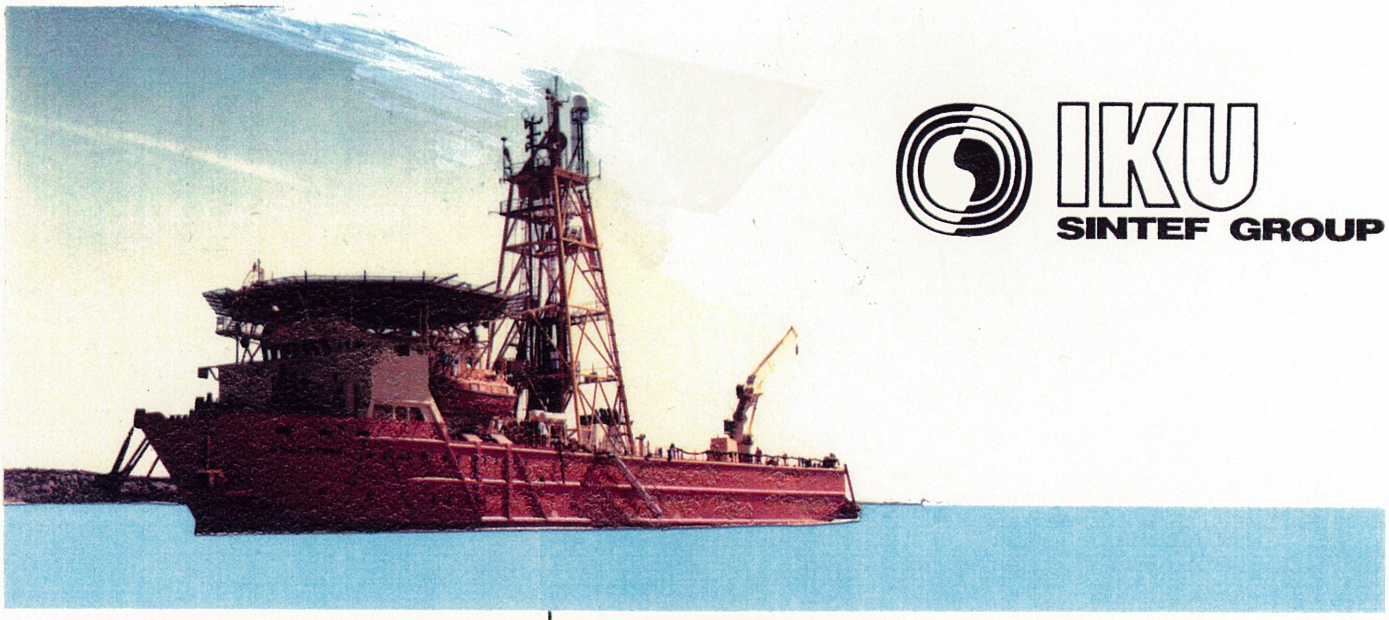
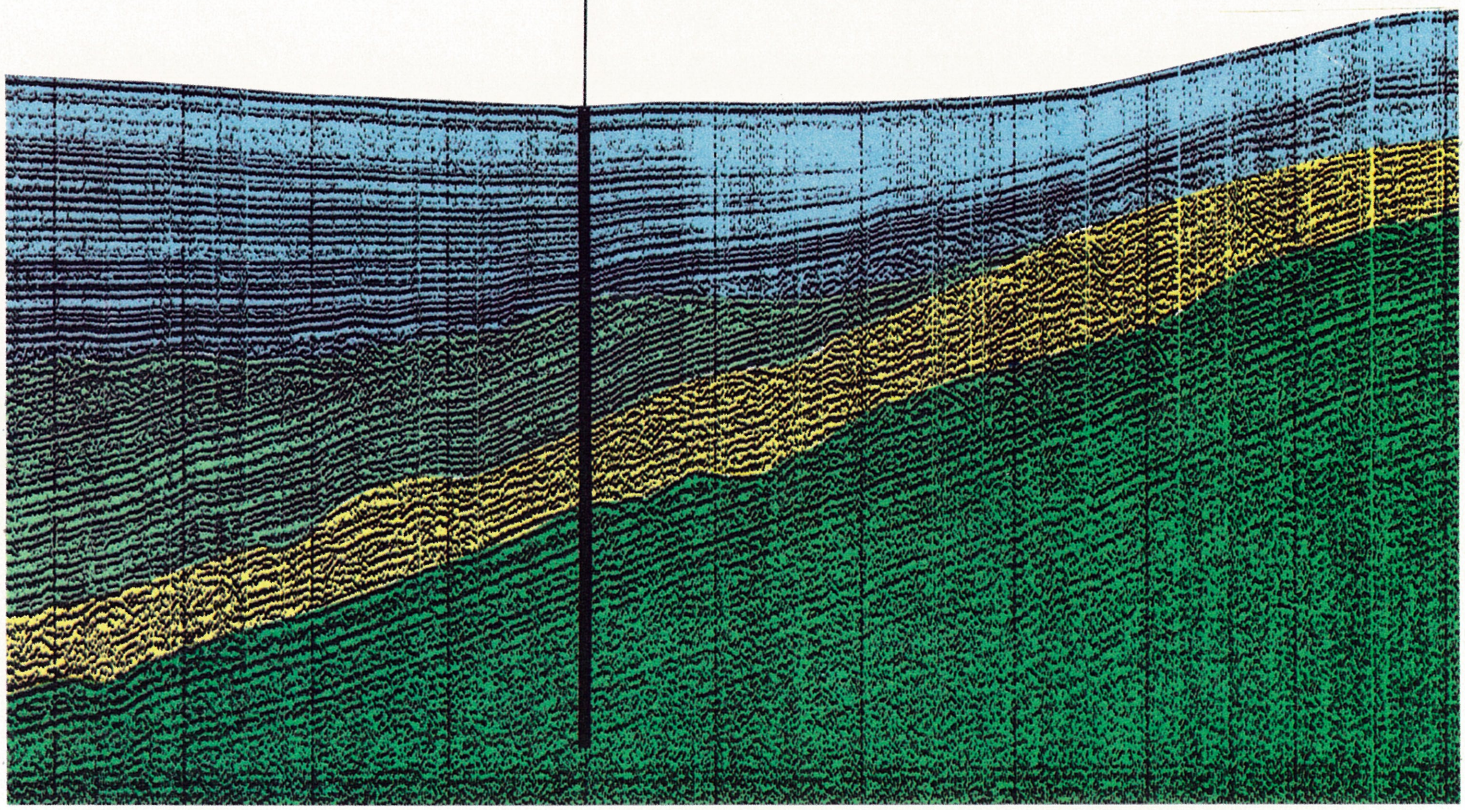


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Shallow Drilling Farsund Subbasin 1989

Appendix A.11 to Main report Organic Geochemical Data



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REPORT

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REPORT TITLE:
SHALLOW DRILLING FARSUND SUBBASIN 1989: APPENDIX A.11

Organic Geochemical Data

REPORT NO.: 21.3460.00/04/89

AUTHORS:
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SUMMARY:

This appendix volume contains:

1) Data obtained from the artificial maturation of a claystone sample from Core 13/1-U-1 using hydrous pyrolysis. These data are accompanied by a descriptive text (Chapter I).

2) Tables and figures of the geochemical data obtained from the core samples drilled by IKU in the Farsund Sub-Basin in 1987 (Chapter II).

   The data are organised core by core, each section having its own table of contents. The text accompanying the data may be found in the main body of the report.

3) A description of the experimental methods and interpretation levels (Chapter III).

KEY WORDS:

Shallow drilling	Source potential
North Sea	Farsund Subbasin
Organic Geochemistry	Hydrous pyrolysis

Skipnes

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PREFACE

This Appendix volume contains:

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2) Tables and figures of the geochemical data obtained from the core samples drilled by IKU in the Farsund Sub-Basin in 1987 (Chapter II).

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2 II LABORATORY RESULTS

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6 III. ANALYTICAL METHODS AND INTERPRETATION LEVELS

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ARTIFICIAL MATURATION OF A CLAYSTONE FROM CORE 13/01-U-01 BY HYDROUS PYROLYSIS

A claystone sample from a thin organic-rich claystone interval in the Middle Jurassic Bryne Fm (142.27-142.40 m) was artificially matured using hydrous pyrolysis in order to examine the source potential of this source rock in greater detail. The organic geochemical data of the original sample are presented together with the other data from Core 13/1-U-1 in Section 3.3.6 of the main report and section A.II.3 of this Appendix volume, but also included in this chapter for the reader's convenience.

The claystone sample had a total organic carbon content of 4.37 wt% and a Rock-Eval hydrogen index of 362 mg HC/g TOC and was therefore classified as a type-II/III kerogen (Table A.I.2). Pyrolysis-GC and pyrolysis-GC-MS (TIC) traces showed predominantly n-alkane/n-alkene doublets with chain lengths up to around C_{27}, although aromatics were present as well. Phenolic compounds were relatively minor. The organic matter of this sample was thermally immature as indicated by a mean vitrinite reflectance of 0.26% Ro and a Tmax value of 435°C. On solvent extraction, the original rock yielded 1153 ppm of bitumen which contained 45 wt% hydrocarbons. Saturated hydrocarbons accounted for 33 wt% of the hydrocarbon fraction.

The gas chromatogram of the extracted saturated hydrocarbon fraction showed a heavy-end biased n-alkane distribution with a maximum at C_{27} and a pronounced odd-over-even predominance (CPI1 = 2.0), suggesting that the bitumen was sourced from an immature kerogen with a significant content of terrestrial material. The gas chromatogram of the aromatic fraction showed a relatively poorly resolved pattern which contained only a few prominent peaks in the higher molecular range. Phenanthrene and its alkylated homologues could not be identified.

In the m/z 217 mass fragmentogram, which represents steranes, the peaks of the 14β(H),17β(H) C_{28}- and of the 14α(H),17α(H) 20R C_{29}-regular sterane (peaks o,t) were dominating. Diasteranes (peaks a-h) were less abundant than regular steranes (peaks j-t), but the C_{21} and C_{22} 5α(H)-steranes (peaks u,v) were more prominent in this sample than in the other samples from this core. The regular C_{29} steranes showed an immature composition with a low abundance (5%) of the 20S diastereomer (peak q) relative to the 20R configuration (peak t) and a moderate content (52%) in ββ-steranes.

Immaturity was also suggested by the composition of the terpenoids (m/z 191), namely by a low abundance of tricyclic compounds, appreciable concentrations of hopenes (peaks 1,5,9), of 17β(H)-trisnorhopane (peak 4) and 17β(H),21β(H)-hopanes (peaks 10,12,13,14), as well as by a strong predominance of the 22R- over the 22S-diastereomer of the C_{31} hopane (peaks G,H; 7% 22S). The transformation of 17β(H),21α(H)-hopane (= moretane, peak F) into 17α(H),21β(H)-hopane (peak E) was with 65% αβ still below the final level, but may have been underestimated due to coelution of moretane with 17β(H),21β(H)-hopane.

The aromatic steroids (m/z 253, 231) were strongly dominated by monoaromatic compounds.

Fifty grammes of the coarsely crushed rock sample (0.5 - 2 mm) were artificially matured in an autoclave of 100 ml volume in the presence of 40 ml water. The gas volume of the autoclave was filled with pure helium at a pressure of one atmosphere. The vessel was heated in a fluidised sandbath at a constant temperature of 340°C for 72 hours. The pressure during the experiment was equivalent to the water vapour pressure at this temperature, which is approximately 146 bars.

On completion of the experiment, the autoclave was depressurised, and the produced gas was analysed for its content in light hydrocarbons and inorganic gases. The autoclave was then opened, and since no oil droplets floated on the water surface, which otherwise could have been collected, the water surface and the interior of the bomb were rinsed with an organic solvent in order to obtain the "expelled pyrolysate". An aliquot of the residual rock was solvent-extracted in a Soxhlet apparatus in order to obtain the "extracted pyrolysate".

The pyrolysed rock residue gave a mean vitrinite reflectance of 1.20% Ro which indicates that the sample, in conventional terms, had reached late or post-oil window maturity (Table A.I.4 and Figure A.I.6). Contrary to that, the Tmax value of the residue was only moderately increased relative to the original value (439°C for the unextracted, 446°C for the extracted residue).

The pyrolysis-gas chromatogram of the residual rock after hydrous pyrolysis and solvent extraction differs from the one of the original rock mainly by showing a lighter composition, however the relative abundance of aromatic compounds is similar to that in the original sample (Figure A.I.1). The

total ion current (TIC) chromatogram from pyrolysis-GC-MS of the kerogen concentrate of the solvent-extracted residual rock which shows only compounds with C-numbers greater than eight, is entirely dominated by n-alkene/n-alkane homologs, similar to the TIC chromatogram of the unpyrolysed sample. The chromatogram of the residual rock after hydrous pyrolysis shows a somewhat increased content of n-alkenes/n-alkanes relative to branched alkenes which is consistent with its higher maturity (Table A.I.3a).

The high aliphaticity of the pyrolysate appears to be in contrast with the low hydrogen index (HI=66) of the residual rock. This may, however, reflect a stronger condensation of the aromatic rings rather than a high abundance of aliphatic structures in the kerogen of the residual rock. In this context it may be interesting to note that the concentration of monoaromatic compounds relative to n-decene has remained unchanged during hydrous pyrolysis while the di- and tri-aromatics show a slight increase relative to n-decene.

A significantly higher methylphenanthrene ratio for the hydrous pyrolysed sample is consistent with its higher maturity. The increased abundance of some sulfur-containing compounds (MDBT) in the hydrous pyrolysed sample was not expected in a naturally matured sample but has earlier been observed in artificially matured samples.

The sample yielded 400 ml gas, which contained of 77 vol% carbon dioxide and 10.5 vol% hydrocarbons. Hydrogen, which is not registered, accounts probably for most of the remaining 12.5 vol%. The carbon dioxide may have been formed partly from the carbonates in the rock and partly from the organic material. The hydrocarbons consisted of 43 vol% methane, followed by ethane (25 %), propane (15 %), and butane + butene (8 %), while the remaining higher molecular hydrocarbons accounted for 9 vol%.

A total amount of 233.8 mg of expelled pyrolysate was collected, which corresponds to 4676 ppm of the rock weight, or 107 mg/g TOC. This pyrolysate contained 87.5 wt% hydrocarbons, of which saturates accounted for 59.5 wt% and aromatics for 28.0 wt%, respectively (Table A.I.7). The extractability of the residual rock was 7770 wt ppm bitumen, or 177.8 mg bitumen per gram of TOC. This extracted pyrolysate was not further analysed.

The gas chromatogram of the saturated hydrocarbons of the expelled pyrolysate was dominated by n-alkanes extending to C_{37} which showed a smooth distribution with a maximum at n-C_{17}. Pristane and phytane could not be recognised. The aromatic fraction also showed a light-end biased composition with abundant alkylnaphthalenes and -phenanthrenes.

The biomarkers in the expelled pyrolysate showed a more mature composition than those in the original bitumen. Hopenes, although still present, were no longer prominent, the 17β(H),21β(H) C_{30}-C_{32} hopanes had disappeared, and 17α(H)-trisnorhopane (peak B in m/z 191) had strongly increased at the expense of 17β(H)-trisnorhopane (peak 4). The percentage of 22S extended hopanes increased from 7 to 41%, while the hopane/moretane ratio decreased.

The aromatic steroids of the expelled pyrolysate have a lighter composition relative to the ones of the EOM, but the aromatisation ratio did not change significantly.

In conclusion, artificial maturation of a claystone from Core 13/1-U-1 showed that this rock generated appreciable amounts of a wet gas, however no directly collectable oil.

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Project no.: 21346000
Location : 13/01-U-01
Date : 89.11.14

Table A.I.1:

DATA FROM ROCK EVAL PYROLYSIS

IKUNO	FRAC NAME	DEPTH (m)	S1 (mg/g rock)	S2 (mg/g rock)	TOC (%)	HYDRO. INDEX (mg/g TOC)	PETR. POTEN. S1+S2	PROD. INDEX S1/(S1+S2)	Tmax (°C)
E6800	BULK	142.40	0.05	15.83	4.37	362	15.88	0.00	435
E6813	PSED	142.40	0.30	5.26	3.43	153	5.56	0.05	439
E6813	EPSED	142.40	0.02	1.81	2.73	66	1.83	0.01	446
			0.02	1.82	2.73	67	1.84	0.01	449

PSED = sediment residue after hydrous pyrolysis
EPSED = solvent-extracted sediment residue after hydrous pyrolysis

Table A.I.2:

DATA FROM PYROLYSIS-GAS CHROMATOGRAMS

IKUNO	Depth (m)	Lithology	C_1	C_2-C_5	C_6-C_{14}	C_{15+} (area %)	mpx /$nC_{8=}$ [1]	mpx /$nC_{10=}$ [2]	HI (mg/gTOC)	TOC (wt%)
Hydrous pyrolysis of claystone from Core 13/1-U-1, 142.40 m										
E6800	142.40	Clst	7.4	4.9	45.9	41.7	0.35	0.47	362	4.37
E6813[4]	142.40	after HyPy	27.0	38.5	34.5	<0.1	0.17	0.40	66	2.73

Legend: [1] = peak height ratio (m+p)-xylene / n-octene
[2] = peak height ratio (m+p)-xylene / n-decene
[3] = data unreliable due to low intensity and high noise
[4] = solvent-extracted residue after hydrous pyrolysis

Table A.I.3a: Molecular ratios from PY-GC-MS mass chromatograms of kerogens: Isoprenoids and alkadienes.

IKU no.	Lithology	Depth	HI	C_{11}-C_{17}[1] alkene/alkane	1-pristene[1] / nC_{17}(ene+ane)	(1+2)-pristene[1] / nC_{17}(ene+ane)	alkadiene[2] / n-decene
E-6800	Claystone	142.40	362	1.13	0.18	0.21	0.23
E-6813	Hy-Py of E-6800	142.40	66	1.54	0.07	0.09	0.11

All ratios are calculated from peak heights.
[1] Measured from the total ion current (TIC) chromatograms.
[2] Alkadienes from m/z 95, n-decene from m/z 97. nC_{12}+nC_{15}+nC_{17} alkadienes are used here.

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Table A.I.3b: Molecular ratios from Py-GC-MS mass chromatograms of kerogens: Xylenes and phenols.

IKU no.	Lithology	Depth	HI	(m+p)-xylene[1] / n-decene	o-xylene[1] / n-decene	phenol[2] / n-decene	meth.phenols[2] / n-decene	o-meth.phenol[2] / (m+p)meth.phenol
E-6800	Claystone	142.40	362	0.2	0.2	0.5	0.9	0.44
E-6813	Hy-Py of E-6800	142.40	66	0.2	0.2	0.8	0.3	0.46

All ratios are calculated from peak heights.
[1] Xylenes from m/z 106, n-decene from m/z 97.
[2] Phenol from m/z 94, methylphenols (o+m+p) from m/z 108, n-decene fromm/z 97.

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Table A.I.3c: Molecular ratios from Py-GC/MS chromatograms and kerogens: Polycyclic aromatics.

IKU no.	Lithology	Depth	HI	(1+2)MN[1] / n-heptadecane	MP[2] / n-decene	3MP+2MP[3] / 9MP+1MP	MDBT[4] / n-tetradecane
E-6800	Claystone	142.40	362	3	0.23	(0.50)	0.2
E-6813	Hy-Py of E-6800	142.40	66	6	0.33	0.98	0.6

All ratios are calculated from peak heights.
[1] Methylnaphthalenes (MN) and n-heptadecane from m/z 141.
[2] Methylphenanthrenes from m/z 192, n-decene from m/z 97. The sum of 3-MP, 2-MP, 9-MP and 1-MP is used.
[3] Methylphenanthrene isomers from m/z 192.
[4] Methyldibenzothiophenes (MDBT) and n-tetradecane from m/z 198. (The 3 highest MDBT peaks are used).

() Doubtful due to poor resolution of 9-MP and 1-MP.

IKU SINTEF-GRUPPEN

IKU SINTEF-GRUPPEN

Core number: 13/01-U-01
Reference number: 21.3460.23
(1/1)

Table A.I.4:

VITRINITE REFLECTANCE DATA

IKU NO	LOCATION	DEPTH (M)	VITRINITE REFLECTANCE	REL RAT	STANDARD DEVIATION	FLUORESCENCE
E-6800 (orig.)	------	142.25-142.40	0.26 (18) 0.53 (2)	F R	0.07 0.03	1-2
E-6813 (py sed)	------	142.25-142.50	1.20 (10) 0.90 (4) 1.49 (8)	P S R	0.09 0.02 0.08	Abs

REL RAT (Reliability Rating): G = Good; F = Fair; P = Poor
S = Stained; R = Reworked.

VISUAL KEROGEN ANALYSIS

TABLE NO.: A.I.5
CORE NO.: 13/01-U-01

Sample	Depth (m)	Composition of residue	Particle size	Preservation palynomorphs	Thermal maturation index *	Remarks
E-7312 orig. sample	142.25	Am: 65-70% Al: + Lm: 10-15% W: 10-15% C:	F-M-L	Good-Fair	3.0 - 3.5	Organic residue dominated by amorphous matter (showing pale yellow to orange coloration in fluorescence light). Freshwater algae present.
E-6813 pyr.sed.	142.27-142.40	Am: 75-80% Lm: >5% W: 5-10% C: 10%	(F)-M-L	No palynomorphs observed	N.D.P.	Organic residue containing mainly dark (brown - dark brown) bundles of degraded amorphous matter.

ABBREVIATIONS:

Am = Amorphous
Al = Algae
W = Woody material
C = Coaly fragments
Lm = Liptinitic material
+ = Present in traces

F = Fine
M = Medium
L = Large

* New TAI (1-10 scale; see experimental).

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Table A.I.6: Yield and composition of hydrous pyrolysis gas.

Gas component	vol% of total gas	vol% of hydrocarbon gas	ml/g rock	mg/g rock
CO2	76.8	---	6.1	12.1
Methane	4.5	43.0	0.4	0.3
C2-hydrocarbons	2.6	25.0	0.2	0.3
C3-hydrocarbons	1.5	14.7	0.1	0.2
C4-hydrocarbons	0.8	8.0	0.1	0.2
C5-hydrocarbons	0.5	4.9	0.0	0.1
C6+-hydrocarbons	0.5	4.3	0.0	0.2
Total	87.4 2	99.9	6.9	13.4

IKU SINTEF-GRUPPEN

Project no.: 21346000
Location : 13/01-U-01
Date : 89.11.28

Table A.I.7a:

WEIGHT OF CHROMATOGRAPHIC FRACTIONS

IKUNO	FRACTION NAME	DEPTH (m)	ROCK EXTR. (g)	EOM (mg)	ASPH (mg)	SAT HC (mg)	ARO HC (mg)	POLAR COMP. (mg)	HC (mg)	NONHC (mg)	TOC (%)
E6800	EOM	142.40	35.2	40.6	19.2	13.4	4.8	8.7	18.2	22.4	4.37
E6813	EXP. PYR.	142.40	50.0	233.8	96.2	139.0	65.6	46.6	204.6	29.2	4.37
E6813	EXTR. PYR.	142.40	33.6	260.7	(not separated into comp. groups)						3.43

initial TOC

Table A.I.7b:

CONCENTRATION OF EOM AND CHROMATOGRAPHIC FRACTIONS
(Weight ppm of rock)

IKUNO	FRACTION NAME	DEPTH (m)	EOM	ASPH	SAT HC	ARO HC	POLAR COMP.	HC	NONHC
E6800	EOM	142.40	1153	545	381	135	246	516	637
E6813	EXPELLED PYR.	142.40	4676	1924	2780	1312	933	4092	584
E6813	EXTRACTED PYR.	142.40	7770	(not separated into compound groups)					

Table A.I.7c:

CONCENTRATION OF EOM AND CHROMATOGRAPHIC FRACTIONS

(mg/g initial TOC)

IKUNO	FRACTION NAME	DEPTH (m)	EOM	ASPH	SAT HC	ARO HC	POLAR COMP.	HC	NONHC
E6800	EOM	142.40	26.4	12.5	8.7	3.1	5.6	11.8	14.6
E6813	EXPELLED PYR.	142.40	107.0	44.0	63.6	30.0	21.4	93.6	13.4
E6813	EXTRACTED PYR.	142.40	177.8	(not separated into compound groups)					

ok rel. to initial TOC (4.37)

Table A.I.7d:

COMPOSITION OF EOM AND CHROMATOGRAPHIC FRACTIONS

IKUNO	FRACTION NAME	DEPTH (m)	ASPH EOM (%)	SAT EOM (%)	ARO EOM (%)	HC EOM (%)	POLAR EOM (%)	SAT HC x 100 / ARO HC	HC x 100 / NONHC
E6800	EOM	142.40	47.3	33.0	11.7	44.7	21.3	282.1	80.9
E6813	EXPELLED PYR.	142.40	41.1	59.5	28.0	87.5	20.0	212.0	700.4
E6813	EXTRACTED PYR.	142.40	(not separated into compound groups)						

Table A.I.8: Summary table for hydrous pyrolysis results.

Claystone sample from Core 13/1-U-1, 142.27-142.40 m (E6800 -> E6813)

Experimental data:

Temperature (°C)	340
Duration (h)	72
Autoclave volume (ml)	100
Rock weight (g)	50
Water volume (ml)	40
Volume of gas generated (ml)	400
Weight of "outwashed" expelled pyrolysate	233.8

Sum of organic products:

	mg/g rock	mg/g of initial TOC
HC gas	1.3	29.7
expelled pyrolysate	4.7	107.6
extracted pyrolysate	7.8	177.8
sum	13.8	315.1
minus EOM	1.2	26.4
net pyrolysis product	12.6	288.7

Project no.: 21346000
Location : 13/01-U-01
Date : 89.10.18

Table A.I.9:

RATIOS DERIVED FROM GAS CHROMATOGRAMS OF SATURATED HYDROCARBONS

IKUNO	FRAC NAME	DEPTH	Pri / Phy	Pri A / n-C17	Phy B / n-C18	A / B	n-C17 / n-C27	n-C31 / n-C19	CPI 1	CPI 2
E6800	EOM	142.40	2.4	0.3	0.2	2.1	0.5	0.7	2.0	2.3
E6813	EXPPY	142.40	-1.0	0.0	-1.0	-1.0	1.9	0.3	1.1	1.1

EOM = extractable organic matter
EXPPY = expelled pyrolysate
-1 = Data not available or cannot be calculated.

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

Code	Depth (m)	αβ/αβ+βα[1] hopanes	%22S[2] ext. hopanes	%20S[3] steranes	%ββ[4] steranes	C_{30} hopene[5] / C_{30} hopane
Core 13/01-U-01						
E6800	142.40	0.65	7	5	52	0.52
E6813	142.40	0.50	43	13	46	0.09

1) E/(E+F) in m/z 191.
2) Average % distribution between first and second eluting isomers of extended hopanes.
3) 100 · q/(q+t) in m/z 217.
4) 100 · r+s/(q+t+2·(r+s)) in m/z 217.
5) 9/(9+E) in m/z 191.

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

Code	Depth (m)	Q/E[1] terpanes	Tm/Ts[2] terpanes	X/E[3] terpanes	Z/E[4] terpanes	a/(a+j)[5] steranes
Core 13/01-U-01						
E6800	152.50	-	1.64	-	-	0.13
E6813	142.40	-	-	-	-	0.31

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 A.I.12: Internal distribution of 14α(H),17α(H), 20R C_{27}, C_{28} and C_{29} regular steranes.

IKUNO	DEPTH m	C_{27} %	C_{28} %	C_{29} %[1)]
E6800 EOM of orig. sample	142.40	24.6	22.1	53.3
E6813 expelled pyrolysate	142.40	38.0	10.0	52.0

[1)] height distribution of peaks j,p,t in m/z 217.

Table A.I.13: Molecular ratios from mass fragmentograms of aromatic steroid hydrocarbons.

IKUNO	DEPTH m	Cracking ratios 20/20+27 tri [1)]	20/20+28 tri [2)]	21/21+28 mono [3)]	Aromatisation ratios 27t/27t+28m [4)]	28t/28t+29m [5)]
Hydrous pyrolysis of claystone sample from Core 13/01-U-01, 142.40 m						
E6800	142.40	0.88	0.84	0.13	0.04	0.06
E6813	142.40	0.86	0.95	0.06	0.11	0.03

All ratios are given in fractions of 1.

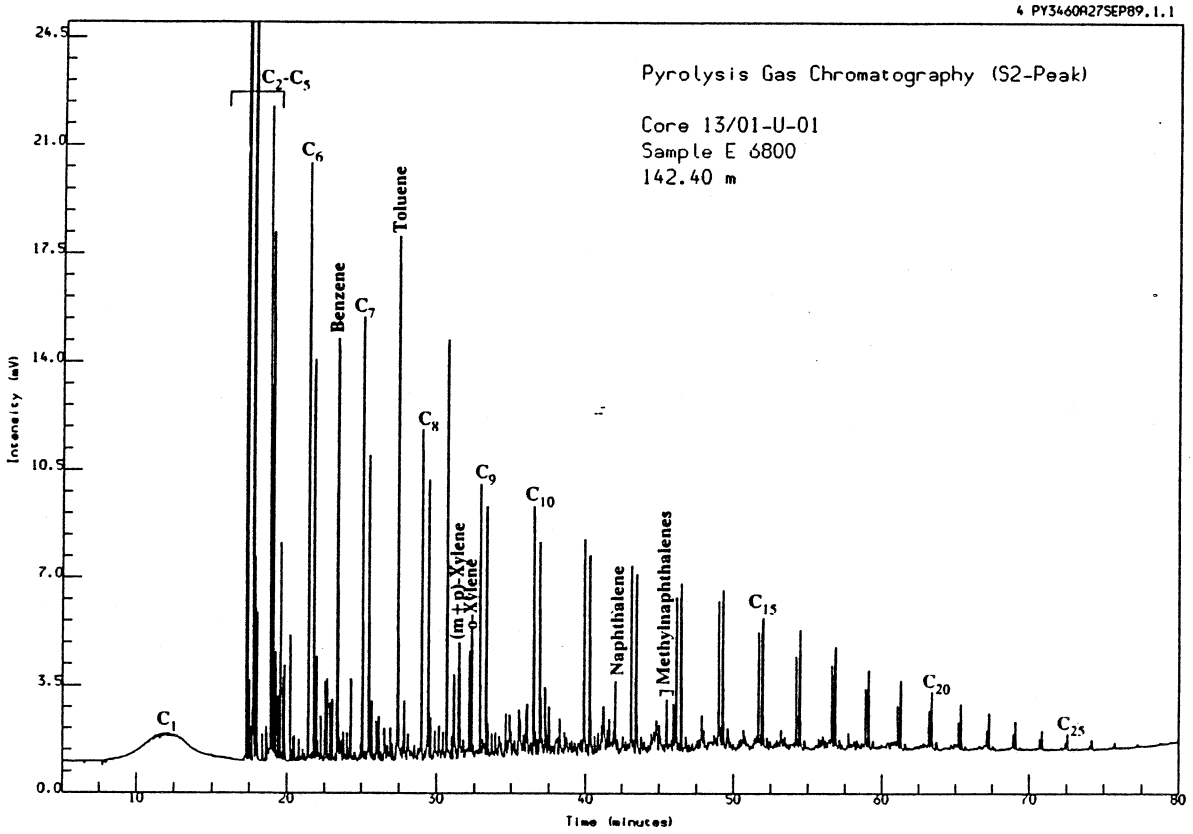
[1)] M/(M+P) in m/z 231 (Mackenzie et al. 1981, main text).
[2)] M/(M+S) in m/z 231 (Mackenzie et al. 1981, note added in proof).
[3)] a/(a+h) in m/z 253 (Mackenzie et al. 1981, note added in proof).
[4)] P/(P+h) in m/z 231 and 253. (Mackenzie et al. 1981, main text)
[5)] S/(S+m+(k*S/(S+R))) (Mackenzie et al. 1981, note added in proof).
-1 = Data are not available or cannot be calculated.

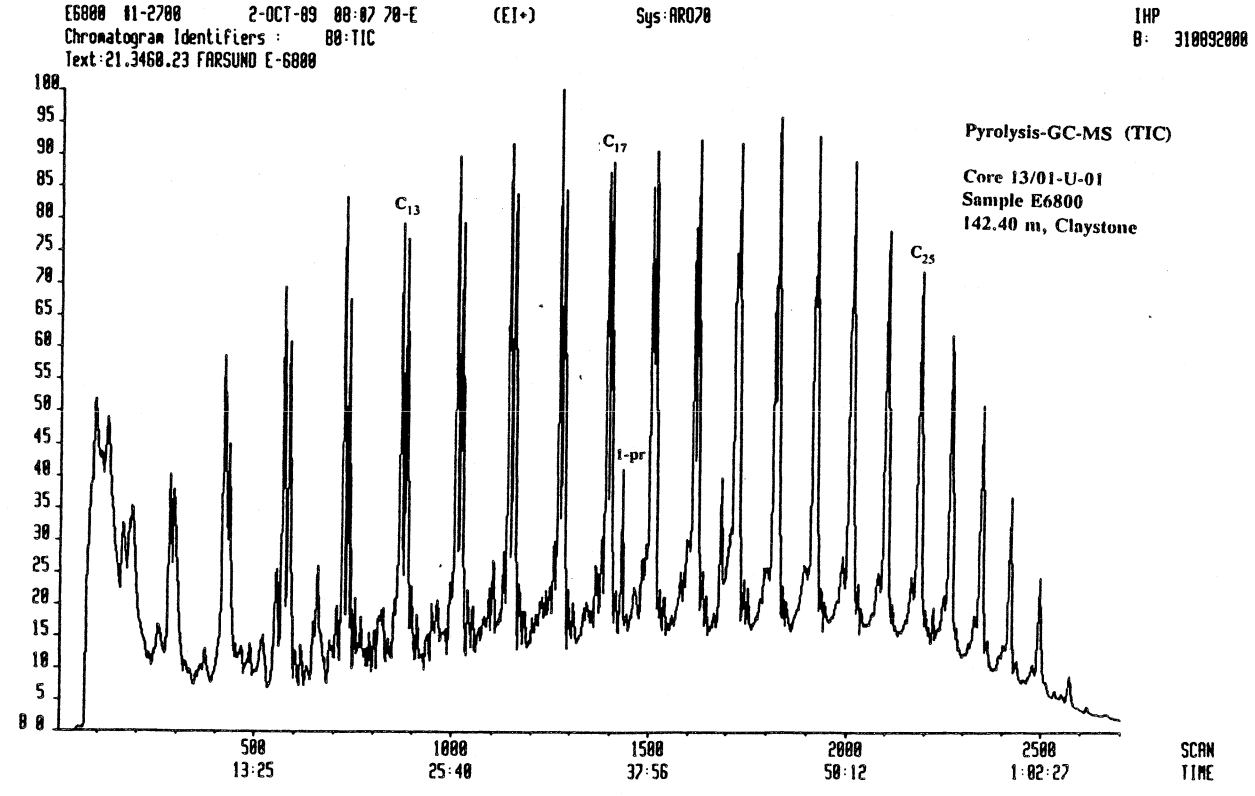
Figure A.I.1:

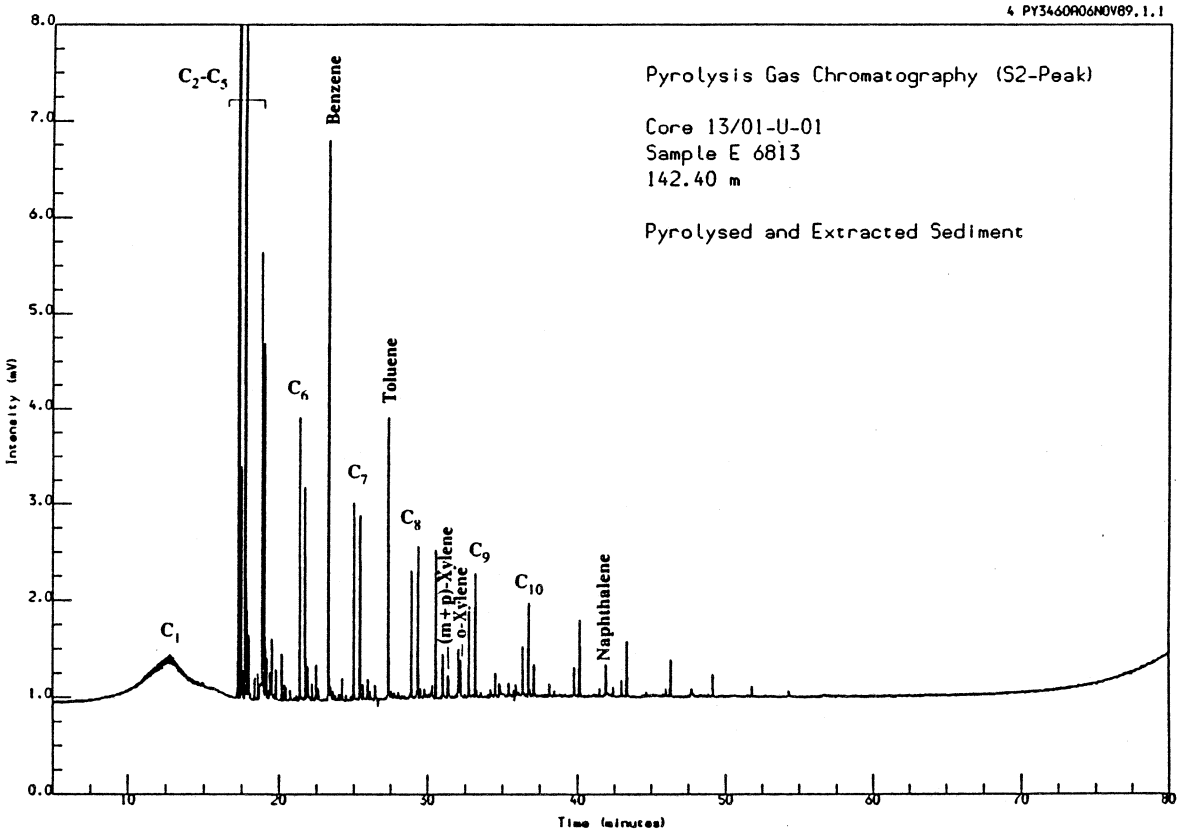
Pyrolysis-gas chromatograms (S2 peak)

and

Pyrolysis-GC-MS total ion chromatograms


4 PY3460A27SEP89.1.1
Pyrolysis Gas Chromatography (S2-Peak)
Core 13/01-U-01
Sample E 6800
142.40 m
Intensity (mV)
Time (minutes)
C2-C5
C6
Benzene
C7
Toluene
C8
(m+p)-Xylene
o-Xylene
C9
C10
Naphthalene
2-Methylnaphthalenes
C15
C20
C25
C1


E6800 11-2700 2-OCT-89 00:07 70-E (EI+) Sys:AR070
Chromatogram Identifiers : 00:TIC
Text:21.3460.23 FARSUND E-6800
IHP
B: 310092000
Pyrolysis-GC-MS (TIC)
Core 13/01-U-01
Sample E6800
142.40 m, Claystone
C13
C17
1-pr
C25
SCAN
TIME


4 PY3460A06NOV89.1.1
Pyrolysis Gas Chromatography (S2-Peak)
Core 13/01-U-01
Sample E 6813
142.40 m
Pyrolysed and Extracted Sediment
C2-C5
Benzene
C6
Toluene
C7
C8
(m+p)-Xylene
o-Xylene
C9
C10
Naphthalene
C1
Intensity (mV)
Time (minutes)

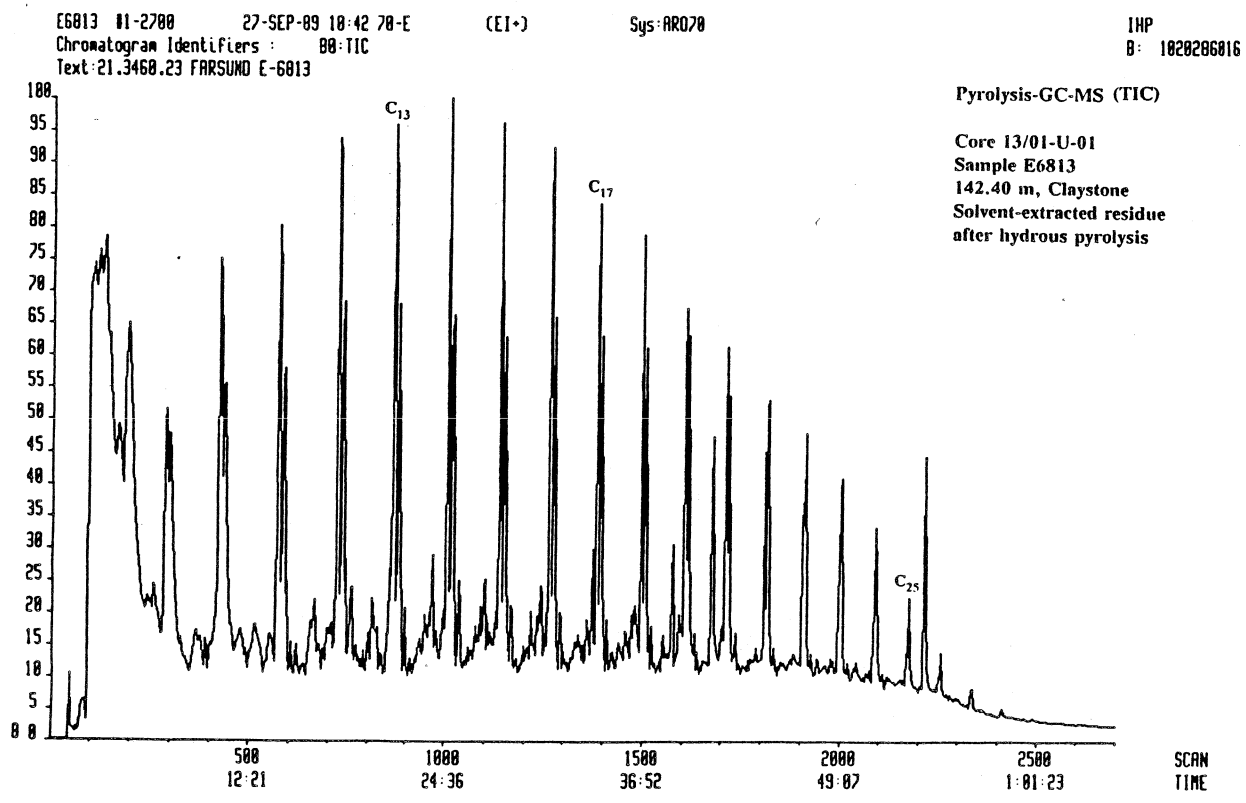
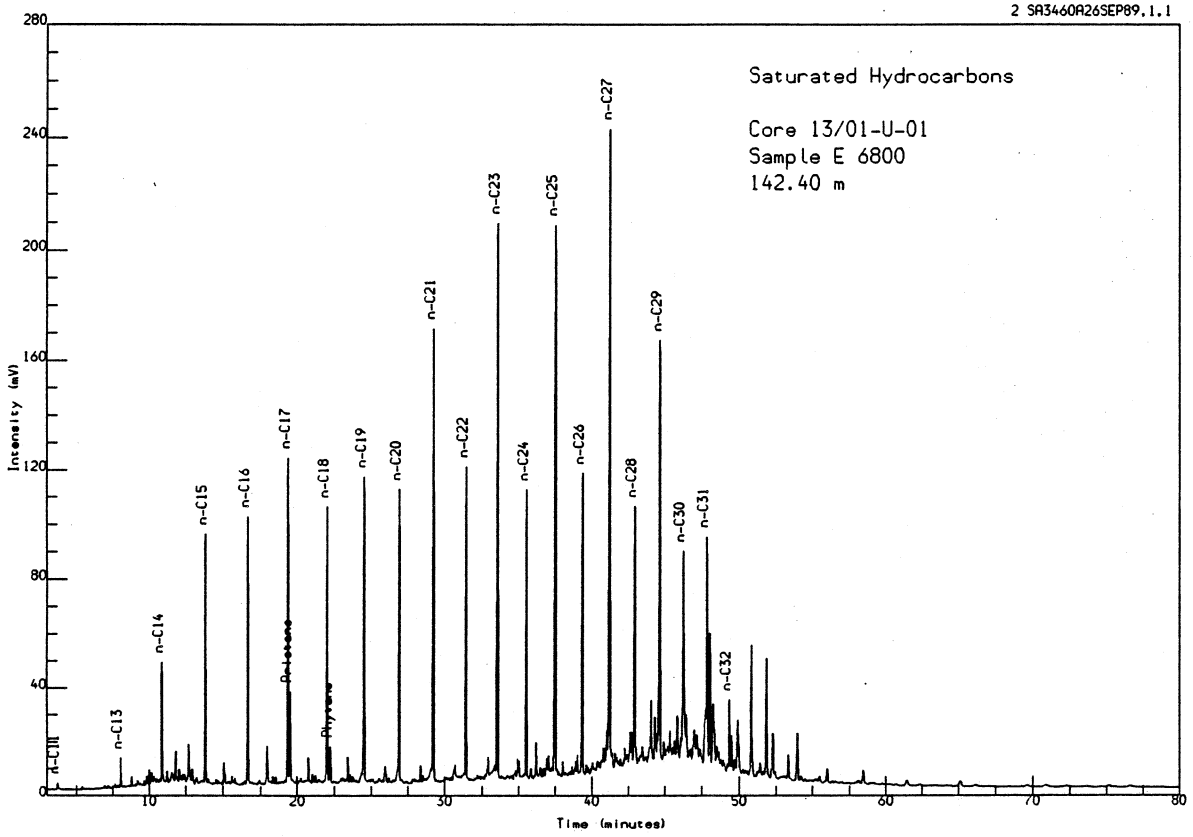

E6813 #1-2700 27-SEP-89 10:42 70-E (EI+) Sys:AR070
IHP
B: 1020286016
Chromatogram Identifiers : 00:TIC
Text:21.3460.23 FARSUND E-6813
Pyrolysis-GC-MS (TIC)
Core 13/01-U-01
Sample E6813
142.40 m, Claystone
Solvent-extracted residue
after hydrous pyrolysis
C13
C17
C25
SCAN
TIME

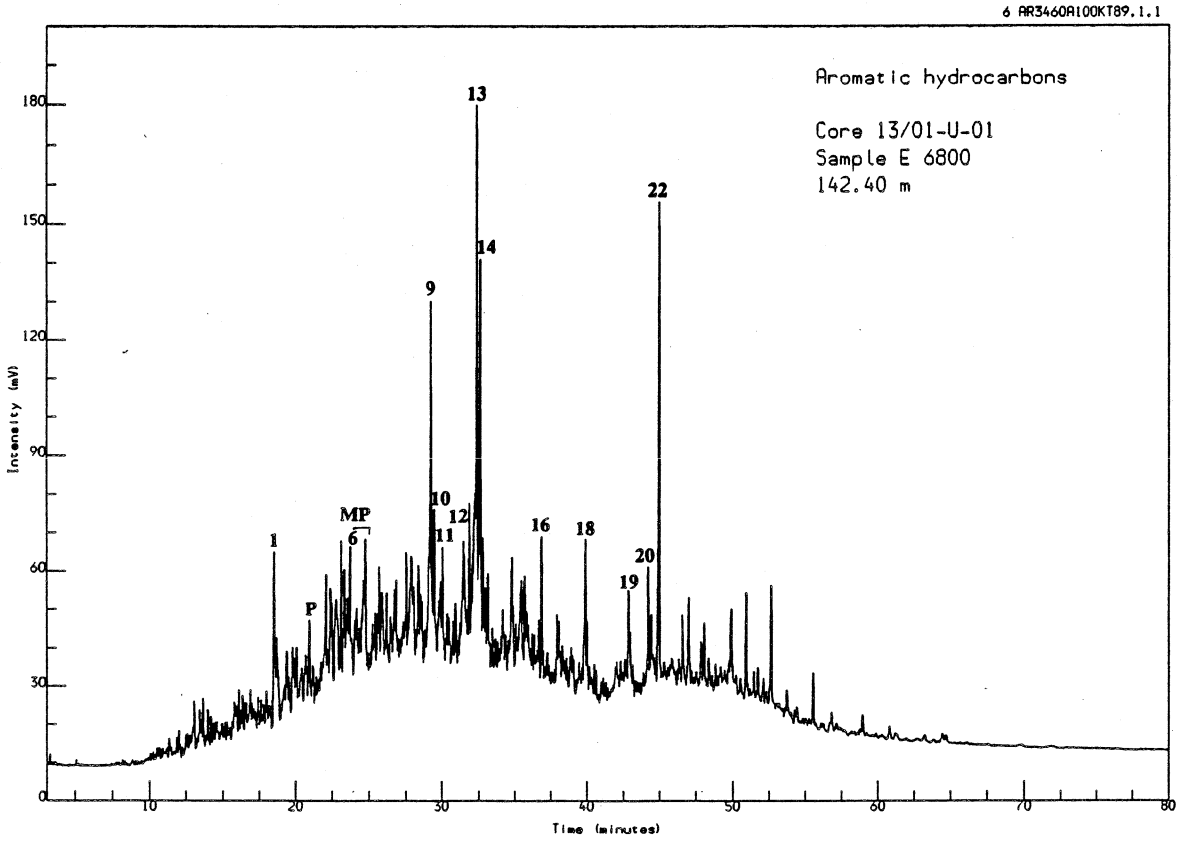
Figure A.I.2:

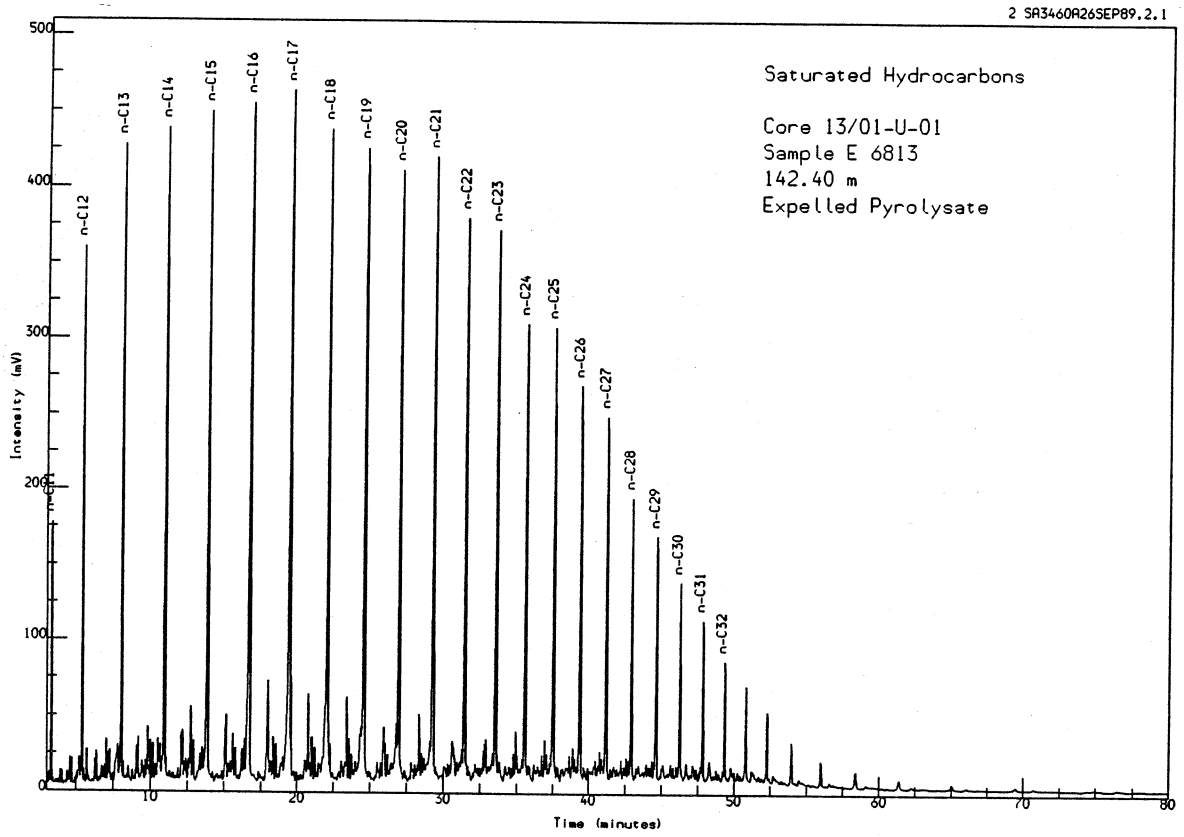
Gas chromatograms of saturated and aromatic hydrocarbons

Peak code	Peak identity
n-C_{15} etc.	- n-alkanes
N	Naphthalene
MN	Methylnaphthalenes
DMN	Dimethylnaphthalenes
TMN	C_3-naphthalenes
P	Phenanthrene
PN	Methylphenanthrenes
DMP	Dimethylphenanthrenes
1	Cadalene (C_5-Naphthalene)
2	C_6-Naphthalene
3	C_{14}-Benzene
4	unidentified
7	Dehydroabietine (?)
8	Dehydroabietane (?)
9	PAH, MW=202
10	Phenylnaphthalene
11	Simonellite
12	Retene
13	PAH, MW=218
14	PAH, MW=216
15	unidentified
16	PAH, MW=228
17	unidentified
18	PAH, MW=242
19	PAH, MW=252
20	PAH, MW=268
21	PAH, MW=252
22	PAH, MW=252
23	PAH, MW=268
24	PAH, MW=264
25	PAH, MW=276
26	PAH, MW=276
27	PAH, MW=292

(PAH = Polcyclic aromatic hydrocarbon)


2 SA3460A26SEP89.1.1
Saturated Hydrocarbons
Core 13/01-U-01
Sample E 6800
142.40 m
Intensity (mV)
Time (minutes)
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


6 AR3460A100KT89.1.1
Aromatic hydrocarbons
Core 13/01-U-01
Sample E 6800
142.40 m
Intensity (mV)
Time (minutes)
1
P
MP
6
9
10
11
12
13
14
16
18
19
20
22


2 SA3460A26SEP89.2.1
Saturated Hydrocarbons
Core 13/01-U-01
Sample E 6813
142.40 m
Expelled Pyrolysate
n-C12
n-C13
n-C14
n-C15
n-C16
n-C17
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
n-C31
n-C32
Intensity (mV)
Time (minutes)

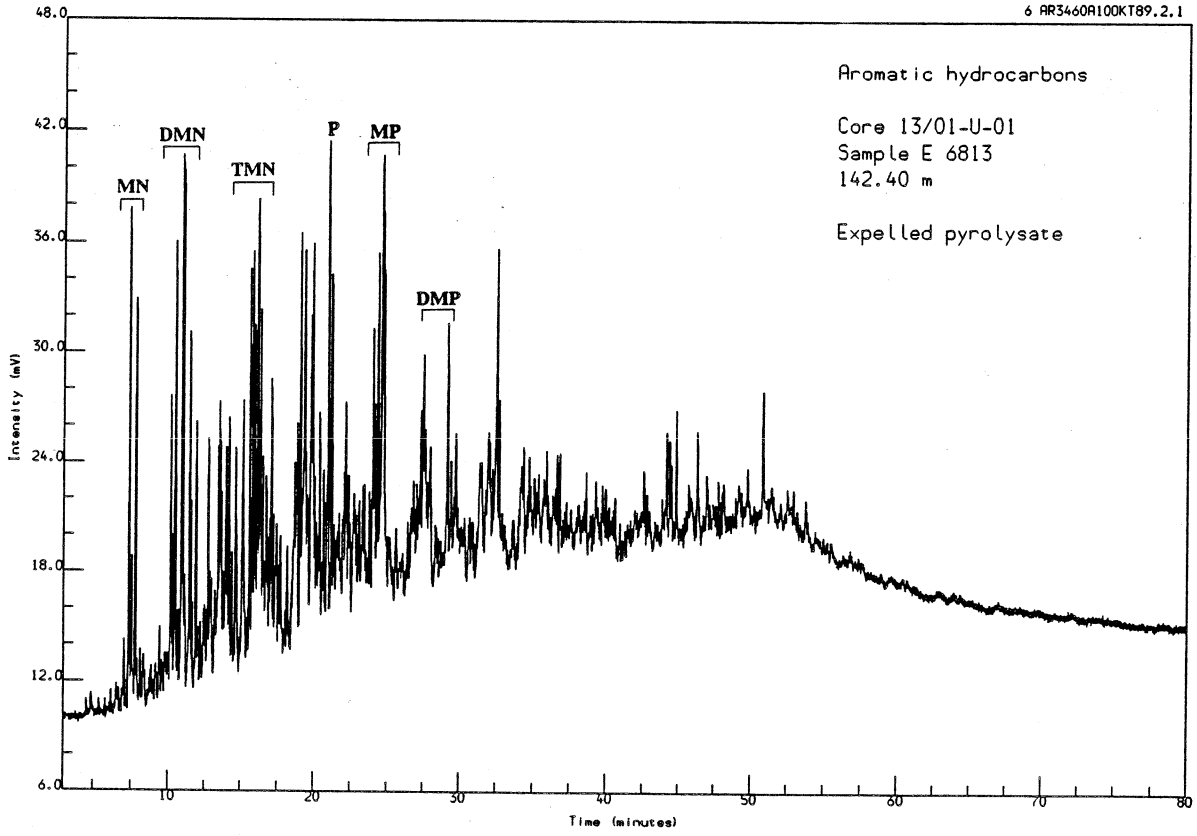

6 AR3460A100KT89.2.1
Aromatic hydrocarbons
Core 13/01-U-01
Sample E 6813
142.40 m
Expelled pyrolysate
MN
DMN
TMN
P
MP
DMP
Intensity (mV)
Time (minutes)

Figure A.I.3:

Mass fragmentograms of m/z 191, 205 (terpanes) and m/z 217, 218 (steranes).

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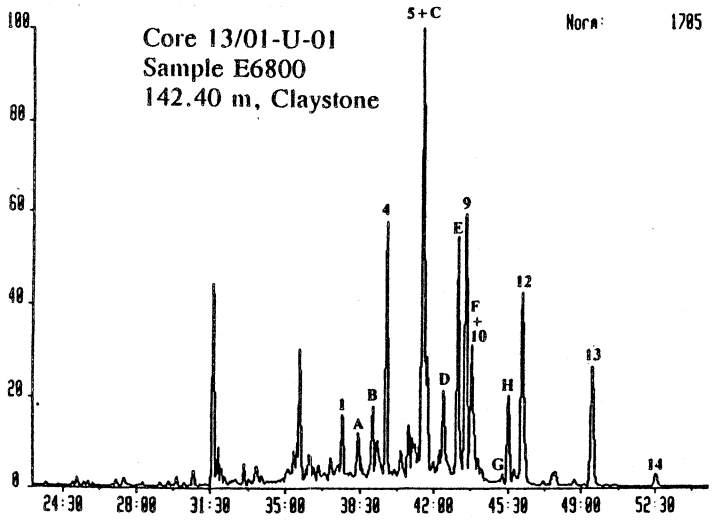
Key for m/z 191, 205 (terpanes):

Peak code	Identification	C-atoms : double bonds
P	C_{23} tricyclic terpane	($C_{23:0}$)
Q	C_{24} tricyclic terpane	($C_{24:0}$)
R	C_{25} tricyclic terpane (17R,17S)	($C_{25:0}$)
S	C_{24} tetracyclic terpane	($C_{24:0}$)
T	C_{26} tricyclic terpane (17R,17S)	($C_{26:0}$)
1	C_{27} hopene	($C_{27:1}$)
A	18α(H)-trisnorneohopane, Ts (?)	($C_{27:0}$)
B	17α(H)-trisnorhopane, Tm	($C_{27:0}$)
4	17β(H)-trisnorhopane	($C_{27:0}$)
5	nor-hop-$\Delta^{13(18)}$-ene	($C_{29:1}$)
C	17α(H), 21β(H)-norhopane	($C_{29:0}$)
6	hop-$\Delta^{17(21)}$-ene	($C_{30:1}$)
D	17β(H),21α(H)-norhopane (= normoretane)	($C_{29:0}$)
E	17α(H),21β(H)-hopane	($C_{30:0}$)
9	hop-$\Delta^{13(18)}$-ene	($C_{30:1}$)
10	17β(H),21β(H)-norhopane	($C_{29:0}$)
F	17β(H),21α(H)-hopane (= moretane)	($C_{30:0}$)
G	17α(H),21β(H)-homohopane (22S)	($C_{31:0}$)
H	17α(H),21β(H)-homohopane (22R)	($C_{31:0}$)
12	17β(H),21β(H)-hopane	($C_{30:0}$)
13	17β(H),21β(H)-homohopane	($C_{31:0}$)
I	17β(H),21α(H)-homohopane (= homomoretane)	($C_{31:0}$)
14	17β(H),21β(H)-bishomohopane	($C_{32:0}$)
15	17β(H),21β(H)-trishomohopane	($C_{33:0}$)
J	17α(H),21β(H)-bishomohopane (22S,22R)	($C_{32:0}$)
K	17α(H),21β(H)-trishomohopane (22S,22R)	($C_{33:0}$)
L	17α(H),21β(H)-tetrakishomohopane (22S,22R)	($C_{34:0}$)
M	17α(H),21β(H)-pentakishomohopane (22S,22R)	($C_{35:0}$)

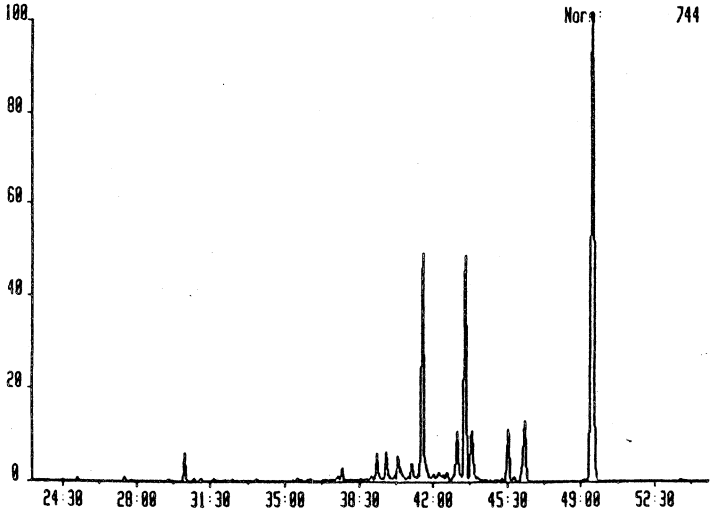
Key for m/z 217 and 218 (steranes):

Peak code	Identification	Formula
u	5α(H)-sterane	$C_{21}H_{36}$
v	5α(H)-sterane	$C_{22}H_{38}$
a	13β(H),17α(H)-diasterane (20S)	$C_{27}H_{48}$
b	13β(H),17α(H)-diasterane (20R)	$C_{27}H_{48}$
c	13α(H),17β(H)-diasterane (20S)	$C_{27}H_{48}$
d	13α(H),17β(H)-diasterane (20R)	$C_{27}H_{48}$
e	13β(H),17α(H)-diasterane (20S)	$C_{28}H_{50}$
f	13β(H),17α(H)-diasterane (20R)	$C_{28}H_{50}$
g	13α(H),17β(H)-diasterane (20S)	$C_{28}H_{50}$
	+ 14α(H),17α(H)-sterane (20S)	$C_{27}H_{48}$
h	13β(H),17α()H)-diasterane (20S)	$C_{29}H_{52}$
	+ 14β(H),17β(H)-sterane (20R)	$C_{27}H_{48}$
i	14β(H),17β(H)-sterane (20S)	$C_{27}H_{48}$
	+ 13α(H),17β(H)-diasterane (20R)	$C_{28}H_{50}$
j	14α(H),17α(H)-sterane (20R)	$C_{27}H_{48}$
k	13β(H),17α(H)-diasterane (20R)	$C_{29}H_{52}$
l	13α(H),17β(H)-diasterane (20S)	$C_{29}H_{52}$
m	14α(H),17α(H)-sterane (20S)	$C_{28}H_{50}$
n	13α(H),17β(H)-diasterane (20R)	$C_{29}H_{52}$
	+ 14β(H),17β(H)-sterane (20R)	$C_{28}H_{50}$
o	14β(H),17β(H)-sterane (20S)	$C_{28}H_{50}$
p	14α(H),17α(H)-sterane (20R)	$C_{28}H_{50}$
q	14α(H),17α(H)-sterane (20S)	$C_{29}H_{52}$
r	14β(H),17β(H)-sterane (20R)	$C_{29}H_{52}$
	+ unknown sterane	
s	14β(H),17β(H)-sterane (20S)	$C_{29}H_{52}$
t	14α(H),17α(H)-sterane (20R)	$C_{29}H_{52}$
*	diasterenes	

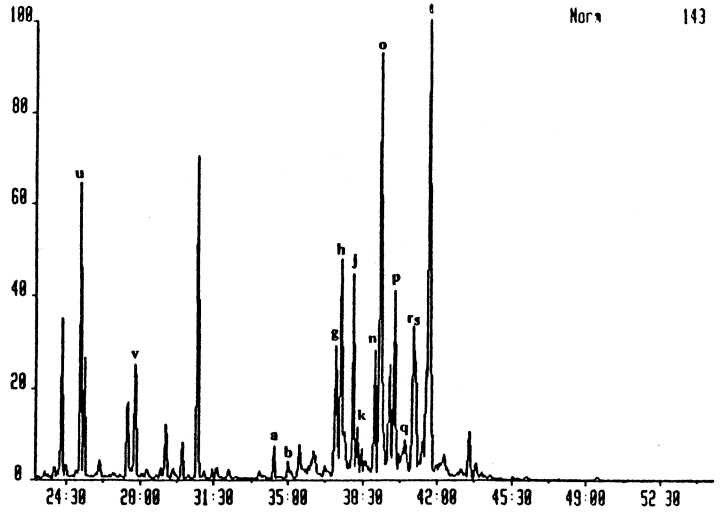
E6800SAT 11-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 191.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E-6800 SAT



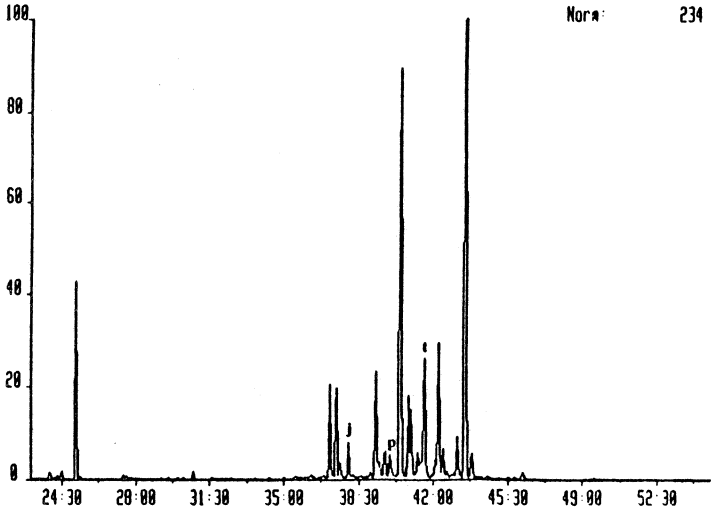
E6800SAT 11-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 205.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E-6800 SAT



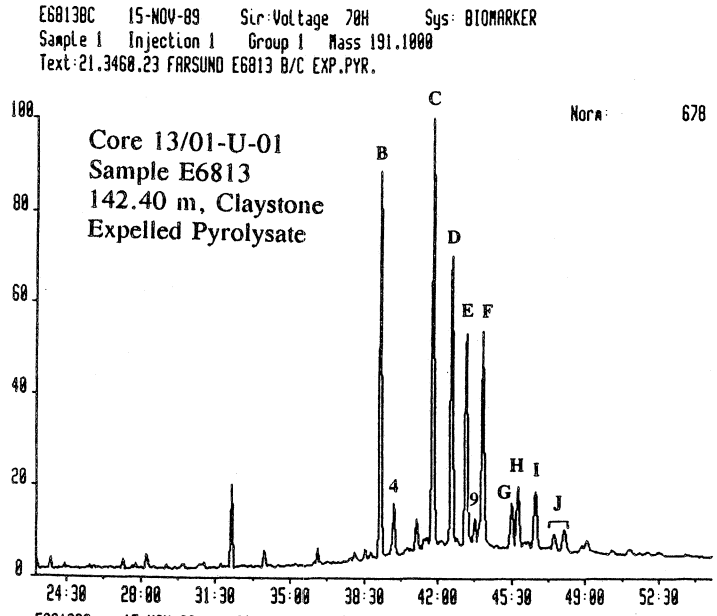
E6800SAT 11-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 217.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E-6800 SAT

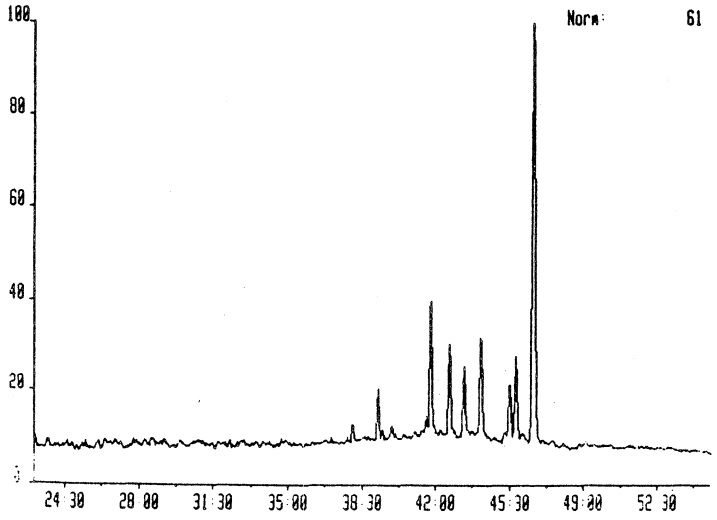


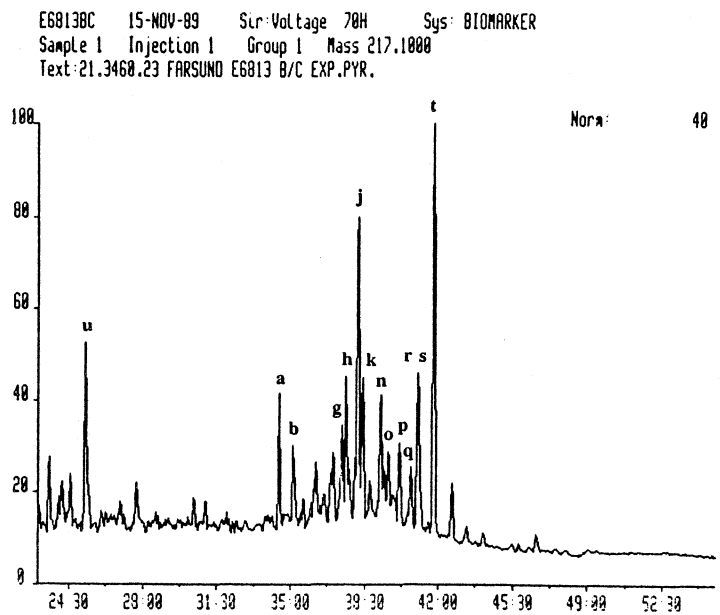
E6800SAT 11-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 218.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E-6800 SAT

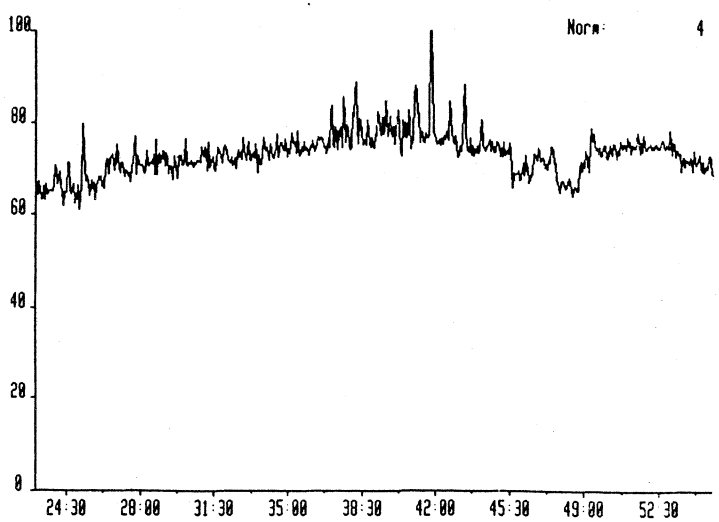


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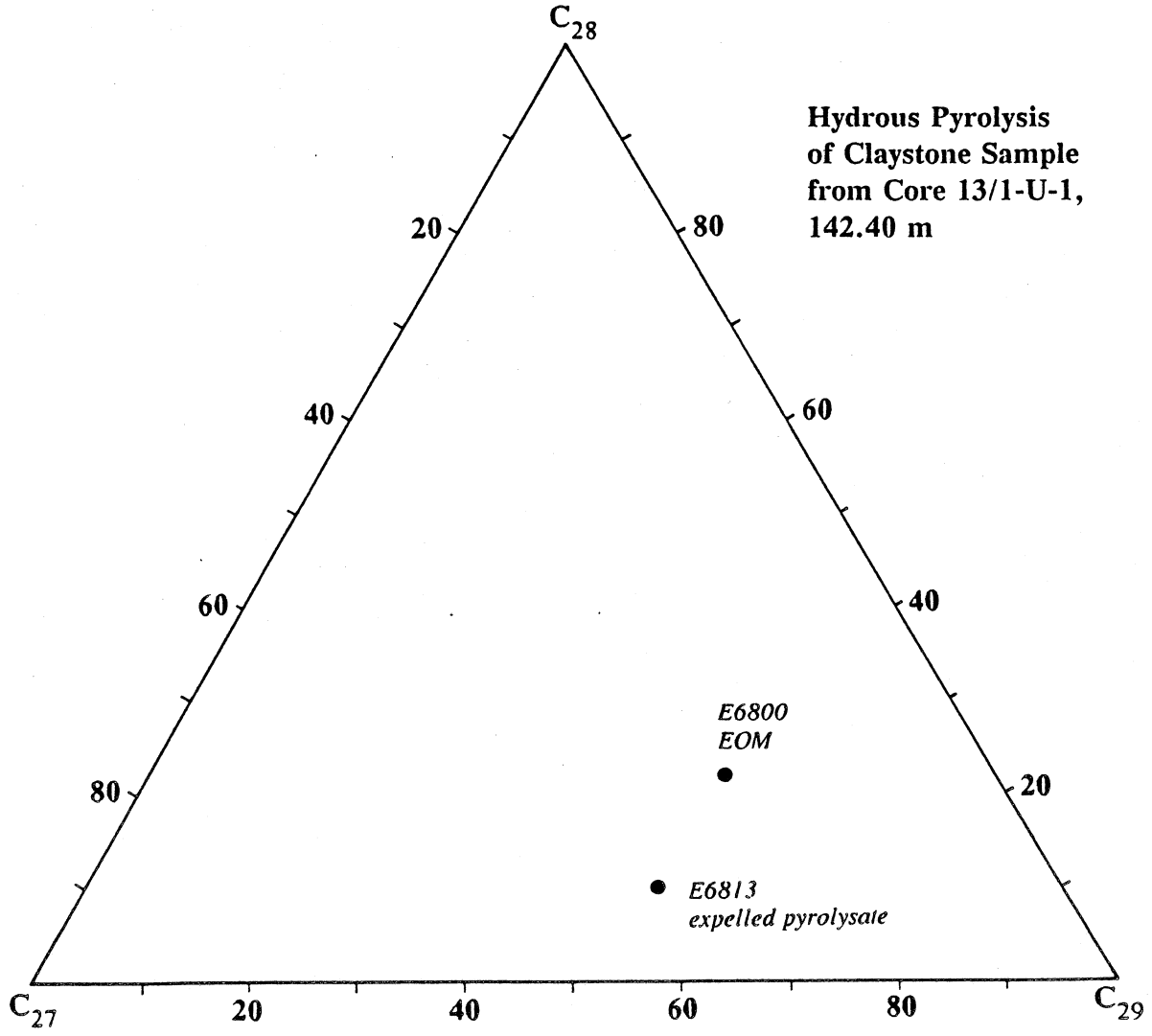


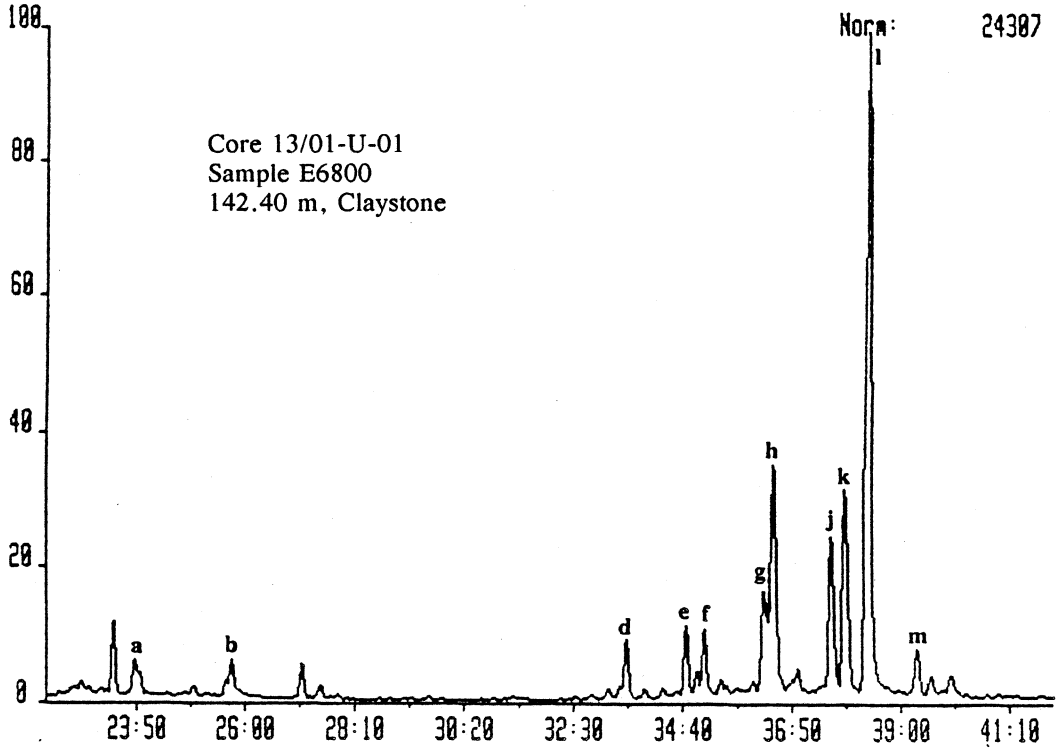
Figure A.I.4: *Internal distribution of 14α(H),17α(H) 20R, C_{27}, C_{28} and C_{29} regular steranes (from m/z 217).*

Figure A.I.5:

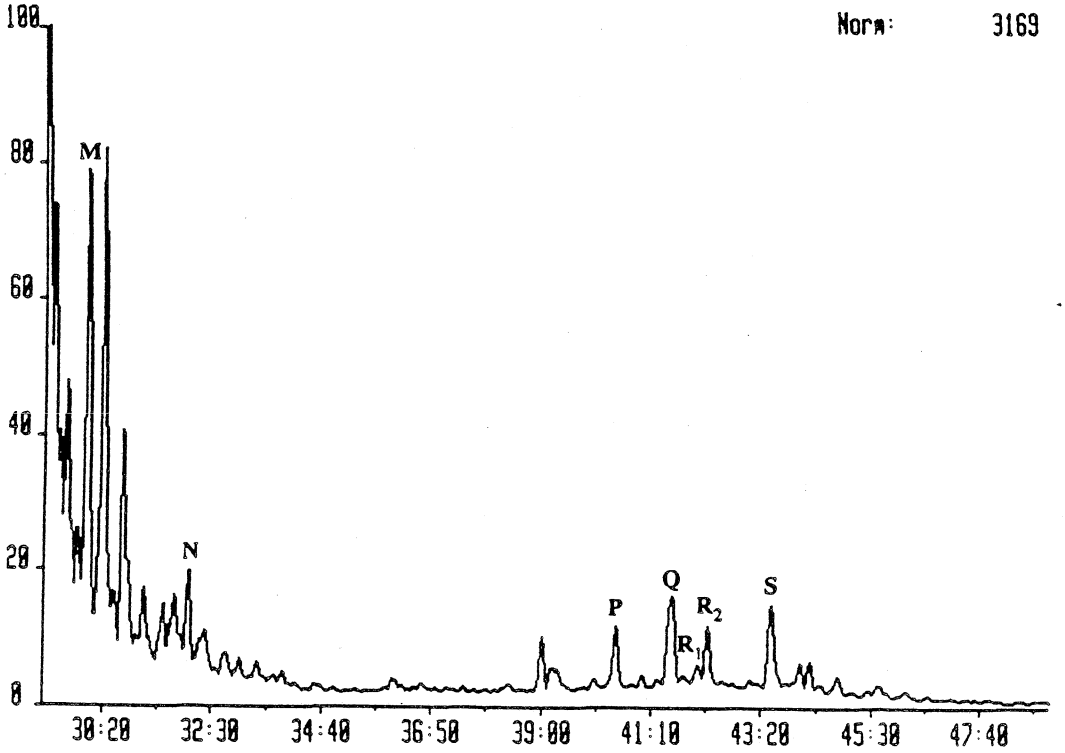
Mass fragmentograms of m/z 231, 253
(aromatic steroid hydrocarbons)

Peak code	Identification
Key for m/z 231 (tri-aromatic steroids):	
M	C_{20} tri-aromatic steroid
N	C_{21} tri-aromatic steroid
O	C_{26} tri-aromatic steroid
P	C_{26}+C_{27} tri-aromatic steroids
Q	C_{28} tri-aromatic steroid
R	C_{27} tri-aromatic steroid
S	C_{28} tri-aromatic steroid
Key for m/z 253 (mono-aromatic steroids):	
a	C_{21} mono-aromatic steroid
b	C_{22} mono-aromatic steroid
c	unidentified compound
d	C_{27} mono-aromatic steroid
e	C_{27} mono-aromatic steroid
f	C_{28} mono-aromatic steroid
g	C_{27} mono-aromatic steroid
h	C_{28}+C_{29} mono-aromatic steroids
i	C_{29} mono-aromatic steroids
j	C_{29} mono-aromatic steroids
k	unidentified compound
l	unidentified compound

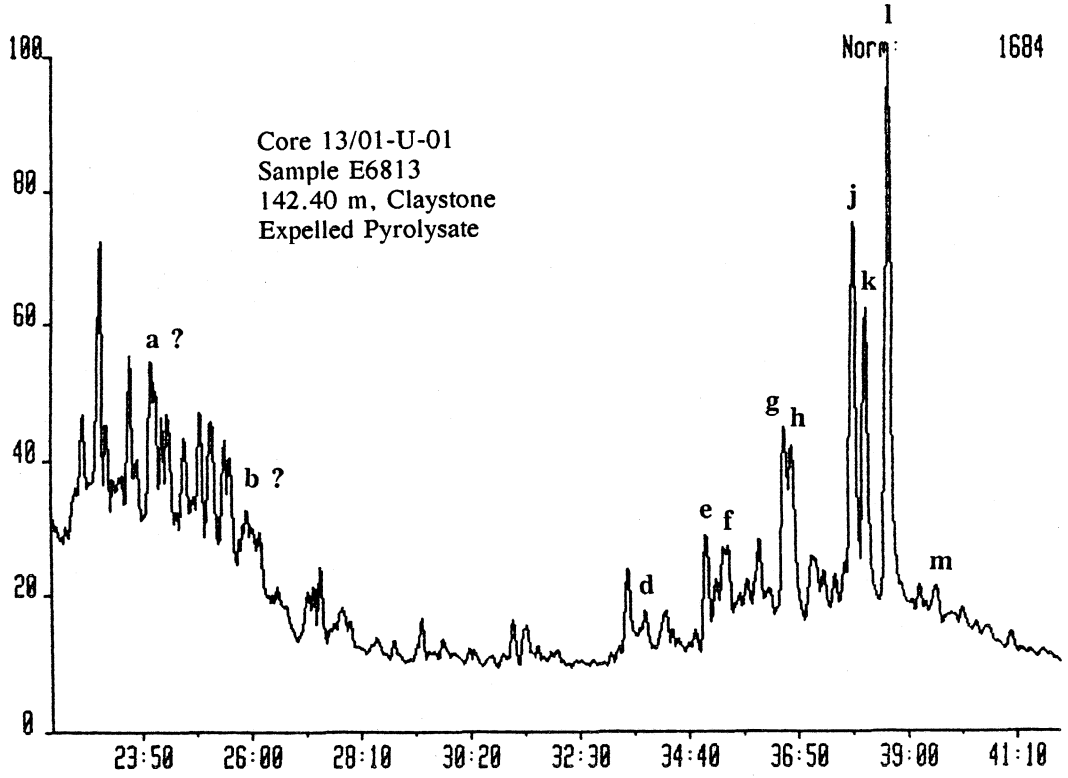
E6800ARO 17-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 253.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E-6800 ARO



E6800ARO 17-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 231.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E-6800 ARO



E6813ARO 14-NOV-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 253.1000
Text:21.3460 FARSUND E6813 ARO EXP.PYR.



E6813ARO 14-NOV-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 231.1000
Text:21.3460 FARSUND E-6813 ARO EXP.PYR.

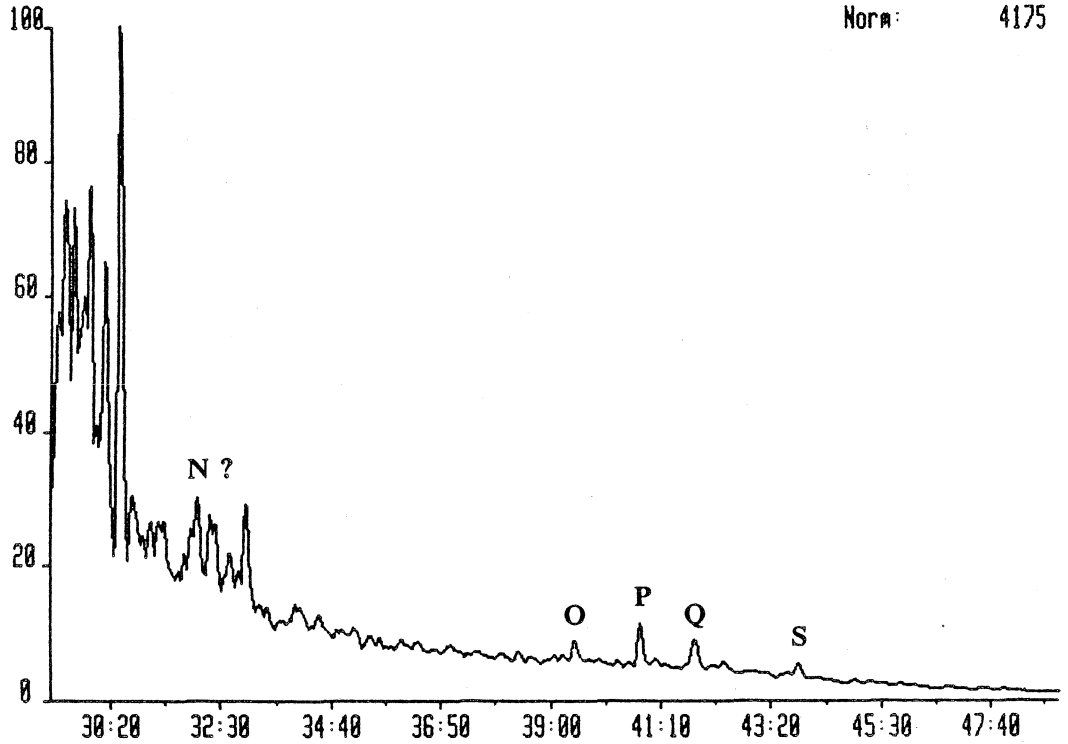
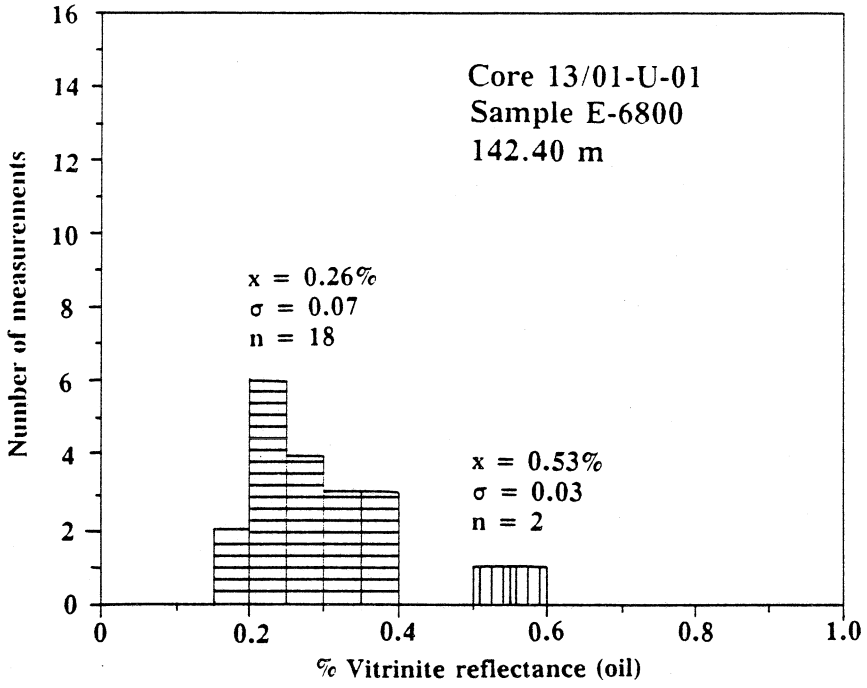
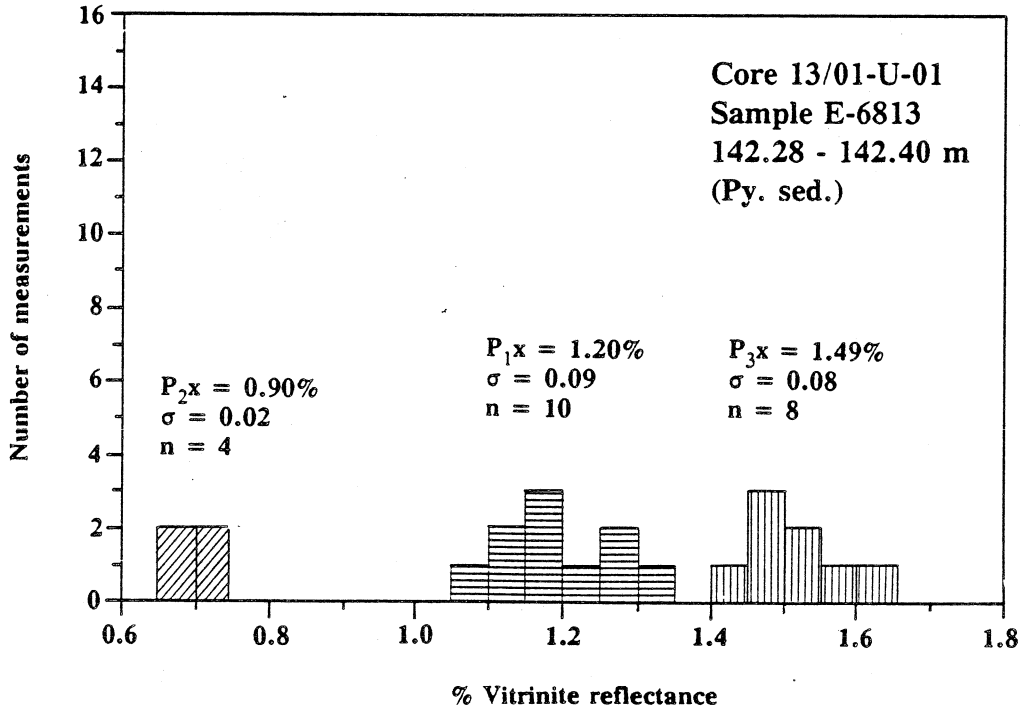


Figure A.I. 6: Vitrinite reflectance histograms.


