Waskada "SBHP Pressures"

January 27, 1983

New Scope Resources Limited
10 Donald St.
Winnipeg, Manitoba
R3C 1L5

Attention: Mr. Jerry Sinclair
Vice-President

Dear Jerry:

Re: New Scope S. Waskada A12-7-1-25 - PVT Study

Your report of the PVT analysis on a fluid sample from the subject well is hereby acknowledged.

The results of this study and of bottom hole pressure surveys recently submitted indicates the reservoir to be in an undersaturated condition with reasonably stable reservoir pressures. Consequently, from a point of view of maximizing ultimate recovery, there does not seem to be any immediate need for pressure maintenance operations, although from an operational point of view, such operations may be desirable.

To better define the reserves associated with this pool and to monitor the future need for pressure maintenance, we request that you obtain a second bottom hole pressure survey (utilizing at least two wells), prior to year end 1983. Please provide details of your proposals in this regard prior to October 1, 1983.

We wish to thank you for your co-operation in obtaining this important reservoir data on a timely basis.

Yours sincerely,

L. R. Dubreuil
Chief Petroleum Engineer
Petroleum Branch

LRD/sb

1540 - 25TH AVENUE N.E., CALGARY, ALBERTA, CANADA T2E 7R2 403/230 9228

CORE LABORATORIES – CANADA, LTD.

1983 06 21

Omega Hydrocarbons Ltd.
630, 330 - 5th Ave. S.W.
Calgary, Alberta
T2P 0L1

Attention: Mr. Ed Wyse

Subject: Separator Flash Analysis
Omega Waskada 04-25-01-26 (W1M)
Waskada Field
Manitoba, Canada
File Number: 7013-83-132

Gentlemen:

Samples of separator gas and liquid were collected from the above subject well by a representative of Omega Hydrocarbons Ltd.on 1983-04-21. The samples were then submitted to our Calgary laboratory for analysis.

Initially, it was requested to physically recombine the separator liquid with sufficient separator gas to produce a fluid with a saturation pressure of 4 220 kPa (gauge) at the reported reservoir temperature of 45.0°C. Flash liberation tests were then conducted on this recombined reservoir fluid duplicating field treater and separator conditions.

Thank you for the opportunity to be of service to yourself and Omega Hydrocarbon Ltd. If you should have any questions concerning this data, please contact the undersigned.

Yours truly,
CORE LABORATORIES-CANADA, LTD.

Tom B. Martin
Supervisor PVT Lab

TG:ds

CORE LABORATORIES — CANADA LTD.
Petroleum Reservoir Engineering
CALGARY, ALBERTA

File 7013-83-132

Well Omego Waskada
04-25-01-26 (W1M)

FIELD SEPARATOR CONDITIONS

SEPARATOR TEST OF RESERVOIR **SAMPLE**

Separator Gauge Pressure, kPa	Separator Temperature °C	Gas/Oil Ratio (1)	Gas/Oil Ratio (2)	Stock Tank Oil Gravity, °API @ 15.56°C	Separator Volume Factor (3)	Separator Volume Factor (4)	Relative Density of Liberated Gas (AIR = 1.000)
4 220 to 1 300	10.0°C	8.94	8.94	38.1	1.052	1.000	0.8622
		Total	8.94				

(1) Cubic metres of gas @ 101.325 kPa (absolute) and 15°C per cubic metre of oil @ indicated pressure and temperature.

(2) Cubic metres of gas @ 101.325 kPa (absolute) and 15°C per cubic metre of oil @ 10°C and 1 300 kPa (gauge)

(3) Cubic metres of saturated oil @ 4 220 kPa (gauge) and 45.0 °C per cubic metre of oil @ 10°C and 1 300 kPa

(4) Cubic metres of oil @ indicated pressure and temperature per cubic metre of oil @ 10°C and 1 300 kPa (gauge)

FIELD TREATER CONDITIONS

SEPARATOR TEST OF RESERVOIR FLUID **SAMPLE**

Separator Gauge Pressure, kPa	Separator Temperature °C	Gas/Oil Ratio (1)	Gas/Oil Ratio (2)	Stock Tank Oil Gravity, °API @ 15.56°C	Separator Volume Factor (3)	Separator Volume Factor (4)	Relative Density of Liberated Gas (AIR = 1.000)
4 220 to 240	50.0	35.65	37.85			1.055	1.027
to 0	15.0	6.46	6.46	38.6	1.155	1.000	1.262
		Total	44.31				

(1) Cubic metres of gas @ 101.325 kPa (absolute) and 15°C per cubic metre of oil @ indicated pressure and temperature.

(2) Cubic metres of gas @ 101.325 kPa (absolute) and 15°C per cubic metre of stock tank oil @ 15°C.

(3) Cubic metres of saturated oil @ 4 220 kPa (gauge) and 45.0 °C per cubic metre of stock tank oil @ 15°C.

(4) Cubic metres of oil @ indicated pressure and temperature per cubic metre of stock tank oil @ 15°C.

CORE LABORATORIES - CANADA LTD.
Petroleum Reservoir Engineering
CALGARY ALBERTA

GAS ANALYSIS

179J8512 — CONTAINER IDENTITY

7013-83-132 — LABORATORY NUMBER

Omego Hydrocarbons Ltd. — OPERATOR

3 of 4 — PAGE

LSD 04-25-01-26 (W1M) — LOCATION

Omega Waskada 04-25-01-26 — WELL OR SAMPLE LOCATION NAME

KB ELEV., m — GRD. ELEV., m

Waskada, Manitoba — FIELD OR AREA

POOL OR ZONE

Omega Hydrocarbons Ltd. — SAMPLER

TEST TYPE & NO.

TEST RECOVERY

Test Separator — POINT OF SAMPLE

AMT. & TYPE CUSHION

@ °C — MUD RESISTIVITY

PUMPING FLOWING GAS LIFT SWAB

WATER m^3/d OIL m^3/d GAS m^3/d

TEST INTERVALS OR PERFS., m

827 — SEPARATOR

RESERVOIR

@ °C — CONTAINER WHEN SAMPLED

807 @16.7 — CONTAINER WHEN RECEIVED

SEPARATOR

PRESSURES, kPa (gauge)

TEMPERATURES, °C

83-04-21 — DATE SAMPLED (Y/M/D)

DATE RECEIVED (Y/M/D)

83-05-10 — DATE ANALYSED (Y/M/D)

ANALYST

REMARKS

COMPONENT	MOLE FRACTION AIR FREE AS REC'D	MOLE FRACTION AIR FREE ACID GAS FREE	mL/m³ AIR FREE AS REC'D
H_2	TRACE		
He	0.0003		
N_2	0.1526		
CO_2	0.0050		
H_2S	0.0000		
C_1	0.6042		
C_2	0.1614		
C_3	0.0587		215.9
iC_4	0.0045		19.7
C_4	0.0092		38.7
iC_5	0.0014		6.8
C_5	0.0014		6.8
C_6	0.0008		4.4
C_7+	0.0005		3.4
TOTAL	1.0000		295.7
		C_5+	21.4

CALCULATED GROSS HEATING VALUE, MJ/m³ @ 15° C & 101.325 kPa(abs.)

41.40 — MOISTURE FREE

41.60 — MOISTURE & ACID GAS FREE

CALCULATED VAPOUR PRESSURE kPa(abs.) @ 37.8° C

91.9 — PENTANES PLUS

CALCULATED TOTAL SAMPLE PROPERTIES (AIR=1) @ 15° C & 101.325 kPa

0.963 kg/m³ — DENSITY

MOISTURE FREE AS SAMPLED

0.785 — RELATIVE DENSITY

22.7 — RELATIVE MOLECULAR MASS

CALCULATED PSEUDOCRITICAL PROPERTIES

AS SAMPLED		ACID GAS FREE	
4439.1 kPa(abs.)	214.7 K	kPa(abs.)	K
p_{Pc}	p_{Tc}	p_{Pc}	p_{Tc}

REMARKS

NOTE: The Gross Heating Value has been calculated in accordance to AGA Report # 5.

CORE LABORATORIES - CANADA LTD.
Petroleum Reservoir Engineering
CALGARY ALBERTA

GAS ANALYSIS

178J15417 — CONTAINER IDENTITY

7013-83-132 — LABORATORY NUMBER

Omega Hydrocarbons Ltd. — OPERATOR

4 of 4 — PAGE

LSD 04-25-01-26 (W1M) — LOCATION

Omega Waskada 04-25-01-26 — WELL OR SAMPLE LOCATION NAME

KB ELEV., m — GRD. ELEV., m

Waskada, Manitoba — FIELD OR AREA

POOL OR ZONE

SAMPLER

TEST TYPE & NO.

TEST RECOVERY

POINT OF SAMPLE

AMT. & TYPE CUSHION

@ °C — MUD RESISTIVITY

PUMPING FLOWING GAS LIFT SWAB

WATER m^3/d OIL m^3/d GAS m^3/d

TEST INTERVALS OR PERFS., m

827 — SEPARATOR

RESERVOIR

@ °C — CONTAINER WHEN SAMPLED

807 @ 22°C — CONTAINER WHEN RECEIVED

SEPARATOR

PRESSURES, kPa (gauge)

TEMPERATURES, °C

83-04-21 — DATE SAMPLED (Y/M/D)

DATE RECEIVED (Y/M/D)

83-05-10 — DATE ANALYSED (Y/M/D)

ANALYST

REMARKS

COMPONENT	MOLE FRACTION AIR FREE AS REC'D	MOLE FRACTION AIR FREE ACID GAS FREE	mL/m^3 AIR FREE AS REC'D
H_2	TRACE		
He	0.0004		
N_2	0.1600		
CO_2	0.0050		
H_2S	0.0000		
C_1	0.5978		
C_2	0.1598		
C_3	0.0585		215.1
iC_4	0.0044		19.2
C_4	0.0093		39.2
iC_5	0.0014		6.8
C_5	0.0014		6.8
C_6	0.0011		6.0
C_7+	0.0009		6.2
TOTAL	1.0000		299.3
		C_5+	25.8

CALCULATED GROSS HEATING VALUE
MJ/m^3 @ 15° C & 101.325 kPa(abs.)

MOISTURE FREE	MOISTURE & ACID GAS FREE
41.17	41.38

CALCULATED VAPOUR PRESSURE
kPa(abs.) @ 37.8° C

PENTANES PLUS
80.9

CALCULATED TOTAL SAMPLE PROPERTIES (AIR=1) @ 15° C & 101.325 kPa

DENSITY	MOISTURE FREE AS SAMPLED RELATIVE DENSITY	RELATIVE MOLECULAR MASS
0.967 kg/m^3	0.789	22.9

CALCULATED PSEUDOCRITICAL PROPERTIES

AS SAMPLED pPc	AS SAMPLED pTc	ACID GAS FREE pPc	ACID GAS FREE pTc
4428.1 kPa(abs.)	214.2 K	kPa(abs.)	K

REMARKS

NOTE: The Gross Heating Value has been calculated in accordance to AGA Report # 5.

CORE LABORATORIES - CANADA LTD.

1982-04-19

APPENDIX 6

Omega Hydrocarbons Ltd.
630, 330 - 5th Ave. S.W.
Calgary, Alberta
T2P 0L4

Attention: Mr. Ed Wyse

Reservoir Fluid Study

Omega Waskada 8-26-1-26 (WIM)
Waskada Field, Manitoba, Canada
Our File Number: 7013-82-20

Gentlemen:

Subsurface samples of reservoir oil were taken from the above subject well by a representative of Core Laboratories-Canada Ltd. on 1982-02-02. The samples were then submitted to our laboratory for a complete reservoir fluid study.

A portion of the reservoir fluid was transferred at high pressure to a high pressure-windowed cell and then heated at constant pressure to the reported reservoir temperature of 45.0°C. The pressure-volume relations of the fluid were measured during a constant expansion down to 1 586 kPa (gauge). The saturation pressure was determined to be 4 220 kPa (gauge) at 45.0°C. The results of this test are shown on pages 1 and 2 of this report.

During differential pressure depletion at 45.0°C, the fluid evolved a total of 51.04 cubic metres of gas at 101.325 kPa (absolute) and 15°C per unit of residual oil at 15°C. The associated formation volume factor was 1.170 units of saturated fluid at 4 220 kPa (gauge) and 45.0°C per unit of residual oil. The density of the liquid phase and the properties of the evolved gases were determined at several pressure levels below the saturation pressure during this depletion. The data obtained from these tests are summarized on page 3. The viscosity of the fluid was measured under similar depletion conditions at 45.0°C, from pressures exceeding the saturation pressure down to atmospheric pressure. The viscosity of the liquid phase varied from a minimum of 1.285 mPa·s at the saturation pressure to a maximum of

HYDROCARBONS Ltd.
TELEPHONE: (403) 261-0743
630 - 330 FIFTH AVENUE S.W., CALGARY, ALBERTA T2P 0L4

DEPARTMENT OF ENERGY AND MINES
JUN 28 1983
PETROLEUM BRANCH

June 24, 1983

Manitoba Petroleum Branch
975 Century Street
Winnipeg, Manitoba
R3H 0W4

Attention: Mr. Bob Dubreuil

Dear Bob:

RE: Lower Amaranth Pool
Revised Flash Liberation Test Results

Enclosed is the revised results of the flash liberation tests done on recombined Lower Amaranth oil and gas sampled during a satellite test of Waskada 4-25-1-26 WPM. Please note that the test results submitted under my covering letter of June 7 are incorrect and should be trashed.

We have been cautioned by Corelab that there seems to be some compositional difference between these samples and the bottom hole sample on which the detailed PVT analysis was done. To illustrate; the ratio of CH_4 to N_2 content in these samples were 3.3 and 3.7 (two samples were taken) whereas the ratio of CH_4 to N_2 in the bottom hole sample previously taken was 7.0. These samples have a significantly greater proportion of N_2 and there is no apparent sampling problem indicating the possibility of compositional variations throughout the field.

Yours truly,

OMEGA HYDROCARBONS LTD.

Ed Wyse
Petroleum Engineer

EW/sp

Waskada PVT Studies

CORE LABORATORIES - CANADA LTD.

