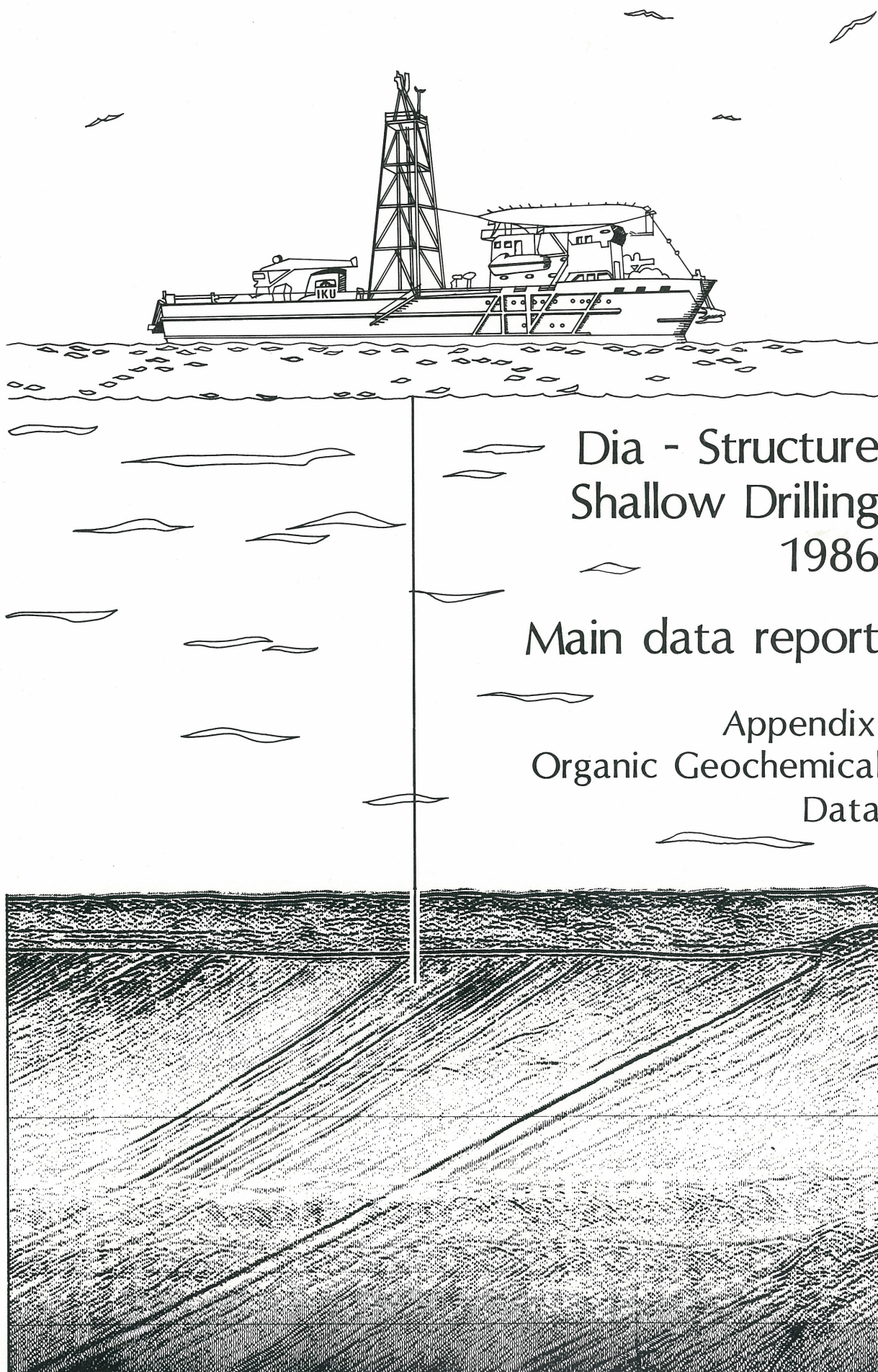




Dia - Structure
Shallow Drilling
1986

Main data report

Appendix:
Organic Geochemical
Data

REPORT

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Dia-Structure Shallow Drilling 1986
Appendix: Organic Geochemical Data

REPORT NO.: 21.3420.00/04/86

AUTHORS:

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22 Dec. 1986	383		T. Bugge	<i>T. Bugge</i>
CLIENT: A/S Norske Shell, BP Petroleum Development (Norway) Ltd, Den norske stats oljeselskap A/S, Elf Aquitaine Norge A/S, Esso Norge A/S, Mobil Exploration Norway Inc., Norsk Agip A/S, Norsk Hydro a.s, Fina Exploration Norway Utenl. A/S, Norwegian Petroleum Directorate, Total Marine Norsk A/S				
SUMMARY: This appendix includes the organic geochemical data tables and figures obtained from the Dia-Structure core samples. The data are organised in a core-by-core basis, each section having its own table of contents. The text accompanying these data may be found in the main body of the report. Also included in this appendix volume is an oil-source rock correlation chapter, and the data obtained from the artificial maturation of two core samples using hydrous pyrolysis. These data are accompanied by a descriptive text (Chapter I and II).				

KEY WORDS:	
Dia-Structure	Source potential
Barents Sea	Maturation
Organic geochemistry	Hydrous pyrolysis

CORRIGENDA

(1) Two canned samples analysed for headspace and occluded gas have been assigned to the wrong well. Another sample probably represents no bedrock and is from slightly greater depth than reported.

Reported assignment	Correct assignment
Sample C5091, 7323/07-U-02, 112.90 m	7323/07-U-01, 112.90 m
Sample C5035, 7323/07-U-02, 118.45 m	7323/07-U-01, 118.45 m
Sample C5090, 7323/07-U-02, 103.00 m	Sample C5090, 7323/07-U-02, 104.05 m This is a hammer sample that probably represents overburden rather than bedrock.

This affects

- Main Volume p. 143 (Figure 3.6.6) and p. 210 (Figure 3.10.4)
- Appendix volume p. 213-215 (Table A.III.5.1a-c) and p. 365-367 (Table A.III.9.1a-c).

The geochemical interpretation remains unaffected.

(2) The TOC contents of the two artificially matured samples have been mixed up in the original report, resulting in wrong concentrations of expelled pyrolysate relative to TOC. This affects Table A.I.3 (TOC column) and Table A.I.5 (all columns), and all digital versions of the organic geochemistry data delivered before 28 May 2009.

The correct values are:

IKU- No.	Core	Depth (m)	TOC (%)	EOM (mg / g TOC)	SAT (mg / g TOC)	ARO (mg / g TOC)	HC (mg / g TOC)	Non HC (mg / g TOC)
C5460	7323/7-U-1	110.02	7.46	250.6	36.5	41.2	77.7	172.9
C5461	7323/7-U-4	115	3.02	179.9	24.1	66.8	90.9	89.0

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1 I ARTIFICIAL MATURATION OF CLAYSTONES
FROM CORES 7323/7-U-1 AND 7323/7-U-4
USING HYDROUS PYROLYSIS

2 II OIL-SOURCE ROCK CORRELATION

3 III LABORATORY RESULTS
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I ARTIFICIAL MATURATION OF CLAYSTONES FROM CORES U-1 AND U-4 USING HYDROUS PYROLYSIS

The two samples at 110 m in core U-1 and 115 m in core U-4 were selected largely on the basis of organic richness and Rock-Eval kerogen type (Table A.I.1). Both samples may be classed as 'organic-rich', the U-1, 110 m sample containing a more hydrogen-rich type II kerogen relative to the type II/III kerogen of the U-4, 115 m sample. Despite the better source potential of the U-1 sample, the U-4 kerogen type appears to account for a greater proportion of the organic-rich argillaceous rocks of cores U-3, U-4, U-1 and U-9.

25 grammes of each sample were artificially matured in a bomb in the presence of water at a temperature of 340°C for 72 hours at a pressure equivalent to water vapour pressure at that temperature. Vitrinite reflectance values (Table A.I.2) of 1.12% Ro (110 m) and 1.14% Ro (115 m) suggest that both samples were matured to similar levels, equivalent to the end of the 'oil-window'.

The 110 m sample containing the more hydrogen-rich kerogen type yielded almost four times the amount of expelled pyrolysate fluid that the 115 m sample yielded (Tables A.I.3-6). The whole oil gas chromatograms indicate that the 110 m expelled pyrolysate is considerably more paraffinic in nature than the 115 m sample (Figure A.I.1). This is reflected also in the higher aromatic hydrocarbon content of the latter sample. Both whole oil gas chromatograms show an oil-like, unimodal n-alkane distribution.

The pyrolysate gas of the 110 m sample has a hydrocarbon content of around 25%, whereas the hydrocarbon content of the 115 m pyrolysate gas is slightly lower at about 20%. The hydrocarbon compositions of the gases are broadly similar (Table A.I.7).

The more naphthenic/aromatic nature of the 115 m expelled pyrolysate is well illustrated by the C₂-C₈ gas chromatogram (Figure A.I.2). Paraffinicity indices (after Thompson, 1978) of 0.76 (110 m) and 0.72 (115 m) suggest thermally mature oils and are consistent with the appearance of the whole oil gas chromatograms.

The saturated hydrocarbon gas chromatograms (Figure A.I.3) of the expelled

pyrolysate show similar oil-like, unimodal n-alkane profiles with peaks decreasing from a maximum at nC_{15} . The 115 m pyrolysate has a relatively higher isoprenoid content than the 110 m pyrolysate, possibly reflecting the slightly more terrestrial nature of the kerogen in the 115 m sample.

Figure A.I.4 compares the n-alkane and isoprenoid composition of the sample extracts/expelled pyrolysates. The main change in the n-alkane composition of the samples during artificial maturation is a depletion in the height of the nC_{26+} n-alkanes and an increase and levelling in the height of the nC_{15} - nC_{20} n-alkanes. A similar change is seen in the isoprenoid composition of the samples, both samples having similar normalised isoprenoid compositions both before and after hydrous pyrolysis.

No recognisable compound groups were observed in the aromatic hydrocarbon gas chromatograms, probably reflecting the artificial maturation process (Figure A.I.5).

The GC-MS fragmentograms of the expelled pyrolysate show a number of differences from those of the unpyrolysed samples which can be attributed to an increase in thermal maturity (Figures A.I.6 and A.I.7). These include an increased diasterane content and a marked reduction in the height of the regular sterane peaks. The main difference in the m/z 191 fragmentograms lies in the increased prominence of the trisnorhopane and norhopane peaks (peaks B and C) and in the equilibration of the homohopane epimers. The appearance of the expelled pyrolysate fragmentograms is similar to those obtained from the migrated EOM at 126.5 m and 135.95 m in core U-8.

The hydrous pyrolysate obtained from the 115 m sample differs from the unpyrolysed extract in more prominent tricyclic terpane and hopane peaks, particularly norhopane, in the m/z 191 fragmentogram (Figure A.I.6). The sterane m/z 217 fragmentogram of the expelled pyrolysate fluid (Figure A.I.7) is largely dominated by diasterane peaks, which are developed to a relatively greater extent than was seen in the migrated EOM from 126.5 m and 135.95 m in core U-8. These changes reflect the increased maturity of the pyrolysate fluid, although given the unnatural means of maturation, the GC-MS data must be used cautiously.

The expelled pyrolysate fraction of the 110 m sample shows similar isotopic values to the parent 110 m sample, the only significant difference being for the NSO fraction (Figure A.I.8). The extract fraction isotope profiles of the U-4 samples and the expelled pyrolysate fluid indicate that relatively little change in isotopic composition has occurred during hydrous pyrolysis. This is not unexpected given the closed nature of the hydrous pyrolysis system.

Carbon isotope data for the C_1 and C_2 pyrolysate gas components indicate an increase in the ^{12}C content of the pyrolysate gases relative to unpyrolysed gases from the same core. On Schoell's (1983) diagram in figure 9, the isotopic composition of the pyrolysate gases follows the maturity trend from that of the unpyrolysed samples.

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Artificial maturation of claystones from cores U-1 and U-4

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- Table A.I.1: Data from Rock-Eval pyrolysis.
- Table A.I.2: Vitrinite reflectance data.
- Table A.I.3: Weight of expelled pyrolysate and chromatographic fractions.
- Table A.I.4: Concentration of expelled pyrolysate and chromatographic fractions.
- Table A.I.5: Concentration of expelled pyrolysate and chromatographic fractions.
- Table A.I.6: Composition of material expelled from the rock
- Table A.I.7: Composition of hydrous pyrolysate gases.
- Table A.I.8: Tabulation of data from gas chromatograms.
- Table A.I.9: Molecular ratios from sterane and terpane mass chromatograms: Maturity ratios.
- Table A.I.10: Molecular ratios from sterane and terpane mass chromatograms: Maturity and source characteristic ratios.
- Table A.I.11: Gas composition of C₁-C₇ hydrocarbons in pyrolysate gas and carbon isotope data.
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- Figure A.I.2: Gas chromatograms of C₂-C₈ hydrocarbons of expelled pyrolysate.
- Figure A.I.3: Saturated hydrocarbon gas chromatograms of expelled pyrolysates.
- Figure A.I.4: Comparison of n-alkane and isoprenoid composition of sample extract before hydrous pyrolysis and expelled pyrolysates.
- Figure A.I.5: Aromatic hydrocarbon gas chromatograms of expelled pyrolysates.
- Figure A.I.6: Mass chromatograms of terpanes (m/z 191) for expelled pyrolysates.
- Figure A.I.7: Mass chromatograms of steranes (m/z 217 and 218) for expelled pyrolysates.
- Figure A.I.8: Carbon isotope expelled pyrolysate fraction profiles.
- Figure A.I.9: Carbon isotopic composition of pyrolysate gases.
- Figure A.I.10: Vitrinite reflectance histograms.

Table A.I.1: Data from Rock-Eval pyrolysis.

I	:	HYDR.	OXYGEN	PETROLEUM	PROD.	TEMP.	I								
I	IKU	DEPTH	:	S1	S2	S3	TOC	INDEX	INDEX	POTENTIAL	INDEX	MAX	I		
I	No.	:	:	:	:	:	:	:	:	:	S1	:	I		
I	:	:	:	:	:	:	:	:	:	:	-----	:	I		
I	m/ft	:	(	mg/g	ROCK	)	(%)	(	mg/g	TOC	)	S1+S2	S1+S2	(C)	I
I	=====	:	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	I	
I	:	:	:	:	:	:	:	:	:	:	:	:	:	I	
I	C 4799	110	:	0.95	40.72	0.20	7.72	527	3	41.67	0.02	427	:	I	
I	7323/7-U-1	:	:	:	:	:	:	:	:	:	:	:	:	I	
I	C 4873	115	:	0.64	13.31	0.34	3.59	371	9	13.95	0.05	421	:	I	
I	7323/7-U-4	:	:	:	:	:	:	:	:	:	:	:	:	I	

DATE : 15 - 12 - 86.

Well Identification: 7323/7-U-1
 Reference number: 21.3420.06
 (1/1)

Table A.I.2: Vitrinite reflectance data.

IKU NO	LOCATION	DEPTH (M)	VITRINITE REFLECTANCE	REL RAT	STANDARD DEVIATION	FLUORE- SCENCE
C 4799	----	110	0.45 (17) 0.18 (1) 0.83 (1)	G S R	0.11 0.00 0.00	2-4
C 5460	----	110	1.12 (18) 0.78 (1) 1.90 (1)	F P R	0.19 0.00 0.00	---
HY-PY						

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

HY-PY: Sample artificially matured by hydrous pyrolysis.

Well Identification: 7323/7-U-4

Reference number: 21.3420.06

(1/1)

Table A.I.2

VITRINITE REFLECTANCE DATA

IKU NO	LOCATION	DEPTH (M)	VITRINITE REFLECTANCE	REL RAT	STANDARD DEVIATION	FLUORE- SCENCE
C 4873	----	115	0.34 (9) 0.63 (10) 0.88 (2)	P R R	0.07 0.06 0.08	4-5
C 5461	----	115	1.14 (12) 0.88 (2) 1.44 (6)	F P R	0.10 0.02 0.07	---
HY-PY						

REL RAT (Reliability Rating): G = Good; F = Fair; P = Poor

S = Stained; R = Reworked.

HY-PY: Sample artificially matured by hydrous pyrolysis.

Project no.: 21.3420.06
 Well ident.: 7323/7-U-1 / 7323/7-U-4
 DATE: 27-11-86, corrected 28-MAY-2009

Corrected replacement of

Table A.I.3: Weight of expelled pyrolysate and chromatographic fractions.

IKU-No.	Core	Depth	Rock weight	EOM	SAT	ARO	HC	Non HC	TOC
		(m)	(g)	(mg)	(mg)	(mg)	(mg)	(mg)	(%)
C5460	7323/7-U-1	110.02	25.0	467.3	68.1	76.9	145.0	322.3	7.46
C5461	7323/7-U-4	115	25.0	135.8	18.2	50.4	68.6	67.2	3.02

Project no.: 21.3420.06
Well ident.: 7323/7-U-1/7323/7-U-4
DATE : 27 - 11 - 86.

Table A.I.4: Concentration of expelled pyrolysate and chromatographic fractions.

I		:					
I	IKU-No	DEPTH	:	EOM	Sat.	Pro.	HC
I		(m)	:				Non HC
I			:				
I	C 5460	110.02	:	18694	2726	3076	5802
I	7323/7-U-1		:				12892
I	C 5461	115	:	5432	728	2016	2744
I	7323/7-U-4		:				2688

Project no.: 21.3420.06
 Well ident.: 7323/7-U-1 / 7323/7-U-4
 DATE: 27-11-86, corrected 28-MAY-2009

Corrected replacement of

Table A.I.5: Concentration of expelled pyrolysate and chromatographic fractions.

IKU-No.	Core	Depth	EOM	SAT	ARO	HC	Non HC
		(m)	(mg / g TOC)	(mg / g TOC)	(mg / g TOC)	(mg / g TOC)	(mg / g TOC)
C5460	7323/7-U-1	110.02	250.6	36.5	41.2	77.7	172.9
C5461	7323/7-U-4	115	179.9	24.1	66.8	90.9	89.0

Project no.: 21.3420.06
Well ident.: 7323/7-U-1/7323/7-U-4
DATE : 27 - 11 - 86.

Table A.I.6: Composition of material expelled from the rock (27.11.86).

I			:	Sat	Aro	HC	SAT	Non HC	HC	I
I	IKU-No	DEPTH	:	---	---	---	---	---	---	I
I			:	EOM	EOM	EOM	Aro	EOM	Non HC	I
I		(m)	:	%	%	%	x 100	%	x 100	I
I			:							I
I	C 5460	110.02	:	14.6	16.5	31.0	88.6	69.0	45.0	I
I	7323/7-U-1		:							I
I	C 5461	115	:	13.4	37.1	50.5	36.1	49.5	102.1	I
I	7323/7-U-4		:							I

Table A.I.7: Composition of hydrous pyrolysate gases.

IKU No	C-5460		C-5461	
	ppm/total gas (vol)	%	ppm/total gas (vol)	%
Oxygen	102371.29	10.23	93505.91	9.35
Nitrogen	420022.69	42.02	376907.34	37.69
CO2	213847.70	21.38	339200.12	33.92
Methane	30903.69	3.09	15030.10	1.50
Ethane	21856.15	2.19	8621.96	0.86
Propane	12505.20	1.25	5066.28	0.51
i-Butane	1905.16	0.19	894.13	0.09
Butene	677.83	0.07	538.63	0.05
n-Butane	3128.86	0.31	1243.01	0.12
neo-C5	421.02	0.04	271.39	0.03
i-Pentane	695.08	0.07	382.69	0.04
n-Pentane	708.24	0.07	386.37	0.04
DCM	93.06	>0.10	106.91	0.01
Cyclo-C5	73.63	>0.10	0.00	0.00
1,2,3-diMeC4	144.87	0.01	121.97	0.01
n-Hexane	160.61	0.02	98.17	0.01
triMeC4	83.17	>0.01	0.00	0.00

Table A.I.8: Tabulation of data from gas chromatograms.

I		DEPTH	:	PRISTANE	PRISTANE	PHYTANE	A	n-C17	I
I	IKU No.		:	-----	A = -----	B = -----	-----	-----	CPI I
I		(m)	:	PHYTANE	n-C17	n-C18	B	n-C27	I
I			:						I
I	C 5460	110.02	:	1.7	0.8	0.6	1.4	2.9	1.1 I
I	7323/7-U-1		:						I
I	C 5461	115	:	1.7	1.5	0.9	1.5	3.1	1.1 I
I	7323/7-U-4		:						I

DATE : 24 - 11 - 86.

Table A.I.9: Molecular ratios from sterane and terpane mass chromatograms.¹
Maturity ratios.

IKU code	Well/depth	$\alpha\beta/\alpha\beta+\beta\alpha$ ¹⁾	%22S ²⁾	%20S ³⁾	% $\beta\beta$ ⁴⁾
<u>Hy-Py</u>					
C-5460	110 m	0.70	55.6	44.0	71.3
C-5461	115 m	0.74	58.8	40.9	73.2

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

2) Average % distribution between first and second eluting isomers of extended hopanes (G-M in m/z 191)

3) q/q+t in m/z 217

4) $2(r+s)/(q+t+2(r+s))$ in m/z 217

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

IKU no.	Well/depth	Q/E ¹⁾	T _m /T _s ²⁾	X/E ³⁾	Z/E ⁴⁾	a/a+j ⁵⁾
<u>Hy-Py</u>						
C-5460	110 m		8.5	-	-	0.75
C-5461	115 m	0.47	6.9	-	-	0.81

- 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 C₂₇ rearranged steranes (a/a+j in m/z 217)

Table A.I.11: Gas composition of the hydrocarbons C_1 to C_7 of hydrous pyrolysate gas samples (Vol %).

Sample no.	Depth	C_1	C_2	C_3	iC_4	nC_4	2.2DMP	iC_5	nC_5	C_6	C_7	Ethen
------------	-------	-------	-------	-------	--------	--------	--------	--------	--------	-------	-------	-------

Well 7323/7-U-1

C-5460	110 m	52.23	22.52	12.49	2.06	3.80	0.17	1.11	1.28	1.94	0.29	1.10
--------	-------	-------	-------	-------	------	------	------	------	------	------	------	------

Well 7323/7-U-4

C-5461	115 m	57.13	19.82	11.41	1.90	3.41	0.02	0.87	1.62	1.73	0.42	1.66
--------	-------	-------	-------	-------	------	------	------	------	------	------	------	------

Table A.I.11. Gas ratios and isotope ratios of hydrocarbons from hydrous pyrolysate gas samples.

Sample no.	Depth (m)	$C_1/\Sigma C_n$	$C_1/(C_2+C_3)$	iC_4/nC_4	$\delta^{13}C_1$	$\delta^{13}C_2$	$\delta^2 C_1$
------------	-----------	------------------	-----------------	-------------	------------------	------------------	----------------

Well 7323/7-U-1

C-5460	110	0.5382	1.52	0.54	-42.5	-37.5	-299
--------	-----	--------	------	------	-------	-------	------

Well 7323/7-U-4

C-5461	115	0.5809	1.82	0.55	-40.5	-35.0	-261
--------	-----	--------	------	------	-------	-------	------

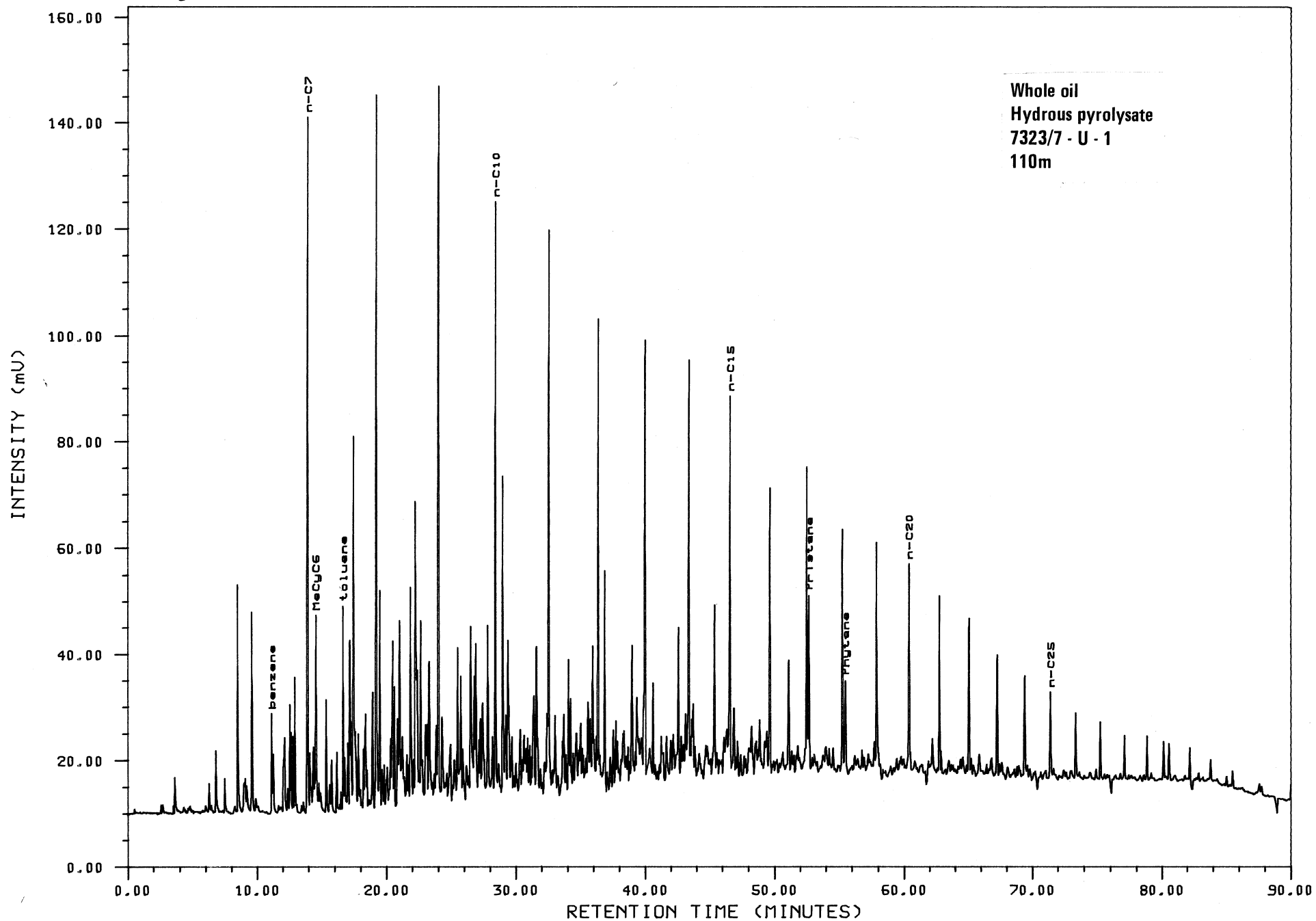
Table A.I.12: Carbon isotope data of extract fractions.

Sample no.	Depth	$\delta^{13}\text{C}$ SAT	$\delta^{13}\text{C}$ ARO	$\delta^{13}\text{C}$ ASP	$\delta^{13}\text{C}$ NSO	$\delta^{13}\text{C}$ WHOLE
<u>Hy-Py</u>						
C-5460	110 m	-31.42	-30.85	-29.48	-29.99	-30.90
C-5461	115 m	-31.58	-31.00	-29.90	-29.96	-31.13

Figure A.I.1: Whole oil gas chromatograms of expelled pyrolysates.

C ₁₀ etc.	- n-alkanes
Cy-C ₆	- cyclohexane
MeCy-C ₆	- methylcyclohexane
Pr	- pristane
Ph	- phytane

Analysis 420C5460T 2,1,1 DIAS,7323/7-1,TOT.OI



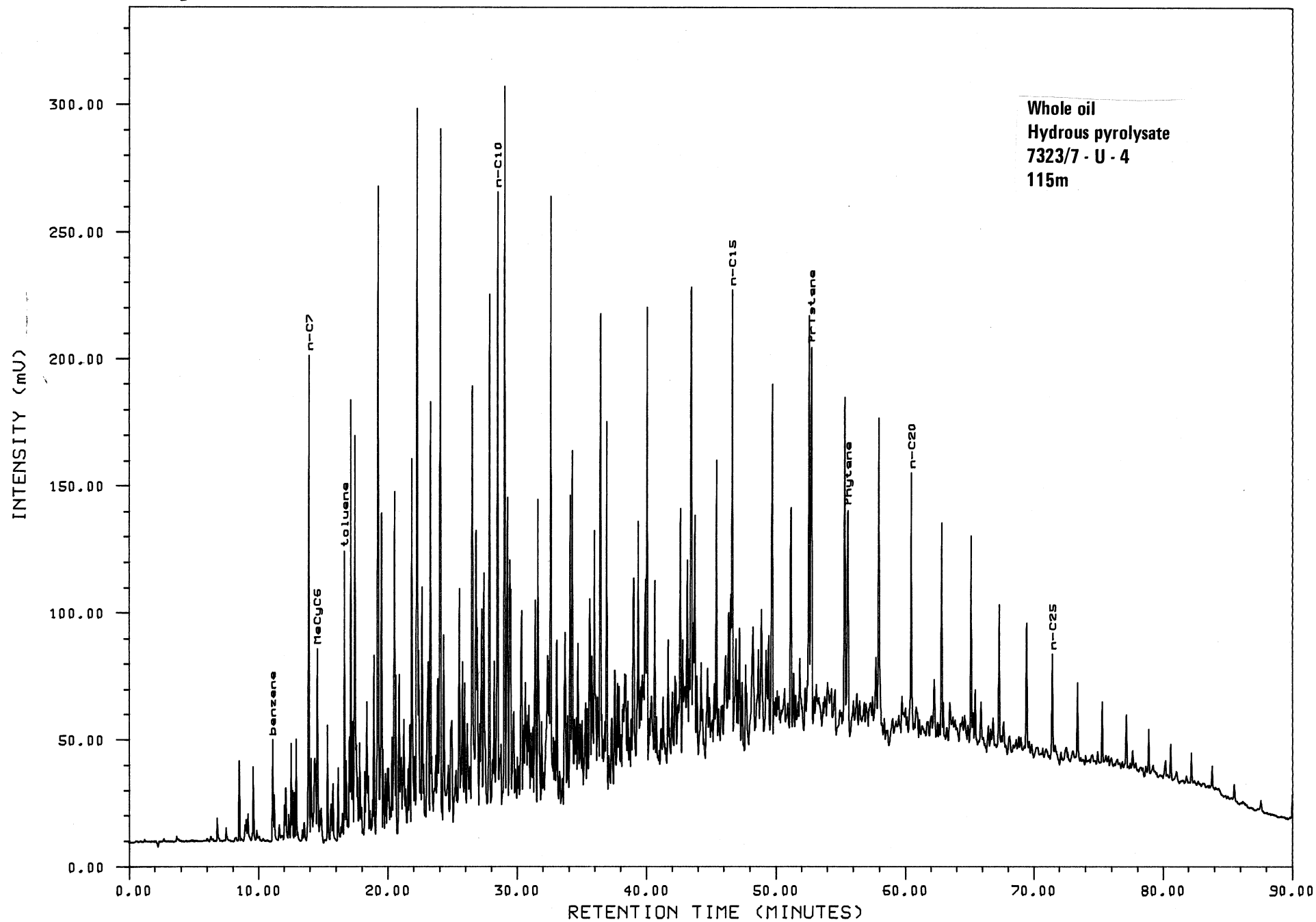
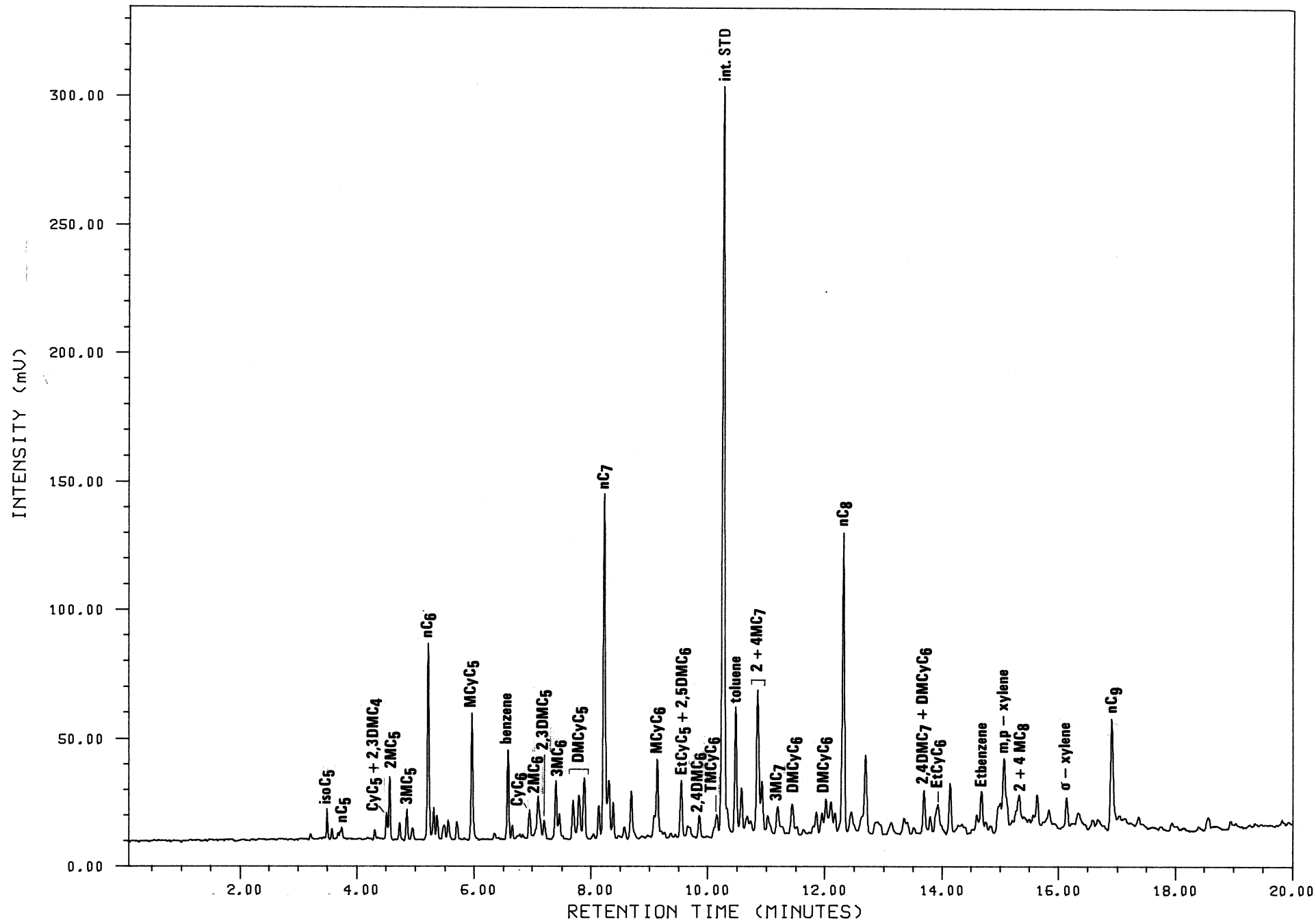


Figure A.I.2: Gas chromatograms of C_2 - C_8 hydrocarbons of expelled pyrolysate.



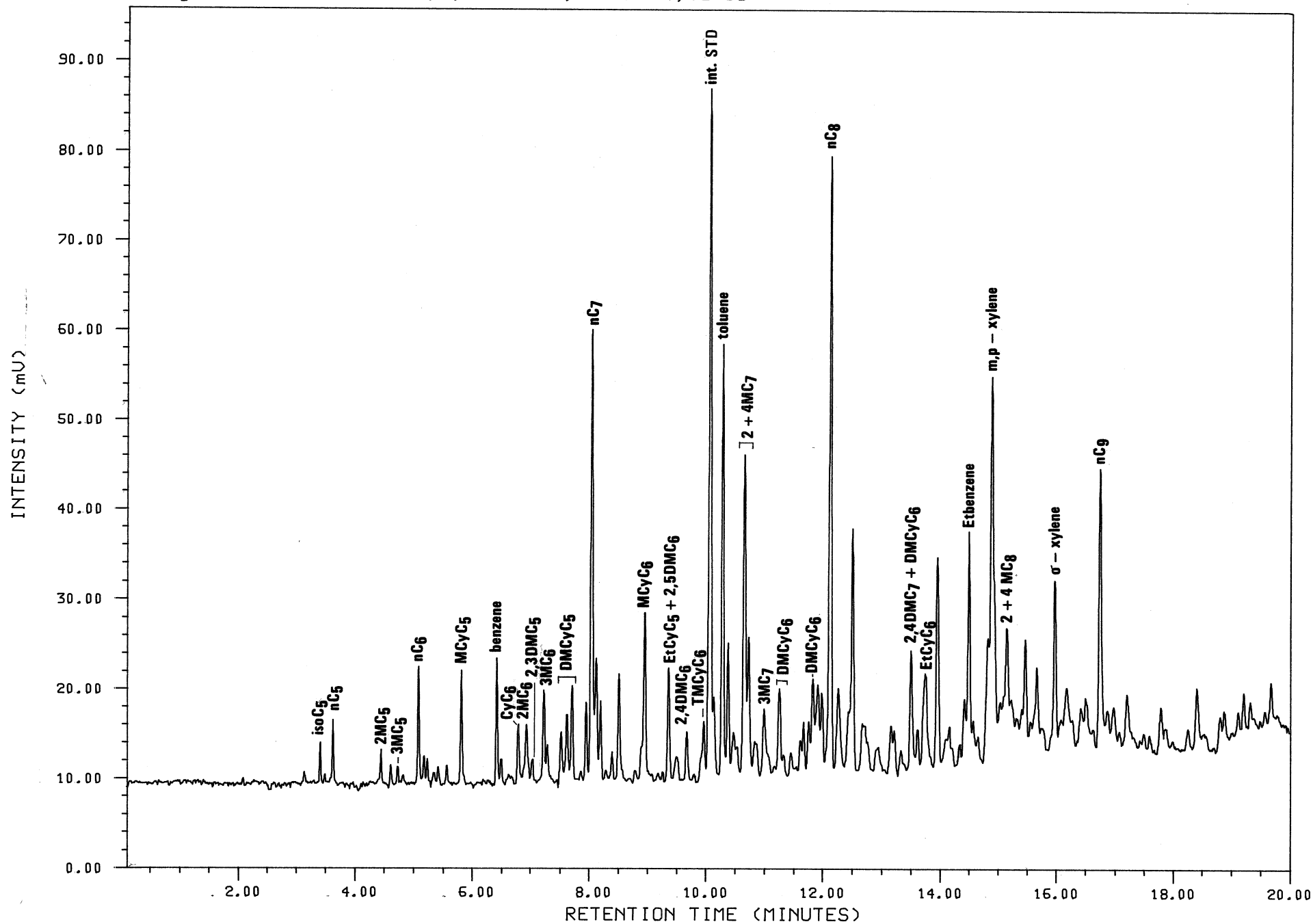


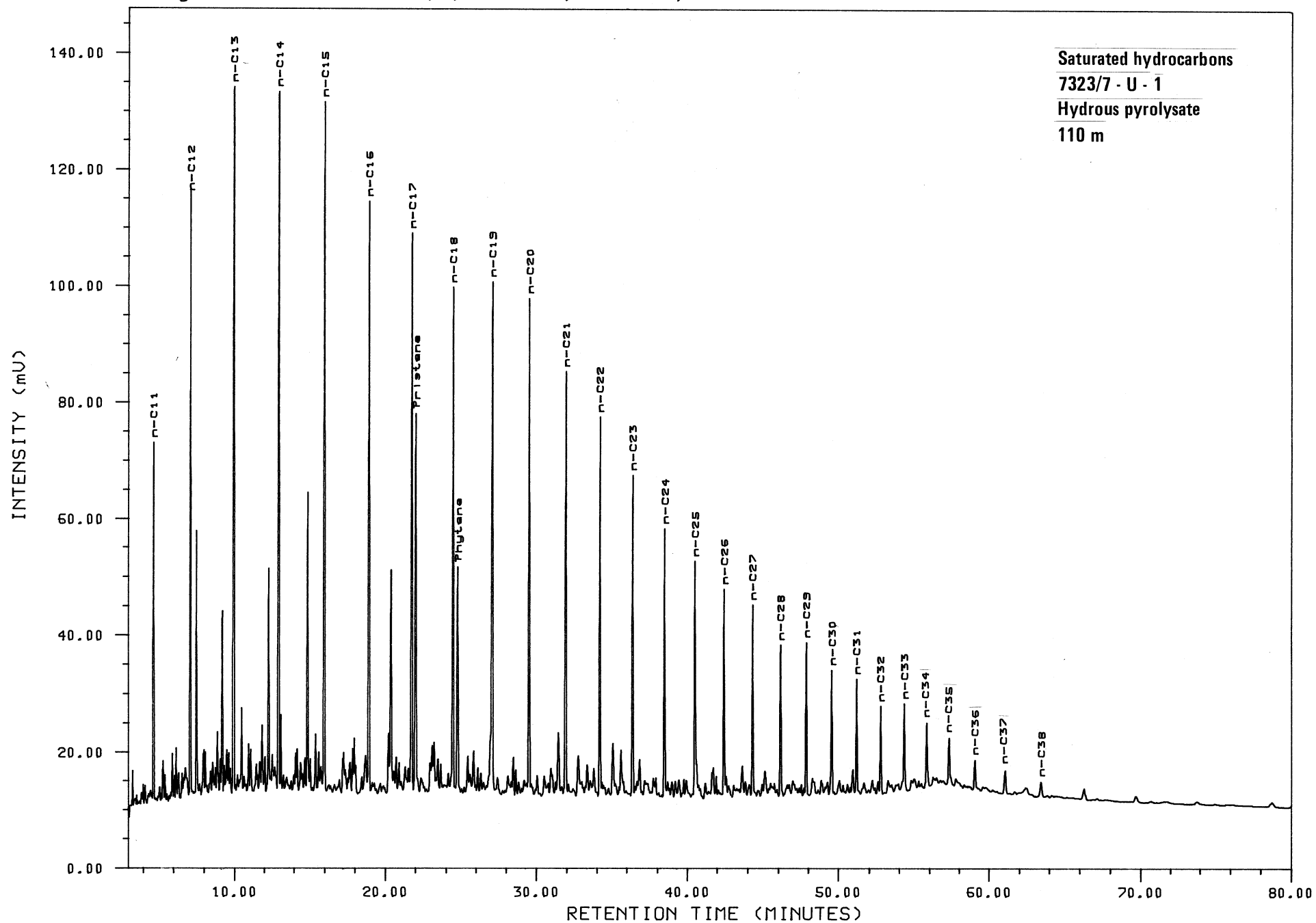
Figure A.I.3: Saturated hydrocarbon gas chromatograms of expelled pyrolysates.

n-C ₁₅ etc.	- n-alkanes
Pr	- pristane
Ph	- phytane
*	- other acyclic isoprenoids

Analysis 420C5460S

2,1,1

DIAS,7323/7-1,SAT



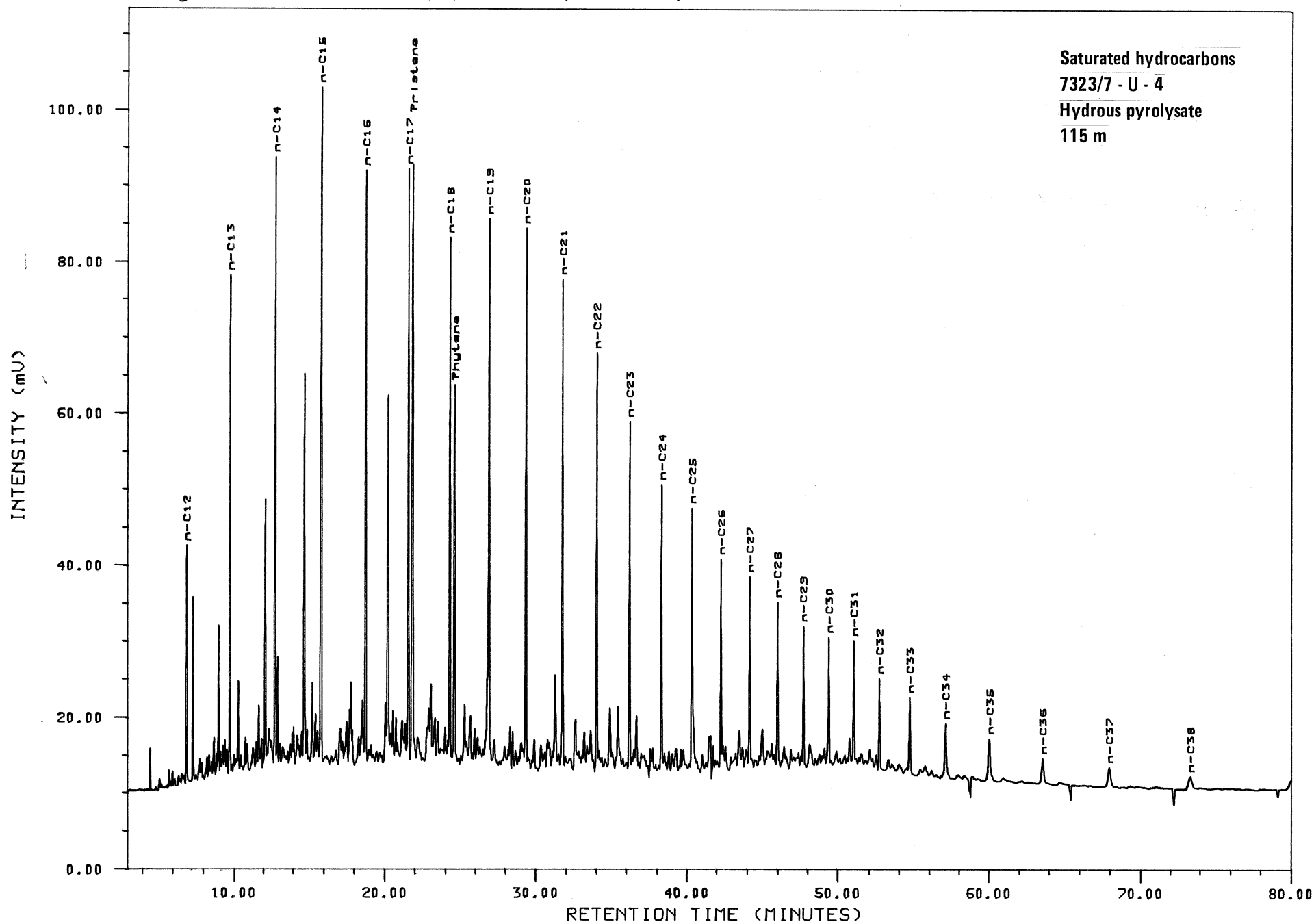


Figure A.I.4a: Comparison of n-alkane and isoprenoid composition of sample extract before hydrous pyrolysis and expelled pyrolysates.

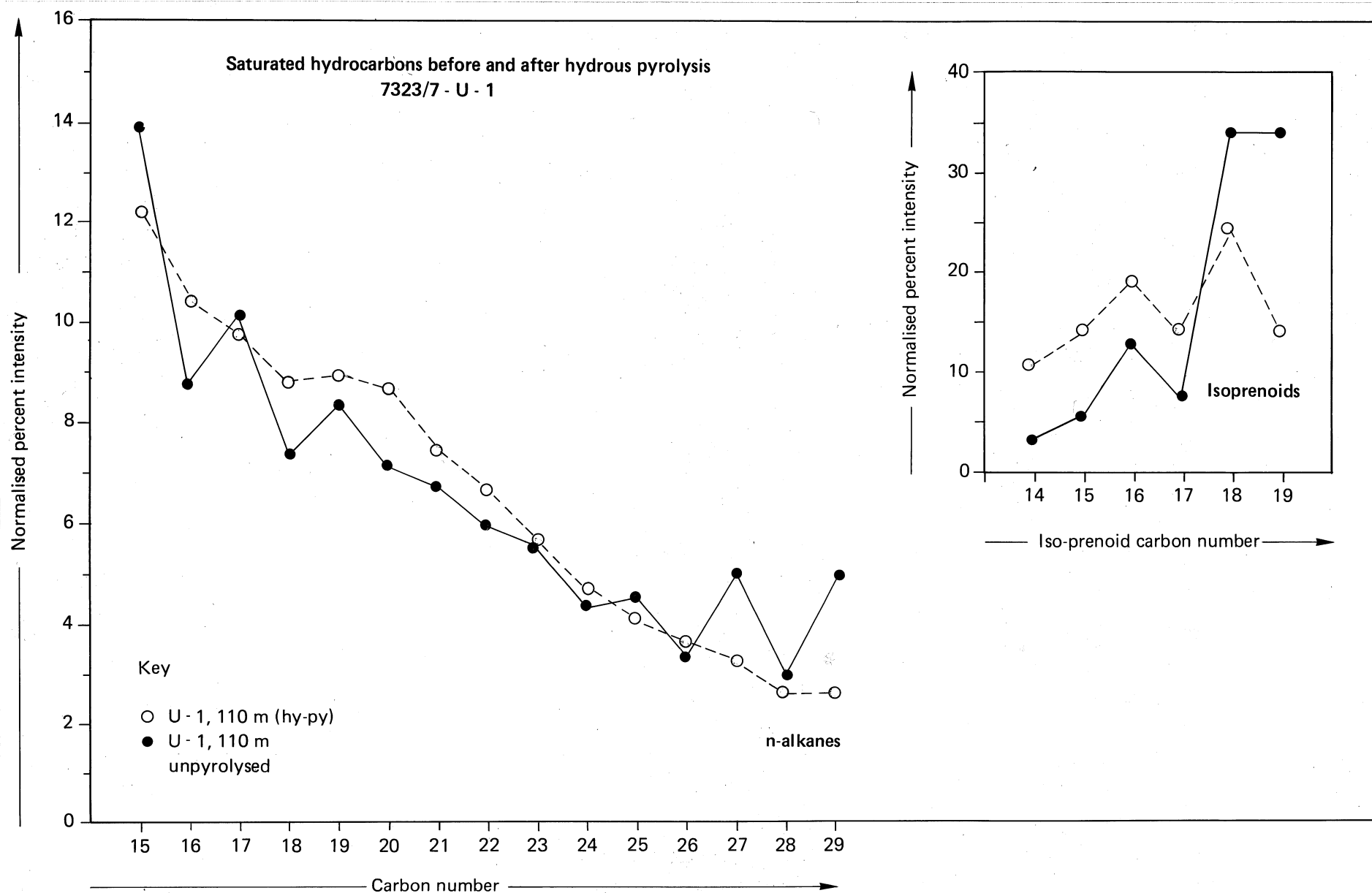


Figure A.I.4b: Comparison of n-alkane and isoprenoid composition of sample extract before hydrous pyrolysis and expelled pyrolysates.

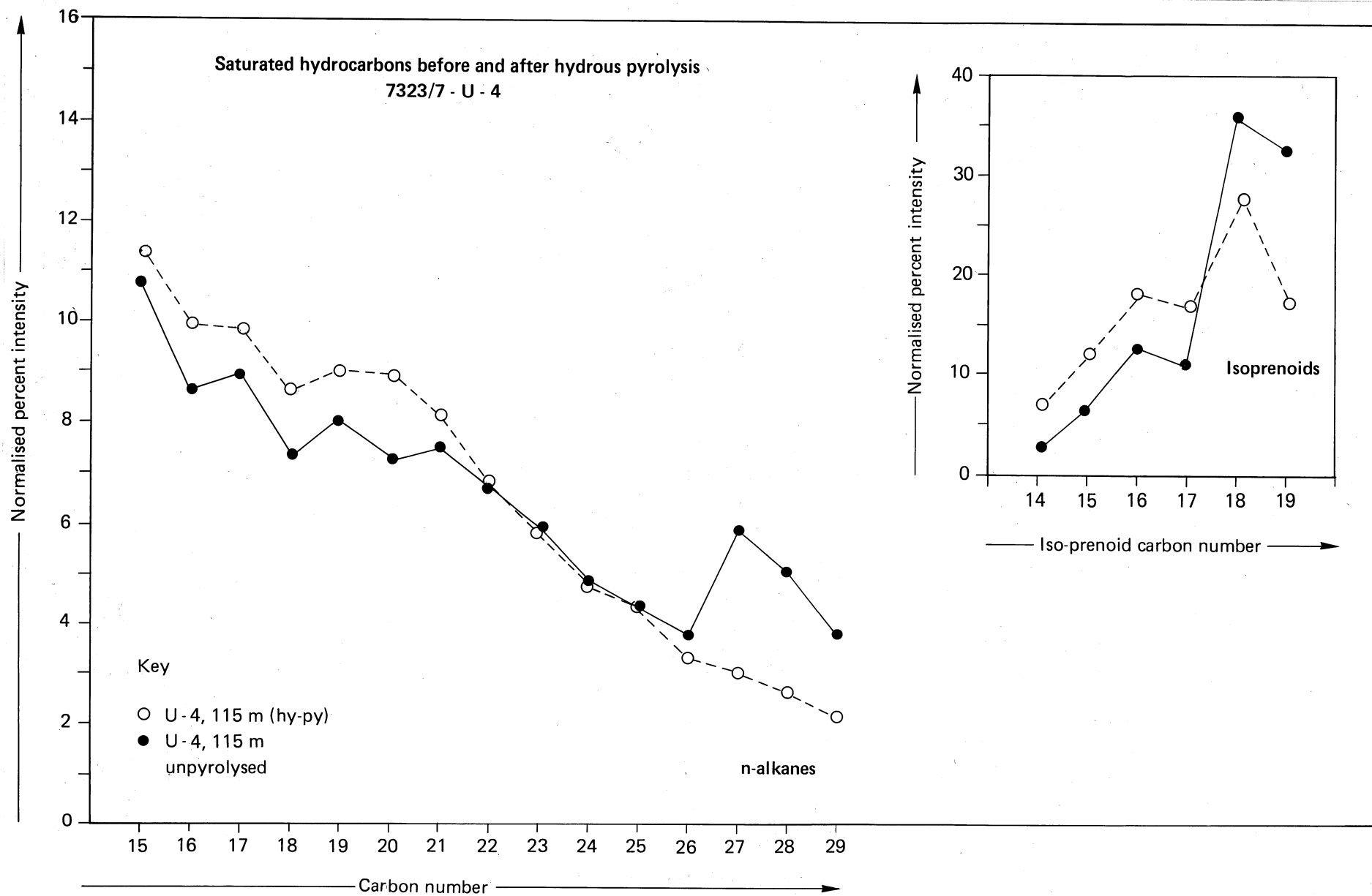
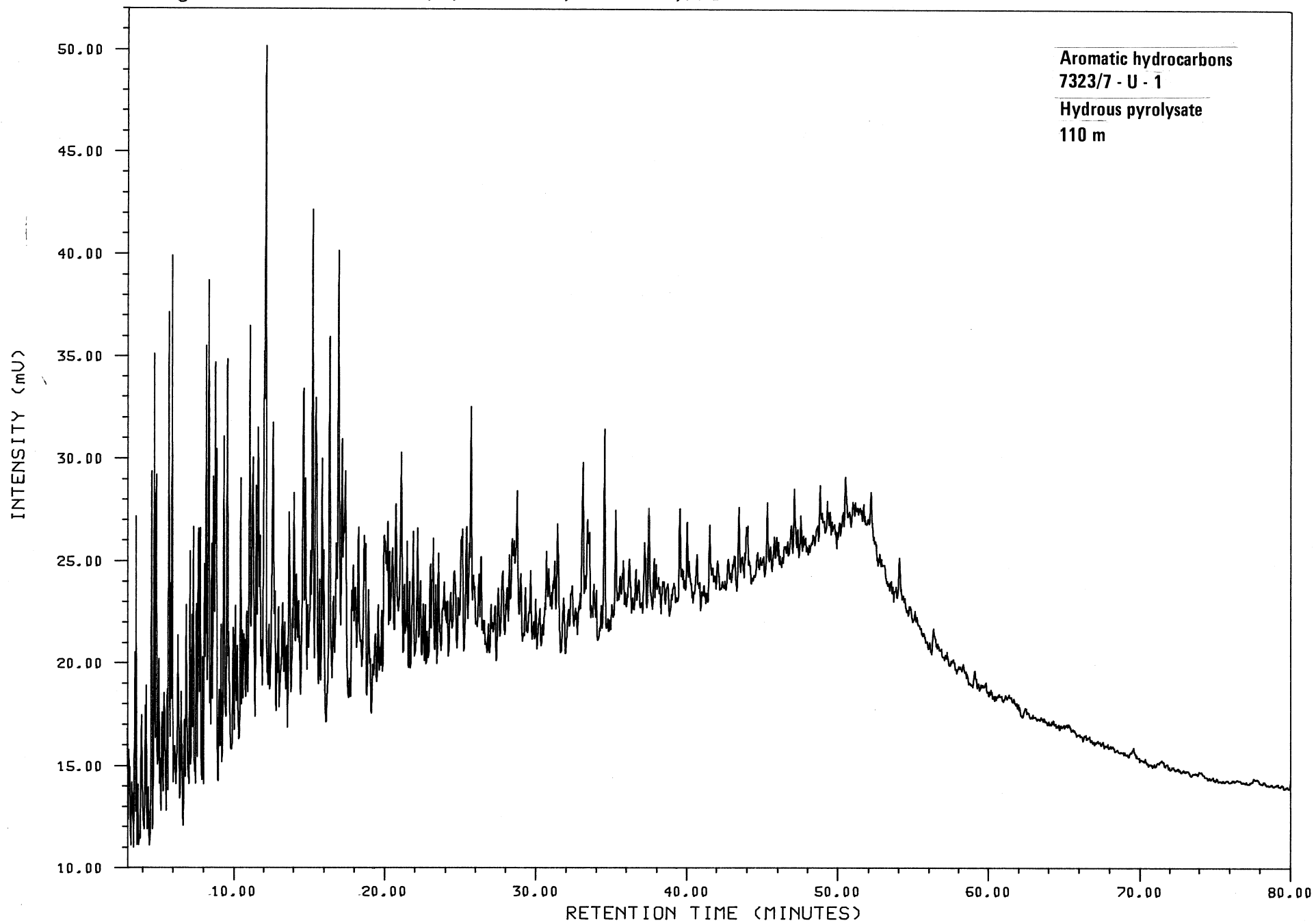


Figure A.I.5: Aromatic hydrocarbon gas chromatograms of expelled pyrolysates.

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

Analysis 420C5460A 2,1,1 DIAS,7323/7-1,ARO



Analysis 420C5461A 2,1,1 DIAS,7323/7-4,ARO

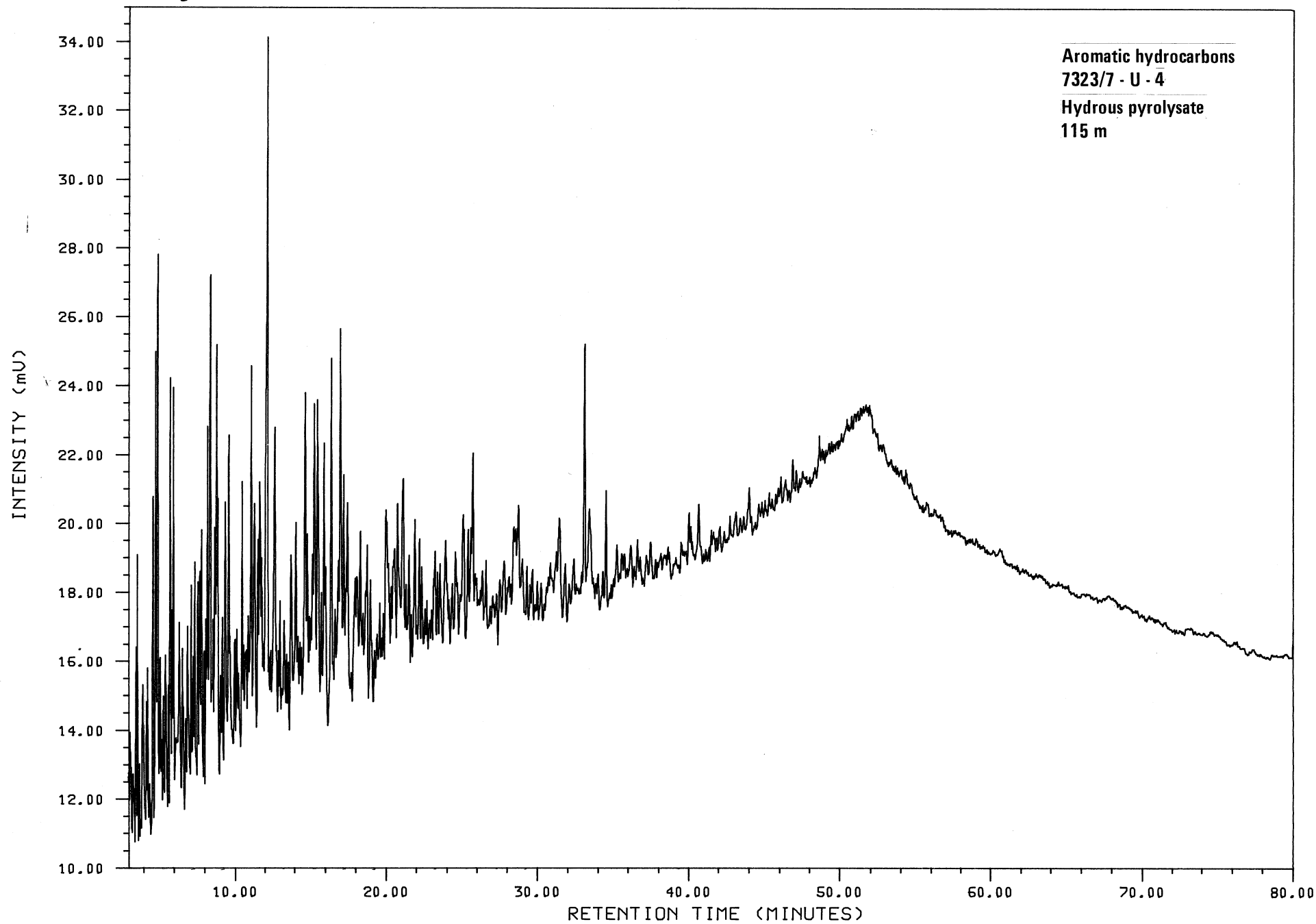
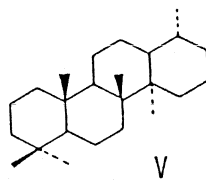
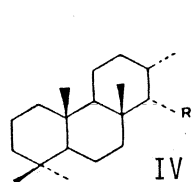
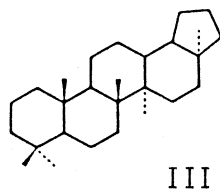
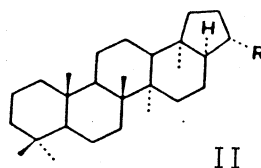
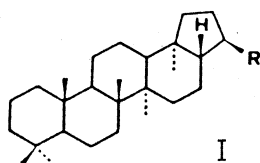


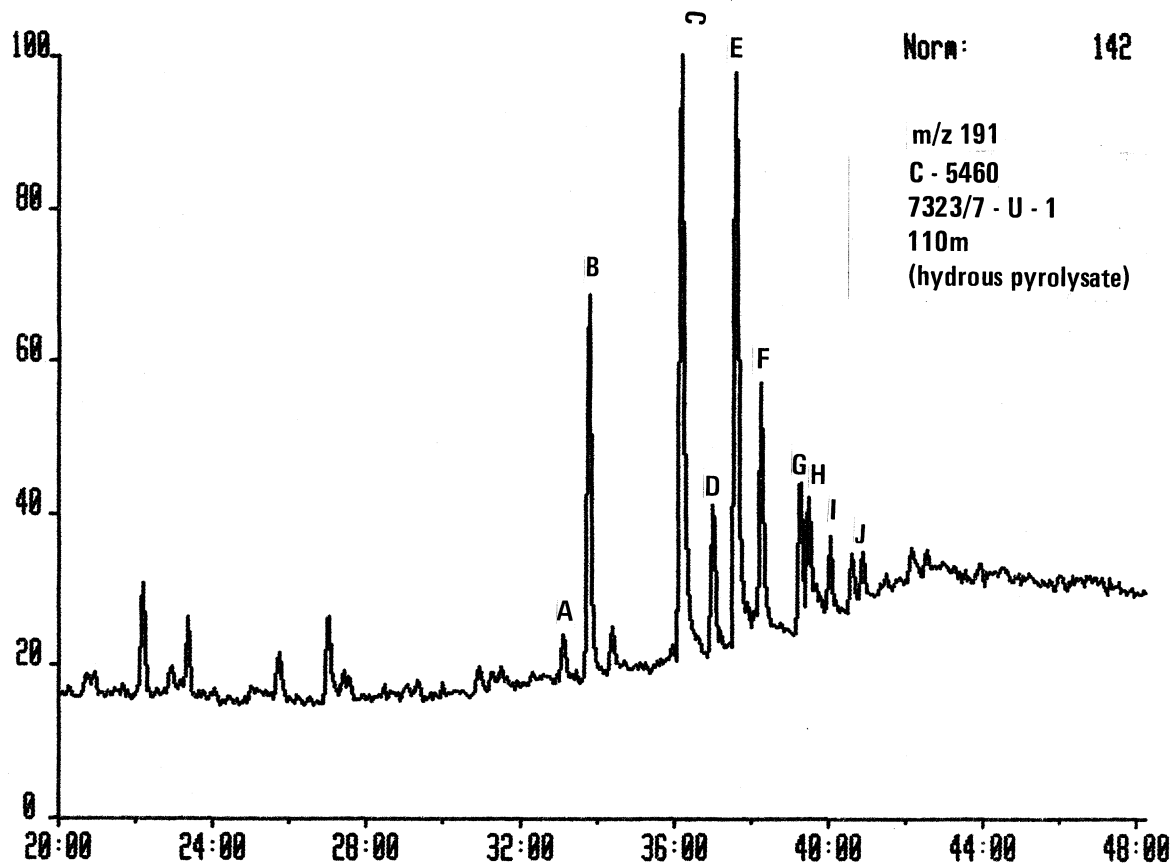
Figure A.I.6: Mass chromatograms of terpanes (m/z 191) for expelled pyrolysates.

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



C5460SAT 13-NOV-86 Sir:Voltage 7070H Acnt:IKU
 Sample 1 Injection 1 Group 1 Mass 191.1000
 Text:

System:TRIT



C5461SAT1 13-NOV-86 Sir:Voltage 7070H Rcnt:IKU
 Sample 1 Injection 1 Group 1 Mass 191.1000
 Text:

System:TRIT

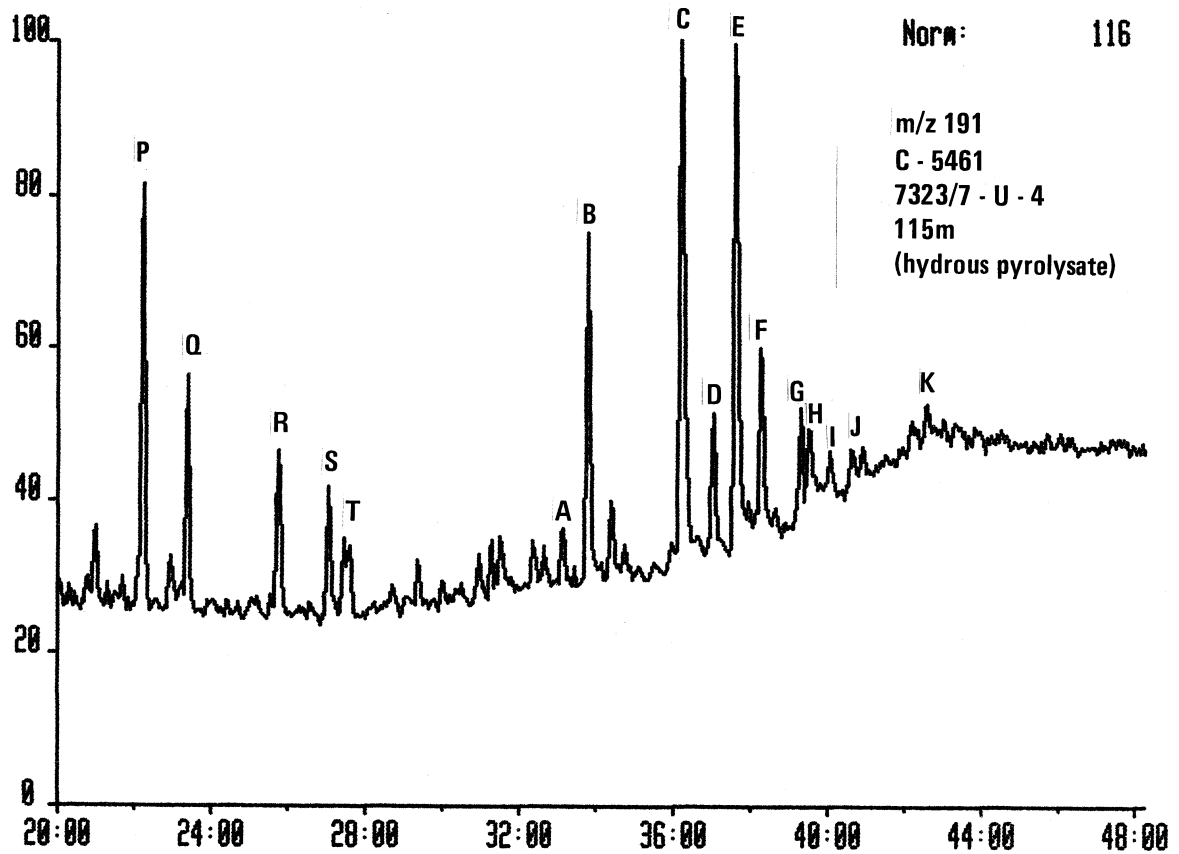
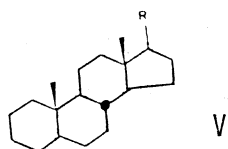
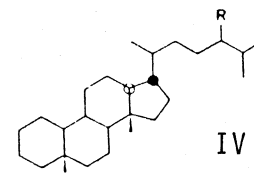
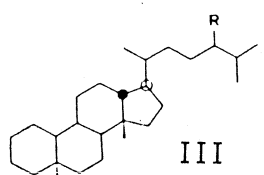
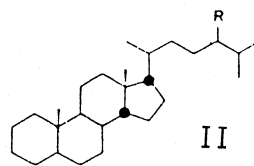
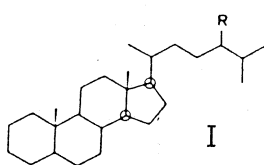


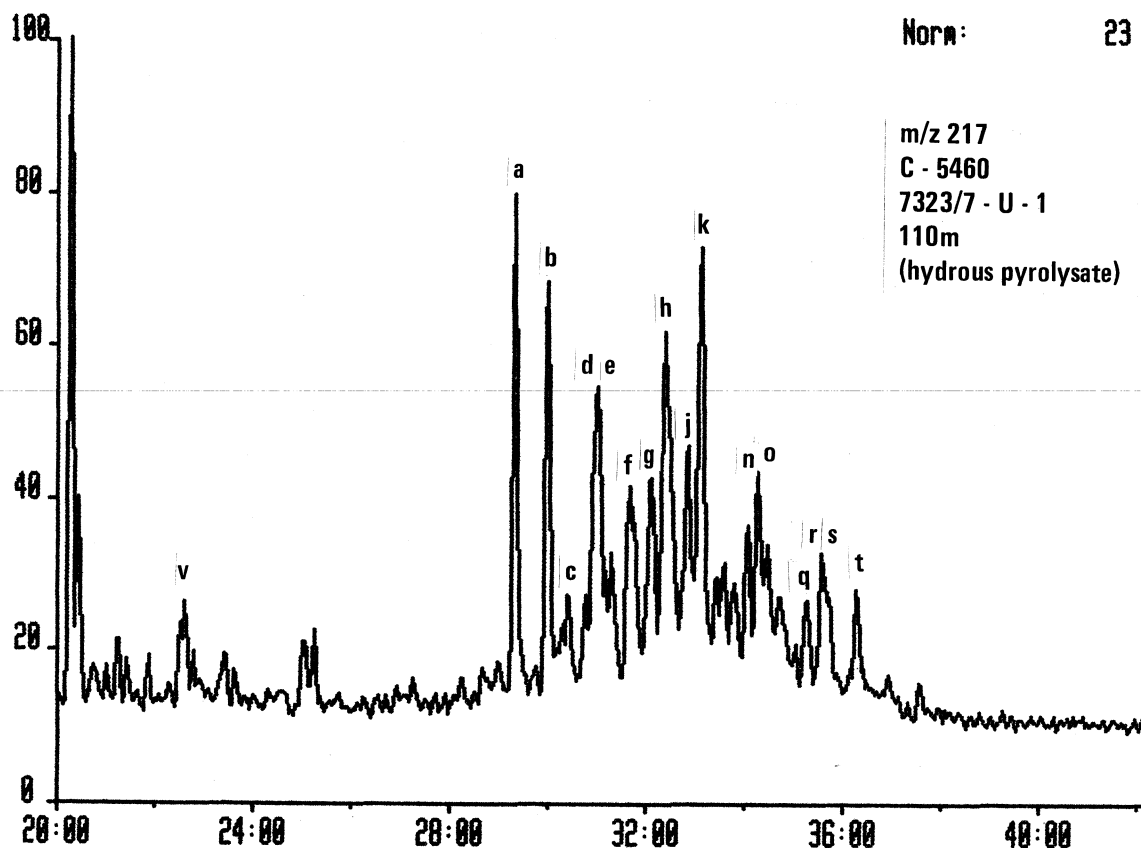
Figure A.I.7: Mass chromatograms of steranes (m/z 217 and 218) for expelled pyrolysates.

a	13 β (H),17 α (H)-diasterane (20S)	C ₂₇ H ₄₈	(III,R=H)
b	13 β (H),17 α (H)-diasterane (20R)	C ₂₇ H ₄₈	(III,R=H)
c	13 α (H),17 β (H)-diasterane (20S)	C ₂₇ H ₄₈	(IV,R=H)
d	13 α (H),17 β (H)-diasterane (20R)	C ₂₇ H ₄₈	(IV,R=H)
e	13 β (H),17 α (H)-diasterane (20S)	C ₂₈ H ₅₀	(III,R=CH ₃)
f	13 β (H),17 α (H)-diasterane (20R)	C ₂₈ H ₅₀	(III,R=CH ₃)
g	13 α (H),17 β (H)-diasterane (20S)	C ₂₈ H ₅₀	(IV,R=CH ₃)
	+ 14 α (H),17 α (H)-sterane (20S)	C ₂₇ H ₄₈	(I,R=H)
h	13 β (H),17 α (H)-diasterane (20S)	C ₂₉ H ₅₂	(III,R=C ₂ H ₅)
	+ 14 β (H),17 β (H)-sterane (20R)	C ₂₇ H ₄₈	(II,R=H)
i	14 β (H),17 β (H)-sterane (20S)	C ₂₇ H ₄₈	(II,R=H)
	+ 13 α (H),17 β (H)-diasterane (20R)	C ₂₈ H ₅₀	(IV,R=CH ₃)
j	14 α (H),17 α (H)-sterane (20R)	C ₂₇ H ₄₈	(I,R=H)
k	13 β (H),17 α (H)-diasterane (20R)	C ₂₉ H ₅₂	(III,R=C ₂ H ₅)
l	13 α (H),17 β (H)-diasterane (20S)	C ₂₉ H ₅₂	(III,R=C ₂ H ₅)
m	14 α (H),17 α (H)-sterane (20S)	C ₂₈ H ₅₀	(I,R=CH ₃)
n	13 α (H),17 β (H)-diasterane (20R)	C ₂₉ H ₅₂	(III,R=C ₂ H ₅)
	+ 14 β (H),17 β (H)-sterane (20R)	C ₂₈ H ₅₀	(II,R=CH ₃)
o	14 β (H),17 β (H)-sterane (20S)	C ₂₈ H ₅₀	(II,R=CH ₃)
p	14 α (H),17 α (H)-sterane (20R)	C ₂₈ H ₅₀	(I,R=CH ₃)
q	14 α (H),17 α (H)-sterane (20S)	C ₂₉ H ₅₂	(I,R=C ₂ H ₅)
r	14 β (H),17 β (H)-sterane (20R)	C ₂₉ H ₅₂	(II,R=C ₂ H ₅)
	+ unknown sterane		
s	14 β (H),17 β (H)-sterane (20S)	C ₂₉ H ₅₂	(II,R=C ₂ H ₅)
t	14 α (H),17 α (H)-sterane (20R)	C ₂₉ H ₅₂	(I,R=C ₂ H ₅)
u	5 α (H)-sterane	C ₂₁ H ₃₆	(V,R=C ₂ H ₅)
v	5 α (H)-sterane	C ₂₂ H ₃₈	(IV,R=C ₃ H ₇)



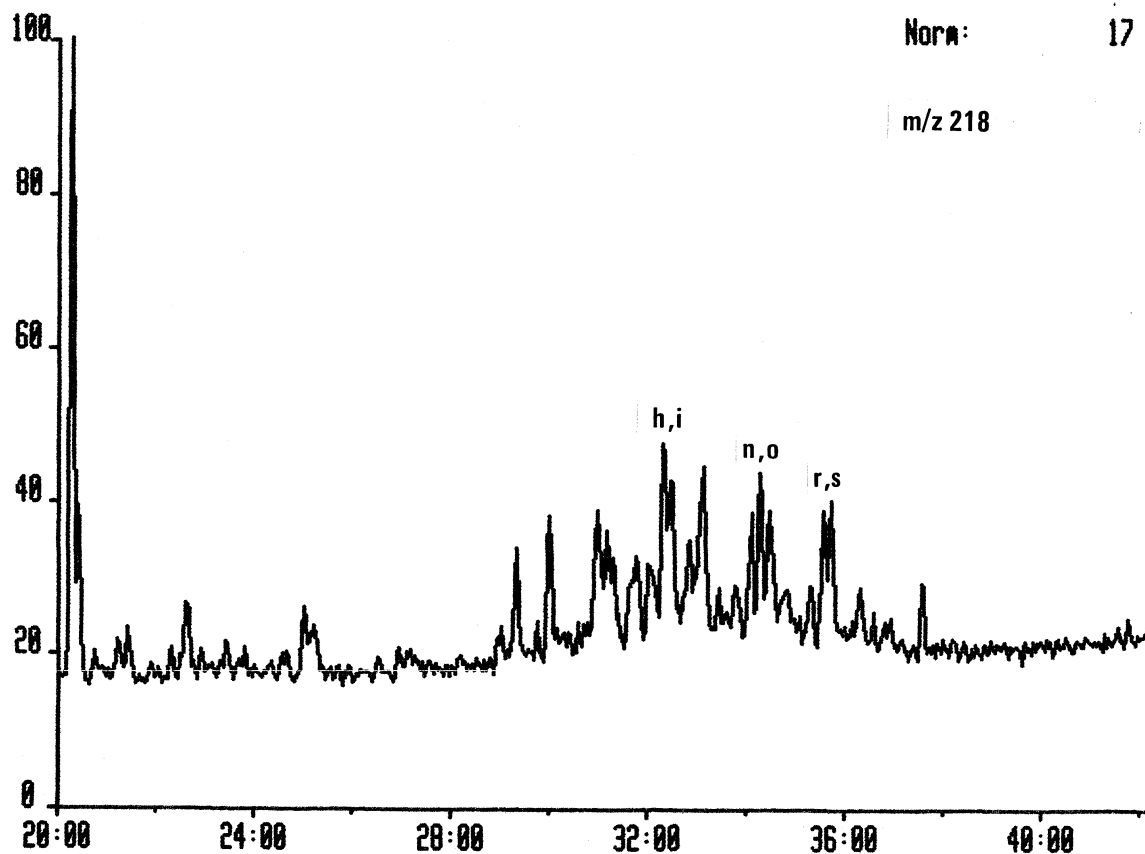
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Text:

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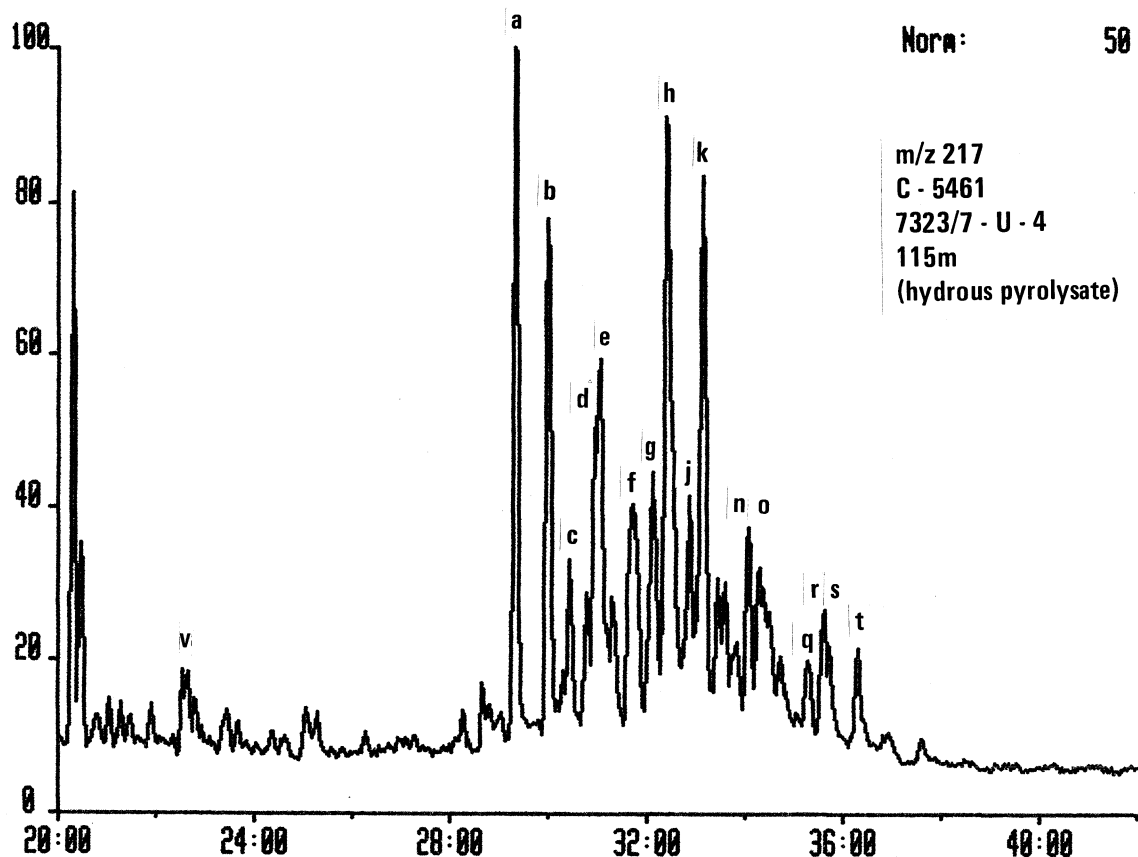
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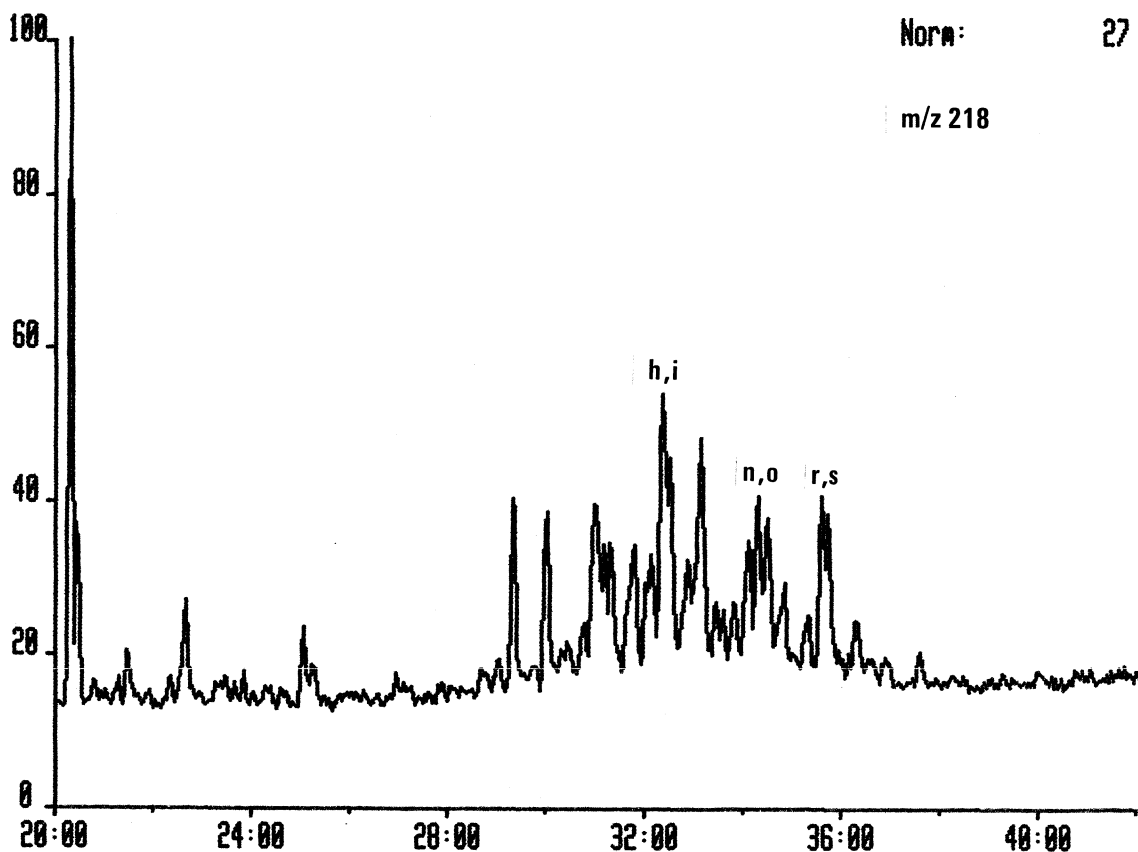
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 Sample 1 Injection 1 Group 1 Mass 218.1000
 Text:

System:TRIT



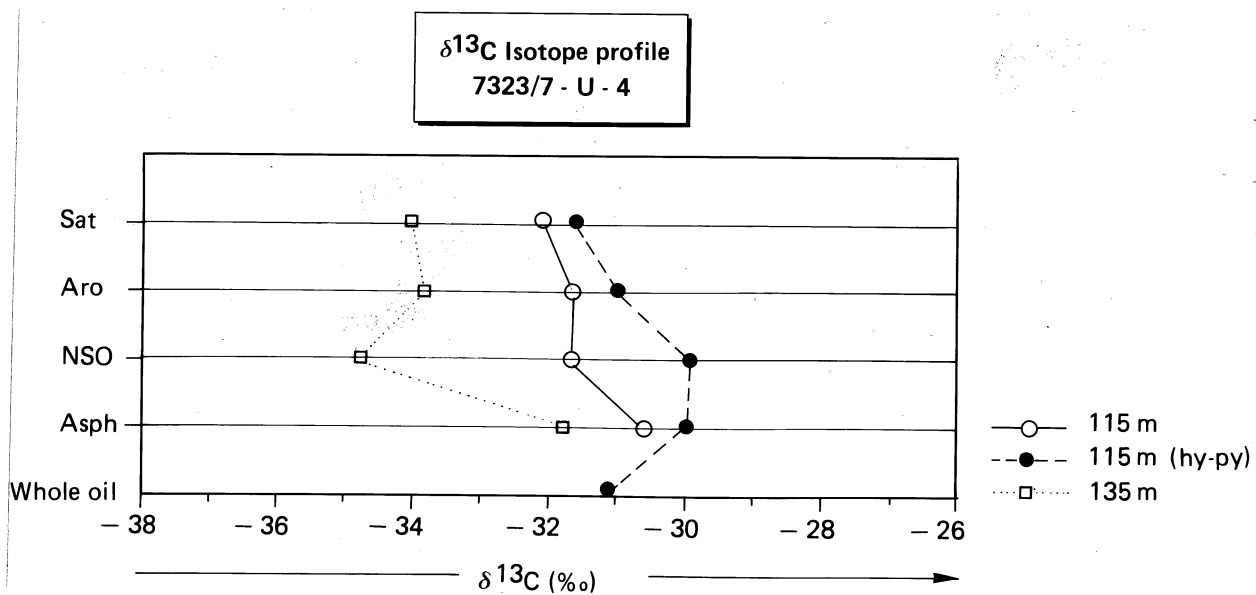
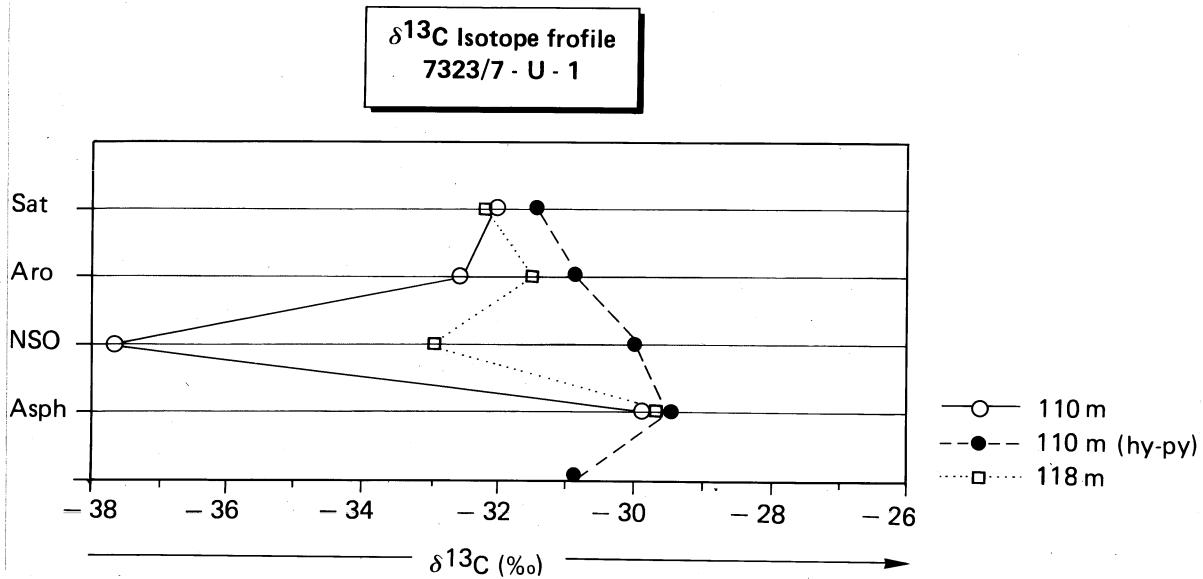


Figure A.I.8: Carbon isotope expelled pyrolysate fraction profiles.

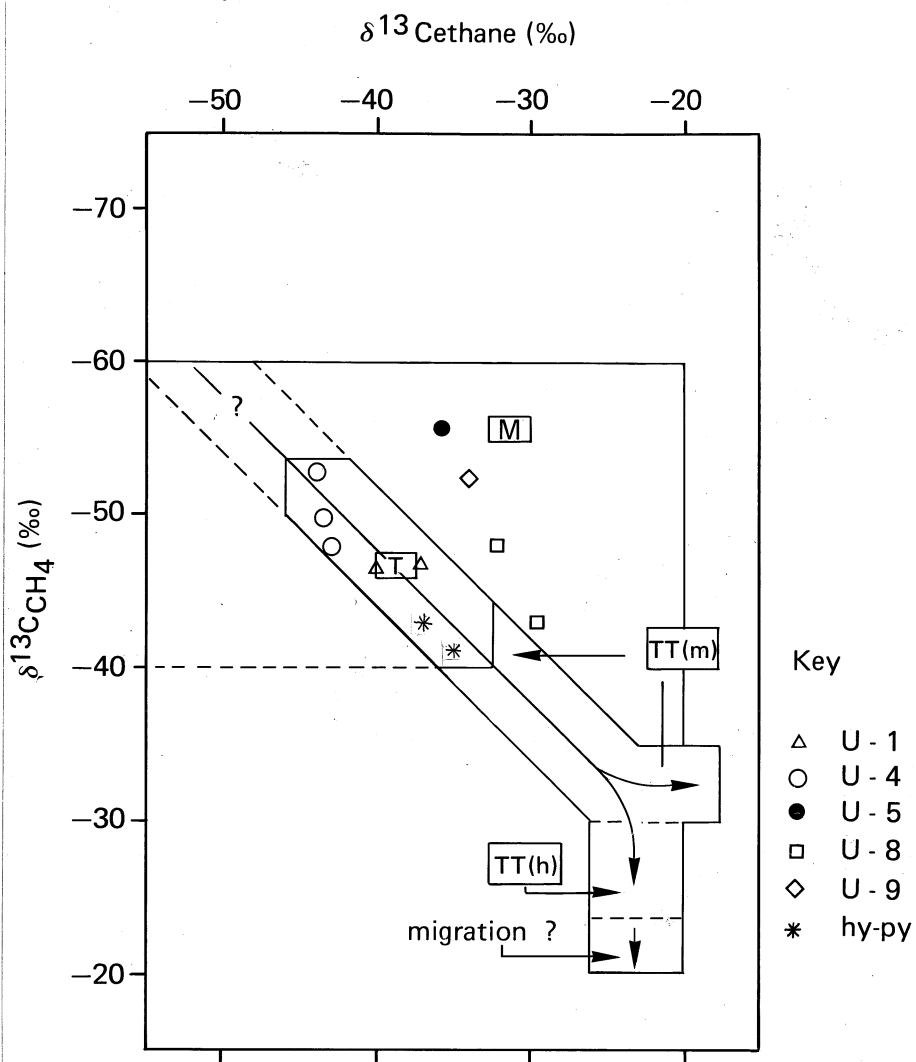
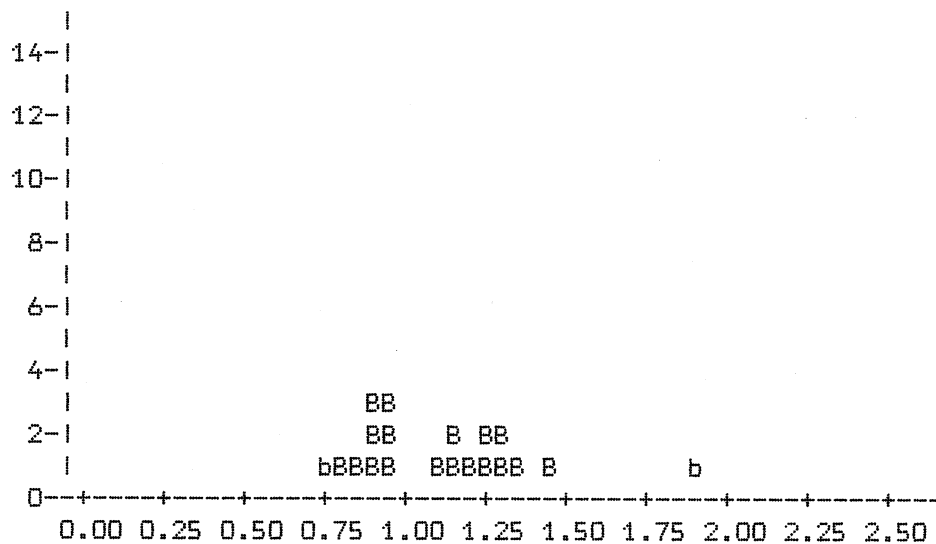


Figure A.I.9: Carbon isotopic composition of pyrolysate gases.

IKU# C-5460 110.0M U-1 HYPY



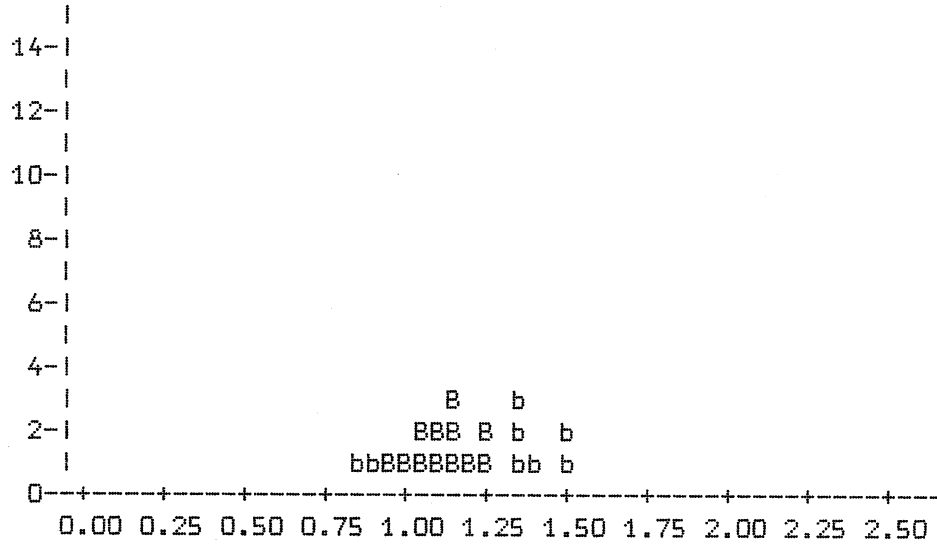
PP	LOW	HIGH	LIT	#VAL	MEAN	STDV
Y	0.84	1.46	ALL	18	1.12	0.19
N	0.78	0.79	ALL	1	0.78	0.00
N	1.90	1.91	ALL	1	1.90	0.00
OVERALL				20	1.14	0.27

ORDERED VALUES FOLLOW:

0.78b 0.84B 0.88B 0.90B 0.93B 0.94B 0.96B 0.98B 0.99B 1.11B 1.16B
 1.18B 1.23B 1.26B 1.27B 1.31B 1.34B 1.38B 1.45B 1.90b

Figure A.1.10 Vitrinite reflectance histograms.

IKU# C-5461 115.0M U-4 HYPY



PP	LOW	HIGH	LIT	#VAL	MEAN	STDV
Y	0.96	1.30	ALL	12	1.14	0.10
N	0.87	0.91	ALL	2	0.88	0.02
N	1.38	1.54	ALL	6	1.44	0.07
OVERALL				20	1.20	0.19

ORDERED VALUES FOLLOW:

0.87b 0.90b 0.96B 1.03B 1.06B 1.09B 1.10B 1.12B 1.16B 1.17B 1.18B
 1.23B 1.25B 1.29B 1.38b 1.38b 1.39b 1.44b 1.51b 1.53b

Figure A.1.10 cont.

II OIL-SOURCE ROCK CORRELATION

Oil-staining has been reported from a number of the Dia-Structure cores, especially cores U-8 and U-9. Hydrocarbon traces have also been reported from the sandstones in core U-6. The presence of significant concentrations of immature, probable early generation products has been indicated in the organic-rich cores U-4 and U-1. The generative potential of the shales in these two cores was demonstrated by the production of paraffinic/paraffinic-naphthenic oils from selected samples after artificial maturation by hydrous pyrolysis. This discussion will attempt to indicate the source of these hydrocarbon occurrences. A combination of gas chromatography and gas chromatography-mass spectrometry (GC-MS) has been used, together with carbon isotope data.

The triangular plot in Figure A.II.1 suggests that the majority of the extracts from the Dia-Structure cores, including at least one of the pyrolysate oils, plot along a trend of increasing saturate content. The most saturate-rich extracts are those thought to represent mature non-indigenous oils from cores U-8 and U-9. The fact that the extracts plot along a common maturation trend would tend to suggest a common source for the extracts.

The isoprenoid composition of the core extracts (Figure A.II.2) divides the extracts into two groups. One group consists of the indigenous extracts and those extracts thought to be locally-sourced. The second group, with a central isoprenoid composition, consists of suspected oil-staining and the pyrolysate oils. The fact that the pyrolysate oils plot in this second group would support a middle Triassic source for the more mature oil-stain extracts.

GC-MS data also tend to suggest that the extracts share a common source. The appearance of the mass fragmentograms is summarised in the individual core descriptions. The mass fragmentograms indicate maturity differences between the different extracts, but there are no indications of any significantly different source inputs.

In terms of C_{27} , C_{28} , C_{29} regular sterane composition (Figure A.II.3), the sample extracts all plot within an elongate area relatively close to the C_{27} - C_{29} axis. The pyrolysate oils plot to the left of the group,

otherwise most of the extracts, including those from oil-stained samples, plot in a relatively small area.

Crossplots of maturity-dependant GC-MS peak ratios are shown in Figures A.II.4a-c. Figure A.II.4a, which plots the 22S hopane ratio against the C_{29} 20S sterane ratio, suggests that the core U-1 and two U-9 extracts are the most thermally immature of the sample extracts. The most mature extracts represent the oil-stained samples from core U-8 and the pyrolysate oils. The extracts appear to span the whole maturity range and suggesting that the non-indigenous material is derived from rocks over a range of different maturities.

In Figure A.II.4b, three distinct groups can be distinguished, consisting of the indigenous extracts and the less mature non-indigenous extracts, the oil-stained samples from cores U-8 and U-9 and the expelled pyrolysate oils. The same groupings can be distinguished in Figure A.II.4c. In both of these diagrams, the expelled pyrolysate plots away from the oil-stain extracts, probably as a result of artificial pyrolysis procedure.

The relatively close grouping of the indigenous/immature non-indigenous extracts would be consistent with a common source. The fact that, in Figures A.II.4a and 4c, the extracts plot along a common maturity trend, especially in the case of Figure A.II.4c which includes the partly source-dependant T_m/T_s ratio, would also support a common source for the sample extracts. Generally similar carbon isotope ratio values for the extracts would also point towards a common source, although it has not been possible to evaluate any fractionations which may have occurred during migration in the non-indigenous extracts.

In conclusion then, the data are consistent with a middle Triassic source for the non-indigenous hydrocarbons in these cores. All of the differences observed in the extracts can be explained in terms of maturity variations, suggesting that the oil-staining is derived from a middle Triassic source rock of variable thermal maturity.

TABLE OF CONTENTS: OIL-SOURCE ROCK CORRELATION

Figure A.II.1: Composition of Extractable Organic Matter (EOM) in Dia-Structure cores.

Figure A.II.2: Isoprenoid hydrocarbon composition of Dia-Structure core EOM.

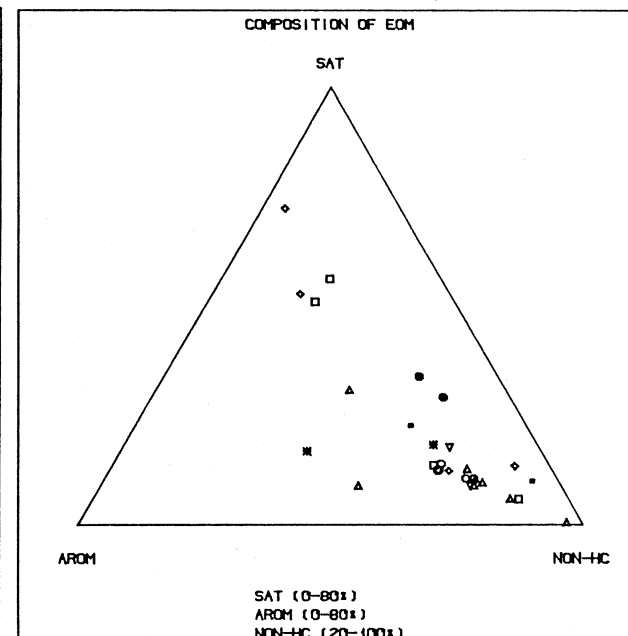
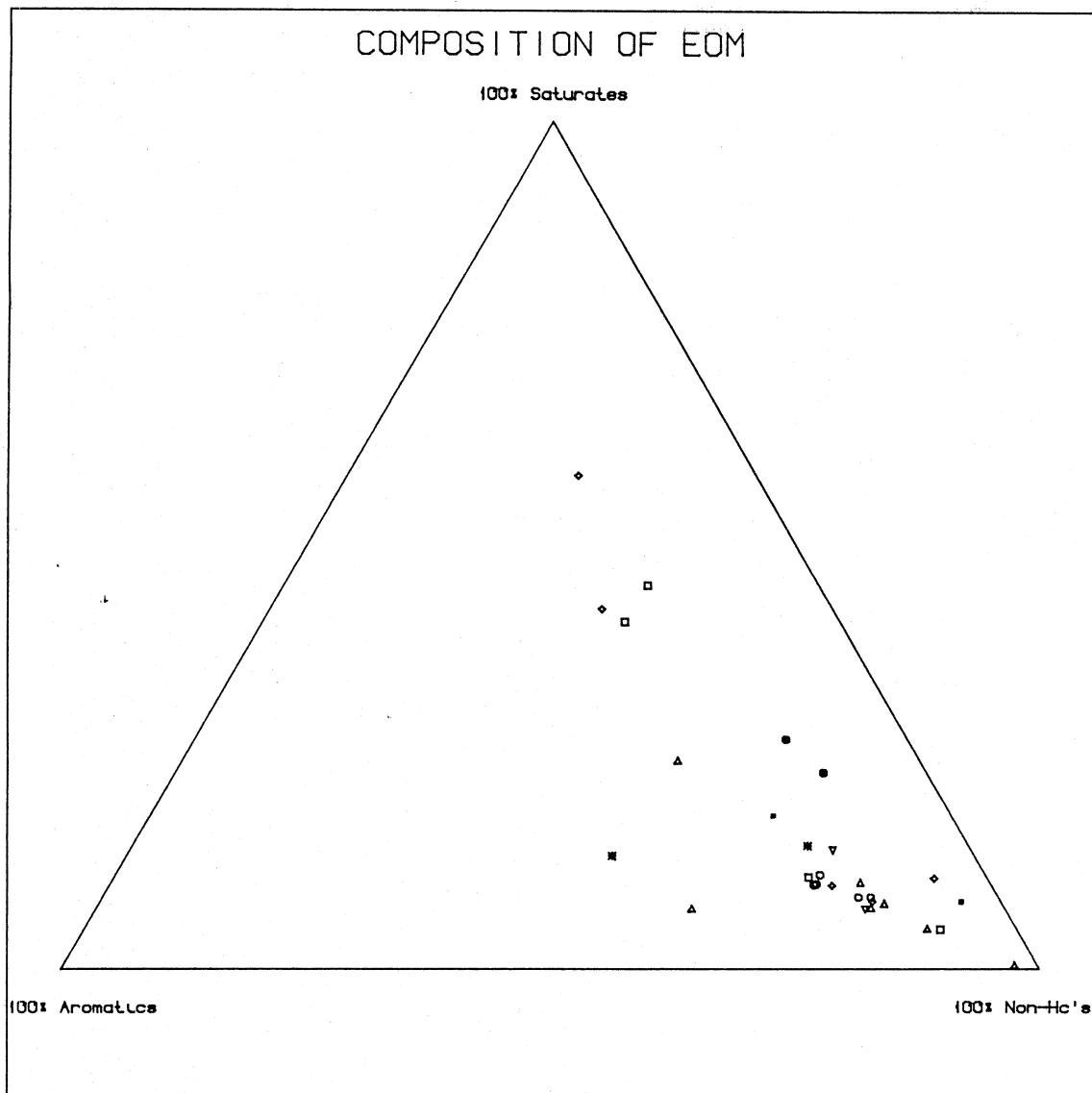
Figure A.II.3: C_{27} , C_{28} , C_{29} , regular sterane composition of Dia-Structure core EOM.

Figure A.II.4a: Cross-plot of C_{31} - C_{35} 22S/22R hopane ratio and C_{29} 20S sterane ratio.

Figure A.II.4b: Cross-plot of $\alpha\beta/\alpha\beta+\beta\alpha$ hopane ratio and C_{29} $\beta\beta$ sterane ratio.

Figure A.II.4c: Cross-plot of Tm/Ts ratio and relative abundance of C_{27} rearranged steranes.

Figure A.II.1: Composition of Extractable Organic Matter (EOM) in Dia-Structure cores.



Key

- ◇ U - 9
- △ U - 1
- U - 4
- ▽ U - 3
- U - 6
- U - 8
- * expelled hy-pyrol.

Figure A.II.2: Isoprenoid hydrocarbon composition of Dia-Structure core EOM.

