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

December 7, 1966

Jackson Brothers
514 North Main
Eureka, Kansas

Gentlemen:

Enclosed herewith is the report of the analysis of the Rotary core taken from the Teichgraeber Lease, Well No. 5, Greenwood County, Kansas, and submitted to our laboratory on December 1, 1966.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Benjamin R. Pearman

Benjamin R. Pearman

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GENERAL INFORMATION & SUMMARY

Company Jackson Bros. Lease Teichgraeber Well No. 5

Location Center South Line NE SW

Section 14 Twp. 25S Rge. 8E County Greenwood State Kansas

Name of Sand	Bartlesville
Top of Core	2333.0
Bottom of Core	2359.0
Top of Sand	2342.2
Bottom of Sand (Analyzed)	2359.0
Total Feet of Permeable Sand	16.8
Total Feet of Floodable Sand	10.4

Distribution of Permeable Sand: Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 1	3.4	3.4
2 - 5	3.0	6.4
5 - 10	3.9	10.3
10 - 50	5.5	15.8
50 & above	1.0	16.8

Average Permeability Millidarcys	15.1
Average Percent Porosity	17.1
Average Percent Oil Saturation	27.0
Average Percent Water Saturation	51.6
Average Oil Content, Bbls./A. Ft.	356.
Total Oil Content, Bbls./Acre	5,991.
Average Percent Oil Recovery by Laboratory Flooding Tests	4.4
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	63.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	652.
Total Calculated Oil Recovery, Bbls./Acre (Primary & Secondary)	2,600.
Packer Setting, Feet	
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F	
Elevation, Feet (Ground Level)	1311.

Fresh water mud was used as the circulating fluid while taking this core. The well was drilled in virgin territory. The core was sampled and the samples sealed in cans by a representative of Oilfield Research Laboratories.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
2333.0 - 2342.2	Gray sandy shale.
2342.2 - 2351.5	Light brown, slightly shaly sandstone.
2351.5 - 2359.0	Light brown sandstone.

Coring was started at a depth of 2333.0 feet in sandy shale and completed at 2359.0 feet in sandstone. This core shows a total of 16.8 feet of sandstone. For the most part, the pay is made up of light brown sandstone.

PERMEABILITY

For the sake of distribution, the core was divided into two sections. The weighted average permeability of the upper and lower sections is 3.2 and 30.0 millidarcys respectively; the overall average being 15.1 (See Table III). By observing the data given on the coregraph, it is noticeable that the sand has an irregular permeability profile. The permeability of the sand varies from 0.23 to a maximum of 56. millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a good weighted average percent oil saturation, namely, 27.0. The weighted average percent oil saturation of the upper and lower sections is 28.4 and 25.4 respectively. The

weighted average percent water saturation of the upper and lower sections is 53.5 and 49.2 respectively; the overall average being 51.6 (See Table III). This gives an overall weighted average total fluid saturation of 78.6 percent. This low total fluid saturation indicates considerable fluid was lost during coring most of which was probably oil.

In an effort to determine whether or not any flushing of the sand occurred during coring, all of the saturation samples were analyzed for chloride content. The results of these tests are given in Tables VI and VII. From the data given in these tables and on the coregraph, it is evident that considerable flushing occurred in the zones of higher permeability.

The weighted average oil content of the upper and lower sections is 352 and 364 barrels per acre foot respectively; the overall average being 356. The total oil content, as shown by this core, is 5,991 barrels per acre of which 3,777 barrels are in the pay sand section (See Table III).

LABORATORY FLOODING TESTS

The sand in this core responded to laboratory flooding tests, as a total recovery of 652 barrels of oil per acre was obtained from 10.4 feet of sand. The weighted average percent oil saturation was reduced from 26.0 to 21.6, or represents an average recovery of 4.4 percent. The weighted average effective permeability of the samples is 3.98 millidarcys, while the average initial fluid production pressure is 23.0 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of

16 samples tested, 13 produced water and 10 oil. This indicates that approximately 63 percent of the sand represented by these samples is floodable pay sand. The tests also show that the sand has a wide variation in effective permeability to water.

CONCLUSION

The results of the laboratory tests indicate that efficient primary and secondary operations in the vicinity of this well should recover approximately 2,600 barrels of oil per acre or an average of 250 barrels per acre foot from the 10.4 feet of floodable pay sand analyzed in this core. These recovery values were calculated using the following data and assumptions:

Original formation volume factor	1.21
Reservoir water saturation, percent	35.0
Average porosity, percent	18.0
Oil saturation after flooding, percent	21.6
Performance factor, percent	50.0
Net floodable pay sand, feet	10.4

This core shows a pay sand section having a good oil saturation, a moderate water saturation and a wide variation in effective permeability to water.

