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PL 046

PETROPHYSICAL EVALUATION OF WELL 15/9-11
PALEOCENE AND TRIASSIC FORMATIONS

Section: LET-SVG / Op.Tekn.
STATOIL - August 1982
Eng.: Jan I. Skagen

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NORWAY OFFSHORE

LICENCE 046

APPRAISAL WELL 15/9-11

WELL DATA

Well name:	15/9-11
Location:	01° 53' 41.9" E 58° 24' 03.2" N
Drilling rig:	Ross Rig

DRILLING PERIOD

Spud date:	17th September 1981
Completion date:	23rd December 1981
KB elevation:	25 meters
Water depth:	87.5 meters
TD:	2950 m
Objectives:	Paleocene sandstone Jurassic/Triassic sandstone
Operator:	Statoil
Partners:	Esso Expl. & Prod. Norway Inc. Norsk Hydro A/S

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ABSTRACT

Well 15/9-11 was an appraisal well drilled on the gamma prospect of the 15/9-block. Previously one well (15/9-9) had been drilled in the south of Gamma structure. The 15/9-9 well showed significant gas-condensate deposits in the Paleocene aged Heimdal formation and was tested with three DST's. The Jurassic/Triassic aged sandstones of the 15/9-9 were dry.

The 15/9-11 well, drilled in the north of the structure, proved large gas-condensate columns in both the Paleocene and Mesozoic aged formation, in sands with good reservoir properties. Both reservoirs were drill stem tested, with one DST in Mesozoic sandstone and two DSTs in the Paleocene sandstone.

1. SUMMARY

In well 15/9-11 the Heimdal sand was reached at 2386 m RKB. This contained sand of fairly good reservoir properties interbedded with some thin shale beds. Most of the interval was hydrocarbon bearing the water contact being estimated to 2442 m. The top of the Mesozoic sand was reached at 2795 m RKB. Also this formation contained sand of fairly good reservoir properties, very clean with just small amount of shale and heavy minerals. Unfortunately this section was not cored. Most of the interval was hydrocarbon bearing, the water contact being located at 2825 m RKB.

Two separate log analyses have been done, one for the Heimdal formation and one for the Mesozoic.

2. HEIMDAL FORMATION

2.1. Summary of results

	Heimdal
Depth interval:	2375 - 2510 m
Reservoir interval:	2386 - 2506 m
Net sand:	110.0 m
Net pay:	36.5 m
Av. porosity (net pay):	22.1 %
Av. S_w (net pay):	22.9 %
H net pay/H gross sand:	0.304

Cut off values used for the interval:

$\emptyset \leq 0.10$ (fractions)
$V_{sh} \geq 0.40$ (fractions)
$S_w \geq 0.60$ (fractions)

The final results are shown in tables 2.1. and 2.2.

2.2. Lithology

The Heimdal Fm. consists mainly of sandstone with some layers of shale. The sandstone is composed of clear quartz grains, which are very fine to fine, occasionally medium, subangular to subrounded. It has silica cement. The depositional environment is considered to be marine, outer shelf to upper bathyal.

2.3. Input parameters

The interval under consideration was logged with the following tools:

1. ISF/BHC/GR
2. FDC/CNL/GR
3. DLL/MSFL/GR
4. HDT
5. RFT

The log quality was very good.

A. Determination of Rw

The SP-curve gives a Rw = 0.049 ohm.m. at 85.6°C (186°F) in the Heimdal formation with a Rmf of 0.093 ohm.m. at 71°C. Analysis of formation water produced from DST no. 2. gives 89600 ppm NaCl, Rw = 0.050 at 85.6°C, which is in good agreement with the Rw from the SP-curve. Comparison of wells drilled in Heimdal sandstone:

25/4-1 (Elf):	0.054 at 135°F	0.0412 at 85.6°C
25/4-4 (Elf):	0.05 at 158°F	0.0427 at 85.6°C
15/9-11 (Statoil):		0.0500 at 85.6°C

The temperature, 85.6°C (186°F), is the maximum temperature recorded during build up in DST no. 3. (2395 - 2415 m RKB).

The volume of Rw = 0.050 at 85.6°C has been used for the Heimdal formation.

B. Mud filtrate resistivity

Rmf from the log heading was 0.093 ohm.m at 71.0°C (160°F) for the Heimdal log run, which gives a Rmf of 0.0803 at reservoir temperature of 85.6°C.

C. GR and PHIN corrections

The GR has been corrected for bore hole size and mud weight (GR-CORR). The corrected values have been used in the computation. The neutron readings have been corrected for downhole temperatures and pressures. Also these corrected values have been used in the computation (fig. 2.1.).

D. Shale properties

A shaly sand method has been applied for the log evaluation. Shale properties for the zone have been taken for Z-histograms using corrected GR of 58+ for the Heimdal formation (fig. 2.4.).

Depth interval	Rt(ohm.m)	RHOB (gm/cc)	DT (μs/ft)	PHIN (p.n.)
2375 - 2510	1.72	2.25	115	0.46

E. Matrix parameters

The following matrix parameters were used as input to the shaly sand model for the reservoir.

Quartz: 2.65 gm/cc, 55 micros/ft, 0.035 (frac) CNL

Fluid parameters: 1.01 gm/cc, 189 micros/ft, 1.00 (frac) CNL

Density-neutron, density-sonic and neutron-sonic cross plots show quartz, shale points and gas effects, figs. 2.2 - 2.3.

2.4. Computation of final rock properties

The final rock properties for this zone are listed at the back of this part of the report and shown in analog form in the attached presentation.

A. Shale corrections

The shale indicators studied were VSHGR, VSHRT, VSHSP, VSHN, VSHDN, VSHN, VSHDS (fig. 2.5.).

For Heimdal formations only the VSHGR was used.

B. Porosity computation

The FDC and CNL porosities were corrected for shale and a primary porosity computed by weighting averaging of the corrected FDC and CNL (by 7:2). A final porosity was computed by corrected the primary porosity for residual hydrocarbons SHR (fig. 2.6.).

C. Rt computation

RLLD and RLLS have been applied to compute a correct Rt for the hydrocarbon zones (RES-CORR-1, Tornado plot). In water zones RILD was used for Rt.

D. Water saturation, Sw

Water saturation was calculated using the Nigeria equation with volume shale exponent of 1.6.

The following values for cementation and saturation exponents M and N and lithological factor A have been applied:

	Interval	M	N	A
Heimdal:	2375-2510	1.82	2.2	1.02

The factors for the Heimdal have been established from core measurements by both Robertson Research, London and Geco, Stavanger.

E. Cut off

The following cut-off values has been used when studying this interval and also other wells in the 15/9-area:

$\emptyset \leq 0.10$ (fractions)
VSH ≥ 0.40 (fractions)
Sw ≥ 0.60 (fractions)

Input parameters listed:

	Interval
	Heimdal
	2375 - 2510
BHT, °C	85.6°C (186°F)
RW, ohm.m	0.050
ppm NaCl	58600
Rmf, ohm.m	0.0803
RT-sh, ohm.m	1.72
RHOB-sh, gm/cc	2.25
DT-sh, µs/ft	115
PHIN-sh, frac	0.46
RHOMA, gm/cc	2.65
DT ma, µs/ft	55.5
PHIN ma, frac	0.035
RHO fl, gm/cc	1.01
DT fl, µs/ft	189
PHIN fl, frac	1.00
GR-max	58
GR-min	36
M	1.82
N	2.2
A	1.02
Vsh-exp.	1.6

2.5 Coring and core analysis

11 cores from 2364 m RKB to 2514 m RKB were taken in the Heimdal formation.

Core No	Depth m RKB	Length m	Recovery %
1	2364-2370	6	100
2	2370-2379	9	33
3	2395-2406	11	100
4	2406-2424	18	100
5	2424-2429	5	100
6	2430-2449	19	72
7	2449-2464	15	57
8	2464-2473	9	0
9	2473-2492	18.5	100
10	2492-2506	14	93.6
11	2506-2514	8	93.8

The following measurements were taken by Geco: Saturation porosity, pore saturations (SO & STW), helium porosity, horizontal and vertical liquid and air permeabilities, grain density. In addition, as mentioned, both Geco and Robertson Research have measured electrical properties on plugs picked from the cores.

These core data has been correlated to log data and the final match is shown in fig. 2.7. to 2.10, and is also shown on the attached presentation.

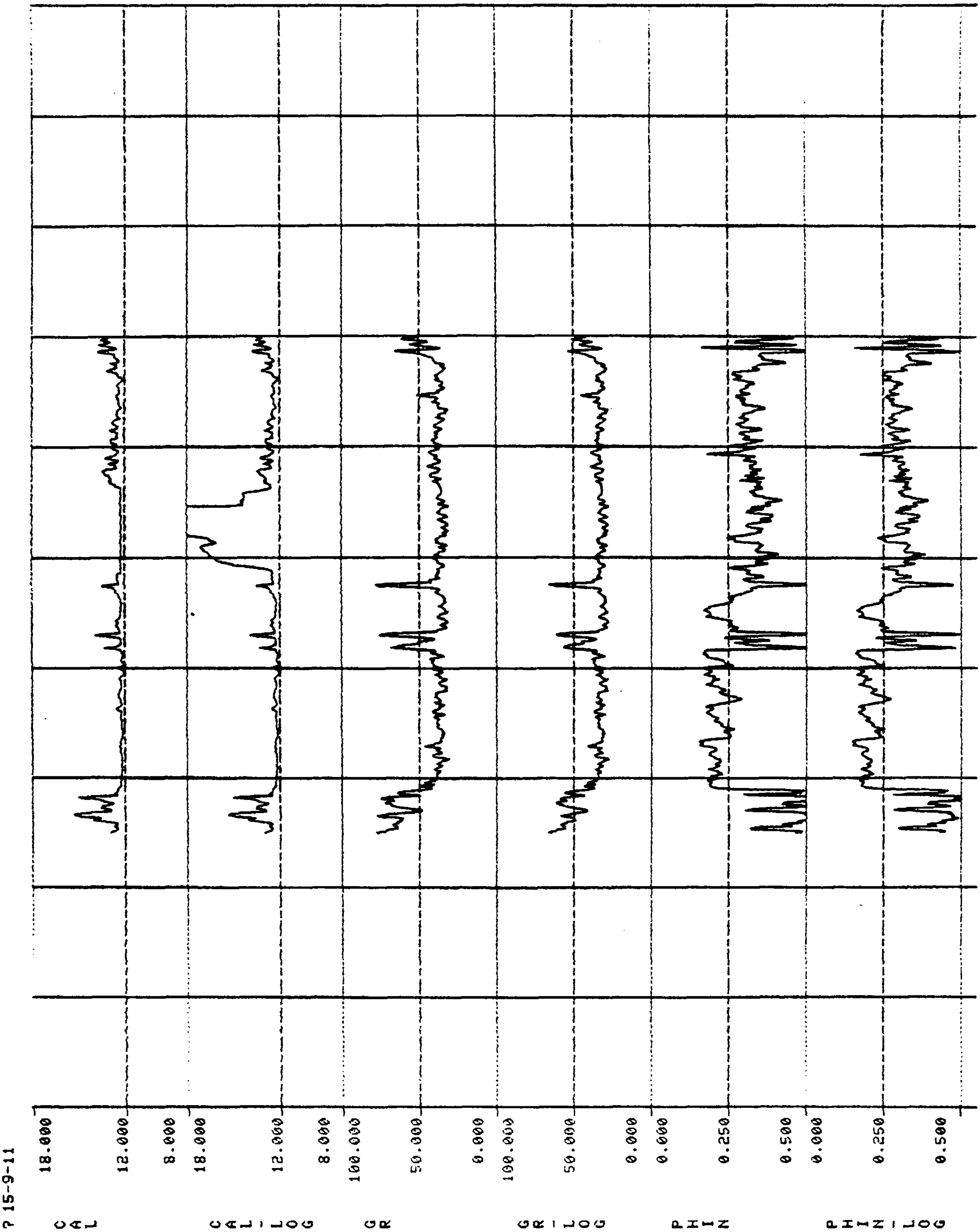
Figures 2.1. - 2.10

Tables 2.1. - 2.2.

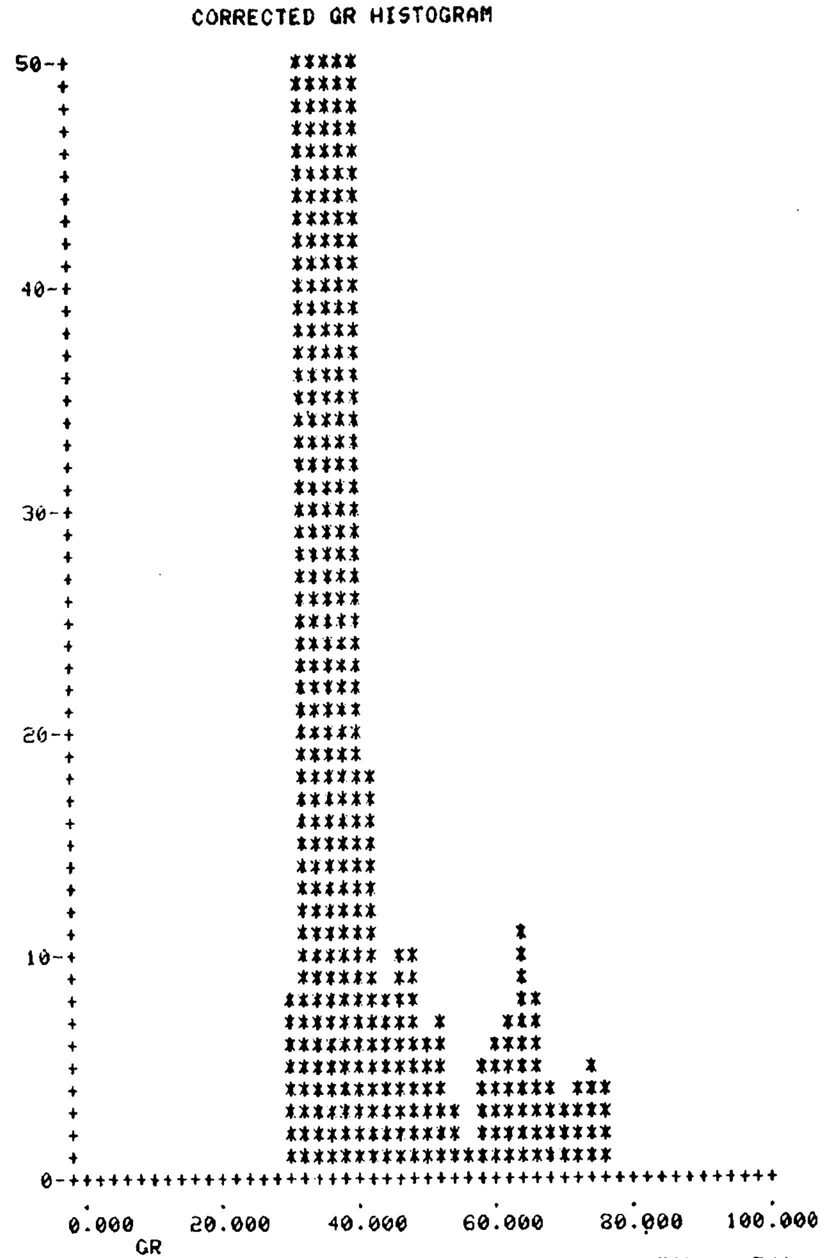
HEIMDAL SANDSTONE

2375 - 2510 m RKB

Fig. 2.1

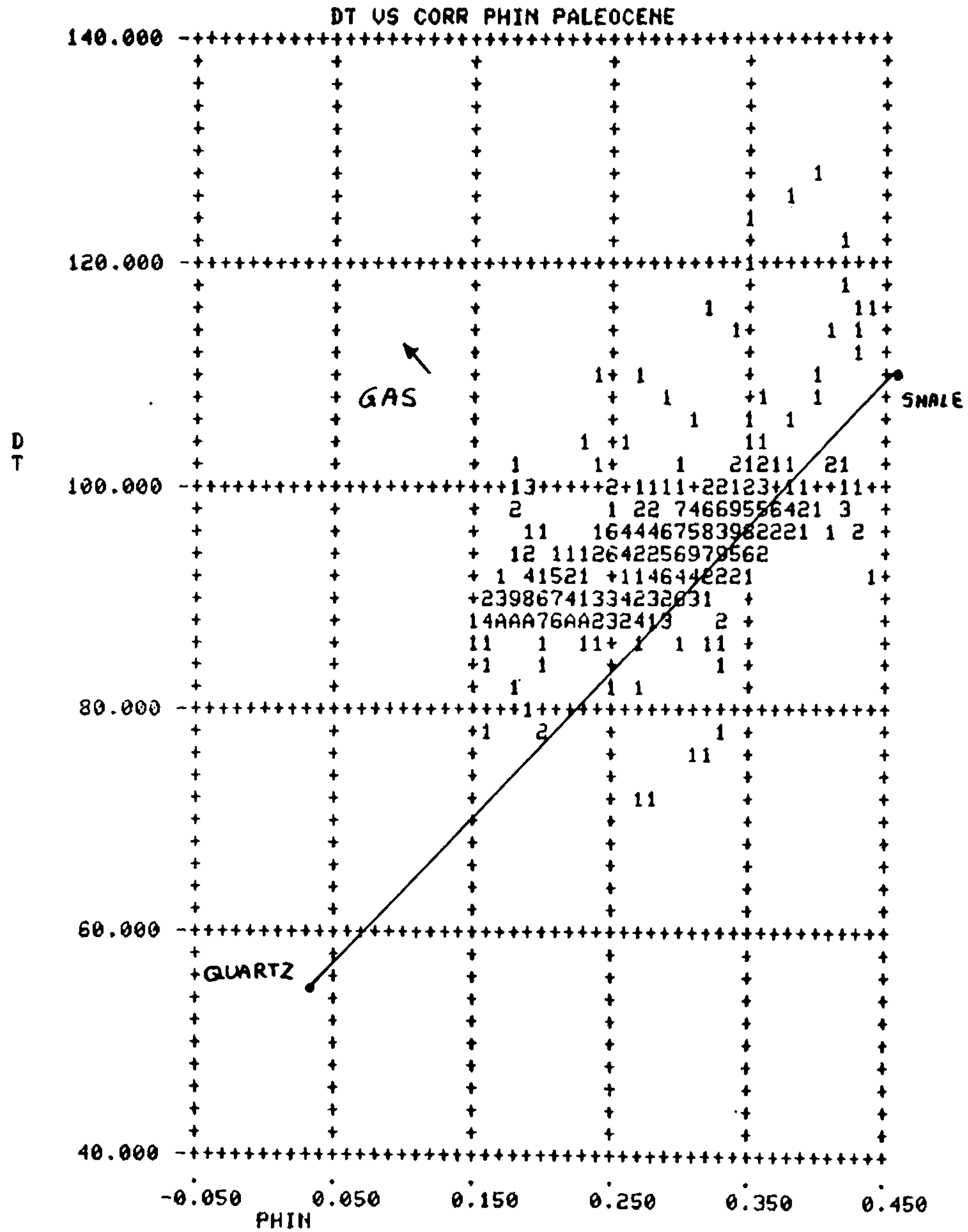


18.000
12.000
8.000
18.000
12.000
8.000
100.000
50.000
0.000
100.000
50.000
0.000
0.000
0.250
0.500
0.000
0.250
0.500
? 15-9-11
CAL
CAL_LOG
GR
GR_LOG
PHIN
PHIN_LOG