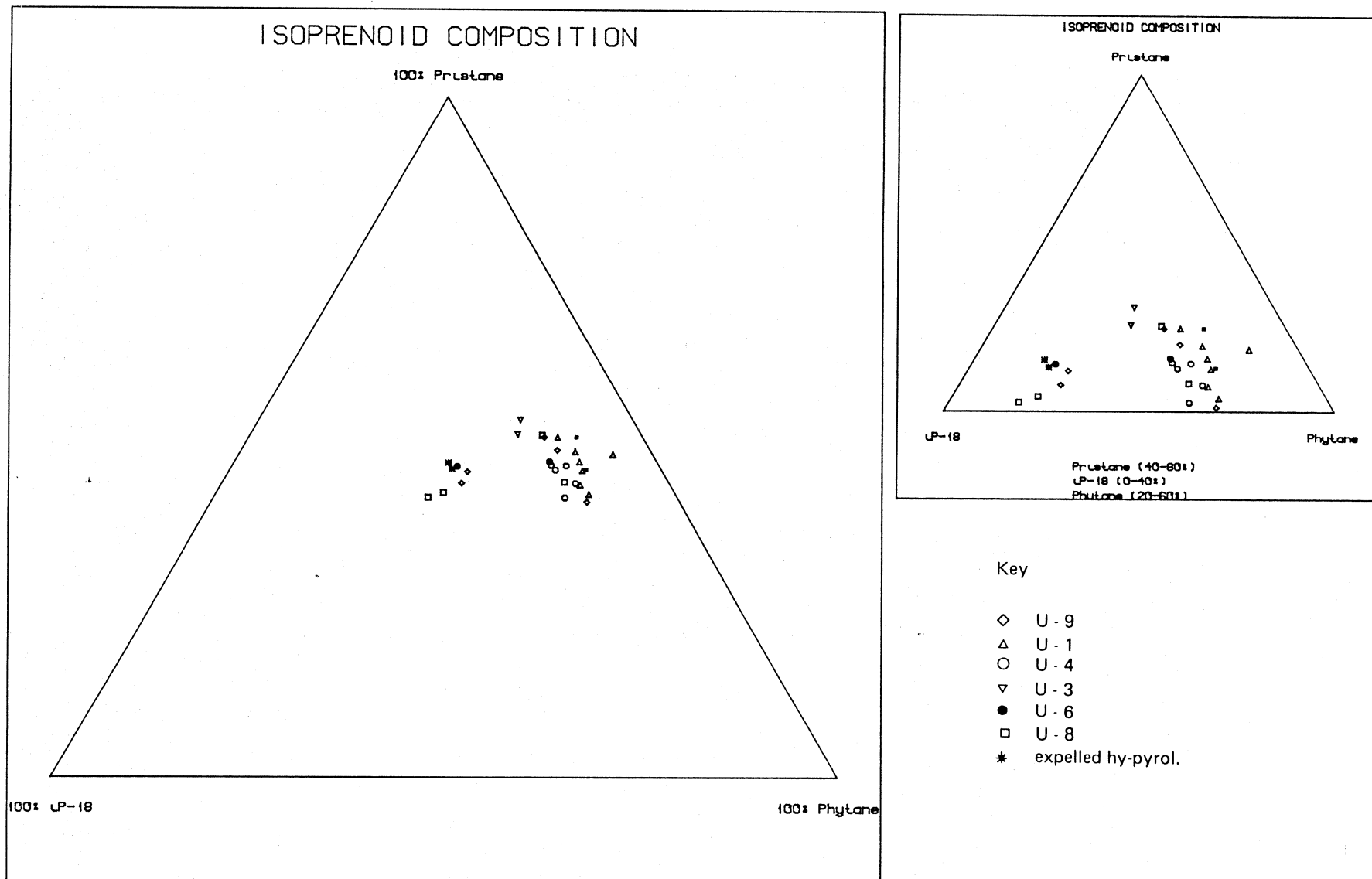
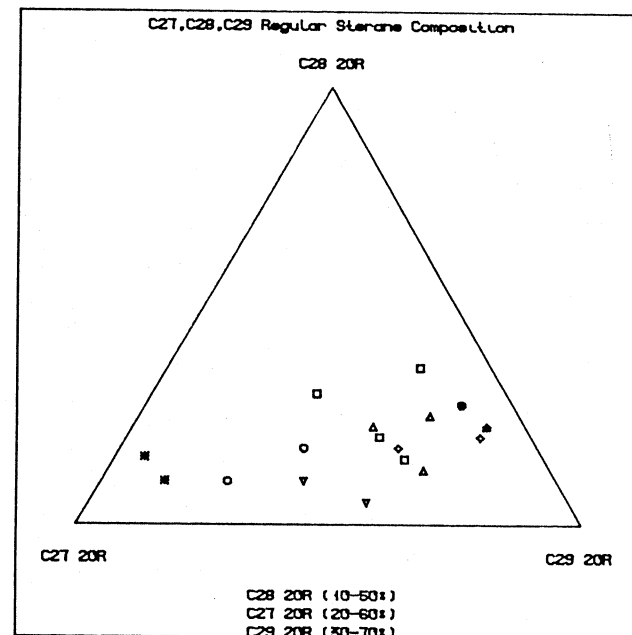
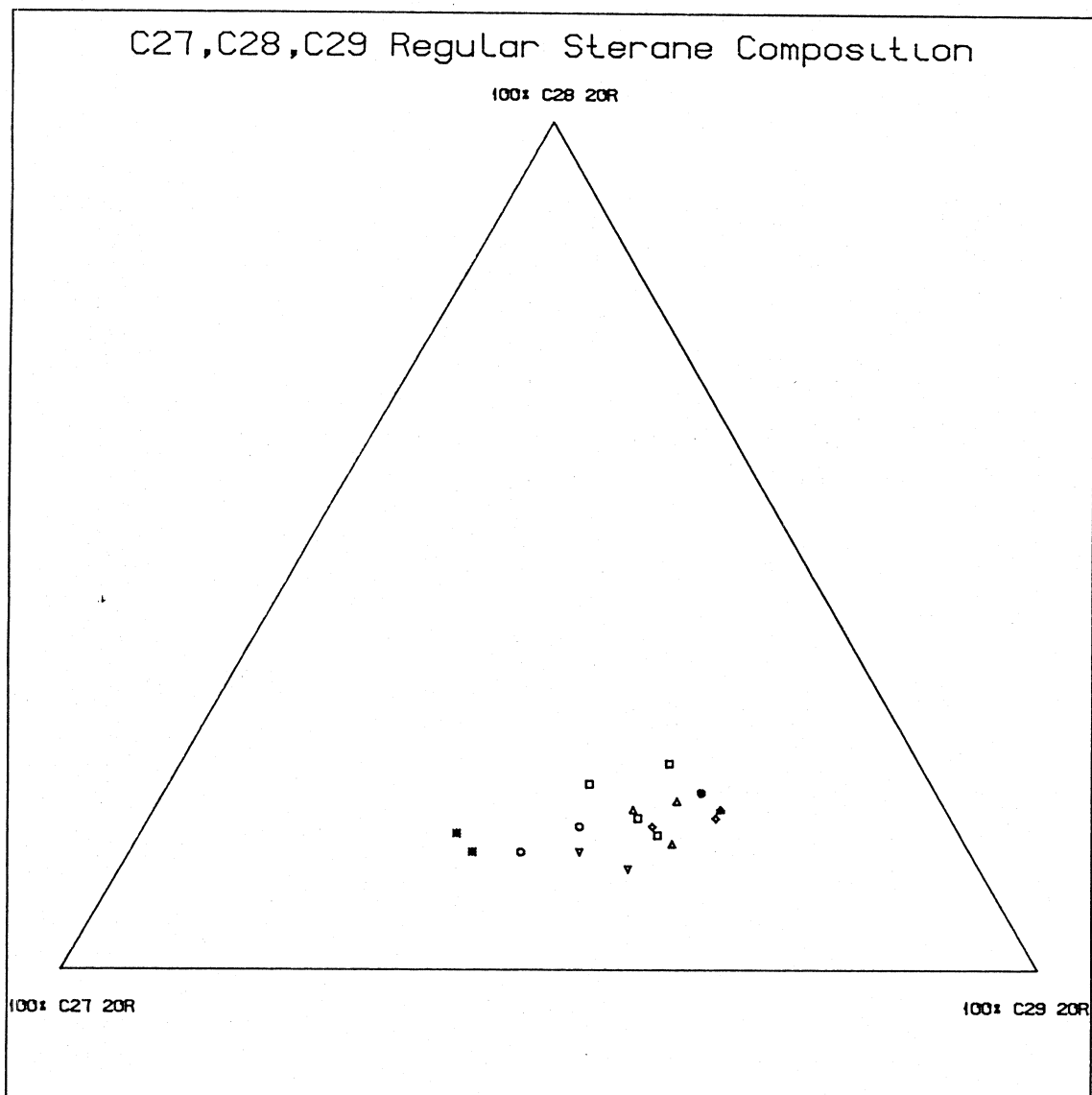


Figure A.11.3: C₂₇, C₂₈, C₂₉ regular sterane composition core EOM.



Key

- ◇ U - 9
- △ U - 1
- U - 4
- ▽ U - 3
- U - 6
- U - 8
- * expelled hy-pyrol.

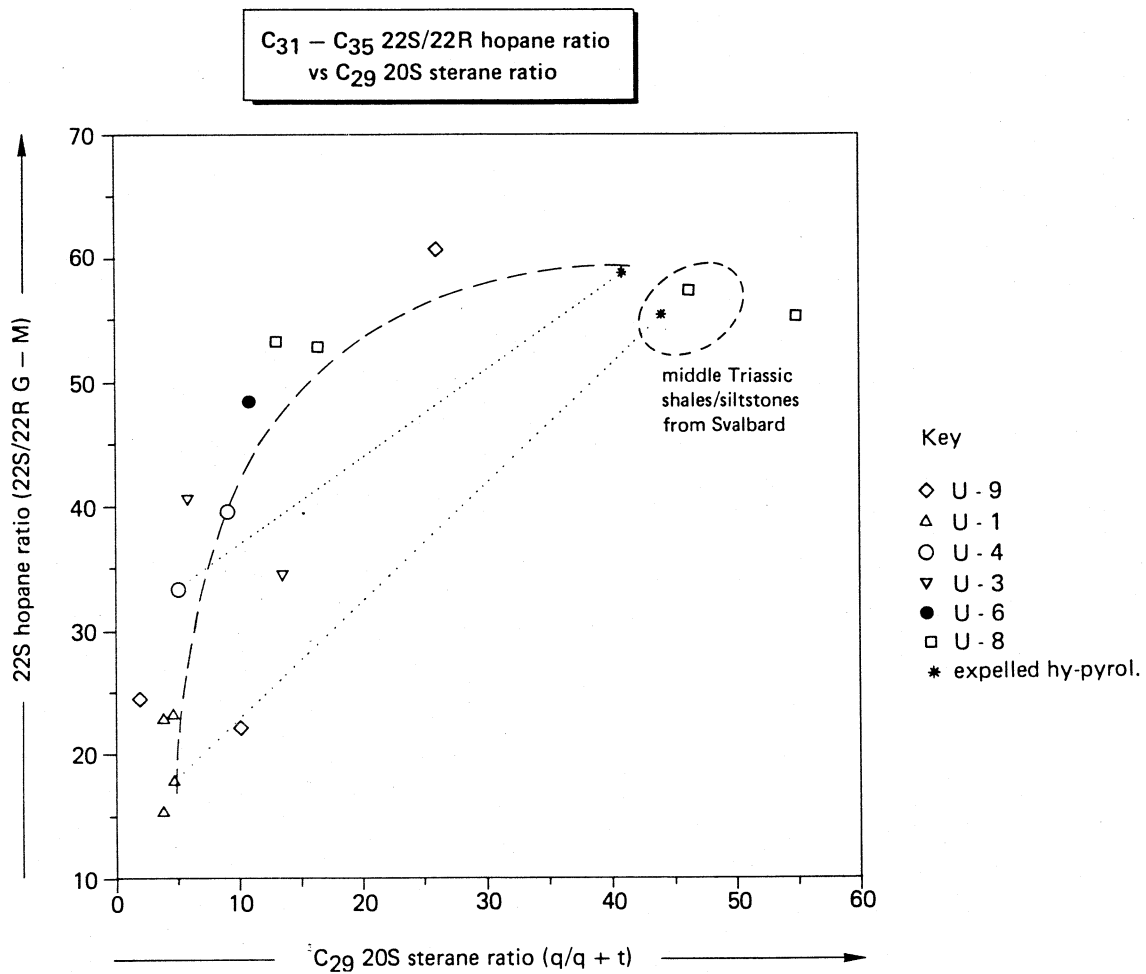


Figure A.II.4a: Cross-plot of C₃₁-C₃₅ 22S/22R hopane ratio and C₂₉ 20S sterane ratio.

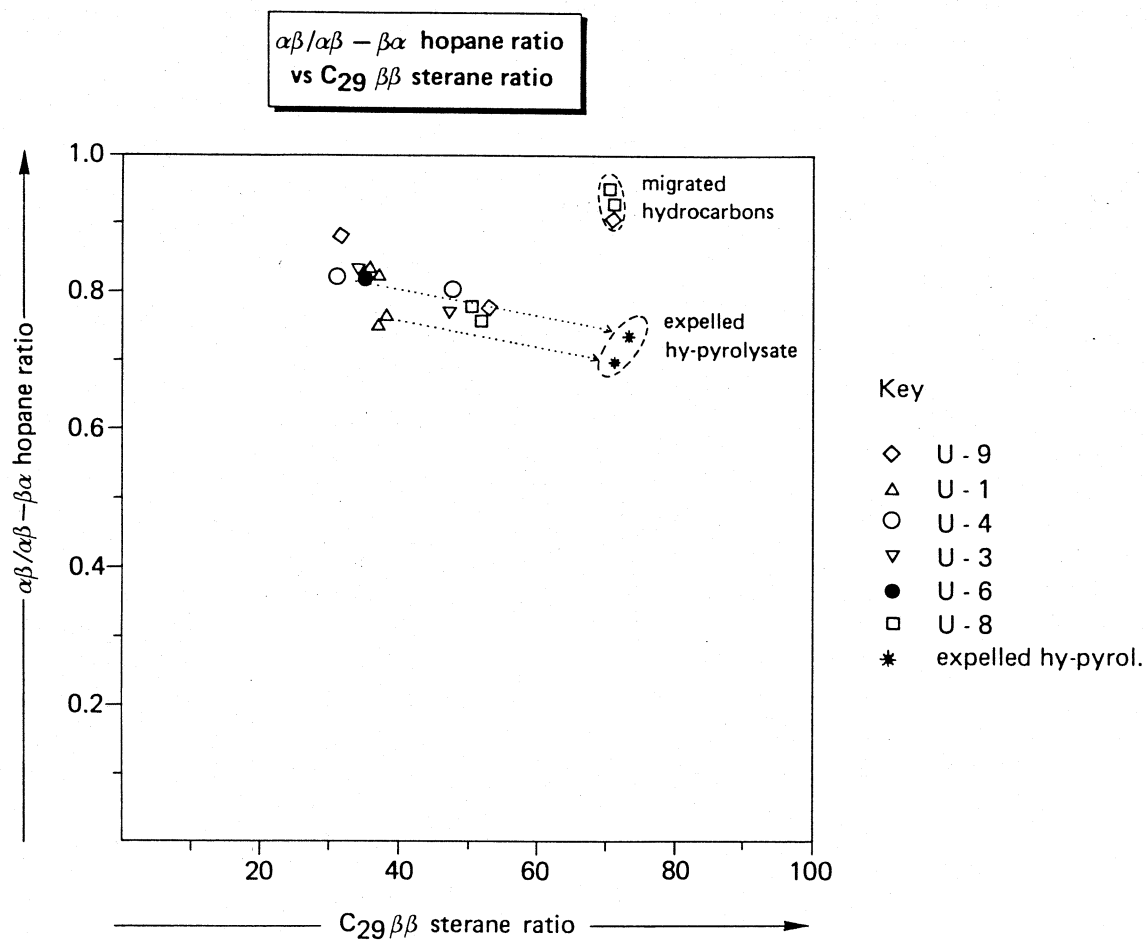


Figure A.II.4b: Cross-plot of $\alpha\beta/\alpha\beta + \beta\alpha$ hopane ratio and $C_{29} \beta\beta$ sterane ratio.

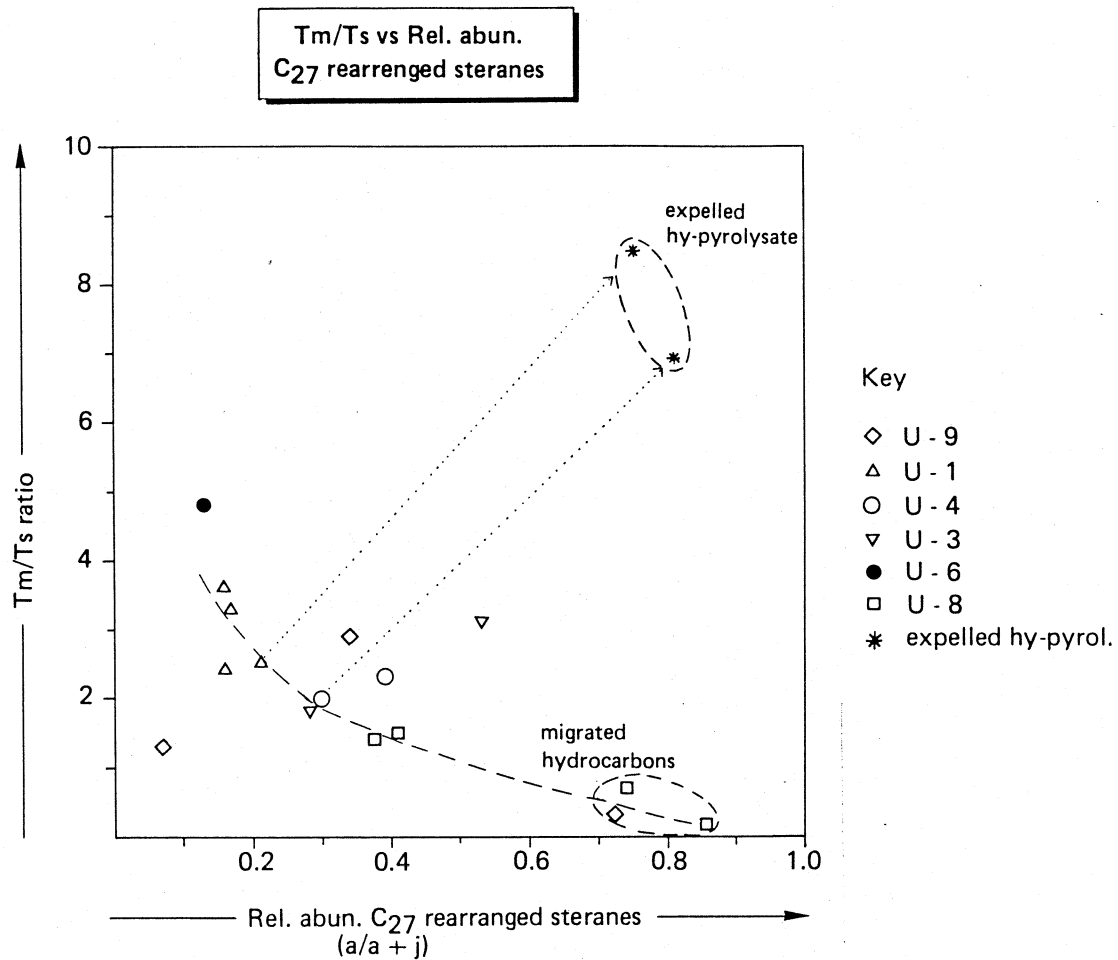


Figure A.II.4c: Cross-plot of T_M/T_S ratio and relative abundance of C₂₇ rearranged steranes.

APPENDIX III.1: TABLE OF CONTENTS

Core 7323/7-U-8:

TABLES

- Table A.III.1.1a: Concentration of C_1 - C_5 + hydrocarbons in headspace gas.
- Table A.III.1.1b: Concentration of C_1 - C_5 + hydrocarbons in occluded gas.
- Table A.III.1.1c: Concentration of C_1 - C_5 + hydrocarbons - summation.
- Table A.III.1.2: Total organic carbon and data from Rock-Eval pyrolysis.
- Table A.III.1.3: Data from pyrolysis-gas chromatograms.
- Table A.III.1.4: Vitrinite reflectance data.
- Table A.III.1.5: Weight of EOM and chromatographic fractions.
- Table A.III.1.6: Concentration of EOM and chromatographic fractions.
- Table A.III.1.7: Concentration of EOM and chromatographic fractions.
- Table A.III.1.8: Composition of material extracted from the rock.
- Table A.III.1.9: Tabulation of data from the gas chromatograms.
- Table A.III.1.10: Molecular ratios from sterane and terpane mass chromatograms. Maturity ratios.
- Table A.III.1.11: Molecular ratios from sterane and terpane mass chromatograms. Maturity and source characteristic ratios.
- Table A.III.1.12: Molecular ratios from mono- and tri-aromatic steranes.
- Table A.III.1.13: $\delta^{13}C$ and δD isotope ratios for adsorbed gas fractions.
- Table A.III.1.14: $\delta^{13}C$ isotope ratios for extract fractions.

FIGURES

- Figure A.III.1.1: Pyrolysis-gas chromatograms (S2 peak).
- Figure A.III.1.2: Saturated hydrocarbon gas chromatograms.
- Figure A.III.1.3: Aromatic hydrocarbon gas chromatograms.
- Figure A.III.1.4: Mass chromatograms of m/z 191 (terpanes).
- Figure A.III.1.5: Mass chromatograms of m/z 217 and 218 (steranes).
- Figure A.III.1.6: Mass chromatograms representing monoaromatic (m/z 239 and 253) and triaromatic (m/z 231) steranes.
- Figure A.III.1.7: Vitrinite reflectance histograms.

Project no.: 21.3420.06
Well ident.: 7323/7-U-8
DATE : 28 - 10 - 86.

Table A.III.1.1a: Concentration of C₁-C₅ hydrocarbons in headspace gas.

[illegible]

1

[illegible]

14

[illegible]

Table A.III.1.2: Total organic carbon and data from Rock-Eval pyrolysis.

I	I	I	I	I	I	I	I	I	I	I	I	I
I	IKU	DEPTH	:	S1	S2	S3	TOC	HYDR. INDEX	OXYGEN INDEX	PETROLEUM POTENTIAL	PROD. INDEX	TEMP. MAX
I	No.		:								S1	
I		m/ft	:	(mg/g ROCK)		(%)	(mg/g TOC)			S1+S2	S1+S2	(C)
I			:									
I	C 4959	102.19	:	0.04	0.02	0.08	0.26	8	31	0.06	0.67	441
I	C 5299	103.25	:	****	****	****	0.29	*****	****	*****	*****	***
I	C 4960	104.19	:	****	****	****	0.17	*****	****	*****	*****	***
I	C 4961	105.19	:	0.04	0.04	0.03	0.32	13	9	0.08	0.50	405
I	C 5302	105.72	:	****	****	****	0.32	*****	****	*****	*****	***
I	C 4962	107.10	:	****	****	****	0.28	*****	****	*****	*****	***
I	C 4963	108.14	:	****	****	****	0.29	*****	****	*****	*****	***
I	C 5305	109.20	:	****	****	****	0.30	*****	****	*****	*****	***
I	C 4964	110.37	:	0.06	0.19	0.02	0.39	49	5	0.25	0.24	391
I	C 4965	111.34	:	****	****	****	0.16	*****	****	*****	*****	***
I	C 5308	112.43	:	****	****	****	0.41	*****	****	*****	*****	***
I	C 4966	113.05	:	0.06	0.11	0.02	0.32	34	6	0.17	0.35	352
I	C 4967	114.35	:	****	****	****	0.27	*****	****	*****	*****	***
I	C 5311	115.20	:	****	****	****	0.33	*****	****	*****	*****	***
I	C 4968	116.52	:	0.06	0.10	0.06	0.27	37	22	0.16	0.38	321
I	C 4969	117.37	:	****	****	****	0.07	*****	****	*****	*****	***
I	C 5315	118.73	:	0.08	1.24	0.16	0.77	161	21	1.32	0.06	424
I	C 5316	119.83	:	****	****	****	0.23	*****	****	*****	*****	***
I	C 5317	121.45	:	****	****	****	0.20	*****	****	*****	*****	***
I	C 4970	122.77	:	****	****	****	0.01	*****	****	*****	*****	***
I	C 5318	123.19	:	****	****	****	0.29	*****	****	*****	*****	***
I	C 5319	124.60	:	****	****	****	0.32	*****	****	*****	*****	***

Table A.III.1.2: cont.

I		:					HYDR.	OXYGEN	PETROLEUM	PROD.	TEMP.	I		
I	IKU	DEPTH	:	S1	S2	S3	TOC	INDEX	INDEX	POTENTIAL	INDEX	MAX	I	
I	No.	:									S1		I	
I		:									-----		I	
I		m/ft	:	(	mg/g ROCK	)	(%)	(	mg/g TOC	)	S1+S2	S1+S2	(C)	I
I														I
I	C 5320	125.06	:	****	****	****	0.34	*****	****	*****	*****	***		I
I			:											I
I	C 5321	126.08	:	****	****	****	0.15	*****	****	*****	*****	***		I
I			:											I
I	C 5322	127.05	:	****	****	****	0.34	*****	****	*****	*****	***		I
I			:											I
I	C 5323	128.05	:	****	****	****	0.40	*****	****	*****	*****	***		I
I			:											I
I	C 4971	128.96	:	0.09	0.17	0.05	0.33	52	15	0.26	0.35	400		I
I			:											I
I	C 5327	130.21	:	****	****	****	0.32	*****	****	*****	*****	***		I
I			:											I
I	C 5329	131.85	:	0.28	1.09	0.08	1.56	70	5	1.37	0.20	434		I
I			:											I
I	C 4972	133.36	:	0.09	0.12	0.08	0.32	38	25	0.21	0.43	362		I
I			:											I
I	C 5331	134.23	:	0.06	0.33	0.00	0.48	69	0	0.39	0.15	429		I
I			:											I
I	C 5332	135.80	:	****	****	****	0.24	*****	****	*****	*****	***		I
I			:											I

:

I

DATE : 16 - 11 - 86.

Table A.III.1.3: Data from pyrolysis-gas chromatograms.

IKU No	DEPTH (m)	C1 %	C2-C5 %	C6-C14 %	C15+ %	(m+p)-xylene/ n-octene
C-5315	118.73	15.16	41.06	35.30	8.48	1.09

Well Identification: 7323/7-U-8
 Reference number: 21.3420.06
 (1/1)

Table A.III.1.4: Vitrinite reflectance data.

IKU NO	LOCATION	DEPTH (M)	VITRINITE REFLECTANCE	REL RAT	STANDARD DEVIATION	FLUORE- SCENCE
C 4964	----	110.4	0.36 (1) 0.67 (1) 1.31 (6)	P R R	0.00 0.00 0.25	6-7
C 5315	----	118.7	0.37 (3) 0.68 (2) 1.09 (3)	P R R	0.11 0.03 0.19	6-7

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

Project no.: 21.3420.06
Well ident.: 7323/7-U-8
DATE : 19 - 11 - 86.

Table A.III.1.5: Weight of EOM and chromatographic fractions.

I	I	I	I	I	I	I	I	I	I	I
I	IKU-No	DEPTH	: Rock	EOM	Sat.	Aro.	HC	Non HC	TOC	I
I			: Extr.							I
I		(m)	: (g)	(mg)	(mg)	(mg)	(mg)	(mg)	(%)	I
I			:							I
I	C 5321	126.08	: 58.2	6.6	0.7	1.2	1.9	4.7	1.38	I
I			:							I
I	C 4991	126.50	: 65.3	245.6	111.2	43.0	154.3	91.4		I
I			:							I
I	C 5329	131.85	: 30.9	7.7	0.4	0.6	1.0	6.7	0.99	I
I			:							I
I	C 4992	135.95	: 37.4	240.2	98.5	52.7	151.3	88.9		I
I			:							I

Project no.: 21.3420.06
 Well ident.: 7323/7-U-8
 DATE : 19 - 11 - 86.

Table A.III.1.6: Concentration of EOM and chromatographic fractions.

I		:						I
I	IKU-No	DEPTH	:	EOM	Sat.	Aro.	HC	Non HC
I		(m)	:					I
I			:					I
I	C 5321	126.08	:	113	12	21	33	80
I			:					I
I	C 4991	126.50	:	3759	1703	658	2361	1398
I			:					I
I	C 5329	131.85	:	250	12	19	31	218
I			:					I
I	C 4992	135.95	:	6422	2634	1410	4044	2378
I			:					I

Project no.: 21.3420.06
Well ident.: 7323/7-U-8
DATE : 19 - 11 - 86.

Table A.III.1.7: Concentration of EOM and chromatographic fractions.

I	IKU-No	DEPTH	:	EOM	Sat.	Aro.	HC	Non HC
I		(m)	:					
I			:					
I	C 5321	126.08	:	8.2	0.9	1.5	2.4	5.8
I			:					
I	C 4991	126.50	:					
I			:					
I	C 5329	131.85	:	25.2	1.2	2.0	3.1	22.1
I			:					
I	C 4992	135.95	:					
I			:					

Project no.: 21.3420.06
Well ident.: 7323/7-U-8
DATE : 19 - 11 - 86.

Table A.III.1.8: Composition of material extracted from the rock.

I			:	Sat	Aro	HC	SAT	Non HC	HC	I
I	IKU-No	DEPTH	:	---	---	---	---	---	---	I
I			:	EOM	EOM	EOM	Aro	EOM	Non HC	I
I		(m)	:	%	%	%	x 100	%	x 100	I
I			:							I
I	C 5321	126.08	:	10.9	18.2	29.1	60.0	70.9	41.0	I
I			:							I
I	C 4991	126.50	:	45.3	17.5	62.8	258.7	37.2	168.9	I
I			:							I
I	C 5329	131.85	:	4.7	7.8	12.5	60.0	87.5	14.2	I
I			:							I
I	C 4992	135.95	:	41.0	22.0	63.0	186.7	37.0	170.0	I
I			:							I

Table A.III.1.9: Tabulation of data from the gas chromatograms.

I	DEPTH	:	PRISTANE	PRISTANE	PHYTANE	A	n-C17		I
I	IKU No.	:	-----	A = -----	B = -----	-----	-----	CPI	I
I	(m)	:	PHYTANE	n-C17	n-C18	B	n-C27		I
I		:							I
I		:							I
I	C 5321	126.08	1.0	0.5	0.4	1.3	0.4	1.1	I
I		:							I
I	C 4991	126.50	1.5	0.9	0.6	1.5	1.9	1.0	I
I		:							I
I	C 5329	131.85	1.3	1.4	1.0	1.4	0.9	1.1	I
I		:							I
I	C 4992	135.95	1.4	1.4	1.1	1.3	2.8	1.0	I
I		:							I

DATE : 24 - 11 - 86.

Table A.III.1.10 Molecular ratios from sterane and terpane mass chromatograms.
Maturity ratios.

IKU code	Well/depth	$\alpha\beta/\alpha\beta+\beta\alpha$ ¹⁾	%22S ²⁾	%20S ³⁾	% $\beta\beta$ ⁴⁾
<u>Well 7323/7-U-8</u>					
C-5321	126.08 m	0.76	52.9	16.5	51.6
C-4991	126.50 m	0.95	55.3	55.0	70.1
C-5329	131.85 m	0.78	53.3	13.1	50.2
C-4992	135.95 m	0.93	57.5	46.2	70.6

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

2) Average % distribution between first and second eluting isomers of extended hopanes (G-M in m/z 191)

3) q/q+t in m/z 217

4) $2(r+s)/(q+t+2(r+s))$ in m/z 217

Table A.III.1.11 Molecular ratios from terpane and sterane mass chromatograms.

Maturity and source characteristic ratios.

IKU no.	Well/depth	Q/E ¹⁾	T _m /T _s ²⁾	X/E ³⁾	Z/E ⁴⁾	a/a+j ⁵⁾
---------	------------	-------------------	--	-------------------	-------------------	---------------------

Well 7323/7-U-8

C-5321	126.08 m	0.06	0.14	-	-	0.38
C-4991	126.50 m	0.38	0.15	0.24	-	0.86
C-5329	131.85 m	0.10	0.15	-	-	0.41
C-4992	135.95 m	0.17	0.69	0.03	-	0.74

- 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 C₂₇ rearranged steranes (a/a+j in m/z 217)

Table A.III.1.12 Molecular ratios from mono- and tri-aromatic steranes.

IKU code	Core	$\%C_{20}/C_{26,27}$ m/z 231	$\%C_{21}/C_{28,29}$ m/z 253
----------	------	---------------------------------	---------------------------------

Well 7323/7-U-8 no.9

C-4991	126.49 - 126.50 m	50.0	43.0
--------	-------------------	------	------

Well 7323/7-U-8 no.12

C-4992	135.95 m	34.0	35.9
--------	----------	------	------

Table A.III.1.13a: Gas composition of the hydrocarbons C_1 to C_7 of adsorbed gas of core samples (Vol %).

Sample no.	Depth (m)	C_1	C_2	C_3	iC_4	nC_4	2.2DMP _r	iC_5	nC_5	C_6	C_7
<u>We11 7323/7-U-8</u>											
C-5076	125.28	29.60	2.16	1.37	1.68	1.84	0.05	3.95	3.55	21.79	34.02
C-5077	131.41	4.76	0.63	3.79	3.19	6.02	0.23	8.29	6.80	32.27	34.03

Table A.III.1.13b: Gas yields of the hydrocarbons C_1 to C_7 of adsorbed gas of core samples (ppb).

Sample no.	Depth (m)	C_1	C_2	C_3	iC_4	nC_4	2.2DMP _r	iC_5	nC_5	C_6	C_7
<u>We11 7323/7-U-8</u>											
C-5076	125.28	187	26	24	38	42	1	112	101	740	1155
C-5077	131.41	152	38	333	369	697	33	1191	978	5537	5839

Table A.III.1.13c: Gas ratios and isotope ratios of the hydrocarbons C_1 to C_7 of adsorbed gas of core samples.

Sample no.	Depth (m)	$C_1/\Sigma C_n$	$C_1/(C_2+C_3)$	iC_4/nC_4	$\delta^{13}C_1$	$\delta^{13}C_1$	$\delta D C_1$
<u>We11 7323/7-U-8</u>							
C-5076	125.28	0.2959	8.38	0.91	-47.6	-32.0	--
C-5077	131.41	0.0475	1.07	0.53	-42.6	-29.6	--

Table A.III.1.14: $^{13}\text{C}/^{12}\text{C}$ -isotope ratios of extract fractions.

Sample no.	Depth	$w^{13}\text{C}$ SAT	$w^{13}\text{C}$ ARO	$w^{13}\text{C}$ ASP	$w^{13}\text{C}$ NSO
------------	-------	-------------------------	-------------------------	-------------------------	-------------------------

Well 7323/7-U-8

C-4991	126.50 m	-30.75	-30.64	-30.52	-34.19
--------	----------	--------	--------	--------	--------

Figure A.III.1.1: Pyrolysis-gas chromatograms (S2 peak).

Analysis 420C5315Q 11,1,1 DIAS,7323/7-8,PY-GC

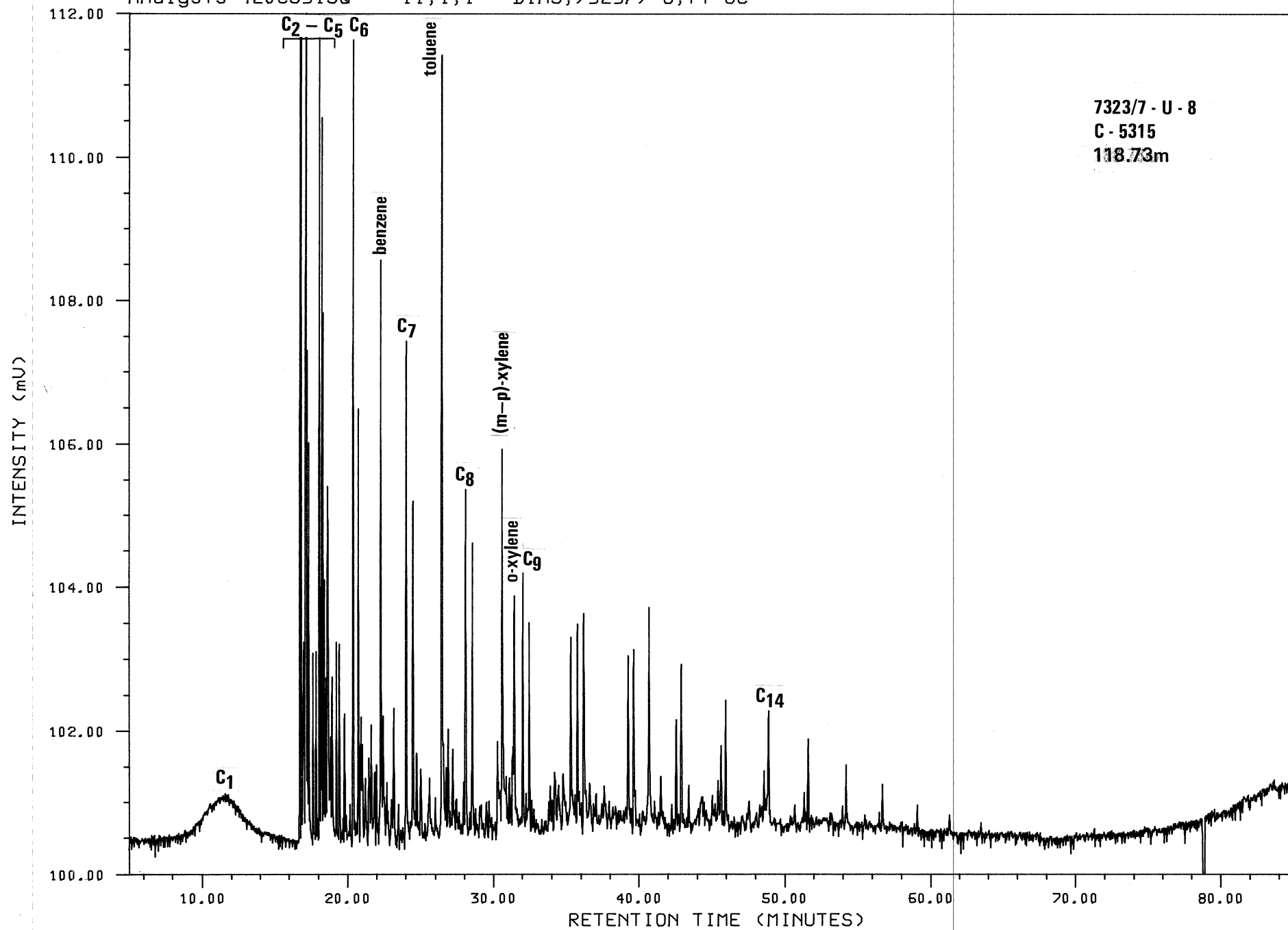
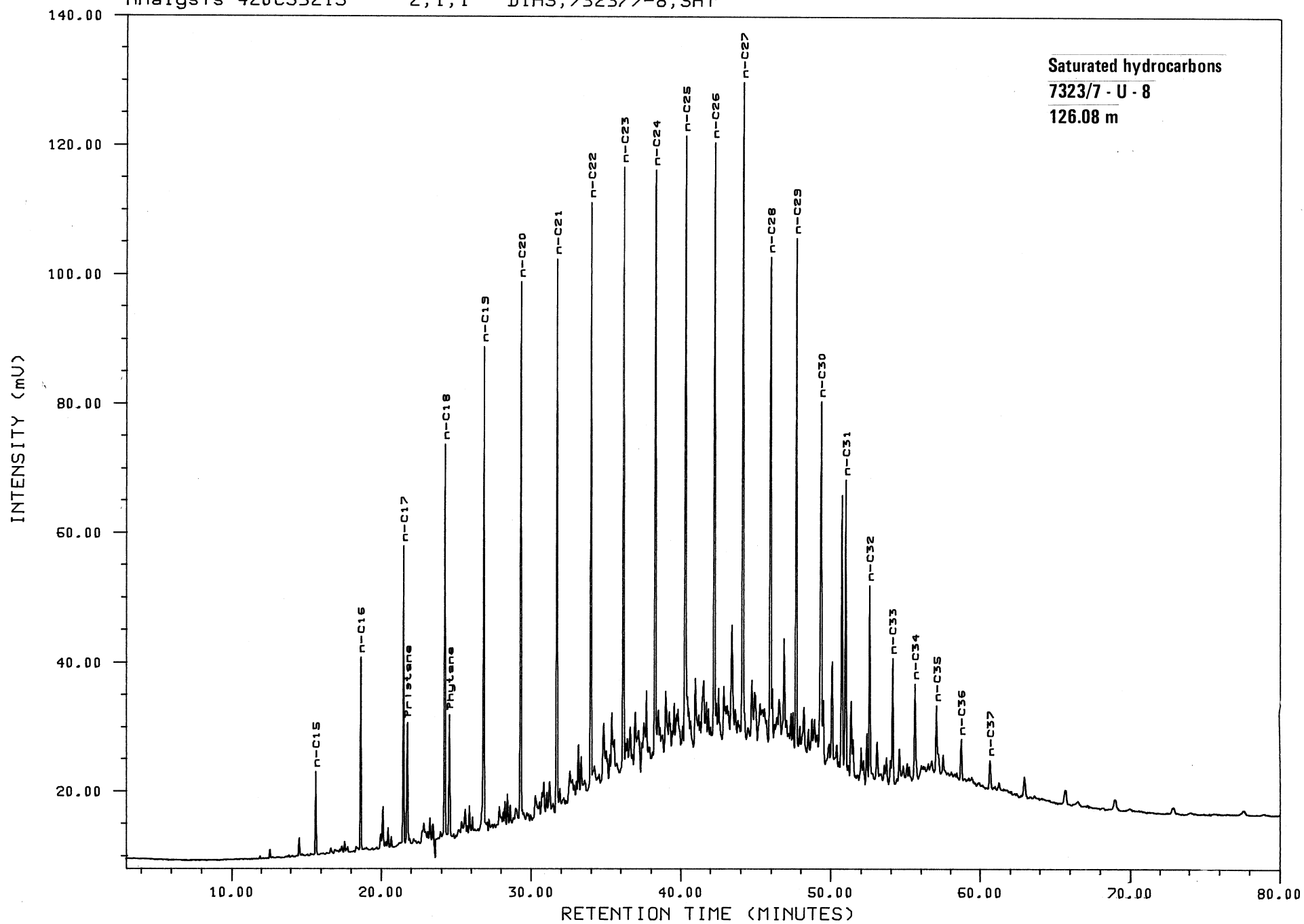


Figure A.III.1.2: Saturated hydrocarbon gas chromatograms.

n-C ₁₅ etc.	- n-alkanes
Pr	- pristane
Ph	- phytane
*	- other acyclic isoprenoids

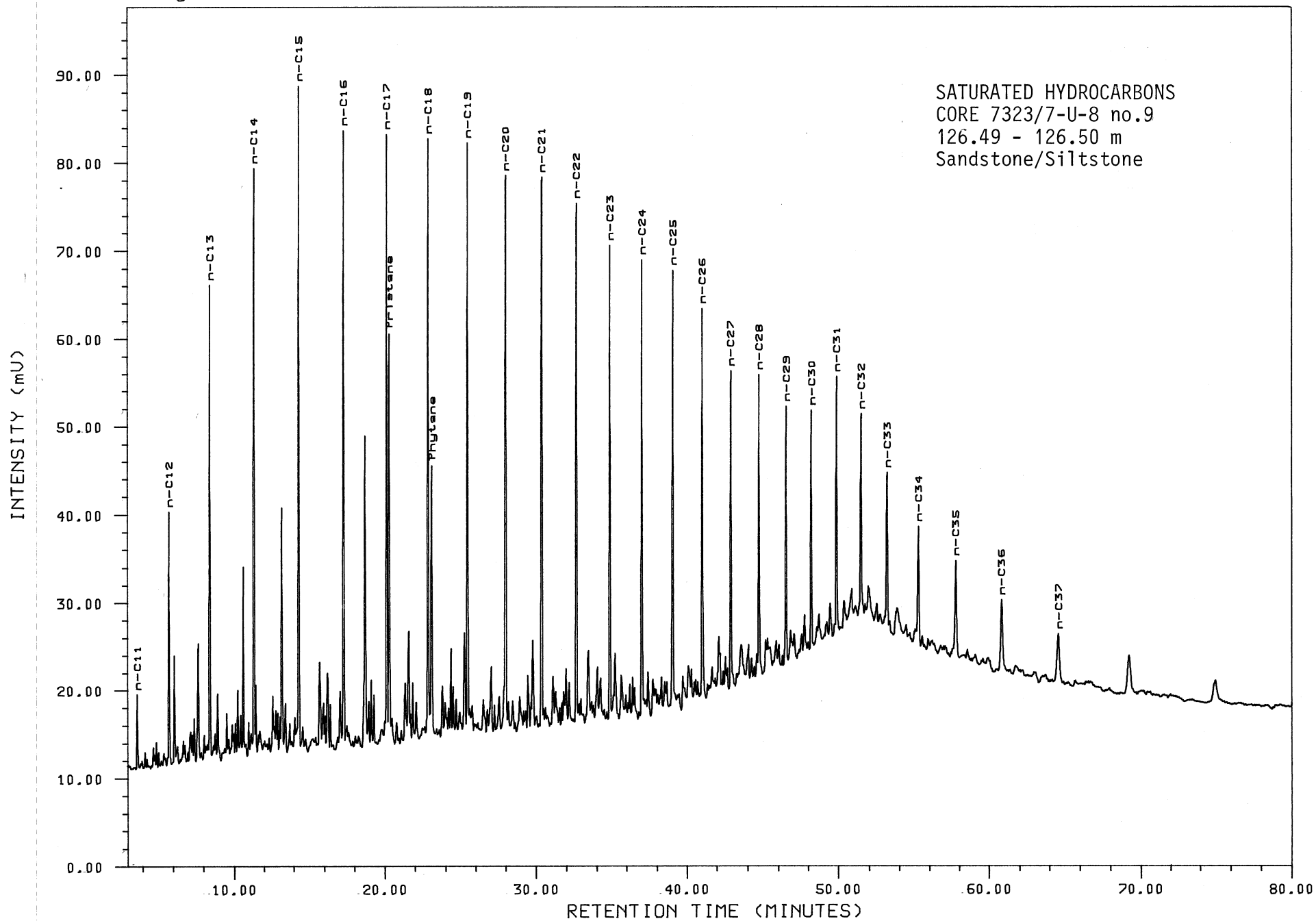
Analysis 420C5321S 2,1,1 DIAS,7323/7-8,SAT



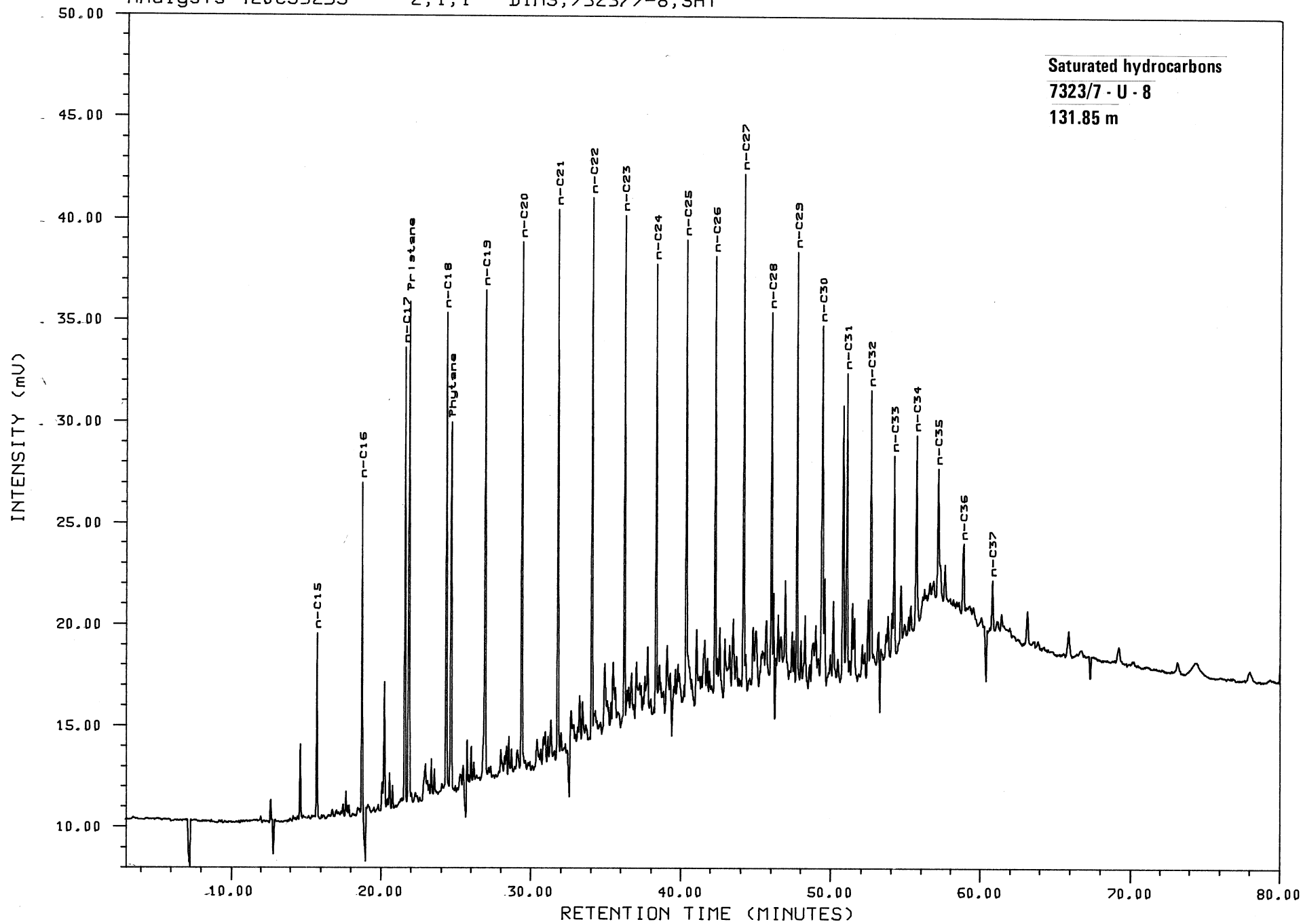
Analysis 420C4991S

2,1,1

DIAS.21.3420.04



Analysis 420C5329S 2,1,1 DIAS,7323/7-8,SAT



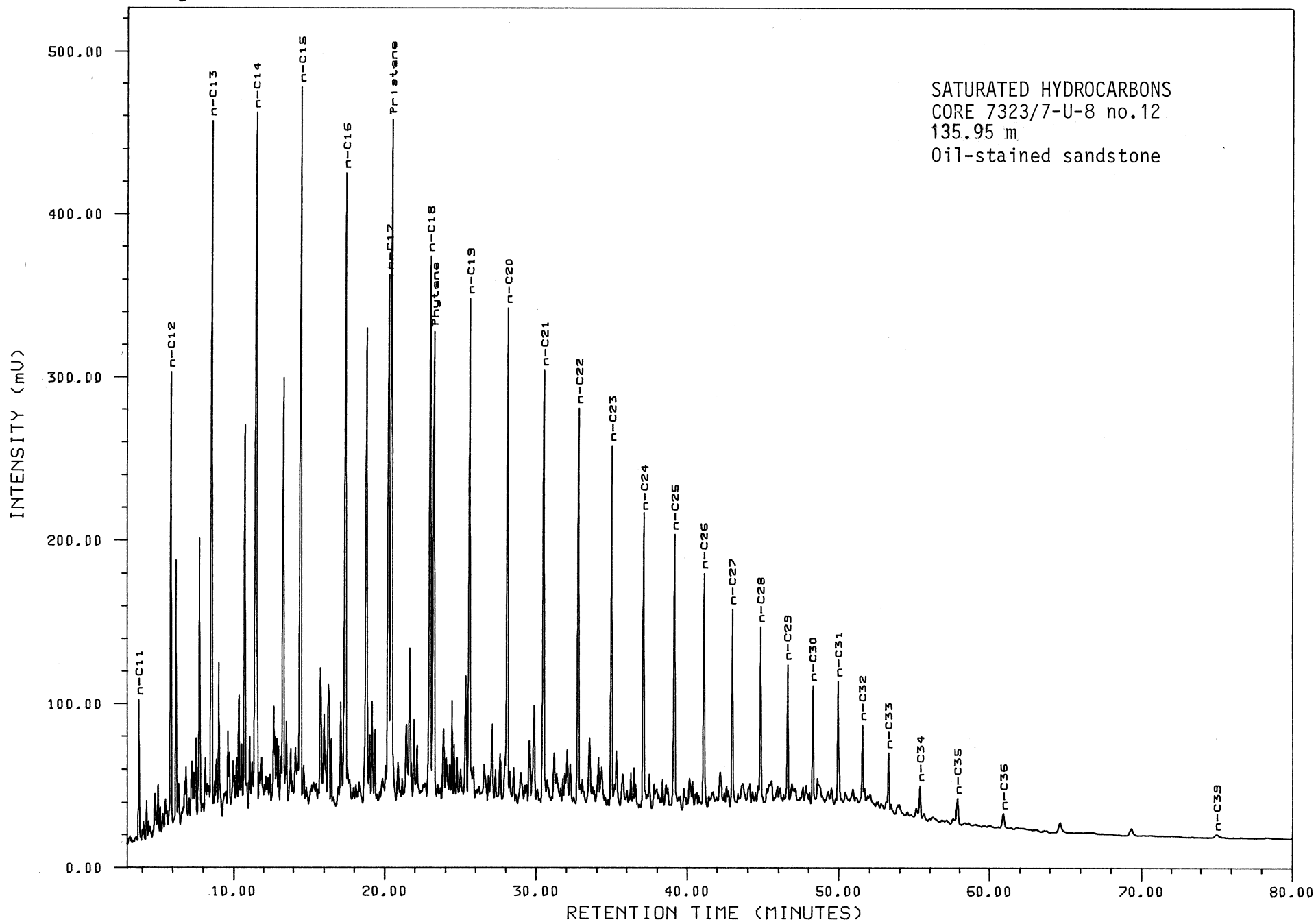
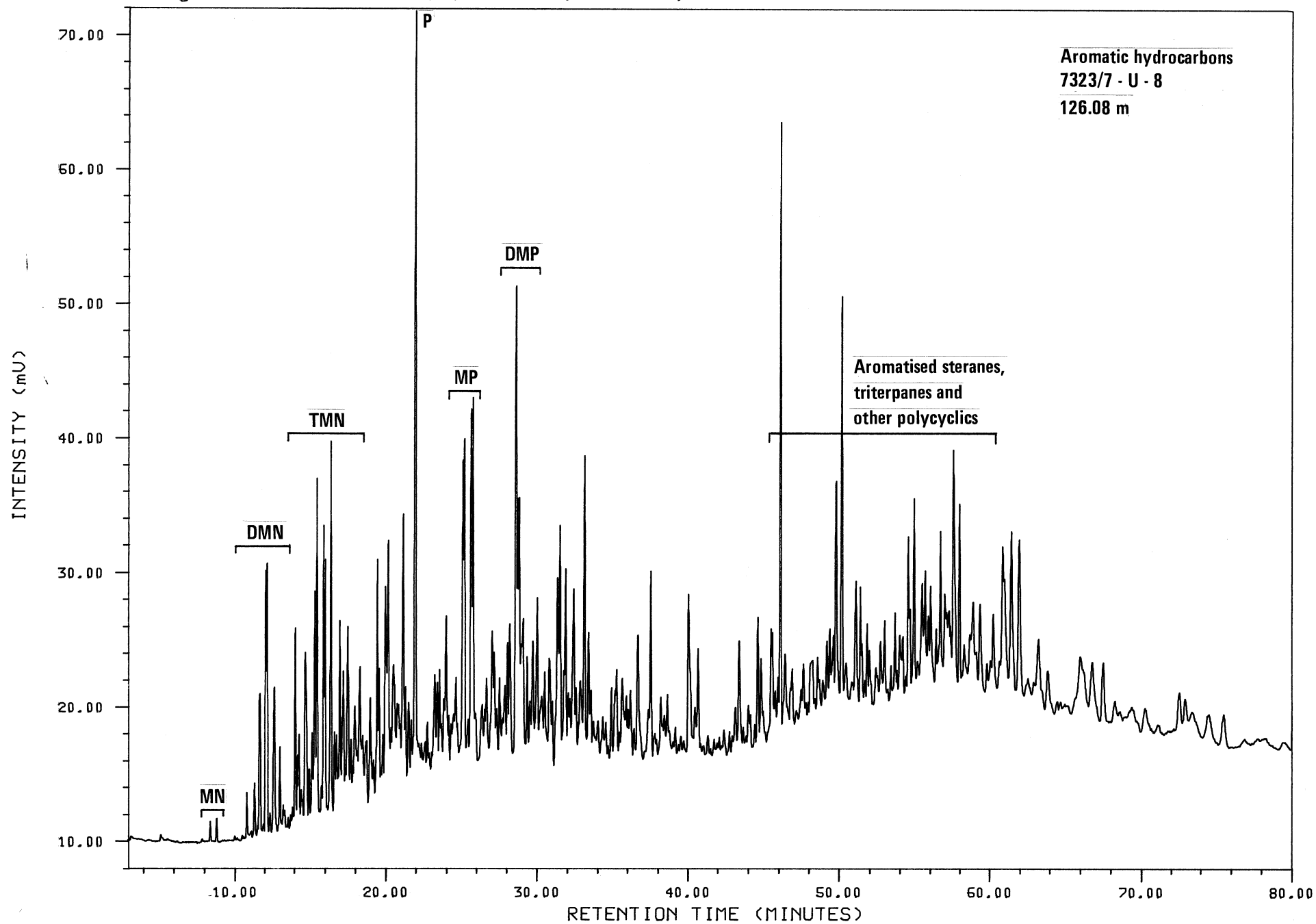


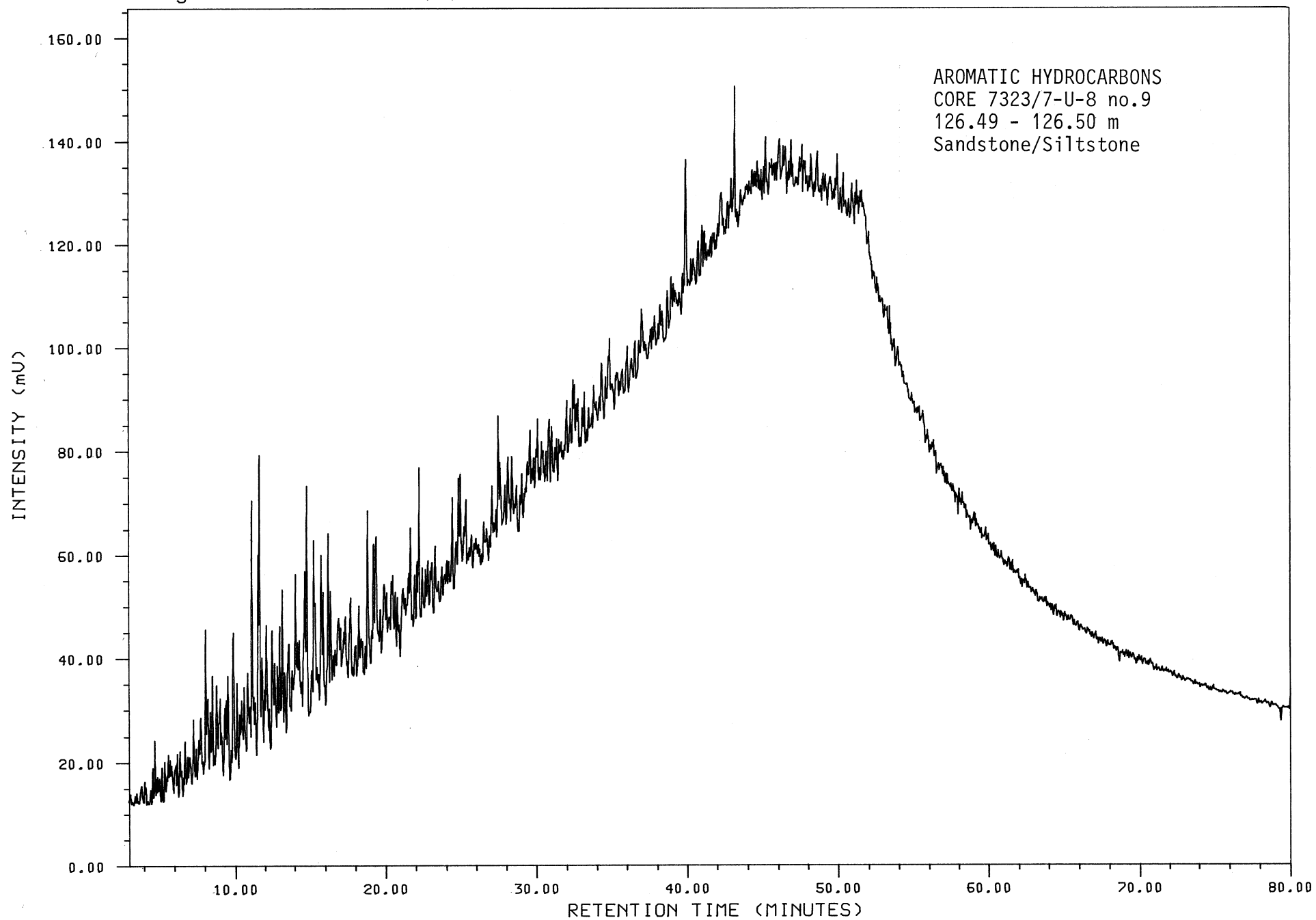
Figure A.III.1.3: Aromatic hydrocarbon gas chromatograms.

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

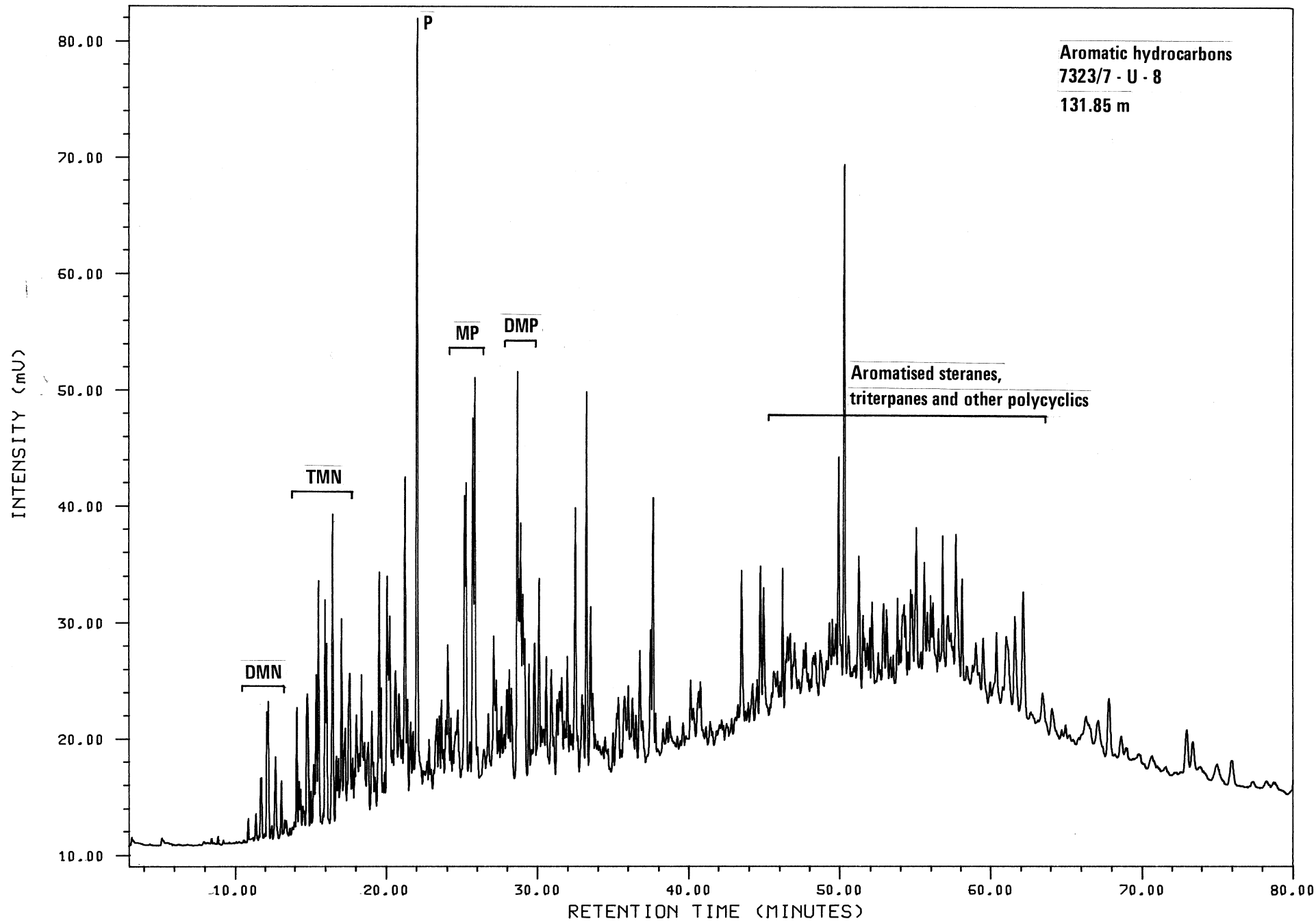
Analysis 420C5321A 2,1,1 DIAS,7323/7-8,ARO



Analysis 420C4991A 2,1,1 DIAS.21.3420.04



Analysis 420C5329A 2,1,1 DIAS,7323/7-8,ARO



Analysis 420C4992A 2,1,1 DIAS.21.3420.04

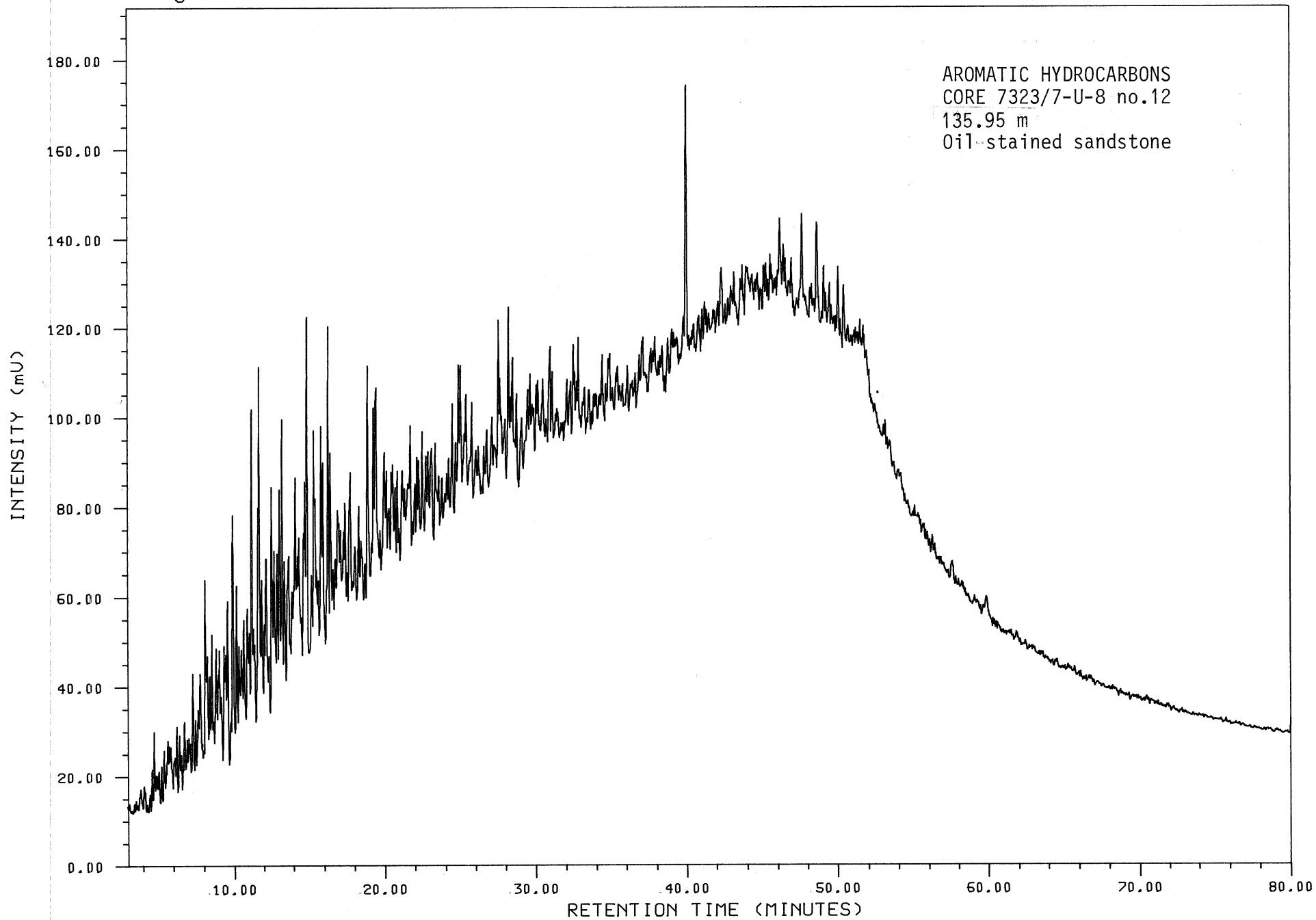
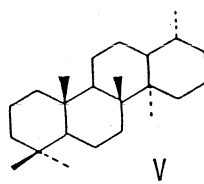
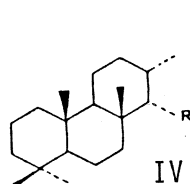
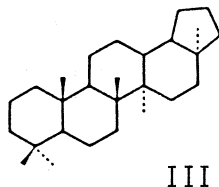
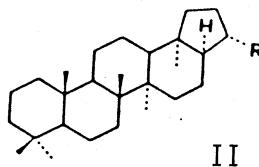
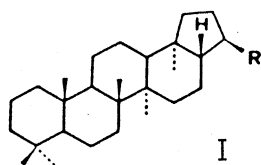


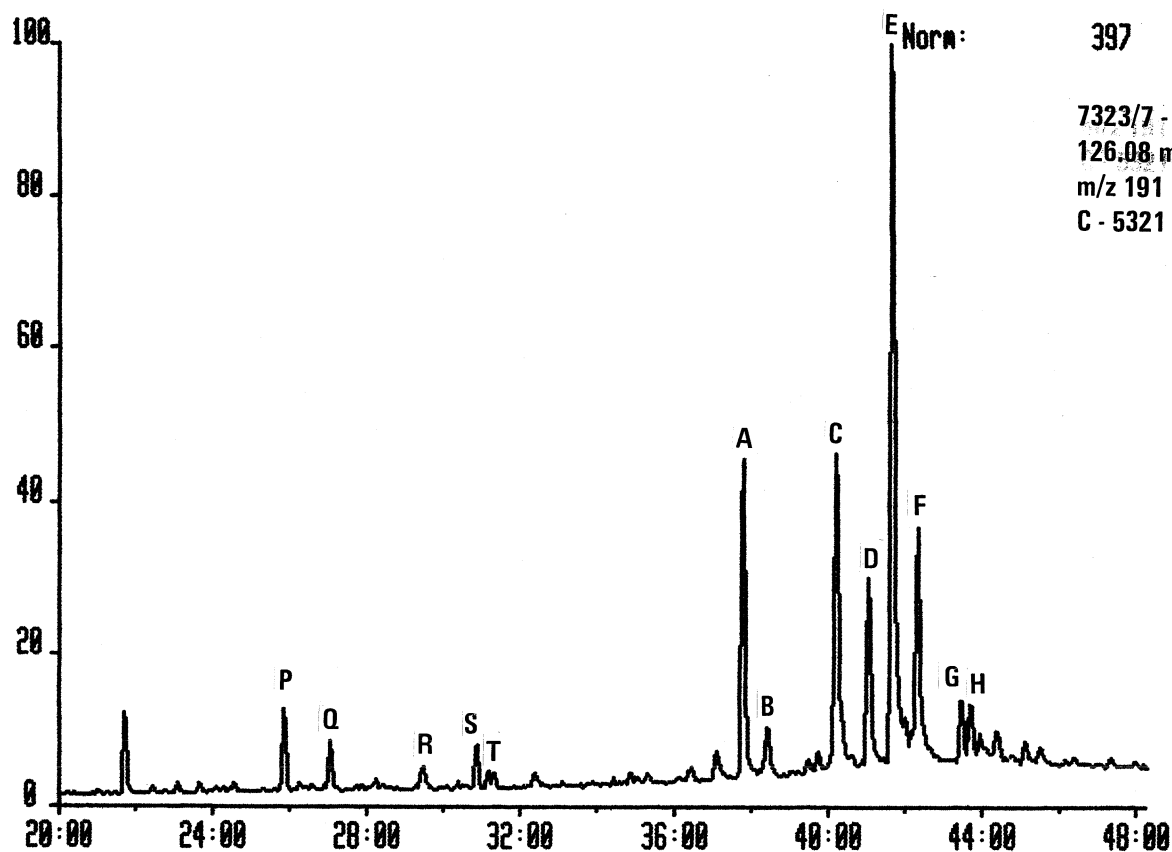
Figure A.III.1.4: Mass chromatograms of m/z 191 (terpanes).

A	T _S , 18α(H)-trisnorneohopane	C ₂₇ H ₄₆	(III)
B	T _m , 17α(H)-trisnorhopane	C ₂₇ H ₄₆	(I, R=H)
C	17α(H)-norhopane	C ₂₉ H ₅₀	(I, R=C ₂ H ₅)
D	17β(H)-normoretane	C ₂₉ H ₅₀	(II, R=C ₂ H ₅)
E	17α(H)-hopane	C ₃₀ H ₅₂	(I, R=C ₃ H ₇)
F	17β(H)-moretane	C ₃₀ H ₅₂	(II, R=C ₃ H ₇)
G	17α(H)-homohopane (22S)	C ₃₁ H ₅₄	(I, R=C ₄ H ₉)
H	17α(H)-homohopane (22R)	C ₃₁ H ₅₄	(I, R=C ₄ H ₉)
	+ unknown triterpane (gammacerane?)		
I	17β(H)-homomoretane	C ₃₁ H ₅₄	(II, R=C ₄ H ₉)
J	17α(H)-bishomohopane (22S,22R)	C ₃₂ H ₅₆	(I, R=C ₅ H ₁₁)
K	17α(H)-trishomohopane (22S,22R)	C ₃₃ H ₅₈	(I, R=C ₆ H ₁₃)
L	17α(H)-tetrakishomohopane (22S,22R)	C ₃₄ H ₆₀	(I, R=C ₇ H ₁₅)
M	17α(H)-pentakishomohopane (22S,22R)	C ₃₅ H ₆₂	(I, R=C ₈ H ₁₇)
Z	bisnorhopane	C ₂₈ H ₄₈	
X	unknown triterpane	C ₃₀ H ₅₂	
P	tricyclic terpane	C ₂₃ H ₄₂	(IV, R=C ₄ H ₉)
Q	tricyclic terpane	C ₂₄ H ₄₄	(IV, R=C ₅ H ₁₁)
R	tricyclic terpane (17R,17S)	C ₂₅ H ₄₆	(IV, R=C ₆ H ₁₃)
S	tetracyclic terpane	C ₂₄ H ₄₂	(V)
T	tricyclic terpane (17R,17S)	C ₂₆ H ₄₈	(IV, R=C ₇ H ₁₅)



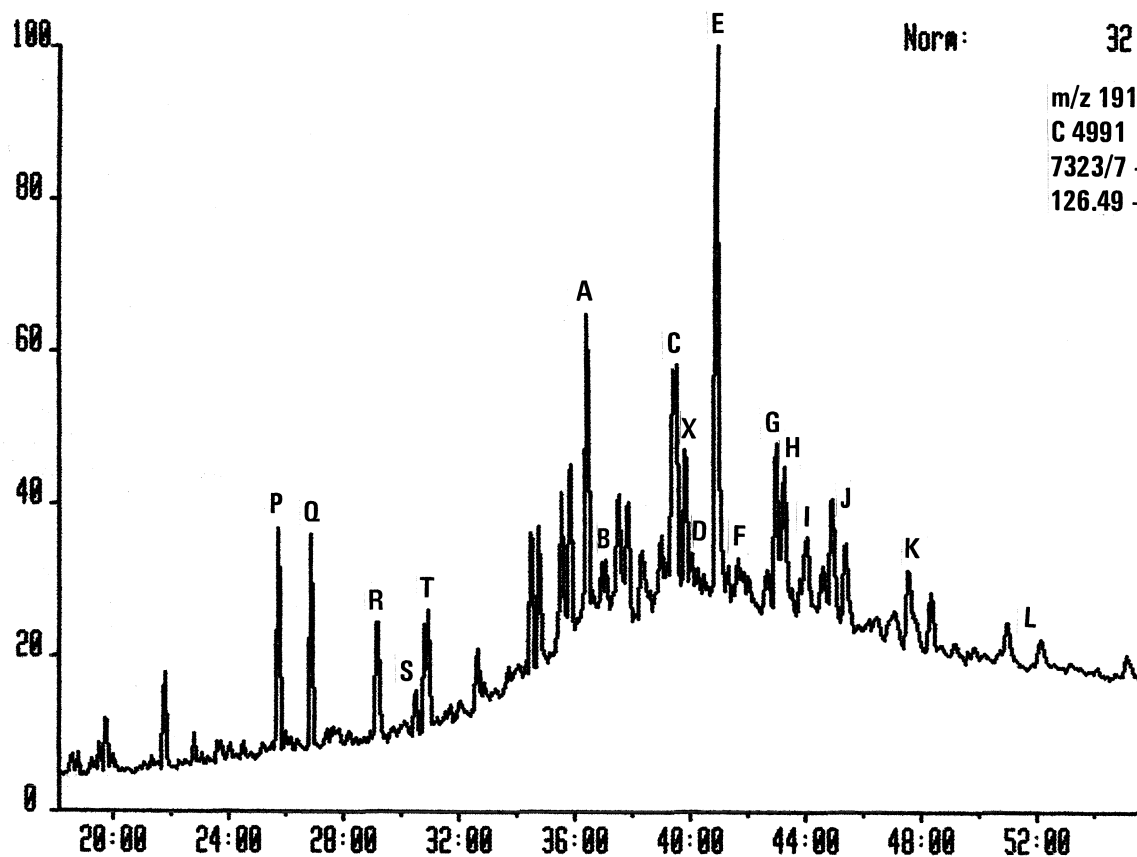
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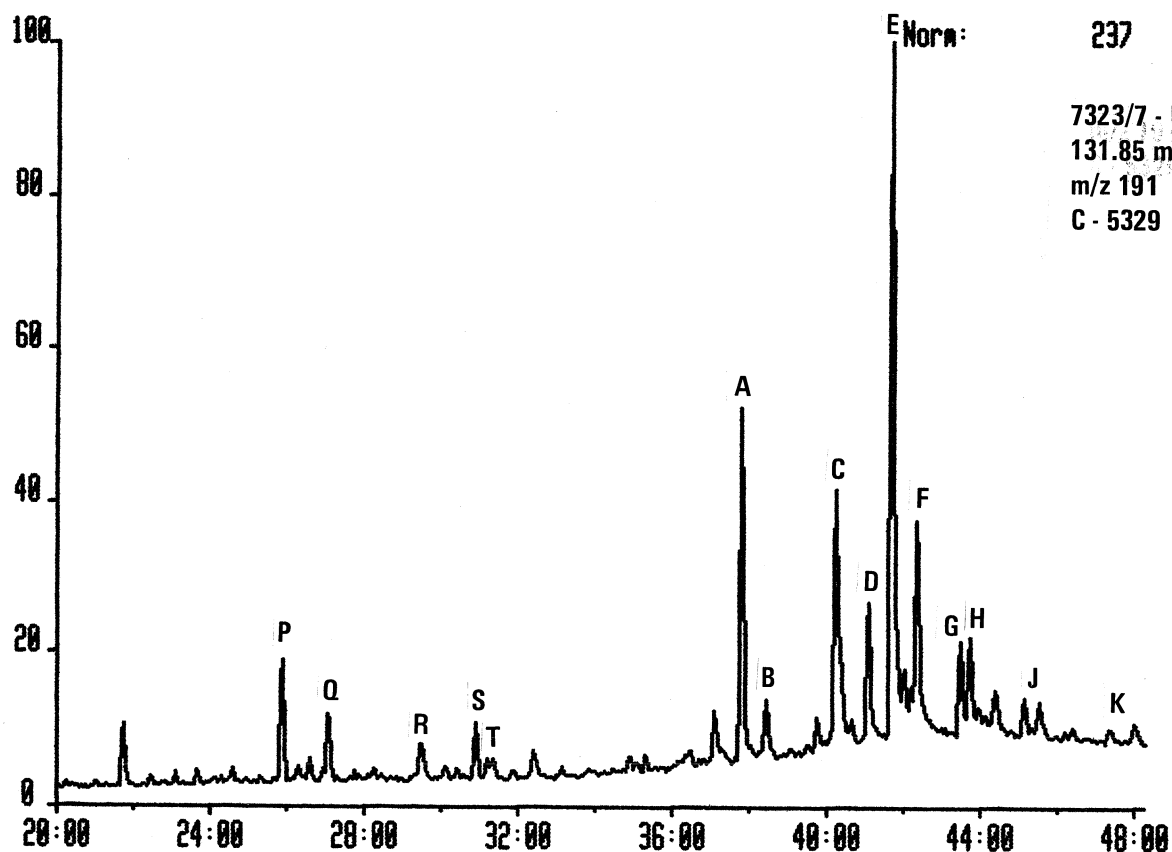


Norm: 32

m/z 191
 C 4991
 7323/7 - U - 8 # 9
 126.49 -.50 m

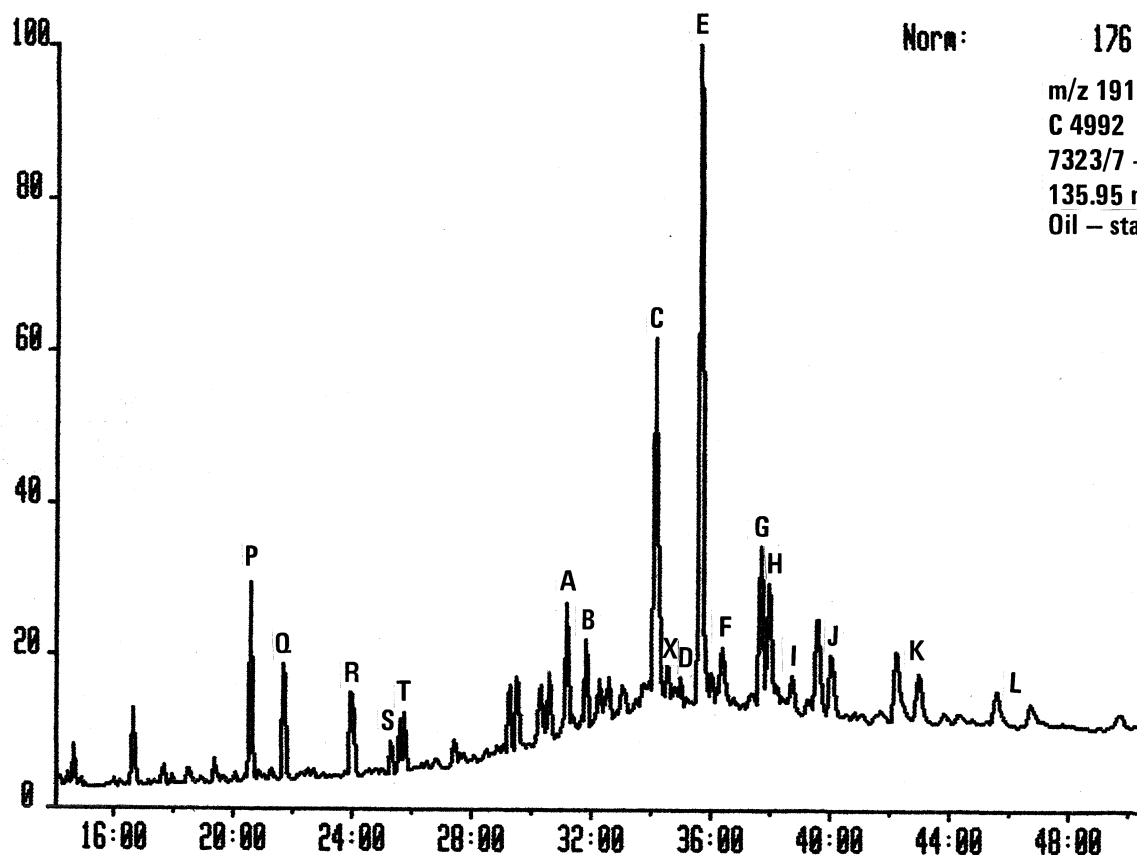
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 Sample 1 Injection 1 Group 1 Mass 191.1000
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System: QUAMID



Norm: 176

m/z 191

C 4992

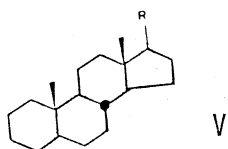
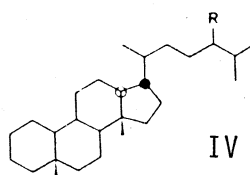
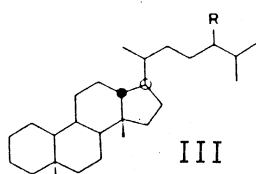
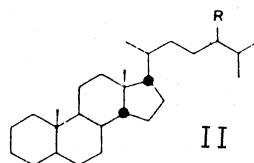
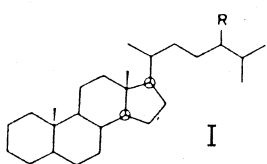
7323/7 - U - 8 # 12

135.95 m

Oil - stained sandstone

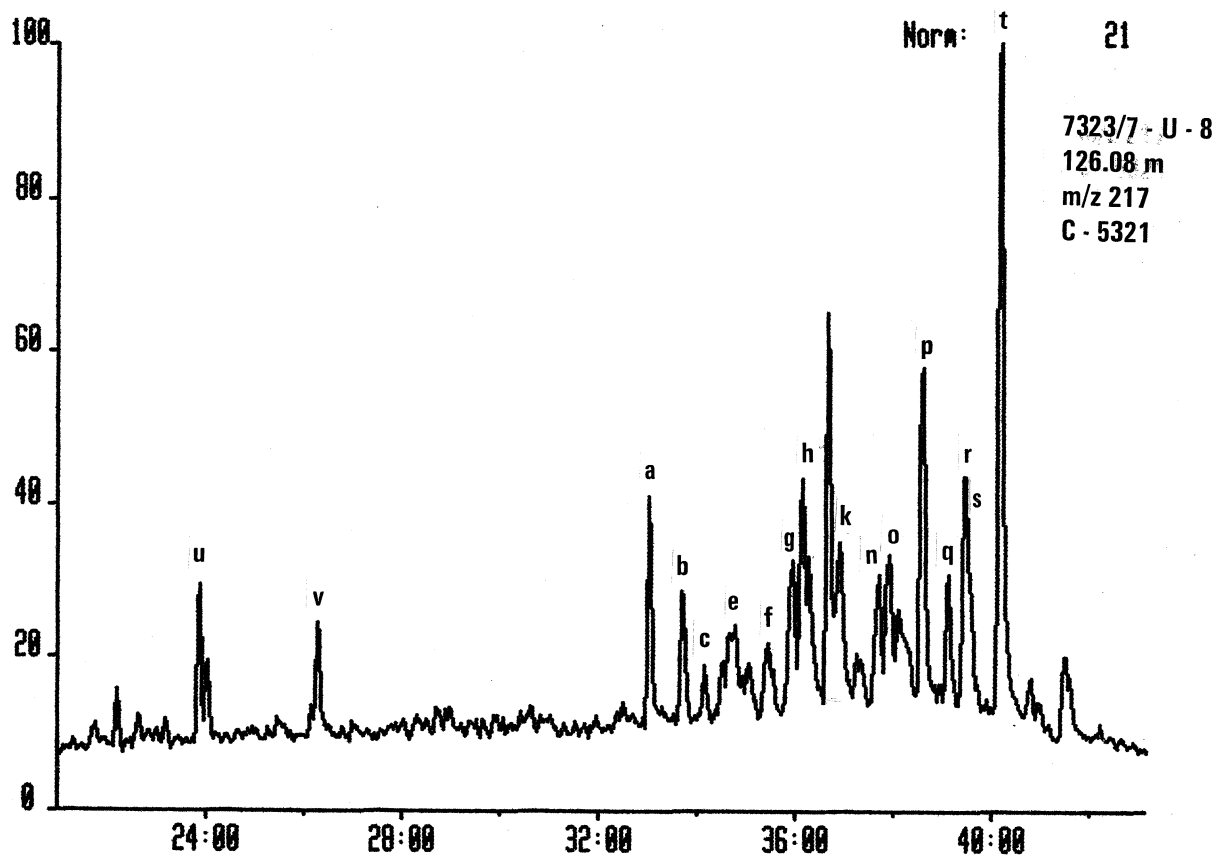
Figure A.III.1.5: Mass chromatograms of m/z 217 and 218 (steranes).

a	13 β (H),17 α (H)-diasterane (20S)	C ₂₇ H ₄₈	(III,R=H)
b	13 β (H),17 α (H)-diasterane (20R)	C ₂₇ H ₄₈	(III,R=H)
c	13 α (H),17 β (H)-diasterane (20S)	C ₂₇ H ₄₈	(IV,R=H)
d	13 α (H),17 β (H)-diasterane (20R)	C ₂₇ H ₄₈	(IV,R=H)
e	13 β (H),17 α (H)-diasterane (20S)	C ₂₈ H ₅₀	(III,R=CH ₃)
f	13 β (H),17 α (H)-diasterane (20R)	C ₂₈ H ₅₀	(III,R=CH ₃)
g	13 α (H),17 β (H)-diasterane (20S)	C ₂₈ H ₅₀	(IV,R=CH ₃)
	+ 14 α (H),17 α (H)-sterane (20S)	C ₂₇ H ₄₈	(I,R=H)
h	13 β (H),17 α (H)-diasterane (20S)	C ₂₉ H ₅₂	(III,R=C ₂ H ₅)
	+ 14 β (H),17 β (H)-sterane (20R)	C ₂₇ H ₄₈	(II,R=H)
i	14 β (H),17 β (H)-sterane (20S)	C ₂₇ H ₄₈	(II,R=H)
	+ 13 α (H),17 β (H)-diasterane (20R)	C ₂₈ H ₅₀	(IV,R=CH ₃)
j	14 α (H),17 α (H)-sterane (20R)	C ₂₇ H ₄₈	(I,R=H)
k	13 β (H),17 α (H)-diasterane (20R)	C ₂₉ H ₅₂	(III,R=C ₂ H ₅)
l	13 α (H),17 β (H)-diasterane (20S)	C ₂₉ H ₅₂	(III,R=C ₂ H ₅)
m	14 α (H),17 α (H)-sterane (20S)	C ₂₈ H ₅₀	(I,R=CH ₃)
n	13 α (H),17 β (H)-diasterane (20R)	C ₂₉ H ₅₂	(III,R=C ₂ H ₅)
	+ 14 β (H),17 β (H)-sterane (20R)	C ₂₈ H ₅₀	(II,R=CH ₃)
o	14 β (H),17 β (H)-sterane (20S)	C ₂₈ H ₅₀	(II,R=CH ₃)
p	14 α (H),17 α (H)-sterane (20R)	C ₂₈ H ₅₀	(I,R=CH ₃)
q	14 α (H),17 α (H)-sterane (20S)	C ₂₉ H ₅₂	(I,R=C ₂ H ₅)
r	14 β (H),17 β (H)-sterane (20R)	C ₂₉ H ₅₂	(II,R=C ₂ H ₅)
	+ unknown sterane		
s	14 β (H),17 β (H)-sterane (20S)	C ₂₉ H ₅₂	(II,R=C ₂ H ₅)
t	14 α (H),17 α (H)-sterane (20R)	C ₂₉ H ₅₂	(I,R=C ₂ H ₅)
u	5 α (H)-sterane	C ₂₁ H ₃₆	(V,R=C ₂ H ₅)
v	5 α (H)-sterane	C ₂₂ H ₃₈	(IV,R=C ₃ H ₇)



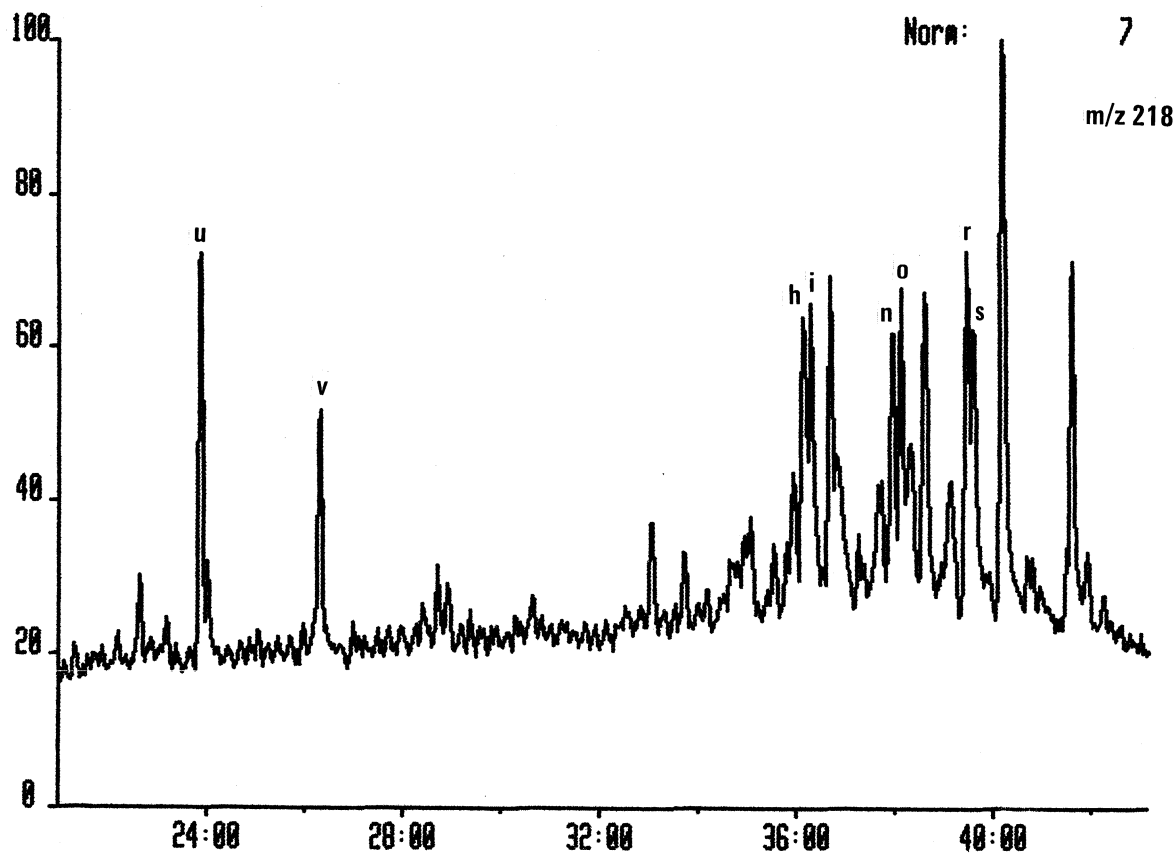
C5321SAT 5-DEC-86 Sir:Voltage 7070H Acnt:IKU
Sample 1 Injection 1 Group 1 Mass 217.1000
Text:

System:TRIT



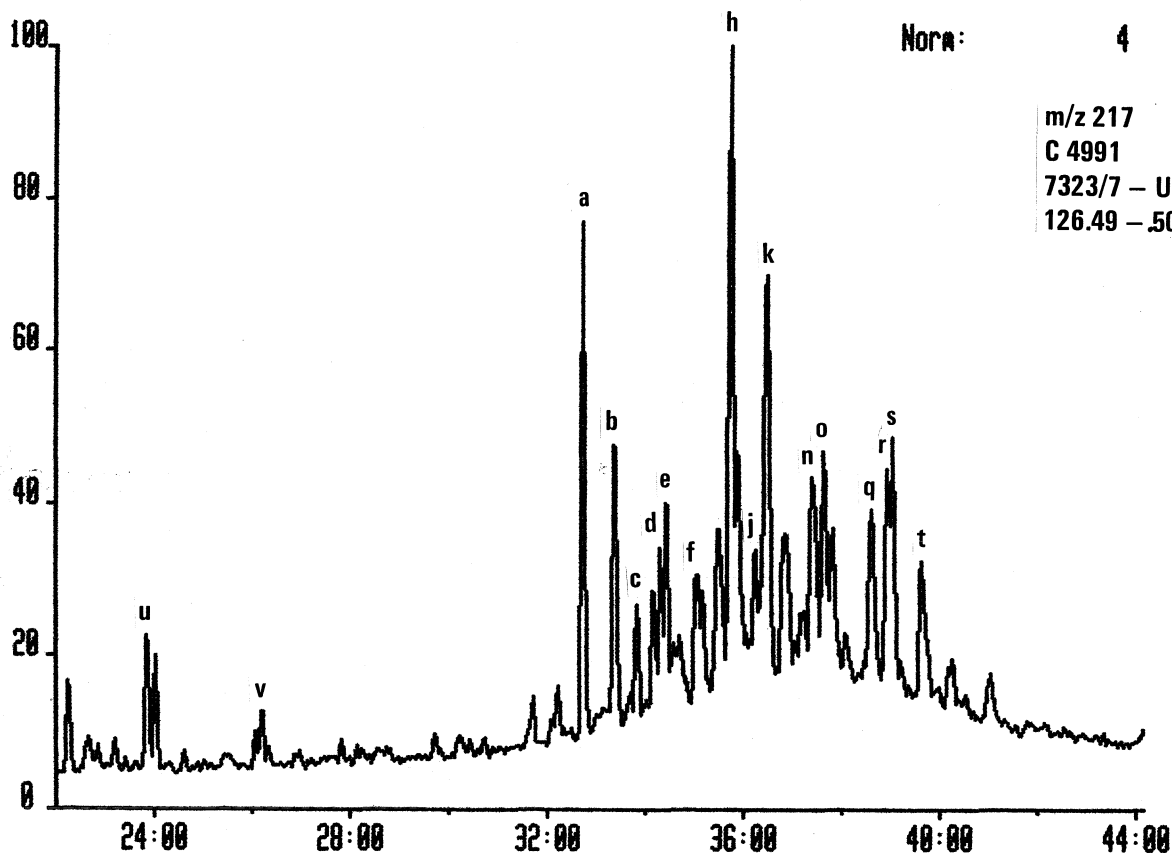
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Sample 1 Injection 1 Group 1 Mass 218.1000
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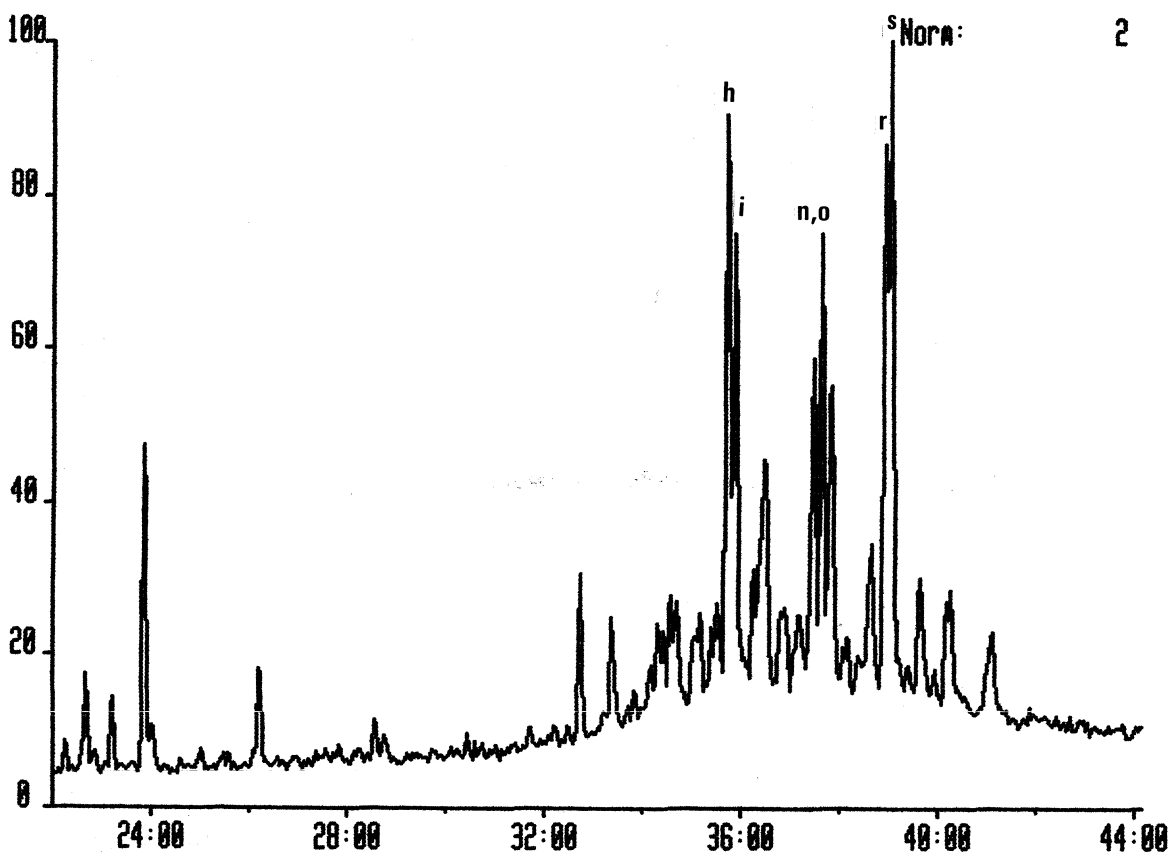
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Text:

System:QUAMID



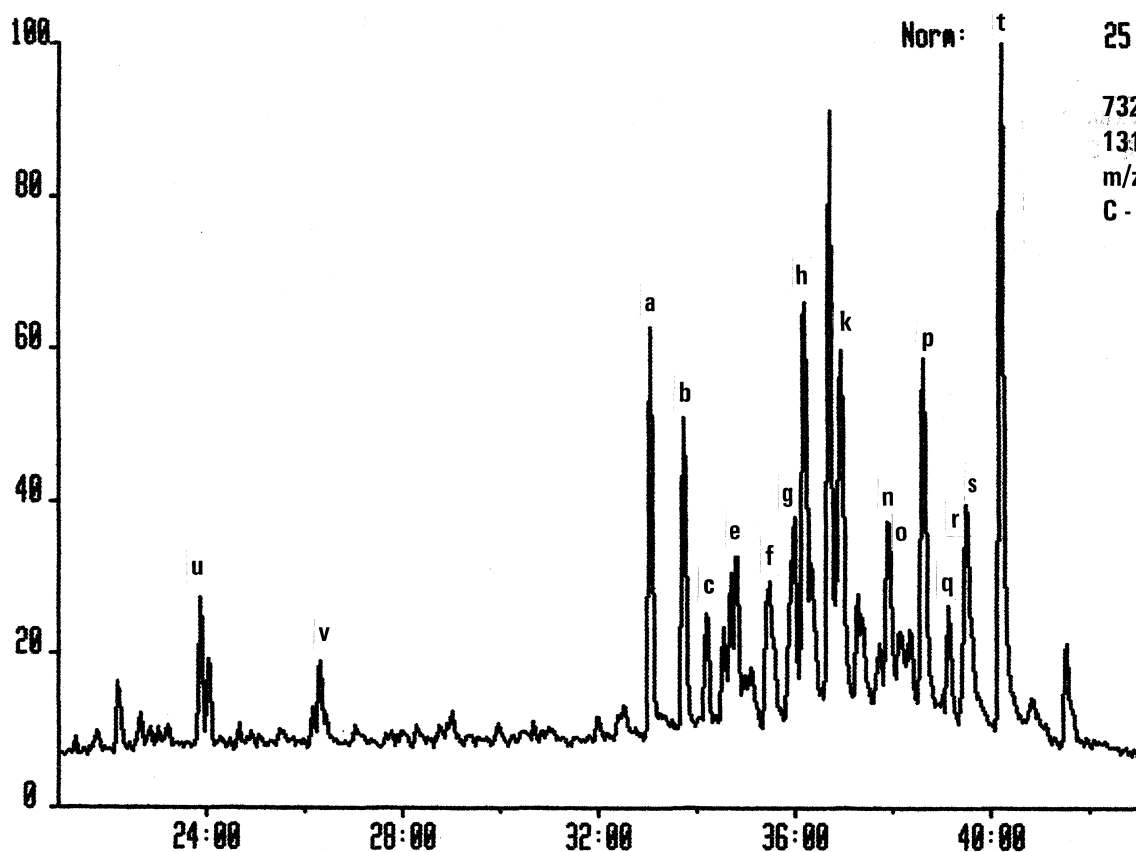
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Sample 1 Injection 1 Group 1 Mass 218.1000
Text:

System:QUAMID



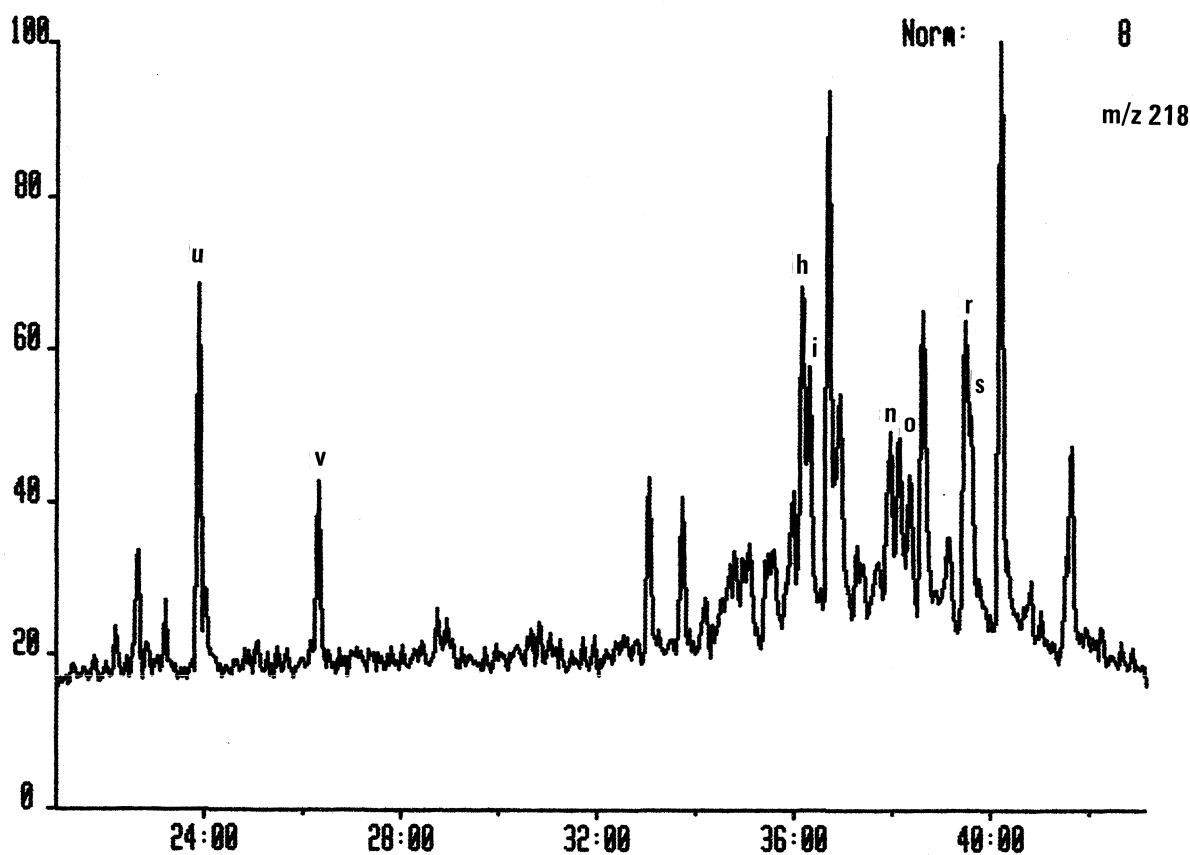
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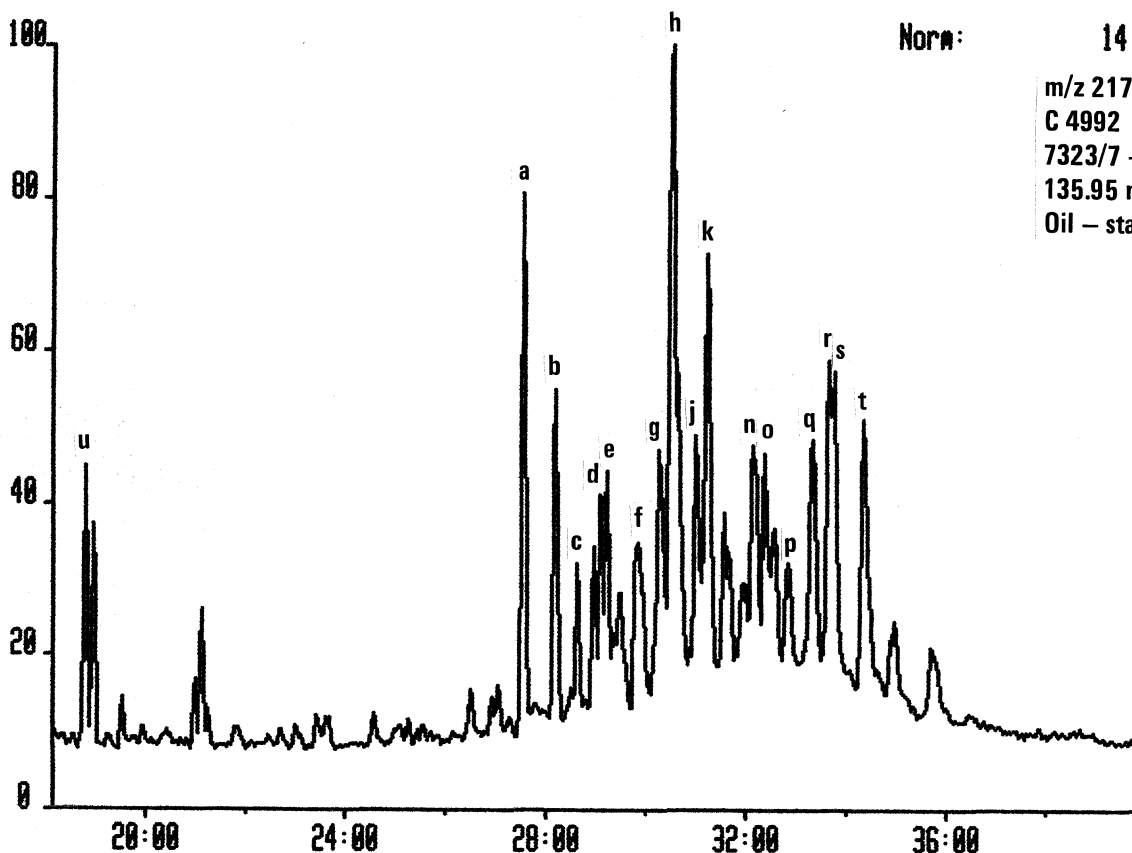
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 Sample 1 Injection 1 Group 1 Mass 218.1000
 Text:

System:TRIT



C4992SAT 28-AUG-86 Sir:Voltage 12-250 Acnt:IKU
Sample 1 Injection 1 Group 1 Mass 217.1000
Text:

System:QUAMID

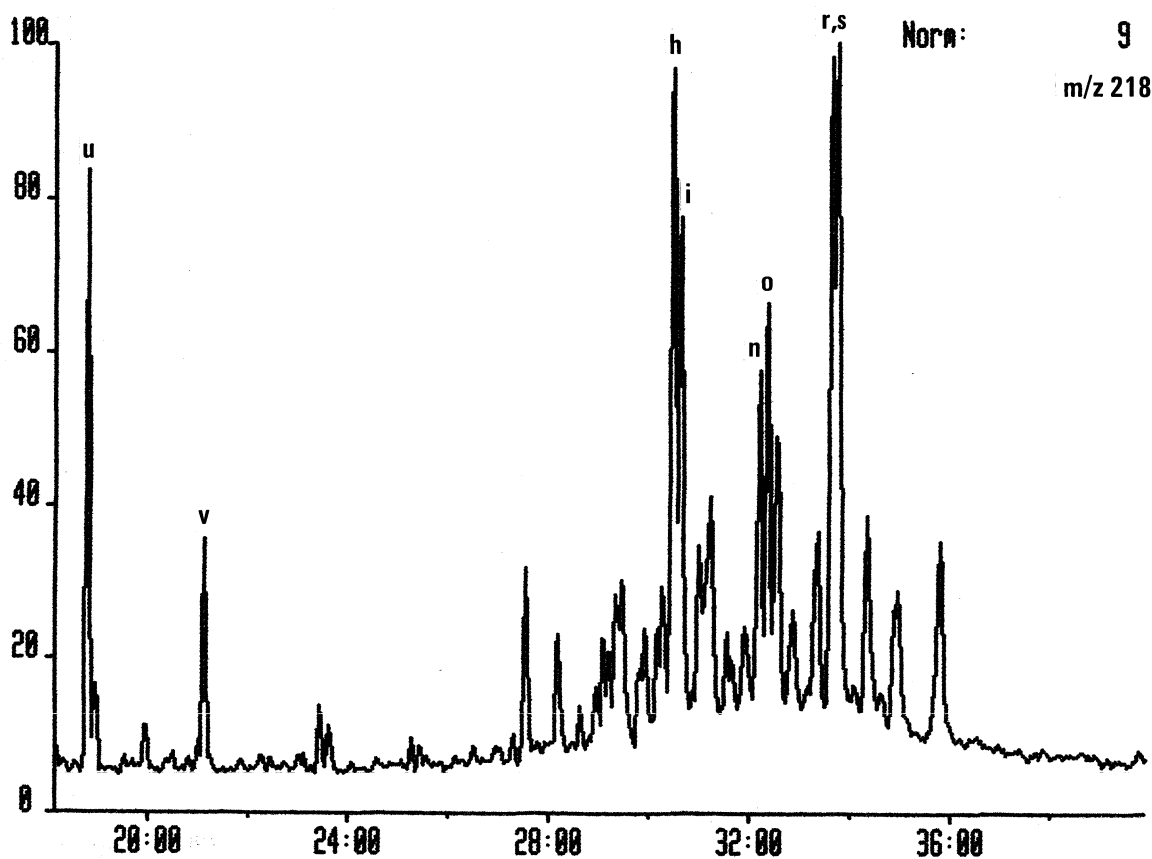


Norm: 14

m/z 217
C 4992
7323/7 - U - 8 # 12
135.95 m
Oil - stained sandstone

C4992SAT 28-AUG-86 Sir:Voltage 12-250 Acnt:IKU
Sample 1 Injection 1 Group 1 Mass 218.1000
Text:

System:QUAMID



Norm: 9
m/z 218

Figure A.III.1.6: Mass chromatograms representing monoaromatic (m/z 239 and 253) and triaromatic (m/z 231) steranes.

m/z 253

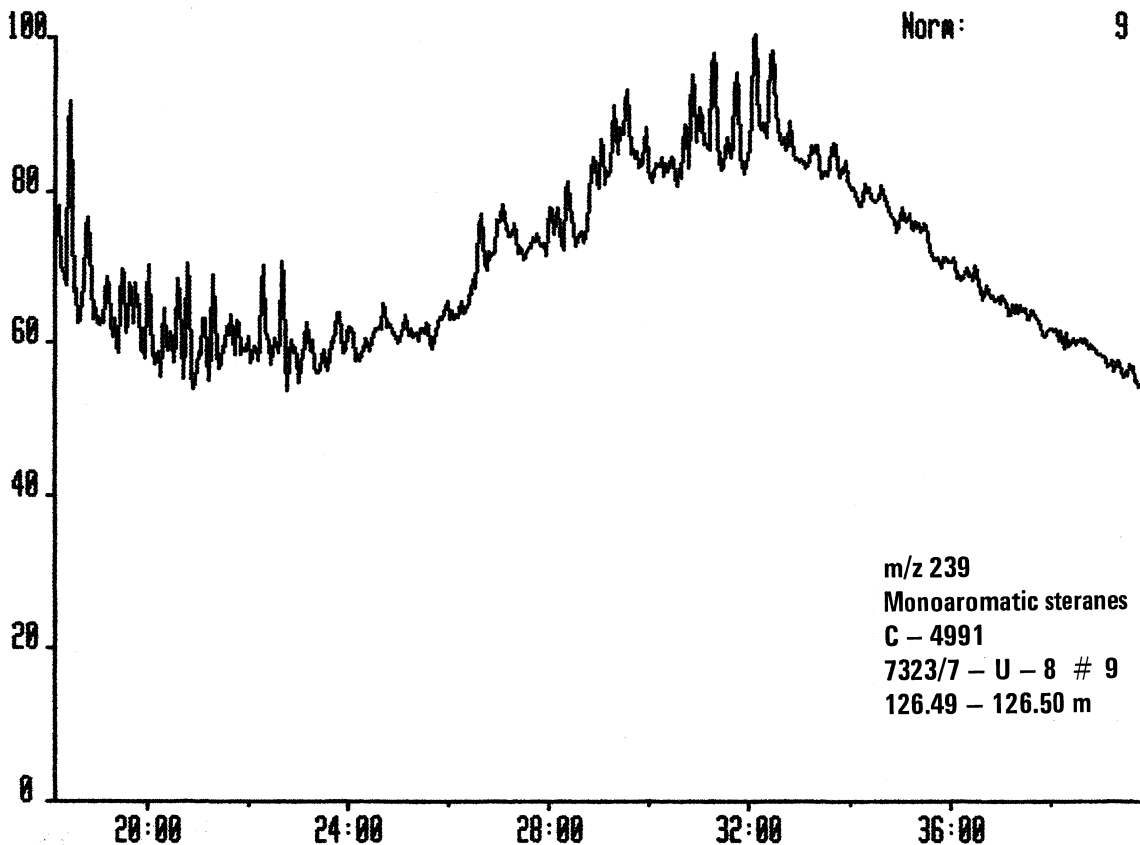
- a - C₂₁ monoaromatic sterane
- b - C₂₂ monoaromatic sterane
- c - unidentified
- d - C₂₇ monoaromatic sterane
- e - C₂₇ monoaromatic sterane
- f - C₂₈ monoaromatic sterane
- g - C₂₇ monoaromatic sterane
- h - C₂₈ + C₂₉ monoaromatic sterane
- i - C₂₉ monoaromatic sterane
- j - C₂₉ monoaromatic sterane
- k - unidentified
- l - unidentified

m/z 231

- M - C₂₀ triaromatic sterane
- N - C₂₁ triaromatic sterane
- O - C₂₆ triaromatic sterane
- P - C₂₆ + C₂₇ triaromatic sterane
- Q - C₂₈ triaromatic sterane
- R - C₂₇ triaromatic sterane
- S - C₂₈ triaromatic sterane

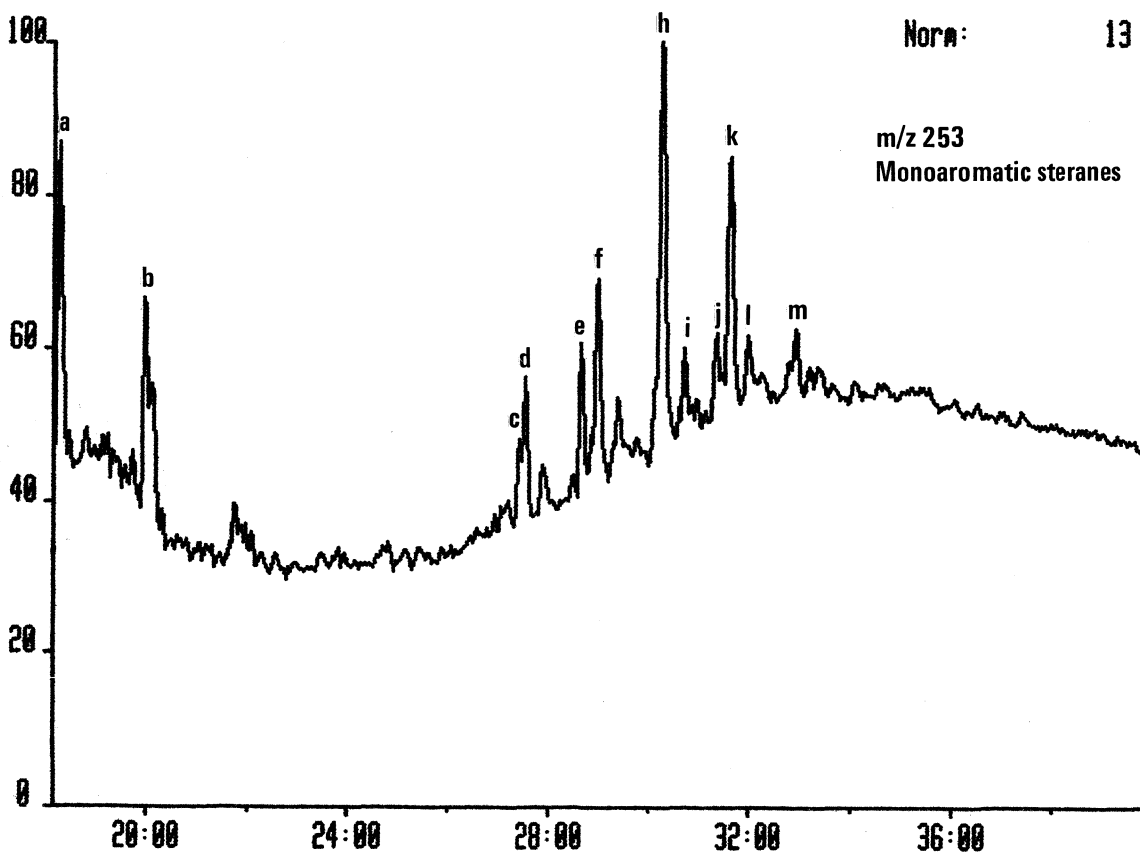
C4991AROS 29-AUG-86 Sir:Voltage 12-250 Acnt:IKU
Sample 1 Injection 1 Group 1 Mass 239.1000
Text:

System:STERANER



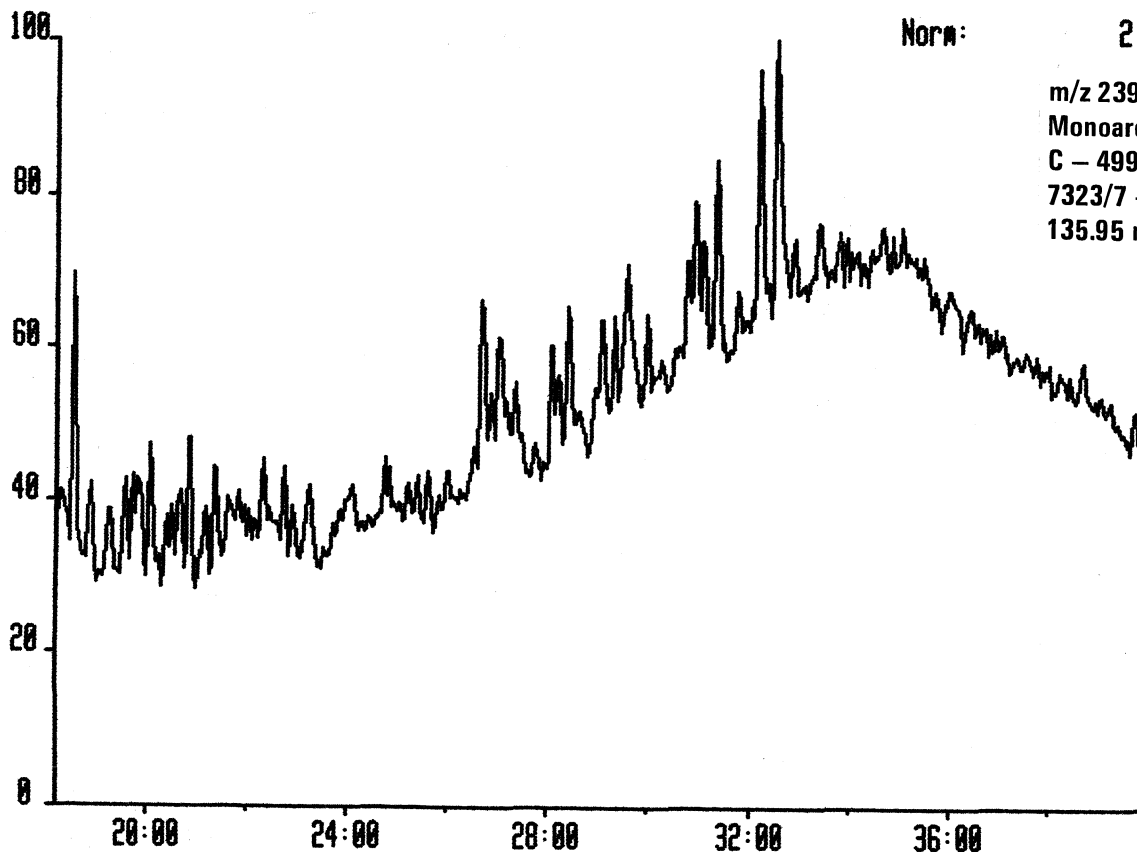
C4991AROS 29-AUG-86 Sir:Voltage 12-250 Acnt:IKU
Sample 1 Injection 1 Group 1 Mass 253.1000
Text:

System:STERANER



C4992AROS 1-SEP-86 Sir:Voltage 12-250 Acnt:IKU
Sample 1 Injection 1 Group 1 Mass 239.1000
Text:

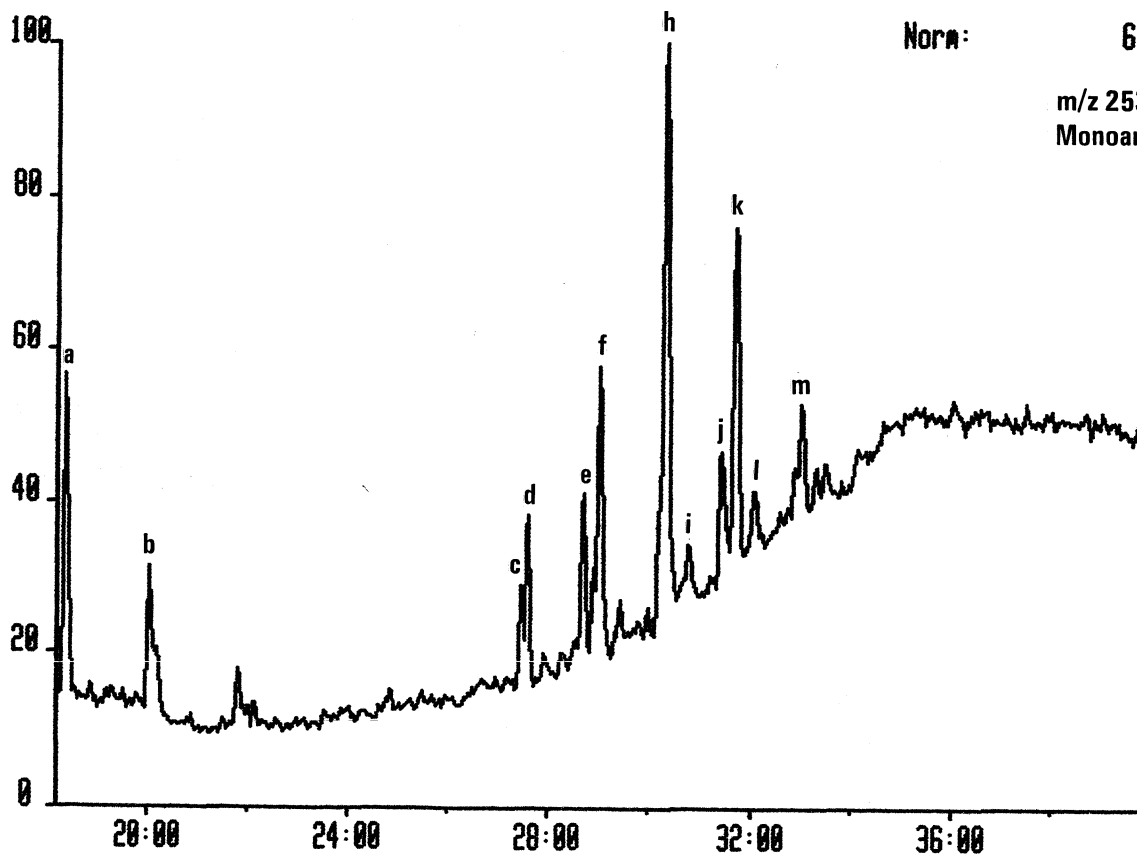
System:STERANER



m/z 239
Monoaromatic steranes
C - 4992
7323/7 - U - 8 # 12
135.95 m

C4992AROS 1-SEP-86 Sir:Voltage 12-250 Acnt:IKU
Sample 1 Injection 1 Group 1 Mass 253.1000
Text:

System:STERANER

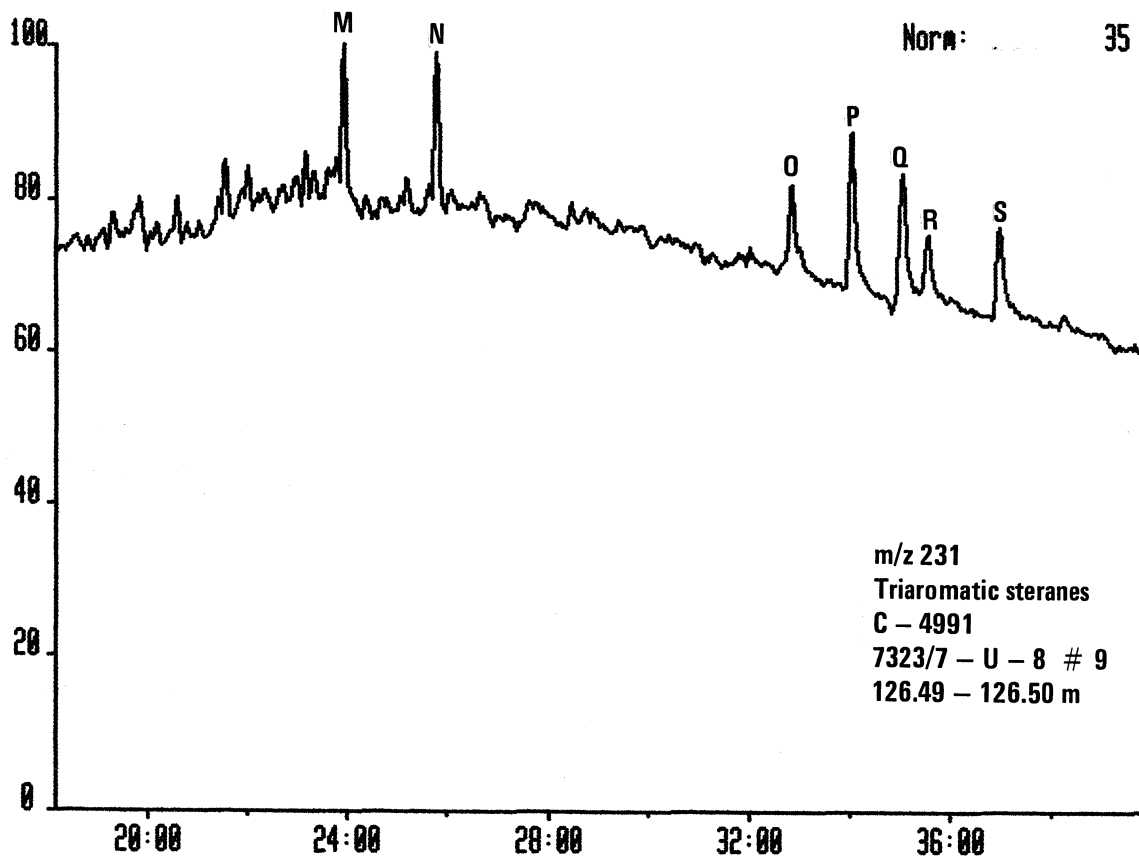


m/z 253
Monoaromatic steranes

C4991AROS 29-AUG-86
Sample 1 Injection 1
Text:

Sir:Voltage 12-250 Acnt:IKU
Group 1 Mass 231.1000

System:STERANER



C4992AROS 1-SEP-86
Sample 1 Injection 1
Text:

Sir:Voltage 12-250 Acnt:IKU
Group 1 Mass 231.1000

System:STERANER

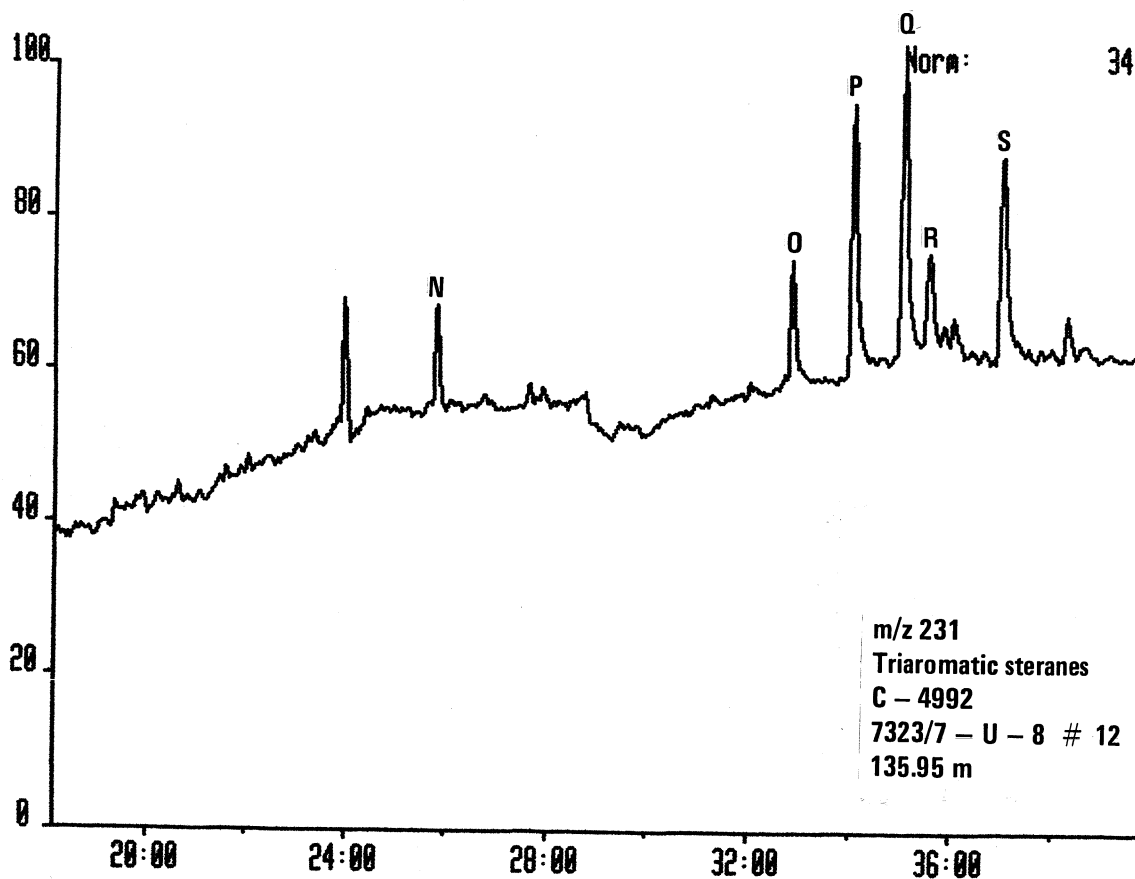


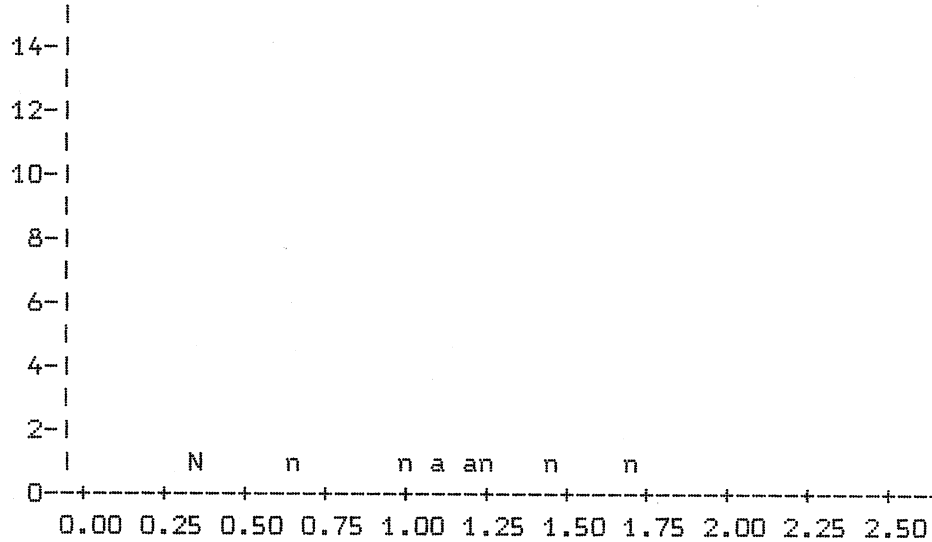
Figure A.III.1.7: Vitrinite reflectance histograms.

Key: A = Grey-black-brown claystone.
 Upper case letters indicate values included in
 the main population. Lower case letters represent
 values in other populations.
 PP = Statistical data populations
 Y = Main population, not necessarily
 representative of sample maturity.
 N = Other populations.
 LOW+ HIGH = Population limits.
 VAL. = Number of measurements in that
 population.

Lithology cross-reference table

A = Clst. gy
 B = Clst. dk gy
 C = Clst. gn
 D = Clst. bn
 E = Clst. rd
 F = Clst. calc.
 G = Clst. carb.
 H = Shale
 I = Sandstone
 J = Limestone
 K = Coal
 L = Lignite
 M = Carbargillite
 N = Siltstone
 O = Bit
 P = X

IKU# C-4964 110.4M 7323/7-U-8

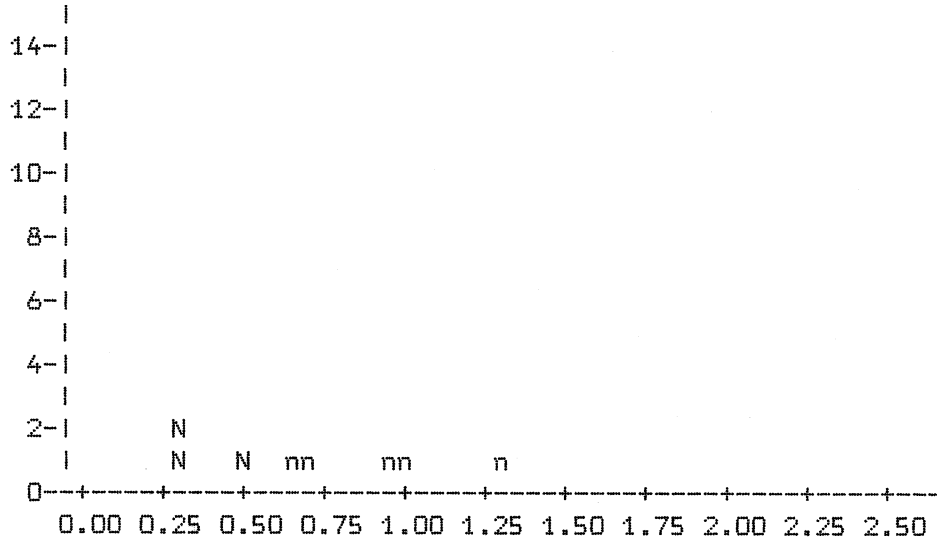


PP	LOW	HIGH	LIT	#VAL	MEAN	STDV
Y	0.36	0.37	ALL	1	0.36	0.00
N	0.67	0.68	ALL	1	0.67	0.00
N	1.02	1.71	ALL	6	1.31	0.25
OVERALL				8	1.11	0.43

ORDERED VALUES FOLLOW:

0.36N 0.67n 1.02n 1.14a 1.24a 1.27n 1.48n 1.70n

IKU# C-5315 118.7M 7323/7-U-8



PP	LOW	HIGH	LIT	#VAL	MEAN	STDV
Y	0.30	0.51	ALL	3	0.37	0.11
N	0.66	0.71	ALL	2	0.68	0.03
N	0.97	1.32	ALL	3	1.09	0.19
OVERALL				8	0.72	0.35

ORDERED VALUES FOLLOW:

0.30N 0.32N 0.50N 0.66n 0.70n 0.97n 1.00n 1.31n

APPENDIX III.2: TABLE OF CONTENTS

Core 7323/7-U-6:

TABLES

- Table A.III.2.1a: Concentration of C_1-C_5 hydrocarbons in headspace gas.
- Table A.III.2.1b: Concentration of C_1-C_5 hydrocarbons in occluded gas.
- Table A.III.2.1c: Concentration of C_1-C_5 hydrocarbons - summation.
- Table A.III.2.2: Total organic carbon and data from Rock-Eval pyrolysis.
- Table A.III.2.3: Weight of EOM and chromatographic fractions.
- Table A.III.2.4: Concentration of EOM and chromatographic fractions.
- Table A.III.2.5: Concentration of EOM and chromatographic fractions.
- Table A.III.2.6: Composition of material extracted from the rock.
- Table A.III.2.7: Tabulation of data from the gas chromatograms.
- Table A.III.2.8: Molecular ratios from sterane and terpane mass chromatograms. Maturity ratios.
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- Figure A.III.2.1: Saturated hydrocarbon gas chromatograms.
- Figure A.III.2.2: Aromatic hydrocarbon gas chromatograms.
- Figure A.III.2.3: Mass chromatograms of m/z 191 (terpanes).
- Figure A.III.2.4: Mass Chromatograms of m/z 217 and 218 (steranes).

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DATE : 28 - 10 - 86.

Table A.III.2.1a: Concentration of C₁-C₅+ hydrocarbons in headspace gas.

[illegible]

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Table A.III.2.1b: Concentration of C₁-C₅ hydrocarbons in occluded gas.

[illegible]

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DATE : 28 - 10 - 86.

Table A.III.2.1c: Concentration of C₁-C₅ hydrocarbons - summation.

[illegible]

Table A.III.2.2: Total organic carbon and data from Rock-Eval pyrolysis.

I		:					HYDR.	OXYGEN	PETROLEUM	PROD.	TEMP.	I		
I	IKU	DEPTH	:	S1	S2	S3	TOC	INDEX	INDEX	POTENTIAL	INDEX	MAX	I	
I	No.	:	:								S1		I	
I		:	:								-----		I	
I		m/ft	:	(	mg/g ROCK	)	(%)	(	mg/g TOC	)	S1+S2	S1+S2	(C)	I
I			:										I	
I			:										I	
I	C 4944	99.59	:	0.13	0.24	0.45	0.42	57	107	0.37	0.35	426	I	
I			:										I	
I	C 4945	102.15	:	****	****	****	0.37	*****	****	*****	*****	***	I	
I			:										I	
I	C 5338	103.45	:	****	****	****	0.28	*****	****	*****	*****	***	I	
I			:										I	
I	C 4946	104.88	:	0.07	0.12	0.28	0.27	44	104	0.19	0.37	373	I	
I			:										I	
I	C 5342	106.60	:	****	****	****	0.29	*****	****	*****	*****	***	I	
I			:										I	
I	C 5343	107.70	:	****	****	****	0.26	*****	****	*****	*****	***	I	
I			:										I	
I	C 4947	109.05	:	****	****	****	0.27	*****	****	*****	*****	***	I	
I			:										I	
I	C 5347	110.60	:	****	****	****	0.23	*****	****	*****	*****	***	I	
I			:										I	
I	C 4948	112.24	:	0.07	0.16	0.09	0.31	52	29	0.23	0.30	392	I	
I			:										I	
I	C 5351	114.65	:	****	****	****	0.27	*****	****	*****	*****	***	I	
I			:										I	
I	C 4949	116.16	:	****	****	****	0.43	*****	****	*****	*****	***	I	
I			:										I	
I	C 4950	118.45	:	0.06	0.20	0.22	0.37	54	59	0.26	0.23	428	I	
I			:										I	
I	C 5355	119.15	:	****	****	****	0.25	*****	****	*****	*****	***	I	
I			:										I	
I	C 5357	121.25	:	****	****	****	0.26	*****	****	*****	*****	***	I	
I			:										I	
I	C 5357	121.25	:	****	****	****	0.26	*****	****	*****	*****	***	I	
I			:										I	
I	C 4951	122.33	:	****	****	****	0.15	*****	****	*****	*****	***	I	
I			:										I	
I	C 5360	123.95	:	****	****	****	0.33	*****	****	*****	*****	***	I	
I			:										I	
I	C 4952	125.20	:	0.06	0.20	0.15	0.41	49	37	0.26	0.23	424	I	
I			:										I	
I	C 5363	126.92	:	****	****	****	0.32	*****	****	*****	*****	***	I	
I			:										I	
I	C 4953	128.39	:	****	****	****	0.01	*****	****	*****	*****	***	I	
I			:										I	
I	C 5366	130.05	:	****	****	****	0.24	*****	****	*****	*****	***	I	
I			:										I	
I	C 4954	131.39	:	0.05	0.16	0.13	0.38	42	34	0.21	0.24	426	I	
I			:										I	

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Table A.III.2.3: Weight of EOM and chromatographic fractions.

I		:	Rock							I
I	IKU-No	DEPTH	: Extr.	EOM	Sat.	Aro.	HC	Non HC	TOC	I
I		:								I
I		(m)	: (g)	(mg)	(mg)	(mg)	(mg)	(mg)	(%)	I
I		:								I
I	C 4944	99.59	: 30.1	9.7	2.6	1.2	3.8	5.9	0.27	I
I		:								I
I	C 4950	118.45	: 37.7	10.3	2.4	1.1	3.5	6.8	0.30	I
I		:								I

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Table A.III.2.4: Concentration of EOM and chromatographic fractions.

I		:							I
I	IKU-No	DEPTH	:	EOM	Sat.	Aro.	HC	Non HC	I
I		(m)	:						I
I									I
I			:						I
I	C 4944	99.59	:	322	88	40	128	195	I
I			:						I
I	C 4950	118.45	:	273	64	29	92	181	I
I			:						I

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Table A.III.2.5: Concentration of EOM and chromatographic fractions.

I		:						I
I	IKU-No	DEPTH	:	EOM	Sat.	Aro.	HC	Non HC
I		(m)	:					
I								I
I			:					I
I	C 4944	99.59	:	119.4	32.5	14.8	47.3	72.1
I			:					I
I	C 4950	118.45	:	91.1	21.2	9.6	30.8	60.3
I			:					I

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Table A.III.2.6: Composition of material extracted from the rock.

I			:	Sat	Aro	HC	SAT	Non HC	HC	I
I	IKU-No	DEPTH	:	---	---	---	---	---	---	I
I			:	EOM	EOM	EOM	Aro	EOM	Non HC	I
I		(m)	:	%	%	%	x 100	%	x 100	I
I			:							I
I			:							I
I	C 4944	99.59	:	27.2	12.4	39.6	220.0	60.4	65.5	I
I			:							I
I	C 4950	118.45	:	23.3	10.5	33.8	222.2	66.2	51.0	I
I			:							I

7323/7-U-6

Table A.III.2.7: Tabulation of data from the gas chromatograms.

I		DEPTH	:	PRISTANE	PRISTANE	PHYTANE	A	n-C17	I
I	IKU No.		:	-----	A = -----	B = -----	-----	-----	I
I		(m)	:	PHYTANE	n-C17	n-C18	B	n-C27	I
I			:						I
I			:						I
I	C 4944	99.59	:	1.0	0.5	0.5	1.2	0.7	I
I			:						I
I	C 4950	118.45	:	1.2	2.1	1.9	1.1	0.6	I
I			:						I
I			:						I

DATE : 24 - 11 - 86.

Table A.III.2.8: Molecular ratios from sterane and terpane mass chromatograms. Maturity ratios.

IKU code	Well/depth	$\alpha\beta/\alpha\beta+\beta\alpha$ ¹⁾	%22S ²⁾	%20S ³⁾	% $\beta\beta$ ⁴⁾
<u>Well 7323/7-U-6</u>					
C-4950	118.45 m	0.82	48.6	11.0	35.1

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

2) Average % distribution between first and second eluting isomers of extended hopanes (G-M in m/z 191)

3) q/q+t in m/z 217

4) $2(r+s)/(q+t+2(r+s))$ in m/z 217

Table A.III.2.9: Molecular ratios from terpane and sterane mass chromatograms. Maturity and source characteristic ratios.

IKU no.	Well/depth	Q/E ¹⁾	T _m /T _s ²⁾	X/E ³⁾	Z/E ⁴⁾	a/a+j ⁵⁾
---------	------------	-------------------	--	-------------------	-------------------	---------------------

Well 7323/7-U-6

C-4950	118.45 m	0.06	4.8	-	0.07	0.13
--------	----------	------	-----	---	------	------

- 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 C₂₇ rearranged steranes (a/a+j in m/z 217)

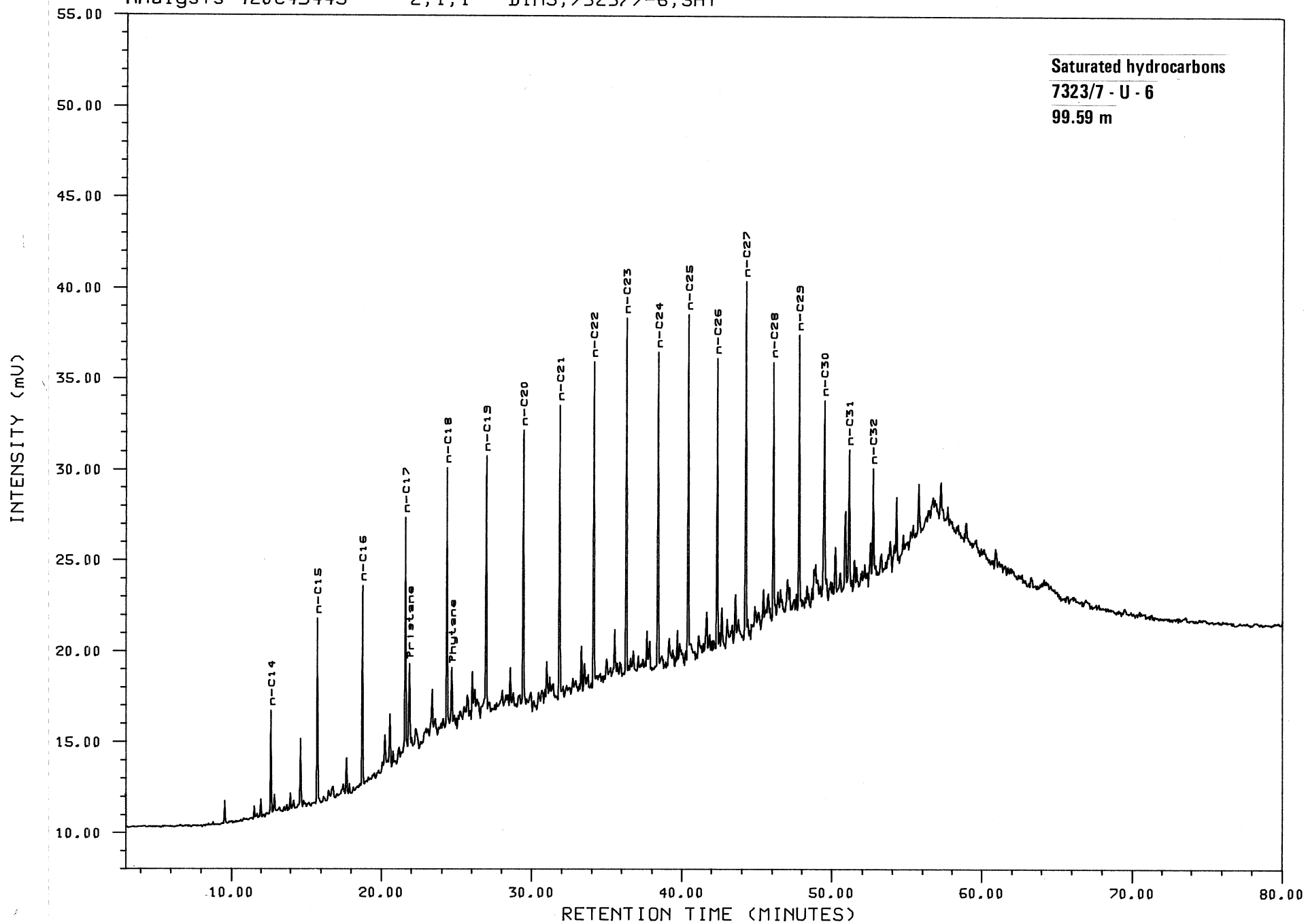
Figure A.III.2.1: Saturated hydrocarbon gas chromatograms.

n-C ₁₅ etc.	- n-alkanes
Pr	- pristane
Ph	- phytane
*	- other acyclic isoprenoids

Analysis 420C4944S

2,1,1

DIAS, 7323/7-6, SAT



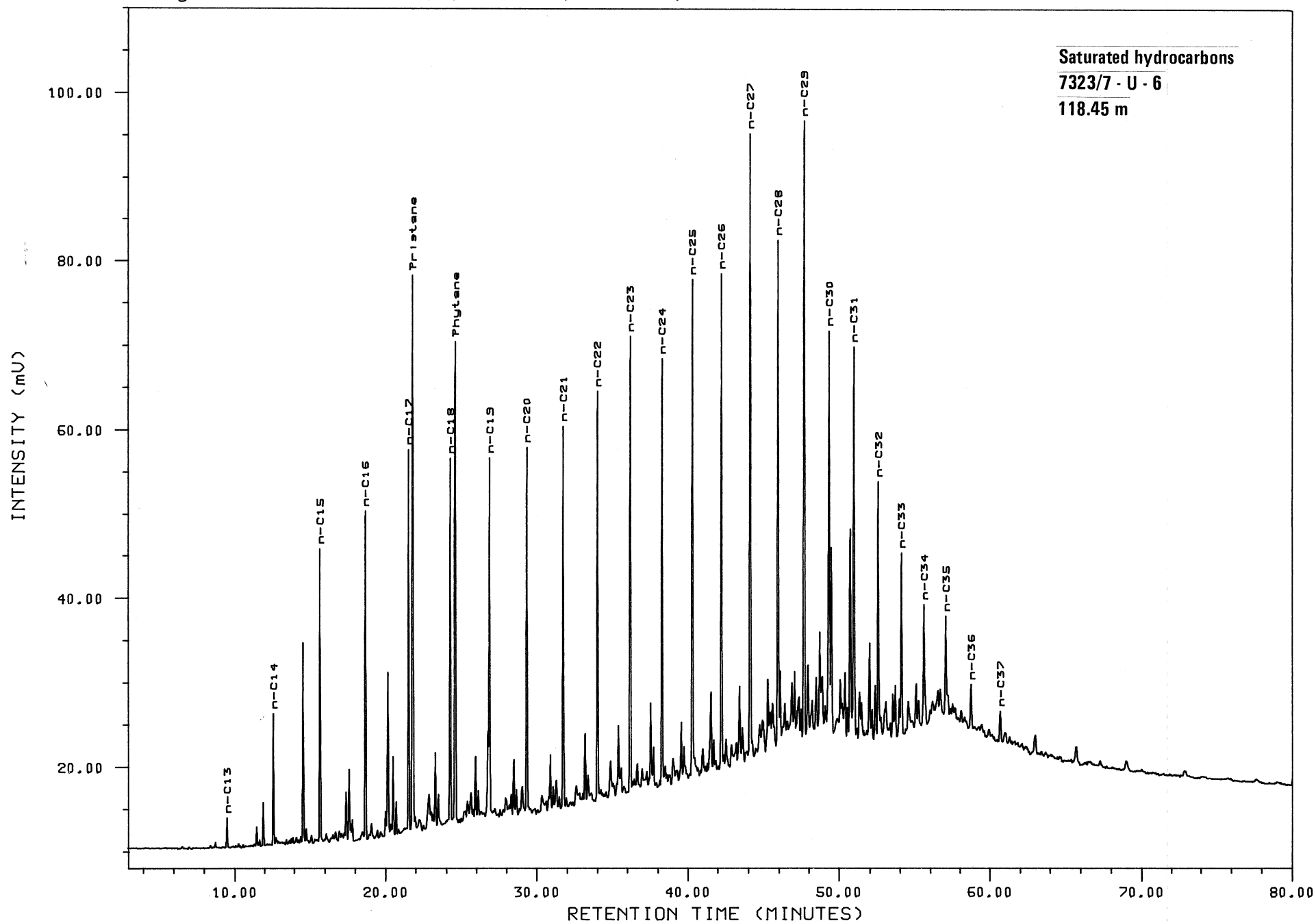
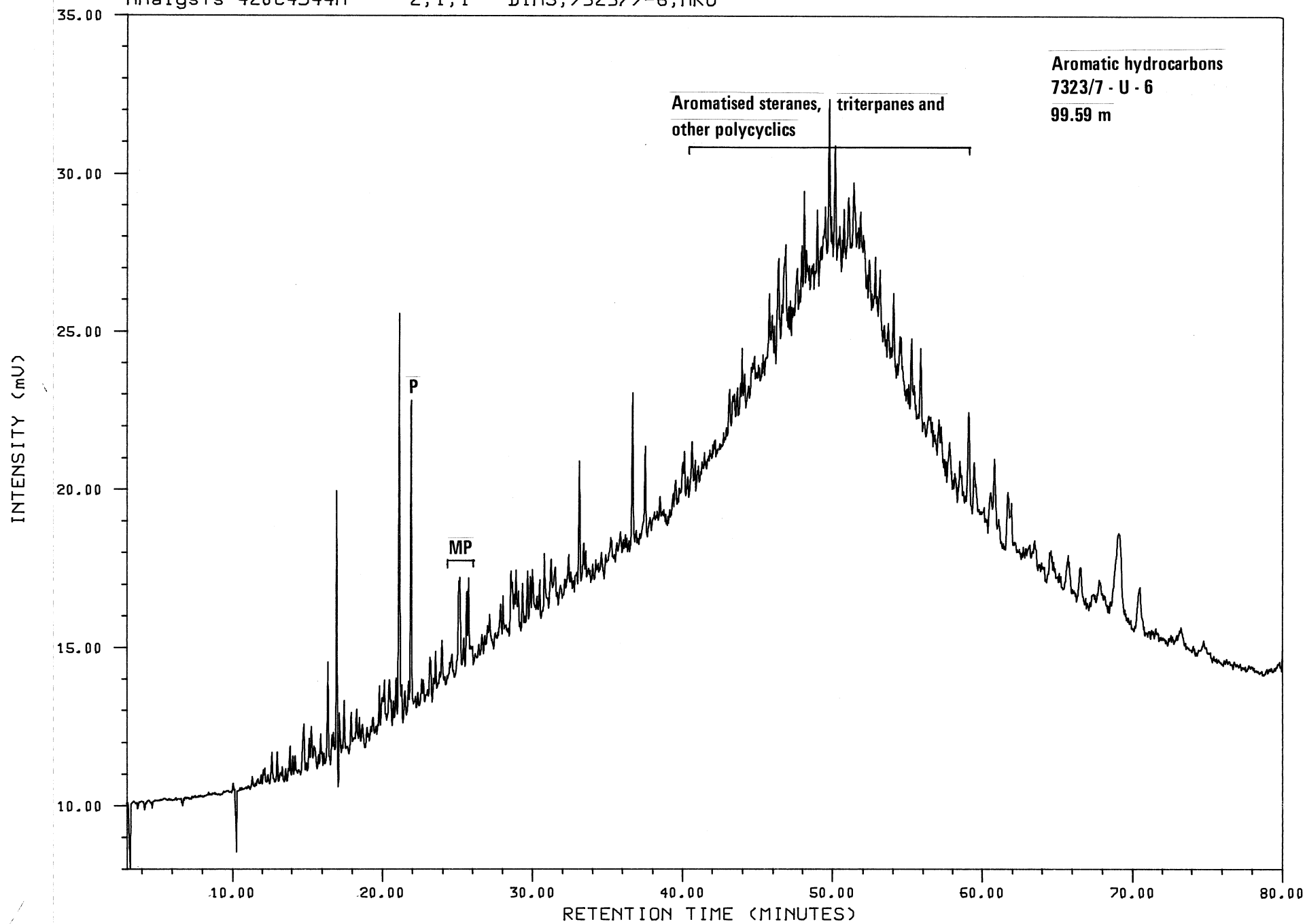


Figure A.III.2.2: Aromatic hydrocarbon gas chromatograms.

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

Analysis 420C4944A 2,1,1 DIAS,7323/7-6,ARO



Analysis 420C4950A

2,1,1

DIAS,7323/7-6,ARO

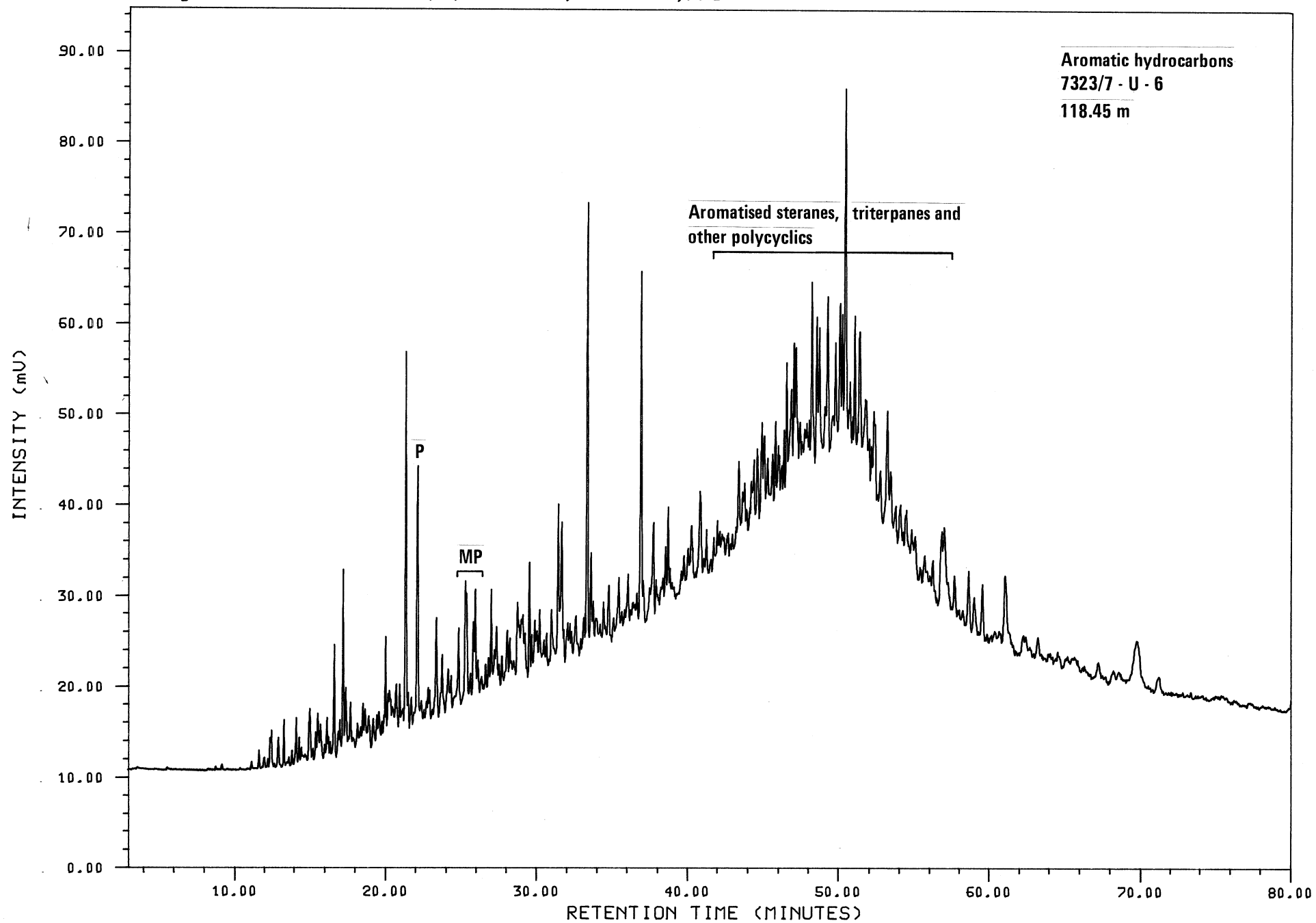
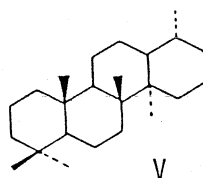
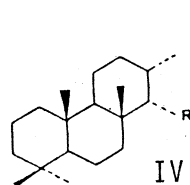
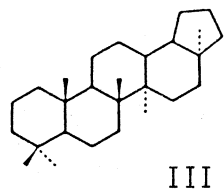
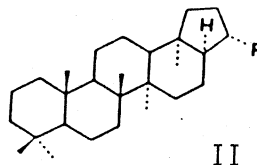
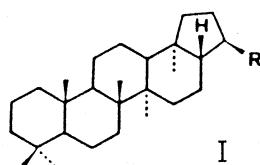


Figure A.III.2.3: Mass chromatograms of m/z 191 (terpanes).

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



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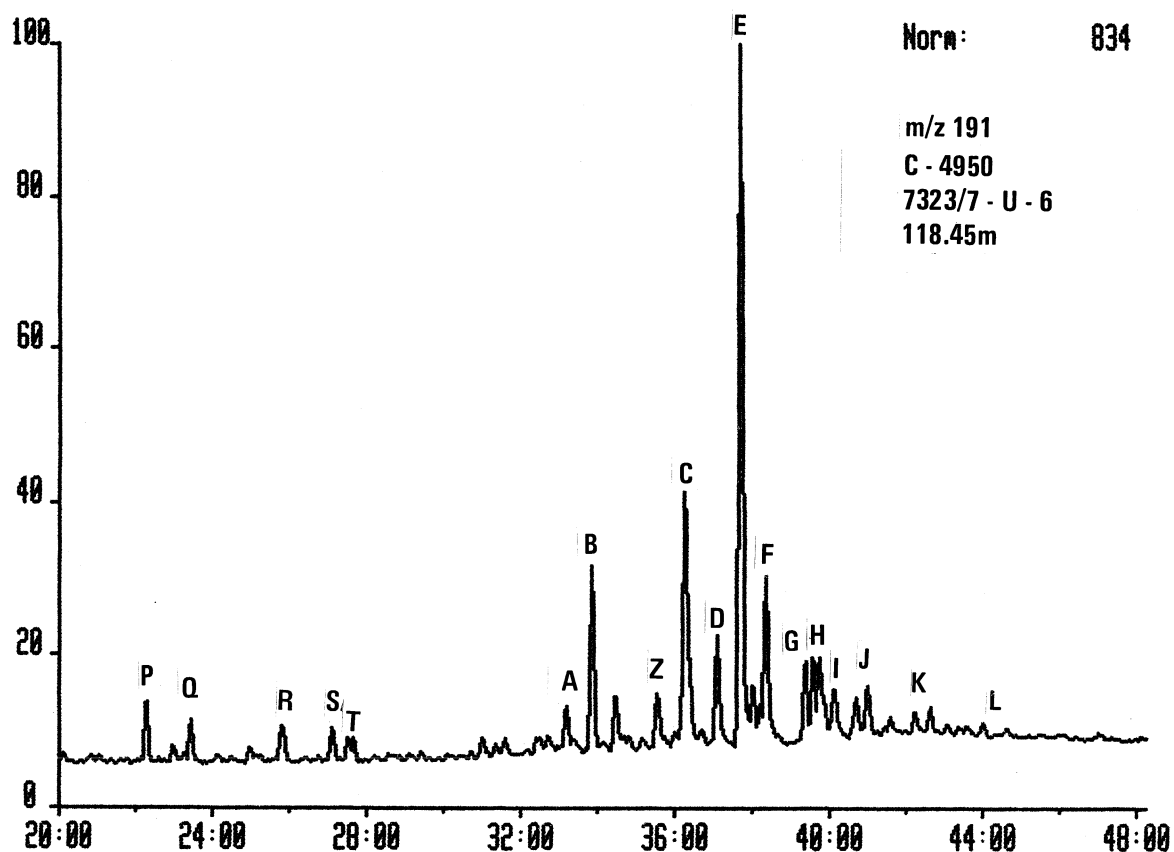
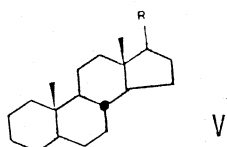
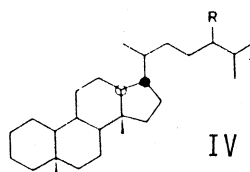
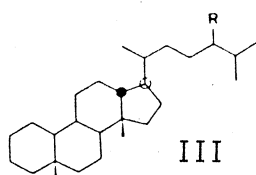
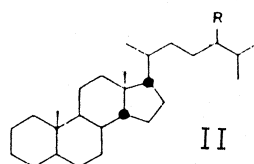
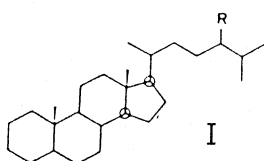


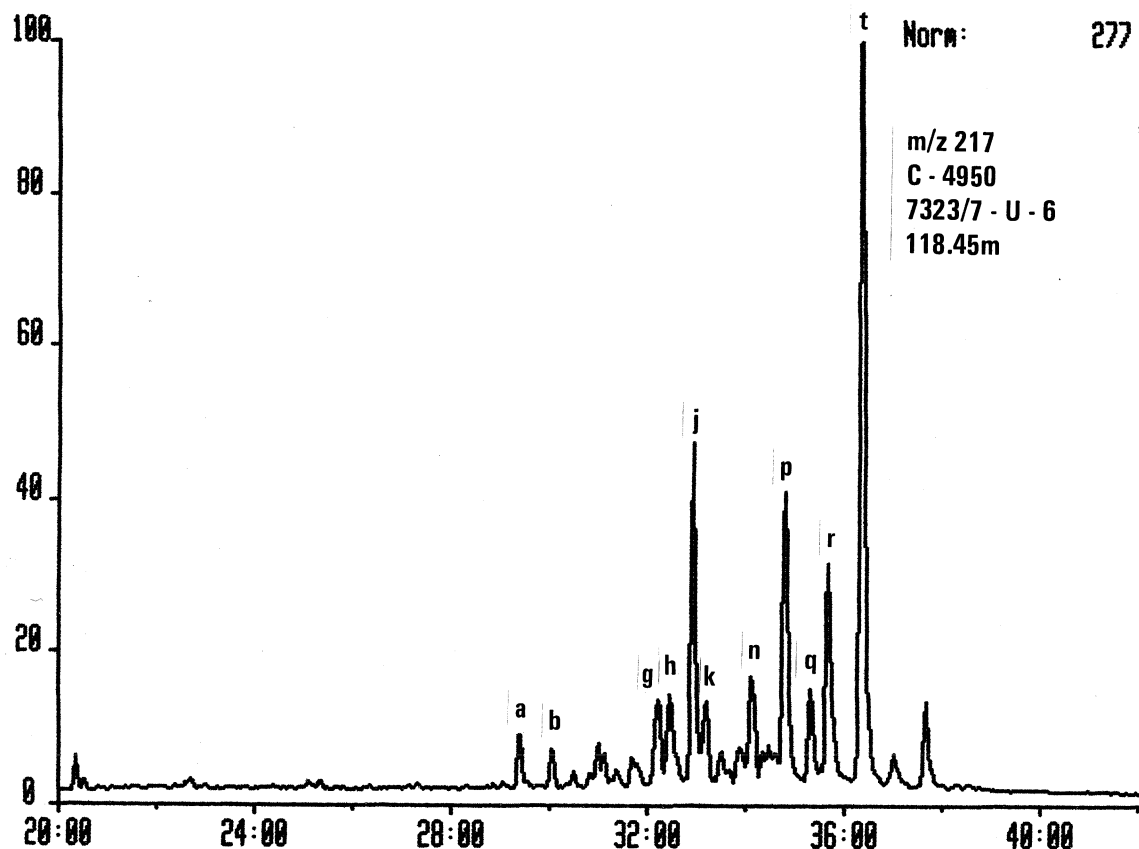
Figure A.III.2.4: Mass Chromatograms of m/z 217 and 218 (steranes).

a	13 β (H),17 α (H)-diasterane (20S)	C ₂₇ H ₄₈	(III,R=H)
b	13 β (H),17 α (H)-diasterane (20R)	C ₂₇ H ₄₈	(III,R=H)
c	13 α (H),17 β (H)-diasterane (20S)	C ₂₇ H ₄₈	(IV,R=H)
d	13 α (H),17 β (H)-diasterane (20R)	C ₂₇ H ₄₈	(IV,R=H)
e	13 β (H),17 α (H)-diasterane (20S)	C ₂₈ H ₅₀	(III,R=CH ₃)
f	13 β (H),17 α (H)-diasterane (20R)	C ₂₈ H ₅₀	(III,R=CH ₃)
g	13 α (H),17 β (H)-diasterane (20S)	C ₂₈ H ₅₀	(IV,R=CH ₃)
	+ 14 α (H),17 α (H)-sterane (20S)	C ₂₇ H ₄₈	(I,R=H)
h	13 β (H),17 α (H)-diasterane (20S)	C ₂₉ H ₅₂	(III,R=C ₂ H ₅)
	+ 14 β (H),17 β (H)-sterane (20R)	C ₂₇ H ₄₈	(II,R=H)
i	14 β (H),17 β (H)-sterane (20S)	C ₂₇ H ₄₈	(II,R=H)
	+ 13 α (H),17 β (H)-diasterane (20R)	C ₂₈ H ₅₀	(IV,R=CH ₃)
j	14 α (H),17 α (H)-sterane (20R)	C ₂₇ H ₄₈	(I,R=H)
k	13 β (H),17 α (H)-diasterane (20R)	C ₂₉ H ₅₂	(III,R=C ₂ H ₅)
l	13 α (H),17 β (H)-diasterane (20S)	C ₂₉ H ₅₂	(III,R=C ₂ H ₅)
m	14 α (H),17 α (H)-sterane (20S)	C ₂₈ H ₅₀	(I,R=CH ₃)
n	13 α (H),17 β (H)-diasterane (20R)	C ₂₉ H ₅₂	(III,R=C ₂ H ₅)
	+ 14 β (H),17 β (H)-sterane (20R)	C ₂₈ H ₅₀	(II,R=CH ₃)
o	14 β (H),17 β (H)-sterane (20S)	C ₂₈ H ₅₀	(II,R=CH ₃)
p	14 α (H),17 α (H)-sterane (20R)	C ₂₈ H ₅₀	(I,R=CH ₃)
q	14 α (H),17 α (H)-sterane (20S)	C ₂₉ H ₅₂	(I,R=C ₂ H ₅)
r	14 β (H),17 β (H)-sterane (20R)	C ₂₉ H ₅₂	(II,R=C ₂ H ₅)
	+ unknown sterane		
s	14 β (H),17 β (H)-sterane (20S)	C ₂₉ H ₅₂	(II,R=C ₂ H ₅)
t	14 α (H),17 α (H)-sterane (20R)	C ₂₉ H ₅₂	(I,R=C ₂ H ₅)
u	5 α (H)-sterane	C ₂₁ H ₃₆	(V,R=C ₂ H ₅)
v	5 α (H)-sterane	C ₂₂ H ₃₈	(IV,R=C ₃ H ₇)



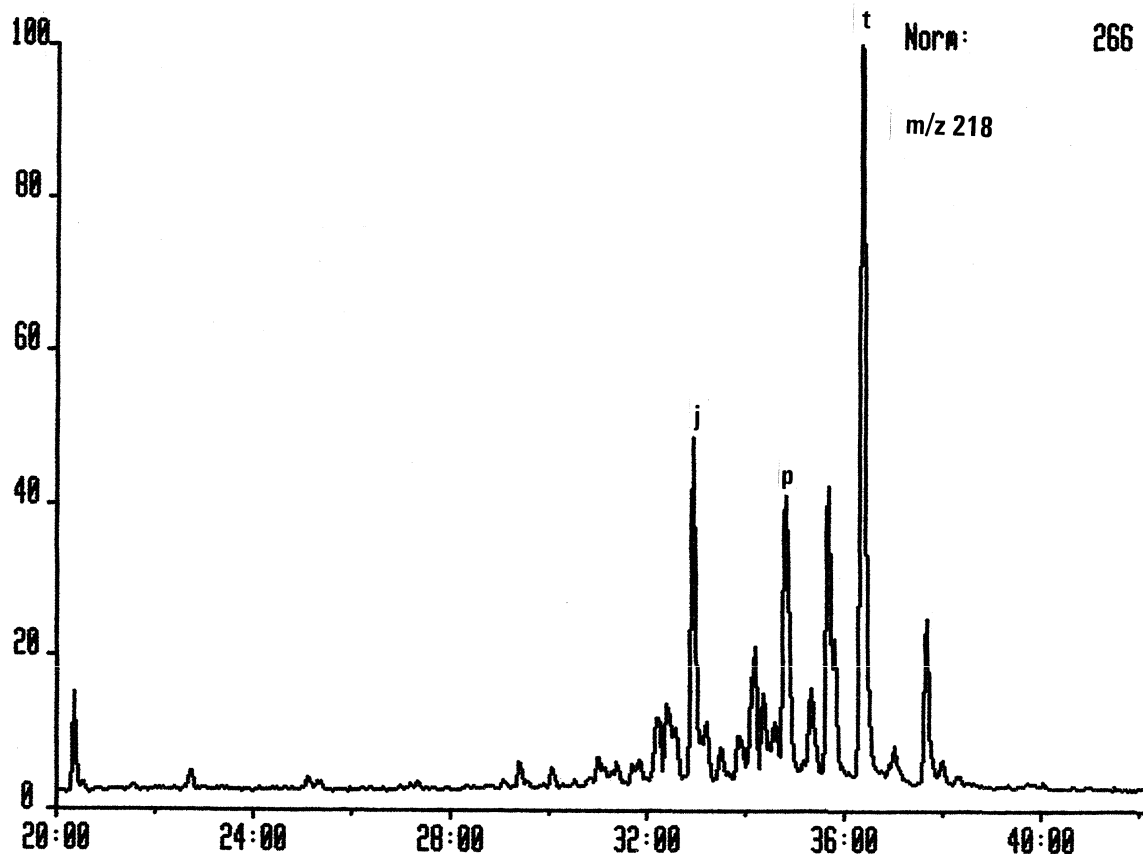
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C4950SAT 12-NOV-86 Sir:Voltage 7070H Acnt:IKU
 Sample 1 Injection 1 Group 1 Mass 218.1000
 Text:

System:TRIT



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Core 7323/7-U-3:

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- Table A.III.3.1b: Concentration of C_1-C_5 hydrocarbons in occluded gas.
- Table A.III.3.1c: Concentration of C_1-C_5 hydrocarbons - summation.
- Table A.III.3.2: Total organic carbon and data from Rock-Eval pyrolysis.
- Table A.III.3.3: Data from pyrolysis-gas chromatograms.
- Table A.III.3.4: Vitrinite reflectance data.
- Table A.III.3.5: Weight of EOM and chromatographic fractions.
- Table A.III.3.6: Concentration of EOM and chromatographic fractions.
- Table A.III.3.7: Concentration of EOM and chromatographic fractions.
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- Figure A.III.3.1: Pyrolysis-gas chromatograms (S2 peak).
- Figure A.III.3.2: Saturated hydrocarbon gas chromatograms.
- Figure A.III.3.3: Aromatic hydrocarbon gas chromatograms.
- Figure A.III.3.4: Mass chromatograms of m/z 191 (terpanes).
- Figure A.III.3.5: Mass chromatograms of m/z 217 and 218 (steranes).
- Figure A.III.3.6: Vitrinite reflectance histograms.

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Table A.III.3.1a: Concentration of C₁-C₅+ hydrocarbons in headspace gas.

[illegible]

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Well ident.: 7323/7-U-3
DATE : 28 - 10 - 86.

Table A.III.3.1b: Concentration of C₁-C₅⁺ hydrocarbons in occluded gas.

[illegible]

Table A.III.3.1c: Concentration of C₁-C₅ hydrocarbons - summation.

[illegible]

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Table A.III.3.2: Total organic carbon and data from Rock-Eval pyrolysis.

I	IKU	DEPTH	:	S1	S2	S3	TOC	HYDR. INDEX	OXYGEN INDEX	PETROLEUM POTENTIAL	PROD. INDEX	TEMP. MAX
I	No.		:								S1	
I		m/ft	:	(	mg/g ROCK	)	(%)	(	mg/g TOC	)	S1+S2	S1+S2 (C)
I	C 4816	99	:	0.87	10.81	0.57	3.36	322	17	11.68	0.07	422
I	C 4817	100	:	****	****	****	4.11	*****	****	*****	*****	***
I	C 4818	101	:	0.66	12.31	0.66	3.80	324	17	12.97	0.05	421
I	C 4819	102	:	****	****	****	4.51	*****	****	*****	*****	***
I	C 4820	103	:	0.79	15.55	0.76	4.27	364	18	16.34	0.05	417
I	C 4821	104	:	****	****	****	3.20	*****	****	*****	*****	***
I	C 4822	105.07	:	0.68	13.31	0.16	3.45	386	5	13.99	0.05	420
I	C 4823	105.93	:	1.25	12.34	0.65	3.36	367	19	13.59	0.09	416
I	C 4824	107	:	0.41	8.55	0.11	2.39	358	5	8.96	0.05	429
I	C 5719	107.16	:	****	****	****	0.76	*****	****	*****	*****	***
I	C 5720	108.03	:	****	****	****	0.82	*****	****	*****	*****	***
I	C 4825	109	:	0.08	1.28	0.37	0.63	203	59	1.36	0.06	429
I	C 4826	110.80	:	0.07	1.03	0.04	0.65	158	6	1.10	0.06	432
I	C 4827	112.37	:	0.59	1.69	0.41	0.67	252	61	2.28	0.26	425
I	C 4828	112.93	:	0.24	1.13	0.09	0.73	155	12	1.37	0.18	433
I	C 4829	114	:	****	****	****	0.41	*****	****	*****	*****	***
I	C 4830	115.96	:	0.12	0.62	0.12	0.61	102	20	0.74	0.16	433
I	C 4831	117	:	****	****	****	0.72	*****	****	*****	*****	***
I	C 4832	118	:	0.09	0.72	0.14	0.56	129	25	0.81	0.11	431
I	C 4833	119	:	****	****	****	0.69	*****	****	*****	*****	***
I	C 4834	120	:	0.08	0.45	2.41	0.68	66	354	0.53	0.15	434
I	C 4835	121	:	****	****	****	0.70	*****	****	*****	*****	***

Table A.III.3.2: cont.

I		:					HYDR. INDEX	OXYGEN INDEX	PETROLEUM POTENTIAL	PROD. INDEX	TEMP. MAX	I
I	IKU	DEPTH	S1	S2	S3	TOC						I
I	No.									S1		I
I												I
I		m/ft	(mg/g ROCK)		(%)	(mg/g TOC)	S1+S2			S1+S2	(C)	I
I												I
I												I
I	C 4836	122.02	0.13	1.45	0.20	0.84	173	24	1.58	0.08	433	I
I												I
I	C 4837	123	****	****	****	1.15	*****	****	*****	*****	***	I
I												I
I	C 4838	124.12	0.07	0.59	0.18	0.60	98	30	0.66	0.11	436	I
I												I
I	C 4839	125	****	****	****	0.81	*****	****	*****	*****	***	I
I												I
I	C 4840	126	0.12	0.51	0.25	0.66	77	38	0.63	0.19	435	I
I												I
I	C 4841	127	****	****	****	0.62	*****	****	*****	*****	***	I
I												I
I	C 4842	128	0.09	0.47	0.28	0.59	80	47	0.56	0.16	432	I
I												I
I	C 4843	129	****	****	****	0.70	*****	****	*****	*****	***	I
I												I
I	C 4844	130.02	0.09	0.43	0.23	0.55	78	42	0.52	0.17	435	I
I												I

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Table A.III.3.3: Data from pyrolysis-gas chromatograms.

IKU No	DEPTH (m)	C1 %	C2-C5 %	C6-C14 %	C15+ %	(m+p)-xylene/ n-octene
C-4816	99	5.12	8.64	56.04	30.21	0.87
C-4820	103	14.87	7.21	55.75	22.17	0.79
C-4824	107	6.19	12.29	57.03	24.49	0.69
C-4828	112.93	3.96	0.22	65.66	30.26	0.62
C-4832	118	3.69	5.09	44.55	46.66	0.63
C-4836	122.02	3.32	7.32	66.93	22.43	0.62
C-4838	124.12	5.64	12.36	63.50	18.50	0.66
C-4840	126	8.13	8.71	60.56	22.60	0.64
C-4844	130.02	8.82	8.06	74.20	8.92	0.48

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 Reference number: 21.3420.06
 (1/1)

Table A.III.3.4: Vitrinite reflectance data.

IKU NO	LOCATION	DEPTH (M)	VITRINITE REFLECTANCE	REL RAT	STANDARD DEVIATION	FLUORE- SCENCE
C 4822	----	105.7	0.45 (20)	G	0.13	3-4
C 4828	----	112.9	0.40 (3)	P	0.09	4-8
			0.83 (5)	R	0.15	
			1.34 (2)	R	0.01	

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

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 DATE : 15 - 11 - 86.

Table A.III.3.5: Weight of EOM and chromatographic fractions.

I			:	Rock						I
I	IKU-No	DEPTH	:	Extr.	EOM	Sat.	Aro.	HC	Non HC	TOC
I			:							I
I		(m)	:	(g)	(mg)	(mg)	(mg)	(mg)	(mg)	(%)
I			:							I
I			:							I
I	C 4820	103	:	13.7	63.8	4.6	9.1	13.7	50.1	3.98
I			:							I
I	C 4828	112.93	:	33.1	22.9	3.2	3.2	6.5	16.4	1.01
I			:							I

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 Well ident.: 7323/7-U-3
 DATE : 15 - 11 - 86.

Table A.III.3.6: Concentration of EOM and chromatographic fractions.

I		:						I
I	IKU-No	DEPTH	:	EOM	Sat.	Aro.	HC	Non HC
I		(m)	:					
I								I
I			:					I
I	C 4820	103	:	4650	332	665	997	3653
I			:					I
I	C 4828	112.93	:	692	98	98	196	496
I			:					I

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Table A.III.3.7: Concentration of EOM and chromatographic fractions.

I		:						I
I	IKU-No	DEPTH	:	EOM	Sat.	Aro.	HC	Non HC
I		(m)	:					
I								I
I			:					I
I	C 4820	103	:	116.8	8.4	16.7	25.1	91.8
I			:					I
I	C 4828	112.93	:	68.5	9.7	9.7	19.4	49.1
I			:					I

Table A.III.3.8: Composition of material extracted from the rock.

I			:	Sat	Aro	HC	SAT	Non HC	HC	I
I	IKU-No	DEPTH	:	---	---	---	---	---	---	I
I			:	EOM	EOM	EOM	Aro	EOM	Non HC	I
I		(m)	:	%	%	%	x 100	%	x 100	I
I			:							I
I	C 4820	103	:	7.1	14.3	21.4	50.0	78.6	27.3	I
I			:							I
I	C 4828	112.93	:	14.1	14.1	28.3	100.0	71.7	39.5	I
I			:							I

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Table A.III.3.9: Tabulation of data from the gas chromatograms.

I		DEPTH	:	PRISTANE	PRISTANE	PHYTANE	A	n-C17	I
I	IKU No.		:	-----	A = -----	B = -----	-----	-----	I
I		(m)	:	PHYTANE	n-C17	n-C18	B	n-C27	I
I			:						I
I			:						I
I	C 4820	103	:	1.6	6.0	4.4	1.4	2.7	1.1
I			:						I
I	C 4828	112.93	:	1.5	4.3	3.3	1.3	1.4	1.1
I			:						I
I			:						I

DATE : 24 - 11 - 86.

Table A.III.3.10: Molecular ratios from sterane and terpane mass chromatograms. Maturity ratios.

IKU code	Well/depth	$\alpha\beta/\alpha\beta+\beta\alpha$ ¹⁾	%22S ²⁾	%20S ³⁾	% $\beta\beta$ ⁴⁾
<u>Well 7323/7-U-3</u>					
C-4820	103 m	0.77	34.6	13.3	46.8
C-4828	112.93 m	0.83	40.5	5.8	34.4

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

2) Average % distribution between first and second eluting isomers of extended hopanes (G-M in m/z 191)

3) q/q+t in m/z 217

4) $2(r+s)/(q+t+2(r+s))$ in m/z 217

Table A.III.3.11: Molecular ratios from sterane and terpane mass chromatograms. Maturity and source characteristic ratios.

IKU no.	Well/depth	Q/E ¹⁾	T _m /T _s ²⁾	X/E ³⁾	Z/E ⁴⁾	a/a+j ⁵⁾
<u>Well 7323/7-U-3</u>						
C-4820	103 m	0.06	3.1	0.09	-	0.53
C-4828	112.93 m	0.04	1.8	-	0.52	0.28

- 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 C₂₇ rearranged steranes (a/a+j in m/z 217)

Table A.III.3.12: $\delta^{13}\text{C}$ isotope ratios for extract fractions.

Sample no.	Depth	$\delta^{13}\text{C}$ SAT	$\delta^{13}\text{C}$ ARO	$\delta^{13}\text{C}$ ASP	$\delta^{13}\text{C}$ NSO
------------	-------	------------------------------	------------------------------	------------------------------	------------------------------

Well 7323/7-U-3

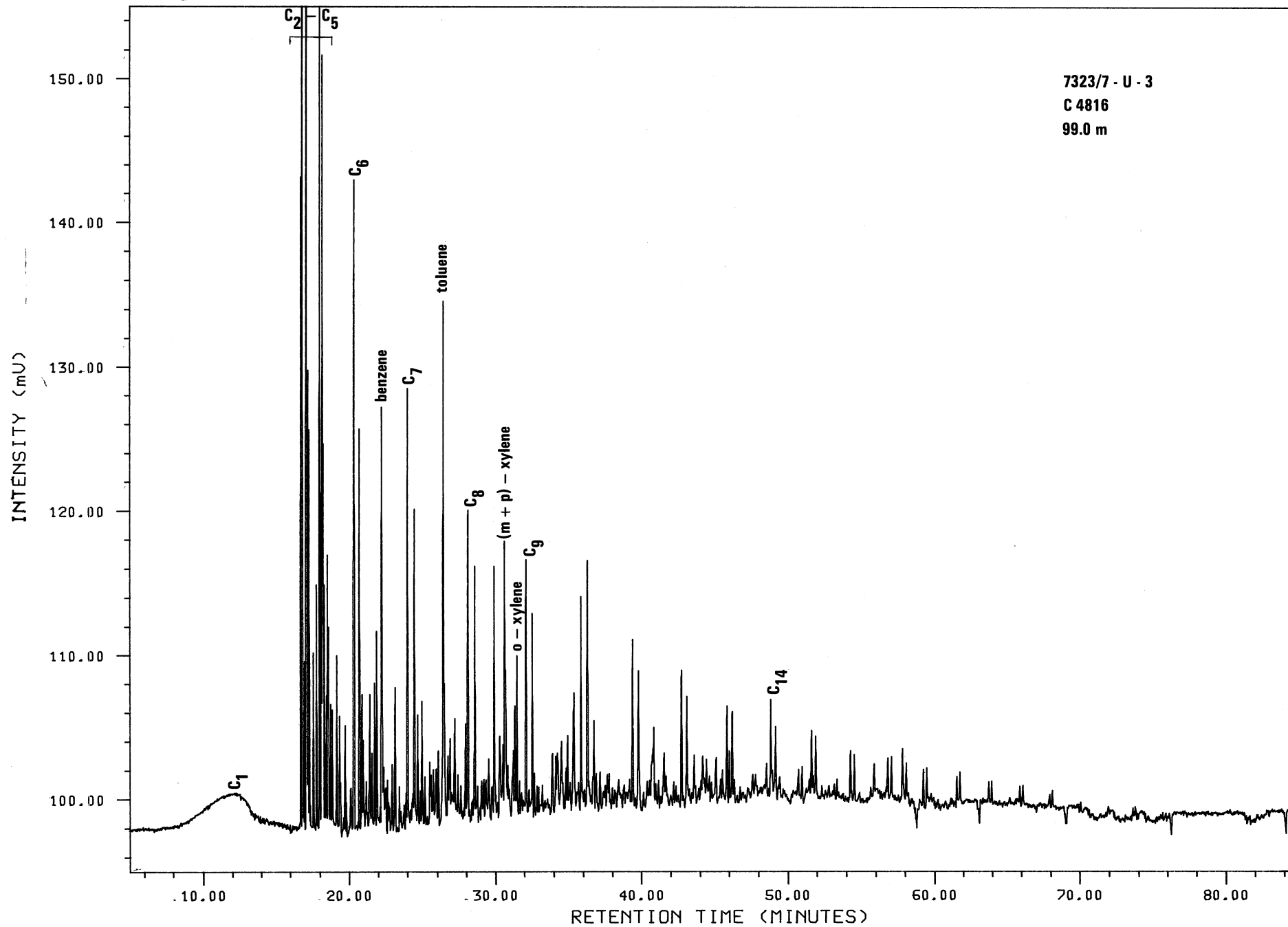
C-4820	103 m	-31.22	-31.09	-29.44	-32.63
C-4828	112.93 m	-29.99	-28.95	-26.59	-32.10

Figure A.III.3.1: Pyrolysis-gas chromatograms (S2 peak).

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11,1,1

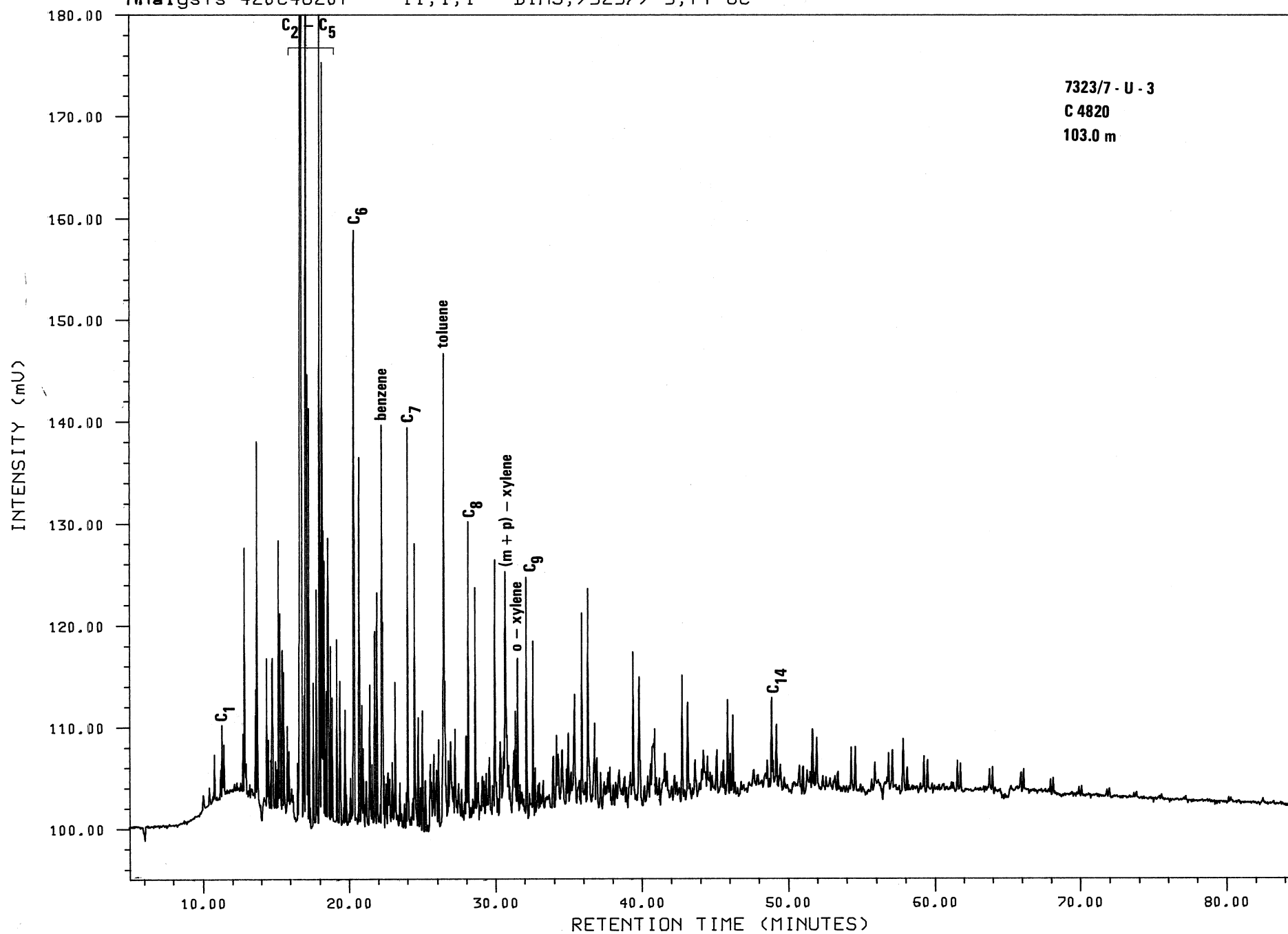
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Analysis 420C4820P

11,1,1

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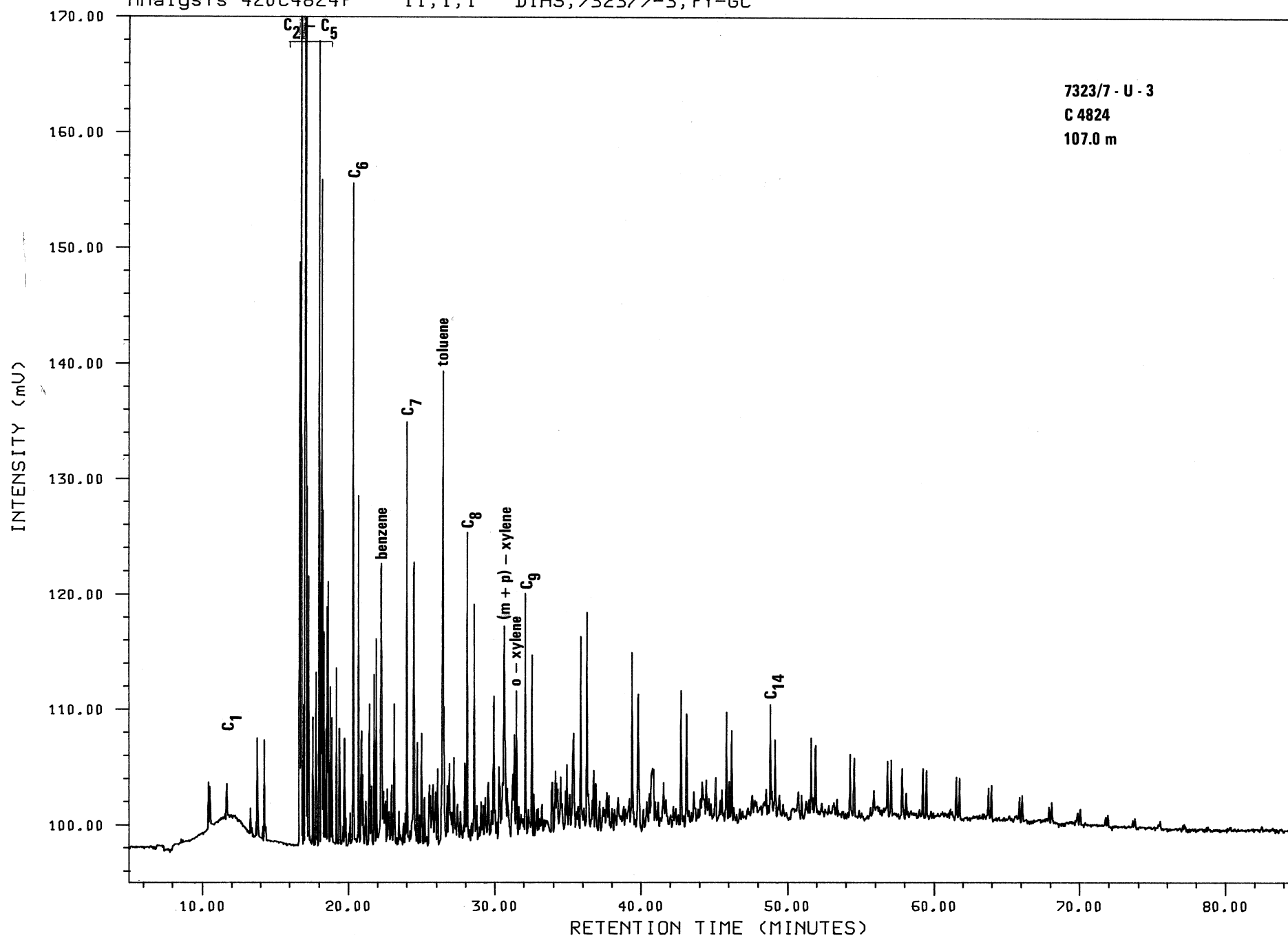


7323/7 - U - 3

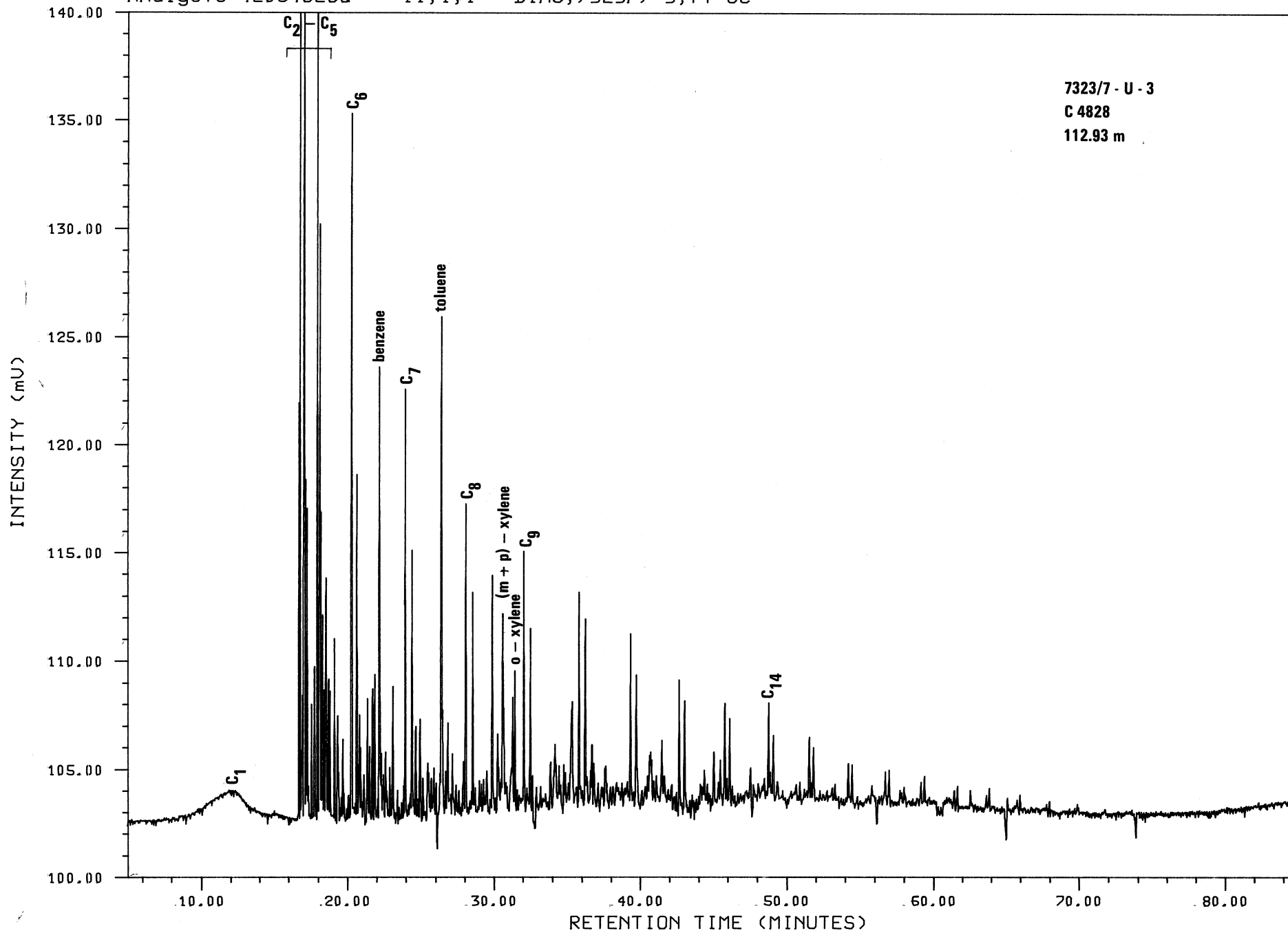
C 4820

103.0 m

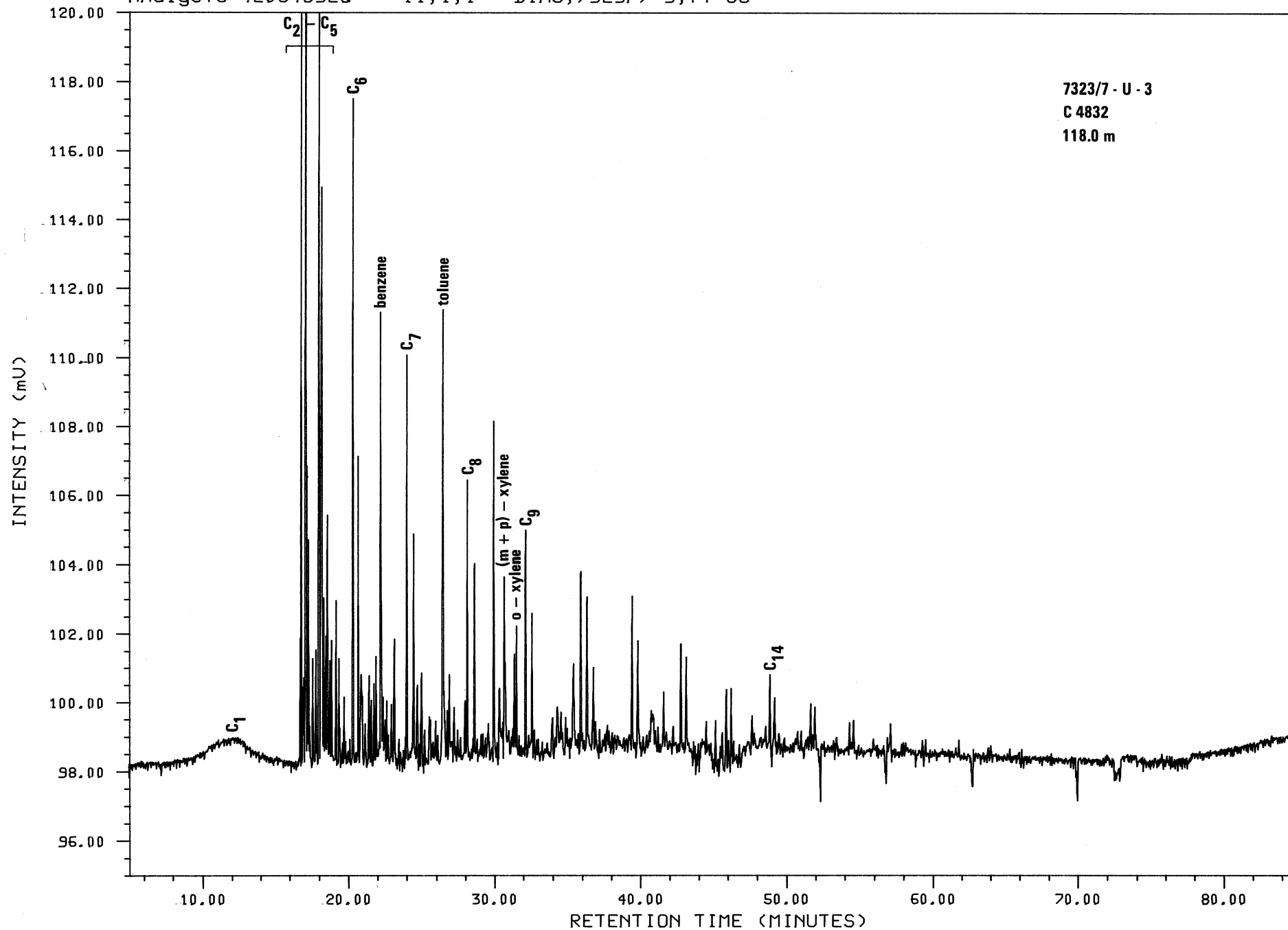
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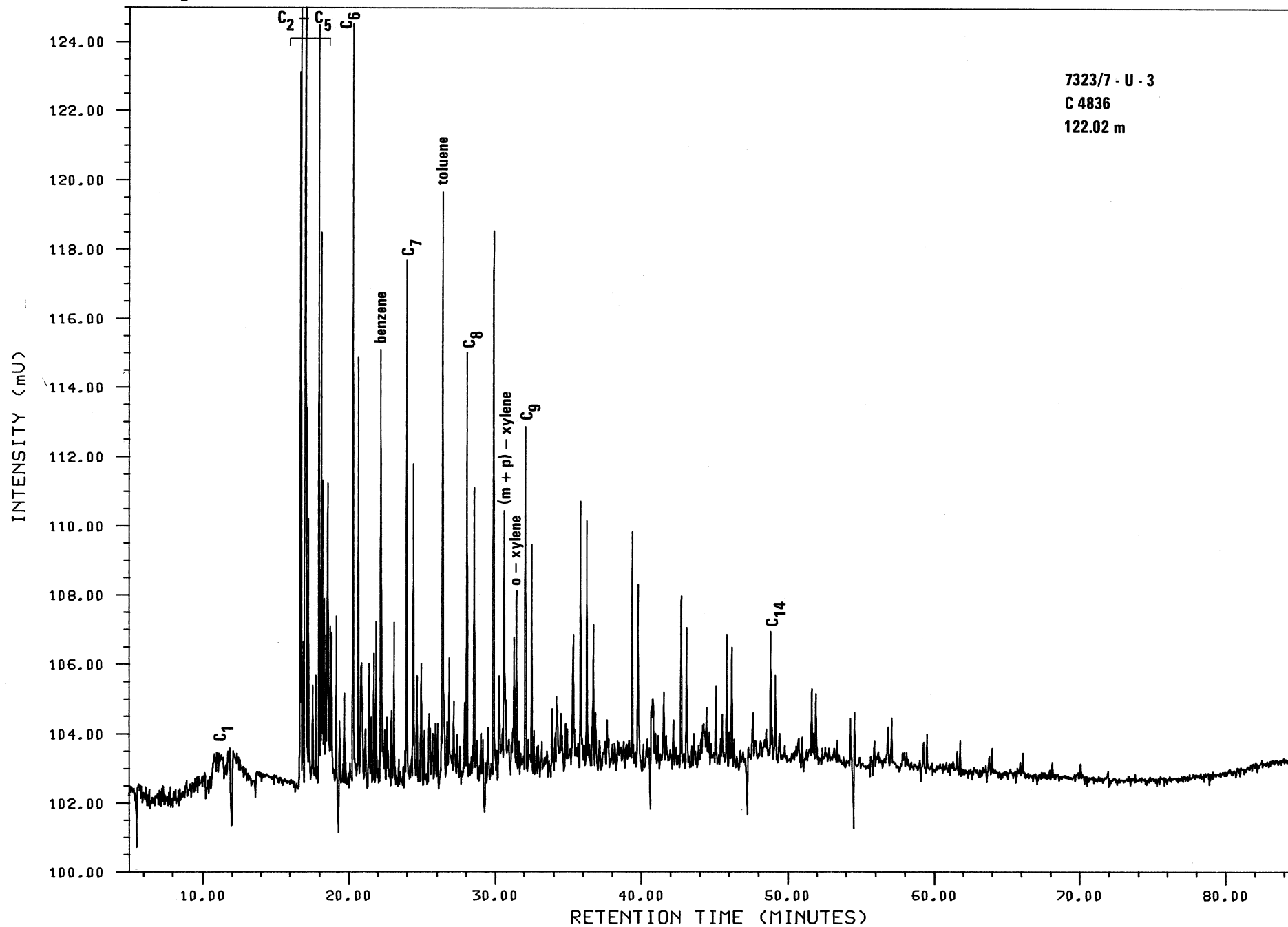
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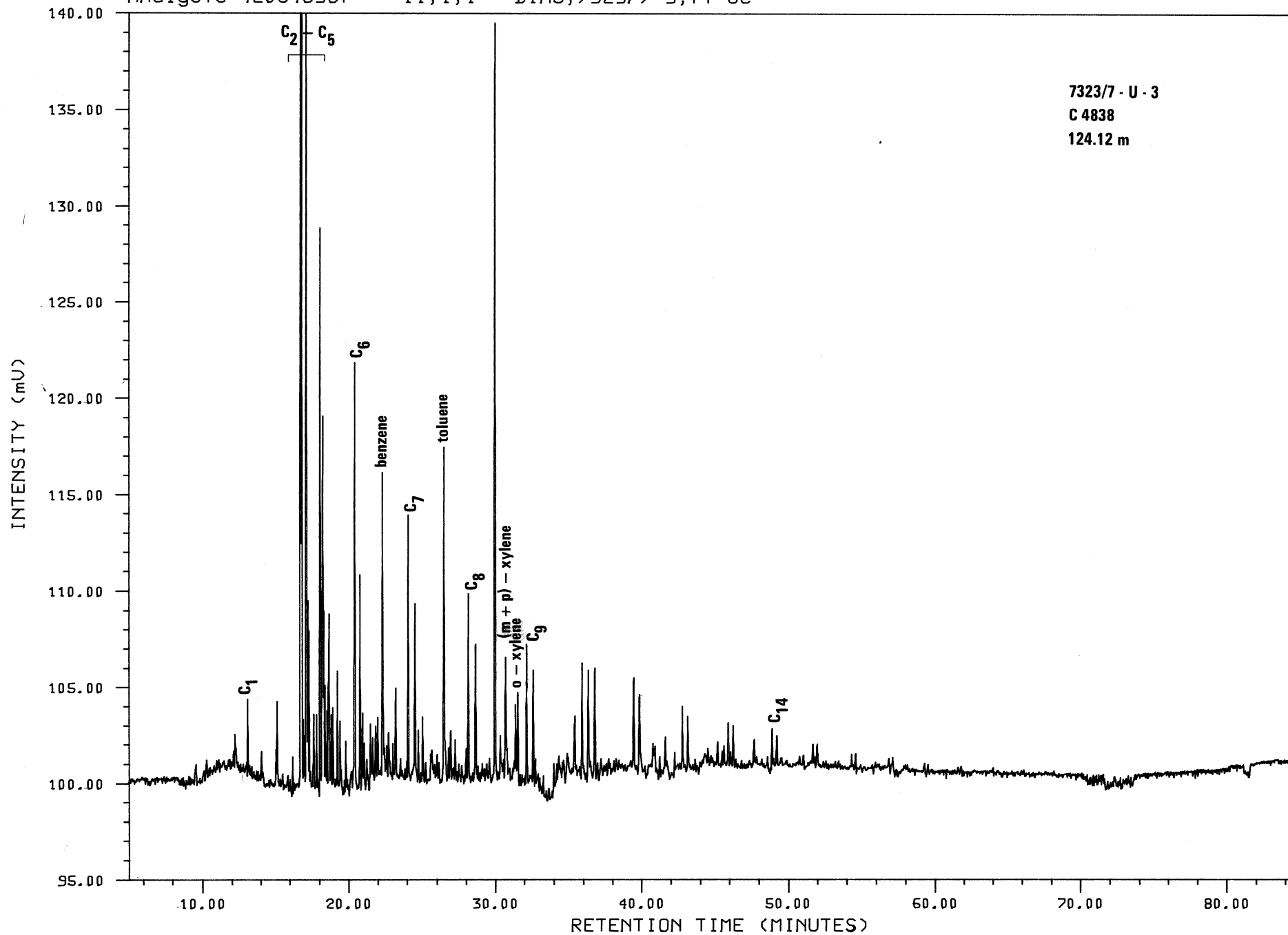
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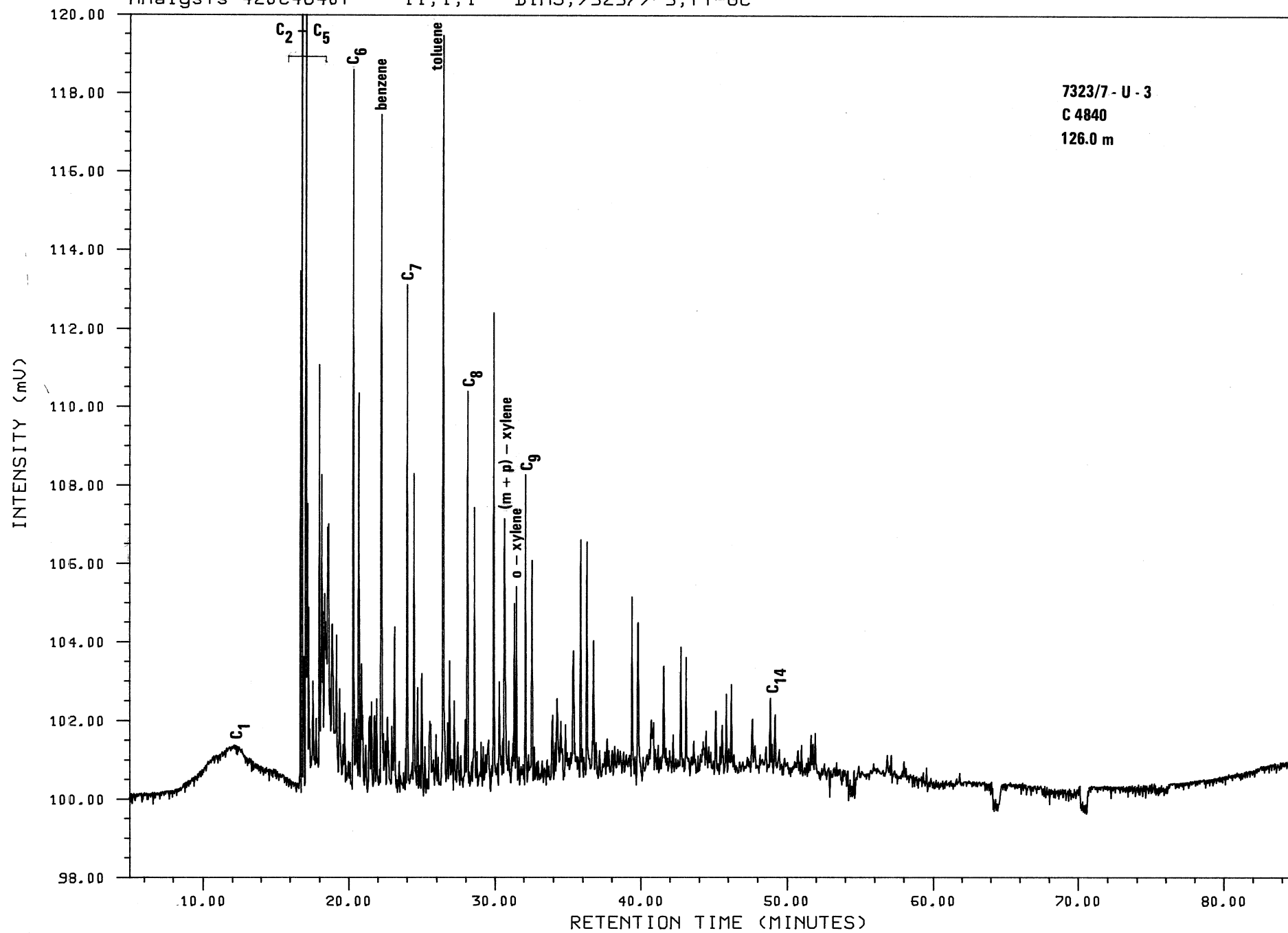
Analysis 420C4836Q 11,1,1 DIAS,7323/7-3,PY-GC



