Depth	1494'	Clock No.	4197	12 hour	Ticket No.	857060

	First Flow Period		First Closed In Pressure			Second Flow Period		Second Closed In Pressure			Third Flow Period		Third Closed In Pressure		
	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.
0	.000	327.0	.000		495.8	.000	496.8	.000		541.5					
1	.0066	358.3	.0068*		541.5	.007	508.3	.301		541.5					
2	.0132	395.8	.0135*		542.6	.014	522.8								
3	.0198	430.2	.0203		542.6	.021	531.1								
4	.0264	465.6				.028	535.3								
5	.0330	495.8				.035	538.4								
6						.042	539.5								
7						.049	540.5								
8						.056	541.5								
9						.063	541.5								
10															
11															
12															
13															
14															
15															

Gauge No.	6704	Depth	1812'	Clock No.	2803	hour	12

0	.000	676.7	.000		675.6	.000	685.0	.000		686.0					
1	.0066	671.5	.0068*		683.9	.007	681.9	.299		686.0					
2	.0132	671.5	.0135*		685.0	.014	681.9								
3	.0198	673.5	.0203		685.0	.021	682.9								
4	.0264	674.6				.028	683.9								
5	.0330	675.6				.035	685.0								
6						.042	686.0								
7						.049	686.0								
8						.056	686.0								
9						.063	686.0								
10															
11															
12															
13															
14															
15															

Reading Interval	1		1		Minutes

REMARKS: *-1 minute intervals

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FORM 183-RI—PRINTED IN U.S.A.

SPECIAL PRESSURE DATA

LITTLE'S 96673 75C 8/74

Appendix B.--Core analyses.

Core Analysis Report

by

CORE Laboratories, Inc.,
Oklahoma City, Okla.

for

U.S. Geological Survey

D.C.L. & F. A. No. 1 Well
Douglas County, Kansas

TEST HOLE 2

U.S. GEOLOGICAL SURVEY
D.C.L. & F.G.A NO. 1 WELL

DOUGLAS COUNTY, KANSAS

DATE: 6/25/80
FORMATION: Arbuckle
DRLG. FLUID:
LOCATION: SE NW NW SEC. 13-12S-17E

FILE NO: 3402-10090
ENGINEER: BOYLE
ELEVATION:

* INDICATES PLUG PERM

WHOLE CORE ANALYSIS

SMP. NO.	DEPTH	PERM. TO AIR MD. MAXIMUM	90 DEG.	VERT.	POROSITY PERCENT	FLUID SATS. OIL	WTR.	GR. DEN.	DESCRIPTION
1	2420.0-21.0	13.0	7.1		11.2	0.0	46.8	2.82	DOL,VGY
2	2421.0-22.0	69.0	4.7		4.8	0.0	41.1	2.83	DOL,VGY
3	2422.0-23.0	16.0	13.0	<0.1	7.8	0.0	66.1	2.73	LM,SHY
4	2423.0-24.0	539.0	190.0	38	12.2	0.0	69.5	2.85	DOL
5	2424.0-25.0	0.7	<0.1		9.5	0.0	57.7	2.83	DOL
6	2425.0-26.0	2.8	2.5		5.6	0.0	72.1	2.64	CHT
7	2426.0-27.0	293.0	77.0		11.6	0.0	58.0	2.83	DOL,VGY,SL/CHT
8	2427.0-28.0	430.0	238.0		13.2	0.0	74.1	2.84	DOL,VGY,SL/CHT
9	2428.0-29.0	*	0.2		14.3	0.0	75.9	2.83	DOL,VGY,SL/CHT
10	2429.0-30.0	9.2	4.6		11.3	0.0	68.4	2.85	DOL,VGY,CHT
11	2430.0-31.0	5.7	0.8		12.1	0.0	33.9	2.83	DOL,VGY,SL/CHT
12	2431.0-32.0	230.0	2.7	49	8.5	0.0	33.7	2.84	DOL,VGY,SL/CHT,VF
13	2432.0-33.0	1705.0	16.0		7.5	0.0	46.8	2.85	DOL,VGY,SL/CHT
14	2433.0-34.0	1.5	0.8		12.2	0.0	28.0	2.81	DOL,VGY,SL/CHT
15	2434.0-35.0	3.8	2.1	<0.1	11.9	0.0	52.8	2.77	DOL,SHY,CHT
16	2435.0-36.0	7.9	7.9		3.6	0.0	63.0	2.68	DOL,CHT
17	2436.0-37.0	105.0	60.0		4.0	0.0	50.5	2.83	DOL,SHY,VGY
18	2437.0-38.0	157.0	155.0	5.2	8.4	0.0	31.3	2.85	DOL,SHY,VGY
19	2438.0-39.0	*	<0.1		2.8	0.0	19.2	2.85	DOL,SHY,VGY
20	2439.0-40.0	*	2.3		16.2	0.0	21.0	2.83	DOL,SHY,VGY
21	2440.0-41.0	*	4.0		8.2	0.0	25.2	2.80	DOL,SHY,VGY
22	2441.0-42.0	*	0.4		10.3	0.0	43.4	2.83	DOL,SHY,VGY
23	2442.0-43.0	*	0.1		11.2	0.0	27.5	2.81	DOL,SHY,VGY
24	2443.0-44.0	*	4.3		9.7	0.0	36.7	2.80	DOL,SHY,VGY

Special Core Analysis Report

by

CORE Laboratories, Inc.,
Oklahoma City, Okla.

for

U.S. Geological Survey

D.C.L. & F.A. No. 1 Well
Douglas County, Kansas

TEST HOLE 2

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
OKLAHOMA CITY, OKLAHOMA

January 14,1981

REPLY TO
SUITE 133
400 SOUTH VERMONT
OKLAHOMA CITY, OKLA.
73108

United States Department of the Interior
Geological Survey
1950 Avenue A - Campus West
Lawrence, Kansas 66045

Attention: Mr. Tony Gogel

Subject: Special Core Analysis Studies
D.C.L. and F.A. No. 1 Well
Douglas County, Kansas
Purchase Request No. 0-4620-0295
CLI File 3404-101-80016

Gentlemen:

This report presents data for electrical resistivity measurements performed on samples recovered from the subject well. These studies were completed as a result of a contract agreement between Mr. Tony Gogel of the U.S. Geological Survey and representatives of Core Laboratories, Inc. on May 27, 1980.

Exposed core segments from the interval 2420-2444 feet were submitted on April 19, 1980. From this core, 1-inch diameter plug samples were requested for routine porosity and air permeability measurements by Mr. Gogel of U.S. Geological Survey. These samples were drilled using tap water as a bit lubricant and coolant, extracted of hydrocarbons in a vapor phase toluene extractor, and dried at 180°F. Boyle's Law porosity and air permeability were measured for each sample. These samples are identified by sample number and lithological description on page 1.

For the electrical resistivity measurements, the samples were leached of all salt with methanol, and dried at 180°F. Boyle's Law porosity and air permeability of each sample were measured. These samples were evacuated and pressure saturated with a simulated brine containing 48,400 ppm sodium chloride which was formulated from information furnished by Mr. Gogel.

Electrical resistivities of the brine and saturated samples were measured at atmospheric conditions. These measurements were repeated for several days until the resistivities of the samples had stabilized. Following the resistivity measurements at atmospheric conditions, electrical resistivities of the samples were measured as a function of effective overburden pressures which were 200, 784, 1567, and 3134 psig. Formation resistivity factors were calculated from these data.

The formation factor data are tabulated on page 2. Formation factor is plotted as a function of porosity on pages 3 through 7 for the various effective overburden pressures. The cementation exponent "m" which is indicated on each plot was determined from the slope of a visual best-fit line drawn relating formation factor to porosity.

The results are as follows:

Effective Overburden Pressure, PSI	a	m
0.0	1.0	1.97
200	1.0	1.99
784	1.0	2.02
1567	1.0	2.05
3134	1.0	2.10

The deviation of the samples off the best-fit line are mainly due to the number of vugs present.

Next, all samples were placed in a porous-plate capillary pressure cell for desaturation. Electrical resistivities were measured at various brine saturations. Resistivity index data were calculated from these measurements.

The resistivity index data are tabulated on page 8. A composite plot for all samples of resistivity index as a function of brine saturation is shown on page 9. The saturation exponent "n" was determined from the slope of the best-fit line relating resistivity index to brine saturation. The saturation exponent "n" is 1.85 for the composite plot, and ranges from 1.72 to 2.07 for the individual samples. The plots for the individual samples are on pages 10 through 14. The variation of resistivity index data can be attributed to the heterogeneous lithology.

This concludes all tests requested. If you have any questions or if we can be of further service, please contact us. We appreciate this opportunity to be of assistance.

Very truly yours,

CORE LABORATORIES, INC.

David C. Monk for
Dale E. Boyle
District Manager

DEB:DCM:cj

7 cc - Addressee

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
OKLAHOMA CITY, OKLAHOMA

File 3404-101-80016

Company U.S. GEOLOGICAL SURVEY
Well D.C.L. AND F.A. NO. 1

OVERBURDEN FORMATION FACTOR DATA

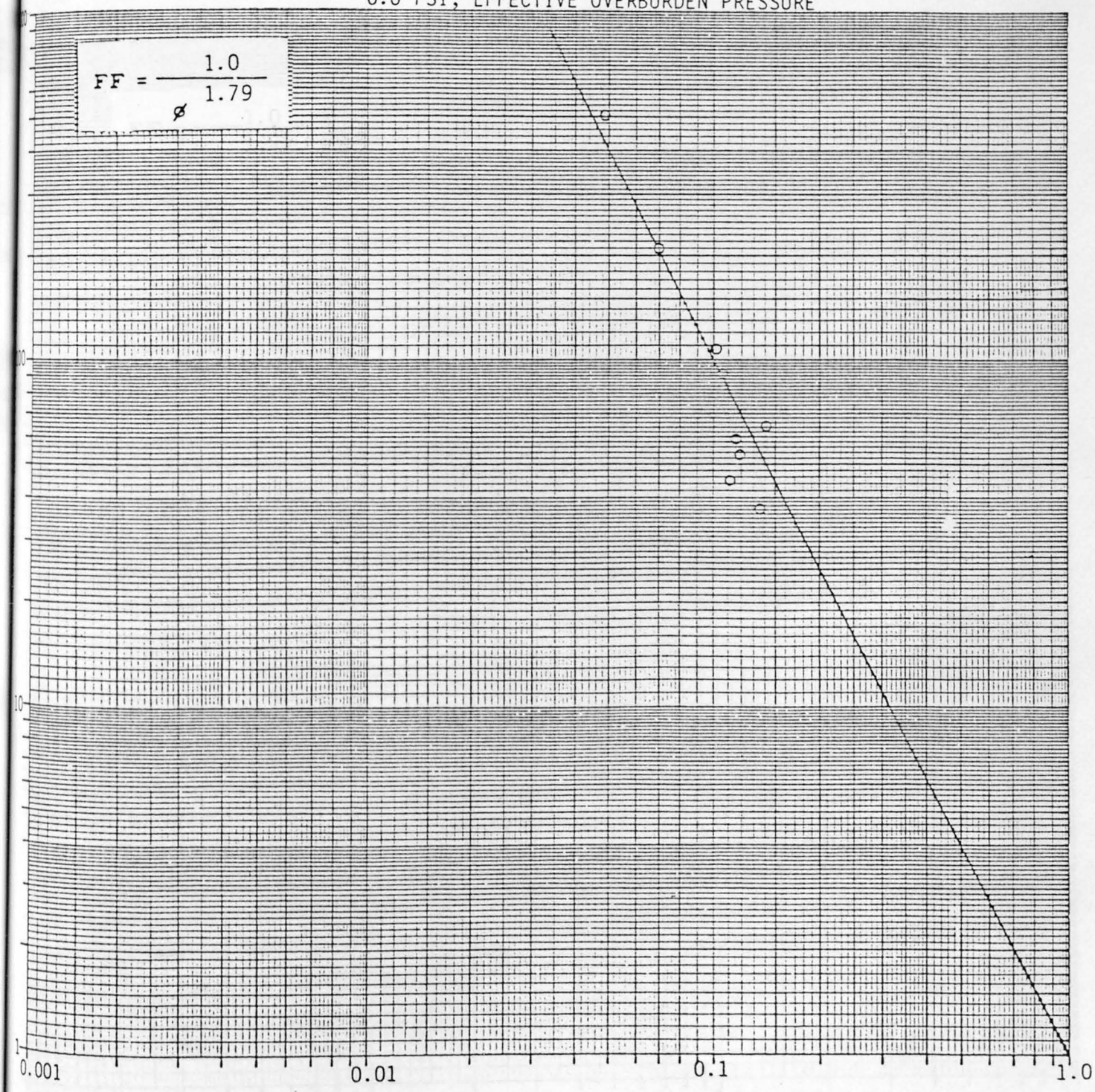
Saturant 48,400 ppm NaCl

Resistivity of Saturant, Ohm-Meters: 0.144 @ 73.0°F

Sample Number	Depth, Feet	Air Permeability, Millidarcies	Porosity, Per Cent	Effective Overburden Pressure, PSI				
				0.0	200	784	1567	3134
				Formation Resistivity Factor				
1	2420-21	6.6	10.2	97.9	107	117	123	131
2	2421-22	0.07	4.9	494	503	611	765	1068
4	2423-24	17	14.2	62.2	64.2	66.9	69.5	72.3
9	2428-29	0.1	7.0	197	209	241	273	360
10	2429-30	12	11.6	58.9	59.1	70.0	73.5	79.0
18	2437-38	5.3	10.6	89.5	90.8	98.0	106	114
20	2439-40	2.2	13.7	35.3	37.0	41.1	43.6	45.5
22	2441-42	0.3	11.2	41.2	44.8	48.0	49.8	51.1
24	2443-44	1.8	11.1	52.8	53.2	56.7	59.7	62.5

Company U.S. GEOLOGICAL SURVEY Formation
Well D.C.L. AND F.A. NO. 1 County DOUGLAS
Field State KANSAS

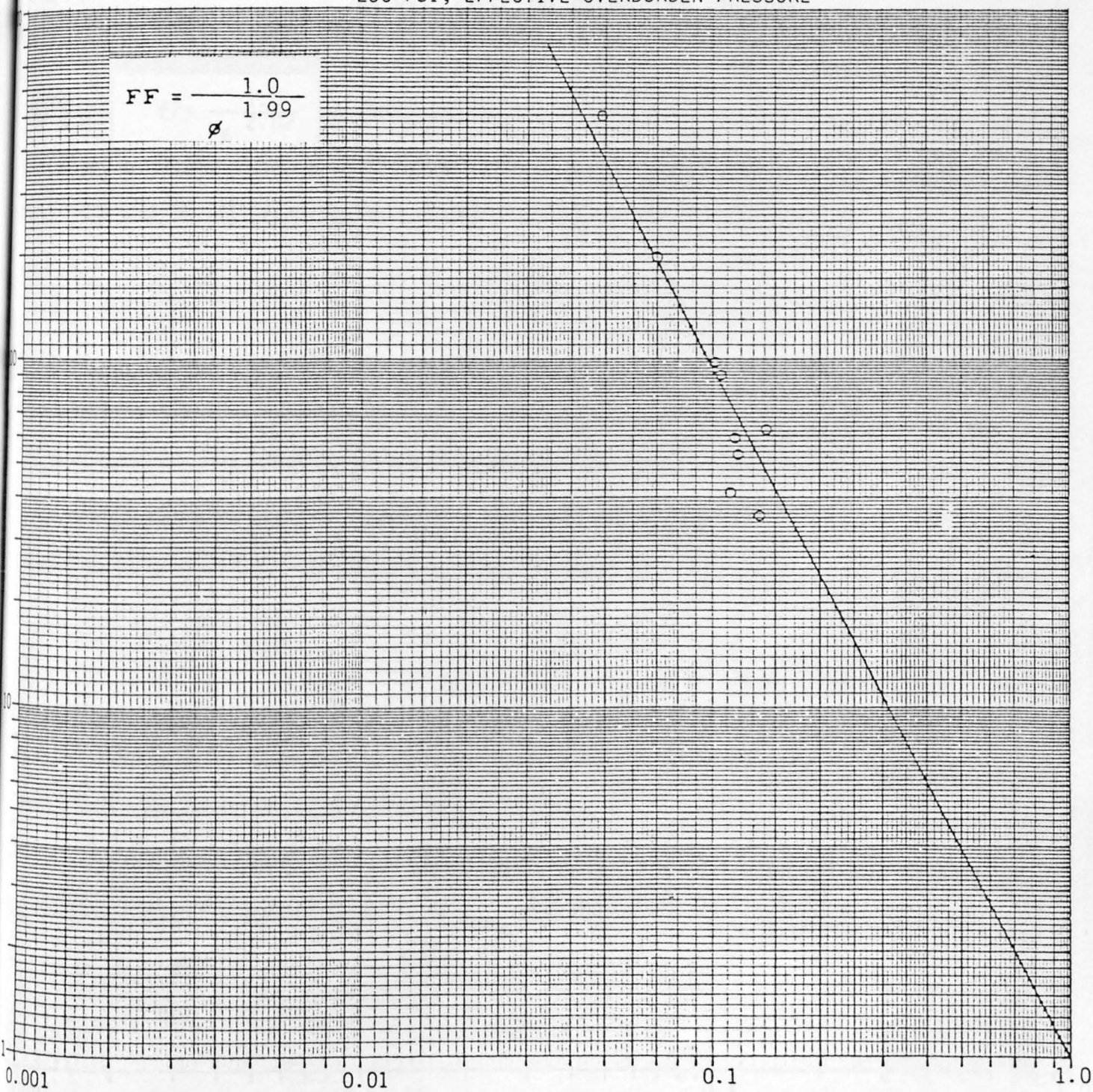
0.0 PSI, EFFECTIVE OVERBURDEN PRESSURE



Company U.S. GEOLOGICAL SURVEY
Well D.C.L. AND F.A. NO. 1
Field

Formation
County DOUGLAS
State KANSAS

200 PSI, EFFECTIVE OVERBURDEN PRESSURE



CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
OKLAHOMA CITY, OKLAHOMA

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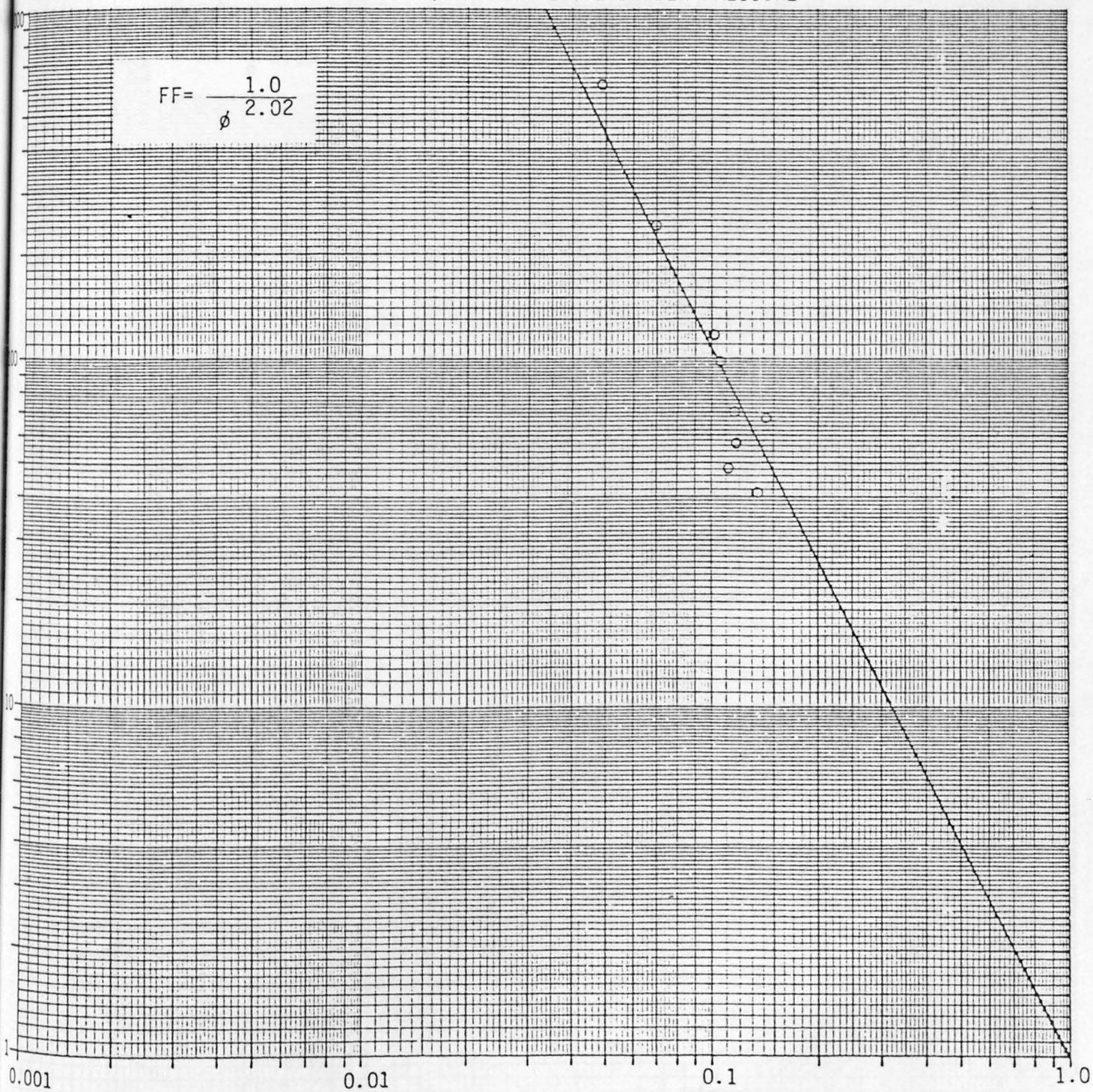
File 3404-101-80016