WELL S15-9-11 DEPTH: 2375.00 2510.00 TOTAL: 541
X.AV: 41.4220

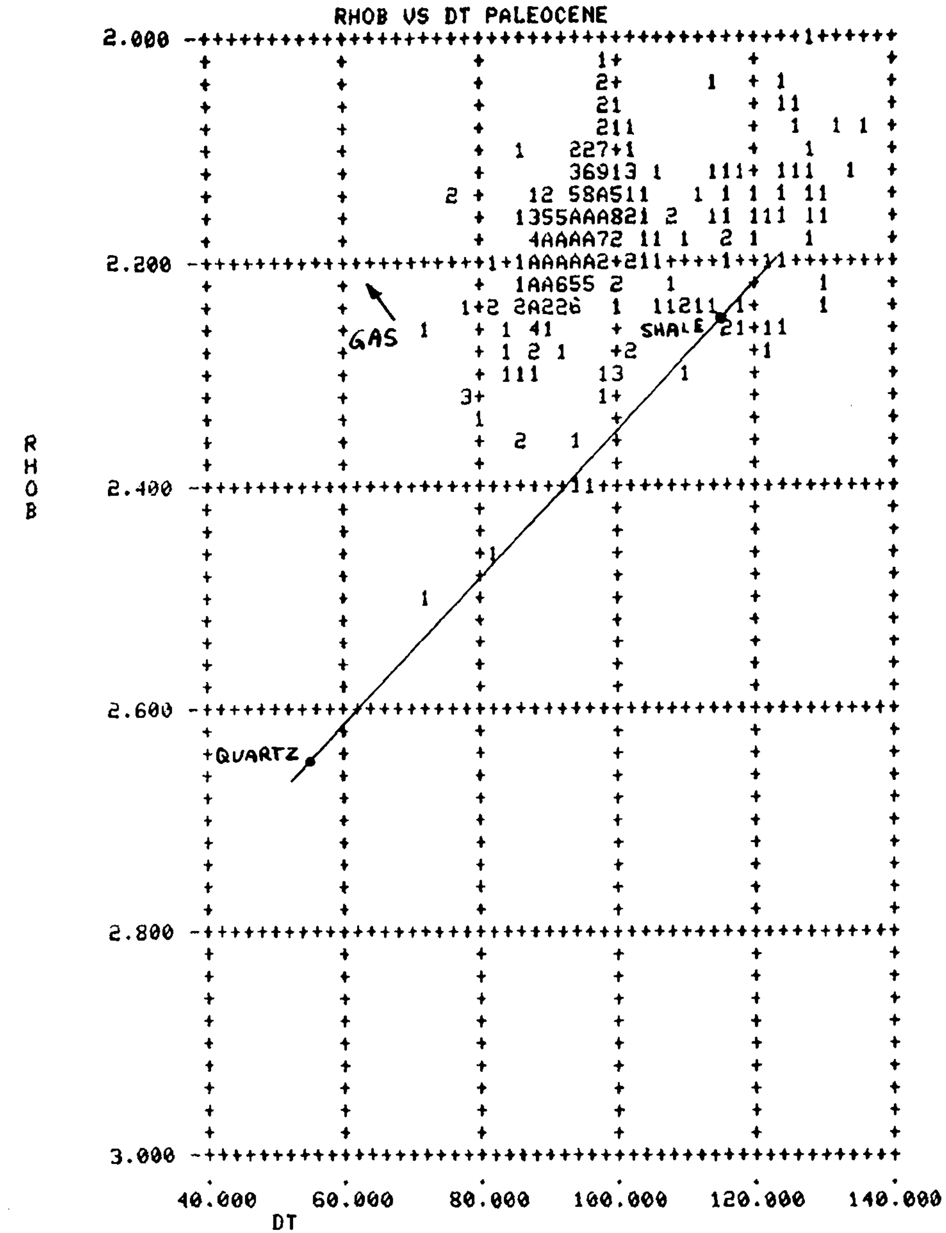
P L O T T E D B Y : JIS



WELL S15-9-11 DEPTH: 2375.00 2510.00 TOTAL: 498
X.AV: 0.2851 Y.AV: 94.8973

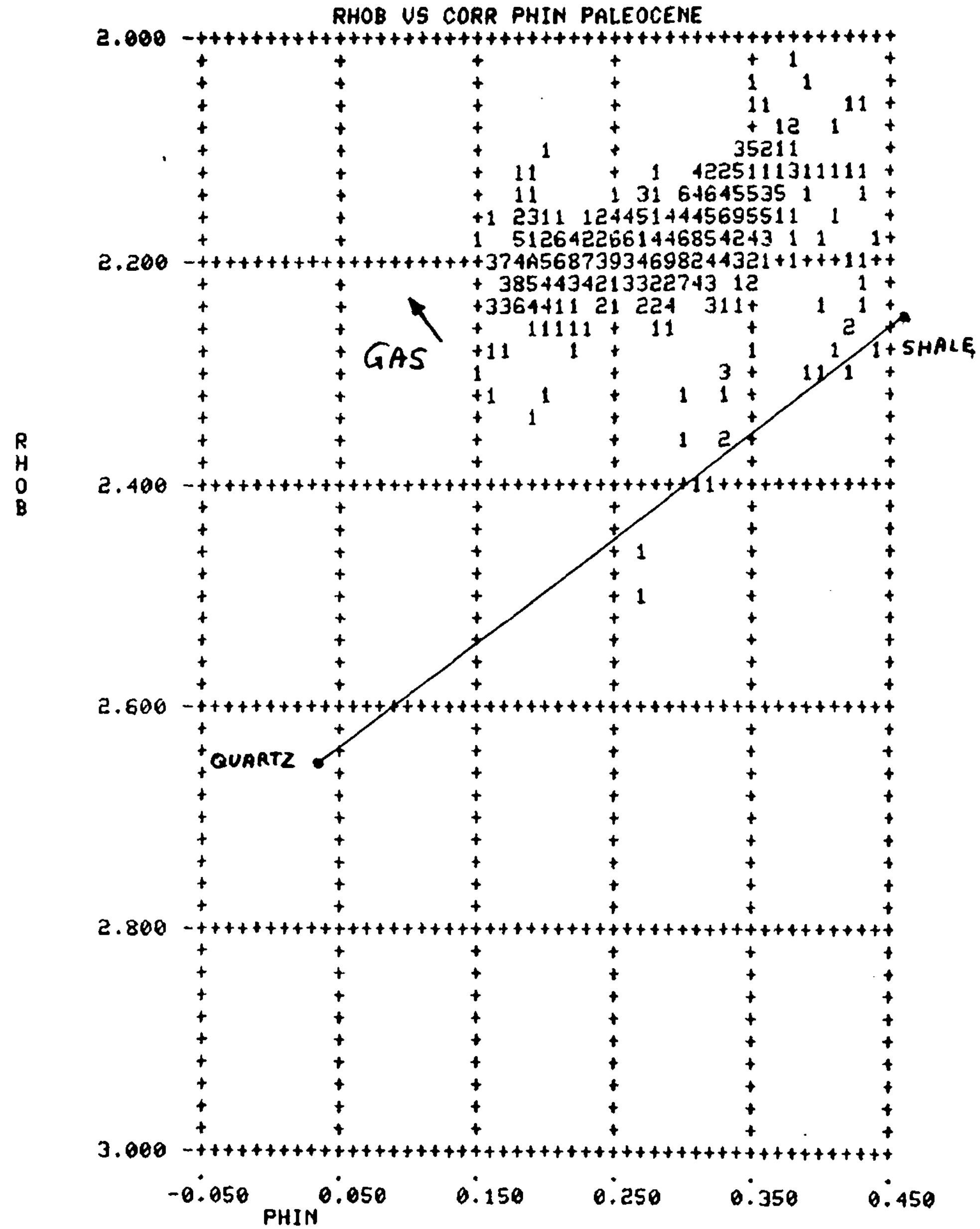
P L O T T E D B Y : JIS

Fig. 2.2



WELL S15-9-11 DEPTH: 2375.00 2510.00 TOTAL: 536
X.AV: 96.8407 Y.AV: 2.1976

P L O T T E D B Y : JIS



WELL S15-9-11 DEPTH: 2375.00 2510.00 TOTAL: 497
X.AV: 0.2848 Y.AV: 2.1992

P L O T T E D B Y : JIS

Fig. 2.3

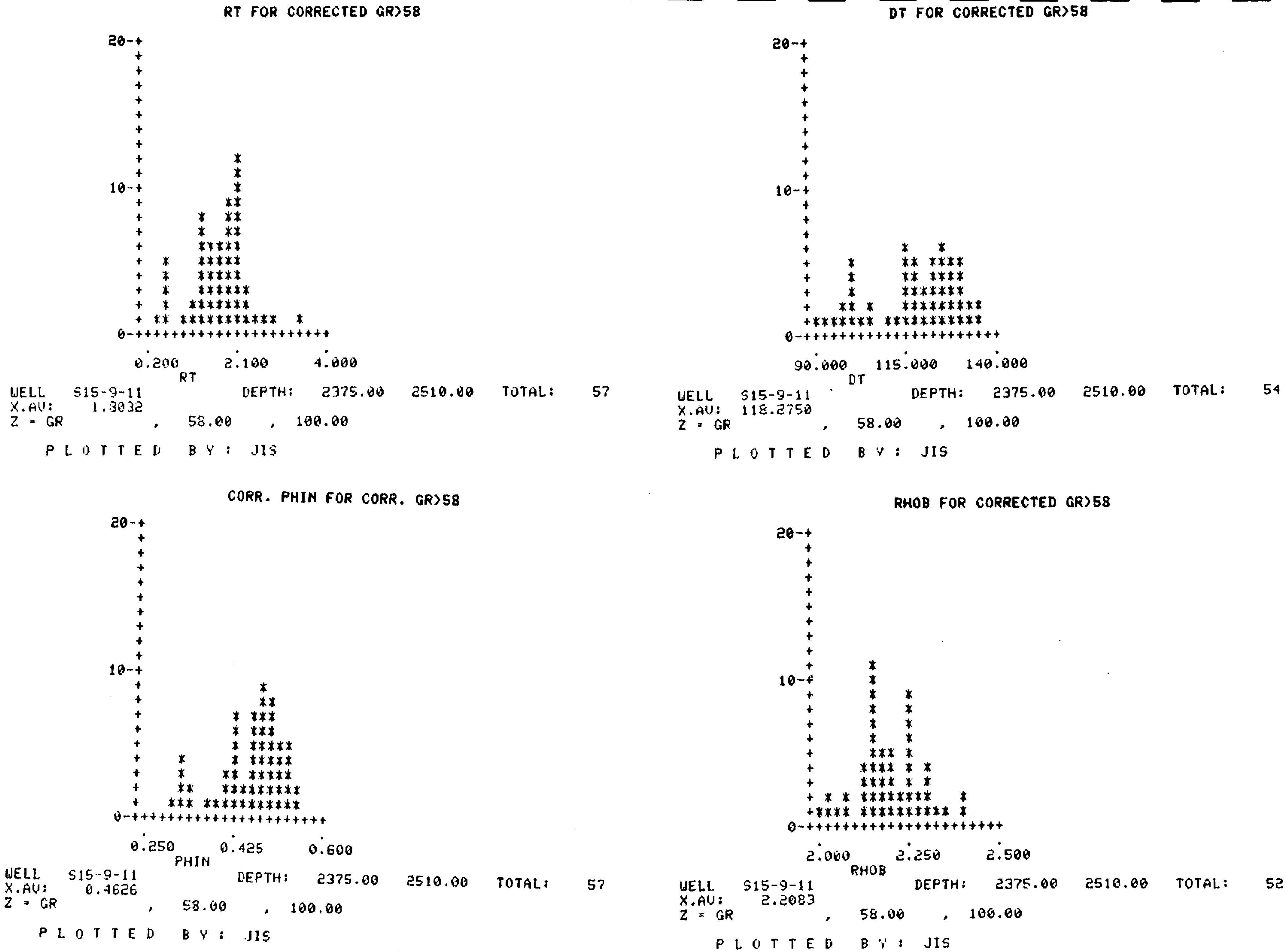

RT FOR CORRECTED GR>58
20-
10-
0-
0.200
2.100
4.000
RT
WELL S15-9-11 DEPTH: 2375.00 2510.00 TOTAL: 57
X.AV: 1.3032
Z = GR , 58.00 , 100.00
P L O T T E D B Y : JIS
DT FOR CORRECTED GR>58
20-
10-
0-
90.000
115.000
140.000
DT
WELL S15-9-11 DEPTH: 2375.00 2510.00 TOTAL: 54
X.AV: 118.2750
Z = GR , 58.00 , 100.00
P L O T T E D B Y : JIS
CORR. PHIN FOR CORR. GR>58
20-
10-
0-
0.250
0.425
0.600
PHIN
WELL S15-9-11 DEPTH: 2375.00 2510.00 TOTAL: 57
X.AV: 0.4626
Z = GR , 58.00 , 100.00
P L O T T E D B Y : JIS
RHOB FOR CORRECTED GR>58
20-
10-
0-
2.000
2.250
2.500
RHOB
WELL S15-9-11 DEPTH: 2375.00 2510.00 TOTAL: 52
X.AV: 2.2083
Z = GR , 58.00 , 100.00
P L O T T E D B Y : JIS

Fig. 2.4

Fig. 2.5

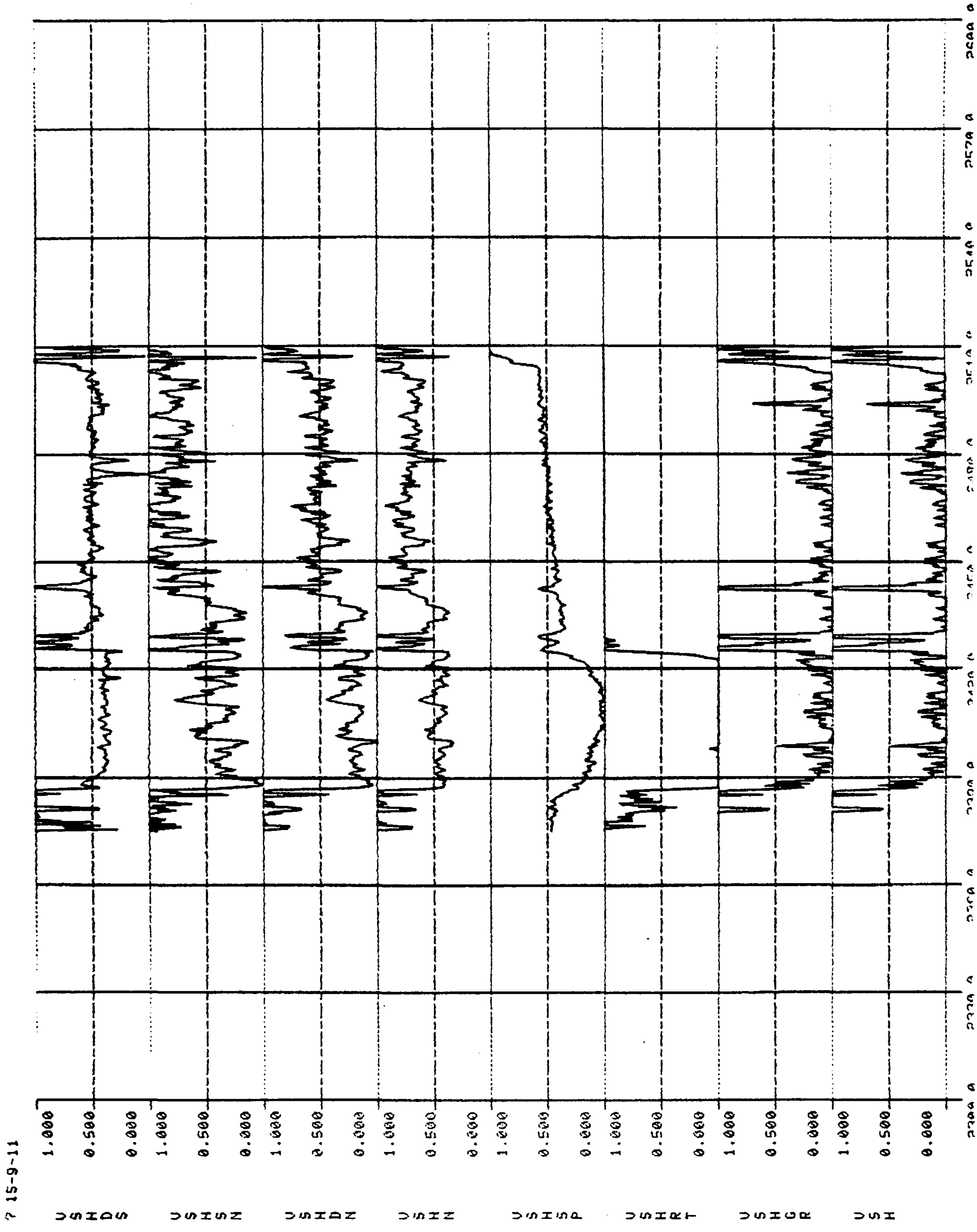


Fig. 2.6

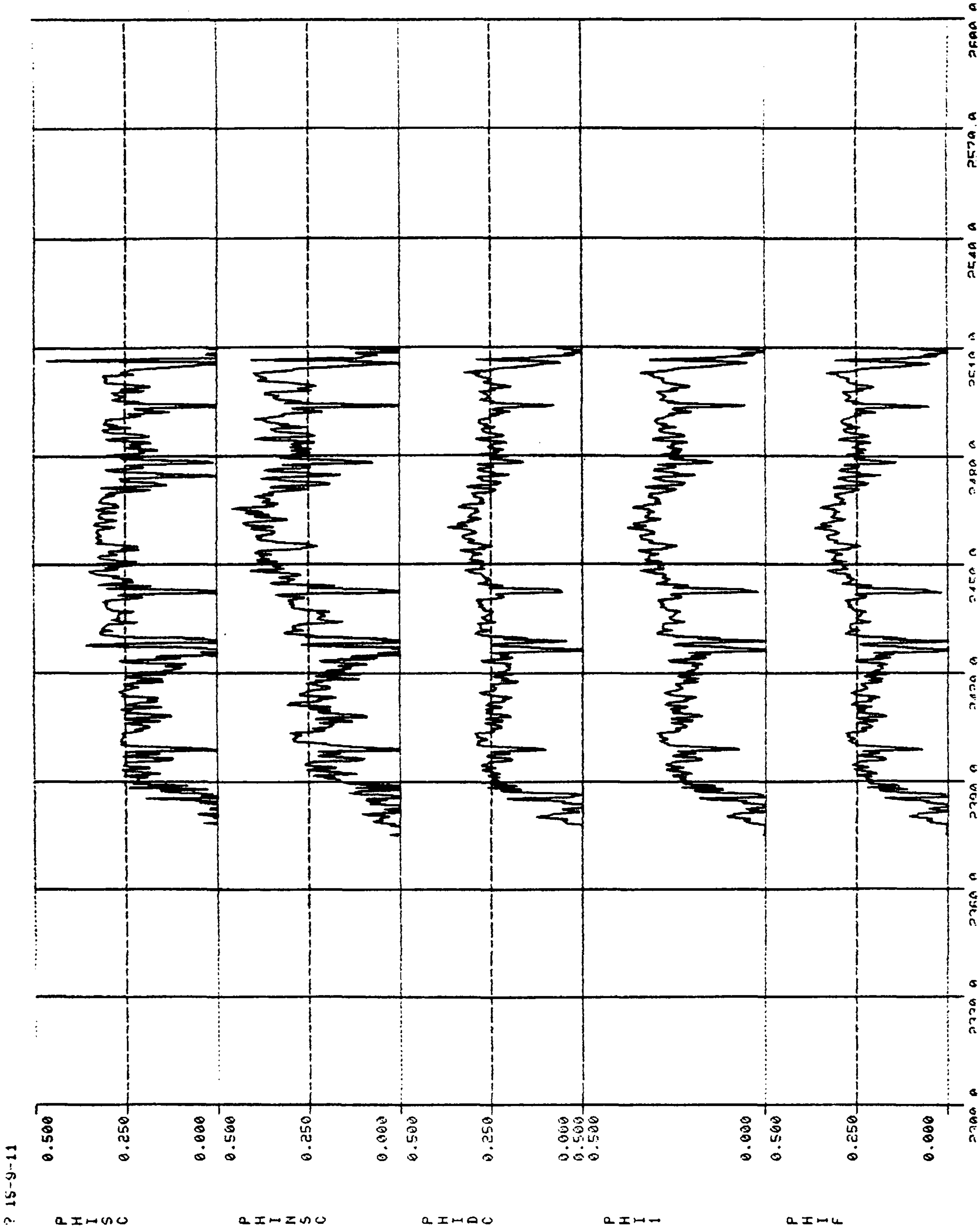
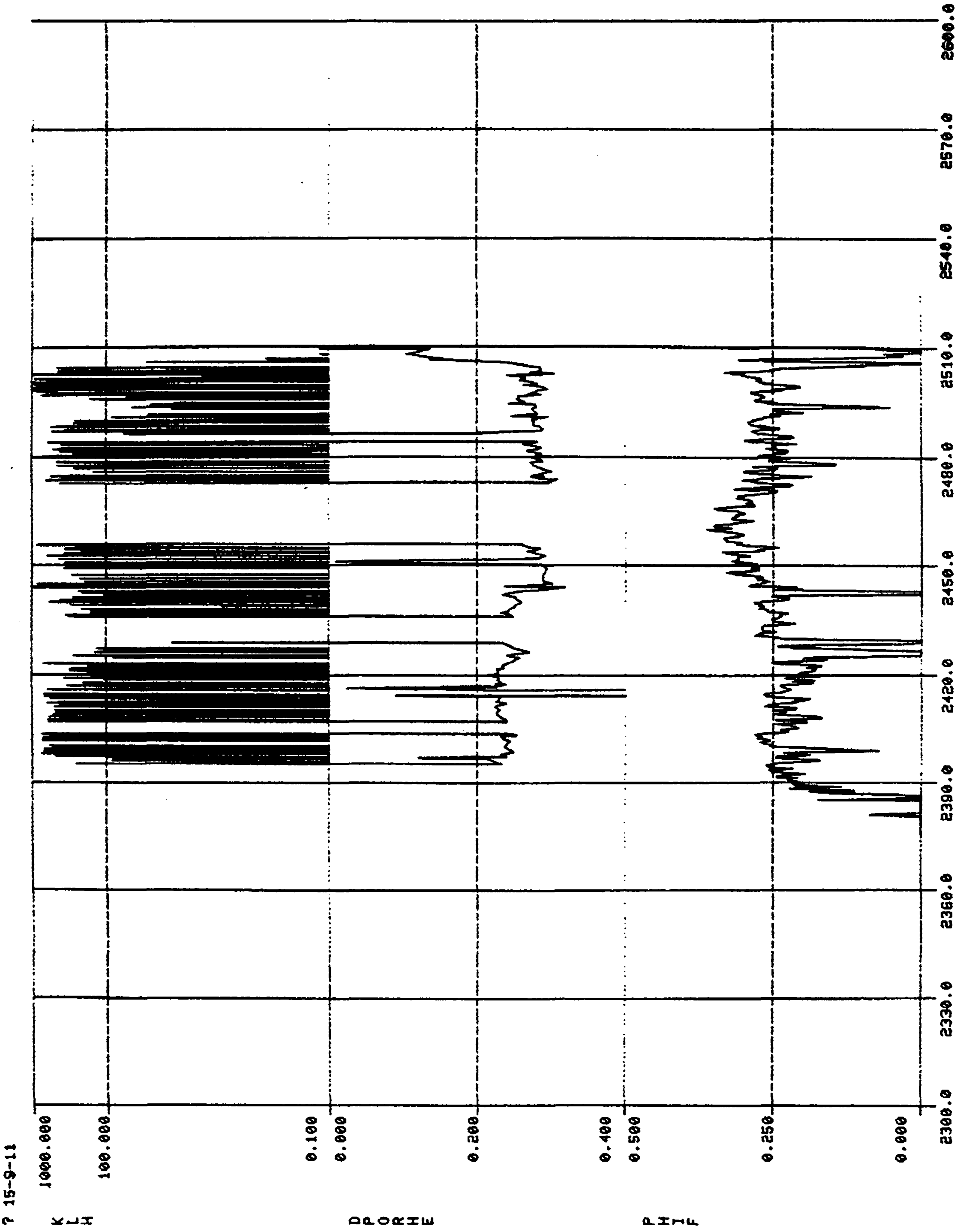


Fig. 2.7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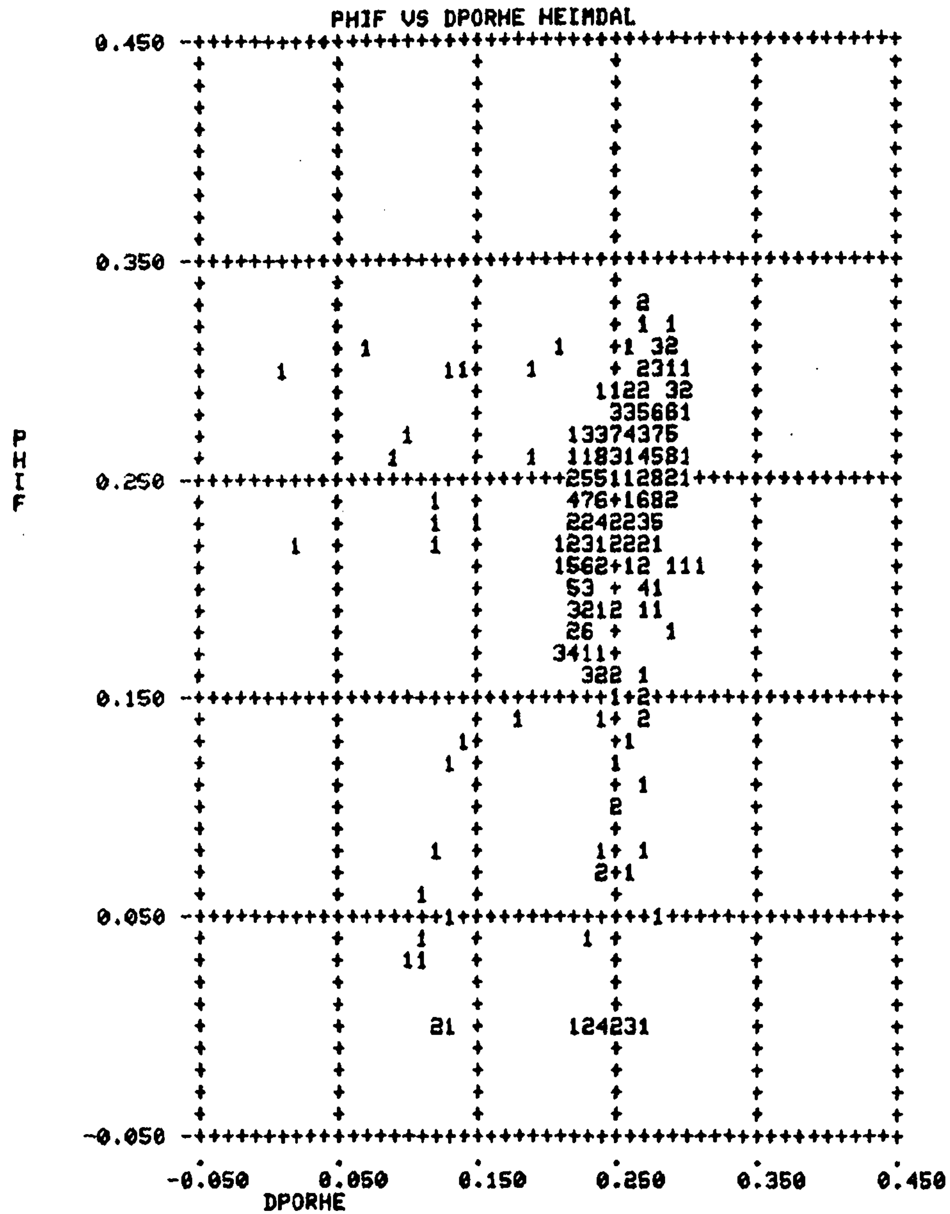
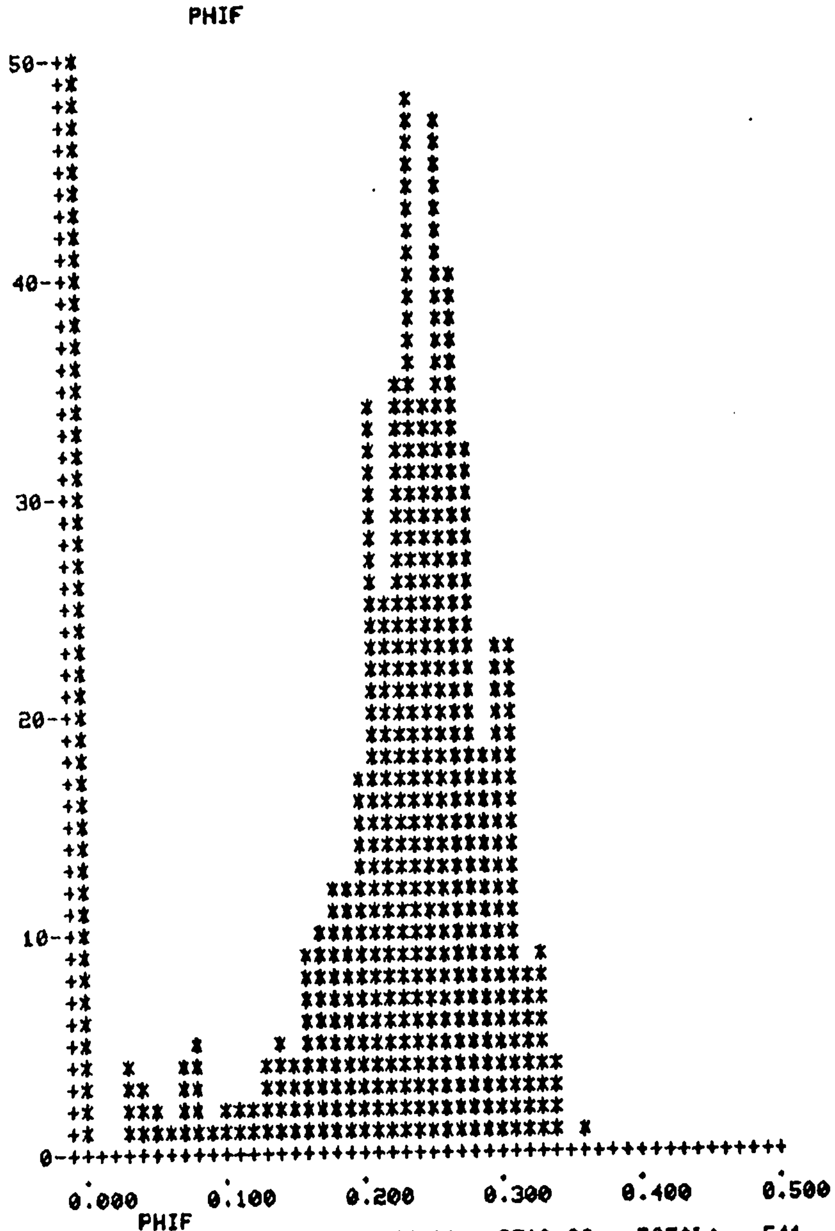
2570.0
2540.0
2510.0
2480.0
2450.0
2420.0
2390.0
2360.0
2330.0
2300.0
1000.000
100.000
0.100
0.000
0.200
0.400
0.500
0.250
0.000
15-9-11
KLH
PHIF



