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DEPARTMENT OF MINES
& NATURAL RESOURCES

JUN 9 1954

DIRECTOR OF MINES

J.S.H.
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G.H.B.
M.J.S.

RESERVOIR FLUID STUDY
FOR
THE CALIFORNIA STANDARD COMPANY
CALIFORNIA STANDARD VIRDEN NO. 13-24 WELL
VIRDEN - ROSELEA FIELD
MANITOBA, CANADA



CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

June 4, 1954

The California Standard Company
Medical Arts Building
Calgary, Alberta, Canada

Attention: Mr. J. F. Ross

Subject: Reservoir Fluid Study
California Standard Virden No. 13-24 Well
Virden-Roselea Field
Manitoba, Canada

Gentlemen:

This report presents the results of laboratory studies performed using subsurface samples collected from the subject well.

The fluid exhibited a saturation pressure of 170 psig at 84° F. The apparent difference between this value and the reported reservoir pressure indicates that the reservoir exists in an undersaturated condition.

Differential vaporization of the fluid resulted in the liberation of 89 standard cubic feet of vapor per barrel of residual liquid. The very low volatility of the system made necessary the presentation of the formation volume factors to four decimal places to indicate the necessary changes. It is felt that this apparent accuracy is beyond the actual laboratory limits of deviation; however, the magnitude of the changes between pressure levels is probably quite reliable. For all practical purposes, only slight shrinkage occurs above 30 to 40 psig as would be expected from the volume of gas evolved. The liquid phase viscosity evidenced similar changes with an increase from 3.36 centipoises at saturation pressure to a maximum of 4.75 centipoises at zero pressure.

The separator tests performed at various pressures indicate very limited response to changes in operating pressure. The fluid behavior is essentially constant at pressures in excess of 10 psig.

The California Standard Company
California Standard Virden No. 13-24 Well

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The composition of the reservoir fluid substantiates the various measured characteristics. The fractional distillation results show a very large concentration of intermediate materials with a virtual absence of methane.

If we may be of any further service, please call upon us. It has been a pleasure to serve you.

Very truly yours,

Core Laboratories, Inc.

A handwritten signature in cursive script, appearing to read "F. O. Reudelhuber".

F. O. Reudelhuber,
Division Engineer

FOR:ma

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

Page 1 of 10File RFL 331Company The California Standard Company Date Sampled April 14, 1954Well California Standard Virden No. 13-24 County _____Field Virden-Roselea State Manitoba, Canada**FORMATION CHARACTERISTICS**

Formation Name	<u>Mississippian, Oolitic</u>
Date First Well Completed	<u>August</u> , 19 <u>53</u>
Original Reservoir Pressure	_____ PSI @ _____ ft.
Original Produced Gas-Oil Ratio	_____ cu. ft./bbl.
Production Rate	_____ bbl./d.
Separator Pressure and Temperature	_____ PSI, _____ ° F.
Oil Gravity at 60° F.	_____ ° API
Datum	<u>580</u> ft. subsea
Original Gas Cap	<u>None</u>

WELL CHARACTERISTICS

Elevation	<u>1451 Feet K. B.</u>
Total Depth	<u>2050</u> ft.
Completion Depth	<u>2050</u> ft.
Tubing Size and Depth	<u>2.0</u> in. to <u>2041</u> ft.
Productivity Index	_____ bbl./d./PSI @ _____ bbl./d.
Last Reservoir Pressure	<u>846</u> PSI @ <u>2031</u> ft.
Date	<u>April 11</u> , 19 <u>54</u>
Reservoir Temperature	<u>84</u> ° F. @ <u>2031</u> ft.
Status of Well	<u>Shut-In 79 Hours</u>
Pressure Gauge	<u>Amerada (CLI)</u>
Normal Production Rate	_____ bbl./d.
Gas-Oil Ratio	_____ cu. ft./bbl.
Separator Pressure and Temperature	_____ PSI, _____ ° F.
Base Pressure	_____ PSI Abs.
Well Making Water	<u>2-5</u> % Cut

SAMPLING CONDITIONS

Sampled at	<u>1750 Feet K. B.</u>
Status of Well	<u>Shut-In April 8, 1954</u>
Gas-Oil Ratio	_____ cu. ft./bbl.
Separator Pressure and Temperature	_____ PSI, _____ ° F.
Tubing Pressure	<u>120</u> PSI
Casing Pressure	<u>120</u> PSI
Core Laboratories Engineer	<u>N. J. C.</u>
Type Sampler	<u>Perco</u>

