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IKU
SINTEF-GRUPPEN

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REPORT

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REPORT TITLE:

ANALYSIS OF OIL AND GAS SAMPLES
FROM WELL 34/7-13.

Final Data report.

REPORT NO.: 22.1898.00/01/88

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B. Thorvaldsen.

DATE:	NO. OF PAGES:	NO. OF APPENDICES:	PROJECT MANAGER:	SIGN.:
22-July-1988	41	-	L. Leith	

CLIENT:

Saga Petroleum A.S., attn.: E.S. Mo

SUMMARY:

This report contains analytical data from organic geochemical analysis of one oil and one gas sample from well 34/7-13. The data include bulk sulphur, nickel and vanadium content of the oil, together with liquid chromatography, gas chromatography and combined GC-MS data. The work was carried out under Saga Petroleum Contract No.: KO-EUG-88-0026.

KEY WORDS:	
Well 34/7-13	Oil and gas sample
Snorre Field	
Organic Geochemistry	

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1. INTRODUCTION

One oil and one gas sample from a Drill Stem Test (DST) in well 34/7-13 (Figure 1) were characterised using organic geochemical techniques as requested by Saga Petroleum A.S. (Contract No.: KO-EUG-88-0026). The analyses were carried out under IKU project number 22.1898.

SAMPLE	IKU No.	GAS/OIL RATIO (Sm^3/m^3)	OIL DENSITY (Kg/m^3)	OIL MOLEC. WT. (gm/mole)
Gas	C-7570			
Oil	C-7454	85.1	838.5	202

(Data obtained under standard conditions for single flash, i.e. 15°C and 1 bar).

The analytical programme used followed that detailed in the contract, i.e.:

- 1) S, Ni, V content of oil.
- 2) CGC of whole oil.
- 3) Topping of oil at 210°C and separation of oil fractions by MPLC (including asphaltene content).
- 4) CGC of Saturate and aromatic fractions.
- 5) GC-MS of saturate fraction (m/z 177,191,205,217,218,231,259).
- 6) $\delta^{13}C$ isotopte ration of C_1, C_2, C_3, iC_4 and nC_4 gas components, and saturate, aromatic, NSO and asphaltene oil fractions.
- 7) δD isotope ratio of C_1 gas component.
- 8) CGC of C_1-C_8 hydrocarbons for the oil and gas samples for recombination to reservoir fluid (GOR provided).

The oil and gas samples were received from GECO on 30th May, 1988.

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

2. ANALYTICAL PROCEDURES

2.1 Gas analyses

Natural gas samples were analysed on an HP 5880 gas chromatograph equipped with a capillary column, an FID for hydrocarbon analysis, 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 silica column coated with 0.5 µm OV-101.
- 3 ft steel column packed with molecular sieve 13x, 80/100 mesh.
- 6 ft steel column packed with Porapack T x 4 ft steel column packed with Porapak Q, 80/100 mesh.

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

Standard gas samples containing methane, ethane, propane, n-butane, n-pentane, n-hexane and hydrogen, oxygen, nitrogen, carbon monoxide, carbon dioxide and methane, respectively, were used for quantification.

2.2 Evaporation of the light components in fluid samples

Prior to chromatographic separation, the oil 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 rediduum left after heating.

2.3 Medium-pressure liquid chromatography (MPLC)

The 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 Rota-vapor, then transferred to glass vials and the remaining solvent removed.

2.4 Gas chromatographic analysis

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

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

The saturated hydrocarbon fractions were diluted with n-hexane and analysed on a Carlo Erba Fractovap gas chromatograph equipped with a 15 m DB-1 fused silica column. Hydrogen was used as a carrier gas with a flow rate of ca. 1.5 ml/min. Injections were performed in split mode (split ratio 1:10). The temperature preogram used was 80°C (2 min.) - 4°C/min. - 280°C.

The total aromatic fractions were diluted with n-hexane and analysed on an HP 5710A gas chromatograph fitted with a 15 m x 0.25 mm (i.d.) DB-5 fused silica column. Hydrogen was used as a carrier gas with a flow rate of 2.5 ml/min. The injection split ratio was 1:10. The temperature program used was 80°C (2 min.) - 4°C/min. - 280°C.

All the data from the gas chromatography analyses were processed on a VG Multichrom laboratory data system.

2.5 Gas chromatography - mass spectrometry (GC-MS)

GC-MS analyses were performed on a VG Quadrapole 12-250 GC-MS system. The HP 5790A series GC was fitted with a 30 m x 0.32 mm (i.d.) fused silica DB-5 capillary column. Helium carrier gas with a flow-rate of 1.5 ml/min. was used. Injections were carried out in splitless mode.

The saturated hydrocarbons were analysed in multiple ion mode (MID) at a scan cycle time of approximately 2 seconds. The mass spectrometer operated at 70 eV electron energy with an ion source temperature of 200°C. Data acquisition was carried out using a VG data system.

Peaks were identified by comparison with elution patterns on certain standard mass fragmentograms. Peak ratios were calculated from peak heights from the appropriate mass fragmentograms.

2.6 $\delta^{13}C$ isotope analysis

The $\delta^{13}C$ isotope analysis was performed using a mass spectrometer at the Institute for Energy Technology (IFE) in Oslo, in accordance with their standard procedure. An NBS-22 standard was used with a reference value of -29.8 0/00.

3. REFERENCES

RADKE, M., WILLSCH, H., WELTE, D.H., 1980: Preparation hydrocarbon group type determination by automated medium-pressure liquid chromatography. Anal. Chem., 52, pp.406-411.

SCHOELL, M., 1983: Genetic characterisation of natural gases. Amer. Assoc. Petrol. Geol. Bull., 67, pp. 2225-2238.

THOMPSON, K.F.M., 1978: Light hydrocarbons in subsurface sediments. Geochim. Cosmochim. Acta, 93, pp. 657-672.

Previous IKU reports concerned with block 34/7 and 34/4 fluids:

05.1725.00/02/84: Fluid characterisation of well 34/7-1.
05.1728.00/02/85: Hydrocarbon characterisation of well 34/7-2.
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.
22.1831.00/01/86: Organic geochemical characterisation of oil and gas samples from well 34/4-6.
22.1837.00/01/86: Asphaltene content of core extracts from 34/4-7 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.
22.1859.00/01/87: Organic geochemical characterisation of oil and gas samples from well 34/4-7.
22.1881.00/01/88: Organic geochemical characterisation of oil and gas samples from well 34/7-12.

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Table 1a: Recombination of Oil and Gas (C1-C8 hydrocarbons)

IKU Nr.: GAS : C-7570 DST1
IKU Nr.: OIL : C-7454
Well : 34/7-13

	yi mol% in gas	xi mol% in oil	z'i mol/comp	zi mol%
N2	0	0	0	
CO2	.7698	0	.002770634	.56
C1	62.7422	0	.225819273	46.43
C2	11.61	0	.041786258	8.59
C3	13.5847	0	.048893521	10.05
isoC4	2.3638	0	.008507696	1.74
nC4	5.805	0	.020893129	4.29
isoC5	1.2178	1.204	.009380850	1.92
nC5	1.3528	2.3141	.014474751	2.97
Light end total	99.4461	3.5181	.372526113	76.60
CyC5 + 2,3DMC4 + 2MC5	.1773	1.5323	.006998693	1.43
3MC5	.0617	.7165	.003196252	.65
nC6	.1292	2.7959	.012070764	2.48
Hexanes total	.3682	5.0447	.022265710	4.57
MCyC5	.0489	1.4707	.006280860	1.29
benzene	.007	.3927	.001655287	.34
CyC6	.0376	1.9226	.008116022	1.66
2MC6	.0102	.6304	.002653495	.54
2,3DMC5	.0102	.2263	.000976080	.20
3MC6	.0111	.8989	.003771275	.77
DMCyC5 x 3	.0148	1.1839	.004967624	1.02
nC7	.0149	2.3222	.009693056	1.99
Heptanes total	.1547	9.0477	.038113703	7.83
MCyC6	.0171	3.1247	.013032144	2.67
EtCyC5 + 2,5DMC6	0	.3321	.001378543	.28
2,4DMC6	0	.1887	.000783291	.16
TMCyC5	0	.1806	.000749668	.15
toluene	.0018	1.2991	.005399029	1.11
2 + 4MC7	.0013	.7865	.003269432	.67
3MC7	0	.4656	.001932700	.39
DMCyC6	0	1.0152	.004214085	.86
nC8	.0012	2.1515	.008935174	1.83
Octanes total	.0214	9.544	.039694071	8.16
2,4DMC7 + DMCyC6	0	.3513	.001458242	.29
EtCyC6	0	.7448	.003091657	.63
Etbenzene	0	.4499	.001867530	.38
m/p-xylene	0	.9437	.003917289	.80
2 + 4MC8	0	.4308	.001788246	.36
o-xylene	0	.3856	.001600621	.32
Nonanes total	0	3.3061	.013723588	2.82
C10+ total	0	69.5394	.288657360	59.35
Total sum	99.9904	100	.486323187	100.00

Moleculw. stock tank oil (Ms)	202	Density stock-tank oil (µs)	.8385
Gas/oil ratio (GOR)	85.1	C2-C8 total	30.4606

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TABLE 1b

C2 - C8 HYDROCARBON COMPOSITION OF THE OILS

C-7454 34/7-13	area	µg	mg/ml	% of tot
isoC3	0			
nC3	0			
isoC4	0			
nC4	0			
isoC5	76875	1.11	3.70	.42
nC5	147751	2.13	7.11	.82
CyC5 + 2,3DMC4 + 2MC5	116860	1.68	5.63	.65
3MC5	54644	.78	2.63	.30
nC6	213217	3.08	10.27	1.19
MCyC5	109548	1.58	5.27	.61
benzene	27164	.39	1.30	.15
CyC6	143210	2.07	6.90	.79
2MC6	55907	.80	2.69	.31
2,3DMC5	20075	.29	.96	.11
3MC6	79711	1.15	3.84	.44
DMCyC5	102884	1.48	4.95	.57
nC7	205926	2.97	9.92	1.14
MCyC6	271544	3.92	13.08	1.51
EtCyC5 + 2,5DMC6	30924	.44	1.49	.17
2,4DMC6	19079	.27	.91	.10
TMCyC5	17946	.25	.86	.10
toluene	105985	1.53	5.10	.59
2 + 4MC7	79508	1.14	3.83	.44
3MC7	47075	.68	2.26	.26
DMCyC6	100828	1.45	4.85	.56
nC8	217500	3.14	10.48	1.21
2,4DMC7 + DMCyC6	39879	.57	1.92	.22
EtCyC6	83226	1.20	4.01	.46
Etbenzene	42295	.61	2.03	.23
m/p-xylene	88704	1.28	4.27	.49
2 + 4MC8	48903	.70	2.35	.27
o-xylene	36245	.52	1.74	.20
sum		37.34	124.48	14.42

totol oil (µg inj): 258.93

%C2-C8 (tot.area) in tot.oil: 19.60

Table 1c: Ratios calculated from C_1-C_8 hydrocarbon data

	C-7454
% Methane :	63.2
% Gas Wetness :	34.0
iC_4/nC_4 Ratio :	0.41
Paraffin Index I :	1.43

% Gas Wetness = (E C_2-C_5)/(E C_1-C_5)
Paraffin Index I (after Thompson, 1978) = 2-MeC_6+3-MeC_6/diMeCyC_5 (3 isomers)

Table 2: δ^{13} and δD isotope ratios for C_1-C_4 gas components

IKU no.		C_1 $\delta^{13}C$ PDB	C_1 δD SMOW	C_2	C_3 $\delta^{13}C$ PDB	iC_4	nC_4
C-7570	DST 1	-47.1	-201	-33.4	-31.0	-30.6	-30.5

Project no.: 22.1898
well ident.: 34/7-13
DATE : 19 - 7 - 88

TABLE 3

CONTENT OF SULPHUR, NICKEL AND VANADIUM IN OIL >210°C

IKU-No	CODE	S	Ni	V
		%	(mg/kg)	(mg/kg)
34/7-13 C-7454		0.42	0.73	8.04

Project no.: 22.1898
Well ident.: 34/7-13
DATE : 22 - 6 - 88.

