

August 18, 1950

Deep Rock Oil Corporation
Atlas Life Building
Tulsa, Oklahoma

Attention: Mr. T. F. Lawry

Gentlemen:

Enclosed herewith is the report of the analysis made on the 2 1/2" rotary core taken from the Bundy Lease, Well No. O-21, Line County, Kansas, and submitted to our laboratory on July 29, 1950.

Very truly yours,

OIL FIELD RESEARCH LABORATORIES

Carl L. Pate

CLP:es

c.c. to Mr. Neil Henderson
Mr. Jack McMeeney

30-20-22E

O-21

Bundy

DEEP ROCK OIL CORPORATION

CORE ANALYSIS REPORT

MUNDY LEASE WELL NO. 2-82

LINE COUNTY, KANSAS

OIL FIELD RESEARCH LABORATORIES

CHANDLER, KANSAS

AUGUST 15, 1952

Oil Field Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Deep Rock Oil Corporation Lease Bundy Well No. 0-21
 Location 1000' East of West line and 950' South of North line, NW 1/4 of NE 1/4 ?
 Section 22 Twp. 30S Rge. 30E County Lin State Kansas

Name of Sand Squirrel
 Top of Core 553.50
 Bottom of Core 597.50
 Top of Sand 560.30
 Bottom of Sand 590.95
 Total Feet of Permeable Sand 32.15

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 5	5.07	5.07
5 - 10	9.35	14.42
10 - 20	4.58	19.00
20 - 40	1.00	20.00
40 - 80	0.75	20.75
80 - 120	0.85	21.60
120 & above	0.55	22.15

Average Permeability, Millidarcys 16.76
 Average Percent Porosity 19.40
 Average Percent Oil Saturation 31.93
 Average Percent Water Saturation 49.21
 Average Oil Content, Bbls./A. Ft. 403.
 Total Oil Content, Bbls./Acre 9,418.
 Average Percent Oil Recovery by Laboratory Flooding Tests 4.91
 Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft. 77.
 Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre 909.
 Total Calculated Oil Recovery, Bbls./Acre 550.

Packer Setting, Feet 560.50

Viscosity, Centipoises @ Note: The above averages are for that part of the sand section extending from the packer setting to the top of the cement plug.

A. P. I. Gravity, degrees @ 60 °F

Water was used as a circulating fluid in the coring of the sand in this well.

FORMATION CORRECTION

The detailed log of the formation cored is as follows:

Depth Interval, <u>Feet</u>	Description
555.50 - 556.00	- Gray sandy shale.
556.00 - 556.40	- Light brown fine grained finely laminated micaceous shaley sandstone.
556.40 - 556.70	- Finely laminated sandstone and shale.
556.70 - 557.60	- Finely laminated shaley sandstone.
557.60 - 558.50	- Finely laminated sandstone and shale.
558.50 - 559.00	- Light brown fine grained micaceous shaley sandstone.
559.00 - 559.45	- Light brown fine grained micaceous sandstone.
559.45 - 560.30	- Laminated sandy shale.
560.30 - 562.13	- Light brown fine grained micaceous sandstone.
562.13 - 563.30	- Laminated sandstone and shale.
563.30 - 563.45	- Light brown fine grained micaceous sandstone.
563.45 - 563.70	- Laminated sandstone and shale.
563.70 - 565.00	- Light brown fine grained micaceous slightly shaley sandstone.
565.00 - 567.30	- Loss.
567.30 - 567.70	- Gray sandy shale.
567.70 - 568.15	- Laminated sandy shale.
568.15 - 568.55	- Gray shale.
568.55 - 569.15	- Laminated sandy shale.
569.15 - 569.30	- Light brown fine grained micaceous sandstone.
569.30 - 570.30	- Brown fine grained micaceous sandstone.