REMARKS:

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VOLUMETRIC DATA OF Reservoir Fluid SAMPLE

1. Saturation pressure (bubble-point pressure) 170 PSI @ 84 ° F.
2. Thermal expansion of saturated oil @ 5000 PSI = $\frac{V @ 84^\circ \text{F.}}{V @ 74^\circ \text{F.}} = \underline{1.00466}$
3. Compressibility of saturated oil @ reservoir temperature: Vol./Vol./PSI:

From 5000 PSI to 3000 PSI = $\underline{5.01 \times 10^{-6}}$
 From 3000 PSI to 1500 PSI = $\underline{5.59 \times 10^{-6}}$
 From 1500 PSI to 170 PSI = $\underline{6.72 \times 10^{-6}}$
4. Specific volume at saturation pressure: cu. ft./# 0.01926 @ 84 ° F.

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Reservoir Fluid SAMPLE TABULAR DATA

PRESSURE PSI GAUGE	PRESSURE-VOLUME RELATIONS @ 84 °F., RELATIVE VOLUME OF OIL AND GAS, V/V _s	VISCOSITY OF OIL @ 84 °F., CENTIPOISES	DIFFERENTIAL VAPORIZATION @ 84 °F.		
			LIBERATED GAS SCF PER BARREL OF RESIDUAL OIL	SOLUTION GAS SCF PER BARREL OF RESIDUAL OIL	RELATIVE OIL VOLUME, V/V _R
5000	0.9729				1.0257
4500	0.9752				1.0282
4000	0.9776				1.0307
3500	0.9802				1.0334
3000	0.9827				1.0361
2500	0.9855				1.0390
2040		3.98			
2000	0.9882				1.0419
1505		3.79			
1500	0.9911				1.0449
1200	0.9928				1.0467
1010		3.62			
1000	0.9941				1.0481
800	0.9953				1.0493
500	0.9974				1.0516
490		3.45			
400	0.9981				1.0523
300	0.9989				1.0531
270		3.39			
200	0.9999				1.0542
170	1.0000	3.36	0	89	1.0543
168		3.36			
160	1.0060				
152	1.0121				
142	1.0260				
140		3.39			
138			2	87	1.0541
129	1.0500				
119	1.0766				
111			5	84	1.0538
102	1.1369				
95		3.46			
85	1.2393				

v = Volume at given pressure.

v_s = Volume at saturation pressure at the specified temperature.v_R = Residual oil volume at 14.7 PSI absolute and 60° F.

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Page 4 of 10File RFL 331Well California Standard
Virden No. 13-24**Reservoir Fluid SAMPLE TABULAR DATA**

PRESSURE PSI GAUGE	PRESSURE-VOLUME RELATIONS @ 84 °F., RELATIVE VOLUME OF OIL AND GAS, V/V _s	VISCOSITY OF OIL @ 84 °F., CENTIPOISES	DIFFERENTIAL VAPORIZATION @ 84 °F.		
			LIBERATED GAS SCF PER BARREL OF RESIDUAL OIL	SOLUTION GAS SCF PER BARREL OF RESIDUAL OIL	RELATIVE OIL VOLUME, V/V _R
77			10	79	1.0530
71	1.4287				
60	1.6377				
52			15	74	1.0523
50		3.58			
49	1.9771				
41	2.3976				
32	3.0210		27	62	1.0489
25		3.84			
0		4.75	89	0	1.0120

@ 60° F. = 1.0000

Gravity of Residual Oil =

35.2° API @ 60° F.

v = Volume at given pressure.

v_s = Volume at saturation pressure at the specified temperature.v_R = Residual oil volume at 14.7 PSI absolute and 60° F.

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SEPARATOR TESTS OF Reservoir Fluid SAMPLE

SEPARATOR PRESSURE, PSI GAUGE	SEPARATOR TEMPERATURE, ° F.	SEPARATOR GAS/OIL RATIO <i>See Foot Note (1)</i>	STOCK TANK GAS/OIL RATIO <i>See Foot Note (1)</i>	STOCK TANK GRAVITY, ° API @ 60° F.	SHRINKAGE FACTOR, $V_R/V_{SAT.}$ <i>See Foot Note (2)</i>	FORMATION VOLUME FACTOR, $V_{SAT.}/V_R$ <i>See Foot Note (3)</i>	SPECIFIC GRAVITY OF FLASHED GAS
0	74	94		34.9	0.9285	1.077	1.4431
10	74	70	12	35.3	0.9372	1.067	
20	74	53	24	35.5	0.9398	1.064	
50	75	18	60	35.5	0.9416	1.062	

- (1) Separator and stock tank Gas/Oil Ratio in cubic feet of gas @ 60° F. and 14.7 PSI absolute per barrel of stock tank oil @ 60° F.
- (2) Shrinkage Factor: $V_R/V_{SAT.}$ is barrels of stock tank oil @ 60° F. per barrel of saturated oil @ 170 PSI gauge and 84° F.
- (3) Formation Volume Factor: $V_{SAT.}/V_R$ is barrels of saturated oil @ 170 PSI gauge and 84° F. per barrel of stock tank oil @ 60° F.

