GECO

15/9-11 Kjernerapport

STATOIL

EVALUATION OF CORE DATA

WELL: 15/9-11

DATE: DECEMBER 1981

statoil

LAB
6/5-82
JKR/AMD

Comment on GECO's report for Statoil:
"Evaluation of core data, 15/9-11, December 1981"

Geco reports the effect of overburden pressures on the water permeability, the porosity and the formation factor for 7 plug-samples. The overburden pressures to be used were: 50, 100, 150 og 200 bars. By this we ment that the pressure difference i hydrostatic pressure in a tri-axial cell and pore pressure (1 atm) should be the pressures quoted above. Geco, however, corrected these pressures by a factor of .62, without mentioning this in the report. Therefore the hydrostatic pressures used by GECO in their core-holder were: 31, 62, 93 and 124 bars.

The results are reported as functions of "net overburden pressure", which are hydrostatic pressures used and divided by the factor .62.

Jon K. Ringen

Jon K. Ringen, LAB

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Comments.

The samples were extracted using methanol as solvent followed by toluene and finally methanol. The samples were dried at 60°C and 40 % relative humidity.

Helium Porosity and Klinkenberg corrected air permeability were measured.

The samples were saturated with evacuated, simulated formationwater containing the following ions, Na 41270 ppm, K 1470 ppm, Mg 1380 ppm, Ca 4750 ppm, Ba 257 ppm, and Sr 302 ppm.

Density of formationwater at 20°C: 1.088 g/cm^3.

Formation resistivity factor, porosity and brine permeability reduction were then measured.

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SAMPLE LIST

Sample No.	Core No.	Depth (m)
1	3	2 396.30
2	3	2 401.55
3	4	2 414.50
4	4	2 422.25
5	6	2 439.00
6	6	2 445.40
7	6	2 447.00

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Porosity and Grain Density

Sample No.	% Porosity	Grain Density
1	21.7	2.64
2	24.9	2.68
3	23.3	2.64
4	23.9	2.65
5	26.2	2.65
6	29.7	2.64
7	29.9	2.64

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PERMEABILITY VERSUS POROSITY

$$\log K = a + \varnothing b$$

Sample no	Permeability Klinkenberg, md	Porosity percent
1	114	21.7
2	509	24.9
3	500	23.3
4	231	23.9
5	279	26.2
6	601	29.7
7	263	29.9

Least squares method yielded

$$\log K = 1.58 + 0.0357\ \varnothing$$

(———————————)

To obtain a better correlation, sample 2,3, and 7 were excluded, yielding;

$$\log K = 0.247 + 0.0853\ \varnothing$$

(——— ——— ———)

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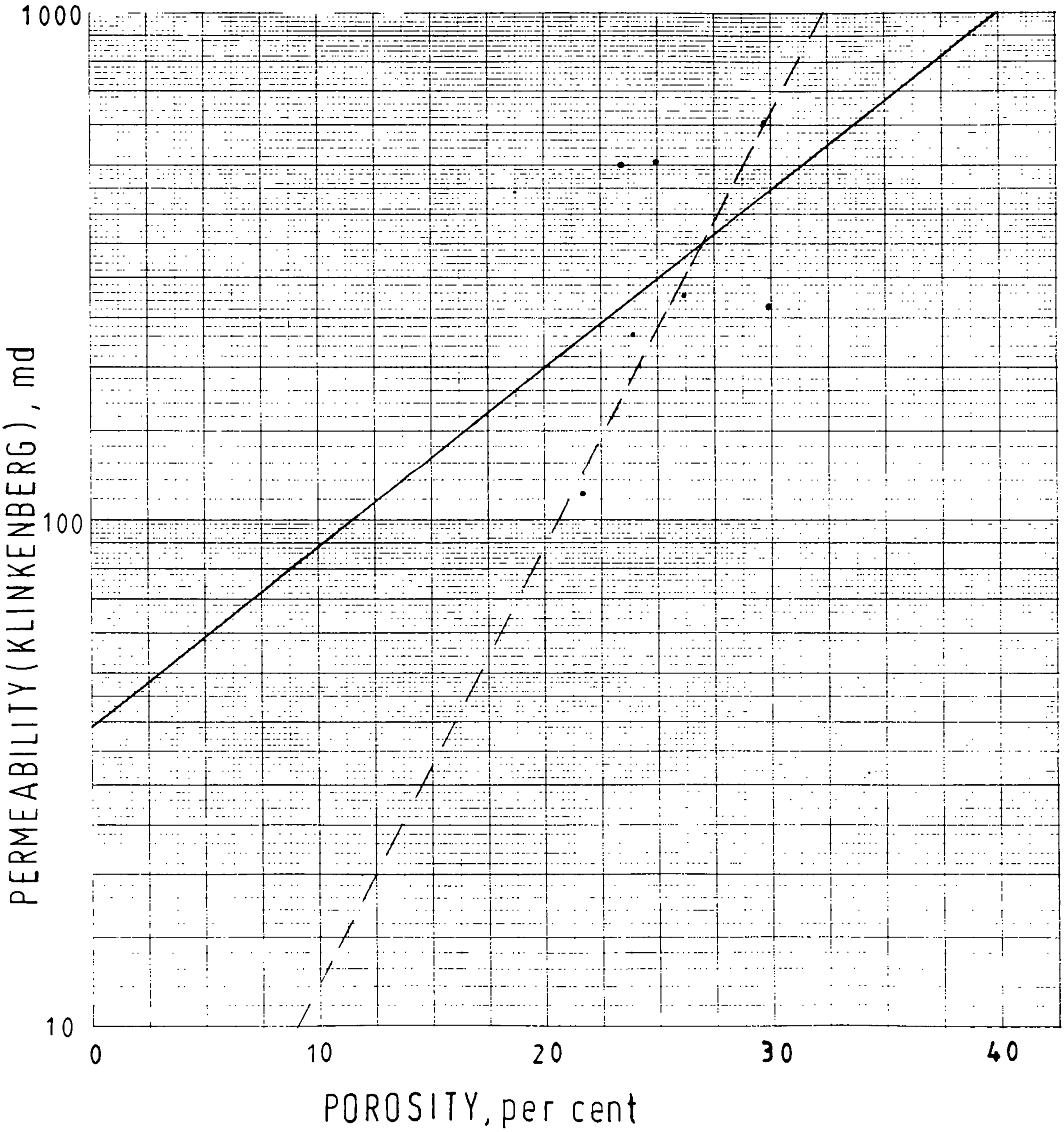
PERMEABILITY VERSUS POROSITY



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Klinkenberg corrected air permeability

