Denne rapport tilhører
STATOIL
99.595. 274-19
L&U DOK. SENTER
L. NR. 12383450079
KODE Well 34/10-15 Or.2
Returneres etter bruk

GECO
GEOPHYSICAL COMPANY
OF NORWAY A·S

STATOIL A.S.

SPECICAL CORE ANALYSIS

WELL: 34/10-15

DATE: November 1983

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COMMENTS

GENERAL: Special core analyses were requested by Statoil on 15 plug samples from well 34/10-15. The samples were cylindrical plugs of 1 inch diameter and of variable quality. Some of the plugs were very poorly consolidated and broke down during the saturation process. Due to this GECO could only complete measurements on 12 samples.

MEASUREMENTS: WATER PERMEABILITY

The plugs were saturated as close as possible to 100 % by using first vacuum and then injecting formation water into a desiccator which contained the samples. They were afterwards exposed to a pressure of 50 bar to ensure good saturation.

The samples were installed in a trixial cell and exposed to a confining pressure of 15 bar to avoid water leakage along the sleeve and the plug. Water permeability was measured by pumping degassed simulated formation water through the plugs at a constant rate until a stable flow was achieved. Pressure transducers measured the pressure difference, Δp.

Six of the samples, nos. 84, 89, 97, 116, 144 and 76, could not be measured due to their low permeability. Even at a very slow flow rate the pressure difference, Δp, would have been extremely high, making accurate measurements extremely difficult.

Then the plugs were cleaned by extraction using methanol. Prior to further analyses, the plugs were dried at 60°C and 40 % relative humidity under controlled conditions.

POROSITY AND GRAIN DENSITY

Grain volume was meaured by Boyles law porosimeter using helium. Bulk volume was obtained by mercury displacement. Knowing also the weight of the sample, porosity and grain density were calculated on all samples.

AIR PERMEABILITY

15 samples were installed in a Hassler holder for air permeability measurements. The sleeve pressure used was 15 bar. Air permeability was measured using N_2 gas.

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FORAMATION RESISTIVITY FACTOR

While installed in the triaxial cell the formation resistivity factor was measured using a frequency of 1 kHz. The parameters "a" and "m" in Archies formula were caculated both by least squares method forced through (FF=1.0, ϕ=1.0) and least squares method with free fit.

Archies formula $$FF = \frac{r_o}{r_w} = a \cdot \phi^{-m}$$

r_o = resistivity of sample (100% saturated)

r_w = resistivity of saturating formation water

a = FF-value at fractional porosity of 1.0

ϕ = fractional porosity

m = cementation factor

The data sets and the calculated values are presented in tabular and graphical form.

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FLUID PROPERTIES

FORMATION WATER

The formation water was made from chlorides of Na, and Ca according to this list:

Na^+	:	14 500	ppm
Ca^{2+}	:	1 000	ppm
Cl	:	24 150	ppm
Resistivity (20 °C)	:	0.181	ohm.m.
Density (20 °C)	:	1.026	g/cm^3
Viscosity (20 °C)	:	1.088	cP

NITROGEN GAS

Viscosity (20 °C)	:	= 0.0176	cP

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PLUG SIZE

Sample no.	Depth (m)	Length (cm)	Diameter (cm)
84	1872.55	2.52	2.49
89	1876.35	2.50	2.47
97	1888.20	2.51	2.47
98	1888.50	2.49	2.41
110	1893.00	2.51	2.46
115	1894.60	2.52	2.44
116	1894.90	2.51	2.46
144	1919.70	2.51	2.47
76	2320.30	2.51	2.47
77	2320.65	2.51	2.48
78	2321.05	2.51	2.48
79	2321.40	2.51	2.48

POROSITY, GRAIN DENSITY, PERMEABILITY AND FORMATION FACTOR

Sample no.	Depth (m)	Porosity (%)	Grain Density (g/cm^3)	Air perm. (mD)	Brine perm. (mD)	Form. Factor
84	1872.55	4.09	2.67	0.011	nmp	365
89	1876.35	5.06	2.67	0.023	nmp	276
97	1888.20	2.27	2.68	0.012	nmp	576
98	1888.50	38.7	2.64	2271	2200	5.56
110	1893.00	10.7	2.69	1.20	0.562	67.1
115	1894.60	32.9	2.72	27.1	10.9	9.38
116	1894.90	3.87	2.71	0.017	nmp	233
144	1919.70	7.32	2.71	0.019	nmp	97.0
76	2320.30	5.63	2.68	0.034	nmp	108
77	2320.65	15.5	2.66	17.0	5.31	32.1
78	2321.05	19.0	2.67	23.0	5.56	21.7
79	2321.40	16.6	2.66	40.4	9.07	29.1

