

OIL FIELD RESEARCH LABORATORIES
CHANUTE, KANSAS

July 6, 1950

B. L. & R. Oil Company
Leon, Kansas

Attention: Dr. Last

Gentlemen:

Enclosed herewith is the report of the analysis made on the Keystone barrel core taken from the Moon Lease, Well No. 1, Woodson County, Kansas, and submitted to our laboratory on June 27, 1950.

Very truly yours,

OIL FIELD RESEARCH LABORATORIES

Carl L. Pate

CLP:cc

c.c.

27-25-17E

MOON 1

B. L. & R. OIL COMPANY

CORE ANALYSIS REPORT

MOON LEASE WELL NO. 1

WOODSON COUNTY, KANSAS

OIL FIELD RESEARCH LABORATORIES

CHANUTE, KANSAS

JULY 6, 1950

Oil Field Research Laboratories

GENERAL INFORMATION & SUMMARY

Company B. L. & R. Oil Company Lease Moon Well No. 1

Location _____

Section 27 Twp. 25 S Rge. 17 E County Woodson State Kansas

Name of Sand	Squirrel
Top of Core	723.00
Bottom of Core	747.20
Top of Sand	730.70
Bottom of Sand	743.73
Total Feet of Permeable Sand	9.90

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 10	0.85	0.85
10 - 20	1.00	1.85
20 - 30	1.20	3.05
30 - 40	1.10	4.15
40 - 60	3.10	7.25
60 & above	2.65	9.90

Average Permeability, Millidarcys	47.23
Average Percent Porosity	17.45
Average Percent Oil Saturation	38.37
Average Percent Water Saturation	35.03
Average Oil Content, Bbls./A. Ft.	525.
Total Oil Content, Bbls./Acre	6,260.
Average Percent Oil Recovery by Laboratory Flooding Tests	10.05
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	170.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	1,319.
Total Calculated Oil Recovery, Bbls./Acre	2,250.
Packer Setting, Feet	-
Viscosity, Centipoises @ <u>98° F.</u>	29.1
A. P. I. Gravity, degrees @ 60 °F	29.3

Fresh 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>
723.00 - 726.10	- Gray shale.
726.10 - 729.15	- Gray shale (discarded at well).
729.15 - 729.40	- Hard gray calcareous sandy shale.
729.40 - 729.71	- Hard gray calcareous conglomeratic fossiliferous shale.
729.71 - 730.70	- Gray shale.
730.70 - 731.35	- Brown fine grained micaceous slightly shaley sandstone.
731.35 - 732.95	- Hard brown fine grained micaceous calcareous sandstone.
732.95 - 733.80	- Dark brown fine grained micaceous sandstone.
733.80 - 733.95	- Laminated sandstone and shale.
733.95 - 734.28	- Brown fine grained laminated micaceous shaley sandstone.
734.28 - 734.80	- Dark brown fine grained micaceous sandstone.
734.80 - 734.90	- Laminated sandstone and shale.
734.90 - 735.20	- Brown fine grained micaceous slightly shaley sandstone.
735.20 - 736.05	- Laminated sandstone and shale.
736.05 - 743.53	- Dark brown fine grained micaceous sandstone.
743.53 - 743.73	- Brown fine grained laminated micaceous shaley sandstone.
743.73 - 744.05	- Laminated sandstone and shale.
744.05 - 744.20	- Laminated shale and sandstone.
744.20 - 744.35	- Brown fine grained micaceous sandstone.
744.35 - 745.15	- Gray sandy shale.
745.15 - 745.40	- Light brown fine grained micaceous sandstone.

27-25-17E

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745.40 - 745.55 - Dark fine grained micaceous carbonaceous sandstone.
745.55 - 747.20 - Gray shale.

Coring was started at a depth of 723.00 feet in gray shale and completed at 747.20 feet in gray shale. This core shows a total of 12.43 feet of sandstone. For the most part, the sand body is made up of fine grained micaceous and hard fine grained micaceous calcareous sandstone.

PERMEABILITY

For the sake of distribution, this core was divided into two sections. The weighted average permeability of the upper and lower sections are 24.86 and 53.69 millidarcys respectively; the overall average being 47.23 (See Table II). By observing the data given on the coregraph, it is noticeable that the sand has a fairly uniform permeability profile.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a fairly good weighted average percent oil saturation, namely, 38.37. The weighted average percent oil saturation of the upper and lower sections are 35.66 and 39.92 respectively. The weighted average percent water saturation of the upper and lower sections are 34.89 and 35.09 respectively; the overall average being 35.03 (See Table IV). This gives an overall weighted average total fluid saturation of 73.40 percent. This low total fluid saturation indicates that an appreciable amount of fluid was lost during coring which was probably oil. Inasmuch as the sand has a comparatively low average percent water saturation, it is evident that most of the oil lost during coring, was due to the expansion of gas carried in solution by the oil.

