744

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

March 17, 1958

DRV

REPLY TO
4010 N. YOUNGS BOULEVARD
P. O. BOX 7128
OKLAHOMA CITY, OKLAHOMA

Continental Oil Company
Drawer 98
Plainville, Kansas

Subject: Core Analysis
J. E. Leonard No. 7 Well
Adell Field
Sheridan County, Kansas

Gentlemen:

Diamond coring equipment and water base mud were used to core the intervals, 3614 to 3692 and 3718 to 3746 feet, in the J. E. Leonard No. 7. Engineers of Core Laboratories, Inc. selected samples of recovered formation for analysis as directed by a representative of Continental Oil Company. These samples were sealed in plastic bags to preserve fluid content and were transported to the Wichita laboratory. The results of the analysis are shown graphically on the accompanying Coregraph and tabularly on pages one through three.

Various intervals were analyzed between the depths of 3619 and 3745 feet. Following is a summary discussion of these zones with interpretations of probable production and other pertinent remarks.

Formation Interval, Feet	Interpretations and Remarks
Toronto	
3619.0 to 3630.0	The sample analyzed in this interval at 3620 to 3621 feet has analysis characteristics which are favorable to oil production. However, the remainder of the formation is characterized by extremely low permeability in association with unfavorable residual fluid saturations and a completion attempt in this interval is, therefore, not recommended.

Formation Interval, Feet	Interpretations and Remarks
Lansing-Kansas City	
3639.0 to 3656.0	This zone is characterized by extremely low permeability and porosity and is considered to be of no productive significance in this well. With the exception of the sample analyzed at 3654 to 3655 feet, all formation in the zone exhibited less than 0.1 millidarcy matrix permeability.
3666.0 to 3667.0	Nonproductive due to low permeability and unfavorable residual fluid distribution.
3667.0 to 3678.0	Oil productive with a small water cut considered possible. Formation in this zone having less than 0.1 millidarcy permeability is considered to be essentially nonproductive and has been excluded when computing the average data and estimates of recoverable oil presented later. The average permeability of the five productive feet in this zone is 47 millidarcys and the total observed natural productive capacity is 235 millidarcy-feet, indicating that a formation treatment may be necessary in order to establish satisfactory rates of flow. Fractures were observed in this zone and these fractures may augment the productive capacity to some extent. The average measured porosity is 12.9 per cent and the estimated connate water saturation is 35 per cent of pore space. Estimates of recoverable oil and a summary of average core analysis data have been presented for this zone on page four.
3678.0 to 3681.0	Decreasing residual oil saturations and high total water saturations indicate this zone to be possibly in the transitional stage from oil to water productive. It is suggested that this zone not be included in the completed interval.

Formation Interval, Feet	Interpretations and Remarks
3681.0 to 3692.0	Nonproductive due to a lack of measurable permeability and unfavorable residual fluid distribution.
3721.5 to 3726.0	Nonproductive. Permeability of this zone is less than 0.1 millidarcy and the measured total water saturations are quite high.
3726.0 to 3736.0	Portions of this zone exhibit residual fluid saturations which are favorable to oil production, although measurable permeability was encountered at only two points. Within this zone from 3730 to 3733 feet, formation is considered to be virtually nonproductive due to unfavorable residual fluid distribution. The seven feet in this zone which exhibit fluid saturations favorable to oil production have an average permeability of 0.3 millidarcy and a total observed natural productive capacity of 2.1 millidarcy-feet. It is, therefore, evident that any significant fluid production from this zone would be dependent upon unusually favorable response to formation treatment. The average measured porosity is 4.5 per cent and the average calculated connate water saturation is 42 per cent of pore space. In view of the doubtful commercial value of this zone, estimates of recoverable oil have not been presented. However, a complete summary of average core analysis data is given on page one.
3736.0 to 3741.0	Nonproductive due to an absence of measurable permeability and unfavorable residual fluid saturations.
3742.0 to 3745.0	No commercial value due to low permeability and porosity.

Recoverable oil estimates have been calculated for the Lansing-Kansas City zone from 3667.0 to 3678.0 feet using the observed core analysis

data from the five productive feet analyzed in the interval in conjunction with estimated reservoir fluid characteristics considered applicable. These estimates are presented on page one of this report and are subject to the conditions set forth in the body of and in the footnotes to the summary page.