WELL S15-9-11 DEPTH: 2375.00 2510.00 TOTAL: 338
X.AV: 0.2503 Y.AV: 0.2248

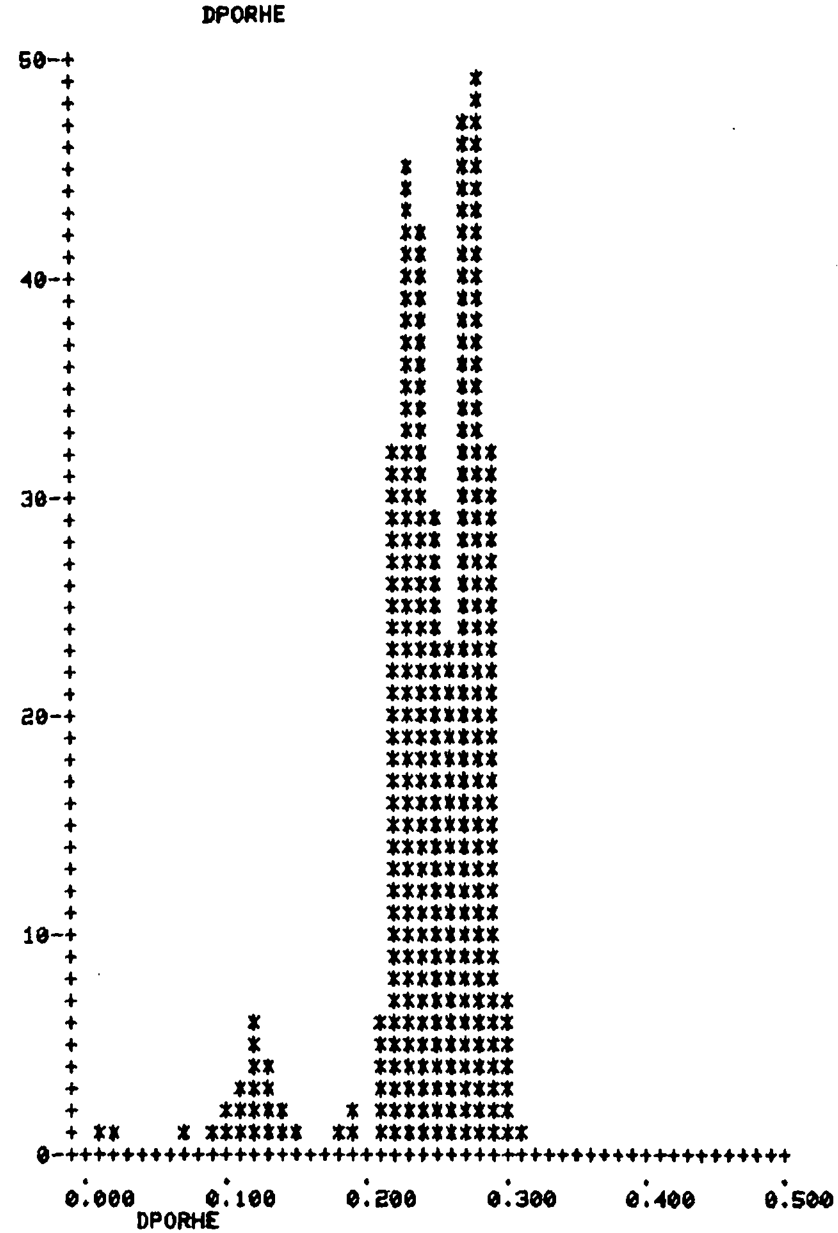
P L O T T E D B Y : JIS

Fig. 2.8



WELL S15-9-11 DEPTH: 2375.00 2510.00 TOTAL: 541
X.AV: 0.2148

P L O T T E D B Y : JIS

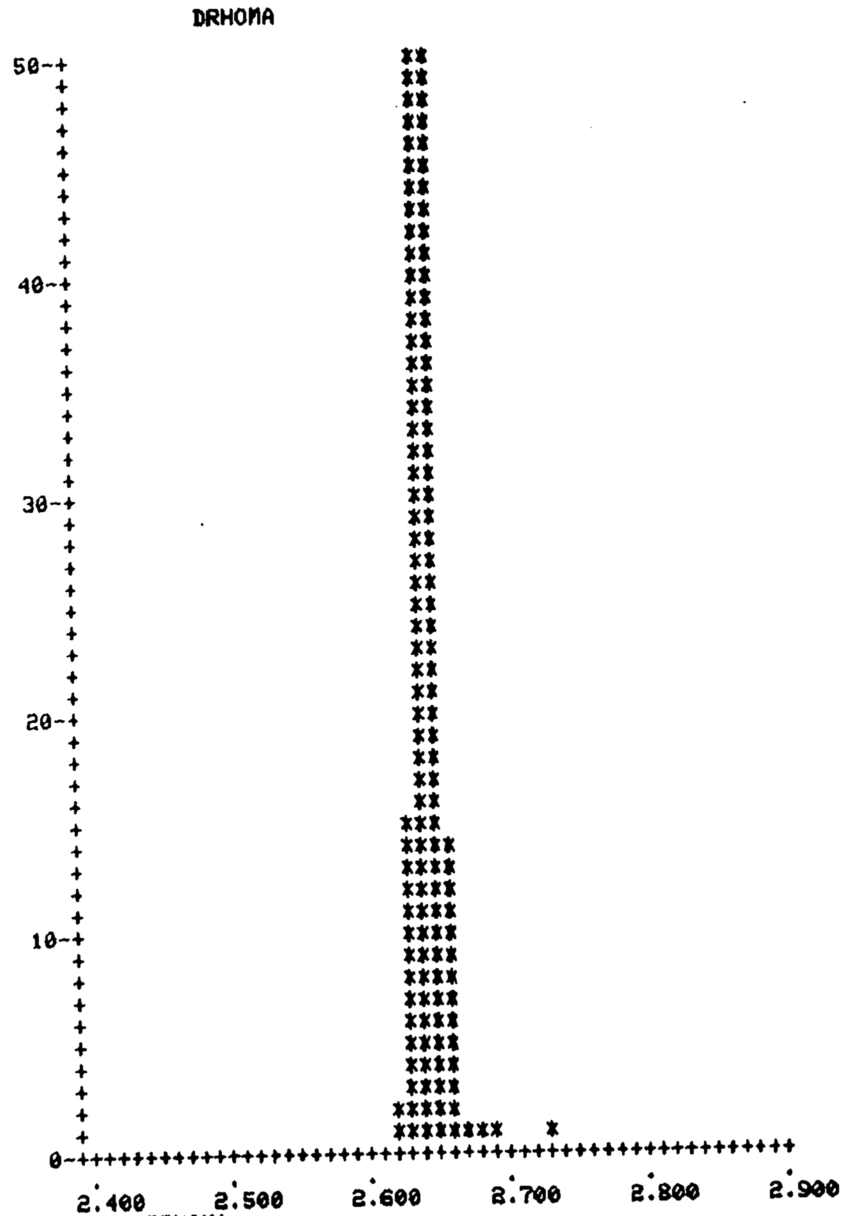


WELL S15-9-11 DEPTH: 2375.00 2510.00 TOTAL: 338
X.AV: 0.2503

P L O T T E D B Y : JIS

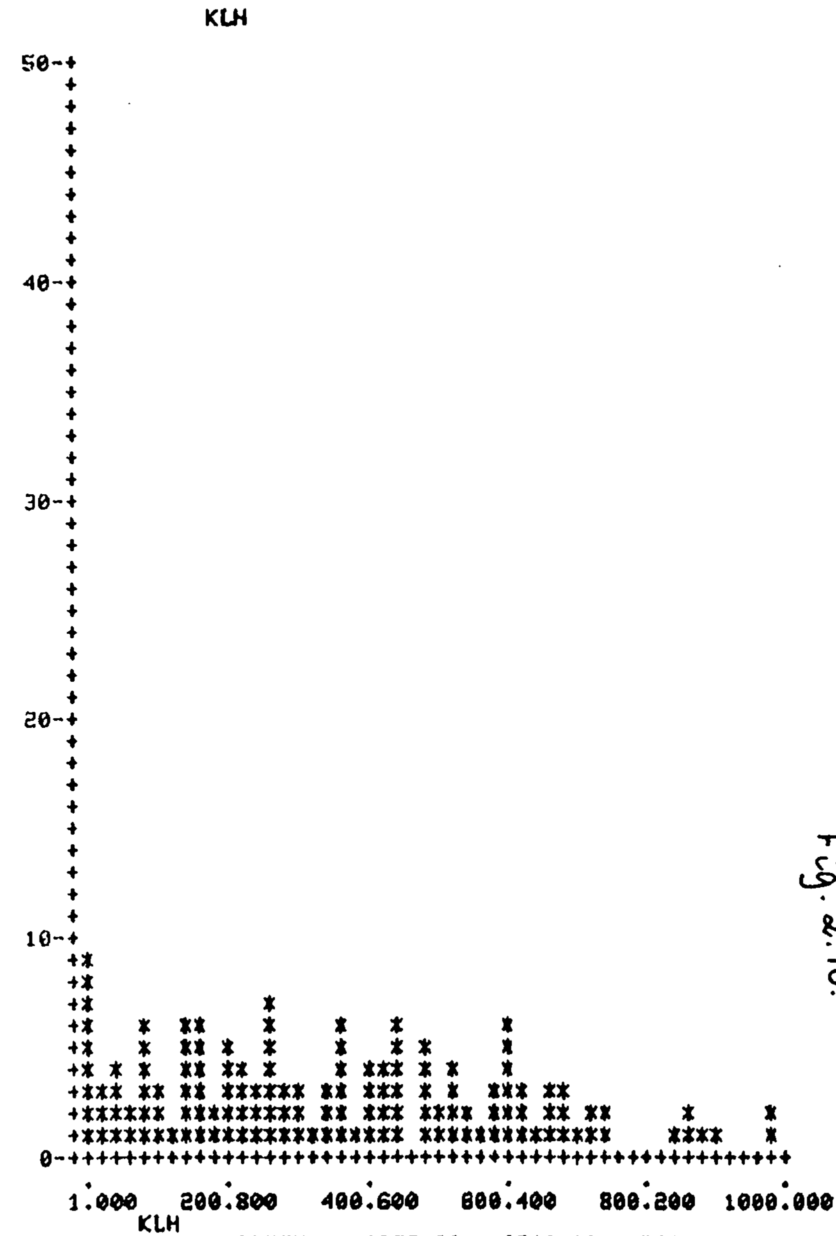
Fig. 2.9

Fig. 2.10.



WELL S15-9-11 DEPTH: 2375.00 2510.00 TOTAL: 330
X.AV: 2.6443

P L O T T E D B Y : JIS



WELL S15-9-11 DEPTH: 2375.00 2510.00 TOTAL: 137
X.AV: 362.2625

P L O T T E D B Y : JIS

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

FIELD: 15/9-11
WELL: 14.55.10.   5 AUGUST9-11982
ENGINEER: . . . . JIS

DEPTH INTERVAL: . . . 2386.00 TO 2506.00
APPLIED CUTOFFS:

.	VSH:	GREATER THAN	0.40
.	PHIF:	LESS THAN	0.10
.	SW:	GREATER THAN	0.60

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

THICKNESS:	120.000
AVERAGE . . . 'PHIF' . . .	0.238
AVERAGE . . . 'VSHALE' . .	0.144
AVERAGE . . . 'SW'	0.718
W.AVERAGE . . 'SW' * 'PHIF'	0.733
AVERAGE . . . 'SH'	0.282
VOID VOLUME: . . . ('PHIF').	28.606
HC VOID VOLUME . . ('SH'*) .	7.625
RES HC VOID VOLUME ('SHR'*).	4.569
MOV HC VOID VOLUME	3.055

****

N E T   P A Y
****

THICKNESS:	36.500
AVERAGE . . . 'PHIF' . . .	0.221
AVERAGE . . . 'VSHALE' . .	0.103
AVERAGE . . . 'SW'	0.229
W.AVERAGE . . 'SW' * 'PHIF'	0.223
AVERAGE . . . 'SH'	0.771
VOID VOLUME: . . . ('PHIF').	8.069
HC VOID VOLUME . . ('SH'*) .	6.269
RES HC VOID VOLUME ('SHR'*).	1.790
MOV HC VOID VOLUME	4.480

****

N E T   S A N D
****

THICKNESS:	110.000
AVERAGE . . . 'PHIF' . . .	0.254
AVERAGE . . . 'VSHALE' . .	0.088
AVERAGE . . . 'SW'	0.705
W.AVERAGE . . 'SW' * 'PHIF'	0.733
AVERAGE . . . 'SH'	0.295
VOID VOLUME: . . . ('PHIF').	27.954
HC VOID VOLUME . . ('SH'*) .	7.462
RES HC VOID VOLUME ('SHR'*).	4.526
MOV HC VOID VOLUME	2.936

****

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

HNETPAY /HGROSS SAND =	0.30417
HNETSAND/HGROSS SAND =	0.91667
HNETPAY /HNETSAND =	0.33182

****

Table 2.2.

WELL: 15-9-11 (2375 - 2510) DATE: 6AUG82/JIS

DEPTH	CUTOFF	VSH	PHIF	SW
2375.00	123.000	1.000	0.000	1.000
2375.25	123.000	1.000	0.000	1.000
2375.50	123.000	1.000	0.000	1.000
2375.75	123.000	1.000	0.000	1.000
2376.00	123.000	1.000	0.000	1.000
2376.25	123.000	1.000	0.000	1.000
2376.50	123.000	1.000	0.000	1.000
2376.75	123.000	1.000	0.000	1.000
2377.00	123.000	1.000	0.000	1.000
2377.25	123.000	1.000	0.000	1.000
2377.50	123.000	1.000	0.000	1.000
2377.75	123.000	1.000	0.000	1.000
2378.00	123.000	1.000	0.000	1.000
2378.25	123.000	1.000	0.000	1.000
2378.50	123.000	1.000	0.000	1.000
2378.75	123.000	1.000	0.000	1.000
2379.00	123.000	1.000	0.000	1.000
2379.25	123.000	1.000	0.000	1.000
2379.50	123.000	1.000	0.000	1.000
2379.75	123.000	1.000	0.000	1.000
2380.00	100.000	1.000	0.000	1.000
2380.25	100.000	1.000	0.000	1.000
2380.50	100.000	1.000	0.000	1.000
2380.75	103.000	0.785	0.086	0.685
2381.00	123.000	0.572	0.083	0.761
2381.25	123.000	0.557	0.045	1.000
2381.50	123.000	0.817	0.001	1.000
2381.75	123.000	1.000	0.000	1.000
2382.00	123.000	1.000	0.000	1.000
2382.25	123.000	1.000	0.000	1.000
2382.50	123.000	1.000	0.000	1.000
2382.75	123.000	1.000	0.000	1.000
2383.00	123.000	1.000	0.000	1.000
2383.25	123.000	1.000	0.000	1.000
2383.50	123.000	1.000	0.000	1.000
2383.75	123.000	1.000	0.000	1.000
2384.00	120.000	1.000	0.000	1.000
2384.25	123.000	1.000	0.000	1.000
2384.50	123.000	1.000	0.000	1.000
2384.75	100.000	1.000	0.000	1.000
2385.00	100.000	1.000	0.000	1.000
2385.25	100.000	0.610	0.174	0.541
2385.50	123.000	0.991	0.001	0.878
2385.75	123.000	1.000	0.000	1.000
2386.00	123.000	1.000	0.000	1.000
2386.25	123.000	1.000	0.000	1.000
2386.50	123.000	0.858	0.038	0.820
2386.75	123.000	0.609	0.098	0.679
2387.00	0.000	0.395	0.149	0.468
2387.25	0.000	0.257	0.185	0.304
2387.50	0.000	0.283	0.189	0.220
2387.75	100.000	0.588	0.114	0.238
2388.00	100.000	0.506	0.139	0.225
2388.25	0.000	0.205	0.232	0.190
2388.50	0.000	0.330	0.184	0.202
2388.75	100.000	0.485	0.136	0.213
2389.00	0.000	0.374	0.160	0.202
2389.25	0.000	0.175	0.212	0.190
2389.50	0.000	0.168	0.217	0.199
2389.75	0.000	0.224	0.206	0.204
2390.00	0.000	0.158	0.217	0.195
2390.25	0.000	0.123	0.210	0.200
2390.50	0.000	0.123	0.215	0.198
2390.75	0.000	0.121	0.226	0.193
2391.00	0.000	0.115	0.226	0.196
2391.25	0.000	0.158	0.210	0.207
2391.50	0.000	0.026	0.244	0.194
2391.75	0.000	0.029	0.243	0.199
2392.00	0.000	0.131	0.215	0.204
2392.25	0.000	0.204	0.196	0.199
2392.50	0.000	0.146	0.214	0.188
2392.75	0.000	0.098	0.229	0.182
2393.00	0.000	0.022	0.250	0.166
2393.25	0.000	0.000	0.257	0.158
2393.50	0.000	0.063	0.239	0.169
2393.75	0.000	0.131	0.218	0.187
2394.00	0.000	0.054	0.242	0.177
2394.25	0.000	0.000	0.261	0.167
2394.50	0.000	0.000	0.261	0.166
2394.75	0.000	0.000	0.253	0.167
2395.00	0.000	0.000	0.245	0.173
2395.25	0.000	0.000	0.242	0.185
2395.50	0.000	0.136	0.207	0.215
2395.75	0.000	0.229	0.174	0.250
2396.00	0.000	0.235	0.172	0.262
2396.25	0.000	0.247	0.177	0.265
2396.50	0.000	0.107	0.216	0.251
2396.75	0.000	0.000	0.245	0.244
2397.00	0.000	0.020	0.243	0.257
2397.25	0.000	0.101	0.216	0.295
2397.50	0.000	0.165	0.189	0.342
2397.75	0.000	0.113	0.208	0.336
2398.00	0.000	0.029	0.232	0.310
2398.25	0.000	0.215	0.168	0.356
2398.50	120.000	0.487	0.072	0.437
2398.75	20.000	0.393	0.085	0.418
2399.00	0.000	0.212	0.147	0.299
2399.25	0.000	0.191	0.176	0.252
2399.50	0.000	0.086	0.215	0.212
2399.75	0.000	0.000	0.248	0.187
2400.00	0.000	0.000	0.255	0.178
2400.25	0.000	0.036	0.253	0.178
2400.50	0.000	0.019	0.264	0.164
2400.75	0.000	0.017	0.266	0.162
2401.00	0.000	0.000	0.272	0.158
2401.25	0.000	0.000	0.261	0.183
2401.50	0.000	0.000	0.255	0.169
2401.75	0.000	0.000	0.264	0.166
2402.00	0.000	0.000	0.274	0.159
2402.25	0.000	0.000	0.276	0.156
2402.50	0.000	0.000	0.269	0.157

2402.75	0.000	0.000	0.272	0.157
2403.00	0.000	0.000	0.280	0.155
2403.25	0.000	0.010	0.275	0.158
2403.50	0.000	0.065	0.244	0.173
2403.75	0.000	0.099	0.231	0.179
2404.00	0.000	0.118	0.225	0.183
2404.25	0.000	0.058	0.237	0.179
2404.50	0.000	0.058	0.236	0.180
2404.75	0.000	0.114	0.212	0.195
2405.00	0.000	0.125	0.209	0.199
2405.25	0.000	0.116	0.213	0.200
2405.50	0.000	0.111	0.219	0.199
2405.75	0.000	0.094	0.231	0.193
2406.00	0.000	0.062	0.246	0.188
2406.25	0.000	0.130	0.228	0.200
2406.50	0.000	0.216	0.194	0.219
2406.75	0.000	0.188	0.195	0.219
2407.00	0.000	0.000	0.245	0.186
2407.25	0.000	0.000	0.245	0.181
2407.50	0.000	0.082	0.215	0.197
2407.75	0.000	0.246	0.169	0.227
2408.00	0.000	0.249	0.174	0.226
2408.25	0.000	0.244	0.180	0.223
2408.50	0.000	0.149	0.212	0.206
2408.75	0.000	0.061	0.241	0.193
2409.00	0.000	0.014	0.247	0.191
2409.25	0.000	0.031	0.231	0.201
2409.50	0.000	0.054	0.228	0.205
2409.75	0.000	0.000	0.251	0.190
2410.00	0.000	0.011	0.248	0.193
2410.25	0.000	0.164	0.212	0.213
2410.50	0.000	0.190	0.211	0.213
2410.75	0.000	0.084	0.242	0.196
2411.00	0.000	0.002	0.264	0.187
2411.25	0.000	0.035	0.260	0.190
2411.50	0.000	0.057	0.256	0.191
2411.75	0.000	0.114	0.235	0.204
2412.00	0.000	0.171	0.213	0.219
2412.25	0.000	0.162	0.209	0.225
2412.50	0.000	0.106	0.217	0.222
2412.75	0.000	0.139	0.201	0.233
2413.00	0.000	0.166	0.188	0.241
2413.25	0.000	0.111	0.205	0.228
2413.50	0.000	0.000	0.241	0.203
2413.75	0.000	0.000	0.251	0.198
2414.00	0.000	0.000	0.262	0.190
2414.25	0.000	0.000	0.266	0.188
2414.50	0.000	0.000	0.260	0.192
2414.75	0.000	0.000	0.250	0.199
2415.00	0.000	0.000	0.237	0.208
2415.25	0.000	0.007	0.229	0.215
2415.50	0.000	0.037	0.221	0.221
2415.75	0.000	0.049	0.222	0.221
2416.00	0.000	0.081	0.225	0.220
2416.25	0.000	0.035	0.231	0.218
2416.50	0.000	0.000	0.237	0.214
2416.75	0.000	0.000	0.237	0.216
2417.00	0.000	0.000	0.220	0.230
2417.25	0.000	0.000	0.192	0.260
2417.50	0.000	0.052	0.182	0.273
2417.75	0.000	0.019	0.217	0.244
2418.00	0.000	0.096	0.202	0.262
2418.25	0.000	0.189	0.180	0.281
2418.50	0.000	0.131	0.192	0.273

2418.75	0.000	0.010	0.225	0.246
2419.00	0.000	0.000	0.230	0.239
2419.25	0.000	0.045	0.219	0.250
2419.50	0.000	0.218	0.172	0.293
2419.75	0.000	0.203	0.171	0.302
2420.00	0.000	0.000	0.228	0.254
2420.25	0.000	0.134	0.203	0.271
2420.50	0.000	0.219	0.191	0.275
2420.75	0.000	0.193	0.203	0.279
2421.00	0.000	0.229	0.188	0.293
2421.25	0.000	0.250	0.182	0.286
2421.50	0.000	0.281	0.178	0.300
2421.75	0.000	0.262	0.183	0.303
2422.00	0.000	0.204	0.194	0.299
2422.25	0.000	0.243	0.182	0.317
2422.50	0.000	0.314	0.168	0.327
2422.75	0.000	0.202	0.192	0.325
2423.00	0.000	0.016	0.243	0.298
2423.25	0.000	0.000	0.251	0.302
2423.50	0.000	0.000	0.253	0.313
2423.75	0.000	0.115	0.214	0.374
2424.00	0.000	0.263	0.169	0.455
2424.25	0.000	0.295	0.160	0.584
2424.50	0.000	0.159	0.199	0.587
2424.75	3.000	0.168	0.196	0.653
2425.00	103.000	0.486	0.188	0.855
2425.25	123.000	1.000	0.000	1.000
2425.50	123.000	1.000	0.000	1.000
2425.75	123.000	1.000	0.000	1.000
2426.00	123.000	1.000	0.000	1.000
2426.25	123.000	1.000	0.000	1.000
2426.50	123.000	0.777	0.001	1.000
2426.75	123.000	0.812	0.076	0.945
2427.00	103.000	0.639	0.103	0.835
2427.25	103.000	0.877	0.124	0.752
2427.50	103.000	0.410	0.213	0.645
2427.75	3.000	0.249	0.241	0.602
2428.00	3.000	0.193	0.226	0.639
2428.25	3.000	0.358	0.164	0.766
2428.50	123.000	0.768	0.041	1.000
2428.75	123.000	1.000	0.000	1.000
2429.00	123.000	1.000	0.000	1.000
2429.25	123.000	1.000	0.000	1.000
2429.50	123.000	1.000	0.000	1.000
2429.75	103.000	0.489	0.159	0.767
2430.00	3.000	0.119	0.235	0.688
2430.25	3.000	0.106	0.247	0.671
2430.50	3.000	0.075	0.261	0.651
2430.75	3.000	0.000	0.281	0.617
2431.00	3.000	0.000	0.279	0.629
2431.25	3.000	0.000	0.275	0.642
2431.50	3.000	0.000	0.263	0.672
2431.75	3.000	0.038	0.245	0.713
2432.00	3.000	0.000	0.264	0.692
2432.25	3.000	0.000	0.289	0.700
2432.50	3.000	0.000	0.289	0.722

2432.75	3.000	0.000	0.269	0.735
2433.00	3.000	0.000	0.269	0.748
2433.25	3.000	0.000	0.268	0.741
2433.50	3.000	0.000	0.267	0.749
2433.75	3.000	0.095	0.233	0.848
2434.00	3.000	0.112	0.213	0.913
2434.25	3.000	0.049	0.232	0.878
2434.50	3.000	0.057	0.236	0.855
2434.75	3.000	0.000	0.247	0.814
2435.00	3.000	0.000	0.250	0.812
2435.25	3.000	0.000	0.253	0.800
2435.50	3.000	0.000	0.244	0.817
2435.75	3.000	0.000	0.241	0.825
2436.00	3.000	0.000	0.241	0.819
2436.25	3.000	0.000	0.236	0.847
2436.50	3.000	0.000	0.238	0.854
2436.75	3.000	0.058	0.226	0.884
2437.00	3.000	0.081	0.226	0.899
2437.25	3.000	0.000	0.255	0.835
2437.50	3.000	0.000	0.261	0.832
2437.75	3.000	0.000	0.260	0.852
2438.00	3.000	0.000	0.264	0.836
2438.25	3.000	0.000	0.274	0.806
2438.50	3.000	0.000	0.268	0.827
2438.75	3.000	0.000	0.266	0.829
2439.00	3.000	0.000	0.275	0.804
2439.25	3.000	0.000	0.271	0.806
2439.50	3.000	0.000	0.270	0.801
2439.75	3.000	0.000	0.278	0.781
2440.00	3.000	0.013	0.282	0.766
2440.25	3.000	0.068	0.259	0.824
2440.50	3.000	0.133	0.237	0.883
2440.75	3.000	0.152	0.227	0.911
2441.00	3.000	0.155	0.223	0.932
2441.25	3.000	0.082	0.236	0.926
2441.50	3.000	0.044	0.253	0.905
2441.75	3.000	0.120	0.246	0.921
2442.00	103.000	0.459	0.164	1.000
2442.25	123.000	1.000	0.000	1.000
2442.50	123.000	1.000	0.000	1.000
2442.75	123.000	1.000	0.000	1.000
2443.00	123.000	1.000	0.000	1.000
2443.25	103.000	0.631	0.152	1.000
2443.50	3.000	0.268	0.248	1.000
2443.75	3.000	0.338	0.220	1.000
2444.00	3.000	0.325	0.211	1.000
2444.25	3.000	0.180	0.249	1.000
2444.50	3.000	0.033	0.292	1.000
2444.75	3.000	0.093	0.286	1.000
2445.00	3.000	0.170	0.268	1.000
2445.25	3.000	0.153	0.264	1.000
2445.50	3.000	0.092	0.269	1.000
2445.75	3.000	0.113	0.257	1.000
2446.00	3.000	0.088	0.262	1.000
2446.25	3.000	0.035	0.277	1.000
2446.50	3.000	0.073	0.275	1.000
2446.75	3.000	0.115	0.269	1.000
2447.00	3.000	0.075	0.269	1.000
2447.25	3.000	0.024	0.276	1.000
2447.50	3.000	0.000	0.298	0.982
2447.75	3.000	0.000	0.317	0.943
2448.00	3.000	0.000	0.319	0.939
2448.25	3.000	0.000	0.329	0.916
2448.50	3.000	0.061	0.304	0.974

