CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS 75207
November 25, 1970

RESERVOIR FLUID ANALYSIS

Phillips Petroleum Company - Norway
P. O. Box 72
Stavanger, Norway

Attention: Mr. P. W. Reynolds

Subject: Reservoir Fluid Study
2/4-4AX Well
(8000 Feet)
Ekofisk Field
Offshore, Norway
Our File Number: RFL 6656

Gentlemen:

A subsurface fluid sample was collected from the subject well on August 10, 1970 by a representative of Core Laboratories, Inc. The sample was taken at a depth of 8000 feet after the well was shut in for one and one-half hours from DST No. 1. The bottom-hole sample was forwarded to our Dallas laboratory for use in a reservoir fluid study and the results of this study are presented in the following report.

At the reservoir temperature of 266° F. the fluid was found to have a bubble point pressure of 5539 psig. During differential pressure depletion the fluid evolved a total of 1966 standard cubic feet of gas per barrel of residual oil at 60° F. The formation volume factor associated with this test was determined to be 2.190 barrels of saturated fluid per barrel of residual oil. The viscosity test was performed under conditions similar to those of the differential pressure depletion and the fluid was found to have a minimum viscosity of 0.219 centipoise at the saturation pressure.

A multi-stage separator test was performed using separation conditions as follows: 1000 psig at 150° F. to 250 psig at 80° F. to 0 psig at 60° F. The data from this test are presented on page six of the report. In addition,

the primary separator gas from the multi-stage separator test was collected and analyzed for hydrocarbons. The results of this analysis are presented on page seven. The hydrocarbon analysis of the reservoir fluid sample was performed by means of low temperature, fractional distillation and may be found on page eight of the report.

Thank you for the opportunity to perform this reservoir fluid study for Phillips Petroleum Company - Norway. If we may assist you further in any manner, please feel free to contact us.

Very truly yours,

Core Laboratories, Inc.
Reservoir Fluid Analysis

P. L. Moses (JF)

P. L. Moses
Manager

PLM:JF:dl

CL-505 CANADA

CORE LABORATORIES, INC.

Petroleum Reservoir Engineering

DALLAS, TEXAS

File RFL 6656

Company Phillips Petroleum Company - Norway Date Sampled August 10, 1970*

Well 2/4-4AX (8000 Feet) Province Offshore

Field Ekofisk Country Norway

FORMATION CHARACTERISTICS

Formation Name	Danian
Date First Well Completed	_____, 19____
Original Reservoir Pressure	_____ PSIG @ _____ Ft.
Original Produced Gas-Oil Ratio	_____ SCF/Bbl
Production Rate	_____ Bbl/Day
Separator Pressure and Temperature	_____ PSIG. _____ °F.
Oil Gravity at 60° F.	_____ °API
Datum	_____ Ft. Subsea
Original Gas Cap	_____

WELL CHARACTERISTICS

Elevation	322** Ft.
Total Depth	10894 Ft.
Producing Interval	10380-10510 Ft.
Tubing Size and Depth	3-1/2 In. to 10319 Ft.
Productivity Index	_____ Bbl/D/PSI @ _____ Bbl/Day
Last Reservoir Pressure	_____ PSIG @ _____ Ft.
Date	_____, 19____
Reservoir Temperature	266 °F. @ 10445 Ft.
Status of Well	_____
Pressure Gauge	_____
Normal Production Rate	_____ Bbl/Day
Gas-Oil Ratio	_____ SCF/Bbl
Separator Pressure and Temperature	_____ PSIG, _____ °F.
Base Pressure	_____ PSIA
Well Making Water	_____ % Cut

SAMPLING CONDITIONS

Sampled at	8000 Ft.
Status of Well	Shut in 1-1/2 hours
Gas-Oil Ratio	_____ SCF/Bbl
Separator Pressure and Temperature	_____ PSIG, _____ °F.
Tubing Pressure	4210 PSIG
Casing Pressure	_____ PSIG
Core Laboratories Engineer	RFB
Type Sampler	Wofford

REMARKS:

* Sample taken at 10:45 A.M.

