A/S NORSKE SHELL

RESISTIVITY INDEX - CAPILLARY PRESSURE

CATION EXCHANGE CAPACITY

CORRECTED GAS PERMEABILITIES

WELL: 31/2-7

DATE: JANUARY 1983

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C O M M E N T S

GENERAL: Saturation exponent was to be measured on 7 samples from well 31/2-7 if possible. 6 of the samples were very friable and collapsed during the cleaning prossess. The plug from depth 1555.4 m, however, was measured.

PREPARATION: All samples were drilled and cut in frozen condition. Plug from 1555.4 was successfully cleaned with methanol, then with toluene and finally with methanol.

Prior to the analysis, the plug was dried at 60°C and 40% rel. humidity.

MEASUREMENTS: POROSITY was measured with helium.

AIR PERMEABILITY was measured at three different pressures using nitrogen. These values were the basis for calculating the permeability, corrected for the Klinkenberg effect.

CAPILLARY PRESSURE - RESISTIVITY INDEX

The plug was saturated with simulated formation water and subsequently placed in a porous plate cell and desaturated by water saturated air at 8 different pressure levels up to 12 bar. Stability time at each pressure level varied from 4 to 5 days. The different water saturations were determined by the weight of the sample.

At the same time the resistivity index was measured using a frequency of 1 kHz. The resistivity index (RI) equation, $RI = b\ Sw^{-n}$ has been evaluated by least squares method forced through RI = 1.0, Sw = 1.0. The forced fit curve is presented graphically.

Resistivity index could not be measured at 12 bar as the plug split.

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PLUG NO. 2 - DEPTH: 1555.40 m

PLUG SIZE

Length: 6.38 cm Diameter: 3.73 cm Bulk volume: 71.06 cm^3

POROSITY & GRAIN DENSITY

Porosity: 29.7 % Grain density: 2.67 g/cm^3

AIR PERMEABILITY

(Mean pressure)$^{-1}$ (atm.abs)$^{-1}$	Air permeability (mD)	Klinkenberg corrected permeability (mD)
0.876	175	153
0.651	170	
0.493	165	

Klinkenberg corrected Air Permeability

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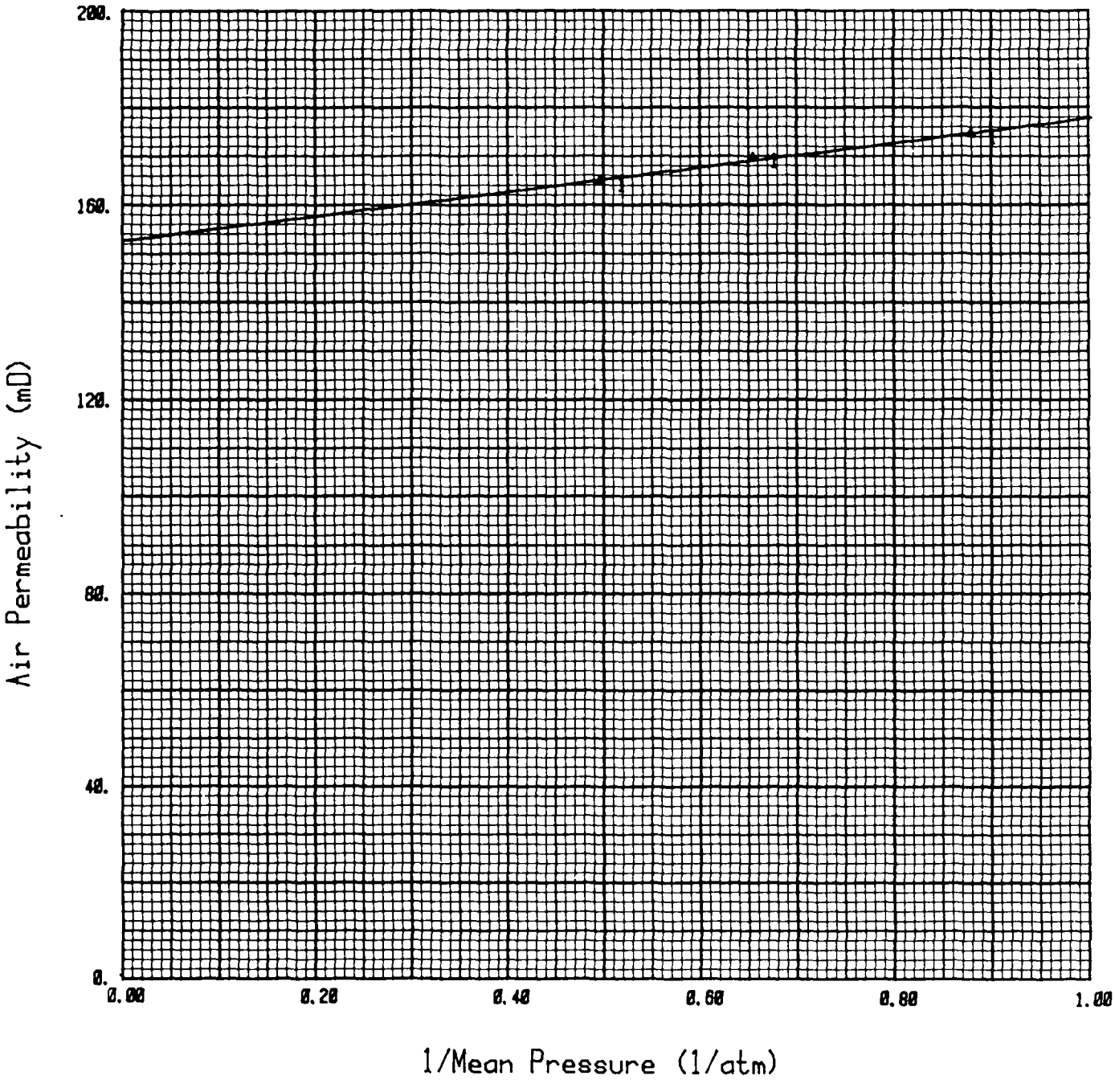
Curve "1" : Klinkenberg perm.: 153 mD
depth : 1555.40 m.