Sample No.	$(\text{Mean Pressure})^{-1}$ $(\text{atm.abs.})^{-1}$	Air permeability md.	Klinkenberg corrected permeability md.
1	0.827	123	
	0.690	121	
	0.591	120	
	0.459	119	114
2	0.948	520	
	0.771	517	
	0.650	516	
	0.494	515	509
3	0.941	511	
	0.766	509	
	0.646	507	
	0.492	506	500
4	0.904	247	
	0.747	242	
	0.629	241	
	0.482	240	231

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Klinkenberg corrected air permeability

Sample No.	(Mean Pressure)$^{-1}$ (atm.abs.)$^{-1}$	Air Permeability md	Klinkenberg corrected permeability md
5	0.911	296	
	0.747	292	
	0.632	290	
	0.484	288	279
6	0.955	613	
	0.776	610	
	0.653	609	
	0.496	607	601
7	0.926	274	
	0.757	271	
	0.640	270	
	0.488	269	263

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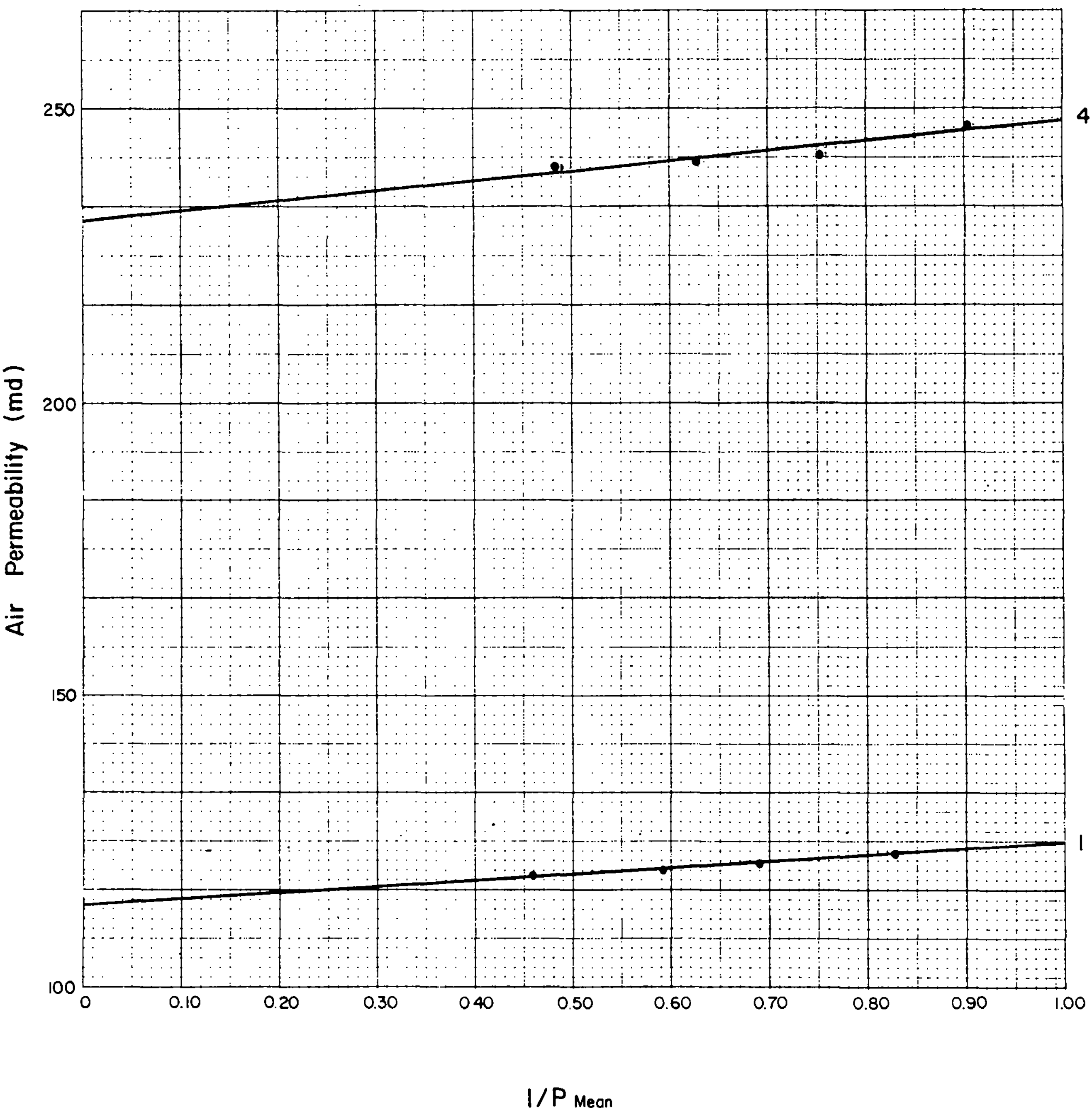
Klinkenberg corrected permeability



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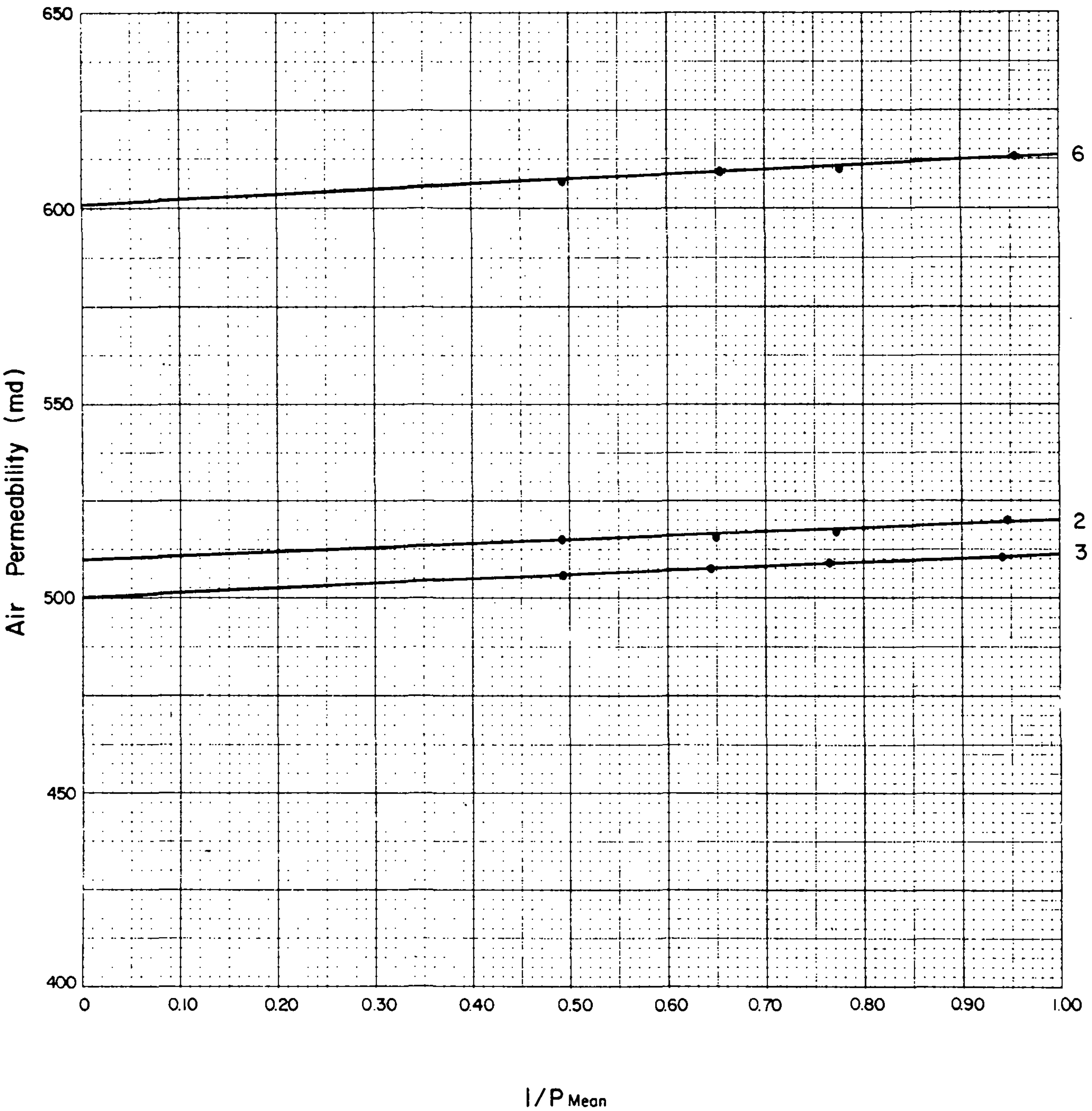
Klinkenberg corrected permeability



