



OILFIELD RESEARCH LABORATORIES

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

September 15, 1967

Jackson Brothers
514 North Main
Eureka, Kansas

Gentlemen:

Enclosed herewith is the report of the analysis of the Rotary core taken from the Barrier Lease, Well No. 39, Greenwood County, Kansas, and submitted to our laboratory on September 11, 1967.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Carl L. Pate

CLP:bj0

6 c.

A fresh water mud was used as a circulating fluid in the coring of the sand in this well. This well was drilled in a virgin area. The core was sampled and 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,</u>	<u>Description</u>
2450.0 - 2450.2	- Hard brownish gray sandstone.
2450.2 - 2456.4	- Brown fine grained sandstone.
2456.4 - 2456.7	- Hard gray sandstone.
2456.7 - 2457.0	- Brown sandstone.
2457.0 - 2457.2	- Gray sandstone.
2457.2 - 2462.3	- Brown fine grained sandstone.
2462.3 - 2465.2	- Gray sandy shale.
2465.2 - 2470.5	- Dark shale
2470.5 - 2474.0	- Gray sandy shale.

PERMEABILITY

The weighted average permeability of the cored section is 12.5 millidarcys. (See Table III). By observing the data given on the coregraph, it is noticeable that the sand has a very irregular permeability profile. The permeability of the sand varies from 0.95 to a maximum of 36. millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a fair weighted average percent oil saturation, namely, 29.2. The weighted average percent water saturation of the cored section is 55.3. (See Table III). This gives an overall weighted average total fluid saturation of 84.5 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 of the sand did occur during coring.

The weighted average oil content of the cored section is 400 barrels per acre foot; while the total oil content, as shown by this core, is 4,634 barrels per acre. (See Table III).

LABORATORY FLOODING TESTS

When taking into consideration that the sand in the core has only a fair oil saturation one would not expect very much oil to be recovered from laboratory flooding tests, however, a total recovery of 500 barrels of oil per acre was obtained from 8.5 feet of sand. The weighted average percent oil saturation was reduced from 31.4 to 27.2, or represents an average recovery of 4.2 percent. The weighted average effective permeability of the samples is 0.68 millidarcys, while the average initial fluid production pressure is 26.3 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 12 samples tested, 11 produced water and 8 oil. This indicates that approximately 67 percent of the sand represented by these samples is floodable pay sand.

CONCLUSION

On the basis of the above data, we estimate that approximately 1,708 barrels of oil per acre or an average of 201 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	1.20
Irreducible, water saturation, percent	38.0
Present oil saturation, percent	51.6
Average porosity, percent	17.7
Oil saturation after flooding, percent	27.2
Performance factor	0.60
Net floodable pay sand, feet	8.5

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

The results of the chloride tests indicate some flushing of the sand in the core did occur during coring. This would partly account for lower oil and higher water saturations in the sand samples.

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Jackson Brothers Lease Barrier Well No. 39

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	2450.5	15.1	30	46	76	351	8.6	0.8	0.8	281	6.88
2	2451.5	17.8	33	50	83	456	19.	1.0	1.8	456	19.00
3	2452.5	18.1	27	54	81	379	28.	1.0	2.8	379	28.00
4	2453.5	17.3	31	57	88	416	3.7	1.0	3.8	416	3.70
5	2454.5	18.6	33	52	85	476	14.	1.0	4.8	476	14.00
6	2455.5	19.3	31	50	81	464	36.	1.4	6.2	650	50.40
7	2456.5	13.1	22	71	93	223	0.95	0.3	6.5	67	0.28
8	2457.5	17.9	17	58	75	236	4.2	0.8	7.3	189	3.36
9	2458.5	17.0	22	59	81	290	3.4	1.0	8.3	290	3.40
10	2459.5	16.1	30	61	91	375	2.7	1.0	9.3	375	2.70
11	2460.5	17.1	34	59	93	451	5.6	1.0	10.3	451	5.60
12	2461.5	18.7	32	58	90	464	5.8	1.3	11.6	604	7.54

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company	Lease	Barrier	Well No.		
Jackson Brothers			39		
Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.		
2450.2 - 2462.3	11.6	12.5	144.86		
Depth Interval, Feet	Feet of Core Analyzed	Average Percent Porosity	Average Percent Water Saturation	Average Oil Content Bbl./A. Ft.	Total Oil Content Bbbl./Acre
2450.2 - 2462.3	11.6	17.5	29.2	400	4,634

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

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	2450.5	15.3	30	356	2	24	28	56	332	12	0.30	25
2	2451.5	17.5	33	448	5	68	28	61	380	27	0.70	25
3	2452.5	18.6	27	389	3	43	24	74	346	42	1.00	20
4	2453.5	16.9	31	406	2	26	29	70	380	24	0.60	25
5	2454.5	18.4	33	471	8	114	25	71	357	61	1.10	20
6	2455.5	19.0	31	457	5	74	26	64	383	55	1.10	20
7	2456.5	12.7	19	187	0	0	19	78	187	3	0.20	45
8	2457.5	17.4	19	256	0	0	19	73	256	13	0.30	30
9	2458.5	16.7	20	259	0	0	20	71	259	7	0.30	40
10	2459.5	15.6	27	327	0	0	27	68	327	0	Imp.	0
11	2460.5	16.8	34	463	4	52	30	67	391	8	0.30	40
12	2461.5	18.3	32	455	4	57	28	65	398	9	0.20	35

Company Jackson Brothers Lease Barrier Well No. 39

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 Brothers	Lease	Barrier	Well No.	39
Depth Interval, Feet	2450.2 - 2462.3				
Feet of Core Analyzed	8.5				
Average Percent Porosity	17.7				
Average Percent Original Oil Saturation	31.4				
Average Percent Oil Recovery	4.2				
Average Percent Residual Oil Saturation	27.2				
Average Percent Residual Water Saturation	66.1				
Average Percent Total Residual Fluid Saturation	93.3				
Average Original Oil Content, Bbbls./A. Ft.	432.				
Average Oil Recovery, Bbbls./A. Ft.	59.				
Average Residual Oil Content, Bbbls./A. Ft.	373.				
Total Original Oil Content, Bbbls./Acre	3,673.				
Total Oil Recovery, Bbbls./Acre	500.				
Total Residual Oil Content, Bbbls./Acre	3,173.				
Average Effective Permeability, Millidarcys	0.68				
Average Initial Fluid Production Pressure, p.s.i.	26.3				

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 Brothers Lease Barrier Well No. 39

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Percent Water Saturation		Total
			Connate	Drilling & Foreign	
1	2450.5	75,950			
2	2451.5	83,650			
3	2452.5	79,500			
4	2453.5	82,800			
5	2454.5	63,950			
6	2455.5	63,225			
7	2456.5	120,250			
8	2457.5	93,100			
9	2458.5	102,000			
10	2459.5	88,900			
11	2460.5	97,200			
12	2461.5	95,700			

Note: ppm — parts per million

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SUMMARY OF WATER DIFFERENTIATION TESTS

TABLE VII

Company Jackson Brothers Lease Barrier Well No. 39

<u>Depth Interval, Feet</u>	<u>Chloride Content of Brine in Sand, ppm</u>	<u>Average Percent Connate Water</u>	<u>Average Percent Drilling & Foreign Water</u>
2450.2 - 2462.3	84,922		

Note: ppm — parts per million.