

CORE LABORATORIES-CANADA, LTD.



1982-04-07

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

Attention: Mr. Ed Wyse

Reservoir Fluid Study

Omega Waskada 8-24-1-26 (W1M)  
Waskada Field, Manitoba, Canada  
Our File Number: 7013-82-34

Gentlemen:

Subsurface samples of reservoir oil were taken from the above subject well by a representative of Core Laboratories-Canada Ltd. on 1982-02-03. 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 1 241 kPa (gauge). The saturation pressure was determined to be 3 158 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 45.40 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 1.150 units of saturated fluid at 3 158 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

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Omega Waskada 8-24-1-26 (W1M)

viscosity of the liquid phase varied from a minimum of 1.154 mPa·s at the saturation pressure to a maximum of 2.581 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 B. Martin

TG:cd

VOLUMETRIC DATA OF RESERVOIR FLUID SAMPLE

1. Saturation pressure (bubble point pressure) 3 158 kPa (gauge) @ 45.0 °C
2. Thermal expansion of saturated oil @ 34 474 kPa (gauge) =  $\frac{V@ 45.0 \text{ °C}}{V@ 22.2 \text{ °C}}$  = 1.02196
3. Density at saturation pressure: 780.40 kg/m<sup>3</sup> @ 45.0 °C
4. Compressibility of saturated oil @ reservoir temperature: Vol/Vol/MPa:
 

From	3 158	kPa to	6 895	kPa =	$11.29 \times 10^{-4}$
From	6 895	kPa to	10 342	kPa =	$10.82 \times 10^{-4}$
From	10 342	kPa to	13 790	kPa =	$9.97 \times 10^{-4}$
From	13 790	kPa to	20 684	kPa =	$9.45 \times 10^{-4}$
From	20 684	kPa to	27 579	kPa =	$8.91 \times 10^{-4}$
From	27 579	kPa to	34 474	kPa =	$8.37 \times 10^{-4}$

PRESSURE-VOLUME RELATIONS AT 45.0 °C

<u>Gauge Pressure, kPa</u>	<u>Relative Volume, V/Vsat (1)</u>	<u>Y Function (2)</u>
34 474	0.9707	
31 026	0.9734	
27 579	0.9763	
24 132	0.9792	
20 684	0.9823	
17 237	0.9854	
13 790	0.9887	
10 342	0.9921	
6 895	0.9958	
5 516	0.9974	
4 826	0.9982	
4 137	0.9989	
3 447	0.9997	
<u>3 158</u>	<u>1.0000</u>	
3 068	1.0121	2.356
2 965	1.0273	2.308
2 703	1.0742	2.188
2 448	1.1343	2.073
2 206	1.2103	1.962
1 931	1.3287	1.837
1 689	1.4759	1.724
1 448	1.6838	1.614
1 241	1.9389	1.521

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

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

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*Petroleum Reservoir Engineering*  
 CALGARY, ALBERTA

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 Well Omega Maskada  
8-24-1-26 (W1M)

**DIFFERENTIAL VAPORIZATION AT 45.0 °C**

Gauge Pressure, kPa	Oil Density, kg/m <sup>3</sup>	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)
3 158	780.4	1.150	1.150	45.40					
2 772	781.6	1.145	1.226	43.22	0.877	0.877	0.946	0.03691	27.09
2 075	784.1	1.136	1.450	38.95	0.858	0.864	0.946	0.04873	20.52
1 407	787.4	1.124	1.932	33.97	0.878	0.870	0.951	0.07068	14.15
862	791.5	1.110	3.012	28.46	0.962	0.900	0.965	0.11229	8.91
0	817.4	1.025	51.252	0.00	1.175	1.073	1.000	1.10632	0.90

Gravity of Residual Oil = 37.3° API at 15.56°C

Density of Residual Oil = 837.4 kg/m<sup>3</sup> 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

<u>kPa Pressure, (gauge)</u>	<u>Oil Viscosity mPa•s</u>	<u>Gas Viscosity mPa•s</u>	<u>Oil/Gas Viscosity Ratio</u>
34 474	1.752		
31 026	1.685		
27 579	1.619		
24 132	1.554		
20 684	1.487		
17 237	1.422		
13 790	1.356		
10 342	1.290		
6 895	1.224		
<u>3 158</u>	<u>1.154</u>		
2 772	1.260	0.0113	111.50
2 075	1.532	0.0111	138.02
1 407	1.791	0.0109	164.81
862	2.070	0.0105	197.14
0	2.581	0.0095	271.68



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 Petroleum Reservoir Engineering  
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SS481

HYDROCARBON LIQUID ANALYSIS

7013-82-34

CONTAINER IDENTITY

LABORATORY NUMBER

Omega Hydrocarbons Ltd.

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OPERATOR

PAGE

LSD 8-24-1-26 W1M

Omega Waskada 8-24-1-26

KB ELEV., m GRD. ELEV., m

LOCATION

WELL OR SAMPLE LOCATION NAME

Waskada, Manitoba

Lower Alida

Core Laboratories

FIELD OR AREA

POOL OR ZONE

SAMPLER

TEST TYPE & NO.