2448.75	3.000	0.116	0.274	1.000
2449.00	3.000	0.072	0.287	1.000
2449.25	3.000	0.089	0.285	1.000
2449.50	3.000	0.115	0.288	1.000
2449.75	3.000	0.195	0.274	1.000
2450.00	3.000	0.162	0.281	0.995
2450.25	3.000	0.000	0.320	0.915
2450.50	3.000	0.065	0.304	0.947
2450.75	3.000	0.190	0.278	0.991
2451.00	3.000	0.117	0.307	0.936
2451.25	3.000	0.064	0.319	0.919
2451.50	3.000	0.044	0.308	0.954
2451.75	3.000	0.000	0.313	0.949
2452.00	3.000	0.000	0.309	0.958
2452.25	3.000	0.000	0.311	0.950
2452.50	3.000	0.000	0.309	0.962
2452.75	3.000	0.072	0.289	0.993
2453.00	3.000	0.029	0.301	0.961
2453.25	3.000	0.000	0.314	0.928
2453.50	3.000	0.000	0.325	0.902
2453.75	3.000	0.000	0.336	0.883
2454.00	3.000	0.124	0.289	0.990
2454.25	3.000	0.150	0.266	1.000
2454.50	3.000	0.079	0.277	1.000
2454.75	3.000	0.118	0.259	1.000
2455.00	3.000	0.166	0.241	1.000
2455.25	3.000	0.078	0.263	1.000
2455.50	3.000	0.068	0.271	1.000
2455.75	3.000	0.022	0.294	0.987
2456.00	3.000	0.000	0.312	0.950
2456.25	3.000	0.000	0.308	0.969
2456.50	3.000	0.000	0.302	0.992
2456.75	3.000	0.000	0.317	0.959
2457.00	3.000	0.000	0.330	0.931
2457.25	3.000	0.000	0.329	0.935
2457.50	3.000	0.000	0.333	0.916
2457.75	3.000	0.000	0.333	0.915
2458.00	3.000	0.000	0.324	0.932
2458.25	3.000	0.000	0.311	0.965
2458.50	3.000	0.000	0.300	1.000
2458.75	3.000	0.000	0.302	0.990
2459.00	3.000	0.000	0.311	0.957
2459.25	3.000	0.000	0.314	0.940
2459.50	3.000	0.000	0.328	0.916
2459.75	3.000	0.000	0.348	0.880
2460.00	3.000	0.043	0.363	0.846
2460.25	3.000	0.092	0.334	0.899
2460.50	3.000	0.059	0.321	0.937
2460.75	3.000	0.000	0.338	0.910
2461.00	3.000	0.000	0.350	0.889
2461.25	3.000	0.000	0.346	0.895
2461.50	3.000	0.000	0.329	0.923
2461.75	3.000	0.030	0.313	0.955
2462.00	3.000	0.037	0.317	0.945
2462.25	3.000	0.108	0.288	1.000
2462.50	3.000	0.068	0.283	1.000

2462.75	3.000	0.019	0.308	0.967
2463.00	3.000	0.020	0.319	0.940
2463.25	3.000	0.000	0.320	0.939
2463.50	3.000	0.000	0.313	0.957
2463.75	3.000	0.000	0.309	0.963
2464.00	3.000	0.000	0.312	0.949
2464.25	3.000	0.000	0.314	0.942
2464.50	3.000	0.078	0.298	0.972
2464.75	3.000	0.032	0.308	0.950
2465.00	3.000	0.000	0.309	0.952
2465.25	3.000	0.000	0.313	0.948
2465.50	3.000	0.000	0.337	0.896
2465.75	3.000	0.045	0.350	0.868
2466.00	3.000	0.104	0.337	0.884
2466.25	3.000	0.116	0.328	0.913
2466.50	3.000	0.071	0.311	0.945
2466.75	3.000	0.087	0.282	1.000
2467.00	3.000	0.036	0.283	1.000
2467.25	3.000	0.000	0.296	0.980
2467.50	3.000	0.000	0.293	0.995
2467.75	3.000	0.000	0.287	1.000
2468.00	3.000	0.000	0.286	1.000
2468.25	3.000	0.000	0.292	1.000
2468.50	3.000	0.000	0.306	0.957
2468.75	3.000	0.000	0.312	0.932
2469.00	3.000	0.031	0.301	0.957
2469.25	3.000	0.049	0.302	0.955
2469.50	3.000	0.024	0.310	0.936
2469.75	3.000	0.074	0.284	0.999
2470.00	3.000	0.040	0.275	1.000
2470.25	3.000	0.107	0.260	1.000
2470.50	3.000	0.189	0.248	1.000
2470.75	3.000	0.230	0.243	1.000
2471.00	3.000	0.122	0.272	1.000
2471.25	3.000	0.000	0.315	0.941
2471.50	3.000	0.108	0.301	0.962
2471.75	3.000	0.199	0.275	1.000
2472.00	3.000	0.318	0.224	1.000
2472.25	3.000	0.298	0.221	1.000
2472.50	3.000	0.315	0.219	1.000
2472.75	3.000	0.270	0.237	1.000
2473.00	3.000	0.142	0.268	1.000
2473.25	3.000	0.067	0.282	1.000
2473.50	3.000	0.079	0.283	1.000
2473.75	3.000	0.028	0.302	0.979
2474.00	3.000	0.056	0.294	0.957
2474.25	3.000	0.171	0.263	1.000
2474.50	3.000	0.339	0.213	1.000
2474.75	3.000	0.397	0.186	1.000
2475.00	3.000	0.211	0.246	1.000
2475.25	3.000	0.240	0.241	1.000
2475.50	3.000	0.171	0.261	1.000
2475.75	3.000	0.072	0.288	1.000
2476.00	3.000	0.012	0.299	1.000
2476.25	3.000	0.012	0.294	1.000
2476.50	3.000	0.113	0.267	1.000
2476.75	3.000	0.200	0.248	1.000
2477.00	3.000	0.208	0.243	1.000
2477.25	3.000	0.134	0.251	1.000
2477.50	3.000	0.100	0.286	0.972
2477.75	3.000	0.199	0.236	1.000
2478.00	3.000	0.290	0.148	1.000
2478.25	3.000	0.321	0.144	1.000
2478.50	3.000	0.356	0.163	1.000

2478.75	3.000	0.289	0.204	1.000
2479.00	3.000	0.199	0.237	1.000
2479.25	3.000	0.096	0.257	1.000
2479.50	3.000	0.059	0.253	1.000
2479.75	3.000	0.146	0.227	1.000
2480.00	3.000	0.195	0.219	1.000
2480.25	3.000	0.061	0.256	1.000
2480.50	3.000	0.000	0.275	1.000
2480.75	3.000	0.115	0.248	1.000
2481.00	3.000	0.200	0.230	1.000
2481.25	3.000	0.188	0.244	1.000
2481.50	3.000	0.180	0.251	1.000
2481.75	3.000	0.265	0.225	1.000
2482.00	3.000	0.214	0.232	1.000
2482.25	3.000	0.127	0.252	1.000
2482.50	3.000	0.102	0.262	1.000
2482.75	3.000	0.171	0.245	1.000
2483.00	3.000	0.149	0.246	1.000
2483.25	3.000	0.089	0.252	1.000
2483.50	3.000	0.089	0.238	1.000
2483.75	3.000	0.181	0.211	1.000
2484.00	3.000	0.162	0.235	1.000
2484.25	3.000	0.085	0.273	0.968
2484.50	3.000	0.027	0.297	0.913
2484.75	3.000	0.000	0.297	0.925
2485.00	3.000	0.033	0.273	0.998
2485.25	3.000	0.151	0.236	1.000
2485.50	3.000	0.192	0.216	1.000
2485.75	3.000	0.176	0.219	1.000
2486.00	3.000	0.149	0.232	1.000
2486.25	3.000	0.091	0.254	1.000
2486.50	3.000	0.052	0.266	1.000
2486.75	3.000	0.004	0.279	0.972
2487.00	3.000	0.000	0.282	0.968
2487.25	3.000	0.000	0.285	0.970
2487.50	3.000	0.000	0.284	0.990
2487.75	3.000	0.051	0.264	1.000
2488.00	3.000	0.137	0.240	1.000
2488.25	3.000	0.036	0.270	1.000
2488.50	3.000	0.020	0.274	1.000
2488.75	3.000	0.072	0.262	1.000
2489.00	3.000	0.000	0.285	1.000
2489.25	3.000	0.000	0.288	1.000
2489.50	3.000	0.000	0.290	0.992
2489.75	3.000	0.000	0.292	0.985
2490.00	3.000	0.000	0.285	1.000
2490.25	3.000	0.000	0.285	1.000
2490.50	3.000	0.068	0.271	1.000
2490.75	3.000	0.093	0.266	1.000
2491.00	3.000	0.094	0.265	0.985
2491.25	3.000	0.099	0.245	1.000
2491.50	3.000	0.042	0.238	1.000
2491.75	3.000	0.022	0.254	0.944
2492.00	3.000	0.144	0.231	0.983
2492.25	3.000	0.254	0.198	1.000
2492.50	3.000	0.184	0.222	1.000

2492.75	3.000	0.125	0.244	1.000
2493.00	3.000	0.104	0.249	1.000
2493.25	3.000	0.093	0.242	1.000
2493.50	3.000	0.215	0.201	1.000
2493.75	123.000	0.594	0.085	1.000
2494.00	123.000	0.691	0.054	1.000
2494.25	103.000	0.522	0.119	1.000
2494.50	3.000	0.876	0.200	1.000
2494.75	3.000	0.048	0.260	0.995
2495.00	3.000	0.117	0.243	1.000
2495.25	3.000	0.097	0.257	1.000
2495.50	3.000	0.019	0.281	1.000
2495.75	3.000	0.000	0.279	1.000
2496.00	3.000	0.000	0.271	1.000
2496.25	3.000	0.000	0.270	1.000
2496.50	3.000	0.033	0.265	1.000
2496.75	3.000	0.022	0.268	0.999
2497.00	3.000	0.000	0.273	0.970
2497.25	3.000	0.000	0.279	0.934
2497.50	3.000	0.000	0.285	0.900
2497.75	3.000	0.006	0.288	0.875
2498.00	3.000	0.133	0.251	0.947
2498.25	3.000	0.175	0.233	0.989
2498.50	3.000	0.064	0.251	0.959
2498.75	3.000	0.081	0.244	0.984
2499.00	3.000	0.160	0.213	1.000
2499.25	3.000	0.178	0.204	1.000
2499.50	3.000	0.166	0.210	1.000
2499.75	3.000	0.103	0.228	1.000
2500.00	3.000	0.045	0.247	0.972
2500.25	3.000	0.015	0.264	0.913
2500.50	3.000	0.000	0.272	0.884
2500.75	3.000	0.000	0.273	0.877
2501.00	3.000	0.000	0.277	0.866
2501.25	3.000	0.000	0.270	0.887
2501.50	3.000	0.000	0.271	0.890
2501.75	3.000	0.000	0.280	0.867
2502.00	3.000	0.000	0.292	0.848
2502.25	3.000	0.000	0.298	0.869
2502.50	3.000	0.000	0.303	0.932
2502.75	3.000	0.160	0.299	0.974
2503.00	3.000	0.147	0.331	0.936
2503.25	3.000	0.181	0.307	1.000
2503.50	3.000	0.218	0.272	1.000
2503.75	3.000	0.214	0.251	1.000
2504.00	3.000	0.210	0.248	1.000
2504.25	3.000	0.278	0.231	1.000
2504.50	3.000	0.376	0.197	1.000
2504.75	103.000	0.460	0.154	1.000
2505.00	103.000	0.514	0.133	1.000
2505.25	103.000	0.635	0.110	1.000
2505.50	123.000	0.818	0.071	1.000
2505.75	123.000	1.000	0.000	1.000
2506.00	123.000	1.000	0.000	1.000
2506.25	103.000	0.804	0.149	0.956
2506.50	3.000	0.168	0.308	0.765
2506.75	3.000	0.008	0.234	0.906
2507.00	3.000	0.169	0.139	1.000
2507.25	103.000	0.438	0.123	1.000
2507.50	103.000	0.724	0.089	0.961
2507.75	123.000	0.902	0.032	1.000
2508.00	123.000	0.755	0.031	1.000
2508.25	123.000	0.512	0.063	1.000
2508.50	23.000	0.380	0.041	1.000
2508.75	123.000	0.692	0.001	1.000
2509.00	123.000	1.000	0.000	1.000
2509.25	123.000	1.000	0.000	1.000
2509.50	123.000	0.868	0.051	0.918
2509.75	123.000	0.631	0.075	1.000
2510.00	123.000	0.697	0.033	1.000

WELL	DEPTH-INTERVAL		DATE	TIME	ID
15-9-11	2375.00	2510.00	6 AUG 82	14:19	JIS

3. MESOZOIC RESERVOIR

3.1. Summary of results

Depth interval:	2775 - 2850 m RKB
Reservoir interval:	2789 - 2831 m RKB
Net sand:	35.25 m
Net pay:	33.75 m
Av. porosity (net pay):	20.5 %
Av. Sw (net pay):	12.7 %
H net pay/H gross sand:	

Cut off values used for the interval:

Ø $\leq$ 0.10 (fractions)
Vsh $\geq$ 0.40 (fractions)
Sw $\geq$ 0.60 (fractions)

The final results are shown in tables 3.1. and 3.2.

3.2. Lithology

This sandstone of Mesozoic age is composed of clear quartz, fine to medium grained, occasionally coarse, subangular to rounded. It is loose to hard, slightly calcareous and pyritic. Traces of glauconite have also been observed.

The depositional environment is interpreted to be marine, marginal marine to inner shelf.

3.3. Input parameters

The interval under consideration was logged with the following tools:

1. ISF-BHC-GR
2. FDC-CNL-GR
3. DLL-MSFL-GR
4. HDT
5. RFT

The log quality was very good.

A. Determination of Rw

For the Mesozoic formation a Rw of 0.0227 ohm.m at 103.9°C (219°F), corresponding to 130000 ppm NaCl, which is normal for Jurassic/Triassic in this area, has been used.

The temperature, 103.9°C (219°F), is the maximum recorded temperature during build up in DST no. 1. (2797 - 2807 m RKB).

B. Mud filtrate resistivity

Rmf from the log heading was 0.0835 ohm.m at 85.6°C (186°F) for the Mesozoic log run, which gives a Rmf of 0.0713 at reservoir temperature of 103.9°C.

C. GR and PHIN corrections

The GR has been corrected for bore hole size and mud weight (GR-CORR). The corrected values have been used in the computation (fig. 3.2. and 3.6.). The neutron readings have been corrected for downhole temperatures and pressures (PHIN-CORR). Also these corrected values have been used in the computation (fig. 3.1.).

D. Shale properties

A shaly sand method has been applied for the log evaluation. Shale properties for the zone have been taken Z-histograms using GR of 72+ for the interval 2775 - 2808 m RKB (figs. 3.4. and 3.5.), and GR of 84+ for the interval 2808 - 2850 m RKB (figs. 3.8. and 3.9.).

Depth interval	Rt (ohm.m)	RHOB (g/cc)	DT (µs/ft)	PHIN (p.n.)
2775 - 2808	1.49	2.46	93	0.33
2808 - 2850	1.87	2.55	78	0.26

E. Matrix parameters

The following matrix parameters were used as input to the shaly sand model for the reservoir.

Quartz: 2.65 g/cc, 55 µs/ft, 0.035 (frac) CNL

Fluid: 1.01 g/cc, 189 µs/ft, 1.000 (frac) CNL

Density-neutron, density-sonic and neutron-sonic cross plots show quartz, shale points and gas effects figs. 3.2. - 3.3. and figs. 3.6. - 3.7.

3.4. Computation of final rock properties

The final rock properties for this zone are listed at the back of this report and shown in analog form in the attached presentation.

A. Shale corrections

The same indicators were studied as for the Heimdal formation (fig. 3.10). Only the VSHGR was used.

B. Porosity computation

Similar to the computation of the Heimdal formation (fig. 3.11.).

C. Rt computation

Also similar to the computation of the Heimdal formation

D. Water saturation, Sw

Similar to the Heimdal formation computation, but the following values for cementation and saturation exponents M and N and lithological factor A have been applied:

Interval, m RKB	M	N	A
2795 - 2850	1.7	1.9	1.0

The factor is normal throughout the whole 15/9-area for Jurassic/Triassic formation and is confirmed by several core measurements in the area. Unfortunately, this zone was not cored.

E. Cut off

The following cut off values have been used when studying this interval:

Ø	≤	0.10	(fractions)
VHS	≥	0.40	(fractions)
Sw	≥	0.60	(fractions)

Input parameters listed:

Zone	Mesozoic	
Intervals	2775-2808	2808-2850
BHT, ^{o}C	103.9 ($219^{o}F$)	103.9 ($219^{o}F$)
Rw, ohm.m	0.0227	0.0227
ppm, NaCl	130000	130000
Rmf, ohm.m	0.0713	0.0713
RT-sh, ohm.m	1.49	1.87
RHOB-sh, g/cc	2.46	2.55
DT-sh, µs/ft	93	78
PHIN-sh, frac	0.33	0.26
RHOMA, g/cc	2.65	2.65
DTma, µs/ft	55.5	55.5
PHINms, frac	0.035	0.035
RHOfl, g/cc	1.01	1.01
DTfl, µs/ft	189	189
PHINfl, frac	1.00	1.00
GR-max	72	84
GR-min	20	16
M	1.7	1.7
N	1.9	1.9
A	1.0	1.0
Vsh-exp.	1.6	1.6

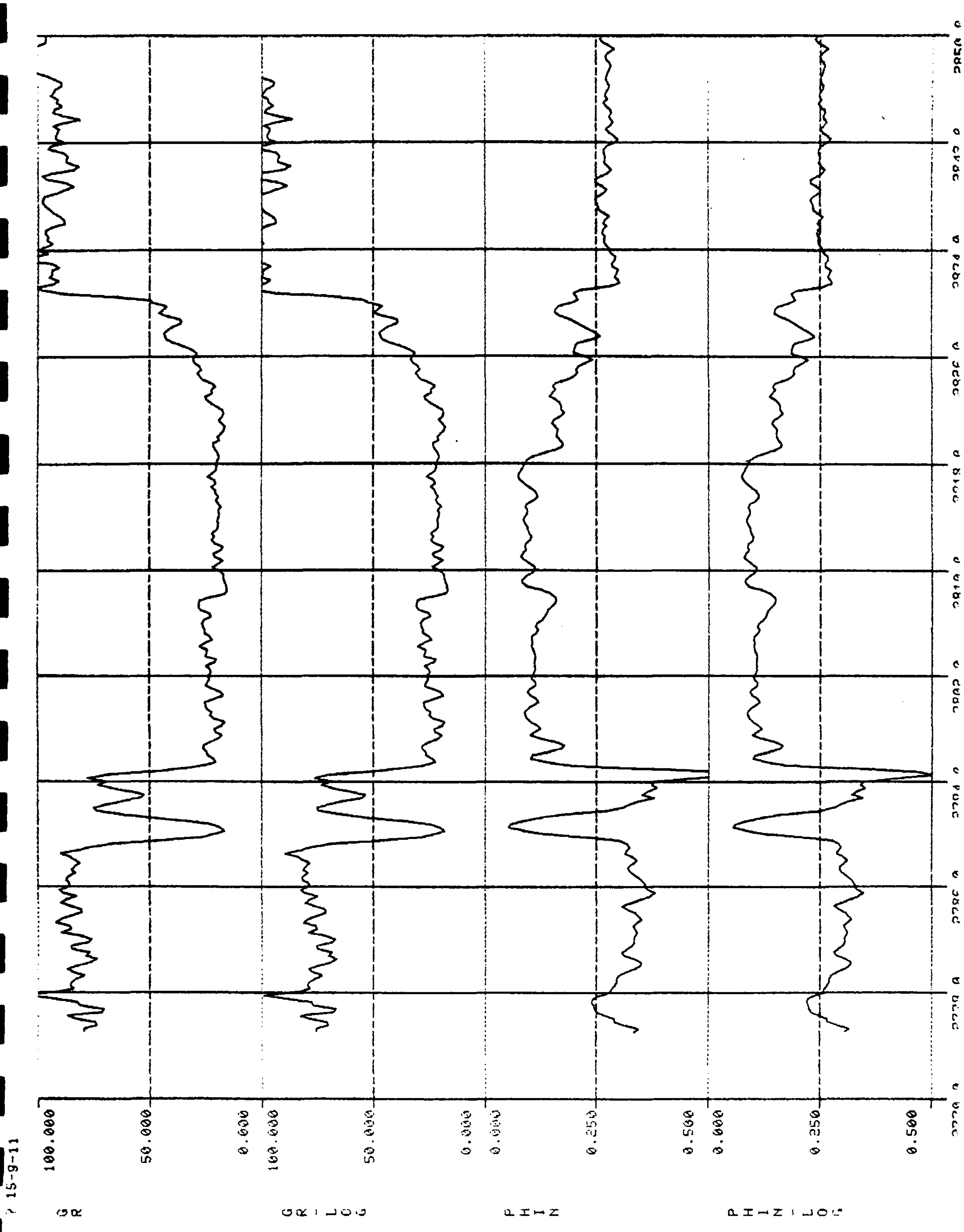
Figures 3.1. - 3.11.

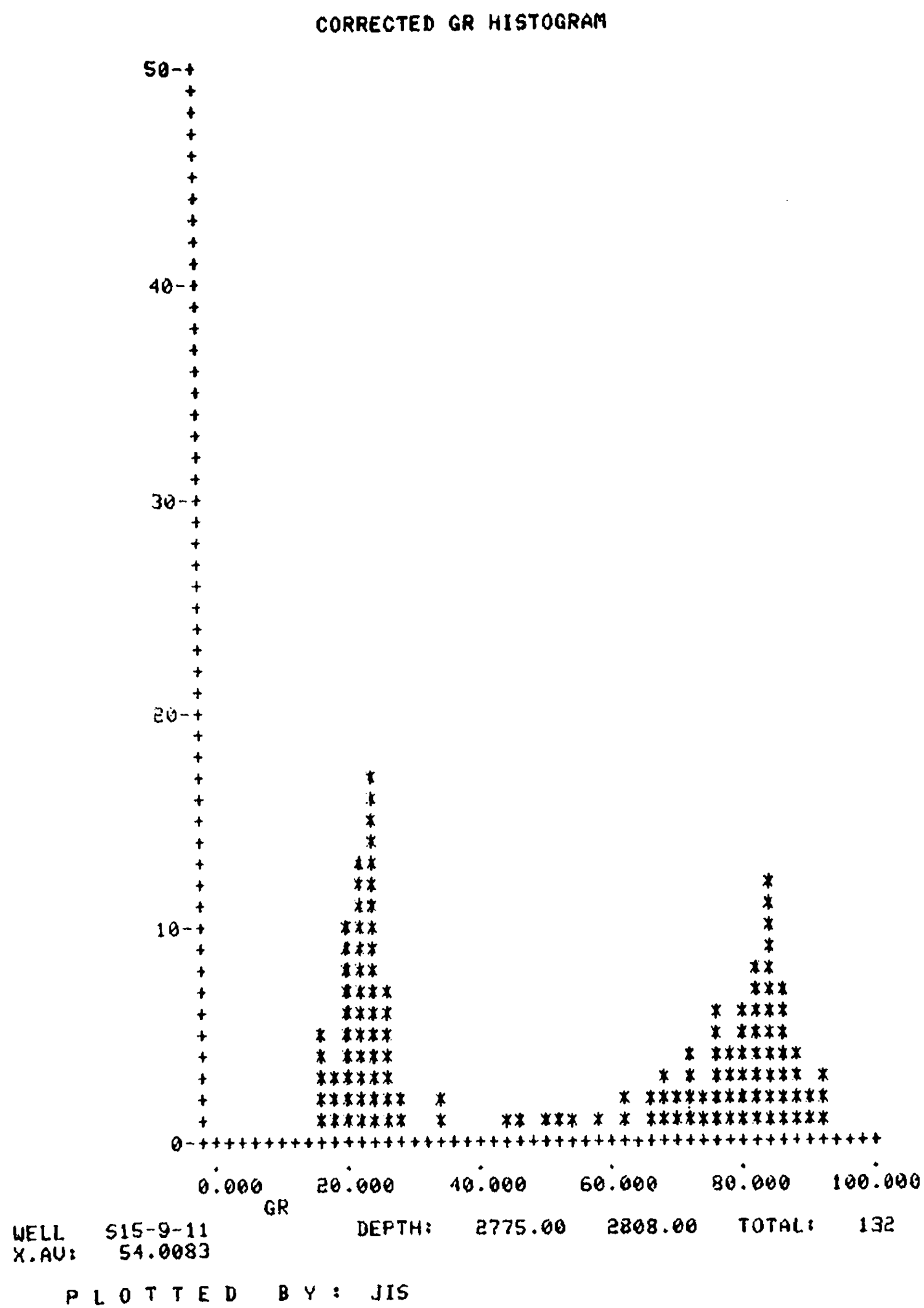
Tables 3.1. - 3.2.