We sincerely appreciate this opportunity to be of service and trust that this report will be of assistance in making a preliminary evaluation of the formations analyzed from the J. E. Leonard No. 7.

Very truly yours,

Core Laboratories, Inc.

J. W. Barbour, Jr.,
District Manager

JWB:JDJ:ds
10 cc. - Addressee
1 cc. - Mr. F. R. Conley
Continental Oil Company
Ponca City, Oklahoma

1-4 → DRV
10 → 7

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

CORE ANALYSIS RESULTS

Company Continental Oil Company | Formation As Noted | File CP-10-24 FC
Well J. E. Leonard No. 7 | Core Type Diamond | Date Report 3-17-58
Field Adell | Drilling Fluid Water Base Mud | Analysts OLP:TC
County Sheridan State Kansas Elev. 2627' RB Location NE SE NW Sec. 12-6S-27W

Lithological Abbreviations

SAND-SD SHALE-SH LIME-LM	DOLOMITE-DOL CHERT-CH GYPSUM-GYP	ANHYDRITE-ANHY CONGLOMERATE-CONG FOSSILIFEROUS-FOSS	SANDY-SDY SHALY-SHY LIMY-LMY	FINE-FN MEDIUM-MED COARSE-CSE	CRYSTALLINE-XLN GRAIN-GRN GRANULAR-GRNL	BROWN-BRN GRAY-GY VUGGY-VGY	FRACTURED-FRAC LAMINATION-LAM STYLOLITIC-STY	SLIGHTLY-SL/ VERY-V/ WITH-W/

SAMPLE NUMBER	DEPTH FEET	PERMEABILITY MILLIDARCYS	POROSITY PER CENT	RESIDUAL SATURATION PER CENT PORE OIL	RESIDUAL SATURATION PER CENT PORE TOTAL WATER	SAMPLE DESCRIPTION AND REMARKS
5-9 → TRNT	Toronto					
	~~3614.0-16.0~~					Sh, gry-grn, lmy
14-17	~~16.0-19.0~~ 13-23	28-33	24-26	40-41	42-44	Sh, maroon, lmy
1	3619.0-20.0	<0.1	13.9	0.0	93.5	Sh, gr-maroon, lmy
2	3620.0-21.0	42	9.7	24.8	40.2	Lm, sl/shy w/gd show, dull flu
3	3621.0-22.0	0.2	18.3	8.7	71.5	Lm, por w/thin frac
4	22.0-23.0	0.1	10.5	0.0	71.5	Lm, xln, no show
5	23.0-24.0	0.1	5.0	0.0	78.0	Lm, shy, xln, no show
6	24.0-25.0	<0.1	4.3	0.0	74.5	Lm, shy, xln, no show
7	25.0-26.0	<0.1	4.8	0.0	81.2	Lm, shy, xln, no show
8	26.0-27.0	<0.1	7.1	0.0	87.4	Lm, shy, xln, no show
9	27.0-28.0	0.1	6.1	0.0	60.7	Lm, xln, no show
10	28.0-29.0	<0.1	4.4	0.0	77.3	Lm, xln, no show
11	29.0-30.0	<0.1	4.4	0.0	61.4	Lm, foss, xln, no show
5-9 → LG KC	~~30.0-39.0~~					Sh, gry-grn & maroon, no shows
	Lansing-Kansas City					
12	3639.0-40.0	<0.1	3.6	0.0	77.8	Lm, xln, no show
13	3640.0-41.0	<0.1	2.8	0.0	57.2	Lm, xln, thin frac, no show
14	3641.0-42.0	<0.1	3.0	0.0	70.0	Lm, shy, foss
15	42.0-43.0	<0.1	2.1	0.0	71.5	Lm, sl/shy
16	43.0-44.0	<0.1	1.6	0.0	50.0	Lm, sl/shy
17	44.0-45.0	<0.1	1.8	0.0	61.2	Lm, sl/shy
18	45.0-46.0	<0.1	1.7	0.0	64.8	Lm, sl/shy
19	46.0-47.0	<0.1	1.6	0.0	31.6	Lm, sl/shy
20	47.0-48.0	<0.1	1.6	0.0	31.6	Lm, sl/shy
21	48.0-49.0	<0.1	2.2	0.0	50.0	Lm, sl/shy
	~~49.0-50.0~~					Too broken for analysis
22	50.0-51.0	<0.1	1.9	0.0	57.9	Lm, dns
23	51.0-52.0	<0.1	2.2	0.0	50.0	Lm, dns
24	52.0-53.0	<0.1	2.6	0.0	61.6	Lm, dns
25	53.0-54.0	<0.1	4.7	19.2	23.4	Lm, xln
26	54.0-55.0	0.4	18.9	0.0	85.0	Lm, weathered, sl/vgy
27	55.0-56.0	<0.1	3.6	0.0	68.3	Lm, shy
	~~3656.0-66.0~~					Sh, gry-grn & maroon w/few fracs waxy on breaks

