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REPORT

REG. NO.:	ACCESSIBILITY:
87.144	Confidential

REPORT TITLE:

ORGANIC GEOCHEMICAL CHARACTERISATION OF OIL AND GAS SAMPLES FROM WELL 34/4-7.

U-535 REPORT NO.: 22.1859.00/01/87

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DATE:	NO. OF PAGES:	NO. OF APPENDICES:	PROJECT MANAGER:	SIGN.:
24.08.87	59		L. LEITH	May Britt Myhr

CLIENT:

SAGA PETROLEUM A.S

BA-87-1219-1
10 SEPT. 1987
REGISTRERT
OLJEDIREKTORATET

SUMMARY:

Two sets of DST oil and gas samples from 34/4-7 were characterised using organic geochemical methods.

The two sets of DST fluids are similar in composition. The DST gases have high gas wetnesses and a thermally mature assemblage of hydrocarbons. The DST oil are low sulphur, paraffinic-napthenic oils.

The two DST oils contain a thermally mature assemblage of hydrocarbons, lying centrally between the least mature and the most mature of the previosly analysed Snorre oils. The 34/4-7 oil are similar to the previously analysed Snorre oils, and probably share a common source with these oils.

KEY WORDS:	
ORGANIC GEOCHEMISTRY	SNORRE FIELD
34/4-7	
DST OIL AND GAS	

" 9: Tabulation of Data From the Gas Chromatograms.
" 10: Ratios Calculated From Aromatic Gas Chromatograms.
" 11: Molecular Ratios From Sterane and Terfane Mass Chromatograms: Maturity Ratios.
" 12: Molecular Ratios From Sterane and Terfane Mass Chromatograms: Maturity and Source-characteristic Ratios.
" 13: Carbon Isotope Ratios From Oil Fractions.

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" 2: Gas Chromatograms of C_1-C_8 Hydrocarbons (DST gas).
" 3: Gas Chromatograms of C_2-C_8 Hydrocarbons (DST oil).
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" 9: Gas Chromatograms of Oil Aromatic fraction (FID/FPD).
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" 11: Mass Chromatograms of Steranes (m/3, 217, 218, 231, 259).
" 12: 5α20R Sterane Composition of DST Oils.

1. INTRODUCTION

Oil and gas samples from Drill Stem Tests (DST) 1 and 2 in well 34/4-7 (Figure 1), were characterised as requested by Saga Petroleum A/S (Contract No.: KO-EUG-87-002). The analyses of the DST fluids was carried out under IKU project number 22.1859. 34/4-7 is drilled on the north-western part of the Snorre field, reaching a total depth of 2924 m in Triassic rocks.

Physical data on the DST fluids were provided by Rogalandsforskning and Geco on the instructions of Saga Petroleum A/S. These data are shown below, along with the IKU numbers assigned to the samples.

SAMPLE	IKU No.	GAS/OIL RATIO (Sm3/m3)	OIL DENSITY (Kg/m3)	OIL MOLEC WT. (gm/mole)
DST 1	C-6310(gas) C-6309(oil)	152.1	832.3	196
DST 2	C-6277(gas) C-6278(oil)	148.8	829.6	190

(Flash conditions (Geco) - 250 barg, 100.8°C to atmosph and 15°C)
(Standard conditions - 15°C at 1 bar (gas); 15°C at atmospheric (oil))

The analytical programme used was that outlined in the contract, and was as follows:

- 1) S, Ni, V content of DST oils.
- 2) CGC of whole oils.
- 3) Topping of oil and separation of oil fractions by MPLC (including asphaltene content).
- 4) CGC of Saturate and Aromatic oil fractions.
- 5) GC-MS of Saturate fraction (m/z 177,191,205,217,218,231,259).
- 6) del 13C isotope ratio of C1, C2, C3, iC4 and nC4 gas fractions; and del 13C isotope ratio of Saturate, Aromatic, NSO and asphaltene oil fractions.
- 7) del H isotope ratio of C1 gas component.
- 8) GC of C1-C8 hydrocarbons of DST oil and gas for recombination of reservoir fluid (GOR provided).

The DST 2 oil and gas samples were received from Geco on 23 June, 1987, and the DST 1 oil and gas samples were received from Rogalandsforskning on 7 July, 1987.

A draft copy of the final report was sent to Saga Petroleum A/S for approval. On approval, ten copies of the final report were sent to Saga Petroleum and a further five copies are stored at IKU A/S.

2. DISCUSSION OF RESULTS

2.1 Recombination of oil and gas samples (C1-C8 hydrocarbons)

The C1-C8 gas data and the C2-C8 oil data are given table 1a-c, and the gas chromatograms are shown in figures 2 and 3, respectively.

In both samples, the composition of the gas C1-C8 hydrocarbons is similar, methane accounting for around 33% to 34% with almost identical gas wetness values of 61.6% (DST-1) and 61.5% (DST-2). In all, n-alkanes account for around 95% of the gaseous compounds. Similar iC-4/nC-4 ratios of 0.29 and 0.31 suggest that the gas samples contain a thermally mature assemblage of hydrocarbon compounds.

The C2-C8 hydrocarbon composition of the two DST oils is also similar, the C2-C8 gas chromatograms of both samples being dominated by n-alkane peaks showing a steady decrease in peak height from nC-5 to nC-8. Variations in the height of the lower molecular-weight components (<C-5), probably reflects evaporative loss during sample collection and/or storage.

The appearance of the gas chromatograms classifies the oils as paraffinic-naphthenic oils. There are no marked differences between the C2-C8 hydrocarbon composition of the 34/4-7 oils and the other Snorre oils, although the 34/4-7 oils may be slightly more paraffinic than some of the other Snorre oils (e.g. 34/7-4).

The data from the gas and oil samples were recombined using the gas/oil ratios supplied by Saga Petroleum A/S in order to simulate the subsurface composition of the DST fluids.

2.2 Carbon and Hydrogen Isotope Ratios of C1-C4 Gas Components

The del-13C and del-D isotope data are given in table 2, and selected data have been cross-plotted in figure 4, according to Schoell (1983).

Tht isotope ratio values show very little variation between the two samples, the DST 2 gas tending to have slightly higher values for the C1 to C3 components than the DST 1 gas. The situation is reversed for the C4 components. Otherwise, the isotope ratio values are broadly similar to those obtained from other Snorre DST gases. This is illustrated in figure 4, where the two 34/4-7 gases plot in similar positions to most other Snorre gases.

These data therefore suggest that the 34/4-7 DST gases are relatively mature, largely thermogenic gases.

2.3 Characterisation of Crude Oil samples

2.3.1 Sulphur, Nickel and Vanadium Content

Both DST oils have similar sulphur contents of around 0.25% (Table 3), which is close to the mean sulphur content of the Snorre oils analysed at IKU (Table 4). Both oils may therefore be considered low-sulphur oils.

The nickel and vanadium concentrations are slightly higher in the DST 1 oil than in the DST 2 oil (Table 3). The concentration of the two components is almost identical within each oil sample. This is only seen in a few of the Snorre oils; e.g. 34/7-5, 34/7-7 DST-1 and all the 34/7-8 oils. In the other oils, the proportion of nickel to vanadium is more variable.

2.3.2 Gross Composition of the crude oil samples

The low-boiling fraction of the DST oils accounts for around 50% of each oil (Table 5), lying slightly above the average for the Snorre oils (ca. 36%). These values are similar to that observed in oil from 34/4-6. The gross composition of the oil samples is summarised in figure 5.

Hydrocarbon compounds account for 80% of the remaining high-boiling oil fraction, saturated hydrocarbon compounds accounting for the greater part of these (Tables 6 and 7). Asphaltene and NSO compounds account for around

2% and 10% of the high-boiling fraction, respectively (Table 8). The DST 1 oil has a slightly higher NSO content and a slightly lower asphaltene content than the DST 2 oil. The asphaltene contents are close to average values for Snorre oils, whereas the NSO content of the 34/4-7 oils are equal to, or slightly above average.

2.3.3 Gas Chromatography of Whole Oil

The two DST samples produced similar whole oil gas chromatograms (Figure 6), showing a broad, slightly bimodal distribution of n-alkane peaks. The main mode lies around the n-C5/n-C6 peak, while there is also a smaller mode around the n-C14/n-C15 peaks. This latter mode may reflect the presence of waxy compounds, both oils having a significant wax content which caused some problems during topping.

The gas chromatograms are generally similar to those of the other Snorre oils, although the slight bimodality is generally not so prominent in the other oils.

2.3.4 Gas Chromatography of Saturate and Aromatic Fractions

The gas chromatograms of the saturatedoil fraction of the two DST oils from well 34/4-7 show similar smooth unimodal distributions of n-alkanes (Figure 7). Both gas chromatograms show a rapid drop in the lower molecular weight compound peaks below nC-17. This is due to evaporative loss during topping of the oil which is largely due to problems on account of the high wax content of the oils. The distribution of n-alkane peaks suggest relatively mature oils, which is supported by carbon preference indices of 1.0 (Table 9). The relatively high pristane/nC-17 ratio values of 0.9 may reflect some evaporative loss, and are therefore not wholly reliable. Similar pristane/phytane ratio values of 1.3 and 1.4 suggest a largely dysoxic depositional environment for the oils' source rock, and are similar to those observed from other Snorre oils (Figure 8).

The FID and FPD aromatic hydrocarbon gas chromatograms (Figure 9) show large humps of unresolved high molecular weight compounds, and relatively

poor resolved peaks. The FPD gas chromatograms show only a few alkyl-dibenzothiophene peaks, which are almost hidden in background noise on the gas chromatogram of the DST 2 aromatic fraction. These peaks are better developed on the gas chromatogram of the DST 1 aromatic fraction.

The alkyl-naphthalene and phenanthrene peaks can be clearly distinguished on the FID gas chromatograms, the alykl-phenanthrenes tending to be rather better developed than the alkyl-naphthalenes. This may be partly due to the evaporative loss mentioned above, although this is not certain. The calculated methyl-phenanthrene indices given in table 10 suggest that the oils are thermally mature, falling between the data from the previously analysed Snorre oils.

2.3.5 Gas Chromatography - Mass Spectrometry of DST oil SAT fraction

The saturate fraction of the two DST oils was analysed by combined GC-MS for eight ions (m/z 163, 177, 191, 205, 217, 218, 231, 259). The terpane and sterane mass chromatograms are shown in figures 10 and 11, and calculated ratios from these mass chromatograms are given in tables 11 and 12.

The two samples produce similar m/z 191 (terpane) mass chromatograms showing prominent hopane peaks and small moretane peaks. The tricyclic terpane peaks are relatively small in both samples. The appearence of the mass chromatograms is similar to those of most of the the Snorre oils.

The m/z 191 peak ratios suggest that the oils are largely thermally mature, with extended hopane ratios of around 60% (%22S) and Tm/Ts ratios of 0.58 to 0.71. These values suggest that the 34/4-7 oils are of average maturity with respect to the other Snorre oils.

The two m/z 217 sterane mass chromatograms of the two DST oils are also similar in appearence, rearranged diasteranes forming the most prominent peaks and suggesting a thermally mature oil. There are no significant differences relative to the other Snorre oils analysed at IKU, suggesting a common source. This is supported by the 5α20R sterane composition of the oils (Figure 12), which within the group of compositions associated with the Snorre oils.

The ratios for the %20S C29 steranes is about average for Snorre oils, whereas, the values for the ββ C29 steranes and the C27 rearranged steranes are among the higher values obtained for these ratios in the Snorre oils.

In conclusion then, the GC-MS data suggest that the two 34/4-7 DST oils are derived from the same source as the previously-analysed oils from this field, and are of average thermal maturity for Snorre oils.

2.3.6 Carbon Isotope Data for DST oil Fractions

Carbon isotope data were obtained for the saturate, aromatic, NSO and asphaltene DST oil fractions, and the data are shown in figure 13 and table 13.

The carbon isotope profiles for the two oils clearly show that both oils have nearly identical isotopic compositions. Only the asphaltene fractions of the oils have different values, the DST 1 oil having the slightly isotopically- heavier asphaltene fraction.

Although the isotopic value of the saturate fraction is around the average value for the Snorre oils, the oil isotope profile is different from the majority of the oils. The main difference lies in the narrow range of values obtained over the four fractions, which leads to a relatively flat, slightly inclined profile. The increased isotope ratio for the asphaltene fraction, with respect to the NSO fraction, is seen in most of the analysed Snorre oils.

3. CONCLUSIONS

The two sets of DST fluids from well 34/4-7 are essentially similar in compostion. The DST gases are thermally mature, with high gas wetness values, as might be expected from gases associated with crude oil. The oils are low sulphur, paraffinic-naphthenic oils, although they are probably more paraffinic than naphthenic.

The oils contain a thermally mature assemblage of organic compounds, lying roughly central between the most mature and least mature of the Snorre oils. The similarity of the 34/4-7 DST oils to the previosly-analysed Snorre oils suggests a common source for the oils. Slight facies differences in the source rock may account for some of the variations in wax content, isoprenoid and biomarker composition.

These two DST oils have a moderate wax content which caused some problems during processing and analysis, although these problems are not as severe as have been encountered with some of the other Snorre oils, e.g. 34/7-10.

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Previous IKU reports concerned with block 34/7 fluids:

05.1725.00/02/84:	Fluid characterisation of well 34/7-1.
05.1728.00/02/85:	Hydrocarbon characterisation of well 34/7-3.
22.1767.00/03/85:	Hydrocarbon characterisation of well 34/7-4.
22.1771.00/03/85:	Analysis of fluid and gas samples from well 34/7-5.
22.1779.00/03/85:	Analysis of fluid and gas samples from well 34/7-6 (DST 2 and DST 3b).
22.1805.00/01/86:	Analysis of fluid and gas samples from well 34/7-7.
22.1830.00/01/86:	Organic geochemical characterisation of oil and gas samples from well 34/7-8.
22.1830.00/02/86:	Organic geochemical characterisation of an FMT oil and gas sample from well 34/7-9.
22.1831.00/01/86:	Organic geochemical characterisation of oil and gas samples from well 34/4-6.
22.1837.00/01/86:	Asphaltene content of core extracts from 34/7-7 and 34/7-10: Data report.
22.1851.00/01/87:	Oil-oil correlation study of DST oils from blocks 34/4 and 34/7.
22.1840.00/01/87:	Organic Geochemical characterisation of DST and FMT samples from well 34/7-10.

5. ANALYTICAL PROCEDURES

Gas analyses

Natural gas (full analysis of hydrocarbons and inert gases):

Natural gas samples were analysed on an HP 5880 gas chromatograph equipped with a capillary column and an FID for hydrocarbon analysis and two packed columns and a TCD for analysis of the inert gases (N_2, O_2, CO_2):

- 50 m x 0.2 mm i.d. fused silical column, coated with 0.5 µm OV-101.
- 3 ft steel column packed with molecular sieve 13x, 80/10 0 mesh.
- 6 ft steel column packed with Porapack T x 4 ft steel column packed with Porapack Q, 80/100 mesh.

Temperature program: 30°C (12 min.) - 8°C/min. - 150°C (5 min.).

A standard gas sample containing methane, ethane, propane, n-butane, n-pentane and n-hexane was used for quantification.

Evaporation of the light components in fluid samples

Prior to chromatographic separation, the oil/condensate samples were heated to 210°C at atmospheric pressure until constant weight (at 210°C) was obtained.

The fraction of light components was determined as the weight difference between the original sample and the residuum left after heating. Separation of extractable organic matter (EOM) fractions

Medium-pressure liquid chromatography (MPLC)

The EOM/oil (>210°C) sample was diluted in DCM (1:3 mg/µl) and the asphaltenes were precipitated using excess n-pentane (40:1 pentane: (DCM+EOM)). The asphaltene fraction was weighed after drying at 50°C for 12 hours.

The remaining maltenes were separated into saturated, aromatic and non-hydrocarbon fractions using an MPLC system with n-hexane as eluant (Radke et al., 1980). The various fractions were concentrated using a Büchi Rotavapor, transferred to glass vials and the remaining solvent removed.

Urea adduction

An aliquot of the saturated hydrocarbon fraction (5 mg) was diluted with n-hexane (2 ml), followed by the addition of acetone (1 ml). A saturated solution of urea in methanol (1 ml) was then added dropwise. The solvent was removed in a nitrogen stream and the adduction procedure repeated twice more. The white crystals were rinsed with hexane (3x5 ml) and the combined extract was filtered through a cotton plug covered with Al203 to produce a non-adduct containing the branched and cyclic hydrocarbons. GC analyses were performed on the non-adduct using the conditions outlined in the next section.

Gas chromatographic analysis

A whole oil sample was analysed using an HP 5730A gas chromatograph fitted with a 15 m DB-5 fused silica column. 0.02 µm of sample solution was injected in split mode (split ratio ≈ 1:10). Hydrogen was used as a carrier gas with a flow rate of 2.5 ml/min, and the temperature programme used was -50°C (2 min) - 4°C/min - 280°C.

The C_2-C_8 hydrocarbon compounds were investigated by hydrogen stripping on a Carlo Erba Fractovap gas chromatograph fitted with a 60 m x 0.32 mm (i.d.) fused silica column coated with DB-1, 1.0 µm. The temperature programme used was 50°C (2 min) - 4°C/min - 210°C. An internal standard was used for quantification.

The saturated hydrocarbon fraction was diluted with n-hexane and analysed on an HP 5730A or an HP 5710 GC. Both GCs are equipped with 15 m DB-1 fused silica columns, and hydrogen is used as carrier gas with a flow rate of about 1.5 ml/min. Injections were performed in split mode (split ratio 1:10). The temperature programme used was 80°C (2 min) - 4°C/min - 280°C.

The total aromatic fractions were diluted with n-hexane and analysed on an Carlo Erba Fractovap Series 2150 gas chromatograph fitted with a DB-5 fused silica column (30 m x 0.25-0.32 mm i.d.), using a hydrogen carrier gas with a flow rate of about 2.5 ml/min. Injection was performed splitless. Alt. B: an HP 5710A gas chromatograph, fitted with a DB-5 fused silica column (15 x 0.25 mm i.d.), using a hydrogen carrier gas with a flow rate of 2.5 ml/min. The injection split ratio was 1:10.

The temperature programme used was 80°C (2 min.) - 4°C/min - 280°C. The AF2 fractions of the aromatic hydrocarbons were analysed on a Varian Series 3700 gas chromatograph with a SE-54 fused silica column (50 m x 0.3 mm) and dual FID/FPD detectors. Hydrogen was used as a carrier gas with a flow rate of 0.5 ml/min. A temperature programme of 80°C (2 min.) - 4°C/min - 280°C was used.

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

Gas chromatography - mass spectrometry (GC-MS)

GC-MS analyses were performed on a VG Quadrupole 12-250 GC-MS system. The HP 5790A Series GC was fitted with a fused silica DB-5 capillary column (30 m x 0.32 mm i.d.). Helium (1.5 ml/min) was used as carrier gas and the injections were performed in split mode (1.5 µl , split ratio 1:15).

The GC oven was programmed from 120°C (2 min.) to 280°C at 4°C/min. for analysis of the saturated hydrocarbons, and from 70°C/min. to 280°C at 4°C/min. for analysis of the aromatic hydrocarbons.

The saturated hydrocarbons were analysed in multiple ion mode (MID) at a scan cycle time of approximately 2 secs. Full data collection was applied for the aromatic hydrocarbons at a scan time of 1 sec./decade. The mass spectrometers operated at 70eV electron energy with an ion source temperature of 200°C. Data acquisition was performed using VG data systems.

Peaks were identified by comparison with elution patterns in certain mass chromatograms. Peak ratios were calculated from peak heights in the appropriate mass chromatograms.

$\delta^{13}C$ isotope analysis

The $\delta^{13}C$ isotope analyses were performed by mass spectrometry at the Institute for Energy Technology (IFE) in Oslo according to their method. Their reference value for the standard NBS-22 is -29.8 °/oo (PDB).

