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PETROPHYSICAL ANALYSIS

Well 1/9-6, Gamma Structure

Petrophysics Section
Reservoir Evaluation
January 1983

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Gradering

Oppdragsgiver

BLOCK 1/9 LICENSE 044

Undertittel

Tittel

# PETROPHYSICAL ANALYSIS

## Well 1/9-6, Gamma Structure

Petrophysics Section
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January 1983


Utarbeidet

DCR Don Ross

Godkjent

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7-2-83

CONTENTS

## Foreword

This report deals with the petrophysical data presently available from well 1/9-6 with reference also to the five wells previously drilled on the block. Several special core analysis procedures have been ordered, but are not available as yet. When available, they may serve to modify these results.

## History

Well 1/9-1, the first well on the block, was drilled on the Alpha structure which lies south of the present well. It discovered hydrocarbons in both the Ekofisk and Tor. Well 1/9-2 was a dry hole with some show in the Ekofisk, but hydrocarbons were confirmed in Ekofisk in well 1/9-3.

Well 1/9-4, discovered hydrocarbons on this, the Gamma structure. Well 1/9-5 was dry with no show.

Well 1/9-6 was drilled by Phillips Petroleum Norway on behalf of Statoil (operator of PL 044). It confirmed hydrocarbons on the Gamma structure in both the Ekofisk and Tor formations.

It should be noted that this was a directionally drilled well. All depths used in the report are in meters of measured (deviated) depths.

# 1 PETROPHYSICAL RESULTS

## 1.1 Log Analysis

Log analysis results indicate producible hydrocarbons in both units of Ekofisk and Tor.

Briefly results are as follows:

Table 1.1 Net Ratios

| Zone | Depth | Gross | Net Sand | N/G | Net Pay | N/G |
|---|---|---|---|---|---|---|
| Ekofisk I | 3411-3465 | 54 | 46 | .85 | 46 | .85 |
| Ekofisk II | 3465-3516 | 50.75 | 9.5 | .19 | 4.75 | .09 |
| Tor I | 3516.25-3600 | 83.75 | 82.75 | .99 | 82.75 | .99 |
| Tor II | 3600.25-3781 | 180.75 | 73 | .40 | 68.25 | .38 |

Table 1.1 Reservoir Parameters

| Zone | Net Pay | Ø | Sw | KH | KV |
|---|---|---|---|---|---|
| Ekofisk I | 46 | .304 | .198 | .418 | .357 |
| Ekofisk II | 4.75 | .236 | .46 | .125 | .097 |
| Tor I | 82.75 | .263 | .099 | 1.675 | 1.31 |
| Tor II | 68.25 | .201 | .271 | .316 | .279 |

Note: Porosities and water saturations are arithmetic averages and permeabilities geometric averages.

These results fall within the following cutoff limits.

- less than 15% shale volume
- less than 50% water saturation
- greater than 20% porosity (Ekofisk)
- greater than 15% porosity (Tor)

The results can be seen in more detail in the Statistics/Plots section.

| | | |
|---|---|---|
| Ekofisk | Statistics, 3.2.1 | Graphics, 3.3.1 |
| Tor | Statistics, 4.2.1 | Graphics, 4.3.1 |

For Ekofisk it can be seen on plot 3.6.1 that water saturations are below the cutoff of 50% throughout the section except for those areas where porosity is below the 20% cutoff. It is thus concluded that all of Ekofisk with sufficient porosity/permeability to produce, would produce water free.

On plot 4.6.1 it can be seen that water saturation in the Tor is quite low in the upper part with a gentle increase as you go deeper. Water saturations reach 100% below 3676 m, but are the result of porosities below the 15% cutoff.

Considering water saturation and porosity, it appears that at 3748 m we encounter the first zone that would produce water. The porous zone at 3772 m is the first porous zone of 100% water. It produced formation water on drill stem test No. 1.

## 1.2 Routine Core Analysis

Cores were recovered from 3416 to 3616 m. A comparison of log porosity and permeabilities is shown below.

Table 1.2 Log/Core Analysis Comparison

| Zone | Ø Log | Ø Core | KH Log | KH Core | KV Log | KV Core |
|---|---|---|---|---|---|---|
| Ekofisk | .203 | .222 | .075 | .061 | .052 | .051 |
| Tor | .24 | .251 | .867 | .635 | .693 | .651 |

Comparison of porosities is reasonably good with core porosity, as to be expected, higher than log porosity.

Permeabilities are quite close in some cases and with an acceptable comparison throughout.

Porosities are averaged arithmetically and permeabilities geometrically. Log data was averaged only over points having core data.

## 1.3 Special Core Analysis

A number of special core analysis procedures are planned for 1/9-6, but have not been completed as yet. Among these are capillary pressure, relative permeabilities and formation factors.

Core analysis from well 1/9-4, also on the Gamma structure, gave the following m, a and n factors:

Table 1.3 Formation Factors/Saturation Exponent from Core Data

| Zone | m | m (w/overburden) | a | n |
|---|---|---|---|---|
| Ekofisk | 2.02 | 2.11 | 1.0 | 2.08 |
| Tor | 1.85 | 1.98 | 1.0 | 1.9 |

For the analysis of Ekofisk m = 2.1, a = 1.0 and n = 2.0 were used. For Tor m = 2.0, a = 1.0 and n = 2.0 were used.

When the core data is available from this well, these values will be evaluated It may be deemed worthwhile to change these values based on the core results.

## 1.4 Drillstem Tests

Three drillstem tests were run over the Tor. One test was run in the Ekofisk.

The test results are given in table 1.4.

Test No. 1 was in the only porous, 100% water saturated zone. It produced only water as could be expected.

Tests No. 2, 3 and 4 produced hydrocarbons with no apparent formation water. These tests support the low water saturations from log analysis.

Since the report on the drillstem tests has not been completed, it is not possible to compare test permeabilities with log permeabilities.

Well 1/9-6

| DST | Perf Interval | Test Interval | Sw | Ø | KH | KV | Recovery |
|---|---|---|---|---|---|---|---|
| 1 | 3772-77 | 3772-77 | 1.0 | .20 | .336 | .361 | Water. Low production rate. Estimated total production: 2 $m^3$ water. |
| 2 | 3636-55 | 3632-70 | .27 | .19 | .248 | .222 | 0.530 $10^6$ $Sm^3$gas/day, 475 $Sm^3$oil/day 32/64" CK. |
| 3 | 3523.5-51<br>3560-69<br>3578.5-87.5 | 3516-3601 | .11 | .26 | 1.556 | 1.223 | 0.850 $10^6$ $Sm^3$gas/day, 700 $Sm^3$oil/day 44/64" CK |
| 4 | 3417-26<br>3444-59.5 | 3411-30<br>3435-65 | .21<br>.24 | .31<br>.28 | .446<br>.298 | .383<br>.248 | 0.850 $10^6$ $Sm^3$gas/day, 605 $Sm^3$ oil/day 56/64" CK. |

Note: Test report not available for comparison of test permeabilities as yet.

Table 1.4 Drillstem Tests

## 1.5 Water Saturation from Capillary Pressure

A water saturation curve was derived from log data in 1/9-6 and capillary pressure measurements in 1/9-4.

Agreement with log derived water saturation is remarkable in Ekofisk. As such, it would support these saturations.

In the Tor section there is a general agreement but in most zones capillary pressure derived water saturation is lower than log derived water saturation. Permeability derived from logs, KLOGH, is higher than core permeability. This higher permeability will result in a water saturation, SWPC, that is too low. Thus the difference in water saturations can partly be a result of permeability differences.

Judged on the basis of capillary pressure derived water saturation, log water saturations would be correct or perhaps, in Tor, too high.

## 1.6 Conclusions

Log analysis results are supported by other reservoir measurements.

Ekofisk would produce water free throughout the section. Areas of high water saturation are controlled by porosity/permeability and would produce no fluid.

Tor would produce water free down to 3717 m. The next lowest zone with sufficient porosity/permeability to give up fluid, is 3746.5 - 3748.5 m. This would produce water. Thus a hydrocarbon-water contact lies somewhere between 3717 m and 3746 m. This corresponds to -3347.35 m and -3374.61 m subsea.

## PETROPHYSICAL PROCEDURES

### 2.1 Water Saturation

Water saturation was derived with the North Sea equation as shown.

$$\frac{1}{\sqrt{Rt}} = \left[ \frac{VCI^{c}}{RCI} + \frac{\phi^{m/2}}{\sqrt{a\ Rw}} \right] Sw^{m/2}$$

The various inputs to this equation are discussed separately below.

### 2.2 Data Correction

The deep laterolog, LLD, was used for Rt in the hydrocarbon zone and the induction curve, ILD, in the water zone. LLD was corrected by use of the Schlumberger tornado chart. ILD was used as recorded.

The neutron curve, PHIN, was adjusted with +.03 pu and the density with -.035 gm/cc. These adjustments were made to achieve a more reasonable porosity match with core analysis. In addition the neutron was corrected environmentally for temperature and pressure.

### 2.3 Rw

Resistivity of produced water in Block 1/9 has ranged from .045 to .017 at formation temperature. In the water test on this well a measured value of .025 at formation temperature was found. Later chemical analysis indicated a lower value. It was decided to use the .025 value, however.

### 2.4 Matrix Values

Matrix values used were those previously established in previous wells for Block 1/9. These and other parameters are shown on Plot 3.5.1 and 4.5.1.

## 2.5. Shale Volume

Shale volume was determined with the gamma ray and litho-density - neutron plot as indicators. For the gamma ray 7 API units were used for 0 shale volume and 70 API units for 100% shale volume.

For the shale volume from the lithodensity-neutron, shale density was chosen as 2.37 and neutron porosity as .36.

## 2.6 Porosity

Porosity was derived with a two mineral solution using limestone and dolomite. The neutron and litho-density inputs were first corrected for shale using the minimum shale value.

## 2.7 Formation Factor/Saturation Exponent

Values were taken from previous analysis. The formation factor exponent with overburden pressure was determined on core plugs from well 1/9-4 as 2.11 for Ekofisk and 1.98 for Tor. Values used were Ekofisk 2.1 and Tor 2.0. The saturation exponent measurements ranged from 2.01 to 2.14 in Ekofisk and 1.82 to 1.96 in Tor. It was decided to use a value of 2.0 throughout.

## 2.8 Permeability

The vertical and horizontal permeabilities, KLOGV, KLOGH, were constructed from log data with relationships previously established for the Gamma structure. These were established from the plot of log porosity vs. the depth corrected vertical and horizontal permeabilities, DKLV, DKLH. These were derived from core data from well 1/9-4 and are shown below.

Ekofisk:

log KLOGH = -2.6867 + 7.5767 PHIF
log KLOGV = -2.9364 + 8.1718 PHIF

Tor:

log KLOGH = -2.8090 + 11.5575 PHIF
log KLOGV = -2.7025 + 10.7472 PHIF

## 2.9 Water Saturation from Capillary Pressure

Water saturations were derived from capillary pressure. Procedure was to generate a J factor from core data, DKLH, DPORHE, and the applied pressure, PC. This J factor was then plotted against the water saturation resulting from the corresponding capillary pressure, PC. A relationship of J to water saturation, Sw, was thus formed.

The values of J and Sw were put into a calculator to establish a power fit between the two. By this manner a mathematical relationship of J to Sw was formed. These values can be seen on page 3.14.1 and 4.14.1.

A continuous J factor curve was then constructed from log data, KLOGH, PHIF, together with the height above free water as the determinate of PC.

The relationship established for J vs Sw was then used on the J curve from log data to establish a water saturation, SWPC, in the well.

Several relationships were used to construct this curve based on permeability ranges. The plugs used are shown below. As mentioned previously, these plugs are from 1/9-4 as results from 1/9-6 are not yet available.

Ekofisk:

| K Range | Depth | DKLH | DPORHE | Min. Sw |
|---|---|---|---|---|
| 100-1 | 3136 | 1.3 | .373 | .053 |
| 1 - .2 | 3129 | .94 | .351 | .179 |
| | 3166.5 | .43 | .316 | .248 |
| .2 - 0 | 3193.25 | .1 | .234 | .253 |

Tor:

| K Range | Depth | DKLH | DPORHE | Min. Sw |
|---|---|---|---|---|
| 100 - .4 | 3260.75 | 2.1 | .293 | .039 |
| | 3227.25 | 2.0 | .318 | .04 |
| | 3243 | 1.1 | .251 | .042 |
| | 3229.25 | .54 | .224 | .051 |
| | 3257.25 | .44 | .206 | .055 |
| .4 - .2 | 3240.5 | .26 | .167 | .097 |

.2 - 0 (used data from Ekofisk)

A plot of these groupings is shown on plots 3.14.2 and 4.14.2.

## 2.10 Cutoffs

Cutoffs used were established on the previous wells. The goal was to achieve uniform field wide values that were applicable with reasonable accuracy to each individual well/zone.

From test results and use of various cutoffs it appears these cutoffs are reasonable. Sensitivity plots 3.16.1, Ekofisk, and 4.16.1, Tor, seem to agree reasonably with these cutoffs.

# GRAPHICAL LOG-PRESENTATION

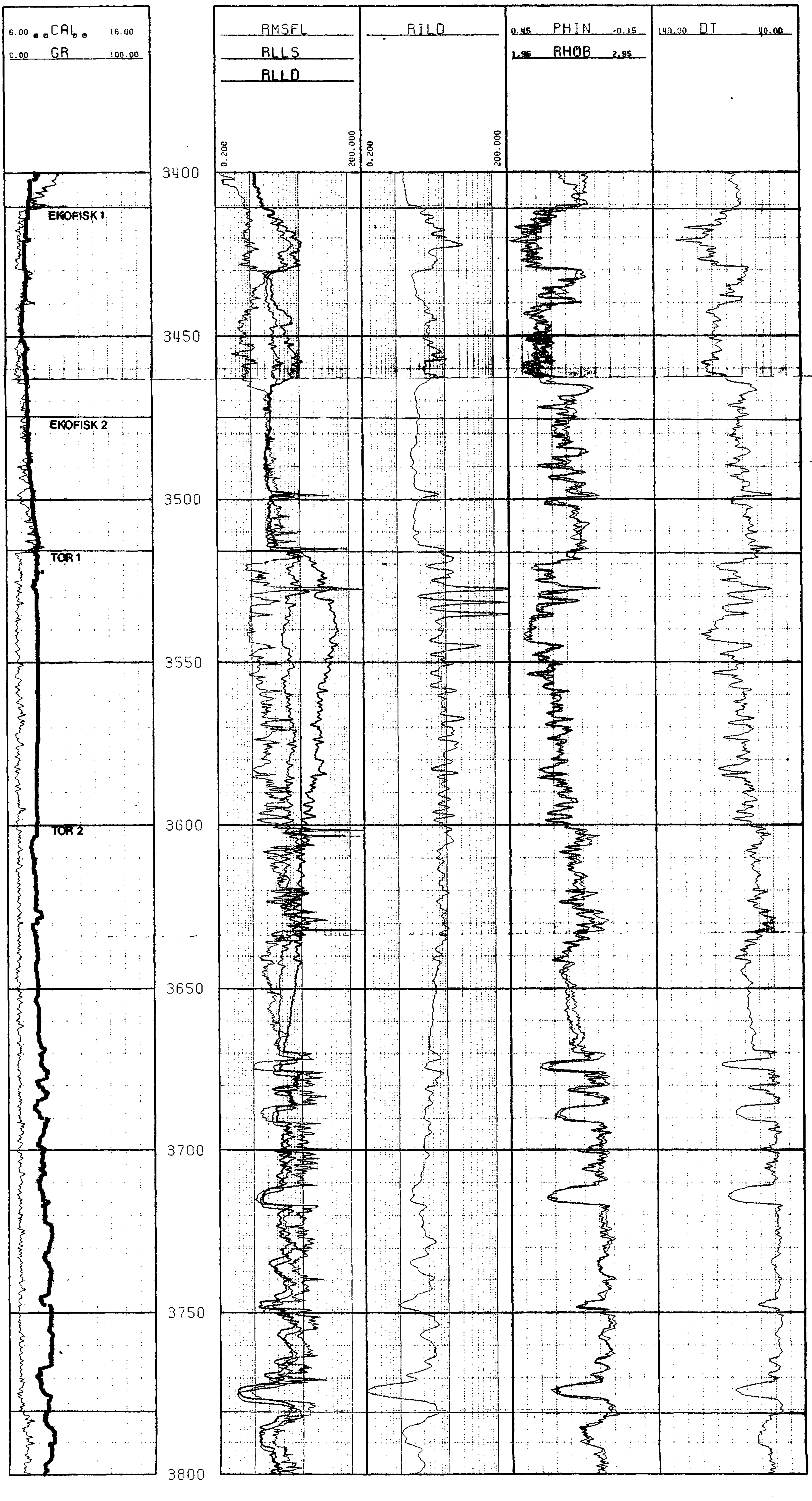
WELL : 1-9-6  DEPTH INTERVALL : 3400.00-3800.00 (METER)

ENGINEER : DCR  SCALE 1:1000

DATE: 14.40.51  1 FEBRUAR 1983

STATOIL

PLOT AV ORIGINAL-LOGGER



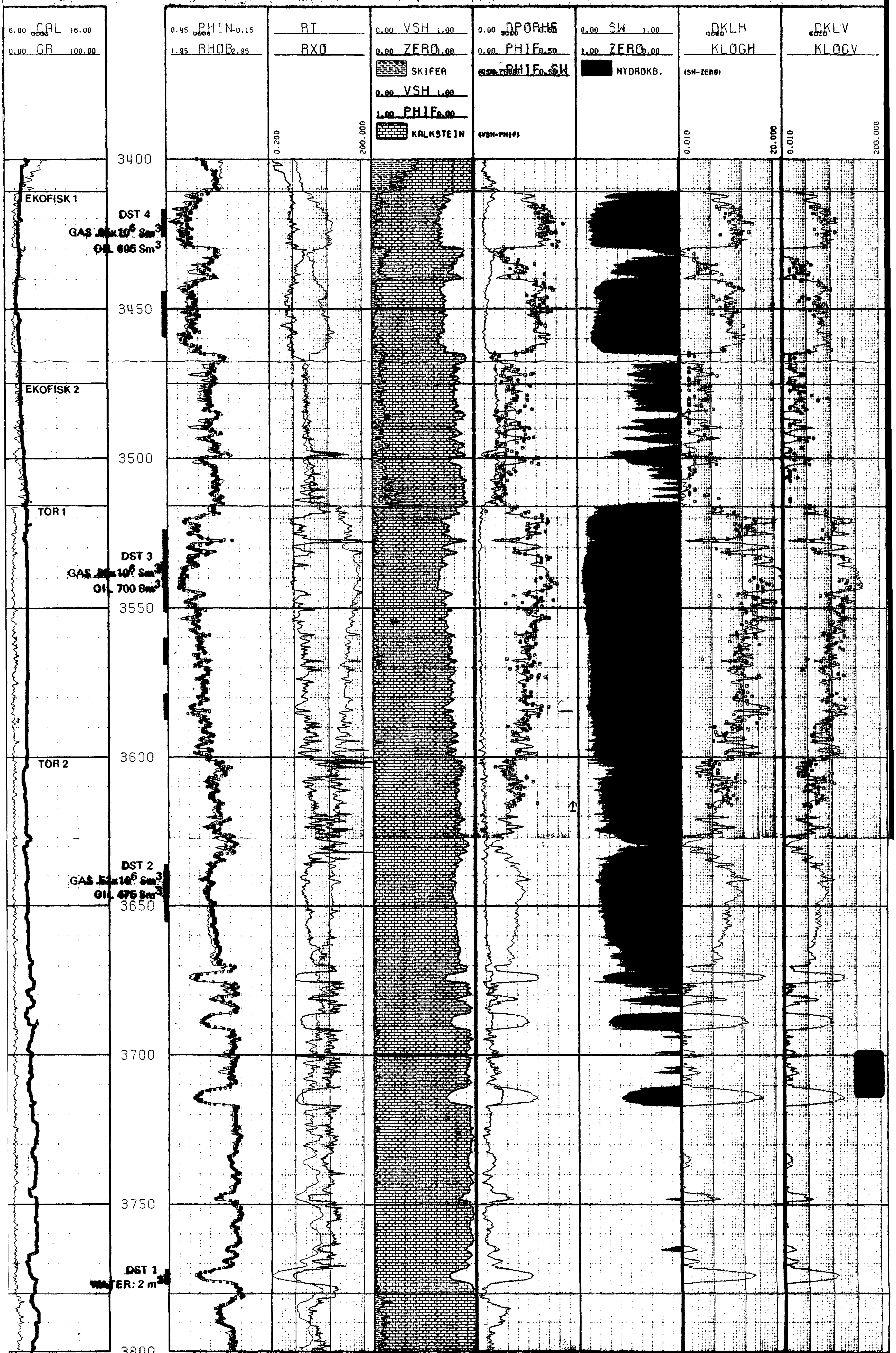
# GRAPHICAL LOG-PRESENTATION

WELL : 1-9-6 DEPTH INTERVALL : 3400.00-3800.00 (METER)

ENGINEER : DCR SCALE 1:1000

DATE: 14.24.19 1 FEBRUAR 1983

STATOIL



| KLOGH | KLOGV |
|---|---|
| .273 | .225 |
| .418 | .357 |
| .418 | .357 |

```
S T A T I S T I C S
**********************

FIELD: . . . . . . . . . . .          TOMMILITEN
WELL:  . . . . . . . . . . .               1-9-6
ENGINEER:  . . . . . . . . . DCR
DATE:  . . . . . .              9.48   13 JAN 1983

DEPTH INTERVAL:  . . .  3411.00 TO  3465.00
APPLIED CUTOFFS:
.                 VSH:  GREATER THAN       0.15
.                PHIF:     LESS THAN       0.20
.                  SU:  GREATER THAN       0.50

T O T A L    D E P T H
*********************************************
THICKNESS: . . . . . . . . . .          54.000
AVERAGE  . . . 'PHIF'  . . .             0.280
AVERAGE  . . . 'VSHALE'  . .             0.054
AVERAGE  . . . 'SW'  . . . .             0.270
W.AVERAGE  . . 'SW' * 'PHIF'             0.229
AVERAGE  . . . 'SH'  . . . .             0.730
VOID VOLUME: . . . ('PHIF').            15.139
HC VOID VOLUME . . ('SH'*) .            11.673
RES HC VOID VOLUME ('SHR'*).             1.341
MOV HC VOID VOLUME . . . . .            10.332
*********************************************

N E T    P A Y
*********************************************
THICKNESS: . . . . . . . . . .          46.000
AVERAGE  . . . 'PHIF'  . . .             0.304
AVERAGE  . . . 'VSHALE'  . .             0.041
AVERAGE  . . . 'SW'  . . . .             0.207
W.AVERAGE  . . 'SW' * 'PHIF'             0.198
AVERAGE  . . . 'SH'  . . . .             0.793
VOID VOLUME: . . . ('PHIF').            13.998
HC VOID VOLUME . . ('SH'*) .            11.221
RES HC VOID VOLUME ('SHR'*).             1.341
MOV HC VOID VOLUME . . . . .             9.880
*********************************************

N E T    S A N D
*********************************************
THICKNESS: . . . . . . . . . .          46.000
AVERAGE  . . . 'PHIF'  . . .             0.304
AVERAGE  . . . 'VSHALE'  . .             0.041
AVERAGE  . . . 'SW'  . . . .             0.207
W.AVERAGE  . . 'SW' * 'PHIF'             0.198
AVERAGE  . . . 'SH'  . . . .             0.793
VOID VOLUME: . . . ('PHIF').            13.998
HC VOID VOLUME . . ('SH'*) .            11.221
RES HC VOID VOLUME ('SHR'*).             1.341
MOV HC VOID VOLUME . . . . .             9.880
*********************************************

N E T / G R O S S    R A T I O S
*********************************************

HNETPAY /HGROSS SAND =  0.85185
HNETSAND/HGROSS SAND =  0.85185
HNETPAY /HNETSAND    =  1.00000
*********************************************
```

| | KLOGH | KLOGV |
|---|---|---|
| TOTAL DEPTH | .030 | .021 |
| NET PAY | .125 | .097 |
| NET SAND | .101 | .077 |

```
 S T A T I S T I C S
*********************

FIELD: . . . . . . . . . . .              TOMMILITEN
WELL:  . . . . . . . . . . .                   1-9-6
ENGINEER:  . . . . . . . . . DCR
DATE:  . . . . .                 9.56   13 JAN 1983

DEPTH INTERVAL:  . . .  3465.25 TO  3516.00
APPLIED CUTOFFS:
.                 USH:  GREATER THAN       0.15
.                PHIF:     LESS THAN       0.20
.                  SU:  GREATER THAN       0.50

 T O T A L   D E P T H
*******************************************
THICKNESS: . . . . . . . . .        50.750
AVERAGE  . . . 'PHIF'  . . .         0.154
AVERAGE  . . . 'VSHALE'  . .         0.114
AVERAGE  . . . 'SW'  . . . .         0.705
W.AVERAGE  . . 'SW' * 'PHIF'         0.659
AVERAGE  . . . 'SH'  . . . .         0.295
VOID VOLUME: . . . ('PHIF').         7.840
HC VOID VOLUME . . ('SH'*) .         2.678
RES HC VOID VOLUME ('SHR'*).         0.756
MOV HC VOID VOLUME . . . . .         1.920
*******************************************

 N E T   P A Y
*******************************************
THICKNESS: . . . . . . . . .         4.750
AVERAGE  . . . 'PHIF'  . . .         0.236
AVERAGE  . . . 'VSHALE'  . .         0.053
AVERAGE  . . . 'SW'  . . . .         0.460
W.AVERAGE  . . 'SW' * 'PHIF'         0.460
AVERAGE  . . . 'SH'  . . . .         0.540
VOID VOLUME: . . . ('PHIF').         1.119
HC VOID VOLUME . . ('SH'*) .         0.604
RES HC VOID VOLUME ('SHR'*).         0.296
MOV HC VOID VOLUME . . . . .         0.308
*******************************************

 N E T   S A N D
*******************************************
THICKNESS: . . . . . . . . .         9.500
AVERAGE  . . . 'PHIF'  . . .         0.224
AVERAGE  . . . 'VSHALE'  . .         0.066
AVERAGE  . . . 'SW'  . . . .         0.498
W.AVERAGE  . . 'SW' * 'PHIF'         0.496
AVERAGE  . . . 'SH'  . . . .         0.502
VOID VOLUME: . . . ('PHIF').         2.124
HC VOID VOLUME . . ('SH'*) .         1.070
RES HC VOID VOLUME ('SHR'*).         0.499
MOV HC VOID VOLUME . . . . .         0.571
*******************************************

 N E T / G R O S S   R A T I O S
*******************************************

HNETPAY /HGROSS SAND =  0.09360
HNETSAND/HGROSS SAND =  0.18719
HNETPAY /HNETSAND    =  0.50000
*******************************************
```

Available Reservoir Measurements

| | |
|---|---|
| Logs: | Induction - Spherical Focused Sonic Log<br>Dual Laterolog - Micro Spherical Focused Log<br>Formation Density Log<br>Lithodensity - Compensated Neutron Log<br>Electromagnetic Propagation Log<br>PHIX - EPHI Quicklook<br>Global |
| Tests: | 3417-26, 3444-59.5 |
| Core Analysis: | 3416-3516 |

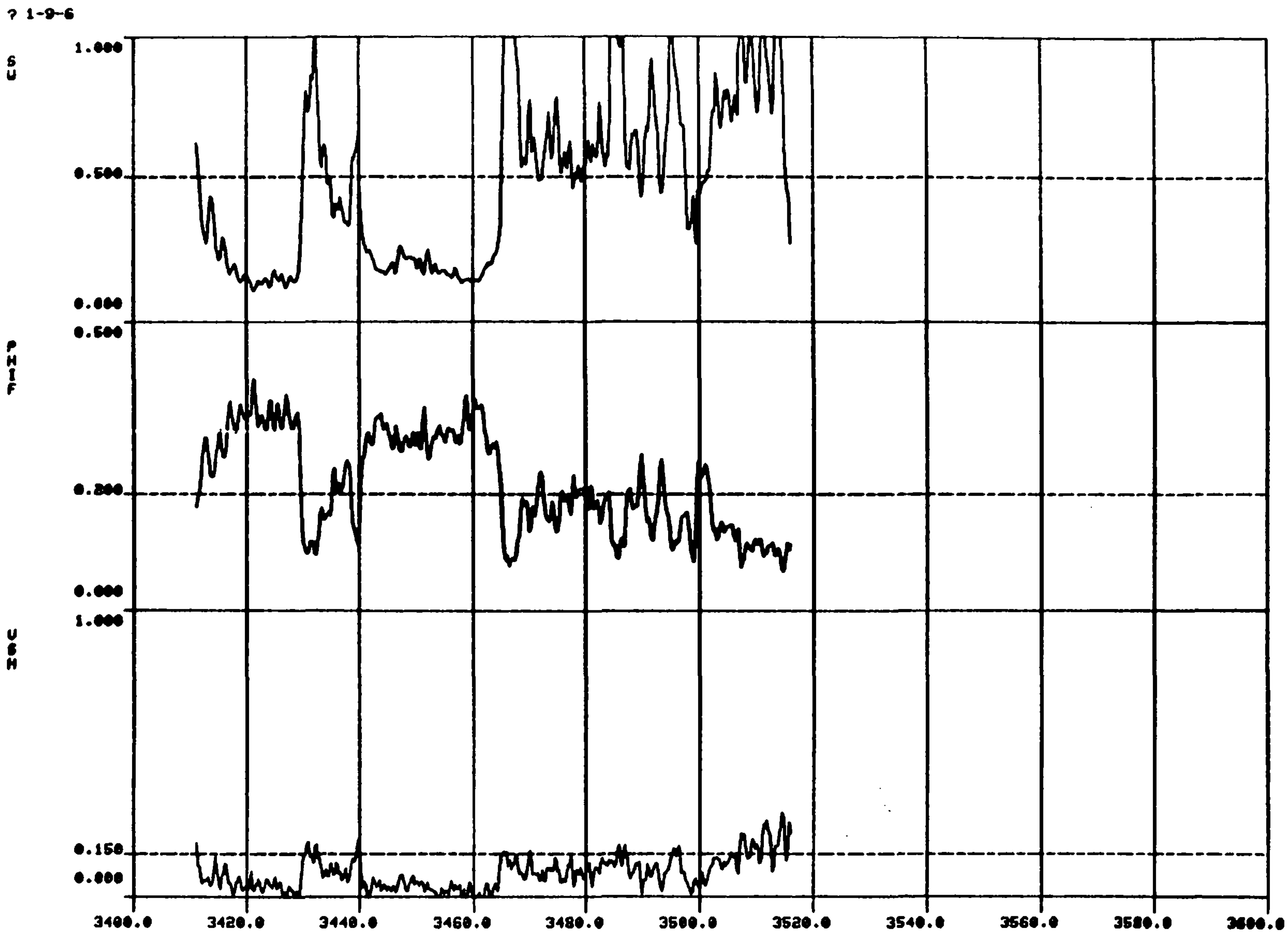
Helium porosity, horizontal and vertical permeability, grain density, summation porosity, pore saturation.