MESOZOIC SANDSTONE

2775 - 2850 m RKB

Fig. 3.1




CORRECTED GR HISTOGRAM
50
40
30
20
10
0
0.000
20.000
40.000
60.000
80.000
100.000
GR
WELL S15-9-11
X.AV: 54.0083
DEPTH: 2775.00 2808.00 TOTAL: 132
PLOTTED BY: JIS

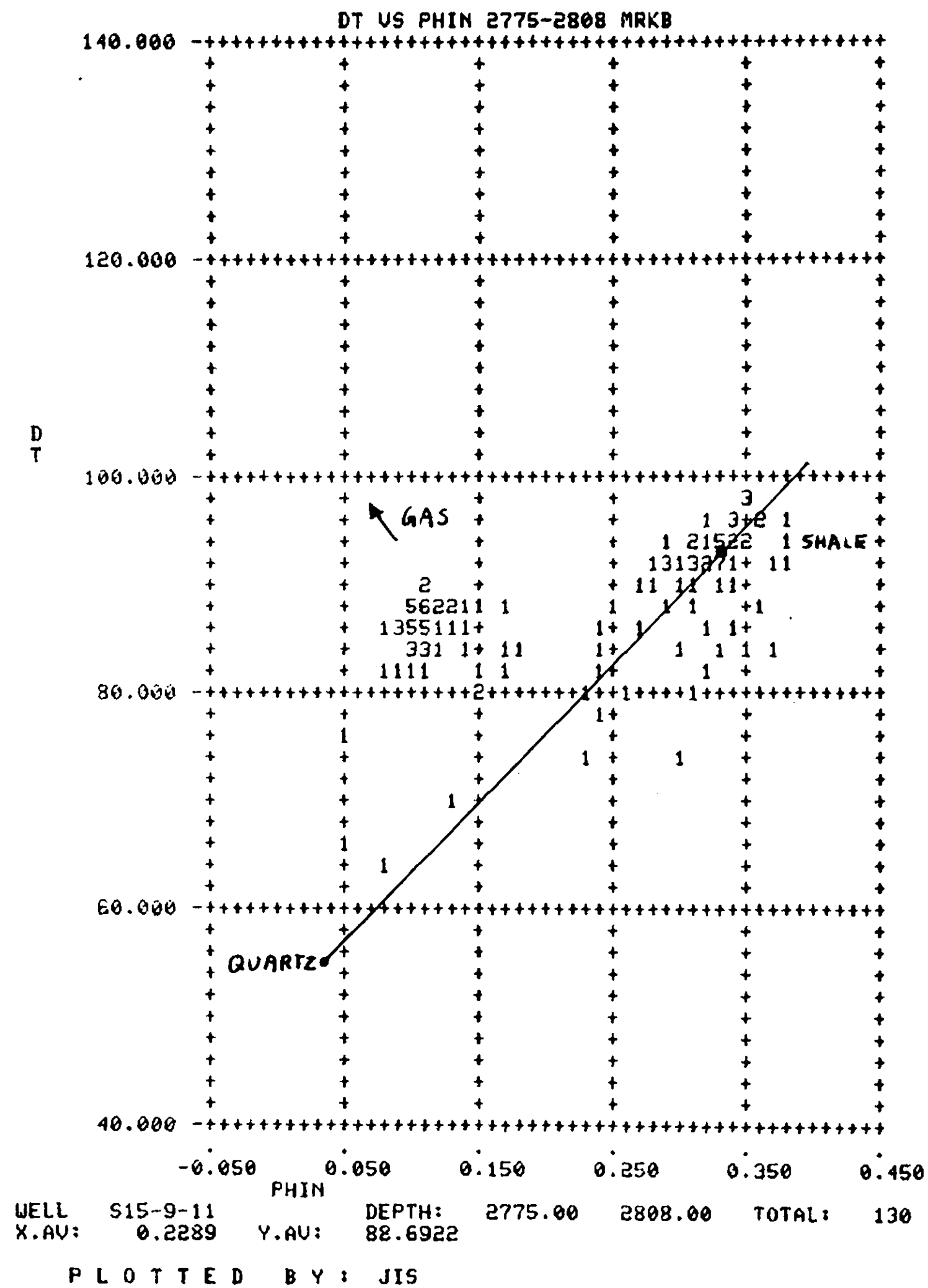
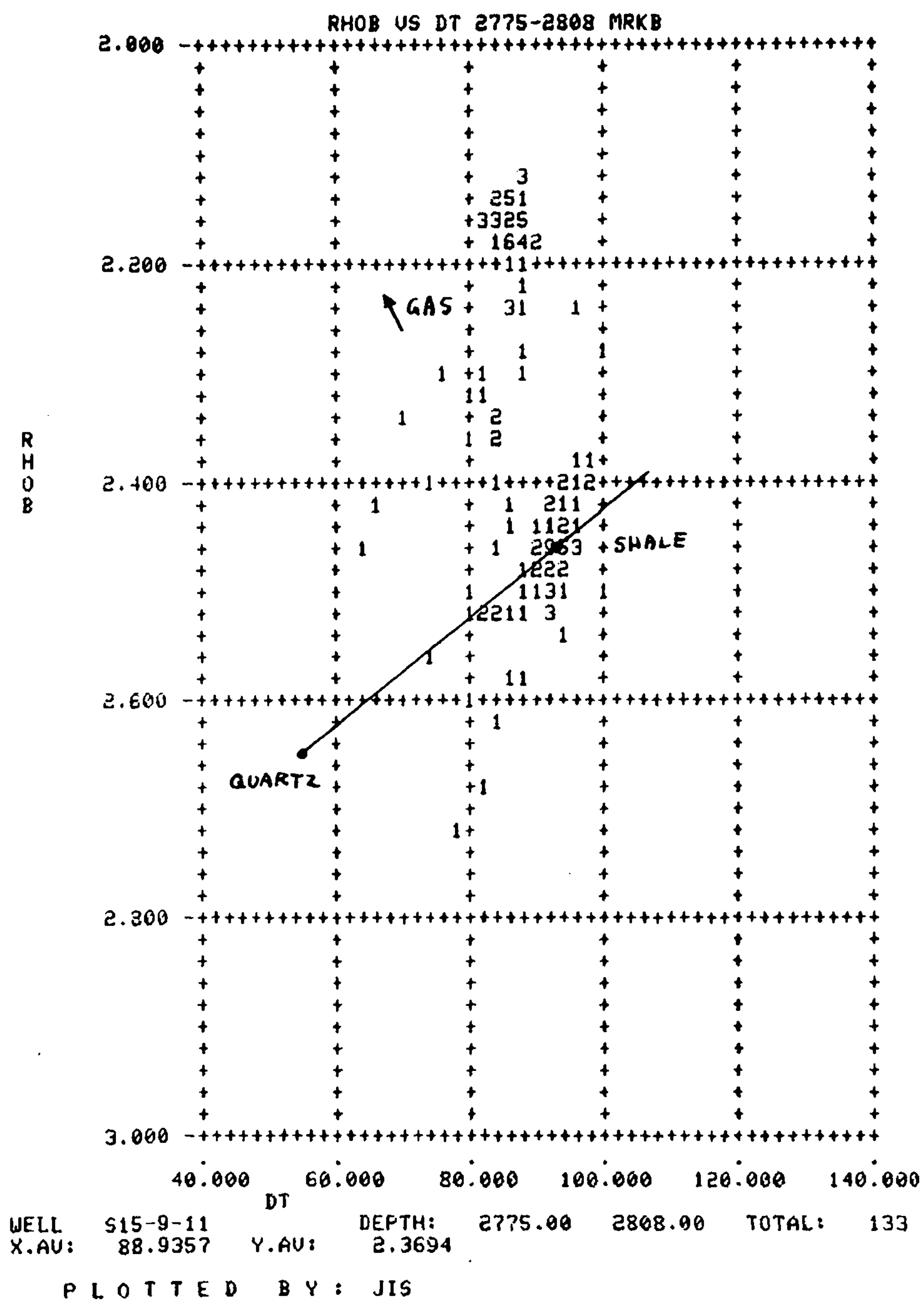

DT VS PHIN 2775-2808 MRKB
140.000
120.000
100.000
80.000
60.000
40.000
DT
GAS
SHALE
QUARTZ
-0.050
0.050
0.150
0.250
0.350
0.450
PHIN
WELL S15-9-11
X.AV: 0.2289 Y.AV: 88.6922
DEPTH: 2775.00 2808.00 TOTAL: 130
PLOTTED BY: JIS

Fig. 3.2


RHOB VS DT 2775-2808 MRKB
RHOB
DT
GAS
SHALE
QUARTZ
2.000
2.200
2.400
2.600
2.300
3.000
40.000
60.000
80.000
100.000
120.000
140.000
WELL S15-9-11 DEPTH: 2775.00 2808.00 TOTAL: 133
X.AU: 88.9357 Y.AU: 2.3694
PLOTTED BY: JIS

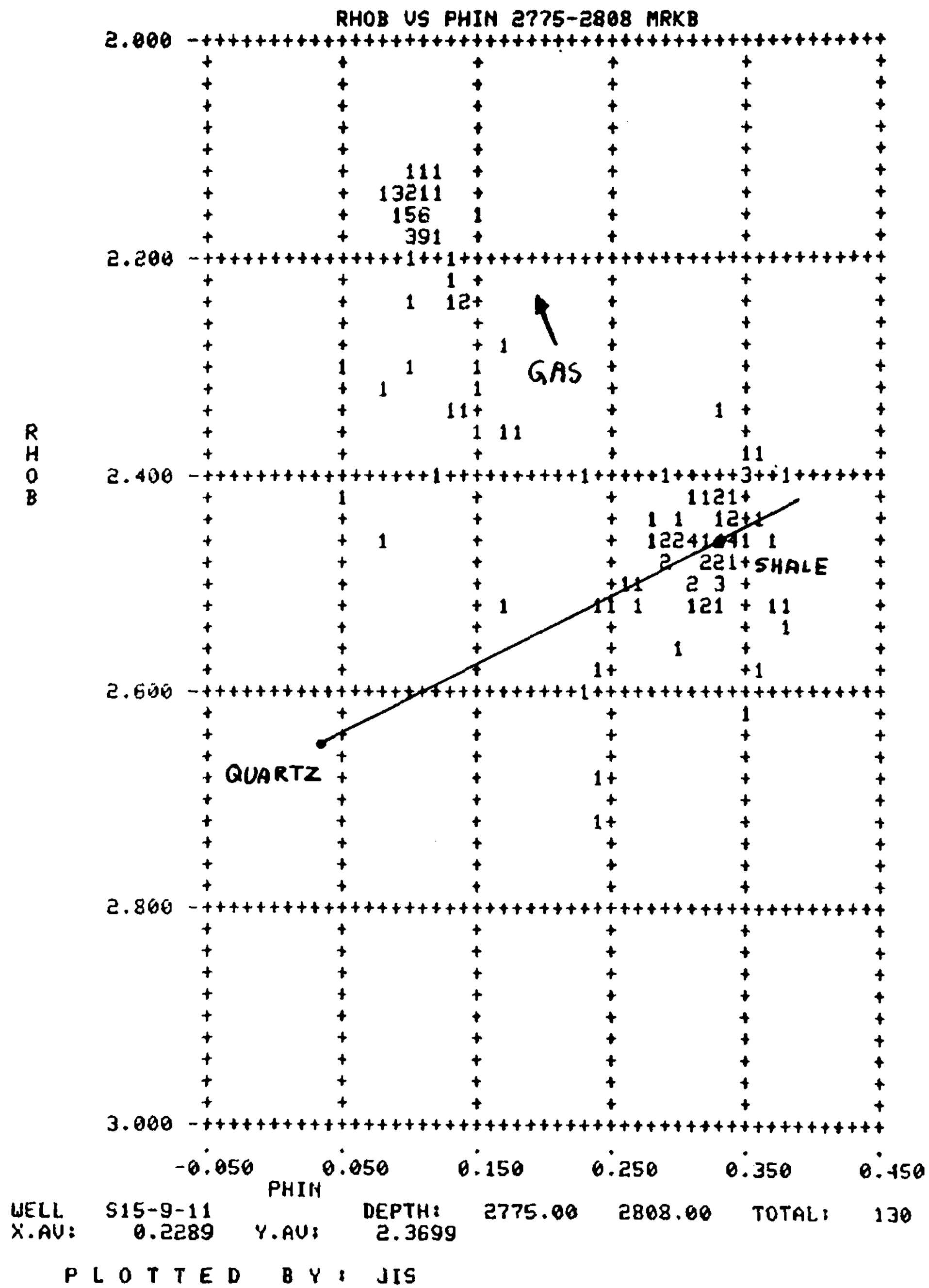
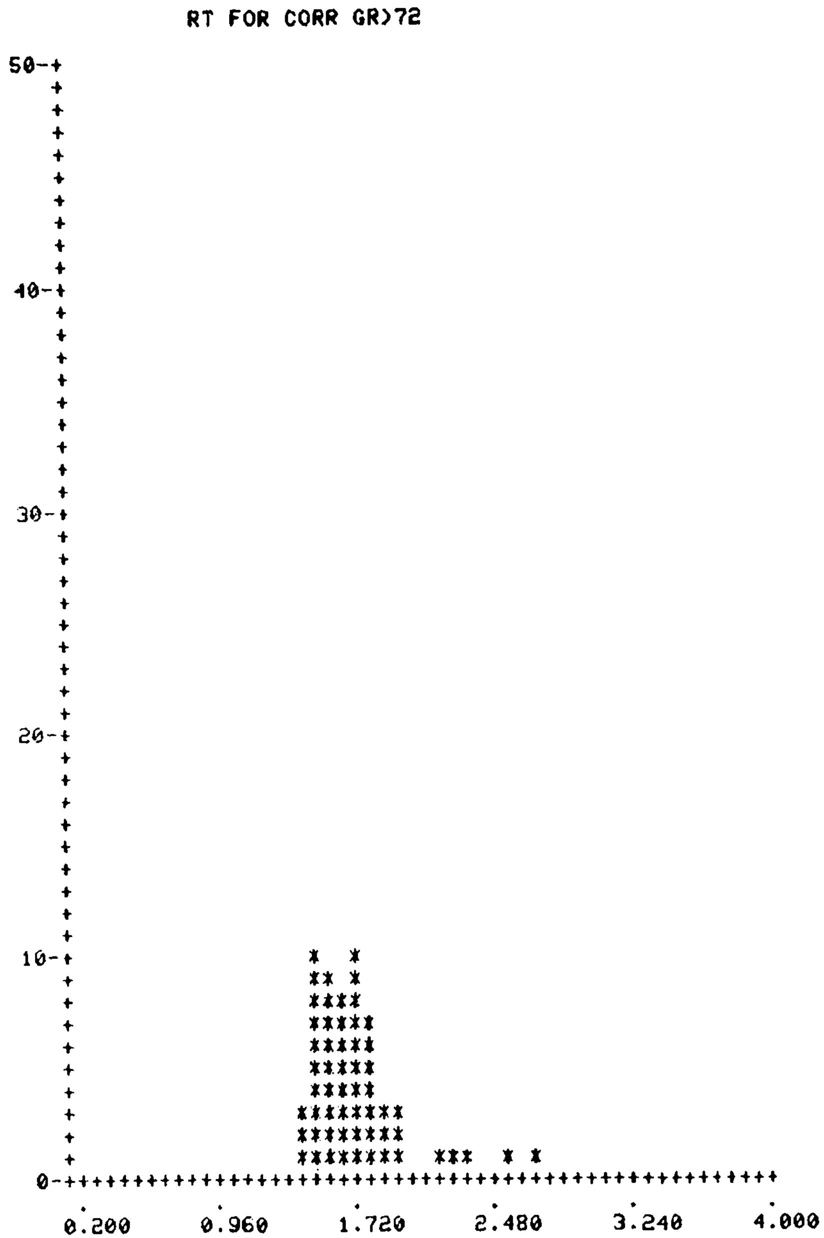

RHOB VS PHIN 2775-2808 MRKB
RHOB
PHIN
GAS
SHALE
QUARTZ
2.000
2.200
2.400
2.600
2.800
3.000
-0.050
0.050
0.150
0.250
0.350
0.450
WELL S15-9-11 DEPTH: 2775.00 2808.00 TOTAL: 130
X.AU: 0.2289 Y.AU: 2.3699
PLOTTED BY: JIS

