PAVLICEK BROTHERS

CORE ANALYSIS REPORT

NELSON LEASE WELL NO. 2

ALLEN COUNTY, KANSAS

OILFIELD RESEARCH LABORATORIES

CHANUTE, KANSAS

OCTOBER 23, 1952

Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Pavlicek Brothers Lease Nelson Well No. 2

Location

Section 21 Twp. 26S Rge. 21E County Allen State Kansas

Name of Sand	Bartlesville
Top of Core	616.00
Bottom of Core	647.00
Top of Pay Sand	638.20
Bottom of Pay Sand	643.20
Total Feet of Permeable Sand	6.43
Total Feet of Floodable Sand	3.38

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 5	1.05	1.05
5 - 10	1.30	2.35
10 - 40	1.08	3.43
40 - 60	1.35	4.78
60 - 80	0.30	5.08
80 & above	1.35	6.43

Average Permeability Millidarcys	40.87
Average Percent Porosity	17.90
Average Percent Oil Saturation	53.05
Average Percent Water Saturation	36.38
Average Oil Content, Bbls./A. Ft.	759.
Total Oil Content, Bbls./Acre	5,830.
Average Percent Oil Recovery by Laboratory Flooding Tests	30.30
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	471.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	1,592.
Total Calculated Oil Recovery, Bbls./Acre	1,600.
Packer Setting, Feet	
Viscosity, Centipoises @ 75° F	15.3
A. P. I. Gravity, degrees @ 60 °F	31.6
Elevation, Feet	

In order to get a true water saturation of the sand, crude oil was used as the circulating fluid in the coring of that part of the cored section extending from 635.30 to 644.50 feet.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
616.00 - 617.70	According to log, dark gray shale (Discarded at well).
617.70 - 619.10	According to log, coal (Discarded at well).
619.10 - 621.00	According to log, gray shale (Discarded at well).
621.00 - 623.50	According to log, loss (Discarded at well).
623.50 - 628.20	According to log, gray shale (Discarded at well).
628.20 - 629.00	According to log, coal (Discarded at well).
629.00 - 632.80	Gray shale (Discarded at well).
632.80 - 633.65	Gray calcareous shale.
633.65 - 634.60	Gray sandy shale.
634.60 - 634.75	Brown fine grained micaceous shaley sandstone.
634.75 - 635.35	Brown fine grained micaceous slightly shaley sandstone.
635.35 - 635.65	Brown fine grained micaceous sandstone.
635.65 - 635.80	Brown fine grained micaceous shaley sandstone.
635.80 - 636.70	Brown fine grained micaceous sandstone.
636.70 - 637.50	Brown fine grained laminated micaceous shaley sandstone.
637.50 - 637.90	Gray sandy shale.
637.90 - 638.20	Brown fine grained laminated micaceous shaley sandstone.
638.20 - 638.30	Dark brown fine grained micaceous sandstone.
638.30 - 638.95	Brown fine grained laminated micaceous shaley sandstone.
638.95 - 639.30	Dark brown fine grained micaceous sandstone.
639.30 - 639.55	Brown fine grained micaceous shaley sandstone.

639.55 - 640.00 - Dark brown fine grained micaceous sandstone.

640.00 - 640.30 - Gray sandy shale.

640.30 - 640.95 - Dark brown fine grained micaceous sandstone.

640.95 - 641.17 - Gray sandy shale.

641.17 - 643.85 - Dark brown fine grained micaceous sandstone.

643.85 - 644.50 - Gray shale.

644.50 - 647.00 - According to log, gray shale (Discarded at well).

Coring was started at a depth of 616.00 feet in dark gray shale and completed at 647.00 feet in gray shale. This core shows a total of 8.33 feet of sandstone. For the most part, the pay is made up of fine grained micaceous to 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 4.23 and 57.41 millidarcys respectively; the overall average being 40.87 (See Table II). By observing the data given on the coregraph, it is noticeable that the sand has a very irregular permeability profile and that the upper part of the sand section is very tight. The sand in this core varies from impermeable to a maximum of 106 millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a very good weighted average percent oil saturation, namely, 53.05. The weighted average percent oil saturation of the upper and lower sections is 41.79 and 61.53 respectively. The weighted average percent water saturation of the upper and lower sections is 49.21 and 26.72 respectively; the overall average being 36.38 (See Table IV). This gives an overall weighted average total fluid saturation of 89.43 percent.

