

OIL FIELD RESEARCH LABORATORIES
CHANUTE, KANSAS

December 30, 1950

Kewanee Oil Company
Kennedy Building
P. O. Box 2339
Tulsa 1, Oklahoma

Gentlemen:

Enclosed herewith is the report of the analysis of the No. 6 Baker barrel core taken from the Kretschmer 100 Acres Lease, Well No. 33, Anderson County, Kansas, and submitted to our laboratory on December 2, 1950.

Very truly yours,

OIL FIELD RESEARCH LABORATORIES

Carl L. Pate

CLP:ean

c.c. to Mr. H. T. Harris
Garnett, Kansas

Kewanee Oil Company
Shidler, Oklahoma

33-20-21E

Kretschmer 33

KEMANEE OIL COMPANY

CORE ANALYSIS REPORT

KRETCHMER 100 ACRES LEASE WELL NO. 33

ANDERSON COUNTY, KANSAS

OIL FIELD RESEARCH LABORATORIES

CHANUTE, KANSAS

DECEMBER 30, 1950

Oil Field Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Kewanee Oil Company Lease Kretchner-100 Acres Well No. 33

Location _____

Section 33 ~~23~~ Twp. 20N Rge. 21E County Anderson State Kansas

Name of Sand	Squirrel
Top of Core	610.20
Bottom of Core	654.00
Pay Top of Sand	618.10
Bottom of Sand	643.50
Total Feet of Permeable Sand	6.55

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 4	0.55	0.55
4 - 8	1.26	1.93
8 - 12	1.40	3.33
12 - 16	1.05	4.38
16 - 32	1.75	6.13
32 & above	0.42	6.55

Average Permeability, Millidarcys	13.98
Average Percent Porosity	18.46
Average Percent Oil Saturation	35.73
Average Percent Water Saturation	49.62
Average Oil Content, Bbls./A. Ft.	515.
Total Oil Content, Bbls./Acre	3,536.
Average Percent Oil Recovery by Laboratory Flooding Tests	10.34
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	154.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	602.
Total Calculated Oil Recovery, Bbls./Acre	1,030.
Packer Setting, Feet	618.00
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F	

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The above averages are for that part of the cored section extending from the packer setting to the bottom of the sand.

Water was used as a circulating fluid in the coring of the sand in this well.

FORMATION CORED

The detailed log of the formation cored is as follows:

<u>Depth Interval,</u> <u>Feet</u>	<u>Description</u>
610.20 - 613.00	- According to log, gray shale (discarded at well).
613.00 - 614.05	- Gray shale.
614.05 - 614.20	- Light brown fine grained micaceous shaley sandstone.
614.20 - 616.95	- Gray shale.
616.95 - 617.40	- Gray sandy shale.
617.40 - 617.65	- Light brown fine grained micaceous sandstone.
617.65 - 617.95	- Light brown fine grained laminated micaceous shaley sandstone.
617.95 - 618.10	- Laminated sandy shale.
618.10 - 619.00	- Light brown fine grained micaceous sandstone.
619.00 - 619.55	- Laminated sandy shale.
619.55 - 619.65	- Brown fine grained micaceous sandstone.
619.65 - 619.98	- Laminated sandy shale.
619.98 - 620.80	- Light brown fine grained micaceous sandstone.
620.80 - 621.25	- Laminated sandy shale.
621.25 - 621.35	- Light brown fine grained micaceous sandstone.
621.35 - 621.50	- Light brown fine grained laminated micaceous shaley sandstone.
621.50 - 624.95	- Laminated sandy shale.
624.95 - 625.10	- Light brown fine grained laminated micaceous shaley sandstone.

- 625.10 - 625.25 - Laminated sandy shale.
- 625.25 - 625.40 - Light brown fine grained laminated micaceous shaley sandstone.
- 625.40 - 626.00 - Laminated sandy shale.
- 626.00 - 626.15 - Light brown fine grained micaceous sandstone.
- 626.15 - 626.40 - Light brown fine grained laminated micaceous shaley sandstone.
- 626.40 - 626.70 - Laminated sandy shale.
- 626.70 - 628.45 - Gray sandy shale.
- 628.45 - 628.60 - Laminated shaley sandstone.
- 628.60 - 628.75 - Light brown fine grained laminated micaceous shaley sandstone.
- 628.75 - 628.90 - Gray sandy shale.
- 628.90 - 629.15 - Light brown fine grained laminated micaceous shaley sandstone.
- 629.15 - 629.30 - Light brown fine grained micaceous sandstone.
- 629.30 - 629.72 - Laminated sandy shale.
- 629.72 - 630.30 - Light brown fine grained laminated micaceous shaley sandstone.
- 630.30 - 630.45 - Light brown fine grained micaceous sandstone.
- 630.45 - 630.60 - Light brown fine grained laminated micaceous shaley sandstone.
- 630.60 - 631.30 - Light brown fine grained micaceous sandstone.
- 631.30 - 633.65 - Gray sandy shale.
- 633.65 - 633.80 - Light brown fine grained laminated micaceous shaley sandstone.
- 633.80 - 635.50 - Laminated sandy shale.
- 635.50 - 636.00 - Light brown fine grained micaceous sandstone.
- 636.00 - 637.20 - Gray sandy shale.
- 637.20 - 639.80 - Gray shale.