Core 13/01-U-01
Sample E-6800
142.40 m
x = 0.26%
σ = 0.07
n = 18
x = 0.53%
σ = 0.03
n = 2
Number of measurements
% Vitrinite reflectance (oil)
0
2
4
6
8
10
12
14
16
0.2
0.4
0.6
0.8
1.0


Core 13/01-U-01
Sample E-6813
142.28 - 142.40 m
(Py. sed.)
P2x = 0.90%
σ = 0.02
n = 4
P1x = 1.20%
σ = 0.09
n = 10
P3x = 1.49%
σ = 0.08
n = 8
Number of measurements
% Vitrinite reflectance
0
2
4
6
8
10
12
14
16
0.6
0.8
1.0
1.2
1.4
1.6
1.8

IKU SINTEF-GRUPPEN

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Core 13/2-U-2

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Project no.: 21346000
Location : 13/02-U-02
Date : 89.08.08

Table A.II.1.1a

TABLE OF GAS RESULTS

Headspace gas (µl gas pr. kg rock)

IKUNO	DEPTH (m)	C1	C2	C3	iC4	nC4	C5+	SUM C1-C4	SUM C2-C4	WET-NESS (%)	iC4 / nC4
E7738	32.31	0	0	0	0	0	0	0	0	-1.0	-1.00
E7745	38.66	0	0	0	0	0	0	0	0	-1.0	-1.00
E7753*)	48.00	-1	-1	-1	-1	-1	-1	-1	-1	-1.0	-1.00
E7762	64.03	0	0	0	0	0	0	0	0	-1.0	-1.00

Table A.II.1.1b

Occluded gas (µl gas pr. kg dry rock)

IKUNO	DEPTH (m)	C1	C2	C3	iC4	nC4	C5+	SUM C1-C4	SUM C2-C4	WET-NESS (%)	iC4 / nC4
E7738	32.31	131	8	3	7	0	0	149	18	12.0	-1.00
E7745	38.66	166	11	0	0	0	0	177	11	6.2	-1.00
E7753	48.00	330	15	2	8	2	0	357	27	7.5	4.00
E7762	64.03	379	17	0	0	0	0	396	17	4.2	-1.00

Table A.II.1.1c

Summation of Headspace and Occluded gas

(µl gas pr. kg dry rock)

IKUNO	DEPTH (m)	C1	C2	C3	iC4	nC4	C5+	SUM C1-C4	SUM C2-C4	WET-NESS (%)	iC4 / nC4
E7738	32.31	131	8	3	7	0	0	149	18	12.1	-1.00
E7745	38.66	166	11	0	0	0	0	177	11	6.2	-1.00
E7753	48.00	330	15	2	8	2	0	357	27	7.6	4.00
E7762	64.03	379	17	0	0	0	0	396	17	4.3	-1.00

Legend:
-1: Data are not available or cannot be determined.
*): Lid jumped off the can when this was taken out from the deep-freezer.

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Table A.II.1.2:
DATA FROM ROCK EVAL PYROLYSIS

IKUNO	FRAC NAME	DEPTH (m)	SAMPLE TYPE	S1 (mg/g rock)	S2 (mg/g rock)	TOC (%)	HYDRO. INDEX (mg/g TOC)	PETR. POTEN. S1+S2	PROD. INDEX S1/(S1+S2)	Tmax (°C)
E7734		28.46	CORE	0.01	0.01	0.11	9	0.02	(0.50)	-1
E7735		29.36	CORE	0.01	0.00	0.14	0	0.01	1.00	(333)
E7736		30.33	CORE	0.01	0.00	0.14	0	0.01	1.00	(315)
E6785		31.64	CORE	0.00	0.00	0.16	0	0.00	-1.00	-1
E7738		32.31	CORE	0.00	0.00	0.16	0	0.00	-1.00	-1
E7741		34.79	CORE	0.01	0.02	0.16	13	0.03	(0.33)	-1
E6786		35.12	CORE	0.00	0.00	0.14	0	0.00	-1.00	-1
E6787		38.58	CORE	0.01	0.00	0.17	0	0.01	1.00	-1
E7745		38.66	CORE	0.00	0.00	0.13	0	0.00	-1.00	-1
E7746		39.48	CORE	0.02	0.02	0.13	15	0.04	(0.50)	-1
E7748		42.81	CORE	0.01	0.00	0.18	0	0.01	1.00	450
E6788		44.42	CORE	0.01	0.03	0.18	17	0.04	(0.25)	-1
E7752		46.52	CORE	0.01	0.03	0.12	25	0.04	(0.25)	-1
E7753		48.00	CORE	0.01	0.04	0.20	20	0.05	(0.20)	(358)
E7756		55.23	CORE	0.01	0.01	0.16	6	0.02	(0.50)	-1
E6789		56.04	CORE	0.02	0.03	0.18	17	0.05	(0.40)	-1
E6790		58.35	CORE	0.01	-1.00	0.16	-1	-1.00	-1.00	-1
E6791		59.00	CORE	0.01	0.02	0.17	12	0.03	(0.33)	-1
E7762		64.03	CORE	0.00	0.00	0.15	0	0.00	-1.00	-1
E6792		72.89	CORE	0.00	0.00	0.16	0	0.00	-1.00	-1
E6793		74.75	CORE	0.03	0.02	0.14	14	0.05	(0.60)	-1
E6794		80.70	CORE	0.00	0.00	0.16	0	0.00	-1.00	-1
E7770		86.45	CORE	0.00	0.00	0.16	0	0.00	-1.00	-1
E6795		88.47	CORE	0.00	0.00	0.18	0	0.00	-1.00	-1
E6996		88.85	CORE	0.04	0.01	0.25	4	0.05	(0.80)	-1
E6997		89.34	CORE	0.01	0.00	0.12	0	0.01	1.00	(315)
E6998		89.59	CORE	0.05	0.01	0.15	7	0.06	(0.83)	-1
E6994		89.68	CORE	0.46	0.61	0.65	94	1.07	0.43	459
E7774		89.69	CORE	0.50	0.48	0.64	75	0.98	0.51	471
E8550		89.86	CORE	0.39	0.27	0.56	48	0.66	0.59	468
E8551		90.15	CORE	0.04	0.01	0.15	7	0.05	(0.80)	(360)
E8552		90.69	CORE	0.02	0.01	0.13	8	0.03	(0.67)	-1
E6796		91.35	CORE	0.01	0.01	0.15	7	0.02	(0.50)	-1
E6797		95.14	CORE	0.00	0.01	0.16	6	0.01	0.00	-1
E7784		99.11	CORE	0.02	0.08	0.24	33	0.10	(0.20)	470
E6798		101.20	CORE	0.01	0.02	0.23	9	0.03	(0.33)	-1
E6995		101.20	CORE	0.02	0.00	0.25	0	0.02	(1.00)	-1
E7788		103.51	CORE	0.02	0.06	0.23	26	0.08	(0.25)	(346)

Legend
-1 - No data available.
( ) - Values doubtful reliability, usually associated with poor S1 and/or S2 peaks.

Table A.II.1.3: Data from Pyrolysis-gas chromatograms.

IKUNO	Depth (m)	Lithology	C_1	C_2-C_5	C_6-C_{14}	C_{15+}	mpx /$nC_{8=}$ [1]	mpx /$nC_{10=}$ [2]	HI (mg/gTOC)	TOC (wt%)
			(	area %		)				
Core 13/02-U-02										
E7753	48.00	Sltst	80.7	2.3	17.0	0.0	2.3	n.d.p.	20	0.20
E7774	89.69	Sltst,calc	44.2	19.0	36.8	0.0	2.5	n.d.p.	75	0.64
E7784[3]	99.11	Clst,calc.	27.1	8.3	54.6	10.0	3.4	n.d.p.	33	0.24

Legend: [1] = peak height ratio (m+p)-xylene / n-octene
[2] = peak height ratio (m+p)-xylene / n-decene
[3] = data unreliable due to low intensity and high noise
[4] = solvent-extracted residue after hydrous pyrolysis

IKU SINTEF-GRUPPEN

Core number: 13/02-U-02
Reference number:21.3460.23
(1/1)

Table A.II.1.4:

VITRINITE REFLECTANCE DATA

IKU NO	LOCATION	DEPTH (M)	VITRINITE** REFLECTANCE	REL RAT	STANDARD DEVIATION	FLUORE-SCENCE
E-7741	------	34.79	2.15 (4)	P	0.46	Abs
E-6773	------	44.30	N.D.P.	-	----	Abs
E-6774	------	46.06	1.28 (5)	P	0.34	Abs
			2.40 (11)	R?	0.21	
E-7755	------	48.72	2.46 (17)	F	0.25	Abs
			3.28 (3)	R	0.15	
E-7774	------	89.69	2.47 (5)	P	0.48	Abs
			3.56 (2)	R?	0.13	
E-7781	------	95.41	2.37 (19)	P	0.34	Abs

REL RAT (Reliability Rating): G = Good; F = Fair; P = Poor
S = Stained; R = Reworked.
**: Reflectance readings obtained on probable chitinozoan fragments due to lack of obvious woody material.

VISUAL KEROGEN ANALYSIS

TABLE NO.: A.II.1.5
CORE NO.: 13/02-U-02

Sample	Depth (m)	Composition of residue	Particle size	Preservation palynomorphs	Thermal maturation index *	Remarks
E-7749	44.30	Am: 10-20% Lm: 10% C: 70-80%	F-M-L	Poor(Fair)	>6.0	Organic residue dominated by black coaly fragments. Liptinitic fraction consists of marine palynomorphs. Abundant pyrite.
E-7775	89.70	Am: 60-70% C: 30-40%	F-M-L	No palynomorphs observed	N.D.P.	Organic residue of grey and dark brown degraded amorphous matter, and black coaly fragments.
E-7789	103.51	Am: 20-25% Lm: <10% C: 70-75%	F-M-L	Poor	>6.0	Comparable to sample E-7789. Only few palynomorphs present. Abundant pyrite.
Analysis of samples at 34.79, 40.97, 46.06 and 69.86 m was unsuccessful.						

ABBREVIATIONS:

Am = Amorphous
Al = Algae
W = Woody material
C = Coaly fragments
Lm = Liptinitic material
+ = Present in traces

F = Fine
M = Medium
L = Large

* New TAI (1-10 scale; see experimental).

IKU SINTEF-GRUPPEN

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Date : 89.11.03

Table A.II.1.6a:

WEIGHT OF CHROMATOGRAPHIC FRACTIONS

IKUNO	DEPTH (m)	SAMPLE TYPE	ROCK EXTR. (g)	EOM (mg)	ASPH (mg)	SAT HC (mg)	ARO HC (mg)	POLAR COMP. (mg)	HC (mg)	NONHC (mg)	TOC (%)
E7753	48.00	CORE	21.1	17.8	1.9	0.0	0.0	1.0	0.0	17.8	0.20
E6994	89.68	CORE	111.9	88.2	4.5	57.9	10.8	9.1	68.7	19.5	0.65
E7774	89.69	CORE	25.4	23.1	2.2	11.0	2.7	2.1	13.7	9.4	0.64
E7784	99.11	CORE	31.1	7.9	0.6	0.0	0.0	1.0	0.0	7.9	0.24
E6995	101.20	CORE	119.8	6.9	2.4	1.0	1.3	1.3	2.3	4.6	0.25

Table A.II.1.6b:

CONCENTRATION OF EOM AND CHROMATOGRAPHIC FRACTIONS

(Weight ppm of rock)

IKUNO	DEPTH (m)	SAMPLE TYPE	EOM	ASPH	SAT HC	ARO HC	POLAR COMP.	HC	NONHC
E7753	48.00	CORE	844	90	0	0	46	0	844
E6994	89.68	CORE	788	40	517	96	81	613	175
E7774	89.69	CORE	910	87	432	105	82	537	373
E7784	99.11	CORE	254	19	0	0	31	0	254
E6995	101.20	CORE	58	20	8	11	11	19	39

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Table A.II.1.6c:

CONCENTRATION OF EOM AND CHROMATOGRAPHIC FRACTIONS

(mg/g TOC)

IKUNO	DEPTH (m)	SAMPLE TYPE	EOM	ASPH	SAT HC	ARO HC	POLAR COMP.	HC	NONHC
E7753	48.00	CORE	422.0	45.0	0.0	0.0	22.8	0.0	422.0
E6994	89.68	CORE	121.2	6.2	79.5	14.8	12.5	94.3	26.9
E7774	89.69	CORE	142.2	13.5	67.4	16.5	12.7	83.9	58.3
E7784	99.11	CORE	105.9	8.0	0.0	0.0	12.9	0.0	105.9
E6995	101.20	CORE	23.0	8.0	3.2	4.4	4.4	7.6	15.4

Table A.II.1.6d:

COMPOSITION OF EOM AND CHROMATOGRAPHIC FRACTIONS

IKUNO	DEPTH (m)	SAMPLE TYPE	ASPH / EOM (%)	SAT / EOM (%)	ARO / EOM (%)	HC / EOM (%)	POLAR / EOM (%)	SAT / ARO x 100	HC / NONHC x 100
E7753	48.00	CORE	10.7	0.0	0.0	0.0	5.4	-1.0	0.0
E6994	89.68	CORE	5.1	65.6	12.2	77.8	10.3	537.5	350.5
E7774	89.69	CORE	9.5	47.4	11.6	59.0	9.0	409.1	144.1
E7784	99.11	CORE	7.6	0.0	0.0	0.0	12.2	-1.0	0.0
E6995	101.20	CORE	34.8	14.0	19.2	33.2	19.2	72.7	49.6

Legend:
-1 = Data are not available or cannot be calculated.

IKU SINTEF-GRUPPEN

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Location : 13/02-U-02
Date : 89.11.06

Table A.II.1.7:

RATIOS DERIVED FROM GAS CHROMATOGRAMS OF SATURATED HYDROCARBONS

IKUNO	FRAC NAME	DEPTH	Pri / Phy	A=Pri / n-C17	B=Phy / n-C18	A / B	n-C17 / n-C27	n-C31 / n-C19	CPI 1	CPI 2
E7753		48.00	0.9	1.1	0.8	1.3	0.8	0.6	1.0	1.0
E6994		89.68	1.6	0.3	0.2	1.5	3.0	0.2	1.1	1.0
E7774		89.69	1.8	0.4	0.2	1.7	3.3	0.2	1.0	0.9
E7784		99.11	0.8	0.6	0.5	1.0	1.2	0.3	1.1	1.0
E6995		101.20	1.3	0.4	0.4	1.1	2.5	0.3	1.4	1.5

Legend:

$$\text{CPI 1} = \frac{1}{2} \cdot \left(\frac{C_{25}+C_{27}+C_{29}+C_{31}}{C_{24}+C_{26}+C_{28}+C_{30}} + \frac{C_{25}+C_{27}+C_{29}+C_{31}}{C_{26}+C_{28}+C_{30}+C_{32}} \right)$$

$$\text{CPI 2} = \frac{2 \cdot C_{27}}{C_{26}+C_{28}}$$

Ratios involving pristane and phytane are calculated from peak areas.
All other ratios are calculated from peak heights.

Table A.II.1.8: *Molecular ratios from sterane and terpane mass chromatograms. Maturity characteristic ratios.*

Code	Depth (m)	αβ/αβ+βα[1] hopanes	%22S[2] ext. hopanes	%20S[3] steranes	%ββ[4] steranes	C_{30} hopene[5] / C_{30} hopane
Core 13/02-U-02						
E7753	48.00	0.96	56	27	66	-
E6994	89.68	0.79	12	15	54	0.16
E6995	101.20	0.84	35	21	56	0.12

1) E/(E+F) in m/z 191.

2) Average % distribution between first and second eluting isomers of extended hopanes.

3) 100 · q/(q+t) in m/z 217.

4) 100 · r+s/(q+t+2·(r+s)) in m/z 217.

5) 9/(9+E) in m/z 191.

Table A.II.1.9: *Molecular ratios from terpane and sterane mass chromatograms. Maturity and source characteristic ratios.*

Code	Depth (m)	Q/E[1] terpanes	Tm/Ts[2] terpanes	X/E[3] terpanes	Z/E[4] terpanes	a/(a+j)[5] steranes
Core 13/02-U-02						
E7553	48.00	-	2.50	-	-	0.81
E6994	89.68	-	3.28	-	-	0.00
E6995	101.20	-	1.91	-	-	0.32

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 A.II.1.10: Internal distribution of 14α(H),17α(H), 20R C_{27}, C_{28} and C_{29} regular steranes.

IKUNO	DEPTH m	C_{27} %	C_{28} %	C_{29} %[1)]
Core 13/02-U-02				
E7753	48.00	46.4	17.9	35.7
E6994	89.68	46.8	21.7	31.5
E6995	101.20	43.8	21.9	34.3

[1)] height distribution of peaks j,p,t in m/z 217.

Table A.II.1.11: Molecular ratios from mass fragmentograms of aromatic steroid hydrocarbons.

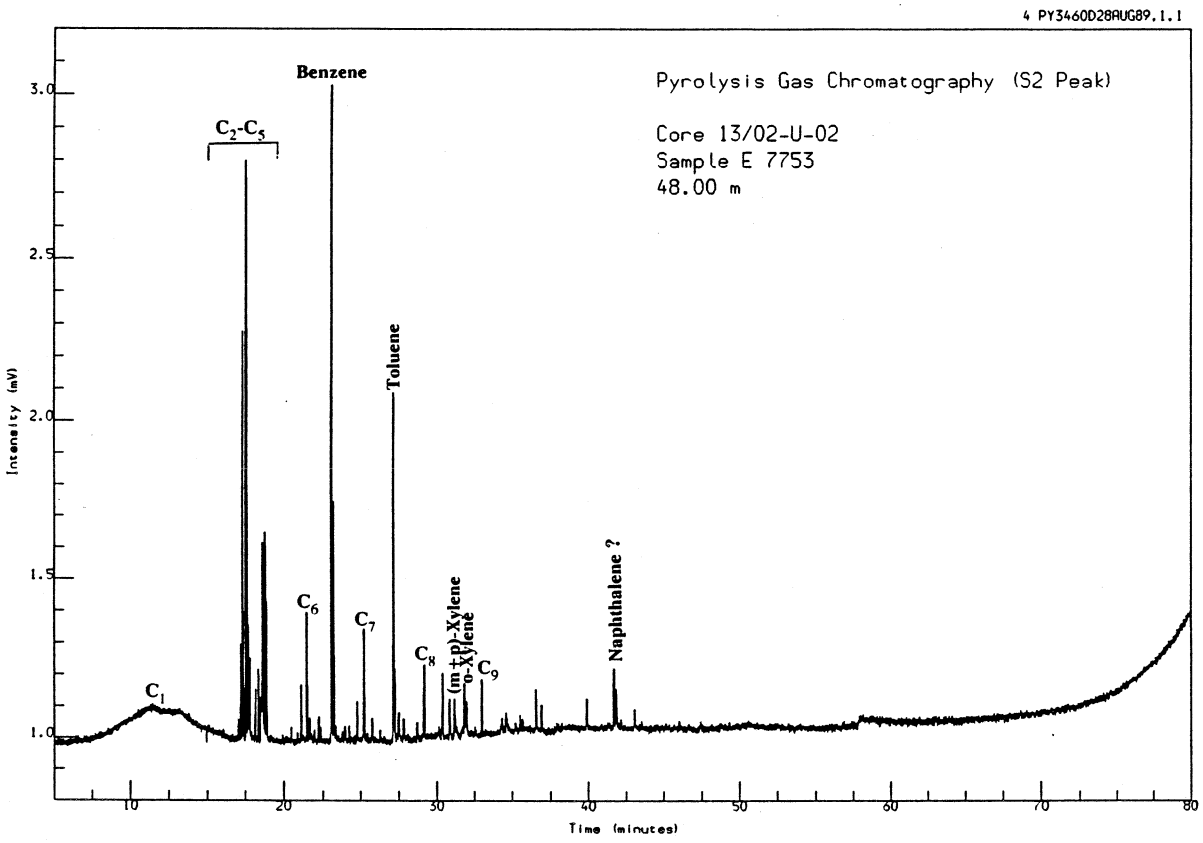
IKUNO	DEPTH	Cracking ratios			Aromatisation ratios	
	m	20/20+27 tri [1]	20/20+28 tri [2]	21/21+28 mono [3]	27t/27t+28m [4]	28t/28t+29m [5]
Core 13/02-U-02						
E7753	48.00	0.11	0.46	0.13	0.08	0.04
E6994	89.68	0.34	0.59	0.10	0.09	0.02
E6995	101.20	0.21	0.50	0.06	0.09	0.03

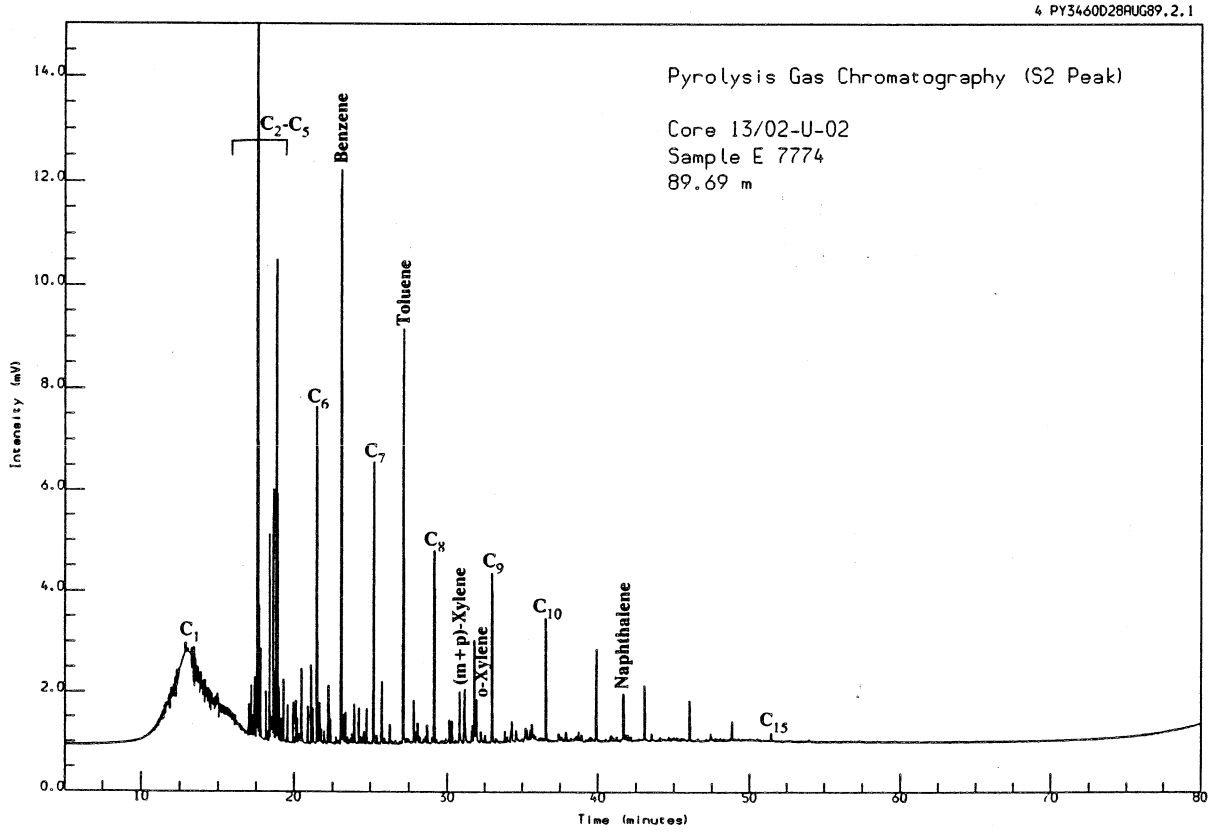
All ratios are given in fractions of 1.

[1] M/(M+P) in m/z 231 (Mackenzie et al. 1981, main text).
[2] M/(M+S) in m/z 231 (Mackenzie et al. 1981, note added in proof).
[3] a/(a+h) in m/z 253 (Mackenzie et al. 1981, note added in proof).
[4] P/(P+h) in m/z 231 and 253. (Mackenzie et al. 1981, main text)
[5] S/(S+m+(k*S/(S+R))) (Mackenzie et al. 1981, note added in proof).
-1 = Data are not available or cannot be calculated.

Figure A.II.1.1:

Pyrolysis-gas chromatograms (S2 peak)


4 PY3460D28AUG89.1.1
Pyrolysis Gas Chromatography (S2 Peak)
Core 13/02-U-02
Sample E 7753
48.00 m
Benzene
C2-C5
Toluene
C6
C7
C8
(m+p)-Xylene
o-Xylene
C9
Naphthalene ?
C1
Intensity (mV)
Time (minutes)


4 PY3460D28AUG89.2.1
Pyrolysis Gas Chromatography (S2 Peak)
Core 13/02-U-02
Sample E 7774
89.69 m
C2-C5
Benzene
Toluene
C6
C7
C8
C9
C10
(m+p)-Xylene
o-Xylene
Naphthalene
C15
C1
Intensity (mV)
Time (minutes)

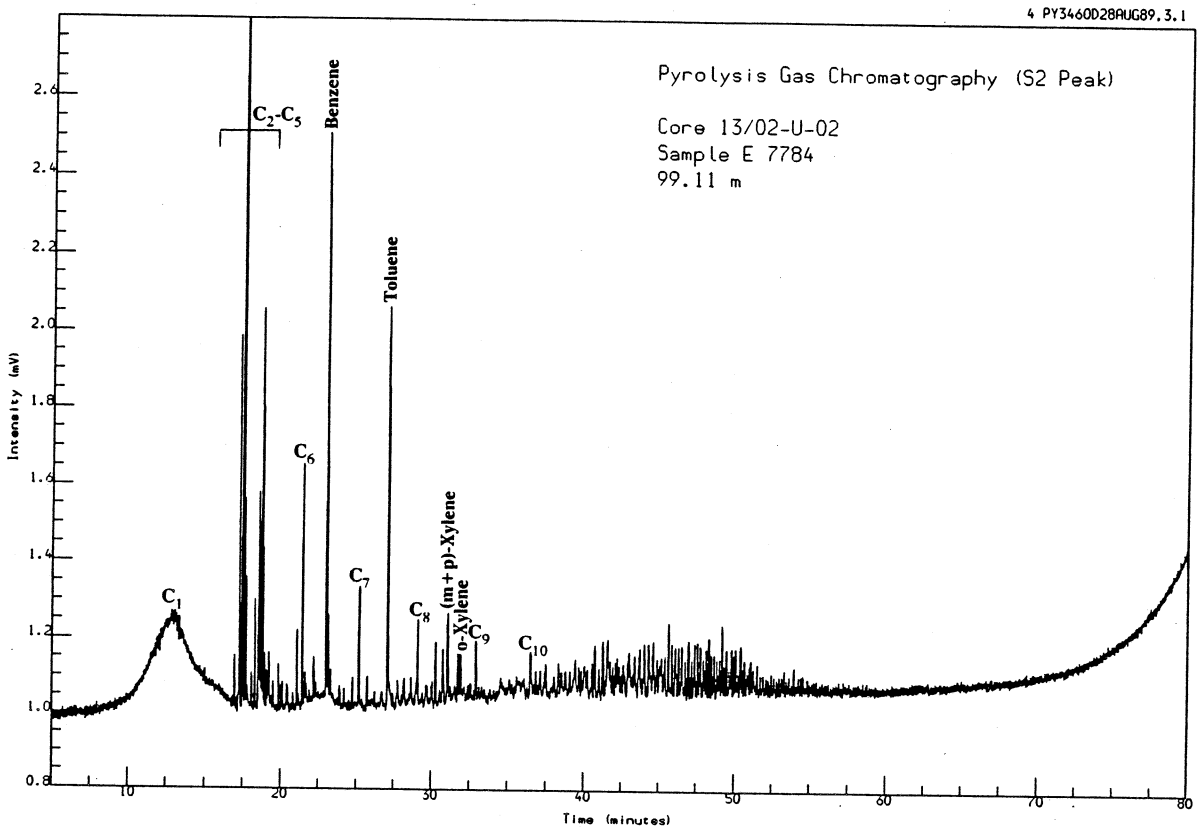
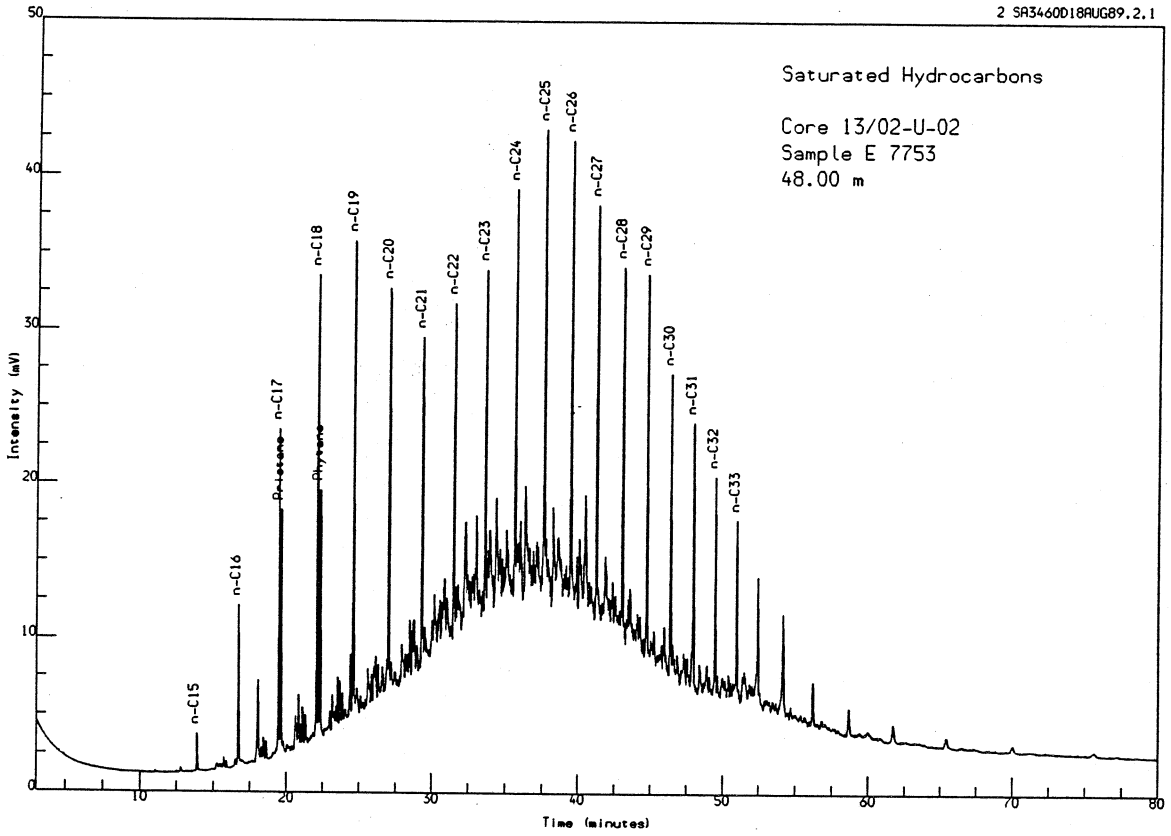

4 PY3460D28AUG89.3.1
Pyrolysis Gas Chromatography (S2 Peak)
Core 13/02-U-02
Sample E 7784
99.11 m
C2-C5
Benzene
Toluene
C6
C7
C8
(m+p)-Xylene
o-Xylene
C9
C10
C1
Intensity (mV)
Time (minutes)

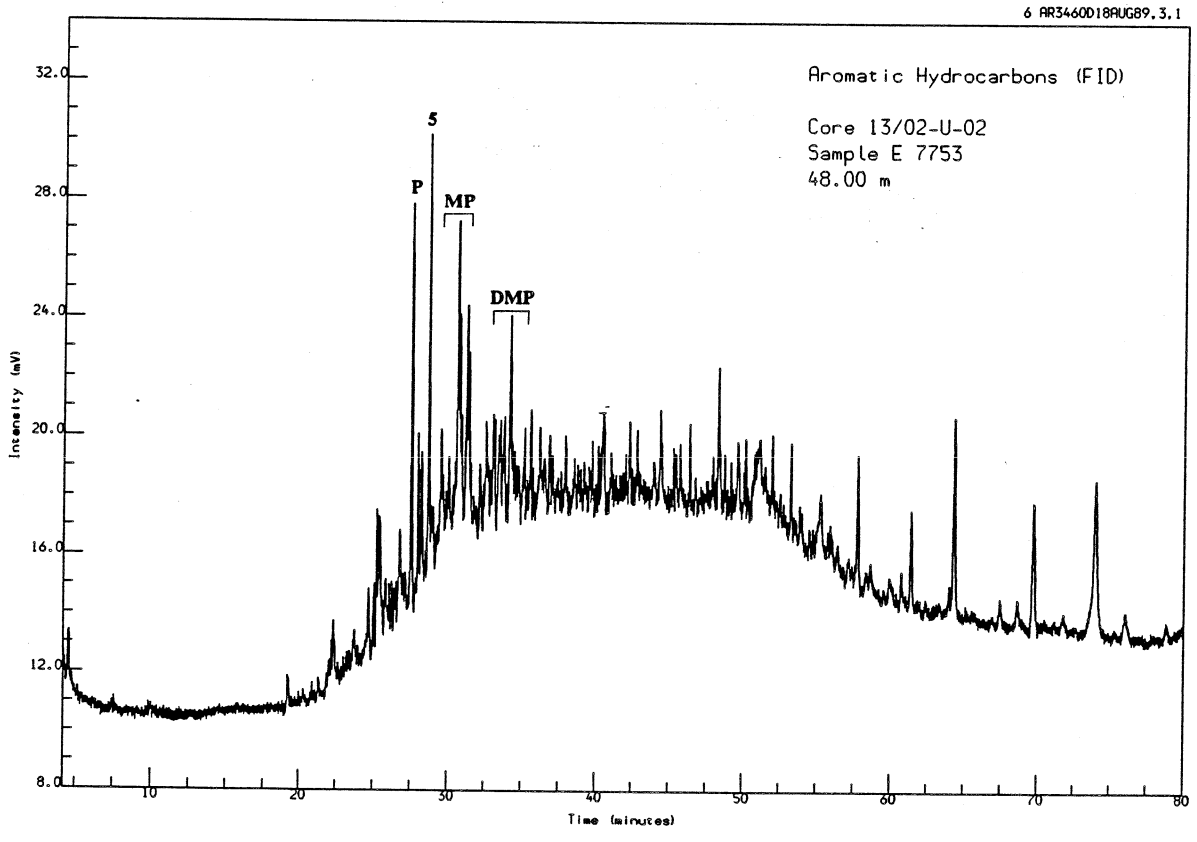
Figure A.II.1.2:

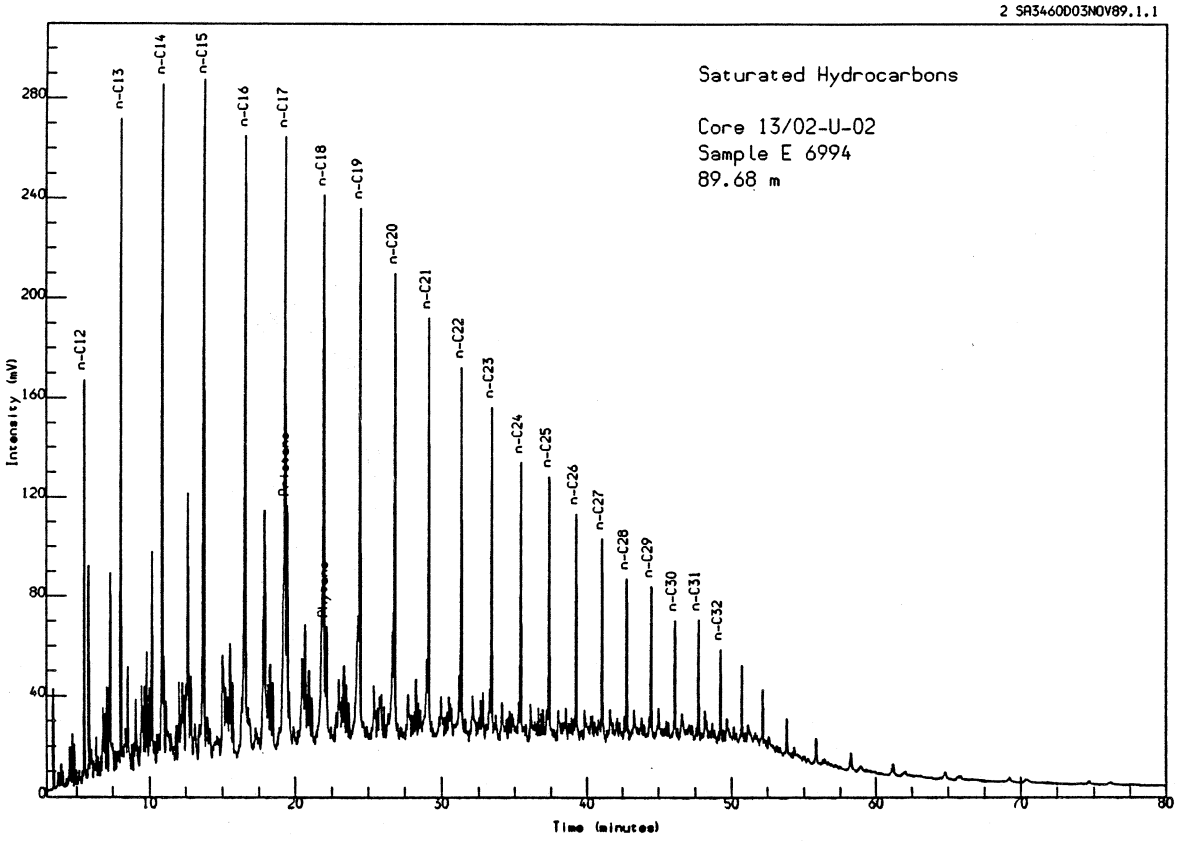
Gas chromatograms of saturated and aromatic hydrocarbons

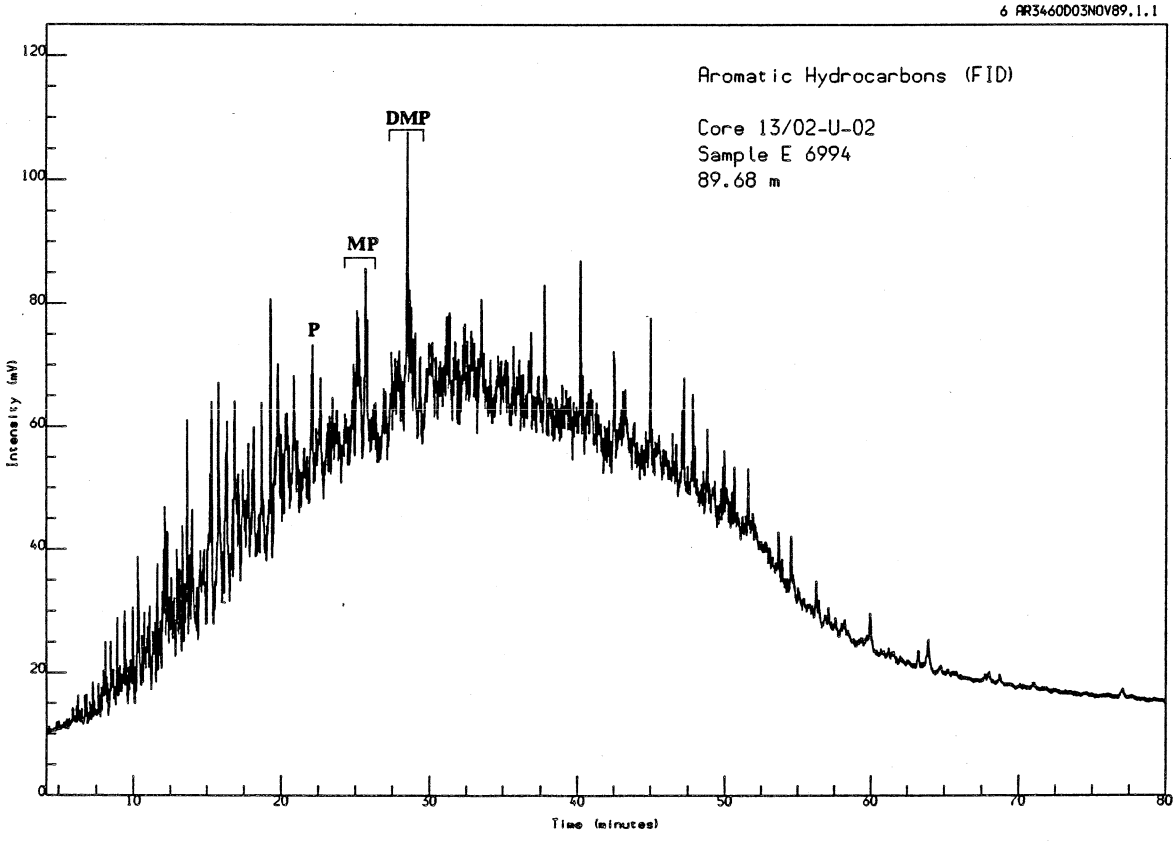
Peak code	Peak identity
n-C_{15} etc.	- n-alkanes
N	Naphthalene
MN	Methylnaphthalenes
DMN	Dimethylnaphthalenes
TMN	C_3-naphthalenes
P	Phenanthrene
PN	Methylphenanthrenes
DMP	Dimethylphenanthrenes
1	Cadalene (C_5-Naphthalene)
2	C_6-Naphthalene
3	C_{14}-Benzene
4	unidentified
7	Dehydroabietine (?)
8	Dehydroabietane (?)
9	PAH, MW=202
10	Phenylnaphthalene
11	Simonellite
12	Retene
13	PAH, MW=218
14	PAH, MW=216
15	unidentified
16	PAH, MW=228
17	unidentified
18	PAH, MW=242
19	PAH, MW=252
20	PAH, MW=268
21	PAH, MW=252
22	PAH, MW=252
23	PAH, MW=268
24	PAH, MW=264
25	PAH, MW=276
26	PAH, MW=276
27	PAH, MW=292

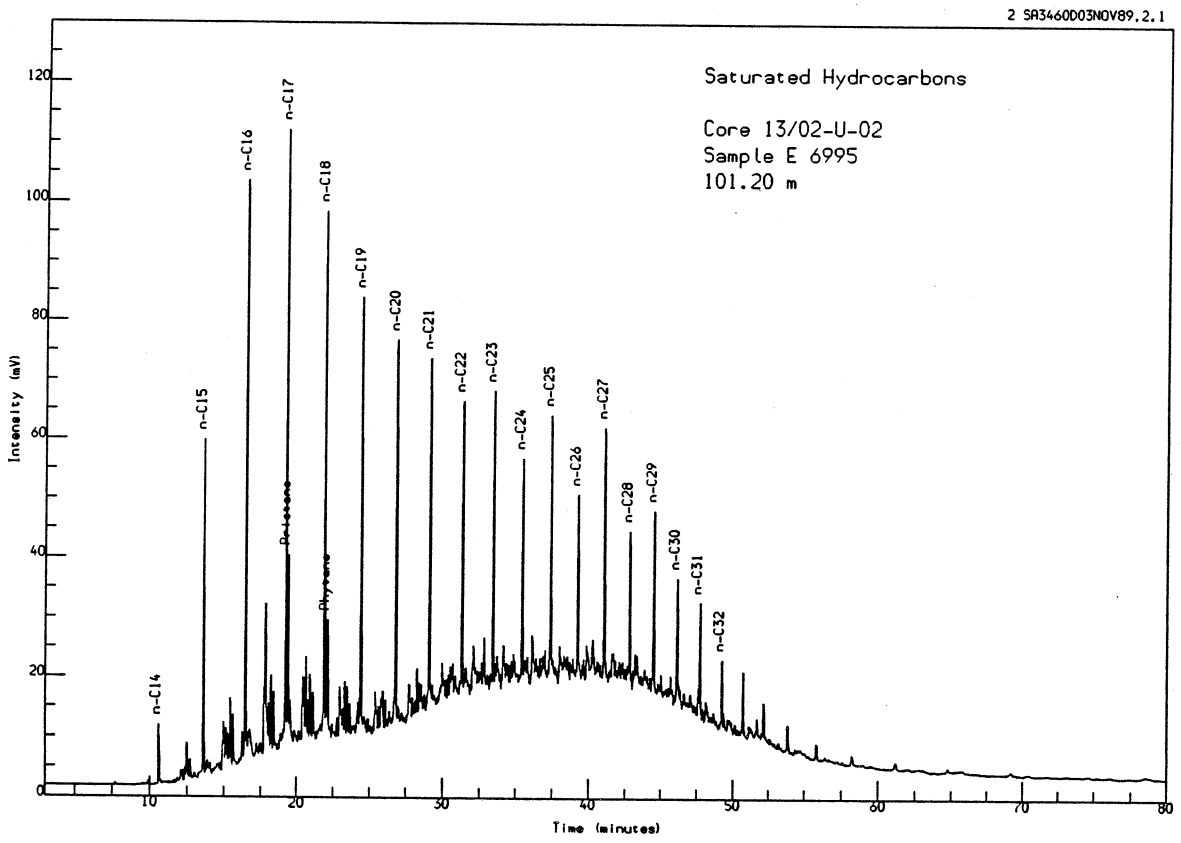
(PAH = Polcyclic aromatic hydrocarbon)


2 SA3460D18AUG89.2.1
Saturated Hydrocarbons
Core 13/02-U-02
Sample E 7753
48.00 m
Intensity (mV)
Time (minutes)
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


6 AR3460D18AUG89.3.1
Aromatic Hydrocarbons (FID)
Core 13/02-U-02
Sample E 7753
48.00 m
Intensity (mV)
Time (minutes)
P
5
MP
DMP


2 SA3460D03NOV89.1.1
Saturated Hydrocarbons
Core 13/02-U-02
Sample E 6994
89.68 m
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
Intensity (mV)
Time (minutes)


6 AR3460D03NOV89.1.1
Aromatic Hydrocarbons (FID)
Core 13/02-U-02
Sample E 6994
89.68 m
DMP
MP
P
Intensity (mV)
Time (minutes)


2 SA3460D03NOV89.2.1
Saturated Hydrocarbons
Core 13/02-U-02
Sample E 6995
101.20 m
Intensity (mV)
Time (minutes)
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

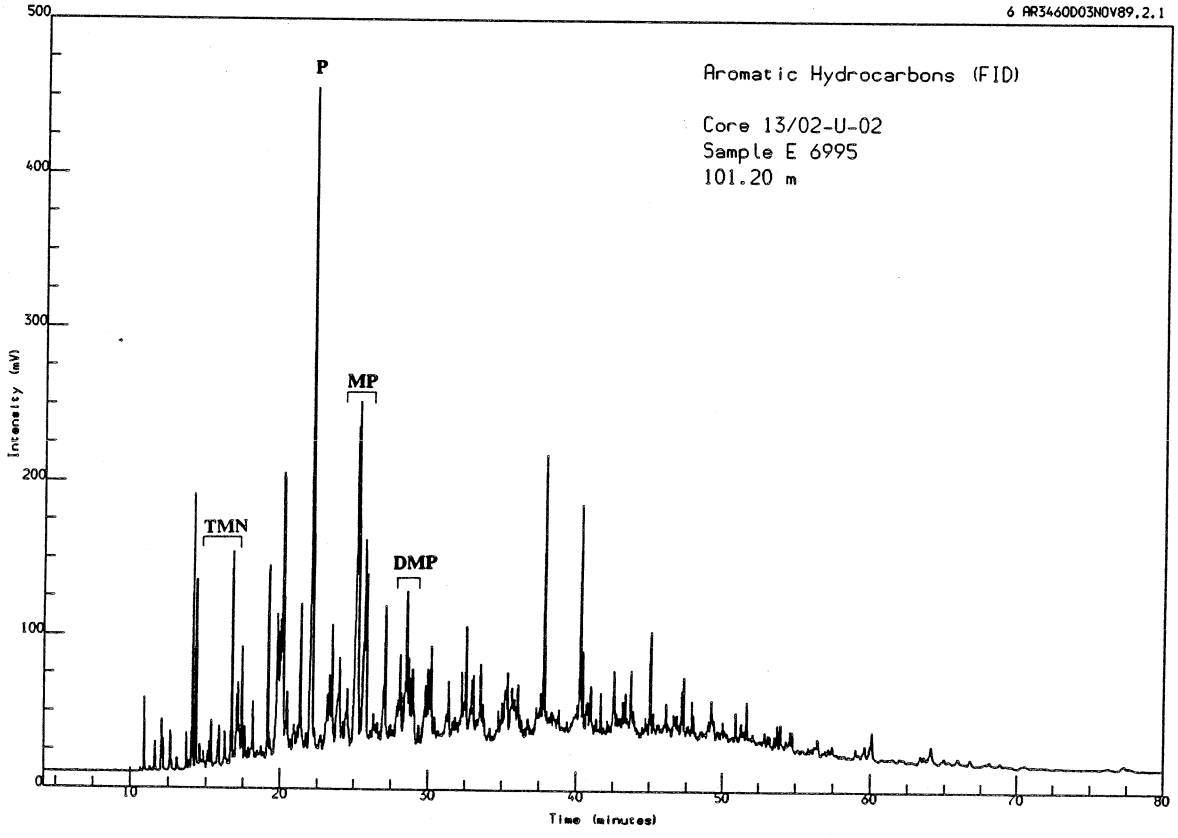

6 AR3460D03NOV89.2.1
Aromatic Hydrocarbons (FID)
Core 13/02-U-02
Sample E 6995
101.20 m
Intensity (mV)
Time (minutes)
P
MP
DMP
TMN

Figure A.II.1.3:

Mass fragmentograms of m/z 191, 205 (terpanes) and m/z 217, 218 (steranes).

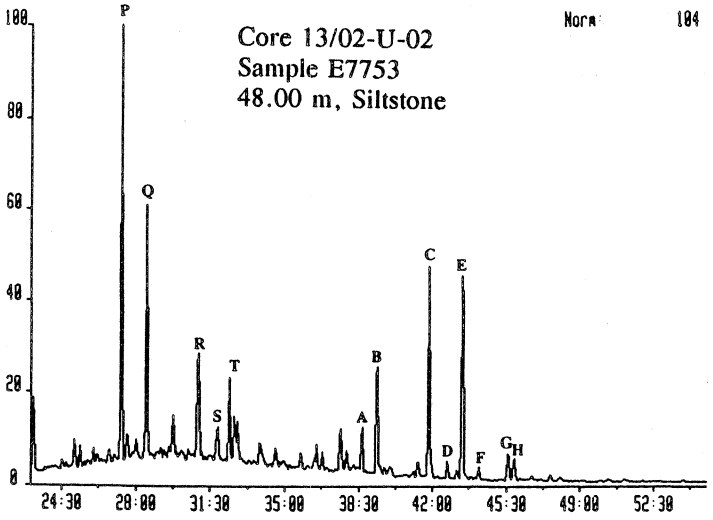
Key for m/z 191, 205 (terpanes):

Peak code	Identification	C-atoms : double bonds
P	C_{23} tricyclic terpane	($C_{23:0}$)
Q	C_{24} tricyclic terpane	($C_{24:0}$)
R	C_{25} tricyclic terpane (17R,17S)	($C_{25:0}$)
S	C_{24} tetracyclic terpane	($C_{24:0}$)
T	C_{26} tricyclic terpane (17R,17S)	($C_{26:0}$)
1	C_{27} hopene	($C_{27:1}$)
A	18α(H)-trisnorneohopane, Ts (?)	($C_{27:0}$)
B	17α(H)-trisnorhopane, Tm	($C_{27:0}$)
4	17β(H)-trisnorhopane	($C_{27:0}$)
5	nor-hop-$\Delta^{13(18)}$-ene	($C_{29:1}$)
C	17α(H), 21β(H)-norhopane	($C_{29:0}$)
6	hop-$\Delta^{17(21)}$-ene	($C_{30:1}$)
D	17β(H),21α(H)-norhopane (= normoretane)	($C_{29:0}$)
E	17α(H),21β(H)-hopane	($C_{30:0}$)
9	hop-$\Delta^{13(18)}$-ene	($C_{30:1}$)
10	17β(H),21β(H)-norhopane	($C_{29:0}$)
F	17β(H),21α(H)-hopane (= moretane)	($C_{30:0}$)
G	17α(H),21β(H)-homohopane (22S)	($C_{31:0}$)
H	17α(H),21β(H)-homohopane (22R)	($C_{31:0}$)
12	17β(H),21β(H)-hopane	($C_{30:0}$)
13	17β(H),21β(H)-homohopane	($C_{31:0}$)
I	17β(H),21α(H)-homohopane (= homomoretane)	($C_{31:0}$)
14	17β(H),21β(H)-bishomohopane	($C_{32:0}$)
15	17β(H),21β(H)-trishomohopane	($C_{33:0}$)
J	17α(H),21β(H)-bishomohopane (22S,22R)	($C_{32:0}$)
K	17α(H),21β(H)-trishomohopane (22S,22R)	($C_{33:0}$)
L	17α(H),21β(H)-tetrakishomohopane (22S,22R)	($C_{34:0}$)
M	17α(H),21β(H)-pentakishomohopane (22S,22R)	($C_{35:0}$)

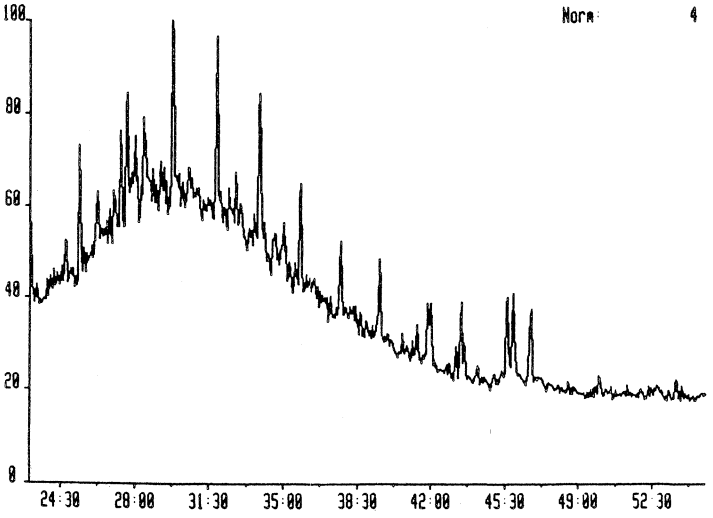
Key for m/z 217 and 218 (steranes):

Peak code	Identification	Formula
u	5α(H)-sterane	$C_{21}H_{36}$
v	5α(H)-sterane	$C_{22}H_{38}$
a	13β(H),17α(H)-diasterane (20S)	$C_{27}H_{48}$
b	13β(H),17α(H)-diasterane (20R)	$C_{27}H_{48}$
c	13α(H),17β(H)-diasterane (20S)	$C_{27}H_{48}$
d	13α(H),17β(H)-diasterane (20R)	$C_{27}H_{48}$
e	13β(H),17α(H)-diasterane (20S)	$C_{28}H_{50}$
f	13β(H),17α(H)-diasterane (20R)	$C_{28}H_{50}$
g	13α(H),17β(H)-diasterane (20S)	$C_{28}H_{50}$
	+ 14α(H),17α(H)-sterane (20S)	$C_{27}H_{48}$
h	13β(H),17α()H)-diasterane (20S)	$C_{29}H_{52}$
	+ 14β(H),17β(H)-sterane (20R)	$C_{27}H_{48}$
i	14β(H),17β(H)-sterane (20S)	$C_{27}H_{48}$
	+ 13α(H),17β(H)-diasterane (20R)	$C_{28}H_{50}$
j	14α(H),17α(H)-sterane (20R)	$C_{27}H_{48}$
k	13β(H),17α(H)-diasterane (20R)	$C_{29}H_{52}$
l	13α(H),17β(H)-diasterane (20S)	$C_{29}H_{52}$
m	14α(H),17α(H)-sterane (20S)	$C_{28}H_{50}$
n	13α(H),17β(H)-diasterane (20R)	$C_{29}H_{52}$
	+ 14β(H),17β(H)-sterane (20R)	$C_{28}H_{50}$
o	14β(H),17β(H)-sterane (20S)	$C_{28}H_{50}$
p	14α(H),17α(H)-sterane (20R)	$C_{28}H_{50}$
q	14α(H),17α(H)-sterane (20S)	$C_{29}H_{52}$
r	14β(H),17β(H)-sterane (20R)	$C_{29}H_{52}$
	+ unknown sterane	
s	14β(H),17β(H)-sterane (20S)	$C_{29}H_{52}$
t	14α(H),17α(H)-sterane (20R)	$C_{29}H_{52}$
*	diasterenes	

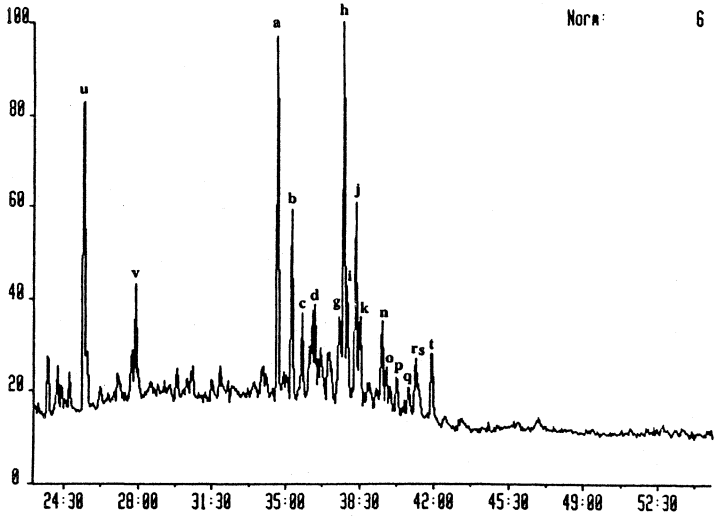
E7753SAT 1-NOV-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 191.1000
Text:21.3468.23 FARSUND 13/02-U-02 E-7753 SAT 48.00 M



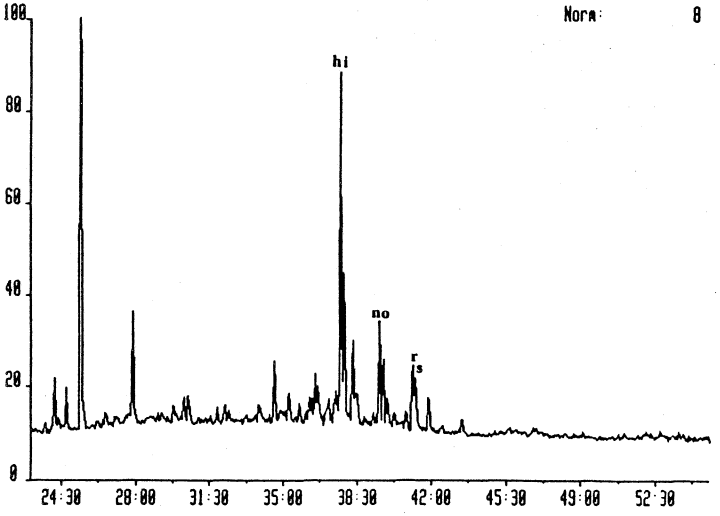
E7753SAT 1-NOV-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 205.1000
Text:21.3468.23 FARSUND 13/02-U-02 E-7753 SAT 48.00 M



E7753SAT 1-NOV-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 217.1000
Text:21.3468.23 FARSUND 13/02-U-02 E-7753 SAT 48.00 M

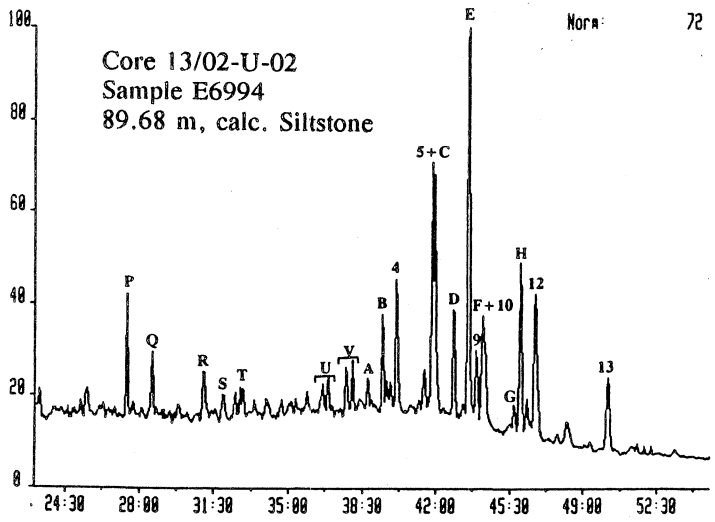


E7753SAT 1-NOV-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 218.1000
Text:21.3468.23 FARSUND 13/02-U-02 E-7753 SAT 48.00 M

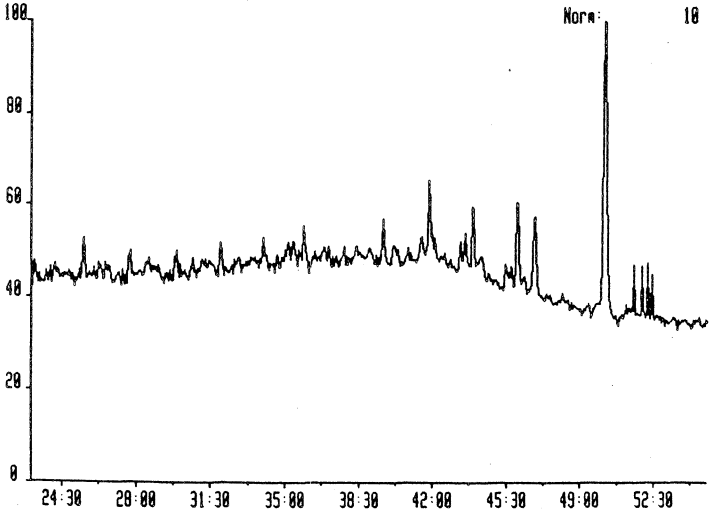


IKU SINTEF-GRUPPEN

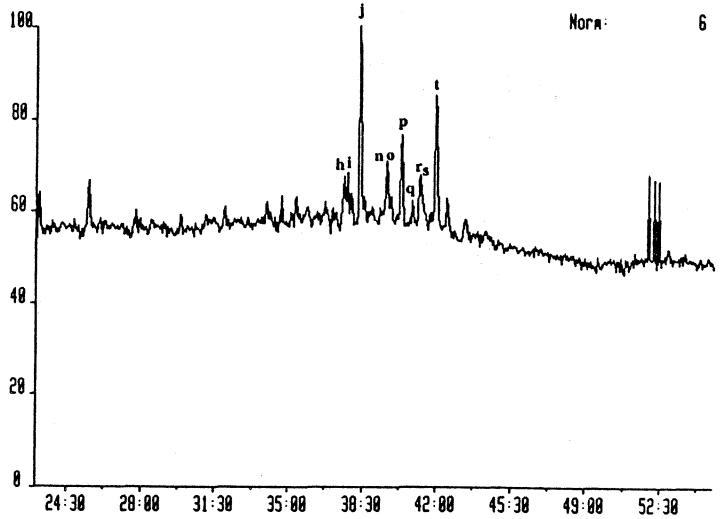
E6994SA1 6-NOV-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 191.1000
Text:21.3460 FARSUND 13/02-U-02 E6994 SAT 89.64 M



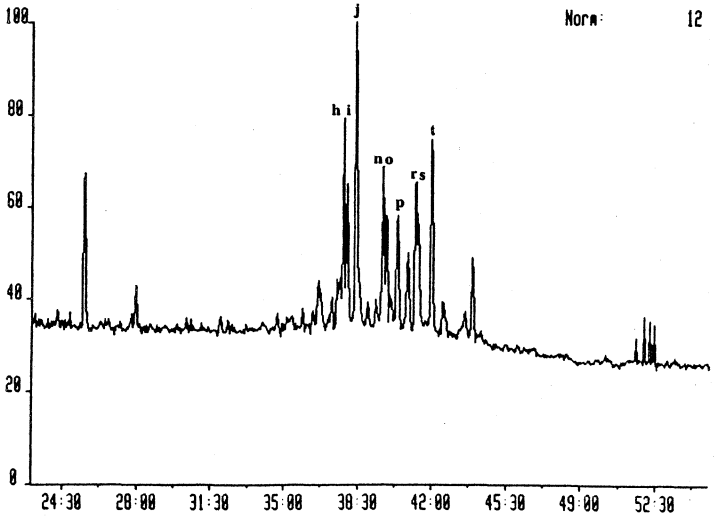
E6994SA1 6-NOV-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 205.1000
Text:21.3460 FARSUND 13/02-U-02 E6994 SAT 89.64 M



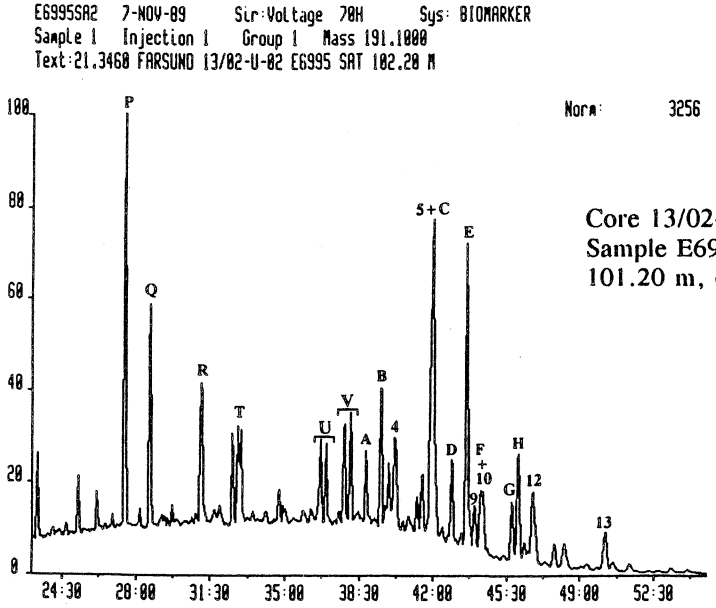
E6994SA1 6-NOV-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 217.1000
Text:21.3460 FARSUND 13/02-U-02 E6994 SAT 89.64 M



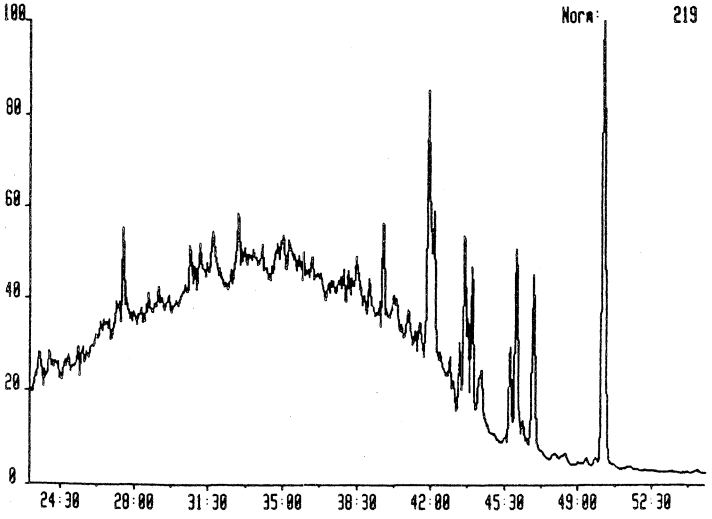
E6994SA1 6-NOV-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 218.1000
Text:21.3460 FARSUND 13/02-U-02 E6994 SAT 89.64 M

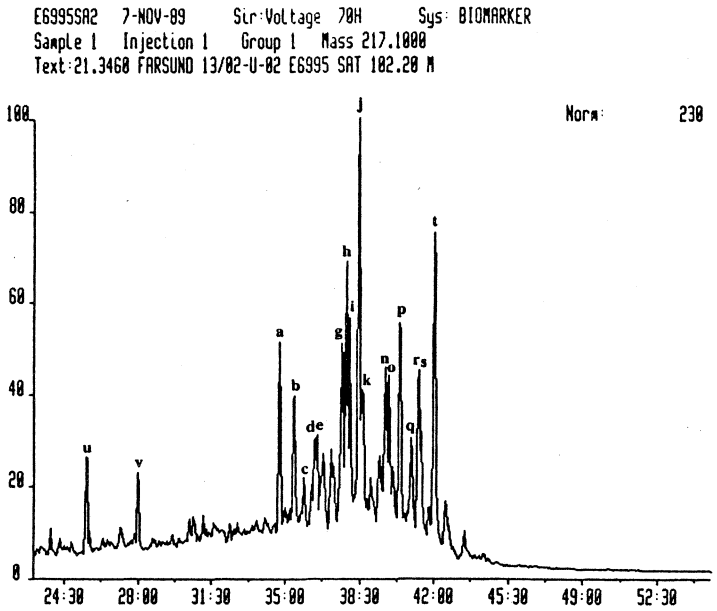


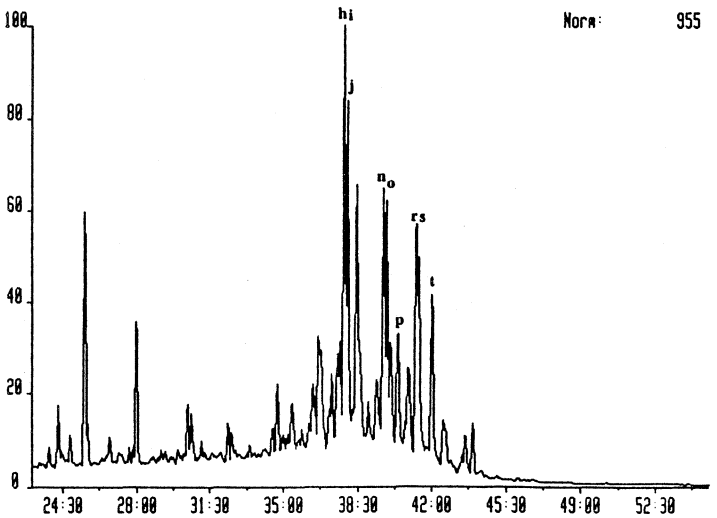
IKU SINTEF-GRUPPEN



Core 13/02-U-02
Sample E6995
101.20 m, calc. Claystone







IKU SINTEF-GRUPPEN

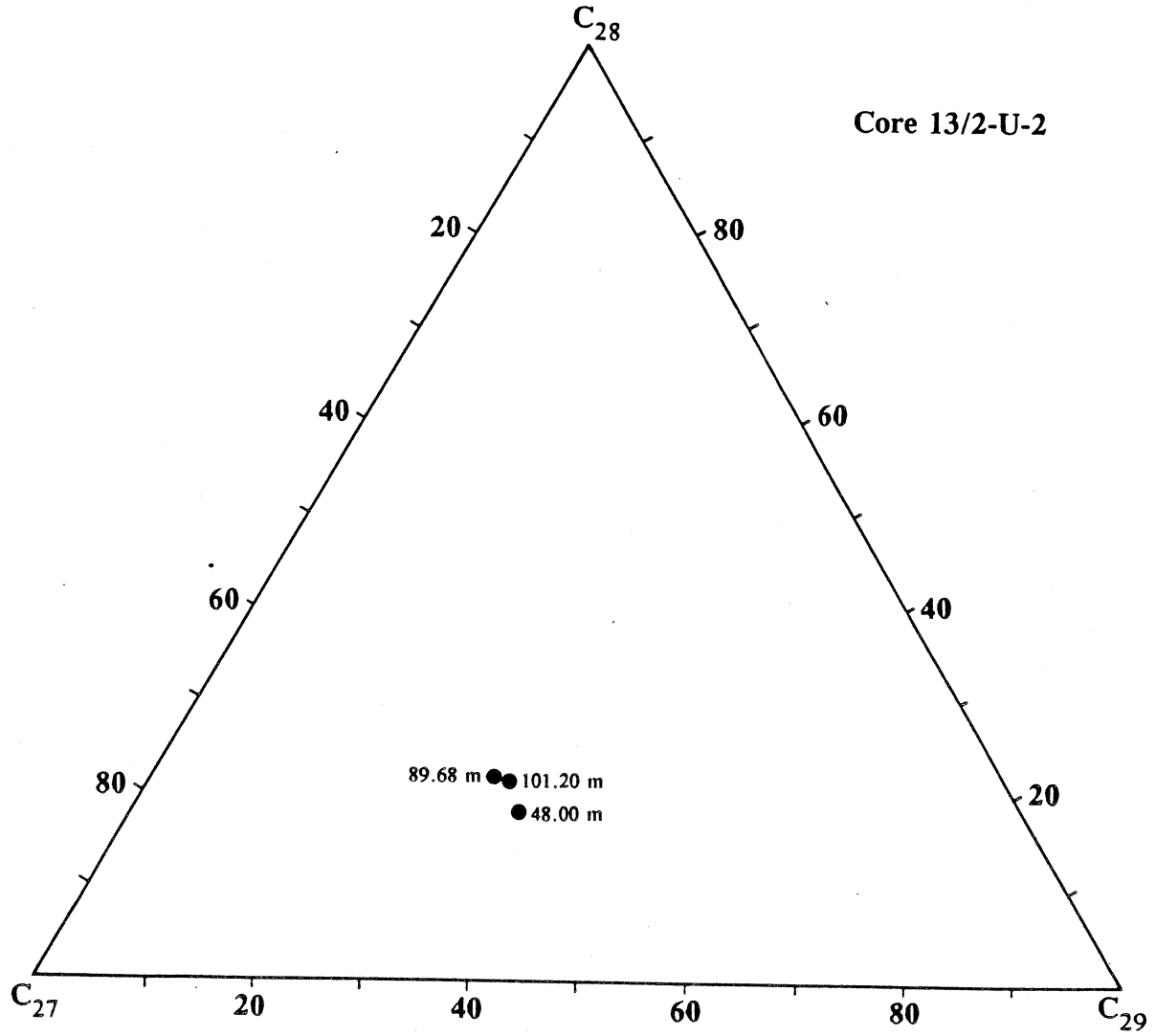


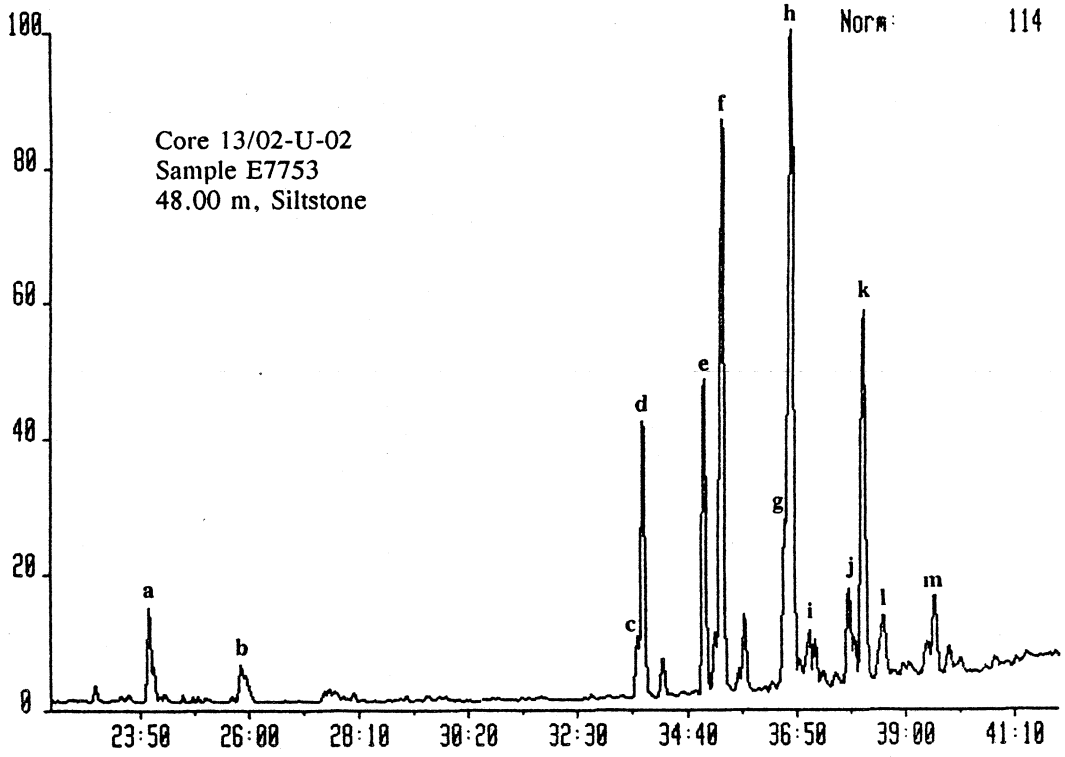
Figure A.II.1.4: *Internal distribution of 14α(H),17α(H) 20R, C_{27}, C_{28} and C_{29} regular steranes (from m/z 217).*

Figure A.II.1.5:

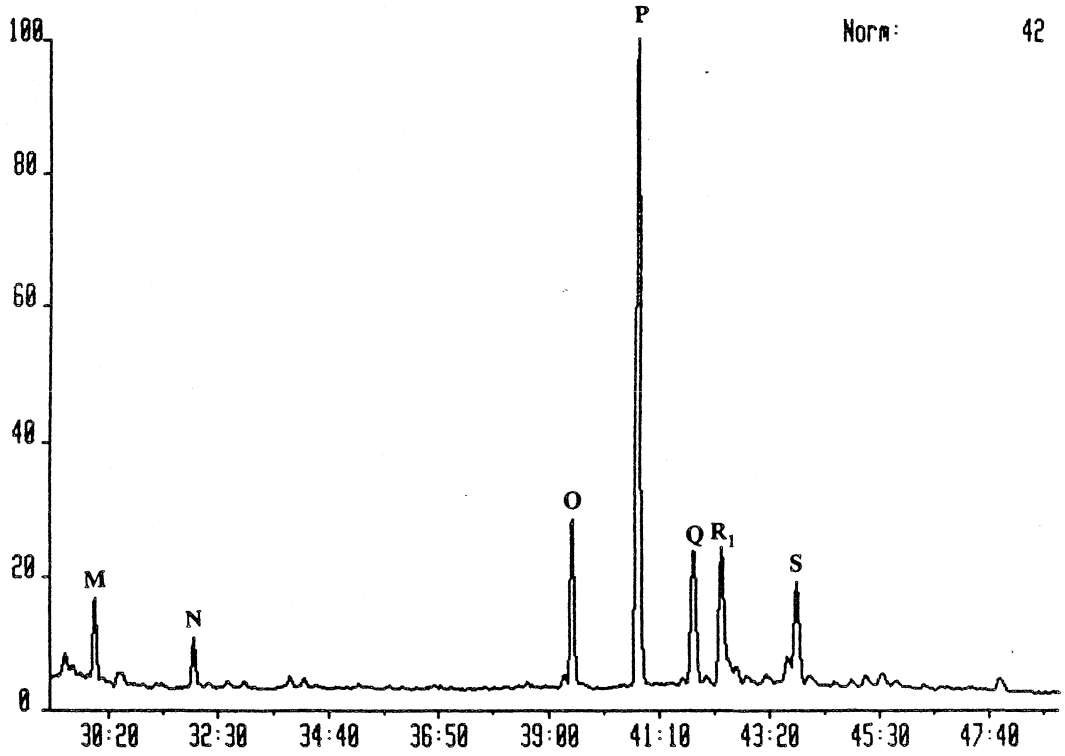
Mass fragmentograms of m/z 231, 253
(aromatic steroid hydrocarbons)

Peak code	Identification
Key for m/z 231 (tri-aromatic steroids):	
M	C_{20} tri-aromatic steroid
N	C_{21} tri-aromatic steroid
O	C_{26} tri-aromatic steroid
P	C_{26}+C_{27} tri-aromatic steroids
Q	C_{28} tri-aromatic steroid
R	C_{27} tri-aromatic steroid
S	C_{28} tri-aromatic steroid
Key for m/z 253 (mono-aromatic steroids):	
a	C_{21} mono-aromatic steroid
b	C_{22} mono-aromatic steroid
c	unidentified compound
d	C_{27} mono-aromatic steroid
e	C_{27} mono-aromatic steroid
f	C_{28} mono-aromatic steroid
g	C_{27} mono-aromatic steroid
h	C_{28}+C_{29} mono-aromatic steroids
i	C_{29} mono-aromatic steroids
j	C_{29} mono-aromatic steroids
k	unidentified compound
l	unidentified compound

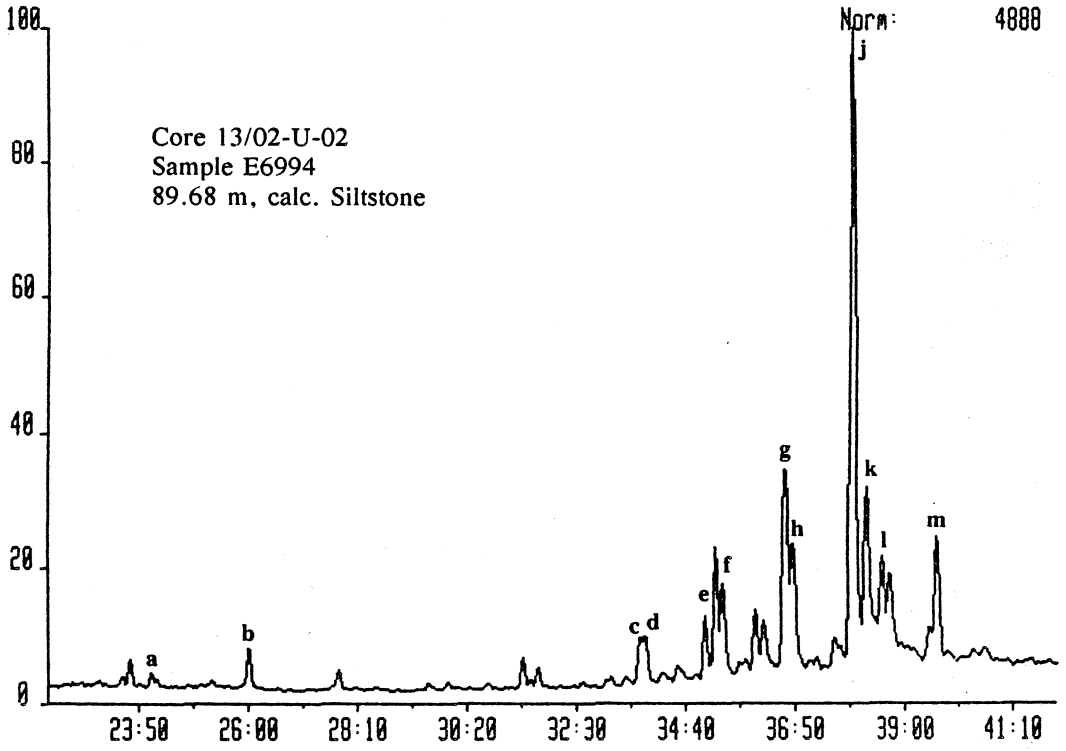
E7753ARO 3-NOV-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 253.1000
Text:21.3460 FARSUND 13/02-U-02 E7753 ARO 48.00 M



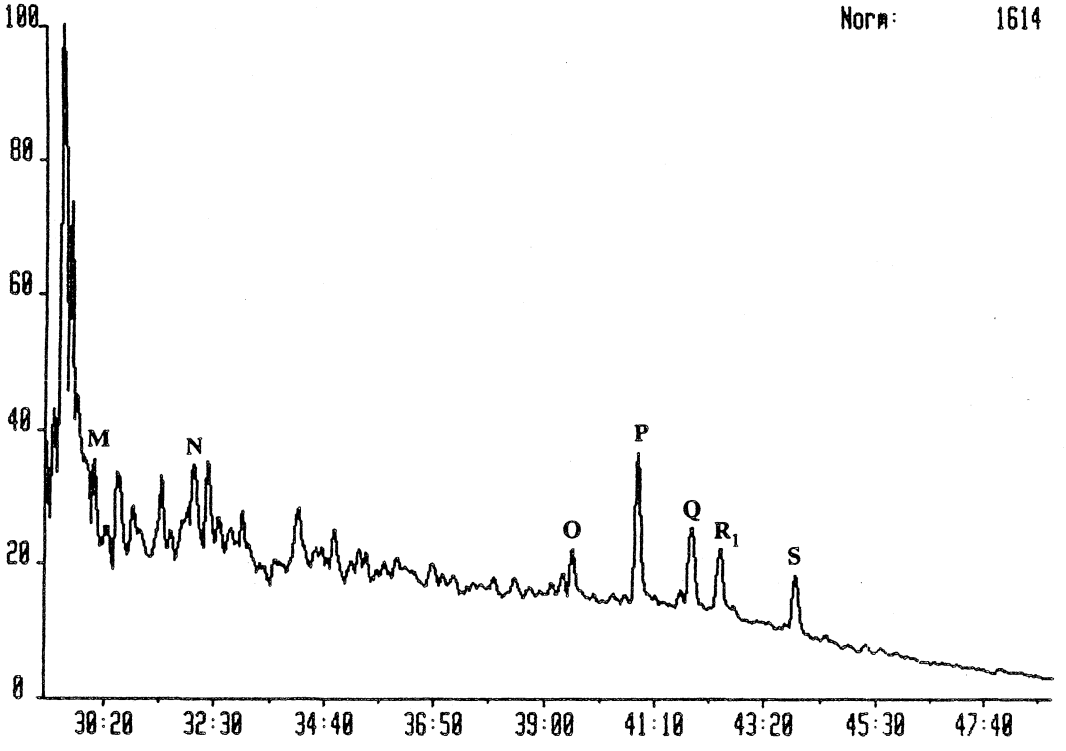
E7753ARO 3-NOV-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 231.1000
Text:21.3460 FARSUND 13/02-U-02 E7753 ARO 48.00 M



E6994ARO 3-NOV-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 253.1000
Text:21.3460 FARSUND 13/02-U-02 E6994 ARO 89.68 M

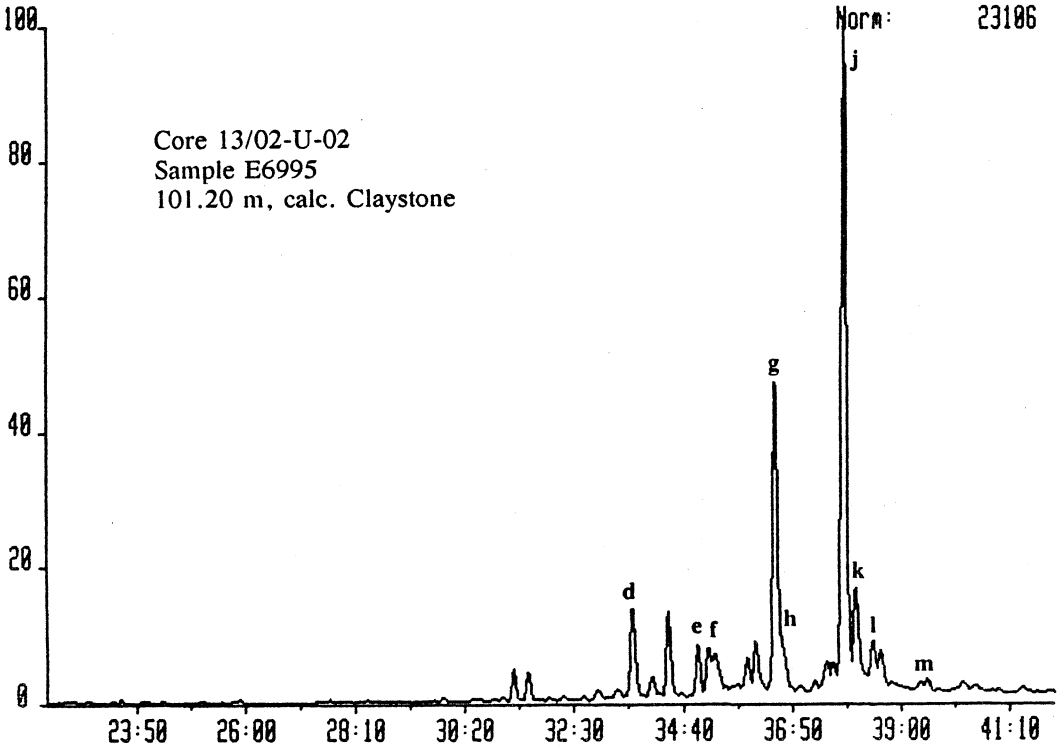


E6994ARO 3-NOV-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 231.1000
Text:21.3460 FARSUND 13/02-U-02 E6994 ARO 89.68 M



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E6995ARO 3-NOV-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 253.1000
Text:21.3460 FARSUND 13/02-U-02 E6995 ARO 101.20 M



E6995ARO 3-NOV-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 231.1000
Text:21.3460 FARSUND 13/02-U-02 E6995 ARO 101.20 M

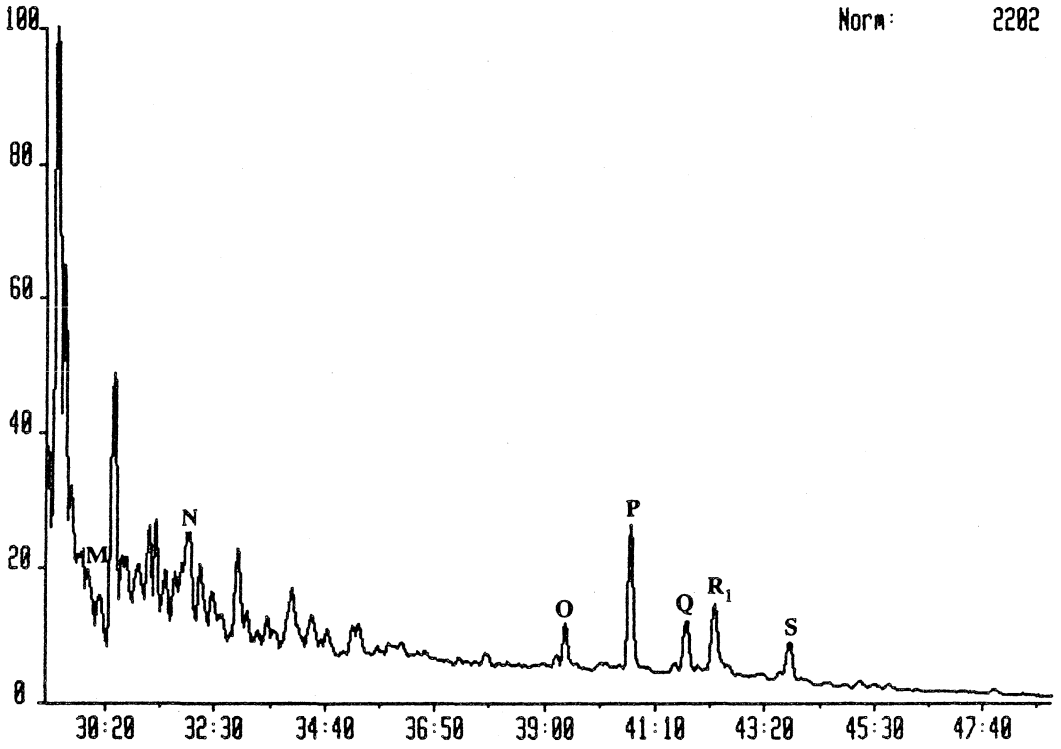
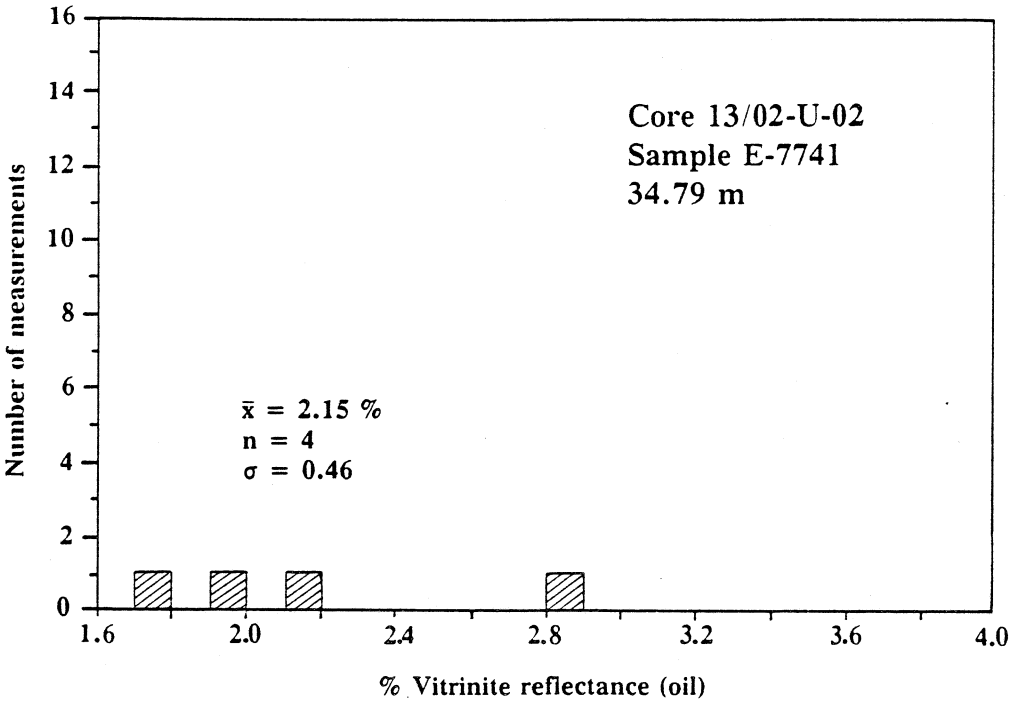
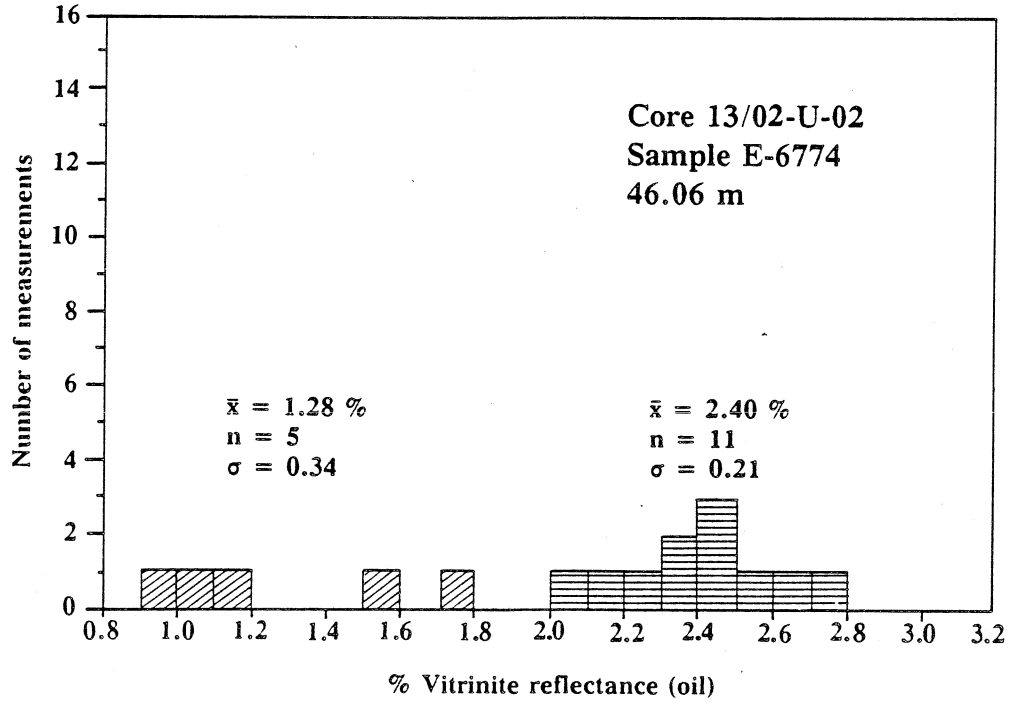
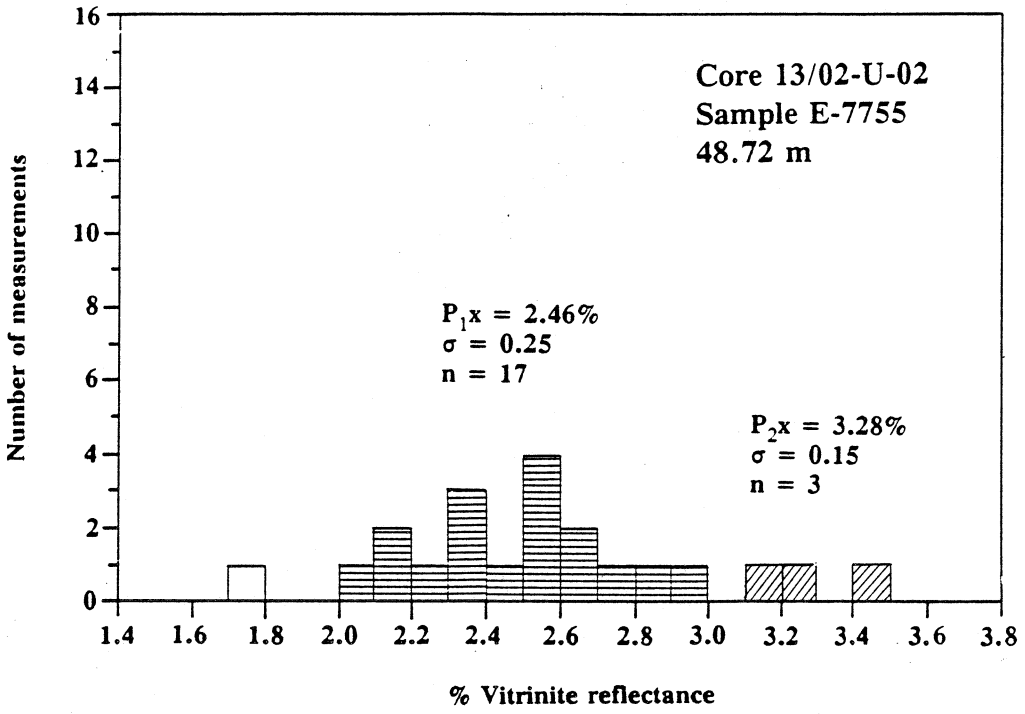
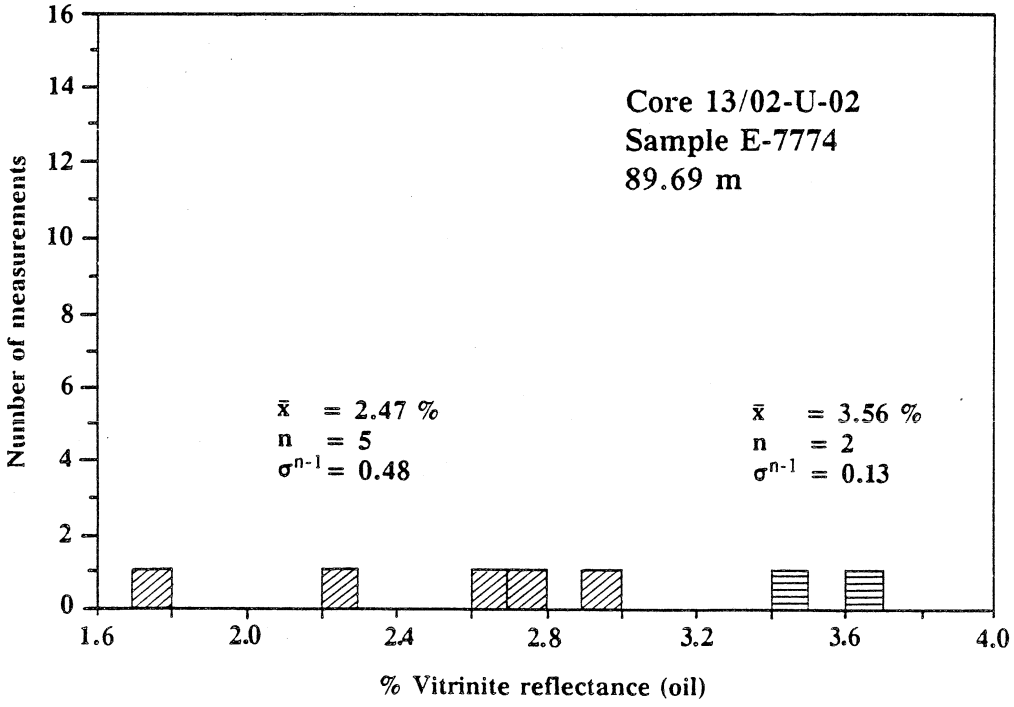


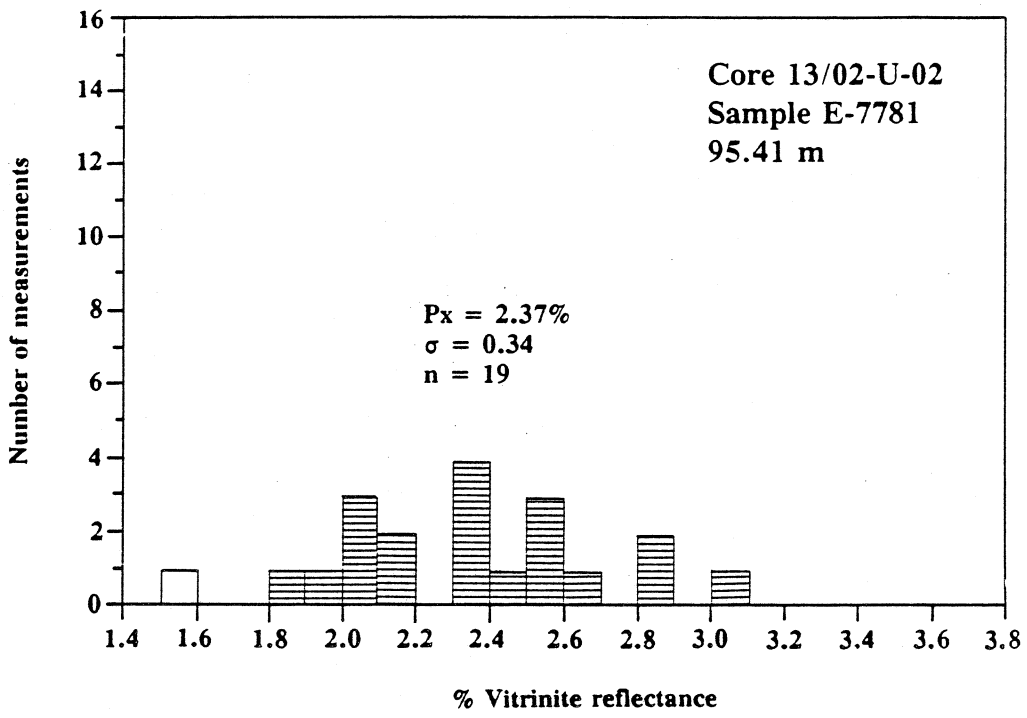
Figure A.II.1.6: Vitrinite reflectance histograms.