Company U.S. GEOLOGICAL SURVEY
Well D.C.L. AND F.A. NO. 1
Field

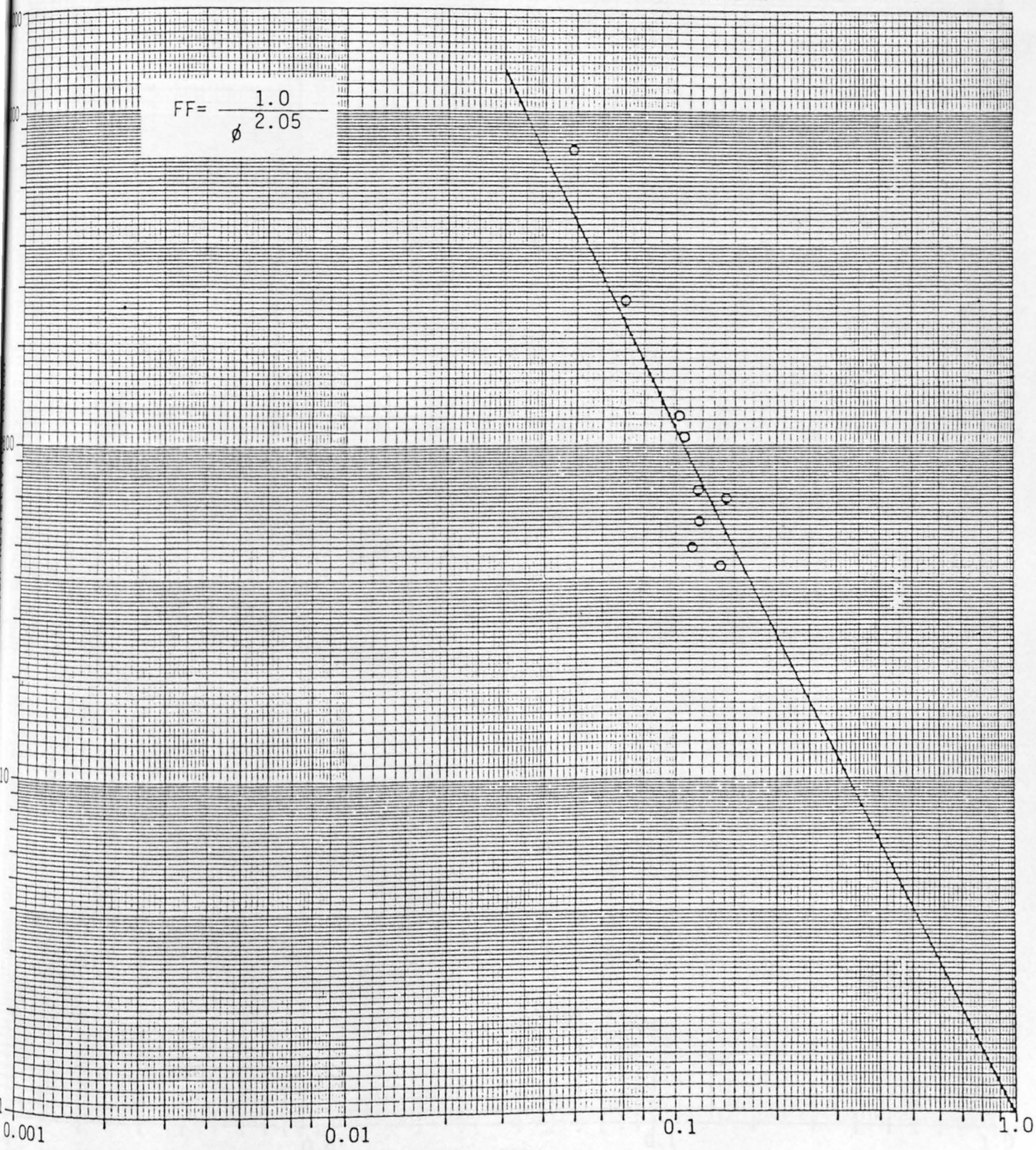
Formation
County DOUGLAS
State KANSAS

784 PSI, EFFECTIVE OVERBURDEN PRESSURE



Company U.S. GEOLOGICAL SURVEY Formation
Well D.C.L. AND F.A. NO. 1 County DOUGLAS
Field State KANSAS

1567 PSI, EFFECTIVE OVERBURDEN PRESSURE

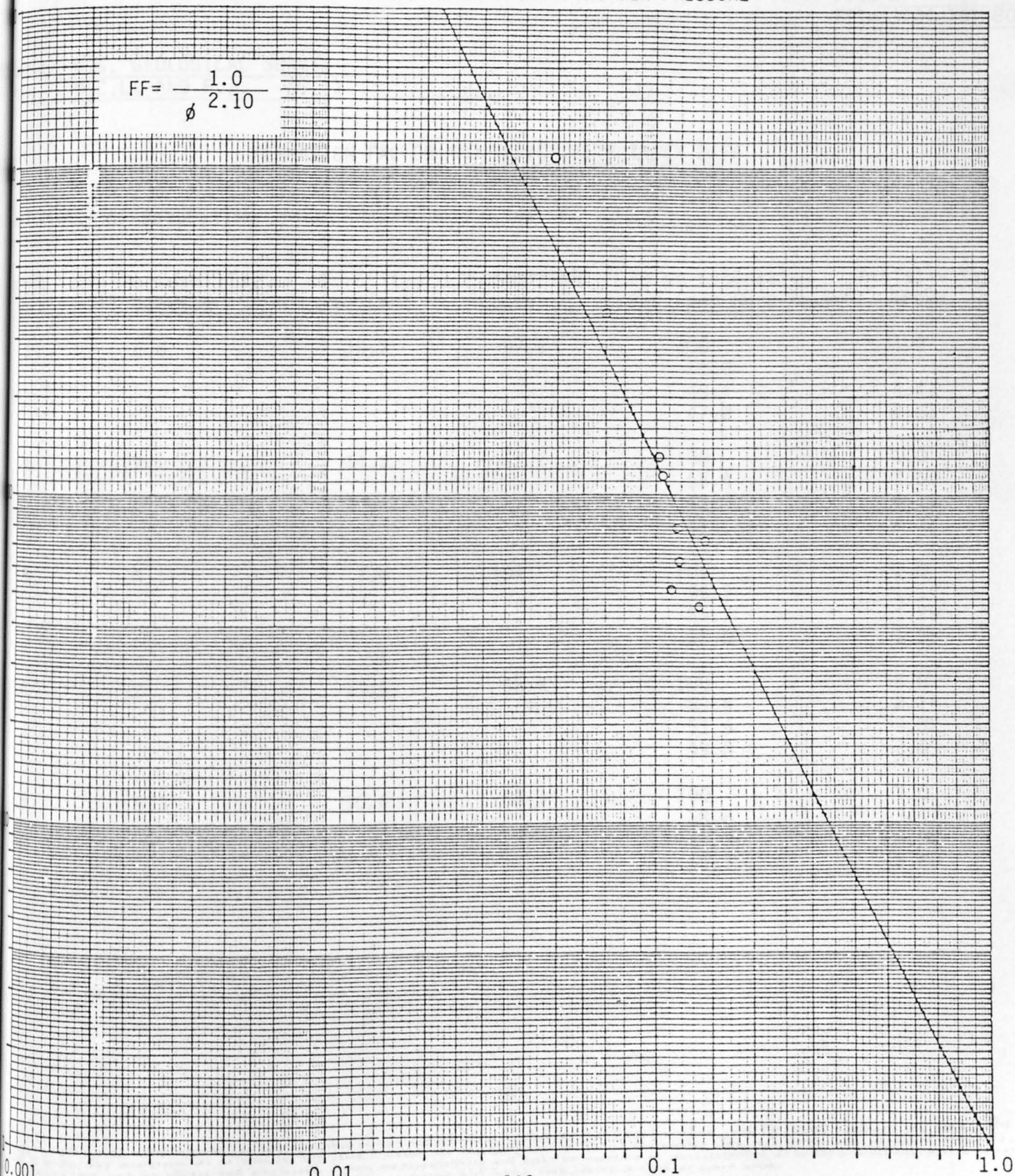


Company U.S. GEOLOGICAL SURVEY
Well D.C.L. AND F.A. NO. 1
Field

Formation
County DOUGLAS
State KANSAS

3134 PSI, EFFECTIVE OVERBURDEN PRESSURE

$$FF = \frac{1.0}{\phi^{2.10}}$$



Company U.S. GEOLOGICAL SURVEY
Well D.C.L. AND F.A. NO. 1

FORMATION FACTOR AND RESISTIVITY INDEX DATA

Resistivity of Saturating Brine, Ohm-Meters: 0.144 @ 73.0°F

Sample Number	Air Permeability, Millidarcies	Porosity, Per Cent	Formation Factor	Brine Saturation Per Cent Pore Space	Resistivity Index
1	6.6	10.2	97.9	100	1.0
				62.0	2.59
				49.4	4.41
				47.2	4.43
4	17	14.2	62.2	100	1.0
				58.4	2.53
				45.8	4.19
				41.0	4.32
9	0.11	7.0	197	100	1.0
				95.2	1.14
				85.7	1.29
				83.6	1.55
10	12	11.6	58.9	100	1.0
				69.6	2.14
				51.6	3.32
				49.8	3.59
18	5.3	10.6	89.5	100	1.0
				58.8	3.17
				47.9	3.92
				43.3	5.80

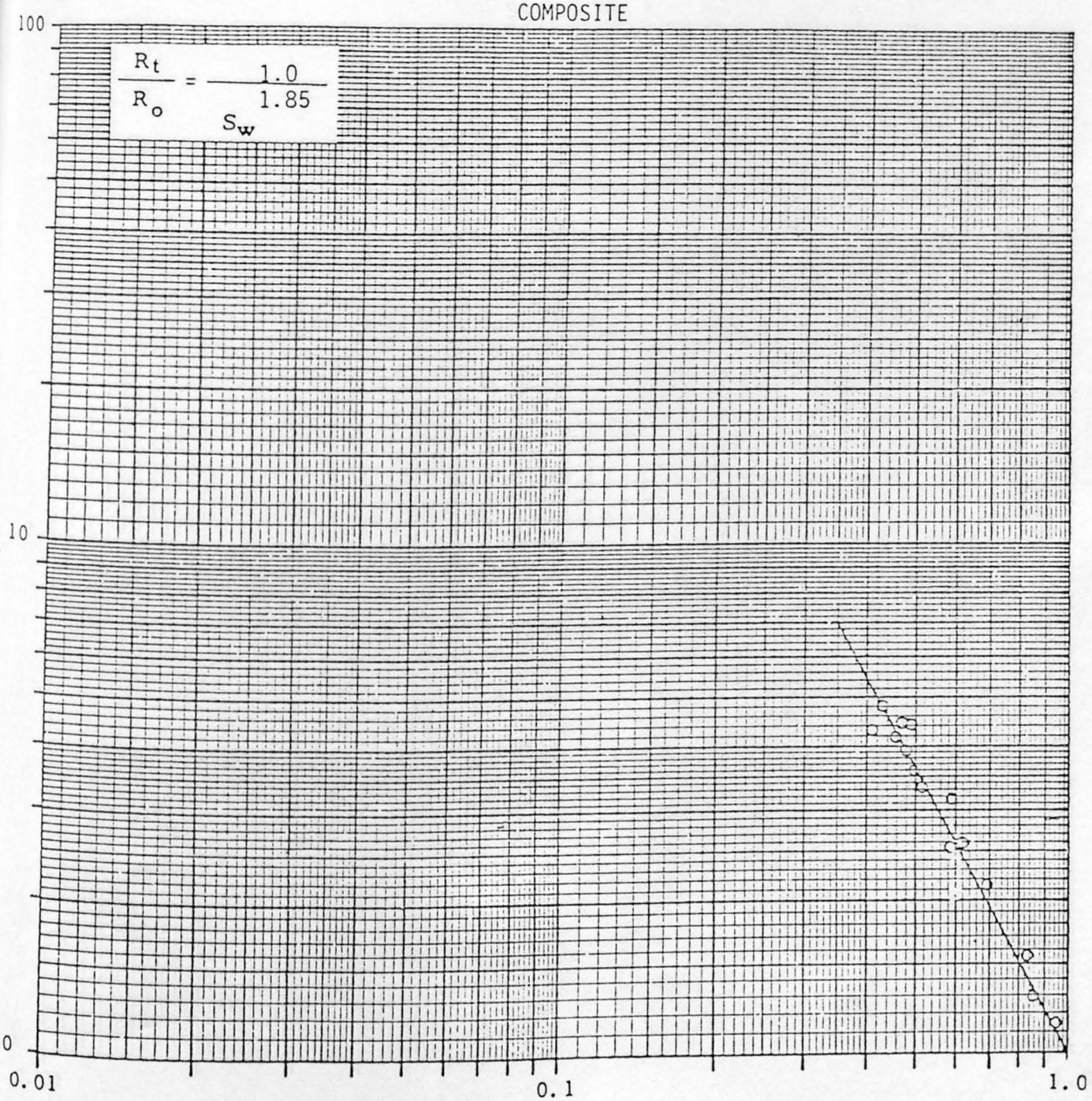
CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
OKLAHOMA CITY, OKLAHOMA

Page 9
File 3404-101-80016

Company U.S. GEOLOGICAL SURVEY
Well D.C.L. AND F.A. NO. 1
Field

Formation
County DOUGLAS
State KANSAS

COMPOSITE



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Petroleum Reservoir Engineering
OKLAHOMA CITY, OKLAHOMA

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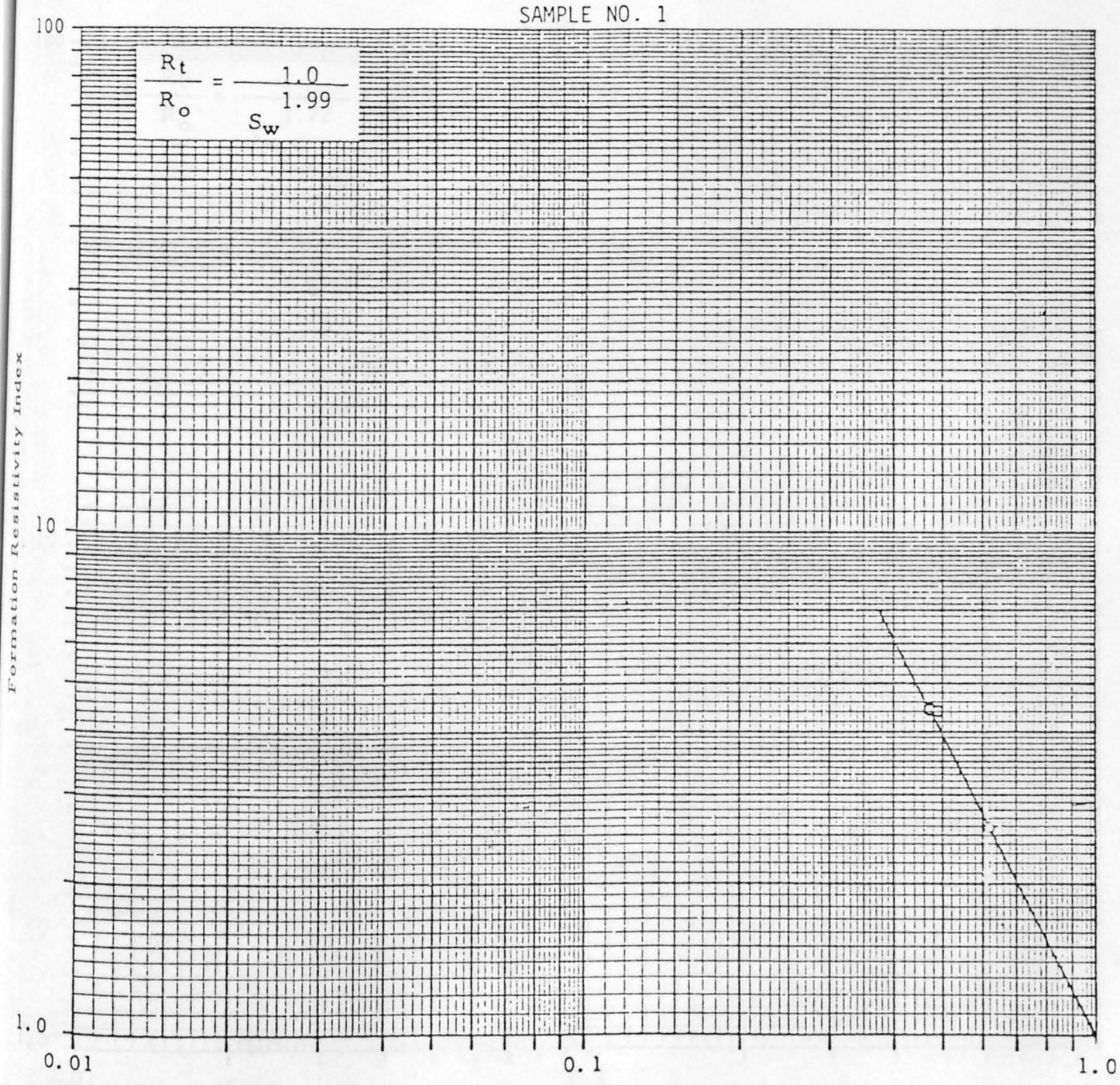
File 3404-101-80016

Company U.S. GEOLOGICAL SURVEY
Well D.C.L. AND F.A. NO. 1
Field

Formation
County DOUGLAS
State KANSAS

SAMPLE NO. 1



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Petroleum Reservoir Engineering
OKLAHOMA CITY, OKLAHOMA

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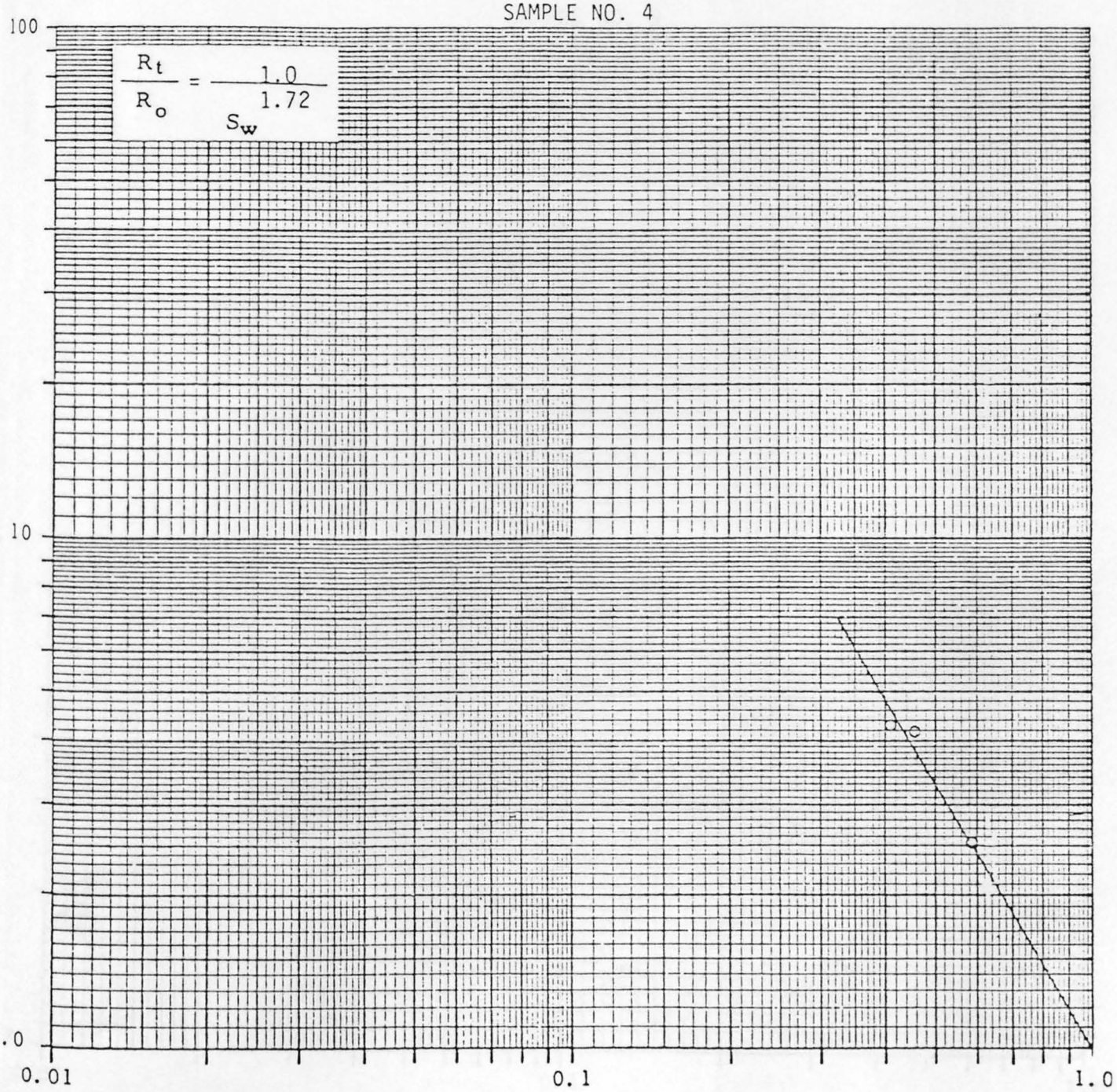
File 3404-101-80016