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KLINKENBERG PERMEABILITY VS. POROSITY

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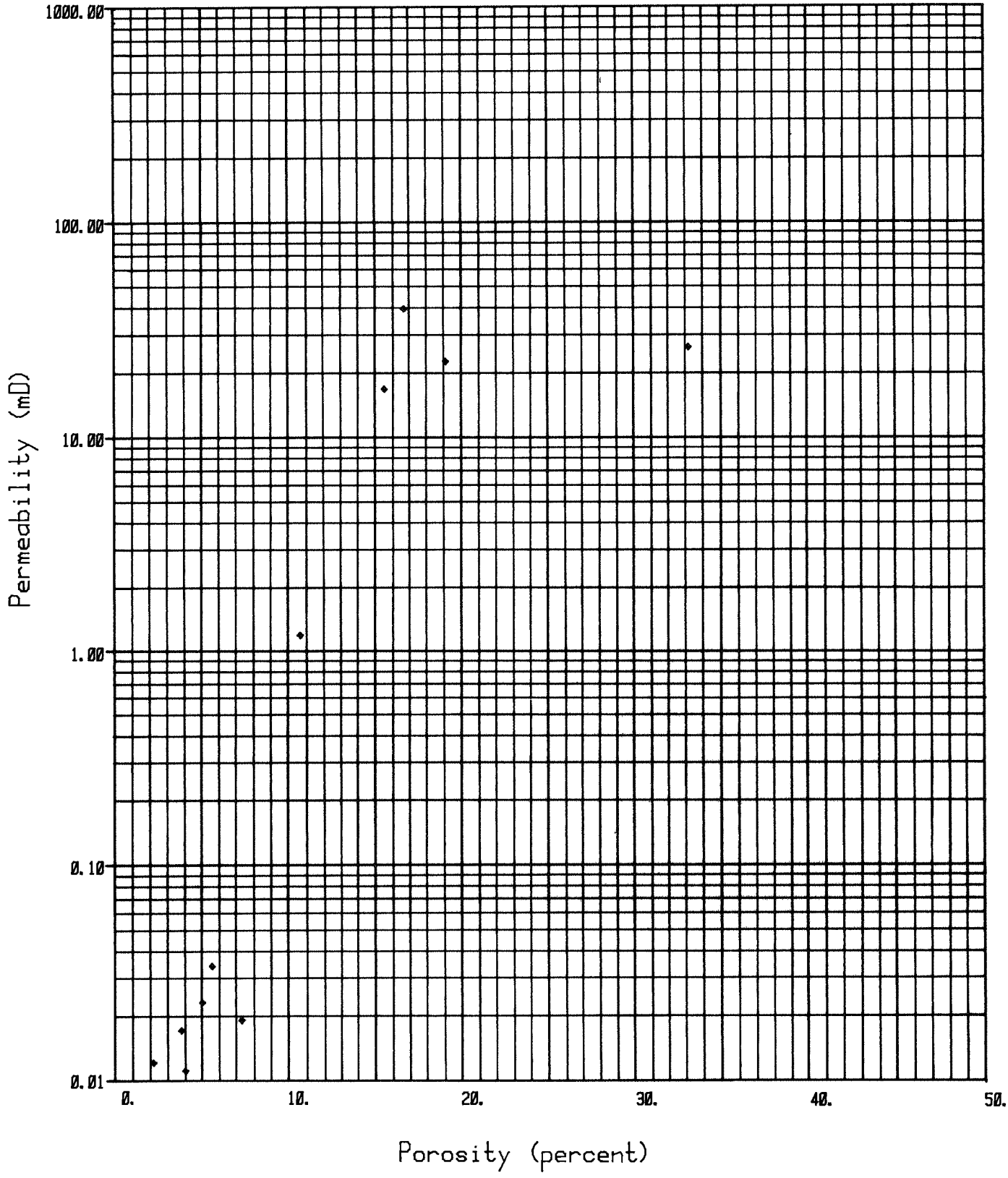
Petroleum laboratory

