OIL FIELD RESEARCH LABORATORIES
CHANUTE, KANSAS

33-21c-12

November 26, 1951

Deep Rock Oil Corporation
Atlas Life Building
Tulsa, Oklahoma

Attention: Mr. T. F. Lawry

Gentlemen:

Enclosed herewith is the report of the analysis of the 2½" Rotary core taken from your Calbeck Lease, Well No. 11, Pratt County, Kansas, and submitted to our laboratory on November 8, 1951.

Very truly yours,

OIL FIELD RESEARCH LABORATORIES

Carl L. Pate

CLP:mm
c.c. to P. O. Box 1146
Hutchinson, Kansas

Calbeck 11

DEEP ROCK OIL CORPORATION

CORE ANALYSIS REPORT

CALBECK LEASE WELL NO. 11

PRATT COUNTY, KANSAS

OIL FIELD RESEARCH LABORATORIES

CHANUTE, KANSAS

NOVEMBER 26, 1951

Oil Field Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Deep Rock Oil Corporation Lease Calbeck Well No. 11

Location NW ¼, NW¼, NE¼

Section 33 Twp. 26 Rge. 13 County Pratt State Kansas

Name of ~~Sand~~ Formation Simpson

Top of Core 4300.00

Bottom of Core 4348.00

Top of Sand 4301.90

Bottom of Sand 4332.90

Total Feet of Permeable Sand (Analyzed) 16.74

Total Feet of Floodable Sand (Analyzed) 5.71

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 2	8.80	8.80
2 - 4	1.23	10.03
4 - 16	2.30	12.33
16 - 48	0.60	12.93
48 - 96	1.88	14.81
96 & above	1.93	16.74

Average Permeability Millidarcys 33.13

Average Percent Porosity 8.53

Average Percent Oil Saturation 27.17

Average Percent Water Saturation 44.91

Average Oil Content, Bbls./A. Ft. 180.

Total Oil Content, Bbls./Acre 3,425.

Average Percent Oil Recovery by Laboratory Flooding Tests 3.90

Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft. 37.

Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre 94.

Total Calculated Oil Recovery, Bbls./Acre -

Packer Setting, Feet -

Viscosity, Centipoises @

A. P. I. Gravity, degrees @ 60 °F 38.0

Elevation, Feet

A drilling mud with a weight of 10.20 pounds per gallon and with a chloride content of 85,400 parts per million was used as the circulating fluid in the coring of the sand in this well.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
4300.00 - 4300.60	Green calcareous sandy shale.
4300.60 - 4300.70	Green laminated calcareous sandy shale.
4300.70 - 4301.20	Loss.
4301.20 - 4301.70	Green laminated calcareous sandy shale.
4301.70 - 4301.90	Green shale.
4301.90 - 4302.80	Brown fine grained micaceous calcareous shaley sandstone.
4302.80 - 4303.40	Brown fine grained micaceous calcareous slightly shaley sandstone.
4303.40 - 4304.30	Limestone.
4304.30 - 4304.60	Sandy limestone.
4304.60 - 4306.00	Brown fine grained micaceous calcareous sandstone.
4306.00 - 4306.20	Brown fine grained micaceous calcareous slightly shaley sandstone.
4306.20 - 4306.40	Brown fine grained micaceous calcareous sandstone.
4306.40 - 4306.60	Brown fine grained micaceous calcareous shaley sandstone.
4306.60 - 4307.68	Brown fine grained micaceous calcareous sandstone.
4307.68 - 4307.82	Brown fine grained laminated micaceous shaley sandstone.
4307.82 - 4308.90	Brown fine grained micaceous calcareous sandstone.
4308.90 - 4309.10	Brown fine grained micaceous calcareous shaley sandstone.

4309.10 - 4309.60 - Loss.

4309.60 - 4310.45 - Brown fine grained micaceous calcareous slightly shaley sandstone.

4310.45 - 4310.80 - Dark fine grained micaceous calcareous sandstone.

4310.80 - 4311.10 - Brown fine grained micaceous calcareous slightly shaley sandstone.

4311.10 - 4311.70 - Dark fine grained micaceous calcareous sandstone.

4311.70 - 4311.80 - Brown fine grained micaceous calcareous shaley sandstone.

4311.80 - 4313.25 - Dark fine grained micaceous calcareous slightly shaley sandstone.

4313.25 - 4313.50 - Brown fine grained micaceous calcareous slightly shaley sandstone.