TABLE 4

FRACTION BOILING BELOW 210 C

IKU-No.	CODE	Crude oil (mg)	EOM >210C (mg)	Low molecular weight compounds (mg)	Low molecular weight compounds (%)
C 7454	34/7-13	189.6	124.4	65.2	34.4

TABLE 5

WEIGHT OF EOM AND CHROMATOGRAPHIC FRACTIONS

IKU-No	CODE	Crude oil (g)	EOM >210°C (mg)	Sat. (mg)	Aro. (mg)	HC (mg)	Non HC (mg)
C 7454	34/7-13	189.6	124.4	69.6	35.9	105.5	18.9

Project No.: 22.1898
Well ident.: 34/7-13
DATE : 13 - 7 - 88

TABLE 6

COMPOSITION OF TOPPED OIL

IKU-No	CODE	Sat / EOM %	Aro / EOM %	HC / EOM %	SAT / Aro x 100	Non HC / EOM %	HC / Non HC x 100
C 7454	34/7-13	55.9	28.9	84.8	193.9	15.2	558.2

TABLE 7

AMOUNT OF ASPHALTENES AND NSO,S IN OIL

IKU-No.	CODE	Crude oil (mg)	Asphaltenes (mg)	Asphaltenes (%)	NSO (mg)	NSO (%)
C 7454	34/7-13	189.6	3.8	2.0	9.0	4.7

Project No.: 22.1898
Well ident.: 34/7-13
DATE : 13 - 7 - 88

T A B L E 8

TABULATION OF DATA FROM THE GAS CHROMATOGRAMS

IKU No.	CODE	PRISTANE / PHYTANE	A= PRISTANE / n-C17	B= PHYTANE / n-C18	A / B	n-C17 / n-C27	CPI 1	CPI 2
C 7454	34/7-13	1.5	0.8	0.6	1.3	3.2	1.0	1.0

DATE : 5 - 7 - 88.

TABLE 9

RATIOS CALCULATED FROM THE AROMATIC GAS CHROMATOGRAMS

IKU-No.	CODE	MPI- 1	MPI-2
C 7454	34/7-13	0.73	0.62

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

Table 10:
Molecular ratios from sterane and terpane mass chromatograms.
Maturity ratios.

Code	Depth (m)	αβ/αβ+βα[1)]	%22S[2)]	%ββ[3)]	%20S[4)]
C-7454		0.93	60.80	72.83	42.55

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

Table 11:
Molecular ratios from terpane and sterane mass chromatograms.
Maturity and source characteristic ratios.

Code	Depth (m)	Q/E[1)]	Tm/Ts[2)]	X/E[3)]	Z/E[4)]	a/a+j[5)]
C-7454		0.14	0.86	0.11	0.21	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 12: $\delta^{13}C$ isotope ratios for extract fractions.

	$\delta^{13}C$ PDB			
IKU no.	SAT	ARO	POLAR	ASF
C-7454	-29.3	-28.2	-28.2	-28.4

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Figure 1

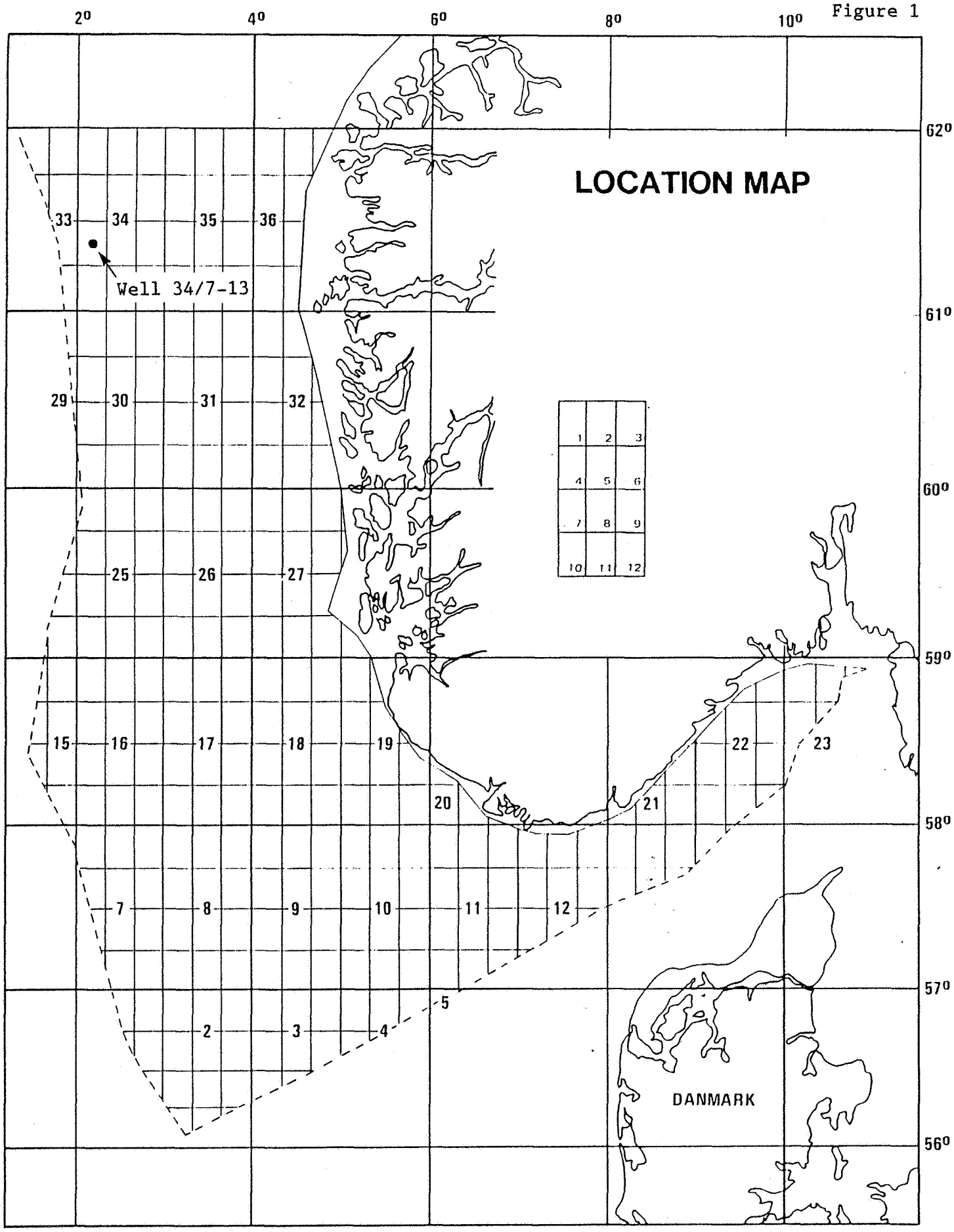
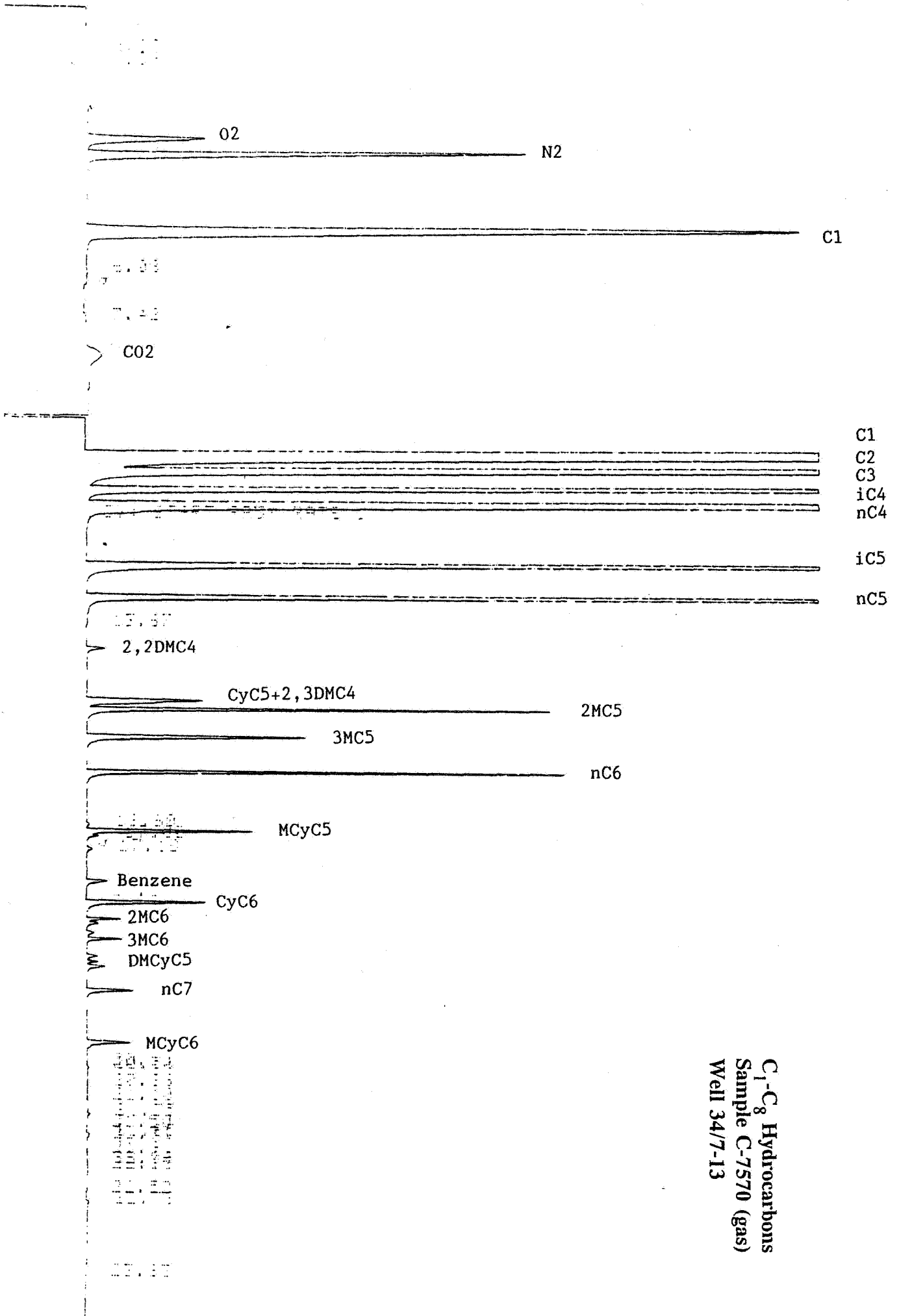


Figure 2.