Core 13/02-U-02
Sample E-7741
34.79 m
x̄ = 2.15 %
n = 4
σ = 0.46
Number of measurements
% Vitrinite reflectance (oil)


Core 13/02-U-02
Sample E-6774
46.06 m
x̄ = 1.28 %
n = 5
σ = 0.34
x̄ = 2.40 %
n = 11
σ = 0.21
Number of measurements
% Vitrinite reflectance (oil)


Core 13/02-U-02
Sample E-7755
48.72 m
P_1x = 2.46%
σ = 0.25
n = 17
P_2x = 3.28%
σ = 0.15
n = 3
Number of measurements
% Vitrinite reflectance


Core 13/02-U-02
Sample E-7774
89.69 m
$\bar{x}$ = 2.47 %
n = 5
σ^{n-1} = 0.48
$\bar{x}$ = 3.56 %
n = 2
σ^{n-1} = 0.13
Number of measurements
% Vitrinite reflectance (oil)


Core 13/02-U-02
Sample E-7781
95.41 m
Px = 2.37%
σ = 0.34
n = 19
Number of measurements
% Vitrinite reflectance
0
2
4
6
8
10
12
14
16
1.4
1.6
1.8
2.0
2.2
2.4
2.6
2.8
3.0
3.2
3.4
3.6
3.8

IKU SINTEF-GRUPPEN

APPENDIX II.2: TABLE OF CONTENTS

Core 13/2-U-1

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Table A.II.2.1a: Concentration of C_1-C_{5+} hydrocarbons in headspace gas.
Table A.II.2.1b: Concentration of C_1-C_{5+} hydrocarbons in occluded gas.
Table A.II.2.1c: Concentration of C_1-C_{5+} hydrocarbons - summation.
Table A.II.2.2: Total organic carbon content and data from Rock-Eval pyrolysis.

IKU SINTEF-GRUPPEN

Project no.: 21346000
Location : 13/02-U-01
Date : 89.08.08

Table A.II.2.1a

TABLE OF GAS RESULTS

Headspace gas (µl gas pr. kg rock)

IKUNO	DEPTH (m)	C1	C2	C3	iC4	nC4	C5+	SUM C1-C4	SUM C2-C4	WET-NESS (%)	iC4 / nC4
E7708*)	69.49	0	0	0	0	0	0	0	0	-1.0	-1.00
E7716	84.03	0	0	0	0	0	0	0	0	-1.0	-1.00

Table A.II.2.1b

Occluded gas (µl gas pr. kg dry rock)

IKUNO	DEPTH (m)	C1	C2	C3	iC4	nC4	C5+	SUM C1-C4	SUM C2-C4	WET-NESS (%)	iC4 / nC4
E7708	69.49	501	40	25	0	2	0	568	67	11.8	0.00
E7716	84.03	474	51	25	0	8	53	558	84	15.0	0.00

Table A.II.2.1c

Summation of Headspace and Occluded gas

(µl gas pr. kg dry rock)

IKUNO	DEPTH (m)	C1	C2	C3	iC4	nC4	C5+	SUM C1-C4	SUM C2-C4	WET-NESS (%)	iC4 / nC4
E7708	69.49	501	40	25	0	2	0	568	67	11.8	0.00
E7716	84.03	474	51	25	0	8	53	558	84	15.1	0.00

Legend:
-1: Data are not available or cannot be determined.
*): Lid jumped off the can when this was taken out from the deep-freezer.

IKU SINTEF-GRUPPEN

Project no.: 21346000
Location : 13/02-U-01
Date : 89.08.07

Table A.II.2.2

DATA FROM ROCK EVAL PYROLYSIS

IKUNO	FRAC NAME	DEPTH (m)	SAMPLE TYPE	S1 (mg/g rock)	S2 (mg/g rock)	TOC (%)	HYDRO. INDEX (mg/g TOC)	PETR. POTEN. S1+S2	PROD. INDEX S1/(S1+S2)	Tmax (°C)
E7709		69.31	CORE	0.01	0.02	0.26	8	0.03	0.33	-1
E7708		69.49	CORE	0.00	0.00	0.11	0	0.00	-1.00	(391)
E7716		84.03	CORE	0.00	0.00	0.10	0	0.00	-1.00	-1
E6763		86.45	CORE	0.01	0.00	0.27	0	0.01	1.00	(342)

Legend:
-1 - No data available.
Comment:
All values, except for the TOC content, are unreliable due to the scarcity of organic material in the samples.

APPENDIX II.3: TABLE OF CONTENTS

Core 13/1-U-1

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Table A.II.3.1b:	Concentration of C_1-C_{5+} hydrocarbons in occluded gas.
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Figure A.II.3.3:	Mass fragmentograms of m/z 191, 205 (terpanes) and m/z 217, 218 (steranes).
Figure A.II.3.4:	Internal distribution of 14α(H),17α(H) 20R, C_{27}, C_{28} and C_{29} regular steranes (from m/z 217).
Figure A.II.3.5:	Mass fragmentograms of m/z 231, 253 (aromatic steroid hydrocarbons).
Figure A.II.3.6:	Vitrinite reflectance histograms.

IKU SINTEF-GRUPPEN

Project no.: 21346000
Location : 13/01-U-01
Date : 89.08.08

Table A.II.3.1a

TABLE OF GAS RESULTS

Headspace gas (µl gas pr. kg rock)

IKUNO	DEPTH (m)	C1	C2	C3	iC4	nC4	C5+	SUM C1-C4	SUM C2-C4	WET-NESS (%)	iC4 --- nC4
E7184	68.48	4003	0	0	0	0	0	4003	0	0.0	-1.00
E7200	81.48	8476	0	0	0	0	0	8476	0	0.0	-1.00
E7220	92.38	7542	0	0	0	0	0	7542	0	0.0	-1.00
E7250	101.16	5499	0	0	0	0	0	5499	0	0.0	-1.00
E7265	108.42	3599	0	0	0	0	0	3599	0	0.0	-1.00
E6775	113.98	975	0	0	0	0	0	975	0	0.0	-1.00
E7296	126.32	0	0	0	0	0	0	0	0	-1.0	-1.00
E7309	137.18	0	0	0	0	0	0	0	0	-1.0	-1.00
E7315*)	145.90	936	0	0	0	0	0	936	0	0.0	-1.00
E7331	156.89	116	0	0	0	0	0	116	0	0.0	-1.00
E7337	163.51	2001	0	0	0	0	0	2001	0	0.0	-1.00
E7350	175.12	1579	0	0	0	0	0	1579	0	0.0	-1.00
E7379	186.65	6549	0	0	0	0	0	6549	0	0.0	-1.00
E7392	197.67	6983	0	0	0	0	0	6983	0	0.0	-1.00
E7404	205.03	2203	0	0	0	0	0	2203	0	0.0	-1.00
E7416	214.62	5129	0	0	0	0	0	5129	0	0.0	-1.00
E7431	224.57	6308	0	0	0	0	0	6308	0	0.0	-1.00
E7449	234.13	6711	0	0	0	0	0	6711	0	0.0	-1.00
E7462	241.67	9757	0	0	0	0	0	9757	0	0.0	-1.00
E7473	247.41	7998	0	0	0	0	0	7998	0	0.0	-1.00
E7490	255.54	5228	0	0	0	0	0	5228	0	0.0	-1.00
E7504	265.30	7969	0	0	0	0	0	7969	0	0.0	-1.00
E7516	275.13	3880	0	0	0	0	0	3880	0	0.0	-1.00
E7521	280.35	2884	0	0	0	0	0	2884	0	0.0	-1.00
E7537	291.17	5454	0	0	0	0	0	5454	0	0.0	-1.00

Legend:
-1: Data are not available or cannot be determined.
*): Lid jumped off the can when this was taken out from the deep-freezer. Can was immediately closed again and headspace gas was determined as usual.

IKU SINTEF-GRUPPEN

Project no.: 21346000
Location : 13/01-U-01
Date : 89.08.08

Table A.II.3.1b

TABLE OF GAS RESULTS

Occluded gas (µl gas pr. kg dry rock)

IKUNO	DEPTH (m)	C1	C2	C3	iC4	nC4	C5+	SUM C1-C4	SUM C2-C4	WET-NESS (%)	iC4 / nC4
E7184	68.48	2706	46	42	21	0	122	2815	109	3.8	-1.00
E7200	81.48	2320	47	58	31	27	135	2483	163	6.5	1.15
E7220	92.38	6377	69	58	30	26	141	6560	183	2.7	1.15
E7250	101.16	2328	37	31	12	0	95	2408	80	3.3	-1.00
E7265	108.42	8361	90	51	18	14	110	8534	173	2.0	1.29
E6775	113.98	2799	88	40	7	5	70	2939	140	4.7	1.40
E7296	126.32	306	54	24	0	2	0	386	80	20.7	0.00
E7309	137.18	274	36	18	0	2	0	330	56	16.9	0.00
E7315	145.90	1628	20	4	0	0	0	1652	24	1.4	-1.00
E7331	156.89	653	69	0	0	13	111	735	82	11.1	0.00
E7337	163.51	6005	74	19	0	8	0	6106	101	1.6	0.00
E7350	175.12	3865	168	62	0	7	89	4102	237	5.7	0.00
E7379	186.65	5557	113	51	3	5	78	5729	172	3.0	0.60
E7392	197.67	3559	72	40	10	20	67	3701	142	3.8	0.50
E7404	205.03	2232	38	20	4	4	0	2298	66	2.8	1.00
E7416	214.62	3661	90	70	8	8	94	3837	176	4.5	1.00
E7431	224.57	4181	83	57	9	11	0	4341	160	3.6	0.82
E7449	234.13	3683	79	65	10	10	104	3847	164	4.2	1.00
E7462	241.67	7376	150	119	16	18	190	7679	303	3.9	0.89
E7473	247.41	5159	125	104	12	14	153	5414	255	4.7	0.86
E7490	255.54	5871	112	61	2	2	0	6048	177	2.9	1.00
E7504	265.30	3381	79	46	0	0	0	3506	125	3.5	-1.00
E7516	275.13	6646	114	54	2	4	25	6820	174	2.5	0.50
E7521	280.35	3401	108	60	15	20	18	3604	203	5.6	0.75
E7537	291.17	5896	123	52	5	9	72	6085	189	3.1	0.56

Legend:
-1: Data are not available or cannot be determined.

IKU SINTEF-GRUPPEN

Project no.: 21346000
Location : 13/01-U-01
Date : 89.08.08

Table A.II.3.1c

TABLE OF GAS RESULTS

Summation of Headspace and Occluded gas

(µl gas pr. kg dry rock)

IKUNO	DEPTH (m)	C1	C2	C3	iC4	nC4	C5+	SUM C1-C4	SUM C2-C4	WET-NESS (%)	iC4 / nC4
E7184	68.48	6709	46	42	21	0	122	6818	109	1.6	-1.00
E7200	81.48	10796	47	58	31	27	135	10959	163	1.5	1.15
E7220	92.38	13919	69	58	30	26	141	14102	183	1.3	1.15
E7250	101.16	7827	37	31	12	0	95	7907	80	1.0	-1.00
E7265	108.42	11960	90	51	18	14	110	12133	173	1.4	1.29
E6775	113.98	3774	88	40	7	5	70	3914	140	3.6	1.40
E7296	126.32	306	54	24	0	2	0	386	80	20.7	0.00
E7309	137.18	274	36	18	0	2	0	330	56	17.0	0.00
E7315	145.90	2564	20	4	0	0	0	2588	24	0.9	-1.00
E7331	156.89	769	69	0	0	13	111	851	82	9.6	0.00
E7337	163.51	8006	74	19	0	8	0	8107	101	1.2	0.00
E7350	175.12	5444	168	62	0	7	89	5681	237	4.2	0.00
E7379	186.65	12106	113	51	3	5	78	12278	172	1.4	0.60
E7392	197.67	10542	72	40	10	20	67	10684	142	1.3	0.50
E7404	205.03	4435	38	20	4	4	0	4501	66	1.5	1.00
E7416	214.62	8790	90	70	8	8	94	8966	176	2.0	1.00
E7431	224.57	10489	83	57	9	11	0	10649	160	1.5	0.82
E7449	234.13	10394	79	65	10	10	104	10558	164	1.6	1.00
E7462	241.67	17133	150	119	16	18	190	17436	303	1.7	0.89
E7473	247.41	13157	125	104	12	14	153	13412	255	1.9	0.86
E7490	255.54	11099	112	61	2	2	0	11276	177	1.6	1.00
E7504	265.30	11350	79	46	0	0	0	11475	125	1.1	-1.00
E7516	275.13	10526	114	54	2	4	25	10700	174	1.6	0.50
E7521	280.35	6285	108	60	15	20	18	6488	203	3.1	0.75
E7537	291.17	11350	123	52	5	9	72	11539	189	1.6	0.56

Legend:
-1: Data are not available or cannot be determined.

IKU SINTEF-GRUPPEN

Project no.: 21346000
Location : 13/01-U-01
Date : 89.11.14

Table A.II.3.2:
DATA FROM ROCK EVAL PYROLYSIS

IKUNO	FRAC NAME	DEPTH (m)	SAMPLE TYPE	S1 (mg/g rock)	S2 (mg/g rock)	TOC (%)	HYDRO. INDEX (mg/g TOC)	PETR. POTEN. S1+S2	PROD. INDEX S1/(S1+S2)	Tmax (°C)
E7178		66.80	CORE	0.00	0.44	1.19	37	0.44	0.00	419
E7181		67.22	CORE	0.04	0.54	1.26	43	0.58	0.07	418
E7180		67.85	CORE	0.04	1.03	1.41	73	1.07	0.04	425
E7179		68.38	CORE	0.02	0.34	1.03	33	0.36	0.06	423
E7184		68.48	CORE	0.02	0.26	1.02	25	0.28	0.07	421
E7185		68.88	CORE	0.04	0.48	1.05	46	0.52	0.08	420
E7187		70.24	CORE	0.05	0.31	0.94	33	0.36	0.14	422
E7188		70.93	CORE	0.05	0.48	1.08	44	0.53	0.09	424
E7190		71.39	CORE	0.05	0.56	1.08	52	0.61	0.08	422
E7192		72.40	CORE	0.07	1.25	1.52	82	1.32	0.05	432
E7193		72.62	CORE	0.06	0.96	1.31	73	1.02	0.06	430
E7195		72.83	CORE	0.05	0.75	1.24	60	0.80	0.06	427
E7196		74.62	CORE	0.07	2.14	1.87	114	2.21	0.03	434
E7197		74.75	CORE	0.05	1.04	1.43	73	1.09	0.05	429
E7199		77.32	CORE	0.06	1.22	1.51	81	1.28	0.05	428
E7201		80.97	CORE	0.04	0.83	1.45	57	0.87	0.05	427
E7200		81.48	CORE	0.02	0.47	1.47	32	0.49	0.04	425
E7203		82.54	CORE	0.03	0.55	1.56	35	0.58	0.05	425
E7206		83.24	CORE	0.05	0.68	1.33	51	0.73	0.07	428
E7207		83.86	CORE	0.04	0.37	1.19	31	0.41	0.10	421
E7208		84.34	CORE	0.05	0.28	1.11	25	0.33	0.15	423
E7209		84.84	CORE	0.05	0.44	1.24	35	0.49	0.10	425
E7210		85.29	CORE	0.05	0.71	1.58	45	0.76	0.07	426
E7214		89.92	CORE	0.12	0.44	1.08	41	0.56	0.21	422
E7215		91.33	CORE	0.04	0.49	1.21	40	0.53	0.08	429
E7216		91.62	CORE	0.05	0.44	1.10	40	0.49	0.10	424
E7217		92.00	CORE	0.04	0.31	0.99	31	0.35	0.11	425
E7219		92.28	CORE	0.03	0.61	1.26	48	0.64	0.05	428
E7220		92.38	CORE	0.02	0.38	1.15	33	0.40	0.05	423
E7221		92.55	CORE	0.04	0.59	1.21	49	0.63	0.06	427
E7224		92.79	CORE	0.10	1.08	1.36	79	1.18	0.08	429
E7225		93.45	CORE	0.04	0.57	1.12	51	0.61	0.07	432
E7228		93.95	CORE	0.03	0.26	0.79	33	0.29	0.10	424
E7229		94.51	CORE	0.06	0.56	1.10	51	0.62	0.10	422
E7227		94.67	CORE	0.04	0.37	1.03	36	0.41	0.10	426
E7230		95.17	CORE	0.03	0.33	0.93	35	0.36	0.08	424
E7231		95.44	CORE	0.04	0.43	1.15	37	0.47	0.09	425
E7232		96.20	CORE	0.04	0.61	1.22	50	0.65	0.06	427
E7233		96.82	CORE	0.09	0.62	1.38	45	0.71	0.13	427
E7234		97.38	CORE	0.00	0.31	1.11	28	0.31	0.00	424
E7237		97.96	CORE	0.04	0.59	1.39	42	0.63	0.06	426
E7235		98.54	CORE	0.05	0.71	1.36	52	0.76	0.07	423
E7249		100.26	CORE	0.03	0.33	1.01	33	0.36	0.08	424
E7247		100.84	CORE	0.05	0.25	0.92	27	0.30	0.17	426
E7250		101.16	CORE	0.01	0.21	0.99	21	0.22	0.05	426

Legend
-1 - No data available.
( ) - Tmax of doubtful reliability, often associated with poor S2 peaks.

IKU SINTEF-GRUPPEN

Project no.: 21346000
Location : 13/01-U-01
Date : 89.11.14

Table A.II.3.2 (continued):
DATA FROM ROCK EVAL PYROLYSIS

IKUNO	FRAC NAME	DEPTH (m)	SAMPLE TYPE	S1 (mg/g rock)	S2 (mg/g rock)	TOC (%)	HYDRO. INDEX (mg/g TOC)	PETR. POTEN. S1+S2	PROD. INDEX S1/(S1+S2)	Tmax (°C)
E7248		101.53	CORE	0.00	0.20	0.89	22	0.20	0.00	421
E7251		101.74	CORE	0.04	0.43	1.07	40	0.47	0.09	425
E7252		102.33	CORE	0.07	0.24	1.01	24	0.31	0.23	425
E7255		102.82	CORE	0.04	0.32	1.01	32	0.36	0.11	422
E7256		103.17	CORE	0.03	0.35	0.94	37	0.38	0.08	422
E7257		104.03	CORE	0.04	0.36	1.07	34	0.40	0.10	426
E7258		104.58	CORE	0.03	0.23	0.83	28	0.26	0.12	423
E7259		105.14	CORE	0.03	0.28	0.97	29	0.31	0.10	425
E7260		105.70	CORE	0.07	0.28	0.94	30	0.35	0.20	424
E7261		106.27	CORE	0.03	0.23	0.88	26	0.26	0.12	428
E7262		106.64	CORE	0.02	0.28	0.92	30	0.30	0.07	427
E7263		107.15	CORE	0.02	0.28	0.89	31	0.30	0.07	424
E7266		108.04	CORE	0.06	0.52	1.14	46	0.58	0.10	427
E7265		108.42	CORE	0.01	0.49	1.40	35	0.50	0.02	427
E7267		109.13	CORE	0.03	1.85	1.85	100	1.88	0.02	433
E7268		109.70	CORE	0.05	3.26	2.16	151	3.31	0.02	431
E7269		110.35	CORE	0.06	4.39	2.55	172	4.45	0.01	431
E7270		111.66	CORE	0.06	3.77	2.32	163	3.83	0.02	434
E7273		112.11	CORE	0.03	0.86	1.98	43	0.89	0.03	432
E7274		112.98	CORE	0.03	2.11	2.00	106	2.14	0.01	434
E7276		113.25	CORE	0.04	1.42	2.10	68	1.46	0.03	430
E7277		113.76	CORE	0.03	1.86	2.46	76	1.89	0.02	433
E6775		113.98	CORE	0.03	1.31	2.00	66	1.34	0.02	431
E7275		113.98	CORE	0.01	1.41	1.85	76	1.42	0.01	433
E7279		115.24	CORE	0.03	2.76	2.38	116	2.79	0.01	437
E7280		115.83	CORE	0.02	1.03	1.90	54	1.05	0.02	436
E7281		116.56	CORE	0.06	2.63	2.71	97	2.69	0.02	433
E7282		117.01	CORE	0.06	5.13	2.68	191	5.19	0.01	434
E7283		117.69	CORE	0.01	0.79	1.74	45	0.80	0.01	430
E7285		118.29	CORE	0.06	4.49	3.02	149	4.55	0.01	432
E7288		120.25	CORE	0.04	2.51	2.14	117	2.55	0.02	433
E7289		121.09	CORE	0.04	3.60	2.40	150	3.64	0.01	437
E7290		121.68	CORE	0.05	3.80	2.34	162	3.85	0.01	433
E7348		122.84	CORE	0.39	47.25	56.60	83	47.64	0.01	429
E7293		124.72	CORE	0.07	7.09	4.07	174	7.16	0.01	432
E7295		126.12	CORE	0.06	4.19	4.74	88	4.25	0.01	439
E7296		126.32	CORE	0.08	10.39	19.60	53	10.47	0.01	430
E7294		126.35	CORE	0.07	7.70	8.18	94	7.77	0.01	429
E7297		127.84	CORE	0.25	21.09	18.90	112	21.34	0.01	438
E7298		128.94	CORE	0.00	1.08	3.48	31	1.08	0.00	429
E7302		130.15	CORE	0.15	15.99	13.10	122	16.14	0.01	422
E7303		130.82	CORE	0.16	9.45	9.04	105	9.61	0.02	427
E7304		132.32	CORE	0.00	0.04	0.26	15	0.04	0.00	434
E7305		133.46	CORE	0.02	1.38	1.91	72	1.40	0.01	433
E7306		135.15	CORE	0.00	0.16	2.20	7	0.16	0.00	422

Legend
-1 - No data available.
( ) - Tmax of doubtful reliability, often associated with poor S2 peaks.

IKU SINTEF-GRUPPEN

Project no.: 21346000
Location : 13/01-U-01
Date : 89.11.14

Table A.II.3.2 (continued):
DATA FROM ROCK EVAL PYROLYSIS

IKUNO	FRAC NAME	DEPTH (m)	SAMPLE TYPE	S1 (mg/g rock)	S2 (mg/g rock)	TOC (%)	HYDRO. INDEX (mg/g TOC)	PETR. POTEN. S1+S2	PROD. INDEX S1/(S1+S2)	Tmax (°C)
E7307		136.03	CORE	0.04	5.07	4.68	108	5.11	0.01	422
E7309		137.18	CORE	0.01	0.10	1.17	9	0.11	0.09	418
E7308		138.75	CORE	0.00	0.13	0.76	17	0.13	0.00	428
E7311		140.93	CORE	0.03	2.32	2.48	94	2.35	0.01	427
E6799		141.34	CORE	0.02	2.96	2.81	105	2.98	0.01	426
E7312		142.25	CORE	0.06	18.39	3.88	474	18.45	0.00	434
E6800		142.40	CORE	0.05	15.83	4.37	362	15.88	0.00	435
E6801		142.43	CORE	0.04	9.12	2.73	334	9.16	0.00	437
E6802		142.44	CORE	0.01	4.44	1.72	258	4.45	0.00	436
E6803		143.57	CORE	0.03	2.78	1.67	166	2.81	0.01	435
E7314		143.92	CORE	0.01	13.56	3.50	387	13.57	0.00	438
				0.02	15.12	3.50	432	15.14	0.00	438
E7315		145.90	CORE	0.01	0.76	0.99	77	0.77	0.01	433
E6804		146.31	CORE	0.02	6.41	3.02	212	6.43	0.00	435
E7318		147.42	CORE	0.01	1.31	1.53	86	1.32	0.01	434
E7330		154.25	CORE	0.00	1.14	2.08	55	1.14	0.00	431
E7331		156.89	CORE	0.00	0.30	0.15	200	0.30	0.00	(480)
E7335		159.35	CORE	0.32	64.85	59.00	110	65.17	0.00	436
E7336		163.15	CORE	0.02	0.28	0.65	43	0.30	0.07	433
E7337		163.51	CORE	0.01	0.20	0.70	29	0.21	0.05	424
E7340		163.56	CORE	0.01	0.32	0.65	49	0.33	0.03	423
E7341		165.70	CORE	0.03	0.39	0.78	50	0.42	0.07	437
E7343		166.81	CORE	0.05	0.21	0.53	40	0.26	0.19	434
E7345		170.84	CORE	0.03	0.56	1.18	47	0.59	0.05	430
E7349		173.37	CORE	0.03	0.49	1.26	39	0.52	0.06	431
E7350		175.12	CORE	0.01	0.40	1.12	36	0.41	0.02	429
E7370		178.96	CORE	0.04	1.09	2.21	49	1.13	0.04	431
E7375		180.06	CORE	0.04	0.76	1.63	47	0.80	0.05	433
E7377		182.89	CORE	0.04	0.63	1.40	45	0.67	0.06	430
E7378		184.22	CORE	0.03	0.48	1.29	37	0.51	0.06	428
E7381		185.83	CORE	0.03	0.47	1.63	29	0.50	0.06	431
E7379		186.65	CORE	0.00	0.38	1.64	23	0.38	0.00	427
E7382		192.92	CORE	0.02	0.23	0.76	30	0.25	0.08	424
E7383		193.42	CORE	0.01	0.18	0.92	20	0.19	0.05	431
E7385		193.92	CORE	0.01	0.21	0.91	23	0.22	0.05	428
E7387		194.72	CORE	0.00	0.16	0.75	21	0.16	0.00	430
E7388		195.57	CORE	0.02	0.16	0.79	20	0.18	0.11	429
E7389		196.04	CORE	0.02	0.12	0.73	16	0.14	0.14	(385)
E7391		196.70	CORE	0.00	0.19	0.80	24	0.19	0.00	424
E7393		197.05	CORE	0.00	0.18	0.79	23	0.18	0.00	428
E7392		197.67	CORE	0.01	0.22	1.27	17	0.23	0.04	428
E7394		198.40	CORE	0.02	0.18	0.79	23	0.20	0.10	430

Legend
-1 - No data available.
( ) - Tmax of doubtful reliability, often associated with poor S2 peaks.

IKU SINTEF-GRUPPEN

Project no.: 21346000
Location : 13/01-U-01
Date : 89.11.14

Table A.II.3.2 (continued):
DATA FROM ROCK EVAL PYROLYSIS

IKUNO	FRAC NAME	DEPTH (m)	SAMPLE TYPE	S1 (mg/g rock)	S2 (mg/g rock)	TOC (%)	HYDRO. INDEX (mg/g TOC)	PETR. POTEN. S1+S2	PROD. INDEX S1/(S1+S2)	Tmax (°C)
E7395		198.83	CORE	0.02	0.19	0.83	23	0.21	0.10	426
E7396		200.01	CORE	0.02	0.20	0.91	22	0.22	0.09	428
E7397		201.00	CORE	0.01	0.19	0.58	33	0.20	0.05	425
E7399		202.29	CORE	0.01	0.11	0.70	16	0.12	0.08	420
E7400		203.09	CORE	0.02	0.19	0.79	24	0.21	0.10	428
E7401		203.87	CORE	0.03	0.16	0.57	28	0.19	0.16	400
E7405		204.62	CORE	0.02	0.14	0.40	35	0.16	0.13	(348)
E7404		205.03	CORE	0.00	0.05	0.41	12	0.05	0.00	422
E7406		205.63	CORE	0.04	0.17	0.50	34	0.21	0.19	(347)
E7407		206.62	CORE	0.02	0.11	0.47	23	0.13	0.15	(394)
E7409		208.29	CORE	0.04	0.25	0.64	39	0.29	0.14	430
E7410		209.04	CORE	0.04	0.26	0.75	35	0.30	0.13	426
E7411		209.89	CORE	0.04	0.27	0.85	32	0.31	0.13	428
E7412		211.90	CORE	0.02	0.27	0.81	33	0.29	0.07	424
E7413		213.43	CORE	0.03	0.22	0.86	26	0.25	0.12	426
E7416		214.62	CORE	0.01	0.14	1.00	14	0.15	0.07	424
E7418		216.47	CORE	0.06	0.54	1.26	43	0.60	0.10	426
E7419		217.47	CORE	0.01	0.33	0.94	35	0.34	0.03	427
E7420		219.18	CORE	0.05	0.45	1.05	43	0.50	0.10	429
E7421		220.15	CORE	0.02	0.39	1.06	37	0.41	0.05	428
E6772		220.34	CORE			0.95				
E7423		220.85	CORE	0.03	0.27	1.04	26	0.30	0.10	429
E7426		221.37	CORE	0.04	0.39	1.00	39	0.43	0.09	431
E7428		222.54	CORE	0.01	0.43	0.83	52	0.44	0.02	430
E7432		223.50	CORE	0.05	0.41	0.95	43	0.46	0.11	429
E7433		223.88	CORE	0.06	0.78	1.32	59	0.84	0.07	432
E7434		224.27	CORE	0.05	0.64	1.30	49	0.69	0.07	431
E6780		224.57	CORE	0.02	0.36	1.18	31	0.38	0.05	426
E7431		224.57	CORE	0.04	0.45	1.19	38	0.49	0.08	431
E7436		225.48	CORE	0.02	0.68	1.12	61	0.70	0.03	429
E7437		226.06	CORE	0.06	0.60	1.19	50	0.66	0.09	432
E7438		226.95	CORE	0.03	0.57	1.17	49	0.60	0.05	428
E7439		227.60	CORE	0.05	0.59	1.43	41	0.64	0.08	425
E7440		228.45	CORE	0.04	0.66	1.50	44	0.70	0.06	433
E7441		229.11	CORE	0.05	0.61	1.51	40	0.66	0.08	434
E7442		230.05	CORE	0.03	0.72	1.27	57	0.75	0.04	428
E7444		230.86	CORE	0.03	0.78	1.45	54	0.81	0.04	433
E7445		231.50	CORE	0.05	0.79	1.38	57	0.84	0.06	434
E7446		232.52	CORE	0.01	0.54	1.31	41	0.55	0.02	438
E7447		233.40	CORE	0.04	0.81	1.45	56	0.85	0.05	433
E7449		234.13	CORE	0.00	0.45	1.04	43	0.45	0.00	425
E7451		235.16	CORE	0.02	0.51	0.99	52	0.53	0.04	426
E7452		235.99	CORE	0.04	0.52	1.21	43	0.56	0.07	430
E7453		237.05	CORE	0.06	1.06	1.40	76	1.12	0.05	434
E7454		237.56	CORE	0.03	0.46	1.15	40	0.49	0.06	428

Legend
-1 - No data available.
( ) - Tmax of doubtful reliability, often associated with poor S2 peaks.

IKU SINTEF-GRUPPEN

Project no.: 21346000
Location : 13/01-U-01
Date : 89.11.14

Table A.II.3.2 (continued):
DATA FROM ROCK EVAL PYROLYSIS

IKUNO	FRAC NAME	DEPTH (m)	SAMPLE TYPE	S1 (mg/g rock)	S2 (mg/g rock)	TOC (%)	HYDRO. INDEX (mg/g TOC)	PETR. POTEN. S1+S2	PROD. INDEX S1/(S1+S2)	Tmax (°C)
E7457		238.70	CORE	0.03	0.42	1.25	34	0.45	0.07	433
E7458		239.86	CORE	0.02	0.44	0.90	49	0.46	0.04	428
E7460		240.91	CORE	0.02	0.50	0.94	53	0.52	0.04	424
E7462		241.67	CORE	0.01	0.81	1.64	49	0.82	0.01	426
E7463		242.37	CORE	0.04	0.94	1.56	60	0.98	0.04	435
E7464		243.19	CORE	0.04	0.86	1.72	50	0.90	0.04	433
E7465		243.90	CORE	0.04	0.95	1.70	56	0.99	0.04	435
E7466		244.55	CORE	0.04	0.84	1.76	48	0.88	0.05	430
E7467		245.24	CORE	0.03	0.74	1.29	57	0.77	0.04	433
E7470		245.77	CORE	0.03	0.64	1.14	56	0.67	0.04	430
E7471		246.29	CORE	0.00	0.63	1.38	46	0.63	0.00	429
E7475		246.69	CORE	0.02	0.49	1.36	36	0.51	0.04	430
E7477		247.17	CORE	0.01	0.77	1.48	52	0.78	0.01	426
E7473		247.41	CORE	0.01	0.86	1.52	57	0.87	0.01	431
E7478		247.99	CORE	0.00	0.51	1.31	39	0.51	0.00	429
E7479		248.98	CORE	0.00	0.57	1.44	40	0.57	0.00	430
E7480		249.77	CORE	0.01	0.76	2.73	28	0.77	0.01	432
E7481		250.56	CORE	0.03	0.91	1.68	54	0.94	0.03	431
E7482		251.17	CORE	0.01	1.26	2.04	62	1.27	0.01	433
E7484		251.76	CORE	0.01	0.95	2.02	47	0.96	0.01	434
E7485		252.48	CORE	0.06	1.06	2.03	52	1.12	0.05	432
E7487		253.27	CORE	0.01	0.96	1.95	49	0.97	0.01	433
E7488		254.29	CORE	0.02	1.08	2.13	51	1.10	0.02	433
E7491		254.88	CORE	0.03	1.17	1.97	59	1.20	0.03	430
E7490		255.54	CORE	0.00	0.22	0.94	23	0.22	0.00	424
E7497		256.92	CORE	0.00	0.29	0.53	55	0.29	0.00	(463)
E7498		259.89	CORE	0.00	0.19	0.64	30	0.19	0.00	428
E7501		262.76	CORE	0.00	0.40	1.17	34	0.40	0.00	425
E7502		263.51	CORE	0.02	0.41	1.14	36	0.43	0.05	426
E7504		265.30	CORE	0.00	0.18	0.89	20	0.18	0.00	424
E7507		267.31	CORE	0.00	0.15	1.04	14	0.15	0.00	428
E7508		267.98	CORE	0.03	0.32	0.77	42	0.35	0.09	424
E7510		268.42	CORE	0.02	0.30	0.94	32	0.32	0.06	445
E7513		271.05	CORE	0.00	0.17	0.78	22	0.17	0.00	425
E7515		273.11	CORE	0.00	0.18	0.60	30	0.18	0.00	426
E7516		275.13	CORE	0.00	0.17	0.67	25	0.17	0.00	429
E7520		279.25	CORE	0.03	0.38	1.06	36	0.41	0.07	427
E7521		280.35	CORE	0.01	0.26	0.97	27	0.27	0.04	433
E7523		282.85	CORE	0.01	0.26	1.03	25	0.27	0.04	428
E7524		284.15	CORE	0.00	0.29	0.85	34	0.29	0.00	431
E7528		285.70	CORE	0.02	0.22	1.07	21	0.24	0.08	437
E7529		287.30	CORE	0.01	0.25	1.39	18	0.26	0.04	428
E7531		288.10	CORE	0.01	0.29	1.26	23	0.30	0.03	427
E7538		289.83	CORE	0.00	0.34	1.42	24	0.34	0.00	429
E7537		291.17	CORE	0.01	0.34	1.43	24	0.35	0.03	431
E7539		291.39	CORE	0.03	0.40	1.11	36	0.43	0.07	425

Legend
-1 - No data available.
( ) - Tmax of doubtful reliability, often associated with poor S2 peaks.

Table A.II.3.3: Data from Pyrolysis-gas chromatograms.

IKUNO	Depth (m)	Lithology	C_1	C_2-C_5	C_6-C_{14}	C_{15+}	mpx /$nC_{8=}$ 1)	mpx /$nC_{10=}$ 2)	HI (mg/gTOC)	TOC (wt%)
			(	area %		)				
Core 13/01-U-01										
E7196	74.62	Clst	0.3	31.9	60.2	7.7	0.88	1.88	114	1.87
E7269	110.35	Clst	7.2	25.0	48.7	19.1	0.88	1.50	172	2.55
E7293	124.72	Sltst/coal	25.8	22.5	46.2	5.5	1.40	3.11	174	4.07
E7312	142.25	Clst	0.1	14.3	41.1	44.5	0.32	0.43	474	3.88
E6800	142.40	Clst	7.4	4.9	45.9	41.7	0.35	0.47	362	4.37
E7314	143.92	Clst	4.8	14.5	38.9	41.7	0.40	0.50	387/432	3.50
E7335	159.35	Coal	24.7	26.6	31.2	17.5	4.27	7.83	110	59.00
E7453	237.05	Mdst	13.9	35.5	49.8	0.8	1.00	2.36	76	1.40
E7485	252.48	Clst	16.5	34.1	48.5	0.9	1.32	3.22	52	2.03

Legend: 1) = peak height ratio (m+p)-xylene / n-octene
2) = peak height ratio (m+p)-xylene / n-decene
3) = data unreliable due to low intensity and high noise
4) = solvent-extracted residue after hydrous pyrolysis

Table A.II.3.4a: Molecular ratios from PY-GC-MS mass chromatograms of kerogens: Isoprenoids and alkadienes.

IKU no.	Lithology	Depth	HI	C_{11}-C_{17}[1] alkene/alkane	1-pristene[1] / nC_{17}(ene+ane)	(1+2)-pristene[1] / nC_{17}(ene+ane)	alkadiene[2] / n-decene
E-7196	Claystone	74.62	114	1.18	0.43	0.74	~0
E-7293	Siltstone/Coal	124.72	174	1.16	0.46	1.14	~0
E-7312	Claystone	142.25	474	1.64	0.14	0.19	0.27
E-7314	Claystone	143.92	432/387	1.68	0.08	0.10	0.28
E-7335	Coal	159.35	110	0.92	2.77	3.84	~0

All ratios are calculated from peak heights.
[1] Measured from the total ion current (TIC) chromatograms.
[2] Alkadienes from m/z 95, n-decene from m/z 97. nC_{12}+nC_{15}+nC_{17} alkadienes are used here.

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Table A.II.3.4b: Molecular ratios from Py-GC-MS mass chromatograms of kerogens: Xylenes and phenols.

IKU no.	Lithology	Depth	HI	(m+p)-xylene[1] / n-decene	o-xylene[1] / n-decene	phenol[2] / n-decene	meth.phenols[2] / n-decene	o-meth.phenol[2] / (m+p)meth.phenol
E-7196	Claystone	74.62	114	1.1	0.8	1.5	1.5	0.89
E-7293	Siltstone/Coal	124.72	174	2.2	1.6	8.0	11.0	0.37
E-7312	Claystone	142.25	474	0.7	0.6	1.4	1.4	0.68
E-6800	Claystone	142.40	362	0.2	0.2	0.5	0.9	0.44
E-7314	Claystone	143.92	432/387	0.7	0.6	1.0	1.0	0.65
E-7335	Coal	159.35	110	6.6	3.6	6.6	12.1	0.68

All ratios are calculated from peak heights.
[1] Xylenes from m/z 106, n-decene from m/z 97.
[2] Phenol from m/z 94, methylphenols (o+m+p) from m/z 108, n-decene from m/z 97.

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Table A.II.3.4c: Molecular ratios from Py-GC/MS chromatograms and kerogens: c) Polycyclic aromatics.

IKU no.	Lithology	Depth	HI	(1+2)MN[1] / n-heptadecane	MP[2] / n-decene	3MP+2MP[3] / 9MP+1MP	MDBT[4] / n-tetradecane
E-7196	Claystone	74.62	114	21	0.18	0.55	0.6
E-7293	Siltstone/Coal	124.72	174	43	1.92	(0.32)	1.5
E-7312	Claystone	142.25	474	5	0.27	-	0.1
E-6800	Claystone	142.40	362	3	0.23	(0.50)	0.2
E-7314	Claystone	143.92	432/387	7	0.18	0.59	0.1
E-7335	Coal	159.35	110	41	1.27	-	1.0

All ratios are calculated from peak heights.
[1] Methylnaphthalenes (MN) and n-heptadecane from m/z 141.
[2] Methylphenanthrenes from m/z 192, n-decene from m/z 97. The sum of 3-MP, 2-MP, 9-MP and 1-MP is used.
[3] Methylphenanthrene isomers from m/z 192.
[4] Methyldibenzothiophenes (MDBT) and n-tetradecane from m/z 198. (The 3 highest MDBT peaks are used).

- Not calculated due to poor resolution of 9-MP and 1-MP.
() Doubtful due to poor resolution of 9-MP and 1-MP.

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Core number: 13/01-U-01
Reference number: 21.3460.23
(1/1)

Table A.II.3.5:

VITRINITE REFLECTANCE DATA

IKU NO	LOCATION	DEPTH (M)	VITRINITE REFLECTANCE	REL RAT	STANDARD DEVIATION	FLUORESCENCE
E-7178	------	66.80	0.48 (7)	P	0.07	2
			0.84 (7)	R	0.10	
E-7210	------	85.29	0.28 (1)	P	0.00	2-3
			0.60 (7)	R	0.08	
			0.97 (2)	R	0.16	
E-7258	------	104.58	0.43 (2)	P	0.07	2-4
			0.79 (2)	R	0.01	
			1.41 (3)	R	0.22	
E-7348	------	122.84	0.28 (30)	F*	0.06	2-4
E-7353	------	130.15	0.33 (25)	F*	0.10	1?
E-6800	------	142.25	0.26 (18)	F	0.07	1-2
		-142.40	0.53 (2)	R	0.03	
E-6771	------	159.35	0.33 (22)	F*	0.09	2-5
E-7377	------	182.89	0.40 (15)	F	0.07	4-6
			0.84 (3)	R	0.14	
E-7399	------	202.29	0.42 (21)	F	0.06	Abs
			0.67 (3)	R	0.10	
E-6772	------	220.35	0.33 (9)	P	0.09	4-6
			0.89 (6)	R	0.09	
E-7479	------	248.98	0.51 (11)	P	0.12	2,4-6
			0.95 (1)	R	0.00	
E-7507	------	267.31	N.D.P.	-	----	---
E-7538	------	289.83	0.35 (29)	G	0.09	2-6

REL RAT (Reliability Rating): G = Good; F = Fair; P = Poor
S = Stained; R = Reworked.

*: Reflectance readings obtained from huminite particles of variable polish.

VISUAL KEROGEN ANALYSIS

TABLE NO.: A.II.3.6
CORE NO.: 13/01-U-01

Sample	Depth (m)	Composition of residue	Particle size	Preservation palynomorphs	Thermal maturation index *	Remarks
E-7196	74.62	Am: 70-75% Al: + Lm: 10-15% W: 5-10% C: 5%	F-M-L	Good-Fair	3.0 - 3.5	Organic residue dominated by amorphous matter,[1] both finely dispersed and larger bundles of granular material (often specked with pyrite and small woody/coaly fragments). Prasinophycean algae present.
E-7269	110.35	Am: 65-70% Al: + Lm: 15-20% W: 5-10% C: 5%	F-M-L	Fair	3.0 - 3.5	Comparable to sample E-7196.
E-7293	124.72	Am: 30-35% Lm: 10-15% W: 45-50% C:	F-M-L	Good-Fair	3.0 - 3.5	Organic residue rich in brown woody and black coaly fragments. Amorphous matter with no fluorescence (terrestrial origin).
E-7312	142.25	Am: 65-70% Al: + Lm: 10-15% W: 10-15% C:	F-M-L	Good-Fair	3.0 - 3.5	Organic residue dominated by amorphous matter (showing pale yellow to orange coloration in fluorescence light). Freshwater algae present.

ABBREVIATIONS:

Am = Amorphous
Al = Algae
W = Woody material
C = Coaly fragments
Lm = Liptinitic material
+ = Present in traces

F = Fine
M = Medium
L = Large

* New TAI (1-10 scale; see experimental).

[1] amorphous matter flouresces dull yellow/orange-brown.

IKU SINTEF-GRUPPEN

VISUAL KEROGEN ANALYSIS

TABLE NO.: A.II.3.6 (cont)
CORE NO.: 13/01-U-01

Sample	Depth (m)	Composition of residue	Particle size	Preservation palynomorphs	Thermal maturation index *	Remarks
E-7314	143.92	Am: 65-70% Al: + Lm: 10-15% W: 10-15% C:	F-M-L	Good-Fair	3.0 - 3.5	Comparable to sample E-7312.
E-7453	237.05	Am: 70-75% Lm: 5-10% W: 15-20% C:	F-M-L	Fair(Poor)	4.0 - 5.0	Organic residue dominated by finely dispersed greyish amorphous matter (with no fluorescence).
E-7485	252.48	Am: 60-65% Lm: 10% W: 20-25% C:	F-M-L	Fair	4.0 - 5.0	Comparable to sample E-7453.

ABBREVIATIONS:

Am = Amorphous
Al = Algae
W = Woody material
C = Coaly fragments
Lm = Liptinitic material
+ = Present in traces

F = Fine
M = Medium
L = Large

* New TAI (1-10 scale; see experimental).

IKU SINTEF-GRUPPEN

Project no.: 21346000
Location : 13/01-U-01
Date : 89.10.05

Table A.II.3.7a:

WEIGHT OF CHROMATOGRAPHIC FRACTIONS

IKUNO	DEPTH (m)	SAMPLE TYPE	ROCK EXTR. (g)	EOM (mg)	ASPH (mg)	SAT HC (mg)	ARO HC (mg)	POLAR COMP. (mg)	HC (mg)	NONHC (mg)	TOC (%)
E7196	74.62	CORE	34.3	16.4	8.2	0.1	0.1	5.1	0.2	16.2	1.87
E7269	110.35	CORE	32.5	18.3	4.0	0.7	0.0	4.7	0.7	17.6	2.55
E7293	124.72	CORE	42.3	101.1	60.8	2.8	12.7	10.5	15.5	85.6	4.07
E7312	142.25	CORE	40.5	45.6	17.8	9.4	7.4	13.6	16.8	28.8	3.88
E6800	142.40	CORE	35.2	40.6	19.2	13.4	4.8	8.7	18.2	22.4	4.37
E7314	143.92	CORE	40.6	25.9	10.3	3.8	2.8	6.7	6.6	19.3	3.50
E7335	159.35	CORE	5.5	109.5	68.2	2.5	12.4	16.7	14.9	94.6	59.00
E7453	237.05	CORE	31.3	11.6	6.3	0.1	0.0	3.3	0.1	11.5	1.40
E7485	252.48	CORE	35.6	17.7	10.4	1.6	0.2	4.1	1.8	15.9	2.03

Table A.II.3.7b:

CONCENTRATION OF EOM AND CHROMATOGRAPHIC FRACTIONS

(Weight ppm of rock)

IKUNO	DEPTH (m)	SAMPLE TYPE	EOM	ASPH	SAT HC	ARO HC	POLAR COMP.	HC	NONHC
E7196	74.62	CORE	479	239	4	4	148	8	471
E7269	110.35	CORE	563	123	22	0	145	22	541
E7293	124.72	CORE	2389	1437	67	299	247	366	2023
E7312	142.25	CORE	1126	440	233	182	336	415	711
E6800	142.40	CORE	1153	545	381	135	246	516	637
E7314	143.92	CORE	637	254	93	69	164	162	475
E7335	159.35	CORE	19909	12400	450	2250	3038	2700	17209
E7453	237.05	CORE	370	201	4	0	104	4	366
E7485	252.48	CORE	497	292	44	7	115	51	446

Project no.: 21346000
Location : 13/01-U-01
Date : 89.10.05

Table A.II.3.7c:

CONCENTRATION OF EOM AND CHROMATOGRAPHIC FRACTIONS

(mg/g TOC)

IKUNO	DEPTH (m)	SAMPLE TYPE	EOM	ASPH	SAT HC	ARO HC	POLAR COMP.	HC	NONHC
E7196	74.62	CORE	25.6	12.8	0.2	0.2	7.9	0.4	25.2
E7269	110.35	CORE	22.1	4.8	0.9	0.0	5.7	0.9	21.2
E7293	124.72	CORE	58.7	35.3	1.6	7.4	6.1	9.0	49.7
E7312	142.25	CORE	29.0	11.3	6.0	4.7	8.7	10.7	18.3
E6800	142.40	CORE	26.4	12.5	8.7	3.1	5.6	11.8	14.6
E7314	143.92	CORE	18.2	7.2	2.6	2.0	4.7	4.6	13.6
E7335	159.35	CORE	33.7	21.0	0.8	3.8	5.1	4.6	29.1
E7453	237.05	CORE	26.5	14.4	0.3	0.0	7.4	0.3	26.2
E7485	252.48	CORE	24.5	14.4	2.2	0.3	5.7	2.5	22.0

Table A.II.3.7d:

COMPOSITION OF EOM AND CHROMATOGRAPHIC FRACTIONS

IKUNO	DEPTH (m)	SAMPLE TYPE	ASPH / EOM (%)	SAT / EOM (%)	ARO / EOM (%)	HC / EOM (%)	POLAR / EOM (%)	SAT / ARO x 100	HC / NONHC x 100
E7196	74.62	CORE	50.0	0.7	0.7	1.4	30.9	100.0	1.5
E7269	110.35	CORE	21.9	4.0	0.0	4.0	25.8	-1.0	4.1
E7293	124.72	CORE	60.1	2.8	12.5	15.3	10.3	22.3	18.1
E7312	142.25	CORE	39.0	20.7	16.1	36.8	29.9	128.3	58.3
E6800	142.40	CORE	47.3	33.0	11.7	44.7	21.3	282.1	80.9
E7314	143.92	CORE	39.8	14.5	10.8	25.3	25.8	134.8	33.9
E7335	159.35	CORE	62.3	2.3	11.3	13.6	15.3	20.0	15.7
E7453	237.05	CORE	54.3	1.0	0.0	1.0	28.1	-1.0	1.1
E7485	252.48	CORE	58.8	8.9	1.4	10.3	23.2	650.0	11.4

Legend:
-1- Cannot be calculated.

IKU SINTEF-GRUPPEN

Project no.: 21346000
Location : 13/01-U-01
Date : 89.10.18

Table A.II.3.8:

RATIOS DERIVED FROM GAS CHROMATOGRAMS OF SATURATED HYDROCARBONS

IKUNO	FRAC NAME	DEPTH	Pri / Phy	Pri A=----- / n-C17	Phy B=----- / n-C18	A / B	n-C17 / n-C27	n-C31 / n-C19	CPI 1	CPI 2
E7196		74.62	1.3	1.2	1.5	0.8	0.7	2.3	1.8	2.0
E7269		110.35	2.0	0.9	0.4	2.0	0.5	1.0	1.8	2.3
E7293		124.72	5.4	4.0	0.8	5.2	0.1	4.7	2.4	2.3
E7312		142.25	1.8	0.4	0.2	1.6	0.5	0.8	1.8	2.1
E6800		142.40	2.4	0.3	0.2	2.1	0.5	0.7	2.0	2.3
E7314		143.92	2.8	0.3	0.1	2.6	0.5	0.6	1.7	1.9
E7335		159.35	23.7	28.6	0.9	30.7	0.2	1.1	2.4	1.8
E7453		237.05	1.2	0.9	0.6	1.5	0.3	2.0	2.0	1.9

Legend:

$$\text{CPI 1} = \frac{1}{2} \cdot \left(\frac{C_{25}+C_{27}+C_{29}+C_{31}}{C_{24}+C_{26}+C_{28}+C_{30}} + \frac{C_{25}+C_{27}+C_{29}+C_{31}}{C_{26}+C_{28}+C_{30}+C_{32}} \right)$$

$$\text{CPI 2} = \frac{2 \cdot C_{27}}{C_{26}+C_{28}}$$

Ratios involving pristane and phytane are calculated from peak areas.
All other ratios are calculated from peak heights.

Table A.II.3.9: *Molecular ratios from sterane and terpane mass chromatograms. Maturity characteristic ratios.*

Code	Depth (m)	αβ/αβ+βα[1] hopanes	%22S[2] ext. hopanes	%20S[3] steranes	%ββ[4] steranes	C_{30} hopene[5] / C_{30} hopane
Core 13/01-U-01						
E7196	74.62	0.69	19	5	49	0.50
E7269	110.35	0.36	19	21	80	0.76
E7293	124.72	0.53	14	22	70	0.55
E7312	142.25	0.68	16	9	55	0.48
E6800	142.40	0.65	7	5	52	0.52
E7314	143.92	0.63	7	7	61	0.59
E7335	159.35	0.40	6	11	66	0.44
E7453	237.05	0.50	12	13	38	0.32
E7485	252.48	0.47	6	8	50	0.28

1) E/(E+F) in m/z 191.

2) Average % distribution between first and second eluting isomers of extended hopanes.

3) 100 · q/(q+t) in m/z 217.

4) 100 · (r+s)/(q+t+2·(r+s)) in m/z 217.

5) 9/(9+E) in m/z 191.

Table A.II.3.10: *Molecular ratios from terpane and sterane mass chromatograms. Maturity and source characteristic ratios.*

Code	Depth (m)	Q/E[1] terpanes	Tm/Ts[2] terpanes	X/E[3] terpanes	Z/E[4] terpanes	a/(a+j)[5] steranes
Core 13/01-U-01						
E7196	74.62	-	3.19	-	-	0.17
E7269	110.35	-	-	-	-	0.05
E7293	124.72	-	1.82	-	-	0.23
E7312	142.25	-	1.07	-	-	0.26
E6800	142.40	-	1.64	-	-	0.13
E7314	143.92	-	0.99	-	-	0.25
E7335	159.35	-	-	-	-	0.33
E7453	237.05	-	19.30	-	-	0.17
E7485	252.48	-	-	-	-	0.22
E6813	142.40	-	-	-	-	0.31

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 A.II.3.11: Internal distribution of 14α(H),17α(H), 20R C_{27}, C_{28} and C_{29} regular steranes.

IKUNO	DEPTH m	C_{27} %	C_{28} %	C_{29} %[1)]
Core 13/01-U-01				
E7196	74.62	44.5	15.2	40.3
E7269	110.35	62.8	10.8	26.4
E7293	124.72	37.2	0.0	62.8
E7312	142.25	29.8	18.1	52.1
E6800	142.40	24.6	22.1	53.3
E7314	143.92	28.6	22.3	49.0
E7335	159.35	12.5	31.2	56.4
E7453	237.05	21.0	15.0	63.9
E7485	252.48	22.9	19.0	58.1

[1)] height distribution of peaks j,p,t in m/z 217.

Table A.II.3.12: Molecular ratios from mass fragmentograms of aromatic steroid hydrocarbons.

IKUNO	DEPTH m	Cracking ratios 20/20+27 tri [1]	20/20+28 tri [2]	21/21+28 mono [3]	Aromatisation ratios 27t/27t+28m [4]	28t/28t+29m [5]
Core 13/01-U-01						
E7196	74.62	0.16	0.37	0.11	0.18	0.05
E7269	110.35	0.20	0.38	0.58	0.96	0.88
E7293	124.72	0.97	0.98	0.08	0.02	0.01
E7312	142.25	0.68	0.79	0.18	0.14	0.10
E6800	142.40	0.88	0.84	0.13	0.04	0.06
E7314	143.92	0.60	0.55	0.12	0.03	0.05
E7335	159.35	0.82	0.82	0.22	0.04	0.01
E7453	237.05	0.20	0.37	0.35	0.25	0.08
E7485	252.48	0.21	0.26	0.34	0.36	0.19

All ratios are given in fractions of 1.

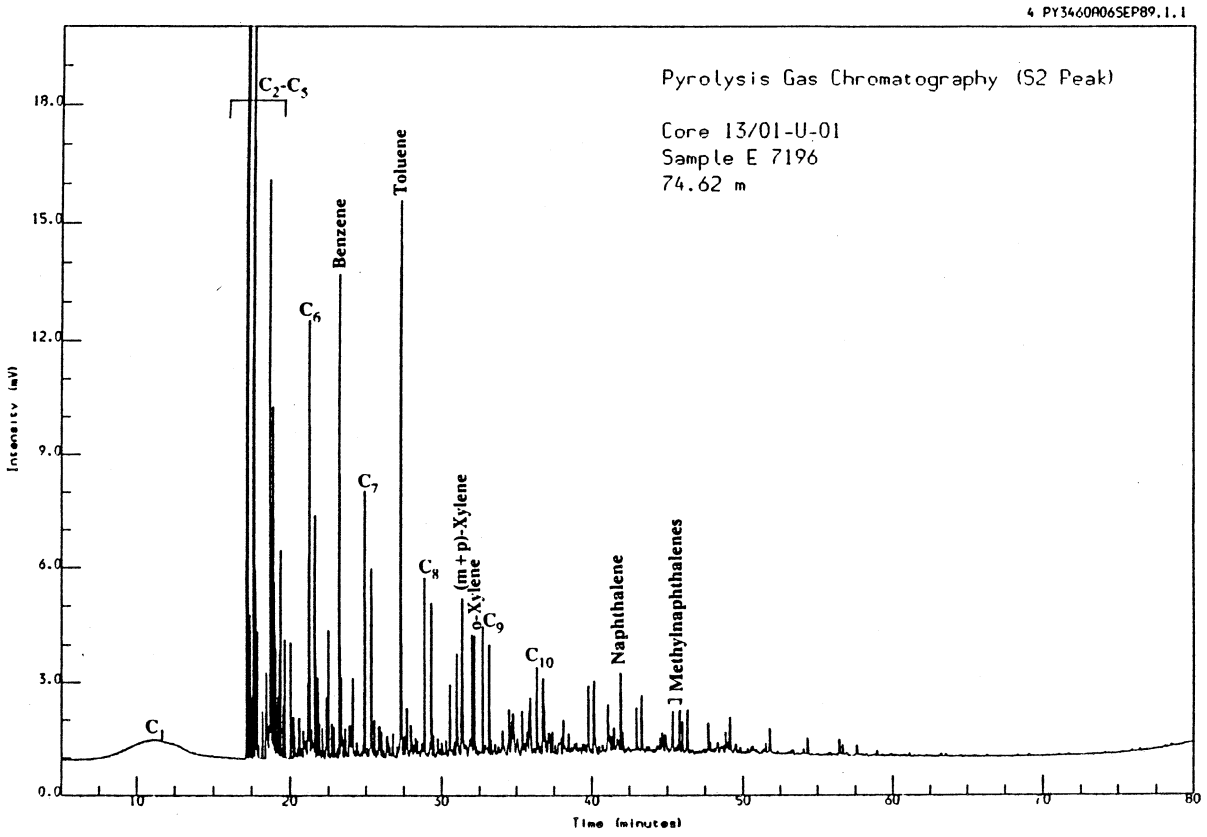
[1] M/(M+P) in m/z 231 (Mackenzie et al. 1981, main text).
[2] M/(M+S) in m/z 231 (Mackenzie et al. 1981, note added in proof).
[3] a/(a+h) in m/z 253 (Mackenzie et al. 1981, note added in proof).
[4] P/(P+h) in m/z 231 and 253. (Mackenzie et al. 1981, main text)
[5] S/(S+m+(k*S/(S+R))) (Mackenzie et al. 1981, note added in proof).
-1 = Data are not available or cannot be calculated.

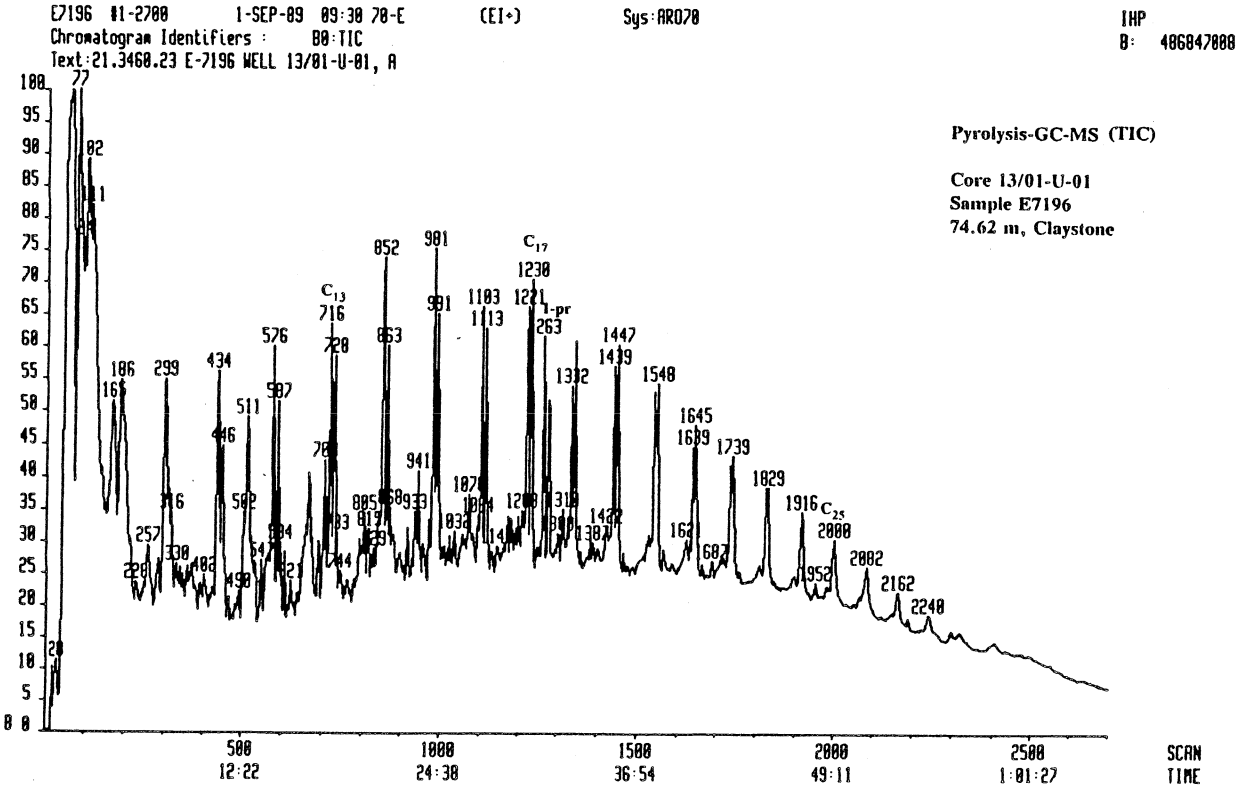
Figure A.II.3.1:

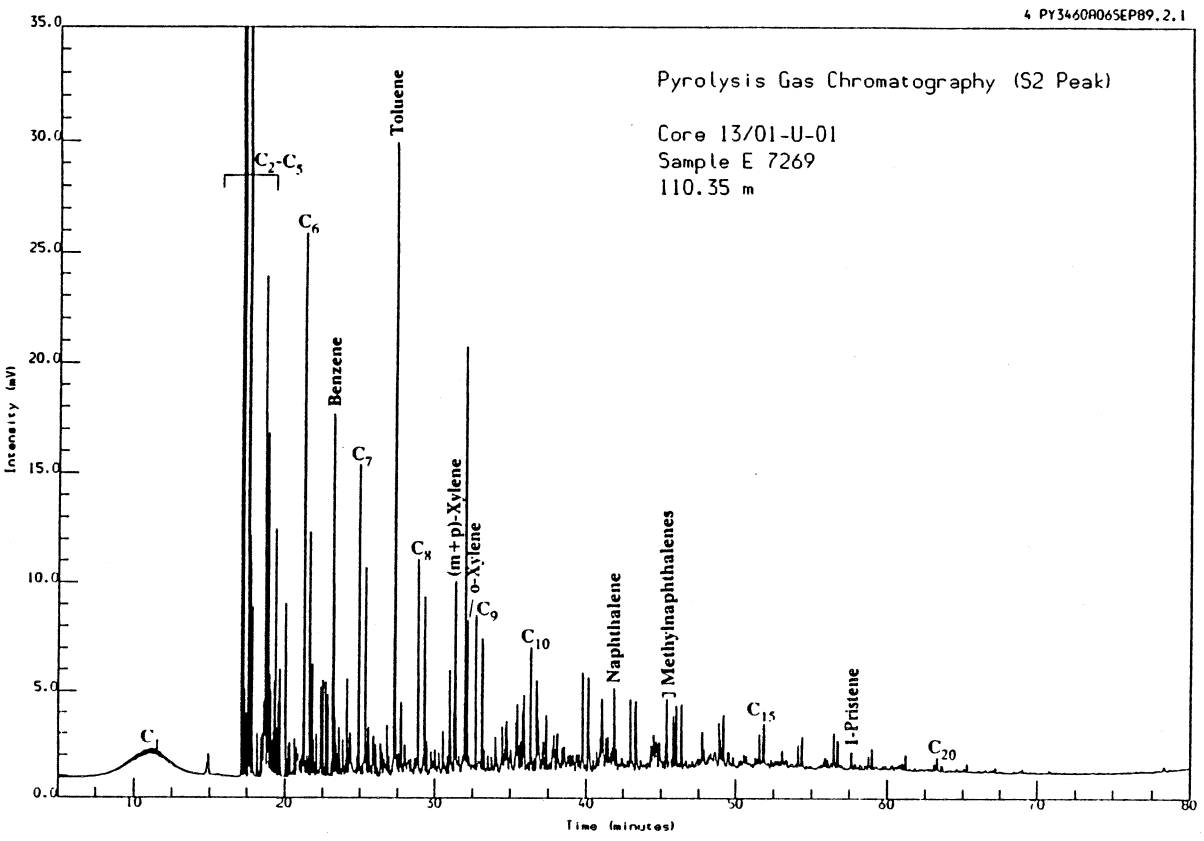
Pyrolysis-gas chromatograms (S2 peak)

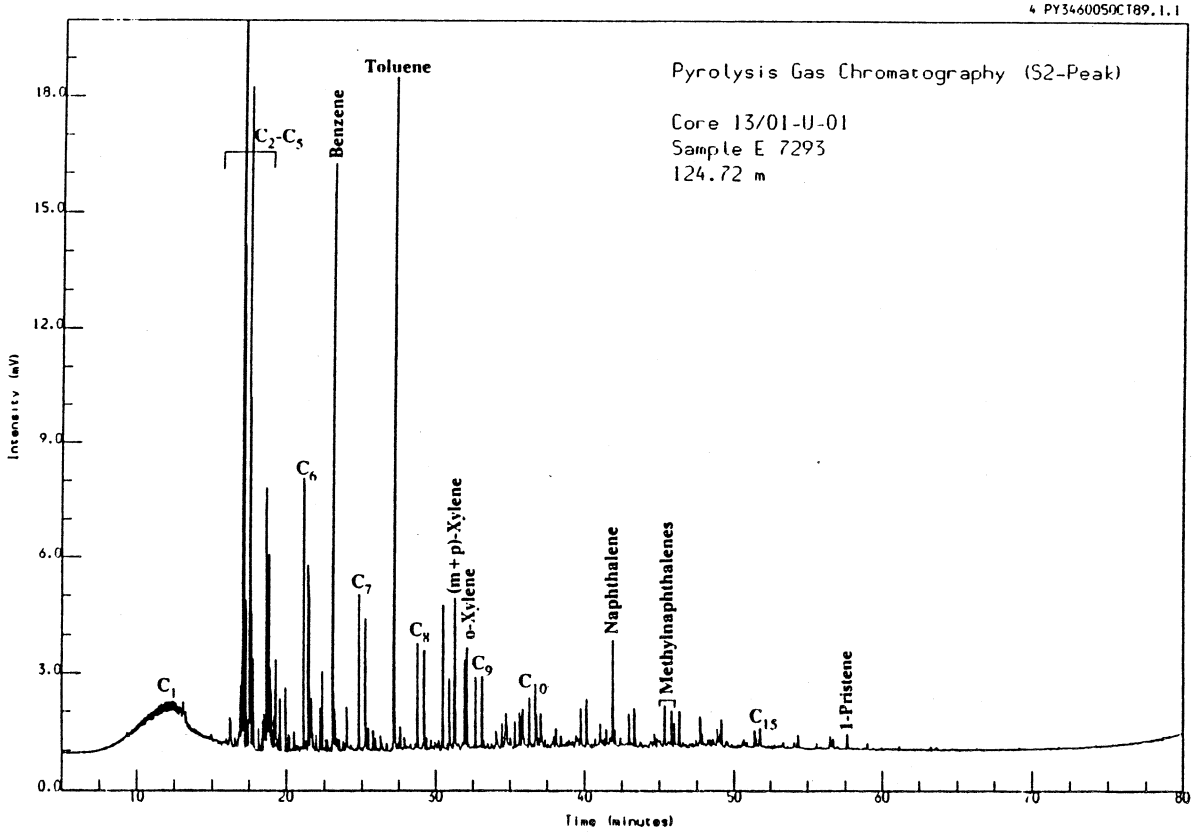
and

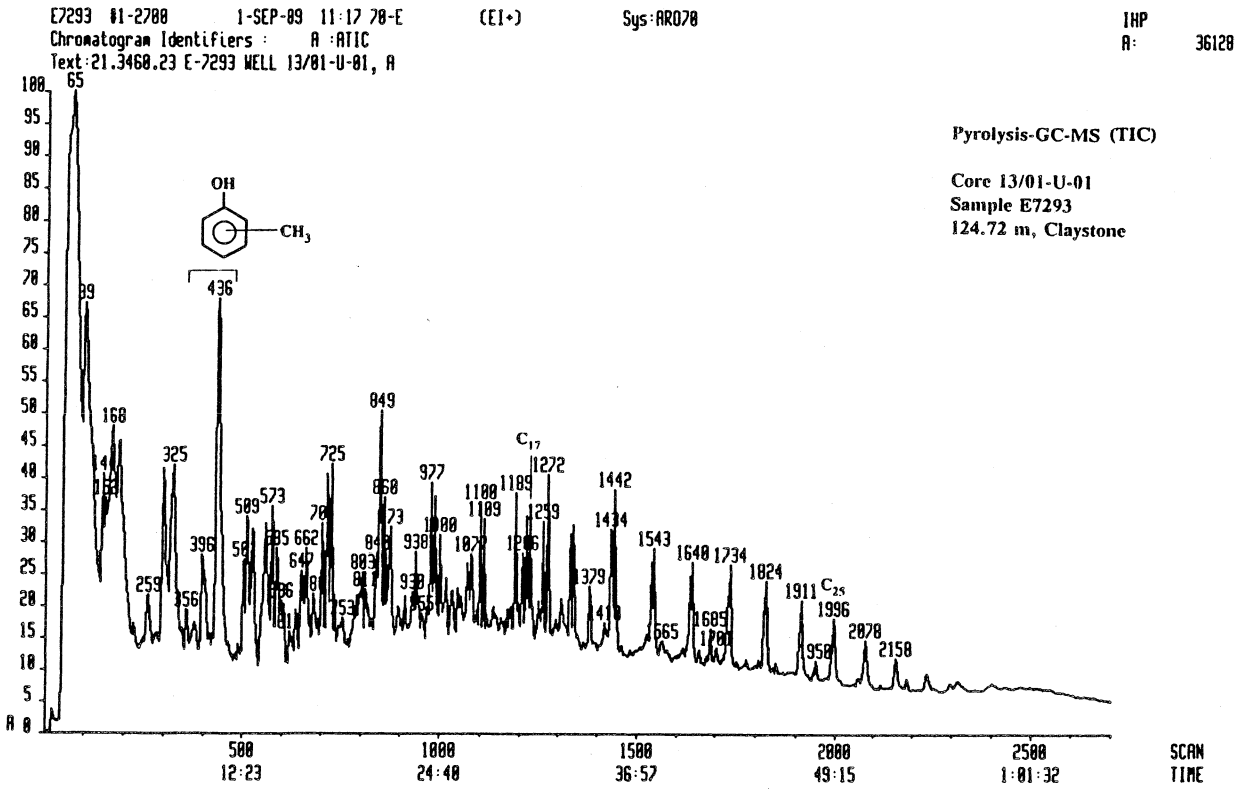
Pyrolysis-GC-MS total ion chromatograms (TIC)

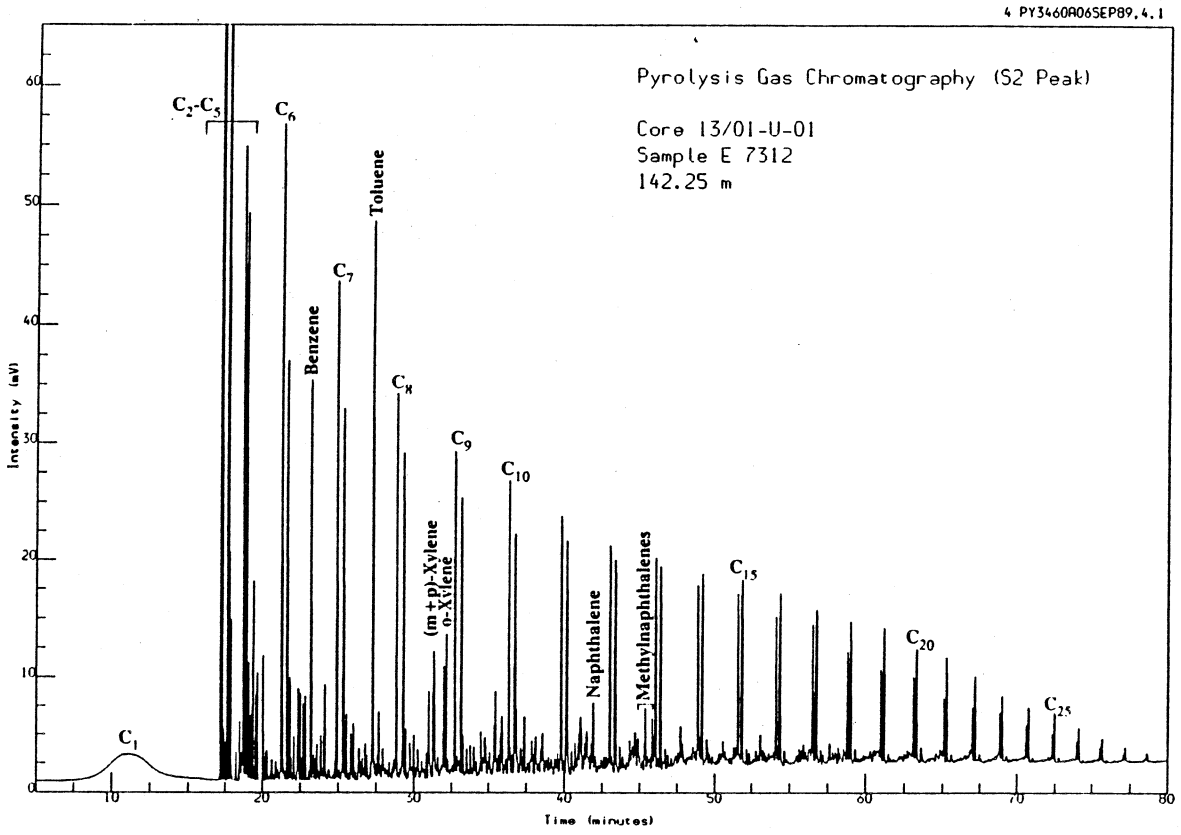

4 PY3460A06SEP89.1.1
Pyrolysis Gas Chromatography (S2 Peak)
Core 13/01-U-01
Sample E 7196
74.62 m
C2-C5
Benzene
Toluene
C6
C7
C8
(m+p)-Xylene
o-Xylene
C9
C10
Naphthalene
Methylnaphthalenes
C1
Intensity (mV)
Time (minutes)

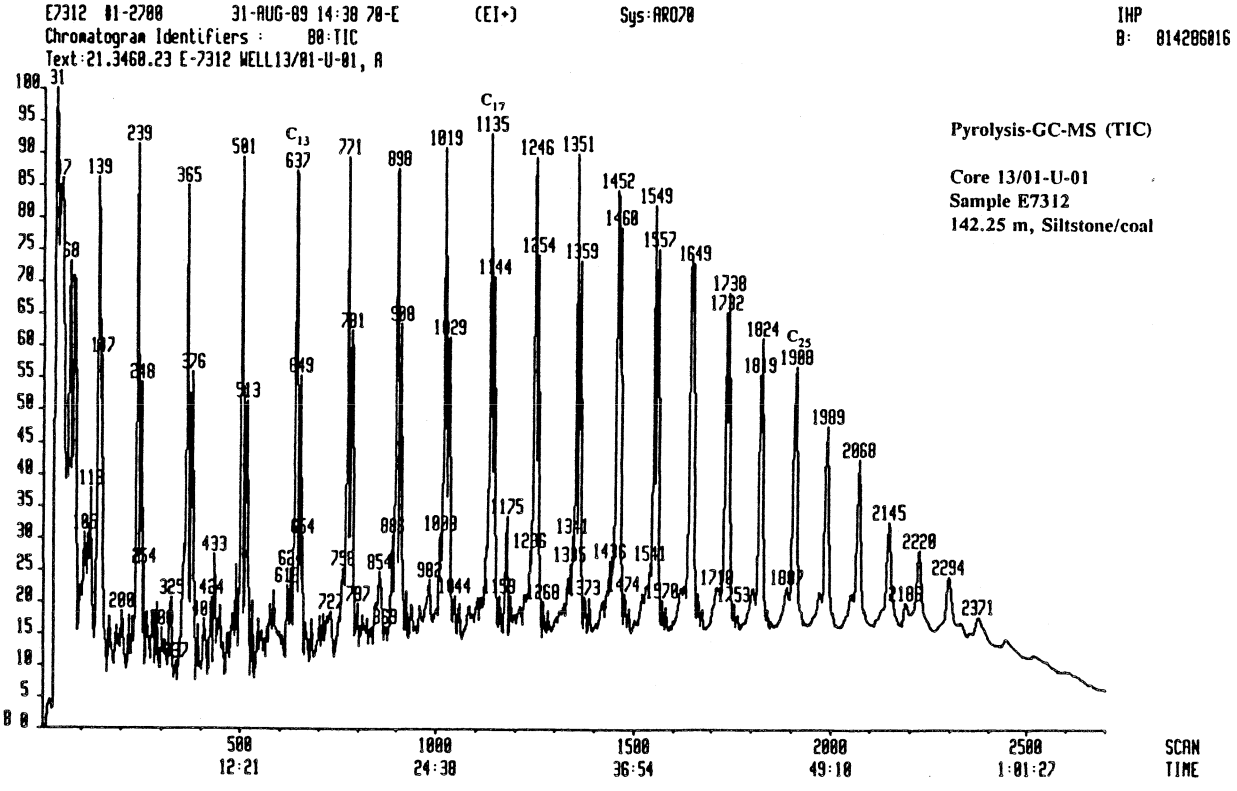

E7196 #1-2700 1-SEP-89 09:30 70-E (EI+) Sys:AR070
Chromatogram Identifiers : 80:TIC
Text:21.3460.23 E-7196 WELL 13/01-U-01, A
IHP
B: 406847000
Pyrolysis-GC-MS (TIC)
Core 13/01-U-01
Sample E7196
74.62 m, Claystone
C13
C17
C25
1-pr
SCAN
TIME

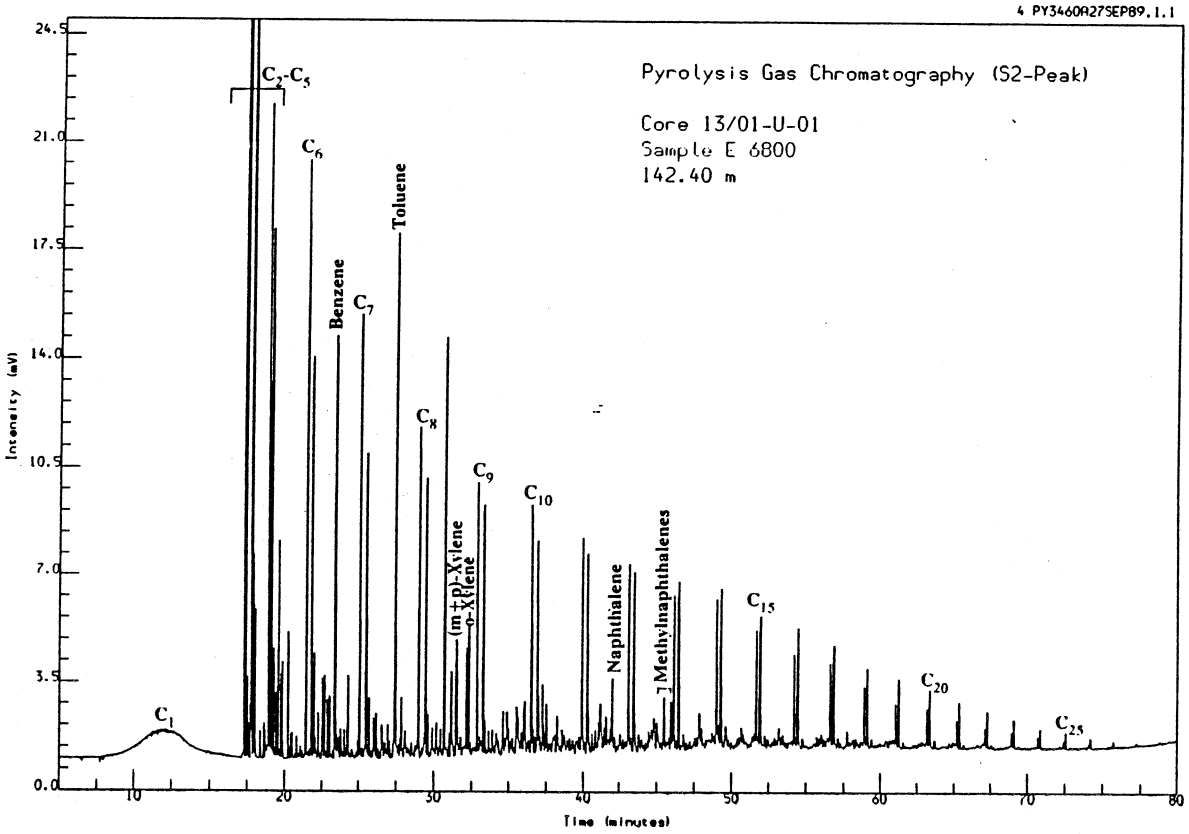

4 PY3460A065EP89.2.1
Pyrolysis Gas Chromatography (S2 Peak)
Core 13/01-U-01
Sample E 7269
110.35 m
Intensity (mV)
Time (minutes)
C1
C2-C5
C6
Benzene
C7
Toluene
C8
(m+p)-Xylene
o-Xylene
C9
C10
Naphthalene
Methylnaphthalenes
C15
1-Pristene
C20

