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PETROPHYSICAL REPORT
34/10-11

Petrophysical Group
April 1981
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GENERAL WELL DATA

Licence	:	50
Wildcat well	:	34/10-11
Location	:	61° 13' 21.6"N 02° 17' 30.9"E
Spudded	:	28.10.1980
Rig released	:	1.3.1981
KB-elevation	:	25 m
Water depth	:	229 m
Total depth	:	2158.5 m RKB
Objective	:	Jurassic sandstone
Operator	:	Statoil
Partners	:	Norsk Hydro, Saga Petroleum
Status	:	Plugged and abandonned

INTRODUCTION.

This is the ninth well on the delta-structure in block 34/10. The main objective was to test the nourth-east part of the structure for hydrocarbon accumulation in the Jurassic sandstone. It was a surprice in the way that no Brent- or Cook-formation were found, but the Statfjordformation came in with good hydrocarbon accumulations. The lower part of the Dunlin formation has also hydrocarbons. The purpose of this report is to evaluate the petrophysical parameters of these formations using electrical logs, core and test data.

SUMMARY.

Both Dunlin and Statfjord encountered hydrocarbons in 34/10-11. The lower part of Trias is water-bearing.

The oil/water-contact is found at + 2083 m RKB in the Trias-formation.

The Dunlin encountered 14.25 m net pay. Average porosity is 23.9% and average watersaturation is 27.6%.

Statfjord formation encountered 86.25 m net pay with average porosity of 28% and average watersaturation of 13.4%.

Trias formation has 46 m net sand with an average porosity of 23.4% and a watersaturation of 48% in the oil zone.

LITHOLOGY.

The reservoir zones have been divided into the following units:

Amundsen (1868 - 1890)	:	Shallow marine Bioturbation, silty sand.
Nansen (1890 - 1935)	:	fluvial in the bottom grading into marginal marin with lagune facies in the top part.
Eriksen (1935 - 2000)	:	Braided stream, fluvial

Raude	(2000 - 2029)	:	point bar, fluvial
Trias	(2029 - 2155.5)	:	fluvial, continental sandstone

LOG QUALITY.

The logs are generally of good quality. Due to too much tension on the cable in certain intervals corrections have to be made.

The GR-log on the FDC/CNL have one erroneous interval that has been smoothed. This is the interval 2131 - 2132.5 m were the GR-values are much to high compared to the GR from the resistivity logs.

The DLL has some intervals with to high tension on the cable which gives problems in the log-readings. The lower-most interval 2089 - 2094 m gives a constant value on the Rmsfl of 2.2 m which is obviously wrong. Therefore the Rxo = R_{LLS} is used in this interval. The LLd and LLs are memorized, therefore they give constant values higher up in the well (2084 - 2089.5 m). Nothing have been done to these values because the correction will be very small.

The interval 1946.5 - 1948.5 m has the same problem. The Rmsfl has been changed to give a similar curve as LLs in the interval. Where the LLd and the LLs have constant values (1942 - 1944.5), we have tried to give a response similar to the Rmsfl.

The GR-curve on the DLL suffers from the same problem. The interval 2079.5 - 2083.5 m gives much to optimistic values and this is caused by tension and memorizing.

The induction is ok because we only use this curve below the oil/water- contact.

The sonic-log has not been used for any evaluation in this well because the validity is questionable. For the evaluation of Amundsen and the top of Nansen it can not be used because it is evident that it reads beyond reasonable values.

INPUT PARAMETERS.

Input parameters to the calculations have been picked from cross-plot, measured data and empirical relations.

FORMATION WATER SALINITY.

No water- tests are available from these formations, but the log analyses indicates the salinity to be the same for Brent, Cook, Statfjord and Trias. The following values have been used for formation water resistivity under reservoir conditions.

Dunlin
Statfjord = 0.073 m at 160^{o}F
Trias

FORMATION TEMPERATURE.

A constant temperature have been used in the whole reservoir section:

Dunlin
Statfjord = 160^{o}F
Trias

MUD PROPERTIES.

At 63°F	at reservoircondition
Rmf = 0.25 Ωm	Rmf = 0.10 Ωm
Rm = 0.47 Ωm	Rm = 0.185 Ωm
Rmc = 1.46 Ωm	Rmc = 0.57 Ωm
30 000 ppm NaCl	

HYDROCARBON DENSITY.

The hydrocarbon density have been picked from RFT-pressure plots. (see appendix). A value of 0.65 gm/cc has been used.

RESISTIVITY.

An inhouse correction-program for DLL-Msfl has been used for borehole and invasion effects. In the water-zone the induction-log has been used uncorrected.

FORMATION FACTOR.

As no core measurements have been undertaken in the Statfjordformation. The Humble relation has been used:

$$F = 0.62 \quad \phi^{-2.15}$$

SATURATION EXPONENT.

Core measurements from Brent give an average value of 1.95 and therefore we use 2.0 in the Statfjordformation.

WATERSATURATION.

The equation recommended by Schlumberger for the North Sea is used and have the following equation.

$$\frac{1}{\sqrt{R_t}} = \left(\frac{(VSH)^C}{\sqrt{R_{CL}}} + \frac{\phi^{m/2}}{\sqrt{a \cdot R_w}} \right) Sw^{n/2}$$

R_t	=	resistivity of the vergine zone
S_w	=	watersaturation in fraction
V_{SH}	=	volume of clay
C	=	clay exponent (1.6 used)
R_{CL}	=	resistivity of clay
ϕ	=	porosity in fraction
m	=	cementing exponent
n	=	saturation exponent
a	=	lithology constant
R_w	=	formation water resistivity

SHALE PARAMETERS.

Shale parameters have been selected from cross-plot and visual inspection of the logs. High content of K-feltspars, mica and some illite increases the GR-reading. This makes it nesseccary to use more indicators for VSH. The table below lists the parameter used zone by zone.

ZONE	ϕ_{NSH}	ρ_{BSH}	R_{SH}	GR_{min}	GR_{max}
Amundsen	0.42	2.35	1.5	30	75
Nansen	0.45	2.37	1.5	38	80
Eriksen	0.42	2.40	1.5	35	90
Raude	0.45	2.43	1.5	35	90
Trias	0.45	2.45	1.2	35	95

COMPUTATIONS.

Shale Volume

Gamma Ray and FDC/CNL cross-plots have been used for Vsh calculations. Where both indicators have been used, the minimum value have been picked as Vsh. Where washouts exists the GR has been excluded as indicator and only FDC/CNL has been used.

POROSITY.

The porosity has been calculated with a complex lithology method using density and neutron logs with the following matrix parameters.

	FDC	CNL
Quartz	2.65	- 0.035
Heavy mineral	2.9	.25
Fluid	1.0	1.0

CORE LOG CORRELATION.

Six cores were cut in the reservoir section. Due to low recovery on the cores it is difficult to correlate the plugs to the logs. Although this is a big problem we have made a correlation which is described below:

From the log-heading it shows the drillers depth to be 3.5 m shallow to the log-depth, and we use that to correct core depth to log depth.

Core 1.

Plugs are taken from 1870 - 1879.6 m. Corrected to log depth this is 1873.5 - 1883.1. It is than possible to correlate the data to the FDC-log where we have a tight zone from 1875.25 - 1875.5. This correlate to core-depth 1871.73 which has a Ø = 14.3.

The top part of the underlaying sand is not that good with a steady Ø of 25% but with low permeability from 47-8 md. This interval is around 1 m thick. The very good sand below this has a thickness of 3 m with a permeability of 700 - 800 md. Below the tight streak 1879.5 very little permeability exist, but still with porosity around 20%.

Core 2.

We antisipate that the starting depth of each core are the drillers depth at that level. Therefore core nr. 2 starts at 1887 which is 1890.5 m log depth. Following the same system, core 3 starts at 1895 m log depth, therefore the plugs from core nr. 2 have to be between 1890.5 m and 1895 m log depth. This section of the FDC-log indicates a silty sand with laminas of shale. This is just the as the plugs shows with moderate porosities around 20% but with permeability less than 1 md.

Core 3.

Core nr. 3 starts at 1895 m log depth and core 4 starts at 1902.5 m. From the logs it is evident that the plugs have to be

from the interval 1895 - 1897.5 because the rest of the interval is almost entirely clay. Only one plug is taken from the good sand having Ø = 25.2%, K_{AIR} = 653 md. The remaining plugs have been taken in the more silty section of this sand. This is because the permeability is less than 10 md for the rest of the plugs.

Core 4.

Core 4 starts at 1902.5 m and ends at 1912.5 m log depth. From the inspection of the logs for this interval it seems as the plugs are taken from the upper part of this zone. Therefore the sand from 1902.5 - 1904 m have a porosity of around 35% and a permeability to air of 670 md with very low vertical permeability. All the other plugs are taken as the core progrades into more and more silty sand. This section grades into clay directly underlayn by a thin coal-bed at 1905 m.

Core 5.

This core starts at 1912.5 m and ends at 1923.5 m log-depth. Because of loose sand, plugs are only taken from 1920.5 - 1923.25 m log depth. Very little data is available because very few plugs could be take due to very loose sand. But a fair guess is that the plugs are taken below the coal-bead at 1920 - 1921 m RKB. This is because it is felt that the sand above is so loose that it would be impossible to get plugs. If we assume that we are right, the sand 1922 - 1923.5 m will have a porosity of 35 - 37% in the best part with permeability of 10 - 15 darcies.

Core 6.

No samples are available from this core because it is taken in a very well developed sand from 1926 - 1939.5 m on the log. Actual core interval is 1920 - 1926.5. The sand is similar in log-response to the interval 1911 - 1918 m RKB where we postulate that no plugs are taken in core 5.

PERMEABILITY.

Horizontal permeability has been ploted against helium porosity for each lithological unit on enclosed graphs in the appendix. There are two distinct trends; for Amundsen and Nansen. For the two lithological units we have the relation:

$$\text{Amundsen} : \phi_{core} = 0.1791 + 0.063 \cdot \log K_{LH} \quad r^2 = 0.71$$
$$\text{Nansen} : \phi_{core} = 0.2036 + 0.037 \cdot \log K_{LH} \quad r^2 = 0.80$$

For the vertical permeability we have found:

$$\text{Amundsen} : \phi_{core} = 0.2338 + 0.0409 \cdot \log K_{LV} \quad r^2 = 0.80$$
$$\text{Nansen} : \phi_{core} = 0.2237 + 0.0307 \cdot \log K_{LV} \quad r^2 = 0.87$$

We have also found a relation between the horisontal and vertical permeability for the two lithological units.

$$\text{Amundsen} : \text{Log KLH} = 0.6593 \cdot \log K_{LV} + 0.6149 \quad r^2 = 0.82$$
$$\text{Nansen} : \text{Log KLH} = 0.8230 \cdot \log K_{LV} + 0.7267 \quad r^2 = 0.99$$

The generated porosity - horizontal permeability relations for Amundsen and Nansen have been used to calculate permeability from logs based on the calculated porosity for these two formations.

Because no data are available for the other members in this well we have used the Nansen equation through all of the Statfjord formation and also Trias. This has been done to see what range of permeability we are talking about in the other members, not to give exact numbers.

TESTING SUMMARY.

Two DST's and two F.I.T's were performed. Here is listed a summary of the main results of these tests:

DST nr. 1 :	Interval	2018 - 2028 m RKB
	Choke	24/64"
	Oil	2542 BOPD
	Gas	2.15 MMSCFD
	GOR	845 SCF/STB
DST nr. 2 :	Interval	1891 - 1896 m RKB
	Choke	20/64"
	Oil	2050 BOPD
	Gas	1.9 MMSCFD
	GOR	926 SCF/STB

Fit-results:

Fit nr. 1 2081 m RKB.
2 3/4 Gallon chamber:
3000 cc oil sp. gravity 0.85
7000 cc mudfiltrate
6 Gallon chamber was empty; plugged flow lines.

Fit nr 2 2050 m RKB
6 gallon chamber gave no results due to plugging of flowline.

Table 1

Petrophysical parameters for 34/10-11

INTERVAL (m RKB)	NET PAY / NET SAND	AVERAGE POROSITY %	AVERAGE Sw %	PERMEABILITY ARITMETICH AVERAGE	PERMEABILITY HARMONIC AVERAGE	NET / GROSS RATIO
1868-1890	14.25	23.9	27.6	26	20	0.64 *
1890-1935	32.5	30.1	9.6	1034	34	0.722
1935-2000	40.5 41.5	26.7 26.4	14.3 15.8	157	1.88	0.623 0.638
2000-2028	13.25 14.75	26.7 25.4	19.8 25.5	121	4.-	0.473 0.526
2028-2083	9.5 15.25	22.1 20.7	48.2 59.4	49	0.1	0.172 0.277
2083-2154	30.75	24.7	100	178	0.23	0.43

Cut-off criterion : VSH > 40%
PHIF < 12%
SW > 65%

NET PAY / NET SAND

* VSH not included as cut-off

Report

Repeat Formation Tester (RFT)

WELL 34/10-11

Engineer: Jan Skagen

Date: 12/2-81

Abstacts

34/10-11 is the 10th well on the Delta-structure on the 34/10-block. This well was drilled to 2155 m RKB through Statfjord/Triassic formations. Two RFT-runs were completed as a part of the final logging program over the reservoir section.

Summary of the RFT-runs

The first RFT-run was done as a intermediate run while drilling through the top sections of the reservoir. Only a few pressure points were taken and is not included in this report.

The second RFT-run was completed as a part of the final logging program for the well. 20 pressure points in the hydrocarbon-zone and water zone plus two segregated samples in the hydrocarbon-zone were planned. 16 pressure points were obtained when the tool got stuck at 2115 m RKB. Several attempts to get free were done with maximum pull on line (5700 psi) with no success.

While being stuck a segretated sample was taken at 2115 m RKB (water-zone). The cable was then cut and the fishing operation started. Further RFT-runs were cancelled due to the risk of being stuck again (725 psi overbalance in hole).

Both chambers, after a successful fishing operation, were bled off offshore. The 1 gallon chamber had a pressure of 20 psi, containing some gas and mud filtrate/formation water. The 2 3/4 gallon chamber had a pressure of 700 psi at surface containing 4.8 cuft of gas plus mud filtrate / formation water. Samples of the gas and liquid were taken and sent onshore for further analysis.

