5.3 Formation Pressure Measurements

A Dresser Atlas Formation Multi Tester (FMT) with both a HP-gauge and a strain gauge were used to measure the formation pressures.

A total of eleven runs with the FMT-tool were performed including the final logging runs (No. 2 and 3). The measurements are summarized in table 5.4.

Six segregated samples were recovered; these are reported in table 5.5.

From the formation pressure plot, fig. 5.1, the gas-oil contact (GOC) is found at 2514 m RKB and the oil-water contact (OWC) at 2525.5 m RKB.

5.4 Testing

Three production tests were performed. One in the oil bearing section and two in the gas bearing section of the Tomma Formation.

The following intervals were tested:

DST No. 1, oil zone: 2519.0 - 2520.5 m RKB.
DST No. 2, gas zone: 2495.7 - 2508.7 m RKB.
DST No. 3, gas zone: 2413.0 - 2419.5 m RKB.

The test objectives were to:

- sample representative reservoir fluid).
- estimate the reservoir pressure and temperature.
- define maximum sand free production.
- obtain the gas and liquid productivity.
- evaluate the reservoir parameters.
- obtain gas/water coning.

DST No. 1

The zone was perforated with an underbalance of 20 bar. The clean-up flow had a duration of seven hours followed by a three hours build-up period.

The bottomhole sampling programme was carried out, and four samples were collected.

The surfaee sampling was carried out during the ten hours long main flow. Six sets for recombination were collected.

One of the objectives of the test was to investigate the gas or water coning behavior.

The rate was therefore increased in steps, and while producing approx. 1500 m^3/d, the GOR started to increase, thus indicating that a gas cone had reached the perforations. After 12 hours of increasing GOR, the rate was decreased in steps and the GOR observed. The rate had to be reduced to 200 Sm^3/d to regain the initial GOR. Collected one sample set for recombination at the end of the gas coning flow period.

The flowperiods, flowrates, and the GOR history are shown in fig. 5.2. Note that the GOR curve has been time shifted (tubing-effect) and adjusted to one set of separator conditions.

The testresults are listed in tables 5.6 and 5.7.

DST No. 2

The interval was perforated with an underbalance of 20 bar. A seven hours long clean-up flow was carried out.

Three bottomhole samples were collected during a 3.5 hours long sampling period. The bottom hole sampling was performed before the main flow in order to have a minimum of liquid drop-out in the wellbore/reservoir.

Performed a 15 hours long main flow during which surface samples were taken from the separator and from a Thornton minilab.

A multirate flow period lasting for 15 hours was carried out.

The flow periods and flowrates are shown in fig. 5.3.

The test results are listed in tables 5.8 and 5.9.

DST No. 3

The interval was perforated with an underbalance of 20 bar. The well was flowed for four hours. High rate sampling gauges were run on wireline in order to get data from the fast build-up anticipated. The well was cleaned up for another three hours and a pressure build-up survey was performed. The gauges got stuck in the "F"-nipple and could not be retrieved.

Surface sampling at the Thornton minilab and at the separator was carried out during the 16 hours long main flow.

Five bottomhole samples were collected.

Finalized the testing of this zone with a multirate flow that had a duration of 16 hours, followed by a short pressure build-up period.

All flowperiods and flowrates are shown in fig. 5.4, while testresults are listed in tables 5.10 and 5.11.

No sand production was observed during the testing of the three zones.

5.5 Fluid Analyses

Six FMT chambers containing pressurized reservoir fluid were collected. Sampling depth and fluid type are listed in table. 5.5.

Fluid samples were obtained from all three drillstem tests.

During the test in the oil zone (DST No. 1) both bottom hole samples and separator samples were collected. Analyses of fluid samples from the oil zone, both FMT and BH, are listed in table 5.12.

In the tests in the gas zone (DST No. 2 and DST No. 3) three different sampling techniques were used. In addition to the usual bottom hole sampling and separator sampling, the Thornton test manifold and minilab were used to collect samples of the two phase flow at wellhead. Analyses will be performed on all three types of samples. To date, only some preliminary data from the analyses of one recombined separator sample and the two bottom hole samples of best quality, are available. These analyses together with the analyses of one FMT sample are listed in table 5.13.

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TABLE 5.4: FORMATION PRESSURE MEASUREMENTS

WELL: 6507/11-3

RUN No.	DEPTH (m RKB)	HYDROSTATIC MUD PRESSURE (psia)	TEMPERATURE CORRECTED (bar) FORMATION PRESSURE (psia)	(bar)
2A	2418.5	5627.1	3623.4	249.9
"	2427.0	5641.6	3626.7	250.1
"	2443.0	5674.1	3629.5	250.3
"	2456.0	5701.3	3633.4	250.6
"	2473.5	5739.6	3637.9	250.9
"	2480.0	5753.6	3640.2	251.0
"	2498.0	5795.2	3652.9	251.9
"	2507.5	5815.9	3647.6	251.6
"	2512.0	5827.6	3651.7	251.8
"	2516.5	5848.5	3655.4	252.1
"	2520.0	5857.6	3659.4	252.4
"	2523.0	5861.2	3661.3	252.5
"	2525.0	5862.9	3669.7	253.1
"	2529.5	5878.1	3669.4	253.1
"	2535.3	5892.0	3680.5	253.8
"	2513.5	5845.3	3654.9	252.1
	2525.0	5869.8	3665.6	252.8
2B	2418.4	5427.3	3623.5	249.9
"	2456.0	5508.2	3634.3	250.6
"	2480.0	5568.3	3644.1	251.3
"	2507.5	5629.4	3650.9	251.8
"	2530.0	5685.4	3669.4	253.1
2K	2642.0	4630.0	3804.0	262.1
"	2675.0	4685.0	3853.0	265.5
"	2730.0	4779.0	3934.0	271.0
"	2810.0	4920.0	4049.0	279.0
"	2872.0	5027.0	4140.0	285.2
"	2940.0	5144.0	4241.0	292.2
"	3090.0	5415.0	4475.0	308.3
"	3200.0	5593.0	4646.0	320.1
"	3226.0	5634.0	4686.0	322.9

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TABLE 5.5: FMT SAMPLES

WELL: 6507/11-3

Depth (m RKB)	Opening pressure (bar)	Temp. (°C)	Type of fluid
2426.5	310	98°C	gas condensate
2456.0	ca. 170	90°C	gas condensate
2473.5 1)	ca. 190	90°C	gas condensate
2512.0 1)	265	100°C	gas condensate
2516.3	-	-	oil
2520.0	-	-	oil

1) Owing to leakage no sample could be transferred

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TABLE 5.6: FLOW DATA
WELL : 650//11-3 DST NO. 1

Event	Date	Clock time (hrs.min)	Choke (mm)	Flowrate (Sm^3/d)	Bottomhole pressure (bar)	Wellhead pressure (bar)	GOR (Sm^3/Sm^3)
Clean-up flow period	28.7	03:30	7.9	210	248.4	91.8	127
First bottom hole sampling flow	29.7	11:30	6.4	138	248.6	89.7	133
Second bottom hole sampling flow	29.7	19:30	6.4	128	248.7	89.5	133
Main flow	30.7	09:00	9.5	301	248.2	95.0	143
Gas-coning flow	30.7	20:45	12.7	535	247.6	95.8	143
	31.7	00:30	17.5	825	246.5	93.7	133
	"	16:15	25.4	1423	243.2	96.3	198
	01.8	04:15	14.3	612	247.0	111.1	201
	"	16:15	7.9	203	248.4	96.6	149

Note: The GOR is measured at different separator conditions.
The bottomhole pressures are measured at 2471.8 m RKB.
The initial pressure at this depth is 249.1 bar.

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TABLE 5.7: BUILD UP DATA
WELL : 6507/11-3 DST NO. 1

MAIN BUILD UP

Date	Time	Pressure	
30.7	09.12.54	248.24	Last flowing pressure
	09.13.18	248.97	
	09.13.48	249.03	
	09.14.48	249.04	
	09.18.48	249.07	
	09.26.48	249.09	
	09.58.48	249.08	
	10.30.48	249.08	
	11.34.48	249.07	
	12.26.48	249.06	

Pressures are from SDP gauge No. 84215 at 2471.8 m RKB.

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TABLE 5.8: FLOW DATA

WELL: 6507/11-3 DST NO. 2

Event	Date	Clock time (hrs.min)	Choke (mm)	Gas rate (10^{6x} Sm^3/d)	Bottomhole pressure (bar)	Wellhead pressure (bar)	CGR ($Sm^3/10^6$ xSm^3)
Clean-up flow	4.8	15:00	14.3	0.587	249.5	190.2	126
Bottom hole sampling	4.8	22:00	9.5	0.258	250.2	195.2	114
Main flow	5.8	17:00	14.3	0.564	249.6	190.9	146
Multi rate flow	5.8	23:00	31.8	1.450	245.0	128.2	166
	6.8	03:00	12.7	0.498	249.8	193.8	142
	"	07:00	22.2	1.130	243.3	162.1	157
	"	11:00	31.8	1.480	245.2	128.6	162

Note: The CGR is measured at different separator conditions.
The bottomhole pressures are measured at 2448.2 m RKB.
The initial pressure at this depth is 250.4 bar.

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TABLE 5.9: BUILD-UP DATA

WELL: 6507/11-3 DST NO. 2

BUILD-UP AFTER THE MULTIRATE FLOW

Date	Time	Pressure (bar)	
6.8	11.00.00	247.63	Last flowing pressure
	11.00.10	251.21	
	11.00.20	251.34	
	11.00.40	251.32	
	11.06.00	251.34	
	11.48.40	251.33	
	12.10.00	251.33	
	12.29.20	251.32	

Pressures are from SDP gauge No. 84275 at 2457.5 m RKB.

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TABLE 5.10: FLOW DATA
WELL : 6507/11-3, DST NO. 3

Event	Date	Clock time (hrs.min)	Choke (mm)	Gas rate (10^6 x Sm^3/d)	Bottomhole pressure (bar)	Wellhead pressure (bar)	CGR ($Sm^3/10^6$ xSm^3)
Clean-up flow	9.8	11:00	15.9	0.655	247.9	187.2	147
Main flow	10.8	21:00	14.3	0.584	248.1	190.8	141
Bottomhole sampling	11.8	05:00	9.5	0.286	248.7	195.8	145
Multi rate flow	11.8	11:00	38.1	1.736	242.9	101.1	161
	11.8	16:00	12.7	0.488	248.3	193.9	146
	11.8	20:00	20.6	0.981	246.9	174.6	150
	11.8	24:00	31.7	1.513	244.4	132.9	155

Note: The CGR is measured at different separator conditions.
The bottomhole pressures are measured at 2375 m RKB.
The initial pressure at this depth is 249.0 bar.

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TABLE 5.11: BUILD-UP DATA

WELL: 6507/11-3 DST NO. 3

BUILD UP PERIOD AFTER THE CLEAN UP FLOW

	Date	Time	BHP (bar)	
9.8	11.02.30	228.699		Last flowing pressure
	11.02.32	249.012		
	11.02.36	249.057		
	11.02.42	249.070		
	11.02.56	249.092		
	11.03.30	249.105		
	11.04.00	249.112		
	11.04.30	249.118		
	11.05.00	249.121		
	11.06.00	249.123		
	11.07.00	249.126		
	11.08.00	249.130		
	11.10.00	249.132		
	11.15.00	249.148		
	11.20.00	249.160		
	11.30.00	249.160		
	11.45.00	249.176		
	12.00.00	249.170		

Pressures are taken from SDP gauge No. 84222 at 2395.9 m RKB.

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TABLE 5.12: FLUID ANALYSES
OIL ZONE
WELL : 6507/11-3

PVT-DATA

Sample type	:	BHS	FMT
Analyzed by	:	Flopetrol	Geco
Type of reservoir fluid	:	Oil	Oil
Perforated interval (m RKB)	:	2519-2520.5	2520
Separator oil production rate (bbl/d)	:	845.7	-
Bubble point pressure (bar)	:	249.6	255
Formation volume factor (Rm^3/m^3) (1)	:		1.479
Solution gas oil ratio (Sm^3/m^3) (1)	:		158.6
Reservoir oil viscosity (mPas)	:		0.36
Reservoir oil density (kg/m^3)	:		662.7
Stock tank oil gravity	:	0.8506 (3)	0.8458 (2)

Composition

	mol %	mol %
N_2	0.17	0.10
CO_2	0.56	0.51
C_1	44.58	46.71
C_2	8.74	8.59
C_3	4.54	4.60
$i\text{-}C_4$	0.94	0.84
$n\text{-}C_4$	1.78	1.79
$i\text{-}C_5$	0.68	0.76
$n\text{-}C_5$	0.79	0.85
C_6	1.18	1.07
C_7	2.53	2.34
C_8	3.84	3.69
C_9	2.62	2.37
C_{10+}	27.00	25.78
Molecular weight C_{10+}	243	251
Density C_{10+} (kg/m_3	869	869.4

1). Corrected for three-stage flash: 1) 70 bar, 68 °C, 2) 18 bar, 27 °C, 3) Atm, 15 °C.

2). After three stage flash

3). After single stage flash

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TABLE 5.13: PVT DATA

WELL: 6507/11-3

PVT-DATA

Sample type	FMT	separator	BHS	BHS
Analyzed by	Geco	Flopetrol	Flopetrol	Flopetrol
Type of reservoir fluid	gas	gas	gas	gas
DST No.		2	2	3
Perforated interval (m RKB)	2426.5	2495-2508	2495-2508	2412.7-2419.7
Separator gas rate (Sm^3/d)	-	0.57×10^6		
Dew point pressure (bar)	256	277	270	260.4
Max. retrograde liquid deposit (%) (4)				
(T=90.3°C P=75.5 bar)	2.58			
(T=90.3°C P=70.9 bar)		2.19		
Reservoir fluid gravity (air = 1)	0.722		0.742	0.746
Stock tank condensate gravity 15°C	0.809		0.806	0.808

Composition

	mol %	mol %	mol %	mol %
N_2	0.56	0.67	0.78	0.48
CO_2	0.67	0.76	0.57	0.70
C_1	83.61	81.98	82.63	82.49
C_2	8.76	8.54	9.08	8.93
C_3	3.12	3.54	3.00	3.36
$i\text{-}C_4$	0.46	0.62	0.48	0.54
$n\text{-}C_4$	0.80	1.06	0.83	0.95
$i\text{-}C_5$	0.28	0.32	0.26	0.30
$n\text{-}C_5$	0.26	0.33	0.29	0.32
C_6	0.22	0.36	0.35	0.35
C_7	0.24	0.49	0.48	0.43
C_8	0.34	0.56	0.55	0.44
C_9	0.28	0.27	0.22	0.19
C_{10+}	0.40	0.50	0.48	0.52
Gas gravity (air = 1)	0.722	0.756	0.742	0.746
Molecular weight	20.91	21.89	21.5	21.6

4) % of hydrocarbon pore space from constant mass study.

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6.2.1 MUD PROPERTIES, DAILY REPORT
Well no: 6507/11-3

Date	Hole size	Hole depth	Mud weight	PV	YP	Gel strength	pH	Alkalinity Pf / Mf	Ca++ mg/l	Cl- mg/l	Sand %	Solids %	Mudtype
850603	36	316.0	1.03										SPUD MUD
850604	36	406.0	1.03										SPUD MUD
850605	36	421.0	1.03										SPUD MUD
850606	17-1/2	449.0	1.05	10	25	30/60	11.0	1.0/0.3	120	1200			GEL MUD
850607	17-1/2	772.0	1.17	10	29	33/54	9.3	0.1/0.2	120	1800	0.3	9.0	GEL MUD
850608	26	868.0	1.18	10	33	35/70	9.4	0.1/0.3	120	2200	0.3	10.0	GEL MUD
850609	26	868.0	1.13	10	20	18/28	8.7	0.1/0.2	160	4000	0.3	10.0	GEL MUD
850610	26	868.0	1.50							19000			GEL MUD
850611	26	868.0	1.50							19000			GEL MUD
850612	26	868.0	1.14	18	28	4/7	9.3	0.1/0.2	1120	19000		5.0	GYP/POLYMER MUD
850613	26	868.0	1.12	14	17	2/3	9.3	0.1/0.3	1120	19000		5.0	GYP/POLYMER MUD
850614	26	868.0	1.12	14	17	2/3	9.3	0.1/0.3	1120	19000		5.0	GYP/POLYMER MUD
850615	26	868.0	1.12	14	17	2/3	9.3	0.1/0.3	1120	19000		5.0	GYP/POLYMER MUD
850616	26	868.0	1.12	14	17	2/3	9.3	0.1/0.3	1120	19000		5.0	GYP/POLYMER MUD
850617	26	868.0	1.12	14	17	2/3	9.3	0.1/0.3	1120	19000		5.0	GYP/POLYMER MUD
850618	26	868.0	1.12	14	17	2/3	9.3	0.1/0.3	1120	19000		5.0	GYP/POLYMER MUD
850619	26	868.0	1.12	14	17	2/3	9.3	0.1/0.3	1120	19000		5.0	GYP/POLYMER MUD
850620	26	868.0	1.12	14	17	2/3	9.3	0.1/0.3	1120	19000		5.0	GYP/POLYMER MUD
850621	26	868.0	1.12	14	17	2/3	9.3	0.1/0.3	1120	19000		5.0	GYP/POLYMER MUD
850622	26	868.0	1.12	14	17	2/3	9.3	0.1/0.3	1120	19000		5.0	GYP/POLYMER MUD
850623	26	868.0	1.12	14	17	2/3	9.3	0.1/0.3	1120	19000		5.0	GYP/POLYMER MUD
850624	26	868.0	1.12	14	17	2/3	9.3	0.1/0.3	1120	19000		5.0	GYP/POLYMER MUD
850625	26	868.0	1.12	14	17	2/3	9.3	0.1/0.3	1120	19000		5.0	GYP/POLYMER MUD
850626	26	868.0	1.12	14	17	2/3	9.3	0.1/0.3	1120	19000		5.0	GYP/POLYMER MUD
850627	26	868.0	1.03	14	17	2/3	9.3	0.1/0.3	1120	19000		5.0	GYP/POLYMER MUD
850628	17-1/2	873.0	1.15	14	25	3/5	10.0	0.1/0.4	1200	20000	1.0	8.0	GYP/POLYMER MUD
850629	17-1/2	1311.0	1.20	16	20	4/7	9.5	0.1/0.3	2160	21000	1.6	11.5	GYP/POLYMER MUD
850630	17-1/2	1584.0	1.23	18	19	5/14	9.3	0.1/0.3	2560	20000	1.5	13.0	GYP/POLYMER MUD
850701	17-1/2	1918.0	1.40	21	25	20/40	9.2	0.1/0.5	2200	21000	2.0	15.0	GYP/POLYMER MUD
850702	17-1/2	1918.0	1.40	23	19	20/40	8.8	0.1/0.5	2080	21000	2.0	16.0	GYP/POLYMER MUD

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6.2.1 MUD PROPERTIES, DAILY REPORT
Well no: 6507/11-3

Date	Hole size	Hole depth	Mud weight	PV	YP	Gel strength	pH	Alkalinity Pf / Mf	Ca++ mg/l	Cl- mg/l	Sand %	Solids %	Mudtype
850703	17-1/2	1903.0	1.40	21	18	18/40	8.8	0.1/0.5	2080	21000	2.0	16.0	GYP/POLYMER MUD
850704	12-1/4	1890.0	1.40	12	18	15/38	9.4	0.1/1.0	1760	20000	2.0	15.0	GYP/POLYMER MUD
850705	12-1/4	2154.0	1.53	25	19	25/60	9.6	0.1/1.5	2400	16000	2.0	17.0	GYP/POLYMER MUD
850706	12-1/4	2318.0	1.53	37	23	12/42	9.7	0.1/2.0	1480	1300	1.0	18.0	GYP/POLYMER MUD
850707	12-1/4	2403.0	1.60	36	17	9/39	10.0	0.1/1.8	1320	9000	1.0	20.0	GYP/POLYMER MUD
850708	12-1/4	2437.0	1.60	33	15	5/22	10.2	0.1/1.9	1480	8000	1.5	20.0	GYP/POLYMER MUD
850709	12-1/4	2467.0	1.60	29	13	3/19	10.2	0.2/2.2	1000	7000	2.0	19.0	GYP/POLYMER MUD
850710	12-1/4	2494.0	1.60	32	15	3/22	10.3	0.2/1.9	1000	7000	2.0	20.0	GYP/POLYMER MUD
850711	12-1/4	2536.0	1.60	29	14	4/20	10.0	0.2/2.0	960	7000	0.8	22.0	GYP/POLYMER MUD
850712	12-1/4	2615.0	1.60	26	19	4/24	10.0	0.1/1.6	760	8000	0.3	24.0	GYP/POLYMER MUD
850713	12-1/4	2615.0	1.60	28	15	4/25	9.8	0.1/1.5	760	8000	0.3	24.0	GYP/POLYMER MUD
850714	12-1/4	2615.0	1.60	20	14	3/25	9.8	0.1/1.0	760	10000	0.3	24.0	GYP/POLYMER MUD
850715	12-1/4	2615.0	1.60	25	10	3/22	9.8	0.1/1.5	760	9000	0.1	24.0	GYP/POLYMER MUD
850716	12-1/4	2615.0	1.60	23	11	3/20	9.6	0.1/1.5	760	9000	0.1	24.0	GYP/POLYMER MUD
850717	12-1/4	2615.0	1.60	23	10	3/20	10.1	0.1/1.5	600	9000	0.1	23.0	GYP/POLYMER MUD
850718	8-1/2	2622.0	1.26	19	10	2/18	10.7	0.3/1.8	200	5000	0.1	12.0	GEL MUD
850719	8-1/2	2644.0	1.21	17	10	3/15	10.6	0.2/1.5	160	4300	0.1	12.0	GEL MUD
850720	8-1/2	2673.0	1.20	16	10	3/12	10.7	0.2/1.5	360	4500	0.1	14.0	GEL MUD
850721	8-1/2	2925.0	1.20	19	12	4/25	10.6	0.2/1.3	240	4500	0.3	12.0	GEL MUD
850722	8-1/2	3048.0	1.20	18	11	3/15	10.3	0.2/1.2	300	5000	0.1	10.0	GEL MUD
850723	8-1/2	3250.0	1.20	16	11	3/15	10.7	0.2/1.2	300	6000	0.1	10.0	GEL MUD
850724	8-1/2	3250.0	1.20	16	11	3/15	10.6	0.2/1.2	300	6000	0.1	10.0	GEL MUD
850725		2774.0	1.23	17	11	3/15	10.5	0.2/1.4	300	6000	0.1	10.0	GEL MUD
850726		2545.0	1.30	15	10	3/13	10.5	0.2/1.4	300	6000	0.1	10.0	GEL MUD
850727		2545.0	1.30	16	10	3/13	10.4	0.2/1.4	300	6000	0.1	10.0	GEL MUD
850728		2524.0	1.30	16	10	3/13	10.4	0.2/1.4	300	6000	0.1	10.0	GEL MUD
850729		2524.0	1.30	16	10	3/13	10.4	0.2/1.4	300	6000	0.1	10.0	GEL MUD
850730		2524.0	1.30	16	10	3/13	10.5	0.2/1.4	300	6000	0.1	10.0	GEL MUD
850731		2545.0	1.30	16	10	3/13	10.5	0.2/1.4	300	6000	0.1	10.0	GEL MUD
850801		2545.0	1.30	14	10	2/10	10.6	0.1/0.7	280	6000	0.1	10.0	GEL MUD

SAGA PETROLEUM A.S.

6.2.1 MUD PROPERTIES, DAILY REPORT
Well no: 6507/11-3

Date	Hole size	Hole depth	Mud weight	PV	YP	Gel strength	pH	Alkalinity Pf / Mf	Ca++ mg/l	Cl- mg/l	Sand %	Solids %	Mudtype
850802		2515.0	1.30	14	10	2/10	10.6	0.1/0.7	280	6000	0.1	10.0	GEL MUD
850803		2515.0	1.30	19	10	3/15	11.0	0.3/1.3	320	6000	0.1	10.0	GEL MUD
850804		2515.0	1.30	19	10	3/15	11.0	0.3/1.2	320	6000	0.1	10.0	GEL MUD
850805		2515.0	1.30	19	10	3/15	10.9	0.3/1.2	320	6000	0.1	10.0	GEL MUD
850806		2515.0	1.30	19	10	3/15	10.9	0.3/1.2	320	6000	0.1	10.0	GEL MUD
850807		2465.0	1.30	16	9	2/9	11.2	0.3/1.4	280	6000	0.1	10.0	GEL MUD
850808		2465.0	1.30	18	11	3/10	11.0	0.2/1.3	280	6000	0.1	11.0	GEL MUD
850809		2465.0	1.30	18	11	3/10	11.0	0.2/1.3	280	6000	0.1	11.0	GEL MUD
850810		2465.0	1.30	18	11	3/10	11.0	0.2/1.3	280	6000	0.1	11.0	GEL MUD
850811		2465.0	1.30	18	10	3/10	11.0	0.2/1.3	280	6000	0.1	11.0	GEL MUD
850812		2465.0	1.30	16	9	3/10	11.0	0.2/1.3	280	6000	0.1	11.0	GEL MUD
850813		.0	1.30	16	9	3/10	11.0	0.2/1.3	280	6000	0.1	11.0	GEL MUD
850814		.0	1.30	16	9	3/10	11.0	0.2/1.3	280	6000	0.1	11.0	GEL MUD

SAGA PETROLEUM A.S.

6.2.2 MUD MATERIALS USED

Well no: 6507/11-3

Materials	Unit	36 in hole	26 in hole	17-1/2 hole	12-1/4 hole	8-1/2 hole	Total
SAPP	50 KG	0	0	0	0	4	4
BARITE	M/T	13	421	275	403	48	1160
BICARBONATE	50 KG	0	0	0	5	7	12
CAUSTIC SODA	25 KG	12	16	68	116	53	265
DRISPAC REG	50 LB	0	0	91	2	0	93
DRISPAC S/L	50 LB	0	0	8	115	10	133
GYPSUM	50 KG	0	0	350	36	0	386
LIME	40 KG	3	0	0	0	0	3
MD	200 L	0	0	0	2	0	2
MILBIO	55 GA	0	0	4	1	0	5
MILPOL 302	25 KG	0	0	131	6	0	137
PERMALOSE	25 KG	0	0	243	34	0	277
PRO-DEFOAMER	25 L	0	0	2	5	5	12
W.O.21	25 KG	0	3	2	0	0	5
BENTONITE	M/T	32	40	0	23	15	110
BENTONITE	50 KG	0	0	36	0	0	36
PRO-THIN	25 KG	0	9	30	411	166	616

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IKU
SINTEF-GRUPPEN

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REPORT

REG. NO.:	ACCESSIBILITY:
86.064	Confidential

REPORT TITLE:

ANALYSIS OF FLUID SAMPLES, WELL 6507/11-3

REPORT NO.: 22.1812.00/01/86

AUTHORS:

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DATE:	NO. OF PAGES:	NO. OF APPENDICES:	PROJECT MANAGER:	SIGN.:
86.06.16	97	-	Liv Schou	Liv Schou

CLIENT:

Saga Petroleum a.s.

SUMMARY:

KEY WORDS:	
Fluids	
6507/11-3	
Hydrocarbon Characterisation	

155/u/anl/1

Skipnes

1. INTRODUCTION

In November 1985, one fluid sample with associated gas (DST 1, 2520 m) from well 6507/11-3 (see location map) was sent to IKU from GECO Petroleum Laboratory for organic geochemical analysis. The aim of the analyses was to characterise the sample with respect to type and maturity of hydrocarbons.

A draft report on this sample was sent to Saga Petroleum (att. E.S. Mo) in December 1985. In April 1986 an additional two fluid samples with associated gases from well 6507/11-3 were received at IKU for the same type of analysis. These analyses were assigned the IKU project code 22.1812 and the samples were given the following IKU numbers:

IKU no.	
C-2936	6507/11-2, DST 1 fluid
C-2937	6507/11-3, DST 1 gas
C-3980	6507/11-3, DST 2 fluid
C-3921	6507/11-3, DST 2 gas
C-3979	6507/11-3, DST 3 fluid
C-3920	6507/11-3, DST 3 gas

The results from single flash for the DST 1 sample were supplied by GECO as follows:

6507/11-3, DST 1 (C-2936 and C-2937):

Flash conditions:	350 barg, 90.8°C to atmosphere
Gas oil ratio:	171.3 Sm^3/Sm^3
B_o at 350 barg:	1.481 m^3/Sm^3
B_o at bubble point:	1.508 m^3/Sm^3
Density of oil at 15°C:	849.2 kg/m^3
Molecular weight of oil:	203
Standard conditions:	for gas volumes = 15°C and 1.000 bara
	for oil volumes = 15°C and atmospheric pressure.

For the DST 2 and DST 3 samples only the gas/oil ratios were supplied:

6507/11-3, DST 2 (C-3980 and C-3921):
Gas oil ratio: 12267 Sm^3/Sm^3

6507/11-3, DST 3 (C-3979 and C-3920):
Gas oil ratio: 10821 $Sm^{3h/Sm3}$

The following analytical program was applied to the samples:

Stock tank oil

- Sulphur content
- Nickel and vanadium content
- API gravity/density
- GC of C_2-C_8 hydrocarbons for recombination
- GC of whole oil
- Chromatographic separation (MPLC) with asphaltene precipitation
- Urea adduction of saturated hydrocarbons
- GC of saturated, branched/cyclic and aromatic hydrocarbons
- GC-MS of saturated hydrocarbons (m/z 191, 217, 218)
- GC-MS of aromatic hydrocarbons
- $^{13}C/^{12}C$ isotope ratios of SAT, ARO, NSO and asphaltenes.

Gas sample

- GC of C_1-C_8 hydrocarbons for recombination
- $^{13}C/^{12}C$ isotope ratios of C_1, C_2, C_3 and C_4
- D/H isotope ratio of C_1.

One copy of this report has been sent to Saga Petroleum a.s., attention E.S. Mo for approval. After approval ten copies of the report will be sent, and ten copies will be stored at IKU.

The analyses were assigned the IKU project code 22.1812.

2. EXPERIMENTAL PROCEDURES

2.1 Gas analysis

C_1-C_{10} analysis was carried out on an HP 5880 gas chromatograph equipped with a 50m x 0.2mm (I.D.) column fused silica column coated with OV 101. Helium was used as a carrier gas at 1ml/min. The inlet split ratio was 1:50. The temperature program was -30°C(1 min.) - 8°C/min. - 130°C (10 min.)

Quantification was carried out using a standard gas containing methane, ethane, propane, n-butane, n-pentane and n-hexane. In addition a natural gas standard obtained from Norsk Hydro was used.

2.2 C_2-C_8 analysis

C_4-C_{10} analysis was carried out on a HP 5880 A gas chromatograph equipped with a 50m x 0.2mm (I.D.) fused silica column coated with OV-101. Helium was used as carrier gas at 1ml/min. The inlet split ratio was 1:60. The temperature program was 35°C (5 min) - 8°C/min. - 200°C (2 min.) which gave good resolution from C_3 upwards. Quantitation was carried out using the same standard gas as for C_1-C_5+ analysis.

2.3 Evaporation of the light components in fluid samples

Prior to chromatographic separation of oil/condensate samples, the fractions boiling below 210°C were removed by heating the samples to constant weight at 210°C is obtained. The heating is performed at atmospheric pressure.

The fraction of light components is determined as the weight difference between the original sample and the amount that is left after the heating.

2.4 Asphaltene precipitation

The topped oil was dissolved in toluene (3:1, volume:weight, toluene:oil), n-pentane was added in excess ($\geq$ 40 times total volume of toluene and oil) and the solution was stored in the dark for 8-16 hours, at ambient temperature.

The solution was filtered to give maltenes on solvent evaporation by rotavapor. The precipitated asphaltenes were redissolved in DCM, and the combined solutions evaporated to constant weight of asphaltenes.

2.5 Chromatographic separation

The fraction of the oil boiling above 210°C was separated into saturated fraction, aromatic fraction and non hydrocarbon fraction using a MPLC system with hexane as eluant (Radke et al., Anal. Chem., 1980). The various fractions were evaporated on a Buchi Rotavapor and transferred to glass vials and dried in stream of nitrogen.

2.6 Urea adduction

Urea-adduction was performed on the saturated hydrocarbon fraction. The sample containing 5 mg of n-alkanes was dissolved in 2 ml of n-hexane and 1 ml of acetone was added. A saturated solution of urea in methanol (1 ml) was then added dropwise. The solvent was removed (N_2) and the adduction step repeated twice. The white crystals were rinsed (3x5ml hexane) and the combined extract filtered (cotton wool plug covered with Al_2O_3), to afford a non-adduct. GC analyses were performed on the samples after the urea adduction, using the same conditions as for the other GC analyses.

2.7 Gas chromatographic analysis

The C_2-C_8 hydrocarbons of the oil were determined on a Carlo Erba Fractovap GC. The column used was a 30m fused silica capillary column coated with SE-54. The temperature program applied was 50°C (2min.) to 180°C at 4°C/min.

The saturated, the branched/cyclic and the aromatic hydrocarbon fractions were each diluted with n-hexane and analysed on a HP 5730A. The GC is equipped with a 15m DB-1 fused silica column and hydrogen (ca. 2.5 ml/min.) is used as carrier gas. Injections are performed in split mode (split ratio 1:10). The temperature program applied is 80°C (2 min.) to 280°C at 4°C/min.

The data processing for all the GC analyses was performed on a VG Multichrom lab data system.

2.8 Gas chromatography - mass spectrometry (GC-MS)

GC-MS analyses were performed on a VG Micromass 70-70H GC-MS-DS system. The Varian Series 3700 GC was fitted with a fused silica OV-1 capillary column (30m x 0.3mm i.d.). Helium (0.7kg/cm^2) was used as carrier gas and the injections were performed in split mode (1.5µl, split ratio 1:15). The saturated hydrocarbons were analysed in multiple ion mode (MID) at a scan cycle time of approximately 2 secs. (Temperature program 120^{o}C (2 min.) - 4^{o}C(min. - 280^{o}C). Full data collection was applied for the aromatic hydrocarbons at a scan time of 1 sec/decade. (Temperature program 80^{o}C (2 min.) - 4^{o}C/min. - 280^{o}C). The mass spectrometer operated at 70eV electron energy and an ion source temperature of 200^{o}C. Data acquisition was done by VG data systems.

Peak identification was performed applying knowledge of elution patterns in certain mass chromatograms. Calculation of peak ratios was done from peak height in the appropriate mass chromatograms.

2.9 Isotope analysis

The isotope analysis was performed by mass spectrometry at Institute for Energy Technology (IFE) in Oslo according to their method. Their reference value for the standard NBS-22 is -29.8 (^{13}C isotope analysis).

2.10 S, Ni and V content of oil samples

The above analyses were carried out by the technical chemistry department of SINTEF. Atomic adsorbtion spectroscopy was used for Ni and V determination and the Eschka method for sulphur determination.

IKU SINTEF-GRUPPEN

Project no.: 22.1812
Well no.: 6507/11-3
DATE : 25 - 4 - 86.

T A B L E : 1.

API GRAVITY OF OIL SAMPLE

IKU-No	CODE	API GRAVITY (DENSITY)	
		Crude oil	>210'C
C 2936	DST 1	34.7 (0.8513)	31.6 (0.8678)
C 3980	DST 2	44.6 (0.8033)	35.5 (0.8471)
C 3979	DST 3	43.8 (0.8072)	36.4 (0.8427)

IKU SINTEF-GRUPPEN

Project no.: 22.1812
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T A B L E : 2.

CONTENT OF SULFUR, NICKEL AND VANADIUM IN OIL >210'

IKU-No	CODE	S %	Ni (mg/kg)	V (mg/kg)
C 2936	DST 1	0.17	0.63	0.88
C 3980	DST 2	0.08	0.22	0.17
C 3979	DST 3	0.05	0.07	0.11

Project no.: 22.1812
Well no.: 6507/11-3
DATE : 25 - 4 - 86.

T A B L E : 3.

FRACTION BOILING BELOW 210'C

IKU-No	CODE	Crude oil (mg)	EOM >210' (mg)	Low molecular weight compounds (mg)	(%)
C 2936	DST 1	370.6	328.0	42.6	11.5
C 3980	DST 2	983.9	146.3	837.6	85.1
C 3979	DST 3	1016.3	180.7	835.6	82.2

Table 4. Amount of asphaltenes.

IKU no.	Well no.	Crude oil (mg)	Asphaltenes (mg)	(%)
C-2936	6507/11-3, DST 1	6 668.7	6.6	0.1
C-3980	6507/11-3, DST 2		no asphaltenes	
C-3979	6507/11-3, DST 3		no asphaltenes	

Project no.: 22.1812
Well no.: 6507/11-3
DATE : 25 - 4 - 86

T A B L E : 5a

CONCENTRATION OF EOM AND CHROMATOGRAPHIC FRACTIONS

IKU-No	CODE	Crude oil (mg)	EOM >210' (mg)	Sat. (mg)	Aro. (mg)	HC (mg)	Non HC (mg)
C 2936	DST 1	370.6	328.0	132.6	54.0	186.6	141.4
C 3980	DST 2	983.9	146.3	91.1	29.7	120.8	25.5
C 3979	DST 3	1016.3	180.7	102.2	33.8	136.0	44.7

Project no.: 22.1812
Well no.: 6507/11-3
DATE : 25 - 4 - 86.

T A B L E : 5b

COMPOSITION OF OIL

IKU-No	CODE	Sat EOM %	Aro EOM %	HC EOM %	SAT Aro x 100	Non HC EOM %	HC Non HC x 100
C 2936	DST 1	40.4	16.5	56.9	245.6	43.1	132.0
C 3980	DST 2	62.3	20.3	82.6	306.7	17.4	473.7
C 3979	DST 3	56.6	18.7	75.3	302.4	24.7	304.3

C1-C8 YIELD
WELL NO:6507/11-3, DST 1
IKU NO,GAS: C-2937
IKU NO,OIL: C-2936
GOR = 171.3 SM3/SM3

Table 6a.
C_1-C_8 yield and recombination of oil and gas sample.