Analysis 420C4838P 11,1,1 DIAS,7323/7-3,PY-GC



Analysis 420C4840P 11,1,1 DIAS,7323/7-3,PY-GC



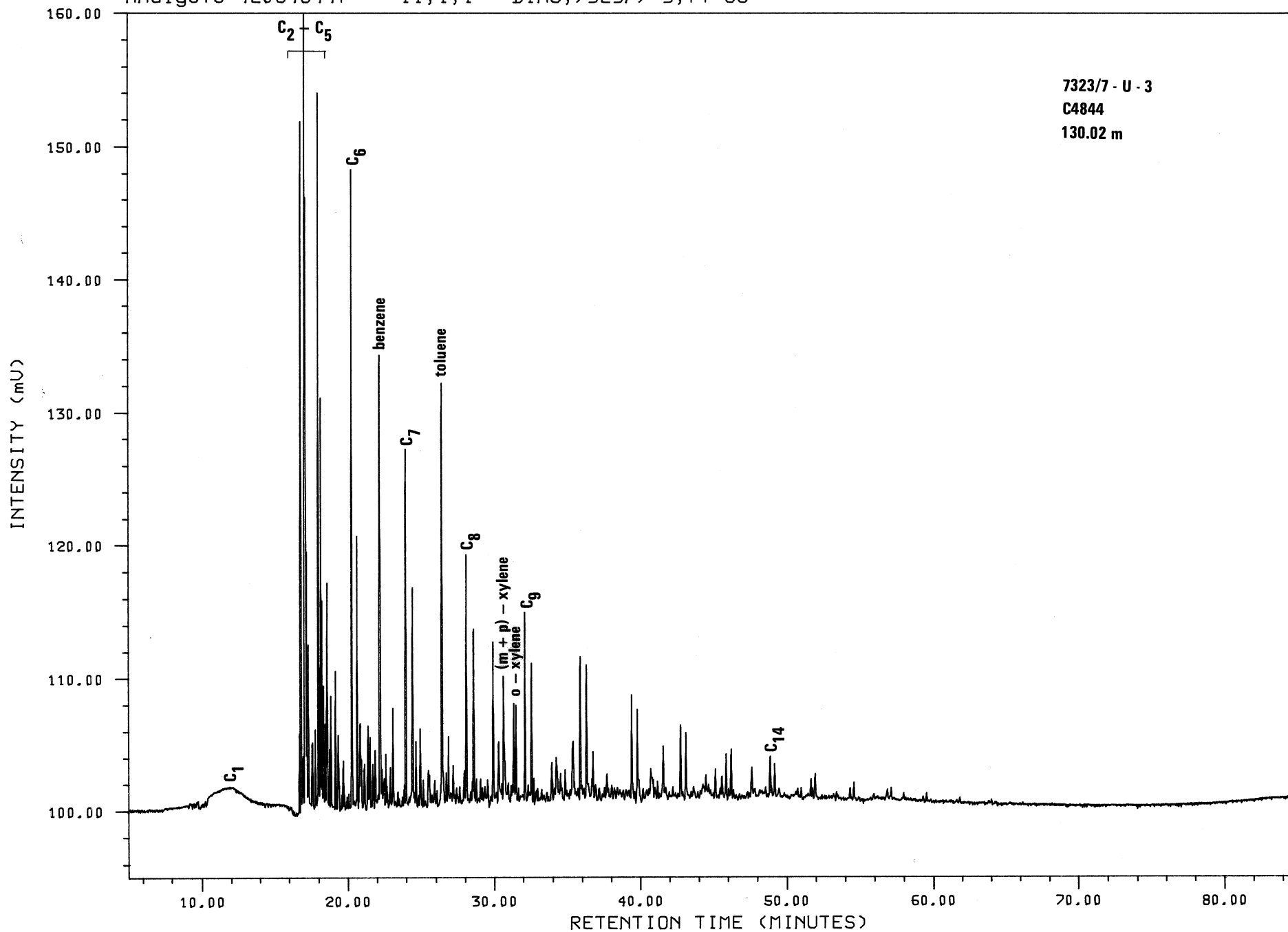
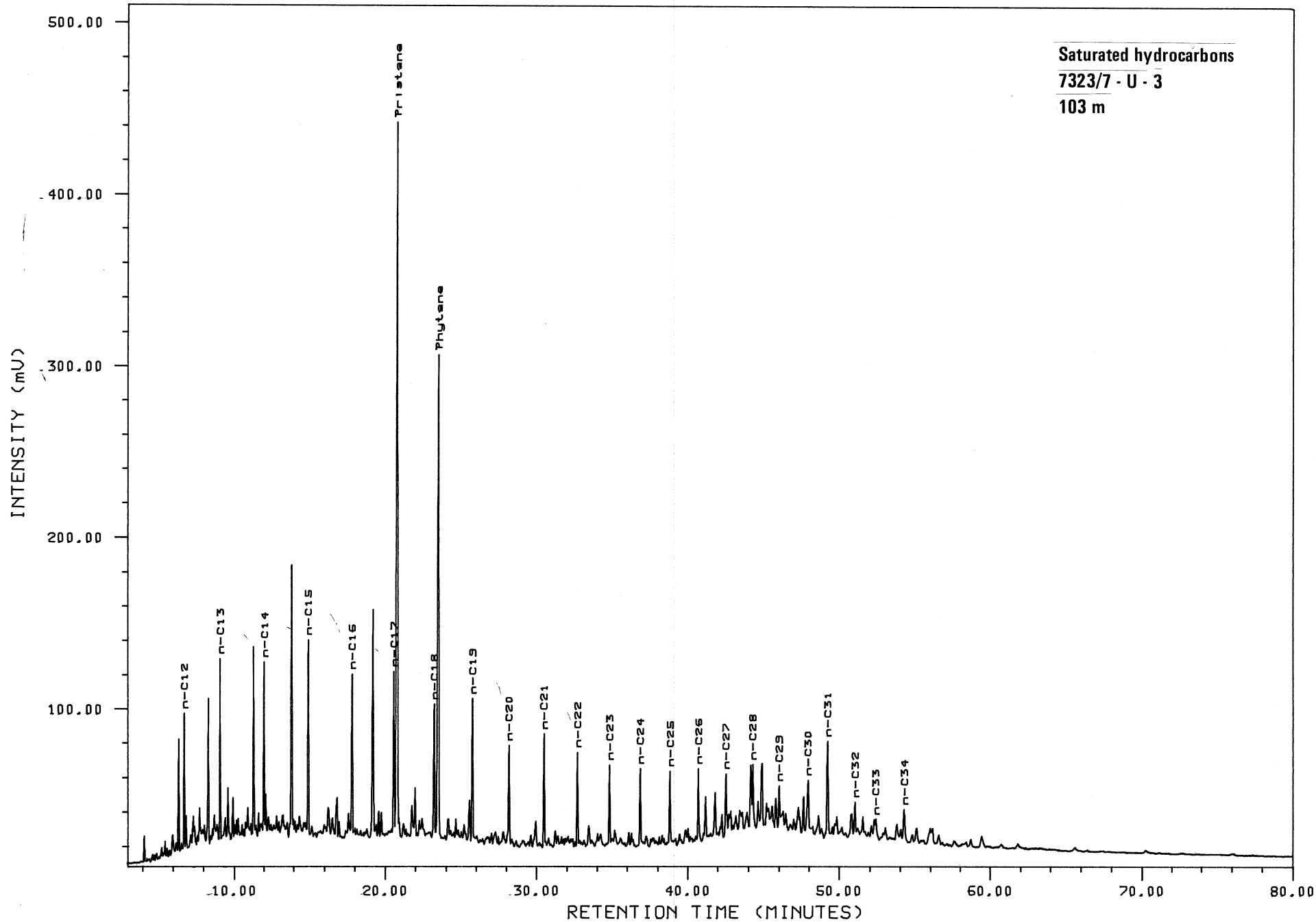


Figure A.III.3.2: Saturated hydrocarbon gas chromatograms.

n-C ₁₅ etc.	- n-alkanes
Pr	- pristane
Ph	- phytane
*	- other acyclic isoprenoids

Analysis 420C4820S 3,1,1 DIAS,7323/7-3,SAT



Analysis 420C4828S 2,1,1 DIAS,7323/7-3,SAT

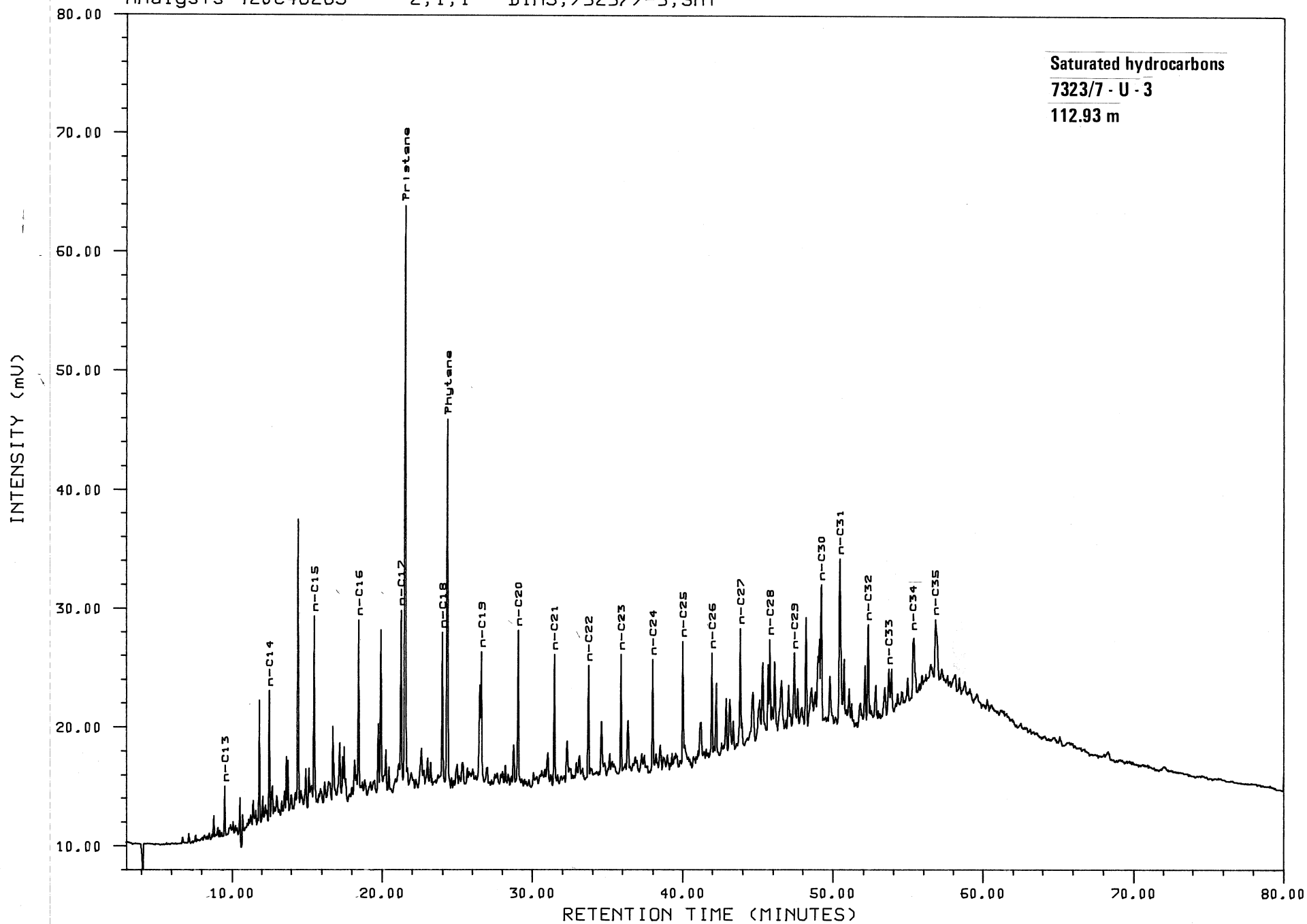
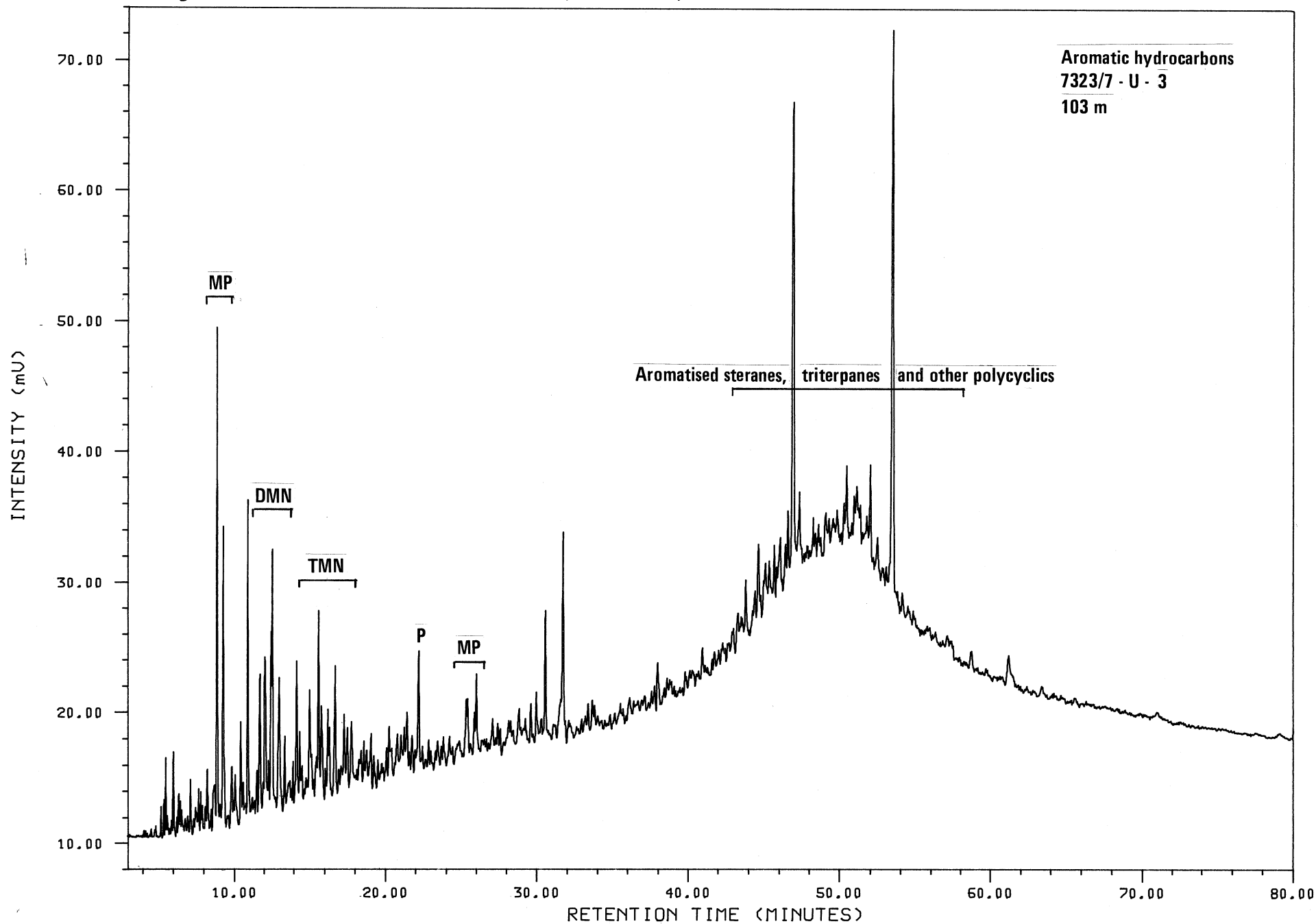


Figure A.III.3.3: Aromatic hydrocarbon gas chromatograms.

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



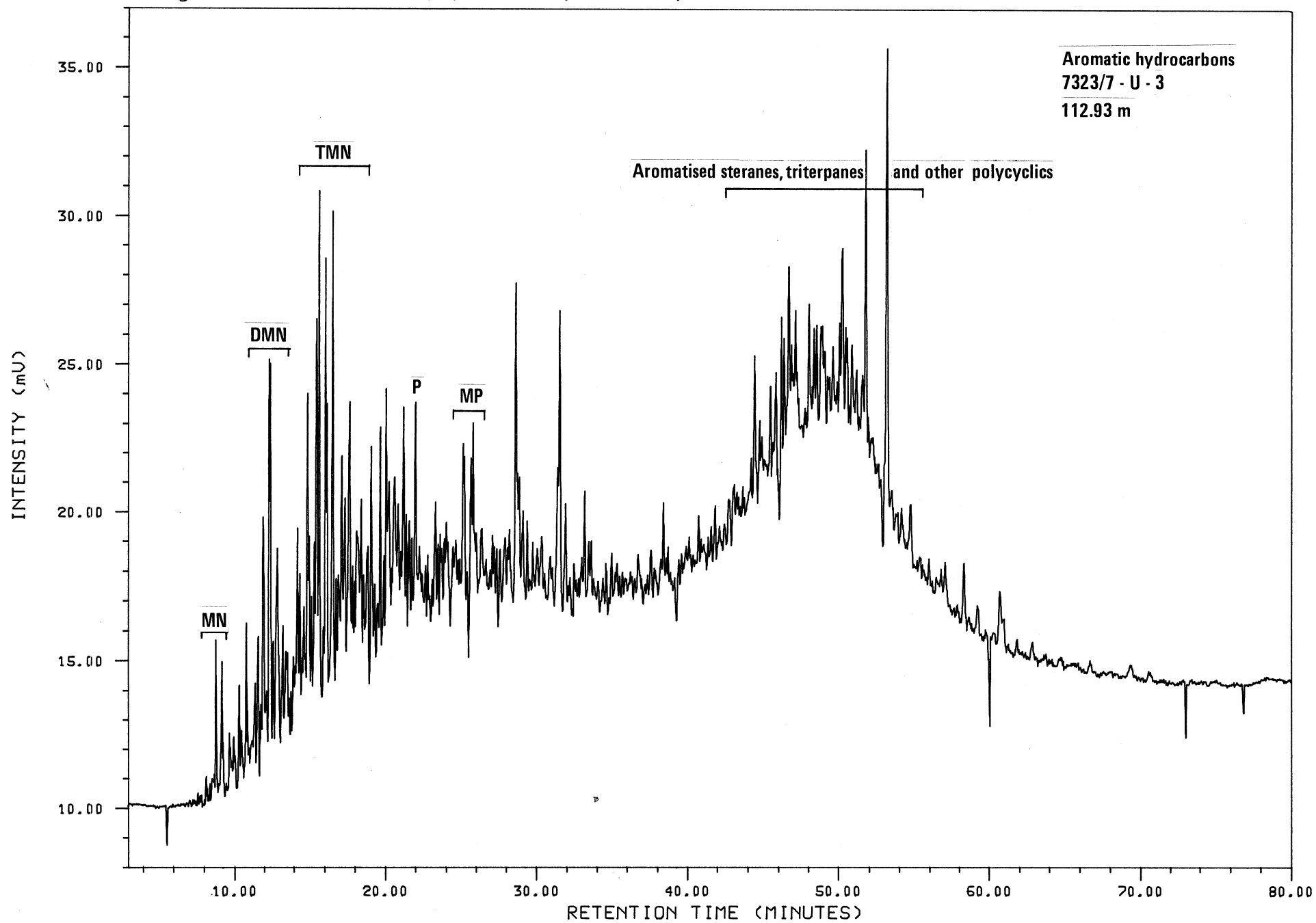
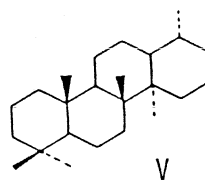
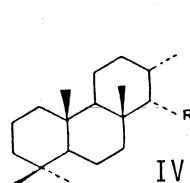
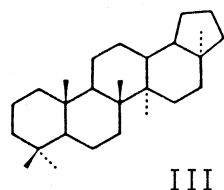
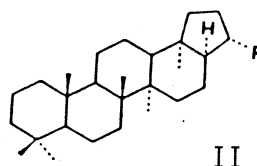
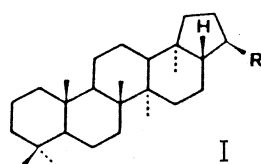


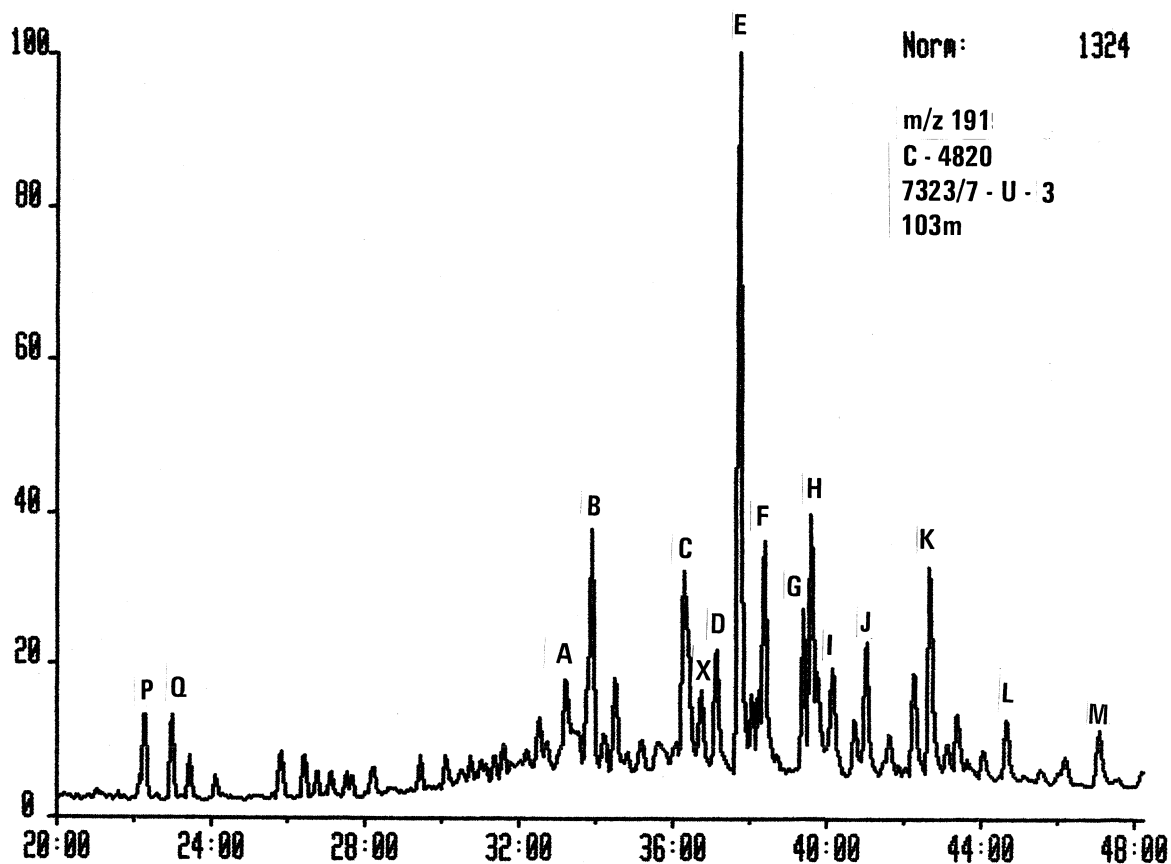
Figure A.III.3.4: Mass chromatograms of m/z 191 (terpanes).

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



C4820SAT 11-NOV-86 Sir:Voltage 7070H Acnt:IKU
 Sample 1 Injection 1 Group 1 Mass 191.1000
 Text:

System:TRIT



C4828SAT 12-NOV-86 Sir:Voltage 7070H Acnt:IKU
 Sample 1 Injection 1 Group 1 Mass 191.1000
 Text:

System:TRIT

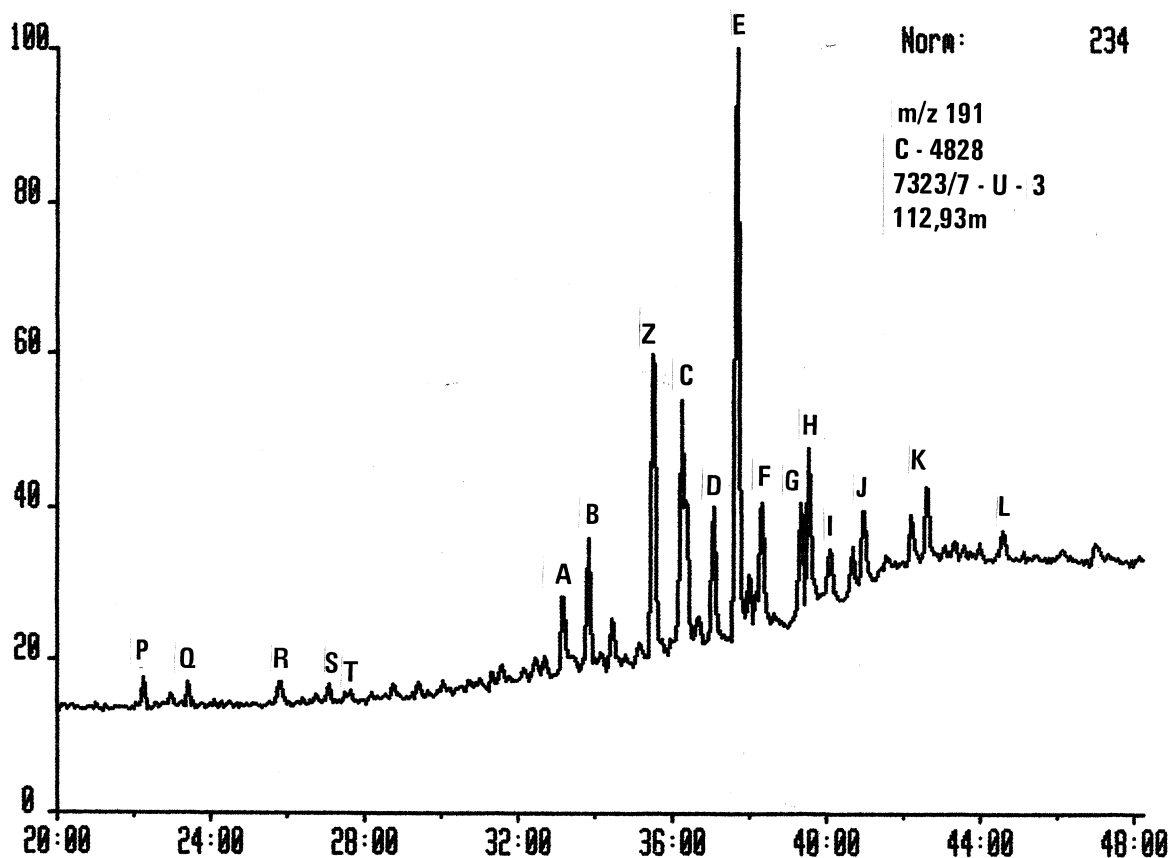
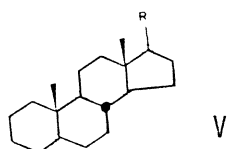
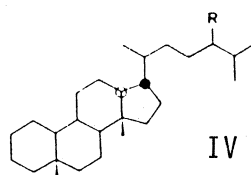
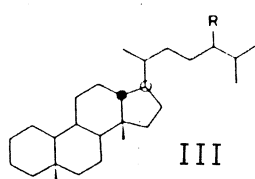
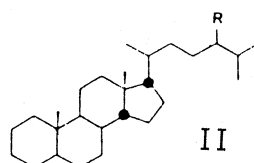
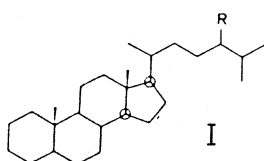


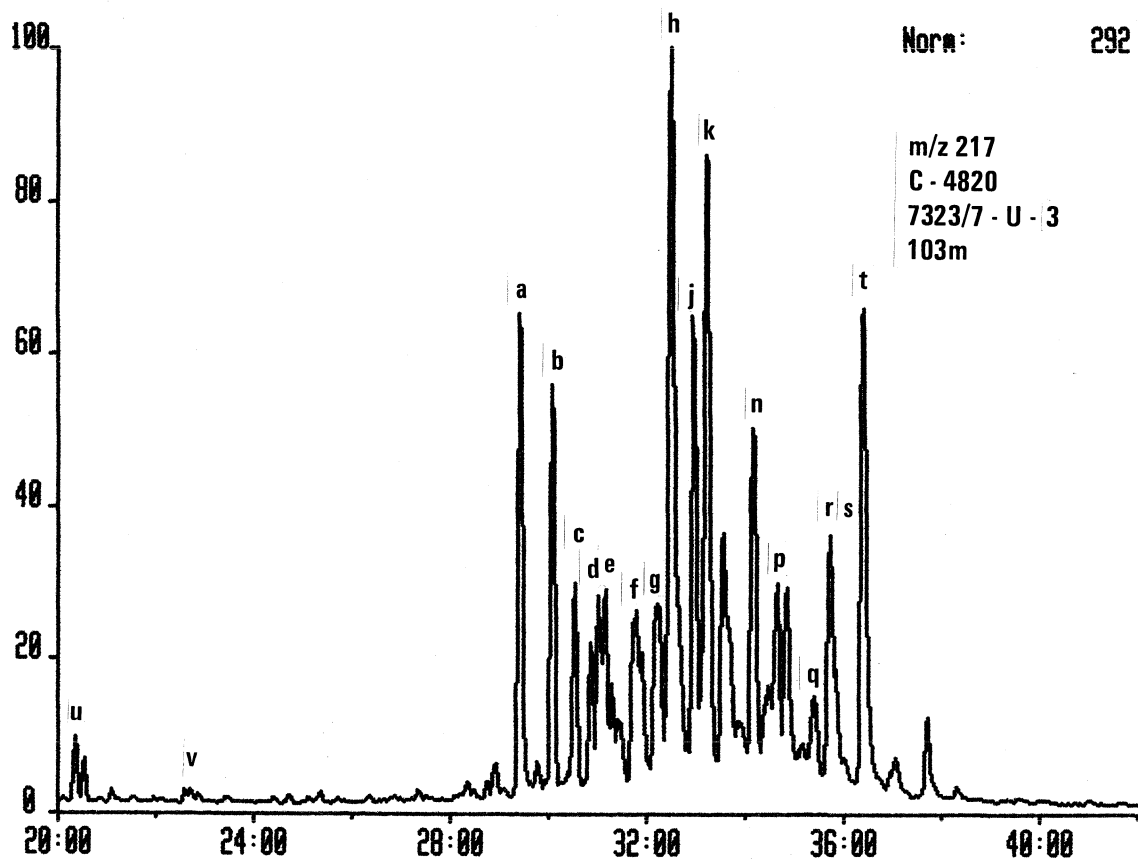
Figure A.III.3.5: Mass chromatograms of m/z 217 and 218 (steranes).

a	13 β (H),17 α (H)-diasterane (20S)	C ₂₇ H ₄₈	(III,R=H)
b	13 β (H),17 α (H)-diasterane (20R)	C ₂₇ H ₄₈	(III,R=H)
c	13 α (H),17 β (H)-diasterane (20S)	C ₂₇ H ₄₈	(IV,R=H)
d	13 α (H),17 β (H)-diasterane (20R)	C ₂₇ H ₄₈	(IV,R=H)
e	13 β (H),17 α (H)-diasterane (20S)	C ₂₈ H ₅₀	(III,R=CH ₃)
f	13 β (H),17 α (H)-diasterane (20R)	C ₂₈ H ₅₀	(III,R=CH ₃)
g	13 α (H),17 β (H)-diasterane (20S)	C ₂₈ H ₅₀	(IV,R=CH ₃)
	+ 14 α (H),17 α (H)-sterane (20S)	C ₂₇ H ₄₈	(I,R=H)
h	13 β (H),17 α (H)-diasterane (20S)	C ₂₉ H ₅₂	(III,R=C ₂ H ₅)
	+ 14 β (H),17 β (H)-sterane (20R)	C ₂₇ H ₄₈	(II,R=H)
i	14 β (H),17 β (H)-sterane (20S)	C ₂₇ H ₄₈	(II,R=H)
	+ 13 α (H),17 β (H)-diasterane (20R)	C ₂₈ H ₅₀	(IV,R=CH ₃)
j	14 α (H),17 α (H)-sterane (20R)	C ₂₇ H ₄₈	(I,R=H)
k	13 β (H),17 α (H)-diasterane (20R)	C ₂₉ H ₅₂	(III,R=C ₂ H ₅)
l	13 α (H),17 β (H)-diasterane (20S)	C ₂₉ H ₅₂	(III,R=C ₂ H ₅)
m	14 α (H),17 α (H)-sterane (20S)	C ₂₈ H ₅₀	(I,R=CH ₃)
n	13 α (H),17 β (H)-diasterane (20R)	C ₂₉ H ₅₂	(III,R=C ₂ H ₅)
	+ 14 β (H),17 β (H)-sterane (20R)	C ₂₈ H ₅₀	(II,R=CH ₃)
o	14 β (H),17 β (H)-sterane (20S)	C ₂₈ H ₅₀	(II,R=CH ₃)
p	14 α (H),17 α (H)-sterane (20R)	C ₂₈ H ₅₀	(I,R=CH ₃)
q	14 α (H),17 α (H)-sterane (20S)	C ₂₉ H ₅₂	(I,R=C ₂ H ₅)
r	14 β (H),17 β (H)-sterane (20R)	C ₂₉ H ₅₂	(II,R=C ₂ H ₅)
	+ unknown sterane		
s	14 β (H),17 β (H)-sterane (20S)	C ₂₉ H ₅₂	(II,R=C ₂ H ₅)
t	14 α (H),17 α (H)-sterane (20R)	C ₂₉ H ₅₂	(I,R=C ₂ H ₅)
u	5 α (H)-sterane	C ₂₁ H ₃₆	(V,R=C ₂ H ₅)
v	5 α (H)-sterane	C ₂₂ H ₃₈	(IV,R=C ₃ H ₇)



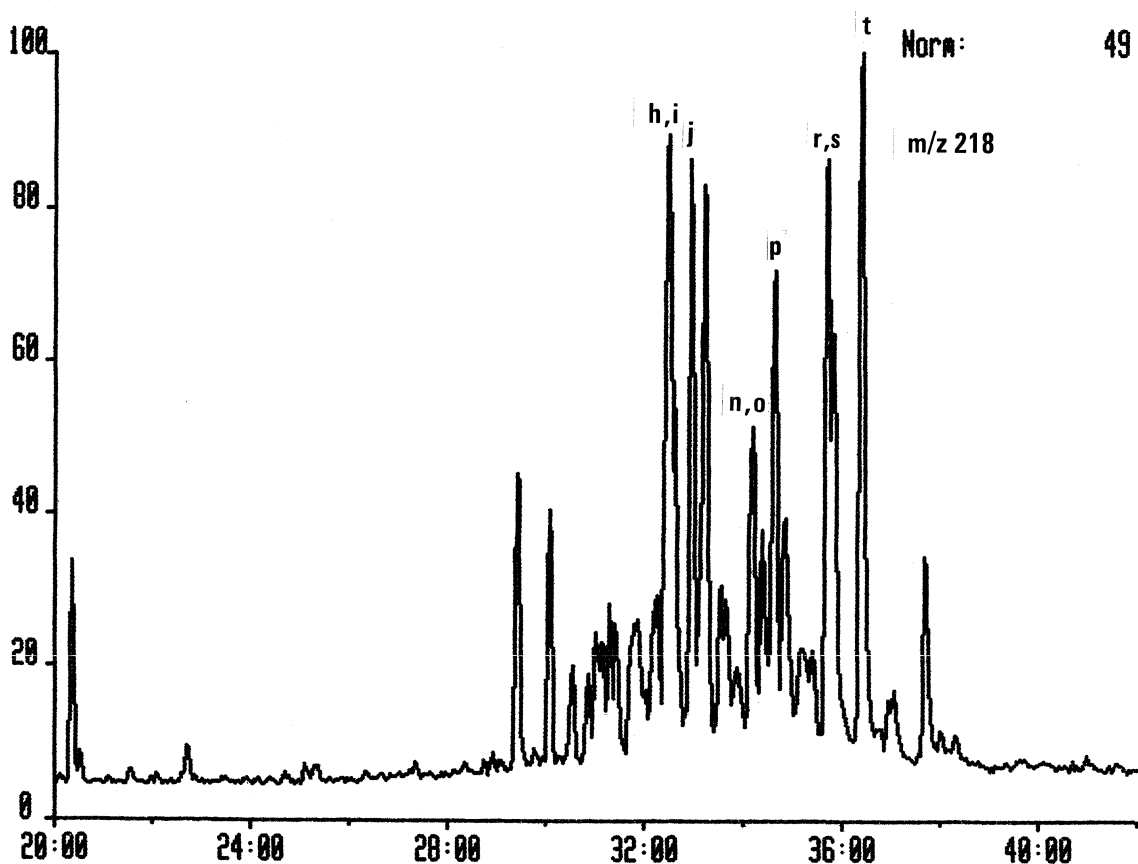
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Text:

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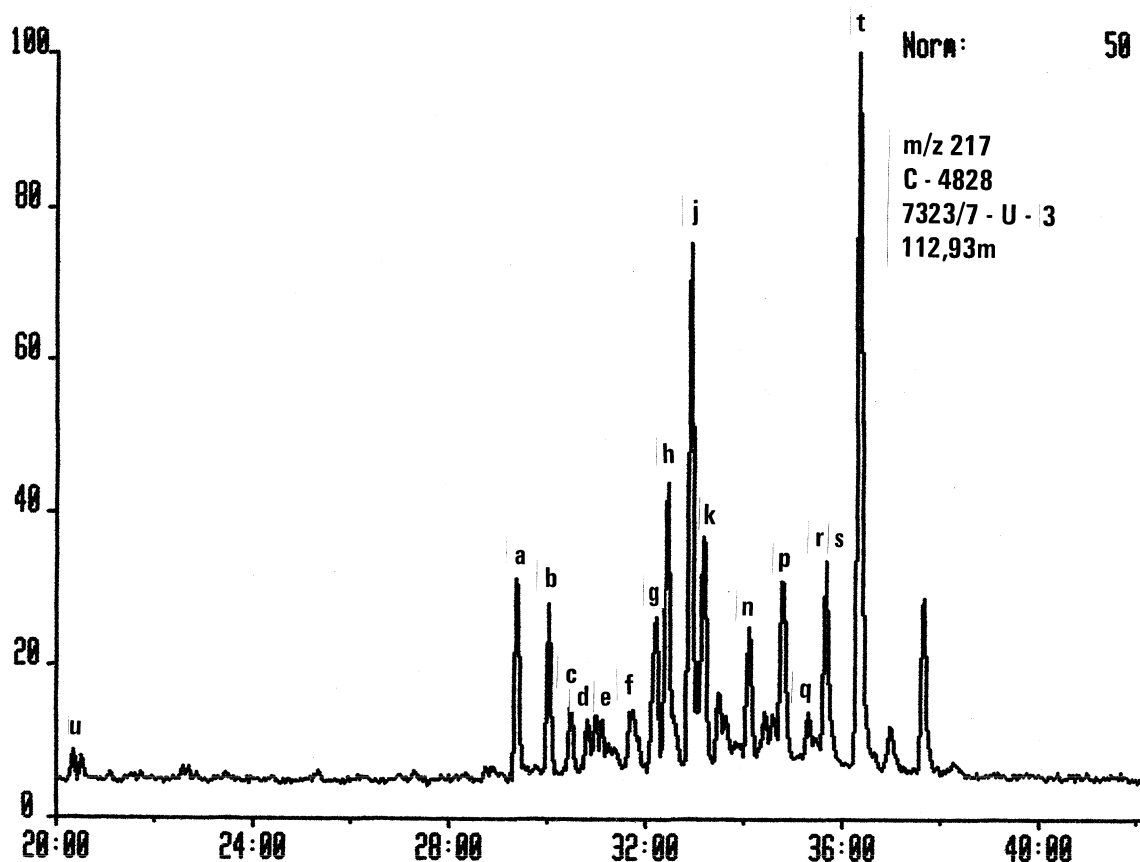
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 Sample 1 Injection 1 Group 1 Mass 217.1000
 Text:

System:TRIT



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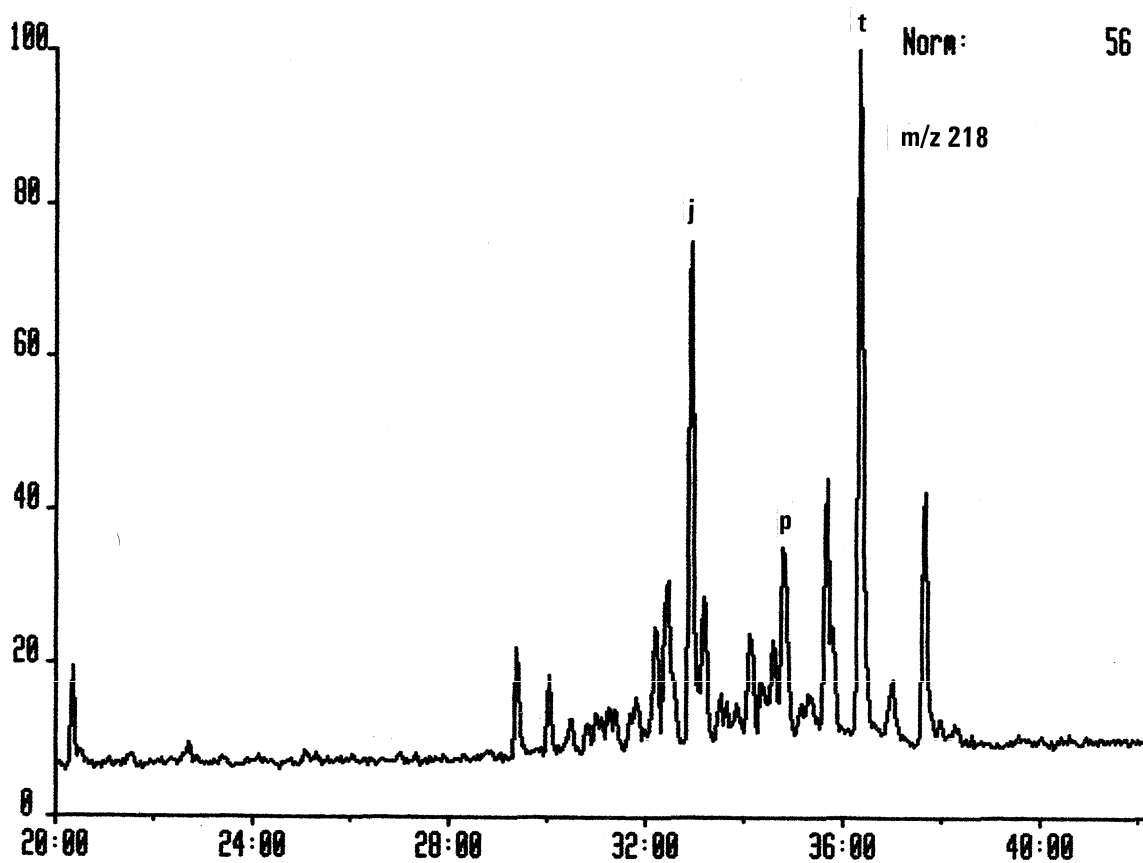


Figure A.III.3.6: Vitrinite reflectance histograms.

Key: A = Grey-black-brown claystone.
 Upper case letters indicate values included in
 the main population. Lower case letters represent
 values in other populations.

 PP = Statistical data populations
 Y = Main population, not necessarily
 representative of sample maturity.
 N = Other populations.

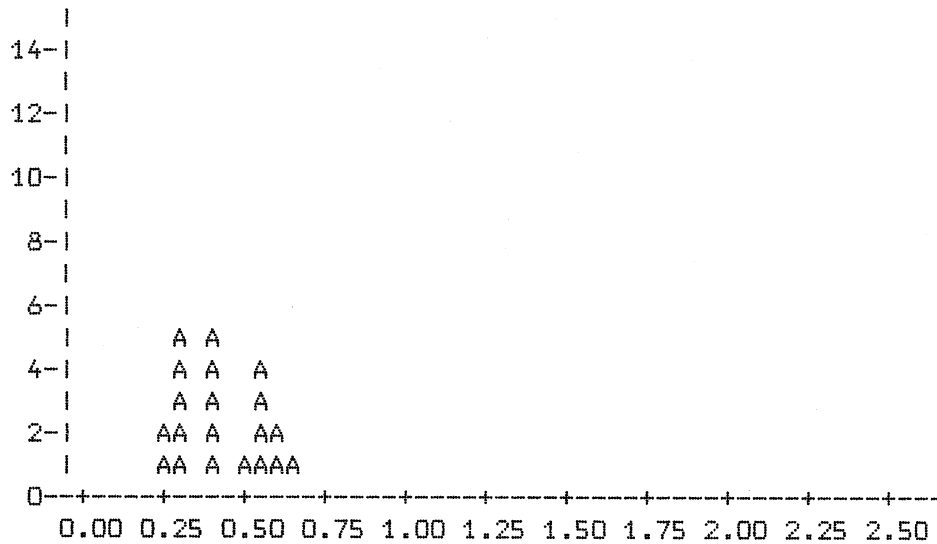
 LOW+ HIGH = Population limits.

 VAL. = Number of measurements in that
 population.

Lithology cross-reference table

A = Clst. gy
 B = Clst. dk gy
 C = Clst. gn
 D = Clst. bn
 E = Clst. rd
 F = Clst. calc.
 G = Clst. carb.
 H = Shale
 I = Sandstone
 J = Limestone
 K = Coal
 L = Lignite
 M = Carbargillite
 N = Siltstone
 O = Bit
 P = X

IKU# C-4822 105.7M 7323/7-U-3

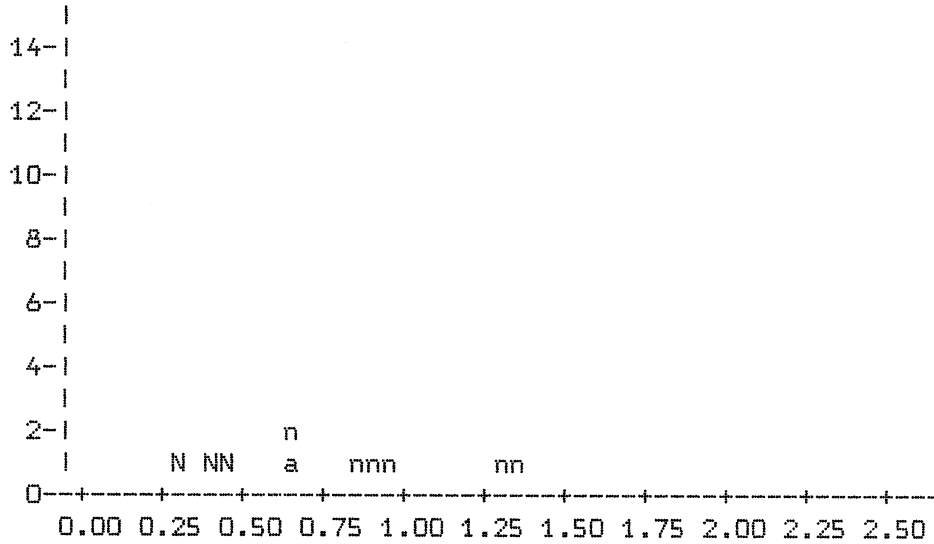


PP LOW HIGH LIT #VAL MEAN STDV
 Y 0.27 0.66 ALL 20 0.45 0.13
 OVERALL 20 0.45 0.13

ORDERED VALUES FOLLOW:

0.27A 0.29A 0.30A 0.31A 0.32A 0.33A 0.34A 0.40A 0.41A 0.42A 0.43A
 0.44A 0.51A 0.55A 0.55A 0.57A 0.59A 0.60A 0.63A 0.65A

IKU# C-4828 112.9M 7323/7-U-3



PP	LOW	HIGH	LIT	#VAL	MEAN	STDV
Y	0.30	0.48	ALL	3	0.40	0.09
N	0.66	1.00	ALL	5	0.83	0.15
N	1.33	1.36	ALL	2	1.34	0.01
OVERALL				10	0.80	0.36

ORDERED VALUES FOLLOW:

0.30N 0.43N 0.47N 0.66n 0.69a 0.88n 0.94n 0.99n 1.33n 1.35n

APPENDIX III.4: TABLE OF CONTENTS continued

Core 7323/7-U-4:

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- Table A.III.4.1b: Concentration of C_1-C_5 + hydrocarbons in occluded gas.
- Table A.III.4.1c: Concentration of C_1-C_5 + hydrocarbons - summation.
- Table A.III.4.2: Total organic carbon and data from Rock-Eval pyrolysis.
- Table A.III.4.3: Data from pyrolysis-gas chromatograms.
- Table A.III.4.4: Vitrinite reflectance data.
- Table A.III.4.5: Weight of EOM and chromatographic fractions.
- Table A.III.4.6: Concentration of EOM and chromatographic fractions.
- Table A.III.4.7: Concentration of EOM and chromatographic fractions.
- Table A.III.4.8: Composition of material extracted from the rock.
- Table A.III.4.9: Tabulation of data from the gas chromatograms.
- Table A.III.4.10: Molecular ratios from sterane and terpane mass chromatograms. Maturity ratios.
- Table A.III.4.11: Molecular ratios from sterane and terpane mass chromatograms. Maturity and source characteristic ratios.
- Table A.III.4.12: $\delta^{13}C$ and δD isotope ratios and composition of adsorbed gas fractions.
- Table A.III.4.13: $\delta^{13}C$ isotope ratios for extract fractions.

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- Figure A.III.4.1: Pyrolysis-gas chromatograms (S2 peak).
- Figure A.III.4.2: Saturated hydrocarbon gas chromatograms.
- Figure A.III.4.3: Aromatic hydrocarbon gas chromatograms.
- Figure A.III.4.4: Mass chromatograms of m/z 191 (terpanes).
- Figure A.III.4.5: Mass chromatograms of m/z 217 and 218 (steranes).
- Figure A.III.4.6: Vitrinite reflectance histograms.

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Well ident.: 7323/7-U-4
DATE : 28 - 10 - 86.

Table A.III.4.1a: Concentration of C₁-C₅ hydrocarbons in headspace gas.

I	I	I	I	I	I	I	I	I	I	I	I	I	I
I	IKU	DEPTH	C1	C2	C3	iC4	nC4	C5+	SUM	SUM	WET-	iC4	I
I	no.	m							C1-C4	C2-C4	NESS	-----	I
I											(%)	nC4	I
I	C 5043	98.51	2643	70					2712	70	2.57	*****	I
I	C 5044	99.92	1671	61	9	47			1788	117	6.55	*****	I
I	C 5045	104.71	21226	126	34	279	19	148	21684	458	2.11	14.76	I
I	C 5046	107.77	18218	2889	1448	694	518	717	23768	5550	23.35	1.34	I
I	C 5047	111.25	17826	2901	2183	710	739	587	24358	6533	26.82	0.96	I
I	C 5048	115.99	8620	4261	5174	1199	4023	2627	23276	14656	62.97	0.30	I
I	C 5049	124.89	5359	3163	3165	863	1210	585	13760	8401	61.05	0.71	I
I	C 5050	126.88	3777	2388	1851	585	688	456	9289	5512	59.34	0.85	I
I	C 5051	135.60	17126	4814	2404	938	988	1121	26269	9143	34.81	0.95	I

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Well ident.: 7323/7-U-4
DATE : 28 - 10 - 86.

Table A.III.4.1b: Concentration of C₁-C₅ hydrocarbons in occluded gas.

I	I	I	I	I	I	I	I	I	I	I	I	I	I
I	IKU	DEPTH	C1	C2	C3	iC4	nC4	C5+	SUM	SUM	WET-	iC4	I
I	no.	m							C1-C4	C2-C4	NESS	-----	I
I											(%)	nC4	I
I	C 5043	98.51	739	407	638	51			1835	1096	59.72	*****	I
I	C 5044	99.92	857	221	724	190		653	1991	1134	56.97	*****	I
I	C 5045	104.71	12195	747	566	604		936	14111	1916	13.58	*****	I
I	C 5046	107.77	2235	8135	489	15923		19127	26782	24547	91.65	*****	I
I	C 5047	111.25	231	907	711	2997		3869	4846	4615	95.23	*****	I
I	C 5048	115.99	610	1735	8767	3134	14013	12505	28259	27650	97.84	0.22	I
I	C 5049	124.89	17312	29430	74810	22701	40350	16318	184604	167292	90.62	0.56	I
I	C 5050	126.88	1791	6780	21098	9997	16116	12725	55782	53992	96.79	0.62	I
I	C 5051	135.60	5233	16062	23932	11218	13319	10194	69763	64531	92.50	0.84	I

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Well ident.: 7323/7-U-4
DATE : 28 - 10 - 86.

Table A.III.4.1c: Concentration of C₁-C₅ hydrocarbons - summation.

I	I	I	I	I	I	I	I	I	I	I	I	I	I
I	IKU	DEPTH	C1	C2	C3	iC4	nC4	C5+	SUM	SUM	WET-	iC4	I
I	no.	m							C1-C4	C2-C4	NESS	-----	I
I											(%)	nC4	I
I	C 5043	98.51	3382	476	638	51			4548	1166	25.63	*****	I
I	C 5044	99.92	2528	282	733	236		653	3780	1252	33.12	*****	I
I	C 5045	104.71	33421	872	601	882	19	1085	35796	2374	6.63	46.69	I
I	C 5046	107.77	20454	11024	1937	16617	518	19844	50550	30097	59.54	32.05	I
I	C 5047	111.25	18057	3808	2894	3707	739	4456	29204	11148	38.17	5.02	I
I	C 5048	115.99	9230	5997	13941	4333	18036	15133	51536	42306	82.09	0.24	I
I	C 5049	124.89	22671	32594	77975	23564	41560	16903	198364	175692	88.57	0.57	I
I	C 5050	126.88	5568	9169	22949	10582	16804	13181	65072	59504	91.44	0.63	I
I	C 5051	135.60	22359	20876	26336	12155	14307	11315	96033	73674	76.72	0.85	I

Table A.III.4.2: Total organic carbon and data from Rock-Eval
 pyrolysis.

I	I	I	I	I	I	I	I	I	I	I	I	I
I	IKU	DEPTH	:	S1	S2	S3	TOC	HYDR. INDEX	OXYGEN INDEX	PETROLEUM POTENTIAL	PROD. INDEX	TEMP. MAX
I	No.		:								S1	
I		m/ft	:	(mg/g ROCK)		(%)	(mg/g TOC)			S1+S2	S1+S2	(C)
I			:									
I	C 4898	95.50	:	****	****	****	1.23	*****	****	*****	*****	***
I	C 4899	95.98	:	0.13	1.39	0.36	1.22	114	30	1.52	0.09	428
I	C 4855	97	:	0.34	3.77	0.17	1.85	204	9	4.11	0.08	433
I	C 4856	98	:	0.24	5.22	0.62	1.80	290	34	5.46	0.04	427
I	C 4857	99	:	0.67	18.10	0.26	4.57	396	6	18.77	0.04	429
I	C 4858	100	:	0.30	6.66	0.59	2.01	331	29	6.96	0.04	429
I	C 4859	101.02	:	0.38	9.98	0.24	3.08	324	8	10.36	0.04	435
I	C 4860	102	:	0.31	10.34	0.62	2.76	375	22	10.65	0.03	430
I	C 4861	103	:	0.63	12.20	0.62	3.32	367	19	12.83	0.05	428
I	C 4862	104	:	0.67	14.90	0.78	3.99	373	20	15.57	0.04	424
I	C 4863	105	:	2.03	36.26	0.39	8.55	424	5	38.29	0.05	417
I	C 4864	106	:	1.06	22.52	1.06	5.53	407	19	23.58	0.04	422
I	C 4865	107	:	1.14	21.40	0.92	8.81	243	10	22.54	0.05	422
I	C 4866	108	:	0.89	19.10	1.06	4.67	409	23	19.99	0.04	419
I	C 4867	109.05	:	0.94	16.75	0.33	4.31	389	8	17.69	0.05	423
I	C 4868	110	:	0.66	14.00	1.13	3.63	386	31	14.66	0.05	424
I	C 4870	112	:	0.40	9.49	0.89	3.02	314	29	9.89	0.04	422
I	C 4871	113	:	0.74	12.67	0.35	3.90	325	9	13.41	0.06	422
I	C 4872	114	:	****	****	****	2.65	*****	****	*****	*****	***
I	C 4873	115	:	0.64	13.31	0.34	3.59	371	9	13.95	0.05	421
I	C 4874	116	:	****	****	****	3.23	*****	****	*****	*****	***

Table A.III.4.2: cont.

I	I	I	I	I	I	I	I	I	I	I	I	I
I	IKU	DEPTH	:	S1	S2	S3	TOC	HYDR. OXYGEN	PETROLEUM	PROD. TEMP.	I	I
I	No.		:					INDEX	POTENTIAL	INDEX	MAX	I
I			:							S1		I
I		m/ft	:	(mg/g ROCK)		(%)	(mg/g TOC)		S1+S2	S1+S2	(C)	I
I			:									I
I	C 4875	117	:	0.46	9.27	0.29	3.13	296	9	9.73	0.05	425
I	C 4876	118	:	****	****	****	2.86	*****	****	*****	*****	***
I	C 4877	119	:	0.79	11.33	0.46	3.33	340	14	12.12	0.07	426
I	C 4878	120	:	****	****	****	3.12	*****	****	*****	*****	***
I	C 4879	121	:	0.39	5.62	0.66	2.25	250	29	6.01	0.06	429
I	C 4880	122.01	:	****	****	****	2.90	*****	****	*****	*****	***
I	C 4881	123	:	0.34	4.88	0.54	2.12	230	25	5.22	0.07	429
I	C 4882	124	:	****	****	****	3.79	*****	****	*****	*****	***
I	C 4883	125	:	0.44	7.65	0.63	2.69	284	23	8.09	0.05	426
I	C 4884	126	:	****	****	****	2.00	*****	****	*****	*****	***
I	C 4885	127	:	0.38	5.72	0.42	2.19	261	19	6.10	0.06	425
I	C 4886	127.97	:	****	****	****	3.22	*****	****	*****	*****	***
I	C 4887	129	:	0.64	10.67	0.70	3.35	319	21	11.31	0.06	422
I	C 4888	130	:	****	****	****	3.42	*****	****	*****	*****	***
I	C 4889	131	:	0.41	6.25	0.63	2.68	233	24	6.66	0.06	425
I	C 4890	132	:	0.50	9.74	0.83	3.01	324	28	10.24	0.05	421
I	C 4891	132.97	:	1.22	21.95	0.76	4.49	489	17	23.17	0.05	419
I	C 4892	134.05	:	1.07	16.47	1.00	4.42	373	23	17.54	0.06	419
I	C 4893	135	:	1.15	23.19	0.80	4.88	475	16	24.34	0.05	423
I	C 4894	136	:	0.73	13.63	1.14	3.68	370	31	14.36	0.05	421
I	C 4895	137.06	:	0.51	8.61	0.81	2.52	342	32	9.12	0.06	423
I	C 4896	138.01	:	****	****	****	3.06	*****	****	*****	*****	***
I	C 4897	138.52	:	0.64	10.18	0.66	3.09	329	21	10.82	0.06	423

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

IKU No	DEPTH (m)	C1 %	C2-C5 %	C6-C14 %	C15+ %	(m+p)-xylene/ n-octene
C-4899	95.98	5.38	14.16	62.26	18.20	1.06
C-4855	97	5.35	7.16	58.13	29.36	0.53
C-4859	101.02	6.46	6.55	60.31	26.69	0.39
C-4863	105	5.81	5.88	49.22	39.09	0.76
C-4867	109.05	4.99	13.14	49.57	32.30	0.65
C-4871	113	4.68	5.50	56.22	33.60	0.78
C-4875	117	4.61	6.82	54.51	34.06	0.68
C-4879	121	6.24	9.09	58.16	26.51	0.62
C-4883	125	2.43	8.12	59.34	30.11	0.68
C-4887	129	4.15	6.20	53.98	35.68	0.83
C-4891	132.97	7.12	7.52	60.87	24.50	0.74
C-4895	137.06	4.94	11.17	52.97	30.91	0.75

Well Identification: 7323/7-U-4
 Reference number: 21.3420.06
 (1/1)

Table A.III.4.4: Vitrinite reflectance data.

IKU NO	LOCATION	DEPTH (M)	VITRINITE REFLECTANCE	REL RAT	STANDARD DEVIATION	FLUORE- SCENCE
C 4873	----	115	0.34 (9) 0.63 (10) 0.88 (2)	P R R	0.07 0.06 0.08	4-5

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

HY-PY: Sample artificially matured by hydrous pyrolysis.

Project no.: 21.3420.06
 Well ident.: 7323/7-U-4
 DATE : 15 - 11 - 86.

Table A.III.4.5: Weight of EOM and chromatographic fractions.

IKU-No	DEPTH	Rock Extr.	EOM	Sat.	Aro.	HC	Non HC	TOC
	(m)	(g)	(mg)	(mg)	(mg)	(mg)	(mg)	(%)
C 4865	107	15.7	69.5	7.8	11.8	19.6	49.9	6.87
C 4873	115	14.2	49.4	4.2	7.1	11.3	38.1	3.39
C 4877	119	20.8	60.8	6.2	10.8	17.0	43.8	2.65
C 4883	125	9.1	26.7	2.3	3.5	5.8	20.9	3.01
C 4893	135	9.8	50.3	5.0	9.1	14.2	36.1	4.90

Project no.: 21.3420.06
 Well ident.: 7323/7-U-4
 DATE : 15 - 11 - 86.

Table A.III.4.6: Concentration of EOM and chromatographic fractions.

IKU-No	DEPTH (m)	EOM	Sat.	Aro.	HC	Non HC
C 4865	107	4430	497	750	1247	3183
C 4873	115	3476	296	498	794	2683
C 4877	119	2923	296	519	815	2108
C 4883	125	2937	251	383	634	2304
C 4893	135	5122	513	929	1442	3680

Project no.: 21.3420.06
 Well ident.: 7323/7-U-4
 DATE : 15 - 11 - 86.

Table A.III.4.7: Concentration of EOM and chromatographic fractions.

IKU-No	DEPTH (m)	EOM	Sat.	Aro.	HC	Non HC
C 4865	107	64.5	7.2	10.9	18.1	46.3
C 4873	115	102.5	8.7	14.7	23.4	79.1
C 4877	119	110.3	11.2	19.6	30.8	79.6
C 4883	125	97.6	8.3	12.7	21.1	76.5
C 4893	135	104.5	10.5	19.0	29.4	75.1

DATE : 15 - 11 - 86.

Table A.III.4.8: Composition of material extracted from the rock.

I			:	Sat	Aro	HC	SAT	Non HC	HC	I
I	IKU-No	DEPTH	:	---	---	---	---	---	---	I
I			:	EOM	EOM	EOM	Aro	EOM	Non HC	I
I		(m)	:	%	%	%	x 100	%	x 100	I
I			:							I
I	C 4865	107	:	11.2	16.9	28.1	66.3	71.9	39.2	I
I			:							I
I	C 4873	115	:	8.5	14.3	22.8	59.3	77.2	29.6	I
I			:							I
I	C 4877	119	:	10.1	17.8	27.9	56.9	72.1	38.7	I
I			:							I
I	C 4883	125	:	8.5	13.0	21.6	65.5	78.4	27.5	I
I			:							I
I	C 4893	135	:	10.0	18.1	28.2	55.3	71.8	39.2	I
I			:							I

Table A.III.4.9: Tabulation of data from the gas chromatograms.

I	DEPTH	:	PRISTANE	PRISTANE	PHYTANE	A	n-C17		I
I	IKU No.	:	-----	A = -----	B = -----	-----	-----	CPI	I
I	(m)	:	PHYTANE	n-C17	n-C18	B	n-C27		I
I		:							I
I	C 4865	107	0.9	3.4	4.7	0.7	1.6	1.2	I
I									I
I	C 4873	115	1.0	5.1	6.5	0.8	1.5	1.0	I
I									I
I	C 4877	119	1.1	5.3	6.4	0.8	1.6	1.0	I
I									I
I	C 4883	125	1.2	7.1	8.1	0.9	0.9	1.0	I
I									I
I	C 4893	135	1.0	7.7	12.0	0.6	2.3	1.3	I
I									I

DATE : 24 - 11 - 86.

Table A.III.4.10 Molecular ratios from sterane and terpane mass chromatograms.
Maturity ratios.

IKU code	Well/depth	$\alpha\beta/\alpha\beta+\beta\alpha$ ¹⁾	%22S ²⁾	%20S ³⁾	% $\beta\beta$ ⁴⁾
<u>Well 7323/7-U-4</u>					
C-4873	115 m	0.82	33.3	5.1	31.0
C-4893	135 m	0.80	39.5	9.1	47.6

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

2) Average % distribution between first and second eluting isomers of extended hopanes (G-M in m/z 191)

3) q/q+t in m/z 217

4) $2(r+s)/(q+t+2(r+s))$ in m/z 217

Table A.III.4.11 Molecular ratios from terpane and sterane mass chromatograms.

Maturity and source characteristic ratios.

IKU no.	Well/depth	Q/E ¹⁾	T _m /T _s ²⁾	X/E ³⁾	Z/E ⁴⁾	a/a+j ⁵⁾
---------	------------	-------------------	--	-------------------	-------------------	---------------------

Well 7323/7-U-4

C-4873	115 m	0.05	2.0	-	-	0.30
C-4893	135 m	0.06	2.3	0.04	-	0.39

- 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 C₂₇ rearranged steranes (a/a+j in m/z 217)

Table A.III.4.12a: Gas composition of the hydrocarbons C_1 to C_7 of adsorbed gas of core samples (Vol %).

Sample no.	Depth (m)	C_1	C_2	C_3	iC_4	nC_4	2.2DMP	iC_5	nC_5	C_6	C_7
<u>Well 7323/7-U-1</u>											
C-5033	107.84	52.01	15.61	4.22	2.10	3.04	0.80	2.13	1.98	10.95	7.16
C-5036	126.69	2.06	7.15	33.88	9.89	18.52	0.13	6.21	6.26	9.12	6.77

Table A.III.4.12b: Gas yields of the hydrocarbons C_1 to C_7 of adsorbed gas of core samples (ppb).

Sample no.	Depth (m)	C_1	C_2	C_3	iC_4	nC_4	2.2DMP	iC_5	nC_5	C_6	C_7
<u>Well 7323/7-U-1</u>											
C-5033	107.84	1083	609	241	159	229	75	199	186	1225	800
C-5036	126.69	672	4364	30334	11664	21853	197	9097	9175	15963	11837

Table A.III.4.12c: Gas ratios and isotope ratios of the hydrocarbons C_1 to C_7 of adsorbed gas of core samples.

Sample no.	Depth (m)	$C_1/\Sigma C_n$	$C_1/(C_2+C_3)$	iC_4/nC_4	$\delta^{13}C_1$	$\delta^{13}C_1$	$\delta^2 C$
<u>Well 7323/7-U-1</u>							
C-5033	107.84	0.5200	2.62	0.69	-46.8	-37.3	-96
C-5036	126.69	0.0206	0.05	0.53	-46.2	-40.3	-139

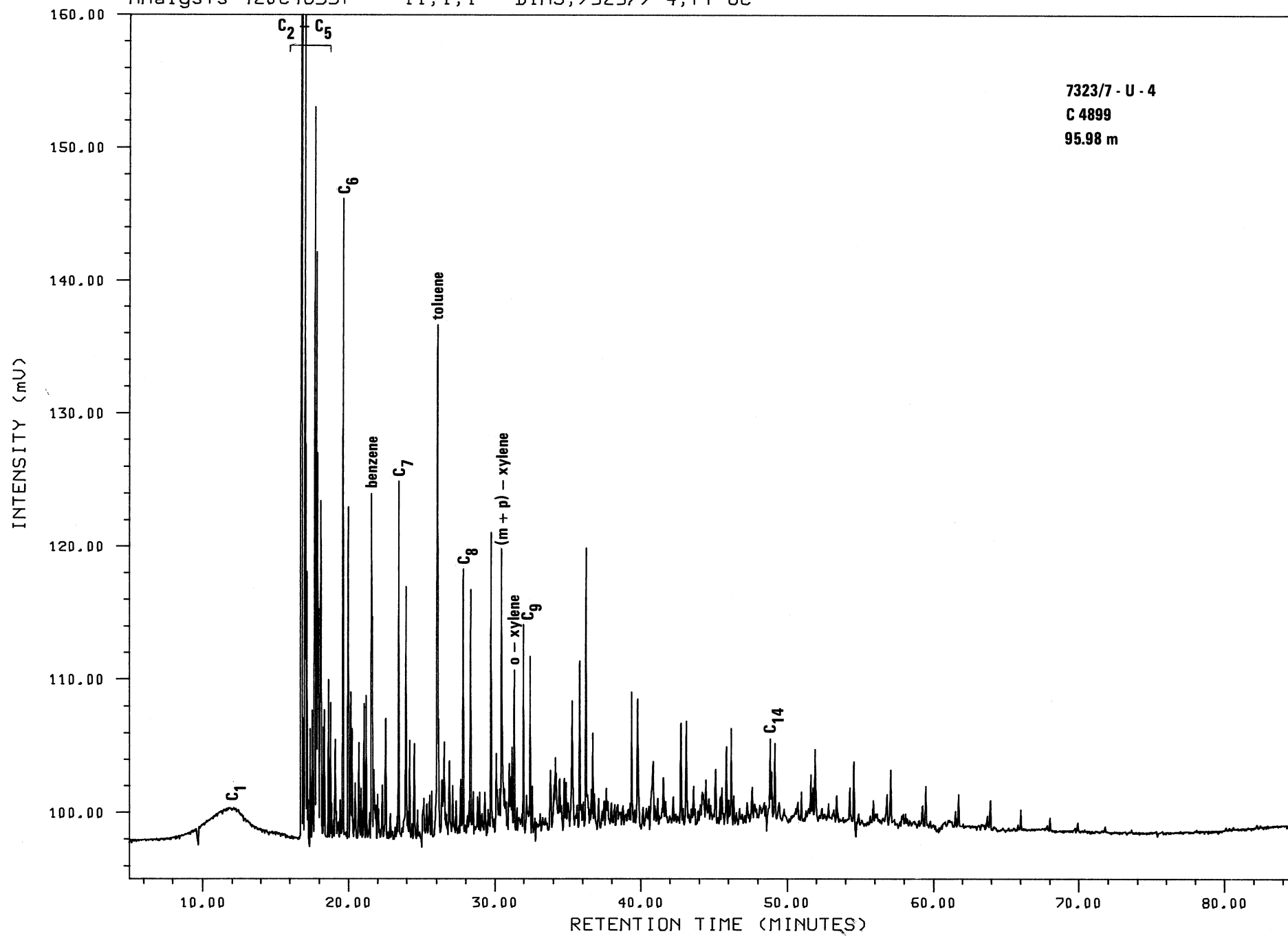
Table A.III.4.13: $\delta^{13}\text{C}$ isotope ratios for extract fractions.

Sample no.	Depth	$\delta^{13}\text{C}$ SAT	$\delta^{13}\text{C}$ ARO	$\delta^{13}\text{C}$ ASP	$\delta^{13}\text{C}$ NSO
------------	-------	------------------------------	------------------------------	------------------------------	------------------------------

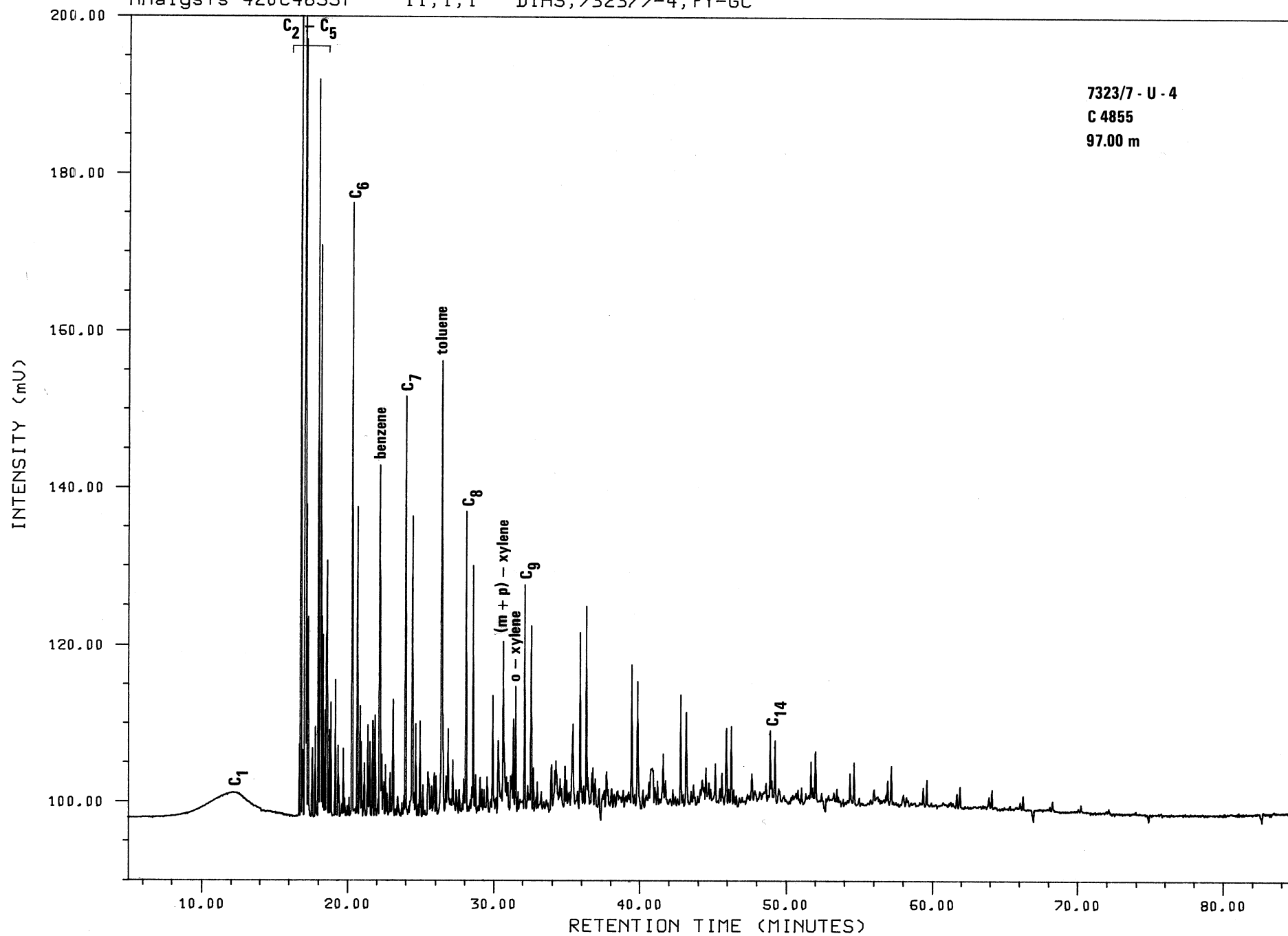
Well 7323/7-U-4

C-4873	115 m	-32.08	-31.65	-30.63	-31.66
C-4893	135 m	-34.03	-33.83	-31.78	-34.75

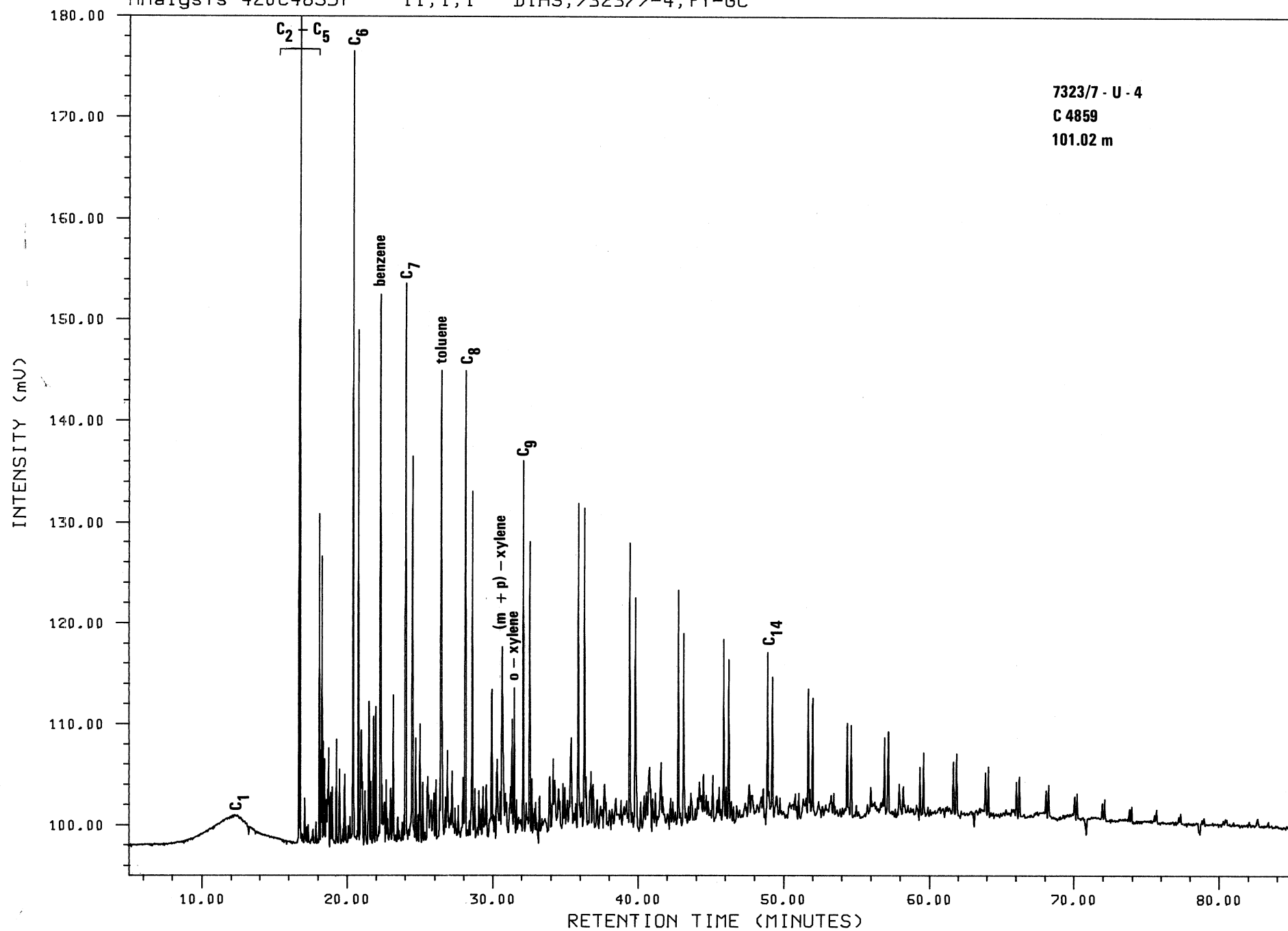
Figure A.III.4.1: Pyrolysis-gas chromatograms (S2 peak).



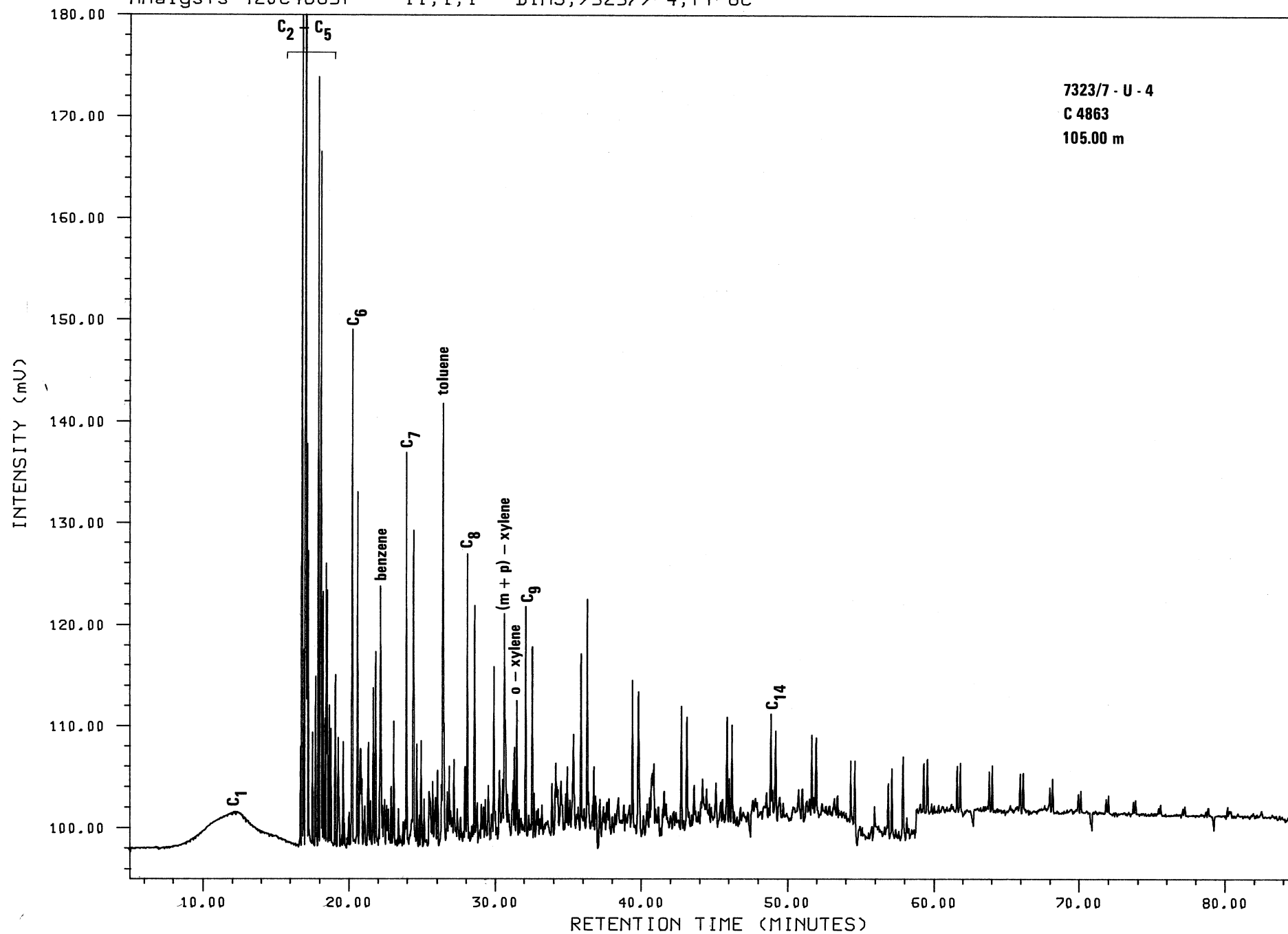
Analysis 420C4855P 11,1,1 DIAS,7323/7-4,PY-GC



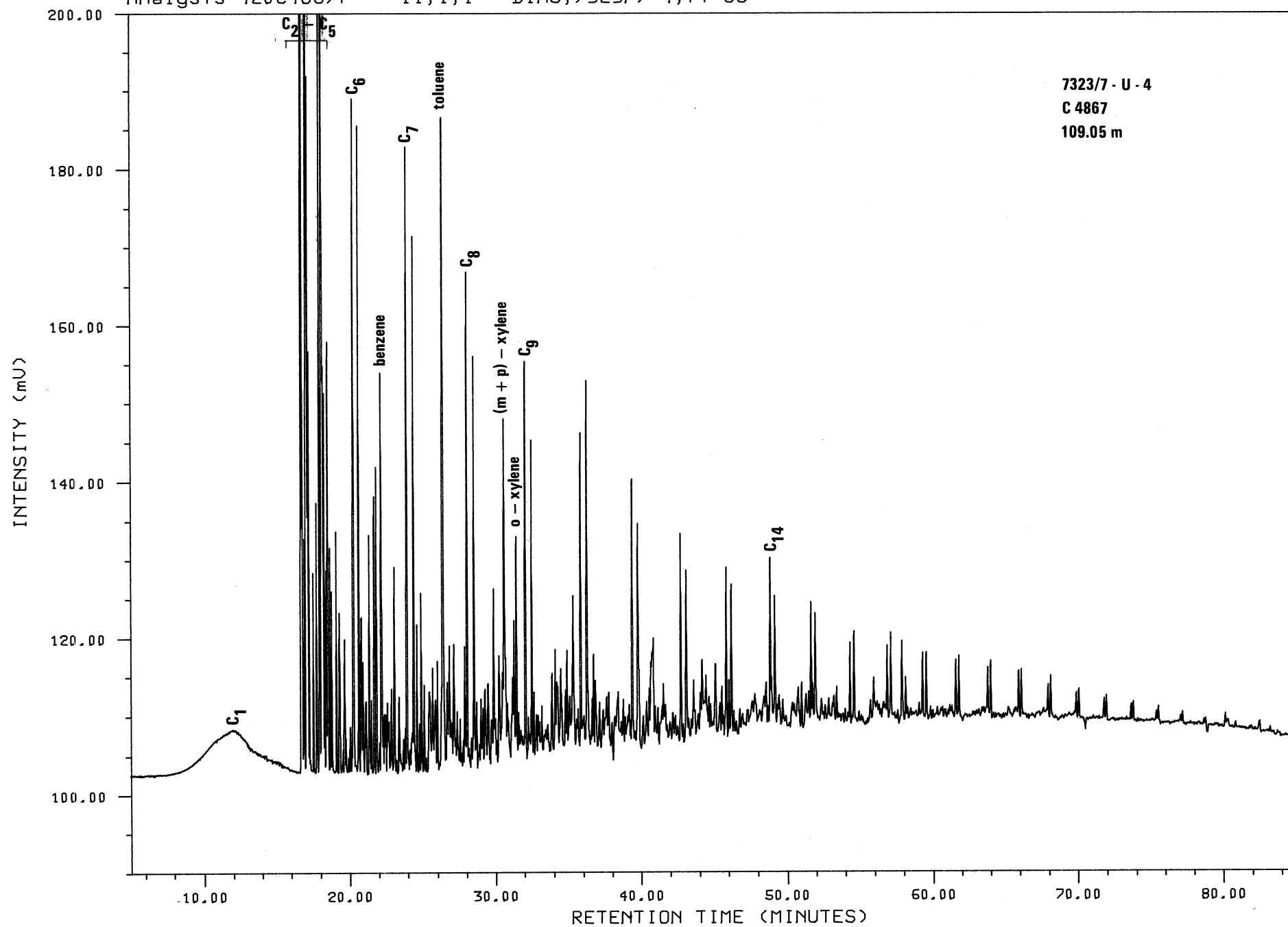
Analysis 420C4859P 11,1,1 DIAS,7323/7-4,PY-GC

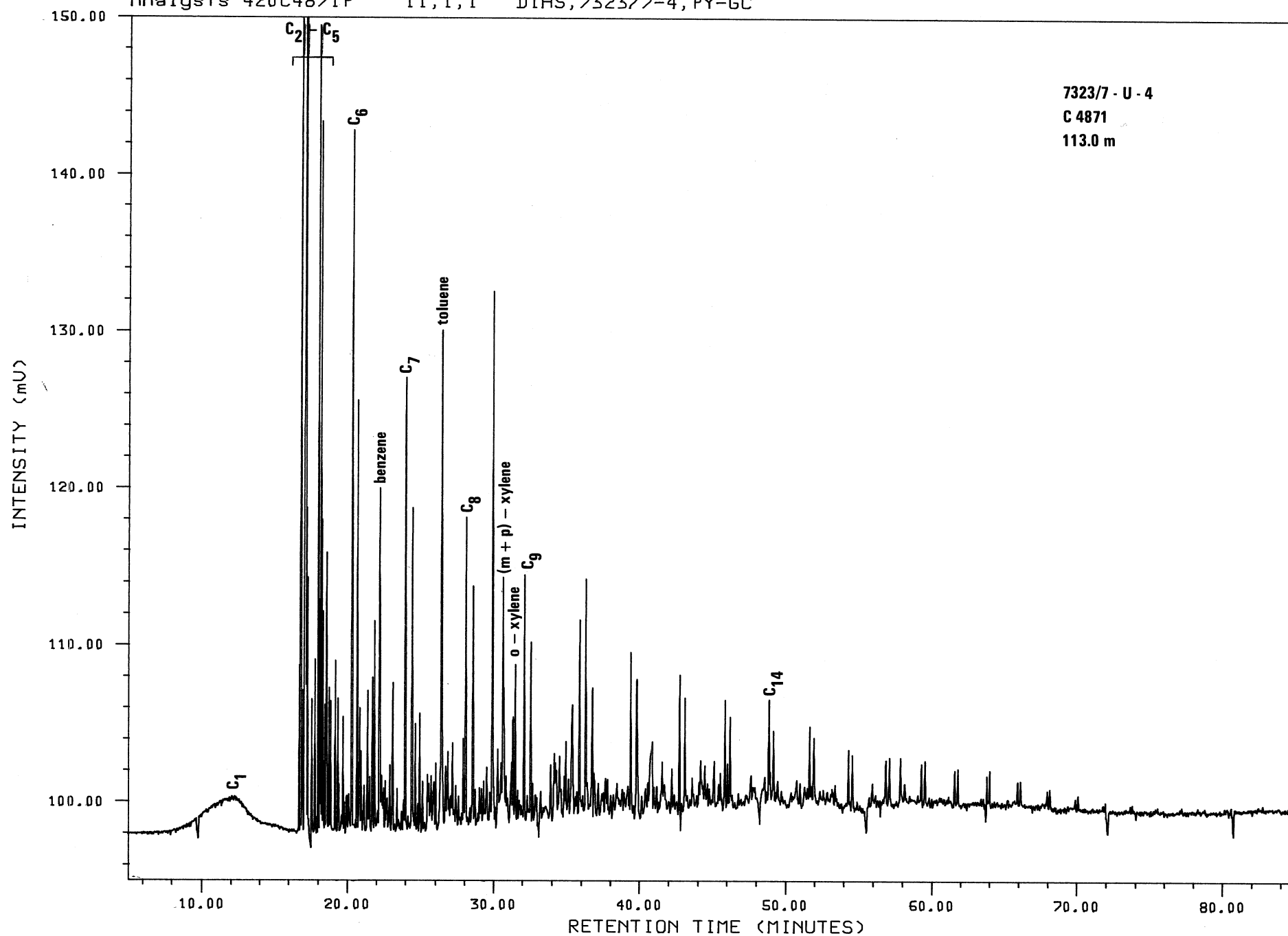


Analysis 420C4863P 11,1,1 DIAS,7323/7-4,PY-GC

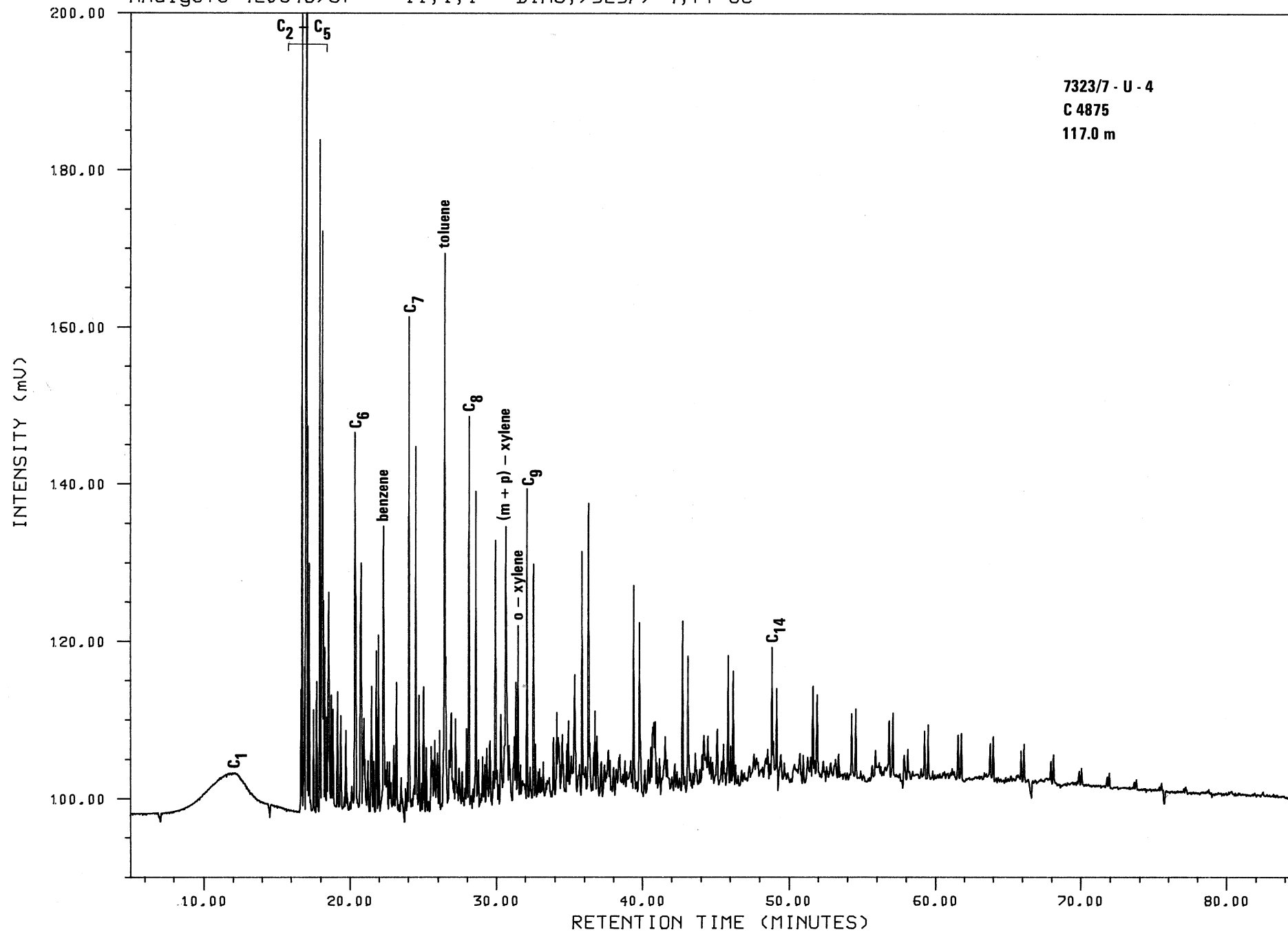


Analysis 420C4867P 11,1,1 DIAS,7323/7-4,PY-GC

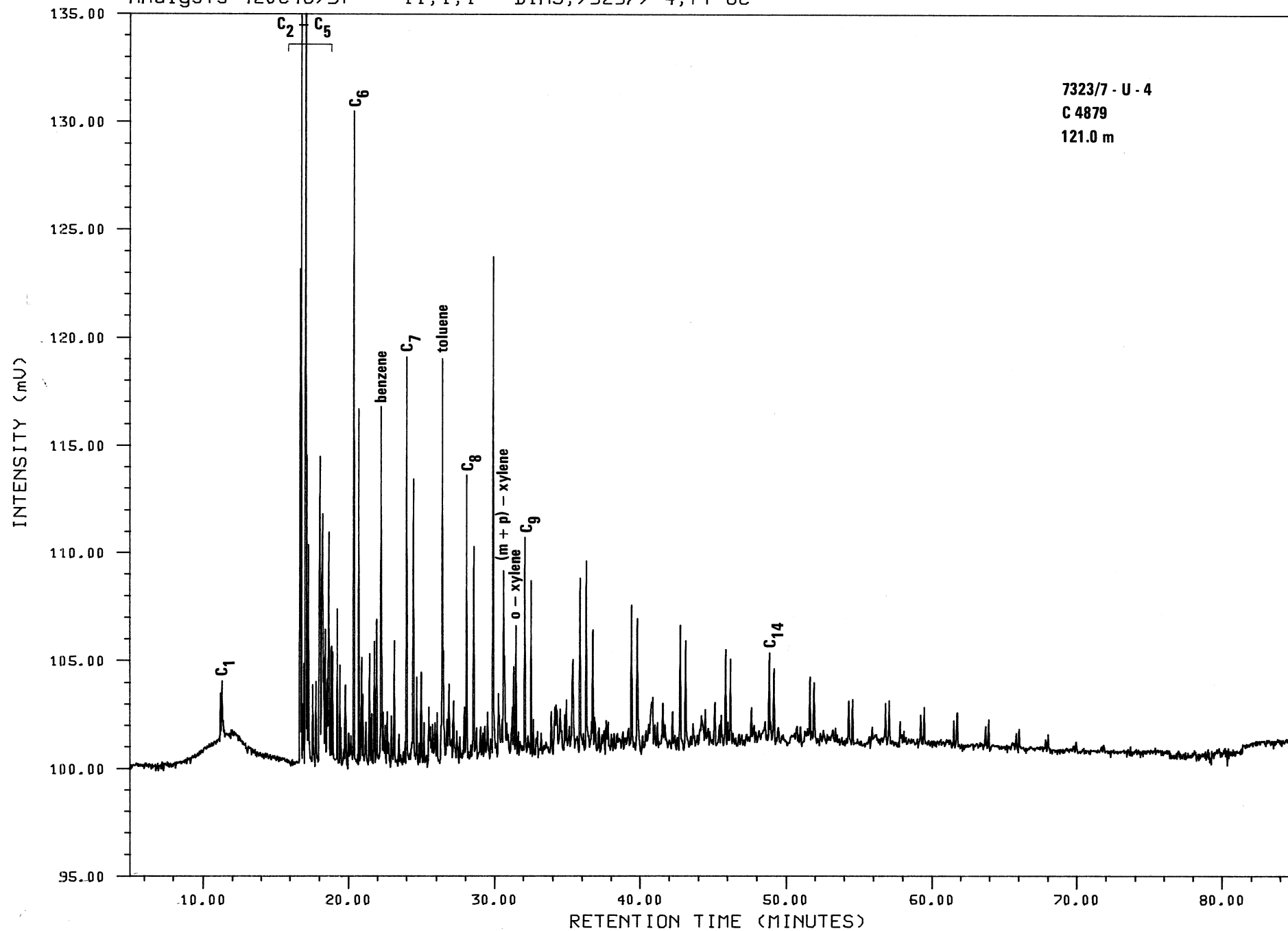




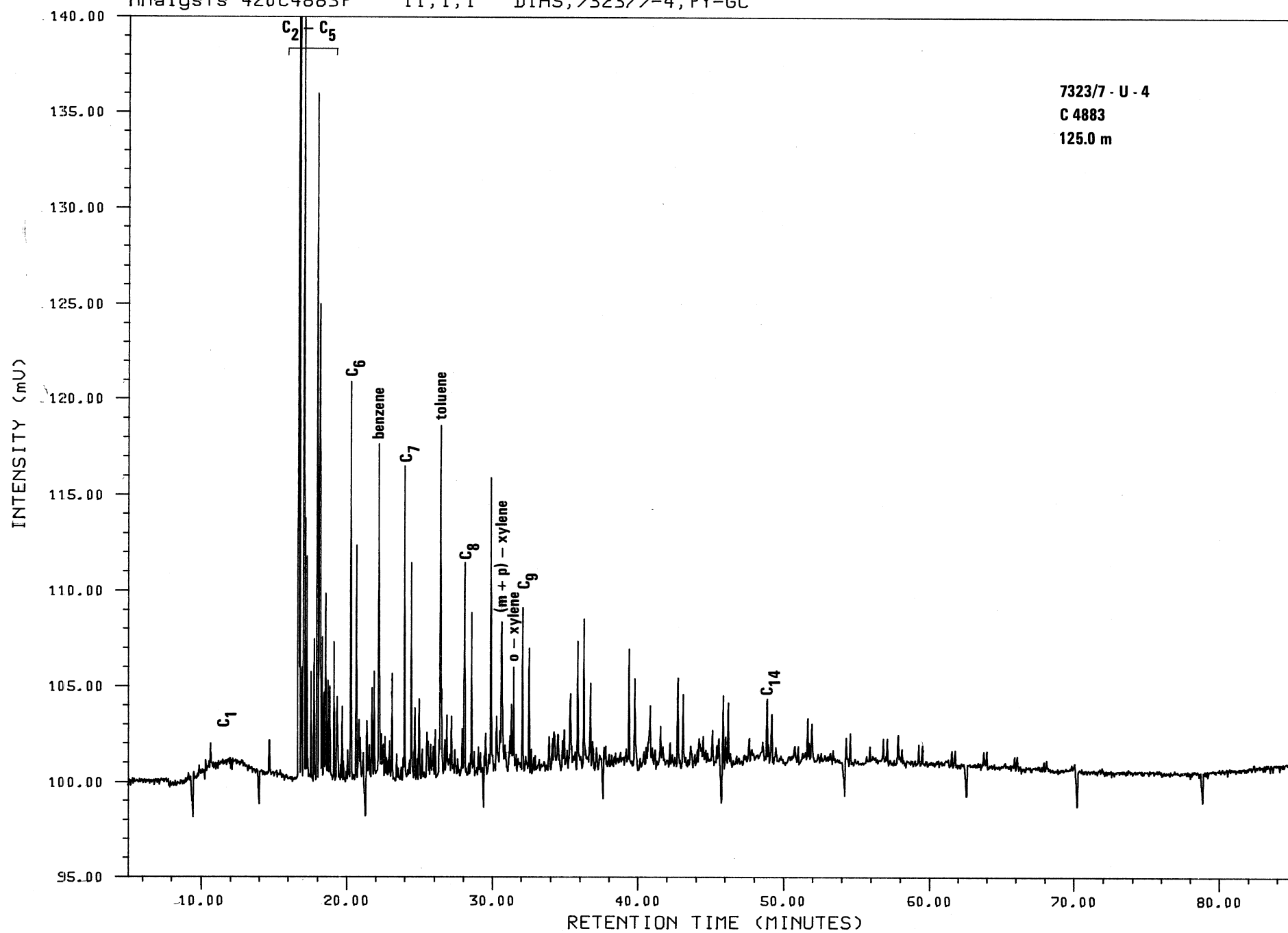
7323/7 - U - 4
C 4871
113.0 m



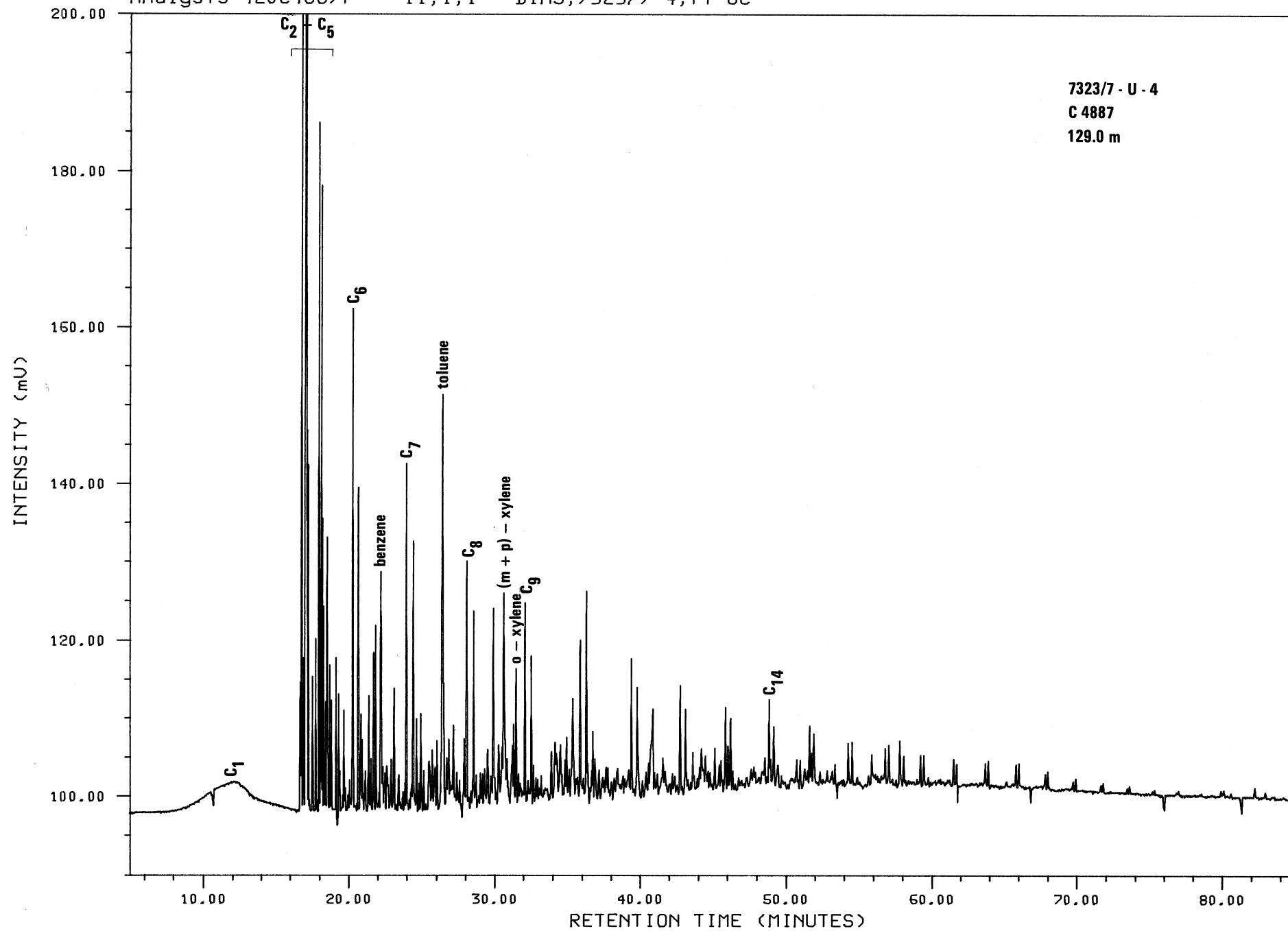
Analysis 420C4879P 11,1,1 DIAS,7323/7-4,PY-GC