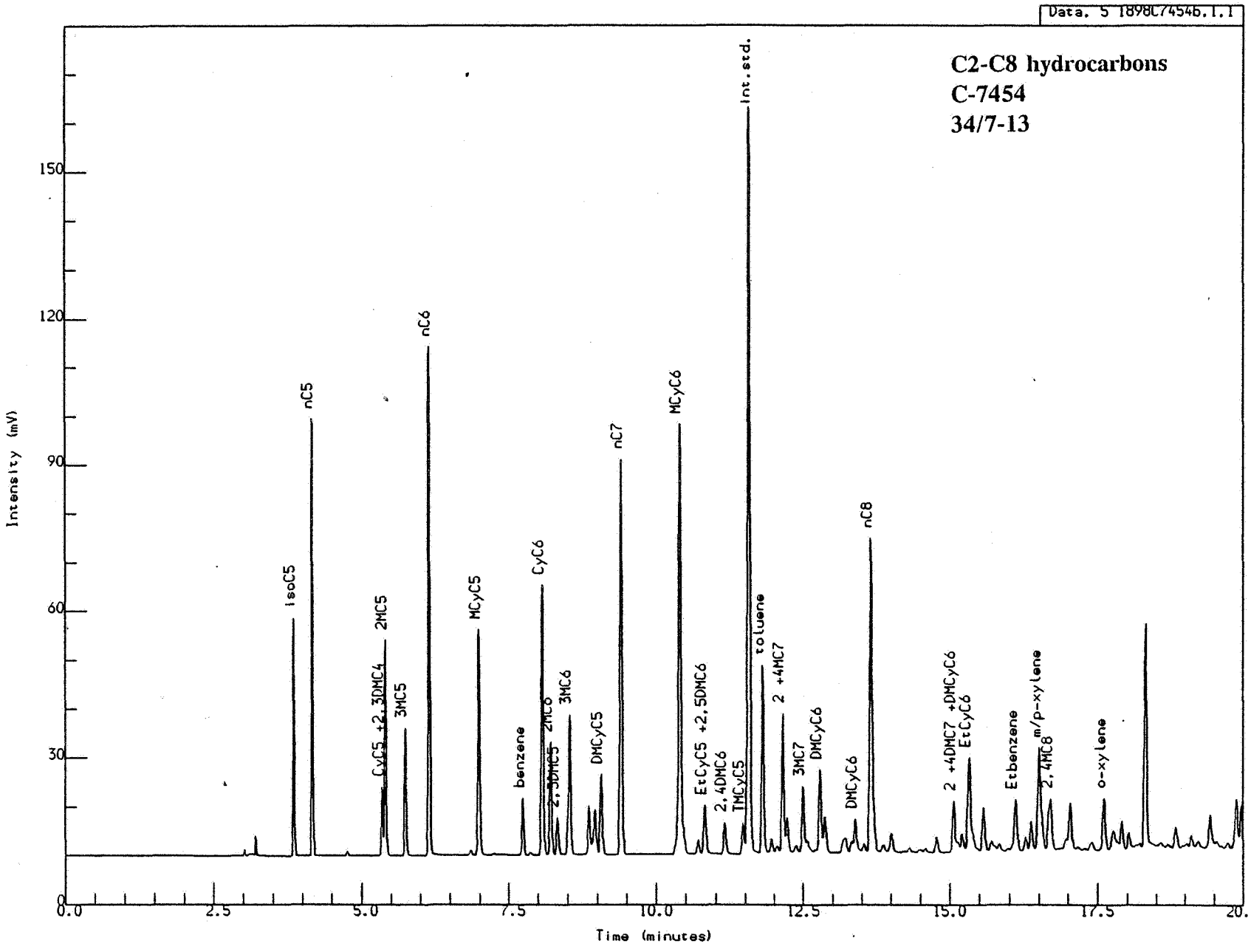
Gas Chromatograms of C_1-C_8 Hydrocarbons (DST gas).



C_1-C_8 Hydrocarbons
Sample C-7570 (gas)
Well 34/7-13

Figure 3.

Gas Chromatograms of C_2-C_8 Hydrocarbons (DST oil).



IKU SINTEF-GRUPPEN

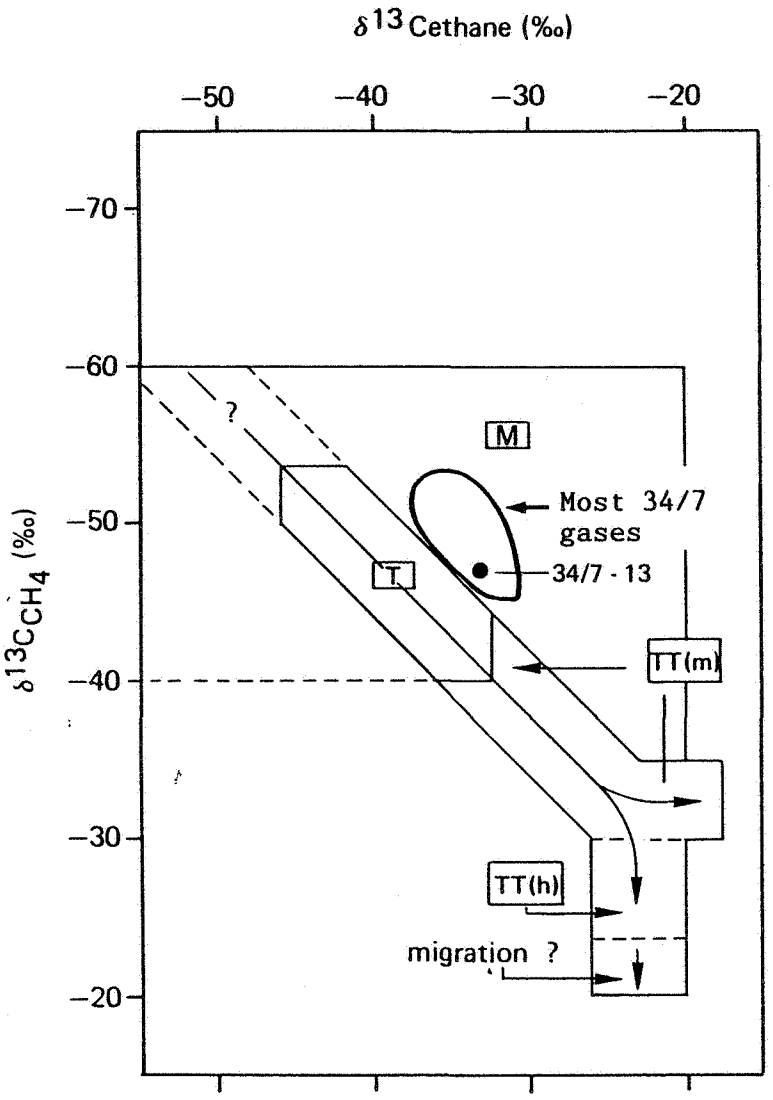


Figure 4a. The 34/7-13 gas plots in the field containing data from most of the previously-analysed Snorre gases (after Schoell 1983).

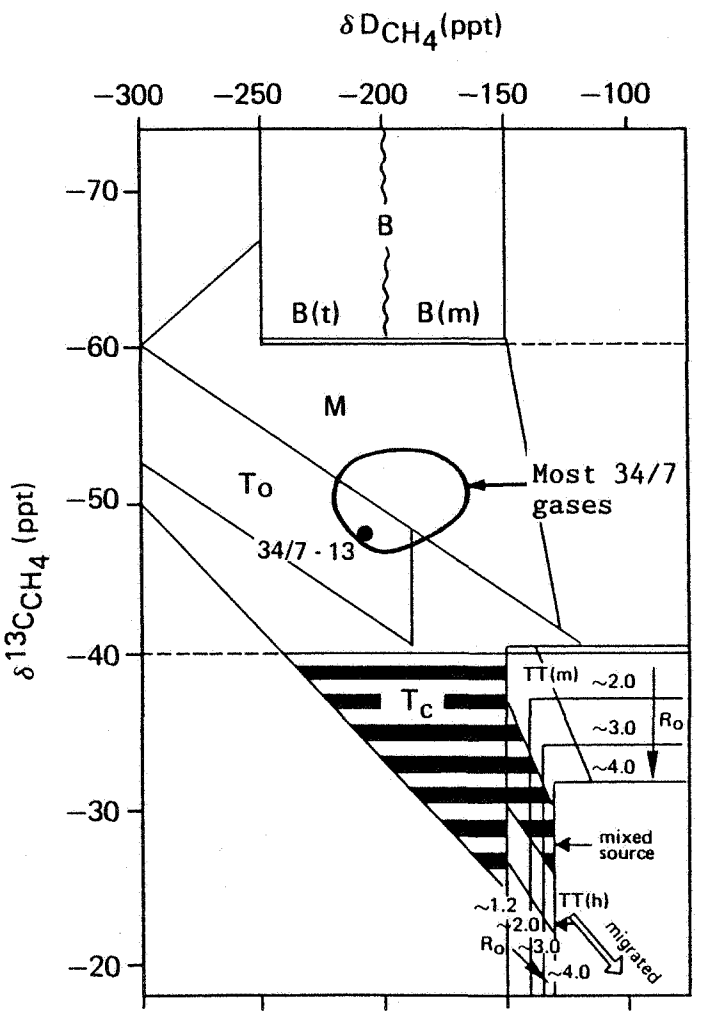
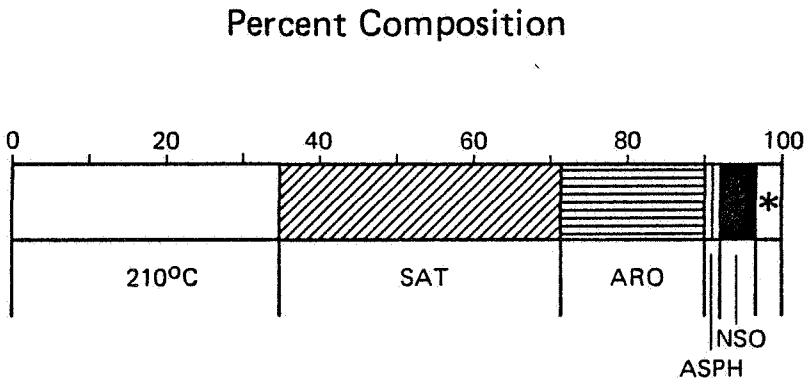


Figure 4b. The 34/7-13 gas plots within the field associated with most of the previously-analysed Snorre gases (after Schoell 1983).



