

OIL FIELD RESEARCH LABORATORIES
CHANUTE, KANSAS

July 14, 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 Cable Tool core taken from the Babb Lease, Well No. C-13, Anderson County, Kansas, and submitted to our laboratory on June 28, 1951.

Very truly yours,

OIL FIELD RESEARCH LABORATORIES

Clayton A. Mattler

CAN:pm
C.C. to Mr. D. E. Auld

DEEP ROCK OIL CORPORATION

CORE ANALYSIS REPORT

BABE LEASE

WELL NO. 0-13

ANDERSON COUNTY, KANSAS

OIL FIELD RESEARCH LABORATORIES

CHANDLER, KANSAS

JULY 14, 1951

Oil Field Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Deep Rock Oil Corporation Lease Rabb Well No. 0-13

Location _____

Section 18 Twp. 21 Rge. 21 County Anderson State Kansas

Name of Sand	Squirrel
Top of Core	591.70
Bottom of Core	639.60
Top of Sand	594.90
Bottom of Sand	636.30
Total Feet of Permeable Sand	25.68

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 8	1.35	1.35
8 - 16	1.85	3.20
16 - 24	7.13	10.33
24 - 32	5.20	15.53
32 - 40	4.35	19.88
40 & above	5.80	25.68

Average Permeability, Millidarcys	30.04
Average Percent Porosity	19.71
Average Percent Oil Saturation	40.88
Average Percent Water Saturation	41.79
Average Oil Content, Bbls./A. Ft.	627.
Total Oil Content, Bbls./Acre	17,000.
Average Percent Oil Recovery by Laboratory Flooding Tests	14.92
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	229.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	5,124.
Total Calculated Oil Recovery, Bbls./Acre	8,550.
Packer Setting, Feet	
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F	

The above averages are for that part of the cored section extending from the packer setting to the top of the cement plug.

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

FORMATION CORED

The detailed log of the formation cored is as follows:

<u>Depth Interval, Feet</u>	<u>Description</u>
591.70 - 593.75	- Gray shale.
593.75 - 594.40	- Finely laminated sandy shale.
594.40 - 594.90	- Laminated shaley sandstone.
594.90 - 595.15	- Brown fine grained slightly laminated micaceous shaley sandstone.
595.15 - 596.35	- Finely laminated sandy shale.
596.35 - 596.70	- Brown fine grained slightly laminated micaceous shaley sandstone.
596.70 - 597.00	- Finely laminated sandy shale.
597.00 - 598.10	- Brown fine grained laminated micaceous shaley sandstone.
598.10 - 598.30	- Brown fine grained micaceous sandstone.
598.30 - 598.50	- Brown fine grained slightly laminated micaceous shaley sandstone.
598.50 - 598.60	- Laminated sandy shale.
598.60 - 599.10	- Brown fine grained micaceous sandstone.
599.10 - 599.30	- Finely laminated shaley sandstone.
599.30 - 599.40	- Finely laminated sandy shale.
599.40 - 599.80	- Brown fine grained laminated micaceous shaley sandstone.
599.80 - 600.02	- Finely laminated sandy shale.
600.02 - 600.25	- Laminated shaley sandstone.

600.25 - 600.55 - Finely laminated sandy shale.
600.55 - 600.80 - Laminated shaley sandstone.
600.80 - 601.00 - Laminated sandy shale.
601.00 - 601.10 - Laminated shaley sandstone.
601.10 - 601.50 - Laminated sandy shale.
601.50 - 601.70 - Brown fine grained micaceous sandstone.
601.70 - 602.30 - Laminated sandy shale.
602.30 - 603.10 - Gray sandy shale.
603.10 - 603.70 - Laminated sandy shale.
603.70 - 604.60 - Brown fine grained micaceous sandstone.
604.60 - 604.92 - Finely laminated shaley sandstone.
604.92 - 611.80 - Brown fine grained micaceous sandstone.
611.80 - 612.00 - Gray sandy shale.
612.00 - 612.53 - Brown fine grained micaceous sandstone.
612.53 - 612.63 - Brown fine grained laminated micaceous shaley sandstone.
612.63 - 613.20 - Brown fine grained micaceous sandstone.
613.20 - 613.35 - Laminated sandy shale.
613.35 - 617.00 - Brown fine grained micaceous sandstone.
617.00 - 617.45 - Limestone.
617.45 - 618.40 - Brown fine grained micaceous sandstone.
618.40 - 622.30 - Loss.
622.30 - 627.60 - Brown fine grained micaceous sandstone.
627.60 - 628.00 - Brown fine grained slightly laminated micaceous shaley sandstone.
628.00 - 628.35 - Brown fine grained laminated micaceous shaley sandstone.
628.35 - 629.30 - Brown fine grained micaceous sandstone.
629.30 - 630.55 - Finely laminated sandy shale.

