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

January 9, 1968

Jackson Brothers
514 North Main
Eureka, Kansas 67045

Gentlemen:

Enclosed herewith is the report of the analysis of the Rotary core taken from the Jackson Heirs Lease, Well No. 22, Greenwood County, Kansas, and submitted to our laboratory on Jamuary 3, 1968

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Carl L. Pate

CLP:bjo

6 c. - Eureka, Kansas

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GENERAL INFORMATION & SUMMARY

Company Jackson Brothers Lease Jackson Heirs Well No. 22

Location SW, SW, NW

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

Name of Sand	Bartlesville
Top of Core	2463.0
Bottom of Core	2475.0
Top of Pay Sand	2465.6
Bottom of Sand	2473.5
Total Feet of Permeable Sand	9.9
Total Feet of Floodable Sand	7.9

Distribution of Permeable Sand: Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 5	2.0	2.0
5 - 25	2.0	4.0
25 - 50	2.9	6.9
50 & above	3.0	9.9

Average Permeability Millidarcys	38.2
Average Percent Porosity	18.3
Average Percent Oil Saturation	26.8
Average Percent Water Saturation	55.7
Average Oil Content, Bbls./A. Ft.	378.
Total Oil Content, Bbls./Acre	3,968.
Average Percent Oil Recovery by Laboratory Flooding Tests	5.1
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	76.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	525.
Total Calculated Oil Recovery, Bbls./Acre (Primary & Secondary)	2,291.
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. 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:

Depth Interval, Feet	Description
2463.0 - 2465.6	Light brown shaly sandstone.
2465.6 - 2473.5	Light brown sandstone.
2473.5 - 2475.0	Dark shale.

Coring was started at a depth of 2463.0 feet in light brown shaly sandstone and completed at 2475.0 feet in dark shale. This core shows a total of 10.5 feet of sandstone. 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 1.3 and 47.5 millidarcys respectively; the overall average being 38.2 (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 Imp. to a maximum of 107 millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a fairly low weighted average percent oil saturation, namely, 26.8. The weighted average percent oil satura-

tion of the upper and lower sections is 30.8 and 25.5 respectively. The weighted average percent water saturation of the upper and lower sections is 59.4 and 54.6 respectively; the overall average being 55.7 (See Table III). This gives an overall weighted average total fluid saturation of 82.5 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 considerable flushing of the sand occurred during coring as the lower more permeable section had a much lower chloride content.

The weighted average oil content of the upper and lower sections is 372 and 380 barrels per acre foot respectively; the overall average being 378. The total oil content, as shown by this core, is 3,968 barrels per acre of which 3,001 barrels are in the pay sand section (See Table III). The pay sand extends from a depth of 2465.6 to 2473.5 feet (lower section).

LABORATORY FLOODING TESTS

When taking into consideration that the sand in the core has a fairly low oil saturation, most of the sand responded very well to laboratory flooding tests, as a total recovery of 525 barrels of oil per acre was obtained from 6.9 feet of sand. The weighted average percent oil saturation was reduced from 26.1 to 21.0, or represents an average recovery of 5.1 percent. The weighted average effective permeability of the samples is 1.48 millidarcys, while the average

initial fluid production pressure is 15.2 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 11 samples tested, 8 produced water and 7 oil. This indicates that approximately 64 percent of the sand represented by these samples will take water.

CONCLUSION

On the basis of the above data, we estimate that approximately 2,291 barrels of oil per acre or an average of 290 barrels per foot can be recovered from the area, represented by this core, by efficient primary and waterflooding methods. The following data and assumptions were used in calculating the above oil recovery value:

Present formation volume factor	1.22
Irreducible water saturation, percent	35.0
Primary recovery, estimated, percent	None
Present oil saturation, percent	53.3
Average porosity, percent	19.3
Oil saturation after flooding, percent	21.0
Performance factor	0.60
Net floodable pay sand, feet	7.9

This core shows a clean pay sand section (2465.6 to 2473.5 feet) having a rather low oil saturation, a high water saturation and a good permeability. Chances are, the rather low oil and high water saturations are partly due to flushing of the core during the cutting of same.