Company U.S. GEOLOGICAL SURVEY
Well D.C.L. AND F.A. NO. 1
Field

Formation
County DOUGLAS
State KANSAS

SAMPLE NO. 4



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Petroleum Reservoir Engineering
OKLAHOMA CITY, OKLAHOMA

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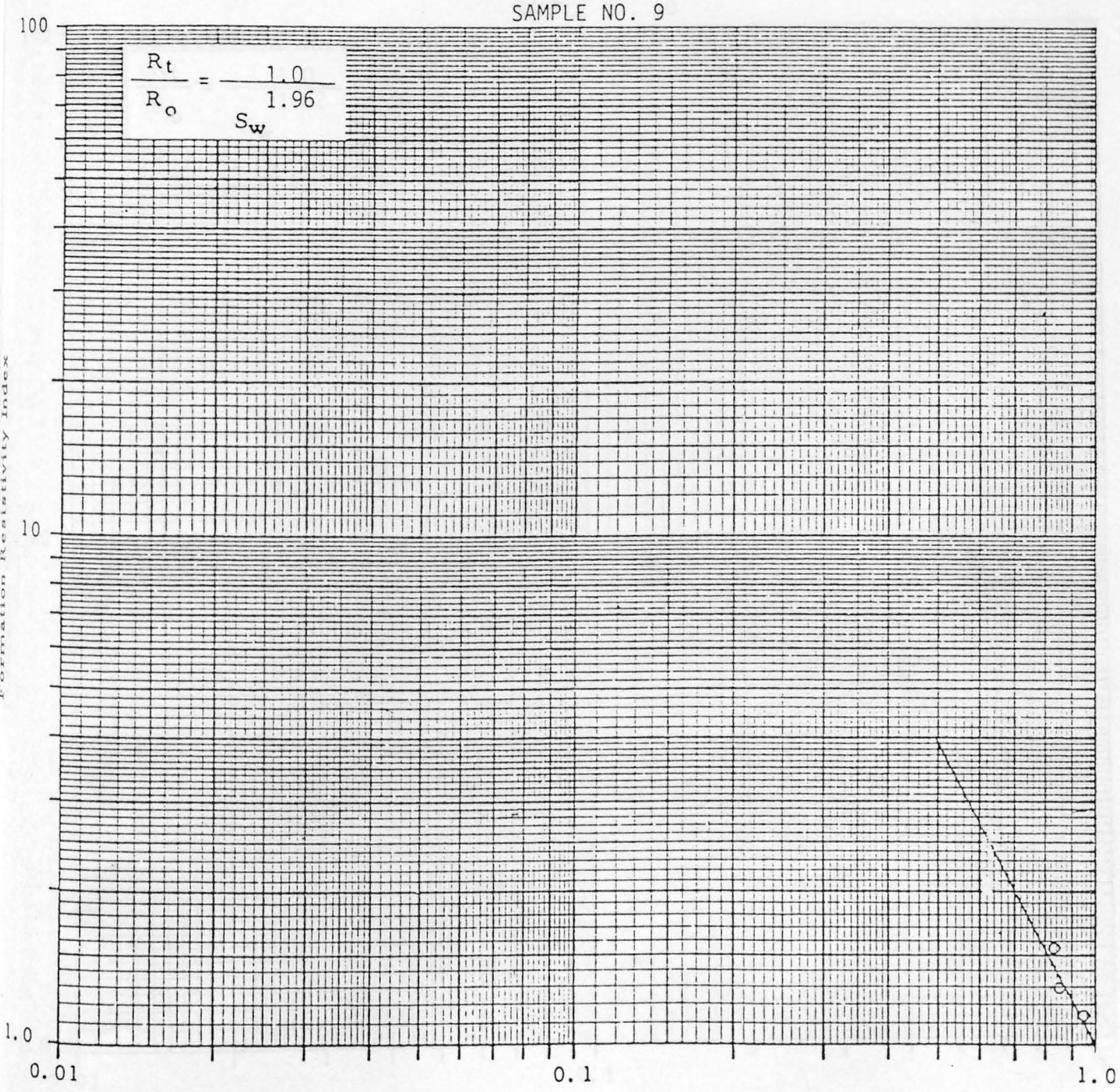
File 3404-101-80016

Company U.S. GEOLOGICAL SURVEY
Well D.C.L. AND F.A. NO. 1
Field

Formation
County DOUGLAS
State KANSAS

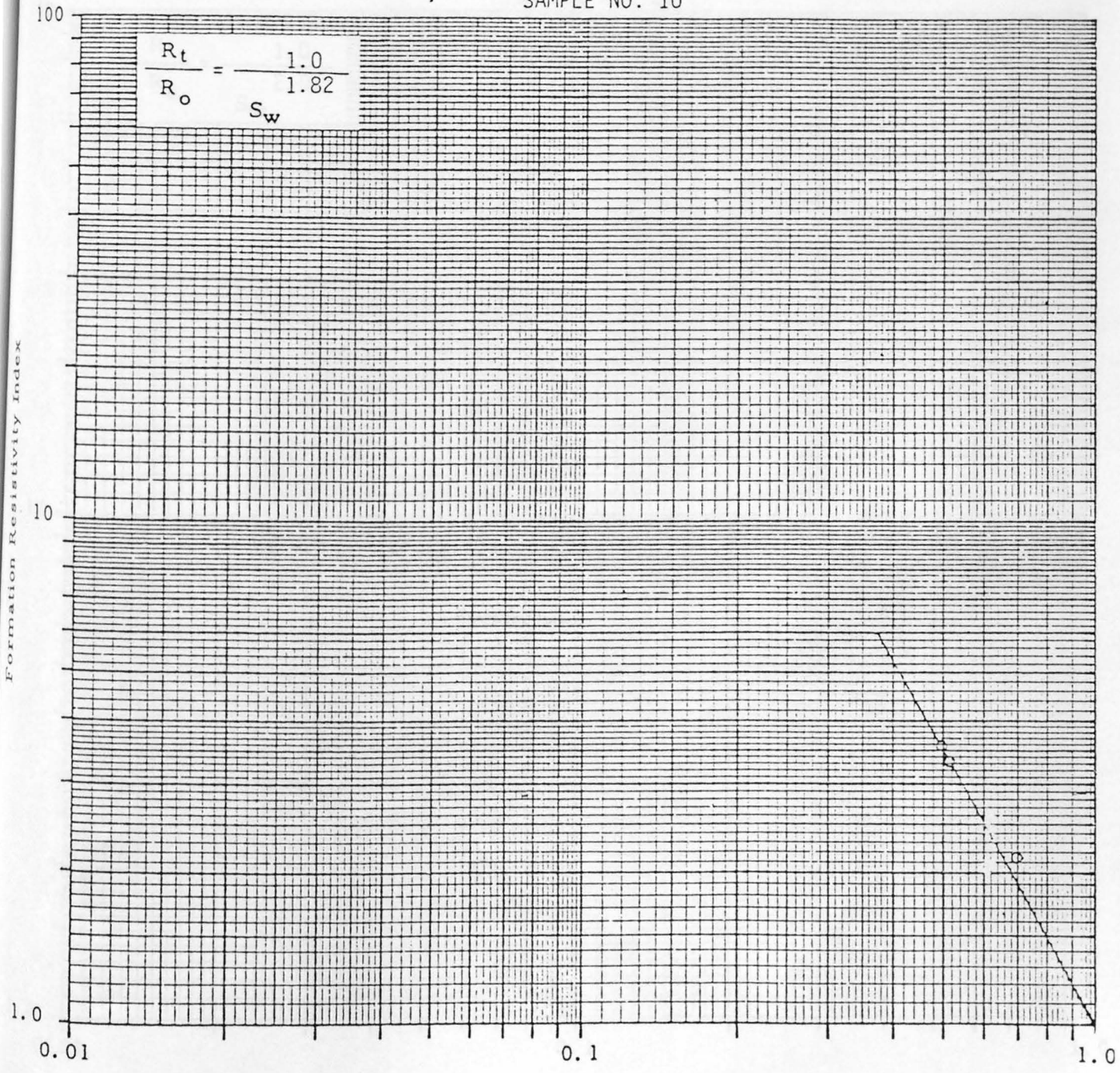
SAMPLE NO. 9



Company U.S. GEOLOGICAL SURVEY
Well D.C.L. AND F.A. NO. 1
Field

Formation
County DOUGLAS
State KANSAS

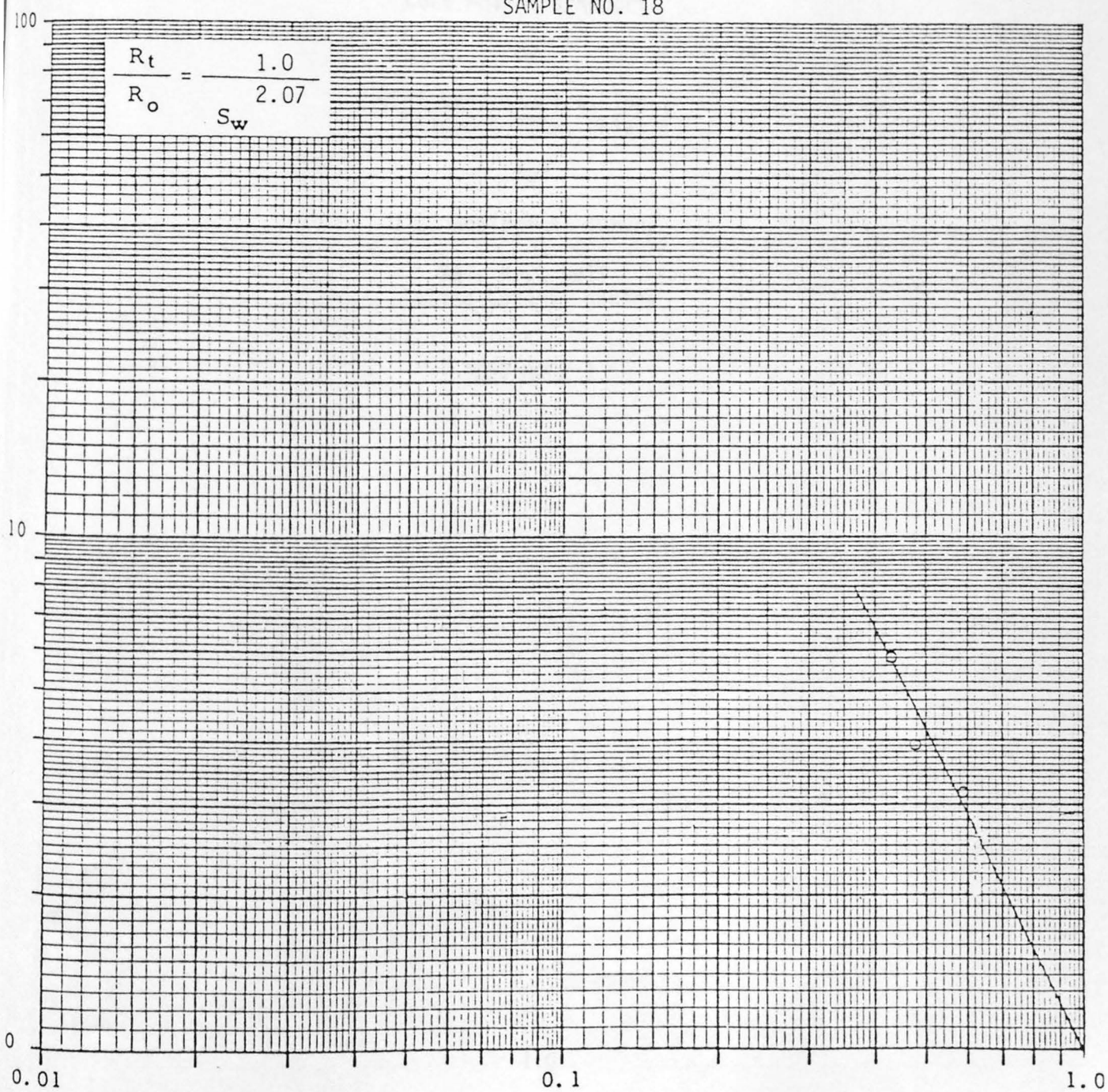
SAMPLE NO. 10



Company U.S. GEOLOGICAL SURVEY
Well D.C.L. AND F.A. NO. 1
Field

Formation
County DOUGLAS
State KANSAS

SAMPLE NO. 18



Core Analysis Report

by

CORE Laboratories, Inc.,
Oklahoma City, Okla.

for

U.S. Geological Survey

Geis No.1 Well
Saline County, Kansas

TEST HOLE 3

U.S. GEOLOGICAL SURVEY
GEIS NO. 1 WELL

SALINE COUNTY, KANSAS

DATE: 6/25/80
FORMATION:
DRLG. FLUID:
LOCATION: SW SW SW SEC. 32-13S-2W

FILE NO: 3402-10092
ENGINEER: BOYLE
ELEVATION:

* INDICATES PLUG PERM

SMP. NO.	DEPTH	PERM. TO AIR MD. MAXIMUM	90 DEG	VERT.	POROSITY PERCENT	FLUID SATS. OIL	WTR.	GR. DEN.	DESCRIPTION
			WHOLE CORE ANALYSIS						
1	3481.0-82.0	*	<0.1		4.9	0.0	60.4	2.81	DOL,VGY
2	3482.0-83.0	182.0	<0.1	<0.1	3.9	0.0	51.7	2.81	DOL,VGY,VF
3	3483.0-84.0	63.0	5.0	<0.1	5.4	0.0	72.6	2.84	DOL,VGY
4	3484.0-85.0	*	0.1		6.0	0.0	50.4	2.83	DOL,VGY
5	3485.0-86.0	16.0	12.0		11.8	0.0	86.6	2.83	DOL,VGY
6	3486.0-87.0	10.0	8.7		6.4	0.0	81.7	2.83	DOL,VGY
7	3487.0-88.0	0.1	0.1	<0.1	2.9	0.0	47.7	2.80	DOL,FEW VGS
8	3488.0-89.0	0.1	0.1		5.4	0.0	72.4	2.82	DOL,VGY
9	3489.0-90.0	8.4	6.8	<0.1	8.8	0.0	63.9	2.83	DOL,VGY
10	3490.0-91.0	51.0	49.0		14.0	0.0	88.9	2.82	DOL,VGY
11	3491.0-92.0	29.0	28.0		14.2	0.0	88.6	2.82	DOL,VGY
12	3492.0-93.0	3114.0	519.0		14.9	0.0	92.1	2.82	DOL,VGY
13	3493.0-94.0	<0.1	<0.1	<0.1	3.9	0.0	36.5	2.84	DOL,VGY

111

Special Core Analysis Report

by

CORE Laboratories, Inc.,
Oklahoma City, Okla.

for

U.S. Geological Survey

Geis No. 1 Well
Saline County, Kansas

TEST HOLE 3

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
OKLAHOMA CITY, OKLAHOMA

REPLY TO
SUITE 133
400 SOUTH VERMONT
OKLAHOMA CITY, OKLA.
73108

February 7, 1981

United States Department of the Interior
Geological Survey
1950 Avenue A - Campus West
Lawrence, Kansas 66045

Attn: Mr. Tony Gogel

Subject: Special Core Analysis Studies
Geis No. 1 Well
Saline County, Kansas
Purchase Request No. 0-4620-0295
CLI File 3404-101-80016

Gentlemen:

This report presents data for electrical resistivity measurements performed on samples recovered from the subject well. These studies were completed as a result of a contract agreement between Mr. Tony Gogel of the U.S. Geological Survey and representatives of Core Laboratories, Inc. on May 27, 1980.

Exposed core segments from the interval 3481-3494 feet were submitted on April 19, 1980. From this core, 1-inch diameter plug samples were requested for routine porosity and air permeability measurements by Mr. Gogel of U.S. Geological Survey. These samples were drilled using tap water as a bit lubricant and coolant, extracted of hydrocarbons in a vapor phase toluene extractor, and dried at 180°F. Boyle's Law porosity and air permeability were measured for each sample. These samples are identified by sample number and lithological description on page 1.

For the electrical resistivity measurements, the samples were leached of all salt with methanol, and dried at 180°F. Boyle's Law porosity and air permeability of each sample were measured. These samples were evacuated and pressure saturated with a simulated brine containing 5900 ppm sodium chloride which was formulated from information furnished by Mr. Gogel.

Electrical resistivities of the brine and saturated samples were measured at atmospheric conditions. These measurements were repeated for several days until the resistivities of the samples had stabilized. Following the reisitivity measurements at atmospheric conditions, electrical resistivities of the samples were measured as a function of effective overburden pressures which were 200, 1058, 2116, and 4232 psig. Formation resistivity factors were calculated from these data.

The formation factor data are tabulated on page 2. Formation factor is plotted as a function of porosity on pages 3 through 7 for the various effective overburden pressures. The cementation exponent "m" which is indicated on each plot was determined from the slope of a visual best-fit line drawn relating formation factor to porosity.

The results are as follows:

Effective Overburden Pressure, PSI	a	m
0.0	1.00	1.83
200	1.00	1.87
1058	1.00	1.96
2116	1.00	2.03
4232	1.00	2.11

The deviation of the samples off the best-fit line can be attributed to the heterogeneous lithology.

Next, all samples were placed in a porous-plate capillary pressure cell for desaturation. Electrical resistivities were measured at various brine saturations. Resistivity index data were calculated from these measurements.

The resistivity index data are tabulated on page 8. A composite plot for all samples of resistivity index as a function of brine saturation is shown on page 9. The saturation exponent "n" was determined from the slope of the best-fit line relating resistivity index to brine saturation. The saturation exponent "n" is 1.41 for the composite plot, and ranges from 1.08 to 1.84 for the individual samples. The plots for the individual samples are on pages 10 through 13. The wide variations of saturation exponents can, as the variations of formation factor data, be attributed to the heterogeneous lithology.

This report concludes all tests requested for this well. If you have any questions or if we can be of further service, please contact us. We appreciate this opportunity to be of assistance.

Very truly yours,

CORE LABORATORIES, INC.