TEST RECOVERY

Bottom Hole

@

°C

POINT OF SAMPLE

AMT. & TYPE CUSHION

MUD RESISTIVITY

PUMPING

FLOWING

GAS LIFT

SWAB

WATER

m<sup>3</sup>/d

OIL

m<sup>3</sup>/d

GAS

m<sup>3</sup>/d

TEST INTERVALS OR PERFS., m

Approx. 20 000

@ °C

@ °C

45.0

SEPARATOR RESERVOIR

CONTAINER WHEN SAMPLED

CONTAINER WHEN RECEIVED

SEPARATOR

PRESSURES, kPa (gauge)

TEMPERATURES, °C

1982-02-03

1982-03-31

DA

DATE SAMPLED (Y/M/D)

DATE RECEIVED (Y/M/D)

DATE ANALYSED (Y/M/D)

ANALYST

REMARKS

COMPONENT	MOLE FRACTION	MASS FRACTION	LIQUID VOL FRACTION
N <sub>2</sub>	.0056	.0011	.0011
CO <sub>2</sub>	.0034	.0010	.0010
H <sub>2</sub> S	.0000	.0000	.0000
C <sub>1</sub>	.0814	.0092	.0240
C <sub>2</sub>	.0881	.0187	.0410
C <sub>3</sub>	.1072	.0333	.0514
C <sub>4</sub>	.0184	.0075	.0105
C <sub>4</sub>	.0600	.0246	.0329
C <sub>5</sub>	.0265	.0135	.0169
C <sub>5</sub>	.0278	.0141	.0176
C <sub>6</sub> <sup>+</sup>	.5816	.8770	.8036
TOTAL	1.0000	1.0000	1.0000

OBSERVED PROPERTIES OF C<sub>6</sub><sup>+</sup> RESIDUE (15/15° C)

855.0 kg/m<sup>3</sup>  
 DENSITY

.8558  
 RELATIVE DENSITY

33.9  
 API @ 15.5° C

214  
 RELATIVE MOLECULAR MASS

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

783.6 kg/m<sup>3</sup>  
 DENSITY

.7843  
 RELATIVE DENSITY

49.0  
 API @ 15.5° C

141.92  
 RELATIVE MOLECULAR MASS

REMARKS

COMPANY  
LOCATION  
SAMPLED FROM

Omega Hydrocarbons Ltd.  
LSD 8-24-1-26 W1M  
Bottom Hole

PAGE  
FILE

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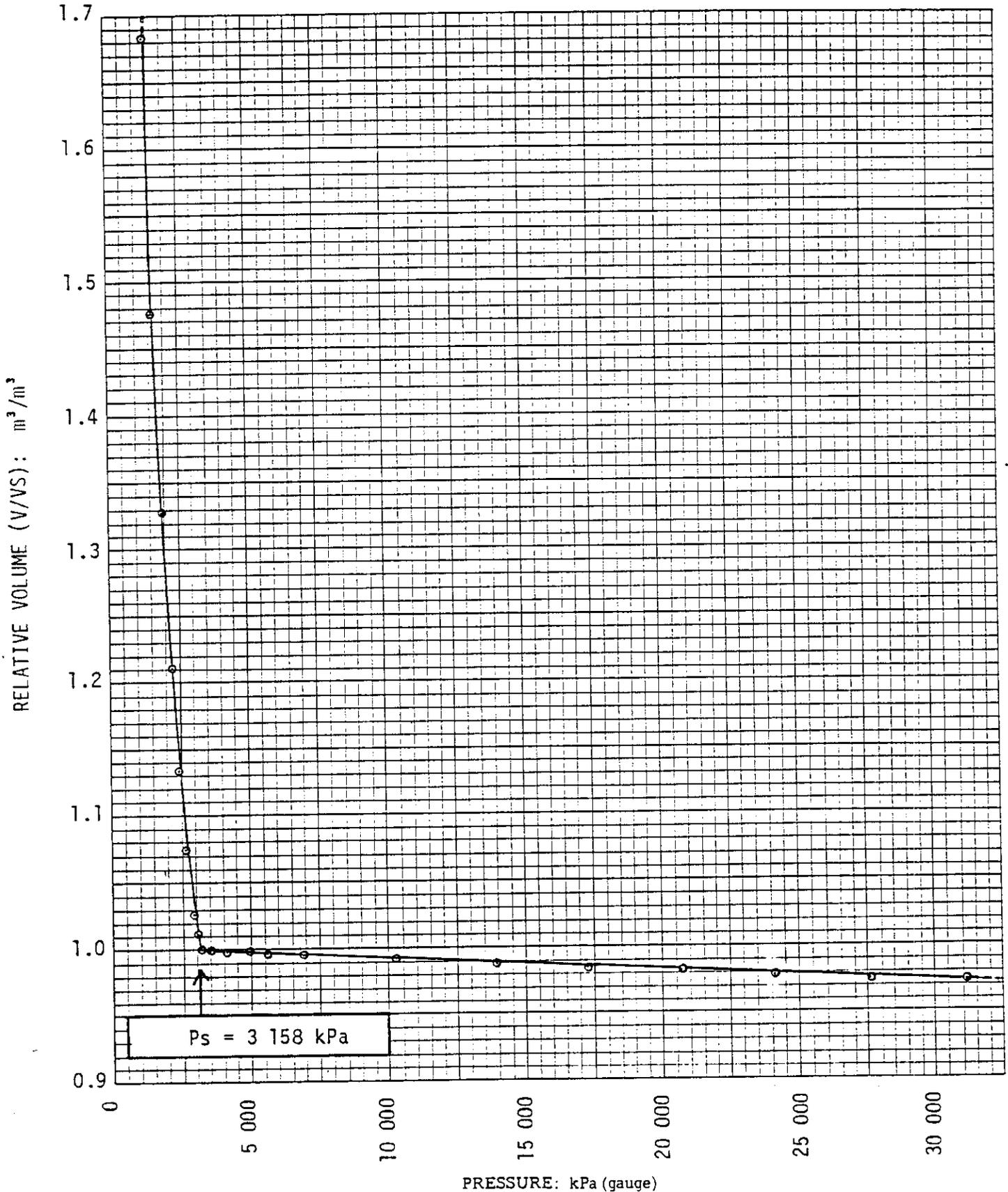
Analysis of C<sub>6</sub>+ Fraction to C<sub>30</sub>+