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Jackson Brothers Lease Jackson Heirs Well No. 22

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	2463.1	10.9	25	69	94	211	Imp.	0.6	0.6	127	0.00
2	2464.1	17.5	34	53	87	462	0.24	1.0	1.6	462	0.24
3	2465.1	15.7	31	60	91	378	2.4	1.0	2.6	378	2.40
4	2466.1	18.7	27	55	82	392	10.	1.0	3.6	392	10.00
5	2467.1	18.5	30	56	86	431	11.	1.0	4.6	431	11.00
6	2468.1	19.2	27	53	80	402	49.	1.0	5.6	402	49.00
7	2469.1	18.0	24	59	83	335	44.	1.0	6.6	335	44.00
8	2470.1	19.7	25	54	79	382	62.	1.0	7.6	382	62.00
9	2471.1	19.2	21	54	75	313	60.	1.0	8.6	313	60.00
10	2472.1	20.8	21	54	75	339	107.	1.0	9.6	339	107.00
11	2473.1	20.1	29	51	80	452	36.	0.9	10.5	407	32.40

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Jackson Brothers Lease Jackson Heirs Well No. 22

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
2463.0 - 2465.6	2.0	1.3	2.64
2465.6 - 2473.5	7.9	47.5	375.40
2463.0 - 2473.5	9.9	38.2	378.04

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
2463.0 - 2465.6	2.6	15.3	30.8	59.4	372	967.
2465.6 - 2473.5	7.9	19.3	25.5	54.6	380	3,001.
2463.0 - 2473.5	10.5	18.3	26.8	55.7	378	3,968.

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Jackson Brothers Lease Jackson Heirs Well No. 22

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	2463.1	11.2	27	235	0	0	27	70	235	0	Imp.	--
2	2464.1	17.0	31	409	0	0	31	61	409	0	Imp.	--
3	2465.1	15.5	28	337	0	0	28	67	337	0	Imp.	--
4	2466.1	18.7	27	392	8	116	19	71	276	32	0.50	20
5	2467.1	18.1	30	421	9	126	21	72	295	27	0.50	25
6	2468.1	19.0	27	398	4	59	23	62	339	95	1.50	10
7	2469.1	17.7	24	330	1	14	23	69	316	36	0.50	20
8	2470.1	19.7	25	382	4	61	21	65	321	102	1.50	10
9	2471.1	19.3	21	314	0	0	21	63	314	62	0.80	10
10	2472.1	21.3	21	348	3	50	18	65	298	145	1.90	10
11	2473.1	20.3	29	457	7	110	22	74	347	150	4.20	10

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 Jackson Heirs Well No. 22

Depth Interval, Feet	2465.6 - 2473.5
Feet of Core Analyzed	6.9
Average Percent Porosity	19.3
Average Percent Original Oil Saturation	26.1
Average Percent Oil Recovery	5.1
Average Percent Residual Oil Saturation	21.0
Average Percent Residual Water Saturation	68.2
Average Percent Total Residual Fluid Saturation	89.2
Average Original Oil Content, Bbls./A. Ft.	389.
Average Oil Recovery, Bbls./A. Ft.	76.
Average Residual Oil Content, Bbls./A. Ft.	313.
Total Original Oil Content, Bbls./Acre	2,682.
Total Oil Recovery, Bbls./Acre	525.
Total Residual Oil Content, Bbls./Acre	2,157.
Average Effective Permeability, Millidarcys	1.48
Average Initial Fluid Production Pressure, p.s.i.	15.2

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 Jackson Heirs Well No. 22

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Percent Water Saturation		
			Connate	Drilling & Foreign	Total
1	2463.1	107,900			
2	2464.1	123,100			
3	2465.1	110,800			
4	2466.1	22,510			
5	2467.1	14,980			
6	2468.1	7,575			
7	2469.1	7,410			
8	2470.1	7,090			
9	2471.1	10,990			
10	2472.1	6,720			
11	2473.1	7,410			

Note: ppm — parts per million

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SUMMARY OF WATER DIFFERENTIATION TESTS

TABLE VII

Company Jackson Brothers Lease Jackson Heirs Well No. 22

Depth Interval, Feet	Chloride Content of Brine in Sand, ppm	Average Percent Connate Water	Average Percent Drilling & Foreign Water
2463.0 - 2465.6	114,877		
2465.6 - 2473.5	10,626		
2463.0 - 2473.5	36,440		

Note: ppm — parts per million.