David C. Monk

David C. Monk for
Dale E. Boyle
District Manager

DEB:DCM:cj

7 cc - Addressee

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
OKLAHOMA CITY, OKLAHOMA

File 3404-101-8001(

Company U.S. GEOLOGICAL SURVEY
Well GEIS NO. 1

OVERBURDEN FORMATION FACTOR DATA

Saturant: 5900 ppm NaCl

Resistivity of Saturant, Ohm-meters: 1.01 @ 72.0°F

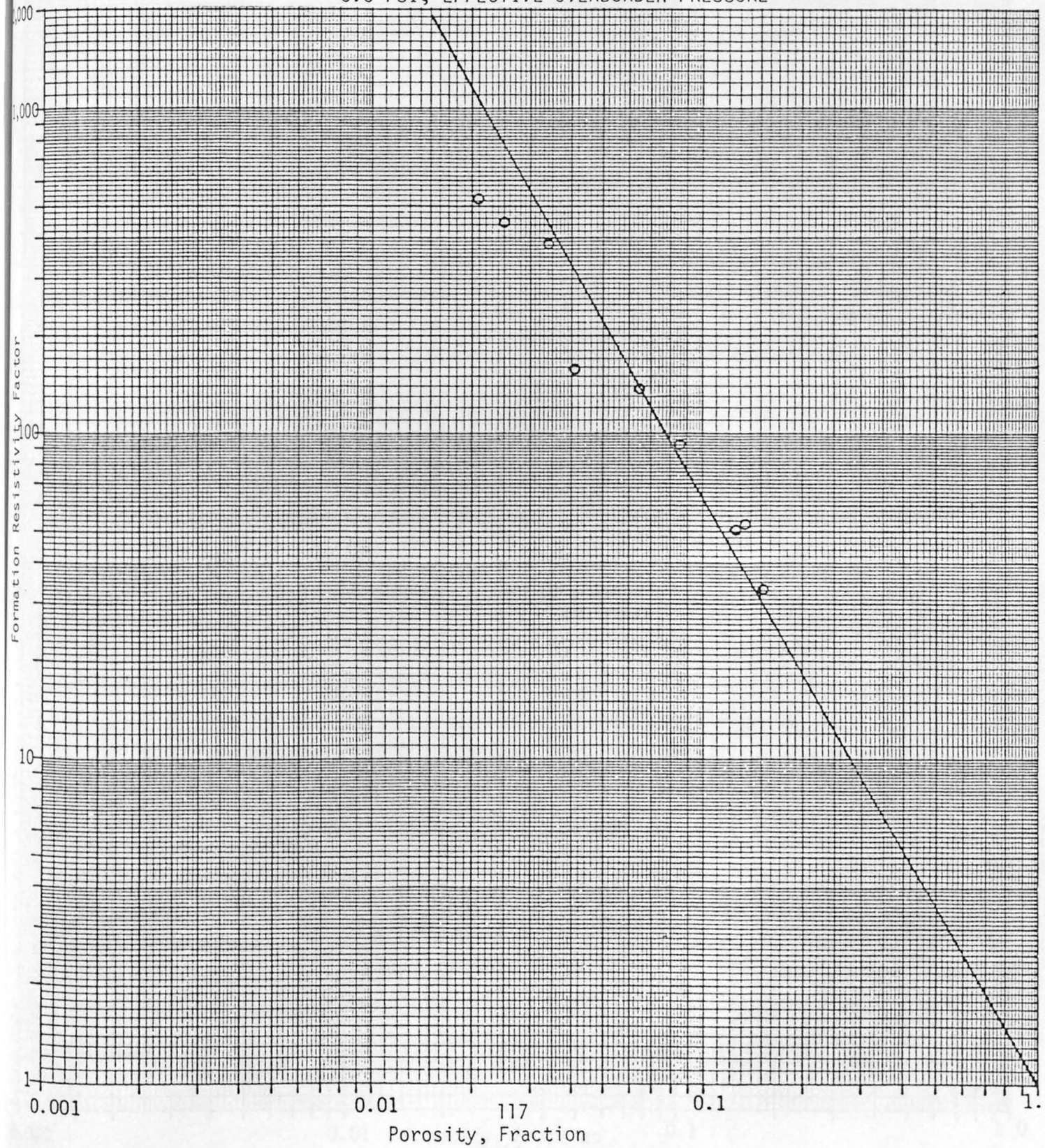
Sample Number	Depth, Feet	Air Permeability, Millidatcies	Porosity, Per Cent	Effective Overburden Pressure, PSI				
				0.0	200	1058	2116	4232
				Formation Resistivity Factor				
2	3482-83	0.02	2.5	445	588	818	1089	1589
4	3484-85	0.02	3.4	382	385	497	437	878
5	3485-86	0.8	13.5	53.0	76.9	93.6	114	147
7	3487-88	0.02	4.1	158	366	502	701	984
8	3488-89	0.05	6.5	138	161	184	212	245
9	3489-90	0.05	8.6	93.3	170	222	321	454
10	3490-91	12	12.7	50.9	62.7	71.7	80.3	90.3
11	3491-92	29	15.1	33.3	41.3	47.2	52.6	59.0
13	3493-94	0.02	2.1	526	910	1200	1652	2500

Company U.S. GEOLOGICAL SURVEY
Well GEIS NO. 1
Field

Formation
County SALINE
State KANSAS

$$FF = \frac{1.0}{\phi^{1.83}}$$

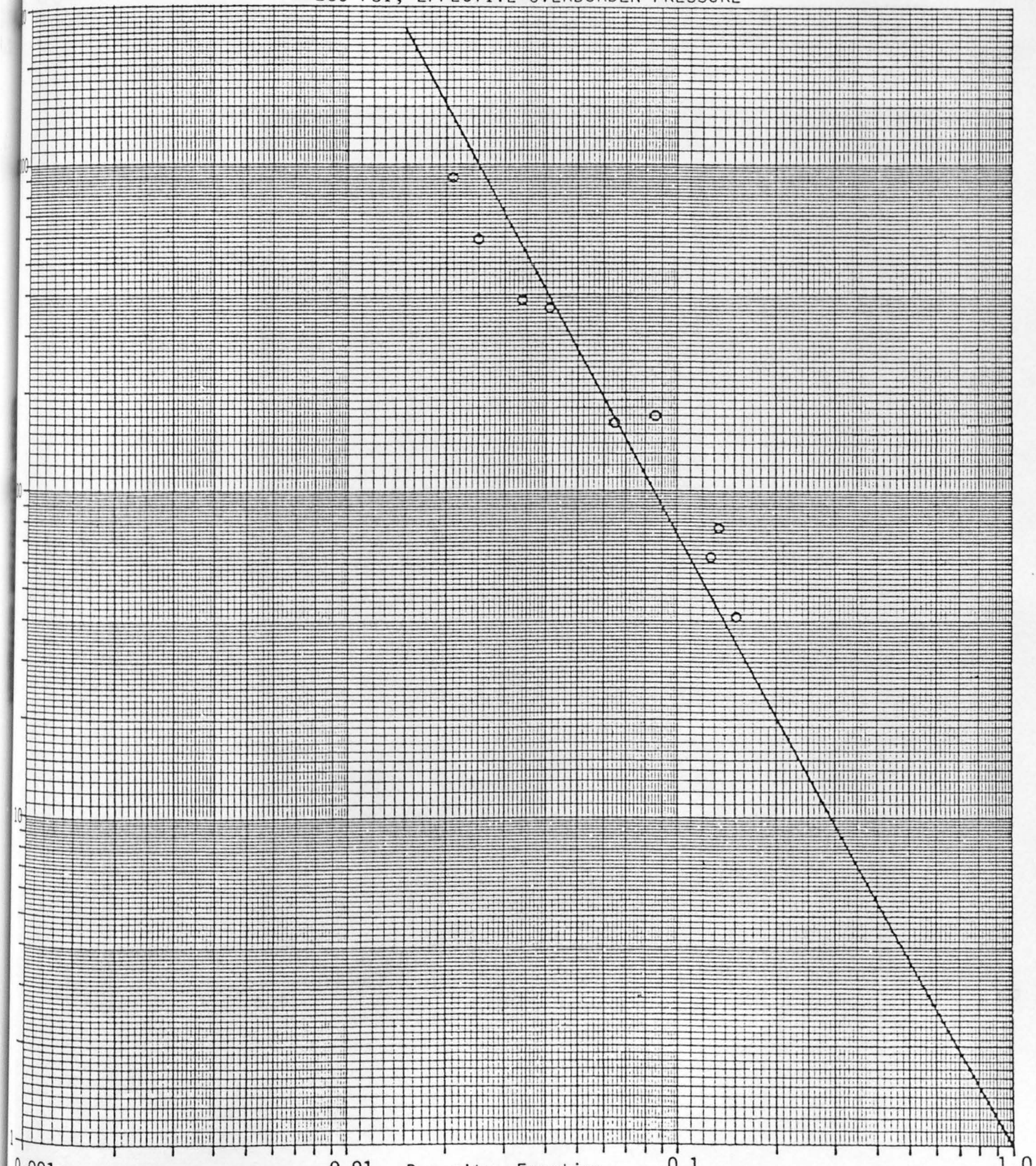
0.0 PSI, EFFECTIVE OVERBURDEN PRESSURE



Company U.S. GEOLOGICAL SURVEY Formation
Well GEIS NO. 1 County SALINE
Field State KANSAS

$$FF = \frac{1.0}{\phi^{1.87}}$$

200 PSI, EFFECTIVE OVERBURDEN PRESSURE

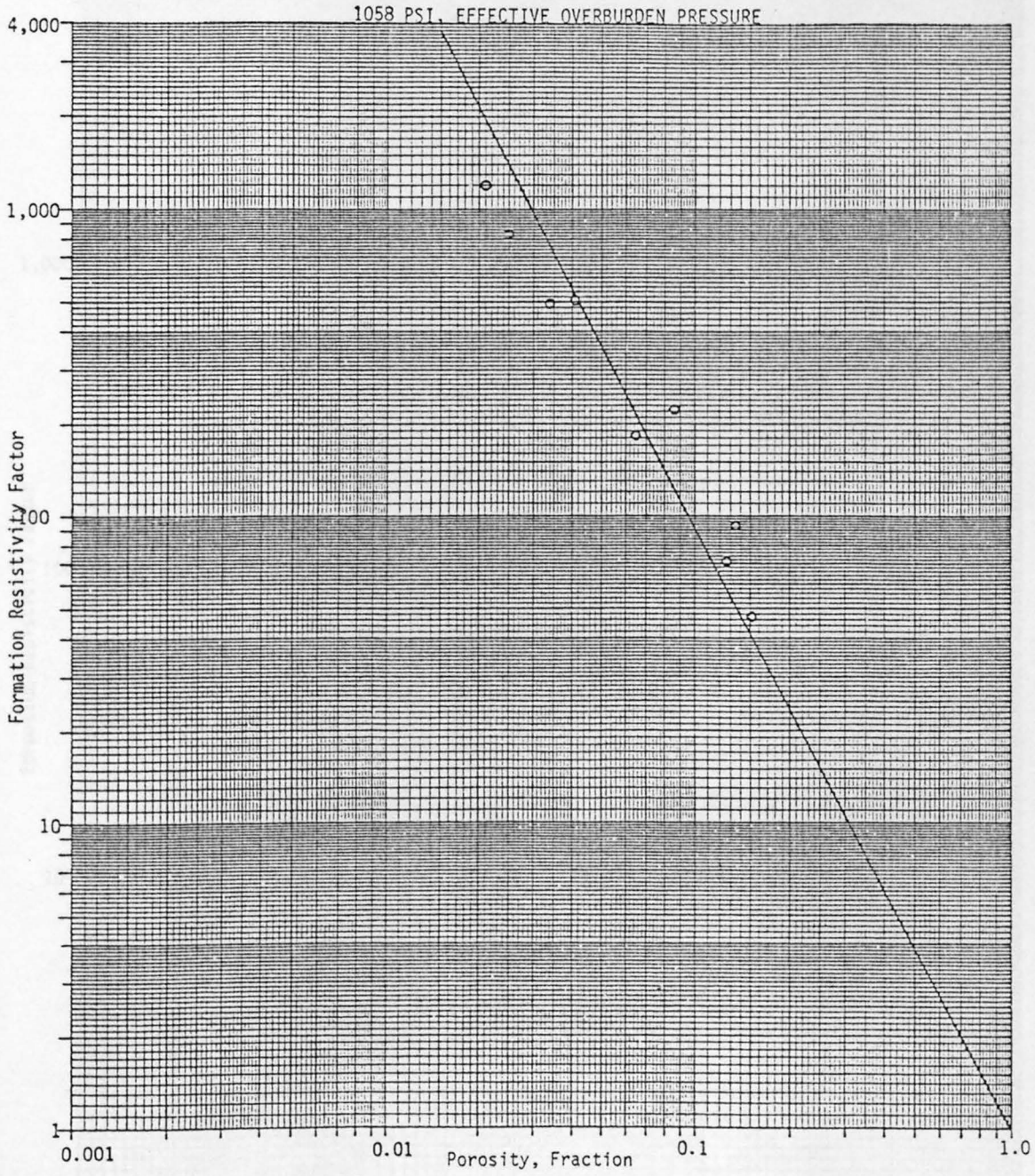


CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
OKLAHOMA CITY, OKLAHOMA

Page 5
File 3404-101-80016

Company U.S. GEOLOGICAL SURVEY Formation
Well GEIS NO. 1 County SALINE
Field State KANSAS

$$FF = \frac{1.0}{\phi^{1.96}}$$



CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
OKLAHOMA CITY, OKLAHOMA

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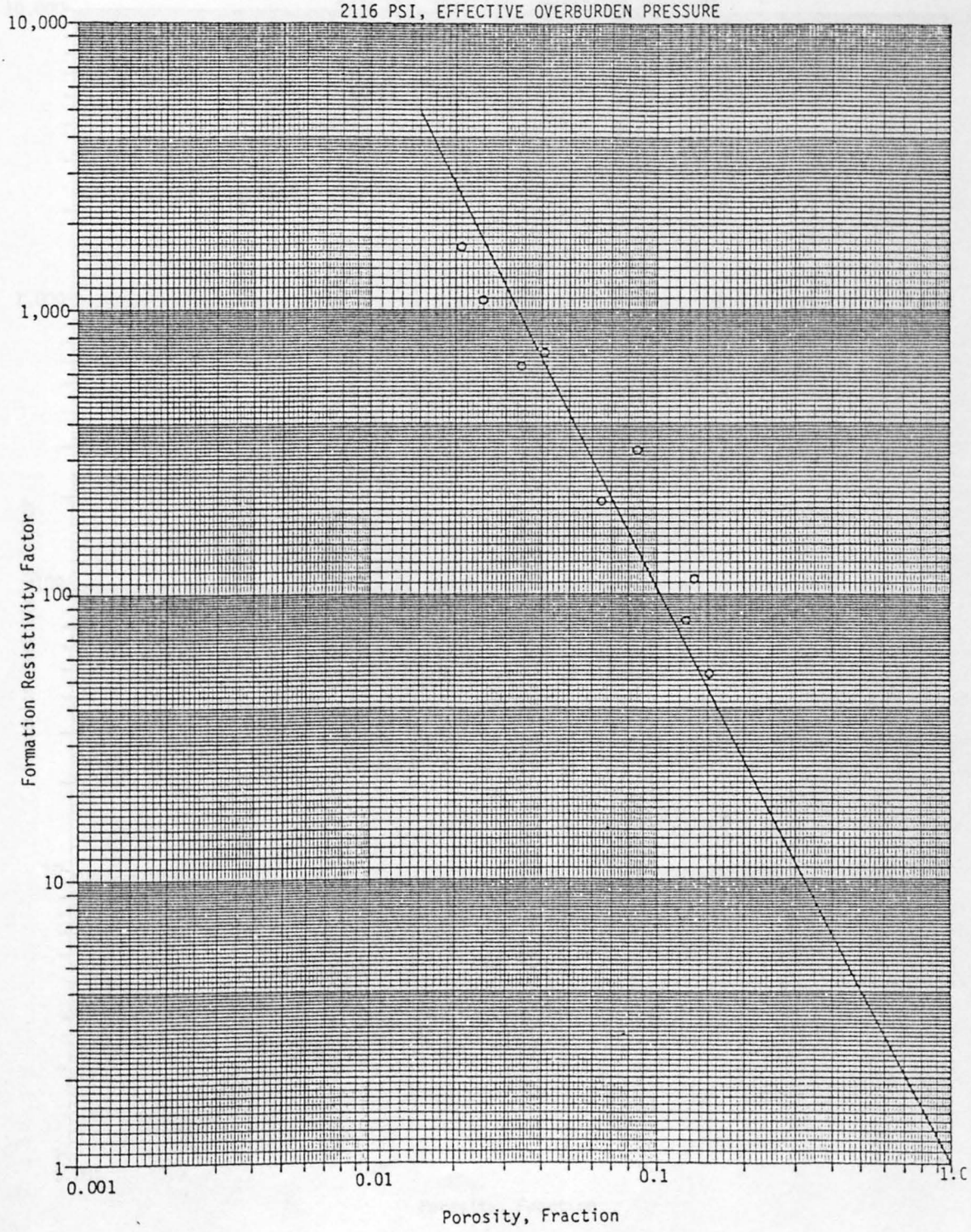
File 3404-101-80016

Company U.S. GEOLOGICAL SURVEY
Well GEIS NO. 1
Field

Formation
County SALINE
State KANSAS

$$FF = \frac{1.0}{\phi^{2.03}}$$

2116 PSI, EFFECTIVE OVERBURDEN PRESSURE



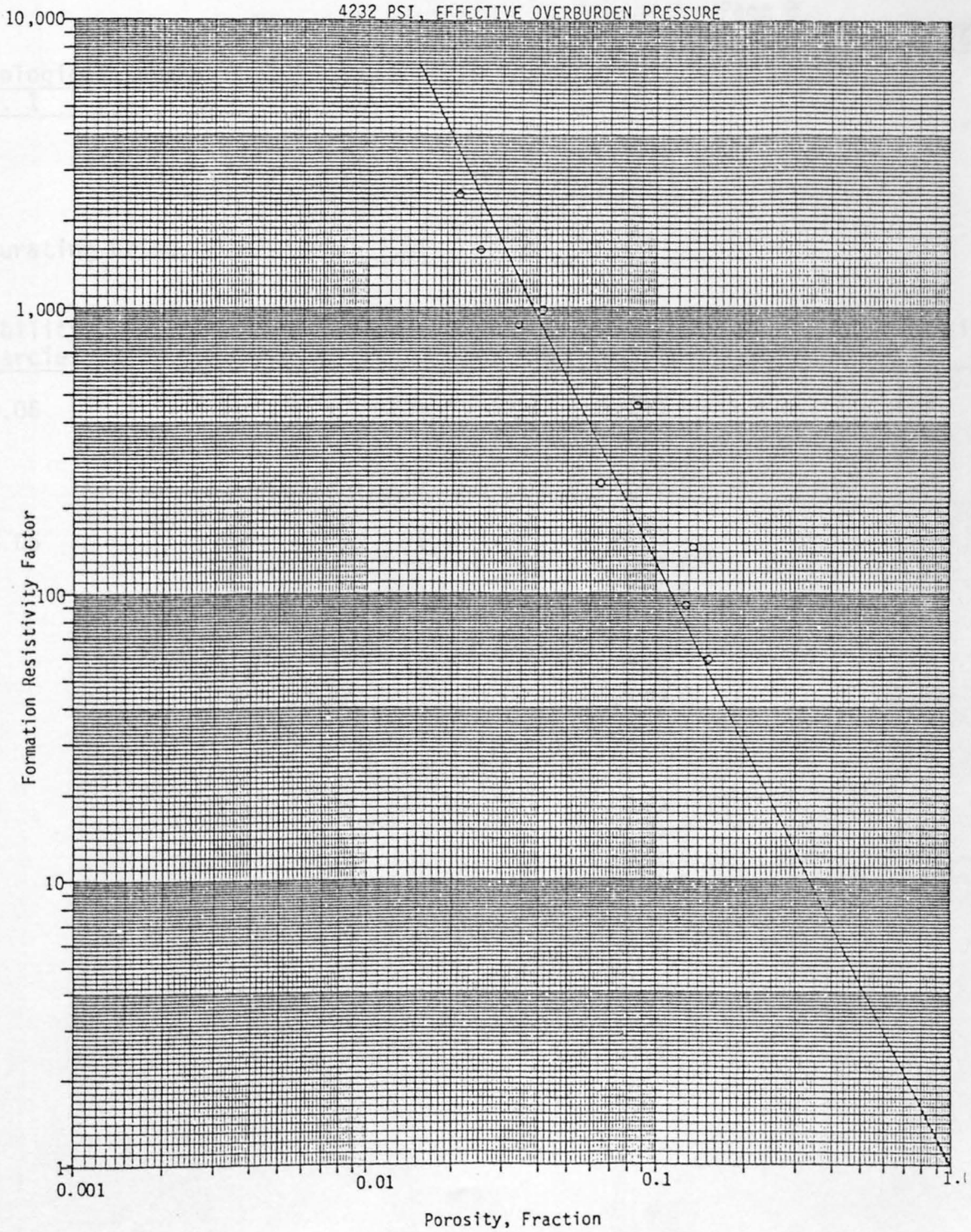
CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
OKLAHOMA CITY, OKLAHOMA