- 639.80 - 640.80 - Light brown fine grained micaceous sandstone.
640.80 - 640.95 - Light brown fine grained micaceous shaley sandstone.
640.95 - 641.80 - Gray sandy shale.
641.80 - 642.95 - Laminated sandy shale.
642.95 - 643.20 - Light brown fine grained laminated micaceous shaley sandstone.
643.20 - 643.50 - Light brown fine grained micaceous sandstone.
643.50 - 643.95 - Brown fine grained micaceous calcareous carbonaceous shaley sandstone.
643.95 - 644.20 - Gray shale.
644.20 - 644.80 - Gray calcareous sandy shale.
644.80 - 654.00 - According to log, dark gray shale (discarded at well).

Coring was started at a depth of 610.20 feet in gray shale and completed at 654.00 feet in gray shale. This core shows a total of 8.75 feet of sandstone. For the most part, the pay sand is made up of fine grained micaceous sandstone. The cored section is badly broken by layers of shale.

PERMEABILITY

For the sake of distribution, the core was divided into two sections. The weighted average permeability of the upper and lower sections are 13.55 and 10.93 millidarcys respectively while that of the pay sand, or that part of the cored section extending from the packer setting to the bottom of the sand, is 13.95 (See Table II). By observing the data given on the coregraph, it is noticeable that the sand has a very irregular permeability profile.

PERCENT SATURATION & OIL CONTENT

The pay sand in this core shows a fairly good weighted average percent oil saturation, namely, 35.73. The weighted average percent

oil saturation of the upper and lower sections are 38.79 and 37.79 respectively. The weighted average percent water saturation of the upper and lower sections are 50.22 and 45.33 respectively while that of the pay sand is 49.62 (See Table IV). This gives an overall weighted average total fluid saturation of 85.35 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 VII and VIII. From the data given in these tables and on the core-graph, it is evident that the sand was not flushed to any appreciable extent as the zones of higher permeability do not necessarily have the lower chloride content. Apparently, most of the oil lost during coring was due to the expansion of gas carried in solution by the oil.

The weighted average oil content of the upper and lower sections are 516 and 524 barrels per acre foot respectively while that of the pay sand is 515. The total oil content, as shown by this core, is 3,926 barrels per acre of which 3,536 barrels are in the pay sand section (See Table IV).

LABORATORY FLOODING TESTS

The pay sand in this core responded fairly well to laboratory flooding tests as a total recovery of 802 barrels of oil per acre was obtained from 5.23 feet of sand. The weighted average percent oil saturation was reduced from 35.95 to 25.61, or represents an average recovery of 10.34 percent. The weighted average effective permeability of the samples is 1.92 millidarcys while the average initial fluid production pressure is 26.4 pounds per square inch (See Table VI).

From the data given in Table V, you will note that of the 17 samples tested, 11 produced water and oil. This indicates that only part of the sand represented by these samples is floodable. The tests also show that the sand has a fairly wide variation in effective permeability.

CONCLUSION

From a study of the above data, we believe that an efficient water flood within the vicinity of this well will recover approximately 1,050 barrels of oil per acre, or an average of 198 barrels per acre foot. In calculating this recovery, an allowance was made for oil lost during coring and it was assumed that the true water saturation of the sand is 37 percent and that the pay is not pressure up.

The principle drawback of this core is the fact that it contains only approximately 5.3 feet of floodable sand and that it is badly broken by layers of shale. Furthermore, the sand is comparatively tight.

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SHOT RECOMMENDATION

Company Keweenaw Oil Company Lease Kretzner 100 Acres Well No. 33

<u>Depth Interval, Feet</u>	<u>Feet of Sand</u>	<u>Size of Shell Inches</u>	<u>Qts./Ft.</u>	<u>Total Quarts</u>
621.0 - 636.0	15.0	4.5	3.1	46.5
636.0 - 640.0	4.0	Spacer	-	-
640.0 - 643.0	<u>3.0</u>	4.5	3.1	<u>9.1</u>
Total	18.0			55.6

Recommended Packer Setting 618.0 feet.