Table 1a

RECOMBINATION OF OIL AND GAS(C1-C8 HYDROCARBONS)

C1-C8 YIELD
Well 34/4-7
IKU No., GAS: C-6310
IKU No., OIL: C-6309, DST1
GOR : 152.1 Sm3/m3

COMPOUNDS	GAS MG/ML	GAS MG/152.1ML	OIL MG/ML	TOTAL HC IN MG/ML OF RESERVOIR FLUID
Methane	0.093	14.145	0.000	14.145
Ethane	0.044	6.692	0.000	6.692
Propane	0.059	8.974	0.000	8.974
i-Butane	0.010	1.521	0.000	1.521
n-Butane	0.034	5.171	1.400	6.571
i-Pentane	0.009	1.369	4.089	5.458
n-Pentane	0.012	1.825	7.435	9.260
Cyclo-C5+				
2,3-diMeC4	0.001	0.152	1.518	1.670
2-MeC5	0.003	0.456	4.012	4.468
3-MeC5	0.002	0.304	2.510	2.814
n-Hexane	0.004	0.608	8.680	9.288
MeCyC5	0.002	0.304	5.496	5.800
Benzene	0.001	0.152	2.062	2.214
Cyclo-C6	0.001	0.152	5.877	6.029
2-MeC6	0.000	0.000	2.694	2.694
2,3-diMeC5	0.000	0.000	1.142	1.142
3-MeC6	0.001	0.152	4.228	4.380
diMeCyC5	0.001	0.152	6.036	6.188
n-Heptane	0.001	0.152	8.988	9.140
MeCyC6	0.001	0.152	11.604	11.756
EtCyC5+				
2,5-diMeC6	0.000	0.000	1.468	1.468
2,4-diMeC6	0.000	0.000	0.934	0.934
triMeCyC5	0.000	0.000	0.853	0.853
Toluene	0.000	0.000	5.480	5.480
2+4MeC7	0.000	0.000	4.488	4.488
3-MeC7	0.000	0.000	2.356	2.356
diMeCyC6	0.000	0.000	4.966	4.966
n-Octane	0.000	0.000	9.138	9.138
2,4-diMeC7+				
diMeCyC6	0.000	0.000	1.744	1.744
EtCyC6	0.000	0.000	3.025	3.025
EtBenzene	0.000	0.000	1.737	1.737
m+p-Xylene	0.000	0.000	4.573	4.573
2+4MeC8	0.000	0.000	2.125	2.125
o-Xylene	0.000	0.000	2.007	2.007
SUM	0.279	42.435	122.665	165.101

Table 1a

RECOMBINATION OF OIL AND GAS(C1-C8 HYDROCARBONS)

C1-C8 YIELD
Well 34/4-7
IKU No., GAS: C-6277
IKU No., OIL: C-6278, DST2
GOR : 148.8 Sm/m3

COMPOUNDS	GAS MG/ML	GAS MG/148.8ML	OIL MG/ML	TOTAL HC IN MG/ML OF RESERVOIR FLUID
Methane	0.356	52.973	0.000	52.973
Ethane	0.176	26.189	0.000	26.189
Propane	0.230	34.224	0.407	34.631
i-Butane	0.039	5.803	0.489	6.292
n-Butane	0.125	18.600	5.387	23.987
i-Pentane	0.031	4.613	5.514	10.127
n-Pentane	0.038	5.654	10.535	16.189
Cyclo-C5+				
2,3-diMeC4	0.004	0.595	2.243	2.838
2-MeC5	0.008	1.190	5.986	7.176
3-MeC5	0.004	0.595	3.775	4.370
n-Hexane	0.009	1.339	12.525	13.864
MeCyC5	0.005	0.744	8.076	8.820
Benzene	0.001	0.149	2.752	2.901
Cyclo-C6	0.003	0.446	8.135	8.581
2-MeC6	0.001	0.149	3.645	3.794
2,3-diMeC5	0.000	0.000	1.359	1.359
3-MeC6	0.001	0.149	5.519	5.668
diMeCyC5	0.002	0.298	7.617	7.915
n-Heptane	0.002	0.298	12.620	12.918
MeCyC6	0.002	0.298	16.402	16.700
EtCyC5+				
2,5-diMeC6	0.000	0.000	2.038	2.038
2,4-diMeC6	0.000	0.000	1.314	1.314
triMeCyC5	0.000	0.000	1.305	1.305
Toluene	0.000	0.000	8.207	8.207
2+4MeC7	0.000	0.000	6.434	6.434
3-MeC7	0.000	0.000	3.307	3.307
diMeCyC6	0.000	0.000	6.779	6.779
n-Octane	0.000	0.000	13.003	13.003
2,4-diMeC7+				
diMeCyC6	0.000	0.000	2.447	2.447
EtCyC6	0.000	0.000	4.388	4.388
EtBenzene	0.000	0.000	2.677	2.677
m+p-Xylene	0.000	0.000	6.758	6.758
2+4MeC8	0.000	0.000	3.012	3.012
o-Xylene	0.000	0.000	3.129	3.129
SUM	1.037	154.306	177.784	332.090

Table 1b

C2-C8 HYDROCARBON COMPOSITION OF THE OILS

C-6309 Well 34/4-7 DST1	area	ug	mg/ml	% of t.oil
isoC3				
nC3	0	.000	.000	.000
iso-C4	0	.000	.000	.000
nC4	81422	.420	1.400	.168
iso-C5	237788	1.226	4.089	.491
nC5	432300	2.230	7.435	.893
CyC5+2,3diMeC4	88280	.455	1.518	.182
2MeC5	233315	1.203	4.012	.482
3MeC5	145949	.753	2.510	.301
nC6	504725	2.604	8.680	1.042
MeCyC5	319577	1.648	5.496	.660
benzene	119901	.618	2.062	.247
CyC6	341709	1.763	5.877	.706
2MeC6	156636	.808	2.694	.323
2,3diMeC5	66432	.342	1.142	.137
3MeC6	245861	1.268	4.228	.508
DiMeCyC5	350989	1.811	6.036	.725
nC7	522603	2.696	8.988	1.079
MeCyC6	674718	3.481	11.604	1.394
EtCyC5+2,5diMeC6	85379	.440	1.468	.176
2,4DiMeC6	54322	.280	.934	.112
triMeCyC5	49596	.255	.853	.102
toluene	318674	1.644	5.480	.658
2+4MeC7	260945	1.346	4.488	.539
3MeC7	136987	.706	2.356	.283
DiMeCyC6	288755	1.489	4.966	.596
nC8	531332	2.741	9.138	1.097
2,4diMeC7+diMeCyC6	101441	.523	1.744	.209
EtCyC6	175887	.907	3.025	.363
EtBenzene	101045	.521	1.737	.208
m,p-Xylene	265912	1.372	4.573	.549
2+4MeC8	123575	.637	2.125	.255
o-xylene	116739	.602	2.007	.241
sum		36.803	122.665	14.739

total oil (ug inj.): 249.690

%C2-C8(tot.area)in tot.oil: 16.931%

Table 1b

C2-C8 HYDROCARBON COMPOSITION OF THE OILS

C-6278 Well 34/4-7 DST2	area	ug	mg/ml	% of t.oil
isoC3				
nC3	16566	.122	.407	.049
iso-C4	19925	.146	.489	.058
nC4	219135	1.616	5.387	.648
iso-C5	224294	1.654	5.514	.663
nC5	428546	3.160	10.535	1.268
CyC5+2,3diMeC4	91266	.673	2.243	.270
2MeC5	243517	1.796	5.986	.720
3MeC5	153555	1.132	3.775	.454
nC6	509470	3.757	12.525	1.507
MeCyC5	328523	2.423	8.076	.972
benzene	111967	.825	2.752	.331
CyC6	330900	2.440	8.135	.979
2MeC6	148298	1.093	3.645	.438
2,3diMeC5	55292	.407	1.359	.163
3MeC6	224484	1.655	5.519	.664
DiMeCyC5	309832	2.285	7.617	.916
nC7	513318	3.786	12.620	1.519
MeCyC6	667154	4.920	16.402	1.974
EtCyC5+2,5diMeC6	82913	.611	2.038	.245
2,4diMeC6	53448	.394	1.314	.158
triMeCyC5	53082	.391	1.305	.157
toluene	333822	2.462	8.207	.987
2+4MeC7	261732	1.930	6.434	.774
3MeC7	134537	.992	3.307	.398
DiMeCyC6	275733	2.033	6.779	.816
nC8	528928	3.901	13.003	1.565
2,4diMeC7+diMeCyC6	99536	.734	2.447	.294
EtCyC6	178515	1.316	4.388	.528
EtBenzene	108907	.803	2.677	.322
m,p-Xylene	274917	2.027	6.758	.813
2+4MeC8	122514	.903	3.012	.362
o-xylene	127286	.938	3.129	.376
sum		53.339	177.784	21.403

total oil (ug inj.):	249.210
%C2-C8(tot.area)in tot.oil:	24.352%

TABLE 1c : RATIOS CALCULATED FROM C1 - C8 HYDROCARBON DATA

		DST-1	DST-2
% Methane	==	34.3	33.3
% Gas Wetness	==	61.6	61.5
iC-4/nC-4 Ratio	==	0.29	0.31
Paraffin Index 1	==	1.15	1.20

% Gas Wetness = (E C2-C5)/(E C1-C5).
Paraffin Index 1 (after Thompson, 1978) = 2-MeC6 + 3-MeC6 / diMeCyC5 (3 isomers).

TABLE 2 : CARBON AND HYDROGEN ISOTOPE RATIOS FOR THE DST GASES

IKU No.	DST No.	C1		C2	C3	iC4	nC4
		d13C	dD	d13C	d13C	d13C	d13C
C-6310	1	-50.9	-208	-35.3	-32.3	-33.1	-31.4
C-6277	2	-50.3	-211	-34.9	-31.5	-34.8	-31.8

Table 3: CONTENT OF SULPHUR, NICKEL AND VANADIUM IN TOPPED OIL (>210°C)

IKU No.	DST No.	S (%)	Ni (mg/kg)	V (mg/kg)
C-6309	1	0.25	1.9	1.8
C-6278	2	0.24	1.3	1.4

TABLE 4 : SUMMARY OF GEOCHEMICAL PROPERTIES OF SNORRE OILS

	MEAN	MIN	MAX	MEAN 34/4-7
API Gravity	36.7	33.9	39.4	----
% Sulphur	0.3	0.2	0.5	0.25
Gas/Oil Ratio	88.9	54.9	163.7	150.5
%<210°C Fraction	36.0	17.1	64.6	48.0
% Asphaltenes (*)	2.5	0.4	16.3	2.1
% Saturates (*)	48.0	27.2	79.4	50.0
Saturate/Aromatic	2.7	0.8	9.9	1.7
Pristane/nC-17 (+)	0.7	0.5	0.9	0.8
Pristane/Phytane (+)	1.5	1.3	1.7	1.4
% 20S C-29 Steranes	47.2	34.0	59.0	46.0
% 22S Hopanes	60.3	54.8	65.3	59.5
% BB C-29 Steranes	75.4	61.7	79.8	77.7
del 13C-SAT	-30.3	-30.7	-29.6	- ?

(* = Percent topped oil)
(+ = Unreliable data excluded)

Table 5

FRACTION BOILING BELOW 210'C

IKU No.	Sample code	Crude oil (mg)	EOM >210'C (mg)	Low molecular weight compounds (mg)	(%)
C-6309	DST 1	353.1	170.2	182.9	48.2
C-6278	DST 2	295.6	154.6	141.0	47.7

Table 6

WEIGHT OF EOM AND CHROMATOGRAPHIC FRACTIONS

IKU-No	Sample code	Crude Oil (g)	Topped Oil >210'C (mg)	Sat. (mg)	Aro. (mg)	HC (mg)	Non HC (mg)
C 6309	DST 1	353.1	170.2	85.4	49.9	135.3	34.9
C 6278	DST 2	295.6	154.6	77.1	46.8	123.9	30.7

Table 7

COMPOSITION OF TOPPED OIL (>210'C)

IKU-No	Sample code	Sat / EOM %	Aro / EOM %	HC / EOM %	SAT / Aro x 100	Non HC / EOM %	HC / Non HC x 100
C 6309	DST 1	50.2	29.3	79.5	171.1	20.5	387.7
C 6278	DST 2	49.9	30.3	80.1	164.7	19.9	403.6

* EOM = Topped oil (>210'C)

Table 8

AMOUNT OF ASPHALTENES AND NSO'S IN OIL

IKU No.	Sample code	Topped oil (mg)	Asphaltenes (mg)	Asphaltenes (%)	NSO (mg)	NSO (%)
C-6309	DST 1	170.2	3.0	1.8	19.2	11.3
C-6278	DST 2	154.6	3.7	2.4	14.1	9.1

Table 9

TABULATION OF DATA FROM THE GASCHROMATOGRAMS

IKU No.	Sample code	PRISTANE / PHYTANE = A	PRISTANE / n-C17 = B	PHYTANE / n-C18	A / B	n-C17 / n-C27	CPI 1	CPI 2
C 6309	DST 1	1.3	0.9	0.6	1.5	2.4	1.0	1.0
C 6278	DST 2	1.4	0.9	0.6	1.5	2.4	1.0	0.9

DATE : 13 - 8 - 87.

TABLE 10 : RATIOS CALCULATED FROM AROMATIC GAS CHROMATOGRAMS

IKU No.	DST No.	MPI-1	MPI-2
C-6309	1	0.76	0.96
C-6278	2	0.72	0.90

MPI 1 = 1.5(2-MP + 3-MP)/P + 1-MP + 9-MP
MPI-2 = 3(2-MP)/P + 1-MP + 9-MP

TABLE 11 : MOLECULAR RATIOS FROM STERANE AND TERPANE MASS CHORMATOGRAMS. MATURITY RATIOS.

IKU code	Depth	$\alpha\beta/\alpha\beta+\beta\alpha$[1]	%22S[2]	%ββ[3]	%20S[4]
C6309 DST1		0.94	59.5	76.7	47.1
C6278 DST2		0.94	59.5	78.6	44.8

1) E/E+F in m/z 191
2) Average % distribution between first and second eluting isomers of extended hopanes (G-M in m/z 191)
3) 2(r+s)/(q+t+2(r+s)) in m/z 217
4) q/q+t in m/z 217

Table 12 : MOLECULAR RATIOS FROM TERPANE AND STERANE MASS CHROMATOGRAMS. MATURITY AND SOURCE CHARACTERISTIC RATIOS.

IKU no.	Depth (m)	Q/E[1]	Tm/Ts[2]	X/E[3]	Z/E[4]	a/a+j[5]
C6309 DST1			0.58	0.08	0.32	0.77
C6278 DST2			0.71	0.09	0.36	0.79

1) Relative abundance of tricyclic terpanes (Q/E in m/z 191)
2) B/A in m/z 191
3) Relative abundance of unknown (X/E in m/z 191)
4) Relative abundance of bisnorhopane (Z/E in m/z 191)
5) Relative abundance of C_{27} rearranged steranes (a/a+j in m/z 217)

TABLE 13 : CARBON ISOTOPE RATIOS FOR 34/4-7 DST CRUDE OIL FRACTIONS

IKU No.	DST No.	SAT	ARO	NSO	ASPH
			(del 13C o/oo)		
C-6309	1	-30.7	-30.0	-29.6	-29.8
C-6278	2	-30.7	-30.0	-29.6	-30.2

Figure 1. Location map.

