

OILFIELD RESEARCH LABORATORIES

536 NORTH HIGHLAND - CHANUTE, KANSAS 66720 - PHONE (316) 431-2650

May 24, 1977

Glenn Caldwell
Box 42
Garnett, Kansas 66032

Dear Mr. Caldwell:

Enclosed herewith is the report of the analysis run on the Rotary core taken from the North Unit Lease, Well No. 26, Anderson County, Kansas, and submitted to our laboratory on May 13, 1977.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

James E. Russell

Geologist

JER:vm
4 c to Garnett, Kansas

GENERAL INFORMATION & SUMMARY

Company Glenn Caldwell Lease North Unit Well No. 26

Location SE SW NW NE

Section 4 Twp. 21S Rge. 21E County Anderson State Kansas

Name of Sand - - - - - Bartlesville

Top of Core - - - - (Received) - - - - 712.0

Bottom of Core - - - - (Received) - - - - 731.4

Top of Sand - - - - (Received) - - - - 712.0

Bottom of Sand - - - - (Received) - - - - 730.7

Total Feet of Permeable Sand - - - - 18.7

Total Feet of Floodable Sand - - - - 16.0

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 25	2.7	2.7
25 - 50	4.0	6.7
50 - 75	2.6	9.3
75 - 100	5.4	14.7
100 & above	4.0	18.7

Average Permeability Millidarcys - - - - 72.6

Average Percent Porosity - - - - 21.3

Average Percent Oil Saturation - - - - 36.9

Average Percent Water Saturation - - - - 46.5

Average Oil Content, Bbls./A. Ft. - - - - 612.

Total Oil Content, Bbls./Acre - - - - 11,436.

Average Percent Oil Recovery by Laboratory Flooding Tests - - - - 8.0

Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft. - - - - 141.

Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre - - - - 2,254.

Total Calculated Oil Recovery, Bbls./Acre - - - -

Packer Setting, Feet - - - -

Viscosity, Centipoises @ - - - -

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

Elevation, Feet - - - -

- 2 -

A salt water mud was used as a circulating fluid in the coring of the sand in this well. The sand reservoir, from which this core was taken, has been repressured with water. The core was sampled by the client.

FORMATION CORED

The detailed log of the formation cored is as follows:

<u>Depth Interval, Feet</u>	<u>Description</u>
712.0 - 718.6	Brown slightly laminated carbonaceous sandstone.
718.6 - 719.0	Hard gray sandy shale.
719.0 - 730.0	Brown fine grained sandstone.
730.0 - 730.7	Grayish brown conglomeratic shaly sandstone.
730.7 - 731.4	Gray sandy shale.

Coring was started at a depth of 712.0 feet in brown slightly laminated carbonaceous sandstone and completed at 731.4 feet in gray sandy shale. This core shows a total of 18.7 feet of sandstone. For the most part, the pay is made up of brown fine grained 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 77.2 and 66.0 millidarcys respectively; the overall average being 72.6 (See Table III). By observing the data given on the coregraph, it is noticeable that the sand has a somewhat irregular permeability profile. The permeability of the sand varies from 1.3 to a maximum of 156 millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a fairly good weighted average percent oil saturation, namely, 36.9. The weighted average percent oil

- 3 -

saturation of the upper and lower sections is 32.3 and 43.4 respectively. The weighted average percent water saturation of the upper and lower sections is 44.1 and 49.8 respectively; the overall average being 46.5 (See Table III). This gives an overall weighted average total fluid saturation of 83.4 percent. The low total fluid saturation of 76.4 for the upper section indicates some fluid was lost during coring which was probably oil.

The weighted average oil content of the upper and lower sections is 531 and 727 barrels per acre foot respectively; the overall average being 612. The total oil content, as shown by this core, is 11,436 barrels per acre of which 10,530 barrels are in the pay sand section (See Table III).