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630.55 - 630.85 - Brown fine grained micaceous sandstone.
630.85 - 631.05 - Brown fine grained laminated micaceous shaley sandstone.
631.05 - 632.40 - Brown fine grained micaceous sandstone.
632.40 - 632.75 - Laminated sandy shale.
632.75 - 633.40 - Brown fine grained micaceous sandstone.
633.40 - 633.70 - Brown fine grained laminated micaceous shaley sandstone.
633.70 - 636.30 - Brown fine grained micaceous sandstone.
636.30 - 637.30 - Laminated sandy shale.
637.30 - 639.60 - Gray shale.

Coring was started at a depth of 591.70 feet in gray shale and completed at a depth of 639.60 feet in gray shale. That part of the cored section extending from 618.40 to 622.30 feet was lost during coring. This core shows a total of 28.33 feet of sandstone of which 27.43 feet are in the pay sand section. The pay sand is made up mainly of brown fine grained micaceous sandstone. The upper part of the cored section is badly broken by layers of sandy shale.

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 6.72, 28.30 and 42.80 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 30.04 millidarcys (See Table II). By observing the data given on the coregraph, it is noticeable that the sand has a fairly irregular permeability profile.

PERCENT SATURATION & OIL CONTENT

The pay sand in this core shows a good weighted average percent oil saturation, namely, 40.88. The weighted average percent oil saturation of the upper, middle and lower sections is 39.39, 40.26 and 44.88. The weighted average percent water saturation of the upper, middle and lower sections is 45.75, 41.33 and 42.65 respectively; while that of the pay sand is 41.79 (See Table IV). The weighted average total fluid saturation of the pay sand is 82.67 percent.

Since salt water was used as a circulating fluid during coring, no chloride determinations were made as the results could not be used to determine the degree of flushing that occurred during coring.

The weighted average oil content of the upper, middle and lower sections is 521, 621 and 713 barrels per acre foot respectively, while that of the pay sand is 627 barrels per acre foot. The total oil content, as shown by this core, is 17,911 barrels per acre of which 17,000 barrels are in the pay sand section.

LABORATORY FLOODING TESTS

This core responded very well to laboratory flooding tests, in that a total recovery of 5,124 barrels of oil per acre was obtained from 22.40 feet of sand analyzed. The weighted average percent oil saturation was reduced from 41.95 to 27.03, or represents an average recovery of 14.92 percent. The weighted average effective permeability of the samples is 3.11 millidarcys, while the average initial fluid production pressure is 16.0 pounds per square inch (See Table VI).

By observing the data given in Table V, you will note that of the 30 samples tested, 23 produced water and 26 oil. This indicates that most of

the sand analyzed is floodable. The tests also show that the sand represented by these samples has a fairly uniform 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 8,550 barrels of oil per acre. This is an average recovery of 364 barrels per acre foot from the 23.50 feet of floodable sand analyzed. In calculating this recovery, an allowance was made for oil lost during coring. It was assumed that the true water saturation of the sand is 38 percent and that the sand is not pressured up.

Oil Field Research Laboratories

SHOT RECOMMENDATION

Company Deep Rock Oil Corporation Lease Babb Well No. 0-13

<u>Depth Interval, Feet</u>	<u>Feet of Sand</u>	<u>Size of Shell Inches</u>	<u>Qts./Ft.</u>	<u>Total Quarts</u>
603.50 - 635.00	31.5	4.0	2.5	78.75