Sample analysis

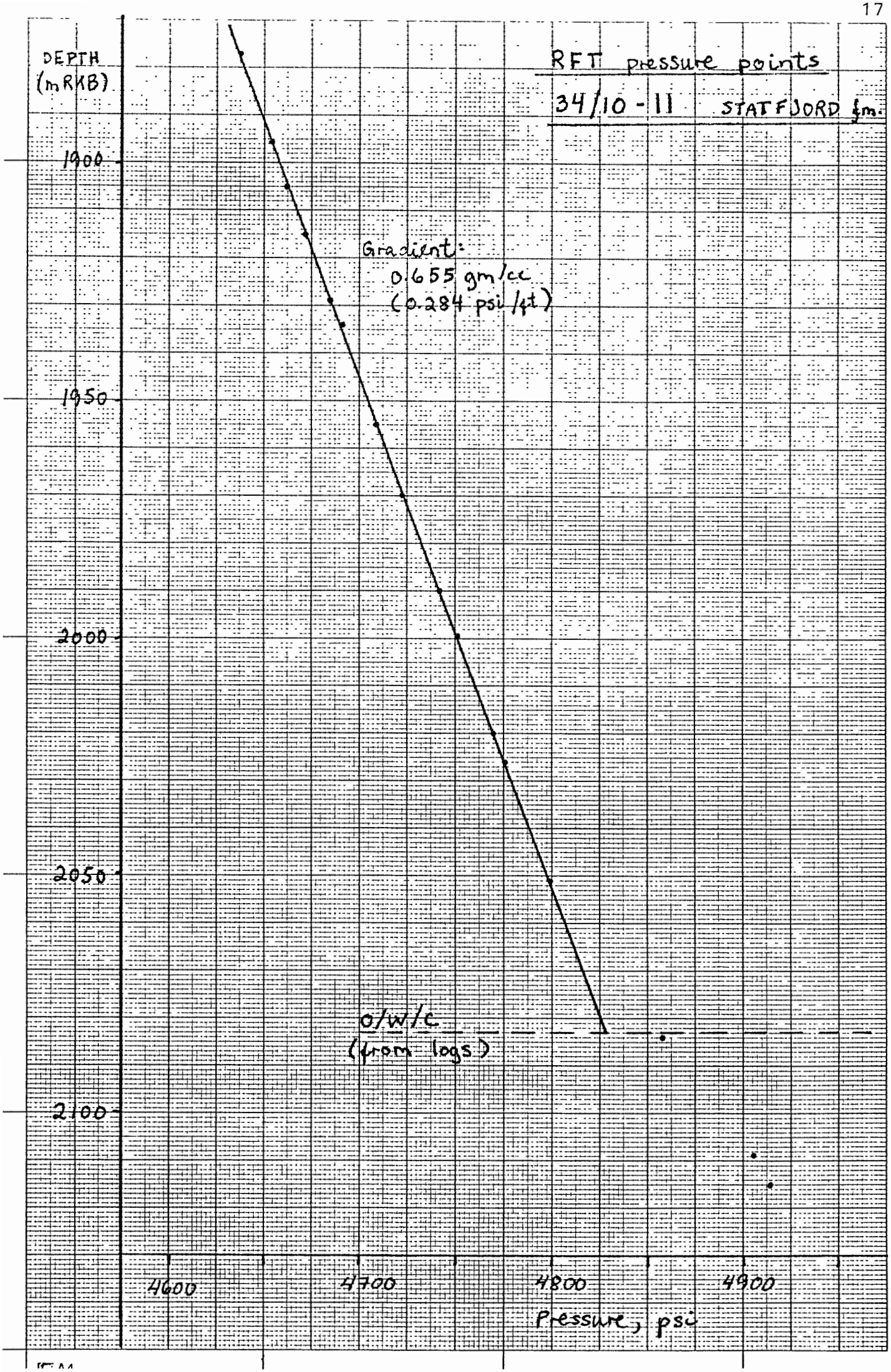
These sample analysis were done offshore by the mud engineers and are rough data.

Mud filtrate		2 3/4 gallon chamber	1 gallon chamber
pH:	11.0	7.0	6.8
Tot hardness:	1000	5500	5700
Ca ++:	300	1400	1500
Mg ++:		720	780
Cl- :	1700	25000	25000

Baroid gas cromatograph of gas from the 2 3/4 gallon chamber:

Methane: 7 - 7.5 %, 40000 ppm
C_2^+: 0.1 %
CO_2: 0 %
H_2 - check negative

Both chambers had 100 % recovery.


RFT pressure points
34/10 - 11 STATFJORD fm.
DEPTH (mRKB)
1900
1950
2000
2050
2100
Gradient:
0.655 gm/cc
(0.284 psi/ft)
o/w/c
(from logs)
4600
4700
4800
4900
Pressure, psi

PRETEST RECORDED DATA

WELL: 34/10-11

DATE: 01.02.81

RUN NO.: 1

Max. rec. temp.: 162°F

Test	Depth	Log hydr.pr. before/after test	Cor. hydr.pr. before test	Draw down	Build up time	Log pretest pressure	Cor.pretest pressure	Cor.hydr.pr. after test	Remarks
No	mRKB	psi	psi, gm/cc	psi	sec.	psi	psi/gm/cc	psi, gm/cc	
1	1870	4959 / 4959	4994 / 1.878	-	-	tight	-	4994 / 1.878	
2	1877	4978 / 4979	5013 / 1.878	·30	21	4605	4638 / 1.738	5014 / 1.878	
3	1895.5	5026 / 5031	5061 / 1.878	1	N.A.	4621	4654 / 1.727	5066 / 2.879	
4	1905	5049 / 5051	5084 / 1.877	7	N.A.	4629	4662 / 1.721	5086 / 1.878	
5	1915	5076 / 5074	5111 / 1.877	47	21	4638	4672 / 1.716	5109 / 1.876	
6	1929	5113 / 5114	5148 / 1.877	274	21	4651	4685 / 1.708	5149 / 1.877	
7	1934	5129 / 5128	5164 / 1.878	111	21	4657	4691 / 1.706	5163 / 1.878	
8	1955	5182 / 5183	5217 / 1.877	14	N.A.	4675	4709 / 1.694	5218 / 1.877	
9	1970	5222 / 5219	5257 / 1.877	2	N.A.	4689	4723 / 1.686	5254 / 1.876	
10	1990	5275 / 5272	5310 / 1.876	500	21	4708	4742 / 1.676	5307 / 1.875	
11	1999.5	5300 / 5297	5335 / 1.876	21	N.A.	4717	4751 / 1.671	5332 / 1.875	
12	2020	5353 / 5352	5388 / 1.876	18	N.A.	4736	4770 / 1.661	5387 / 1.876	
13	2026	5370 / 5369	5405 / 1.876	214	21	4742	4776 / 1.658	5404 / 1.876	
14	2035	5384 / 5394	5429 / 1.876	-	-	tight	-	5429 / 1.876	
15	2051	5435 / 5436	5470 / 1.876	1573	21	4765	4799 / 1.645	5471 / 1.876	
16	2084	5522 / 5523	5557 / 1.875	42	21	4824	4858 / 1.639	5558 / 1.876	
17	2109	5587 / 5585	5622 / 1.875	1896	N.A.	4872	4906 / 1.636	5620 / 1.874	Partly plugging
18	2115	5605 / 5604	5640 / 1.875	1896	N.A.	4880	4914 / 1.634	5639 / 1.875	
19	2115	5601 / 5602	5636 / 1.874	67	N.A.	4879	4913 / 1.634	5637 / 1.874	Sampling

RFT - sampling data

Well: 34/10-11
Date: 01.02.81
Run no:1
Type of sample (segreg./separate): Segregated
Chamber sizes, lower: 1 gal bottle no: -
upper: 2 3/4 gal bottle no: -
Choke sizes: 4 x 0.015
Filter type: -

Depth	m	2115
Log hydr. pres. bef. setting	psi	5636 (1.874(
Log pretest pressure	psi	4879
Cor. pretest pressure	psi (g/cc)	4913 (1.634)
/upper chamber:		
time opened		22:00
log flowing pressure	psi	4874
log shut-in pressure	psi	4879
time sealed		22:26
cor. flowing pressure	psi	4908 (1.632)
cor. shut-in pressure	psi (g/cc)	4913 (1.634)
Lower/ chamber		
time opened		22:28
log flowing pressure	psi	4872
log shut-in pressure	psi	4879
time sealed		22:38
cor. flowing pressure	psi	4906 (1.631)
cor. shut-in pressure	psi (g/cc)	4913 (1.634)
Log hydr. pres. after retracting	psi	5637 (1.874)
Max. recorded temp.	^{o}F	165
Surf. pres., lower ch.	psi	20
Surf. pres., upper ch.	psi	700

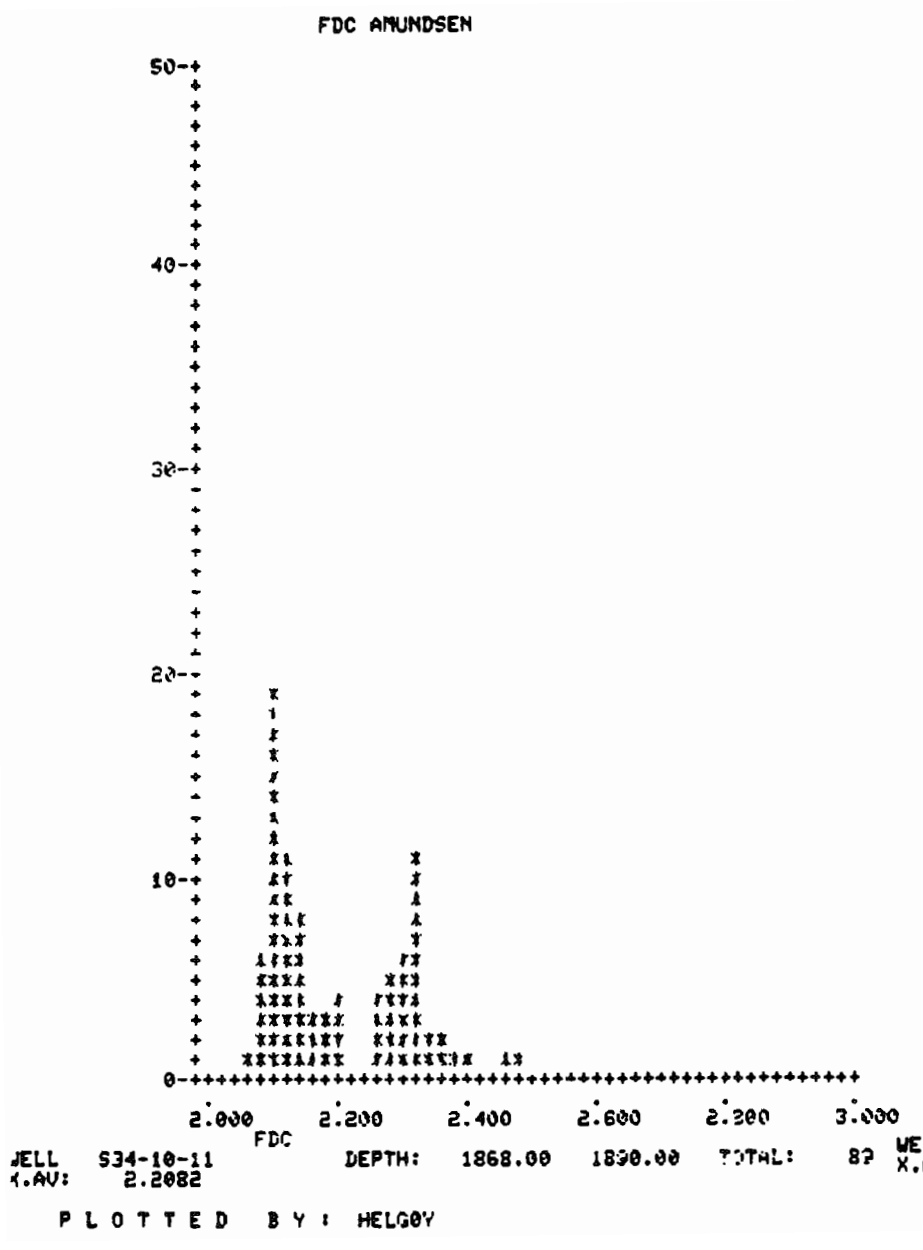
Comments: Tool stuck
Both chambers bled off at surface.

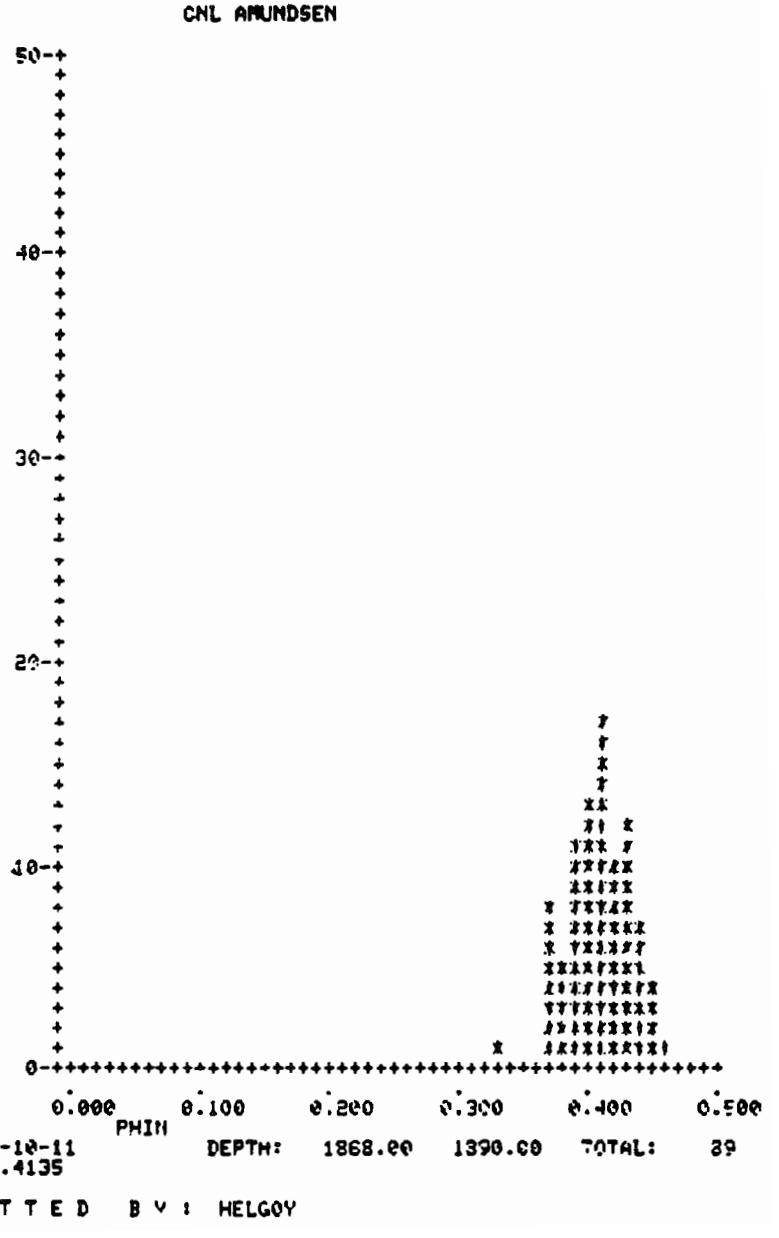
APPENDIX

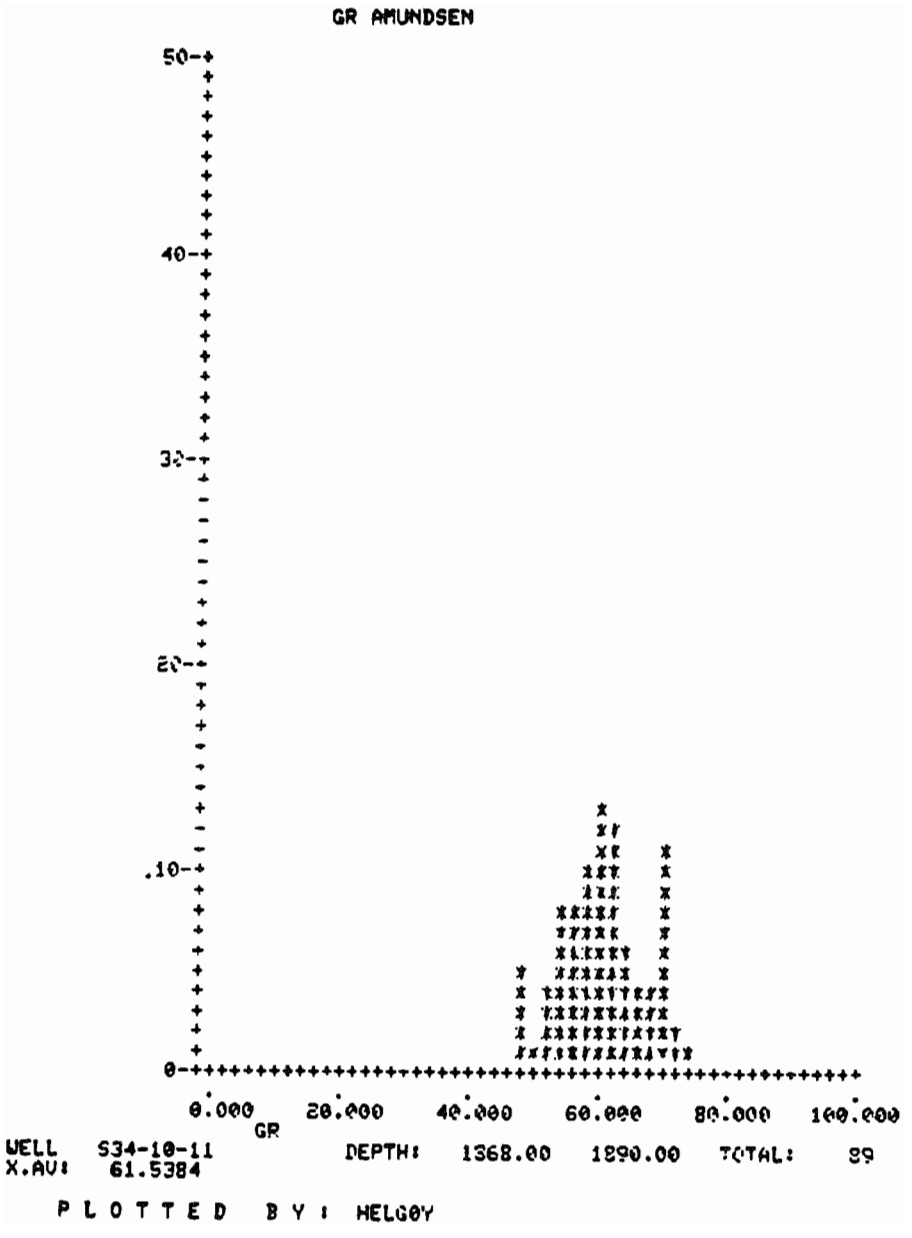
- Crossplots log vs log
  permeability vs porosity
  log vs core
  histograms