Company : STATOIL A/S
Well : 34/10-15



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FORMATION RESISTIVITY FACTOR / FRACTIONAL POROSITY

Sample no.	Depth (m)	FF	Frac. porosity
84	1872.55	365	0.041
89	1876.35	276	0.051
97	1888.20	576	0.023
98	1888.50	5.56	0.387
110	1893.00	67.1	0.107
115	1894.60	9.38	0.329
116	1894.90	233	0.039
144	1919.70	97.0	0.073
76	2320.30	108	0.056
77	2320.65	32.1	0.155
78	2321.05	21.7	0.190
79	2321.40	29.1	0.166

Forced fit : $FF = \phi^{-1.77}$

Free fit : $FF = 1.47 \cdot \phi^{-1.63}$

FORMATION RESISTIVITY FACTOR VERSUS POROSITY

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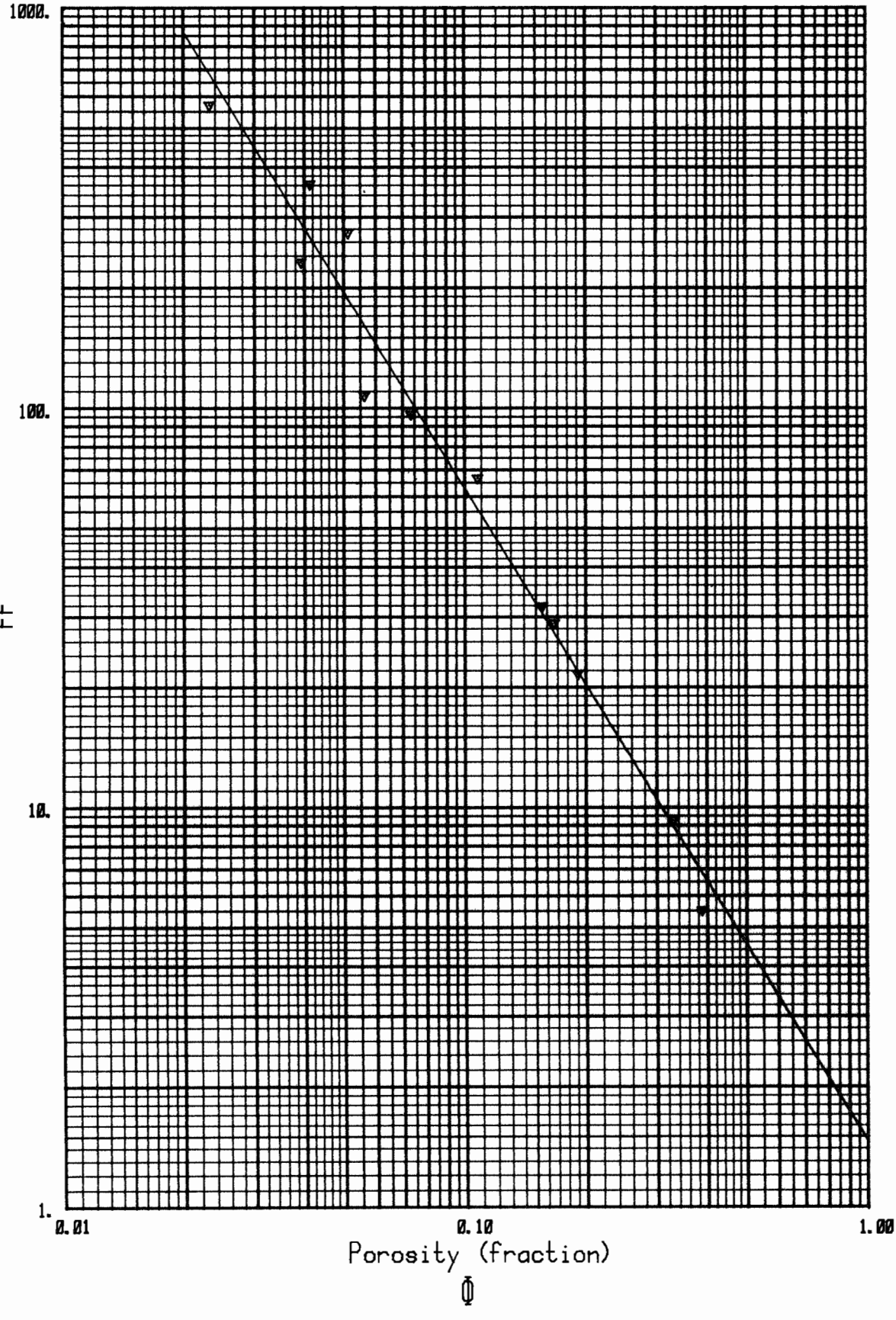
Petroleum laboratory

