6.3 Mud report

36" Hole, 30" casing

The 36" hole was drilled to 179 m using sea water and flushed with high viscosity spud mud with returns to the sea bed. The 30" casing was run and cemented. Materials used in this section were Bentonite, Caustic Soda and Soda Ash.

26" hole section, 20" casing

The 17 1/2" pilot hole was drilled to 615 m. At this point a leak was discovered in the 30" casing at 158 m and a cement plug had to be set and squeezed behind the 30" casing. The riser was displaced to sea water before the hole was underreamed to 26". Prior to running the 20" casing the hole was reamed from 370 m to TD. Circulated and conditioned the mud and raised the mud weight to 1,17 rd before running the logs. The casing was then run and cemented with the shoe at 601 m.

Materials used were Barite, Bentonite, Caustic Soda, Soda Ash and Lime.

17 1/2" hole, 13 3/8" casing

The 17 1/2" hole section was drilled to 2115 m using a KCl/Drispac mud. Drilled the 17 1/2" hole in steps to 948 m, 1099 m, 1252 m, 1368 m, 1451 m, 1533 m, 1615 m, 1666 m, 1948 m, 1957 m and 2115 m. Had great problems with the excess gumbo in this section. Had to circulate and condition the mud several times and due to this some 3000 bbls of mud were lost over the shakers. Some mud also had to be dumped because of its extremely high drill solids content.

The mud weight in this section was raised from 1,32 rd at 948 m to 1,62 rd at 2115 m.

After logging a wiper trip was made, and the 13 3/8" casing was run with no problems at all with the shoe at 2100 m.

Materials used were Barite, Bentonite, Caustic Soda, Soda Ash, Drispac R, Drispac SL, Desco, KCl and DD.

12 1/4" hole, 9 5/8" casing

The 12 1/4" hole was drilled to 3955 m. In the first section of the 12 1/4" hole the same KCl/Drispac mud was used, as in the previous section. There were in this section too some losses of mud over the shakers due to the gumbo shale, but these problems were not so great as for the previous section. The mud weight in this section was in the first part 1,65 rd, and in the lime stone section 1,61 rd. From 2115 m to 3228 m a wiper trip was made each 100 m and some fill was experienced on nearly every trip. From approx. 3200 m to approx. 3300 m there were some problems with tight spot and fill.

In the lime stone section the mud was gradually converted to a fully dispersed gel-lignosulfonate system.

In this section a turbine assembly was used to drill through the lime stone .

The mud was circulated and conditioned and the casing was run with no problems with the shoe at 3944 m.

Materials used in this section was Barite, Bentonite, Caustic Soda, Soda Ash, Lime, KCl, Desco, Resinex, Spersene, XP-20, Drispac R, Drispac SL, DD, Magcolube, Magconol and Al. Stearate.

8 3/8" hole, 7" liner

The 8 3/8" hole section was drilled to 4478 m. The mud properties were maintained within the program parameters. Had to increase the amount of barite and other chemicals due to a higher mud weight than expected. Because of the high temperature in the hole near TD the amount of fluid loss control agents and thinners were also higher than expected.

After logging a wiper trip was made and the 7" liner was ran with the shoe at 4444 m.

The materials used in this section was Barite, Bentonite, Caustic Soda, Lime, Soda Ash, Spersene, XP-20, Resinex, Magconol, Magcolube, DD.

SECTION D

WELL TESTING

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Down hole test string
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Gas rate v Time Main Flow DST No. 1
Gas/Oil ratio v Time Main Flow DST No. 1
Horner plot, Final build up DST No. 2

PRODUCTION TESTING
WELL 7/11-5

a. INTRODUCTION

In june 1982 two sandstone zones were production tested in order to achieve the following objectives:

DST no. 1: -Obtain representative reservoir fluid samples
-Determine reservoir productivity
-Verify reservoir properties

DST no. 2: -Determine reservoir productivity

This report summarizes the data gathered during the two tests, and presents the results from the analysis of the data.

b. SUMMARY

Test intervals: DST no.1: 4185 - 4197 m
DST no.2: 4165 - 4174 m

Test periods:

DST no.	1	2
Main flow period (Hrs.)	12	4
Main build up period (Hrs.)	24	8

Average test data recorded during the main flow period of DST no. 1:

	units	
Oil rate	STB/D	2956
Gas rate	MMSCF/D	4.17
Sep. G.O.R.	SCF/STB	1410
Wellhead temp.	D.F.	163
Wellhead press.	Psig	2083
Choke size	1/64"	36
Gas gravity	Air=1	0.876
Oil gravity	D.API	39.2
Sep. press.	Psig	105
Sep. Temp.	D.F.	153
B.S.& W.	%	0.6
CO_2	%	6
H_2S	%	nil

Test data recorded during main flow period of DST no. 2 is limited to the flow/unloading of the water cushion only. This is because the well was not flowed long enough to get the hydrocarbons to the surface, as this would have taken unreasonably long time with the low permeability involved in this case. However, during the reversing out of the test string, it was visually observed that the zone produced oil.

Wellhead pressures was to low to be measured.

Flow rates measured at the stock tank during the flow period of DST no. 2:

Real time	Cumulative production BBL	Calculated flow rates BBl/D
19:42	0	0
20:42	5.0	120
21:42	11.0	144
22:42	18.5	180
23:42	27.5	216
24:00	31.0	280

c. RESULTS AND CONCLUSIONS

Analysis of the test data has given the following results:

	Units	DST no.1	DST no.2
Kh	md*ft	472.4	18.9
Ko	md	6.75	0.64
Skin	-	0	0
Prod.index	STB/D/psi	1.54	0.07
Flow Eff.	-	1.0	1.0
P*	Psig	8559.5	8554.2
T max.	D.F.	-	322
Ref. depth	mRKB	4184	4163

The productivity index given for DST no. 2 is an average value. The actual calculated productivity indexes were increasing slightly. The reason for this increase could be expansion of gas from the produced hydrocarbons, which would successivly give a higher cumulative production than the "true" value.

All calculations are based on general accepted fluid correlations. Some of the results may therefore be changed when actual PVT-data is applied.

Temperature measurements from DST no. 1 is not available due to malfunction of the bottom hole gauges. The maximum recorded bottom hole temperature in DST no. 2 is measured after a very low and very short flow period. There is therefore reason to believe that the actual reservoir temperature is higher.

d. PRESSURE ANALYSIS TECHNIQUE

Method of analysis used in the calculations is conventional Horner analysis.

e. SAMPLING

During main flow period of DST no. 1, two sets of separator recombination samples were taken. 2 * 20 LTR. water samples and 3 * 20 LTR. stock tank oil samples were also taken.

In DST no. 2 no sampling was performed.

Parameters used in pressure build up calculations:

DST no. 1

Producing interval	21.45	m
Perforated interval	12.0	m
Average porosity	22	%
Average oil saturation	70	%
Oil gravity	39.2	D.API
Gas gravity	0.872	Air=1
Oil formatoin vol. factor	1.92	Res.BBl/BBl
Oil viscosity	0.16	cP
Oil compressibility	39.4*E-6	1/Psi
Water compressibility	3.9*E-6	1/Psi
Formation compressibility	4.3*E-6	1/Psi
Total compressibility	3.3*E-5	1/Psi
Wellbore radius	0.258	ft
Horner time	12.25	Hrs
P well flowing	6639.0	Psig
P one hour	8058.8	Psig
Slope of Horner straight line	312.5	Psi/cycle

Parameters used in pressure build up calculations,

DST no. 2

Producing interval	9.0	m
Perforated interval	9.0	m
Average porosity	13	%
Average oil saturation	70	%
Oil gravity	39.2	D.API
Gas gravity	0.872	Air=1
Oil formation vol. factor	1.92	Res.BBl/BBl
Oil viscosity	0.16	cP
Oil compressibility	39.4*E-6	1/Psi
Water compressibility	3.9*E-6	1/Psi
Formation compressibility	4.3*E-6	1/Psi
Total compressibility	3.3*E-5	1/Psi
Wellbore radius	0.258	ft
Horner time	4.3	Hrs
P well flowing	5409.0	Psig
P one hour	8409.6	Psig
Slope of Horner straight line	739.9	Psi/cycle

Parameters used in productivity index calculations:

Real time	Calculated flow rate BBl/D	B.hole press. Psig	Prod. index
19:42	0	-	-
20:42	120	6146.6	0.05
21:42	144	5979.6	0.06
22:42	180	5742.4	0.06
23:42	216	5464.8	0.07
24:00	280	5432.0	0.09

Horner analysis Dst no. 1

$$K_o h = \frac{162.5 \times Q \times \mu \times B}{m} = 472.4 \text{ md} \cdot \text{ft}$$

$K_o = 6.75$ md (with h = producing interval)

$$\bar{s} = 1.151 \left[\frac{P_{1hr} - P_{wf}}{m} - \log \frac{K_o}{\phi \times \mu \times C_t \times (r_w)^2} + 3.23 \right]$$

$\bar{s} = 0$

$$\Delta P_{skin} = m \times 0.87 \times s = 0$$

Actual productivity index: $J_{actual} = \frac{Q}{P^* - P_{wf}} = 1.54$ b/d/psi

Ideal productivity index : $J_{ideal} = \frac{Q}{(P^* - P_{wf}) - \Delta P_{skin}} = 1.54$ b/d/psi

Flow efficiency : $\frac{J_{actual}}{J_{ideal}} = 1.0$

Horner analysis Dst no. 2

$$K_oh = \frac{162.6 \times Q \times \mu \times B}{m} = 18.9 \text{ md} \times \text{ft}$$

$K_o = 0.64$ md (with h = perforated interval)

$$s = 1.151 \left[\frac{P_{1hr} - P_{wf}}{m} - \log \frac{K_o}{\phi \times \mu \times C_t \times (r_w)^2} + 3.23 \right]$$

$s = 0$

$\Delta P_{skin} = m \times 0.87 \times s = 0$

Productivity indexes for Dst no. 2, ref. text.