<u>Boiling Point Range (°C)</u>	<u>Component</u>	<u>Carbon Number</u>	<u>Mole Fraction</u>	<u>Mass Fraction</u>
36.1- 68.9	Hexanes	C6	.0325✓	.0210
68.9- 98.3	Heptanes	C7	.0468✓	.0352
98.3-125.6	Octanes	C8	.0489✓	.0419
125.6-150.6	Nonanes	C9	.0397✓	.0382
150.6-173.9	Decanes	C10	.0386	.0412
173.9-196.1	Undecanes	C11	.0359	.0421
196.1-215.0	Dodecanes	C12	.0282	.0360
215.0-235.0	Tridecanes	C13	.0274	.0378
235.0-252.2	Tetradecanes	C14	.0229	.0341
252.2-270.6	Pentadecanes	C15	.0197	.0314
270.6-287.8	Hexadecanes	C16	.0177	.0301
287.8-302.8	Heptadecanes	C17	.0161	.0290
302.8-317.2	Octadecanes	C18	.0137	.0261
317.2-330.0	Nonadecanes	C19	.0114	.0230
330.0-344.4	Eicosanes	C20	.0099	.0211
344.4-357.2	Heneicosanes	C21	.0091	.0201
357.2-369.4	Docosanes	C22	.0085	.0198
369.4-380.0	Tricosanes	C23	.0073	.0179
380.0-391.1	Tetracosanes	C24	.0068	.0173
391.1-401.7	Pentacosanes	C25	.0063	.0166
401.7-412.2	Hexacosanes	C26	.0053	.0145
412.2-422.2	Heptacosanes	C27	.0048	.0138
422.2-431.7	Octacosanes	C28	.0044	.0130
431.7-441.1	Nonacosanes	C29	.0040	.0123
441.1 Plus	Triacontanes Plus	C30+	.0422	.1904
<u>AROMATICIS</u>				
80.0	Benzene	C <sub>6</sub> H <sub>6</sub>	.0019✓	.0011
110.6	Toluene	C <sub>7</sub> H <sub>8</sub>	.0101✓	.0070
136.1-138.9	Ethylbenzene, p + m-Xylene	C <sub>8</sub> H <sub>10</sub>	.0108✓	.0086
144.4	o-Xylene	C <sub>8</sub> H <sub>10</sub>	.0057✓	.0046
168.9	1,2,4 Trimethylbenzene	C <sub>9</sub> H <sub>12</sub>	.0061✓	.0055
<u>NAPHTHENES</u>				
68.9	Cyclopentane	C <sub>5</sub> H <sub>10</sub>	.0004✓	.0002
72.2	Methylcyclopentane	C <sub>6</sub> H <sub>12</sub>	.0100✓	.0063
81.1	Cyclohexane	C <sub>6</sub> H <sub>12</sub>	.0124✓	.0079
101.1	Methylcyclohexane	C <sub>7</sub> H <sub>14</sub>	.0161✓	.0119
	TOTAL		.5816	.8770
	Mole Fraction of C <sub>7</sub> +			.5244
	Mass Fraction of C <sub>7</sub> +			.8405
	Calculated Relative Molecular Mass of C <sub>7</sub> +			228.
	Calculated Relative Density of C <sub>7</sub> +			.8636
	Calculated Density of C <sub>7</sub> + (kg/m <sup>3</sup> )			862.8

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.

