OILFIELD RESEARCH LABORATORIES

536 NORTH HIGHLAND - CHANUTE, KANSAS - PHONE HE1-2650

January 10, 1967

Jackson Brothers
514 North Main
Eureka, Kansas

Gentlemen:

Enclosed herewith is the report of the analysis of the Rotary core taken from the Jackson Heirs Lease, Well No. 18, Greenwood County, Kansas, and submitted to our laboratory on January 5, 1967.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Benjamin R. Pearman

BRP:rf

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GENERAL INFORMATION & SUMMARY

Company Jackson Bros. Lease Jackson Heirs Well No. 18

Location NE NW NW

Section 23 Twp. 25S Rge. 8E County Greenwood State Kansas

Name of Sand - - - - - - - - - - Bartlesville - - - -	Upper	Middle
Top of Core -	2371.0	2397.8
Bottom of Core - - - - - - - - - - - - - - - - - - -	2373.3	2400.6
Top of Sand - - - - - (Analyzed) - - - - - - - - - -	2371.0	2397.8
Bottom of Sand - - - - - - - - - - - - - - - - - - -	2373.3	2400.6
Total Feet of Permeable Sand - - - - - - - - - - - - - - -	2.3	0.8
Total Feet of Floodable Sand - - - - - - - - - - - - - - -	0.0	0.0

Distribution of Permeable Sand: Permeability Range Millidarcys		Feet	Cum. Ft.
Upper	0 - 10	1.7	1.7
	10 & above	0.6	2.3
Lower	0 - 0.5	0.8	0.8

Average Permeability Millidarcys - - - - - - - - - - - - - - -	7.9	0.45
Average Percent Porosity - - - - - - - - - - - - - - - - -	15.8	9.5
Average Percent Oil Saturation - - - - - - - - - - - - - - -	34.0	29.0
Average Percent Water Saturation - - - - - - - - - - - - - -	41.3	62.1
Average Oil Content, Bbls./A. Ft. - - - - - - - - - - - - - -	418.	222.
Total Oil Content, Bbls./Acre - - - - - - - - - - - - - - -	961.	621.
Average Percent Oil Recovery by Laboratory Flooding Tests - - - - - - -	0	0
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft. - - - - - -	0	0
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre - - - - - -	0	0
Total Calculated Oil Recovery, Bbls./Acre - - - - - - - - - - - - -	0	0
Packer Setting, Feet - - - - - - - - - - - - - - - - - -		
Viscosity, Centipoises @ - - - - - - - - - - - - - - - - -		
A. P. I. Gravity, degrees @ 60 °F - - - - - - - - - - - - - -		
Elevation, Feet -		

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GENERAL INFORMATION & SUMMARY

Company Jackson Bros. Lease Jackson Heirs Well No. 18

Location NE NW NW

Section 23 Twp. 25S Rge. 8E County Greenwood State Kansas

Name of Sand	Lower Bartlesville
Top of Core	2408.0
Bottom of Core	2438.0
Top of Sand (Analyzed)	2415.6
Bottom of Sand	2434.5
Total Feet of Permeable Sand	12.9
Total Feet of Floodable Sand	9.9

Distribution of Permeable Sand: Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 5	5.0	5.0
5 - 10	4.0	9.0
10 & above	3.9	12.9

Average Permeability Millidarcys	22.1
Average Percent Porosity	16.2
Average Percent Oil Saturation	26.0
Average Percent Water Saturation	61.7
Average Oil Content, Bbls./A. Ft.	337.
Total Oil Content, Bbls./Acre	6,380.
Average Percent Oil Recovery by Laboratory Flooding Tests	6.9
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	99.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	984.
Total Calculated Oil Recovery, Bbls./Acre (Primary & Secondary)	1,800.
Packer Setting, Feet	
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F	
Elevation, Feet	

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

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
	UPPER & MIDDLE BARTLESVILLE
2371.0 - 2373.3	Gray and brown, laminated, slightly calcareous, shaly sandstone.
2373.3 - 2388.0	Dark gray, sandy shale.
2388.0 - 2395.0	Shale.
2395.0 - 2396.3	Gray sandy shale.
2396.3 - 2398.8	Gray, calcareous, sandy shale.
2398.8 - 2399.6	Brown and gray, calcareous, shaly sandstone.
2399.6 - 2401.0	Gray, slightly calcareous, sandy shale.
2401.0 - 2405.0	Sandy shale.
2405.0 - 2408.0	Loss.
	LOWER BARTLESVILLE
2408.0 - 2417.2	Gray sandy shale.
2417.2 - 2419.6	Gray, laminated sandstone and shale.
2419.6 - 2424.6	Light brown, slightly shaly sandstone.
2424.6 - 2426.6	Gray shaly sandstone.
2426.6 - 2434.5	Light brown sandstone.
2434.5 - 2437.0	Black shale.
2437.0 - 2438.0	Coal.