COMPOUND	GAS MG/ML	GAS MG/171.3ML	OIL MG/ML	TOTAL HC IN MG/ML OF RESERVOIR FLUID
Methane	0.493	84.451	0.000	84.451
Ethane	0.190	32.547	0.000	32.547
Propane	0.151	25.866	0.000	25.866
i-Butane	0.038	6.509	0.351	6.860
n-Butane	0.067	11.477	1.446	12.923
i-Pentane	0.024	4.111	3.330	7.441
n-Pentane	0.021	3.597	4.714	8.311
Cyclo-C5+				
2,3-diMeC4	0.003	0.514	1.710	2.224
2-MeC5	0.006	1.028	3.400	4.428
3-MeC5	0.003	0.514	2.389	2.903
n-Hexane	0.006	1.028	7.098	8.126
MeCyC5	0.004	0.685	6.809	7.494
Benzene	0.001	0.171	3.968	4.139
CycloC6	0.004	0.685	9.095	9.780
2-MeC6	0.000	0.000	2.339	2.339
2,3-diMeC5	0.000	0.000	0.770	0.770
3-MeC6	0.000	0.000	3.035	3.035
diMeCyC5	0.000	0.000	6.268	6.268
n-Heptane	0.000	0.000	7.939	7.939
MeCyC6	0.003	0.514	21.925	22.439
EtCyC5+				
2,5-diMeC6	0.000	0.000	2.168	2.168
2,4-diMeC6	0.000	0.000	1.159	1.159
triMeCyC5	0.000	0.000	0.877	0.877
Toluene	0.000	0.000	19.295	19.295
2-MeC7+				
4-MeC7	0.000	0.000	3.935	3.935
3-MeC7	0.000	0.000	2.505	2.505
diMeCyC6	0.000	0.000	6.765	6.765
n-Octane	0.000	0.000	8.548	8.548
2,4-diMeC7+				
diMeCyC6	0.000	0.000	1.529	1.529
EtCyC6	0.000	0.000	3.516	3.516
EtBenzene	0.000	0.000	2.943	2.943
m,p-xylene	0.000	0.000	15.565	15.565
2-MeC8+				
4-MeC8	0.000	0.000	3.198	3.198
O-Xylene	0.000	0.000	3.343	3.343
SUM	1.014	173.697	161.932	335.629

C1-C8 YIELD
WELL NO:6507/11-3 , DST 2
IKU NO,GAS: C-3921
IKU NO,OIL: C-3980
GOR = 12267 SM3/SM3

COMPOUND	GAS MG/ML	GAS MG/12267ML	OIL MG/ML	TOTAL HC IN MG/ML OF RESERVOIR FLUID
Methane	0.499	6119.467	0.000	6119.467
Ethane	0.115	1405.062	0.000	1405.062
Propane	0.065	801.280	0.000	801.280
i-Butane	0.014	171.947	0.000	171.947
n-Butane	0.025	304.688	0.000	304.688
i-Pentane	0.009	107.557	1.901	109.458
n-Pentane	0.009	111.912	3.137	115.049
Cyclo-C5+				
2,3-diMeC4	0.001	15.689	1.136	16.825
2-MeC5	0.003	35.587	3.163	38.750
3-MeC5	0.002	19.406	2.194	21.600
n-Hexane	0.004	46.615	7.334	53.949
MeCyC5	0.003	31.588	6.751	38.339
Benzene	0.001	17.088	3.652	20.740
CycloC6	0.003	32.446	9.808	42.254
2-MeC6	0.000	7.287	3.845	11.132
2,3-diMeC5	0.000	0.000	1.214	1.214
3-MeC6	0.000	7.323	4.802	12.125
diMeCyC5	0.000	8.918	7.256	16.174
n-Heptane	0.001	14.352	13.901	28.253
MeCyC6	0.003	34.176	33.950	68.126
EtCyC5+				
2,5-diMeC6	0.000	0.000	2.654	2.654
2,4-diMeC6	0.000	0.000	1.380	1.380
triMeCyC5	0.000	0.000	1.073	1.073
Toluene	0.000	9.102	27.911	37.013
2-MeC7+				
4-MeC7	0.000	0.000	7.965	7.965
3-MeC7	0.000	0.000	4.595	4.595
diMeCyC6	0.000	0.000	11.776	11.776
n-Octane	0.000	0.000	21.113	21.113
2,4-diMeC7+				
diMeCyC6	0.000	0.000	2.889	2.889
EtCyC6	0.000	0.000	7.530	7.530
EtBenzene	0.000	0.000	5.833	5.833
m+p-xylene	0.000	0.000	34.157	34.157
2-MeC8+				
4-MeC8	0.000	0.000	6.235	6.235
O-Xylene	0.000	0.000	7.204	7.204
SUM	0.757	9301.490	246.372	9547.849

C1-C8 YIELD
WELL NO:6507/11-3 , DST 3
IKU NO,GAS: C-3920
IKU NO,OIL: C-3979
GOR = 10821 SM3/SM3

COMPOUND	GAS MG/ML	GAS MG/10821ML	OIL MG/ML	TOTAL HC IN MG/ML OF RESERVOIR FLUID
Methane	0.556	6013.392	0.000	6013.392
Ethane	0.130	1402.953	0.000	1402.953
Propane	0.076	818.068	0.000	818.068
i-Butane	0.017	185.688	0.319	186.007
n-Butane	0.030	321.254	0.314	321.568
i-Pentane	0.014	146.419	2.169	148.588
n-Pentane	0.012	128.553	2.641	131.194
Cyclo-C5+				
2,3-diMeC4	0.002	20.138	2.050	22.188
2-MeC5	0.004	47.483	4.232	51.715
3-MeC5	0.002	26.436	2.708	29.144
n-Hexane	0.006	66.582	6.994	73.576
MeCyC5	0.004	46.606	6.354	52.960
Benzene	0.002	18.785	2.839	21.624
CycloC6	0.005	48.933	9.463	58.396
2-MeC6	0.001	12.747	3.577	16.324
2,3-diMeC5	0.000	7.834	1.269	9.103
3-MeC6	0.001	12.964	4.926	17.890
diMeCyC5	0.002	21.480	7.461	28.941
n-Heptane	0.002	26.847	12.502	39.349
MeCyC6	0.006	65.402	30.448	95.850
EtCyC5+				
2,5-diMeC6	0.000	0.000	2.455	2.455
2,4-diMeC6	0.000	3.993	1.436	5.429
triMeCyC5	0.000	0.000	1.112	1.112
Toluene	0.001	14.316	22.481	36.797
2-MeC7+				
4-MeC7	0.000	4.718	7.649	12.367
3-MeC7	0.000	0.000	4.466	4.466
diMeCyC6	0.000	4.621	11.259	15.880
n-Octane	0.000	7.813	19.425	27.238
2,4-diMeC7+				
diMeCyC6	0.000	0.000	3.533	3.533
EtCyC6	0.000	0.000	7.179	7.179
EtBenzene	0.000	0.000	4.896	4.896
m+p-xylene	0.000	0.000	31.064	31.064
2-MeC8+				
4-MeC8	0.000	0.000	5.721	5.721
O-Xylene	0.000	0.000	6.982	6.982
SUM	0.873	9474.025	229.942	9703.949

Table 6b. Composition of gas-samples.

C-2937, 6507/11-3, DST 1

Methane	:	48.6%
Ethane	:	18.7%
Propane	:	14.9%
i-Butane	:	3.7%
n-Butane	:	6.6%
i-Pentane	:	2.4%
n-Pentane	:	2.1%
ΣC_1-C_5	:	97.0%

Wetness : 47% (51%)

C-3921, 6507/11-3, DST 2

Methane	:	65.9%
Ethane	:	15.2%
Propane	:	8.6%
i-Butane	:	1.8%
n-Butane	:	3.3%
i-Pentane	:	1.2%
n-Pentane	:	1.2%
ΣC_1-C_5	:	97.0%

Wetness : 30% (34%)

3920, 6507/11-3, DST 3

Methane	:	63.7%
Ethane	:	14.9%
Propane	:	8.7%
i-Butane	:	1.9%
n-Butane	:	3.4%
i-Pentane	:	1.6%
n-Pentane	:	1.4%

$\Sigma C_1\text{-}C_5$: 95.6%

Wetness : 31% (36%)

Wetness is given as:

$$\frac{\Sigma C_2\text{-}C_4}{\Sigma C_1\text{-}C_4} \quad \text{or} \quad \left(\frac{\Sigma C_2\text{-}C_n}{\Sigma C_1\text{-}C_n}\right)$$

T A B L E 7

TABULATION OF DATA FROM THE GASCHROMATOGRAMS

IKU No.	CODE	PRISTANE / n-C17	PRISTANE / PHYTANE	CPI-1
C 2936	DST 1	0.7	1.6	1.1
C 3980	DST 2	0.6	2.3	1.0
C 3979	DST 3	0.7	2.5	0.9

DATE : 25 - 4 - 86.

Table 8a. Molecular parameters from aromatic hydrocarbon GC's.

IKU no.	Well no.	MPI 1	MPI 2
C-2936	6507/11-3, DST 1	1.01	0.81
C-3980	6507/11-3, DST 2	not calculable	
C-3979	6507/11-3, DST 3	not calculable	

MPI 1 = methylphenanthrene index 1 = 1.5 x (3MP+2MP)/(P+9MP+1MP)
MPI 2 = methylphenanthrene index 2 = 3 x 2MP/(P+9MP+1MP)

Table 8b. Molecular ratios from sulphur-aromatic compound GC's.

IKU no.	Well no.	4-MDBT/DBT	2+3-MDBT/DBT	4-MDBT/1-MDBT
C-2936	6507/11-3, DST 1	3.49	0.91	24.8
C-3980	6507/11-3, DST 2	2.92	0.38	27.6
C-3979	6507/11-3, DST 3	2.47	0.40	26.9

Table 9. Molecular ratios calculated from terpanes and steranes mass chromatograms.
Maturity ratios.

IKU no.	Well no.	αβ/αβ+βα	%22S	%ββ	%20S
C-2936	6507/11-3, DST 1	0.91	62.4	82.2	50.0
*C-3980	6507/11-3, DST 2	-	-	73.7	40.0
*C-3979	6507/11-3, DST 3	0.89	55.6	78.6	50.0

Table 10. Molecular ratios calculated from terpanes and steranes mass chromatograms.
Source characteristics and maturity ratios.

IKU no.	Well no.	Q/E	Tm/Ts	X/E	Z/E	a/a+j
C-2936	6507/11-3, DST 1	0.13	0.32	0.26	0.10	0.94
*C-3980	6507/11-3, DST 2	1.00	-	0.31	-	-
*C-3979	6507/11-3, DST 3	1.00	-	0.25	-	-

* poor sample

Table 11. Isotope analysis.

Hydrogen isotope ratios of gas samples.

IKU no.		δD (C1)
C-2937	DST 1	-190.0
C-3921	DST 2	-200.0
C-3920	DST 3	-200.0

Carbon isotope ratios ($\delta^{13}C$) of gas components.

IKU no.		C_1	C_2	C_3	iC_4	nC_4
C-2937	DST 1	-42.2	-30.3	-27.1	-23.2	-21.4
C-3921	DST 2	-41.6	-28.1	-26.3	-25.7	-28.0
C-3920	DST 3	-41.7	-28.2	-25.8	-26.8	-27.8

Carbon isotope ratios ($\delta^{13}C$) of fluid fractions.

IKU no.		SAT	ARO	NSO	Asphaltenes	
C-2936	DST 1	-28.2	-26.2	-26.5	-27.6	-27.5
		-	-26.2	-	-27.4	
C-3980	DST 2	-28.3	-25.9	-	-	
C-3979	DST 3	-28.3	-25.9	-	-	

FIGURE 1

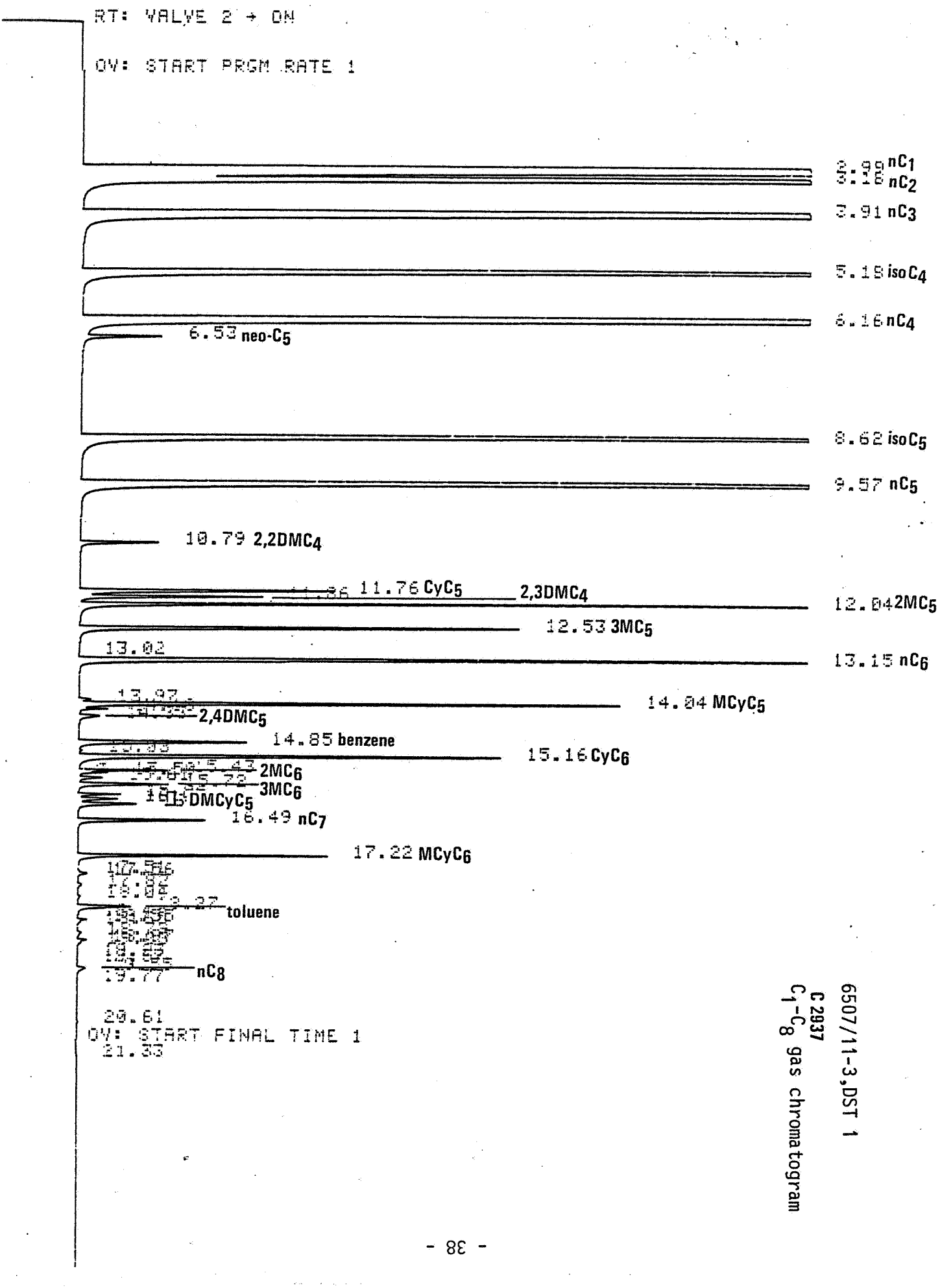
C_2-C_8 AND C_1-C_8 HYDROCARBON GAS CHROMATOGRAMS

C_2-C_8 list

List of C2-C8 hydrocarbons

C2	ethane
C3	propane
MC3	methyl-propane
nC4	butane
isoC5	iso-pentane
nC5	pentane
2,2DMC4	2,2-dimethyl-butane
CyC5	cyclopentane
2,3DMC4	2,3-dimethyl-butane
2MC5	2-methyl-pentane
3MC5	3-methyl-pentane
nC6	hexane
MCyC5	methyl-cyclopentane
benzene	
CyC6	cyclohexane
2MC6	2-methyl-hexane
2,3DMC5	2,3-dimethyl-pentane
3MC6	3-methyl-hexane
DMCyC5	dimethyl-cyclopentane
nC7	heptane
MCyC6	methyl-cyclohexane
EtCyC5	ethyl-cyclopentane
2,5DMC6	2,5-dimethyl-hexane
2,4DMC6	2,4-dimethyl-hexane
TMCyC5	trimethyl-cyclopentane
toluene	
2MC7	2-methyl-heptane
4MC7	4-methyl-heptane
3MC7	3-methyl-heptane
DMCyC6	dimethyl-cyclohexane
nC8	octane
2,4DMC7	2,4-dimethyl-heptane
EtCyC6	ethyl-cyclohexane
Et benzene	ethyl-benzene
m,p-xylene	meta,para-xylene
2MC8	2-methyloctane
4MC8	4-methyloctane
o-xylene	orto-xylene
int.std.	2,3,4-trimethyl-pentane

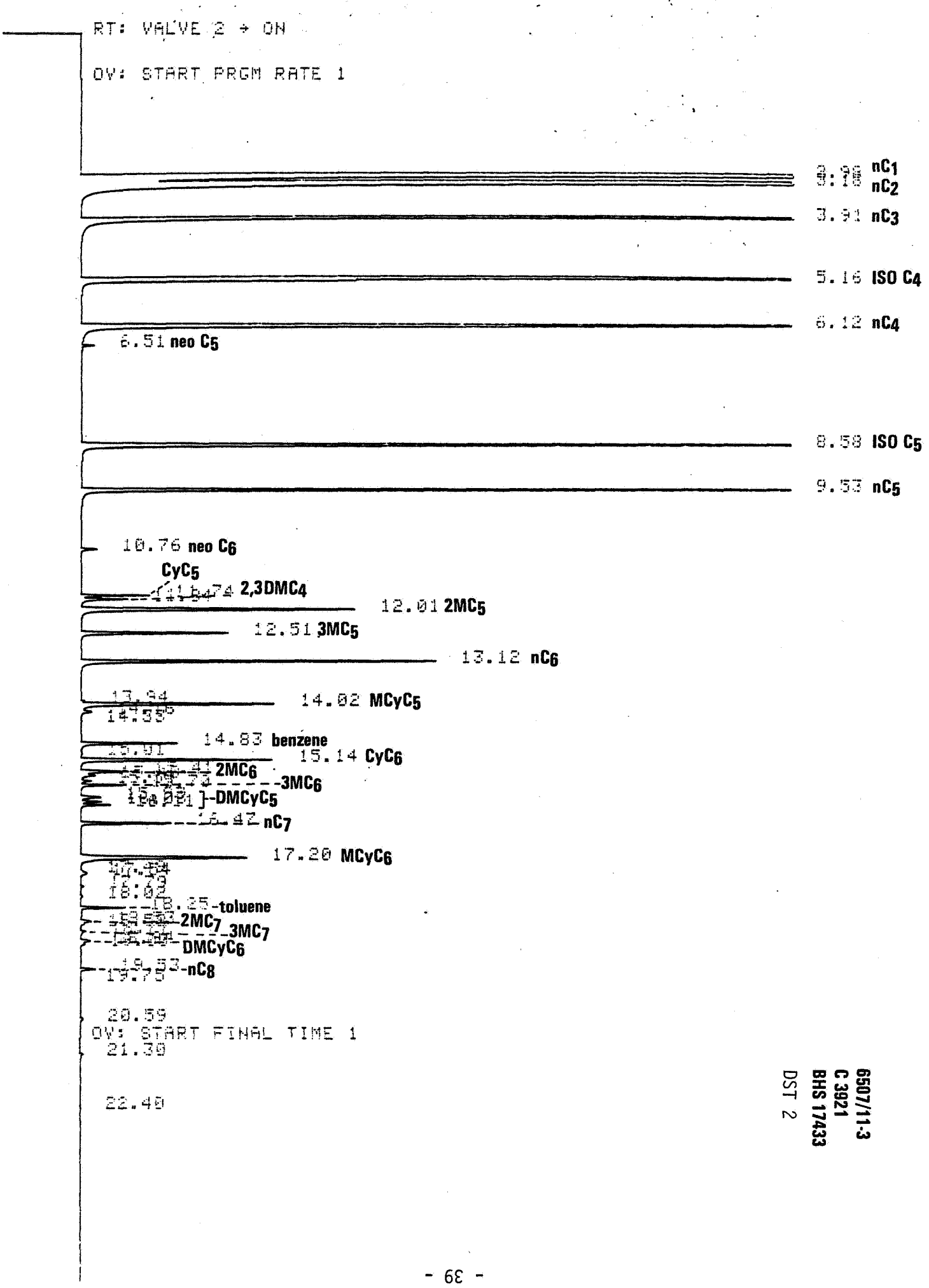
SAGA 6507/11-3



6507/11-3, DST 1

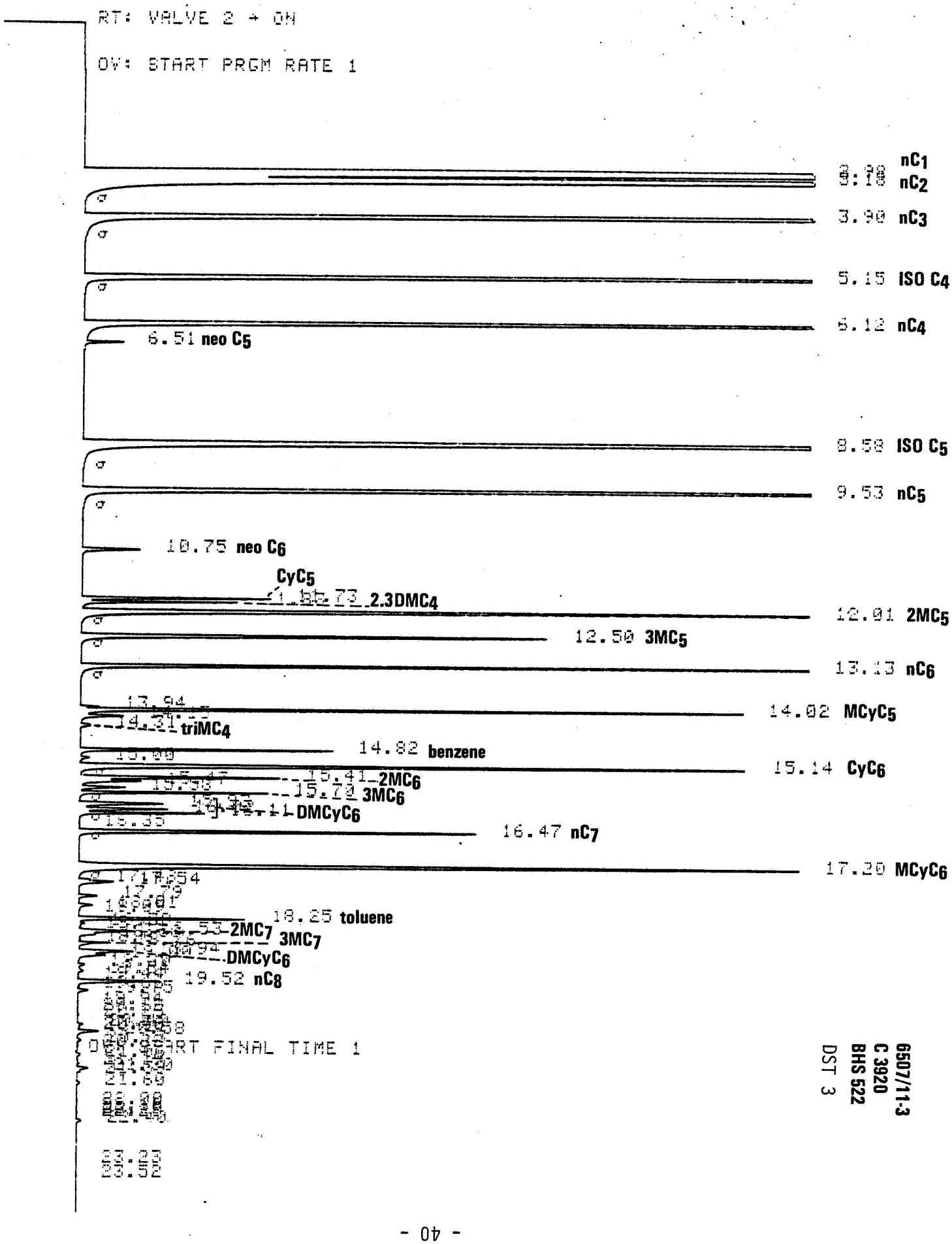
C 2937

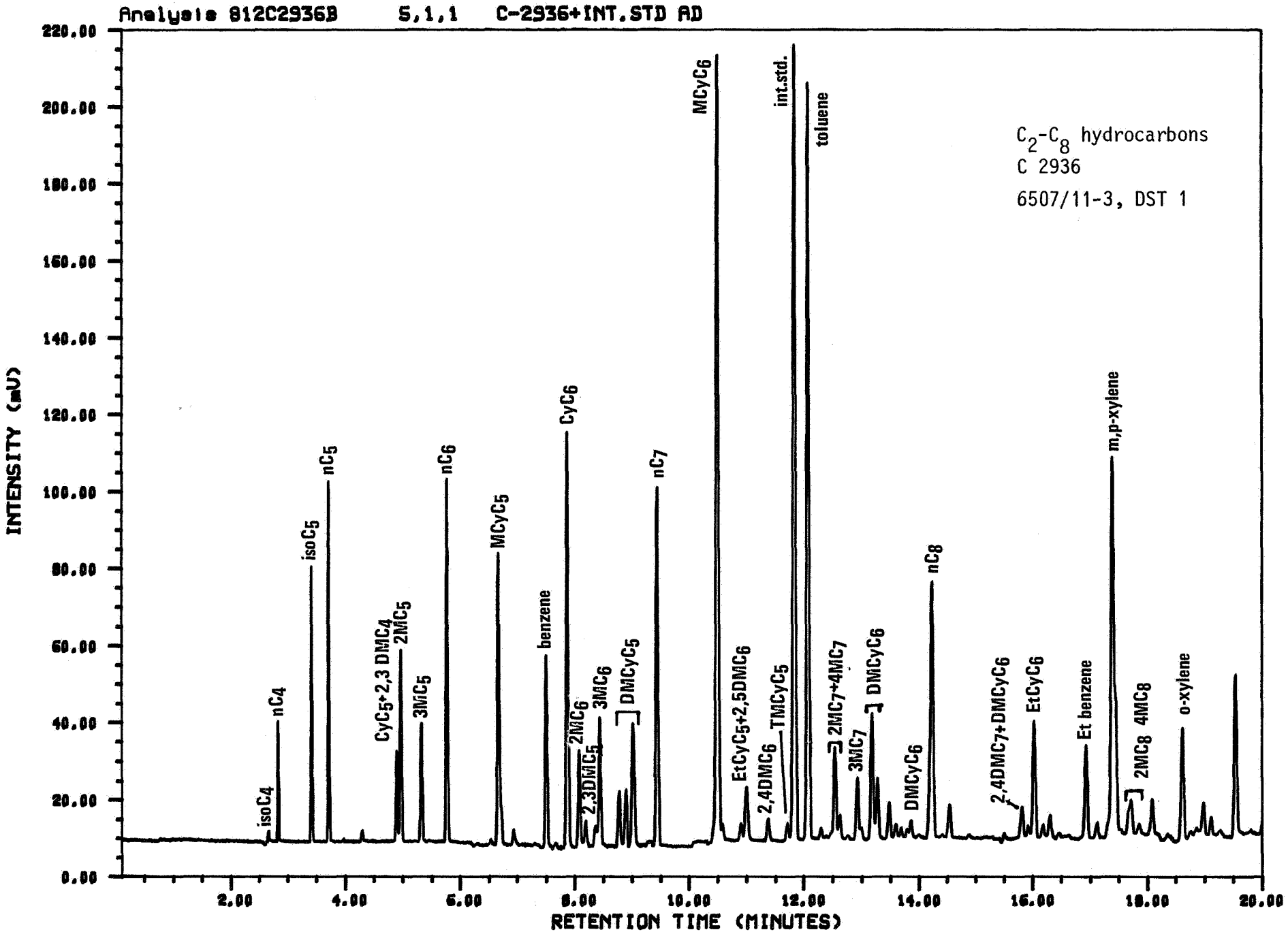
C_1-C_8 gas chromatogram

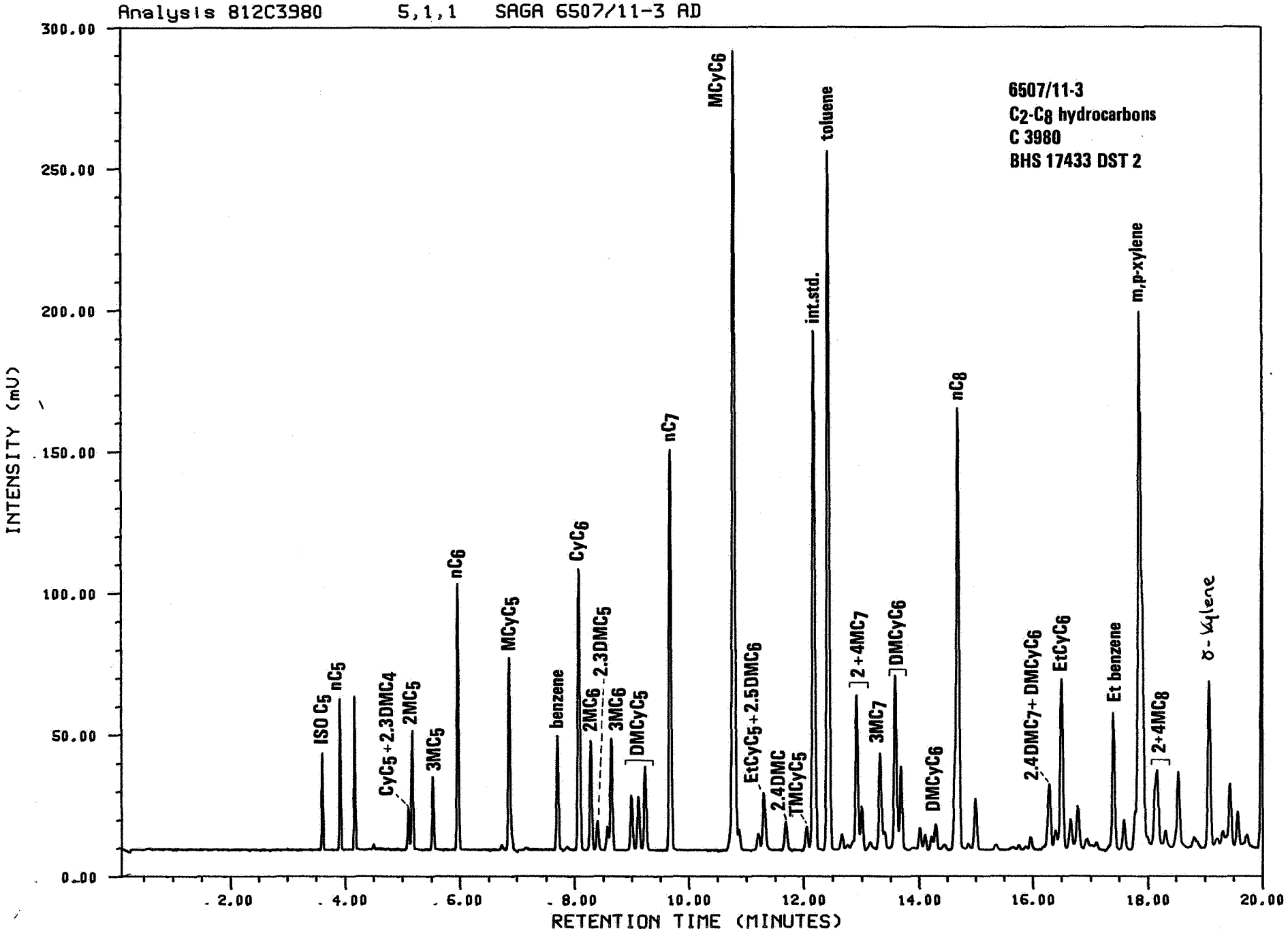


6507/11-3
C 3921
BHS 17433
DST 2

LIST OVEN TEMP
OVEN TEMP=-30°C SETPT=-30°C LIMIT=405°C




Analysis 812C2936B 5,1,1 C-2936+INT.STD AD
C_2-C_8 hydrocarbons
C 2936
6507/11-3, DST 1
INTENSITY (mV)
RETENTION TIME (MINUTES)
isoC4
nC4
isoC5
nC5
CyC5+2,3 DMC4
2MC5
3MC5
nC6
MCyC5
benzene
CyC6
2MC6
2,3DMC5
3MC6
DMCyC5
nC7
MCyC6
EtCyC5+2,5DMC6
2,4DMC6
TMCyC5
int.std.
toluene
2MC7+4MC7
3MC7
DMCyC6
DMCyC6
nC8
2,4DMC7+DMCyC6
EtCyC6
Et benzene
m,p-xylene
2MC8
4MC8
o-xylene


Analysis 812C3980 5,1,1 SAGA 6507/11-3 AD
6507/11-3
C2-C8 hydrocarbons
C 3980
BHS 17433 DST 2
INTENSITY (mV)
RETENTION TIME (MINUTES)
300.00
250.00
200.00
150.00
100.00
50.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
ISO C5
nC5
CyC5+2.3DMC4
2MC5
3MC5
nC6
MCyC5
benzene
CyC6
2MC6
2.3DMC5
3MC6
DMCyC5
nC7
MCyC6
EtCyC5+2.5DMC6
2.4DMC
TMCyC5
int.std.
toluene
2+4MC7
3MC7
DMCyC6
DMCyC6
nC8
2.4DMC7+DMCyC6
EtCyC6
Et benzene
m,p-xylene
2+4MC8
o-Xylene