Recommended Packer Setting - - - 598.00

Note: Plug hole back to - - - 636.00

Oil Field Research Laboratories
RESULTS OF PERMEABILITY TESTS
TABLE I

Company Deep Rock Oil Corporation Lease Rabb Well No. 0-13

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
1	594.95	2.3	0.25	0.25	0.58
2	596.55	7.9	0.35	0.60	2.77
3	597.08	3.4	0.45	1.05	1.53
4	597.79	3.3	0.45	1.50	1.49
5	598.00	4.5	0.20	1.70	0.90
6	598.70	18.	0.15	1.85	2.70
7	598.85	17.	0.35	2.20	5.95
8	599.45	1.7	0.25	2.45	0.43
9	599.76	Imp.	0.15	2.60	0.00
10	600.70	Imp.	0.25	2.85	0.00
11	601.05	0.91	0.30	3.15	0.27
12	601.66	16.	0.20	3.35	3.20
13	603.81	22.	0.50	3.85	11.00
14	604.52	7.1	0.40	4.25	2.84
15	604.95	46.	0.38	4.63	17.48
16	605.60	39.	0.60	5.23	23.40
17	606.25	38.	0.70	5.93	26.60
18	606.91	29.	0.60	6.53	17.40
19	607.46	25.	0.40	6.93	10.00
20	607.70	33.	0.15	7.08	4.95
21	607.82	37.	0.45	7.53	16.65
22	608.40	32.	0.40	7.93	12.80
23	608.74	35.	0.50	8.43	17.50
24	609.33	26.	0.35	8.78	9.10
25	609.54	15.	0.20	8.98	3.00
26	609.77	13.	0.40	9.38	5.20
27	610.30	28.	0.45	9.83	12.60
28	610.70	13.	0.30	10.13	13.90
29	610.85	35.	0.35	10.48	12.25
30	611.34	47.	0.35	10.83	16.45
31	611.73	32.	0.30	11.13	9.60
32	612.26	19.	0.53	11.66	10.07
33	612.77	48.	0.57	12.23	27.36
34	613.42	26.	0.15	12.38	3.50
35	613.58	46.	0.40	12.78	18.40
36	614.18	22.	0.60	13.38	13.20
37	614.85	20.	0.70	14.08	14.00
38	615.70	23.	0.70	14.78	16.10
39	616.25	29.	0.45	15.23	13.05
40	616.40	18.	0.65	15.88	11.70

Oil Field Research Laboratories

RESULTS OF PERMEABILITY TESTS

TABLE I

Company Deep Rock Oil Corporation Lease Babb Well No. 0-13

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
41	617.48	6.9	0.30	16.28	2.07
42	618.04	15.	0.45	16.63	6.75
43	618.35	18.	0.20	16.83	3.60
44	622.37	49.	0.30	17.13	14.70
45	622.82	26.	0.65	17.78	16.90
46	623.57	23.	0.45	18.23	10.35
47	623.83	28.	0.45	18.68	12.60
48	624.35	32.	0.40	19.08	12.80
49	624.74	27.	0.35	19.43	9.45
50	624.96	20.	0.20	19.63	4.00
51	625.16	26.	0.10	19.73	2.60
52	625.25	21.	0.45	20.18	9.45
53	625.90	28.	0.40	20.58	11.20
54	626.17	21.	0.35	20.93	7.35
55	626.65	31.	0.50	21.43	15.50
56	627.15	46.	0.70	22.13	32.20
57	628.59	12.	0.50	22.63	6.00
58	629.15	28.	0.35	22.98	9.80
59	629.26	23.	0.10	23.08	2.30
60	630.60	57.	0.30	23.38	17.10
61	631.35	39.	0.50	23.88	19.50
62	631.74	47.	0.55	24.43	25.85
63	632.35	18.	0.30	24.73	5.40
64	632.80	59.	0.65	25.38	38.35
65	633.74	55.	0.35	25.73	19.25
66	634.25	40.	0.35	26.08	14.00
67	634.55	73.	0.45	26.53	32.85
68	635.06	23.	0.50	27.03	11.50
69	635.64	46.	0.45	27.48	20.70
70	636.05	19.	0.50	27.98	9.50

Oil Field Research Laboratories
SUMMARY OF PERMEABILITY TESTS

TABLE II

Company Deep Rock Oil Corporation Lease Babb Well No. 0-13

Depth Interval Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity, Ft. x Md.
594.90 - 601.70	2.95	6.72	19.82
603.70 - 630.85	20.03	28.30	567.22
631.05 - 636.30	4.60	42.80	196.90
598.00 - 636.00	25.68	30.04	771.42