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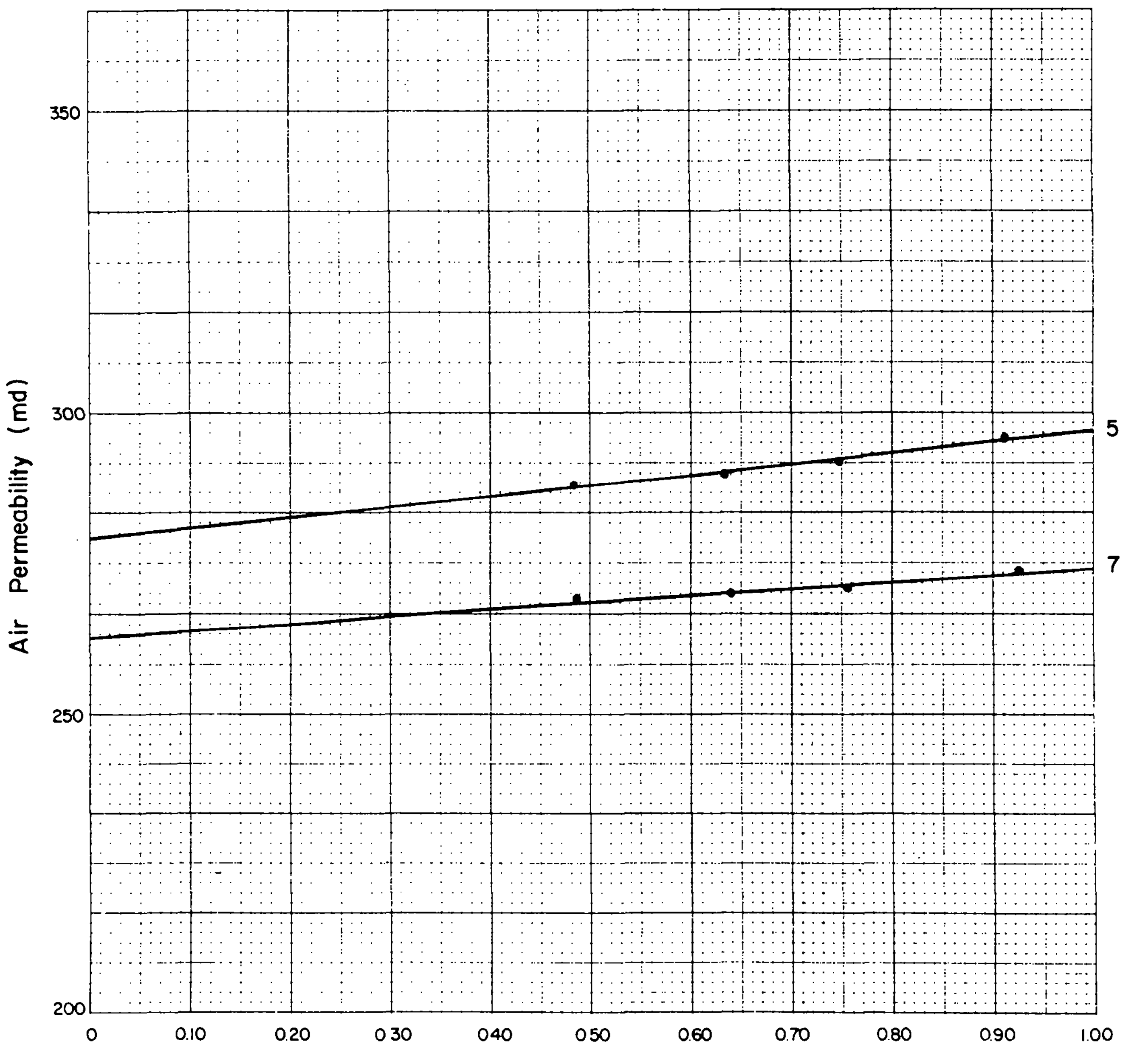
Klinkenberg corrected permeability



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Permeability Reduction with net overburden

Sample no.	Room KBrine original md	50 Bar KBrine md	50 Bar Fraction of original	100 Bar KBrine md	100 Bar Fraction of original	150 Bar KBrine md	150 Bar Fraction of original	200 Bar KBrine md	200 Bar Fraction of original
1	103	83	0.806	78	0.757	75	0.728	73	0.709
2	490	408	0.833	348	0.710	341	0.696	333	0.680
3	507	427	0.842	408	0.805	391	0.771	383	0.755
4	172	122	0.709	116	0.674	113	0.657	109	0.634
5	247	152	0.615	147	0.595	142	0.575	138	0.559
6	446	341	0.765	300	0.673	277	0.621	264	0.592
7	253	202	0.798	183	0.723	173	0.684	162	0.640

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Porosity Reduction with net overburden