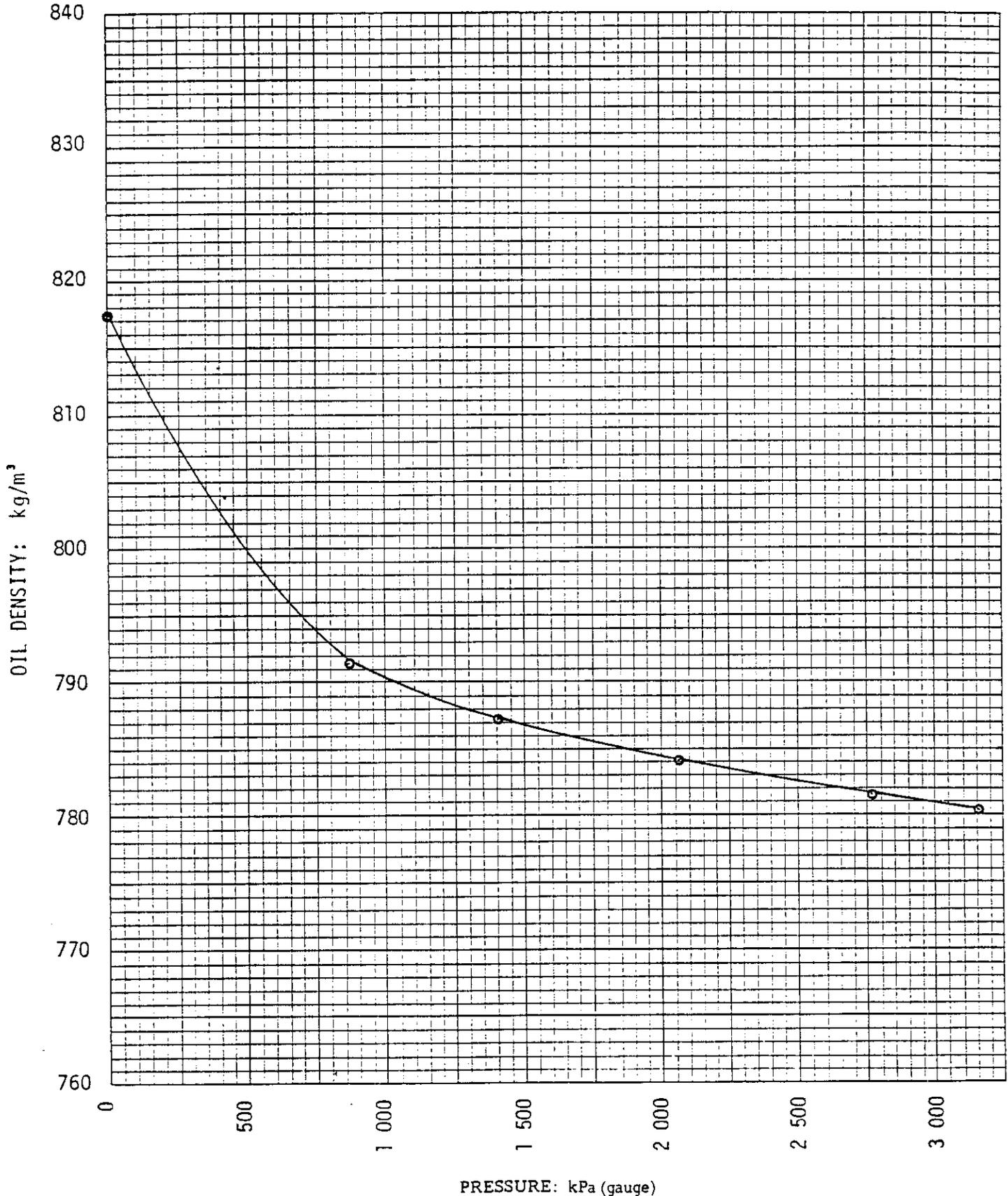
RELATIVE VOLUME (V/V<sub>S</sub>) AT 45.0°C

Company	Omega Hydrocarbons Ltd.	Formation	Lower Alida
Well	Omega Waskada 8-24-1-26 (WIM)	Province	Manitoba
Field	Waskada	Country	Canada