Page 7
File 3404-101-80016

Company U.S. GEOLOGICAL SURVEY
Well GEIS NO. 1
Field

Formation
County SALINE
State KANSAS

$$FF = \frac{1.0}{\phi^{2.11}}$$



CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
OKLAHOMA CITY, OKLAHOMA

File 3404-101-80016

Company U.S. Geological Survey
Well Geis NO. 1

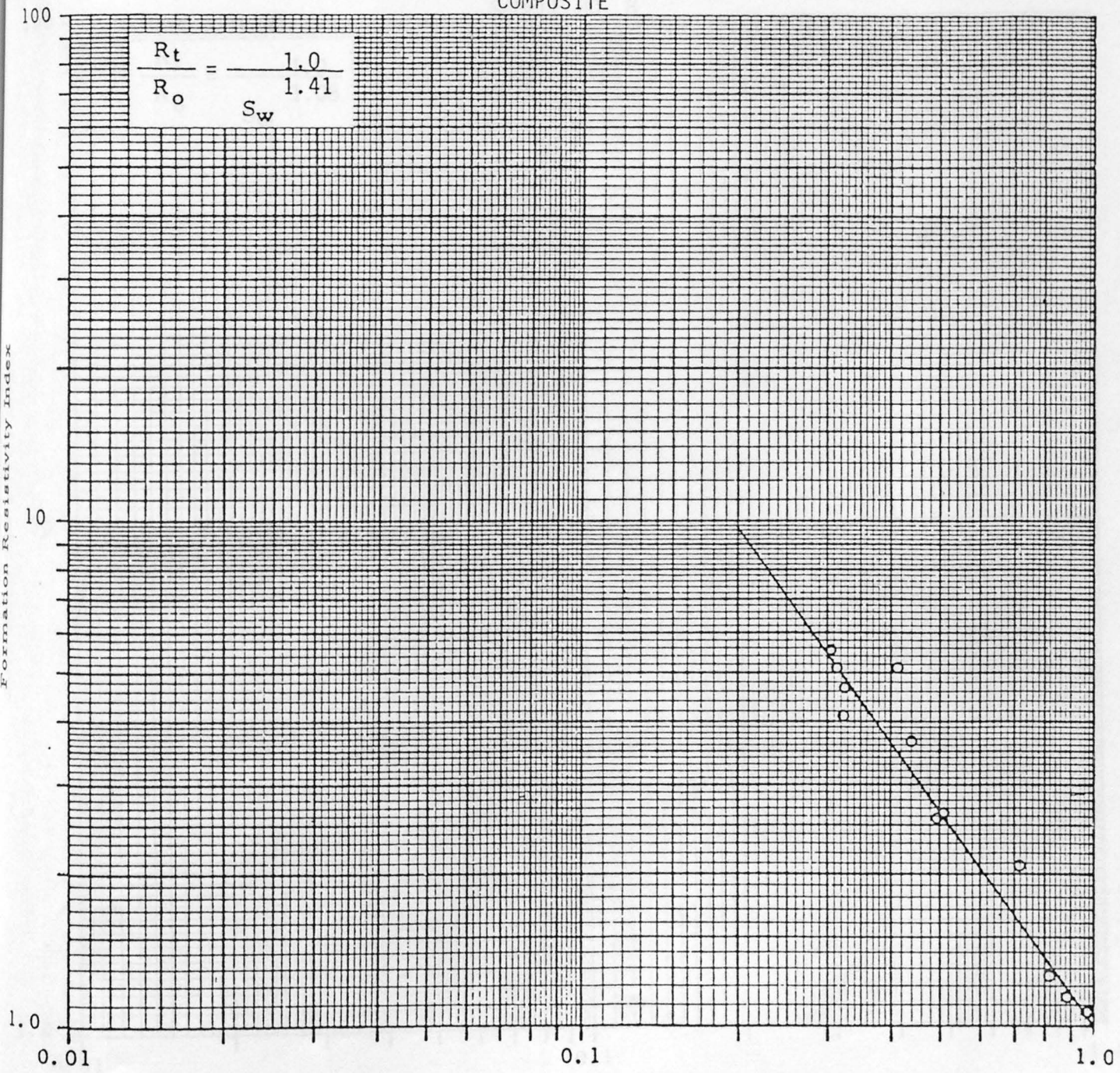
FORMATION FACTOR AND RESISTIVITY INDEX DATA

Resistivity of Saturating Brine, Ohm-Meters: 1.01 @ 72.0°F

Sample Number	Air Permeability, Millidarcies	Porosity, Per Cent	Formation Factor	Brine Saturation Per Cent Pore Space	Resistivity Index
8	0.05	6.5	138	100	1.0
				97.3	1.07
				88.4	1.14
				82.0	1.26
9	0.05	8.6	93.3	100	1.0
				72.0	2.08
				44.6	3.68
				41.3	5.12
10	12	12.7	50.9	100	1.0
				49.9	2.59
				32.3	4.10
				30.6	5.58
11	29	15.1	33.3	100	1.0
				50.9	2.64
				32.6	4.67
				31.5	5.12

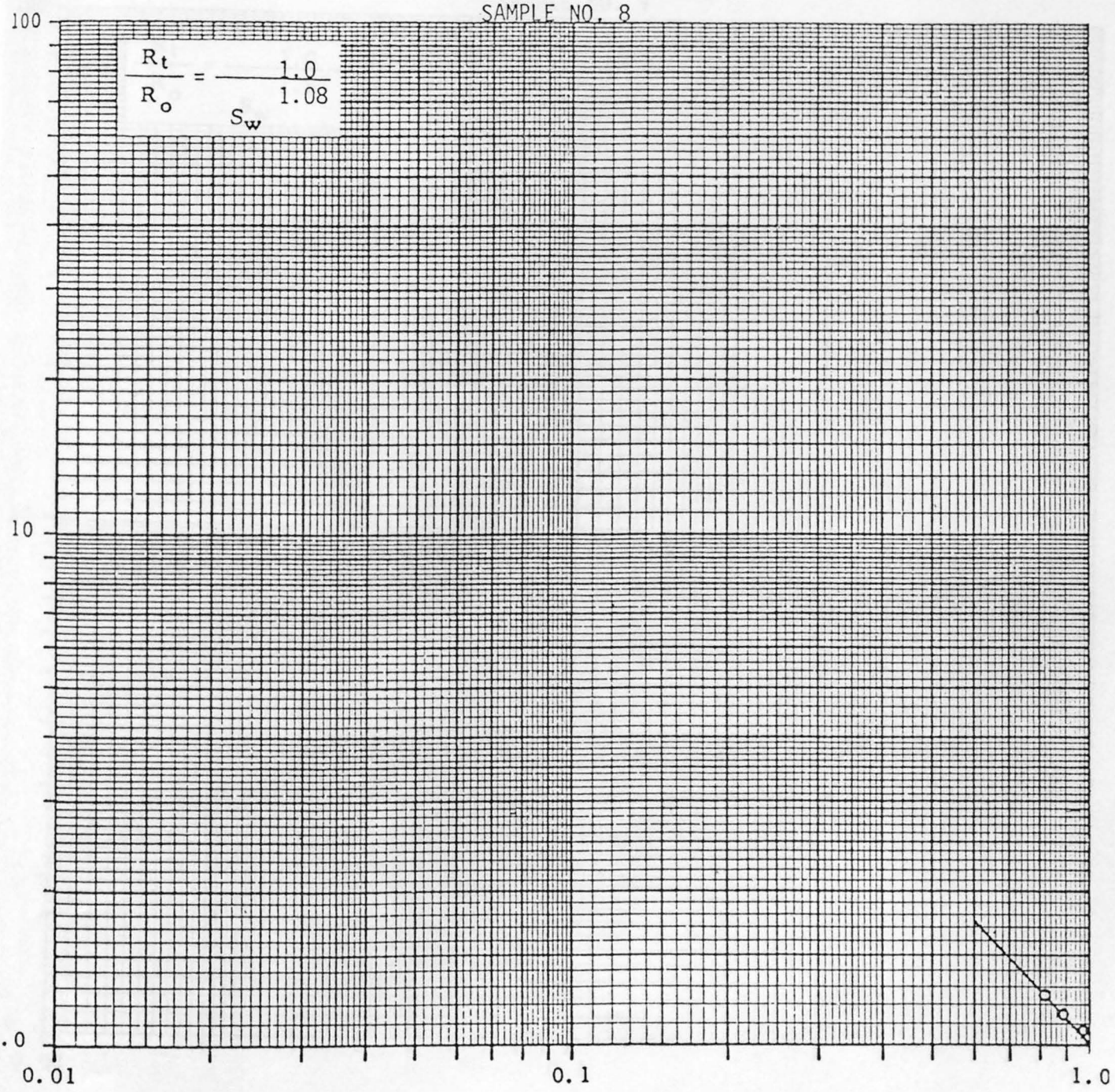
Company U.S. GEOLOGICAL SURVEY Formation
Well GEIS NO. 1 County SALINE
Field State KANSAS

COMPOSITE



Company U.S. GEOLOGICAL SURVEY Formation
Well GEIS NO. 1 County SALINE
Field State KANSAS

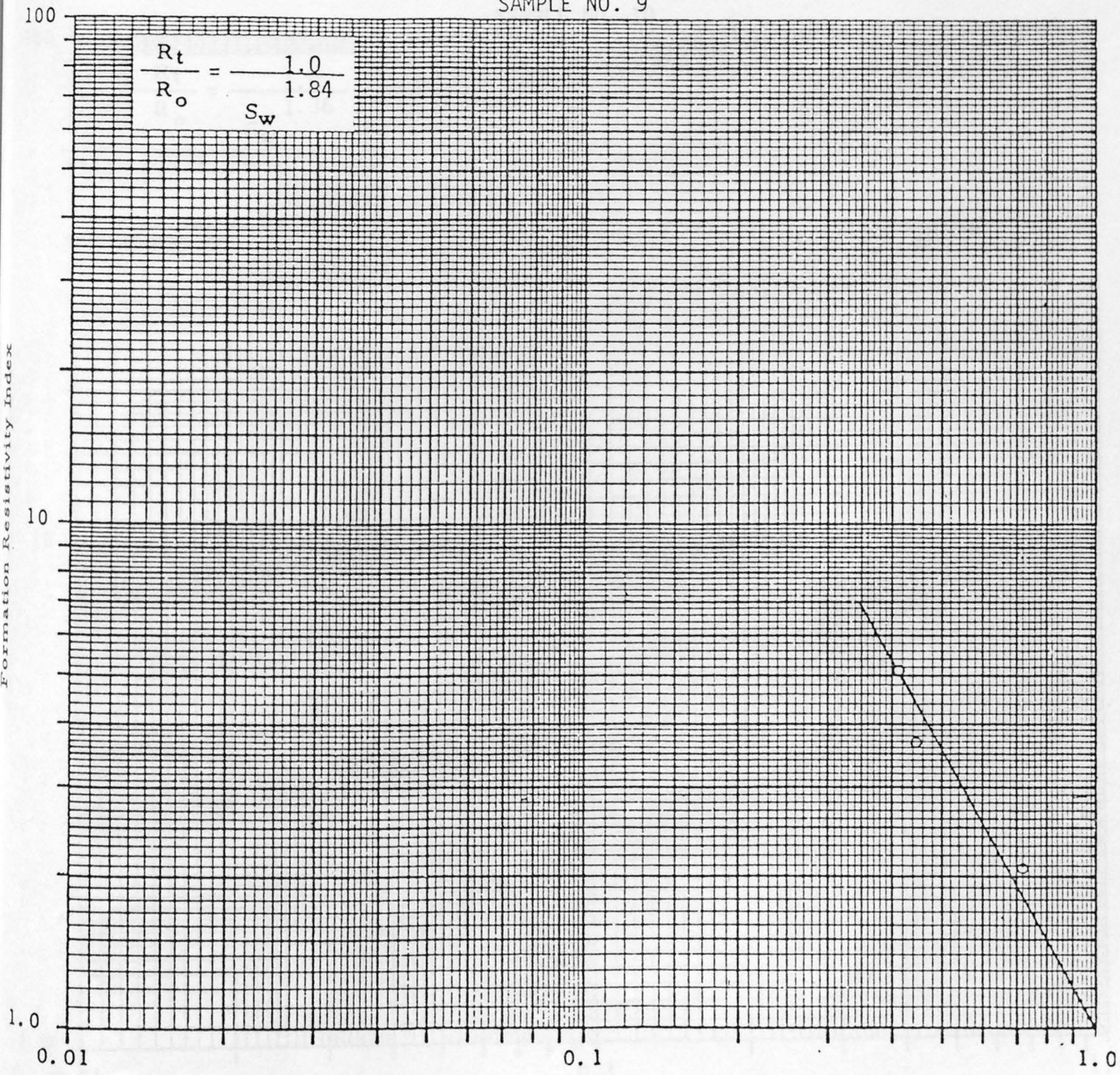
SAMPLE NO. 8



Company U.S. GEOLOGICAL SURVEY
Well GEIS NO. 1
Field

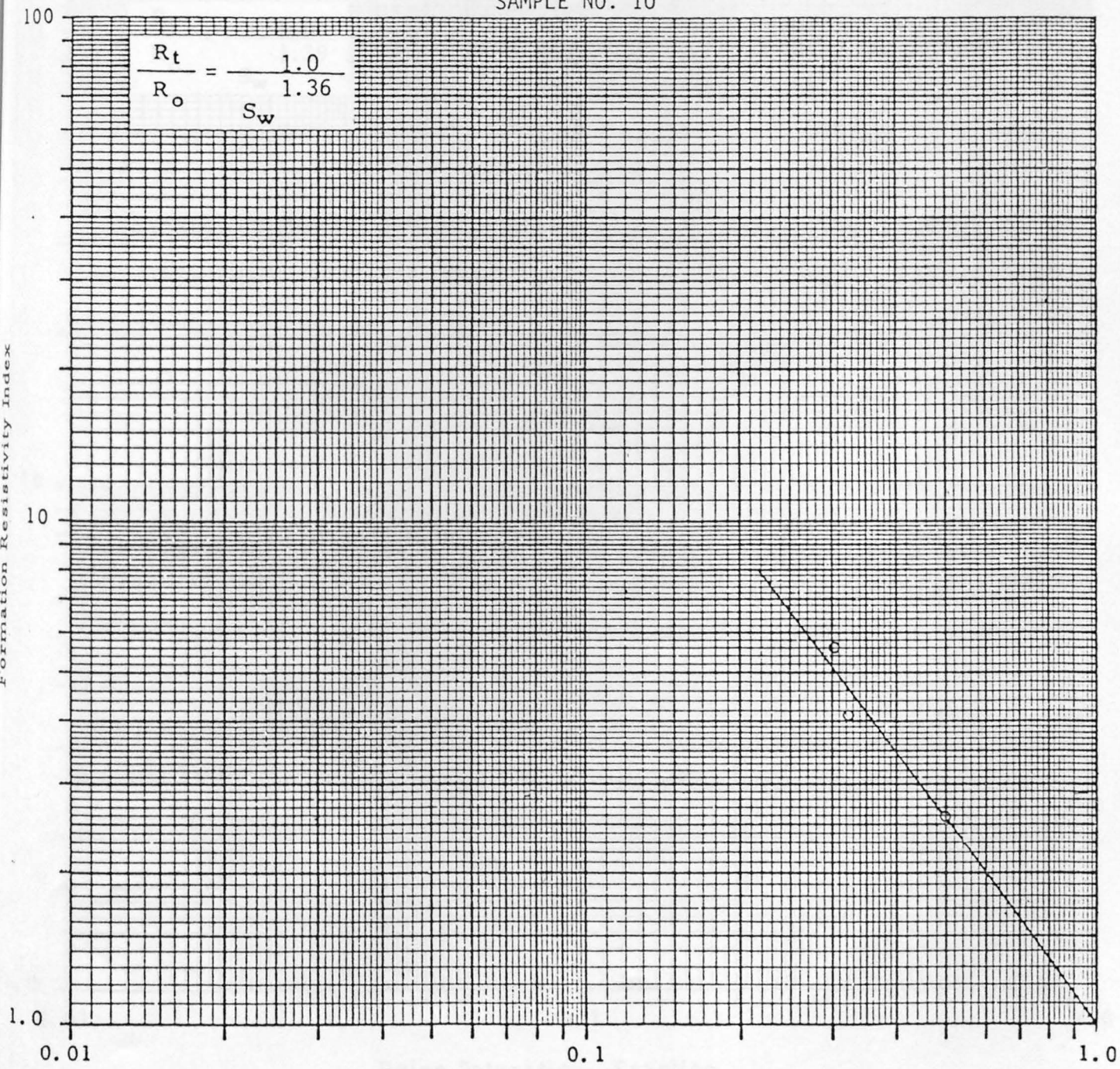
Formation
County SALINE
State KANSAS

SAMPLE NO. 9



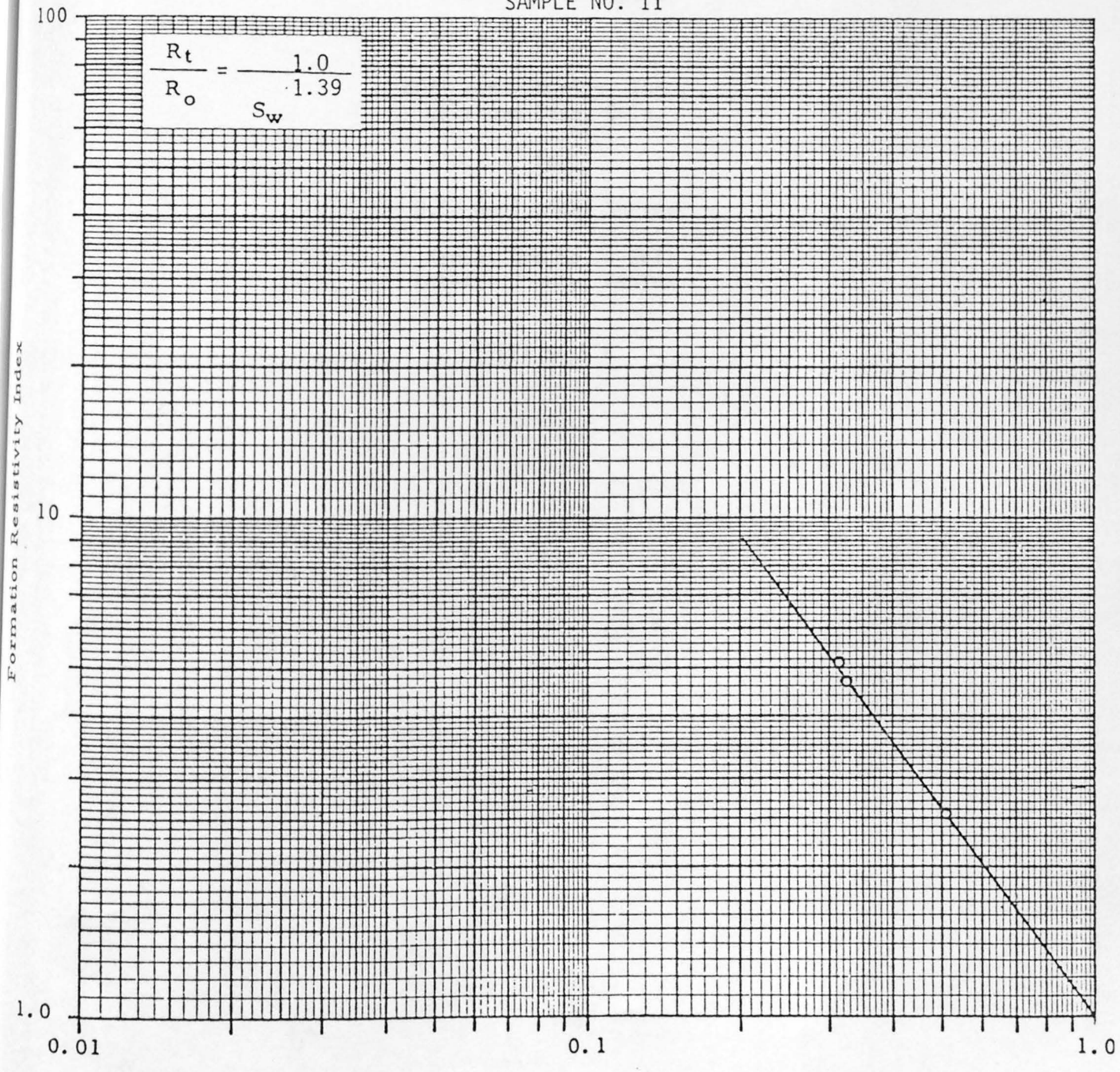
Company U.S. GEOLOGICAL SURVEY Formation
Well GEIS NO. 1 County SALINE
Field State KANSAS

SAMPLE NO. 10



Company U.S. GEOLOGICAL SURVEY Formation
Well GEIS NO. 1 County SALINE
Field State KANSAS

SAMPLE NO. 11



Core Analysis Report

by

CORE Laboratories, Inc.,
Oklahoma City, Okla.

for

U.S. Geological Survey

Kansas Ord No. 1 Well
Labette County, Kansas

TEST HOLE 4

U.S. GEOLOGICAL SURVEY
KANSAS ORD NO. 1 WELL
PARSONS FIELD
LABETTE COUNTY, KANSAS

DATE: 6/25/80
FORMATION: ARBUCKLE
DRLG. FLUID:
LOCATION: SW/4 SEC. 22-31S-20E

FILE NO: 3402-10127
ENGINEER: BOYLE
ELEVATION:

* INDICATES PLUG PERM

SMP. NO.	DEPTH	PERM. TO AIR MD. MAXIMUM	90 DEG	VERT.	POROSITY PERCENT	FLUID SATS. OIL	WTR.	GR. DEN.	DESCRIPTION
			WHOLE CORE ANALYSIS						
1	1419.0-20.0	<0.1	<0.1	<0.1	5.6	0.0	68.9	2.82	DOL,VGY
2	1420.0-21.0	0.3	<0.1		4.9	0.0	64.8	2.82	DOL,VGY
3	1421.0-22.0	0.4	<0.1		3.5	0.0	45.0	2.82	DOL,VGY
4	1422.0-23.0	<0.1	<0.1	<0.1	7.4	0.0	18.6	2.84	DOL
5	1423.0-24.0	0.1	<0.1		8.8	0.0	21.0	2.78	DOL
6	1424.0-25.0	11.0	9.3	0.5	8.1	0.0	32.1	2.83	DOL,SHY,SL/CHT
7	1425.0-26.0	0.1	<0.1		4.9	0.0	30.8	2.84	DOL
8	1426.0-27.0	2216.0	0.1		3.0	0.0	50.3	2.86	DOL,SL/VGY,VF
9	1427.0-28.0	1971.0	0.4	<0.1	5.7	0.0	39.8	2.81	DOL,VGY,CHT
10	1428.0-29.0	0.3	0.1		7.2	0.0	37.9	2.80	DOL,SL/VGY,CHT
11	1429.0-30.0	*	<0.1		3.6	0.0	62.8	2.79	DOL,VGY,VF
12	1430.0-31.0	*	0.1		6.2	0.0	73.6	2.84	DOL,VGY,VF
13	1431.0-32.0	*	<0.1		4.2	0.0	57.3	2.81	DOL,VGY
14	1432.0-33.0	*	<0.1		2.9	0.0	33.4	2.83	DOL,SL/VGY
15	1433.0-34.0	<0.1	<0.1	<0.1	3.8	0.0	65.0	2.79	DOL,VGY

Special Core Analysis Report

by

CORE Laboratories, Inc.,
Oklahoma City, Okla.

for

U.S. Geological Survey

Kansas Ord No. 1 Well
Labette County, Kansas

TEST HOLE 4

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
OKLAHOMA CITY, OKLAHOMA

REPLY TO
SUITE 133
400 SOUTH VERMONT
OKLAHOMA CITY, OKLA.
73108

January 20, 1981

United States Department of the Interior
Geological Survey
1950 Avenue A - Campus West
Lawrence, Kansas 66045

Subject: Special Core Analysis Studies
Kansas Ord No. 1 Well
Arbuckle Formation
Labette County, Kansas
Purchase Request No. 0-4620-0295
CLI File 3404-101-80016

Gentlemen:

This report presents data for electrical resistivity measurements performed on samples recovered from the subject well. These studies were completed as a result of a contract agreement between Mr. Tony Gogel of the U.S. Geological Survey and representatives of Core Laboratories, Inc. on May 27, 1980.