Sample No.	Room Ø% original	50 Bar Ø%	50 Bar Fraction of original	100 Bar Ø%	100 Bar Fraction of original	150 Bar Ø%	150 Bar Fraction of original	200 Bar Ø%	200 Bar Fraction of original
1	21.7	20.8	0.959	20.5	0.945	20.4	0.940	20.3	0.935
2	24.9	24.1	0.968	23.8	0.956	23.6	0.948	23.5	0.944
3	23.3	22.6	0.970	22.3	0.957	22.1	0.948	22.0	0.944
4	23.9	23.2	0.971	23.0	0.962	22.8	0.954	22.7	0.950
5	26.2	25.4	0.969	25.1	0.958	24.9	0.950	24.8	0.947
6	29.7	28.9	0.973	28.6	0.963	28.5	0.960	28.4	0.956
7	29.9	28.8	0.963	28.5	0.953	28.2	0.943	28.0	0.936

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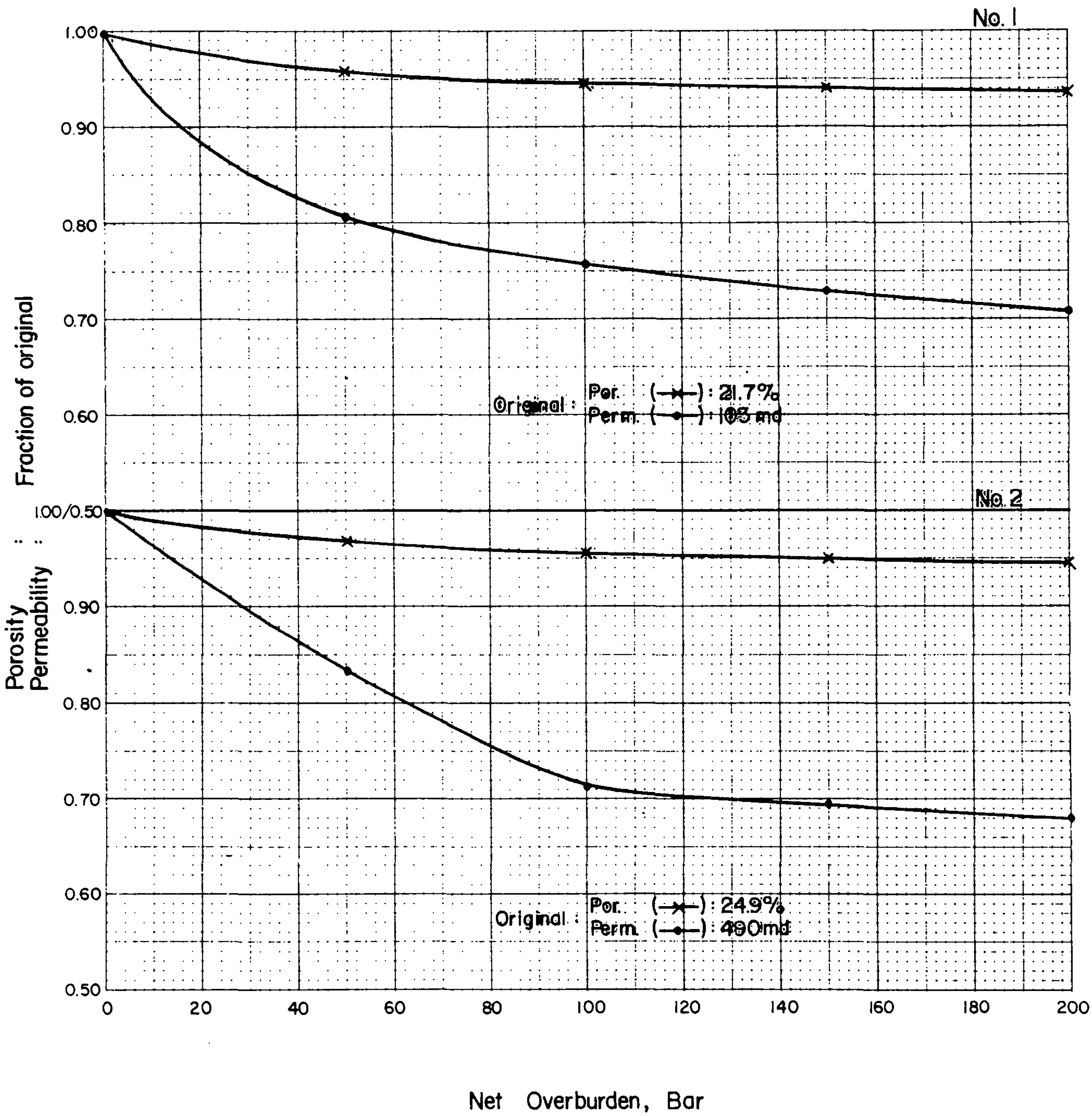
Permeability, Porosity Versus Net Overburden



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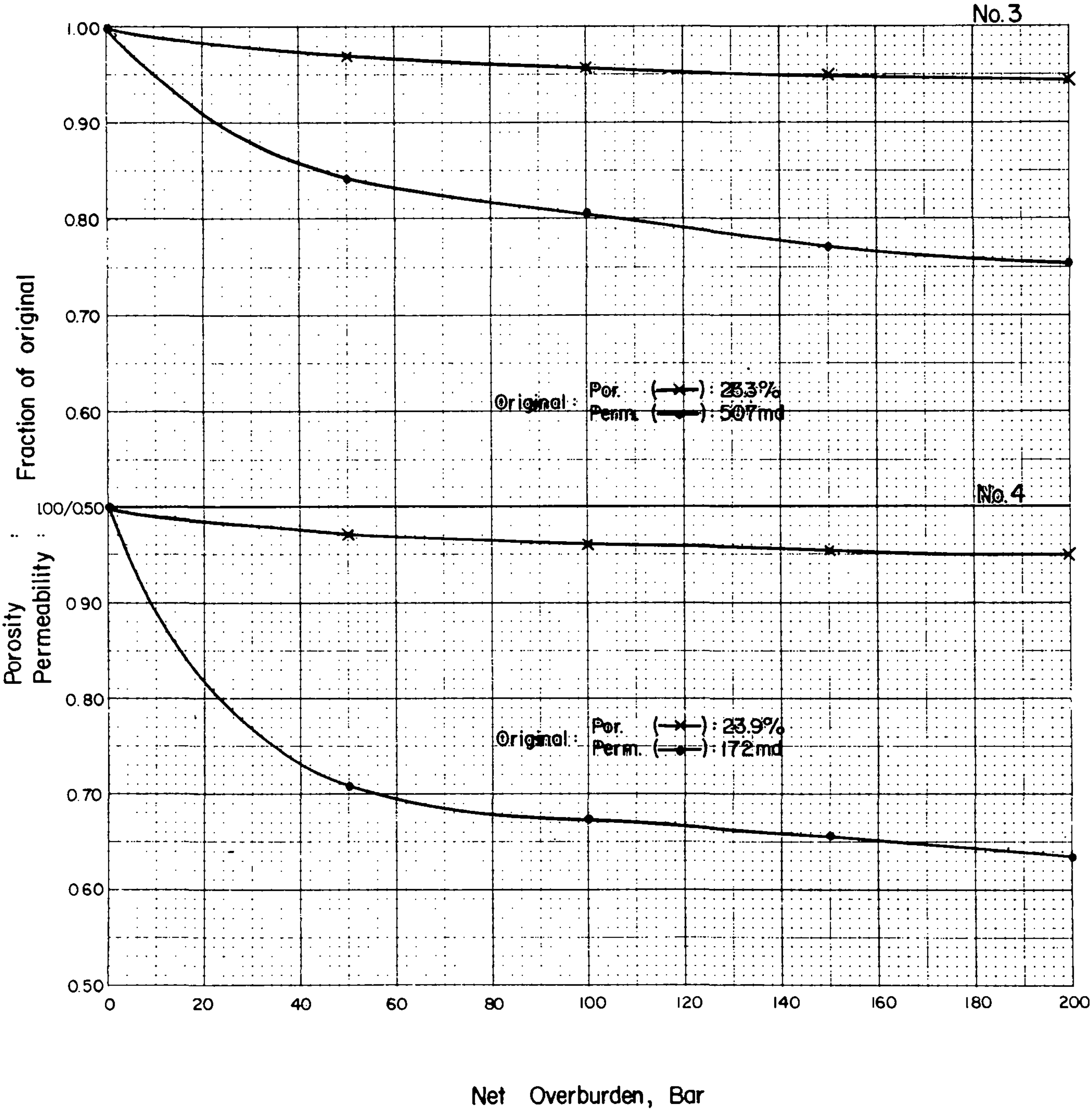
Permeability, Porosity Versus Net Overburden