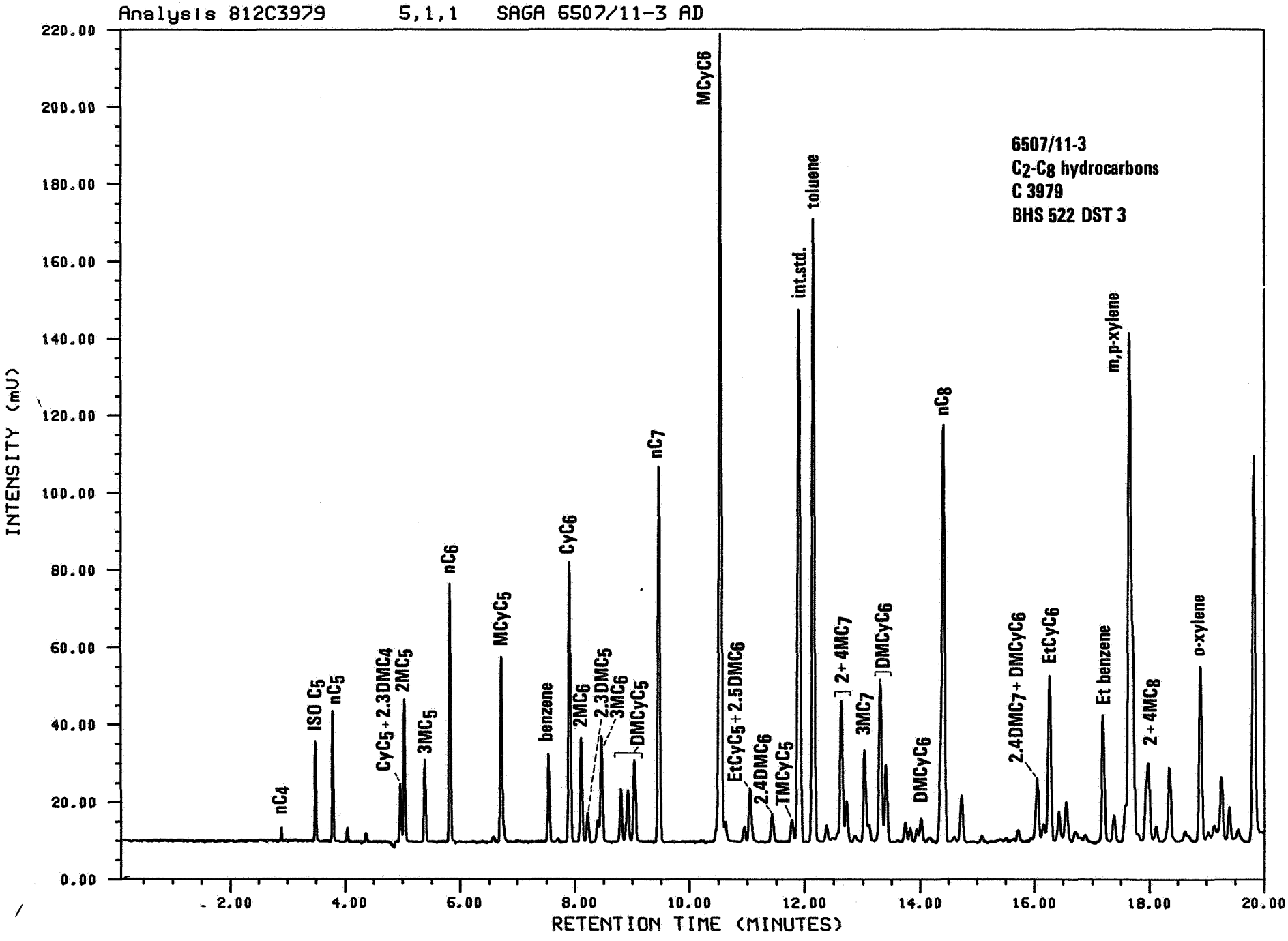
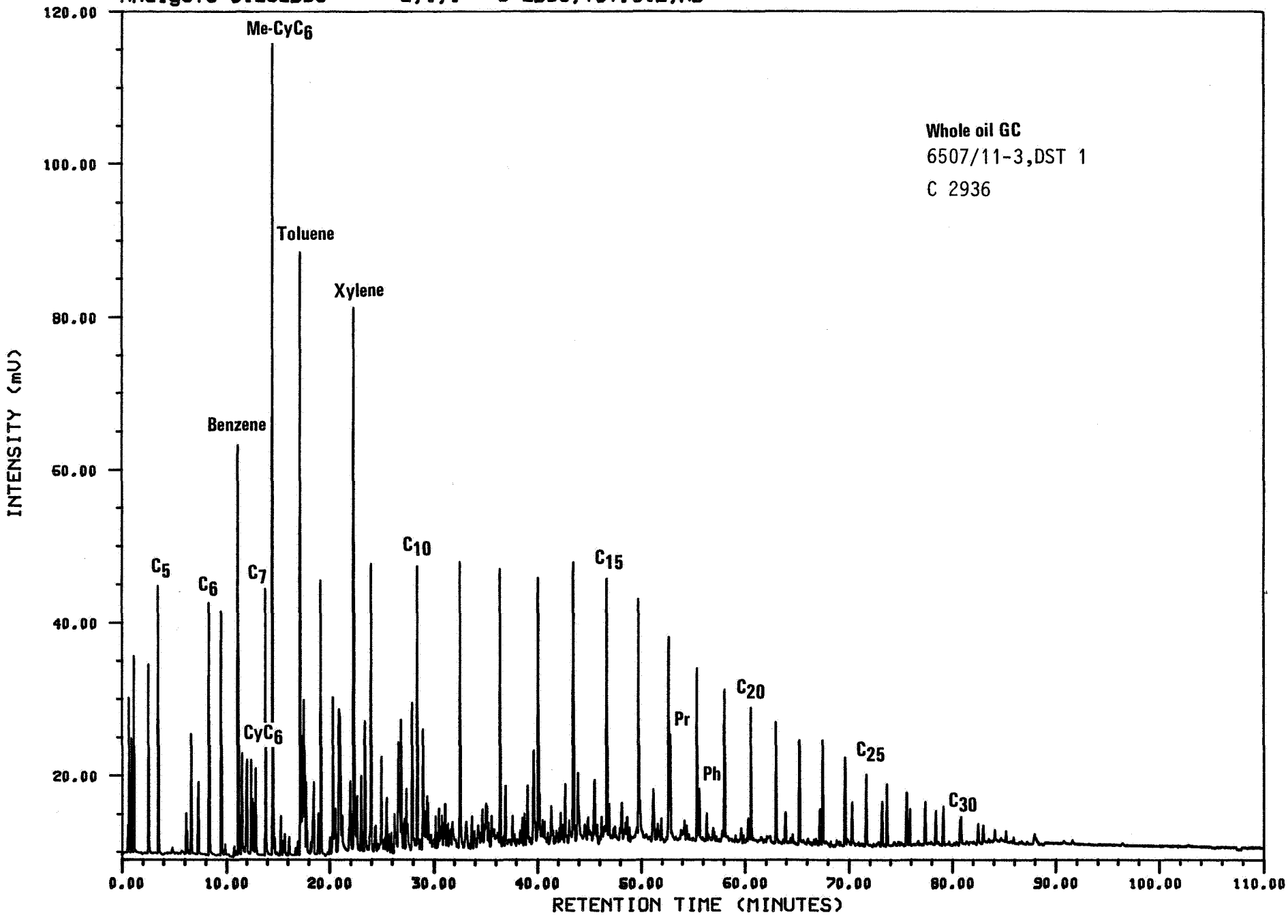
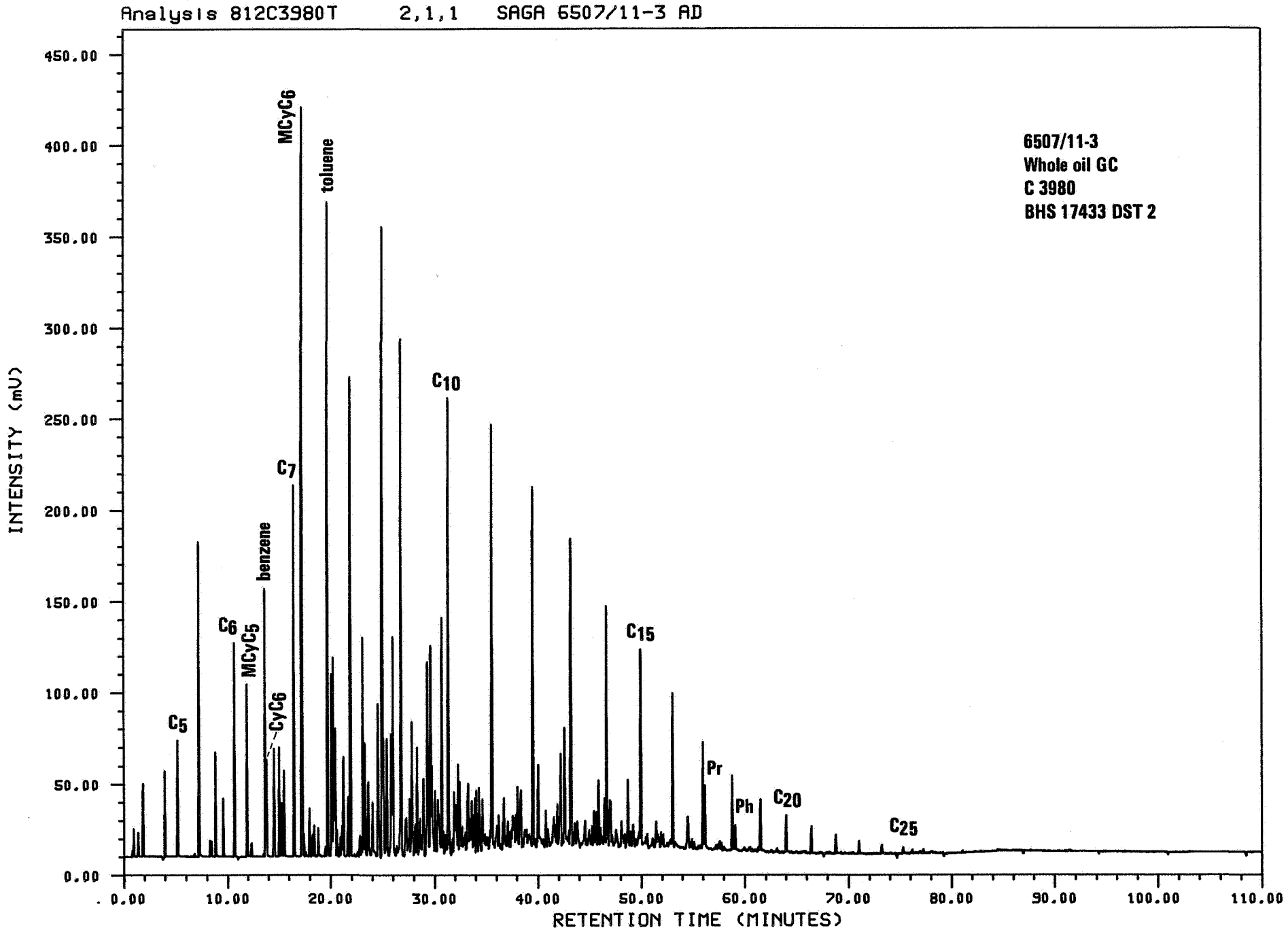

Analysis 812C3979 5,1,1 SAGA 6507/11-3 AD
6507/11-3
C2-C8 hydrocarbons
C 3979
BHS 522 DST 3
INTENSITY (mU)
RETENTION TIME (MINUTES)
nC4
ISO C5
nC5
CyC5+2.3DMC4
2MC5
3MC5
nC6
MCyC5
benzene
CyC6
2MC6
2.3DMC5
3MC6
DMCyC5
nC7
MCyC6
EtCyC5+2.5DMC6
2.4DMC6
TMCyC5
int.std.
toluene
2+4MC7
3MC7
DMCyC6
DMCyC6
nC8
2.4DMC7+DMCyC6
EtCyC6
Et benzene
m,p-xylene
2+4MC8
o-xylene

FIGURE 2

WHOLE OIL GAS CHROMATOGRAMS

Cy-C6	-	cyclohexane
MeCy-C6	-	methylcyclohexane
Pr	-	pristane
Ph	-	phytane
C10 etc.	-	n-alkanes


Analysis 812C2936 2,1,1 C-2936,TOT.OIL,AD
Whole oil GC
6507/11-3,DST 1
C 2936
INTENSITY (mV)
RETENTION TIME (MINUTES)
120.00
100.00
80.00
60.00
40.00
20.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
100.00
110.00
Me-CyC6
Toluene
Xylene
Benzene
C5
C6
C7
CyC6
C10
C15
Pr
Ph
C20
C25
C30


Analysis 812C3980T 2,1,1 SAGA 6507/11-3 AD
6507/11-3
Whole oil GC
C 3980
BHS 17433 DST 2
INTENSITY (mV)
RETENTION TIME (MINUTES)
MCyC6
toluene
C7
benzene
C6
MCyC5
CyC6
C5
C10
C15
Pr
Ph
C20
C25
450.00
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
100.00
110.00

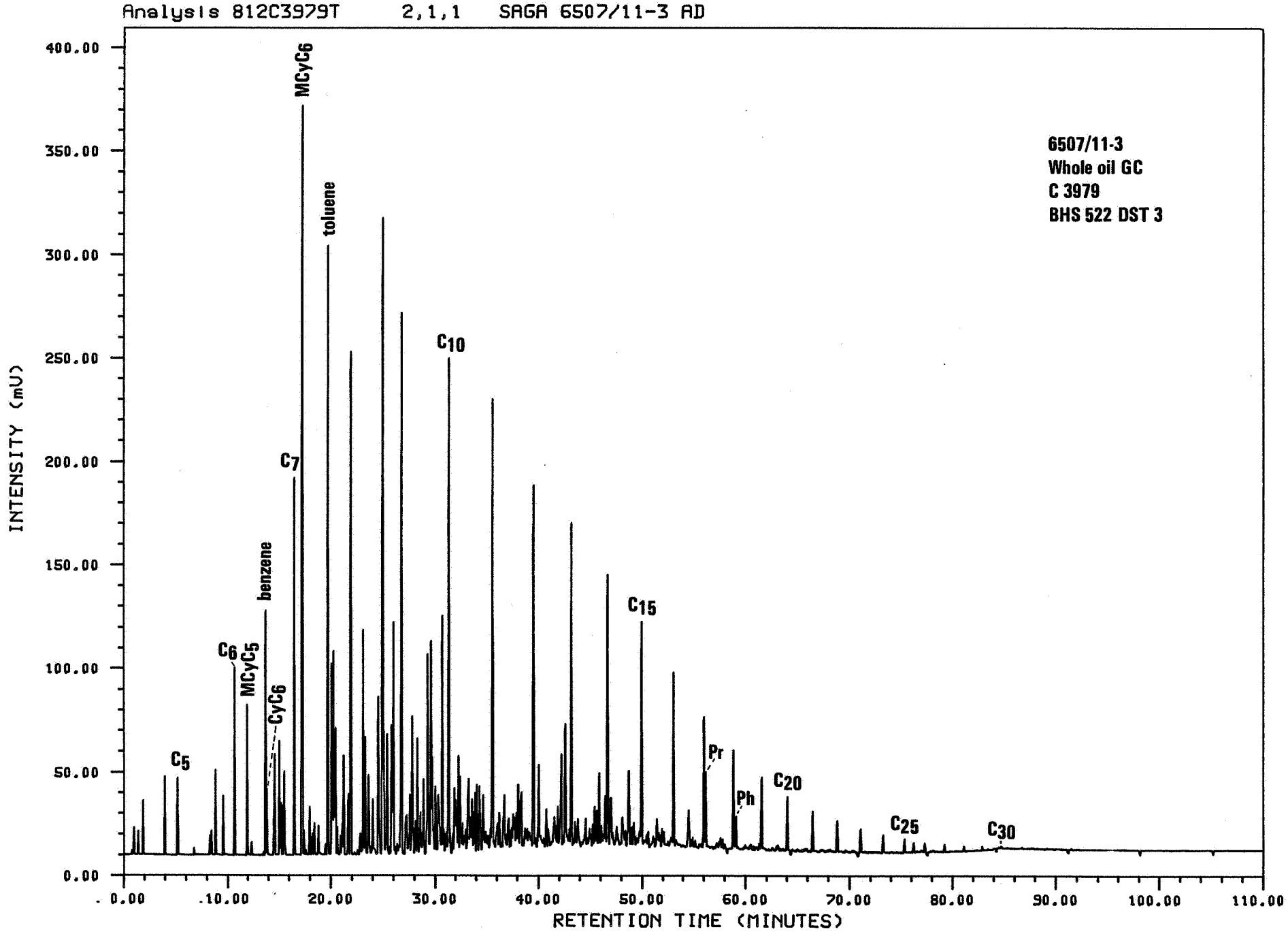
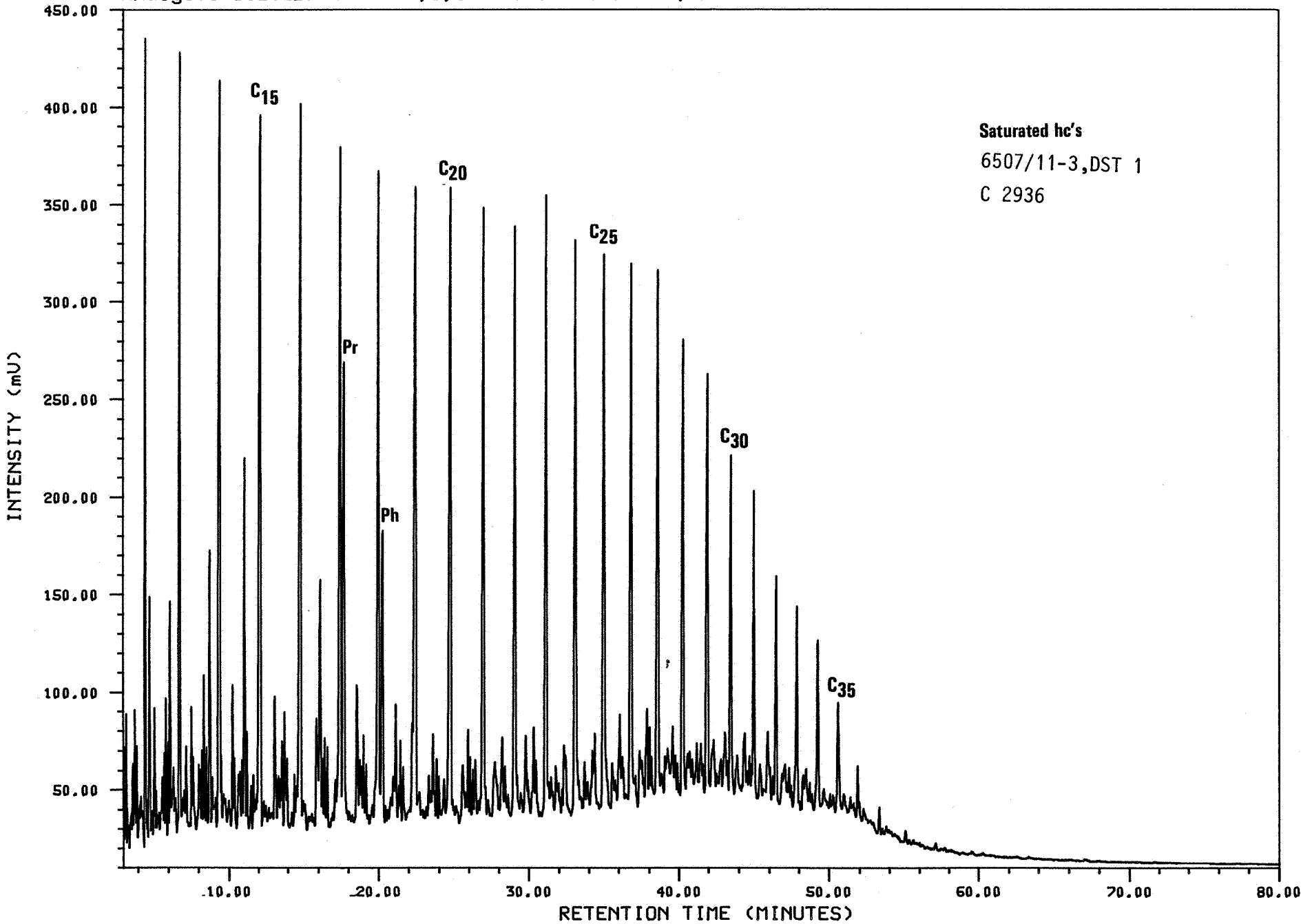
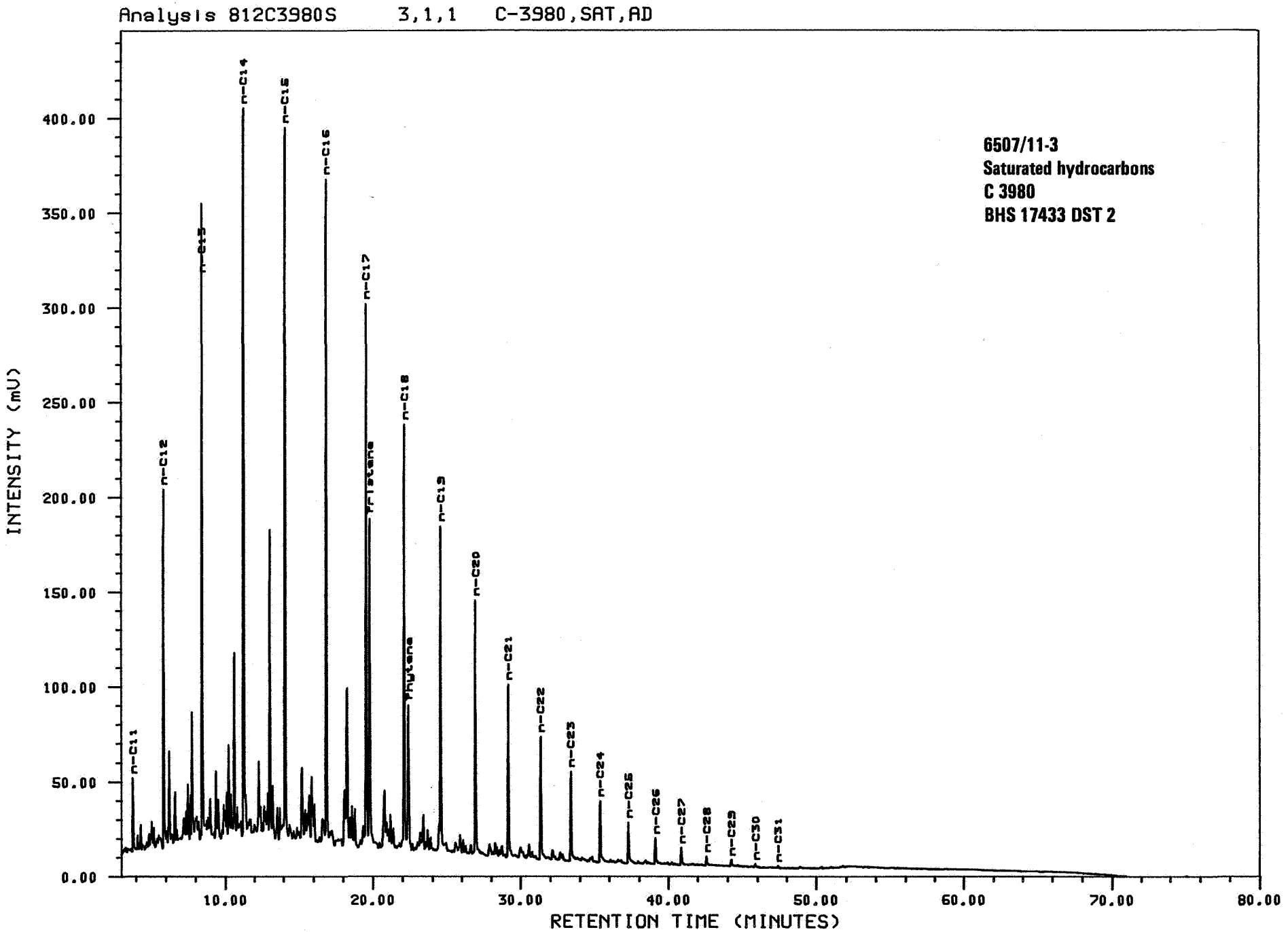

Analysis 812C3979T 2,1,1 SAGA 6507/11-3 AD
6507/11-3
Whole oil GC
C 3979
BHS 522 DST 3
INTENSITY (mU)
RETENTION TIME (MINUTES)
MCyC6
toluene
C10
C7
benzene
C6
MCyC5
CyC6
C5
C15
Pr
Ph
C20
C25
C30

FIGURE 3

SATURATED HYDROCARBON GAS CHROMATOGRAMS

Pr - pristane
Ph - phytane
n-C15 etc. - n-alkanes


Analysis 812C2936S 3,1,1 SAGA 6507/11-3,SAT
Saturated hc's
6507/11-3,DST 1
C 2936
C15
C20
C25
C30
C35
Pr
Ph
INTENSITY (mU)
RETENTION TIME (MINUTES)
450.00
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00


Analysis 812C3980S 3,1,1 C-3980,SAT,AD
6507/11-3
Saturated hydrocarbons
C 3980
BHS 17433 DST 2
INTENSITY (mU)
RETENTION TIME (MINUTES)
0.00
50.00
100.00
150.00
200.00
250.00
300.00
350.00
400.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
n-C11
n-C12
n-C13
n-C14
n-C15
n-C16
n-C17
Pristane
n-C18
Phytane
n-C19
n-C20
n-C21
n-C22
n-C23
n-C24
n-C25
n-C26
n-C27
n-C28
n-C29
n-C30
n-C31

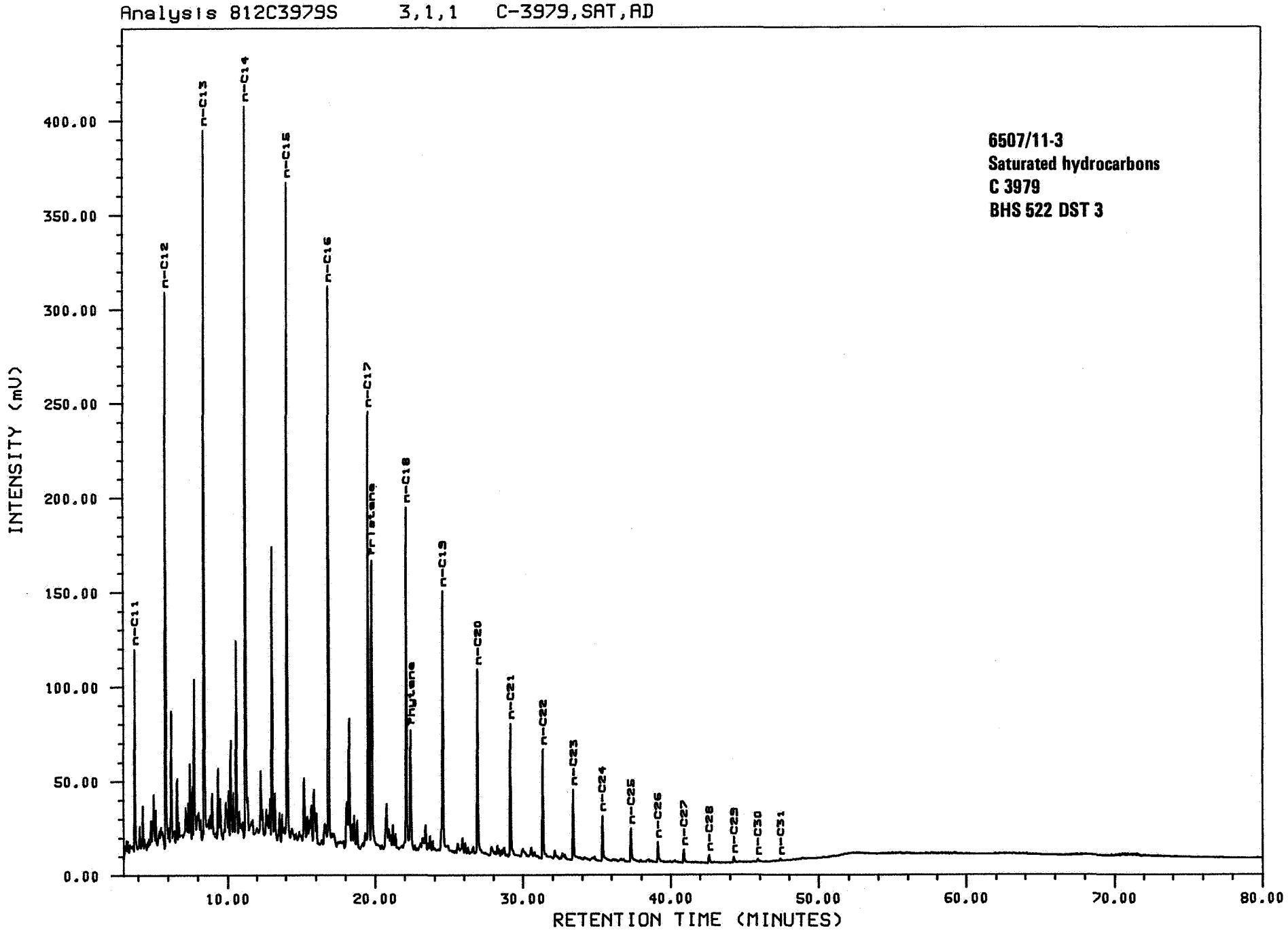
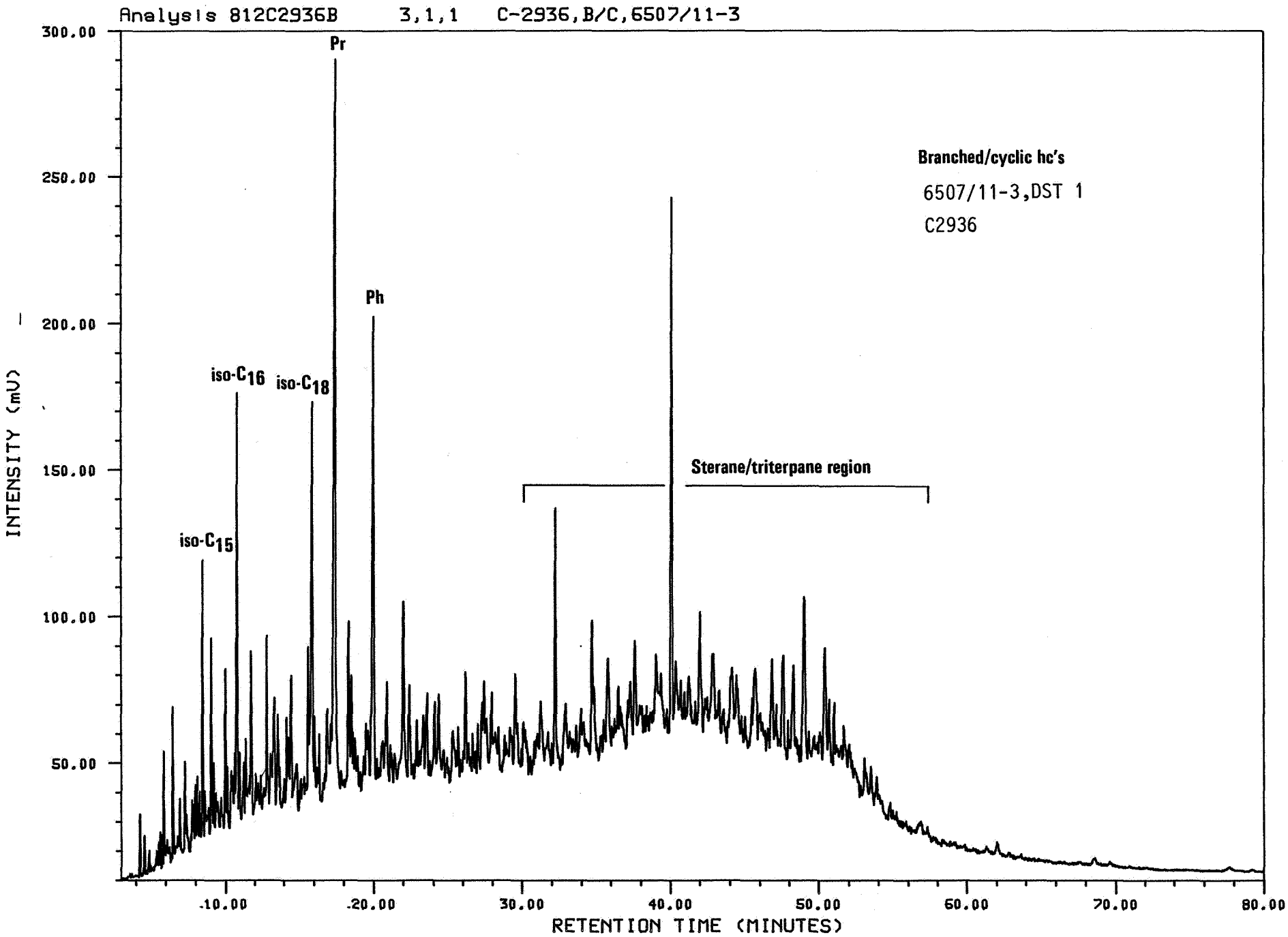
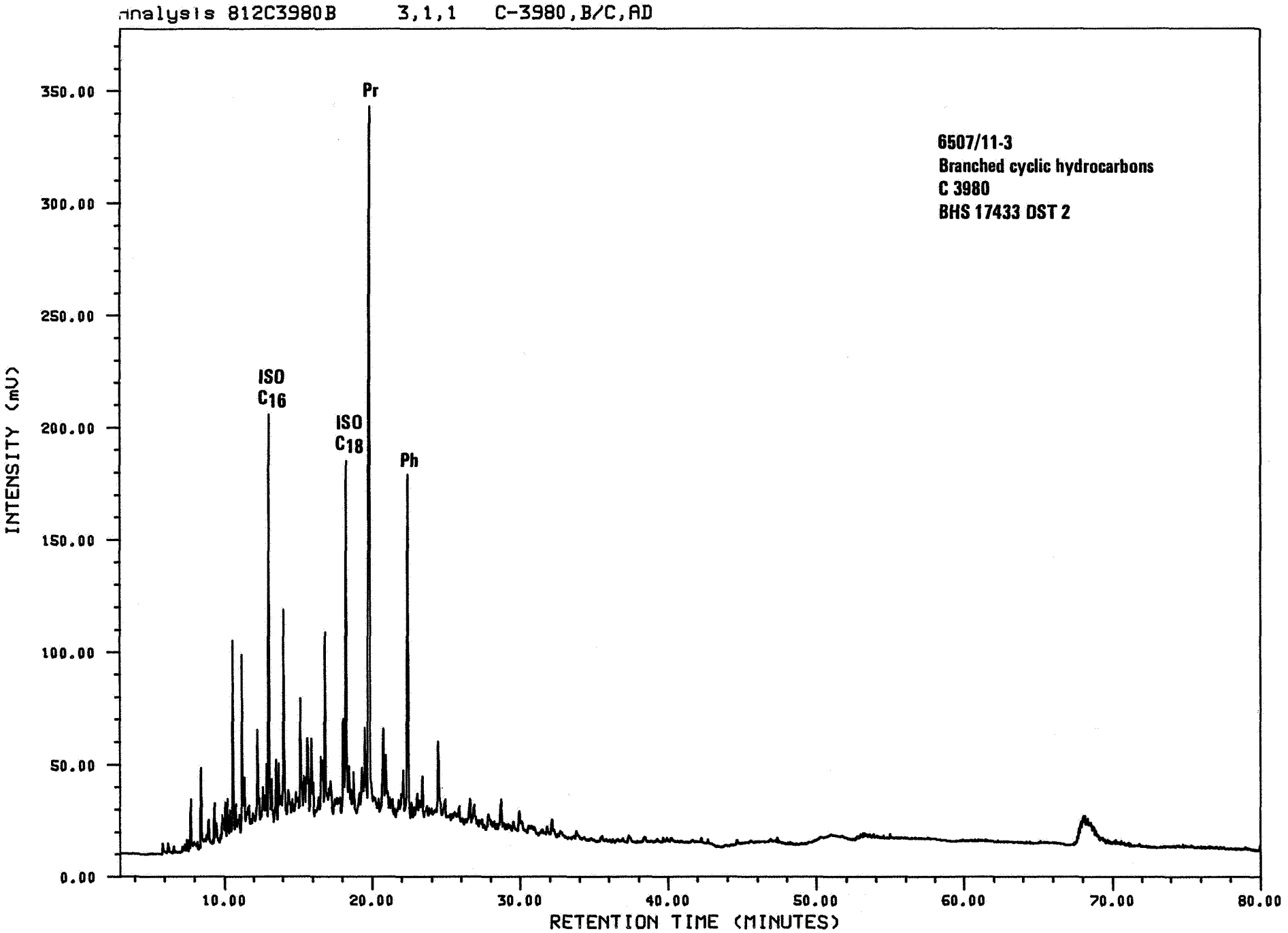

Analysis 812C3979S 3,1,1 C-3979,SAT,AD
6507/11-3
Saturated hydrocarbons
C 3979
BHS 522 DST 3
INTENSITY (mV)
RETENTION TIME (MINUTES)
n-C11
n-C12
n-C13
n-C14
n-C15
n-C16
n-C17
Pristane
n-C18
Phytane
n-C19
n-C20
n-C21
n-C22
n-C23
n-C24
n-C25
n-C26
n-C27
n-C28
n-C29
n-C30
n-C31

FIGURE 4

BRANCHED/CYCLIC HYDROCARBON GAS CHROMATOGRAMS

Pr - pristane
Ph - phytane
isopr.C18 etc. - isoprenoids


Analysis 812C2936B 3,1,1 C-2936,B/C,6507/11-3
Branched/cyclic hc's
6507/11-3,DST 1
C2936
Pr
Ph
iso-C16
iso-C18
iso-C15
Sterane/triterpane region
INTENSITY (mV)
300.00
250.00
200.00
150.00
100.00
50.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
RETENTION TIME (MINUTES)


Analysis 812C3980B 3,1,1 C-3980,B/C,AD
Pr
ISO C16
ISO C18
Ph
6507/11-3
Branched cyclic hydrocarbons
C 3980
BHS 17433 DST 2
INTENSITY (mV)
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
RETENTION TIME (MINUTES)

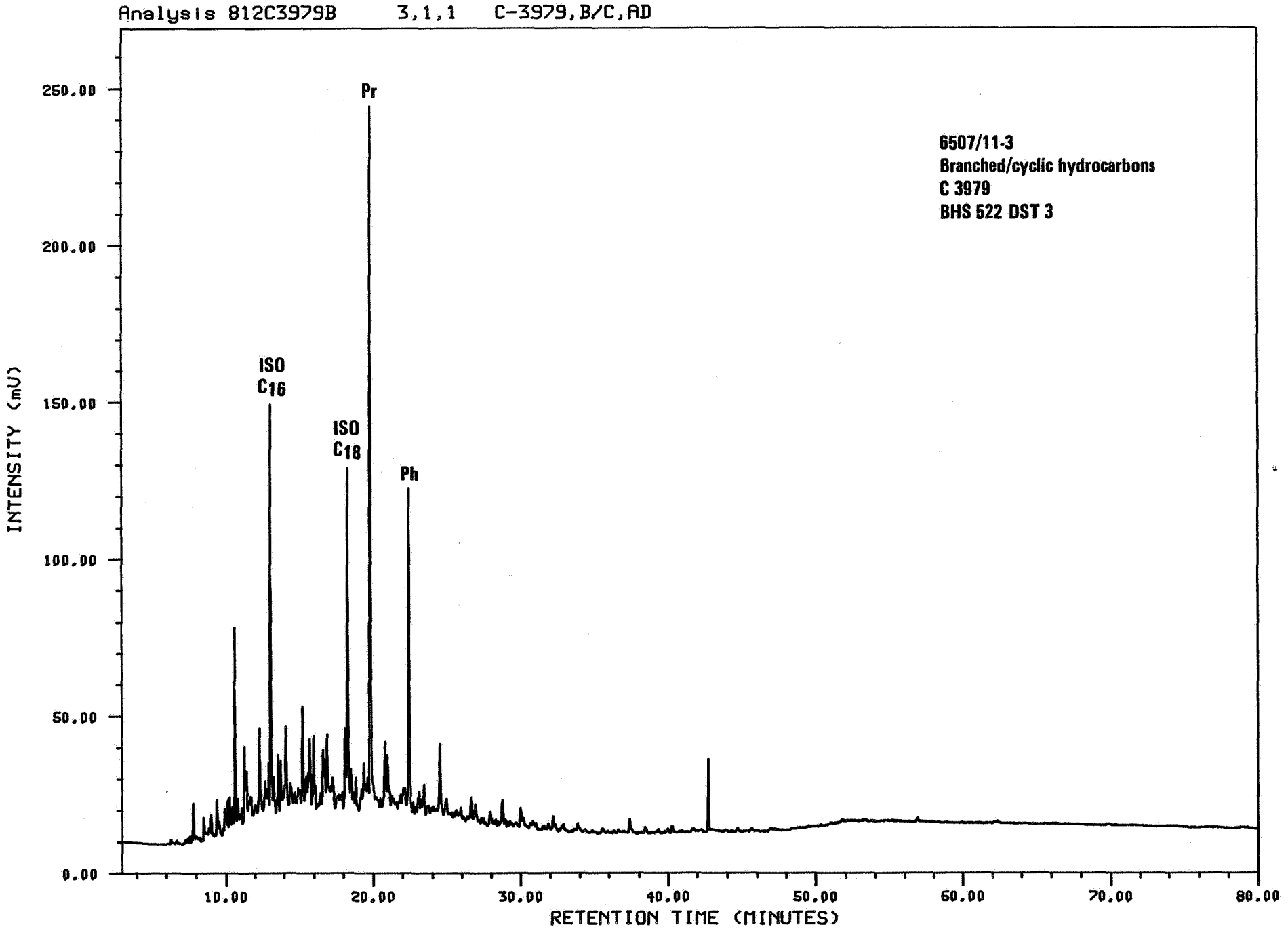
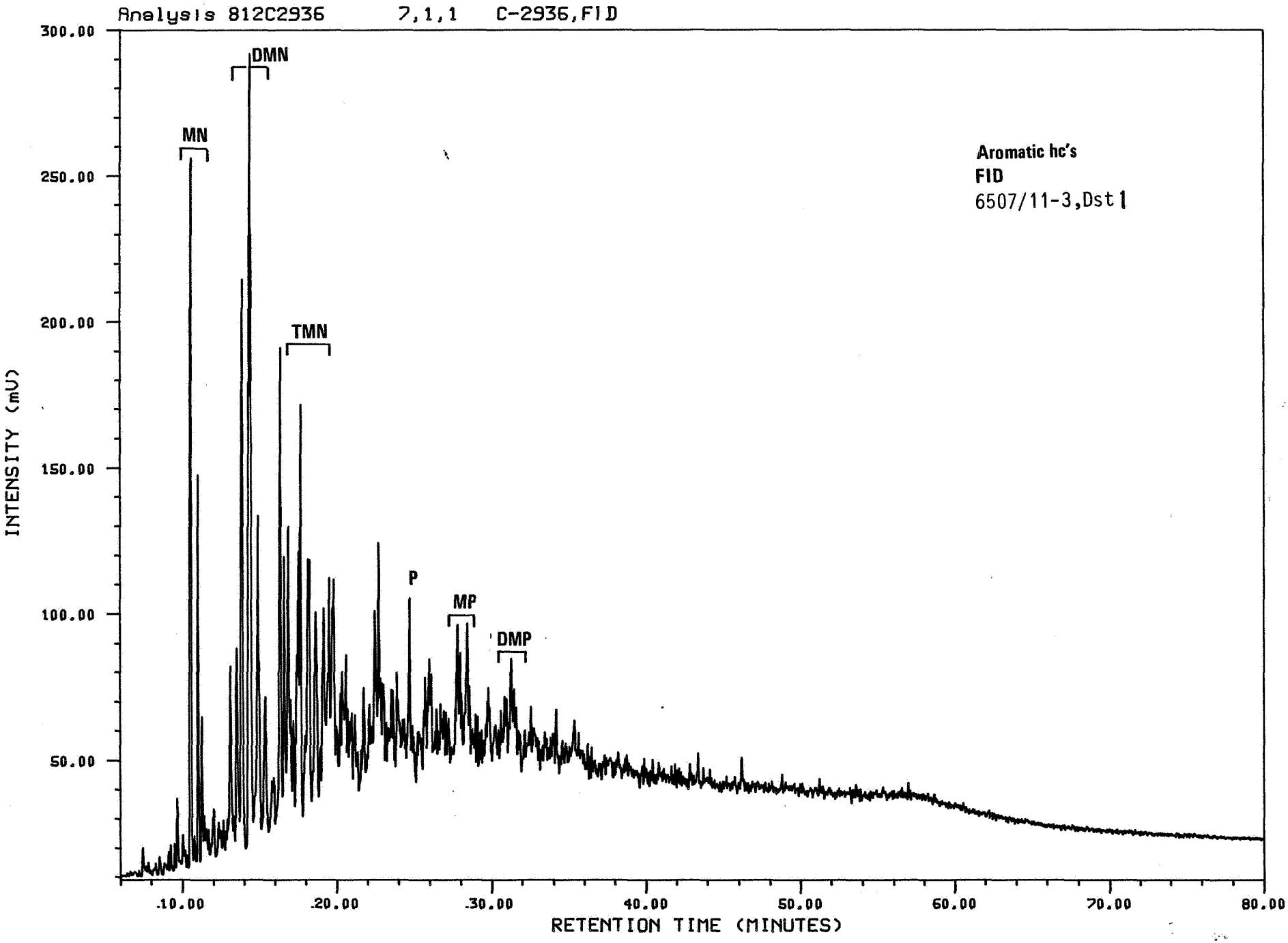
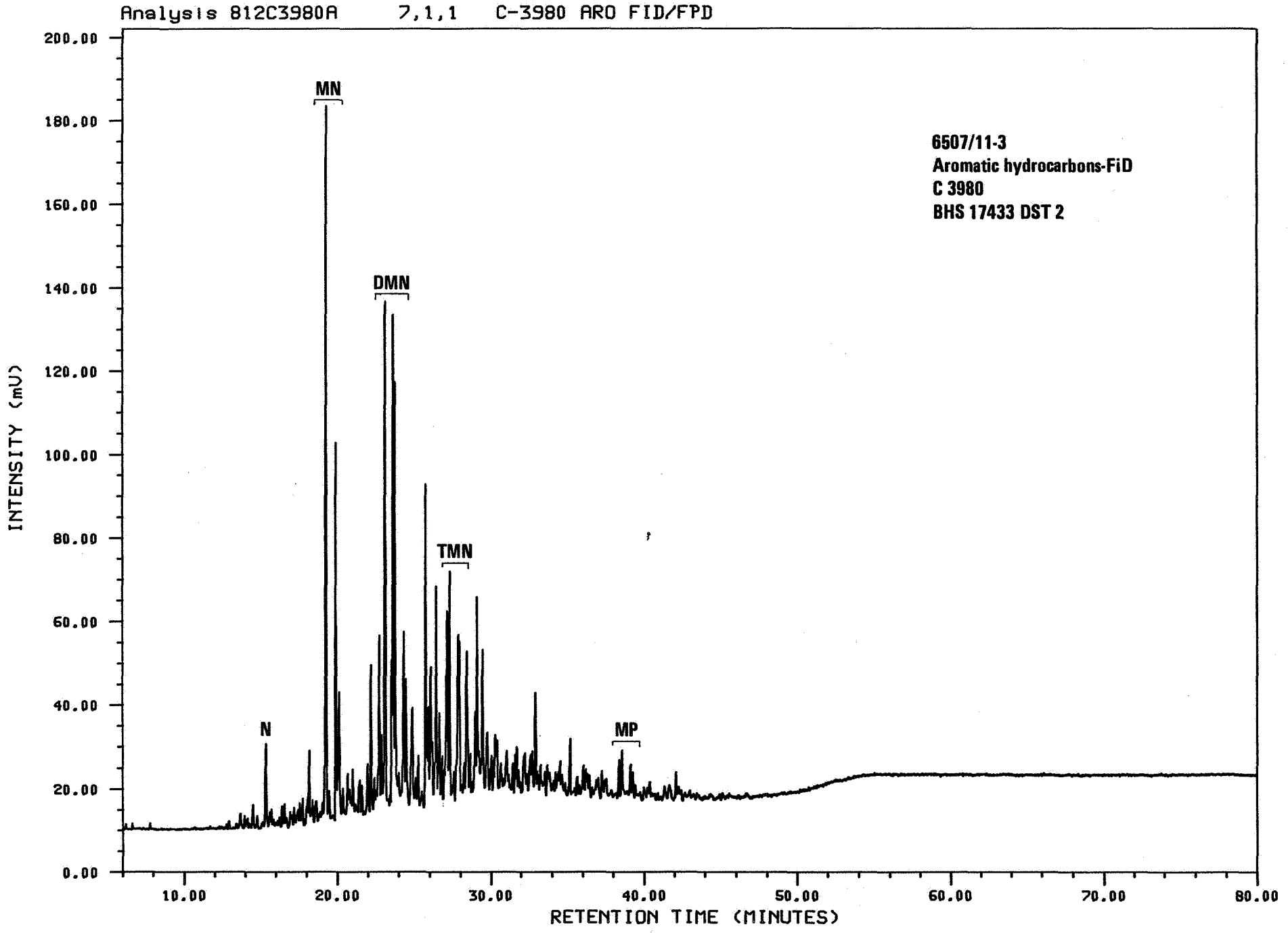

