

Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Look up 10  
elevation  
1362

Company Jackson Bros. Lease G. K. Jackson Heirs Well No. 10

Location SE NE NW

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

Name of Sand	Cattleman	Bartlesville
Top of Core	2311.0	2377.0
Bottom of Core	2338.0	2408.0
Top of Sand	2313.2	2390.2
Bottom of Sand	2338.0	2403.5
Total Feet of Permeable Sand	7.7	13.3
Total Feet of Floodable Sand	1.0	13.3

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

	Feet	Cum. Ft.
Cattleman	2 - 5	4.6
	5 - 13	7.7
Bartlesville	0 - 6	6.4
	18 - 30	11.4
	30 & above	13.3

Average Permeability Millidarcys	5.5	17.4
Average Percent Porosity	14.5	18.1
Average Percent Oil Saturation	17.3	29.4
Average Percent Water Saturation	63.3	52.6
Average Oil Content, Bbls./A. Ft.	188.	411.
Total Oil Content, Bbls./Acre	2,092.	5,473.
Average Percent Oil Recovery by Laboratory Flooding Tests	2.0	9.4
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	23.	131.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	23.	1,747.
Total Calculated Oil Recovery, Bbls./Acre	430.	3,900.
Packer Setting, Feet		
Viscosity, Centipoises @		
A. P. I. Gravity, degrees @ 60 °F		
Elevation, Feet		

Fresh water mud was used as the circulating fluid while taking this core. The core was sampled and the samples sealed in cans by a representative of Oilfield Research Laboratories. The well was drilled in virgin territory. The Cattleman sand does not appear to have any water-flood potential. The following discussion will cover only the Bartlesville Sand.

#### FORMATION CORED

The detailed log of the formation cored is as follows:

<u>Depth Interval,</u> <u>Feet</u>	<u>Description</u>
	<u>CATTLEMAN</u>
2311.0 - 2313.2	Sandy shale.
2313.2 - 2317.3	Gray shaly sandstone.
2317.3 - 2331.0	Sandy shale.
2331.0 - 2333.0	Gray shaly sandstone.
2333.0 - 2338.0	Grayish light brown, shaly sandstone.
2338.0 - 2377.0	Drilled.

#### BARTLESVILLE

2377.0 - 2390.2	Sandy shale.
2390.2 - 2403.5	Light brown, slightly shaly sandstone.
2403.5 - 2408.0	Shale.

Coring was started at a depth of 2377.0 feet in sandy shale and completed at 2408.0 feet in shale. This core shows a total of 13.3 feet of sandstone. For the most part, the pay is made up of light brown, slightly shaly sandstone.

#### PERMEABILITY

The weighted average permeability of the Bartlesville section is 17.4 millidarcys (See Table III). By observing the data given on the coregraph, it is noticeable that the sand has a rather irregular permeability profile. The permeability of the sand varies from 0.98 to a

maximum of 49. millidarcys.

#### PERCENT SATURATION & OIL CONTENT

The sand in this core shows a good weighted average percent oil saturation, namely, 29.4. The weighted average percent water saturation is 52.6 (See Table III). This gives an overall weighted average total fluid saturation of 82.0 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 did occur; because, in general, the zones of higher permeability show a lower chloride content.

The weighted average oil content of the section is 411 barrels per acre foot. The total oil content, as shown by this core, is 5,473 barrels per acre (See Table III).

#### LABORATORY FLOODING TESTS

The sand in this core responded to laboratory flooding tests, as a total recovery of 1,747 barrels of oil per acre was obtained from 13.3 feet of sand. The weighted average percent oil saturation was reduced from 29.4 to 20.0, or represents an average recovery of 9.4 percent. The weighted average effective permeability of the samples is 2.14 millidarcys, while the average initial fluid production pressure is 23.8 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 13 samples tested, all produced water and oil. This indicates that approximately 100 percent of the sand represented by these samples is floodable pay sand. The tests also show that the sand has a fairly uniform effective permeability to water.