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CAPILLARY PRESSURE - RESISTIVITY INDEX

Restored state method - porous plate

Sample no.: 2 Depth: 1555.4 m

Permeability: 153 mD Porosity: 29.7 % Grain density: 2.67 g/cm^3

FF = 7.18 (room conditions)

Capillary pressure (bar)	Water saturation Sw (frac.)	Resistivity index RI
0	1.000	1.00
0.1	0.972	1.25
0.2	0.771	2.23
0.4	0.567	3.78
0.7	0.468	6.91
1.2	0.435	7.48
2.0	0.412	8.45
3.0	0.402	9.01
12.0	0.390	nmp

$$RI = Sw^{-2.43}$$

CAPILLARY PRESSURE CURVE

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Company : A/S NORSKE SHELL

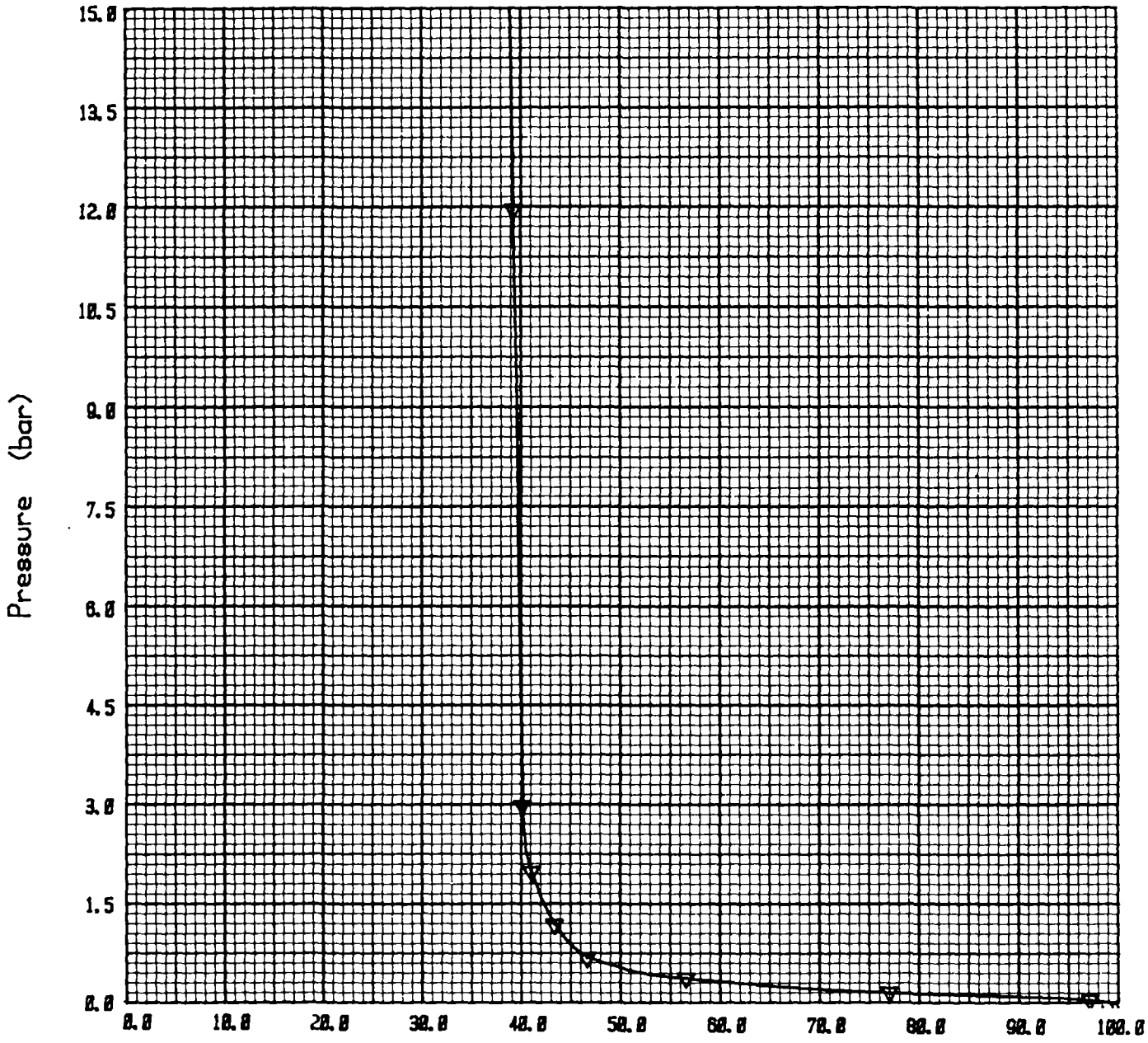
Well : 31/2-7

Depth : 1555.40 m

Air Perm.: 153 mD

Porosity : 29.7 %

Gr. Dens.: 2.67 g/cm^3



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Resitivity index versus water Saturation

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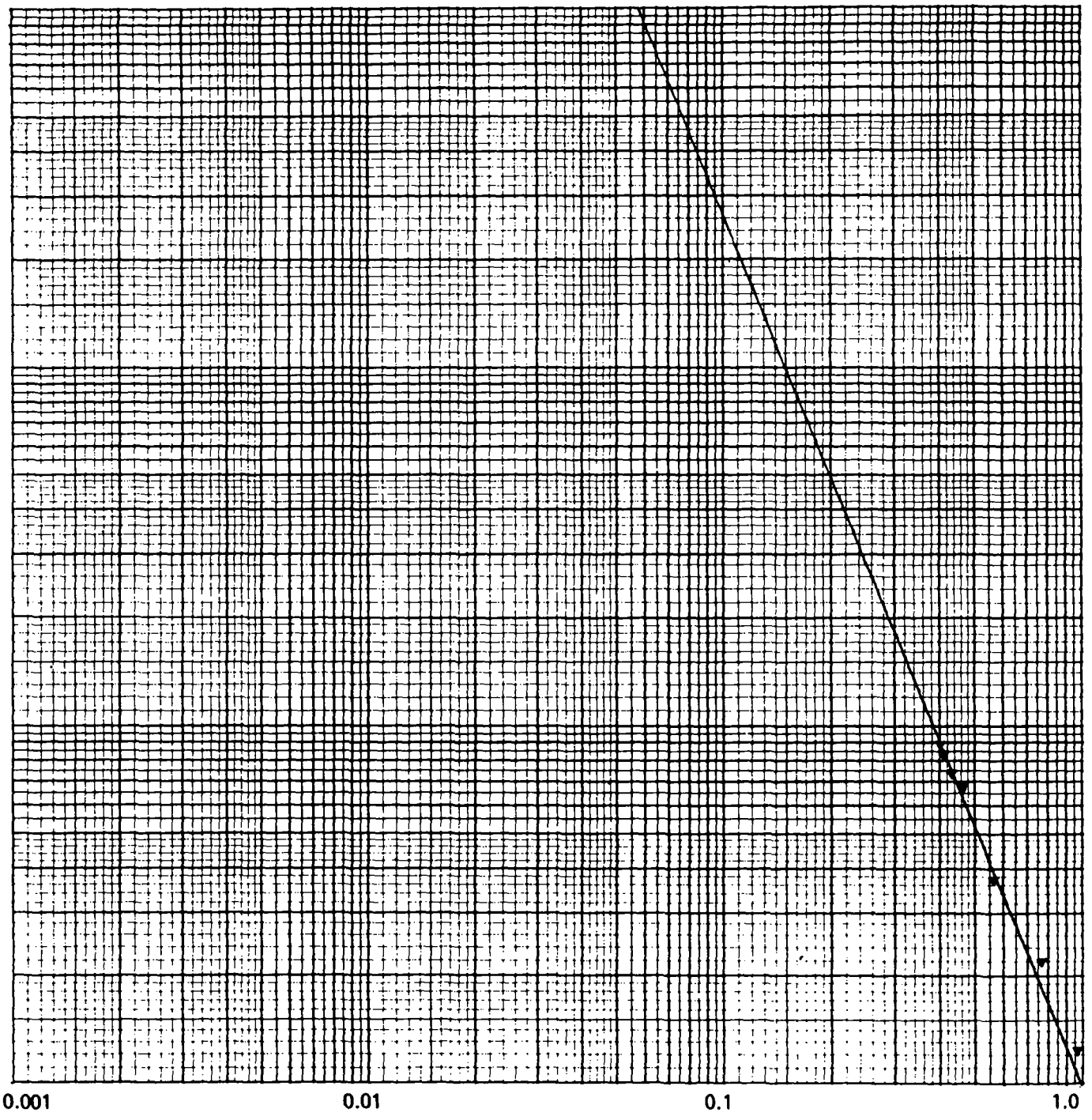
Company ..A/S .NORSKE .SHELL.....