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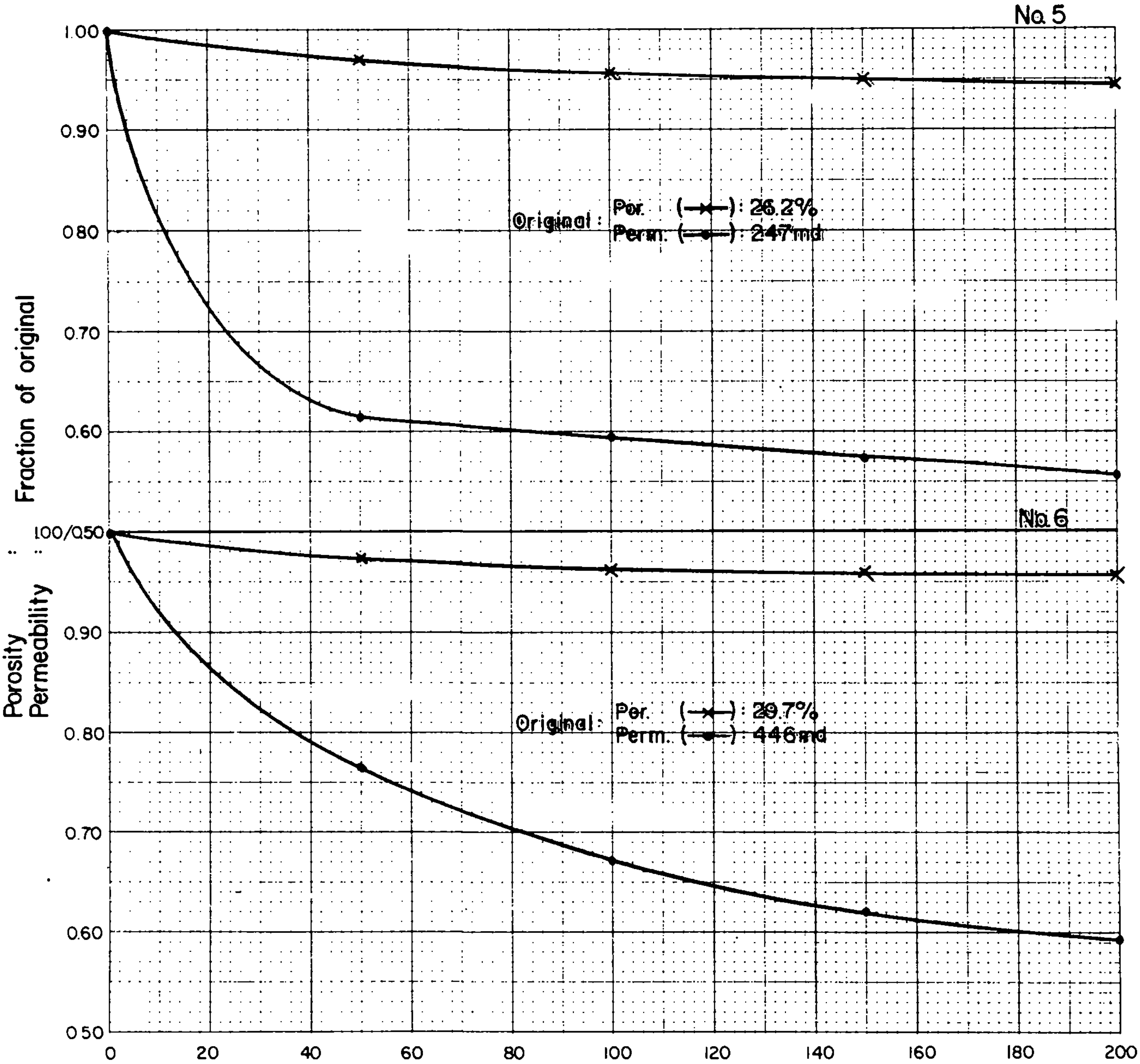
Permeability, Porosity Versus Net Overburden