*: — Amount of material lost during analytical procedure.

Figure 5. Gross composition of the 34/7-13 oil.

Figure 6.

Gas Chromatograms of Whole Oil.

C_{10} etc.	- n-alkanes
Cy-C_6	- cyclohexane
MeCy-C_6	- methylcyclohexane
Pr	- pristane
Ph	- phytane

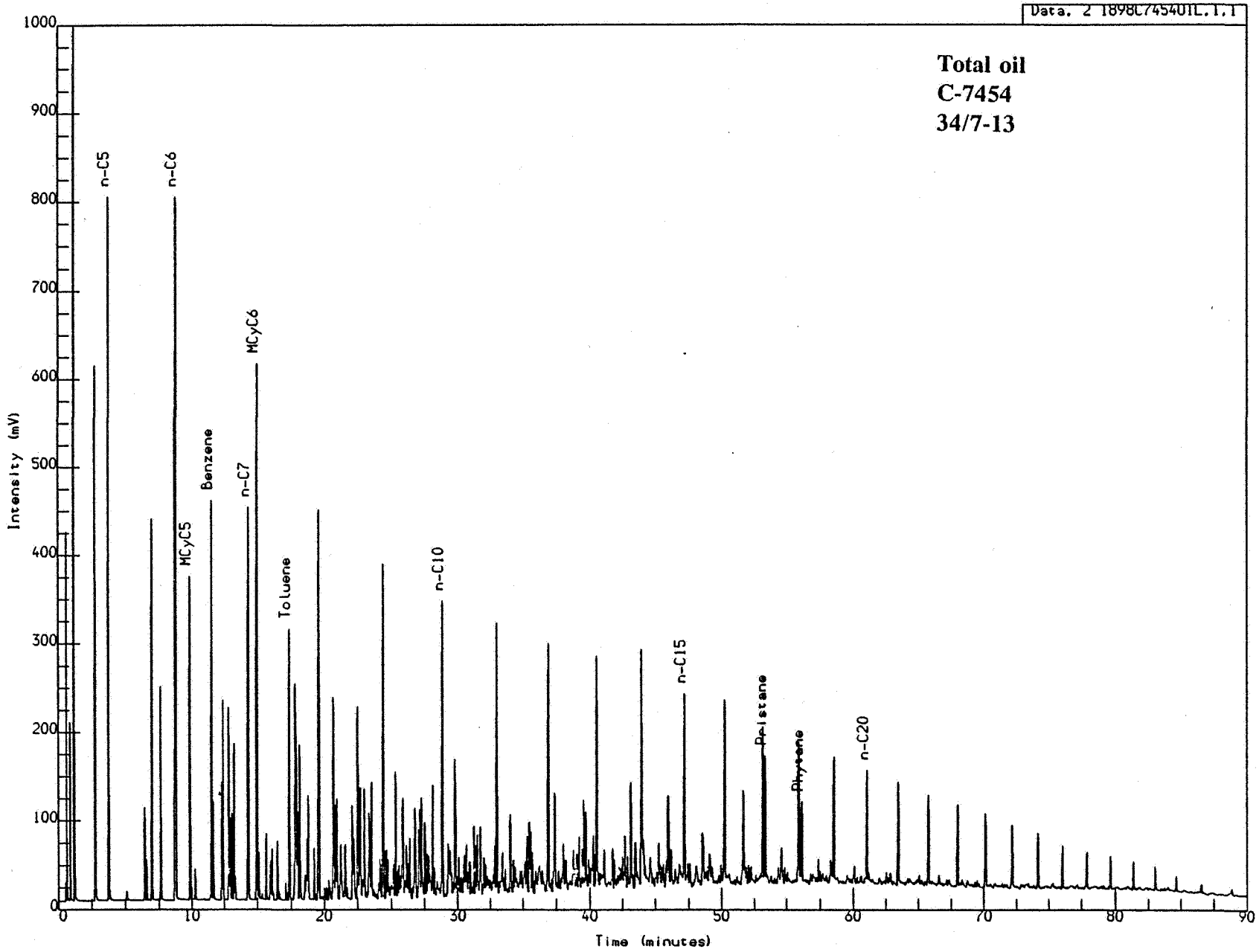
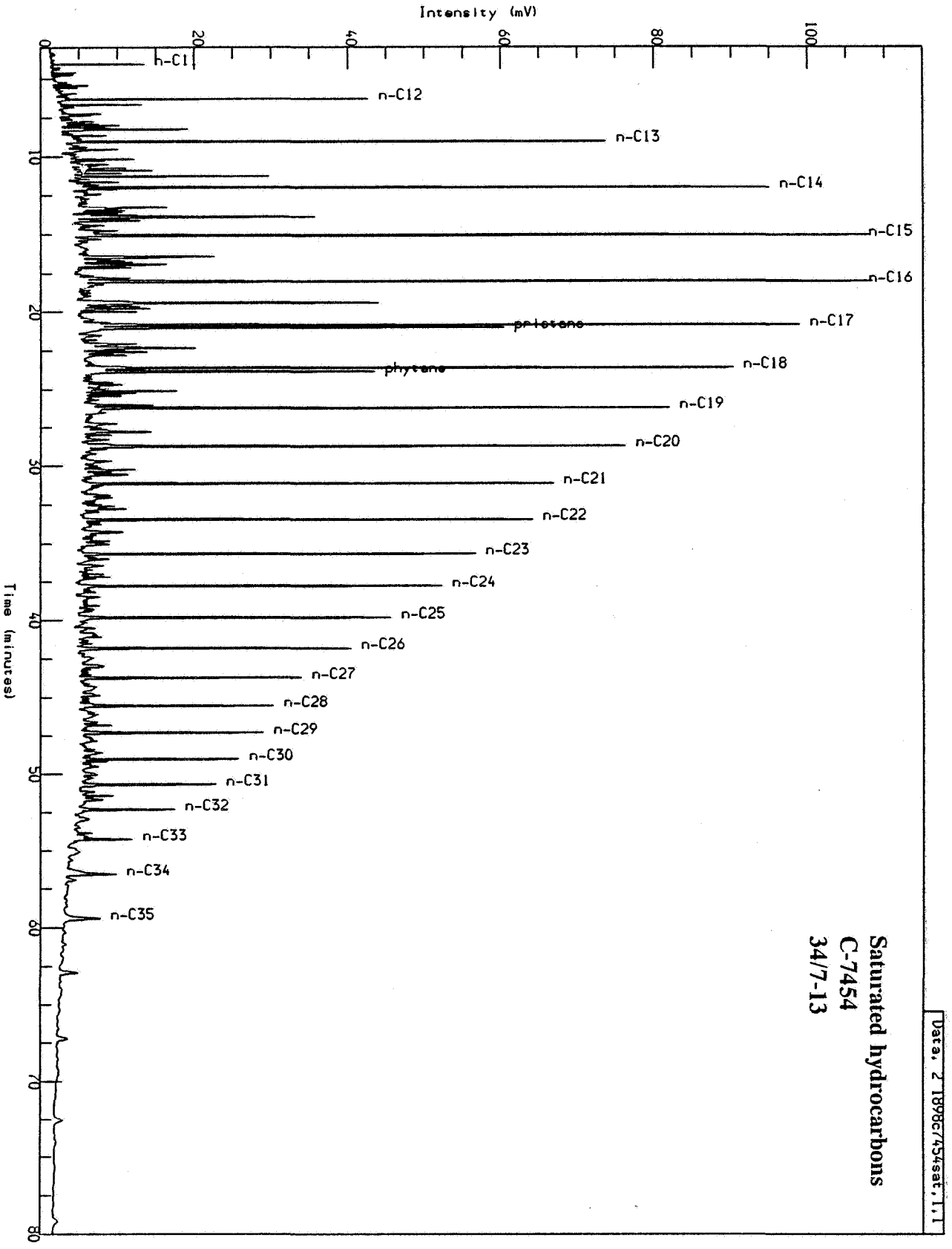


Figure 7.

Gas Chromatograms of Oil Saturate Fractions.


Intensity (mV)
0
20
40
60
80
100
Time (minutes)
10
20
30
40
50
60
70
80
n-C1
n-C12
n-C13
n-C14
n-C15
n-C16
pristane
n-C17
phytane
n-C18
n-C19
n-C20
n-C21
n-C22
n-C23
n-C24
n-C25
n-C26
n-C27
n-C28
n-C29
n-C30
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n-C35
Saturated hydrocarbons
C-7454
34/7-13
Data: 2 1898c7454sat;1.1

