OILFIELD RESEARCH LABORATORIES
536 NORTH HIGHLAND - CHANUTE, KANSAS - PHONE HE1-2650

August 14, 1967

Pat Michaelis
19½ South Jefferson
Iola, Kansas

Dear Sir:

Enclosed herewith is the report of the analysis of the Rotary core taken from the Levi Ott Lease, Well No. 7, Greenwood County, Kansas, and submitted to our laboratory on August 6, 1967.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Carl L. Pate

CLP:rf

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GENERAL INFORMATION & SUMMARY

Company Pat Michaelis Lease Levi Ott Well No. 7

Location 330' South of Center

Section 7 Twp. 22S Rge. 13E County Greenwood State Kansas

Name of Lime - Kansas City	Upper	Lower
Top of Core	1112.0	1150.0
Bottom of Core	1123.3	1160.3
Top of Lime (Cored)	1112.0	1150.0
Bottom of Lime (Cored)	1123.3	1160.3
Total Feet of Permeable Lime	10.5	9.6
Total Feet of Floodable Lime	-	6.1

Distribution of Permeable Lime

	Permeability Range Millidarcys	Feet	Cum. Ft.
Upper K.C.	0 - 10	5.7	5.7
	10 - 30	2.0	7.7
	30 & above	2.8	10.5
Lower K.C.	0 - 10	4.0	4.0
	10 - 100	3.6	7.6
	100 & above	2.0	9.6

Average Permeability Millidarcys	384.6	79.5
Average Percent Porosity	15.4	26.9
Average Percent Oil Saturation	28.9	23.5
Average Percent Water Saturation	67.7	32.9
Average Oil Content, Bbls./A. Ft.	347.	509.
Total Oil Content, Bbls./Acre	3644.	4891.
Average Percent Oil Recovery by Laboratory Flooding Tests		7.5
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.		165.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre		1009.
Total Calculated Oil Recovery, Bbls./Acre (Primary & Secondary)		4195.
Packer Setting, Feet		
Viscosity, Centipoises @		
A. P. I. Gravity, degrees @ 60 °F		
Elevation, Feet		

A fresh water mud was used as a circulating fluid in the coring of the limestone in this well. The lower Kansas City lime is a virgin formation. The cores were sampled by an employee of Oilfield Research Laboratories.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description

UPPER LIMESTONE

1112.0 - 1112.8 - Hard, gray, slightly vuggy limestone.

1112.8 - 1115.0 - Light brown, vuggy limestone.

1115.0 - 1122.9 - Hard, grayish brown limestone.

1122.9 - 1123.3 - Grayish brown, shaly limestone.

1123.3 - 1124.0 - Loss.

LOWER LIMESTONE

1150.0 - 1157.7 - Brown limestone.

1157.7 - 1159.6 - Hard, gray, vuggy limestone.

1159.6 - 1160.3 - Hard, gray limestone.

1160.3 - 1161.0 - Loss.

LOWER KANSAS CITY LIMESTONE

Coring was started at a depth of 1150.0 feet in brown limestone and completed at 1161.0 feet, probably in hard, gray limestone. There was a core loss from 1160.3 to 1161.0 feet. This core shows a total of 10.3 feet of limestone. The pay is made up of brown, very porous limestone.

PERMEABILITY

The weighted average permeability of the cored section is 79.5

millidarcys (See Table III). By observing the data given on the core-graph, it is noticeable that the lime has a very irregular permeability profile. The permeability of the lime varies from 0.40 to a maximum of 406.0 millidarcys.

PERCENT SATURATION & OIL CONTENT

The lime in this core shows a fairly low weighted average percent oil saturation, namely, 23.5. The weighted average percent water saturation of the cored section is 32.9 (See Table III). This gives an overall weighted average total fluid saturation of 66.4 percent. This low total fluid saturation indicates considerable fluid was lost during coring which probably was oil.

The weighted average oil content of the cored section is 509 barrels per acre foot; while the total oil content, as shown by this core, is 4,891 barrels per acre (See Table III).

LABORATORY FLOODING TESTS

When taking into consideration that the lime has a fairly low oil saturation, it responded very well to laboratory flooding tests; as a total recovery of 1,009 barrels of oil per acre was obtained from 6.1 feet of lime. The weighted average percent oil saturation was reduced from 26.5 to 19.0, or represents an average recovery of 7.5 percent. The weighted average effective permeability of the samples is 1.65 millidarcys, while the average initial fluid production pressure is 26.2 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 10 samples tested, 8 produced water and 6 oil. This indicates

that approximately 60 percent of the lime represented by these samples is floodable.

ACID SOLUBILITY

Tests show that the acid solubility of the lower Kansas City lime varies from 92 to 100 percent (See Table II). This indicates that the lime should respond very well to acid treatment.

CONCLUSION

On the basis of the above data, we estimate that approximately 4,195 barrels of oil per acre or an average of 688 barrels per acre foot can be recovered from the area, represented by this core, by efficient primary and water flood operations. The following data and assumptions were used in calculating the above oil recovery value:

Original formation volume factor	1.06
Irreducible water saturation, percent	14.0
Primary recovery, estimated, percent	None
Present oil saturation, percent	81.1
Average porosity, percent	28.6
Oil saturation after flooding, percent	19.0
Performance factor	0.50
Net floodable pay lime, feet	6.1

This core shows a rather thin, clean pay section (1150.0 to 1157.7 feet) having a fairly low oil and water saturation and a good average porosity and permeability. The limestone is also very soluble in hydrochloric acid.

