

Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Jackson Bros. Lease G.K. Jackson Heirs Well No. 13

Location SE SE NW

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

Table with 2 columns: Name of Sand, and values. Rows include Bartlesville, Top of Core (2394.0), Bottom of Core (2413.0), Top of Sand (2403.6), Bottom of Sand (2408.2), Total Feet of Permeable Sand (3.6), and Total Feet of Floodable Sand (2.6).

Distribution of Permeable Sand:

Table with 3 columns: Permeability Range Millidarcys, Feet, and Cum. Ft. Rows show ranges 0-3 and 3 & above with corresponding values.

Table with 2 columns: Property Name and Value. Rows include Average Permeability (4.9), Average Percent Porosity (14.1), Average Percent Oil Saturation (13.5), Average Percent Water Saturation (74.7), Average Oil Content (155), Total Oil Content (2,197), Average Percent Oil Recovery (1.8), Average Oil Recovery (23), Total Oil Recovery (61), Total Calculated Oil Recovery (663), Packer Setting, Viscosity, A. P. I. Gravity, and Elevation.

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 by an employee of Oilfield Research Laboratories.

#### FORMATION CORED

The detailed log of the formation cored is as follows:

<u>Depth Interval,</u> <u>Feet</u>	<u>Description</u>
2394.0 - 2408.2	- Grayish light brown, shaly sandstone.
2408.2 - 2413.0	- Black shale.

Coring was started at a depth of 2394.0 feet in grayish light brown, shaly sandstone and completed at 2413.0 feet in black shale. This core shows a total of 14.2 feet of sandstone. The pay is made up of grayish brown, 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 0.0 and 4.9 millidarcys respectively (See Table III). The permeability of the sand varies from impermeable to a maximum of 8.4 millidarcys.

#### PERCENT SATURATION & OIL CONTENT

The sand in this core shows a low weighted average percent oil saturation, namely, 13.5. The weighted average percent oil saturation of the upper and lower sections is 10.5 and 19.9 respectively. The weighted average percent water saturation of the upper and lower sections is 82.3 and 59.0 respectively; the overall average being 74.7 (See Table III). This gives an overall weighted average total fluid saturation of 88.2 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 the cutting of same.

The weighted average oil content of the upper and lower sections is 105 and 259 barrels per acre foot respectively; the overall average being 155. The total oil content, as shown by this core, is 2,197 barrels per acre of which 1,189 barrels are in the pay sand section (See Table III). The tests show that the pay sand section extends from 2403.6 to 2408.2 feet (lower section).

#### LABORATORY FLOODING TESTS

The sand in this core did not respond satisfactorily to laboratory flooding tests, as a total recovery of only 61 barrels of oil per acre was obtained from 2.6 feet of sand. The weighted average percent oil saturation was reduced from 19.4 to 17.6, or represents an average recovery of 1.8 percent. The weighted average effective permeability of the samples is 0.20 millidarcys, while the average initial fluid production pressure is 50.0 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 14 samples tested, 3 produced water and 2 oil. This indicates that approximately 14 percent of the sand represented by these samples is floodable pay sand.

#### CONCLUSION

From a study of the above data, we estimate that approximately 276

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barrels of oil per acre can be recovered from the area, represented by this core, by efficient primary production methods. An additional recovery of 387 barrels of oil per acre can be expected from efficient water-flooding methods. The following data and assumptions were used in calculating the above oil recovery values:

Original formation volume factor	1.22
Present formation volume factor	-
Irreducible water saturation, percent	42.0
Primary recovery, estimated, percent	None
Present oil saturation, percent	49.4
Average porosity, percent	16.6
Oil saturation after flooding, percent	17.6
Performance factor	0.55
Net floodable pay sand, feet	2.6

This core shows a shaly sand section having a high water saturation and a low oil saturation and permeability. In fact, only 3.6 feet of the sand was permeable.

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**RESULTS OF SATURATION & PERMEABILITY TESTS**

**TABLE 1-B**

Company Jackson Brothers Lease G.K. Jackson Heirs Well No. 13

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	2394.1	14.8	8	86	94	92	Imp.	0.6	0.6	55	0.00
2	2395.1	13.4	2	96	98	21	Imp.	1.0	1.6	21	0.00
3	2396.1	10.8	1	97	98	8	Imp.	1.0	2.6	8	0.00
4	2397.1	16.1	13	76	89	162	Imp.	1.0	3.6	162	0.00
5	2398.1	11.4	14	83	97	124	Imp.	1.0	4.6	124	0.00
6	2399.1	8.3	22	74	96	142	Imp.	1.0	5.6	142	0.00
7	2400.1	18.2	13	75	88	183	Imp.	1.0	6.6	183	0.00
8	2401.1	15.2	15	67	82	177	Imp.	1.0	7.6	177	0.00
9	2402.1	11.8	7	83	90	64	Imp.	1.0	8.6	64	0.00
10	2403.1	10.3	9	87	96	72	Imp.	1.0	9.6	72	0.00
11	2404.1	16.6	20	57	77	257	1.5	1.0	10.6	257	1.50
12	2405.1	15.7	15	64	79	183	2.6	1.0	11.6	183	2.60
13	2406.1	18.4	26	59	85	371	Imp.	1.0	12.6	371	0.00
14	2407.1	16.0	19	57	76	236	8.4	1.6	14.2	378	13.44
								<b>Total</b>	-----	<b>2,197</b>	