Sequence of events

DST no. 1

DATE	TIME	EVENT
30.05.82	06:16	Perforated test interval
	10:15	Start R.I.H. with test string
31.05.82	05:09	Set test packer
	06:40	Open APR-N valve
	06:42	Open choke manifold on 18/32" Adj. choke
	06:46	Shut in choke for initial build up
	06:49	Shut in APR-N valve
	07:52	Open APR-N valve
	07:53	Open choke manifold on 36/64" Adj. choke
	08:16	Oil- and gas-cut mud to surface
	08:30	Open choke to 38/64" and back to 36/64" to check for plugging
	08:41	Choke back to 20/64" to get burner lighted
	08:48	Increase choke to 36/64" Adj. again
	09:02	Change to 36/64" fixed choke
	10:15	Flow directed through separator
	20:01	Bypass separator
	20:05	Shut in choke manifold for build up
	20:06	Shut in APR-N valve
01.06.82	19:43	Start bleeding off tubing pressure
	20:00	Proceed to kill the well

Sequence of events
DST no. 2

DATE	TIME	EVENT
03.06.82	16:20	Perforated test interval
	20:00	Start R.I.H. with test string
04.06.82	15:28	Set test packer
	15:40	Try to open APR-N valve without success
	15:48	Bleed off anulus pressure
	15:59	Pressure up tubing to 1500 Psi
	16:03	Open APR-N tester valve
	16:04	Open choke manifold to 12/64" Adj. choke
	16:09	Wellhead pressure is suddenly up to 1800 Psi
	16:10	Wellhead pressure is decreasing fast
	16:13	Wellhead pressure is rising fast to 1390 Psi
	16:14	Flow rate is now very small. It looks like the well is plugged up
	16:17	Wellhead pressure rise to 1098 Psi, and then falls off to zero
	16:20	Shut in choke manifold only, for initial build up
	17:50	Open choke to 36/64" Adj.
	17:51	Wellhead pressure dropped to zero
	18:09	Open choke to 60/64" Adj.
	18:30	Bypass choke manifold (eqv.164/64"choke)
	19:00	Try to pump water down test string to clean out eventual plugging. Wellhead press was 4500 Psi, and no fluids could be pumped down
	19:15	Open bypass on choke manifold. No change in flow
	19:21	Try to inject water again. Wellhead press. is 4900 Psi, and formation does not take any fluids
	19:35	Open bypass on choke manifold. No change in flow observed.
	19:40	Shut in choke to check that the well is not dead.
	19:42	Open choke to 12/64" Adj.
	19:55	Bypass choke manifold. Wellhead press. not measurable.
	24:00	Shut in choke and APR-N valve for build up period.
05.06.82	08:06	Proceed to kill the well

Norsk Hydro

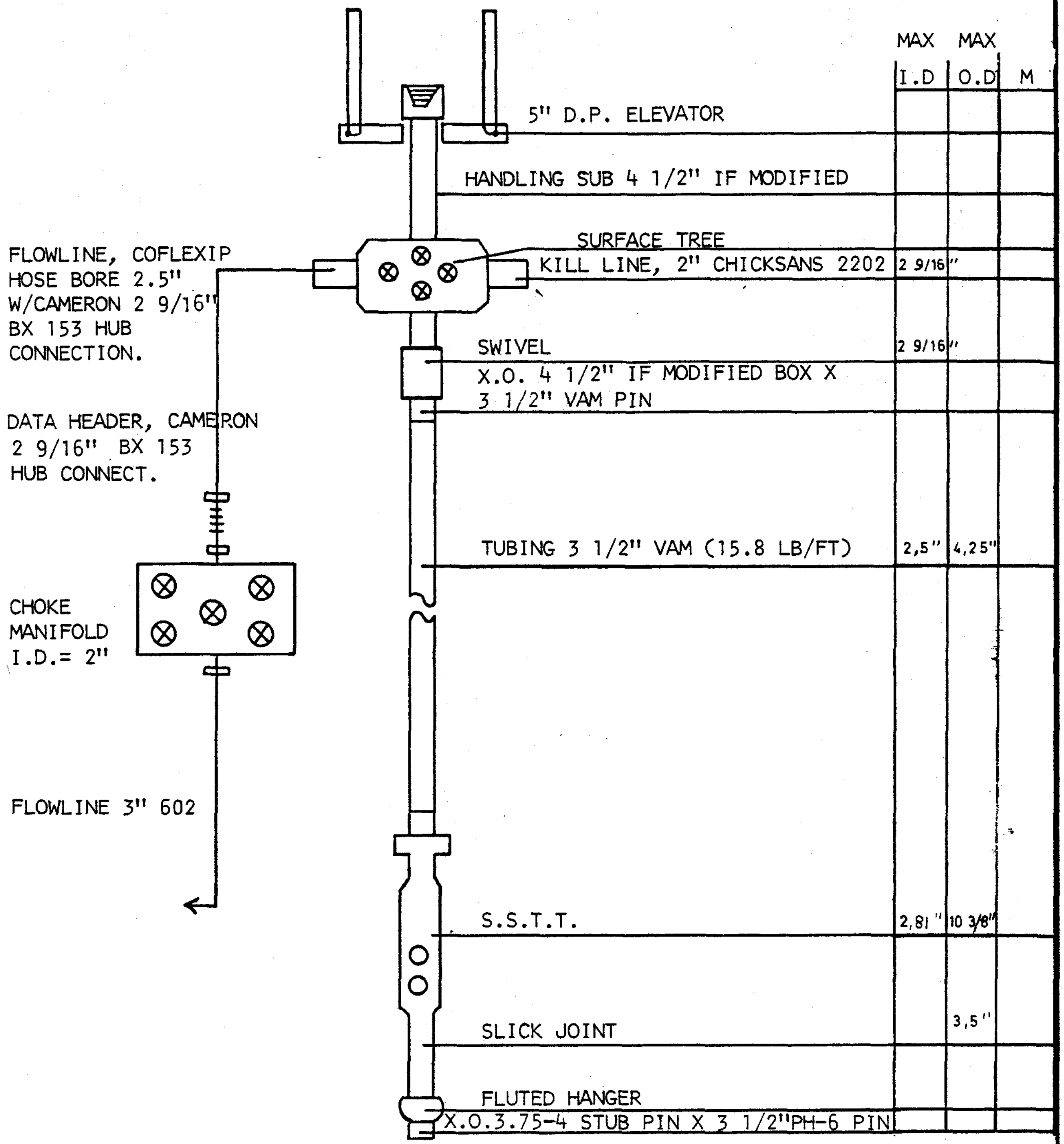
FLOW DATA

DATE/TIME	PRESS.	TEMP.	CHOKE SIZE	SEPARATOR DATA								WELLSTREAM FIELD ANALYSIS					
	W.HEAD B.HOLE	W.HEAD B.HOLE	MANIFOLD HEATER	PRESS.	OIL TEMP.	GAS TEMP.	OIL RATE	GAS RATE	G.O.R.	OIL GRAVITY	GAS GRAVITY	B.S.&W	pH	CHLORIDES	CALCIUM/ MAGNESIUM	CO_2	H_2S
DST NO 1	PSI	°F	64th IN.	PSIG	°F	°F	STB/D	MMSCF/D	SCF/STB	API	AIR=1	%		ppm	ppm	%	%
31.05.82/10:15	1887 6595	108	36		Flow through separator												
11:30	1929 6601	120	36	265	120		4450.0	3.64	818.0	23.3	0.792	2.0 WATER					
13:10	 6637		36													4	0
13:30	2045 6646	136	36	90	132		3049.3	4.12	1351.1	36.8	0.872	1.6 WATER					
13:45	 6646		36													6	0
14:00	2015 6642	140	36	90	137		3166.6	4.10	1294.8	37.3	0.872	1.6 WATER					
14:30	2025 6650	142	36	90	139		3189.4	4.12	1291.8	37.3	0.872	1.0 WATER					
15:00	2037 6649	143	36	90	143		2948.3	4.13	1400.8	37.3	0.872	1.0 WATER					
15:30	2035 6643	146	36	90	144		2932.4	4.13	1408.4	37.3	0.882	1.0 WATER					
16:00	2044 6639	148	36	90	145		2971.4	4.15	1397.1	31.0	0.882	0.6 WATER				1.0	0
16:30	2047 6639	151	36	90	146		2970.4	4.15	1397.1	31.0	0.882	0.6 WATER					
17:00	2055 6639	152	36	90	147		2961.4	4.15	1401.4	31.0	0.882	0.6 WATER					
17:30	2056 6639	154	36	90	148		2973.3	4.16	1399.1	31.0	0.89	0.05 WATER					
18:00	2061 6639	156	36	90	150		2923.2	4.17	1426.5	33.9	0.89	0.9 WATER					
18:30	2068 6639	159	36	90	152		2907.9	4.25	1461.5	34.7	0.864	0.9 WATER					
19:00	2075 6639	161	36	90	152		2928.9	4.25	1451.1	34.7	0.864	1.0 WATER					

Norsk Hydro

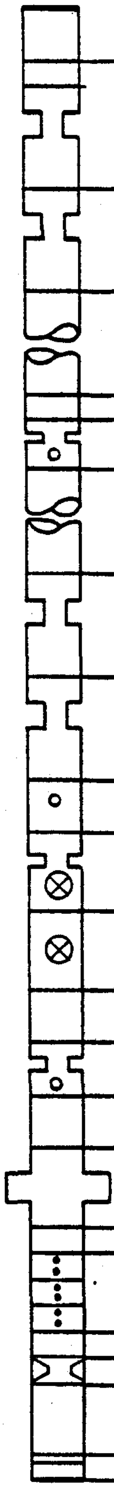
FLOW DATA

DATE/TIME	PRESS.	TEMP.	CHOKE SIZE	SEPARATOR DATA								WELLSTREAM FIELD ANALYSIS					
	W.HEAD / B.HOLE	W.HEAD / B.HOLE	MANIFOLD / HEATER	PRESS.	OIL TEMP.	GAS TEMP.	OIL RATE	GAS RATE	G.O.R.	OIL GRAVITY	GAS GRAVITY	B.S.&W	pH	CHLORIDES	CALCIUM/ MAGNESIUM	CO_2	H_2S
DST NO 1	PSI	°F	64th IN.	PSIG	°F	°F	STB/D	MMSCF/D	SCF/STB	API	AIR=1	%		ppm	ppm	%	%
19:30	2078 / 6625	162	36	90	153		2929.7	4.24	1447.2	33.6	0.872	0.5 WATER					
20:00	2083 / 6629	163	36	90	153		2932.9	4.21	1435.4	33.6	0.872	0.5 WATER					
20:01					BYPASS SEPARATOR												