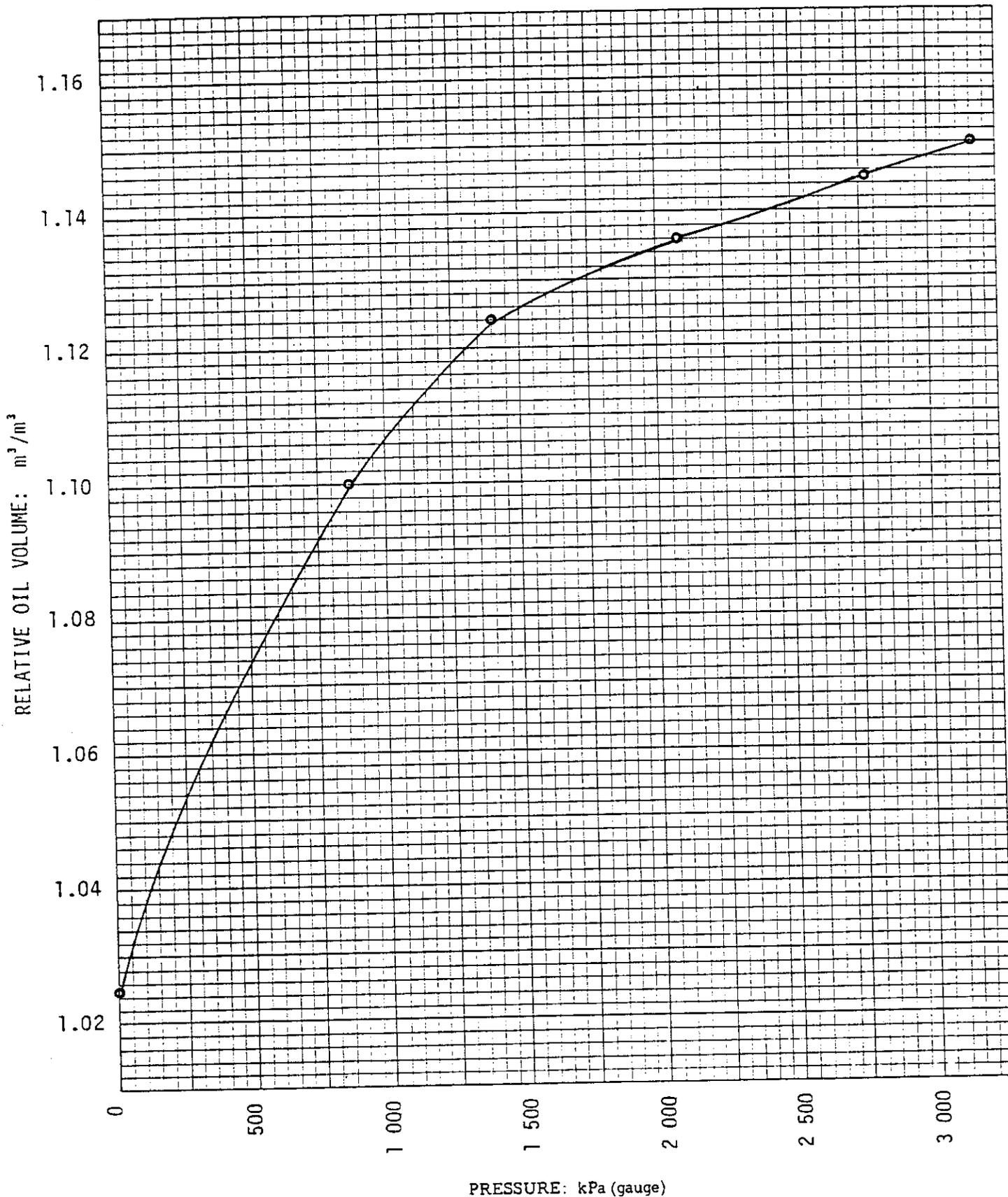
OIL DENSITY

Company	Omega Hydrocarbons Ltd.	Formation	Lower Alida
Well	Omega Waskada 8-24-1-26 (WIM)	Province	Manitoba
Field	Waskada	Country	Canada



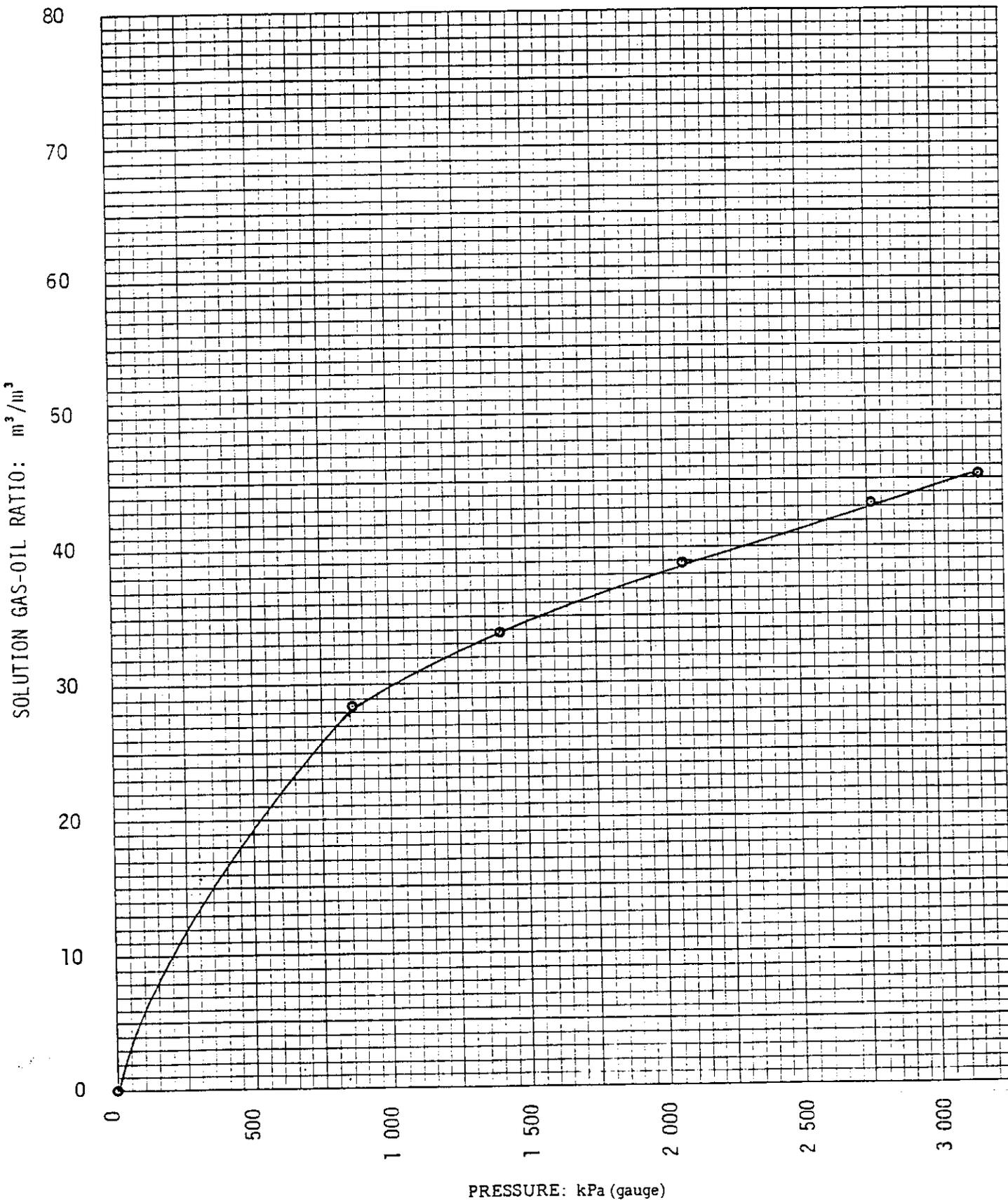
RELATIVE OIL VOLUME (V/VR)

Company	<u>Omega Hydrocarbons Ltd.</u>	Formation	<u>Lower Alida</u>
Well	<u>Omega Waskada 8-24-1-26 (W1M)</u>	Province	<u>Manitoba</u>
Field	<u>Waskada</u>	Country	<u>Canada</u>