CONCLUSION

The results of the laboratory tests indicate that efficient primary and secondary operations in the vicinity of this well should recover approximately 1,840 and 2,060 barrels of oil per acre from the Bartlesville zone respectively. An additional 430 barrels of oil per acre could be recovered from the Cattleman zone by efficient primary operations. The following data and assumptions were used in calculating the foregoing recovery values:

	<u>Cattleman</u>	<u>Bartlesville</u>
Original formation volume factor	1.19	1.22
Reservoir water saturation, percent	-	40.0
Expected primary recovery, estimated, percent	10.0	12.0
Average porosity, percent	13.1	18.1
Oil saturation after flooding, percent	-	20.0
Performance factor, percent	-	55.0
Net floodable pay sand, feet	0	13.3

The Cattleman core shows a rather shaly pay section having a somewhat low oil saturation, a high water saturation and a low permeability.

The Bartlesville zone shows a pay section having a good oil saturation, a moderate water saturation and a fairly uniform effective permeability to water.

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-3

Company Jackson Bros. Lease G.K. Jackson Heirs Well No. 10

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 rd.
			Oil	Water	Total			Ft.	Cum. Ft.		
<u>CATTLEMAN</u>											
1	2314.1	16.5	13	65	78	167	6.9	1.4	1.4	234	9.66
2	2315.1	16.5	8	68	76	103	5.0	1.0	2.4	103	5.00
3	2316.1	18.7	10	76	86	145	7.8	1.0	3.4	145	7.80
4	2317.1	17.9	9	49	58	125	13.	0.7	4.1	88	9.10
5	2331.1	13.6	24	59	83	254	Imp.	0.6	4.7	152	0.00
6	2332.1	11.4	16	64	80	142	Imp.	1.4	6.1	199	0.00
7	2333.1	13.8	28	50	78	300	2.2	0.6	6.7	180	1.32
8	2334.1	13.5	25	57	82	262	2.3	1.0	7.7	262	2.30
9	2335.1	13.4	22	61	83	229	3.3	1.0	8.7	229	3.30
10	2336.1	15.3	23	54	77	274	3.9	1.0	9.7	274	3.90
11	2337.1	10.9	19	76	95	161	Imp.	1.4	11.1	226	0.00
<u>BARTLESVILLE</u>											
12	2391.1	16.0	35	59	94	435	1.3	1.4	1.4	609	1.82
13	2392.1	19.6	23	53	76	350	2.1	1.0	2.4	350	2.10
14	2393.1	19.8	33	45	78	507	18.	1.0	3.4	507	18.00
15	2394.1	16.1	31	61	92	387	30.	1.0	4.4	387	30.00
16	2395.1	18.1	26	49	75	365	4.1	1.0	5.4	365	4.10
17	2396.1	18.1	26	51	77	365	5.4	1.0	6.4	365	5.40
18	2397.1	15.9	28	57	85	345	27.	1.0	7.4	345	27.00
19	2398.1	19.5	33	50	83	499	29.	1.0	8.4	499	29.00
20	2399.1	20.2	25	52	77	392	27.	1.0	9.4	392	27.00
21	2400.1	17.6	31	48	79	423	0.98	1.0	10.4	423	0.98
22	2401.1	15.5	28	57	85	337	2.4	1.0	11.4	337	2.40
23	2402.1	19.0	37	55	92	546	49.	1.0	12.4	546	49.00
24	2403.1	21.7	23	44	67	387	39.	0.9	13.3	348	35.10

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**SUMMARY OF PERMEABILITY & SATURATION TESTS**

**TABLE III**

Company Jackson Bros. Lease G.K. Jackson Heirs Well No. 10

	Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
<u>Cattleman</u>	2313.2 - 2338.0	7.7	5.5	42.38
<u>Bartlesville</u>	2390.2 - 2403.5	13.3	17.4	231.90

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 Bbl./Acres
			<u>Cattleman</u>			
2313.2 - 2338.0	11.1	14.5	17.3	63.3	188	2,092
			<u>Bartlesville</u>			
2390.2 - 2403.5	13.3	18.1	29.4	52.6	411	5,473

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Jackson Bros. G.K. Johnson Heirs Well No. 10

