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Oilfield Research Laboratories

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Elevation

GENERAL INFORMATION & SUMMARY

Company Jackson Brothers Lease Crews Well No. 6

Location NW¼, NE¼, NE¼

Section 3 Twp. 26S Rge. 8E County Greenwood State Kansas

Name of Sand	Bartlesville
Top of Core	2525.0
Bottom of Core	2548.0
Permeable Top of Sand	2533.0
Permeable Bottom of Sand	2543.5
Total Feet of Permeable Sand	8.8
Total Feet of Floodable Sand	2.6

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 1	2.2	2.2
1 - 2	2.7	4.9
2 - 4	1.0	5.9
4 & above	2.9	8.8

Average Permeability Millidarcys	2.6
Average Percent Porosity	16.1
Average Percent Oil Saturation	16.3
Average Percent Water Saturation	68.2
Average Oil Content, Bbls./A. Ft.	205.
Total Oil Content, Bbls./Acre	3,575.
Average Percent Oil Recovery by Laboratory Flooding Tests	4.1
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	60.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	155.
Total Calculated Oil Recovery, Bbls./Acre	1,220.
Packer Setting, Feet	
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F	
Elevation, Feet	

This well was drilled in virgin territory. A fresh water mud was used as the circulating fluid during the coring of the sand.

This core was sampled and the samples were sealed in cans by a representative of Oilfield Research Laboratories.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
2525.0 - 2529.0	Gray shaley sandstone.
2529.0 - 2533.0	Gray and light brown laminated shaley sandstone.
2533.0 - 2537.3	Light brown slightly laminated shaley sandstone.
2537.3 - 2543.5	Grayish light brown laminated shaley sandstone.
2543.5 - 2544.8	Gray laminated shaley sandstone.
2544.8 - 2546.2	Gray shaley sandstone.
2546.2 - 2548.0	Gray shale.

Coring was started at a depth of 2525.0 feet in gray shaley sandstone and completed at 2548.0 feet in gray shale. This core shows a total of 21.0 feet of sandstone. For the most part, the pay is made up of laminated shaley 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 1.9 and 3.2 millidarcys respectively; the overall average being 2.6 (See Table III). By observing the data given on the coregraph, it is noticeable that the sand is very tight. The permeability of the sand varies from 0.58 to a maximum of 11 millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a low weighted average percent oil sat-

uration, namely, 16.3. The weighted average percent oil saturation of the upper and lower sections is 12.7 and 20.7 respectively. The weighted average percent water saturation of the upper and lower sections is 72.6 and 63.0 respectively; the overall average being 68.2 (See Table III). This gives an overall weighted average total fluid saturation of 84.5 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 chloride content of the water in the sand was comparatively uniform indicating that the sand was not flushed excessively.

The weighted average oil content of the upper and lower sections is 153 and 270 barrels per acre foot respectively; the overall average being 205. The total oil content, as shown by this core, is 3,575 barrels per acre (See Table III).

LABORATORY FLOODING TESTS

Part of the sand in this core responded fairly well to laboratory flooding tests, as a total recovery of 155 barrels of oil per acre was obtained from 2.6 feet of sand. The weighted average percent oil saturation was reduced from 20.0 to 15.9, or represents an average recovery of 4.1 percent. The weighted average effective permeability of the samples is 0.451 millidarcys, while the average initial fluid production pressure is 38.3 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 18 samples tested, 4 produced water and 3 oil. This indicates that approximately 22 percent of the sand represented by these samples will take water. The tests also show that the sand is tight.

CONCLUSION

From a study of the enclosed data, we believe that efficient hydraulic fracturing and primary production methods will recover approximately 870 barrels of oil per acre from the area of which this core is representative. An additional recovery of approximately 350 barrels of oil per acre may be achieved by an efficient water-flood within the vicinity of this well, providing fracturing does not cause channeling or by-passing of the water. The following factors and assumptions were used in calculating this recovery:

Original formation volume factor	1.19
True water saturation, percent	45.0
Primary oil recovery	None
Calculated present oil recovery, percent	46.1
Porosity, percent	19.0
Oil saturation at abandonment, percent	20.0
Performance factor, percent	55.0

This core shows a shaley sand section having low oil and high water saturations. The analysis results show 2.6 feet of floodable sand in the cored section. It is evident that the pay sand is in the interval extending from 2533.0 to 2543.5 feet.