** From RKB to sea bed.

VOLUMETRIC DATA OF Reservoir Fluid SAMPLE

1. Saturation pressure (bubble-point pressure) 5539 PSIG @ 266 °F.
2. Thermal expansion of saturated oil @ 7000 PSI $= \frac{\text{V @ 266 °F}}{\text{V @ 72 °F}} =$ 1.14217
3. Compressibility of saturated oil @ reservoir temperature: Vol/Vol/PSI:

   From 7000 PSI to 6500 PSI = 18.25×10^{-6}

   From 6500 PSI to 6000 PSI = 21.41×10^{-6}

   From 6000 PSI to 5539 PSI = 24.60×10^{-6}
4. Specific volume at saturation pressure: ft^3/lb 0.02769 @ 266 °F.

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Well 2/4-4AX (8000 Feet)

Reservoir Fluid SAMPLE TABULAR DATA

PRESSURE PSI GAUGE	PRESSURE-VOLUME RELATION @ 266 °F., RELATIVE VOLUME OF OIL AND GAS, V/VSAT.	VISCOSITY OF OIL @ 266 °F., CENTIPOISES	DIFFERENTIAL LIBERATION @ 266 °F.		
			GAS/OIL RATIO LIBERATED PER BARREL OF RESIDUAL OIL	GAS/OIL RATIO IN SOLUTION PER BARREL OF RESIDUAL OIL	RELATIVE OIL VOLUME, V/VR
7000	0.9691	0.243			2.123
6700		0.238			
6500	0.9781				2.142
6400		0.232			
6100		0.227			
6000	0.9887				2.166
5900	0.9909				2.170
5800	0.9933	0.222			2.176
5700	0.9956				2.181
5600	0.9983				2.187
5539	1.0000	0.219	0	1966	2.190
5492	1.0023				
5454	1.0043				
5355	1.0094				
5300		0.235	215	1751	2.065
5186	1.0188				
4900		0.260	477	1489	1.920
4868	1.0391				
4478	1.0699				
4400		0.295	718	1248	1.791
4069	1.1115				
3900		0.330	914	1052	1.692
3603	1.1744				
3400		0.368	1075	891	1.612
3159	1.2588				
2900		0.407	1214	752	1.546
2727	1.3755				
2400		0.457	1343	623	1.483
2152	1.6209				
1900		0.500	1462	504	1.428
1613	2.0358				

V = Volume at given pressure
VSAT. = Volume at saturation pressure and the specified temperature.
VR = Residual oil volume at 14.7 PSI absolute and 60° F.

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Well 2/4-4AX (8000 Feet)

Reservoir Fluid SAMPLE TABULAR DATA

PRESSURE PSI GAUGE	PRESSURE-VOLUME RELATION @ 266 °F., RELATIVE VOLUME OF OIL AND GAS, $V/V_{SAT.}$	VISCOSITY OF OIL @ 266 °F., CENTIPOISES	DIFFERENTIAL LIBERATION @ 266 °F.		
			GAS/OIL RATIO LIBERATED PER BARREL OF RESIDUAL OIL	GAS/OIL RATIO IN SOLUTION PER BARREL OF RESIDUAL OIL	RELATIVE OIL VOLUME, V/V_R
1400		0.577	1571	395	1.376
1184	2.6779				
900		0.667	1678	288	1.325
821	3.7378				
400		0.821	1786	180	1.267
125			1861	105	1.215
0		1.182	1966	0	1.097
				@ 60° F. =	1.000

Gravity of residual oil = 32.5° API @ 60° F.

V = Volume at given pressure
$V_{SAT.}$ = Volume at saturation pressure and the specified temperature.
V_R = Residual oil volume at 14.7 PSI absolute and 60° F.

Differential Pressure Depletion at 266° F.