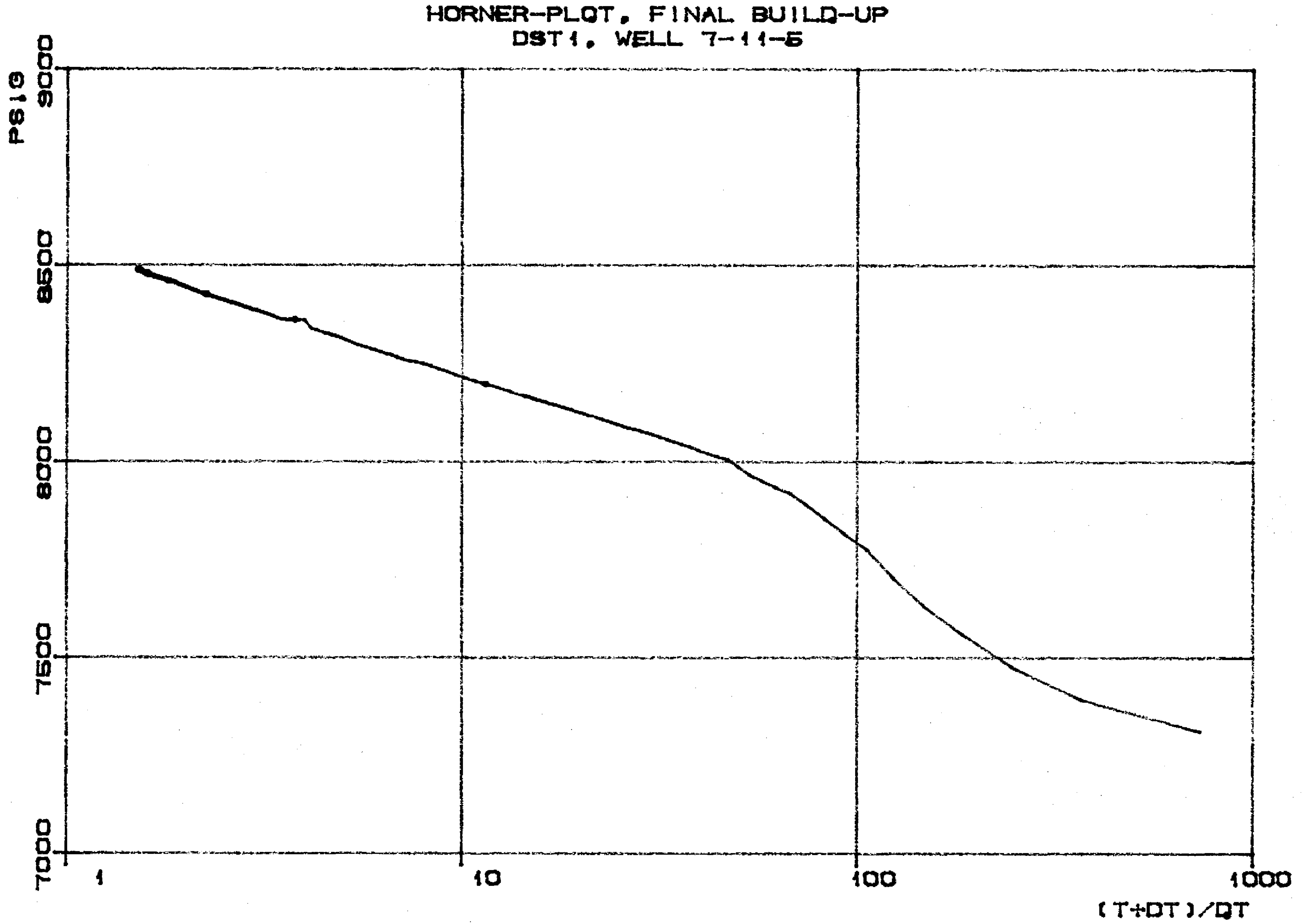
Norsk Hydro Drilling Department	SURFACE EQUIPMENT AND LANDING STRING WELL 7/11 - 5 TREASURE SEEKER	Gr. no.: 7/2	Fig.: 3
		Date: 4/12 1981 Sign: KKO HES	Dwg. no.: 45/25

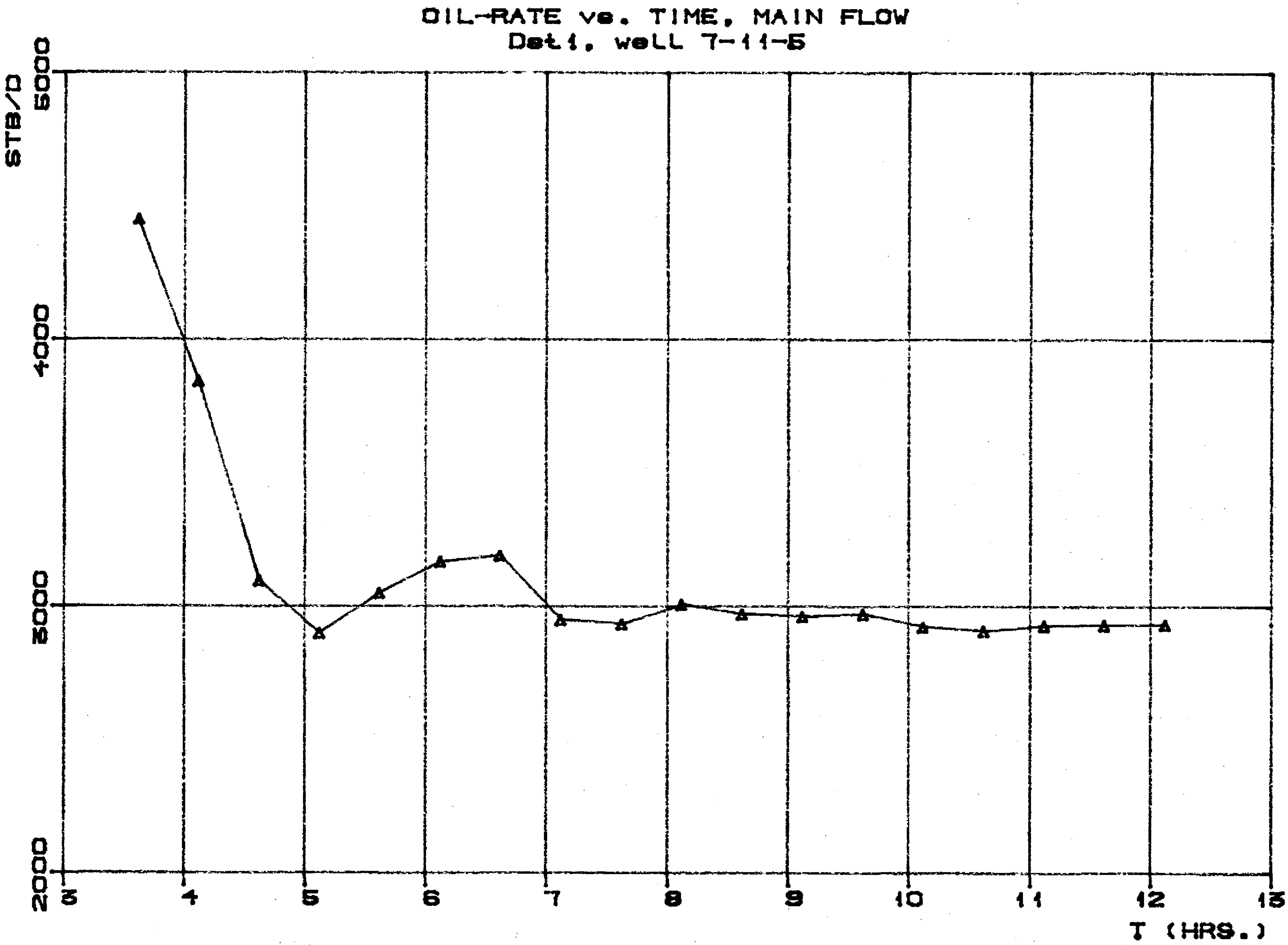
NH.DD.28.2.80



TOOL DECRIPTION	BOX	PIN
3 1/2"PH-6, 12.95 LB/FT	HYDRIL PH-6	HYDRIL PH-6
SUB	3 1/2" PH-6	3 1/2" IF
SLIP JOINT OPEN	3 1/2" IF	3 1/2" IF
SLIP JOINT CLOSED	3 1/2" IF	3 1/2" IF
4 3/4" DC, 5 STAND	3 1/2" IF	3 1/2" IF
SUB	3 1/2" IF	2 7/8" EUE
RTTS CIRC. VALVE	2 7/8" EUE	3 1/2" IF
4 3/4"DC, 1 STAND	3 1/2" IF	3 1/2" IF
SLIP JOINT CLOSED	3 1/2" IF	3 1/2" IF
SLIP JOINT CLOSED	3 1/2" IF	3 1/2" IF
APR-M CIRC. VALVE	3 1/2" IF	3 1/2" IF
DRILL PIPE TESTER VALVE	3 1/2" IF	3 1/2" IF
APR-N TESTER VALVE	3 1/2" IF	3 1/2" IF
BIG JOHN JAR	3 1/2" IF	2 7/8" EUE
7" RTTS CIRC. VALVE	2 7/8" EUE	2 7/8" EUE
RTTS SAFETY JOINT	2 7/8" EUE	4 5/32" 8N THD
7" RTTS PACKER	4 5/32" 8N THD	2 7/8" EUE BOX
SUB	2 7/8" DP	2 7/8" EUE
3 X 5' PERF. ANCHOR	2 7/8" DP PIN	2 7/8" DP
SUB	2 7/8" DP	2 7/8" EUE
F. NIPPLE	2 3/8" EUE	2 3/8" EUE
3 X 10' 2 3/8" TAIL PIPE	2 3/8" EUE	2 3/8" EUE
PIN COLLAR	2 3/3" EUE	2 3/8" EUE BOX

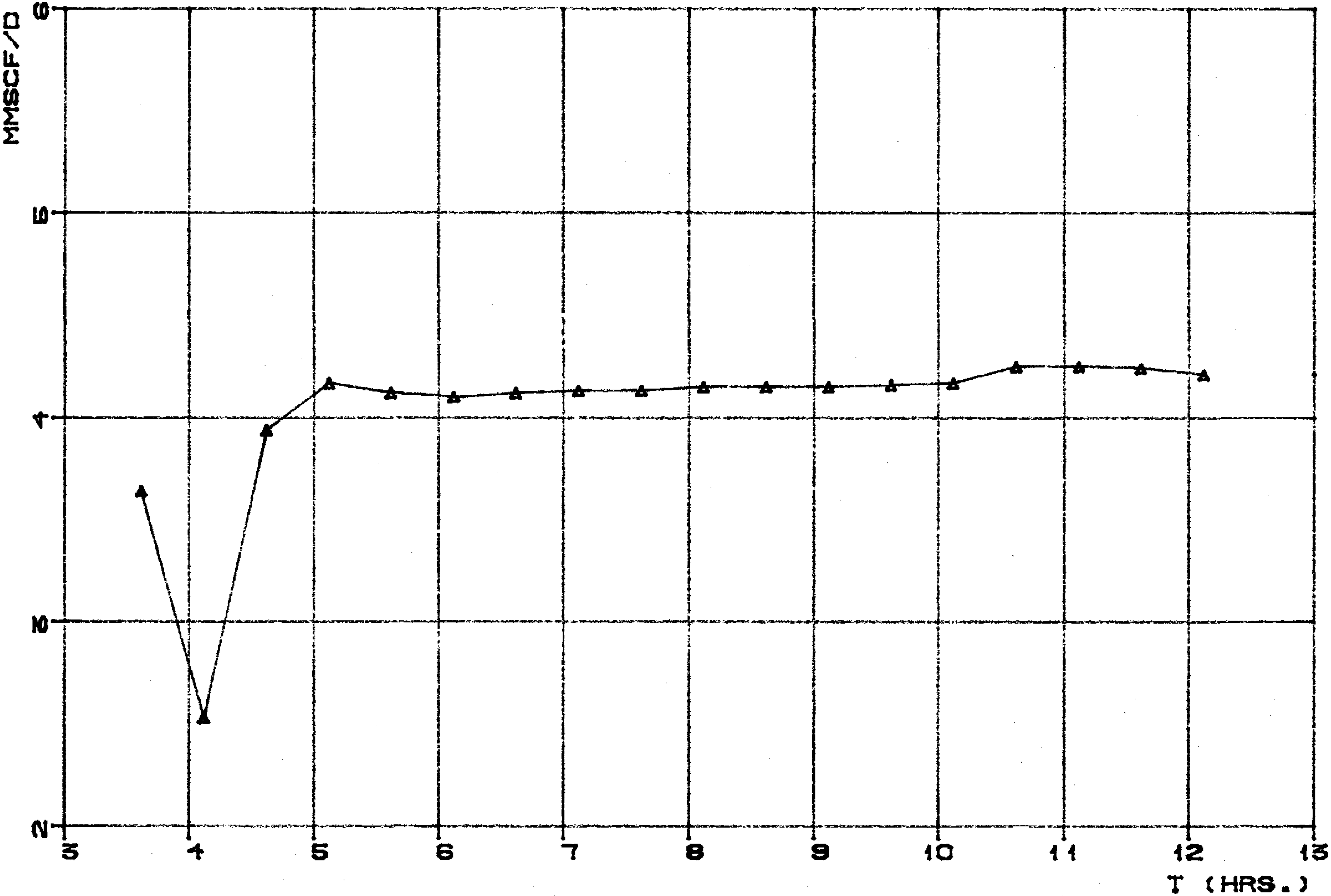
Norsk Hydro Drilling Department	DOWNHOLE TEST STRING WELL 7/11-5	Gr. no.: 5	Fig.: 2
		Date: 11/5 - 1982 Sign: KKO / HES	Dwg. no.: 8