Ordered, but not yet available.
Formation factor room conditions.
Capillary pressure air-water.
Resistivity index.
Capillary pressure air-mercury with determination of pore size distribution.

Formation factor, porosity, permeability with net confining pressure.
Gas-oil relative permeability.
Gas-water relative permeability.

# LOG ANALYSIS PARAMETERS

| ZONE | EKOFISK |
|---|---|
| Depths | 3411-3516 |
| Porosity method | Litho |
| Water saturation method | North Sea |
| Pb min 1 | 2.7 |
| Pb min 2 | 2.87 |
| Psh | 2.37 |
| Pf | 1.0 |
| Phc | 0.6 |
| NØma min 1 | 0 |
| NØma min 2 | +0.025 |
| NØfl | 1 |
| GRmin | 7 |
| GRmax | 70 |
| Rmf | .065 |
| Rw | .025 |
| Rsh | .6 |
| m | 2.1 |
| a | 1.0 |
| n | 2.0 |
| VSH Determinants | GR,DN |
| VSH exponent | 1.6 |
| BHT | 228°F |
| Cutoffs VSH | .15 |
| Ø | .20 |
| SW | .50 |
| Log KLOGH | -2.6867+7.5767 PHIF |
| Log KLOGV | -2.9364+8.1718 PHIF |
| SWPC (100-.4 md) | $.0254J^{-1.5658}$ |
| SWPC (.4-.2 md) | $.06023J^{-1.0409}$ |
| SWPC (.2-0 md) | $.0646J^{-1.1876}$ |


? 1-9-6
SW
PHIF
VSH
1.000
0.500
0.000
0.500
0.200
0.000
1.000
0.150
0.000
3400.0
3420.0
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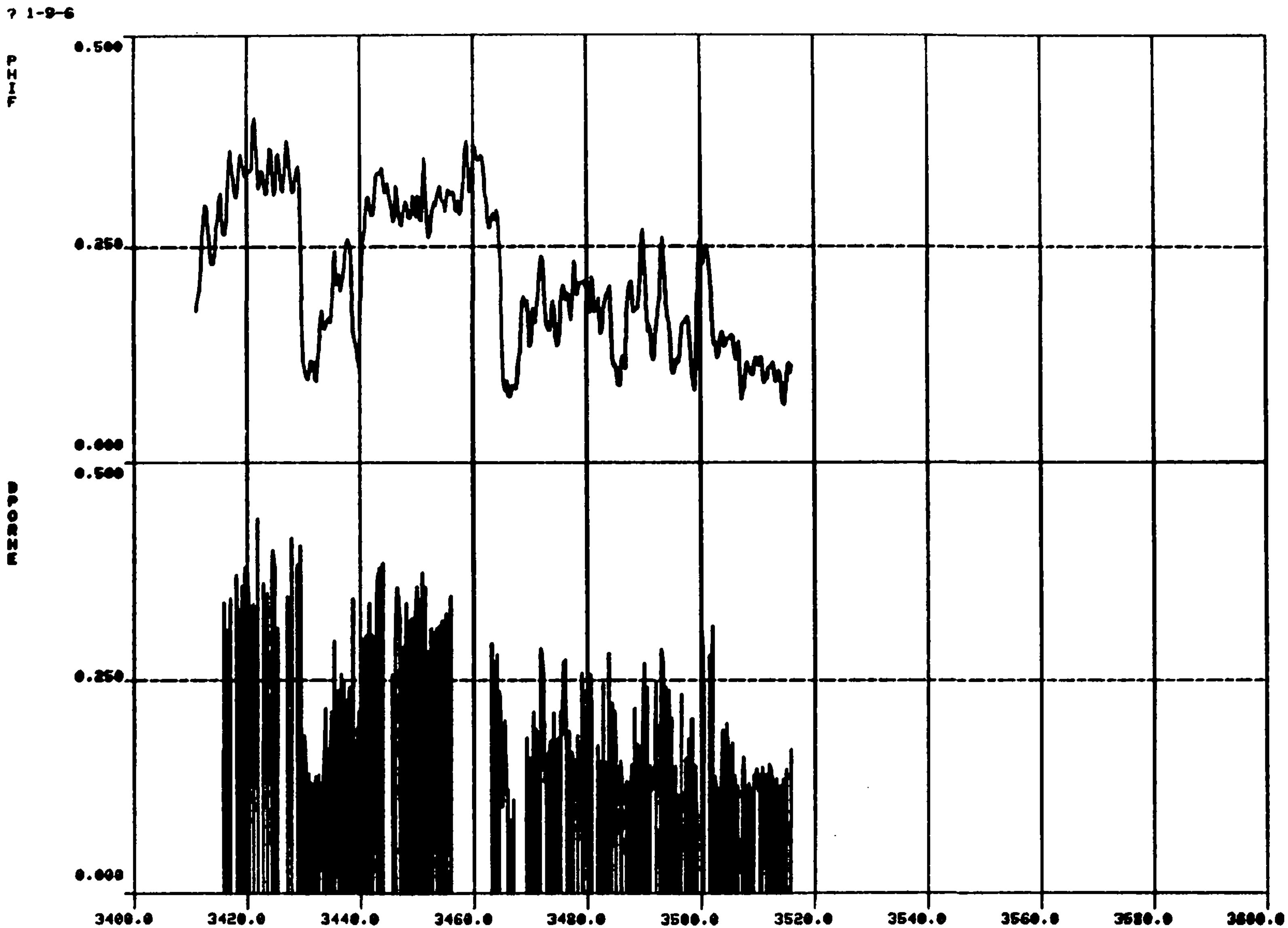
3580.0
3600.0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0.000
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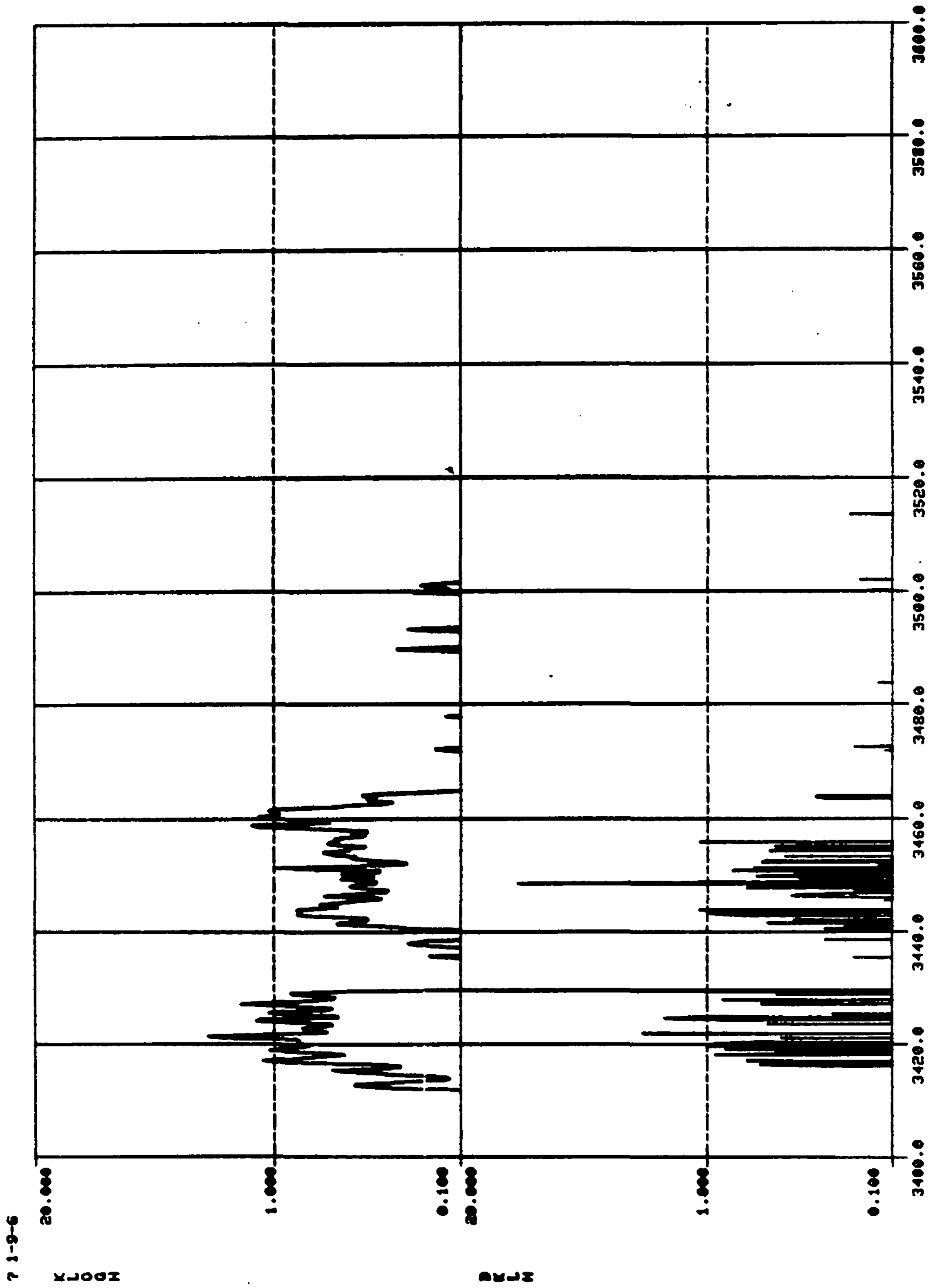
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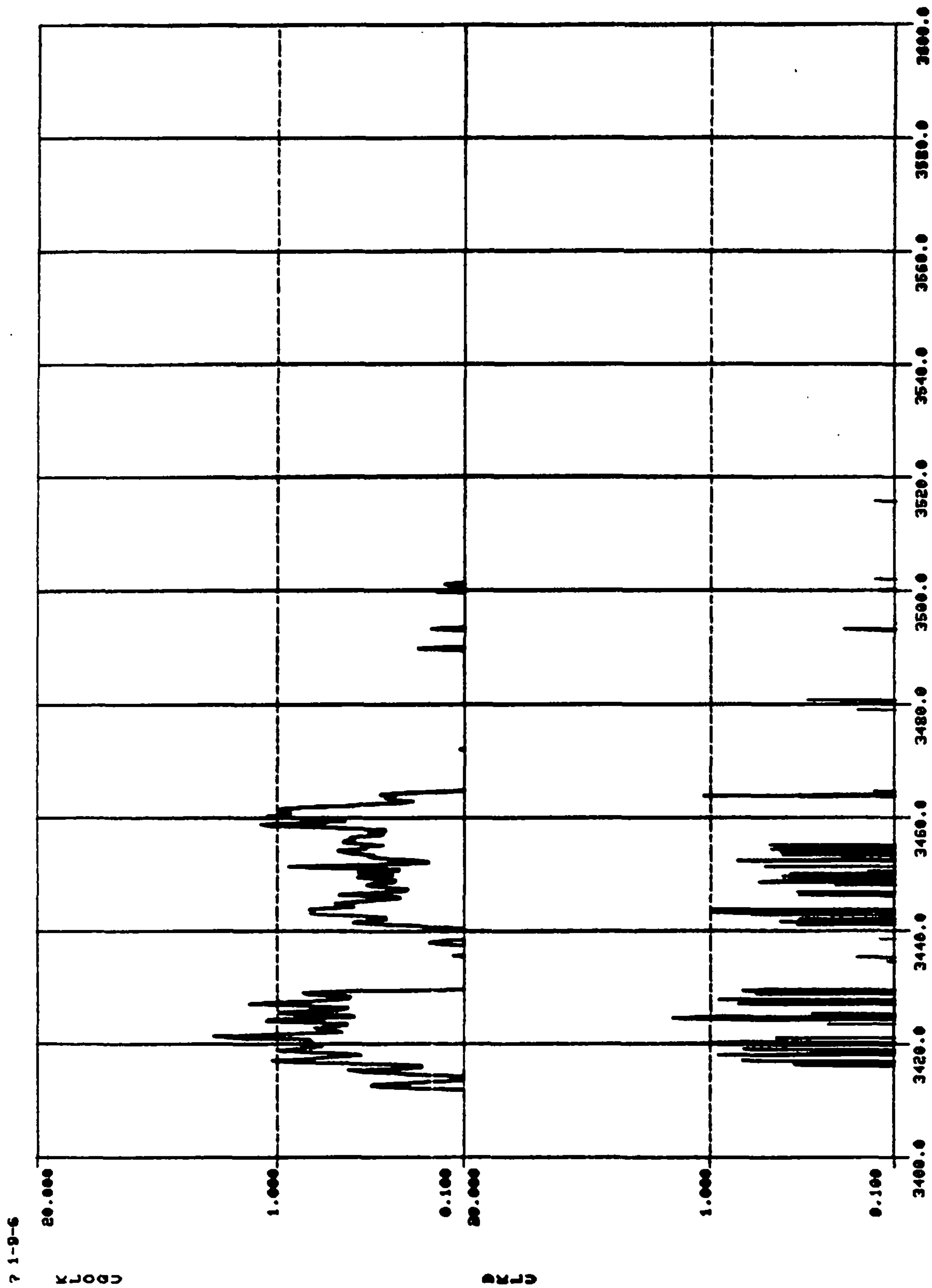
20.000
1.000
0.100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0.100
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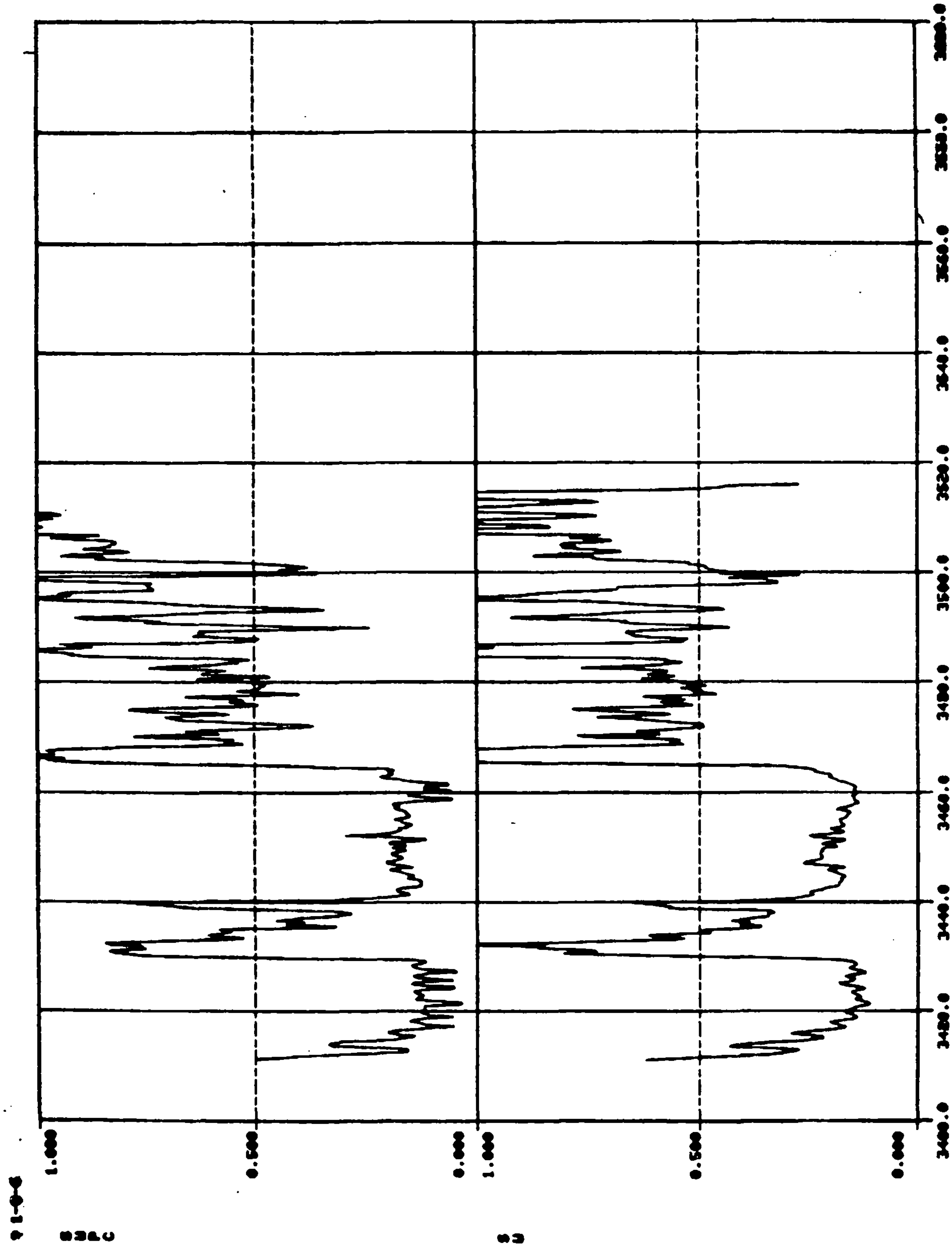
3600.0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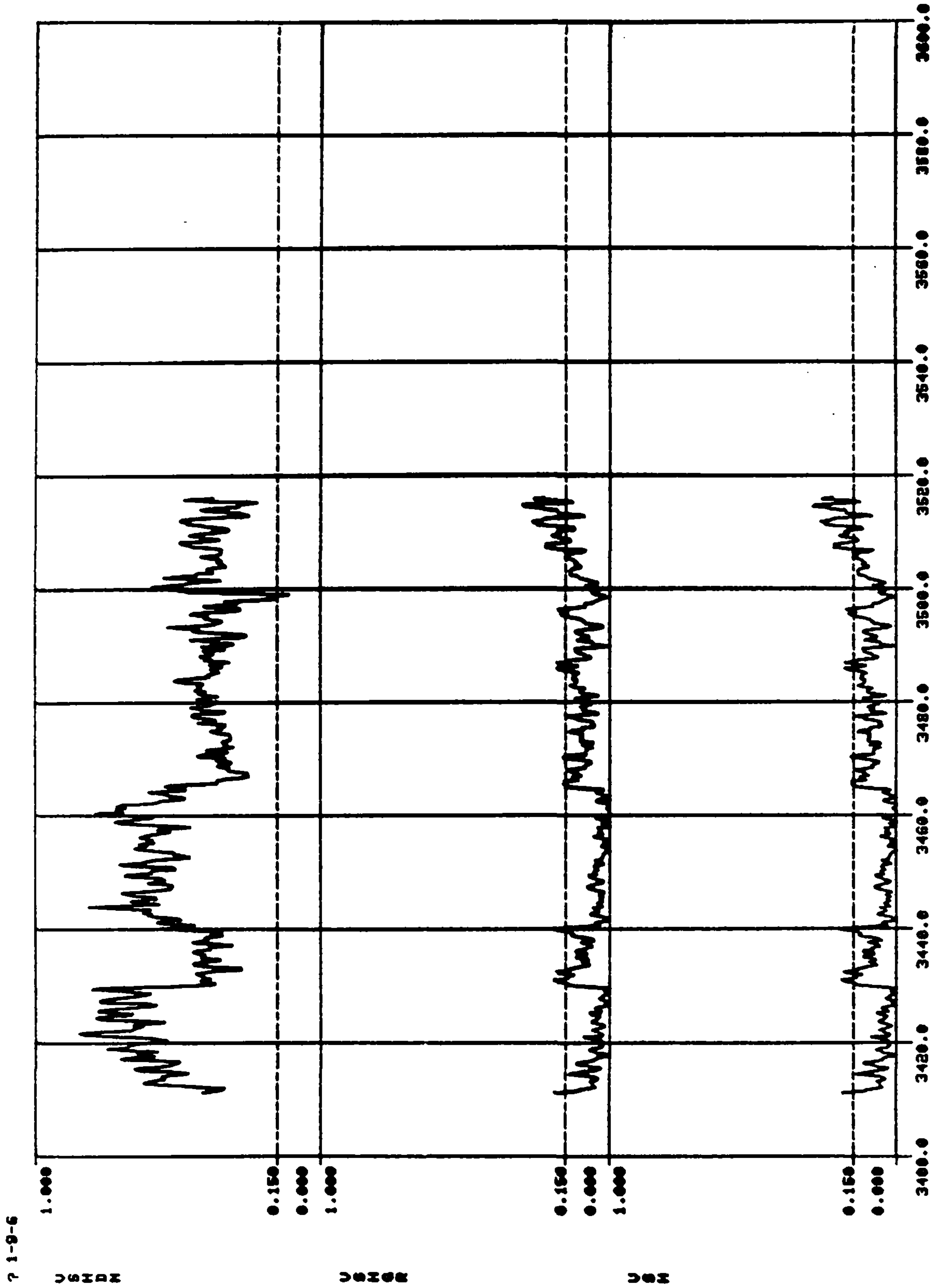
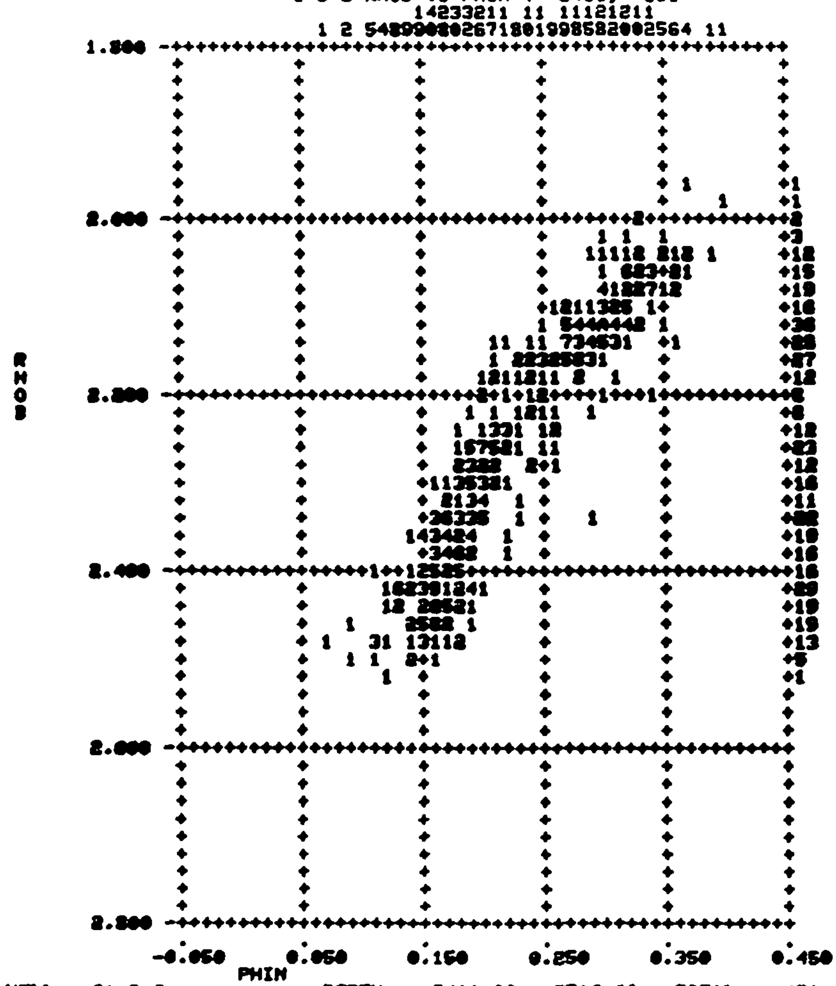


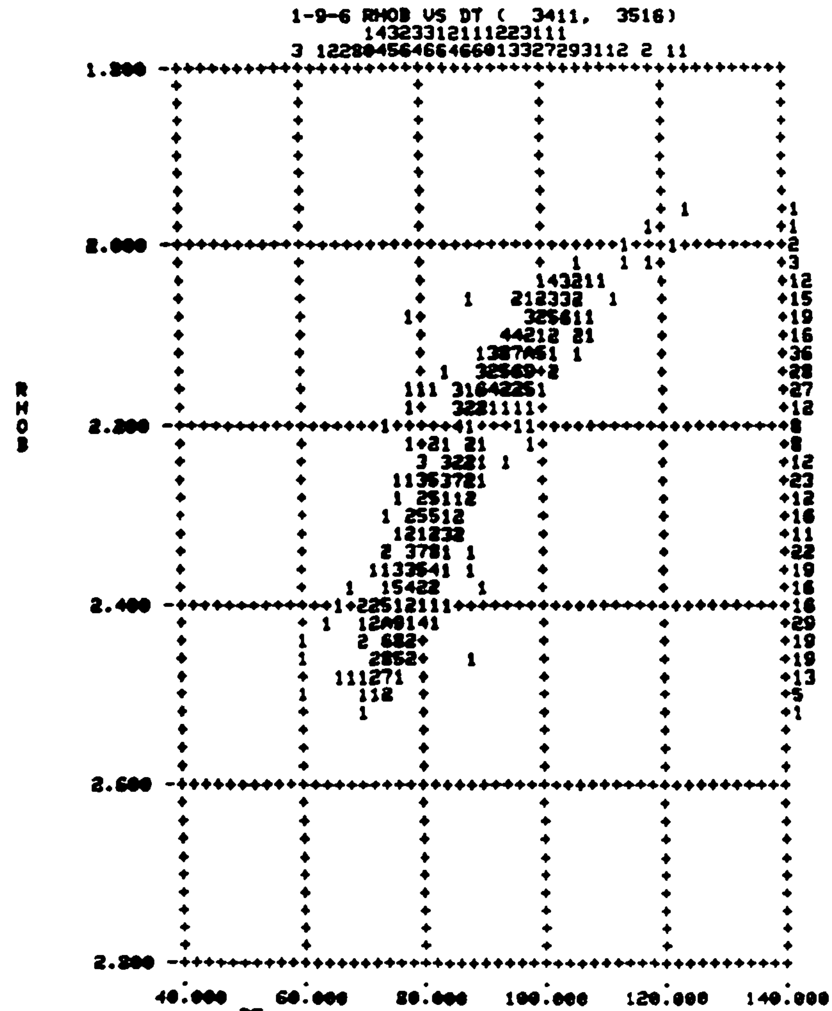
3400.0
3420.0
3440.0
3460.0
3480.0
3500.0
3520.0
3540.0
3560.0
3580.0
3600.0
1.000
0.150
0.000
1.000
0.150
0.000
1.000
0.150
0.000

1-9-6 RHOB VS PHIN ( 3411, 351




WELL 81-9-6 DEPTH: 3411.00 3516.00 TOTAL: 481
X.AV: 0.2335 Y.AV: 2.2679

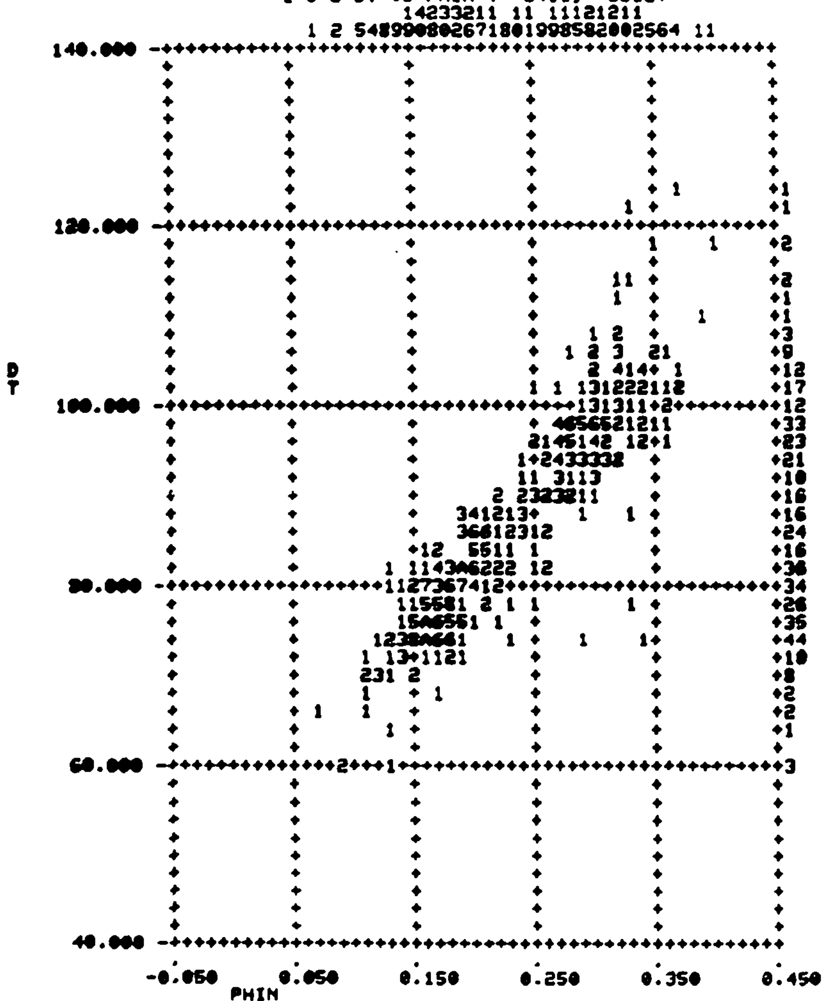
P L O T T E D B Y : DCR




WELL S1-9-6 DEPTH: 3411.00 3516.00 TOTAL: 421
X.AV: 87.4627 Y.AV: 2.2679

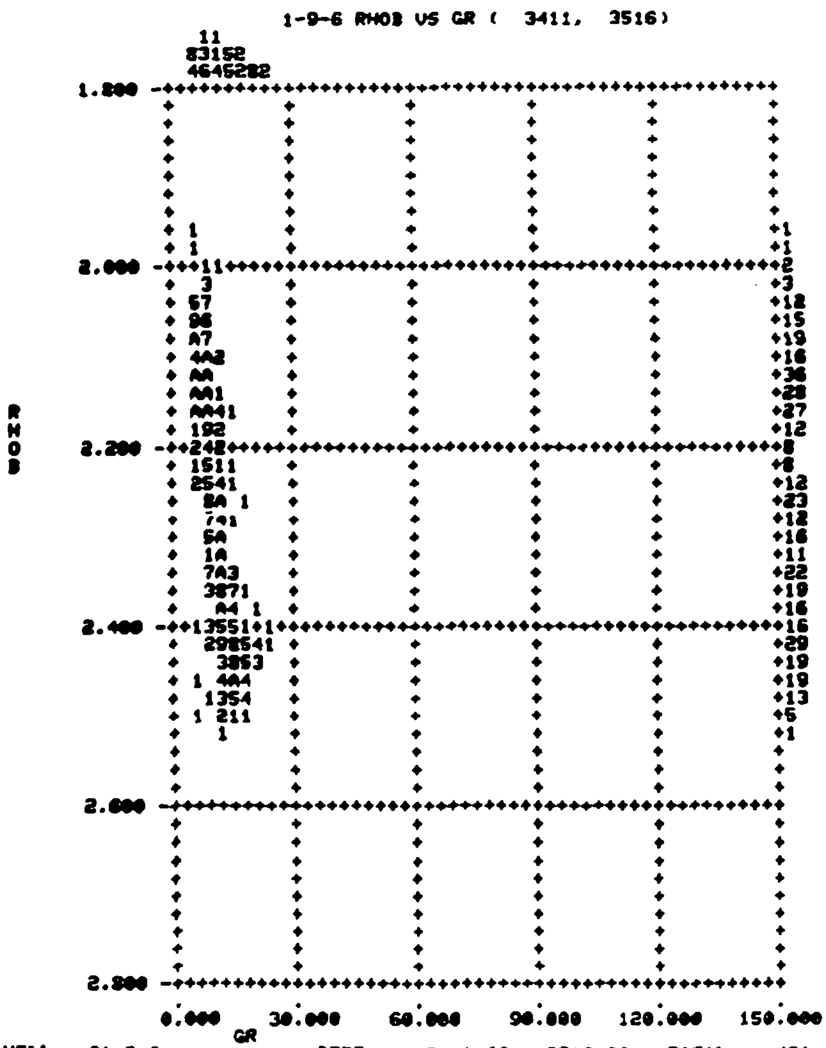
PLOTTED BY: DCR

1-9-6 DT VS PHIN ( 3411, 3516)