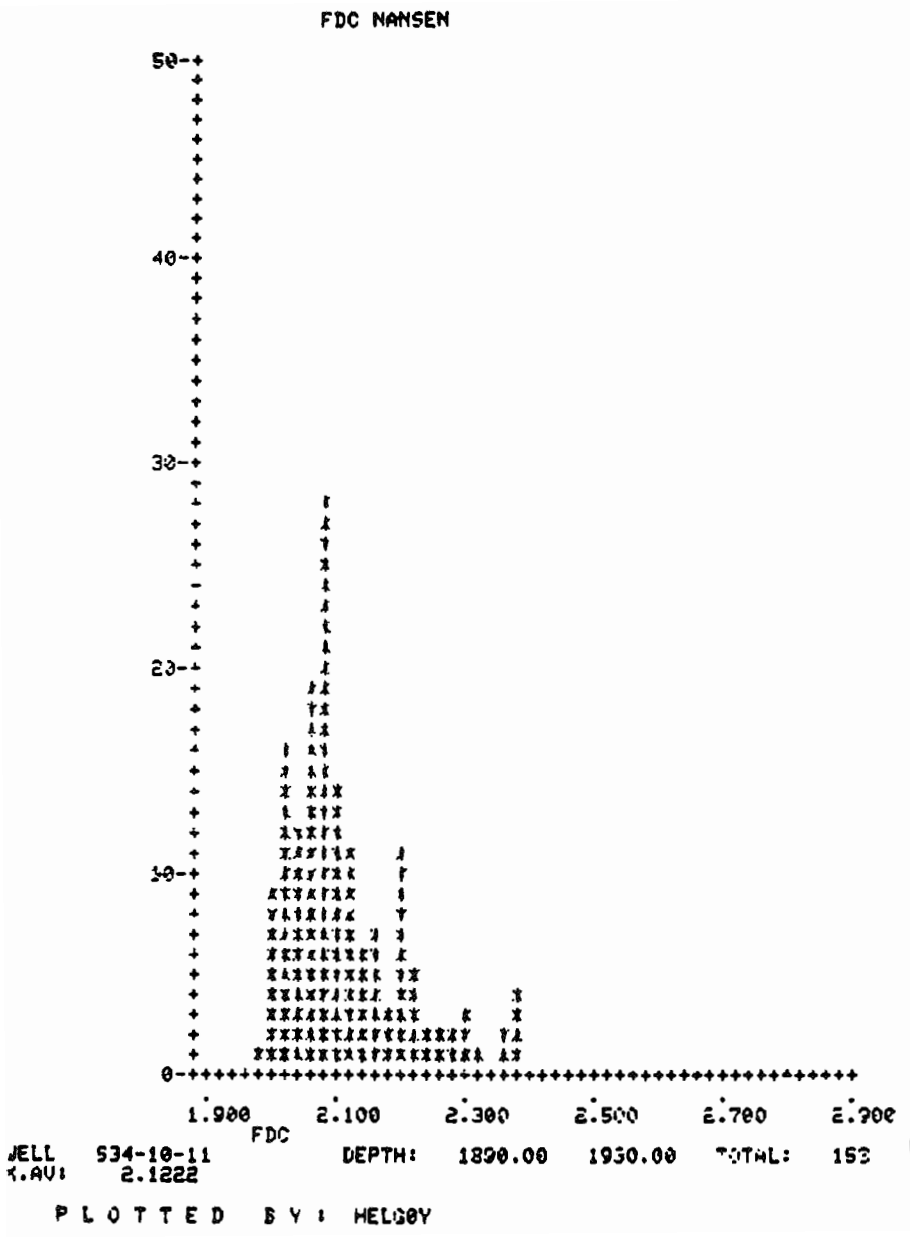
- Summary log

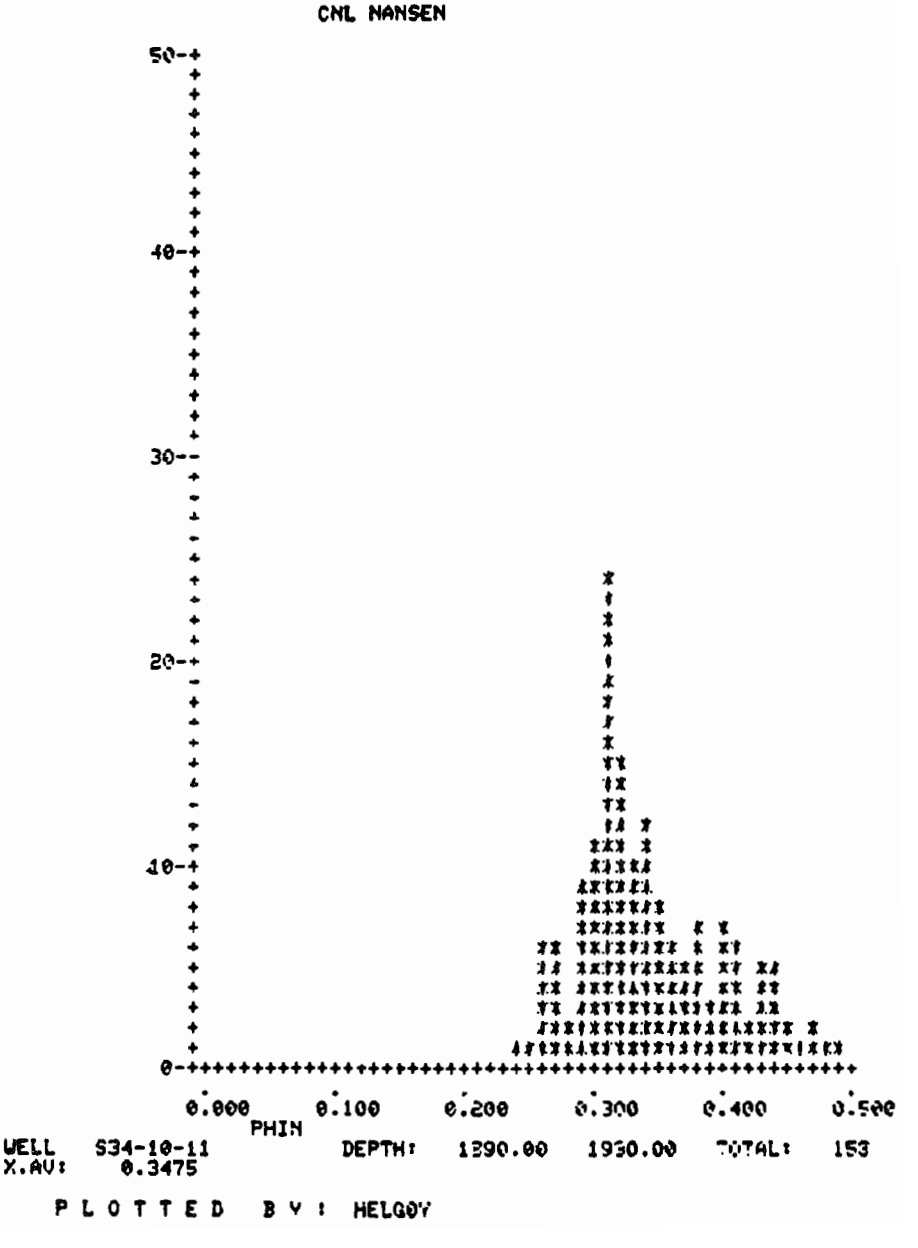
- CPI

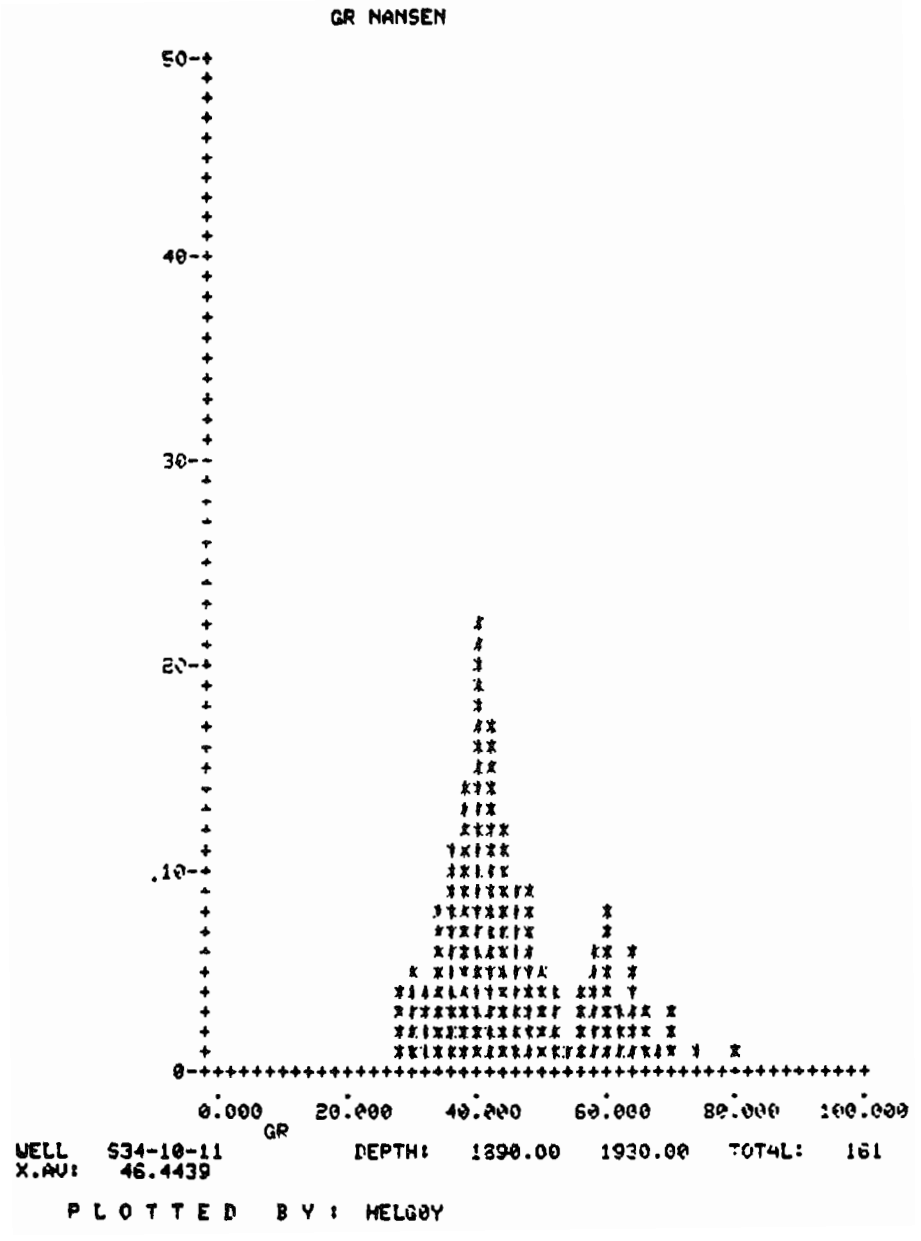

FDC AMUNDSEN
50
40
30
20
10
0
2.000
2.200
2.400
2.600
2.800
3.000
FDC
WELL S34-10-11 DEPTH: 1868.00 1890.00 TOTAL: 89
X.AV: 2.2082
PLOTTED BY : HELGOY

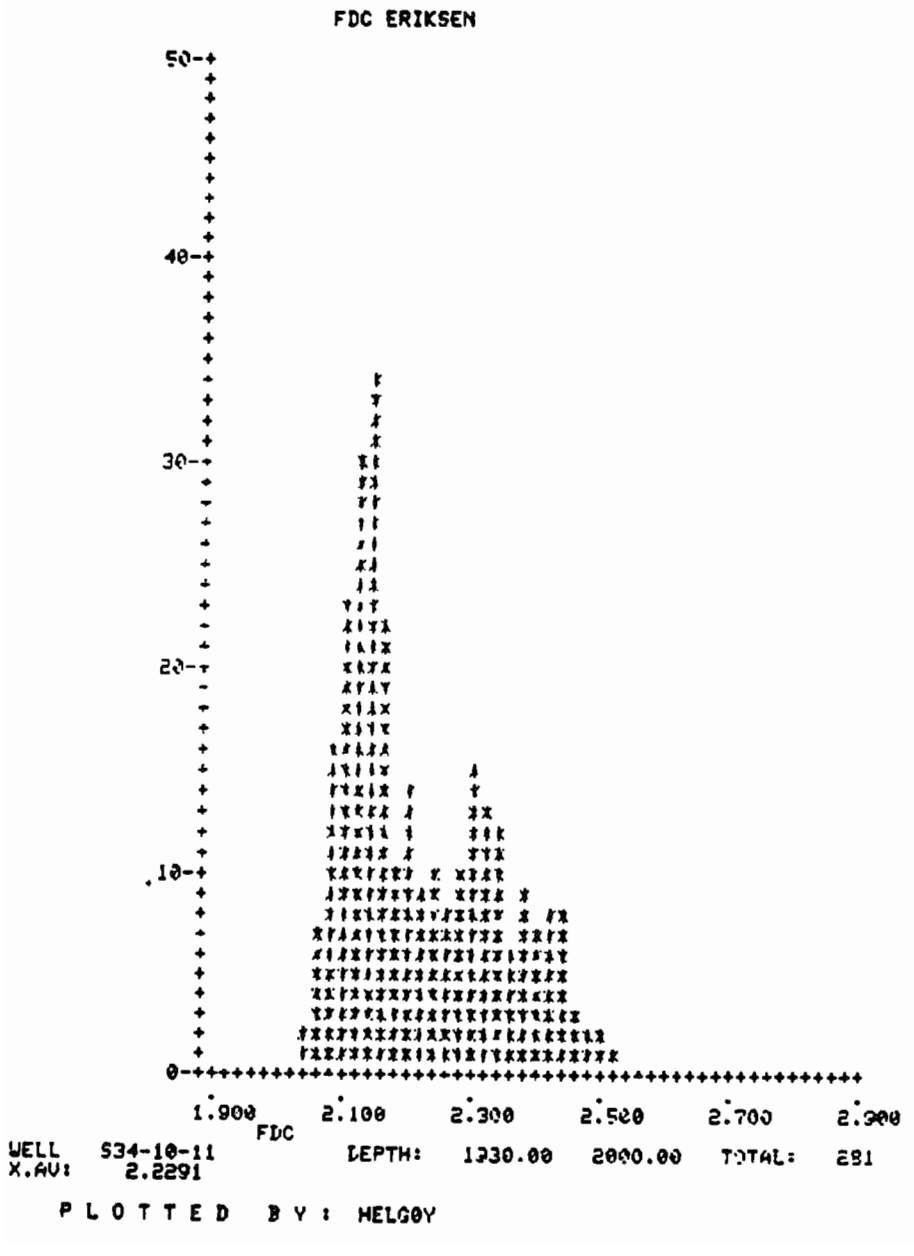

CNL AMUNDSEN
50
40
30
20
10
0
0.000
0.100
0.200
0.300
0.400
0.500
PHIN
WELL S34-10-11 DEPTH: 1868.00 1890.00 TOTAL: 89
X.AV: 0.4135
PLOTTED BY : HELGOY