LABORATORY FLOODING TESTS

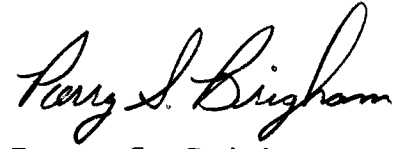
The sand in this core responded fairly well to laboratory flooding tests, as a total recovery of 2,254 barrels of oil per acre was obtained from 16.0 feet of sand. The weighed average percent oil saturation was reduced from 37.1 to 29.1, or represents an average recovery of 8.0 percent. The weighted average effective permeability of the samples is 11.3 millidarcys, while the average initial fluid production pressure is 13.4 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 19 samples tested, 16 produced water and oil. This indicates that approximately 84 percent of the sand represented by these samples is floodable pay sand. The tests also show that the sand has a wide variation in effective permeability to water.

CONCLUSION

Because the sand reservoir has been repressured with water, no calculated oil recovery is given as there are too many unknown factors.

Laboratory flooding tests show the pay sand section extends from 713.0 to 730.0 feet. The core shows a clean sand section having a fairly good oil saturation, a moderate water saturation, and good porosity and permeability.

A handwritten signature in cursive script, reading "Perry S. Brigham". The signature is written in dark ink and is positioned above the printed name.

Perry S. Brigham

Oilfield Research Laboratories

RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Glenn Caldwell Lease North Unit Well No. 26

Sample No.	Depth, Feet	Effective Porosity Percent	Percent Saturation			Oil Content Bbls. / A Ft.	Perm., Mill.	Feet of Sand		Total Oil Content	Perm. Capacity Ft. X md.
			Oil	Water	Total			Ft.	Cum. Ft.		
1	712.5	19.2	26	45	71	387	72.	1.0	1.0	387	72.00
2	713.5	23.1	40	35	75	717	137.	1.0	2.0	717	137.00
3	714.5	22.3	32	40	72	554	99.	1.0	3.0	554	99.00
4	715.5	23.6	39	37	76	714	156.	1.0	4.0	714	156.00
5	716.5	19.9	26	50	76	402	11.	1.0	5.0	402	11.00
6	717.5	21.6	29	43	72	486	84.	1.0	6.0	486	84.00
7	718.5	21.3	33	42	75	545	53.	0.6	6.6	327	31.80
8	719.5	22.3	29	51	80	502	97.	1.4	8.0	703	135.80
9	720.5	19.6	39	42	81	593	68.	1.0	9.0	593	68.00
10	721.5	18.9	36	45	81	528	19.	1.0	10.0	528	19.00
11	722.5	19.7	28	52	80	428	36.	1.0	11.0	428	36.00
12	723.5	19.8	41	47	88	630	38.	1.0	12.0	630	38.00
13	724.5	21.5	39	47	86	651	35.	1.0	13.0	651	35.00
14	725.5	23.2	41	48	89	738	89.	1.0	14.0	738	89.00
15	726.5	23.9	46	51	97	853	32.	1.0	15.0	853	32.00
16	727.5	22.2	41	57	98	706	113.	1.0	16.0	706	113.00
17	728.5	21.7	45	52	97	758	118.	1.0	17.0	758	118.00
18	729.5	20.8	46	50	96	742	82.	1.0	18.0	742	82.00
19	730.5	19.1	50	45	95	741	1.3	0.7	18.7	519	0.91

Oilfield Research Laboratories

SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Glenn Caldwell Lease North Unit Well No. 26

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
712.0 - 723.0	11.0	77.2	849.60
723.0 - 730.7	7.7	66.0	507.91
712.0 - 730.7	18.7	72.6	1,357.51

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
712.0 - 723.0	11.0	21.1	32.3	44.1	531	5,839
723.0 - 730.7	7.7	21.6	43.4	49.8	727	5,597
712.0 - 730.7	18.7	21.3	36.9	46.5	612	11,436

Oilfield Research Laboratories

RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Glenn Caldwell Lease North Unit Well No. 26