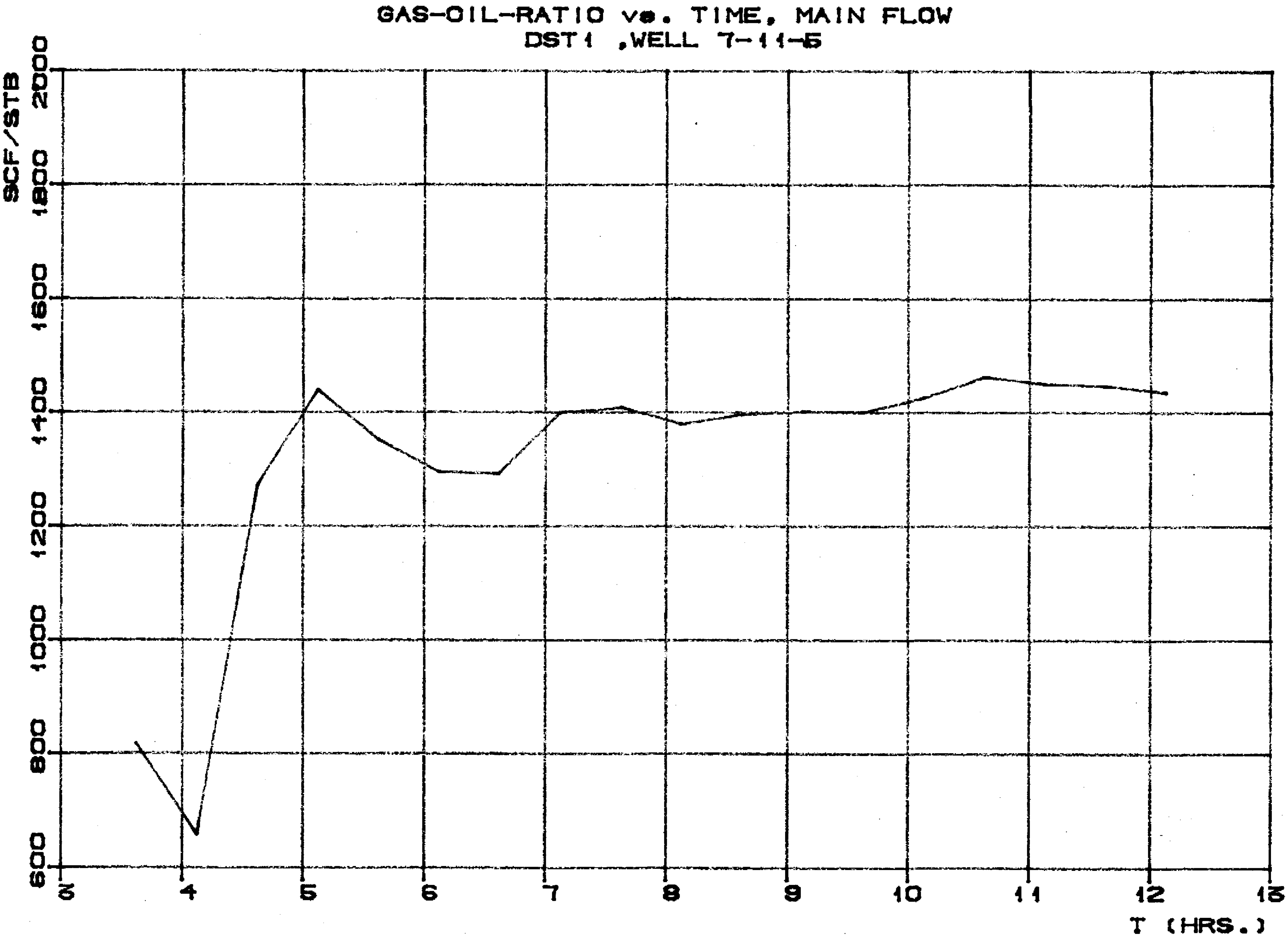

HORNER-PLOT, FINAL BUILD-UP
DST1, WELL 7-11-5
PSIG
9000
8500
8000
7500
7000
1
10
100
1000
(T+DT)/DT

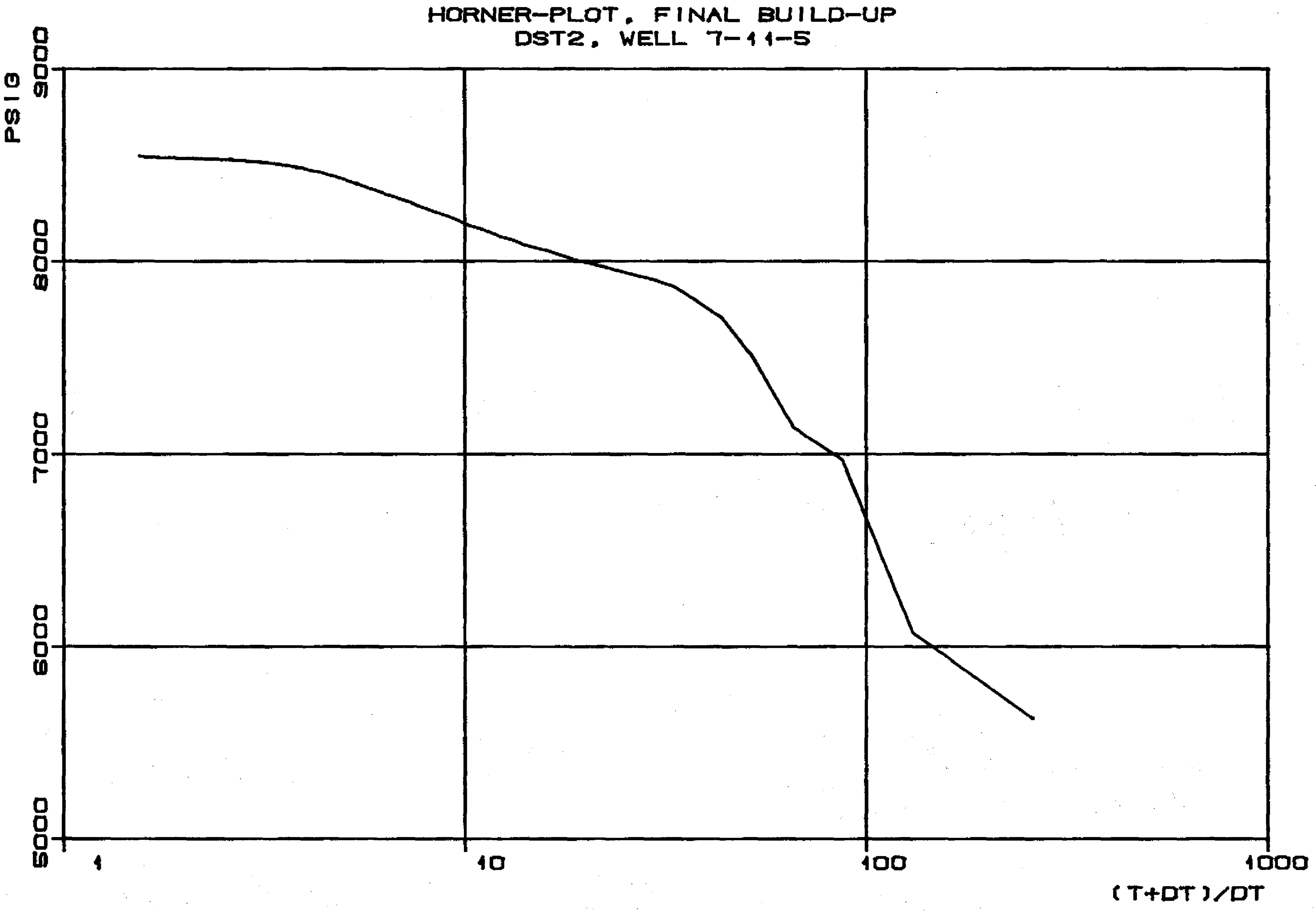


OIL-RATE vs. TIME, MAIN FLOW
Dst.1, well 7-11-6
STB/D
5000
4000
3000
2000
3
4
5
6
7
8
9
10
11
12
13
T (HRS.)

GAS-RATE vs. TIME, MAIN FLOW
Det.1 ,well 7-11-6




GAS-OIL-RATIO vs. TIME, MAIN FLOW
DST1 ,WELL 7-11-5
SCF/STB
2000
1800
1600
1400
1200
1000
800
600
3
4
5
6
7
8
9
10
11
12
13
T (HRS.)


HORNER-PLOT, FINAL BUILD-UP
DST2, WELL 7-11-5
PSIG
9000
8000
7000
6000
5000
1
10
100
1000
(T+DT)/DT

RFT RESULTS

7/11-5

RUN 1				
DEPTH	M (RKB)	H.P. (PSI)	F.P. (PSI)	PERM.
1/1	4165,0	10493	8669	POOR
2/1	4168,5	10501	8575	POOR
3/1	4172,0	10512	8656	POOR
4/1	4176,0	10517	8591	POOR
5/1	4178,5	10525	8563	POOR
6/1	4181,5	10529	8561	GOOD
7/1	4186,0	10537	8562	POOR
8/1	4188,0	10543	8564	GOOD
9/1	4189,5	10541	8565	GOOD
10/1	4192,0	10548	8566	V. GOOD
11/1	4194,5	10557	8571	GOOD
12/1	4196,0	10555	8570	GOOD
13/1	4198,0	10564	8575	FAIR
14/1	4202,0	10570	8576	V. GOOD
15/1	4214,0	10607	–	NO SEAL
16/1	4222,5	10630	–	NO SEAL
17/1	4230,0	10652	–	NO SEAL
18/1	4239,5	10667	–	NO SEAL
19/1	4300,0	10808	–	NO SEAL

RUN 1				
20/1	4188,0	10543	8564	GOOD

Took segregated sample at 4188 m.
Recovered mud filtrate only.