1982-04-19

APPENDIX 6

Omega Hydrocarbons Ltd.
630, 330 - 5th Ave. S.W.
Calgary, Alberta
T2P 0L4

Attention: Mr. Ed Wyse

Reservoir Fluid Study

Omega Waskada 8-26-1-26 (WIM)
Waskada Field, Manitoba, Canada
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Omega Hydrocarbons Ltd. Omega Waskada 8-26-1-26 (W1M)

2.904 mPa•s at atmospheric pressure. The viscosity data is summarized on page 4.

The composition of the reservoir fluid was determined by low temperature, fractional distillation and is shown on pages 5 and 6.

Thank you for the opportunity to perform this study for you. Should you have any questions concerning the data, please contact us.

Yours truly,
CORE LABORATORIES-CANADA LTD.

Tom G. Martin
for
Dwayne E. Rasmussen

TG:cd

CORE LABORATORIES — CANADA LTD.
Petroleum Reservoir Engineering
CALGARY, ALBERTA

File 7013-82-20
Well Omega Waskada
8-26-1-26 (W1M)

VOLUMETRIC DATA OF RESERVOIR FLUID SAMPLE

1. Saturation pressure (bubble point pressure) 4 220 kPa (gauge) @ 45.0 °C
2. Thermal expansion of saturated oil @ 34 474 kPa (gauge) = V@ 45.0 °C / V@ 22.8 °C = 1.01830
3. Density at saturation pressure: 777.4 kg/m³ @ 45.0 °C
4. Compressibility of saturated oil @ reservoir temperature: Vol/ Vol/MPa:

From	4 220	kPa to	6 895	kPa	=	12.38×10^{-4}
From	6 895	kPa to	13 790	kPa	=	11.14×10^{-4}
From	13 790	kPa to	20 684	kPa	=	10.19×10^{-4}
From	20 684	kPa to	27 579	kPa	=	9.21×10^{-4}
From	27 579	kPa to	34 474	kPa	=	8.97×10^{-4}

PRESSURE-VOLUME RELATIONS AT 45.0 °C

Gauge Pressure, kPa	Relative Volume, V/Vsat (1)	Y Function (2)
34 474	0.9700	
27 579	0.9760	
20 684	0.9822	
13 790	0.9891	
6 895	0.9967	
6 205	0.9975	
5 516	0.9984	
4 826	0.9991	
4 220	1.0000	
3 875	1.0307	2.826
3 503	1.0742	2.681
3 116	1.1374	2.497
2 744	1.2234	2.322
2 392	1.3385	2.166
2 082	1.4886	2.004
1 779	1.6994	1.856
1 586	1.8875	1.759

(1) Cubic metres at indicated pressure and temperature per cubic metre of saturated oil.

(2) $Y = \dfrac{(Psat-P)}{(P + 101.325)(\text{Relative Volume}-1)}$

DIFFERENTIAL VAPORIZATION AT 45.0 °C

Gauge Pressure, kPa	Oil Density, kg/m³	Relative Oil Volume (1)	Relative Total Volume (2)	Solution Gas /Oil Ratio (3)	Incremental Gas Density*	Cumulative Gas Density*	Deviation Factor Z	Gas Formation Volume Factor (4)	Gas Expansion Factor (5)
4 220	777.4	1.170	1.170	51.04					
3 482	779.5	1.163	1.268	47.49	0.895	0.895	0.947	0.02963	33.75
2 813	780.9	1.156	1.403	44.29	0.869	0.882	0.951	0.03658	27.34
2 082	783.2	1.147	1.699	39.84	0.883	0.882	0.960	0.04929	20.29
1 413	786.3	1.135	2.297	34.86	0.908	0.891	0.970	0.07180	13.93
958	791.1	1.119	3.366	29.35	1.028	0.926	0.979	0.10360	9.65
0	817.9	1.025	57.492	0.00	1.306	1.145	1.000	1.10632	0.90

Gravity of Residual Oil = 37.2° API at 15.56°C

Density of Residual Oil = 837.9 kg/m³ at 15.56°C

* Relative Density (AIR = 1.000)

(1) Cubic metres of oil at indicated pressure and temperature per cubic metre of residual oil at 15°C.

(2) Cubic metres of oil plus liberated gas at indicated pressure and temperature per cubic metre of residual oil at 15°C.

(3) Cubic metres of gas at 101.325 kPa (absolute) and 15°C per cubic metre of residual oil at 15°C.

(4) Cubic metres of gas at indicated pressure and temperature per cubic metre at 101.325 kPa (absolute) and 15°C.

(5) Cubic metres of gas at 101.325 kPa (absolute) and 15°C per cubic metre at indicated pressure and temperature.

VISCOSITY AT 45.0 °C

Gauge Pressure kPa	Oil Viscosity, mPa•s	Gas Viscosity, * mPa•s	Oil/Gas Viscosity Ratio
34 474	1.913		
31 026	1.843		
27 579	1.772		
24 132	1.699		
20 684	1.626		
17 237	1.554		
13 790	1.481		
10 342	1.410		
6 895	1.338		
4 220	1.285		
3 482	1.319	0.0115	114.70
2 813	1.367	0.0113	120.97
2 082	1.432	0.0110	130.18
1 413	1.548	0.0108	143.33
0	2.904	0.0102	284.71

* Calculated from the correlation by Lee, Eakin and Gonzalez:
"The Viscosity of Natural Gases", August 1966 — Journal of Petroleum Technology.

CORE LABORATORIES CANADA LTD
Petroleum Reservoir Engineering
CALGARY ALBERTA

HYDROCARBON LIQUID ANALYSIS

B-257 (CONTAINER IDENTITY) | 7013-82-20 (LABORATORY NUMBER)

Omega Hydrocarbons Ltd. (OPERATOR) | 5 of 15 (PAGE)

LSD 8-26-1-26 W1M (LOCATION) | Omega Waskada 8-26-1-26 (WELL OR SAMPLE LOCATION NAME) | KB ELEV. m | GRD ELEV. m

Waskada, Manitoba (FIELD OR AREA) | Spearfish (POOL OR ZONE) | Core Laboratories (SAMPLER)

TEST TYPE & NO. | TEST RECOVERY

Bottom Hole (POINT OF SAMPLE) | AMT. & TYPE CUSHION | @ °C MUD RESISTIVITY

906.5 - 918.5 (TEST INTERVALS OR PERFS. m)

PUMPING | FLOWING | GAS LIFT | SWAB

WATER m^3/d | OIL m^3/d | GAS m^3/d

SEPARATOR / RESERVOIR: 1 500 | @ °C CONTAINER WHEN SAMPLED | @ °C CONTAINER WHEN RECEIVED | SEPARATOR: 45.0

PRESSURES, kPa (gauge) — TEMPERATURES, °C

DATE SAMPLED (Y/M/D) | DATE RECEIVED (Y/M/D) | DATE ANALYSED (Y/M/D): 1982-03-19 | ANALYST: DA | REMARKS

COMPONENT	MOLE FRACTION	MASS FRACTION	LIQUID VOL FRACTION
N_2	.0138	.0029	.0028
CO_2	.0003	.0001	.0001
H_2S	.0000	.0000	.0000
C_1	.0964	.0116	.0299
C_2	.0874	.0198	.0428
C_3	.1053	.0350	.0531
iC_4	.0192	.0084	.0115
C_4	.0605	.0265	.0349
iC_5	.0279	.0152	.0187
C_5	.0294	.0160	.0195
C_{6+}	.5598	.8645	.7867
TOTAL	1.0000	1.0000	1.0000

OBSERVED PROPERTIES OF C_{6+} RESIDUE (15/15° C)

848.2 kg/m^3 DENSITY | .8490 RELATIVE DENSITY | 35.2 API @ 15.5° C

205 RELATIVE MOLECULAR MASS

CALCULATED PROPERTIES OF TOTAL SAMPLE (15/15° C)

771.7 kg/m^3 DENSITY | .7723 RELATIVE DENSITY | 51.8 API @ 15.5° C

132.75 RELATIVE MOLECULAR MASS

REMARKS

COMPANY Omega Hydrocarbons Ltd.
LOCATION LSD 8-26-1-26 (W1M)
SAMPLED FROM Bottom Hole

FILE 7013-82-20

Analysis of C_6^+ Fraction to C_{30}^+

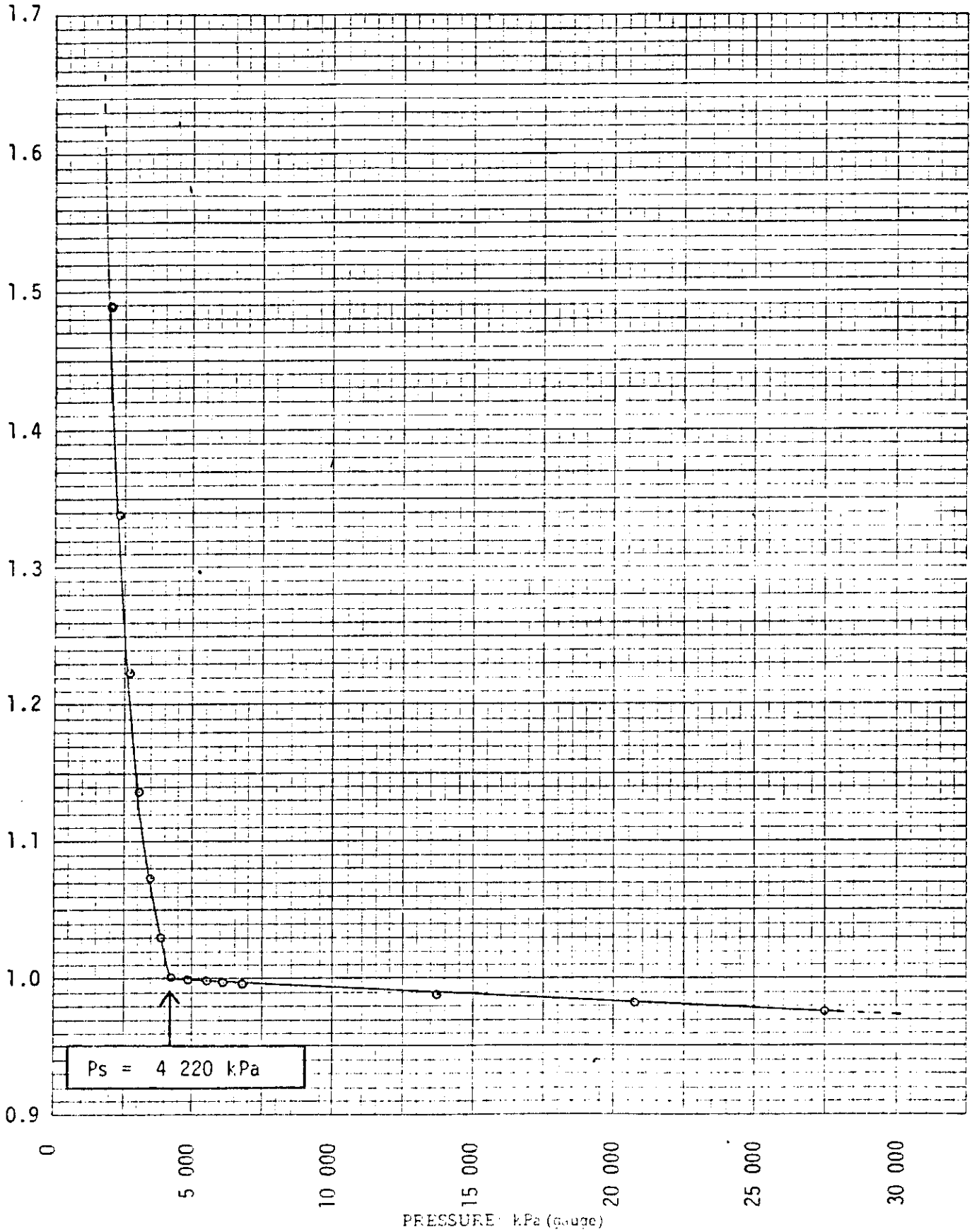
Boiling Point Range (°C)	Component	Carbon Number	Mole Fraction	Mass Fraction
36.1- 68.9	Hexanes	C_6	.0445	.0311
68.9- 98.3	Heptanes	C_7	.0452	.0368
98.3-125.6	Octanes	C_8	.0470	.0435
125.6-150.6	Nonanes	C_9	.0373	.0388
150.6-173.9	Decanes	C_{10}	.0379	.0437
173.9-196.1	Undecanes	C_{11}	.0342	.0433
196.1-215.0	Dodecanes	C_{12}	.0279	.0386
215.0-235.0	Tridecanes	C_{13}	.0252	.0377
235.0-252.2	Tetradecanes	C_{14}	.0211	.0339
252.2-270.6	Pentadecanes	C_{15}	.0188	.0325
270.6-287.8	Hexadecanes	C_{16}	.0169	.0310
287.8-302.8	Heptadecanes	C_{17}	.0146	.0285
302.8-317.2	Octadecanes	C_{18}	.0126	.0260
317.2-330.0	Nonadecanes	C_{19}	.0107	.0233
330.0-344.4	Eicosanes	C_{20}	.0099	.0228
344.4-357.2	Heneicosanes	C_{21}	.0082	.0197
357.2-369.4	Docosanes	C_{22}	.0076	.0190
369.4-380.0	Tricosanes	C_{23}	.0070	.0185
380.0-391.1	Tetracosanes	C_{24}	.0062	.0171
391.1-401.7	Pentacosanes	C_{25}	.0055	.0158
401.7-412.2	Hexacosanes	C_{26}	.0051	.0151
412.2-422.2	Heptacosanes	C_{27}	.0044	.0137
422.2-431.7	Octacosanes	C_{28}	.0040	.0128
431.7-441.1	Nonacosanes	C_{29}	.0035	.0115
441.1 Plus	Triacontanes Plus	C_{30}^+	.0315	.1539
	AROMATICS			
80.0	Benzene	C_6H_6	.0017	.0011
110.6	Toluene	C_7H_8	.0089	.0066
136.1-138.9	Ethylbenzene, p + m-Xylene	C_8H_{10}	.0093	.0080
144.4	o-Xylene	C_8H_{10}	.0047	.0040
168.9	1,2,4 Trimethylbenzene	C_9H_{12}	.0052	.0050
	NAPHTHENES			
68.9	Cyclopentane	C_5H_{10}	.0003	.0002
72.2	Methylcyclopentane	C_6H_{12}	.0140	.0095
81.1	Cyclohexane	C_6H_{12}	.0143	.0098
101.1	Methylcyclohexane	C_7H_{14}	.0146	.0117
	TOTAL		.5598	.8645

Mole Fraction of C_7^+	.4850
Mass Fraction of C_7^+	.8128
Calculated Relative Molecular Mass of C_7^+	223.
Calculated Relative Density of C_7^+	.8602
Calculated Density of C_7^+ (kg/m³)	859.5

The above boiling point ranges refer to the normal paraffin hydrocarbon boiling in that range. Other hydrocarbons (aromatics, olefins, naphthenes and branched hydrocarbons) may have higher or lower carbon numbers, but are grouped and reported according to their boiling point.