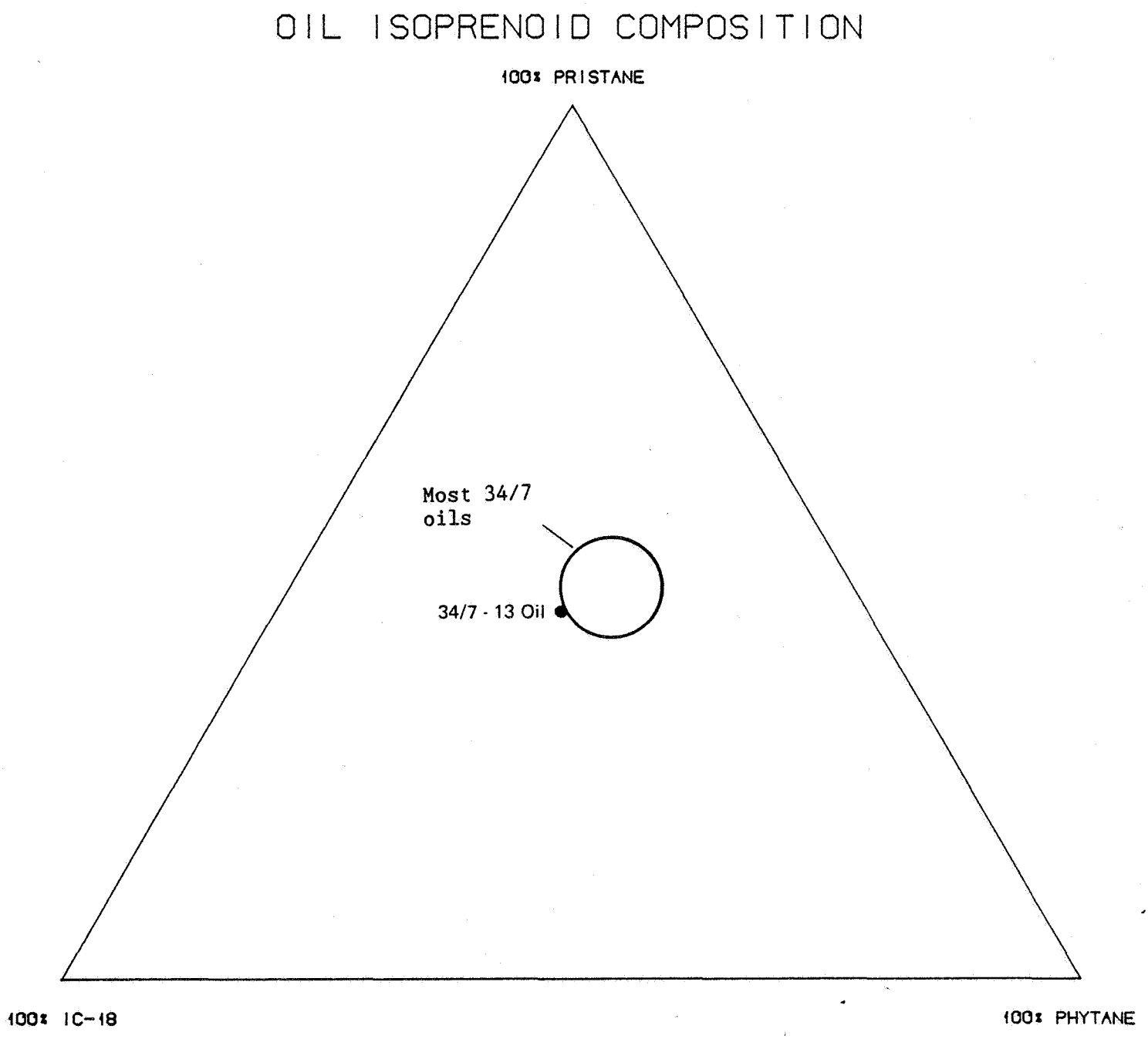


Figure 8. Isoprenoid composition of the 34/7-13 oil.

Figure 9.

Gas Chromatograms of Oil Aromatic Fractions.

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

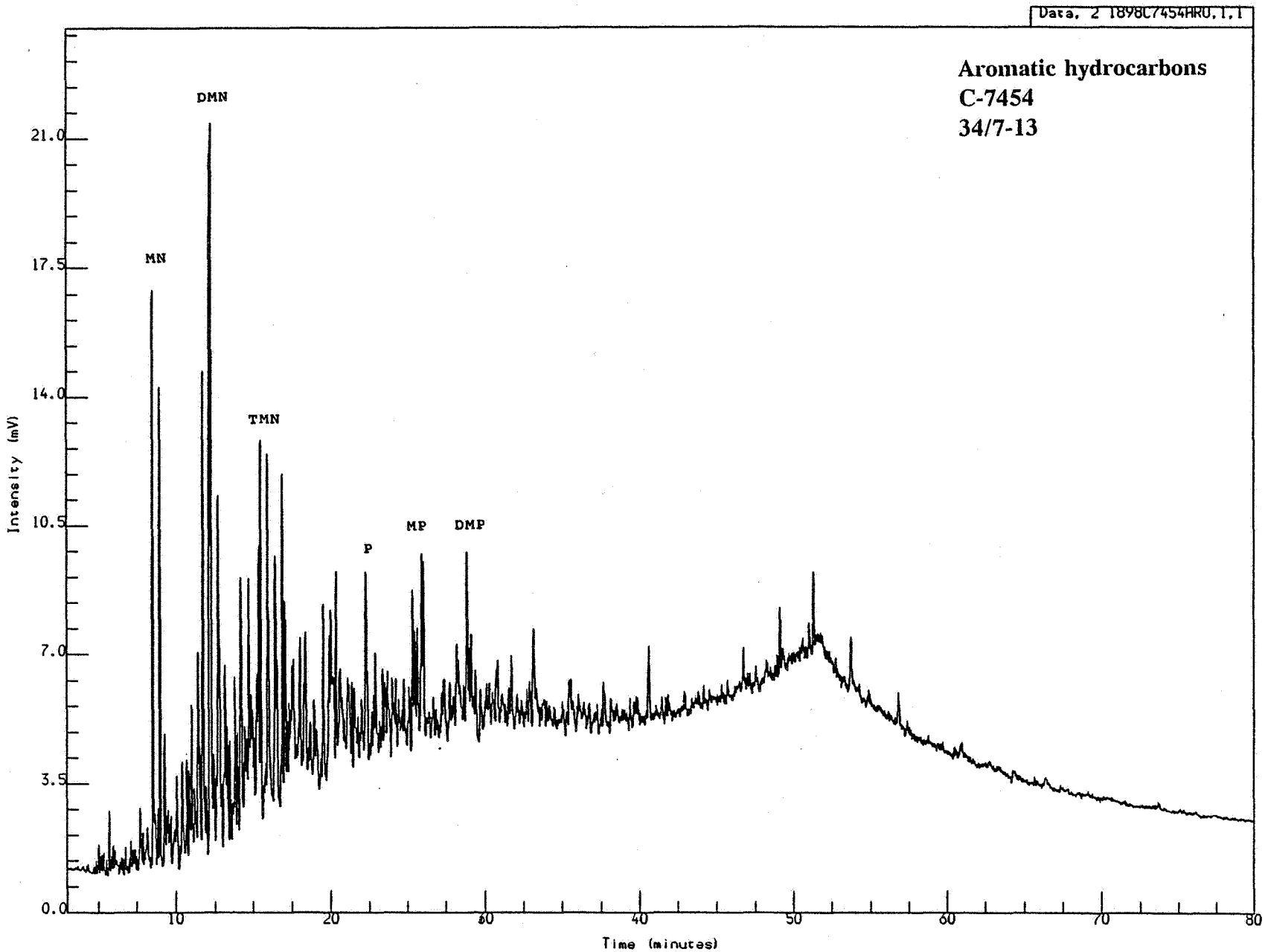
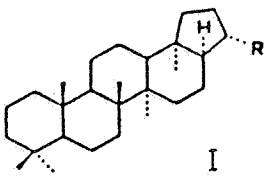


Figure 10.

Mass Fragmentograms of Terpanes (m/z 163, 177, 191, 205).

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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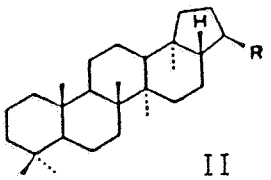

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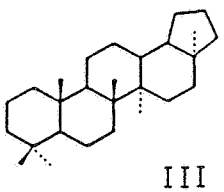
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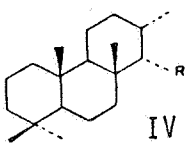

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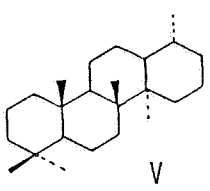
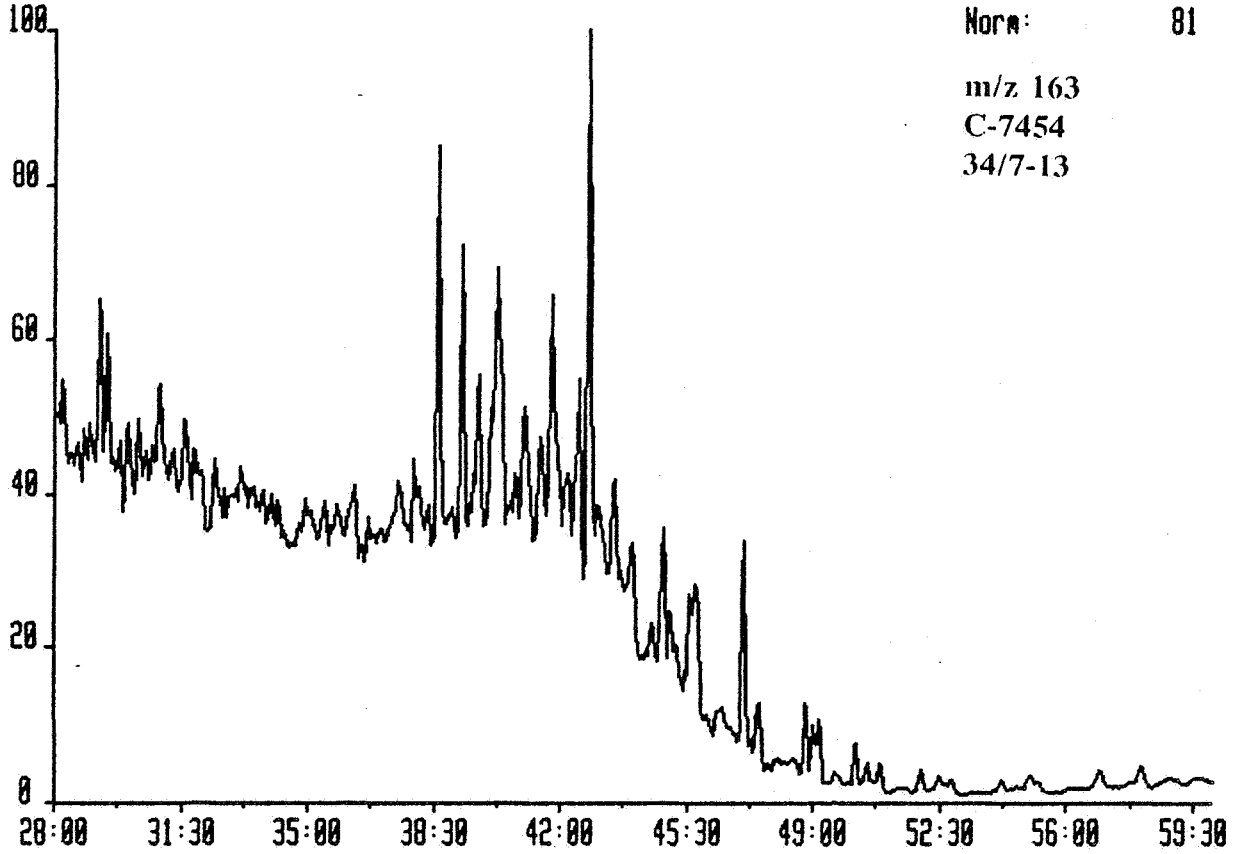
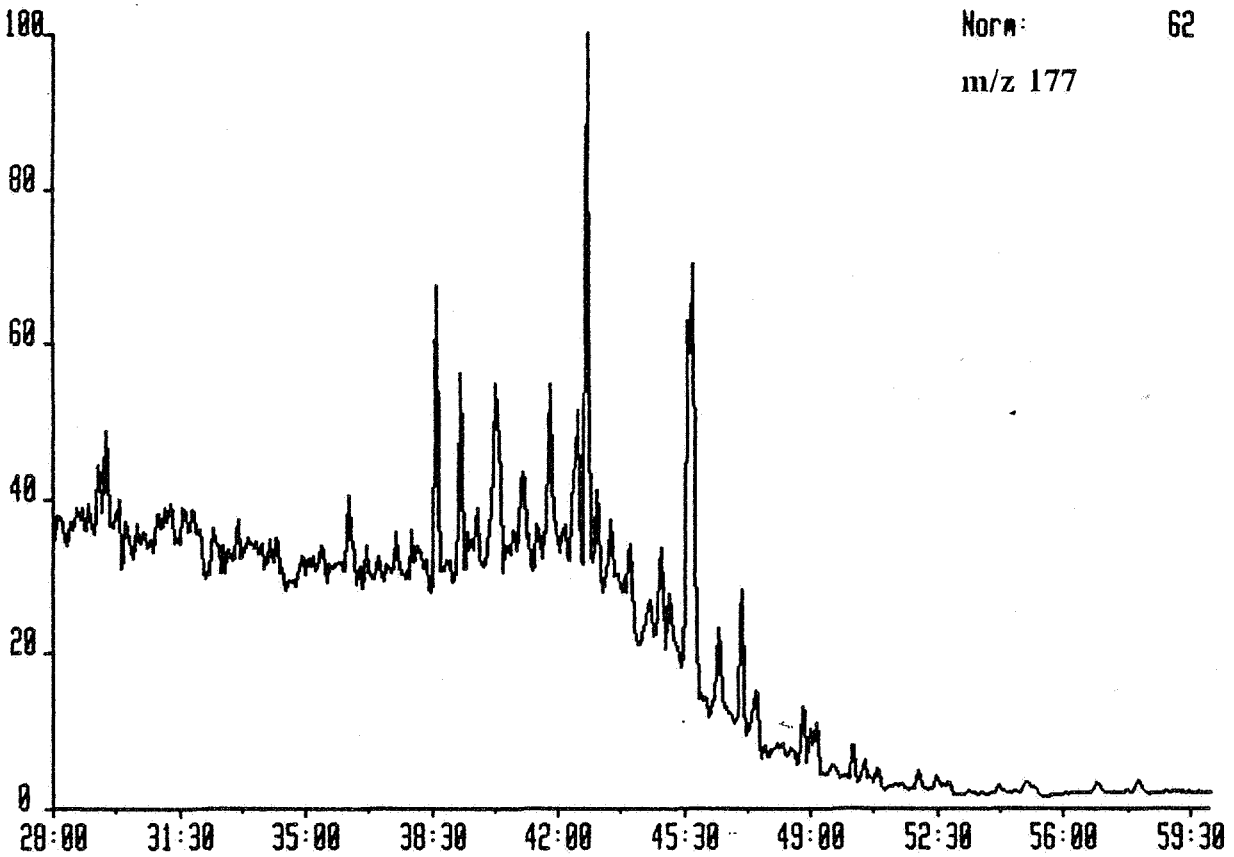