Analysis 812C3979B 3,1,1 C-3979,B/C,AD
250.00
200.00
150.00
100.00
50.00
0.00
INTENSITY (mV)
ISO C16
ISO C18
Pr
Ph
6507/11-3
Branched/cyclic hydrocarbons
C 3979
BHS 522 DST 3
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
RETENTION TIME (MINUTES)

FIGURE 5a

AROMATIC HYDROCARBON GAS CHROMATOGRAMS

N,MN,DMN,TMN	- naphthalene and alkylated homologs
P,MP,DMP	- phenanthrene and alkylated homologs


Analysis 812C2936 7,1,1 C-2936,FID
300.00
250.00
200.00
150.00
100.00
50.00
INTENSITY (mV)
MN
DMN
TMN
P
MP
DMP
Aromatic hc's
FID
6507/11-3,Dst1
.10.00
.20.00
.30.00
40.00
50.00
60.00
70.00
80.00
RETENTION TIME (MINUTES)


Analysis 812C3980A 7,1,1 C-3980 ARO FID/FPD
6507/11-3
Aromatic hydrocarbons-FiD
C 3980
BHS 17433 DST 2
N
MN
DMN
TMN
MP
INTENSITY (mV)
RETENTION TIME (MINUTES)
0.00
20.00
40.00
60.00
80.00
100.00
120.00
140.00
160.00
180.00
200.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00

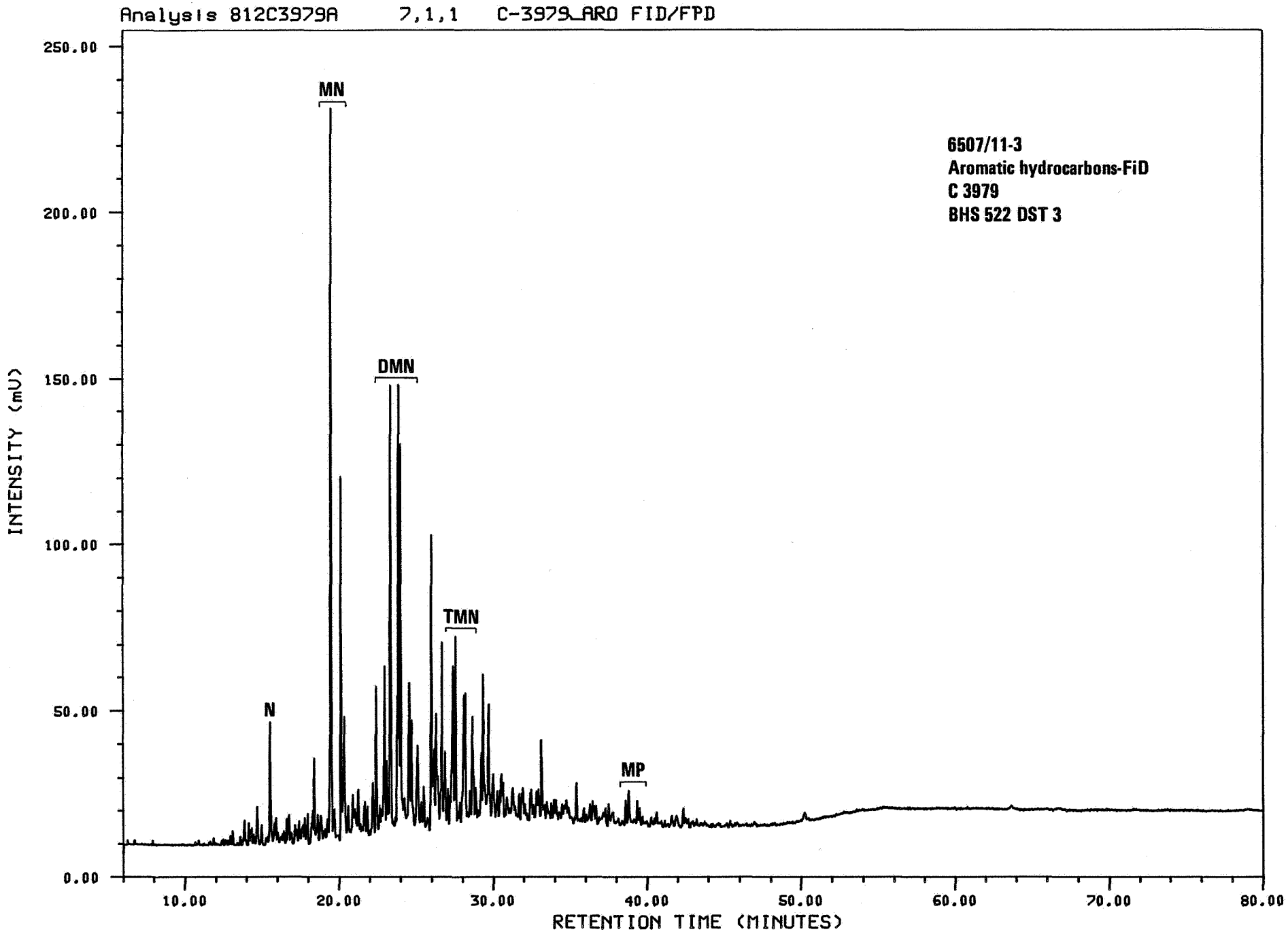
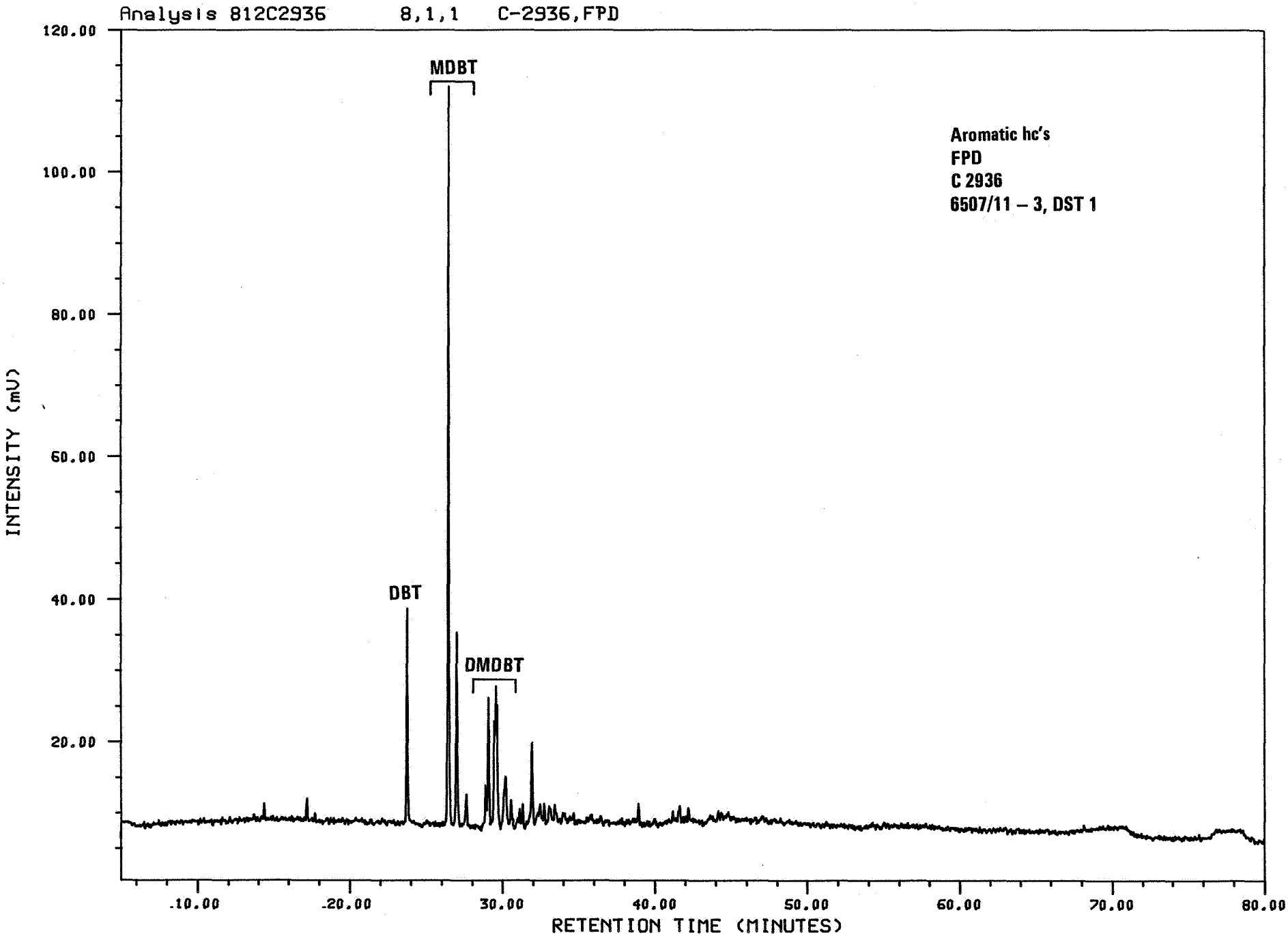
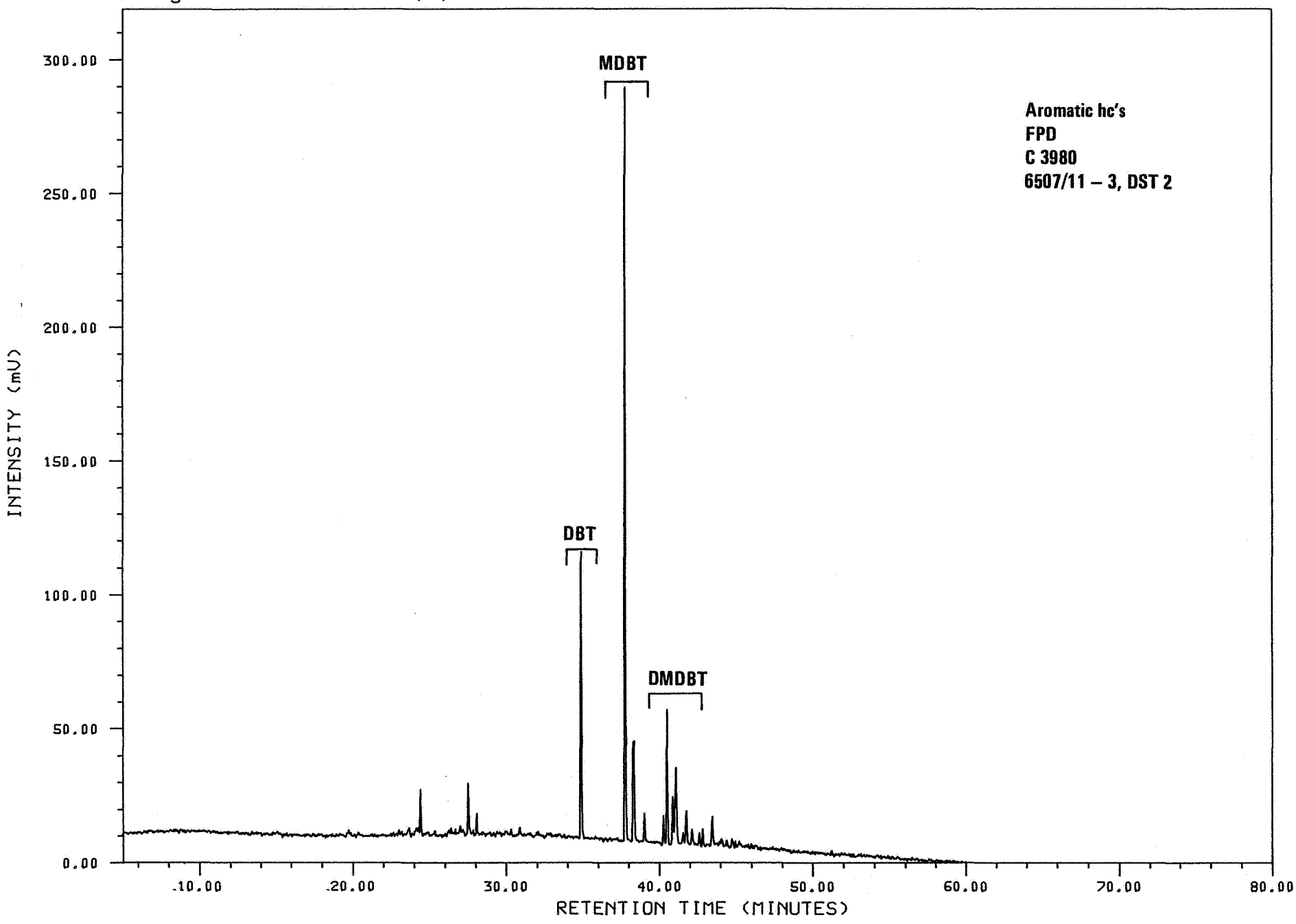

Analysis 812C3979A 7,1,1 C-3979_ARO FID/FPD
250.00
200.00
150.00
100.00
50.00
0.00
INTENSITY (mV)
MN
DMN
TMN
N
MP
6507/11-3
Aromatic hydrocarbons-FiD
C 3979
BHS 522 DST 3
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
RETENTION TIME (MINUTES)

FIGURE 5b

GAS CHROMATOGRAMS OF AROMATIC HYDROCARBONS,
FPD DETECTION

DBT,MDBT,DMDBT - dibenzothiophene and alkylated homologs


Analysis 812C2936 8,1,1 C-2936,FPD
120.00
100.00
80.00
60.00
40.00
20.00
INTENSITY (mV)
MDBT
DBT
DMDBT
Aromatic hc's
FPD
C 2936
6507/11 – 3, DST 1
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
RETENTION TIME (MINUTES)


Analysis 812C3980A 8,1,1 C-3980 ARO FID/FPD
MDBT
DBT
DMDBT
Aromatic hc's
FPD
C 3980
6507/11 – 3, DST 2
INTENSITY (mV)
300.00
250.00
200.00
150.00
100.00
50.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
RETENTION TIME (MINUTES)

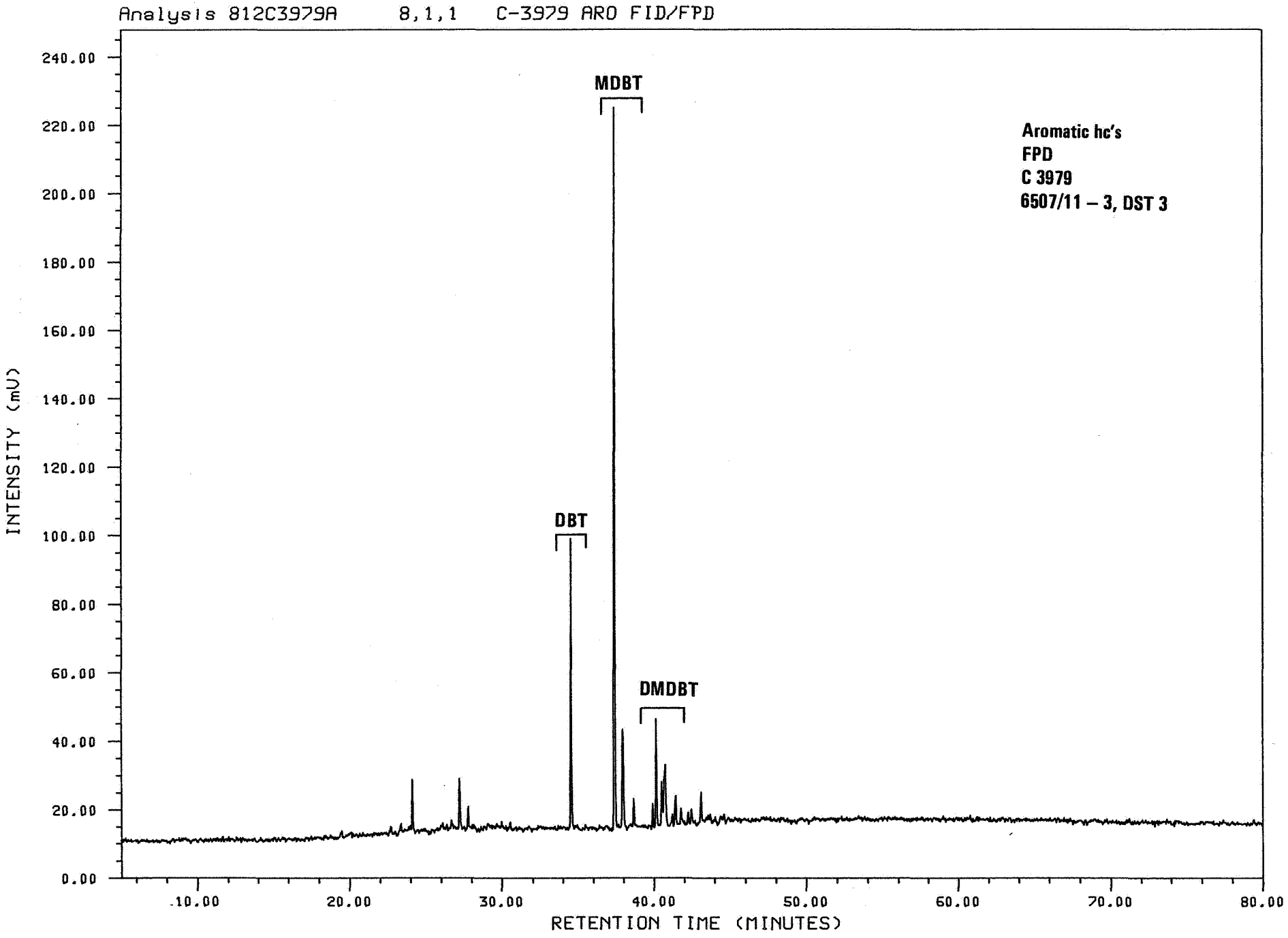
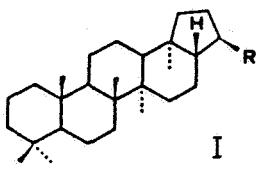

Analysis 812C3979A 8,1,1 C-3979 ARO FID/FPD
MDBT
DBT
DMDBT
Aromatic hc's
FPD
C 3979
6507/11 – 3, DST 3
INTENSITY (mU)
240.00
220.00
200.00
180.00
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
RETENTION TIME (MINUTES)

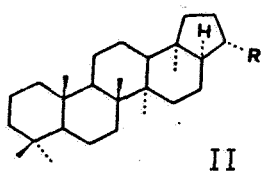
Figure 6a

Mass chromatograms representing terpanes (m/z 191)

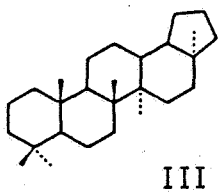
A	T_s, 18α(H)-trisnorneohopane	$C_{27}H_{46}$	(III)
B	T_m, 17α(H)-trisnorhopane	$C_{27}H_{46}$	(I,R=H)
C	17α(H)-norhopane	$C_{29}H_{50}$	(I,R=C_2H_5)
D	17β(H)-normoretane	$C_{29}H_{50}$	(II,R=C_2H_5)
E	17α(H)-hopane	$C_{30}H_{52}$	(I,R=C_3H_7)
F	17β(H)-moretane	$C_{30}H_{52}$	(II,R=C_3H_7)
G	17α(H)-homohopane (22S)	$C_{31}H_{54}$	(I,R=C_4H_9)
H	17α(H)-homohopane (22R)	$C_{31}H_{54}$	(I,R=C_4H_9)
	+ unknown triterpane (gammacerane?)		
I	17β(H)-homomoretane	$C_{31}H_{54}$	(II,R=C_4H_9)
J	17α(H)-bishomohopane (22S,22R)	$C_{32}H_{56}$	(I,R=C_5H_{11})
K	17α(H)-trishomohopane (22S,22R)	$C_{33}H_{58}$	(I,R=C_6H_{13})
L	17α(H)-tetrakishomohopane (22S,22R)	$C_{34}H_{60}$	(I,R=C_7H_{15})
M	17α(H)-pentakishomohopane (22S,22R)	$C_{35}H_{62}$	(I,R=C_8H_{17})
Z	bisnorhopane	$C_{28}H_{48}$	
X	unknown triterpane	$C_{30}H_{52}$	
P	tricyclic terpane	$C_{23}H_{42}$	(IV,R=C_4H_9)
Q	tricyclic terpane	$C_{24}H_{44}$	(IV,R=C_5H_{11})
R	tricyclic terpane (17R,17S)	$C_{25}H_{46}$	(IV,R=C_6H_{13})
S	tetracyclic terpane	$C_{24}H_{42}$	(V)
T	tricyclic terpane (17R,17S)	$C_{26}H_{48}$	(IV,R=C_7H_{15})

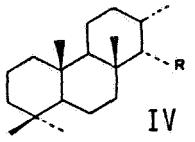


I

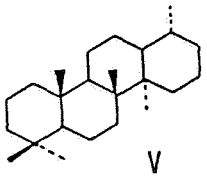


II


III

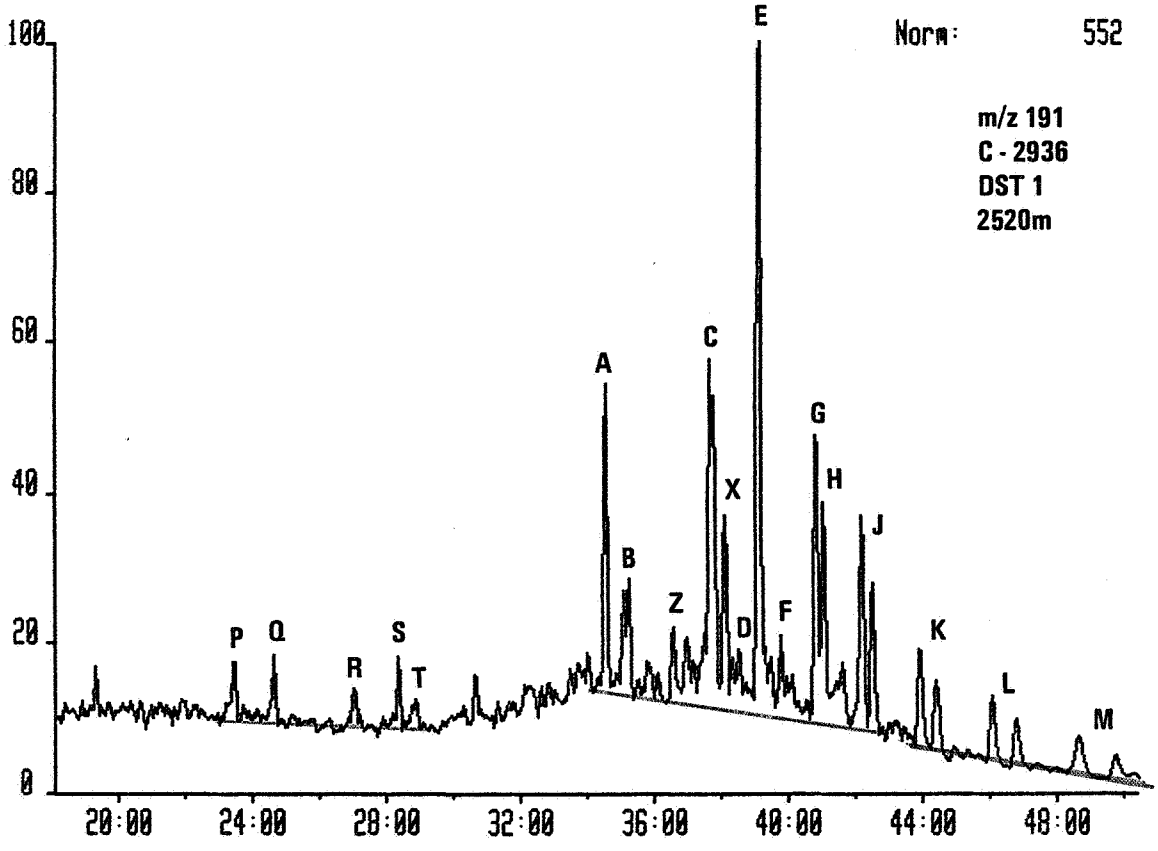


IV

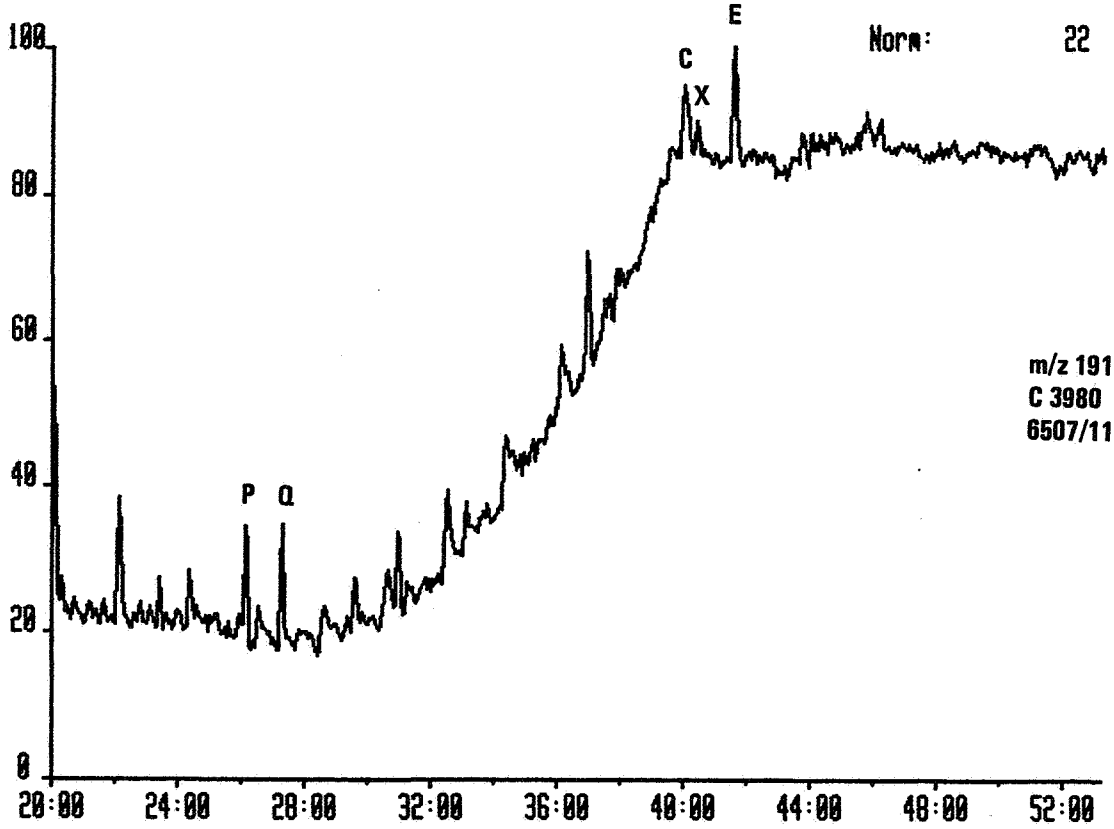

V

IKU
SINTEF-GRUPPEN

C2936SATT 6-NOV-85 Sir:Voltage 7070H Acnt:IKU System:TRIT
Sample 1 Injection 1 Group 1 Mass 191.1000
Text:

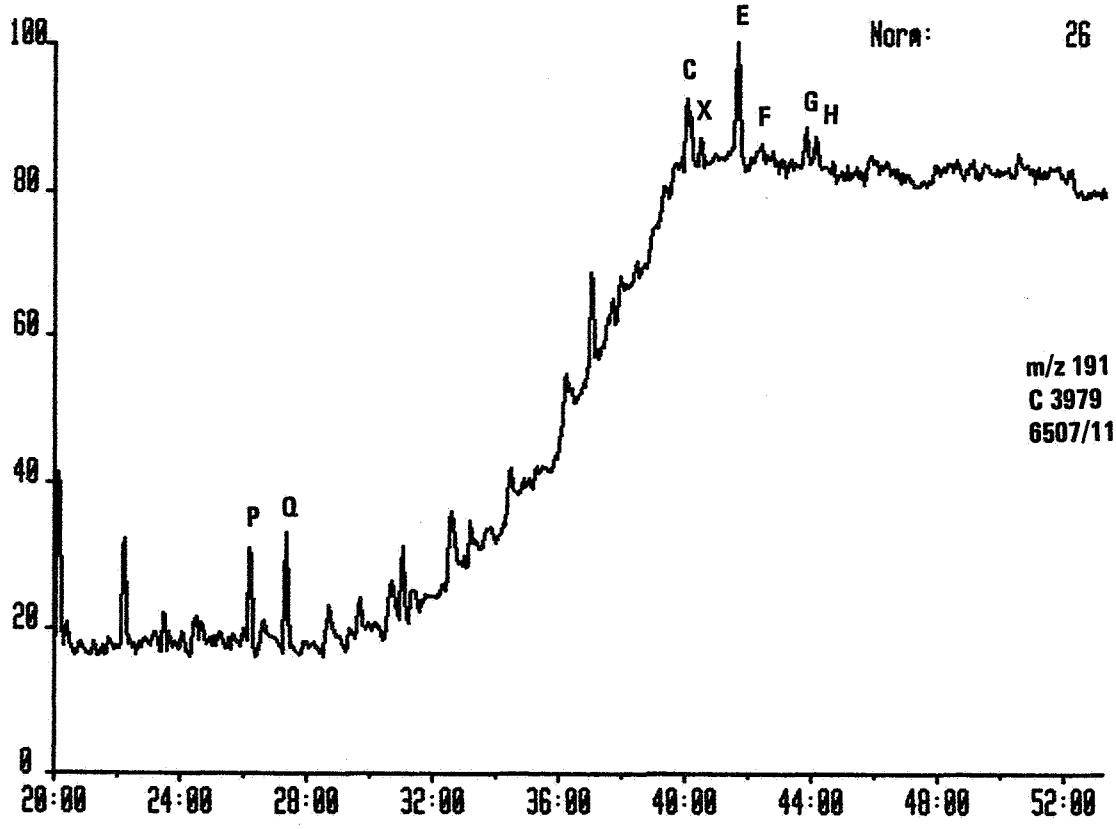


C3980SAT 15-APR-86 Sir:Voltage 12-250 Acnt:IKU System:QUANID
Sample 1 Injection 1 Group 1 Mass 191.1000
Text:



m/z 191
C 3980
6507/11 – 3, DST 2

C3979SAT 15-APR-86 Sir:Voltage 12-250 Acnt:IKU System:QUAMID
Sample 1 Injection 1 Group 1 Mass 191.1000
Text:

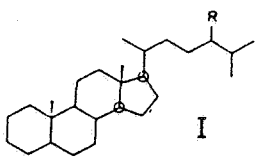


m/z 191
C 3979
6507/11 – 3, DST 3

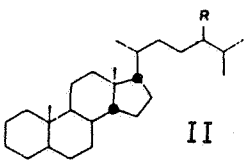
Figure 6b

Mass chromatograms representing steranes (m/z 217 and 218)

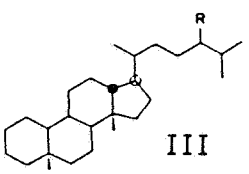
a	13β(H),17α(H)-diasterane (20S)	$C_{27}H_{48}$	(III,R=H)
b	13β(H),17α(H)-diasterane (20R)	$C_{27}H_{48}$	(III,R=H)
c	13α(H),17β(H)-diasterane (20S)	$C_{27}H_{48}$	(IV,R=H)
d	13α(H),17β(H)-diasterane (20R)	$C_{27}H_{48}$	(IV,R=H)
e	13β(H),17α(H)-diasterane (20S)	$C_{28}H_{50}$	(III,R=CH_3)
f	13β(H),17α(H)-diasterane (20R)	$C_{28}H_{50}$	(III,R=CH_3)
g	13α(H),17β(H)-diasterane (20S)	$C_{28}H_{50}$	(IV,R=CH_3)
	+ 14α(H),17α(H)-sterane (20S)	$C_{27}H_{48}$	(I,R=H)
h	13β(H),17α(H)-diasterane (20S)	$C_{29}H_{52}$	(III,R=C_2H_5)
	+ 14β(H),17β(H)-sterane (20R)	$C_{27}H_{48}$	(II,R=H)
i	14β(H),17β(H)-sterane (20S)	$C_{27}H_{48}$	(II,R=H)
	+ 13α(H),17β(H)-diasterane (20R)	$C_{28}H_{50}$	(IV,R=CH_3)
j	14α(H),17α(H)-sterane (20R)	$C_{27}H_{48}$	(I,R=H)
k	13β(H),17α(H)-diasterane (20R)	$C_{29}H_{52}$	(III,R=C_2H_5)
l	13α(H),17β(H)-diasterane (20S)	$C_{29}H_{52}$	(III,R=C_2H_5)
m	14α(H),17α(H)-sterane (20S)	$C_{28}H_{50}$	(I,R=CH_3)
n	13α(H),17β(H)-diasterane (20R)	$C_{29}H_{52}$	(III,R=C_2H_5)
	+ 14β(H),17β(H)-sterane (20R)	$C_{28}H_{50}$	(II,R=CH_3)
o	14β(H),17β(H)-sterane (20S)	$C_{28}H_{50}$	(II,R=CH_3)
p	14α(H),17α(H)-sterane (20R)	$C_{28}H_{50}$	(I,R=CH_3)
q	14α(H),17α(H)-sterane (20S)	$C_{29}H_{52}$	(I,R=C_2H_5)
r	14β(H),17β(H)-sterane (20R)	$C_{29}H_{52}$	(II,R=C_2H_5)
	+ unknown sterane		
s	14β(H),17β(H)-sterane (20S)	$C_{29}H_{52}$	(II,R=C_2H_5)
t	14α(H),17α(H)-sterane (20R)	$C_{29}H_{52}$	(I,R=C_2H_5)
u	5α(H)-sterane	$C_{21}H_{36}$	(V,R=C_2H_5)
v	5α(H)-sterane	$C_{22}H_{38}$	(IV,R=C_3H_7)