For the sake of future information, all of the saturation samples were analyzed for chloride content. The results of these tests are given in Tables VII and VIII.

The weighted average oil content of the upper and lower sections is 507 and 949 barrels per acre foot respectively; the overall average being 759. The total oil content, as shown by this core, is 5,830 barrels per acre (See Table IV).

VISCOSITY

The viscosity of a sample of crude oil taken from a pumping well on this lease is 15.3 centipoises at 75° F. The A.P.I. gravity of the oil is 31.6° at 60° F. With other factors being favorable, a sand containing an oil of this viscosity should respond very satisfactorily to water repressuring.

LABORATORY FLOODING TESTS

Part of the sand in this core responded very well to laboratory flooding tests, as a total recovery of 1,592 barrels of oil per acre was obtained from 3.38 feet of sand. The weighted average percent oil saturation was reduced from 59.47 to 29.17, or represents an average recovery of 30.30 percent. The weighted average effective permeability of the samples is 4.85 millidarcys, while the average initial fluid production pressure is 16.7 pounds per square inch (See Table VI).

By observing the data given in Table V, you will note that of the 10 samples tested, 8 produced water and 6 oil. This indicates that approximately 53 percent of the sand represented by this core is floodable. The tests also show that part of the sand is very tight.

CONCLUSION

On the basis of the above data, it is evident that an efficient water flood within the vicinity of this well will recover approximately 1,600 barrels of oil per acre or an average of 473 barrels per acre foot from the 3.38 feet of floodable sand analyzed. In calculating this recovery, an allowance was made for oil lost during coring, and it is assumed that the primary production and the true water saturation of the sand are 8 and 27 percent respectively.

The principle drawback of this core is the fact that it shows a thin floodable sand section. From the above data, it is evident that this well was drilled near the edge of the trend or a bone.

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RESULTS OF PERMEABILITY TESTS

TABLE 1

Company Pavlicek Brothers Lease Nelson Well No. 2

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
1	634.95	Imp.	0.60	0.60	0.00
2	635.45	8.3	0.30	0.90	2.49
3	635.82	4.4	0.25	1.15	1.10
4	636.30	5.5	0.65	1.80	3.58
5	636.80	1.6	0.80	2.60	1.28
6	638.70	Imp.	0.65	3.25	0.00
7	639.12	58.	0.35	3.60	20.30
8	639.60	56.	0.75	4.35	42.00
9	640.40	40.	0.25	4.60	10.00
10	640.75	91.	0.40	5.00	36.40
11	641.20	38.	0.28	5.28	10.64
12	641.70	106.	0.50	5.78	53.00
13	642.20	93.	0.45	6.23	41.85
14	642.65	14.	0.50	6.73	7.00
15	643.10	64.	0.30	7.03	19.20
16	643.30	37.	0.30	7.33	11.10
17	643.70	8.1	0.35	7.68	2.84

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SUMMARY OF PERMEABILITY TESTS

TABLE II

Company Pavlicek Brothers Lease Nelson Well No. 2

Depth Interval Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity, Ft. x Md.
634.75 - 638.95	2.00	4.23	8.45
638.95 - 643.85	4.43	57.41	254.33
634.75 - 643.85	6.43	40.87	262.78