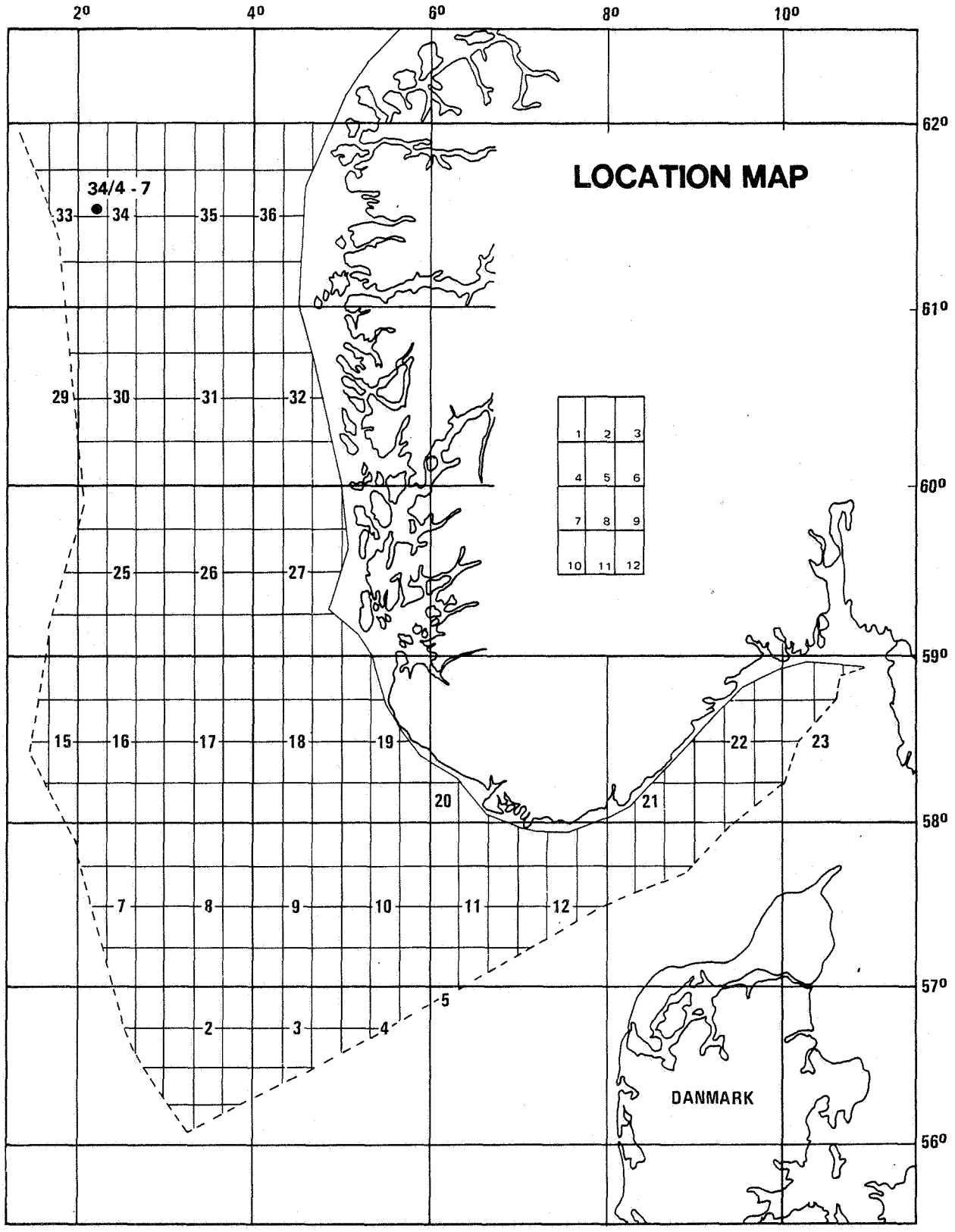
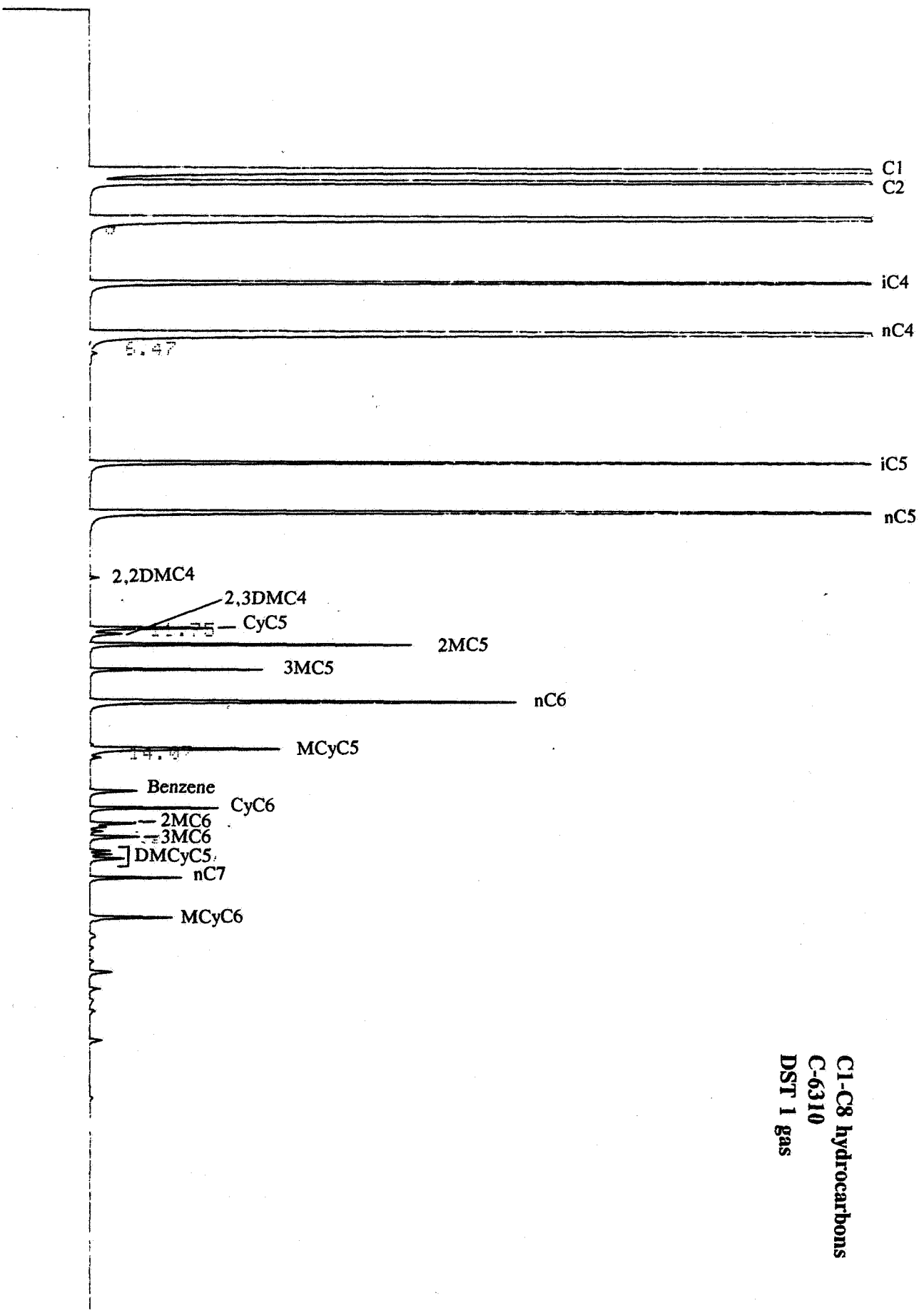
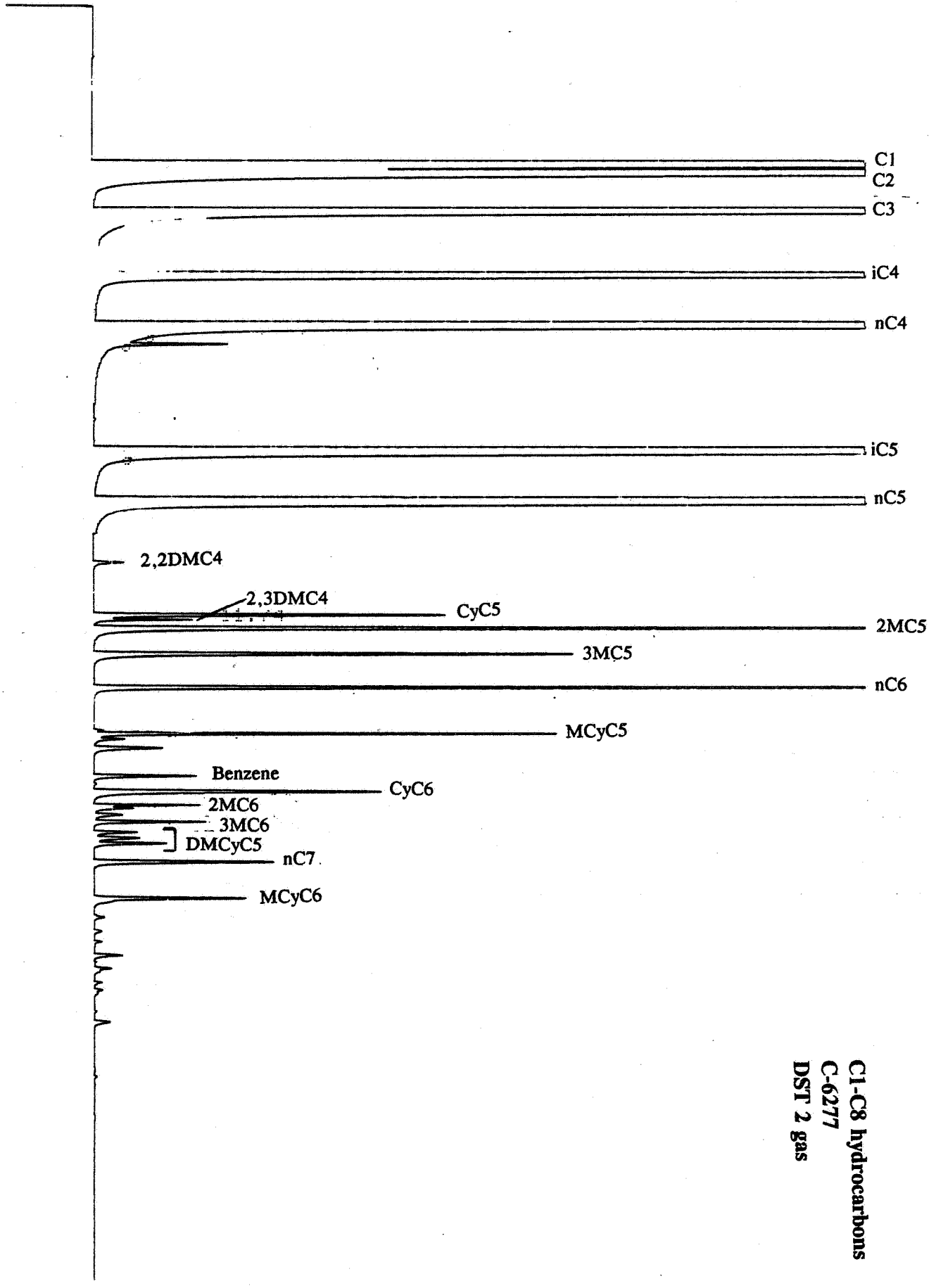


Figure 2:

Gas chromatograms of C_1-C_8 hydrocarbons from the gas samples



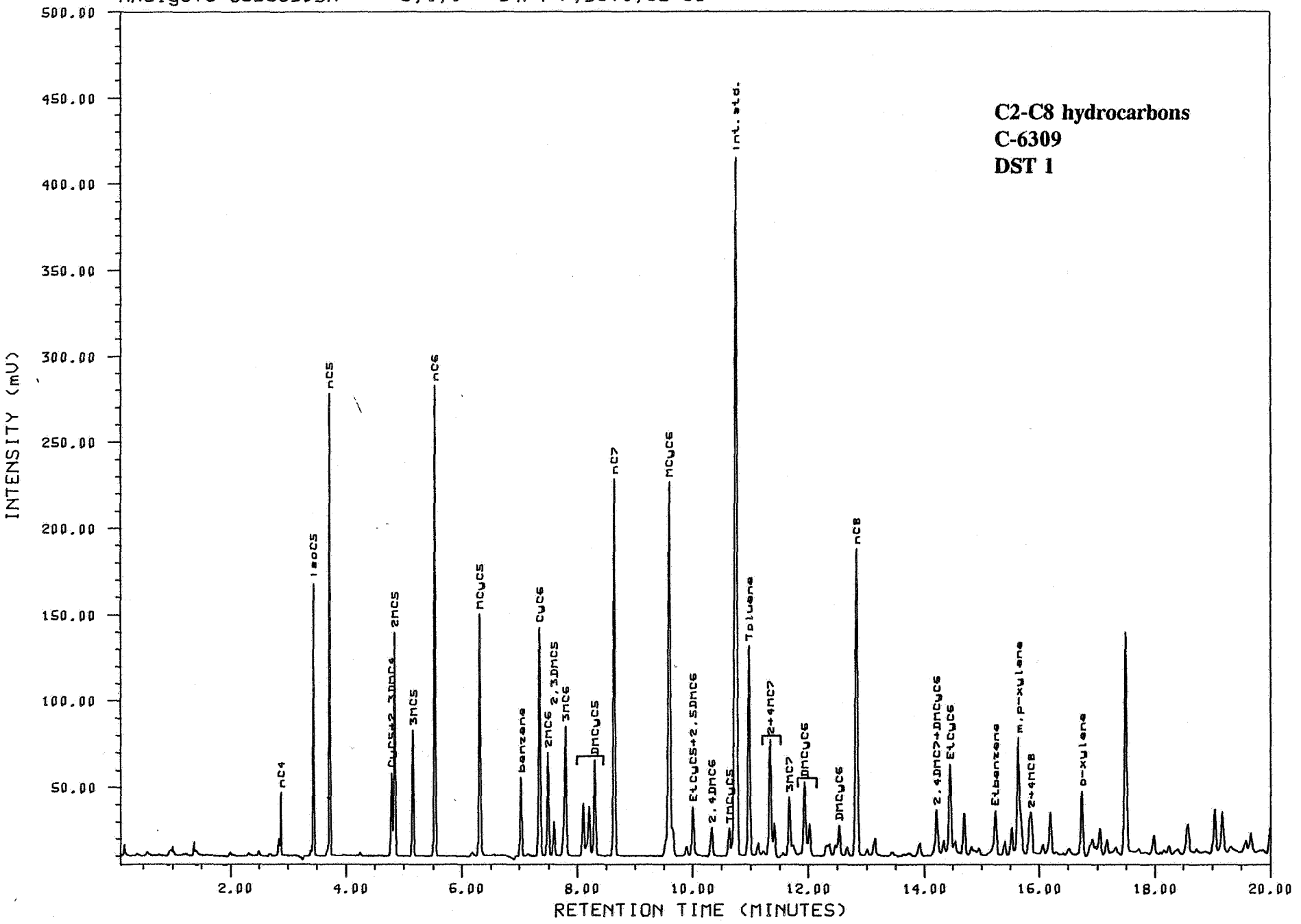
C1-C8 hydrocarbons
C-6310
DST 1 gas

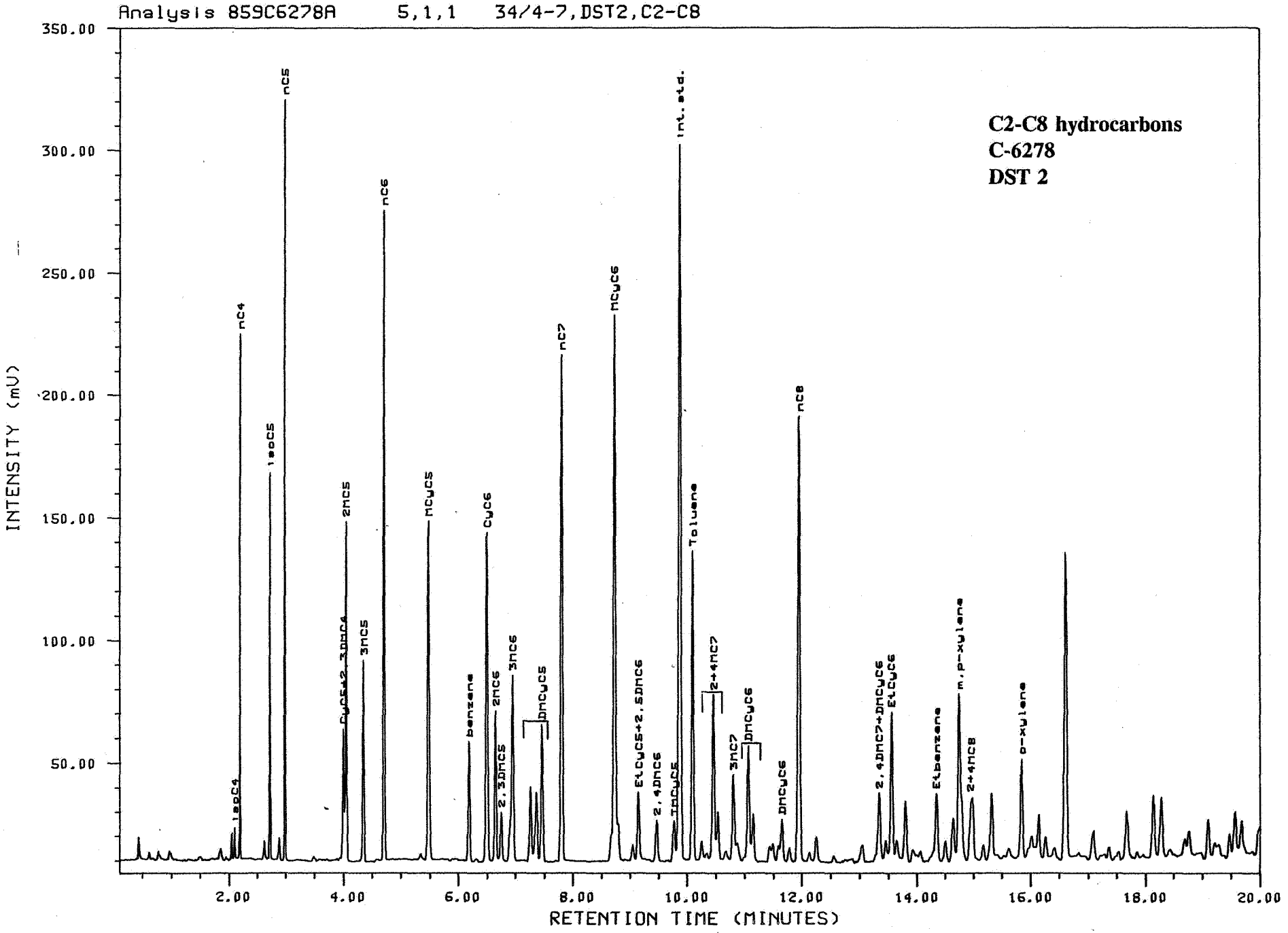


C1-C8 hydrocarbons
C-6277
DST 2 gas

Figure 3:

Gas Chromatograms of C_2-C_8 Hydrocarbons (oil)


Analysis 859C6309A 5,1,1 34/4-7,DST1,C2-C8
C2-C8 hydrocarbons
C-6309
DST 1
INTENSITY (mV)
RETENTION TIME (MINUTES)
nC4
isoC5
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
Ebenzene
m,p-xylene
2+4MC8
o-xylene


Analysis 859C6278A 5,1,1 34/4-7,DST2,C2-C8
C2-C8 hydrocarbons
C-6278
DST 2
INTENSITY (mV)
RETENTION TIME (MINUTES)
350.00
300.00
250.00
200.00
150.00
100.00
50.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
isoC4
nC4
isoC5
nC5
2MC5
CyC5+2,3DMC4
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
Etbenzene
m,p-xylene
2+4MC8
o-xylene

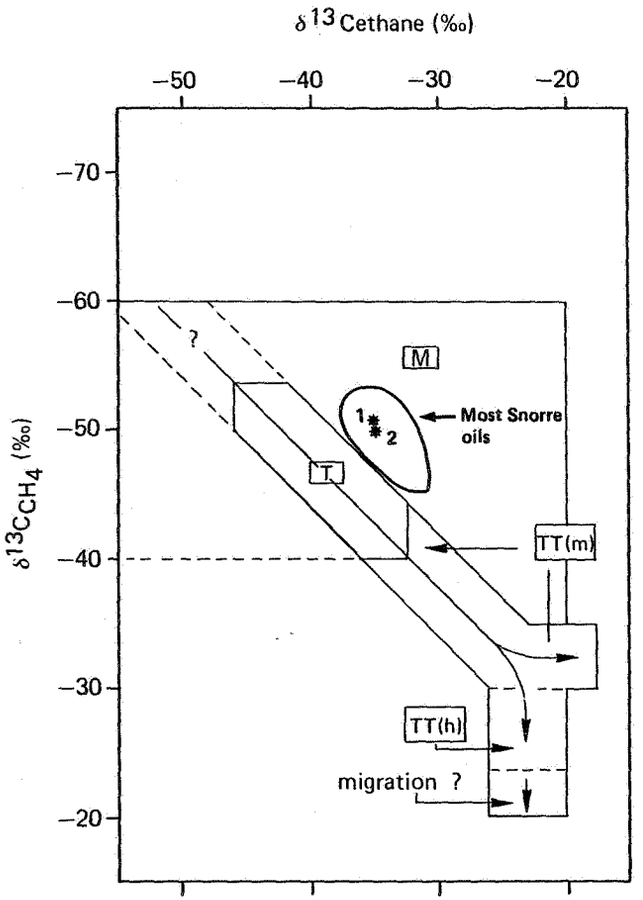


Figure 4a: The two DST gases plot in the same area as the other Snorre oils - close to the boundary of the area associated with thermogenically - derived gas, (after Schoell, 1983).

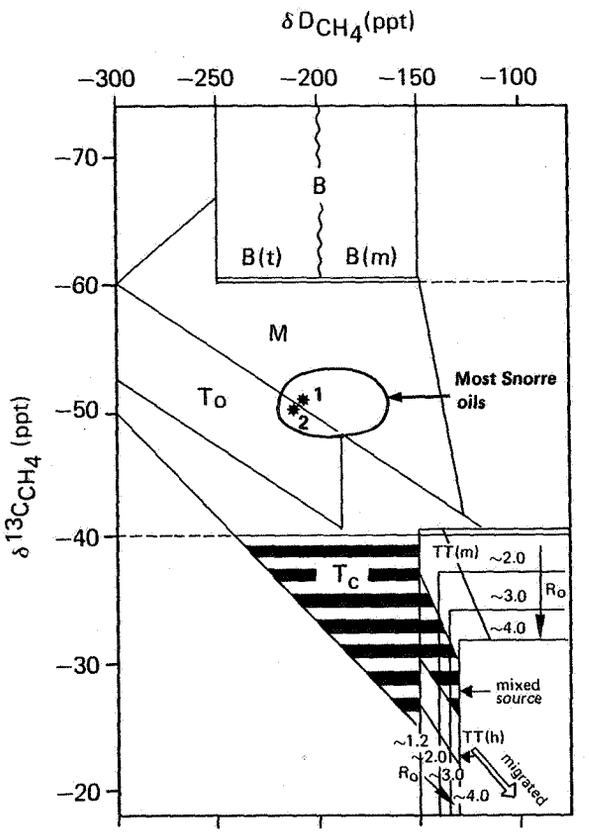
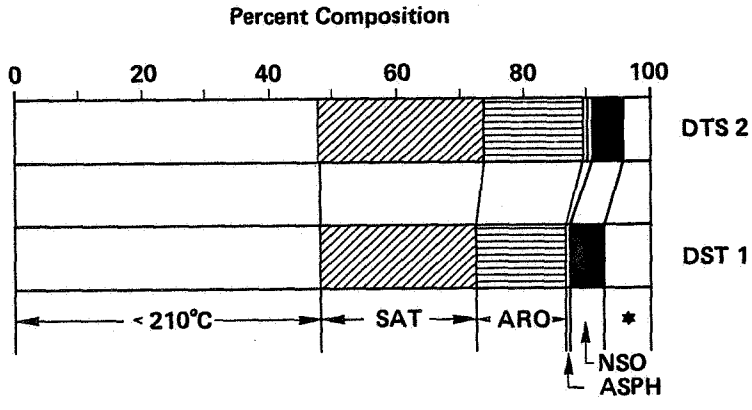


Figure 4b: The two gases plot with most of the other Snorre gases on the boundary between thermogenic oil - associated gases and biogenic gases, (after Schoell, 1983).