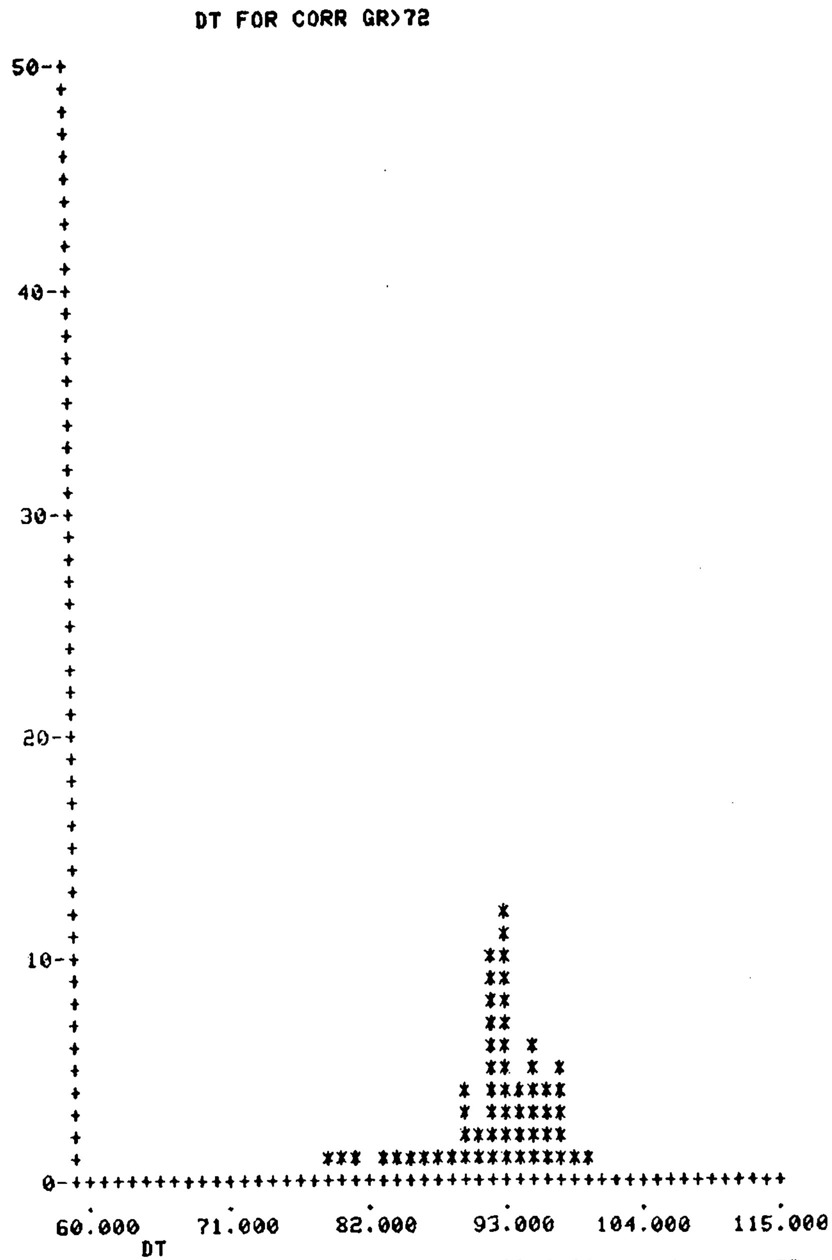
Fig. 3.3

Fig. 3.4



WELL S15-9-11 DEPTH: 2775.00 2808.00 TOTAL: 58
X.AV: 1.7595
Z = GR , 72.00 , 100.00

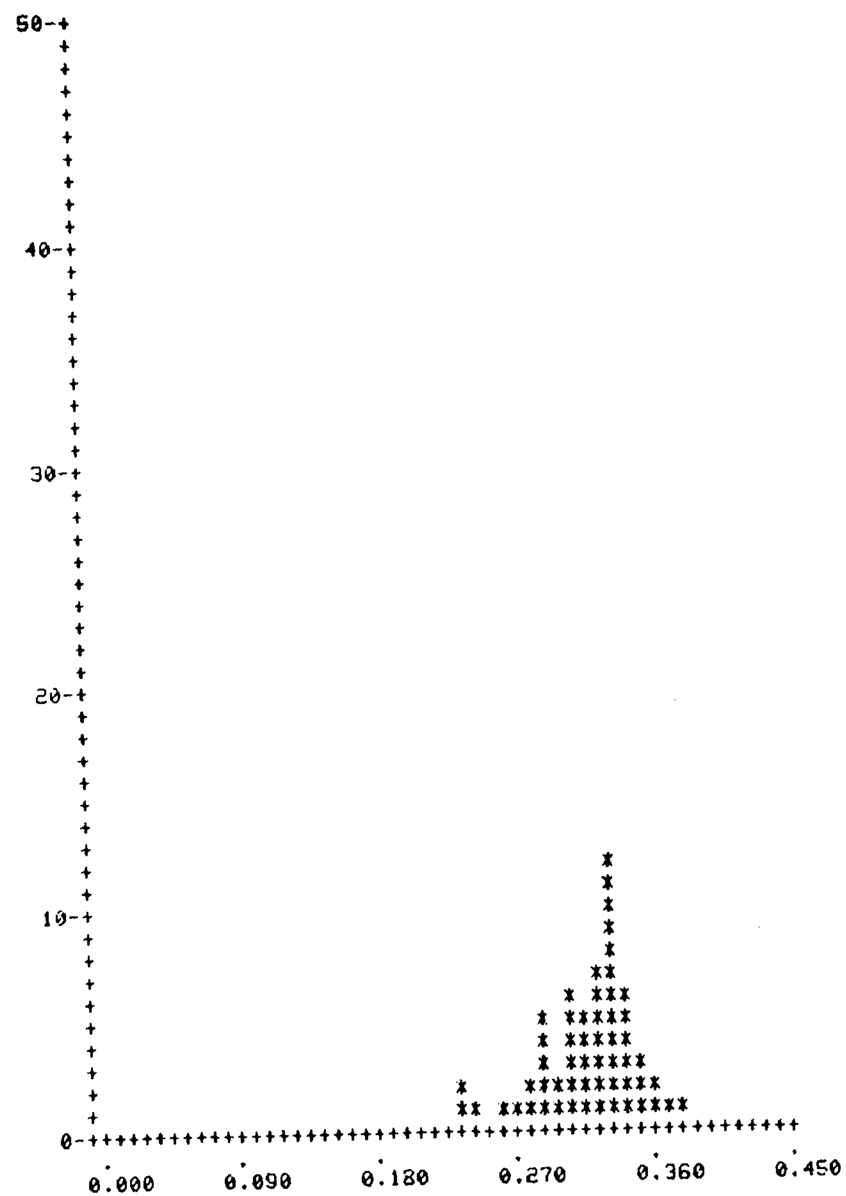
P L O T T E D B Y : JIS



WELL S15-9-11 DEPTH: 2775.00 2808.00 TOTAL: 58
X.AV: 92.7656
Z = GR , 72.00 , 100.00

P L O T T E D B Y : JIS

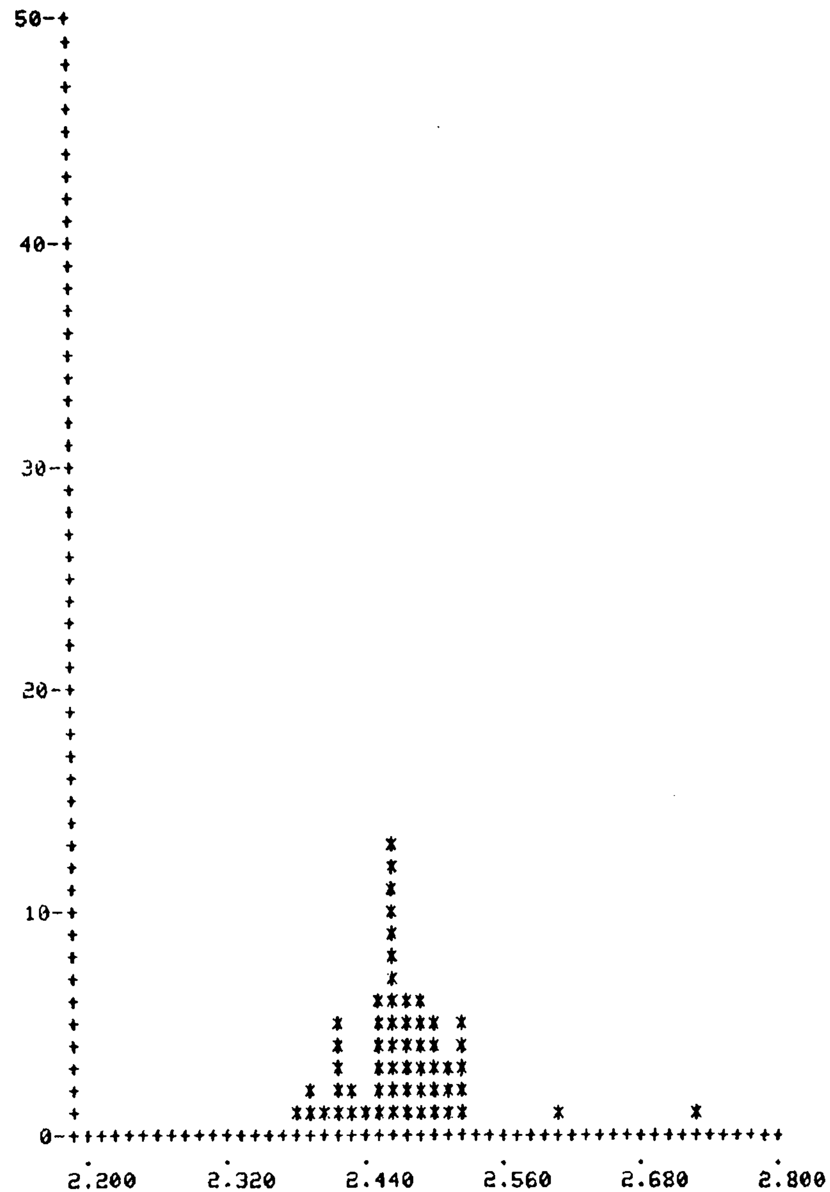
CORR PHIN FOR CORR GR>72



WELL S15-9-11 DEPTH: 2775.00 2808.00 TOTAL: 57
X.AV: 0.3218
Z = GR , 72.00 , 100.00

P L O T T E D B Y : JIS

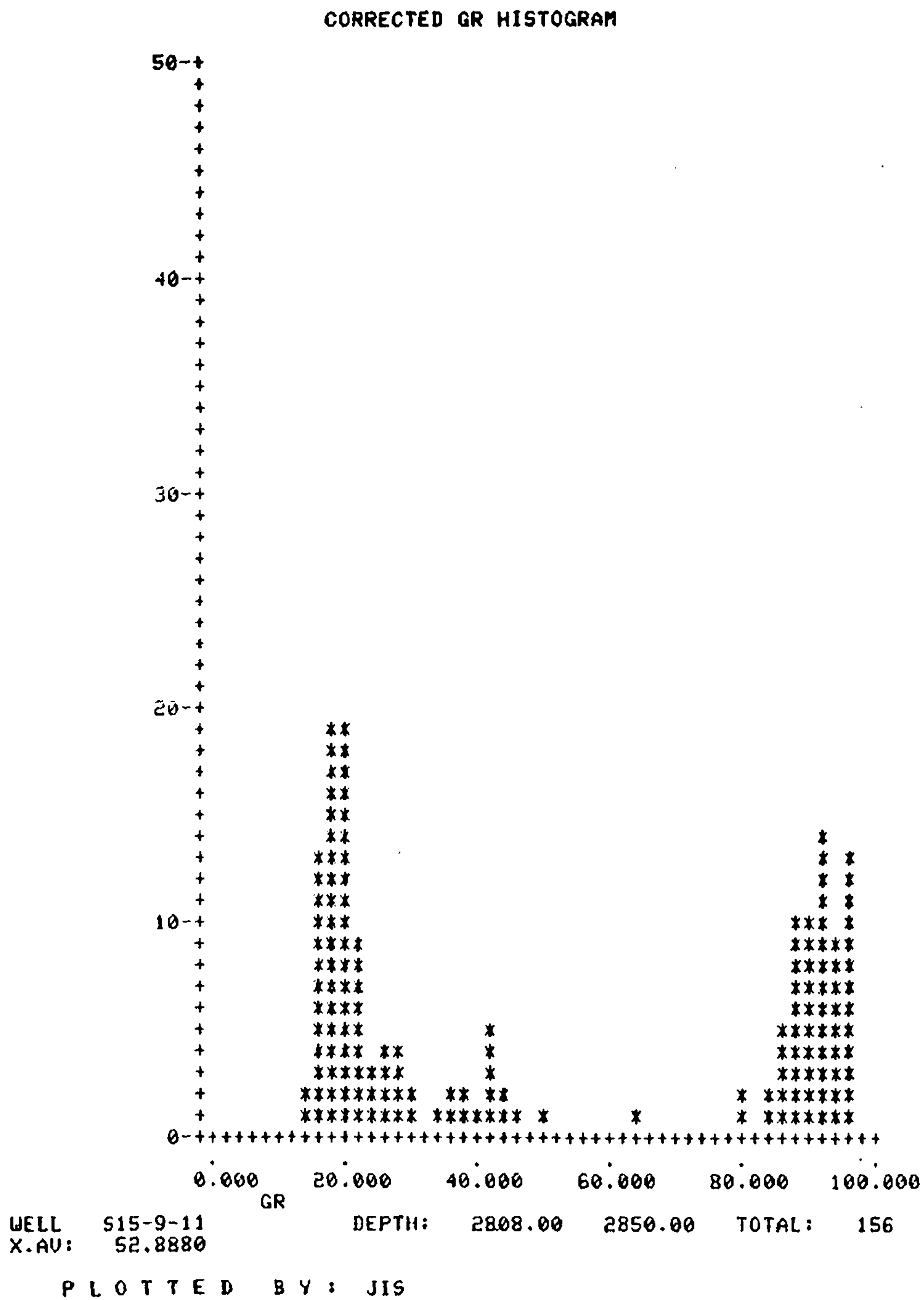
RHOB FOR CORR GR>72



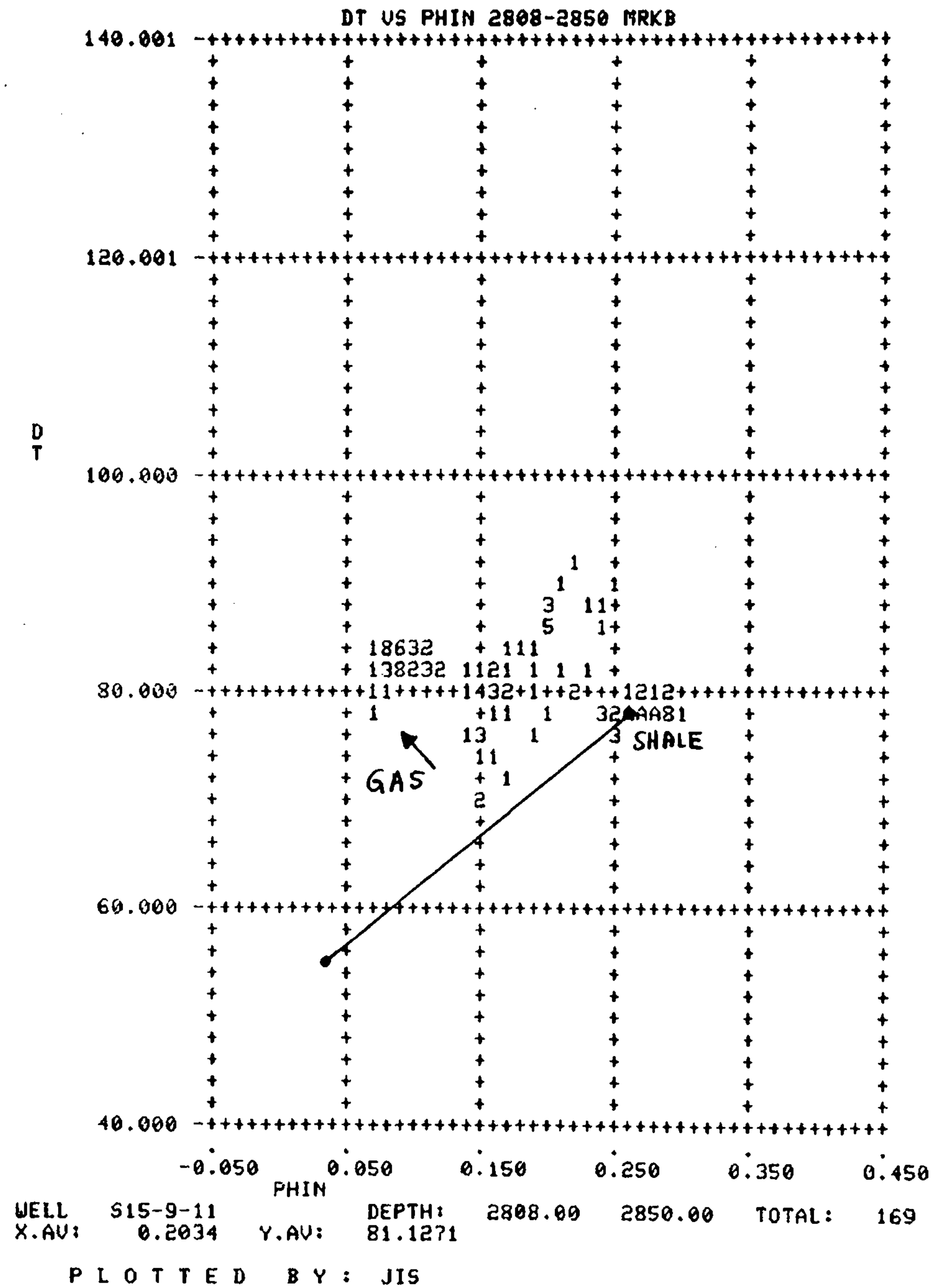
WELL S15-9-11 DEPTH: 2775.00 2808.00 TOTAL: 58
X.AV: 2.4787
Z = GR , 72.00 , 100.00

P L O T T E D B Y : JIS

Fig. 3.5

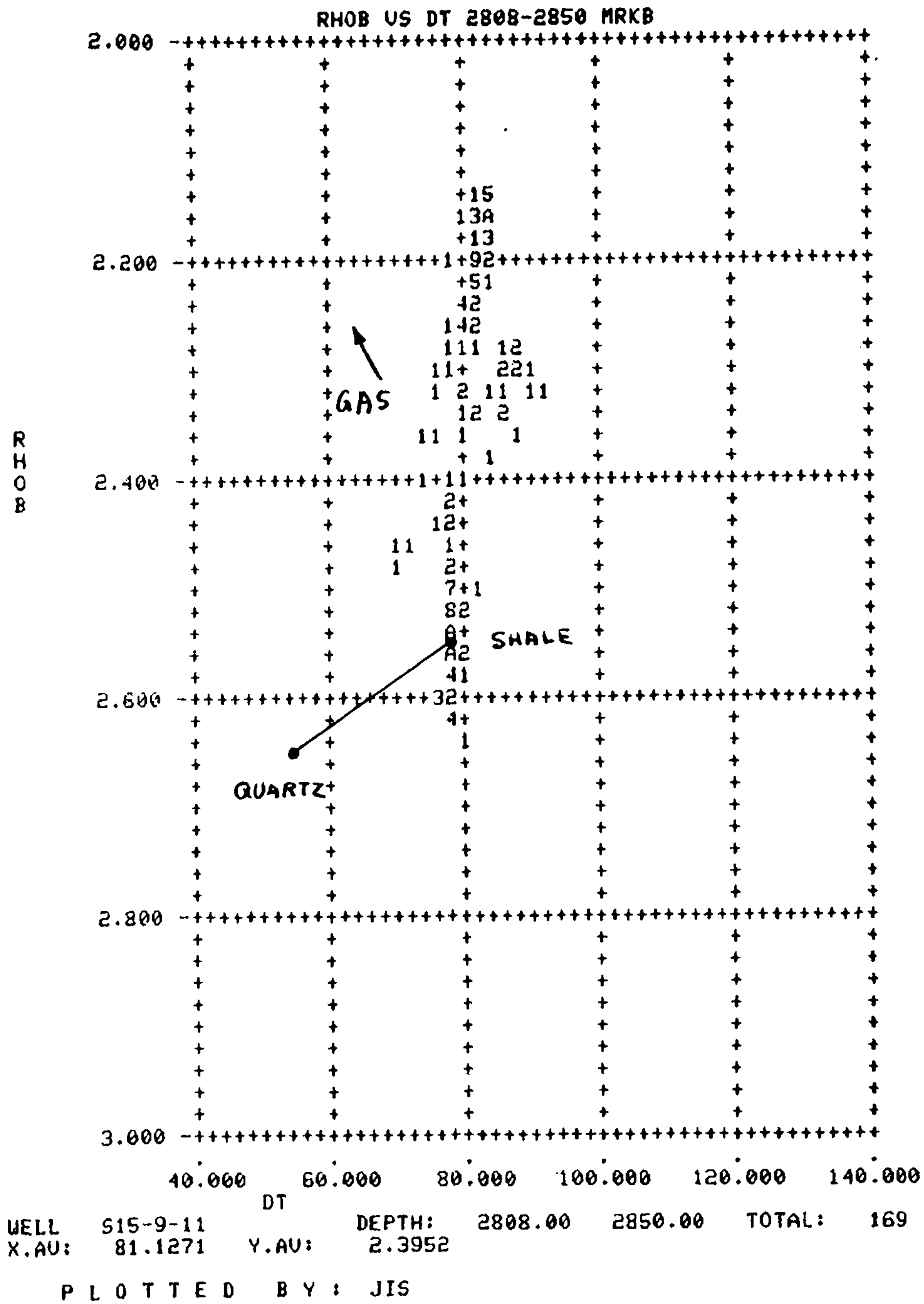


CORRECTED GR HISTOGRAM
50
40
30
20
10
0
0.000
20.000
40.000
60.000
80.000
100.000
GR
WELL S15-9-11
X.AV: 52.8880
DEPTH: 2808.00 2850.00
TOTAL: 156
PLOTTED BY: JIS



DT VS PHIN 2808-2850 MRKB
140.001
120.001
100.000
80.000
60.000
40.000
DT
GAS
SHALE
-0.050
0.050
0.150
0.250
0.350
0.450
PHIN
WELL S15-9-11
X.AV: 0.2034
Y.AV: 81.1271
DEPTH: 2808.00 2850.00
TOTAL: 169
PLOTTED BY: JIS

Fig. 3.6


RHOB VS DT 2808-2850 MRKB
RHOB
2.000
2.200
2.400
2.600
2.800
3.000
40.000
60.000
80.000
100.000
120.000
140.000
DT
GAS
SHALE
QUARTZ
WELL S15-9-11 DEPTH: 2808.00 2850.00 TOTAL: 169
X.AV: 81.1271 Y.AV: 2.3952
PLOTTED BY: JIS

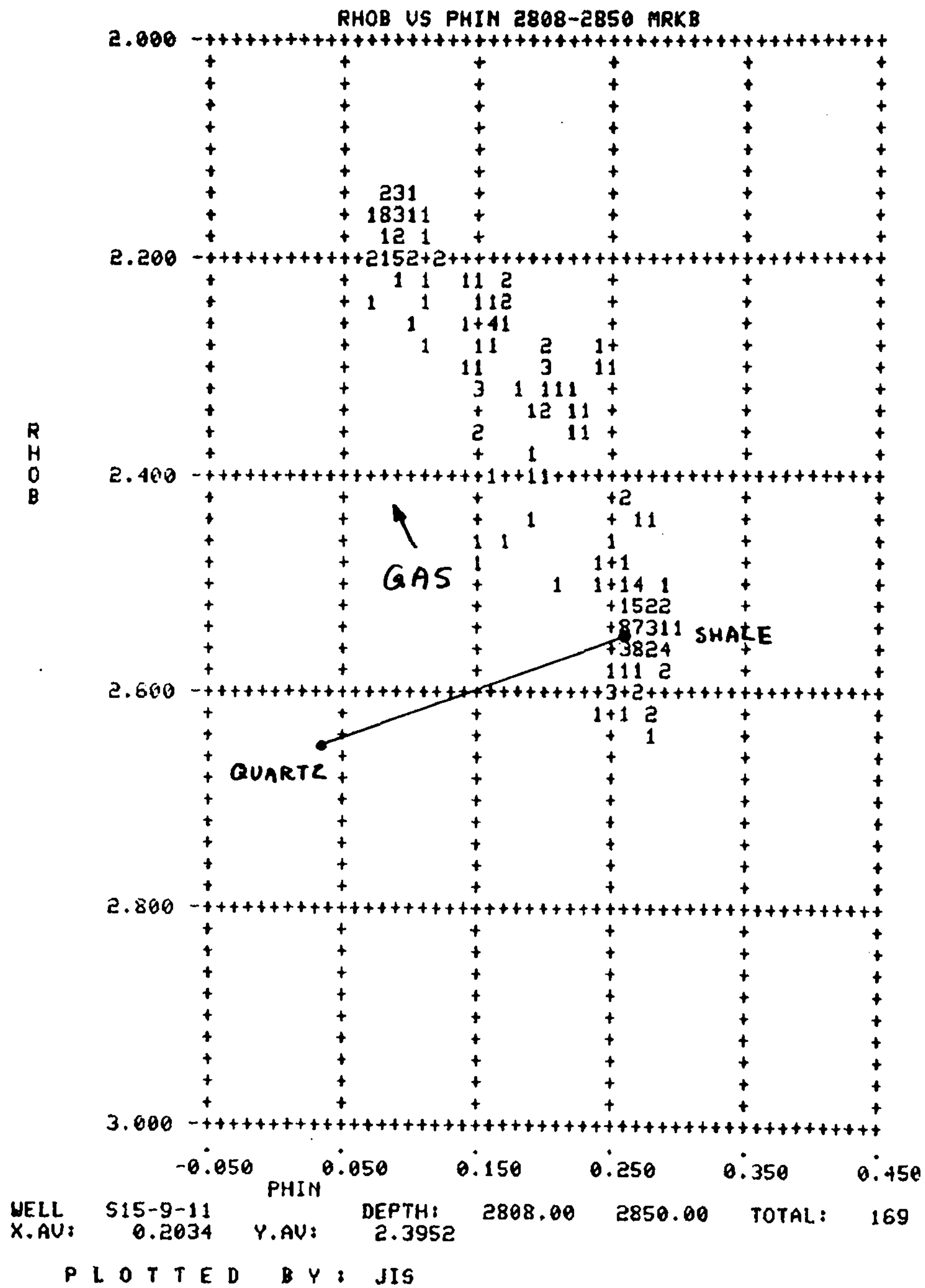
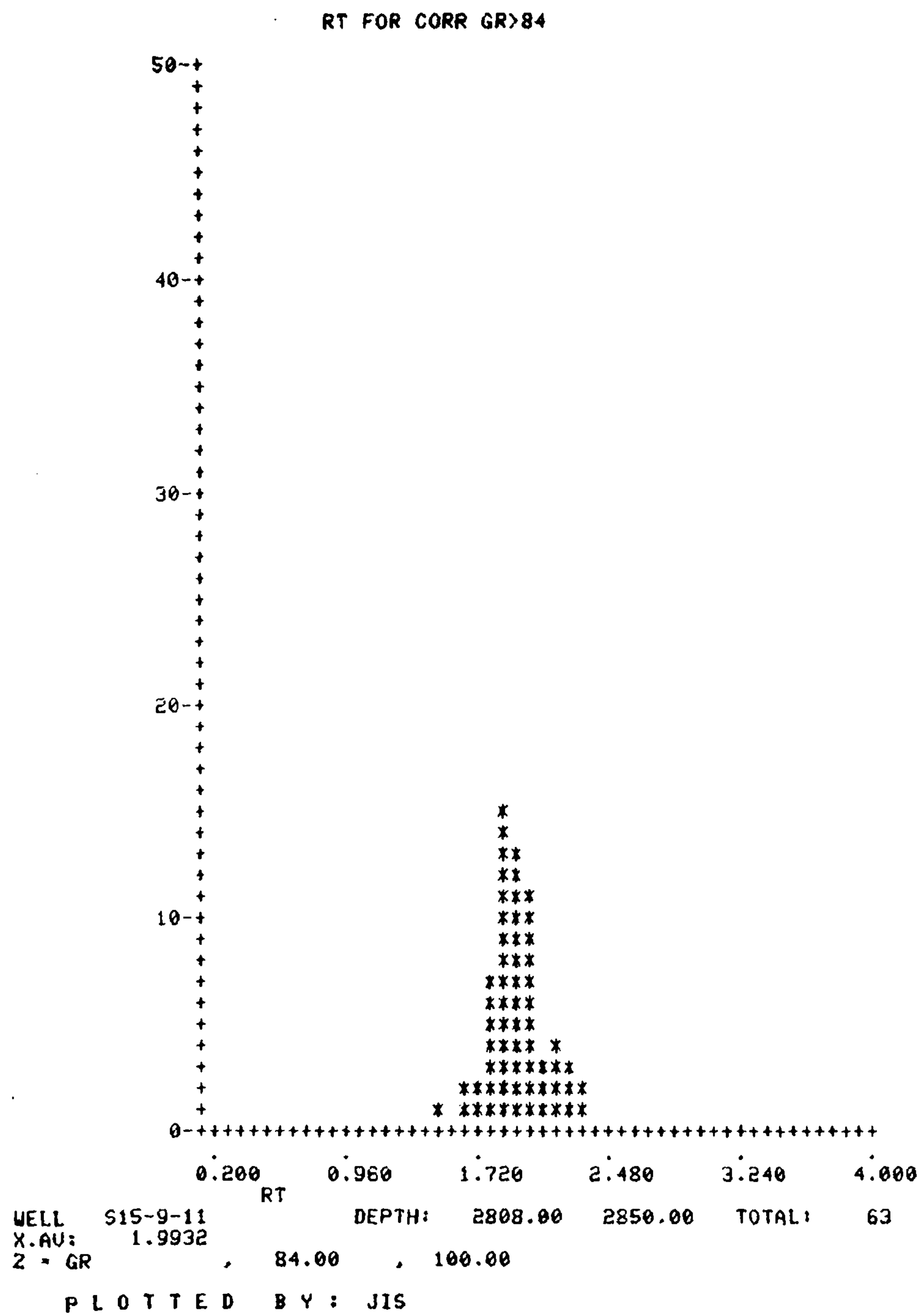

RHOB VS PHIN 2808-2850 MRKB
RHOB
2.000
2.200
2.400
2.600
2.800
3.000
-0.050
0.050
0.150
0.250
0.350
0.450
PHIN
GAS
SHALE
QUARTZ
WELL S15-9-11 DEPTH: 2808.00 2850.00 TOTAL: 169
X.AV: 0.2034 Y.AV: 2.3952
PLOTTED BY: JIS

Fig. 3.7


RT FOR CORR GR>84
50
40
30
20
10
0
0.200
0.960
1.720
2.480
3.240
4.000
RT
WELL S15-9-11 DEPTH: 2808.00 2850.00 TOTAL: 63
X.AV: 1.9932
Z - GR , 84.00 , 100.00
P L O T T E D B Y : JIS

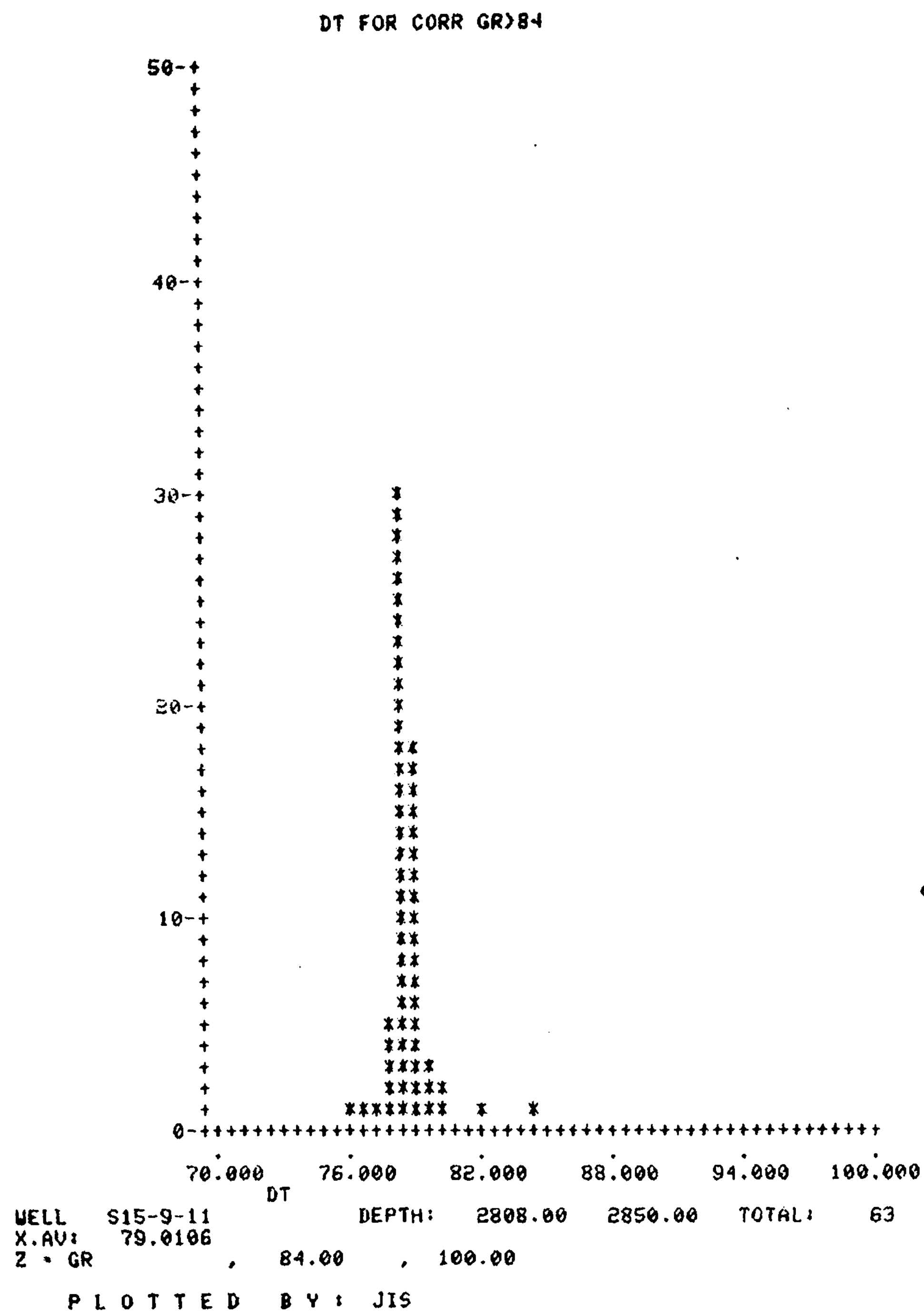
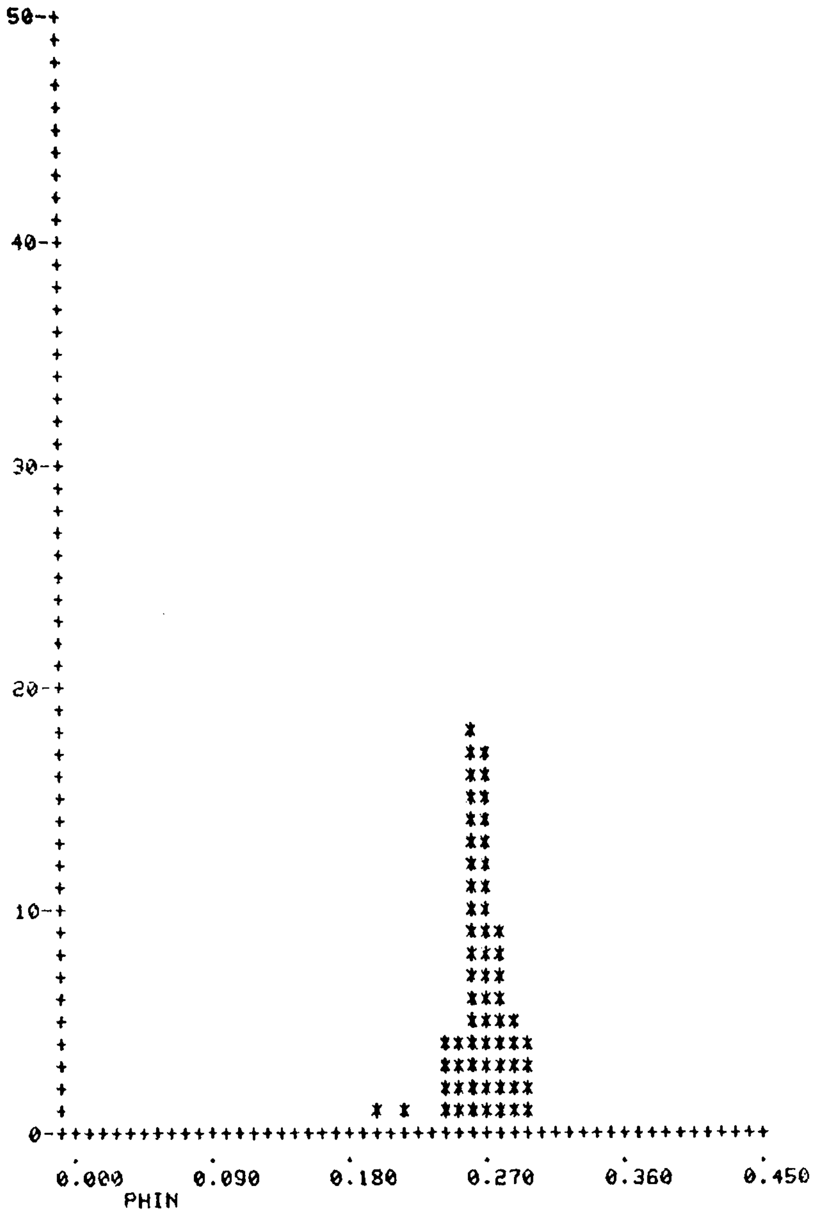

DT FOR CORR GR>84
50
40
30
20
10
0
70.000
76.000
82.000
88.000
94.000
100.000
DT
WELL S15-9-11 DEPTH: 2808.00 2850.00 TOTAL: 63
X.AV: 79.0106
Z - GR , 84.00 , 100.00
P L O T T E D B Y : JIS

