

# OILFIELD RESEARCH LABORATORIES

- REGISTERED ENGINEERS -

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July 7, 1962

Jackson Brothers  
514 North Main  
Eureka, Kansas

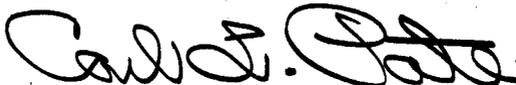
Gentlemen:

Enclosed herewith is the report of the analysis of the Rotary core taken from the Crew Lease, Well No. 13, Greenwood County, Kansas, and submitted to our laboratory on June 26 and 29, 1962.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES



Carl L. Pate

CLP:rf

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# Oilfield Research Laboratories

## GENERAL INFORMATION & SUMMARY

Company Jackson Brothers Lease Crew Well No. 13

Location SW $\frac{1}{4}$

Section 34 Twp. 25S Rge. 8E County Greenwood State Kansas

Name of Sand (Limestone) Kansas City

Top of Core - - - - - 1900.0

Bottom of Core - - - - - 1917.5

Top of ~~Sand~~ Saturated Limestone - - - - - 1906.0

Bottom of ~~Sand~~ Limestone (Cored) - - - - - 1917.5

Total Feet of Permeable ~~Sand~~ Limestone - - - - - 3.9

Total Feet of Floodable Sand - - - - - -

Distribution of Permeable Sand:  
Permeability Range  
Millidarcys

Feet

Cum. Ft.

0 - 1	1.0	1.0
1 - 2	2.0	3.0
2 & above	0.9	3.9

Average Permeability Millidarcys - - - - - 11.3

Average Percent Porosity - - - - - 8.0

Average Percent Oil Saturation - - - - - 44.2

Average Percent Water Saturation - - - - - 27.5

Average Oil Content, Bbls./A. Ft. - - - - - 246.

Total Oil Content, Bbls./Acre - - - - - 2,832.

Average Percent Oil Recovery by Laboratory Flooding Tests - - - - -

Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft. - - - - -

Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre - - - - -

Total Calculated Oil Recovery, Bbls./Acre - - - - -

Packer Setting, Feet - - - - -

Viscosity, Centipoises @ - - - - -

A. P. I. Gravity, degrees @ 60 °F - - - - -

Elevation, Feet - - - - -

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## GENERAL INFORMATION & SUMMARY

Company Jackson Brothers Lease Crew Well No. 13

Location SW $\frac{1}{4}$

Section 34 Twp. 25S Rge. 8E County Greenwood State Kansas

Name of <del>Sand</del> / - <u>Limestone</u> - - - - -	Basin
Top of Core - - - - -	2008.0
Bottom of Core - - - - -	2032.0
Top of <del>Sand</del> / - <u>Saturated Limestone</u> - - - - -	2013.0
Bottom of <del>Sand</del> / - <u>Saturated Limestone</u> - - - - -	2017.6
Total Feet of Permeable <del>Sand</del> / - <u>Limestone</u> - - - - -	3.6
Total Feet of Floodable Sand - - - - -	-

Distribution of Permeable Sand: Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 2	0.6	0.6
2 - 4	1.0	1.6
4 & above	2.0	3.6

Average Permeability Millidarcys - - - - -	9.2
Average Percent Porosity - - - - -	5.4
Average Percent Oil Saturation - - - - -	25.7
Average Percent Water Saturation - - - - -	55.6
Average Oil Content, Bbls./A. Ft. - - - - -	148.
Total Oil Content, Bbls./Acre - - - - -	799:
Average Percent Oil Recovery by Laboratory Flooding Tests - - - - -	
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft. - - - - -	
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre - - - - -	
Total Calculated Oil Recovery, Bbls./Acre - - - - -	
Packer Setting, Feet - - - - -	
Viscosity, Centipoises @ - - - - -	
A. P. I. Gravity, degrees @ 60 °F - - - - -	
Elevation, Feet - - - - -	

# Oilfield Research Laboratories

## GENERAL INFORMATION & SUMMARY

Company Jackson Brothers Lease Crew Well No. 13

Location SW $\frac{1}{4}$

Section 34 Twp. 25S Rge. 8E County Greenwood State Kansas

Name of Sand	Bartlesville
Top of Core	2504.0
Bottom of Core	2517.0
Pay	
Top of Sand	2507.0
Bottom of Sand (Cored)	2517.0
Total Feet of Permeable Sand	11.0
Total Feet of Floodable Sand	7.0

**Distribution of Permeable Sand:**  
Permeability Range  
Millidarcys

Feet

Cum. Ft.

	Feet	Cum. Ft.
0 - 1	3.0	3.0
1 - 4	4.0	7.0
4 - 10	2.0	9.0
10 & above	2.0	11.0

Average Permeability Millidarcys	3.8
Average Percent Porosity	16.5
Average Percent Oil Saturation	22.1
Average Percent Water Saturation	60.8
Average Oil Content, Bbls./A. Ft.	283.
Total Oil Content, Bbls./Acre	3,562.
Average Percent Oil Recovery by Laboratory Flooding Tests	5.1
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	71.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	498.
Total Calculated Oil Recovery, Bbls./Acre	1,205.
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 zones in this well. The core was sampled and sealed in tin cans by a representative of Oilfield Research Laboratories.