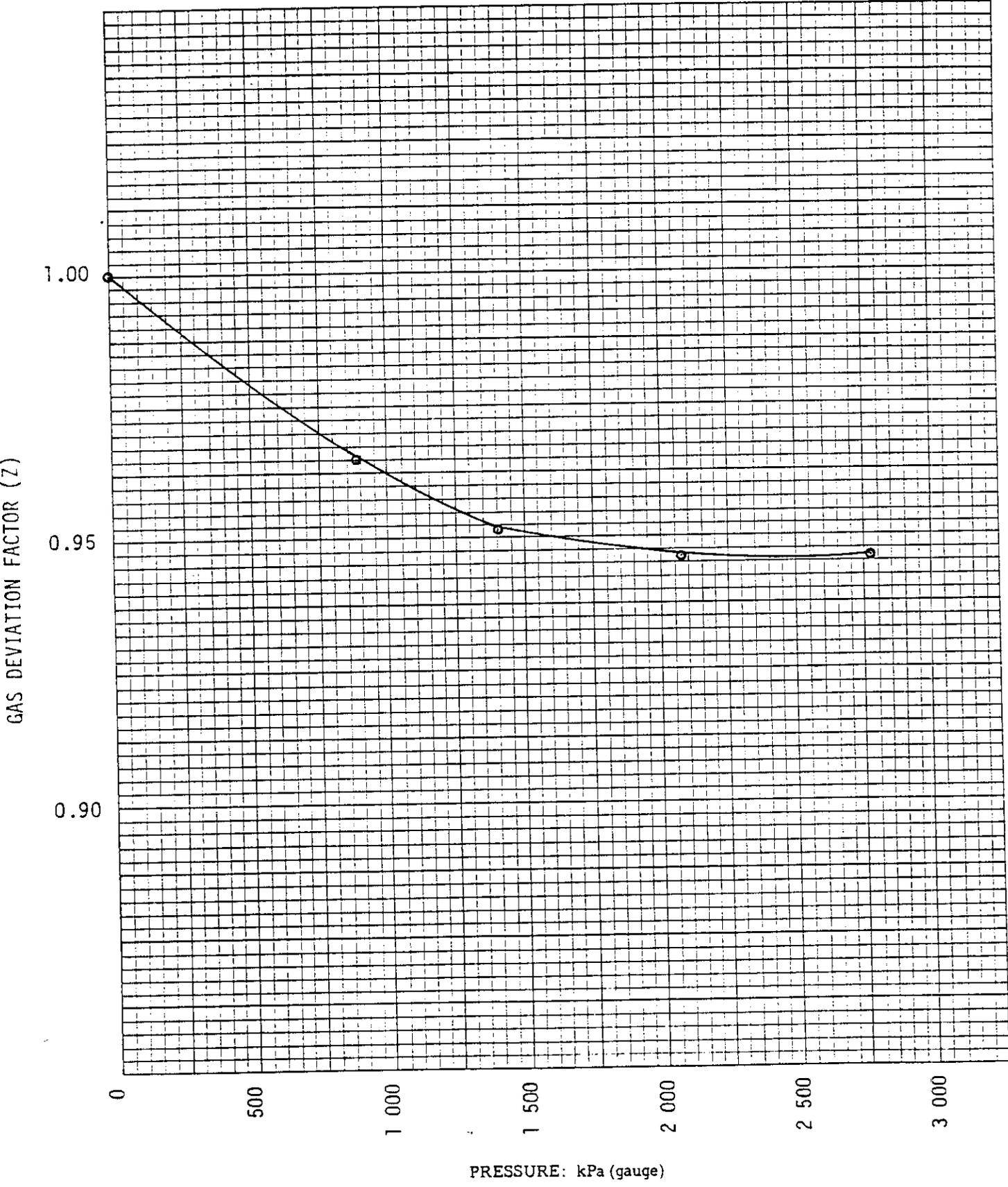
SOLUTION GAS-OIL RATIO

Company	Omega Hydrocarbons Ltd.	Formation	Lower Alida
Well	Omega Waskada 8-24-1-26 (W1M)	Province	Manitoba
Field	Waskada	Country	Canada