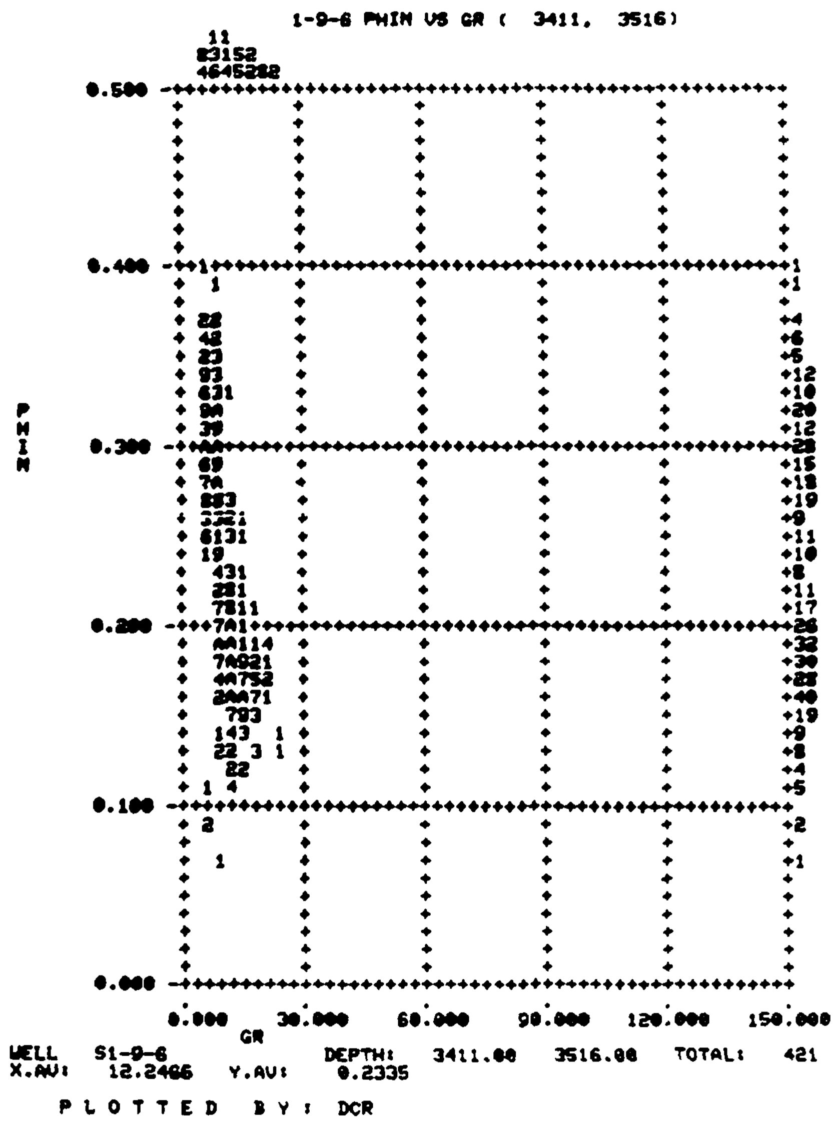

WELL S1-9-6 DEPTH: 3411.00 3516.00 TOTAL: 421
X.AV: 0.2335 Y.AV: 87.4627

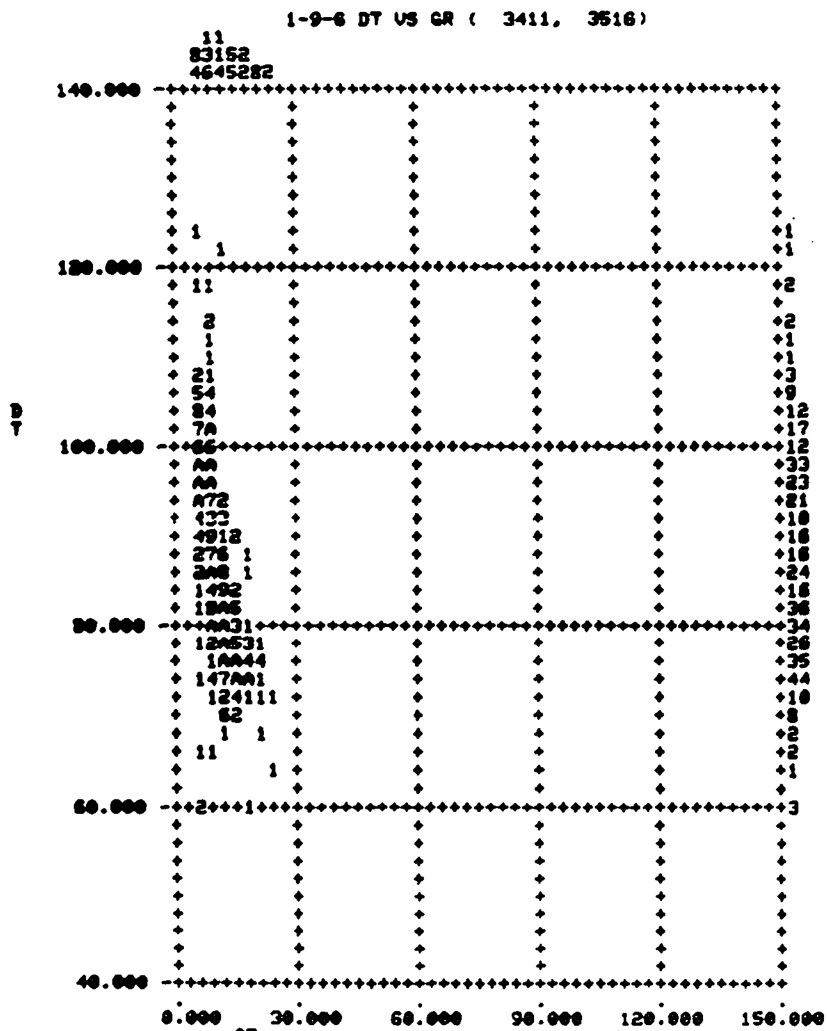
P L O T T E D B Y : DCR




WELL S1-9-6 DEPTH: 3411.00 3516.00 TOTAL: 421
X.AV: 12.2466 Y.AV: 2.2679

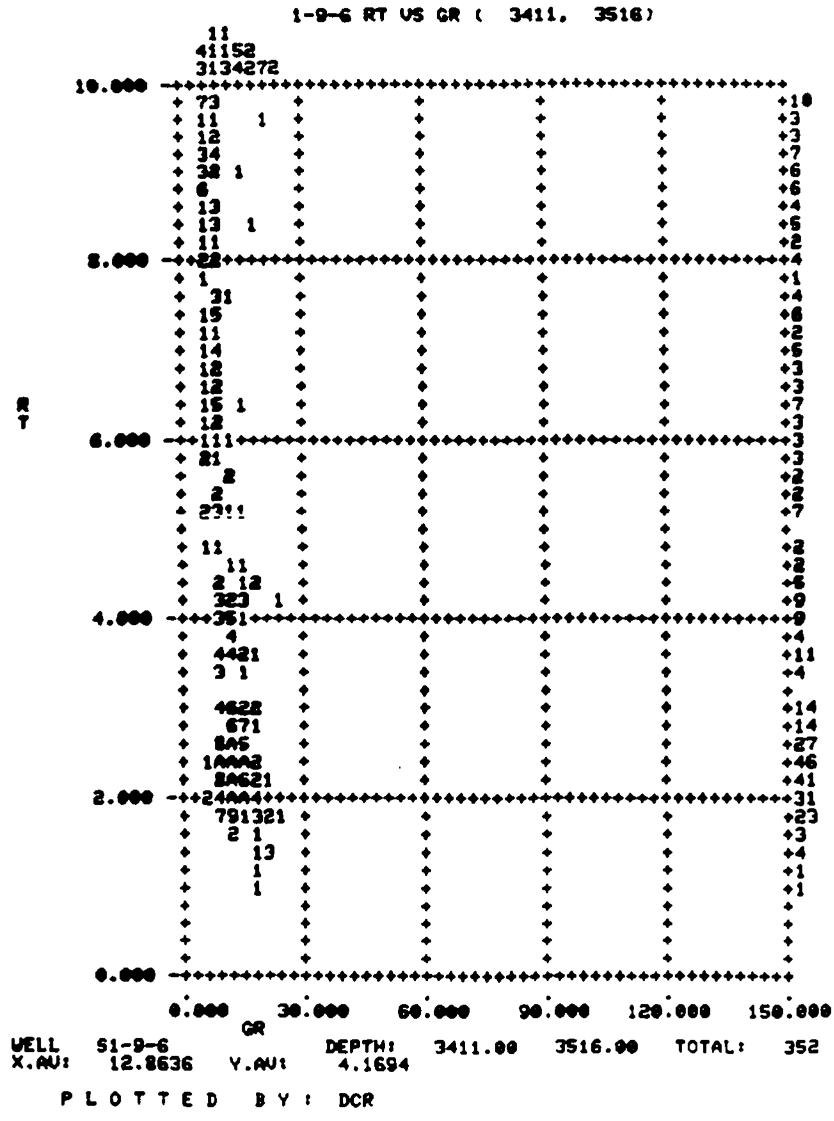
P L O T T E D B Y : DCR

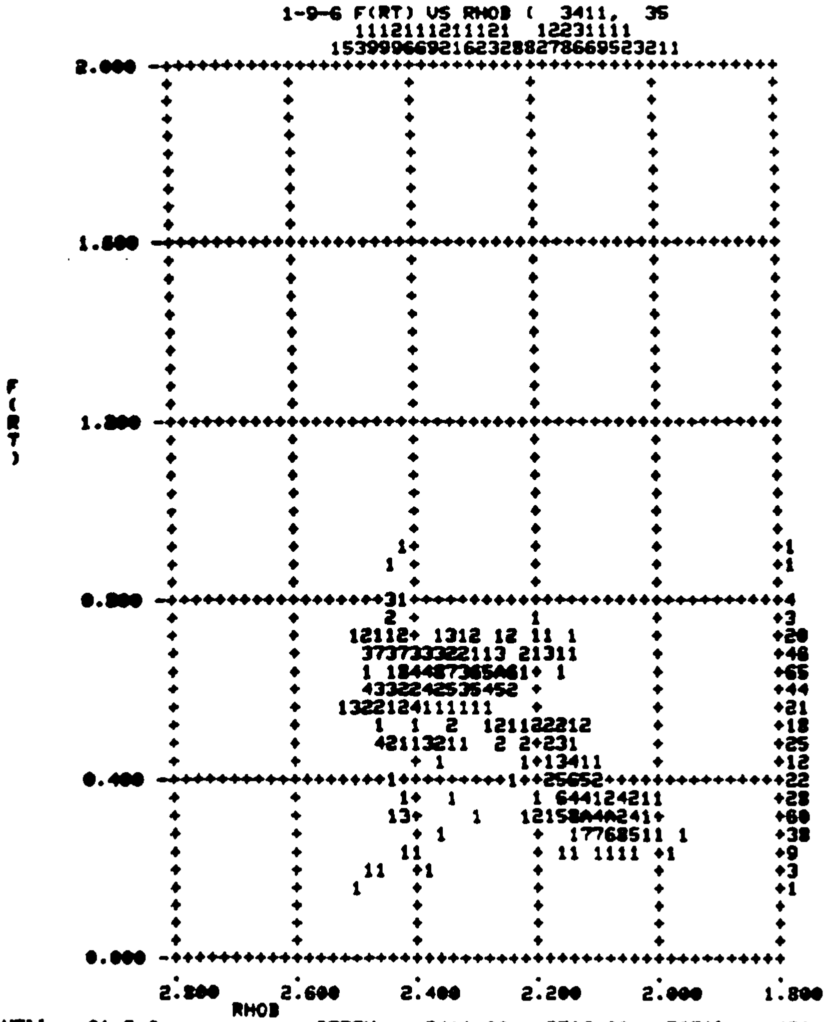

1-9-6 PHIN VS GR ( 3411, 3516)
0.500
0.400
0.300
0.200
0.100
0.000
PHIN
0.000
30.000
60.000
90.000
120.000
150.000
GR
WELL S1-9-6
DEPTH: 3411.00 3516.00 TOTAL: 421
X.AV: 12.2466 Y.AV: 0.2335
PLOTTED BY: DCR




WELL 51-9-6 DEPTH: 3411.00 3516.00 TOTAL: 421
X.AV: 12.2466 Y.AV: 87.4627

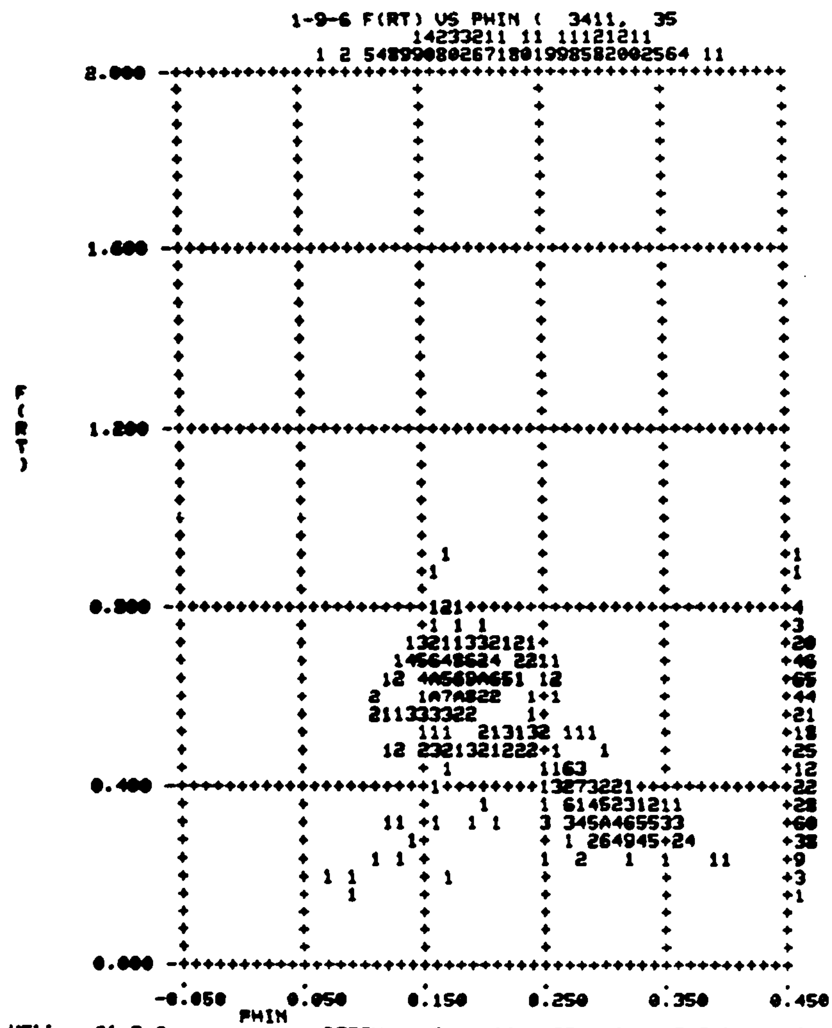
P L O T T E D B Y : DCR


1-9-6 RT VS GR ( 3411, 3516)
RT
GR
10.000
8.000
6.000
4.000
2.000
0.000
0.000
30.000
60.000
90.000
120.000
150.000
WELL S1-9-6 DEPTH: 3411.00 3516.00 TOTAL: 352
X.AV: 12.8636 Y.AV: 4.1694
PLOTTED BY: DCR



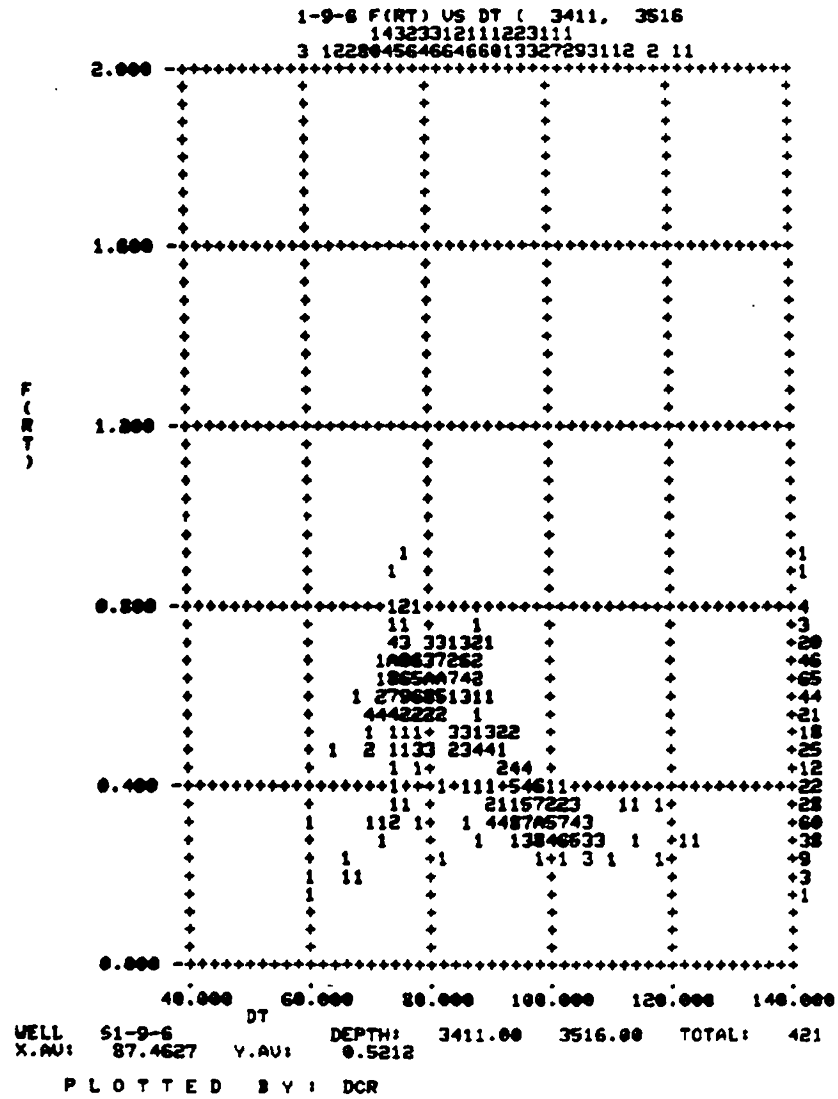

WELL S1-9-6 DEPTH: 3411.00 3516.00 TOTAL: 421
X.AV: 2.2679 Y.AV: 0.5212

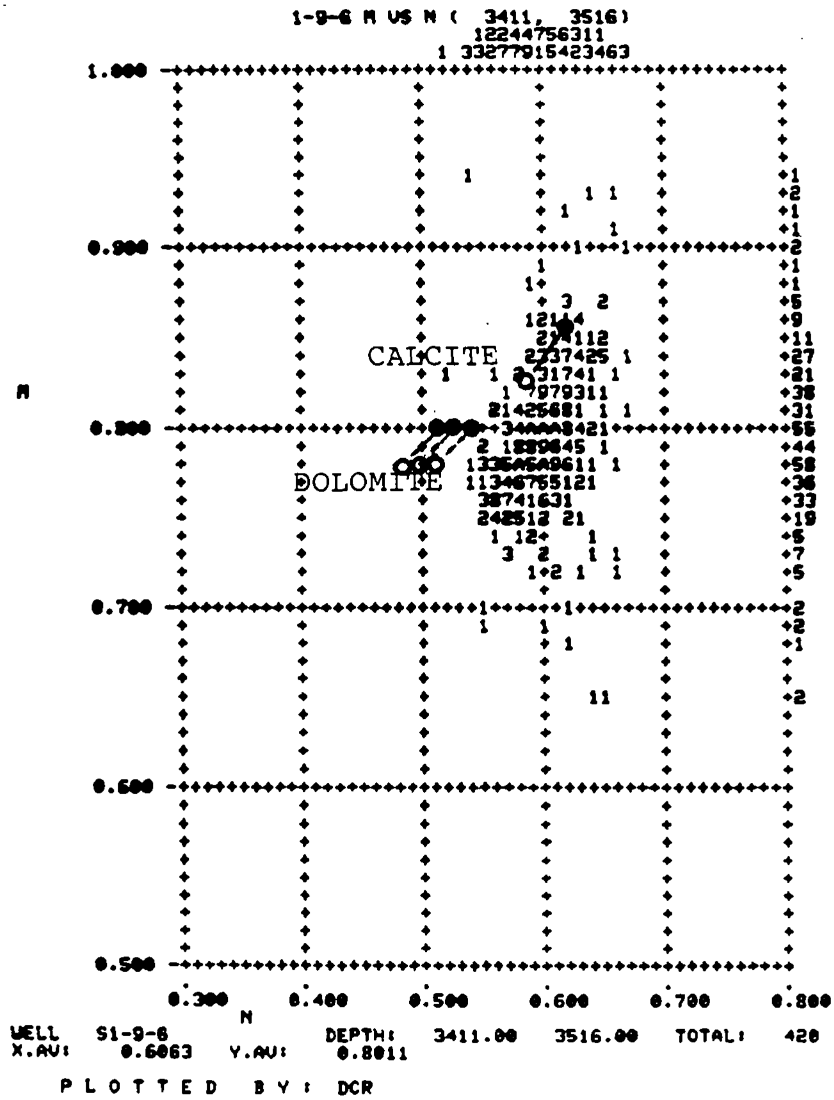
P L O T T E D B Y : DCR

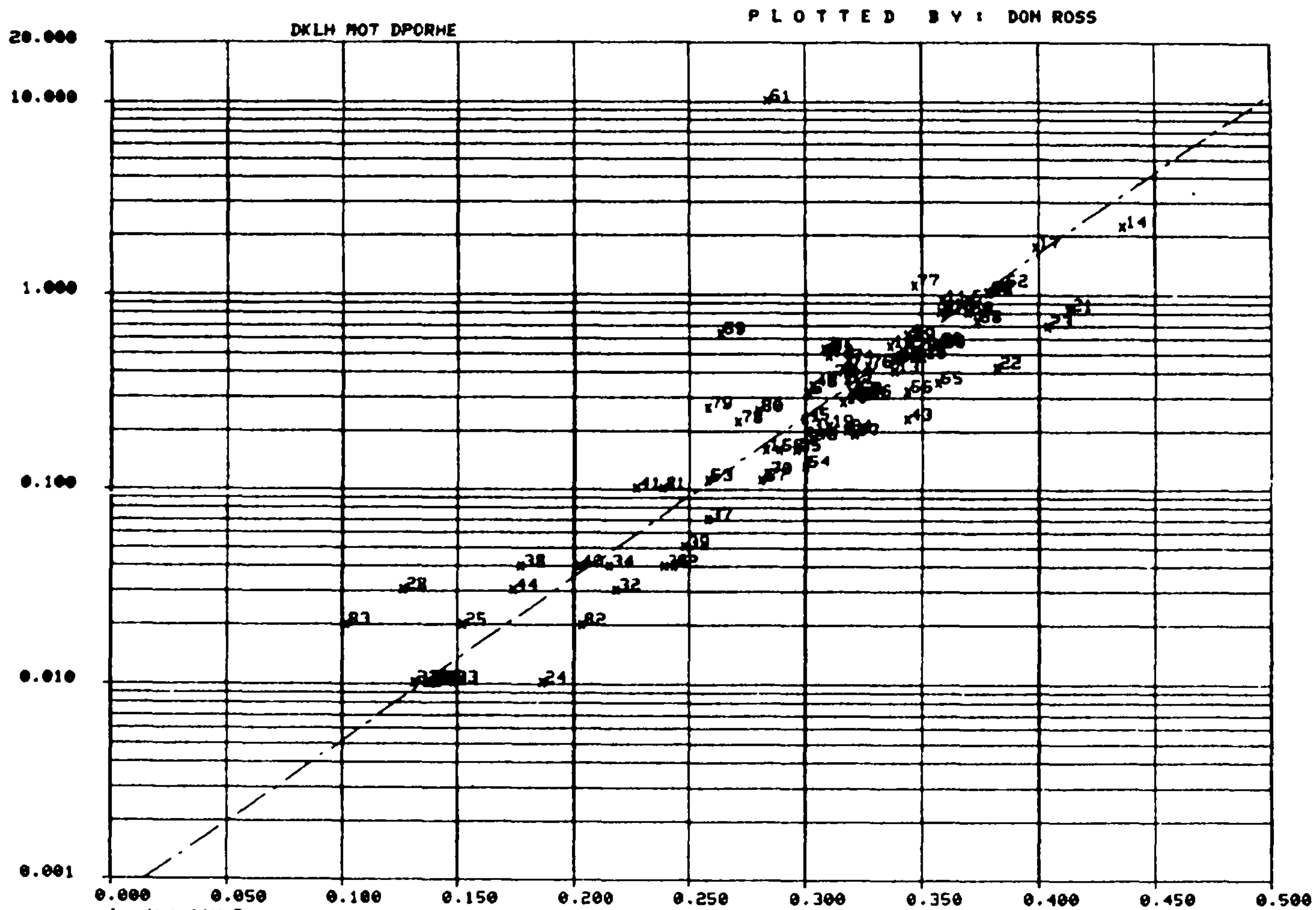



WELL S1-9-6 DEPTH: 3411.00 3516.00 TOTAL: 421
X.AV: 0.2336 Y.AV: 0.5212

PLOTTED BY: DCR


1-9-6 F(RT) VS DT ( 3411, 3516
2.000
1.600
1.200
0.800
0.400
0.000
F(RT)
40.000
60.000
80.000
100.000
120.000
140.000
DT
WELL S1-9-6 DEPTH: 3411.00 3516.00 TOTAL: 421
X.AV: 87.4627 Y.AV: 0.5212
P L O T T E D B Y : DCR


1-9-6 M VS N ( 3411, 3516)
CALCITE
DOLOMITE
M
N
WELL S1-9-6 DEPTH: 3411.00 3516.00 TOTAL: 420
X.AV: 0.6063 Y.AV: 0.8011
PLOTTED BY: DCR



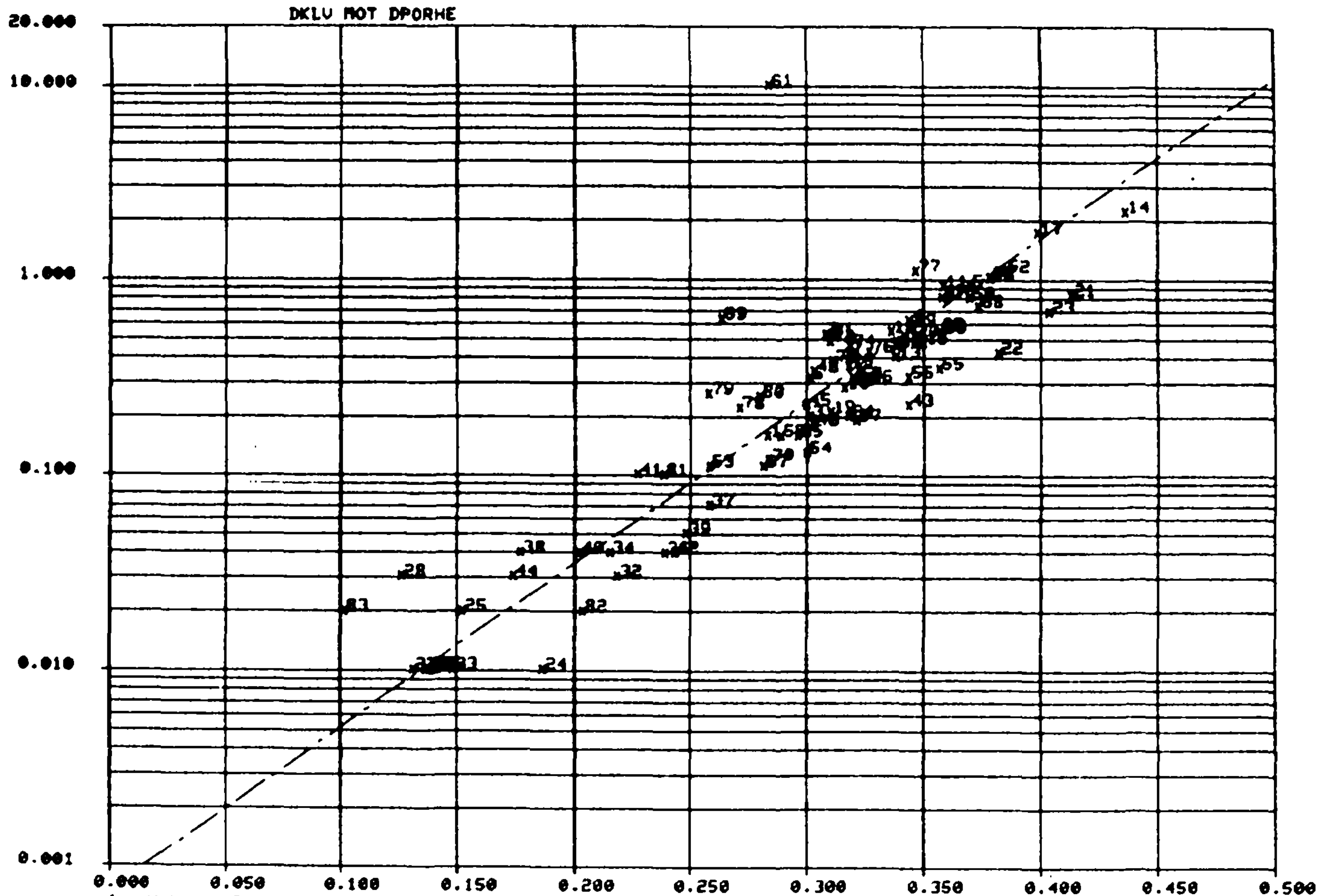

Log(Y)=A*X+B

A= 8.31207671 B= -3.11875295 C2= 0.80919217

DO YOU WANT TO DELETE ANY POINTS?