4313.50 - 4313.80 - Dark fine grained micaceous calcareous shaley carbonaceous sandstone.

4313.80 - 4314.00 - Brown fine grained micaceous calcareous slightly shaley sandstone.

4314.00 - 4314.35 - Dark fine grained micaceous calcareous shaley carbonaceous sandstone.

4314.35 - 4314.90 - Brown fine grained micaceous calcareous shaley sandstone.

4314.90 - 4315.10 - Dark fine grained micaceous calcareous shaley carbonaceous sandstone.

4315.10 - 4315.38 - Laminated calcareous micaceous carbonaceous shaley sandstone.

4315.38 - 4316.00 - Dark fine grained micaceous calcareous shaley carbonaceous sandstone.

4316.00 - 4317.40 - Brown fine grained laminated micaceous calcareous shaley sandstone.

4317.40 - 4317.60 - Limestone.

4317.60 - 4318.18 - Brown fine grained laminated micaceous calcareous shaley sandstone.

4318.18 - 4318.26 - Limestone.

4318.26 - 4319.10 - Brown fine grained micaceous calcareous shaley sandstone.

4319.10 - 4319.30 - Limestone.

4319.30 - 4320.40 - Brown fine grained micaceous calcareous slightly shaley sandstone.

4320.40 - 4320.60 - Dark fine grained micaceous calcareous carbonaceous sandstone.

4320.60 - 4321.05 - Brown fine grained micaceous calcareous shaley sandstone.

4321.05 - 4322.60 - Dark fine grained micaceous calcareous carbonaceous shaley sandstone.

4322.60 - 4330.70 - Gray shaley limestone with limestone inclusions.

4330.70 - 4332.90 - Dark fine grained calcareous sandstone.

4332.90 - 4344.55 - Gray sandy shale.

4344.55 - 4345.20 - Brown fine grained micaceous calcareous shaley sandstone.

4345.20 - 4348.00 - Gray sandy shale.

Coring was started at a depth of 4300.00 feet in green calcareous shale and completed at 4348.00 feet in gray sandy shale. This core shows a total of 21.37 feet of formation containing oil. For the most part, the pay is made up of fine grained micaceous calcareous to shaley sandstone. There was a loss extending from 4309.10 to 4309.60 feet which was probably sandstone.

PERMEABILITY

For the sake of distribution, the core was divided into three sections. The weighted average permeability of the upper, middle and lower sections is 113.19, 2.08 and 13.69 millidarcys respectively; the overall average being 33.13 (See Table II). By observing the data given on the coregraph, it is noticeable that the sand has a very irregular permeability profile.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a low weighted average percent oil saturation, namely, 27.17. The weighted average percent oil saturation of the upper, middle and lower sections is 23.22, 28.87 and 28.54 respectively. The weighted average percent water saturation of the upper, middle and lower sections is 43.43, 42.14 and 53.83 respectively; the overall average being 44.91. (See Table IV). This gives an overall weighted average total fluid saturation of 72.08 percent. This low total fluid saturation indicates that an appreciable amount of fluid was lost during coring which was probably oil.

In an effort to determine the degree of flushing of the sand during coring, all of the saturation samples were analyzed for chloride content. The results of these tests are given in Table VII and VIII. From the data given in these tables and on the coregraph, it is evident that some flushing of the sand did occur during coring. As for the most part, the zones of higher permeability have the lower chloride content.

The weighted average oil content of the upper, middle and lower sections is 185, 191 and 132 barrels per acre foot respectively; the overall average being 180. The total oil content, as shown by this core, is 3,425 barrels per acre (See Table IV). Inasmuch as the sand has a low percent porosity, naturally the oil content is comparatively low in relationship to the percent oil saturation.

LABORATORY FLOODING TESTS

The sand in this core responded very poorly to laboratory flooding tests, as a total recovery of 94 barrels of oil per acre was obtained from 2.51 feet of sand. The weighted average percent oil saturation was reduced from 23.90 to 20.00, or represents an average recovery of 3.90

percent. The weighted average effective permeability of the samples is 14.82, while the average initial fluid production pressure is 13.3 pounds per square inch (See Table VI).

By observing the data given in Table V, you will note that of the 16 samples tested, 6 produced water and 3 oil. This indicates that only part of the formation tested will take water. The tests also show that the part that will take water has a wide variation in effective permeability. On the basis of these tests, a total of 4.16 feet of sand tested was permeable to water.