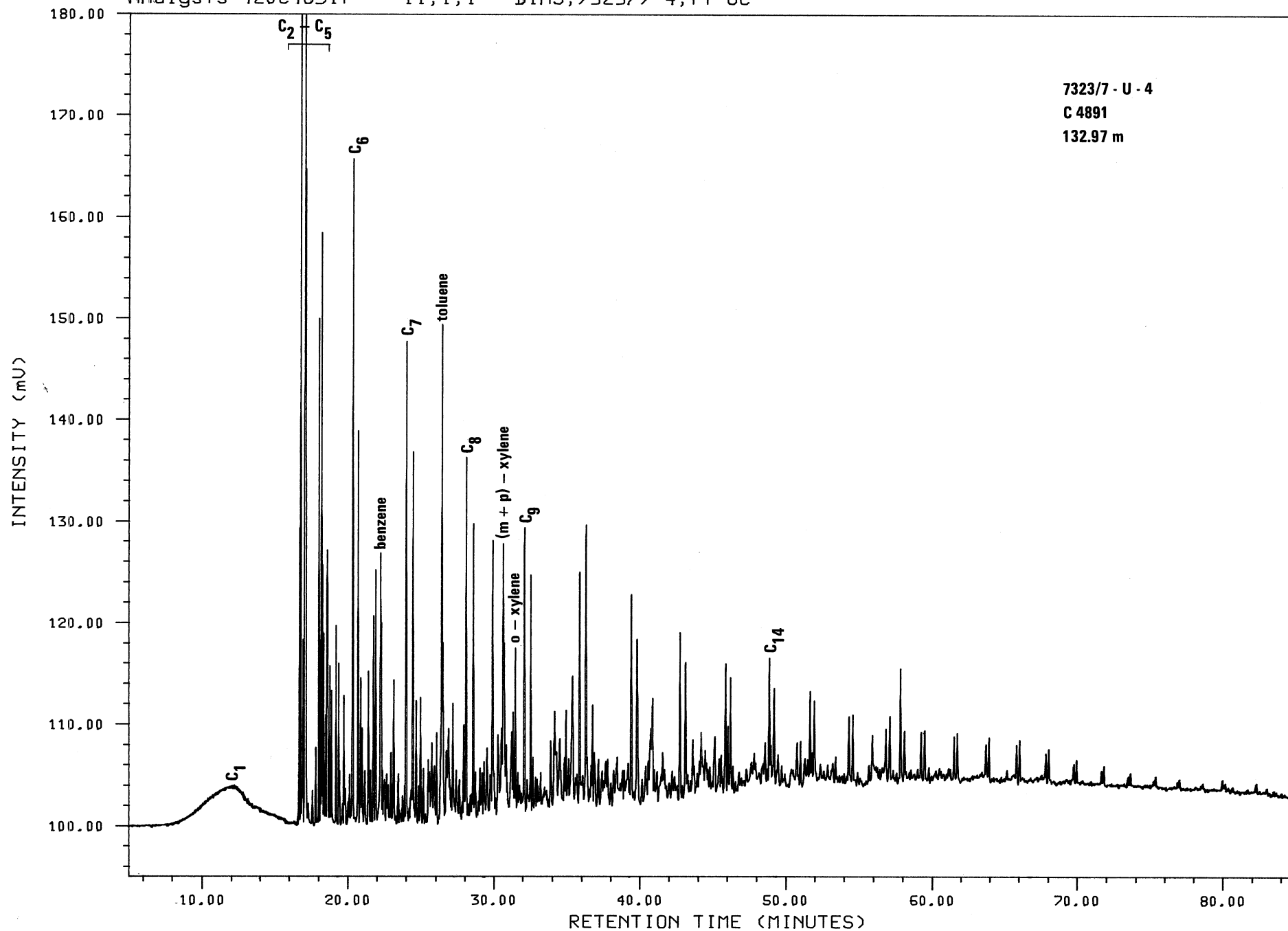
Analysis 420C4883P 11,1,1 DIAS,7323/7-4,PY-GC



Analysis 420C4887P 11,1,1 DIAS,7323/7-4,PY-GC



Analysis 420C4891P 11,1,1 DIAS,7323/7-4,PY-GC



Analysis 420C4895P 11,1,1 DIAS,7323/7-4,PY-GC

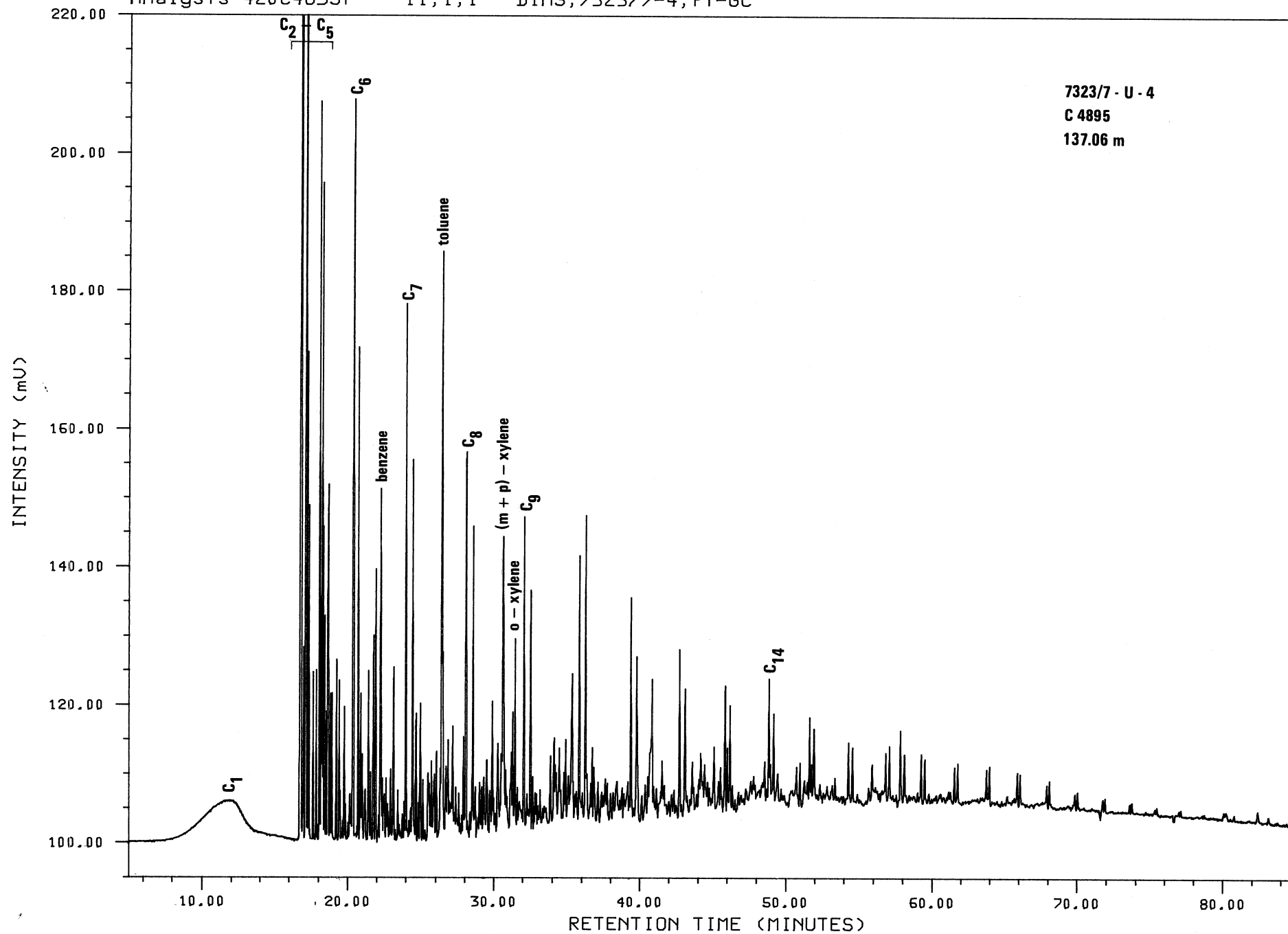
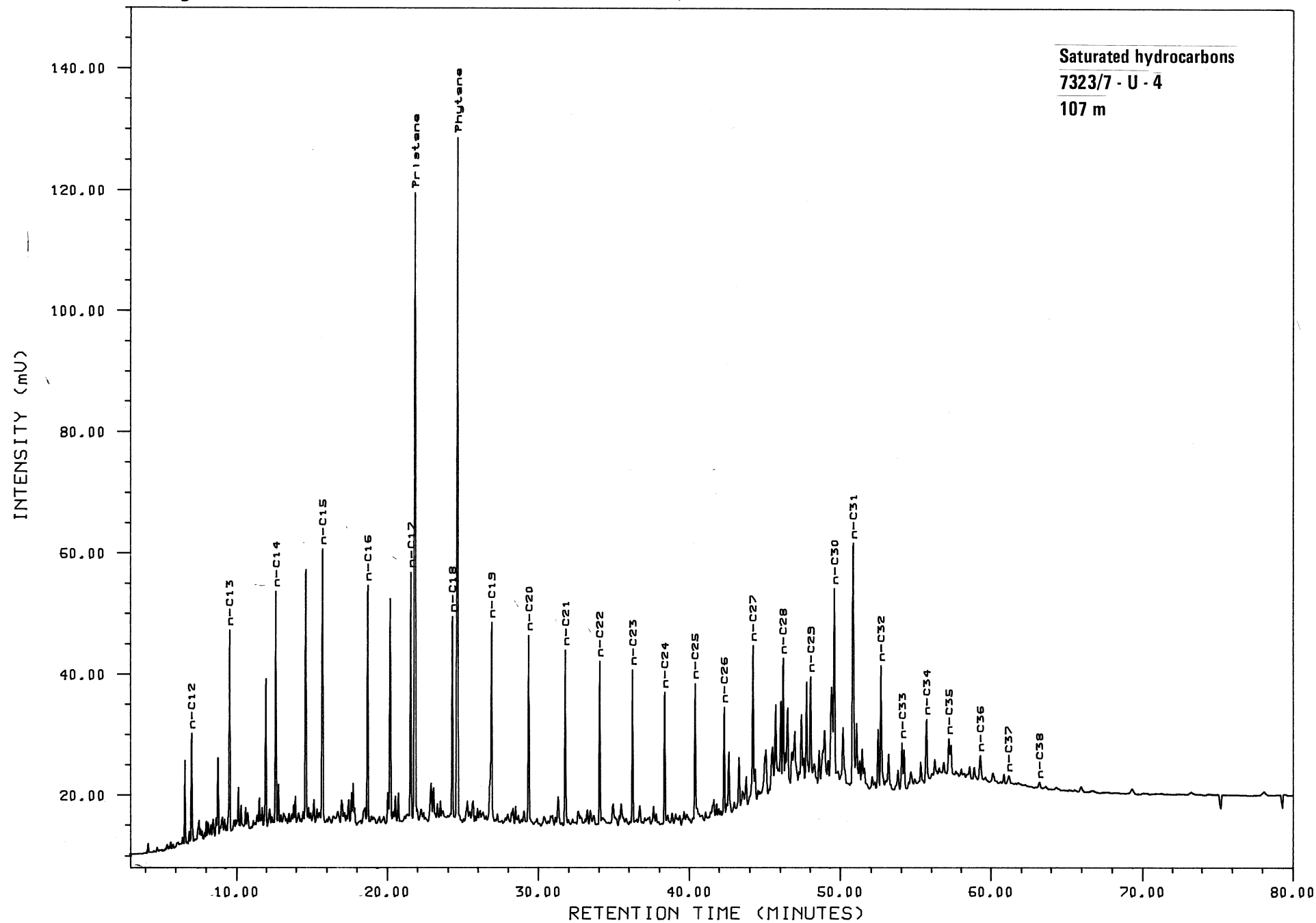
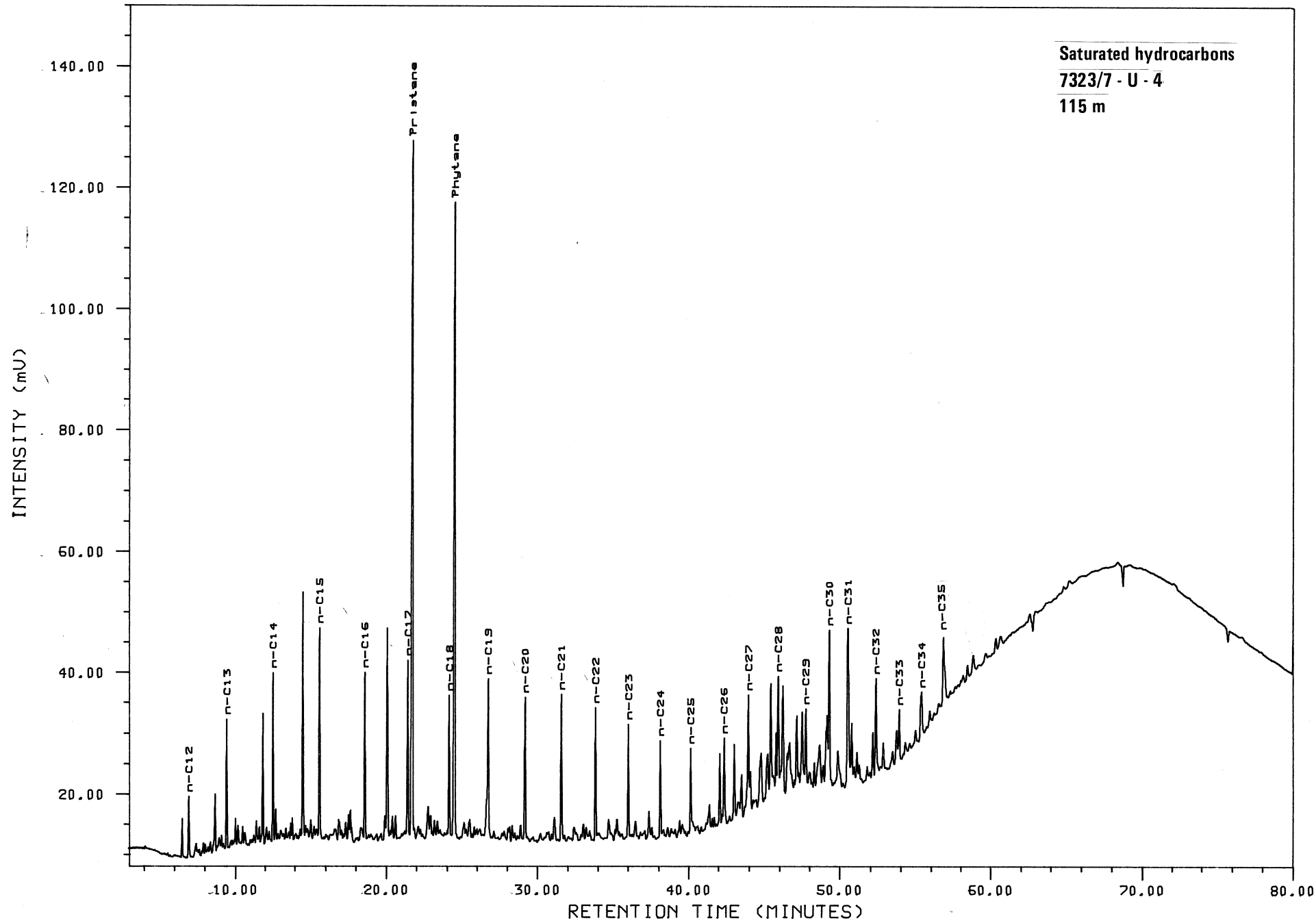


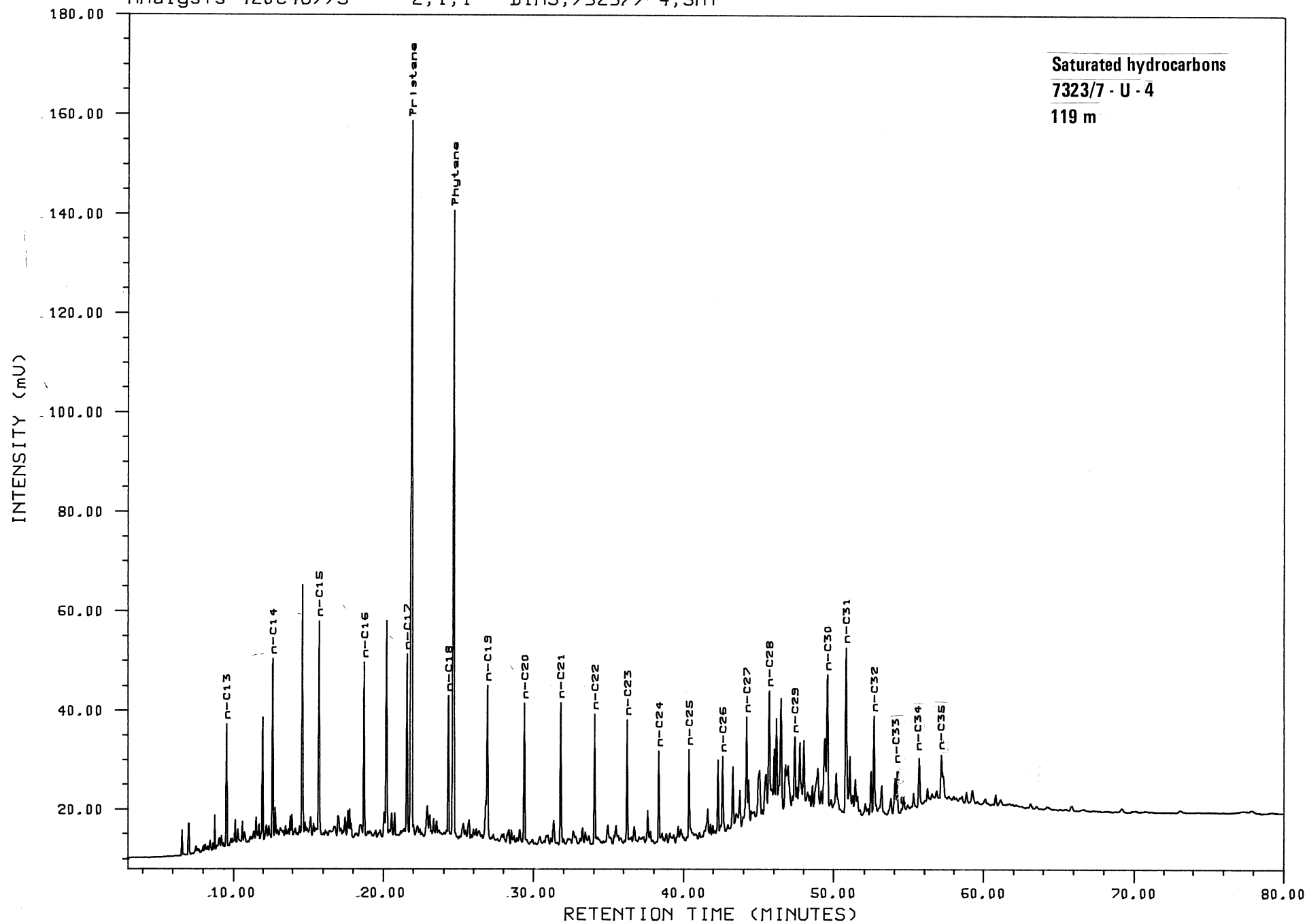
Figure A.III.4.2: Saturated hydrocarbon gas chromatograms.

n-C ₁₅ etc.	- n-alkanes
Pr	- pristane
Ph	- phytane
*	- other acyclic isoprenoids

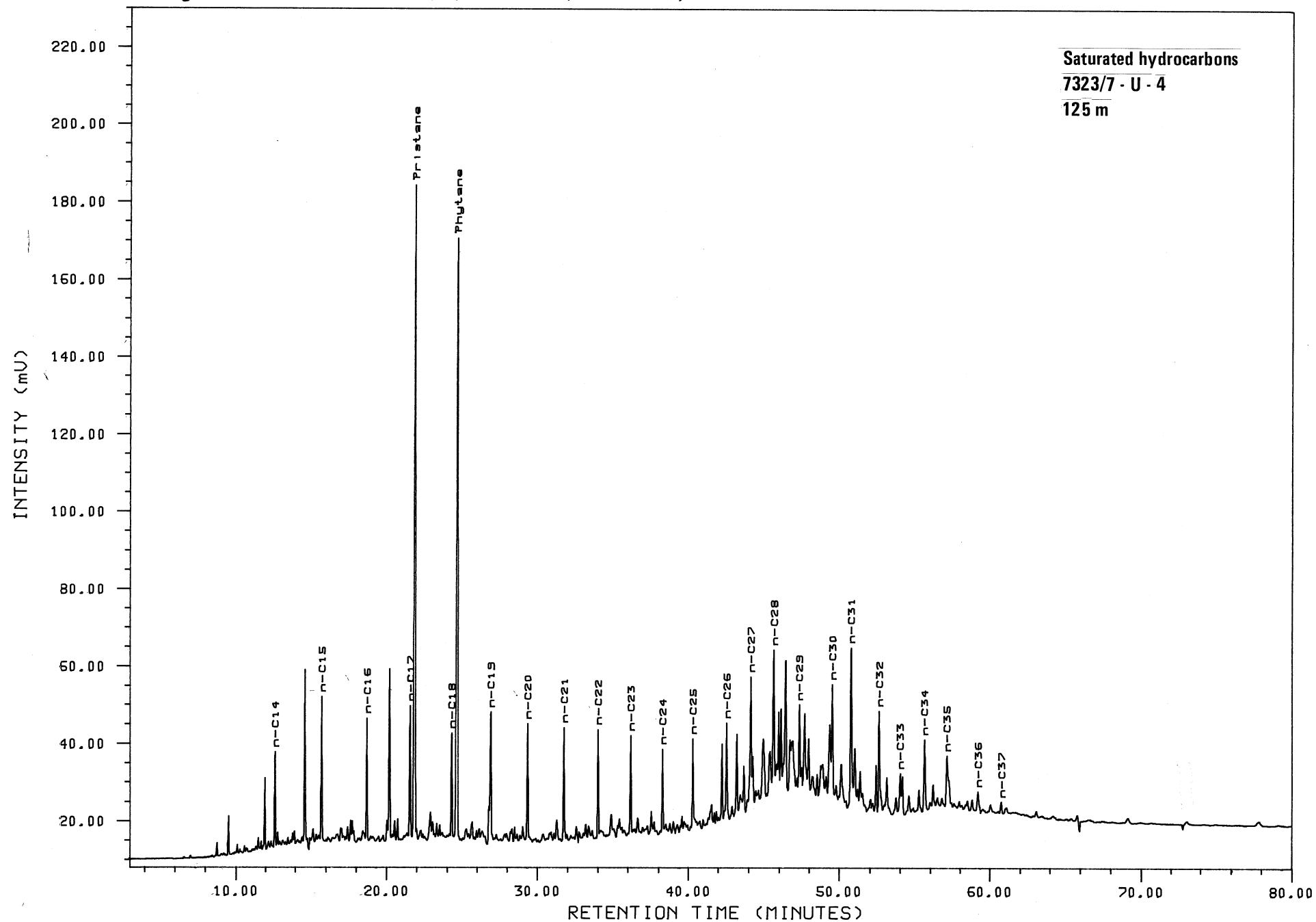




Analysis 420C4877S 2,1,1 DIAS,7323/7-4,SAT



Analysis 420C4883S 2,1,1 DIAS,7323/7-4,SAT



Analysis 420C4893S 2,1,1 DIAS,7323/7-4,SAT

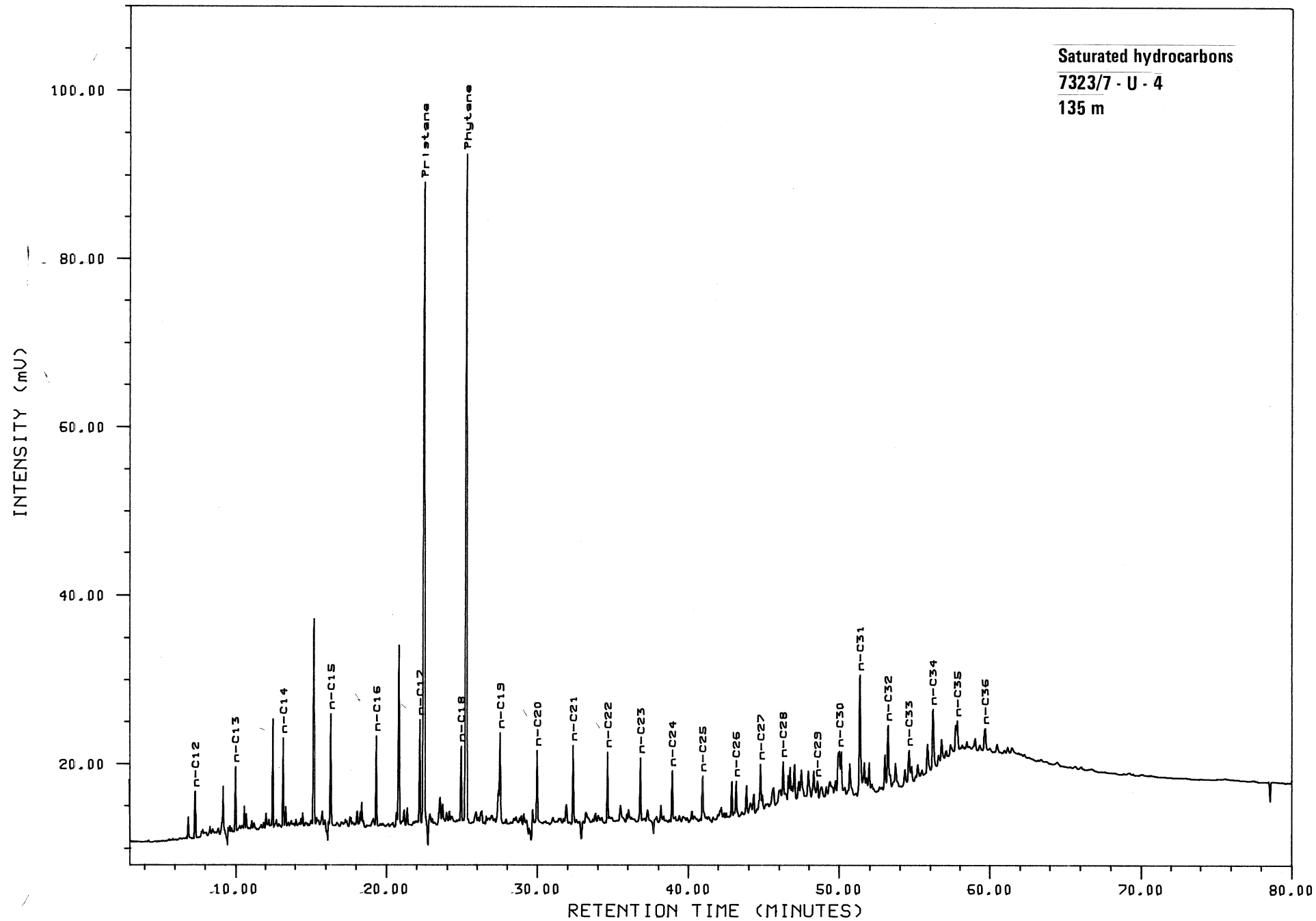
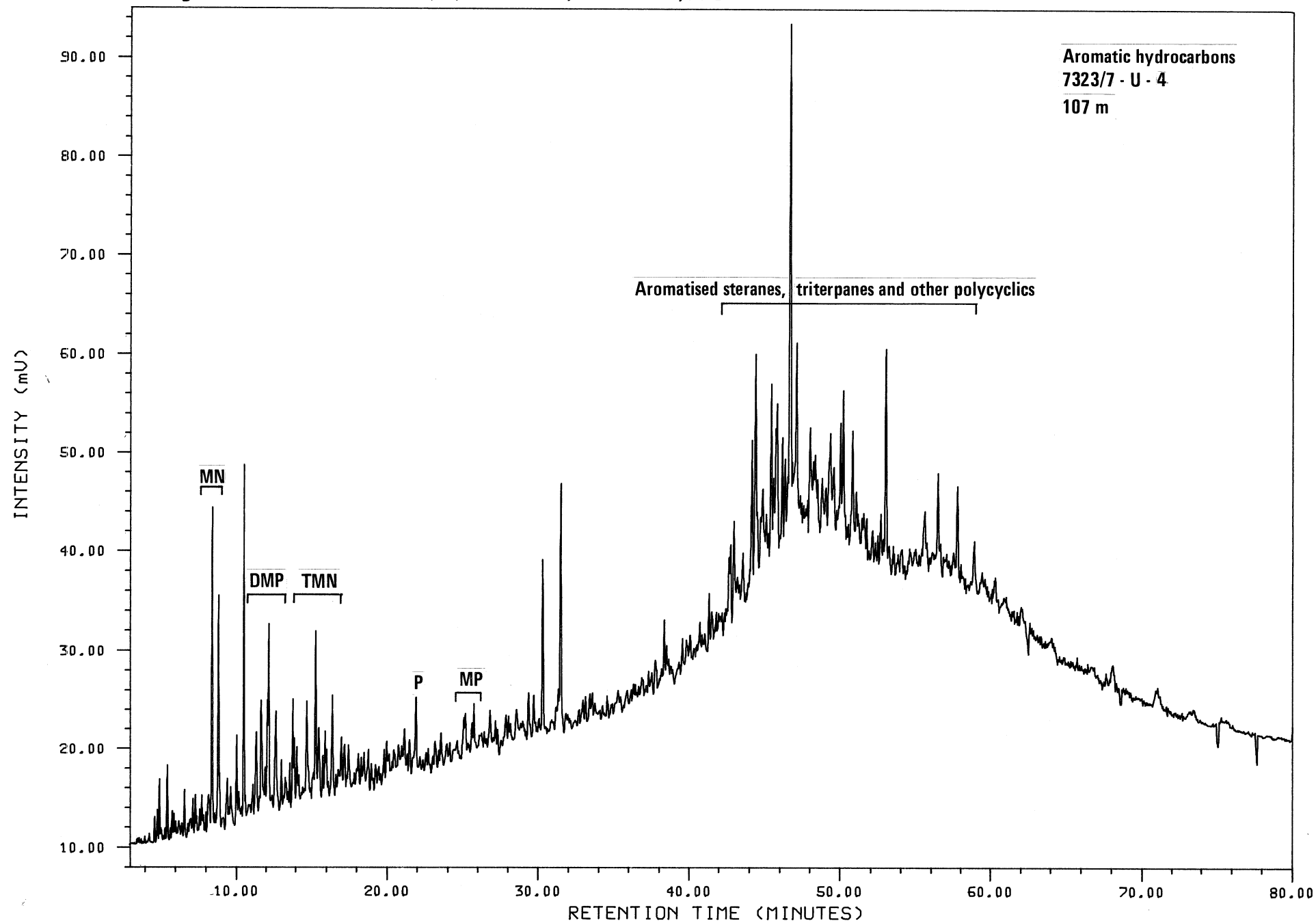
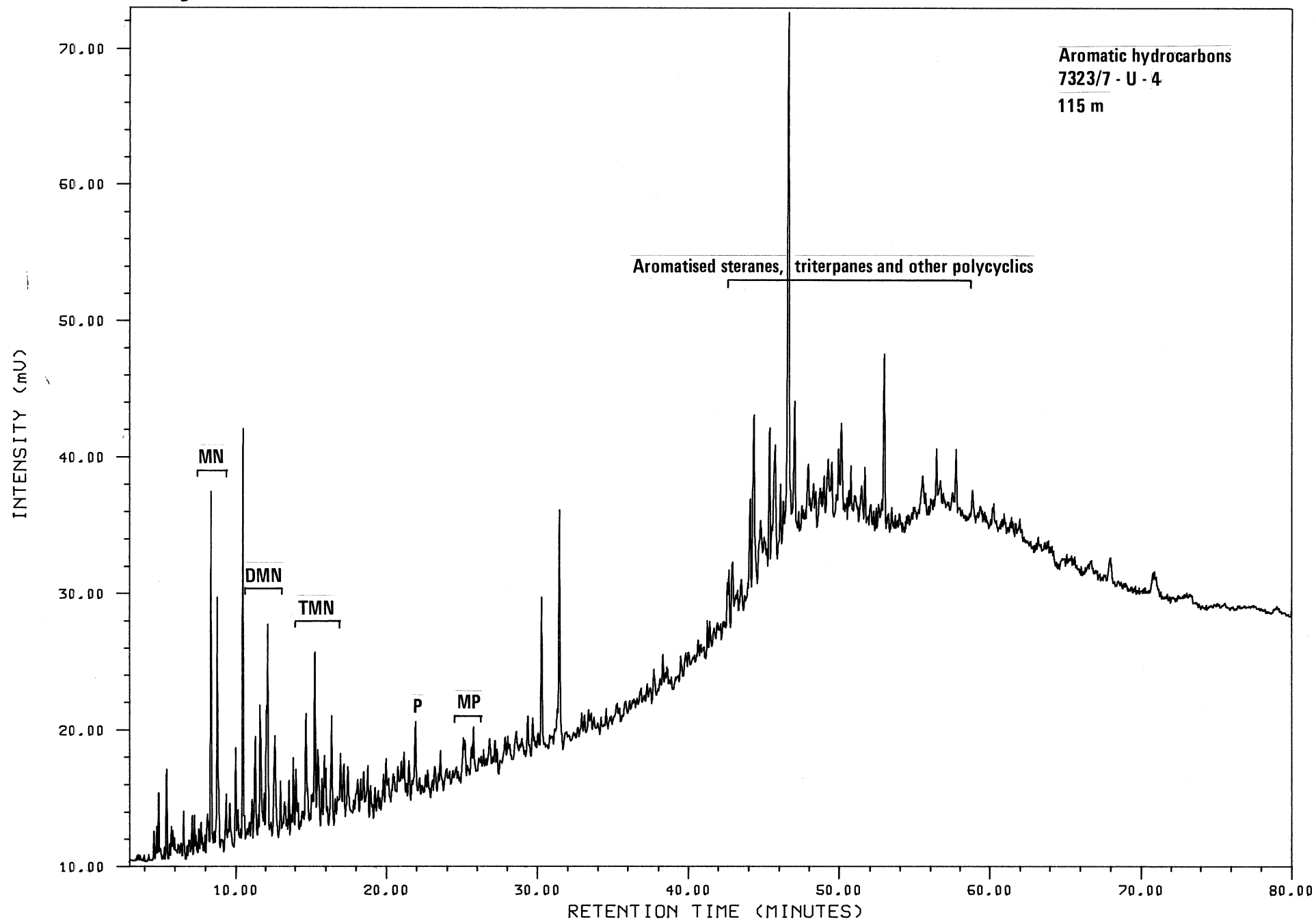


Figure A.III.4.3: Aromatic hydrocarbon gas chromatograms.

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



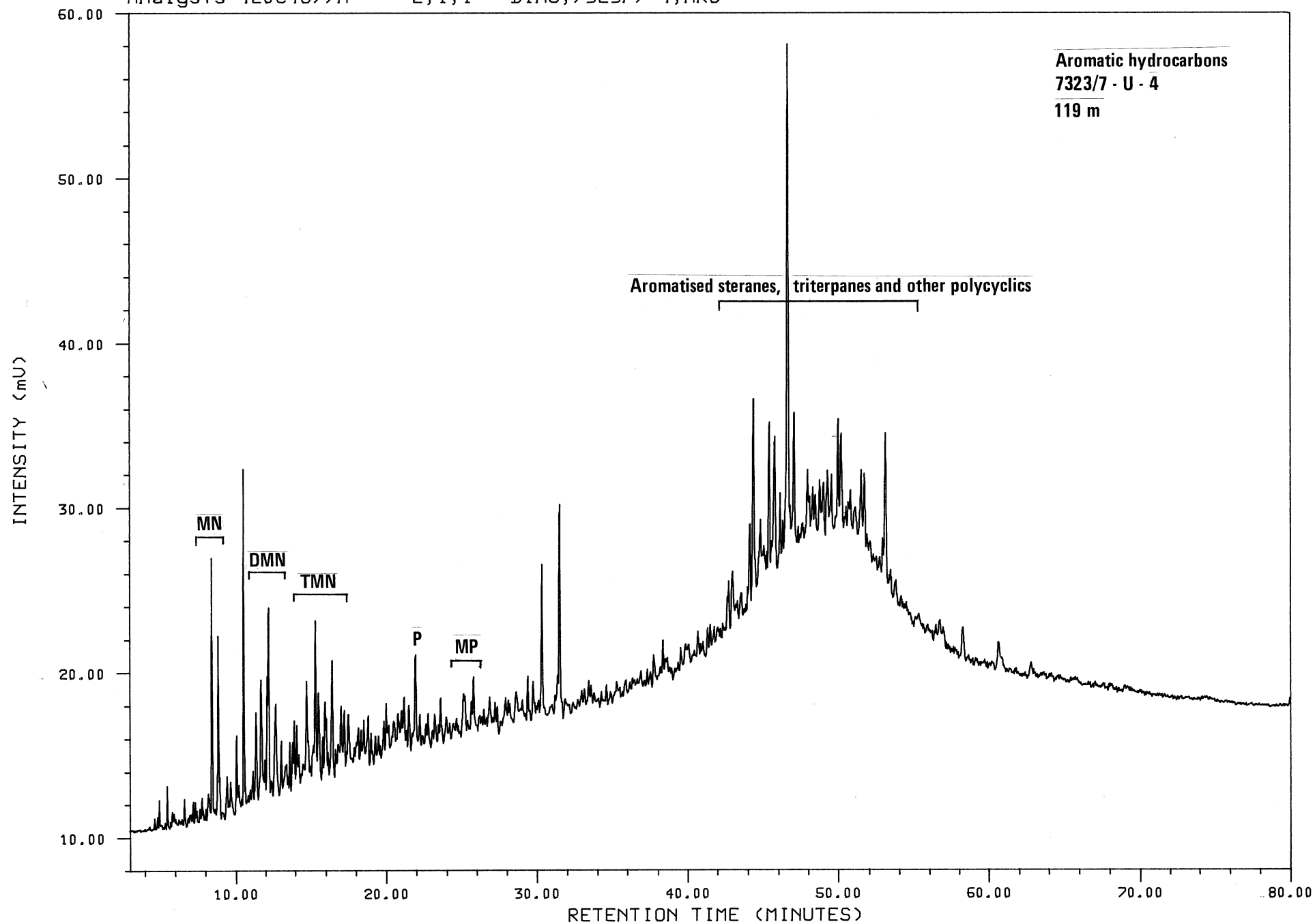
Analysis 420C4873A 2,1,1 DIAS,7323/7-4,ARO



Analysis 420C4877A

2,1,1

DIAS,7323/7-4,ARO



Analysis 420C4893A

2,1,1

DIAS, 7323/7-4, ARO

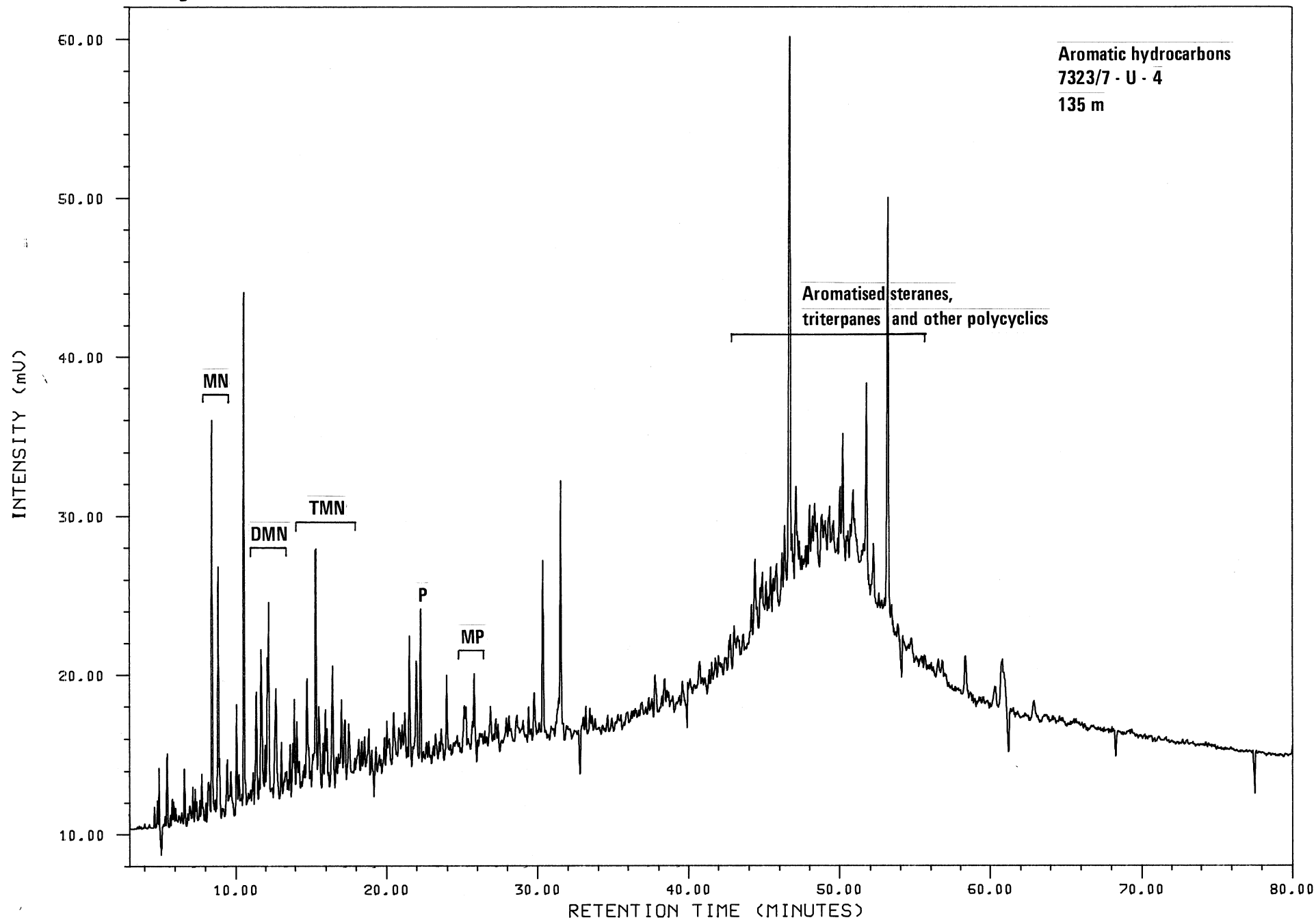
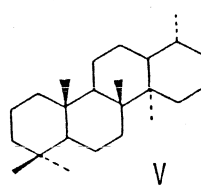
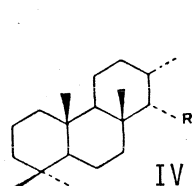
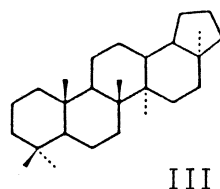
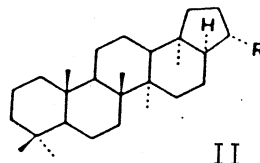
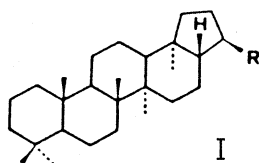


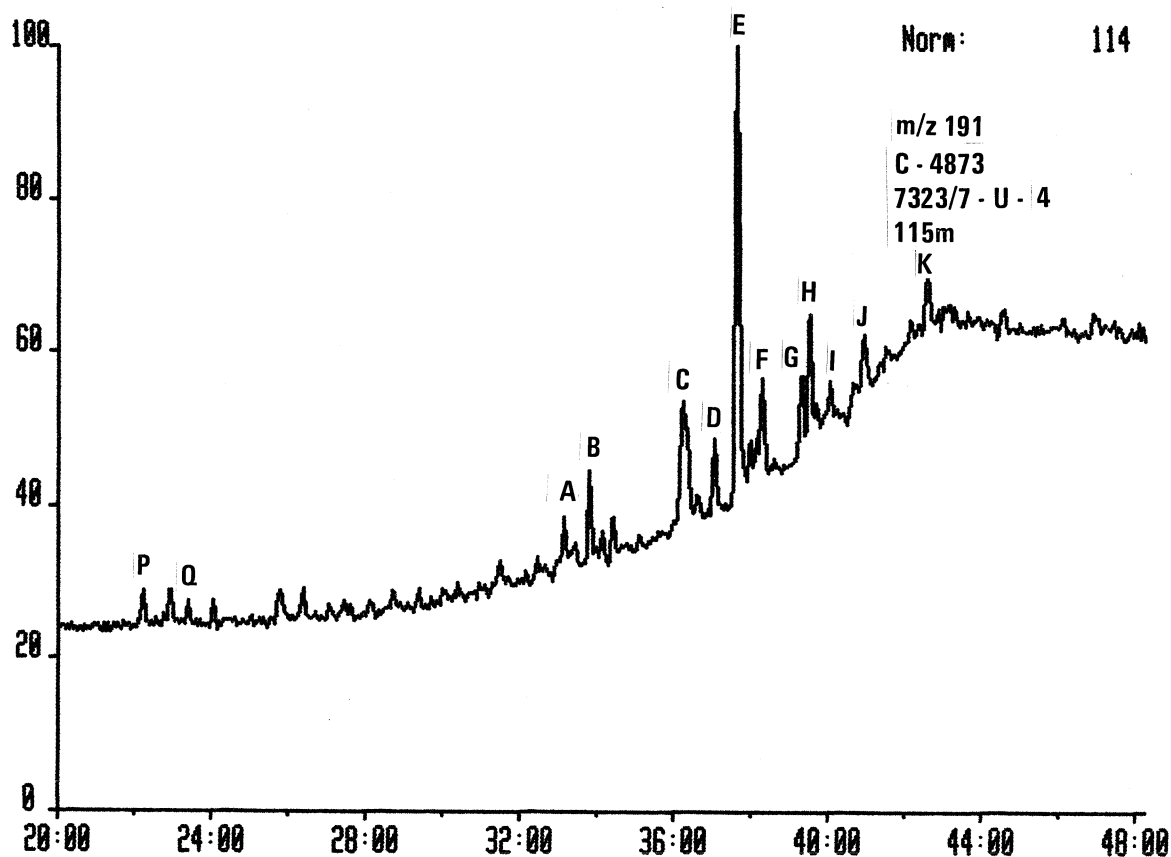
Figure A.III.4.4: Mass chromatograms of m/z 191 (terpanes).

A	T _s , 18α(H)-trisnorneohopane	C ₂₇ H ₄₆	(III)
B	T _m , 17α(H)-trisnorhopane	C ₂₇ H ₄₆	(I, R=H)
C	17α(H)-norhopane	C ₂₉ H ₅₀	(I, R=C ₂ H ₅)
D	17β(H)-normoretane	C ₂₉ H ₅₀	(II, R=C ₂ H ₅)
E	17α(H)-hopane	C ₃₀ H ₅₂	(I, R=C ₃ H ₇)
F	17β(H)-moretane	C ₃₀ H ₅₂	(II, R=C ₃ H ₇)
G	17α(H)-homohopane (22S)	C ₃₁ H ₅₄	(I, R=C ₄ H ₉)
H	17α(H)-homohopane (22R)	C ₃₁ H ₅₄	(I, R=C ₄ H ₉)
	+ unknown triterpane (gammacerane?)		
I	17β(H)-homomoretane	C ₃₁ H ₅₄	(II, R=C ₄ H ₉)
J	17α(H)-bishomohopane (22S,22R)	C ₃₂ H ₅₆	(I, R=C ₅ H ₁₁)
K	17α(H)-trishomohopane (22S,22R)	C ₃₃ H ₅₈	(I, R=C ₆ H ₁₃)
L	17α(H)-tetrakishomohopane (22S,22R)	C ₃₄ H ₆₀	(I, R=C ₇ H ₁₅)
M	17α(H)-pentakishomohopane (22S,22R)	C ₃₅ H ₆₂	(I, R=C ₈ H ₁₇)
Z	bisnorhopane	C ₂₈ H ₄₈	
X	unknown triterpane	C ₃₀ H ₅₂	
P	tricyclic terpane	C ₂₃ H ₄₂	(IV, R=C ₄ H ₉)
Q	tricyclic terpane	C ₂₄ H ₄₄	(IV, R=C ₅ H ₁₁)
R	tricyclic terpane (17R,17S)	C ₂₅ H ₄₆	(IV, R=C ₆ H ₁₃)
S	tetracyclic terpane	C ₂₄ H ₄₂	(V)
T	tricyclic terpane (17R,17S)	C ₂₆ H ₄₈	(IV, R=C ₇ H ₁₅)



C4873SAT 12-NOV-86 Sir:Voltage 7070H Acnt:IKU
 Sample 1 Injection 1 Group 1 Mass 191.1000
 Text:

System:TRIT



C4893SAT 12-NOV-86 Sir:Voltage 7070H Rcnt:IKU
Sample 1 Injection 1 Group 1 Mass 191.1000
Text:

System:TRIT

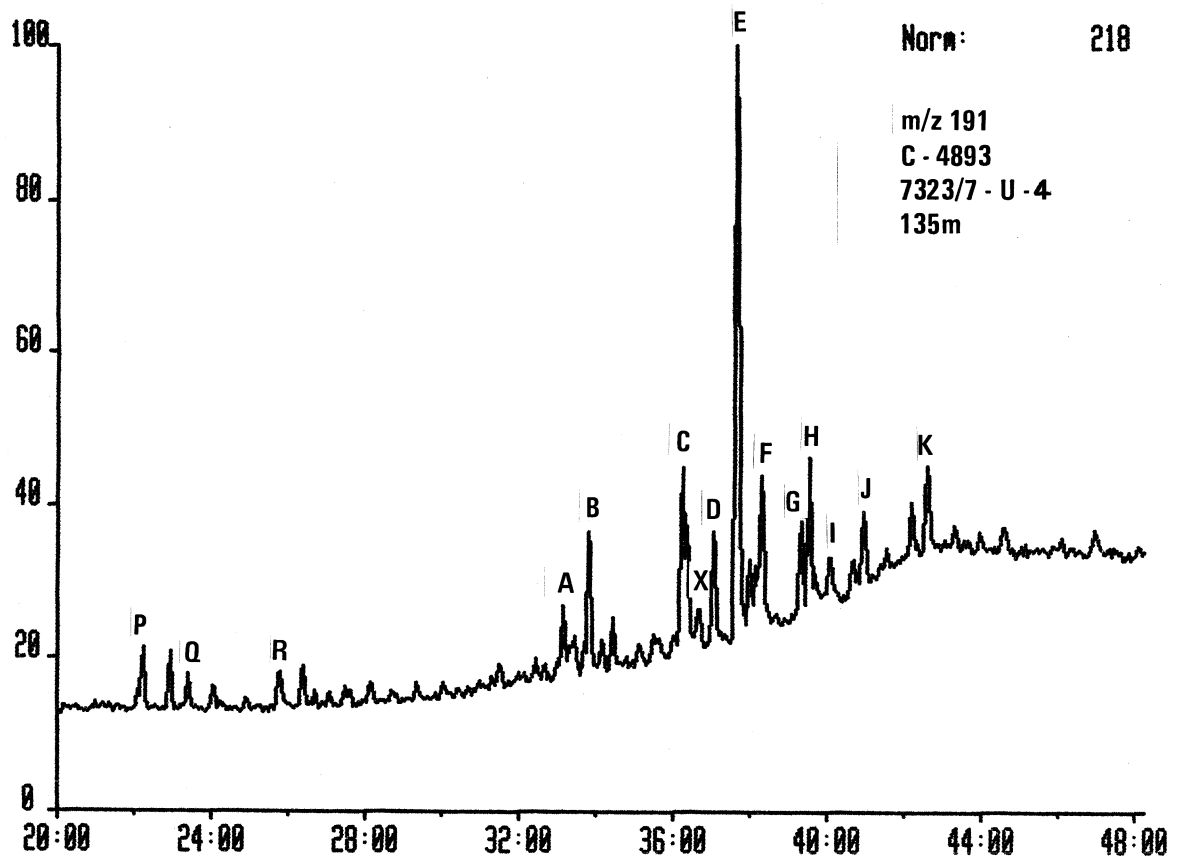
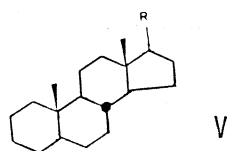
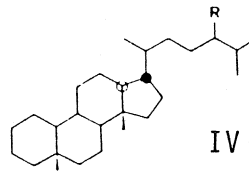
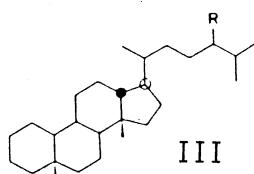
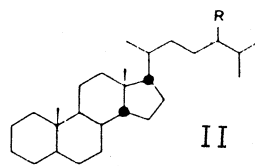
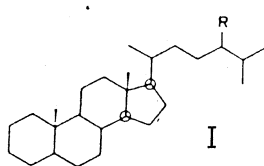


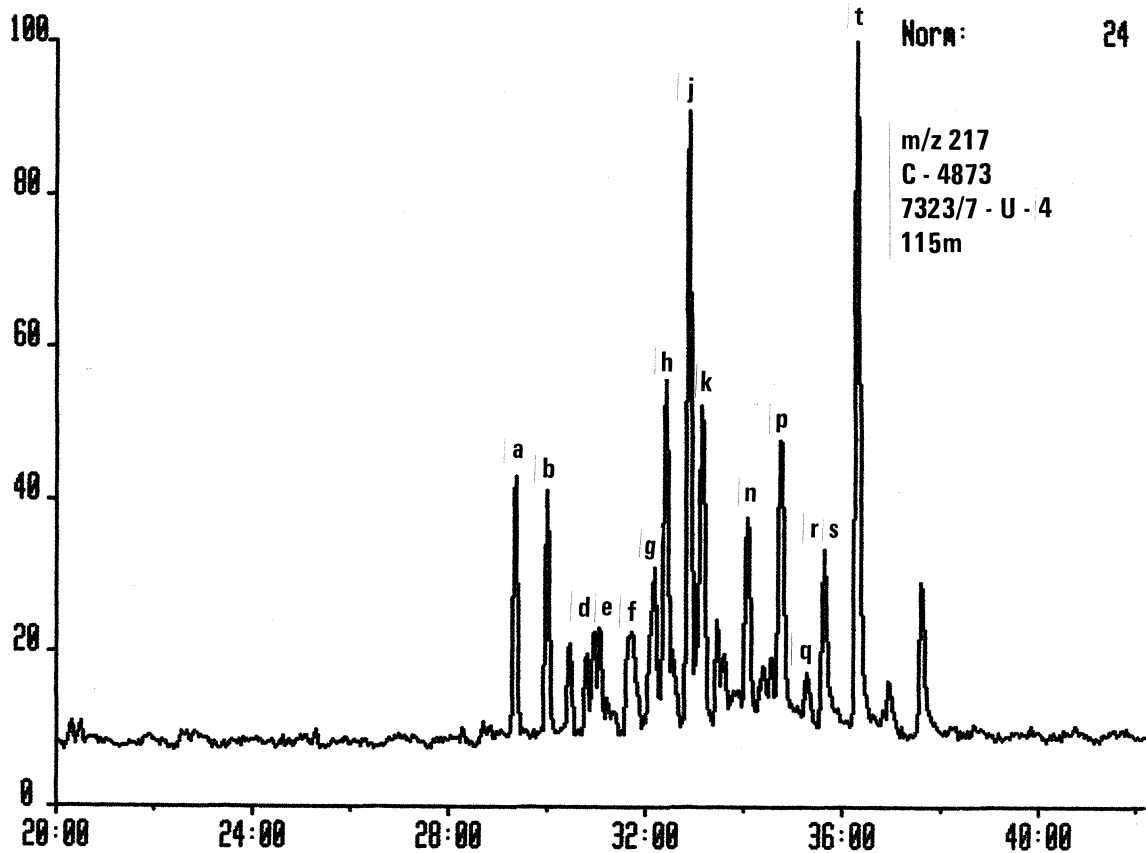
Figure A.III.4.5: Mass chromatograms of m/z 217 and 218 (steranes).

a	13 β (H),17 α (H)-diasterane (20S)	C ₂₇ H ₄₈	(III,R=H)
b	13 β (H),17 α (H)-diasterane (20R)	C ₂₇ H ₄₈	(III,R=H)
c	13 α (H),17 β (H)-diasterane (20S)	C ₂₇ H ₄₈	(IV,R=H)
d	13 α (H),17 β (H)-diasterane (20R)	C ₂₇ H ₄₈	(IV,R=H)
e	13 β (H),17 α (H)-diasterane (20S)	C ₂₈ H ₅₀	(III,R=CH ₃)
f	13 β (H),17 α (H)-diasterane (20R)	C ₂₈ H ₅₀	(III,R=CH ₃)
g	13 α (H),17 β (H)-diasterane (20S)	C ₂₈ H ₅₀	(IV,R=CH ₃)
	+ 14 α (H),17 α (H)-sterane (20S)	C ₂₇ H ₄₈	(I,R=H)
h	13 β (H),17 α (H)-diasterane (20S)	C ₂₉ H ₅₂	(III,R=C ₂ H ₅)
	+ 14 β (H),17 β (H)-sterane (20R)	C ₂₇ H ₄₈	(II,R=H)
i	14 β (H),17 β (H)-sterane (20S)	C ₂₇ H ₄₈	(II,R=H)
	+ 13 α (H),17 β (H)-diasterane (20R)	C ₂₈ H ₅₀	(IV,R=CH ₃)
j	14 α (H),17 α (H)-sterane (20R)	C ₂₇ H ₄₈	(I,R=H)
k	13 β (H),17 α (H)-diasterane (20R)	C ₂₉ H ₅₂	(III,R=C ₂ H ₅)
l	13 α (H),17 β (H)-diasterane (20S)	C ₂₉ H ₅₂	(III,R=C ₂ H ₅)
m	14 α (H),17 α (H)-sterane (20S)	C ₂₈ H ₅₀	(I,R=CH ₃)
n	13 α (H),17 β (H)-diasterane (20R)	C ₂₉ H ₅₂	(III,R=C ₂ H ₅)
	+ 14 β (H),17 β (H)-sterane (20R)	C ₂₈ H ₅₀	(II,R=CH ₃)
o	14 β (H),17 β (H)-sterane (20S)	C ₂₈ H ₅₀	(II,R=CH ₃)
p	14 α (H),17 α (H)-sterane (20R)	C ₂₈ H ₅₀	(I,R=CH ₃)
q	14 α (H),17 α (H)-sterane (20S)	C ₂₉ H ₅₂	(I,R=C ₂ H ₅)
r	14 β (H),17 β (H)-sterane (20R)	C ₂₉ H ₅₂	(II,R=C ₂ H ₅)
	+ unknown sterane		
s	14 β (H),17 β (H)-sterane (20S)	C ₂₉ H ₅₂	(II,R=C ₂ H ₅)
t	14 α (H),17 α (H)-sterane (20R)	C ₂₉ H ₅₂	(I,R=C ₂ H ₅)
u	5 α (H)-sterane	C ₂₁ H ₃₆	(V,R=C ₂ H ₅)
v	5 α (H)-sterane	C ₂₂ H ₃₈	(IV,R=C ₃ H ₇)



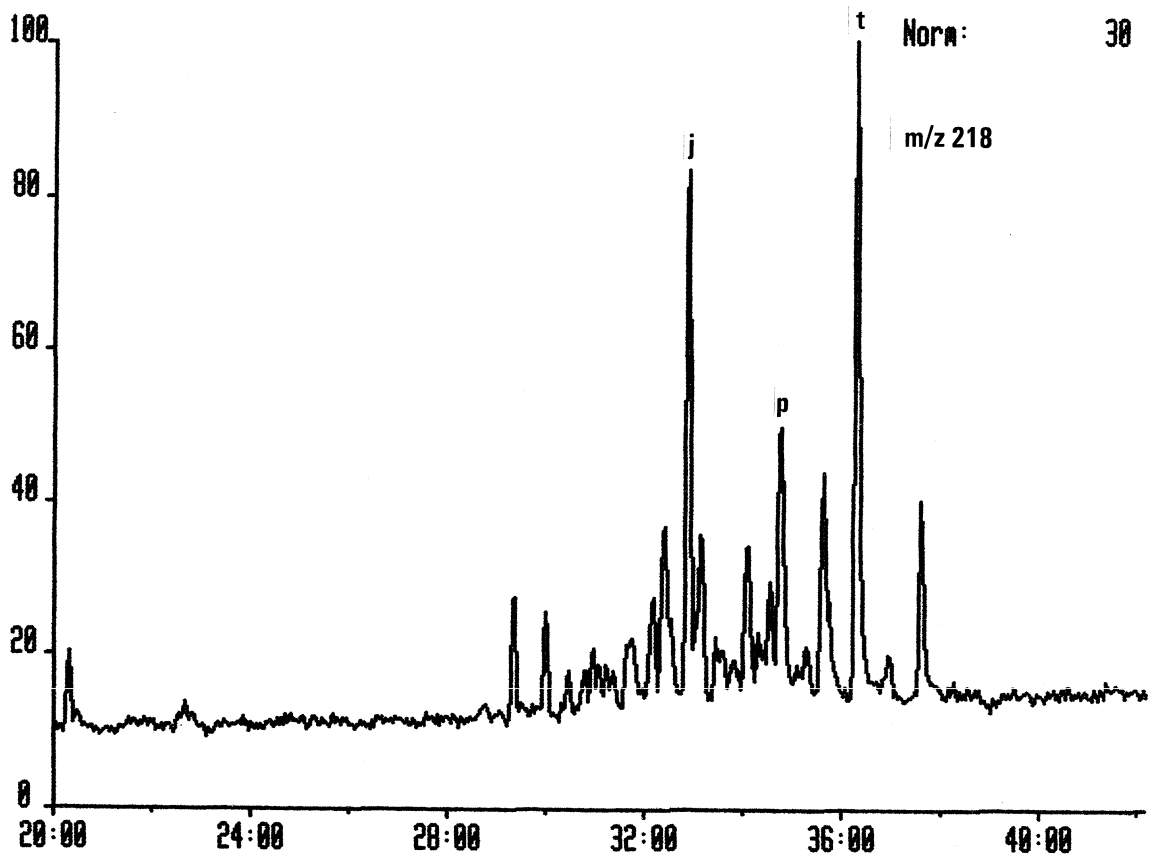
C4873SAT 12-NOV-86 Sir:Voltage 7070H Acnt:IKU
 Sample 1 Injection 1 Group 1 Mass 217.1000
 Text:

System:TRIT



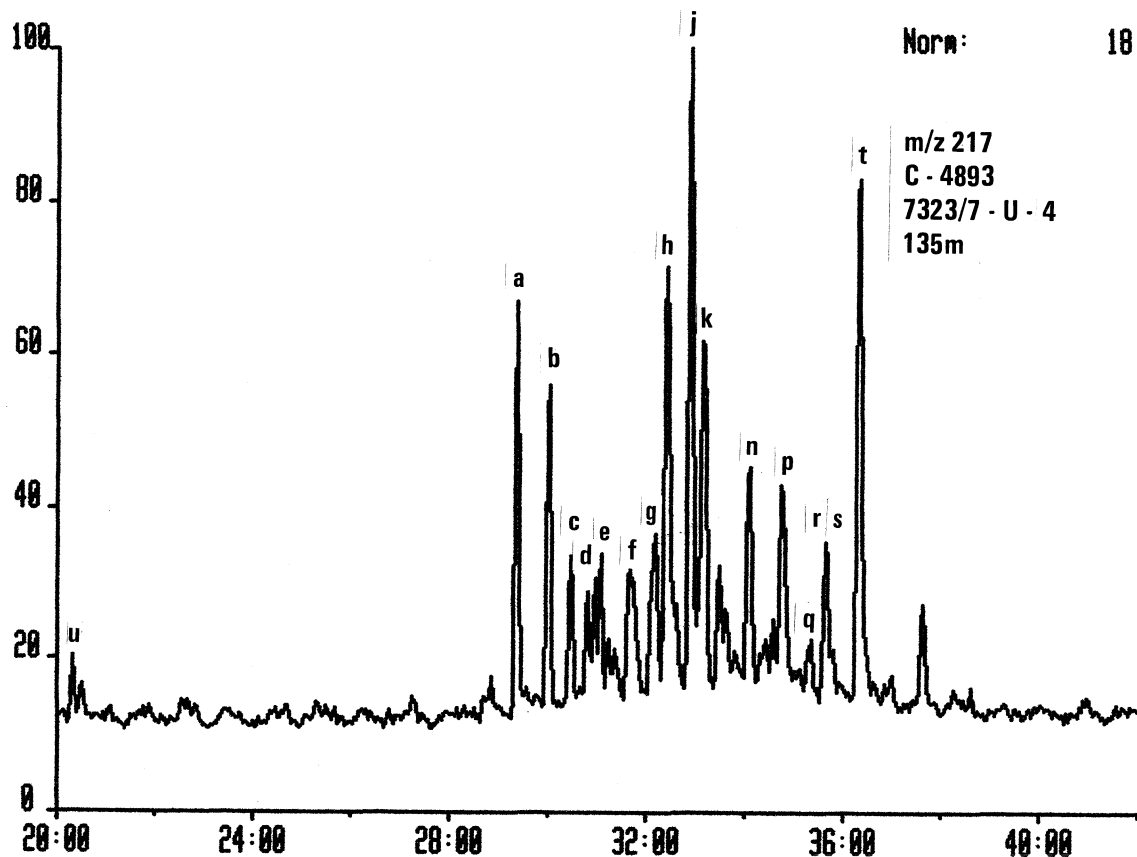
C4873SAT 12-NOV-86 Sir:Voltage 7070H Acnt:IKU
 Sample 1 Injection 1 Group 1 Mass 218.1000
 Text:

System:TRIT



C4893SAT 12-NOV-86 Sir:Voltage 7070H Acnt:IKU
Sample 1 Injection 1 Group 1 Mass 217.1000
Text:

System:TRIT



C4893SAT 12-NOV-86 Sir:Voltage 7070H Acnt:IKU
Sample 1 Injection 1 Group 1 Mass 218.1000
Text:

System:TRIT

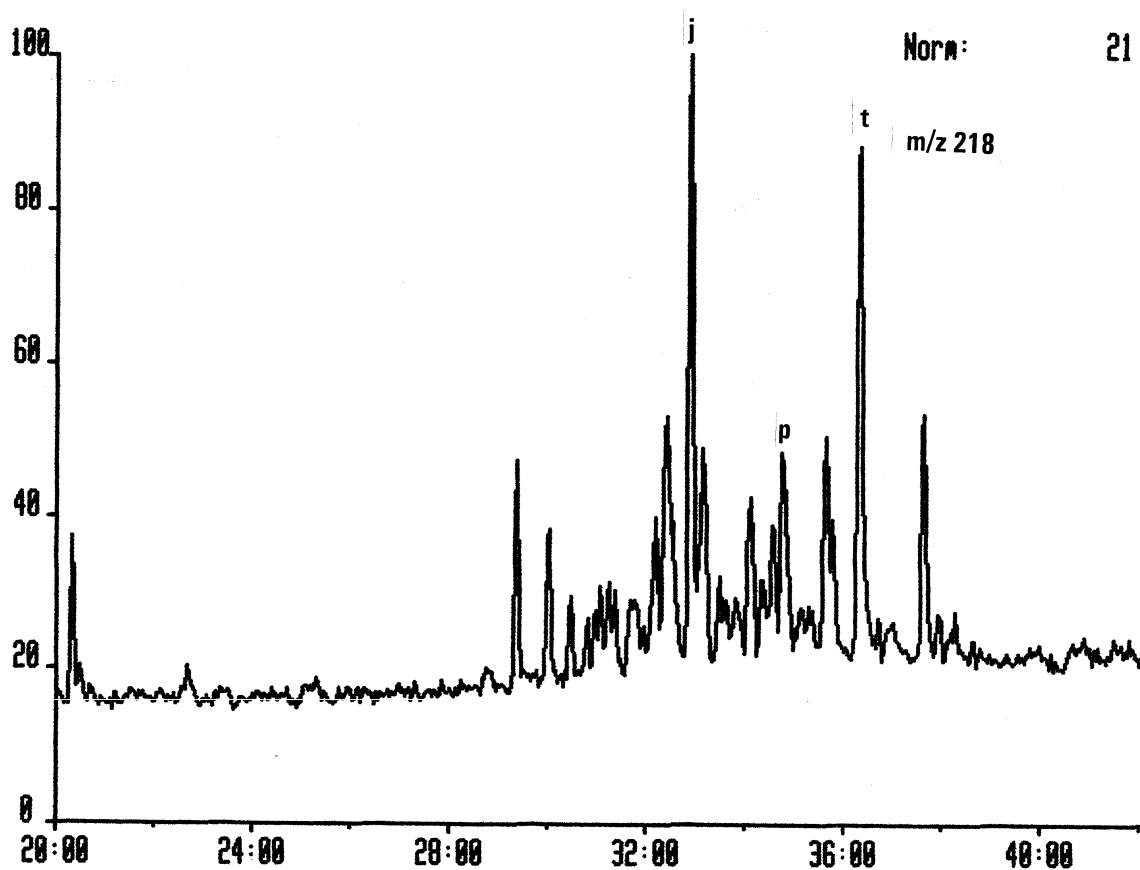


Figure A.III.4.6: Vitrinite reflectance histograms.

Key: A = Grey-black-brown claystone.
 Upper case letters indicate values included in
 the main population. Lower case letters represent
 values in other populations.

 PP = Statistical data populations
 Y = Main population, not necessarily
 representative of sample maturity.
 N = Other populations.

 LOW+ HIGH = Population limits.

 VAL. = Number of measurements in that
 population.

Lithology cross-reference table

A = Clst. gy
 B = Clst. dk gy
 C = Clst. gn
 D = Clst. bn
 E = Clst. rd
 F = Clst. calc.
 G = Clst. carb.
 H = Shale
 I = Sandstone
 J = Limestone
 K = Coal
 L = Lignite
 M = Carbargillite
 N = Siltstone
 O = Bit
 P = X

[illegible]

ORDERED VALUES FOLLOW:

0.25d 0.29d 0.30d 0.31d 0.34d 0.36d 0.36d 0.40d 0.47d 0.56d 0.57d
0.58d 0.60d 0.60d 0.61d 0.68d 0.68d 0.70d 0.72d 0.82d 0.94d

APPENDIX III.5: TABLE OF CONTENTS continued

Core 7323/7-U-1:

TABLES

- Table A.III.5.1a: Concentration of C_1-C_5 hydrocarbons in headspace gas.
- Table A.III.5.1b: Concentration of C_1-C_5 hydrocarbons in occluded gas.
- Table A.III.5.1c: Concentration of C_1-C_5 hydrocarbons - summation.
- Table A.III.5.2: Total organic carbon and data from Rock-Eval pyrolysis.
- Table A.III.5.3: Data from pyrolysis-gas chromatograms.
- Table A.III.5.4: Vitrinite reflectance data.
- Table A.III.5.5: Weight of EOM and chromatographic fractions.
- Table A.III.5.6: Concentration of EOM and chromatographic fractions.
- Table A.III.5.7: Concentration of EOM and chromatographic fractions.
- Table A.III.5.8: Composition of material extracted from the rock.
- Table A.III.5.9: Tabulation of data from the gas chromatograms.
- Table A.III.5.10: Molecular ratios from sterane and terpane mass chromatograms. Maturity ratios.
- Table A.III.5.11: Molecular ratios from sterane and terpane mass chromatograms. Maturity and source characteristic ratios.
- Table A.III.5.12: $\delta^{13}C$ and δD isotope ratios and composition of adsorbed gas fractions.
- Table A.III.5.13: $\delta^{13}C$ isotope ratios for extract fractions.

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- Figure A.III.5.1: Pyrolysis-gas chromatograms (S2 peak).
- Figure A.III.5.2: Saturated hydrocarbon gas chromatograms.
- Figure A.III.5.3: Aromatic hydrocarbon gas chromatograms.
- Figure A.III.5.4: Mass chromatograms of m/z 191 (terpanes).
- Figure A.III.5.5: Mass chromatograms of m/z 217 and 218 (steranes).
- Figure A.III.5.6: Vitrinite reflectance histograms.

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Table A.III.5.1a: Concentration of C₁-C₅ hydrocarbons in headspace gas.

[illegible]

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Table A.III.5.1b: Concentration of C₁-C₅ hydrocarbons in occluded gas.

I	IKU	DEPTH	C1	C2	C3	iC4	nC4	C5+	SUM C1-C4	SUM C2-C4	WET- NESS (%)	iC4 ----- nC4	I
I	no.	m											I
I	C 5031	96.81	403	26	25	16			470	67	14.22	*****	I
I	C 5032	104.38	109	17	179	124	113	415	542	433	79.83	1.10	I
I	C 5033	107.84	15580	818	10	13		148	16421	841	5.12	*****	I
I	C 5036	126.69	15450	34834	67750	11588	27331	24575	156954	141504	90.16	0.42	I

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Table A.III.5.1c: Concentration of C₁-C₅ hydrocarbons - summation.

I	I	I	I	I	I	I	I	I	I	I	I	I	I
I	IKU	DEPTH	C1	C2	C3	iC4	nC4	C5+	SUM	SUM	WET-	iC4	I
I	no.	m							C1-C4	C2-C4	NESS	-----	I
I											(%)	nC4	I
I													I
I	C 5031	96.81	4191	51	25	16			4282	91	2.13	*****	I
I	C 5032	104.38	2538	52	179	216	113	415	3097	560	18.07	1.91	I
I	C 5033	107.84	64439	1259	10	13		148	65722	1282	1.95	*****	I
I	C 5036	126.69	20376	38651	67750	11588	27331	24575	165696	145320	87.70	0.42	I

Table A.III.5.2: Total organic carbon and data from Rock-Eval
pyrolysis.

Table A.III.5.2: cont.

I		:					HYDR.	OXYGEN	PETROLEUM	PROD.	TEMP.	I		
I	IKU	DEPTH	:	S1	S2	S3	TOC	INDEX	INDEX	POTENTIAL	INDEX	MAX	I	
I	No.		:								S1		I	
I			:								-----		I	
I		m/ft	:	(	mg/g ROCK	)	(%)	(	mg/g TOC	)	S1+S2	S1+S2	(C)	I
I	=====			=====									I	
I			:										I	
I	C 4805	116	:	0.78	28.35	0.18	5.61	505	3	29.13	0.03	426	I	
I			:										I	
I	C 4806	117	:	0.00	0.06	0.78	0.70	9	111	0.06	0.00	419	I	
I			:										I	
I	C 4807	118	:	0.28	8.78	0.15	2.91	302	5	9.06	0.03	434	I	
I			:										I	
I	C 4808	119	:	0.51	15.09	1.00	4.34	348	23	15.60	0.03	425	I	
I			:										I	
I	C 4809	120	:	0.12	3.14	0.34	1.58	199	22	3.26	0.04	437	I	
I			:										I	
I	C 4810	121	:	0.14	3.08	1.09	1.38	223	79	3.22	0.04	428	I	
I			:										I	
I	C 4811	122	:	0.10	2.23	0.13	1.43	156	9	2.33	0.04	434	I	
I			:										I	
I	C 4812	123	:	0.12	1.37	0.96	0.98	140	98	1.49	0.08	428	I	
I			:										I	
I	C 4813	124	:	0.88	34.60	0.15	5.88	588	3	35.48	0.02	427	I	
I			:										I	
I	C 4814	125	:	0.30	11.72	1.10	3.29	356	33	12.02	0.02	429	I	
I			:										I	
I	C 4815	126	:	0.71	22.96	0.20	4.29	535	5	23.67	0.03	431	I	
I			:										I	

DATE : 16 - 11 - 86.

[illegible]

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 Reference number: 21.3420.06
 (1/1)

Table A.III.5.4: Vitrinite reflectance data.

IKU NO	LOCATION	DEPTH (M)	VITRINITE REFLECTANCE	REL RAT	STANDARD DEVIATION	FLUORE- SCENCE
C 4799	----	110	0.45 (17) 0.18 (1) 0.83 (1)	G S R	0.11 0.00 0.00	2-4
C 4801	----	112	0.44 (10) 0.78 (10)	F R	0.07 0.10	5-6
C 4803	----	114	0.44 (15) 0.67 (3) 1.13 (1)	G R R	0.09 0.03 0.00	3-4
C 4809	----	120	0.52 (7) 0.22 (3) 1.00 (8)	P S R	0.15 0.02 0.06	2-4

REL RAT (Reliability Rating): G = Good; F = Fair; P = Poor
 S = Stained; R = Reworked.
 HY-PY: Sample artificially matured by hydrous pyrolysis.

Project no.: 21.3420.06
 Well ident.: 7323/7-U-1
 DATE : 15 - 11 - 86.

Table A.III.5.5: Weight of EOM and chromatographic fractions.

I	I	I	I	I	I	I	I	I	I	I
I	IKU-No	DEPTH	: Rock	EOM	Sat.	Aro.	HC	Non HC	TOC	I
I			: Extr.							I
I		(m)	: (g)	(mg)	(mg)	(mg)	(mg)	(mg)	(%)	I
I			:							I
I	C 4793	104	: 4.1	3.4	0.8	0.8	1.7	1.7	1.19	I
I	C 4799	110	: 32.1	206.6	14.8	66.2	81.0	125.6	8.49	I
I	C 4801	112	: 43.0	89.3	7.0	10.7	17.6	71.7	1.83	I
I	C 4805	116	: 18.1	89.2	0.5	2.0	2.5	86.7	5.70	I
I	C 4807	118	: 20.5	44.1	3.2	6.0	9.2	34.9	2.66	I
I	C 4811	122	: 20.6	25.0	1.2	2.3	3.5	21.5	1.34	I
I	C 4813	124	: 14.8	74.0	7.7	9.8	17.4	56.6	4.87	I
I			:							I

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Table A.III.5.6: Concentration of EOM and chromatographic fractions.

IKU-No	DEPTH (m)	EOM	Sat.	Aro.	HC	Non HC
C 4793	104	840	207	207	415	425
C 4799	110	6434	461	2062	2523	3912
C 4801	112	2078	162	249	411	1668
C 4805	116	4936	27	113	139	4797
C 4807	118	2151	158	293	451	1700
C 4811	122	1215	58	111	169	1046
C 4813	124	5003	517	659	1176	3827

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Table A.III.5.7: Concentration of EOM and chromatographic fractions.

IKU-No	DEPTH (m)	:	EOM	Sat.	Aro.	HC	Non HC	:
C 4793	104	:	70.5	17.4	17.4	34.9	35.7	:
C 4799	110	:	75.8	5.4	24.3	29.7	46.1	:
C 4801	112	:	113.6	8.9	13.6	22.4	91.1	:
C 4805	116	:	86.6	0.5	2.0	2.4	84.2	:
C 4807	118	:	80.9	5.9	11.0	16.9	63.9	:
C 4811	122	:	90.7	4.4	8.3	12.6	78.0	:
C 4813	124	:	102.7	10.6	13.5	24.2	78.6	:

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Table A.III.5.8: Composition of material extracted from the rock.

I	I	I	I	I	I	I	I	I	I	I
	IKU-No	DEPTH	:	Sat	Aro	HC	SAT	Non HC	HC	
			:	---	---	---	---	---	---	
			:	EOM	EOM	EOM	Aro	EOM	Non HC	
		(m)	:	%	%	%	x 100	%	x 100	
I	I	I	I	I	I	I	I	I	I	I
	C 4793	104	:	24.7	24.7	49.4	100.0	50.6	97.7	
	C 4799	110	:	7.2	32.0	39.2	22.4	60.8	64.5	
	C 4801	112	:	7.8	12.0	19.8	65.2	80.2	24.6	
	C 4805	116	:	0.5	2.3	2.8	23.5	97.2	2.9	
	C 4807	118	:	7.3	13.6	21.0	54.0	79.0	26.5	
	C 4811	122	:	4.8	9.1	13.9	52.6	86.1	16.2	
	C 4813	124	:	10.3	13.2	23.5	78.5	76.5	30.7	

Table A.III.5.9: Tabulation of data from the gas chromatograms.

I	DEPTH	:	PRISTANE	PRISTANE	PHYTANE	A	n-C17		I
I	IKU No.	:	-----	A = -----	B = -----	-----	-----	CPI	I
I	(m)	:	PHYTANE	n-C17	n-C18	B	n-C27		I
I	=====	=====	=====	=====	=====	=====	=====	=====	I
I		:							I
I	C 4793 104	:	0.9	1.6	1.2	1.4	0.2	1.8	I
I		:							I
I	C 4799 110	:	1.0	3.6	5.2	0.7	1.6	1.2	I
I		:							I
I	C 4801 112	:	0.8	3.7	5.6	0.7	1.2	1.5	I
I		:							I
I	C 4805 116	:	1.0	4.0	4.5	0.9	1.0	1.3	I
I		:							I
I	C 4807 118	:	1.2	4.6	4.8	1.0	0.8	1.5	I
I		:							I
I	C 4811 122	:	0.7	3.3	4.4	0.7	0.6	1.5	I
I		:							I
I	C 4813 124	:	1.0	4.1	5.0	0.8	0.9	1.2	I
I		:							I
I	=====	=====	=====	=====	=====	=====	=====	=====	I

DATE : 25 - 11 - 86.

Table A.III.5.10: Molecular ratios from sterane and terpane mass chromatograms. Maturity ratios.

IKU code	Well/depth	$\alpha\beta/\alpha\beta+\beta\alpha$ ¹⁾	%22S ²⁾	%20S ³⁾	% $\beta\beta$ ⁴⁾
<u>Well 7323/7-U-1</u>					
C-4799	110 m	0.76	17.9	4.7	37.6
C-4807	118 m	0.82	22.9	3.8	36.6
C-4811	122 m	0.83	23.1	4.7	35.2
C-4813	124 m	0.75	15.4	3.8	36.6

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

2) Average % distribution between first and second eluting isomers of extended hopanes (G-M in m/z 191)

3) q/q+t in m/z 217

 4) $2(r+s)/(q+t+2(r+s))$ in m/z 217

Table A.III.5.11: Molecular ratios from sterane and terpane mass chromatograms. Maturity and source characteristic ratios.

IKU no.	Well/depth	Q/E ¹⁾	T _m /T _s ²⁾	X/E ³⁾	Z/E ⁴⁾	a/a+j ⁵⁾
<u>Well 7323/7-U-1</u>						
C-4799	110 m	0.03	2.5	-	-	0.21
C-4807	118 m	0.04	2.4	-	0.19	0.16
C-4811	122 m	0.01	3.3	-	0.04	0.17
C-4813	124 m	-	3.6	-	-	0.16

- 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 C₂₇ rearranged steranes (a/a+j in m/z 217)

Table A.III.5.12a: Gas composition of the hydrocarbons C_1 to C_7 of adsorbed gas of core samples (Vol %).

Sample no.	Depth (m)	C_1	C_2	C_3	iC_4	nC_4	2.2DMP	iC_5	nC_5	C_6	C_7
<u>Well 7323/7-U-1</u>											
C-5033	107.84	52.01	15.61	4.22	2.10	3.04	0.80	2.13	1.98	10.95	7.16
C-5036	126.69	2.06	7.15	33.88	9.89	18.52	0.13	6.21	6.26	9.12	6.77

Table A.III.5.12b: Gas yields of the hydrocarbons C_1 to C_7 of adsorbed gas of core samples (ppb).

Sample no.	Depth (m)	C_1	C_2	C_3	iC_4	nC_4	2.2DMP	iC_5	nC_5	C_6	C_7
<u>Well 7323/7-U-1</u>											
C-5033	107.84	1083	609	241	159	229	75	199	186	1225	800
C-5036	126.69	672	4364	30334	11664	21853	197	9097	9175	15963	11837

Table A.III.5.12c: Gas ratios and isotope ratios of the hydrocarbons C_1 to C_7 of adsorbed gas of core samples.

Sample no.	Depth (m)	$C_1/\Sigma C_n$	$C_1/(C_2+C_3)$	iC_4/nC_4	$\delta^{13}C_1$	$\delta^{13}C_1$	$\delta^2 C_1$
<u>Well 7323/7-U-1</u>							
C-5033	107.84	0.5200	2.62	0.69	-46.8	-37.3	-96
C-5036	126.69	0.0206	0.05	0.53	-46.2	-40.3	-139

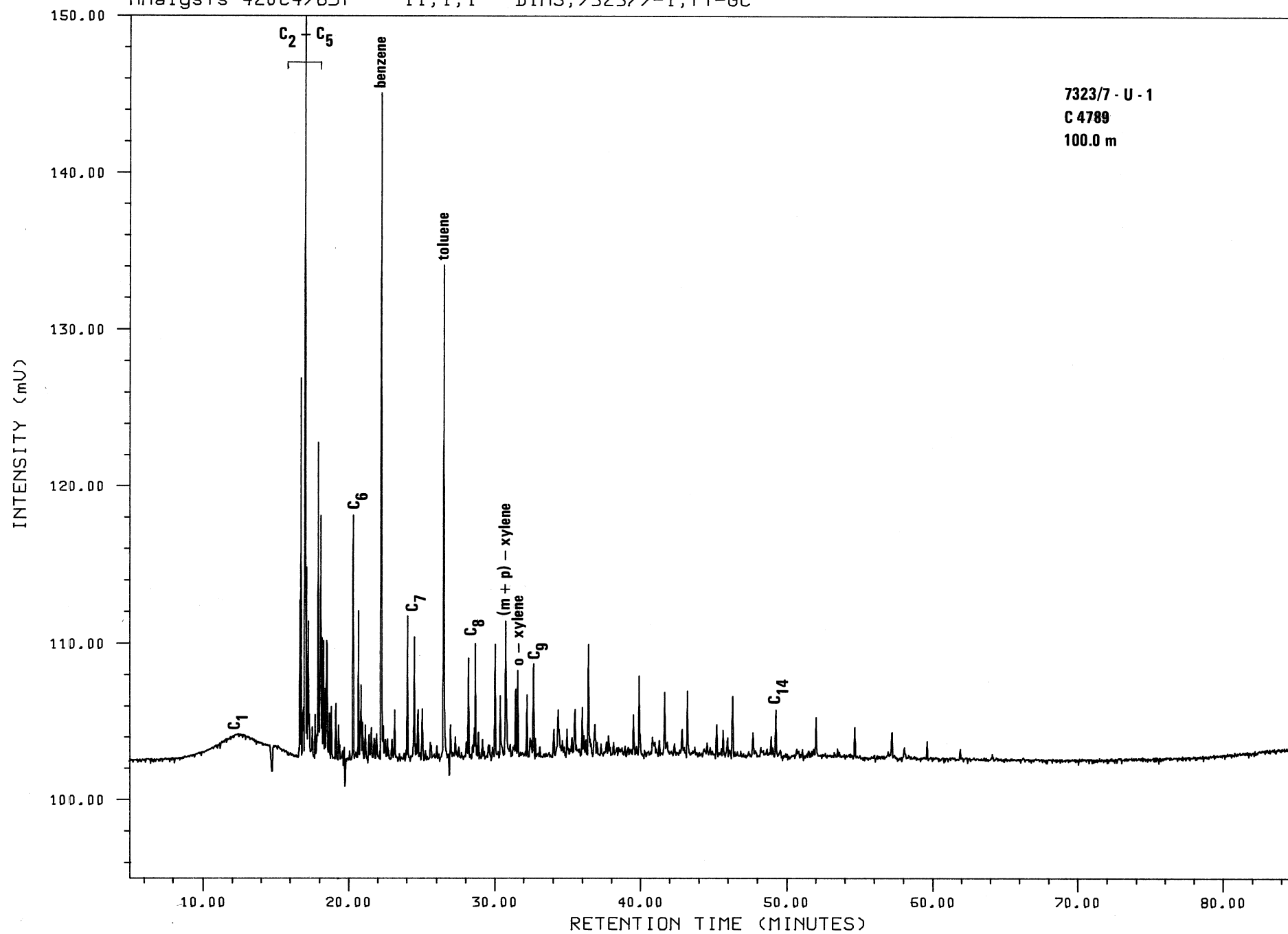
Table A.III.5.13: $\delta^{13}\text{C}$ isotope ratios for extract fractions.

Sample no.	Depth	$\delta^{13}\text{C}$ SAT	$\delta^{13}\text{C}$ ARO	$\delta^{13}\text{C}$ ASP	$\delta^{13}\text{C}$ NSO
------------	-------	------------------------------	------------------------------	------------------------------	------------------------------

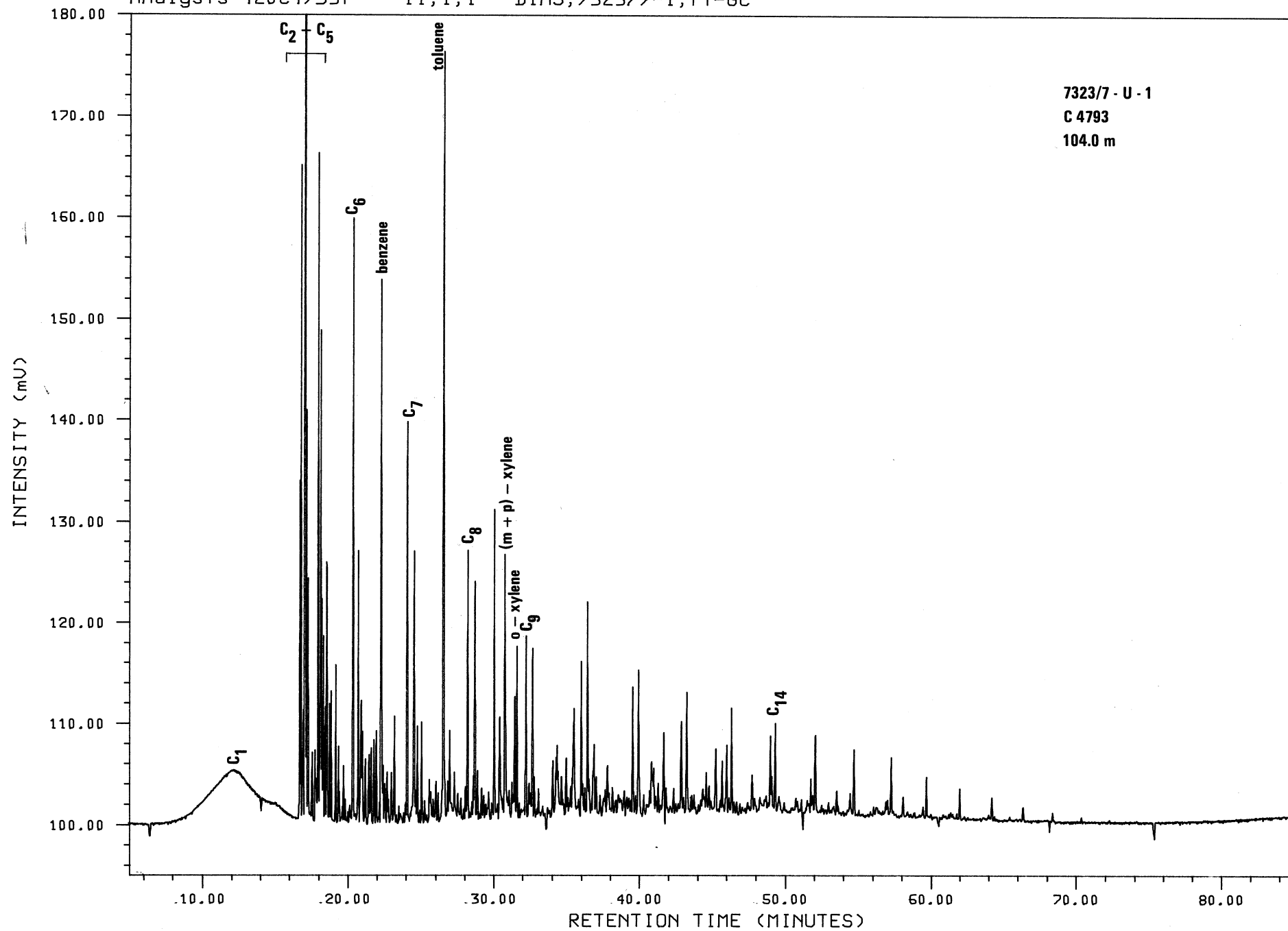
Well 7323/7-U-1

C-4799	110 m	-32.09	-32.54	-29.86	-37.71
C-4807	118 m	-32.11	-31.50	-29.71	-32.95

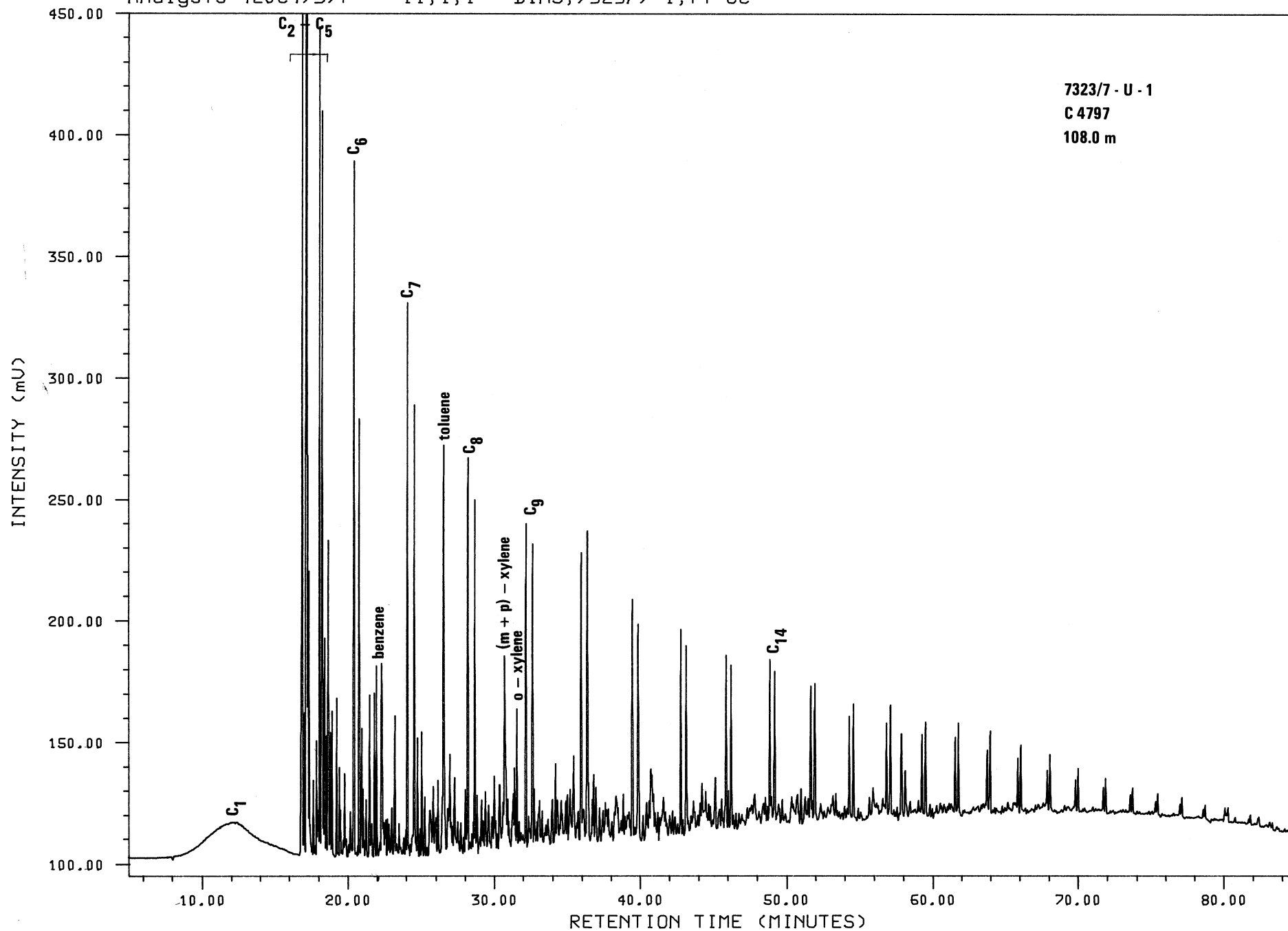
Figure A.III.5.1: Pyrolysis-gas chromatograms (S2 peak).