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HYDROCARBON ANALYSIS OF Reservoir Fluid SAMPLE

COMPONENT	WEIGHT %	MOL %	DENSITY @ 60° F. GRAMS PER CUBIC CENTIMETER	° API @ 60° F.	MOLECULAR WEIGHT
Methane	0.10	1.10			
Ethane	0.86	5.02			
Propane	2.07	8.27			
Iso-butane	0.64	1.93			
N-butane	2.07	6.27			
Iso-pentane	1.24	3.03			
N-pentane	1.18	2.88			
Hexanes	3.14	6.41			
Heavier	88.63	64.74	0.8758	29.9	241
Hydroden Sulfide	0.07	0.35			
	100.00	100.00			

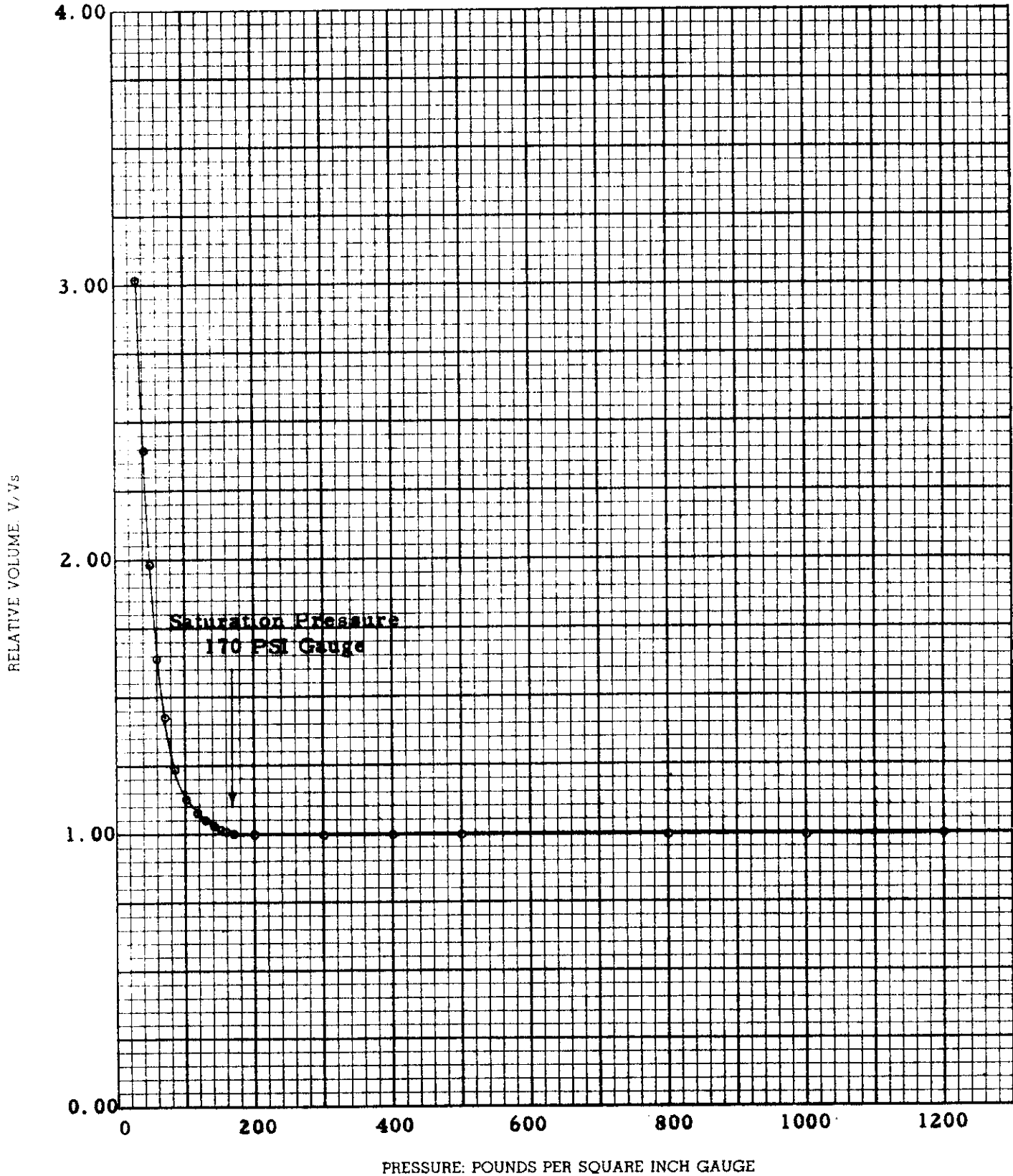
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F. O. Reudelhuber