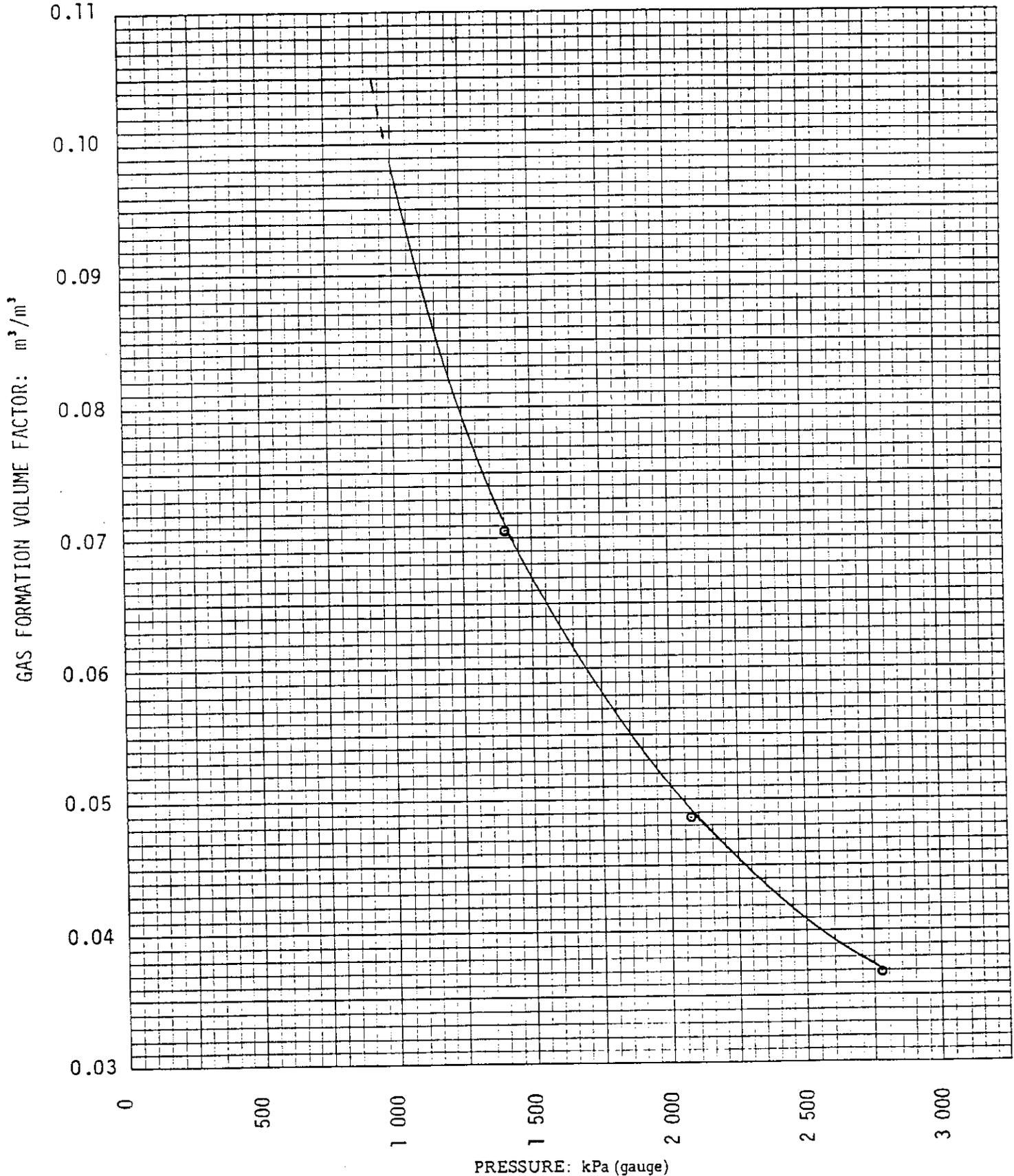
GAS DEVIATION FACTOR (Z)

Company	<u>Omega Hydrocarbons Ltd.</u>	Formation	<u>Lower Alida</u>
Well	<u>Omega Waskada 8-24-1-26 (W1M)</u>	Province	<u>Manitoba</u>
Field	<u>Waskada</u>	Country	<u>Canada</u>