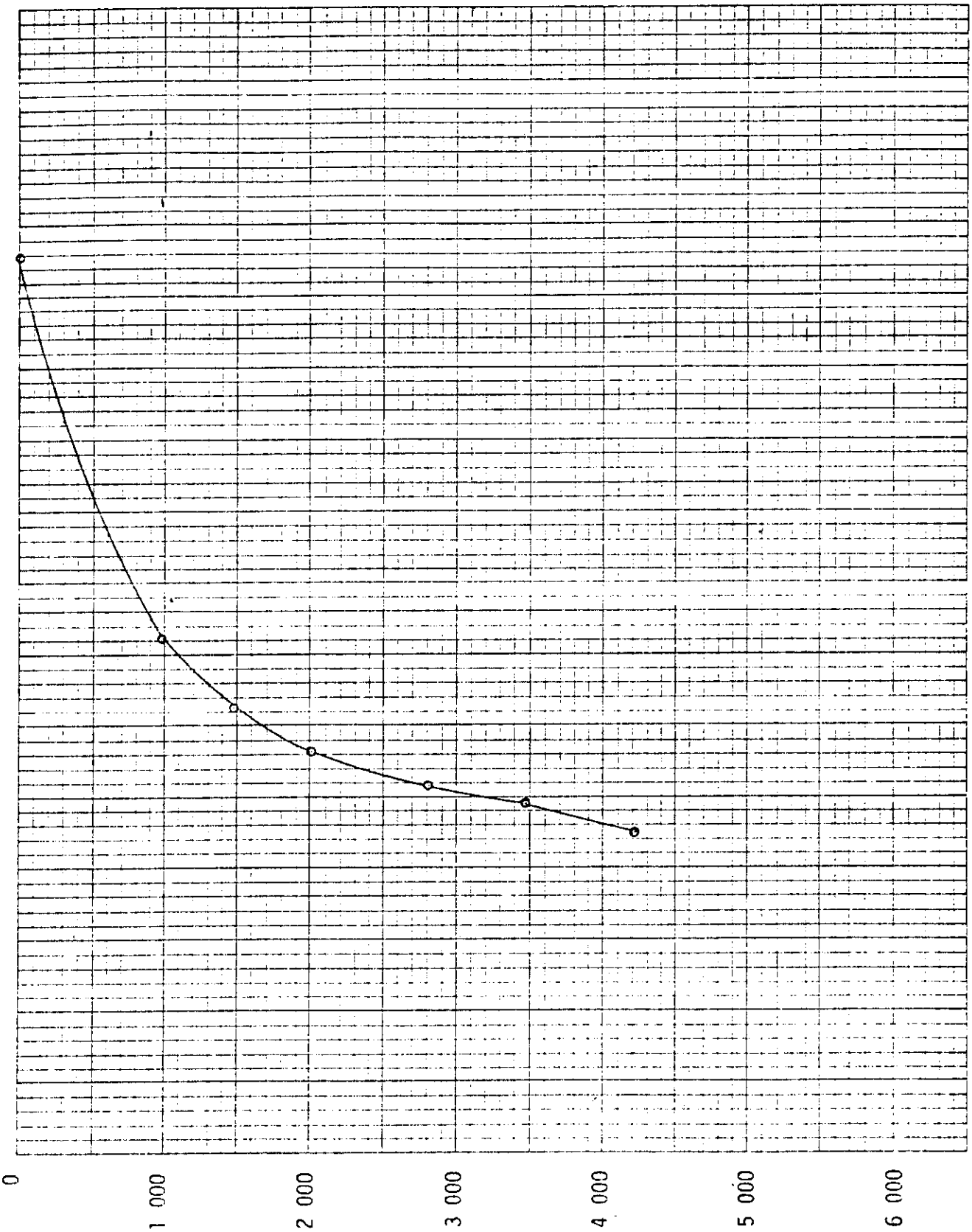
RELATIVE VOLUME (V/VS) AT 45.0°C

Company Omega Hydrocarbons Ltd. Formation Spearfish
Well Omega Waskada 8-26-1-26 (WIM) Province Manitoba
Field Waskada Country Canada



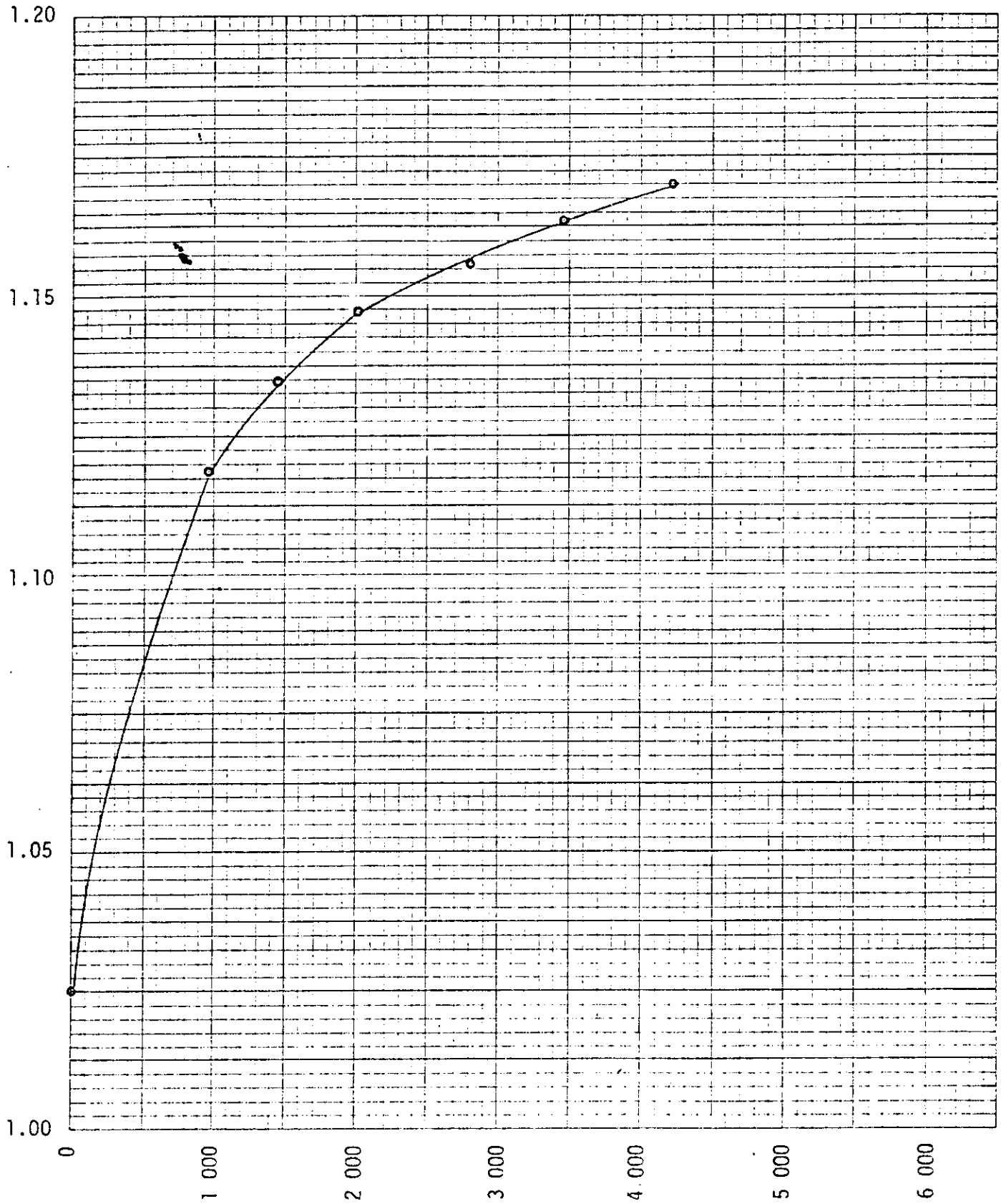
OIL DENSITY

Company Omega Hydrocarbons Ltd. Formation Spearfish
Well Omega Waskada 8-26-1-26 (WIM) Province Manitoba
Field Waskada Country Canada



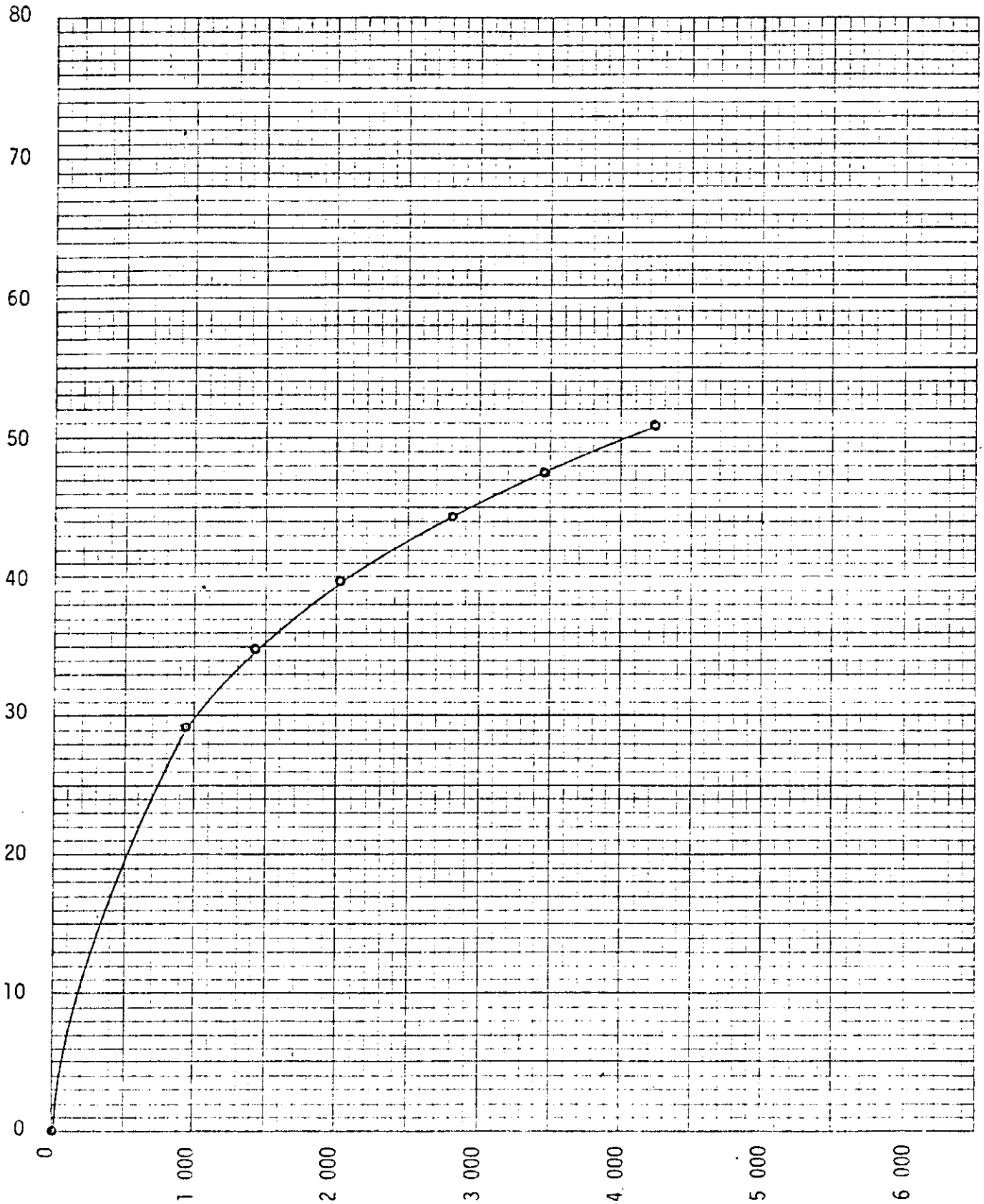
RELATIVE OIL VOLUME (V/VR)

Company Omega Hydrocarbons Ltd. Formation Spearfish
Well Omega Waskada 8-26-1-26 (WIM) Province Manitoba
Field Waskada Country Canada