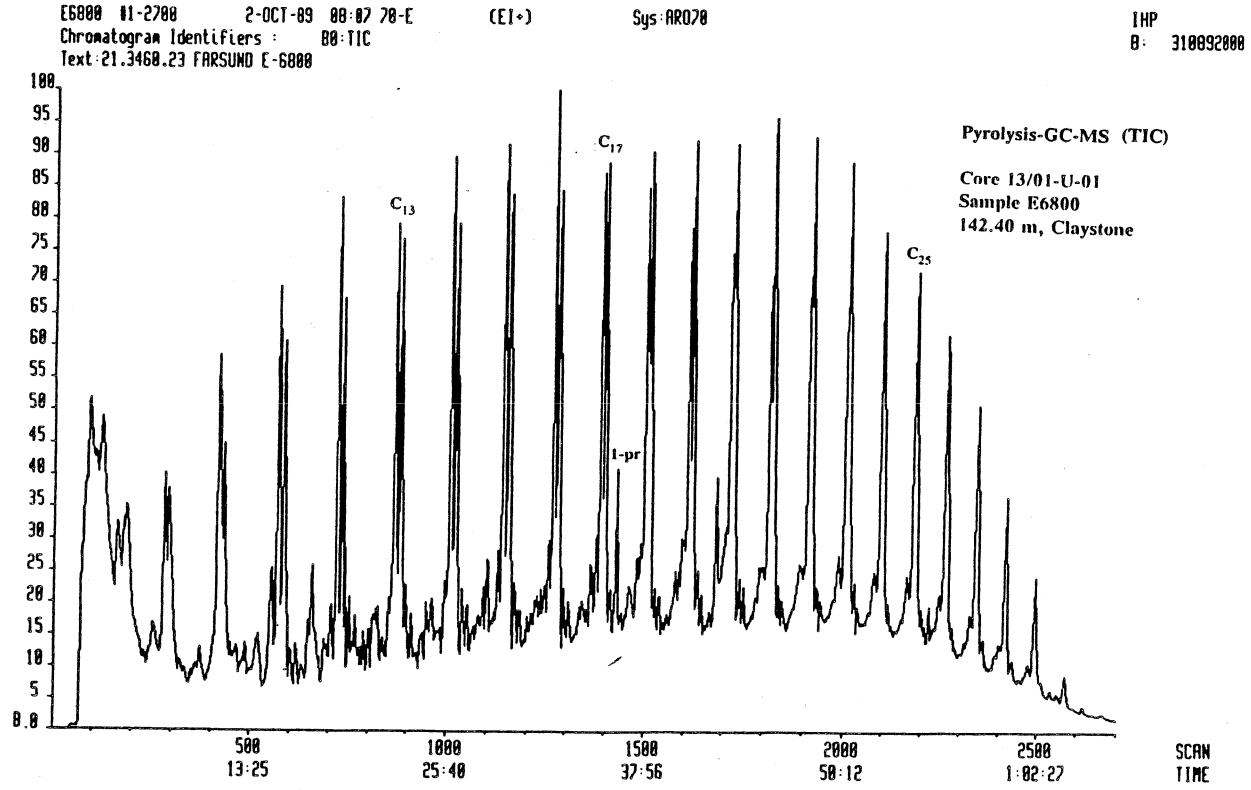

4 PY3460050CT89.1.1
Pyrolysis Gas Chromatography (S2-Peak)
Core 13/01-U-01
Sample E 7293
124.72 m
Toluene
Benzene
C_2-C_5
C_6
C_7
C_8
(m+p)-Xylene
o-Xylene
C_9
C_{10}
Naphthalene
Methylnaphthalenes
C_{15}
1-Pristene
C_1
Intensity (mV)
Time (minutes)

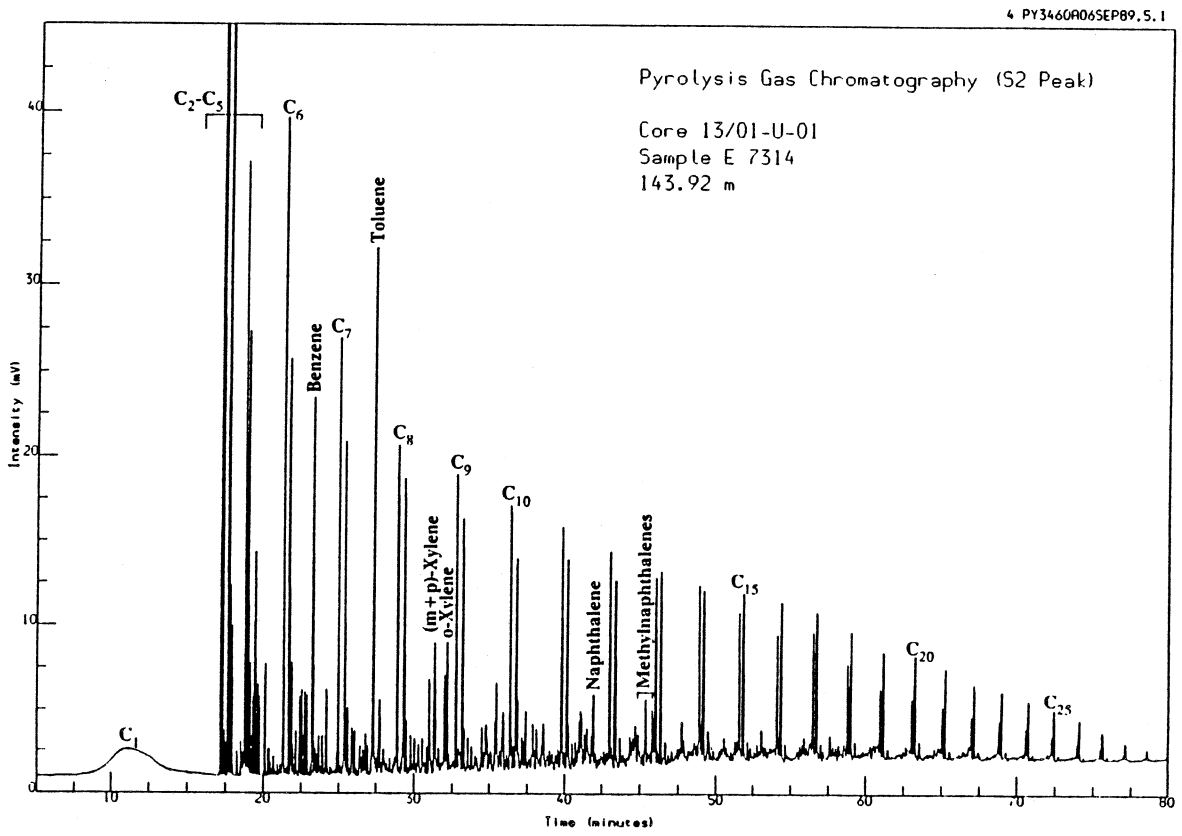

E7293 81-2700 1-SEP-89 11:17 70-E (EI+) Sys:AR070
Chromatogram Identifiers : A :ATIC
Text:21.3468.23 E-7293 WELL 13/01-U-01, A
IHP
A: 36128
Pyrolysis-GC-MS (TIC)
Core 13/01-U-01
Sample E7293
124.72 m, Claystone
OH
CH_3
436
C_{17}
C_{25}
SCAN
TIME

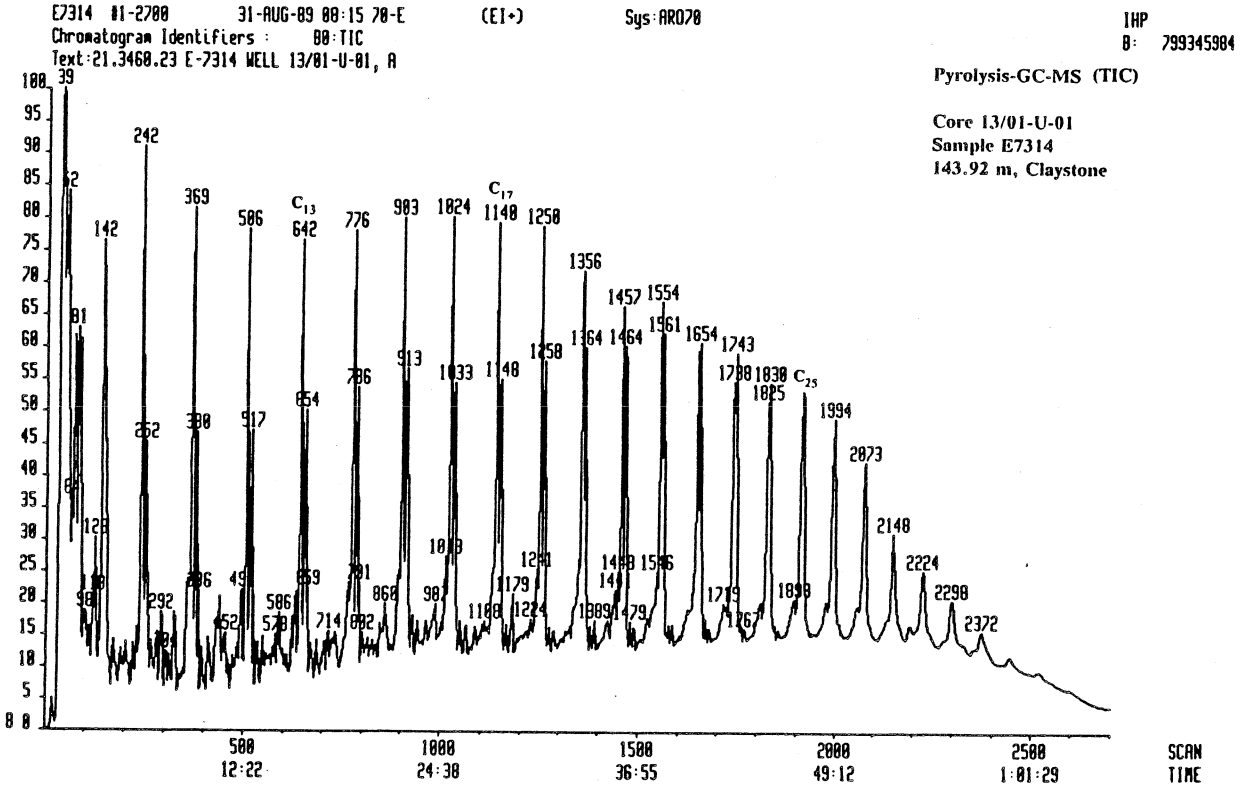

4 PY3460A06SEP89.4.1
Pyrolysis Gas Chromatography (S2 Peak)
Core 13/01-U-01
Sample E 7312
142.25 m
C2-C5
C6
Benzene
C7
Toluene
C8
(m+p)-Xylene
o-Xylene
C9
C10
Naphthalene
Methylnaphthalenes
C15
C20
C25
C1
Intensity (mV)
Time (minutes)

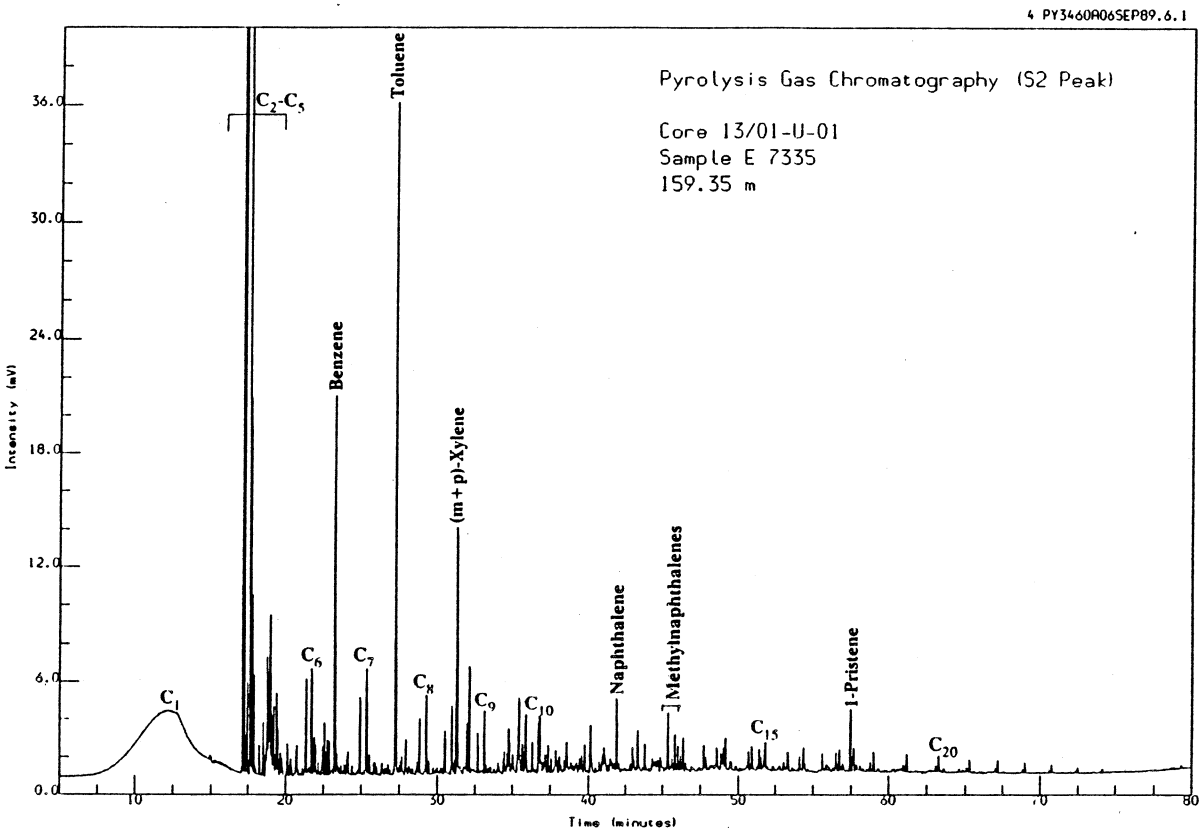

E7312 #1-2700 31-AUG-89 14:38 70-E (EI+) Sys:AR070
IHP
B: 814206816
Chromatogram Identifiers : 80:TIC
Text:21.3468.23 E-7312 WELL13/01-U-01, A
Pyrolysis-GC-MS (TIC)
Core 13/01-U-01
Sample E7312
142.25 m, Siltstone/coal
C13
C17
C25
SCAN
TIME

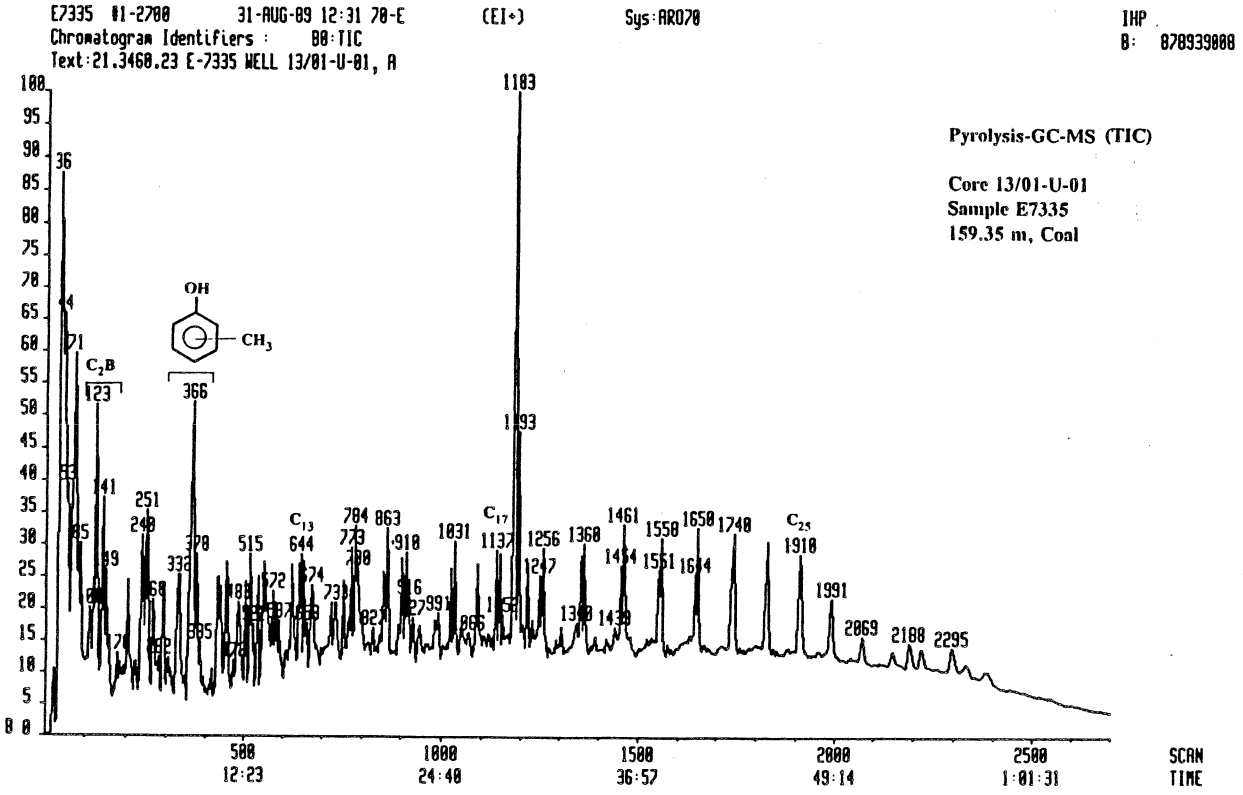

4 PY3460A27SEP89.1.1
Pyrolysis Gas Chromatography (S2-Peak)
Core 13/01-U-01
Sample E 6800
142.40 m
Intensity (mV)
Time (minutes)
C2-C5
C6
Toluene
Benzene
C7
C8
C9
C10
(m+p)-Xylene
o-Xylene
Naphthalene
1-Methylnaphthalenes
C15
C20
C25
C1

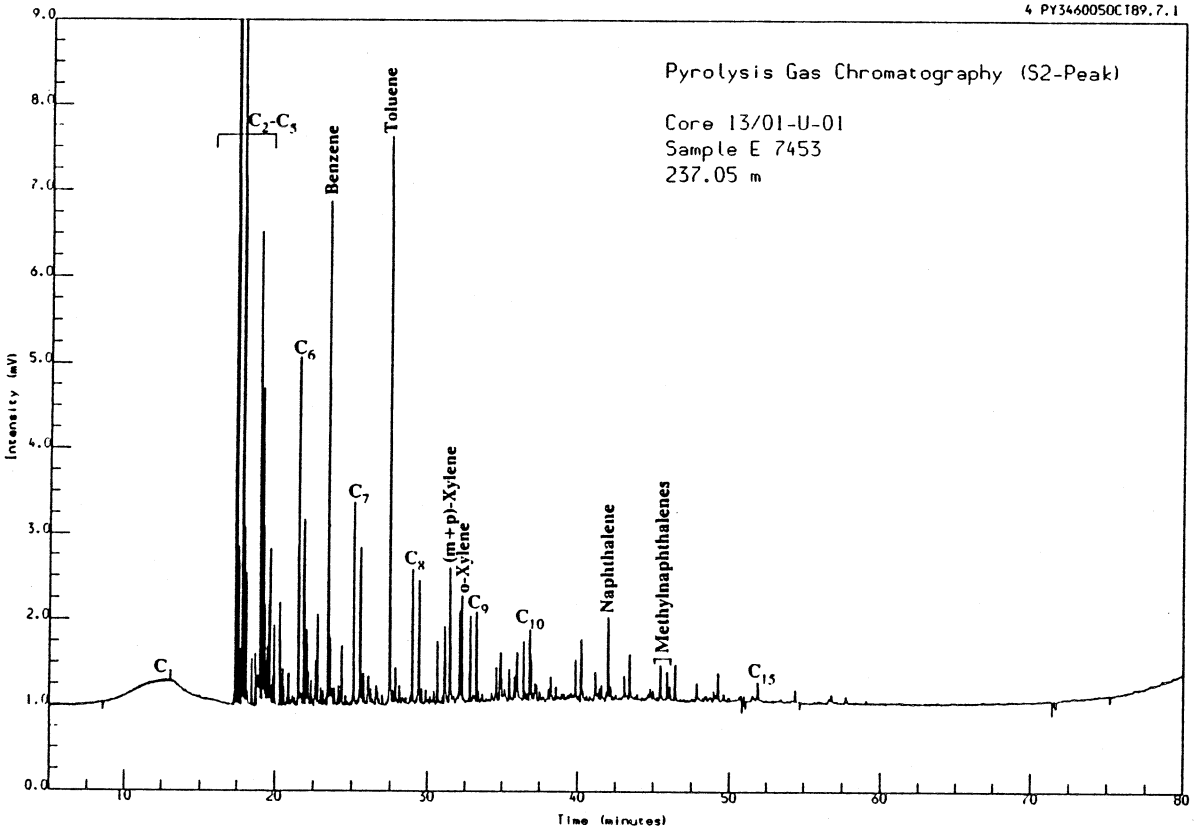

E6800 #1-2700 2-OCT-89 00:07 70-E (EI+) Sys:AR070
Chromatogram Identifiers : 00:TIC
Text:21.3468.23 FARSUND E-6800
IHP
0: 310892000
Pyrolysis-GC-MS (TIC)
Core 13/01-U-01
Sample E6800
142.40 m, Claystone
C13
C17
1-pr
C25
SCAN
TIME


4 PY3460A06SEP89.5.1
Pyrolysis Gas Chromatography (S2 Peak)
Core 13/01-U-01
Sample E 7314
143.92 m
C2-C5
C6
Benzene
C7
Toluene
C8
C9
(m+p)-Xylene
o-Xylene
C10
Naphthalene
Methylnaphthalenes
C15
C20
C25
C1
Intensity (mV)
Time (minutes)


E7314 #1-2700 31-AUG-89 08:15 70-E (EI+) Sys:AR070
Chromatogram Identifiers : 80:TIC
Text:21.3460.23 E-7314 WELL 13/01-U-01, A
IHP
8: 799345984
Pyrolysis-GC-MS (TIC)
Core 13/01-U-01
Sample E7314
143.92 m, Claystone
C13
C17
C25
SCAN
TIME


4 PY3460A06SEP89.6.1
Pyrolysis Gas Chromatography (S2 Peak)
Core 13/01-U-01
Sample E 7335
159.35 m
C2-C5
Toluene
Benzene
(m+p)-Xylene
Naphthalene
Methylnaphthalenes
1-Pristene
C1
C6
C7
C8
C9
C10
C15
C20
Intensity (mV)
Time (minutes)


E7335 81-2700 31-AUG-89 12:31 70-E (EI+) Sys:AR070
Chromatogram Identifiers : 88:TIC
Text:21.3468.23 E-7335 WELL 13/01-U-01, A
IHP
B: 878939888
Pyrolysis-GC-MS (TIC)
Core 13/01-U-01
Sample E7335
159.35 m, Coal
OH
CH3
C2B
C13
C17
C25
SCAN
TIME


4 PY3460050CT89.7.1
Pyrolysis Gas Chromatography (S2-Peak)
Core 13/01-U-01
Sample E 7453
237.05 m
C2-C5
Benzene
Toluene
C6
C7
Cx
(m+p)-Xylene
o-Xylene
C9
C10
Naphthalene
Methylnaphthalenes
C15
C1
Intensity (mV)
Time (minutes)

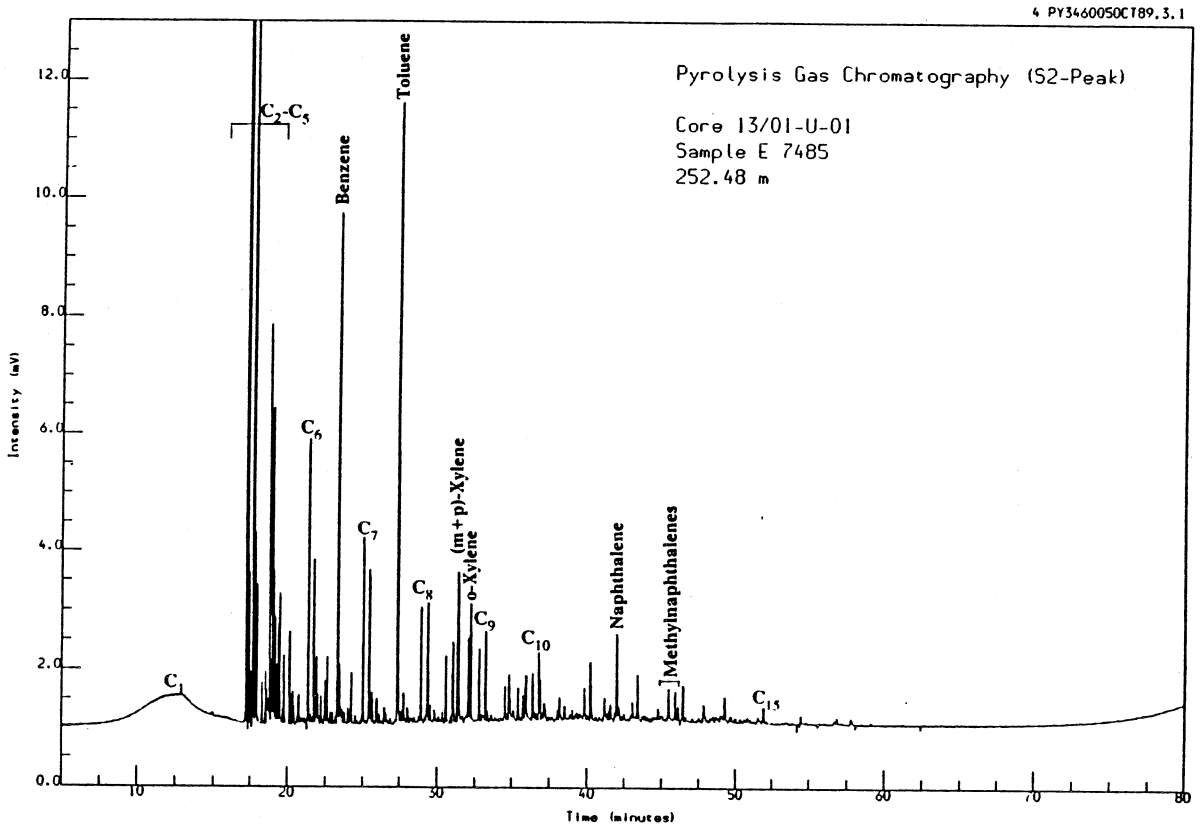
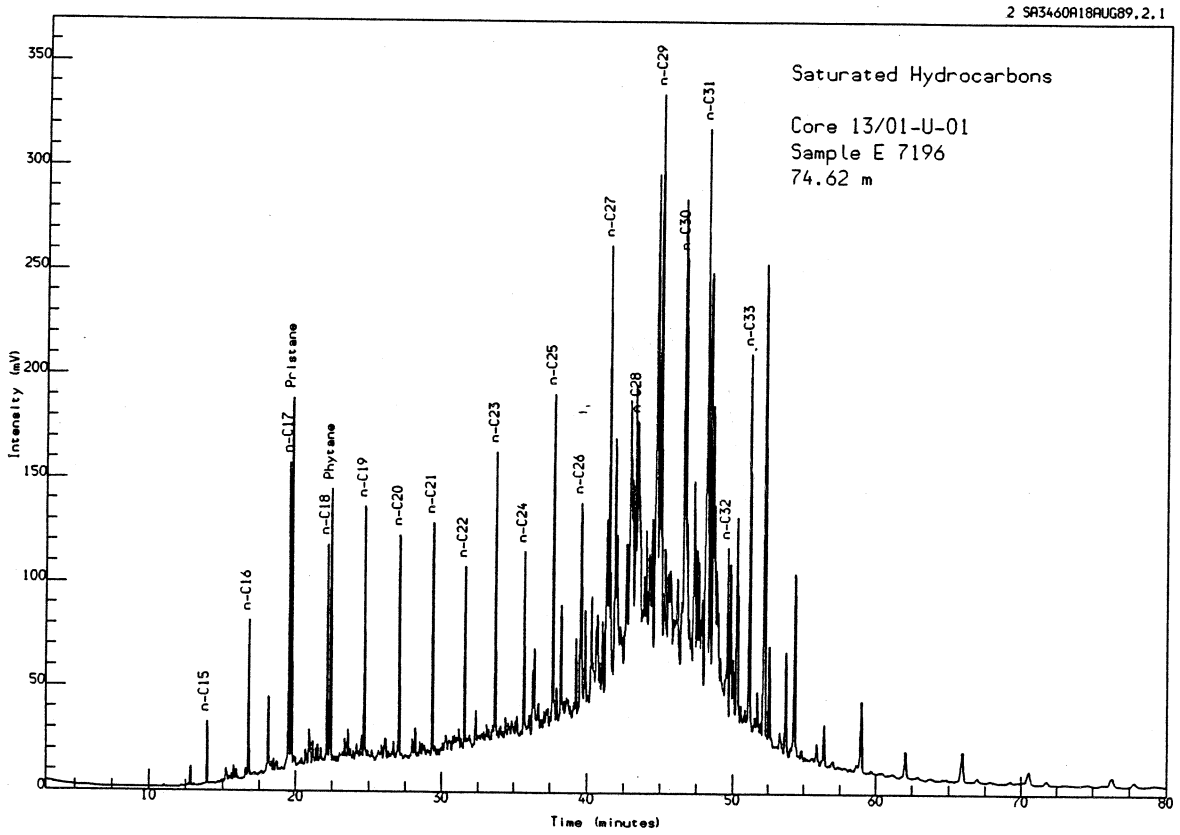

4 PY3460050CT89.3.1
Pyrolysis Gas Chromatography (S2-Peak)
Core 13/01-U-01
Sample E 7485
252.48 m
Intensity (mV)
Time (minutes)
C1
C2-C5
Benzene
Toluene
C6
C7
C8
(m+p)-Xylene
o-Xylene
C9
C10
Naphthalene
Methylnaphthalenes
C15

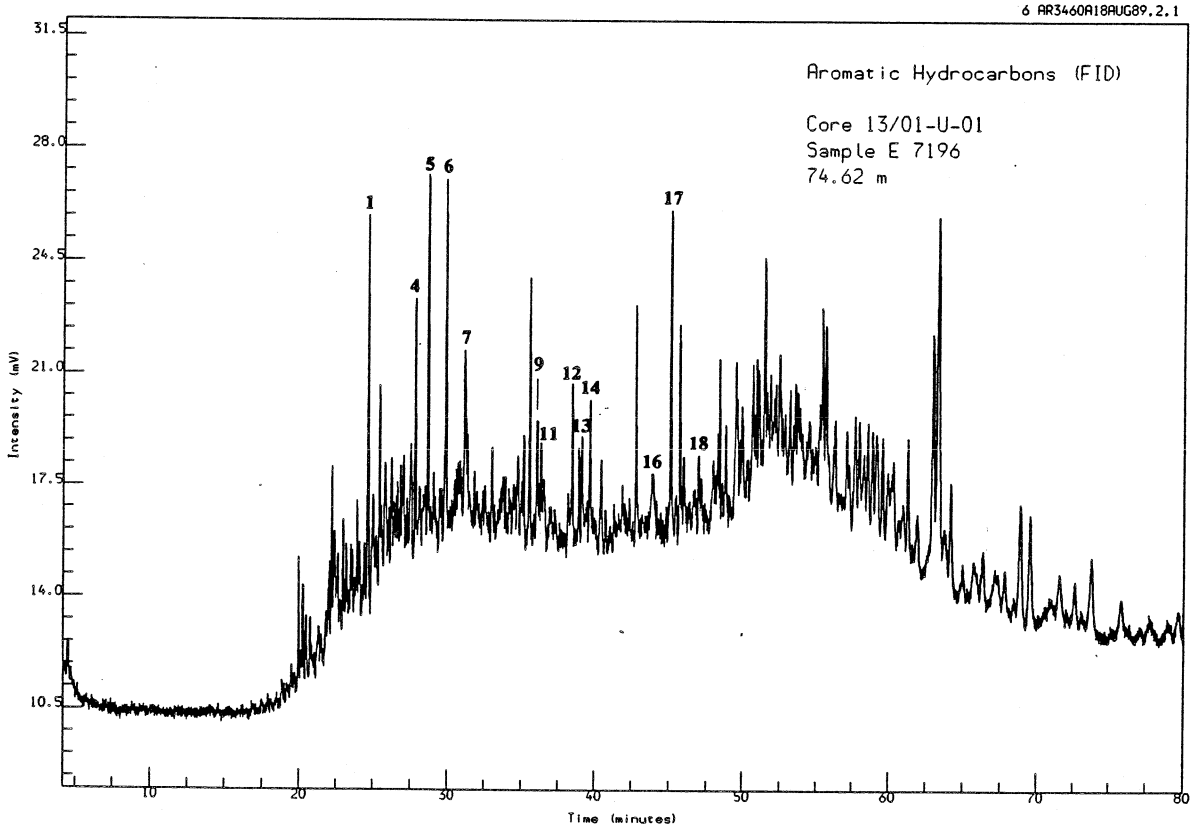
Figure A.II.3.2:

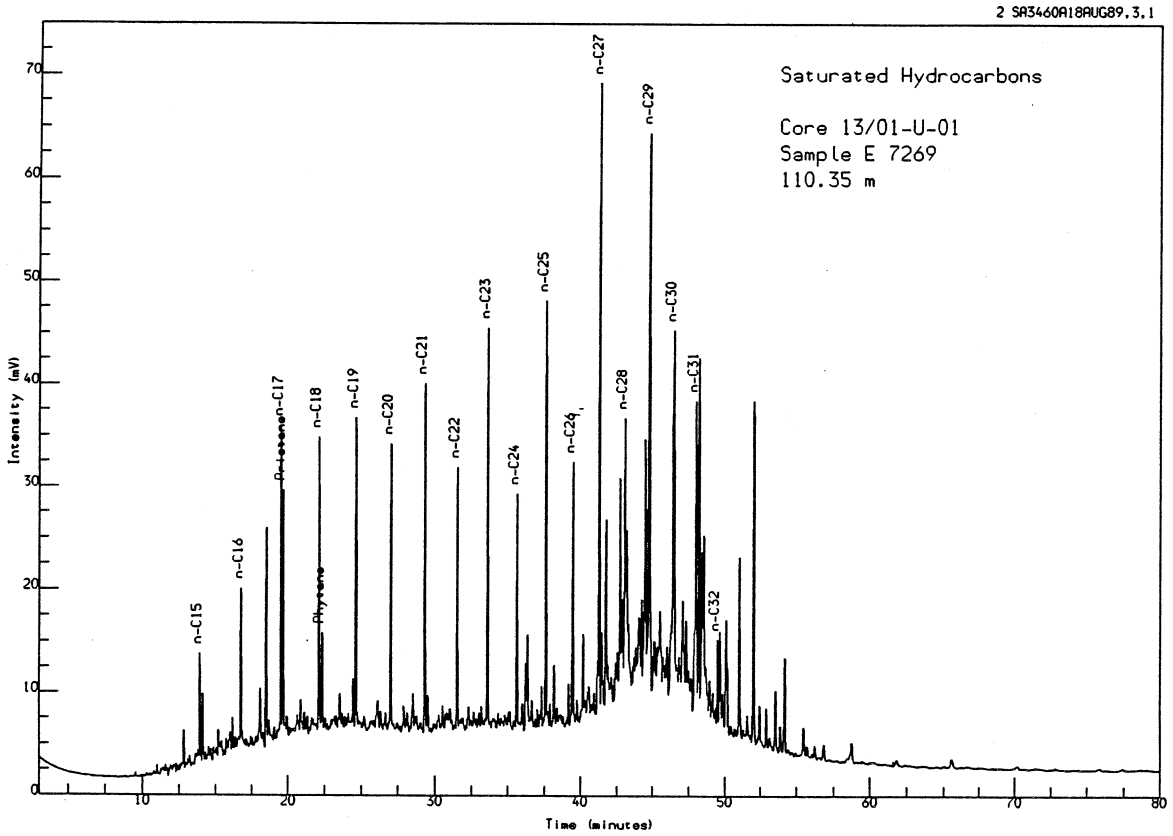
Gas chromatograms of saturated and aromatic hydrocarbons

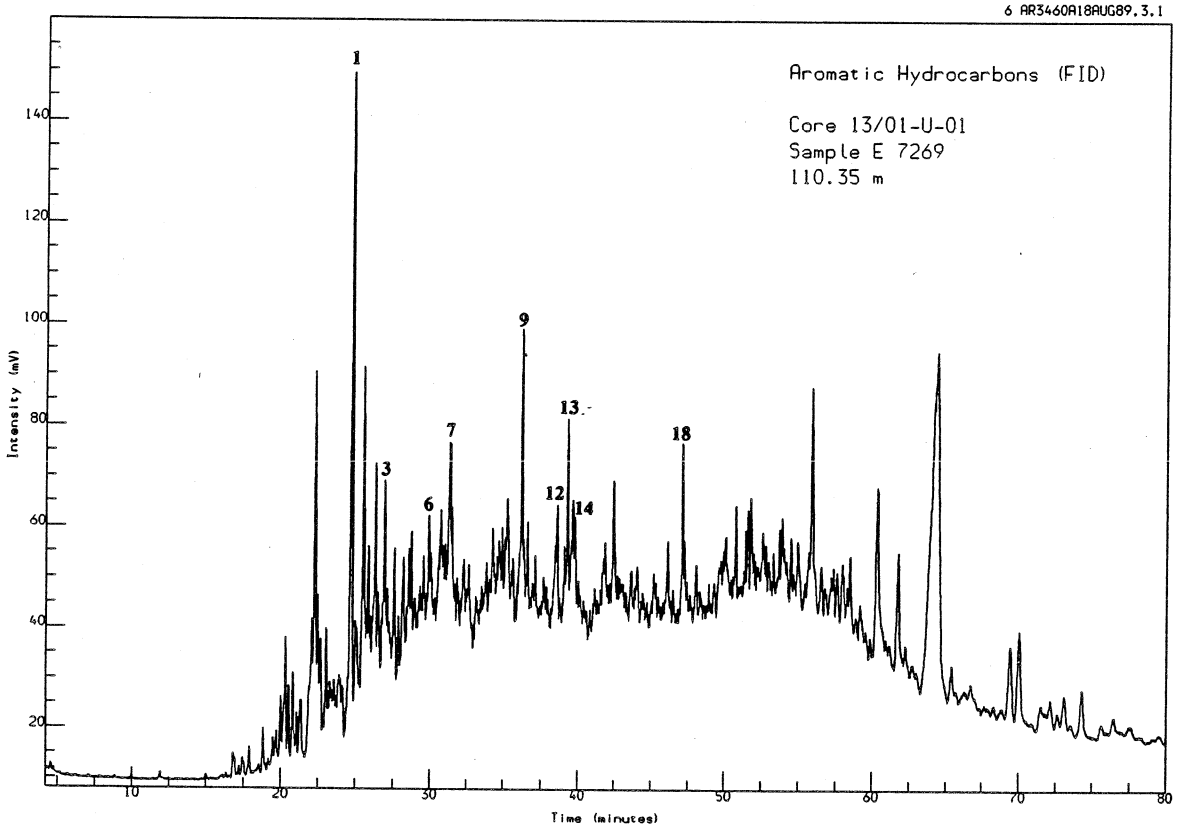
Peak code	Peak identity
n-C_{15} etc.	- n-alkanes
N	Naphthalene
MN	Methylnaphthalenes
DMN	Dimethylnaphthalenes
TMN	C_3-naphthalenes
P	Phenanthrene
PN	Methylphenanthrenes
DMP	Dimethylphenanthrenes
1	Cadalene (C_5-Naphthalene)
2	C_6-Naphthalene
3	C_{14}-Benzene
4	unidentified
7	Dehydroabietine (?)
8	Dehydroabietane (?)
9	PAH, MW=202
10	Phenylnaphthalene
11	Simonellite
12	Retene
13	PAH, MW=218
14	PAH, MW=216
15	unidentified
16	PAH, MW=228
17	unidentified
18	PAH, MW=242
19	PAH, MW=252
20	PAH, MW=268
21	PAH, MW=252
22	PAH, MW=252
23	PAH, MW=268
24	PAH, MW=264
25	PAH, MW=276
26	PAH, MW=276
27	PAH, MW=292

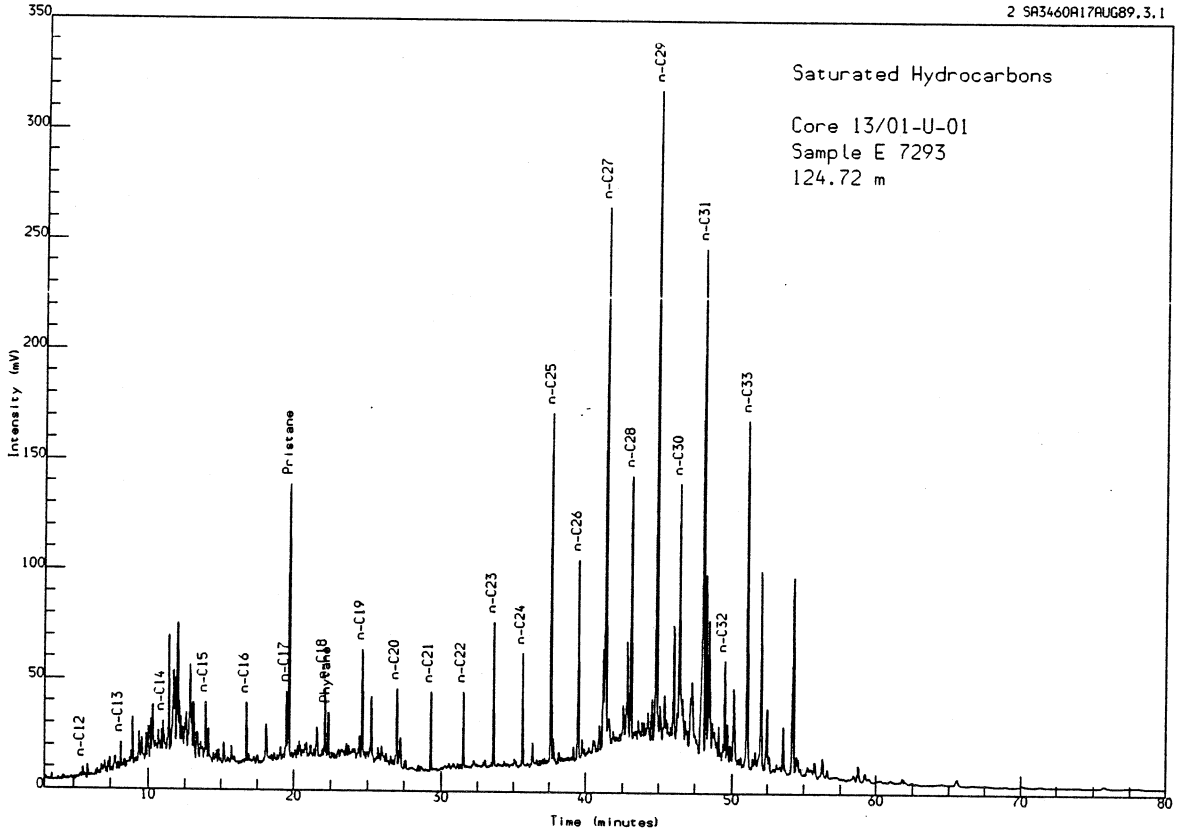
(PAH = Polcyclic aromatic hydrocarbon)

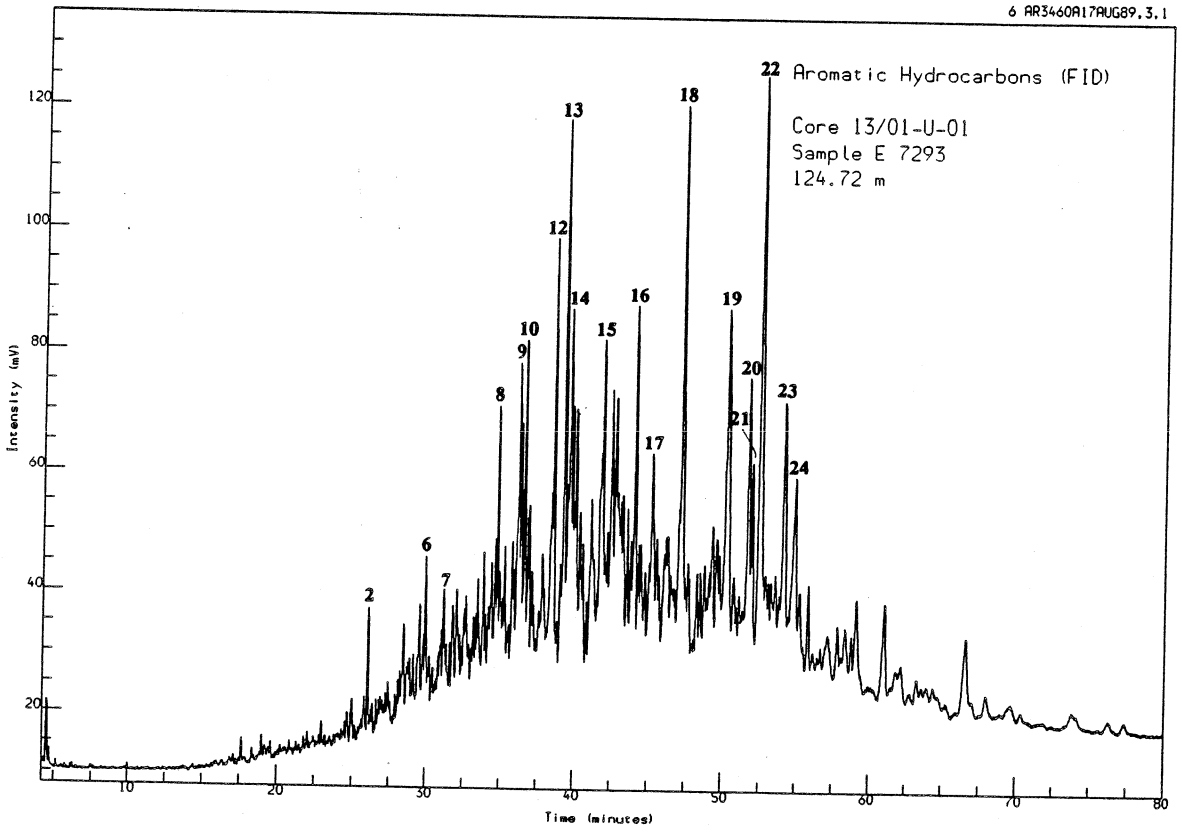

2 SA3460A18AUG89.2.1
Saturated Hydrocarbons
Core 13/01-U-01
Sample E 7196
74.62 m
n-C15
n-C16
n-C17
Pristane
n-C18
Phytane
n-C19
n-C20
n-C21
n-C22
n-C23
n-C24
n-C25
n-C26
n-C27
n-C28
n-C29
n-C30
n-C31
n-C32
n-C33
Intensity (mV)
Time (minutes)

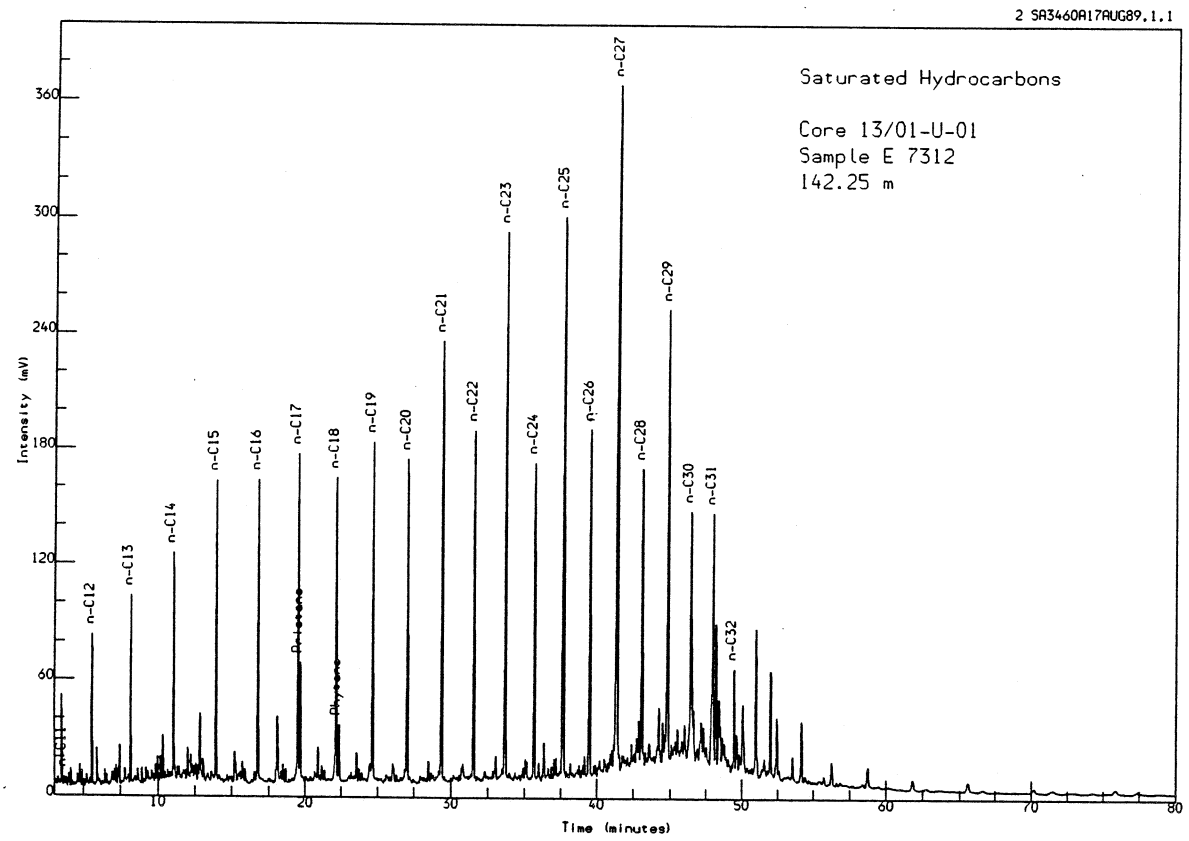

6 AR3460A18AUG89.2.1
Aromatic Hydrocarbons (FID)
Core 13/01-U-01
Sample E 7196
74.62 m
1
4
5
6
7
9
11
12
13
14
16
17
18
Intensity (mV)
Time (minutes)

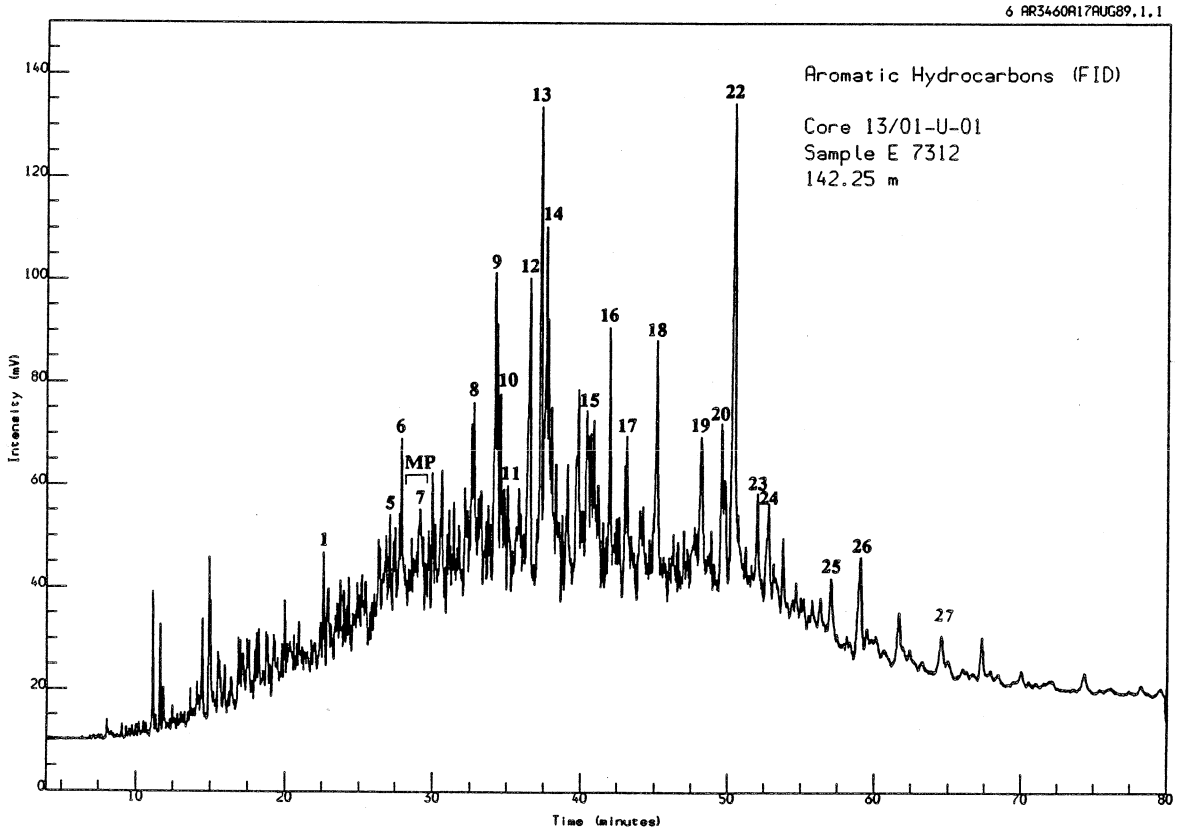

2 SA3460A18AUG89.3.1
Saturated Hydrocarbons
Core 13/01-U-01
Sample E 7269
110.35 m
n-C15
n-C16
Pristane
n-C17
n-C18
Phytane
n-C19
n-C20
n-C21
n-C22
n-C23
n-C24
n-C25
n-C24
n-C27
n-C28
n-C29
n-C30
n-C31
n-C32
Intensity (mV)
Time (minutes)

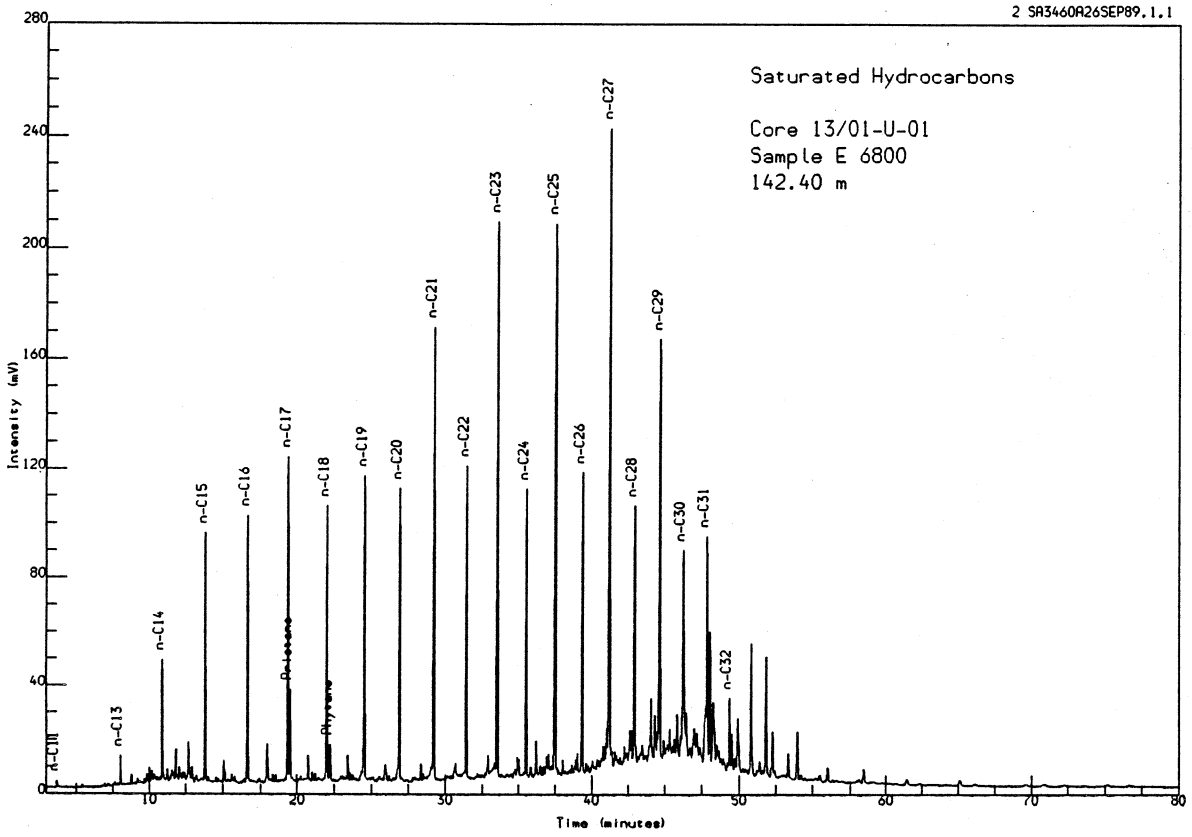

6 AR3460A18AUG89.3.1
Aromatic Hydrocarbons (FID)
Core 13/01-U-01
Sample E 7269
110.35 m
1
3
6
7
9
12
13
14
18
Intensity (mV)
Time (minutes)

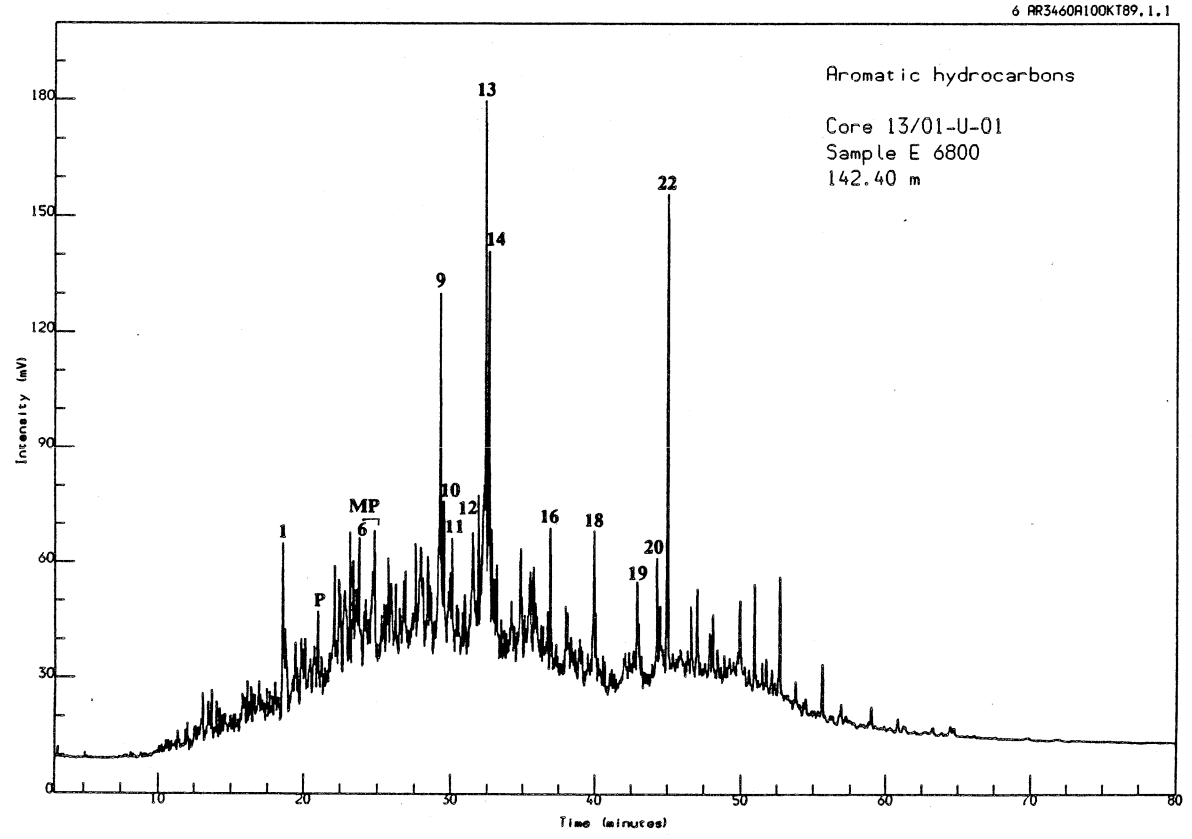

2 SA3460A17AUG89.3.1
Saturated Hydrocarbons
Core 13/01-U-01
Sample E 7293
124.72 m
Intensity (mV)
Time (minutes)
n-C12
n-C13
n-C14
n-C15
n-C16
n-C17
Pristane
Phytane
n-C18
n-C19
n-C20
n-C21
n-C22
n-C23
n-C24
n-C25
n-C26
n-C27
n-C28
n-C29
n-C30
n-C31
n-C32
n-C33

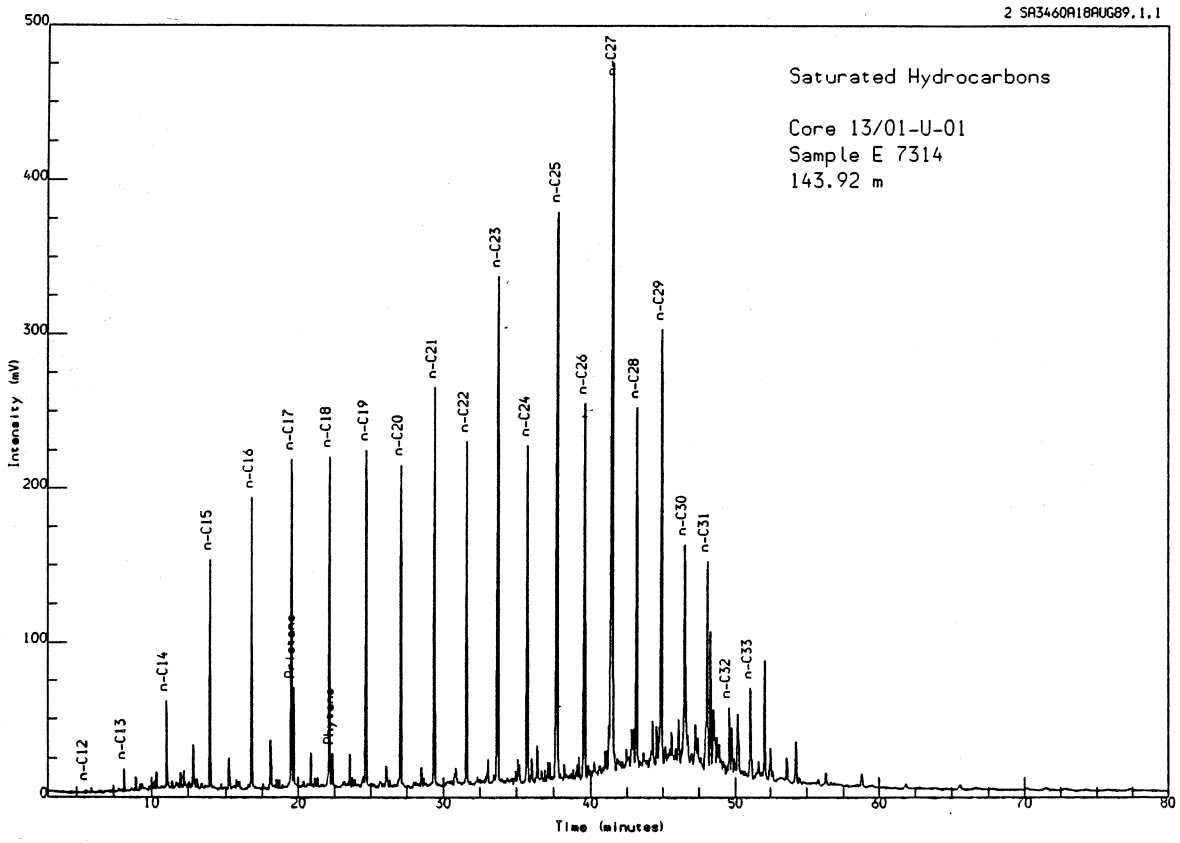

6 AR3460A17AUG89.3.1
Aromatic Hydrocarbons (FID)
Core 13/01-U-01
Sample E 7293
124.72 m
Intensity (mV)
Time (minutes)
2
6
7
8
9
10
12
13
14
15
16
17
18
19
20
21
22
23
24

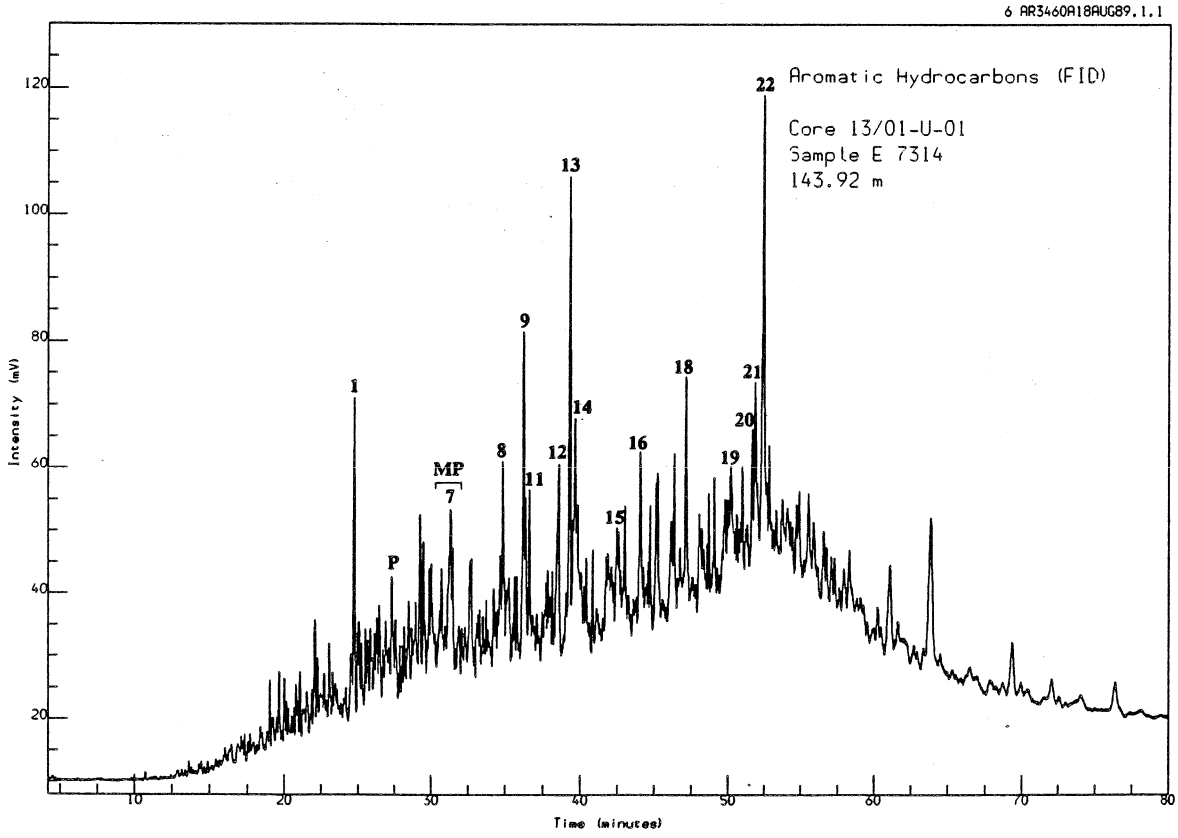

2 SA3460A17AUG89.1.1
Saturated Hydrocarbons
Core 13/01-U-01
Sample E 7312
142.25 m
n-C12
n-C13
n-C14
n-C15
n-C16
n-C17
Pristane
n-C18
Phytane
n-C19
n-C20
n-C21
n-C22
n-C23
n-C24
n-C25
n-C26
n-C27
n-C28
n-C29
n-C30
n-C31
n-C32
Intensity (mV)
Time (minutes)

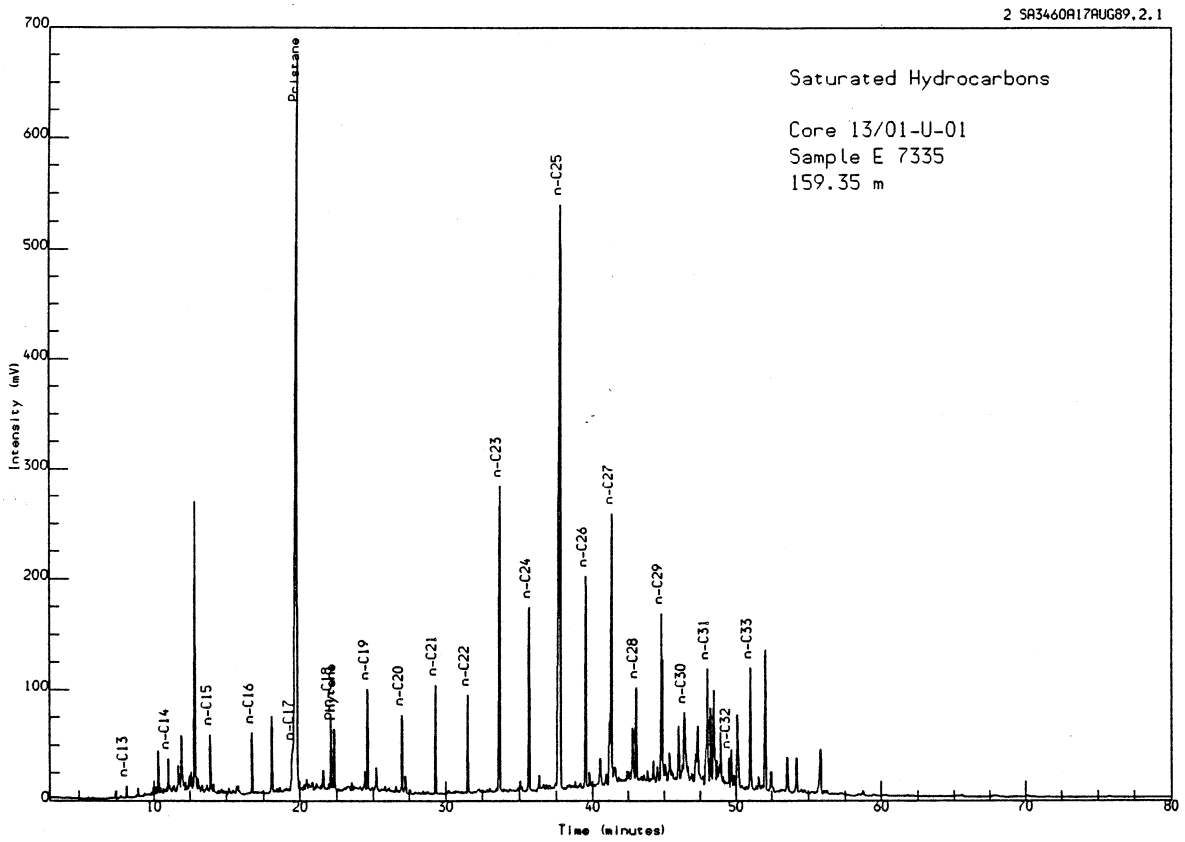

6 AR3460A17AUG89.1.1
Aromatic Hydrocarbons (FID)
Core 13/01-U-01
Sample E 7312
142.25 m
MP
Intensity (mV)
Time (minutes)

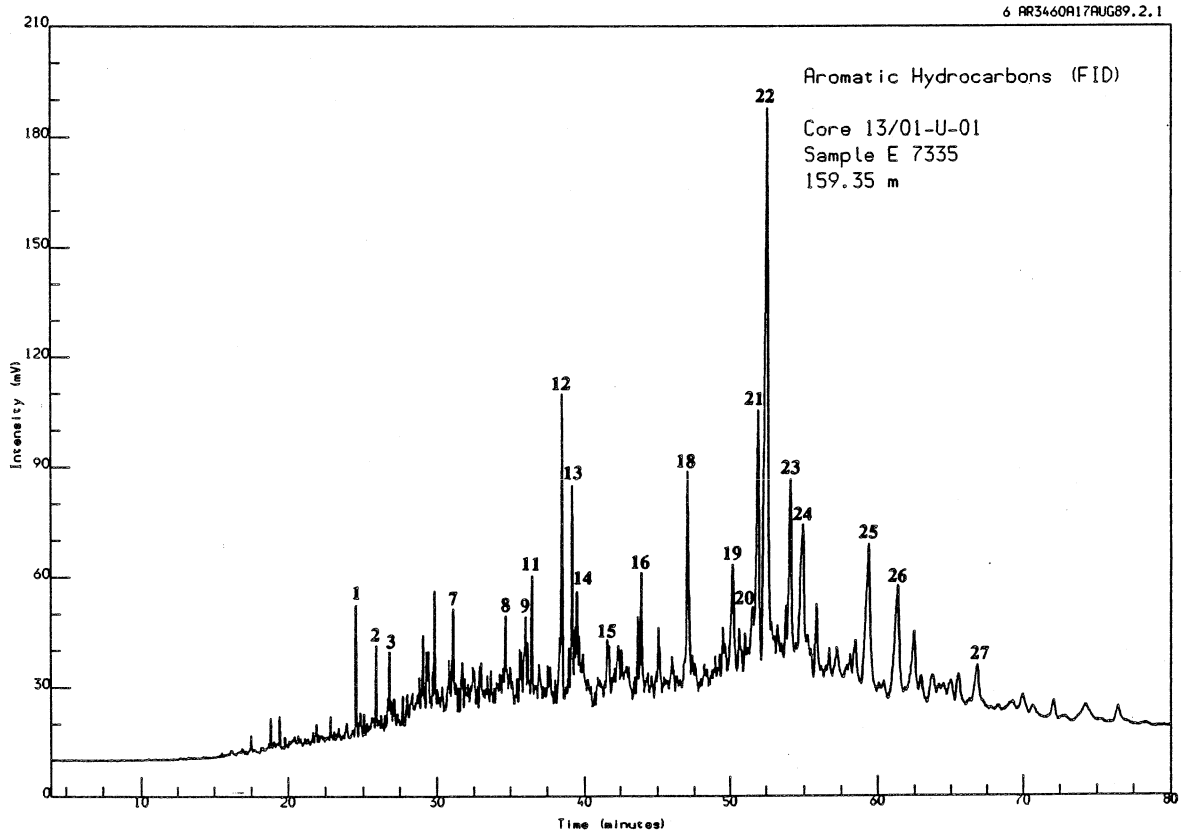

2 SA3460A26SEP89.1.1
Saturated Hydrocarbons
Core 13/01-U-01
Sample E 6800
142.40 m
Intensity (mV)
Time (minutes)
n-C13
n-C14
n-C15
n-C16
n-C17
Pristane
n-C18
Phytane
n-C19
n-C20
n-C21
n-C22
n-C23
n-C24
n-C25
n-C26
n-C27
n-C28
n-C29
n-C30
n-C31
n-C32

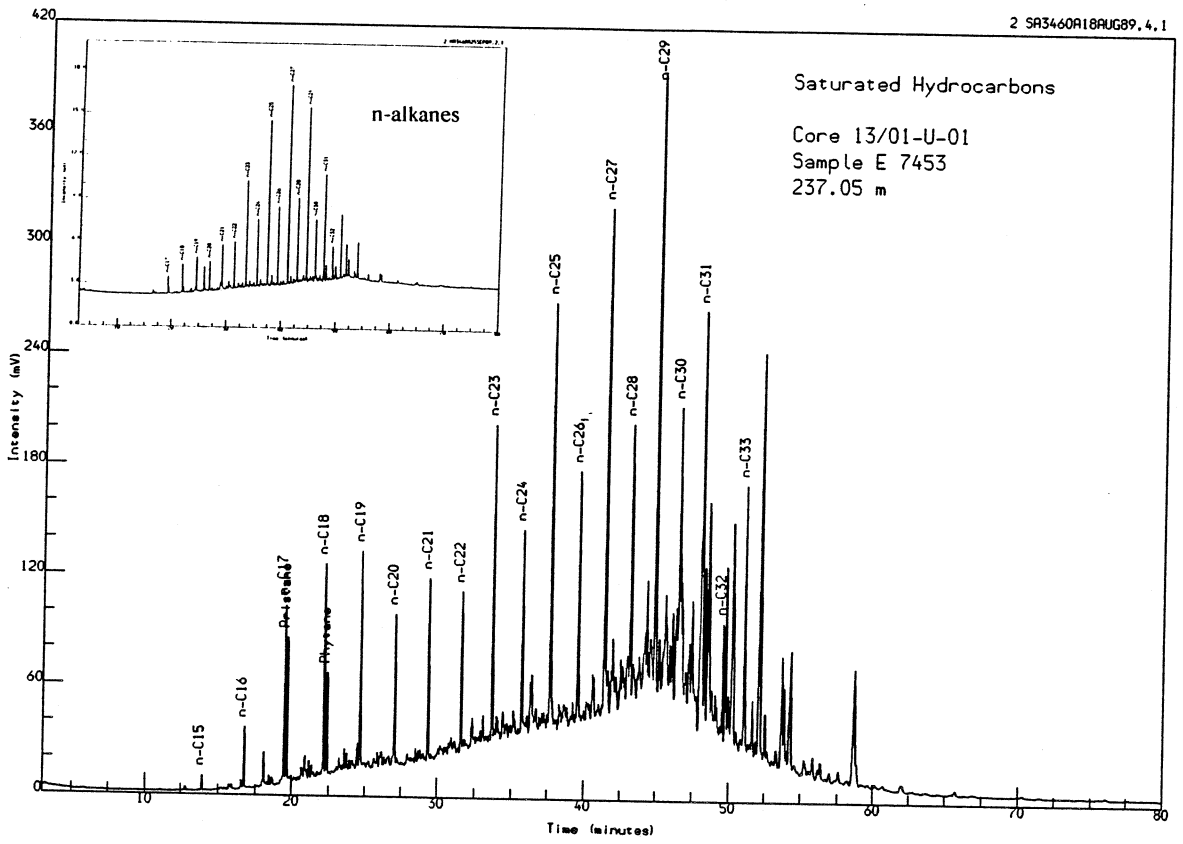

6 AR3460A10OKT89.1.1
Aromatic hydrocarbons
Core 13/01-U-01
Sample E 6800
142.40 m
Intensity (mV)
Time (minutes)
1
P
MP
6
9
10
11
12
13
14
16
18
19
20
22

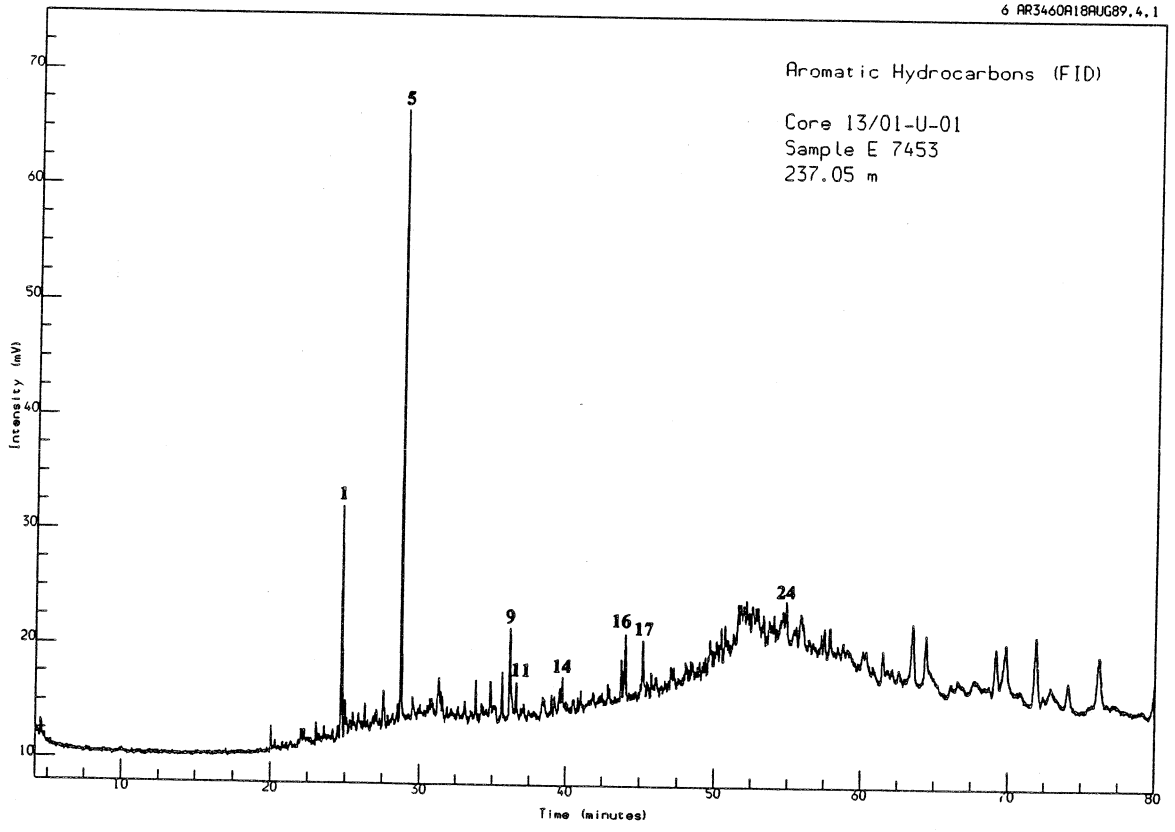

2 SA3460A18AUG89.1.1
Saturated Hydrocarbons
Core 13/01-U-01
Sample E 7314
143.92 m
Intensity (mV)
Time (minutes)
n-C12
n-C13
n-C14
n-C15
n-C16
n-C17
Pristane
n-C18
Phytane
n-C19
n-C20
n-C21
n-C22
n-C23
n-C24
n-C25
n-C26
n-C27
n-C28
n-C29
n-C30
n-C31
n-C32
n-C33

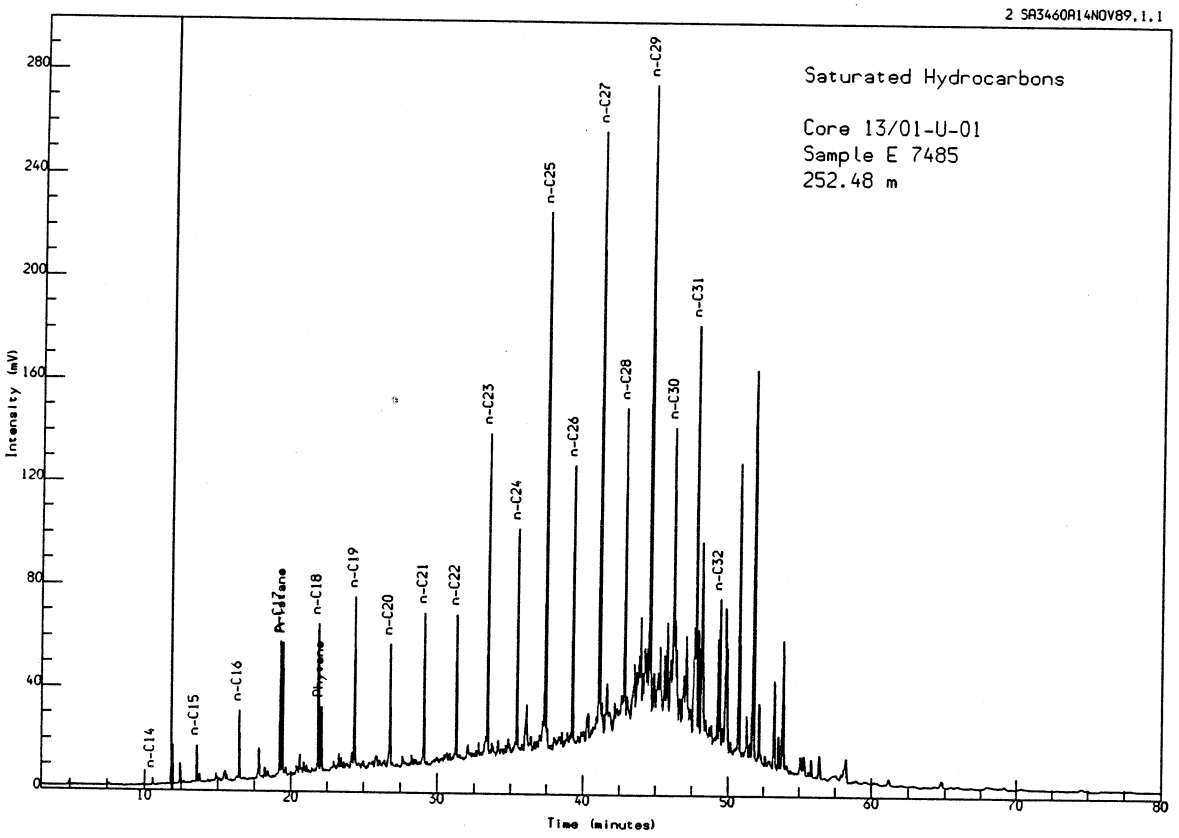

6 AR3460A18AUG89.1.1
Aromatic Hydrocarbons (FID)
Core 13/01-U-01
Sample E 7314
143.92 m
Intensity (mV)
Time (minutes)
1
P
MP
7
8
9
11
12
13
14
15
16
18
19
20
21
22


2 SA3460A17AUG89.2.1
Saturated Hydrocarbons
Core 13/01-U-01
Sample E 7335
159.35 m
Intensity (mV)
Time (minutes)
n-C13
n-C14
n-C15
n-C16
n-C17
Pristane
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
n-C31
n-C32
n-C33


6 AR3460A17AUG89.2.1
Aromatic Hydrocarbons (FID)
Core 13/01-U-01
Sample E 7335
159.35 m
Intensity (mV)
Time (minutes)
1
2
3
7
8
9
11
12
13
14
15
16
18
19
20
21
22
23
24
25
26
27


2 SA3460A18AUG89.4.1
Saturated Hydrocarbons
Core 13/01-U-01
Sample E 7453
237.05 m
n-alkanes
Intensity (mV)
Time (minutes)
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


6 AR3460A18AUG89.4.1
Aromatic Hydrocarbons (FID)
Core 13/01-U-01
Sample E 7453
237.05 m
Intensity (mV)
Time (minutes)
1
5
9
11
14
16
17
24


2 SA3460A14NOV89.1.1
Saturated Hydrocarbons
Core 13/01-U-01
Sample E 7485
252.48 m
Intensity (mV)
Time (minutes)
n-C14
n-C15
n-C16
Pristane
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
n-C31
n-C32

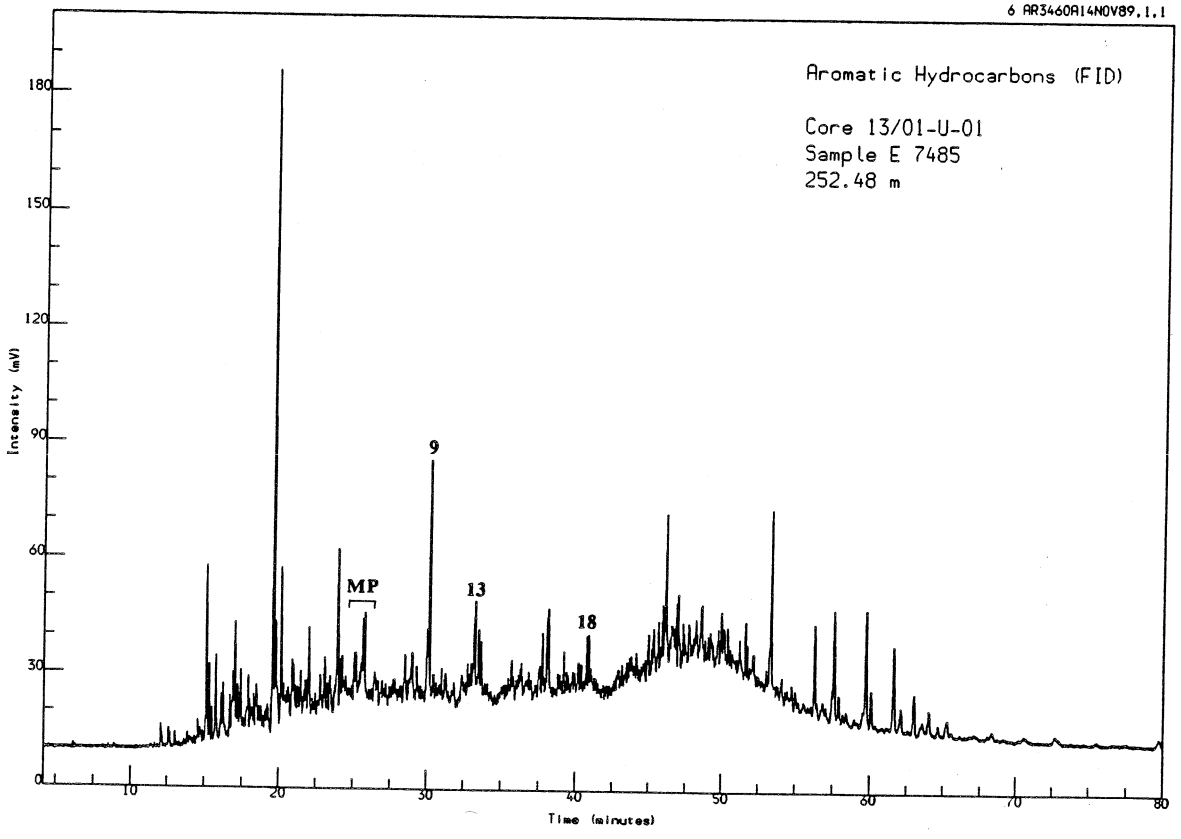

6 AR3460A14NOV89.1.1
Aromatic Hydrocarbons (FID)
Core 13/01-U-01
Sample E 7485
252.48 m
Intensity (mV)
Time (minutes)
MP
9
13
18

Figure A.II.3.3:

Mass fragmentograms of m/z 191, 205 (terpanes) and m/z 217, 218 (steranes).