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RESULTS OF SATURATION TESTS

TABLE III

Company Pavlicek Brothers Lease Nelson Well No. 2

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.	
F-1	634.65	8.3	42.7	-	-	275	0.15	0.15	41
1	634.72	14.0	31.9	54.7	86.6	347	0.90	1.05	312
2	636.00	17.8	52.4	45.6	98.0	725	1.05	2.10	761
3	637.05	14.7	35.6	49.0	84.6	407	0.80	2.90	326
4	638.05	15.0	51.8	45.4	97.2	604	0.30	3.20	181
F-4A	638.25	18.4	37.1	-	-	530	0.10	3.30	53
5	639.01	18.9	47.1	25.9	73.0	691	0.60	3.90	415
6	639.91	19.7	62.5	24.0	86.5	956	0.45	4.35	430
7	640.87	20.2	75.0	22.7	97.7	1,177	0.65	5.00	765
F-7A	641.21	21.0	34.0	-	-	554	0.33	5.33	183
8	641.90	20.9	62.8	33.5	96.3	1,020	0.90	6.23	919
9	642.85	19.0	65.9	26.2	92.1	972	0.80	7.03	779
10	643.50	19.5	67.5	24.4	91.9	1,021	0.65	7.68	665
							Total - - - - - - - - - -		5,830

Note: "A" Samples were taken from the core after it was received in the laboratory.

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SUMMARY OF SATURATION TESTS

TABLE IV

Company Pavlicek Brothers Lease Nelson Well No. 2

Depth Interval, Feet	Feet of Core Analyzed	Average Percent Porosity	Average Percent Oil Saturation	Average Percent Water Saturation	Average Oil Content Bbls./A. Ft.	Total Oil Content Bbls./Acre
634.60–638.30	3.30	15.33	41.79	49.21	507	1,674
638.95–643.85	4.38	19.84	61.53	26.72	949	4,156
634.60–643.85	7.68	17.90	53.05	36.38	759	5,830

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RESULTS OF LABORATORY FLOODING TESTS

TABLE V

Company Pavlicek Brothers Lease Nelson Well No. 2

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.
			Percent	Bbls./A. Ft.	Percent	Bbls./A. Ft.	% Oil	% Water	Bbls./A. Ft.			
1	634.65	8.3	42.7	275	0.0	0	42.7	44.2	275	0	Imp.	50#
2	636.00	17.5	51.5	700	0.0	0	51.5	47.4	700	4	0.158	35
3	637.05	14.2	33.8	391	0.0	0	33.8	54.5	391	3	0.169	45
4A	638.25	18.4	37.1	530	8.4	120	28.7	58.2	410	78	1.25	20
5A	639.20	19.0	47.1	694	20.7	305	26.4	65.0	389	126	6.17	15
6A	640.52	20.0	75.0	1,164	45.6	707	29.4	62.6	457	77	3.28	28
7A	641.21	21.0	34.0	554	6.2	101	27.8	54.5	453	118	4.76	20
8	641.90	21.0	68.8	1,024	32.4	528	30.4	65.5	496	169	7.52	15
9	642.85	19.4	65.9	993	35.6	536	30.3	61.1	457	56	2.52	10
10	643.50	19.2	66.0	985	0.0	0	66.0	30.0	985	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 contains residual oil.
"A" - Samples were taken from the core after it was received in the laboratory.

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SUMMARY OF LABORATORY FLOODING TESTS

TABLE VI

Company Pavlicek Brothers Lease Nelson Well No. 2

Depth Interval, Feet	638.20 - 643.20
Feet of Core Analyzed	3.38
Average Percent Porosity	19.97
Average Percent Original Oil Saturation	59.47
Average Percent Oil Recovery	30.30
Average Percent Residual Oil Saturation	29.17
Average Percent Residual Water Saturation	63.49
Average Percent Total Residual Fluid Saturation	92.66
Average Original Oil Content, Bbls./A. Ft.	925.
Average Oil Recovery, Bbls./A. Ft.	471.
Average Residual Oil Content, Bbls./A. Ft.	454.
Total Original Oil Content, Bbls./Acre	3,127.
Total Oil Recovery, Bbls./Acre	1,592.
Total Residual Oil Content, Bbls./Acre	1,535.
Average Effective Permeability, Millidarcys	4.85
Average Initial Fluid Production Pressure, p.s.i.	16.7

NOTE: Only those samples which recovered oil were used in calculating the above averages.

