

OILFIELD RESEARCH LABORATORIES

813 EAST SIXTH
OKMULGEE, OKLAHOMA
PHONE: 1486

- REGISTERED ENGINEERS -

Chanute, Kansas

536 N. HIGHLAND
CHANUTE, KANSAS
PHONE: 728

January 28, 1959

Graybol Oil Corporation
2200 National Bank Bldg.
Tulsa 3, Oklahoma

Gentlemen:

Enclosed herewith is the report of the analysis of the 2 11/16" Rotary core taken from your Winchell Lease, Well No. 5, Chautauqua County, Kansas, and submitted to our laboratory on January 25, 1959.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Carl L. McElrea
Carl L. McElrea

CLM:cc

5 cc.

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GENERAL INFORMATION & SUMMARY

Company Graybeal Oil Corporation Lease Winchell Well No. 3

Location NE 1/4, SW 1/4, NW 1/4

Section 13 Twp 35S Rge 9E County Chautauqua State Kansas

Name of Sand - - - - - Wayside

Top of Core - - - - - 1579.0

Bottom of Core - - - - - 1598.0

Top of Sand - - - - - ?

Bottom of Sand - - - - - (Analyzed) 1596.0

Total Feet of Permeable Sand - - - - - 10.6

Good
Total Feet of Floodable Sand - - - - - 4.0

Distribution of Permeable Sand: Permeability Range Millidarcys

Feet

Cum. Ft.

0 - 2	3.6	3.6
2 - 4	2.5	8.1
4 & above	2.5	10.6

Average Permeability Millidarcys - - - - - 3.3

Average Percent Porosity - - - - - 15.0

Average Percent Oil Saturation - - - - - 16.7

Average Percent Water Saturation - - - - - 36.2

Average Oil Content, Bbls./A. Ft. - - - - - 295.

Total Oil Content, Bbls./Acre - - - - - 3,115.0

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 - primary production - - - - - 620.

Packer Setting, Feet - - - - -

Viscosity, Centipoises @ - - - - -

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

Elevation, Feet - - - - -

A fresh water base mud was used as the circulating fluid during the coring of the sand.

This core was sampled and the samples were sealed in plastic bags by a representative of our laboratory.

FORMATION CORED

The detailed log of the formation cored is as follows:

<u>Depth Interval, Feet</u>	<u>Description</u>
1579.0 - 1581.1	Light brown and gray laminated shaley sandstone.
1581.1 - 1582.1	Light brown slightly shaley sandstone.
1582.1 - 1592.0	Light brown and gray laminated shaley sandstone.
1592.0 - 1596.0	Light brown slightly shaley sandstone.
1596.0 - 1597.4	Gray and light brown shaley sandstone.
1597.4 - 1598.0	Loss.

Coring was started at a depth of 1579.0 feet in light brown and gray laminated shaley sandstone and completed at 1598.0 feet. The core representing the interval extending from 1597.4 to 1598.0 feet was not recovered. This core shows a total of 18.4 feet of sandstone. For the most part, the pay is made up of light brown and gray 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 5.2 and 2.2 millidarcys respectively; the overall average being 3.3 (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 0.69 to a maximum of 24 millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a low weighted average percent oil saturation, namely, 16.7. The weighted average percent oil saturation of the upper and lower sections is 17.2 and 16.4 respectively. The weighted average percent water saturation of the upper and lower sections is 51.9 and 58.8 respectively; the overall average being 56.2 (See Table III). This gives an overall weighted average total fluid saturation of 72.9 percent. This low total fluid saturation indicates considerable fluid was lost during coring, part of which probably was oil.

The weighted average oil content of the upper and lower sections is 191 and 197 barrels per acre foot respectively; the overall average being 195. The total oil content, as shown by this core, is 3,115 barrels per acre (See Table III).

LABORATORY FLOODING TESTS

The sand in this core did not respond very satisfactorily to laboratory flooding tests as none of the samples produced oil, probably because of the low oil saturations.

By observing the data given in Table IV, you will note that of the 16 samples tested, 9 produced water. This indicates that approximately 56 percent of the sand represented by these samples will take water. The tests also show that the sand is comparatively tight.

CONCLUSION

On the basis of the enclosed data, we believe that efficient hydraulic fracturing and primary production methods will recover approximately 620 barrels of oil per acre from the area represented by this core. An additional recovery of approximately 320 barrels of oil per acre may be achieved by an efficient water-flood, provided fracturing

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-4-

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	1.11
True water saturation, percent	47.0
Primary oil recovery, percent	None
Calculated present oil saturation, percent	47.8
Porosity, percent	16.0
Oil saturation at abandonment, percent	25.0
Performance factor	0.50

The analysis results indicate that the sand in this core is tight and has low oil and high water saturations. It is evident that the oil saturations probably were reduced to residual values during coring.