- 570.80 - 571.00 - Laminated sandstone and shale.
- 571.00 - 571.30 - Light brown fine grained micaceous sandstone.
- 571.30 - 571.80 - Gray sandy shale.
- 571.80 - 571.80 - Finely laminated shaley sandstone.
- 571.80 - 572.40 - Laminated sandstone and shale.
- 572.40 - 572.85 - Finely laminated shale and sandstone.
- 572.85 - 573.80 - Brown fine grained micaceous sandstone.
- 573.80 - 574.85 - Laminated sandstone and shale.
- 574.85 - 575.85 - Gray shale.
- 575.85 - 576.85 - Brown fine grained micaceous sandstone.
- 576.85 - 578.90 - Light brown fine grained micaceous sandstone.
- 578.90 - 579.80 - Light brown fine grained slightly laminated micaceous shaley sandstone.
- 579.80 - 580.40 - Brown fine grained micaceous sandstone.
- 580.40 - 582.30 - Light brown fine grained micaceous sandstone.
- 582.30 - 582.70 - Dark fine grained micaceous carbonaceous sandstone.
- 582.70 - 583.15 - Light brown fine grained micaceous carbonaceous sandstone.
- 583.15 - 588.20 - Light brown fine grained micaceous slightly shaley sandstone.
- 588.20 - 592.35 - Brown fine grained micaceous sandstone.
- 592.35 - 593.35 - Light brown fine grained micaceous sandstone.
- 593.35 - 595.08 - Light brown fine grained slightly laminated micaceous carbonaceous sandstone.
- 595.08 - 596.25 - Gray sandy shale.
- 596.25 - 596.10 - Light brown fine grained micaceous sandstone.
- 596.10 - 596.30 - Light brown fine grained laminated micaceous carbonaceous sandstone.
- 596.30 - 597.30 - Light brown fine grained micaceous sandstone.
- 597.30 - 597.80 - Loss.

Coring was started at a depth of 555.50 feet in sandy shale and completed at 597.30 feet probably in sandstone. This core shows a total of 29.94 feet of sandstone. The upper part of the cored section is badly broken by layers of shale and laminated sandstone and shale. For the most part, the lower part of the sand section is made up of fine grained micaceous to shaley 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 are 7.69, 15.79 and 77.00 millidarcys respectively, while that of the pay sand, or that part of the cored section extending from the packer setting to the top of the cement plug, is 15.75 (See Table II). By observing the data given above and on the coregraph, it is noticeable that the lower part of the cored section has a considerable higher permeability than the remainder of the core.

PERCENT SATURATION & OIL CONTENT

The pay sand in this core shows a fairly good weighted average percent oil saturation, namely, 31.93. The weighted average percent oil saturation of the upper, middle and lower sections are 17.75, 31.93 and 24.00 respectively. The weighted average percent water saturation of the upper, middle and lower sections are 55.51, 49.01 and 35.14 respectively, while that of the pay sand is 49.21 (See Table IV). This gives an overall weighted average total fluid saturation of 51.14 percent. This fairly low total fluid saturation indicates that an appreciable amount of fluid was lost during coring which was probably oil.

In an effort to get some idea of the degree of flushing of the sand during coring, all of the saturation samples were analysed for

chloride content. The results of these tests are given in Tables VII and VIII. By observing the data given in these tables and on the core-graph, it is apparent that salt water was used as a circulating fluid as the chloride content of the sand samples is more or less uniform from top to bottom.

The weighted average oil content of the upper, middle and lower sections are 346, 486 and 409 barrels per acre foot respectively, while that of the pay sand is 483. The total oil content, as shown by this core, is 12,721 barrels per acre of which 9,416 barrels are in the pay sand section.

LABORATORY FLOODING TESTS

The sand in this core did not respond very well to laboratory flooding tests as a total recovery of only 909 barrels of oil per acre was obtained from 11.88 feet of sand. The weighted average percent oil saturation was reduced from 32.07 to 27.16, or represents an average recovery of 4.91 percent. The weighted average effective permeability of the samples is 0.413 millidarcys while the average initial fluid production pressure is 30.4 pounds per square inch (See Table VI).

By observing the data given in Table V, you will note that of the 26 samples tested, 20 produced water and 12 oil. From the results of these tests, it is evident that the loose zone at the bottom of the sand section is more or less watered out and for this reason, it was recommended that the hole be plugged back to 590.30 feet. With the exception of the lower part of the sand section, the tests show that the sand has a low effective permeability.

CONCLUSION

From a study of the above data, we believe that an efficient water flood within the vicinity of this well will recover approximately 850

barrels of oil per acre. In calculating this recovery, an allowance was made for oil lost during coring and it was assumed that the true water saturation of the sand is 45 percent.

From the data given above, it is evident that the sand in this core is partly watered out as most of the sand has a rather high percent water saturation.