Exposed core segments from the interval 1419-1434 feet was submitted on May 8, 1980. From this core, 1-inch diameter plug samples were selected for routine porosity and air permeability measurements by Mr. Gogel of U.S. Geological Survey. These samples were drilled using tap water as a bit lubricant and coolant, extracted of hydrocarbons in a vapor phase toluene extractor, and dried at 180°F. Boyle's Law porosity and air permeability were measured for each sample. These samples are identified by sample number and lithological description on page 1.

For the electrical resistivity measurements, the samples were leached of all salt with methanol, and dried at 180°F. Boyle's Law porosity and air permeability of each sample were remeasured. These samples were evacuated and pressure saturated with a simulated brine containing 19,200 ppm sodium chloride which was formulated from information furnished by Mr. Gogel.

Electrical resistivities of the brine and saturated samples were measured at atmospheric conditions. These measurements were repeated for several days until the resistivities of the samples had stabilized. Following the resistivity measurements at atmospheric conditions, electrical resistivities of the samples were measured as a function of effective overburden pressures which were 200, 718, 1435, and 2870 psig. Formation resistivity factors were calculated from these data.

The formation factor data are tabulated on page 2. Formation factor is plotted as a function of porosity on pages 3 through 7 for the various effective overburden pressures. The cementation exponent "m" which is indicated on each plot was determined from the slope of a visual best-fit line drawn relating formation factor to porosity.

The results are as follows:

Effective Overburden Pressure, PSI	a	m
0.0	1.00	1.80
200	1.00	1.85
718	1.00	1.88
1435	1.00	1.94
2870	1.00	2.00

The deviation of the samples off the best-fit line is attributed to the numerous vugs present.

Next, all samples were placed in a porous-plate capillary pressure cell for desaturation. Electrical resistivities were measured at various brine saturations. Resisitivity index data were calculated from these measurements.

The resistivity index data are tabulated on page 8. A composite plot for all samples of resistivity index as a function of brine saturation is shown on page 9. The saturation exponent "n" was determined from the slope of the best-fit line relating resistivity index to brine saturation. The saturation exponent "n" is 1.12 for the composite plot, and ranges from 1.02 to 1.41 for the individual samples. The plots for the individual samples are on pages 10 through 14. The variation of resistivity index data as the variations of the formation factor data can be attributed to the hetergenous lithology.

This report concludes all tests requested for this well. If you have any questions or if we can be of further service, please contact us. We appreciate this opportunity to be of assistance.

Very truly yours,

CORE LABORATORIES, INC.

David C. Monk

David C. Monk for
Dale E. Boyle
District Manager

DEB:DCM:cj

7 cc - Addressee

Company U.S. GEOLOGICAL SURVEY
Well KANSAS ORD NO. 1

OVERBURDEN FORMATION FACTOR DATA

Saturant: 19,200 ppm NaCl

Resistivity of Saturant 0.332 @ 72.0°F

Sample Number	Depth, Feet	Air Permeability, Millidarcies	Porosity, Per Cent	Effective Overburden Pressure, PSI				
				0.0	200	718	1435	2870
				Formation Resistivity Factor				
2	1420-21	0.01	5.8	250	263	287	319	394
4	1422-23	0.08	6.7	142	158	170	191	220
5	1423-24	0.08	7.5	96.3	110	121	133	138
7	1425-26	0.04	3.5	276	306	379	446	515
8	1426-27	0.01	1.8	895	969	1071	1195	1453
9	1427-28	0.01	8.5	122	123	128	142	154
11	1429-30	0.001	2.5	365	554	700	907	1564
12	1430-31	0.001	6.0	282	322	362	408	546
13	1431-32	0.001	3.4	1075	1257	1530	2015	2818
14	1432-33	0.001	2.0	432	668	787	974	1185

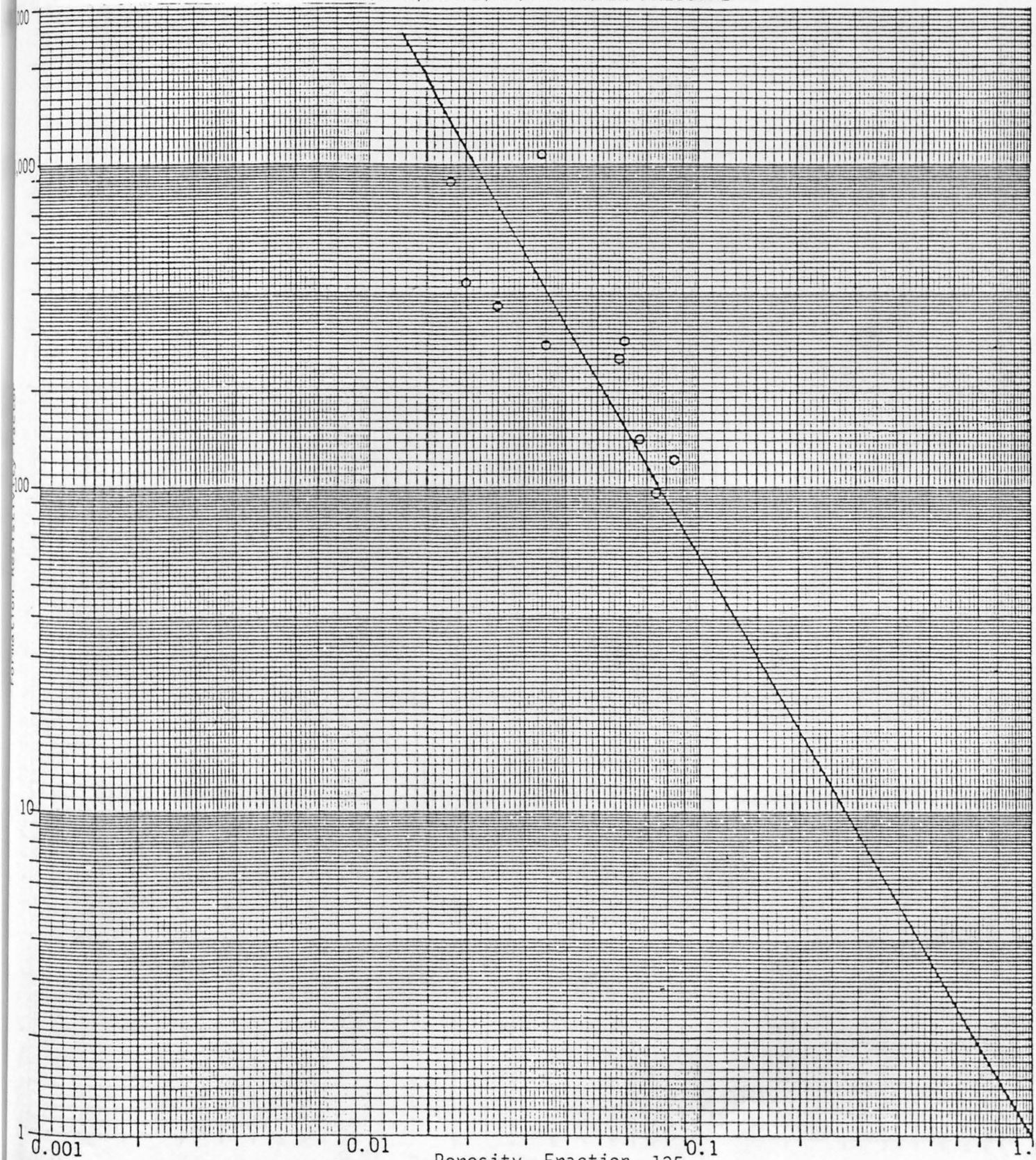
CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
OKLAHOMA CITY, OKLAHOMA

Page 3
File 3404-101-80016

Company U.S. GEOLOGICAL SURVEY
Well KANSAS ORD NO. 1
Field PARSONS
Formation ARBUCKLE
County LABETTE
State KANSAS

$FF = \frac{1.0}{\phi^{1.82}}$

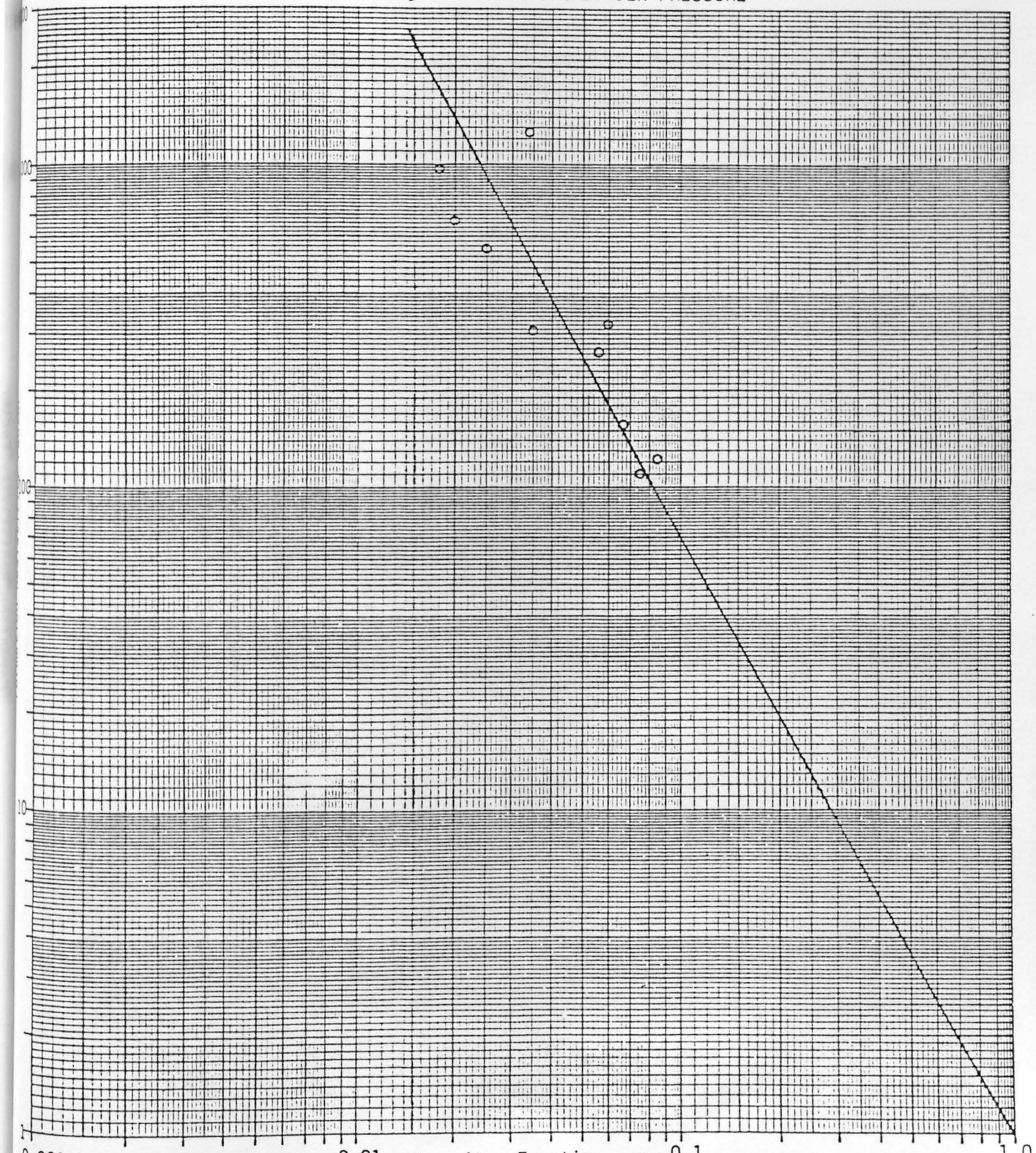
0 PSI EFFECTIVE OVERBURDEN PRESSURE



Company U.S. GEOLOGICAL SURVEY
Formation ARBUCKLE
Well KANSAS ORD NO. 1
County LABETTE
Field PARSONS
State KANSAS

$$FF = \frac{1.0}{\phi^{1.85}}$$

200 PSI, EFFECTIVE OVERBURDEN PRESSURE



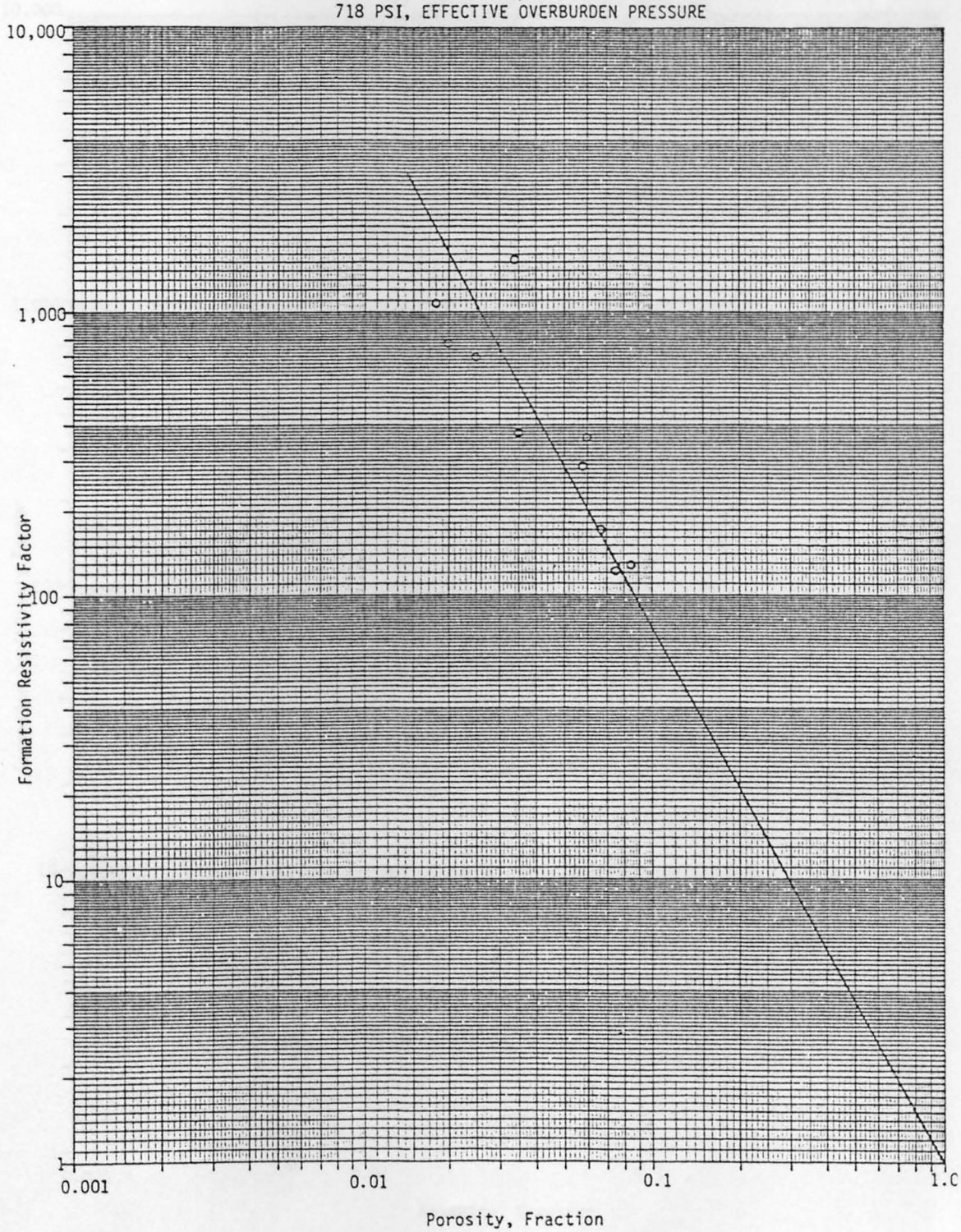
CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
OKLAHOMA CITY, OKLAHOMA

Page 5
File 3404-101-80016

Company U.S. GEOLIGICAL SURVEY — Formation ARBUCKLE
Well KANSAS ORD NO. 1 — County LABETTE
Field PARSONS — State KANSAS