Sample No.	Depth, Feet	Initial Permeability, Darcys	Original Oil Saturation		Oil Recovery		Residual Saturation			Volume of Water Recovered, cc	Initial Permeability, Darcys	Initial Permeability, Darcys
			%	ml/A.F.	%	ml/A.F.	% Oil	% Water	ml/A.F.			
<u>CATTLEMAN</u>												
1	2314.1	16.8	13	169	0	0	13	66	169	71	1.90	20
2	2315.1	17.0	8	106	0	0	8	90	106	66	1.40	20
3	2316.1	18.4	9	128	0	0	9	82	128	62	1.30	20
4	2317.1	18.2	11	155	0	0	11	87	155	190	5.00	20
5	2331.1	14.0	23	250	0	0	23	76	250	10	0.300	50
6	2332.1	11.2	18	156	0	0	18	63	156	0	Imp.	-
7	2333.1	14.2	29	319	0	0	29	52	319	8	0.300	50
8	2334.1	13.4	25	260	0	0	25	56	260	0	Imp.	-
9	2335.1	13.8	24	257	0	0	24	68	257	7	0.600	50
10	2336.1	15.1	23	269	2	23	21	68	246	7	0.600	50
11	2337.1	11.3	20	175	0	0	20	77	175	0	Imp.	-
<u>BARTLESVILLE</u>												
12	2391.1	16.5	35	448	18	230	17	82	218	21	0.700	30
13	2392.1	19.5	23	348	5	76	18	78	272	64	1.70	20
14	2393.1	19.5	33	499	14	212	19	80	287	57	1.50	30
15	2394.1	16.4	31	394	14	178	17	81	216	123	3.90	20
16	2395.1	18.3	26	369	7	99	19	79	270	122	3.80	20
17	2396.1	18.6	26	375	5	72	21	78	303	123	4.20	20
18	2397.1	16.2	28	351	11	138	17	81	213	20	0.500	30
19	2398.1	19.6	33	501	9	137	24	75	364	71	2.00	20
20	2399.1	20.0	25	388	7	109	18	79	279	35	1.10	30
21	2400.1	17.5	31	420	7	95	24	72	325	15	0.400	30
22	2401.1	16.0	28	347	2	25	26	72	322	103	2.00	20
23	2402.1	19.4	37	556	13	195	24	75	361	143	3.70	20
24	2403.1	21.3	23	380	6	99	17	78	281	126	2.80	20

Notes: cc—cubic centimeter.

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

ca—Determined by passing water through sample which still contains residual oil.

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SUMMARY OF LABORATORY FLOORING TESTS

TABLE V

Company	Jackson Bros.	G.K. Jackson Heirs	Well No. 10
	CATTLEMAN	BARTLESVILLE	
Depth Interval, Feet	2313.2 - 2338.0	2390.2 - 2403.5	
Feet of Core Analyzed	1.0	13.3	
Average Percent Porosity	15.1	18.3	
Average Percent Original Oil Saturation	23.0	29.4	
Average Percent Oil Recovery	2.0	9.4	
Average Percent Residual Oil Saturation	21.0	20.0	
Average Percent Residual Water Saturation	68.0	77.8	
Average Percent Total Residual Fluid Saturation	89.0	97.8	
Average Original Oil Content, Bbls./A. Ft.	269.	415.	
Average Oil Recovery, Bbls./A. Ft.	23.	131.	
Average Residual Oil Content, Bbls./A. Ft.	246.	284.	
Total Original Oil Content, Bbls./Acre	269.	5,517.	
Total Oil Recovery, Bbls./Acre	23.	1,747.	
Total Residual Oil Content, Bbls./Acre	246.	3,770.	
Average Effective Permeability, Millidarcys	0.600	2.14	
Average Initial Fluid Production Pressure, p.s.i.	50.0	23.8	

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. 10

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Percent Water Saturation		Total
			Connate	Drilling & Foreign	
1	2314.1	104,750			
2	2315.1	124,000			
3	2316.1	90,000			
4	2317.1	57,550			
5	2331.1	133,750			
6	2332.1	111,250			
7	2333.1	125,600			
8	2334.1	129,150			
9	2335.1	102,250			
10	2336.1	101,900			
11	2337.1	130,400			
12	2391.1	101,400			
13	2392.1	83,850			
14	2393.1	64,300			
15	2394.1	64,000			
16	2395.1	83,100			
17	2396.1	62,800			
18	2397.1	98,000			
19	2398.1	72,850			
20	2399.1	50,800			
21	2400.1	91,300			
22	2401.1	99,750			
23	2402.1	18,250			
24	2403.1	31,050			

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. 10

<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>
2313.2 - 2338.0	110,400		
2390.2 - 2403.5	72,000		

Note: ppm — parts per million.