IKU SINTEF-GRUPPEN

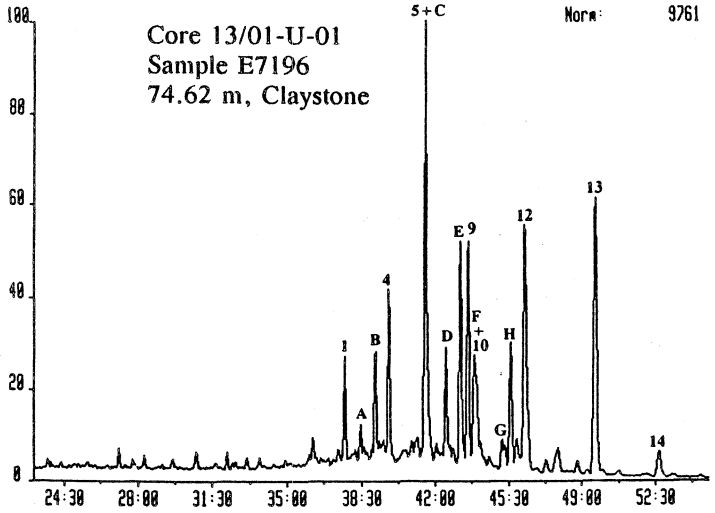
Key for m/z 191, 205 (terpanes):

Peak code	Identification	C-atoms : double bonds
P	C_{23} tricyclic terpane	($C_{23:0}$)
Q	C_{24} tricyclic terpane	($C_{24:0}$)
R	C_{25} tricyclic terpane (17R,17S)	($C_{25:0}$)
S	C_{24} tetracyclic terpane	($C_{24:0}$)
T	C_{26} tricyclic terpane (17R,17S)	($C_{26:0}$)
1	C_{27} hopene	($C_{27:1}$)
A	18α(H)-trisnorneohopane, Ts (?)	($C_{27:0}$)
B	17α(H)-trisnorhopane, Tm	($C_{27:0}$)
4	17β(H)-trisnorhopane	($C_{27:0}$)
5	nor-hop-$\Delta^{13(18)}$-ene	($C_{29:1}$)
C	17α(H), 21β(H)-norhopane	($C_{29:0}$)
6	hop-$\Delta^{17(21)}$-ene	($C_{30:1}$)
D	17β(H),21α(H)-norhopane (= normoretane)	($C_{29:0}$)
E	17α(H),21β(H)-hopane	($C_{30:0}$)
9	hop-$\Delta^{13(18)}$-ene	($C_{30:1}$)
10	17β(H),21β(H)-norhopane	($C_{29:0}$)
F	17β(H),21α(H)-hopane (= moretane)	($C_{30:0}$)
G	17α(H),21β(H)-homohopane (22S)	($C_{31:0}$)
H	17α(H),21β(H)-homohopane (22R)	($C_{31:0}$)
12	17β(H),21β(H)-hopane	($C_{30:0}$)
13	17β(H),21β(H)-homohopane	($C_{31:0}$)
I	17β(H),21α(H)-homohopane (= homomoretane)	($C_{31:0}$)
14	17β(H),21β(H)-bishomohopane	($C_{32:0}$)
15	17β(H),21β(H)-trishomohopane	($C_{33:0}$)
J	17α(H),21β(H)-bishomohopane (22S,22R)	($C_{32:0}$)
K	17α(H),21β(H)-trishomohopane (22S,22R)	($C_{33:0}$)
L	17α(H),21β(H)-tetrakishomohopane (22S,22R)	($C_{34:0}$)
M	17α(H),21β(H)-pentakishomohopane (22S,22R)	($C_{35:0}$)

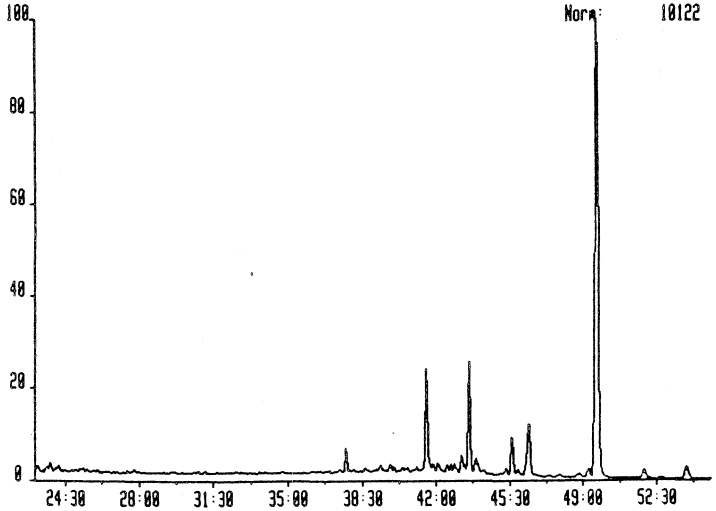
Key for m/z 217 and 218 (steranes):

Peak code	Identification	Formula
u	5α(H)-sterane	$C_{21}H_{36}$
v	5α(H)-sterane	$C_{22}H_{38}$
a	13β(H),17α(H)-diasterane (20S)	$C_{27}H_{48}$
b	13β(H),17α(H)-diasterane (20R)	$C_{27}H_{48}$
c	13α(H),17β(H)-diasterane (20S)	$C_{27}H_{48}$
d	13α(H),17β(H)-diasterane (20R)	$C_{27}H_{48}$
e	13β(H),17α(H)-diasterane (20S)	$C_{28}H_{50}$
f	13β(H),17α(H)-diasterane (20R)	$C_{28}H_{50}$
g	13α(H),17β(H)-diasterane (20S)	$C_{28}H_{50}$
	+ 14α(H),17α(H)-sterane (20S)	$C_{27}H_{48}$
h	13β(H),17α()H)-diasterane (20S)	$C_{29}H_{52}$
	+ 14β(H),17β(H)-sterane (20R)	$C_{27}H_{48}$
i	14β(H),17β(H)-sterane (20S)	$C_{27}H_{48}$
	+ 13α(H),17β(H)-diasterane (20R)	$C_{28}H_{50}$
j	14α(H),17α(H)-sterane (20R)	$C_{27}H_{48}$
k	13β(H),17α(H)-diasterane (20R)	$C_{29}H_{52}$
l	13α(H),17β(H)-diasterane (20S)	$C_{29}H_{52}$
m	14α(H),17α(H)-sterane (20S)	$C_{28}H_{50}$
n	13α(H),17β(H)-diasterane (20R)	$C_{29}H_{52}$
	+ 14β(H),17β(H)-sterane (20R)	$C_{28}H_{50}$
o	14β(H),17β(H)-sterane (20S)	$C_{28}H_{50}$
p	14α(H),17α(H)-sterane (20R)	$C_{28}H_{50}$
q	14α(H),17α(H)-sterane (20S)	$C_{29}H_{52}$
r	14β(H),17β(H)-sterane (20R)	$C_{29}H_{52}$
	+ unknown sterane	
s	14β(H),17β(H)-sterane (20S)	$C_{29}H_{52}$
t	14α(H),17α(H)-sterane (20R)	$C_{29}H_{52}$
*	diasterenes	

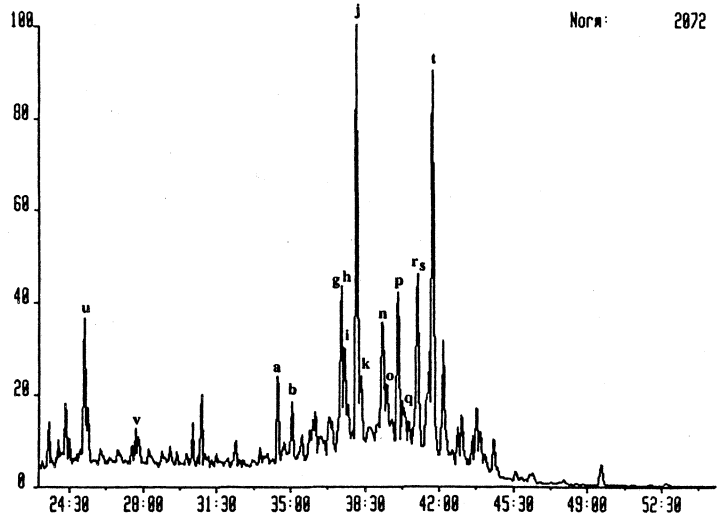
E7196SAT 12-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 191.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E-7196 SAT



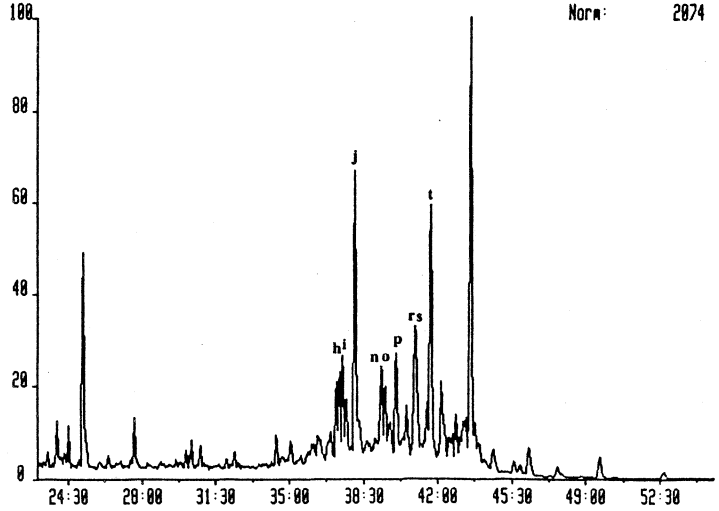
E7196SAT 12-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 205.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E-7196 SAT



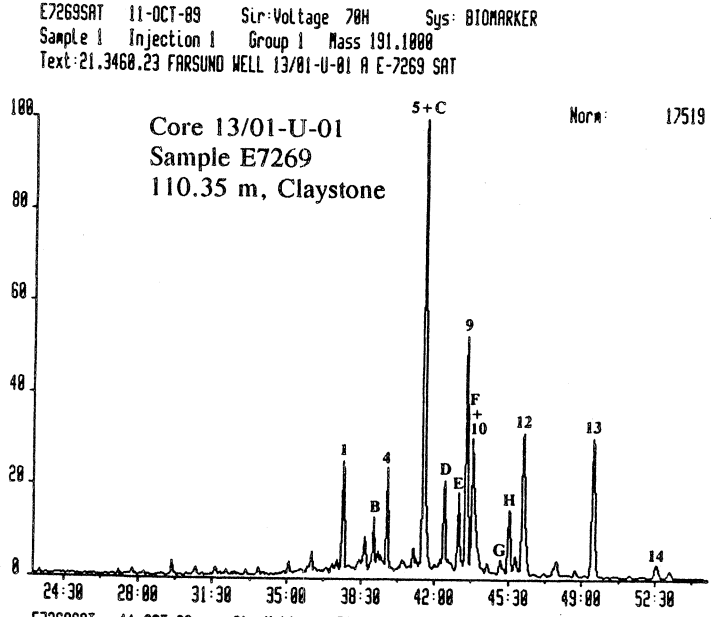
E7196SAT 12-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 217.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E-7196 SAT

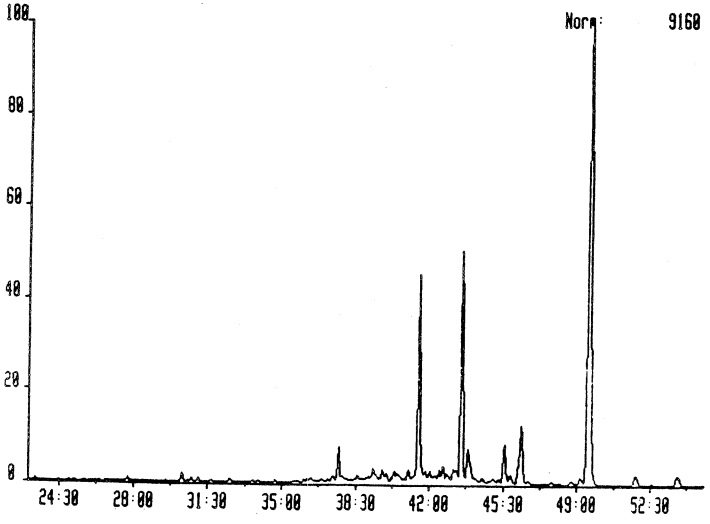


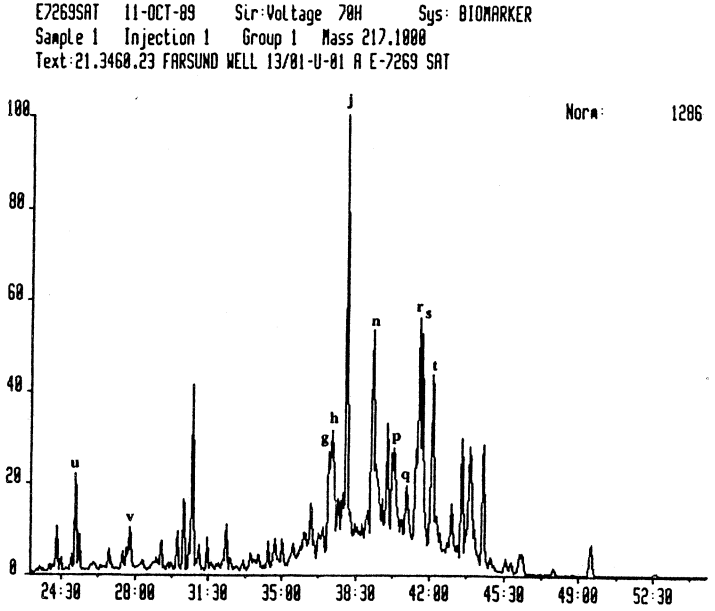
E7196SAT 12-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 218.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E-7196 SAT

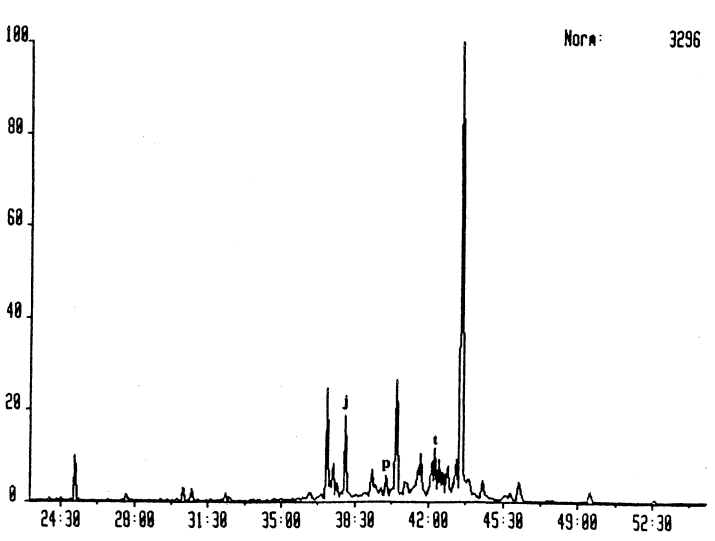


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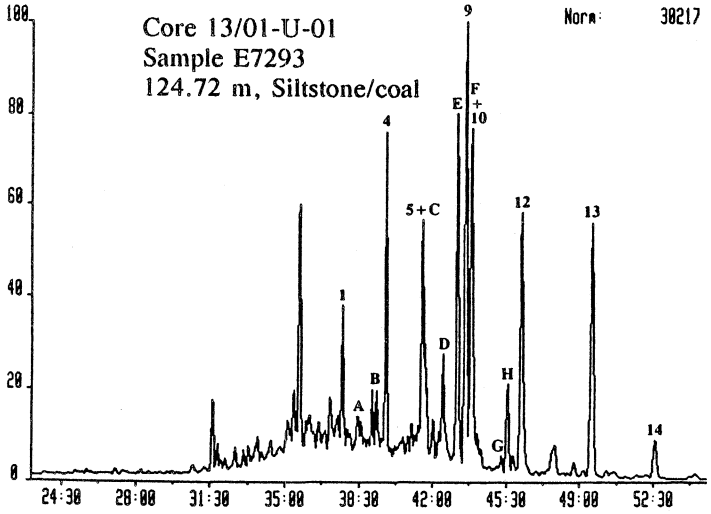




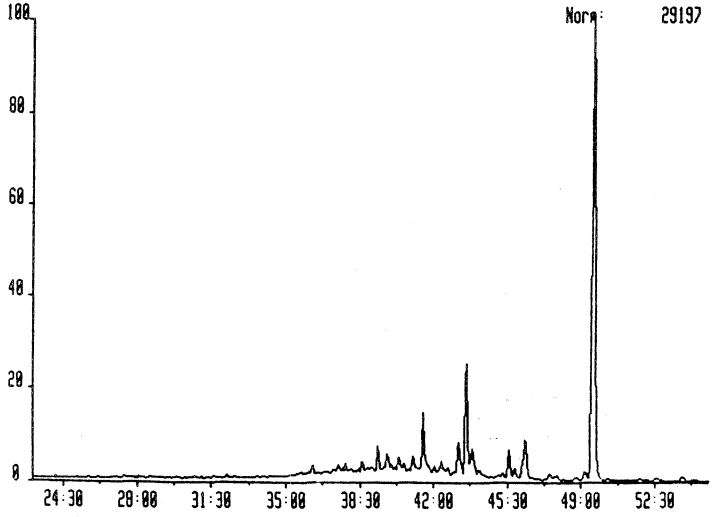


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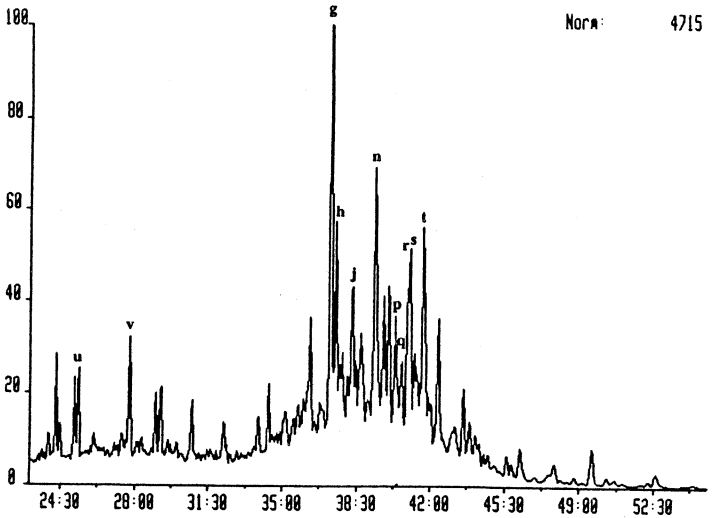
E7293SAT 11-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 191.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E-7293 SAT



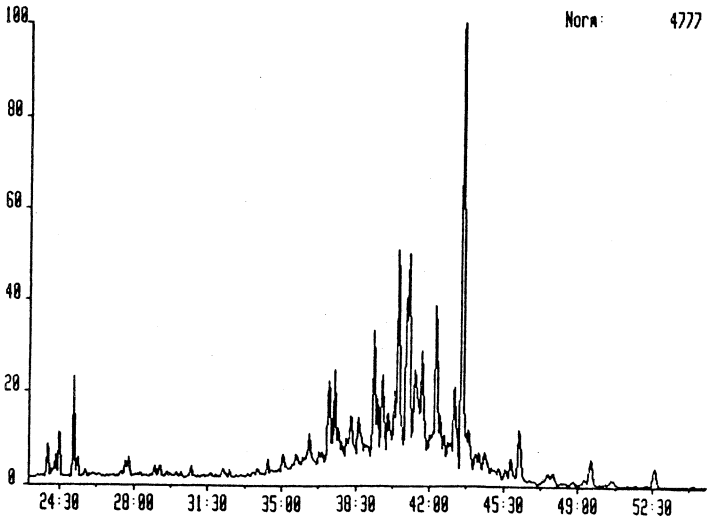
E7293SAT 11-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 205.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E-7293 SAT



E7293SAT 11-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 217.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E-7293 SAT

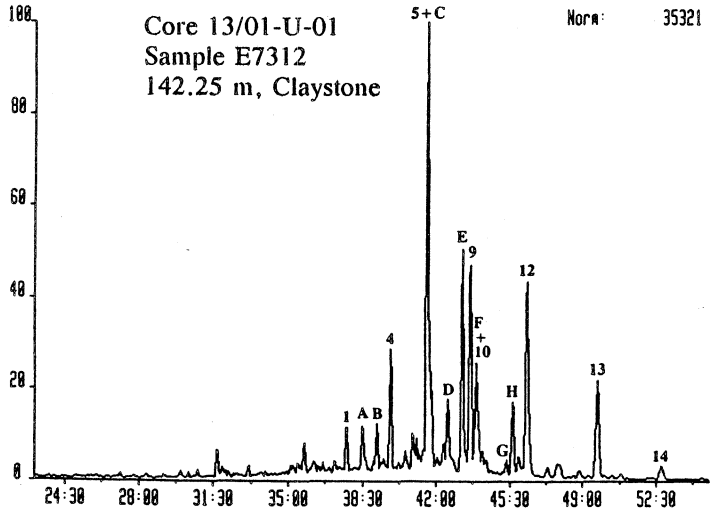


E7293SAT 11-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 218.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E-7293 SAT

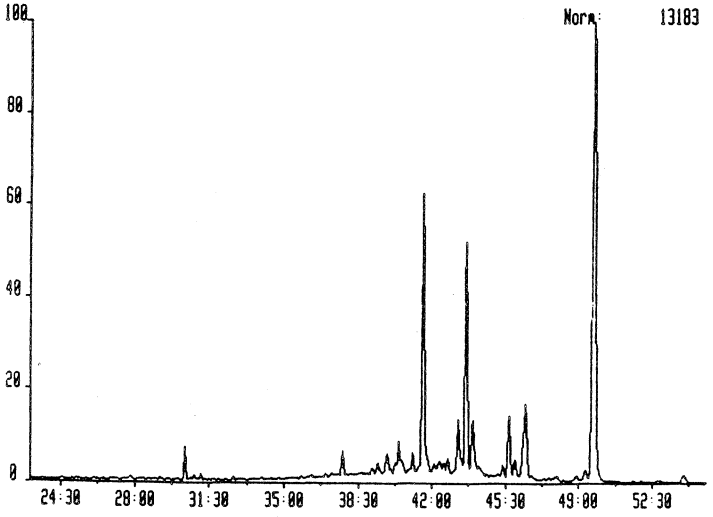


IKU SINTEF-GRUPPEN

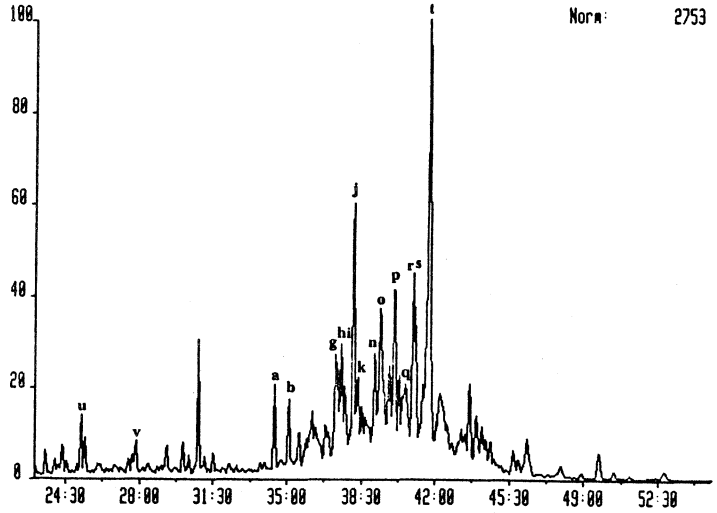
E7312SA1 12-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 191.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E7312 SAT



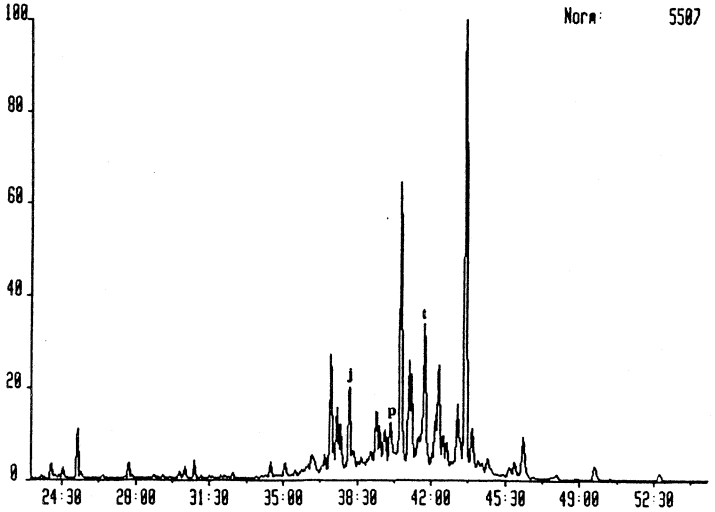
E7312SA1 12-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 205.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E7312 SAT



E7312SA1 12-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 217.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E7312 SAT

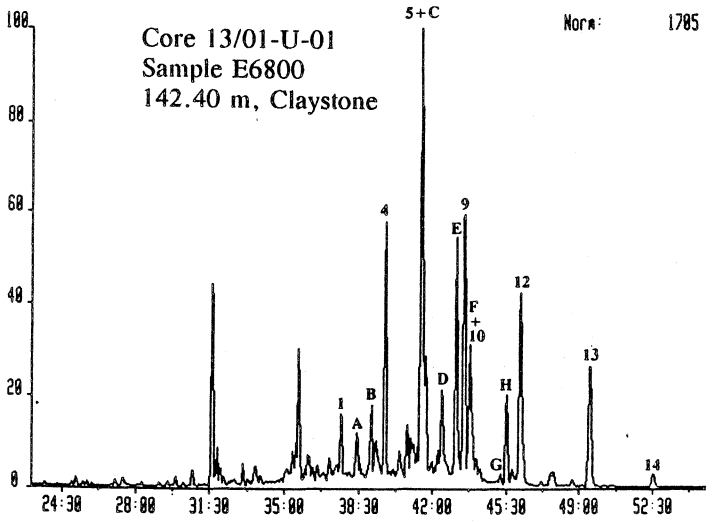


E7312SA1 12-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 218.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E7312 SAT

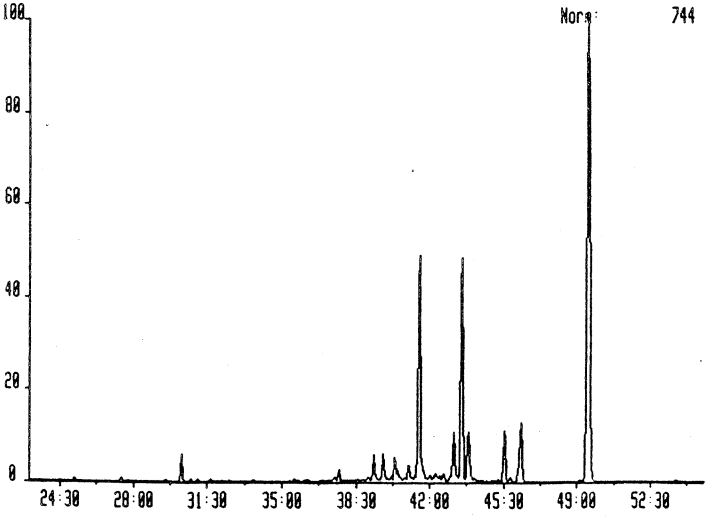


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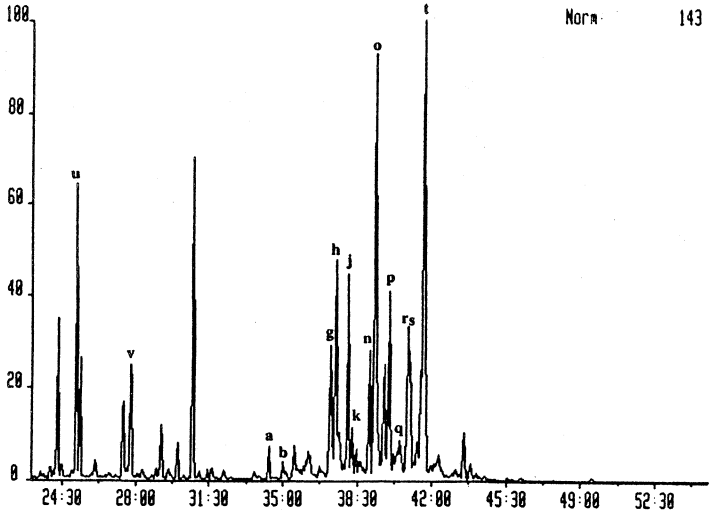
E6800SAT 11-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 191.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E-6800 SAT



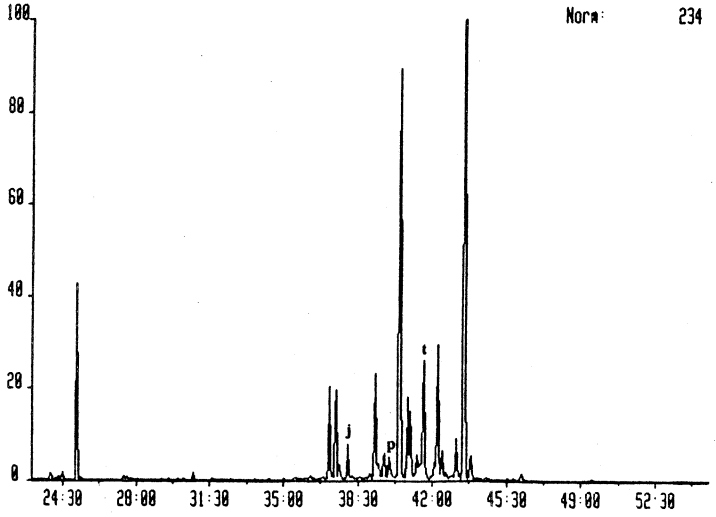
E6800SAT 11-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 205.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E-6800 SAT



E6800SAT 11-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 217.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E-6800 SAT

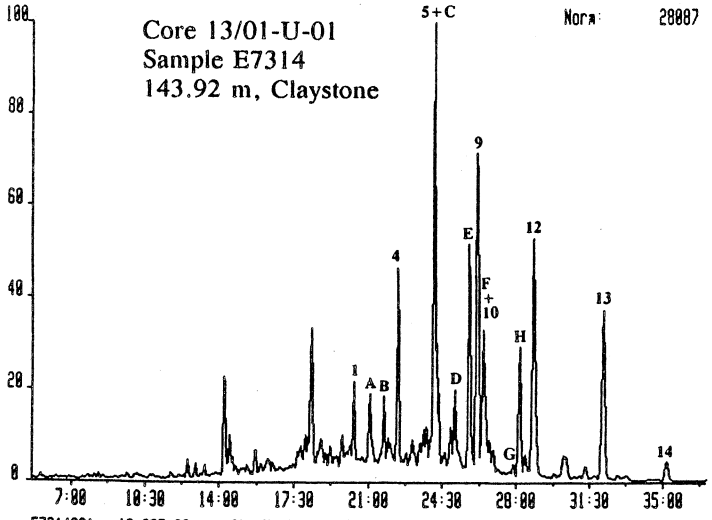


E6800SAT 11-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 218.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E-6800 SAT

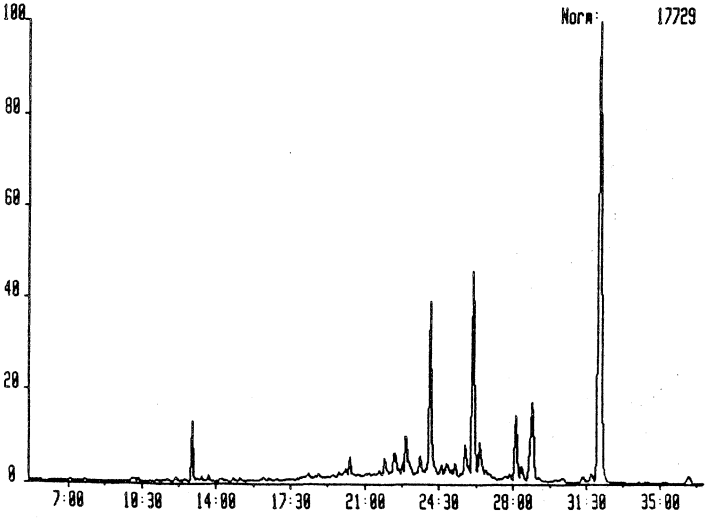


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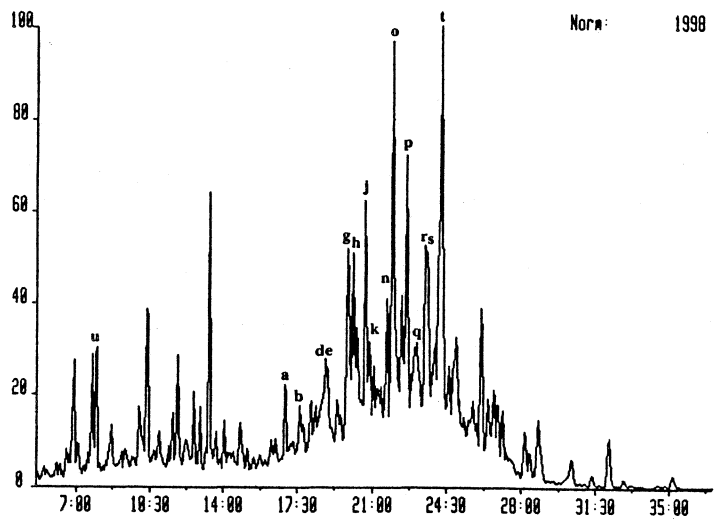
E7314SA1 12-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 191.1000
Text:21.3468.23 FARSUND WELL 13/01-U-01 A E-7314 SAT



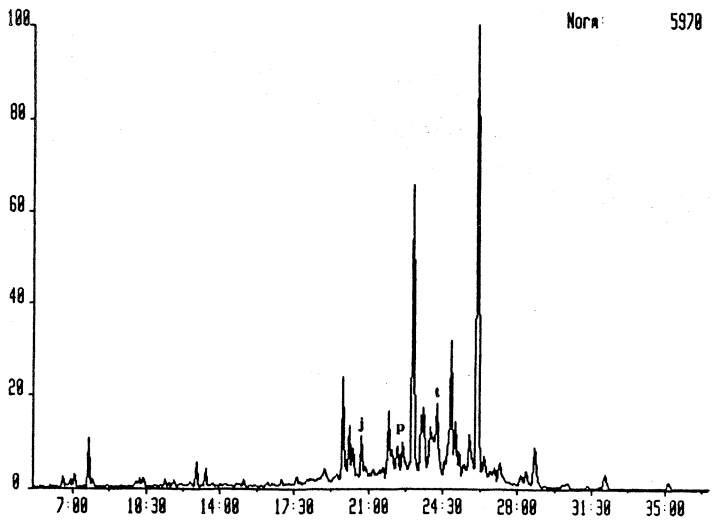
E7314SA1 12-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 205.1000
Text:21.3468.23 FARSUND WELL 13/01-U-01 A E-7314 SAT



E7314SA1 12-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 217.1000
Text:21.3468.23 FARSUND WELL 13/01-U-01 A E-7314 SAT

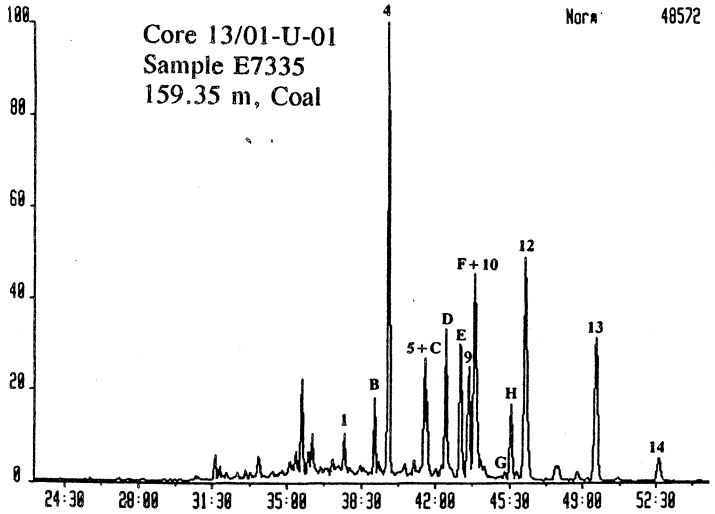


E7314SA1 12-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 218.1000
Text:21.3468.23 FARSUND WELL 13/01-U-01 A E-7314 SAT

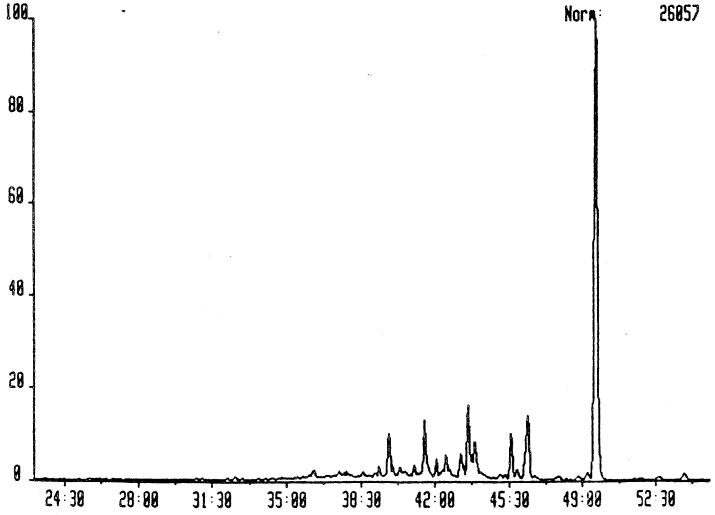


IKU SINTEF-GRUPPEN

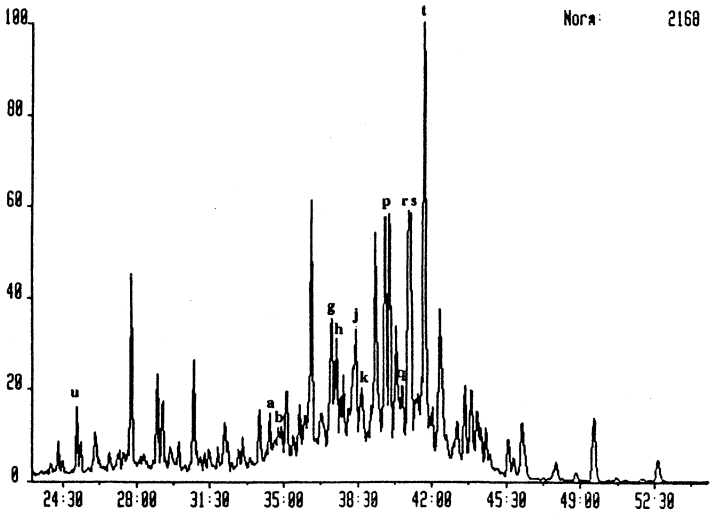
E7335SAT 12-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 191.1000
Text:21.3468.23 FARSUND WELL 13/01-U-01 A E-7335 SAT



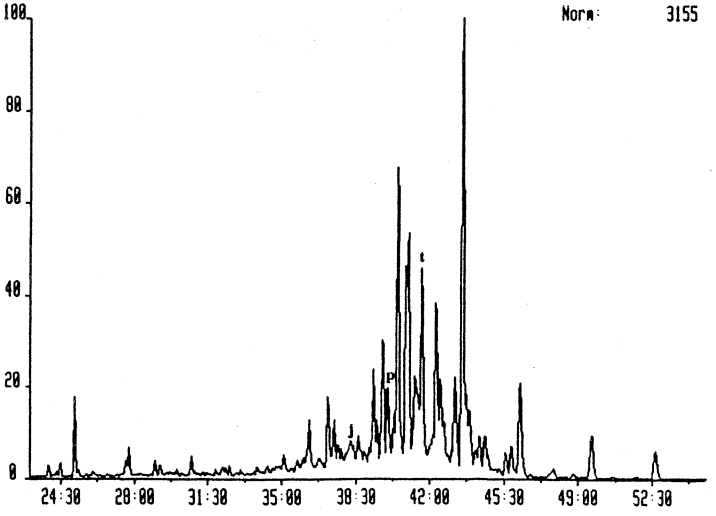
E7335SAT 12-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 205.1000
Text:21.3468.23 FARSUND WELL 13/01-U-01 A E-7335 SAT



E7335SAT 12-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 217.1000
Text:21.3468.23 FARSUND WELL 13/01-U-01 A E-7335 SAT

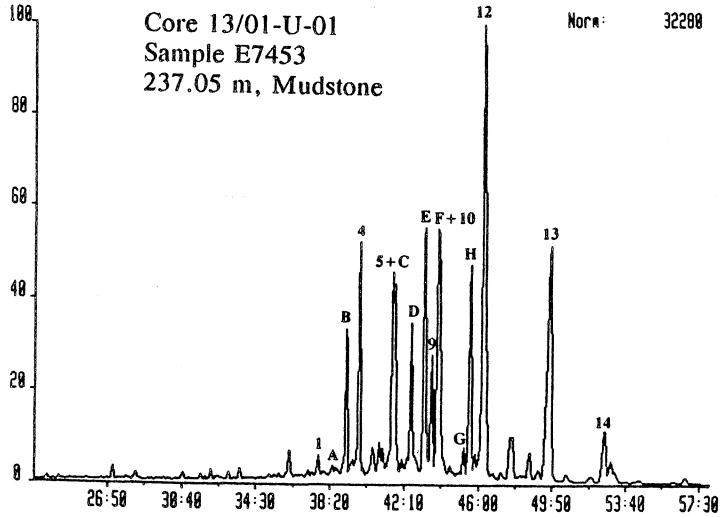


E7335SAT 12-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 218.1000
Text:21.3468.23 FARSUND WELL 13/01-U-01 A E-7335 SAT

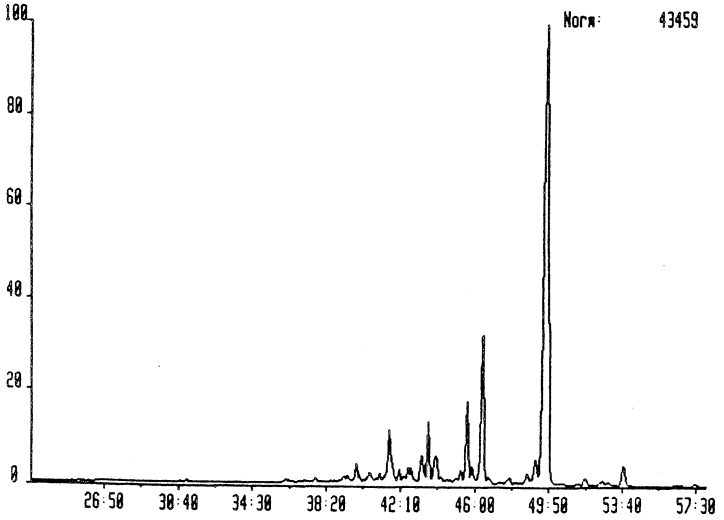


IKU SINTEF-GRUPPEN

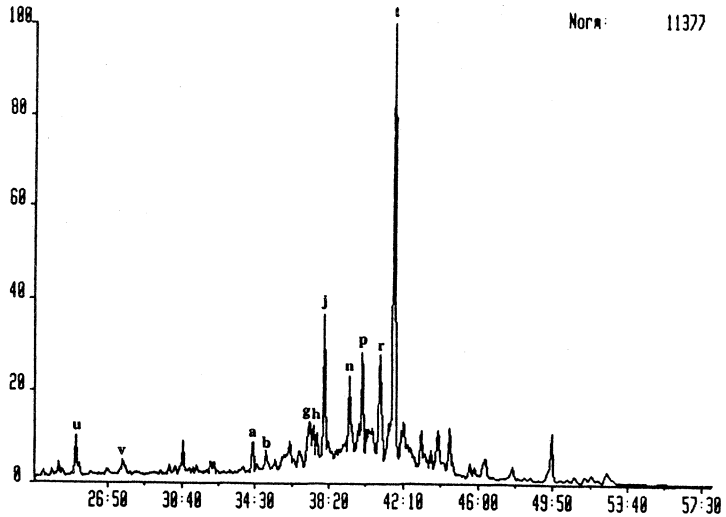
E7453BCM 5-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 191.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E 7453 B/C MID



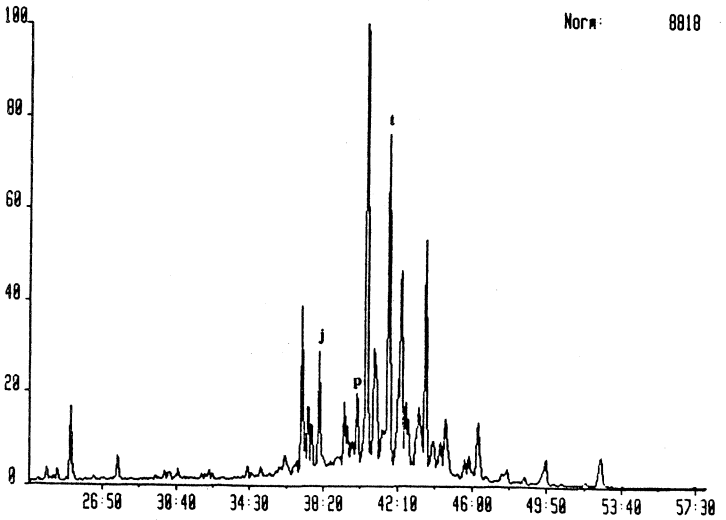
E7453BCM 5-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 205.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E 7453 B/C MID



E7453BCM 5-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 217.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E 7453 B/C MID

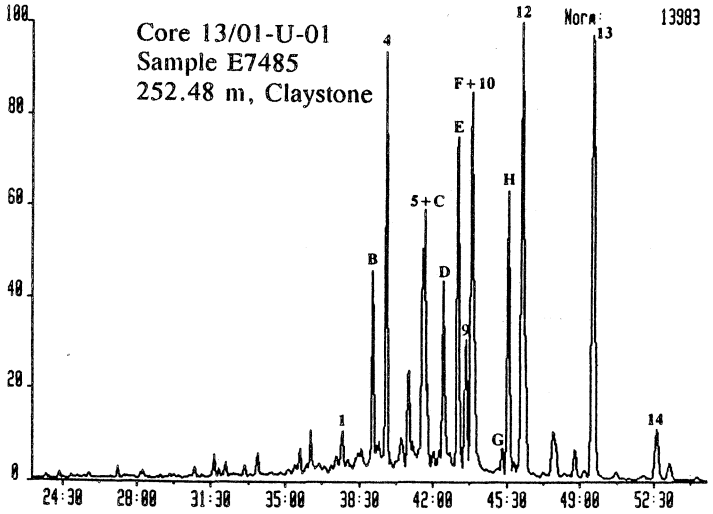


E7453BCM 5-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 218.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E 7453 B/C MID

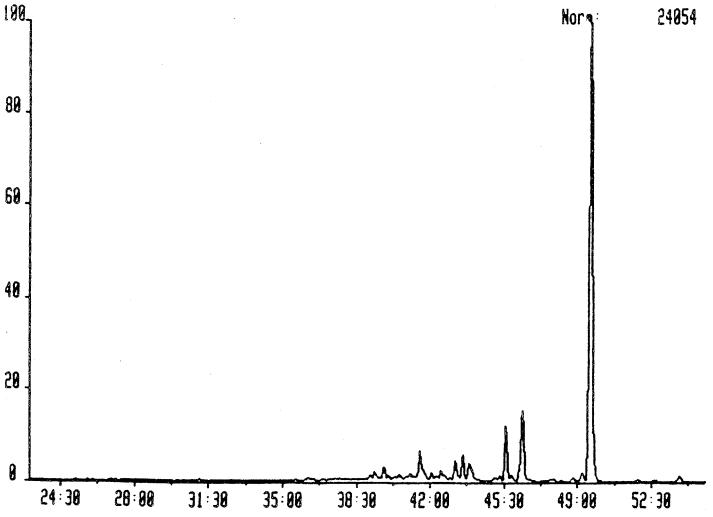


IKU SINTEF-GRUPPEN

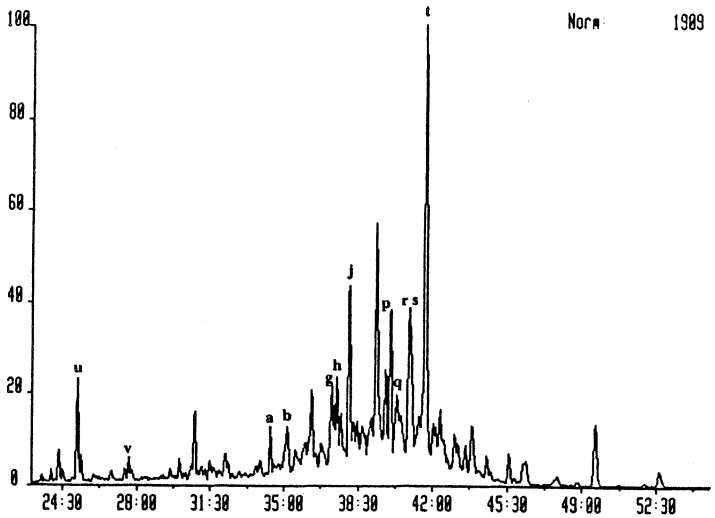
E7485SAT 12-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 191.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E-7485 SAT



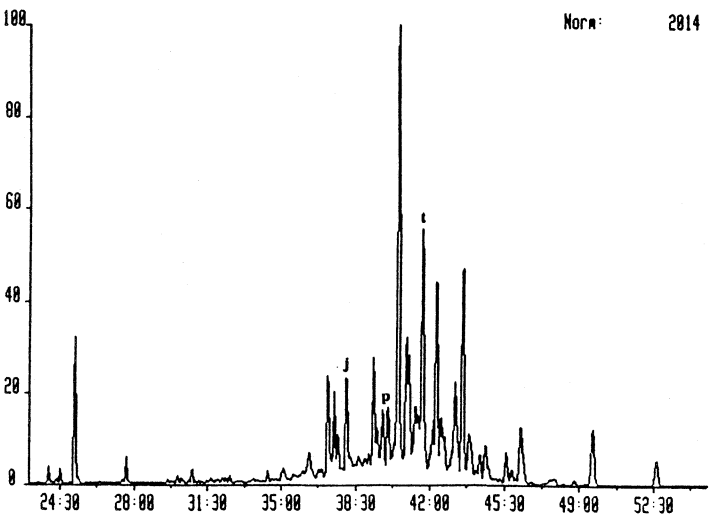
E7485SAT 12-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 285.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E-7485 SAT



E7485SAT 12-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 217.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E-7485 SAT



E7485SAT 12-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 218.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E-7485 SAT



IKU SINTEF-GRUPPEN

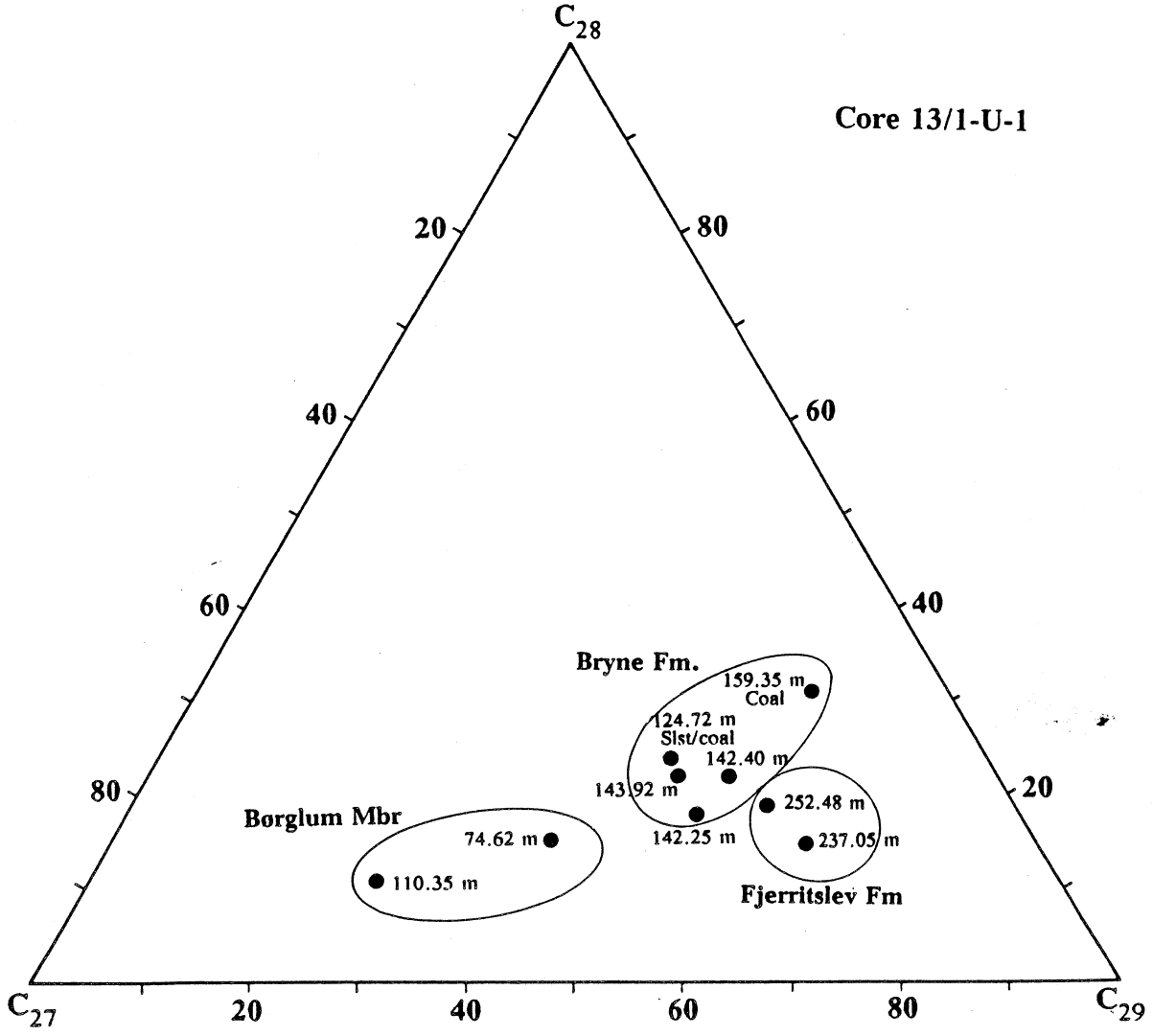


Figure A.II.3.4: *Internal distribution of 14α(H),17α(H) 20R, C_{27}, C_{28} and C_{29} regular steranes (from m/z 217).*

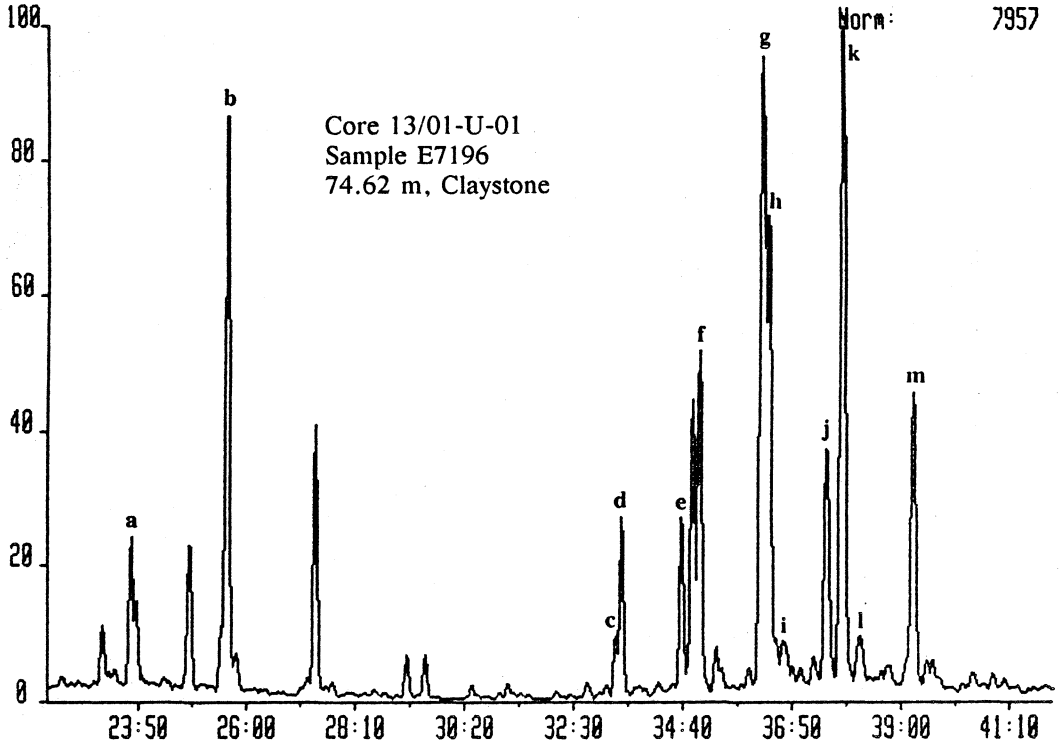
Figure A.II.3.5:

Mass fragmentograms of m/z 231, 253
(aromatic steroid hydrocarbons)

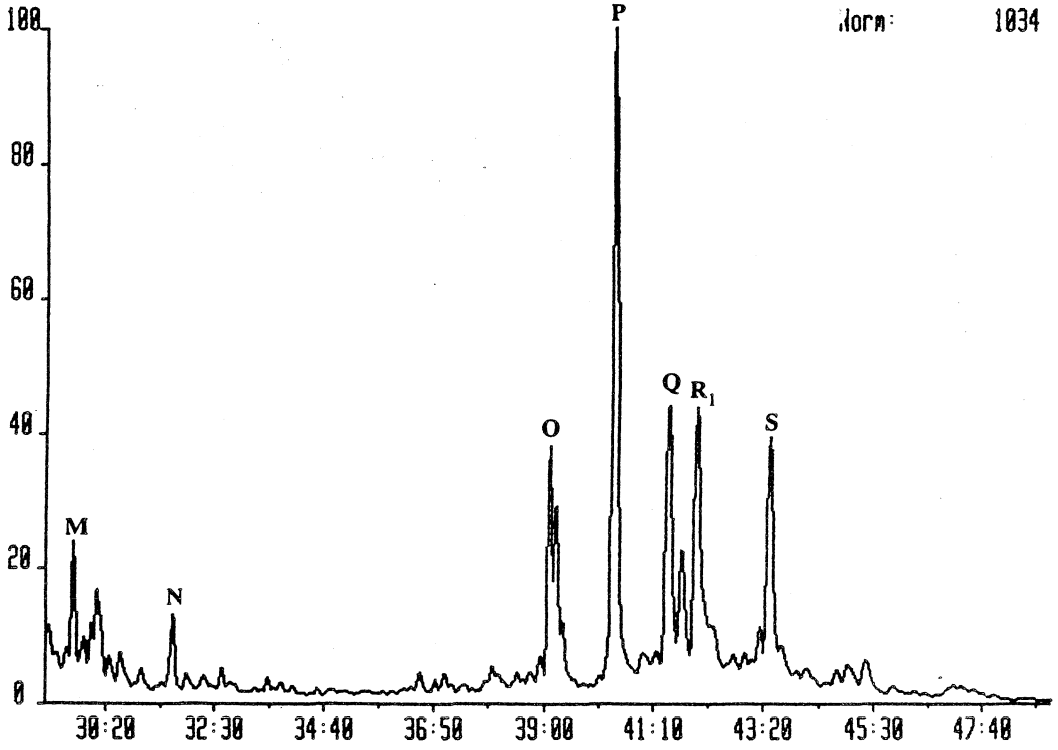
Peak code	Identification
Key for m/z 231 (tri-aromatic steroids):	
M	C_{20} tri-aromatic steroid
N	C_{21} tri-aromatic steroid
O	C_{26} tri-aromatic steroid
P	C_{26}+C_{27} tri-aromatic steroids
Q	C_{28} tri-aromatic steroid
R	C_{27} tri-aromatic steroid
S	C_{28} tri-aromatic steroid
Key for m/z 253 (mono-aromatic steroids):	
a	C_{21} mono-aromatic steroid
b	C_{22} mono-aromatic steroid
c	unidentified compound
d	C_{27} mono-aromatic steroid
e	C_{27} mono-aromatic steroid
f	C_{28} mono-aromatic steroid
g	C_{27} mono-aromatic steroid
h	C_{28}+C_{29} mono-aromatic steroids
i	C_{29} mono-aromatic steroids
j	C_{29} mono-aromatic steroids
k	unidentified compound
l	unidentified compound

IKU SINTEF-GRUPPEN

E7196AR1 17-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 253.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E-7196 ARO

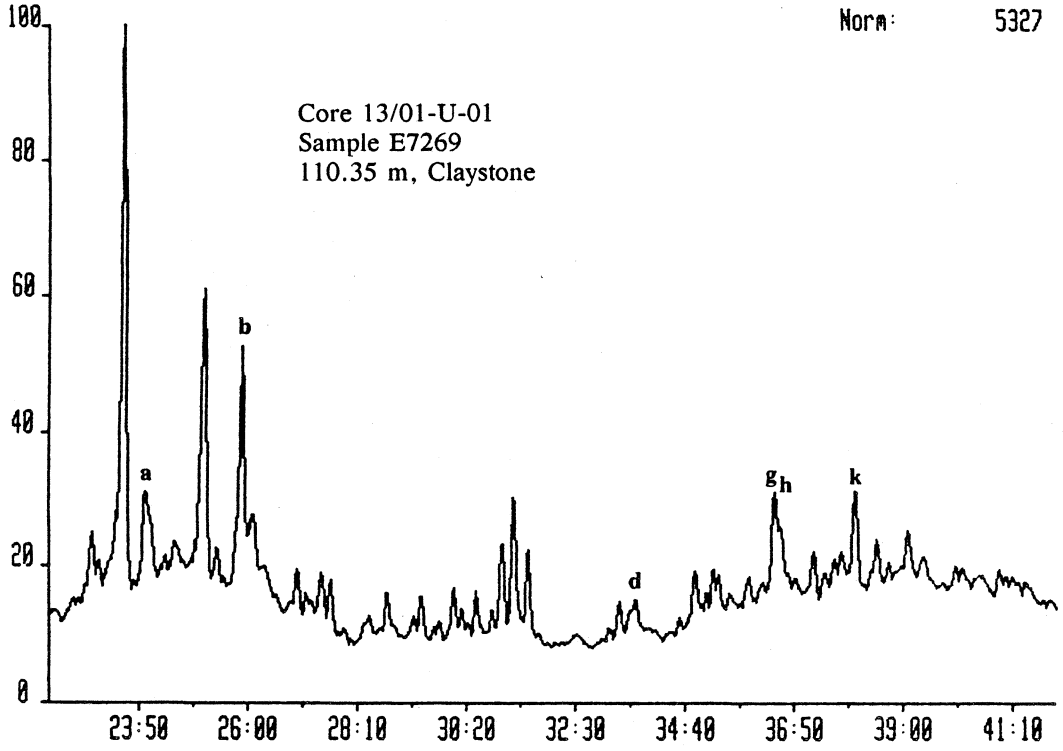


E7196AR1 17-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 231.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E-7196 ARO

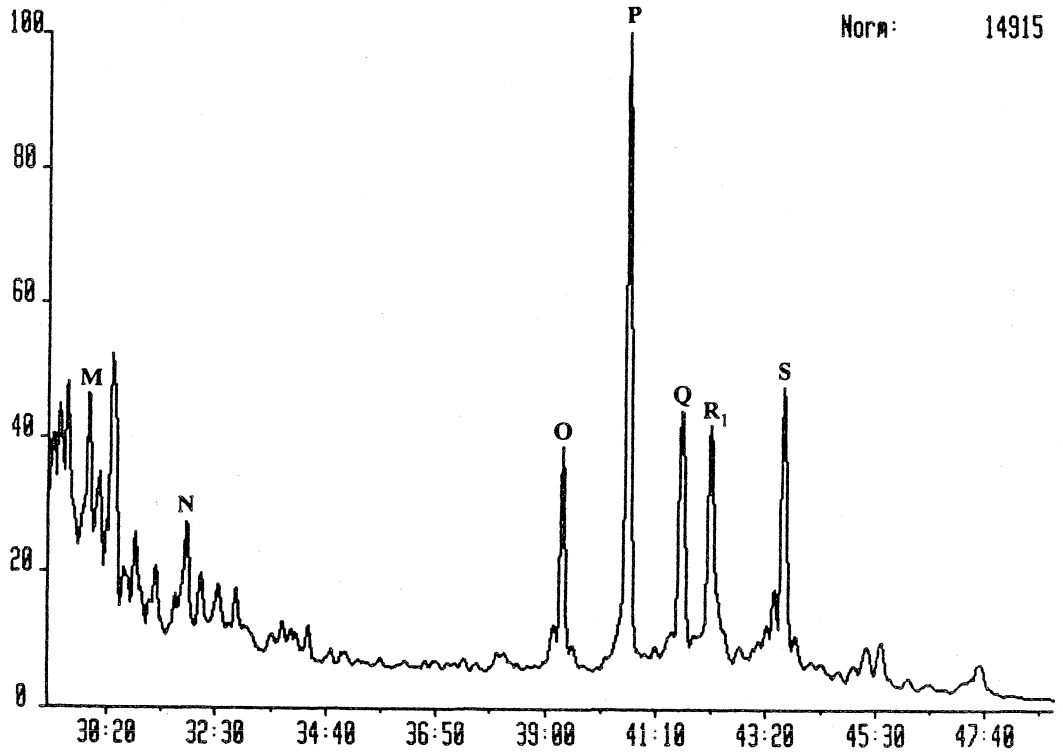


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E7269ARO 9-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 253.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E-7269 ARO

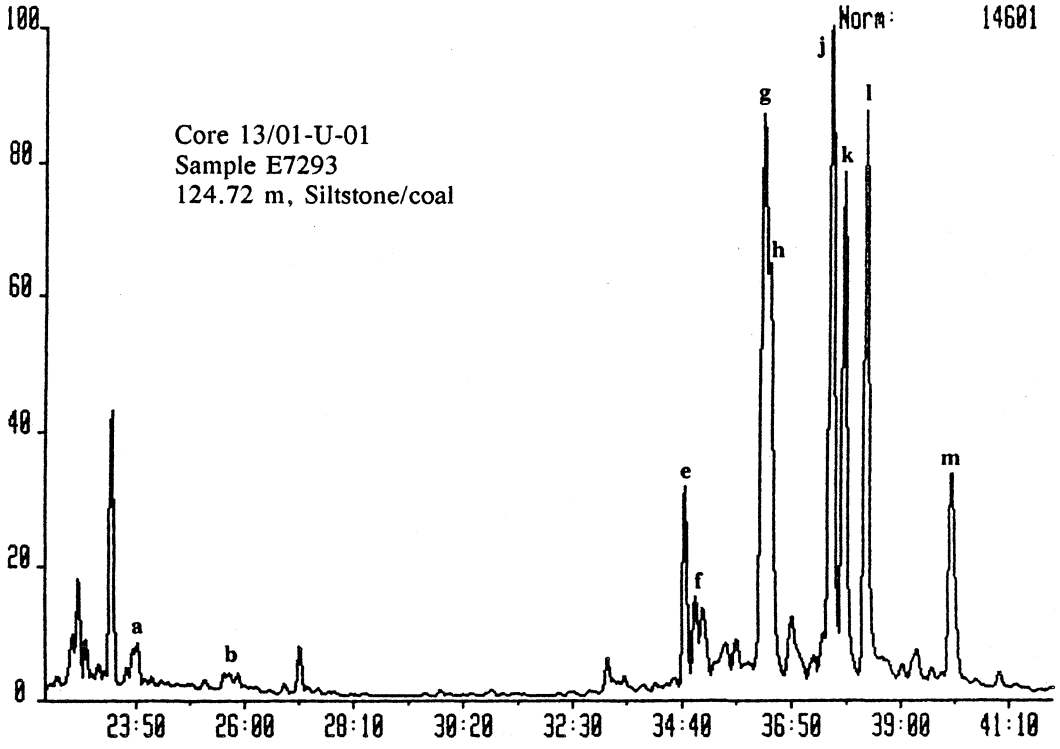


E7269ARO 9-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 231.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E-7269 ARO

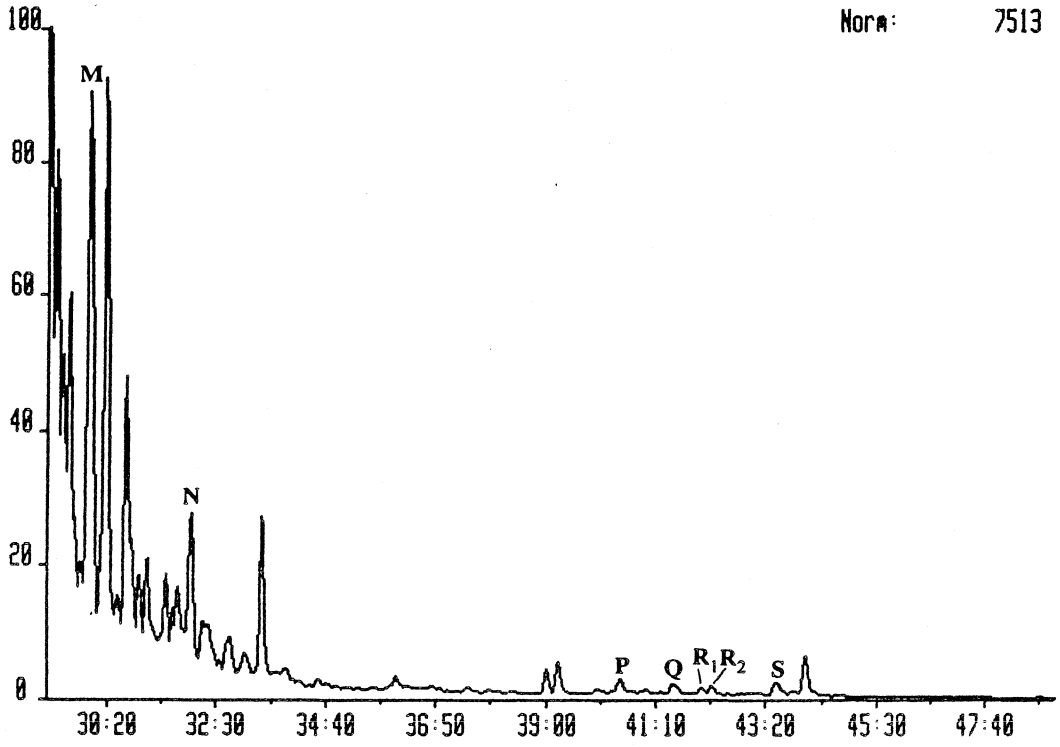


IKU SINTEF-GRUPPEN

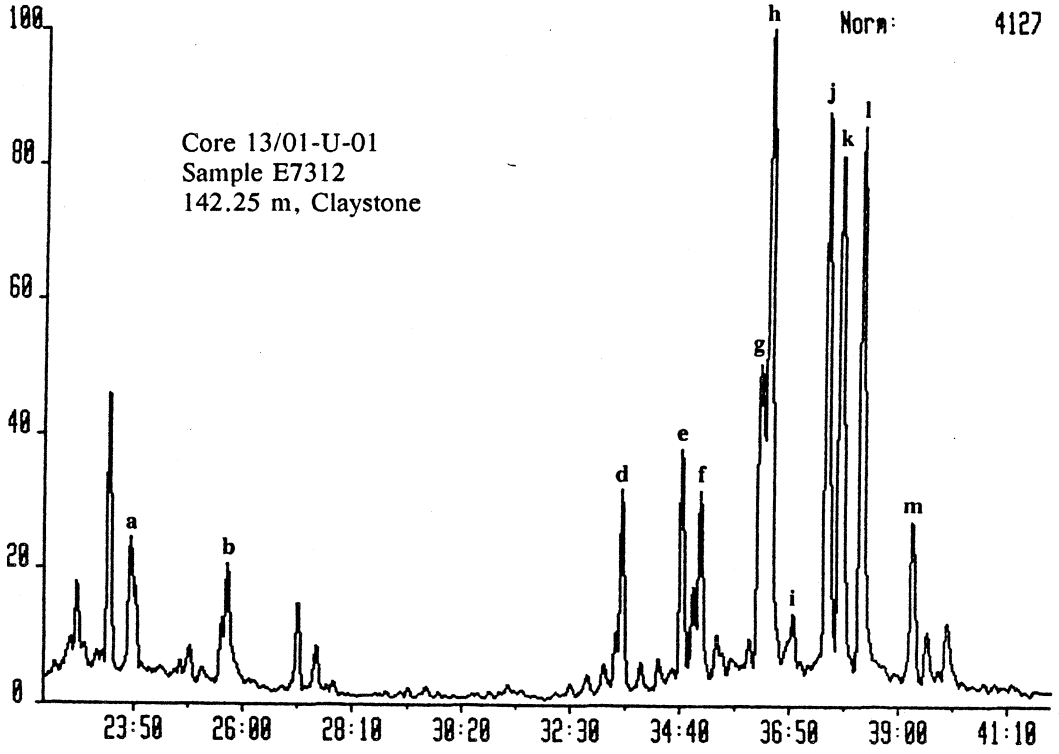
E7293 17-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 253.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E7293 ARO



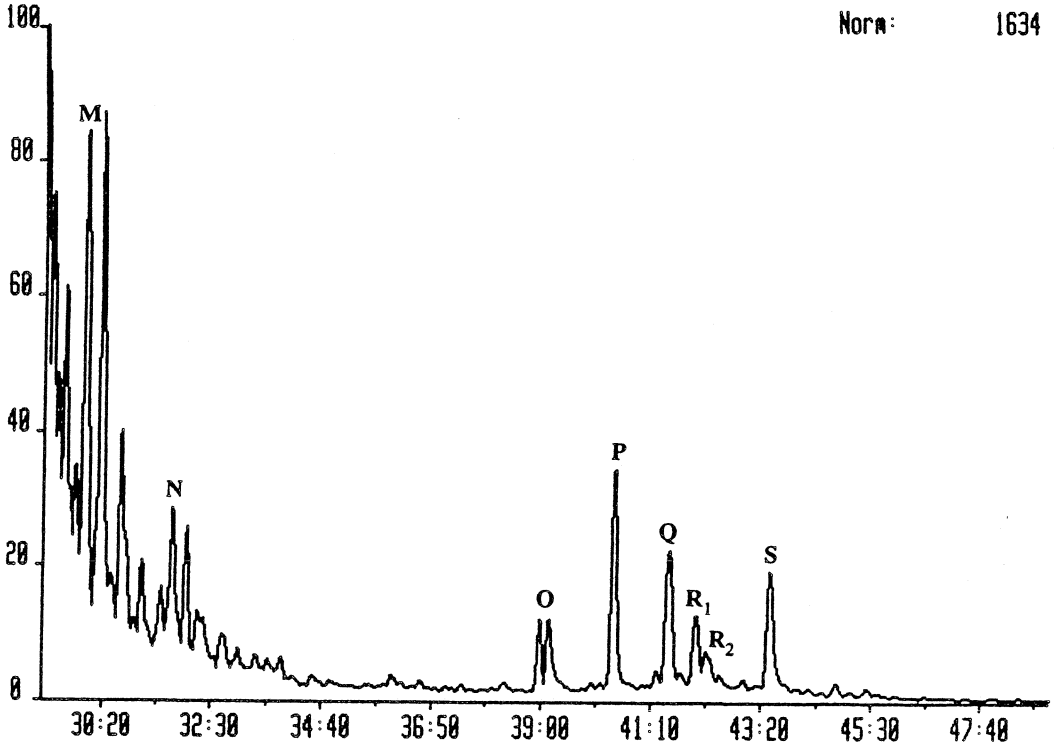
E7293 17-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 231.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E7293 ARO



E7312AR1 17-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 253.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E-7312 ARO

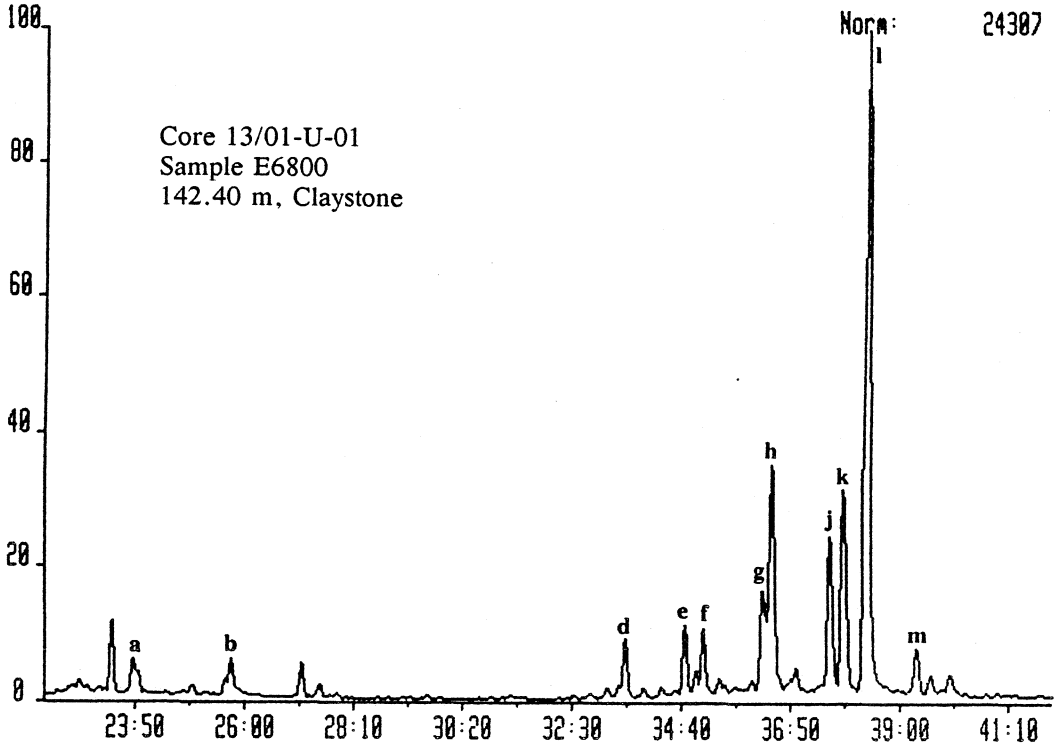


E7312AR1 17-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 231.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E-7312 ARO

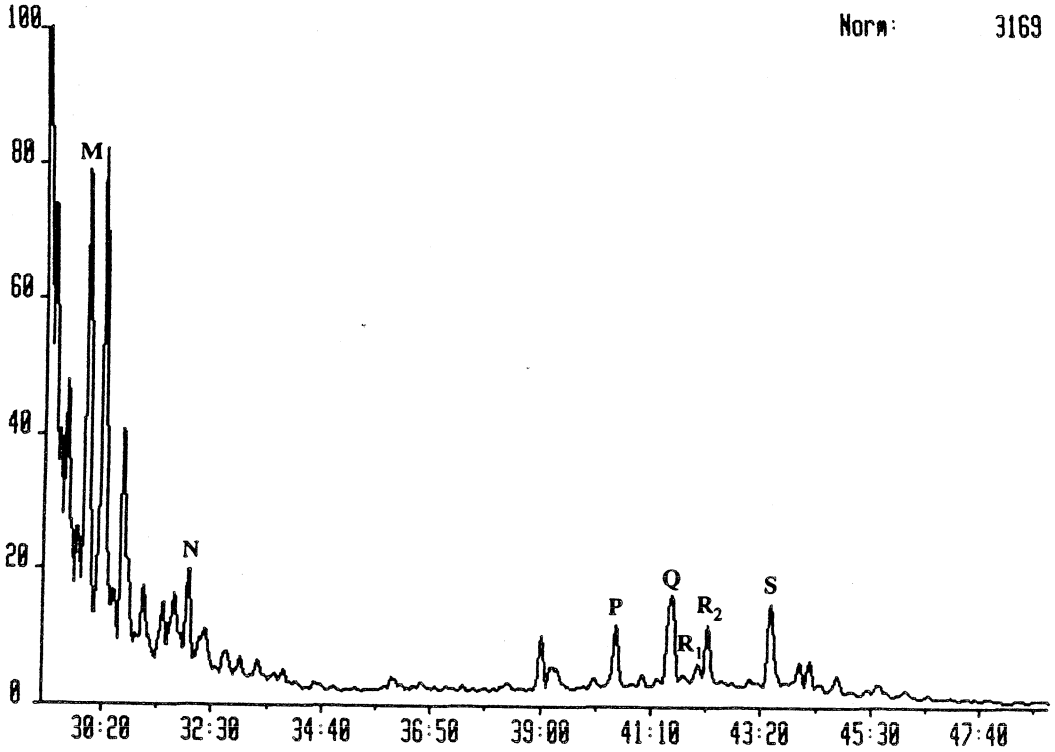


IKU SINTEF-GRUPPEN

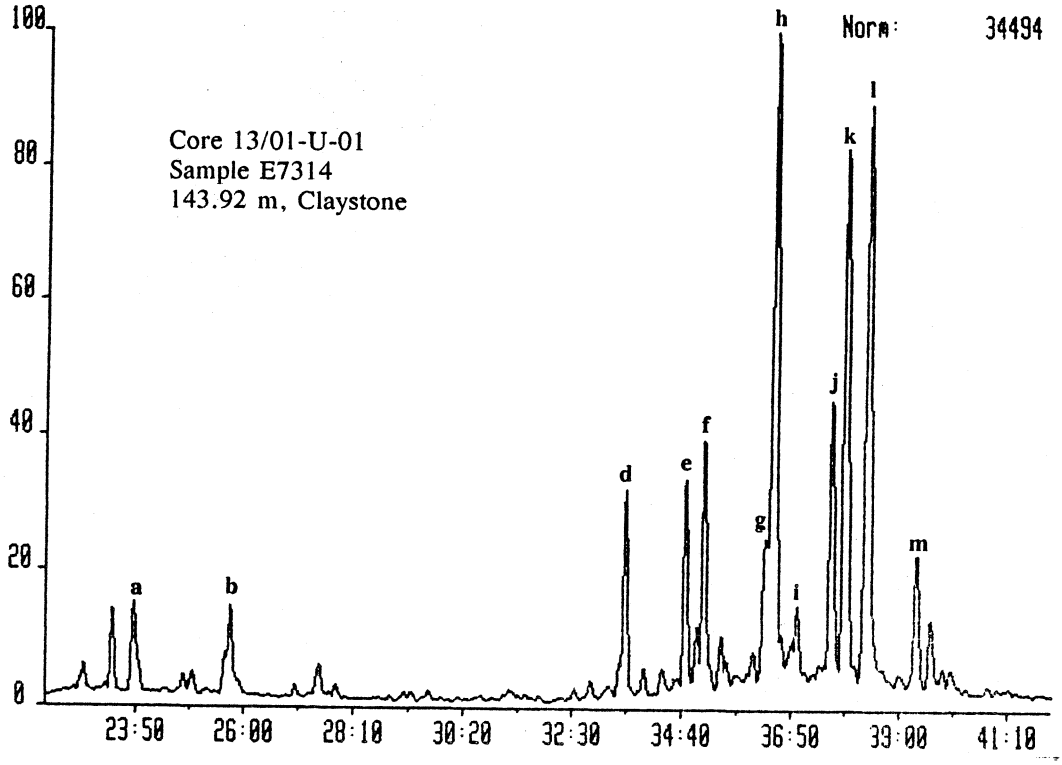
E6800ARO 17-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 253.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E-6800 ARO



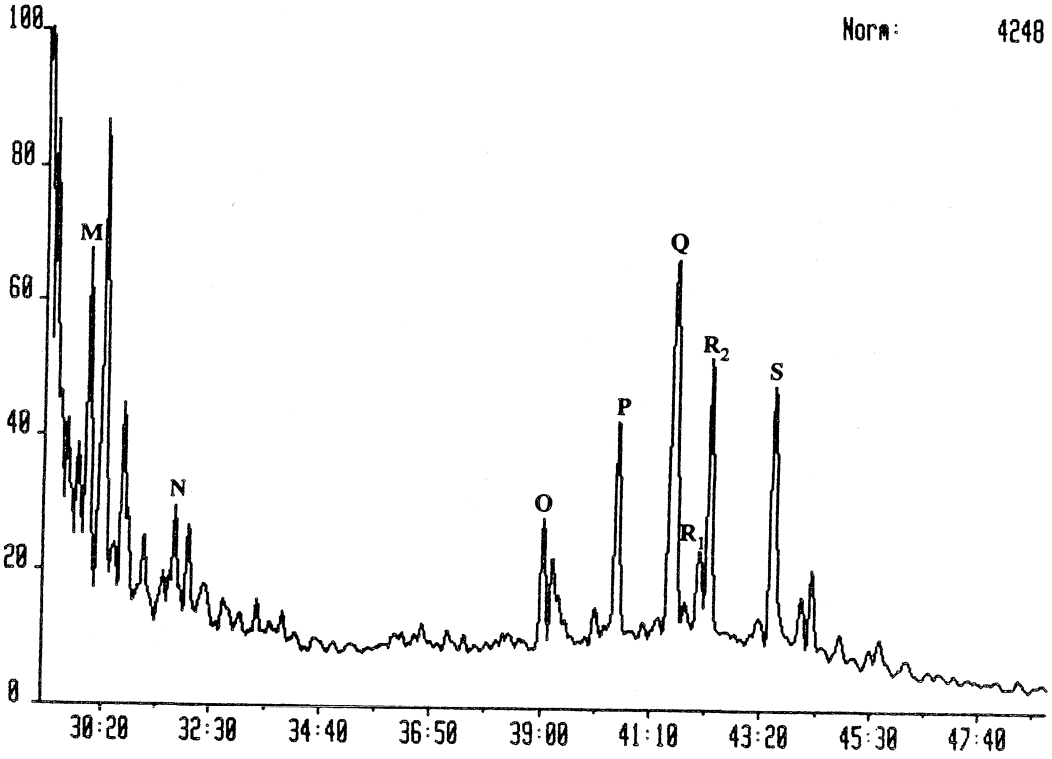
E6800ARO 17-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 231.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E-6800 ARO



E7314ARO 10-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 253.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E-7314 ARO

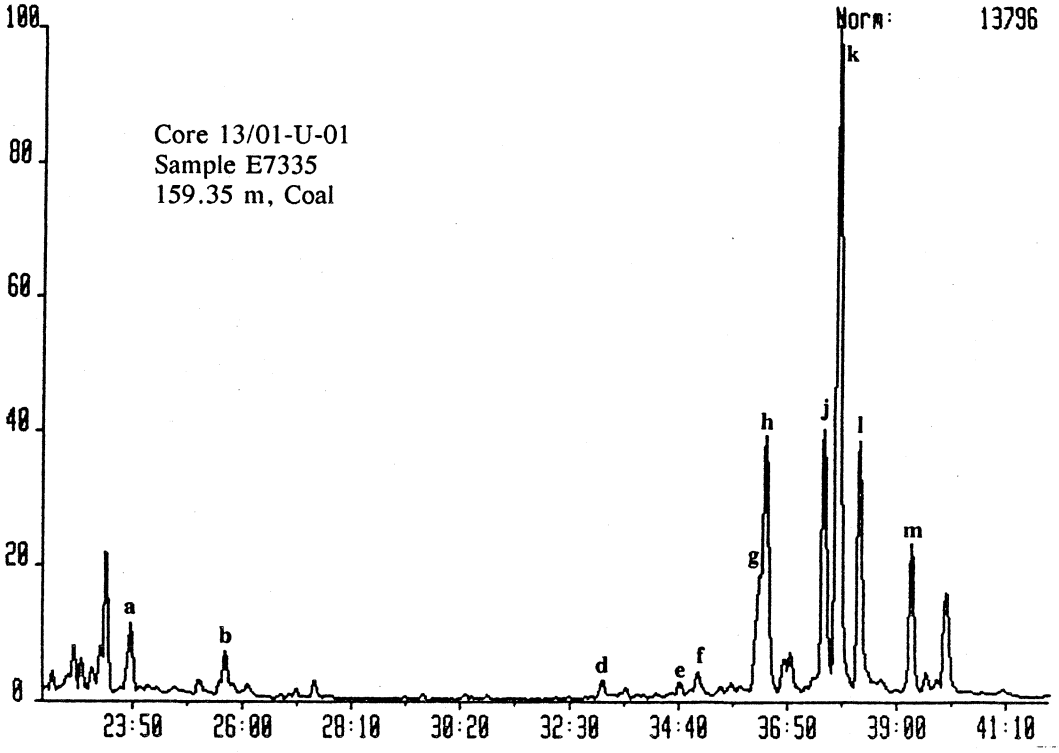


E7314ARO 10-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 231.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E-7314 ARO

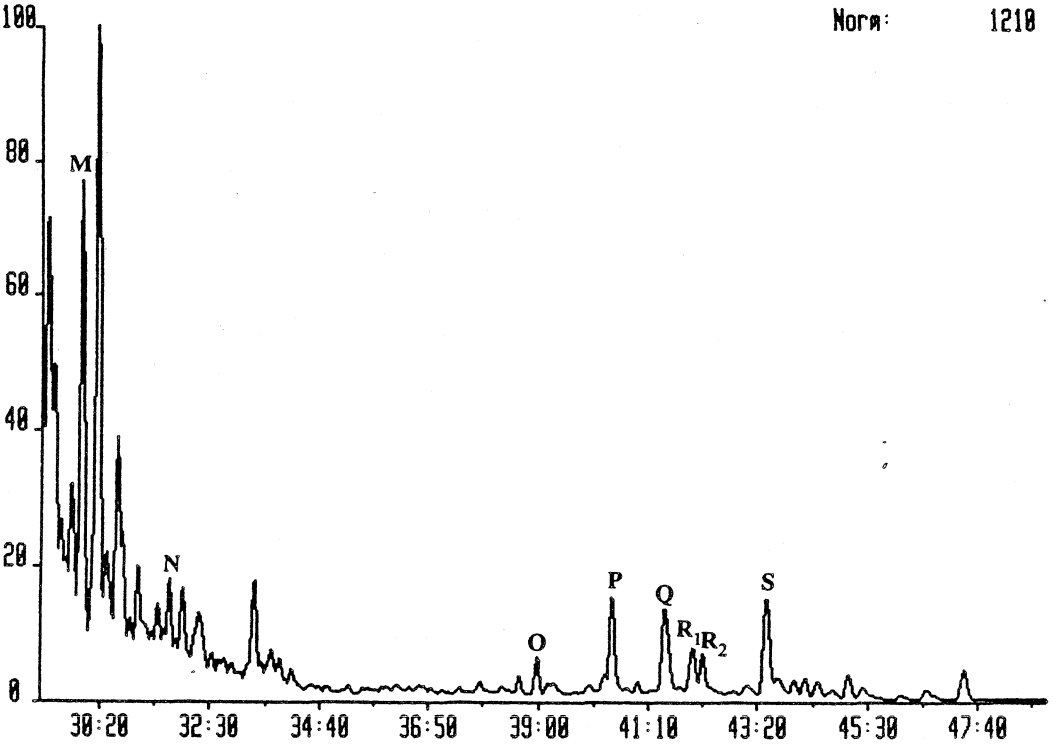


IKU SINTEF-GRUPPEN

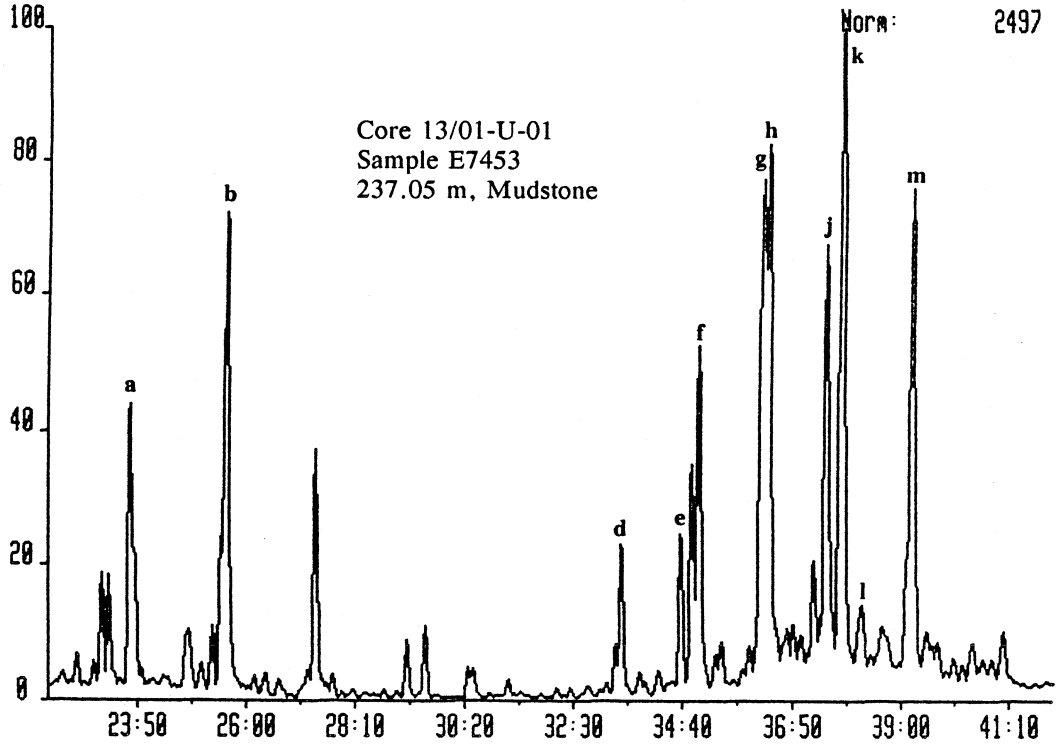
E7335AR1 17-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 253.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E-7335 ARO