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CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

File CP-10-24 FC Page No. 2
Well J. E. Leonard No. 7

CORE ANALYSIS RESULTS

SAMPLE NUMBER	DEPTH FEET	PERMEABILITY MILLIDARCYS	POROSITY PER CENT	RESIDUAL SATURATION PER CENT PORE		SAMPLE DESCRIPTION AND REMARKS
				OIL	TOTAL WATER	
28	3666.0-67.0	<0.1	12.3	0.0	94.3	Sh, lmy
29	3667.0-68.0	86	11.5	22.6	34.8	Lm, w/pp vgs, vert frac
30	3668.0-69.0	15	12.8	11.7	53.8	Lm, w/pp vgs
31	69.0-70.0	91	14.4	24.3	43.7	Lm, w/pp vgs
32	70.0-71.0	<0.1	7.4	0.0	81.0	Lm, dns, xln
33	71.0-72.0	13	13.5	11.1	57.0	Lm, w/pp vgs, sev large vgs
34	72.0-73.0	<0.1	5.0	0.0	84.0	Lm, dns, xln
	~~73.0-76.0~~					Sh, maroon, lmy, no show
35	76.0-77.0	<0.1	7.4	12.2	74.4	Lm, dns, w/few pp vgs
36	77.0-78.0	27	12.1	19.8	43.0	Lm, w/pp vgs
37	78.0-79.0	18	18.9	9.5	76.7	Lm, shy, maroon, some weathering
38	79.0-80.0	6.2	21.8	5.1	72.6	Lm, dol
39	80.0-81.0	0.7	19.4	0.0	72.2	Lm, sl/shy, vgy
40	81.0-82.0	<0.1	7.5	0.0	90.8	Lm, w/sh strks, foss
41	82.0-83.0	<0.1	10.8	0.0	63.0	Lm, grn, sl/dol
42	83.0-84.0	<0.1	15.9	0.0	83.0	Lm, sl/shy
43	84.0-85.0	<0.1	17.2	0.0	78.5	Lm, sl/shy
44	85.0-86.0	<0.1	14.0	0.0	83.0	Lm, sl/shy
45	86.0-87.0	<0.1	2.0	0.0	80.0	Lm, sl/xln, shy
46	87.0-88.0	<0.1	2.0	0.0	80.0	Lm, sl/xln, shy
47	88.0-89.0	<0.1	1.8	0.0	72.2	Lm, sl/xln, shy
48	89.0-90.0	<0.1	1.7	0.0	76.5	Lm, sl/xln, shy
49	90.0-91.0	<0.1	2.4	0.0	66.8	Lm, xln, sl/shy
50	91.0-92.0	<0.1	4.2	0.0	76.3	Lm, xln, sl/shy, vert frac
	~~92.0-18.0~~					Drilled
	~~3718.0-20.0~~					Sh, maroon
	~~20.0-21.5~~					Sh, chrty, sl/lmy
51	3721.5-23.0	<0.1	5.9	0.0	89.8	Lm, shy, sl/xln
52	3723.0-24.0	<0.1	1.4	0.0	85.8	Lm, shy, sl/xln
53	24.0-25.0	<0.1	4.0	0.0	85.0	Lm, shy, sl/xln
54	25.0-26.0	<0.1	1.6	0.0	62.5	Lm, xln, pp vgs, sl/shy
55	26.0-27.0	<0.1	4.4	20.2	25.0	Lm, xln, pp vgs, dns
56	27.0-28.0	<0.1	4.8	25.1	60.7	Lm, xln, shy, pp vgs
57	28.0-29.0	<0.1	2.5	26.9	44.2	Lm, xln, chrty, shy
58	29.0-30.0	<0.1	1.8	27.8	44.6	Lm, xln, sl/shy, pp vgs, vert frac
59	30.0-31.0	<0.1	2.4	0.0	87.6	Lm, massive, xln, sl/shy
60	31.0-32.0	<0.1	1.9	0.0	58.0	Lm, sl/xln, shy
61	3732.0-33.0	<0.1	0.8	0.0	37.4	Lm, sl/xln, shy