Well ..31/2-7..... Kair ....153.....

Sample No..... Ø...29.7.....

Depth....1555.4.m..... Gr. Dens..... $RI = 1.00 * S_w^{-2.43}$



Resistivity index (RI)

Water Saturation, Fraction of Pore Space.
"S_w"

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DETERMINATION OF CATION EXCHANGE CAPACITY

Cation Exchange Capacity

The cation exchange capacity was measured by the wet chemistry method. The matrix was carefully broken down in an ultra sonic bath using methanol and toluene as solvents.

The cation exchange capacity was determined as the capacity of spending cobalt in a hexammin cobalt (III) chlorid solution.

The cation exchange capacity is reported with porosity and air permeability from the adjoining plug depth.

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CATION EXCHANGE CAPACITY

Depth (m)	K.e.l. (mD)	Ø (%)	meq/100 gr
1547.50	182	28.5	1.85
1551.50	2294	29.5	1.51
1554.40	254	27.2	2.37
1564.50	6669	34.1	2.16
1571.60	7149	32.5	0.88
1574.30	6179	32.2	0.81
1591.45	173	24.9	3.22
1595.40	1567	32.4	0.89
1597.60	139	28.9	2.93
1601.50	49.7	28.2	4.27
1607.30	8.73	21.7	3.81

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KLINKENBERG CORRECTED AIR PERMEABILITY

(Supplement to SCAL report submitted Nov. 1982)

DEPTH (m)	1/Mean Pressure $(atm.abs.)^{-1}$	Air Permeability Ka (mD)	Klinkenberg corr. perm. K (mD)
1547.50	0.789	211	183
	0.602	205	
	0.464	199	
1551.50	0.894	2465	2297
	0.661	2429	
	0.498	2389	
1554.40	0.827	279	256
	0.624	274	
	0.477	269	
1564.50	0.906	8725	6675
	0.667	8263	
	0.502	7789	
1571.60	0.909	8266	7165
	0.669	8076	
	0.503	7745	
1574.30	0.908	6834	6201
	0.669	6700	
	0.503	6542	
1591.45	0.868	184	175
	0.647	182	
	0.490	180	
1595.40	0.908	1701	1568
	0.668	1677	
	0.503	1638	
1597.60	0.862	145	141
	0.643	143	
	0.488	143	
1601.50	0.788	54.9	50.0
	0.601	53.7	
	0.464	52.9	
1607.30	0.626	10.25	8.73
	0.502	9.84	
	0.402	9.73	