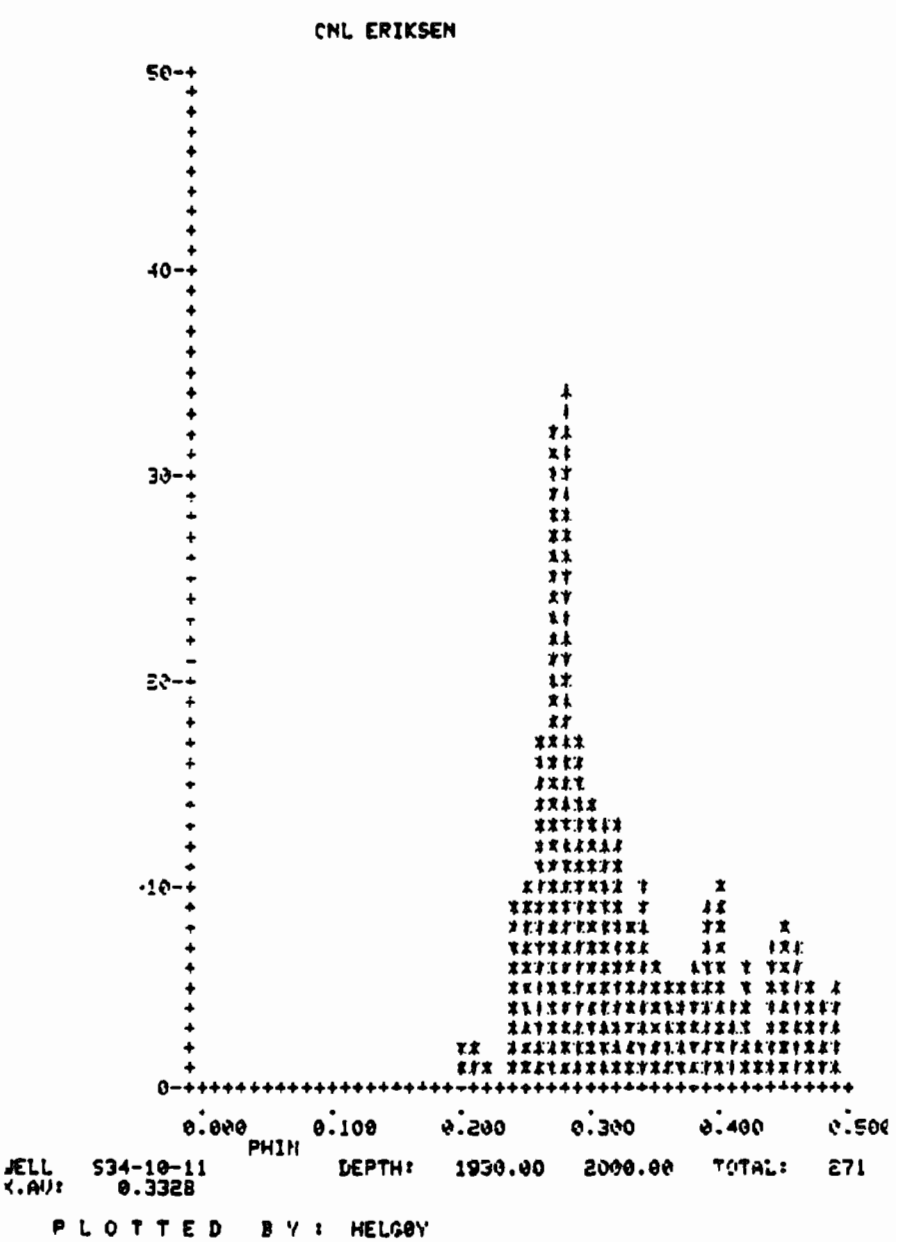

GR AMUNDSEN
50-
40-
30-
20-
10-
0-
0.000
20.000
40.000
60.000
80.000
100.000
GR
WELL 534-10-11
DEPTH: 1368.00 1890.00 TOTAL: 89
X.AV: 61.5384
PLOTTED BY: HELGØY

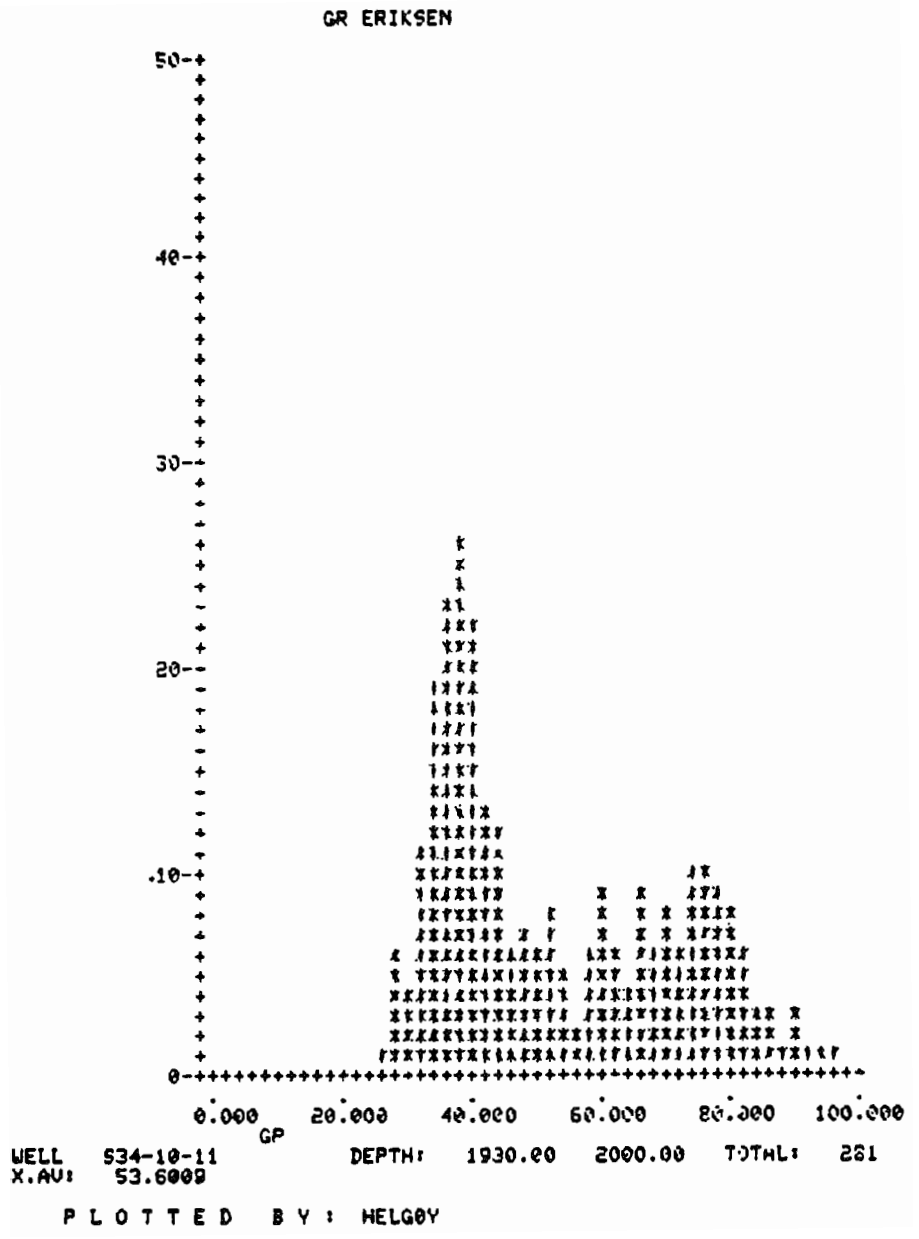

FDC NANSEN
50
40
30
20
10
0
1.900
2.100
2.300
2.500
2.700
2.900
FDC
WELL S34-10-11 DEPTH: 1890.00 1930.00 TOTAL: 153
X.AV: 2.1222
PLOTTED BY: HELGOY

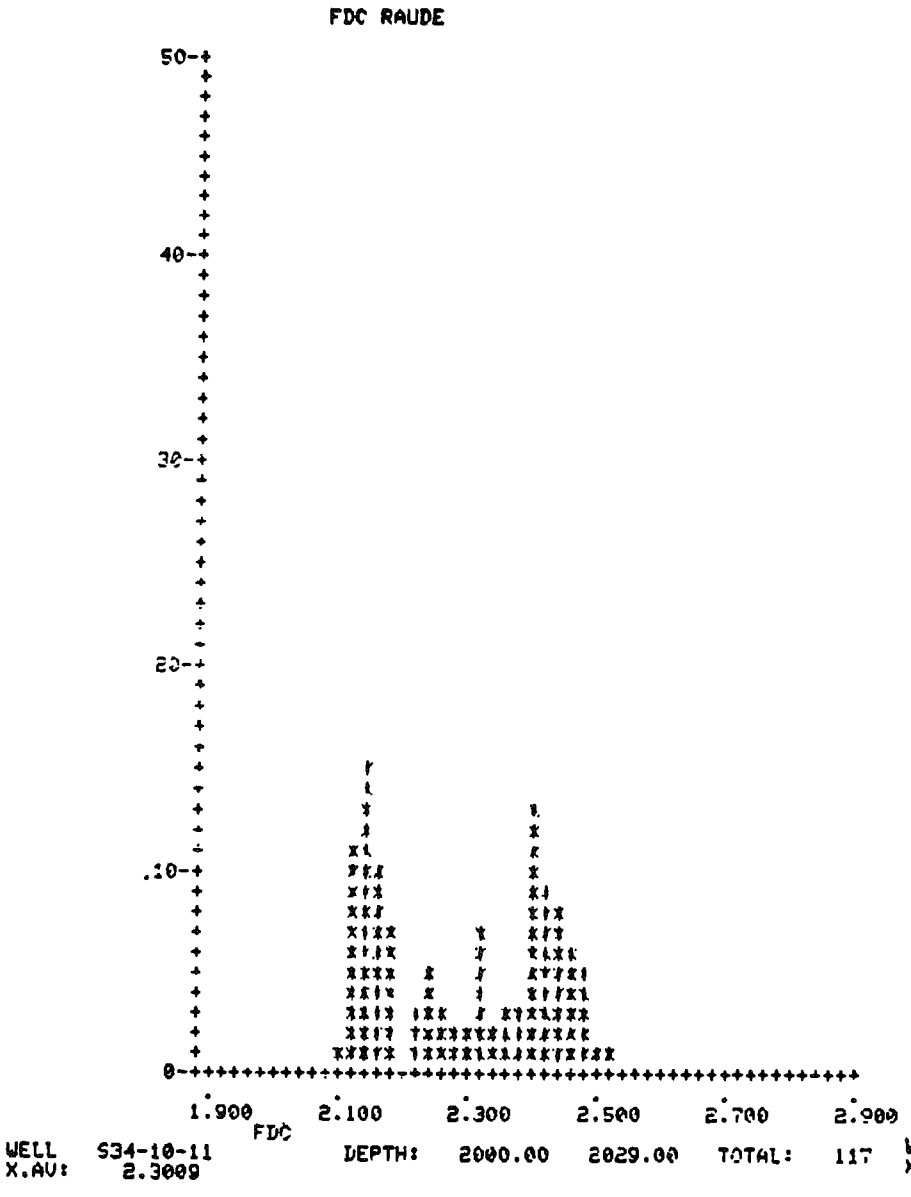

CNL NANSEN
50
40
30
20
10
0
0.000
0.100
0.200
0.300
0.400
0.500
PHIN
WELL S34-10-11 DEPTH: 1890.00 1930.00 TOTAL: 153
X.AV: 0.3475
PLOTTED BY: HELGOY

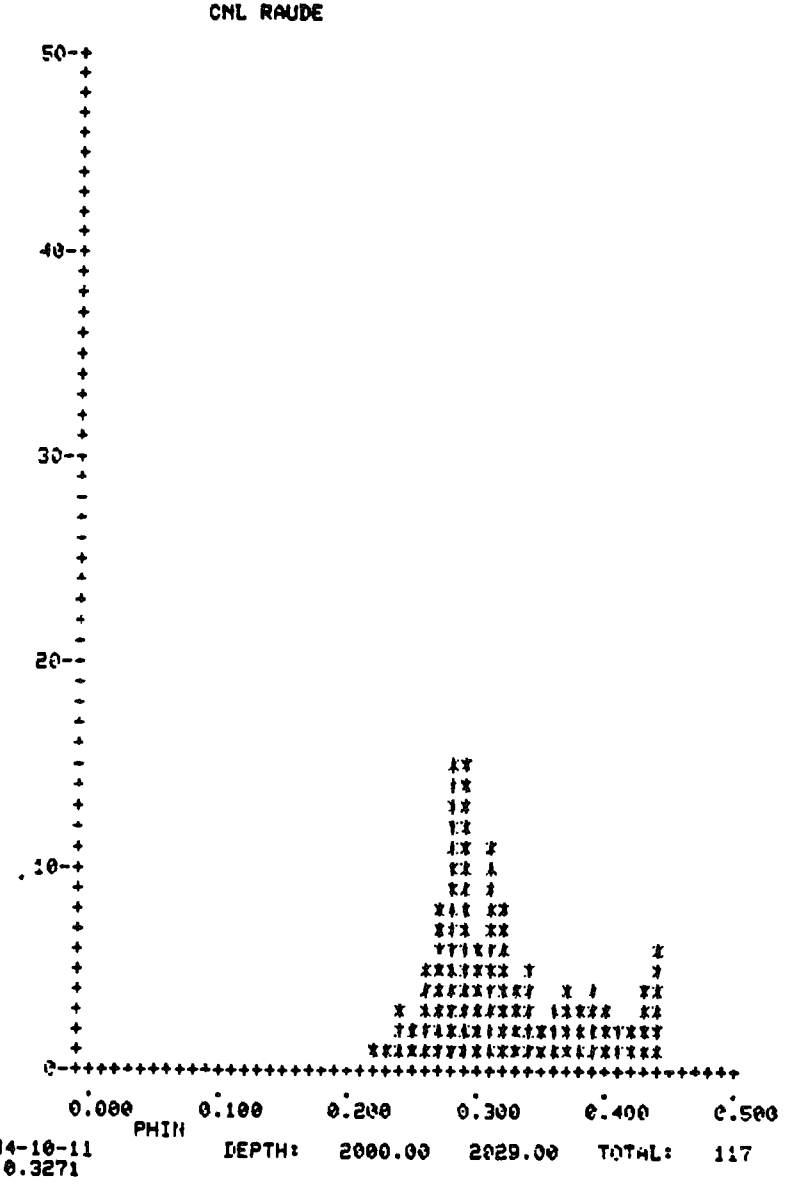

GR NANSEN
50-
40-
30-
20-
10-
0-
0.000
20.000
40.000
60.000
80.000
100.000
GR
WELL 534-10-11
DEPTH: 1890.00 1930.00
TOTAL: 161
X.AV: 46.4439
PLOTTED BY: HELGOY

