(10)

Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Jackson Bros. Lease G. K. Jackson Heirs Well No. 6

Location NW SE NW

Section 23 Twp. 25S Rge. ~~9E~~ 8E County Greenwood State Kansas

Name of Sand	Bartlesville
Top of Core	2359.0
Bottom of Core	2375.7
Top of Pay Sand	2359.5
Bottom of Sand	2375.0
Total Feet of Permeable Sand	14.5
Total Feet of Floodable Sand	12.5

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 5	2.0	2.0
5 - 10	4.1	6.1
10 - 20	2.0	8.1
20 - 30	2.0	10.1
30 & above	4.4	14.5

Average Permeability Millidarcys	18.2
Average Percent Porosity	17.8
Average Percent Oil Saturation	29.2
Average Percent Water Saturation	41.7
Average Oil Content, Bbls./A. Ft.	399.
Total Oil Content, Bbls./Acre	6,386.
Average Percent Oil Recovery by Laboratory Flooding Tests	11.1
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	166.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	1,741.
Total Calculated Oil Recovery, Bbls./Acre - (Primary & Secondary)	4,525.
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 by a representative of Oilfield Research Laboratories.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
2359.0 - 2359.5	Hard, light brown, fine grained sandstone.
2359.5 - 2375.0	Grayish brown, fine grained, slightly shaly sandstone.
2375.0 - 2375.7	Black shale.

Coring was started at a depth of 2359.0 feet in hard, light brown, fine grained sandstone and completed at 2375.7 feet in black shale. This core shows a total of 16.0 feet of sandstone. For the most part, the pay is made up of grayish brown, fine grained, 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 16.0 and 19.4 millidarcys respectively; the overall average being 18.2 (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 impermeable to a maximum of 44. millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a fairly low weighted average percent oil saturation, namely, 29.2. The weighted average percent oil saturation of the upper and lower sections is 27.0 and 30.8 respectively. The weighted average percent water saturation of the upper and lower sections is 42.5 and 41.2 respectively; the overall average being 41.7 (See Table

III). This gives an overall weighted average total fluid saturation of 70.9 percent. This low total fluid saturation indicates considerable fluid was lost during coring which was probably oil.

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 upper and lower sections is 347 and 428 barrels per acre foot respectively; the overall average being 399. The total oil content, as shown by this core, is 6,386 barrels per acre (See Table III).

LABORATORY FLOODING TESTS

When taking into consideration that the sand in the core has a fairly low oil saturation, it responded very well to laboratory flooding tests, as a total recovery of 1,741 barrels of oil per acre was obtained from 10.5 feet of sand. The weighted average percent oil saturation was reduced from 29.0 to 17.9, or represents an average recovery of 11.1 percent. The weighted average effective permeability of the samples is 3.3 millidarcys, while the average initial fluid production pressure is 35.5 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 16 samples tested, 12 produced water and 10 oil. This indicates that approximately 62 percent of the sand represented by these samples is floodable pay sand. The tests also show that the sand has a rather wide variation in permeability.

CONCLUSION

From a study of the above data, it is estimated that approximately 1,850 barrels of oil per acre can be recovered from the area, represented

by this core, by efficient primary production methods. An additional oil recovery of 2,675 barrels of oil per acre or an average of 214 barrels per acre foot can be expected by efficient water-flooding. The following data and assumptions were used in calculating the above oil recovery values:

Original formation volume factor	1.20
Irreducible water saturation, percent	34.0
Primary recovery, estimated, percent	None.
Present oil saturation, percent	57.2
Average porosity, percent	19.1
Oil saturation after flooding, percent	17.9
Performance factor, percent	55.0
Net floodable pay sand, feet	12.5

This core shows a rather clean sand section having a fairly low oil saturation, a moderate water saturation and a wide variation in permeability. No doubt considerable oil was forced out of the sand in the core by solution gas as the core was removed from the well. Of course some drilling water would replace part of the oil.

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Jackson Bros. Lease G.W. Jackson Heirs Well No. 6

Sample No.	Depth, Feet	Effective Porosity Percent	Percent Saturation			Oil Content Bbls. / A Ft.	Perm., Millidarcys	Feet of Sand		Total Oil Content	Perm. Capacity Ft. X md.
			Oil	Water	Total			Ft.	Cum. Ft.		
1	2359.1	7.2	40	48	88	223	Imp.	0.5	0.5	111	0.00
2	2360.1	20.7	19	41	60	305	5.0	1.1	1.6	336	5.50
3	2361.1	20.4	35	45	80	554	27.	1.0	2.6	554	27.00
4	2362.1	20.0	17	46	63	284	35.	1.0	3.6	284	35.00
5	2363.1	18.1	28	42	70	393	11.	1.0	4.6	393	11.00
6	2364.1	17.2	34	42	76	453	3.3	1.0	5.6	453	3.30
7	2365.1	13.9	23	58	81	248	Imp.	1.0	6.6	248	0.00
8	2366.1	18.0	38	41	79	530	21.	1.0	7.6	530	21.00
9	2367.1	18.5	26	41	67	373	35.	1.0	8.6	373	35.00
10	2368.1	19.8	25	47	72	383	7.9	1.0	9.6	383	7.90
11	2369.1	17.5	37	40	77	501	11.	1.0	10.6	501	11.00
12	2370.1	13.8	27	51	78	288	0.30	1.0	11.6	288	0.30
13	2371.1	14.9	31	47	78	358	9.7	1.0	12.6	358	9.70
14	2372.1	18.6	34	34	68	490	44.	1.0	13.6	490	44.00
15	2373.1	18.0	34	37	71	474	5.6	1.0	14.6	474	5.60
16	2374.1	21.5	27	35	62	450	34.	1.4	16.0	630	47.60
								Total------		- 6,386	