Klinkenberg corrected Air Permeability

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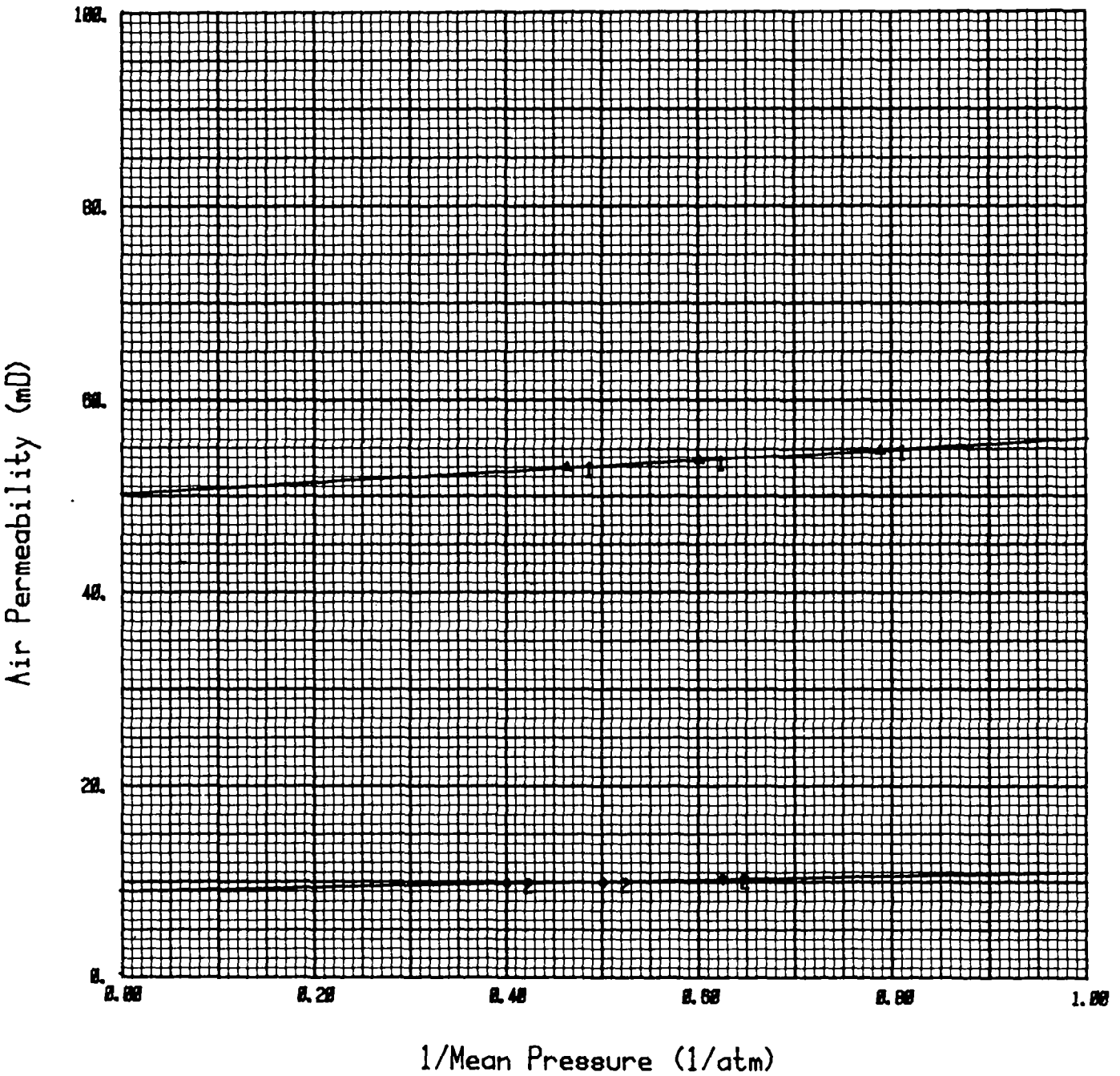
Curve "1" : Klinkenberg perm.: 50.0 mD
depth : 1601.50 m,

Curve "2" : Klinkenberg perm.: 8.73 mD
depth : 1607.30 m,



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Klinkenberg corrected Air Permeability