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RESULTS OF PERMEABILITY TESTS
TABLE I

Company Keweenaw Oil Company Lease Kretzner 100 Acres Well No. 33

Sample No.	Depth, Feet	Permeability Millidarcys	Feet of Core		Permeability Capacity Ft. x Md.
			Ft.	Cum. Ft.	
1	618.25	21.	0.25	0.25	5.25
2	618.50	25.	0.25	0.50	6.25
3	618.75	11.	0.40	0.90	4.40
4	619.64	34.	0.30	1.20	10.20
5	620.00	46.	0.12	1.32	5.52
6	620.15	28.	0.20	1.52	5.60
7	620.56	20.	0.35	1.87	7.00
8	620.75	4.2	0.15	2.02	0.63
9	621.30	2.5	0.10	2.12	0.25
10	625.04	5.9	0.15	2.27	0.89
11	625.34	4.1	0.15	2.42	0.62
12	626.06	5.9	0.15	2.57	0.89
13	626.36	2.5	0.25	2.82	0.63
14	628.66	6.2	0.15	2.97	0.93
15	628.95	7.1	0.25	3.22	1.78
16	629.80	4.6	0.28	3.50	1.29
17	630.27	8.1	0.30	3.80	2.43
18	630.70	27.	0.20	4.00	5.40
19	630.94	20.	0.50	4.50	10.00
20	633.74	Imp.	0.15	4.65	0.00
21	635.55	14.	0.50	5.15	7.00
22	639.85	12.	0.20	5.35	2.40
23	640.21	13.	0.35	5.70	4.55
24	640.55	11.	0.45	6.15	4.95
25	643.00	8.8	0.25	6.40	2.20
26	643.40	1.6	0.30	6.70	0.48

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SUMMARY OF PERMEABILITY TESTS

TABLE II

Company Keweenaw Oil Company Lease Kretzschmar 100 Acres Well No. 33

Depth Interval Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity, Ft. x Md.
614.05 - 631.30	4.50	15.55	69.96
633.65 - 643.50	2.05	10.53	21.58
618.00 - 643.50	6.55	13.98	91.54

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RESULTS OF SATURATION TESTS

TABLE III

Company Keweenaw Oil Company Lease Kreighner 100 Acres Well No. 33

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.	
F-1	614.13	14.9	38.6	-	447	0.15	0.15	67
1	617.73	17.1	44.2	87.2	587	0.55	0.70	323
2	618.92	19.9	39.5	89.9	611	0.90	1.60	550
3	619.76	20.1	32.0	78.0	500	0.30	1.90	150
4	620.42	20.7	33.6	80.6	541	0.82	2.72	444
F-6	621.42	15.8	37.0	-	454	0.25	2.97	114
F-10	625.03	17.3	33.6	-	450	0.15	3.12	68
10	626.23	16.2	31.2	93.9	392	0.40	3.52	157
11	628.53	16.1	18.1	85.7	226	0.15	3.67	34
F-12	628.66	15.9	26.0	-	321	0.15	3.82	68
F-13	629.08	16.8	30.0	-	392	0.25	4.07	98
12	629.23	20.0	35.8	79.3	556	0.15	4.22	84
F-14	630.37	19.1	40.8	-	605	0.15	4.37	91
13	630.54	16.3	31.2	95.7	394	0.15	4.52	82
14	631.07	19.5	38.4	87.1	581	0.70	5.22	407
F-16	631.73	15.0	35.8	-	417	0.15	5.37	63
16	633.76	18.1	42.1	82.8	591	0.50	5.87	296
17	635.04	18.4	37.6	82.8	537	0.55	6.42	296
F-19	640.73	19.1	33.3	-	509	0.45	6.87	229
18	640.86	17.7	36.8	92.5	506	0.15	7.02	76
19	643.13	16.7	46.4	95.3	602	0.25	7.27	150
F-20	643.27	16.3	31.9	-	406	0.30	7.57	122
					Total			3,926

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SUMMARY OF SATURATION TESTS

TABLE IV

Company	Lease	Well No.	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
Kovance Oil Company	Kretzinger 100 Acres	33	614.05-631.30	5.22	18.49	35.79	50.22	516	2,694
			633.65-643.50	2.35	17.83	37.79	45.38	524	1,232
			618.00-643.50	6.87	18.46	35.73	49.62	515	3,536