In order to get some idea of 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 Tables 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 the tighter part of the formation has the higher chloride content.

The weighted average oil content of the upper and lower sections are 366 and 616 barrels per acre foot respectively; the overall average being 525. The total oil content, as shown by this core, is 6,260 barrels per acre (See Table IV).

VISCOSITY

The viscosity of a sample of oil taken from a nearby producing well is 29.1 centipoises at 78° F. The A.P.I. gravity of the oil is 29.3° at 60° F. With other factors being favorable, a sand containing an oil of this viscosity should respond satisfactorily to water repressuring.

LABORATORY FLOODING TESTS

The sand in this core responded fairly well to laboratory flooding tests as a total recovery of 1,319 barrels of oil per acre was obtained from 7.78 feet of sand. The weighted average percent oil saturation was reduced from 38.22 to 28.17, or represents an average recovery of 10.05 percent. The weighted average effective permeability of the samples is 5.48 millidarcys while the average initial fluid production pressure is 18.8 pounds per square inch (See Table VI).

By observing the data given in Table V, you will note that of the 13 samples tested, 9 took water and 8 produced oil. This indicates that most of the sand represented by these samples is floodable. These

tests also show that the upper part of the sand is very tight and naturally did not respond to laboratory flooding tests.

CONCLUSION

From a study of the above data, we believe that an efficient water flood within the vicinity of this well will recover approximately 2,250 barrels of oil per acre. In calculating this recovery an allowance was made for oil lost during coring.

The principle drawback of this core is the fact that it contains only approximately 8.3 feet of floodable sand.

Oil Field Research Laboratories
RESULTS OF PERMEABILITY TESTS
TABLE I

Company B. L. & R. Oil Company Lease Moore Well No. 1

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
1	731.15	Imp.	0.65	0.65	0.00
2	731.50	Imp.	0.35	1.00	0.00
3	731.85	Imp.	0.40	1.40	0.00
4	732.24	1.2	0.30	1.70	0.36
5	732.58	1.7	0.55	2.25	0.93
6	733.15	46.	0.35	2.60	16.10
7	733.50	66.	0.30	2.90	19.80
8	733.75	26.	0.20	3.10	5.20
9	734.35	15.	0.27	3.37	4.05
10	734.72	35.	0.25	3.62	8.75
11	736.45	52.	0.65	4.27	33.80
12	737.05	25.	0.50	4.77	12.50
13	737.42	65.	0.40	5.17	26.00
14	737.80	38.	0.40	5.57	15.20
15	738.25	53.	0.45	6.02	23.85
16	738.65	58.	0.45	6.47	26.10
17	739.12	33.	0.45	6.92	14.85
18	739.52	59.	0.40	7.32	23.60
19	739.90	79.	0.35	7.67	27.65
20	740.25	63.	0.30	7.97	18.90
21	740.55	66.	0.40	8.37	26.40
22	740.95	53.	0.40	8.77	21.20
23	741.40	161.	0.40	9.17	64.40
24	741.80	47.	0.40	9.57	18.80
25	742.25	64.	0.50	10.07	32.00
26	742.80	29.	0.50	10.57	14.50
27	743.33	17.	0.53	11.10	9.01
28	743.70	18.	0.20	11.30	3.60

Oil Field Research Laboratories

SUMMARY OF PERMEABILITY TESTS

TABLE II

Company	B.L. & R. Oil Company		Lease	Moon	Well No.	1
Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity, Ft. x Md.			
730.70 - 735.20	2.22	24.86	55.19			
736.05 - 745.55	7.68	53.69	412.36			
730.70 - 745.55	9.90	47.23	467.55			

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RESULTS OF SATURATION TESTS

TABLE III

Company B.L. & R. Oil Company Lease Mo on Well No. 1

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	730.95	10.0	37.1	35.3	72.4	288	0.65	0.65	187
2	732.13	10.1	37.6	25.7	63.3	295	1.05	1.70	310
F3	732.86	12.8	38.0	-	-	378	0.55	2.25	208
3	733.03	16.3	41.1	29.1	70.2	519	0.95	3.20	493
4	734.13	16.2	26.5	46.8	73.3	334	0.85	4.05	284
5	735.13	15.4	30.4	51.1	81.5	363	0.30	4.35	109
6	736.26	21.6	40.8	31.4	72.2	686	0.65	5.00	446
7	737.33	20.6	42.2	28.1	70.3	674	1.20	6.20	809
8	738.53	19.4	44.2	29.8	74.0	665	1.20	7.40	798
9	739.75	19.4	38.4	46.2	84.6	579	1.10	8.50	637
10	740.84	19.4	33.9	39.0	72.9	511	1.30	9.80	664
11	742.12	20.2	45.2	27.6	72.8	708	1.20	11.00	850
12	743.17	18.7	34.0	45.9	79.9	493	0.83	11.83	409
13	744.27	18.6	38.5	36.2	72.7	556	0.10	11.93	56
							Total	- - - -	6,260