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Petroleum Reservoir Engineering
DALLAS, TEXAS

File CP-10-24 FC Page No. 3
Well J. E. Leonard No. 7

CORE ANALYSIS RESULTS

SAMPLE NUMBER	DEPTH FEET	PERMEABILITY MILLIDARCYS	POROSITY PER CENT	RESIDUAL SATURATION PER CENT PORE		SAMPLE DESCRIPTION AND REMARKS
				OIL	TOTAL WATER	
62	3733.0-~~34.0~~	<0.1	4.4	15.9	36.4	Lm, xln, sl/shy, dns, sm vgs, vert frac
63	3734.0-35.0	1.3	5.0	18.1	52.1	Lm, xln, sl/shy, dns, sm vgs, vert frac
64	3735.0-~~36.0~~	0.6	8.8	20.5	35.3	Lm, xln, sl/shy, dns, sm vgs, vert frac, chrty
65	3736.0-~~37.0~~	<0.1	4.0	0.0	57.6	Lm, xln, sl/shy, dns, sm vgs, vert frac, chrty
66	3737.0-38.0	<0.1	1.8	0.0	61.2	Lm, dns, sl/xln, sl/shy
67	3738.0-39.0	<0.1	3.0	0.0	89.9	Lm, dns, shy
68	39.0-40.0	<0.1	7.9	0.0	92.6	Lm, shy
69	40.0-41.0	<0.1	3.5	0.0	91.4	Lm, dns, shy
	~~41.0-42.0~~					Sh, blk
70	42.0-43.0	<0.1	2.8	10.7	78.7	Lm, xln, vert frac
71	43.0-44.0	<0.1	4.0	52.4	27.4	Lm, calcite, shy
72	44.0-45.0	<0.1	1.0	30.0	50.0	Lm, calcite, shy
	~~45.0-46.0~~					Sh, blk

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Form F-11B

CORE LABORATORIES, INC.

Petroleum Reservoir Engineering

DALLAS, TEXAS

Well J. E. Leonard No. 7

CORE SUMMARY AND CALCULATED RECOVERABLE OIL

FORMATION NAME AND DEPTH INTERVAL: Lansing-Kansas City 3667.0-3678.0

FEET OF CORE RECOVERED FROM ABOVE INTERVAL	11.0	AVERAGE TOTAL WATER SATURATION: PER CENT OF PORE SPACE		46.5
FEET OF CORE INCLUDED IN AVERAGES	5.0	AVERAGE CONNATE WATER SATURATION: PER CENT OF PORE SPACE	(e)	35
AVERAGE PERMEABILITY: MILLIDARCYS	47	OIL GRAVITY: °API	(e)	39
PRODUCTIVE CAPACITY: MILLIDARCY-FEET	235	ORIGINAL SOLUTION GAS-OIL RATIO: CUBIC FEET PER BARREL	(e)	30
AVERAGE POROSITY: PER CENT	12.9	ORIGINAL FORMATION VOLUME FACTOR: BARRELS SATURATED OIL PER BARREL STOCK-TANK OIL	(e)	1.05
AVERAGE RESIDUAL OIL SATURATION: PER CENT OF PORE SPACE	17.9	CALCULATED ORIGINAL STOCK-TANK OIL IN PLACE: BARRELS PER ACRE-FOOT		620