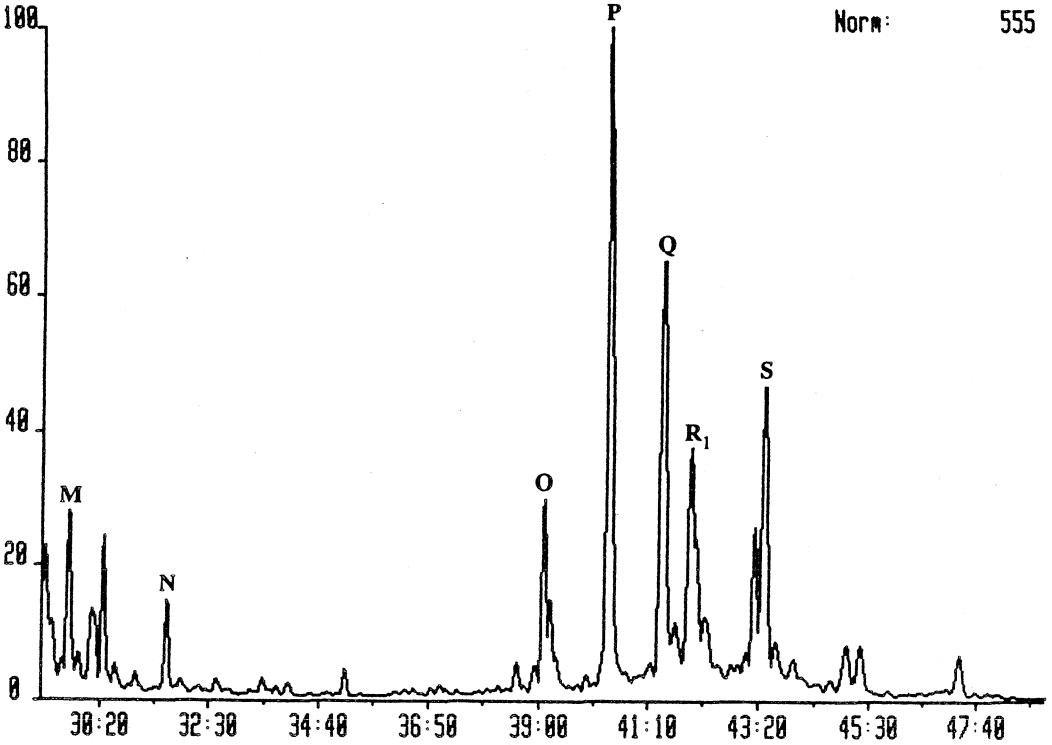
E7335AR1 17-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 231.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E-7335 ARO



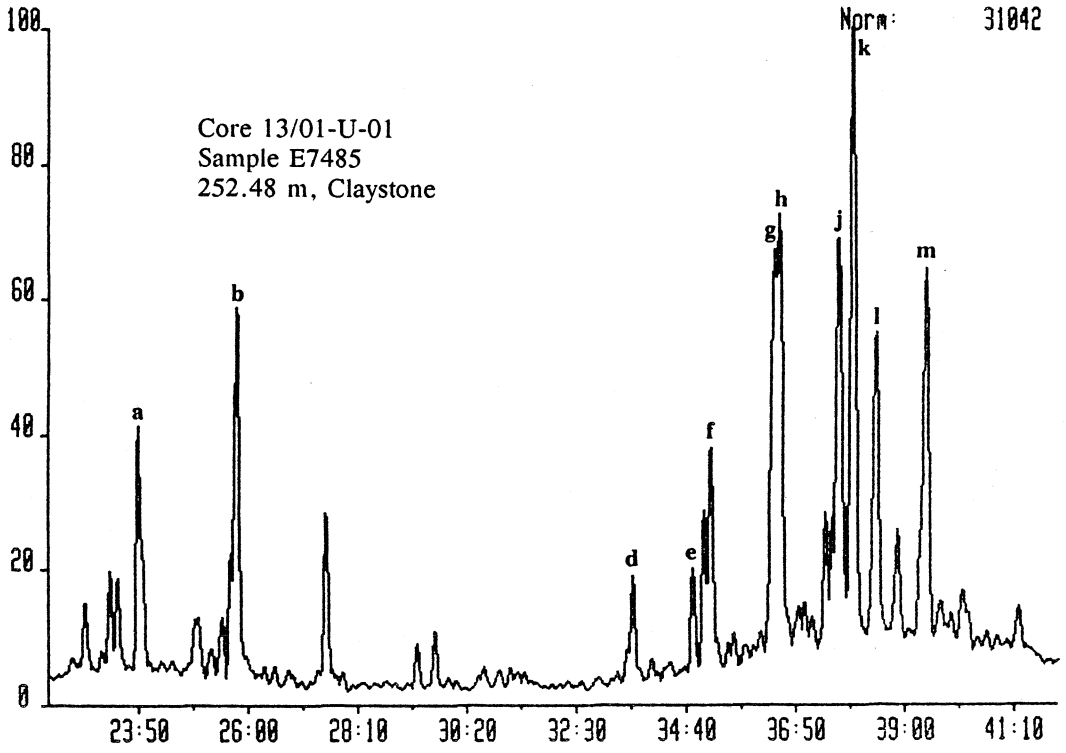
E7453AR1 17-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 253.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E-7453 ARO



E7453AR1 17-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 231.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E-7453 ARO



E7485ARO 10-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 253.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E-7485 ARO



E7485ARO 10-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 231.1000
Text:21.3460.23 FARSUND WELL 13/01-U-01 A E-7485 ARO

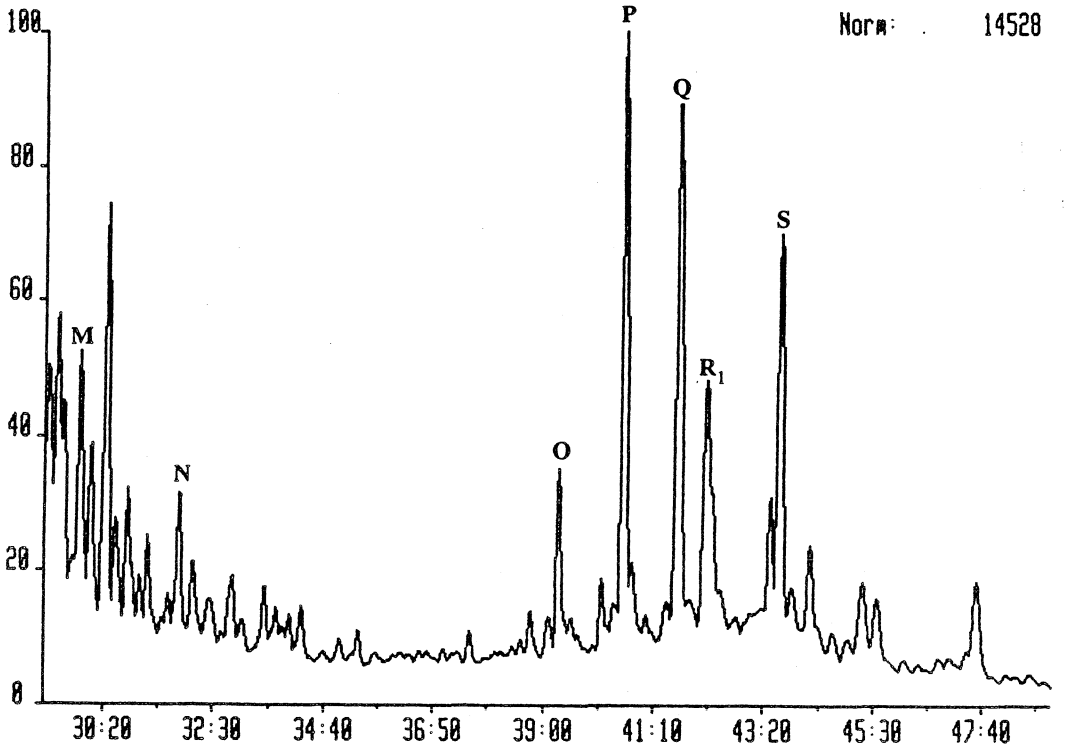
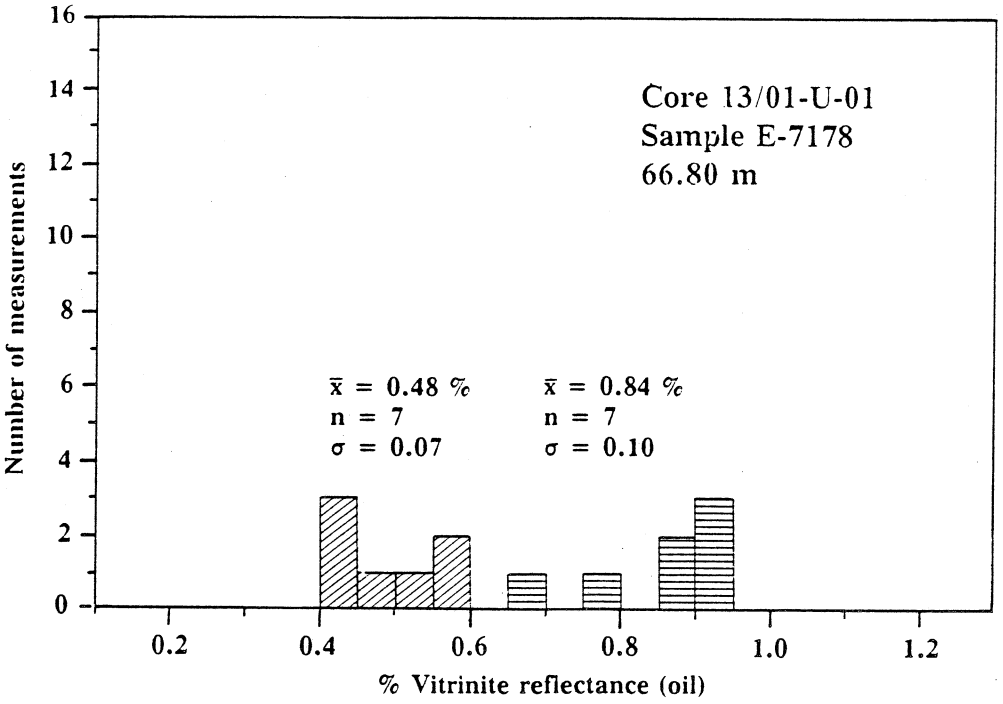
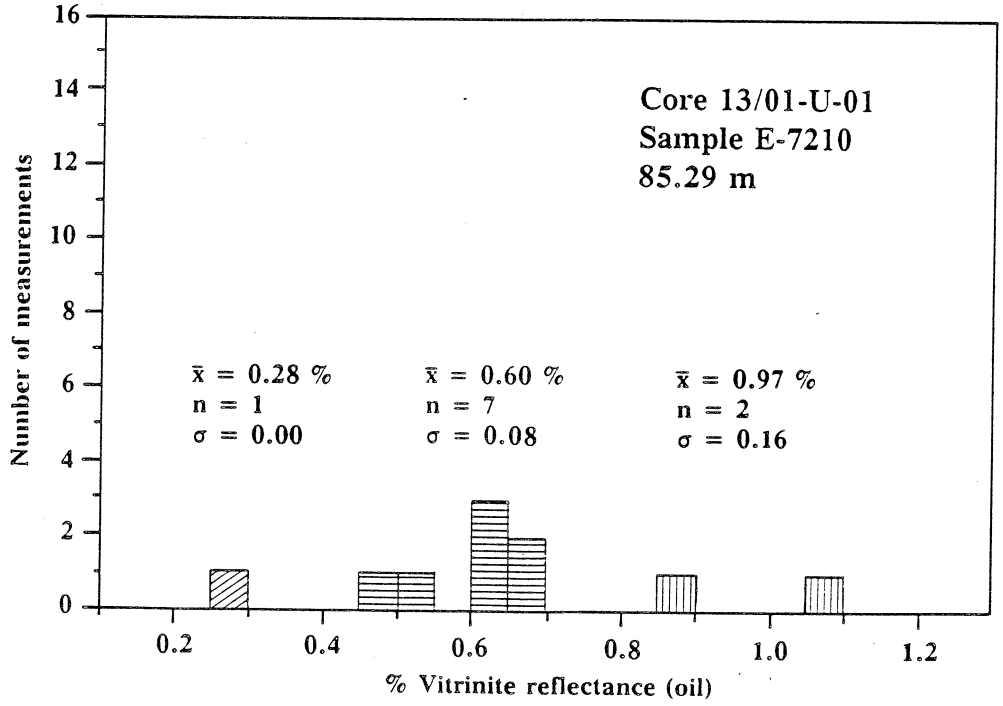
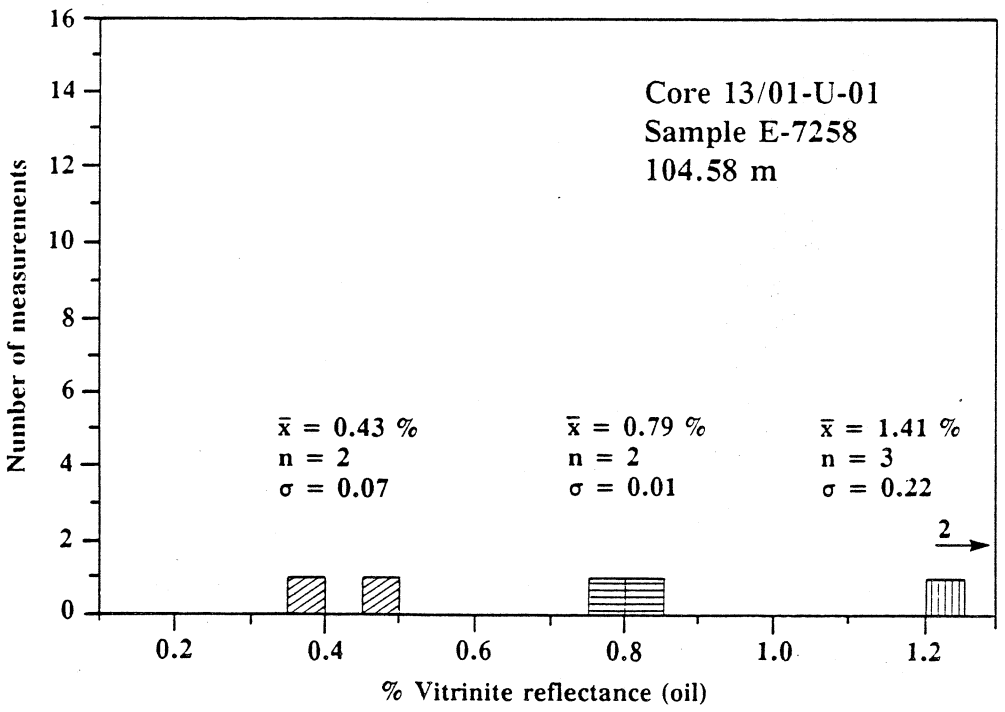
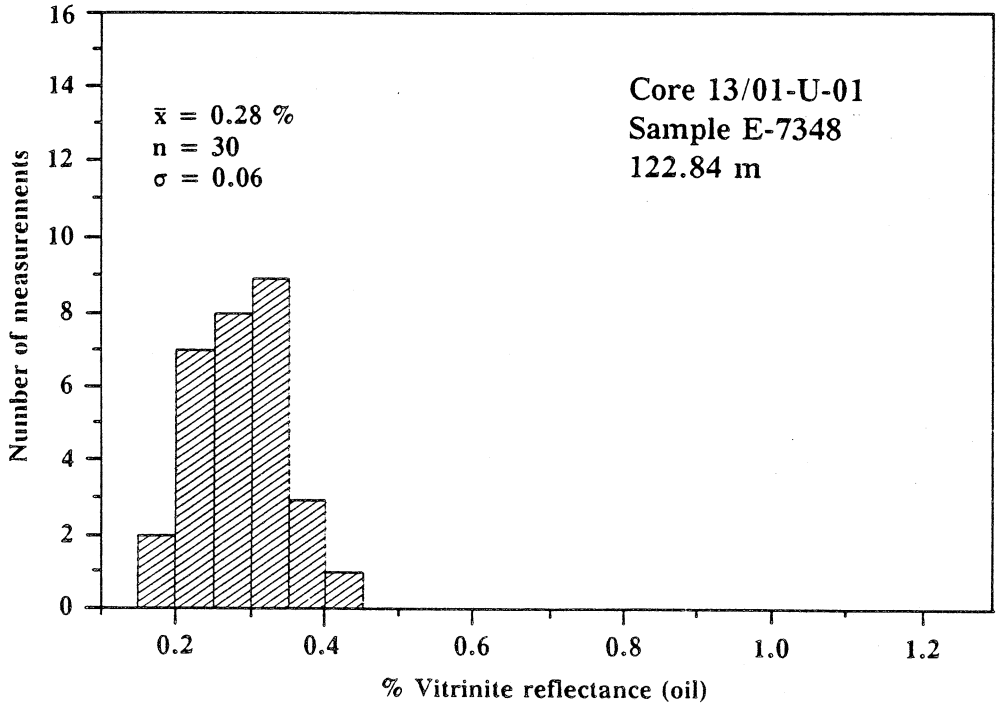


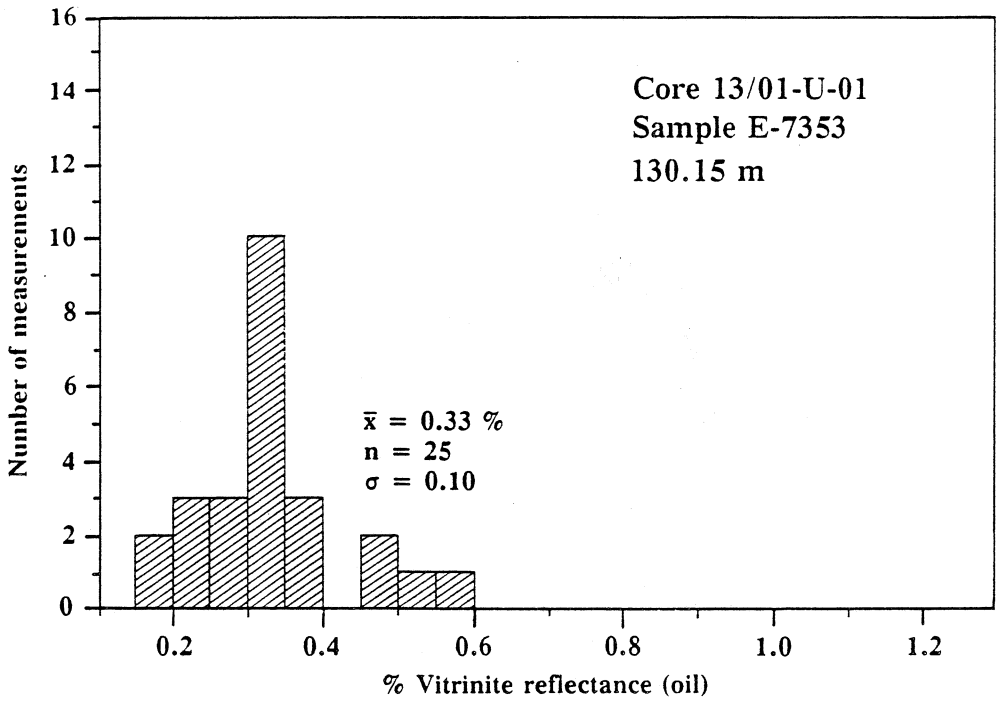
Figure A.II.3.6: Vitrinite reflectance histograms.

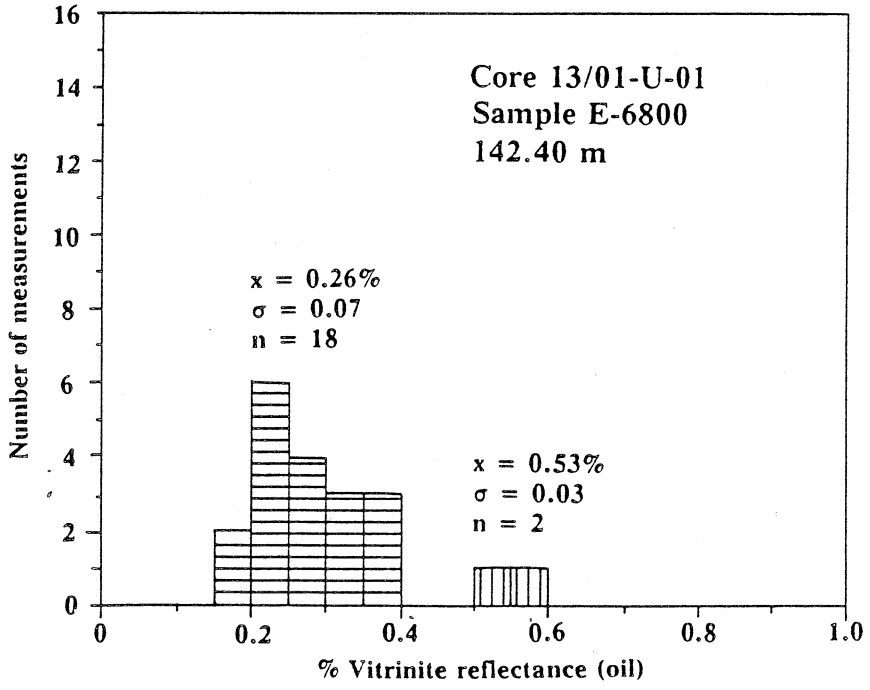

Core 13/01-U-01
Sample E-7178
66.80 m
x̄ = 0.48 %
n = 7
σ = 0.07
x̄ = 0.84 %
n = 7
σ = 0.10
Number of measurements
% Vitrinite reflectance (oil)

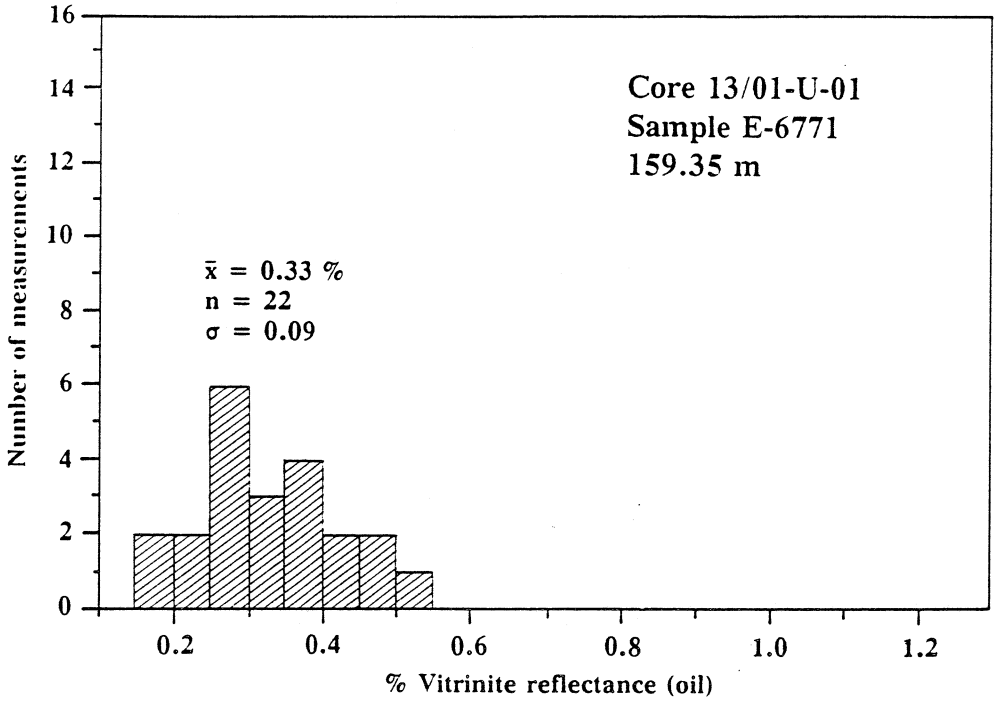

Core 13/01-U-01
Sample E-7210
85.29 m
x̄ = 0.28 %
n = 1
σ = 0.00
x̄ = 0.60 %
n = 7
σ = 0.08
x̄ = 0.97 %
n = 2
σ = 0.16
Number of measurements
% Vitrinite reflectance (oil)

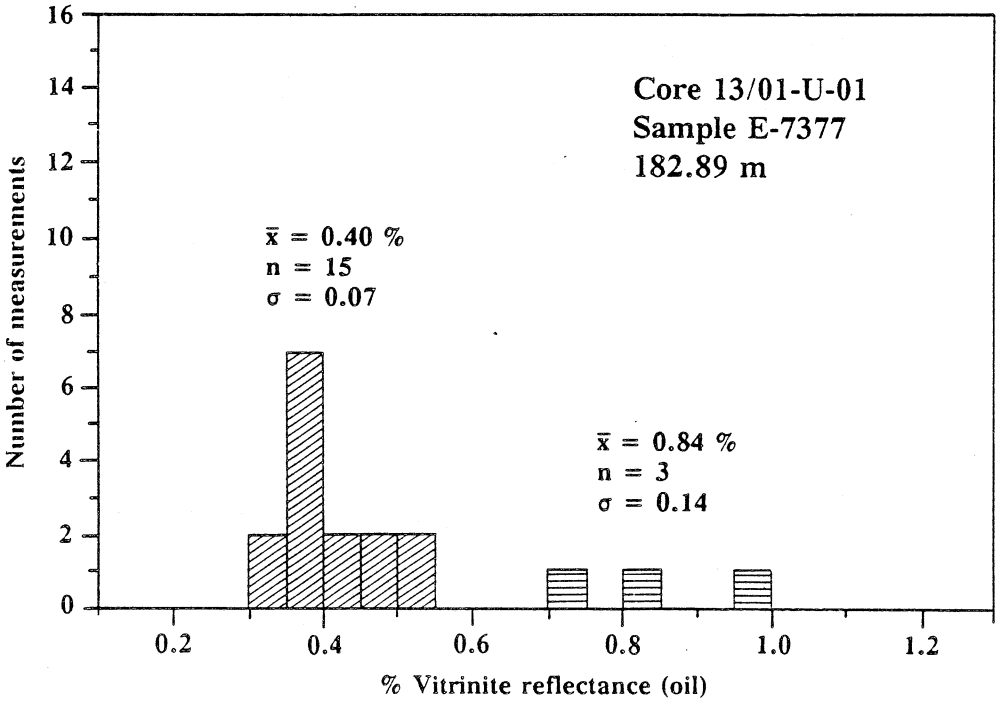

Core 13/01-U-01
Sample E-7258
104.58 m
x̄ = 0.43 %
n = 2
σ = 0.07
x̄ = 0.79 %
n = 2
σ = 0.01
x̄ = 1.41 %
n = 3
σ = 0.22
2
Number of measurements
% Vitrinite reflectance (oil)

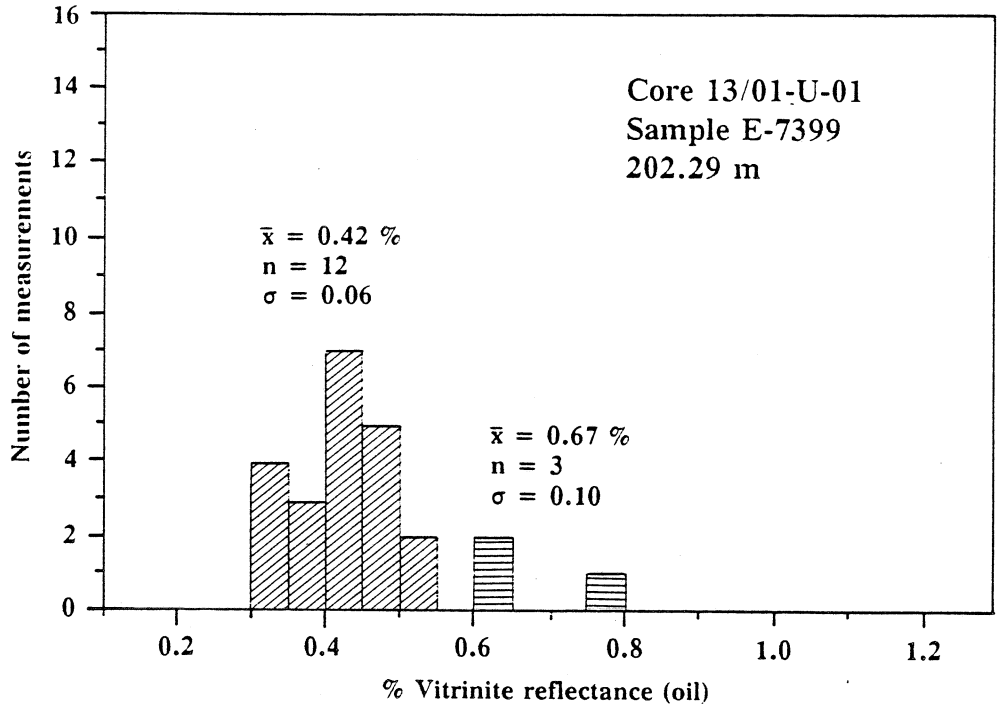

Core 13/01-U-01
Sample E-7348
122.84 m
x̄ = 0.28 %
n = 30
σ = 0.06
Number of measurements
% Vitrinite reflectance (oil)

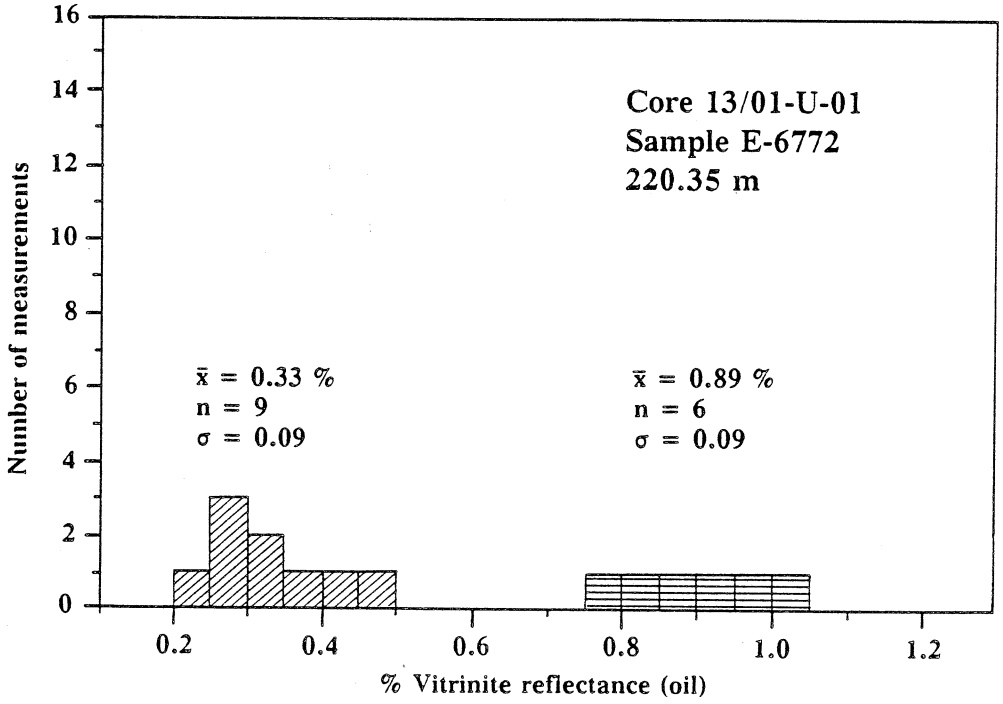

Core 13/01-U-01
Sample E-7353
130.15 m
x̄ = 0.33 %
n = 25
σ = 0.10
Number of measurements
% Vitrinite reflectance (oil)
0
2
4
6
8
10
12
14
16
0.2
0.4
0.6
0.8
1.0
1.2

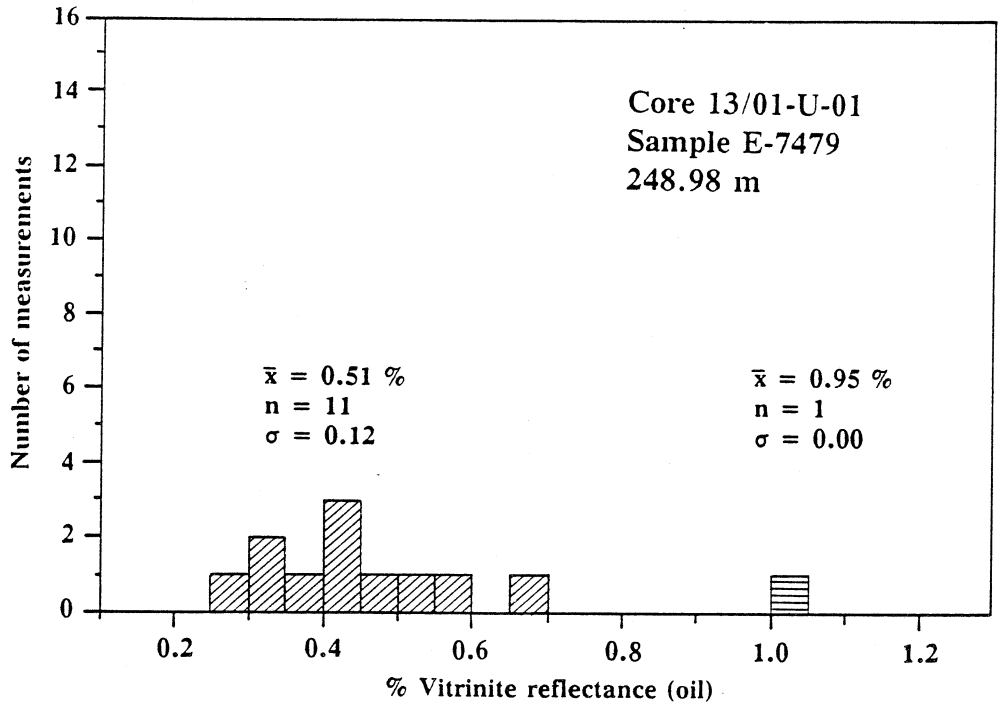

Core 13/01-U-01
Sample E-6800
142.40 m
x = 0.26%
σ = 0.07
n = 18
x = 0.53%
σ = 0.03
n = 2
Number of measurements
% Vitrinite reflectance (oil)
0
2
4
6
8
10
12
14
16
0
0.2
0.4
0.6
0.8
1.0

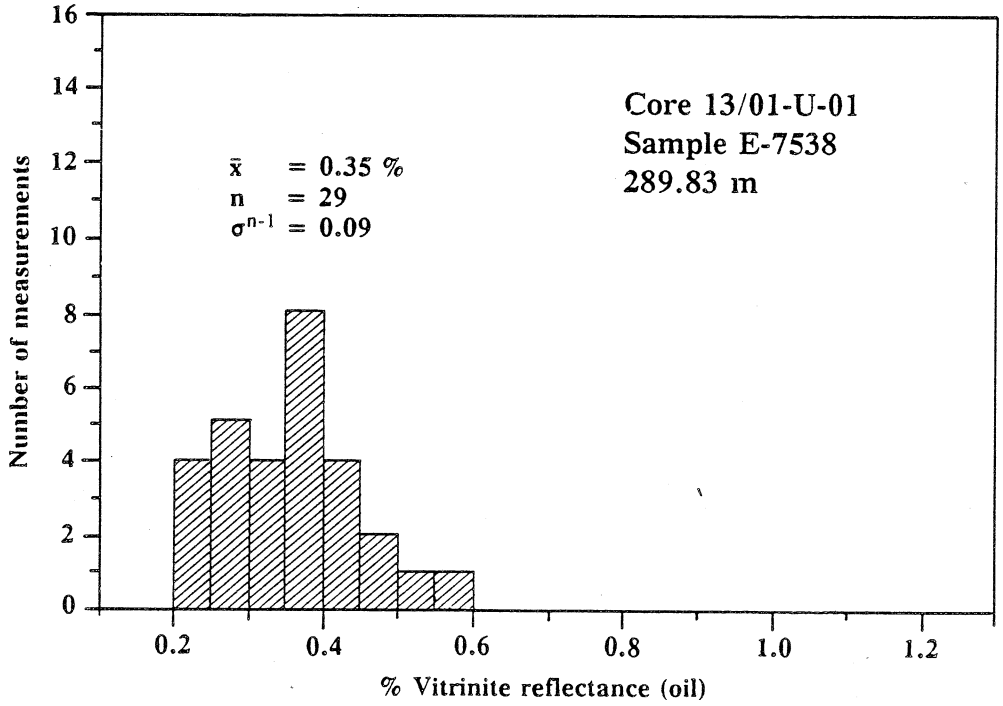

Core 13/01-U-01
Sample E-6771
159.35 m
x̄ = 0.33 %
n = 22
σ = 0.09
Number of measurements
% Vitrinite reflectance (oil)


Core 13/01-U-01
Sample E-7377
182.89 m
x̄ = 0.40 %
n = 15
σ = 0.07
x̄ = 0.84 %
n = 3
σ = 0.14
Number of measurements
% Vitrinite reflectance (oil)


Core 13/01-U-01
Sample E-7399
202.29 m
x̄ = 0.42 %
n = 12
σ = 0.06
x̄ = 0.67 %
n = 3
σ = 0.10
Number of measurements
% Vitrinite reflectance (oil)


Core 13/01-U-01
Sample E-6772
220.35 m
x̄ = 0.33 %
n = 9
σ = 0.09
x̄ = 0.89 %
n = 6
σ = 0.09
Number of measurements
% Vitrinite reflectance (oil)


Core 13/01-U-01
Sample E-7479
248.98 m
x̄ = 0.51 %
n = 11
σ = 0.12
x̄ = 0.95 %
n = 1
σ = 0.00
Number of measurements
% Vitrinite reflectance (oil)


Core 13/01-U-01
Sample E-7538
289.83 m
x̄ = 0.35 %
n = 29
σ^n-1 = 0.09
Number of measurements
% Vitrinite reflectance (oil)

IKU SINTEF-GRUPPEN

APPENDIX II.4: TABLE OF CONTENTS

Core 13/1-U-2

TABLES

Table A.II.4.1a: Concentration of C_1-C_{5+} hydrocarbons in headspace gas.
Table A.II.4.1b: Concentration of C_1-C_{5+} hydrocarbons in occluded gas.
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Table A.II.4.2: Total organic carbon content and data from Rock-Eval pyrolysis.
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Table A.II.4.5: Visual kerogen analysis.
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Table A.II.4.10: Internal distribution of 14α(H),17α(H) 20R, C_{27}, C_{28} and C_{29} regular steranes (from m/z 217).
Table A.II.4.11: Molecular ratios from mass fragmentograms of aromatic steroid hydrocarbons.

FIGURES

Figure A.II.4.1: Pyrolysis-gas chromatograms (S2 peak)
Figure A.II.4.2: Gas chromatograms of saturated and aromatic hydrocarbons.
Figure A.II.4.3: Mass fragmentograms of m/z 191, 205 (terpanes) and m/z 217, 218 (steranes).
Figure A.II.4.4: Internal distribution of 14α(H),17α(H) 20R, C_{27}, C_{28} and C_{29} regular steranes (from m/z 217).
Figure A.II.4.5: Mass fragmentograms of m/z 231, 253 (aromatic steroid hydrocarbons).
Figure A.II.4.6: Vitrinite reflectance histograms.

IKU SINTEF-GRUPPEN

Project no.: 21346000
Location : 13/01-U-02
Date : 89.08.08

Table A.II.4.1a

TABLE OF GAS RESULTS

Headspace gas (µl gas pr. kg rock)

IKUNO	DEPTH (m)	C1	C2	C3	iC4	nC4	C5+	SUM C1-C4	SUM C2-C4	WET-NESS (%)	iC4 --- nC4
E7551	121.67	4057	27	0	0	0	0	4084	27	0.6	-1.00
E7564	134.07	5442	32	0	0	0	0	5474	32	0.5	-1.00
E7580	143.91	7231	0	0	0	0	0	7231	0	0.0	-1.00
E7588	152.10	6119	0	0	0	0	0	6119	0	0.0	-1.00
E7605	160.55	5657	0	0	0	0	0	5657	0	0.0	-1.00
E7618	166.45	7125	0	0	0	0	0	7125	0	0.0	-1.00
E7647	181.35	7212	0	0	0	0	0	7212	0	0.0	-1.00
E7668	192.06	8505	42	0	0	0	0	8547	42	0.4	-1.00
E7684	200.72	14635	61	0	0	0	0	14696	61	0.4	-1.00
E7693	206.44	7030	0	0	0	0	0	7030	0	0.0	-1.00

Table A.II.4.1b

Occluded gas (µl gas pr. kg dry rock)

IKUNO	DEPTH (m)	C1	C2	C3	iC4	nC4	C5+	SUM C1-C4	SUM C2-C4	WET-NESS (%)	iC4 --- nC4
E7551	121.67	2227	78	97	42	42	251	2486	259	10.4	1.00
E7564	134.07	2394	76	106	47	44	258	2667	273	10.2	1.07
E7580	143.91	4309	91	109	44	40	229	4593	284	6.1	1.10
E7588	152.10	3170	65	73	32	28	186	3368	198	5.8	1.14
E7605	160.55	2099	51	48	12	17	136	2227	128	5.7	0.71
E7618	166.45	3569	85	87	40	35	199	3816	247	6.4	1.14
E7647	181.35	3624	84	100	44	37	231	3889	265	6.8	1.19
E7668	192.06	4797	127	151	69	56	299	5200	403	7.7	1.23
E7684	200.72	2867	93	116	53	42	265	3171	304	9.5	1.26
E7693	206.44	5138	121	141	62	49	281	5511	373	6.7	1.27

Legend:
-1: Data are not available or cannot be determined.

IKU SINTEF-GRUPPEN

Project no.: 21346000
Location : 13/01-U-02
Date : 89.08.08

Table A.II.4.1c

Summation of Headspace and Occluded gas

(µl gas pr. kg dry rock)

IKUNO	DEPTH (m)	C1	C2	C3	iC4	nC4	C5+	SUM C1-C4	SUM C2-C4	WET-NESS (%)	iC4 / nC4
E7551	121.67	6284	105	97	42	42	251	6570	286	4.4	1.00
E7564	134.07	7836	108	106	47	44	258	8141	305	3.7	1.07
E7580	143.91	11540	91	109	44	40	229	11824	284	2.4	1.10
E7588	152.10	9289	65	73	32	28	186	9487	198	2.1	1.14
E7605	160.55	7756	51	48	12	17	136	7884	128	1.6	0.71
E7618	166.45	10694	85	87	40	35	199	10941	247	2.3	1.14
E7647	181.35	10836	84	100	44	37	231	11101	265	2.4	1.19
E7668	192.06	13302	169	151	69	56	299	13747	445	3.2	1.23
E7684	200.72	17502	154	116	53	42	265	17867	365	2.0	1.26
E7693	206.44	12168	121	141	62	49	281	12541	373	3.0	1.27

Legend:
-1: Data are not available or cannot be determined.

IKU SINTEF-GRUPPEN

Project no.: 21346000
Location : 13/01-U-02
Date : 89.11.06

Table A.II.4.2:
DATA FROM ROCK EVAL PYROLYSIS

IKUNO	FRAC NAME	DEPTH (m)	SAMPLE TYPE	S1 (mg/g rock)	S2 (mg/g rock)	TOC (%)	HYDRO. INDEX (mg/g TOC)	PETR. POTEN. S1+S2	PROD. INDEX S1/(S1+S2)	Tmax (°C)
E7546		118.98	CORE	0.03	0.74	1.03	72	0.77	0.04	428
E7549		120.83	CORE	0.02	0.61	0.95	64	0.63	0.03	426
E7551		121.67	CORE	0.00	0.29	0.93	31	0.29	0.00	427
E7552		122.95	CORE	0.04	0.66	0.85	78	0.70	0.06	427
E7554		124.39	CORE	0.03	1.14	1.12	102	1.17	0.03	436
E7556		126.02	CORE	0.03	0.43	0.72	60	0.46	0.07	427
E7557		129.25	CORE	0.03	0.31	0.68	46	0.34	0.09	423
E7562		133.01	CORE	0.02	1.06	0.86	123	1.08	0.02	436
E7564		134.07	CORE	0.00	0.51	1.03	50	0.51	0.00	427
E7566		134.62	CORE	0.03	0.59	0.94	63	0.62	0.05	428
E7569		135.94	CORE	0.04	0.52	0.75	69	0.56	0.07	424
E7570		136.61	CORE	0.04	0.97	1.12	87	1.01	0.04	431
E7571		137.54	CORE	0.06	1.00	1.08	93	1.06	0.06	431
E7573		138.99	CORE	0.05	1.20	1.04	115	1.25	0.04	431
E7578		141.69	CORE	0.05	2.02	1.44	140	2.07	0.02	436
E7579		142.95	CORE	0.02	0.49	0.80	61	0.51	0.04	426
E7580		143.91	CORE	0.01	0.34	1.13	30	0.35	0.03	428
E7582		144.50	CORE	0.04	0.53	0.87	61	0.57	0.07	422
E7583		145.59	CORE	0.03	0.40	0.65	62	0.43	0.07	423
E7586		147.82	CORE	0.02	0.11	0.39	28	0.13	0.15	419
E7587		149.39	CORE	0.02	0.23	0.46	50	0.25	0.08	418
E7589		150.56	CORE	0.04	0.21	0.43	49	0.25	0.16	420
E7590		151.50	CORE	0.04	0.27	0.51	53	0.31	0.13	419
E7588		152.10	CORE	0.00	0.14	0.51	27	0.14	0.00	423
E7593		154.12	CORE	0.03	0.60	0.71	85	0.63	0.05	428
E7595		155.27	CORE	0.02	0.30	0.80	38	0.32	0.06	426
E7598		156.18	CORE	0.03	0.41	0.80	51	0.44	0.07	429
E7599		157.02	CORE	0.03	0.32	0.65	49	0.35	0.09	424
E7600		157.60	CORE	0.00	0.16	0.67	24	0.16	0.00	427
E7601		158.68	CORE	0.04	0.23	0.54	43	0.27	0.15	427
E7606		159.17	CORE	0.03	0.20	0.50	40	0.23	0.13	428
E7605		160.55	CORE	0.00	0.11	0.60	18	0.11	0.00	423
E7609		161.50	CORE	0.02	0.23	0.61	38	0.25	0.08	426
E7610		162.14	CORE	0.02	0.28	0.63	44	0.30	0.07	426
E7613		164.01	CORE	0.02	0.22	0.59	37	0.24	0.08	419
E7615		164.74	CORE	0.02	0.24	0.63	38	0.26	0.08	425
E7618		166.45	CORE	0.01	0.17	0.84	20	0.18	0.06	424
E7620		166.96	CORE	0.02	0.21	0.61	34	0.23	0.09	426
E7623		168.30	CORE	0.01	0.22	0.60	37	0.23	0.04	426
E7625		169.80	CORE	0.01	0.30	0.67	45	0.31	0.03	424
E7629		170.74	CORE	0.01	0.25	0.65	38	0.26	0.04	423
E7633		172.59	CORE	0.01	0.23	0.64	36	0.24	0.04	422
E7634		173.49	CORE	0.03	0.30	0.67	45	0.33	0.09	421
E7635		174.20	CORE	0.04	0.27	0.70	39	0.31	0.13	420

Legend
-1 - No data available.
( ) - Tmax of doubtful reliability, often associated with poor S2 peaks.

IKU SINTEF-GRUPPEN

Project no.: 21346000
Location : 13/01-U-02
Date : 89.11.06

Table A.II.4.2 (continued):
DATA FROM ROCK EVAL PYROLYSIS

IKUNO	FRAC NAME	DEPTH (m)	SAMPLE TYPE	S1 (mg/g rock)	S2 (mg/g rock)	TOC (%)	HYDRO. INDEX (mg/g TOC)	PETR. POTEN. S1+S2	PROD. INDEX S1/(S1+S2)	Tmax (°C)
E7637		175.75	CORE	0.07	0.30	0.67	45	0.37	0.19	424
E7638		177.12	CORE	0.03	0.28	0.65	43	0.31	0.10	420
E7641		178.06	CORE	0.05	0.36	0.70	51	0.41	0.12	420
E7649		179.32	CORE	0.03	0.33	0.78	42	0.36	0.08	424
E7650		180.63	CORE	0.03	0.30	0.76	39	0.33	0.09	420
E7647		181.35	CORE	0.01	0.19	0.87	22	0.20	0.05	422
E7651		181.42	CORE	0.04	0.28	0.83	34	0.32	0.13	423
E7653		182.52	CORE	0.02	0.30	0.89	34	0.32	0.06	419
E7654		183.69	CORE	0.03	0.30	0.83	36	0.33	0.09	422
E7658		185.05	CORE	0.03	0.34	0.65	52	0.37	0.08	424
E7659		185.85	CORE	0.02	0.31	0.83	37	0.33	0.06	424
E7661		187.27	CORE	0.03	0.38	0.93	41	0.41	0.07	424
E7662		188.77	CORE	0.02	0.30	0.98	31	0.32	0.06	425
E7663		189.59	CORE	0.03	0.29	1.02	28	0.32	0.09	415
E6776		190.76	CORE	0.00	0.29	1.01	29	0.29	0.00	424
E6777		191.10	CORE	0.00	0.51	1.39	37	0.51	0.00	425
E6778		191.22	CORE	0.08	9.49	3.54	268	9.57	0.01	428
E7665		191.24	CORE	0.07	8.60	3.07	280	8.67	0.01	433
E6805		191.50	CORE	0.03	0.48	1.08	44	0.51	0.06	424
E6779		191.86	CORE	0.03	3.08	2.23	138	3.11	0.01	431
E7668		192.06	CORE	0.00	0.31	1.23	25	0.31	0.00	426
E7670		193.00	CORE	0.02	0.50	1.24	40	0.52	0.04	430
E6806		193.60	CORE	0.01	0.37	1.28	29	0.38	0.03	422
E7671		193.89	CORE	0.01	0.24	1.00	24	0.25	0.04	424
E7672		195.27	CORE	0.01	0.18	0.94	19	0.19	0.05	427
E7674		195.95	CORE	0.00	0.21	1.05	20	0.21	0.00	423
E7677		196.90	CORE	0.03	0.59	1.23	48	0.62	0.05	420
E7679		197.51	CORE	0.06	2.24	1.86	120	2.30	0.03	427
E6807		198.04	CORE	0.07	4.84	2.90	167	4.91	0.01	430
E7680		198.63	CORE	0.06	2.29	2.07	111	2.35	0.03	428
E6808		199.33	CORE	0.01	0.36	1.40	26	0.37	0.03	420
E7682		200.13	CORE	0.02	0.36	1.12	32	0.38	0.05	419
E7684		200.72	CORE	0.01	0.23	1.09	21	0.24	0.04	423
E7685		201.83	CORE	0.03	0.26	0.82	32	0.29	0.10	419
E7687		202.70	CORE	0.02	0.27	0.78	35	0.29	0.07	417
E7688		203.87	CORE	0.02	0.37	0.94	39	0.39	0.05	424
E7691		204.96	CORE	0.02	0.29	1.00	29	0.31	0.06	419
E7694		205.37	CORE	0.02	0.30	0.94	32	0.32	0.06	419
E7702		206.15	CORE	0.02	0.36	0.62	58	0.38	0.05	424
E7693		206.44	CORE	0.00	0.24	1.06	23	0.24	0.00	425
E7697		206.68	CORE	0.02	0.37	1.12	33	0.39	0.05	423
E7698		207.30	CORE	0.01	0.21	1.14	18	0.22	0.05	425
E7701		207.60	CORE	0.02	0.26	1.03	25	0.28	0.07	423

Legend
-1 - No data available.
( ) - Tmax of doubtful reliability, often associated with poor S2 peaks.

Table A.II.4.3: Data from pyrolysis-gas chromatograms.

IKUNO	Depth (m)	Lithology	C_1	C_2-C_5	C_6-C_{14}	C_{15+}	mpx /$nC_{8=}$ 1)	mpx /$nC_{10=}$ 2)	HI (mg/gTOC)	TOC (wt%)
			(area %)							
Core 13/01-U-02										
E7554	124.39	Clst	8.9	23.4	66.7	7.1	0.45	0.76	102	1.12
E7578	141.69	Clst	9.3	27.2	55.3	8.2	0.76	1.42	140	1.44
E7580	143.91	Clst	26.6	19.0	54.2	0.2	0.90	2.36	30	1.13
E7582	144.50	Clst	18.6	20.0	61.3	3.2	0.75	2.25	61	0.87
E7665	191.24	Clst	9.6	13.7	54.7	22.0	0.95	1.37	280	3.07
E6779	191.86	Clst	12.2	16.7	58.5	12.6	1.00	1.71	138	2.23
E7668	192.06	Clst	11.6	28.1	54.9	5.4	0.92	2.00	25	1.23
E7667	196.90	Clst	17.2	35.8	46.3	0.7	1.39	2.08	48	1.23
E7680	198.63	Clst	15.9	20.2	55.6	8.4	1.56	3.90	111	2.07
E7682	200.13	Clst	21.0	33.6	40.4	5.0	1.67	5.00	32	1.12

Legend: 1) = peak height ratio (m+p)-xylene / n-octene
2) = peak height ratio (m+p)-xylene / n-decene
3) = data unreliable due to low intensity and high noise
4) = solvent-extracted residue after hydrous pyrolysis

Core number: 13/01-U-02
Reference number:21.3460.23
(1/1)

Table A.II.4.4:

VITRINITE REFLECTANCE DATA

IKU NO	LOCATION	DEPTH (M)	VITRINITE REFLECTANCE	REL RAT	STANDARD DEVIATION	FLUORE-SCENCE
E-7546	------	118.98	0.42 (4)	P	0.12	2-4
			0.78 (6)	R	0.08	
E-7573	------	138.99	0.53 (10)	P	0.10	2-3
			0.97 (4)	R	0.13	
E-7601	------	158.68	0.43 (1)	P	0.00	2-4
			0.78 (5)	R	0.07	
			1.02 (3)	R	0.01	
E-7642	------	178.95	0.38 (4)	P	0.10	2-4
			0.77 (7)	R	0.12	
			1.14 (1)	R	0.00	
E-7680	------	198.63	0.48 (10)	P	0.11	2-4
			0.81 (4)	R	0.06	
E-7701	------	207.60	0.60 (2)	P	0.10	2?
			1.31 (3)	R	0.22	

REL RAT (Reliability Rating): G = Good; F = Fair; P = Poor
S = Stained; R = Reworked.
*: Reflectance readings obtained from huminite particles of variable polish.

VISUAL KEROGEN ANALYSIS

TABLE NO.: A.II.4.5
CORE NO.: 13/01-U-02

Sample	Depth (m)	Composition of residue	Particle size	Preservation palynomorphs	Thermal maturation index *	Remarks
E-7545	118.96	Am: >90% Lm: <5% W: 5% C:	F-M-L	Good-Fair	3.0 - 4.0	Organic residue totally dominated by amorphous matter, both finely dispersed and small-medium greyish/brownish granular aggregates. The amorphous matter does not fluoresce.
E-7554	124.39	Am: 65-70% Lm: 15-20% W: 10-15% C:	F-M-L	Fair	3.0 - 4.0	Organic residue dominated by amorphous material; most medium to large dark granular aggregates. The amorphous ground-mass is specked with small fragments showing strong yellow colouration in fluorescence light (algal/bacterial and/or liptinitic material).
E-7853	137.51	Am: 65-70% Lm: 15-20% W: 10-15% C:	F-M-L	Good-Fair	3.0 - 4.0	Comparable to sample E-7554.
E-7577	141.68	Am: 65-70% Lm: 20-25% W: 5-10% C:	F-M-L	Good-Fair	3.0 - 4.0	Comparable to samples from 124.39 m and 137.51 m but with a small increase in the proportion of liptinitic material compared to that of dark brown/black woody and coaly fragments.

ABBREVIATIONS:

Am = Amorphous
Al = Algae
W = Woody material
C = Coaly fragments
Lm = Liptinitic material
+ = Present in traces

F = Fine
M = Medium
L = Large

* New TAI (1-10 scale; see experimental).

IKU SINTEF-GRUPPEN

VISUAL KEROGEN ANALYSIS

TABLE NO.: A.II.4.5 (cont)
CORE NO.: 13/01-U-02

Sample	Depth (m)	Composition of residue	Particle size	Preservation palynomorphs	Thermal maturation index *	Remarks
E-7591	151.50	Am: 65-70% Lm: 15-20% W: 10-15% C:	F-M-L	Good-Fair	3.0 - 4.0	Comparable to samples from 124.39 m and 137.51 m
E-7619	166.89	Sieved residue: Am: 10% Lm: 25-30% W: 60-65% C:	F-M-L	Good-Fair	3.0 - 4.0	Only sieved residue available. This is enriched in bladeshape dark brown and black woody/coaly fragments.
E-6778	191.22	Am: 65-70% Lm: 15-20% W: 10-15% C:	F-M-L	Good-Fair	3.0 - 4.0	Comparable to sample E-7554 (124.39 m).
E-7669	192.08	Am: 85-90% Lm: 5-10% W: 5% C:	F-M-L	Good-Fair	3.0 - 4.0	Organic residue dominated by amorphous matter, both finely dispersed and larger granular aggregates. The amorphous matter shows no fluorescence colouration.

ABBREVIATIONS:

Am = Amorphous
Al = Algae
W = Woody material
C = Coaly fragments
Lm = Liptinitic material
+ = Present in traces

F = Fine
M = Medium
L = Large

* New TAI (1-10 scale; see experimental).

IKU SINTEF-GRUPPEN

VISUAL KEROGEN ANALYSIS

TABLE NO.: A.II.4.5 (cont)
CORE NO.: 13/01-U-02

Sample	Depth (m)	Composition of residue	Particle size	Preservation palynomorphs	Thermal maturation index *	Remarks
E-7678	197.45	Sieved residue: Am: 25% Lm: 25% W: 50% C:	F-M-L	Good-Fair	3.0 - 4.0	Only sieved residue available. This is enriched in woody/coaly fragments. Amorphous matter shows no fluorescence colouration.
E-7680	198.63	Am: 85-90% Lm: ca.5% W: ca.5% C:	F-M-L	Good-Fair	3.0 - 4.0	Organic residue dominated by amorphous matter. Mostly greyish finely dispersed or medium-sized bundles. Also containing some larger dark granular aggregates, specked with strong yellow fluorescent material (+pyrite and small coaly fragments).
E-7870	200.12	Am: 75-80% Lm: 5% W: 15-20% C:	F-M-L	Good-Fair	3.0 - 4.0	Organic residue dominated by greyish amorphous matter (showing no fluorescence colouration).
Analysis of samples at 124.37, 139.02, 144.16 and 180.63 m was unsuccessful.						

ABBREVIATIONS:

Am = Amorphous
Al = Algae
W = Woody material
C = Coaly fragments
Lm = Liptinitic material
+ = Present in traces

F = Fine
M = Medium
L = Large

* New TAI (1-10 scale; see experimental).

IKU SINTEF-GRUPPEN

IKU SINTEF-GRUPPEN

Project no.: 21346000
Location : 13/01-U-02
Date : 89.10.18

Table A.II.4.6a:

WEIGHT OF CHROMATOGRAPHIC FRACTIONS

IKUNO	DEPTH (m)	SAMPLE TYPE	ROCK EXTR. (g)	EOM (mg)	ASPH (mg)	SAT HC (mg)	ARO HC (mg)	POLAR COMP. (mg)	HC (mg)	NONHC (mg)	TOC (%)
E7554	124.39	CORE	34.7	8.8	4.4	0.1	0.0	1.1	0.1	8.7	1.12
E7578	141.69	CORE	34.5	11.8	4.4	0.5	0.0	4.1	0.5	11.3	1.44
E7582	144.50	CORE	43.3	7.7	2.6	0.1	0.0	2.5	0.1	7.6	0.87
E7593	154.12	CORE	22.2	8.7	3.1	0.1	0.0	2.0	0.1	8.6	0.71
E7665	191.24	CORE	33.0	31.4	10.0	2.1	3.9	10.5	6.0	25.4	3.07
E6779	191.86	CORE	23.0	16.2	6.4	1.2	0.0	5.3	1.2	15.0	2.23
E7677	196.90	CORE	35.5	9.3	3.5	0.5	0.6	1.3	1.1	8.2	1.23
E7680	198.63	CORE	32.1	19.2	5.4	1.2	2.7	7.6	3.9	15.3	2.07

Table A.II.4.6b:

CONCENTRATION OF EOM AND CHROMATOGRAPHIC FRACTIONS

(Weight ppm of rock)

IKUNO	DEPTH (m)	SAMPLE TYPE	EOM	ASPH	SAT HC	ARO HC	POLAR COMP.	HC	NONHC
E7554	124.39	CORE	253	127	3	0	31	3	250
E7578	141.69	CORE	342	128	14	0	119	14	328
E7582	144.50	CORE	178	60	3	0	58	3	175
E7593	154.12	CORE	392	140	5	0	92	5	387
E7665	191.24	CORE	952	303	63	118	317	181	771
E6779	191.86	CORE	705	278	53	0	231	53	652
E7677	196.90	CORE	262	99	14	17	37	31	231
E7680	198.63	CORE	599	168	38	83	238	121	478

Project no.: 21346000
Location : 13/01-U-02
Date : 89.10.18

Table A.II.4.6c:

CONCENTRATION OF EOM AND CHROMATOGRAPHIC FRACTIONS

(mg/g TOC)

IKUNO	DEPTH (m)	SAMPLE TYPE	EOM	ASPH	SAT HC	ARO HC	POLAR COMP.	HC	NONHC
E7554	124.39	CORE	22.6	11.3	0.3	0.0	2.8	0.3	22.3
E7578	141.69	CORE	23.8	8.9	1.0	0.0	8.3	1.0	22.8
E7582	144.50	CORE	20.4	6.9	0.3	0.0	6.7	0.3	20.1
E7593	154.12	CORE	55.2	19.7	0.8	0.0	13.0	0.8	54.4
E7665	191.24	CORE	31.0	9.9	2.0	3.8	10.3	5.8	25.2
E6779	191.86	CORE	31.6	12.5	2.4	0.0	10.4	2.4	29.2
E7677	196.90	CORE	21.3	8.0	1.1	1.4	3.0	2.5	18.8
E7680	198.63	CORE	28.9	8.1	1.8	4.0	11.5	5.8	23.1

Table A.II.4.6d:

COMPOSITION OF EOM AND CHROMATOGRAPHIC FRACTIONS

IKUNO	DEPTH (m)	SAMPLE TYPE	ASPH / EOM (%)	SAT / EOM (%)	ARO / EOM (%)	HC / EOM (%)	POLAR / EOM (%)	SAT / ARO x 100	HC / NONHC x 100
E7554	124.39	CORE	50.0	1.4	0.0	1.4	12.3	-1.0	1.4
E7578	141.69	CORE	37.3	4.1	0.0	4.1	34.7	-1.0	4.3
E7582	144.50	CORE	33.8	1.6	0.0	1.6	32.8	-1.0	1.6
E7593	154.12	CORE	35.6	1.4	0.0	1.4	23.5	-1.0	1.4
E7665	191.24	CORE	31.8	6.6	12.4	19.0	33.3	53.1	23.5
E6779	191.86	CORE	39.5	7.5	0.0	7.5	32.8	-1.0	8.1
E7677	196.90	CORE	37.6	5.2	6.5	11.7	14.3	80.0	13.2
E7680	198.63	CORE	28.1	6.3	13.9	20.2	39.7	45.5	25.3

Legend:
-1 = Data are not available or cannot be calculated.

IKU SINTEF-GRUPPEN

Project no.: 21346000
Location : 13/01-U-02
Date : 89.10.19

Table A.II.4.7:

RATIOS DERIVED FROM GAS CHROMATOGRAMS OF SATURATED HYDROCARBONS

IKUNO	FRAC NAME	DEPTH	Pri / Phy	Pri A=----- / n-C17	Phy B=----- / n-C18	A / B	n-C17 ----- / n-C27	n-C31 ----- / n-C19	CPI 1	CPI 2
E7554		124.39	1.1	0.6	0.4	1.4	0.5	0.9	1.7	1.8
E7578		141.69	1.6	0.8	0.6	1.4	0.9	0.5	2.0	2.5
E7582		144.50	1.3	0.7	0.6	1.3	0.6	0.8	1.9	2.4
E7593		154.12	1.0	0.8	0.6	1.5	0.6	0.6	2.2	3.1
E7665		191.24	1.0	0.9	1.3	0.7	1.0	0.7	1.7	1.8
E6779		191.86	1.0	0.8	1.0	0.8	0.6	0.8	1.2	1.2
E7677		196.90	1.2	1.0	0.8	1.3	1.5	0.3	1.8	2.1
E7680		198.63	0.7	3.3	6.6	0.5	1.4	0.6	1.2	1.1

Legend:

$$CPI\ 1 = \frac{1}{2} \cdot \left(\frac{C_{25}+C_{27}+C_{29}+C_{31}}{C_{24}+C_{26}+C_{28}+C_{30}} + \frac{C_{25}+C_{27}+C_{29}+C_{31}}{C_{26}+C_{28}+C_{30}+C_{32}} \right)$$

$$CPI\ 2 = \frac{2 \cdot C_{27}}{C_{26}+C_{28}}$$

Ratios involving pristane and phytane are calculated from peak areas.
All other ratios are calculated from peak heights.

Table A.II.4.8: Molecular ratios from sterane and terpane mass chromatograms. Maturity characteristic ratios.

Code	Depth (m)	αβ/αβ+βα[1] hopanes	%22S[2] ext. hopanes	%20S[3] steranes	%ββ[4] steranes	C_{30} hopene[5] / C_{30} hopane
Core 13/01-U-02						
E7554	124.39	0.59	8	2	55	0.54
E7578	141.69	0.54	7	1	49	0.60
E7582	144.50	0.56	9	3	48	0.64
E7665	191.24	0.63	6	2	53	0.51
E6779	191.86	0.59	6	2	58	0.68
E7677	196.90	0.59	5	1	31	0.59
E7680	198.63	0.67	5	2	52	0.64

1) E/(E+F) in m/z 191.

2) Average % distribution between first and second eluting isomers of extended hopanes.

3) 100 · q/(q+t) in m/z 217.

4) 100 · (r+s)/(q+t+2·(r+s)) in m/z 217.

5) 9/(9+E) in m/z 191.

Table A.II.4.9: *Molecular ratios from terpane and sterane mass chromatograms. Maturity and source characteristic ratios.*

Code	Depth (m)	Q/E[1] terpanes	Tm/Ts[2] terpanes	X/E[3] terpanes	Z/E[4] terpanes	a/(a+j)[5] steranes
Core 13/01-U-02						
E7554	124.39	-	3.06	-	-	0.10
E7578	141.69	-	3.59	-	-	0.06
E7582	144.50	-	2.78	-	-	0.11
E7665	191.24	-	2.80	-	-	0.05
E6779	191.86	-	2.61	-	-	0.02
E7677	196.90	-	4.55	-	-	0.05
E7680	198.63	-	2.98	-	-	0.00

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 A.II.4.10: Internal distribution of 14α(H),17α(H), 20R C_{27}, C_{28} and C_{29} regular steranes.

IKUNO	DEPTH m	C_{27} %	C_{28} %	C_{29} %[1)]
Core 13/01-U-02				
E7554	124.39	36.3	14.6	49.1
E7578	141.69	46.1	13.2	40.7
E7582	144.50	46.5	13.3	40.2
E7665	191.24	60.9	11.9	27.2
E6779	191.86	60.3	13.2	26.5
E7677	196.90	38.0	7.9	54.0
E7680	198.63	48.4	13.7	37.9

1) height distribution of peaks j,p,t in m/z 217.

Table A.II.4.11: Molecular ratios from mass fragmentograms of aromatic steroid hydrocarbons.

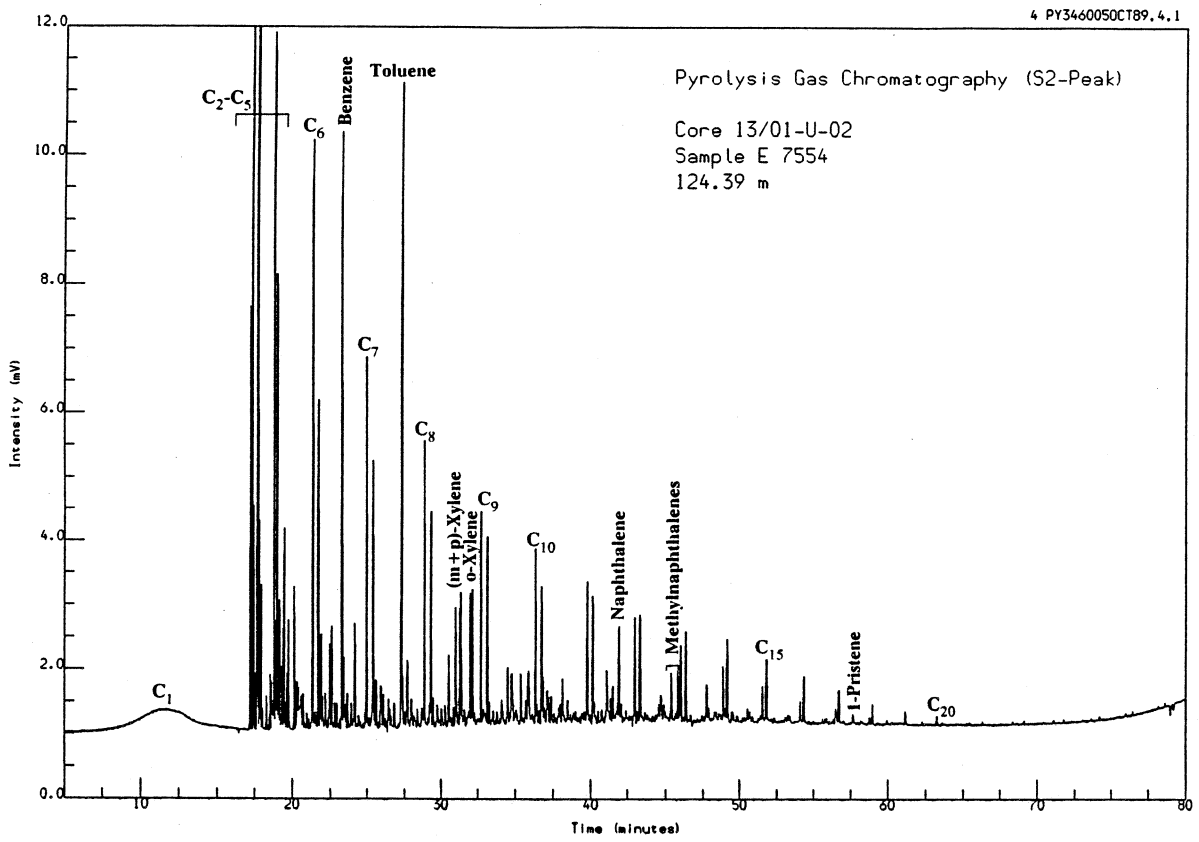
IKUNO	DEPTH	Cracking ratios			Aromatisation ratios	
	m	20/20+27 tri [1]	20/20+28 tri [2]	21/21+28 mono [3]	27t/27t+28m [4]	28t/28t+29m [5]
Core 13/01-U-02						
E7554	124.39	0.10	0.43	0.10	0.01	0.00
E7578	141.69	0.11	0.31	0.18	0.61	-1.00
E7582	144.50	0.26	0.57	0.32	0.02	0.01
E7665	191.24	0.10	0.27	0.07	0.02	0.01
E6779	191.86	0.13	0.48	0.27	0.94	0.67
E7677	196.90	0.17	0.61	0.17	0.03	0.00
E7680	198.63	0.10	0.27	0.07	0.03	0.01

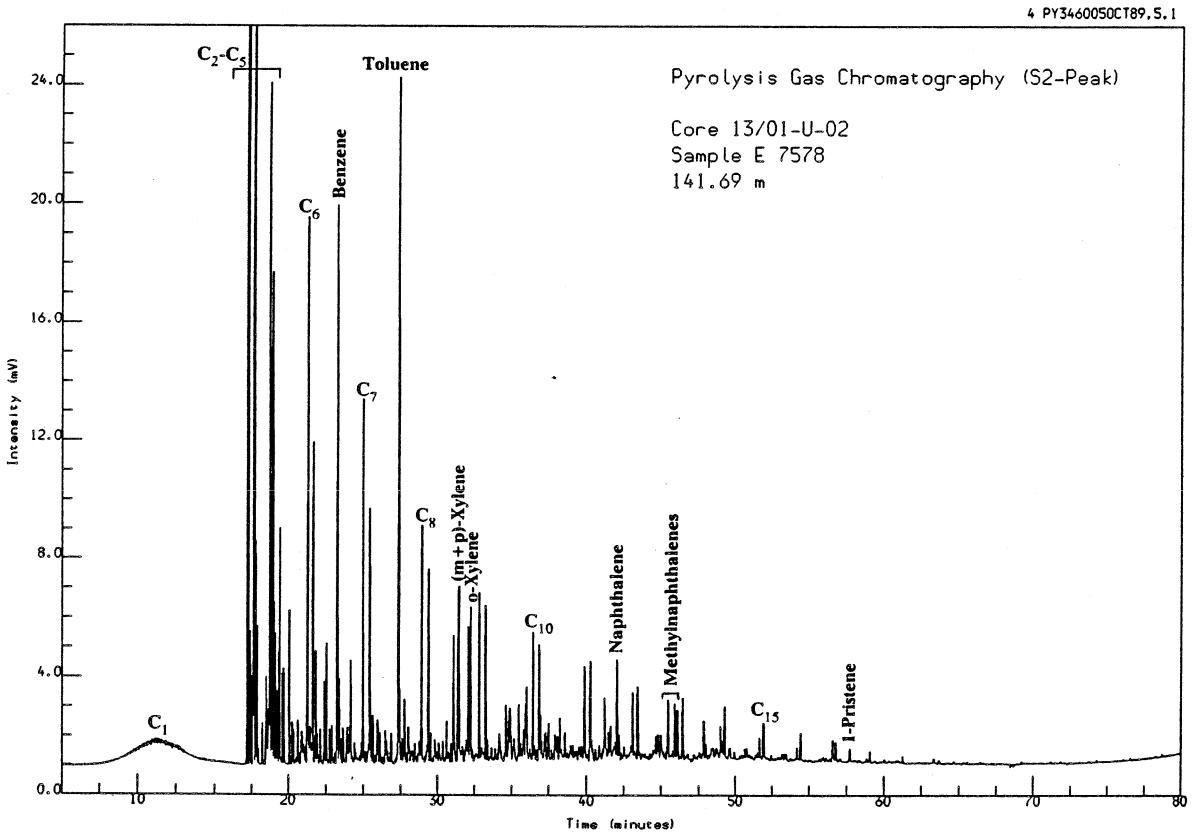
All ratios are given in fractions of 1.

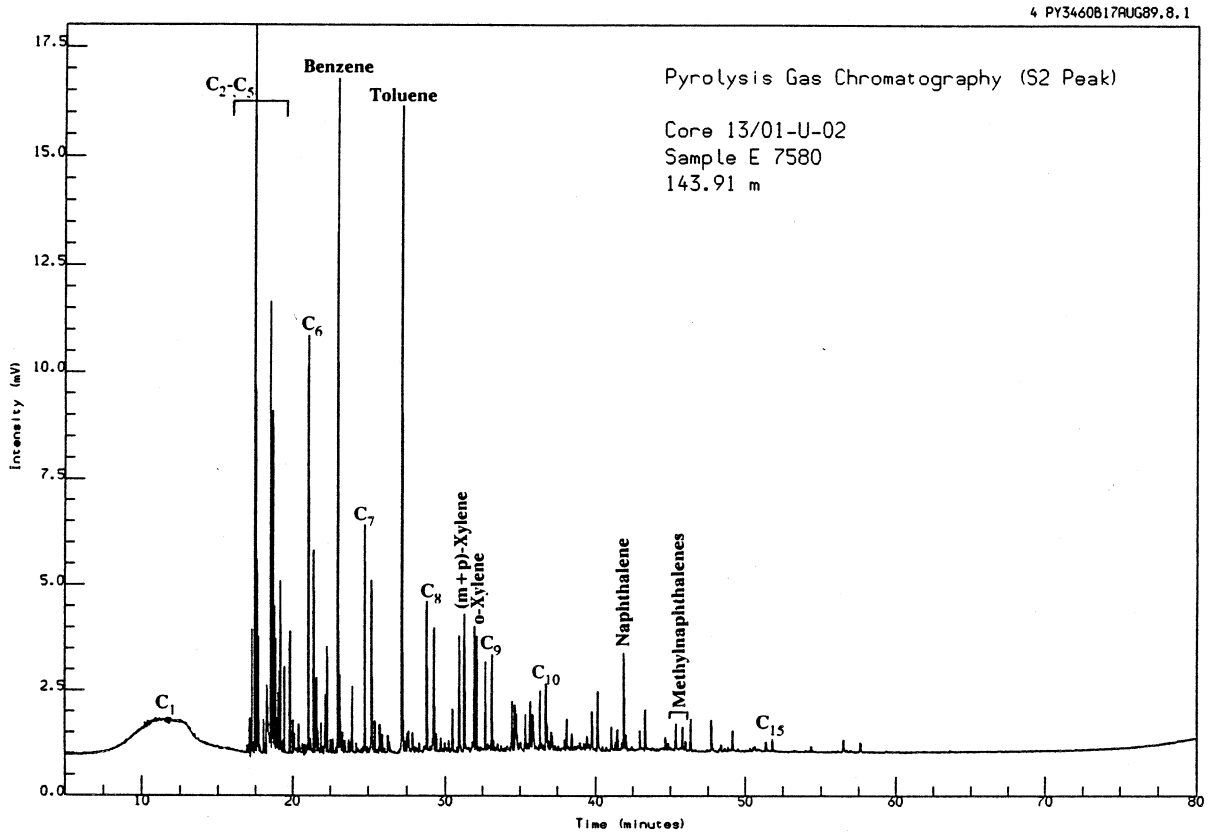
[1] M/(M+P) in m/z 231 (Mackenzie et al. 1981, main text).
[2] M/(M+S) in m/z 231 (Mackenzie et al. 1981, note added in proof).
[3] a/(a+h) in m/z 253 (Mackenzie et al. 1981, note added in proof).
[4] P/(P+h) in m/z 231 and 253. (Mackenzie et al. 1981, main text)
[5] S/(S+m+(k*S/(S+R))) (Mackenzie et al. 1981, note added in proof).
-1 = Data are not available or cannot be calculated.