Oil Field Research Laboratories
RESULTS OF LABORATORY FLOODING TESTS

TABLE V

Company Kewanee Oil Company Lease Kretchmer 100 Acres Well No. 33

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	Bbbs./A. Ft.	Percent	Bbbs./A. Ft.	% Oil	% Water	Bbbs./A. Ft.			
1	614.13	14.9	38.6	447	0.0	0	38.6	59.4	447	0	Imp.	50 +
2	617.93	17.1	45.3	602	0.0	0	45.3	46.1	602	0	Imp.	50 +
3	618.63	20.0	38.1	516	15.8	214	22.3	72.1	302	77	2.70	20
4	619.63	20.0	31.7	492	11.6	180	20.1	73.2	312	118	4.48	15
5	620.28	21.0	33.6	548	14.4	235	19.2	71.5	313	127	4.41	15
6	621.42	15.8	37.0	454	0.0	0	37.0	59.1	454	0	Imp.	50 +
10	625.03	17.3	33.6	450	2.1	28	31.4	61.2	422	0	0.008	40
11A	626.37	17.0	30.2	398	1.4	18	28.8	58.8	380	2	0.211	40
12	628.66	15.9	26.0	321	0.0	0	26.0	67.9	321	0	Imp.	50 +
13	629.08	16.8	30.0	392	0.0	0	30.0	60.0	392	1	0.064	45
14	630.37	19.1	40.8	605	16.2	240	24.6	67.8	365	117	3.20	15
15	631.23	19.6	38.7	589	15.7	239	23.0	71.2	350	61	1.79	20
16	633.73	15.0	35.8	417	0.0	0	35.8	40.8	417	0	Imp.	50 +
17	635.94	17.7	41.6	573	0.8	11	40.8	50.8	562	8	0.204	35
18	639.86	17.7	38.9	520	5.7	78	32.2	63.6	442	8	0.374	35
19	640.73	19.1	33.3	509	8.5	141	24.8	65.3	368	35	0.913	20
20	643.27	16.3	31.9	406	9.6	122	22.3	66.5	284	8	0.280	35

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.
"A" sample was taken from the core after it was received in the laboratory.

Oil Field Research Laboratories

SUMMARY OF LABORATORY FLOODING TESTS

TABLE VI

Company	Lease	Acres	Well No.
Kewanee Oil Company	Kretzhammer	100	33
Depth Interval, Feet	618.10 - 631.30	635.50 - 643.50	618.00 - 643.50
Feet of Core Analyzed	3.42	1.80	5.22
Average Percent Porosity	19.65	17.83	19.02
Average Percent Original Oil Saturation	35.53	36.78	35.95
Average Percent Oil Recovery	12.81	5.67	10.34
Average Percent Residual Oil Saturation	22.72	31.11	25.61
Average Percent Residual Water Saturation	69.74	61.00	66.72
Average Percent Total Residual Fluid Saturation	92.46	92.11	92.33
Average Original Oil Content, Bbls./A. Ft.	523.	514.	520.
Average Oil Recovery, Bbls./A. Ft.	191.	83.	154.
Average Residual Oil Content, Bbls./A. Ft.	332.	431.	366.
Total Original Oil Content, Bbls./Acre	1,790.	924.	2,714.
Total Oil Recovery, Bbls./Acre	653.	149.	802.
Total Residual Oil Content, Bbls./Acre	1,137.	775.	1,912.
Average Effective Permeability, Millidarcys	2.69	0.446	1.92
Average Initial Fluid Production Pressure, p.s.i.	23.6	31.3	26.4

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

Oil Field Research Laboratories
RESULTS OF WATER DIFFERENTIATION TESTS
TABLE VII

Company Kewanee Oil Company Lease Kratzmer 100 Acres Well No. 33

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Percent Water Saturation		
			Connate	Drilling & Foreign	Total
1	617.73	11,200			
2	618.92	14,100			
3	619.76	16,700			
4	620.42	17,900			
10	626.23	16,300			
11	628.53	17,500			
12	629.23	17,500			
13	630.54	16,800			
14	631.07	15,300			
16	635.76	22,100			
17	640.04	20,000			
18	640.86	20,000			
19	643.13	24,200			
Note:		ppm - parts per million.			

Oil Field Research Laboratories

SUMMARY OF WATER DIFFERENTIATION TESTS

TABLE VIII

Company Kewanee Oil Company Lease Yatchmar 100 Acres Well No. 33

Depth Interval, Feet	Chloride Content of Brine in Sand, ppm	Average Percent Connate Water	Average Percent Drilling & Foreign Water
617.40 - 631.30	15,425		
635.50 - 643.20	21,469		
618.00 - 643.20	17,633		

Note: ppm - parts per million.