V

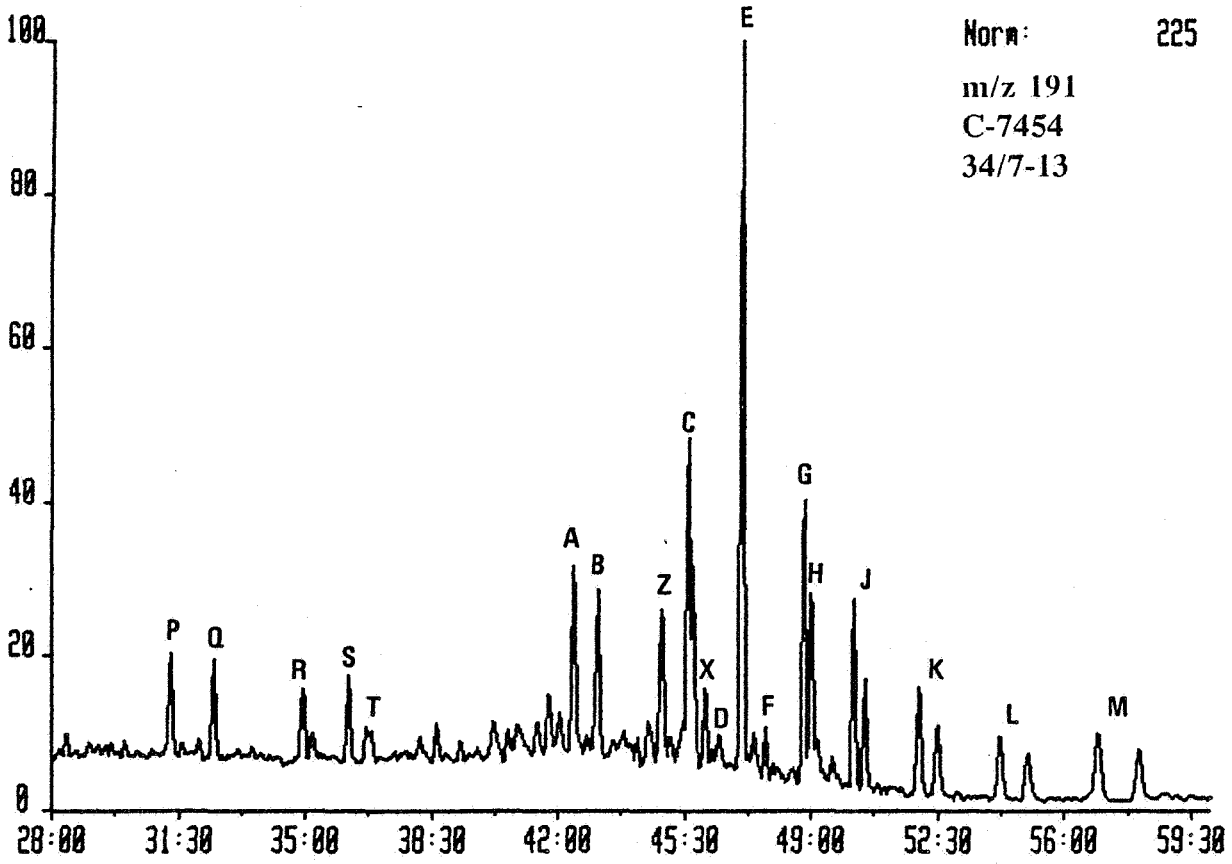
C7454S 25-JUN-88 Sir:Voltage 12-250 Sys: QUADAUTO
Sample 1 Injection 1 Group 1 Mass 163.1000
Text:



C7454S 25-JUN-88 Sir:Voltage 12-250 Sys: QUADAUTO
Sample 1 Injection 1 Group 1 Mass 177.1000
Text:



C7454S 25-JUN-88 Sir:Voltage 12-250 Sys: QUADAUTO
Sample 1 Injection 1 Group 1 Mass 191.1000
Text:



C7454S 25-JUN-88 Sir:Voltage 12-250 Sys: QUADAUTO
Sample 1 Injection 1 Group 1 Mass 205.1000
Text:

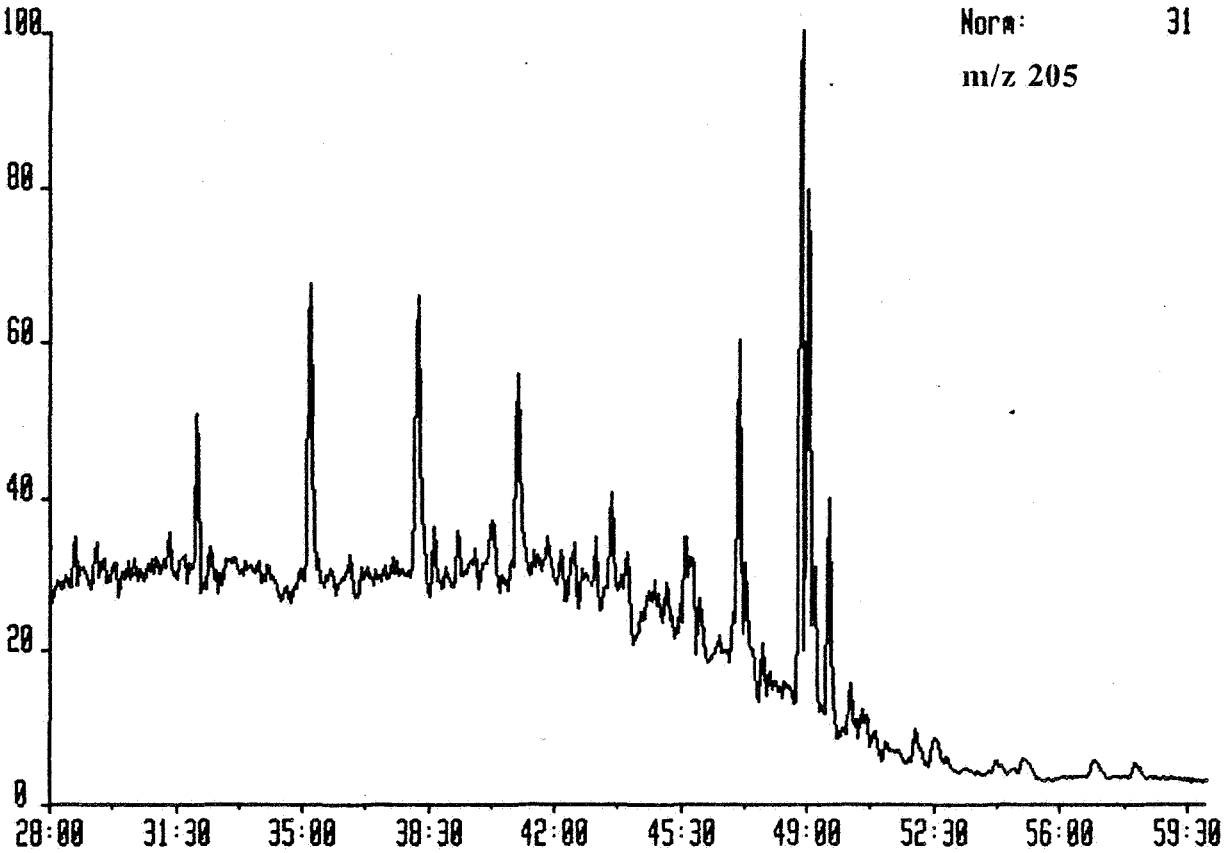
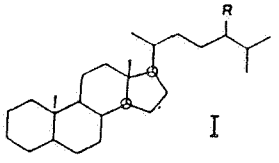


Figure 11.

Mass Fragmentograms of Steranes (m/z 217, 218, 231, 259).