Pressure PSIG	Oil Density Gms/Cc	Gas Gravity	Deviation Factor Z
5539	0.5784		
5300	0.5912	0.977	1.049
4900	0.6082	0.933	0.986
4400	0.6270	0.885	0.943
3900	0.6419	0.840	0.917
3400	0.6564	0.801	0.907
2900	0.6690	0.783	0.903
2400	0.6824	0.771	0.904
1900	0.6952	0.765	0.915
1400	0.7080	0.775	0.926
900	0.7211	0.809	0.949
400	0.7364	0.932	0.977
125	0.7511	1.268	
0	0.7855	2.231	

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Well 2/4-4AX (8000 Feet)

SEPARATOR TESTS OF Reservoir Fluid SAMPLE

SEPARATOR PRESSURE, PSI GAUGE	SEPARATOR TEMPERATURE, ° F.	GAS/OIL RATIO (1)	GAS/OIL RATIO (2)	STOCK TANK GRAVITY, ° API @ 60° F.	Formation Volume Factor (3)	Separator Volume Factor (4)	SPECIFIC GRAVITY OF FLASHED GAS
1000	150	1057	1233			1.166	0.691
to 250	80	132	141			1.068	0.706
to 0	60	115	115	37.7	1.853	1.000	1.110

(1) Gas/Oil Ratio in cubic feet of gas @ 60° F. and 14.7 PSI absolute per barrel of oil @ indicated pressure and temperature.

(2) Gas/Oil Ratio in cubic feet of gas @ 60° F. and 14.7 PSI absolute per barrel of stock tank oil @ 60° F.

(3) Formation Volume Factor is barrels of saturated oil @ 5539 PSI gauge and 266° F. per barrel of stock tank oil @ 60° F.

(4) Separator Volume Factor is barrels of oil @ indicated pressure and temperature per barrel of stock tank oil @ 60° F.

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Company Phillips Petroleum Company - Norway Formation Danian

Well 2/4-4AX (8000 Feet) Province Offshore

Field Ekofisk Country Norway

HYDROCARBON ANALYSIS OF Separator GAS SAMPLE

COMPONENT	MOL PER CENT	G P M
Hydrogen Sulfide		
Carbon Dioxide	1.22	
Nitrogen	0.35	
Methane	84.04	
Ethane	8.43	2.124
Propane	3.27	0.898
iso-Butane	0.43	0.140
n-Butane	0.97	0.305
iso-Pentane	0.24	0.088
n-Pentane	0.30	0.108
Hexanes	0.23	0.094
Heptanes plus	0.52	0.235
	100.00	3.992

Calculated gas gravity (air = 1.000) = 0.691

Calculated gross heating value = 1188 BTU
per cubic foot of dry gas at 14.696 psia at 60° F.

Collected at 1000 psig and 150 ° F.

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Company Phillips Petroleum Company - Norway Formation Danian

Well 2/4-4AX (8000 Feet) County Offshore

Field Ekofisk State Norway

HYDROCARBON ANALYSIS OF Reservoir Fluid SAMPLE

COMPONENT	MOL PER CENT	WEIGHT PER CENT	DENSITY @ 60° F. GRAMS PER CUBIC CENTIMETER	° API @ 60° F.	MOLECULAR WEIGHT
Hydrogen Sulfide					
Carbon Dioxide	0.93	0.60			
Nitrogen	0.21	0.09			
Methane	58.77	13.82			
Ethane	7.57	3.34			
Propane	4.09	2.64			
iso-Butane	0.91	0.78			
n-Butane	2.09	1.77			
iso-Pentane	0.77	0.82			
n-Pentane	1.15	1.22			
Hexanes	1.75	2.20			
Heptanes plus	21.76	72.72	0.8578	33.3	228
	100.00	100.00			

