

25-16-Z1E

OILFIELD RESEARCH LABORATORIES

536 NORTH HIGHLAND - CHANUTE, KANSAS - PHONE HE1-2650

January 19, 1966

John J. Robertson
Box 873
Shawnee, Oklahoma

Dear Sir:

Enclosed herewith is the report of the analysis of the Rotary core taken from the Boehm Lease, Well No. 1-P, Miami County, Kansas, and submitted to our laboratory on January 12, 1966.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Benjamin R. Pearman
Benjamin R. Pearman

BRP:rf

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GENERAL INFORMATION & SUMMARY

Company	<u>John J. Robertson</u>	Lease	<u>Boehm</u>	Well No.	<u>1-P</u>
Location	<u>E$\frac{1}{2}$, SW</u>				
Section	<u>25</u>	Twp.	<u>16S</u>	Rge.	<u>21E</u>
		County	<u>Miami</u>	State	<u>Kansas</u>
Name of Sand	- - - - -				Squirrel
Top of Core	- - - - -				649.0
Bottom of Core	- - - - -				671.0
Top of Sand	- - - - -				649.0
Bottom of Sand	- - - - -				671.0
Total Feet of Permeable Sand	- - - - -				22.0
Total Feet of Floodable Sand	- - - - -				17.0
Distribution of Permeable Sand:					
Permeability Range Millidarcys	Feet	Cum. Ft.			
11 - 20	10.0	10.0			
20 - 50	6.0	16.0			
50 - 100	3.0	19.0			
100 & above	3.0	22.0			
Average Permeability Millidarcys	- - - - -				47.5
Average Percent Porosity	- - - - -				21.8
Average Percent Oil Saturation	- - - - -				48.4
Average Percent Water Saturation	- - - - -				38.8
Average Oil Content, Bbls./A. Ft.	- - - - -				820.
Total Oil Content, Bbls./Acre	- - - - -				18,041.
Average Percent Oil Recovery by Laboratory Flooding Tests	- - - - -				8.7
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	- - - - -				152.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	- - - - -				2,581.
Total Calculated Oil Recovery, Bbls./Acre	-	(Primary & Secondary)			3,930.
Packer Setting, Feet	- - - - -				
Viscosity, Centipoises @	- - - - -				
A. P. I. Gravity, degrees @ 60 °F	- - - - -				
Elevation, Feet	- - - - -				

Native mud was used as the circulating fluid while taking this core. The core samples were sealed in plastic bags and the samples submitted to the laboratory by a representative of the client. The well was drilled in non-virgin territory.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Description
<u>Feet</u>

649.0 - 671.0 - Dark brown, laminated, shaly sandstone.

This core shows a total of 22.0 feet of sandstone. For the most part, the pay is made up of dark brown, laminated, 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 59.5 and 32.9 millidarcys respectively; the overall average being 47.5 (See Table III). By observing the data given on the coregraph, it is noticeable that the sand has a rather irregular permeability profile. The permeability of the sand varies from 11. to a maximum of 161. millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a good weighted average percent oil saturation, namely, 48.4. The weighted average percent oil saturation of the upper and lower sections is 52.4 and 43.7 respectively. The weighted average percent water saturation of the upper and lower sections is 34.8 and 43.5 respectively; the overall average being 38.8 (See Table III). This gives an overall weighted average total fluid saturation of

87.2 percent.

The weighted average oil content of the upper and lower sections is 901 and 723 barrels per acre foot respectively; the overall average being 820. The total oil content, as shown by this core, is 18,041 barrels per acre (See Table III).

LABORATORY FLOODING TESTS

The sand in this core responded to laboratory flooding tests, as a total recovery of 2,581 barrels of oil per acre was obtained from 17.0 feet of sand. The weighted average percent oil saturation was reduced from 49.4 to 40.7, or represents an average recovery of 8.7 percent. The weighted average effective permeability of the samples is 0.669 millidarcys, while the average initial fluid production pressure is 38.8 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 22 samples tested, 16 produced water and 17 oil. This indicates that approximately 77 percent of the sand represented by these samples is floodable pay sand. The tests show that the sand has a wide variation in effective permeability to water. Also the results of the flood-pot tests indicate that fresh water has a tendency to decrease the effective permeability of the sand. It is recommended that salt water or a low pH water be used as the flooding medium.