Calculated maximum solution gas drive recovery is 119 barrels per acre-foot, assuming production could be continued until reservoir pressure declined to zero psig. Calculated maximum water drive recovery is 440 barrels per acre-foot, assuming full maintenance of original reservoir pressure, 100% areal and vertical coverage, and continuation of production to 100% water cut. (*Please refer to footnotes for further discussion of recovery estimates.*)

FORMATION NAME AND DEPTH INTERVAL: Lansing-Kansas City 3726.0-3736.0

FEET OF CORE RECOVERED FROM ABOVE INTERVAL	10.0	AVERAGE TOTAL WATER SATURATION: PER CENT OF PORE SPACE		42.6
FEET OF CORE INCLUDED IN AVERAGES	7.0	AVERAGE CONNATE WATER SATURATION: PER CENT OF PORE SPACE	(c)	42
AVERAGE PERMEABILITY: MILLIDARCYS	0.3	OIL GRAVITY: °API		
PRODUCTIVE CAPACITY: MILLIDARCY-FEET	2.1	ORIGINAL SOLUTION GAS-OIL RATIO: CUBIC FEET PER BARREL		
AVERAGE POROSITY: PER CENT	4.5	ORIGINAL FORMATION VOLUME FACTOR: BARRELS SATURATED OIL PER BARREL STOCK-TANK OIL		
AVERAGE RESIDUAL OIL SATURATION: PER CENT OF PORE SPACE	22.1	CALCULATED ORIGINAL STOCK-TANK OIL IN PLACE: BARRELS PER ACRE-FOOT		

Calculated maximum solution gas drive recovery is barrels per acre-foot, assuming production could be continued until reservoir pressure declined to zero psig. Calculated maximum water drive recovery is barrels per acre-foot, assuming full maintenance of original reservoir pressure, 100% areal and vertical coverage, and continuation of production to 100% water cut. (*Please refer to footnotes for further discussion of recovery estimates.*)

(c) Calculated (e) Estimated (m) Measured (*) Refer to attached letter.

These recovery estimates represent theoretical maximum values for solution gas and water drive. They assume that production is started at original reservoir pressure; i.e., no account is taken of production to date or of prior drainage to other areas. The effects of factors tending to reduce actual ultimate recovery, such as economic limits on oil production rates, gas-oil ratios, or water-oil ratios, have not been taken into account. Neither have factors been considered which may result in actual recovery intermediate between solution gas and complete water drive recoveries, such as gas cap expansion, gravity drainage, or partial water drive. Detailed predictions of ultimate oil recovery to specific abandonment conditions may be made in an engineering study in which consideration is given to overall reservoir characteristics and economic factors.

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CORE LABORATORIES, INC. *Petroleum Reservoir Engineering*

COMPANY CONTINENTAL OIL COMPANY | FIELD ADELL | FILE CP 10-24 PC

WELL J. E. LEONARD NO. 7 | COUNTY SHERIDAN | DATE 3-6-58

LOCATION SE-NE-SW SEC 12-6S-27W | STATE KANSAS | ELEV. 2627' RB

CORE-GAMMA CORRELATION

These analyses, opinions or interpretations are based on observations and material supplied by the client to whom, and for whose exclusive and confidential use, this report is made. The interpretations or opinions expressed represent the best judgment of Core Laboratories, Inc. (all errors and omissions excepted); but Core Laboratories, Inc. and its officers and employees, assume no responsibility and make no warranty or representations as to the productivity, proper operation, or profitableness of any oil, gas or other mineral well or sand in connection with which such report is used or relied upon.

VERTICAL SCALE: 5" = 100'

COREGRAPH

PERMEABILITY, Maximum — MILLIDARCYS — 80 60 40 20 0

TOTAL WATER — PERCENT TOTAL WATER — 80 60 40 20 0

POROSITY ---- PERCENT — 32 24 16 8 0

OIL SATURATION ---- PERCENT PORE SPACE — 0 20 40 60 80

LITHOLOGY LOG

3620

3640

3660

3680

3700

3720

3740

3760

TORONTO

LANSING-KANSAS CITY

DRILLED