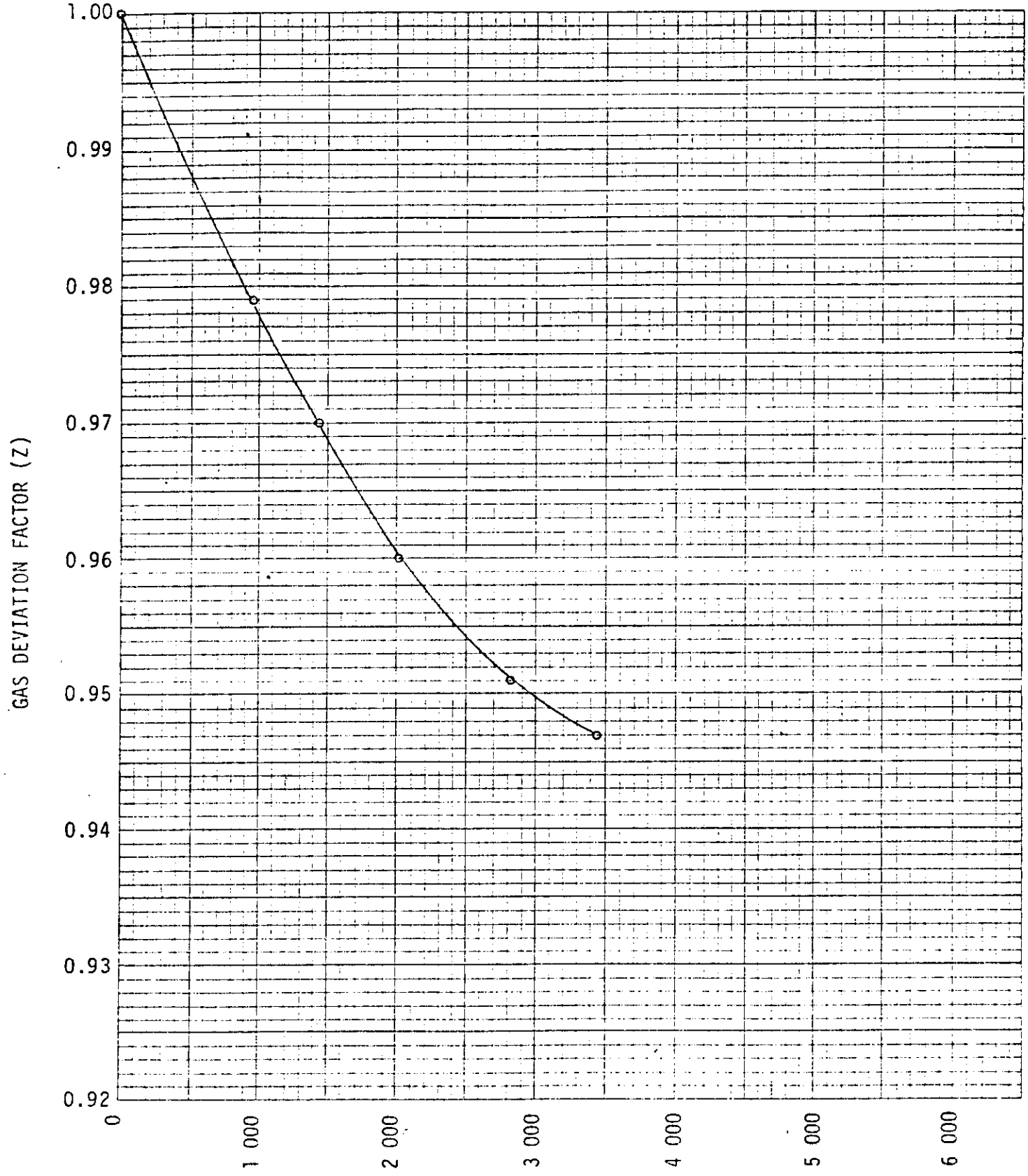
SOLUTION GAS-OIL RATIO

Company Omega Hydrocarbons Ltd. Formation Spearfish
Well Omega Waskada 8-26-1-26 (WIM) Province Manitoba
Field Waskada Country Canada



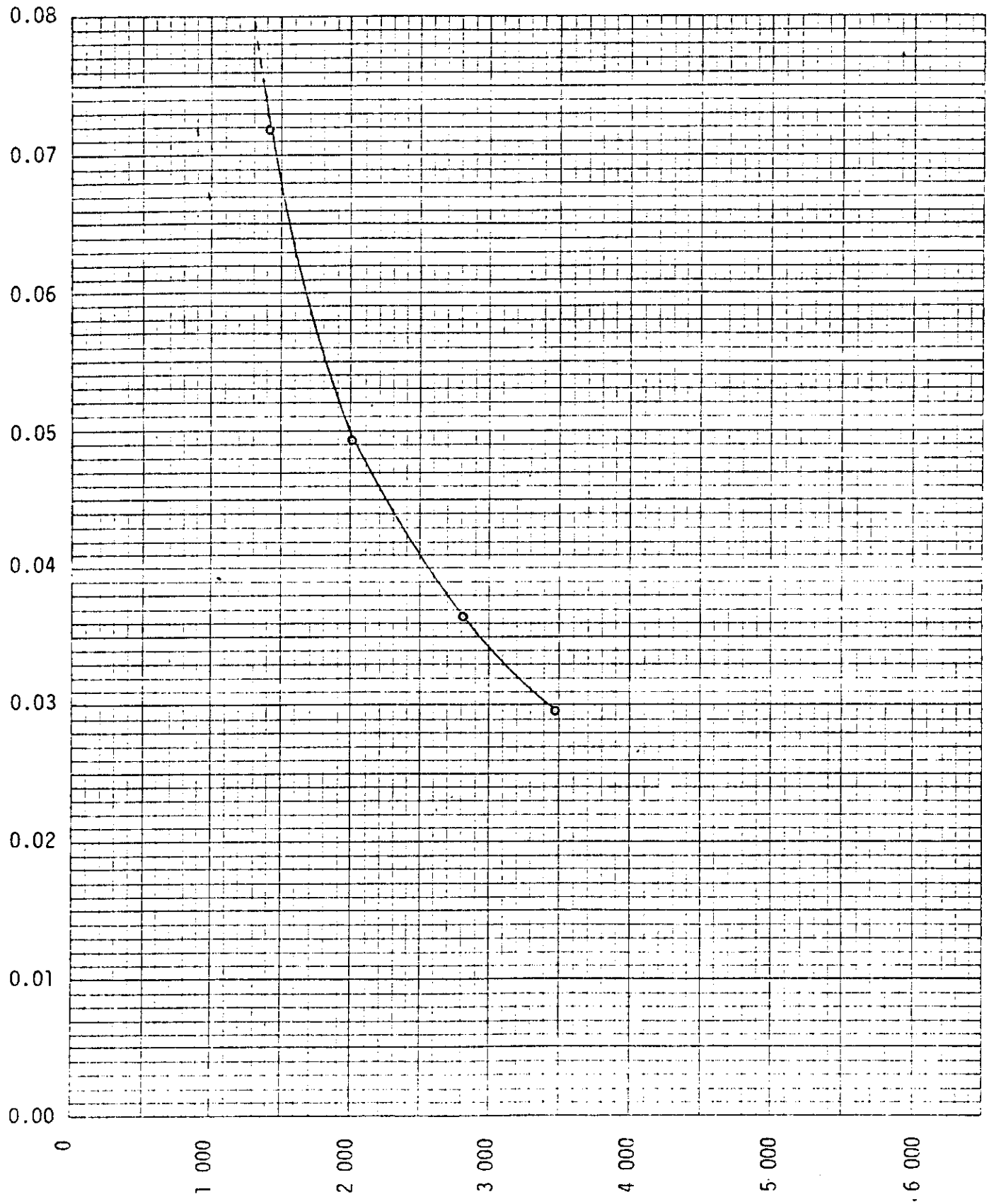
GAS DEVIATION FACTOR (Z)

Company Omega Hydrocarbons Ltd. Formation Spearfish
Well Omega Waskada 8-26-1-26 (WIM) Province Manitoba
Field Waskada Country Canada



GAS FORMATION VOLUME FACTOR

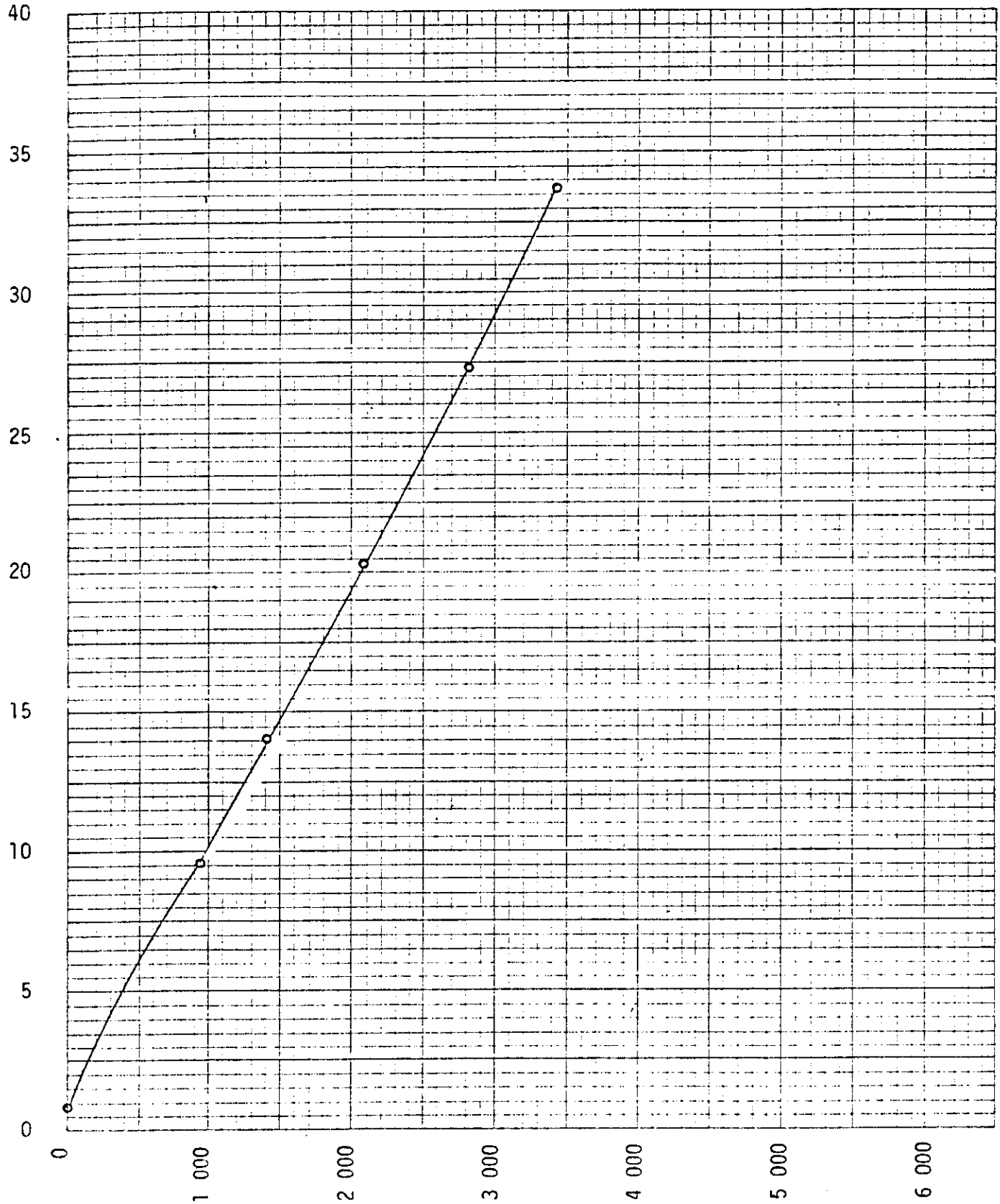
Company Omega Hydrocarbons Ltd. Formation Spearfish
Well Omega Waskada 8-26-1-26 (WIM) Province Manitoba
Field Waskada Country Canada



GAS EXPANSION FACTOR

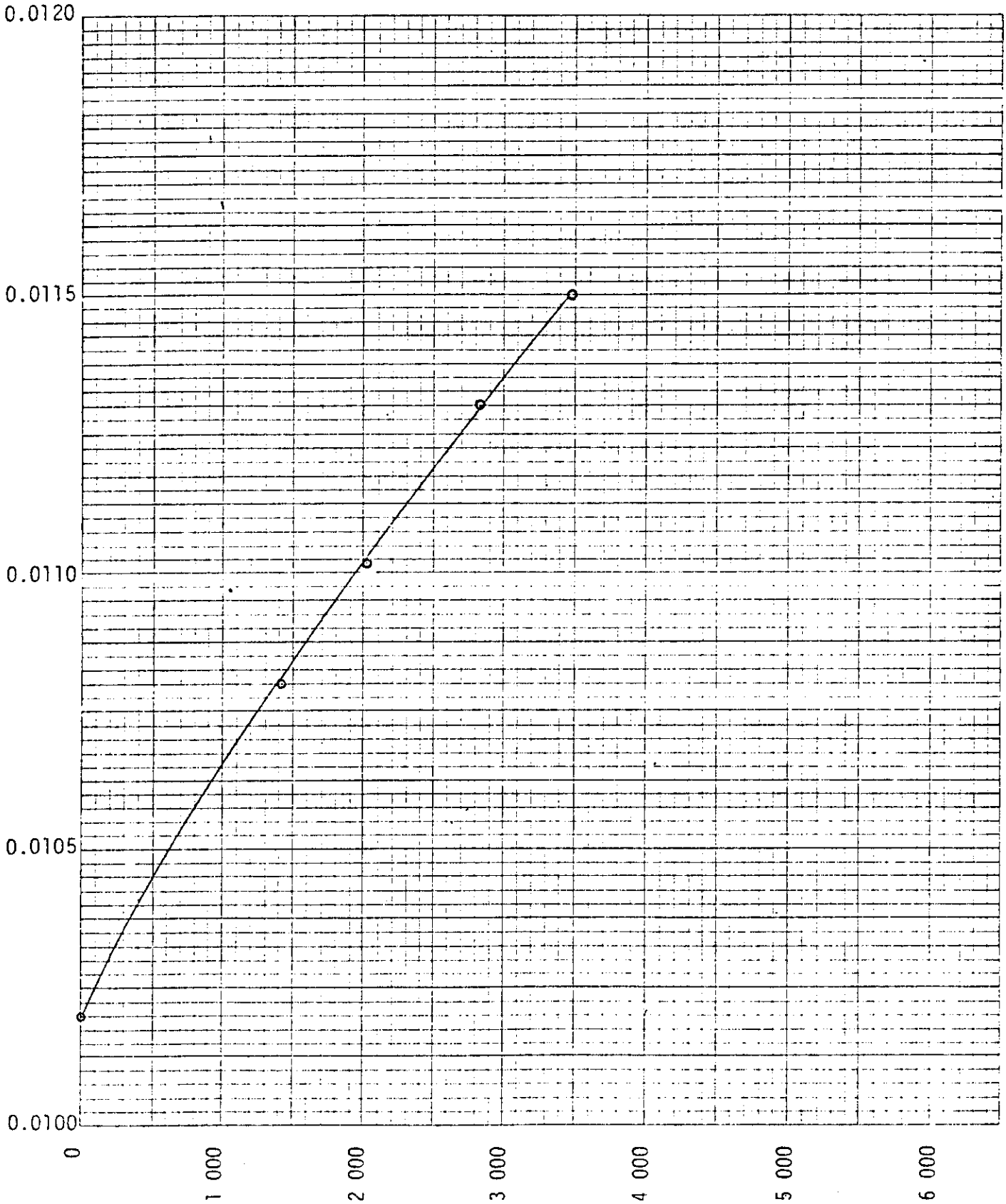
Company Omega Hydrocarbons Ltd.
Well Omega Waskada 8-26-1-26 (WIM)
Field Waskada