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SUMMARY OF SATURATION TESTS

TABLE IV

Company B.L. & R. Oil Company Lease Moon Well No. 1

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
730.70-735.20	4.35	13.36	35.66	34.89	366	1,591
736.05-745.55	7.58	19.80	39.92	35.09	616	4,669
730.70-745.55	11.93	17.45	38.37	35.03	525	6,260

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RESULTS OF LABORATORY FLOODING TESTS

TABLE V

Company B.L. & R. Oil Company

Lease Moon

Well No. 1

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.			
1	730.75	10.3	36.2	289	0.0	0	36.2	59.4	289	2	0.056	45
2	731.95	11.2	36.4	317	0.0	0	36.4	49.0	317	0	Imp.	50 +
3	732.86	12.8	38.0	378	0.0	0	38.0	51.7	378	0	Imp.	50 +
4	734.04	14.0	27.2	296	0.0	0	27.2	64.2	296	0	Imp.	50 +
5	734.95	17.3	30.1	404	3.6	48	26.5	64.6	356	13.5	0.436	35
6	736.13	23.4	38.0	709	11.0	200	28.0	63.3	509	111	8.26	15
7	737.17	22.7	39.9	703	14.2	250	25.7	66.8	453	100	8.81	15
8	738.38	20.0	41.7	662	16.7	259	26.0	68.8	403	159	6.58	15
9	739.62	22.8	36.6	648	5.3	94	31.3	66.8	554	63	5.17	15
10	740.67	20.2	31.7	497	2.9	45	28.8	64.8	452	120	5.67	15
11	741.93	22.8	45.0	797	17.6	312	27.4	68.0	485	48	4.51	15
12	743.04	14.4	34.9	391	3.1	35	31.8	63.6	356	10.5	0.305	25
14	745.47	15.1	37.2	436	0.0	0	37.2	48.3	436	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.

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SUMMARY OF LABORATORY FLOODING TESTS

TABLE VI

Company	<u>B.L. & R. Oil Company</u>	Lease	<u>Moore</u>	Well No.	<u>1</u>
Depth Interval, Feet	734.95 - 743.53				
Feet of Core Analyzed	7.78				
Average Percent Porosity	20.84				
Average Percent Original Oil Saturation	38.22				
Average Percent Oil Recovery	10.05				
Average Percent Residual Oil Saturation	28.17				
Average Percent Residual Water Saturation	56.20				
Average Percent Total Residual Fluid Saturation	94.37				
Average Original Oil Content, Bbls./A. Ft.	623.				
Average Oil Recovery, Bbls./A. Ft.	170.				
Average Residual Oil Content, Bbls./A. Ft.	453.				
Total Original Oil Content, Bbls./Acre	4,843.				
Total Oil Recovery, Bbls./Acre	1,319.				
Total Residual Oil Content, Bbls./Acre	3,524.				
Average Effective Permeability, Millidarcys	5.48				
Average Initial Fluid Production Pressure, p.s.i.	18.8				

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 B.L. & R. Oil Company Lease Moon Well No. 1

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Connate	Percent Water Saturation Drilling & Foreign	Total
1	730.95	56,100			
2	732.13	68,400			
3	733.03	43,000			
4	734.13	35,800			
5	735.13	29,900			
6	736.26	31,400			
7	737.33	34,800			
8	738.53	34,000			
9	739.75	51,800			
10	740.84	45,800			
11	742.12	29,800			
12	743.17	51,500			
13	744.27	59,300			
Note: ppm - parts per million					

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SUMMARY OF WATER DIFFERENTIATION TESTS

TABLE VIII

Company B. L. & R. Oil Company Lease Moon Well No. 1

Depth Interval, Feet	Chloride Content of Brine in Sand, ppm	Average Percent Connate Water	Average Percent Drilling & Foreign Water
730.70 - 735.20	49,587		
736.05 - 745.55	40,096		
730.70 - 745.55	43,274		

Note: ppm - parts per million