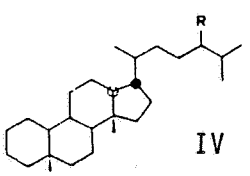
I



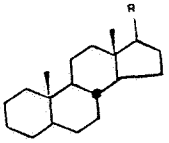
II



III

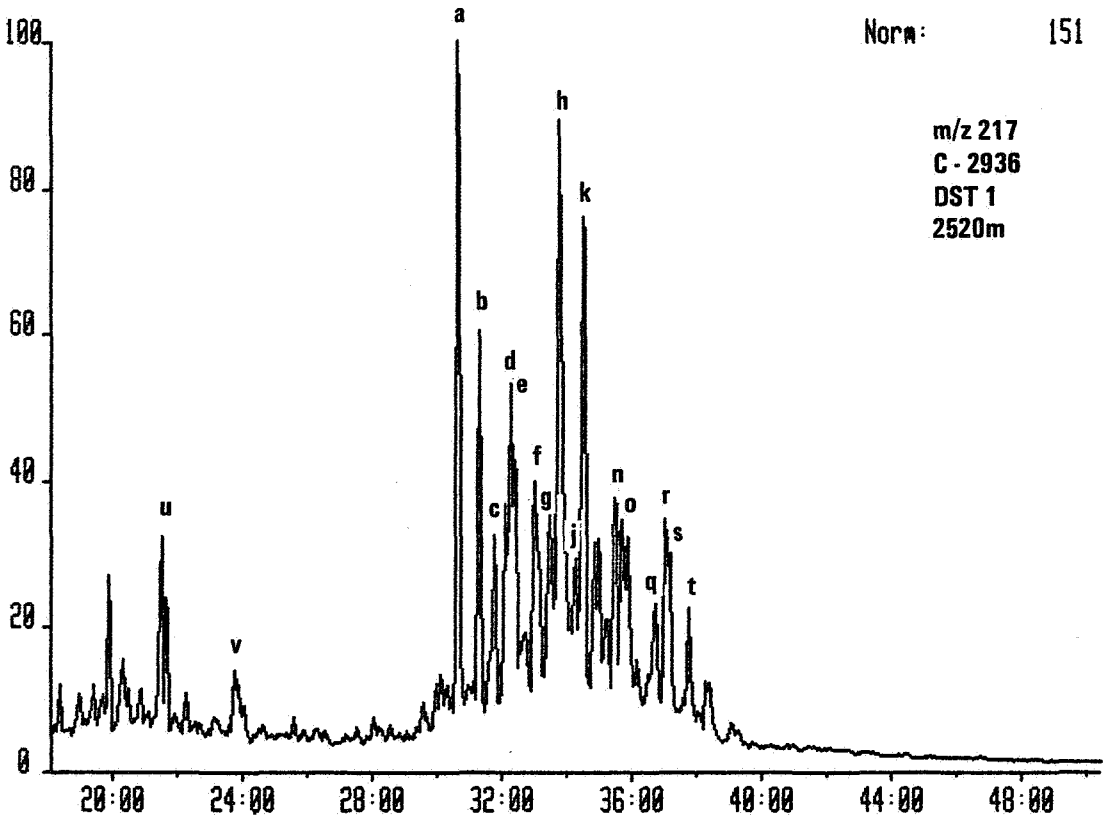


IV

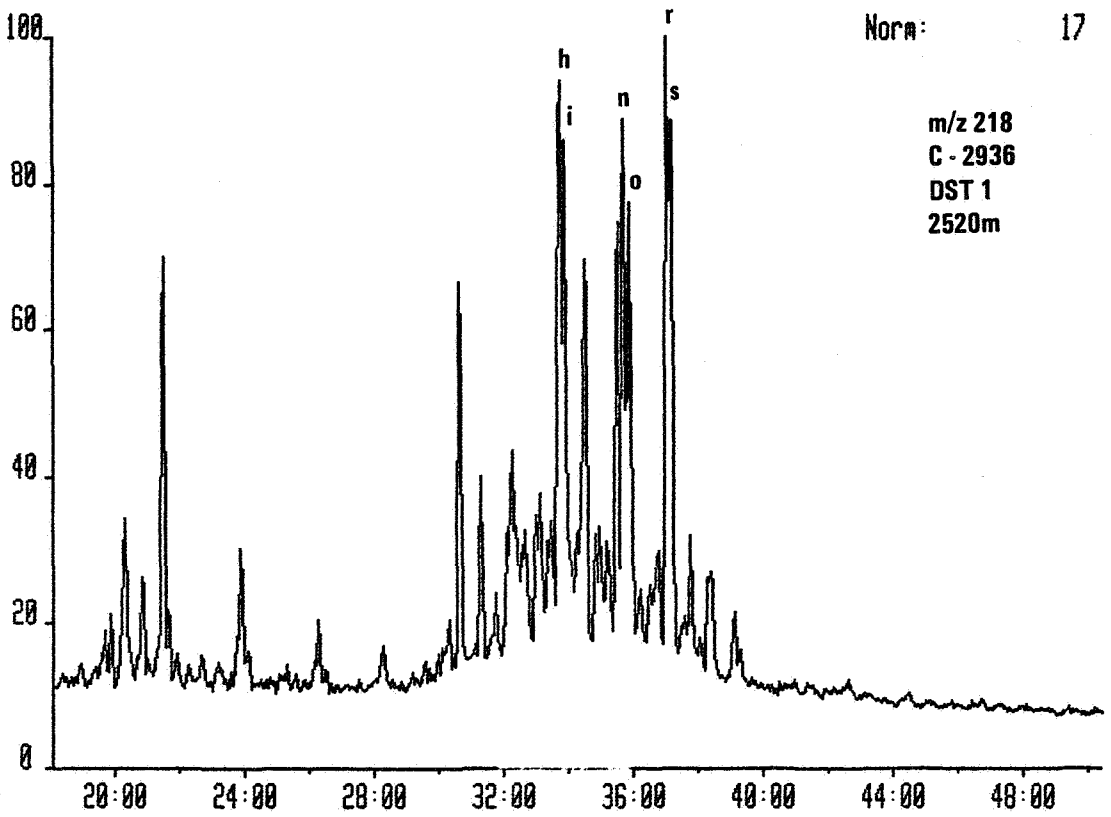


V

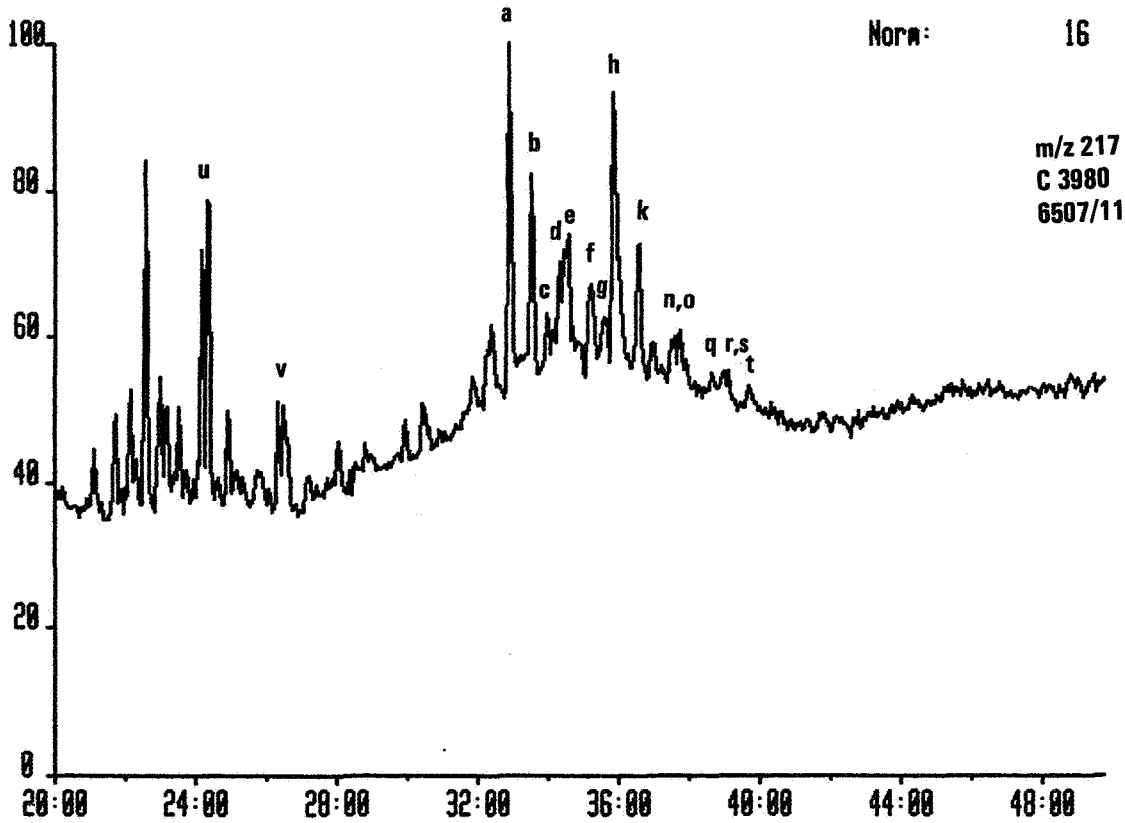
C2936SATT 6-NOV-85 Sir:Voltage 7070H Acnt:IKU System:TRIT
Sample 1 Injection 1 Group 1 Mass 217.1000
Text:



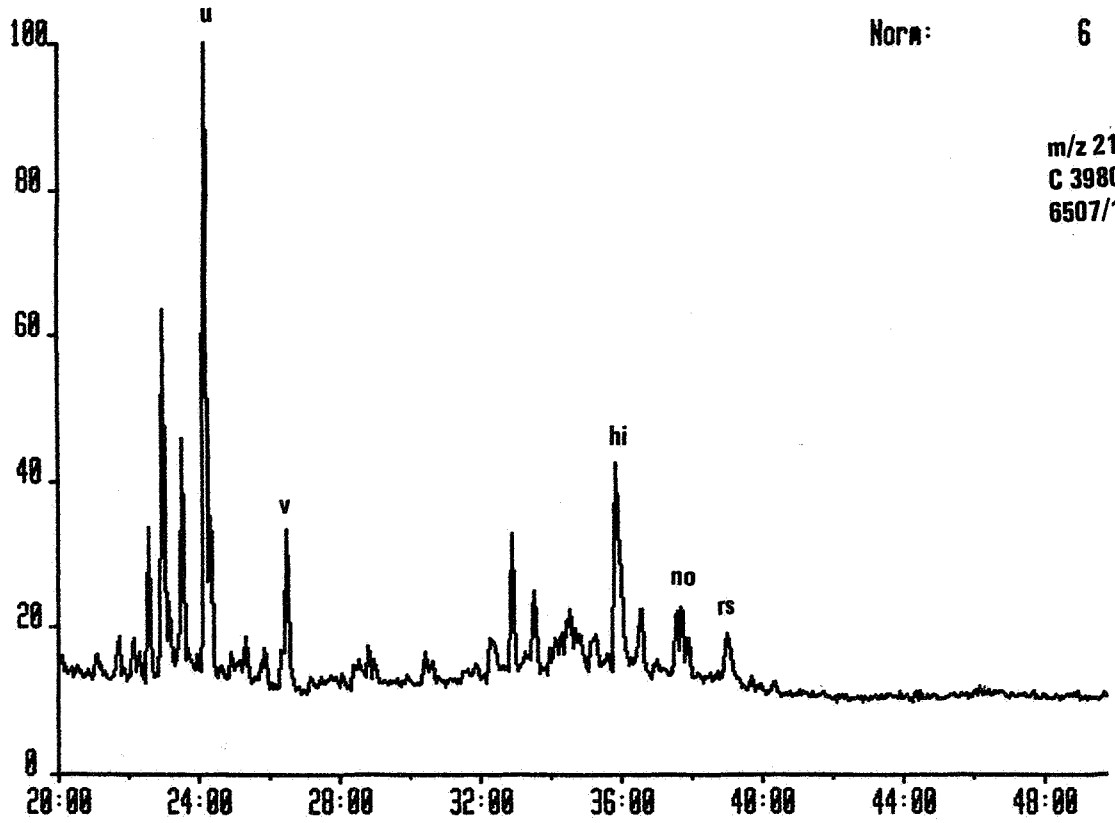
C2936SATT 6-NOV-85 Sir:Voltage 7070H Acnt:IKU System:TRIT
Sample 1 Injection 1 Group 1 Mass 218.1000
Text:



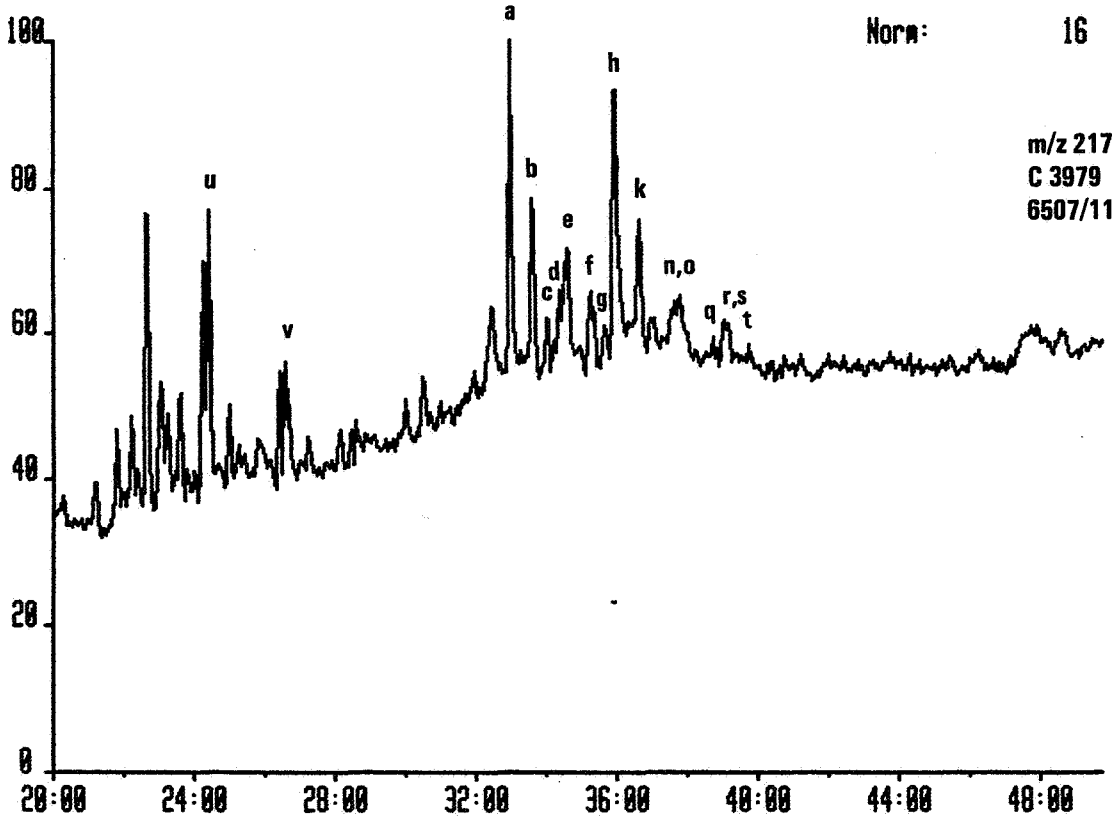
C3980SAT 15-APR-86 Sir:Voltage 12-250 Acnt:IKU System:QUANTID
Sample 1 Injection 1 Group 1 Mass 217.1000
Text:



C3980SAT 15-APR-86 Sir:Voltage 12-250 Acnt:IKU System:QUANTID
Sample 1 Injection 1 Group 1 Mass 218.1000
Text:



C3979SAT 15-APR-86 Sir:Voltage 12-250 Acnt:IKU System:QUANTID
Sample 1 Injection 1 Group 1 Mass 217.1000
Text:



C3979SAT 15-APR-86 Sir:Voltage 12-250 Acnt:IKU System:QUANTID
Sample 1 Injection 1 Group 1 Mass 218.1000
Text:

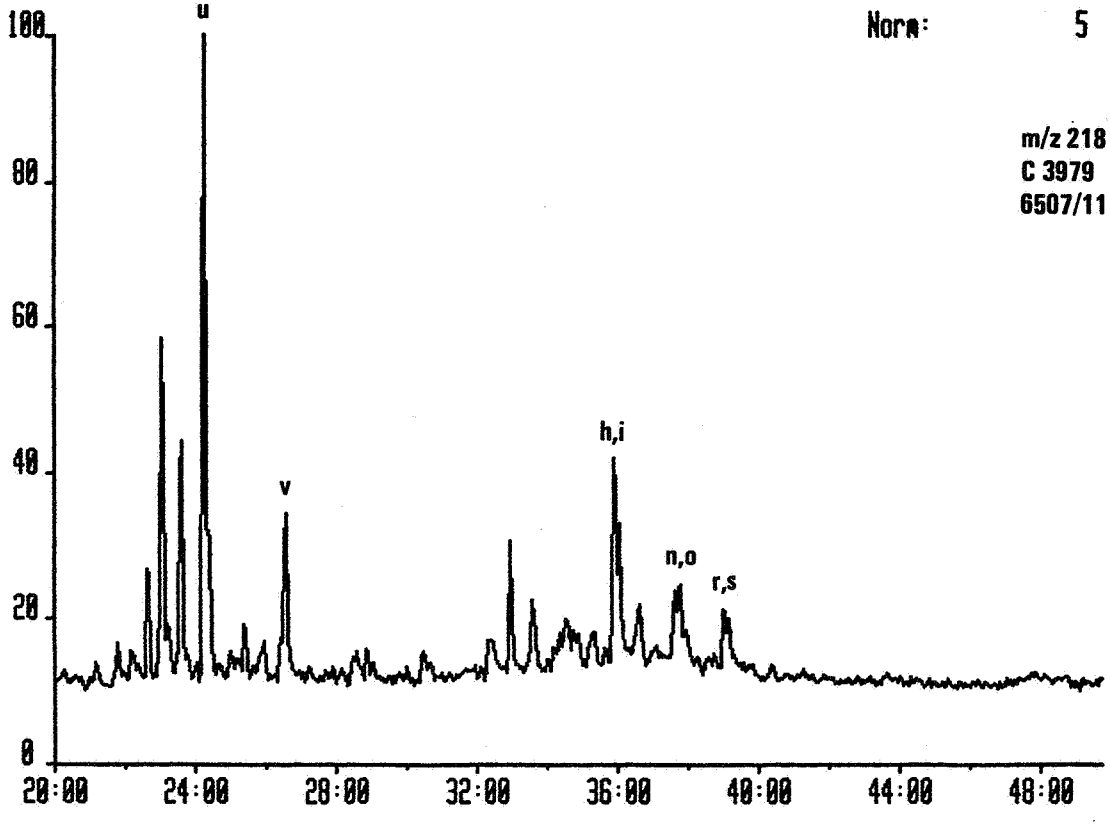
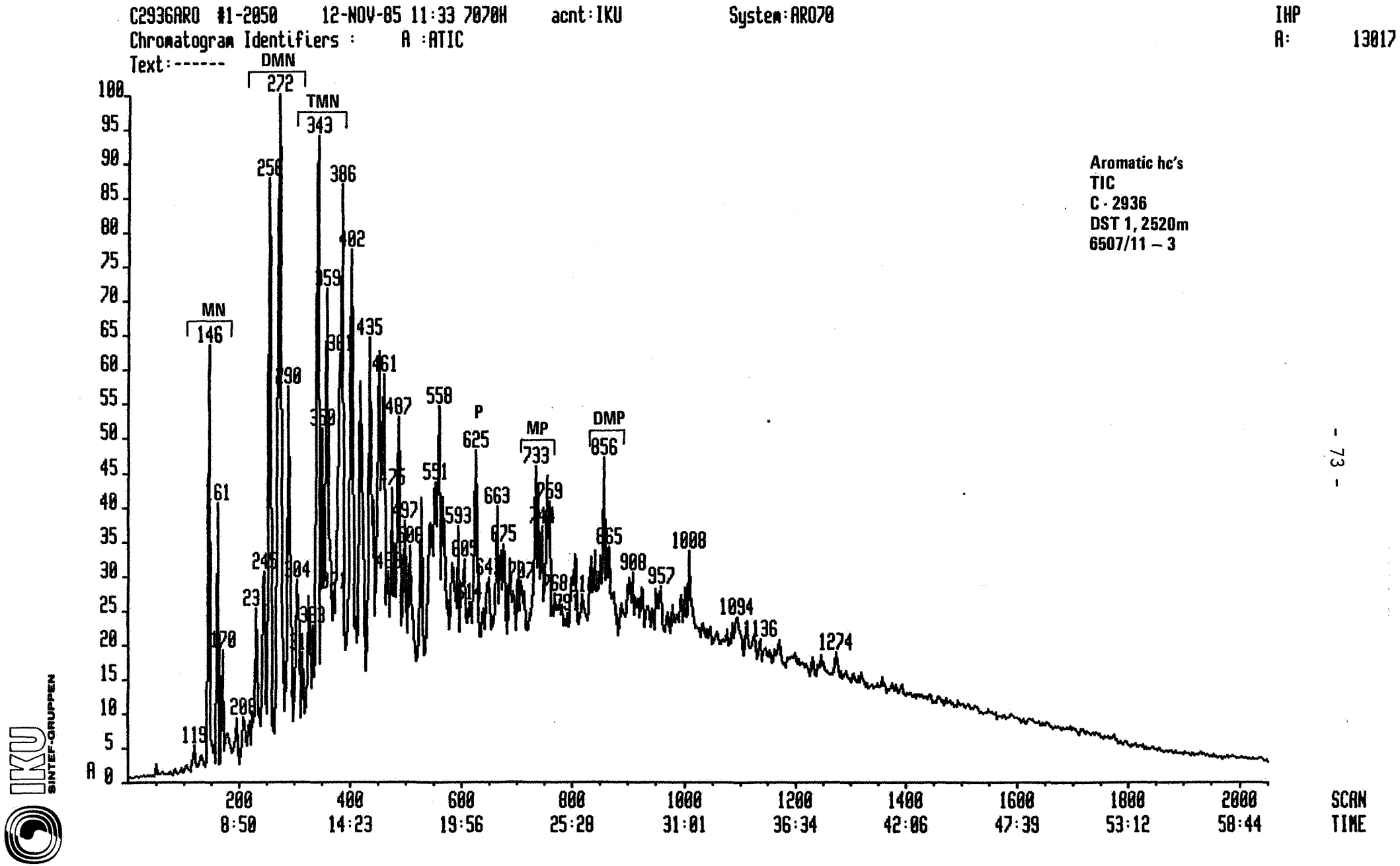


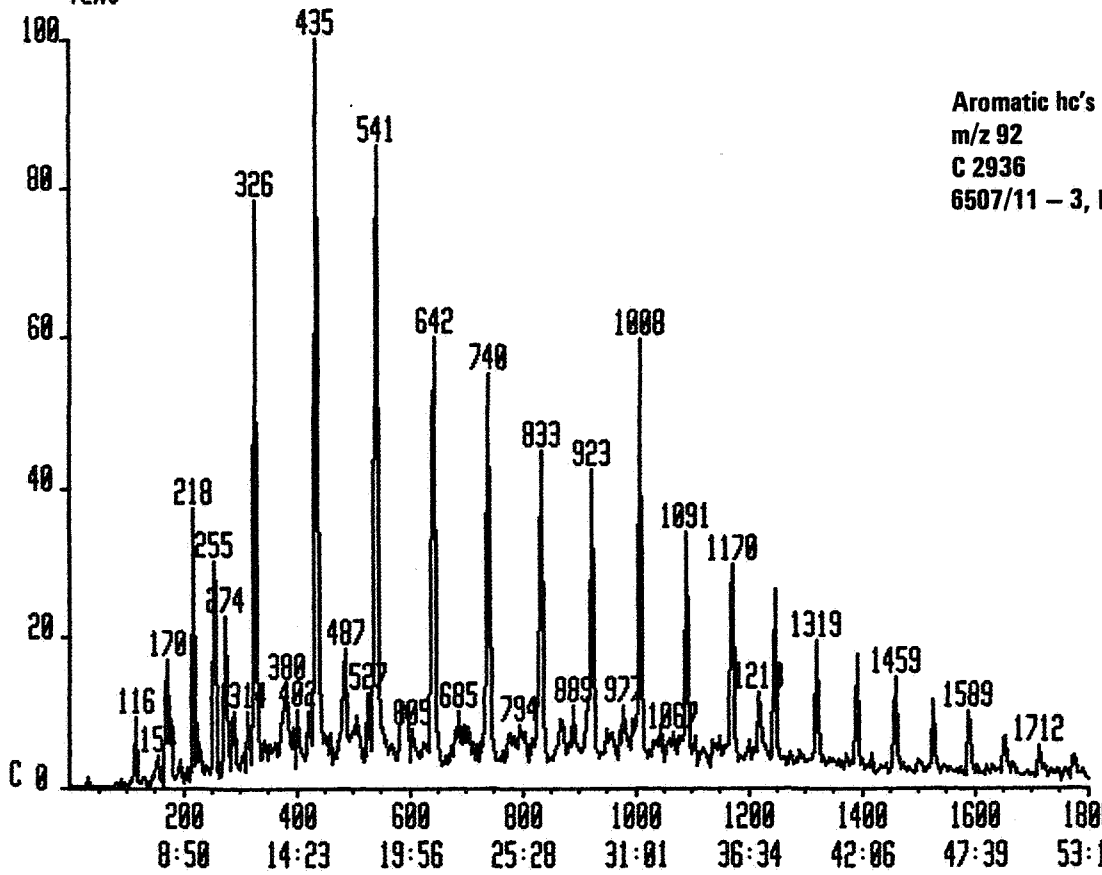
FIGURE 7

MASS CHROMATOGRAMS REPRESENTING AROMATIC HYDROCARBONS

TIC	- total ion chromatogram
m/z 92,106	- alkyl benzenes
m/z 142,156,170	- alkyl naphthalenes
m/z 178,192,206	- phenanthrene and alkyl phenanthrenes
m/z 184,198,212	- dibenzothiophene and alkyl dibenzothiophenes
m/z 231	- triaromatic steranes
m/z 253	- monoaromatic steranes

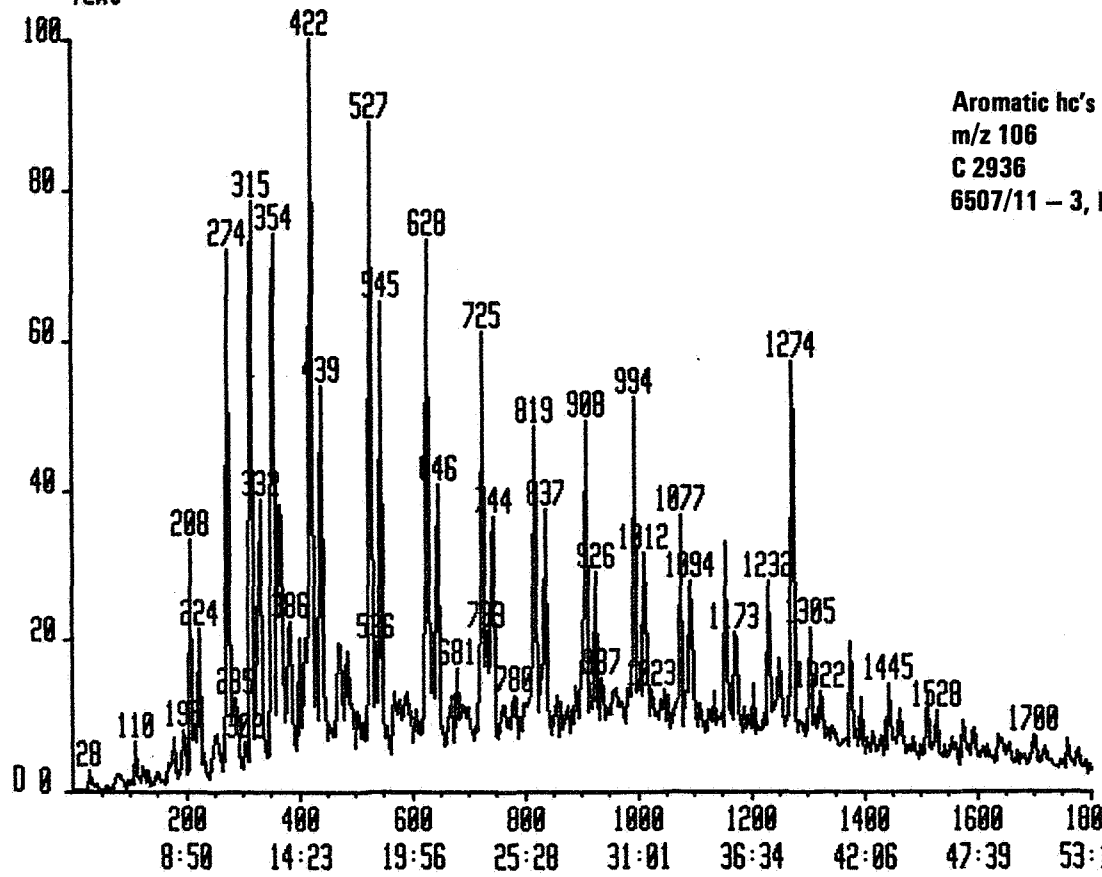

C2936ARO #1-2050 12-NOV-85 11:33 7070H acnt:IKU System:AR070 IHP
Chromatogram Identifiers : A :ATIC A: 13017
Text:------
DMN
272
TMN
343
MN
146
P
625
MP
733
DMP
856
Aromatic hc's
TIC
C - 2936
DST 1, 2520m
6507/11 – 3
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
A 0
200 8:50
400 14:23
600 19:56
800 25:28
1000 31:01
1200 36:34
1400 42:06
1600 47:39
1800 53:12
2000 58:44
SCAN
TIME

C2936ARO #1-1800 12-NOV-85 11:33 7070H acnt:IKU System:ARO70HP
Chromatogram Identifiers : C1:92 C: 6286000
Text:------

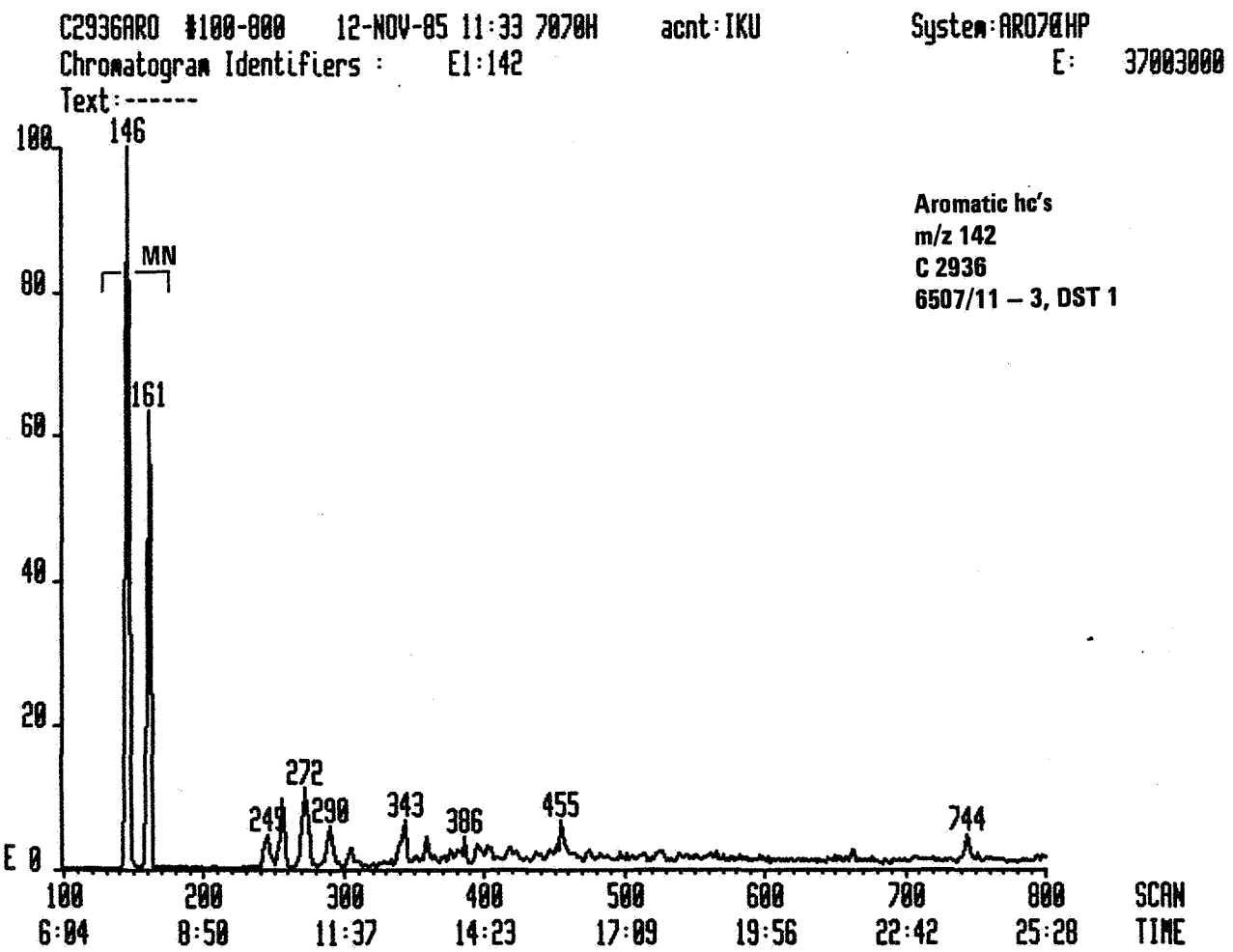


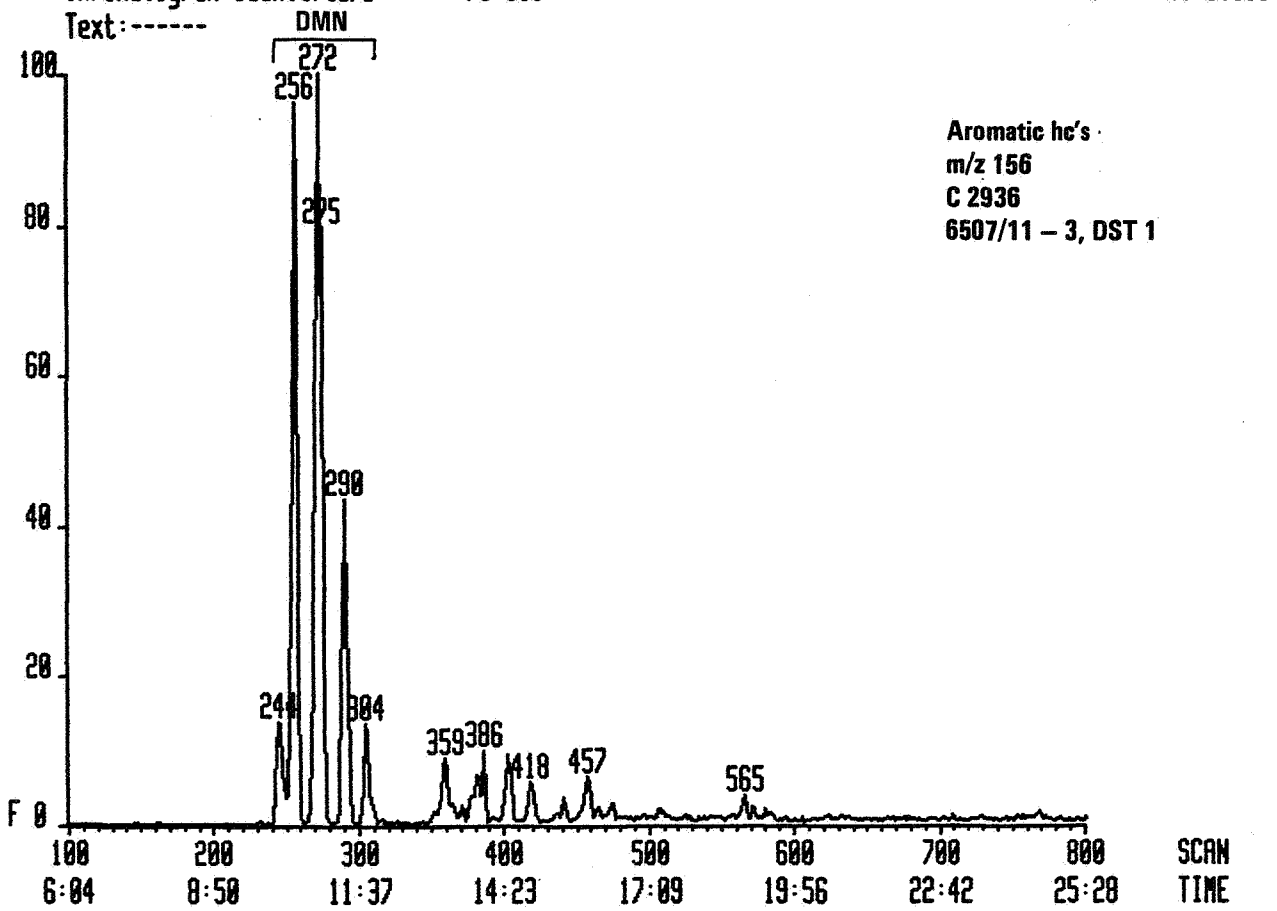
Aromatic hc's
m/z 92
C 2936
6507/11 – 3, DST 1

C2936ARO #1-1800 12-NOV-85 11:33 7070H acnt:IKU System:ARO70HP
Chromatogram Identifiers : D1:106 D: 5156000
Text:------