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Pat Michaelis Lease Levi Ott Well No. 7

Sample No.	Depth, Feet	Effective Porosity Percent	Percent Saturation			Oil Content Bbls. / A Ft.	Perm., Mill.	Feet of Sand		Total Oil Content	Perm. Capacity Ft. X md.
			Oil	Water	Total			Ft.	Cum. Ft.		
						UPPER KANSAS CITY LIME					
1	1113.1	15.0	21	70	91	244	3835.	0.8	0.8	195	3068.00
2	1114.1	15.4	20	72	92	239	241.	1.4	2.2	335	337.30
3	1115.1	17.2	45	52	97	599	939.	0.6	2.8	359	563.40
4	1116.1	17.5	38	59	97	515	3.3	1.0	3.8	515	3.30
5	1117.1	18.6	35	63	98	505	9.5	1.0	4.8	505	9.50
6	1118.1	16.2	22	74	96	276	2.0	1.0	5.8	276	2.00
7	1119.1	13.7	21	77	98	223	3.3	1.0	6.8	223	3.30
8	1120.1	15.8	29	69	98	355	26.	1.0	7.8	355	26.00
9	1121.1	16.9	33	65	98	432	21.	1.0	8.8	432	21.00
10	1122.1	11.2	32	65	97	278	1.6	1.3	10.1	361	2.08
11	1123.1	11.8	24	74	98	220	6.1	0.4	10.5	88	2.44
						LOWER KANSAS CITY LIME					
12	1150.1	28.2	28	31	59	612	24.	0.6	11.1	367	14.40
13	1151.1	28.8	30	28	58	669	0.40	1.0	12.1	669	0.40
14	1152.1	27.8	28	28	56	604	406.	1.0	13.1	604	406.00
15	1153.1	25.3	35	23	58	686	9.0	1.0	14.1	686	9.00
16	1154.1	31.7	22	19	41	540	31.	1.0	15.1	540	31.00
17	1155.1	30.3	25	19	44	586	178.	1.0	16.1	586	178.00
18	1156.1	28.6	24	27	51	532	8.4	1.0	17.1	532	8.40
19	1157.1	29.4	28	29	57	638	92.	1.1	18.2	702	101.20
20	1158.1	17.0	9	73	82	119	16.	0.9	19.1	107	14.40
21	1159.1	21.1	6	56	62	98	0.70	1.0	20.1	98	0.70

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RESULTS OF ACID SOLUBILITY TESTS

TABLE II

Company Pat Michaelis Lease Levi Ott Well No. 7

Sample No.	Depth, Feet	Percent Acid Solubility
1	1113.1	92
2	1114.1	92
3	1115.1	91
4	1116.1	92
5	1117.1	92
6	1118.1	91
7	1119.1	93
8	1120.1	93
9	1121.1	88
10	1122.1	94
11	1123.1	73
12	1150.1	95
13	1151.1	92
14	1152.1	96
15	1153.1	95
16	1154.1	100
17	1155.1	94
18	1156.1	92
19	1157.1	95
20	1158.1	96
21	1159.1	95

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Pat Michaelis **Lease** Levi Ott **Well No.** 7

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
	UPPER KANSAS CITY LIME		
1112.8 - 1123.3	10.5	384.6	4,038.32
	LOWER KANSAS CITY LIME		
1150.0 - 1159.6	9.6	79.5	763.50

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
		UPPER KANSAS CITY LIME				
1112.8 - 1123.3	10.5	15.4	28.9	67.7	347	3,644
		LOWER KANSAS CITY LIME				
1150.0 - 1159.6	9.6	26.9	23.5	32.9	509	4,891

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Pat Michaelis Lease Levi Ott Well No. 7

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.
			%	Bbls./A. Ft.	%	Bbls./A. Ft.	% Oil	% Water	Bbls./A. Ft.			
					LOWER KANSAS CITY LIME							
12	1150.1	27.7	26	559	0	0	26	39	559	0	Imp.	-
13	1151.1	28.4	27	595	0	0	27	37	595	0	Imp.	-
14	1152.1	28.2	28	613	2	44	26	40	569	12	0.40	40
15	1153.1	25.8	35	700	18	360	17	51	340	30	0.55	30
16	1154.1	31.2	22	533	4	97	18	45	436	84	2.00	20
17	1155.1	30.4	25	589	6	141	19	52	448	190	4.90	20
18	1156.1	29.0	24	540	6	135	18	42	405	48	1.00	20
19	1157.1	29.9	28	650	10	232	18	49	418	47	1.20	30
20	1158.1	17.6	7	96	0	0	7	80	96	18	0.40	30
21	1159.1	20.7	9	145	0	0	9	68	145	20	0.40	30

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 V

Company Pat Michaelis Lease Levi Ott Well No. 7

Depth Interval, Feet	1151.6 - 1157.7
Feet of Core Analyzed	6.1
Average Percent Porosity	28.6
Average Percent Original Oil Saturation	26.5
Average Percent Oil Recovery	7.5
Average Percent Residual Oil Saturation	19.0
Average Percent Residual Water Saturation	45.8
Average Percent Total Residual Fluid Saturation	64.8
Average Original Oil Content, Bbls./A. Ft.	594.
Average Oil Recovery, Bbls./A. Ft.	165.
Average Residual Oil Content, Bbls./A. Ft.	429.
Total Original Oil Content, Bbls./Acre	3,625.
Total Oil Recovery, Bbls./Acre	1,009.
Total Residual Oil Content, Bbls./Acre	2,616.
Average Effective Permeability, Millidarcys	1.65
Average Initial Fluid Production Pressure, p.s.i.	26.2

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