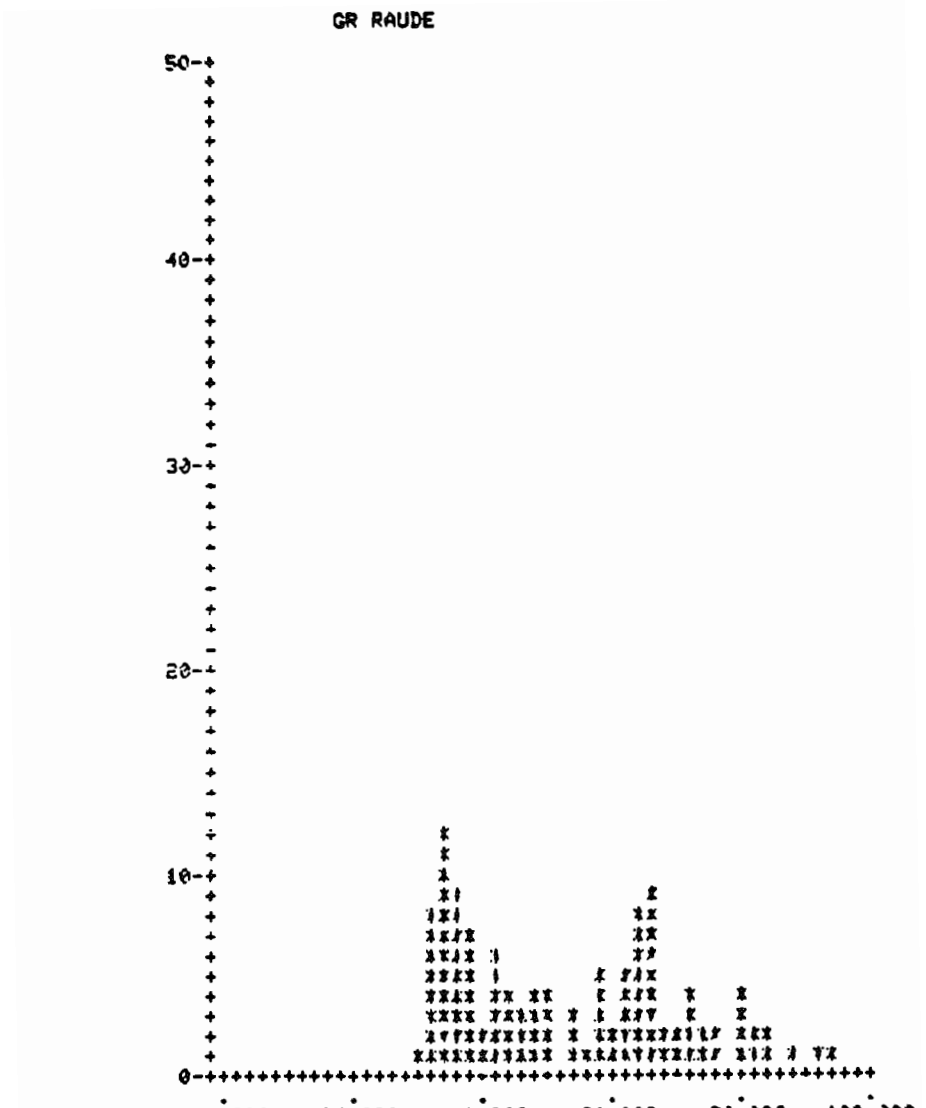

FDC ERIKSEN
50-
40-
30-
20-
10-
0-
1.900
2.100
2.300
2.500
2.700
2.900
FDC
WELL 34-10-11
X.AV: 2.2291
DEPTH: 1930.00 2000.00 TOTAL: 281
PLOTTED BY : HELGOY

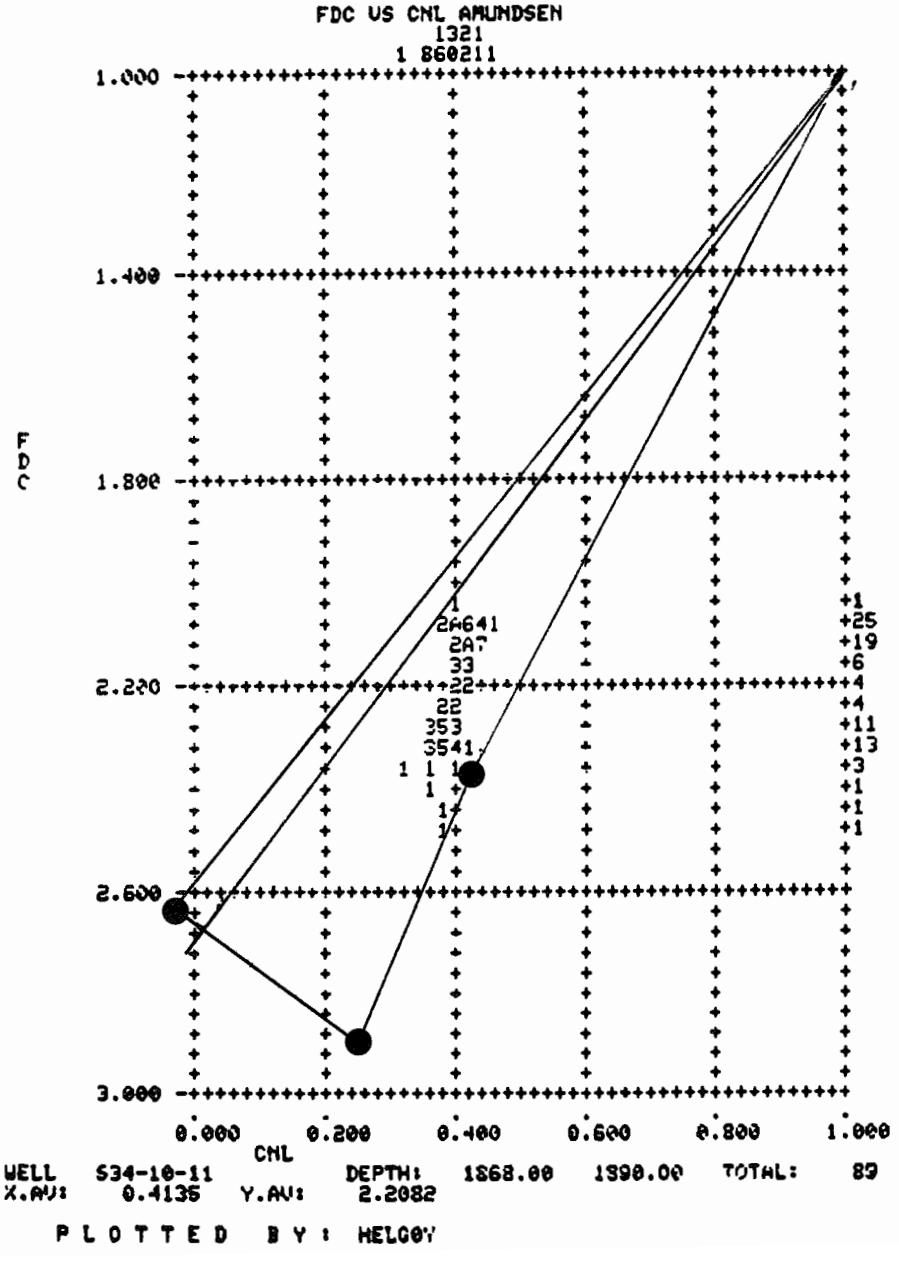

CNL ERIKSEN
50-
40-
30-
20-
10-
0-
0.000
0.100
0.200
0.300
0.400
0.500
PHIN
WELL 34-10-11
X.AV: 0.3328
DEPTH: 1930.00 2000.00 TOTAL: 271
PLOTTED BY : HELGOY

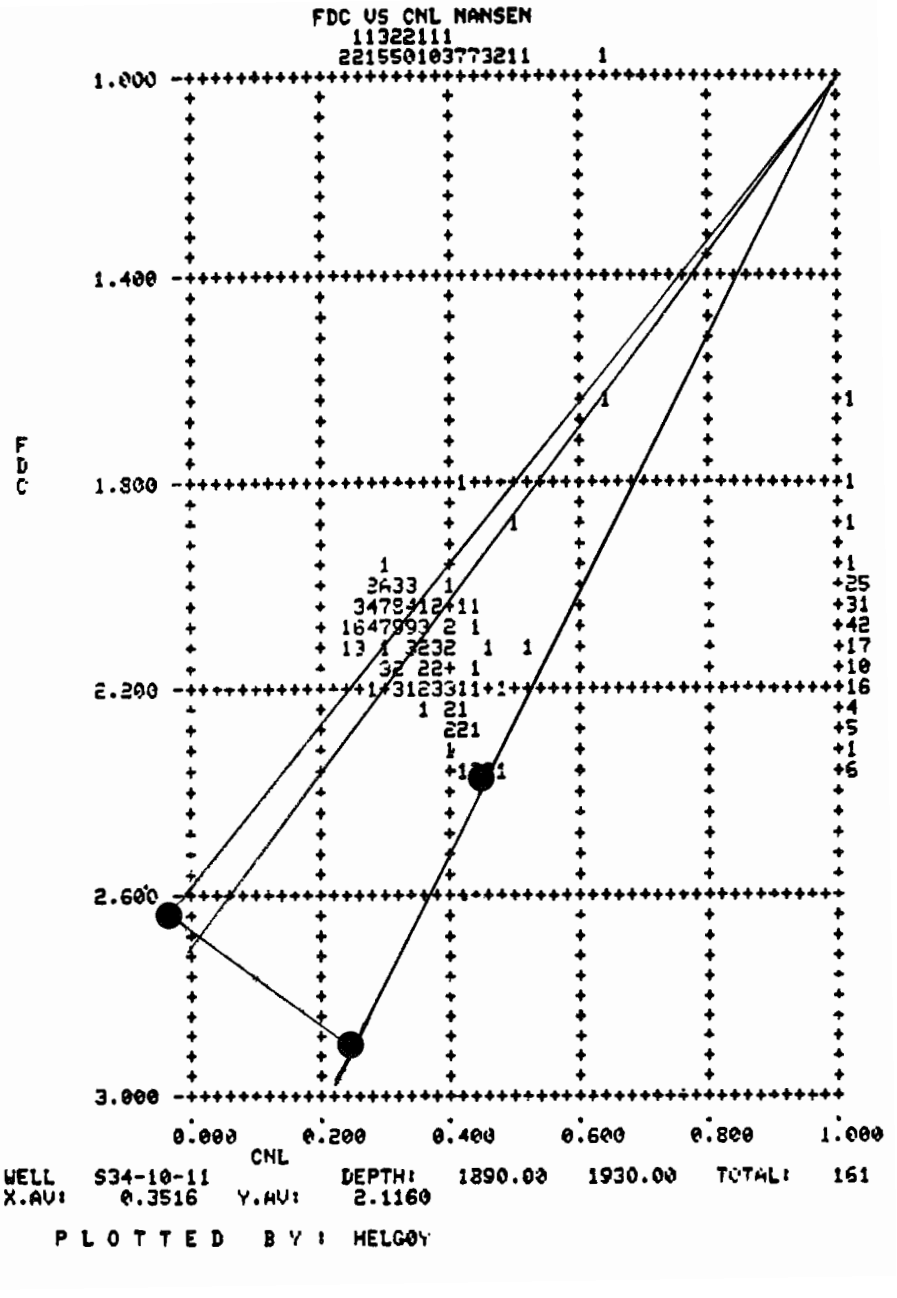

GR ERIKSEN
50
40
30
20
10
0
0.000
20.000
40.000
60.000
80.000
100.000
GP
WELL 534-10-11
DEPTH: 1930.00 2000.00
TOTAL: 281
X.AV: 53.6009
PLOTTED BY : HELGØY

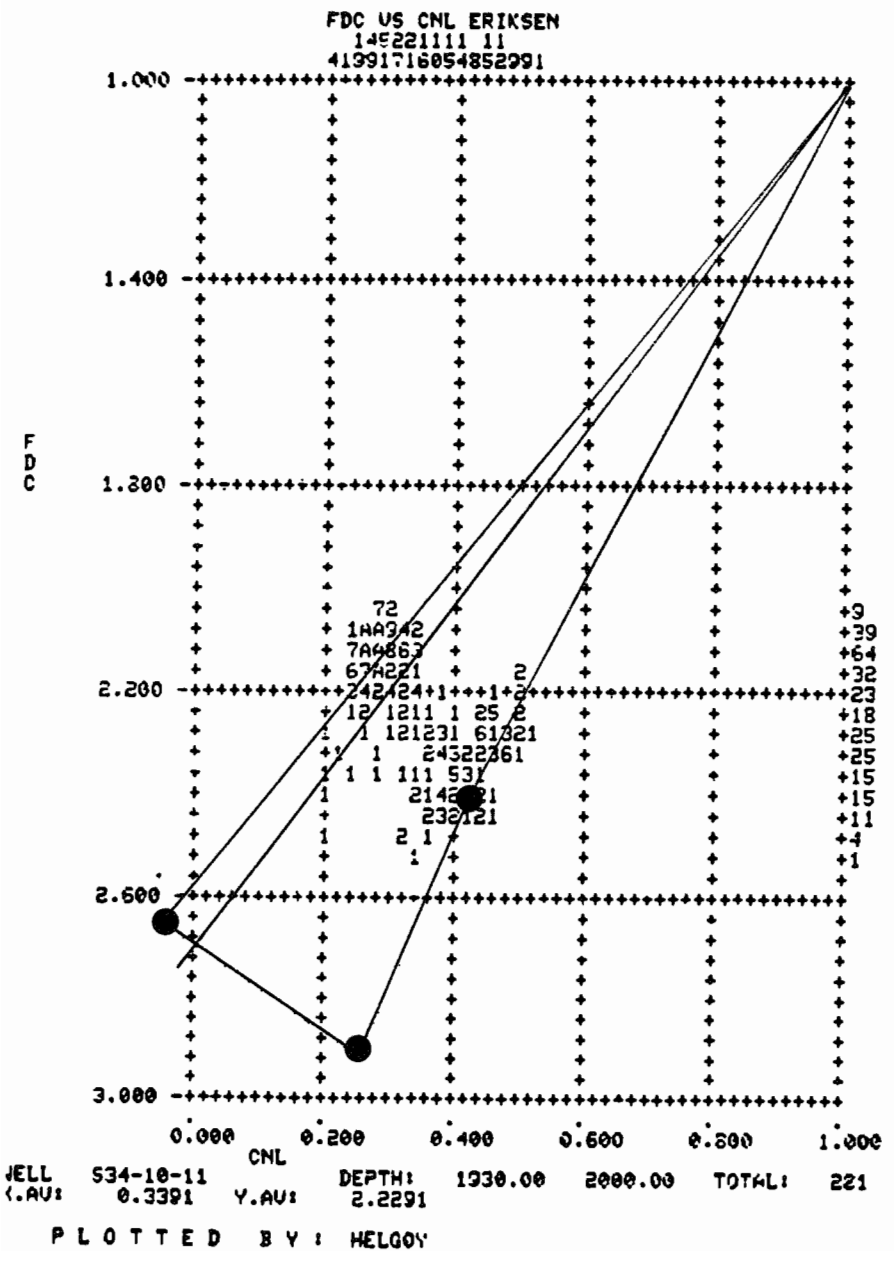

FDC RAUDE
50-
40-
30-
20-
.10-
0-
1.900
2.100
2.300
2.500
2.700
2.900
FDC
WELL S34-10-11
X.AV: 2.3009
DEPTH: 2000.00 2029.00 TOTAL: 117
PLOTTED BY : HELGOY