Air permeability, porosity, saturation and acid solubility tests were run on the Kansas City and Basin Limestones while a complete analysis was run on the Bartlesville Sand. The following discussion pertains only to the Bartlesville sand reservoir.

#### FORMATION CORED

<u>Depth Interval,</u> <u>Feet</u>	<u>Description</u>
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#### KANSAS CITY LIMESTONE

1900.0 - 1906.0	- Gray shaly limestone.
1906.0 - 1917.5	- Brownish gray limestone.
1917.5 - 2008.0	- Drilled.

#### BASIN LIMESTONE

2008.0 - 2013.0	- Gray shaly limestone.
2013.0 - 2020.0	- Brownish gray limestone.
2020.0 - 2021.0	- Gray shaly limestone.
2021.0 - 2032.0	- Gray shaly limestone (discarded).
2032.0 - 2504.0	- Drilled.

#### BARTLESVILLE SAND

2504.0 - 2504.4	- Gray sandy shale.
2504.4 - 2505.0	- Gray shaly sandstone.
2505.0 - 2514.0	- Light brown, slightly shaly sandstone.
2514.0 - 2517.0	- Light brown, slightly calcareous sandstone.

#### BARTLESVILLE SAND

Coring was started at a depth of 2504.0 feet in gray sandy shale and completed at 2517.0 feet in light brown, slightly calcareous sandstone. This core shows a total of 12.0 feet of sandstone. For the most part, the pay is made up of light brown, 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 1.5 and 5.7 millidarcys respectively; the overall average being 3.8 (See Table III). By observing the data given on the coregraph, it is noticeable that the sand has a fairly irregular permeability profile. The permeability of the sand varies from impermeable to a maximum of 11. millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a low weighted average percent oil saturation, namely, 22.1. The weighted average percent oil saturation of the upper and lower sections is 19.1 and 25.3 respectively. The weighted average percent water saturation of the upper and lower sections is 63.5 and 58.0 respectively; the overall average being 60.8 (See Table III). This gives an overall weighted average total fluid saturation of 82.9 percent.

The weighted average oil content of the upper and lower sections is 234 and 336 barrels per acre foot respectively; the overall average being 283. The total oil content, as shown by this core, is 3,562 barrels per acre (See Table III).

LABORATORY FLOODING TESTS

When taking into consideration that the sand in the core has a low oil saturation, part of the sand responded fairly well to laboratory flooding tests, as a total recovery of 498 barrels of oil per acre was obtained from 7.0 feet of sand. The weighted average percent oil saturation was reduced from 23.7 to 18.6, or represents an average recovery of 5.1 percent. The weighted average effective permeability of the samples is 0.602 millidarcys, while the average initial fluid production pressure is 45.0 pounds per square inch (See Table V).

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By observing the data given in Table IV, you will note that of the 13 samples tested, 7 produced water and oil. This indicates that approximately 54 percent of the sand represented by these samples is floodable pay sand.

### CONCLUSION

On the basis of the above data, it is evident that an efficient water-flood, within the vicinity of this well, will recover approximately 1,205 barrels of oil per acre or an average of 172 barrels per acre foot from the 7 feet of floodable sand analyzed. In calculating the above oil recovery value, the following data and assumptions were employed:

Original formation volume factor	1.23
Present formation volume factor	1.04
Irreducible water saturation, percent	40.0
Primary recovery, estimated, percent	8.0
Present oil saturation, percent	42.7
Average porosity, percent	17.4
Oil saturation after flooding, percent	18.6
Performance factor,	0.55
Net floodable pay sand, feet	7.0

This core shows a rather thin sand section having a low oil saturation, a high water saturation and a low permeability. Chances are, some flushing of the core occurred during the cutting of same. This could partly account for the low oil and high water saturations.

RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Jackson Brothers Lease Crew Well No. 13

