

# OILFIELD RESEARCH LABORATORIES

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

June 4, 1976

BMS Enterprises  
8485 Kathy Lane  
Lincoln, Nebraska 68526

Gentlemen:

Enclosed herewith is the report of the analysis of the Rotary core taken from the Flake Estate Lease, Well No. 1, Coffey County, Kansas, and submitted to our laboratory on June 1, 1976.

Your business is greatly appreciated.

Very truly yours,

OILFIELD RESEARCH LABORATORIES

Carl L. Pate

CLP:bl  
4 c to Lincoln, Nebraska  
1 c to Richard B. Schmidt  
Topeka, Kansas 66604



A water base mud was used as a circulating fluid in the coring of the sand in this well. This well was drilled in a virgin area. The core was sampled by a representative of Oilfield Research Laboratories.

#### FORMATION CORED

The detailed log of the formation cored is as follows:

<u>Depth Interval,</u> <u>Feet</u>	<u>Description</u>
990.0 - 994.4	Gray shale.
994.4 - 995.1	Laminated very shaly sandstone.
995.1 - 995.8	Dark brown sandstone.
995.8 - 996.1	Gray sandy shale.
996.1 - 996.7	Dark slightly shaly sandstone.
996.7 - 998.7	Dark fine grained sandstone.
998.7 - 999.3	Dark shaly sandstone.
999.3 - 1003.7	Dark sandstone.
1003.7 - 1005.0	Dark very shaly sandstone.
1005.0 - 1005.5	Gray sandy shale.

Coring was started at a depth of 990.0 feet in gray shale and completed at 1005.5 feet in gray sandy shale. This core shows a total of 10.3 feet of sandstone. For the most part, the pay is made up of dark fine grained sandstone.

#### PERMEABILITY

The weighted average permeability of the cored section is 58.9 millidarcys. By observing the data given on the coregraph, it is noticeable that the sand has a very irregular permeability profile. The

permeability of the sand varies from 1.3 to a maximum of 147 millidarcys.

#### PERCENT SATURATION & OIL CONTENT

The sand in this core shows a good weighted average percent oil saturation, namely, 42.3. The weighted average percent water saturation of the cored section is 29.9. This gives an overall weighted average total fluid saturation of 72.2 percent. This low total fluid saturation indicates considerable fluid was lost during coring which was probably oil.

The weighted average oil content of the cored section is 652 barrels per acre foot. The total oil content, as shown by this core, is 6,333 barrels per acre (See Table III).

#### LABORATORY FLOODING TESTS

The sand in this core responded very well to laboratory flooding tests, as a total recovery of 1,747 barrels of oil per acre was obtained from 7.1 feet of sand. The weighted average percent oil saturation was reduced from 49.7 to 34.7, or represents an average recovery of 15.0 percent. The weighted average effective permeability of the samples is 4.73 millidarcys, while the average initial fluid production pressure is 21.1 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 11 samples tested, 9 produced water and oil. This indicates that approximately 82 percent of the sand represented by these samples is floodable pay sand. The tests also show that the pay sand section extends from a depth of 995.1 to 1003.7 feet.

CONCLUSION

On the basis of the above data, we estimate that approximately 2,293 barrels of oil per acre can be recovered from the sand reservoir, represented by this core, by efficient primary and waterflood operations. The following data and assumptions were used in calculating the above oil recovery value:

Present formation volume factor	1.06
Irreducible water saturation, percent	23.0
Primary recovery	None
Present oil saturation, percent	72.6
Average porosity, percent	20.0
Oil saturation after flooding, percent	34.7
Performance factor	0.55
Net floodable pay sand, feet	7.1

The core shows a rather clean pay sand section (995.1 to 1003.7 feet) having a good oil saturation, a fairly low water saturation and a good permeability and porosity.

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE I-B

Company BMS Enterprises Lease Flake Estate Well No. 1

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			Ft.	Cum. Ft.		
1	994.5	16.9	21	63	275	1.3	0.7	0.7	192	0.91
2	995.5	19.3	49	21	734	43.	0.7	1.4	514	30.00
3	996.5	18.7	50	22	726	28.	0.6	2.0	436	16.80
4	997.5	18.4	53	20	757	26.	1.3	3.3	985	33.80
5	998.5	18.9	48	30	704	32.	0.7	4.0	493	22.40
6	999.5	22.1	56	18	960	118.	0.7	4.7	672	82.50
7	1000.5	20.5	50	20	796	35.	1.0	5.7	796	35.00
F-8	1001.3	23.1	45	-	791	-	0.4	6.1	316	-
8	1001.5	17.4	39	36	527	119.	0.6	6.7	316	71.50
9	1002.5	21.0	49	24	798	145.	1.0	7.7	798	145.00
10	1003.5	23.1	44	32	788	147.	0.7	8.4	551	103.00
11	1004.5	18.7	14	45	203	5.7	1.3	9.7	264	7.40