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	712.5	19.2	26	387	0	0	26	45	387	0	Imp.	-
2	713.5	23.2	40	720	10	180	30	67	540	365	21.24	10
3	714.5	22.0	35	598	8	137	27	70	461	248	12.00	10
4	715.5	22.8	39	690	11	195	28	64	495	338	19.99	15
5	716.5	20.8	26	420	5	81	21	73	339	49	2.10	15
6	717.5	21.2	29	477	7	115	22	74	362	119	4.50	20
7	718.5	23.7	33	607	6	111	27	64	496	256	8.80	10
8	719.5	23.6	29	531	5	92	24	72	439	256	17.49	10
9	720.5	19.8	39	599	10	154	29	68	445	39	1.70	25
10	721.5	18.9	36	528	0	0	36	45	528	0	Imp.	-
11	722.5	20.0	28	435	4	63	24	74	372	135	5.50	15
12	723.5	20.7	40	643	12	193	28	69	450	71	3.00	20
13	724.5	21.7	39	657	6	101	33	64	556	98	3.90	15
14	725.5	24.7	41	786	8	173	32	66	613	216	19.15	10
15	726.5	25.0	46	892	12	232	34	63	660	330	17.14	10
16	727.5	23.7	41	754	8	147	33	64	607	333	17.85	10
17	728.5	22.2	45	775	9	155	36	60	620	303	14.37	10
18	729.5	21.3	46	760	8	132	38	59	628	287	9.00	10
19	730.5	19.1	50	741	0	0	50	45	741	0	Imp.	-

Notes: cc—cubic centimeter.

*—Volume of water recovered at the time of maximum oil recovery.

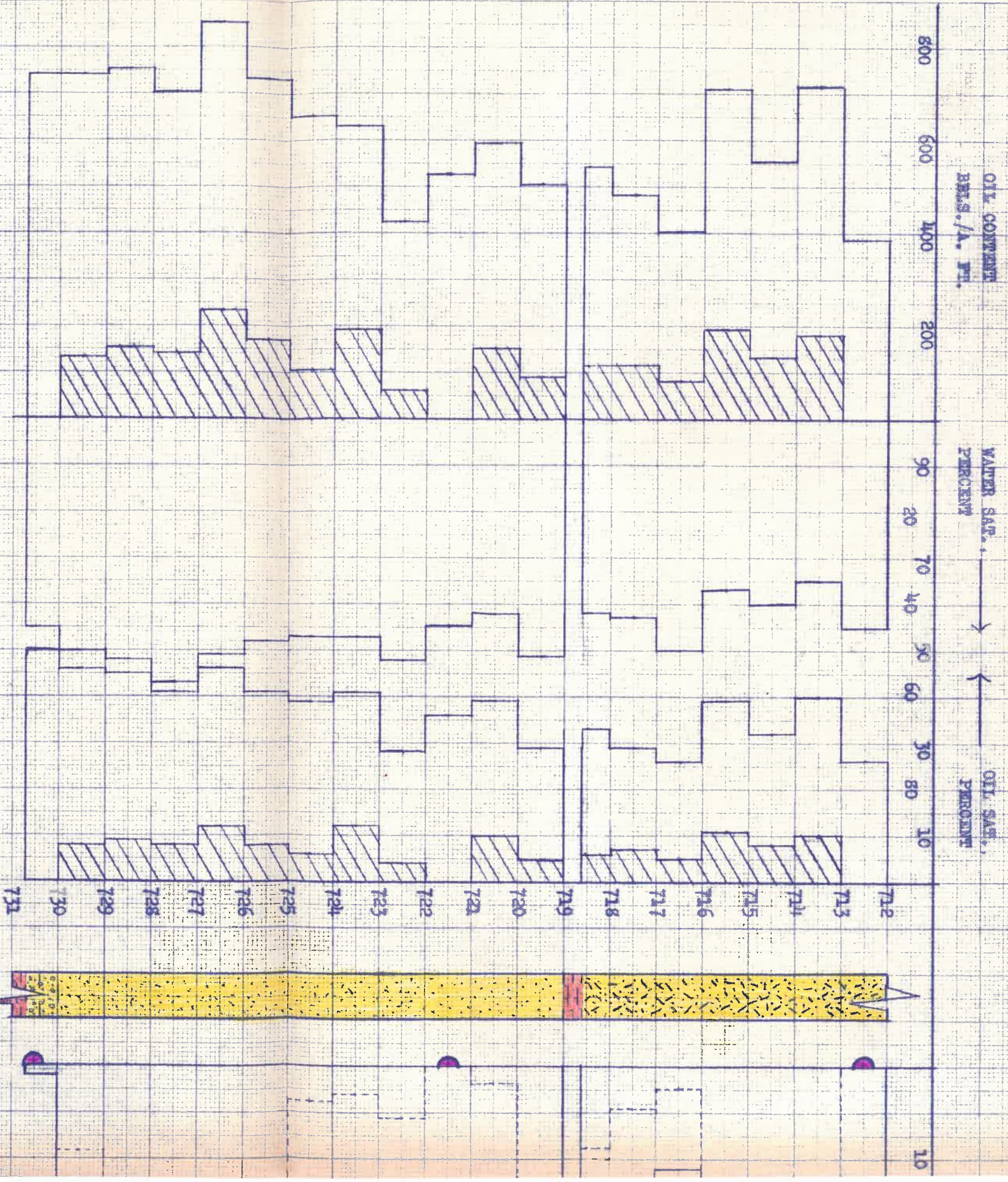
**—Determined by passing water through sample which still contains residual oil.