PLEASE REPEAT
NO

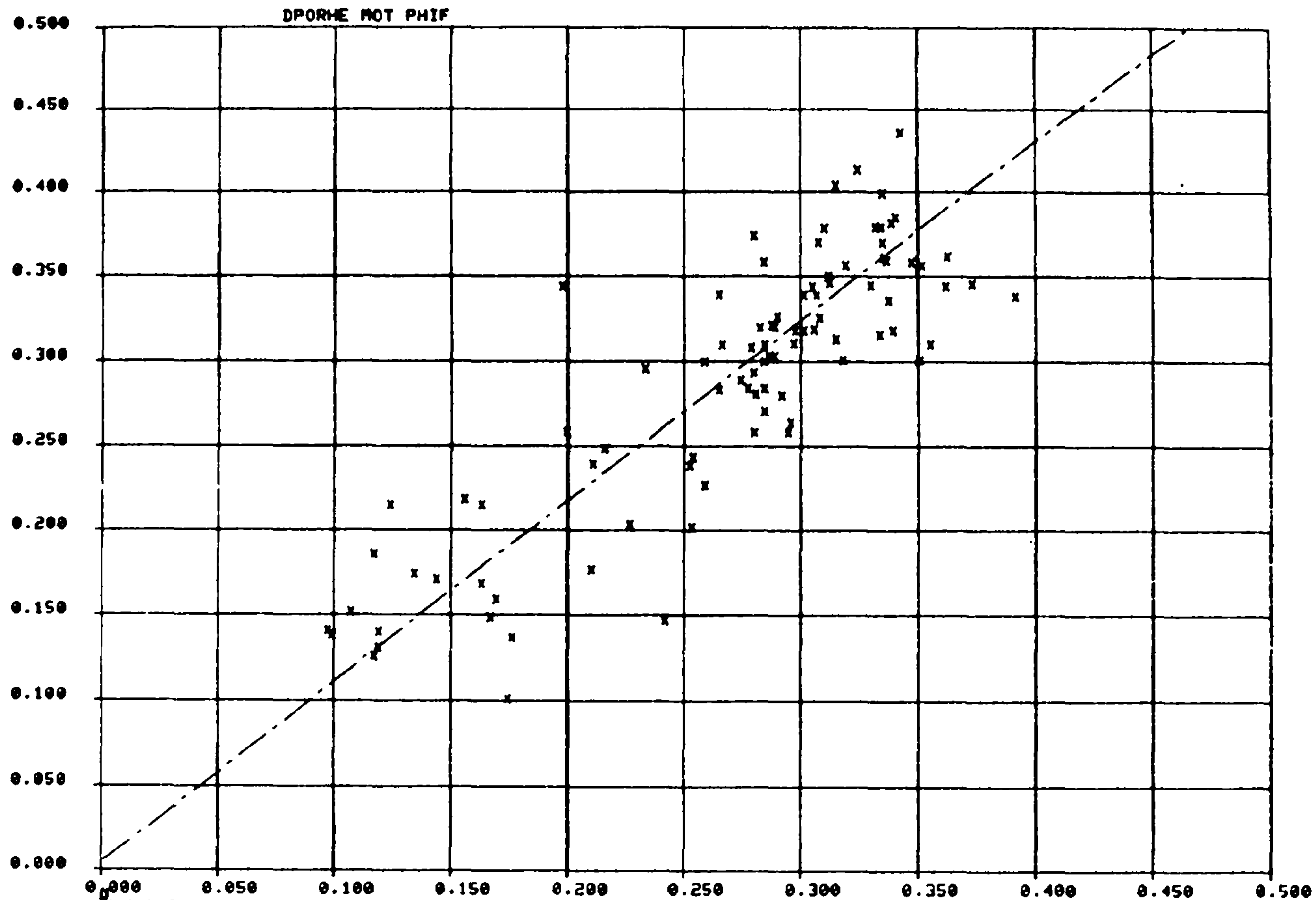
WELL S1-9-6 DEPTH: 3411.00 3516.00 TOTAL: 83 X.AV: 0.2921 Y.AV: 0.5025




Log(Y)=A*X+B
A= 8.31207671 B= -3.11875295 C2= 0.80919217
DO YOU WANT TO DELETE ANY POINTS?
NO

WELL 51-9-6 DEPTH: 3411.00 3516.00 TOTAL: 83 X.AV: 0.2921 Y.AV: 0.5025

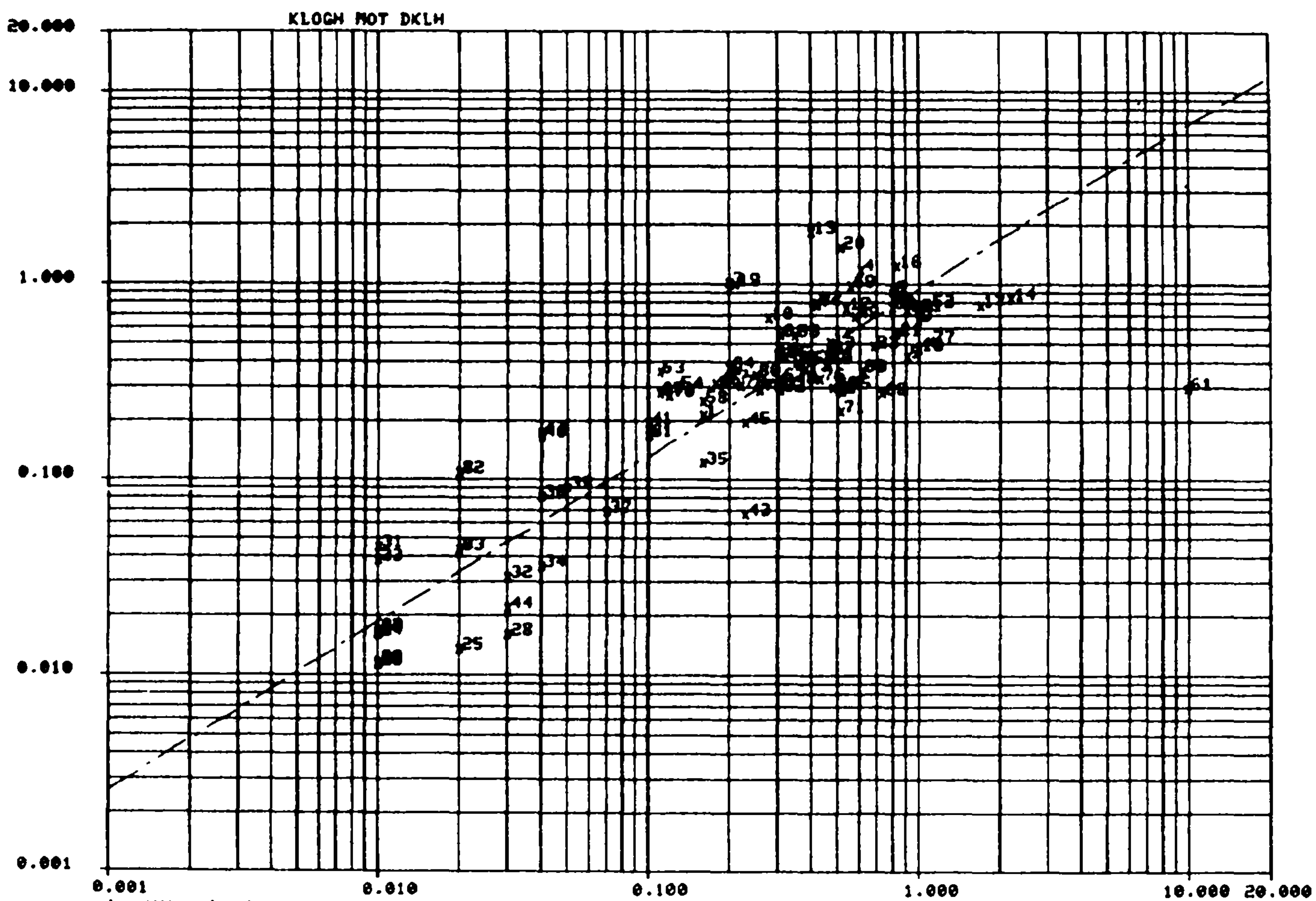
P L O T T E D B Y : DON ROSS




Y=A*X+B    A= 1.06311111    B= 0.00532667
THE LINE INTERSECTS THE LEFT Y-AXIS AT THE POINT 0.005
THE LINE INTERSECTS THE UPPER X-AXIS AT THE POINT 0.465
OK?
YES

WELL S1-9-6    DEPTH: 3411.00 3516.00    TOTAL: 92    X.AV: 0.2679    Y.AV: 0.2871

P L O T T E D  B Y : DON ROSS

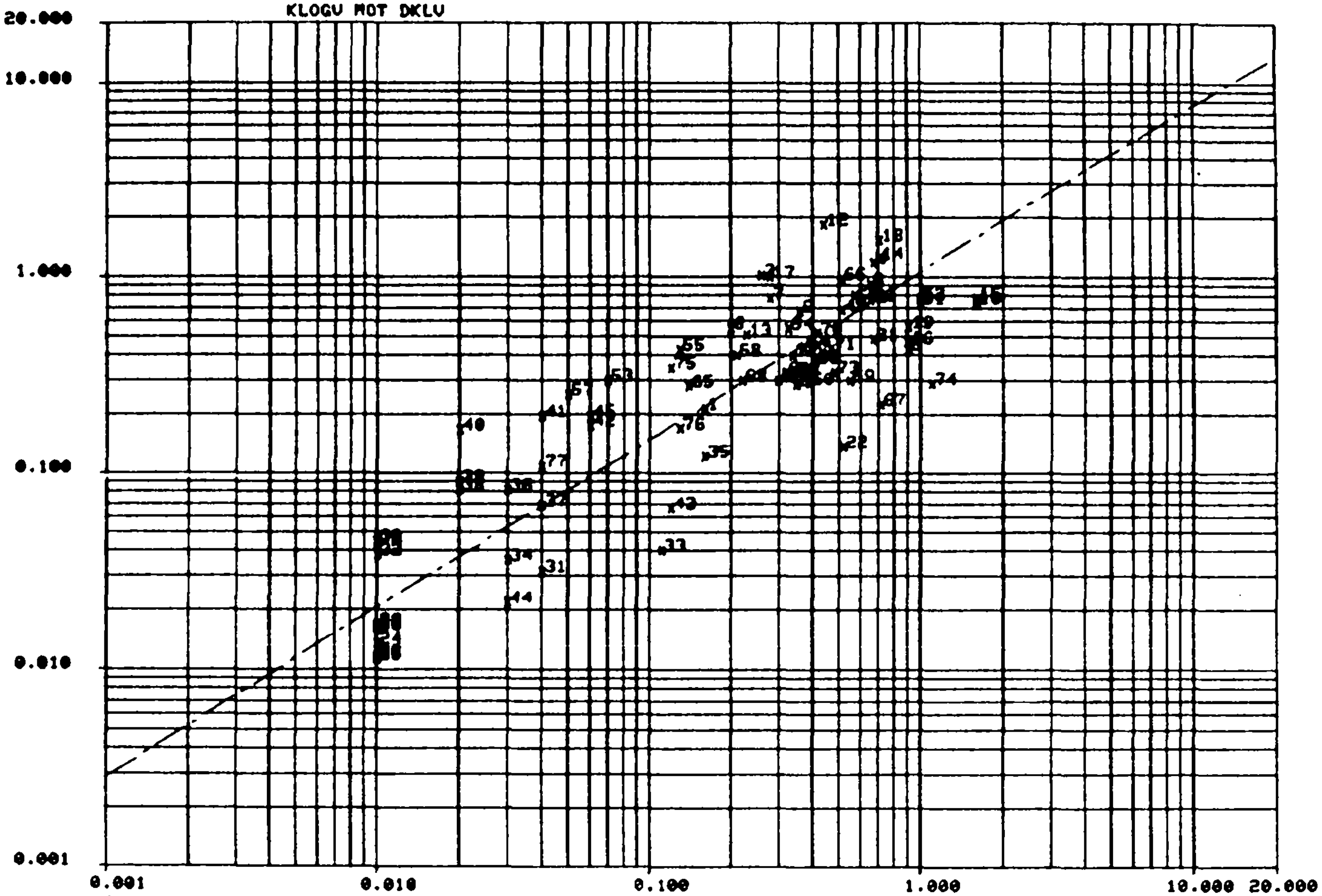



Log(Y)=A*Log(X)+B
A= 0.84956273 B= -0.03357949 C2= 0.71951868
DO YOU WANT TO DELETE ANY POINTS?
NO

WELL 51-9-6 DEPTH: 3411.00 3516.00 TOTAL: 83 X.AV: 0.5025 Y.AV: 0.4067

P L O T T E D B Y : DON ROSS

KLOGU MOT DKLU




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

A= 0.85379464 B= 0.02139148 C2= 0.75428606

DO YOU WANT TO DELETE ANY POINTS?

NO

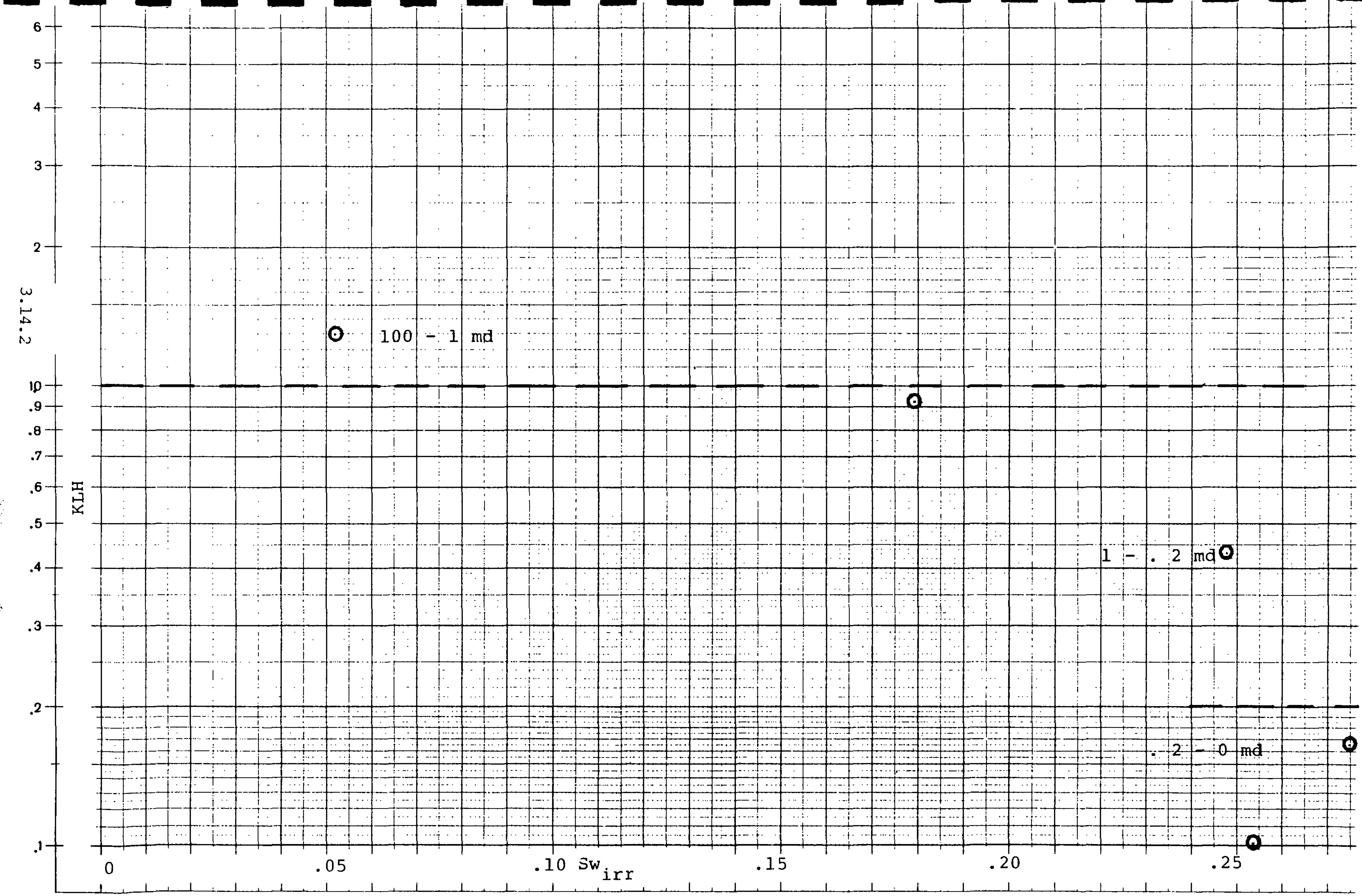
WELL S1-9-6 DEPTH: 3411.00 3516.00 TOTAL: 78 X.AV: 0.3504 Y.AV: 0.3964

P L O T T E D B Y : DON ROSS

## Core Plugs Ekofisk

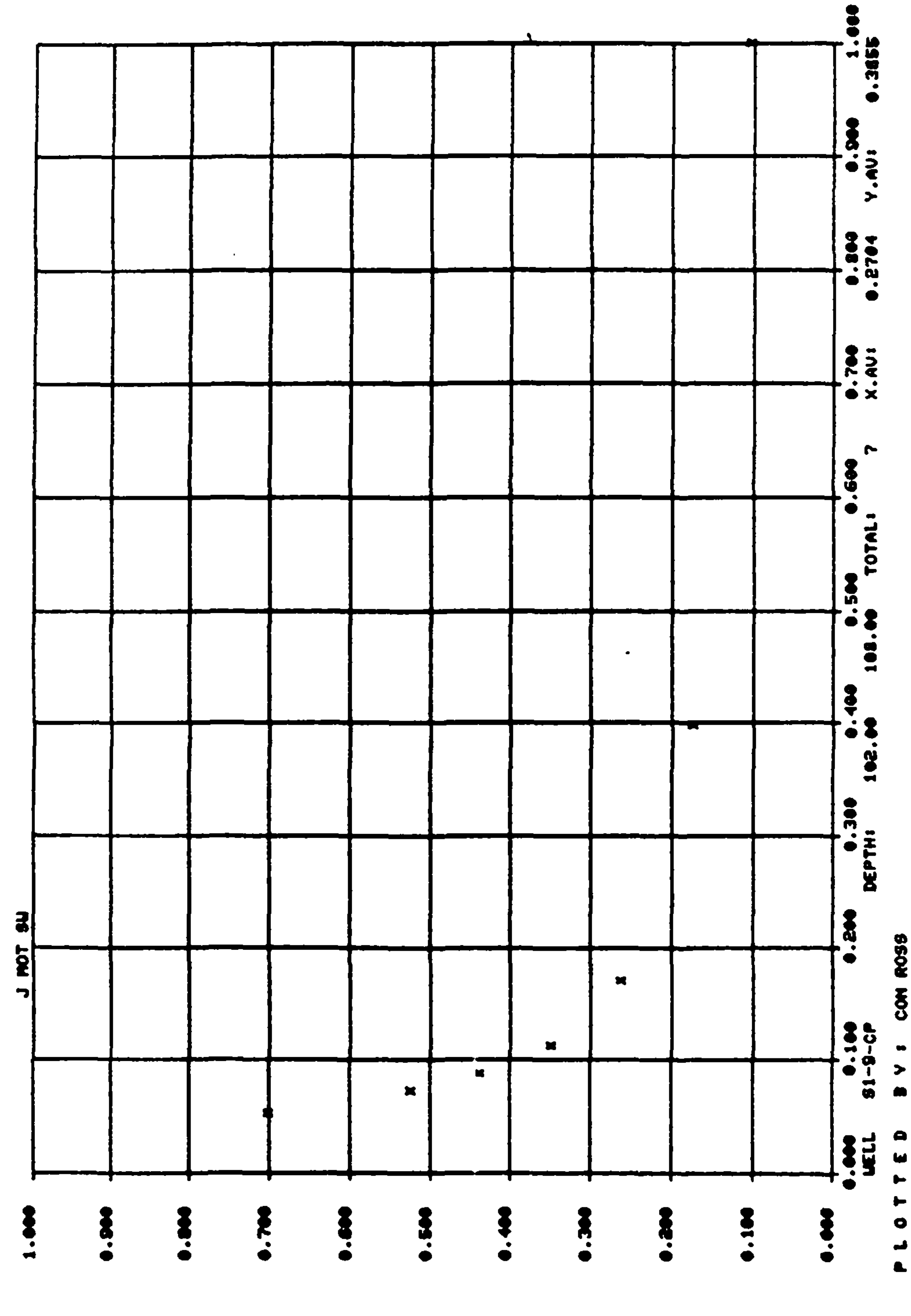
WELL: 1-9-CP ( 102 - 138 ) DATE: 1FEB83/DCR

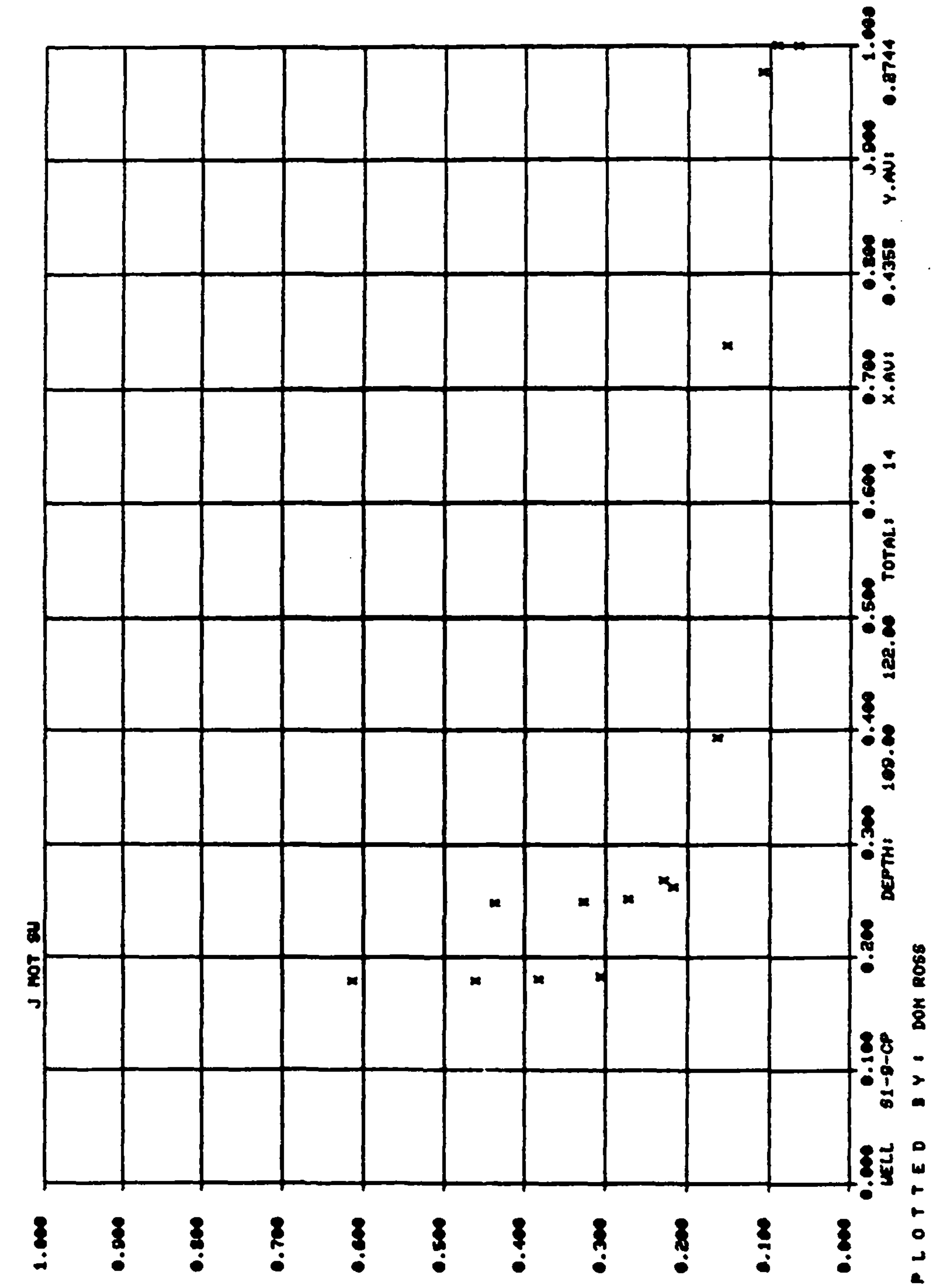
| DEPTH | DYBDE | KLH | POR | SW | PC | J | |
|---|---|---|---|---|---|---|---|
| 102.00 | 3136.000 | 1.300 | 0.373 | 1.000 | 300.000 | 0.105 | Ekofisk 100-1 md |
| 103.00 | 3136.000 | 1.300 | 0.373 | 0.397 | 500.000 | 0.175 | |
| 104.00 | 3136.000 | 1.300 | 0.373 | 0.170 | 750.000 | 0.263 | |
| 105.00 | 3136.000 | 1.300 | 0.373 | 0.112 | 1000.000 | 0.351 | |
| 106.00 | 3136.000 | 1.300 | 0.373 | 0.088 | 1250.000 | 0.438 | |
| 107.00 | 3136.000 | 1.300 | 0.373 | 0.073 | 1500.000 | 0.526 | |
| 108.00 | 3136.000 | 1.300 | 0.373 | 0.053 | 2000.000 | 0.701 | |
| 109.00 | 3129.500 | 0.940 | 0.351 | 1.000 | 300.000 | 0.092 | Ekofisk 1-.2 md |
| 110.00 | 3129.500 | 0.940 | 0.351 | 0.737 | 500.000 | 0.154 | |
| 111.00 | 3129.500 | 0.940 | 0.351 | 0.287 | 750.000 | 0.230 | |
| 112.00 | 3129.500 | 0.940 | 0.351 | 0.182 | 1000.000 | 0.307 | |
| 113.00 | 3129.500 | 0.940 | 0.351 | 0.180 | 1250.000 | 0.384 | |
| 114.00 | 3129.500 | 0.940 | 0.351 | 0.179 | 1500.000 | 0.461 | |
| 115.00 | 3129.500 | 0.940 | 0.351 | 0.179 | 2000.000 | 0.615 | |
| 116.00 | 3166.500 | 0.430 | 0.316 | 1.000 | 300.000 | 0.066 | |
| 117.00 | 3166.500 | 0.430 | 0.316 | 0.976 | 500.000 | 0.110 | |
| 118.00 | 3166.500 | 0.430 | 0.316 | 0.392 | 750.000 | 0.164 | |
| 119.00 | 3166.500 | 0.430 | 0.316 | 0.261 | 1000.000 | 0.219 | |
| 120.00 | 3166.500 | 0.430 | 0.316 | 0.261 | 1250.000 | 0.274 | |
| 121.00 | 3166.500 | 0.430 | 0.316 | 0.249 | 1500.000 | 0.329 | |
| 122.00 | 3166.500 | 0.430 | 0.316 | 0.248 | 2000.000 | 0.438 | |
| 123.00 | 0.000 | 0.220 | 0.300 | 1.000 | 500.000 | 0.080 | |
| 124.00 | 0.000 | 0.220 | 0.300 | 0.504 | 750.000 | 0.121 | |
| 125.00 | 0.000 | 0.220 | 0.300 | 0.307 | 1000.000 | 0.161 | |
| 126.00 | 0.000 | 0.220 | 0.300 | 0.226 | 1250.000 | 0.201 | |
| 127.00 | 0.000 | 0.220 | 0.300 | 0.184 | 1500.000 | 0.241 | |
| 128.00 | 0.000 | 0.220 | 0.300 | 0.136 | 2000.000 | 0.322 | |
| 129.00 | 3149.250 | 0.170 | 0.236 | 1.000 | 750.000 | 0.120 | Ekofisk + Tor .2-0 md |
| 130.00 | 3149.250 | 0.170 | 0.236 | 0.732 | 1000.000 | 0.159 | |
| 131.00 | 3149.250 | 0.170 | 0.236 | 0.532 | 1250.000 | 0.199 | |
| 132.00 | 3149.250 | 0.170 | 0.236 | 0.405 | 1500.000 | 0.239 | |
| 133.00 | 3149.250 | 0.170 | 0.236 | 0.275 | 2000.000 | 0.319 | |
| 134.00 | 3193.250 | 0.100 | 0.234 | 1.000 | 750.000 | 0.092 | |
| 135.00 | 3193.250 | 0.100 | 0.234 | 0.753 | 1000.000 | 0.123 | |
| 136.00 | 3193.250 | 0.100 | 0.234 | 0.488 | 1250.000 | 0.153 | |
| 137.00 | 3193.250 | 0.100 | 0.234 | 0.378 | 1500.000 | 0.184 | |
| 138.00 | 3193.250 | 0.100 | 0.234 | 0.253 | 2000.000 | 0.245 | |