Analysis 420C4793P 11,1,1 DIAS,7323/7-1,PY-GC

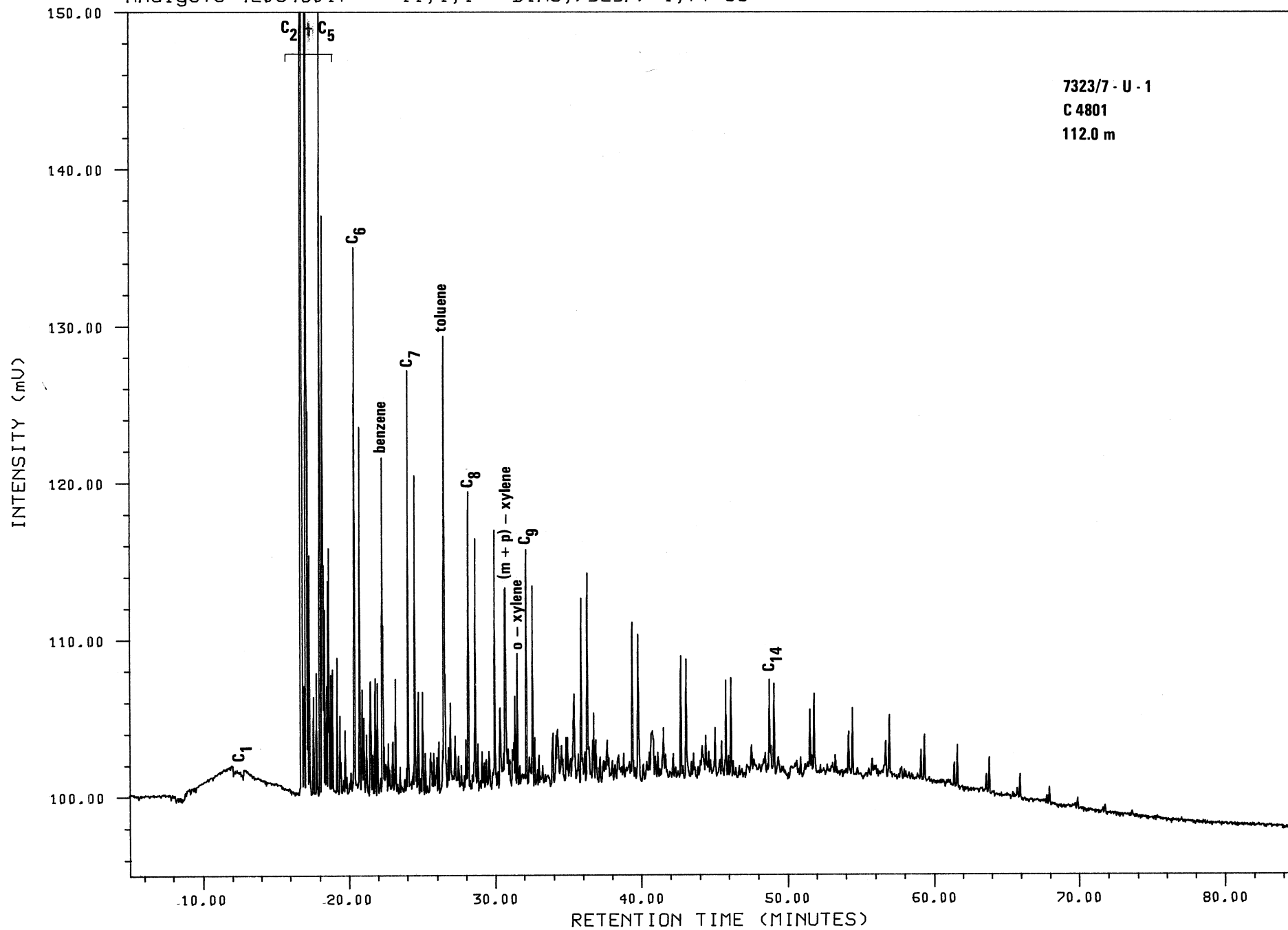


Analysis 420C4797P 11,1,1 DIAS,7323/7-1,PY-GC

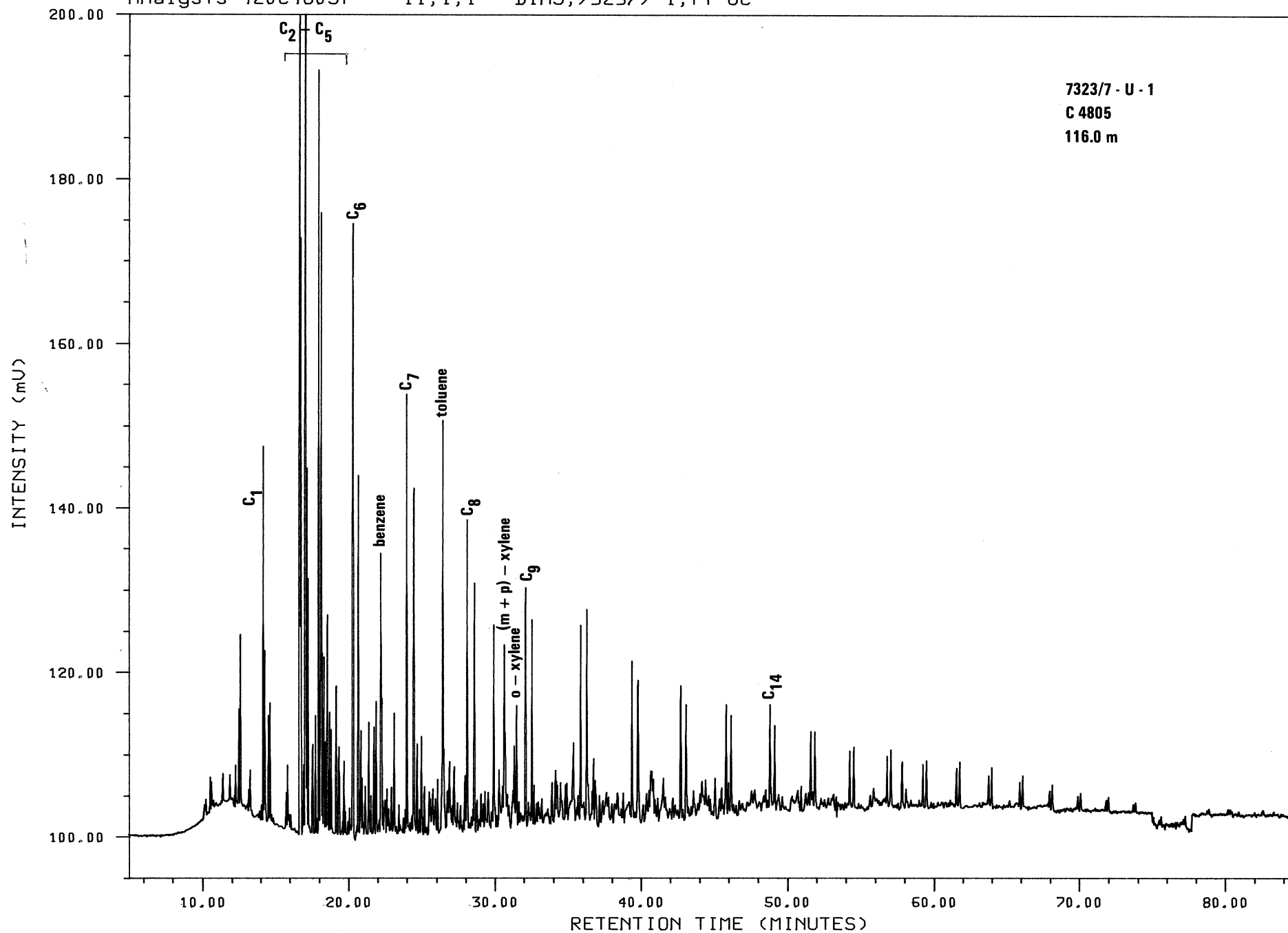


7323/7 - U - 1
C 4797
108.0 m

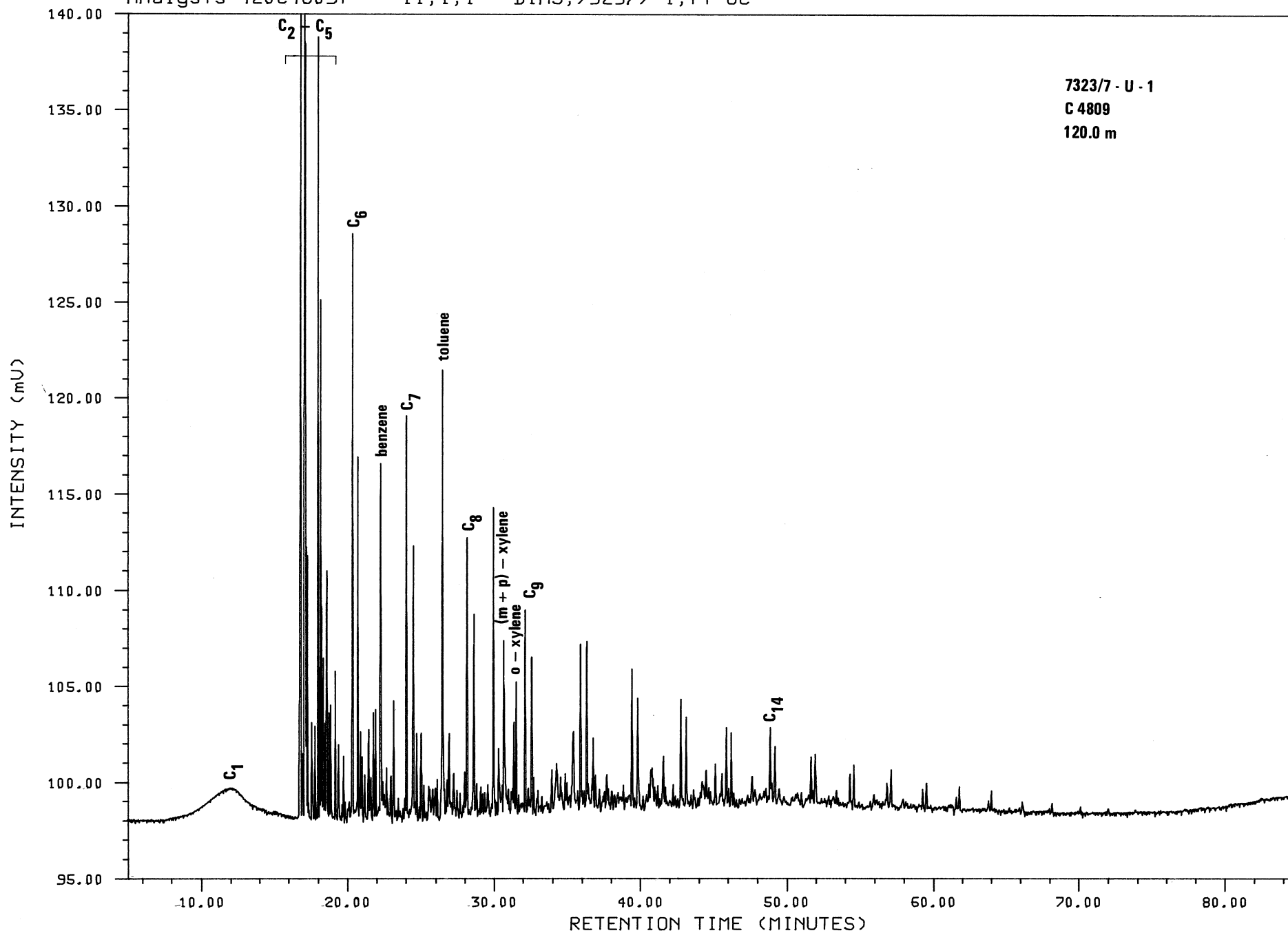
Analysis 420C4801P 11,1,1 DIAS,7323/7-1,PY-GC



Analysis 420C4805P 11,1,1 DIAS,7323/7-1,PY-GC



Analysis 420C4809P 11,1,1 DIAS,7323/7-1,PY-GC



7323/7 - U - 1
C 4809
120.0 m

Analysis 420C4813P 11,1,1 DIAS,7323/7-1,PY-GC

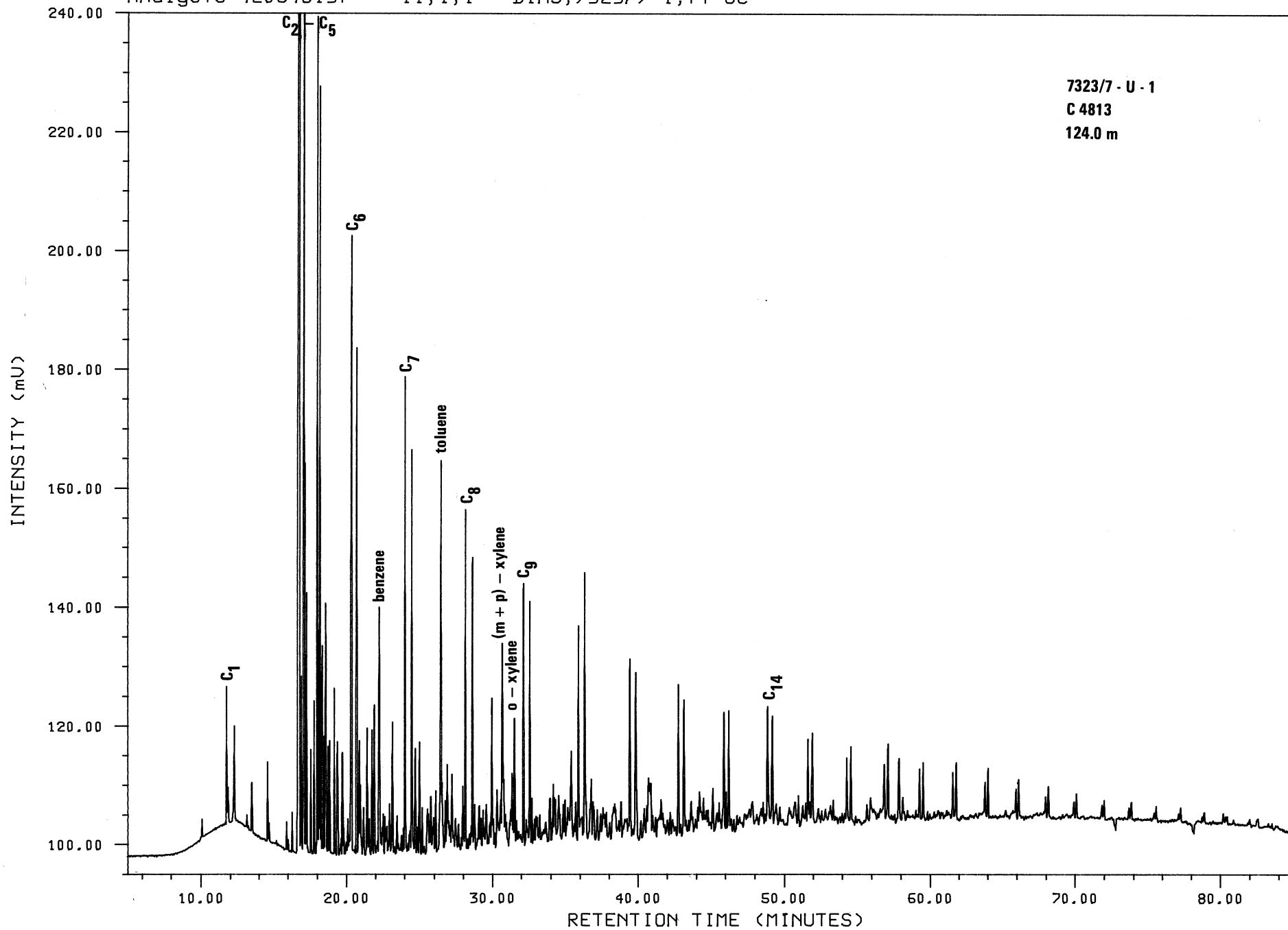


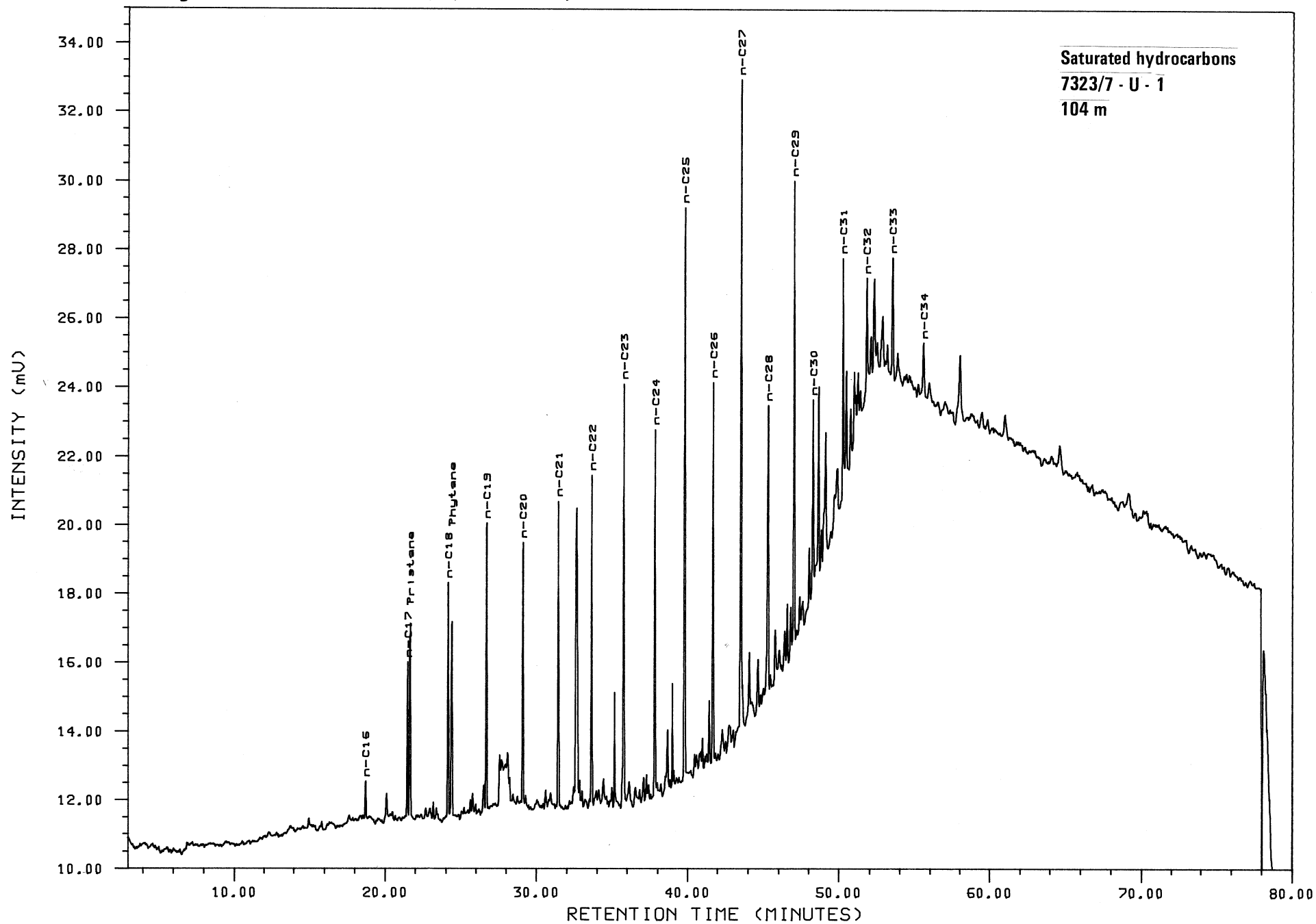
Figure A.III.5.2: Saturated hydrocarbon gas chromatograms.

n-C ₁₅ etc.	- n-alkanes
Pr	- pristane
Ph	- phytane
*	- other acyclic isoprenoids

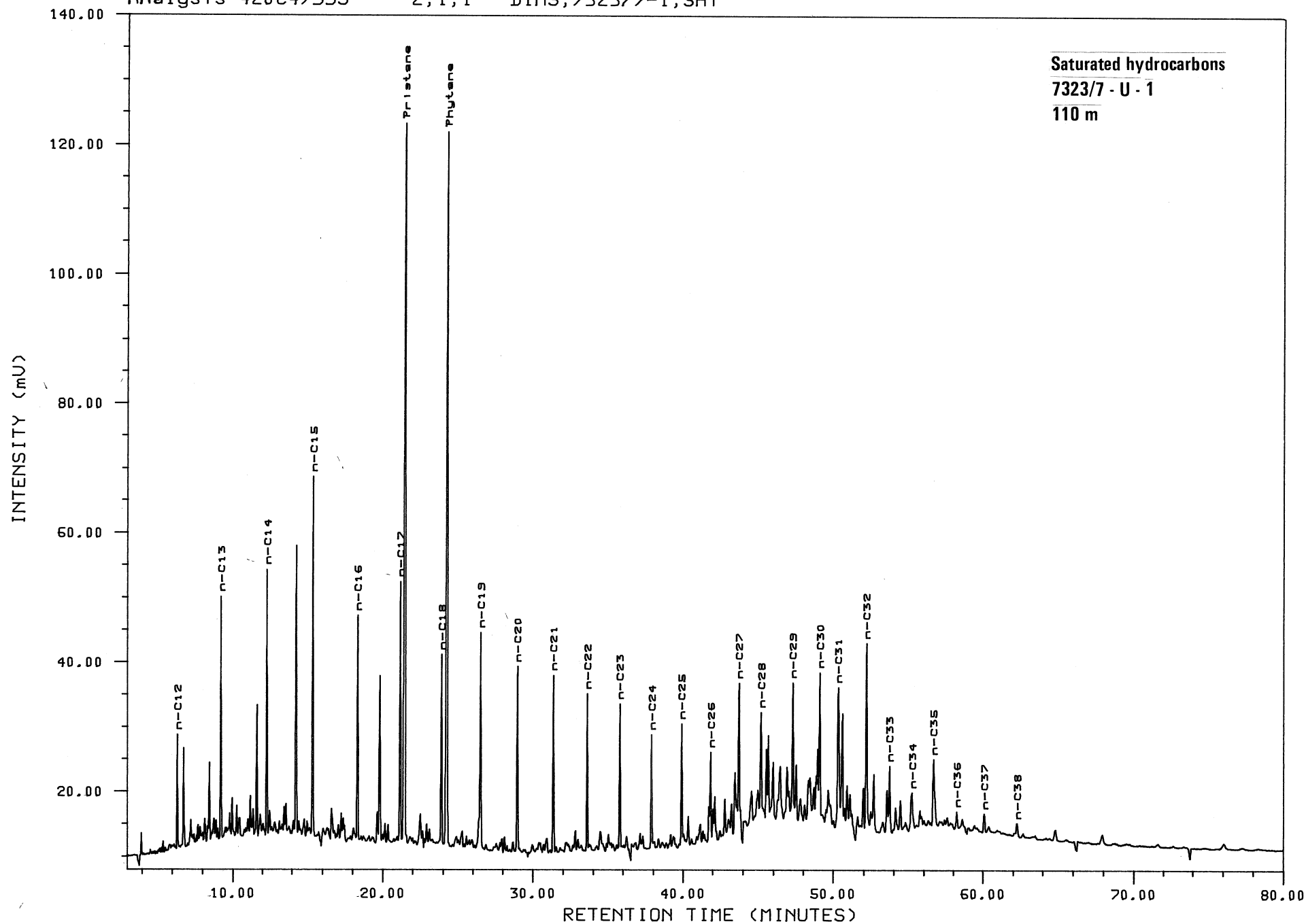
Analysis 420C4793S

3,1,1

DIAS, 7323/7-1



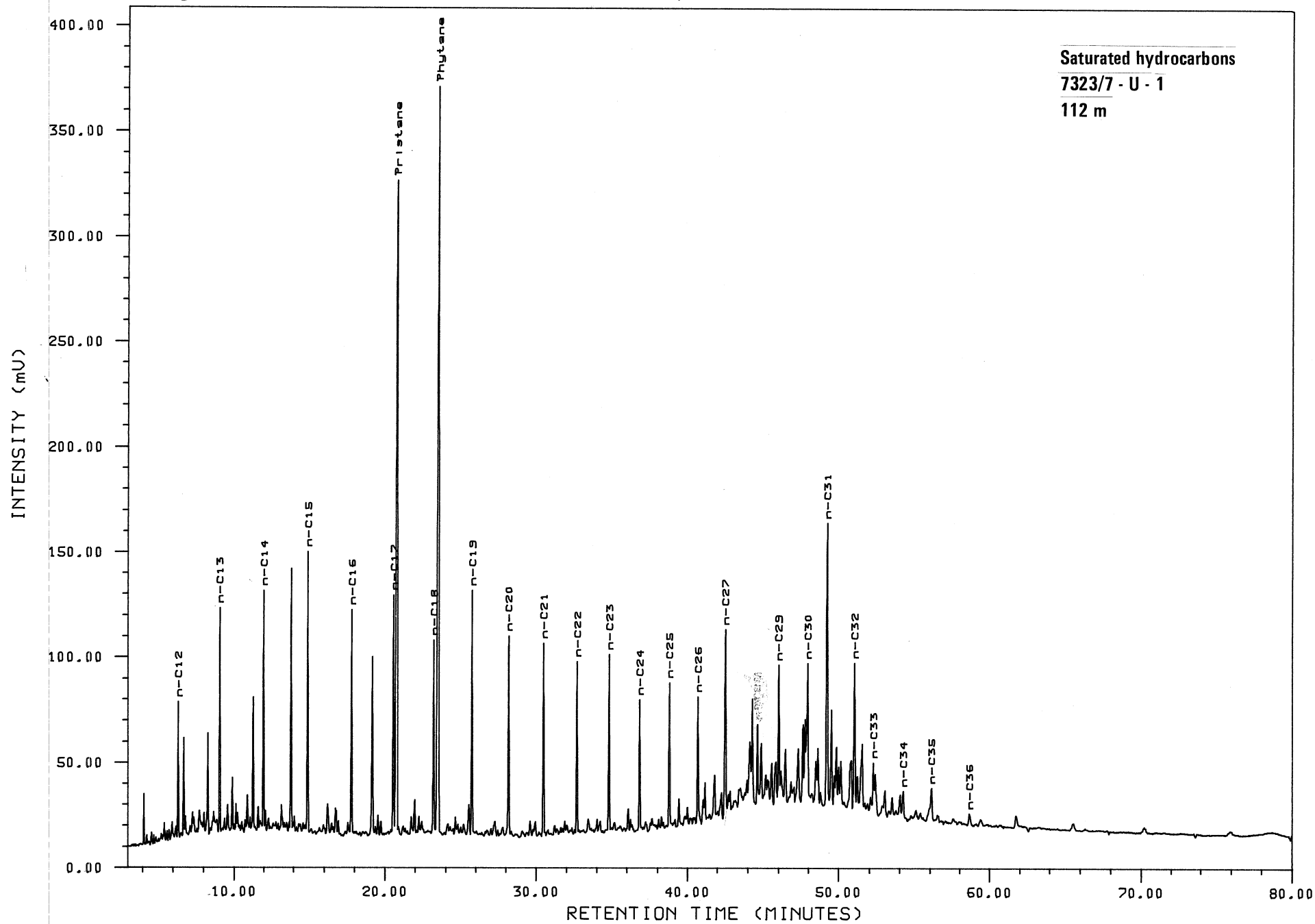
Analysis 420C4799S 2,1,1 DIAS,7323/7-1,SAT



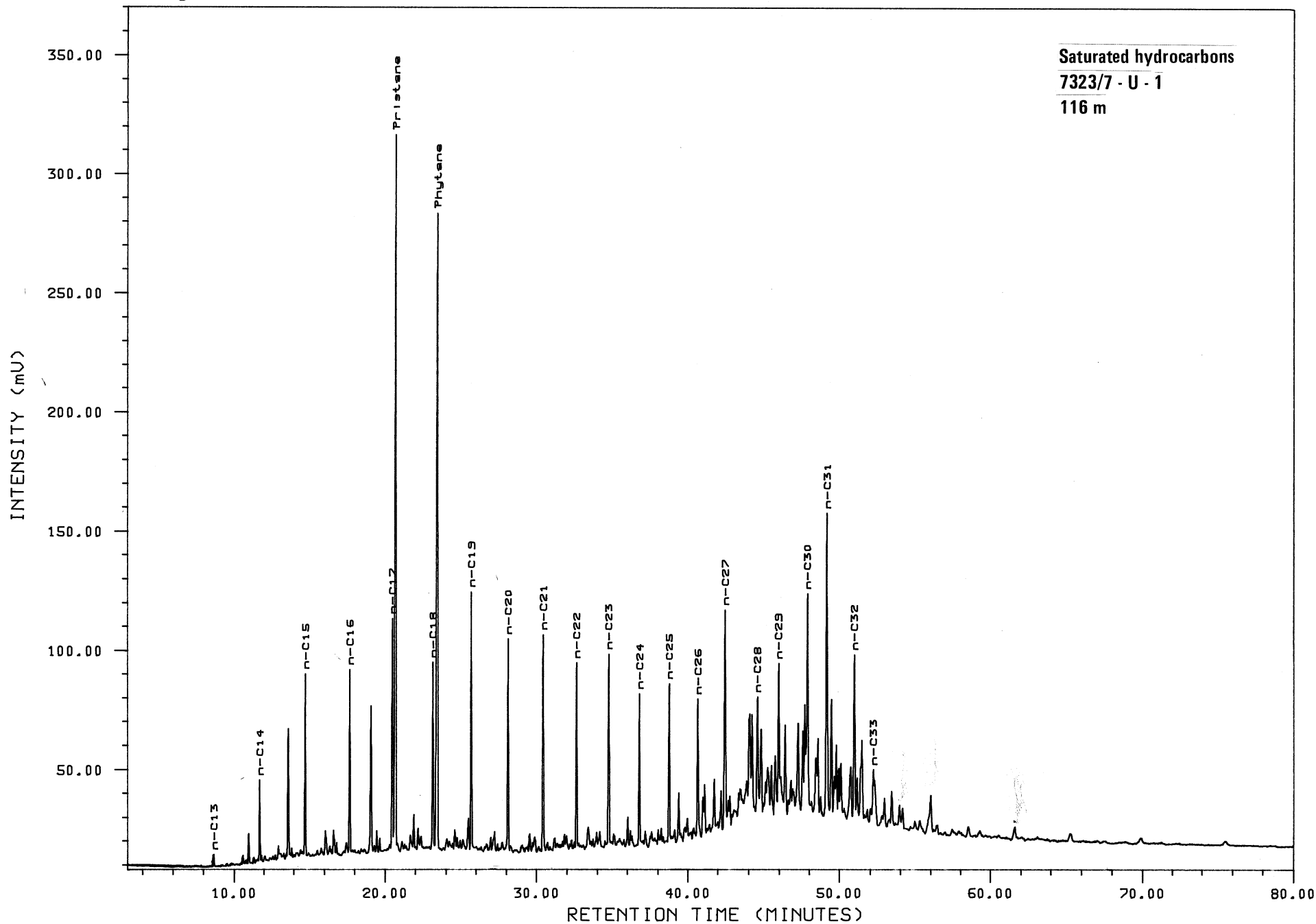
Analysis 420C4801S

3,1,1

DIAS,7323/7-1,SAT



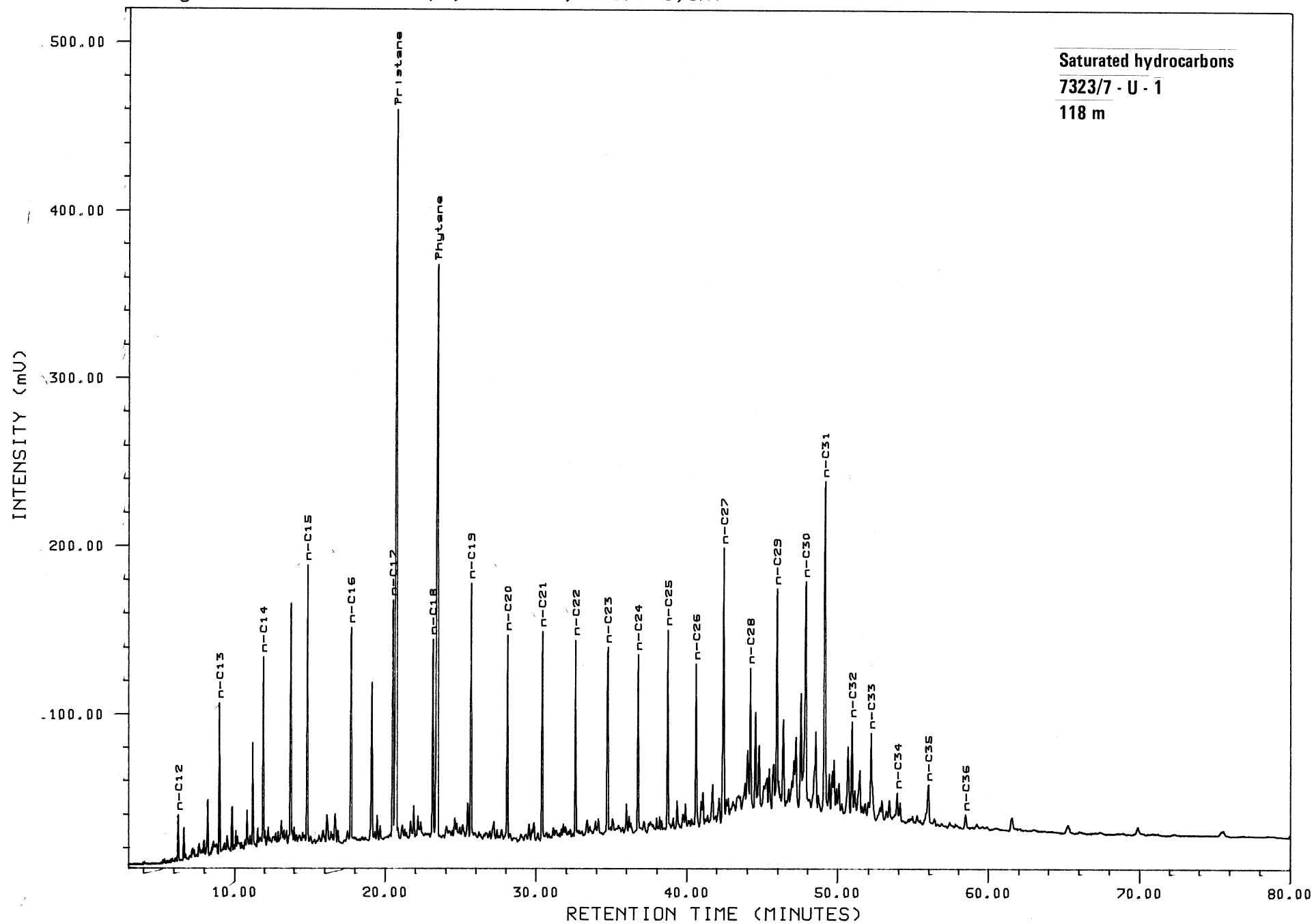
Analysis 420C4805S 3,1,1 DIAS,7323/7-1,SAT



Analysis 420C4807S

3,1,1

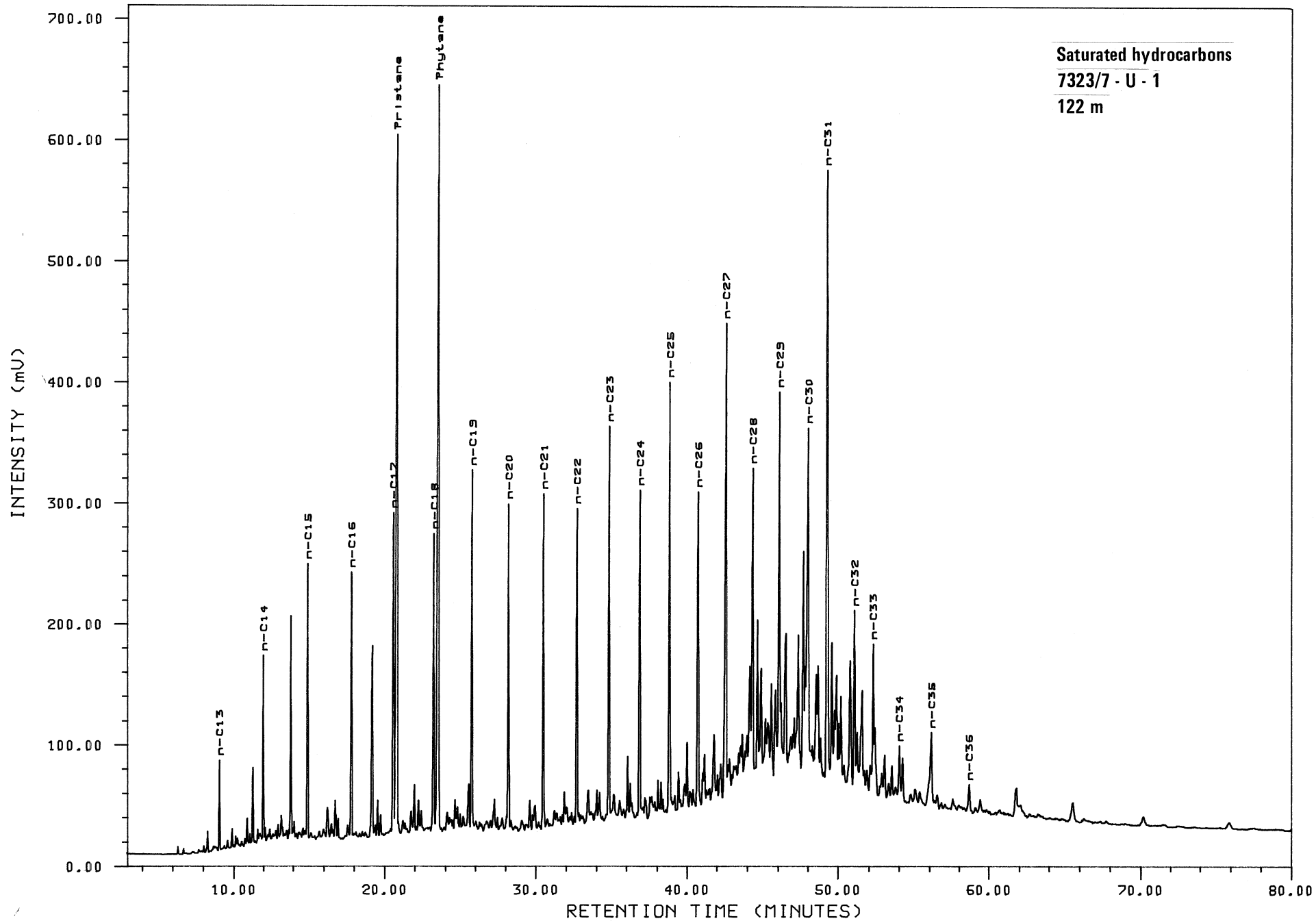
DIAS,7323/7-1,SAT



Analysis 420C4811S

3,1,1

DIAS,7323/7-1,SAT



Analysis 420C4813S

2,1,1

DIAS,7323/7-1,SAT

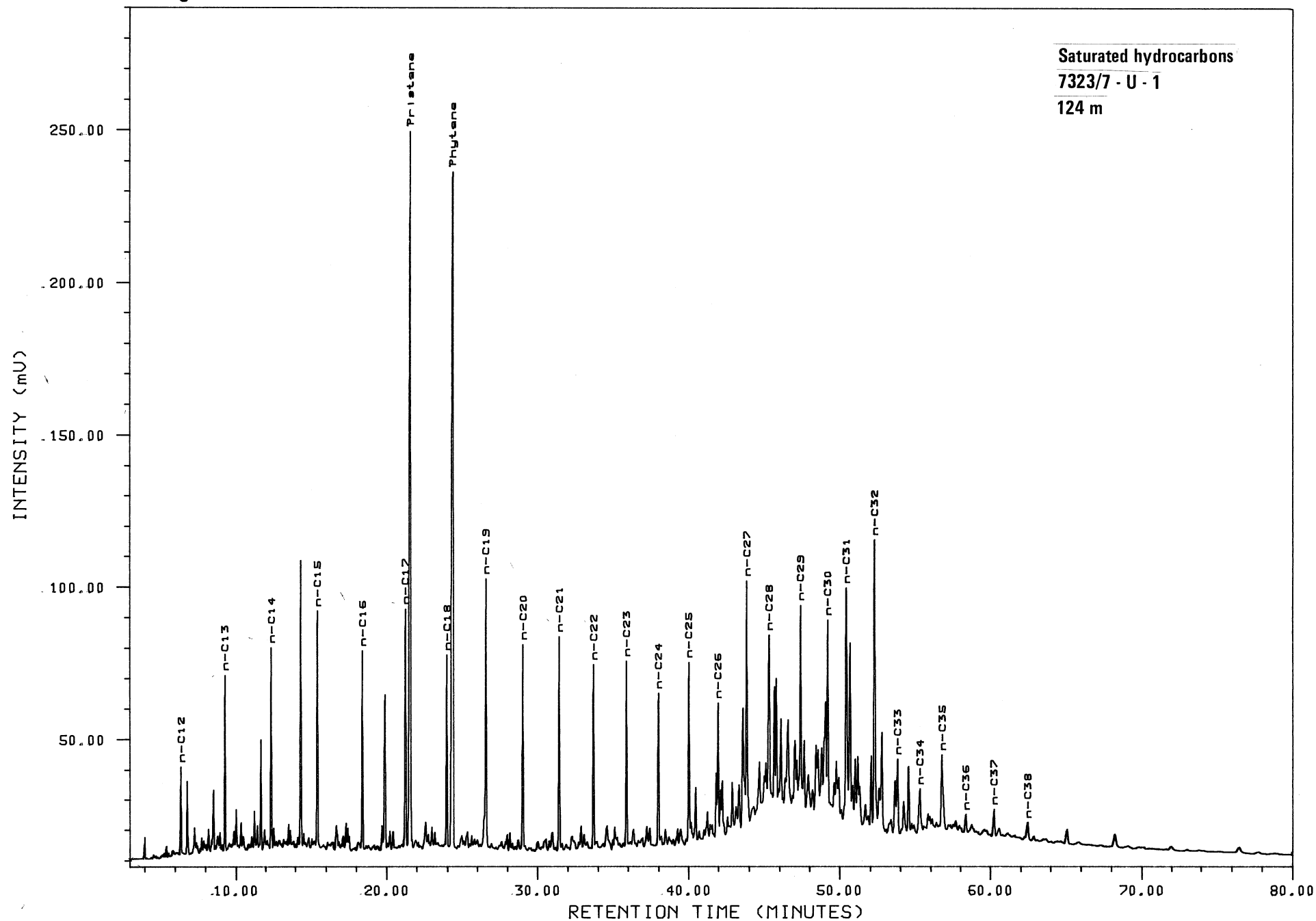
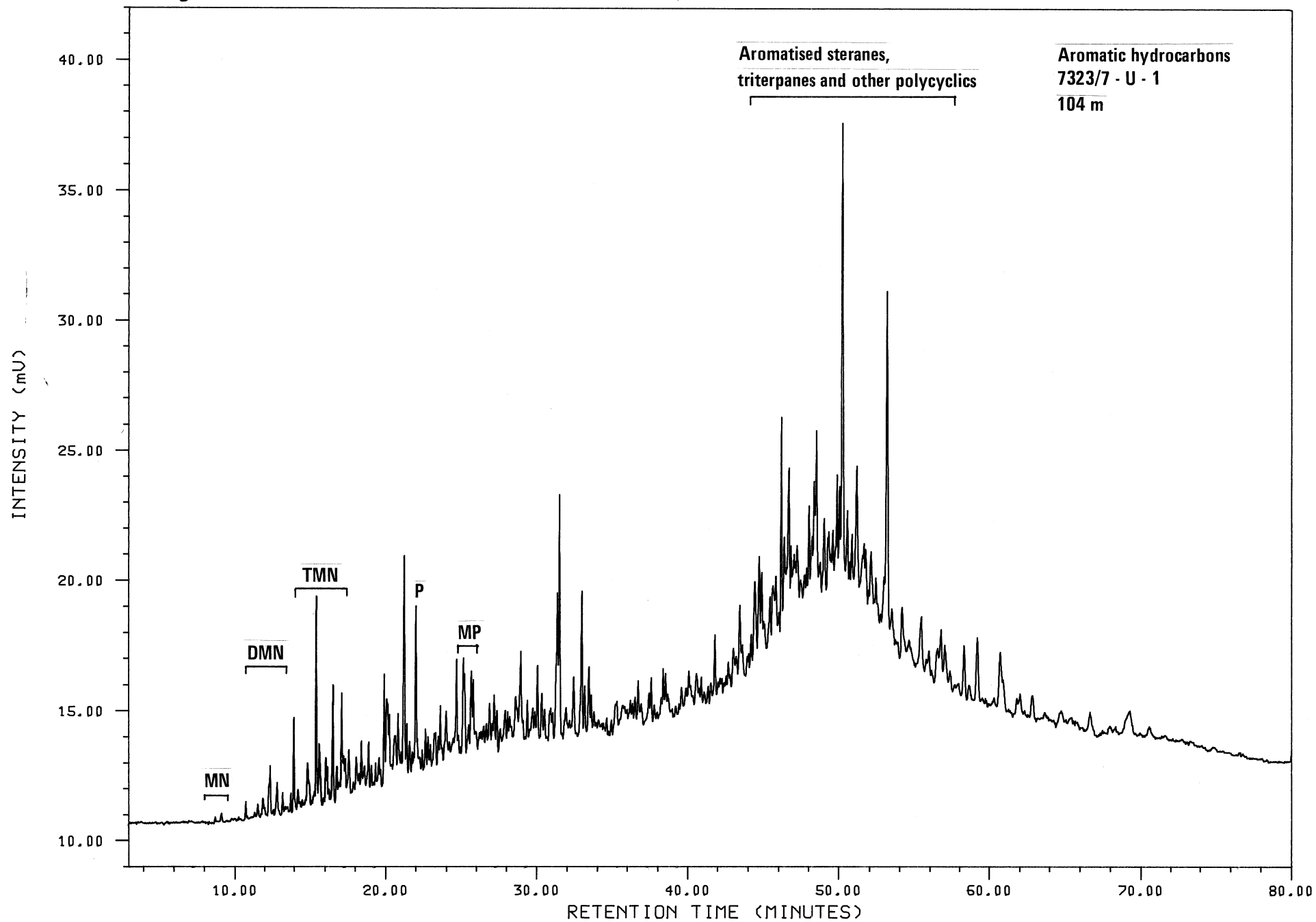


Figure A.III.5.3: Aromatic hydrocarbon gas chromatograms.

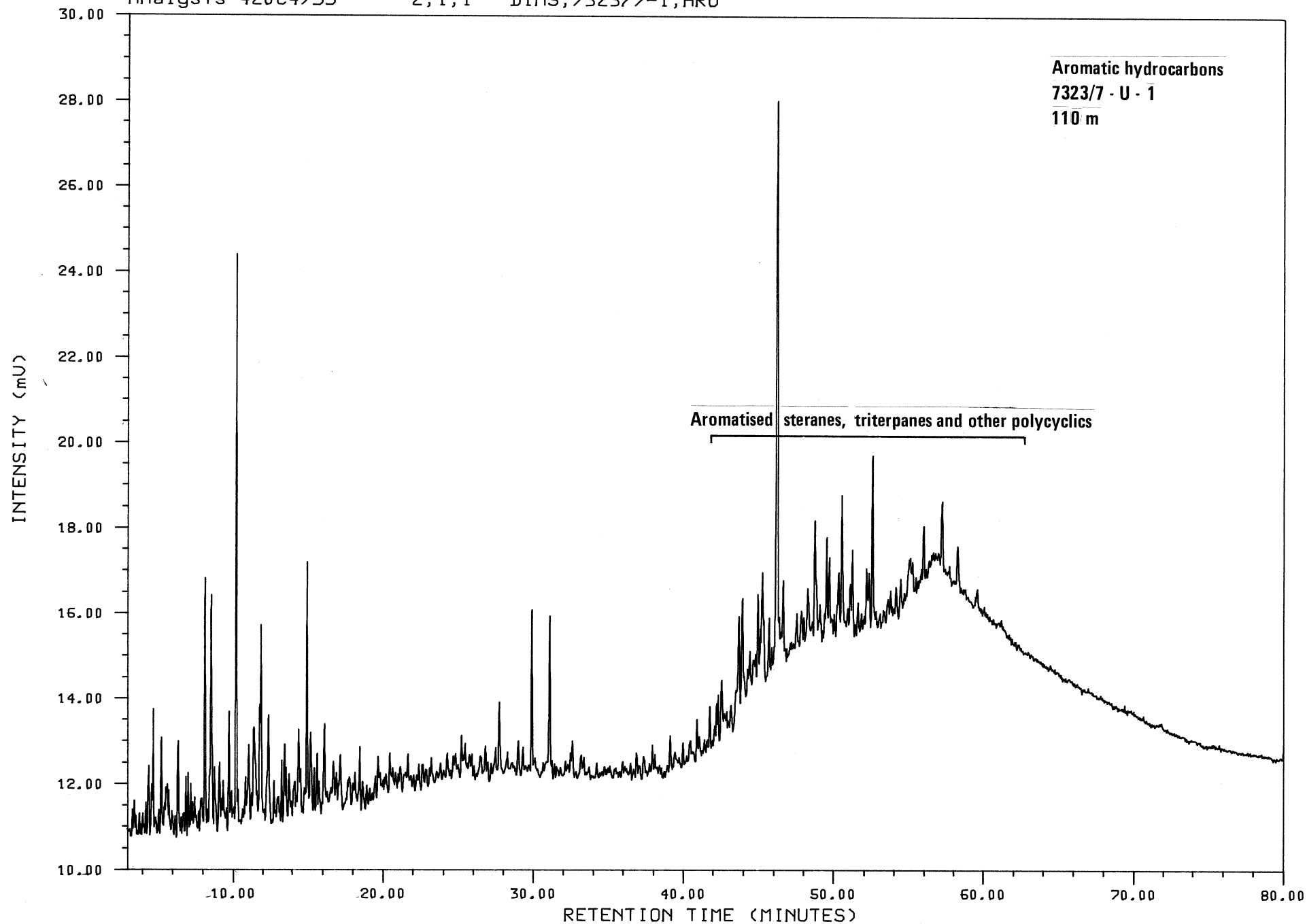
N,MN,DMN,TMN	- naphthalene and alkylated homologs
P,MP,DMP	- phenanthrene and alkylated homologs



Analysis 420C4799

2,1,1

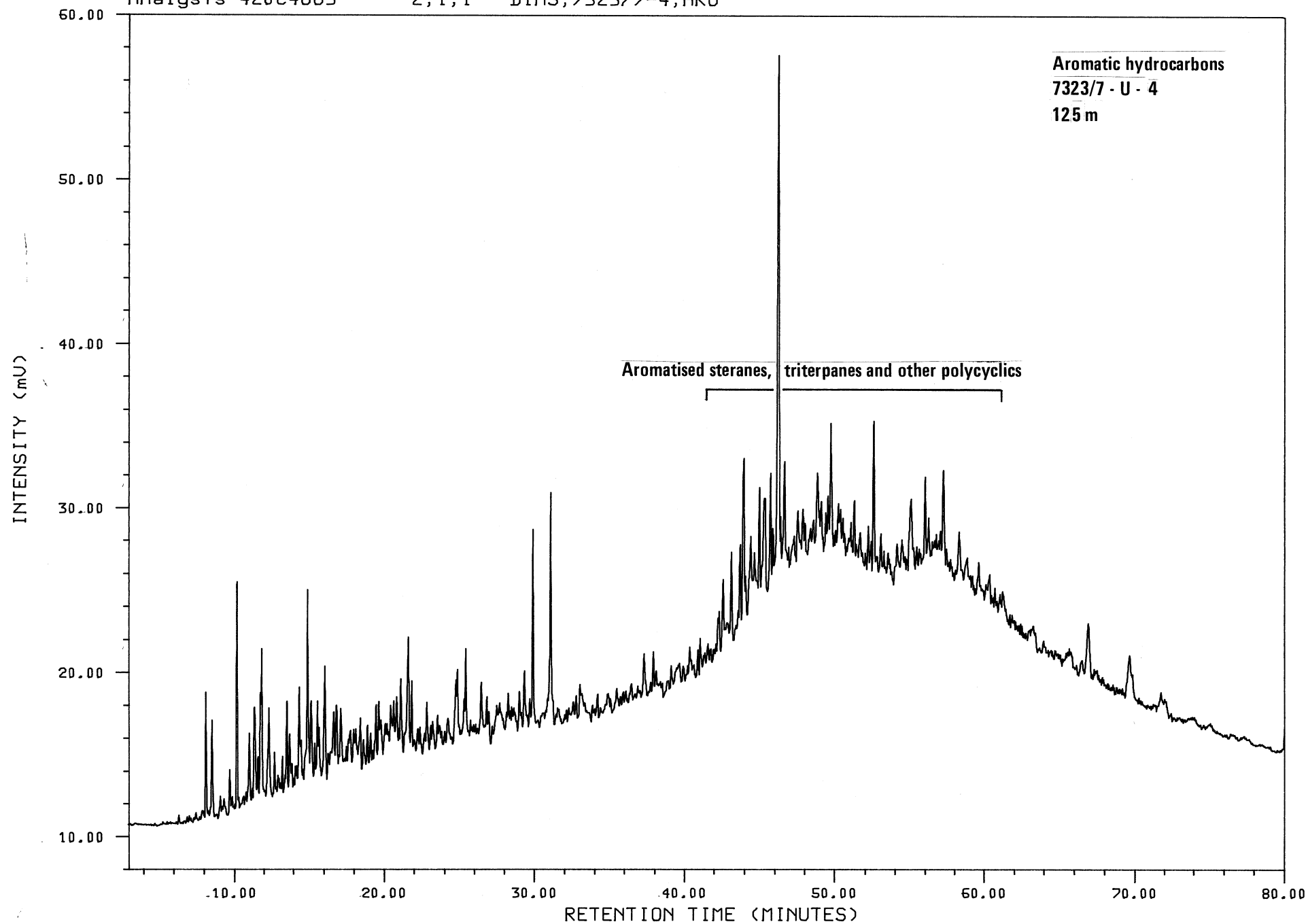
DIAS,7323/7-1,ARO



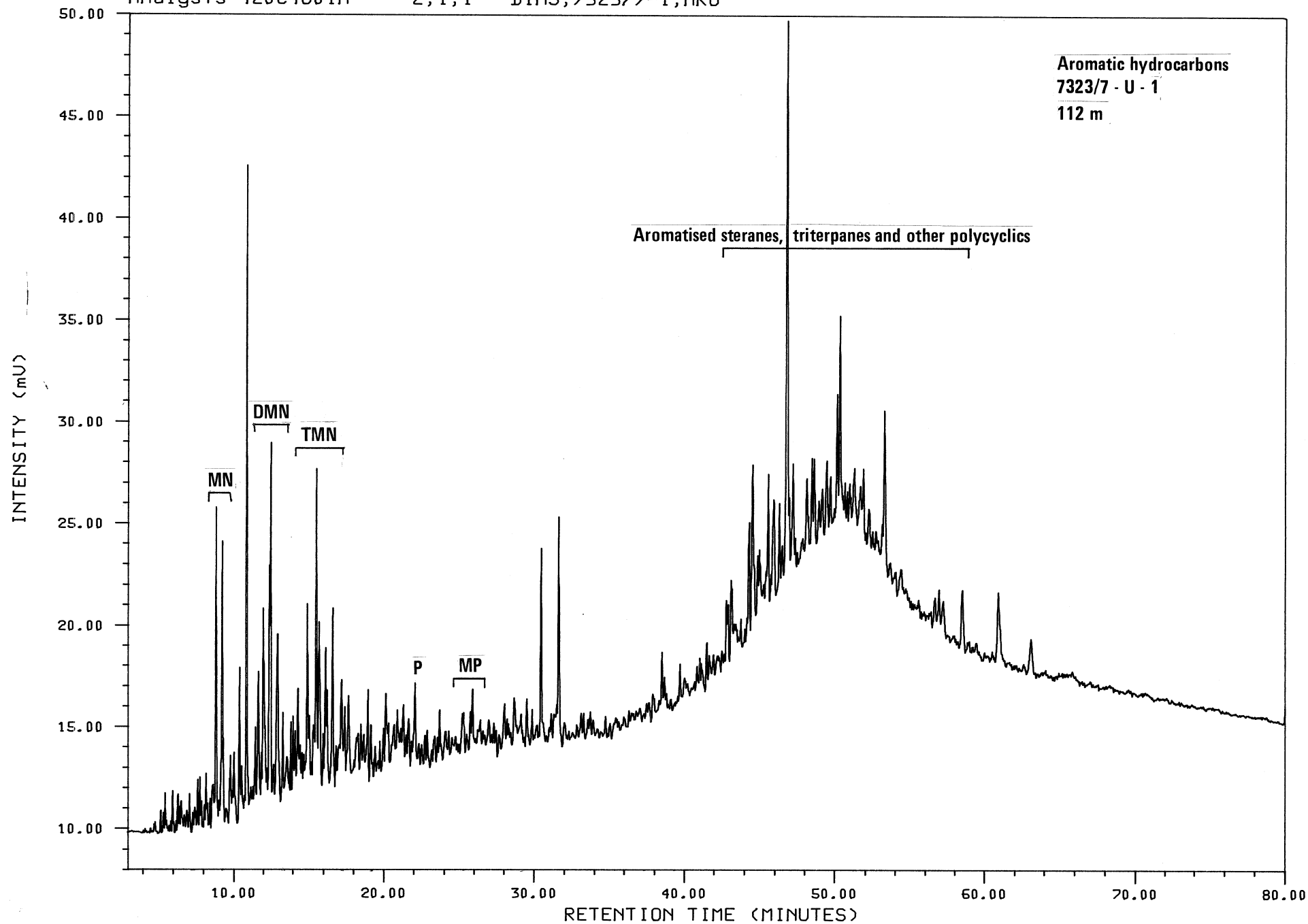
Analysis 420C4883

2,1,1

DIAS,7323/7-4,ARO



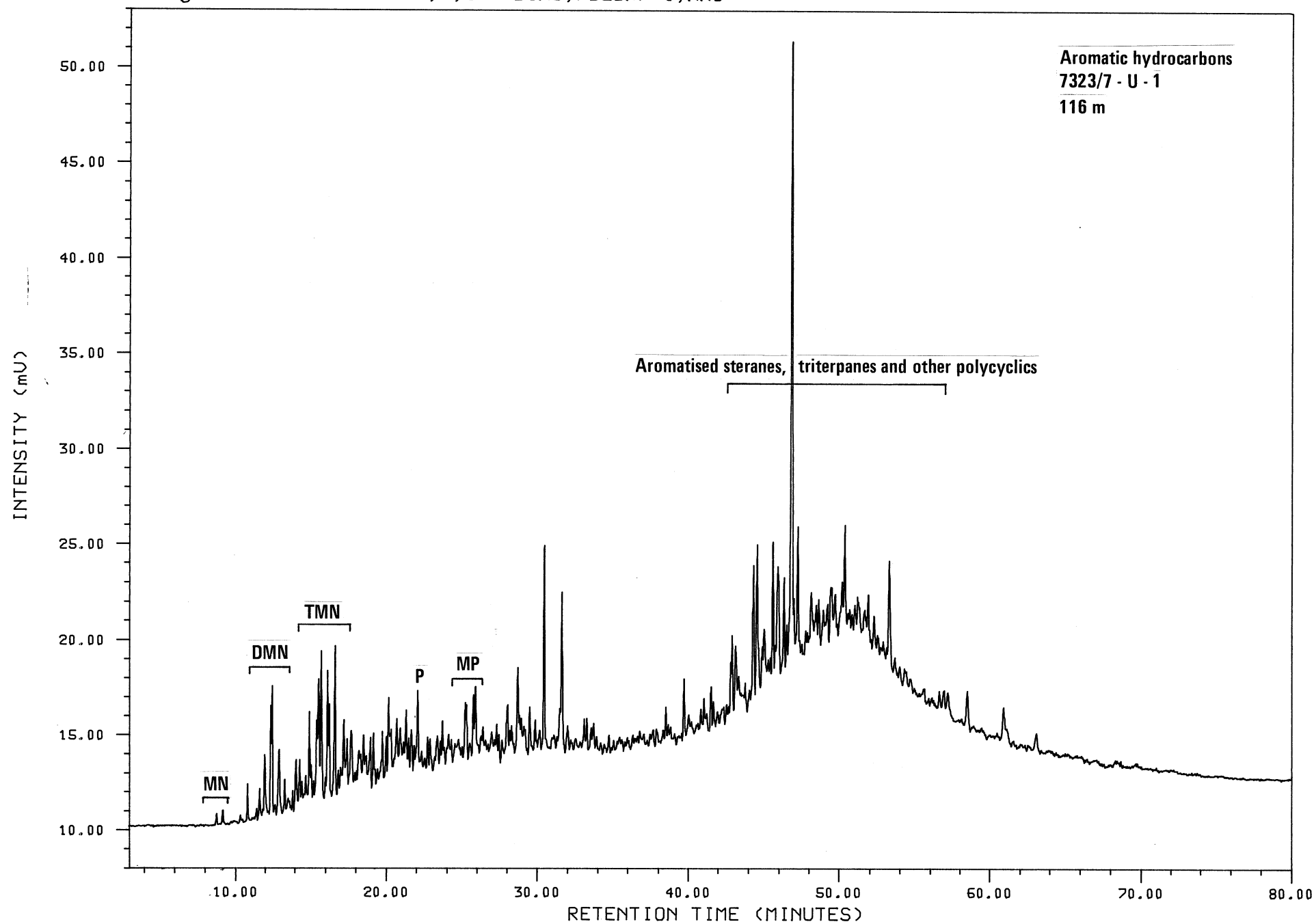
Analysis 420C4801A 2,1,1 DIAS,7323/7-1,ARO



Analysis 420C4805A

2,1,1

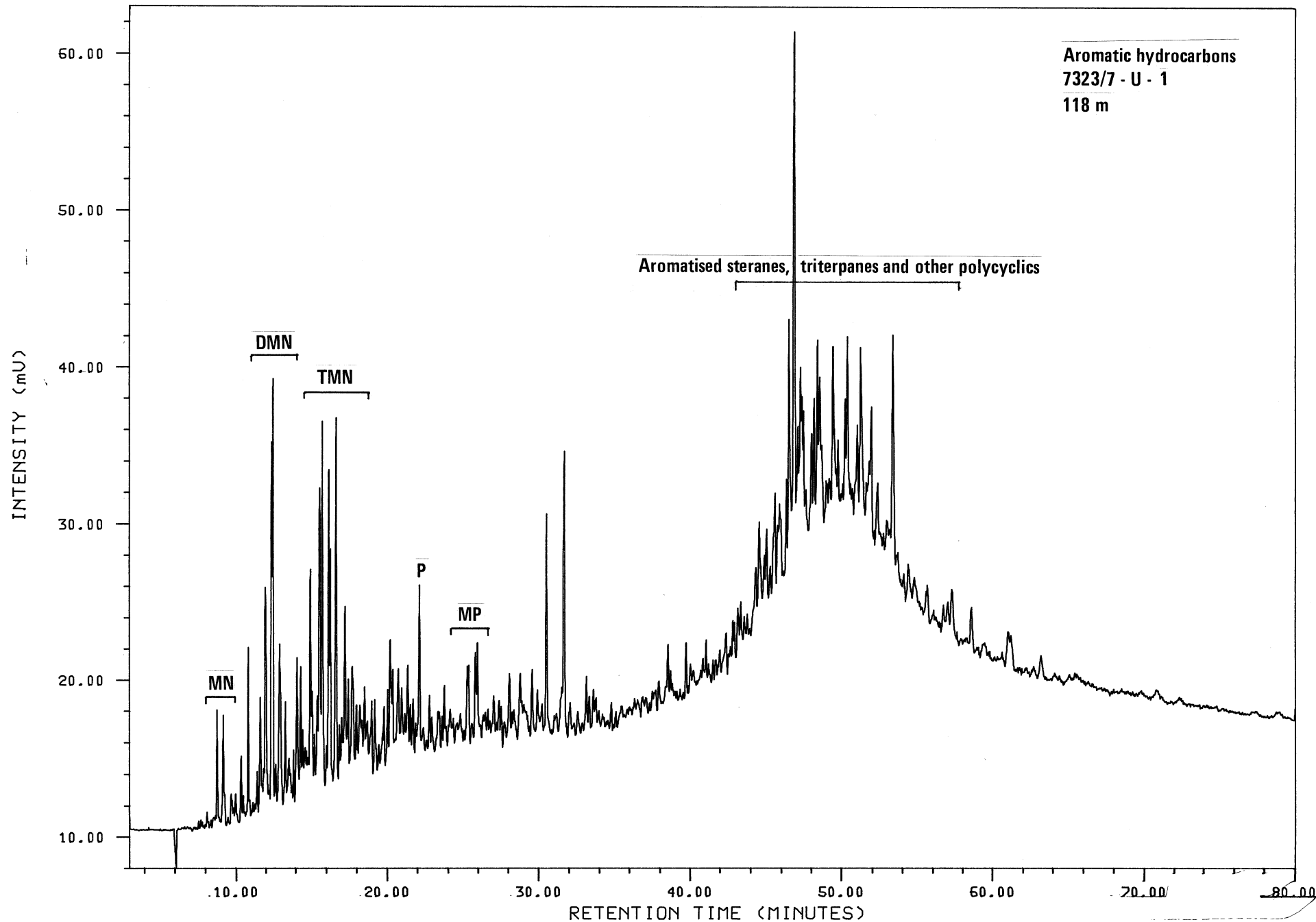
DIAS,7323/7-1,ARO



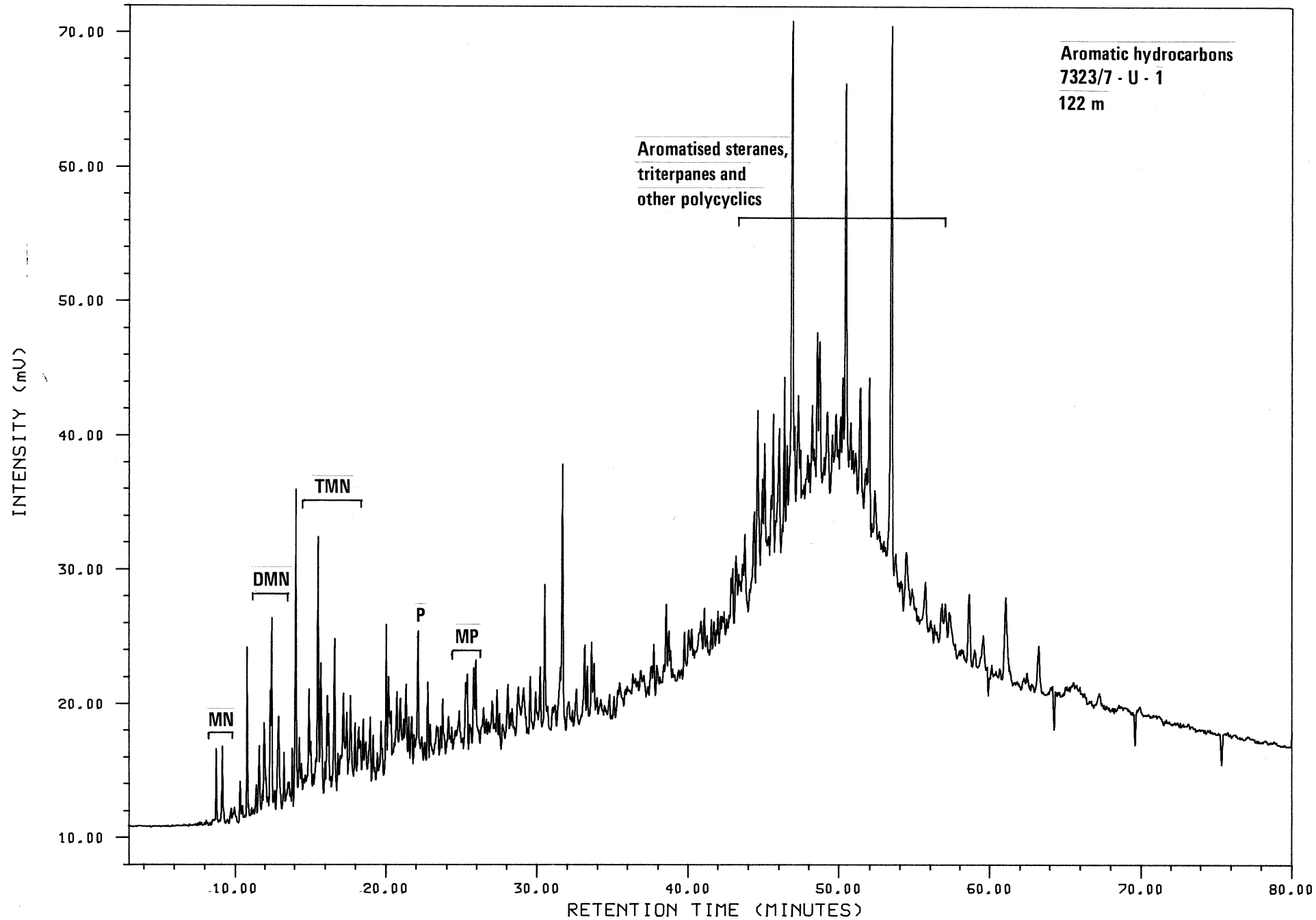
Analysis 420C4807A

2,1,1

DIAS,7323/7-1,ARO



Analysis 420C4811A 2,1,1 DIAS,7323/7-1,ARO



Analysis 420C4813A 2,1,1 DIAS,7323/7-1,ARO

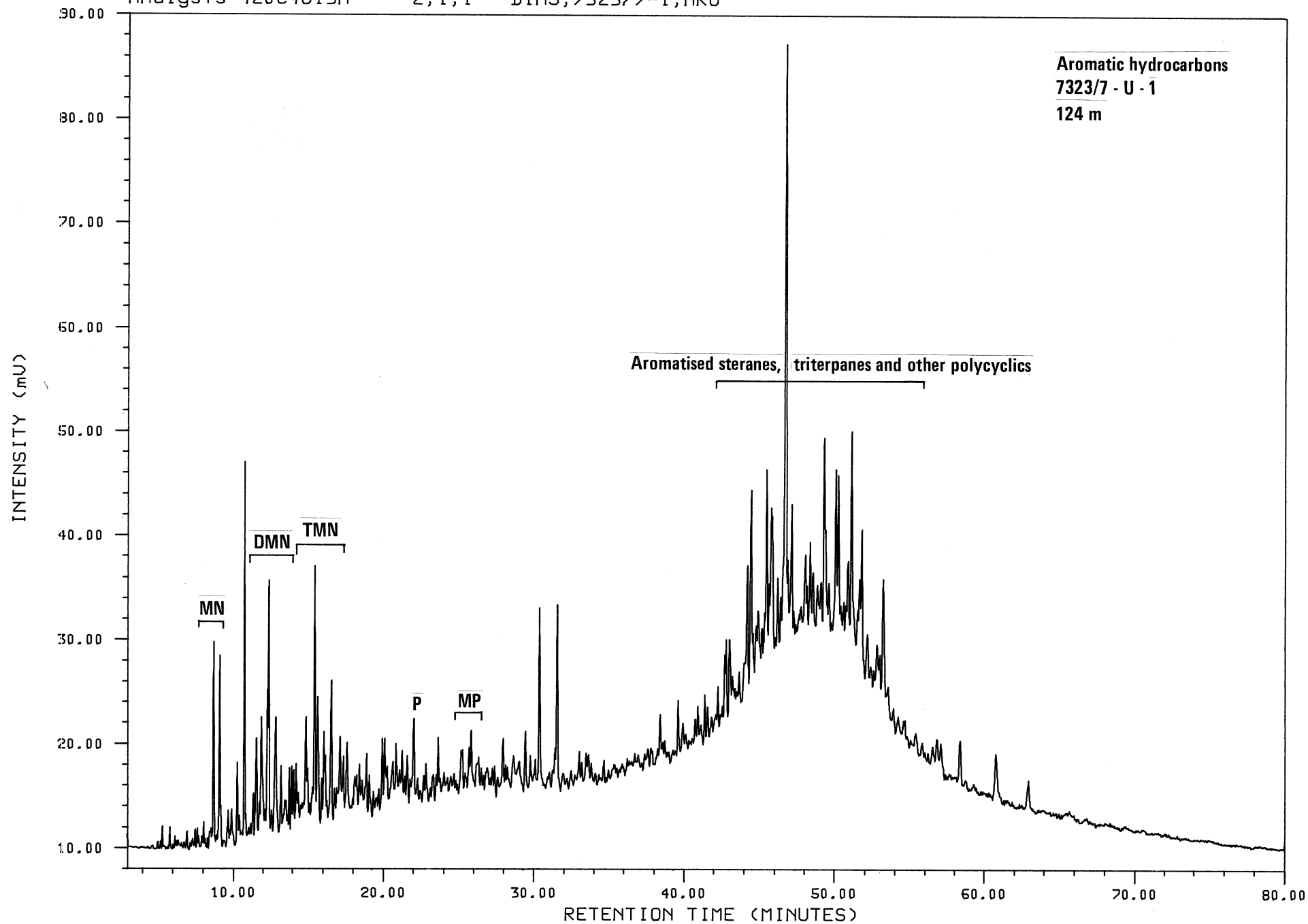
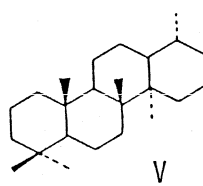
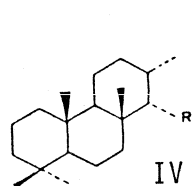
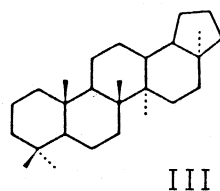
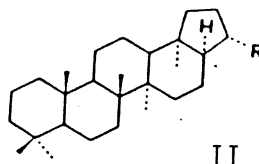
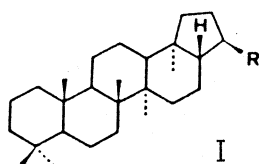


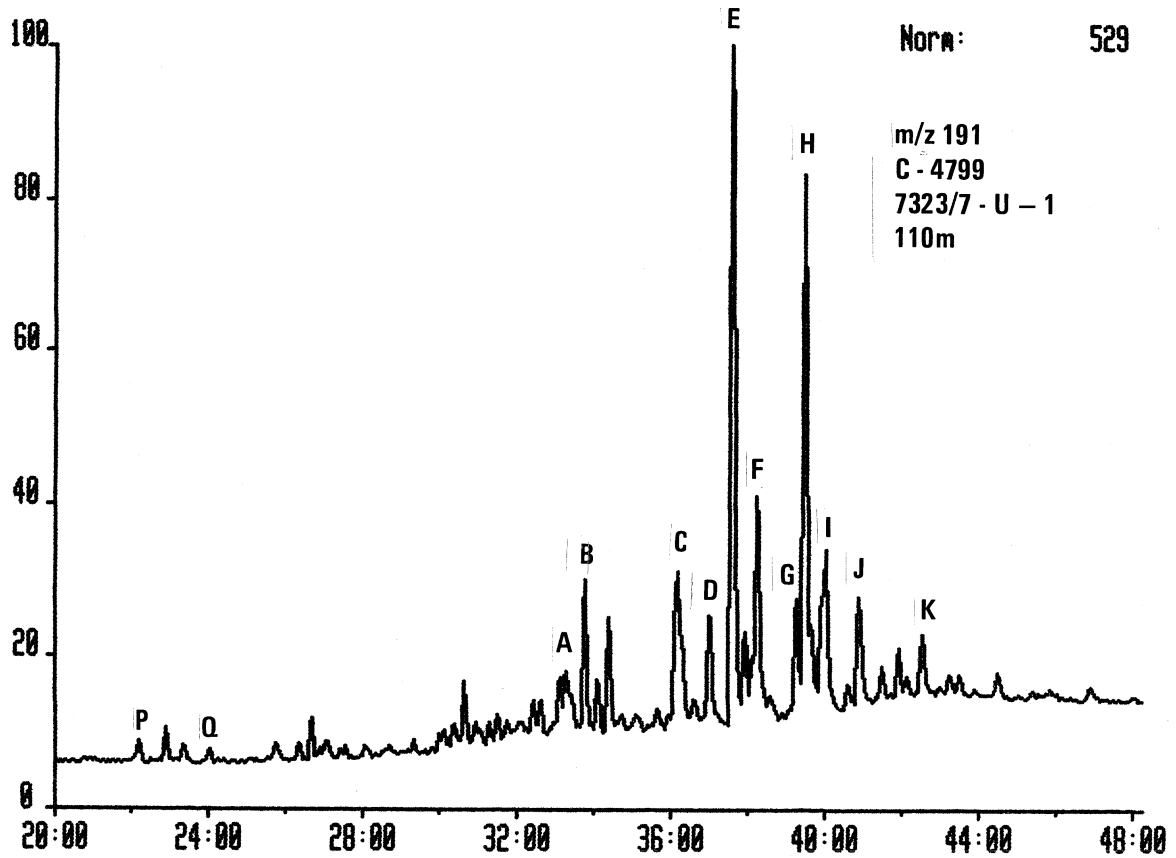
Figure A.III.5.4: Mass chromatograms of m/z 191 (terpanes).

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



C4799SAT 12-NOV-86 Sir:Voltage 7070H Acnt:IKU
Sample 1 Injection 1 Group 1 Mass 191.1000
Text:

System:TRIT



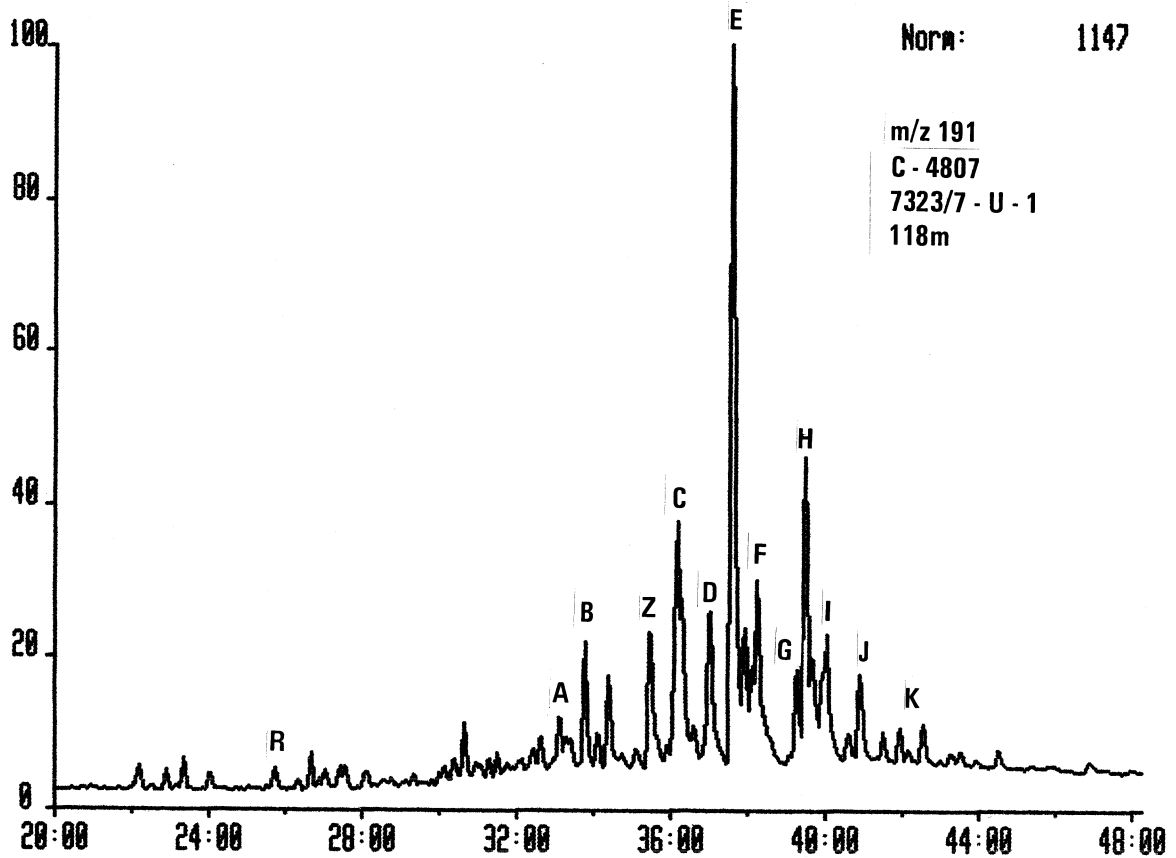


IKU
SINTEF-GRUPPEN

-256-

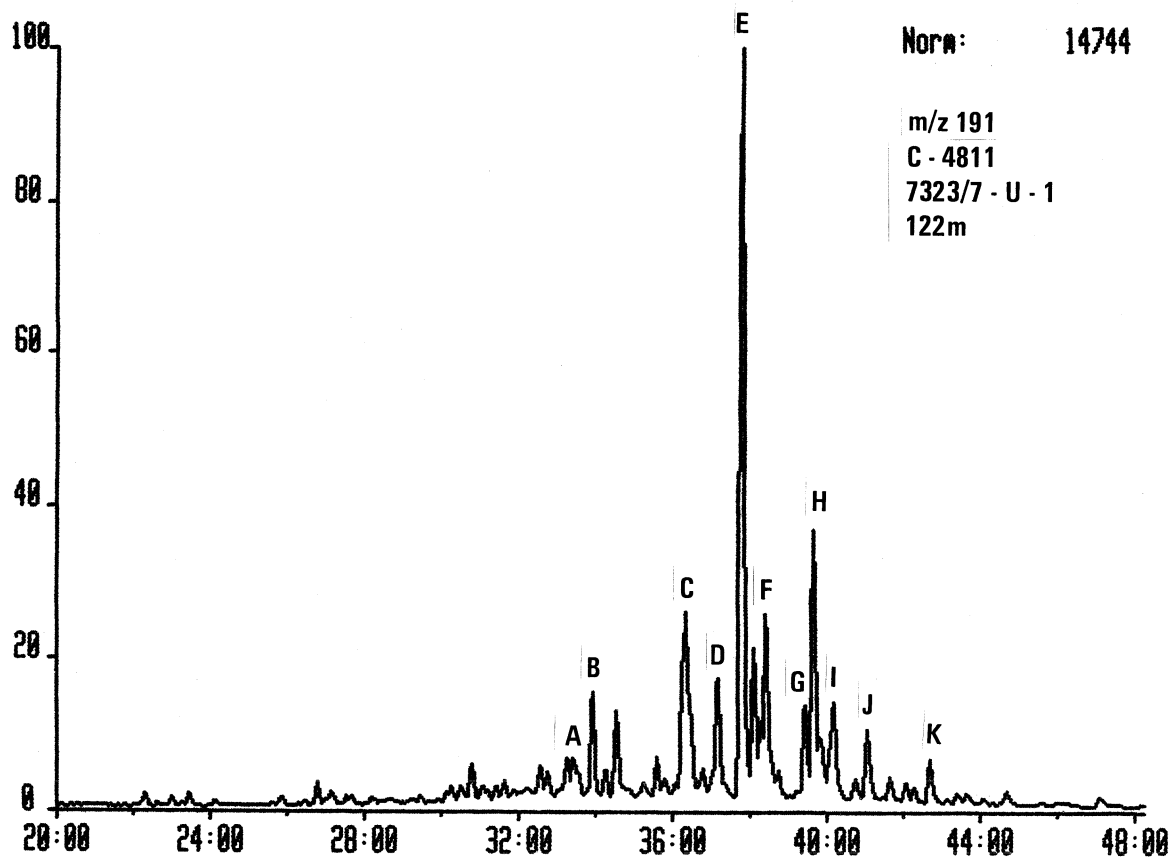
C4807SAT1 13-NOV-86 Sir:Voltage 7070H Acnt:IKU
Sample 1 Injection 1 Group 1 Mass 191.1000
Text:

System:TRIT



C4811SAT 11-NOV-86 Sir:Voltage 7070H Acnt:IKU
 Sample 1 Injection 1 Group 1 Mass 191.1000
 Text:

System:TRIT



C4813SAT 11-NOV-86 Sir:Voltage 7070H Acnt:IKU
Sample 1 Injection 1 Group 1 Mass 191.1000
Text:

System:TRIT

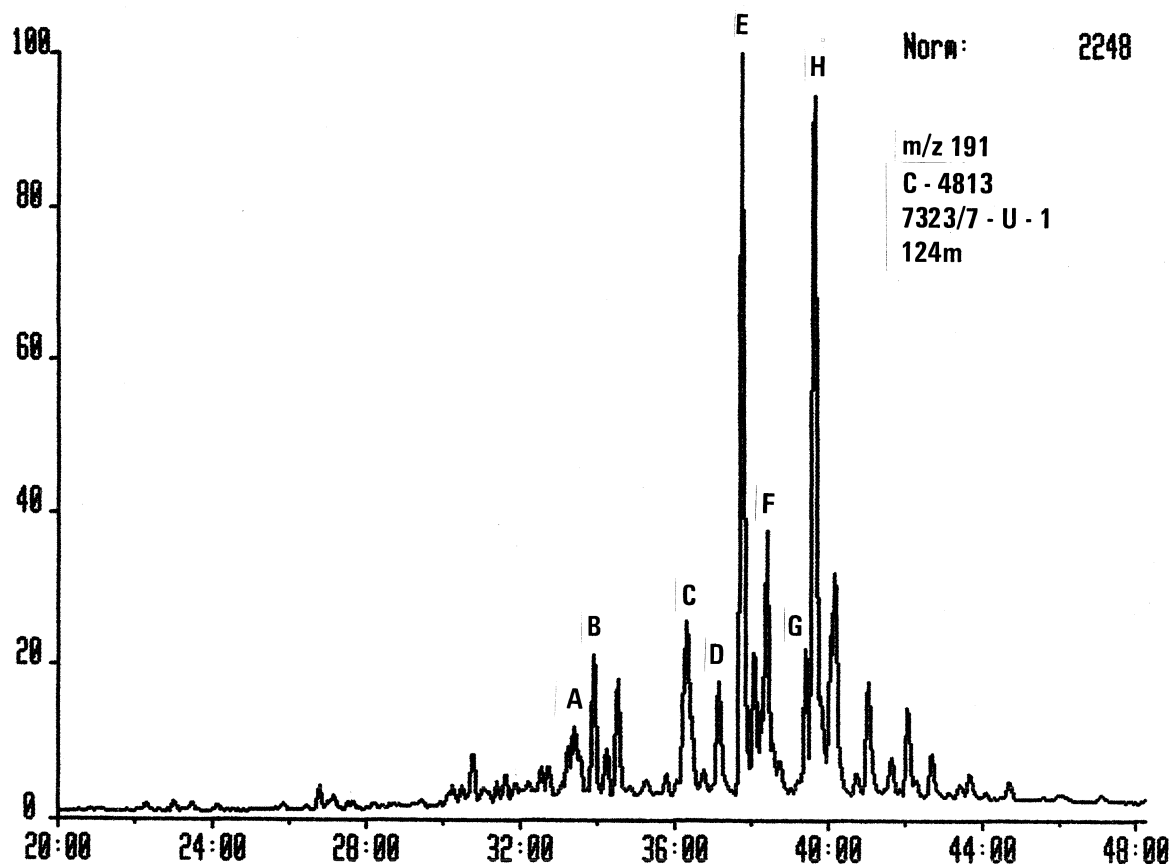
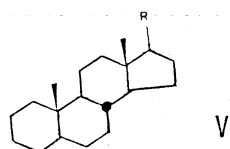
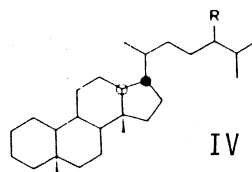
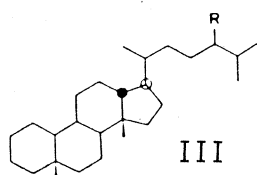
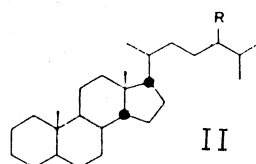
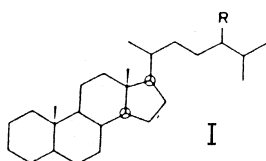


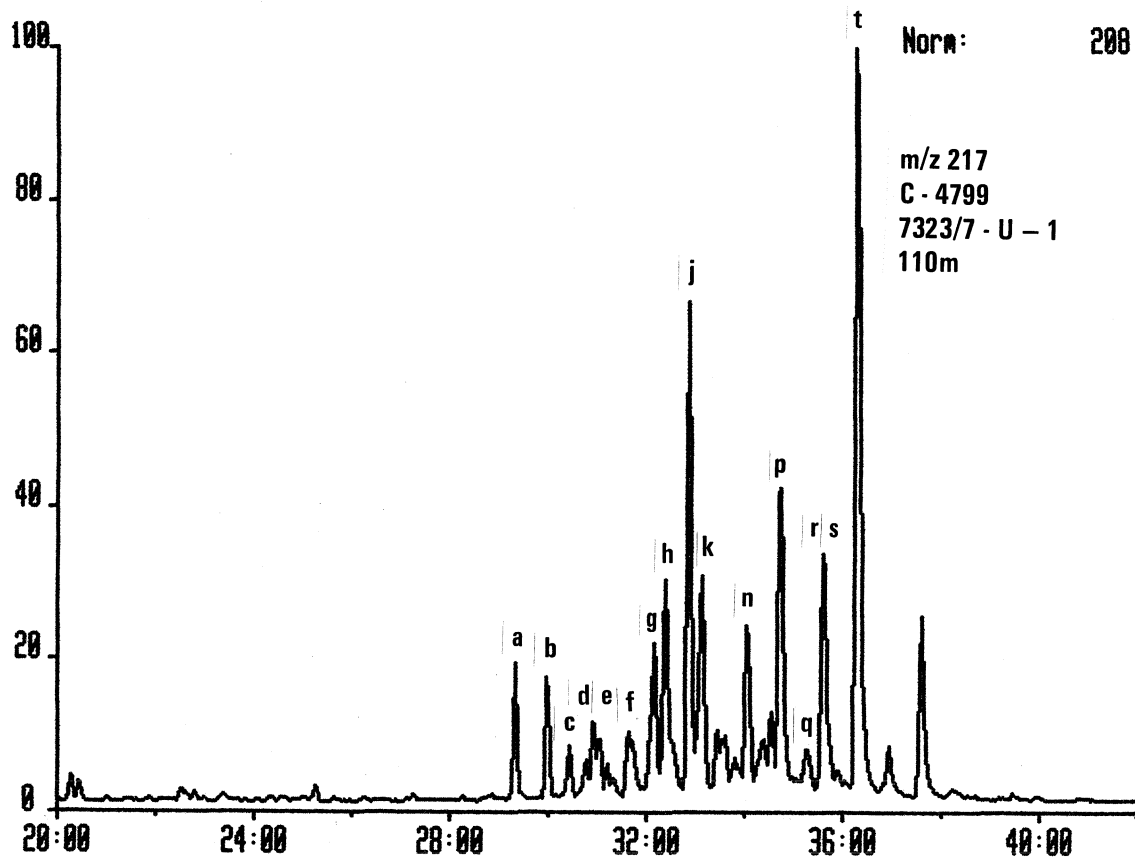
Figure A.III.5.5: Mass chromatograms of m/z 217 and 218 (steranes).

a	13 β (H),17 α (H)-diasterane (20S)	C ₂₇ H ₄₈	(III,R=H)
b	13 β (H),17 α (H)-diasterane (20R)	C ₂₇ H ₄₈	(III,R=H)
c	13 α (H),17 β (H)-diasterane (20S)	C ₂₇ H ₄₈	(IV,R=H)
d	13 α (H),17 β (H)-diasterane (20R)	C ₂₇ H ₄₈	(IV,R=H)
e	13 β (H),17 α (H)-diasterane (20S)	C ₂₈ H ₅₀	(III,R=CH ₃)
f	13 β (H),17 α (H)-diasterane (20R)	C ₂₈ H ₅₀	(III,R=CH ₃)
g	13 α (H),17 β (H)-diasterane (20S)	C ₂₈ H ₅₀	(IV,R=CH ₃)
	+ 14 α (H),17 α (H)-sterane (20S)	C ₂₇ H ₄₈	(I,R=H)
h	13 β (H),17 α (H)-diasterane (20S)	C ₂₉ H ₅₂	(III,R=C ₂ H ₅)
	+ 14 β (H),17 β (H)-sterane (20R)	C ₂₇ H ₄₈	(II,R=H)
i	14 β (H),17 β (H)-sterane (20S)	C ₂₇ H ₄₈	(II,R=H)
	+ 13 α (H),17 β (H)-diasterane (20R)	C ₂₈ H ₅₀	(IV,R=CH ₃)
j	14 α (H),17 α (H)-sterane (20R)	C ₂₇ H ₄₈	(I,R=H)
k	13 β (H),17 α (H)-diasterane (20R)	C ₂₉ H ₅₂	(III,R=C ₂ H ₅)
l	13 α (H),17 β (H)-diasterane (20S)	C ₂₉ H ₅₂	(III,R=C ₂ H ₅)
m	14 α (H),17 α (H)-sterane (20S)	C ₂₈ H ₅₀	(I,R=CH ₃)
n	13 α (H),17 β (H)-diasterane (20R)	C ₂₉ H ₅₂	(III,R=C ₂ H ₅)
	+ 14 β (H),17 β (H)-sterane (20R)	C ₂₈ H ₅₀	(II,R=CH ₃)
o	14 β (H),17 β (H)-sterane (20S)	C ₂₈ H ₅₀	(II,R=CH ₃)
p	14 α (H),17 α (H)-sterane (20R)	C ₂₈ H ₅₀	(I,R=CH ₃)
q	14 α (H),17 α (H)-sterane (20S)	C ₂₉ H ₅₂	(I,R=C ₂ H ₅)
r	14 β (H),17 β (H)-sterane (20R)	C ₂₉ H ₅₂	(II,R=C ₂ H ₅)
	+ unknown sterane		
s	14 β (H),17 β (H)-sterane (20S)	C ₂₉ H ₅₂	(II,R=C ₂ H ₅)
t	14 α (H),17 α (H)-sterane (20R)	C ₂₉ H ₅₂	(I,R=C ₂ H ₅)
u	5 α (H)-sterane	C ₂₁ H ₃₆	(V,R=C ₂ H ₅)
v	5 α (H)-sterane	C ₂₂ H ₃₈	(IV,R=C ₃ H ₇)



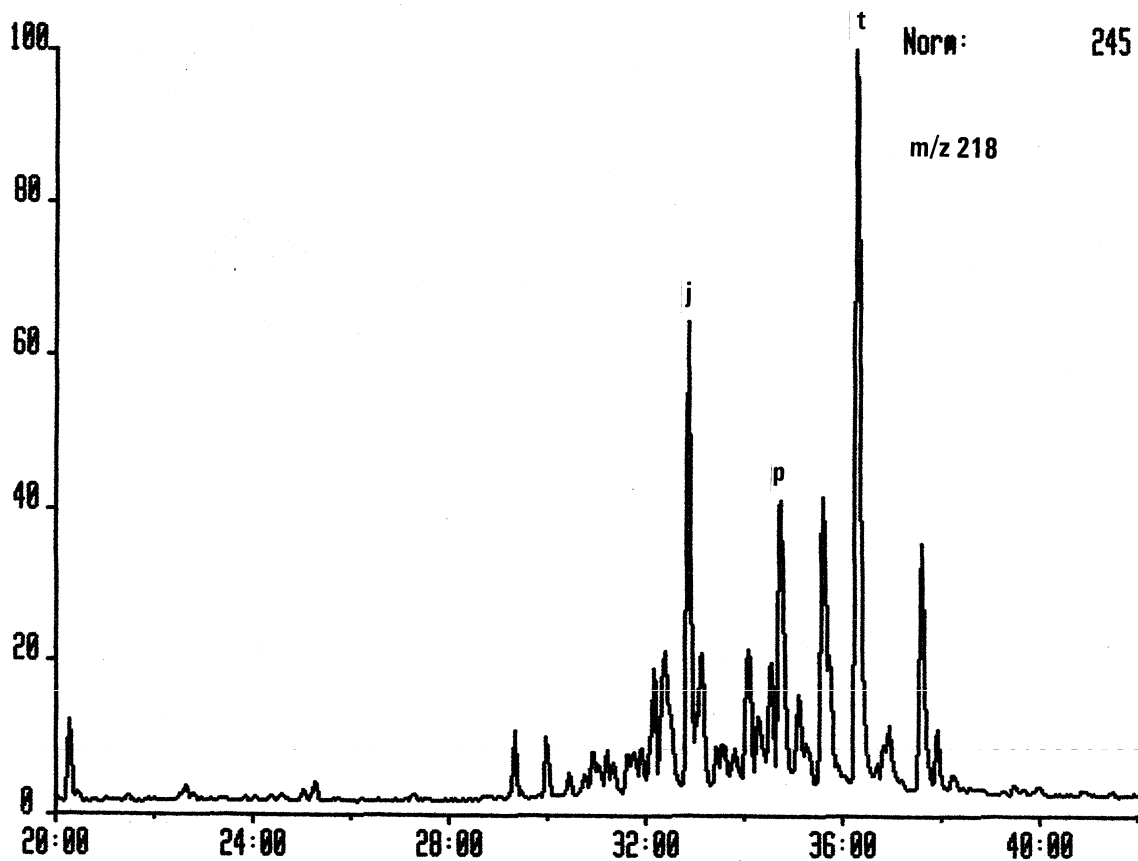
C4799SAT 12-NOV-86 Sir:Voltage 7070H Acnt:IKU
Sample 1 Injection 1 Group 1 Mass 217.1000
Text:

System:TRIT



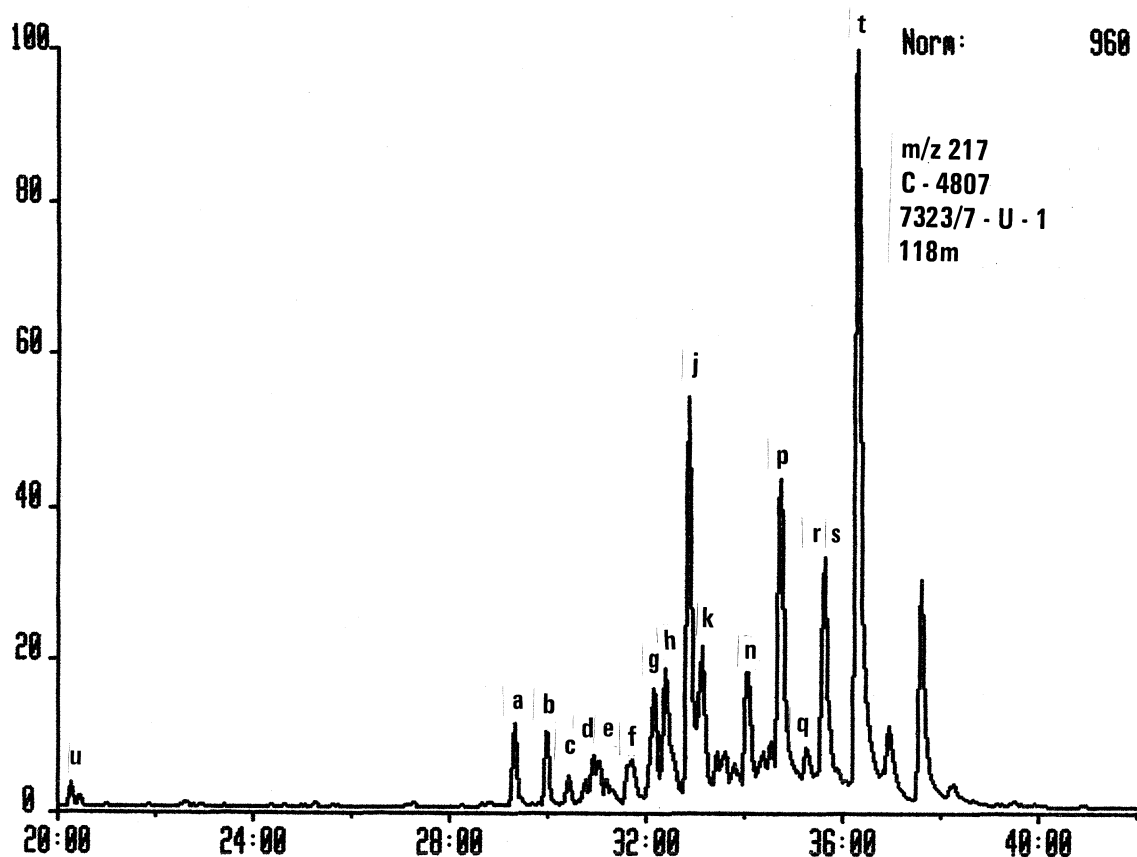
C4799SAT 12-NOV-86 Sir:Voltage 7070H Acnt:IKU
Sample 1 Injection 1 Group 1 Mass 218.1000
Text:

System:TRIT



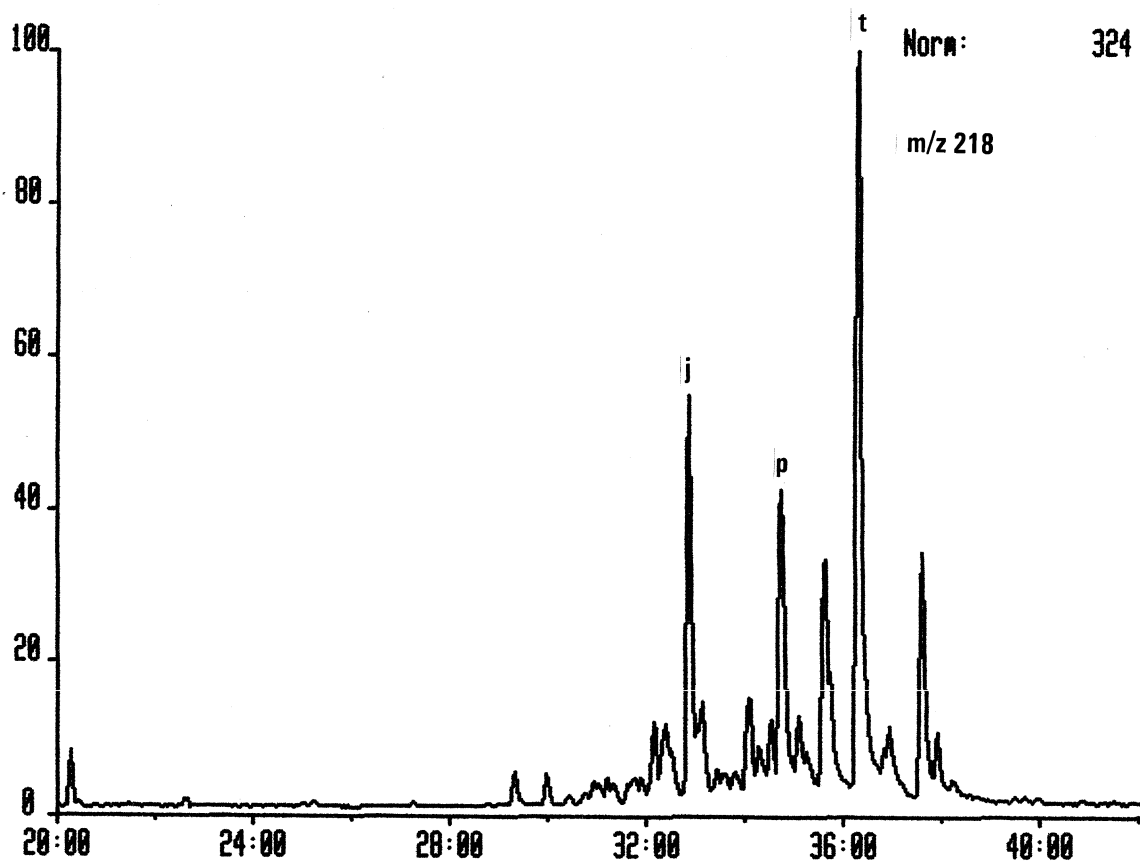
C4807SAT1 13-NOV-86 Sir:Voltage 7070H Acnt:IKU
Sample 1 Injection 1 Group 1 Mass 217.1000
Text:

System:TRIT



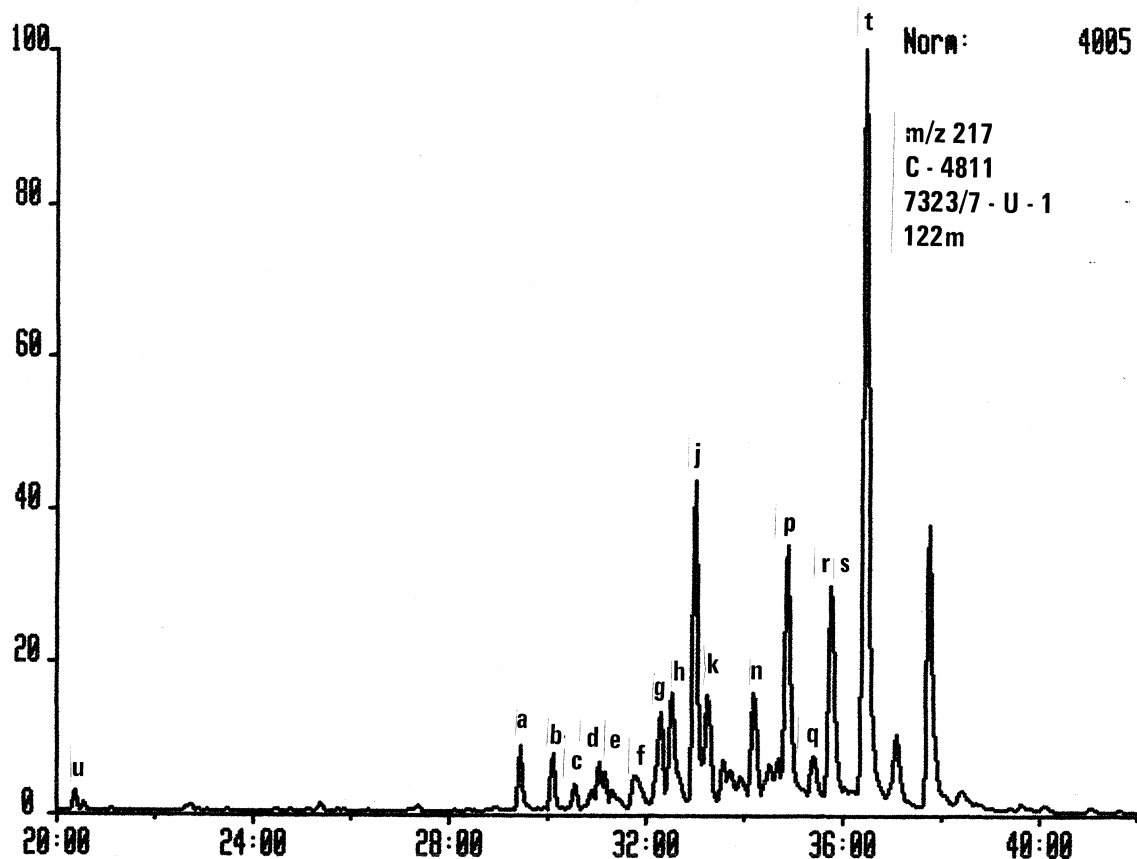
C4807SAT1 13-NOV-86 Sir:Voltage 7070H Acnt:IKU
Sample 1 Injection 1 Group 1 Mass 218.1000
Text:

System:TRIT



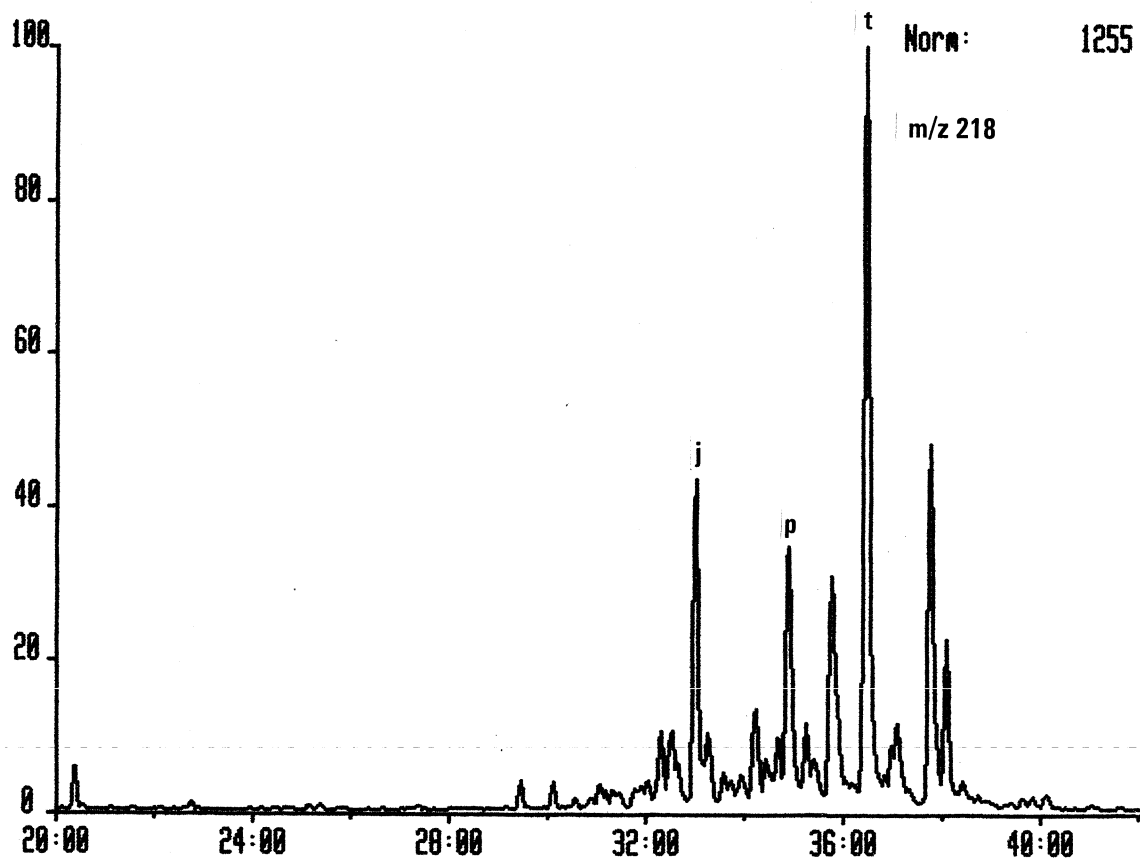
C4811SAT 11-NOV-86 Sir:Voltage 7070H Acnt:IKU
Sample 1 Injection 1 Group 1 Mass 217.1000
Text:

System:TRIT



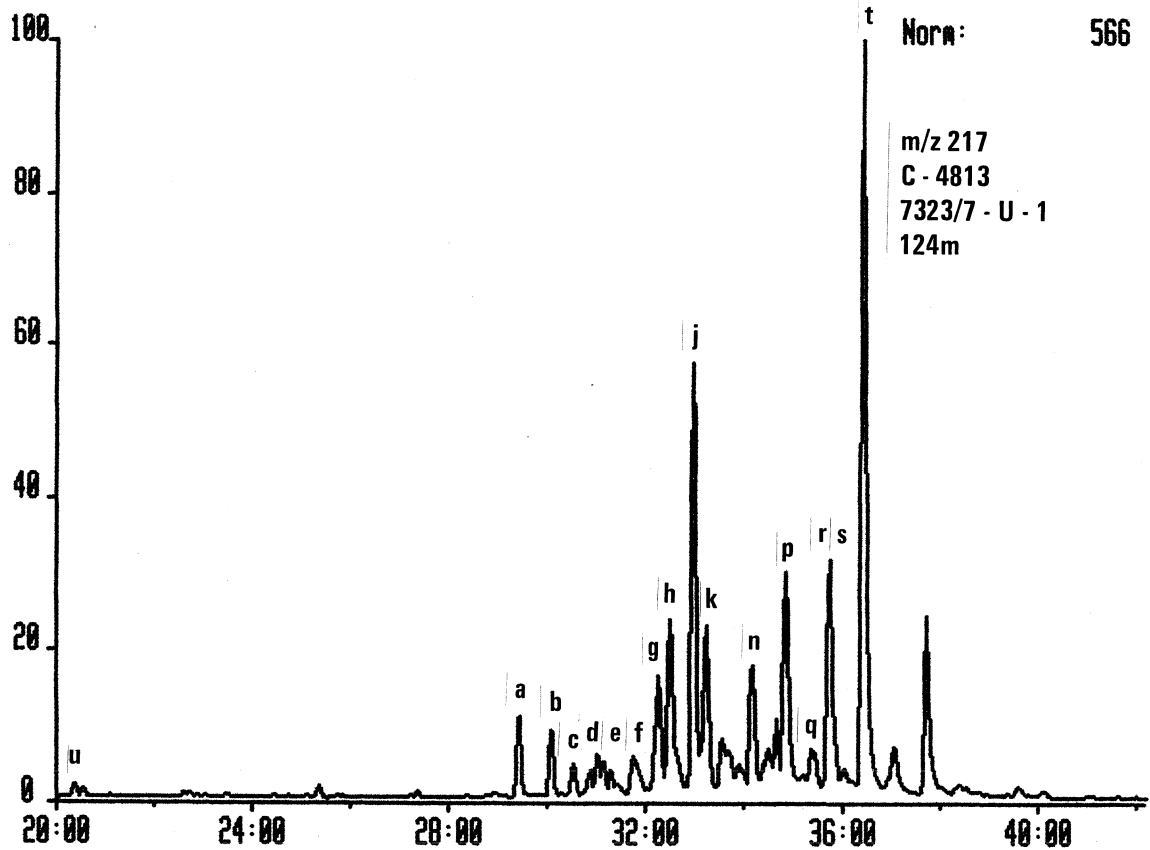
C4811SAT 11-NOV-86 Sir:Voltage 7070H Acnt:IKU
Sample 1 Injection 1 Group 1 Mass 218.1000
Text:

System:TRIT



C4813SAT 11-NOV-86 Sir:Voltage 7070H Acnt:IKU
Sample 1 Injection 1 Group 1 Mass 217.1000
Text:

System:TRIT



C4813SAT 11-NOV-86 Sir:Voltage 7070H Acnt:IKU
Sample 1 Injection 1 Group 1 Mass 218.1000
Text:

System:TRIT

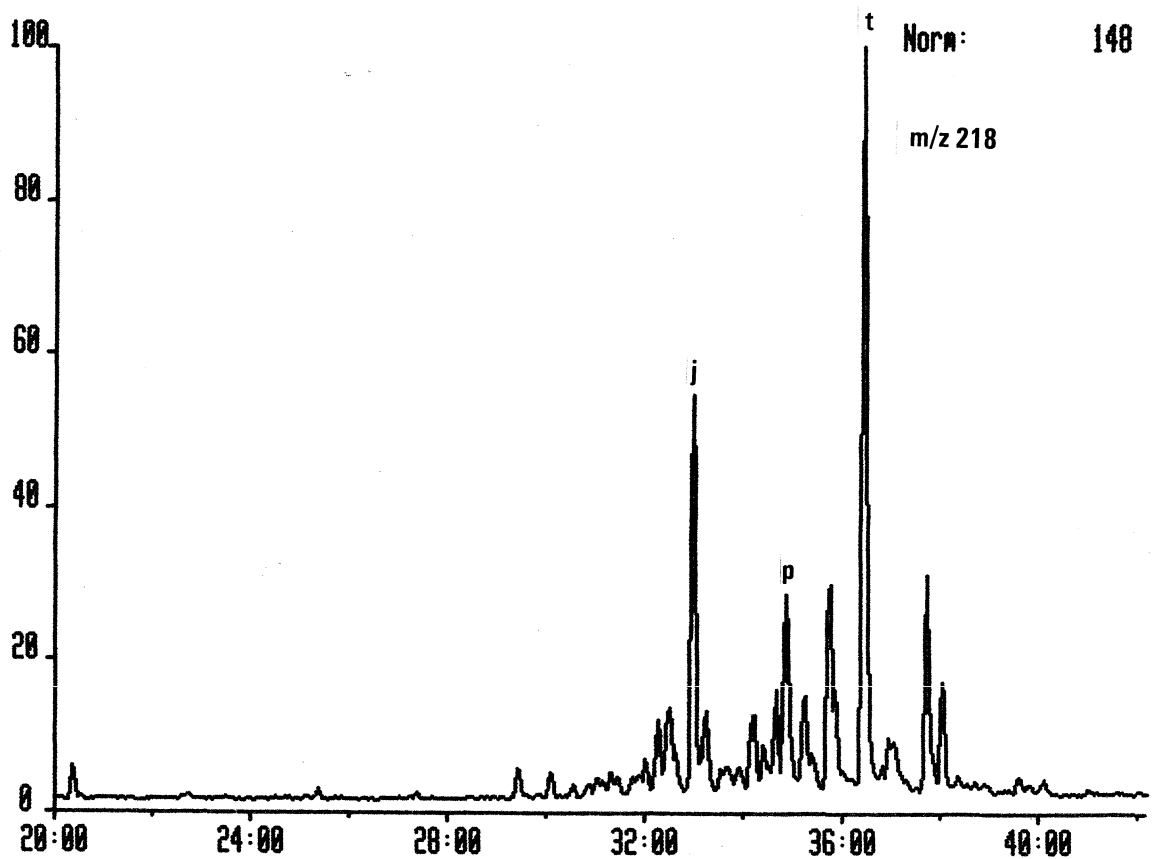


Figure A.III.5.6: Vitrinite reflectance histograms.

Key: A = Grey-black-brown claystone.
 Upper case letters indicate values included in
 the main population. Lower case letters represent
 values in other populations.

 PP = Statistical data populations
 Y = Main population, not necessarily
 representative of sample maturity.
 N = Other populations.

 LOW+ HIGH = Population limits.

 VAL. = Number of measurements in that
 population.

Lithology cross-reference table

A = Clst. gy
 B = Clst. dk gy
 C = Clst. gn
 D = Clst. bn
 E = Clst. rd
 F = Clst. calc.
 G = Clst. carb.
 H = Shale
 I = Sandstone
 J = Limestone
 K = Coal
 L = Lignite
 M = Carbargillite
 N = Siltstone
 O = Bit
 P = X

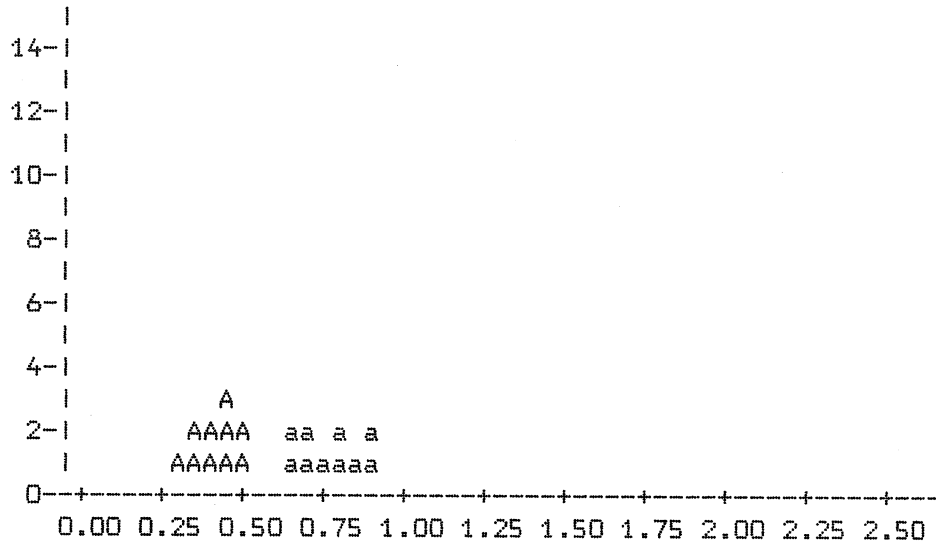


A dot plot showing the distribution of the number of 'd' characters in 2500 random strings of length 10. The x-axis represents the number of 'd's from 0.00 to 2.50 in increments of 0.25. The y-axis represents frequency from 0 to 14. The distribution is unimodal and centered around 0.5, with a peak frequency of 4 at 0.5 'd's.