CONCLUSION

Inasmuch as we are not familiar with this area and due to the fact that we do not have any data pertaining to the primary production history we are not including a calculated secondary recovery value for the area represented by this core. Furthermore, it is doubtful whether it would be economical to repressure this zone with water as the pay sand section is very thin for its depth. Inasmuch as the sand is very calcareous, no doubt the permeability of the formation to water could be increased by acidizing prior to water injection.

The cored section also has a low porosity which greatly reduces the volume of fluid that the capillaries will hold.

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RESULTS OF PERMEABILITY TESTS

TABLE I

Company Deep Rock Oil Corporation Lease Calbeck Well No. 11

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
1	4302.00	Imp.	0.90	0.90	0.00
2	4302.90	Imp.	0.20	1.10	0.00
3	4303.10	Imp.	0.40	1.50	0.00
4	4303.95	Imp.	0.90	2.40	0.00
5	4304.65	0.96	0.50	2.90	0.48
6	4305.50	21.	0.60	3.50	12.60
7	4305.92	Fractured	0.30	3.80	-
8	4306.50	Imp.	0.20	4.00	0.00
9	4306.95	236.	1.08	5.08	254.88
10	4307.75	1.1	0.14	5.22	0.15
11	4308.20	93.	1.08	6.30	100.44
12	4308.95	Imp.	0.20	6.50	0.00
13	4309.75	171.	0.40	6.90	68.40
14	4310.25	98.	0.45	7.35	44.10
15	4310.70	7.2	0.35	7.70	2.52
16	4311.40	0.91	0.60	8.30	0.55
17	4312.20	5.1	0.60	8.90	3.06
18	4312.60	0.70	0.85	9.75	0.60
19	4313.55	Imp.	0.30	10.05	0.00
20	4314.40	8.9	0.55	10.60	4.90
21	4315.65	0.50	0.62	11.22	0.31
22	4316.35	1.4	0.70	11.92	0.98
23	4317.00	Imp.	0.50	12.42	0.00
24	4317.35	4.9	0.20	12.62	0.98
25	4317.92	3.2	0.58	13.20	1.86
26	4318.20	Imp.	0.08	13.28	0.00
27	4318.55	0.29	0.84	14.12	0.24
28	4319.35	1.3	0.40	14.52	0.52
29	4320.00	0.52	0.70	15.22	0.36
30	4320.70	0.40	0.45	15.67	0.18
31	4321.35	0.38	0.55	16.22	0.21
32	4321.96	Imp.	0.60	16.82	0.00
33	4322.40	0.461	0.40	17.22	0.18
34	4322.90	0.52	0.65	17.87	0.34
35	4323.55	Imp.	0.65	18.52	0.00
36	4324.37	4.7	0.60	19.12	2.82
37	4324.70	Imp.	0.80	19.92	0.00
38	4326.20	Imp.	1.00	20.92	0.00
39	4327.60	Imp.	0.80	21.72	0.00
40	4328.30	63.	0.80	22.52	50.40

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RESULTS OF PERMEABILITY TESTS

TABLE I

Company Deep Rock Oil Corporation Lease Calhoak Well No. 11

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
41	4329.30	Imp.	1.00	23.52	0.00
42	4330.25	0.58	0.90	24.42	0.52
43	4330.97	Imp.	0.80	25.22	0.00
44	4332.75	Imp.	0.90	26.12	0.00
45	4333.45	Imp.	1.10	27.22	0.00
46	4343.00	0.70	0.50	27.72	0.35
47	4344.65	2.6	0.65	28.37	1.69

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SUMMARY OF PERMEABILITY TESTS

TABLE II

Company Deep Rock Oil Corporation Lease Calbeck Well No. 11

Depth Interval Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity, Ft. x Md.
4301.90 - 4310.45	4.25	113.19	481.05
4310.45 - 4322.60	8.39	2.08	17.45
4322.60 - 4345.20	4.10	13.69	56.12
4301.90 - 4345.20	16.74	33.13	554.62