Coring was started at a depth of 2371.0 feet in the upper Bartlesville and completed at 2438.0 feet in coal. For the most part, the pay is made up of light brown sandstone.

Since only the lower Bartlesville section responded to laboratory flooding tests, the following discussion will be limited to that zone.

PERMEABILITY

For the sake of distribution, the lower zone was divided into two sections. The weighted average permeability of these two sections is 1.3 and 28.4 millidarcys respectively; the overall average being 22.1 (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 impermeable to a maximum of 110. millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a good weighted average percent oil saturation, namely, 26.0. The weighted average percent oil saturation of the upper and lower sections is 18.6 and 30.3 respectively. The weighted average percent water saturation of the upper and lower sections is 71.1 and 56.1 respectively; the overall average being 61.7 (See Table III). This gives an overall weighted average total fluid saturation of 87.7 percent.

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 some flushing occurred because the zones of higher permeability show lower chloride content.

The weighted average oil content of the upper and lower sections is 210 and 413 barrels per acre foot respectively; the overall average being 337. The total oil content, as shown by this core, is 6,380 barrels per acre of which 4,361 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 984 barrels of oil per acre was obtained from 9.9 feet of sand. The weighted average percent oil saturation was reduced from 30.9 to 24.0, or represents an average recovery of 6.9 percent. The weighted average effective permeability of the samples is 3.23 millidarcys, while the average initial fluid production pressure is 32.8 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 24 samples tested in the entire core, 13 produced water and 9 oil. This indicates that approximately 37 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 1,800 barrels of oil per acre or an average of 182 barrels per acre foot from 9.9 feet of floodable pay sand analyzed in this core. These recovery values were calculated using the following data and assumptions:

Original formation volume factor	1.22
Reservoir water saturation, percent	45.0
Average porosity, percent	18.5
Oil saturation after flooding, percent	24.0
Performance factor, percent	50.0
Net floodable pay sand, feet	9.9

This core shows a pay sand section (2422.6 - 2434.5) 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 Jackson Heirs Well No. 18

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 & MIDDLE					
1	2371.1	15.6	30	36	66	363	13.	0.6	0.6	218	7.80
2	2372.1	16.1	38	37	75	474	9.7	1.0	1.6	474	9.70
3	2373.1	15.5	32	52	84	384	0.85	0.7	2.3	269	0.60
4	2398.1	6.1	28	55	83	132	Imp.	1.0	1.0	132	0.00
5	2399.1	12.5	43	50	93	416	0.45	0.8	1.8	333	0.36
6	2400.1	10.6	19	79	98	156	Imp.	1.0	2.8	156	0.00
						LOWER					
7	2416.1	9.2	25	72	97	178	Imp.	1.0	1.0	178	0.00
8	2417.1	10.8	20	79	99	168	Imp.	0.6	1.6	101	0.00
9	2418.1	11.4	3	91	94	27	Imp.	1.4	3.0	38	0.00
10	2419.1	15.2	16	80	96	189	Imp.	1.0	4.0	189	0.00
11	2420.1	15.8	31	61	92	380	0.50	1.0	5.0	380	0.50
12	2421.1	18.2	19	53	72	268	1.2	1.0	6.0	268	1.20
13	2422.1	17.5	23	58	81	312	2.7	1.0	7.0	312	2.70
14	2423.1	18.1	31	53	84	435	5.0	1.0	8.0	435	5.00
15	2424.1	17.8	28	53	81	386	2.6	1.0	9.0	386	2.60
16	2425.1	12.7	25	65	90	246	Imp.	1.0	10.0	246	0.00
17	2426.1	13.0	31	64	95	312	Imp.	1.0	11.0	312	0.00
18	2427.1	18.3	31	57	88	439	5.2	1.0	12.0	439	5.20
19	2428.1	19.2	39	53	92	580	8.1	1.0	13.0	580	8.10
20	2429.1	17.4	26	57	83	350	9.4	1.0	14.0	350	9.40
21	2430.1	16.6	33	52	85	425	14.	1.0	15.0	425	14.00
22	2431.1	18.5	35	51	86	502	20.	1.0	16.0	502	20.00
23	2432.1	16.6	29	66	95	373	7.5	1.0	17.0	373	7.50
24	2433.1	21.0	28	52	80	456	110.	1.9	18.9	866	209.00

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Jackson Bros. Lease Jackson Heirs Well No. 18

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
	UPPER & MIDDLE		
2371.0 - 2373.3	2.3	7.9	18.10
2397.8 - 2400.6	0.8	0.45	0.36

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
2371.0 - 2373.3	2.3	15.8	34.0	41.3	418	961
2397.8 - 2400.6	2.8	9.5	29.0	62.1	222	621

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Jackson Bros. Lease Jackson Heirs Well No. 18

LOWER

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
2415.6 - 2422.6	3.0	1.3	3.90
2422.6 - 2434.5	9.9	28.4	280.80
2415.6 - 2434.5	12.9	22.1	284.70

