



OILFIELD RESEARCH LABORATORIES

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

August 13, 1966

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. 15, Greenwood County, Kansas, and submitted to our laboratory on August 9, 1966.

Your business is greatly appreciated.

Very truly yours,

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Carl L. Pate

CLP:rf

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GENERAL INFORMATION & SUMMARY

Company	Jackson Brothers	Lease	Jackson Heirs	Well No.	15
Location	NE NW SW				
Section	23	Twp.	25S	Rge.	8E
	County		Greenwood		State
					Kansas
Name of Sand					Bartlesville
Top of Core					2391.0
Bottom of Core					2435.0
Top of ^{Permeable} Sand					2417.6
Bottom of Sand					2431.1
Total Feet of Permeable Sand					13.5
Total Feet of Floodable Sand					9.5
Distribution of Permeable Sand:					
Permeability Range Millidarcys	Feet		Cum. Ft.		
0 - 5	4.0		4.0		
5 - 10	5.0		9.0		
10 - 20	2.0		11.0		
20 & above	2.5		13.5		
Average Permeability Millidarcys					
				10.0	
Average Percent Porosity					
				16.9	
Average Percent Oil Saturation					
				26.9	
Average Percent Water Saturation					
				52.5	
Average Oil Content, Bbls./A. Ft.					
				349.	
Total Oil Content, Bbls./Acre					
				5,620.	
Average Percent Oil Recovery by Laboratory Flooding Tests					
				5.7	
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.					
				75.	
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre					
				565.	
Total Calculated Oil Recovery, Bbls./Acre (Primary & Secondary)					
				2,348.	
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 sand in this well. The core was sampled and the samples sealed in tin cans by an employee of Oilfield Research Laboratories.

FORMATION CORED

The detailed log of the formation cored is as follows:

<u>Depth Interval, Feet</u>	<u>Description</u>
2391.0 - 2402.0	Sandy shale.
2402.0 - 2404.0	Black shale.
2404.0 - 2415.0	Sandy shale.
2415.0 - 2431.1	Light brown, slightly shaly sandstone.
2431.1 - 2435.0	Shale.

Coring was started at a depth of 2391.0 feet in sandy shale and completed at 2435.0 feet in shale. This core shows a total of 16.1 feet of sandstone. The pay is made up of light brown, fine grained, slightly shaly 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 6.6 and 11.5 millidarcys respectively; the overall average being 10.0 (See Table III). By observing the data given on the core-graph, it is noticeable that the sand has an irregular permeability profile. The permeability of the sand varies from impermeable to a maximum of 26. millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a fairly low weighted average percent oil saturation, namely, 26.9. The weighted average percent oil saturation of the upper and lower sections is 23.9 and 28.9 respectively. The weighted average percent water saturation of the upper and lower sections is 54.8 and 51.0 respectively; the overall average being 52.5 (See Table III). This gives an overall weighted average total fluid saturation of 79.4 percent. This fairly low total fluid saturation indicates some fluid was lost during coring 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 some flushing of the sand did occur during coring as the more permeable lower section had a lower average chloride content.

The weighted average oil content of the upper and lower sections is 317 and 372 barrels per acre foot respectively; the overall average being 349. The total oil content, as shown by this core, is 5,620 barrels per acre (See Table III).

LABORATORY FLOODING TESTS

When taking into consideration that the sand in the core has a fairly low oil saturation, one would expect a low oil recovery from laboratory flooding tests. A total recovery of 565 barrels of oil per acre was obtained from 7.5 feet of sand. The weighted average

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percent oil saturation was reduced from 27.3 to 21.6, or represents an average recovery of 5.7 percent. The weighted average effective permeability of the samples is 0.77 millidarcys, while the average initial fluid production pressure is 41.4 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 15 samples tested, 9 produced water and 7 oil. This indicates that approximately 47 percent of the sand represented by these samples is floodable pay sand.

CONCLUSION

From a study of the enclosed data we estimate that approximately 1,226 barrels of oil per acre or an average of 129 barrels per acre foot can be recovered from the area, represented by this core, by efficient primary production methods. An additional oil recovery of 1,122 barrels per acre or an average of 117 barrels per acre foot can be expected from efficient waterflooding. The following data and assumptions were used in calculating the above oil recovery values:

Original formation volume factor	1.22
Irreducible water saturation, percent	40.0
Primary recovery, estimated, percent	None
Present oil saturation, percent	50.2
Average porosity, percent	16.9
Oil saturation after flooding, percent	21.6
Performance factor	0.55
Net floodable pay sand, feet	9.5

This core shows a rather clean sand section having a fairly low oil saturation, a rather high water saturation and a low permeability.

No doubt, some oil was flushed from the core during the cutting of same. This would partly account for the rather low oil and high water saturations.