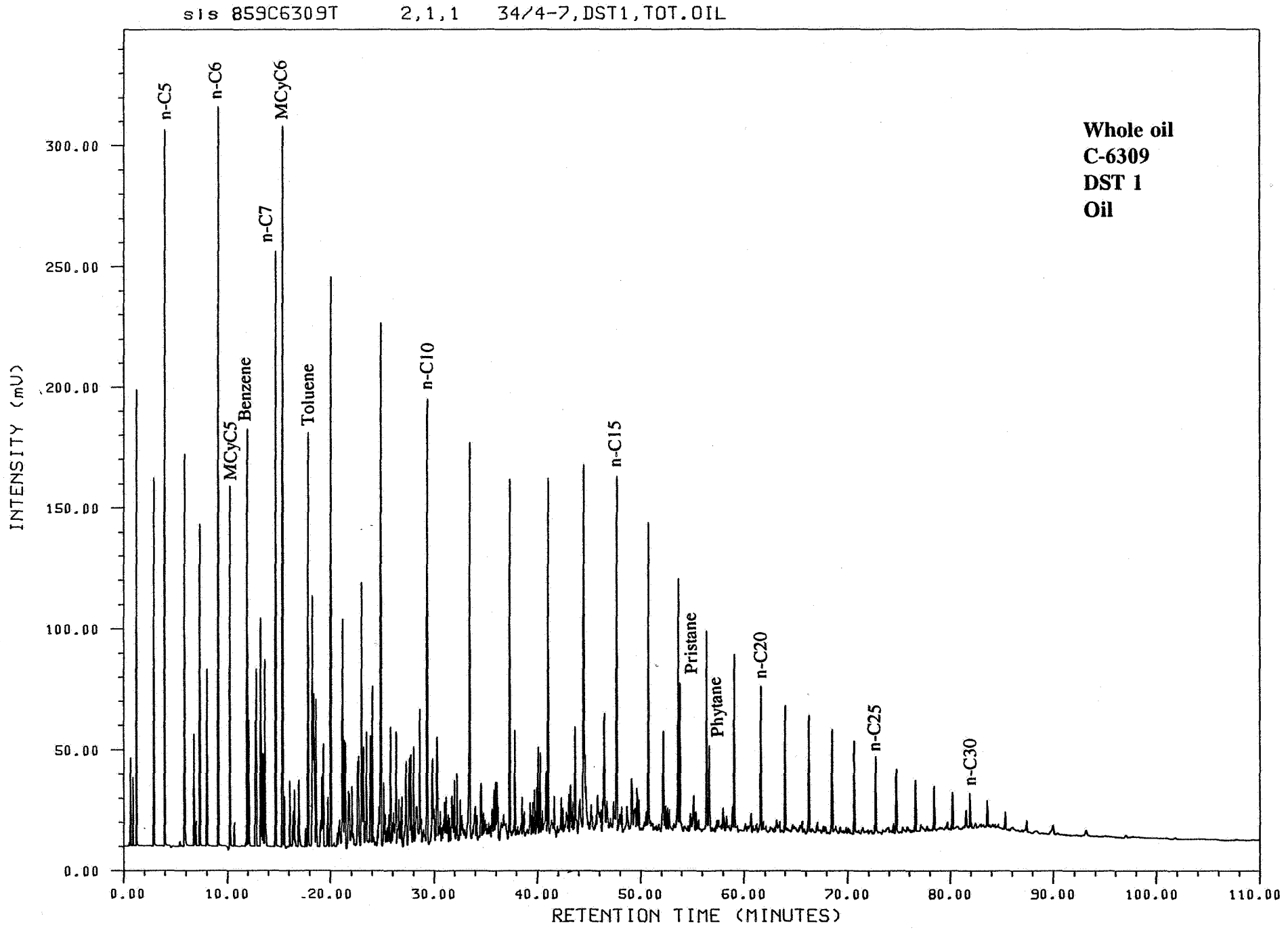


* Loss: Amount of material lost during analytical procedure

Figure 5. Gross composition of the 34/4-7 DST oils.

Figure 6:

Gas Chromatograms of DST Whole Oils


sis 859C6309T 2,1,1 34/4-7,DST1,TOT.OIL
Whole oil
C-6309
DST 1
Oil
n-C5
n-C6
MCyC6
MCyC5
Benzene
n-C7
Toluene
n-C10
n-C15
Pristane
Phytane
n-C20
n-C25
n-C30
INTENSITY (mV)
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
RETENTION TIME (MINUTES)

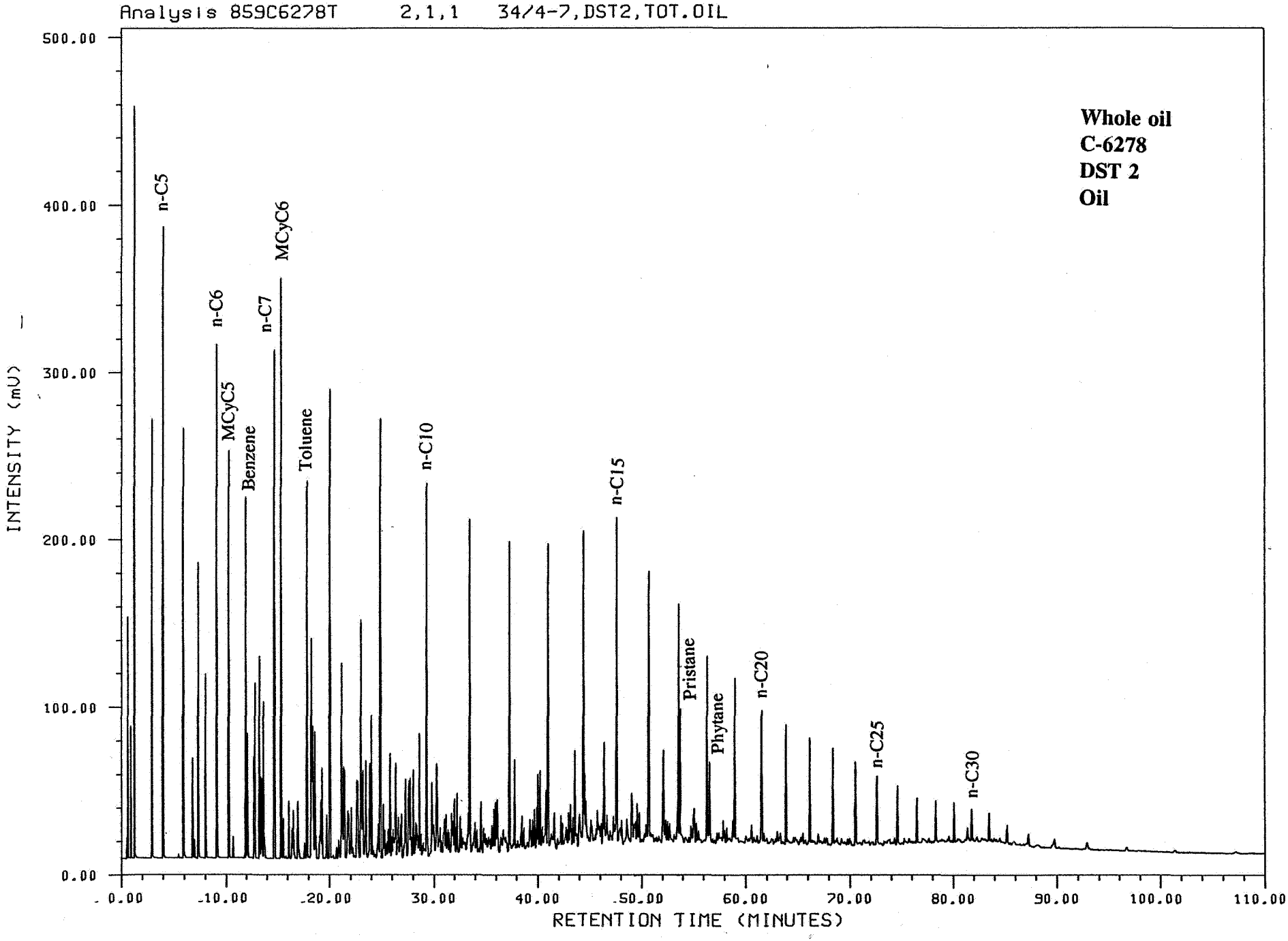
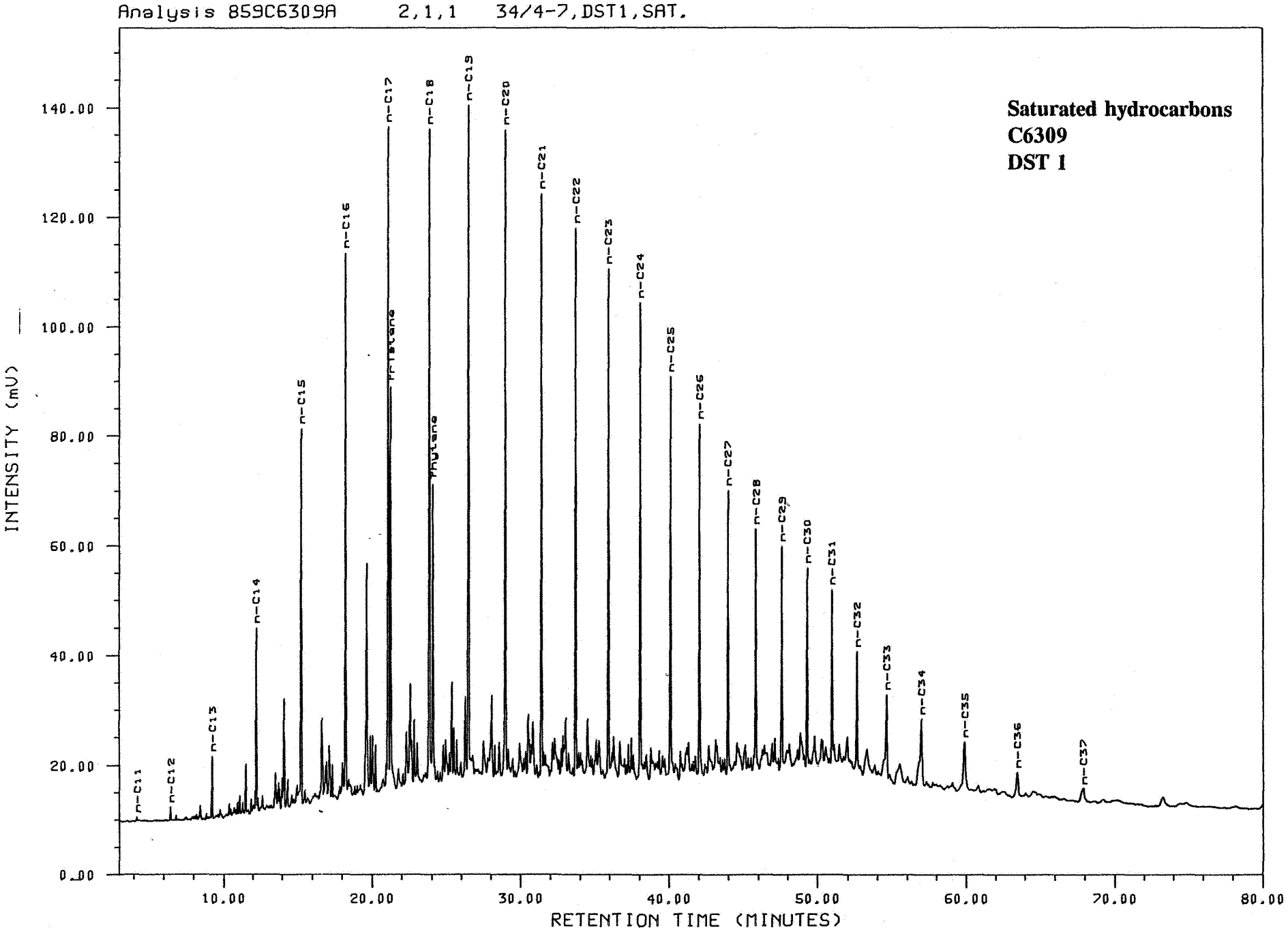
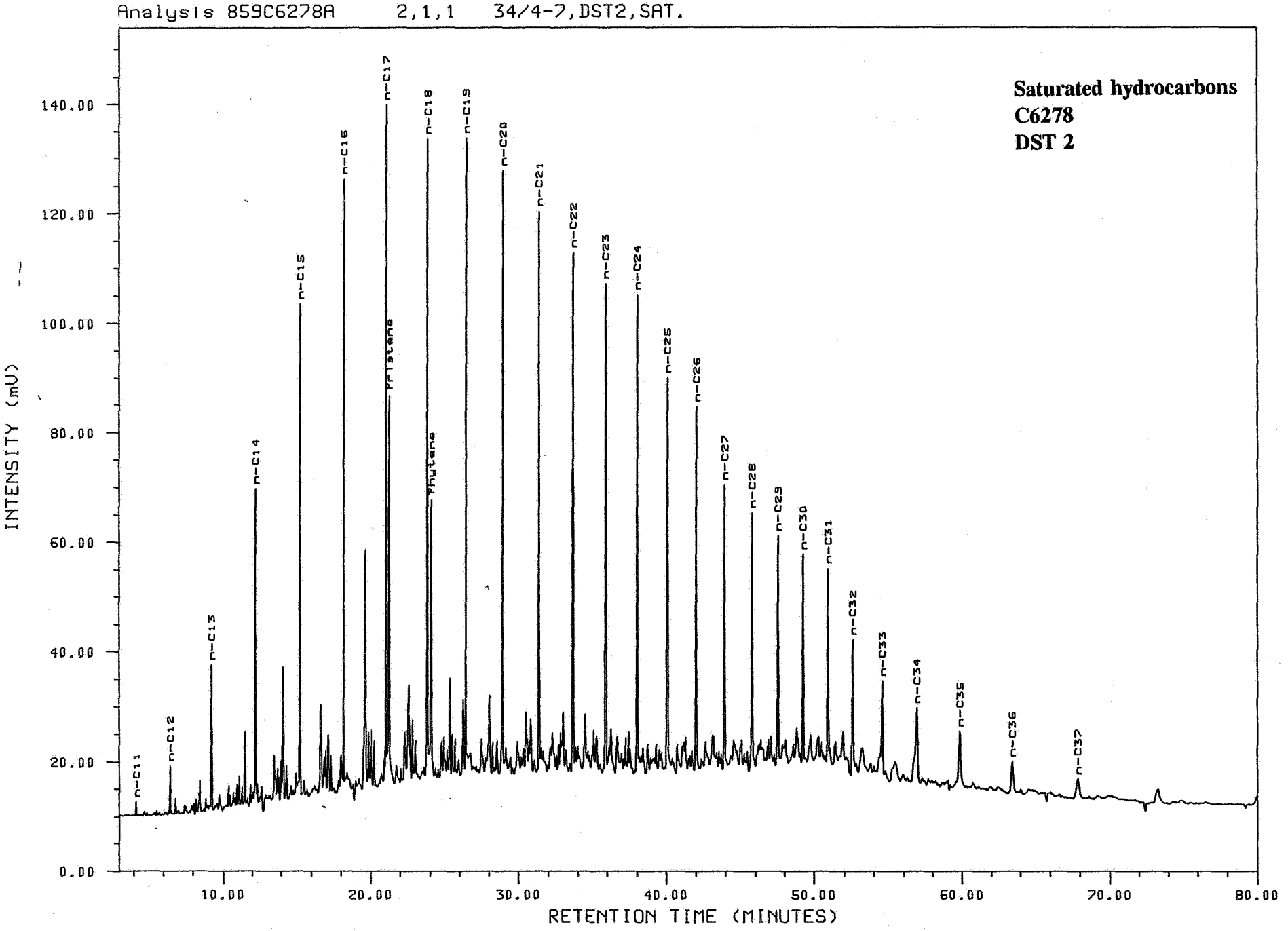

Analysis 859C6278T 2,1,1 34/4-7,DST2,TOT.OIL
Whole oil
C-6278
DST 2
Oil
n-C5
n-C6
MCyC5
Benzene
n-C7
MCyC6
Toluene
n-C10
n-C15
Pristane
Phytane
n-C20
n-C25
n-C30
INTENSITY (mV)
RETENTION TIME (MINUTES)
500.00
400.00
300.00
200.00
100.00
0.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
100.00
110.00

Figure 7:

Gas Chromatograms of DST Oil Saturate Fractions


Analysis 859C6309A 2,1,1 34/4-7,DST1,SAT.
Saturated hydrocarbons
C6309
DST 1
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
n-C32
n-C33
n-C34
n-C35
n-C36
n-C37


Analysis 859C6278A 2,1,1 34/4-7,DST2,SAT.
Saturated hydrocarbons
C6278
DST 2
INTENSITY (mV)
RETENTION TIME (MINUTES)
0.00
20.00
40.00
60.00
80.00
100.00
120.00
140.00
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
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n-C30
n-C31
n-C32
n-C33
n-C34
n-C35
n-C36
n-C37