Formation Spearfish
Province Manitoba
Country Canada



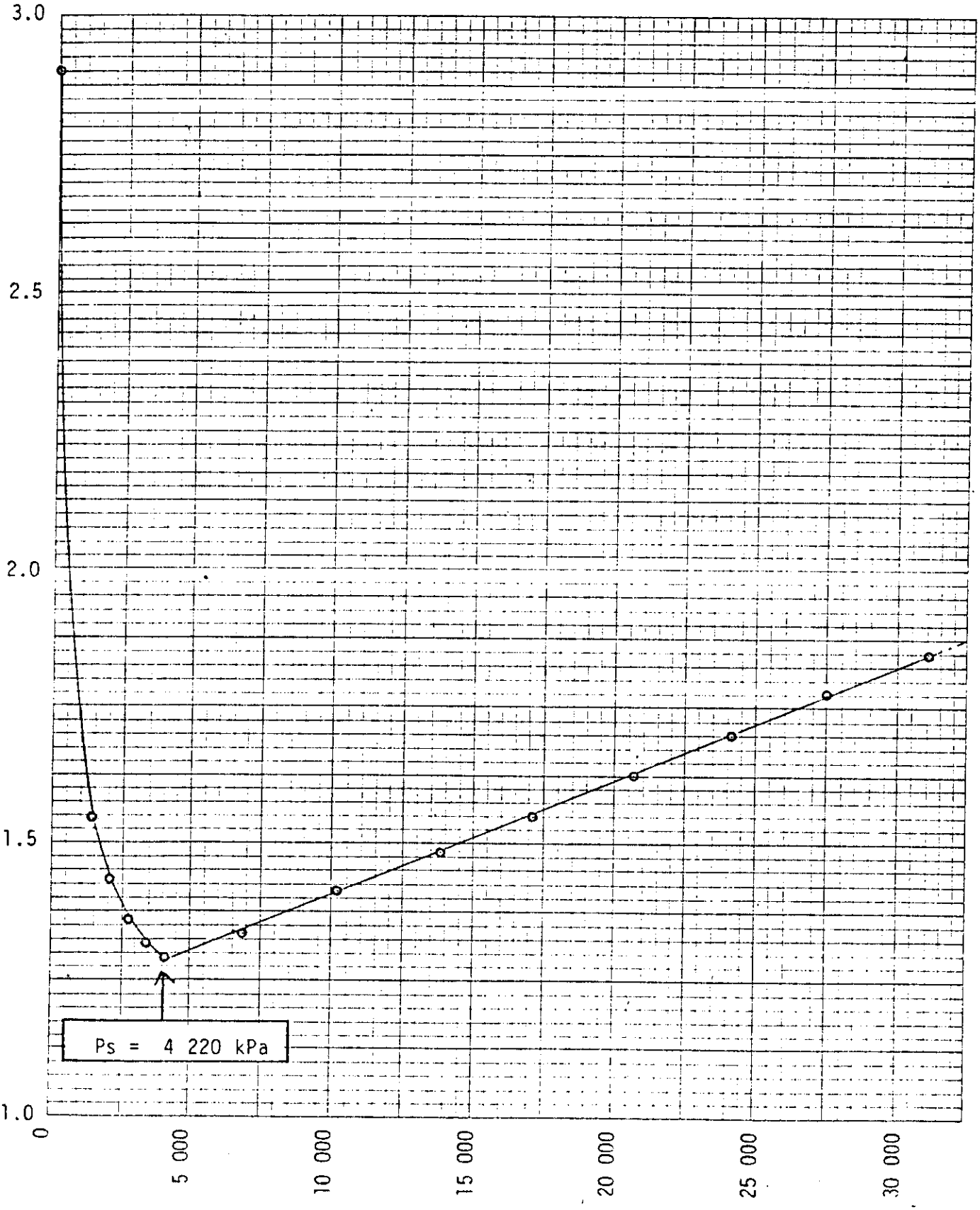
GAS VISCOSITY

Company Omega Hydrocarbons Ltd. Formation Spearfish
Well Omega Waskada 8-26-1-26 (WIM) Province Manitoba
Field Waskada Country Canada

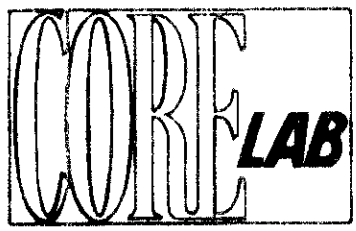


OIL VISCOSITY AT 45.0°C

Company Omega Hydrocarbons Ltd. Formation Spearfish
Well Omega Waskada 8-26-1-26 (WIM) Province Manitoba
Field Waskada Country Canada



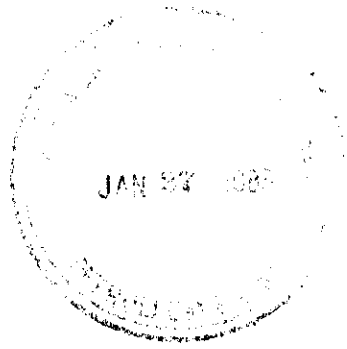
RESERVOIR FLUIDS ANALYSIS



CORE LABORATORIES - CANADA, LTD.

Winterhawk Petroleum Consulting Services Ltd.

January 25, 1983



New Scope Resources Ltd.
10 Donald Street
Winnipeg, Manitoba
R3C 1L5

Attention: Jerry Sinclair, Vice-President

Dear Sir:

Re: Reservoir Fluid Study
New Scope S. Waskada
A12-7-1-25 WPM
South Waskada Field

Please find enclosed three (3) copies of the above study performed by Core Laboratories - Canada Ltd.

Two (2) copies of the report have been forwarded to the Manitoba Department of Energy and Mines. One (1) copy has been sent to Ram Engineering as well.

If you require more information or interpretation please contact our firm.

Yours very truly,

R.A. (Bob) Browning
Vice President Operations

km

cc: Manitoba Department of Energy and Mines - L.R. Dubreuil
Ram Engineering

Memorandum from THE DESK OF L. R. DUBREUIL

Date Jan 27/83

To: Clare

PVT Study A12-7-1-25.

Results of a PVT analysis from a bottom hole sample on A12-7-1-26 (New Scope) have been received and is attached.

The report indicates a bubble point of 6129kPa (889psig)

The solution gas-oil ratio (flash liberation) varied from 61.22 - 61.79 m^3/m^3 (343.8 - 347.0 SCF/STB)

The flash formation volume factor is 1.207 for a shrinkage factor of 0.828

Memorandum from THE DESK OF L. R. DUBREUIL

Date

To :

Previous pressure data submitted for the pool indicats a pressure of approximately 1300 psig. in December 82. This ~~appears to be~~ is a slight decline from a pressure measured in September 82 of 1332 psig

In view of the undersaturated condition of the pool and the relatively stable pressure, the need for pressure maintenance is probably not immediate.

It would however be useful to get a further reading on reservoir pressure in about

Memorandum from THE DESK OF L. R. DUBREUIL

*Date*_____

To :

one year (mox) to permit material balance calculations and to monitor the need for pressure maintenance A draft letter to this effect is attached.

THINK POSITIVE

1540 25TH AVENUE N.E. CALGARY ALBERTA CANADA T2E 7R2 403/230-9228

CORE LABORATORIES-CANADA, LTD.

1983-01-24

Winterhawk Petroleum Consulting Services Ltd.
102, 1040 - 7th Ave. S.W.
Calgary, Alberta
T2P 3G9

Attention: Mr. Bob Browning

Subject: Reservoir Fluid Study
New Scope S. Waskada A12-7-1-25 (WIM)
South Waskada Field
Manitoba, Canada
File Number: 7013-82-262

Gentlemen:

Subsurface samples of reservoir oil were collected from the above subject well by a representative of Core Laboratories-Canada, Ltd. on 1982-12-02. The samples were then submitted to our Calgary laboratory for a complete reservoir fluid study.

A portion of the reservoir fluid was transferred at high pressure to a high pressure-windowed cell and then heated at constant pressure to the reported reservoir temperature of 46.7°C. The pressure-volume relations of the fluid were measured during a constant composition expansion down to 2 206 kPa (gauge). The saturation pressure was determined to be 6 129 kPa (gauge) at 46.7°C. The results of this test are shown on pages 2 and 3 of this report.

During differential pressure depletion at 46.7°C, the fluid evolved a total of 67.51 cubic metres of gas at 101.325 kPa (absolute) and 15°C per unit of residual oil at 15°C. The associated formation volume factor was 1.241 units of saturated fluid at 6 129 kPa (gauge) and 46.7°C per unit of residual oil. The density of the liquid phase and the properties of the evolved gases were determined at several pressure levels below the saturation pressure during this depletion. The data obtained from these tests are summarized on page 4. The viscosity of the fluid was measured under similar depletion conditions at 46.7°C, from pressures exceeding the saturation pressure down to atmospheric pressure. The viscosity of the liquid phase varied from a minimum of 0.901 mPa•s at the saturation pressure to a maximum of 3.309 mPa•s at atmospheric pressure. The viscosity data is summarized on page 5.

Two separator flash tests were run using primary pressures of 172 kPa (gauge) and 103 kPa (gauge) at 48.9°C. The results of these tests are tabulated on pages 6 and 7.

Winterhawk Petroleum Consulting Services Ltd.
New Scope S. Waskada A12-7-1-25 (WIM)

The composition of the reservoir fluid was determined by low temperature, fractional distillation and is shown on pages 8 and 9.

Thank you for the opportunity to perform this study for you. Should you have any questions concerning the data, please contact us.

Yours truly,
CORE LABORATORIES-CANADA, LTD.

Tom B. Martin

Tom B. Martin
Supervisor PVT Lab

TG:cd

Company	Winterhawk Petroleum Consulting Services Ltd.	Formation	
Well	New Scope S. Waskada A12-7-1-25 (W1M)	Province	Manitoba
Field	South Waskada	Country	Canada

SAMPLING CONDITIONS

	Sample No. 1	Sample No. 2
Date Well Sampled	1982-12-02	1982-12-02
Time Well Sampled	0920 Hours	1115 Hours
Hours Shut-in Prior to Sampling	24 Hours	24 Hours
Gas-Oil Contact in the Tubing (m)	N/A	N/A
Oil-Water Contact in the Tubing (m)	900	900
Sampling Depth (m)	880	880
Sampling Depth Pressure (kPa, gauge)	8 950	8 950
Sampling Depth Temperature (°C)	46.7	46.7
Tubing Pressure at Surface (kPa, gauge)	1 819	1 819
Sampler Opening Press. at Surface (kPa, guage)	4 550	4 400
Field Saturation Pressure (kPa, gauge)	5 100	4 900
Type of Sampler Used	Wofford	Wofford
Sample Transfer Pressure (kPa, gauge)	18 200	19 000
Liquid Used to Transfer Sample	Mercury	Mercury
Sample Transferred to Container No.	SS423	80-7
Volume of Sample Container (mL)	600	500
Sample Shipping Pressure (kPa, gauge)	< 20 000	< 23 000
State of Sample as Shipped to Lab	Two-Phase	Two-Phase
Sampled By	Core Laboratories - Edmonton	

VOLUMETRIC DATA OF RESERVOIR FLUID SAMPLE

1. Saturation pressure (bubble point pressure) 6 129 kPa (gauge) @ 46.7 °C
2. Thermal expansion of saturated oil @ 34 474 kPa (gauge) = $\frac{V@\ 46.7\ °C}{V@\ 22.2\ °C}$ = 1.02213
3. Density at saturation pressure: 759.0 kg/m³ @ 46.7 °C
4. Compressibility of saturated oil @ reservoir temperature: Vol/ Vol/MPa:

From	6 129	kPa to	10 342	kPa	=	13.85×10^{-4}
From	10 342	kPa to	13 790	kPa	=	12.01×10^{-4}
From	13 790	kPa to	17 237	kPa	=	11.47×10^{-4}
From	17 237	kPa to	20 684	kPa	=	10.92×10^{-4}
From	20 684	kPa to	24 132	kPa	=	10.67×10^{-4}
From	24 132	kPa to	27 579	kPa	=	10.11×10^{-4}
From	27 579	kPa to	31 026	kPa	=	9.54×10^{-4}
From	31 026	kPa to	34 474	kPa	=	9.28×10^{-4}

PRESSURE-VOLUME RELATIONS AT 46.7 °C

Gauge Pressure, kPa	Relative Volume, V/Vsat (1)	Y Function (2)
34 474	0.9692	
31 026	0.9723	
27 579	0.9755	
24 132	0.9789	
20 684	0.9825	
17 237	0.9862	
13 790	0.9901	
10 342	0.9942	
7 584	0.9979	
6 895	0.9988	
6 129	1.0000	
5 861	1.0146	3.082
5 571	1.0329	2.988
5 033	1.0763	2.798
4 426	1.1454	2.587
3 916	1.2278	2.418
3 413	1.3447	2.242
2 951	1.4991	2.086
2 482	1.7349	1.921
2 206	1.9316	1.825

(1) Cubic metres at indicated pressure and temperature per cubic metre of saturated oil.

(2) $Y = \frac{(Psat-P)}{(P + 101.325)(\text{Relative Volume}-1)}$

DIFFERENTIAL VAPORIZATION AT 46.7 °C

Gauge Pressure, kPa	Oil Density, kg/m³	Relative Oil Volume (1)	Relative Total Volume (2)	Solution Gas /Oil Ratio (3)	Incremental Gas Density*	Cumulative Gas Density*	Deviation Factor Z	Gas Formation Volume Factor (4)	Gas Expansion Factor (5)
6 129	759.0	1.241	1.241	67.51					
4 881	762.3	1.227	1.356	61.18	0.853	0.853	0.898	0.02031	49.24
4 144	764.7	1.217	1.463	57.27	0.851	0.852	0.905	0.02402	41.63
3 482	766.8	1.208	1.620	53.18	0.866	0.856	0.915	0.02878	34.75
2 765	769.6	1.197	1.894	48.38	0.892	0.865	0.927	0.03645	27.43
2 075	773.5	1.183	2.387	42.86	0.942	0.882	0.943	0.04883	20.48
1 379	777.5	1.167	3.436	36.46	0.995	0.905	0.960	0.07308	13.68
827	782.8	1.148	5.581	30.06	1.047	0.930	0.975	0.11836	8.45
0	818.1	1.026	76.113	0.00	1.610	1.234	1.000	1.11224	0.90

Gravity of Residual Oil = 37.0° API at 15.56°C

Density of Residual Oil = 839.1 kg/m³ at 15.56°C

* Relative Density (AIR = 1.000)

(1) Cubic metres of oil at indicated pressure and temperature per cubic metre of residual oil at 15°C.