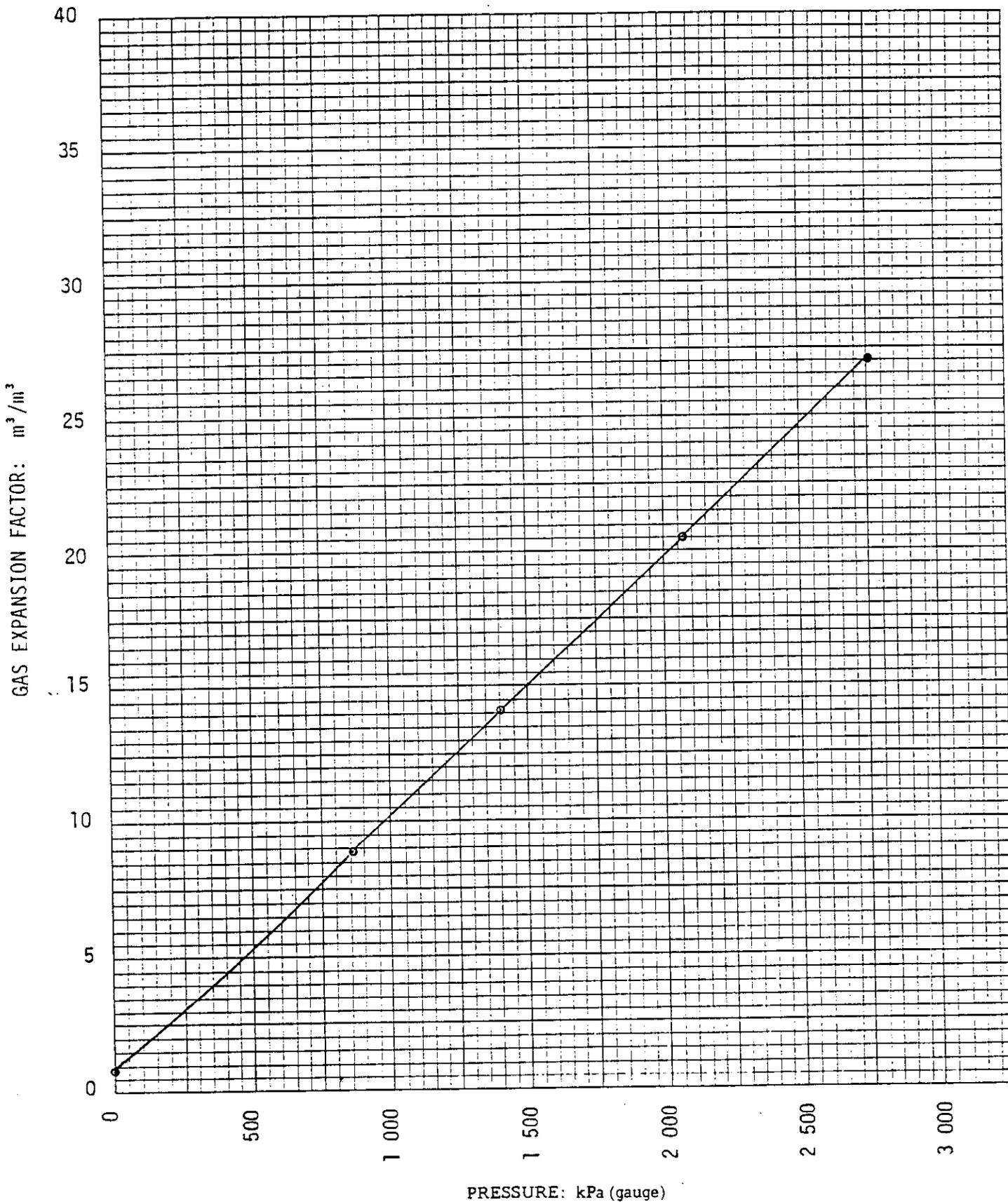
GAS FORMATION VOLUME FACTOR

Company	Omega Hydrocarbons Ltd.	Formation	Lower Alida
Well	Omega Waskada 8-24-1-26 (W1M)	Province	Manitoba
Field	Waskada	Country	Canada



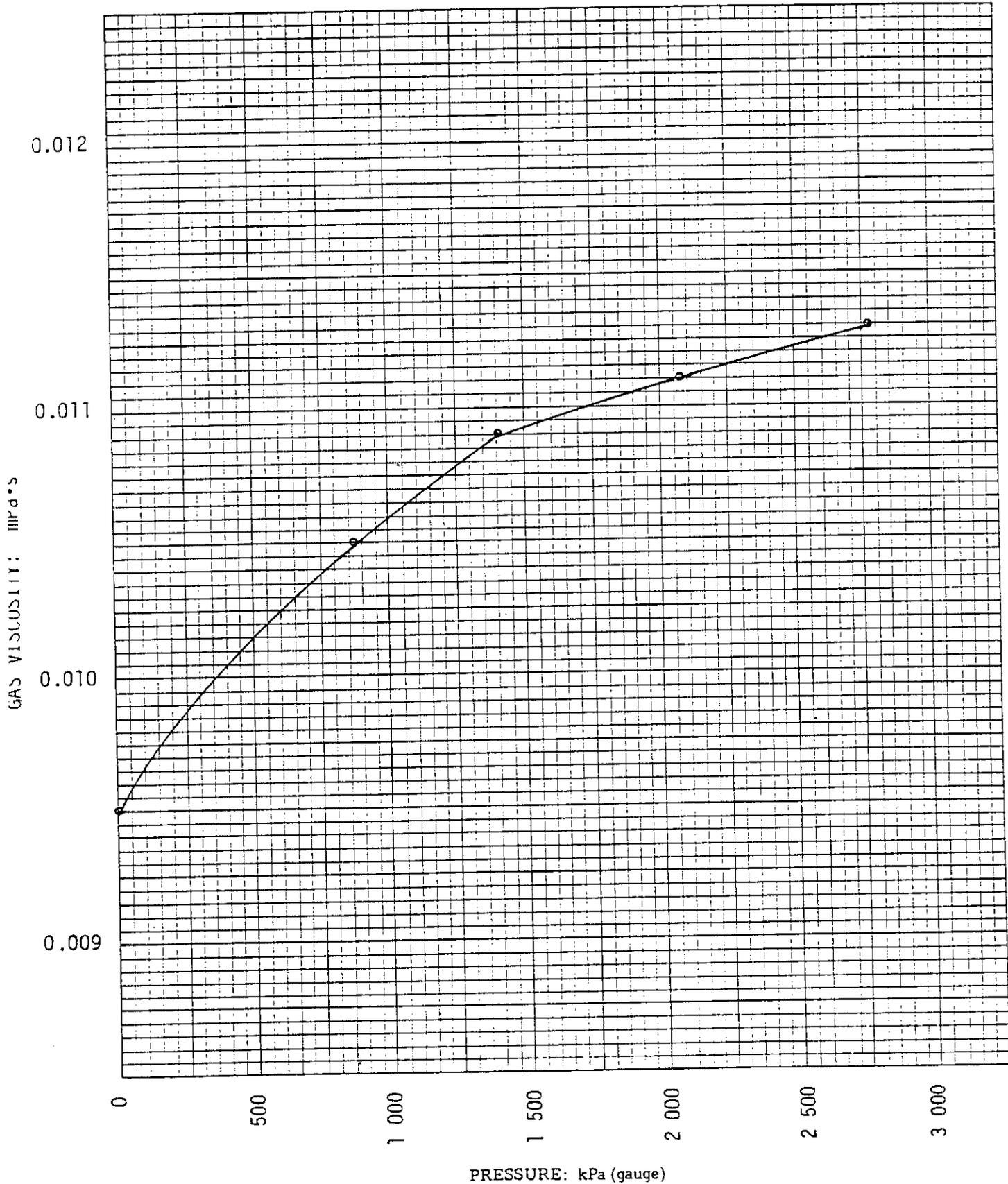
GAS EXPANSION FACTOR

Company	Omega Hydrocarbons Ltd.	Formation	Lower Alida
Well	Omega Waskada 8-24-1-26 (W1M)	Province	Manitoba
Field	Waskada	Country	Canada



GAS VISCOSITY

Company	<u>Omega Hydrocarbons Ltd.</u>	Formation	<u>Lower Alida</u>
Well	<u>Omega Waskada 8-24-1-26 (W1M)</u>	Province	<u>Manitoba</u>
Field	<u>Waskada</u>	Country	<u>Canada</u>



OIL VISCOSITY AT 45.0°C

Company	Omega Hydrocarbons Ltd.	Formation	Lower Alida
Well	Omega Waskada 8-24-1-26 (W1M)	Province	Manitoba
Field	Waskada	Country	Canada