Oilfield Research Laboratories
SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

Company	Glenn Caldwell	Lease	North Unit	Well No.	26
Depth Interval, Feet	713.0 - 723.0	723.0 - 730.0	713.0 - 730.0		
Feet of Core Analyzed	9.0	7.0	16.0		
Average Percent Porosity	21.9	22.8	22.3		
Average Percent Original Oil Saturation	32.9	42.4	37.1		
Average Percent Oil Recovery	7.3	9.0	8.0		
Average Percent Residual Oil Saturation	25.6	33.4	29.1		
Average Percent Residual Water Saturation	69.9	63.6	67.1		
Average Percent Total Residual Fluid Saturation	95.5	97.0	96.2		
Average Original Oil Content, Bbls./A. Ft.	561.	753.	645.		
Average Oil Recovery, Bbls./A. Ft.	125.	162.	141.		
Average Residual Oil Content, Bbls./A. Ft.	436.	591.	504.		
Total Original Oil Content, Bbls./Acre	5,048.	5,267.	10,318.		
Total Oil Recovery, Bbls./Acre	1,121.	1,133.	2,254.		
Total Residual Oil Content, Bbls./Acre	3,927.	4,134.	8,061.		
Average Effective Permeability, Millidarcys	10.8	12.1	11.3		
Average Initial Fluid Production Pressure, p.s.i.	14.4	12.1	13.4		