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RESULTS OF WATER DIFFERENTIATION TESTS

TABLE VII

Company Pavlicek Brothers Lease Nelson Well No. 2

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Percent Water Saturation		
			Connate	Drilling & Foreign	Total
1	634.72	17,300			
2	636.00	20,100			
3	637.05	19,200			
4	638.05	21,600			
5	639.01	18,800			
6	639.91	23,000			
7	640.87	23,200			
8	641.90	16,000			
9	642.85	21,600			
10	643.50	22,400			

Note: ppm - parts per million.

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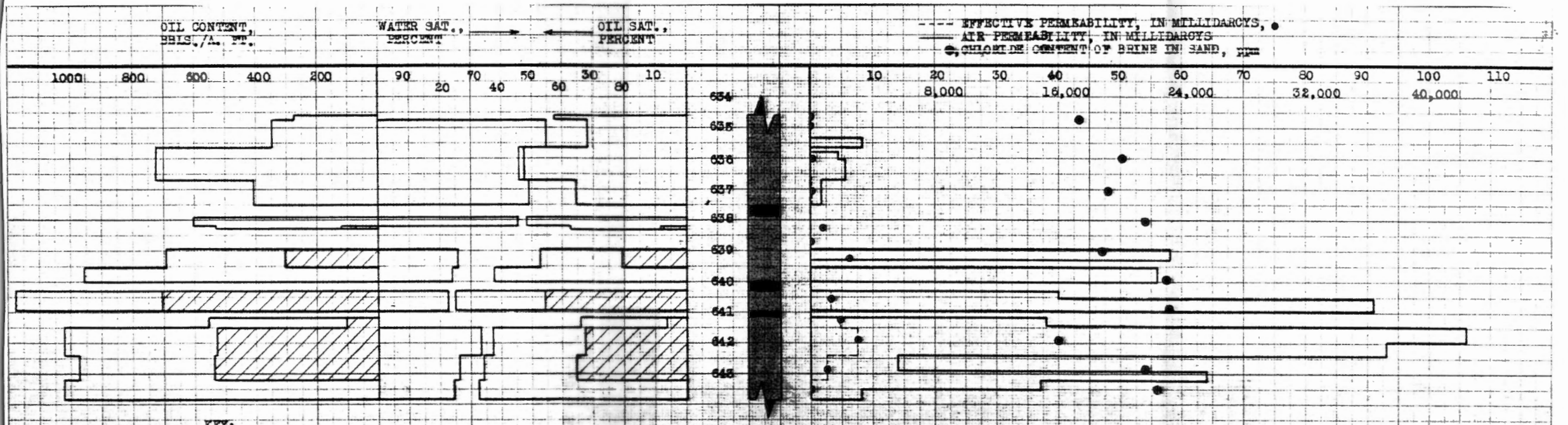
SUMMARY OF WATER DIFFERENTIATION TESTS

TABLE VIII

Company Pavlicek Brothers Lease Nelson Well No. 2

Depth Interval, Feet	Chloride Content of Brine in Sand, ppm	Average Percent Connate Water	Average Percent Drilling & Foreign Water
634.75 - 638.20	19,207		
638.95 - 643.85	20,506		
634.75 - 643.85	19,948		

Note: ppm - parts per million.



PAVLICEK BROTHERS

NELSON LEASE WELL NO. 2

ALLEN COUNTY, KANSAS

DEPTH INTERVAL, FEET	FEET OF CORE ANALYZED	AVG. OIL SATURATION PERCENT	AVG. WATER SATURATION PERCENT	AVG. OIL CONTENT BBLS./A.FT.	TOTAL OIL CONTENT BBLS./ACRE	AVG. AIR PERMEABILITY, MILLIDARCYS	CALCULATED OIL RECOVERY BBLS./ACRE
634.60 - 638.30	3.30	41.79	49.21	507	1,674	4.83	
638.96 - 643.34	4.38	61.53	26.72	949	4,156	57.41	
634.60 - 643.35	7.68	53.05	36.38	759	5,830	40.87	1,600

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