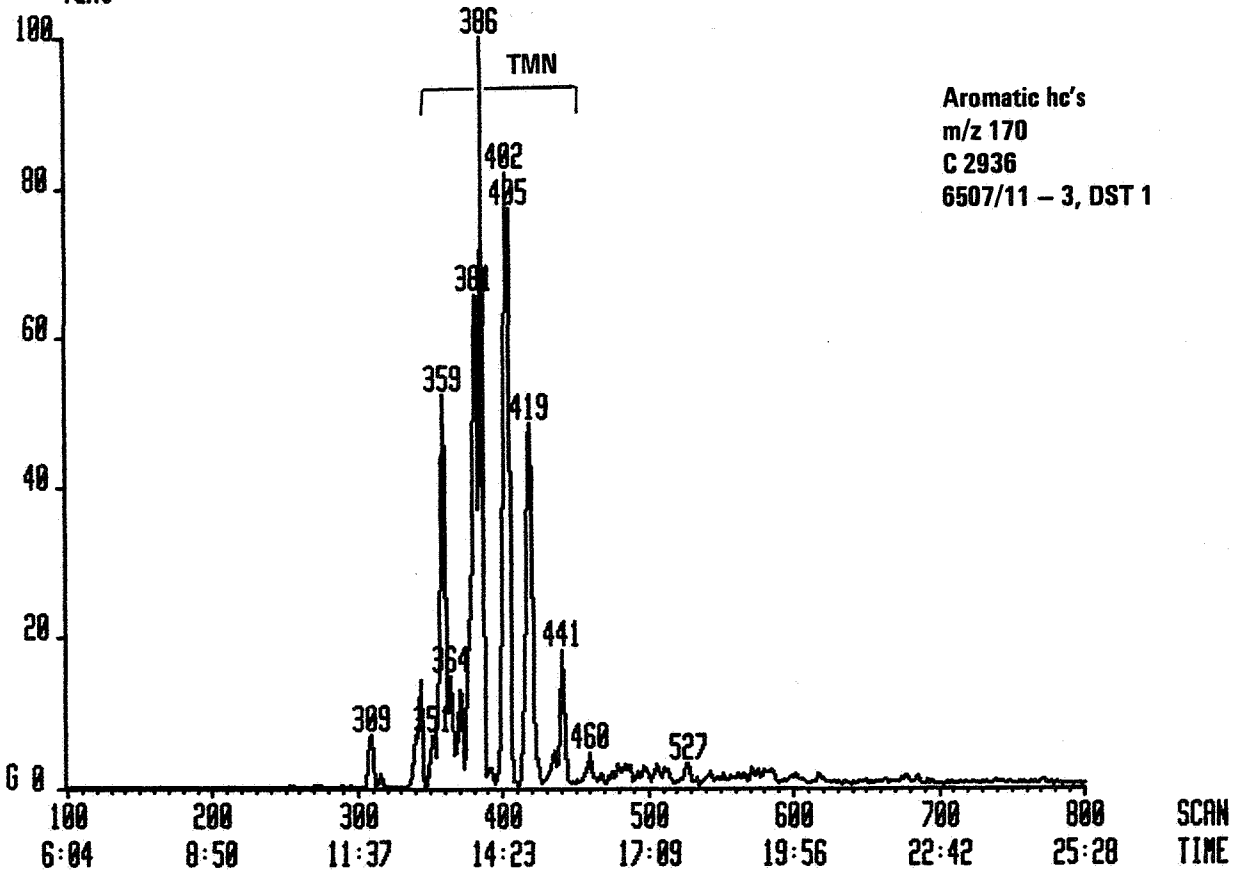


Aromatic hc's
m/z 106
C 2936
6507/11 – 3, DST 1

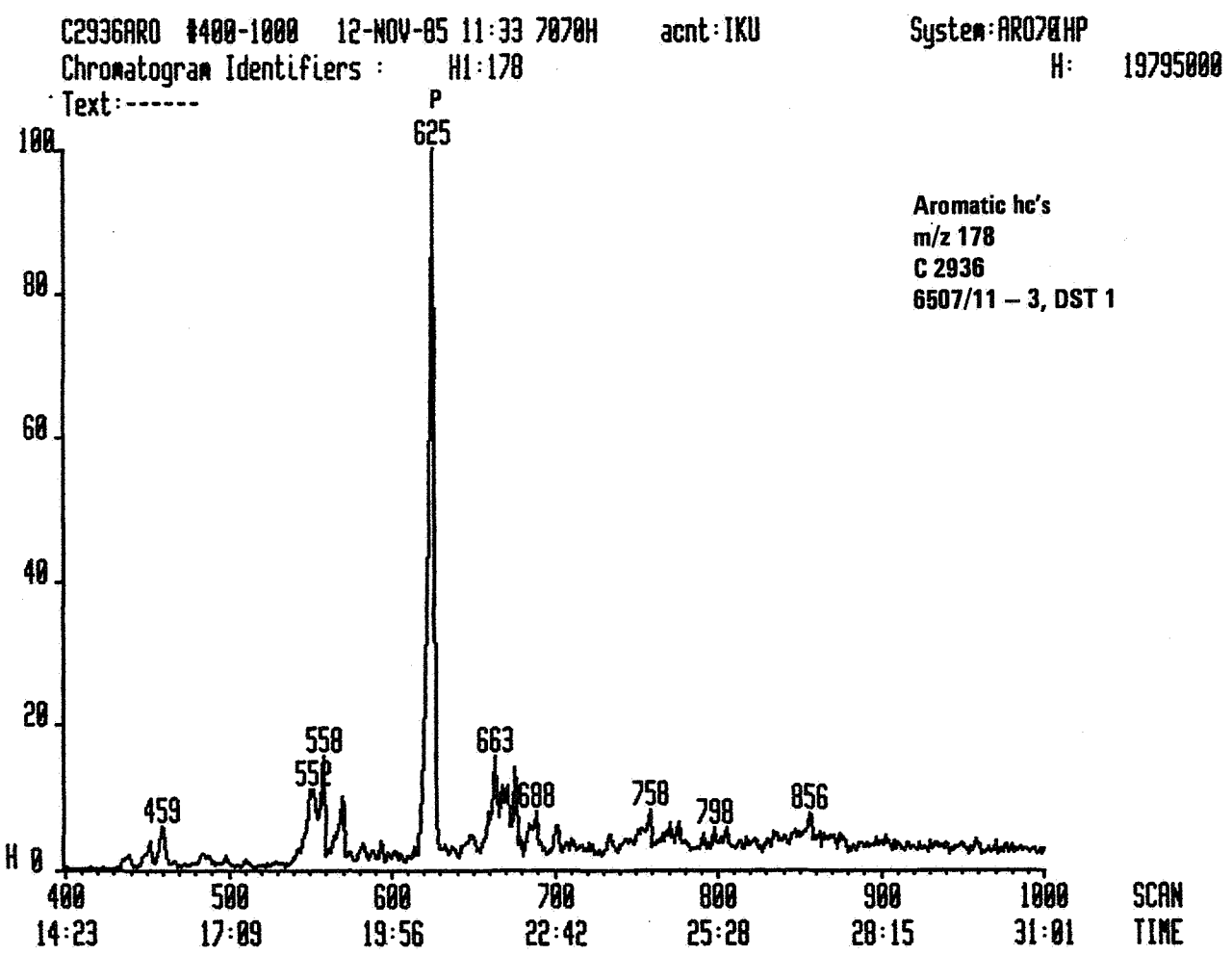

C2936ARO #100-800 12-NOV-85 11:33 7070H acnt:IKU System:ARO70&HP
Chromatogram Identifiers : E1:142 E: 37003000
Text:------
146
MN
161
272
249
290
343
386
455
744
E 0
100 200 300 400 500 600 700 800 SCAN
6:04 8:50 11:37 14:23 17:09 19:56 22:42 25:28 TIME
Aromatic hc's
m/z 142
C 2936
6507/11 – 3, DST 1

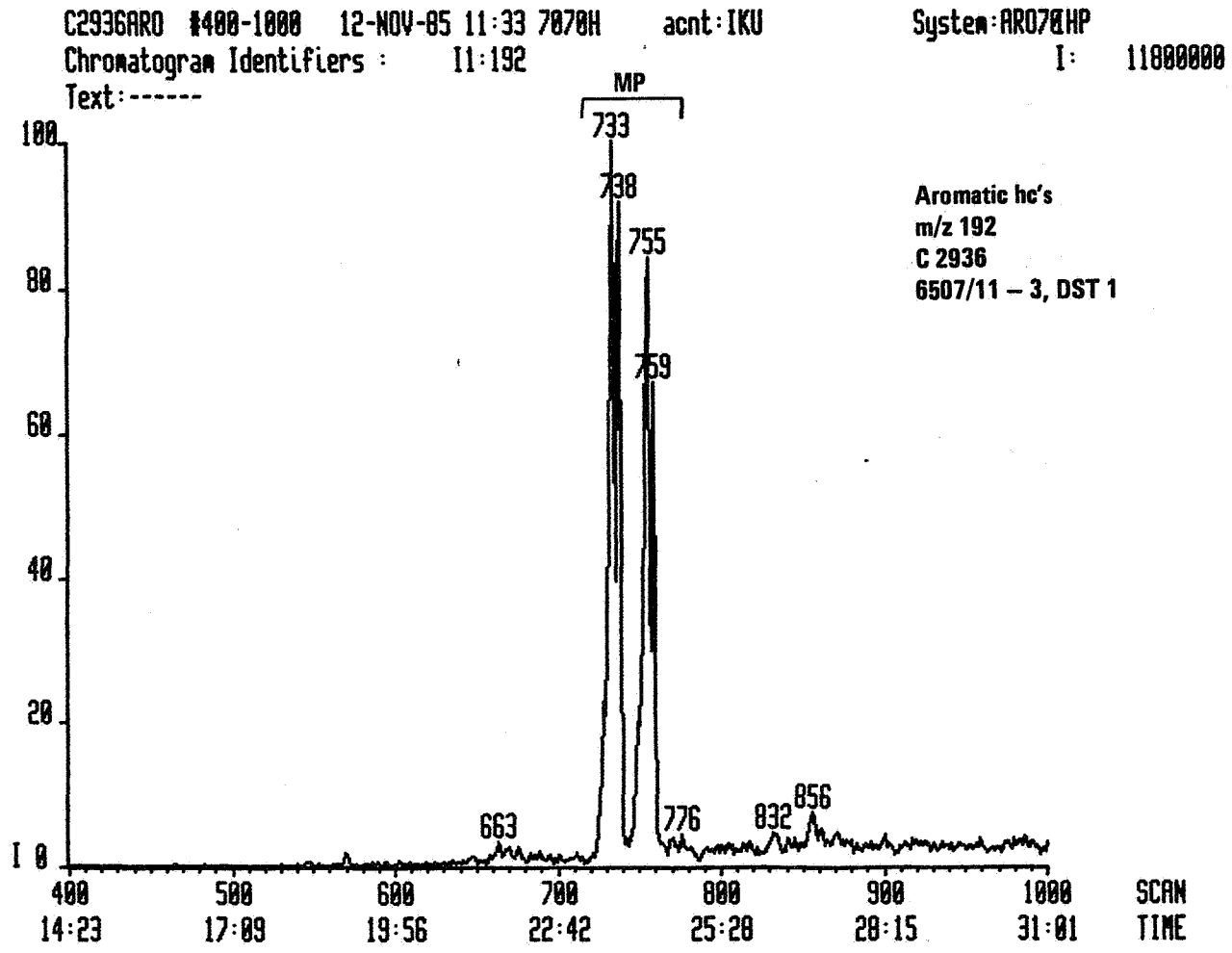

C2936ARO #100-800 12-NOV-85 11:33 7070H acnt:IKU System:ARO70&HP
Chromatogram Identifiers : F1:156 F: 39706000
Text:------
DMN
272
256
295
290
244
304
359
386
418
457
565
F 0
100 200 300 400 500 600 700 800 SCAN
6:04 8:50 11:37 14:23 17:09 19:56 22:42 25:28 TIME
Aromatic hc's
m/z 156
C 2936
6507/11 – 3, DST 1

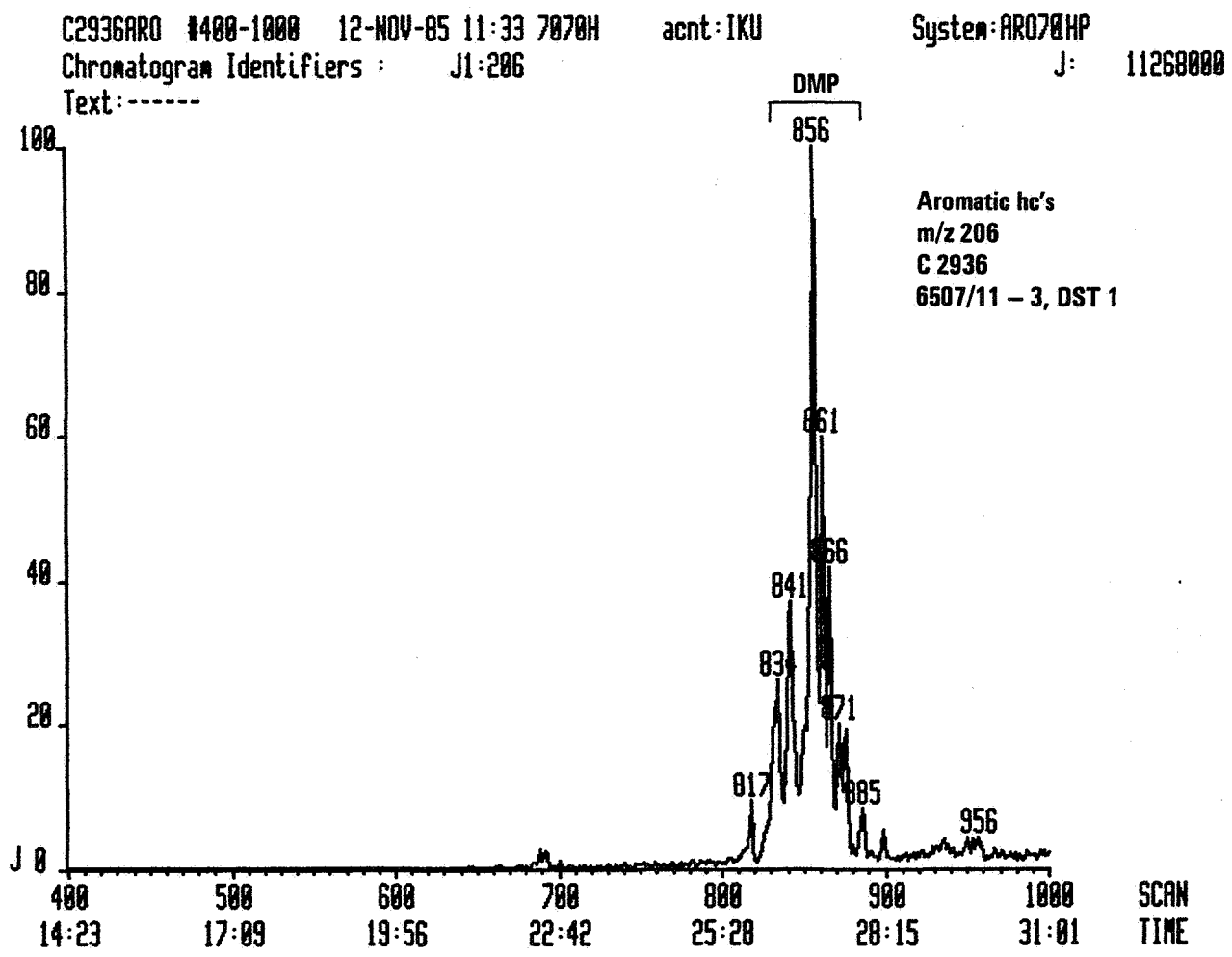
C2936ARO #100-800 12-NOV-85 11:33 7070H acnt:IKU System:ARO70HP
Chromatogram Identifiers : G1:170 G: 29742000
Text:------



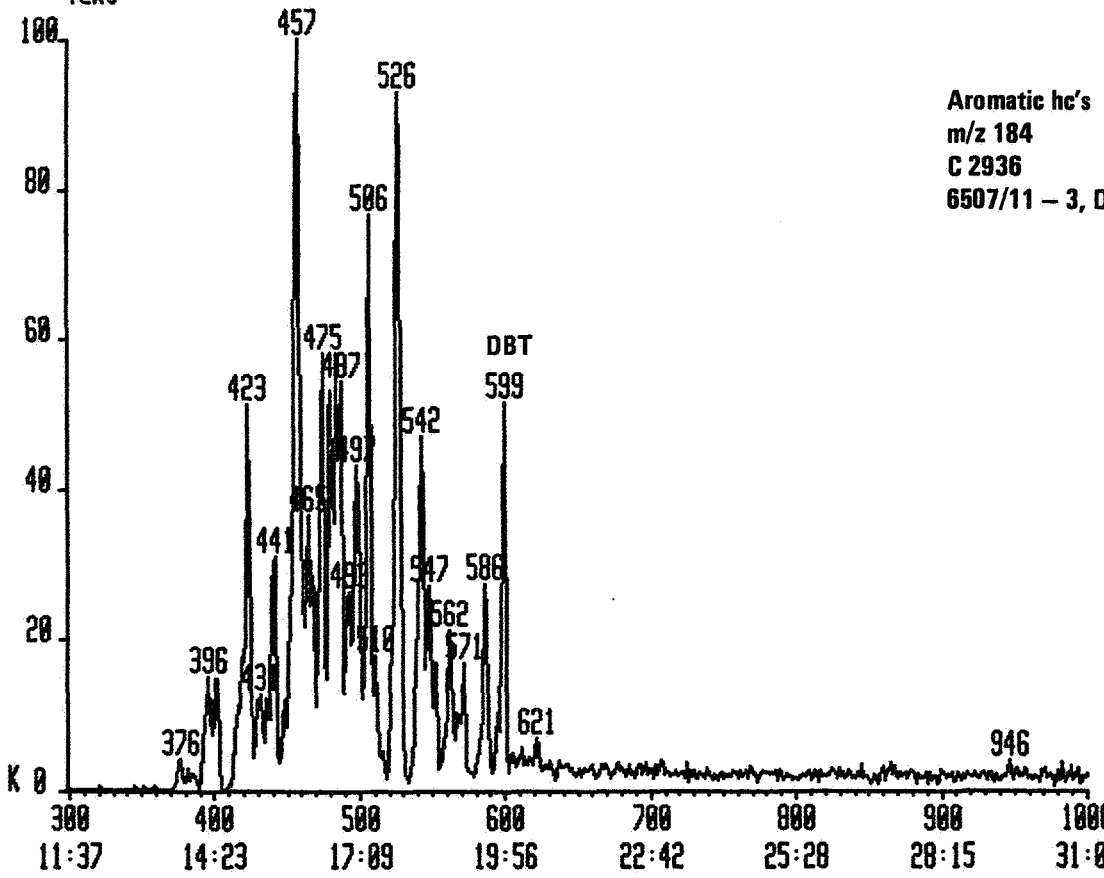
Aromatic hc's
m/z 170
C 2936
6507/11 – 3, DST 1


C2936ARO #400-1000 12-NOV-85 11:33 7070H acnt:IKU System:ARO70HP
Chromatogram Identifiers : H1:178 H: 19795000
Text:------
P
625
558
559
459
663
688
758
798
856
H 0
400 500 600 700 800 900 1000 SCAN
14:23 17:09 19:56 22:42 25:28 28:15 31:01 TIME
Aromatic hc's
m/z 178
C 2936
6507/11 – 3, DST 1


C2936ARO #400-1000 12-NOV-85 11:33 7070H acnt:IKU System:ARO70HP
Chromatogram Identifiers : I1:192 I: 11000000
Text:------
MP
733
738
755
759
663
776
832
856
I 0
400 500 600 700 800 900 1000 SCAN
14:23 17:09 19:56 22:42 25:28 28:15 31:01 TIME
Aromatic hc's
m/z 192
C 2936
6507/11 – 3, DST 1

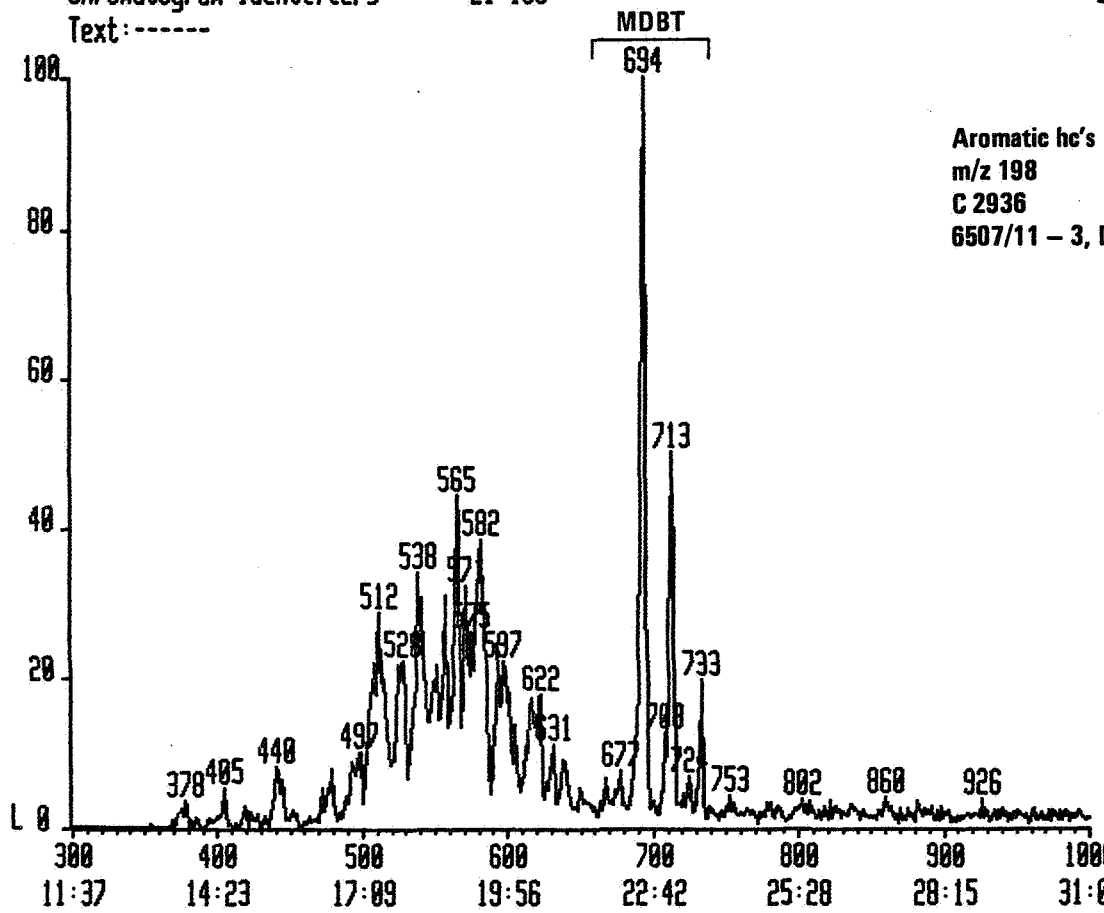

C2936ARO #400-1000 12-NOV-85 11:33 7070H acnt:IKU System:ARO70HP
Chromatogram Identifiers : J1:206 J: 11268000
Text:------
DMP
856
861
866
841
834
871
817
885
956
Aromatic hc's
m/z 206
C 2936
6507/11 – 3, DST 1
100
80
60
40
20
J 0
400 500 600 700 800 900 1000 SCAN
14:23 17:09 19:56 22:42 25:28 28:15 31:01 TIME

C2936ARO #300-1000 12-NOV-85 11:33 7070H acnt:IKU System:ARO70HP
Chromatogram Identifiers : K1:184 K: 6192000
Text:------

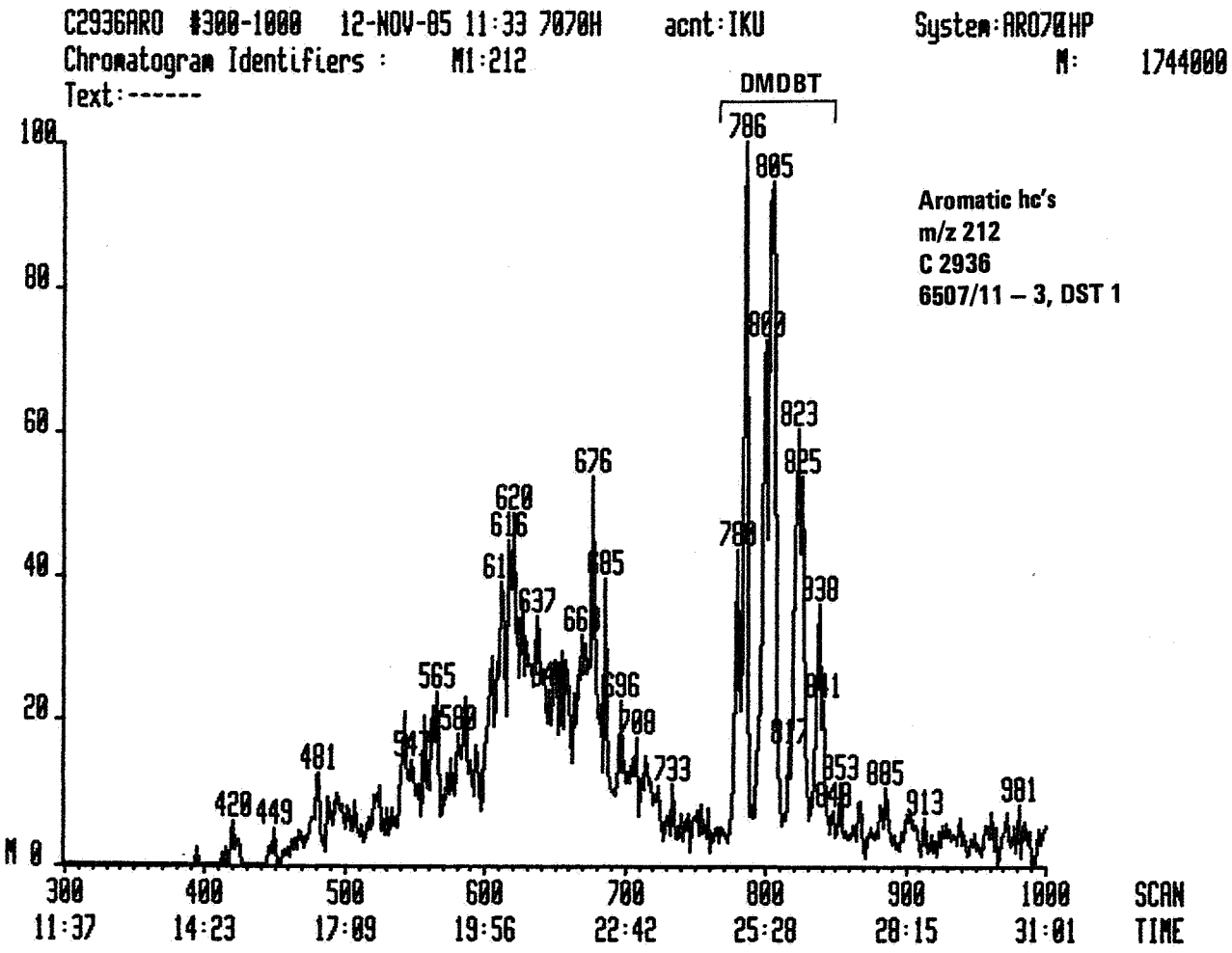


Aromatic hc's
m/z 184
C 2936
6507/11 – 3, DST 1

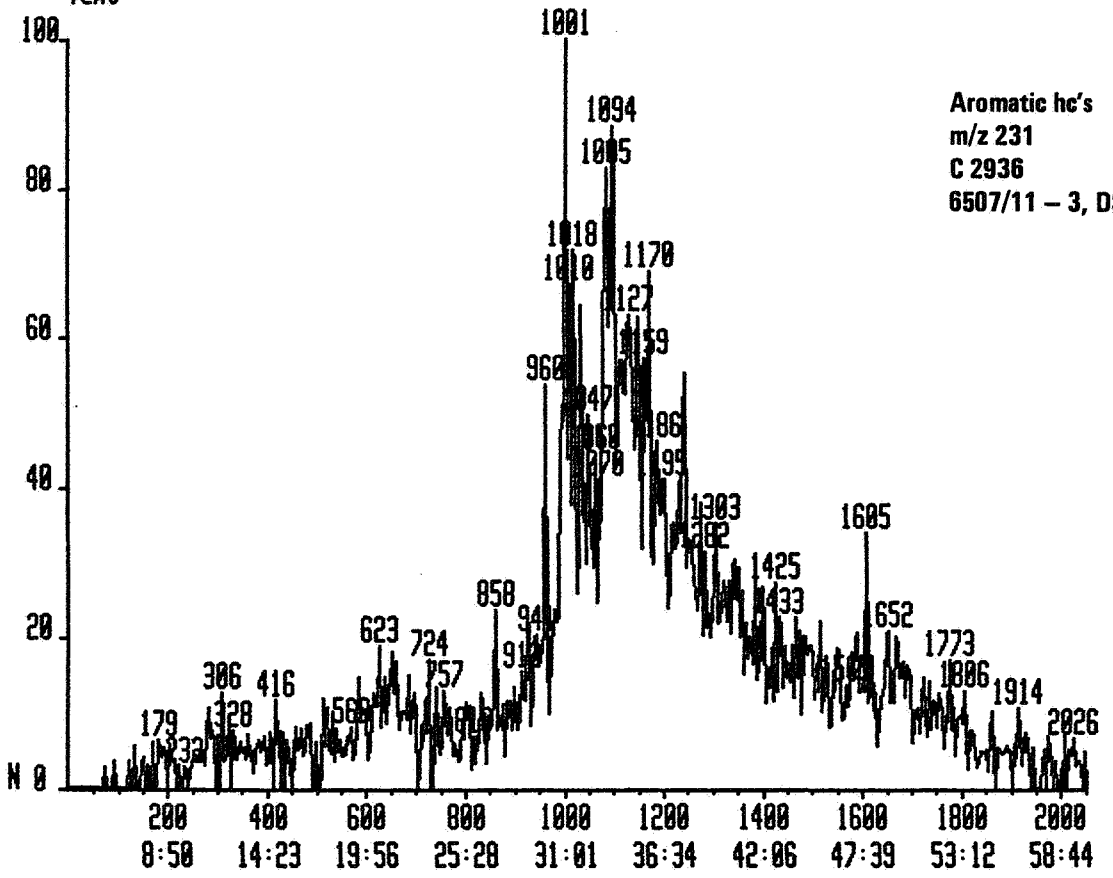
C2936ARO #300-1000 12-NOV-85 11:33 7070H acnt:IKU System:ARO70HP
Chromatogram Identifiers : L1:198 L: 4369000
Text:------



Aromatic hc's
m/z 198
C 2936
6507/11 – 3, DST 1


C2936ARO #300-1000 12-NOV-85 11:33 7070H acnt:IKU System:ARO70HP
Chromatogram Identifiers : M1:212 M: 1744000
Text:------
DMDBT
Aromatic hc's
m/z 212
C 2936
6507/11 – 3, DST 1
100
80
60
40
20
M 0
786
805
823
825
676
620
565
481
420
449
733
885
913
981
300 400 500 600 700 800 900 1000 SCAN
11:37 14:23 17:09 19:56 22:42 25:28 28:15 31:01 TIME

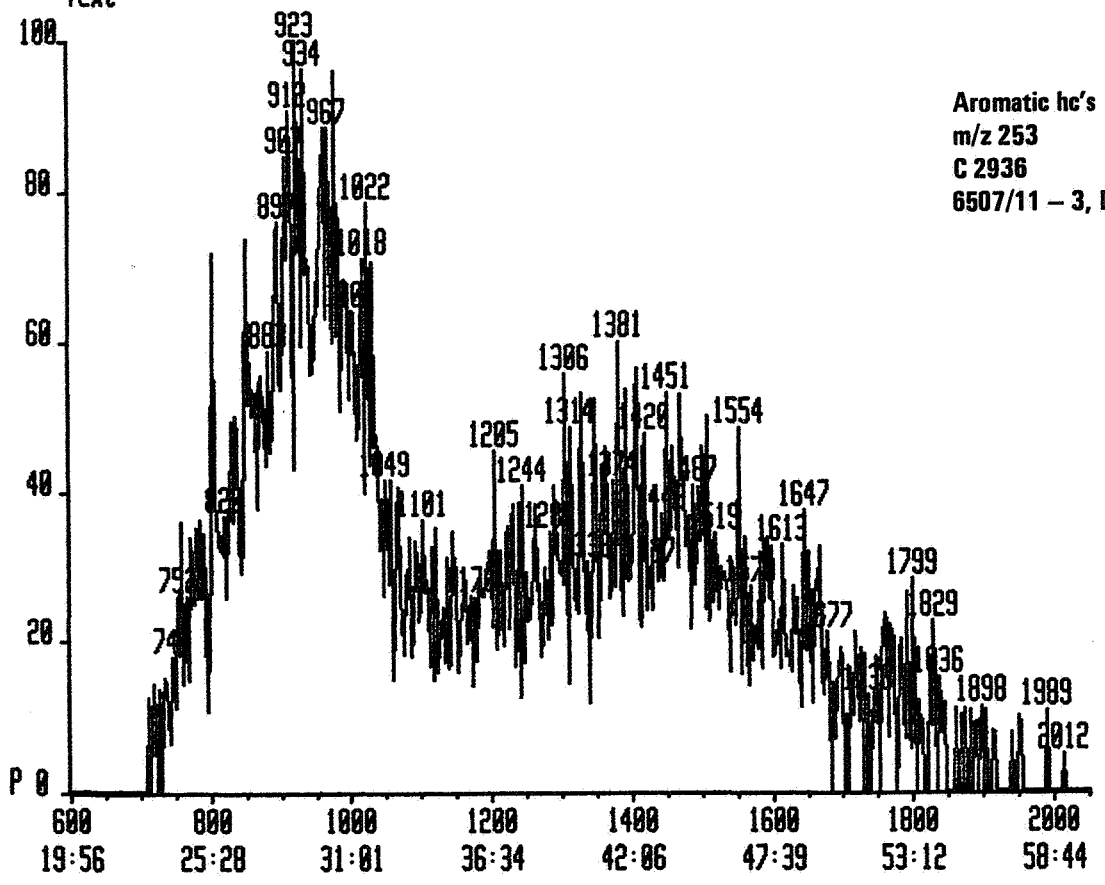
C2936ARO #1-2050 12-NOV-85 11:33 7070H acnt:IKU System:ARO70HP
Chromatogram Identifiers : N1:231 N: 634000
Text:------



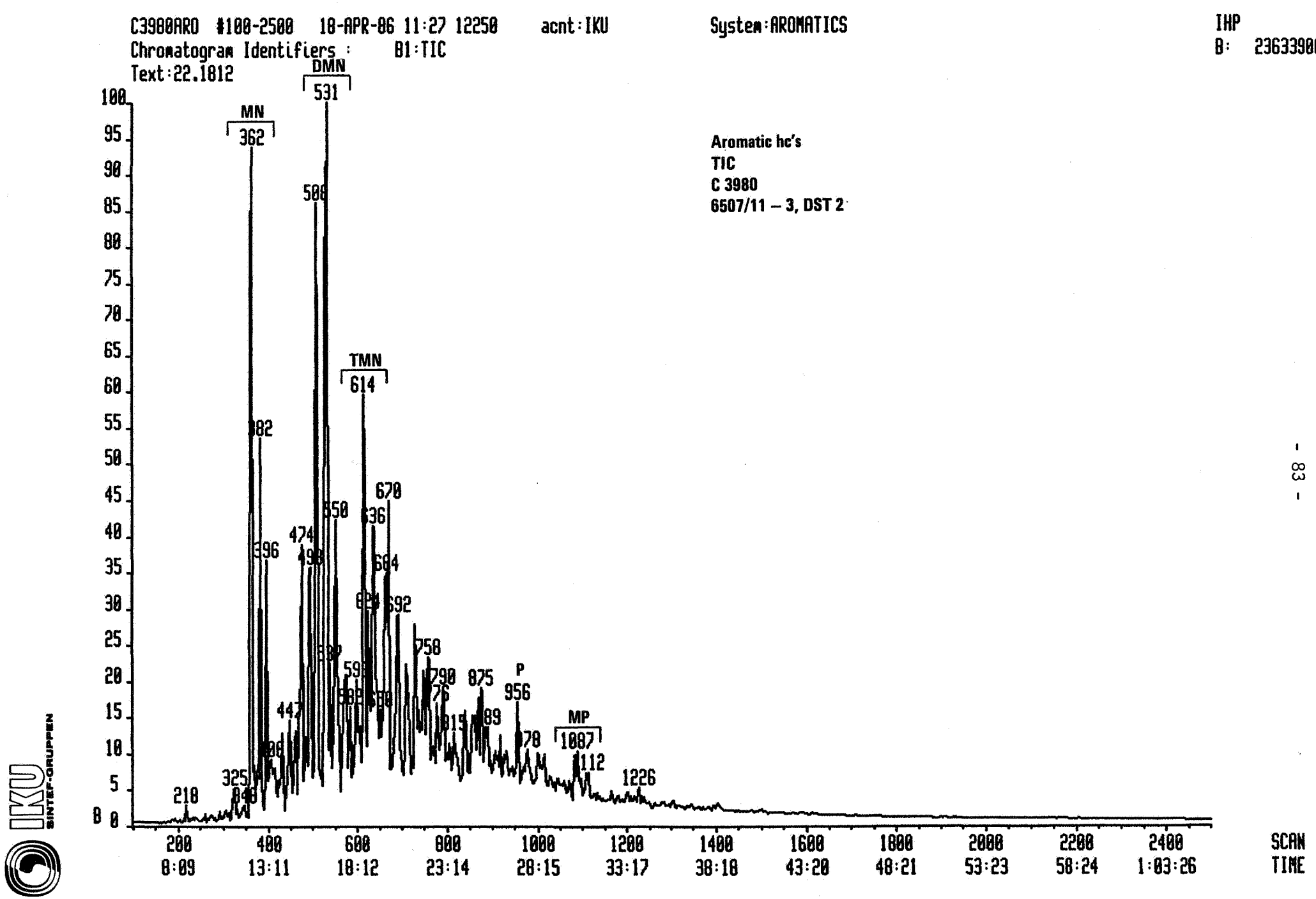
Aromatic hc's
m/z 231
C 2936
6507/11 – 3, DST 1