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## SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company	Lease	Flake Estate	Well No.		
BMS Enterprises			1		
Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.		
994.4 - 1005.0	9.3	58.9	548.31		
Depth Interval, Feet	Feet of Core Analyzed	Average Percent Porosity	Average Percent Water Saturation	Average Oil Content Bbl./A. Ft.	Total Oil Content Bbls./Acre
994.4 - 1005.0	9.7	19.6	42.3	29.9	6,333

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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	Bbls./A. Ft.			
1	994.5	16.0	23	286	0	0	23	65	286	0	Imp.	-
2	995.5	19.1	49	728	14	208	35	55	520	7	0.24	40
3	996.5	18.2	50	708	10	142	40	59	566	20	0.57	25
4	997.5	20.3	53	837	18	284	35	64	553	139	3.85	15
5	998.5	19.8	48	739	12	185	36	62	554	35	0.90	25
6	999.5	22.4	56	976	22	383	34	56	593	174	6.12	15
7	1000.5	20.3	50	790	14	222	36	56	568	42	0.98	25
8	1001.3	23.1	45	791	10	180	34	65	611	174	5.23	20
9	1002.5	21.8	49	831	16	271	33	66	560	341	9.39	15
10	1003.5	24.3	44	831	14	264	30	69	567	349	15.30	15
11	1004.5	17.4	12	162	0	0	12	52	162	0	Imp.	-

Company BMS Enterprises Lease Flake Estate Well No. 1

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	BMS Enterprises	Lease	Flake Estate	Well No.	1
Depth Interval, Feet	994.4 - 1005.0				
Feet of Core Analyzed	7.1				
Average Percent Porosity	20.9				
Average Percent Original Oil Saturation	49.7				
Average Percent Oil Recovery	15.0				
Average Percent Residual Oil Saturation	34.7				
Average Percent Residual Water Saturation	61.4				
Average Percent Total Residual Fluid Saturation	96.1				
Average Original Oil Content, Bbls./A. Ft.	809.				
Average Oil Recovery, Bbls./A. Ft.	246.				
Average Residual Oil Content, Bbls./A. Ft.	563.				
Total Original Oil Content, Bbls./Acre	5,742.				
Total Oil Recovery, Bbls./Acre	1,747.				
Total Residual Oil Content, Bbls./Acre	3,995.				
Average Effective Permeability, Millidarcys	4.73				
Average Initial Fluid Production Pressure, p.s.i.	21.1				

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

500

550

600

Base of KC

650

700

\* This log is from

B+S Oil Co

Crofts 6

Coffey Co

100' REC NW 1/4

100' ENL NW 1/4

28 22S 16E

This log is near

(Core)

Lincoln 77

Flake I

3 1/2 S 10 E

Coffey Co

elev. 7000

Cored Cherokee (992' - 1005')

N00 ENE NW 1/4  
28 22S 16E

This log is near  
Lincoln 77

Flake I  
Block 10E  
Coffee Co.  
Elev. 1000

Cored Cherokee (992' - 1005')

(ind)