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**SUMMARY OF PERMEABILITY & SATURATION TESTS**

**TABLE III**

Company Jackson Brothers Lease G.K. Jackson Heirs Well No. 13

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
2403.6 - 2408.2	3.6	4.9	17.54

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
2394.0 - 2403.6	9.6	13.0	10.5	82.3	105	1,008
2403.6 - 2408.2	4.6	16.6	19.9	59.0	259	1,189
2394.0 - 2408.2	14.2	14.1	13.5	74.7	155	2,197

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Jackson Bros. Lease G.K. Jackson Heirs Well No. 13

Sample No.	Depth, Feet	Effective Porosity Percent	Original Oil Saturation		Oil Recovery		Residual Saturation			Volume of Water Recovered cc <sup>a</sup>	Effective Permeability $\frac{\text{mD-cm}^2}{\text{cm}}$ <sup>cc</sup>	Initial Fluid Production Pressure Lbs./Sq./In.
			%	Ehh./A. Ft.	%	Ehh./A. Ft.	S <sub>Oil</sub>	S <sub>Water</sub>	Ehh./A. Ft.			
1	2394.1	14.4	9	101	0	0	9	88	101	None	Imp.	-
2	2395.1	13.7	1	11	0	0	1	98	11	None	Imp.	-
3	2396.1	10.4	3	24	0	0	3	95	24	None	Imp.	-
4	2397.1	15.6	11	133	0	0	11	82	133	None	Imp.	-
5	2398.1	11.7	12	109	0	0	12	86	109	None	Imp.	-
6	2399.1	8.8	20	137	0	0	20	78	137	None	Imp.	-
7	2400.1	17.8	10	138	0	0	10	84	138	None	Imp.	-
8	2401.1	15.5	12	144	0	0	12	75	144	None	Imp.	-
9	2402.1	11.4	9	80	0	0	9	85	80	None	Imp.	-
10	2403.1	10.7	6	50	0	0	6	92	50	None	Imp.	-
11	2404.1	17.0	20	264	3	40	17	78	224	3	0.20	50
12	2405.1	16.1	16	200	0	0	16	82	200	3	0.20	50
13	2406.1	17.9	23	319	0	0	23	75	319	None	Imp.	-
14	2407.1	16.4	19	242	1	13	18	80	229	3	0.20	50

Notes: cc—cubic centimeter.

<sup>a</sup>—Volume of water recovered at the time of maximum oil recovery.

<sup>cc</sup>—Determined by passing water through sample which still contains residual oil.

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## SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

Company <u>Jackson Bros.</u>	Lease <u>G.K. Jackson Heirs</u>	Well No. <u>13</u>
Depth Interval, Feet	2403.6 - 2408.2	
Feet of Core Analyzed	2.6	
Average Percent Porosity	16.6	
Average Percent Original Oil Saturation	19.4	
Average Percent Oil Recovery	1.8	
Average Percent Residual Oil Saturation	17.6	
Average Percent Residual Water Saturation	79.2	
Average Percent Total Residual Fluid Saturation	96.8	
Average Original Oil Content, Bbls./A. Ft.	250.	
Average Oil Recovery, Bbls./A. Ft.	23.	
Average Residual Oil Content, Bbls./A. Ft.	227.	
Total Original Oil Content, Bbls./Acre	651.	
Total Oil Recovery, Bbls./Acre	61.	
Total Residual Oil Content, Bbls./Acre	590.	
Average Effective Permeability, Millidarcys	0.20	
Average Initial Fluid Production Pressure, p.s.i.	50.0	

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 G.K. Jackson Heirs Well No. 13

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Percent Water Saturation	
			Connate	Drilling & Foreign
1	2394.1	108,800		
2	2395.1	103,000		
3	2396.1	102,750		
4	2397.1	93,700		
5	2398.1	94,400		
6	2399.1	48,550		
7	2400.1	85,000		
8	2401.1	95,500		
9	2402.1	116,800		
10	2403.1	97,300		
11	2404.1	95,500		
12	2405.1	104,200		
13	2406.1	107,800		
14	2407.1	74,900		

Note: ppm — parts per million

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SUMMARY OF WATER DIFFERENTIATION TESTS

TABLE VII

Company Jackson Bros. Lease G.K. Jackson Heirs Well No. 13

<u>Depth Interval, Feet</u>	<u>Chloride Content of Brine in Sand, ppm</u>	<u>Average Percent Connate Water</u>	<u>Average Percent Drilling &amp; Foreign Water</u>
2394.0 - 2403.6	93,990		
2403.6 - 2408.2	92,891		
2394.0 - 2408.2	93,634		

Note: ppm -- parts per million.