(2) Cubic metres of oil plus liberated gas at indicated pressure and temperature per cubic metre of residual oil at 15°C.

(3) Cubic metres of gas at 101.325 kPa (absolute) and 15°C per cubic metre of residual oil at 15°C.

(4) Cubic metres of gas at indicated pressure and temperature per cubic metre at 101.325 kPa (absolute) and 15°C.

(5) Cubic metres of gas at 101.325 kPa (absolute) and 15°C per cubic metre at indicated pressure and temperature.

VISCOSITY AT 46.7 °C

Gauge Pressure kPa	Oil Viscosity, mPa•s	Gas Viscosity, * mPa•s	Oil/Gas Viscosity Ratio
34 474	1.136		
31 026	1.108		
27 579	1.079		
24 132	1.050		
20 684	1.023		
17 237	0.994		
13 790	0.965		
10 342	0.936		
6 895	0.908		
6 129	0.901		
4 881	0.935	0.0123	76.02
4 144	0.960	0.0119	80.67
3 482	0.988	0.0116	85.17
2 765	1.021	0.0113	90.35
2 075	1.062	0.0109	97.43
1 379	1.108	0.0105	105.52
827	1.169	0.0101	115.74
0	3.309	0.0083	398.67

* Calculated from the correlation by Lee, Eakin and Gonzalez:
"The Viscosity of Natural Gases", August 1966 — Journal of Petroleum Technology.

SEPARATOR TEST OF RESERVOIR FLUID **SAMPLE**

Separator Gauge Pressure, kPa	Separator Temperature °C	Gas/Oil Ratio (1)	Gas/Oil Ratio (2)	Stock Tank Oil Gravity, °API @ 15.56°C	Formation Volume Factor (3)	Separator Volume Factor (4)	Relative Density of Liberated Gas (AIR = 1.000)
6 129 to 172	48.9	51.04	53.77			1.053	1.0409
to 0	26.7	7.38	7.45	38.4	1.207	1.009	1.2940
		Total	61.22				

(1) Cubic metres of gas @ 101.325 kPa (absolute) and 15°C per cubic metre of oil @ indicated pressure and temperature.

(2) Cubic metres of gas @ 101.325 kPa (absolute) and 15°C per cubic metre of stock tank oil @ 15°C.

(3) Cubic metres of saturated oil @ 6 129 kPa (gauge) and 46.7 °C per cubic metre of stock tank oil @ 15°C.

(4) Cubic metres of oil @ indicated pressure and temperature per cubic metre of stock tank oil @ 15°C.

SEPARATOR TEST OF RESERVOIR FLUID **SAMPLE**

Separator Gauge Pressure, kPa	Separator Temperature °C	Gas/Oil Ratio (1)	Gas/Oil Ratio (2)	Stock Tank Oil Gravity, °API @ 15.56°C	Formation Volume Factor (3)	Separator Volume Factor (4)	Relative Density of Liberated Gas (AIR = 1.000)
6 129 to 103	48.9	55.77	57.98			1.040	1.0983
to 0	26.7	3.77	3.81	38.4	1.207	1.009	N/M
		Total	61.79				

N/M - Not Measured, due to insufficient liberated gas.

(1) Cubic metres of gas @ 101.325 kPa (absolute) and 15°C per cubic metre of oil @ indicated pressure and temperature.

(2) Cubic metres of gas @ 101.325 kPa (absolute) and 15°C per cubic metre of stock tank oil @ 15°C.

(3) Cubic metres of saturated oil @ 6 129 kPa (gauge) and 46.7 °C per cubic metre of stock tank oil @ 15°C.

(4) Cubic metres of oil @ indicated pressure and temperature per cubic metre of stock tank oil @ 15°C.

CORE LABORATORIES - CANADA LTD.
Petroleum Reservoir Engineering
CALGARY ALBERTA

SS423 (CONTAINER IDENTITY)

HYDROCARBON LIQUID ANALYSIS

7013-82-262 (LABORATORY NUMBER)

Winterhawk Petroleum Consulting Services Ltd. (OPERATOR)

8 of 18 (PAGE)

LSD 12-7-1-25 W1M (LOCATION)

New Scope S. Waskada A12-7-1-25 (WELL OR SAMPLE LOCATION NAME)

KB ELEV., m

GRD. ELEV., m

South Waskada, Manitoba (FIELD OR AREA)

POOL OR ZONE

Core Laboratories (SAMPLER)

TEST TYPE & NO.

TEST RECOVERY

Bottomhole (POINT OF SAMPLE)

AMT. & TYPE CUSHION

@ °C MUD RESISTIVITY

PUMPING FLOWING GAS LIFT SWAB

TEST INTERVALS OR PERFS., m

WATER m³/d OIL m³/d GAS m³/d

SEPARATOR / RESERVOIR: 18 300 @ °C CONTAINER WHEN SAMPLED @ °C CONTAINER WHEN RECEIVED

SEPARATOR: 9.0

PRESSURES, kPa (gauge)

TEMPERATURES, °C

1982-12-02 (DATE SAMPLED (Y/M/D))

1982-12-14 (DATE RECEIVED (Y/M/D))

DATE ANALYSED (Y/M/D)

ANALYST

REMARKS

COMPONENT	MOLE FRACTION	MASS FRACTION	LIQUID VOL FRACTION
N_2	0.0151	0.0034	0.0032
CO_2	0.0007	0.0002	0.0002
H_2S	0.0007	0.0002	0.0002
C_1	0.1407	0.0181	0.0460
C_2	0.0931	0.0224	0.0480
C_3	0.0943	0.0333	0.0501
iC_4	0.0181	0.0084	0.0114
C_4	0.0564	0.0262	0.0344
iC_5	0.0228	0.0132	0.0162
C_5	0.0259	0.0150	0.0182
C_{6+}	0.5322	0.8596	0.7721
TOTAL	1.0000	1.0000	1.0000

OBSERVED PROPERTIES OF C_{6+} RESIDUE (15/15° C)

852.3 kg/m³ DENSITY

0.8531 RELATIVE DENSITY

34.4 API @ 15.5° C

202 RELATIVE MOLECULAR MASS

CALCULATED PROPERTIES OF TOTAL SAMPLE (15/15° C)

765.5 kg/m³ DENSITY

0.7662 RELATIVE DENSITY

53.3 API @ 15.5° C

125.03 RELATIVE MOLECULAR MASS

REMARKS

COMPANY Winterhawk Petroleum Consulting Services Ltd. PAGE 9 of 18
LOCATION LSD 12-7-1-25 W1M FILE 7013-82-262
SAMPLED FROM Bottomhole

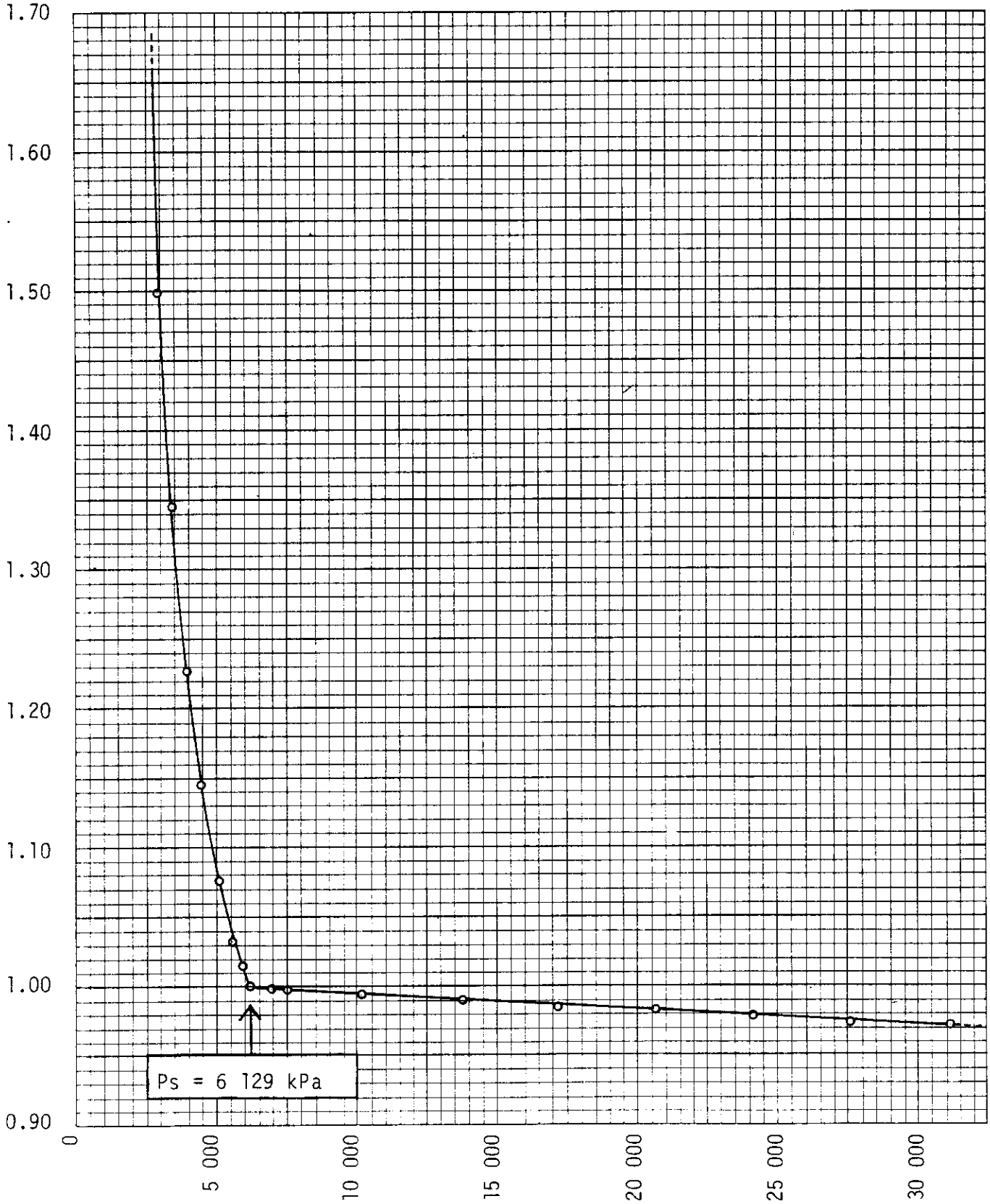
Analysis of C6 Fraction to C30+

Boiling Point Range (C)	Component	Carbon Number	Mole Fraction	Mass Fraction
36.1- 68.9	Hexanes	C6	0.0440	0.0330
68.9- 98.3	Heptanes	C7	0.0439	0.0383
98.3-125.6	Octanes	C8	0.0446	0.0444
125.6-150.6	Nonanes	C9	0.0350	0.0391
150.6-173.9	Decanes	C10	0.0358	0.0444
173.9-196.1	Undecanes	C11	0.0311	0.0423
196.1-215.0	Dodecanes	C12	0.0247	0.0366
215.0-235.0	Tridecanes	C13	0.0253	0.0406
235.0-252.2	Tetradecanes	C14	0.0190	0.0329
252.2-270.6	Pentadecanes	C15	0.0193	0.0357
270.6-287.8	Hexadecanes	C16	0.0151	0.0299
287.8-302.8	Heptadecanes	C17	0.0135	0.0282
302.8-317.2	Octadecanes	C18	0.0120	0.0267
317.2-330.0	Nonadecanes	C19	0.0098	0.0229
330.0-344.4	Eicosanes	C20	0.0092	0.0225
344.4-357.2	Heneicosanes	C21	0.0078	0.0202
357.2-369.4	Docosanes	C22	0.0072	0.0195
369.4-380.0	Tricosanes	C23	0.0066	0.0187
380.0-391.1	Tetracosanes	C24	0.0059	0.0175
391.1-401.7	Pentacosanes	C25	0.0051	0.0155
401.7-412.2	Hexacosanes	C26	0.0045	0.0144
412.2-422.2	Heptacosanes	C27	0.0043	0.0142
422.2-431.7	Octacosanes	C28	0.0044	0.0152
431.7-441.1	Nonacosanes	C29	0.0037	0.0131
441.1 PLUS	Triacontanes Plus	C30+	0.0253	0.1323
	AROMATICS			
80.0	Benzene	C6H6	0.0020	0.0013
110.6	Toluene	C7H8	0.0100	0.0080
136.1-138.9	Ethylbenzene, p + m-Xylene	C8H10	0.0098	0.0090
144.4	o-Xylene	C8H10	0.0050	0.0047
168.9	1,2,4 Trimethylbenzene	C9H12	0.0042	0.0044
	NAPHTHENES			
48.9	Cyclopentane	C5H10	0.0011	0.0007
72.2	Methylcyclopentane	C6H12	0.0121	0.0089
81.1	Cyclohexane	C6H12	0.0151	0.0110
101.1	Methylcyclohexane	C7H14	0.0158	0.0135
	TOTAL		0.5322	0.8596
	Mole Fraction of C7+			0.4579
	Mass Fraction of C7+			0.8047
	Calculated Relative Molecular Mass of C7+			220
	Calculated Relative Density of C7+			0.8655
	Calculated Density of C7+ (kg/m3)			864.7

The above boiling ranges refer to the normal paraffin hydrocarbon boiling in that range. Other hydrocarbons (aromatics, olefins, naphthenes and branched hydrocarbons) may have higher or lower carbon numbers, but are grouped and reported according to their boiling point.