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Jackson Bros. Lease Teichgraeber Well No. 5

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.		
1	2343.1	15.1	26	56	82	304	0.23	1.4	1.4	426	0.32
2	2344.1	12.9	29	60	89	290	0.36	1.0	2.4	290	0.36
3	2345.1	16.4	22	55	77	280	0.78	1.0	3.4	280	0.78
4	2346.1	16.4	25	58	83	318	2.3	1.0	4.4	318	2.30
5	2347.1	16.3	37	50	87	468	2.3	1.0	5.4	468	2.30
6	2348.1	16.5	32	50	82	409	6.3	1.0	6.4	409	6.30
7	2349.1	16.6	32	52	84	412	5.5	1.0	7.4	412	5.50
8	2350.1	17.7	30	48	78	411	6.5	1.0	8.4	411	6.50
9	2351.1	15.8	23	52	75	282	6.0	0.9	9.3	254	5.40
10	2352.1	17.7	21	50	71	288	26	1.1	10.4	317	28.60
11	2353.1	16.9	33	51	84	432	13.	1.0	11.4	432	13.00
12	2354.1	17.0	22	54	76	290	31.	1.0	12.4	290	31.00
13	2355.1	17.5	24	52	76	325	2.3	1.0	13.4	325	2.30
14	2356.1	17.7	30	44	74	411	56.	1.0	14.4	411	56.00
15	2357.1	19.8	22	50	72	338	50.	1.0	15.4	338	50.00
16	2358.1	21.6	26	45	71	436	31.	1.4	16.8	610	43.40
								Total		5,991	

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Jackson Bros. Lease Teichgraeber Well No. 5

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
2342.2 - 2351.5	9.3	3.2	29.76
2351.5 - 2359.0	7.5	30.0	224.30
2342.2 - 2359.0	16.8	15.1	254.06

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
2342.2 - 2351.5	9.3	15.9	28.4	53.5	352	3,268
2351.5 - 2359.0	7.5	18.5	25.4	49.2	364	2,723
2342.2 - 2359.0	16.8	17.1	27.0	51.6	356	5,991

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Jackson Bros. Lease Teichgraeber Well No. 5

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.			
1	2343.1	15.0	27	314	0	0	27	59	314	0	Imp.	-
2	2344.1	12.9	29	290	0	0	29	62	290	0	Imp.	-
3	2345.1	16.6	23	296	0	0	23	54	296	0	Imp.	-
4	2346.1	16.8	25	326	0	0	25	69	326	4	0.200	50
5	2347.1	16.3	35	442	0	0	35	58	442	2	0.100	50
6	2348.1	16.3	33	417	0	0	33	62	417	7	0.300	50
7	2349.1	17.0	30	395	4	53	26	65	342	19	0.400	40
8	2350.1	17.5	30	407	3	41	27	69	366	22	0.624	30
9	2351.1	16.1	22	274	2	25	20	67	249	29	0.800	30
10	2352.1	17.3	21	281	2	27	19	77	254	107	2.50	20
11	2353.1	17.4	33	446	10	135	23	76	311	89	1.90	20
12	2354.1	17.3	22	294	3	40	19	80	254	141	3.90	20
13	2355.1	17.3	24	321	3	40	21	69	281	58	1.22	20
14	2356.1	18.0	30	419	7	98	23	74	321	269	8.00	20
15	2357.1	20.1	22	343	2	31	20	77	312	428	13.10	10
16	2358.1	21.1	26	426	7	115	19	77	311	194	6.33	20

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 Jackson Bros. Lease Teichgraeber Well No. 5

Depth Interval, Feet	2348.6 - 2359.0
Feet of Core Analyzed	10.4
Average Percent Porosity	18.0
Average Percent Original Oil Saturation	26.0
Average Percent Oil Recovery	4.4
Average Percent Residual Oil Saturation	21.6
Average Percent Residual Water Saturation	73.3
Average Percent Total Residual Fluid Saturation	94.9
Average Original Oil Content, Bbls./A. Ft.	363.
Average Oil Recovery, Bbls./A. Ft.	63.
Average Residual Oil Content, Bbls./A. Ft.	300.
Total Original Oil Content, Bbls./Acre	3,777.
Total Oil Recovery, Bbls./Acre	652.
Total Residual Oil Content, Bbls./Acre	3,125.
Average Effective Permeability, Millidarcys	3.98
Average Initial Fluid Production Pressure, p.s.i.	23.0

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

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RESULTS OF WATER DIFFERENTIATION TESTS

TABLE VI

Company Jackson Bros. Lease Teichgraeber Well No. 5

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Percent Water Saturation		
			Connate	Drilling & Foreign	Total
1	2343.1	124,700			
2	2344.1	136,100			
3	2345.1	111,500			
4	2346.1	114,400			
5	2347.1	119,450			
6	2348.1	126,750			
7	2349.1	82,550			
8	2350.1	116,650			
9	2351.1	102,000			
10	2352.1	51,100			
11	2353.1	97,900			
12	2354.1	38,300			
13	2355.1	108,300			
14	2356.1	55,400			
15	2357.1	17,500			
16	2358.1	19,050			

Note: ppm — parts per million

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SUMMARY OF WATER DIFFERENTIATION TESTS

TABLE VII

Company Jackson Bros. Lease Teichgraeber Well No. 5

Depth Interval, Feet	Chloride Content of Brine in Sand, ppm	Average Percent Connate Water	Average Percent Drilling & Foreign Water
2342.2 - 2351.5	116,800		
2351.5 - 2359.0	53,400		
2342.2 - 2359.0	88,400		

Note: ppm — parts per million.