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



FLOOD POT RECOVERY
IMPERMEABLE TO WATER

CARBONACEOUS SANDSTONE

SANDY SHALE

GLENN CAL
NORTH UNIT LEASE
ANDERSON COUNTY E

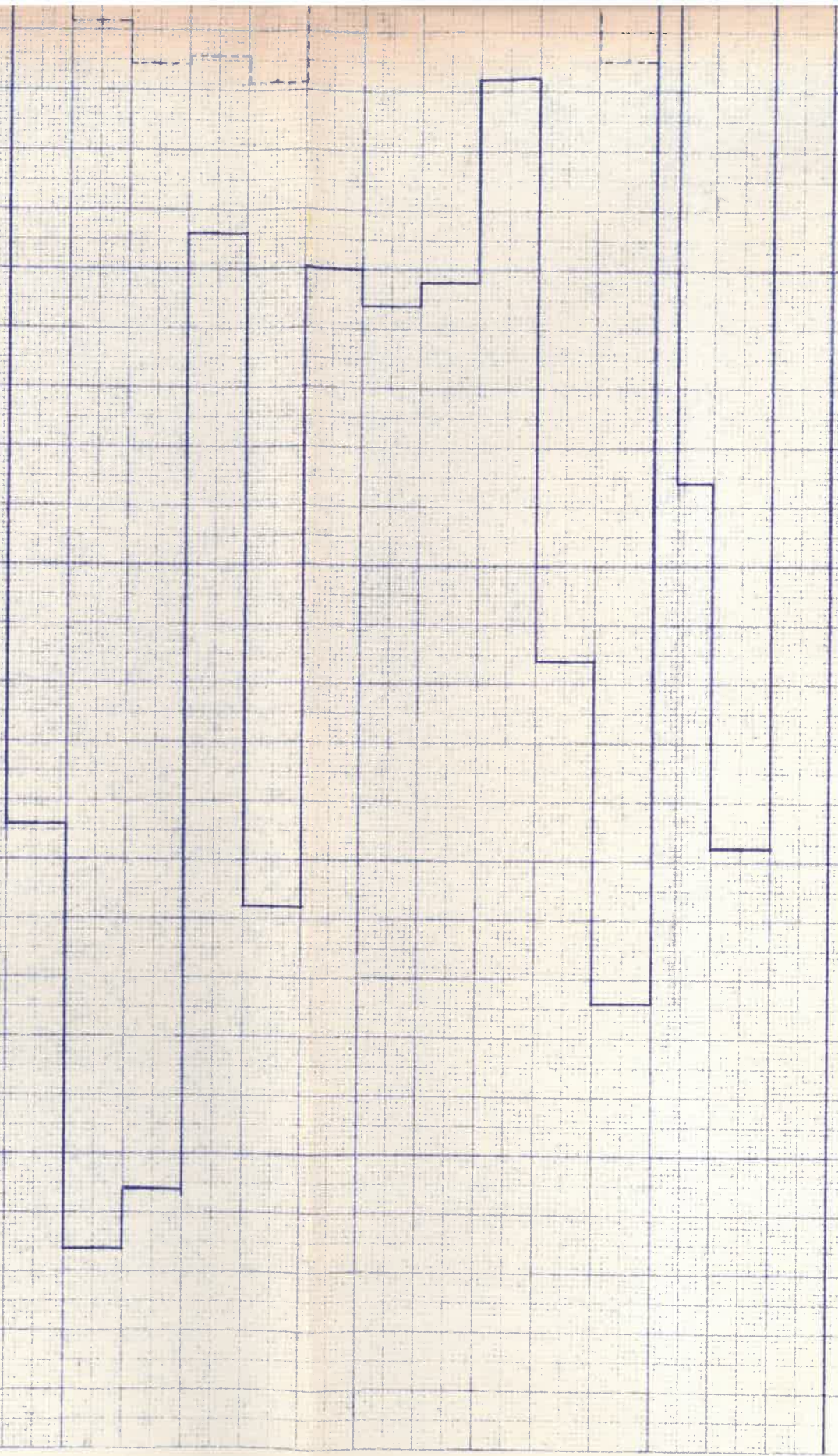
DEPTH INTERVAL, FEET	FEET OF CORE ANALYZED	AVERAGE POROSITY PERCENT	AVG. OIL SATURATION PERCENT	A SA P
712.0 - 723.0	11.0	21.1	32.3	
723.0 - 730.7	7.7	21.5	43.4	
712.0 - 730.7	18.7	21.3	36.9	

AIR PERMEABILITY, IN MILLIDARCS
EFFECTIVE PERMEABILITY, IN MILLIDARCS

20 30 40 50 60 70 80 90 100 110 120 130

37 →

56 →



SANDSTONE

SANDSTONE

CONGLOMERATE SEALY SANDSTONE

DWELL

WELL NO. 26

MSAS

G. WATER SATURATION	AVG. OIL CONTENT	TOTAL OIL CONTENT	AVG. AIR PERMEABILITY, MILLIDARCS	CALCULATED OIL RECOVERY, BBL./ACRE
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POINT	BBL./A.FT.	BBL./ACRE	MILLIDARCS	BBL./ACRE
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49.1	531	5,459	77.2	
49.8	727	5,597	66.0	
46.5	612	11,456	72.5	

OILFIELD RESEARCH LABORATORIES
CHANDLER, KANSAS
MAY, 1977.