RUN 1				
DEPTH	M (RKB)	H.P. (PSI)	F.P. (PSI)	PERM.
20/1	4188,0	10543	8564	GOOD

Took segregated sample at 4188 m.
Recovered mud filtrate only.

RUN 2				
21/1	4193,0	10518	8560	GOOD

Took segregated sample at 4193 m.
Recovered mud filtrate only.

DST RESULTS

DST 1

Perforated interval: 4185 - 4197 m (RKB)
Flow rate: 2956 STB/D, 4,17 MMSCF/D
Oil gravity: 39,2° API
Gas gravity: 0,876 (Air = 1)
GOR: 1410 SCF/STB
Choke size: 36/64"
Wellhead press.: 2083 Psig.

DST 2

Perforated interval: 4165 - 4174 m
Flow rate: 280 STB/D
(No flow to surface, flow calculated from the flow/unloading of the water cushion).
Oil gravity: NA
Gas gravity: NA
GOR: NA
Choke size: 36/64"
Well head press.: NA

Checked: B.Læ
Date: 29.11.82.

U- 316 3

BP RESEARCH

Sunbury Research Centre

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EXPLORATION AND PRODUCTION DIVISION

GEOCHEMISTRY
BRANCH

GCB/182-P1/89

NOVEMBER 1989

GEOCHEMICAL DATA FOR AN OIL FROM 7/11-5, OFFSHORE NORWAY

By
S.A. Baylis

Work By
S.A. Baylis and M.P. Dee

Sponsored by:

BP Norway

Approved by:

R.I. Crisp

TABLE 1

OIL ANALYSIS

SAMPLE	7/11-5 DST-1
DEPTHRANGE(m)	4185-4197.0

RESERVOIR/FORMATION	ULA SST
SAMPLE TYPE	CRUDE
LOCATION	OFFSHORE NORWAY

API GRAVITY @ 15 deg C	36.3
DENSITY @ 15 deg C	0.8430
WAX % wt	7.50
WAX MPT deg C	48.0
POUR POINT	-12.0
ASPHALTENES %wt	0.29
SULPHUR %wt	0.1
NITROGEN ppm	310
NICKEL ppm	<2
VANADIUM ppm	<2
KINEMATIC VISCOSITY cST @ 20deg C	7.81
n-ALKANE CPI	1.02
PRISTANE/PHYTANE	1.64
PR/nC17	0.51
PH/nC18	0.35
R22	1.02
ALKANE INDEX	73

TYPE ANALYSIS BY HPLC ON DE-ASPHALTENED RESIDUE >200 C

SATURATES %wt	69.5
AROMATICS %wt	26.5
RESIDUE %wt	4.0

CARBON ISOTOPE RATIOS per mil

TOTAL OIL		-29.3
ASPHALTENES		-28.5
SATURATES		-29.7
AROMATICS		-28.5
RESIDUE		-28.4
STANDARD	NBS 22	-29.8

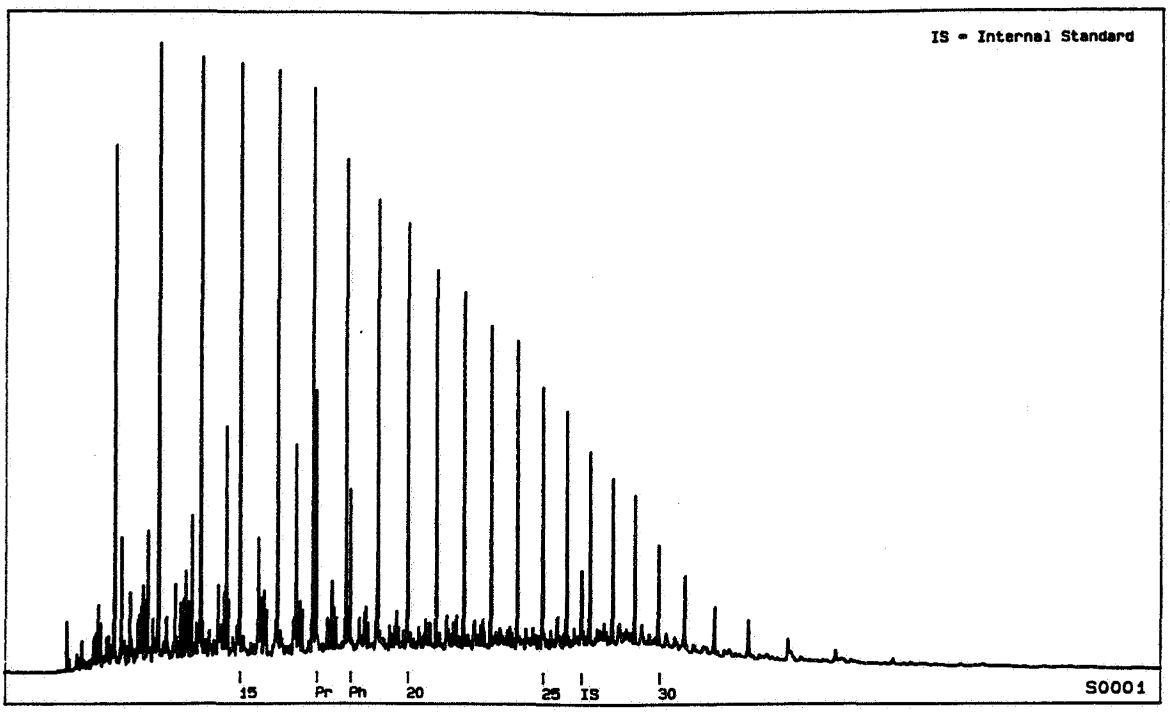
BIOMARKER RATIOS

H1		S1	0.74	A1	
H2		S2	0.79	A2	
H3		S3		A3	
H4	ABS	S4	36:29:35	A4	
H5		S5		A5	
H6		S6		A6	
H7		S7			
H10		S8			
H11		S9		M2	1.56
H12		S10		M3	1.15
H13				M4	
H14					
H15					
H16					
H17					

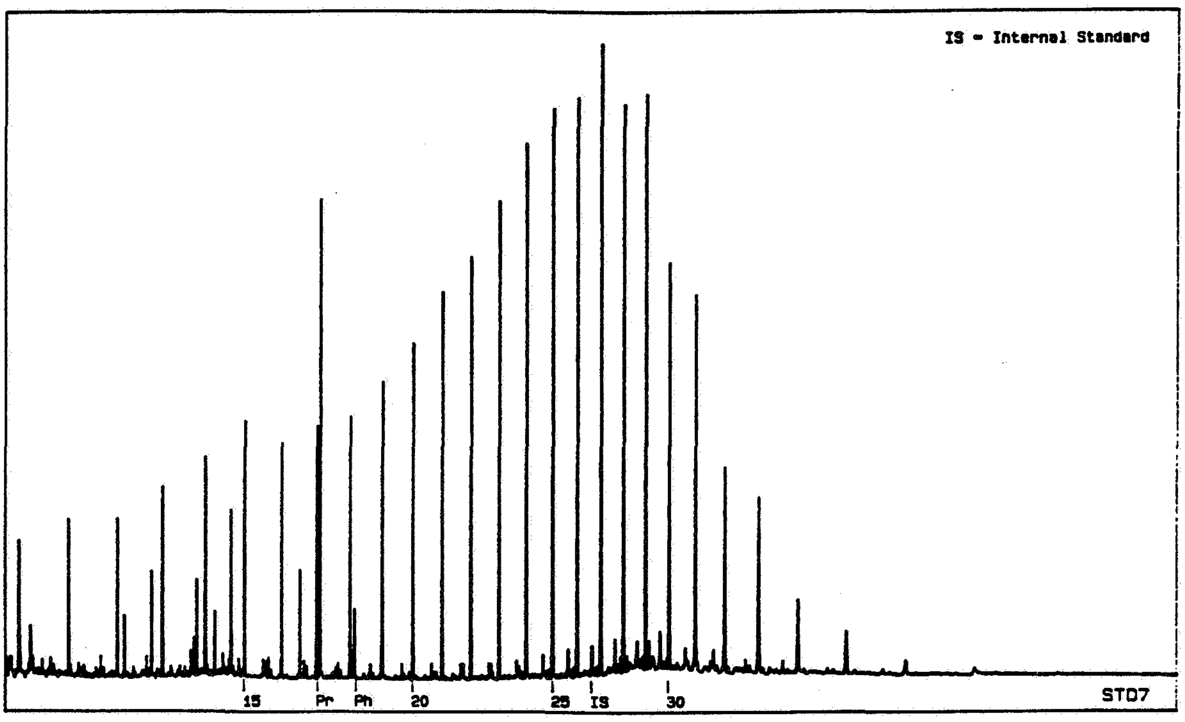
QUANTITATIVE ANALYSIS

SATURATE FRACTION	QSNALK	81799	ppm
	QSNC20	4610	ppm
	QSC29ST	36	ppm
	QSC30HO		ppm
	QSC32HO		ppm
AROMATIC FRACTION	QAMONAR		ppm
	QATRIAR		ppm
	QAMEPH	55837	ppm