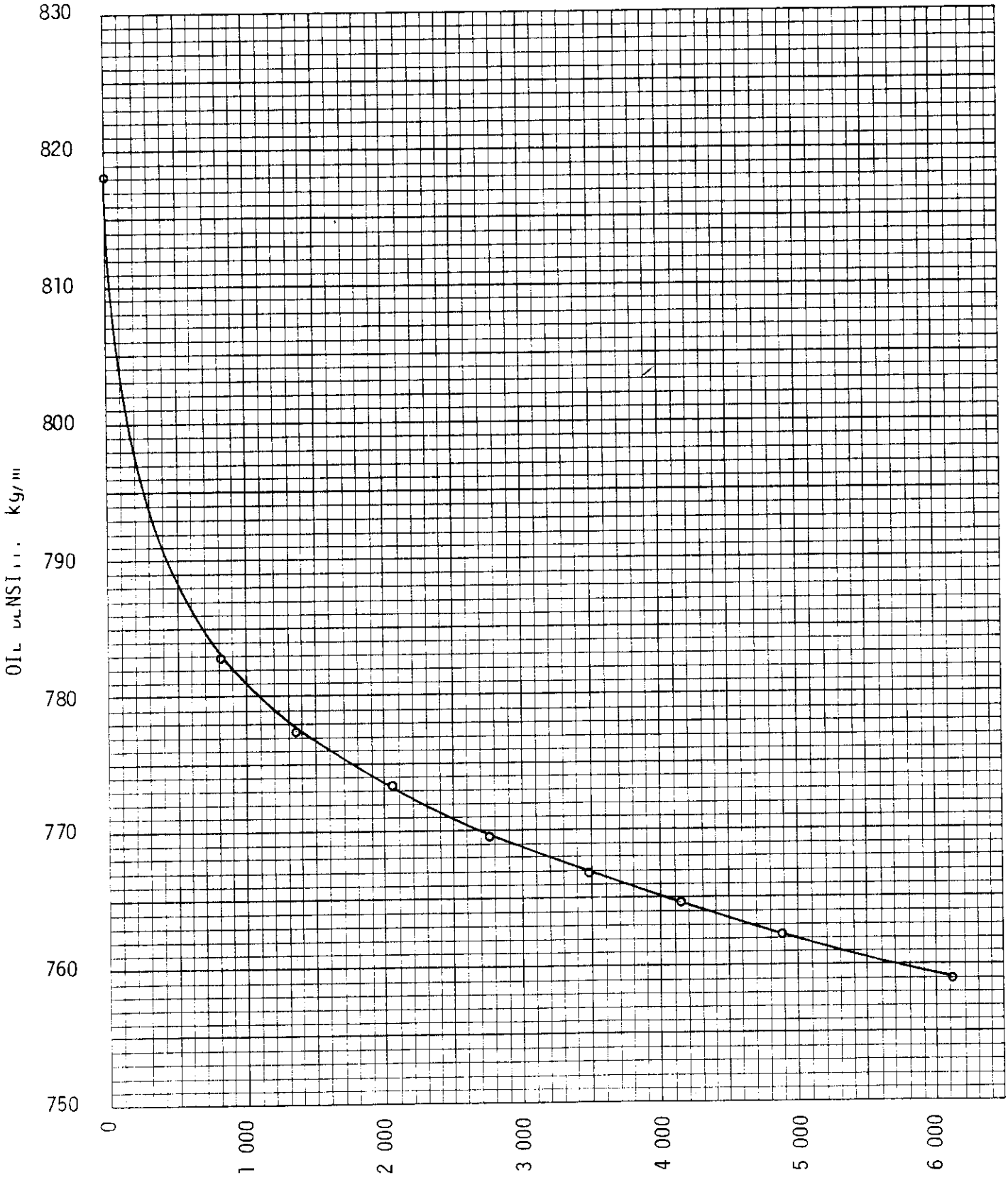
RELATIVE VOLUME (V/VS) AT 46.7°C

Company Winterhawk Petroleum Consulting Services Ltd. Formation
Well New Scope S. Waskada A12-7-1-25 (WIM) Province Manitoba
Field South Waskada Country Canada



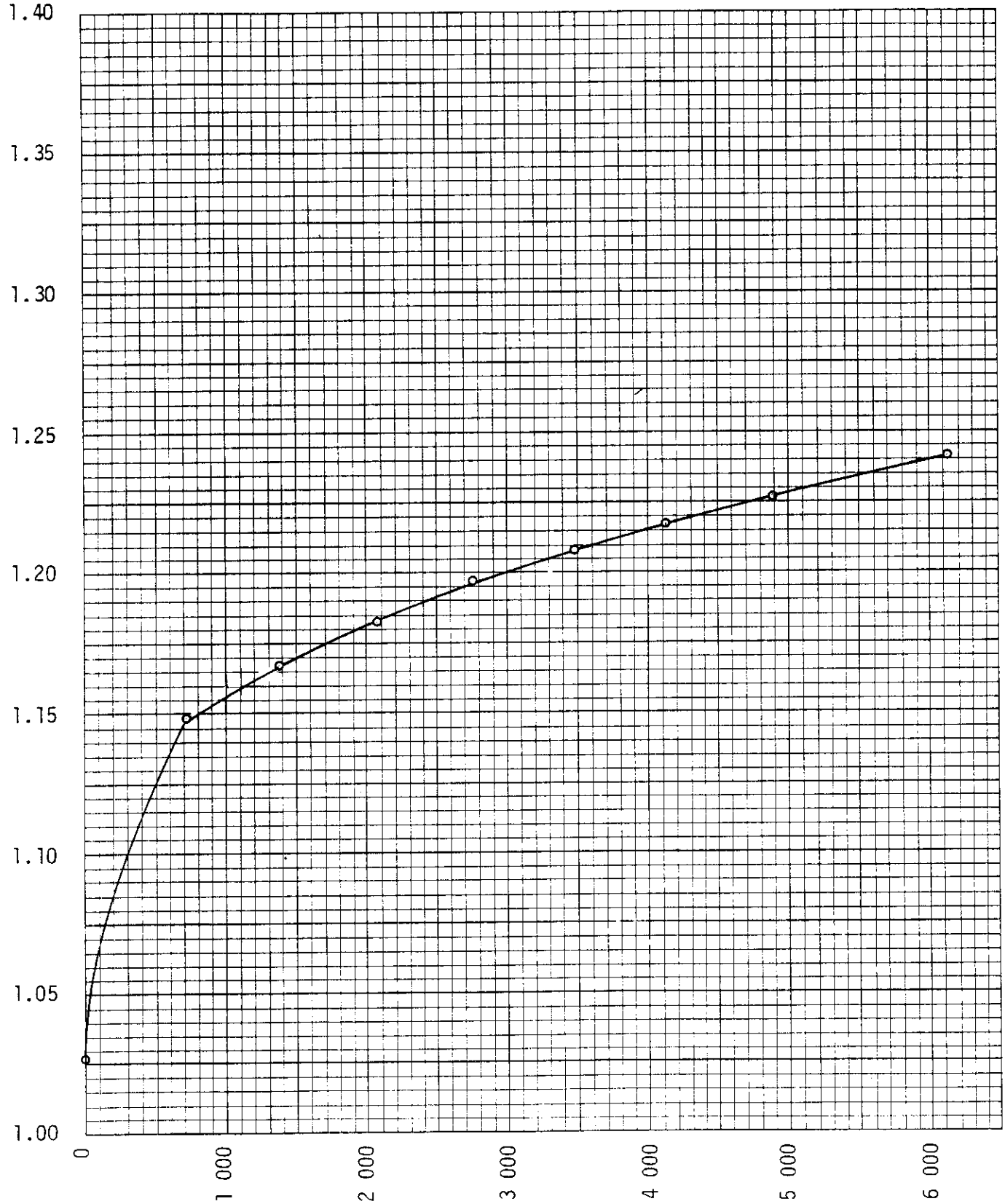
OIL DENSITY

Company Winterhawk Petroleum Consulting Services Ltd.
Well New Scope S. Waskada A12-7-1-25 (WIM)
Field South Waskada
Formation
Province Manitoba
Country Canada



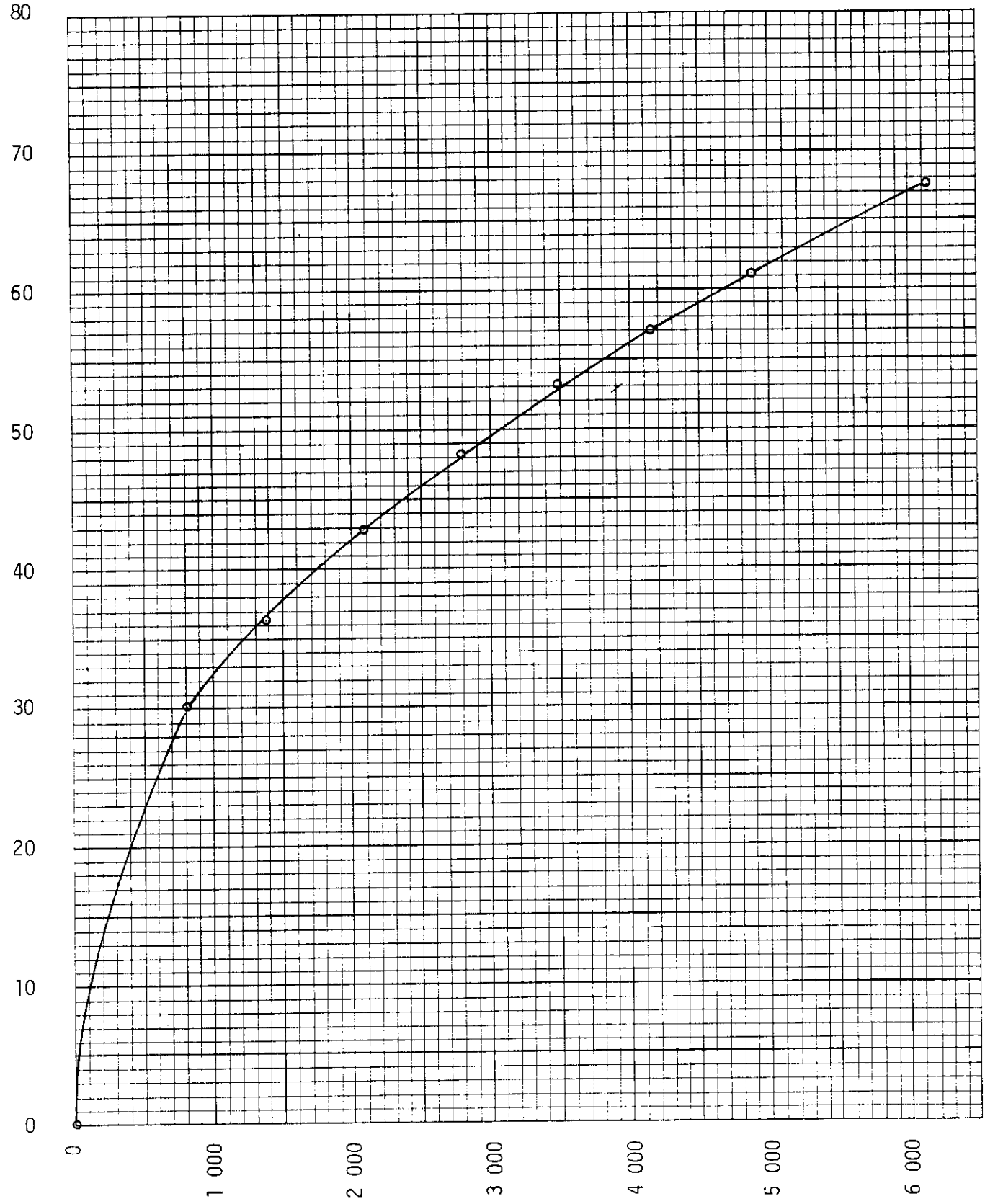
RELATIVE OIL VOLUME (V/VR)

Company Winterhawk Petroleum Consulting Services Ltd.
Well New Scope S. Waskada A12-7-1-25 (WIM)
Field South Waskada
Formation
Province Manitoba
Country Canada



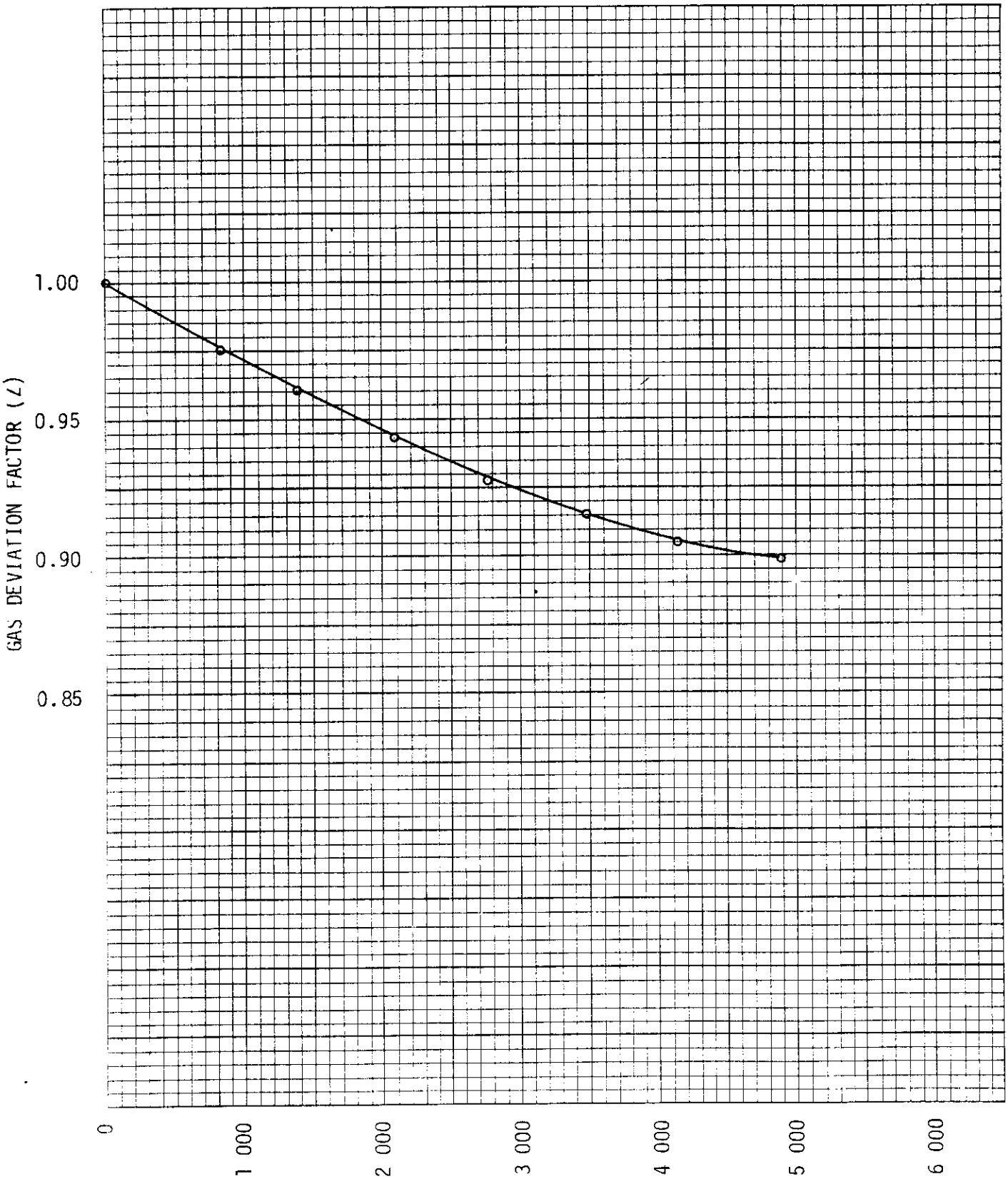
SOLUTION GAS-OIL RATIO

Company Winterhawk Petroleum Consulting Services Ltd. Formation
Well New Scope S. Waskada A12-7-1-25 (W1M) Province Manitoba
Field South Waskada Country Canada