Sample No.	Depth, Feet	Effective Porosity Percent	Percent Saturation			Oil Content Bbbs. / A Ft.	Perm., Mill.	Feet of Sand		Total Oil Content	Perm. Capacity Ft. X md.
			Oil	Water	Total			Ft.	Cum. Ft.		
						<u>KANSAS CITY LIMESTONE</u>					
1	1906.1	5.6	58	22	80	252	Imp.	0.6	0.6	151	0.00
2	1907.1	7.9	59	20	79	352	Imp.	1.0	1.6	352	0.00
3	1908.1	4.6	72	12	84	257	Imp.	1.0	2.6	257	0.00
4	1909.1	3.1	61	28	89	146	Imp.	1.0	3.6	146	0.00
5	1910.1	5.5	48	17	65	204	Imp.	1.0	4.6	204	0.00
6	1911.1	8.7	33	26	59	222	Imp.	1.0	5.6	222	0.00
7	1912.1	7.5	30	30	60	174	Imp.	1.0	6.6	174	0.00
8	1913.1	11.9	23	30	53	212	1.2	1.0	7.6	212	1.20
9	1914.1	8.1	51	29	80	320	Imp.	1.0	8.6	320	0.00
10	1915.1	12.8	28	36	64	278	0.99	1.0	9.6	278	0.99
11	1916.1	7.2	32	35	67	178	1.4	1.0	10.6	178	1.40
12	1917.1	12.1	40	44	84	375	45.	0.9	11.5	338	40.50
						<u>BASIN LIMESTONE</u>					
13	2013.1	3.0	30	25	55	70	1.5	0.6	12.1	42	0.90
14	2014.1	5.4	35	38	73	146	15.	1.0	13.1	146	15.00
15	2015.1	3.7	34	54	88	97	14.	1.0	14.1	97	14.00
16	2016.1	3.8	23	64	87	68	3.3	1.0	15.1	68	3.30
17	2017.1	6.0	44	52	96	204	Imp.	1.0	16.1	204	0.00
18	2018.1	5.5	19	48	67	77	Imp.	1.0	17.1	77	0.00
19	2019.1	8.0	7	90	97	43	Imp.	1.4	18.5	60	0.00
20	2020.1	5.9	23	48	71	105	Imp.	1.0	19.5	105	0.00



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## SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company	Jackson Brothers	Lease	Crew	Well No.					
Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Pt. x Md.	Total Oil Content Bbls./Acre	Average Percent Porosity	Average Percent Oil Saturation	Average Percent Water Saturation	Average Oil Content Bbl./A. Ft.	
<u>Kansas City Limestone</u>									
1912.6 - 1917.5	3.9	11.3	44.09						
<u>Basin Limestone</u>									
2013.0 - 2016.6	3.6	9.2	33.20						
<u>Kansas City Limestone</u>									
1906.0 - 1917.5	11.5	8.0		2,832	44.2	27.5	246		
<u>Basin Limestone</u>									
2013.0 - 2021.0	8.0	5.4		799	25.7	55.6	148		

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## SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Jackson Brothers Lease Crew Well No. 13

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Pt. x Md.
<u>Bartlesville Sandstone</u>			
2506.0 - 2511.0	5.0	1.5	7.40
2511.0 - 2517.0	6.0	5.7	34.50
2506.0 - 2511.0	11.0	3.8	41.90

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
<u>Bartlesville Sandstone</u>						
2504.4 - 2511.0	6.6	15.9	19.1	63.5	234	1,543
2511.0 - 2517.0	6.0	17.2	25.3	58.0	336	2,019
2504.4 - 2517.0	12.6	16.5	22.1	60.8	283	3,562

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Jackson Brothers Lease Crew Well No. 13

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			
					<u>BARFLESVILLE SAND</u>						
1	2504.5	15.0	17	198	0	0	13	198	0	Imp.	-
2	2505.5	14.4	18	201	0	0	18	201	0	Imp.	-
3	2506.5	15.6	20	242	0	0	20	242	0	Imp.	-
4	2507.5	15.1	25	292	2	23	23	269	3	0.166	60
5	2508.5	16.6	18	232	0	0	18	232	0	Imp.	-
6	2509.5	16.8	14	182	0	0	14	182	0	Imp.	-
7	2510.5	16.8	19	287	2	26	17	261	6	0.300	50
8	2511.5	18.4	27	385	8	114	19	271	7	0.250	50
9	2512.5	17.1	27	358	8	106	19	252	11	0.600	50
10	2513.5	18.2	26	367	8	113	18	254	9	0.500	50
11	2514.5	15.7	27	329	0	0	27	329	0	Imp.	-
12	2515.5	18.9	22	323	7	103	15	220	138	1.90	20
13	2516.5	17.2	20	267	1	13	19	254	17	0.500	35

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 2507.0 - 2517.0 Crew 13 Well No. 13

Depth Interval, Feet	2507.0 - 2517.0
Feet of Core Analyzed	7.0
Average Percent Porosity	17.4
Average Percent Original Oil Saturation	23.7
Average Percent Oil Recovery	5.1
Average Percent Residual Oil Saturation	18.6
Average Percent Residual Water Saturation	75.2
Average Percent Total Residual Fluid Saturation	93.8
Average Original Oil Content, Bbls./A. Ft.	325.
Average Oil Recovery, Bbls./A. Ft.	71.
Average Residual Oil Content, Bbls./A. Ft.	254.
Total Original Oil Content, Bbls./Acre	2,279.
Total Oil Recovery, Bbls./Acre	498.
Total Residual Oil Content, Bbls./Acre	1,781.
Average Effective Permeability, Millidarcys	0.602
Average Initial Fluid Production Pressure, p.s.i.	45.0

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