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RESULTS OF SATURATION TESTS

TABLE III

Company Deep Rock Oil Corporation Lease Calbeck Well No. 11

Sat. No.	Depth, Feet	Effective Porosity Percent	Percent Saturation			Oil Content Bbls./A. Ft.	Feet of Core		Total Oil Content Bbls./Acre
			Oil	Water	Total		Ft.	Cum. Ft.	
3	4302.70	8.7	16.2	68.9	85.1	110	0.90	0.90	99
4	4303.30	3.6	26.2	23.1	49.3	73	0.60	1.50	44
5	4304.45	4.9	29.4	46.9	76.3	112	0.30	180	34
F- 5A	4304.95	9.2	26.5	-	-	189	0.90	2.70	170
6	4305.70	10.2	24.0	22.7	46.7	191	0.50	3.20	96
F- 6	4306.10	13.1	25.3	-	-	258	0.20	3.40	52
7	4307.13	15.2	22.4	41.7	64.1	264	1.08	4.48	285
8	4308.40	12.8	23.2	43.8	67.0	231	1.08	5.56	250
9	4310.60	11.6	42.2	23.7	65.9	381	0.35	5.91	134
F- 9	4310.95	7.5	34.6	-	-	201	0.30	6.21	60
10	4311.55	8.3	36.4	32.2	68.6	302	0.60	6.81	181
F-10	4311.95	9.9	24.6	-	-	189	0.70	7.51	132
11	4313.12	5.1	34.8	44.8	79.6	138	0.75	8.26	104
F-11	4313.36	7.7	41.4	-	-	248	0.25	8.51	62
12	4313.90	7.9	22.6	48.2	70.8	139	0.20	8.71	28
F-12	4314.10	9.8	17.8	-	-	136	0.35	9.06	48
13	4314.80	9.1	21.0	53.5	74.5	149	0.55	9.61	82
F-13	4315.00	8.7	26.5	-	-	179	0.20	9.81	36
14	4315.90	10.1	25.6	39.7	65.3	201	0.62	10.43	125

Oil Field Research Laboratories

RESULTS OF SATURATION TESTS

TABLE III

Company Deep Rock Oil Corporation Lease Calbeck Well No. 11

Sat. No.	Depth, Feet	Effective Porosity Percent	Percent Saturation			Oil Content Bbls./A. Ft.	Feet of Core		Total Oil Content Bbls./Acre
			Oil	Water	Total		Ft.	Cum. Ft.	
F-14	4316.15	8.2	31.1	-	-	242	1.40	11.83	338
15	4317.75	8.9	21.9	54.7	76.6	151	0.55	12.38	83
16	4318.75	8.6	30.4	39.3	69.7	203	0.84	13.22	171
17	4320.20	7.8	22.8	46.4	79.2	138	1.10	14.32	152
F-17	4320.50	5.9	27.5	-	-	126	0.20	14.52	25
18	4321.50	6.3	30.0	47.3	77.3	147	0.95	15.47	140
19	4322.50	7.2	31.7	26.1	57.8	177	0.60	16.07	106
24	4330.80	4.0	35.4	36.4	71.8	110	0.80	16.87	88
25	4332.00	5.9	29.4	52.9	82.3	135	1.50	18.37	202
26	4345.10	10.5	18.3	77.8	96.1	190	0.65	19.02	98
								Total - - - -	3,425

Note: "A" Sample was taken from the core after it was received in the laboratory.

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SUMMARY OF SATURATION TESTS

TABLE IV

Company Deep Rock Oil Corporation Lease Calbeck Well No. 11

Depth Interval, Feet	Feet of Core Analyzed	Average Percent Porosity	Average Percent Oil Saturation	Average Percent Water Saturation	Average Oil Content Bbl./A. Ft.	Total Oil Content Bbls./Acre
4301.90-4308.90	5.56	10.38	23.22	43.43	185	1,030
4310.45-4322.60	10.51	8.15	28.87	42.14	191	2,007
4330.70-4345.20	2.95	6.41	28.54	53.83	132	388
4301.90-4345.20	19.02	8.53	27.17	44.91	180	3,425