Oil Field Research Laboratories

SHOT RECOMMENDATION

Company Deep Rock Oil Corporation Lease o Bandy Well No. Q-23

Depth Interval, Feet	Feet of Sand	Size of Shell Inches	Qts./Ft.	Total Quarts
566.5 - 588.5	22.0	4 1/2	3.1	71.3

Recommended Packer Setting - 580.5 feet
Note: Plug hole back to 590.5 feet

Oil Field Research Laboratories
RESULTS OF PERMEABILITY TESTS
TABLE I

Company Deep Rock Oil Co. Lease Bundy Well No. 0-21

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
1	555.93	3.1	0.20	0.20	0.62
2	556.65	0.80	0.30	0.50	0.24
3	557.00	4.5	0.60	1.10	2.70
4	557.70	Imp.	0.40	1.50	0.00
5	559.43	16.	0.48	1.98	7.67
6	560.40	6.9	0.55	2.53	3.79
7	561.20	7.9	0.55	3.08	4.35
8	561.60	9.5	0.30	3.38	2.85
9	561.87	16.	0.43	3.81	6.88
10	562.26	2.2	0.37	4.18	0.81
11	563.20	2.6	0.30	4.48	0.78
12	563.43	12.	0.15	4.63	1.80
13	564.13	9.4	0.60	5.23	5.64
14	564.90	6.8	0.70	5.93	4.76
15	568.03	5.7	0.45	6.38	2.57
16	568.60	2.2	0.60	6.98	1.32
17	569.23	12.	0.15	7.13	1.80
18	569.60	13.	0.50	7.63	6.50
19	570.04	12.	0.50	8.13	6.00
20	571.03	4.9	0.15	8.28	0.74
21	571.25	14.	0.15	8.43	2.10
22	572.47	2.2	0.45	8.88	0.99
23	573.17	8.7	0.45	9.33	3.92
24	573.46	16.	0.20	9.53	3.20
25	574.20	0.46	0.55	10.08	0.25
26	575.53	Imp.	0.35	10.43	0.00
27	576.13	14.	0.75	11.18	10.50
28	576.45	35.	0.25	11.43	8.75
29	576.70	7.7	0.25	11.68	1.93
30	576.95	9.8	0.60	12.28	5.88
31	577.78	13.	0.50	12.78	6.50
32	578.03	9.4	0.30	13.08	2.82
33	578.35	4.0	0.70	13.78	2.80
34	579.03	3.3	0.35	14.13	1.15
35	579.43	1.8	0.25	14.38	0.45
36	580.03	29.	0.60	14.98	17.40
37	580.45	14.	0.25	15.23	3.50

Oil Field Research Laboratories
RESULTS OF PERMEABILITY TESTS

TABLE I

Deep Rock Oil Co.

Bundy

0-21

Company _____ Lease _____ Well No. _____

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
38	580.84	8.5	0.65	15.88	5.52
39	581.53	11.	0.40	16.28	6.40
40	581.90	8.3	0.40	16.68	3.32
41	582.20	15.	0.20	16.88	3.00
42	582.77	8.8	0.30	17.18	2.64
43	583.04	4.6	0.15	17.33	0.69
44	583.37	6.0	0.65	17.98	3.90
45	584.10	2.9	0.50	18.48	1.45
46	584.43	4.2	0.30	18.78	1.26
47	584.70	4.7	0.40	19.18	1.88
48	585.37	5.1	0.55	19.73	2.80
49	585.73	5.9	0.35	20.08	2.06
50	586.03	5.3	0.50	20.58	2.65
51	586.63	9.0	0.40	20.98	3.60
52	587.04	5.9	0.45	21.43	2.66
53	587.40	7.4	0.55	21.98	4.07
54	588.03	15.	0.40	22.38	6.00
55	588.40	47.	0.35	22.73	16.45
56	588.73	193.	0.55	23.28	106.20
57	589.33	60.	0.40	23.68	24.00
58	589.64	117.	0.35	24.03	40.95
59	590.00	87.	0.50	24.53	43.50
60	590.67	22.	0.45	24.98	9.90
61	591.02	52.	0.45	25.43	23.40
62	591.40	122.	0.45	25.88	56.95
63	592.00	117.	0.65	26.53	76.05
64	592.45	30.	0.25	26.78	12.50
65	592.77	8.6	0.50	27.28	4.30
66	593.40	9.4	0.45	27.73	4.23
67	593.64	26.	0.30	28.03	7.80
68	594.10	141.	0.65	28.68	98.15
69	594.80	132.	0.58	29.26	76.52
70	595.33	36.	0.20	29.46	7.20
71	595.53	58.	0.65	30.11	37.70
72	596.13	23.	0.20	30.31	4.60
73	596.73	68.	0.50	30.81	94.00