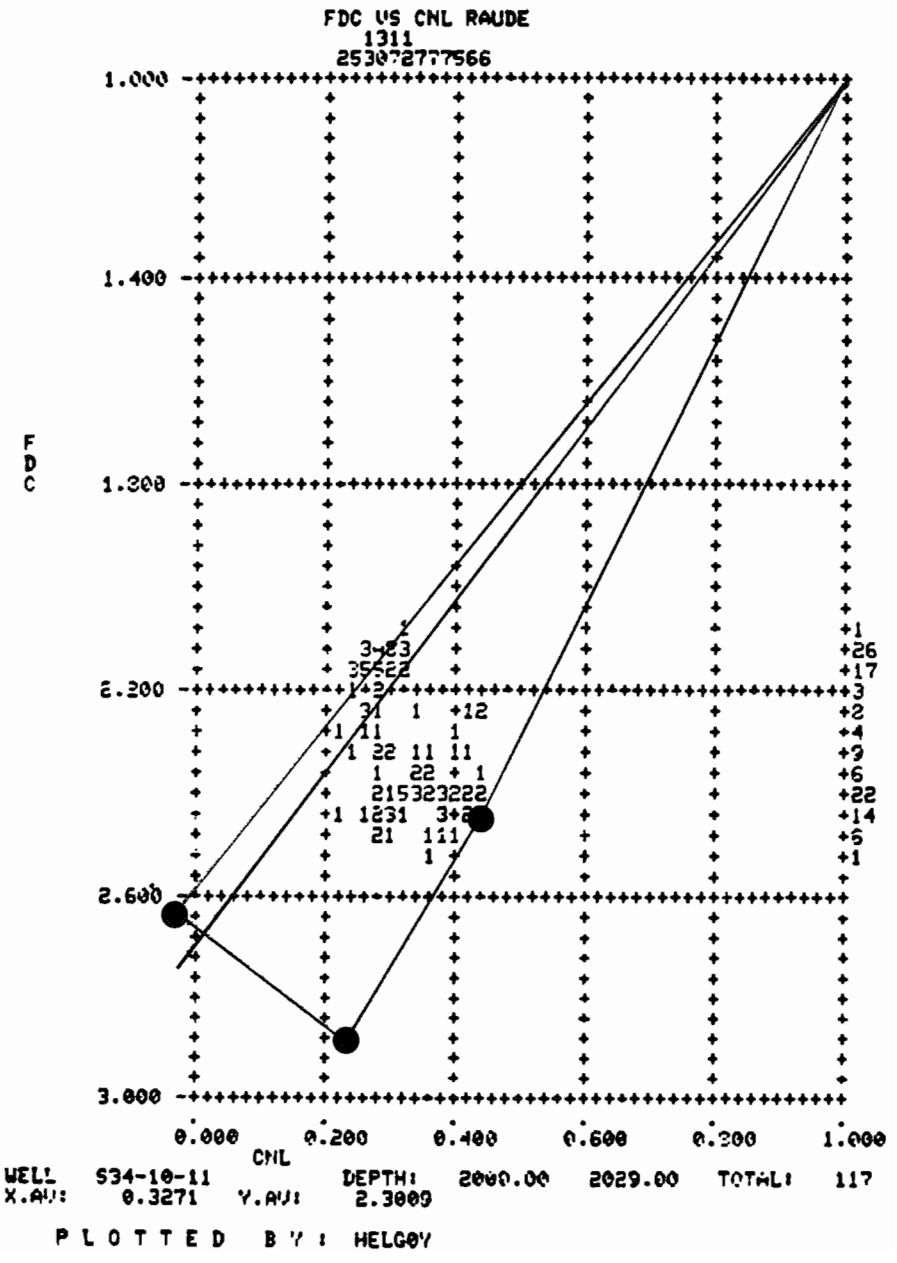

CNL RAUDE
50-
40-
30-
20-
.10-
0-
0.000
0.100
0.200
0.300
0.400
0.500
PHIN
WELL S34-10-11
X.AV: 0.3271
DEPTH: 2000.00 2029.00 TOTAL: 117
PLOTTED BY : HELGOY

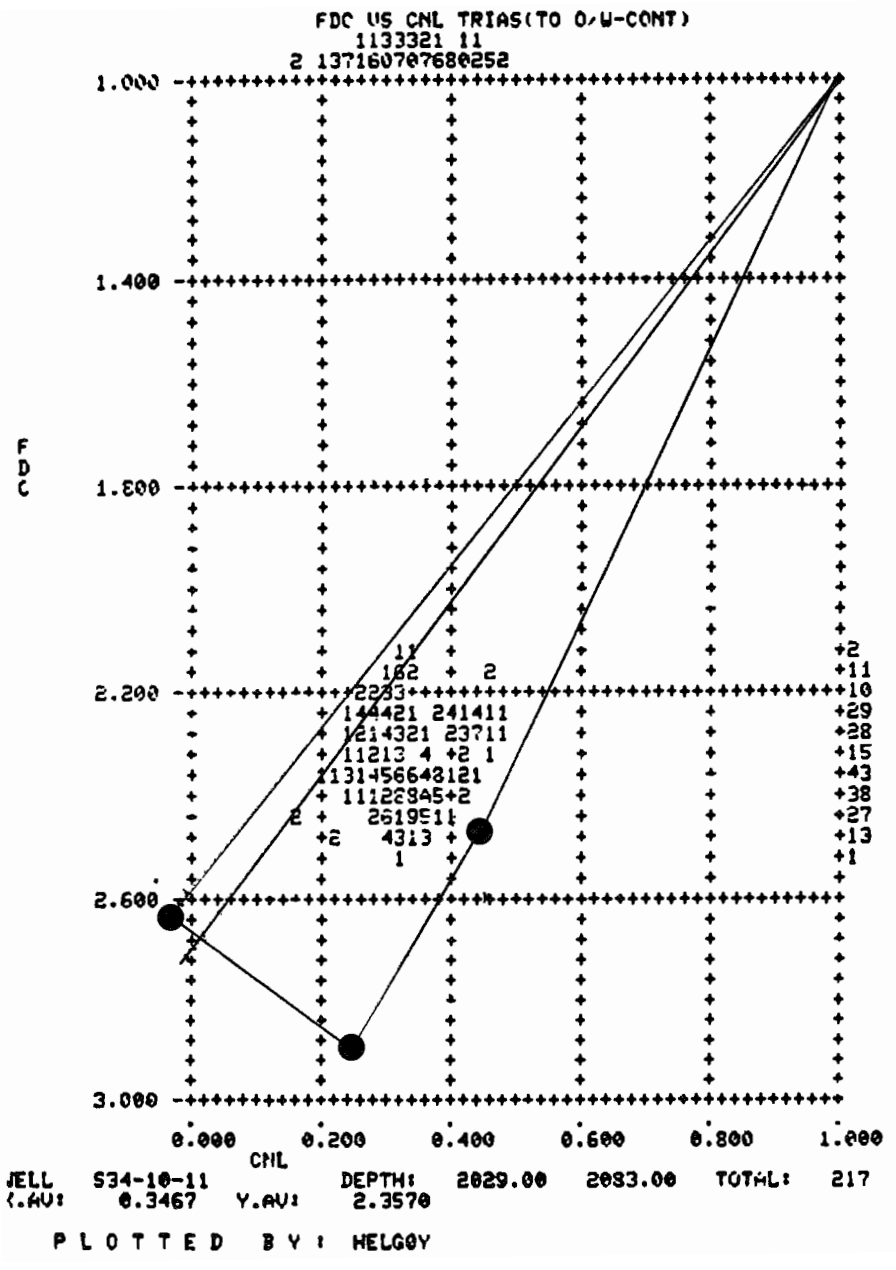

GR RAUDE
50-
40-
30-
20-
10-
0-
0.000
20.000
40.000
60.000
80.000
100.000
GR
WELL 534-10-11
DEPTH: 2000.00 2029.00
TOTAL: 116
AVG: 54.0365
PLOTTED BY: HELGOY

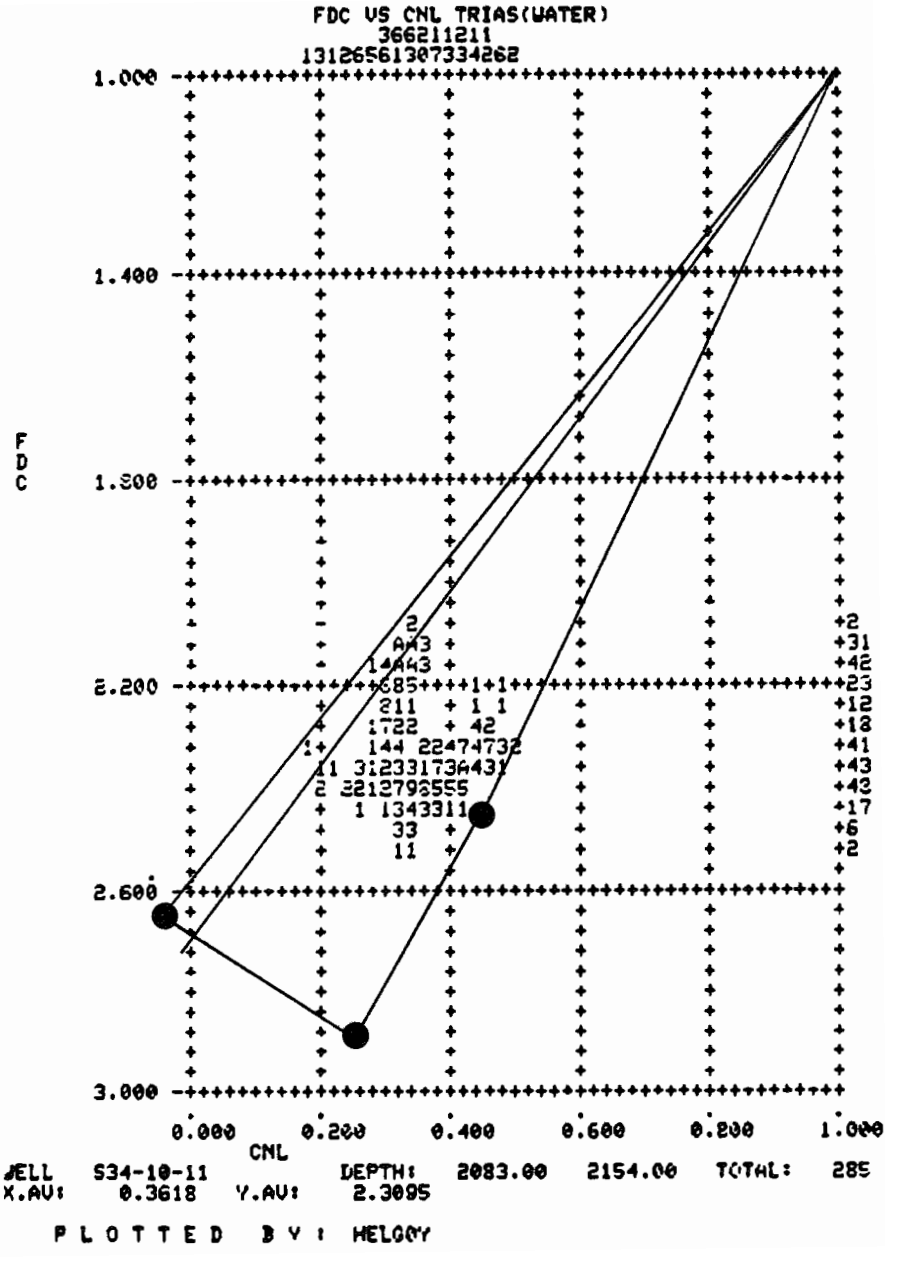

FDC VS CNL AMUNDSEN
1321
1 860211
1.000
1.400
1.800
2.200
2.600
3.000
FDC
0.000
0.200
0.400
0.600
0.800
1.000
CNL
WELL S34-10-11 DEPTH: 1868.00 1890.00 TOTAL: 89
X.AV: 0.4135 Y.AV: 2.2082
PLOTTED BY : HELGØY


FDC VS CNL NANSEN
11322111
221550103773211 1
1.000
1.400
1.800
2.200
2.600
3.000
FDC
0.000
0.200
0.400
0.600
0.800
1.000
CNL
WELL S34-10-11 DEPTH: 1890.00 1930.00 TOTAL: 161
X.AV: 0.3516 Y.AV: 2.1160
PLOTTED BY : HELGØY

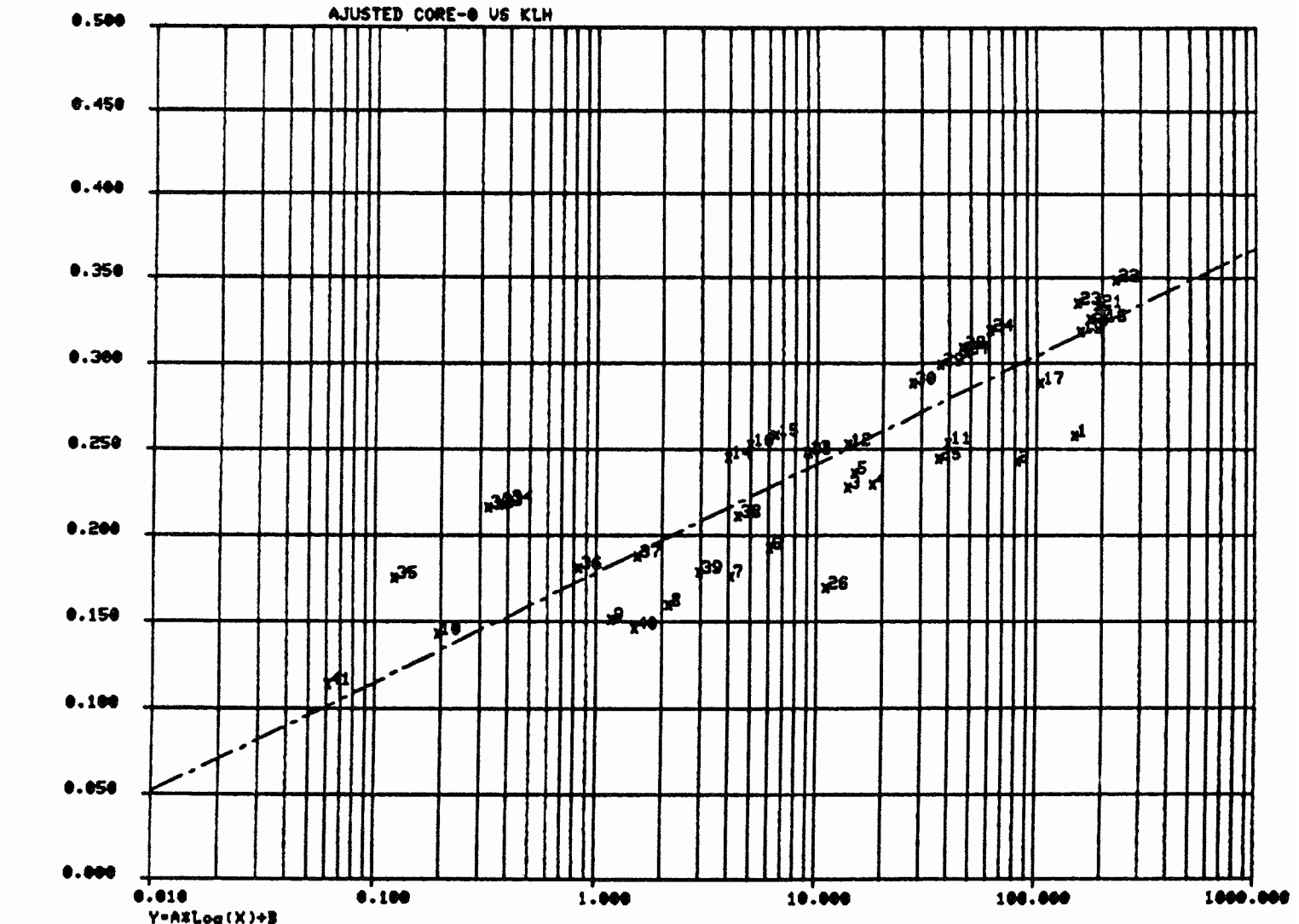

FDC VS CNL ERIKSEN
1.000
1.400
1.800
2.200
2.600
3.000
FDC
0.000
0.200
0.400
0.600
0.800
1.000
CNL
WELL 534-10-11 DEPTH: 1930.00 2000.00 TOTAL: 221
X.AV: 0.3391 Y.AV: 2.2291
PLOTTED BY: HELGOY