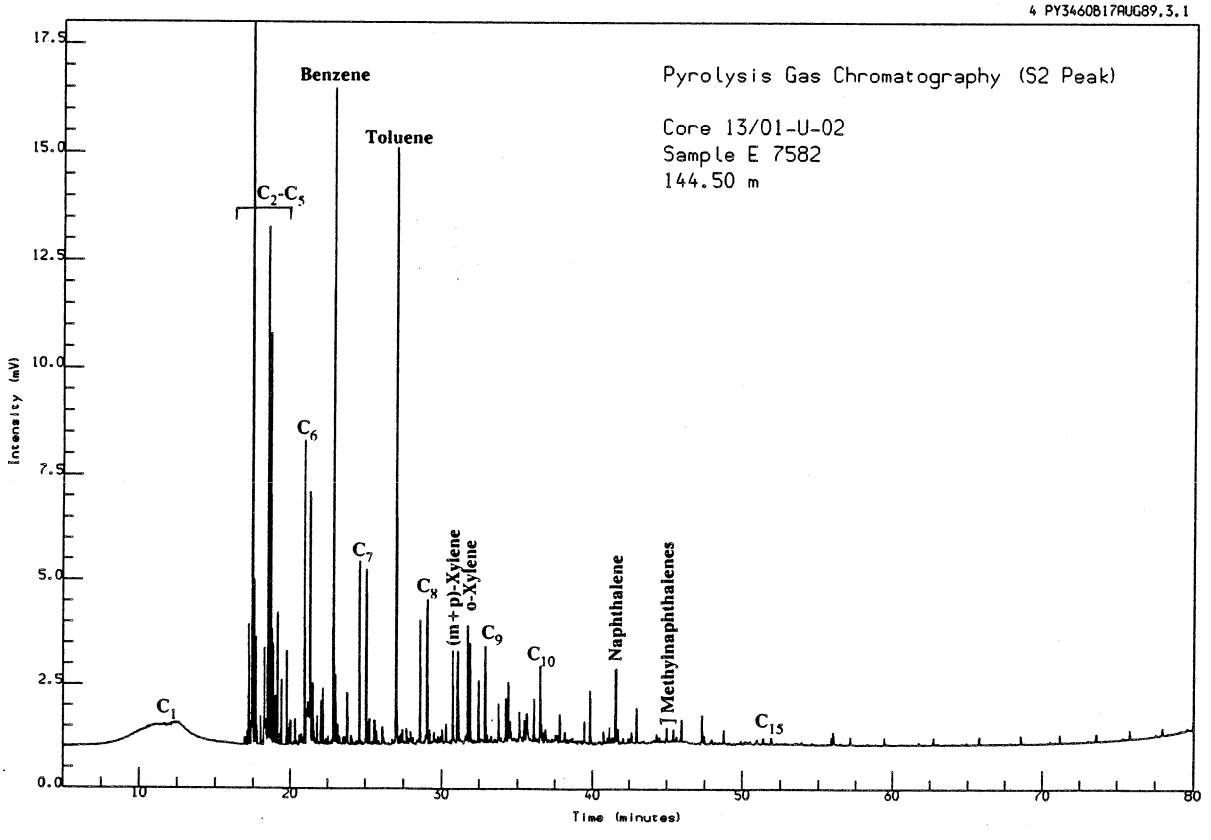
Figure A.II.4.1:

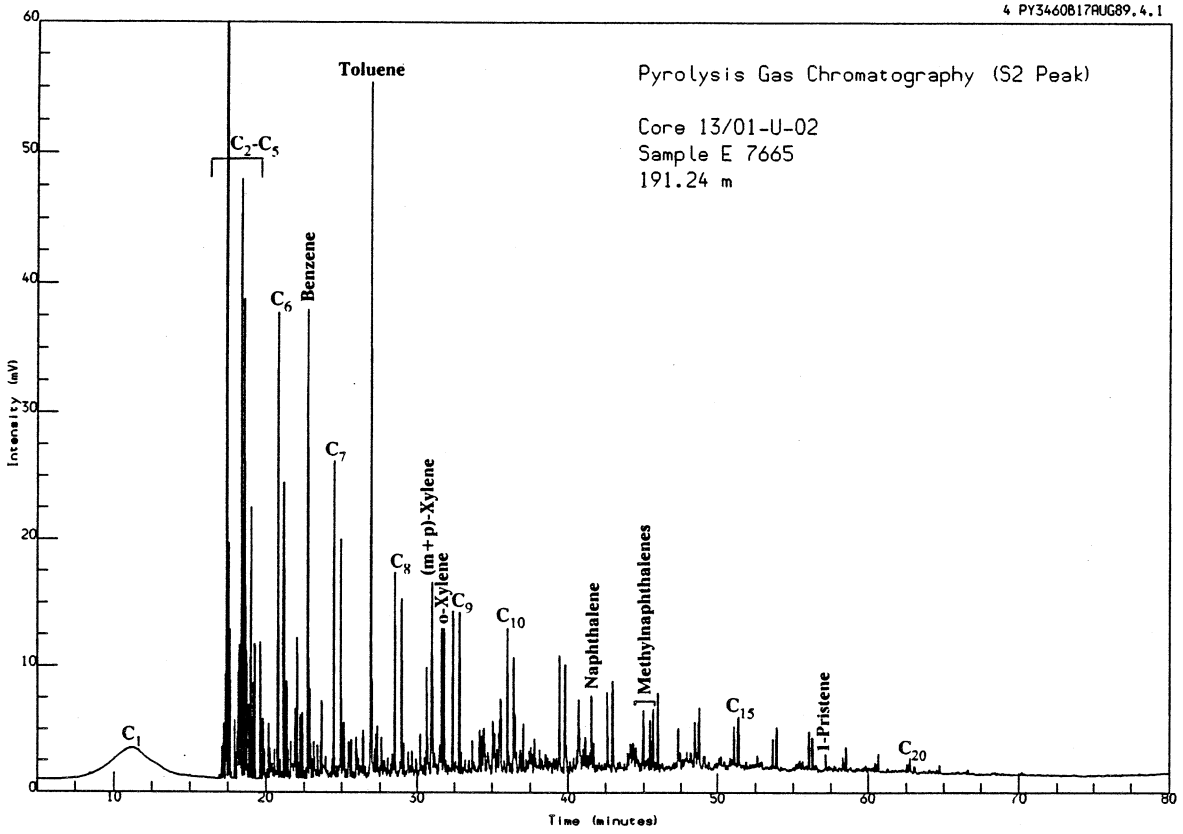
Pyrolysis-gas chromatograms (S2 peak)

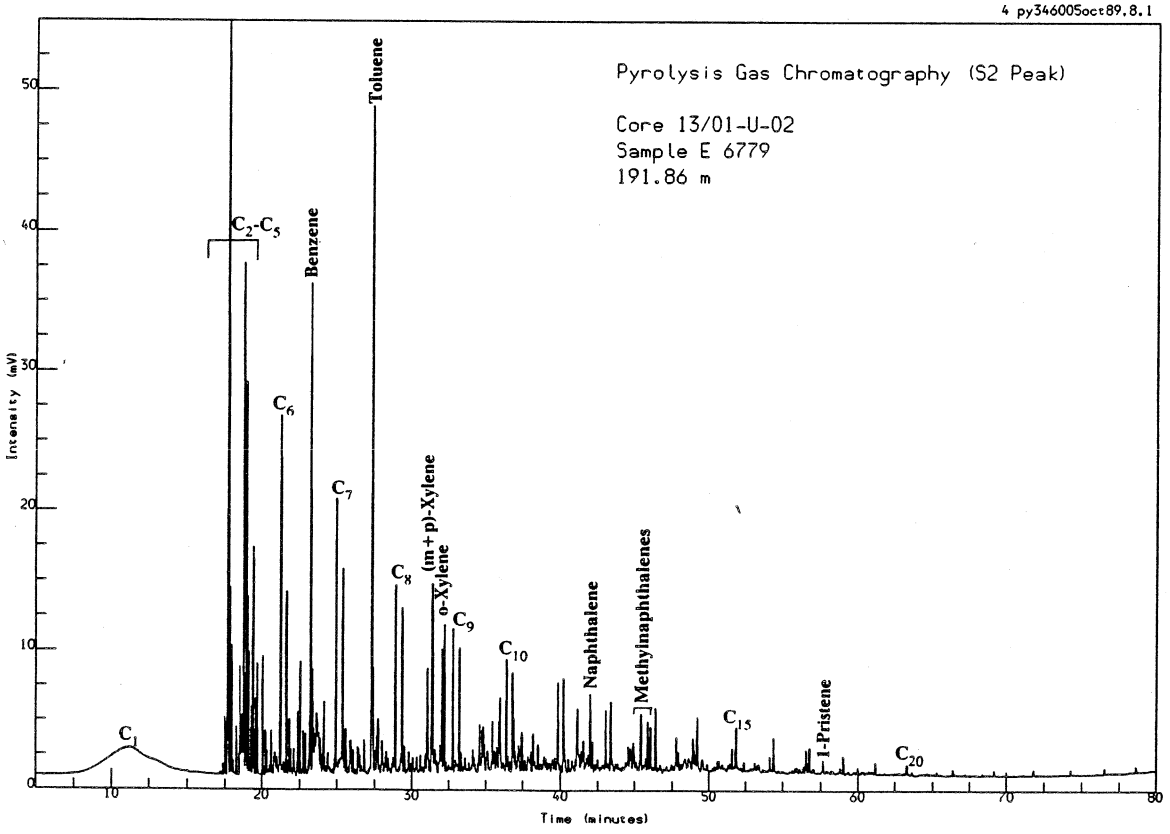

4 PY3460050CT89.4.1
Pyrolysis Gas Chromatography (S2-Peak)
Core 13/01-U-02
Sample E 7554
124.39 m
C2-C5
C6
Benzene
Toluene
C7
C8
(m+p)-Xylene
o-Xylene
C9
C10
Naphthalene
Methylnaphthalenes
C15
1-Pristene
C20
C1
Intensity (mV)
Time (minutes)

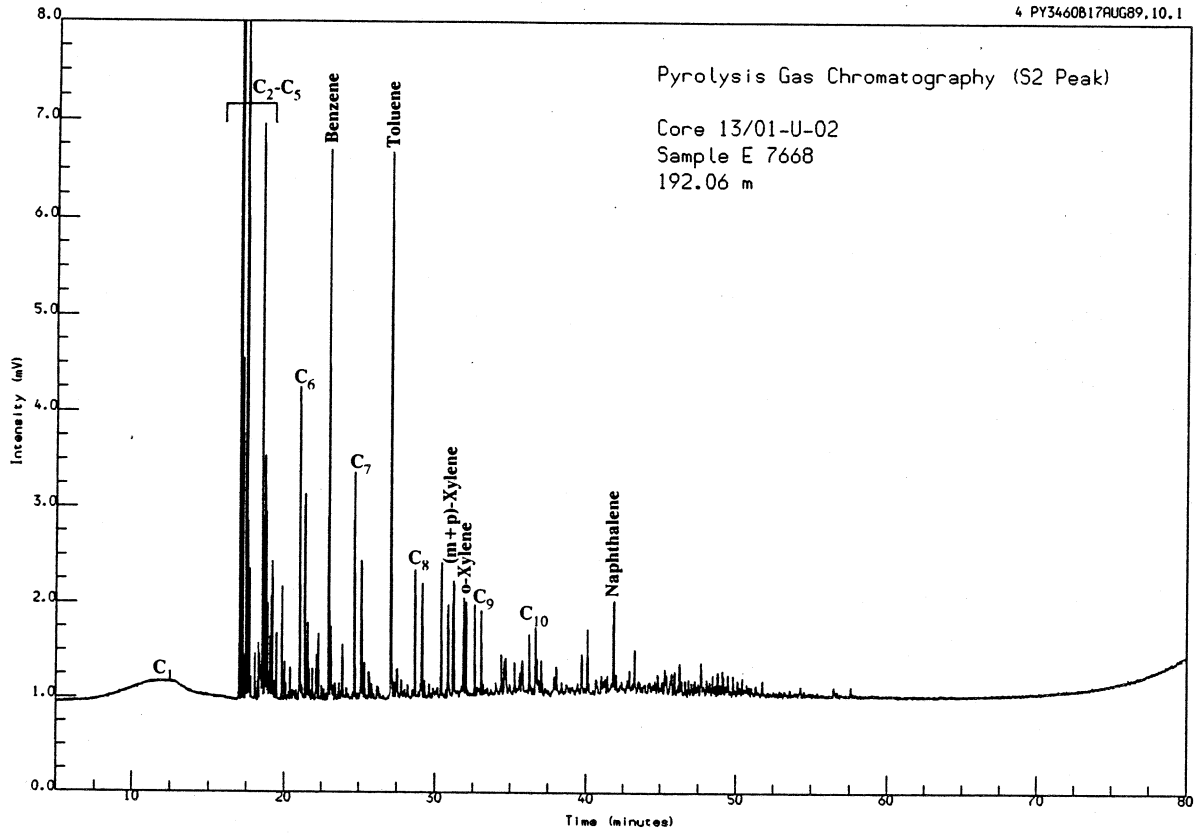

4 PY3460050CT89.5.1
Pyrolysis Gas Chromatography (S2-Peak)
Core 13/01-U-02
Sample E 7578
141.69 m
C2-C5
Toluene
C6
Benzene
C7
C8
(m+p)-Xylene
o-Xylene
C10
Naphthalene
Methylnaphthalenes
C15
1-Pristene
C1
Intensity (mV)
Time (minutes)

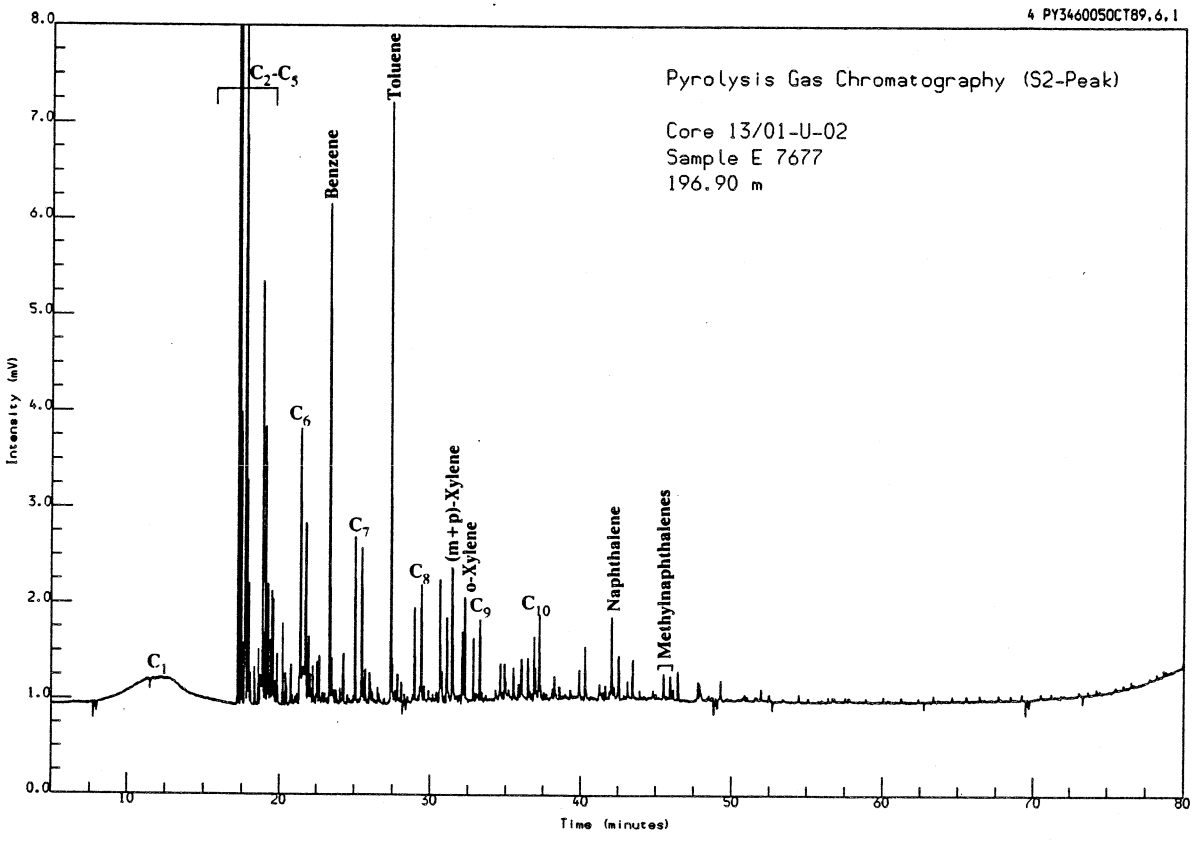

4 PY3460B17AUG89.8.1
Pyrolysis Gas Chromatography (S2 Peak)
Core 13/01-U-02
Sample E 7580
143.91 m
Benzene
Toluene
C2-C5
C6
C7
C8
(m+p)-Xylene
o-Xylene
C9
C10
Naphthalene
Methylnaphthalenes
C15
C1
Intensity (mV)
Time (minutes)

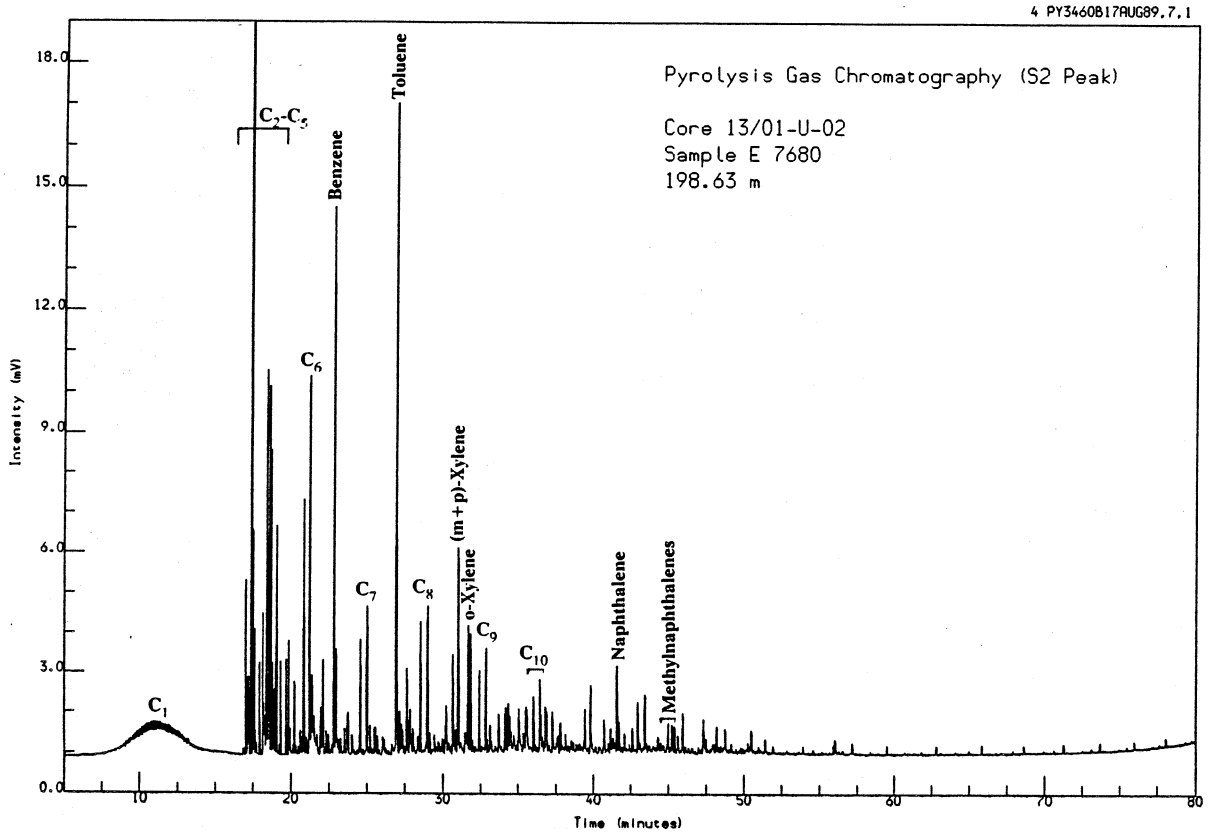

4 PY3460B17AUG89.3.1
Pyrolysis Gas Chromatography (S2 Peak)
Core 13/01-U-02
Sample E 7582
144.50 m
Benzene
Toluene
C2-C5
C6
C7
C8
(m+p)-Xylene
o-Xylene
C9
C10
Naphthalene
Methylnaphthalenes
C15
C1
Intensity (mV)
Time (minutes)


4 PY3460817AUG89.4.1
Pyrolysis Gas Chromatography (S2 Peak)
Core 13/01-U-02
Sample E 7665
191.24 m
Intensity (mV)
Time (minutes)
C1
C2-C5
C6
Benzene
C7
Toluene
C8
(m+p)-Xylene
o-Xylene
C9
C10
Naphthalene
Methylnaphthalenes
C15
i-Pristene
C20


4 py346005oct89.8.1
Pyrolysis Gas Chromatography (S2 Peak)
Core 13/01-U-02
Sample E 6779
191.86 m
Intensity (mV)
Time (minutes)
C1
C2-C5
C6
Benzene
C7
Toluene
C8
(m+p)-Xylene
o-Xylene
C9
C10
Naphthalene
Methylnaphthalenes
C15
i-Pristene
C20


4 PY3460817AUG89.10.1
Pyrolysis Gas Chromatography (S2 Peak)
Core 13/01-U-02
Sample E 7668
192.06 m
C2-C5
Benzene
Toluene
C6
C7
C8
(m+p)-Xylene
o-Xylene
C9
C10
Naphthalene
C1
Intensity (mV)
Time (minutes)


4 PY3460050CT89.6.1
Pyrolysis Gas Chromatography (S2-Peak)
Core 13/01-U-02
Sample E 7677
196.90 m
C2-C5
Toluene
Benzene
C6
C7
C8
(m+p)-Xylene
o-Xylene
C9
C10
Naphthalene
Methylnaphthalenes
C1
Intensity (mV)
Time (minutes)


4 PY3460B17AUG89.7.1
Pyrolysis Gas Chromatography (S2 Peak)
Core 13/01-U-02
Sample E 7680
198.63 m
Intensity (mV)
Time (minutes)
C1
C2-C5
C6
Benzene
C7
Toluene
C8
(m+p)-Xylene
o-Xylene
C9
C10
Naphthalene
Methylnaphthalenes

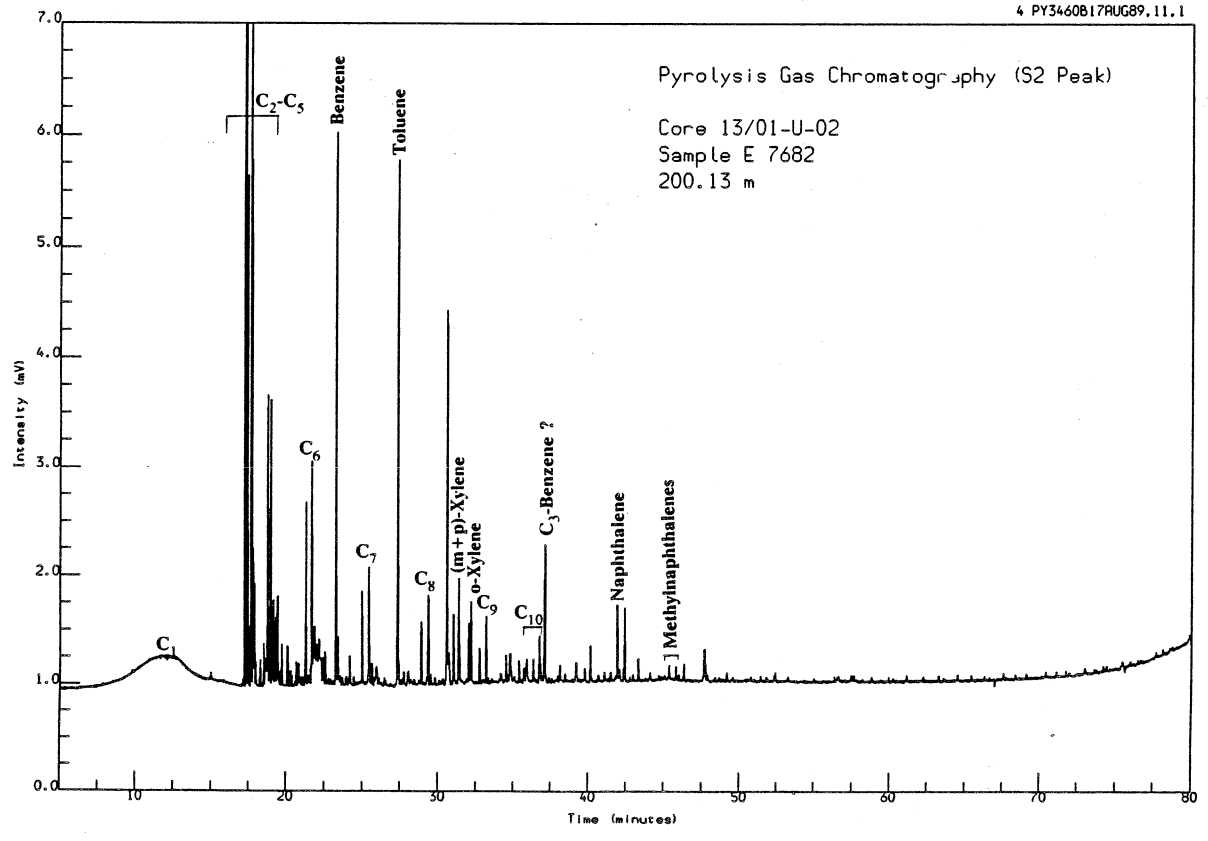
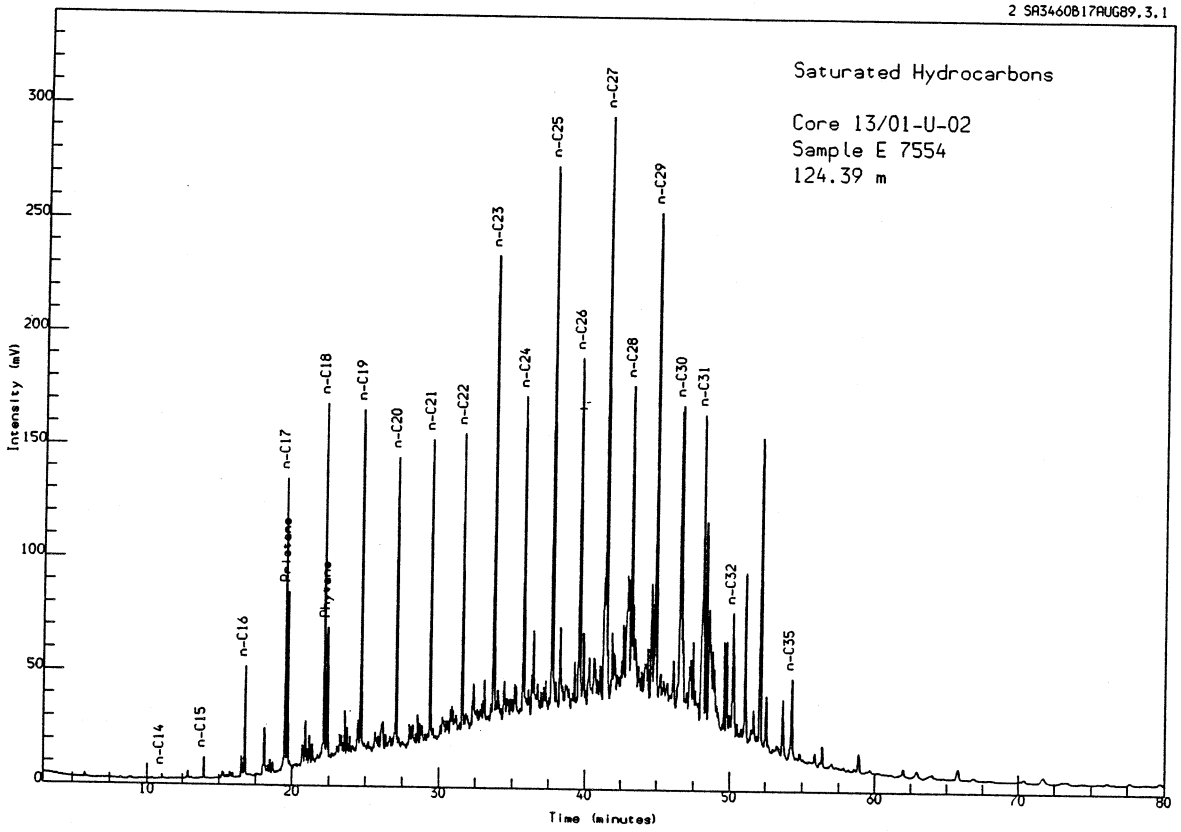

4 PY3460B17AUG89.11.1
Pyrolysis Gas Chromatography (S2 Peak)
Core 13/01-U-02
Sample E 7682
200.13 m
Intensity (mV)
Time (minutes)
C1
C2-C5
C6
Benzene
C7
Toluene
C8
(m+p)-Xylene
o-Xylene
C9
C10
C3-Benzene ?
Naphthalene
Methylnaphthalenes

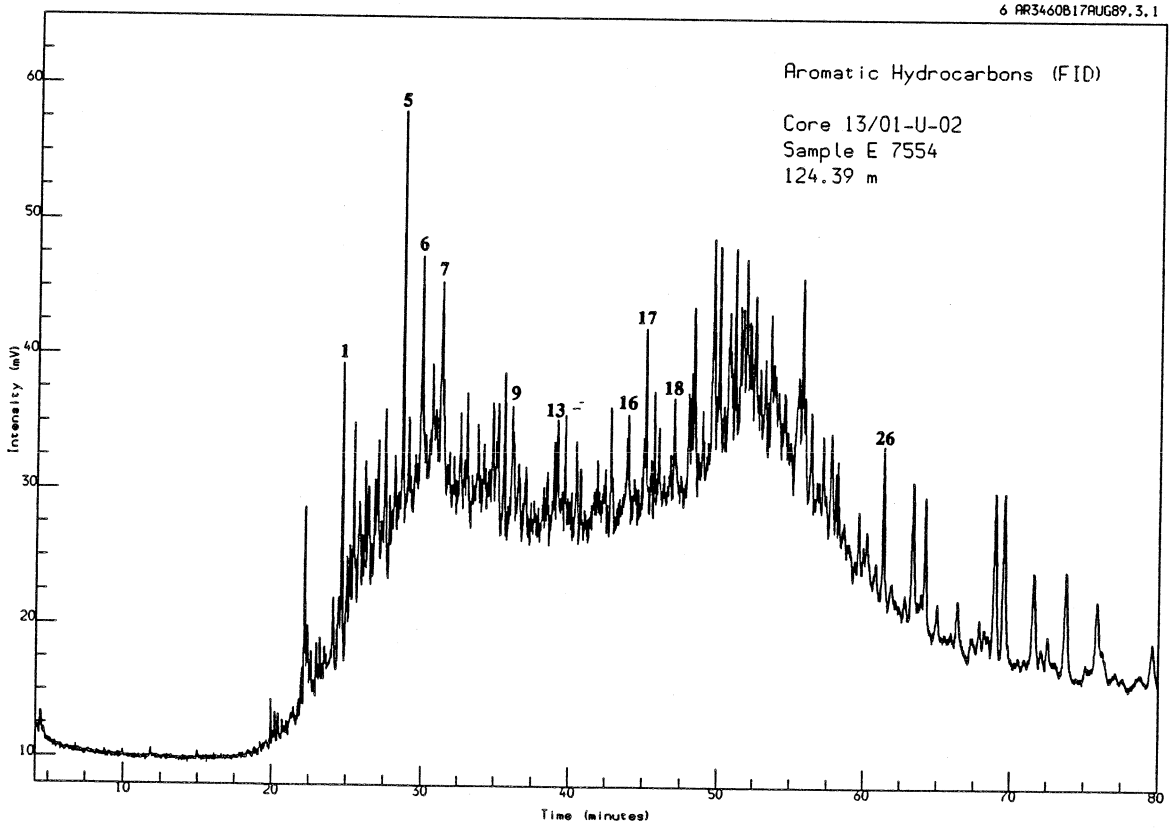
Figure A.II.4.2:

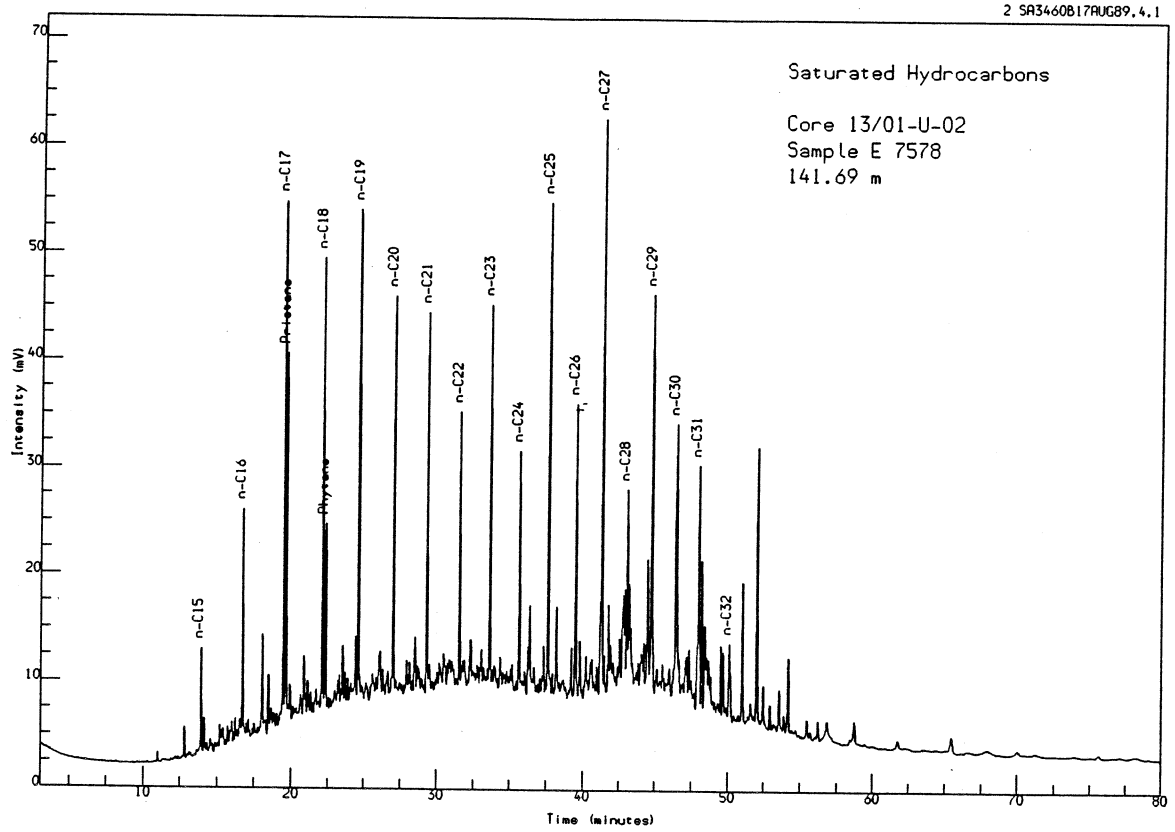
Gas chromatograms of saturated and aromatic hydrocarbons

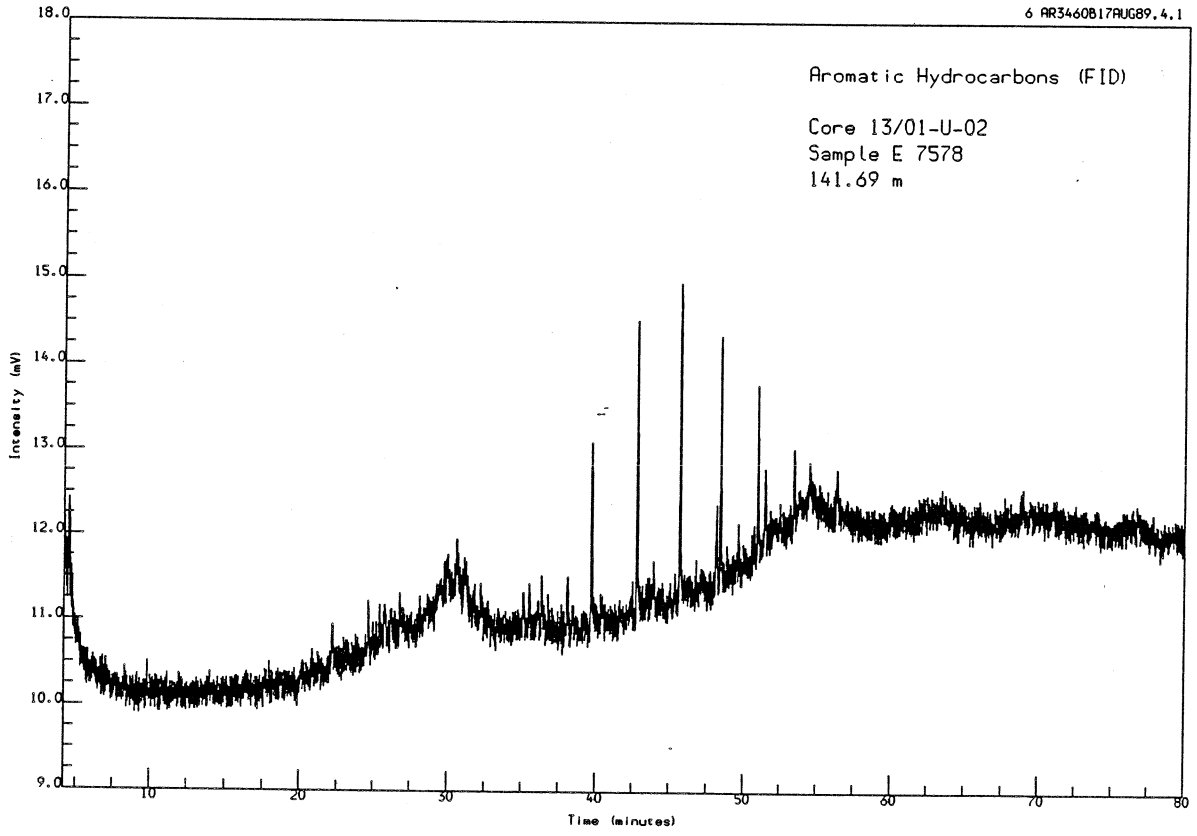
Peak code	Peak identity
n-C_{15} etc.	- n-alkanes
N	Naphthalene
MN	Methylnaphthalenes
DMN	Dimethylnaphthalenes
TMN	C_3-naphthalenes
P	Phenanthrene
PN	Methylphenanthrenes
DMP	Dimethylphenanthrenes
1	Cadalene (C_5-Naphthalene)
2	C_6-Naphthalene
3	C_{14}-Benzene
4	unidentified
7	Dehydroabietine (?)
8	Dehydroabietane (?)
9	PAH, MW=202
10	Phenylnaphthalene
11	Simonellite
12	Retene
13	PAH, MW=218
14	PAH, MW=216
15	unidentified
16	PAH, MW=228
17	unidentified
18	PAH, MW=242
19	PAH, MW=252
20	PAH, MW=268
21	PAH, MW=252
22	PAH, MW=252
23	PAH, MW=268
24	PAH, MW=264
25	PAH, MW=276
26	PAH, MW=276
27	PAH, MW=292

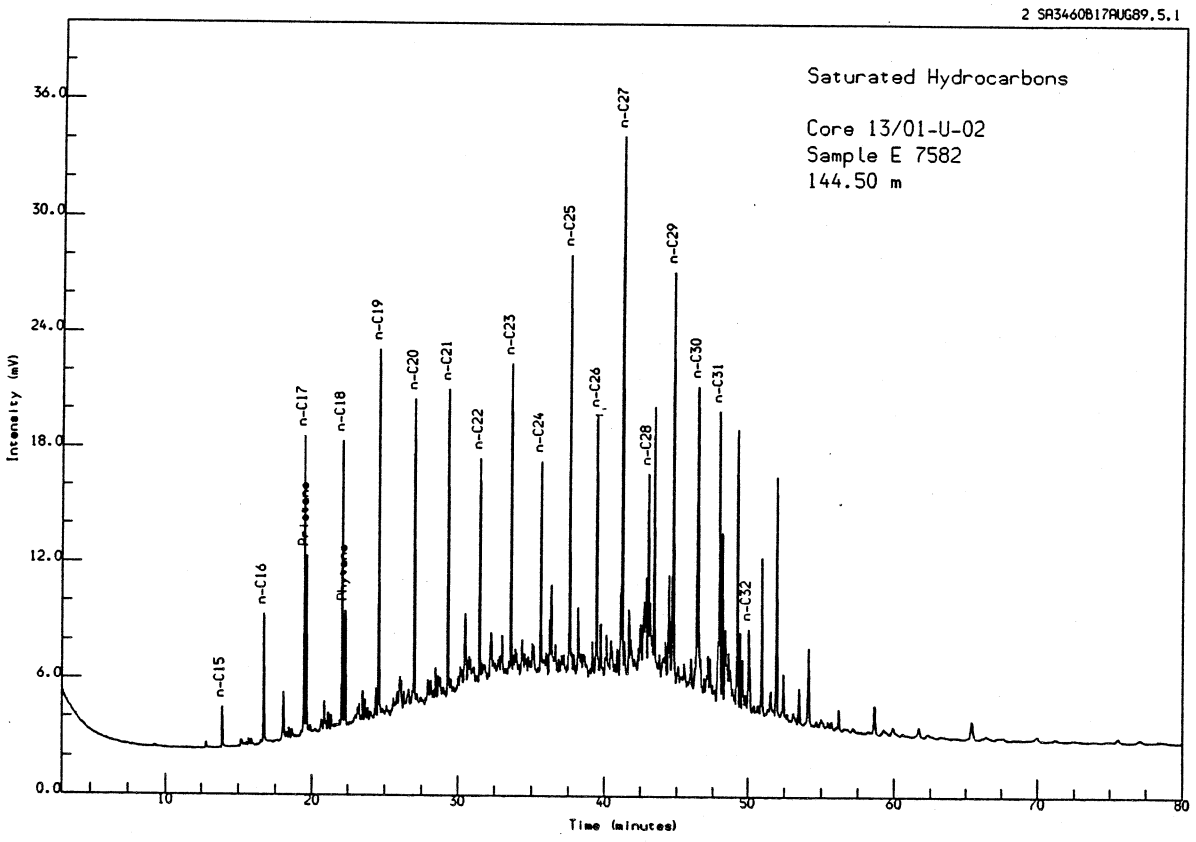
(PAH = Polcyclic aromatic hydrocarbon)

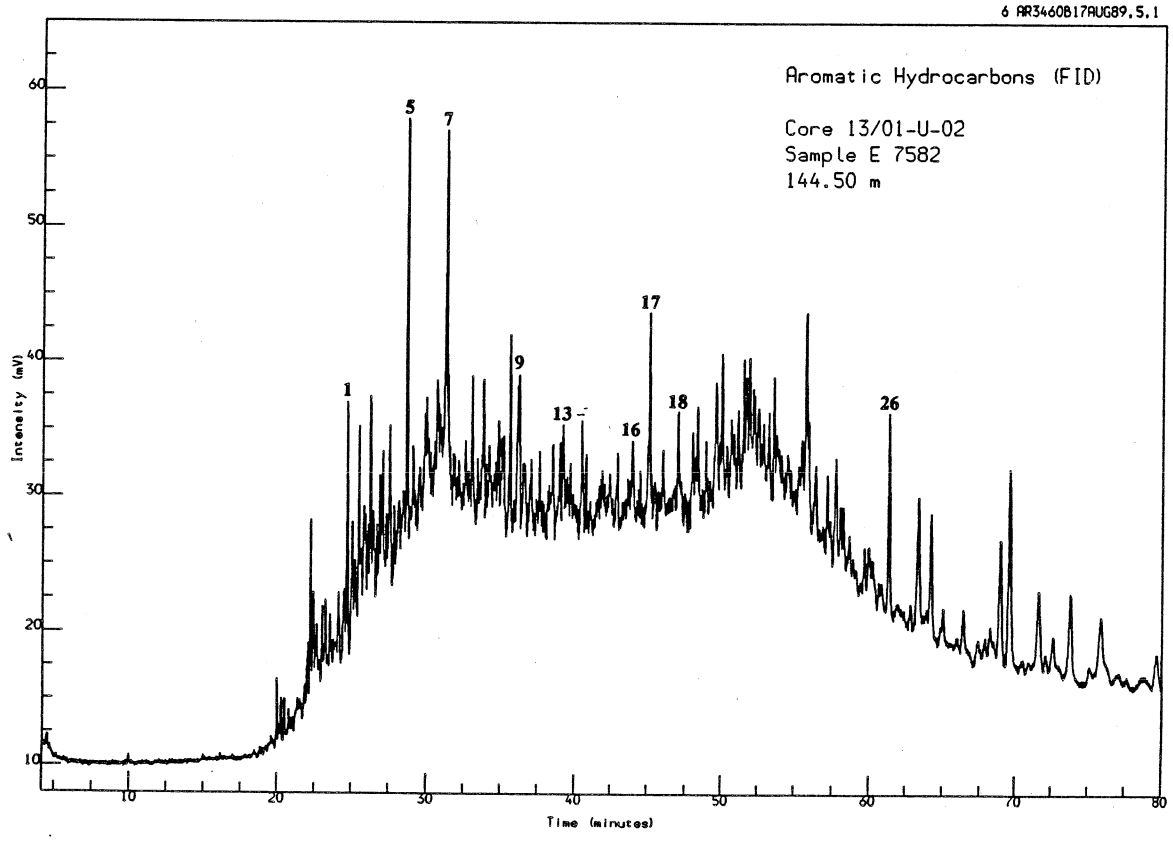

2 SA3460B17AUG89.3.1
Saturated Hydrocarbons
Core 13/01-U-02
Sample E 7554
124.39 m
Intensity (mV)
Time (minutes)
n-C14
n-C15
n-C16
n-C17
Pristane
Phytane
n-C18
n-C19
n-C20
n-C21
n-C22
n-C23
n-C24
n-C25
n-C26
n-C27
n-C28
n-C29
n-C30
n-C31
n-C32
n-C35

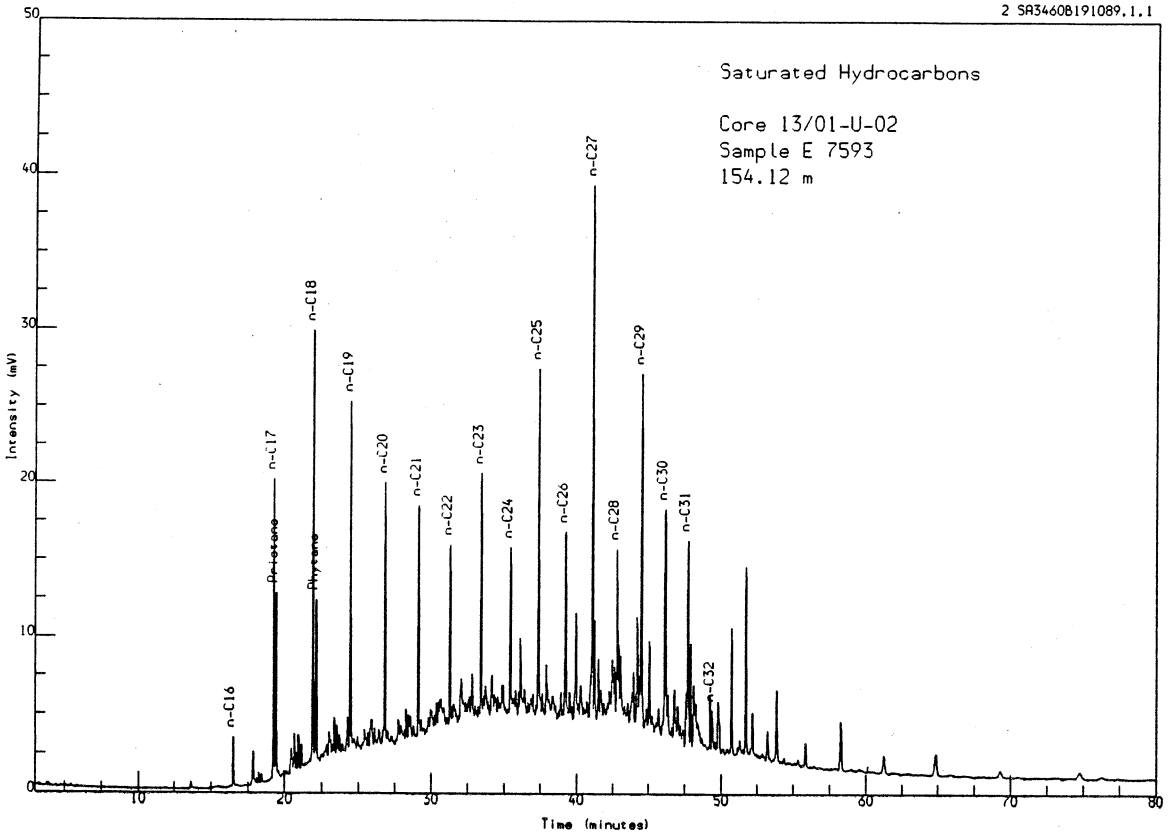

6 AR3460B17AUG89.3.1
Aromatic Hydrocarbons (FID)
Core 13/01-U-02
Sample E 7554
124.39 m
Intensity (mV)
Time (minutes)
1
5
6
7
9
13
16
17
18
26

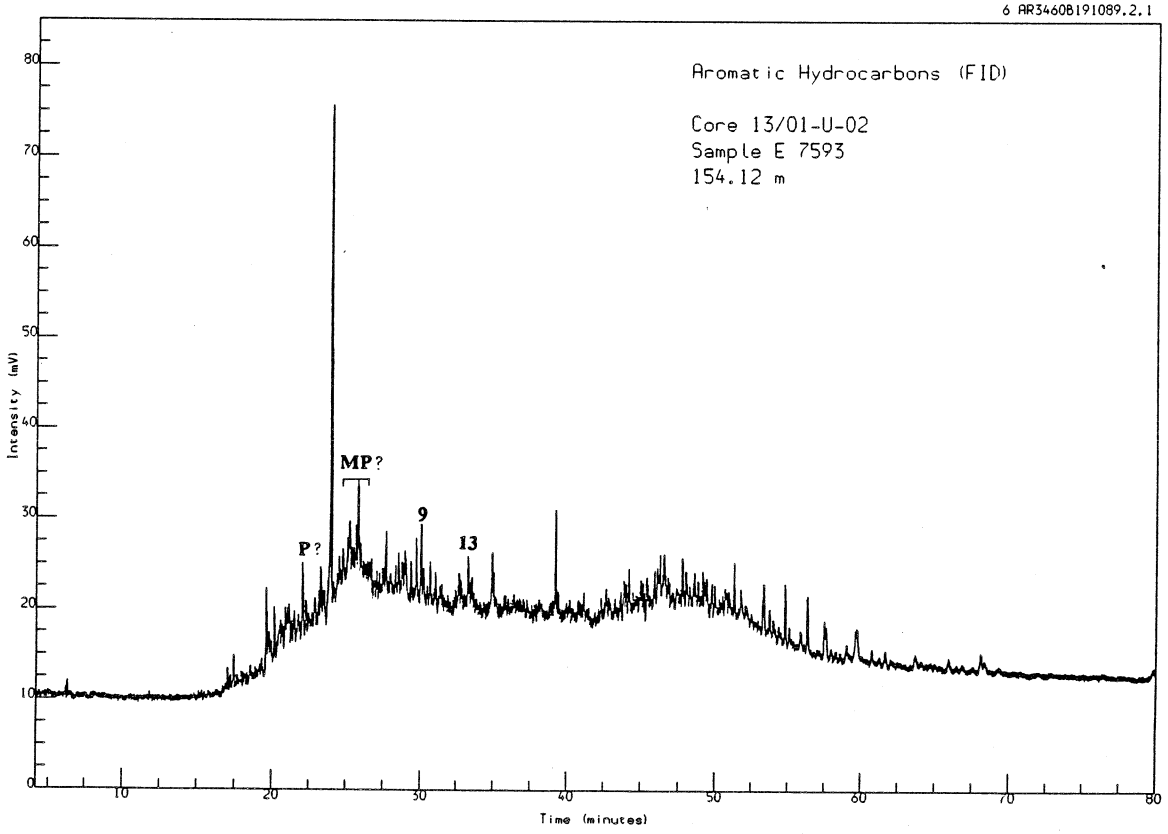

2 SA3460B17AUG89.4.1
Saturated Hydrocarbons
Core 13/01-U-02
Sample E 7578
141.69 m
Intensity (mV)
Time (minutes)
n-C15
n-C16
Pristane
n-C17
Phytane
n-C18
n-C19
n-C20
n-C21
n-C22
n-C23
n-C24
n-C25
n-C26
n-C27
n-C28
n-C29
n-C30
n-C31
n-C32

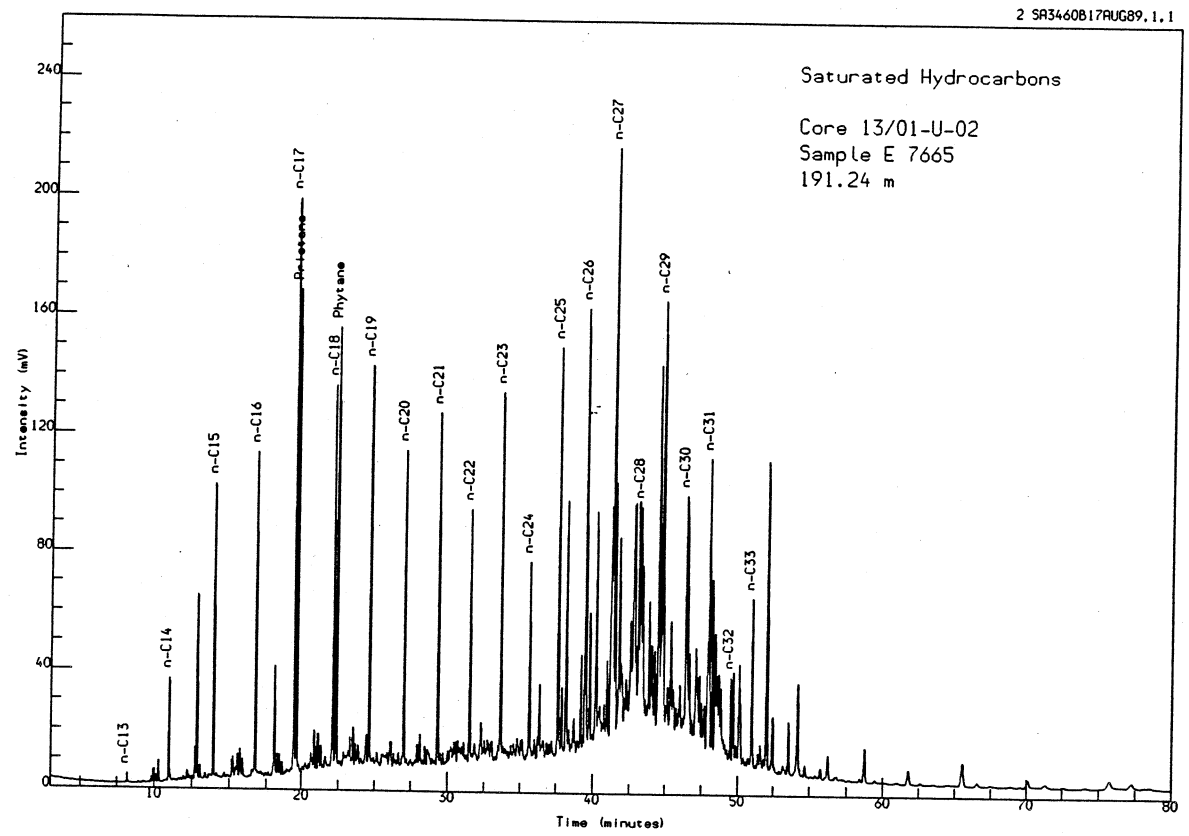

6 AR3460B17AUG89.4.1
Aromatic Hydrocarbons (FID)
Core 13/01-U-02
Sample E 7578
141.69 m
Intensity (mV)
Time (minutes)

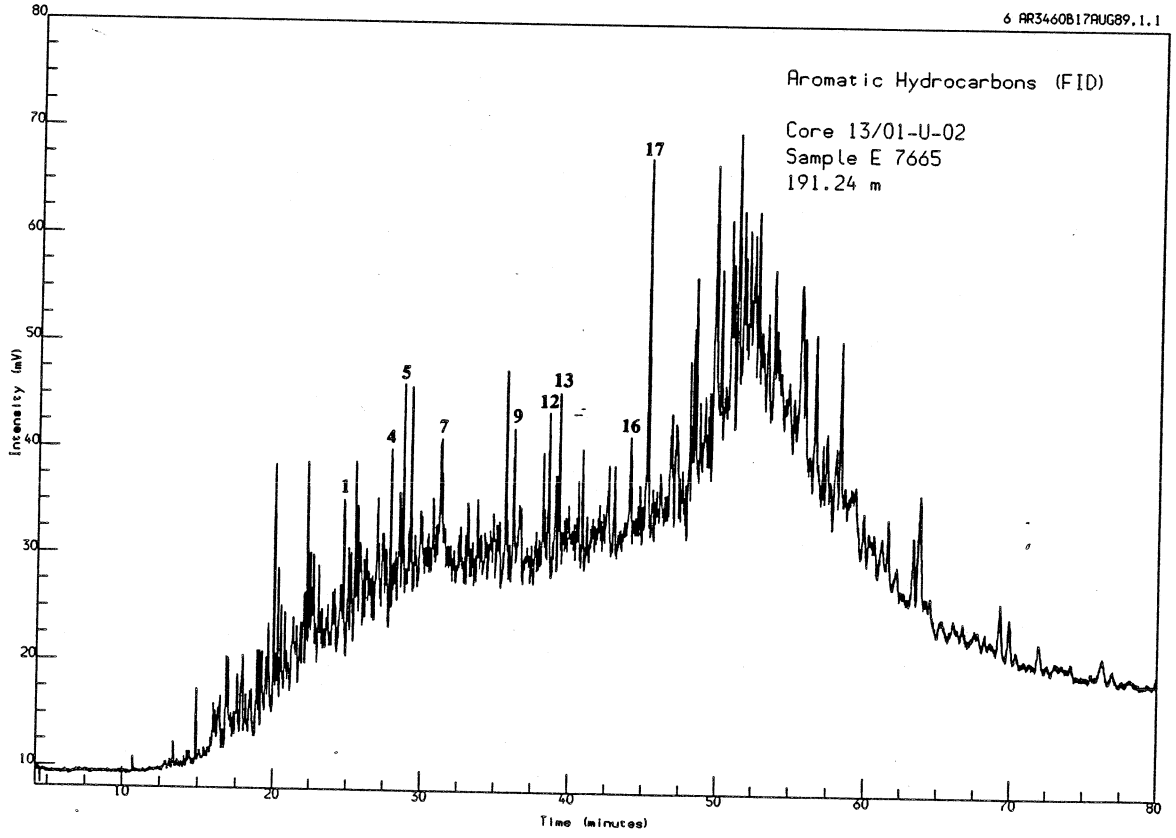

2 SA3460B17AUG89.5.1
Saturated Hydrocarbons
Core 13/01-U-02
Sample E 7582
144.50 m
Intensity (mV)
Time (minutes)
n-C15
n-C16
n-C17
Pristane
n-C18
Phytane
n-C19
n-C20
n-C21
n-C22
n-C23
n-C24
n-C25
n-C26
n-C27
n-C28
n-C29
n-C30
n-C31
n-C32

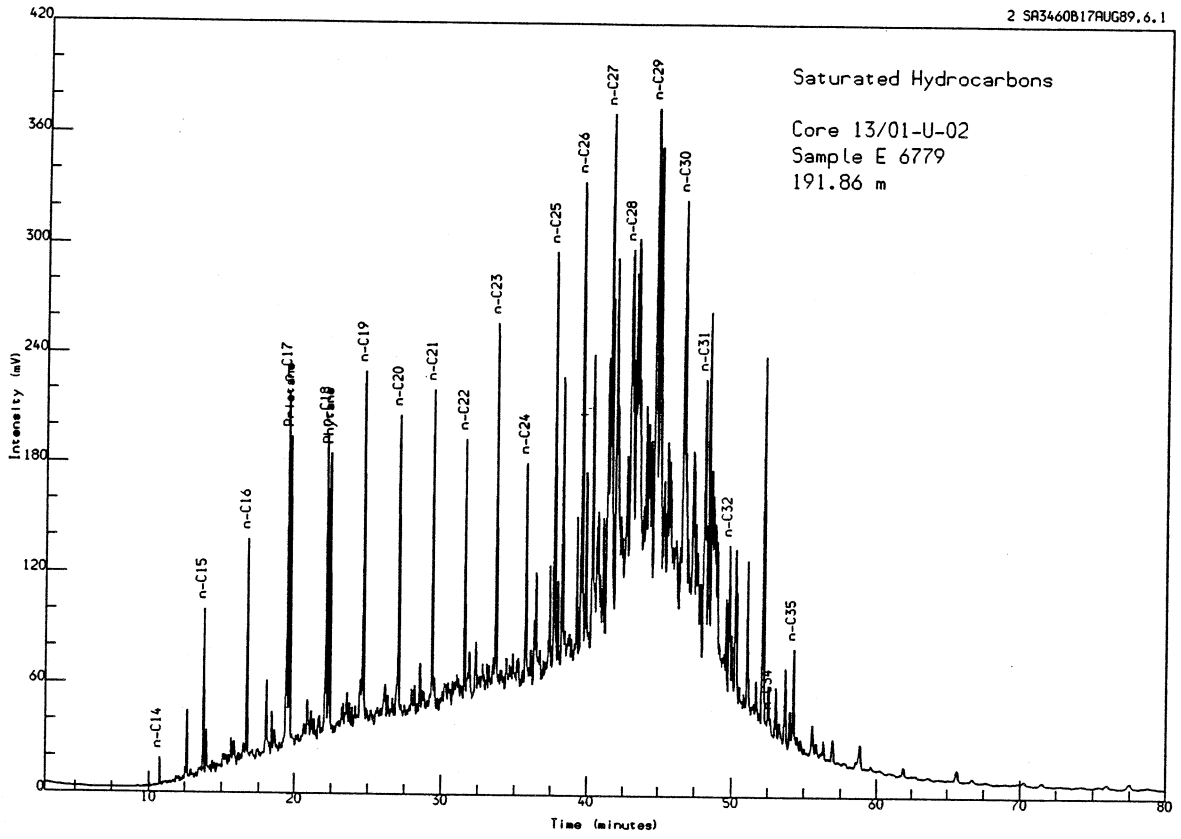

6 AR3460B17AUG89.5.1
Aromatic Hydrocarbons (FID)
Core 13/01-U-02
Sample E 7582
144.50 m
Intensity (mV)
Time (minutes)
1
5
7
9
13
16
17
18
26

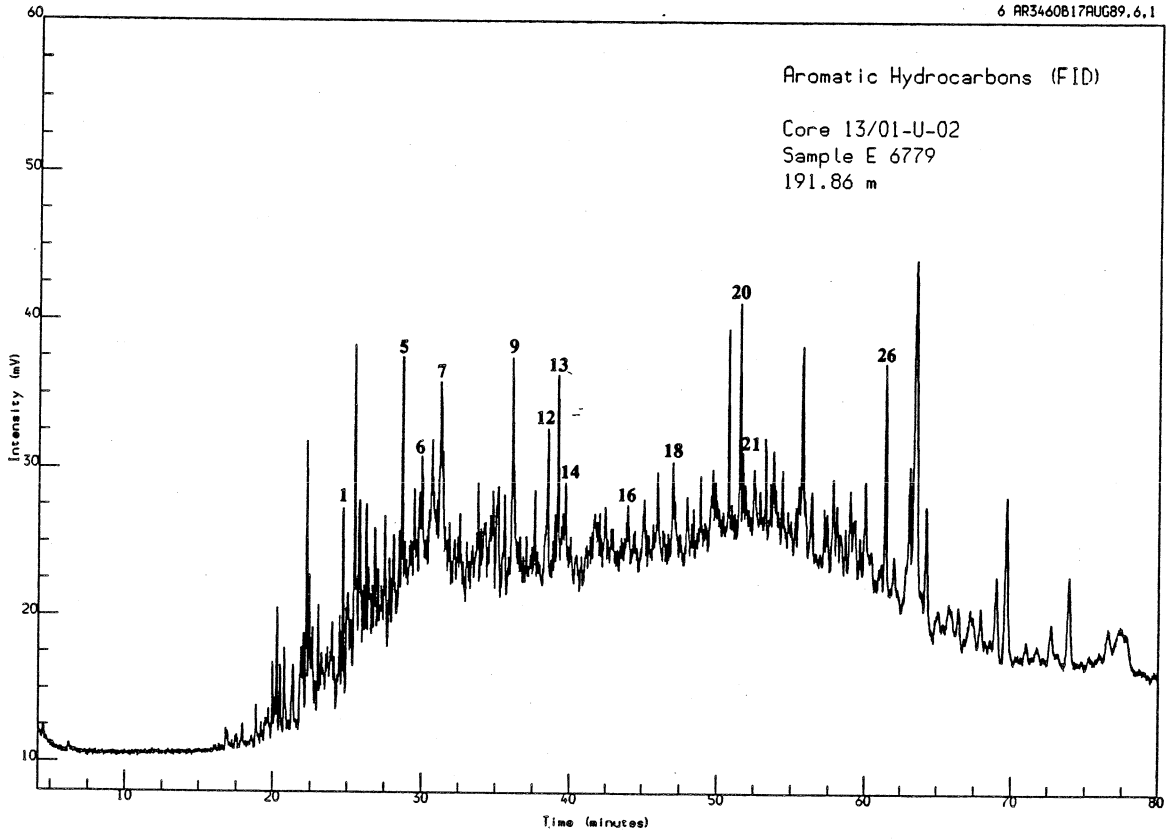

2 SA3460B191089.1.1
Saturated Hydrocarbons
Core 13/01-U-02
Sample E 7593
154.12 m
n-C16
n-C17
Pristane
n-C18
Phytane
n-C19
n-C20
n-C21
n-C22
n-C23
n-C24
n-C25
n-C26
n-C27
n-C28
n-C29
n-C30
n-C31
n-C32
Intensity (mV)
Time (minutes)

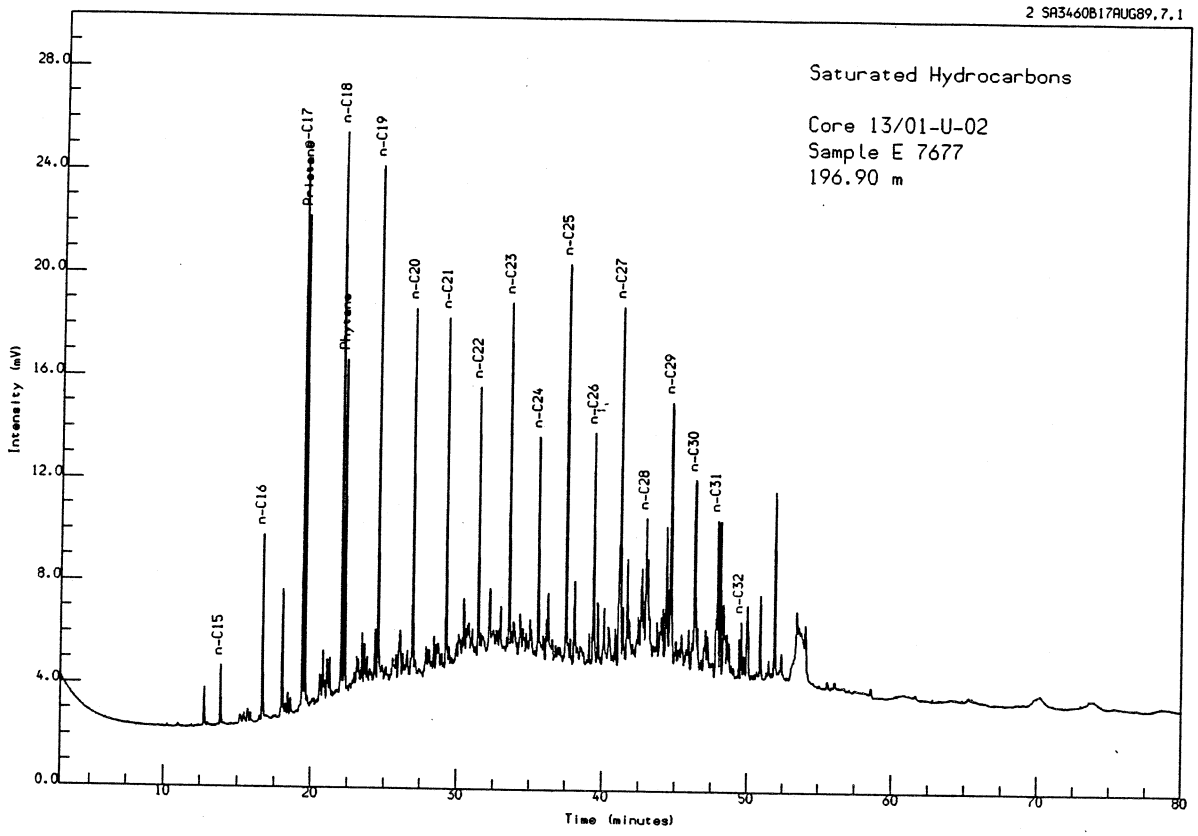

6 AR3460B191089.2.1
Aromatic Hydrocarbons (FID)
Core 13/01-U-02
Sample E 7593
154.12 m
P?
MP?
9
13
Intensity (mV)
Time (minutes)

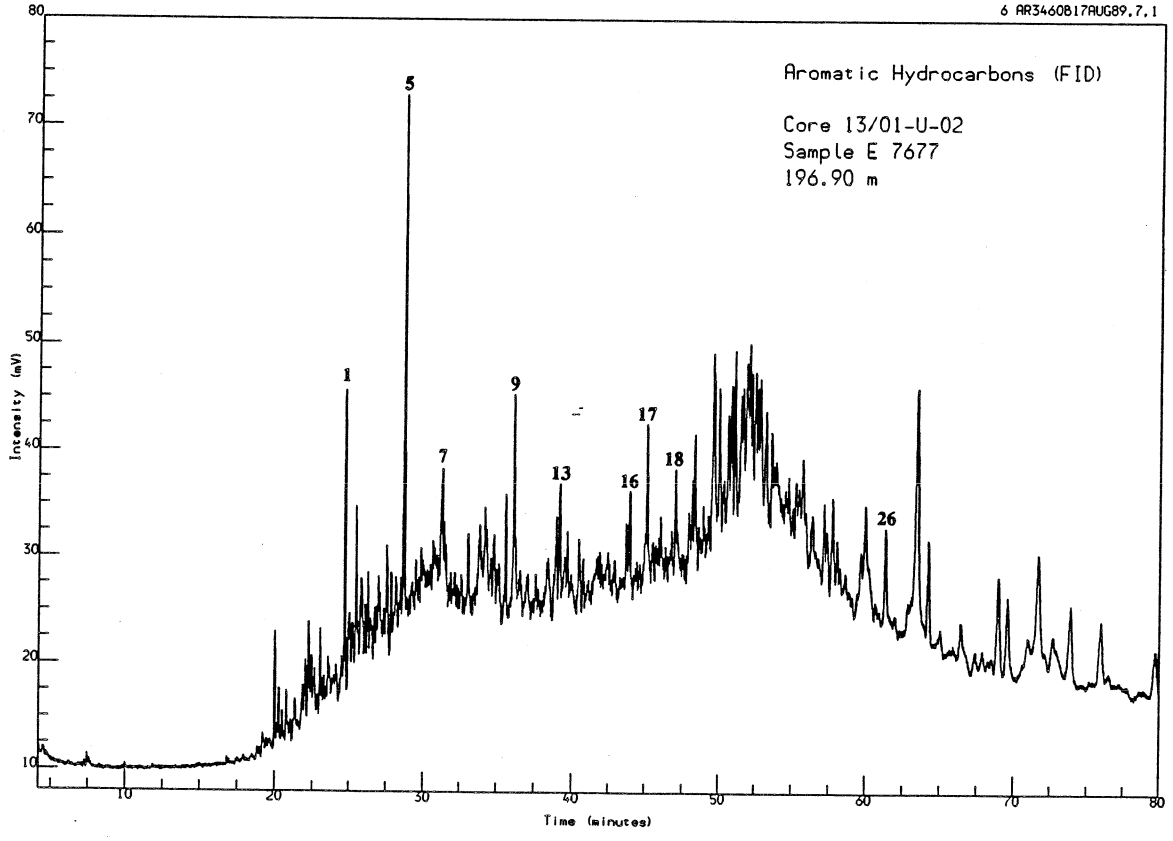

2 SA3460B17AUG89.1.1
Saturated Hydrocarbons
Core 13/01-U-02
Sample E 7665
191.24 m
Intensity (mV)
Time (minutes)
n-C13
n-C14
n-C15
n-C16
Pristane
n-C17
Phytane
n-C18
n-C19
n-C20
n-C21
n-C22
n-C23
n-C24
n-C25
n-C26
n-C27
n-C28
n-C29
n-C30
n-C31
n-C32
n-C33

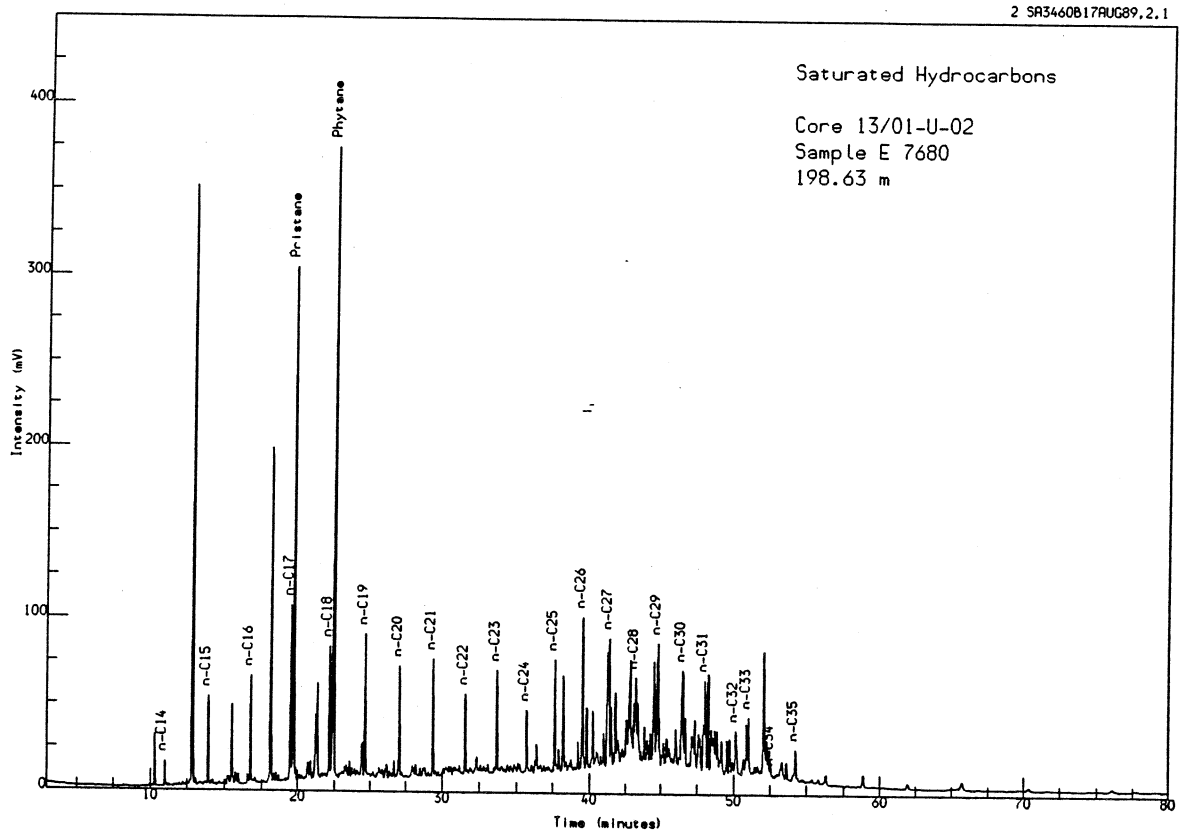

6 AR3460B17AUG89.1.1
Aromatic Hydrocarbons (FID)
Core 13/01-U-02
Sample E 7665
191.24 m
Intensity (mV)
Time (minutes)
1
4
5
7
9
12
13
16
17


2 SA3460B17AUG89.6.1
Saturated Hydrocarbons
Core 13/01-U-02
Sample E 6779
191.86 m
Intensity (mV)
Time (minutes)
n-C14
n-C15
n-C16
n-C17
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
n-C31
n-C32
n-C35


6 AR3460B17AUG89.6.1
Aromatic Hydrocarbons (FID)
Core 13/01-U-02
Sample E 6779
191.86 m
Intensity (mV)
Time (minutes)
1
5
6
7
9
12
13
14
16
18
20
21
26


2 SA3460B17AUG89.7.1
Saturated Hydrocarbons
Core 13/01-U-02
Sample E 7677
196.90 m
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
Intensity (mV)
Time (minutes)


6 AR3460B17AUG89.7.1
Aromatic Hydrocarbons (FID)
Core 13/01-U-02
Sample E 7677
196.90 m
1
5
7
9
13
16
17
18
26
Intensity (mV)
Time (minutes)


2 SA3460B17AUG89.2.1
Saturated Hydrocarbons
Core 13/01-U-02
Sample E 7680
198.63 m
Intensity (mV)
Time (minutes)
Pristane
Phytane
n-C14
n-C15
n-C16
n-C17
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
n-C31
n-C32
n-C33
n-C34
n-C35

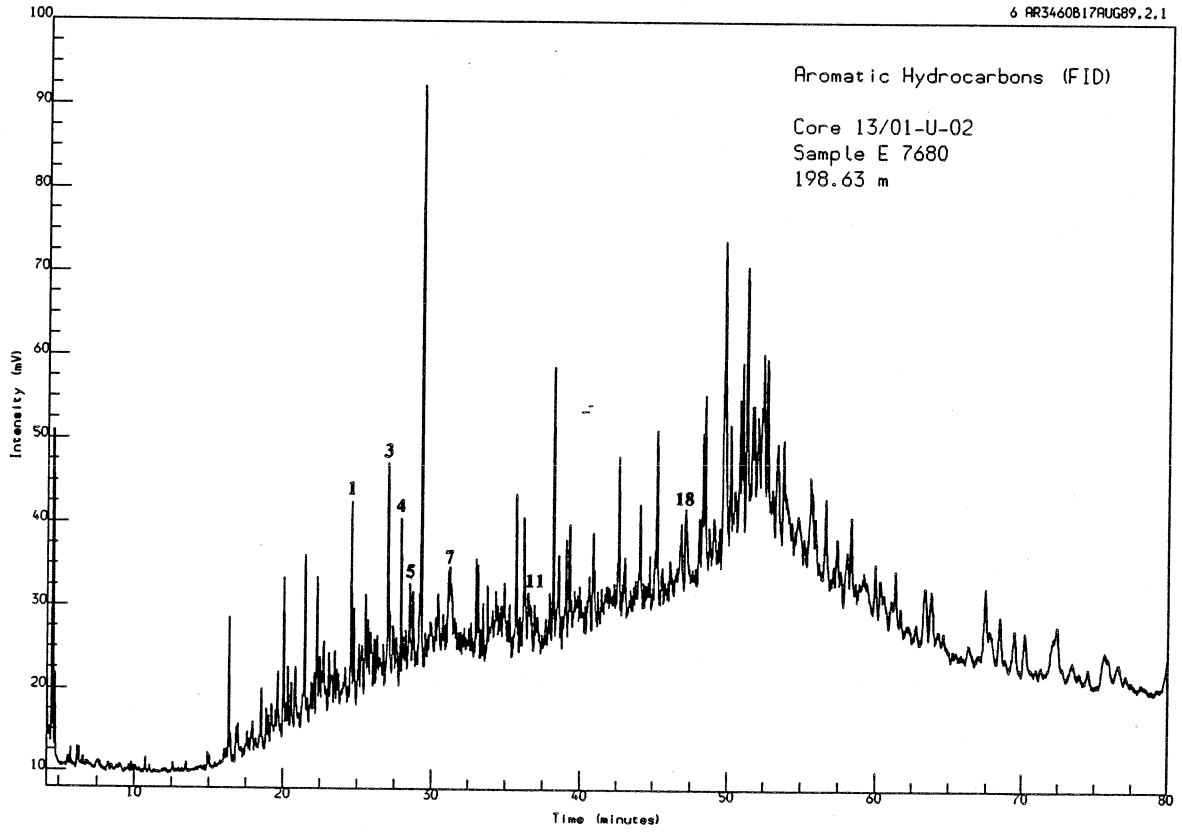

6 AR3460B17AUG89.2.1
Aromatic Hydrocarbons (FID)
Core 13/01-U-02
Sample E 7680
198.63 m
Intensity (mV)
Time (minutes)
1
3
4
5
7
11
18

Figure A.II.4.3:

Mass fragmentograms of m/z 191, 205 (terpanes) and m/z 217, 218 (steranes).

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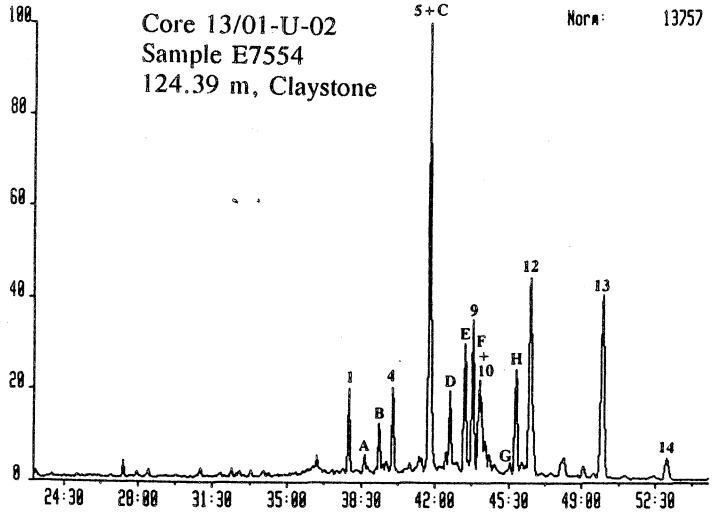
Key for m/z 191, 205 (terpanes):

Peak code	Identification	C-atoms : double bonds
P	C_{23} tricyclic terpane	($C_{23:0}$)
Q	C_{24} tricyclic terpane	($C_{24:0}$)
R	C_{25} tricyclic terpane (17R,17S)	($C_{25:0}$)
S	C_{24} tetracyclic terpane	($C_{24:0}$)
T	C_{26} tricyclic terpane (17R,17S)	($C_{26:0}$)
1	C_{27} hopene	($C_{27:1}$)
A	18α(H)-trisnorneohopane, Ts (?)	($C_{27:0}$)
B	17α(H)-trisnorhopane, Tm	($C_{27:0}$)
4	17β(H)-trisnorhopane	($C_{27:0}$)
5	nor-hop-$\Delta^{13(18)}$-ene	($C_{29:1}$)
C	17α(H), 21β(H)-norhopane	($C_{29:0}$)
6	hop-$\Delta^{17(21)}$-ene	($C_{30:1}$)
D	17β(H),21α(H)-norhopane (= normoretane)	($C_{29:0}$)
E	17α(H),21β(H)-hopane	($C_{30:0}$)
9	hop-$\Delta^{13(18)}$-ene	($C_{30:1}$)
10	17β(H),21β(H)-norhopane	($C_{29:0}$)
F	17β(H),21α(H)-hopane (= moretane)	($C_{30:0}$)
G	17α(H),21β(H)-homohopane (22S)	($C_{31:0}$)
H	17α(H),21β(H)-homohopane (22R)	($C_{31:0}$)
12	17β(H),21β(H)-hopane	($C_{30:0}$)
13	17β(H),21β(H)-homohopane	($C_{31:0}$)
I	17β(H),21α(H)-homohopane (= homomoretane)	($C_{31:0}$)
14	17β(H),21β(H)-bishomohopane	($C_{32:0}$)
15	17β(H),21β(H)-trishomohopane	($C_{33:0}$)
J	17α(H),21β(H)-bishomohopane (22S,22R)	($C_{32:0}$)
K	17α(H),21β(H)-trishomohopane (22S,22R)	($C_{33:0}$)
L	17α(H),21β(H)-tetrakishomohopane (22S,22R)	($C_{34:0}$)
M	17α(H),21β(H)-pentakishomohopane (22S,22R)	($C_{35:0}$)

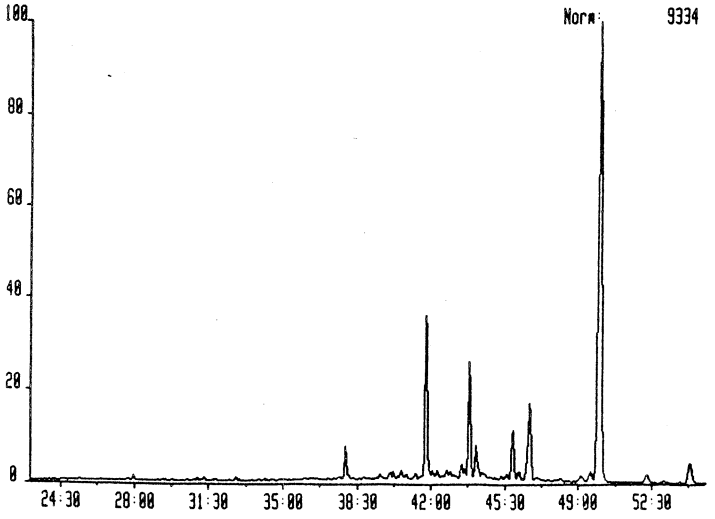
Key for m/z 217 and 218 (steranes):

Peak code	Identification	Formula
u	5α(H)-sterane	$C_{21}H_{36}$
v	5α(H)-sterane	$C_{22}H_{38}$
a	13β(H),17α(H)-diasterane (20S)	$C_{27}H_{48}$
b	13β(H),17α(H)-diasterane (20R)	$C_{27}H_{48}$
c	13α(H),17β(H)-diasterane (20S)	$C_{27}H_{48}$
d	13α(H),17β(H)-diasterane (20R)	$C_{27}H_{48}$
e	13β(H),17α(H)-diasterane (20S)	$C_{28}H_{50}$
f	13β(H),17α(H)-diasterane (20R)	$C_{28}H_{50}$
g	13α(H),17β(H)-diasterane (20S)	$C_{28}H_{50}$
	+ 14α(H),17α(H)-sterane (20S)	$C_{27}H_{48}$
h	13β(H),17α()H)-diasterane (20S)	$C_{29}H_{52}$
	+ 14β(H),17β(H)-sterane (20R)	$C_{27}H_{48}$
i	14β(H),17β(H)-sterane (20S)	$C_{27}H_{48}$
	+ 13α(H),17β(H)-diasterane (20R)	$C_{28}H_{50}$
j	14α(H),17α(H)-sterane (20R)	$C_{27}H_{48}$
k	13β(H),17α(H)-diasterane (20R)	$C_{29}H_{52}$
l	13α(H),17β(H)-diasterane (20S)	$C_{29}H_{52}$
m	14α(H),17α(H)-sterane (20S)	$C_{28}H_{50}$
n	13α(H),17β(H)-diasterane (20R)	$C_{29}H_{52}$
	+ 14β(H),17β(H)-sterane (20R)	$C_{28}H_{50}$
o	14β(H),17β(H)-sterane (20S)	$C_{28}H_{50}$
p	14α(H),17α(H)-sterane (20R)	$C_{28}H_{50}$
q	14α(H),17α(H)-sterane (20S)	$C_{29}H_{52}$
r	14β(H),17β(H)-sterane (20R)	$C_{29}H_{52}$
	+ unknown sterane	
s	14β(H),17β(H)-sterane (20S)	$C_{29}H_{52}$
t	14α(H),17α(H)-sterane (20R)	$C_{29}H_{52}$
*	diasterenes	

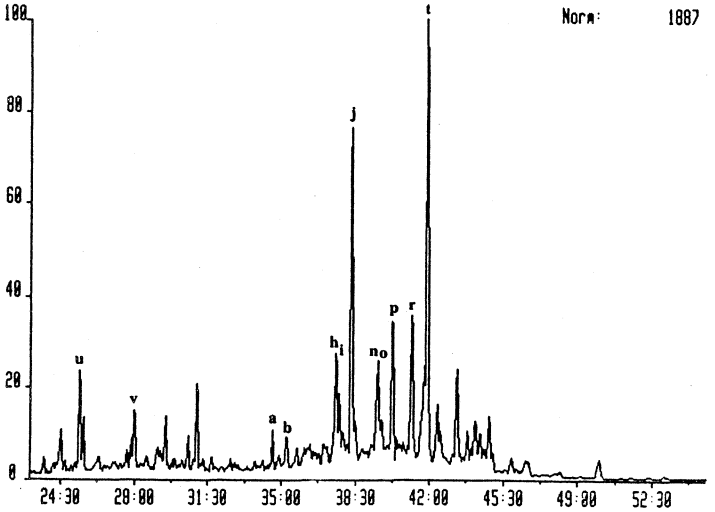
E7554SA1 31-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 191.1000
Text:21.3468.23 FARSUND 13/01-U-02 E-7554 SAT 124.39 M



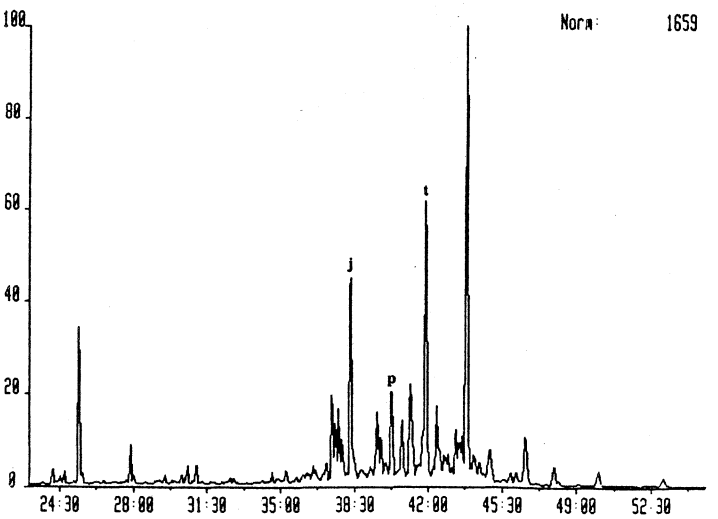
E7554SA1 31-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 205.1000
Text:21.3468.23 FARSUND 13/01-U-02 E-7554 SAT 124.39 M



E7554SA1 31-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 217.1000
Text:21.3468.23 FARSUND 13/01-U-02 E-7554 SAT 124.39 M

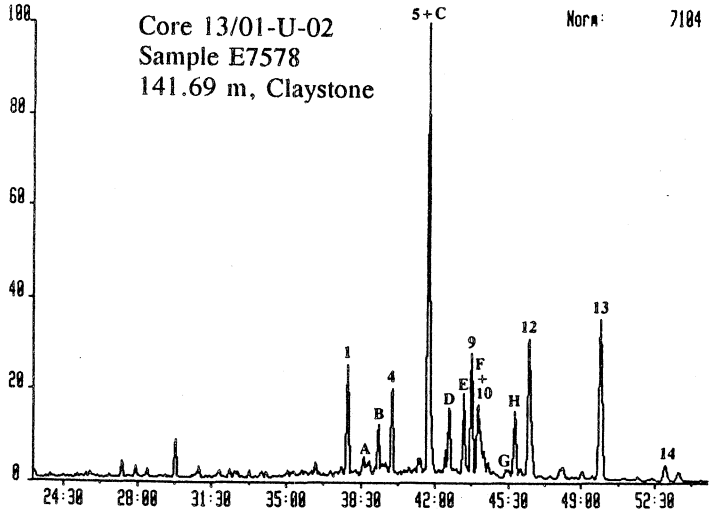


E7554SA1 31-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 218.1000
Text:21.3468.23 FARSUND 13/01-U-02 E-7554 SAT 124.39 M

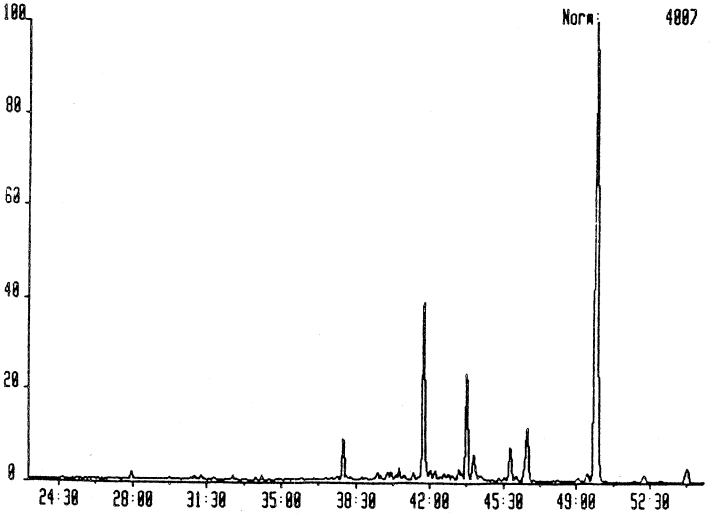


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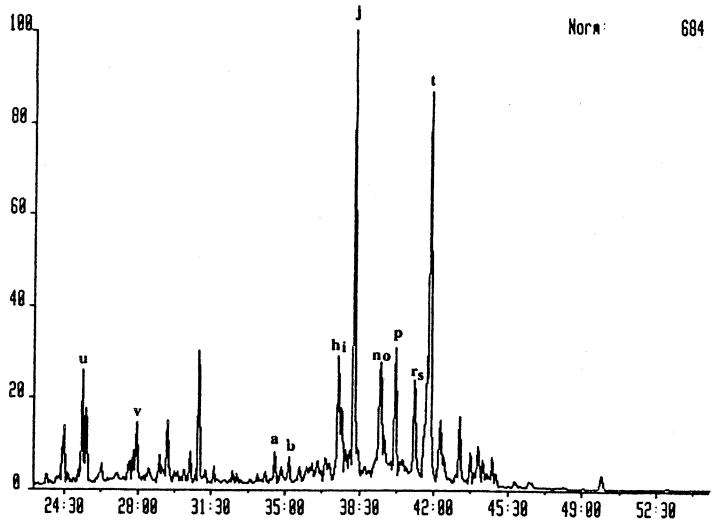
E7578SAT 31-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 191.1000
Text:21.3460.23 FARSUND 13/01-U-02 E7578 SAT 141.69 M



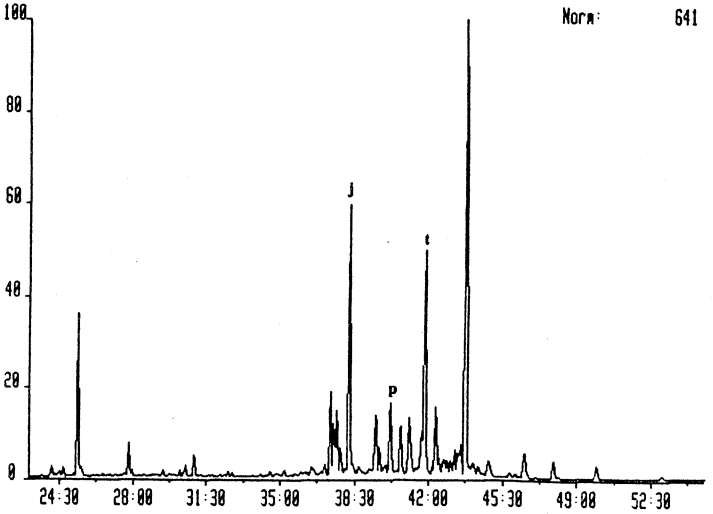
E7578SAT 31-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 205.1000
Text:21.3460.23 FARSUND 13/01-U-02 E7578 SAT 141.69 M



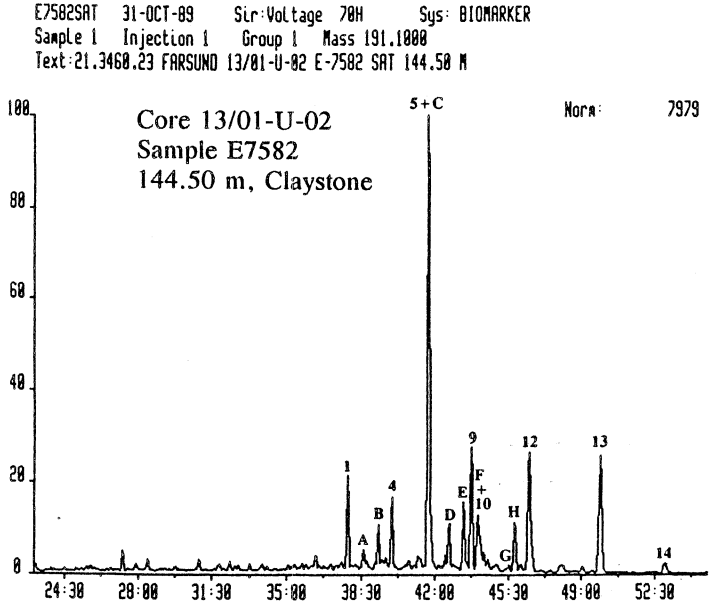
E7578SAT 31-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 217.1000
Text:21.3460.23 FARSUND 13/01-U-02 E7578 SAT 141.69 M

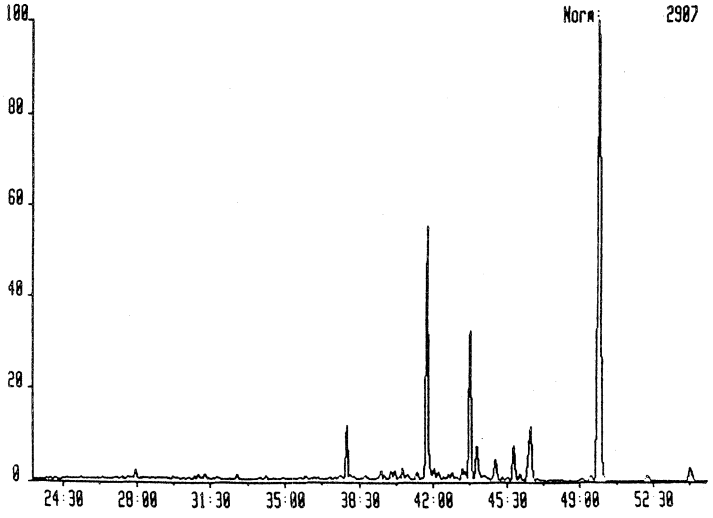


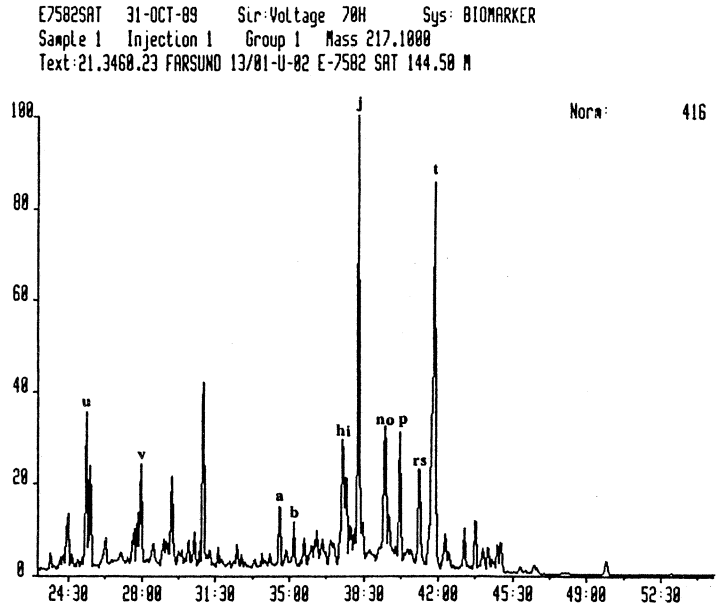
E7578SAT 31-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 218.1000
Text:21.3460.23 FARSUND 13/01-U-02 E7578 SAT 141.69 M

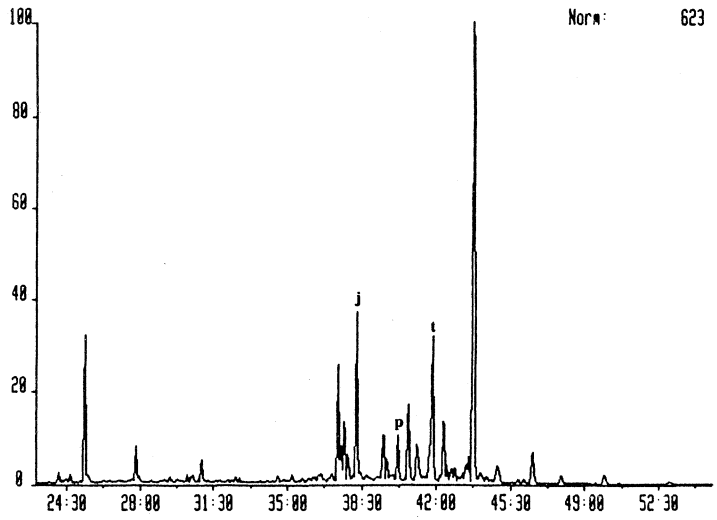


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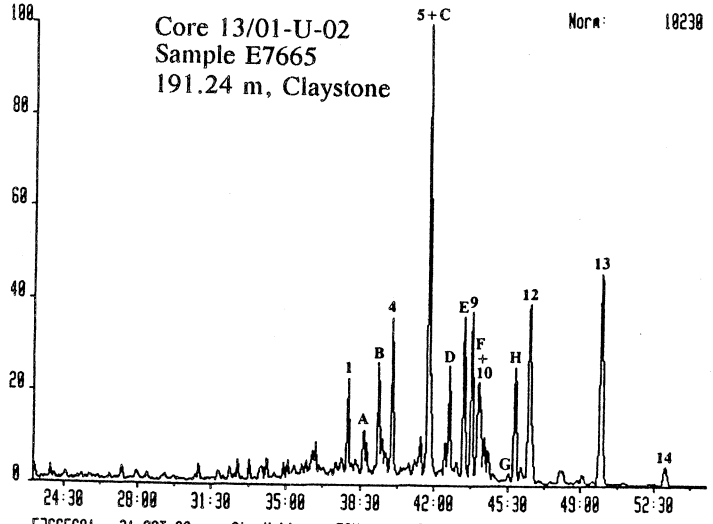