Oil Field Research Laboratories

RESULTS OF SATURATION TESTS

TABLE III

Company Deep Rock Oil Corporation Lease Babb Well No. 0-13

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-1A	595.03	16.1	22.4	-	-	280	0.25	0.25	70
1	597.60	17.5	45.1	44.6	89.7	612	1.10	1.35	673
F-2	598.20	18.6	37.8	-	-	446	0.20	1.55	89
2	598.40	14.7	41.9	48.3	90.2	476	0.20	1.75	95
F-3	599.00	17.5	41.4	-	-	562	0.50	2.25	281
3	599.20	14.8	39.2	54.1	93.3	450	0.20	2.45	90
F-4A	599.67	16.3	37.7	-	-	477	0.40	2.85	199
4	600.12	17.4	36.2	42.2	78.4	490	0.23	3.08	113
F-5A	601.60	20.0	31.6	-	-	490	0.20	3.28	98
8	604.30	20.7	37.4	31.9	69.3	601	0.90	4.18	541
9	605.30	19.8	45.45	38.2	83.7	705	0.68	4.86	480
10	606.00	19.6	36.1	34.4	70.5	550	1.00	5.86	550
11	607.30	19.3	43.1	40.11	83.2	646	1.15	7.01	744
12	608.20	17.7	49.5	33.0	82.5	680	0.85	7.86	578
13	609.10	20.1	43.6	31.2	74.8	679	1.05	8.91	712
14	610.10	18.4	45.5	33.2	78.7	649	1.05	9.96	680
15	611.20	20.5	39.4	26.4	65.8	628	0.70	10.66	440
F-16A	611.64	18.8	37.8	-	-	552	0.40	11.06	221
16	612.10	21.1	34.6	38.7	73.3	567	0.53	11.59	300

RESULTS OF SATURATION TESTS

Deep Rock Oil Corporation

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0-13

Company _____ Lease _____ Well No. _____

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.	
17	613.10	21.0	40.5	30.0	70.5	660	0.57	12.16	376
18	613.90	20.6	48.2	36.1	84.3	770	1.25	13.41	969
19	615.30	20.9	32.5	48.8	81.3	528	1.10	14.51	581
20	616.10	20.7	31.2	45.5	76.7	502	0.80	15.31	401
21	616.90	19.5	33.5	45.0	78.5	456	0.50	15.81	228
22	617.90	19.8	34.9	50.0	84.9	536	0.95	16.76	510
23	623.30	20.1	45.3	48.8	94.1	708	1.40	18.16	990
24	624.20	19.7	36.7	51.5	88.2	562	0.80	18.96	450
F-24A	624.88	19.9	28.7	-	-	443	0.70	19.66	310
25	625.68	19.8	40.7	57.8	98.5	626	0.90	20.56	564
26	626.50	19.7	42.5	52.0	94.5	650	0.80	21.36	520
F-27A	627.24	20.0	37.1	-	-	576	0.70	22.06	404
27	627.90	20.2	39.7	45.3	85.0	623	0.75	22.81	467
28	629.00	20.2	46.8	45.6	92.4	735	0.95	23.76	698
29	632.10	20.8	38.8	46.4	85.2	656	1.35	25.11	885
30	633.32	20.2	45.1	44.0	89.1	706	0.95	26.06	670
31	634.10	20.0	45.1	34.5	79.6	700	0.70	26.76	490
32	634.90	20.0	49.0	42.5	91.5	763	1.90	28.66	1450
Total - - - - -								17,911	

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

Oil Field Research Laboratories

SUMMARY OF SATURATION TESTS

TABLE IV

Company Deep Rock Oil Corporation Lease Babb Well No. 0-13

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
594.90-601.70	3.28	17.16	39.39	45.78	521	1,708
603.70-629.30	20.48	19.93	40.26	41.35	621	12,708
631.05-636.30	4.90	20.24	44.88	42.65	713	3,495
598.00-636.00	27.11	19.71	40.88	41.79	627	17,000