Fig. 3.8

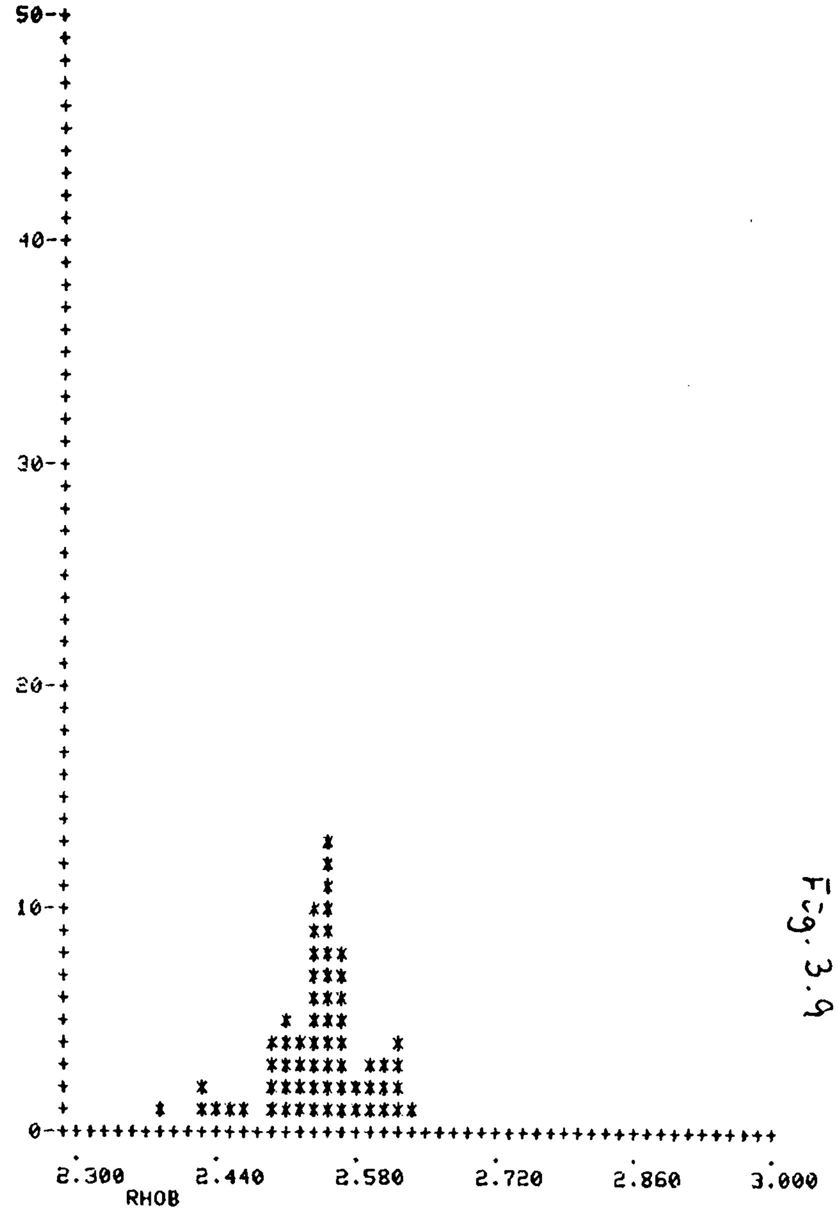
CORR PHIN FOR CORR GR>84



WELL S15-9-11 DEPTH: 2808.00 2850.00 TOTAL: 63
X.AV: 0.2711
Z = GR , 84.00 , 100.00

P L O T T E D B Y : JIS

RHOB FOR CORR GR>84



WELL S15-9-11 DEPTH: 2808.00 2850.00 TOTAL: 63
X.AV: 2.5493
Z = GR , 84.00 , 100.00

P L O T T E D B Y : JIS

Fig. 3.9

Fig. 3.10

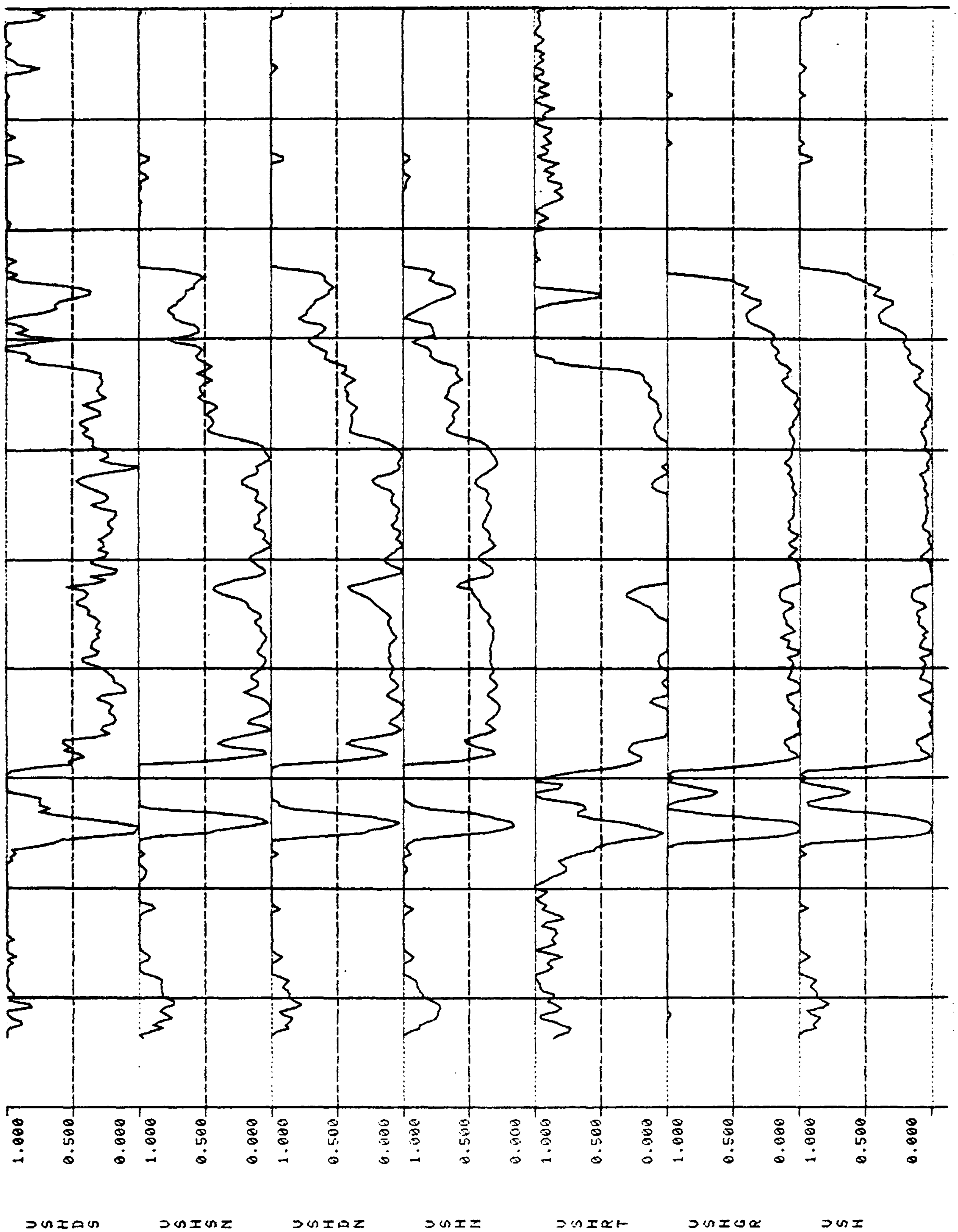

1.000
0.500
0.000
1.000
0.500
0.000
1.000
0.500
0.000
1.000
0.500
0.000
1.000
0.500
0.000
1.000
0.500
0.000
1.000
0.500
0.000

Fig. 3.11

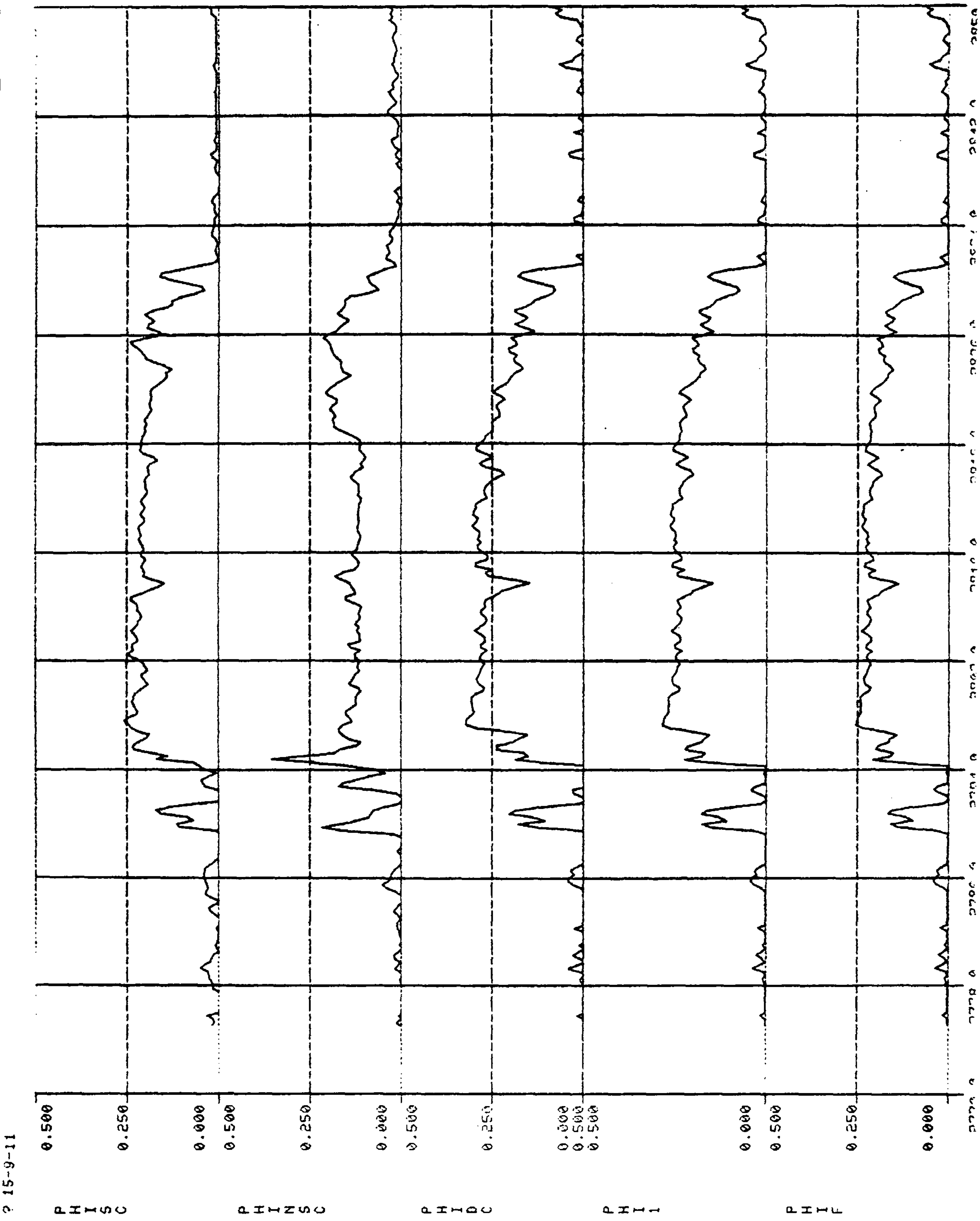


Table 3.1

S T A T I S T I C S

****

```
FIELD: . . . . . . . . . .          15/9-11
WELL:  . . . . . 15.01.11.     5 AUG05T9-11982
ENGINEER:. . . . . . . . . . JIS

DEPTH INTERVAL:  . . .  2789.00 TO  2831.00
APPLIED CUTOFFS:
.              VSH:  GREATER THAN      0.40
.             PHIF:     LESS THAN      0.10
.               SW:  GREATER THAN      0.60
```

T O T A L   D E P T H

THICKNESS:	42.000
AVERAGE . . . 'PHIF' . . .	0.180
AVERAGE . . . 'VSHALE' . .	0.177
AVERAGE . . . 'SW'	0.258
W.AVERAGE . . 'SW' * 'PHIF'	0.150
AVERAGE . . . 'SH'	0.742
VOID VOLUME: . . . ('PHIF').	7.545
HC VOID VOLUME . . ('SH'*) .	6.417
RES HC VOID VOLUME ('SHR'*).	4.475
MOV HC VOID VOLUME	1.942

N E T   P A Y

THICKNESS:	33.750
AVERAGE . . . 'PHIF' . . .	0.205
AVERAGE . . . 'VSHALE' . .	0.074
AVERAGE . . . 'SW'	0.127
W.AVERAGE . . 'SW' * 'PHIF'	0.113
AVERAGE . . . 'SH'	0.873
VOID VOLUME: . . . ('PHIF').	6.918
HC VOID VOLUME . . ('SH'*) .	6.139
RES HC VOID VOLUME ('SHR'*).	4.307
MOV HC VOID VOLUME	1.832

N E T   S A N D

THICKNESS:	35.250
AVERAGE . . . 'PHIF' . . .	0.203
AVERAGE . . . 'VSHALE' . .	0.084
AVERAGE . . . 'SW'	0.150
W.AVERAGE . . 'SW' * 'PHIF'	0.130
AVERAGE . . . 'SH'	0.850
VOID VOLUME: . . . ('PHIF').	7.141
HC VOID VOLUME . . ('SH'*) .	6.214
RES HC VOID VOLUME ('SHR'*).	4.347
MOV HC VOID VOLUME	1.867

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

HNETPAY /HGROSS SAND =	0.80357
HNETSAND/HGROSS SAND =	0.83929
HNETPAY /HNETSAND =	0.95745

Table 3.2

WELL: 15-9-11 (2775 - 2850) DATE: 6AUG82/JIS

DEPTH	CUTOFF	VSH	PHIF	SW
2775.00	123.000	1.000	0.000	1.000
2775.25	123.000	1.000	0.000	1.000
2775.50	123.000	0.966	0.001	1.000
2775.75	123.000	0.872	0.014	0.836
2776.00	123.000	0.897	0.001	1.000
2776.25	123.000	0.866	0.001	1.000
2776.50	123.000	0.844	0.001	1.261
2776.75	123.000	0.912	0.001	1.110
2777.00	123.000	0.946	0.001	0.982
2777.25	123.000	0.832	0.001	1.179
2777.50	123.000	0.778	0.001	1.353
2777.75	123.000	0.830	0.001	1.000
2778.00	123.000	0.873	0.001	1.136
2778.25	123.000	0.865	0.005	1.050
2778.50	123.000	0.881	0.008	1.031
2778.75	123.000	0.916	0.001	1.104
2779.00	123.000	0.899	0.005	1.059
2779.25	123.000	0.871	0.035	0.770
2779.50	123.000	0.936	0.017	0.878
2779.75	123.000	1.000	0.000	1.000
2780.00	123.000	1.000	0.000	1.000
2780.25	123.000	1.000	0.000	1.000
2780.50	123.000	1.000	0.000	1.000
2780.75	123.000	0.958	0.001	1.000
2781.00	123.000	0.924	0.009	0.868
2781.25	123.000	0.969	0.001	1.000
2781.50	123.000	1.000	0.000	1.000
2781.75	123.000	1.000	0.000	1.000
2782.00	123.000	1.000	0.000	1.000
2782.25	123.000	0.990	0.020	0.724
2782.50	123.000	1.000	0.000	1.000
2782.75	123.000	1.000	0.000	1.000
2783.00	123.000	1.000	0.000	1.000
2783.25	123.000	1.000	0.000	1.000
2783.50	123.000	1.000	0.000	1.000
2783.75	123.000	1.000	0.000	1.000
2784.00	123.000	1.000	0.000	1.000
2784.25	123.000	1.000	0.000	1.000
2784.50	123.000	0.938	0.001	1.000
2784.75	123.000	0.987	0.001	0.951
2785.00	123.000	1.000	0.000	1.000
2785.25	123.000	1.000	0.000	1.000
2785.50	123.000	1.000	0.000	1.000
2785.75	123.000	1.000	0.000	1.000
2786.00	123.000	1.000	0.000	1.000
2786.25	123.000	1.000	0.000	1.000
2786.50	123.000	1.000	0.000	1.000
2786.75	123.000	1.000	0.000	1.000
2787.00	123.000	0.996	0.003	0.857
2787.25	123.000	0.996	0.001	1.000
2787.50	123.000	1.000	0.000	1.000
2787.75	123.000	1.000	0.000	1.000
2788.00	123.000	1.000	0.000	1.000
2788.25	123.000	1.000	0.000	1.000
2788.50	123.000	0.954	0.001	1.000
2788.75	123.000	0.999	0.000	1.000
2789.00	123.000	1.000	0.000	1.000
2789.25	123.000	0.911	0.001	1.000
2789.50	123.000	0.473	0.034	0.631
2789.75	0.000	0.139	0.137	0.122
2790.00	0.000	0.023	0.156	0.082
2790.25	20.000	0.000	0.098	0.184
2790.50	0.000	0.000	0.118	0.279
2790.75	0.000	0.031	0.165	0.316
2791.00	0.000	0.129	0.155	0.417
2791.25	23.000	0.307	0.098	0.634
2791.50	123.000	0.557	0.012	1.444
2791.75	123.000	0.839	0.001	1.000
2792.00	123.000	0.937	0.001	1.000
2792.25	123.000	0.946	0.022	0.698
2792.50	123.000	0.820	0.040	0.764
2792.75	123.000	0.662	0.031	1.164
2793.00	123.000	0.628	0.001	2.209
2793.25	123.000	0.749	0.001	1.424
2793.50	123.000	0.908	0.001	1.000
2793.75	123.000	1.000	0.000	1.000
2794.00	123.000	0.947	0.001	1.000
2794.25	123.000	1.000	0.000	1.000
2794.50	100.000	0.951	0.131	0.324
2794.75	100.000	0.527	0.208	0.241
2795.00	0.000	0.292	0.161	0.247
2795.25	0.000	0.102	0.153	0.199
2795.50	0.000	0.011	0.200	0.153
2795.75	0.000	0.032	0.192	0.205
2796.00	0.000	0.084	0.164	0.270
2796.25	0.000	0.089	0.161	0.266
2796.50	0.000	0.120	0.143	0.268
2796.75	0.000	0.115	0.175	0.151
2797.00	0.000	0.056	0.234	0.057
2797.25	0.000	0.000	0.256	0.047
2797.50	0.000	0.000	0.252	0.047
2797.75	0.000	0.015	0.252	0.039
2798.00	0.000	0.020	0.246	0.034
2798.25	0.000	0.000	0.241	0.032
2798.50	0.000	0.000	0.242	0.030
2798.75	0.000	0.018	0.240	0.029
2799.00	0.000	0.003	0.242	0.039
2799.25	0.000	0.000	0.243	0.066
2799.50	0.000	0.029	0.236	0.094
2799.75	0.000	0.087	0.220	0.091
2800.00	0.000	0.102	0.214	0.046
2800.25	0.000	0.019	0.229	0.033
2800.50	0.000	0.000	0.232	0.042
2800.75	0.000	0.000	0.232	0.057
2801.00	0.000	0.028	0.227	0.061
2801.25	0.000	0.093	0.224	0.053
2801.50	0.000	0.080	0.219	0.048
2801.75	0.000	0.063	0.214	0.057
2802.00	0.000	0.077	0.219	0.062
2802.25	0.000	0.052	0.227	0.065
2802.50	0.000	0.058	0.223	0.069

2802.75	0.000	0.094	0.211	0.072
2803.00	0.000	0.019	0.227	0.063
2803.25	0.000	0.004	0.226	0.053
2803.50	0.000	0.099	0.213	0.044
2803.75	0.000	0.090	0.214	0.043
2804.00	0.000	0.078	0.223	0.044
2804.25	0.000	0.062	0.238	0.040
2804.50	0.000	0.072	0.226	0.038
2804.75	0.000	0.039	0.219	0.046
2805.00	0.000	0.059	0.214	0.050
2805.25	0.000	0.105	0.215	0.049
2805.50	0.000	0.103	0.224	0.054
2805.75	0.000	0.093	0.224	0.068
2806.00	0.000	0.117	0.215	0.082
2806.25	0.000	0.108	0.219	0.088
2806.50	0.000	0.047	0.224	0.102
2806.75	0.000	0.060	0.209	0.146
2807.00	0.000	0.137	0.192	0.189
2807.25	0.000	0.154	0.184	0.248
2807.50	0.000	0.155	0.163	0.278
2807.75	0.000	0.146	0.138	0.261
2808.00	0.000	0.089	0.169	0.155
2808.25	0.000	0.001	0.218	0.056
2808.50	0.000	0.000	0.221	0.029
2808.75	0.000	0.000	0.203	0.030
2809.00	0.000	0.001	0.231	0.029
2809.25	0.000	0.009	0.229	0.034
2809.50	0.000	0.013	0.207	0.043
2809.75	0.000	0.017	0.210	0.046
2810.00	0.000	0.045	0.220	0.039
2810.25	0.000	0.087	0.226	0.028
2810.50	0.000	0.050	0.228	0.028
2810.75	0.000	0.021	0.220	0.033
2811.00	0.000	0.000	0.228	0.033
2811.25	0.000	0.025	0.223	0.033
2811.50	0.000	0.034	0.224	0.034
2811.75	0.000	0.016	0.234	0.037
2812.00	0.000	0.027	0.238	0.038
2812.25	0.000	0.073	0.233	0.039
2812.50	0.000	0.075	0.228	0.039
2812.75	0.000	0.055	0.237	0.040
2813.00	0.000	0.047	0.237	0.040
2813.25	0.000	0.048	0.232	0.039
2813.50	0.000	0.030	0.235	0.040
2813.75	0.000	0.038	0.224	0.047
2814.00	0.000	0.046	0.210	0.052
2814.25	0.000	0.041	0.216	0.050
2814.50	0.000	0.050	0.217	0.050
2814.75	0.000	0.029	0.216	0.057
2815.00	0.000	0.049	0.209	0.072
2815.25	0.000	0.062	0.207	0.089
2815.50	0.000	0.049	0.199	0.096
2815.75	0.000	0.065	0.183	0.090
2816.00	0.000	0.068	0.188	0.073
2816.25	0.000	0.094	0.208	0.053
2816.50	0.000	0.037	0.222	0.056
2816.75	0.000	0.027	0.210	0.063
2817.00	0.000	0.044	0.193	0.061
2817.25	0.000	0.025	0.210	0.049
2817.50	0.000	0.007	0.228	0.044
2817.75	0.000	0.023	0.229	0.047
2818.00	0.000	0.046	0.222	0.051
2818.25	0.000	0.055	0.215	0.053
2818.50	0.000	0.042	0.215	0.055

2818.75	0.000	0.051	0.214	0.064
2819.00	0.000	0.065	0.213	0.073
2819.25	0.000	0.079	0.215	0.077
2819.50	0.000	0.082	0.218	0.080
2819.75	0.000	0.045	0.213	0.081
2820.00	0.000	0.055	0.201	0.078
2820.25	0.000	0.033	0.201	0.069
2820.50	0.000	0.012	0.204	0.066
2820.75	0.000	0.007	0.206	0.071
2821.00	0.000	0.027	0.198	0.077
2821.25	0.000	0.046	0.187	0.080
2821.50	0.000	0.022	0.201	0.083
2821.75	0.000	0.016	0.217	0.097
2822.00	0.000	0.025	0.211	0.102
2822.25	0.000	0.064	0.198	0.097
2822.50	0.000	0.099	0.184	0.103
2822.75	0.000	0.128	0.175	0.128
2823.00	0.000	0.136	0.168	0.147
2823.25	0.000	0.091	0.167	0.148
2823.50	0.000	0.097	0.154	0.187
2823.75	0.000	0.071	0.160	0.292
2824.00	0.000	0.100	0.174	0.383
2824.25	0.000	0.155	0.179	0.411
2824.50	0.000	0.170	0.176	0.417
2824.75	0.000	0.185	0.191	0.415
2825.00	0.000	0.160	0.194	0.448
2825.25	0.000	0.172	0.180	0.504
2825.50	0.000	0.204	0.185	0.501
2825.75	0.000	0.214	0.197	0.434
2826.00	0.000	0.204	0.169	0.478
2826.25	3.000	0.190	0.144	0.660
2826.50	3.000	0.226	0.163	0.700
2826.75	3.000	0.274	0.175	0.607
2827.00	3.000	0.334	0.155	0.628
2827.25	3.000	0.387	0.149	0.722
2827.50	0.000	0.398	0.169	0.568
2827.75	100.000	0.406	0.174	0.456
2828.00	0.000	0.383	0.156	0.463
2828.25	0.000	0.349	0.141	0.500
2828.50	0.000	0.295	0.131	0.514
2828.75	0.000	0.297	0.109	0.522
2829.00	20.000	0.381	0.085	0.524
2829.25	120.000	0.439	0.071	0.574
2829.50	123.000	0.414	0.077	0.666
2829.75	3.000	0.390	0.108	0.665
2830.00	100.000	0.462	0.134	0.571
2830.25	100.000	0.513	0.152	0.494
2830.50	100.000	0.593	0.140	0.545
2830.75	103.000	0.637	0.101	0.609
2831.00	123.000	0.802	0.033	0.857
2831.25	123.000	1.000	0.000	1.000
2831.50	123.000	1.000	0.000	1.000
2831.75	123.000	1.000	0.000	1.000
2832.00	123.000	1.000	0.000	1.000
2832.25	123.000	1.000	0.000	1.000
2832.50	123.000	1.000	0.000	1.000

2832.75	123.000	1.000	0.000	1.000
2833.00	123.000	1.000	0.000	1.000
2833.25	123.000	1.000	0.000	1.000
2833.50	123.000	1.000	0.000	1.000
2833.75	123.000	1.000	0.000	1.000
2834.00	123.000	1.000	0.000	1.000
2834.25	123.000	1.000	0.000	1.000
2834.50	123.000	0.996	0.020	0.734
2834.75	123.000	1.000	0.000	1.000
2835.00	123.000	1.000	0.000	1.000
2835.25	123.000	1.000	0.000	1.000
2835.50	123.000	1.000	0.000	1.000
2835.75	123.000	1.000	0.000	1.000
2836.00	123.000	1.000	0.000	1.000
2836.25	123.000	1.000	0.000	1.000
2836.50	123.000	1.000	0.000	1.000
2836.75	123.000	1.000	0.000	1.000
2837.00	123.000	1.000	0.000	1.000
2837.25	123.000	1.000	0.000	1.000
2837.50	123.000	1.000	0.000	1.000
2837.75	123.000	1.000	0.000	1.000
2838.00	123.000	1.000	0.000	1.000
2838.25	123.000	1.000	0.000	1.000
2838.50	123.000	1.000	0.000	1.000
2838.75	123.000	1.000	0.000	1.000
2839.00	123.000	0.913	0.029	0.722
2839.25	123.000	0.909	0.031	0.729
2839.50	123.000	1.000	0.000	1.000
2839.75	123.000	1.000	0.000	1.000
2840.00	123.000	1.000	0.000	1.000
2840.25	123.000	0.966	0.001	1.000
2840.50	123.000	1.000	0.000	1.000
2840.75	123.000	1.000	0.000	1.000
2841.00	123.000	1.000	0.000	1.000
2841.25	123.000	1.000	0.000	1.000
2841.50	123.000	1.000	0.000	1.000
2841.75	123.000	1.000	0.000	1.000
2842.00	123.000	1.000	0.000	1.000
2842.25	123.000	1.000	0.000	1.000
2842.50	123.000	1.000	0.000	1.000
2842.75	123.000	1.000	0.000	1.000
2843.00	123.000	1.000	0.000	1.000
2843.25	123.000	1.000	0.000	1.000
2843.50	123.000	1.000	0.000	1.000
2843.75	123.000	0.960	0.019	0.744
2844.00	123.000	1.000	0.000	1.000
2844.25	123.000	1.000	0.000	1.000
2844.50	123.000	1.000	0.000	1.000
2844.75	123.000	1.000	0.000	1.000
2845.00	123.000	1.000	0.000	1.000
2845.25	123.000	1.000	0.000	1.000
2845.50	123.000	0.974	0.036	0.630
2845.75	123.000	0.958	0.052	0.586
2846.00	123.000	1.000	0.000	1.000
2846.25	123.000	1.000	0.000	1.000
2846.50	123.000	1.000	0.000	1.000
2846.75	123.000	1.000	0.000	1.000
2847.00	123.000	1.000	0.000	1.000
2847.25	123.000	1.000	0.000	1.000
2847.50	123.000	1.000	0.000	1.000
2847.75	123.000	1.000	0.000	1.000
2848.00	123.000	1.000	0.000	1.000
2848.25	123.000	1.000	0.000	1.000
2848.50	123.000	1.000	0.000	1.000
2848.75	123.000	1.000	0.000	1.000
2849.00	123.000	1.000	0.000	1.000
2849.25	123.000	0.991	0.050	0.563
2849.50	123.000	0.921	0.062	0.549
2849.75	123.000	0.919	0.047	0.621
2850.00	123.000	0.902	0.067	0.522

WELL	DEPTH-INTERVAL		DATE	TIME	ID
15-9-11	2775.00	2850.00	6 AUG 82	14:26	JI6

4. TESTING 15/9-11

A. Repeat formation tester (RFT)

Prior to testing the well, RFT's were run in both the Heimdal and Mesozoic formations. The results are listed in Table 4.1.