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
2415.6 - 2422.6	7.0	14.1	18.6	71.1	210	1,466
2422.6 - 2434.5	11.9	17.5	30.3	56.1	413	4,914
2415.6 - 2434.5	18.9	16.2	26.0	61.7	337	6,380

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Jackson Bros. Lease Jackson Heirs Well No. 18

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.			
						UPPER & MIDDLE						
1	2371.1	15.9	30	370	0	0	30	58	370	10	0.200	40
2	2372.1	15.6	40	484	0	0	40	56	484	6	0.200	50
3	2373.1	15.1	35	409	0	0	35	63	409	5	0.300	50
4	2398.1	6.6	27	138	0	0	27	57	138	0	Imp.	-
5	2399.1	12.7	42	413	0	0	42	53	413	0	Imp.	-
6	2400.1	10.6	19	156	0	0	19	80	156	0	Imp.	-
						LOWER						
7	2416.1	9.3	26	187	0	0	26	73	187	0	Imp.	-
8	2417.1	10.7	21	174	0	0	21	76	174	0	Imp.	-
9	2418.1	11.5	4	36	0	0	4	93	36	0	Imp.	-
10	2419.1	15.0	17	198	0	0	17	81	198	0	Imp.	-
11	2420.1	15.8	30	368	0	0	30	63	368	0	Imp.	-
12	2421.1	18.1	20	281	0	0	20	54	281	0	Imp.	-
13	2422.1	17.8	25	345	0	0	25	62	345	2	0.200	50
14	2423.1	18.2	31	437	3	42	28	69	395	10	0.300	45
15	2424.1	18.1	28	393	2	28	26	71	365	3	0.200	50
16	2425.1	13.0	25	252	0	0	25	65	252	0	Imp.	-
17	2426.1	13.0	30	302	0	0	30	65	302	0	Imp.	-
18	2427.1	17.8	31	427	5	69	26	66	358	16	0.444	40

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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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Jackson Bros. Lease Jackson Heirs Well No. 18

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.			
19	2428.1	19.0	39	574	11	162	28	65	412	23	0.500	40
20	2429.1	17.8	26	358	5	69	21	73	289	31	0.700	30
21	2430.1	17.0	33	435	11	145	22	77	290	25	0.700	40
22	2431.1	18.5	35	502	6	86	29	70	416	41	1.00	30
23	2432.1	17.0	29	382	6	79	23	75	303	57	1.50	30
24	2433.1	20.7	28	449	10	160	18	76	289	408	14.00	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 Jackson Heirs Well No. 18

Depth Interval, Feet	2422.6 - 2434.5
Feet of Core Analyzed	9.9
Average Percent Porosity	18.5
Average Percent Original Oil Saturation	30.9
Average Percent Oil Recovery	6.9
Average Percent Residual Oil Saturation	24.0
Average Percent Residual Water Saturation	71.9
Average Percent Total Residual Fluid Saturation	95.9
Average Original Oil Content, Bbls./A. Ft.	440.
Average Oil Recovery, Bbls./A. Ft.	99.
Average Residual Oil Content, Bbls./A. Ft.	341.
Total Original Oil Content, Bbls./Acre	4,361.
Total Oil Recovery, Bbls./Acre	984.
Total Residual Oil Content, Bbls./Acre	3,377.
Average Effective Permeability, Millidarcys	3.23
Average Initial Fluid Production Pressure, p.s.i.	32.8

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 Jackson Heirs. Well No. 18

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Percent Water Saturation Connate	Drilling & Foreign	Total
		UPPER & MIDDLE			
1	2371.1	129,200			
2	2372.1	132,750			
3	2373.1	130,800			
4	2398.1	149,300			
5	2399.1	127,900			
6	2400.1	111,900			
		LOWER			
7	2416.1	72,700			
8	2417.1	75,950			
9	2418.1	95,150			
10	2419.1	108,600			
11	2420.1	103,200			
12	2421.1	105,200			
13	2422.1	88,150			
14	2423.1	105,800			
15	2424.1	99,700			
16	2425.1	106,250			
17	2426.1	90,800			
18	2427.1	86,800			
19	2428.1	91,500			
20	2429.1	102,800			
21	2430.1	119,200			
22	2431.1	105,800			
23	2432.1	89,550			
24	2433.1	13,870			

Note: ppm — parts per million

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SUMMARY OF WATER DIFFERENTIATION TESTS

TABLE VII

Company Jackson Bros. Lease Jackson Heirs Well No. 18

Depth Interval, Feet	Chloride Content of Brine in Sand, ppm	Average Percent Connate Water	Average Percent Drilling & Foreign Water
	UPPER & MIDDLE		
2371.0 - 2373.3	131,200		
2397.8 - 2400.6	129,000		
	LOWER		
2415.6 - 2422.6	93,800		
2422.6 - 2434.5	86,100		
2415.6 - 2434.5	89,100		

Note: ppm — parts per million.