Core Laboratories, Inc.
Reservoir Fluid Analysis

P. L. Moses (JF)

P. L. Moses
Manager

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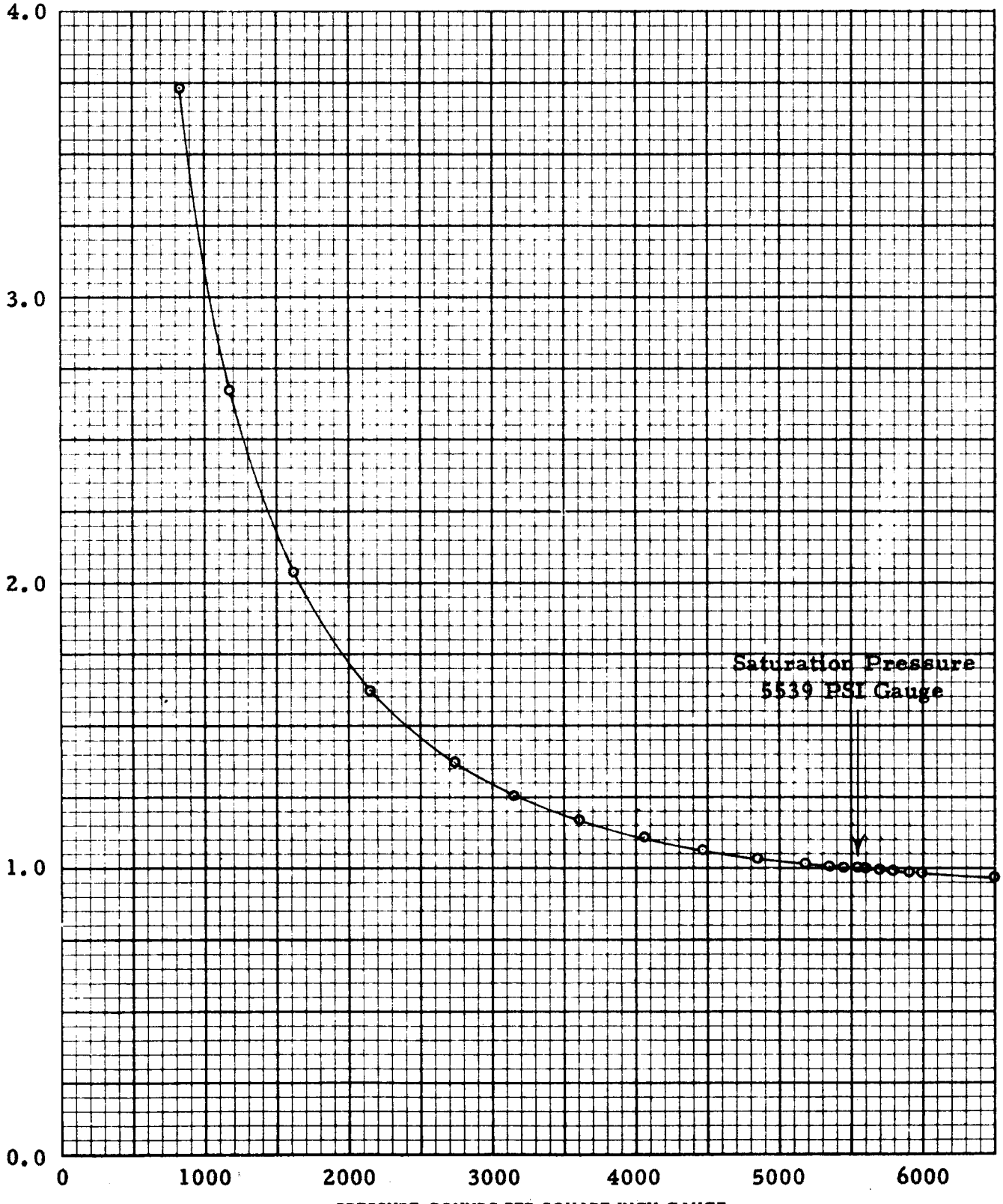
PRESSURE-VOLUME RELATIONS OF RESERVOIR FLUID

Company Phillips Petroleum Company - Norway
Formation Danian
Well 2/4-4AX (8000 Feet)
Province Offshore
Field Ekofisk
Country Norway