IKU
SINTEF-GRUPPEN

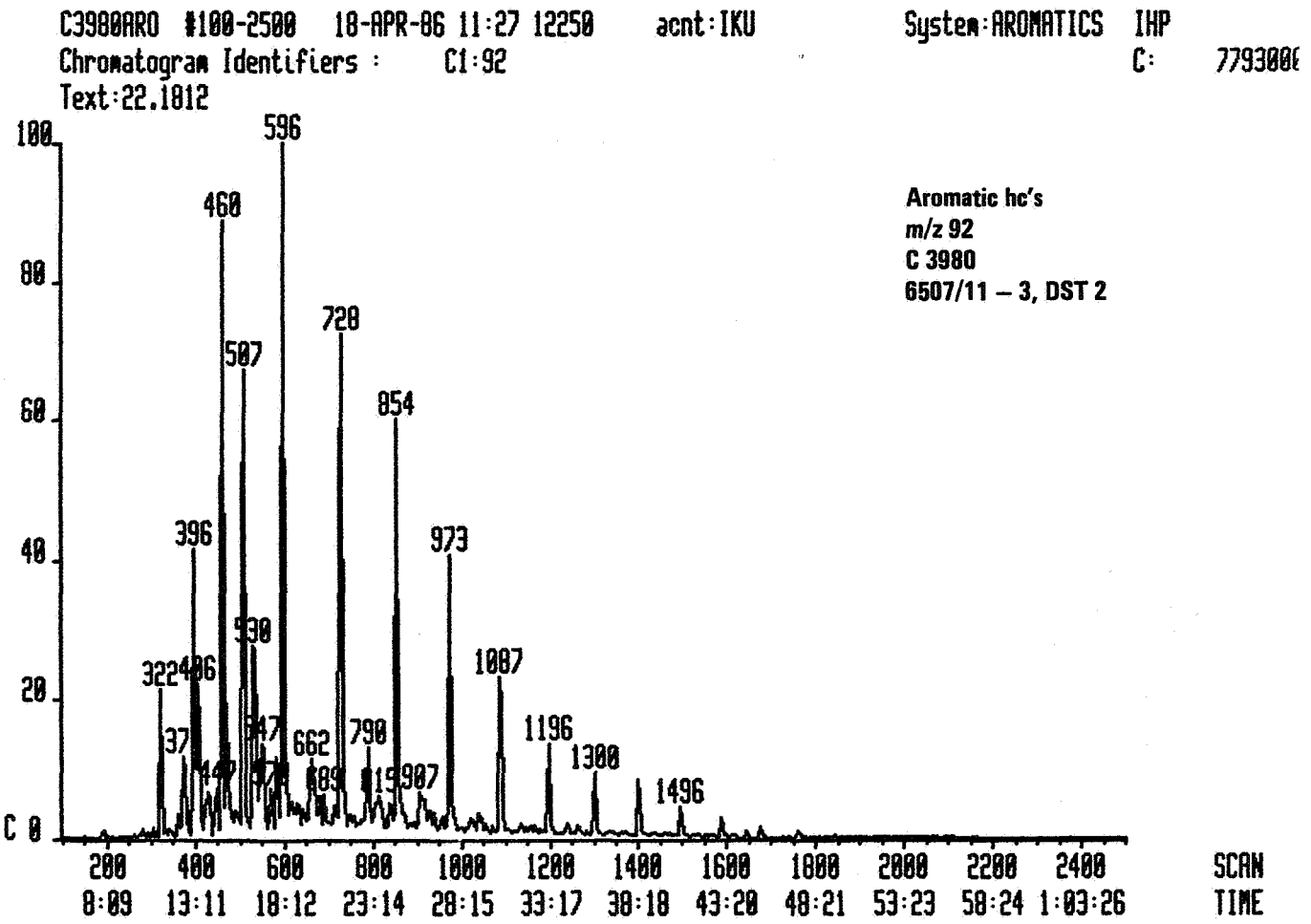
C2936ARO #600-2050 12-NOV-85 11:33 7070H acnt:IKU System:ARO70HP
Chromatogram Identifiers : P1:253 P: 265000
Text:------

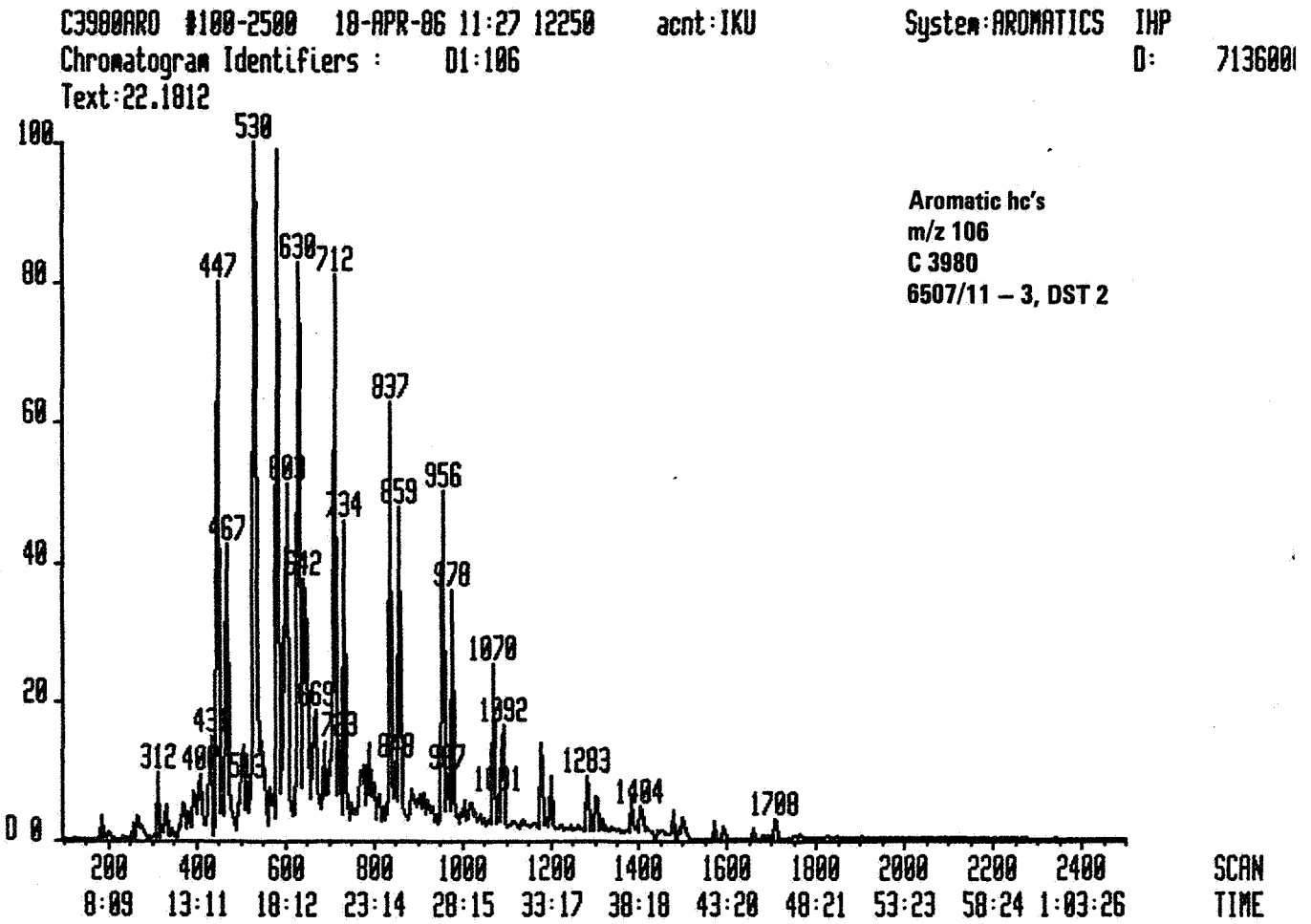


Aromatic hc's
m/z 253
C 2936
6507/11 – 3, DST 1



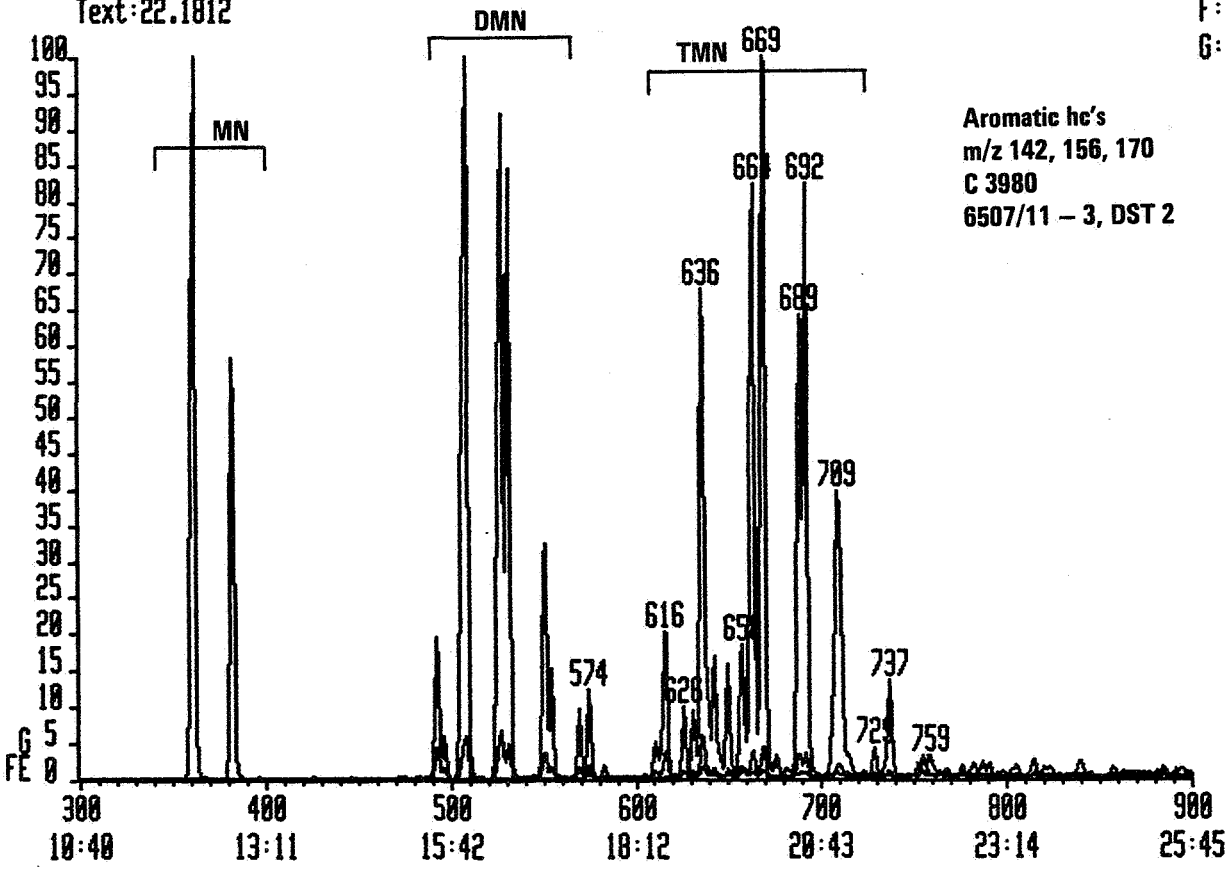
IKU
SINTEF-GRUPPEN


C3980ARO #100-2500 18-APR-86 11:27 12250 acnt:IKU System:AROMATICS IHP
Chromatogram Identifiers : C1:92 C: 7793000
Text:22.1812
Aromatic hc's
m/z 92
C 3980
6507/11 – 3, DST 2
596
460
728
507
854
396
973
530
1087
322
406
37
662
790
1196
1300
1496
907
C 0
200 400 600 800 1000 1200 1400 1600 1800 2000 2200 2400
SCAN
8:09 13:11 18:12 23:14 28:15 33:17 38:18 43:20 48:21 53:23 58:24 1:03:26
TIME

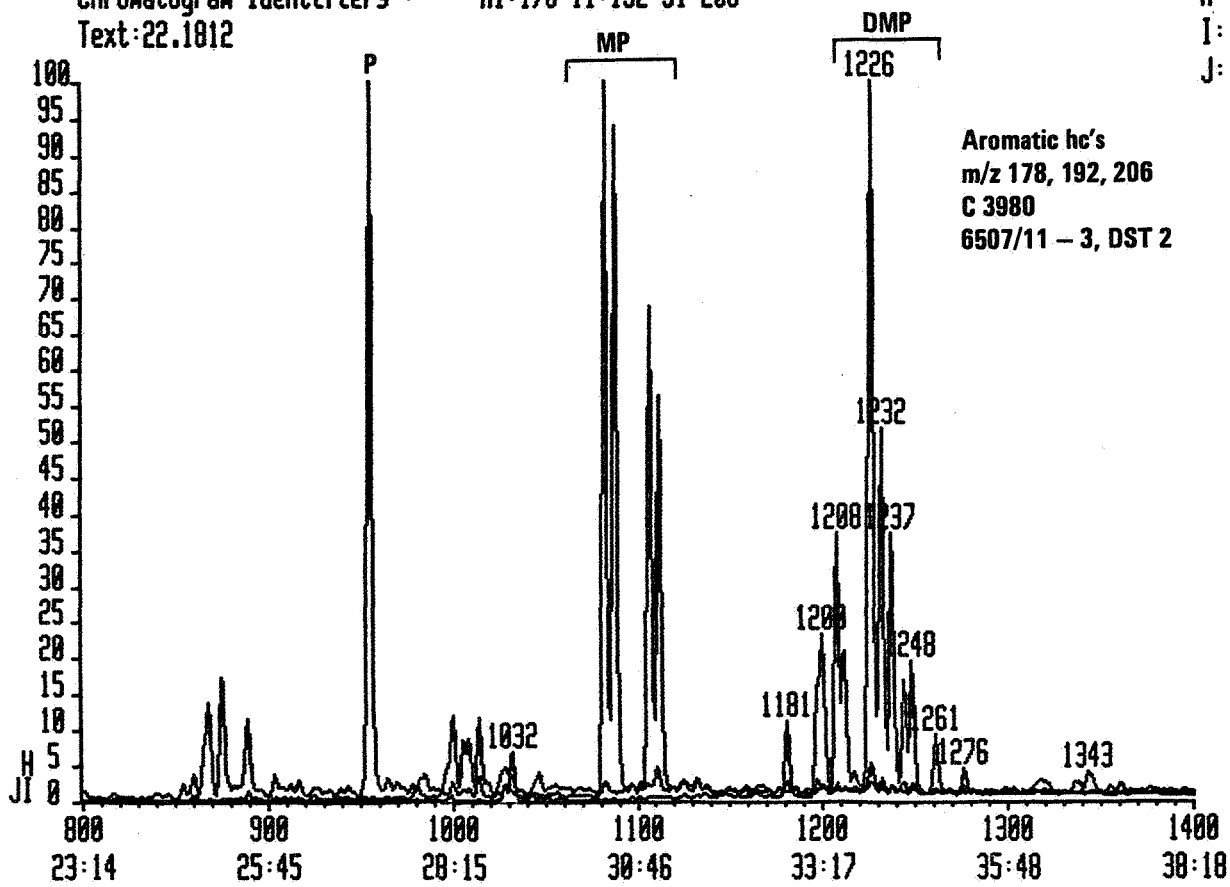

C3980ARO #100-2500 18-APR-86 11:27 12250 acnt:IKU System:AROMATICS IHP
Chromatogram Identifiers : D1:106 D: 7136001
Text:22.1812
Aromatic hc's
m/z 106
C 3980
6507/11 – 3, DST 2
530
447
630
712
837
956
859
467
978
1070
1283
1484
1708
312
D 0
200 400 600 800 1000 1200 1400 1600 1800 2000 2200 2400
SCAN
8:09 13:11 18:12 23:14 28:15 33:17 38:18 43:20 48:21 53:23 58:24 1:03:26
TIME

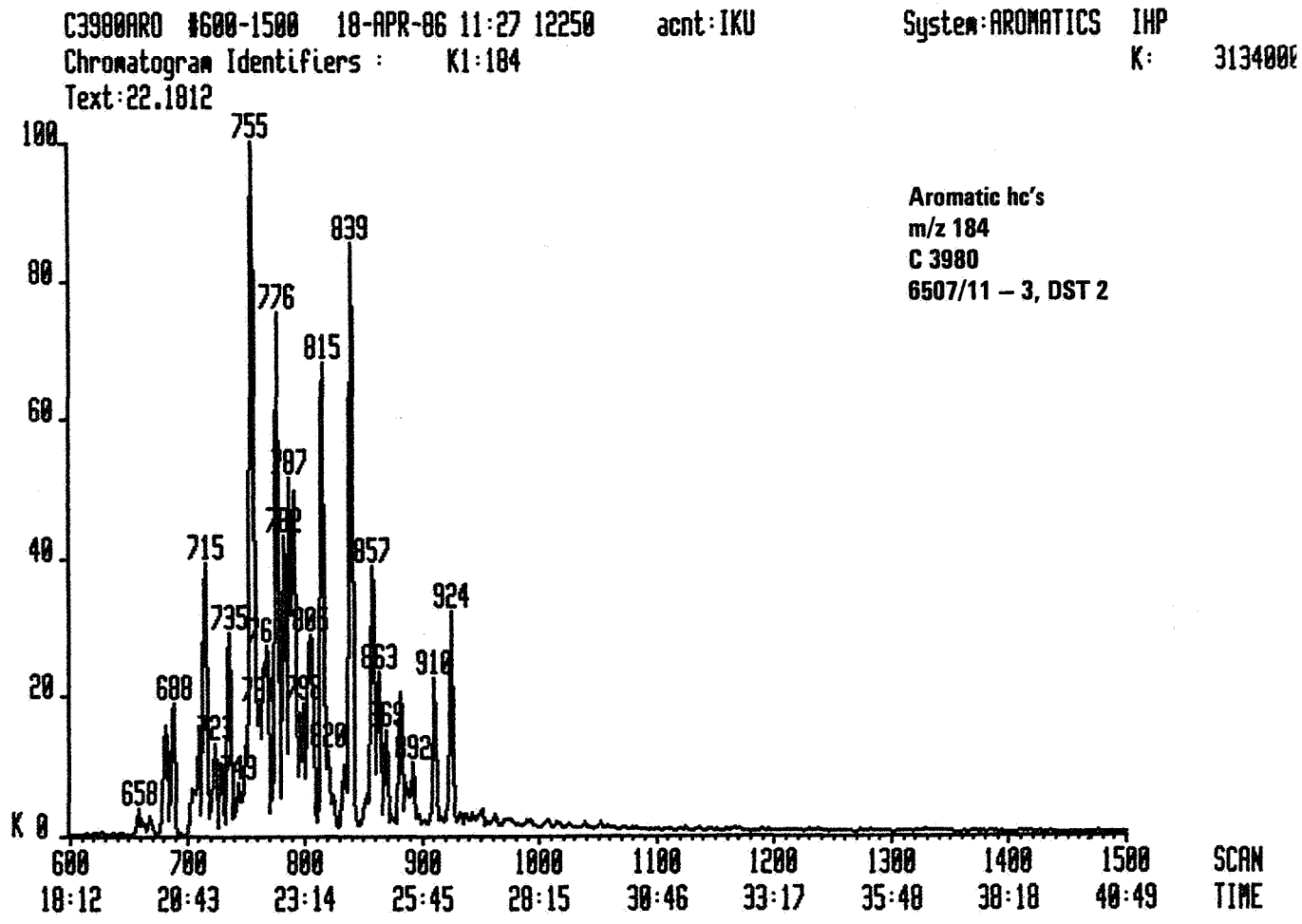
IKU SINTEF-GRUPPEN

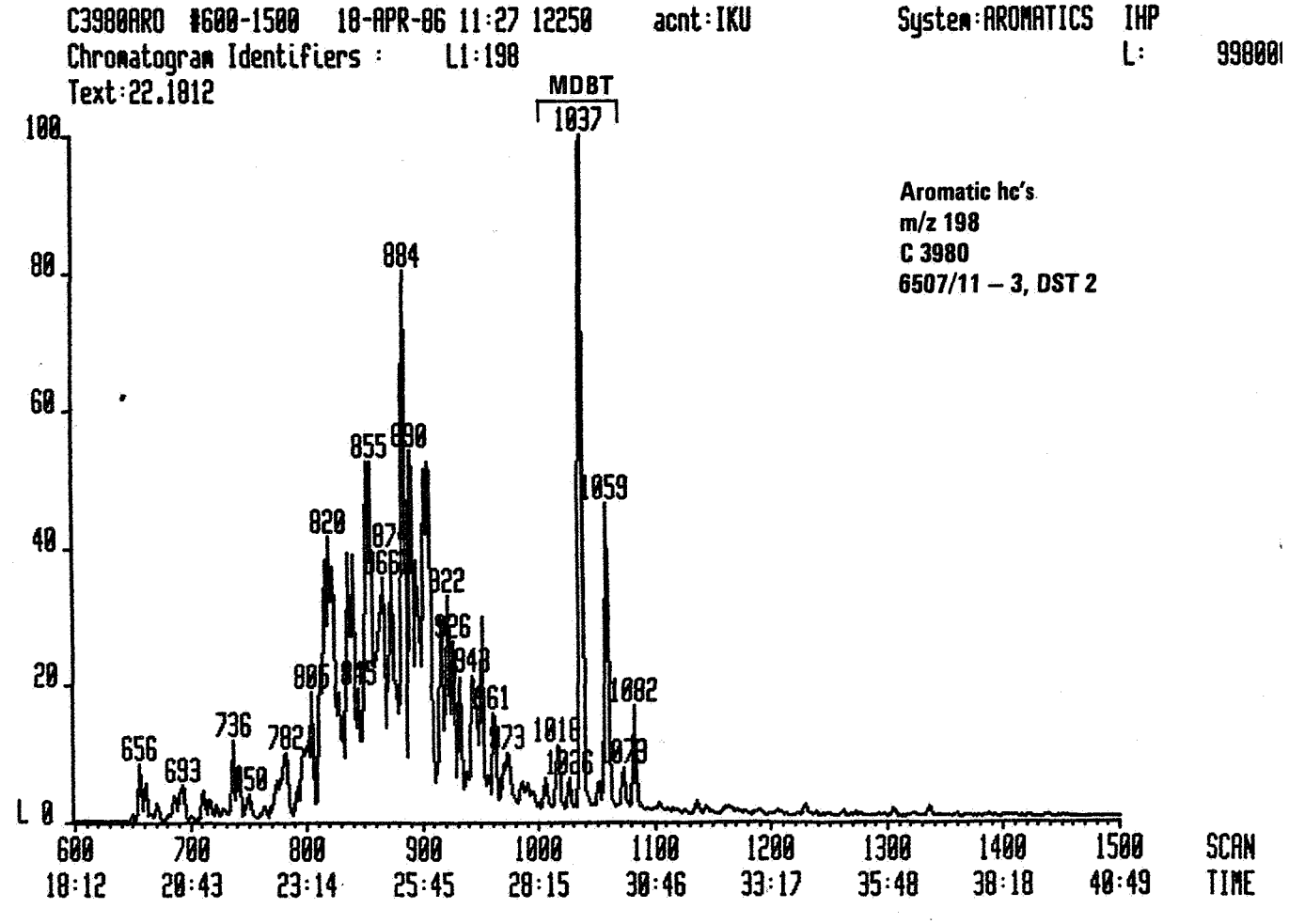
C3980ARO #300-900 18-APR-86 11:27 12250 acnt:IKU System:AROMATICS IHP
Chromatogram Identifiers : E1:142 F1:156 G1:170
Text:22.1812

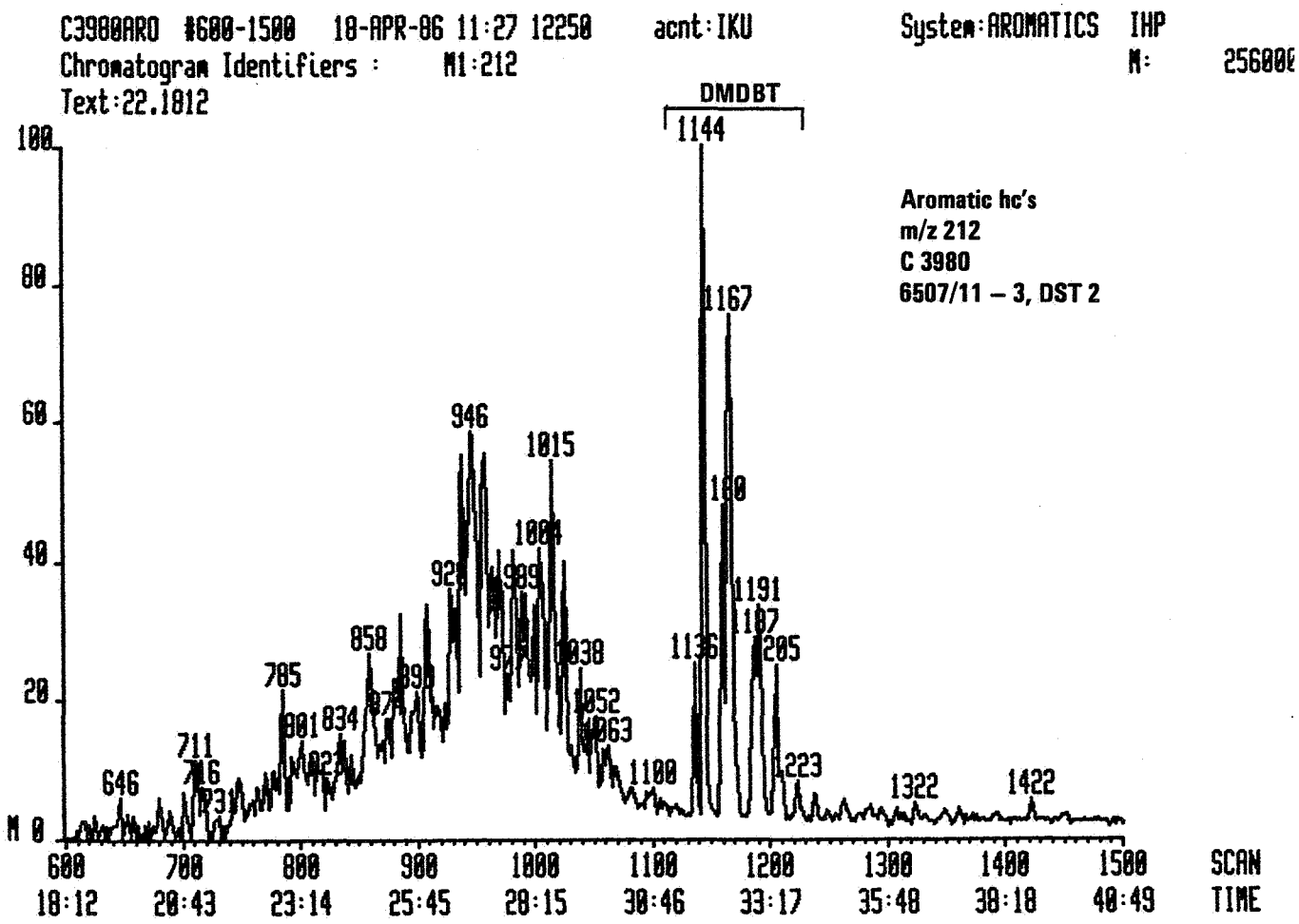


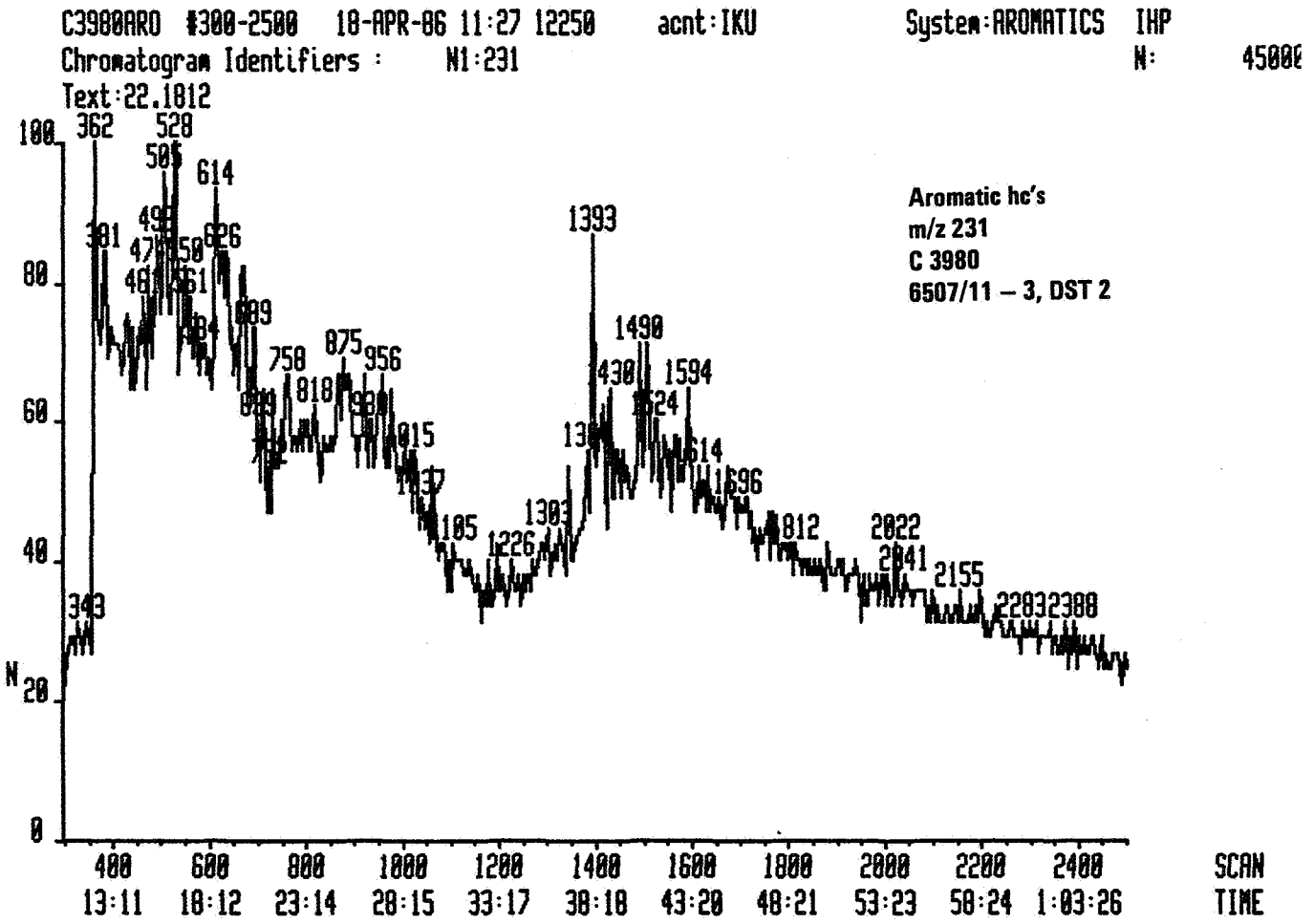
C3980ARO #800-1400 18-APR-86 11:27 12250 acnt:IKU System:AROMATICS IHP
Chromatogram Identifiers : H1:178 I1:192 J1:206
Text:22.1812

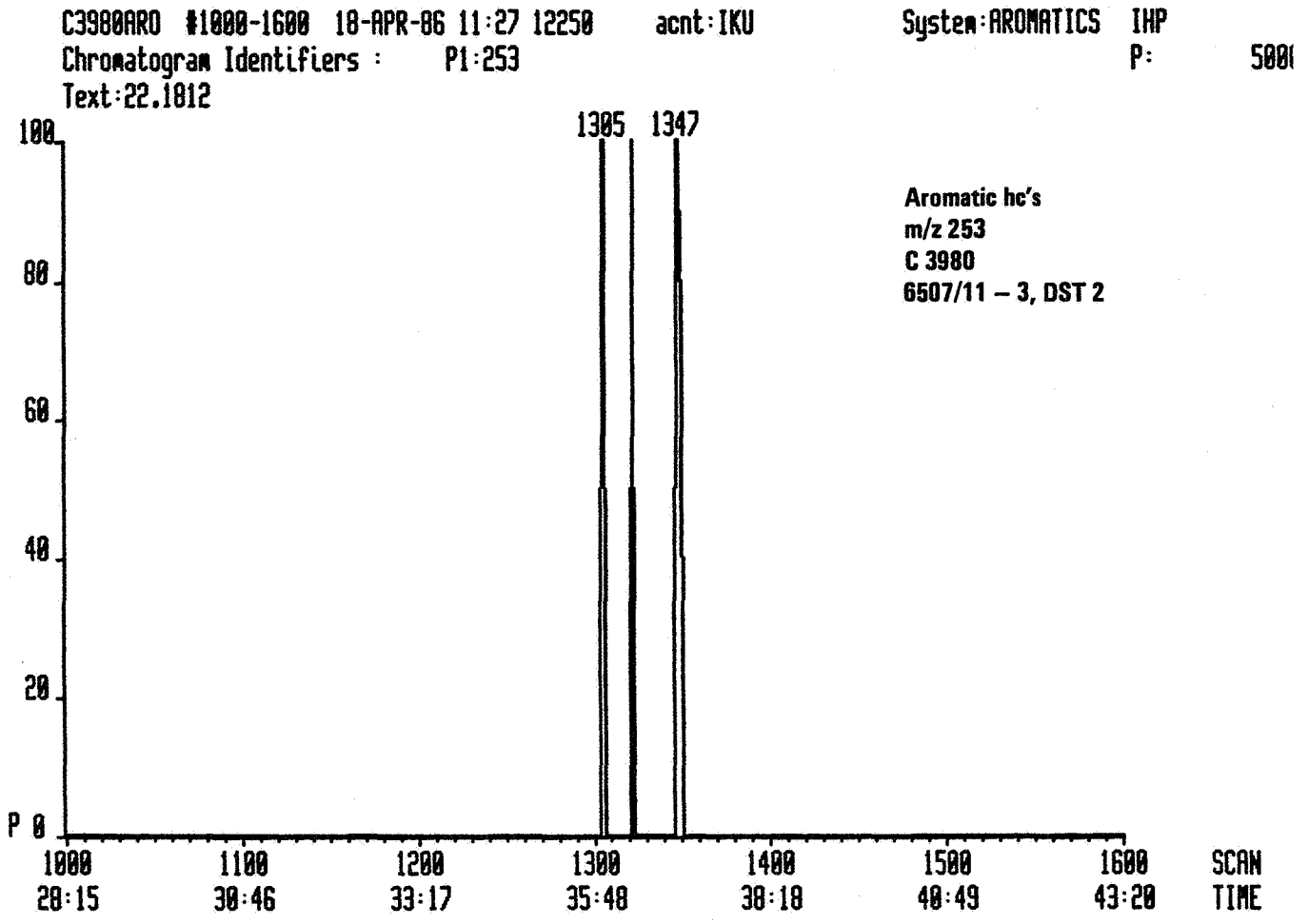


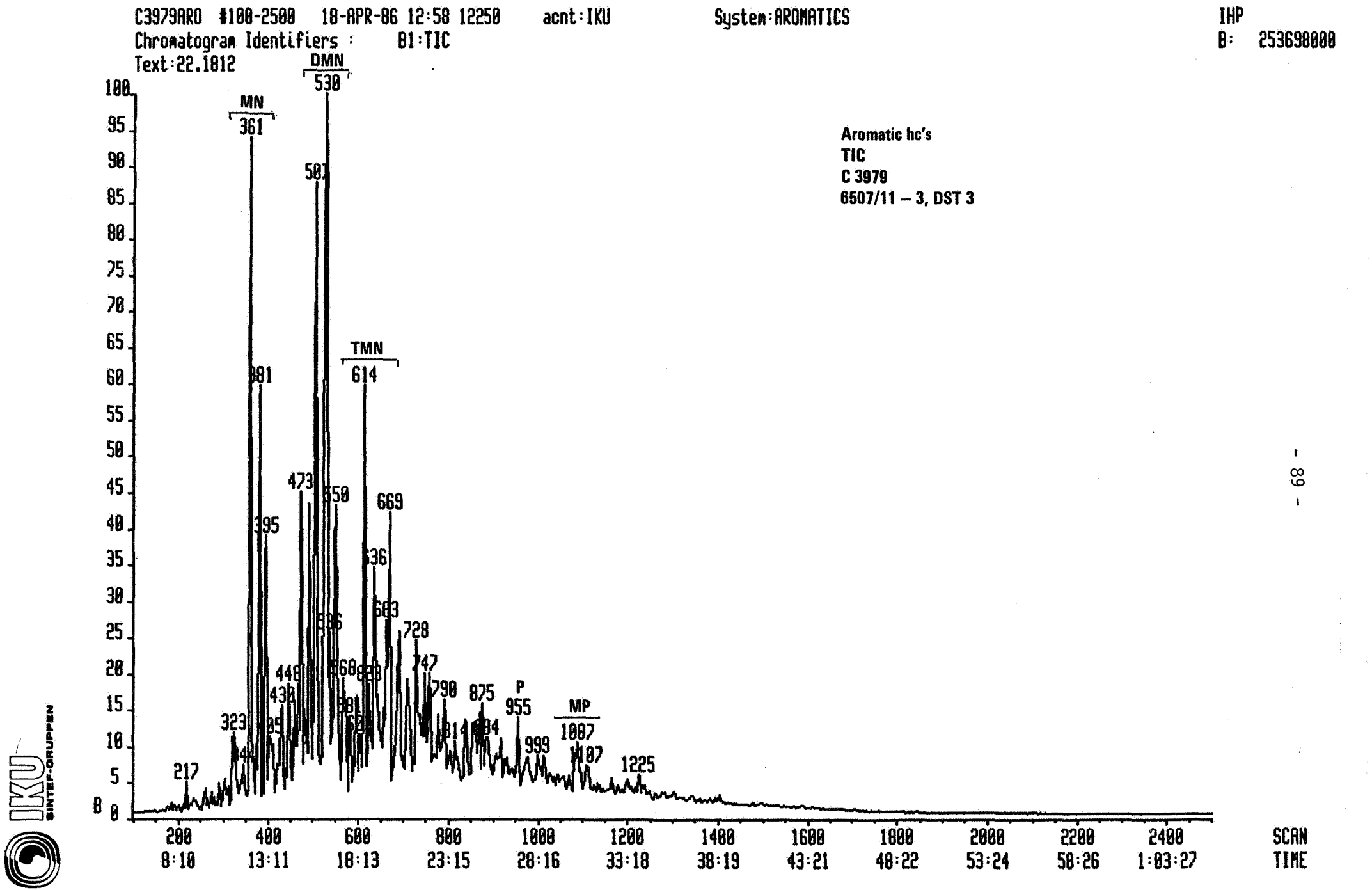

C3980ARO #600-1500 18-APR-86 11:27 12250 acnt:IKU System:AROMATICS IHP
Chromatogram Identifiers : K1:184 K: 3134000
Text:22.1812
Aromatic hc's
m/z 184
C 3980
6507/11 – 3, DST 2
755
839
776
815
715
857
924
735
688
658
K 0
600 700 800 900 1000 1100 1200 1300 1400 1500 SCAN
18:12 20:43 23:14 25:45 28:15 30:46 33:17 35:48 38:18 40:49 TIME