Net Overburden, Bar

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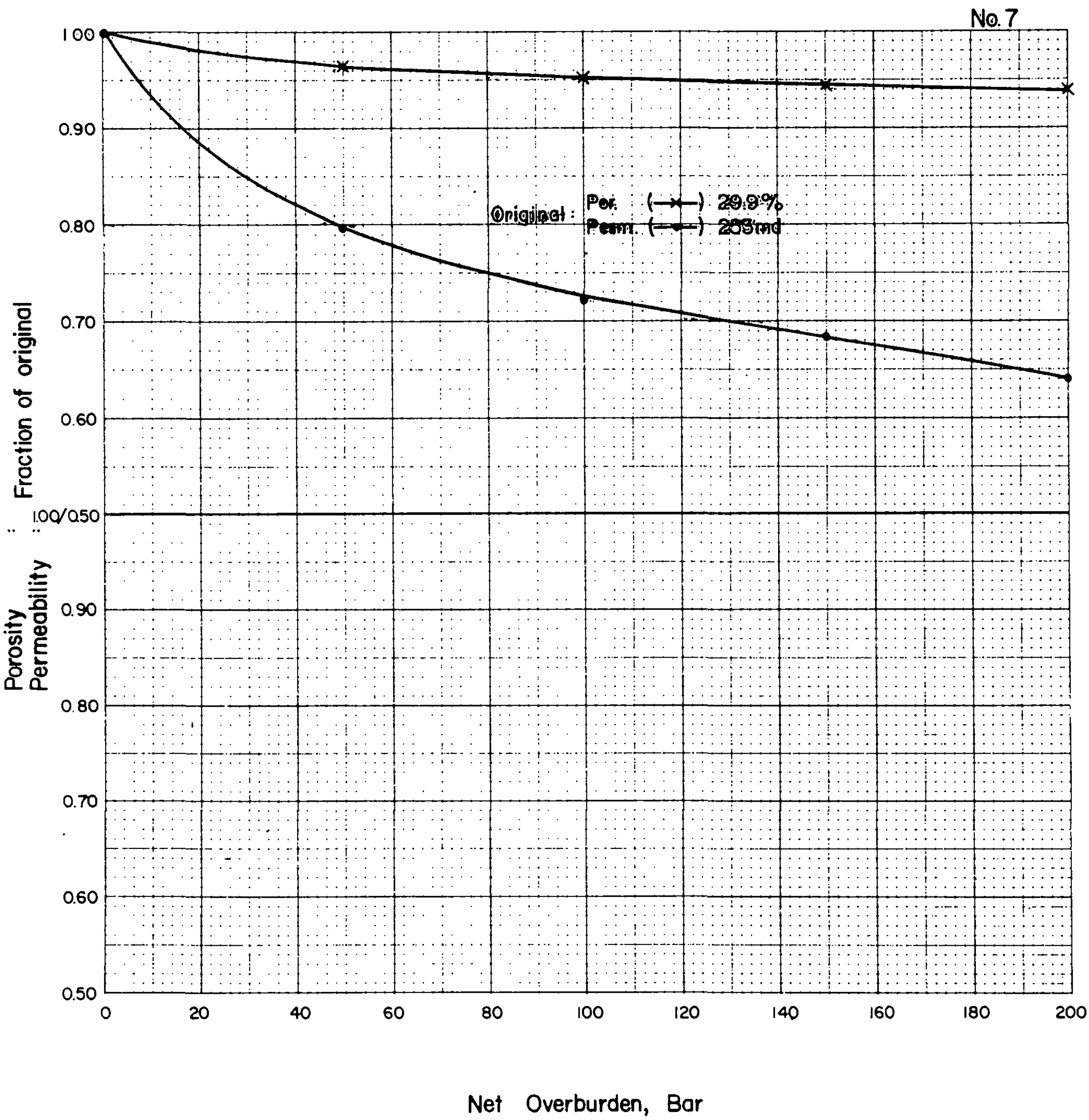
Permeability, Porosity Versus Net Overburden



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Porosity and Formation Resistivity Factor
measured at 4 different net overburden pressures

$$FF = a \cdot \emptyset^{-m}$$

Brine Resistivity at 20°C: 0.0708 Ω m

Sample	Room		50 Bar		100 Bar		150 Bar		200 Bar	
	Ø%	FF	Ø%	FF	Ø%	FF	Ø%	FF	Ø%	FF
1	21.7	13.81	20.8	15.05	20.5	15.50	20.4	15.75	20.3	15.99
2	24.9	12.35	24.1	13.26	23.8	13.73	23.6	13.97	23.5	14.10
3	23.3	12.32	22.6	13.03	22.3	13.37	22.1	13.51	22.0	13.65
4	23.9	14.50	23.2	15.69	23.0	15.31	22.8	15.45	22.7	15.56
5	26.2	14.58	25.4	15.42	25.1	15.90	24.9	16.03	24.8	16.05
6	29.7	9.35	28.9	9.91	28.6	10.13	28.5	10.07	28.4	10.21
7	29.9	9.03	28.8	9.78	28.5	10.06	28.2	10.16	28.0	10.28

By weighted least squares method, forced through FF=1.0, Ø=1.0.

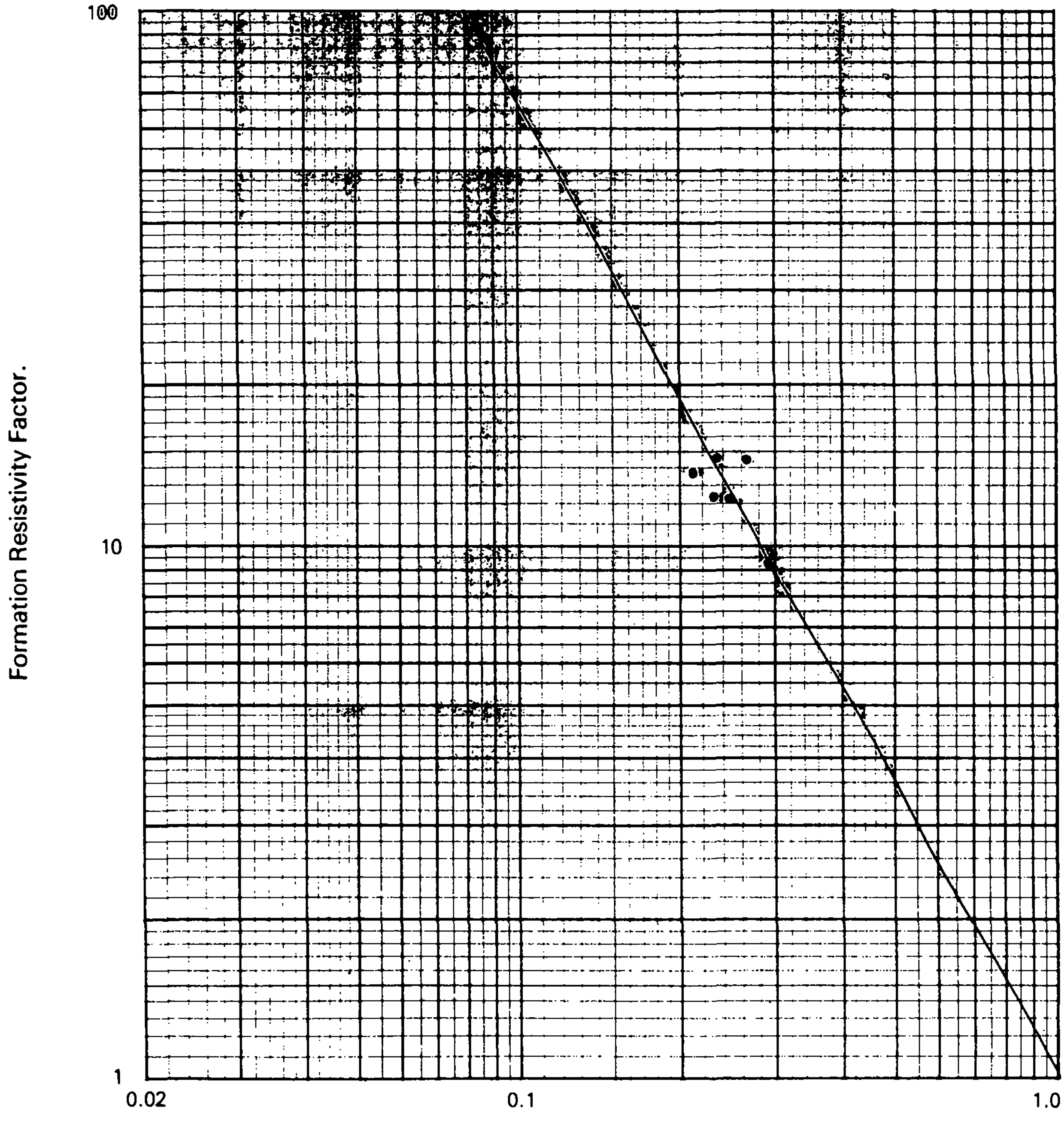
	Room	50 Bar	100 Bar	150 Bar	200 Bar
a	1.02	1.02	1.01	1.02	1.02
m	1.81	1.81	1.82	1.82	1.81