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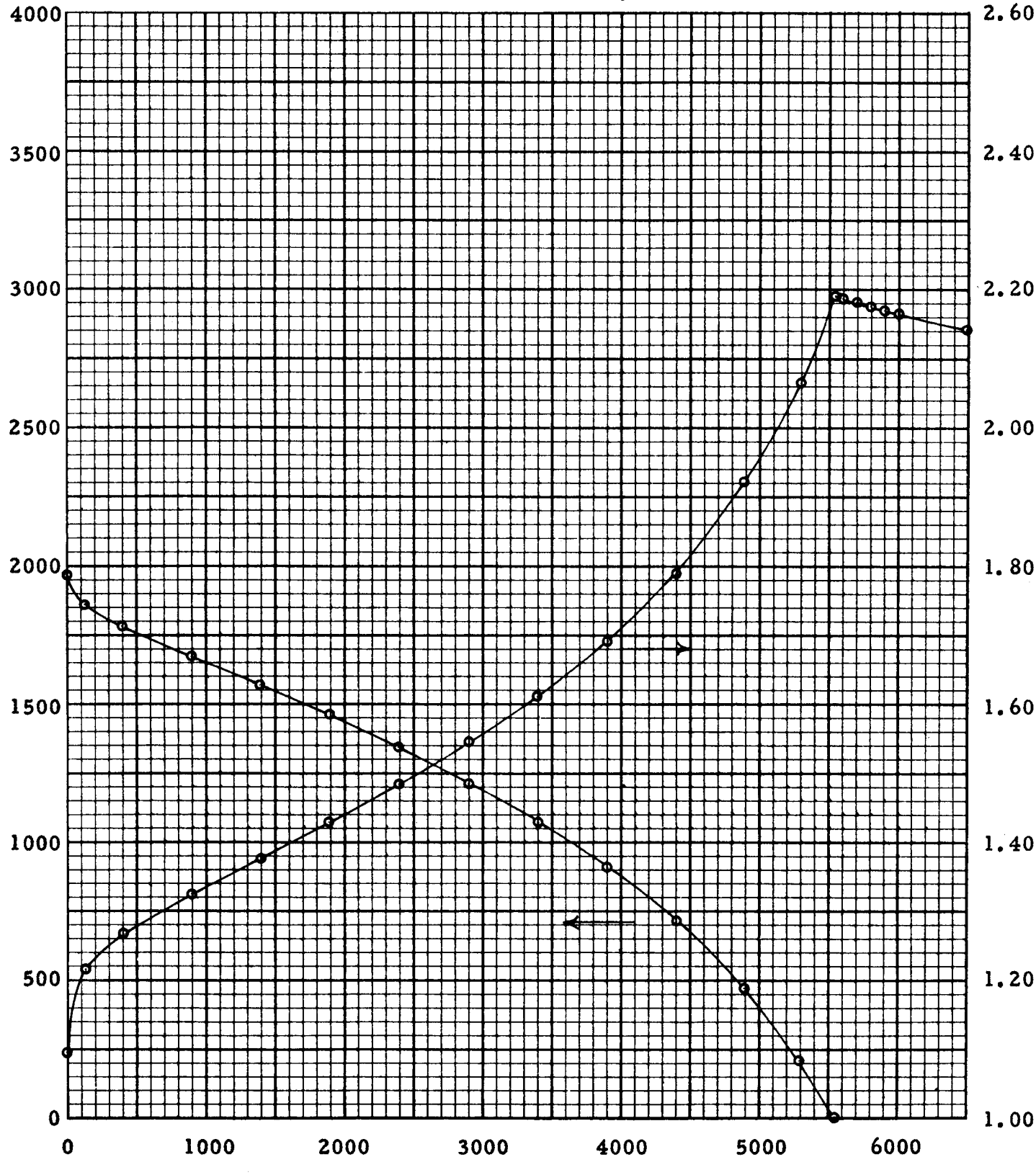
DIFFERENTIAL VAPORIZATION OF RESERVOIR FLUID

Company Phillips Petroleum Company - Norway
Formation Danian
Well 2/4-4AX (8000 Feet)
Province Offshore
Field Ekofisk
Country Norway