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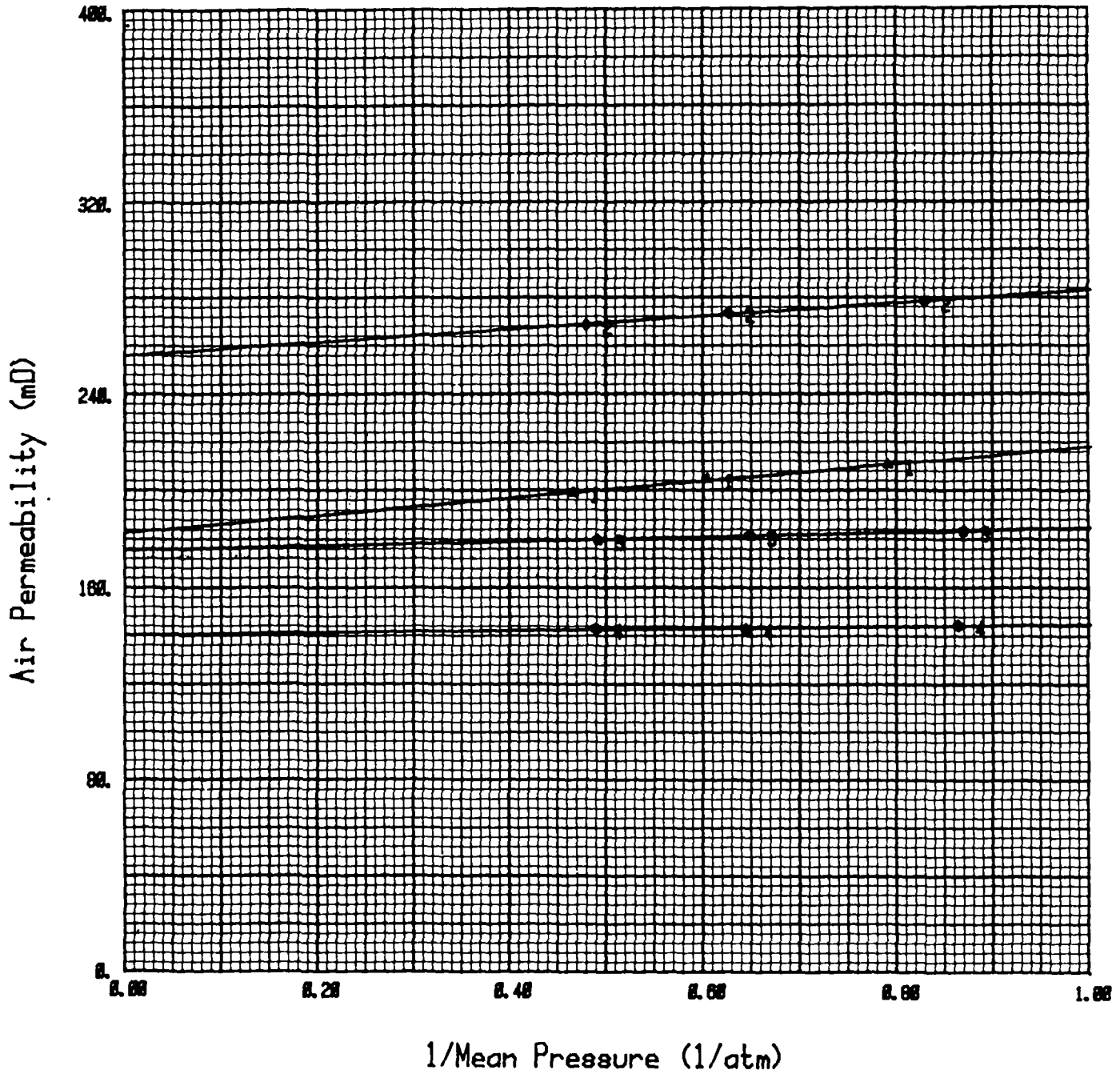
Curve "1" : Klinkenberg perm.: 183 mD
depth : 1547.50 m,