OIL FIELD MEASUREMENT INFORMATION

TABLE 1A

RESULTS OF VERTICAL EFFECTIVE PERMEABILITY

Company Deep Rock Oil Corporation Lease Bundy Well No. C-21

Sample No.	Depth, Feet	Vertical Effective Permeability Millidarcys
A B C D	588.60 590.90 591.80 592.25	0.607 Imp. 0.338 1.64

Oil Field Research Laboratories

SUMMARY OF PERMEABILITY TESTS

TABLE II

Company Deep Rock Oil Corporation Lease Bundy Well No. 0-21

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity, Ft. x Md.
556.00-559.48	1.38	7.69	10.61
560.30-591.10	22.95	18.79	431.23
591.10-597.30	5.53	77.00	425.80
560.50-590.50	22.15	18.76	415.45

Oil Field Research Laboratories

RESULTS OF SATURATION TESTS

TABLE III

Company Deep Rock Oil Corporation Lease Brady Well No. 0-21

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.	
1	556.30	19.3	18.7	56.5	75.2	280	0.40	0.40	112
2	557.43	15.0	16.0	75.0	91.0	186	0.90	1.30	167
3	558.90	17.8	14.8	-	-	204	0.20	1.50	41
3	559.17	21.2	21.2	41.3	62.5	350	0.48	1.98	168
4	560.99	19.1	34.2	39.1	73.3	506	1.10	3.08	556
5A	562.04	20.4	31.6	-	-	500	0.73	3.81	363
6	564.59	19.6	36.7	39.5	76.2	558	1.30	5.11	725
8A	569.37	21.3	34.9	-	-	577	0.50	5.61	288
9	570.18	20.6	34.3	-	-	548	0.50	6.11	274
9	570.40	16.4	19.6	70.4	90.0	250	0.70	6.81	175
10	571.67	16.0	13.8	84.7	98.5	172	0.30	7.11	52
11	572.99	17.9	29.7	57.5	88.2	426	0.65	7.76	277
13	575.98	20.6	32.5	46.1	78.6	519	1.00	8.76	518
14	577.41	20.2	33.6	43.9	77.5	533	1.45	10.21	773
15	578.80	19.0	30.0	50.6	80.6	445	0.90	11.11	400
16	579.86	19.8	32.4	44.	-	498	0.90	12.01	448
17	581.32	19.7	32.9	45.1	78.0	503	1.90	13.91	956
18	582.60	20.6	44.6	35.4	80.0	711	0.40	14.31	285
19	583.87	20.4	27.6	47.0	74.6	477	1.35	15.66	590
20	585.16	18.0	27.4	56.1	83.5	383	1.30	16.96	498

RESULTS OF SATURATION TESTS

TABLE III

Company Deep Root Oil Corporation

Lease _____ **Priddy**

Well No. 22

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.	
21	526.46	18.4	35.1	46.5	91.6	501	1.30	18.26	651
22	587.33	19.6	33.1	47.5	80.6	503	1.10	19.36	554
23	589.13	18.3	32.8	53.5	86.3	468	1.60	20.96	745
24	590.50	21.8	32.7	48.5	79.2	594	1.30	22.26	720
25	591.86	22.7	26.9	51.7	78.6	475	1.25	23.51	594
26	593.18	19.3	24.0	55.2	79.2	359	1.20	24.71	431
27	594.60	22.4	24.6	51.2	75.8	428	1.53	26.24	635
28	595.98	23.5	22.4	60.6	82.4	410	0.85	27.09	349
29	597.18	21.9	20.9	67.2	88.1	354	1.00	28.09	354
							Total -	- - - -	12,721

Note: "A" samples were drilled from the core after it was received in the laboratory.

Oil Field Research Laboratories

SUMMARY OF SATURATION TESTS

TABLE IV

Company <u>Deep Rock Oil Corporation</u>			Lease <u>Bundy</u>		Well No. <u>0-21</u>	
Depth Interval, Feet	Feet of Core Analyzed	Average Percent Porosity	Average Percent Oil Saturation	Average Percent Water Saturation	Average Oil Content Bbls./A. Ft.	Total Oil Content Bbls./Acre
556.00-559.48	1.98	17.68	17.78	55.51	246	430
560.30-591.10	20.28	19.47	31.98	49.01	486	9,850
591.10-597.30	5.83	21.92	24.00	56.14	409	2,383
560.50-590.50	19.48	19.40	31.93	49.21	483	9,418