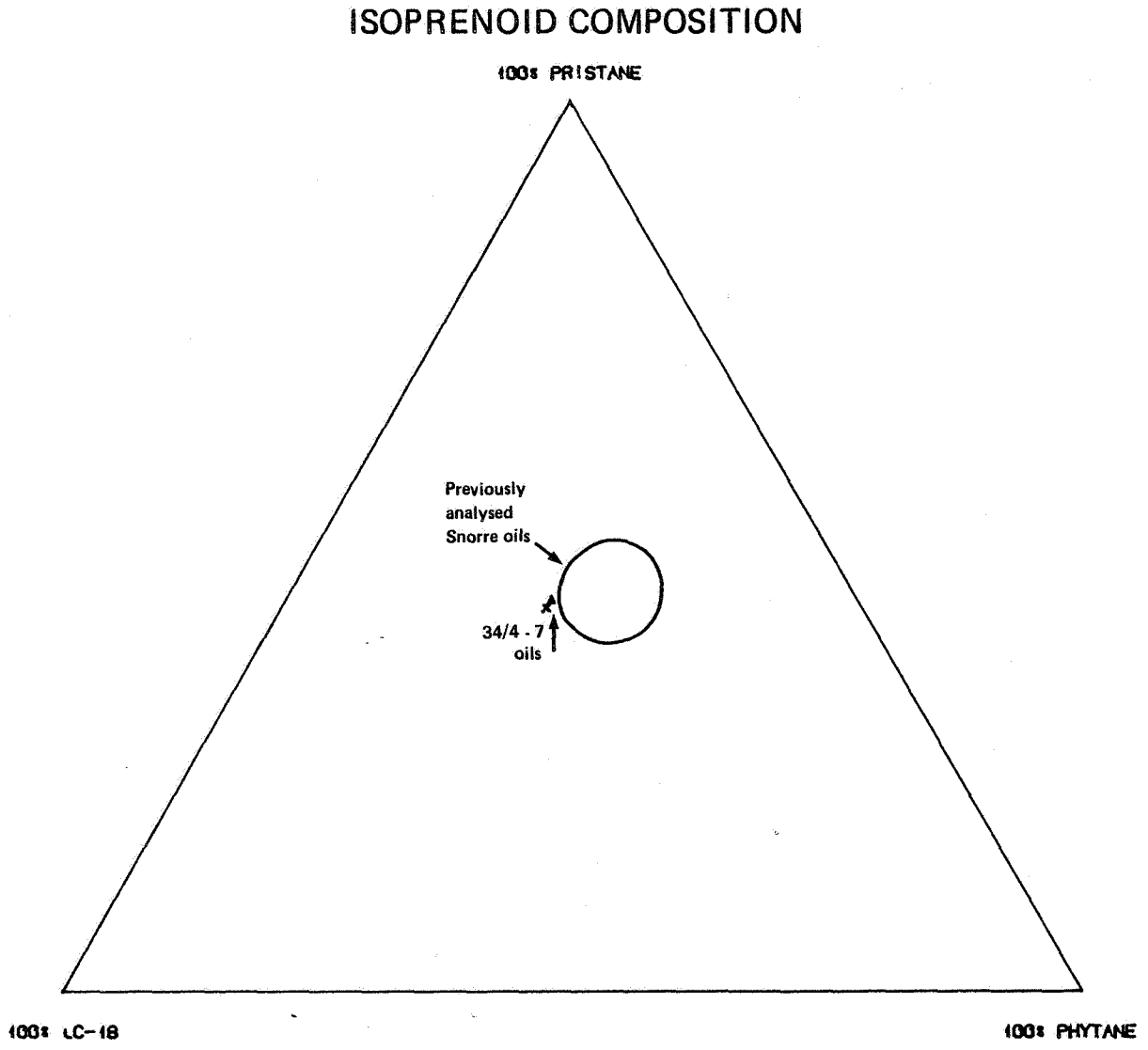
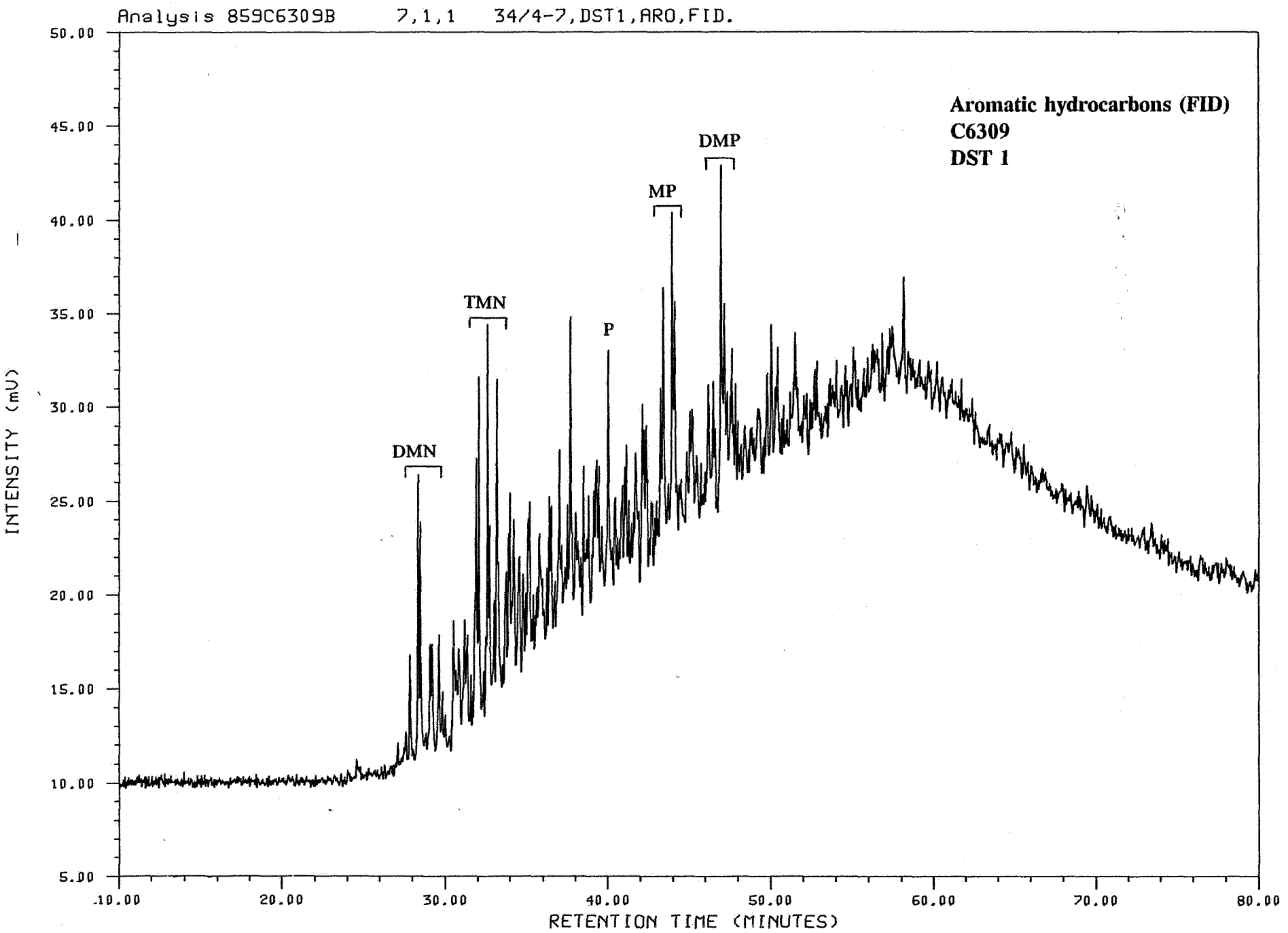


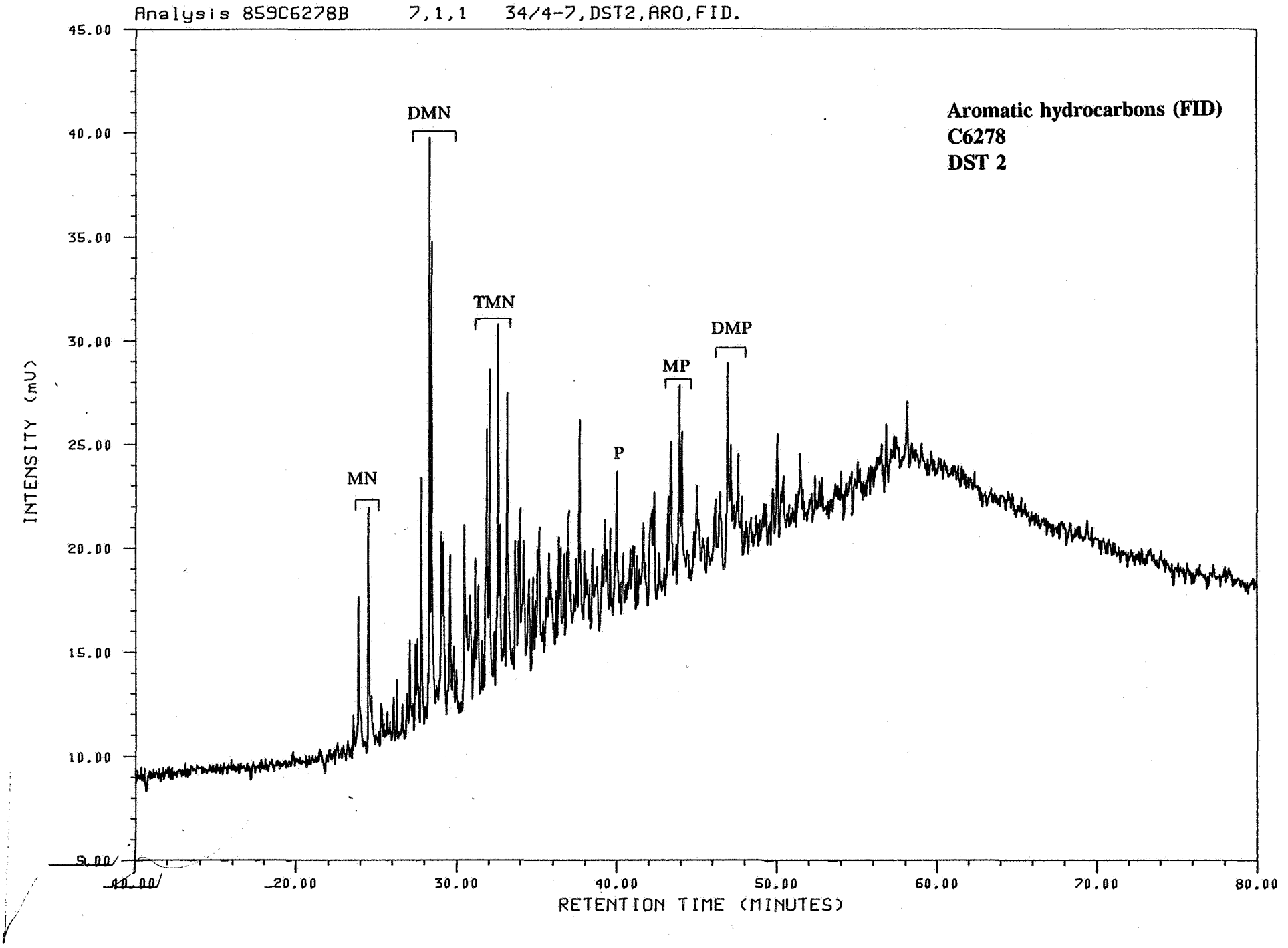
Figure 8: Isoprenoid Composition of DST Oils.

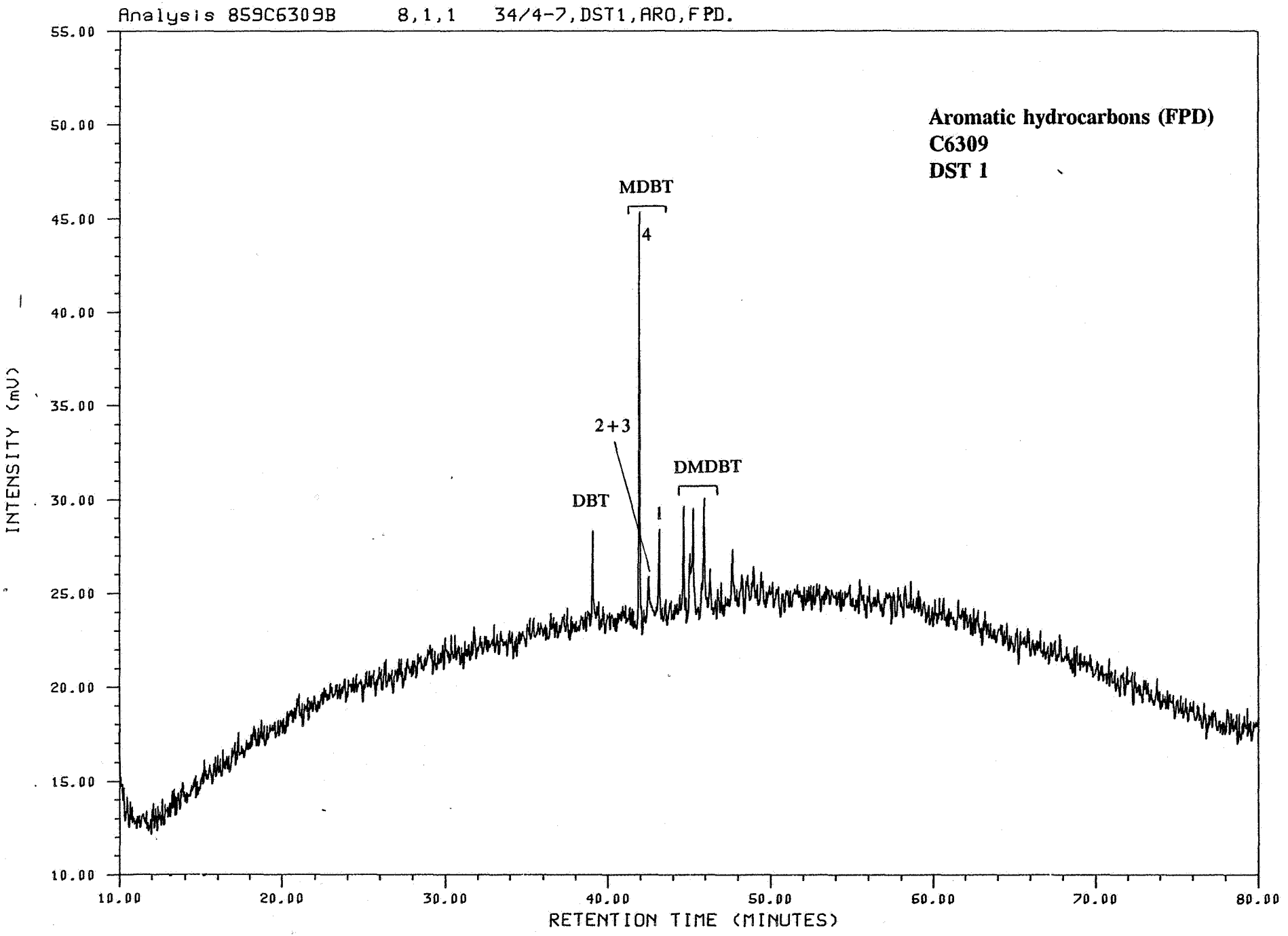
Figure 9:

Gas Chromatograms of DST Oil Aromatic Fractions
(FID/FPD)

MN, DMN, TMN : alkyl naphthalenes
P, MP, DMP : phenanthrene and alkyl phenanthrene
DBT, MDBT, DMDBT : Dibenzo-thiophenes


Analysis 859C6309B 7,1,1 34/4-7,DST1,ARO,FID.
Aromatic hydrocarbons (FID)
C6309
DST 1
DMN
TMN
P
MP
DMP
INTENSITY (mV)
RETENTION TIME (MINUTES)
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00


Analysis 859C6278B 7,1,1 34/4-7,DST2,ARO,FID.
Aromatic hydrocarbons (FID)
C6278
DST 2
MN
DMN
TMN
P
MP
DMP
INTENSITY (mV)
RETENTION TIME (MINUTES)
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00


Analysis 859C6309B 8,1,1 34/4-7,DST1,ARO,FPD.
Aromatic hydrocarbons (FPD)
C6309
DST 1
MDBT
4
2+3
DMDBT
DBT
1
INTENSITY (mV)
RETENTION TIME (MINUTES)
55.00
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00

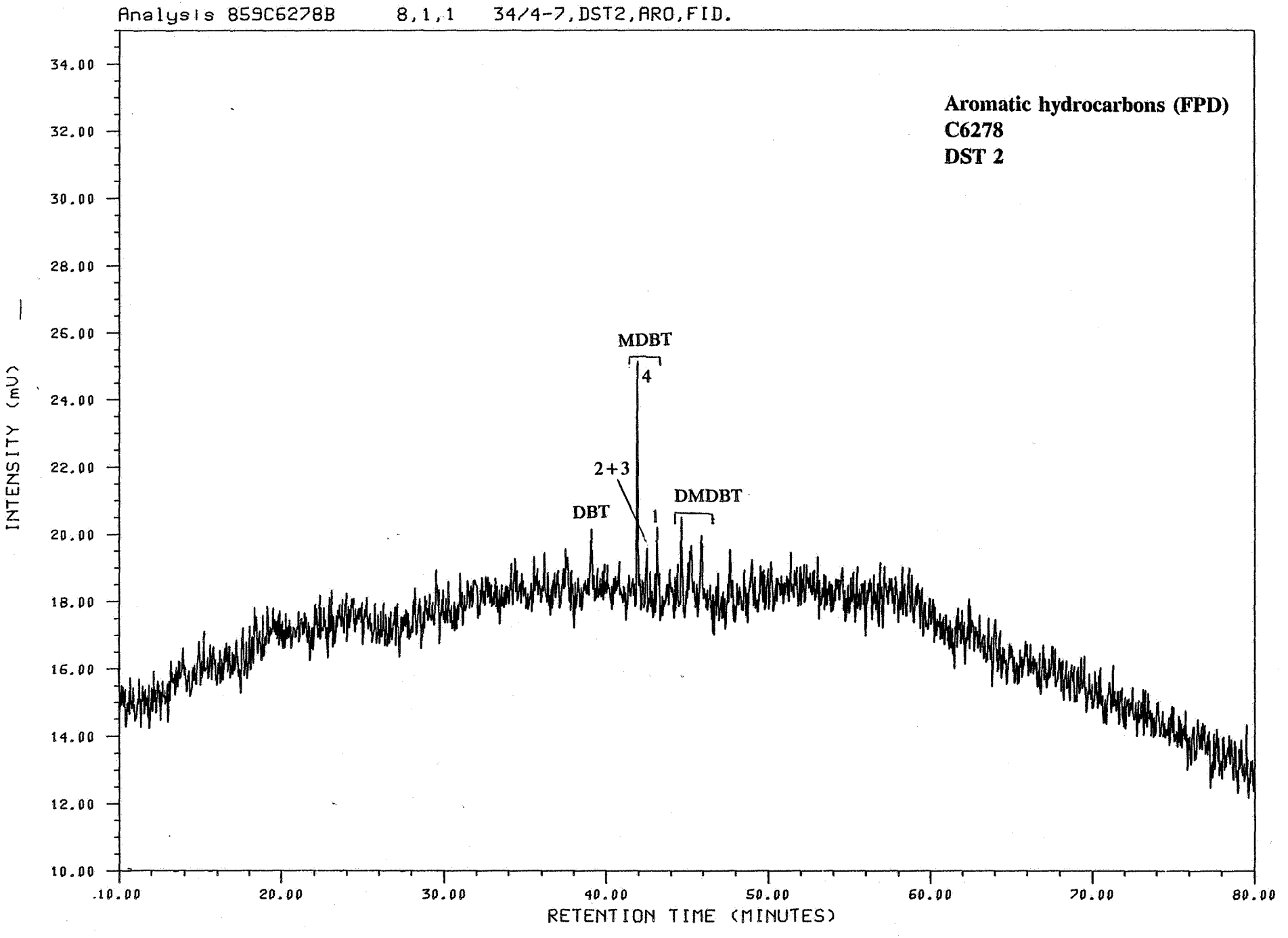
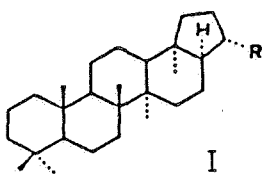

Analysis 859C6278B 8,1,1 34/4-7,DST2,ARO,FID.
Aromatic hydrocarbons (FPD)
C6278
DST 2
MDBT
4
2+3
DBT
1
DMDBT
INTENSITY (mV)
34.00
32.00
30.00
28.00
26.00
24.00
22.00
20.00
18.00
16.00
14.00
12.00
10.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
RETENTION TIME (MINUTES)

Figure 10:

Mass chromatograms representing terpanes (m/z 191)

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})
A	T_s, 18α(H)-trisnorneohopane	$C_{27}H_{46}$	(III)
B	T_m, 17α(H)-trisnorhopane	$C_{27}H_{46}$	(I,R=H)
Z	bisnorhopane	$C_{28}H_{48}$	
C	17α(H)-norhopane	$C_{29}H_{50}$	(I,R=C_2H_5)
X	unknown triterpane	$C_{30}H_{52}$	
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})



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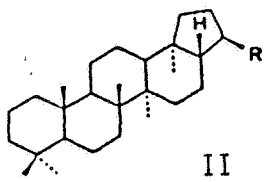

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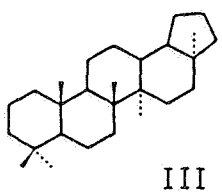

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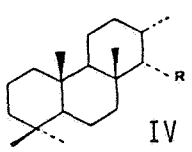

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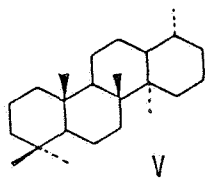