Oil Field Research Laboratories

RESULTS OF LABORATORY FLOODING TESTS

TABLE V

Company Deep Rock Oil Corporation Lease Calbeck Well No. 11

Sample No.	Depth, Feet	Effective Porosity Percent	Original Oil Saturation		Oil Recovery		Residual Saturation			Volume of Water Recovered cc*	Effective Permeability, Millidarcys **	Initial Fluid Production Pressure Lbs./Sq. In.
			Percent	Bbls./A. Ft.	Percent	Bbls./A. Ft.	% Oil	% Water	Bbls./A. Ft.			
5	4302.30	8.7	15.4	104	0.0	0	15.4	72.6	104	0	Imp.	50#
5A	4304.95	9.2	26.5	169	0.0	0	26.5	62.0	169	168	5.31	10
6	4306.10	13.1	35.3	258	0.0	0	35.3	61.1	258	94	12.09	10
7	4307.41	15.3	31.6	257	4.1	49	17.5	70.2	206	307	17.12	5
8	4308.80	12.6	32.8	221	2.5	24	20.3	66.7	197	181	16.76	10
9	4310.95	7.5	34.6	201	7.6	44	27.0	60.0	157	15	0.187	25
10	4311.95	9.9	24.6	189	0.0	0	24.6	64.3	189	22	0.802	25
11	4313.36	7.7	41.4	248	0.0	0	41.4	45.5	248	0	Imp.	50#
12	4314.10	9.8	17.8	156	0.0	0	17.8	74.4	156	0	Imp.	50#
13	4315.00	8.7	26.5	179	0.0	0	26.5	70.5	179	0	Imp.	50#
14	4316.15	8.8	31.1	242	0.0	0	31.1	44.5	242	0	Imp.	50#
16	4318.95	8.3	29.5	190	0.0	0	29.5	43.7	190	0	Imp.	50#
17	4320.50	5.9	27.5	126	0.0	0	27.5	43.7	126	0	Imp.	50#
18	4321.70	6.7	30.0	156	0.0	0	30.0	30.0	156	0	Imp.	50#
25A	4331.65	5.4	28.6	120	0.0	0	28.6	54.1	120	0	Imp.	50#
26	4344.90	9.8	18.6	142	0.0	0	18.6	76.4	142	0	Imp.	50#

Notes: cc = cubic centimeter
* = Volume of water recovered at the time of maximum oil recovery.
** = Determined by passing water through sample which still contains residual oil.
"A" = Sample was taken from the core after it was received in the laboratory.

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SUMMARY OF LABORATORY FLOODING TESTS

TABLE VI

Company Deep Rock Oil Corporation Lease Calbeck Well No. 1

Depth Interval Feet	4306.60 - 4311.10
Feet of Core Analyzed	2.51
Average Percent Porosity	13.00
Average Percent Original Oil Saturation	23.90
Average Percent Oil Recovery	3.90
Average Percent Residual Oil Saturation	20.00
Average Percent Residual Water Saturation	67.29
Average Percent Total Residual Fluid Saturation	87.29
Average Original Oil Content, Bbls./A. Ft.	294.
Average Oil Recovery, Bbls./A. Ft.	37.
Average Residual Oil Content, Bbls./A. Ft.	197.
Total Original Oil Content, Bbls./Acre	587.
Total Oil Recovery, Bbls./Acre	94.
Total Residual Oil Content, Bbls./Acre	493.
Average Effective Permeability, Millidarcys	14.82
Average Initial Fluid Production Pressure, p.s.i.	13.3

NOTE: Only those samples which recovered oil were used in calculating the above averages.

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RESULTS OF WATER DIFFERENTIATION TESTS

TABLE VII

Company Deep Rock Oil Corporation Lease Calbeck Well No. 11

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Percent Water Saturation		
			Connate	Drilling & Foreign	Total
3	4302.70	101,500			
4	4303.30	168,200			
5	4304.45	1[illegible]5,900			
6	4305.70	121,000			
7	4307.13	72,600			
8	4308.40	84,000			
9	4310.60	96,000			
10	4311.55	115,800			
11	4313.12	125,200			
12	4313.90	106,700			
13	4314.80	93,900			
14	4315.90	114,000			
15	4317.75	104,500			
16	4318.75	114,900			
17	4320.20	46,600			
18	4321.50	130,400			
19	4322.50	141,800			
24	4330.80	140,200			
25	4332.00	49,500			
26	4345.10	100,800			

Note: ppm - parts per million.

Oil Field Research Laboratories

SUMMARY OF WATER DIFFERENTIATION TESTS

TABLE VIII

Company Deep Rock Oil Corporation Lease Calbeck Well No. 11

Depth Interval, Feet	Chloride Content of Brine in Sand, ppm	Average Percent Connate Water	Average Percent Drilling & Foreign Water
4301.90-4308.90	104,400		
4310.45-4322.60	106,900		
4330.70-4345.20	85,400		
4301.90-4345.20	101,800		

Note: ppm - parts per million.