Oil Field Research Laboratories

RESULTS OF LABORATORY FLOODING TESTS

TABLE V

Company Deep Rock Oil Corporation Lease Babb Well No. 0-13

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.			
1A	595.03	16.1	22.4	280	0.0	0	22.4	68.4	280	47	1.48	25
1	597.40	17.1	44.7	592	0.0	0	44.7	50.4	592	0	Imp.	50
2	598.20	18.6	27.8	446	9.3	134	28.5	71.0	412	15	0.421	25
3	599.00	17.5	41.4	562	6.2	64	35.2	55.5	478	4	0.303	45
4A	599.67	16.3	37.7	477	0.0	0	37.7	55.0	477	0	Imp.	50
5A	601.60	20.0	31.6	490	6.2	96	25.4	73.4	394	56	2.20	25
8	604.10	20.5	36.6	583	11.1	177	25.5	72.0	406	31	1.27	25
9	605.10	20.0	45.2	701	14.7	228	30.5	65.5	473	149	9.40	15
10	605.80	19.9	36.9	570	15.5	240	21.4	70.7	330	131	6.34	15
11	607.10	19.2	43.7	651	17.5	261	26.2	69.4	390	113	5.88	10
12	608.00	17.8	48.5	670	22.0	304	26.5	71.2	366	96	3.96	15
13	608.90	20.5	42.0	667	12.9	205	29.1	68.4	462	173	4.19	15
14	609.90	18.3	46.4	658	24.7	350	21.7	72.2	308	77	2.20	15
15	611.00	20.6	40.7	650	21.3	340	19.4	73.4	310	159	5.27	15
16A	611.64	18.8	37.8	552	14.5	212	23.3	70.0	340	90	2.77	15
17	612.66	20.9	39.8	645	9.4	152	20.4	60.5	493	114	6.90	10
18	613.70	20.2	49.0	768	17.4	273	31.6	60.4	495	88	3.63	15
19	615.10	20.5	33.1	527	11.4	161	21.7	72.7	346	91	2.10	15
21	616.70	19.5	32.5	491	8.4	127	24.1	69.7	364	98	1.94	20
22	617.70	19.6	35.9	546	13.0	198	22.9	70.4	348	138	3.28	10
23	623.10	20.7	43.6	701	15.8	254	27.8	66.1	447	130	3.36	15
24A	624.68	19.9	28.7	443	0.0	0	28.7	64.7	443	156	6.38	15
25	625.42	19.3	41.7	624	13.9	208	27.8	65.3	416	138	4.81	10
26	626.30	19.3	42.7	639	13.7	203	29.0	65.5	434	156	4.65	20
27A	627.24	20.0	37.1	576	12.8	199	24.3	70.2	377	145	6.80	15
28	628.80	20.6	45.4	725	22.8	364	22.6	71.2	361	109	1.95	15
29	631.90	20.4	38.3	607	8.5	135	29.8	65.7	472	154	8.02	10
30	632.94	20.0	44.3	688	13.0	233	29.3	67.1	455	173	9.10	5
31	633.90	20.4	43.6	690	15.3	242	28.3	67.0	448	139	10.00	10
32	634.70	19.7	49.6	759	15.2	232	34.4	57.3	527	212	8.85	10

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 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	Babb	Well No.	0-13
Depth, Interval, Feet	598.10-601.70	603.70-629.30	631.05-636.30	598.10-636.00		
Feet of Core Analyzed	0.90	16.90	4.90	22.40		
Average Percent Porosity	18.33	19.83	20.06	19.83		
Average Percent Original Oil Saturation	38.45	41.49	44.60	41.95		
Average Percent Oil Recovery	6.89	15.80	13.35	14.92		
Average Percent Residual Oil Saturation	31.56	25.69	31.25	27.03		
Average Percent Residual Water Saturation	63.00	68.27	62.90	67.03		
Average Percent Total Residual Fluid Saturation	94.56	93.96	94.15	94.06		
Average Original Oil Content, Bbls./A. Ft.	542.	638.	694.	644.		
Average Oil Recovery, Bbls./A. Ft.	98.	242.	207.	229.		
Average Residual Oil Content, Bbls./A. Ft.	444.	396.	487.	415.		
Total Original Oil Content, Bbls./Acre	488.	10,775.	3,399.	14,434.		
Total Oil Recovery, Bbls./Acre	88.	4,091.	1,015.	5,124.		
Total Residual Oil Content, Bbls./Acre	400.	6,684.	2,384.	9,310.		
Average Effective Permeability, Millidarcys	0.749	4.33	8.83	5.11		
Average Initial Fluid Production Pressure, p.s.i.	31.7	15.0	8.8	16.0		

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