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RESULTS OF PERMEABILITY TESTS

TABLE I

Company Jackson Brothers Lease Crews Well No. 6

Sample No.	Depth Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
1	2527.2	Imp.	0.5	0.5	0.00
2	2527.7	Imp.	0.4	0.9	0.00
3	2528.1	Imp.	0.5	1.4	0.00
4	2528.6	Imp.	0.4	1.8	0.00
5	2528.9	Imp.	0.2	2.0	0.00
6	2529.4	1.5	0.7	2.7	1.05
7	2529.9	Imp.	0.5	3.2	0.00
8	2530.4	Imp.	0.5	3.7	0.00
9	2530.9	Imp.	0.5	4.2	0.00
10	2531.4	Imp.	0.5	4.7	0.00
11	2531.9	Imp.	0.5	5.2	0.00
12	2532.4	Imp.	0.5	5.7	0.00
13	2532.9	Imp.	0.3	6.0	0.00
14	2533.4	0.97	0.7	6.7	0.68
15	2533.9	2.3	0.5	7.2	1.15
16	2534.4	1.9	0.5	7.7	0.95
17	2534.9	1.1	0.5	8.2	0.55
18	2535.4	0.58	0.5	8.7	0.29
19	2535.9	4.2	0.5	9.2	2.10
20	2536.4	3.1	0.5	9.7	1.55
21	2536.9	4.6	0.6	10.3	2.76
22	2537.4	Imp.	0.4	10.7	0.00
23	2537.9	1.1	0.5	11.2	0.55
24	2538.4	Imp.	0.5	11.7	0.00
25	2538.9	0.84	0.5	12.2	0.42
26	2539.4	1.4	0.5	12.7	0.70
27	2539.9	4.3	0.5	13.2	2.15
28	2540.4	4.1	0.5	13.7	2.05
29	2540.9	Imp.	0.5	14.2	0.00
30	2541.4	Imp.	0.5	14.7	0.00
31	2541.9	Imp.	0.5	15.2	0.00
32	2542.4	0.64	0.5	15.7	0.32
33	2542.9	4.1	0.5	16.2	2.05
34	2543.4	11.	0.3	16.5	3.30
35	2544.9	Imp.	0.4	16.9	0.00
36	2545.4	Imp.	0.5	17.4	0.00

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RESULTS OF SATURATION TESTS

TABLE II

Company Jackson Brothers Lease Crews Well No. 6

Sat. No.	Depth, Feet	Effective Porosity Percent	Percent Saturation			Oil Content Bbls./A. Ft.	Feet of Core		Total Oil Content Bbls./Acre
			Oil	Water	Total		Ft.	Cum. Ft.	
1	2527.4	9.5	12	82	94	89	0.9	0.9	80
2	2528.3	13.4	10	67	77	104	1.1	2.0	114
3	2529.1	20.2	12	67	79	188	0.6	2.6	113
4	2530.1	14.4	13	82	95	145	1.0	3.6	145
5	2531.1	17.2	11	73	84	147	1.0	4.6	147
6	2532.1	14.7	16	77	93	182	1.4	6.0	255
7	2533.1	14.4	13	68	81	145	0.6	6.6	87
8	2534.1	17.0	12	73	85	158	1.0	7.6	158
9	2535.1	18.5	15	60	75	215	1.0	8.6	215
10	2536.1	16.7	12	73	85	156	1.0	9.6	156
11	2537.1	19.7	15	54	69	229	0.7	10.3	160
12	2538.1	15.2	22	63	85	260	1.3	11.6	338
13	2539.1	16.2	29	63	92	365	1.0	12.6	365
14	2540.1	18.4	18	61	79	257	1.0	13.6	257
15	2541.1	14.2	18	73	91	198	1.0	14.6	198
16	2542.1	18.4	19	64	83	272	1.0	15.6	272
17	2543.1	18.3	26	51	77	369	0.9	16.5	332
18	2545.1	15.4	17	71	88	203	0.9	17.4	183
							Total-	- - - - -	-3,575