FDC VS CNL RAUDE
1.000
1.400
1.800
2.200
2.600
3.000
FDC
0.000
0.200
0.400
0.600
0.800
1.000
CNL
WELL 534-10-11 DEPTH: 2000.00 2029.00 TOTAL: 117
X.AV: 0.3271 Y.AV: 2.3009
PLOTTED BY: HELGOY


FDC VS CNL TRIAS(TO O/W-CONT)
1.000
1.400
1.800
2.200
2.600
3.000
FDC
0.000
0.200
0.400
0.600
0.800
1.000
CNL
WELL S34-10-11 DEPTH: 2029.00 2083.00 TOTAL: 217
X.AV: 0.3467 Y.AV: 2.3570
PLOTTED BY : HELGOY


FDC VS CNL TRIAS(WATER)
1.000
1.400
1.800
2.200
2.600
3.000
FDC
0.000
0.200
0.400
0.600
0.800
1.000
CNL
WELL S34-10-11 DEPTH: 2083.00 2154.00 TOTAL: 285
X.AV: 0.3618 Y.AV: 2.3095
PLOTTED BY : HELGOY

AMUNDSEN



Y=A*Log(X)+B

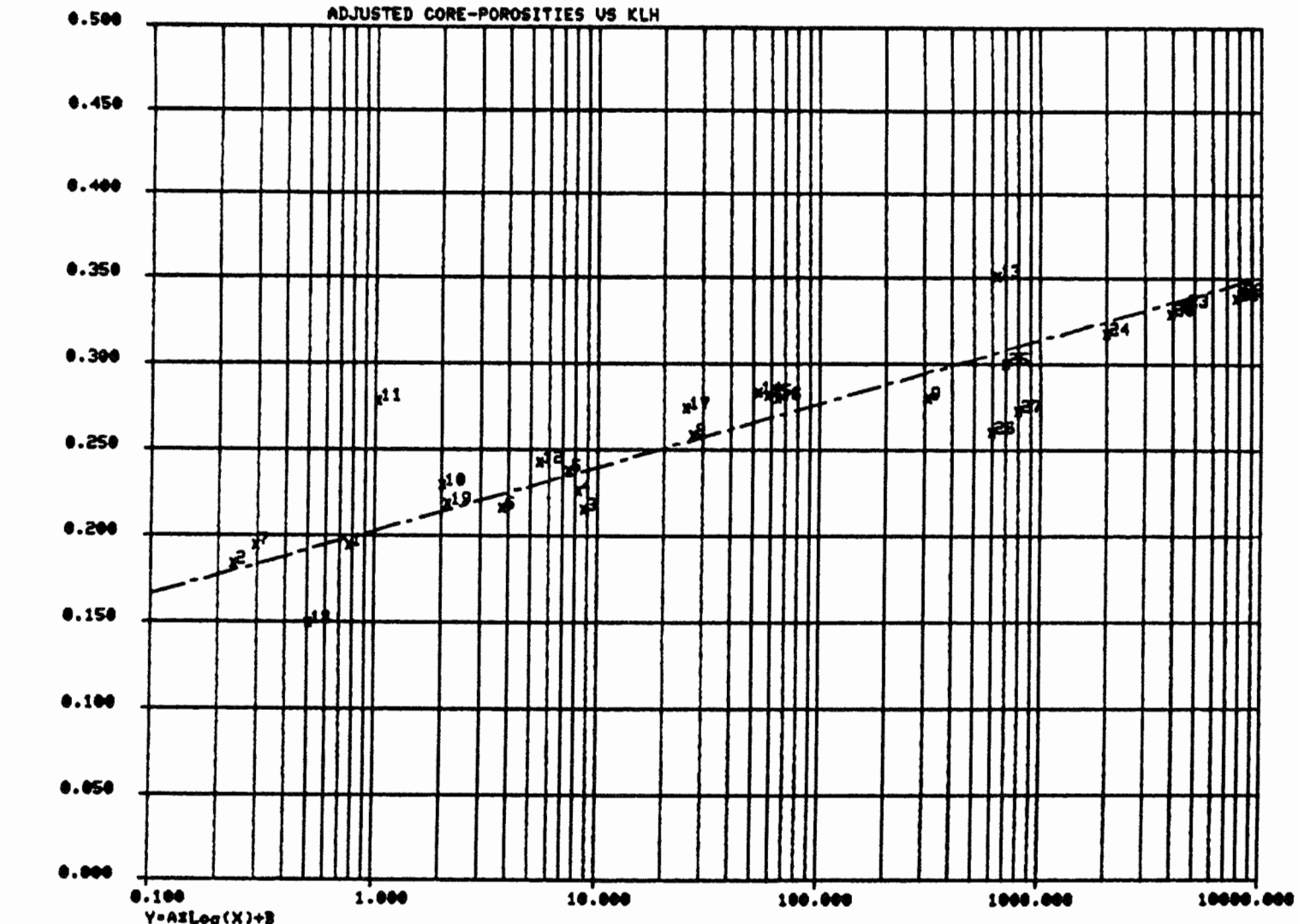
A= 0.06312601 B= 0.17911474 C2= 0.71068693

DO YOU WANT TO DELETE ANY POINTS?
NO

WELL 834-10-11 DEPTH: 1868.00 1890.00 TOTAL: 41 X.AV: 45.9123 Y.AV: 0.2404

P L O T T E D B Y : MELODY

NANSEN



Y=AxLog(X)+B

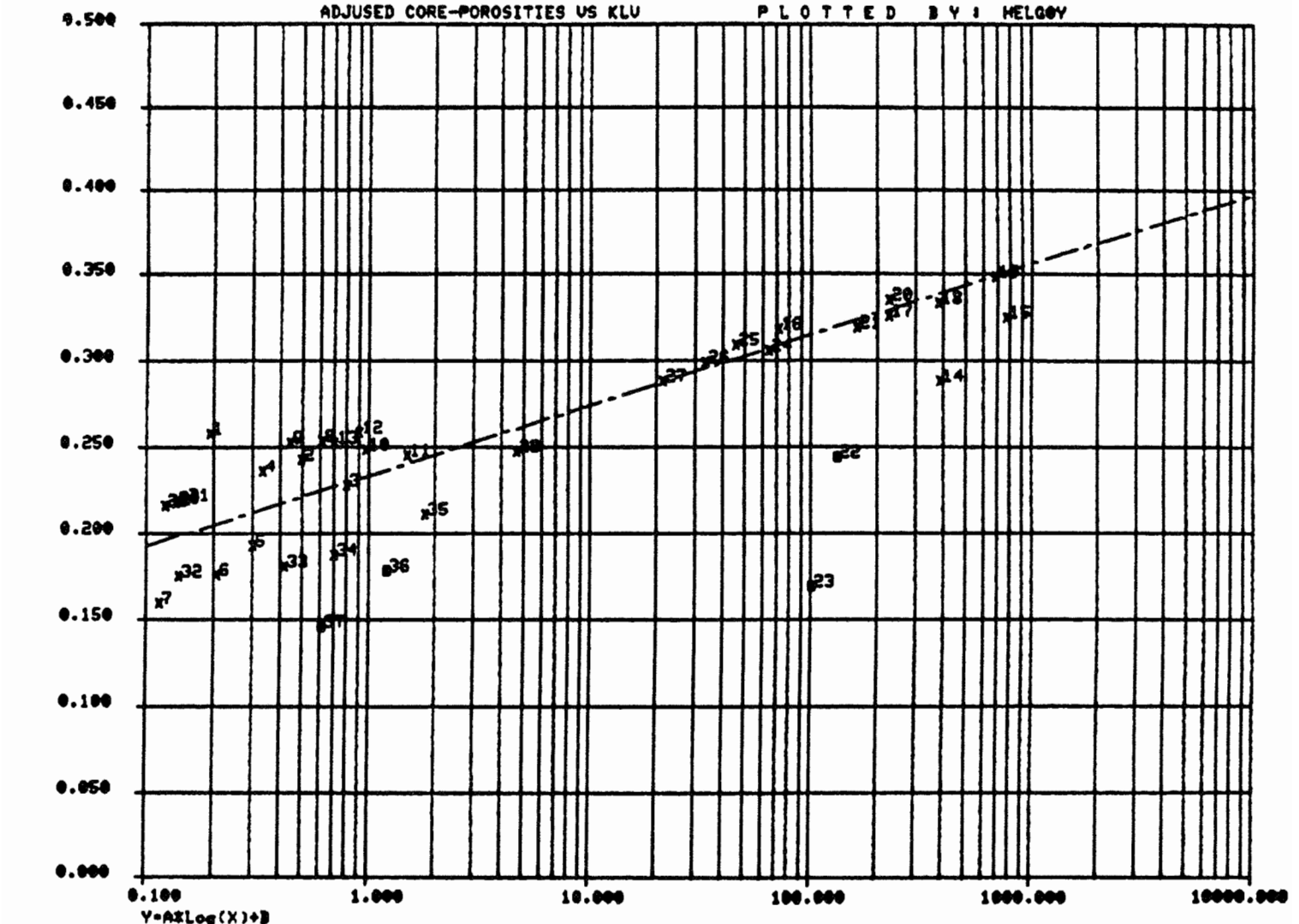
A= 0.03704361 B= 0.20363687 C2= 0.79926880