$$FF = \frac{1.0}{\phi^{1.88}}$$

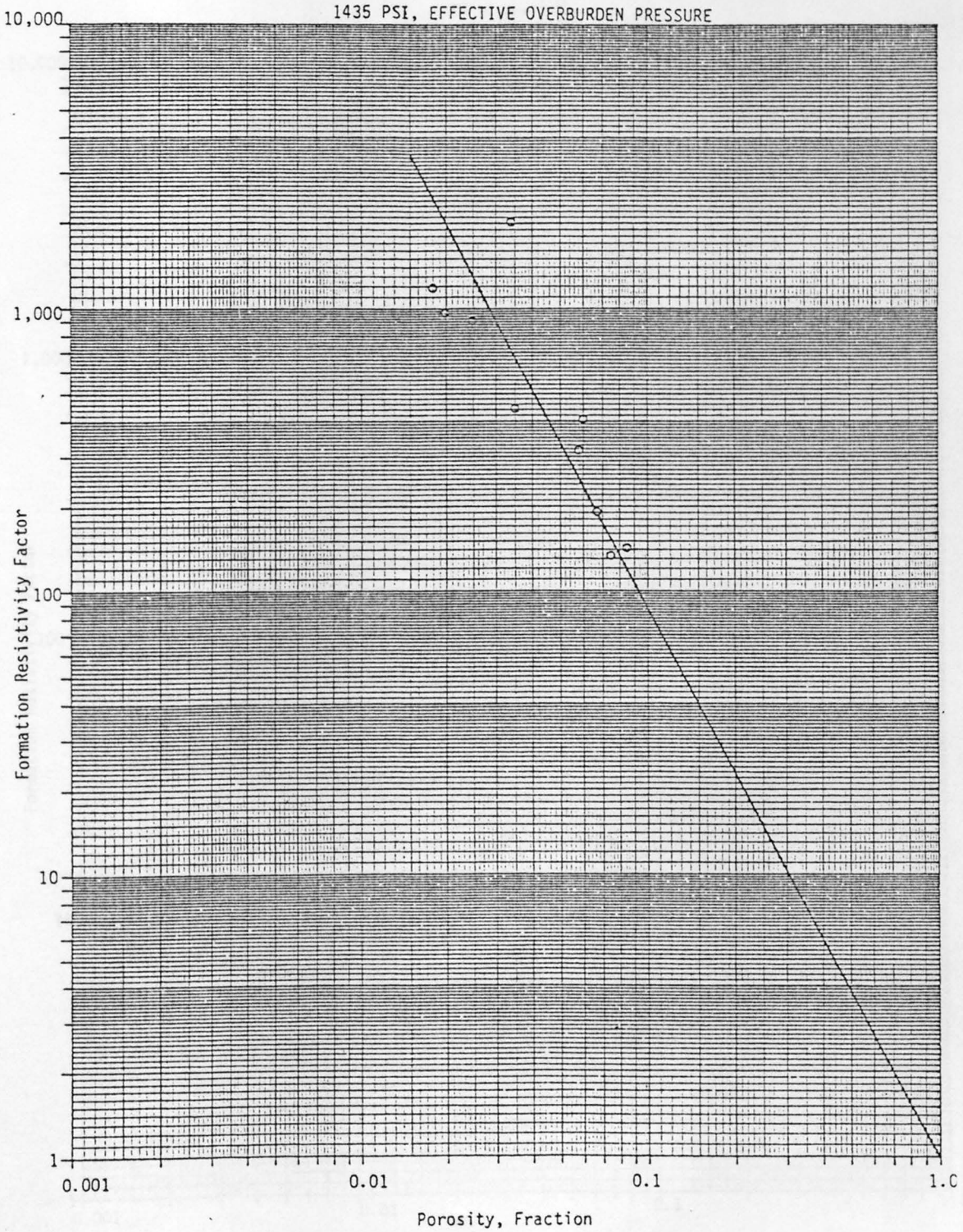
718 PSI, EFFECTIVE OVERBURDEN PRESSURE



Company U.S. GEOLOGICAL SURVEY
Well KANSAS ORD NO. 1
Field PARSONS

Formation ARBUCKLE
County LABETTE
State KANSAS

$$FF = \frac{1.0}{\phi^{1.94}}$$



CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
OKLAHOMA CITY, OKLAHOMA

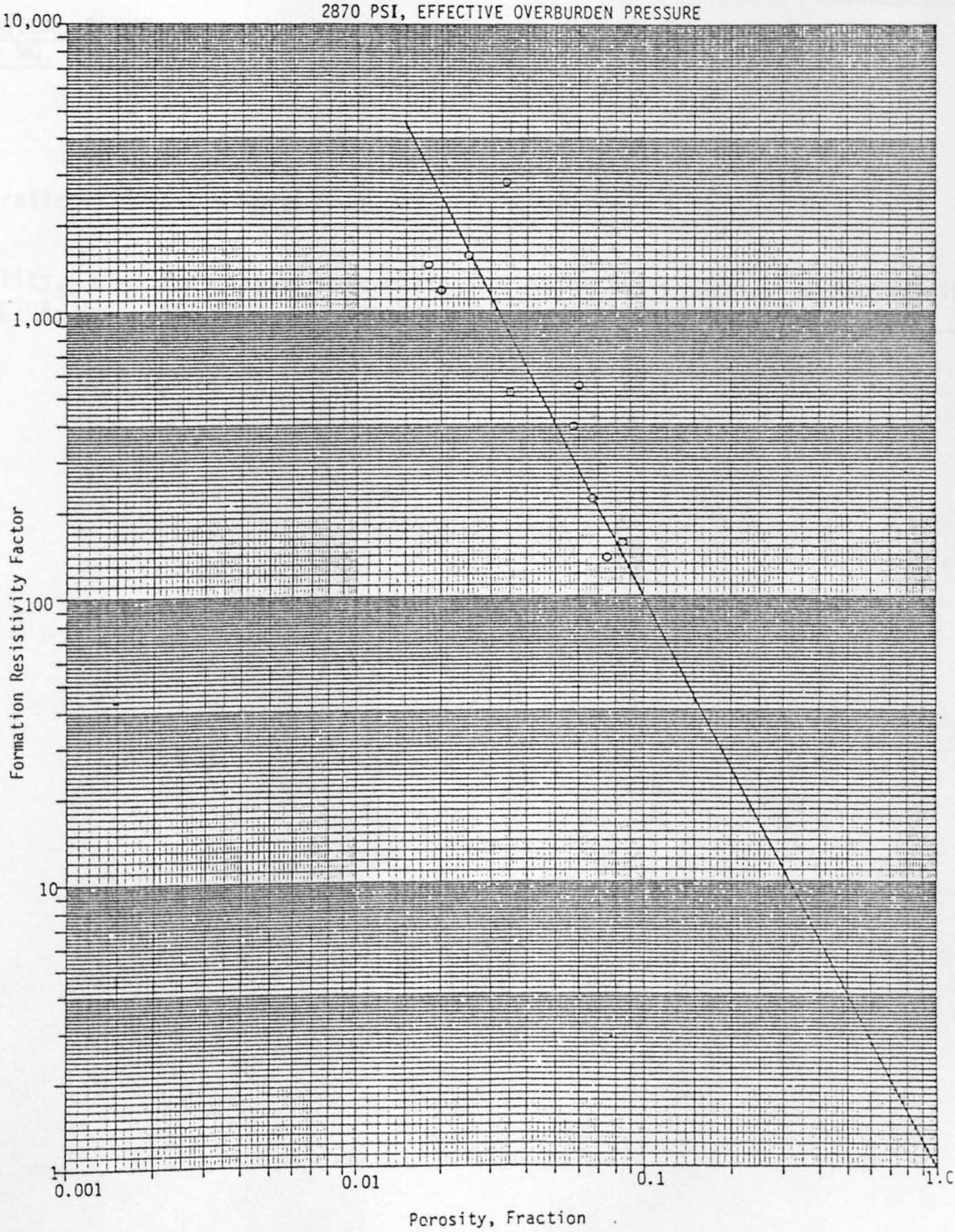
Page 7 of
File 3404-101-80016

Company U.S. GEOLOGICAL SURVEY
Well KANSAS ORD NO. 1
Field PARSONS

Formation ARBUCKLE
County LABETTE
State KANSAS

$$FF = \frac{1.0}{\phi^{2.00}}$$

2870 PSI, EFFECTIVE OVERBURDEN PRESSURE



CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
OKLAHOMA CITY, OKLAHOMA

File 3404-101-8001

Company U.S. GEOLOGICAL SURVEY
Well KANSAS ORD NO. 1

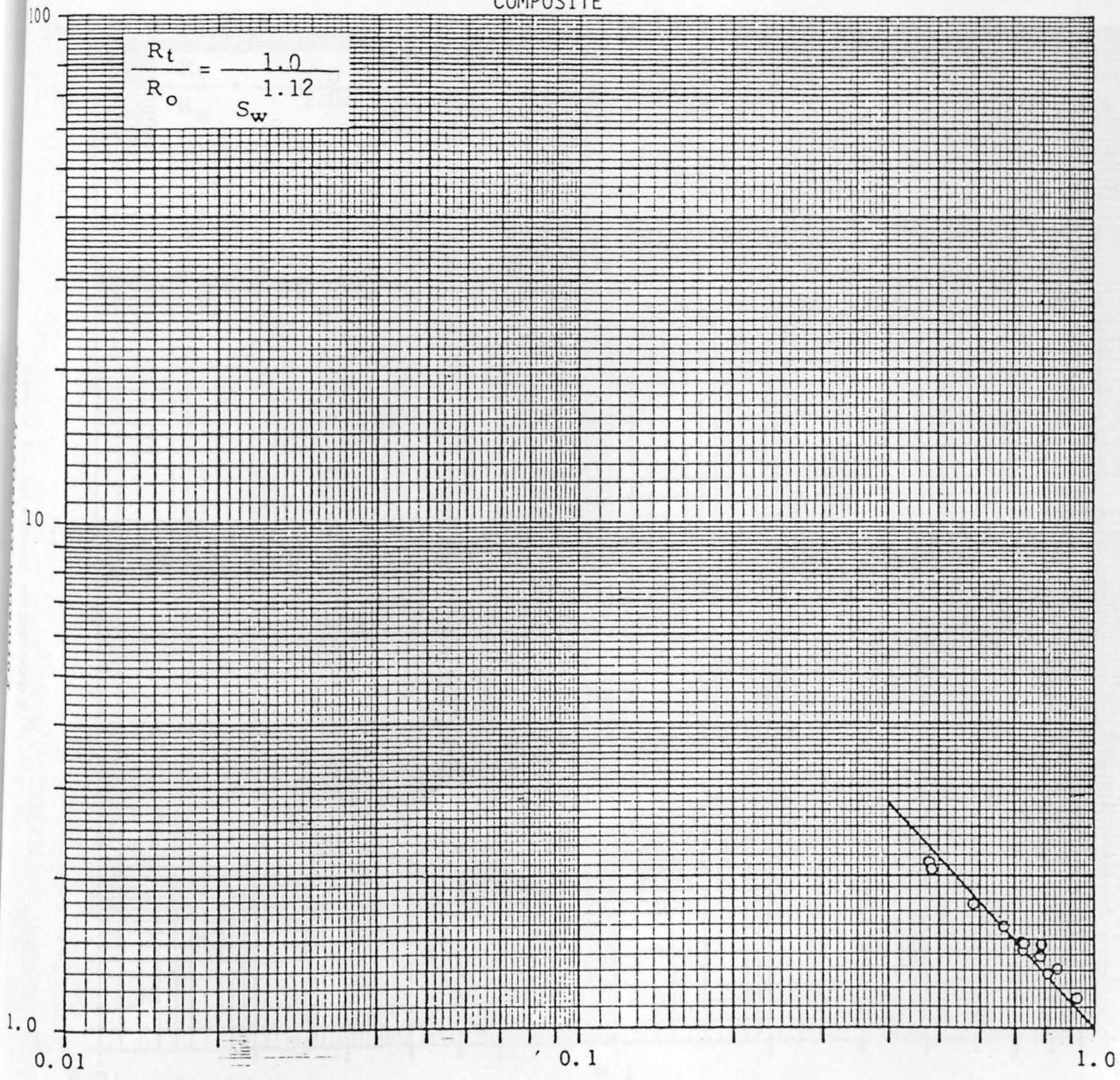
FORMATION FACTOR AND RESISTIVITY INDEX DATA

Resistivity of Saturating Brine, Ohm-meters: 0.332 @ 72.0°F

Sample Number	Air Permeability, Millidarcies	Porosity, Per Cent.	Formation Factor	Brine Saturation Per Cent Pore Space	Resistivity Index
2	0.01	5.8	250	100	1.0
				58.1	1.75
				48.4	2.05
				48.0	2.11
4	0.08	6.7	142	100	1.0
				84.7	1.31
				79.2	1.47
				78.5	1.39
5	0.08	7.5	96.3	100	1.0
				92.2	1.14
				81.5	1.28
				73.4	1.47
7	0.04	4.3	276	100	1.0
				72.6	1.48
				71.5	1.49
13	<0.01	3.4	1075	100	1.0
				73.0	1.44
				71.2	1.48
				66.8	1.59

Company U.S. GEOLOGICAL SURVEY Formation ARBUCKLE
Well KANSAS ORD NO. 1 County LABETTE
Field PARSONS State KANSAS