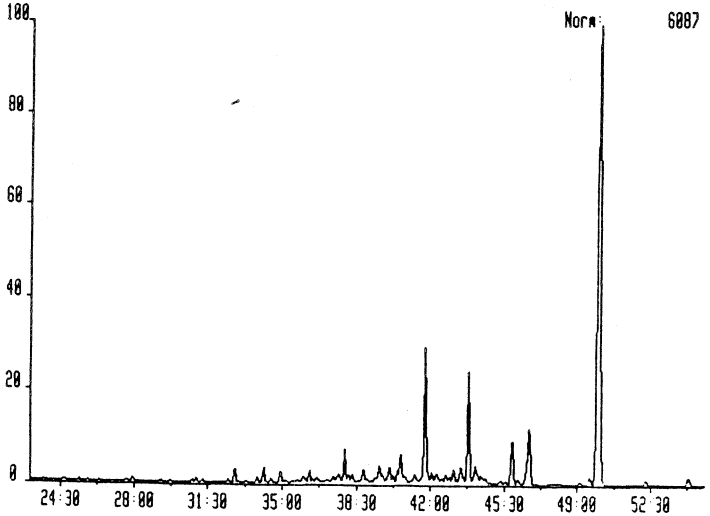


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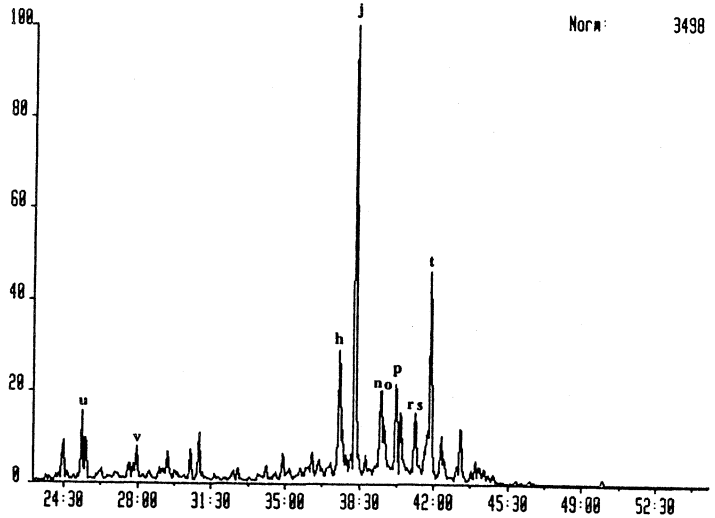
E7665SA1 31-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 191.1000
Text:21.3468.23 FARSUND 13/01-U-02 E-7665 SAT 191.24 M



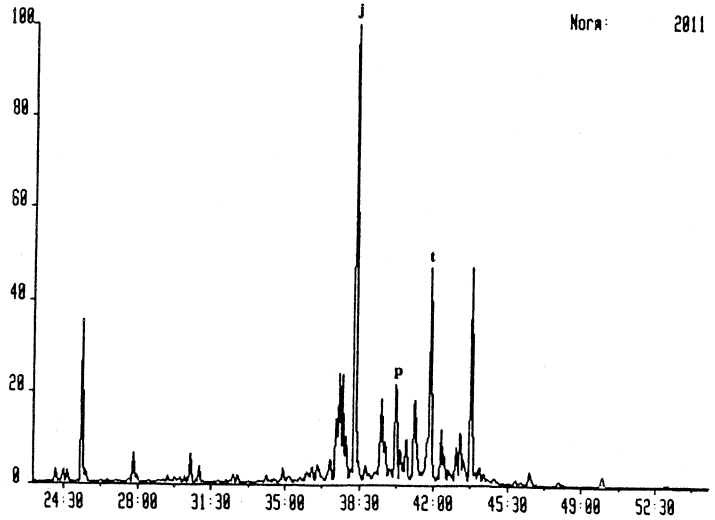
E7665SA1 31-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 205.1000
Text:21.3468.23 FARSUND 13/01-U-02 E-7665 SAT 191.24 M



E7665SA1 31-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 217.1000
Text:21.3468.23 FARSUND 13/01-U-02 E-7665 SAT 191.24 M

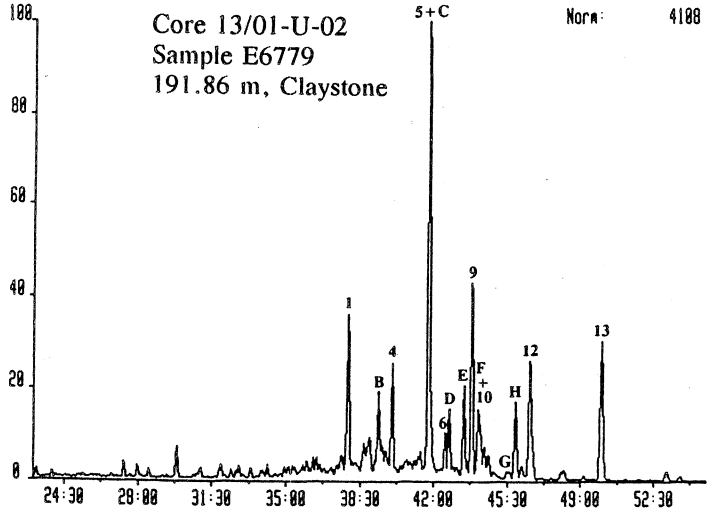


E7665SA1 31-OCT-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 218.1000
Text:21.3468.23 FARSUND 13/01-U-02 E-7665 SAT 191.24 M

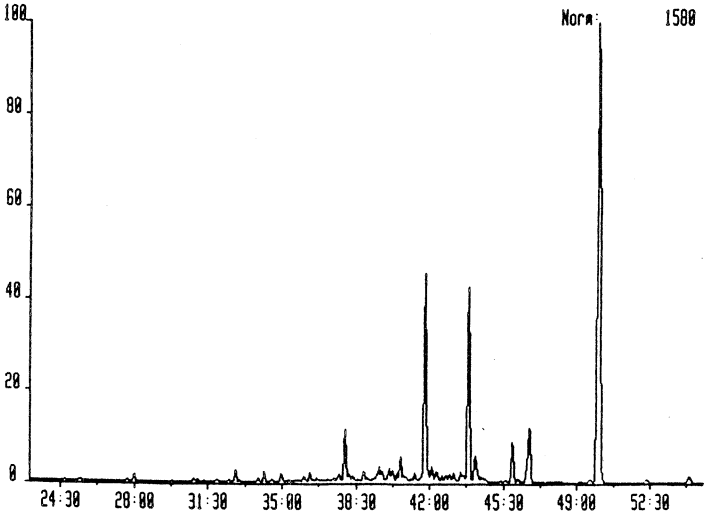


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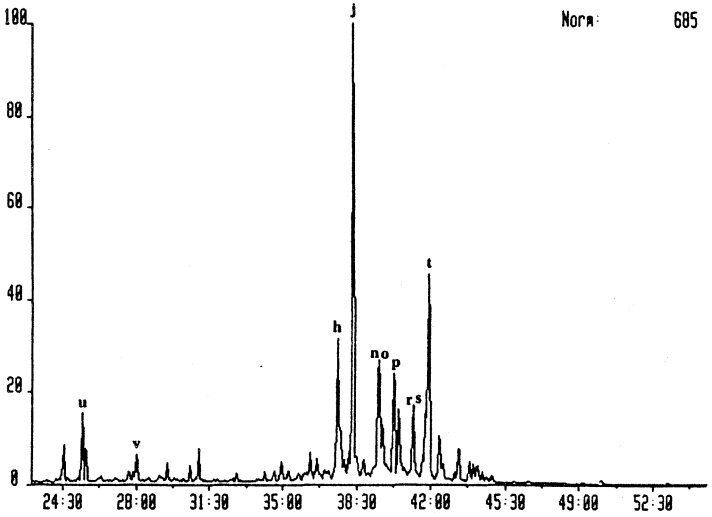
E6779SAT 1-NOV-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 191.1000
Text:21.3468.23 FARSUND 13/01-U-02 E-6779 SAT 191.86 M



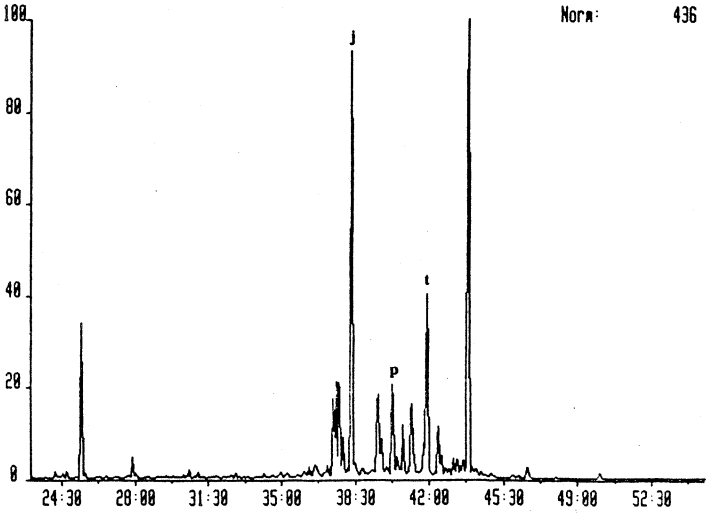
E6779SAT 1-NOV-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 205.1000
Text:21.3468.23 FARSUND 13/01-U-02 E-6779 SAT 191.86 M



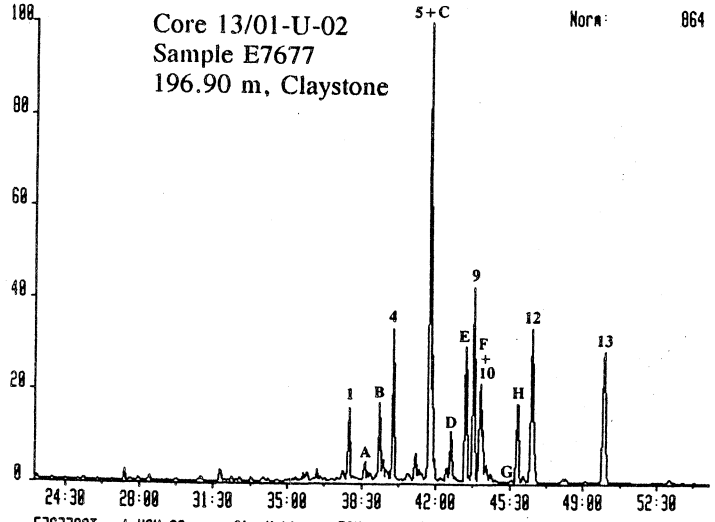
E6779SAT 1-NOV-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 217.1000
Text:21.3468.23 FARSUND 13/01-U-02 E-6779 SAT 191.86 M

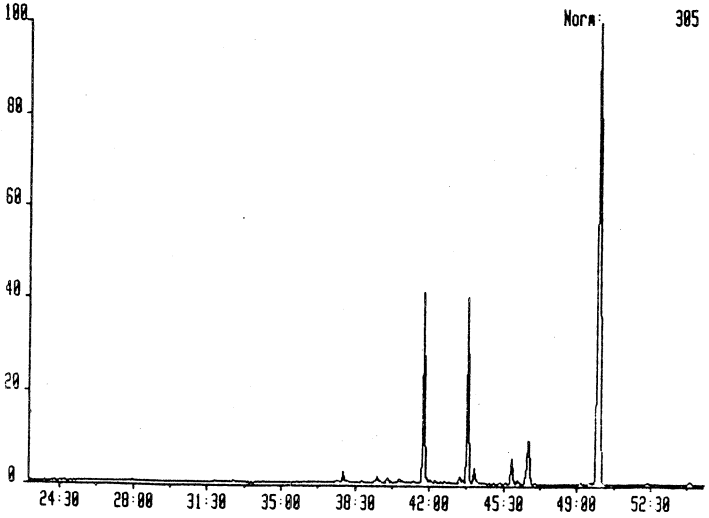


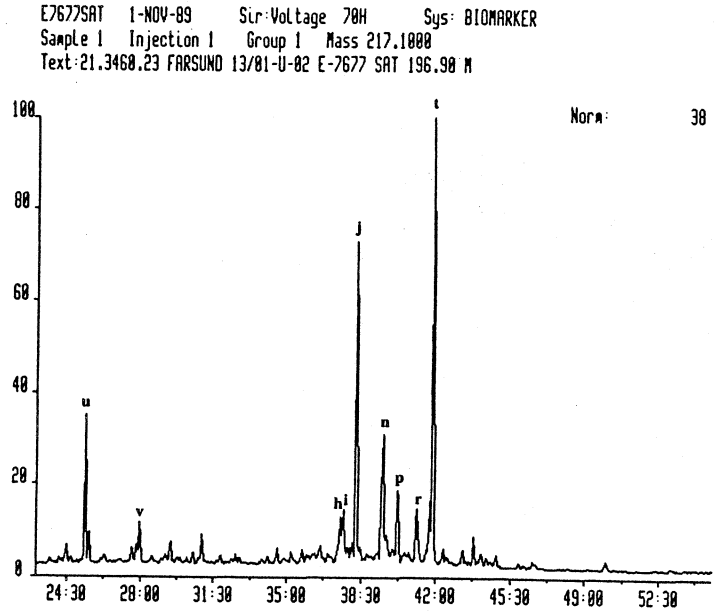
E6779SAT 1-NOV-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 218.1000
Text:21.3468.23 FARSUND 13/01-U-02 E-6779 SAT 191.86 M

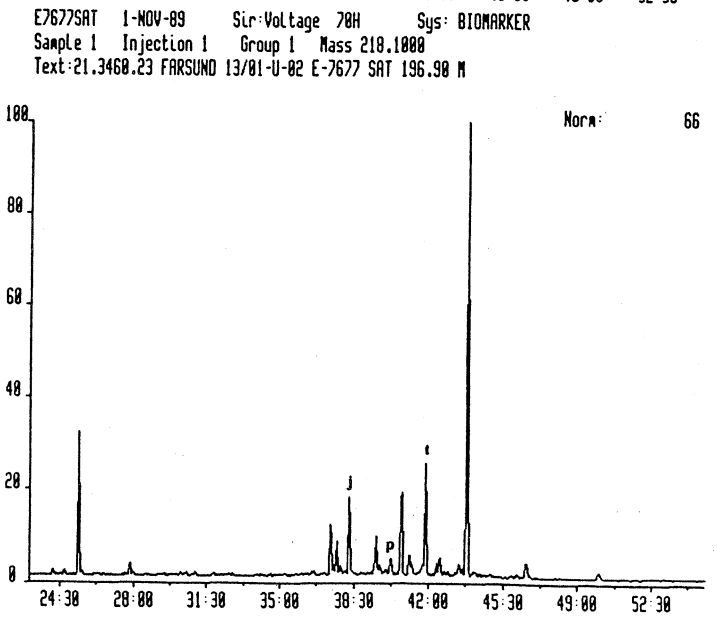


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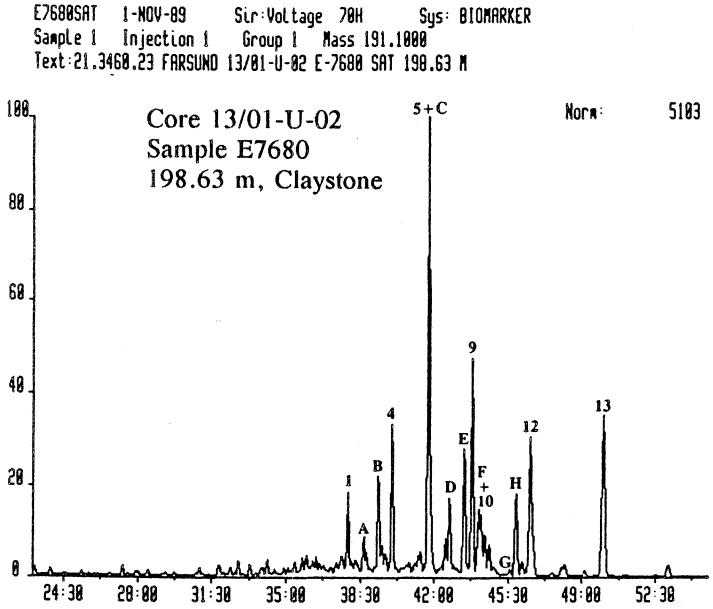


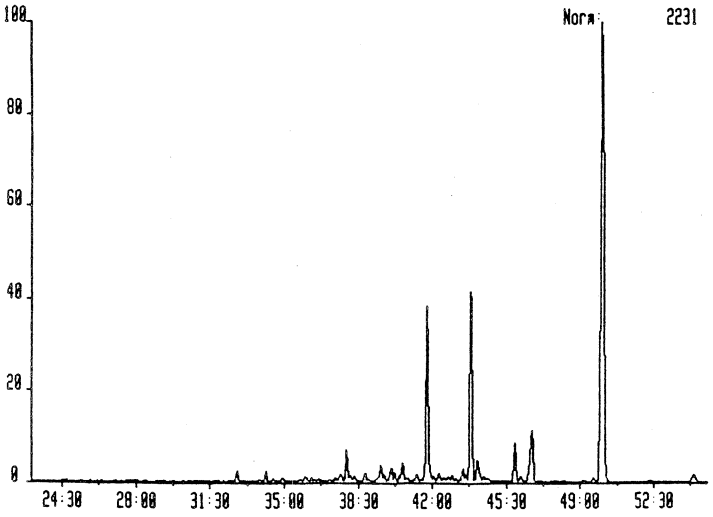


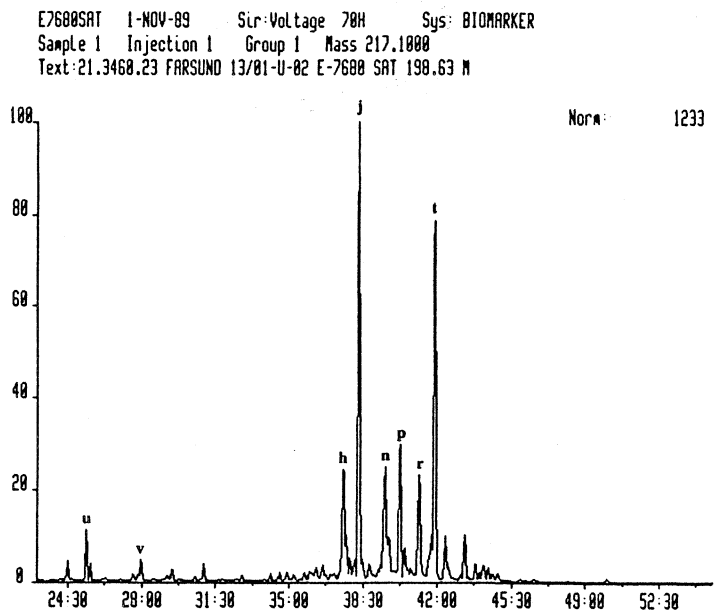


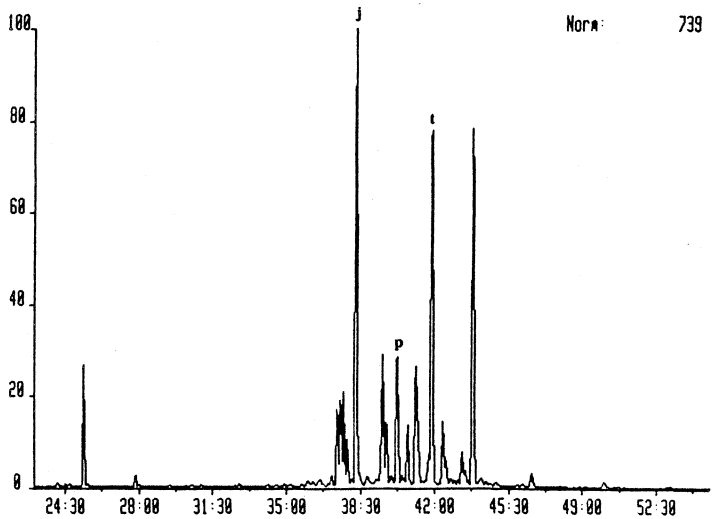


IKU SINTEF-GRUPPEN









IKU SINTEF-GRUPPEN

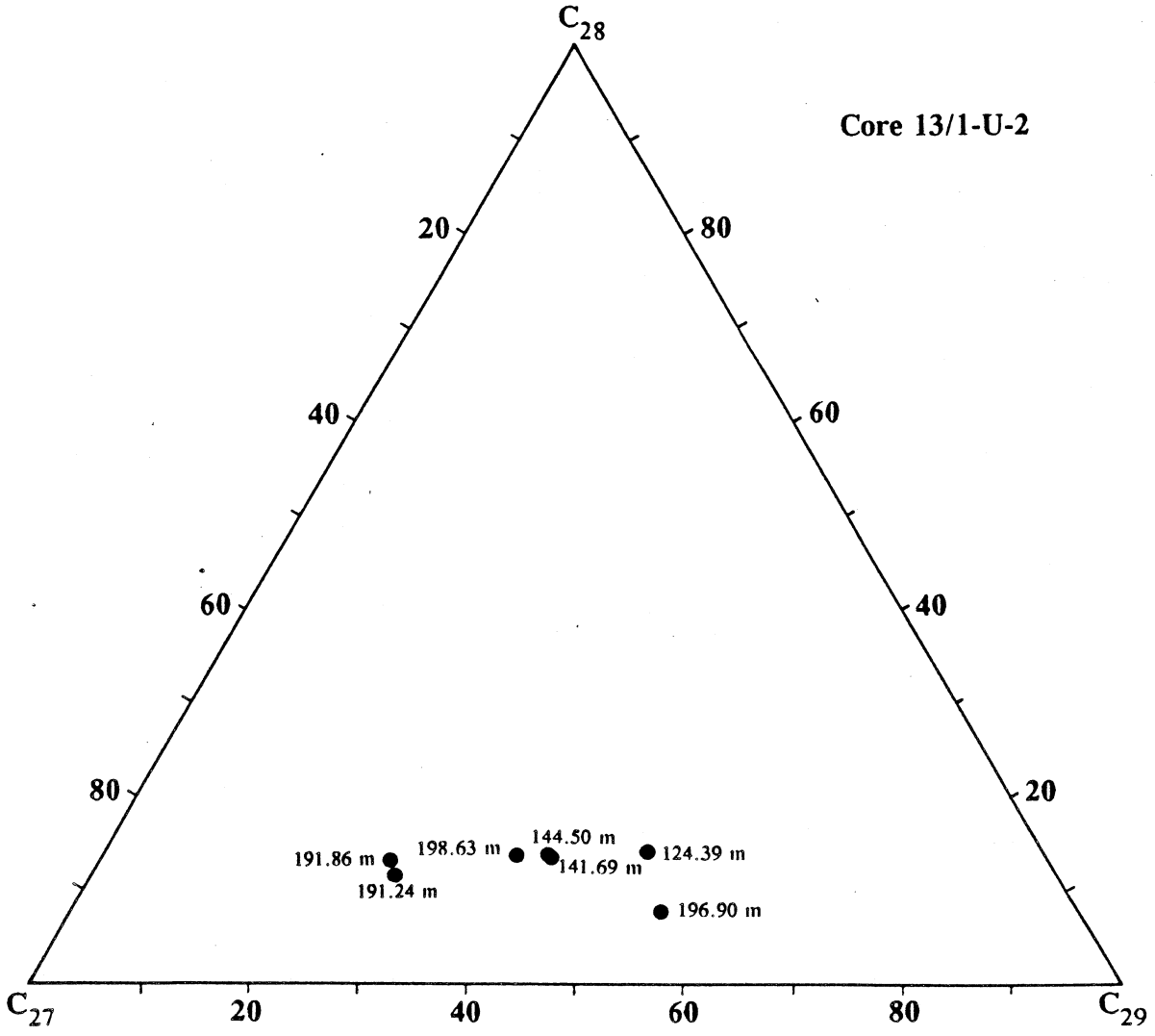


Figure A.II.4.4: *Internal distribution of 14α(H),17α(H) 20R, C_{27}, C_{28} and C_{29} regular steranes (from m/z 217).*

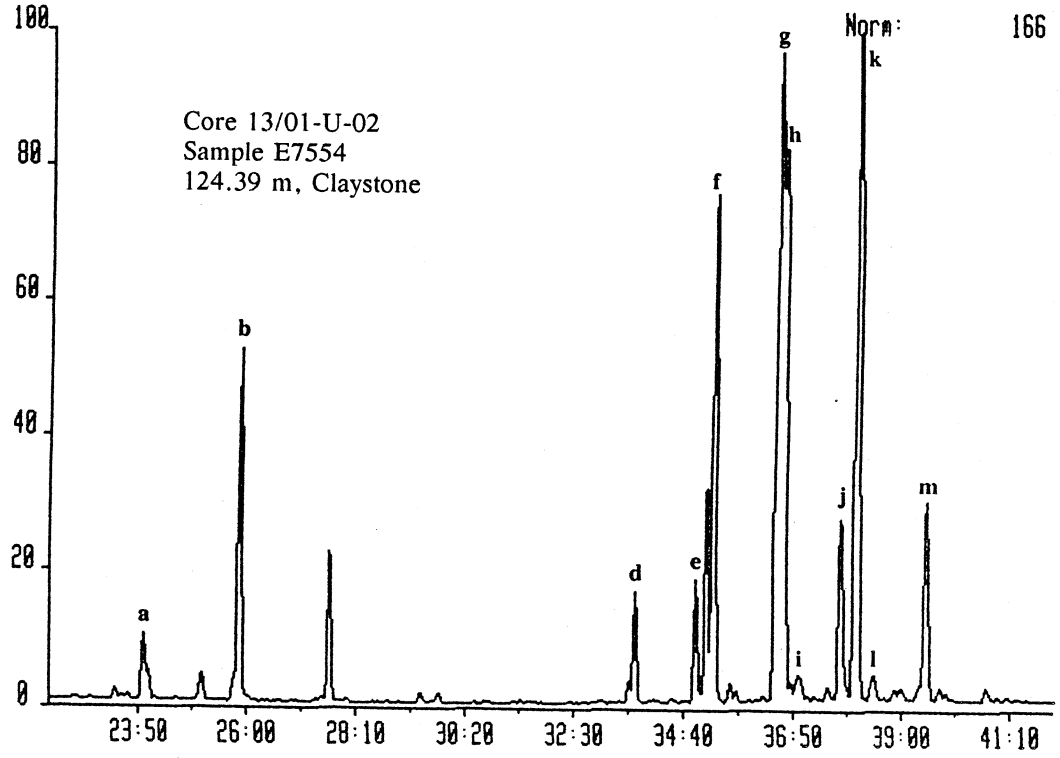
Figure A.II.4.5:

Mass fragmentograms of m/z 231, 253
(aromatic steroid hydrocarbons)

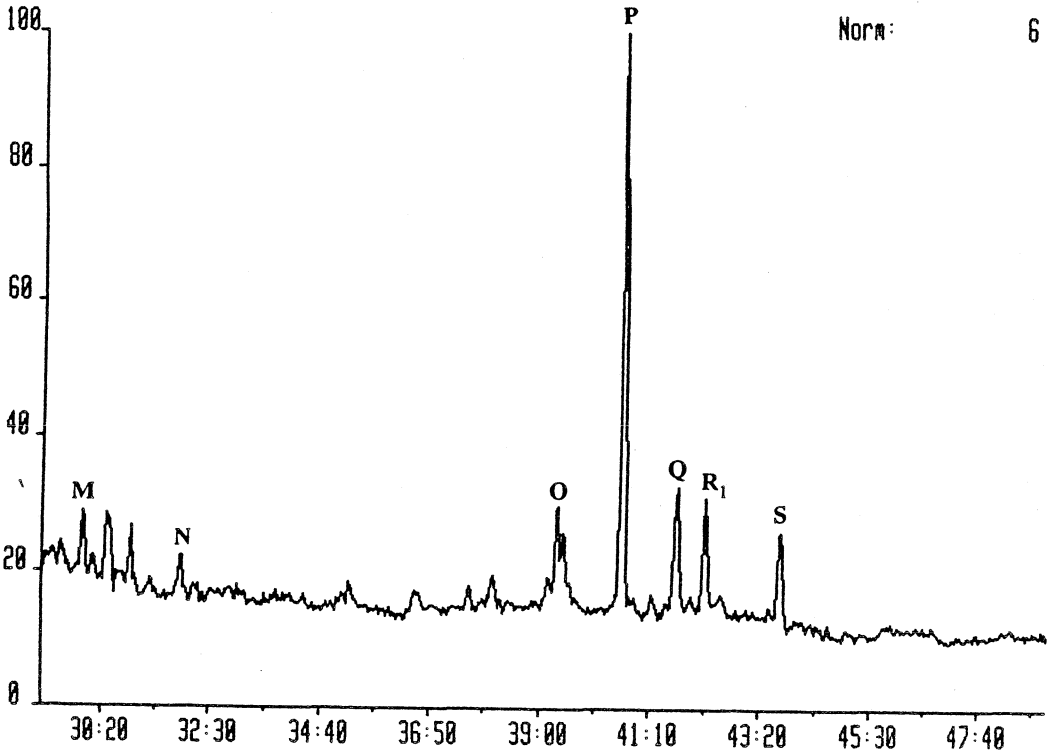
Peak code	Identification
Key for m/z 231 (tri-aromatic steroids):	
M	C_{20} tri-aromatic steroid
N	C_{21} tri-aromatic steroid
O	C_{26} tri-aromatic steroid
P	C_{26}+C_{27} tri-aromatic steroids
Q	C_{28} tri-aromatic steroid
R	C_{27} tri-aromatic steroid
S	C_{28} tri-aromatic steroid
Key for m/z 253 (mono-aromatic steroids):	
a	C_{21} mono-aromatic steroid
b	C_{22} mono-aromatic steroid
c	unidentified compound
d	C_{27} mono-aromatic steroid
e	C_{27} mono-aromatic steroid
f	C_{28} mono-aromatic steroid
g	C_{27} mono-aromatic steroid
h	C_{28}+C_{29} mono-aromatic steroids
i	C_{29} mono-aromatic steroids
j	C_{29} mono-aromatic steroids
k	unidentified compound
l	unidentified compound

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E7554ARO 2-NOV-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 253.1000
Text:21.3460.23 FARSUND 13/01-U-02 E-7554 ARO 124.39 M

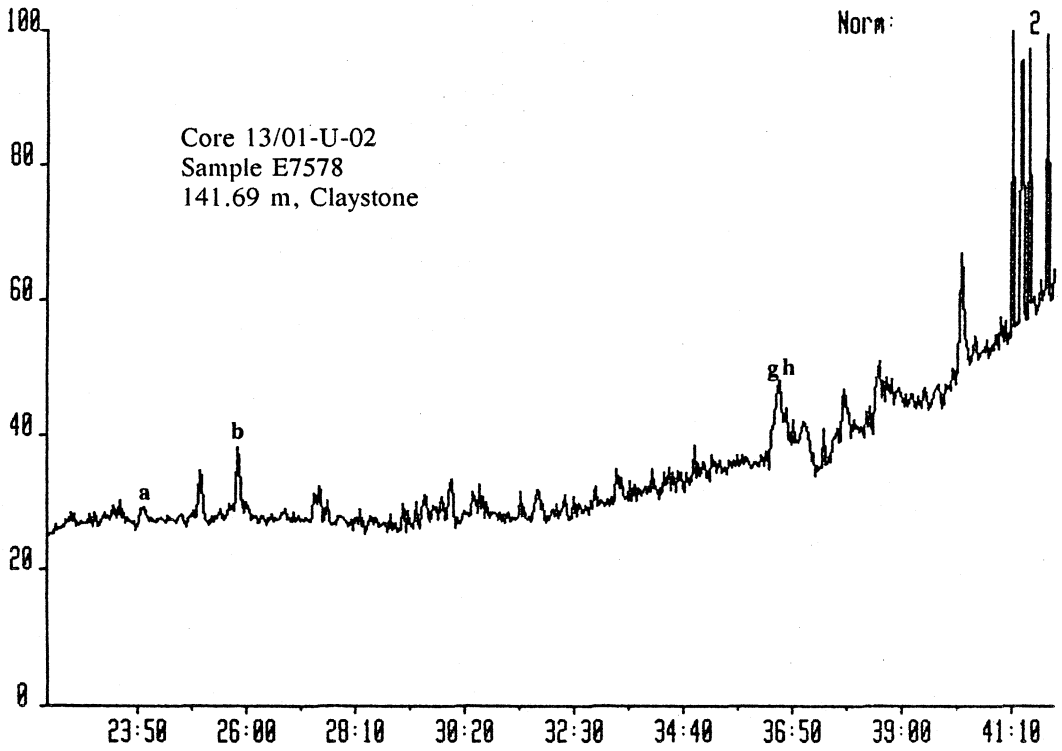


E7554ARO 2-NOV-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 231.1000
Text:21.3460.23 FARSUND 13/01-U-02 E-7554 ARO 124.39 M

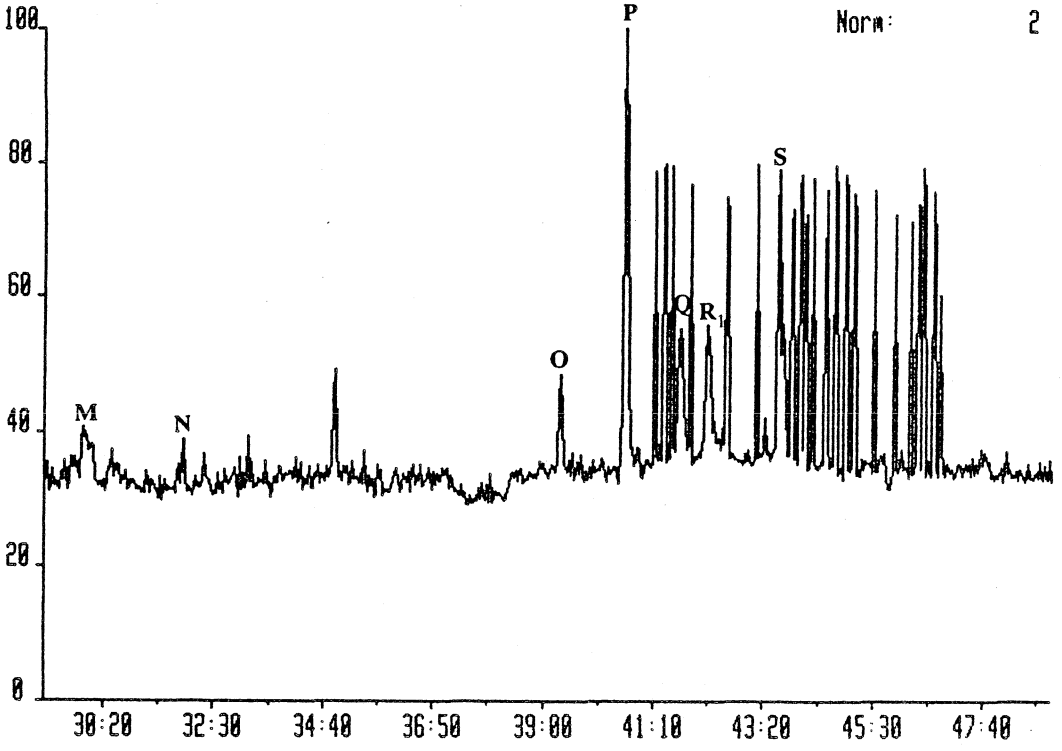


IKU SINTEF-GRUPPEN

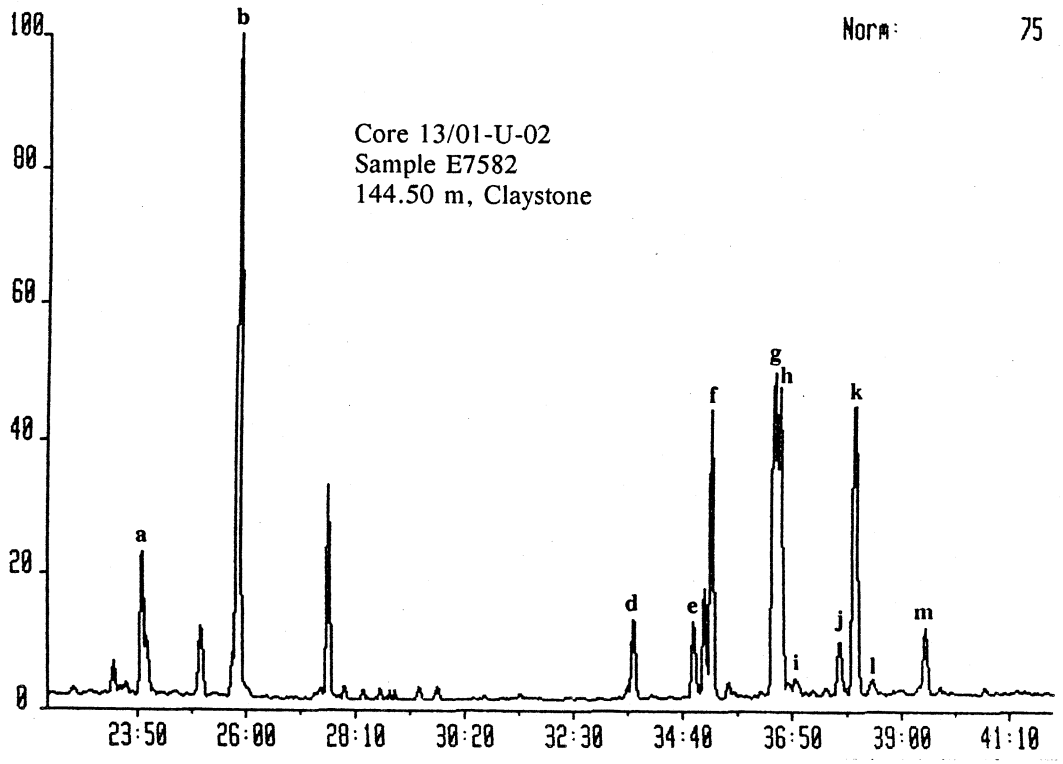
E7578ARO 2-NOV-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 253.1000
Text:21.3460.23 FARSUND 13/01-U-02 E-7578 ARO 141.69 M



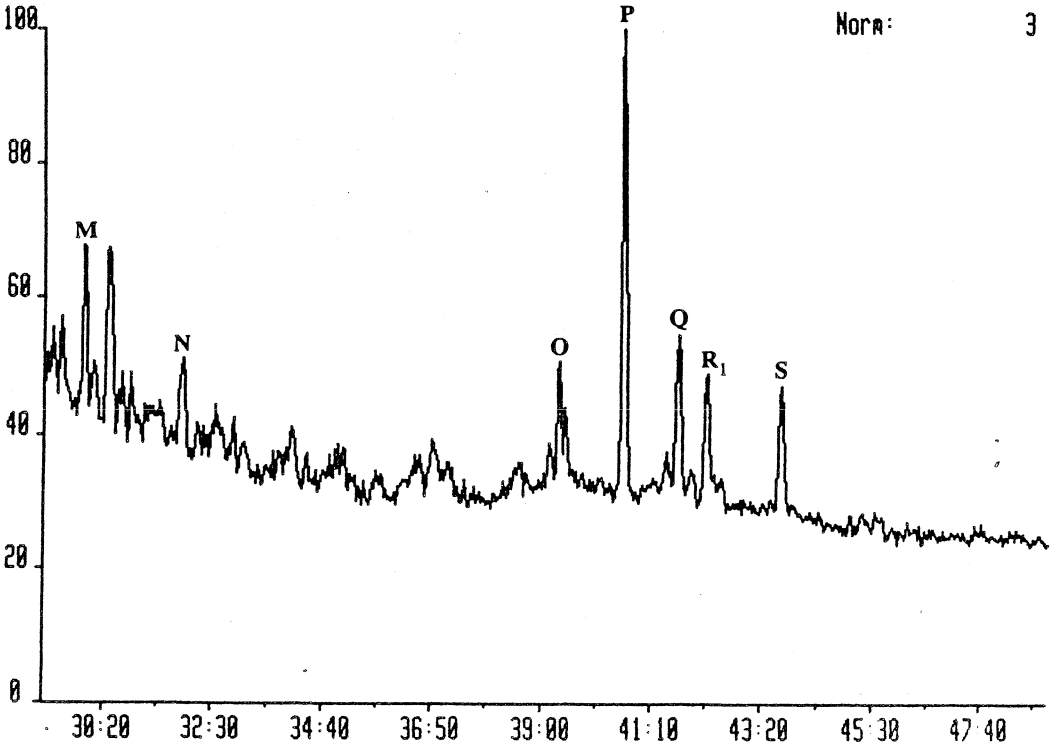
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Sample 1 Injection 1 Group 1 Mass 231.1000
Text:21.3460.23 FARSUND 13/01-U-02 E-7578 ARO 141.69 M



E7582ARO 2-NOV-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 253.1000
Text:21.3460.23 FARSUND 13/01-U-02 E-7582 ARO 144.50 M

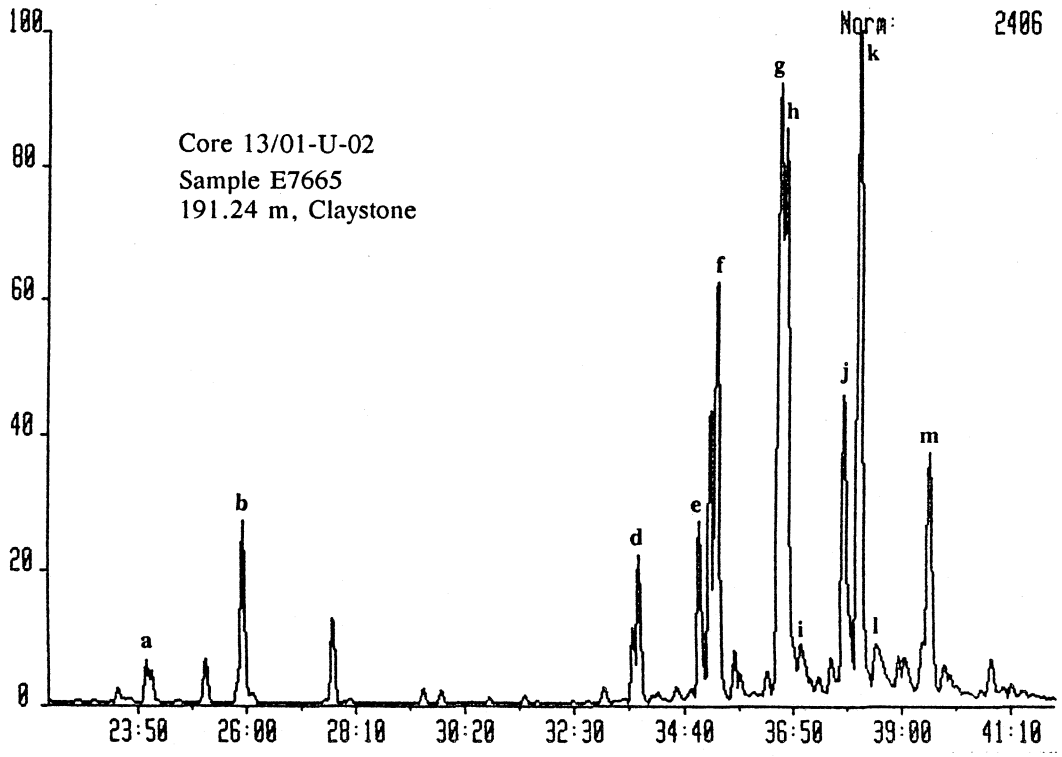


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Sample 1 Injection 1 Group 1 Mass 231.1000
Text:21.3460.23 FARSUND 13/01-U-02 E-7582 ARO 144.50 M

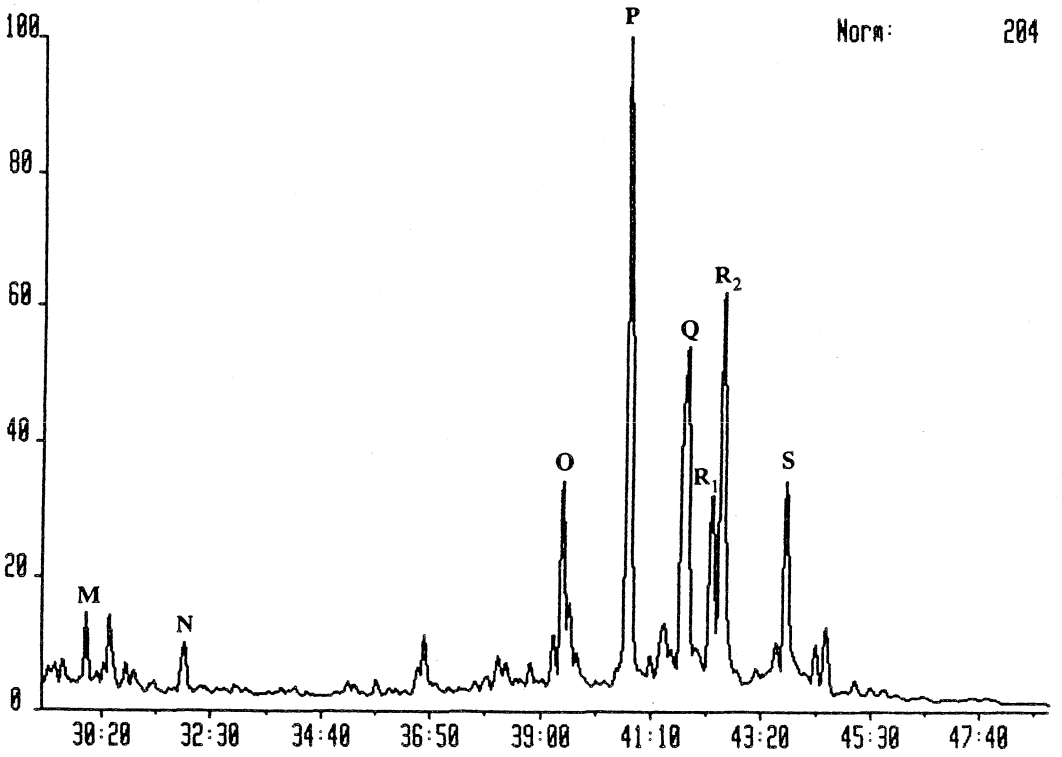


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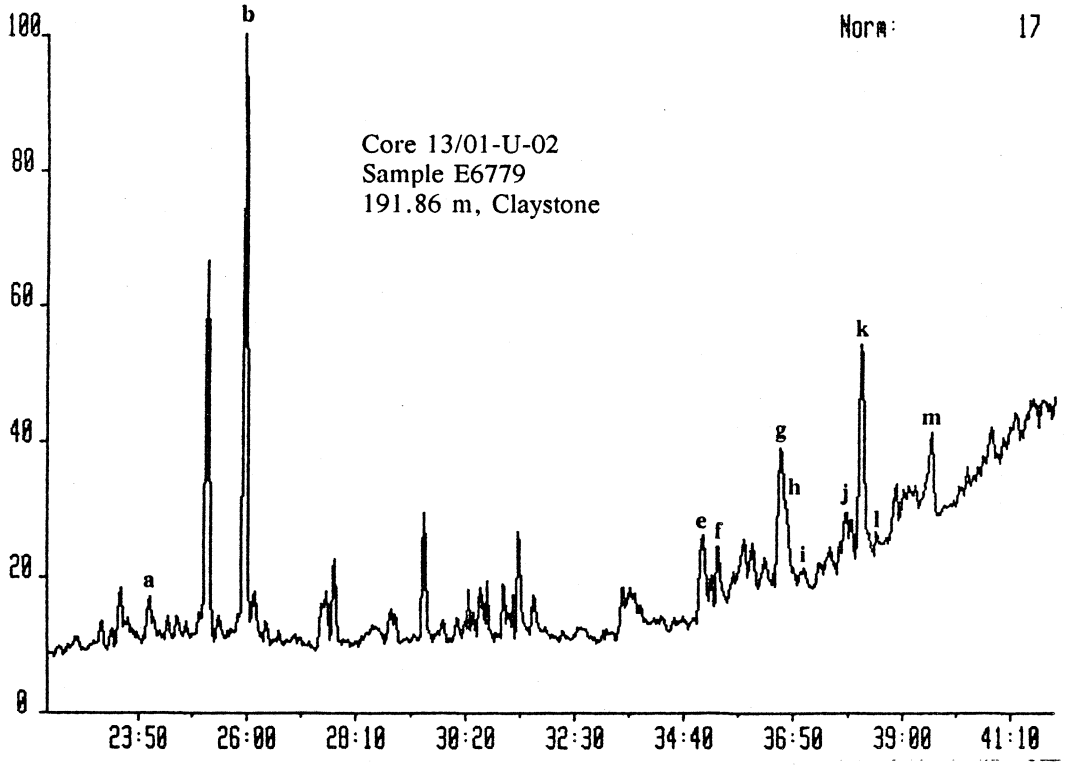
E7665ARO 3-NOV-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 253.1000
Text:21.3460.23 FARSUND 13/01-U-02 E-7665 ARO 191.24 m



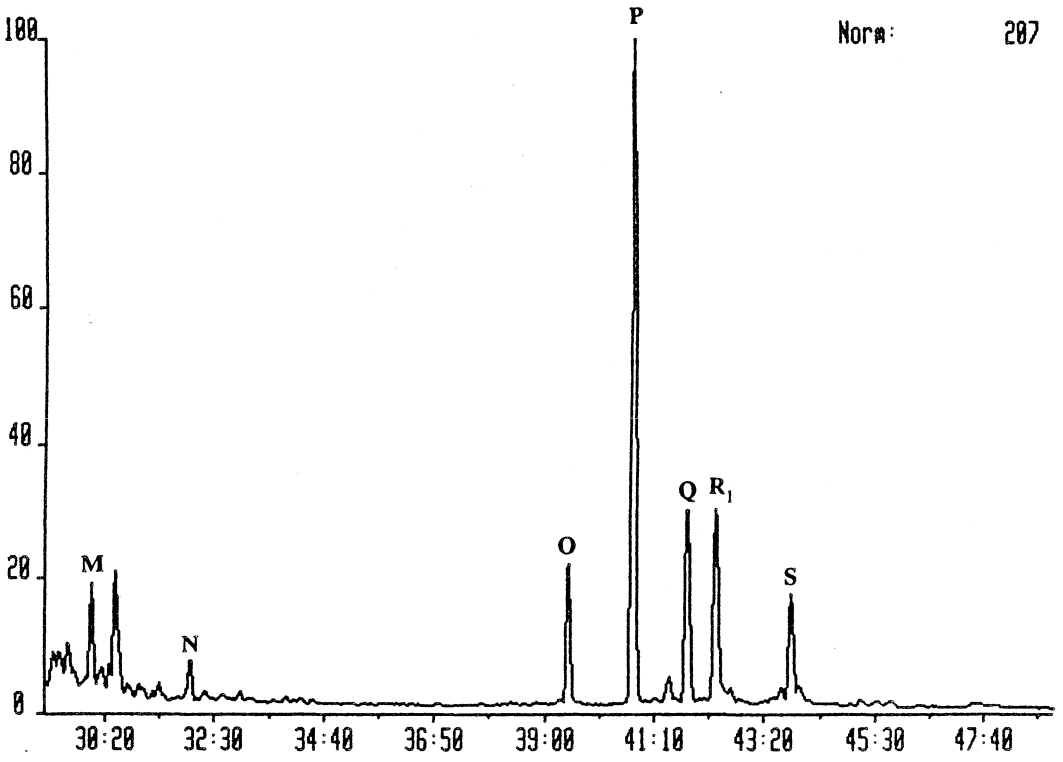
E7665ARO 3-NOV-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 231.1000
Text:21.3460.23 FARSUND 13/01-U-02 E-7665 ARO 191.24 m



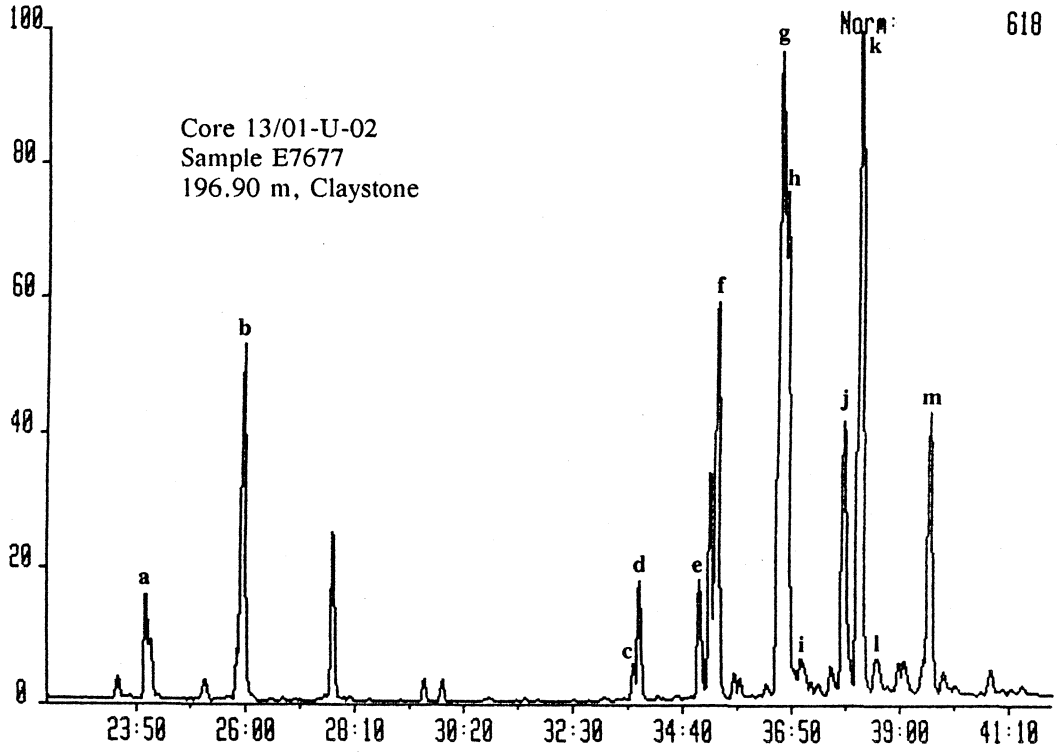
E6779ARO 3-NOV-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 253.1000
Text:21.3460.23 FARSUND 13/01-U-02 E6779ARO 191.86 M



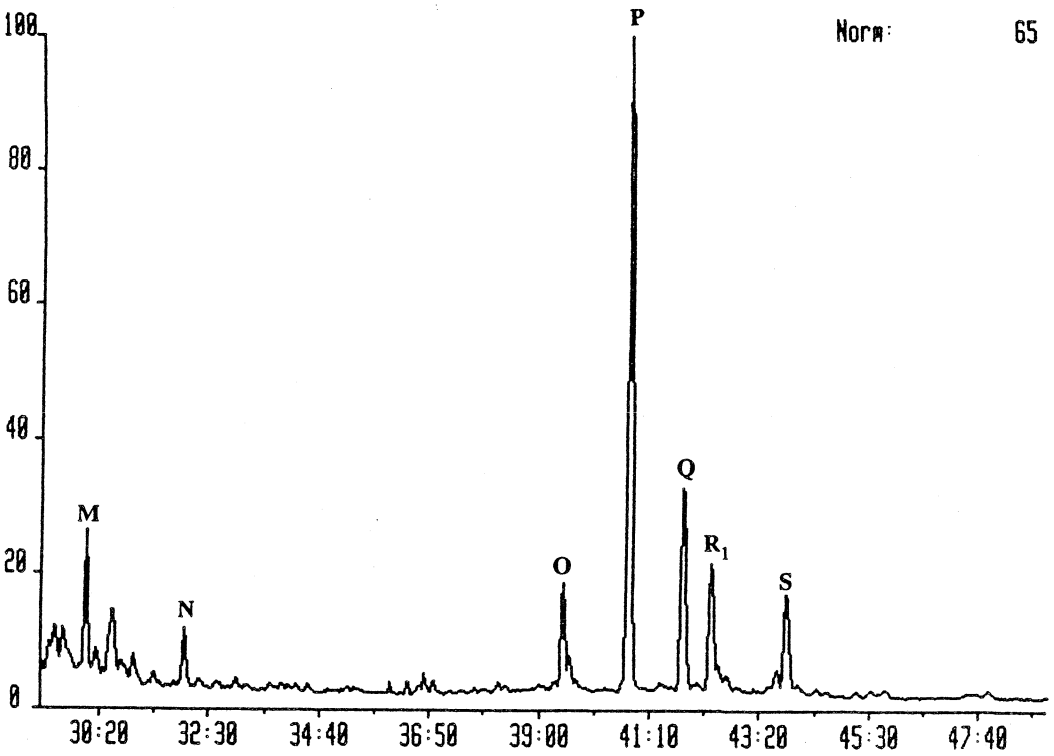
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Sample 1 Injection 1 Group 1 Mass 231.1000
Text:21.3460.23 FARSUND 13/01-U-02 E6779ARO 191.86 M



E7677ARO 3-NOV-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 253.1000
Text:21.3460 FARSUND 13/01-U-02 E7677 ARO 196.90 M

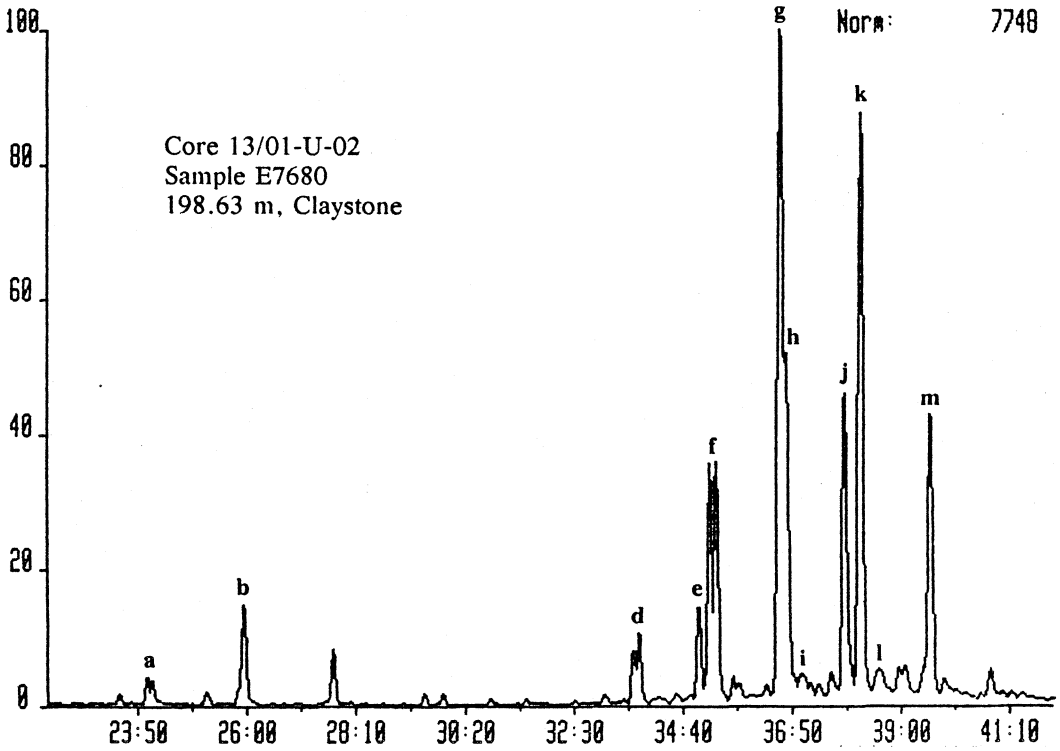


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Sample 1 Injection 1 Group 1 Mass 231.1000
Text:21.3460 FARSUND 13/01-U-02 E7677 ARO 196.90 M



IKU SINTEF-GRUPPEN

E7680ARO 3-NOV-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 253.1000
Text:21.3460 FARSUND 13/01-U-02 E7680 ARO 198.63 M



E7680ARO 3-NOV-89 Sir:Voltage 70H Sys: BIOMARKER
Sample 1 Injection 1 Group 1 Mass 231.1000
Text:21.3460 FARSUND 13/01-U-02 E7680 ARO 198.63 M

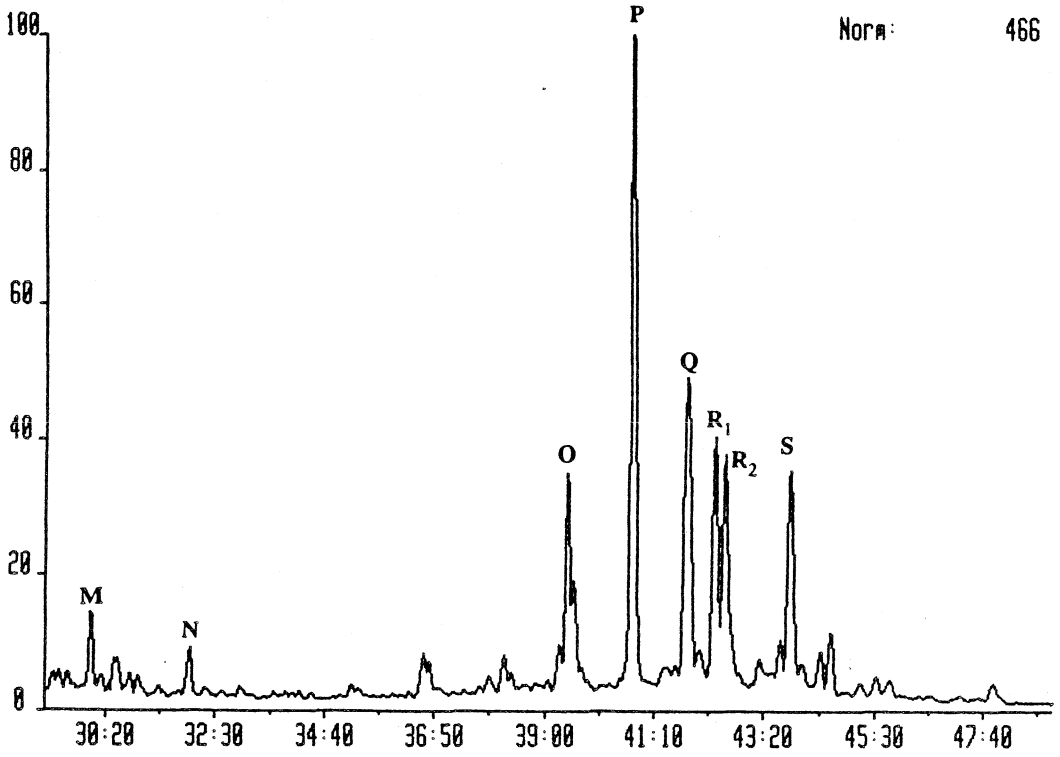
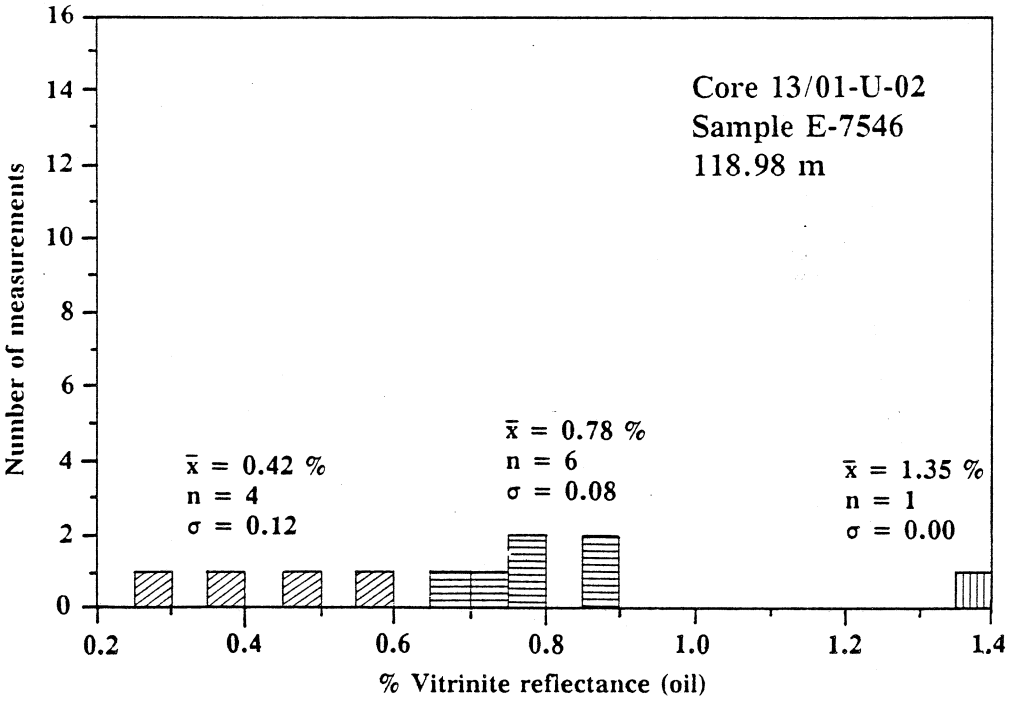
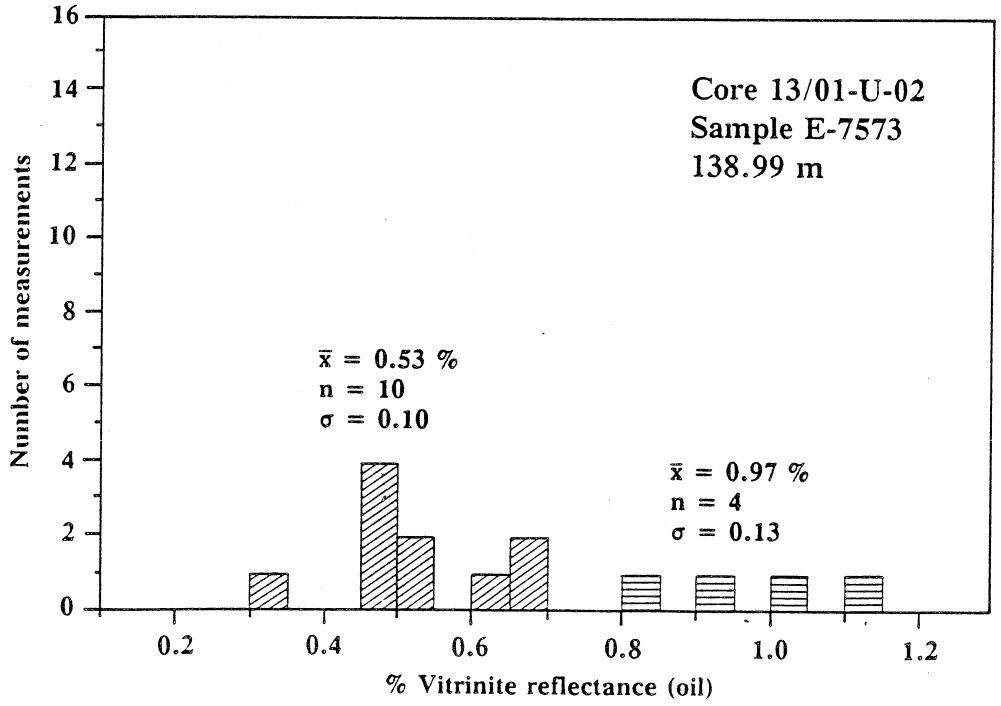
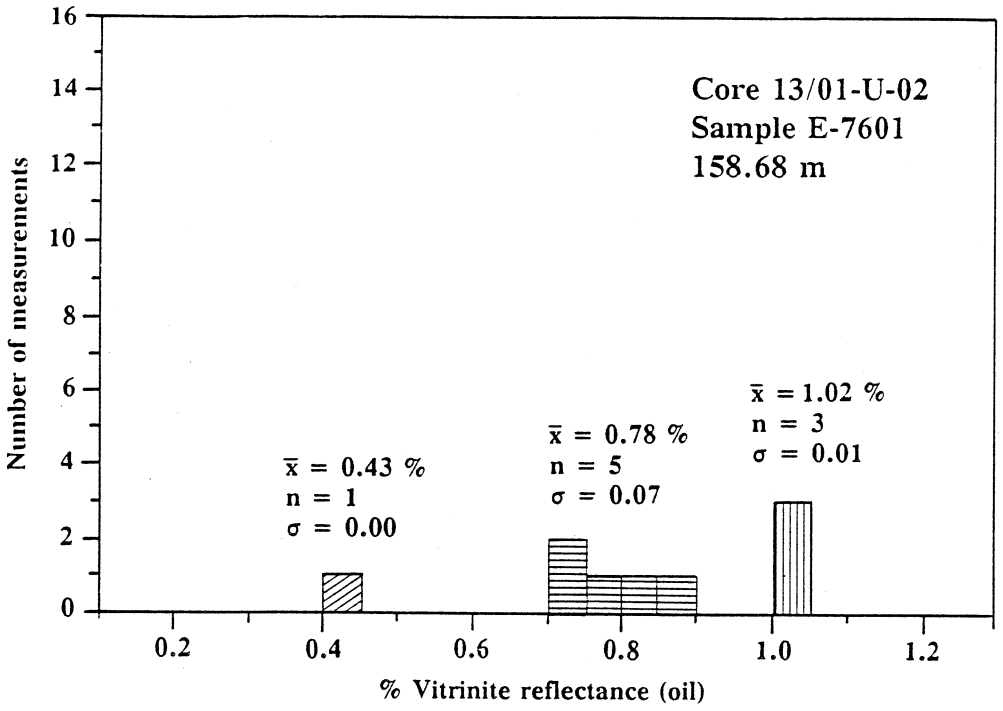
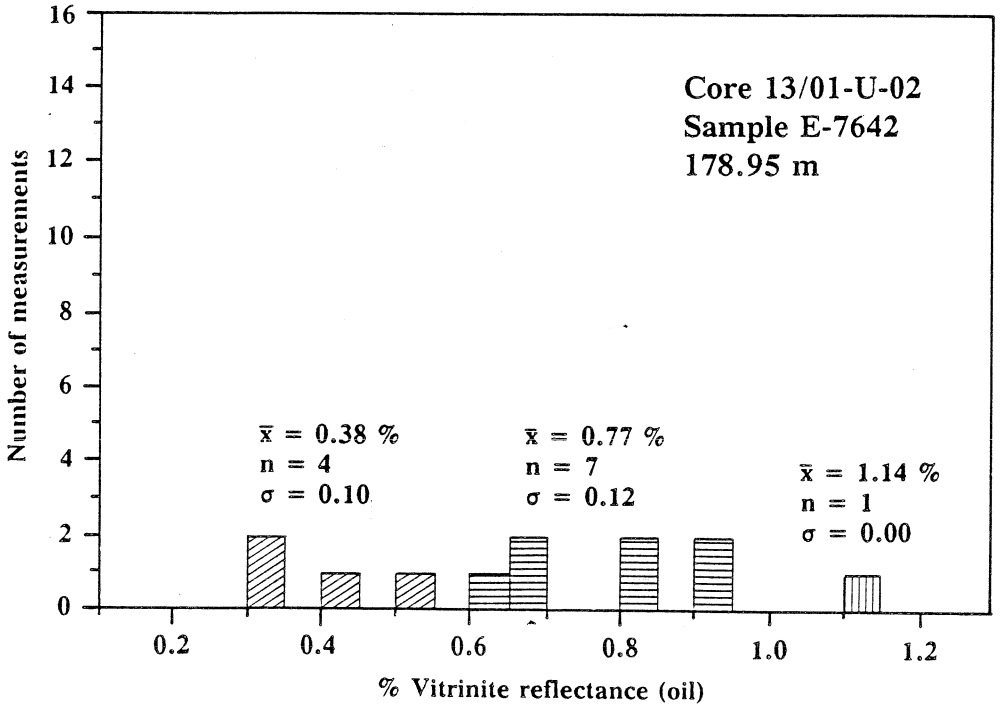


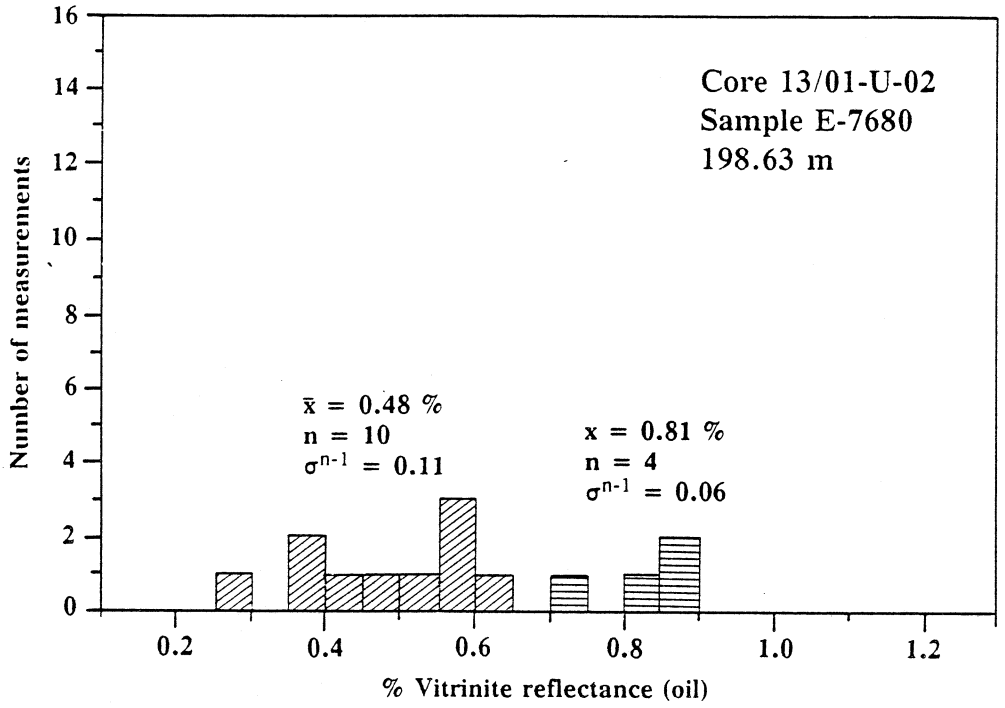
Figure A.II.4.6: Vitrinite reflectance histograms.

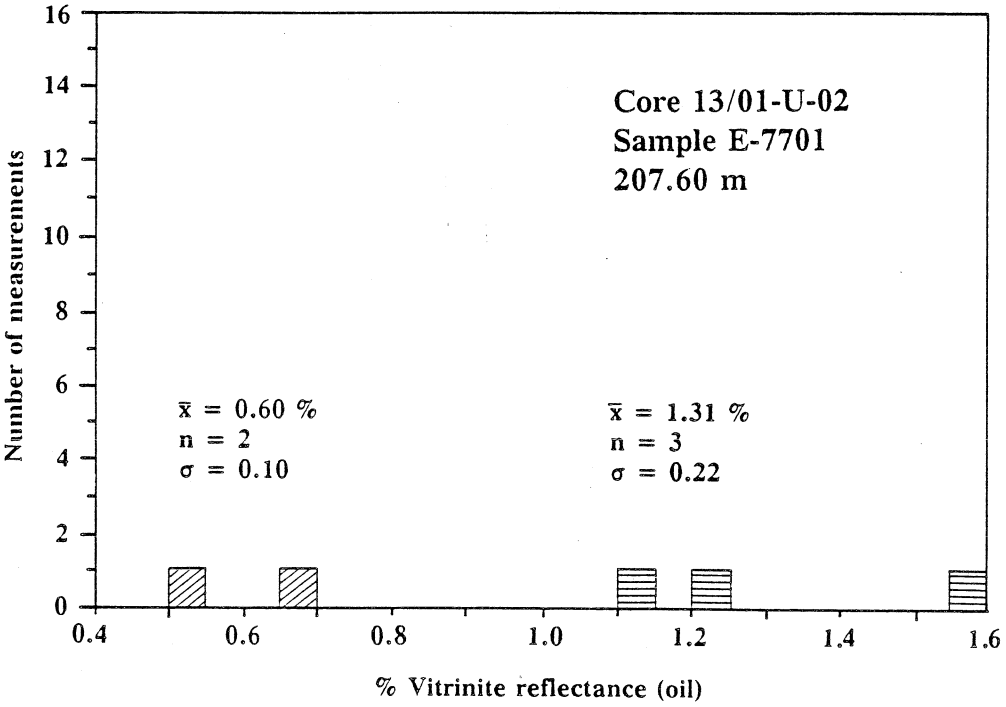

Core 13/01-U-02
Sample E-7546
118.98 m
x̄ = 0.42 %
n = 4
σ = 0.12
x̄ = 0.78 %
n = 6
σ = 0.08
x̄ = 1.35 %
n = 1
σ = 0.00
Number of measurements
% Vitrinite reflectance (oil)


Core 13/01-U-02
Sample E-7573
138.99 m
x̄ = 0.53 %
n = 10
σ = 0.10
x̄ = 0.97 %
n = 4
σ = 0.13
Number of measurements
% Vitrinite reflectance (oil)


Core 13/01-U-02
Sample E-7601
158.68 m
x̄ = 0.43 %
n = 1
σ = 0.00
x̄ = 0.78 %
n = 5
σ = 0.07
x̄ = 1.02 %
n = 3
σ = 0.01
Number of measurements
% Vitrinite reflectance (oil)


Core 13/01-U-02
Sample E-7642
178.95 m
x̄ = 0.38 %
n = 4
σ = 0.10
x̄ = 0.77 %
n = 7
σ = 0.12
x̄ = 1.14 %
n = 1
σ = 0.00
Number of measurements
% Vitrinite reflectance (oil)


Core 13/01-U-02
Sample E-7680
198.63 m
x̄ = 0.48 %
n = 10
σ^n-1 = 0.11
x = 0.81 %
n = 4
σ^n-1 = 0.06
Number of measurements
% Vitrinite reflectance (oil)


Core 13/01-U-02
Sample E-7701
207.60 m
x̄ = 0.60 %
n = 2
σ = 0.10
x̄ = 1.31 %
n = 3
σ = 0.22
Number of measurements
% Vitrinite reflectance (oil)

APPENDIX III: TABLE OF CONTENTS

Experimental Methods

Interpretation levels

EXPERIMENTAL METHODS

Gas analyses

Hydrous pyrolysis gas (full analysis of hydrocarbons and inert gases):

The gas samples from hydrous pyrolysis 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 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 Porapak T x 4 ft steel column packed with Porapak Q, 80/100 mesh.

Temperature programme: 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.

The concentrations were corrected for air contamination by assuming that the pyrolysis gas is oxygen-free.

Headspace gas:

A septum was attached to the can and a sample of the headspace gas was taken for analysis of C_1, C_2, C_3, i-C_4, nC_4 and C_{5+} hydrocarbons.

This analysis was performed on Carlo Erba Fractovap 2150 and 2350 gas chromatographs equipped with 2 m x 1/8" stainless steel columns filled with Porapak Q on Chromosorb using nitrogen as carrier gas. An oven temperature of 150°C was used. After elution of n-butane, the column was back-flushed and C_{5+} compounds were recorded as one peak. A standard gas sample containing methane, ethane, propane, n-butane, n-pentane and n-hexane (100 ppm each) was used for quantification.

The can was then opened and headspace volume, water volume, and sample weight were measured. The canned samples were washed with warm water (30-40°C) on 4.0, 2.0 and 0.125 mm sieves to remove drilling mud and were then dried at 35°C.

Occluded gas:

Prior to drying, an aliquot of the 1-4 mm fraction of each sample was crushed in water for 10 minutes using a gas-tight ball mill. The evolved gas was analysed as described for headspace gas.

Total Organic Carbon

Bulk samples were crushed in a disk mill or mortar. Aliquots of the samples were then weighed into Leco crucibles, then treated three times with hot 10% HCl in order to remove carbonate, and finally washed four times with distilled water in order to remove any traces of HCl. The crucibles were then placed on a hot plate (60°C) and dried for 24 hours. The total organic carbon (TOC) content of the dried samples was determined using a CS 244 carbon/sulphur analyser.

The instrument was calibrated using a sediment standard with 2.72% carbon. Calibration and blank runs were carried out every 15th measurement.

Rock-Eval pyrolysis

Powdered sample (100 mg shale, 5-10 mg coal) was weighed into a platinum crucible (the base and cover of which are made of sintered steel), and analysed on a Rock-Eval II pyrolyser (Girdel/IFP) under standard conditions (Carrier gas: helium; flow rate: 100 ml/min.; temperature programme: 300°C (3 min.) - 25°C/min. - 550°C).

Pyrolysis Gas Chromatography (Py-GC Programmed)

Thermal extraction (S1)

The whole rock sample (20-30 mg) was placed in a boat-shaped sample probe and thermo-extracted in a stream of helium at 340°C for 4 minutes.

Pyrolysis-Gas Chromatography (S2)

The thermo-extracted sample was pyrolysed in a helium atmosphere using a furnace type pyrolyser as described by Solli et al. (1984). The pyrolysis temperature program was 340°C - 50°C/min. - 550°C. The outlet of the furnace was directly connected to a splitter (30:1) which enabled the pyrolysis products to be simultaneously recorded as a bulk "S2" peak by an FID and passed into a gas chromatograph. The pyrolysis products were trapped on the chromatographic column by cooling the front part of the column with liquid nitrogen. On completion of the pyrolysis programme, the collected pyrolysis products were injected on to the column by removing the nitrogen bath. The GC conditions are outlined below.

GC conditions

Column: 30 m DB-1, i.d. 0.32 mm, fused silica capillary column.
Carrier gas: Helium, inlet pressure 7.5. psi; flow rate 1.5 ml/min.

Temp. programme: -10°C (16 min.) - 5°C/min. - 320°C (10 min.)

Preparation of kerogen concentrates for Py-GC-MS

The powdered and pre-extracted rock sample was treated overnight with concentrated HCl (200 ml), followed by treatment with hot 40% HF (100 ml, 50°C, overnight). The acids were removed by decanting and repeated washing with hot water (2 hours), 10% ammonium carbonate solution (>2 hours), and cold water (2x2 hours).

The kerogen was further purified by extraction with methanol, methanol/DCM (1:1) and hexane/DCM (1:1).

Flash pyrolysis-GC-MS (PY-GC-MS)

Flash PY-GC-MS was performed on a Chemical Data Systems (CDS) Pyroprobe 120 connected to a Varian 3700 chromatograph. The MS system was a VG 70-70H.

GC conditions:

Column:	30 m x 0.32 mm i.d. fused silica, DB-5, 0.25 µm film thickness
Carrier gas:	He, 1.5 ml/min.
Inlet split ratio:	1:15
Temperature programme:	Ful scan analysis (FS): 40°C (1 min) - 4°C/min - 280°C (20 min).

A suspension of kerogen in methanol was applied to the platinum ribbon probe and the solvent was evaporated. The probe was then inserted into the pyrolysis chamber and heated in a stream of helium to 600°C (ramp time 5-10 ms) for 5 seconds. The pyrolysis chamber and interface were kept at a temperature of 300°C.

The mass spectrometer operated at 70 eV electron energy with an ion source temperature of 200°C and at a pressure of 10^{-5} mBar. Full data collection was performed at a scan time of 1 second per decade.

Extractable Organic Matter

Powdered rock was extracted in a Soxhlet apparatus for 18 hours. Boiling dichloromethane (DCM) containing 7% (v/v) methanol was used as a solvent.

DCM of organic geochemical grade was used and blank analyses indicated that the occurrence of contaminating hydrocarbons was negligible. Activated copper fillings were used in order to remove any free sulfur from the samples.

The potential contaminants were extracted in a beaker using dichloromethane. In the case of "Super Mix", methanol was used in addition.

After extraction, the solvent was evaporated using a Büchi Rotavapor and the amount of extracted organic matter (EOM) was determined.

Medium-pressure liquid chromatography (MPLC)

The EOM or 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. Then they were transferred to glass vials. The remaining solvent was removed.

Gas chromatographic analysis

The saturated fractions were diluted with n-hexane and analysed on an HP 5730A gas chromatograph equipped with a 15 m DB-1 fused silica column. Hydrogen was used as a carrier gas with a flow rate of about 1.5 ml/min. Injections were performed in split mode (split ratio 1:10). The temperature program used was 80°C (2 min.) - 4°C/min. - 280°C.

The total aromatic fractions were diluted with n-hexane and analysed on a Varian 3700 gas chromatograph, fitted with a DB-5 fused silica column (30 m x 0.25 mm i.d.), and equipped with an FID and a sulphur-specific dual-flame FPD detector. Hydrogen with a flow rate of 2.5 ml/min was used as carrier gas. The injection split ratio was 1:10. The temperature programme used was 60°C (2 min.) - 4°C/min. - 280°C.

All the data from the GC analyses were processed on a VG Multichrom lab data system.

Gas chromatography - mass spectrometry (GC-MS)

GC-MS analyses were performed on a VG Micromass 70-70H GC-MS-DS system. A Varian Series 3700 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 a carrier gas. Saturated fractions were injected in split mode (1.5 µl, split ratio 1:15), aromatic fractions in splitless mode.

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

The hydrocarbons were analysed in multiple ion mode (MID) at a scan cycle time of approximately 2 secs. 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.

Vitrinite Reflectance

Vitrinite reflectance measurements were carried out on whole-rock samples as follows: the rock samples were broken up if necessary, and mounted in a fast-setting synthetic resin. Temperatures in excess of 50°C were avoided as these can result in alteration of the organic material. Once the resin was set, the sample plugs were ground on coarse silicon carbide paper in order to expose an area of sample for polishing. The samples were then ground on 600 and 280 grade silicon carbide paper to remove any coarse scratches.

Where clastic sediments were involved, grinding and polishing was carried out using propan-2-ol to avoid swelling of any clay minerals in the sample. If coals were to be measured, then water was used.

After coarse grinding, the samples are polished on Selvyt-covered laps using 5/20 and gamma grade alumina powder. Following polishing, the surface of the sample plugs was carefully cleaned to remove any traces of the polishing powders.

Reflectance measurements were carried out using a Leitz MPV-Compact microscope and photo-multiplier combination. The measurements were made under oil immersion, using an oil with a refractive index of 1.518 at a wavelength of 546 nm. The surface of the sample was examined for suitable vitrinite particles, and measurements were taken on these. The reflectance of a vitrinite particle was determined relative to an optical glass standard with a known reflectance of a similar order to that of the sample.

If possible, a minimum of twenty reflectance measurements was taken on each sample. Coals and carbonaceous claystone samples provide the most reliable data, while sandstones and carbonates provide the least reliable data.

The samples were also examined in ultra-violet light in order to better determine the composition and colour of the fluorescent material present in the sample. The colour of certain liptinite macerals in ultra-violet light can be related to the thermal maturity of the sample kerogen. A scale comparing vitrinite reflectance measurements and sporinite fluorescence to thermal maturity is shown in Table 3 of the interpretation levels.

Evaluation of kerogen type and thermal maturity in transmitted light

The rock samples were crushed and treated with hydrochloric acid and hydrofluoric acid in order to remove the mineral matter and isolate the kerogen. The isolated kerogen was mounted in glycerine jelly on microscope slides as a strew-mount.

The treatment of the isolated kerogen varied according to the requirements and preservation of the samples.

This included:

T-slide: total acid residue.
O-slide: kerogen debris remaining after flotation in $ZnBr_2$ to remove heavy minerals.
Si-slide: sieved residue.
X-slide: oxidised residue.

T- and/or O-slides were necessary in order to evaluate the kerogen composition/palynofacies of the samples.

Si- and/or X-slides were required if it was necessary to concentrate larger kerogen fragments or spores/pollen for spore colouration and/or age determination, respectively, (N.B.: oxidised residue is not used for spore colour determination as oxidation will alter the colour).

The samples were examined using a Leitz Dialux microscope with a white halogen light source. Objective lenses of 10x and 63x magnification were used. The higher magnification allowed a more detailed description of the kerogen, with resolution down to 2µm diameter.

Thermal alteration indices (TAI) were measured from the colour of spores and pollen. The techniques used for this are adapted from Staplin (1969) and Burgess (1974). IKU has used a 1-10 scale for thermal alteration index (TAI)/Spore colouration index (SCI) since December, 1986.

Kerogen terminology

The following kerogen terminology is used:

1. Amorphous material - degraded, unstructured material of unidentified origin.
2. Algal material - particles of recogniseably algal origin.
3. Liptinitic material - recogniseable spores, pollen, cuticle and cysts.
4. Woody material - structured and unstructured woody tissue.
5. Coaly material - black, reworked or oxidised material.

Comparison of microscopic thermal maturation systems at IKU
(Only approximate guide and not intended to indicate absolute limits.)

MATURATION LEVEL	SPORE COLOUR TAI (old)	SPORE COLOUR TAI (new)	VITRINITE REFLECTANCE %Ro	SPORINITE FLUORESCENCE
IMMATURE	1 - 2-	1.0 - 3.5	0.25 - 0.40	1 - 4
EARLY MATURITY	2- - 2	3.5 - 4.0	0.40 - 0.60	4 - 6
MODERATE MATURITY	2 - 2+	4.0 - 4.5	0.60 - 0.80	6 - 7
MATURITY	2+ - 3-	4.5 - 5.5	0.80 - 1.00	7 - 8
LATE MATURITY	3- - 3	5.5 - 6.0	1.00 - 1.20	8 - 9
POST-MATURE	3 - 5	6.0 -10.0	>1.20	Absent

At IKU, TAI determination is generally undertaken on bisaccates.

Relation between fluorescence colour and sporinite fluorescence zones:

EXC. 400 nm
BAR. 530 nm

colour	G	G/Y	Y	Y/O	L.O	M.O.	D.O.	O/R	R
zone	1	2	3	4	5	6	7	8	9

INTERPRETATION LEVELS

The following interpretation levels are used as approximate guidelines but not intended to indicate absolute limits.

1 TOTAL ORGANIC CARBON (TOC)

TOC (wt%)	Richness of source rock
<0.5	Poor Source Rock
0.5-1	Fair Source Rock
1-2	Good Source Rock
>2	Rich Source Rock

2 ROCK-EVAL PYROLYSIS

a) Data Supplied

S1	Free hydrocarbons (mg/g rock).
S2	Potential or pyrolysable hydrocarbons of kerogen (mg/g rock).
S3	Oxygen content of kerogen (mg CO_2/g rock).
Hydrogen Index	S2/TOC x 100 (mg hydrocarbons/g TOC).
Oxygen Index	S3/TOC x 100 (mg CO_2/g TOC).
Petroleum Potential	S1+S2 (mg HC/g rock).
Production Index	S1/(S1+S2).
Tmax	Temperature at which the S2 peak is at maximum (°C).

b) Interpretation

Kerogen type	Hydrogen Index (mg HC/g TOC)
Type I	>650
Type II	400-650
Type II/III	200-400
Type III	50-200
Type IV	<50

N.B.
Hydrogen index is affected by organic carbon and carbonate mineral contents. Thus decreasing TOC contents, where the same organic matter type is present, can result in reduced hydrogen indices (Katz 1983 and Espitalié et al. 1984).

Petroleum Potential	S1+S2 (mg HC/g rock)
Poor	<1
Fair	1-5
Good	5-10
Rich	>10

S1 and S2 values can be raised by the presence of migrated bitumens.

Production Index	S1/(S1+S2)
Primary bitumen	<0.1
Generated or migrated hydrocarbons	0.1-0.5
Predominantly migrated Hydrocarbons or stain	>0.5

Tmax

Variations in values can occur due to maturity, kerogen type, migrated bitumens or low S2 peaks. The following maturity boundaries are therefore only approximate.

Tmax (°C)	Maturity stages of type II kerogens	Equivalent vitrinite reflectance in coals (% Ro)
425	Immature	0.5
435		0.7
	Oil generation zone	
450		1.0
>450	Gas generation zone	

3 EXTRACTABLE ORGANIC MATTER (OR SOLUBLE BITUMEN)

a) Data Supplied

Weight of extracted rock	(g)
EOM extractable organic matter	(mg, mg/g of rock, mg/g TOC)
Sat saturated hydrocarbons	(mg, mg/g of rock, mg/g TOC, wt% of EOM)
Aro aromatic hydrocarbons	(mg, mg/g of rock, mg/g TOC, wt% of EOM)
HC/EOM = (Sat+Aro)/EOM	(wt%)
Non-HC/EOM	(wt%)
HC/non-HC x 100	
Sat/Aro x 100	

b) Interpretation of source-rock richness based on hydrocarbon content.

Hydrocarbon content is dependent on maturity, total organic carbon content and kerogen type as well as being influenced by migrated hydrocarbons. The values should therefore be treated as a rough guide only.

Source rock richness	HC (ppm of rock)
Poor	<100
Fair	100-250
Good	250-500
Rich	>500

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Shallow Drilling Farsund Subbasin

Appendix A.11 to Main Report

Organic Geochemical Data

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