PRESSURE-VOLUME RELATIONS OF RESERVOIR FLUID

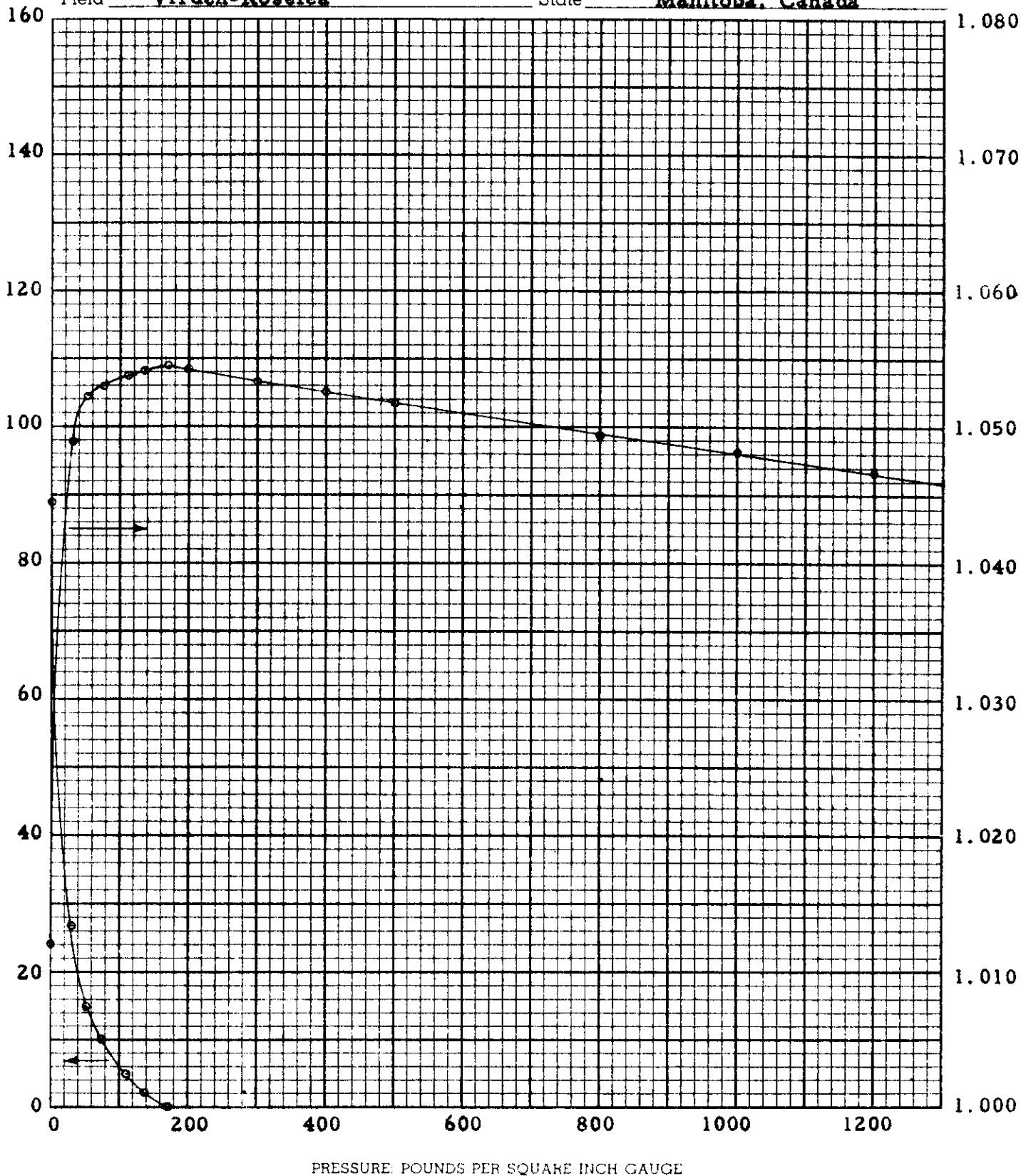
Company The California Standard Company Formation Mississippian, Oolitic
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Field Virden-Roselea State Manitoba, Canada