GAS LIBERATED: STANDARD CUBIC FEET PER BARREL OF RESIDUAL OIL

RELATIVE LIQUID VOLUME: V/V_R

PRESSURE: POUNDS PER SQUARE INCH GAUGE

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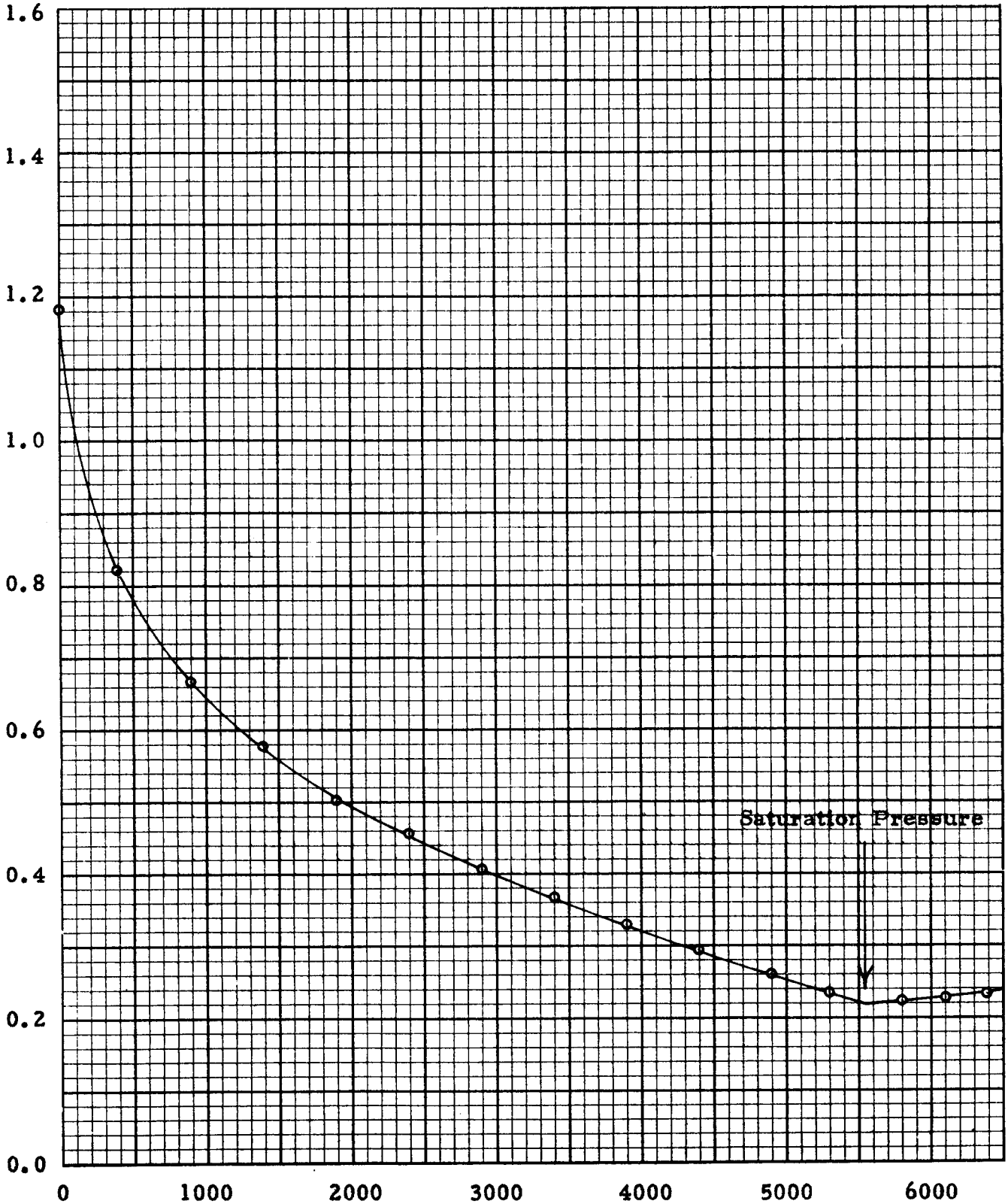
DALLAS, TEXAS

VISCOSITY OF RESERVOIR FLUID

Company Phillips Petroleum Company - Norway
Formation Danian
Well 2/4-4AX (8000 Feet)
Province Offshore
Field Ekofisk
Country Norway



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