DO YOU WANT TO DELETE ANY POINTS?
NO

WELL 534-16-11 DEPTH: 1890.00 1930.00 TOTAL: 27 X.AV: 1094.4565 Y.AV: 0.2631
Z = DPOR , 0.05 , 0.50

P L O T T E D B Y : HELGØY

AMUNDSEN

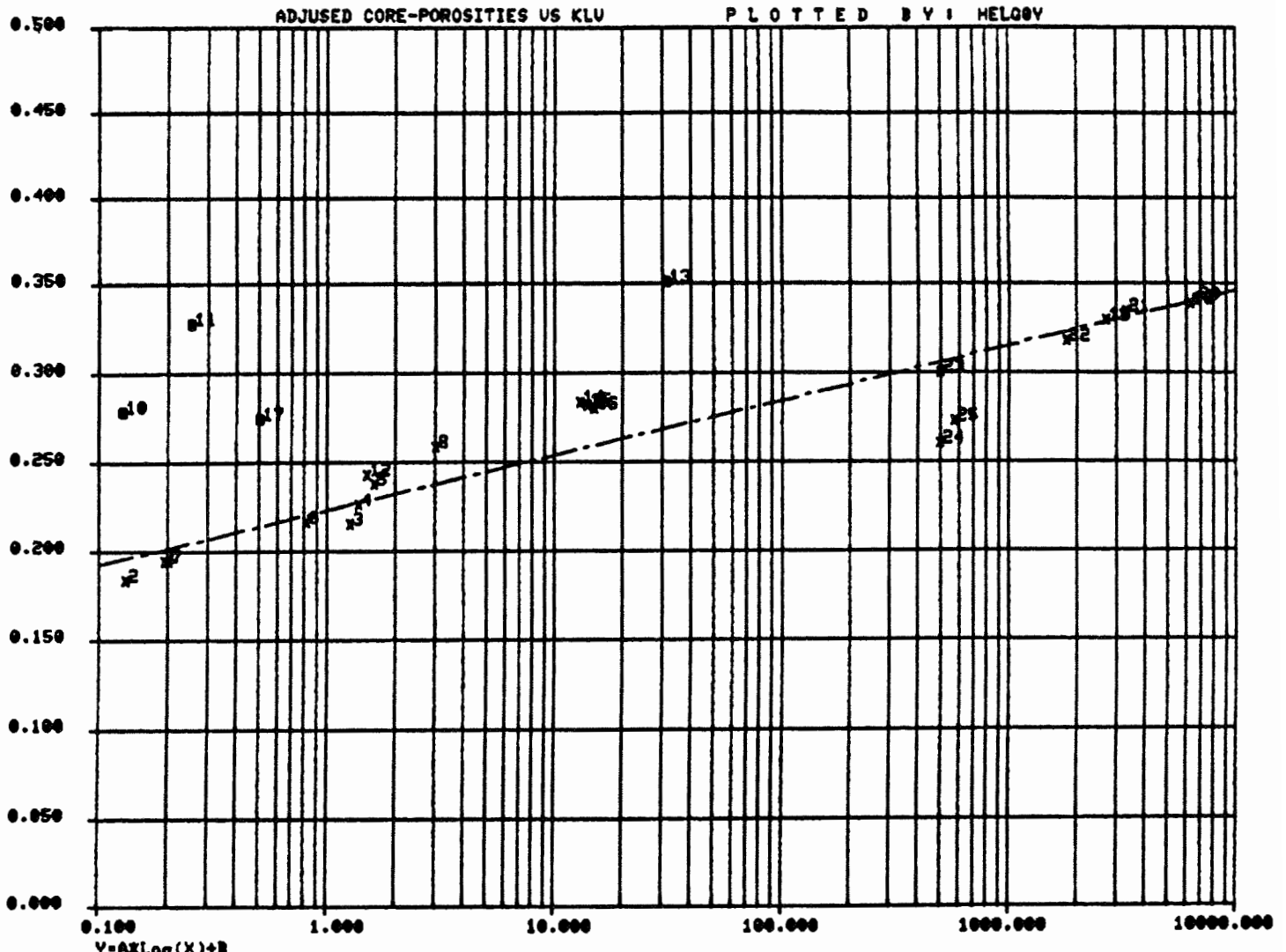


DO YOU WANT TO DELETE ANY POINTS?
NO

DO YOU WANT TO ADD ANY POINTS?
NO

WELL 34-10-11 DEPTH: 1868.00 1898.00 TOTAL: 33 X.AV: 93.6355 Y.AV: 0.2569
? = DPOR , 0.05 , 0.50

NANSEN

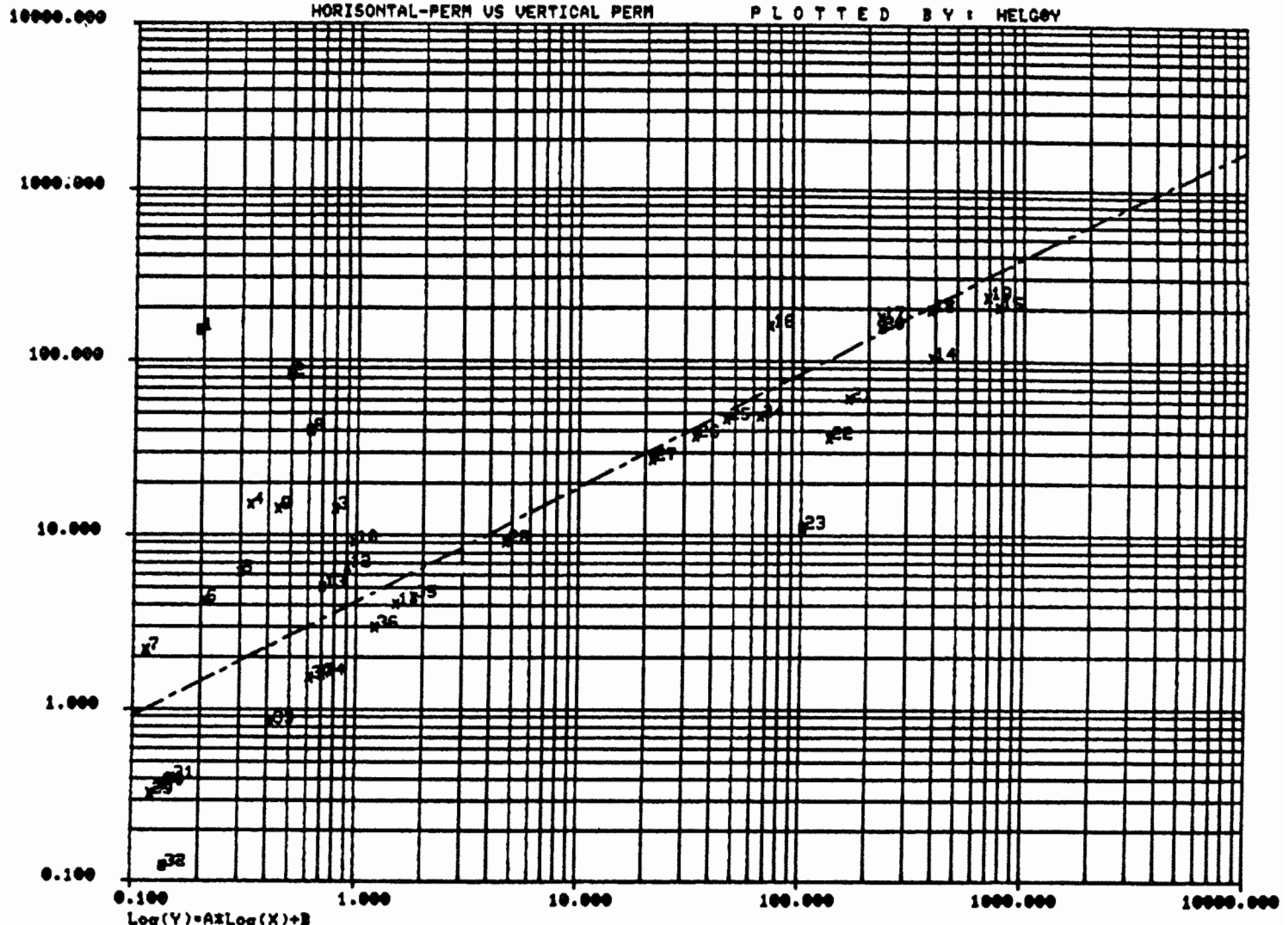


DO YOU WANT TO DELETE ANY POINTS?
NO

DO YOU WANT TO ADD ANY POINTS?
NO

WELL 534-10-11 DEPTH: 1890.00 1930.00 TOTAL: 21 X.AV: 1069.1940 Y.AV: 0.2667
Z = DPOR , 0.05 , 0.50

AMUNDSEN



Log(Y)=A*Log(X)+B

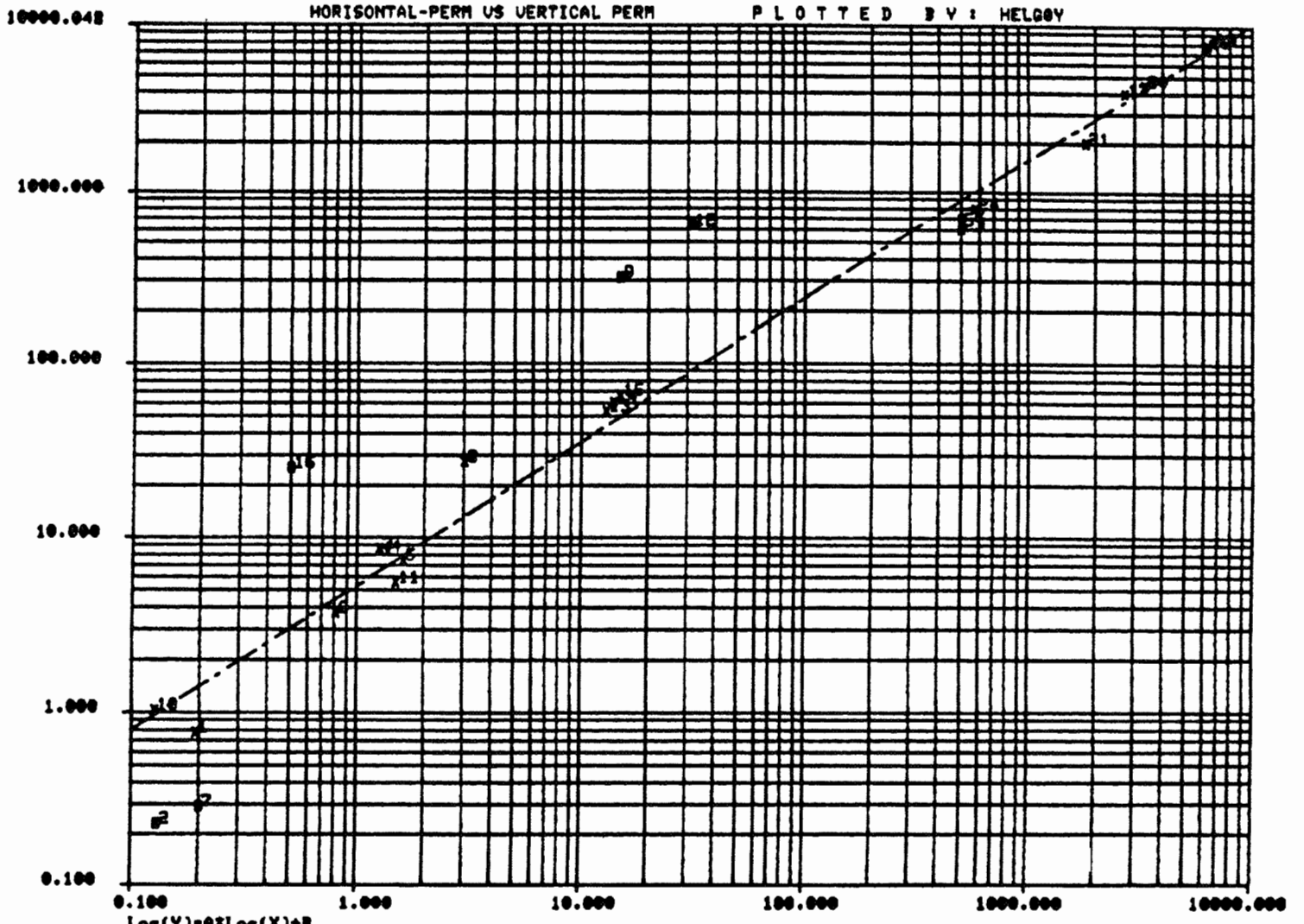
A= 0.65937439 B= 0.61490988 C2= 0.82192257

DO YOU WANT TO DELETE ANY POINTS?
NO

DO YOU WANT TO ADD ANY POINTS?
NO

WELL 934-10-11 DEPTH: 1868.00 1890.00 TOTAL: 32 X.AV: 100.7142 Y.AV: 49.3706
Z = DPOR , 0.05 , 0.50

NANSEN



Log(Y)=A*Log(X)+B

A= 0.82307434 B= 0.72672962 C2= 0.99069856

)O YOU WANT TO DELETE ANY POINTS?
)O

)O YOU WANT TO ADD ANY POINTS?
)O

ELL 34-10-11 DEPTH: 1890.00 1930.00 TOTAL: 19 X.AV: 1180.9484 Y.AV: 1563.7813
: = DPOR , 0.05 , 0.50

COMPUTERIZED LOG INTERPRETATION

PROGRAM: PGM0377 N-10/FORUS
VERSION: 2 (26FEB80) +
BY: C.O.PETTERSEN/PRO

WELL: 34-10-11
FIELD: DELTA-EAST
ENGINEER: HELGOY
DATE: 27-4-81

DEPTH INTERVAL: 1860 - 2154 (METER)
RKB: 25.0 (METER) SCALE: 1 : 200
PERMANENT DATUM: MSL
DEPTH REFERENCE: FDC/CNL

INPUT PARAMETERS:

DEPTH INTERVAL	RW	RMF	RSH	RHOBSH	PHINSH	DTSH	FORM.TEMP. (DEG. F)
1860 - 2154	0.073	0.105	1.50	2.35	0.45	120.0	160

GRAPHICAL LØG-PRESENTATION

WELL : 34-10-11 DEPTH INTERVALL :1860.00-2154.00 (METER)

ENGINEER :THY SCALE 1:200

STATOIL

DATE: 08.58.42 10 APRIL 1981

STRATIGRAPHY (REF. RKB)

STRATIGRAPHY (REF. RKB)	ACTUAL
TØP JURASSIC	1868 M
TØP DUNLIN GRØUP	1868 M
TØP STATFJØRD FM	1890 M
TØP TRIASSIC	2028 M
TØTAL DEPTH (TD)	2155 M

P E T R Ø P H Y S I C A L E V A L U A T I Ø N

INPUT PARAMETERS

RW=0.073 RMF=0.10 RSH=1.5 PHINSH=X.XX RHØHC=0.65 G/(CC**3)

M=2.15 N=2 A=0.62 RHØBSH=X.XX TEMP=160 (DEG. F)

PØRØSITY

	FDC	CNL
QUARTZ	2.65	-0.035
HEAVY MINERAL	2.90	0.25
FLUID	1.0	1.0

STATISTICS

FØRMATIØN	NET-PAY	AVR PHI	AVR SW
DUNLIN	14.25	23.9%	27.6%
STATFJØRD	86.25	28.0%	13.4%
TRIAS	46.0	23.4%	48.2% IN THE ØIL-SØNE

CURVE IDENTIFICATION — REMARKS — LØG

CAL = CALIPER (INCH) .... DLL-MSFL
BIT = BIT SIZE (INCH)
GR = GAMMA RAY (API UNITS) .... FDC/CNL
RHØB = BULK DENSITY (G/CM**3) .... FDC
PHIN = NEUTRØN PØRØSITY (L.S. UNITS) .... CNL
RXØ = MICRØSPHERICAL RESISTIVITY (ØHMM) ... MSFL
RLLS = DUAL LATERØLØG -SHALLØW (ØHMM) ...... DLL
RLLD = DUAL LATERØLØG -DEEP (ØHMM) .... DLL
DT = SØNIC (MICRØSEC/FEET) .... BHC
SAND = PØSITIVE SEPARATIØN ØN THE FDC/CNL ØVERLAY
SILT = NEGATIVE ------------ " ------------------
MUD = MUDCAKE (CALIPER - BITSIZE).......... DLL-MSFL

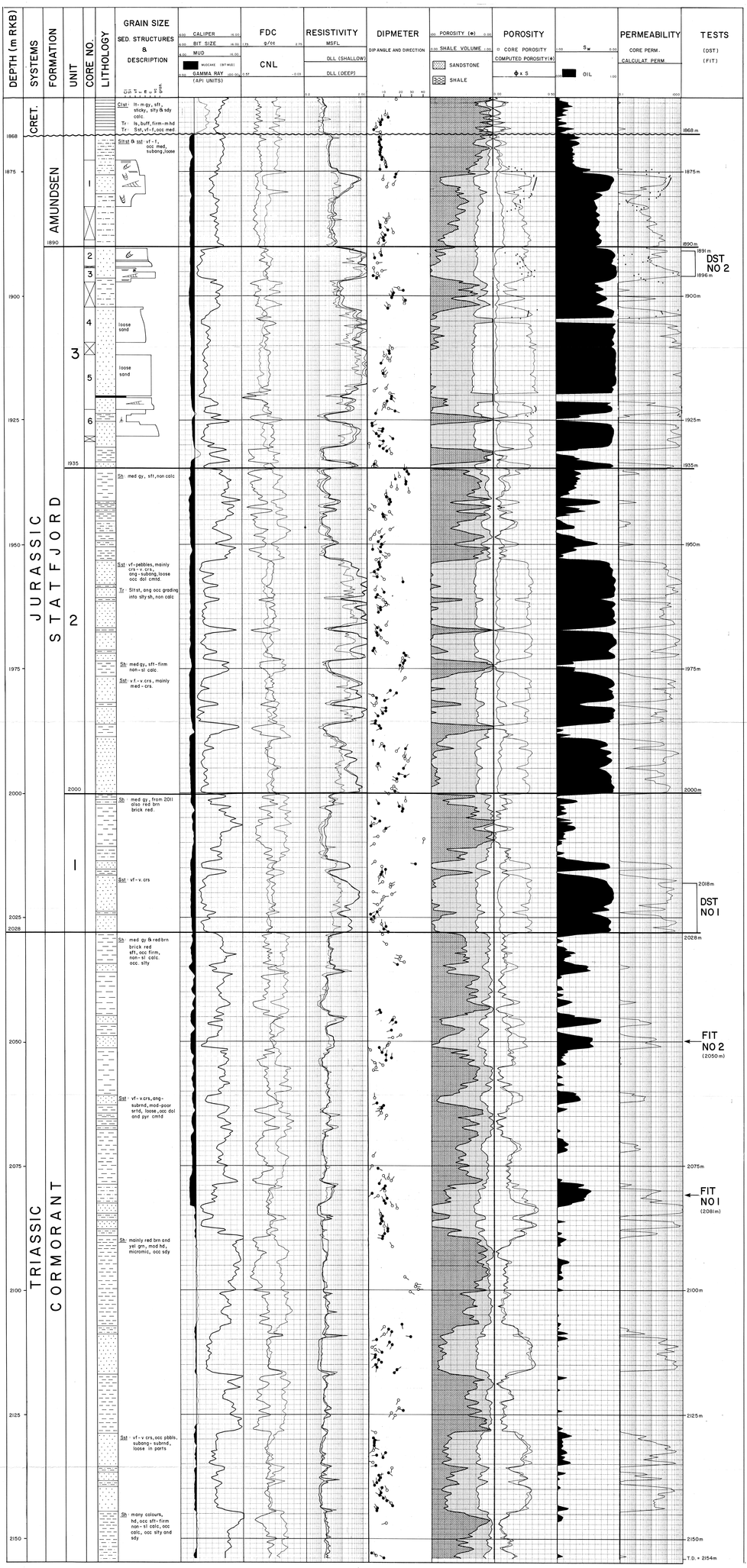
VSH = SHALE VØLUME (FRACTIØNS)......................COMPUTED
PHIF = FINAL PØRØSITY (FRACTIØNS)...................COMPUTED
DPØR = CØRE PØRØSITY DEPTH SHIFTED (%)..............FRØM CØRE
DRHØMA = GRAIN DENSITY DEPTH SHIFTED (G/CM**3)........NØT AVAIL
RHØMAA = APPARENT MATRIX DENSITY (G/CM**3)............NØT AVAIL
SW = WATER SATURATIØN (FRACTIØNS)..................COMPUTED
DKH = HØRIZ. PERMEAB. DEPTH SHIFETED (M-DARCY) ....FRØM CØRE
KLØGH = CALCULATED PERMEABILITY (K-\ RELATIØN)........COMPUTED

NØTE: HELIUM PØRØSITY (DPØR) AND GRAIN DENSITY (DRHØMA) FRØM CØRE ANALYSIS ARE DEPTH-CØRRECT. TØ MATCH FIN. PØR. (PHIF) AND APPARENT MATRIX DENSITY (RHØMAA) FRØM LØG EVALUATIØN. SAME DEPTH CØRRECTIØNS APPLIED TØ HØRISØNTAL PERMEABILITY DEPTH CØRRECTED VALUES ARE INTERPØLATED AND DØ THEREFØRE NØT MATCH ØRIGINAL CØRE DATA

PREPARED BY: T.HELGØY

RESERVOIR LOG

34/10-11



GEOLOGICAL SYMBOLS

SAND SANDSTONE · SHALE · DOLOMITE · TUFF
SILT SILTSTONE · LIMESTONE · MARL · ANHYDRITE/SALT
CLAY CLAYSTONE · CHALK · COAL LIGNITE · CHERT
UNCONFORMITY · FAULT

DST NO 1: (2018-2028)
OIL: 2542 STB/D, CHOKE 24/64"
GAS: 2.15 x 10^6 SCF/D
GOR: 846 SCF/STB
DENSITY OIL: 0.83

DST NO 2: (1891-1896)
OIL: 2500 STB/D, CHOKE 24/64"
GAS: 2.38 x 10^6 SCF/D
GOR: 952 SCF/STB
DENSITY OIL: 0.83

FIT NO 1: ~3000 cc oil SP.GR: 0.85
~7000 cc water

FIT NO 2: NO RECOVERY