DIFFERENTIAL VAPORIZATION OF RESERVOIR FLUID

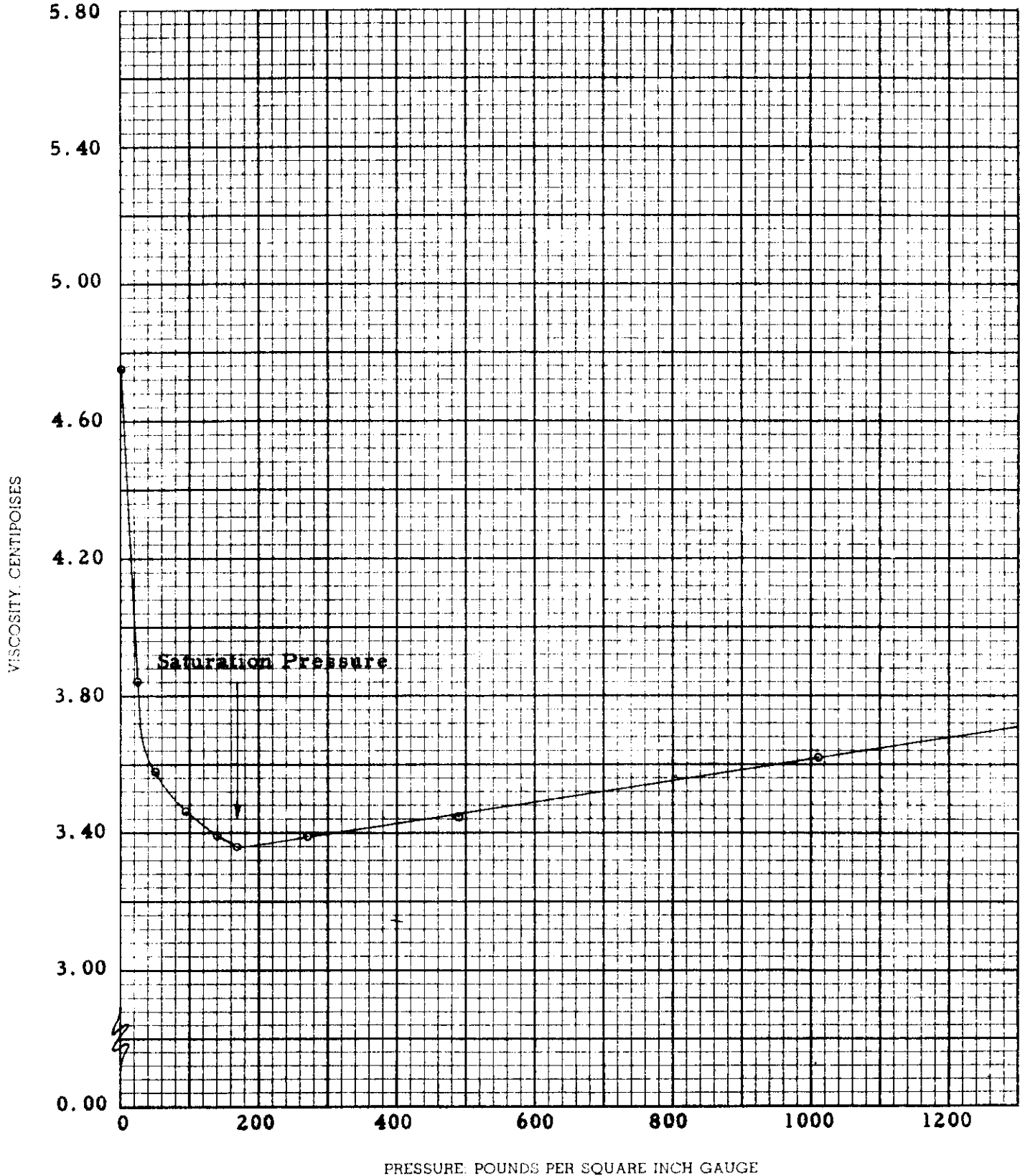
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GAS LIBERATED STANDARD CUBIC FEET PER BARREL OF RESIDUAL OIL



VISCOSITY OF RESERVOIR FLUID

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