CODING LISTS FOR BIOMARKERS CAN BE FOUND AT THE BACK OF THIS REPORT



7/11-5 (CRU) DST-1 4197m



STANDARD

SAC FRACTION CHROMATOGRAMS

GCB ref. 89090IL040
Figure 1

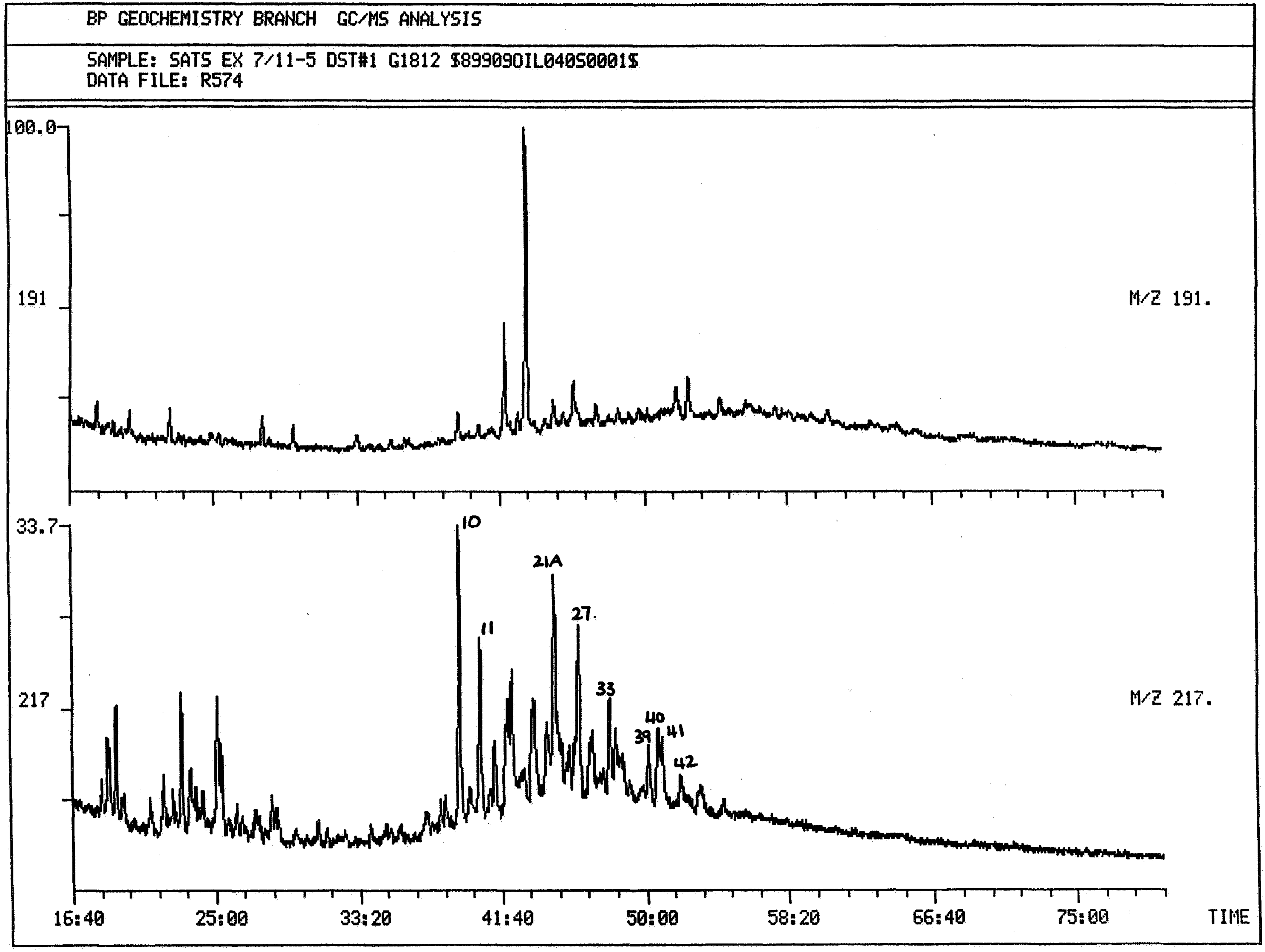

BP GEOCHEMISTRY BRANCH GC/MS ANALYSIS
SAMPLE: SATS EX 7/11-5 DST#1 G1812 $89909OIL040S0001$
DATA FILE: R574
100.0
191
M/Z 191.
33.7
10
11
21A
27.
33
39
40
41
42
217
M/Z 217.
16:40
25:00
33:20
41:40
50:00
58:20
66:40
75:00
TIME

Figure 2.1

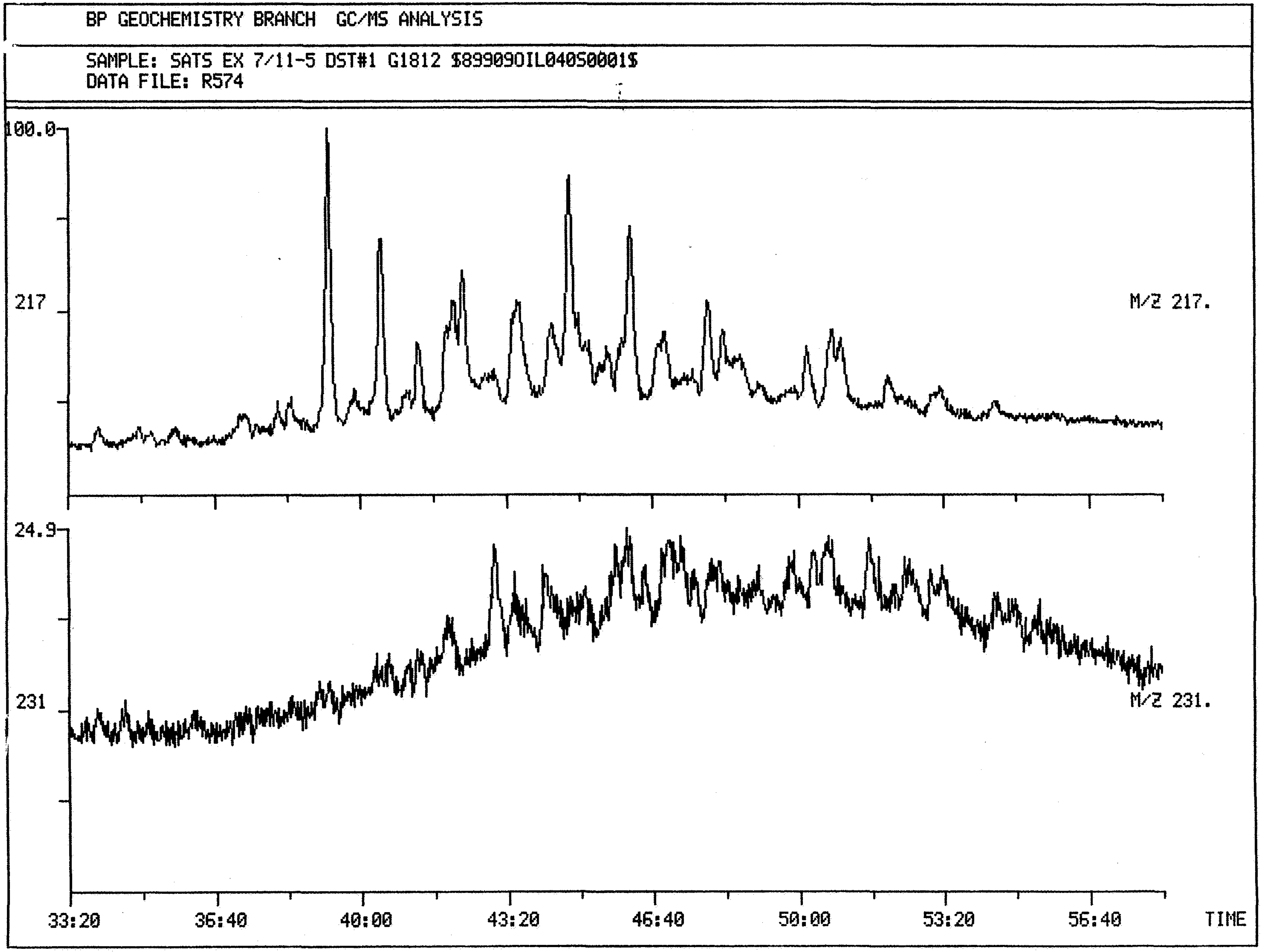

BP GEOCHEMISTRY BRANCH GC/MS ANALYSIS
SAMPLE: SATS EX 7/11-5 DST#1 G1812 $899090IL040S0001$
DATA FILE: R574
100.0
217
M/Z 217.
24.9
231
M/Z 231.
33:20
36:40
40:00
43:20
46:40
50:00
53:20
56:40
TIME

Figure 2.2

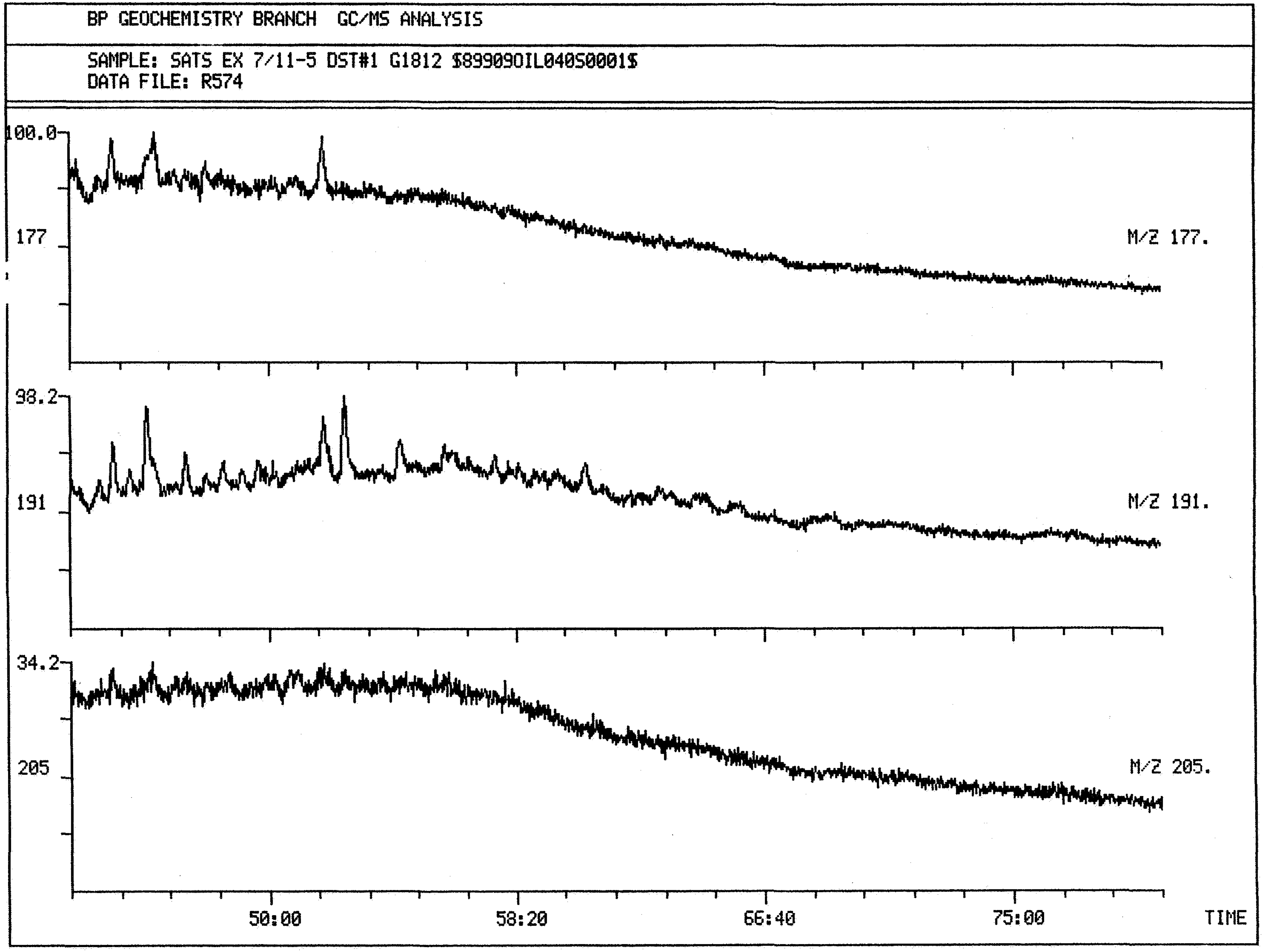

BP GEOCHEMISTRY BRANCH GC/MS ANALYSIS
SAMPLE: SATS EX 7/11-5 DST#1 G1812 $899090IL040S0001$
DATA FILE: R574
100.0
177
M/Z 177.
98.2
191
M/Z 191.
34.2
205
M/Z 205.
50:00
58:20
66:40
75:00
TIME