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Jackson Bros. Lease G.K. Jackson Heirs Well No. 6

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
2359.5 - 2364.6	5.1	16.0	81.80
2365.6 - 2375.0	9.4	19.4	182.10
2359.5 - 2375.0	14.5	18.2	263.90

Depth Interval, Feet	Feet of Core Analyzed	Average Percent Porosity	Average Percent Oil Saturation	Average Percent Water Saturation	Average Oil Content Bbl./Ac. Ft.	Total Oil Content Bbls./Acre
2359.0 - 2365.6	6.6	17.6	27.0	42.5	347	2,359
2365.6 - 2375.0	9.4	18.0	30.8	41.2	428	4,027
2359.0 - 2375.0	16.0	17.8	29.2	41.7	399	6,386

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RESULTS OF LABORATORY FLOODING TESTS

Sheet 27

Property Jackson Bros. Lease G.T. Jackson Heirs Well No. 6

Sample No.	Depth, Feet	Formation Porosity Percent	Original Oil Saturation		Oil Recovery		Residual Saturation			Volume of Water Recovered cc*	Relative Permeability Ratio**	Initial Field Production Pressure Lbs./Sq./In.
			%	Bbls/A.Ft.	%	Bbls/A.Ft.	% Oil	% Water	Bbls/A.Ft.			
1	2359.1	6.8	37	195	0	0	37	52	195	0	Imp.	-
2	2360.1	20.2	19	297	2	31	17	75	266	10	0.300	50
3	2361.1	20.8	35	565	12	194	23	76	371	116	2.10	40
4	2362.1	20.5	17	271	2	32	15	81	239	217	6.00	30
5	2363.1	17.5	26	353	0	0	26	47	353	0	Imp.	-
6	2364.1	17.5	30	407	0	0	30	49	407	0	Imp.	-
7	2365.1	14.2	21	231	0	0	21	72	231	0	Imp.	-
8	2366.1	17.6	38	519	15	205	23	73	314	13	0.300	50
9	2367.1	19.0	26	383	10	147	16	76	236	88	2.30	30
10	2368.1	19.9	25	386	10	154	15	81	232	183	4.50	30
11	2369.1	17.9	37	514	13	181	24	61	333	8	0.300	50
12	2370.1	14.1	26	284	0	0	26	70	284	9	0.300	50
13	2371.1	15.3	27	321	0	0	27	63	321	7	0.200	50
14	2372.1	18.9	34	499	19	279	15	77	220	90	1.80	30
15	2373.1	18.2	34	480	17	240	17	72	240	30	0.600	30
16	2374.1	21.0	27	440	12	196	15	81	244	233	11.00	20

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 Bros. Lease S.K. Jackson Heirs Well No. 6

Depth Interval, Feet	2359.5 - 2362.6	2365.6 - 2475.0	2359.5 - 2475.0
Feet of Core Analyzed	3.1	7.4	10.5
Average Percent Porosity	20.5	19.0	19.5
Average Percent Original Oil Saturation	23.5	31.3	29.0
Average Percent Oil Recovery	5.2	13.6	11.1
Average Percent Residual Oil Saturation	18.3	17.7	17.9
Average Percent Residual Water Saturation	77.2	74.8	75.5
Average Percent Total Residual Fluid Saturation	95.5	92.5	93.4
Average Original Oil Content, Bbls./A. Ft.	375.	459.	435.
Average Oil Recovery, Bbls./A. Ft.	84.	200.	166.
Average Residual Oil Content, Bbls./A. Ft.	291.	259.	269.
Total Original Oil Content, Bbls./Acre	1,163.	3,398.	4,561.
Total Oil Recovery, Bbls./Acre	260.	1,481.	1,741.
Total Residual Oil Content, Bbls./Acre	903.	1,917.	2,820.
Average Effective Permeability, Millidarcys	3.0	3.4	3.3
Average Initial Fluid Production Pressure, p.s.i.	41.0	33.5	35.5

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. 6

Sample No.	Depth, Feet	Chloride Content of Water in Sand ppm	Percent Water Saturation		
			Connate	Drilling & Foreign	Total
1	2359.1	169,600			
2	2360.1	90,500			
3	2361.1	66,900			
4	2362.1	75,300			
5	2363.1	109,100			
6	2364.1	113,500			
7	2365.1	112,200			
8	2366.1	108,100			
9	2367.1	122,700			
10	2368.1	69,600			
11	2369.1	124,000			
12	2370.1	135,900			
13	2371.1	110,100			
14	2372.1	120,700			
15	2373.1	122,600			
16	2374.1	69,750			

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. 6

Depth Interval, Feet	Chloride Content of Water in Sand, ppm	Average Percent Connate Water	Average Percent Drilling & Foreign Water
2359.0 - 2365.6	100,167		
2365.6 - 2375.0	107,904		
2359.0 - 2375.0	104,712		

Note: ppm — parts per million.