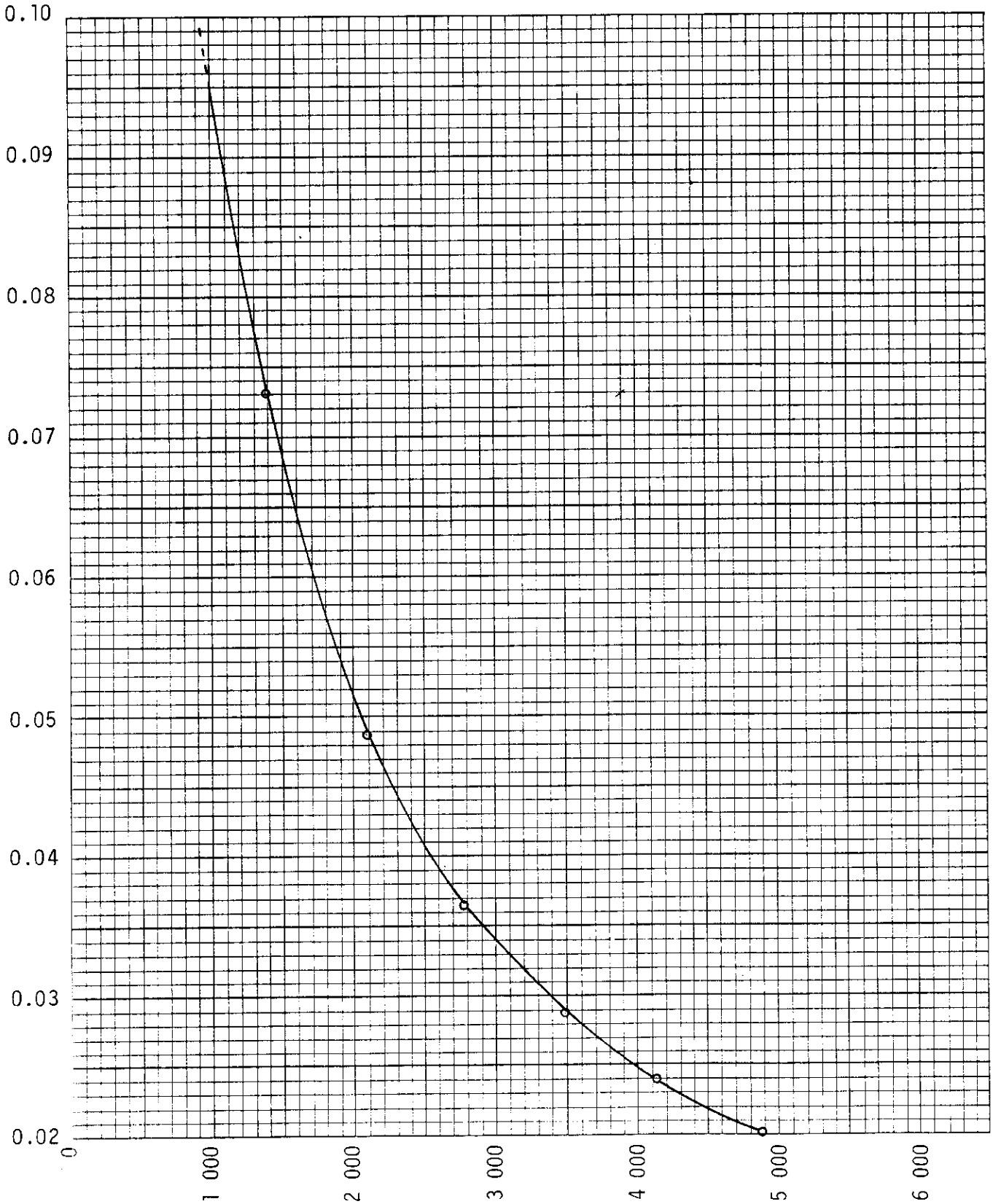
GAS DEVIATION FACTOR (Z)

Company Winterhawk Petroleum Consulting Services Ltd. Formation
Well New Scope S. Waskada A12-7-1-25 (WIM) Province Manitoba
Field South Waskada Country Canada



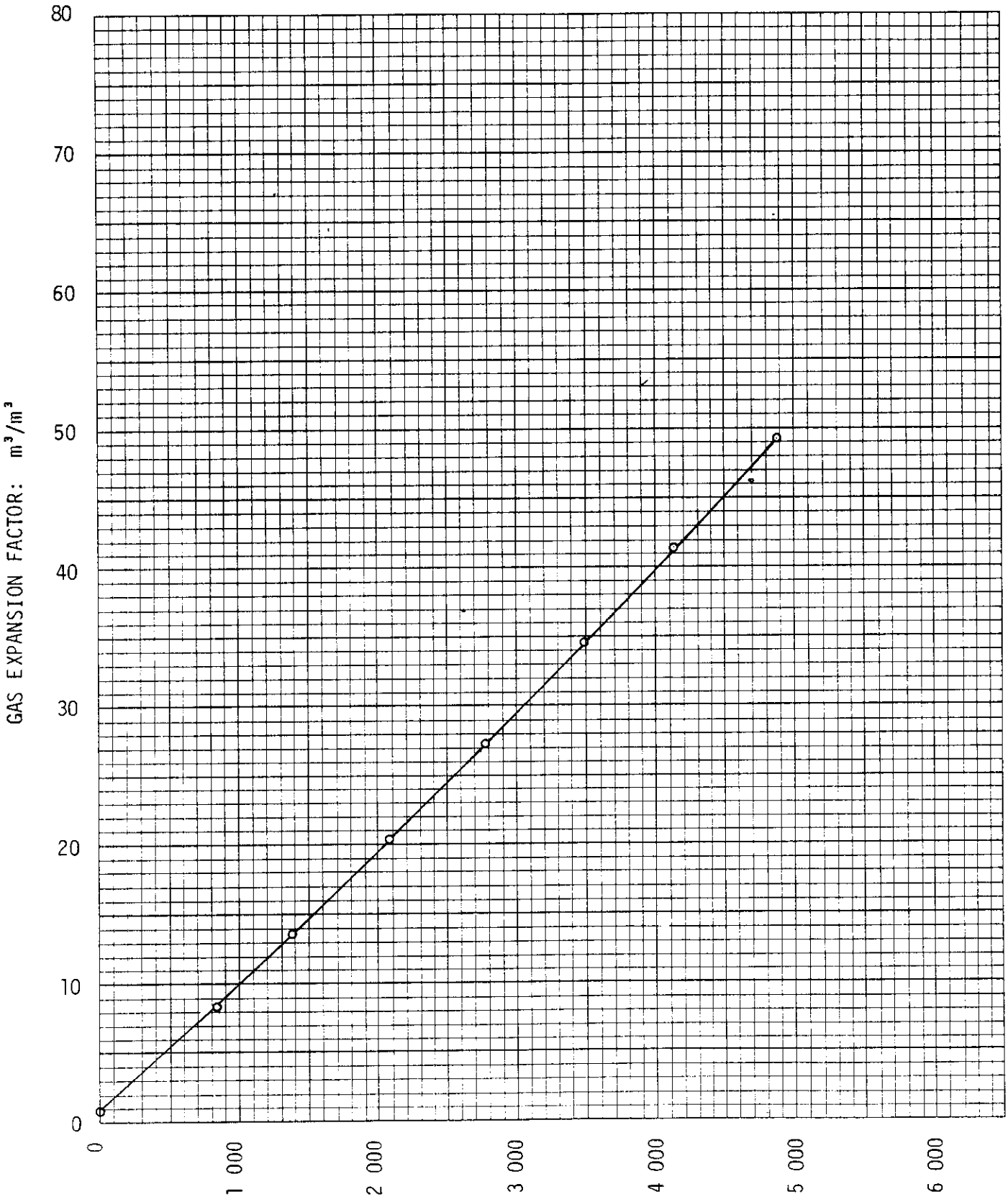
GAS FORMATION VOLUME FACTOR

Company Winterhawk Petroleum Consulting Services Ltd. Formation
Well New Scope S. Waskada A12-7-1-25 (WIM) Province Manitoba
Field South Waskada Country Canada



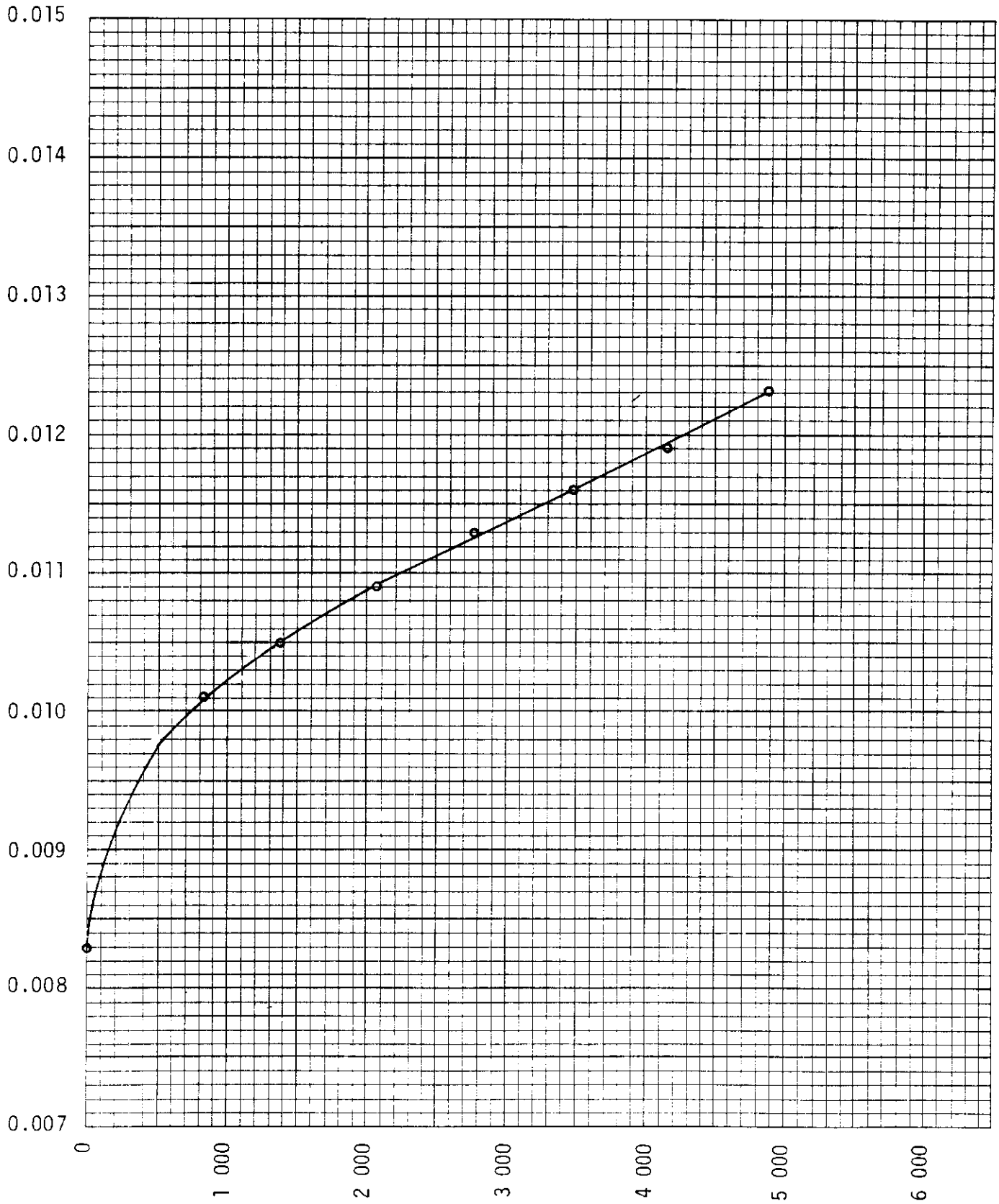
GAS EXPANSION FACTOR

Company Winterhawk Petroleum Consulting Services Ltd. Formation
Well New Scope S. Waskada A12-7-1-25 (WIM) Province Manitoba
Field South Waskada Country Canada



GAS VISCOSITY

Company Winterhawk Petroleum Consulting Services Ltd.
Well New Scope S. Waskada A12-7-1-25 (WIM)
Field South Waskada
Formation
Province Manitoba
Country Canada



OIL VISCOSITY AT 46.7°C

Company Winterhawk Petroleum Consulting Services Ltd.
Well New Scope S. Waskada A12-7-1-25 (WIM)
Field South Waskada
Formation
Province Manitoba
Country Canada