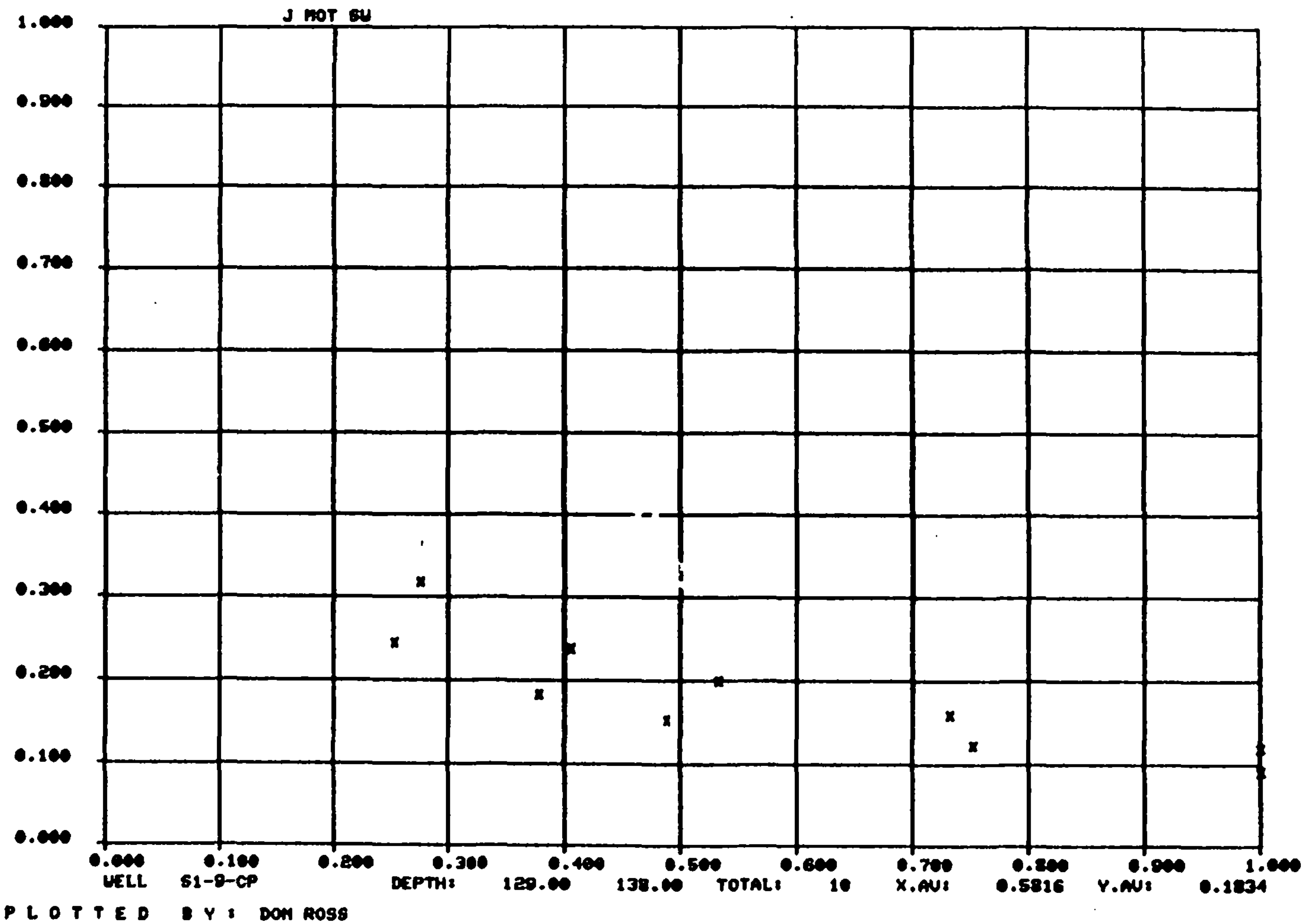


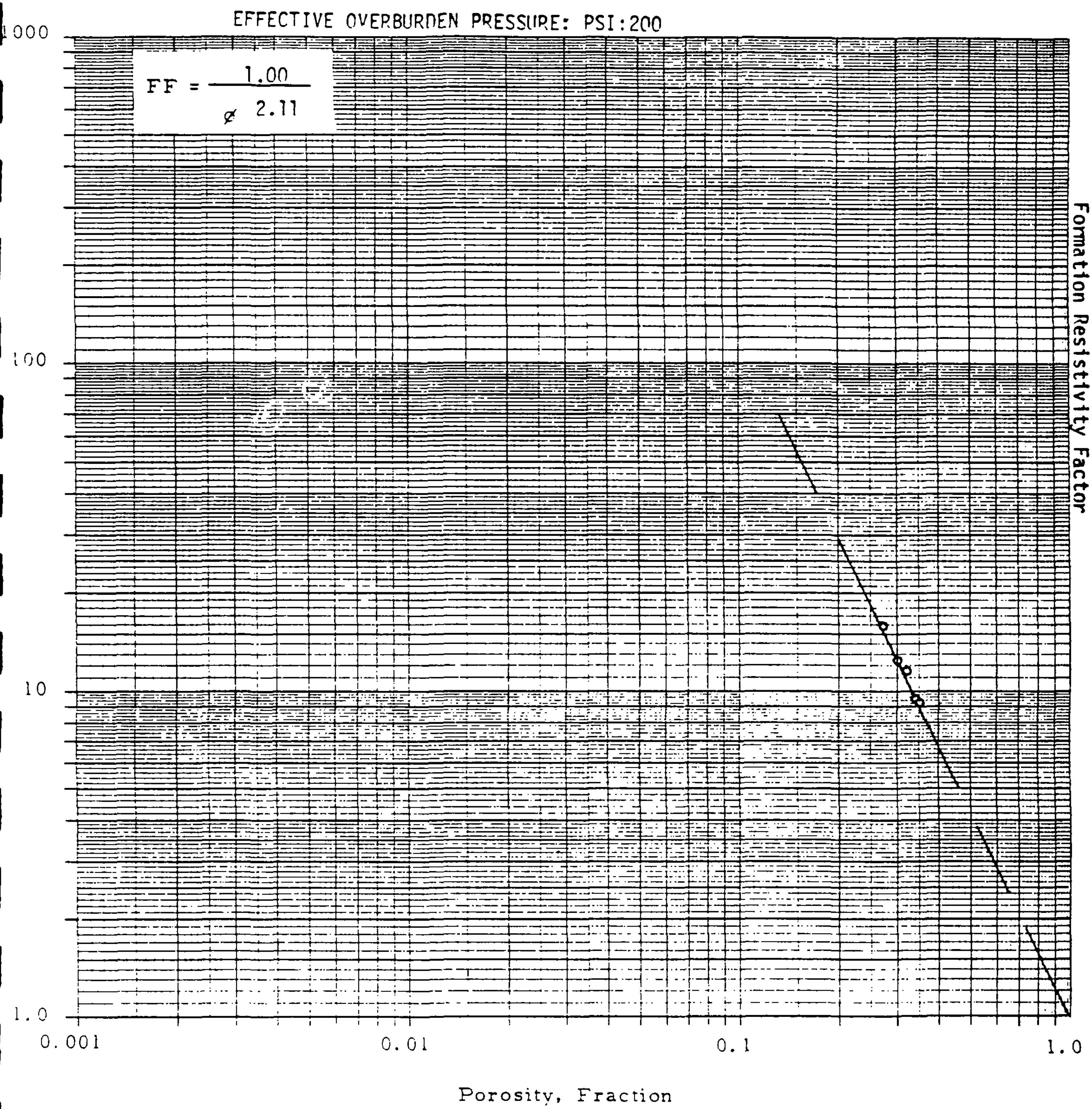

PLUG GROUPINGS FOR SWPC DETERMINATION - EKOFISK

3.14.2


J MOT SW
0.000
0.100
0.200
0.300
0.400
0.500
0.600
0.700
0.800
0.900
1.000
WELL S1-9-CP
DEPTH: 102.00 108.00
TOTAL: 7
X.AV: 0.2704
Y.AV: 0.3855
PLOTTED BY: CON ROSS

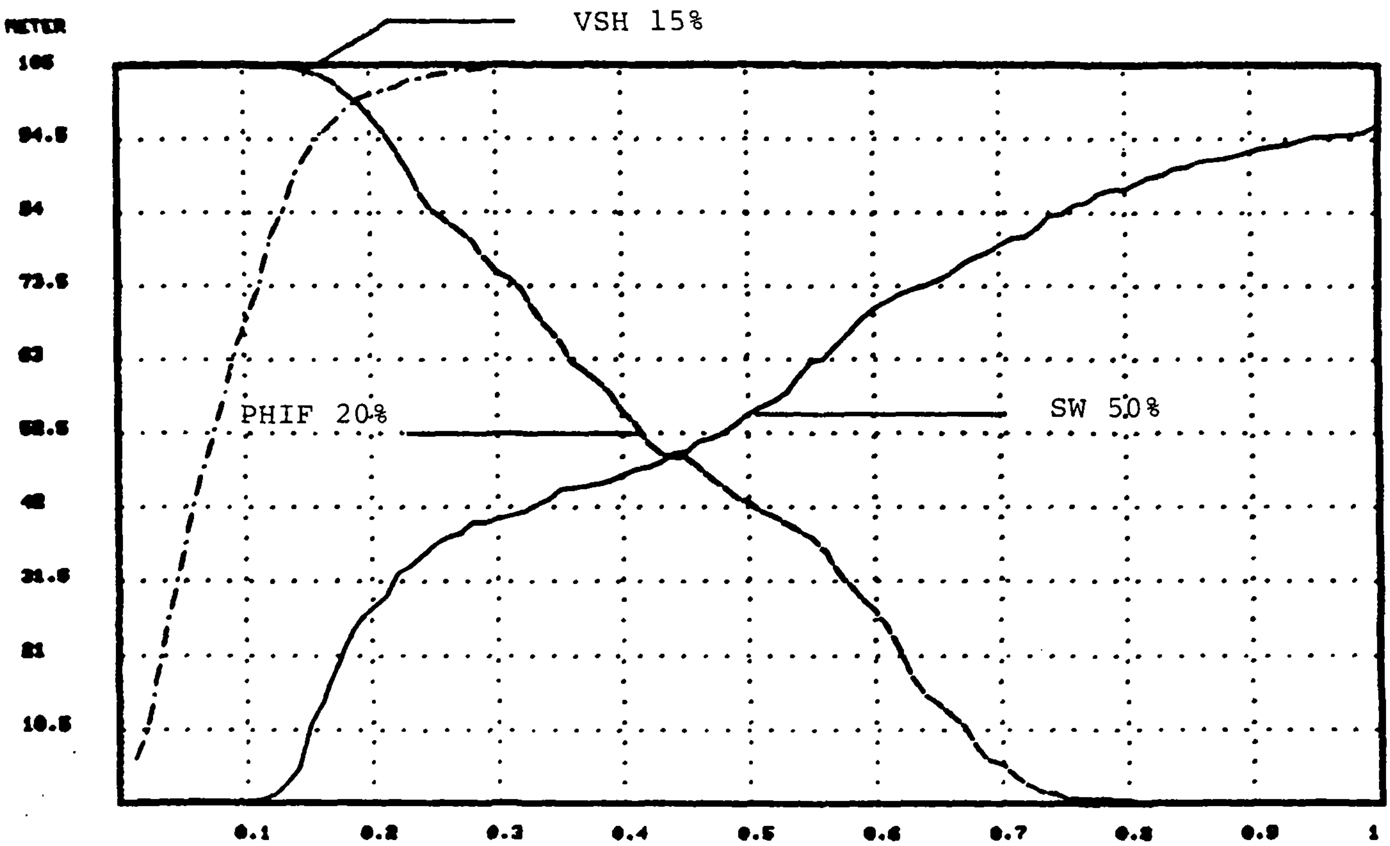

J MOT SW
WELL 51-9-CP
DEPTH: 109.00 122.00
TOTAL: 14
X.AV: 0.4358
Y.AV: 0.8744
PLOTTED BY: DON ROSS
0.000
0.100
0.200
0.300
0.400
0.500
0.600
0.700
0.800
0.900
1.000


J MOT SW
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0.000 0.100 0.200 0.300 0.400 0.500 0.600 0.700 0.800 0.900 1.000
WELL S1-9-CP DEPTH: 129.00 138.00 TOTAL: 10 X.AV: 0.5816 Y.AV: 0.1834
PLOTTED BY: DOM ROSS


EFFECTIVE OVERBURDEN PRESSURE: PSI:200
FF = 1.00 / ø 2.11
1000
100
10
1.0
0.001
0.01
0.1
1.0
Porosity, Fraction
Formation Resistivity Factor

# SENSITIVITETS-PLOT

WELL: 1-9-6
INTERVAL: 3411.00 , 3516.00
TID : 7.56 31/JAN/1983




1: 0.000 - SW - 1.000 >
2: 0.000 - PHIF - 0.500 <
3: 0.000 - VSH - 1.000 >

SEE PLOT 3.1.1

| | KLOGH | KLOGV |
|---|---|---|
| TOTAL DEPTH | 1.602 | 1.258 |
| NET PAY | 1.675 | 1.31 |
| NET SAND | 1.675 | 1.31 |

```
 S T A T I S T I C S
*********************

FIELD: . . . . . . . . . . .           TOMMILITEN
WELL:  . . . . . . . . . . .                1-9-6
ENGINEER:  . . . . . . . . . DCR
DATE:  . . . . .             10. 2   13 JAN 1983

DEPTH INTERVAL:  . . .  3516.25 TO  3600.00
APPLIED CUTOFFS:
.                VSH:  GREATER THAN      0.15
.               PHIF:     LESS THAN      0.15
.                 SW:  GREATER THAN      0.50

 T O T A L    D E P T H
******************************************
THICKNESS: . . . . . . . . .        83.750
AVERAGE  . . . 'PHIF'  . . .         0.261
AVERAGE        'VSHALE'  . .         0.017
AVERAGE  . . . 'SW'  . . . .         0.105
W.AVERAGE  . . 'SW' * 'PHIF'         0.100
AVERAGE  . . . 'SH'  . . . .         0.895
VOID VOLUME: . . . ('PHIF').        21.878
HC VOID VOLUME . . ('SH'*) .        19.701
RES HC VOID VOLUME ('SHR'*).         5.687
MOV HC VOID VOLUME . . . . .        14.015
******************************************

 N E T    P A Y
******************************************
THICKNESS: . . . . . . . . .        82.750
AVERAGE  . . . 'PHIF'  . . .         0.263
AVERAGE  . . . 'VSHALE'  . .         0.016
AVERAGE  . . . 'SW'  . . . .         0.104
W.AVERAGE  . . 'SW' * 'PHIF'         0.099
AVERAGE  . . . 'SH'  . . . .         0.896
VOID VOLUME: . . . ('PHIF').        21.761
HC VOID VOLUME . . ('SH'*) .        19.606
RES HC VOID VOLUME ('SHR'*).         5.624
MOV HC VOID VOLUME . . . . .        13.982
******************************************

 N E T    S A N D
******************************************
THICKNESS: . . . . . . . . .        82.750
AVERAGE  . . . 'PHIF'  . . .         0.263
AVERAGE  . . . 'VSHALE'  . .         0.016
AVERAGE  . . . 'SW'  . . . .         0.104
W.AVERAGE  . . 'SW' * 'PHIF'         0.099
AVERAGE  . . . 'SH'  . . . .         0.896
VOID VOLUME: . . . ('PHIF').        21.761
HC VOID VOLUME . . ('SH'*) .        19.606
RES HC VOID VOLUME ('SHR'*).         5.624
MOV HC VOID VOLUME . . . . .        13.982
******************************************

 N E T / G R O S S    R A T I O S
******************************************

HNETPAY /HGROSS SAND  =  0.98806
HNETSAND/HGROSS SAND  =  0.98806
HNETPAY /HNETSAND     =  1.00000
******************************************
```

## S T A T I S T I C S

| | | |
|---|---|---|
| FIELD: . . . . . . . . . . . | | TOMMILITEN |
| WELL: . . . . . . . . . . . | | 1-9-6 |
| ENGINEER: . . . . . . . . . . | DCR | |
| DATE: . . . . . . | 10. 4 | 13 JAN 1983 |

DEPTH INTERVAL: . . . 3600.25 TO 3781.00

APPLIED CUTOFFS:

| | | |
|---|---|---|
| VSH: | GREATER THAN | 0.15 |
| PHIF: | LESS THAN | 0.15 |
| SW: | GREATER THAN | 0.50 |

## T O T A L   D E P T H

| | |
|---|---|
| THICKNESS: . . . . . . . . . | 180.750 |
| AVERAGE . . . 'PHIF' . . . | 0.130 |
| AVERAGE . . . 'VSHALE' . . | 0.012 |
| AVERAGE . . . 'SW' . . . . | 0.642 |
| W.AVERAGE . . 'SW' * 'PHIF' | 0.498 |
| AVERAGE . . . 'SH' . . . . | 0.358 |
| VOID VOLUME: . . . ('PHIF'). | 23.510 |
| HC VOID VOLUME . . ('SH'*) . | 11.797 |
| RES HC VOID VOLUME ('SHR'*). | 3.577 |
| MOV HC VOID VOLUME . . . . . | 8.220 |

## N E T   P A Y

| | |
|---|---|
| THICKNESS: . . . . . . . . . | 68.250 |
| AVERAGE . . . 'PHIF' . . . | 0.201 |
| AVERAGE . . . 'VSHALE' . . | 0.009 |
| AVERAGE . . . 'SW' . . . . | 0.270 |
| W.AVERAGE . . 'SW' * 'PHIF' | 0.271 |
| AVERAGE . . . 'SH' . . . . | 0.730 |
| VOID VOLUME: . . . ('PHIF'). | 13.698 |
| HC VOID VOLUME . . ('SH'*) . | 9.985 |
| RES HC VOID VOLUME ('SHR'*). | 2.539 |
| MOV HC VOID VOLUME . . . . . | 7.446 |

## N E T   S A N D

| | |
|---|---|
| THICKNESS: . . . . . . . . . | 76.000 |
| AVERAGE . . . 'PHIF' . . . | 0.202 |
| AVERAGE . . . 'VSHALE' . . | 0.009 |
| AVERAGE . . . 'SW' . . . . | 0.329 |
| W.AVERAGE . . 'SW' * 'PHIF' | 0.335 |
| AVERAGE . . . 'SH' . . . . | 0.671 |
| VOID VOLUME: . . . ('PHIF'). | 15.365 |
| HC VOID VOLUME . . ('SH'*) . | 10.212 |
| RES HC VOID VOLUME ('SHR'*). | 2.638 |
| MOV HC VOID VOLUME . . . . . | 7.574 |

## N E T / G R O S S   R A T I O S

| | |
|---|---|
| HNETPAY /HGROSS SAND = | 0.37759 |
| HNETSAND/HGROSS SAND = | 0.42047 |
| HNETPAY /HNETSAND = | 0.89803 |

| KLOGH | KLOGV |
|---|---|
| .049 | .049 |
| .316 | .279 |
| ..328 | .288 |

SEE PLOT 3.3.1

## Available Reservoir Measurements

| | |
|---|---|
| Logs: | Induction - Spherical Focused Sonic Log<br>Dual Laterolog - Micro Spherical Focused Log<br>Formation Density Log<br>Lithodensity - Compensated Neutron Log<br>Electromagnetic Propagation Log<br>PHIX - EPHI Quicklook<br>Global |
| Tests: | 3523.5-51, 3560-69, 3578.5-87.5<br>3636-55<br>3772-77 |
| Core Analysis: | 3516.25-3616 |

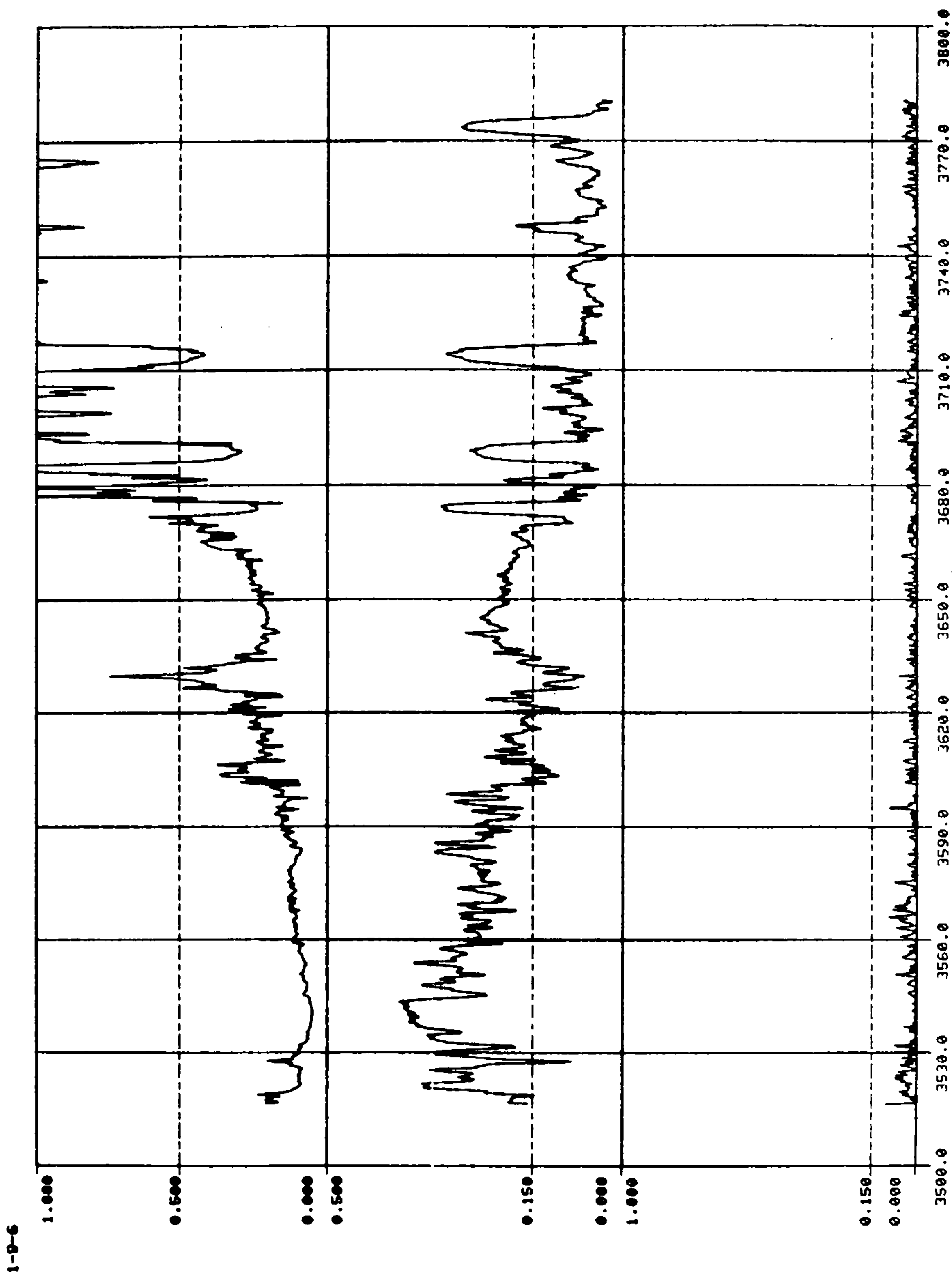
Helium porosity, horizontal and vertical permeability, grain density, summation porosity, pore saturation.

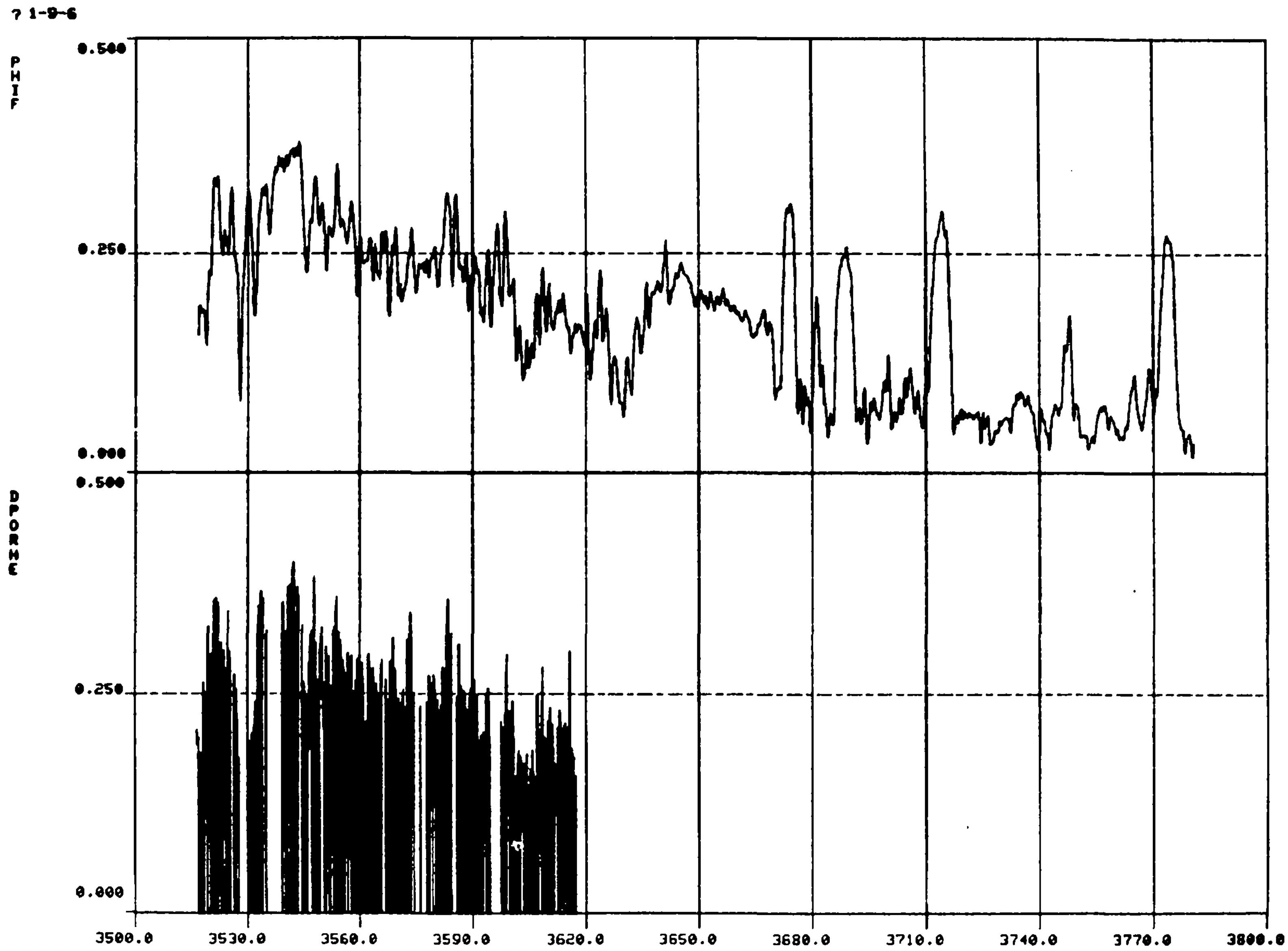
Ordered, but not yet available.
Formation factor room conditions.
Capillary pressure air-water.
Resistivity index.
Capillary pressure air-mercury with determination of pore size distribution.

Formation factor, porosity, permeability with net confining pressure.
Gas-oil relative permeability.
Gas-water relative permeability.