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TABLE 1-B

Company		Jackson Bros.		Lease		Jackson Heirs		Well No.		15	
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	2416.1	17.5	21	67	88	285	Imp.	1.6	1.6	456	0.00
2	2417.1	18.6	25	59	84	361	Imp.	1.0	2.6	361	0.00
3	2418.1	15.3	25	53	78	296	2.2	1.0	3.6	296	2.20
4	2419.1	17.7	25	50	75	343	6.3	1.0	4.6	343	6.30
5	2420.1	16.7	21	48	69	272	9.6	1.0	5.6	272	9.60
6	2421.1	16.7	28	44	72	362	7.9	1.0	6.6	362	7.90
7	2422.1	18.1	24	47	71	337	9.1	1.0	7.6	337	9.10
8	2423.1	14.7	34	52	86	388	2.5	1.0	8.6	388	2.50
9	2424.1	15.4	33	55	88	394	6.3	1.0	9.6	394	6.30
10	2425.1	15.3	21	51	72	249	2.2	1.0	10.6	249	2.20
11	2426.1	16.5	24	51	75	308	19.	1.0	11.6	308	19.00
12	2427.1	15.3	36	48	84	427	4.6	1.0	12.6	427	4.60
13	2428.1	15.7	30	53	83	365	26.	1.0	13.6	365	26.00
14	2429.1	18.0	40	48	88	558	10.	1.0	14.6	558	10.00
15	2430.1	19.7	22	53	75	336	20.	1.5	16.1	504	30.00
Total									5,620		

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company	Jackson Bros.	Lease	Jackson Heirs	Well No.	15
	Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.	
	2415.0 - 2421.6	4.0	6.6	26.00	
	2421.6 - 2431.1	9.5	11.5	109.70	
	2415.0 - 2431.1	13.5	10.0	135.70	

	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
	2415.0 - 2421.6	6.6	17.1	23.9	54.8	317	2,090
	2421.6 - 2431.1	9.5	16.7	28.9	51.0	372	3,530
	2415.0 - 2431.1	16.1	16.9	26.9	52.5	349	5,620

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company			Jackson Bros.			Lesse			Jackson Heirs			Well No.			15		
Sample No.	Depth, Feet	Effective Porosity Percent	Original Oil Saturation		Oil Recovery		Residual Saturation		Volume of Water Recovered cc ^a	Effective Permeability mDarcy ^{cc}	Initial Field Production Pressure Lbs./Sq./In.						
			%	Bbbl./A. Ft.	%	Bbbl./A. Ft.	% Oil	% Water				Bbbl./A. Ft.					
1	2416.1	17.1	20	266	0	0	20	70	0	Imp.	-						
2	2417.1	18.3	22	312	0	0	22	65	0	Imp.	-						
3	2418.1	15.6	23	278	0	0	23	60	0	Imp.	-						
4	2419.1	17.3	22	295	0	0	22	61	15	0.300	50						
5	2420.1	16.7	20	259	0	0	20	68	4	0.200	50						
6	2421.1	16.2	25	315	0	0	25	50	0	Imp.	-						
7	2422.1	18.2	24	339	4	56	20	68	28	0.700	30						
8	2423.1	15.0	31	361	0	0	31	59	0	Imp.	-						
9	2424.1	15.8	33	405	7	86	26	70	16	0.400	40						
10	2425.1	15.8	21	257	1	12	20	66	15	0.800	50						
11	2426.1	16.8	24	313	7	91	17	81	86	2.30	30						
12	2427.1	15.0	33	384	0	0	33	55	0	Imp.	-						
13	2428.1	15.8	30	368	8	98	22	73	20	0.500	50						
14	2429.1	17.5	40	544	13	177	27	70	6	0.200	50						
15	2430.1	19.5	22	333	2	30	20	80	28	0.600	40						

Notes: cc—cubic centimeter.

^a—Volume of water recovered at the time of maximum oil recovery.

^{cc}—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.	15
Depth Interval, Feet	2421.6 - 2431.1				
Feet of Core Analyzed	7.5				
Average Percent Porosity	17.2				
Average Percent Original Oil Saturation	27.3				
Average Percent Oil Recovery	5.7				
Average Percent Residual Oil Saturation	21.6				
Average Percent Residual Water Saturation	73.1				
Average Percent Total Residual Fluid Saturation	94.7				
Average Original Oil Content, Bbls./A. Ft.	363.				
Average Oil Recovery, Bbls./A. Ft.	75.				
Average Residual Oil Content, Bbls./A. Ft.	288.				
Total Original Oil Content, Bbls./Acre	2,726.				
Total Oil Recovery, Bbls./Acre	565.				
Total Residual Oil Content, Bbls./Acre	2,161.				
Average Effective Permeability, Millidarcys	0.77				
Average Initial Fluid Production Pressure, p.s.i.	41.4				

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

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SUMMARY OF WATER DIFFERENTIATION TESTS

TABLE VII

Company Jackson Bros. Lease Jackson Heirs Well No. 15

Depth Interval, Feet	Chloride Content of Brine in Sand, ppm	Average Percent Connate Water	Average Percent Drilling & Foreign Water
2415.0 - 2421.6	95,788		
2421.6 - 2431.1	90,374		
2415.0 - 2431.1	92,593		

Note: ppm — parts per million.

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RESULTS OF WATER DIFFERENTIATION TESTS
TABLE VI

Company Jackson Bros. Lease Jackson Heirs Well No. 15

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Percent Connate	Water Saturation Drilling & Foreign	Total
1	2416.1	90,500			
2	2417.1	91,000			
3	2418.1	93,500			
4	2419.1	66,700			
5	2420.1	124,500			
6	2421.1	111,750			
7	2422.1	63,200			
8	2423.1	95,000			
9	2424.1	104,100			
10	2425.1	102,750			
11	2426.1	103,400			
12	2427.1	101,200			
13	2428.1	96,300			
14	2429.1	98,700			
15	2430.1	62,600			

Note: ppm — parts per million