Figs. 4.1. and 4.4. show the different gradients obtained from the RFT-runs and comparison between the wells 15/9-9 and 15/9-11. Fig. 4.2. shows that there is full pressure communication between 15/9-9 and 15/9-11 in the Heimdal formation. The RFT indicates a gas-water contact around 2425 m RKB. The log analysis in 15/9-11 indicates a 100 % water saturation at 2442 m RKB and 50 - 80 % water saturation between 2425 to 2442 m RKB. In the transition zone it is hard to get good gas gradients from the RFT. The log interpretation was confirmed by DST no. 2. in 15/9-11, perforated from 2432 to 2440 m RKB, in which both gas/condensate and water were produced in large quantities. The gas-water contact is therefore set at 2442 m RKB. In fig. 4.1. the pressure gauge shut in pressures are plotted from DST no. 2, also confirming a gas gradient in this transition zone.

Fig. 4.3. shows the RFT from 15/9-11 in the Mesozoic, giving a good gas gradient. At 2825 m RKB the pressure points give a new gradient, but higher than formation water. This is caused by high shale content and reduced permeability and is not a definitive gas/water contact, more likely a gas to 100 % shale contact.

Fig. 4.4. shows a significant pressure difference between 15/9-9 and 15/9-11, indicating no pressure communication between the wells at the Mesozoic level.

B. Drill stem tests (DST)

Three DST-tests were carried out in this well, one in the Mesozoic sandstone and two in the Heimdal sandstone formation. Test results have been presented in a separate test report of the 15/9-11 well.

DST no. 1

The objective of this test, perforated from 2797 - 2807 m RKB, was to obtain fluid samples and investigate reservoir properties of the hydrocarbon bearing Mesozoic sandstone. No sand was produced and CO_2 was 0.5 - 1.0%, H_2S negative. The well was flowed on 40/64" choke for a longer period producing gas and condensate with no water. Three sets of PVT-samples were taken at the separator.

DST no. 2

The objective of test no. 2, perforated at 2432 - 2440 m RKB, was to obtain fluid samples, to test the potential gas/water contact, investigate reservoir properties, test for possible water-cut (water saturation from logs up to 80%) and to check for sand production. After a long flow period on 32/64" choke the test had to be aborted due to leakage in heater gas outlet. One good set of PVT samples was taken at the separator.

The well produced gas, condensate and water (760 BPD), and good samples of formation water were obtained. The well was opened on a 1" choke and sand was produced. This was reduced by choking back to 28/64" after a clean-up period. To be able to produce water a final flow on 32/64" choke was necessary. No H_2S was produced and the CO_2-content in the gas was 0.1-0.5%.

DST no. 3

The objective of test no. 3, perforated from 2395 - 2415 m RKB, was to obtain fluid samples, investigate reservoir properties and check for sand production in the main pay section of the Heimdal formation. The test was mechanically successful, opened up on 48/64" choke for a longer period, then shut in for a longer period and then a multirate flow on three chokes with increasing sizes. The well was then shut in for a final build up. The well produced gas and condensate and PVT samples were taken at the separator in both flow periods. No H_2S was produced and the CO_2- content was 0.7 %. The BS+W was 0.8 % and there was no sand production.

Figures 4.1. - 4.4.

Table 4.1.

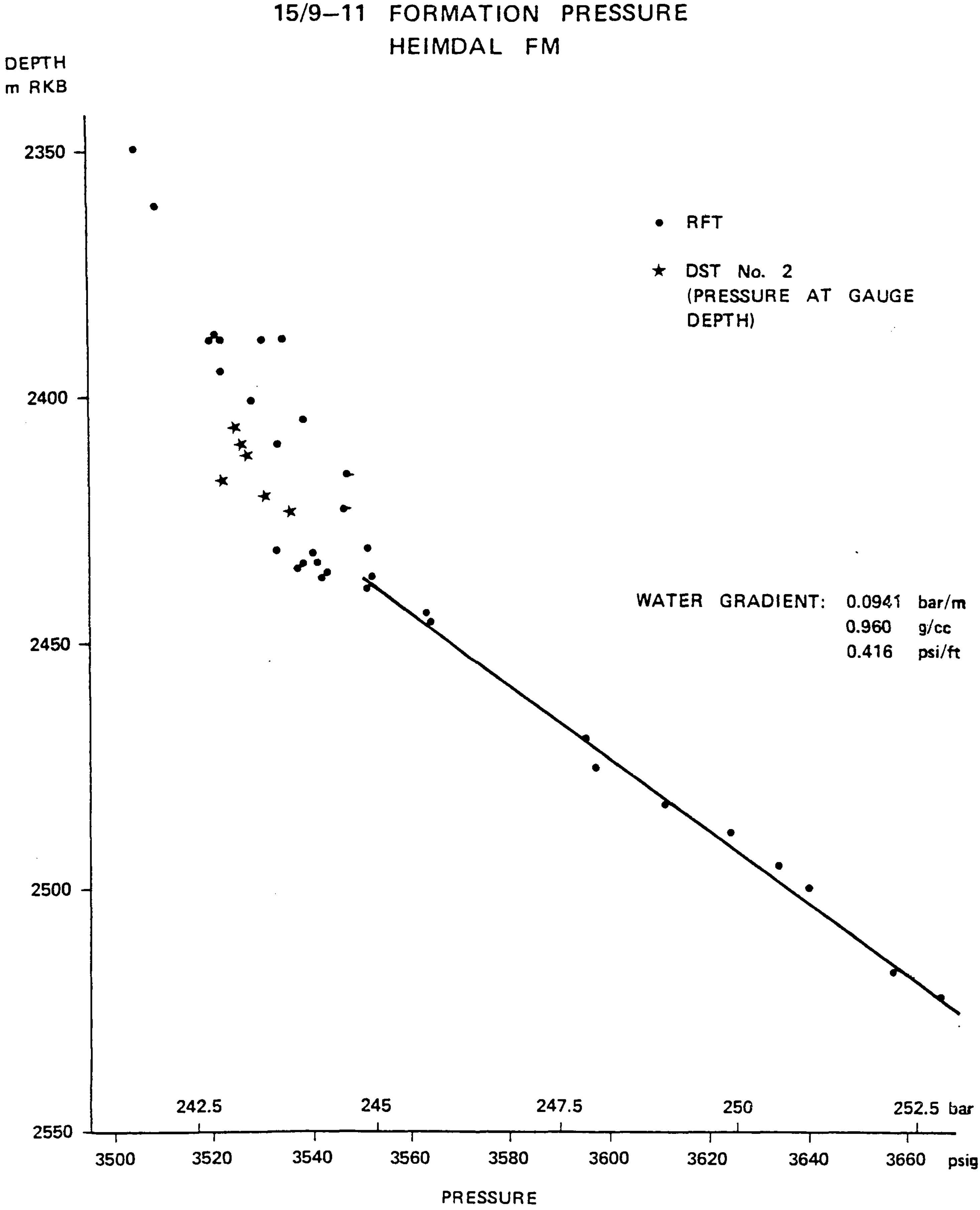
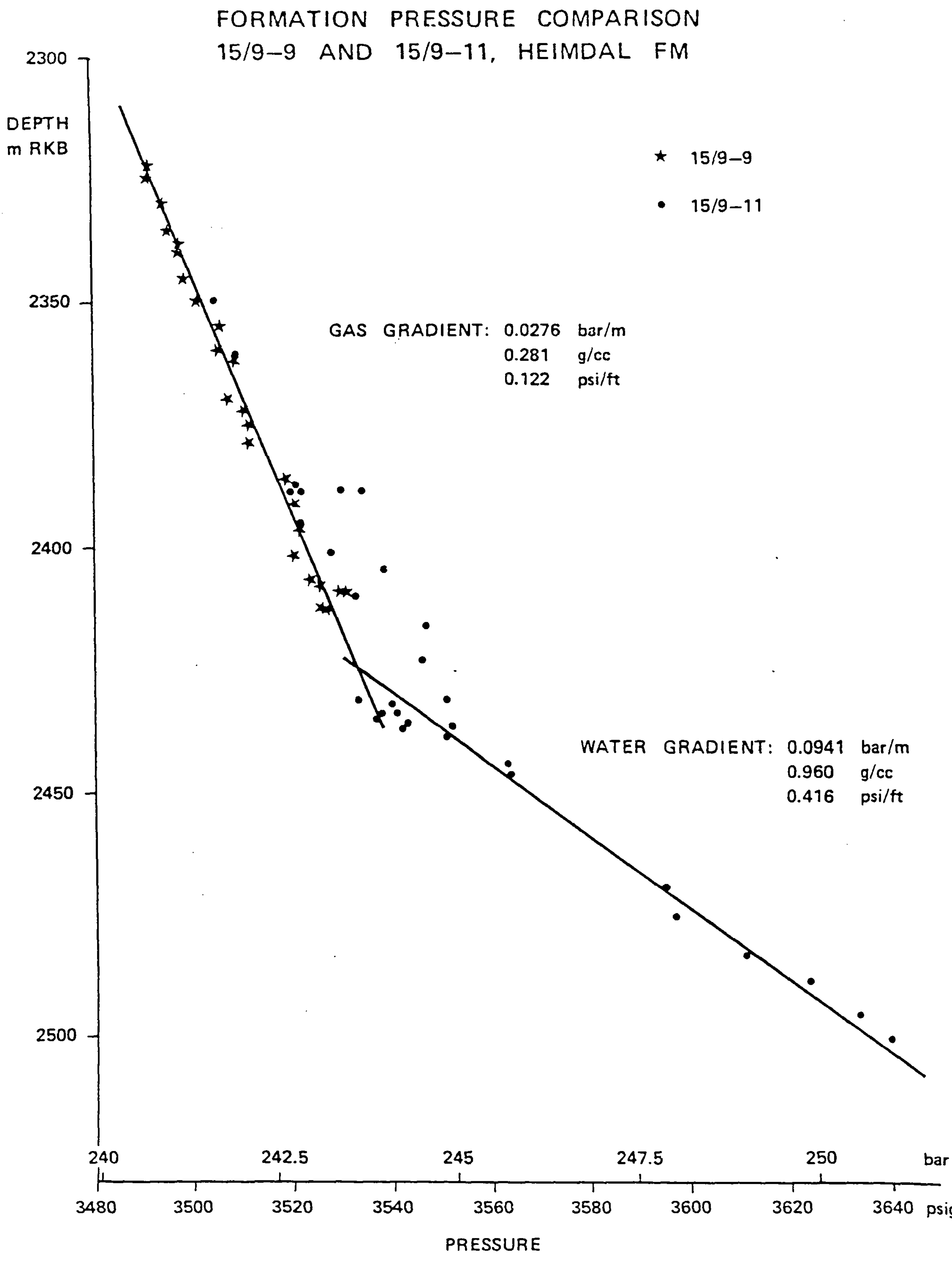

15/9-11 FORMATION PRESSURE
HEIMDAL FM
DEPTH
m RKB
2350
2400
2450
2500
2550
• RFT
★ DST No. 2
(PRESSURE AT GAUGE
DEPTH)
WATER GRADIENT: 0.0941 bar/m
0.960 g/cc
0.416 psi/ft
242.5
245
247.5
250
252.5 bar
3500
3520
3540
3560
3580
3600
3620
3640
3660 psig
PRESSURE

Fig. 4.2



FORMATION PRESSURE COMPARISON
15/9-9 AND 15/9-11, HEIMDAL FM
DEPTH
m RKB
2300
2350
2400
2450
2500
15/9-9
15/9-11
GAS GRADIENT: 0.0276 bar/m
0.281 g/cc
0.122 psi/ft
WATER GRADIENT: 0.0941 bar/m
0.960 g/cc
0.416 psi/ft
240
242.5
245
247.5
250
bar
3480
3500
3520
3540
3560
3580
3600
3620
3640
psig
PRESSURE

Fig. 4.3

15/9–11 FORMATION PRESSURE
JURASSIC / TRIASSIC FM

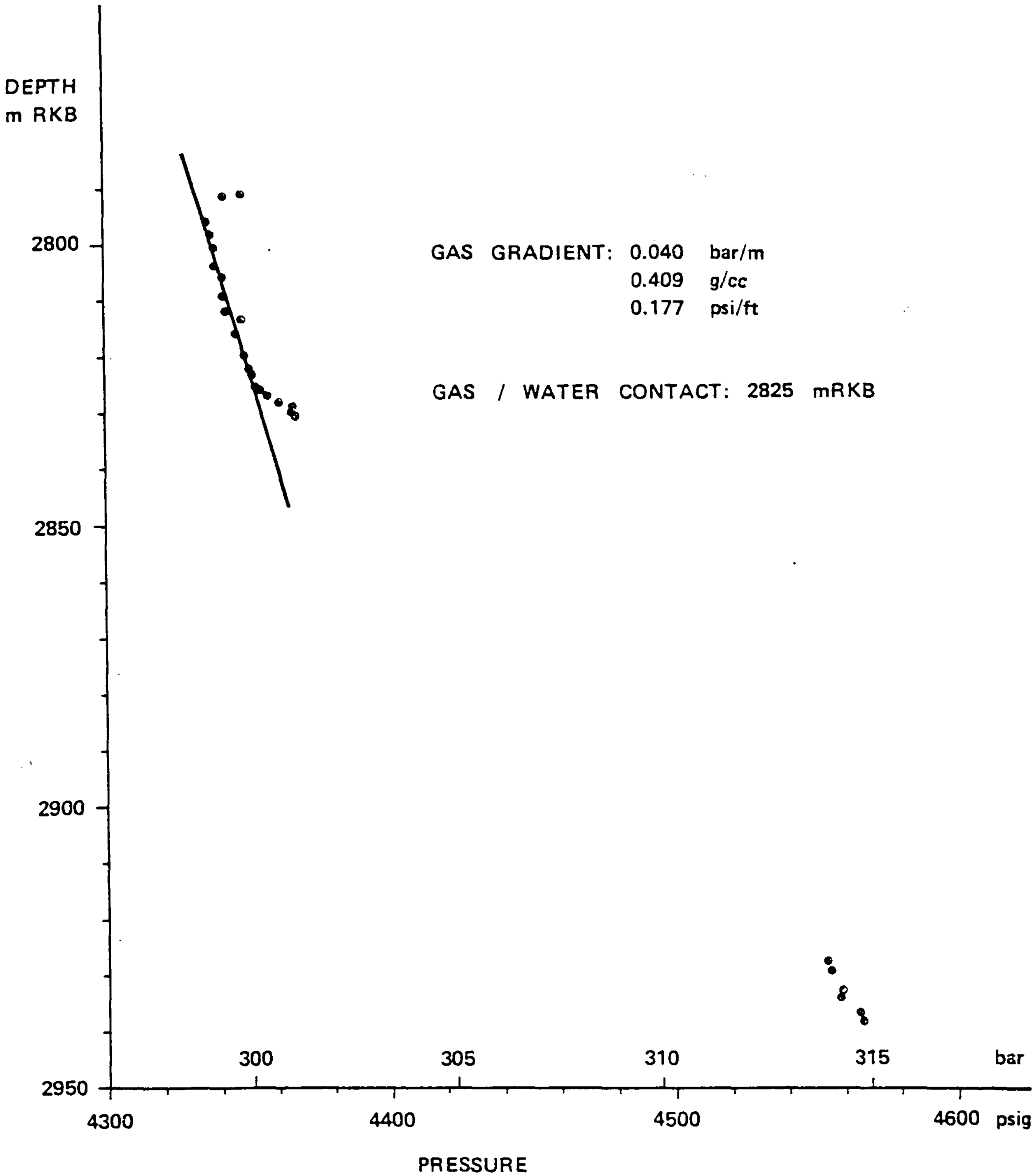


Fig. 4.4

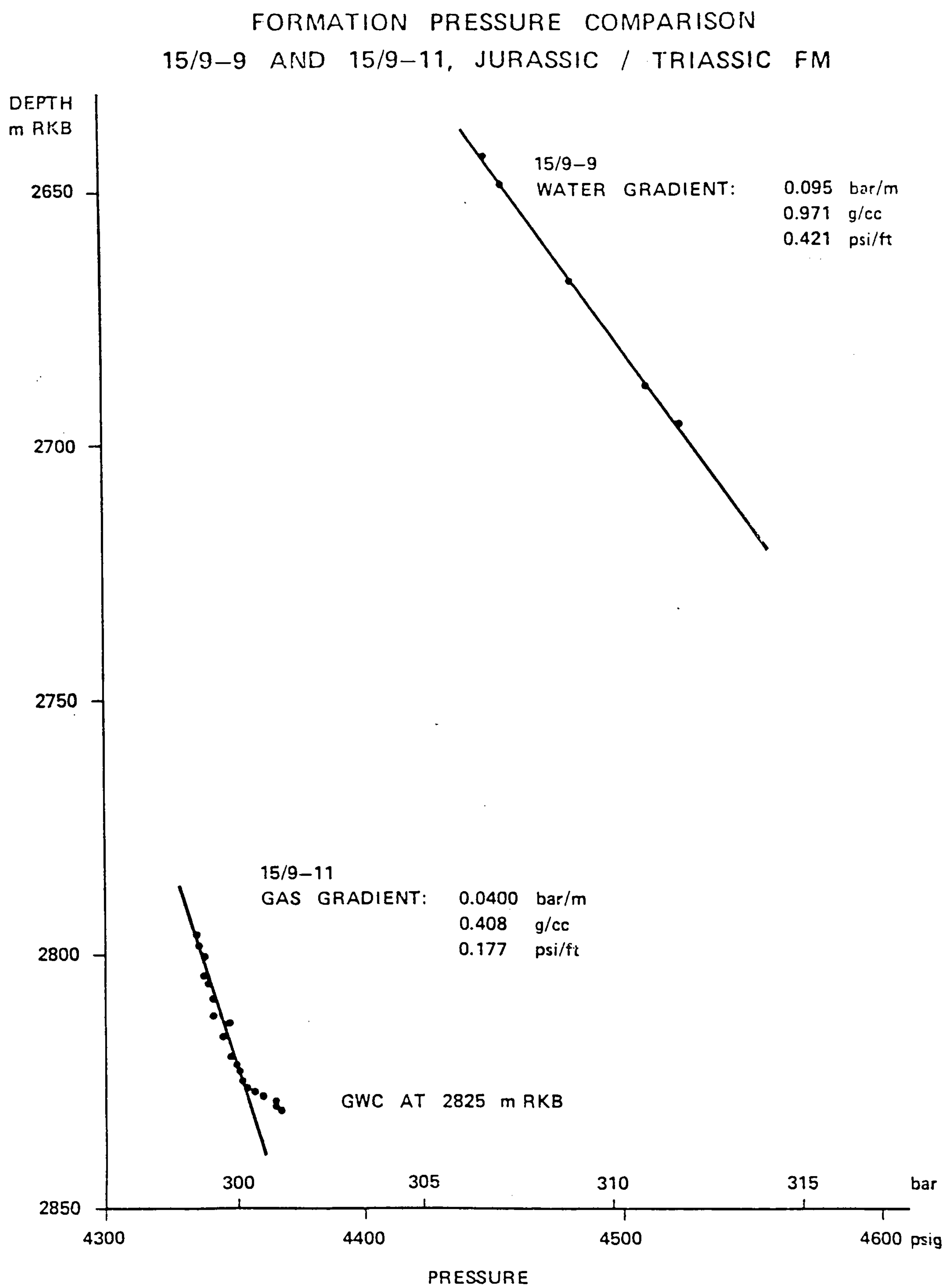

FORMATION PRESSURE COMPARISON
15/9-9 AND 15/9-11, JURASSIC / TRIASSIC FM
DEPTH
m RKB
2650
2700
2750
2800
2850
15/9-9
WATER GRADIENT: 0.095 bar/m
0.971 g/cc
0.421 psi/ft
15/9-11
GAS GRADIENT: 0.0400 bar/m
0.408 g/cc
0.177 psi/ft
GWC AT 2825 m RKB
300
305
310
315
bar
4300
4400
4500
4600 psig
PRESSURE

Table 4.1

statoil

RFT pressure points 15/9-11

Depth, m RKB	Pressure, kPa - g/cc	Run no.	Comments
2349.5	24152.3 - 1.049	1	
2351.0	24662.5 - 1.070	1	Supercharge
2361.0	24193.7 - 1.045	1	
2387.5	24276.4 - 1.037	1	
2388.5	24338.5 - 1.039	1	
2388.5	24366.0 - 1.040	1	
2388.5	24269.5 - 1.036	1	
2388.5	24276.4 - 1.037	1	
2395.0	24283.3 - 1.034	1	
2401.0	24324.7 - 1.033	1	
2405.0	24393.6 - 1.035	1	Supercharge
2410.0	24359.1 - 1.031	1	
2416.0	24455.7 - 1.032	1	
2423.0	24448.8 - 1.029	1	
2431.0	24662.5 - 1.027	1	
2431.5	24359.2 - 1.022	2	
2432.0	24407.4 - 1.024	1	
2434.0	24424.3 - 1.023	1	
2434.0	24393.7 - 1.022	2	
2435.0	24386.7 - 1.021	1	
2436.0	24428.1 - 1.023	1	
2436.5	24490.1 - 1.025	1	
2436.5	24386.7 - 1.021	1	
2437.0	24421.2 - 1.022	1	
2439.0	24483.3 - 1.024	1	
2444.0	24566.0 - 1.025	1	
2446.0	24572.9 - 1.025	1	
2469.5	24786.6 - 1.024	1	
2475.5	24800.4 - 1.022	1	
2483.0	24896.9 - 1.023	1	
2488.5	24986.6 - 1.024	1	
2495.3	24044.4 - 1.024	1	
2500.0	25096.6 - 1.024	1	
2517.0	25214.1 - 1.022	1	
2790.8	29985.3 - 1.096	3	
2791.0	29895.7 - 1.090	3	
2796.0	29937.0 - 1.094	3	
2798.0	29902.5 - 1.090	3	

continued.

Depth, m RKB	Pressure, kPa - g/cc	Run no.	Comments
2801.0	29916.3 - 1.089	3	
2804.0	29916.3 - 1.089	3	
2806.0	29930.1 - 1.088	3	
2809.0	29937.0 - 1.087	3	
2812.0	29943.9 - 1.086	3	
2816.0	29964.6 - 1.085	3	
2820.0	29985.3 - 1.085	3	
2823.0	30006.0 - 1.084	3	
2825.8	29985.3 - 1.082	4	
2826.0	30026.7 - 1.084	3	
2826.0	30012.9 - 1.083	4	
2826.5	30047.4 - 1.084	4	
2827.0	30040.5 - 1.084	3	
2828.0	30068.0 - 1.085	3	
2829.0	30102.5 - 1.085	3	
2830.0	30102.5 - 1.085	3	
2830.5	30109.4 - 1.085	3	
2927.5	31398.7 - 1.094	4	
2929.0	31405.6 - 1.093	4	
2932.5	31433.2 - 1.093	4	
2934.0	31426.3 - 1.092	4	
2936.0	31481.4 - 1.093	4	
2938.0	31474.5 - 1.093	4	

5. DISCUSSION

Since the Mesozoic sandstone was not cored a check on the computed rock properties is not possible. This should be done if, in the future, this Mesozoic sandstone is cored in a new appraisal well.

There is good agreement between the computed rock properties and the values measured on cores from the Heimdal sandstone, in particular between the log porosity and helium porosity. The RFT data indicates a gas-water contact in Heimdal at 2425 m RKB. The log interpretation shows a 50 - 80 % water saturation between 2425 to 2442 m RKB and 100 % water at 2442 m RKB. DST no. 2., perforated from 2432 to 2440 m RKB confirmed the log interpretation, where gas and condensate were produced in large quantities, but also water. The gas-water contact is therefore sat to 2442 m RKB. By applying the normal cut-off values the interval from 2425 - 2442 m RKB will not turn out as pay. But the good results from DST no. 2. show that this interval is highly producible, though with a high water production. The summary of results, i.e. the net pay, does not include this interval.

The RFT taken in the Mesozoic confirms that the entire sand section in this well is filled up with hydrocarbons. A gas-water contact is set to 2825 m RKB, but at this point the shale volume starts increasing and at 2831 m RKB there is 100 % shale. Therefore, the accuracy of this contact is questionable.

6. CONCLUSION

Well 15/9-11 confirms the considerable reserves on the Gamma structure that was discovered by the 15/9-9 well in the Heimdal Formation. It also confirms considerable reserves at the Mesozoic level which was not seen in the 15/9-9 well and thus increases the importance of the eastern part of the 15/9-block and the northern part of the Gamma structure.

The results from logs, cores and drill stem tests in the Heimdal formation indicate a reservoir of good quality.

Although the well was not cored at the Mesozoic level, results from logs and drill stem test indicate a reservoir of good quality also at this level.