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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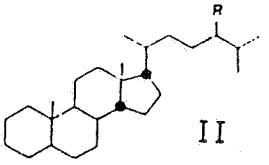

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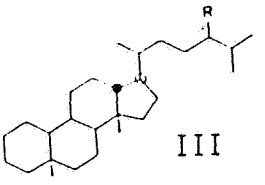

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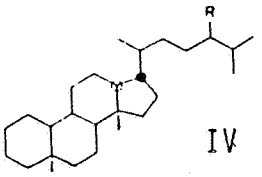

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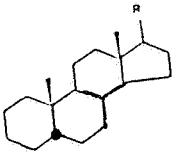
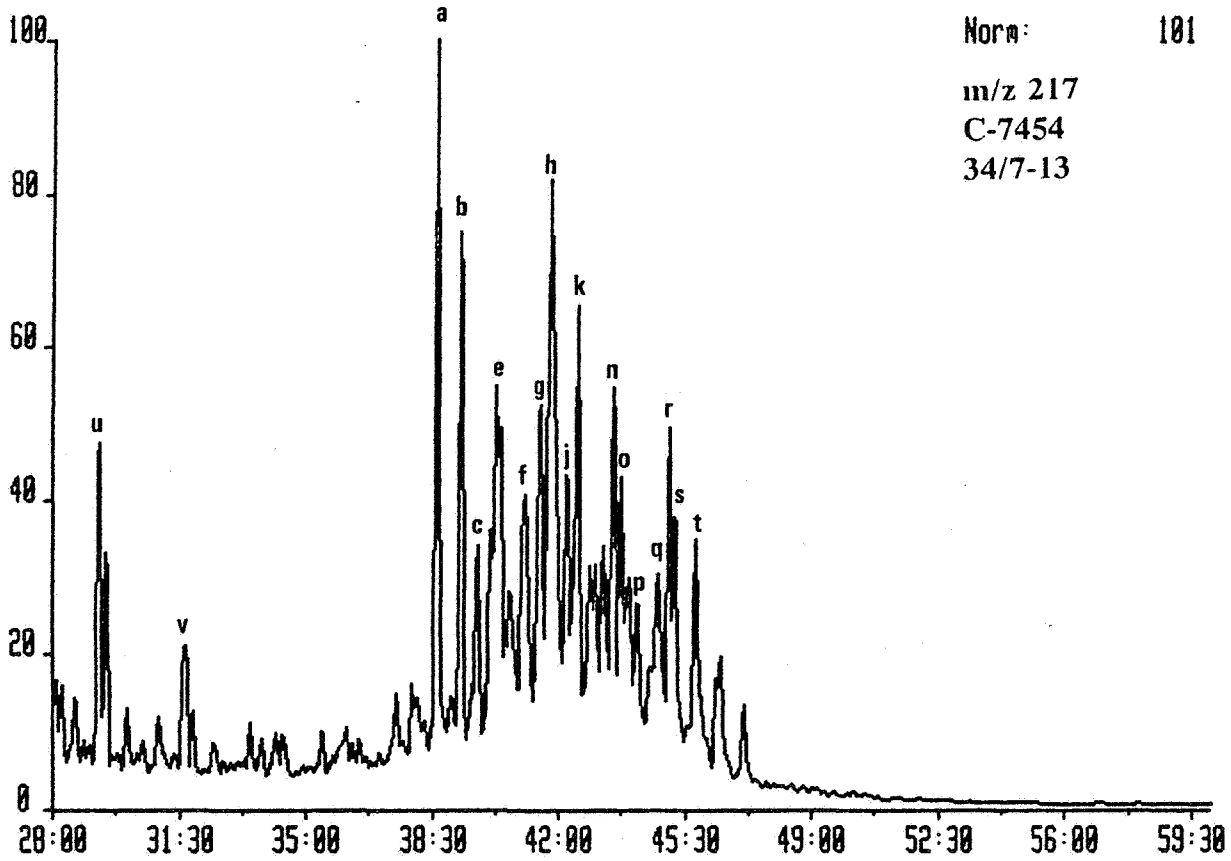
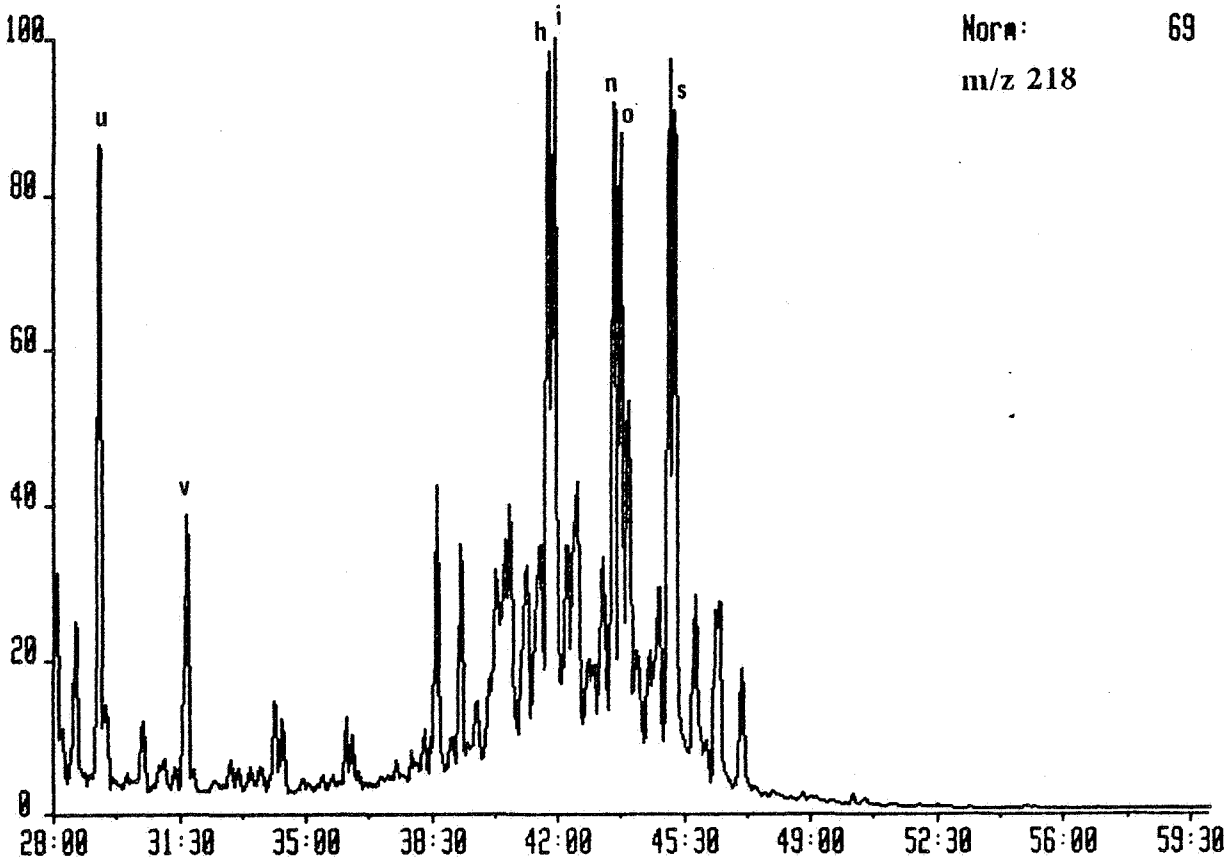


V

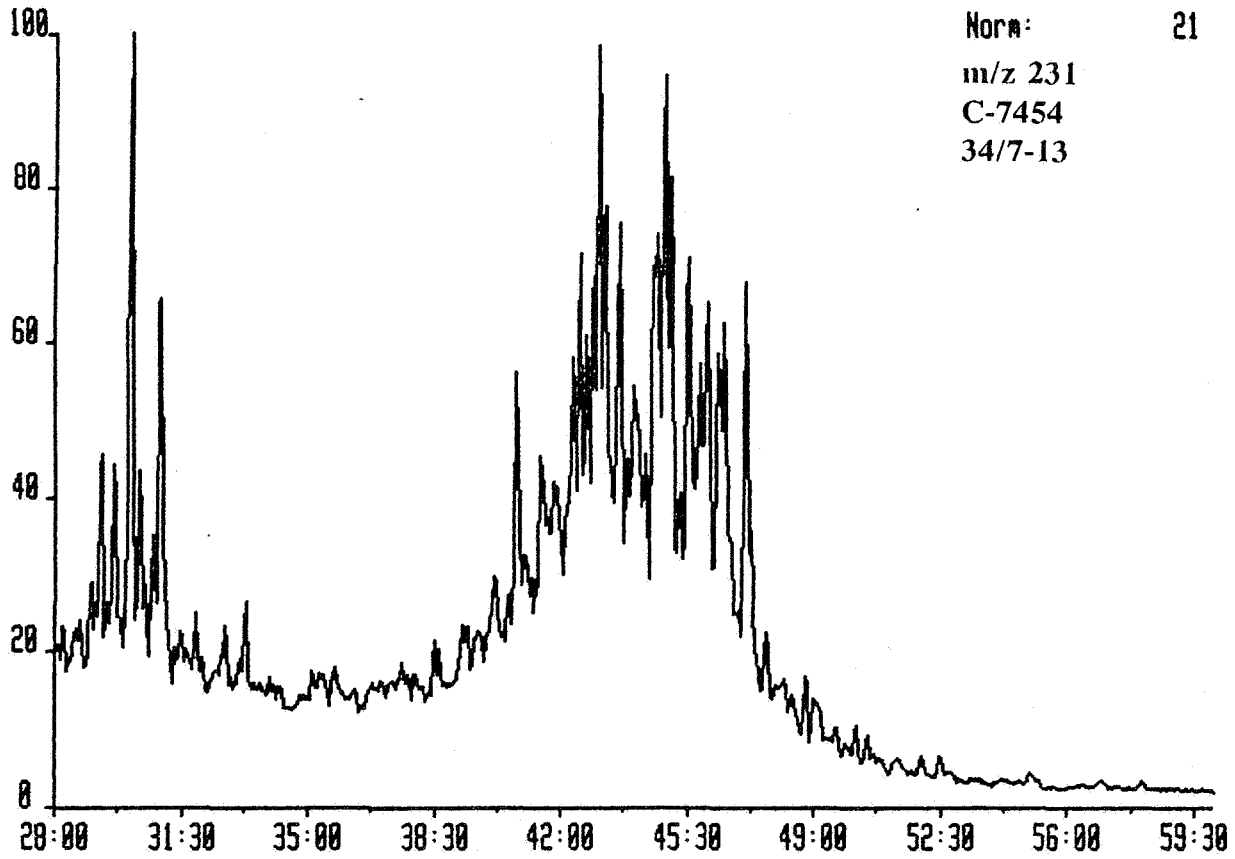
C7454S 25-JUN-88 Sir:Voltage 12-250 Sys: QUADAUTO
Sample 1 Injection 1 Group 1 Mass 217.1000
Text:



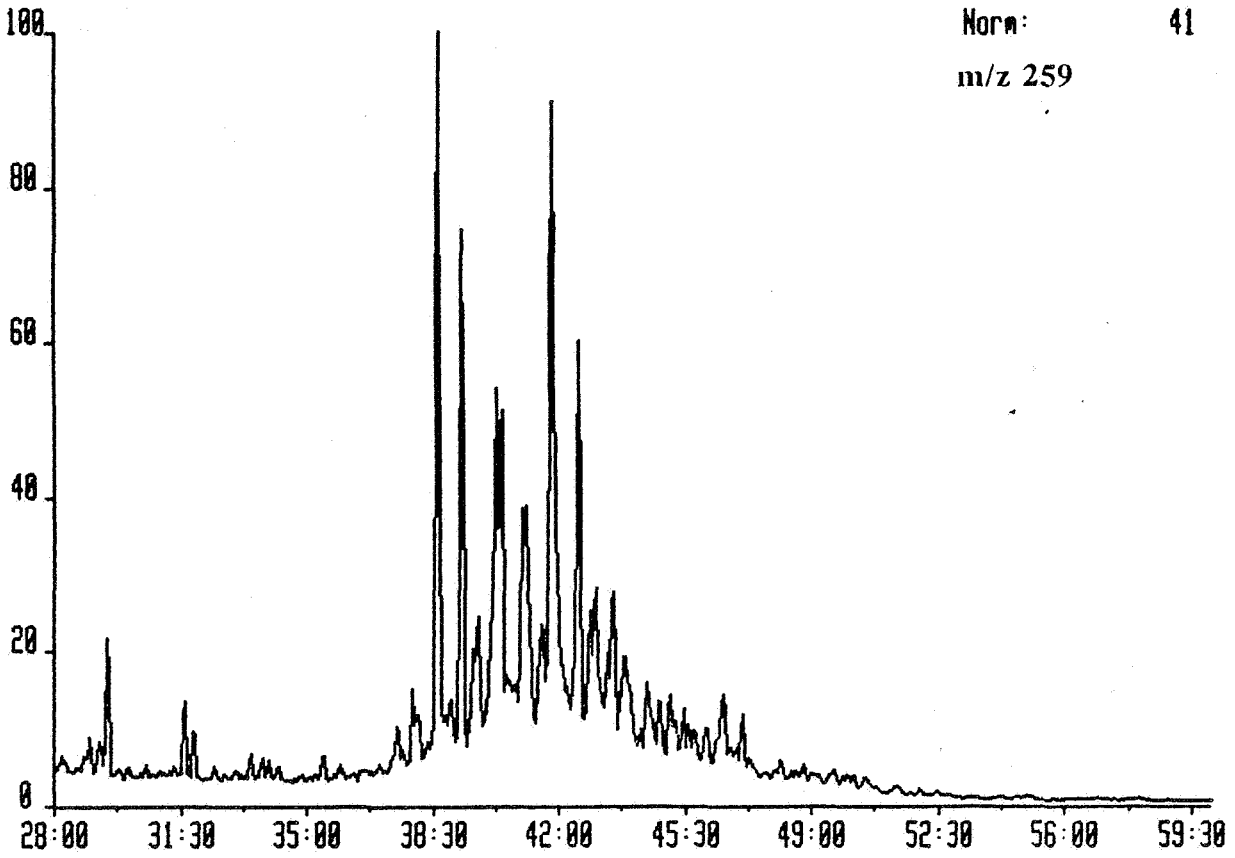
C7454S 25-JUN-88 Sir:Voltage 12-250 Sys: QUADAUTO
Sample 1 Injection 1 Group 1 Mass 218.1000
Text:



C7454S 25-JUN-88 Sir:Voltage 12-250 Sys: QUADAUTO
Sample 1 Injection 1 Group 1 Mass 231.1000
Text:



C7454S 25-JUN-88 Sir:Voltage 12-250 Sys: QUADAUTO
Sample 1 Injection 1 Group 1 Mass 259.1000
Text:



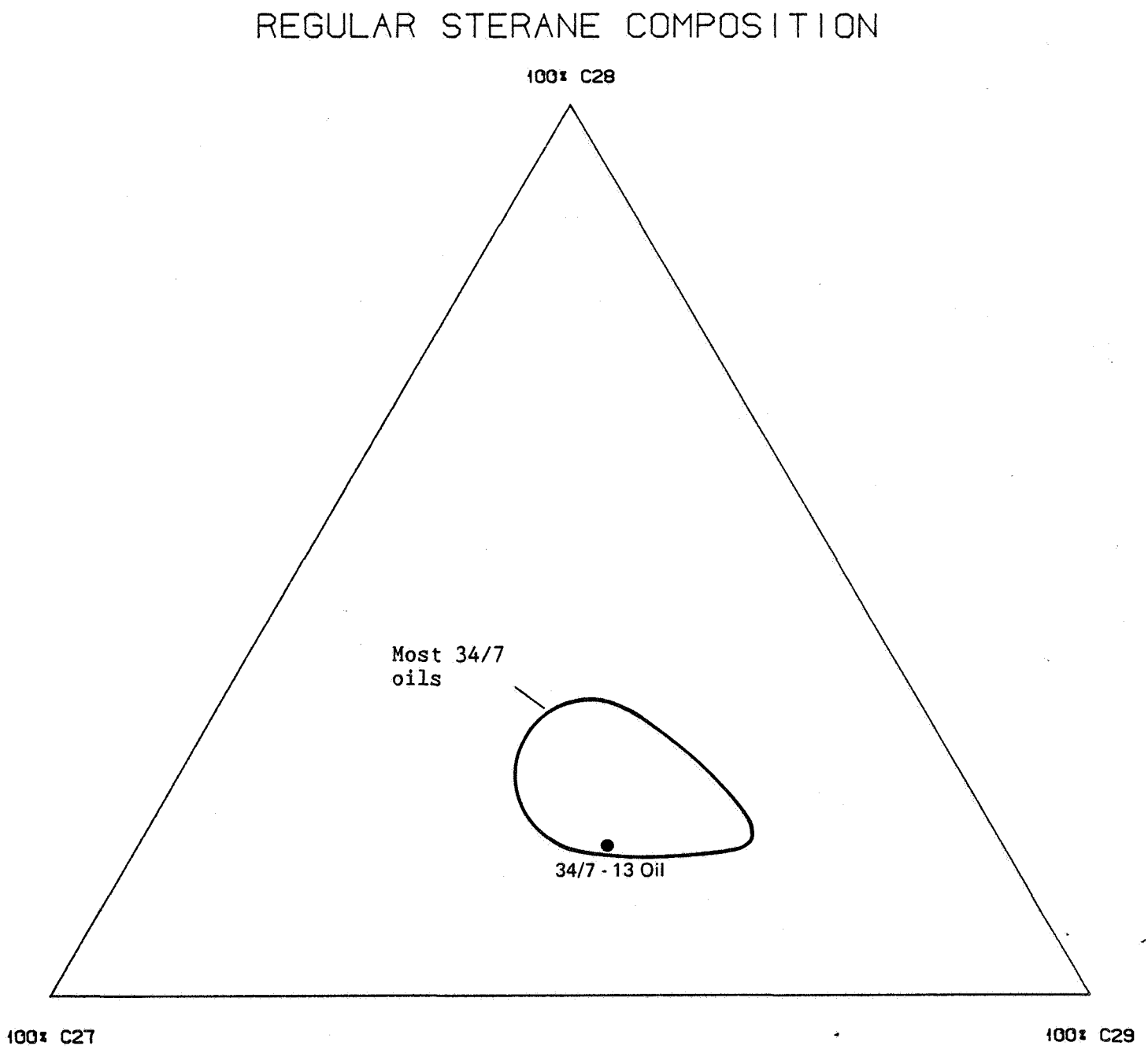
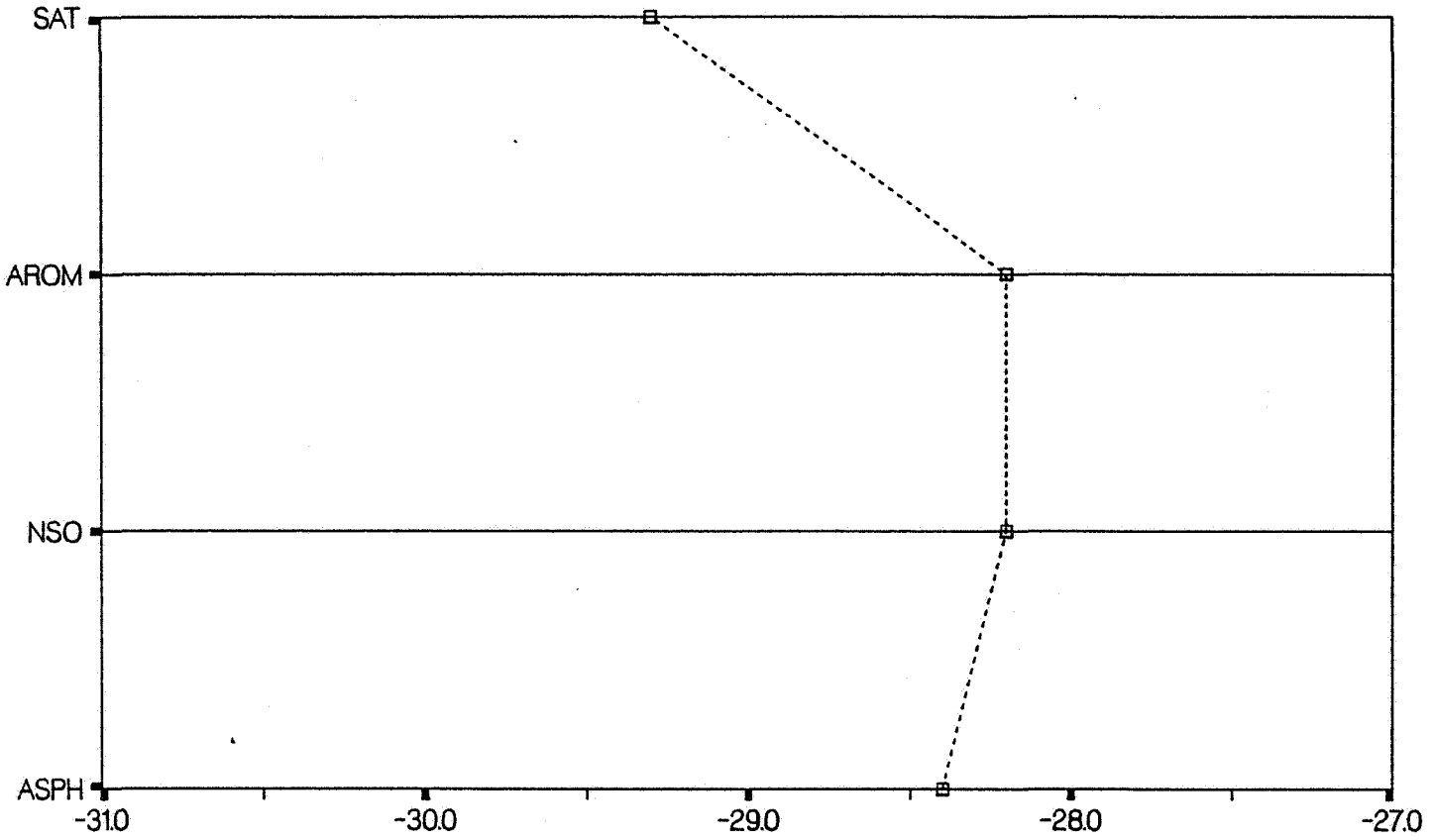


Figure 12. 5α20R sterane composition of the 34/7-13 oil.

CARBON ISOTOPE FRACTION FOR 34/7-13 OIL

(SAGA CONTRACT KO-EUG-88-0026/IKU PROJECT 22.1898)



IKU SINTEF-GRUPPEN

Figure 13