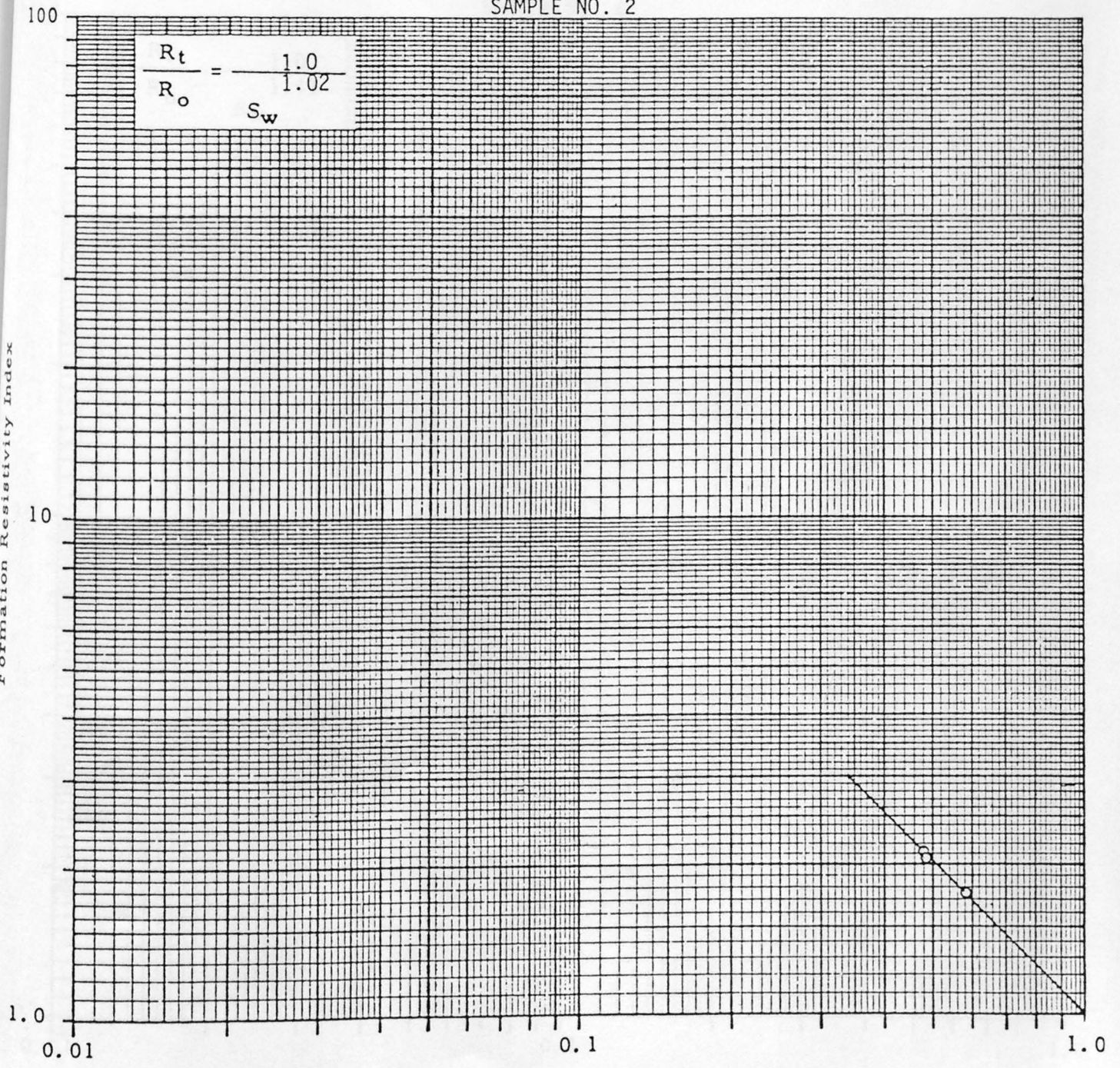
COMPOSITE



Company U.S. GEOLOGICAL SURVEY
Well KANSAS ORD NO. 1
Field PARSONS

Formation ARBUCKLE
County LABETTE
State KANSAS

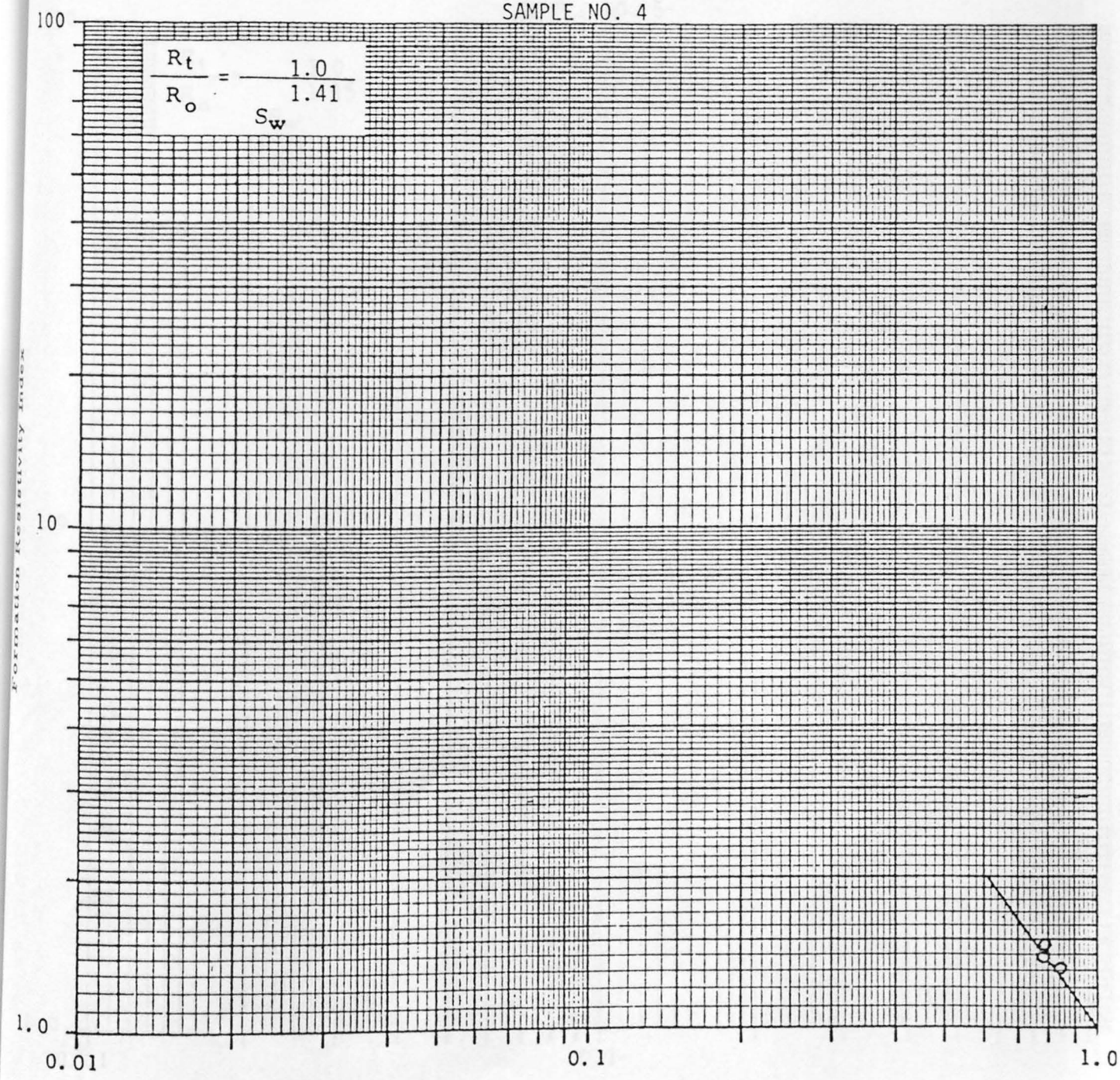
SAMPLE NO. 2



Company U.S. GEOLOGICAL SURVEY
Well KANSAS ORD NO. 1
Field PARSONS

Formation ARBUCKLE
County LABETTE
State KANSAS

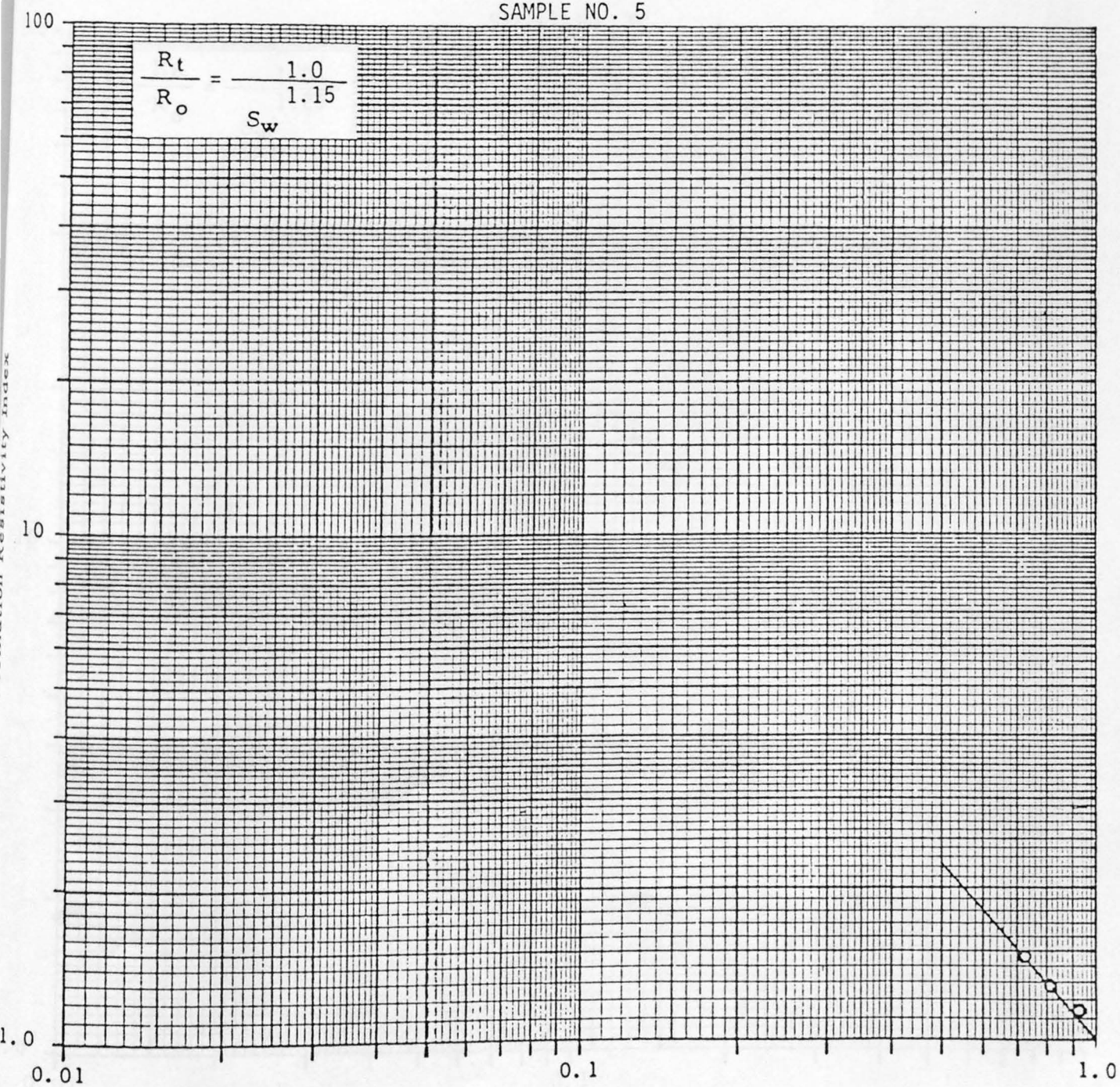
SAMPLE NO. 4



Company U.S. GEOLOGICAL SURVEY
Well KANSAS ORD NO. 1
Field PARSONS

Formation ARBUCKLE
County LABETTE
State KANSAS

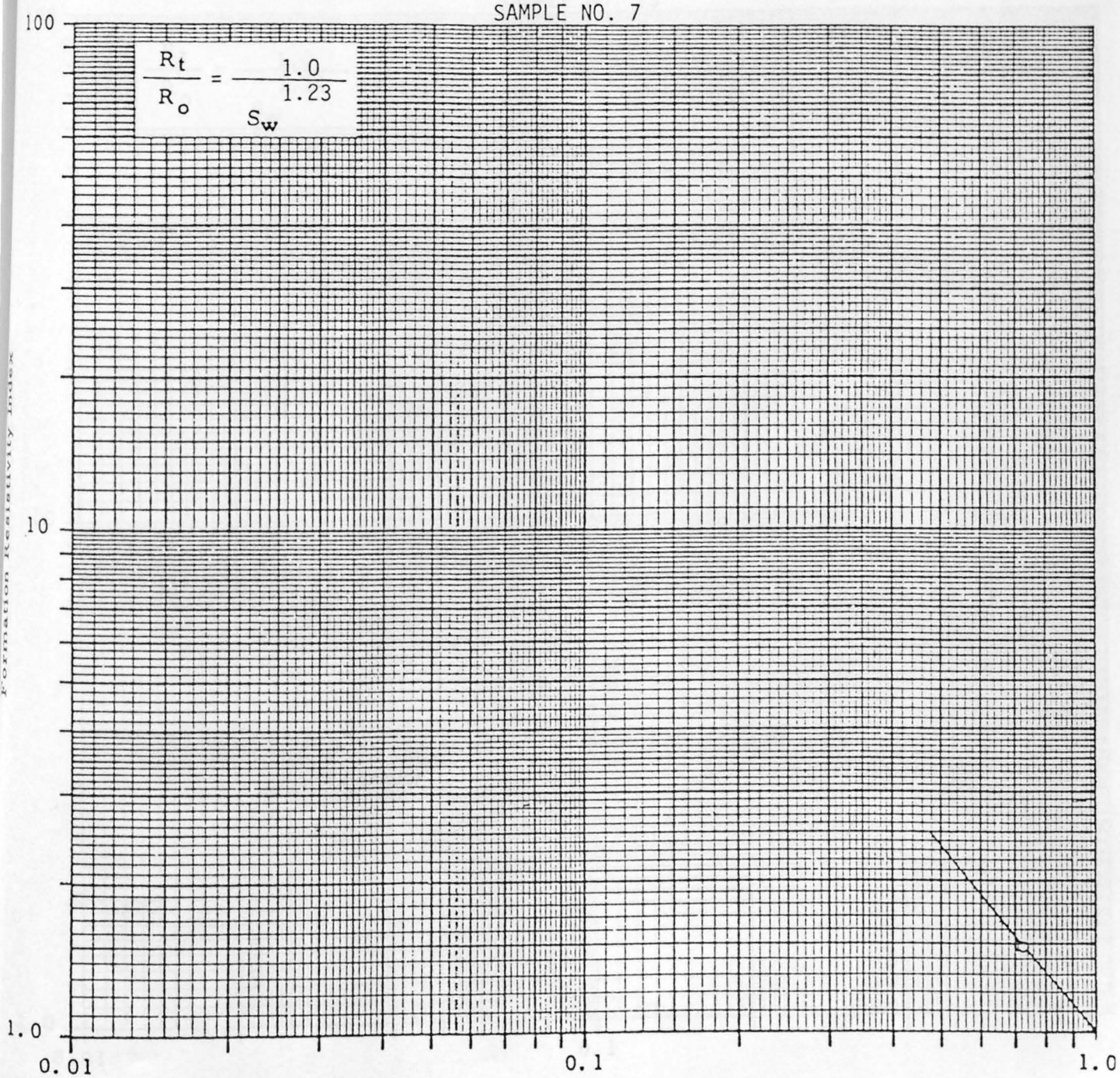
SAMPLE NO. 5



Company U.S. GEOLOGICAL SURVEY
Well KANSAS ORD NO. 1
Field PARSONS

Formation ARBUCKLE
County LABETTE
State KANSAS

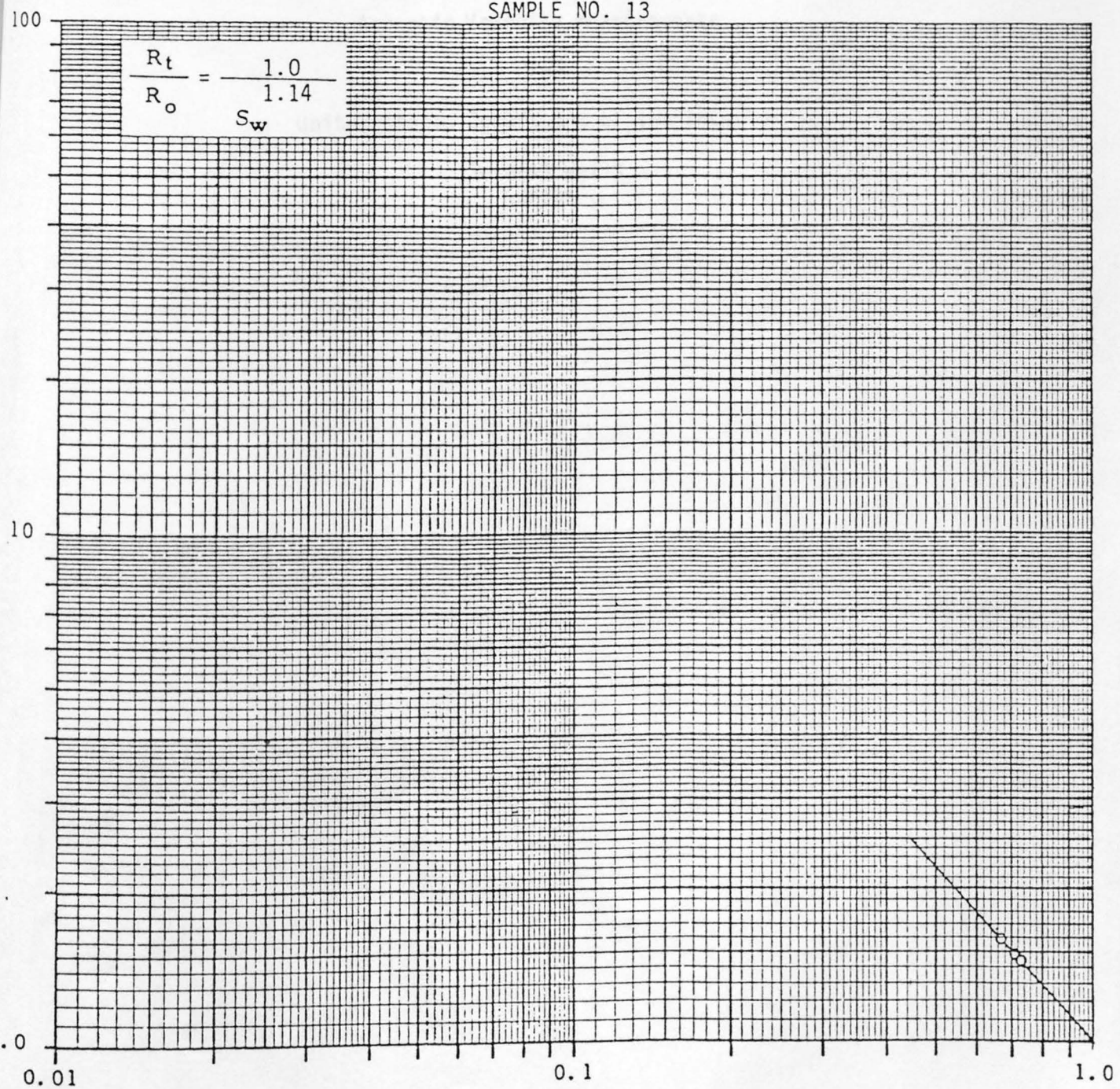
SAMPLE NO. 7



Company U.S. GEOLOGICAL SURVEY
Well KANSAS ORD NO. 1
Field PARSONS

Formation ARBUCKLE
County LABETTE
State KANSAS

SAMPLE NO. 13



Acoustic Velocity Measurements

for

United States Department of the Interior

Several Wells
Kansas

7501 STEMMONS FREEWAY, BOX 47547, DALLAS, TEXAS 75247 · 214/631-8270

CORE LABORATORIES, INC.
Special Core Analysis

October 17, 1980

United States Department of the Interior
Geological Survey
1950 Avenue "A"
Campus West
Lawrence, Kansas 66045

Attention: Mr. Tony Gogel

Subject: Acoustic Velocity Measurements
Kansas ORD No. 1, DCL and F A No. 1, and
Geis No. 1 Wells
Kansas
File Number: SCAL-308-80257

Gentlemen:

On or about April 28, 1980, core plugs from the subject wells were submitted to the Special Core Analysis Department of Core Laboratories, Inc., at Dallas, Texas, with a request for Acoustic Velocity Measurements. The results of the tests are reported herein, and the samples used in this study are lithologically described and identified as to well, sample number, and depth interval on Page 1.

Five previously prepared core plugs from each subject well were submitted for use in this study. The ends of some core plugs were trimmed in order to obtain suitable test samples. These samples were extracted of any hydrocarbons present using toluene, leached of any salts present using methyl alcohol, and dried. Boyle's Law porosity was determined on each sample. The samples from the Kansas ORD No. 1 Well were evacuated and pressure-saturated with a brine containing 19.8 grams/liter sodium chloride. Samples from the DCL and FGA No. 1 Well and the Geis No. 1 Well were fully saturated with brines containing 51.1 gram/liter sodium chloride and 5.9 grams/liter sodium chloride, respectively.

Direct measurements of the transit times for acoustic compression waves were then made on each sample at overburden pressures of 500 psi, 1000 psi, 1500 psi, 2000 psi, and 2500 psi. The results are presented in tabular form on Pages 2 through 4, and in graphical form on Pages 5 through 8.

Well-defined relationships between transit times and porosities are not apparent. This may be due to the fact that much of the porosity present in these core plugs appears to be of a secondary nature (vugs and fractures), and this type of porosity does not usually affect transit time measurements in the same manner as matrix porosity.

It has been a pleasure performing this study on behalf of the United States Department of the Interior Geological Survey. Should there be any questions concerning these test results, or if we could be of any further assistance, please do not hesitate to contact us.

Very truly yours,

Core Laboratories, Inc.

Catherine A. Dottle

Catherine A. Dottle
for Duane L. Archer, Manager
Special Core Analysis

CAD:mc
7 cc. - Addressee

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS 75247

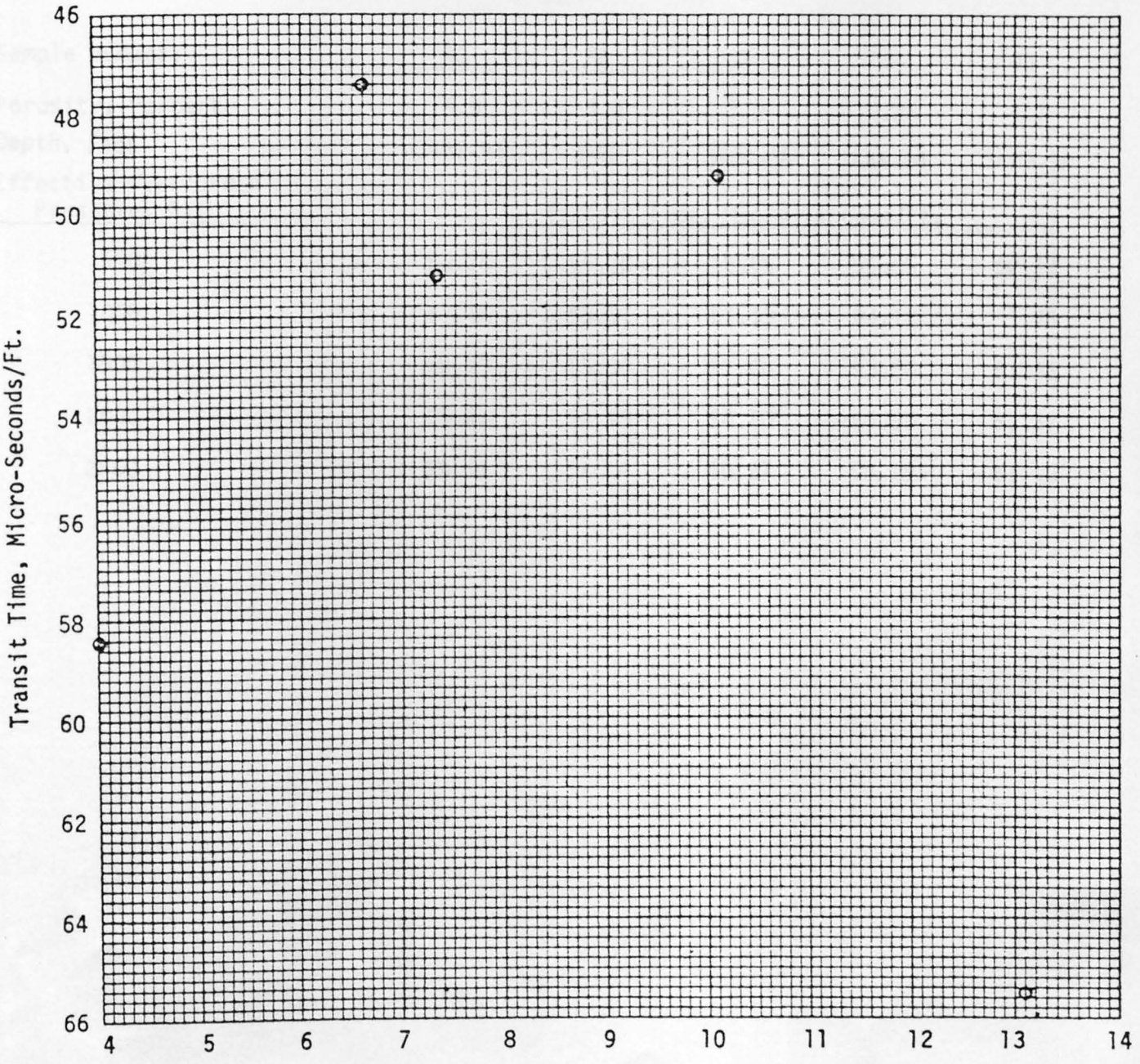
Acoustic Velocity Data

DCL and F A No. 1 Well

Sample Number:	22	29	34	39	40
Porosity, Percent:	6.6	7.3	13.1	10.1	4.0
Depth, Feet	2421-22	2428-29	2433-34	2438-39	2439-40
Effective Overburden Pressure, PSI	Transit Time, Micro-Seconds/Ft.				
500	47.99	52.35	72.48	50.70	60.64
1000	47.57	51.53	68.51	49.79	59.37
1500	47.37	51.26	65.52	49.18	58.42
2000	47.16	50.98	63.54	48.57	57.47
2500	46.96	50.98	62.54	48.27	56.52

Company United States Department of the Interior Geological Survey
Formation
Well DCL and F.A No. 1
County Douglas
Field
State Kansas

Effective Overburden Pressure: 1500 psi



CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS 75247

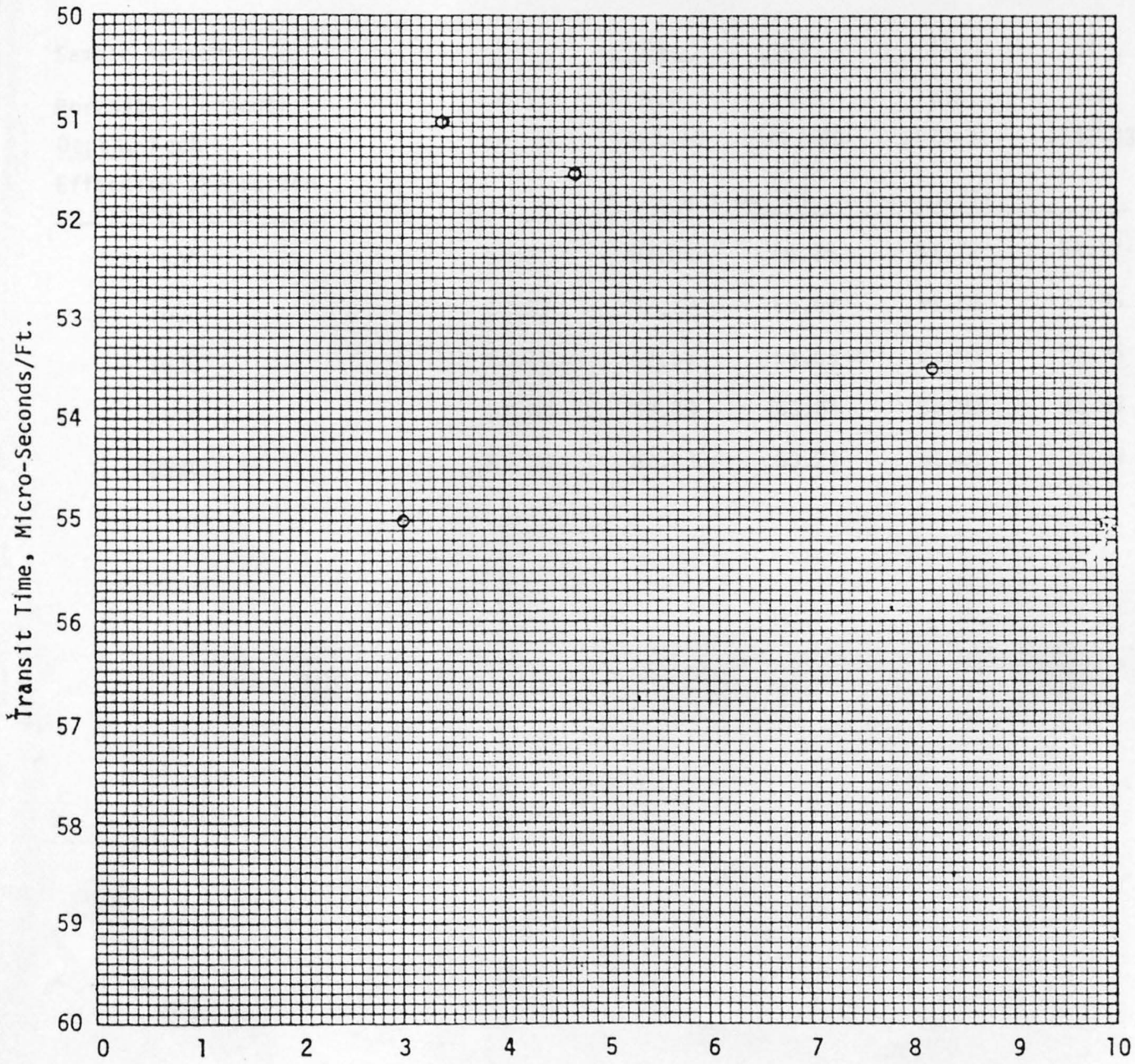
Acoustic Velocity Data

Geis No. 1 Well

Sample Number:	43	F8	85	86	90
Porosity, Percent:	9.9	3.0	3.3	8.2	4.7
Depth, Feet	3481-82	3482	3484-85	3485-86	3489-90
Effective Overburden Pressure, PSI	Transit Time, Micro-Seconds/Ft.				
500	58.74	56.15	52.65	55.05	52.14
1000	57.15	55.57	51.33	54.12	51.75
1500	55.03	55.00	51.06	53.50	51.56
2000	55.03	54.43	50.80	53.50	51.37
2500	54.50	54.14	50.27	53.18	51.18

Company United States Department of the Interior Geological Survey Formation
Well Geis No. 1 County Saline
Field State Kansas

Effective Overburden Pressure: 1500 psi



CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS 75247

Acoustic Velocity Data

Kansas ORD No. 1 Well

Sample Number:	21	24	28	31	33
Porosity, Percent:	4.1	9.0	5.5	6.2	3.1
Depth, Feet	1420-21	1423-24	1427-28	1430-31	1432-33
Effective Overburden Pressure, PSI	Transit Time, Micro-Seconds/Ft.				
500	53.31	63.01	56.36	51.72	54.17
1000	52.81	62.70	55.42	51.26	53.95
1500	52.31	62.54	54.63	51.03	53.95
2000	51.80	62.39	53.84	50.80	53.95
2500	51.30	62.23	53.21	50.80	53.95

Company United States Department of the Interior Geological Survey Formation

Well Kansas ORD No. 1 County Labette

Field State Kansas

Effective Overburden Pressure: 1500 psi