Figure 2.3

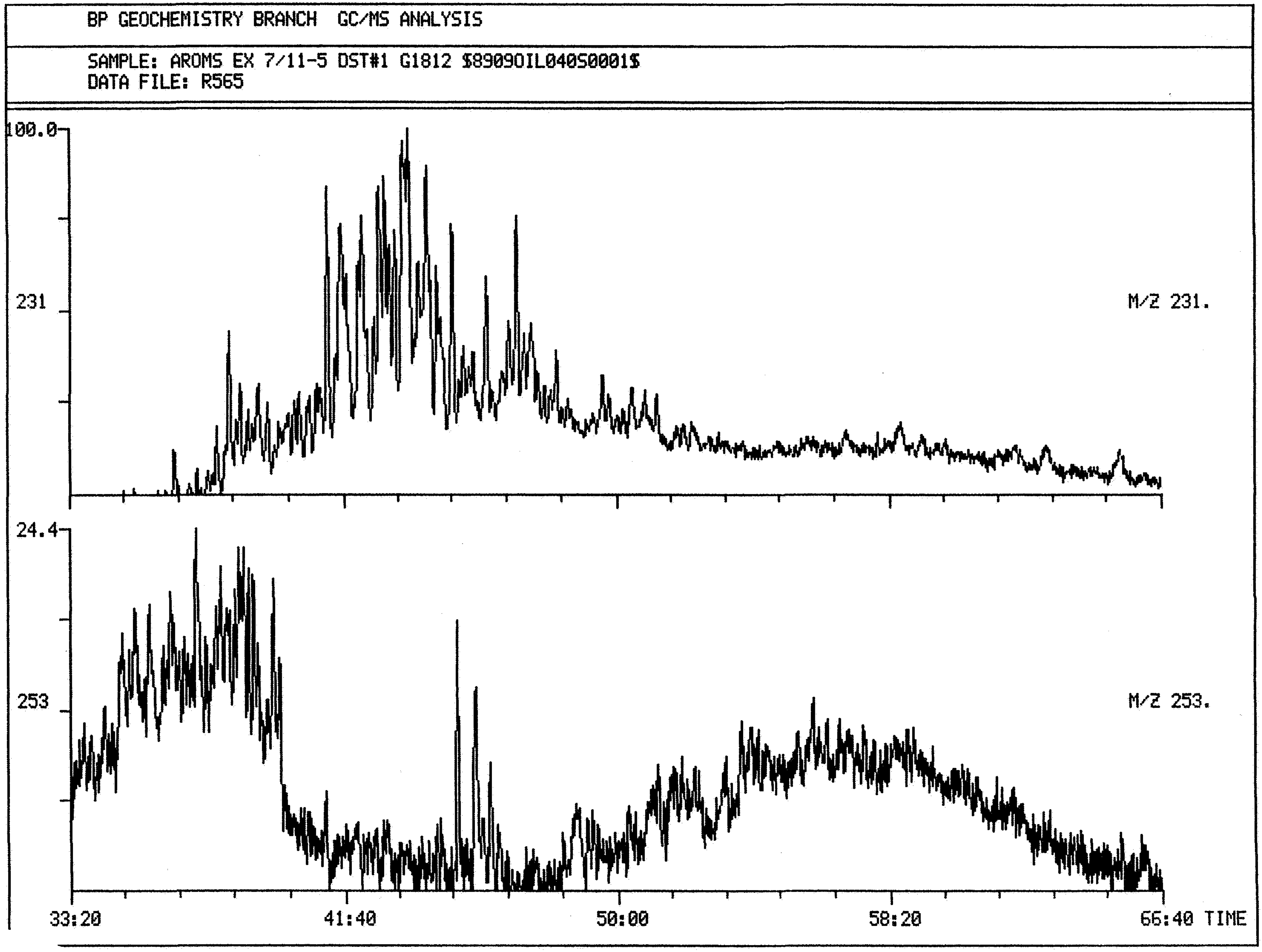

BP GEOCHEMISTRY BRANCH GC/MS ANALYSIS
SAMPLE: AROMS EX 7/11-5 DST#1 G1812 $89090IL040S0001$
DATA FILE: R565
100.0
231
M/Z 231.
24.4
253
M/Z 253.
33:20
41:40
50:00
58:20
66:40 TIME

Figure 3.1

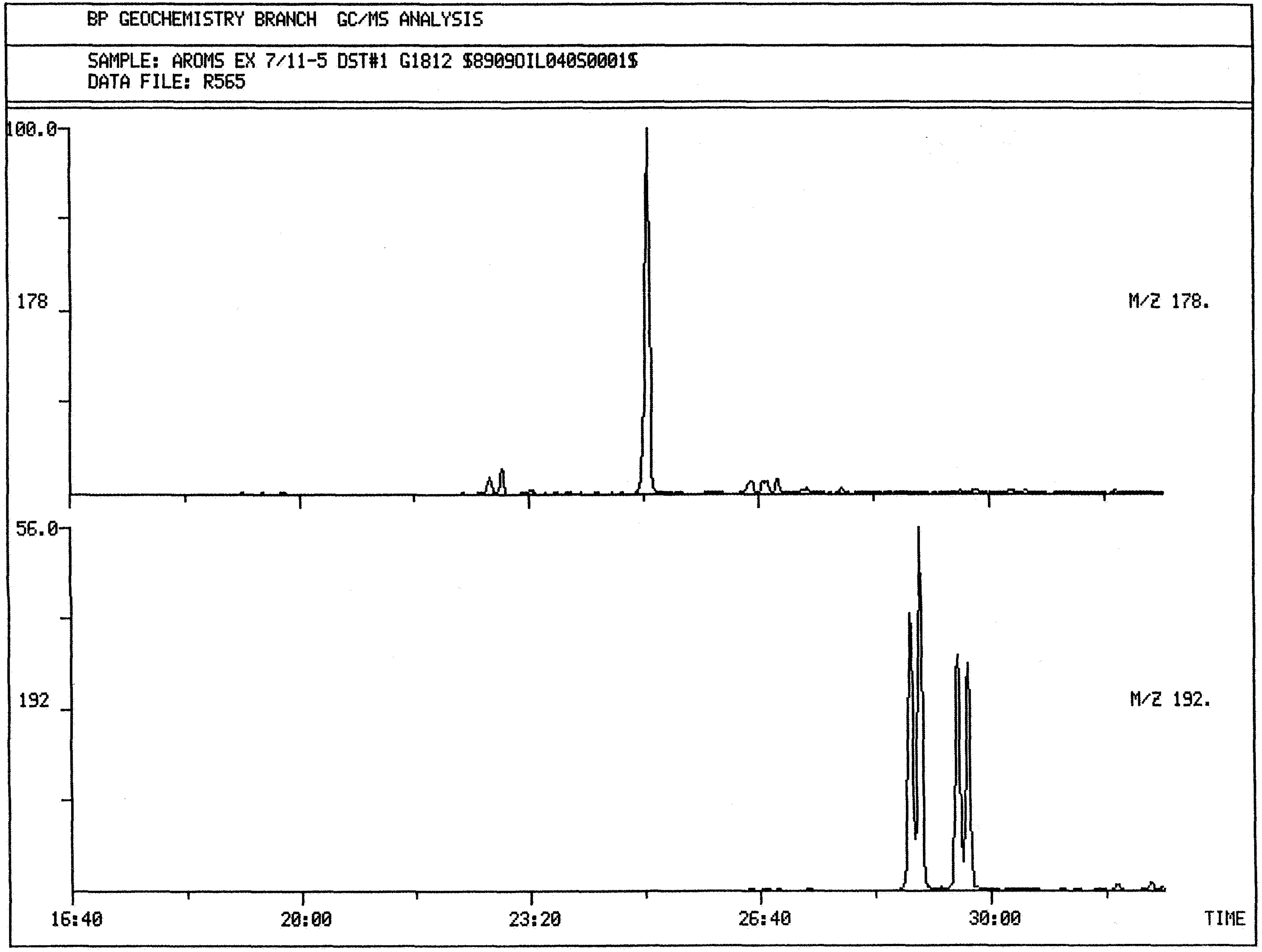

BP GEOCHEMISTRY BRANCH GC/MS ANALYSIS
SAMPLE: AROMS EX 7/11-5 DST#1 G1812 $89090IL040S0001$
DATA FILE: R565
100.0
178
M/Z 178.
56.0
192
M/Z 192.
16:40
20:00
23:20
26:40
30:00
TIME