Formation Factor versus Porosity

Company ..Statoil..

Well ....15/9 - 11 ....Room Condition..........................

FF = 1.02 Ø $^{-1.81}$



Fractional Porosity.

Formation Factor versus Porosity

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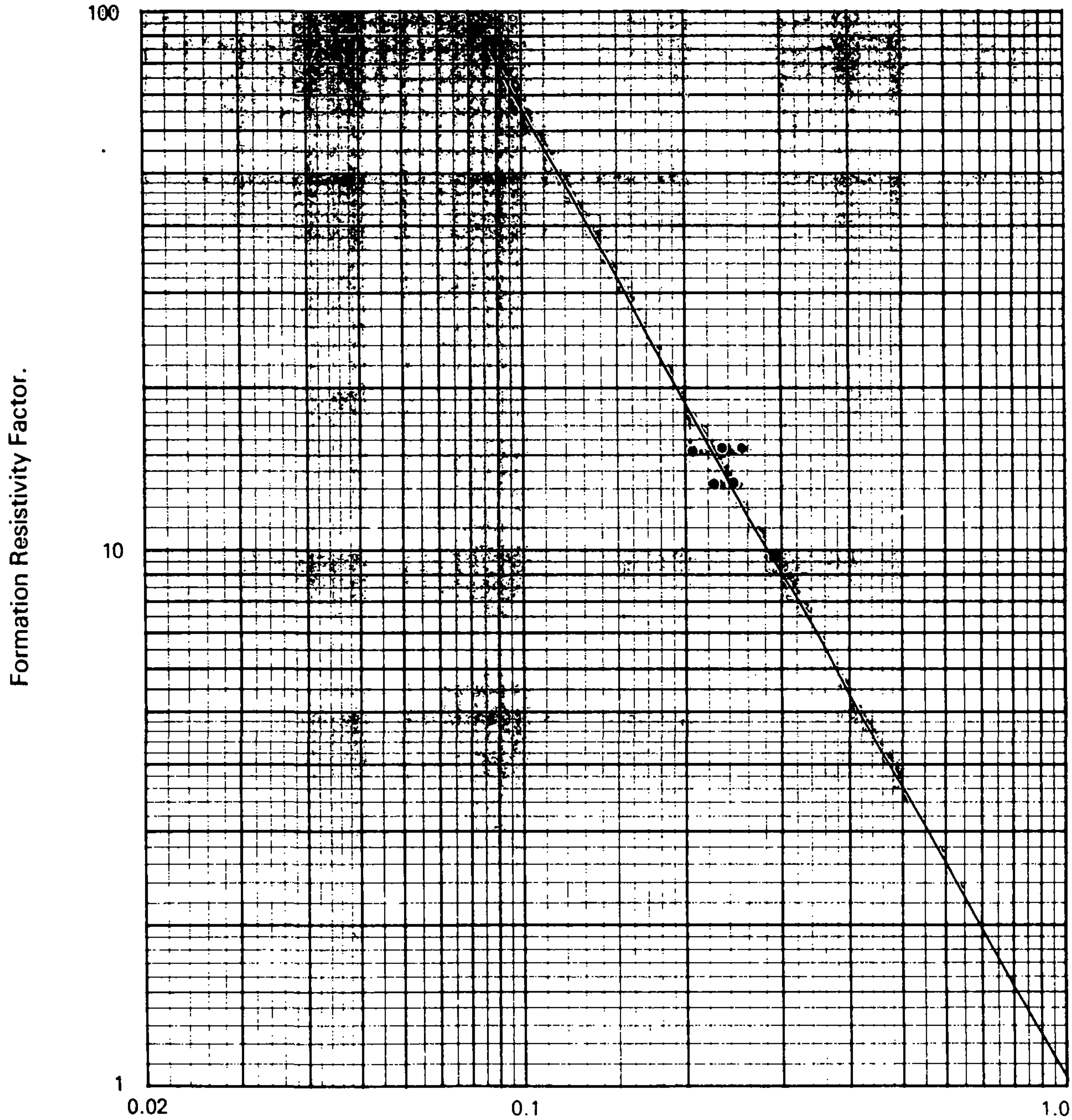
Company Statoil

Well 15/9-11

Net Overburden Pressure: 50 Bars

FF= $1.02\,\phi^{-1.81}$



Fractional Porosity.