Curve "2" : Klinkenberg perm.: 256 mD
depth : 1554.40 m,

Curve "3" : Klinkenberg perm.: 175 mD
depth : 1591.45 m,

Curve "4" : Klinkenberg perm.: 141 mD
depth : 1597.60 m,



Klinkenberg corrected Air Permeability

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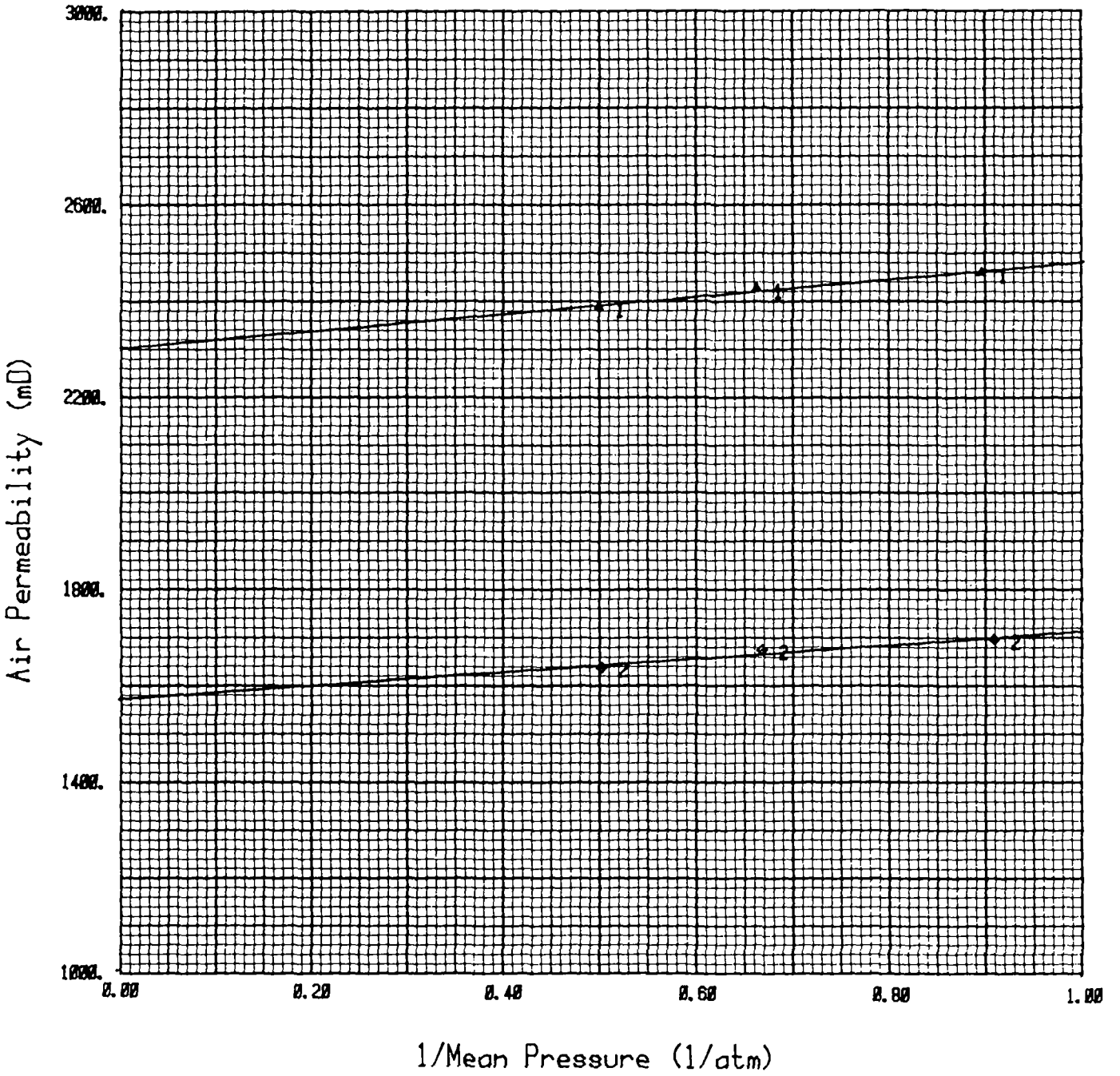
Curve "1" : Klinkenberg perm.: 2297 mD
depth : 1551.50 m,

Curve "2" : Klinkenberg perm.: 1568 mD
depth : 1595.40 m,



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Klinkenberg corrected Air Permeability

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Curve "1" : Klinkenberg perm.: 6675 mD
depth : 1564.50 m,

Curve "2" : Klinkenberg perm.: 7165 mD
depth : 1571.60 m,

Curve "3" : Klinkenberg perm.: 6201 mD
depth : 1574.30 m,