Company : STATOIL A/S.
Well : 34/10-15
Atmospheric condition. Free fit.
$FF = 1.47 * \Phi^{-1.63}$



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FORMATION RESISTIVITY FACTOR VERSUS POROSITY

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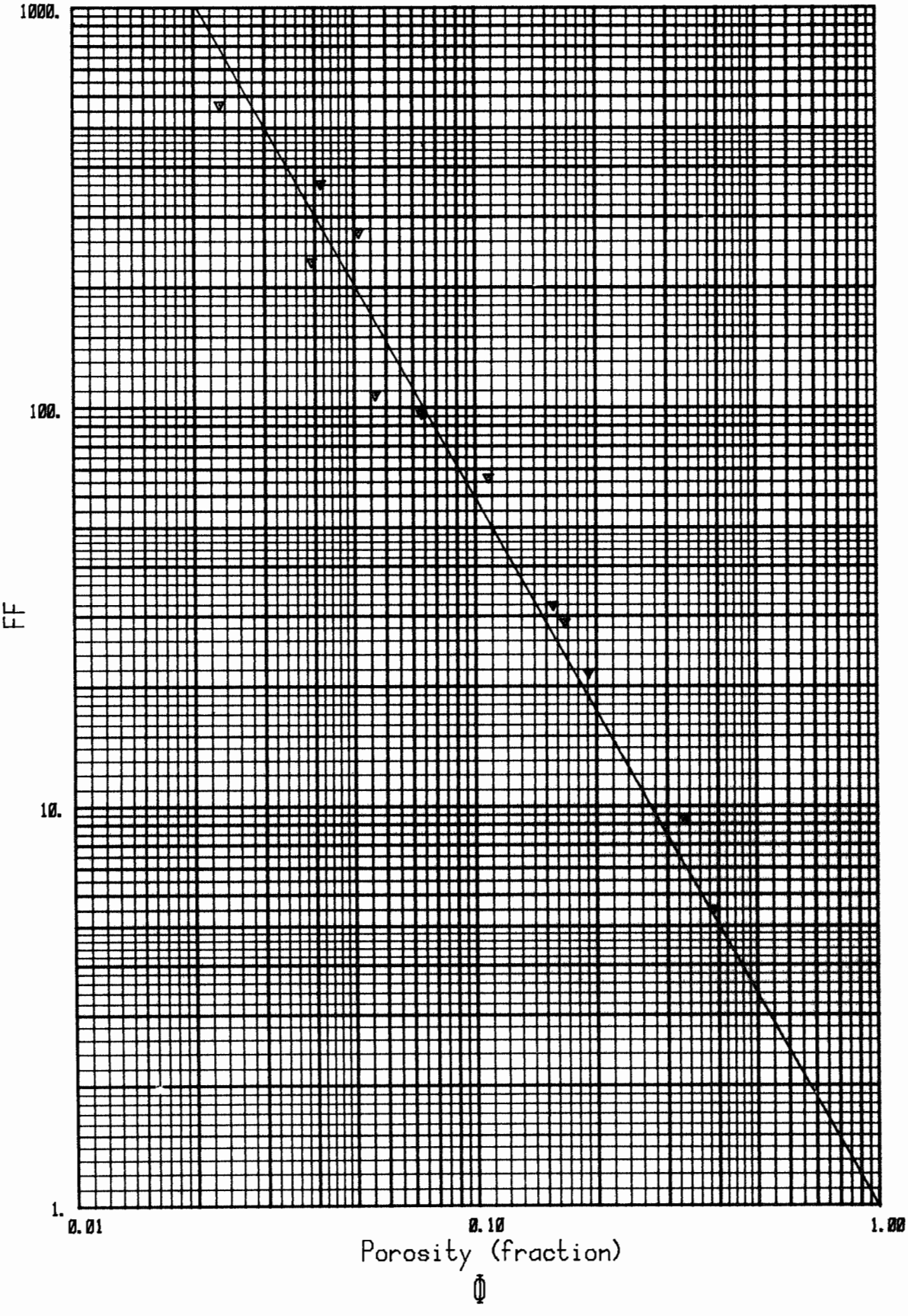

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