700

750

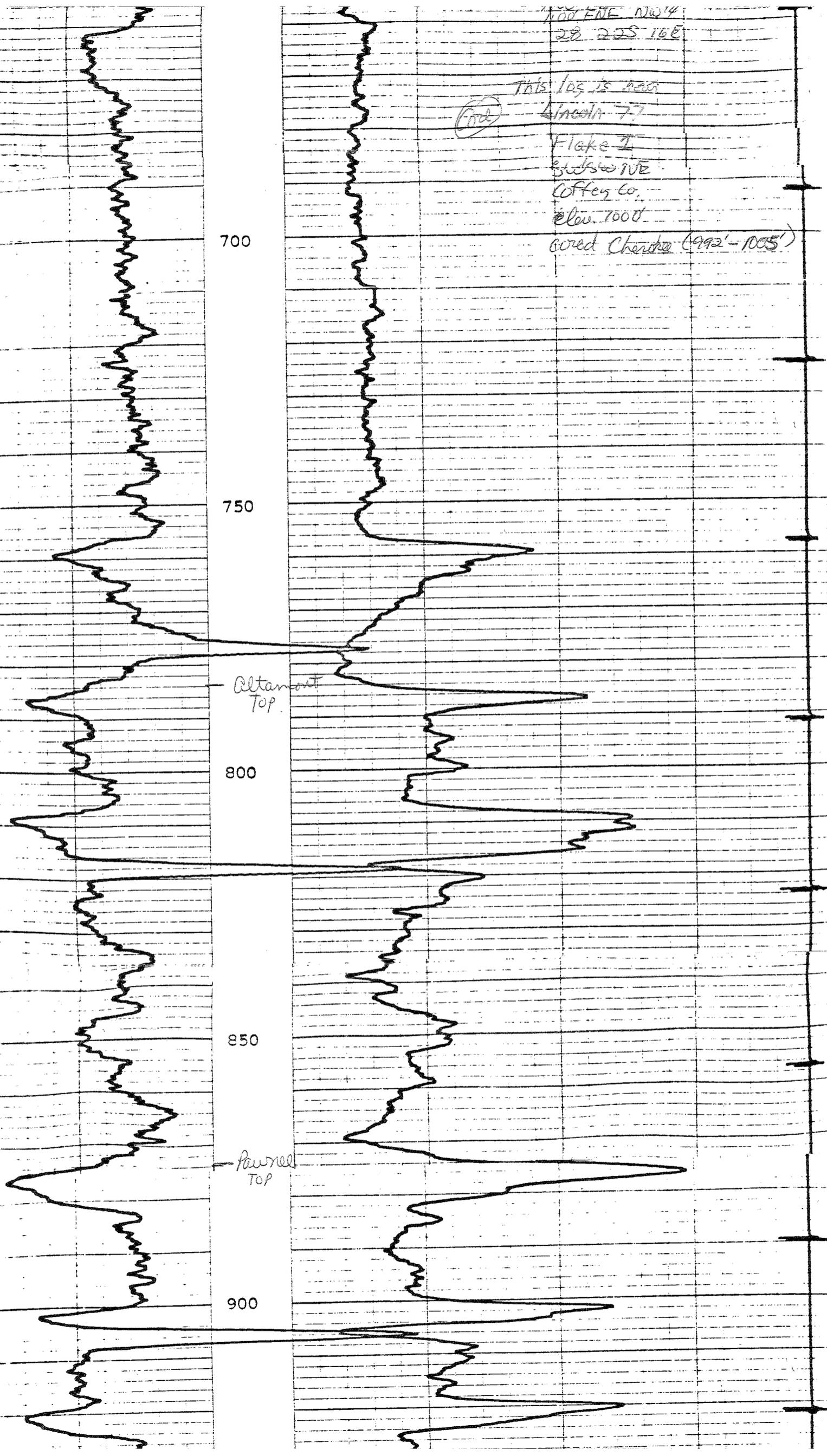
Altamont  
TOP

800

850

Pawnee  
TOP

900



850

*Pawnee  
Top*

900

950  
*Cherokee Top*

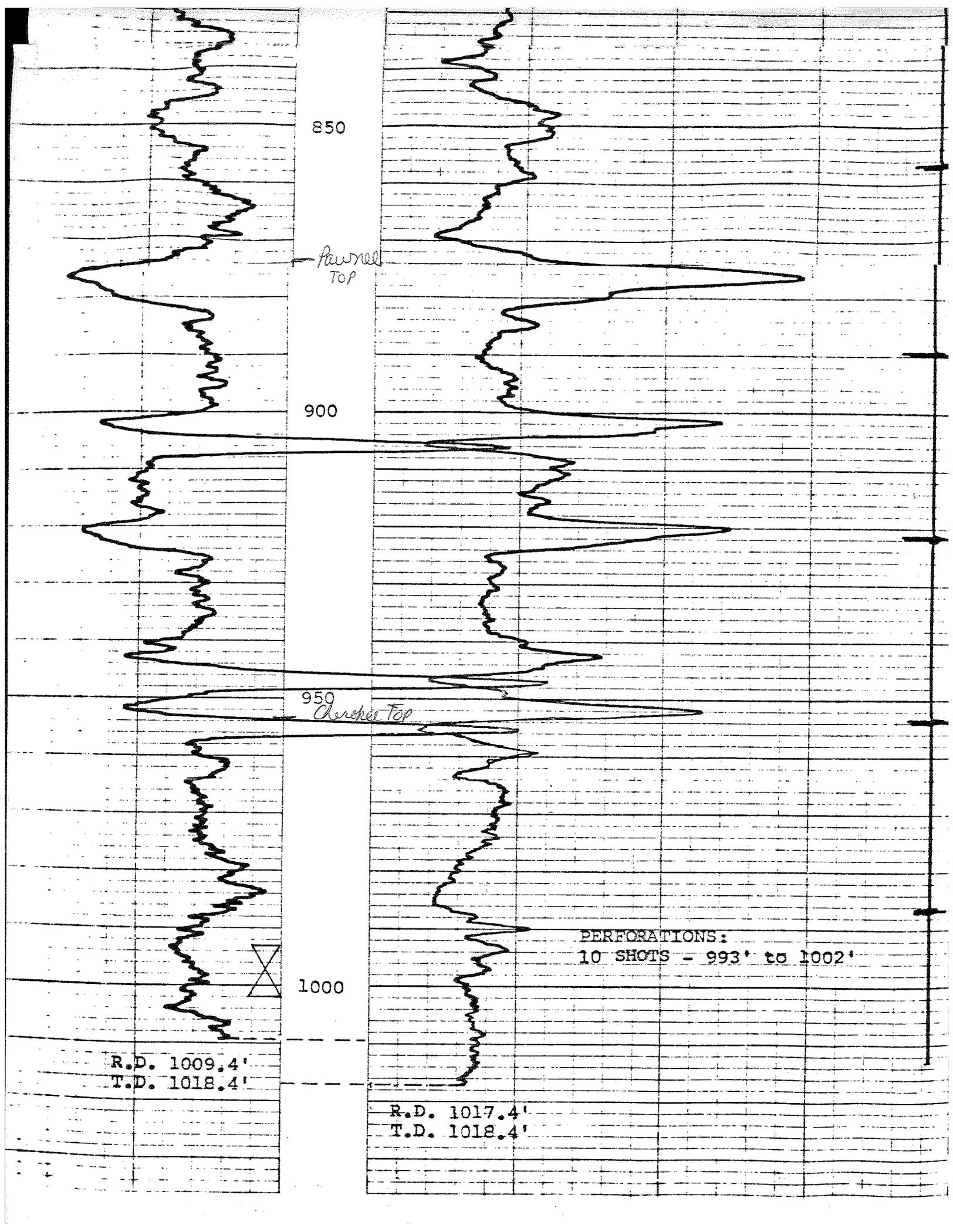
1000

R.D. 1009.4'  
T.D. 1018.4'



PERFORATIONS:  
10 SHOTS - 993' to 1002'

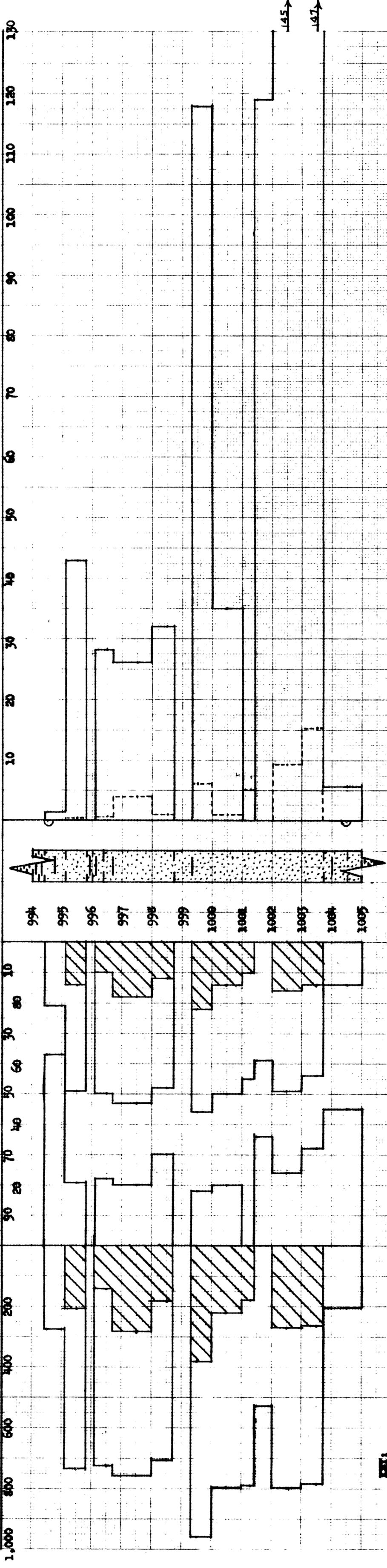
R.D. 1017.4'  
T.D. 1018.4'



— AIR PERMEABILITY, IN MILLIDARCYTS  
 - - - - - EFFECTIVE PERMEABILITY, IN MILLIDARCYTS

WATER SAT., PERCENT ←  
 OIL SAT., PERCENT →

OIL COLUMN, INLS./A. FT.



SHALY SANDSTONE  
 SANDSTONE

SHALY SANDSTONE  
 SANDSTONE

SHALY SANDSTONE  
 SANDSTONE

# BMS ENTERPRISES

FLACK LEASE TRACT  
 COUNTY CORNER, KANSAS  
 WELL NO. 1

WELL DEPTH, FEET	AVERAGE PERCENT POROSITY	AVERAGE SATURATION PERCENT	AVERAGE WATER SATURATION PERCENT	AVERAGE OIL COLUMN INLS./A. FT.	TOTAL OIL COLUMN INLS./A. FT.	AVERAGE AIR PERMEABILITY, MILLIDARCYTS	CALCULATED OIL RECOVERY PERCENT
994.4 - 1005.0	19.6	42.3	29.9	654	6,338	96.9	2.89 (Primary & waterflooding)

OKLAHOMA RESEARCH LABORATORIES  
 CHAMBER, KANSAS  
 JUNE, 1976