Figure 3.2

MOLECULAR PARAMETER LIST

BP CODE	PARAMETER	USE
H1	C_{32} HOPANE 22S/(22S+22R)	M
H2	C_{31} HOPANE 22S/(22S+22R)	M
H3	C_{30} HOPANE/(C_{30} HOPANE+C_{30} MORETANE)	MS
H4	$\beta\beta$ HOPANES PRESENT/ABSENT	M
H5	C_{30}:C_{31}:C_{32}:C_{33}:C_{34}:C_{35} HOPANE DISTRIBUTION	S
H6	C_{27} HOPANES $T_s/(T_s+T_m)$	MS
H7	C_{33} HOPANE 22S/(22S+22R)	M
H8	C_{34} HOPANE 22S/(22S+22R)	M
H9	C_{35} HOPANE 22S/(22S+22R)	M
H10	RESIN DITERPANES % RELATIVE TO C_{30} HOPANE (PEAK G)	S
H11	C_{23} EXT TRICYCLIC TERPANE % RELATIVE TO C_{30} HOPANE (PEAK G)	S
H12	C_{24} TETRACYCLIC TERPANE % RELATIVE TO C_{30} HOPANE (PEAK G)	S
H13	28,30 BISNORHOPANE (PEAK X) % RELATIVE TO C_{30} HOPANE (PEAK G)	S
H14	PENTACYCLANE II % RELATIVE TO C_{30} HOPANE (PEAK G)	S
H15	OLEANANE % RELATIVE TO C_{30} HOPANE (PEAK G)	S
H16	GAMMACERANE % RELATIVE TO (PEAK G)	S
H17	HOPANES $C_{35}/(C_{34}+C_{35})$ %	S
S1	C_{29} $\alpha\alpha\alpha$ STERANES 20S/(20S+20R)	M
S2	C_{29} STERANES $\alpha\beta\beta/(\alpha\beta\beta+\alpha\alpha\alpha)$	M
S3	STERANES $\alpha\alpha\alpha$ C_{27}:C_{28}:C_{29}	S
S4	STERANES $\alpha\beta\beta$ C_{27}:C_{28}:C_{29}	S
S5	$\beta\alpha$ DIASTERANES/(SAME+$\alpha\alpha\alpha$+$\alpha\beta\beta$ STERANES) %	SM
S6	LOW MOLECULAR WEIGHT STERANES RELATIVE TO C_{29} STERANES	S
S7	STERANE INDEX $C_{27}/(C_{27}+C_{29})$ % (FROM S3)	S
S8	4-ME C_{30} STERANE % RELATIVE TO C_{29} 20R $\alpha\alpha\alpha$ STERANE (PEAK 42)	S
S9	4-ME STERANES INDEX $C_{28}/(C_{28}+C_{30})$ %	S
S10	BICADINANES PRESENT/ABSENT	S
A1	C_{28} 20R TRIAROM. STERANE/(SAME+C_{29} 20R MONOAROM. STERANE)	M
A2	SUM TRIAROM. STERANES/(SAME+SUM MONOAROM. STERANES)	M
A3	C_{20} TRIAROM. STERANE/(SAME+C_{28} 20R TRIAROM. STERANE)	M
A4	C_{20}+C_{21} TRIAROM. STERANE/(SAME+SUM C_{26}-C_{28} TRIAROM. STERANES)	M
A5	C_{26} 20S TRIAROM. STERANE/C_{28} 20S TRIAROM. STERANE	S
A6	C_{27} 20R TRIAROM. STERANE/C_{28} 20R TRIAROM. STERANE	S
M2	PHENANTHRENES (3ME+2ME)/(9ME+1ME)	M
M3	MPI [(3ME+2ME)/(PHENANTHRENE+9ME+1ME)] * 1.5	M
M4	SUM C_{27}-C_{35} HOPANES/(SAME+ SUM C_{27}-C_{29} STERANES) %	S
ALKIND	ALKANE INDEX n-C_{17}/(n-C_{17}+n-C_{27}) %	S
R22	R22 INDEX (2 * n-C_{22})/(n-C_{21}+n-C_{23})	SM

NOTES:

1. S=SOURCE PARAMETER, M=MATURITY PARAMETER.

2. TRIAROM. STERANE=MONOMETHYL TRIAROMATIC STERANES
MONOAROM. STERANE=DIMETHYL MONOAROMATIC STERANES.

(5/6/89)

BIOMARKER IDENTIFICATION - PENTACYCLIC HYDROCARBONS

BP CODE	TENTATIVE ASSIGNMENT BASED ON MASS SPECTROMETRY (m/e 191)
I	9-DODECYLPERHYDROANTHRACENE [INTERNAL STANDARD]
T_s	18α(H)-22,29,30-TRISNORNEOHOPANE
T_m	17α(H)-22,29,30-TRISNORHOPANE
θ	17α(H)-29,30-BISNORHOPANE
Q	17β(H)-22,29,30-TRISNORHOPANE
W	17α(H)-25,30-BISNORHOPANE
X	17α(H),18α(H),21β(H)-28,30-BISNORHOPANE
Y	17α(H)-25-NORHOPANE
D	17α(H),21β(H)-30-NORHOPANE
π	C30 PENTACYCLIC TRITERPANE
A	17β(H),21α(H)-30-NORMORETANE
B	18α(H)-OLEANANE
G	17α(H),21β(H)-HOPANE
φ	17α(H)-30NOR-29-METHYLHOPANE
H	17β(H),21β(H)-30-NORHOPANE
K	17β(H),21α(H)-MORETANE
N	(22S)-17α(H),21β(H)-30-METHYLHOPANE
O	(22R)-17α(H),21β(H)-30-METHYLHOPANE
S	GAMMACERANE
P	17β(H),21β(H)-HOPANE
R	17β(H),21α(H)-30-METHYLMORETANE
U	(22S)-17α(H),21β(H)-30-ETHYLHOPANE
V	(22R)-17α(H),21β(H)-30-ETHYLHOPANE
J	17β(H),21β(H)-METHYLHOPANE
α	(22S)-17α(H),21β(H)-30-n-PROPYLHOPANE
β	(22R)-17α(H),21β(H)-30-n-PROPYLHOPANE
L	17β(H),21β(H)-ETHYLHOPANE
γ	(22S)-17α(H),21β(H)-30-n-BUTYLHOPANE
δ	(22R)-17α(H),21β(H)-30-n-BUTYLHOPANE
ε	(22S)-17α(H),21β(H)-30-n-PENTYLHOPANE
ζ	(22R)-17α(H),21β(H)-30-n-PENTYLHOPANE

BIOMARKER IDENTIFICATION - STERANES

BP CODE	TENTATIVE ASSIGNMENT BASED ON MASS SPECTROMETRY (m/e 217)
10	(20S)-13β(H),17α(H)-DIACHOLESTANE
11	(20R)-13β(H),17α(H)-DIACHOLESTANE
13	(20S)-13α(H),17β(H)-DIACHOLESTANE
14	(20R)-13α(H),17β(H)-DIACHOLESTANE
15	(24S/R)-(20S)-13β(H),17α(H)-24-METHYLDIACHOLESTANE
16	(24S/R)-(20S)-13β(H),17α(H)-24-METHYLDIACHOLESTANE
18	(24S/R)-(20R)-13β(H),17α(H)-24-METHYLDIACHOLESTANE
19	(24R/S)-(20R)-13β(H),17α(H)-24-METHYLDIACHOLESTANE
20A	(24S/R)-(20S)-13α(H),17β(H)-24-METHYLDIACHOLESTANE
20B	(20S)-5α(H),14α(H),17α(H)-CHOLESTANE
21A	(24R+S)-(20S)-13β(H),17α(H)-24-ETHYLDIACHOLESTANE
21B	(20R)-5α(H),14β(H),17β(H)-ISOCHOLESTANE
22	(20S)-5α(H),14β(H),17β(H)-ISOCHOLESTANE
25	(20R)-5α(H),14α(H),17α(H)-CHOLESTANE
27	(24S+R)-(20R)-13β(H),17α(H)-24-ETHYLDIACHOLESTANE
29	(24S+R)-(20S)-13α(H),17β(H)-24-ETHYLDIACHOLESTANE
33A	(24S+R)-(20R)-5α(H),14β(H),17β(H)-24-METHYLISOCHOLESTANE
33B	(24S+R)-(20R)-13α(H),17β(H)-24-ETHYLDIACHOLESTANE
34	(24S+R)-(20S)-5α(H),14β(H),17β(H)-24-METHYLISOCHOLESTANE
36	(24S+R)-(20R)-5α(H),14α(H),17α(H)-24-METHYLCHOLESTANE
39	(24S+R)-(20S)-5α(H),14α(H),17α(H)-24-ETHYLCHOLESTANE
40	(24S+R)-(20S)-5α(H),14β(H),17β(H)-24-ETHYLISOCHOLESTANE
41	(24S+R)-(20R)-5α(H),14β(H),17β(H)-24-ETHYLISOCHOLESTANE
42	(24S+R)-(20R)-5α(H),14α(H),17α(H)-24-ETHYLCHOLESTANE
46	(24S+R)-(20R)C_{30} STERANE

BIOMARKER IDENTIFICATION - AROMATIC STEROIDAL HYDROCARBONS (AROMATIC STERANES)

BP CODE	TENTATIVE ASSIGNMENT BASED ON MASS SPECTROMETRY (m/e 253 mass fragmentogram)
F22	C_{21} DIMETHYL MONOAROMATIC STERANE
F23	C_{22} DIMETHYL MONOAROMATIC STERANE
F2	C_{27}(20S)5β(H)DIMETHYL MONOAROMATIC STERANE
F3	C_{27}(20R)5β(H)DIMETHYL MONOAROMATIC STERANE
F4	C_{27}(20S)5α(H)DIMETHYL MONOAROMATIC STERANE
F5	C_{28}(20S)5β(H)DIMETHYL MONOAROMATIC STERANE
F6	C_{27}(20R)5α(H)DIMETHYL MONOAROMATIC STERANE
F7	C_{28}(20S)5α(H)DIMETHYL MONOAROMATIC STERANE
F8	C_{28}(20R)5β(H)DIMETHYL MONOAROMATIC STERANE
F9	C_{29}(20S)5β(H)DIMETHYL MONOAROMATIC STERANE
F10	C_{29}(20S)5α(H)DIMETHYL MONOAROMATIC STERANE
F11	C_{28}(20R)5α(H)DIMETHYL MONOAROMATIC STERANE
F12	C_{29}(20R)5β(H)DIMETHYL MONOAROMATIC STERANE
F13	C_{29}(20R)5α(H)DIMETHYL MONOAROMATIC STERANE
Ω	$C_{20}H_{12}$ POLYAROMATIC HYDROCARBONS
	(m/e 231 mass fragmentogram)
F14	C_{20}METHYL TRIAROMATIC STERANE
F15	C_{21}METHYL TRIAROMATIC STERANE
F16	C_{26}(20S)METHYL TRIAROMATIC STERANE
F17	C_{26}(20R)METHYL TRIAROMATIC STERANE
F18	C_{27}(20S)METHYL TRIAROMATIC STERANE
F19	C_{28}(20S)METHYL TRIAROMATIC STERANE
F20	C_{27}(20R)METHYL TRIAROMATIC STERANE
F21	C_{28}(20R)METHYL TRIAROMATIC STERANE

BIOMARKER IDENTIFICATION - NORHOPANES

BP CODE	TENTATIVE ASSIGNMENT BASED ON MASS SPECTROMETRY (m/e 177)
W	17α(H)-25,30-BISNORHOPANE
Y	17α(H)-25-NORHOPANE
D	17α(H),21β(H)-30-NORHOPANE
C1	(22S)-17α(H)-25-NOR-30-METHYLHOPANE
G	17α(H),21β(H)HOPANE
C2	(22R)-17α(H)-25-NOR-30-METHYLHOPANE
C3	(22S)-17α(H)-25-NOR-30-ETHYLHOPANE
C4	(22R)-17α(H)-25-NOR-30-ETHYLHOPANE
C5	(22S)-17α(H)-25-NOR-30-n-PROPYLHOPANE
C6	(22R)-17α(H)-25-NOR-30-n-PROPYLHOPANE
C7	(22S)-17α(H)-25-NOR-30-n-BUTYLHOPANE
C8	(22R)-17α(H)-25-NOR-30-n-BUTYLHOPANE
C9	(22S)-17α(H)-25-NOR-30-n-PENTYLHOPANE
C10	(22R)-17α(H)-25-NOR-30-n-PENTYLHOPANE