CONCLUSION

Based on the results of the laboratory tests, it appears that efficient primary and secondary operations in the vicinity of this well should recover approximately 3,930 barrels of oil per acre or an average

of 281 barrels per acre foot from the 14.0 feet of floodable pay sand analyzed in this core. The recovery values were calculated using the following data and assumptions:

Original formation volume factor	1.04
Reservoir water saturation, percent	25.0
Average porosity, percent	22.0
Oil saturation after flooding, percent	40.7
Performance factor, percent	50.0
Net floodable pay sand, feet	14.0

This core shows a more or less shaly pay sand section having a good oil saturation, a moderate water saturation and a wide variation in effective permeability to water.

Any oil already recovered from the area represented by this core should be subtracted from the above calculated values.

RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company		John J. Robertson		Lease		Boehm		Well No.		1-P	
Depth Interval, Feet	Feet of Core Analyzed	Average Percent Porosity	Average Percent Oil Saturation	Average Percent Water Saturation	Average Oil Content Bbl./A. Ft.	Permeability Capacity Ft. x Md.	Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.	Total Oil Content Bbls./Acre
649.0 - 661.0	12.0	22.1	52.4	34.8	901	714.00	649.0 - 661.0	12.0	59.5	714.00	10,808
661.0 - 671.0	10.0	21.3	43.7	43.5	723	329.00	661.0 - 671.0	10.0	32.9	329.00	7,233
649.0 - 671.0	22.0	21.8	48.4	38.8	820	1,043.00	649.0 - 671.0	22.0	47.5	1,043.00	18,041

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

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			
1	649.5	23.7	51	937	10	184	41	50	11	0.700	50
2	650.5	20.3	53	834	8	126	45	50	0	0.030	50
3	651.5	20.7	47	754	6	96	41	52	2	0.200	50
4	652.5	20.3	52	818	10	157	42	49	0	0.015	50
5	653.5	19.4	51	766	0	0	51	40	0	Imp.	-
6	654.5	24.0	55	1,022	17	316	38	48	12	0.625	30
7	655.5	23.2	54	972	18	324	36	58	7	0.400	40
8	656.5	24.3	53	998	10	188	43	54	6	0.400	40
9	657.5	23.5	48	874	14	255	34	57	36	0.800	30
10	658.5	22.5	52	907	11	192	41	53	5	0.300	40
11	659.5	19.6	54	821	0	0	54	43	0	Imp.	-
12	660.5	22.2	61	1,050	12	206	49	50	4	0.300	40
13	661.5	20.8	49	789	3	48	46	53	0	0.005	50
14	662.5	20.3	43	676	0	0	43	50	0	Imp.	-
15	663.5	21.2	42	690	0	0	42	56	3	0.200	50
16	664.5	20.6	44	703	6	96	38	58	6	0.300	50
17	665.5	21.2	47	772	4	66	43	52	14	0.500	30
18	666.5	22.9	51	905	9	160	42	50	61	1.50	30
19	667.5	19.2	40	596	0	0	40	56	4	0.400	50
20	668.5	21.6	45	754	3	50	42	55	13	0.400	40
21	669.5	22.7	38	668	2	35	36	62	108	2.40	20
22	670.5	21.1	40	654	5	82	35	62	113	2.50	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	John J. Robertson	Lease	Boehm	Well No.	1-P
Depth Interval, Feet	649.0 - 661.0	661.0 - 671.0	649.0 - 671.0		
Feet of Core Analyzed	10.0	7.0	17.0		
Average Percent Porosity	22.5	21.5	22.0		
Average Percent Original Oil Saturation	52.6	44.9	49.4		
Average Percent Oil Recovery	11.6	4.6	8.7		
Average Percent Residual Oil Saturation	41.0	40.3	40.7		
Average Percent Residual Water Saturation	52.1	56.0	53.6		
Average Percent Total Residual Fluid Saturation	93.1	96.3	94.3		
Average Original Oil Content, Bbls./A. Ft.	916.	749.	848.		
Average Oil Recovery, Bbls./A. Ft.	204.	77.	152.		
Average Residual Oil Content, Bbls./A. Ft.	712.	672.	696.		
Total Original Oil Content, Bbls./Acre	9,166.	5,245.	14,411.		
Total Oil Recovery, Bbls./Acre	2,044.	537.	2,581.		
Total Residual Oil Content, Bbls./Acre	7,122.	4,708.	11,830.		
Average Effective Permeability, Millidarcys	0.377	1.09	0.669		
Average Initial Fluid Production Pressure, p.s.i.	42.0	34.3	38.8		

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