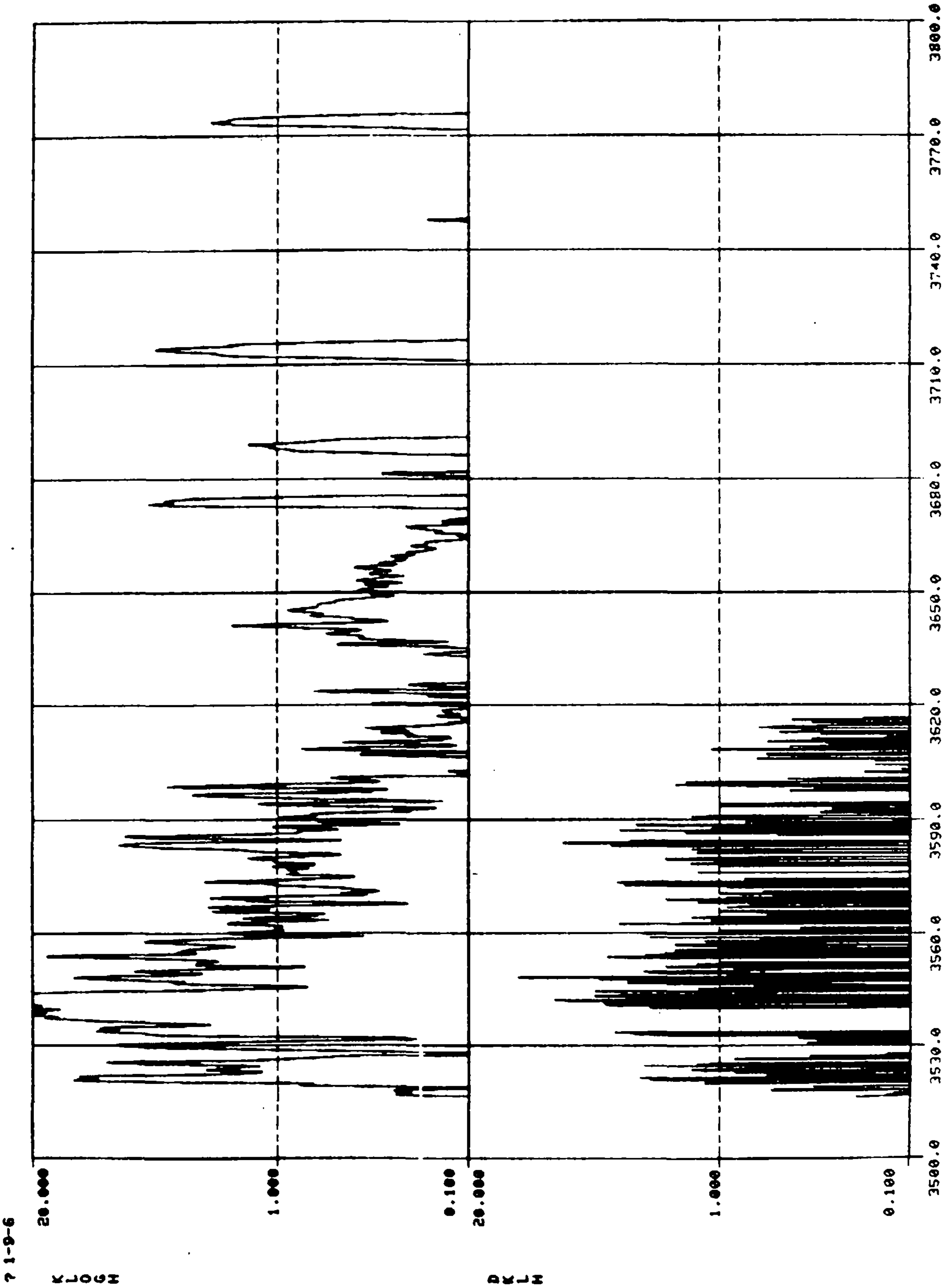
LOG ANALYSIS PARAMETERS

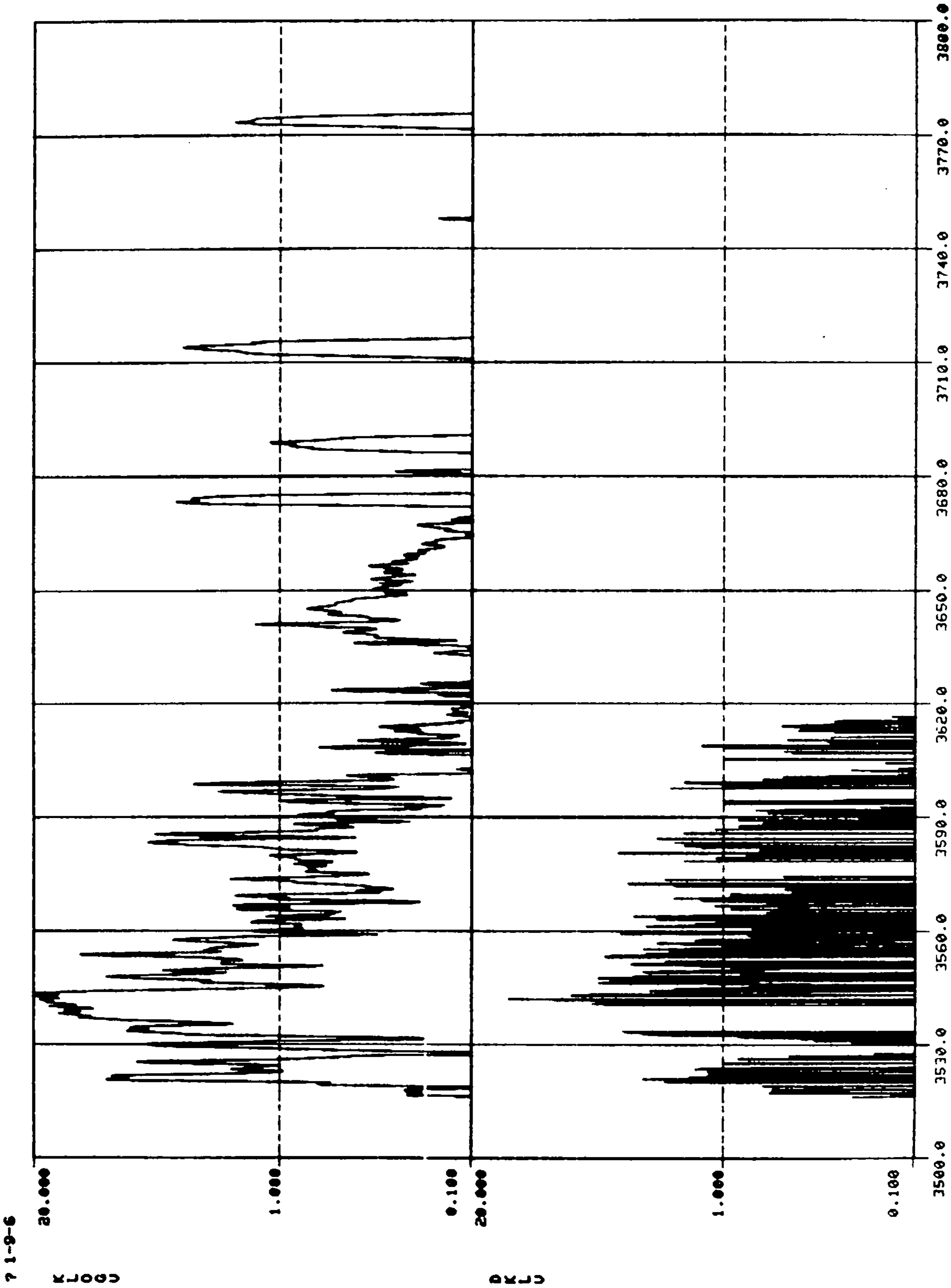
| ZONE | TOR |
|---|---|
| Depths | 3516.25-3781 |
| Porosity method | Litho |
| Water saturation method | North Sea |
| Pb min 1 | 2.7 |
| Pb min 2 | 2.87 |
| Psh | 2.37 |
| Pf | 1.0 |
| Phc | 0.6 |
| NØma min 1 | 0 |
| NØma min 2 | +0.025 |
| NØfl | 1 |
| GRmin | 7 |
| GRmax | 70 |
| Rmf | .064 |
| Rw | .025 |
| Rsh | .6 |
| m | 2.0 |
| a | 1.0 |
| n | 2.0 |
| VSH Determinants | GR,DN |
| VSH exponent | 1.6 |
| BHT | 230°F |
| Cutoffs VSH | .15 |
| Ø | .20 |
| SW | .50 |
| Log KLOGH | -2.8090+11.5575 PHIF |
| Log KLOGV | -2.7025+10.7472 PHIF |
| SWPC (100-.4 md) | $.02403J^{-1.4718}$ |
| SWPC (.4-.2 md) | $.0329J^{-1.303}$ |
| SWPC (.2-0 md) | $.0646J^{-1.1876}$ |

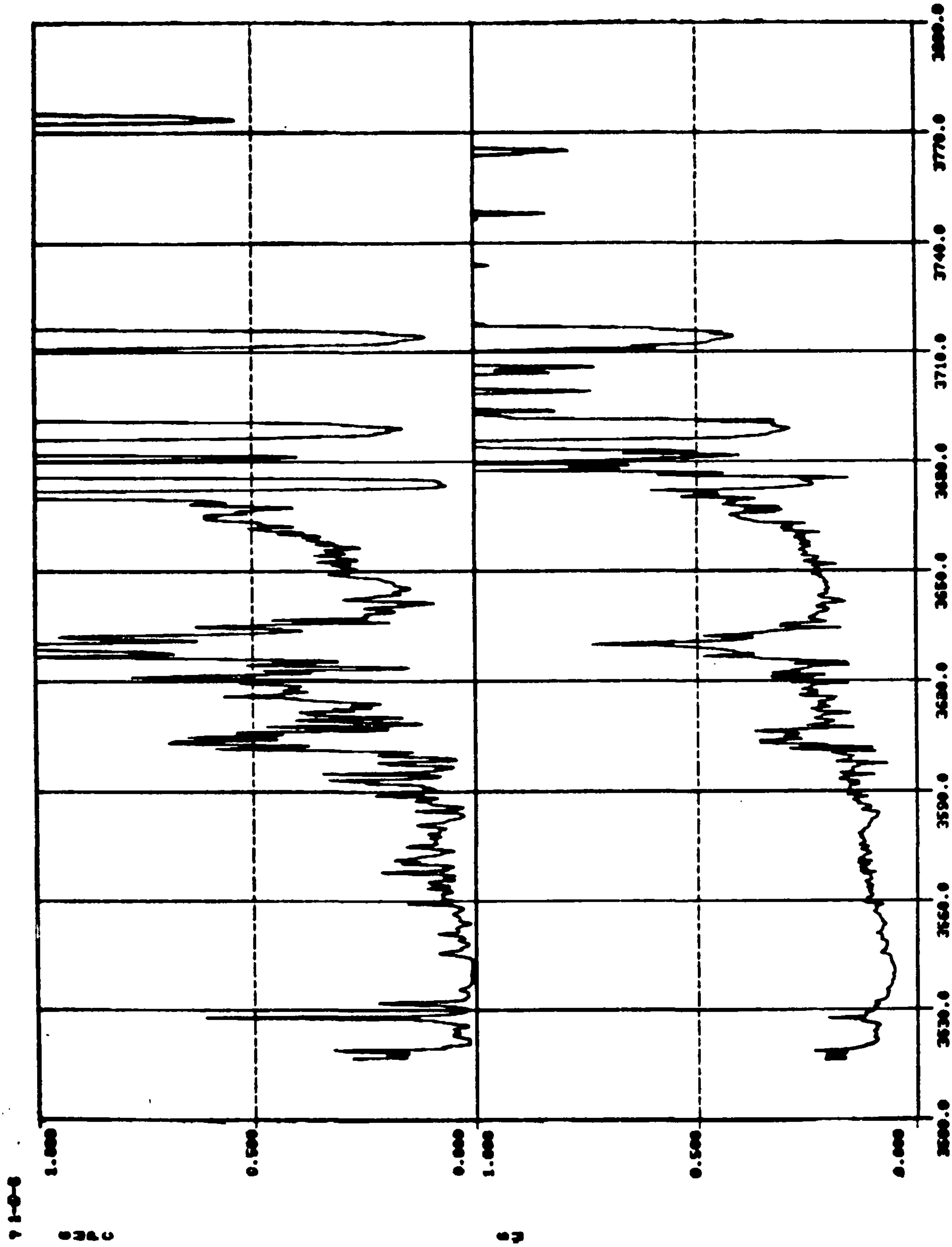

7 1-9-6
CS
PHIF
HSC
1.000
0.500
0.000
0.500
0.150
0.000
1.000
0.150
0.000
3500.0
3530.0
3560.0
3590.0
3620.0
3650.0
3680.0
3710.0
3740.0
3770.0
3800.0

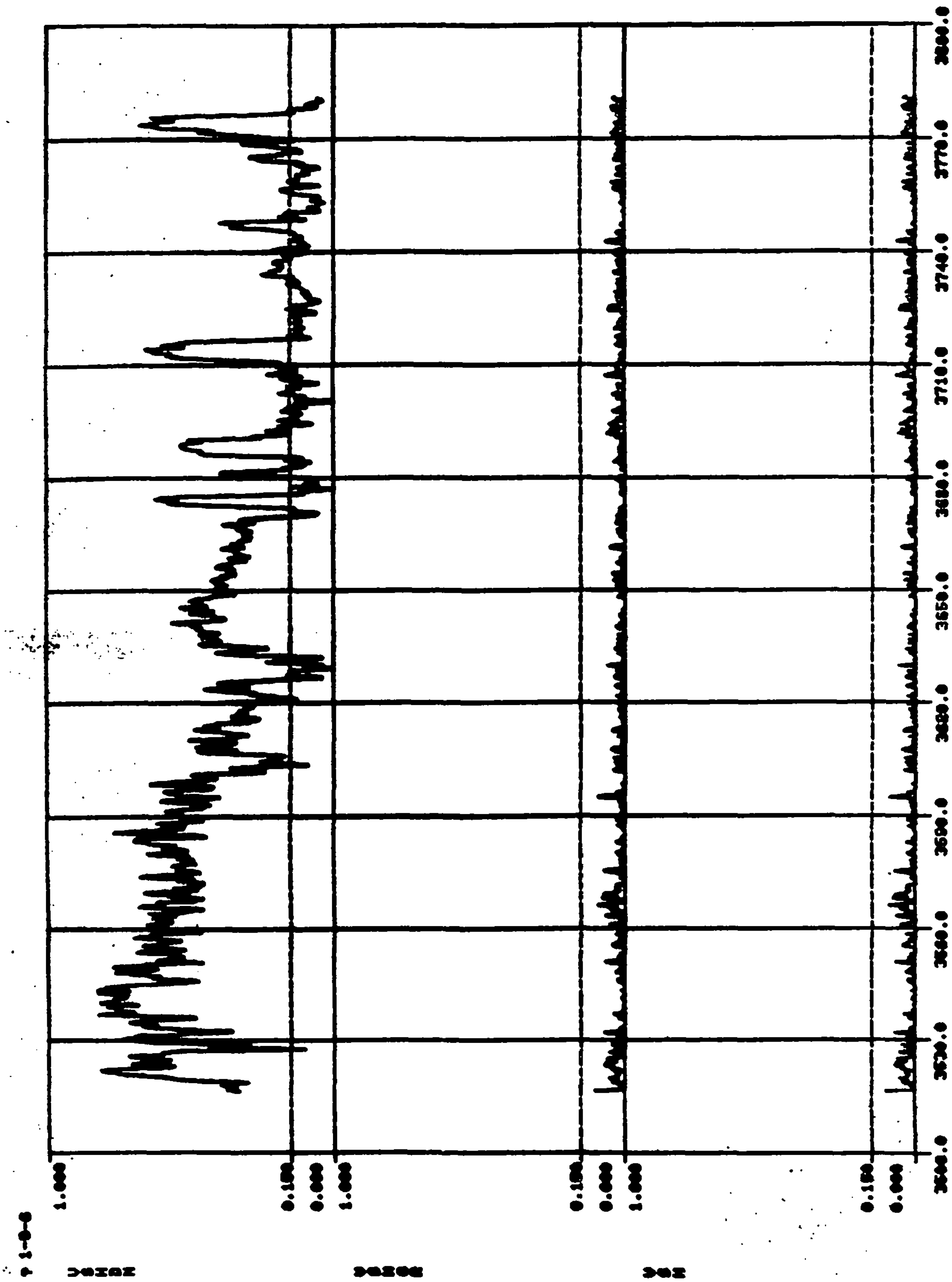


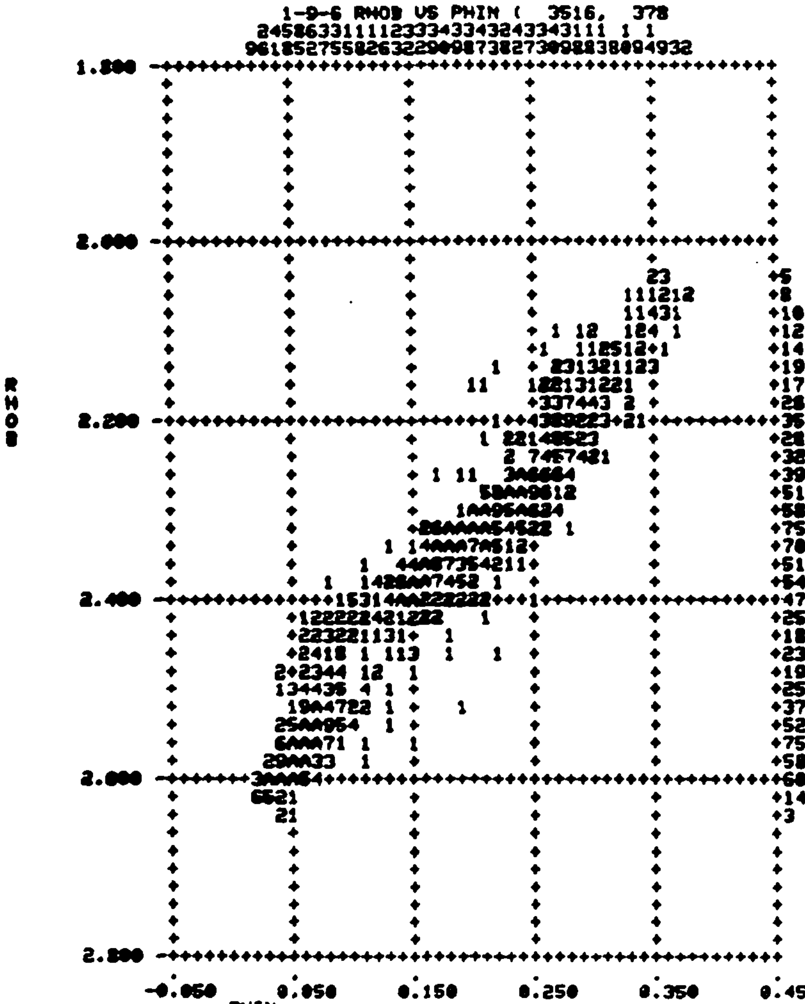
? 1-9-6
PHIF
DPORHE
0.500
0.250
0.000
0.500
0.250
0.000
3500.0
3530.0
3560.0
3590.0
3620.0
3650.0
3680.0
3710.0
3740.0
3770.0
3800.0


7 1-9-6
KLOGH
PKLH
20.000
1.000
0.100
20.000
1.000
0.100
3500.0
3530.0
3560.0
3590.0
3620.0
3650.0
3680.0
3710.0
3740.0
3770.0
3800.0


20.000
1.000
0.100
20.000
1.000
0.100
3500.0
3530.0
3560.0
3590.0
3620.0
3650.0
3680.0
3710.0
3740.0
3770.0
3800.0


3800.0
3770.0
3740.0
3710.0
3680.0
3650.0
3620.0
3590.0
3560.0
3530.0
3500.0
1.000
0.500
0.000
1.000
0.500
0.000

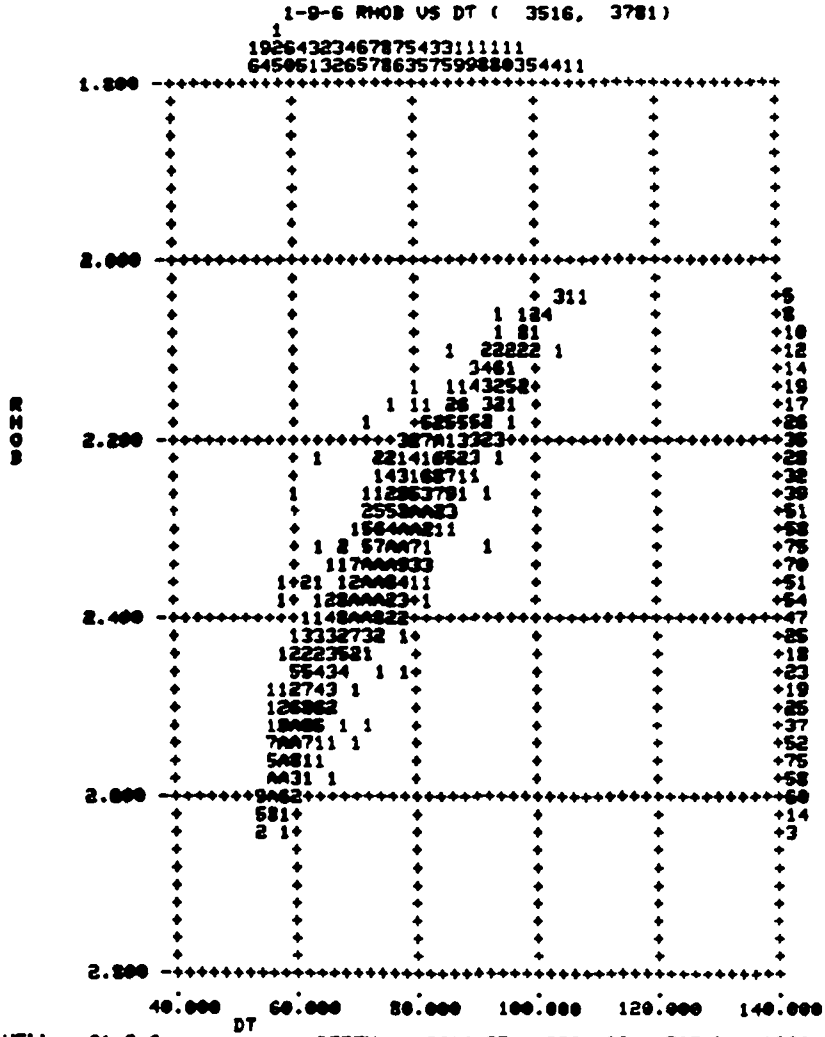





WELL S1-9-6 DEPTH: 3516.25 3781.00 TOTAL: 1060
X.AV: 0.1717 Y.AV: 2.3899

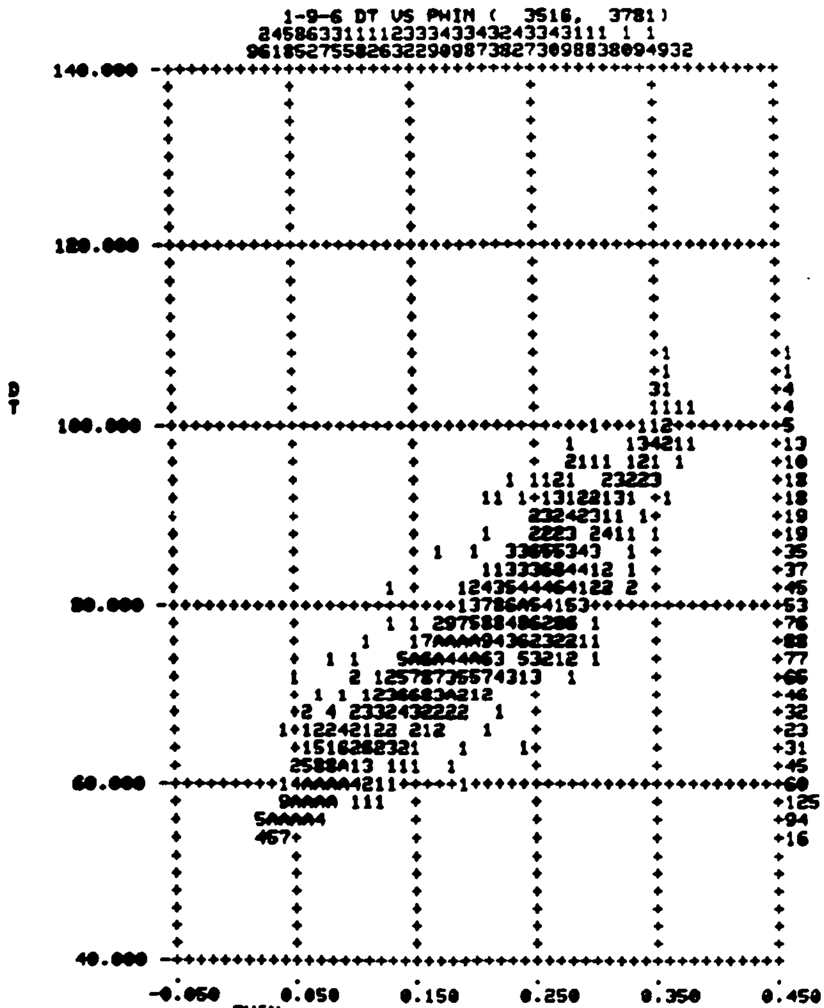
P L O T T E D B Y : DCR

1-9-6 RHOB VS DT ( 3516, 3781)



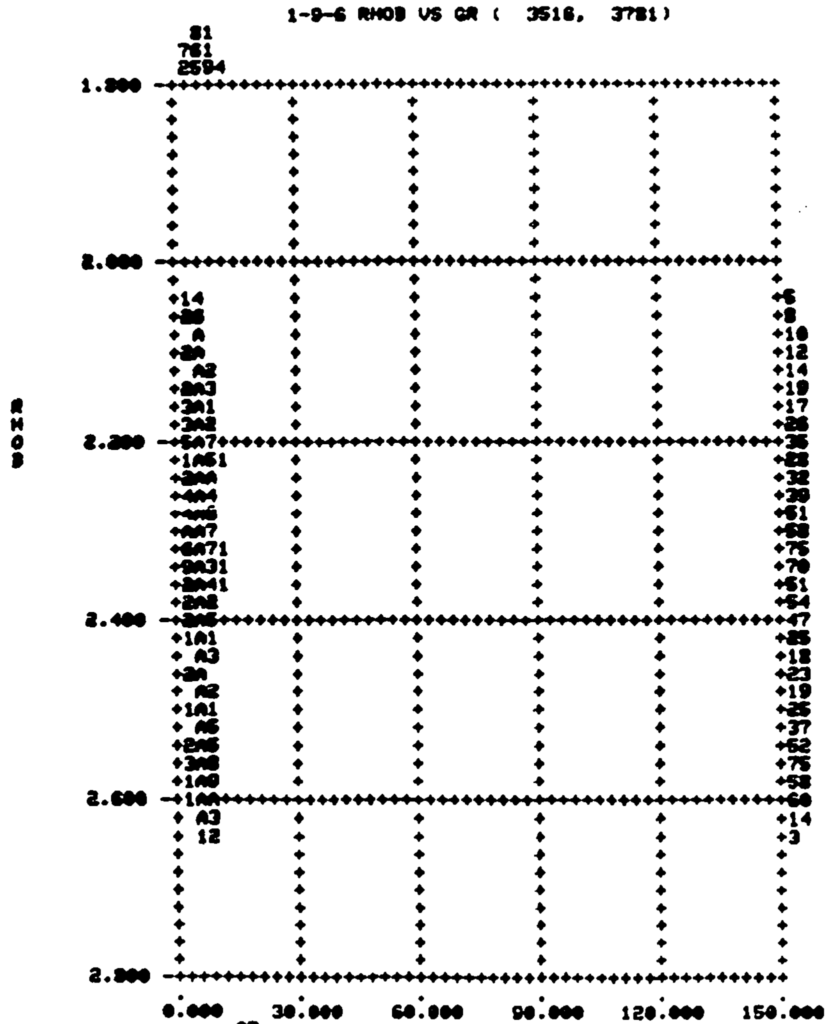

WELL S1-9-6 DEPTH: 3516.25 3781.00 TOTAL: 1068
X.AV: 72.8751 Y.AV: 2.3899

P L O T T E D B Y : DCR



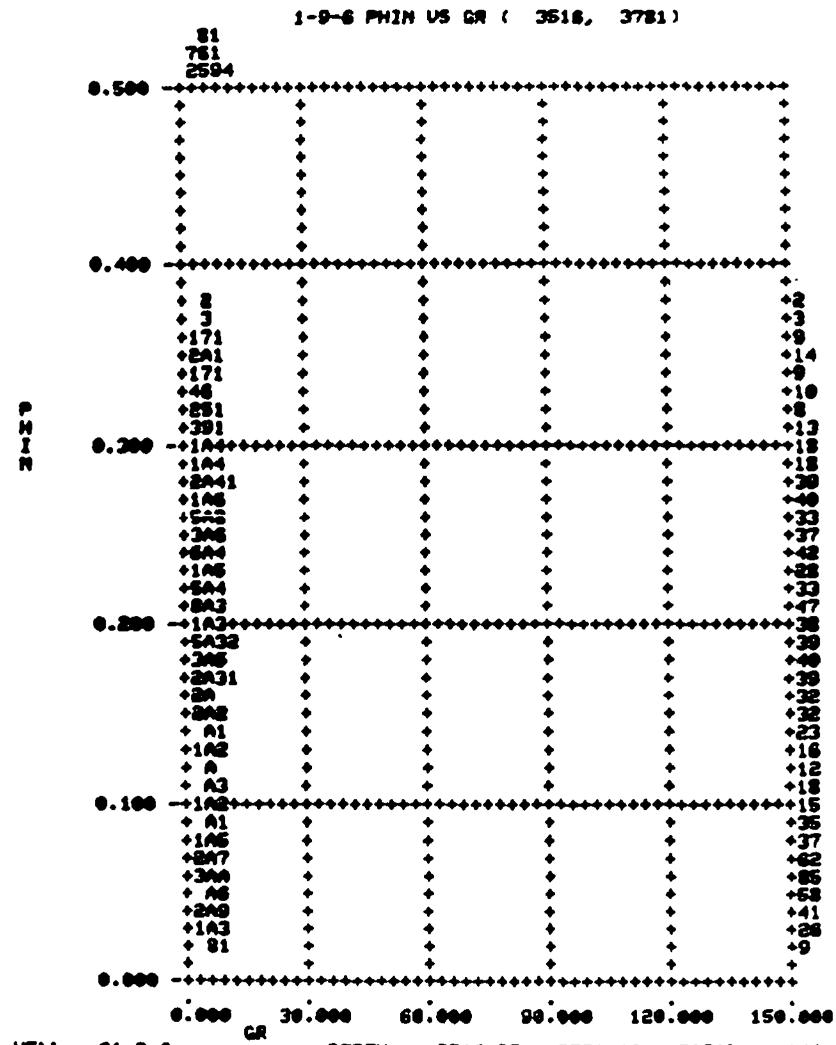

WELL S1-9-6 DEPTH: 3516.25 3781.00 TOTAL: 1060
X.AV: 0.1717 Y.AV: 72.8751

PLOTTED BY: DCR




WELL S1-9-6 DEPTH: 3516.25 3781.00 TOTAL: 1060
X.AV: 7.6404 Y.AV: 2.3899

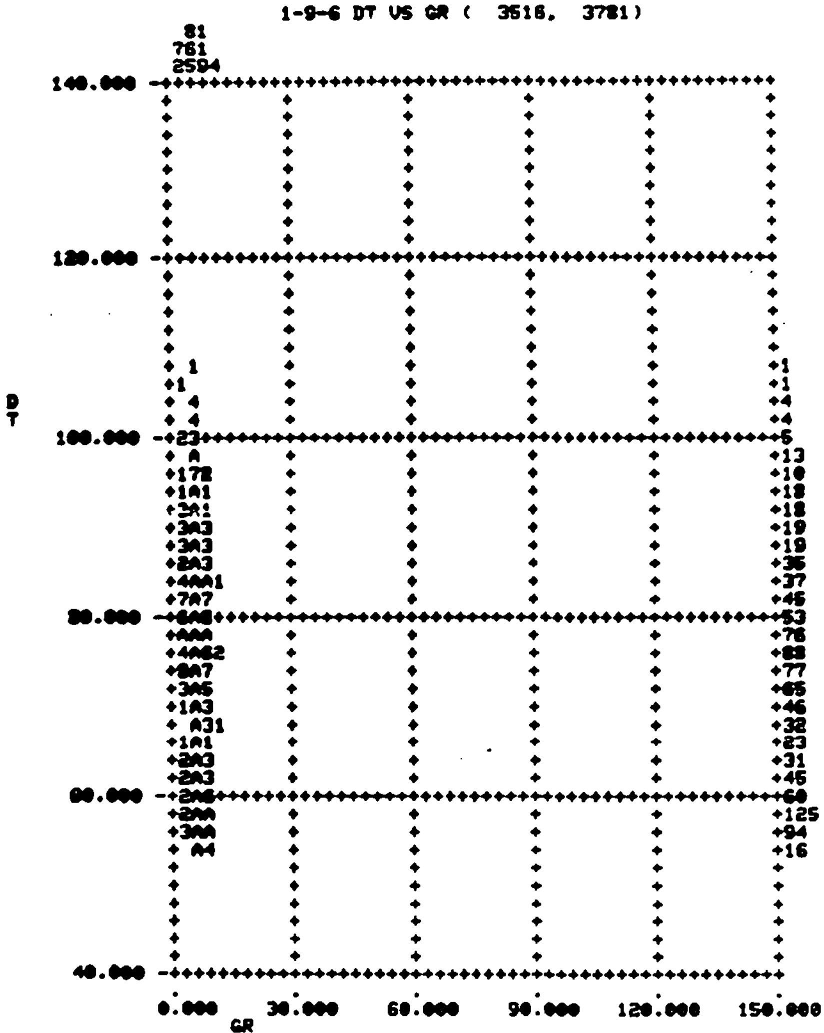
P L O T T E D B Y : DCR




WELL S1-9-6 DEPTH: 3516.25 3781.00 TOTAL: 1060
X.AV: 7.6404 Y.AV: 0.1717

P L O T T E D B Y : DCR

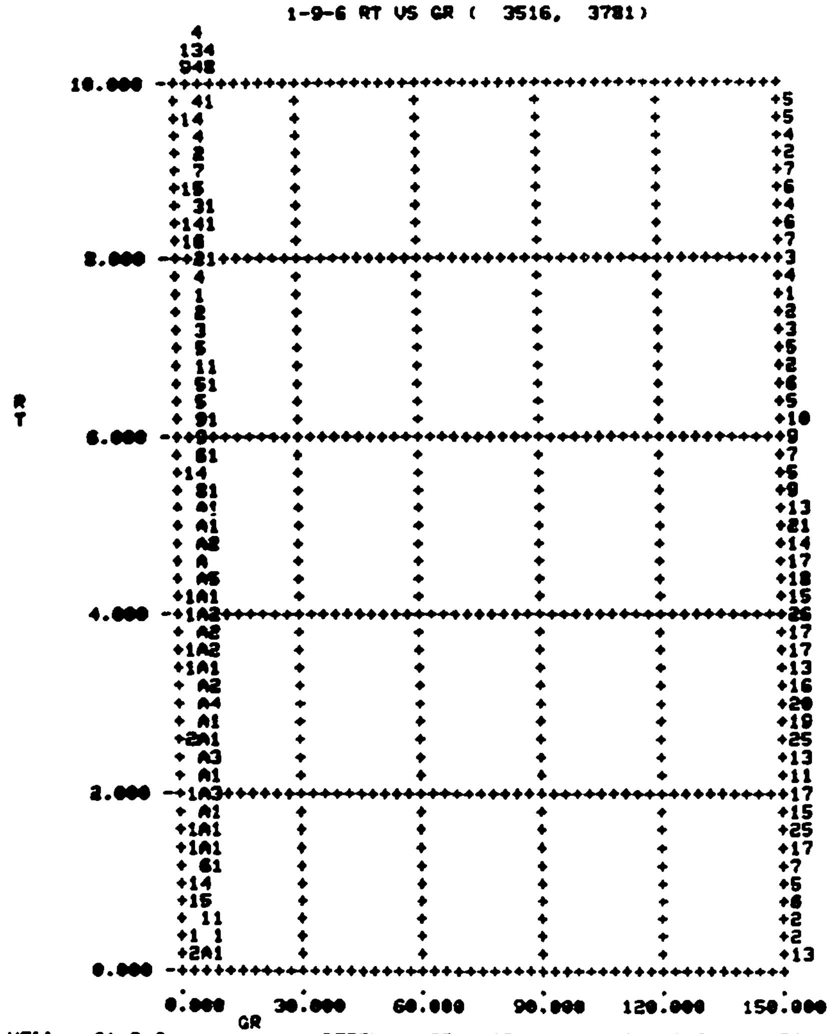
1-9-6 DT VS GR ( 3516, 3781)