Formation Factor versus Porosity

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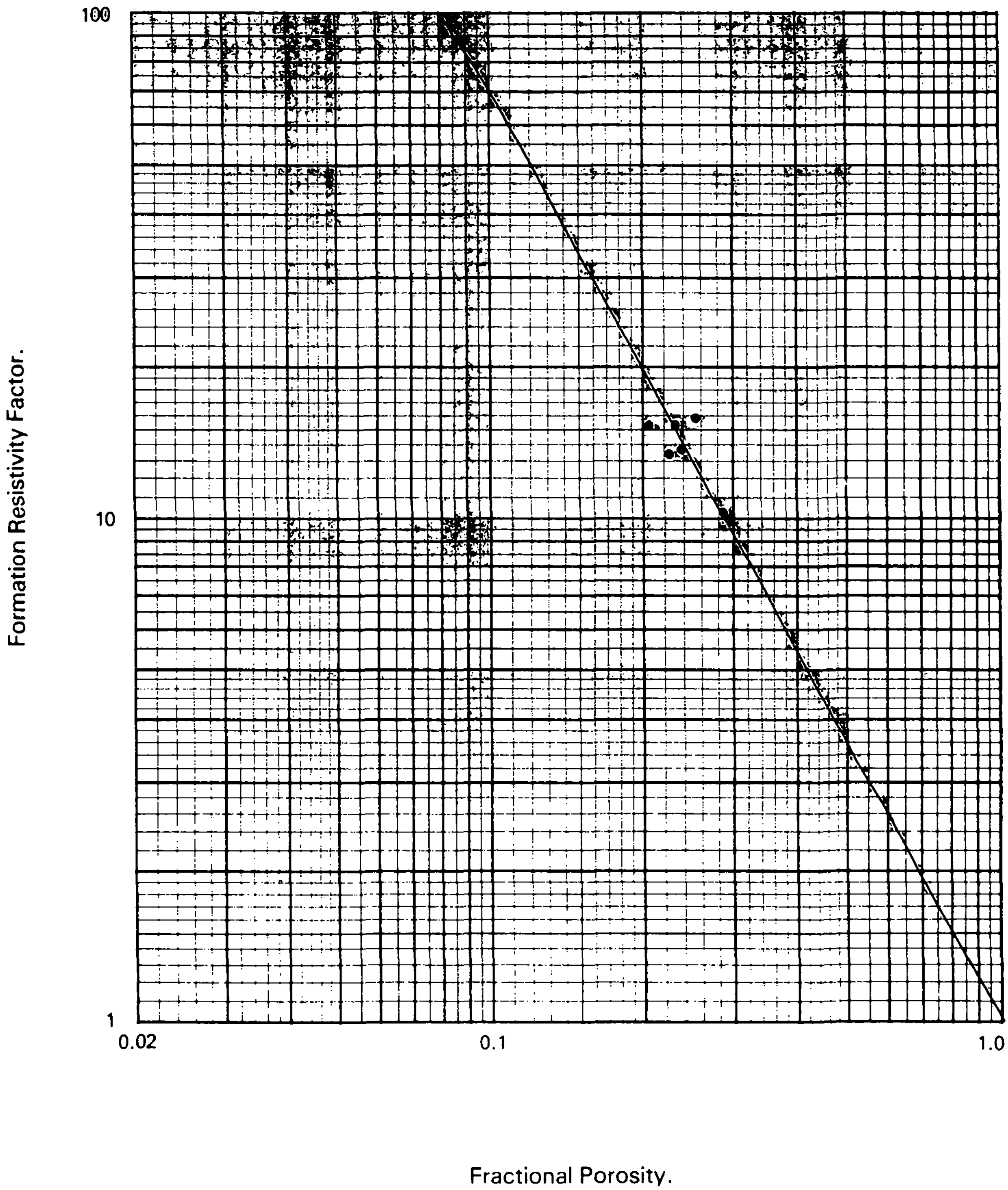
Company ......Statoil......

Well ......15/9-11......

Net Overburden Pressure: 100 Bars

FF = 1.01 $\emptyset^{-1.82}$



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Formation Factor versus Porosity

Company Statoil

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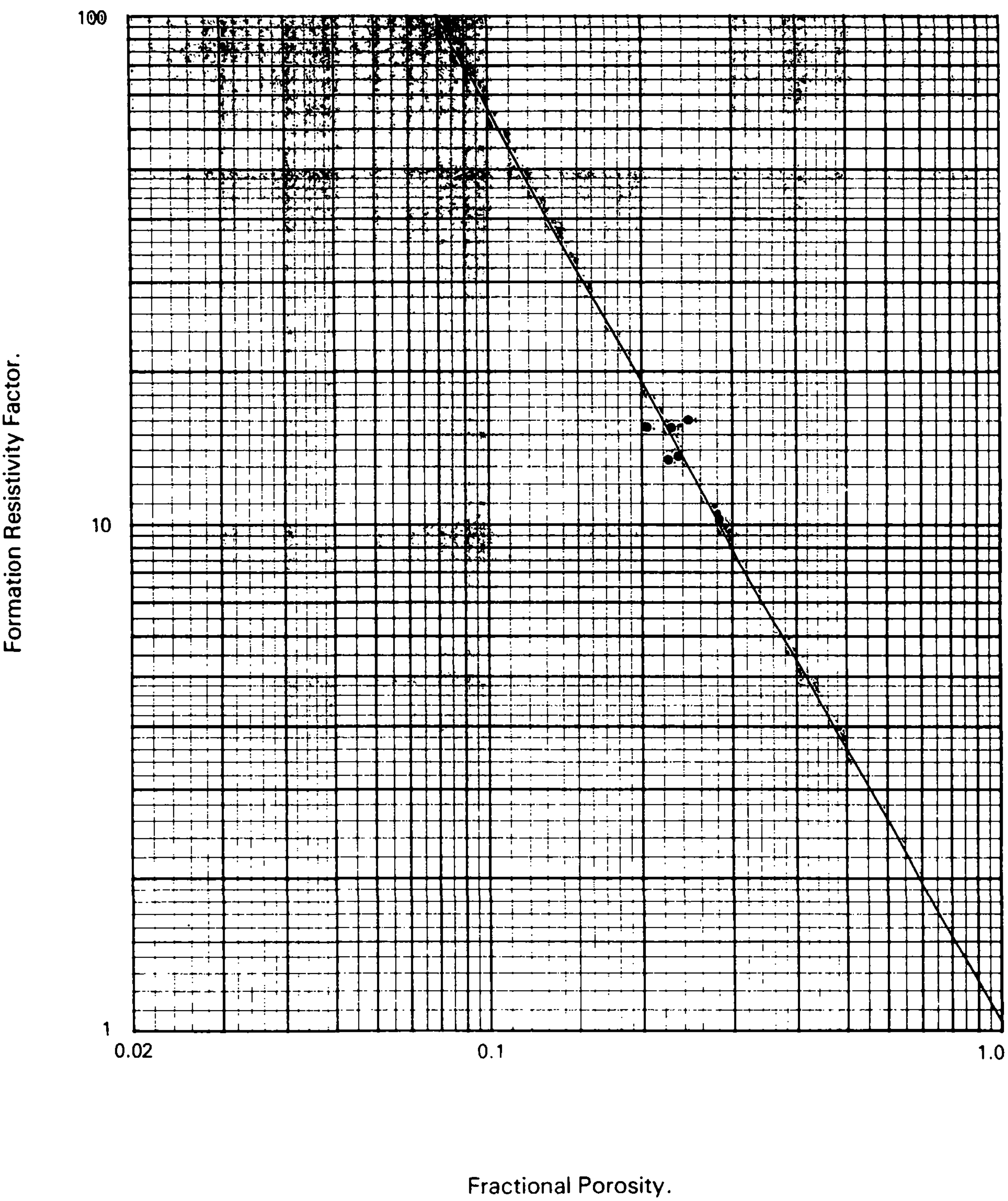
Net Overburden Pressure: 150 Bars

FF = 1.02 $\phi^{-1.82}$



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Formation Factor versus Porosity

Company Statoil

Well 15/9 - 11

Net Overburden Pressure : 200 Bars

FF = $1.02\ \phi^{-1.81}$