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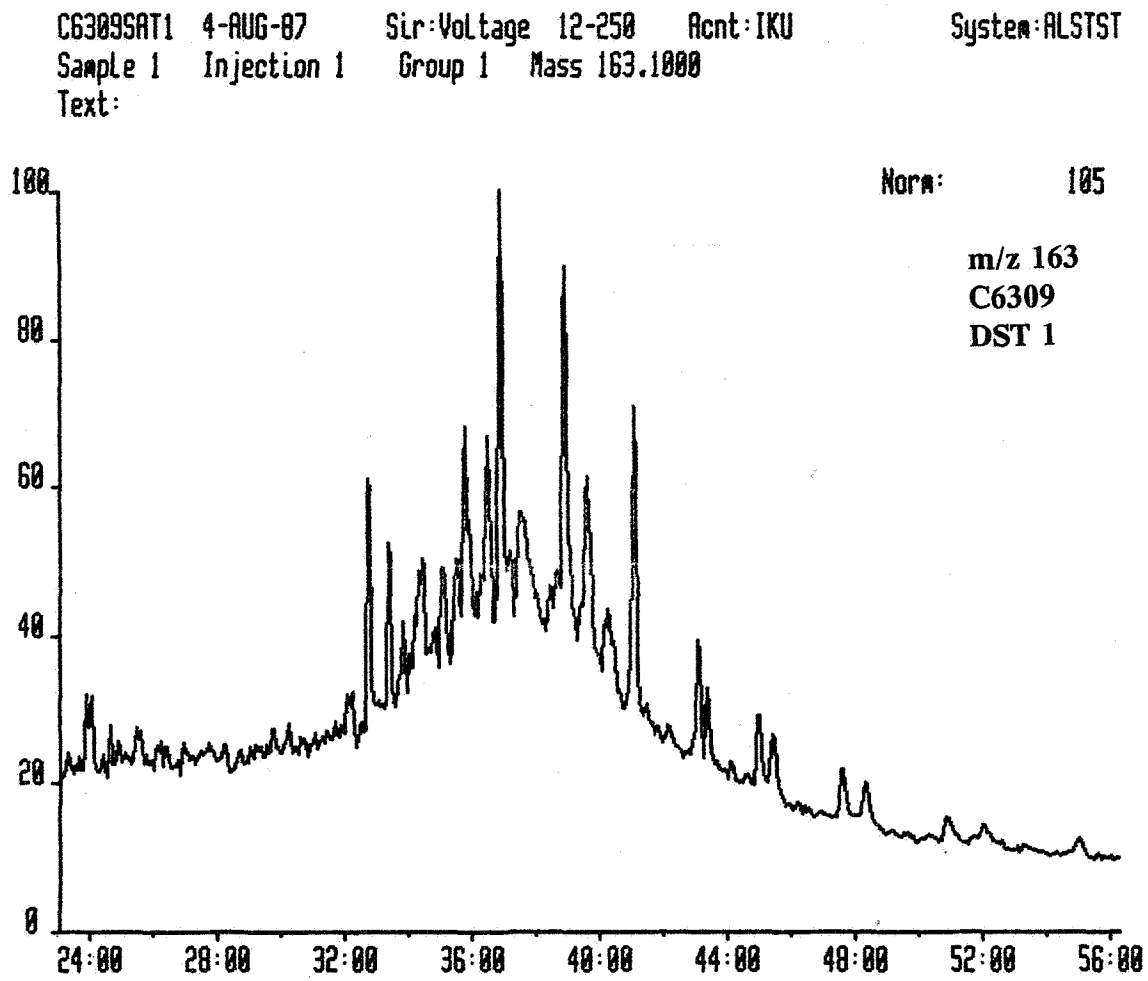
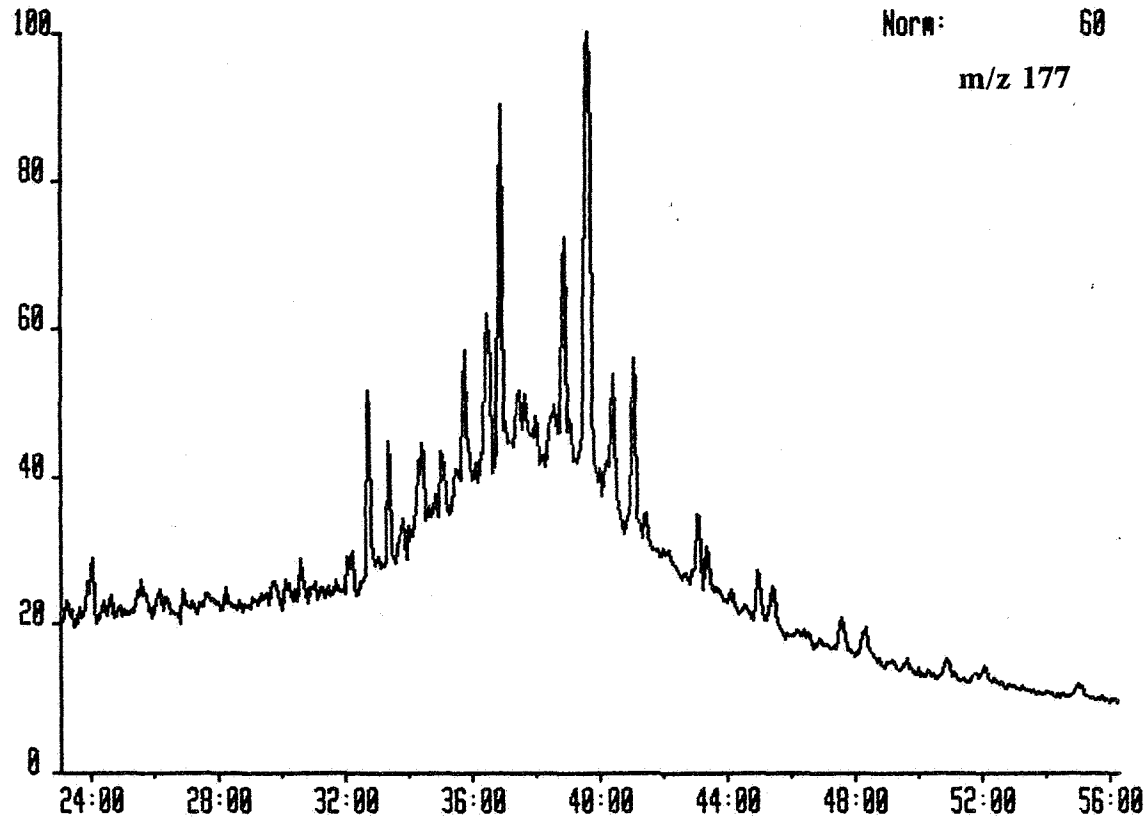
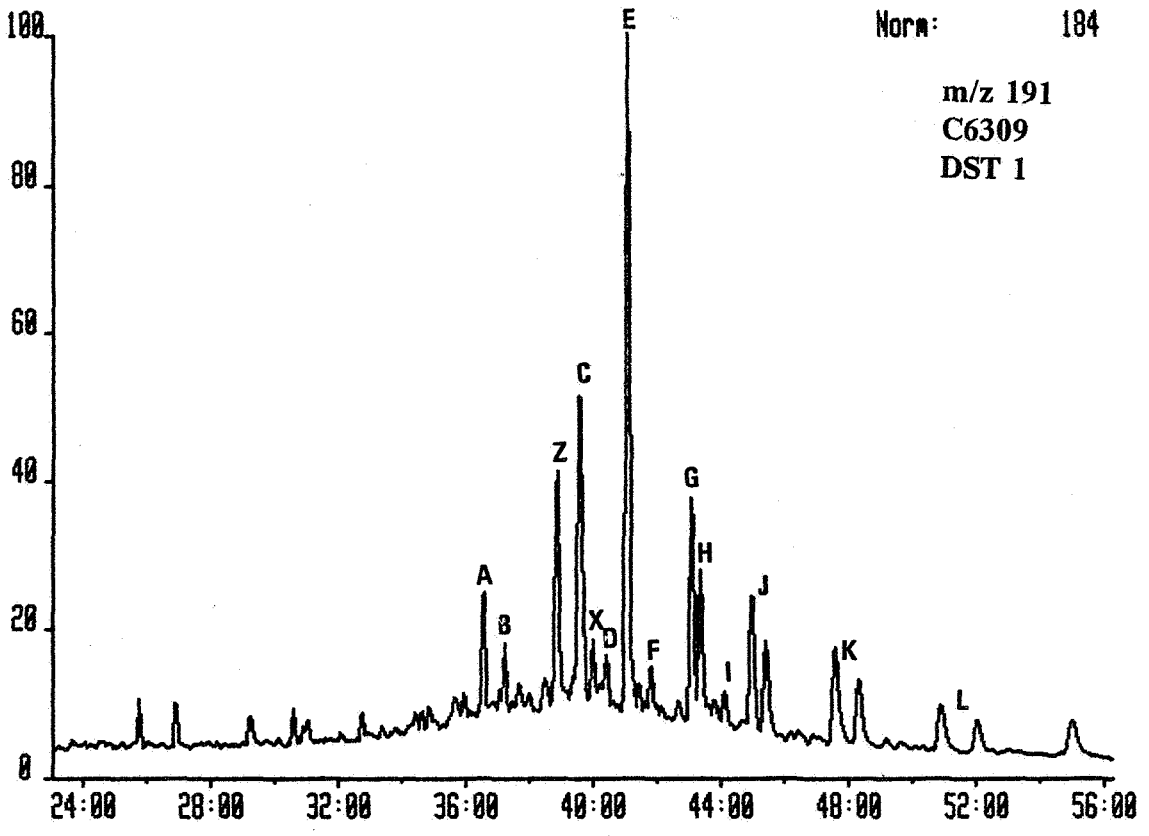

C6309SAT1 4-AUG-87 Sir:Voltage 12-250 Acnt:IKU System:ALSTST
Sample 1 Injection 1 Group 1 Mass 163.1000
Text:
Norm: 105
m/z 163
C6309
DST 1
100
80
60
40
20
0
24:00
28:00
32:00
36:00
40:00
44:00
48:00
52:00
56:00

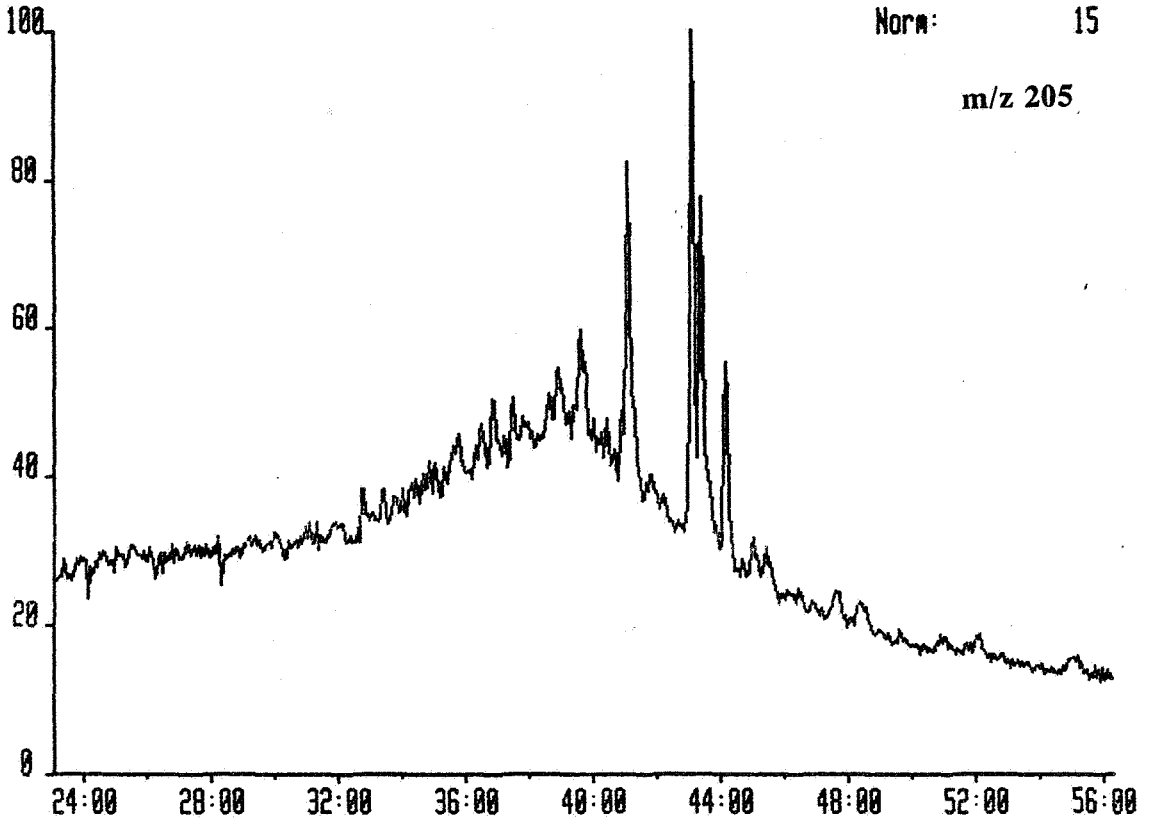

C6309SAT1 4-AUG-87 Sir:Voltage 12-250 Acnt:IKU System:ALSTST
Sample 1 Injection 1 Group 1 Mass 177.1000
Text:
Norm: 60
m/z 177
100
80
60
40
20
0
24:00
28:00
32:00
36:00
40:00
44:00
48:00
52:00
56:00

IKU
SINTEF-GRUPPEN

C6309SAT1 4-AUG-87 Sir:Voltage 12-250 Acnt:IKU System:ALSTST
Sample 1 Injection 1 Group 1 Mass 191.1000
Text:

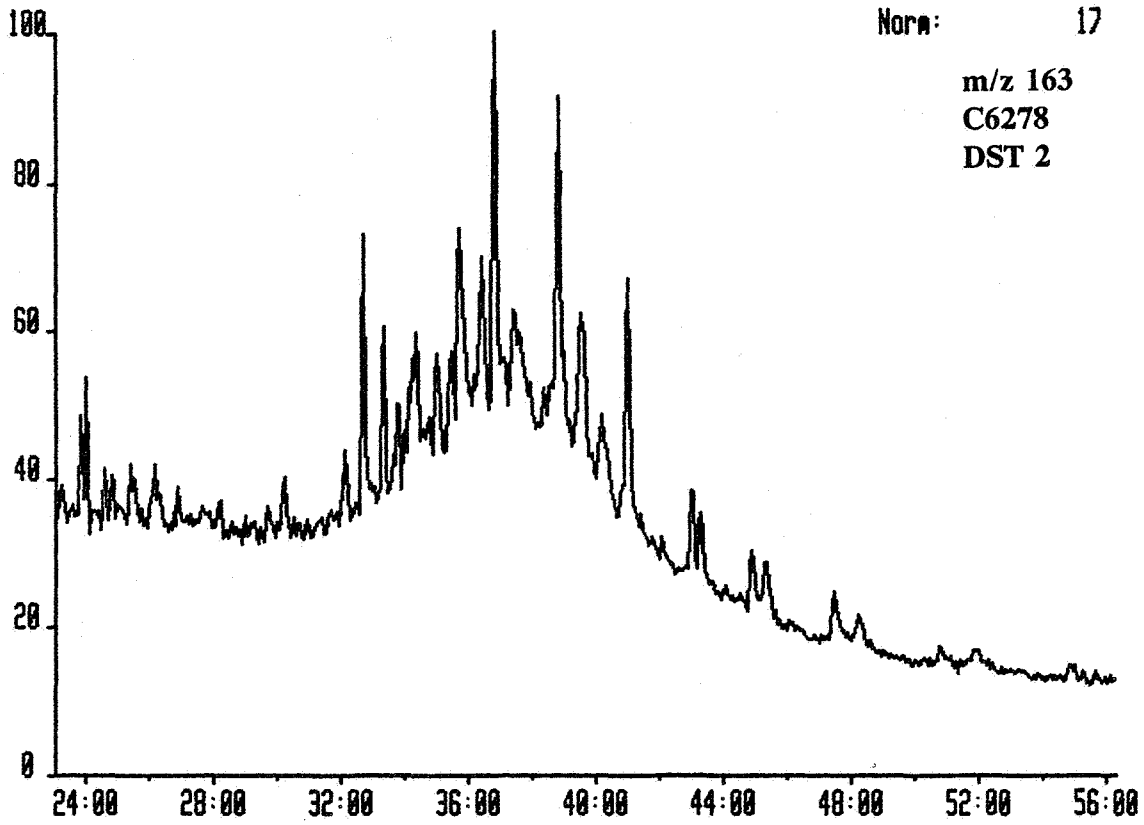


C6309SAT1 4-AUG-87 Sir:Voltage 12-250 Acnt:IKU System:ALSTST
Sample 1 Injection 1 Group 1 Mass 205.1000
Text:

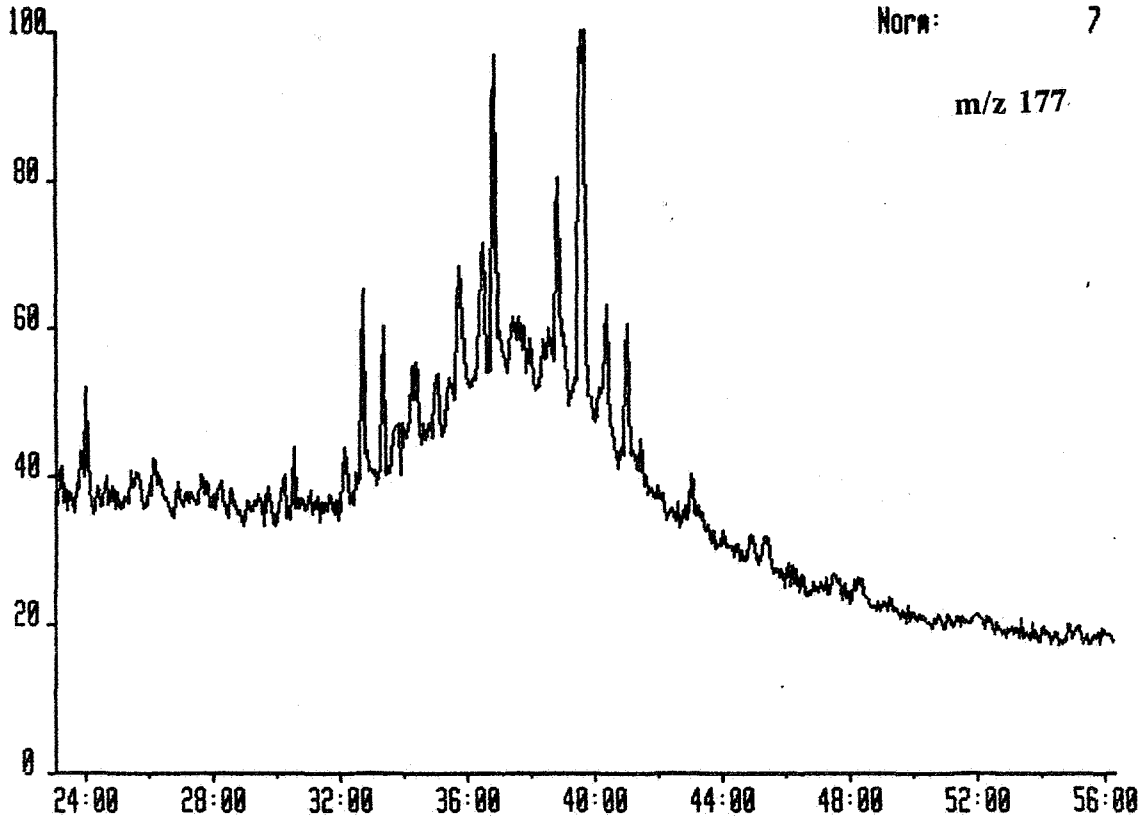


IKU
SINTEF-GRUPPEN

C6278SAT 4-AUG-87 Sir:Voltage 12-250 Acnt:IKU System:ALSTST
Sample 1 Injection 1 Group 1 Mass 163.1000
Text:

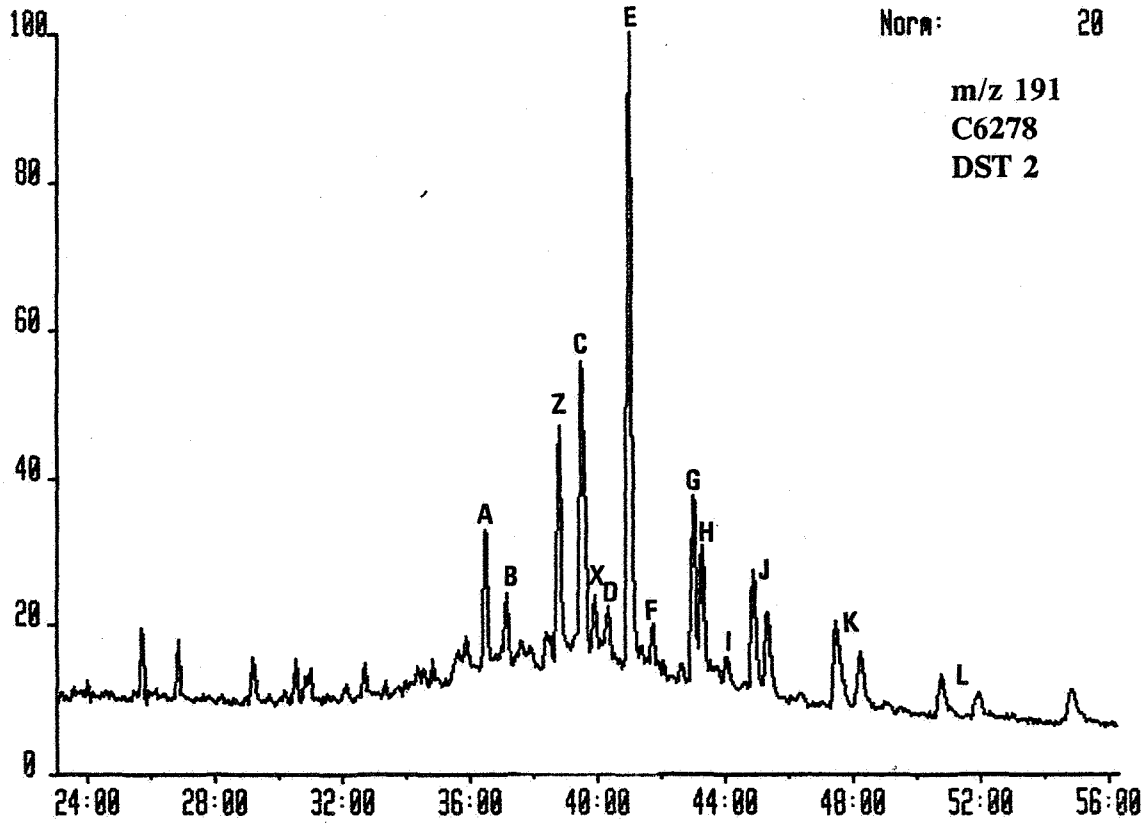


C6278SAT 4-AUG-87 Sir:Voltage 12-250 Acnt:IKU System:ALSTST
Sample 1 Injection 1 Group 1 Mass 177.1000
Text:



IKU SINTEF-GRUPPEN

C6278SAT 4-AUG-87 Sir:Voltage 12-250 Acnt:IKU System:ALSTST
Sample 1 Injection 1 Group 1 Mass 191.1000
Text:



C6278SAT 4-AUG-87 Sir:Voltage 12-250 Acnt:IKU System:ALSTST
Sample 1 Injection 1 Group 1 Mass 205.1000
Text:

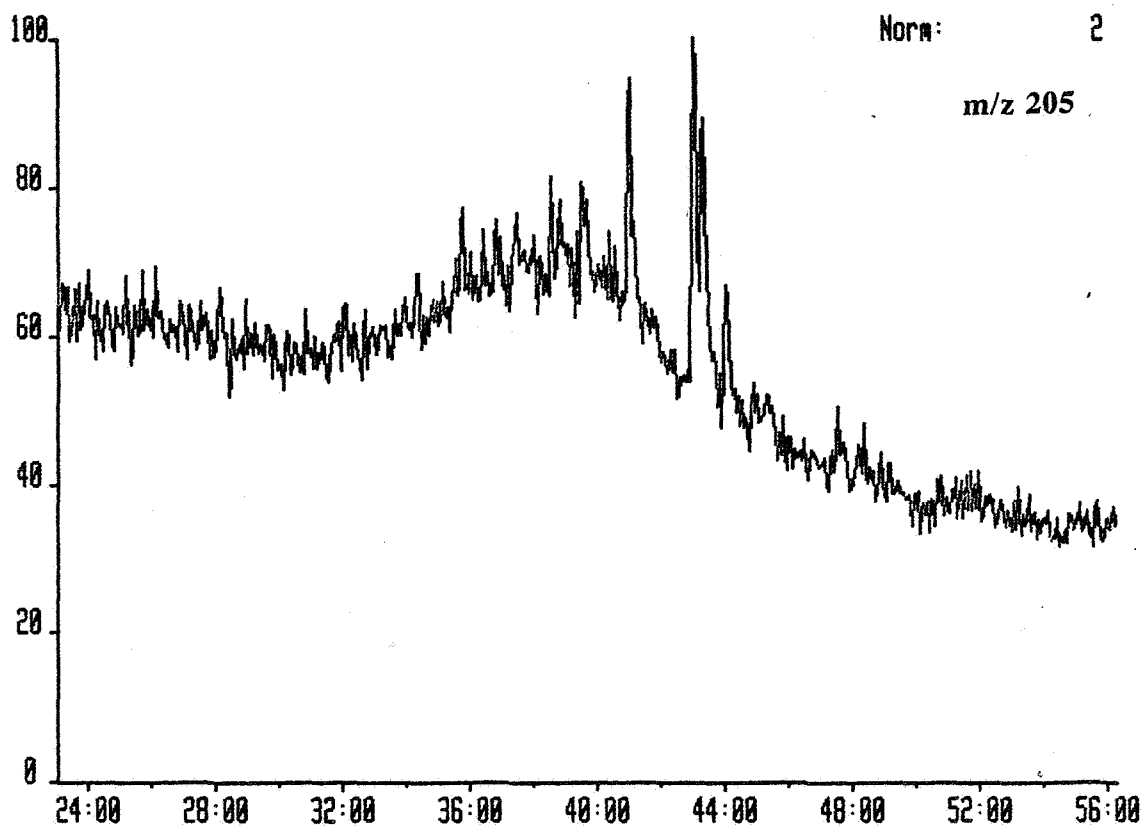
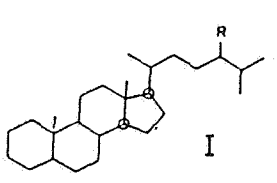


Figure 11:

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

u	5α(H)-sterane	$C_{21}H_{36}$	(V,R=C_2H_5)
v	5α(H)-sterane	$C_{22}H_{38}$	(V,R=C_3H_7)
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)	$C_{29}H_{52}$	(IV,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)	$C_{29}H_{52}$	(IV,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)



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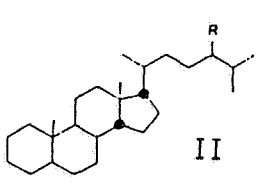

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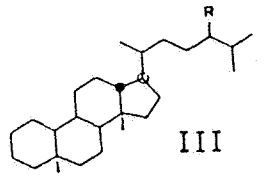

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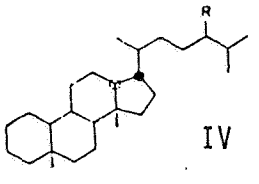

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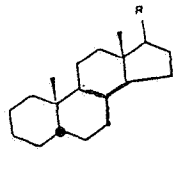
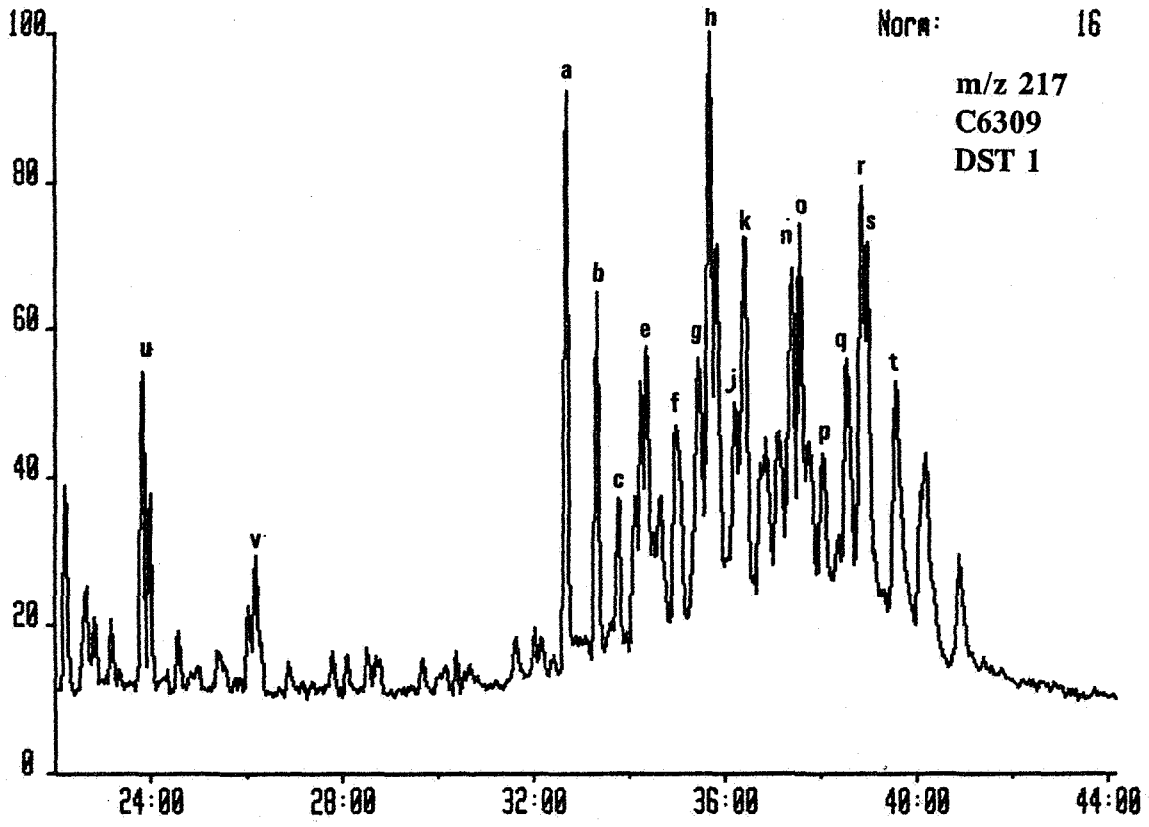


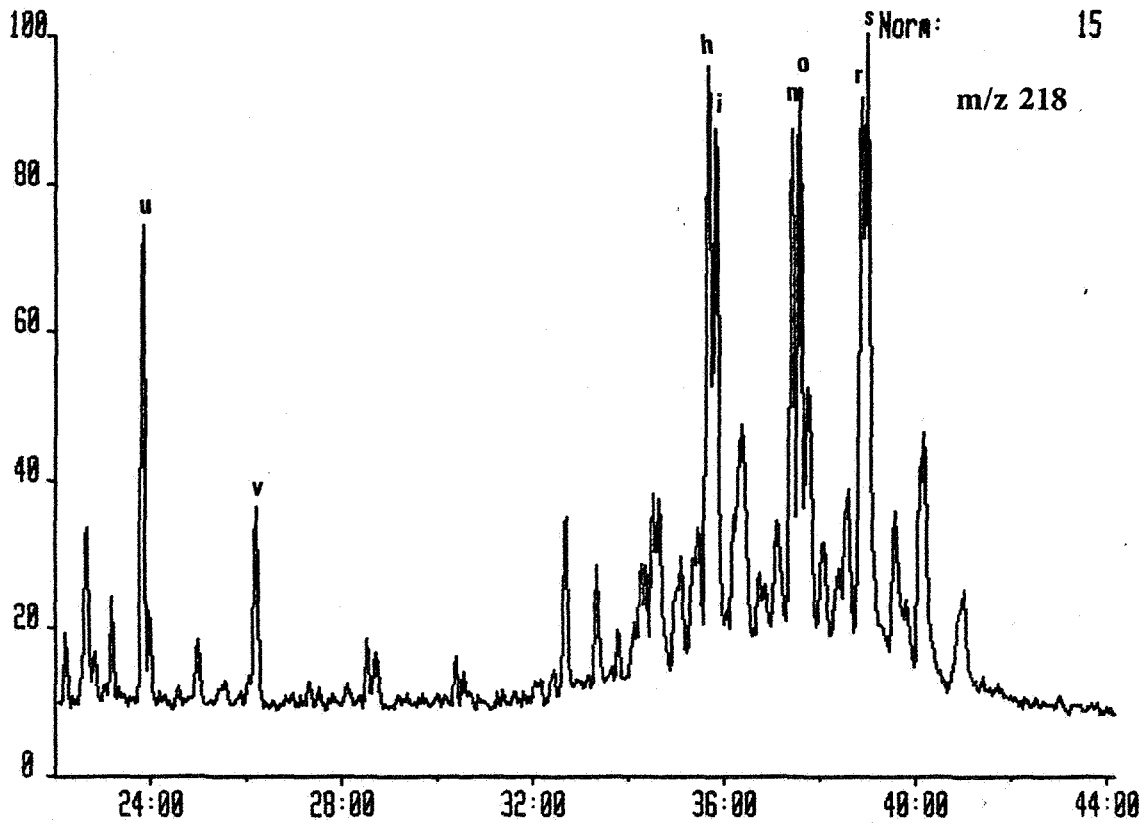
V

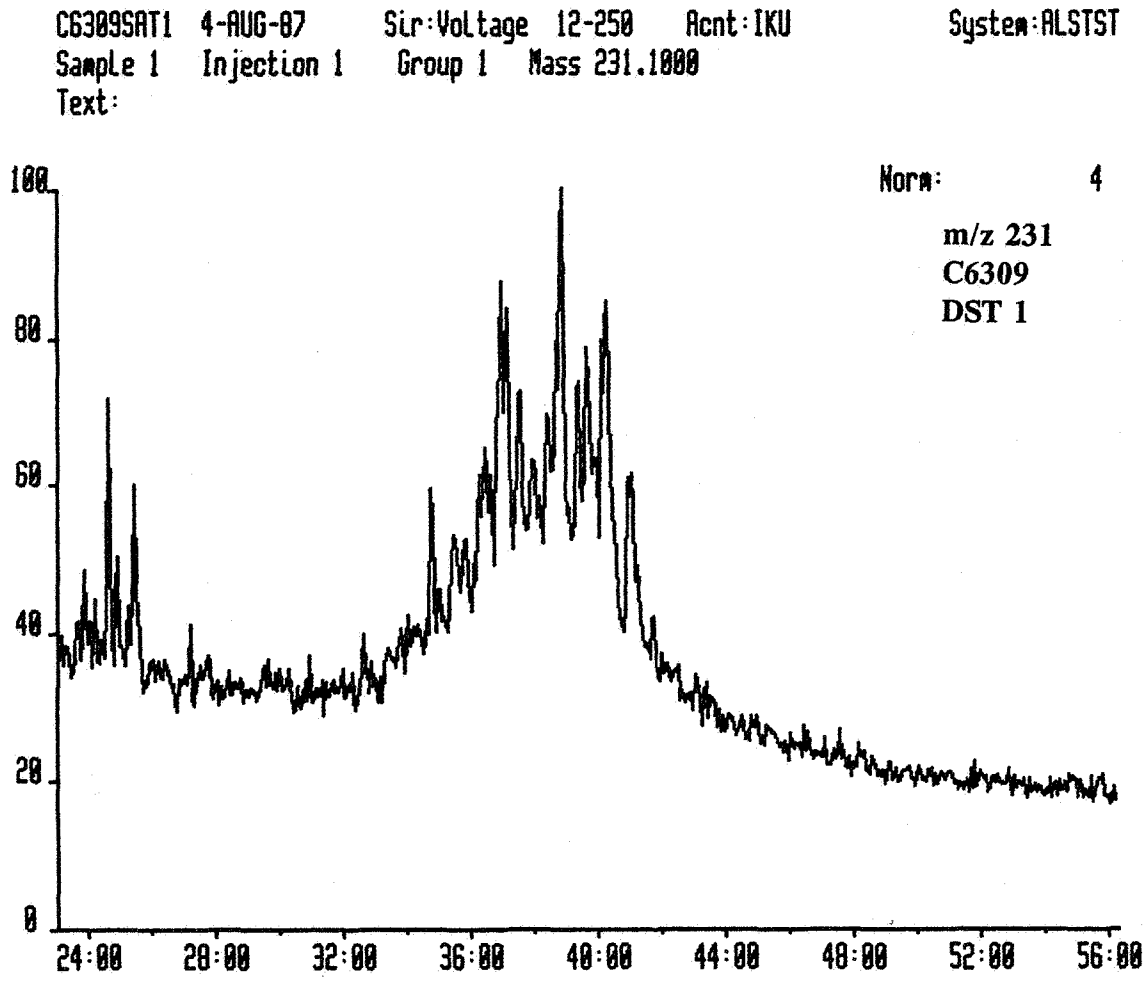
IKU
SINTEF-GRUPPEN

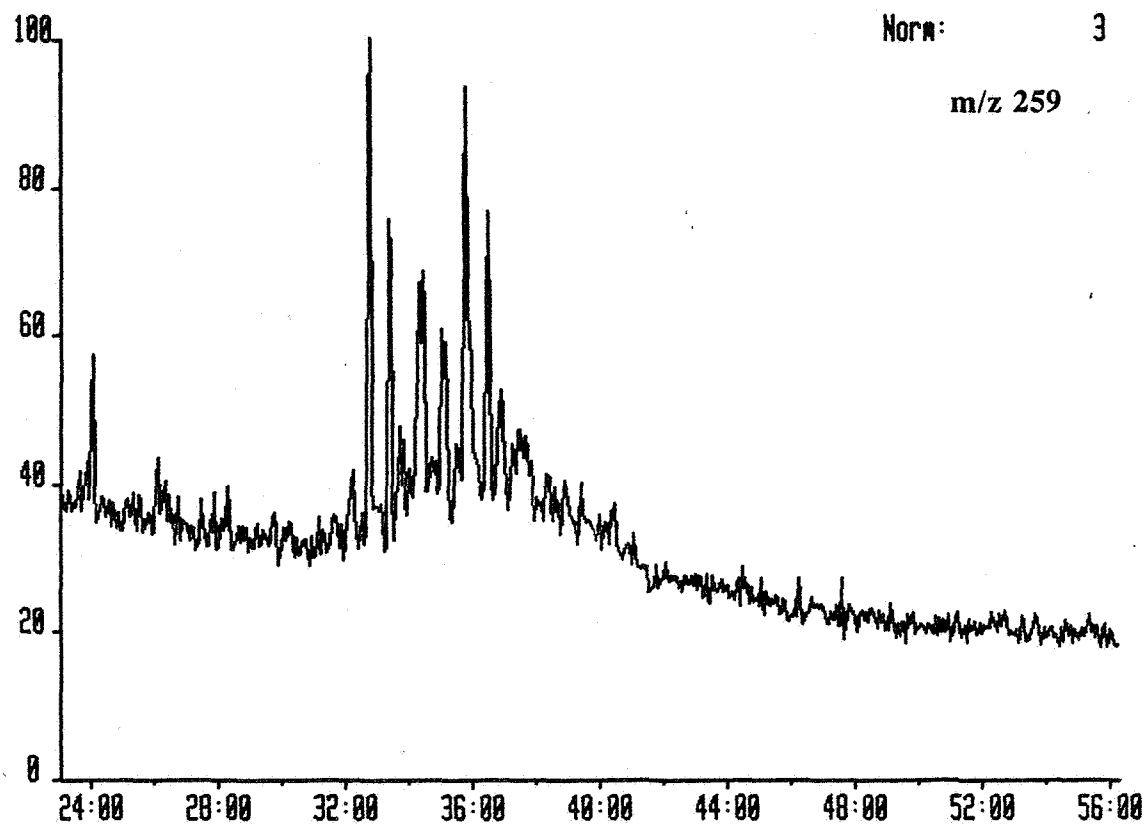
C6309SAT1 4-AUG-87 Sir:Voltage 12-250 Acnt:IKU System:ALSTST
Sample 1 Injection 1 Group 1 Mass 217.1000
Text:



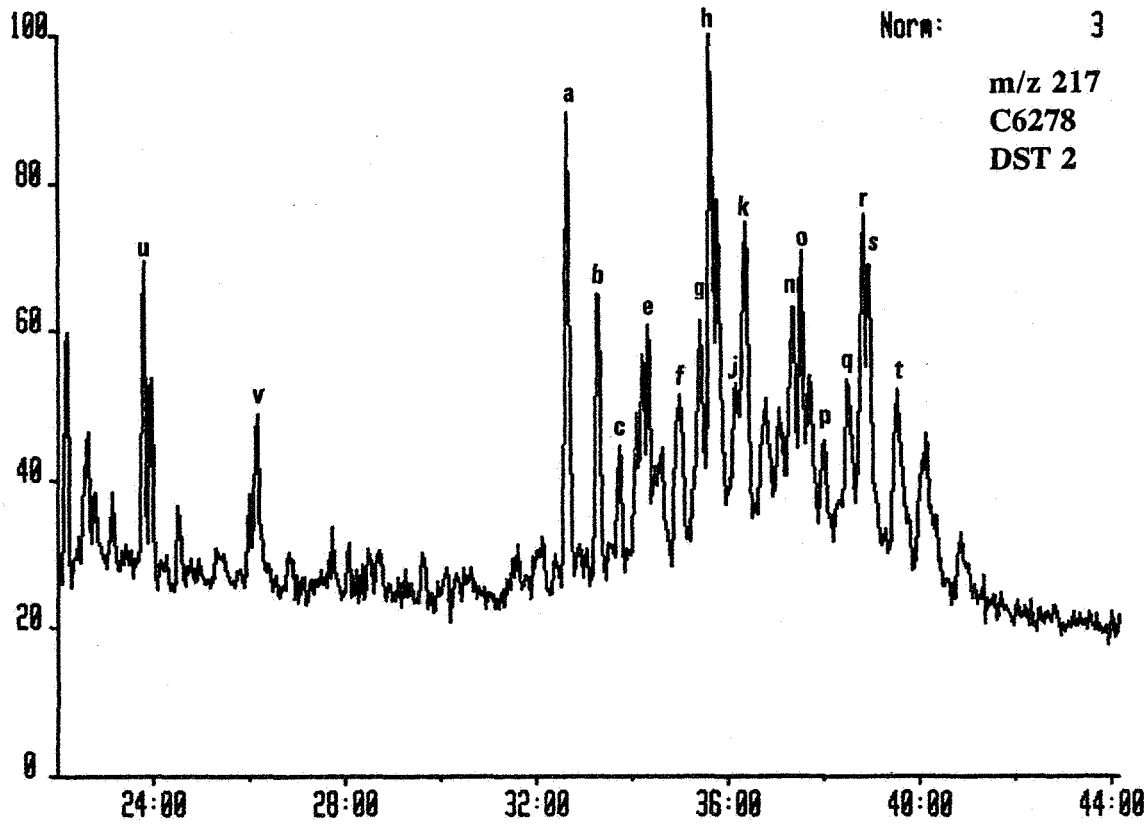
C6309SAT1 4-AUG-87 Sir:Voltage 12-250 Acnt:IKU System:ALSTST
Sample 1 Injection 1 Group 1 Mass 218.1000
Text:



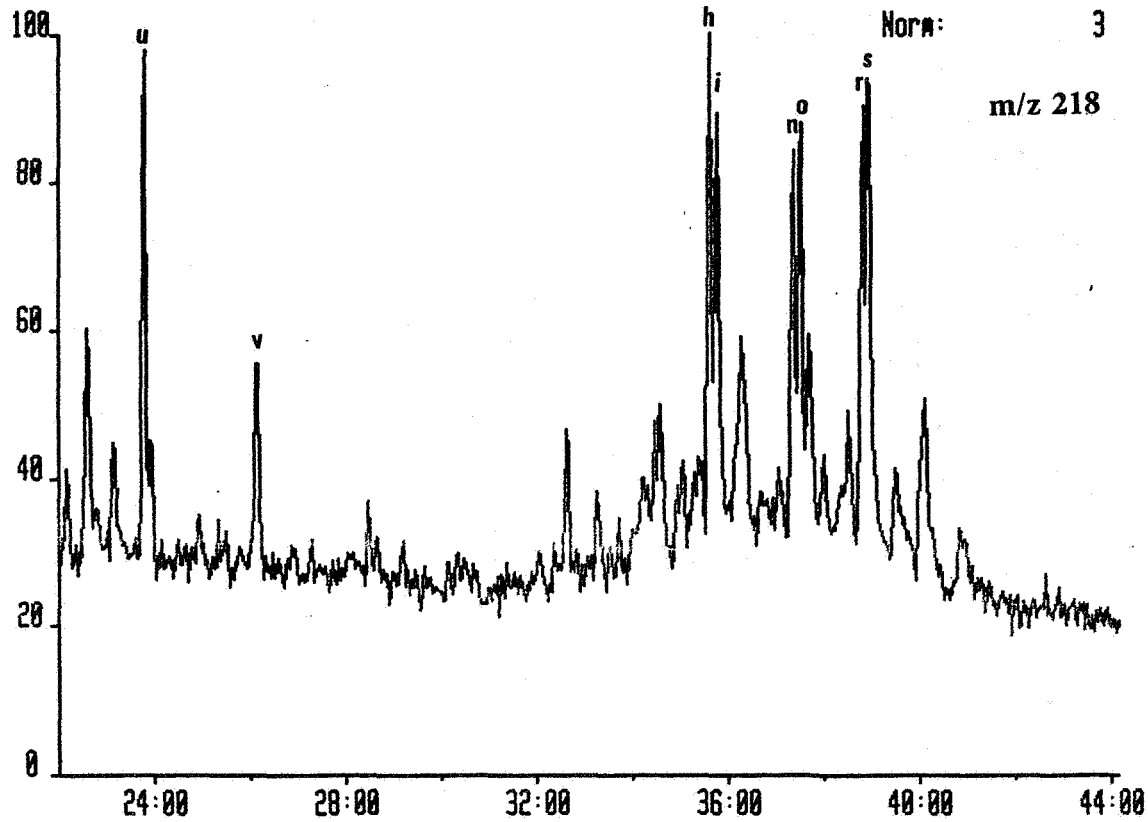

C6309SAT1 4-AUG-87 Sir:Voltage 12-250 Acnt:IKU System:ALSTST
Sample 1 Injection 1 Group 1 Mass 231.1000
Text:
Norm: 4
m/z 231
C6309
DST 1
100
80
60
40
20
0
24:00
28:00
32:00
36:00
40:00
44:00
48:00
52:00
56:00


C6309SAT1 4-AUG-87 Sir:Voltage 12-250 Acnt:IKU System:ALSTST
Sample 1 Injection 1 Group 1 Mass 259.1000
Text:
Norm: 3
m/z 259
100
80
60
40
20
0
24:00
28:00
32:00
36:00
40:00
44:00
48:00
52:00
56:00

C6278SAT 4-AUG-87 Sir:Voltage 12-250 Acnt:IKU System:ALSTST
Sample 1 Injection 1 Group 1 Mass 217.1000
Text:

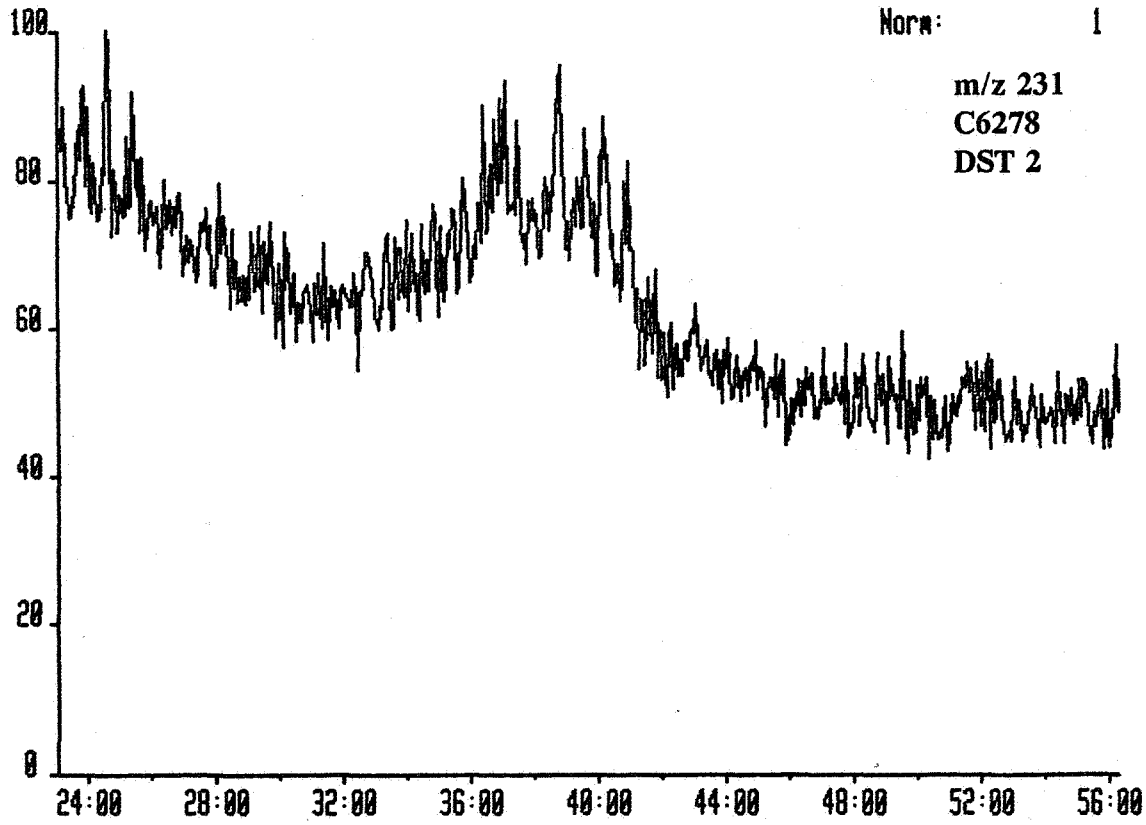


C6278SAT 4-AUG-87 Sir:Voltage 12-250 Acnt:IKU System:ALSTST
Sample 1 Injection 1 Group 1 Mass 218.1000
Text:

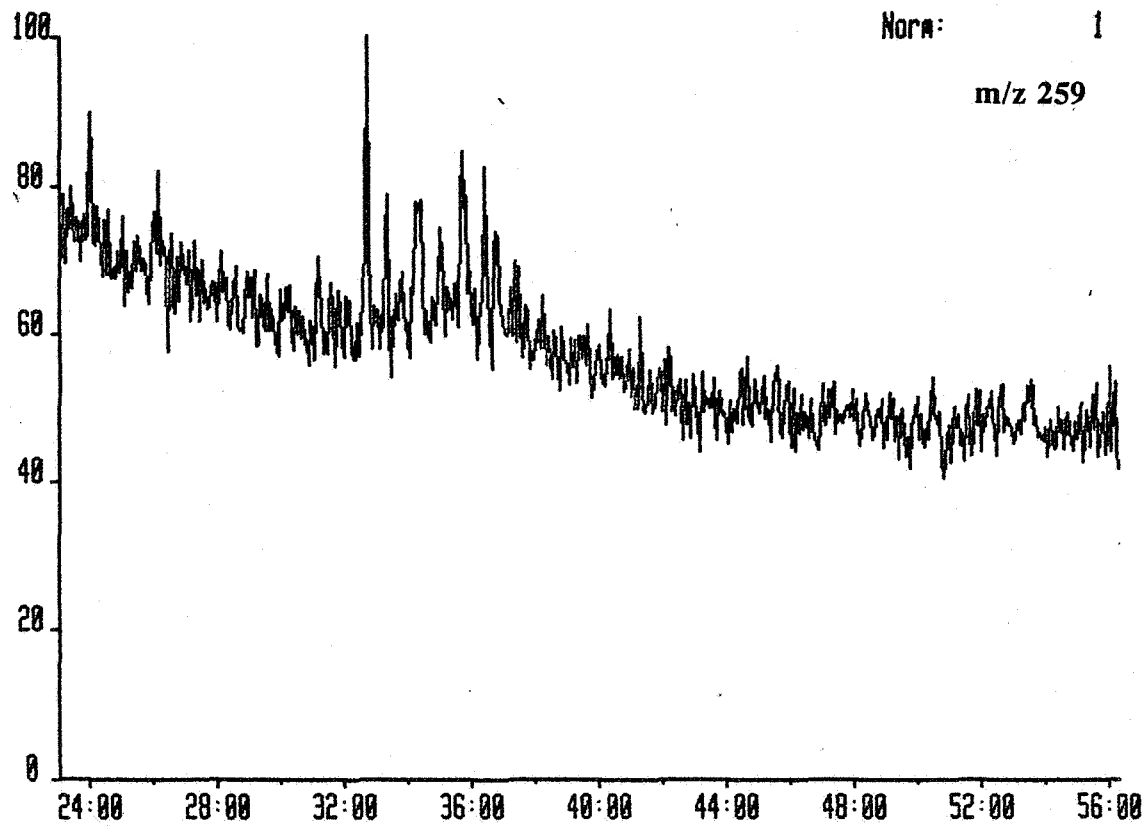


IKU
SINTEF-GRUPPEN

C6278SAT 4-AUG-87 Sir:Voltage 12-250 Acnt:IKU System:ALSTST
Sample 1 Injection 1 Group 1 Mass 231.1000
Text:



C6278SAT 4-AUG-87 Sir:Voltage 12-250 Acnt:IKU System:ALSTST
Sample 1 Injection 1 Group 1 Mass 259.1000
Text:



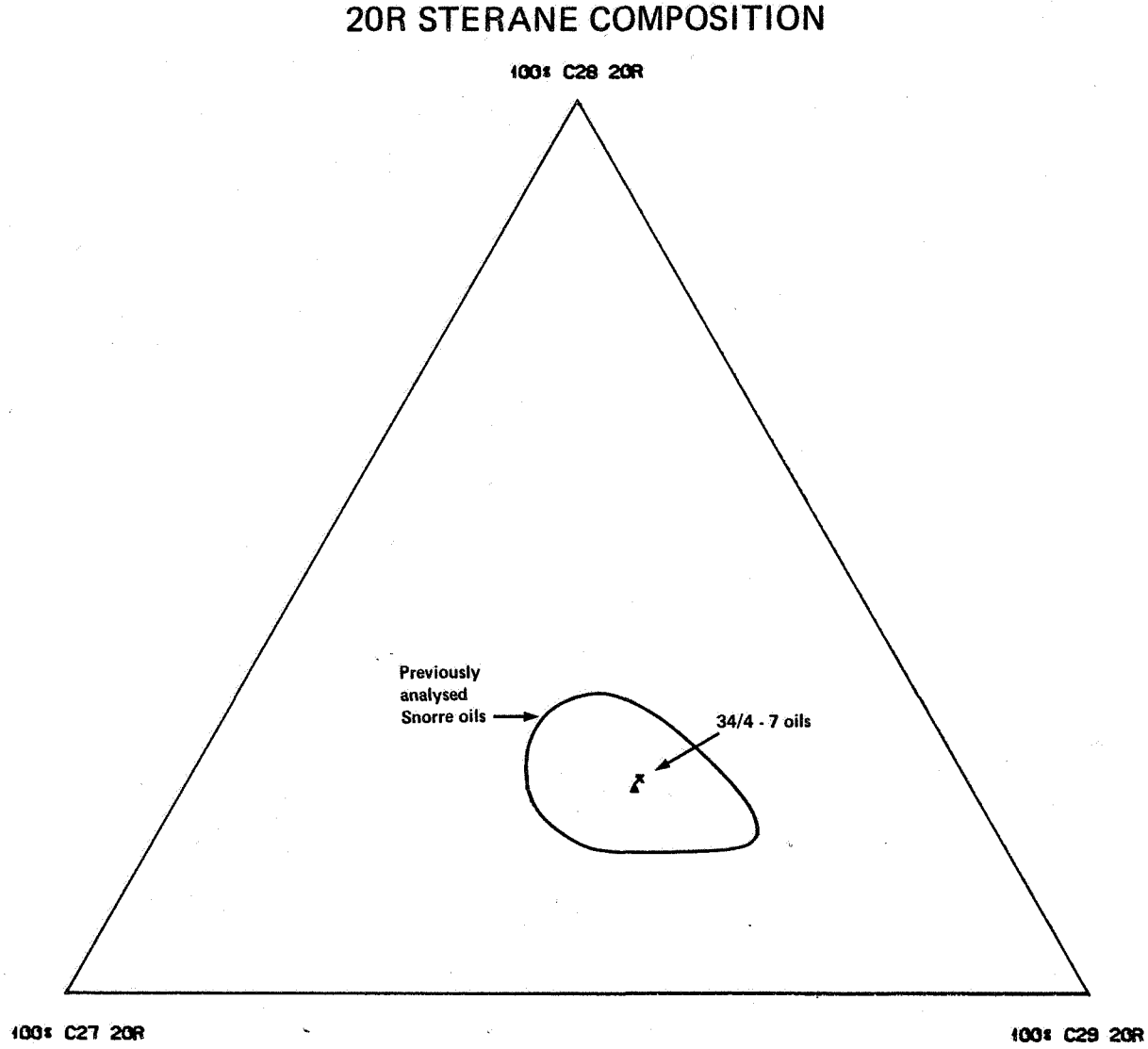
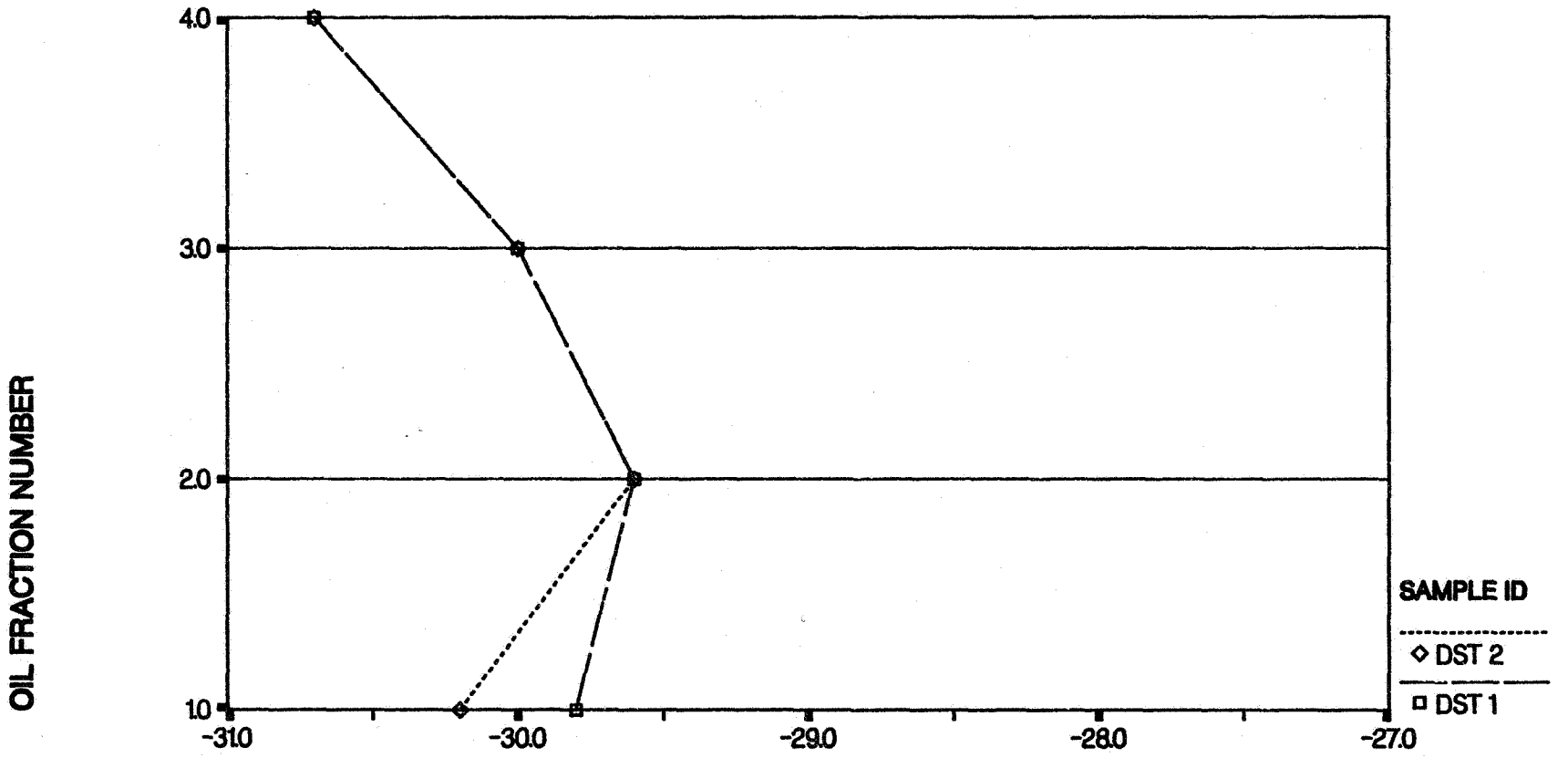


Figure 12: 5α20R Sterane Composition of the 34/4-7 DST Oils.

CARBON ISOTOPE PROFILES FOR OIL FRACTIONS FROM 34/4-7



EXTRACT FRACTIONS: 1=ASPHALTENES;2=NSO;3=AROMATICS;4=SATURATES.

Figure 13.