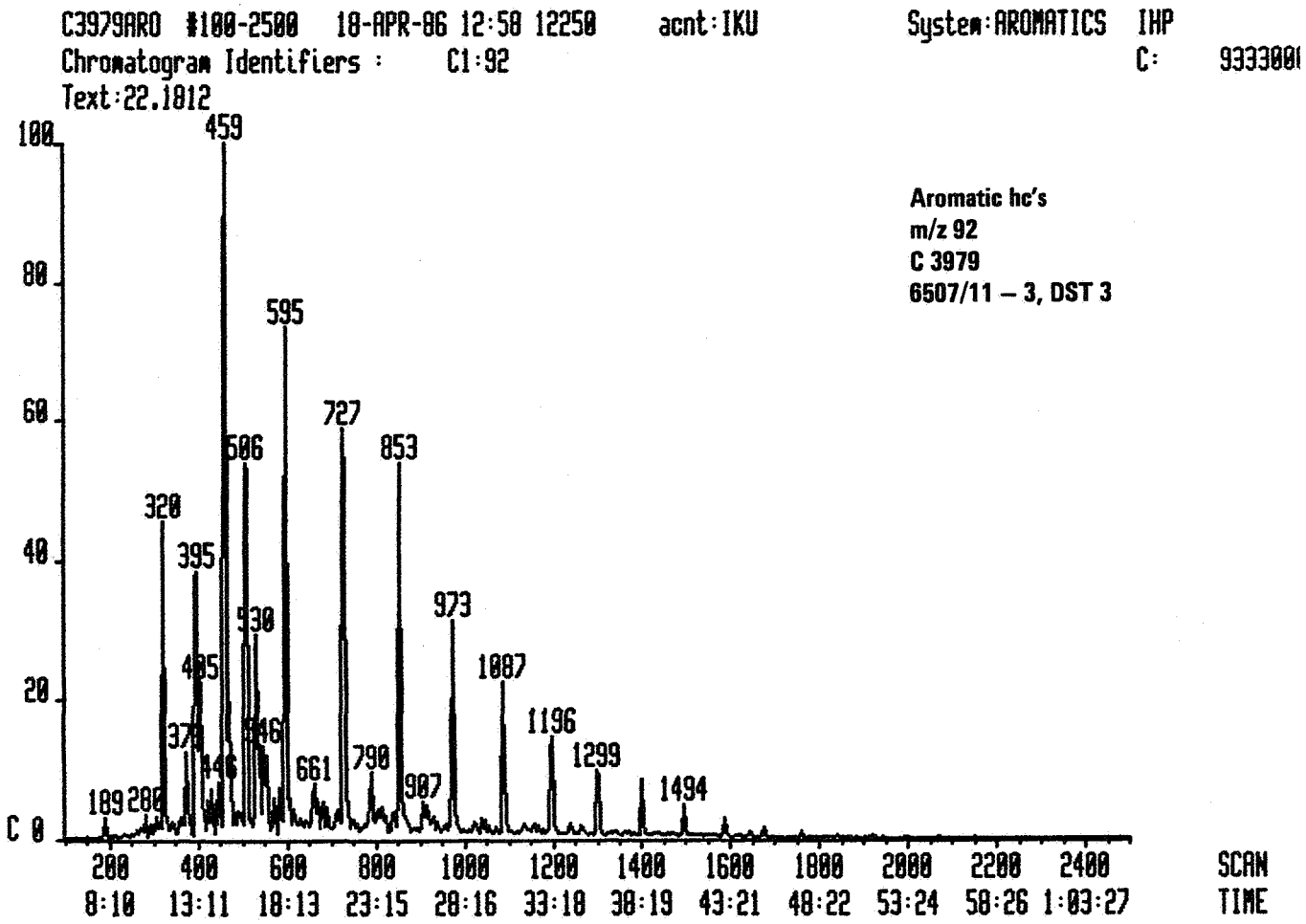

C3980ARO #600-1500 18-APR-86 11:27 12250 acnt:IKU System:AROMATICS IHP
Chromatogram Identifiers : L1:198 L: 998000
Text:22.1812
MDBT
1037
Aromatic hc's
m/z 198
C 3980
6507/11 – 3, DST 2
884
1059
820
822
736
656
693
782
1082
L 0
600 700 800 900 1000 1100 1200 1300 1400 1500 SCAN
18:12 20:43 23:14 25:45 28:15 30:46 33:17 35:48 38:18 40:49 TIME

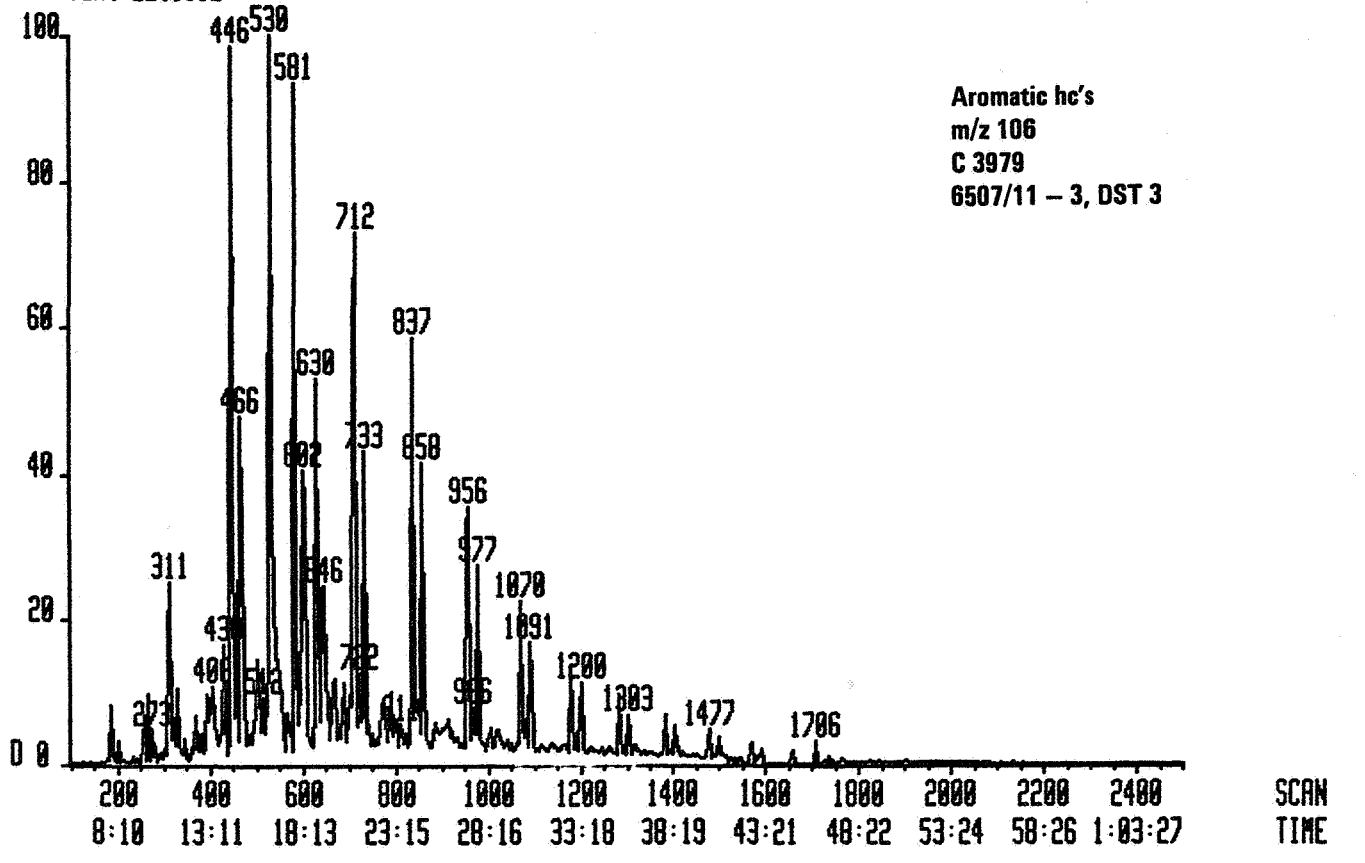

C3980ARO #600-1500 18-APR-86 11:27 12250 acnt:IKU System:AROMATICS IHP
Chromatogram Identifiers : M1:212
Text:22.1812
DMDBT
1144
Aromatic hc's
m/z 212
C 3980
6507/11 – 3, DST 2
100
80
60
40
20
M 0
1167
946
1015
1191
858
705
711
646
1136
1322
1422
600
700
800
900
1000
1100
1200
1300
1400
1500
18:12
20:43
23:14
25:45
28:15
30:46
33:17
35:48
38:18
40:49
SCAN
TIME

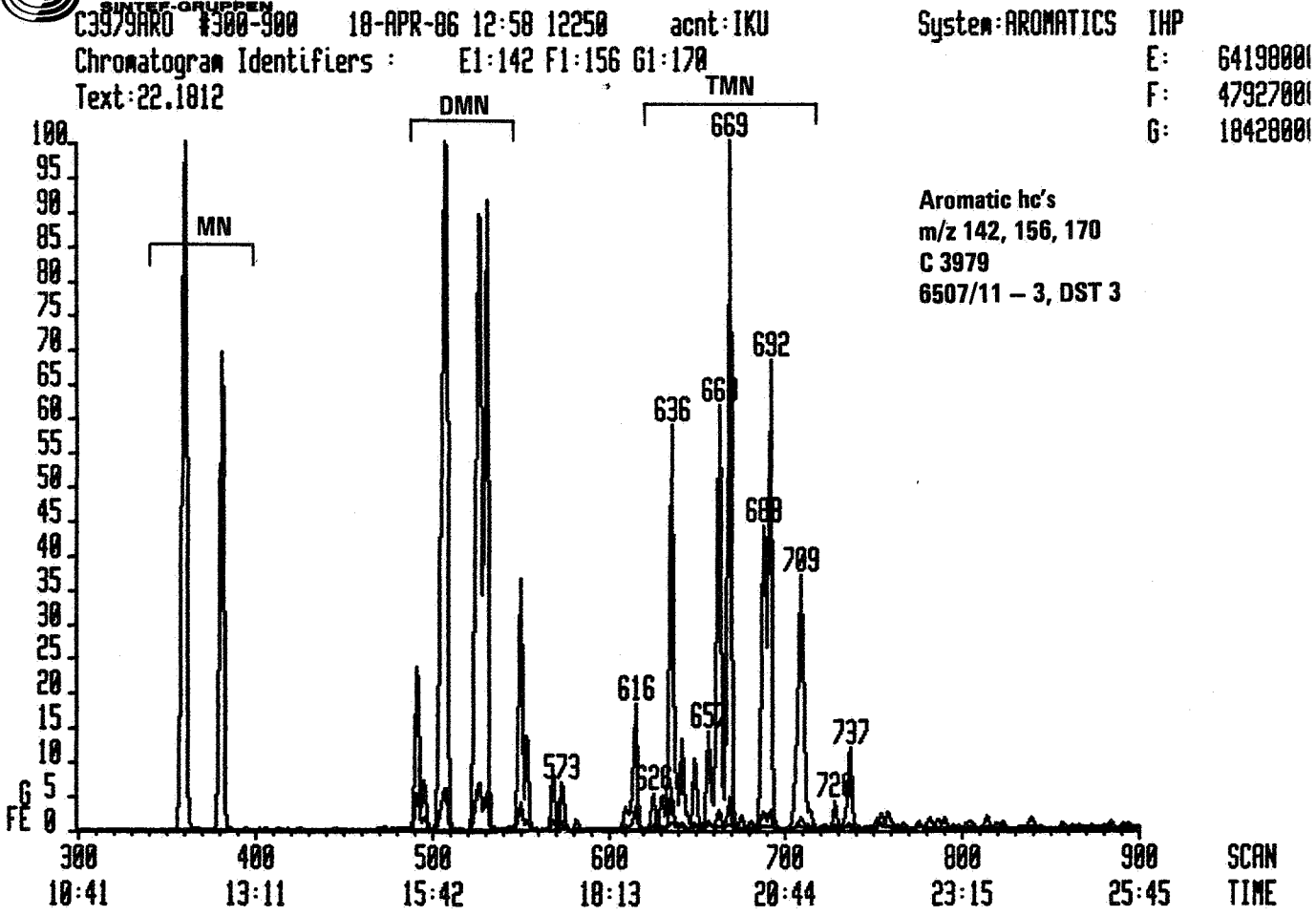

C3980ARO #300-2500 18-APR-86 11:27 12250 acnt:IKU System:AROMATICS IHP
Chromatogram Identifiers : N1:231
N: 45000
Text:22.1812
Aromatic hc's
m/z 231
C 3980
6507/11 – 3, DST 2
SCAN
TIME

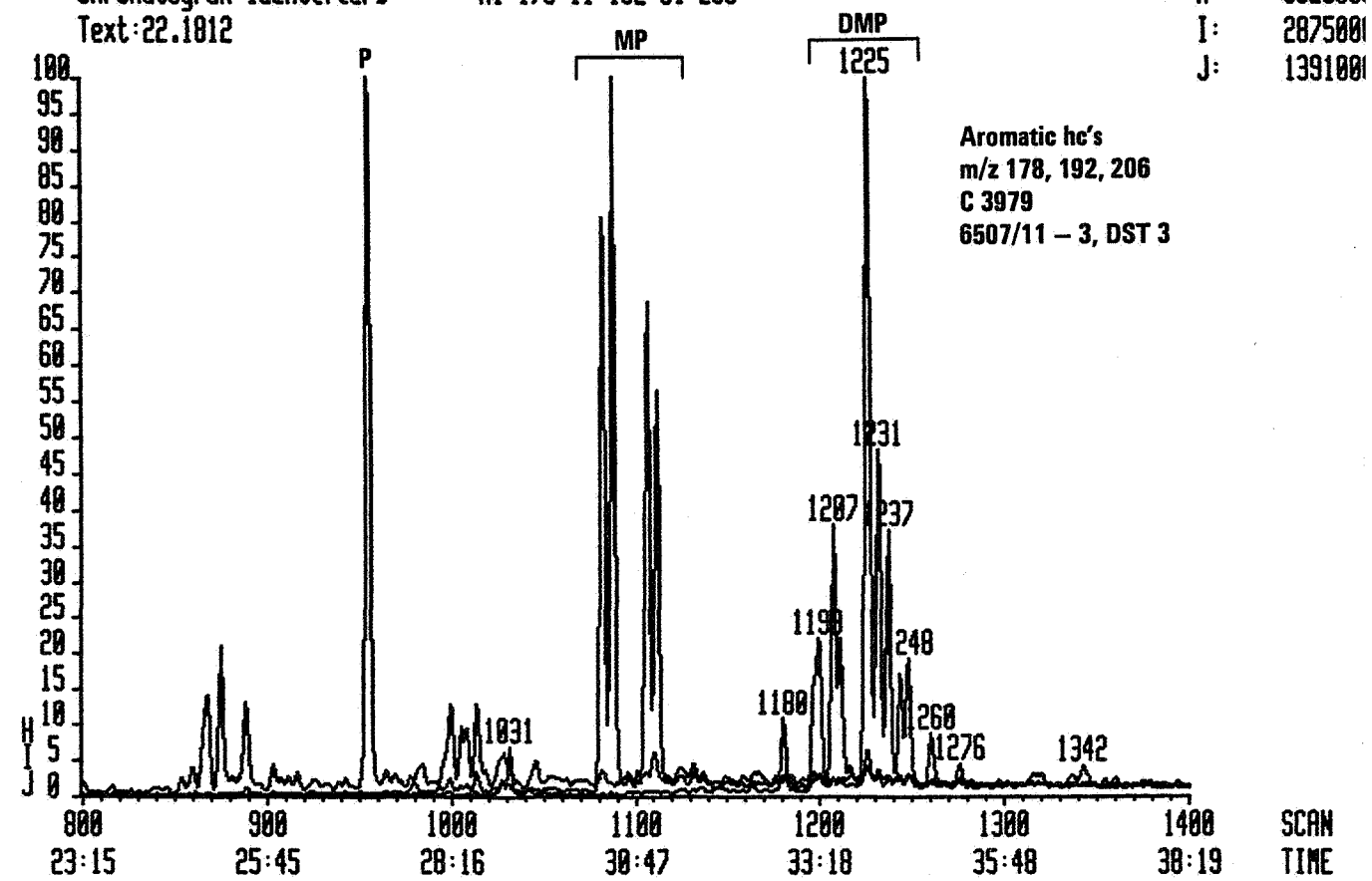

C3980ARO #1000-1600 18-APR-86 11:27 12250 acnt:IKU System:AROMATICS IHP
Chromatogram Identifiers : P1:253
P: 5000
Text:22.1812
Aromatic hc's
m/z 253
C 3980
6507/11 – 3, DST 2
SCAN
TIME


C3979ARO #100-2500 18-APR-86 12:58 12250 acnt:IKU System:AROMATICS IHP
Chromatogram Identifiers : B1:TIC B: 253698000
Text:22.1812
DMN
530
MN
361
TMN
614
P
955
MP
1007
Aromatic hc's
TIC
C 3979
6507/11 – 3, DST 3
SCAN TIME
8:10
13:11
18:13
23:15
28:16
33:18
38:19
43:21
48:22
53:24
58:26
1:03:27
IKU
SINTEF-GRUPPEN

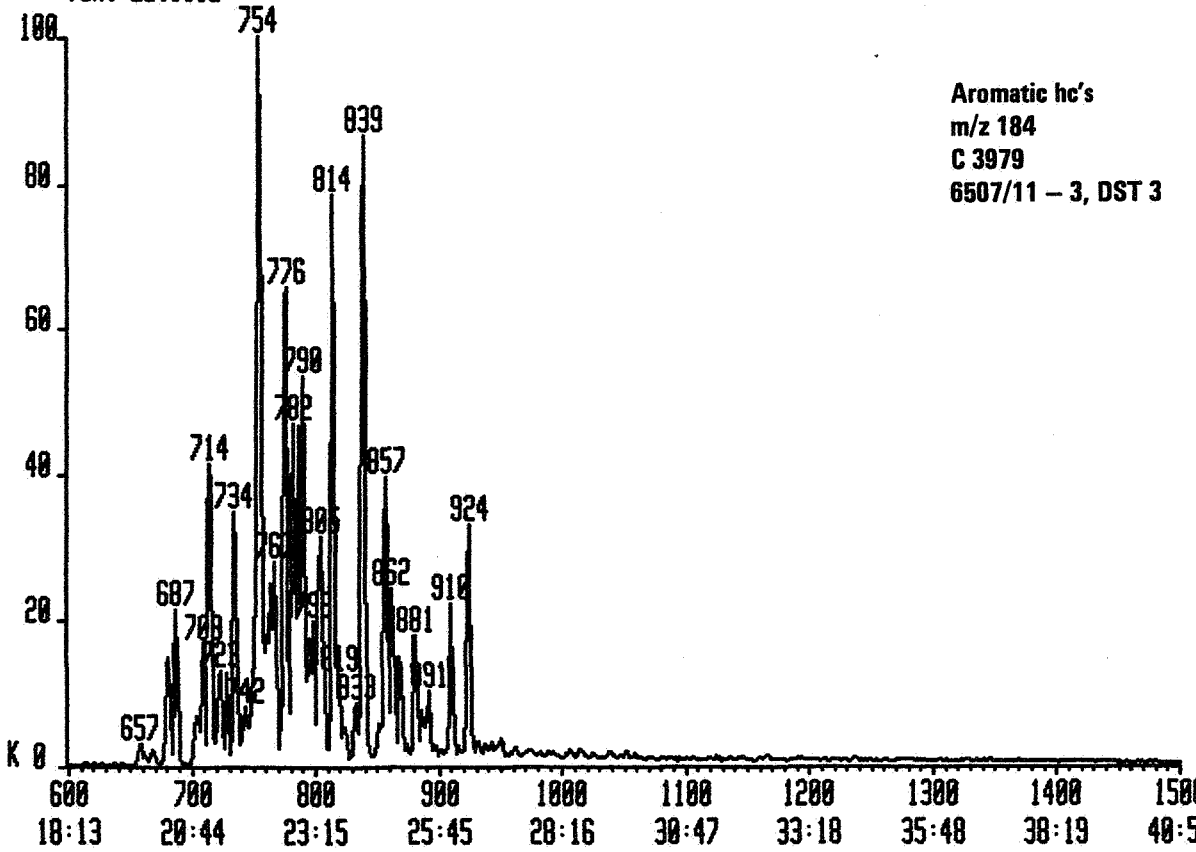

C3979ARO #100-2500 18-APR-86 12:58 12250 acnt:IKU System:AROMATICS IHP
Chromatogram Identifiers : C1:92 C: 9333000
Text:22.1812
Aromatic hc's
m/z 92
C 3979
6507/11 – 3, DST 3
459
595
727
853
506
320
395
930
973
485
1087
1196
1299
1494
661
790
907
189
200
C 0
200 400 600 800 1000 1200 1400 1600 1800 2000 2200 2400
SCAN
8:10 13:11 18:13 23:15 28:16 33:18 38:19 43:21 48:22 53:24 58:26 1:03:27
TIME


C3979ARO #100-2500 18-APR-86 12:58 12250 acnt:IKU System:AROMATICS IHP
Chromatogram Identifiers : D1:106 D: 793700
Text:22.1812
Aromatic hc's
m/z 106
C 3979
6507/11 – 3, DST 3
446
530
581
712
837
630
733
658
956
977
1070
1091
1200
1303
1477
1706
311
D 0
200 400 600 800 1000 1200 1400 1600 1800 2000 2200 2400
SCAN
8:10 13:11 18:13 23:15 28:16 33:18 38:19 43:21 48:22 53:24 58:26 1:03:27
TIME


C3979ARO #300-900 18-APR-86 12:58 12250 acnt:IKU
Chromatogram Identifiers : E1:142 F1:156 G1:170
Text:22.1812
System:AROMATICS IHP
E: 64190001
F: 47927001
G: 18428001
MN
DMN
TMN
669
692
636
709
616
737
573
Aromatic hc's
m/z 142, 156, 170
C 3979
6507/11 – 3, DST 3
SCAN
TIME

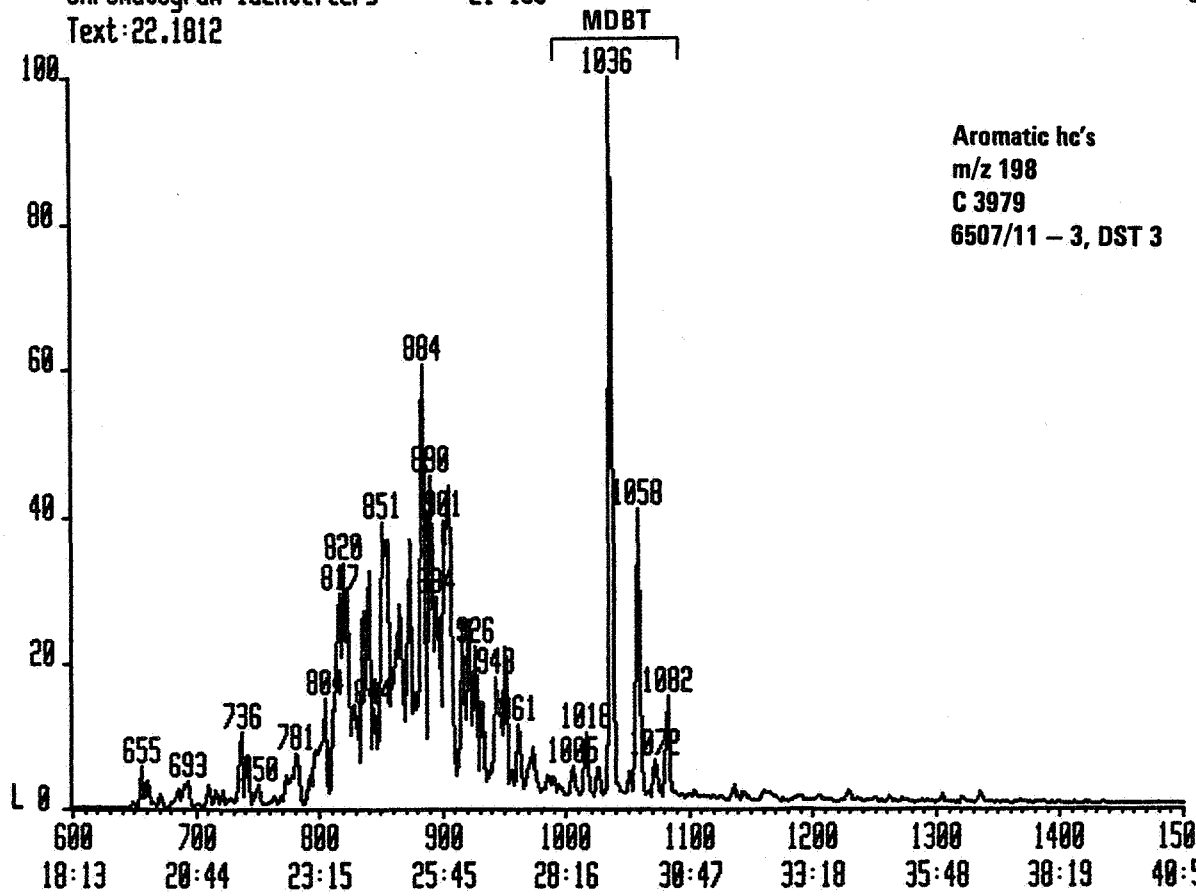

C3979ARO #800-1400 18-APR-86 12:58 12250 acnt:IKU
Chromatogram Identifiers : H1:178 I1:192 J1:206
Text:22.1812
System:AROMATICS IHP
H: 56290001
I: 28750001
J: 13910001
P
MP
DMP
1225
1231
1207
1237
1248
1180
1031
1276
1342
Aromatic hc's
m/z 178, 192, 206
C 3979
6507/11 – 3, DST 3
SCAN
TIME

C3979ARO #600-1500 18-APR-86 12:58 12250 acnt:IKU System:AROMATICS IHP
Chromatogram Identifiers : K1:184 K: 285500
Text:22.1812

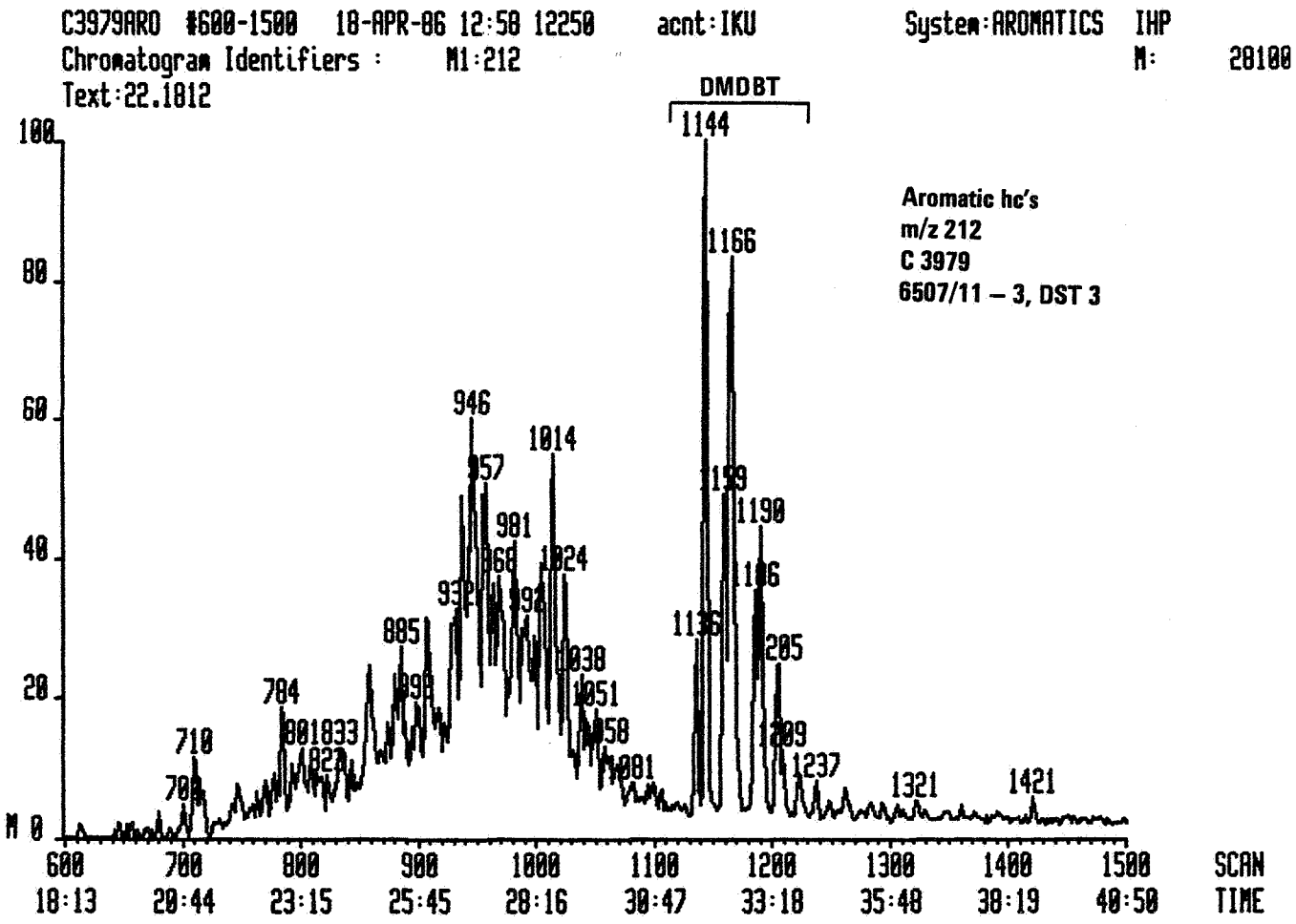


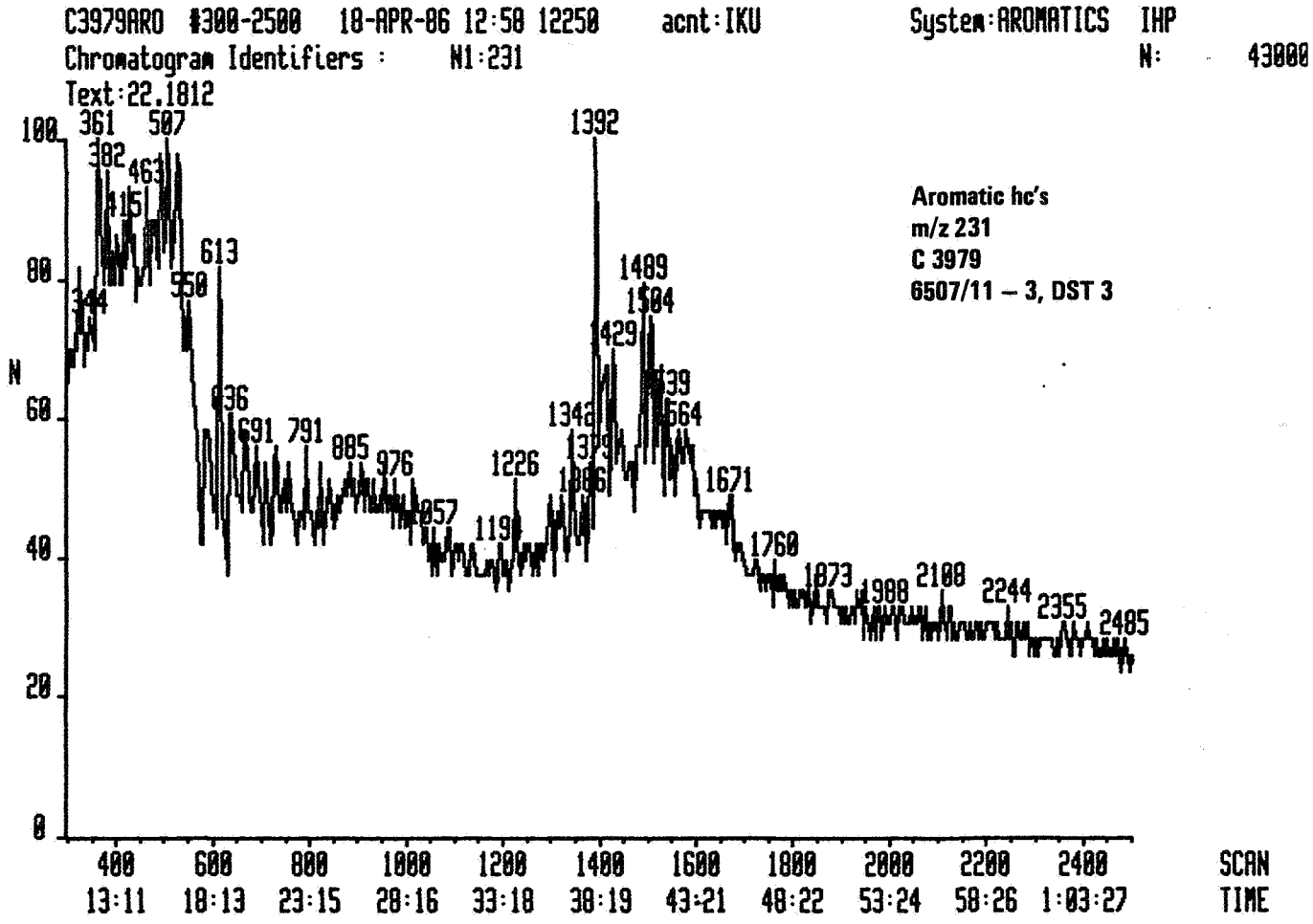
Aromatic hc's
m/z 184
C 3979
6507/11 – 3, DST 3

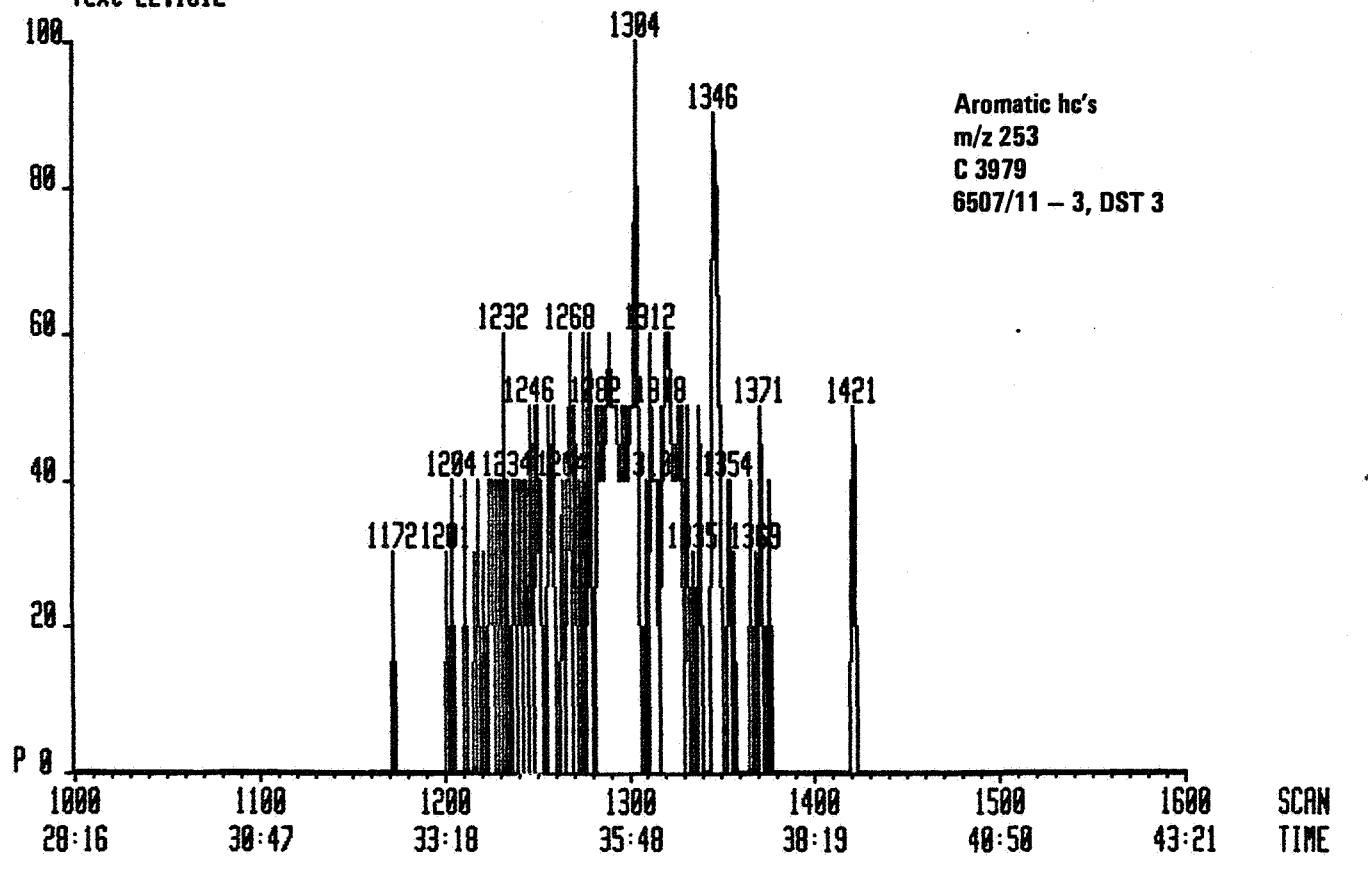
C3979ARO #600-1500 18-APR-86 12:58 12250 acnt:IKU System:AROMATICS IHP
Chromatogram Identifiers : L1:198 L: 122700
Text:22.1812



Aromatic hc's
m/z 198
C 3979
6507/11 – 3, DST 3


C3979ARO #600-1500 18-APR-86 12:58 12250 acnt:IKU System:AROMATICS IHP
Chromatogram Identifiers : M1:212 M: 28100
Text:22.1812
DMDBT
1144
1166
946
1014
957
981
1190
1136
205
710
784
885
1237
1321
1421
Aromatic hc's
m/z 212
C 3979
6507/11 – 3, DST 3
100
80
60
40
20
M 0
600 700 800 900 1000 1100 1200 1300 1400 1500 SCAN
18:13 20:44 23:15 25:45 28:16 30:47 33:18 35:48 38:19 40:50 TIME


C3979ARO #300-2500 18-APR-86 12:58 12250 acnt:IKU System:AROMATICS IHP
Chromatogram Identifiers : N1:231 N: 43000
Text:22.1812
Aromatic hc's
m/z 231
C 3979
6507/11 – 3, DST 3
N
SCAN
TIME


C3979ARO #1000-1600 18-APR-86 12:58 12250 acnt:IKU System:AROMATICS IHP
Chromatogram Identifiers : P1:253 P: 10000
Text:22.1812
Aromatic hc's
m/z 253
C 3979
6507/11 – 3, DST 3
P
SCAN
TIME