TABLE V

Company Deep Rock Oil CorporationLease Bundy

Sample No.	Depth, Feet	Effective Porosity Percent	Original Oil Saturation		Oil Recovery		Res. % Oil
			Percent	Bbbls./A. Ft.	Percent	Bbbls./A. Ft.	
1	556.10	16.6	17.4	224	0.0	0	17.4
2	557.20	16.4	15.0	179	0.0	0	15.0
3	558.90	17.8	14.8	204	0.0	0	14.8
4	560.64	19.6	31.9	460	3.6	52	28.3
5A	562.04	20.4	31.4	500	3.9	52	27.7
6	564.32	20.3	36.2	571	12.0	169	24.2
6A	569.37	21.3	34.9	577	9.0	149	25.9
9	570.16	20.6	34.3	548	11.4	162	22.9
11A	573.33	21.5	29.5	492	4.2	70	25.3
13	575.79	20.5	34.6	550	6.4	102	26.2
14	577.19	18.5	36.9	515	3.3	47	22.6
15	578.56	16.8	29.1	425	5.0	73	24.1
16	579.60	18.2	33.3	474	0.0	0	23.6
17	581.05	18.2	32.1	452	1.6	25	20.3
18	582.40	18.3	45.4	545	0.0	0	45.4
19	583.59	20.3	26.4	416	1.2	19	25.2
20	584.94	18.8	26.4	386	0.0	0	26.4
21	586.22	16.7	37.6	427	0.0	0	37.6
22	587.59	18.7	34.0	493	0.0	0	34.0
23	588.92	16.2	29.4	416	0.0	0	29.4
24	590.24	25.4	27.3	424	4.2	76	23.1
25	591.62	21.3	24.1	407	0.0	0	24.1
26	592.97	19.2	25.0	373	0.0	0	25.0
27	594.32	22.6	22.1	388	0.0	0	22.1
28	595.74	22.5	24.9	435	0.0	0	24.9
29	596.91	22.0	19.3	350	0.0	0	19.3

Notes: cc- cubic centimeter

*Vol- of water recovered at the time of maximum oil recovery.

**Determined by passing water through sample which still contains residual

*A samples were drilled from the core after it was received in the laboratory

Oil Field Research Laboratories

SUMMARY OF LABORATORY FLOODING TESTS

TABLE VI

Company Deep Rock Oil Corporation Lease Bundy Well No. 0-21

Depth, Interval, Feet	560.50 - 590.50
Feet of Core Analyzed	11.88
Average Percent Porosity	19.83
Average Percent Original Oil Saturation	32.07
Average Percent Oil Recovery	4.91
Average Percent Residual Oil Saturation	27.16
Average Percent Residual Water Saturation	65.61
Average Percent Total Residual Fluid Saturation	92.77
Average Original Oil Content, Bbls./A. Ft.	493.
Average Oil Recovery, Bbls./A. Ft.	77.
Average Residual Oil Content, Bbls./A. Ft.	416.
Total Original Oil Content, Bbls./Acre	5,847.
Total Oil Recovery, Bbls./Acre	909.
Total Residual Oil Content, Bbls./Acre	4,938.
Average Effective Permeability, Millidarcys	0.413
Average Initial Fluid Production Pressure, p.s.i.	30.4

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

Oil Field Research Laboratories
RESULTS OF WATER DIFFERENTIATION TESTS
TABLE VII

Company Deep Rock Oil Corporation Lease Bundy Well No. 0-21

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Connate	Percent Water Saturation Drilling & Foreign	Total
1	556.30	16,300			
2	557.43	17,300			
3	559.17	14,600			
4	560.99	17,400			
6	564.59	17,700			
9	570.40	15,200			
10	571.67	13,600			
11	572.99	14,400			
13	575.98	14,400			
14	577.41	14,600			
15	578.80	12,700			
16	579.86	15,600			
17	581.32	16,400			
18	582.60	22,000			
19	583.87	15,100			
20	585.16	14,800			
21	586.46	13,500			
22	587.33	16,500			
23	589.13	15,000			
24	590.50	15,500			
25	591.86	12,600			
26	593.18	14,400			
27	594.60	17,450			
28	595.98	15,000			
29	597.18	8,570			
Total ppm-parts per million					

Oil Field Research Laboratories

SUMMARY OF WATER DIFFERENTIATION TESTS

TABLE VIII

Company Deep Rock Oil Corporation Lease Frank Well No. 0-21

Depth Interval, Feet	Chloride Content of Brine in Sand, ppm	Average Percent Connate Water	Average Percent Drilling & Foreign Water
556.00-559.48	16,360		
560.30-591.10	15,470		
591.10-597.90	13,910		
560.50-590.50	15,440		

Note: ppm-parts per million