WELL S1-9-6 DEPTH: 3516.25 3781.00 TOTAL: 1060
X.AV: 7.6404 Y.AV: 72.8751

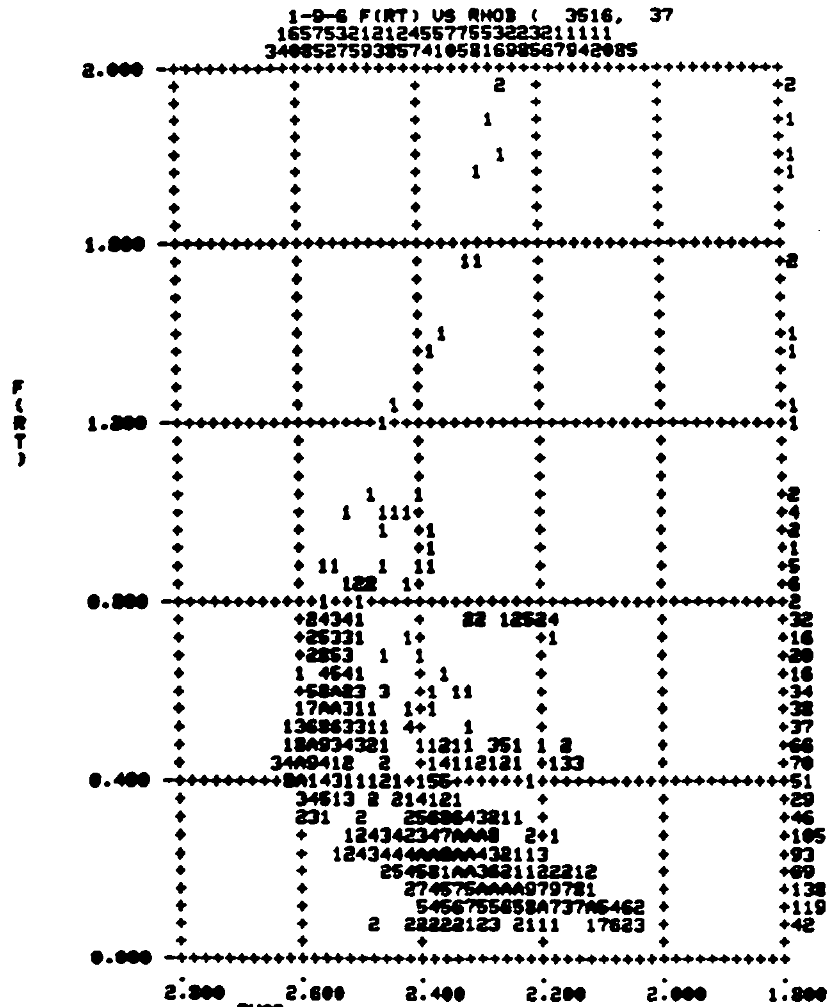
P L O T T E D B Y : DCR

1-9-6 RT VS GR ( 3516, 3781)



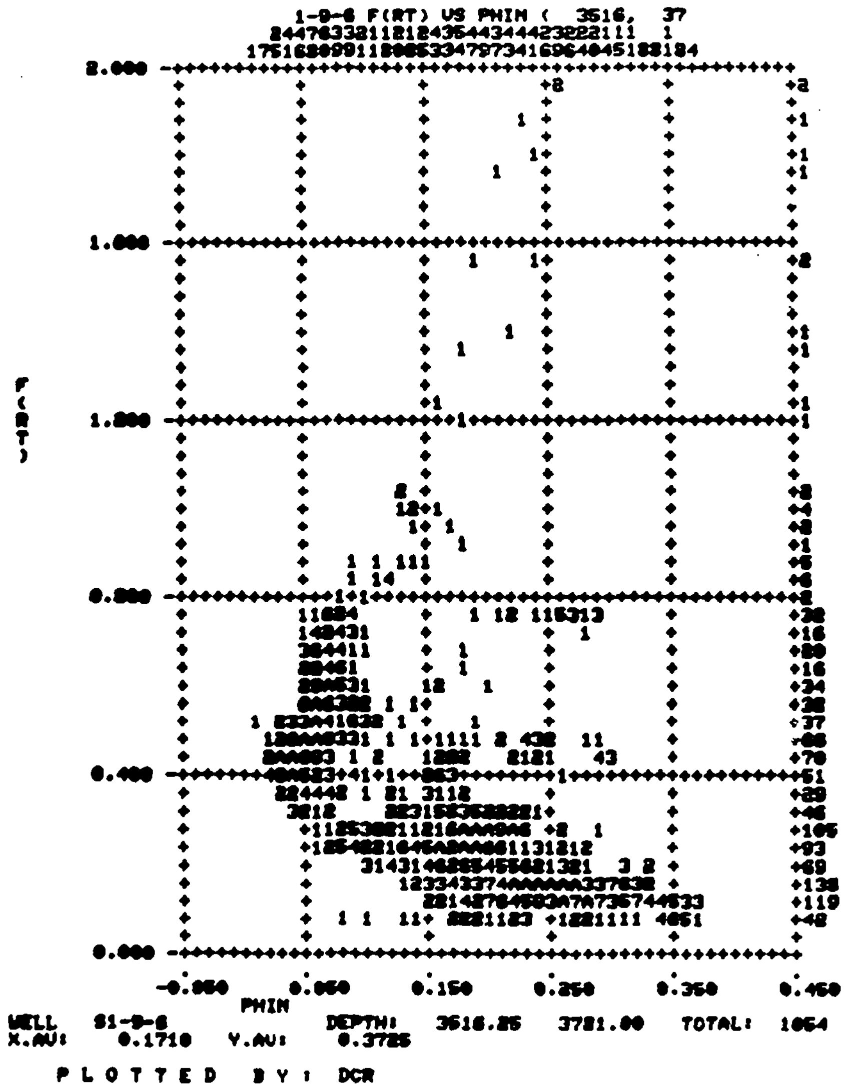

WELL S1-9-6 DEPTH: 3516.25 3781.00 TOTAL: 501
X.AV: 7.6299 Y.AV: 4.1505

P L O T T E D B Y : DCR

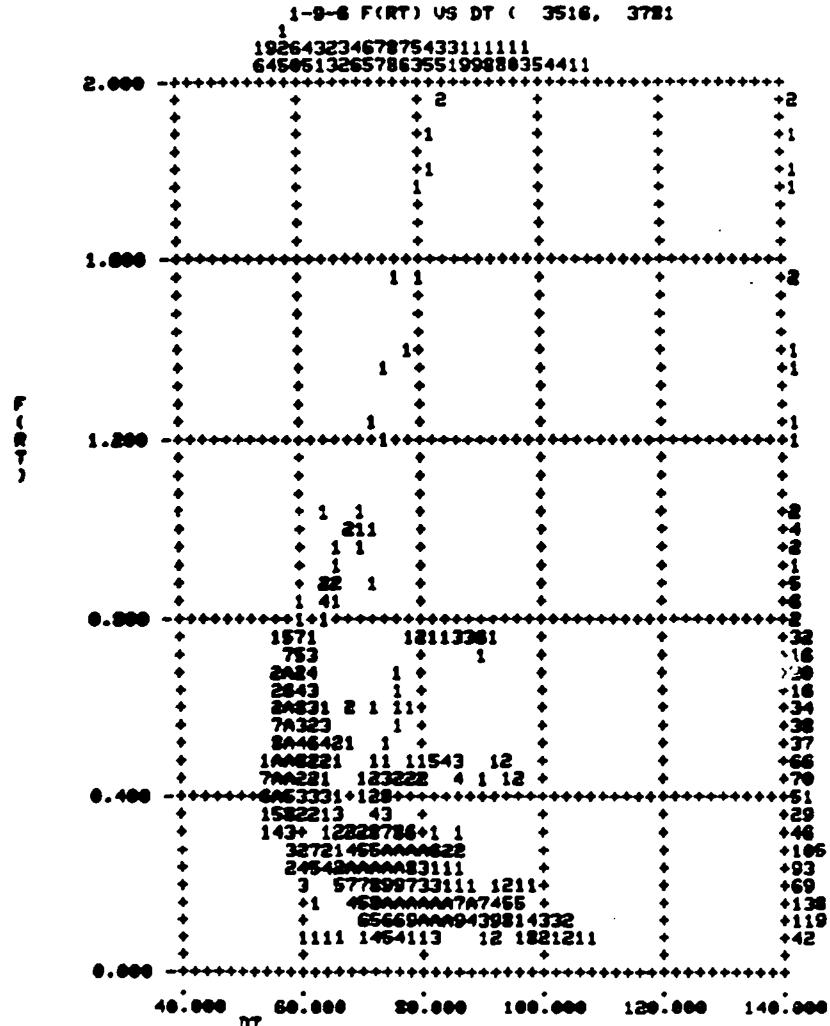



WELL 51-9-6 DEPTH: 3516.25 3781.00 TOTAL: 1054
X.AV: 2.3907 Y.AV: 0.3725

P L O T T E D B Y : DCR

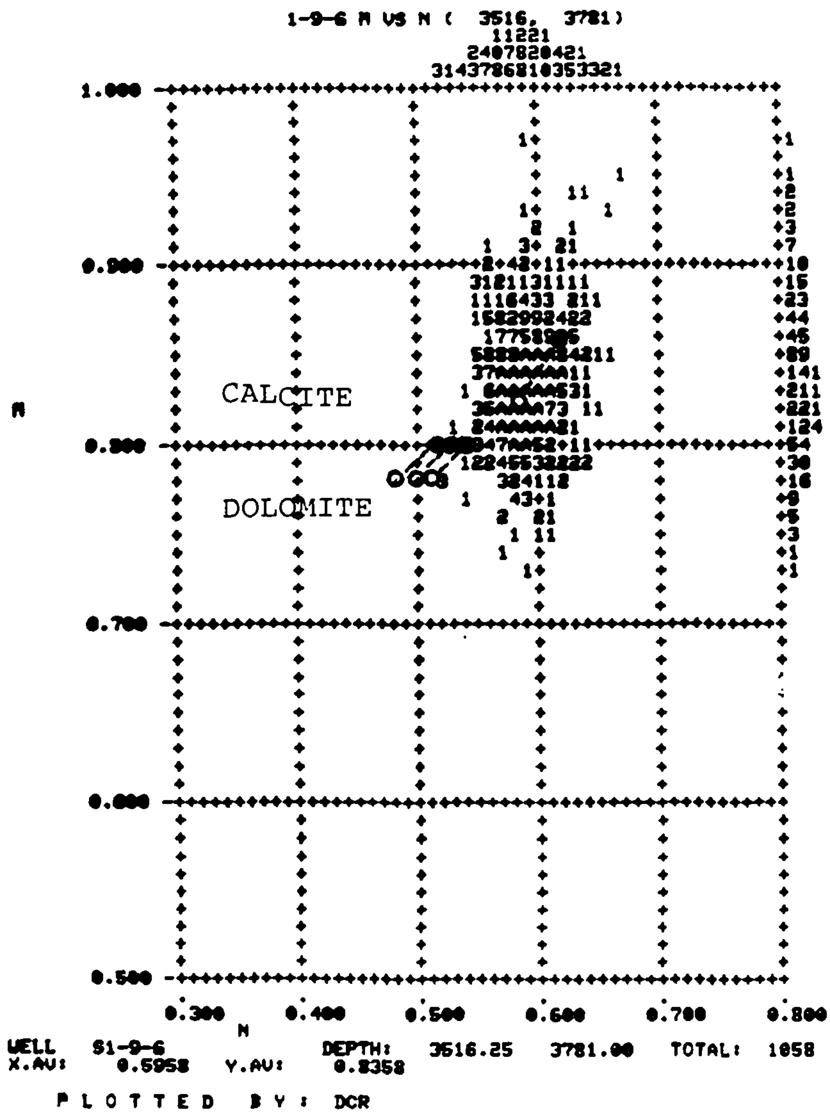

F(RT) VS PHIN
2.000
0.400
0.000
F(RT)
-0.050 0.050 0.150 0.250 0.350 0.450
PHIN
WELL 31-9-6 DEPTH: 3516.25 3781.00 TOTAL: 1054
X.AV: 0.1710 Y.AV: 0.3725
PLOTTED BY: DCR

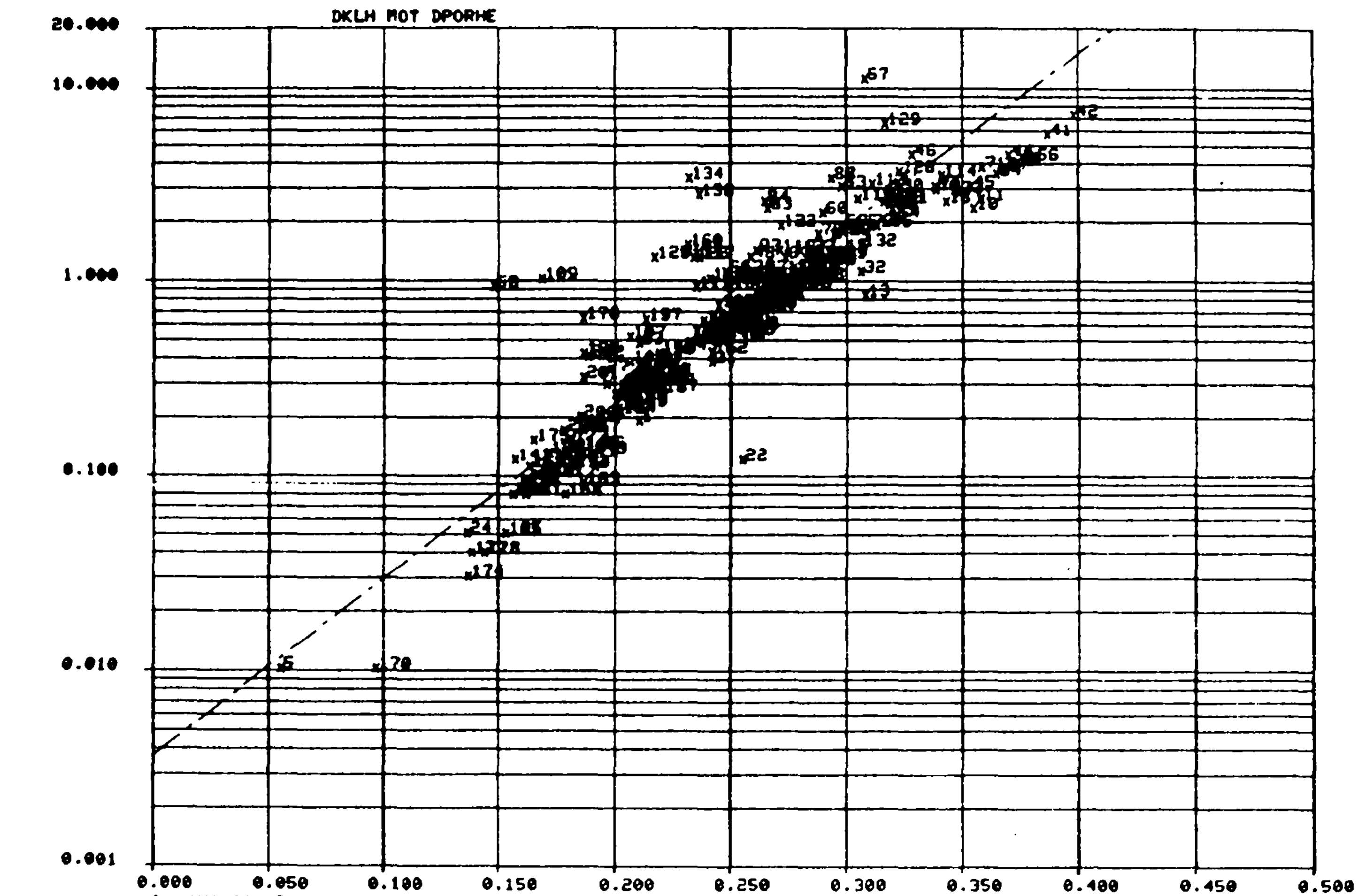
1-9-6 F(RT) VS DT ( 3516, 3781




WELL 61-9-6 DEPTH: 3516.25 3781.00 TOTAL: 1054
X.AV: 72.7985 Y.AV: 0.3725

P L O T T E D B Y : DCR

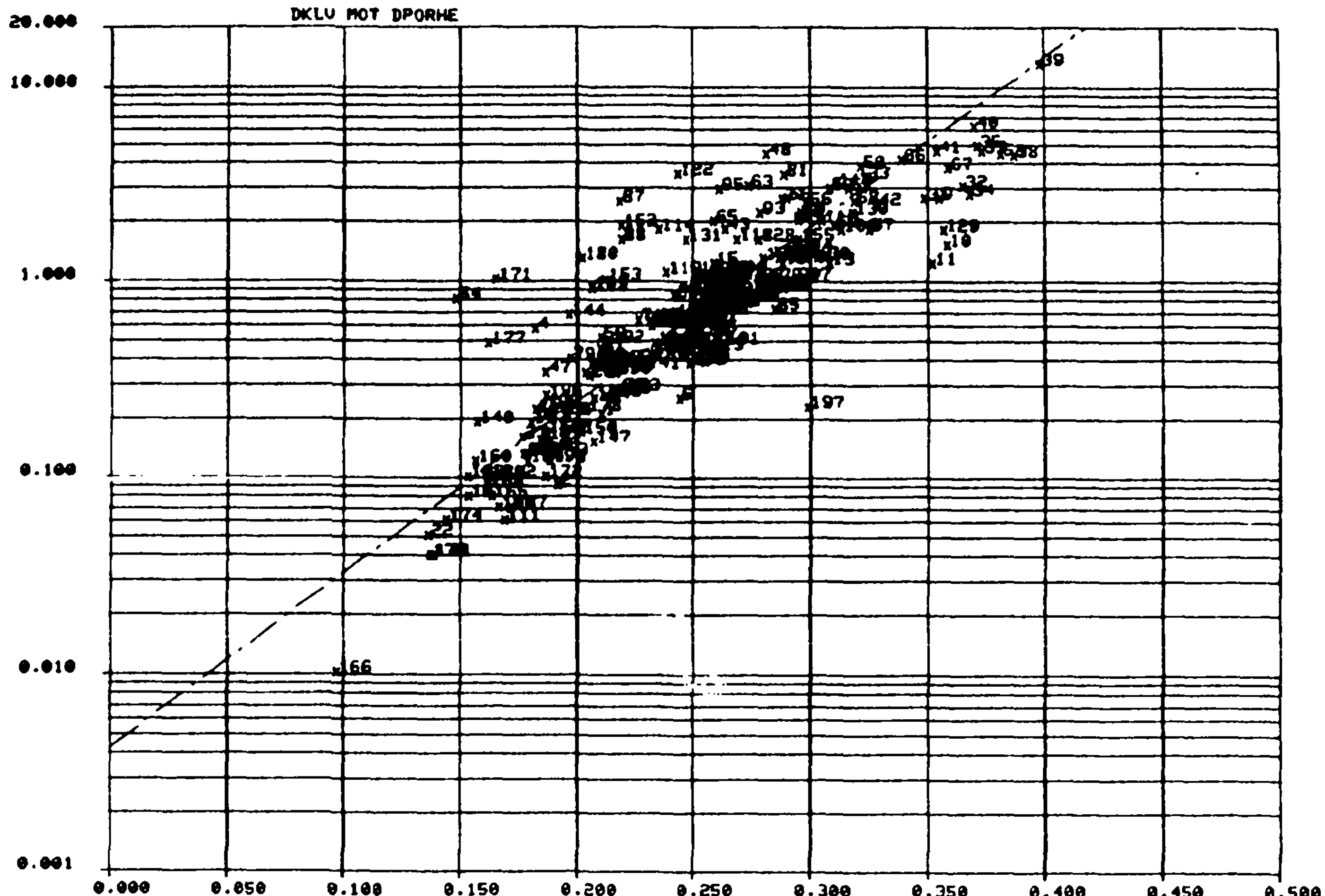

1-9-6 M VS N ( 3516, 3781)
1.000
0.900
0.800
0.700
0.600
0.500
0.300
0.400
0.500
0.600
0.700
0.800
N
M
CALCITE
DOLOMITE
WELL S1-9-6 DEPTH: 3516.25 3781.00 TOTAL: 1058
X.AV: 0.5958 Y.AV: 0.8358
PLOTTED BY: DCR




Log(Y)=A*X+B
A= 9.01693903 B= -2.43410467 C2= 0.82097034
DO YOU WANT TO DELETE ANY POINTS?
K-NO

WELL 51-9-6 DEPTH: 3516.25 3781.00 TOTAL: 205 X.AV: 0.2481 Y.AV: 1.1811

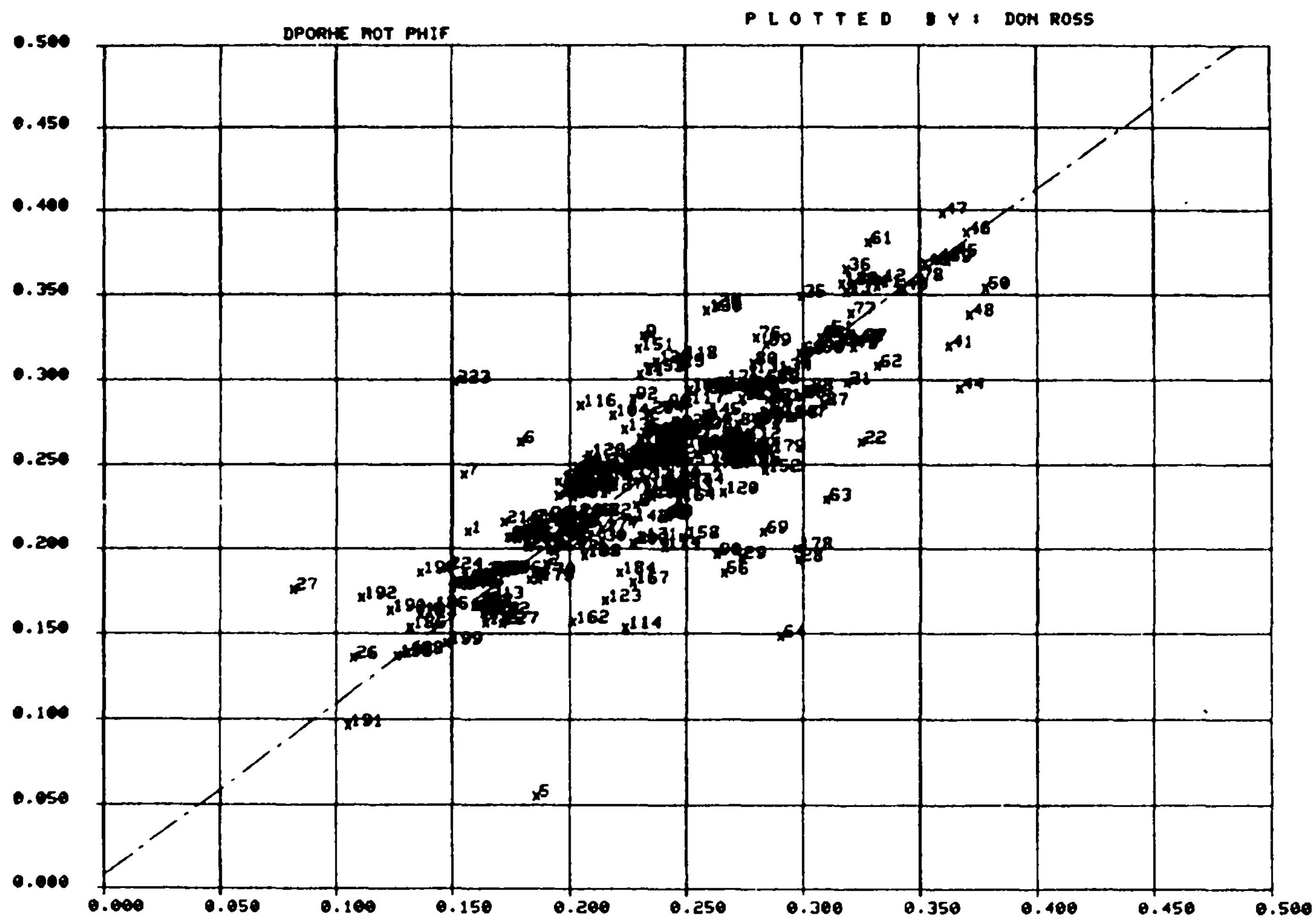
P L O T T E D B Y : DON ROSS



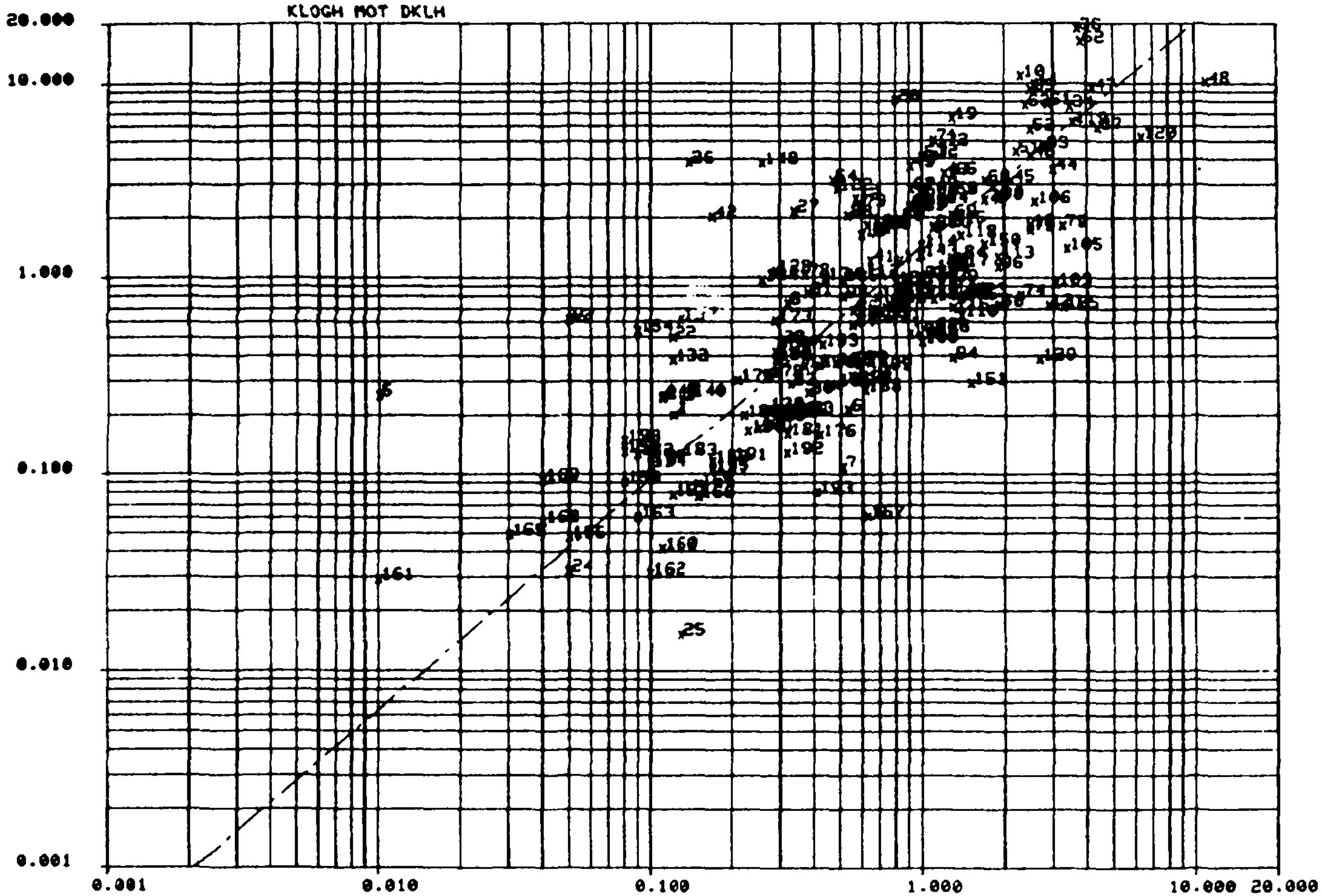

Log(Y)=A*X+B
A= 8.79049045 B= -2.36872442 C2= 0.74082006
DO YOU WANT TO DELETE ANY POINTS?
NO

WELL S1-9-6 DEPTH: 3516.25 3781.00 TOTAL: 200 X.AV: 0.2483 Y.AV: 1.1615

P L O T T E D B Y : DON ROSS



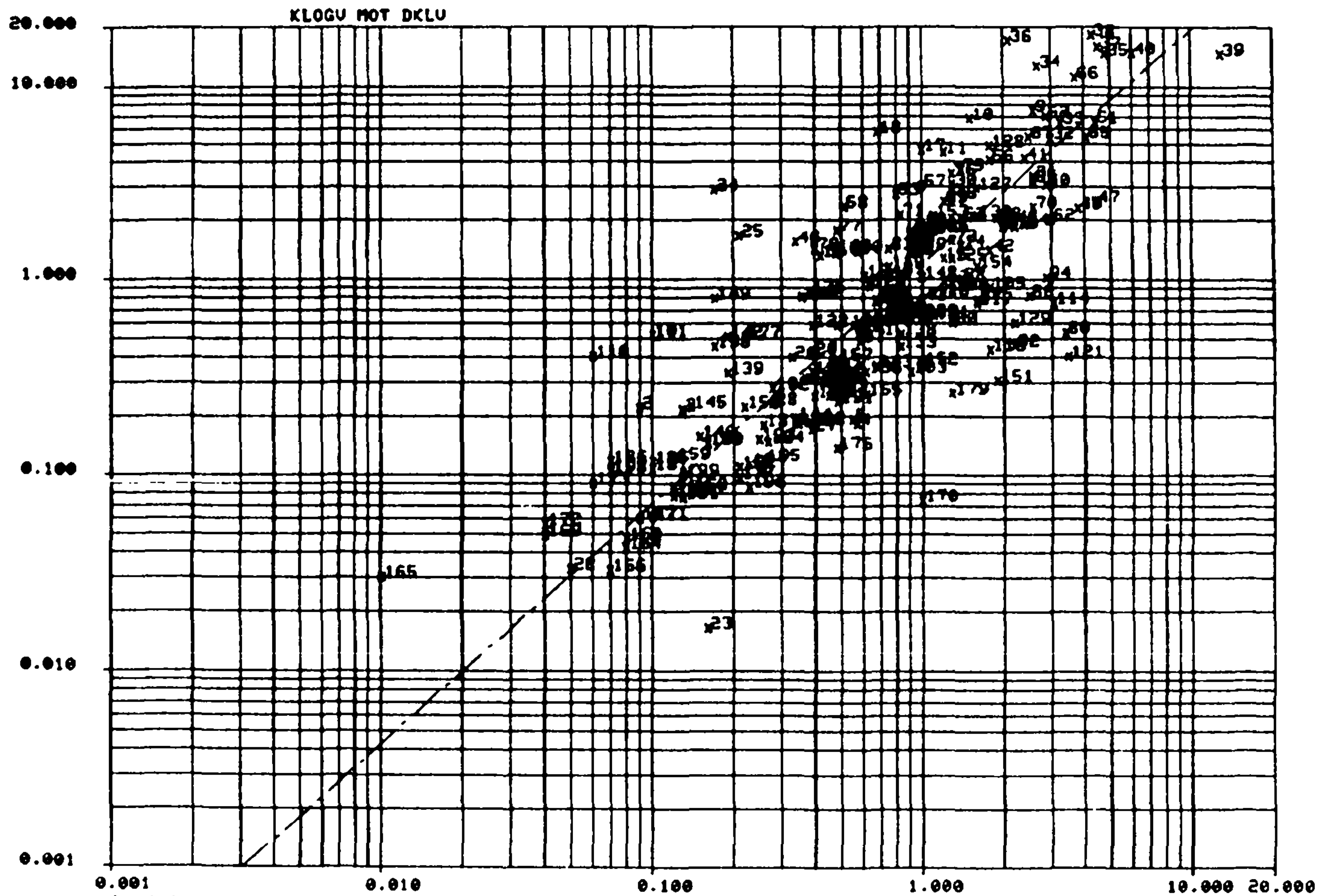

```
Y=A*X+B
A=       1.01058085      B=     0.00860225      C2=     0.64206011
DO YOU WANT TO DELETE ANY POINTS?
NNO

PLEASE REPEAT
NO

WELL    51-9-6          DEPTH:   3516.25   3781.00   TOTAL:   227   X.AV:   0.2402   Y.AV:   0.2513
```