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RESULTS OF PERMEABILITY TESTS

TABLE I

Company Graybol Oil Corporation Lease Winchell Well No. 5

Sample No.	Depth Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
1	1579.3	Imp.	0.6	0.6	0.00
2	1579.8	1.2	0.5	1.1	0.60
3	1580.3	4.4	0.5	1.6	2.20
4	1580.8	1.5	0.5	2.1	0.75
5	1581.3	24.	0.5	2.6	12.00
6	1581.8	6.1	0.5	3.1	3.05
7	1582.3	Imp.	0.5	3.6	0.00
8	1583.8	Imp.	0.5	4.1	0.00
9	1584.3	0.71	0.5	4.6	0.36
10	1584.8	2.2	0.5	5.1	1.10
11	1585.3	Imp.	0.5	5.6	0.00
12	1585.8	Imp.	0.5	6.1	0.00
13	1586.3	1.3	0.5	6.6	0.65
14	1586.8	0.69	0.5	7.1	0.34
15	1587.3	5.6	0.5	7.6	2.80
16	1587.8	4.5	0.5	8.1	2.25
17	1588.3	1.4	0.5	8.6	0.70
18	1588.8	Imp.	0.5	9.1	0.00
19	1589.3	2.9	0.5	9.6	1.45
20	1589.8	1.1	0.5	10.1	0.55
21	1590.3	0.90	0.5	10.6	0.45
22	1590.8	Fractured	0.5	11.1	-
23	1591.3	Imp.	0.5	11.6	0.00
24	1591.8	Imp.	0.4	12.0	0.00
25	1592.4	1.1	0.6	12.6	0.66
26	1592.8	1.1	0.5	13.1	0.55
27	1593.3	1.0	0.5	13.6	0.50
28	1593.8	2.5	0.5	14.1	1.25
29	1594.3	2.4	0.5	14.6	1.20
30	1594.8	Imp.	0.5	15.1	0.00
31	1595.3	3.8	0.5	15.6	1.90

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RESULTS OF SATURATION TESTS

TABLE II

Company Graybol Oil Corporation Lease Winchell Well No. 315

Sat. No.	Depth, Feet	Effective Porosity Percent	Percent Saturation		Oil Content Bbls./A. Ft.	Feet of Core		Total Oil Content Bbls./Acre
			Oil	Water		Ft.	Cum. Ft.	
1	1579.1	12.6	17	55	166	0.6	0.6	0.6
2	1580.1	13.6	15	54	158	1.0	1.6	1.6
3	1581.0	12.0	12	65	112	0.5	2.1	2.1
4	1581.2	17.8	16	-	212	0.5	2.6	2.6
5	1582.0	16.8	16	-	209	0.5	3.1	3.1
6	1582.2	13.8	13	56	139	0.5	3.6	3.6
7	1584.1	14.1	17	57	186	1.0	4.6	4.6
8	1585.1	17.0	19	42	251	1.0	5.6	5.6
9	1586.1	12.4	24	44	231	1.0	6.6	6.6
10	1587.1	16.5	13	66	166	1.0	7.6	7.6
11	1588.1	15.7	17	56	207	1.0	8.6	8.6
12	1589.1	15.7	21	55	256	1.0	9.6	9.6
13	1590.1	15.1	12	60	141	1.0	10.6	10.6
14	1591.1	14.9	12	62	139	1.4	12.0	12.0
15	1592.1	14.4	11	66	123	0.6	12.6	12.6
16	1593.1	17.0	22	56	290	1.0	13.6	13.6
17	1594.1	16.9	19	54	249	1.0	14.6	14.6
18	1595.1	13.3	19	57	196	1.4	16.0	16.0
Total-						-	-	-3,115

SUMMARY OF PERMEABILITY & SATURATION TESTS

Company Graybol Oil Corporation Lease Winchell Well No. 5

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
1579.6 - 1586.6	4.0	5.2	20.71
1586.6 - 1595.6	6.6	2.2	14.60
1579.6 - 1595.6	10.6	3.3	35.31

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company			Graybol Oil Corporation			Lease			Winchell			Well No.		5
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	1579.1	12.2	16	151	0	0	16	76	151	Imp.	50+			
2	1580.1	13.4	18	187	0	0	18	70	187	0.339	40			
3	1581.2	17.1	16	212	0	0	16	74	212	0.800	30			
4	1582.0	16.8	16	209	0	0	16	73	209	0.770	20			
5	1584.1	13.9	19	205	0	0	19	68	205	Imp.	50+			
6	1585.1	16.9	18	236	0	0	18	64	236	Imp.	50+			
7	1586.1	12.5	26	252	0	0	26	59	252	Imp.	50+			
8	1587.1	16.4	16	204	0	0	16	73	204	0.373	40			
9	1588.1	15.8	15	184	0	0	15	76	184	0.215	40			
10	1589.5	16.1	19	237	0	0	19	68	237	0.155	50			
11	1590.1	15.1	13	152	0	0	13	63	152	Imp.	50+			
12	1591.1	14.8	12	138	0	0	12	68	138	Imp.	50+			
13	1592.3	14.7	13	148	0	0	13	65	148	Imp.	50+			
14	1593.1	16.5	21	269	0	0	21	66	269	0.088	50			
15	1594.1	17.0	22	290	0	0	22	67	290	0.188	50			
16	1595.1	13.7	21	223	0	0	21	66	223	0.197	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.