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Jackson Brothers Lease Crews Well No. 6

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
2529.0 - 2536.6	4.3	1.9	8.01
2536.6 - 2543.5	4.5	3.2	14.61
2529.0 - 2543.5	8.8	2.6	22.62

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
2527.0 - 2536.6	9.6	15.5	12.7	72.6	153	1,470
2536.6 - 2545.7	7.8	16.8	20.7	63.0	270	2,105
2527.0 - 2545.7	17.4	16.1	16.3	68.2	205	3,575

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Jackson Brothers Lease Crews Well No. 6

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	2527.4	9.7	9	68	0	0	9	87	68	0	Imp.	50+
2	2528.3	13.8	14	150	0	0	14	79	150	0	Imp.	50+
3	2529.1	20.4	15	238	0	0	15	73	238	0	Imp.	50+
4	2530.1	14.8	10	115	0	0	10	82	115	0	Imp.	50+
5	2531.1	17.0	8	105	0	0	8	79	105	0	Imp.	50+
6	2532.1	14.8	15	172	0	0	15	75	172	0	Imp.	50+
7	2533.1	13.9	17	183	0	0	17	70	183	0	Imp.	50+
8	2534.1	17.4	16	216	0	0	16	82	216	0	Imp.	50+
9	2535.1	18.1	16	225	0	0	16	74	225	0	Imp.	50+
10	2536.1	17.2	14	187	0	0	14	79	187	0	Imp.	50+
11	2537.1	20.3	15	236	2	32	13	78	204	20	0.600	35
12	2538.1	15.2	26	307	0	0	26	73	307	0	Imp.	50+
13	2539.1	15.7	28	341	0	0	28	63	341	0	Imp.	50+
14	2540.1	18.7	18	261	2	29	16	74	232	6	0.202	45
15	2541.1	14.7	15	171	0	0	15	76	171	0	Imp.	50+
16	2542.1	18.8	17	248	0	0	17	71	248	4	0.101	50
17	2543.1	18.7	26	377	8	116	18	70	261	22	0.610	35
18	2545.1	15.7	18	219	0	0	18	76	219	0	Imp.	50+

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 Crews Well No. 6

Depth Interval, Feet	2536.6 - 2543.5
Feet of Core Analyzed	2.6
Average Percent Porosity	19.1
Average Percent Original Oil Saturation	20.0
Average Percent Oil Recovery	4.1
Average Percent Residual Oil Saturation	15.9
Average Percent Residual Water Saturation	73.6
Average Percent Total Residual Fluid Saturation	89.5
Average Original Oil Content, Bbls./A. Ft.	295.
Average Oil Recovery, Bbls./A. Ft.	60.
Average Residual Oil Content, Bbls./A. Ft.	235.
Total Original Oil Content, Bbls./Acre	765.
Total Oil Recovery, Bbls./Acre	155.
Total Residual Oil Content, Bbls./Acre	610.
Average Effective Permeability, Millidarcys	0.451
Average Initial Fluid Production Pressure, p.s.i.	38.3

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 Crews Well No. 6

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Percent Water Saturation		
			Connate	Drilling & Foreign	Total
1	2527.4	75,800			
2	2528.3	71,000			
3	2529.1	66,800			
4	2530.1	64,400			
5	2531.1	63,800			
6	2532.1	64,700			
7	2533.1	65,200			
8	2534.1	67,400			
9	2535.1	61,600			
10	2536.1	63,200			
11	2537.1	59,500			
12	2538.1	70,800			
13	2539.1	64,800			
14	2540.1	68,500			
15	2541.1	68,200			
16	2542.1	70,200			
17	2543.1	73,300			
18	2545.1	79,400			

Note: ppm — parts per million

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SUMMARY OF WATER DIFFERENTIATION TESTS

TABLE VII

Company Jackson Brothers Lease Crews Well No. 6

Depth Interval, Feet	Chloride Content of Brine in Sand, ppm	Average Percent Connate Water	Average Percent Drilling & Foreign Water
2527.0 - 2536.6	66,300		
2536.6 - 2545.7	69,600		
2527.0 - 2545.7	67,800		

Note: ppm — parts per million.