Log(Y)=A*Log(X)+B
A= 1.17029829 B= 0.14095503 C2= 0.57693991
DO YOU WANT TO DELETE ANY POINTS?
NO

WELL 51-9-6 DEPTH: 3516.25 3781.00 TOTAL: 196 X.AV: 1.0567 Y.AV: 1.7570

P L O T T E D B Y : DON ROSS




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

A= 1.21920580 B= 0.06566125 C2= 0.64178918

DO YOU WANT TO DELETE ANY POINTS?

NO

WELL S1-9-6 DEPTH: 3516.25 3781.00 TOTAL: 199 X.AV: 1.1447 Y.AV: 1.7652

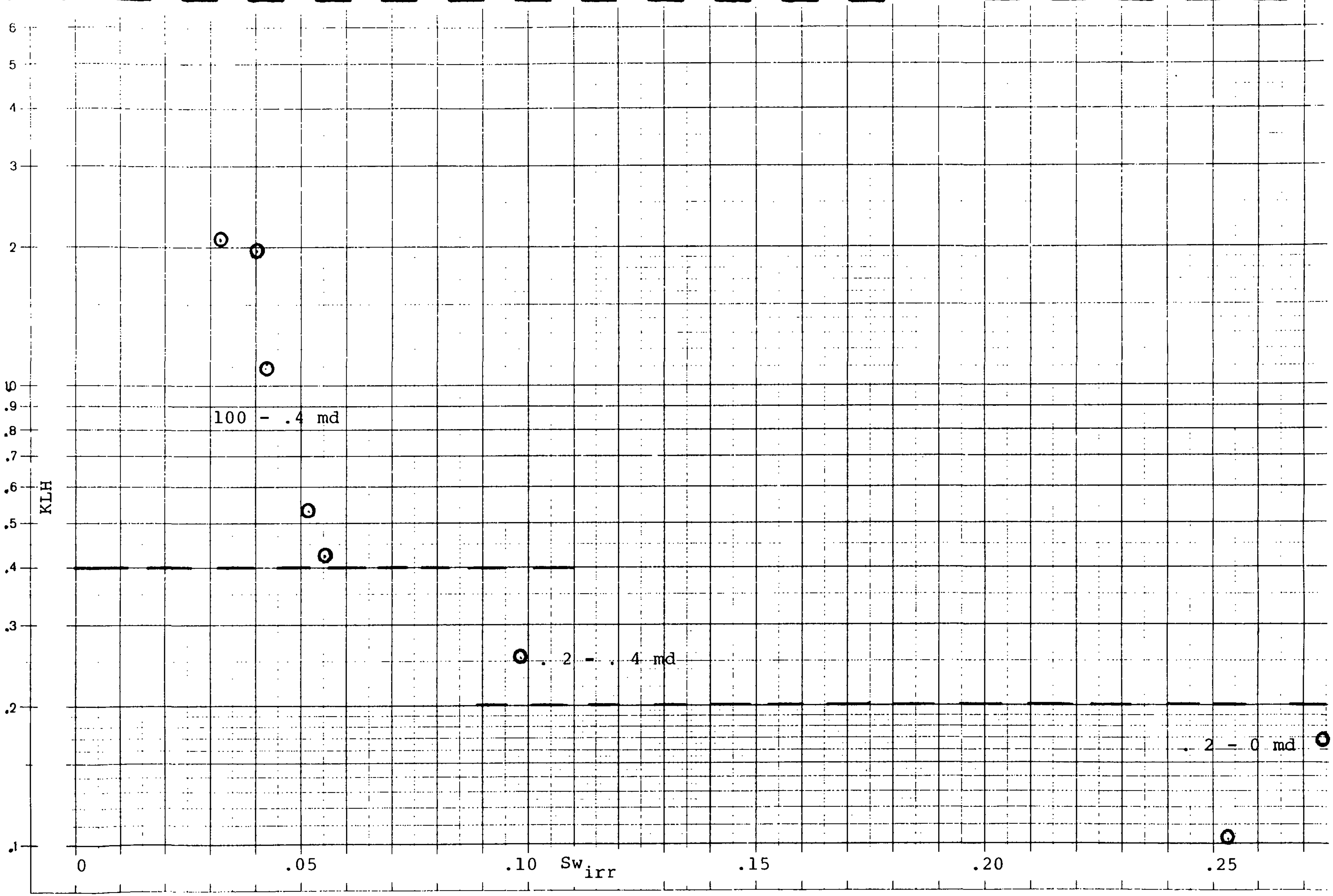
P L O T T E D B Y : DON ROSS

WELL: 1-9-CP ( 139 - 183 ) DATE: 1FEB83/DCR

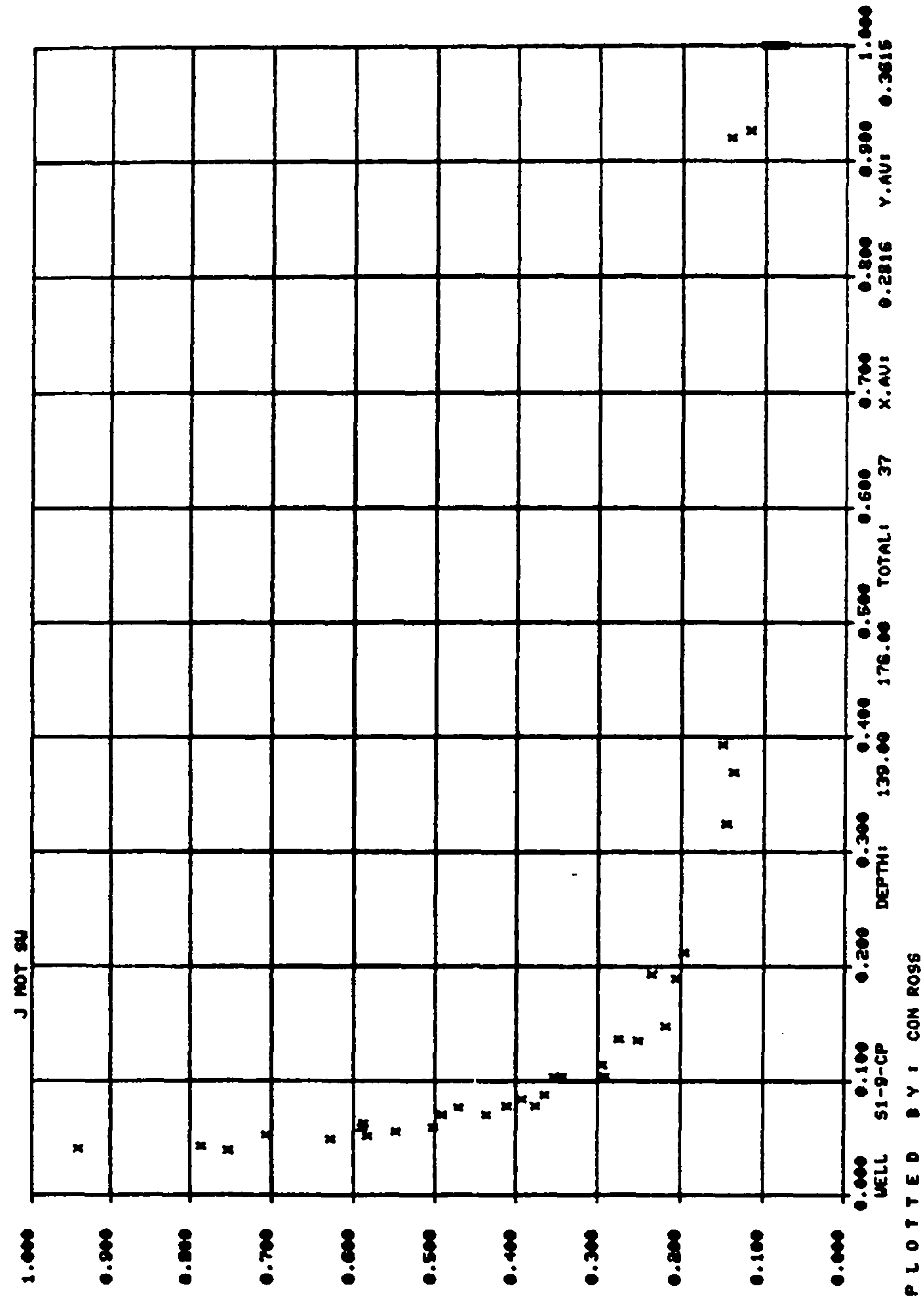
| DEPTH | DYBDE | KLH | POR | SW | PC | J |
|---|---|---|---|---|---|---|
| 139.00 | 3227.250 | 2.000 | 0.318 | 1.000 | 200.000 | 0.094 |
| 140.00 | 3227.250 | 2.000 | 0.318 | 0.920 | 300.000 | 0.141 |
| 141.00 | 3227.250 | 2.000 | 0.318 | 0.193 | 500.000 | 0.235 |
| 142.00 | 3227.250 | 2.000 | 0.318 | 0.103 | 750.000 | 0.353 |
| 143.00 | 3227.250 | 2.000 | 0.318 | 0.076 | 1000.000 | 0.471 |
| 144.00 | 3227.250 | 2.000 | 0.318 | 0.062 | 1250.000 | 0.589 |
| 145.00 | 3227.250 | 2.000 | 0.318 | 0.053 | 1500.000 | 0.706 |
| 146.00 | 3227.250 | 2.000 | 0.318 | 0.040 | 2000.000 | 0.942 |
| 147.00 | 3260.750 | 2.100 | 0.293 | 1.000 | 200.000 | 0.101 |
| 148.00 | 3260.750 | 2.100 | 0.293 | 0.392 | 300.000 | 0.151 |
| 149.00 | 3260.750 | 2.100 | 0.293 | 0.135 | 500.000 | 0.251 |
| 150.00 | 3260.750 | 2.100 | 0.293 | 0.078 | 750.000 | 0.377 |
| 151.00 | 3260.750 | 2.100 | 0.293 | 0.069 | 1000.000 | 0.503 |
| 152.00 | 3260.750 | 2.100 | 0.293 | 0.049 | 1250.000 | 0.628 |
| 153.00 | 3260.750 | 2.100 | 0.293 | 0.039 | 1500.000 | 0.754 |
| 154.00 | 3260.750 | 2.100 | 0.293 | 0.032 | 2000.000 | 1.006 |
| 155.00 | 3243.000 | 1.100 | 0.251 | 1.000 | 200.000 | 0.079 |
| 156.00 | 3243.000 | 1.100 | 0.251 | 0.926 | 300.000 | 0.118 |
| 157.00 | 3243.000 | 1.100 | 0.251 | 0.211 | 500.000 | 0.197 |
| 158.00 | 3243.000 | 1.100 | 0.251 | 0.114 | 750.000 | 0.295 |
| 159.00 | 3243.000 | 1.100 | 0.251 | 0.084 | 1000.000 | 0.393 |
| 160.00 | 3243.000 | 1.100 | 0.251 | 0.070 | 1250.000 | 0.491 |
| 161.00 | 3243.000 | 1.100 | 0.251 | 0.059 | 1500.000 | 0.590 |
| 162.00 | 3243.000 | 1.100 | 0.251 | 0.042 | 2000.000 | 0.786 |
| 163.00 | 3229.250 | 0.540 | 0.224 | 1.000 | 300.000 | 0.087 |
| 164.00 | 3229.250 | 0.540 | 0.224 | 0.324 | 500.000 | 0.146 |
| 165.00 | 3229.250 | 0.540 | 0.224 | 0.147 | 750.000 | 0.219 |
| 166.00 | 3229.250 | 0.540 | 0.224 | 0.104 | 1000.000 | 0.292 |
| 167.00 | 3229.250 | 0.540 | 0.224 | 0.087 | 1250.000 | 0.364 |
| 168.00 | 3229.250 | 0.540 | 0.224 | 0.070 | 1500.000 | 0.437 |
| 169.00 | 3229.250 | 0.540 | 0.224 | 0.051 | 2000.000 | 0.583 |
| 170.00 | 3257.250 | 0.440 | 0.206 | 1.000 | 300.000 | 0.082 |
| 171.00 | 3257.250 | 0.440 | 0.206 | 0.369 | 500.000 | 0.137 |
| 172.00 | 3257.250 | 0.440 | 0.206 | 0.189 | 750.000 | 0.206 |
| 173.00 | 3257.250 | 0.440 | 0.206 | 0.136 | 1000.000 | 0.274 |
| 174.00 | 3257.250 | 0.440 | 0.206 | 0.104 | 1250.000 | 0.343 |
| 175.00 | 3257.250 | 0.440 | 0.206 | 0.078 | 1500.000 | 0.412 |
| 176.00 | 3257.250 | 0.440 | 0.206 | 0.055 | 2000.000 | 0.549 |
| 177.00 | 3240.500 | 0.260 | 0.167 | 1.000 | 300.000 | 0.070 |
| 178.00 | 3240.500 | 0.260 | 0.167 | 0.672 | 500.000 | 0.117 |
| 179.00 | 3240.500 | 0.260 | 0.167 | 0.285 | 750.000 | 0.176 |
| 180.00 | 3240.500 | 0.260 | 0.167 | 0.191 | 1000.000 | 0.234 |
| 181.00 | 3240.500 | 0.260 | 0.167 | 0.152 | 1250.000 | 0.293 |
| 182.00 | 3240.500 | 0.260 | 0.167 | 0.133 | 1500.000 | 0.351 |
| 183.00 | 3240.500 | 0.260 | 0.167 | 0.097 | 2000.000 | 0.469 |

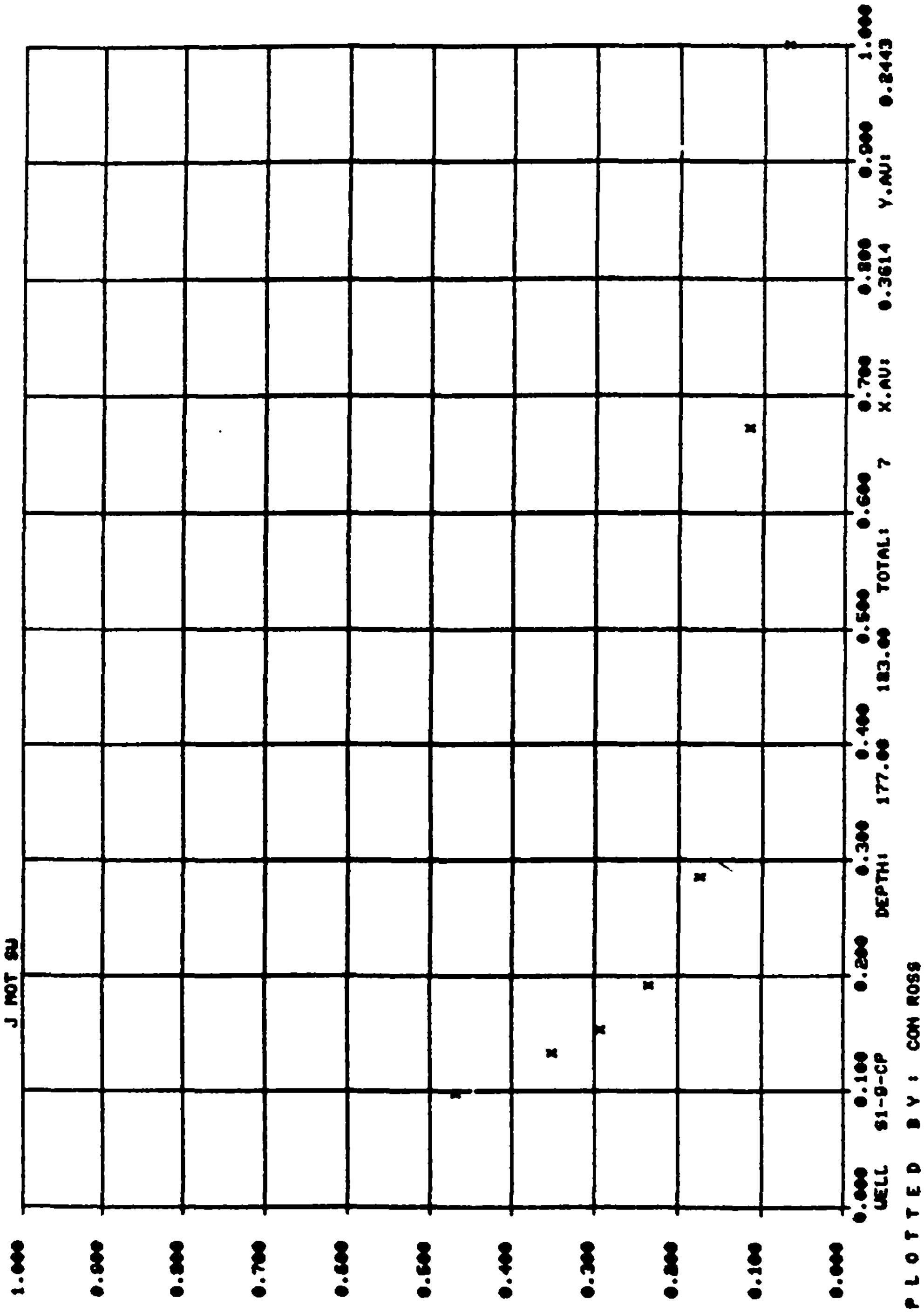
(139–176) Tor 100 - .4 md

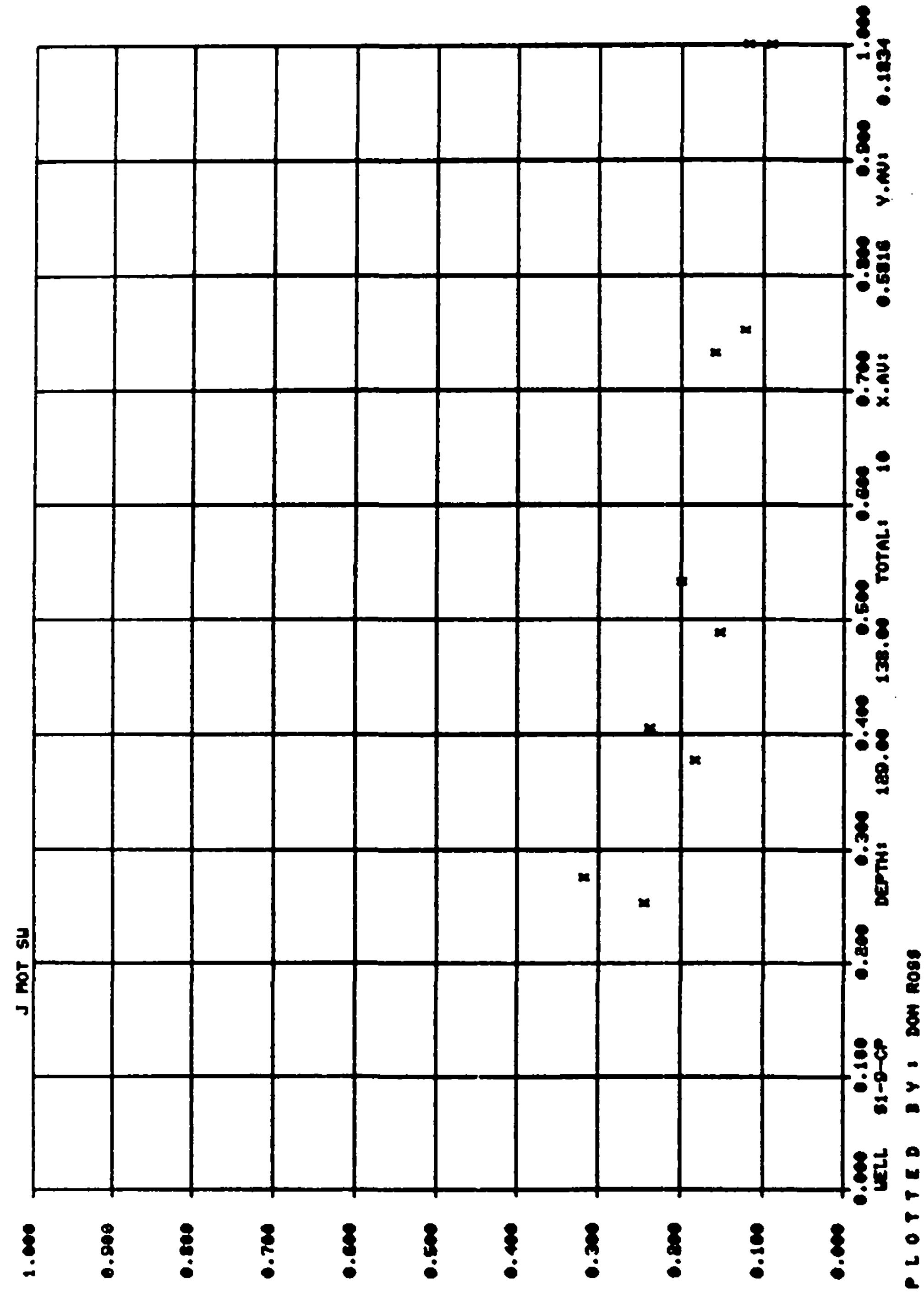
(177–183) Tor .4-.2

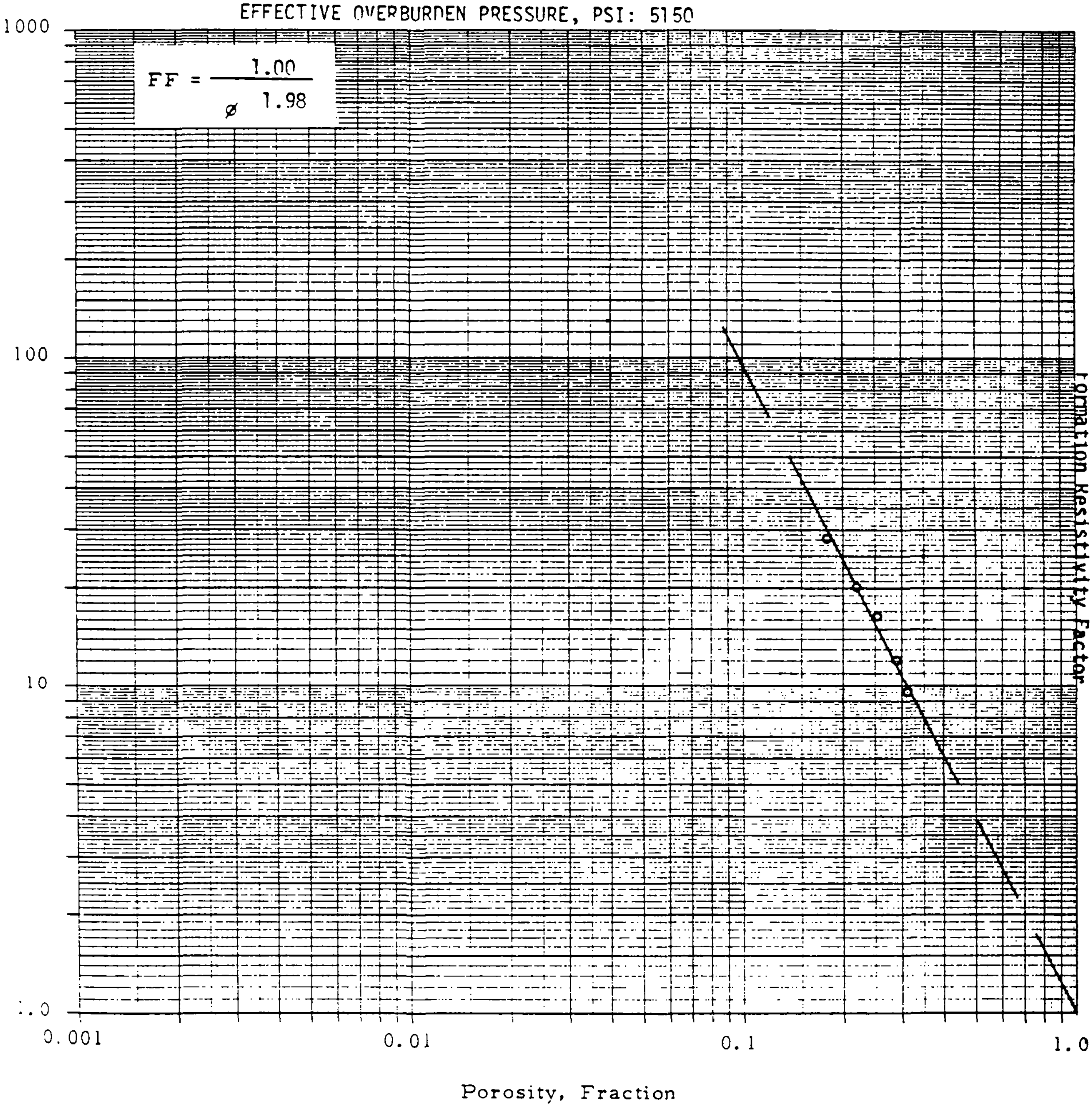



PLUG GROUPINGS FOR SWPC DETERMINATION - TOR


J MOT SW
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0.000
0.100
0.200
0.300
0.400
0.500
0.600
0.700
0.800
0.900
1.000
WELL S1-9-CP
DEPTH: 139.00 176.00
TOTAL: 37
X.AV: 0.2816
Y.AV: 0.3615
P L O T T E D B Y : CON ROSS


J MOT SW
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0.000 0.100 0.200 0.300 0.400 0.500 0.600 0.700 0.800 0.900 1.000
WELL S1-9-CP DEPTH: 177.00 183.00 TOTAL: 7 X.AV: 0.3614 Y.AV: 0.2443
PLOTTED BY: CON ROSS


J MOT SW
0.000
0.100
0.200
0.300
0.400
0.500
0.600
0.700
0.800
0.900
1.000
WELL 81-9-CP DEPTH: 189.00 138.00 TOTAL: 10 X.AV: 0.5816 Y.AV: 0.1834
PLOTTED BY: DON ROSS


EFFECTIVE OVERBURDEN PRESSURE, PSI: 5150
FF = 1.00 / ø 1.98
1000
100
10
1.0
0.001
0.01
0.1
1.0
Porosity, Fraction
Formation Resistivity Factor

# SENSITIVITETS-PLOT

WELL: 1-9-6
INTERVAL: 3516.25 , 3781.00
TID : 7.53 31/JAN/1983