Number of 'd's	Frequency
0.00	1
0.25	2
0.50	4
0.75	1
1.00	0
1.25	0
1.50	0
1.75	0
2.00	0
2.25	0
2.50	0

0.18d 0.23d 0.26d 0.29d 0.32d 0.34d 0.37d 0.39d 0.42d 0.43d 0.47d
0.50B 0.50D 0.50D 0.53D 0.58D 0.59D 0.59D 0.60D 0.83d

IKU# C-4801 112.0M 7323/7-U-1

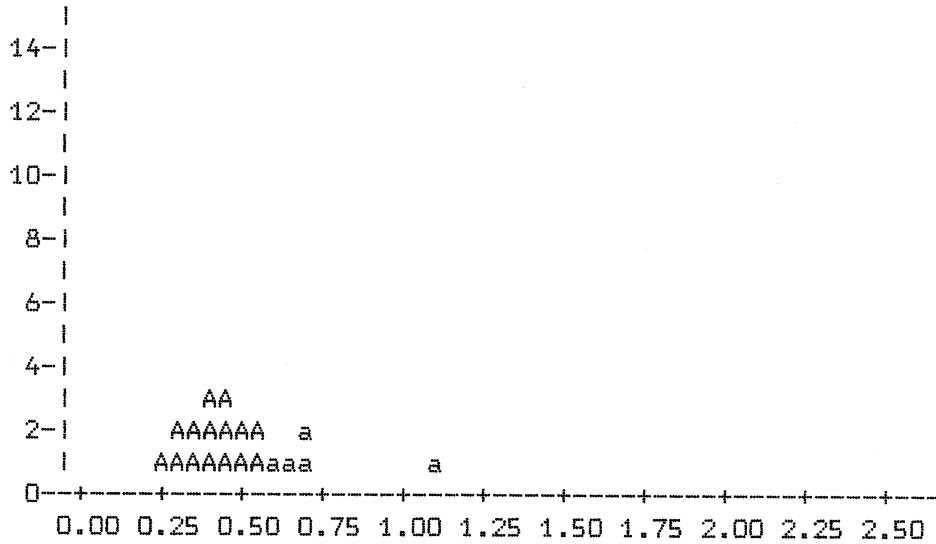


	PP	LOW	HIGH	LIT	#VAL	MEAN	STDV
Y	0.31	0.55	ALL	10	0.44	0.07	
N	0.65	0.94	ALL	10	0.78	0.10	
OVERALL	20	0.61	0.19				

ORDERED VALUES FOLLOW:

0.31A 0.39A 0.39A 0.41A 0.43A 0.45A 0.46A 0.48A 0.53A 0.54A 0.65a
 0.66a 0.72a 0.73a 0.76a 0.81a 0.83a 0.85a 0.90a 0.93a

IKU# C-4803 114.0M 7323/7-U-1

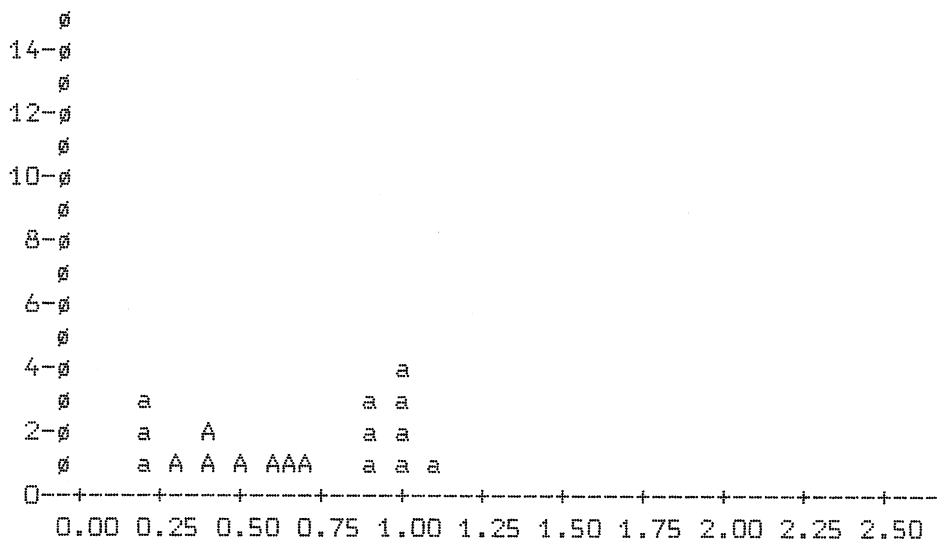


PP	LOW	HIGH	LIT	#VAL	MEAN	STDV
Y	0.28	0.58	ALL	15	0.44	0.09
N	0.64	0.71	ALL	3	0.67	0.03
N	1.13	1.14	ALL	1	1.13	0.00
OVERALL				20	0.52	0.19

ORDERED VALUES FOLLOW:

0.28A 0.32A 0.34A 0.39A 0.39A 0.42A 0.43A 0.44A 0.45A 0.48A 0.48A
 0.53A 0.54A 0.55A 0.57A 0.64a 0.66a 0.70a 0.71a 1.13a

IKU# C 4809 120.0M 7323/7-U-1



PP	LOW	HIGH	LIT	#VAL	MEAN	STDV
Y	0.31	0.72	ALL	7	0.52	0.15
N	0.20	0.25	ALL	3	0.22	0.02
N	0.91	1.11	ALL	8	1.00	0.06
OVERALL				18	0.68	0.32

ORDERED VALUES FOLLOW:

0.20a	0.22a	0.24a	0.31A	0.40A	0.41A	0.54A	0.60A	0.66A	0.71A	0.91a
0.94a	0.94a	1.00a	1.02a	1.04a	1.04a	1.10a				

APPENDIX III.6: TABLE OF CONTENTS continued

Core 7323/7-U-7:

TABLES

Table A.III.6.1a: Concentration of C_1-C_5 hydrocarbons in headspace gas.

Table A.III.6.1b: Concentration of C_1-C_5 hydrocarbons in occluded gas.

Table A.III.6.1c: Concentration of C_1-C_5 hydrocarbons - summation.

Table A.III.6.2: Total organic carbon and data from Rock-Eval pyrolysis.

Table A.III.6.3: Data from pyrolysis-gas chromatograms.

Table A.III.6.4: Vitrinite reflectance data.

FIGURES

Figure A.III.6.1: Pyrolysis-gas chromatograms (S2 peak).

Figure A.III.6.2: Vitrinite reflectance histograms.

Project no.: 21.3420.06
Well ident.: 7323/7-U-7
DATE : 28 - 10 - 86.

Table A.III.6.1a: Concentration of C₁-C₅ hydrocarbons in headspace gas.

[illegible]

Project no.: 21.3420.06
Well ident.: 7323/7-U-7
DATE : 28 - 10 - 86.

Table A.III.6.1b: Concentration of C₁-C₅+ hydrocarbons in occluded gas.

[illegible]

Project no.: 21.3420.06
Well ident.: 7323/7-U-7
DATE : 28 - 10 - 86.

Table A.III.6.1c: Concentration of C₁-C₅⁺ hydrocarbons - summation.

[illegible]

Table A.III.6.2: Total organic carbon and data from Rock-Eval
 pyrolysis.

IKU No.	DEPTH m/ft	S1 (mg/g ROCK)	S2 (mg/g ROCK)	S3 (mg/g ROCK)	TOC (%)	HYDR. INDEX (mg/g TOC)	OXYGEN INDEX (mg/g TOC)	PETROLEUM POTENTIAL S1+S2	PROD. INDEX S1+S2	TEMP. MAX (C)
C 4955	98.20	0.13	2.58	1.33	2.05	126	65	2.71	0.05	433
C 4956	98.98	****	****	****	2.14	*****	****	*****	*****	***
C 5262	99.50	0.06	0.97	1.28	0.61	159	210	1.03	0.06	430
C 4957	100.35	0.11	2.32	0.66	1.85	125	36	2.43	0.05	435
C 4958	100.95	****	****	****	1.53	*****	****	*****	*****	***
C 5264	101.55	0.11	1.72	0.49	1.51	114	32	1.83	0.06	426
C 5265	102.10	****	****	****	1.71	*****	****	*****	*****	***

DATE : 16 - 11 - 86.

Table A.III.6.3: Data from pyrolysis-gas chromatograms.

[illegible]

Well Identification: 7323/7-U-7
 Reference number: 21.3420.06
 (1/1)

Table A.III.6.4: Vitrinite reflectance data.

IKU NO	LOCATION	DEPTH (M)	VITRINITE REFLECTANCE	REL RAT	STANDARD DEVIATION	FLUORE- SCENCE
C 4956	----	99	0.38 (14) 0.21 (1) 0.65 (4)	F S R	0.08 0.00 0.05	4-6

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

Figure A.III.6.1: Pyrolysis-gas chromatograms (S2 peak).

Analysis 420C4957P 11,1,1 DIAS,7323/7-7,PY-GC

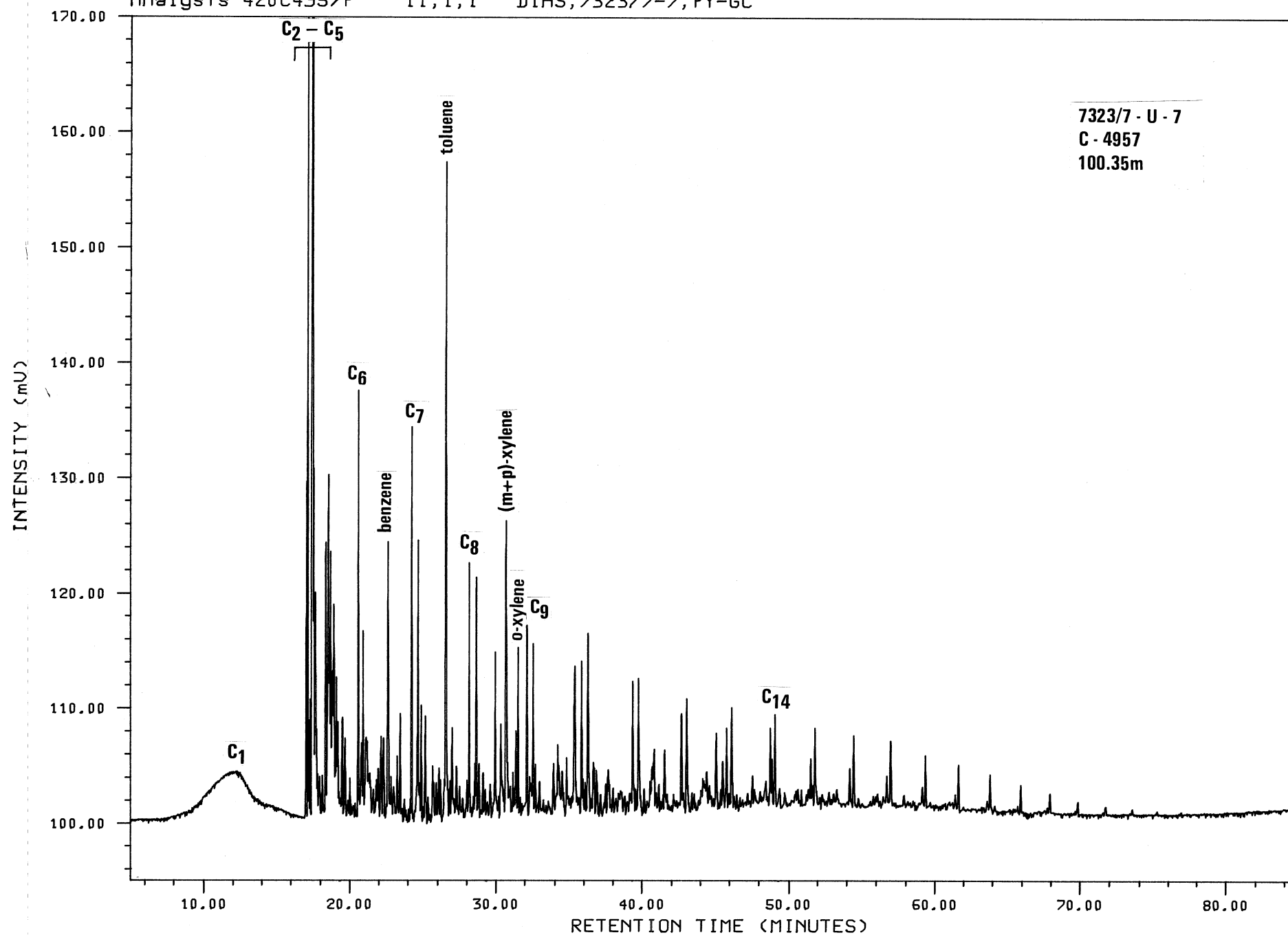


Figure A.III.6.2: Vitrinite reflectance histograms.

Key: A = Grey-black-brown claystone.
 Upper case letters indicate values included in
 the main population. Lower case letters represent
 values in other populations.

 PP = Statistical data populations
 Y = Main population, not necessarily
 representative of sample maturity.
 N = Other populations.

 LOW+ HIGH = Population limits.

 VAL. = Number of measurements in that
 population.

Lithology cross-reference table

A = Clst. gy
 B = Clst. dk gy
 C = Clst. gn
 D = Clst. bn
 E = Clst. rd
 F = Clst. calc.
 G = Clst. carb.
 H = Shale
 I = Sandstone
 J = Limestone
 K = Coal
 L = Lignite
 M = Carbargillite
 N = Siltstone
 O = Bit
 P = X

IKU# C 4956 99.0M 7323/7-U-7

```

  0
14-0
  0
12-0
  0
10-0
  0
  8-0
  0
  6-0
  0
  4-0
  0      DDD
  2-0      DDDD D d
  0      dDDDDDD ddd  d
0-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
  0.00 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00 2.25 2.50

```

```

PP LOW HIGH LIT #VAL MEAN STDV
Y 0.28 0.54 ALL 14 0.38 0.08
N 0.21 0.22 ALL 1 0.21 0.00
N 0.60 0.72 ALL 4 0.65 0.05
      OVERALL 20 0.45 0.18

```

ORDERED VALUES FOLLOW:

```

0.21d 0.28D 0.28D 0.29D 0.32D 0.33D 0.34D 0.38D 0.38D 0.39D 0.40D
0.41D 0.45D 0.50D 0.53D 0.60d 0.61d 0.67d 0.71d 0.93d

```

APPENDIX III.7: TABLE OF CONTENTS continued

Core 7323/7-U-9:

TABLES

- Table A.III.7.1a: Concentration of C_1-C_5 + hydrocarbons in headspace gas.
- Table A.III.7.1b: Concentration of C_1-C_5 + hydrocarbons in occluded gas.
- Table A.III.7.1c: Concentration of C_1-C_5 + hydrocarbons - summation.
- Table A.III.7.2: Total organic carbon and data from Rock-Eval pyrolysis.
- Table A.III.7.3: Data from pyrolysis-gas chromatograms.
- Table A.III.7.4: Vitrinite reflectance data.
- Table A.III.7.5: Weight of EOM and chromatographic fractions.
- Table A.III.7.6: Concentration of EOM and chromatographic fractions.
- Table A.III.7.7: Concentration of EOM and chromatographic fractions.
- Table A.III.7.8: Composition of material extracted from the rock.
- Table A.III.7.9: Tabulation of data from the gas chromatograms.
- Table A.III.7.10: Molecular ratios from sterane and terpane mass chromatograms. Maturity ratios.
- Table A.III.7.11: Molecular ratios from sterane and terpane mass chromatograms. Maturity and source characteristic ratios.
- Table A.III.7.12: Molecular ratios from mono- and tri-aromatic steranes.
- Table A.III.7.13: $\delta^{13}C$ and δD isotope ratios for adsorbed gas fractions.
- Table A.III.7.14: $\delta^{13}C$ isotope ratios for extract fractions.

FIGURES

- Figure A.III.7.1: Pyrolysis-gas chromatograms (S2 peak).
- Figure A.III.7.2: Saturated hydrocarbon gas chromatograms.
- Figure A.III.7.3: Aromatic hydrocarbon gas chromatograms.
- Figure A.III.7.4: Mass chromatograms of m/z 191 (terpanes).
- Figure A.III.7.5: Mass chromatograms of m/z 217 and 218 (steranes).
- Figure A.III.7.6: Mass chromatograms representing monoaromatic (m/z 239 and 253) and triaromatic (m/z 231) steranes.
- Figure A.III.7.7: Vitrinite reflectance histograms.

Project no.: 21.3420.06
Well ident.: 7323/7-U-9
DATE : 28 - 10 - 86.

Table A.III.7.1a: Concentration of C₁-C₅ + hydrocarbons in headspace gas.

I	I	I	I	I	I	I	I	I	I	I	I	I	I
I	IKU	DEPTH	C1	C2	C3	iC4	nC4	C5+	SUM	SUM	WET-	iC4	I
I	no.	m							C1-C4	C2-C4	NESS	-----	I
I											(%)	nC4	I
I	C 5083	94.70	5694						5694		0.00	*****	I
I	C 5088	99.10	11469	48					11516	48	0.41	*****	I
I	C 5081	103.48	22029	77					22106	77	0.35	*****	I
I	C 5085	107.63	4641	59	158				4858	218	4.48	*****	I
I	C 5084	109.38	3876		338	843	1072	56480	6129	2253	36.75	0.79	I
I	C 5089	115.38			39		125		164	164	100.00	0.00	I
I	C 5086	119.05					554	29298	554	554	100.00	0.00	I
I	C 5087	121.63	499	608	2188	493	2904	5330	6693	6194	92.54	0.17	I

Project no.: 21.3420.06
Well ident.: 7323/7-U-9
DATE : 28 - 10 - 86.

Table A.III.7.1b: Concentration of C₁-C₅+ hydrocarbons in occluded gas.

[illegible]

Project no.: 21.3420.06
Well ident.: 7323/7-U-9
DATE : 28 - 10 - 86.

Table A.III.7.1c: Concentration of C₁-C₅ hydrocarbons - summation.

[illegible]

[illegible]

DATE : 16 - 11 - 86.

Table A.III.7.3: Data from pyrolysis-gas chromatograms.

IKU No	DEPTH (m)	C1 %	C2-C5 %	C6-C14 %	C15+ %	(m+p)-xylene/ n-octene
C-4975	95.72	12.12	30.06	56.19	1.63	0.71
C-4979	102.78	10.68	27.79	59.55	1.97	0.20*
C-5279	106.97	10.44	25.83	58.08	5.65	0.58
C-4981	109.33	10.60	25.22	58.26	5.92	0.76
C-4985	117.03	21.93	33.65	44.27	0.15	0.76

* :- Possibly oil-stained

Well Identification: 7323/7-U-9

Reference number: 21.3420.06

(1/1)

Table A.III.7.4: Vitrinite reflectance data.

IKU NO	LOCATION	DEPTH (M)	VITRINITE REFLECTANCE	REL RAT	STANDARD DEVIATION	FLUORE- SCENCE
C 4976	----	73.3	0.49 (10) 0.22 (2) 0.69 (2)	F S R	0.10 0.01 0.02	3-5
C 4983	----	114.5	0.43 (13) 0.19 (2) 0.82 (4)	G S R	0.10 0.01 0.11	4-5

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

Project no.: 21.3420.06
Well ident.: 7323/7-U-9
DATE : 19 - 11 - 86.

Table A.III.7.5: Weight of EOM and chromatographic fractions.

I			: Rock							I
I	IKU-No	DEPTH	: Extr.	EOM	Sat.	Aro.	HC	Non HC	TOC	I
I			:							I
I		(m)	: (g)	(mg)	(mg)	(mg)	(mg)	(mg)	(%)	I
I			:							I
I			:							I
I	C 4973	93.90	: 20.9	54.5	5.4	8.9	14.3	40.2	3.66	I
I			:							I
I	C 4979	102.78	: 15.6	204.2	86.8	48.3	135.1	69.1	1.63	I
I			:							I
I	C 4981	109.33	: 25.3	32.9	2.6	4.3	7.0	25.9	0.18	I
I			:							I
I	C 4993	121	: 17.4	22.3	2.4	1.2	3.6	18.7		I
I			:							I
I	C 4987	121.23	: 2.1	3.3	1.9	0.6	2.5	0.8	0.87	I
I			:							I

Project no.: 21.3420.06
 Well ident.: 7323/7-U-9
 DATE : 19 - 11 - 86.

Table A.III.7.6: Concentration of EOM and chromatographic fractions.

I			:						I
I	IKU-No	DEPTH	:	EOM	Sat.	Aro.	HC	Non HC	I
I		(m)	:						I
I			:						I
I	C 4973	93.90	:	2614	259	426	685	1929	I
I	C 4979	102.78	:	13073	5557	3089	8646	4427	I
I	C 4981	109.33	:	1300	104	171	275	1025	I
I	C 4993	121	:	1285	138	69	207	1078	I
I	C 4987	121.23	:	1602	932	291	1223	379	I
I			:						I

Project no.: 21.3420.06
 Well ident.: 7323/7-U-9
 DATE : 19 - 11 - 86.

Table A.III.7.7: Concentration of EOM and chromatographic fractions.

I	I	I	I	I	I	I	I	I	I
I	IKU-No	DEPTH	:	EOM	Sat.	Aro.	HC	Non HC	I
I		(m)	:						I
I			:						I
I	C 4973	93.90	:	71.4	7.1	11.6	18.7	52.7	I
I	C 4979	102.78	:	802.0	340.9	189.5	530.4	271.6	I
I	C 4981	109.33	:	722.2	57.9	94.8	152.8	569.4	I
I	C 4993	121	:						I
I	C 4987	121.23	:	184.1	107.1	33.5	140.6	43.5	I
I			:						I

Project no.: 21.3420.06
Well ident.: 7323/7-U-9
DATE : 19 - 11 - 86.

Table A.III.7.8: Composition of material extracted from the rock.

I			:	Sat	Aro	HC	SAT	Non HC	HC	I
I	IKU-No	DEPTH	:	---	---	---	---	---	---	I
I			:	EOM	EOM	EOM	Aro	EOM	Non HC	I
I		(m)	:	%	%	%	x 100	%	x 100	I
I			:							I
I	C 4973	93.90	:	9.9	16.3	26.2	60.8	73.8	35.5	I
I			:							I
I	C 4979	102.78	:	42.5	23.6	66.1	179.9	33.9	195.3	I
I			:							I
I	C 4981	109.33	:	8.0	13.1	21.2	61.1	78.8	26.8	I
I			:							I
I	C 4993	121	:	10.8	5.4	16.1	200.0	83.9	19.3	I
I			:							I
I	C 4987	121.23	:	58.2	18.2	76.4	320.0	23.6	323.1	I
I			:							I

Table A.III.7.9: Tabulation of data from the gas chromatograms.

I	DEPTH	:	PRISTANE	PRISTANE	PHYTANE	A	n-C17		I
I	IKU No.	:	-----	A = -----	B = -----	-----	-----	CPI	I
I	(m)	:	PHYTANE	n-C17	n-C18	B	n-C27		I
I		:							I
I		:							I
I	C 4973	93.90	0.9	3.7	4.6	0.8	1.0	1.0	I
I		:							I
I	C 4979	102.78	2.5	0.4	0.9	0.4	0.8	1.1	I
I		:							I
I	C 4981	109.33	1.2	3.5	3.9	0.9	1.7	1.2	I
I		:							I
I	C 4993	121	1.0	1.0	1.0	1.0	1.7	1.2	I
I		:							I
I	C 4987	121.23	1.3	1.0	0.7	1.5	2.1	1.1	I
I		:							I

DATE : 24 - 11 - 86.

Table A.III.7.10 Molecular ratios from sterane and terpane mass chromatograms.
Maturity ratios.

IKU code	Well/depth	$\alpha\beta/\alpha\beta+\beta\alpha$ ¹⁾	%22S ²⁾	%20S ³⁾	% $\beta\beta$ ⁴⁾
<u>Well 7323/7-U-9</u>					
C-4979	102.78 m	0.91	60.9	25.9	71.0
C-4981	109.33 m	0.88	24.4	2.0	31.8
C-4993	121.00 m	0.77	22.3	9.8	53.2

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

2) Average % distribution between first and second eluting isomers of extended hopanes (G-M in m/z 191)

3) q/q+t in m/z 217

4) $2(r+s)/(q+t+2(r+s))$ in m/z 217

Table A.III.7.11 Molecular ratios from terpane and sterane mass chromatograms.
 Maturity and source characteristic ratios.

IKU no.	Well/depth	Q/E ¹⁾	T _m /T _s ²⁾	X/E ³⁾	Z/E ⁴⁾	a/a+j ⁵⁾
<u>Well 7323/7-U-9</u>						
C-4979	102.78 m	0.38	0.3	0.13	-	0.72
C-4981	109.33 m	0.03	1.3	-	0.10	0.07
C-4993	121.00 m	0.07	2.9	0.03	-	0.34

- 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 C₂₇ rearranged steranes (a/a+j in m/z 217)

Table A.III.7.12 Molecular ratios from mono- and tri-aromatic steranes.

IKU code	Core	$\%C_{20}/C_{26,27}$ m/z 231	$\%C_{21}/C_{28,29}$ m/z 253
----------	------	---------------------------------	---------------------------------

Well 7323/7-U-9 no.12

C-4993	121.00 m	28.6	6.1
--------	----------	------	-----

Table A.III.7.13a: Gas composition of the hydrocarbons C_1 to C_7 of adsorbed gas of core samples (Vol %).

Sample no.	Depth (m)	C_1	C_2	C_3	iC_4	nC_4	2.2DMP	iC_5	nC_5	C_6	C_7
------------	-----------	-------	-------	-------	--------	--------	--------	--------	--------	-------	-------

Well 7323/7-U-9

C-5081	103.48	67.61	8.88	5.15	2.33	1.99	0.64	1.65	0.65	8.86	2.24
--------	--------	-------	------	------	------	------	------	------	------	------	------

Table A.III.7.13b: Gas yields of the hydrocarbons C_1 to C_7 of adsorbed gas of core samples (ppb).

Sample no.	Depth (m)	C_1	C_2	C_3	iC_4	nC_4	2.2DMP	iC_5	nC_5	C_6	C_7
------------	-----------	-------	-------	-------	--------	--------	--------	--------	--------	-------	-------

Well 7323/7-U-9

C-5081	103.48	1257	309	263	157	134	53	138	54	885	223
--------	--------	------	-----	-----	-----	-----	----	-----	----	-----	-----

Table A.III.7.13c: Gas ratios and isotope ratios of the hydrocarbons C_1 to C_7 of adsorbed gas of core samples.

Sample no.	Depth (m)	$C_1/\Sigma C_n$	$C_1/(C_2+C_3)$	iC_4/nC_4	$\delta^{13}C_1$	$\delta^{13}C_1$	$\delta^2 C_1$
------------	-----------	------------------	-----------------	-------------	------------------	------------------	----------------

Well 7323/7-U-9

C-5081	103.48	0.6761	4.81	1.17	-52.1	-34.1	--
--------	--------	--------	------	------	-------	-------	----

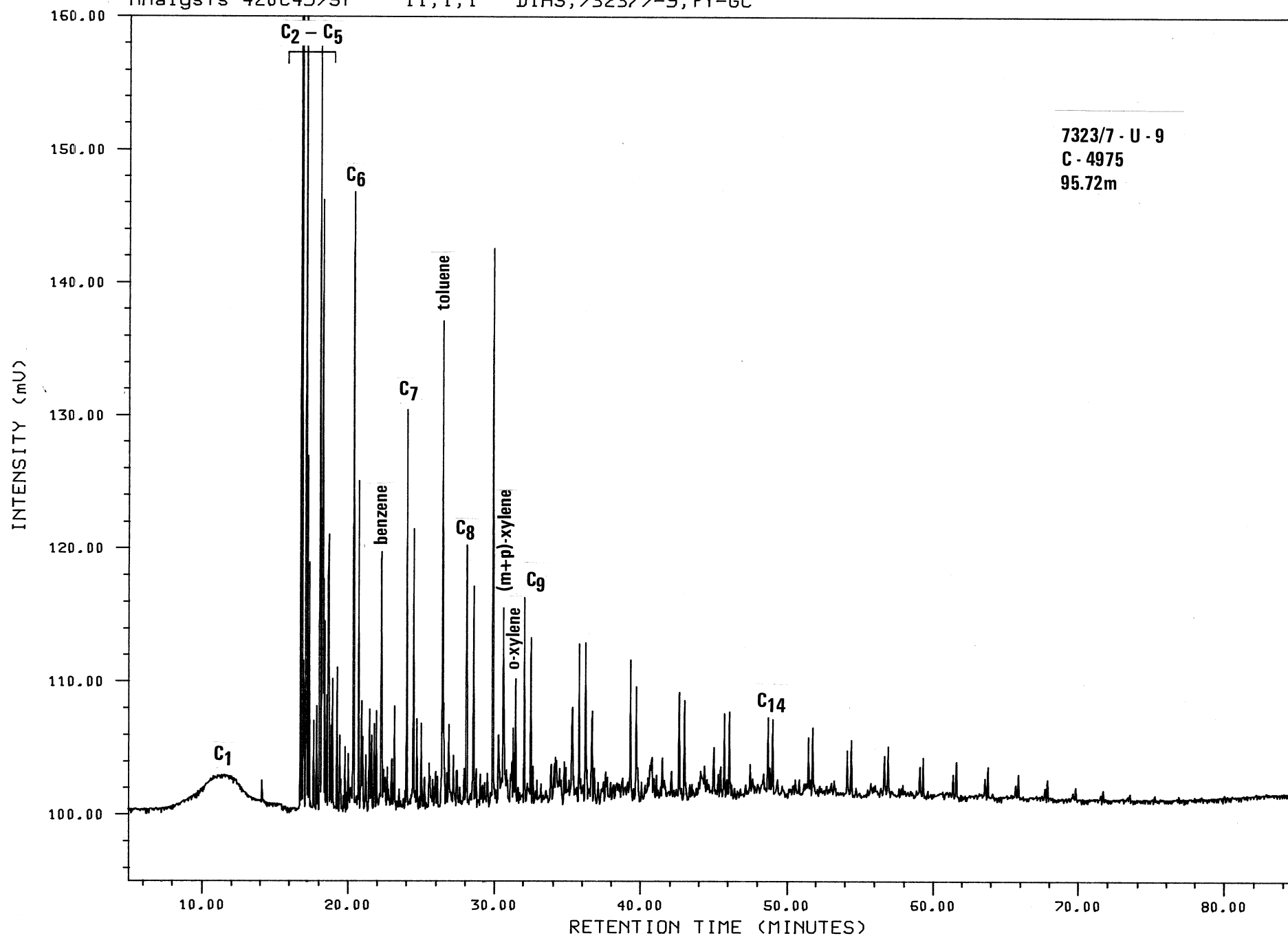
Table A.III.7.14: $\delta^{13}\text{C}$ isotope ratios for extract fractions.

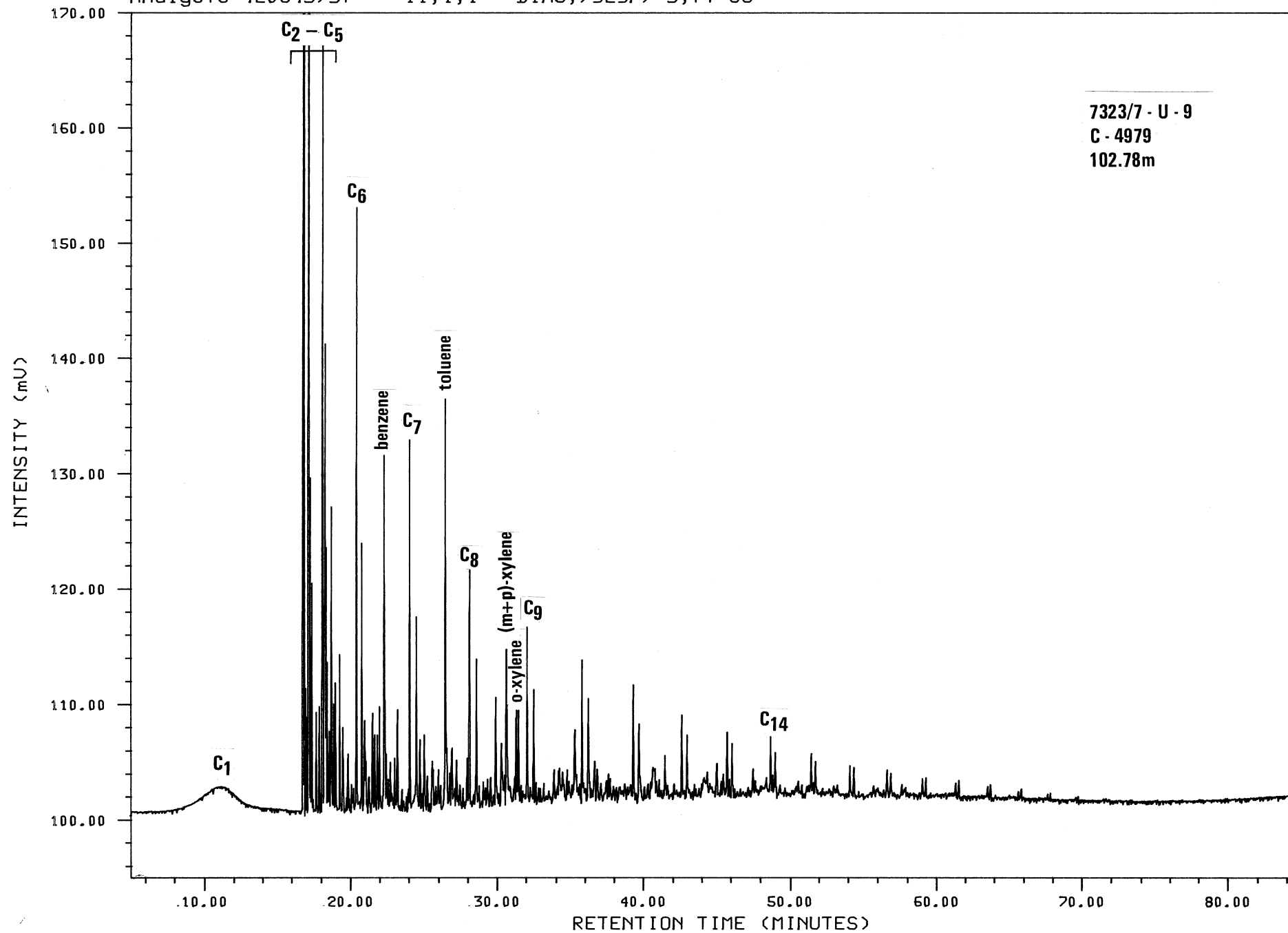
Sample no.	Depth	$\delta^{13}\text{C}$ SAT	$\delta^{13}\text{C}$ ARO	$\delta^{13}\text{C}$ ASP	$\delta^{13}\text{C}$ NSO
------------	-------	------------------------------	------------------------------	------------------------------	------------------------------

Well 7323/7-U-9

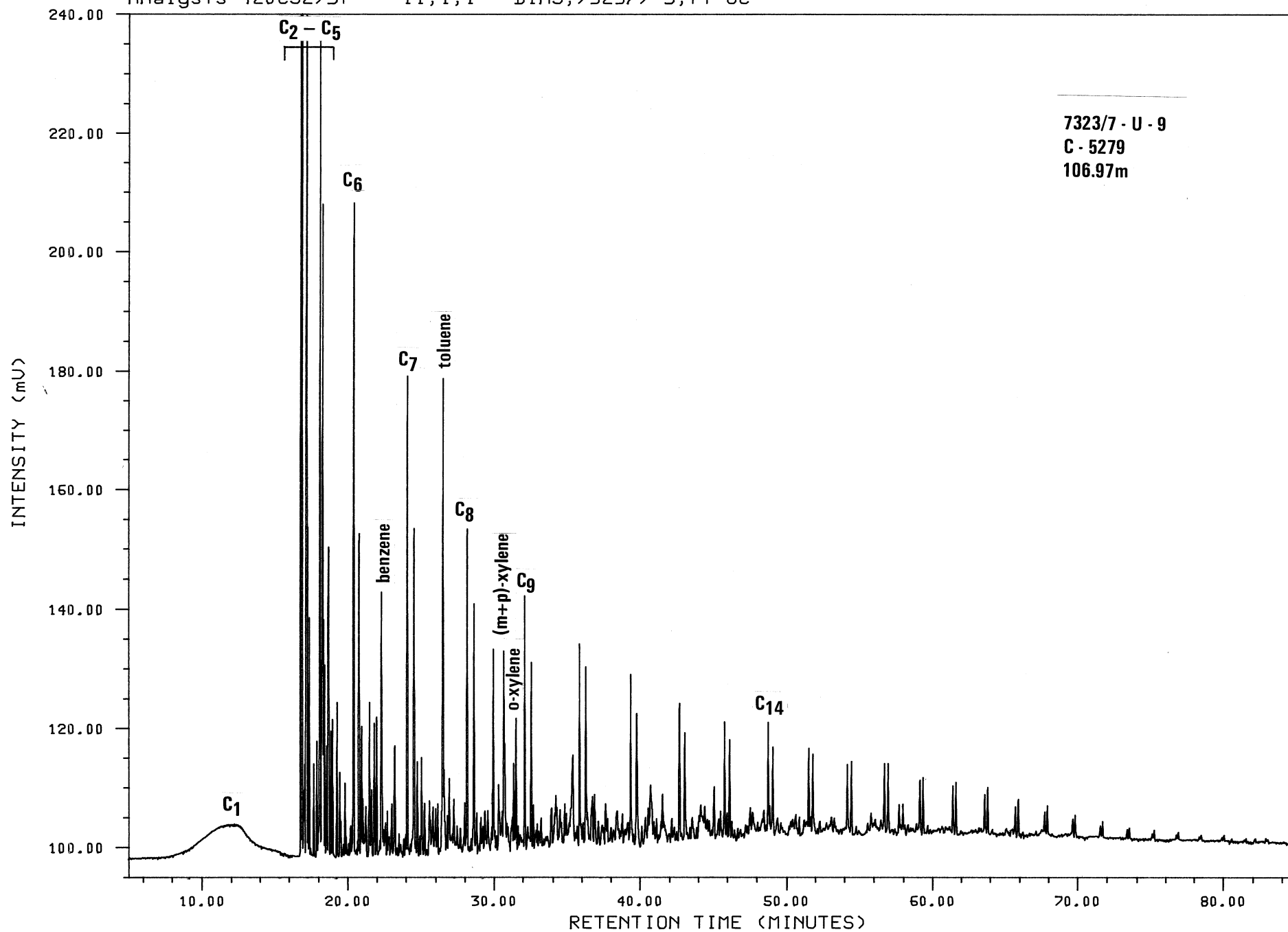
C-4979	102.78 m	-30.98	-30.87	-29.54	-34.39
C-4981	102.33 m	-32.07	-31.24	-29.63	-30.99

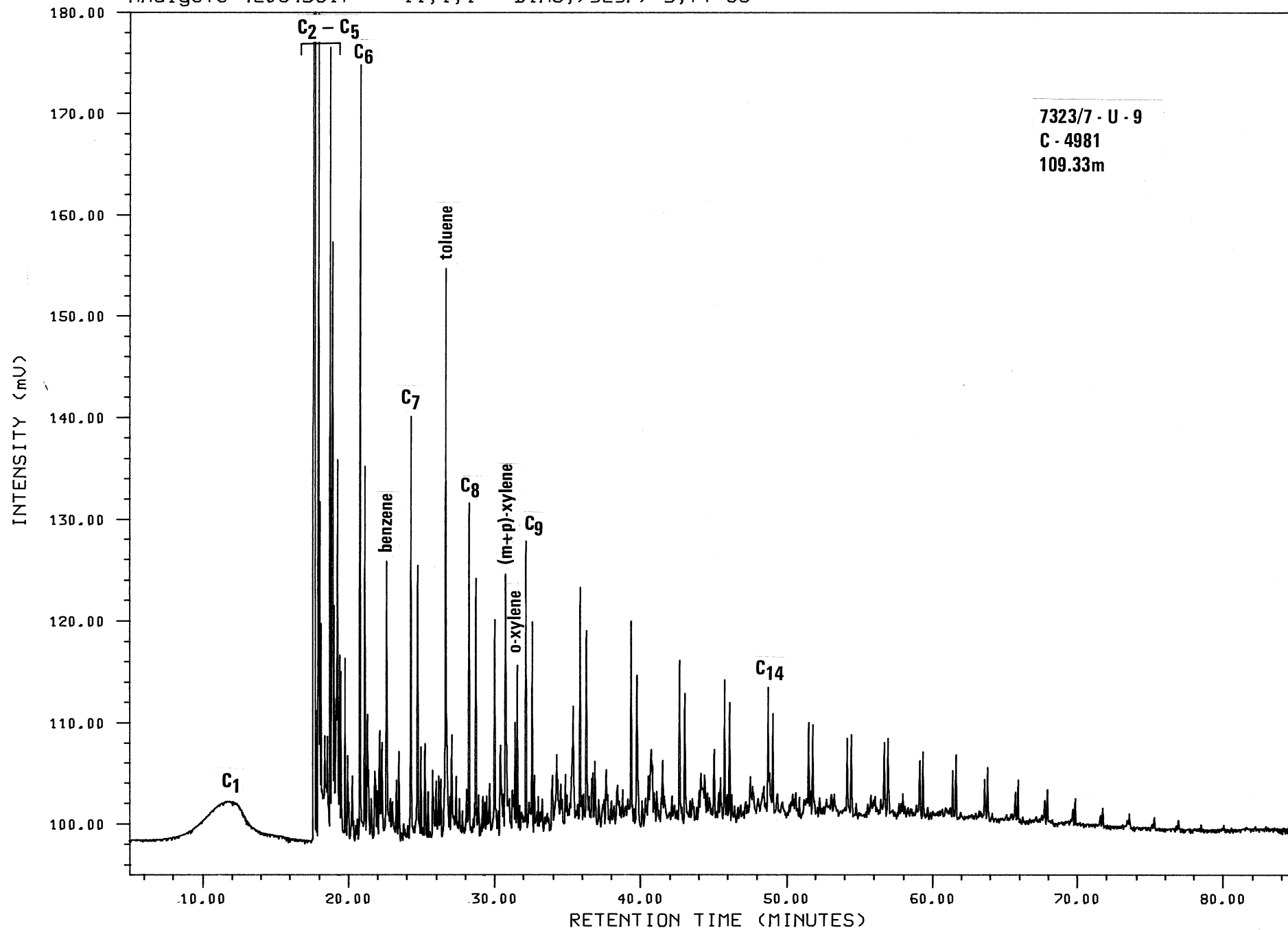
Figure A.III.7.1: Pyrolysis-gas chromatograms (S2 peak).





Analysis 420C5279P 11,1,1 DIAS,7323/7-9,PY-GC





Analysis 420C4985P 11,1,1 DIAS,7323/7-9,PY-GC

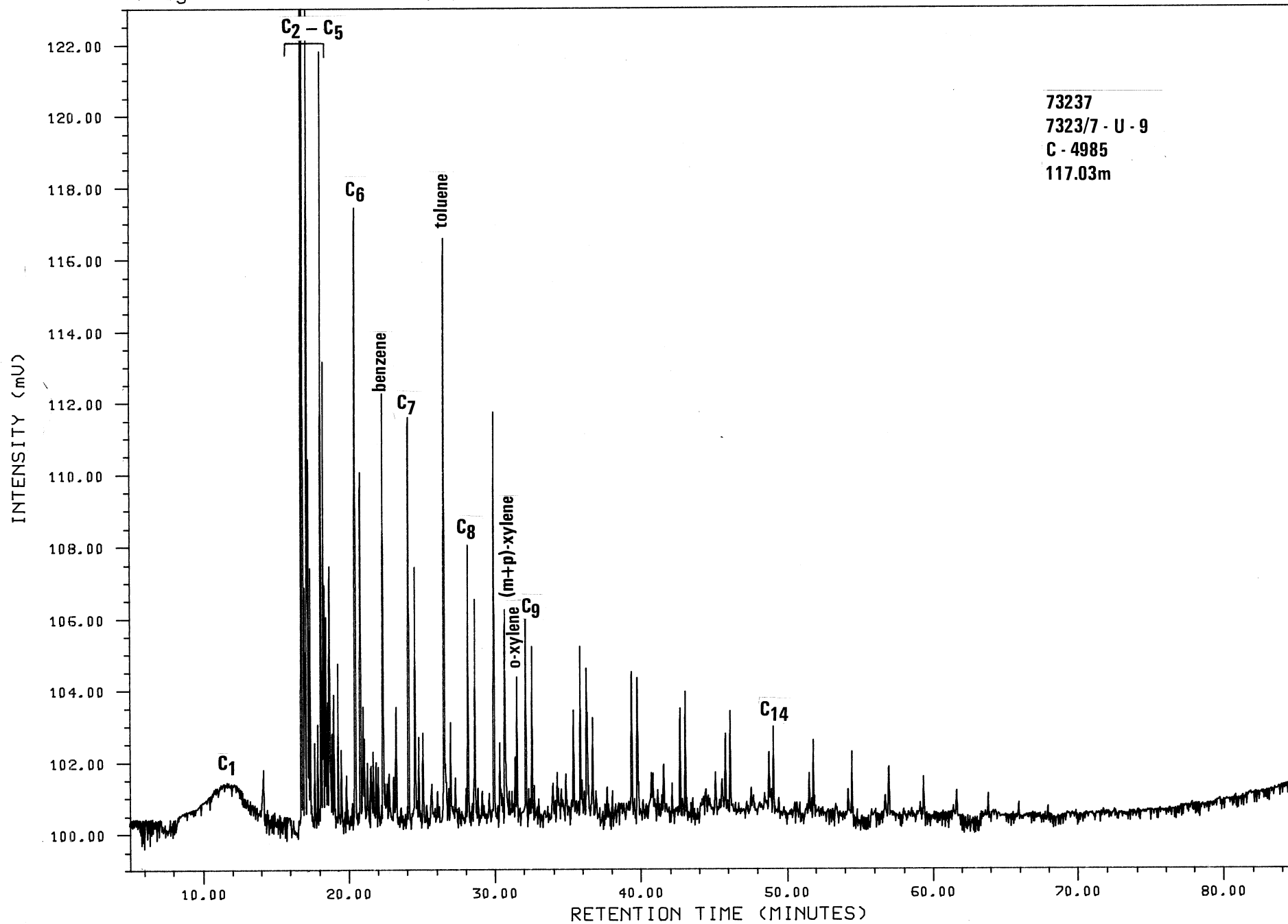


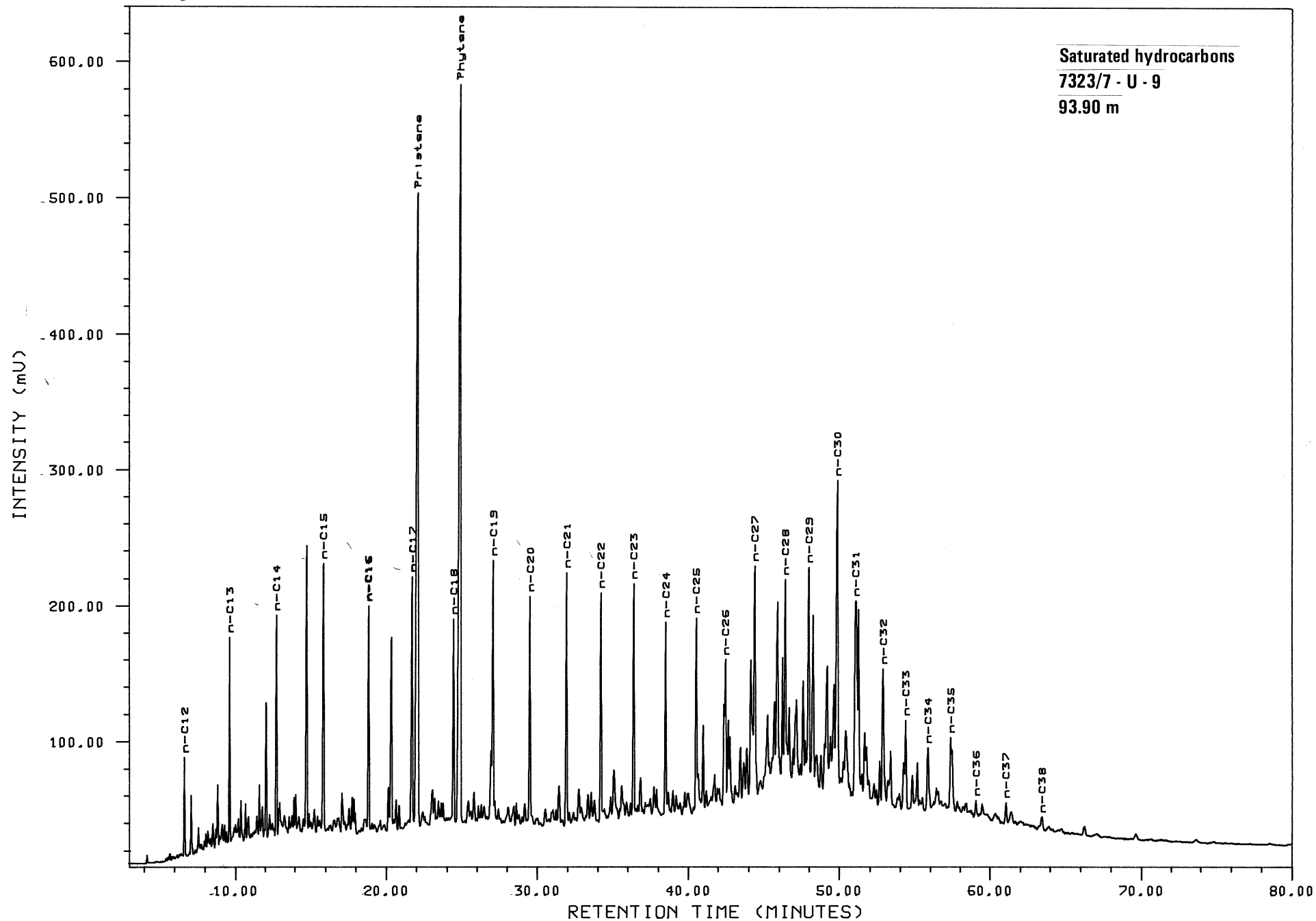
Figure A.III.7.2: Saturated hydrocarbon gas chromatograms.

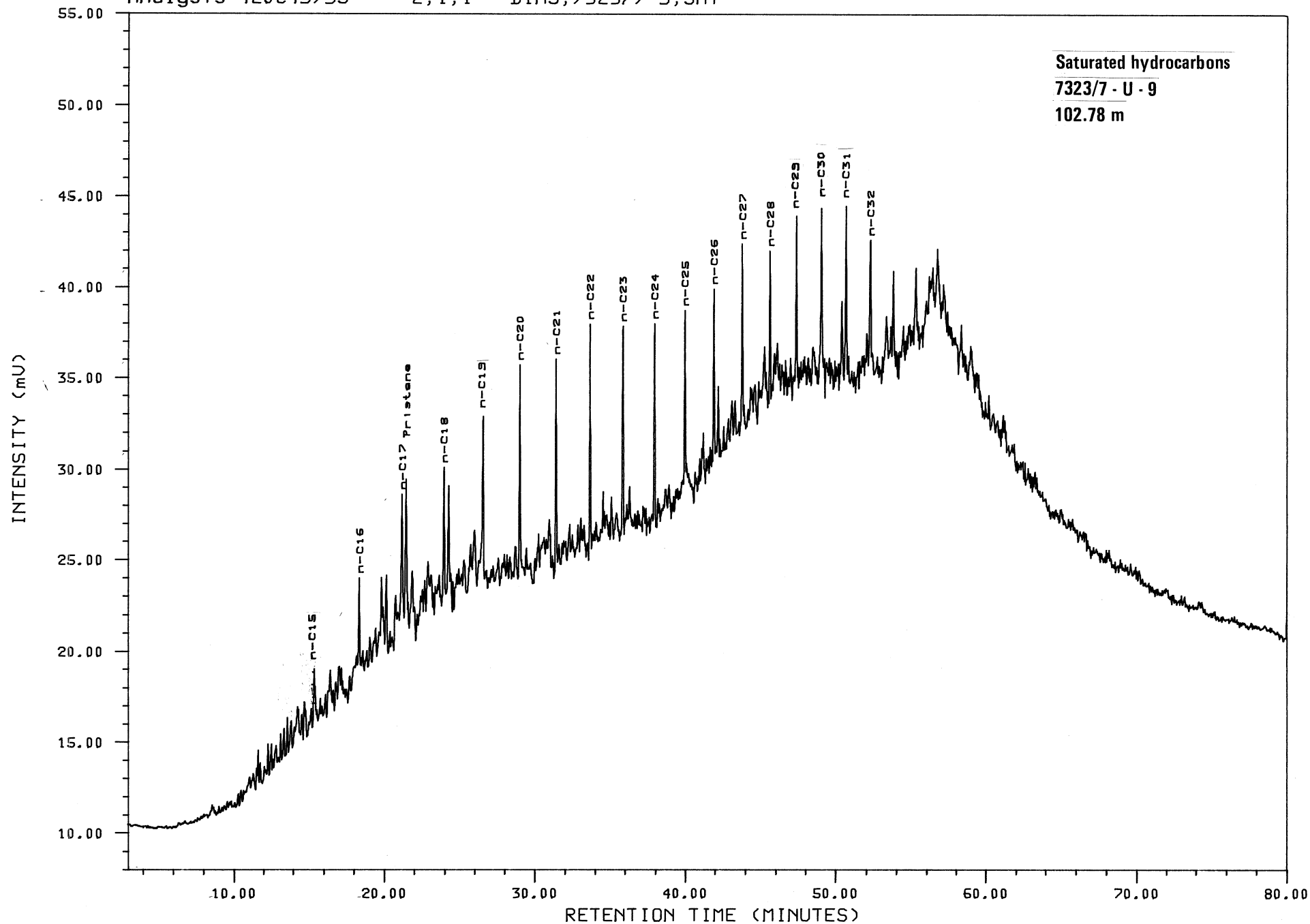
n-C ₁₅ etc.	- n-alkanes
Pr	- pristane
Ph	- phytane
*	- other acyclic isoprenoids

Analysis 420C4973S

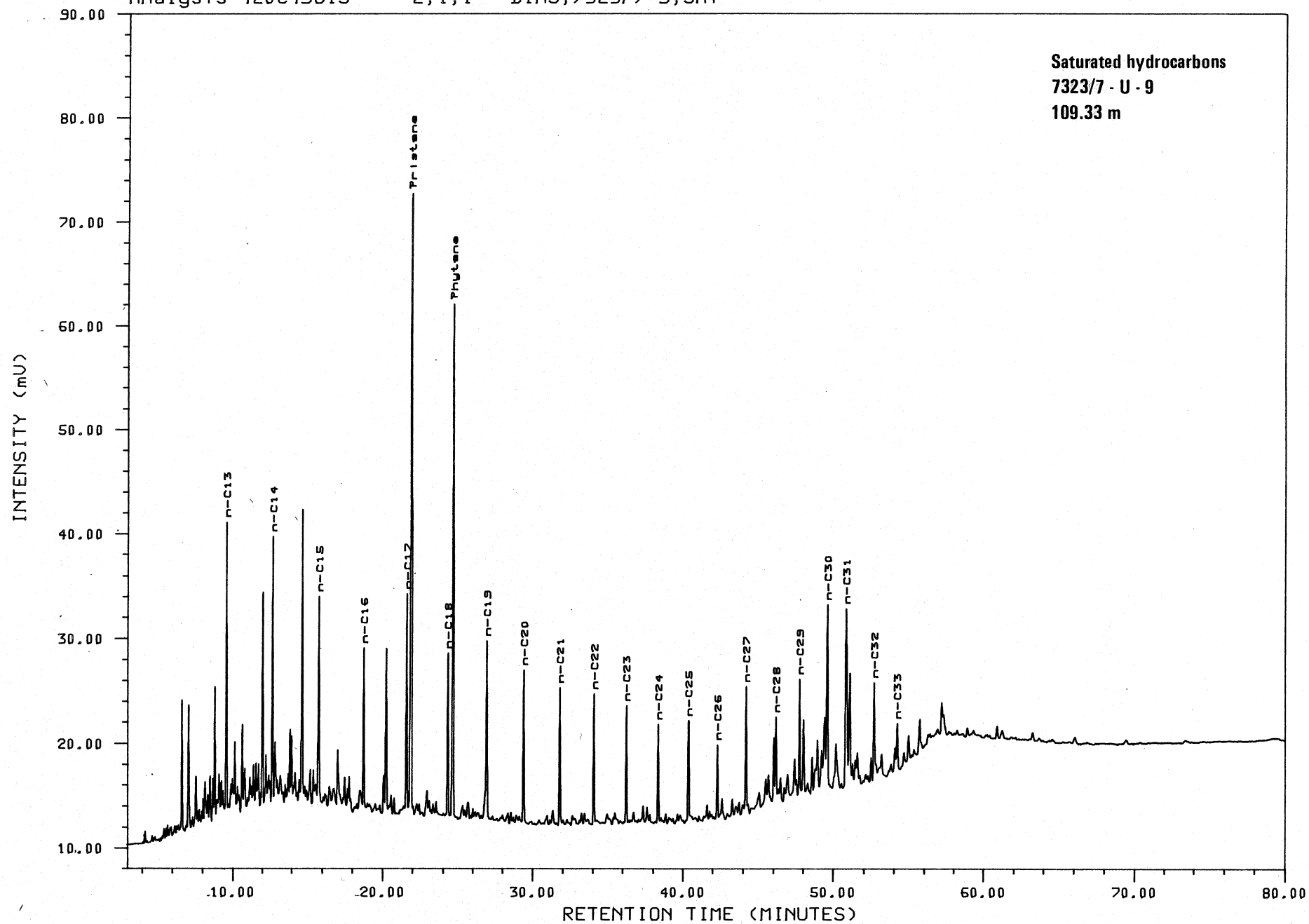
2,1,1

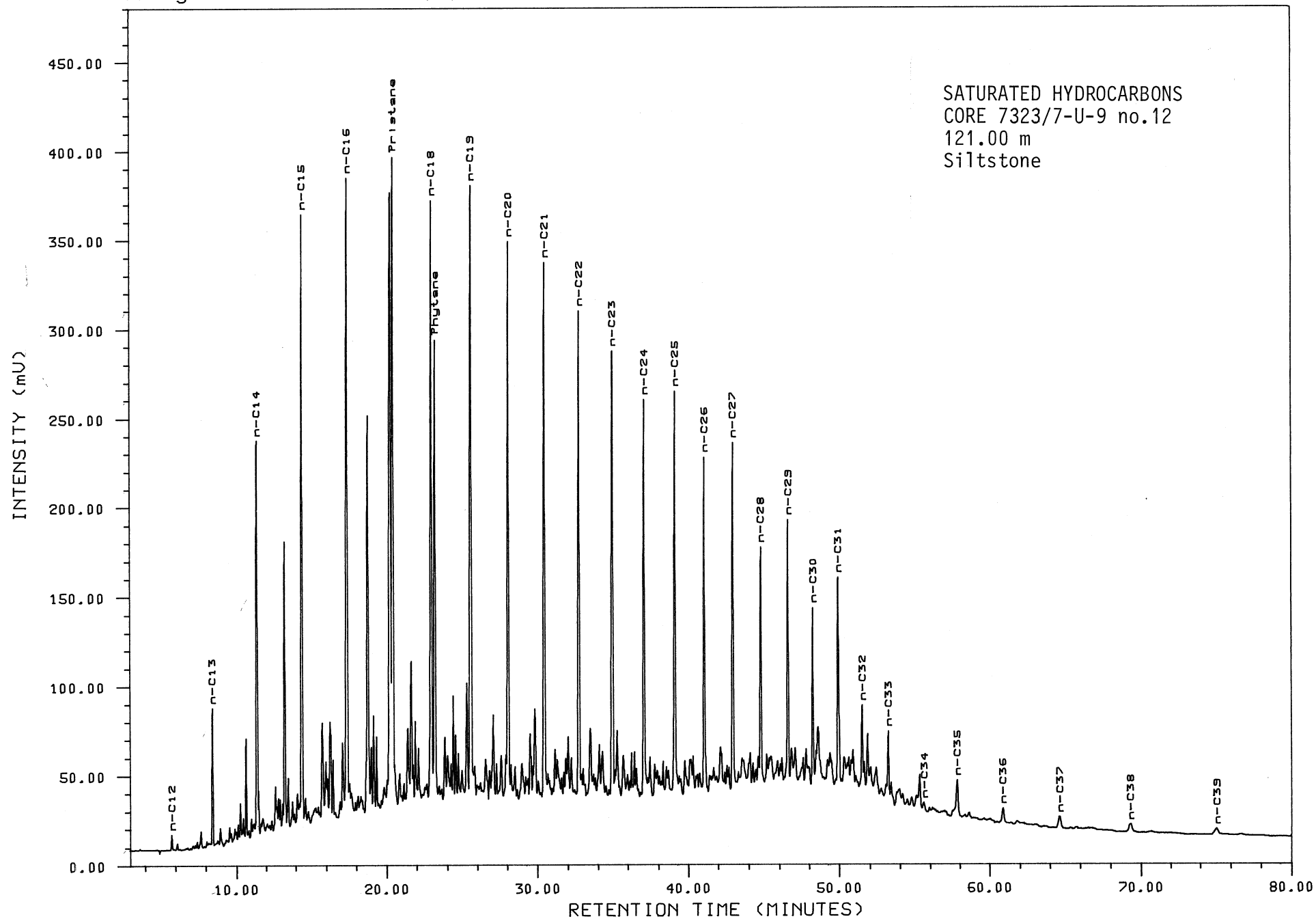
DIAS,7323/7-9,SAT





Analysis 420C4981S 2,1,1 DIAS,7323/7-9,SAT





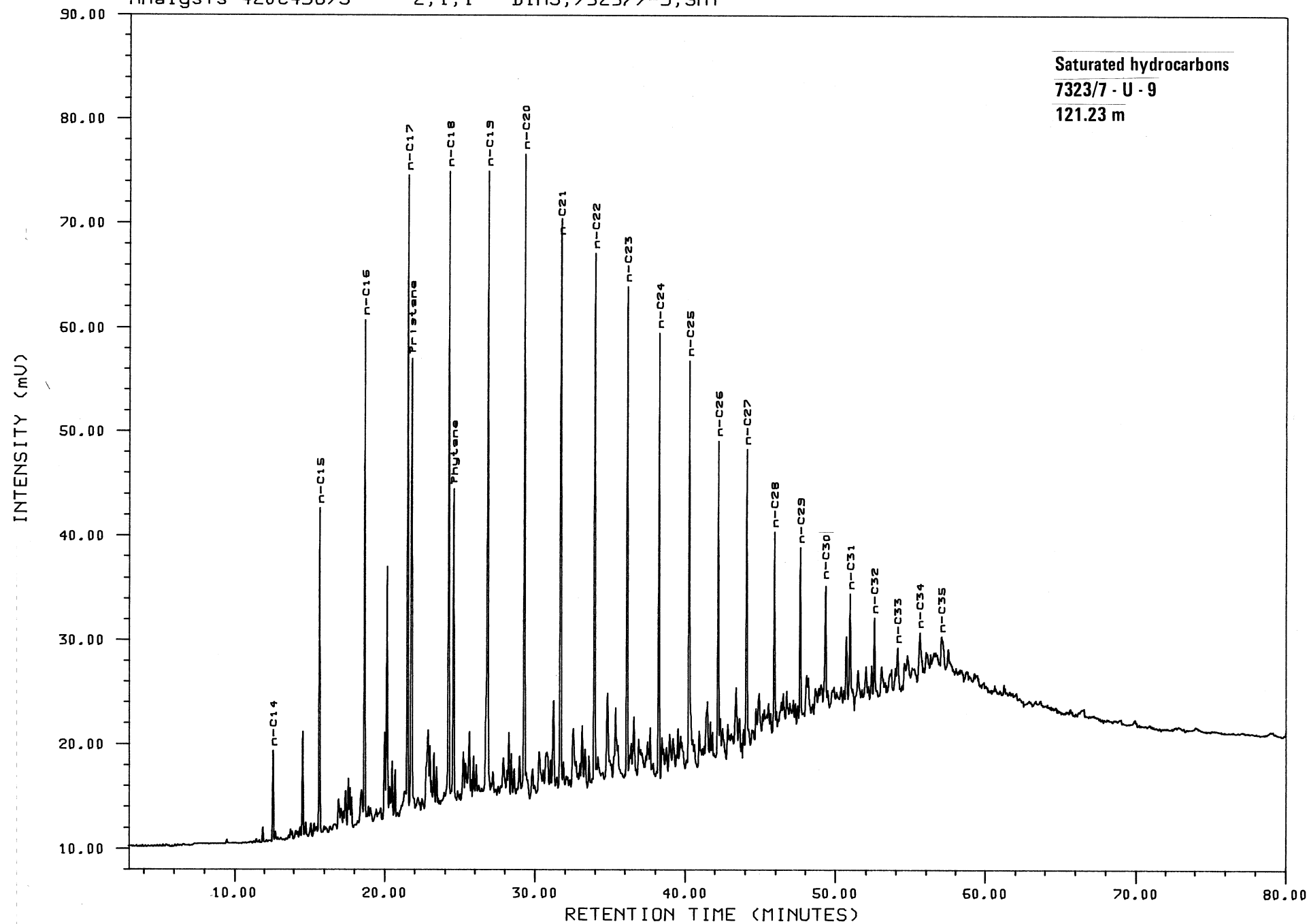
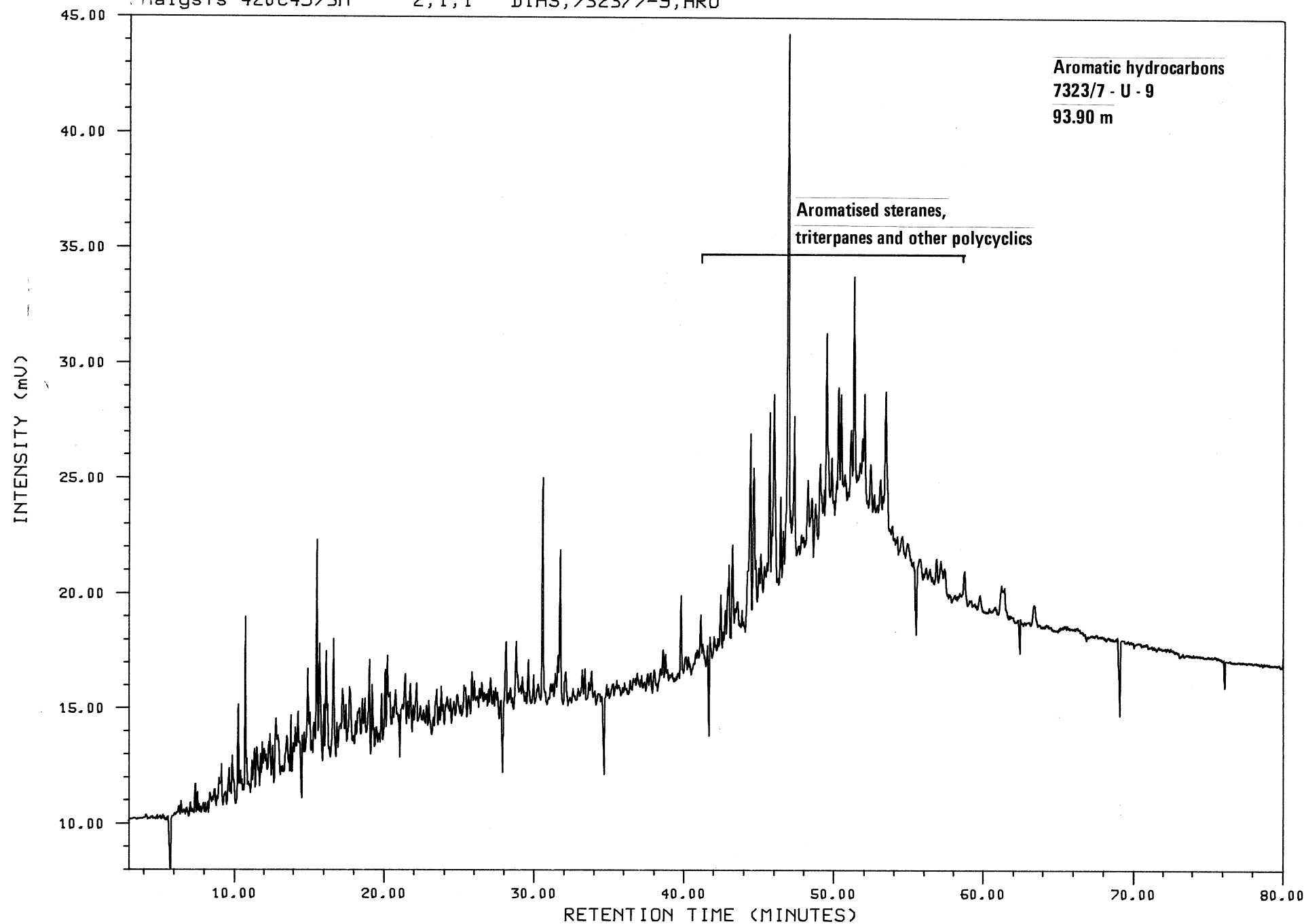


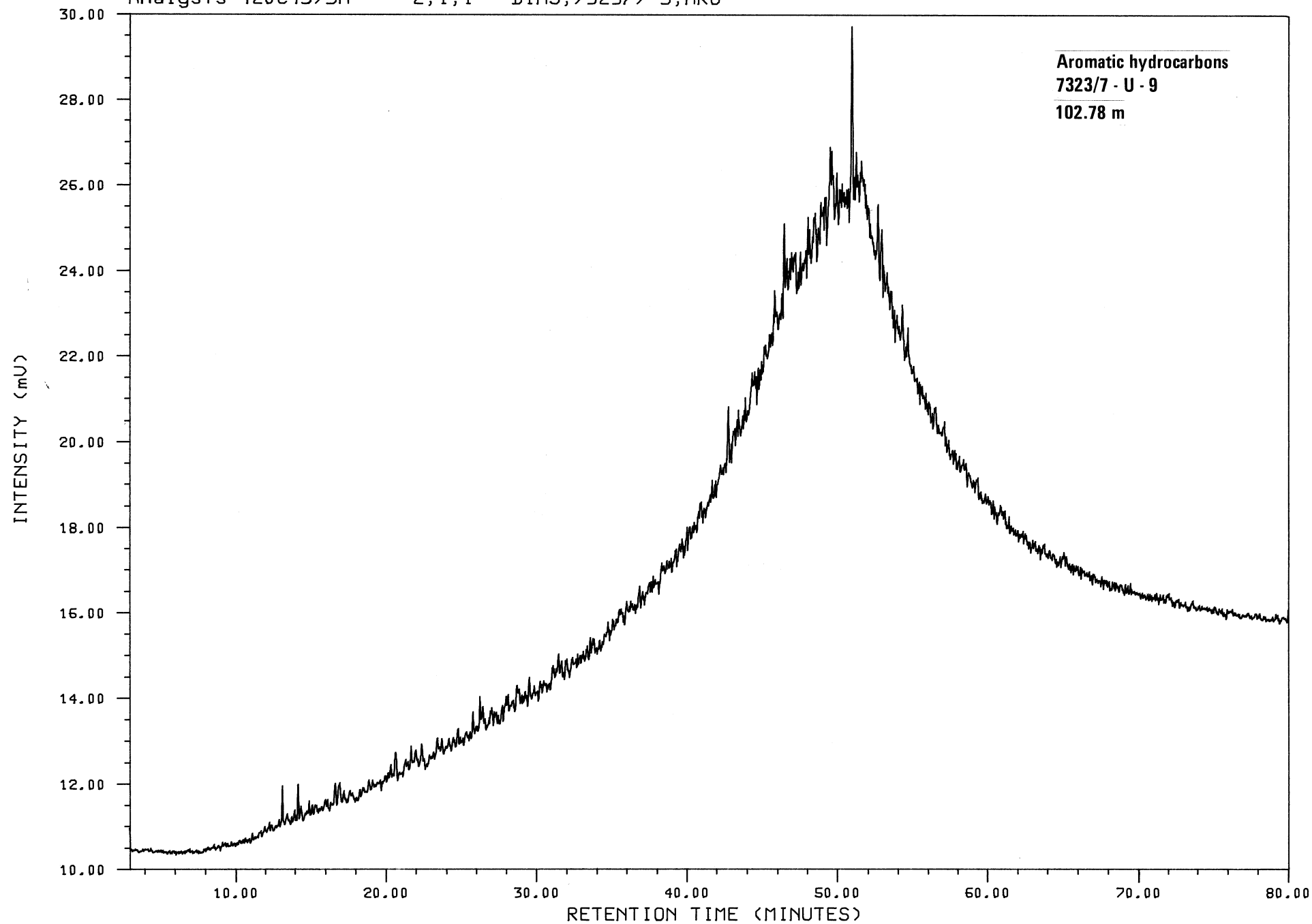
Figure A.III.7.3: Aromatic hydrocarbon gas chromatograms.

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

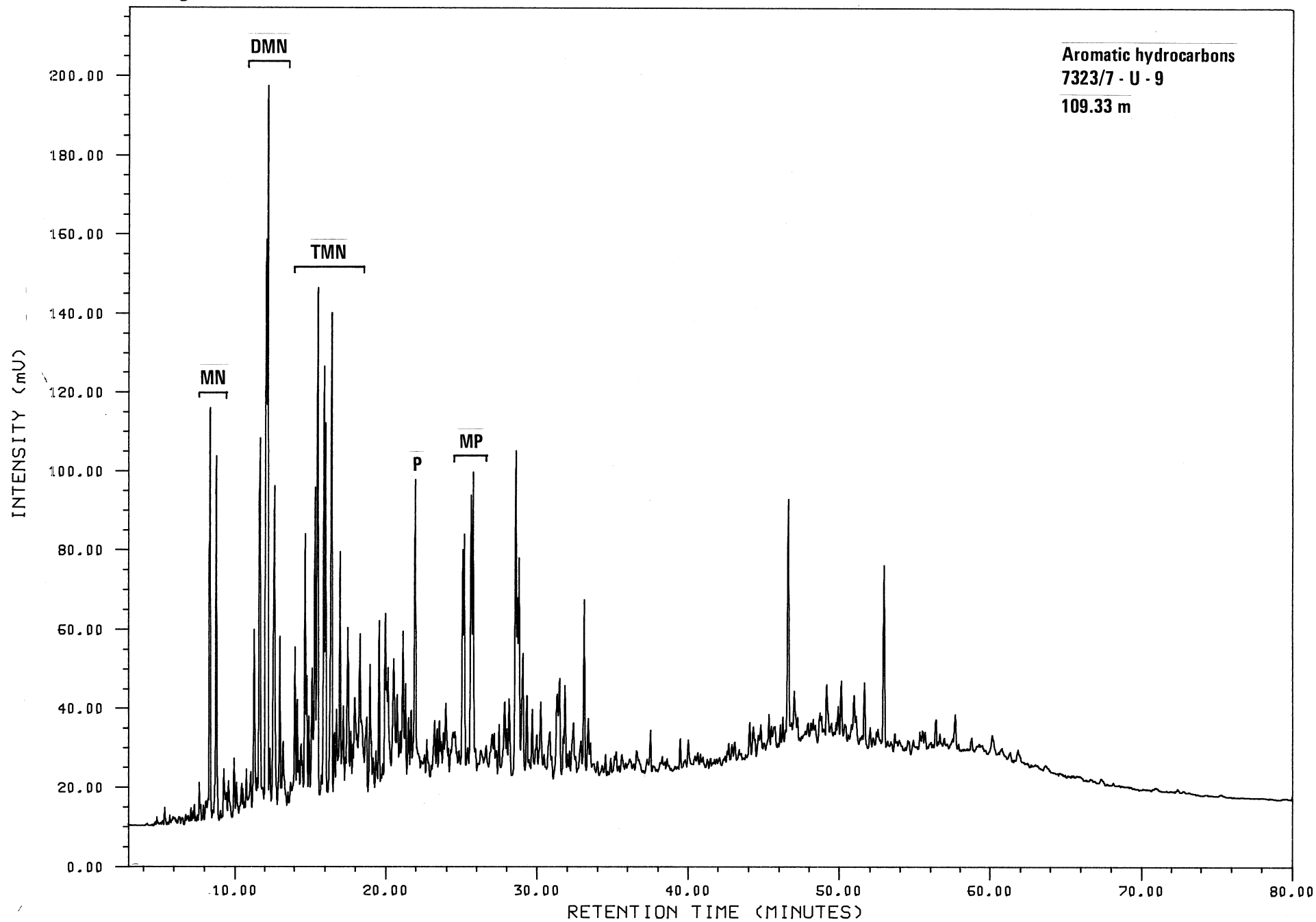


Analysis 420C4979A 2,1,1 DIAS,7323/7-9,ARO

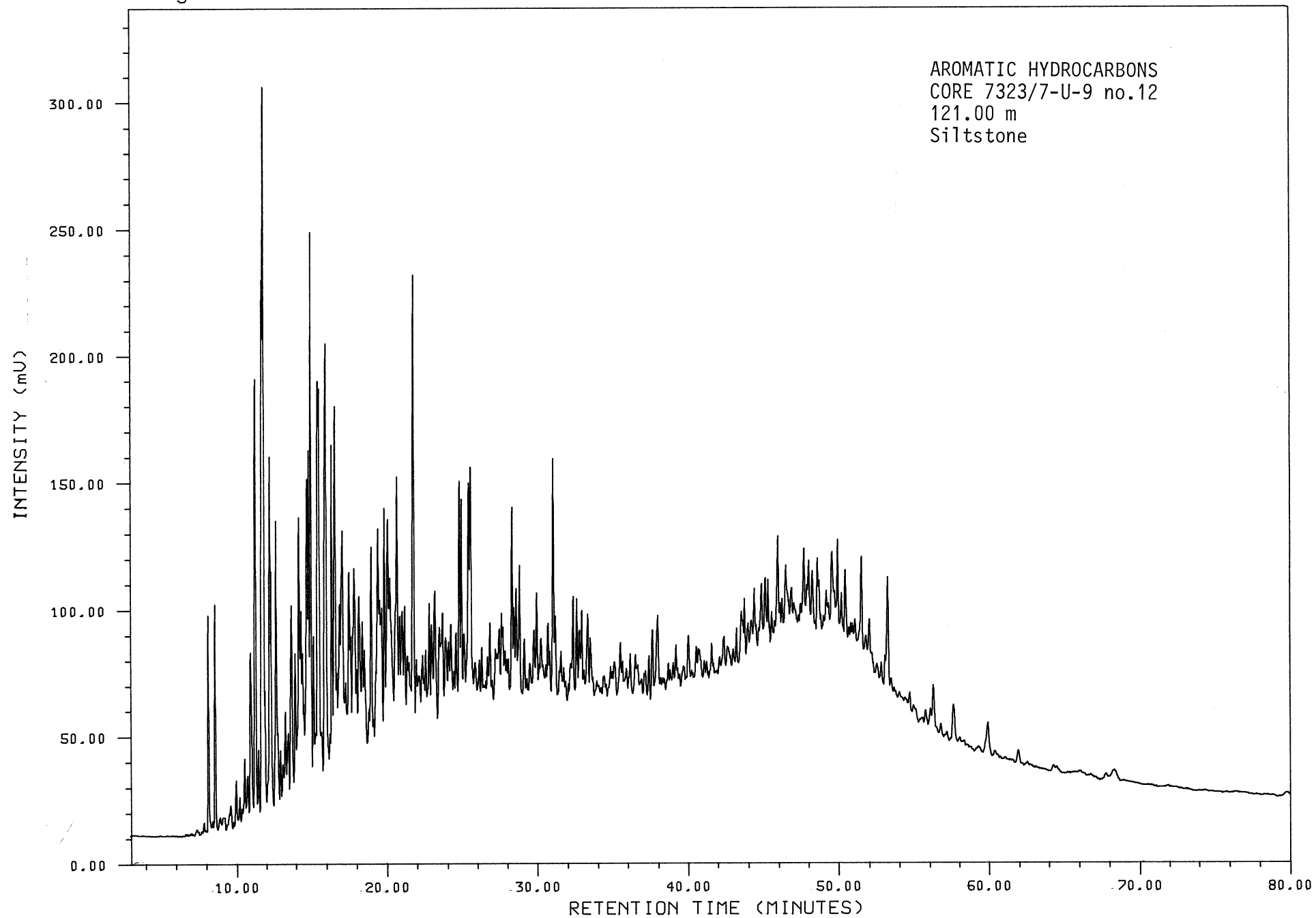
Aromatic hydrocarbons
7323/7 - U - 9
102.78 m



Analysis 420C4981A 2,1,1 DIAS,7323/7-9,ARO



Analysis 420C4993A 2,1,1 DIAS.21.3420.04



Analysis 420C4987A 2,1,1 DIAS,7323/7-9,ARO

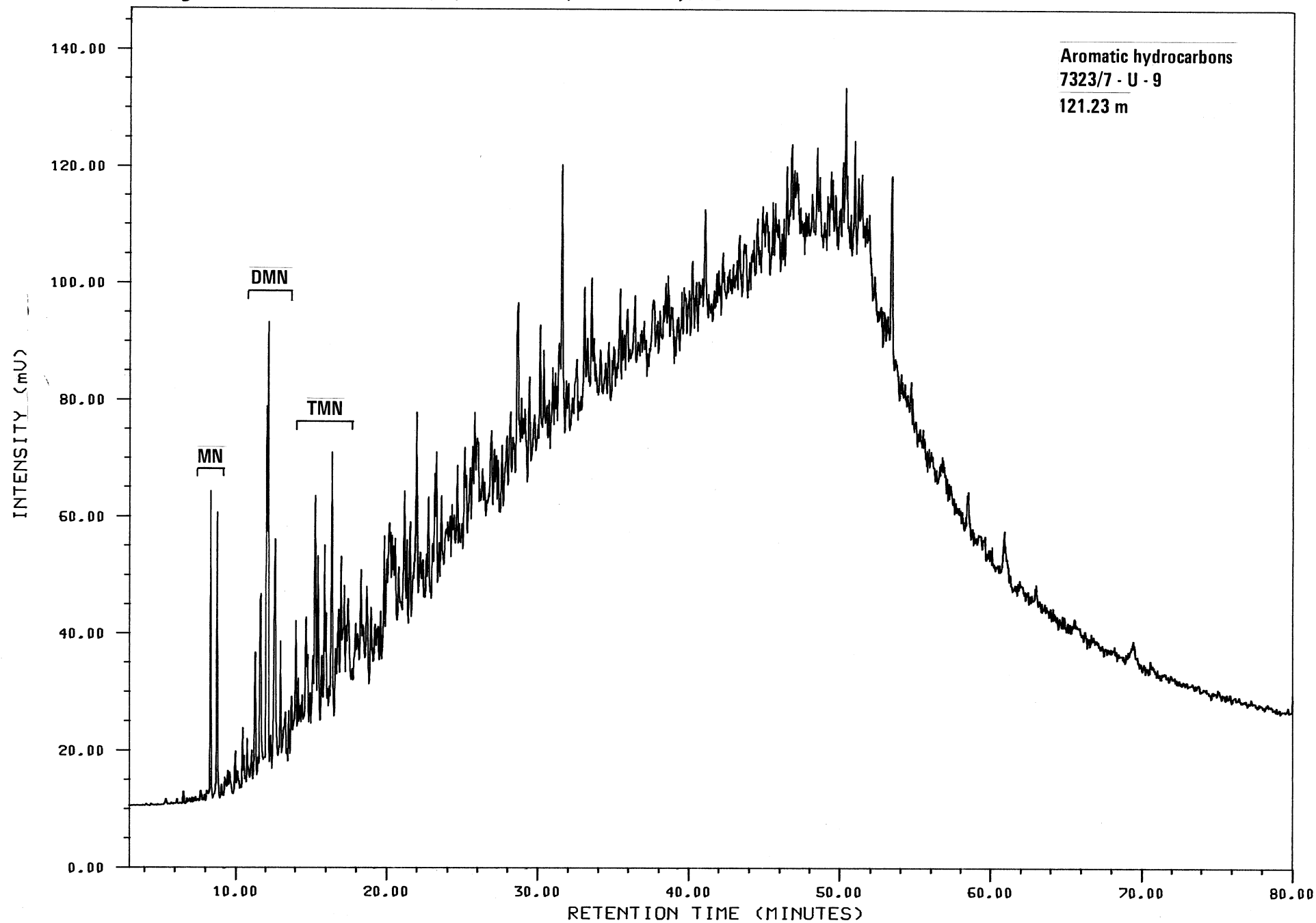
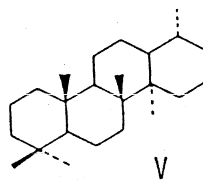
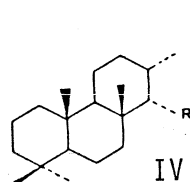
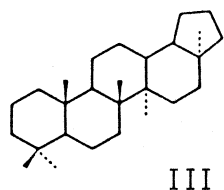
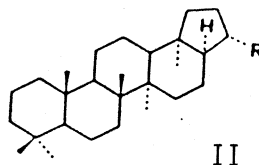
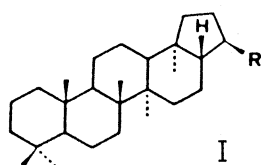


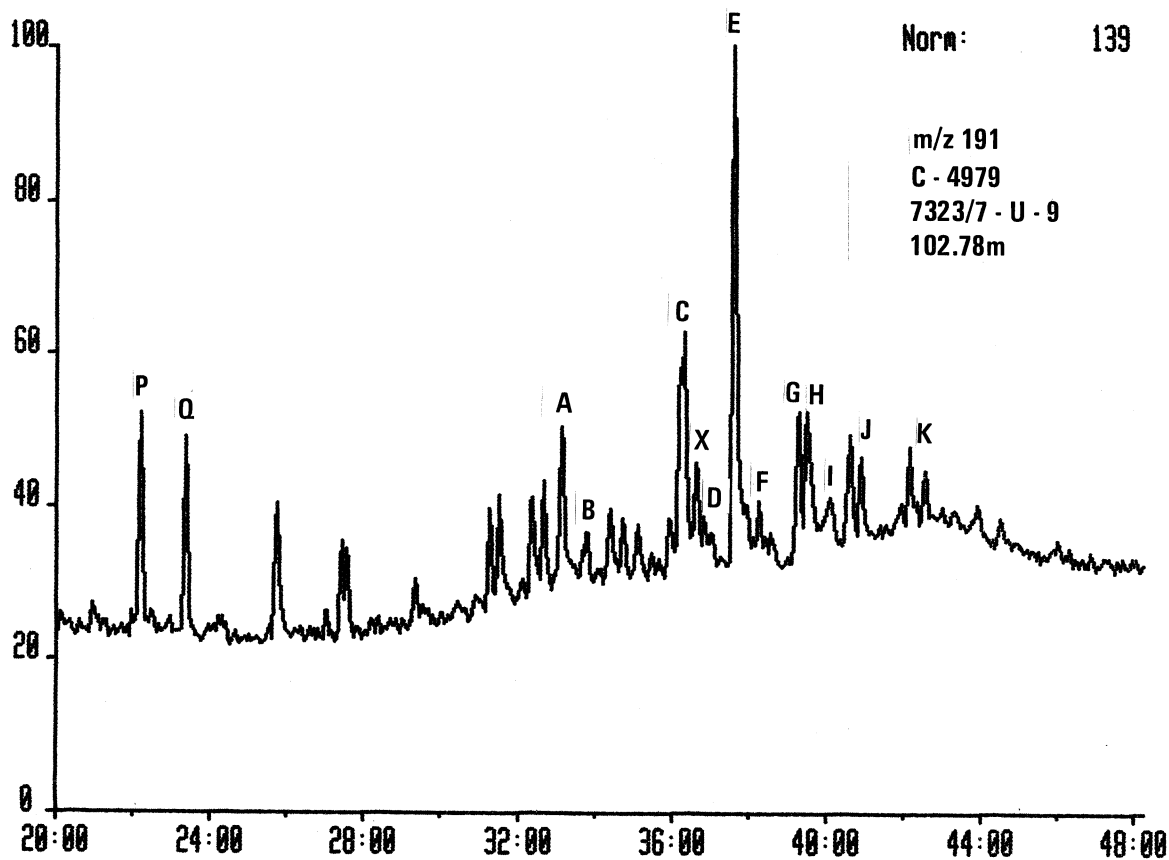
Figure A.III.7.4: Mass chromatograms of m/z 191 (terpanes).

A	T _S , 18α(H)-trisnorneohopane	C ₂₇ H ₄₆	(III)
B	T _m , 17α(H)-trisnorhopane	C ₂₇ H ₄₆	(I, R=H)
C	17α(H)-norhopane	C ₂₉ H ₅₀	(I, R=C ₂ H ₅)
D	17β(H)-normoretane	C ₂₉ H ₅₀	(II, R=C ₂ H ₅)
E	17α(H)-hopane	C ₃₀ H ₅₂	(I, R=C ₃ H ₇)
F	17β(H)-moretane	C ₃₀ H ₅₂	(II, R=C ₃ H ₇)
G	17α(H)-homohopane (22S)	C ₃₁ H ₅₄	(I, R=C ₄ H ₉)
H	17α(H)-homohopane (22R)	C ₃₁ H ₅₄	(I, R=C ₄ H ₉)
	+ unknown triterpane (gammacerane?)		
I	17β(H)-homomoretane	C ₃₁ H ₅₄	(II, R=C ₄ H ₉)
J	17α(H)-bishomohopane (22S, 22R)	C ₃₂ H ₅₆	(I, R=C ₅ H ₁₁)
K	17α(H)-trishomohopane (22S, 22R)	C ₃₃ H ₅₈	(I, R=C ₆ H ₁₃)
L	17α(H)-tetrakishomohopane (22S, 22R)	C ₃₄ H ₆₀	(I, R=C ₇ H ₁₅)
M	17α(H)-pentakishomohopane (22S, 22R)	C ₃₅ H ₆₂	(I, R=C ₈ H ₁₇)
Z	bisnorhopane	C ₂₈ H ₄₈	
X	unknown triterpane	C ₃₀ H ₅₂	
P	tricyclic terpene	C ₂₃ H ₄₂	(IV, R=C ₄ H ₉)
Q	tricyclic terpene	C ₂₄ H ₄₄	(IV, R=C ₅ H ₁₁)
R	tricyclic terpene (17R, 17S)	C ₂₅ H ₄₆	(IV, R=C ₆ H ₁₃)
S	tetracyclic terpene	C ₂₄ H ₄₂	(V)
T	tricyclic terpene (17R, 17S)	C ₂₆ H ₄₈	(IV, R=C ₇ H ₁₅)



C4979SAT 13-NOV-86 Sir:Voltage 7070H Acnt:IKU
Sample 1 Injection 1 Group 1 Mass 191.1000
Text:

System:TRIT



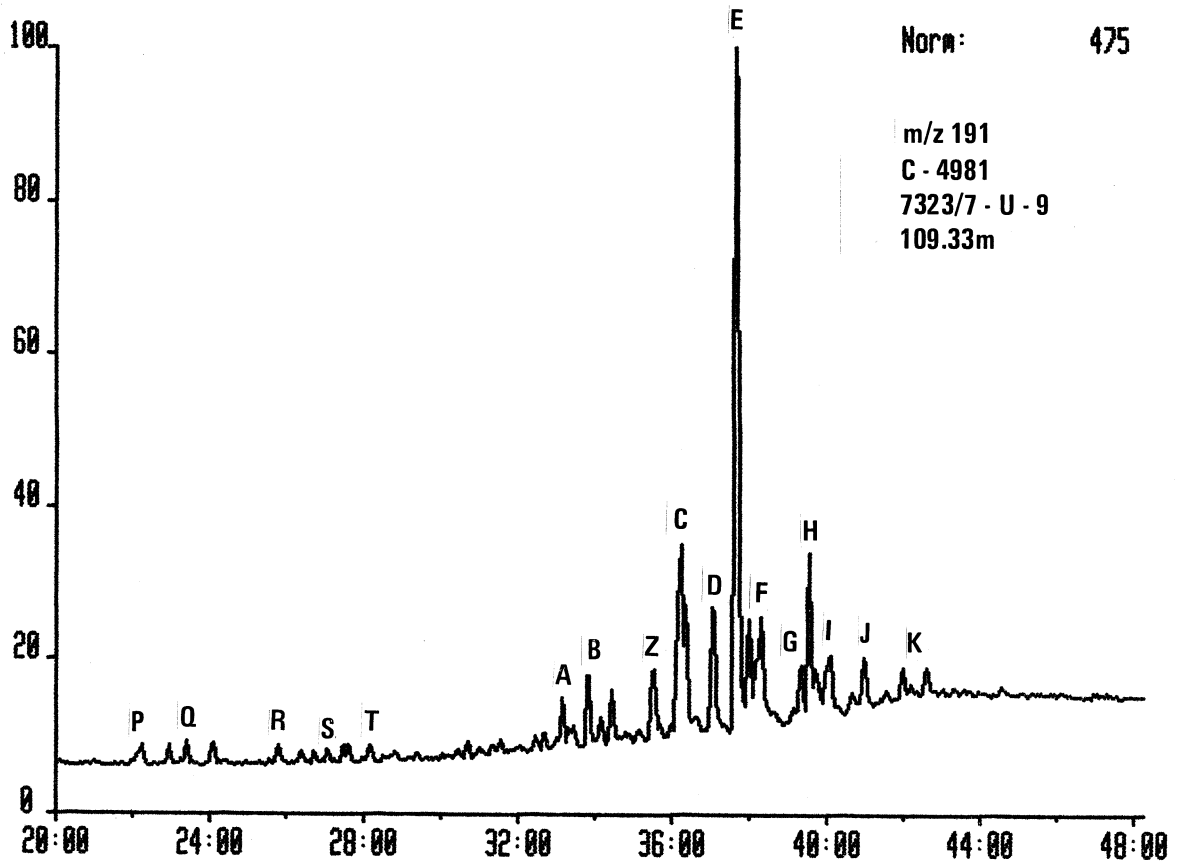


IKU
SINTEF-GRUPPEN

-318-

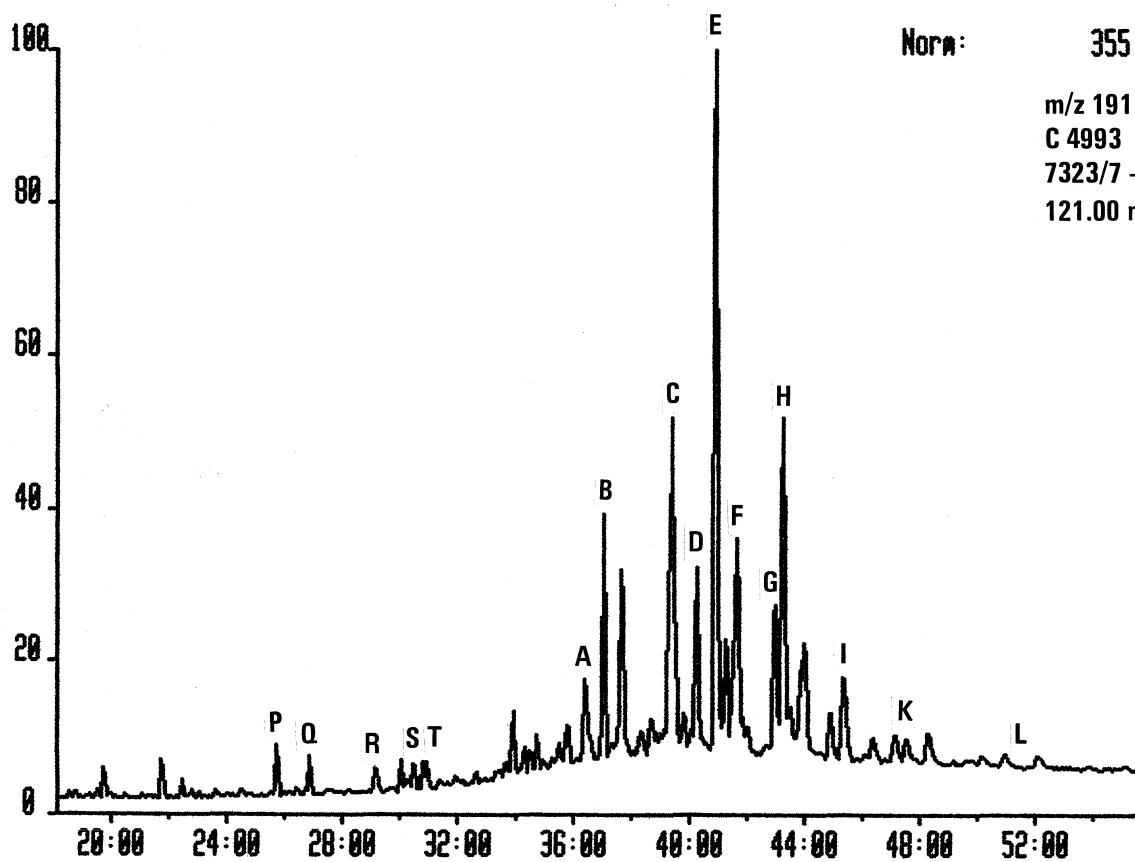
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Sample 1 Injection 1 Group 1 Mass 191.1000
Text:

System:TRIT



C4993SAT 28-AUG-86 Sir:Voltage 12-250 Acnt:IKU
Sample 1 Injection 1 Group 1 Mass 191.1000
Text:

System:QUAMID

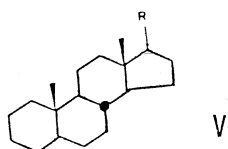
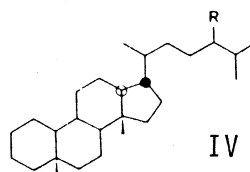
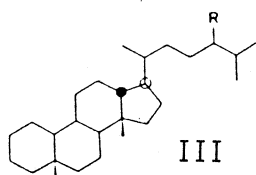
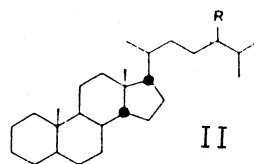
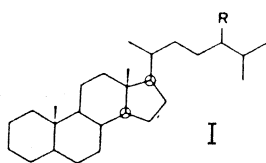


Norm: 355

m/z 191
C 4993
7323/7 - U - 9 # 12
121.00 m

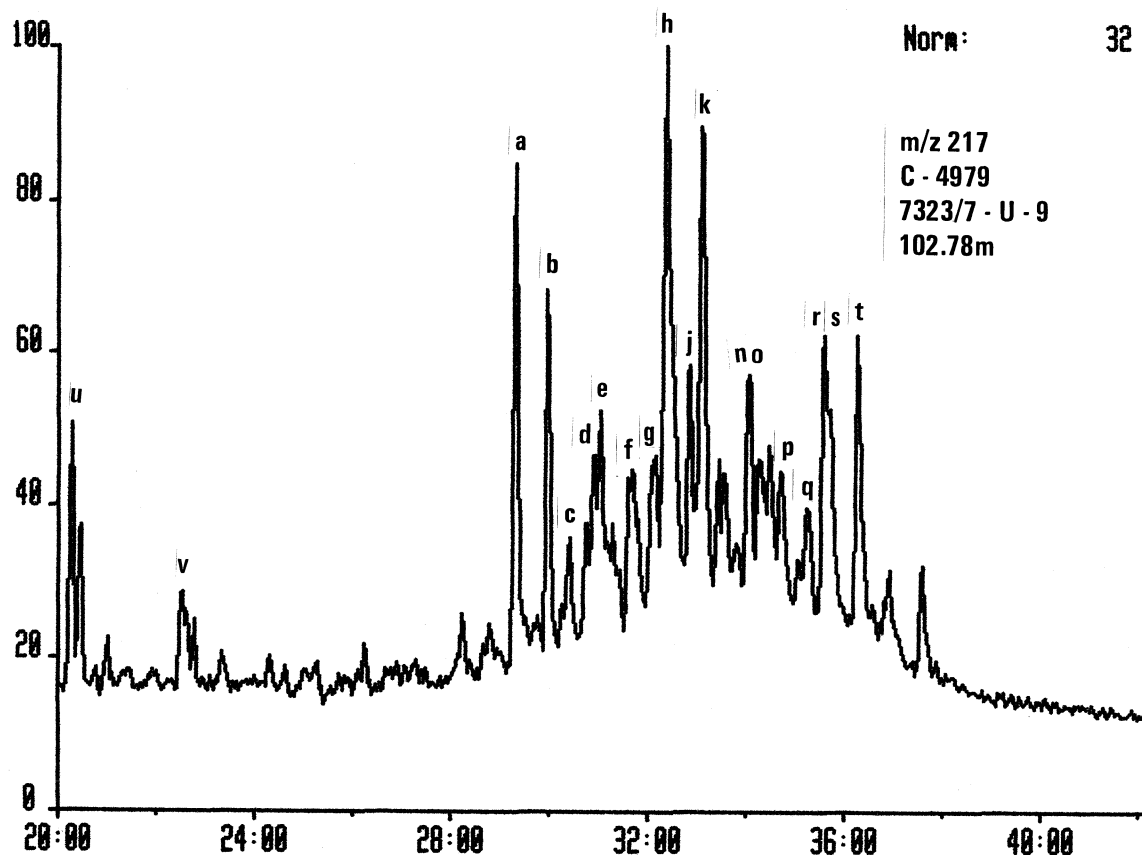
Figure A.III.7.5: Mass chromatograms of m/z 217 and 218 (steranes).

a	13 β (H),17 α (H)-diasterane (20S)	C ₂₇ H ₄₈	(III,R=H)
b	13 β (H),17 α (H)-diasterane (20R)	C ₂₇ H ₄₈	(III,R=H)
c	13 α (H),17 β (H)-diasterane (20S)	C ₂₇ H ₄₈	(IV,R=H)
d	13 α (H),17 β (H)-diasterane (20R)	C ₂₇ H ₄₈	(IV,R=H)
e	13 β (H),17 α (H)-diasterane (20S)	C ₂₈ H ₅₀	(III,R=CH ₃)
f	13 β (H),17 α (H)-diasterane (20R)	C ₂₈ H ₅₀	(III,R=CH ₃)
g	13 α (H),17 β (H)-diasterane (20S)	C ₂₈ H ₅₀	(IV,R=CH ₃)
	+ 14 α (H),17 α (H)-sterane (20S)	C ₂₇ H ₄₈	(I,R=H)
h	13 β (H),17 α (H)-diasterane (20S)	C ₂₉ H ₅₂	(III,R=C ₂ H ₅)
	+ 14 β (H),17 β (H)-sterane (20R)	C ₂₇ H ₄₈	(II,R=H)
i	14 β (H),17 β (H)-sterane (20S)	C ₂₇ H ₄₈	(II,R=H)
	+ 13 α (H),17 β (H)-diasterane (20R)	C ₂₈ H ₅₀	(IV,R=CH ₃)
j	14 α (H),17 α (H)-sterane (20R)	C ₂₇ H ₄₈	(I,R=H)
k	13 β (H),17 α (H)-diasterane (20R)	C ₂₉ H ₅₂	(III,R=C ₂ H ₅)
l	13 α (H),17 β (H)-diasterane (20S)	C ₂₉ H ₅₂	(III,R=C ₂ H ₅)
m	14 α (H),17 α (H)-sterane (20S)	C ₂₈ H ₅₀	(I,R=CH ₃)
n	13 α (H),17 β (H)-diasterane (20R)	C ₂₉ H ₅₂	(III,R=C ₂ H ₅)
	+ 14 β (H),17 β (H)-sterane (20R)	C ₂₈ H ₅₀	(II,R=CH ₃)
o	14 β (H),17 β (H)-sterane (20S)	C ₂₈ H ₅₀	(II,R=CH ₃)
p	14 α (H),17 α (H)-sterane (20R)	C ₂₈ H ₅₀	(I,R=CH ₃)
q	14 α (H),17 α (H)-sterane (20S)	C ₂₉ H ₅₂	(I,R=C ₂ H ₅)
r	14 β (H),17 β (H)-sterane (20R)	C ₂₉ H ₅₂	(II,R=C ₂ H ₅)
	+ unknown sterane		
s	14 β (H),17 β (H)-sterane (20S)	C ₂₉ H ₅₂	(II,R=C ₂ H ₅)
t	14 α (H),17 α (H)-sterane (20R)	C ₂₉ H ₅₂	(I,R=C ₂ H ₅)
u	5 α (H)-sterane	C ₂₁ H ₃₆	(V,R=C ₂ H ₅)
v	5 α (H)-sterane	C ₂₂ H ₃₈	(IV,R=C ₃ H ₇)



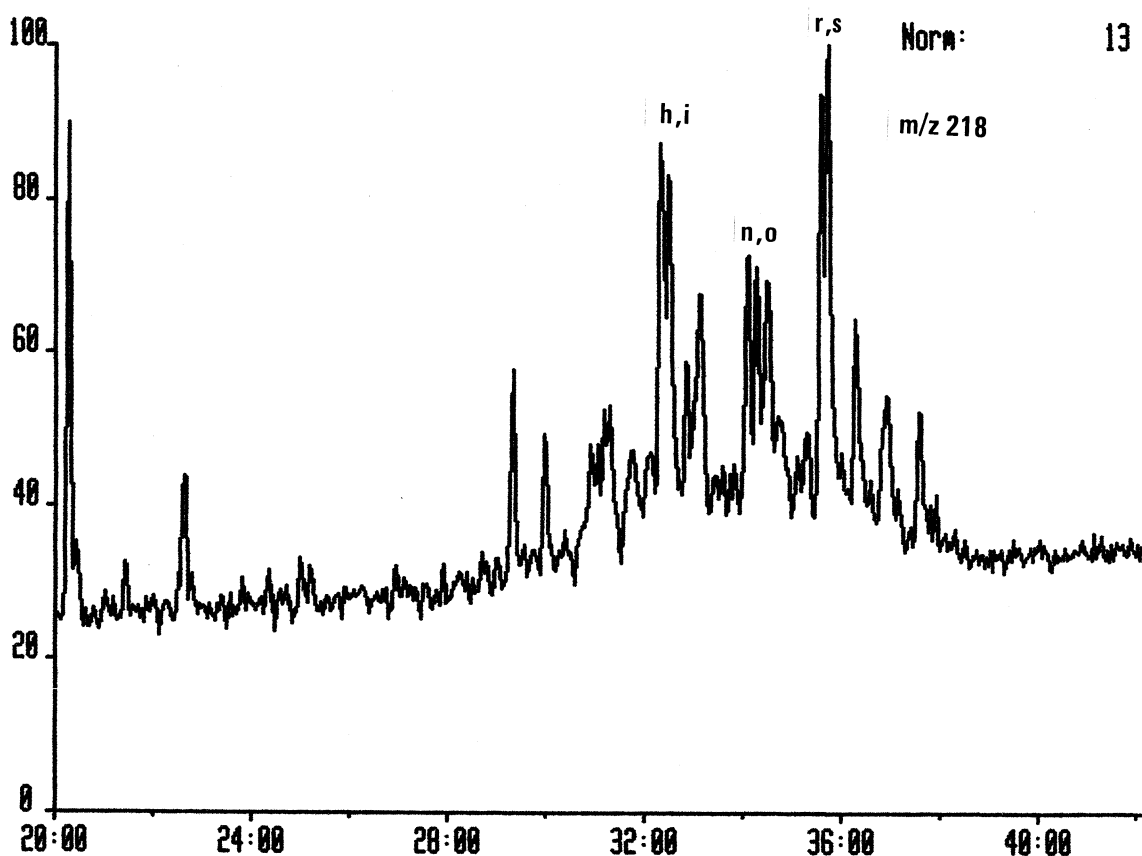
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Sample 1 Injection 1 Group 1 Mass 217.1000
Text:

System:TRIT



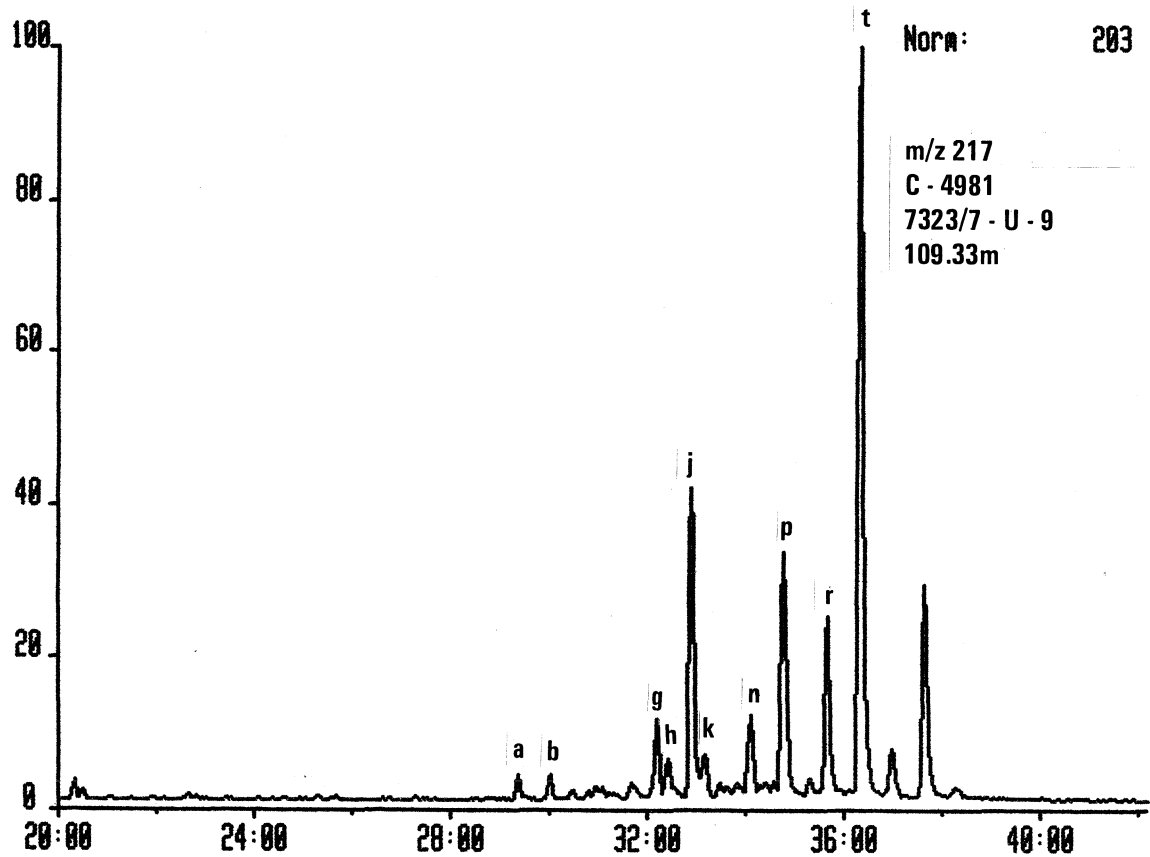
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Sample 1 Injection 1 Group 1 Mass 218.1000
Text:

System:TRIT



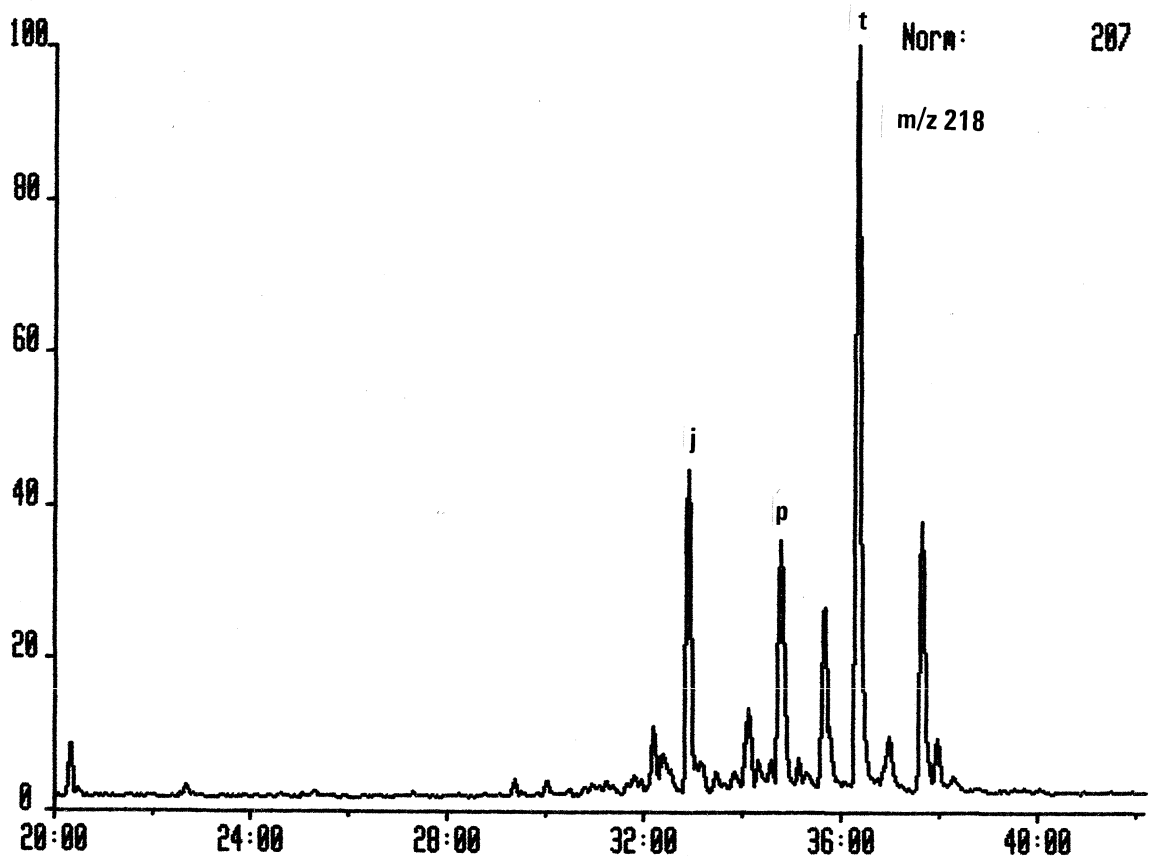
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Sample 1 Injection 1 Group 1 Mass 217.1000
Text:

System:TRIT



C4981SAT 12-NOV-86 Sir:Voltage 7070H Acnt:IKU
Sample 1 Injection 1 Group 1 Mass 218.1000
Text:

System:TRIT





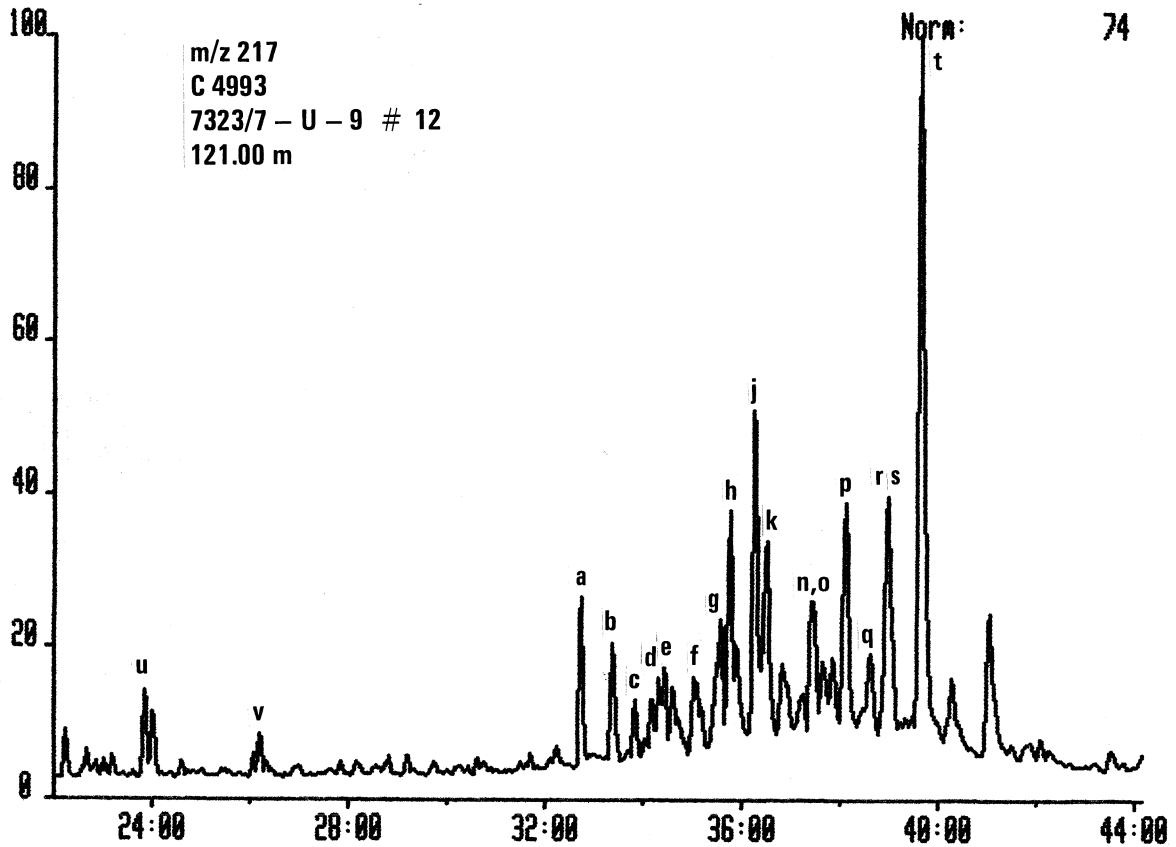
IKU

SINTEF-GRUPPEN

-323-

C4993SAT 28-AUG-86 Sir:Voltage 12-250 Acnt:IKU
Sample 1 Injection 1 Group 1 Mass 217.1000
Text:

System:QUAMID



C4993SAT 28-AUG-86 Sir:Voltage 12-250 Acnt:IKU
Sample 1 Injection 1 Group 1 Mass 218.1000
Text:

System:QUAMID

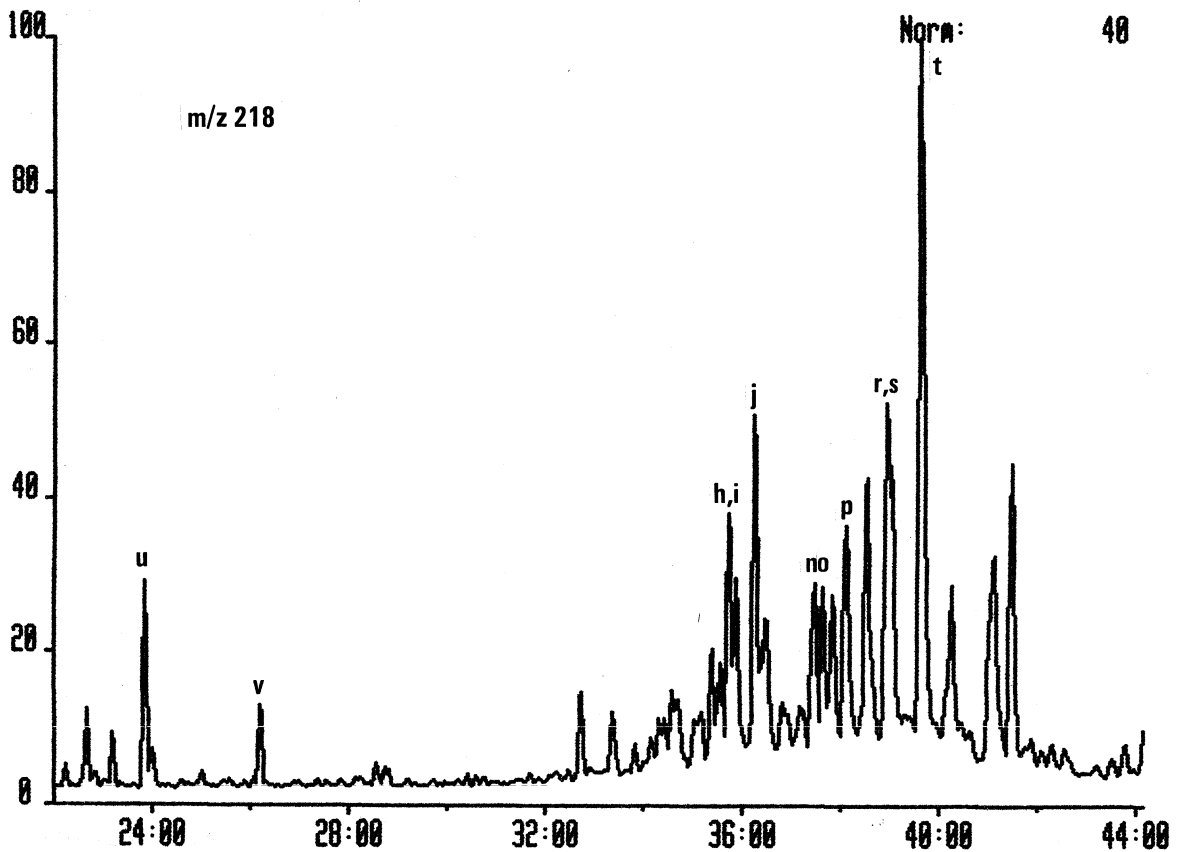


Figure A.III.7.6: Mass chromatograms representing monoaromatic (m/z 239 and 253) and triaromatic (m/z 231) steranes.

m/z 253

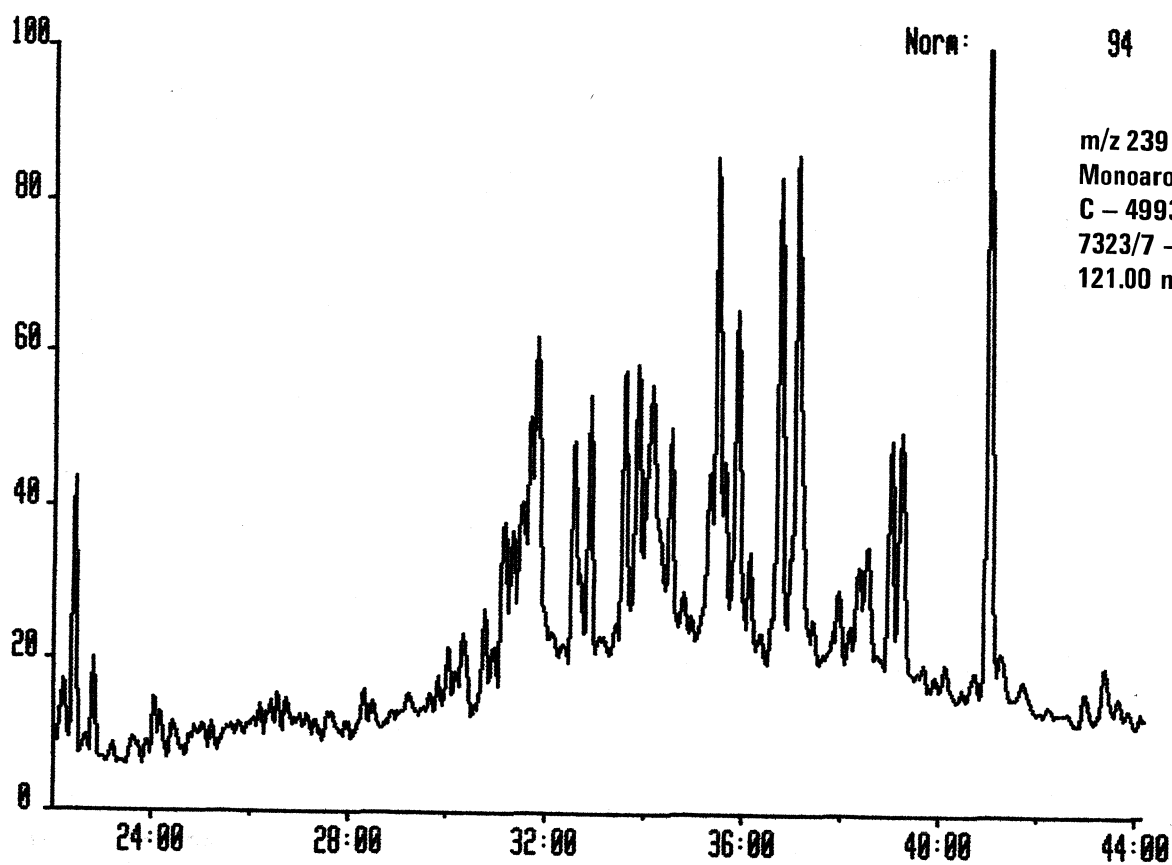
- a - C₂₁ monoaromatic sterane
- b - C₂₂ monoaromatic sterane
- c - unidentified
- d - C₂₇ monoaromatic sterane
- e - C₂₇ monoaromatic sterane
- f - C₂₈ monoaromatic sterane
- g - C₂₇ monoaromatic sterane
- h - C₂₈ + C₂₉ monoaromatic sterane
- i - C₂₉ monoaromatic sterane
- j - C₂₉ monoaromatic sterane
- k - unidentified
- l - unidentified

m/z 231

- M - C₂₀ triaromatic sterane
- N - C₂₁ triaromatic sterane
- O - C₂₆ triaromatic sterane
- P - C₂₆ + C₂₇ triaromatic sterane
- Q - C₂₈ triaromatic sterane
- R - C₂₇ triaromatic sterane
- S - C₂₈ triaromatic sterane

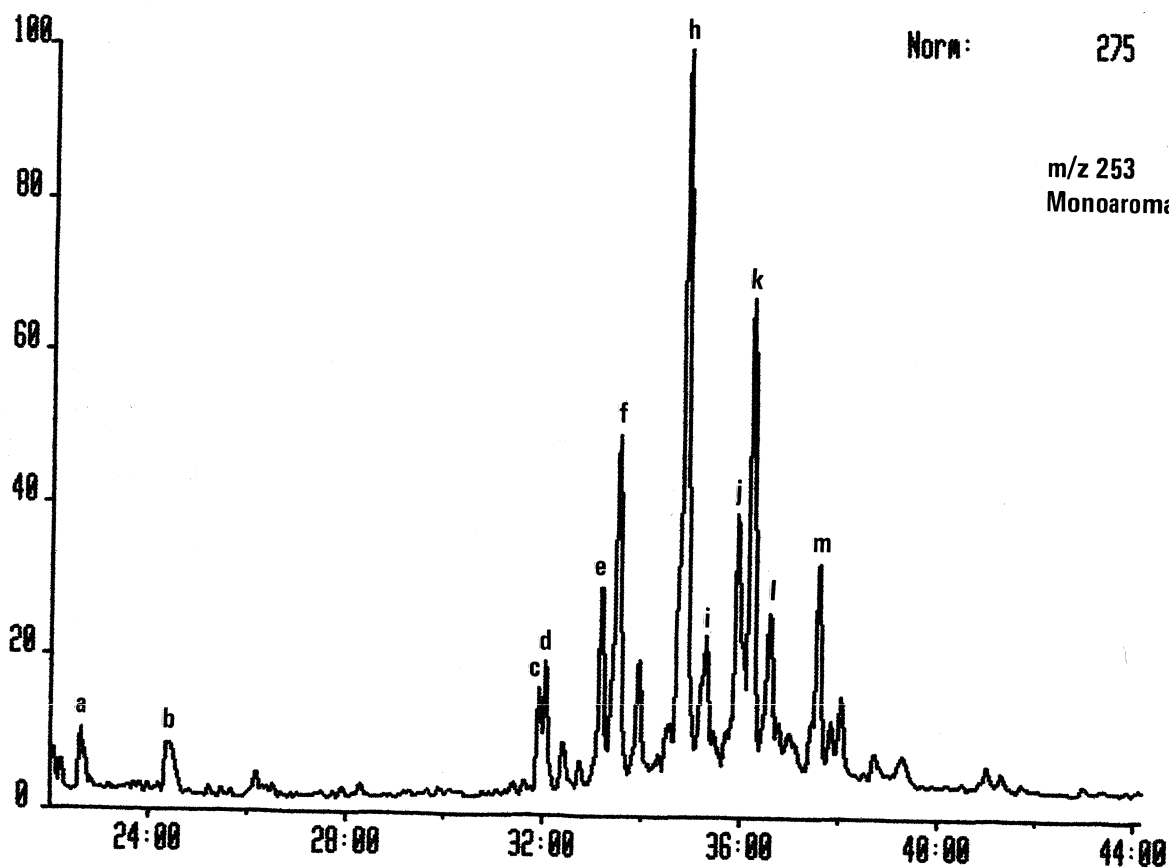
C4993AROS 1-SEP-86 Sir:Voltage 12-250 Acnt:IKU
Sample 1 Injection 1 Group 1 Mass 239.1000
Text:

System:STERANER



C4993AROS 1-SEP-86 Sir:Voltage 12-250 Acnt:IKU
Sample 1 Injection 1 Group 1 Mass 253.1000
Text:

System:STERANER



C4993AROS 1-SEP-86

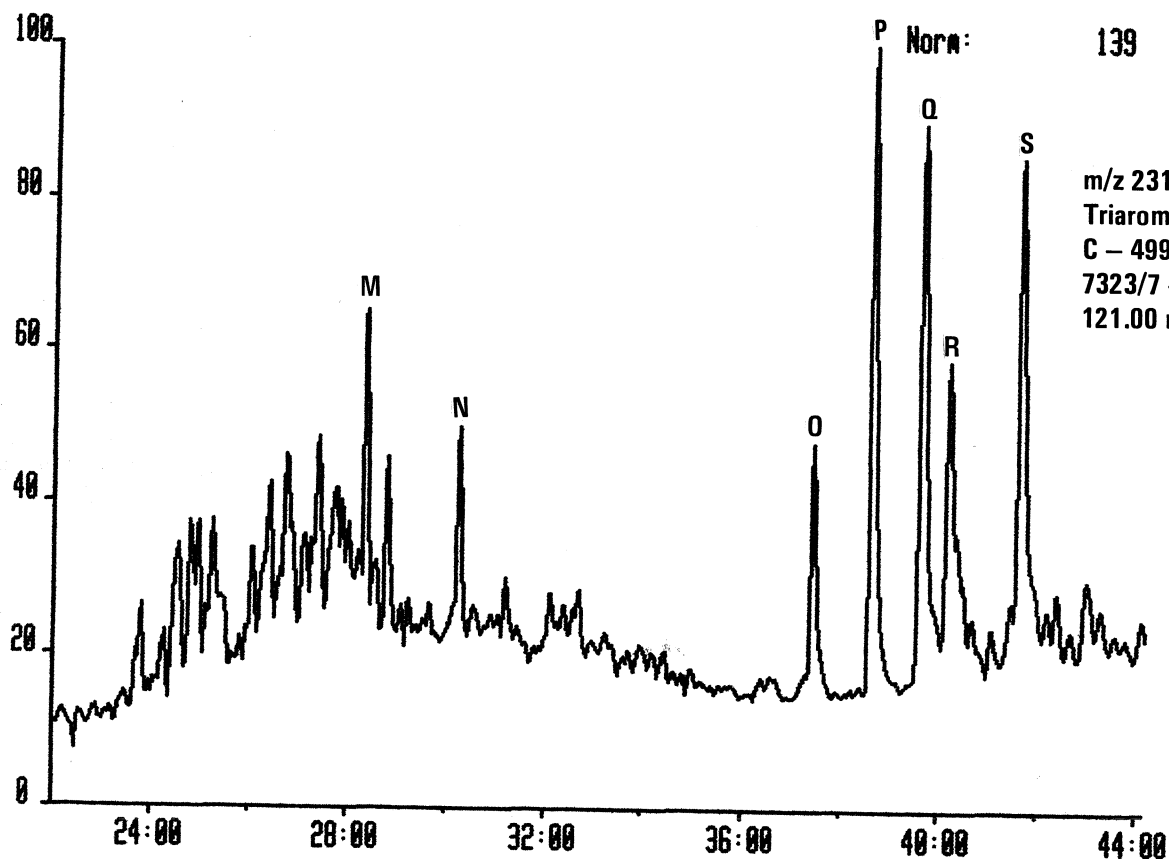
Sir: Voltage 12-250 Acnt: IKU

System: STERANER

Sample 1 Injection 1

Group 1 Mass 231.1000

Text:



m/z 231
Triaromatic steranes
C - 4993
7323/7 - U - 9 # 12
121.00 m

Figure A.III.7.7: Vitrinite reflectance histograms.

Key: A = Grey-black-brown claystone.
 Upper case letters indicate values included in
 the main population. Lower case letters represent
 values in other populations.

 PP = Statistical data populations
 Y = Main population, not necessarily
 representative of sample maturity.
 N = Other populations.

 LOW+ HIGH = Population limits.

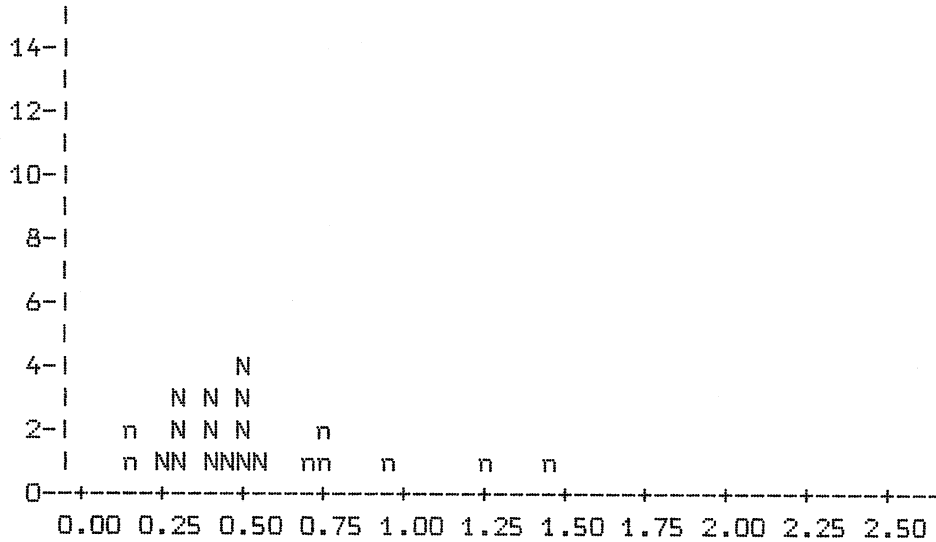
 VAL. = Number of measurements in that
 population.

Lithology cross-reference table

A = Clst. gy
 B = Clst. dk gy
 C = Clst. gn
 D = Clst. bn
 E = Clst. rd
 F = Clst. calc.
 G = Clst. carb.
 H = Shale
 I = Sandstone
 J = Limestone
 K = Coal
 L = Lignite
 M = Carbargillite
 N = Siltstone
 O = Bit
 P = X

0.21d 0.22d 0.35d 0.36d 0.43d 0.45d 0.45d 0.47d 0.56d 0.57d 0.63d
0.64d 0.68d 0.71d

IKU# C-4983 114.5M 7323/7-U-9



PP	LOW	HIGH	LIT	#VAL	MEAN	STDV
Y	0.28	0.60	ALL	13	0.43	0.10
N	0.18	0.20	ALL	2	0.19	0.01
N	0.74	0.99	ALL	4	0.82	0.11
OVERALL				21	0.57	0.33

ORDERED VALUES FOLLOW:

 0.18n 0.19n 0.28N 0.31N 0.31N 0.34N 0.40N 0.41N 0.44N 0.45N 0.50N
 0.51N 0.52N 0.52N 0.59N 0.74n 0.77n 0.79n 0.98n 1.28n 1.45n

APPENDIX III.8: TABLE OF CONTENTS continued

Core 7323/7-U-5:

TABLES

Table A.III.8.1a: Concentration of C_1-C_5 + hydrocarbons in headspace gas.

Table A.III.8.1b: Concentration of C_1-C_5 + hydrocarbons in occluded gas.

Table A.III.8.1c: Concentration of C_1-C_5 + hydrocarbons - summation.

Table A.III.8.2: Total organic carbon and data from Rock-Eval pyrolysis.

Table A.III.8.3: Data from pyrolysis-gas chromatograms.

Table A.III.8.4: Vitrinite reflectance data.

Table A.III.8.5: Weight of EOM and chromatographic fractions.

Table A.III.8.6: Concentration of EOM and chromatographic fractions.

Table A.III.8.7: Concentration of EOM and chromatographic fractions.

Table A.III.8.8: Composition of material extracted from the rock.

Table A.III.8.9: Tabulation of data from the gas chromatograms.

Table A.III.8.10: $\delta^{13}C$ and δD isotope ratios for adsorbed gas fractions.

FIGURES

Figure A.III.8.1: Pyrolysis-gas chromatograms (S2 peak).

Figure A.III.8.2: Saturated hydrocarbon gas chromatograms.

Figure A.III.8.3: Aromatic hydrocarbon gas chromatograms.

Figure A.III.8.4: Vitrinite reflectance histograms.

Project no.: 21.3420.06
Well ident.: 7323/7-U-5
DATE : 28 - 10 - 86.

Table A.III.8.1a: Concentration of C₁-C₅ hydrocarbons in headspace gas.

[illegible]

Project no.: 21.3420.06
Well ident.: 7323/7-U-5
DATE : 28 - 10 - 86.

Table A.III.8.1b: Concentration of C₁-C₅+ hydrocarbons in occluded gas.

[illegible]

Project no.: 21.3420.06
Well ident.: 7323/7-U-5
DATE : 28 - 10 - 86.

Table A.III.8.1c: Concentration of C₁-C₅ hydrocarbons - summation.

[illegible]

Table A.III.8.2: Total organic carbon and data from Rock-Eval
pyrolysis.

[illegible]

Table A.III.8.2: cont.

I			:					HYDR. OXYGEN	PETROLEUM	PROD.	TEMP.	I		
I	IKU	DEPTH	:	S1	S2	S3	TOC	INDEX	INDEX	POTENTIAL	INDEX	MAX	I	
I	No.		:								S1		I	
I			:								-----		I	
I		m/ft	:	(	mg/g ROCK	)	(%)	(	mg/g TOC	)	S1+S2	S1+S2	(C)	I
I	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	=====	I
I			:											I
I	C 4922	117	:	0.09	0.51	5.02	1.10	46	456	0.60	0.15	435		I
I			:											I
I	C 4923	118	:	****	****	****	1.16	*****	****	*****	*****	***		I
I			:											I
I	C 4924	119	:	0.23	0.23	1.08	1.22	19	89	0.46	0.50	378		I
I			:											I
I	C 4925	120	:	****	****	****	1.16	*****	****	*****	*****	***		I
I			:											I
I	C 4926	121	:	0.07	0.40	1.92	1.05	38	183	0.47	0.15	432		I
I			:											I
I	C 4927	122.10	:	****	****	****	1.26	*****	****	*****	*****	***		I
I			:											I
I	C 4928	123.16	:	0.04	0.40	1.12	1.15	35	97	0.44	0.09	432		I
I			:											I
I	C 4929	124	:	****	****	****	1.26	*****	****	*****	*****	***		I
I			:											I
I	C 4930	125	:	0.03	0.31	0.45	1.13	27	40	0.34	0.09	436		I
I			:											I
I	C 4931	125.99	:	****	****	****	1.04	*****	****	*****	*****	***		I
I			:											I
I	C 4932	126.96	:	0.05	0.37	1.17	1.02	36	115	0.42	0.12	432		I
I			:											I
I	C 4933	128.01	:	****	****	****	1.12	*****	****	*****	*****	***		I
I			:											I
I	C 4934	129	:	0.08	0.45	2.41	1.19	38	203	0.53	0.15	434		I
I			:											I
I	C 4935	130	:	****	****	****	1.05	*****	****	*****	*****	***		I
I			:											I
I	C 4936	131	:	0.06	0.49	2.42	1.24	40	195	0.55	0.11	436		I
I			:											I
I	C 4937	132.05	:	****	****	****	1.06	*****	****	*****	*****	***		I
I			:											I
I	C 4938	133.03	:	0.05	0.43	1.00	1.17	37	85	0.48	0.10	431		I
I			:											I
I	C 4939	134.20	:	****	****	****	1.22	*****	****	*****	*****	***		I
I			:											I
I	C 4940	135	:	0.08	0.40	1.75	1.18	34	148	0.48	0.17	436		I
I			:											I
I	C 4941	136.01	:	****	****	****	1.23	*****	****	*****	*****	***		I
I			:											I
I	C 4942	136.94	:	0.04	0.31	2.77	1.11	28	250	0.35	0.11	435		I
I			:											I

Table A.III.8.3: Data from pyrolysis-gas chromatograms.

IKU No	DEPTH (m)	C1 %	C2-C5 %	C6-C14 %	C15+ %	(m+p)-xylene/ n-octene
C-4900	95	5.65	1.82	37.48	55.05	0.49
C-4904	99	16.53	4.51	57.11	21.85	1.14
C-4908	103	14.79	17.53	37.79	29.88	0.88
C-4912	106.99	28.55	6.75	47.70	17.00	0.86
C-4916	111.05	15.79	4.07	64.55	15.60	0.85
C-4920	115	14.28	4.38	64.00	17.34	1.15
C-4924	119	27.04	7.52	55.28	10.17	1.04
C-4928	123.16	5.59	4.14	82.40	7.87	0.81
C-4932	126.96	8.61	2.02	75.06	14.32	0.61
C-4936	131	7.86	2.14	56.18	33.83	0.76
C-4940	135	10.43	16.65	54.96	17.96	0.90

Well Identification: 7323/7-U-5
 Reference number: 21.3420.06
 (1/1)

Table A.III.8.4: Vitrinite reflectance data.

IKU NO	LOCATION	DEPTH (M)	VITRINITE REFLECTANCE	REL RAT	STANDARD DEVIATION	FLUORE- SCENCE
C 4909	----	104	0.44 (16) 0.72 (5) 1.01 (1)	F R R	0.09 0.07 0.00	5-6

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

Project no.: 21.3420.06
 Well ident.: 7323/7-U-5
 DATE : 15 - 11 - 86.

Table A.III.8.5: Weight of EOM and chromatographic fractions.

I			: Rock							I
I	IKU-No	DEPTH	: Extr.	EOM	Sat.	Aro.	HC	Non HC	TOC	I
I			:							I
I		(m)	: (g)	(mg)	(mg)	(mg)	(mg)	(mg)	(%)	I
I			:							I
I	C 4918	113.08	: 6.0	2.4	0.5	0.2	0.7	1.7	0.30	I
I			:							I
I	C 4924	119	: 6.0	6.0	0.5	0.2	0.7	5.3	0.47	I
I			:							I

Project no.: 21.3420.06
Well ident.: 7323/7-U-5
DATE : 15 - 11 - 86.

Table A.III.8.6: Concentration of EOM and chromatographic fractions.

I	IKU-No	DEPTH	EOM	Sat.	Aro.	HC	Non HC
I		(m)					
I							
I							
I	C 4918	113.08	397	79	40	119	278
I							
I	C 4924	119	995	80	40	119	876
I							

Project no.: 21.3420.06
 Well ident.: 7323/7-U-5
 DATE : 15 - 11 - 86.

Table A.III.8.7: Concentration of EOM and chromatographic fractions.

I			:						I
I	IKU-No	DEPTH	:	EOM	Sat.	Aro.	HC	Non HC	I
I		(m)	:						I
I			:						I
I	C 4918	113.08	:	132.5	26.5	13.2	39.7	92.7	I
I			:						I
I	C 4924	119	:	211.7	16.9	8.5	25.4	186.3	I
I			:						I

Project no.: 21.3420.06
 Well ident.: 7323/7-U-5
 DATE : 15 - 11 - 86.

Table A.III.8.8: Composition of material extracted from the rock.

I			:	Sat	Aro	HC	SAT	Non HC	HC	I
I	IKU-No	DEPTH	:	---	---	---	---	---	---	I
I			:	EOM	EOM	EOM	Aro	EOM	Non HC	I
I		(m)	:	%	%	%	x 100	%	x 100	I
I			:							I
I	C 4918	113.08	:	20.0	10.0	30.0	200.0	70.0	42.9	I
I			:							I
I	C 4924	119	:	8.0	4.0	12.0	200.0	88.0	13.6	I
I			:							I

Table A.III.8.9: Tabulation of data from the gas chromatograms.

I		DEPTH	:	PRISTANE	PRISTANE	PHYTANE	A	n-C17		I
I	IKU No.		:	-----	A = -----	B = -----	-----	-----	CPI	I
I		(m)	:	PHYTANE	n-C17	n-C18	B	n-C27		I
I			:							I
I	C 4918	113.08	:	1.2	0.7	0.5	1.5	0.2	2.1	I
I			:							I
I	C 4924	119	:	1.0	0.8	0.7	1.1	0.4	2.0	I
I			:							I

DATE : 24 - 11 - 86.

Table A.III.8.10a: Gas composition of the hydrocarbons C_1 to C_7 of adsorbed gas of core samples (Vol %).

Sample no.	Depth (m)	C_1	C_2	C_3	iC_4	nC_4	2.2DMP	iC_5	nC_5	C_6	C_7
------------	-----------	-------	-------	-------	--------	--------	--------	--------	--------	-------	-------

Well 7323/7-U-5

C-5055	118.54	33.16	1.78	2.93	3.71	5.42	0.12	5.51	6.65	23.35	17.38
--------	--------	-------	------	------	------	------	------	------	------	-------	-------

Table A.III.8.10b: Gas yields of the hydrocarbons C_1 to C_7 of adsorbed gas of core samples (ppb).

Sample no.	Depth (m)	C_1	C_2	C_3	iC_4	nC_4	2.2DMP	iC_5	nC_5	C_6	C_7
------------	-----------	-------	-------	-------	--------	--------	--------	--------	--------	-------	-------

Well 7323/7-U-5

C-5055	118.54	531	53	129	215	315	9	397	479	2010	1496
--------	--------	-----	----	-----	-----	-----	---	-----	-----	------	------

Table A.III.8.10c: Gas ratios and isotope ratios of the hydrocarbons C_1 to C_7 of adsorbed gas of core samples.

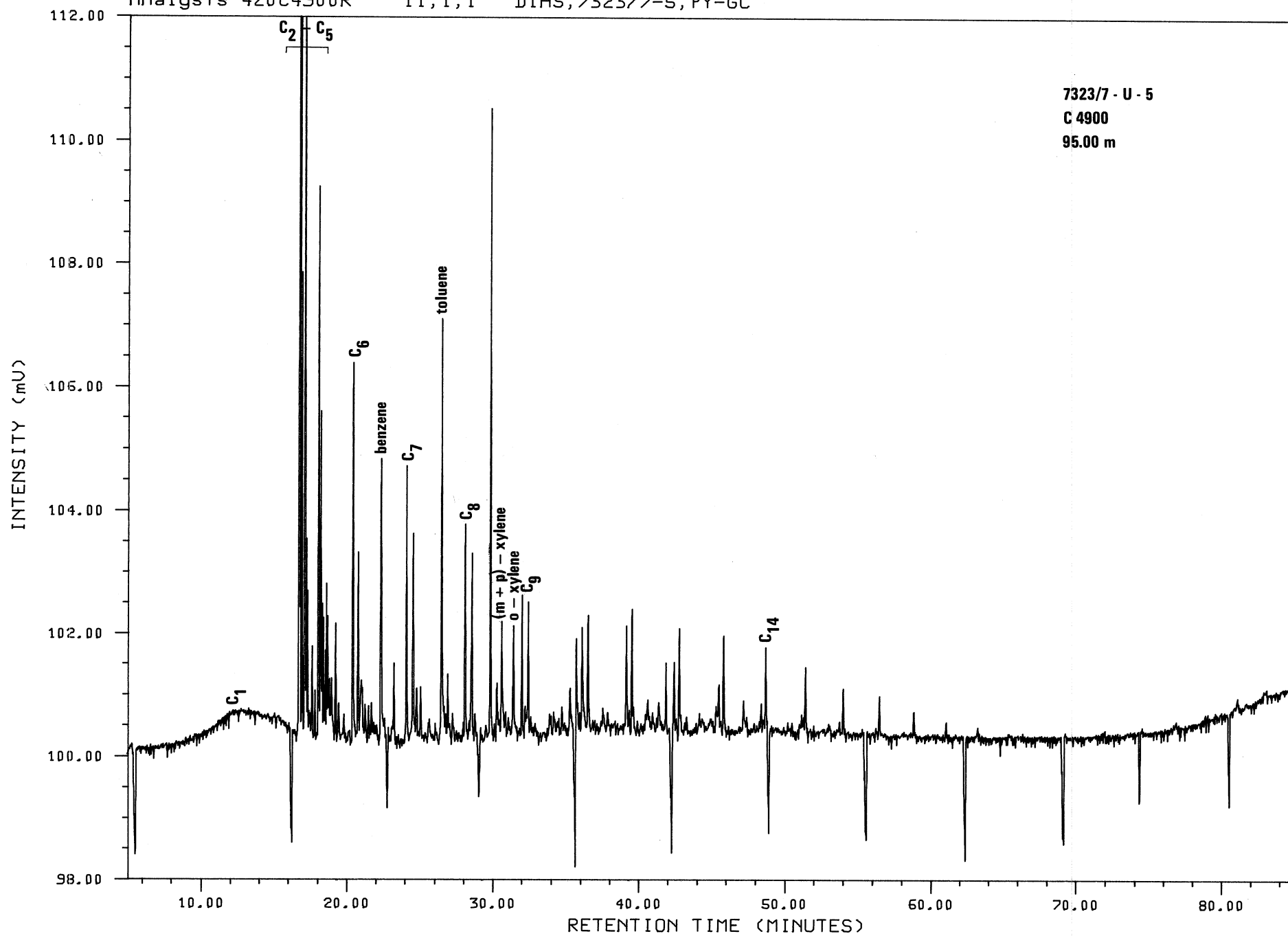
Sample no.	Depth (m)	$C_1/\Sigma C_n$	$C_1/(C_2+C_3)$	iC_4/nC_4	$\delta^{13}C_1$	$\delta^{13}C_1$	$\delta^2 C_1$
------------	-----------	------------------	-----------------	-------------	------------------	------------------	----------------

Well 7323/7-U-5

C-5055	118.54	0.3316	7.04	0.68	-55.6	-35.6	-129
--------	--------	--------	------	------	-------	-------	------

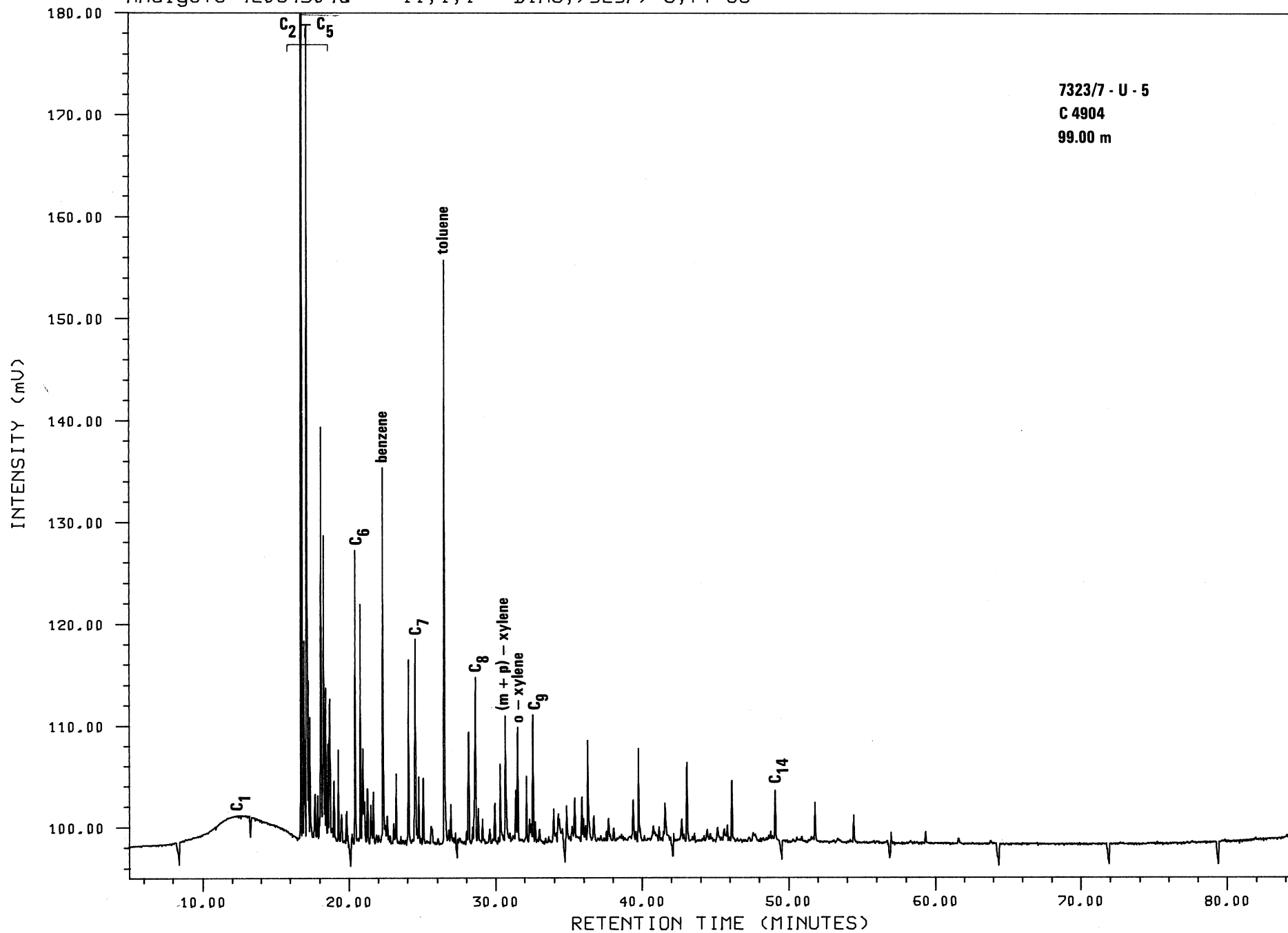
Figure A.III.8.1: Pyrolysis-gas chromatograms (S2 peak).

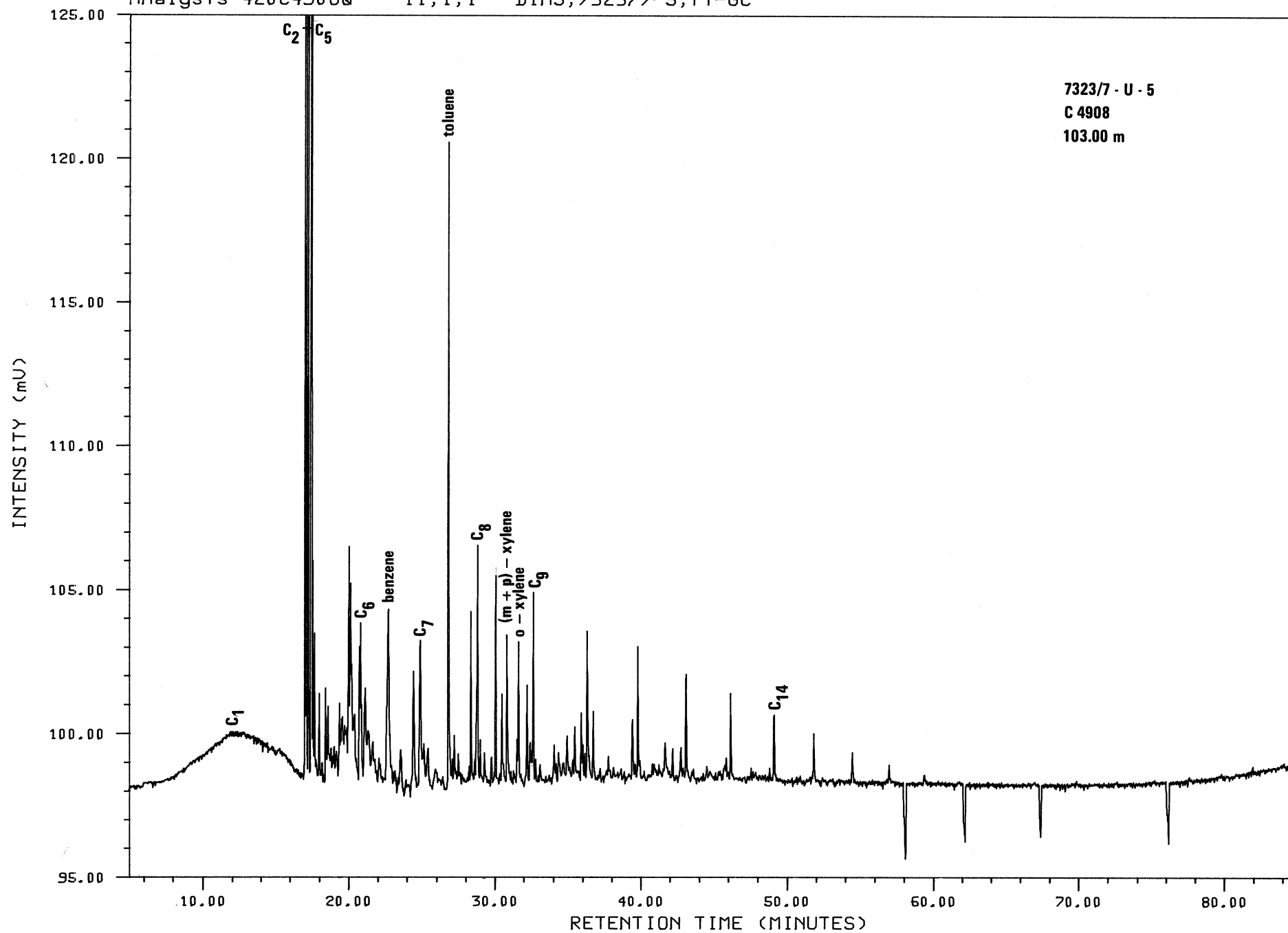
Analysis 420C4900R 11,1,1 DIAS,7323/7-5,PY-GC



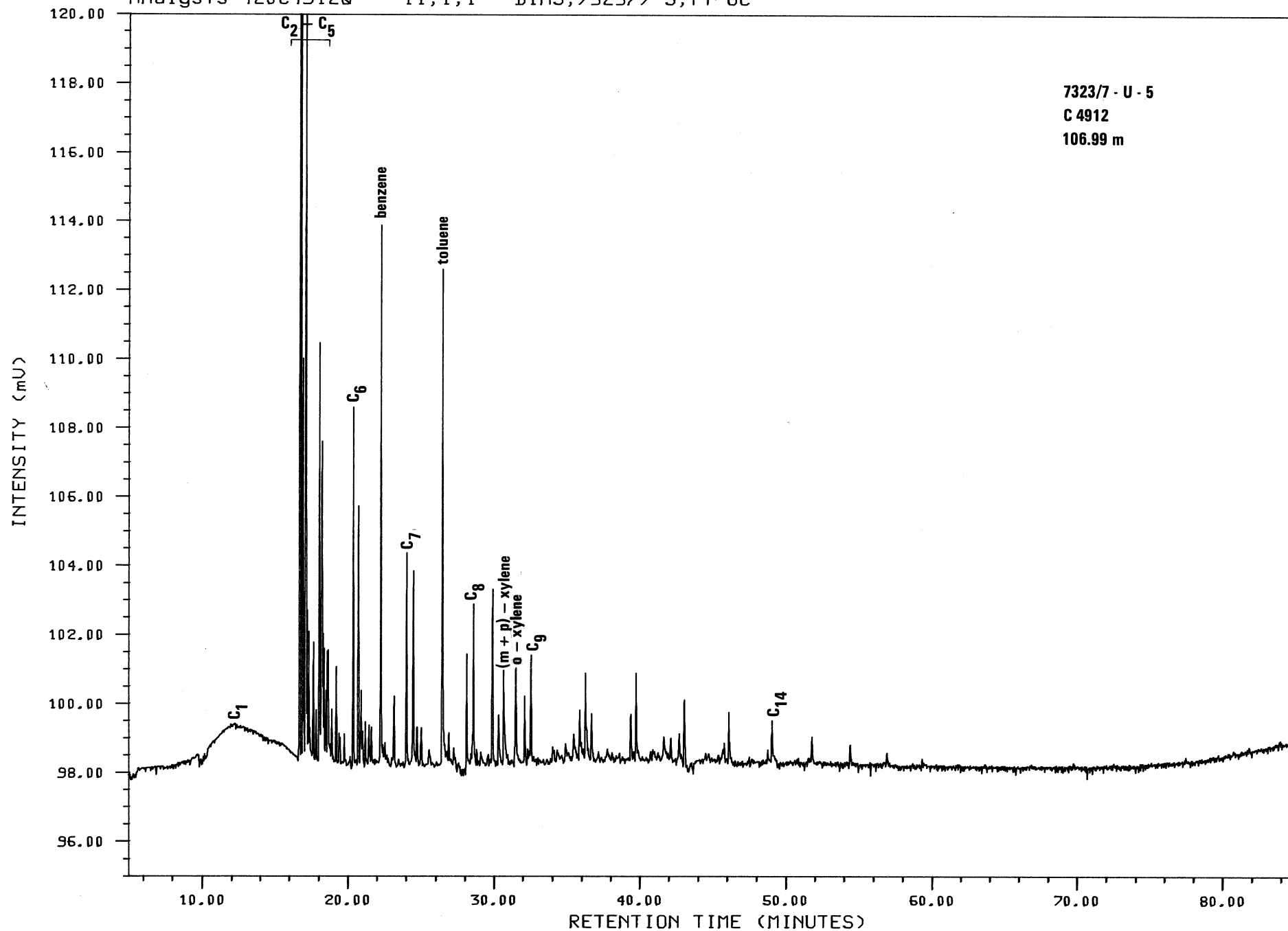
Analysis 420C4904Q 11,1,1 DIAS,7323/7-5,PY-GC

7323/7 - U - 5
C 4904
99.00 m

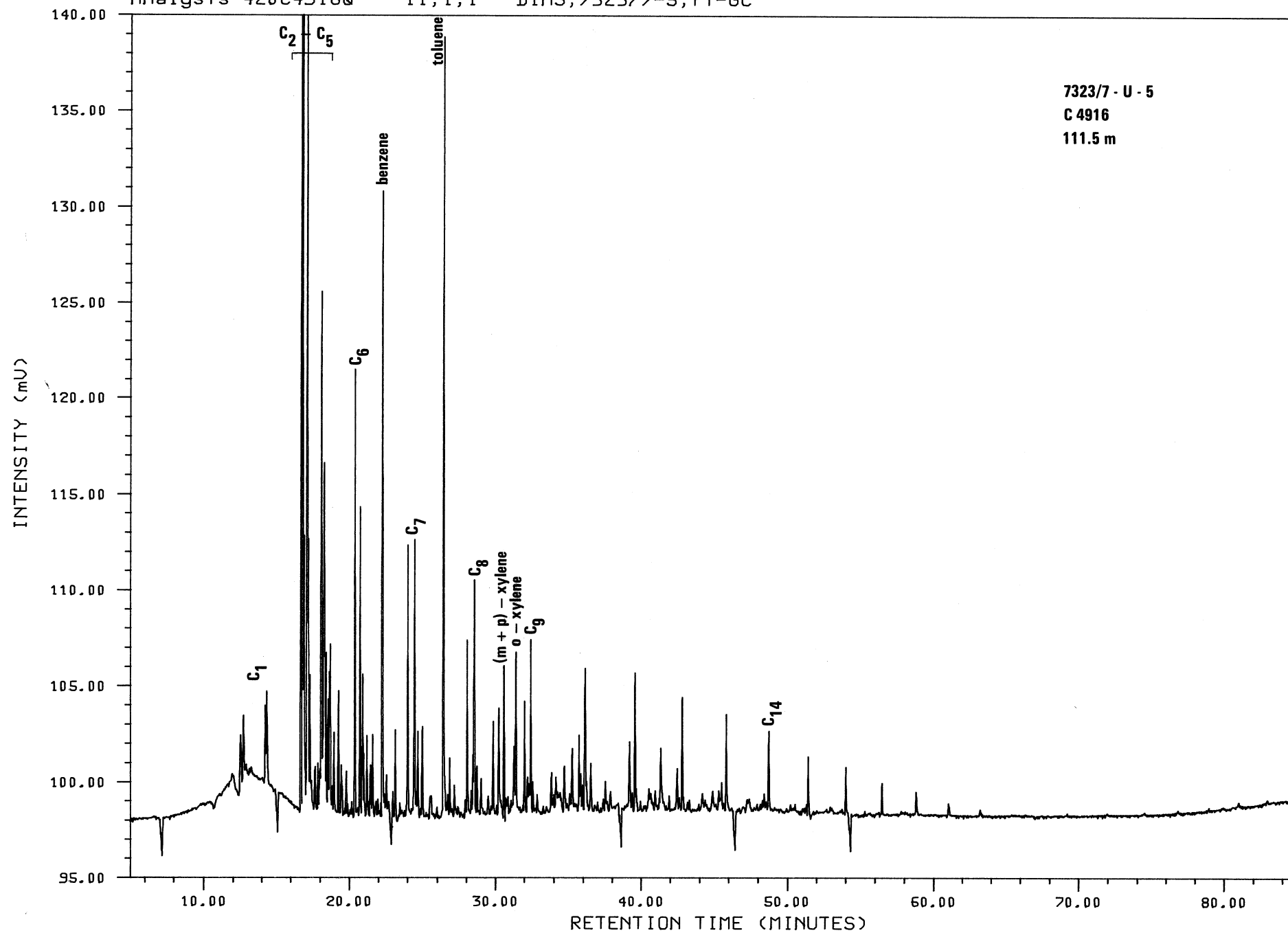




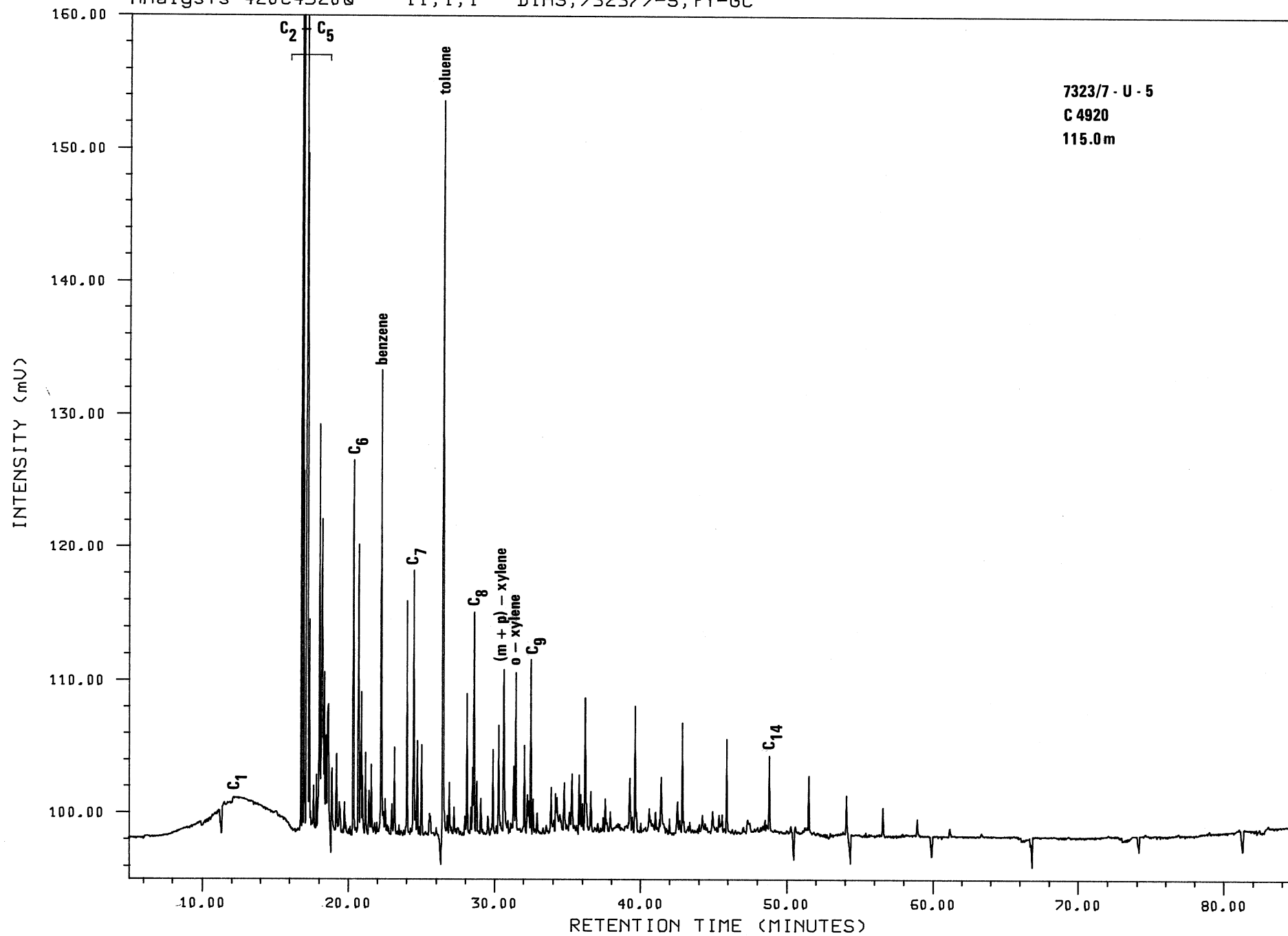
Analysis 420C4912Q 11,1,1 DIAS,7323/7-5,PY-GC



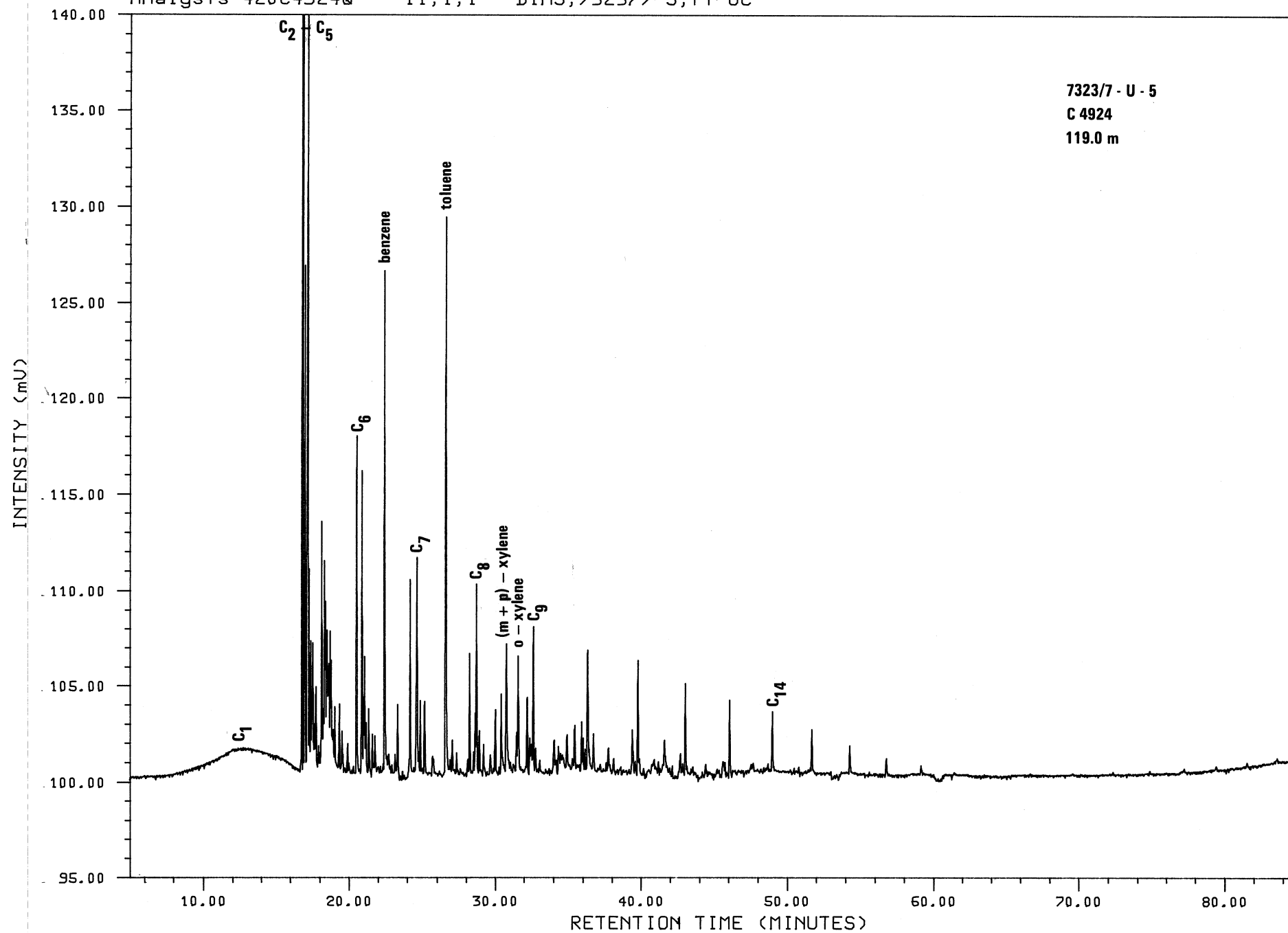
Analysis 420C4916Q 11,1,1 DIAS,7323/7-5,PY-GC



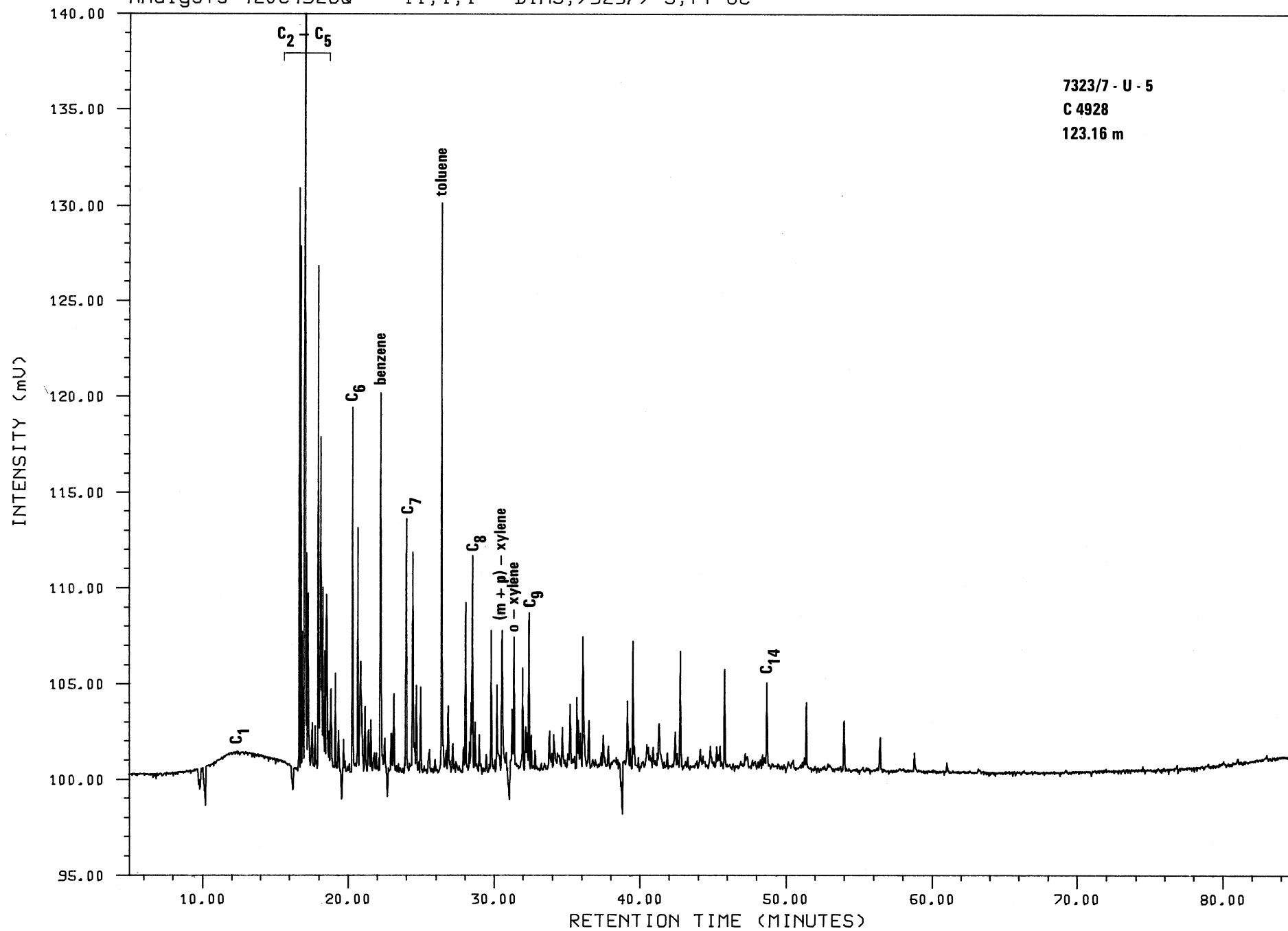
Analysis 420C4920Q 11,1,1 DIAS,7323/7-5,PY-GC



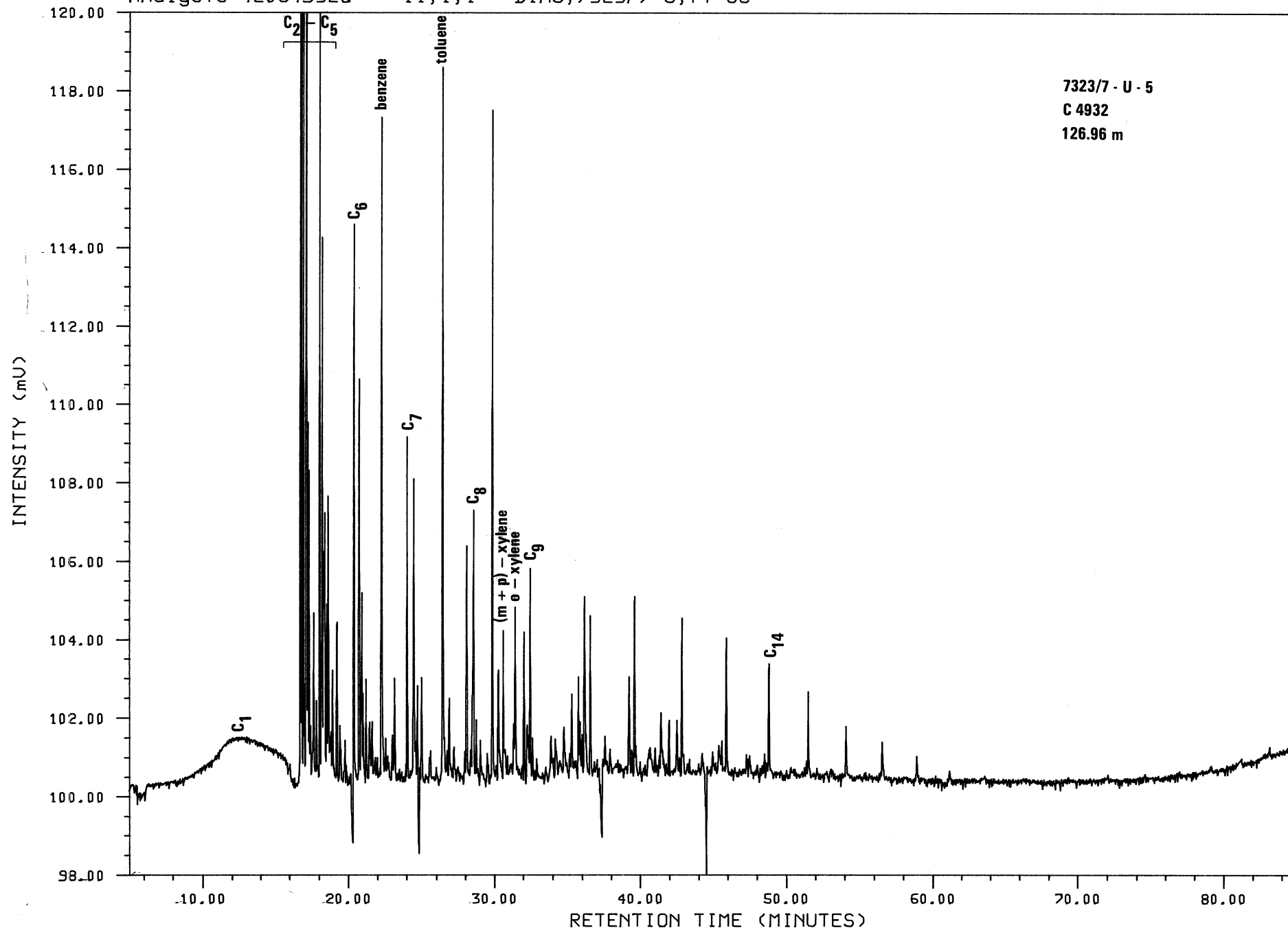
Analysis 420C4924Q 11,1,1 DIAS,7323/7-5,PY-GC



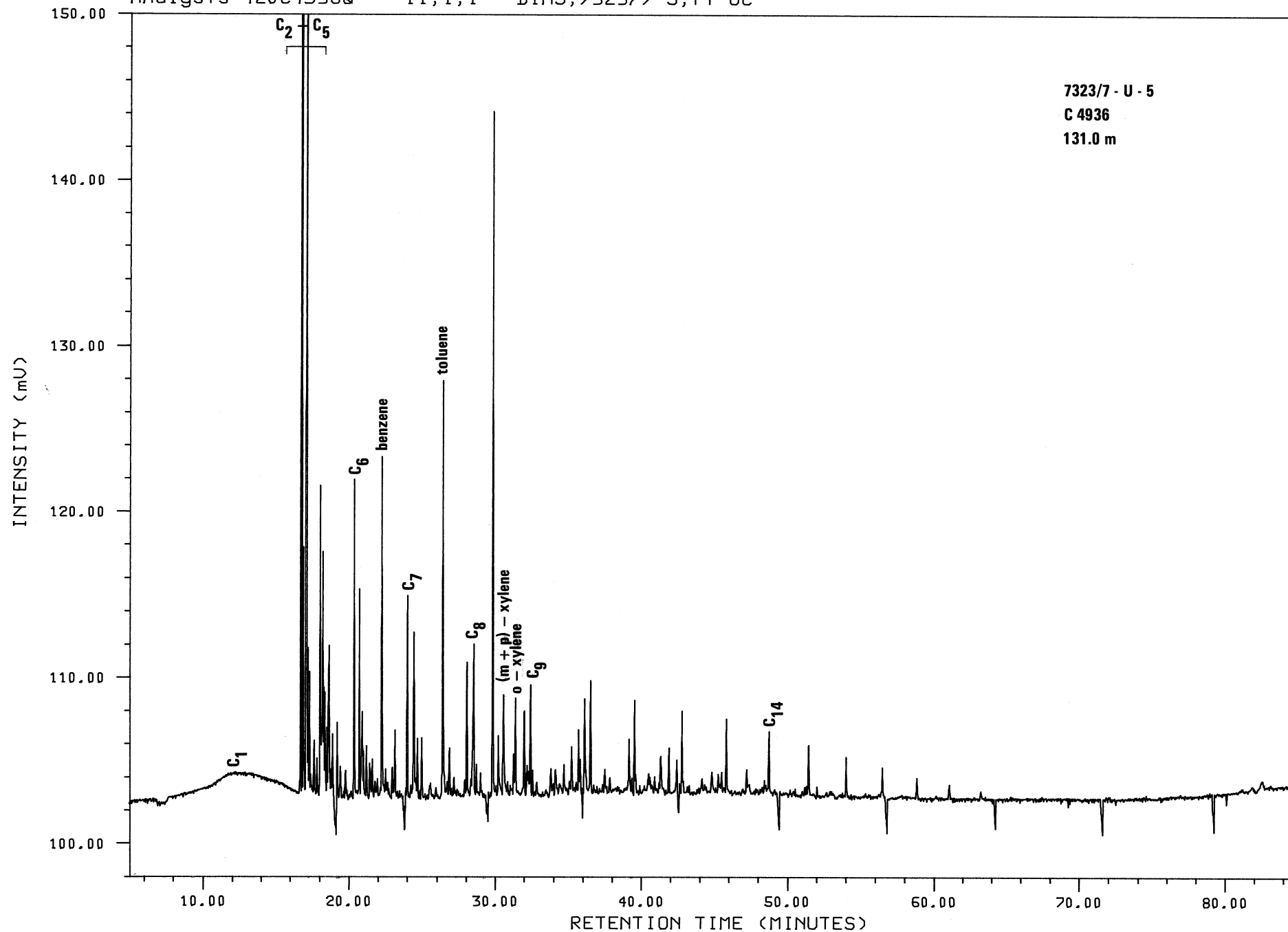
Analysis 420C4928Q 11,1,1 DIAS,7323/7-5,PY-GC



Analysis 420C4932Q 11,1,1 DIAS,7323/7-5,PY-GC



Analysis 420C4936Q 11,1,1 DIAS,7323/7-5,PY-GC



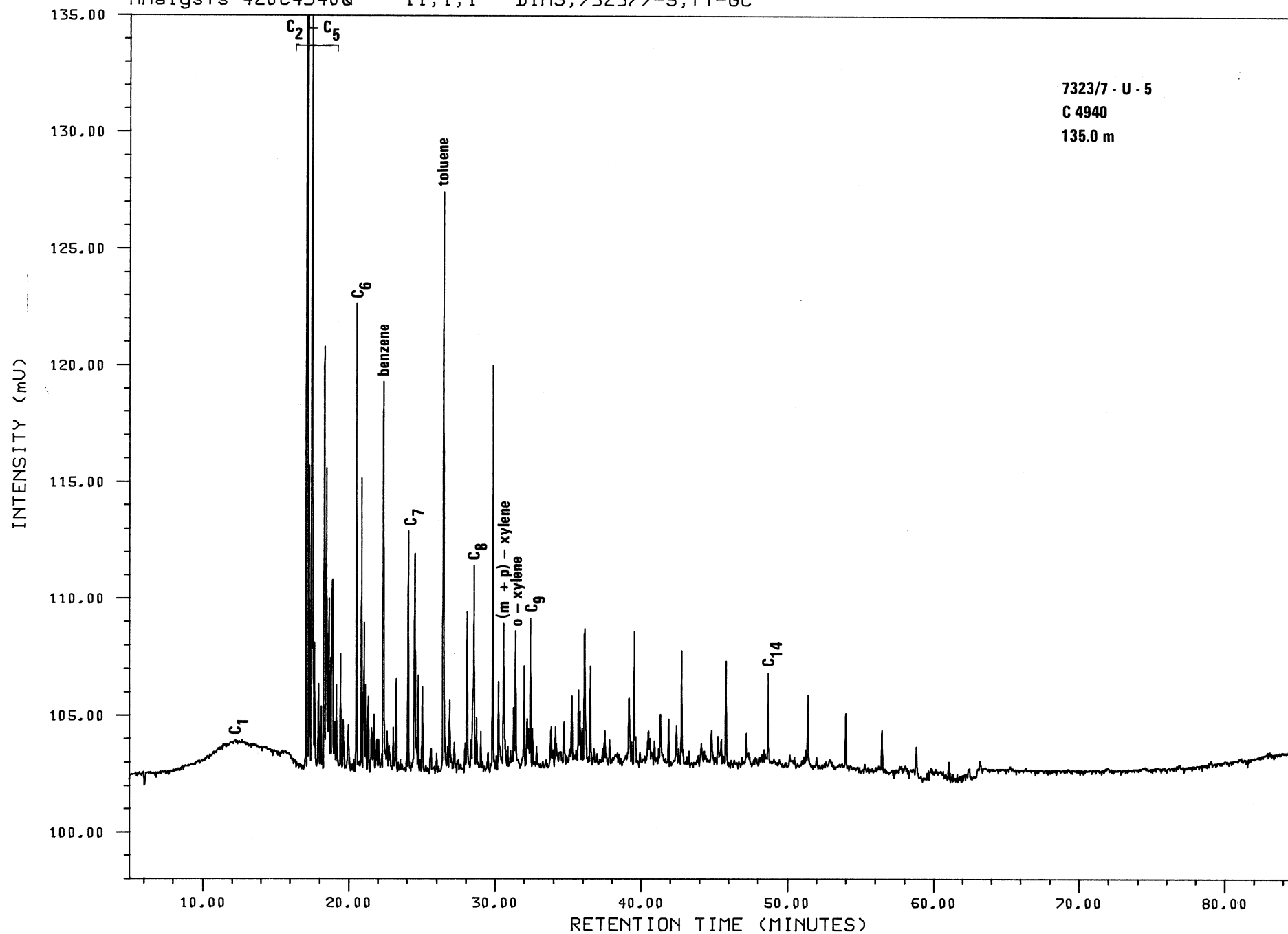


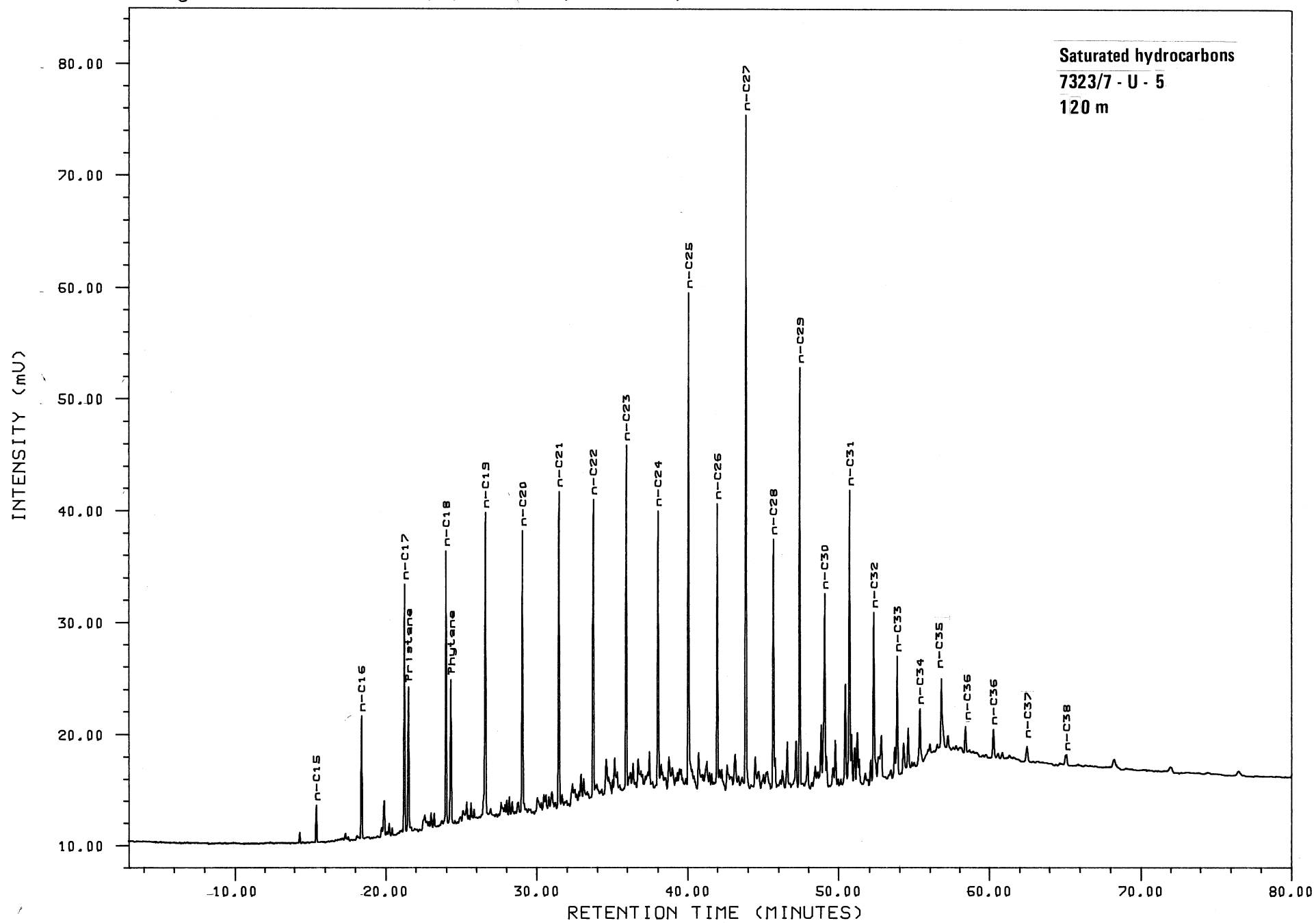
Figure A.III.8.2: Saturated hydrocarbon gas chromatograms.

n-C ₁₅ etc.	- n-alkanes
Pr	- pristane
Ph	- phytane
*	- other acyclic isoprenoids

Analysis 420C4924

2,1,1

DIAS, 7323/7-5, SAT



Analysis 420C4918S 2,1,1 DIAS,7323/7-5,SAT

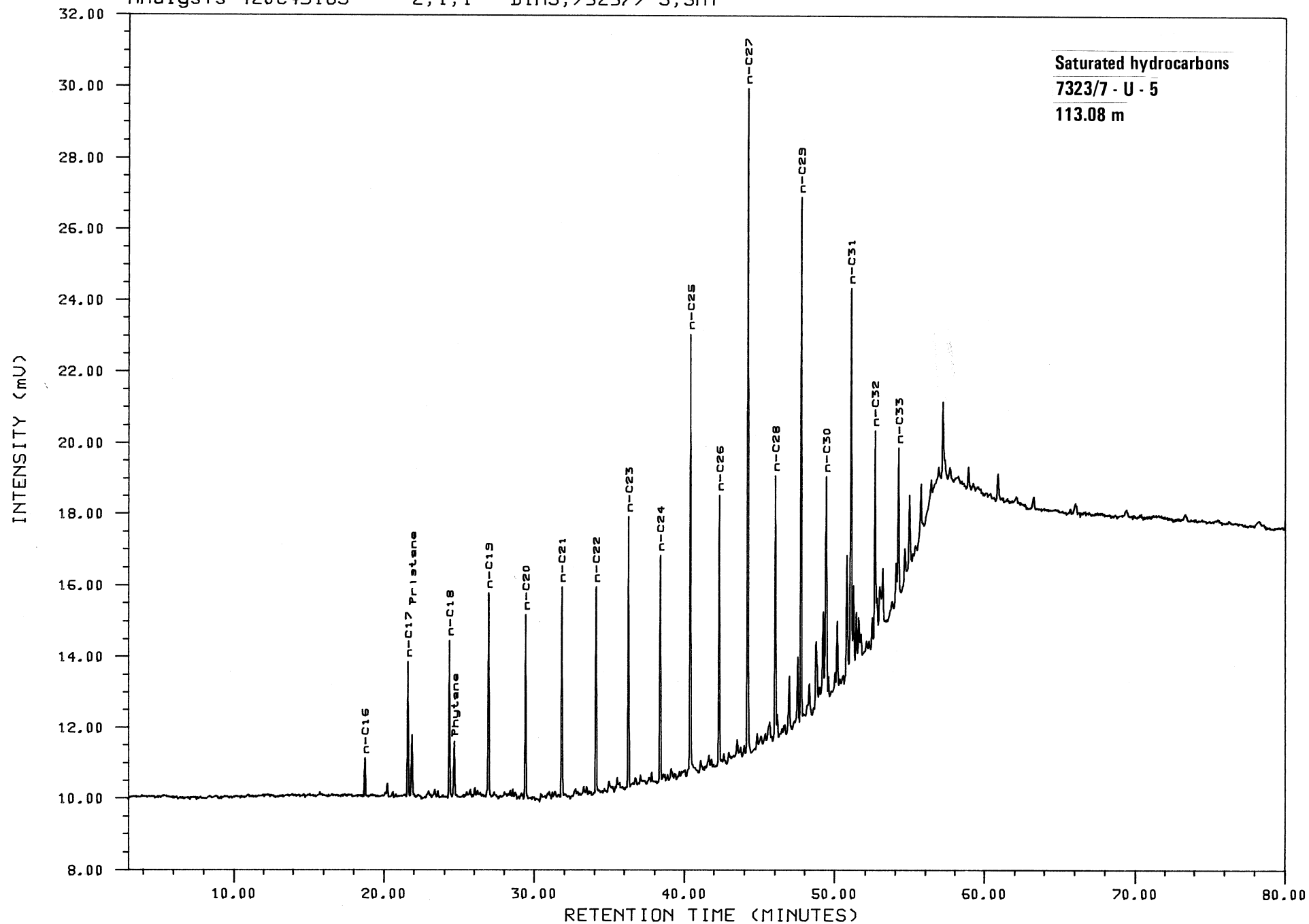
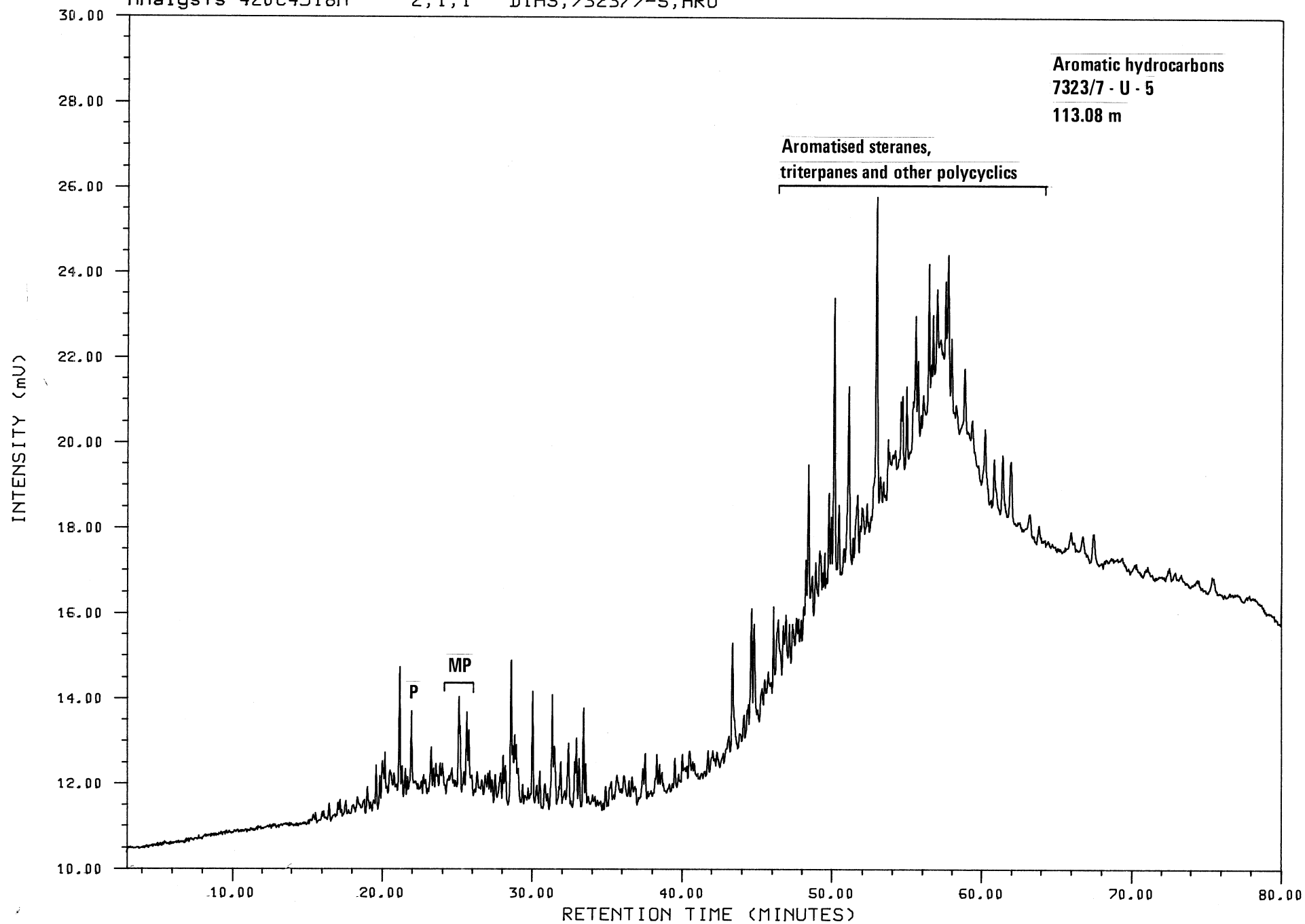


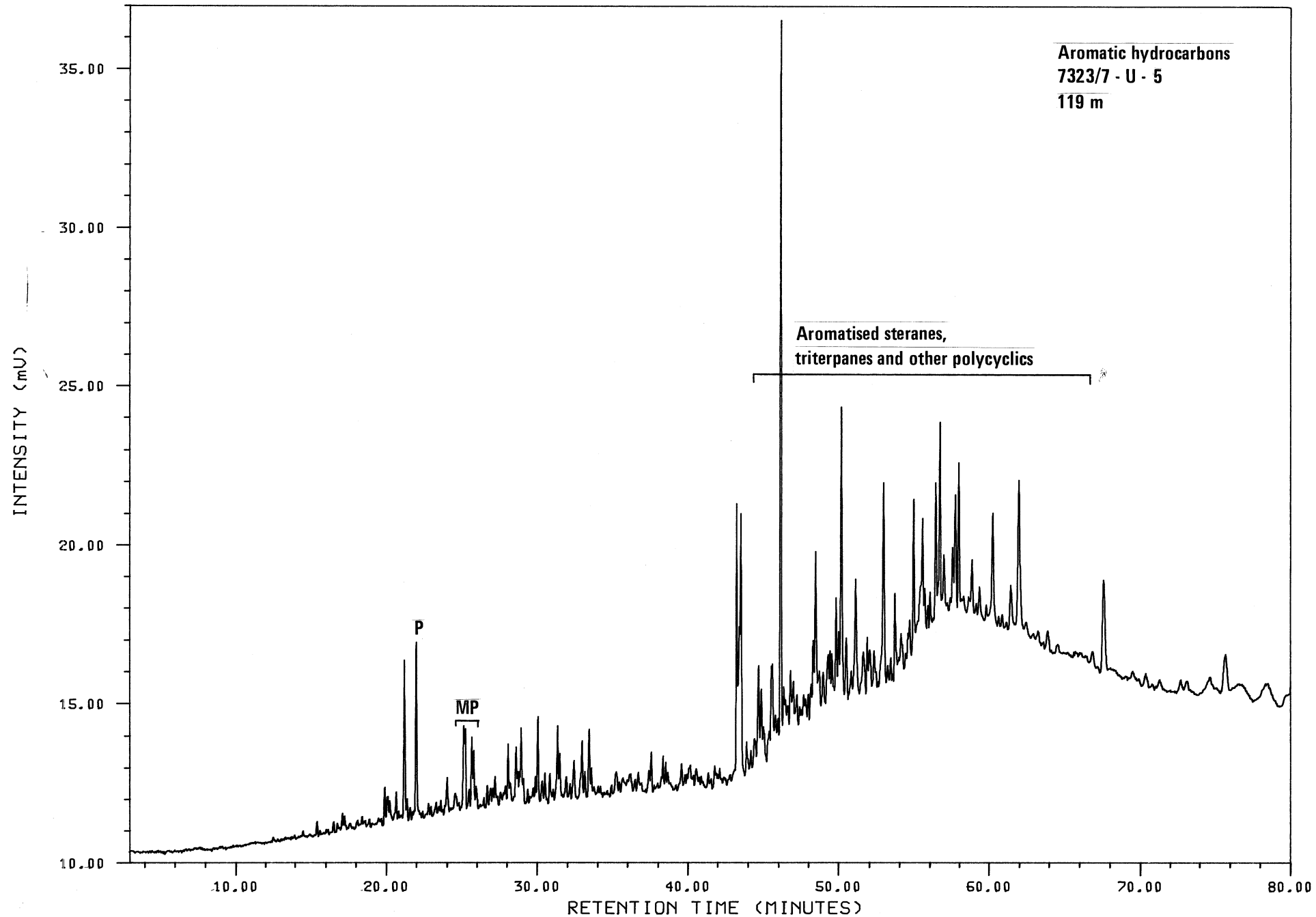
Figure A.III.8.3: Aromatic hydrocarbon gas chromatograms.

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

Analysis 420C4918A 2,1,1 DIAS,7323/7-5,ARO



Analysis 420C4924A 2,1,1 DIAS,7323/7-5,ARO



Key: A = Grey-black-brown claystone.

Upper case letters indicate values included in the main population. Lower case letters represent values in other populations.

PP = Statistical data populations

Y = Main population, not necessarily representative of sample maturity.

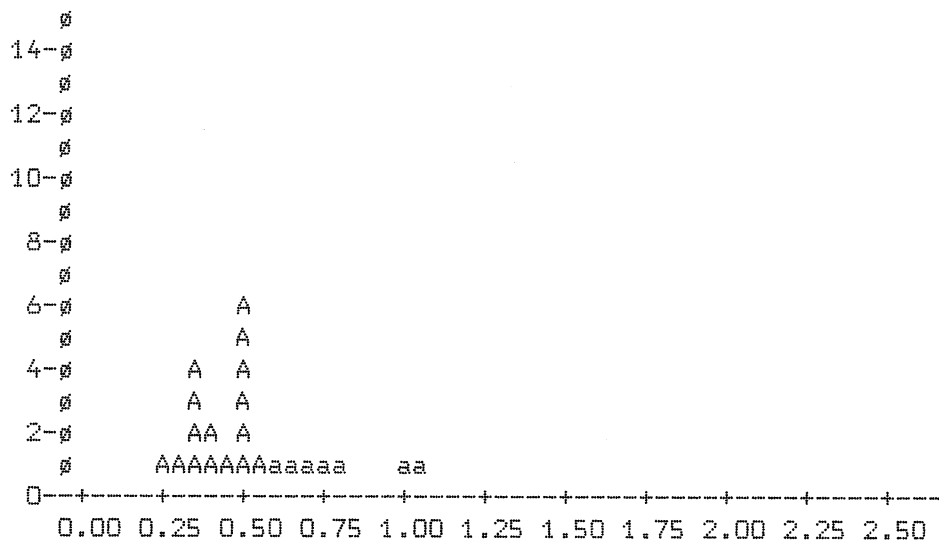
N = Other populations.

LOW+ HIGH = Population limits.

VAL. = Number of measurements in that population.

A = Clst. gy
B = Clst. dk gy
C = Clst. gn
D = Clst. bn
E = Clst. rd
F = Clst. calc.
G = Clst. carb.
H = Shale
I = Sandstone
J = Limestone
K = Coal
L = Lignite
M = Carbargillite
N = Siltstone
O = Bit
P = X

IKU# C 4909 104.0M 7323/7-U-5



PP	LOW	HIGH	LIT	#VAL	MEAN	STDV
Y	0.26	0.58	ALL	16	0.44	0.09
N	0.64	0.81	ALL	5	0.72	0.07
N	1.01	1.06	ALL	1	1.01	0.00
OVERALL				23	0.56	0.21

ORDERED VALUES FOLLOW:

0.26A 0.32A 0.36A 0.36A 0.37A 0.39A 0.43A 0.44A 0.48A 0.50A 0.50A
 0.52A 0.53A 0.53A 0.54A 0.57A 0.64a 0.66a 0.72a 0.79a 0.80a 1.01a
 1.06a

APPENDIX III.9: TABLE OF CONTENTS continued

Core 7323/7-U-2:

TABLES

Table A.III.9.1a: Concentration of C_1 - C_5 + hydrocarbons in headspace gas.

Table A.III.9.1b: Concentration of C_1 - C_5 + hydrocarbons in occluded gas.

Table A.III.9.1c: Concentration of C_1 - C_5 + hydrocarbons - summation.

Table A.III.9.2: Total organic carbon and data from Rock-Eval pyrolysis.

Table A.III.9.3: Data from pyrolysis-gas chromatograms.

FIGURES

Figure A.III.9.1: Pyrolysis-gas chromatograms (S2 peak).

Project no.: 21.3420.06
Well ident.: 7323/7-U-2
DATE : 4 - 11 - 86.

Table A.III.9.1a: Concentration of C₁-C₅ hydrocarbons in headspace gas.

[illegible]

Project no.: 21.3420.06
Well ident.: 7323/7-U-2
DATE : 4 - 11 - 86.

Table A.III.9.1b: Concentration of C₁-C₅ hydrocarbons in occluded gas.

[illegible]

Project no.: 21.3420.06
Well ident.: 7323/7-U-2
DATE : 4 - 11 - 86.

Table A.III.9.1c: Concentration of C₁-C₅ hydrocarbons - summation.

[illegible]

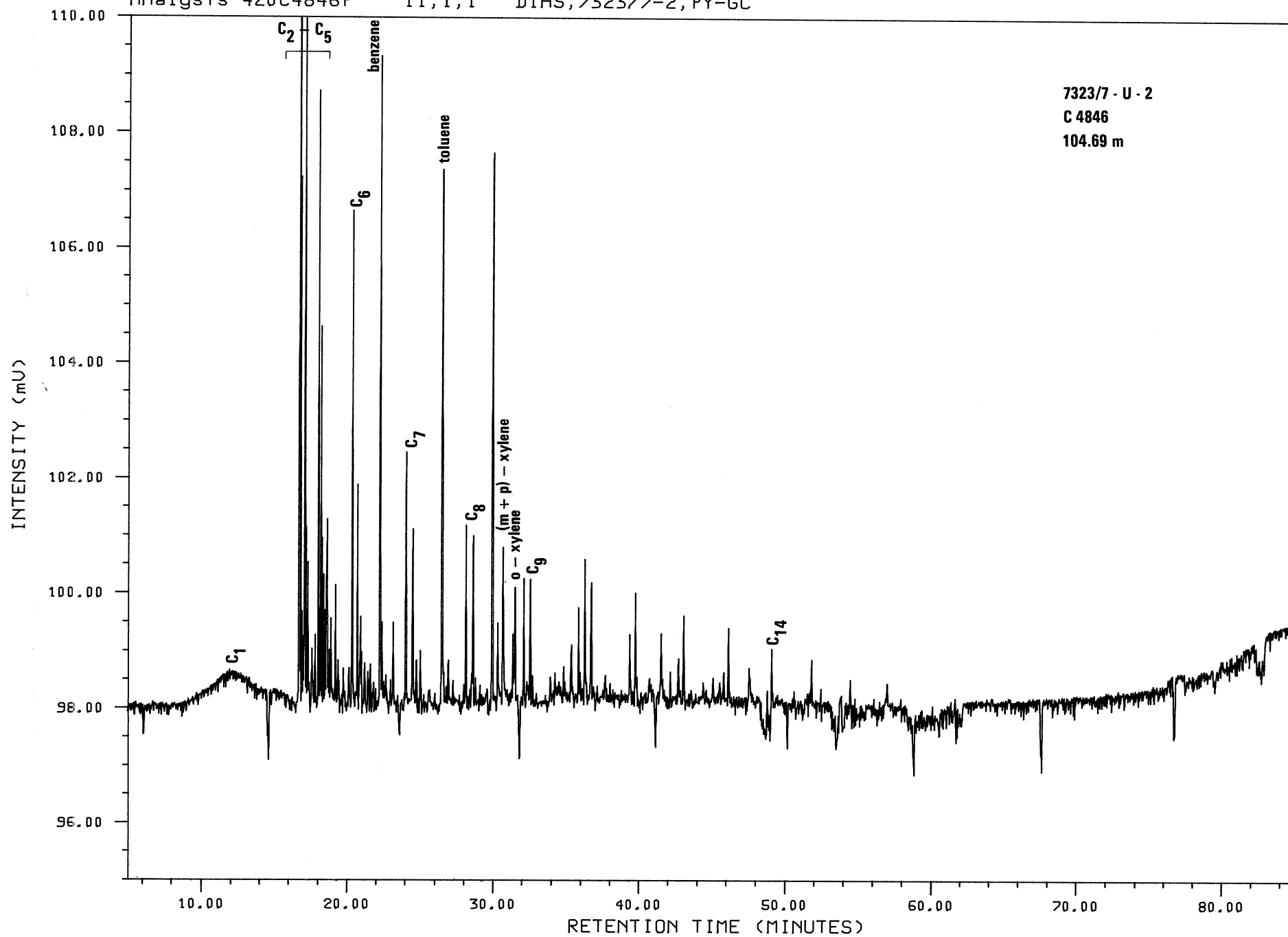
Table A.III.9.2: Total organic carbon and data from Rock-Eval
 pyrolysis.

I	IKU	DEPTH	:	S1	S2	S3	TOC	HYDR. INDEX	OXYGEN INDEX	PETROLEUM POTENTIAL	PROD. INDEX	TEMP. MAX
I	No.		:								S1	
I		m/ft	:	(mg/g ROCK)			(%)	(mg/g TOC)		S1+S2	S1+S2	(C)
I			:									
I	C 4846	104.69	:	0.06	0.42	0.58	0.97	43	60	0.48	0.13	433
I	C 4847	105.03	:	****	****	****	0.98	*****	****	*****	*****	***
I	C 4848	106.11	:	0.06	0.46	0.99	1.02	45	97	0.52	0.12	435
I	C 4849	108.61	:	****	****	****	1.09	*****	****	*****	*****	***
I	C 4850	111.71	:	0.05	0.34	0.58	1.05	32	55	0.39	0.13	435
I	C 4851	112.03	:	****	****	****	1.07	*****	****	*****	*****	***
I	C 4852	112.42	:	0.03	0.44	0.30	0.95	46	32	0.47	0.06	434

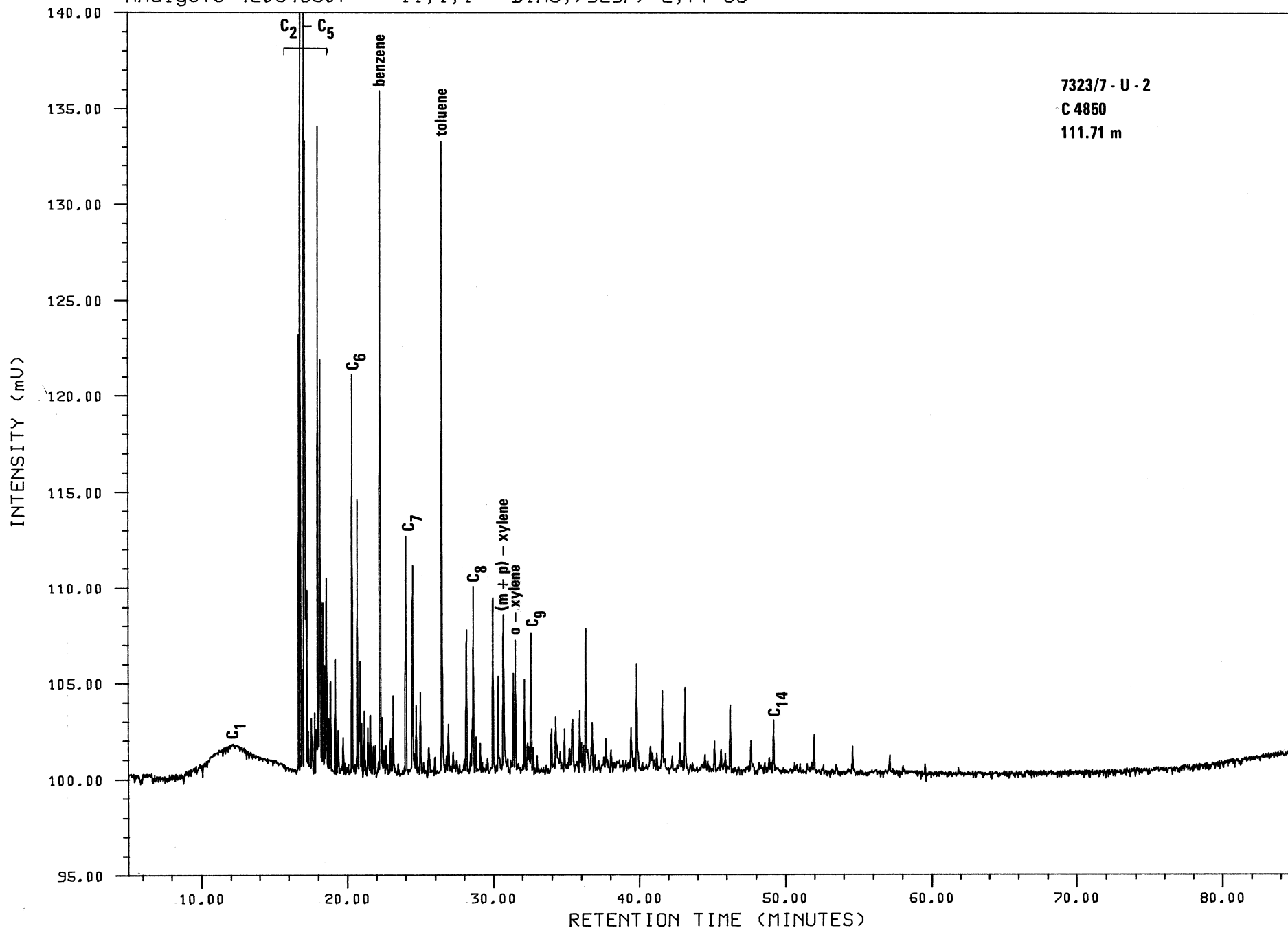
DATE : 16 - 11 - 86.

I	I	I	I	I	I	I	I	I
I IKU No	I DEPTH	I C1	I C2-C5	I C6-C14	I C15+	I (m+p)-xylene/ n-octene	I	I
I	I (m)	I %	I %	I %	I %	I	I	I
I C-4846	I 104.69	I 2.59	I 3.24	I 47.22	I 46.94	I 0.61	I	I
I C-4850	I 111.71	I 10.55	I 10.98	I 59.64	I 18.82	I 1.11	I	I

Figure A.III.9.1: Pyrolysis-gas chromatograms (S2 peak).



Analysis 420C4850P 11,1,1 DIAS,7323/7-2,PY-GC



III.10 ANALYTICAL METHODS

Gas analyses

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 Porapack 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.

Total Organic Carbon

Bulk samples were crushed in a mortar. Aliquots of the samples were then weighed into Leco crucibles, treated three times with hot 10% HCl to remove carbonate, and washed 4 times with distilled water 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 Leco CR12 carbon analyser.

The instrument was calibrated using a Triassic shale (4.96% TOC) as a standard. 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.; Temp. Program: 300°C (3 min.) - 25°C/min. - 550°C).

Preparation of kerogen concentrates

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). The dried kerogen sample was then analysed for Total Carbon content.

Fluorescence spectroscopy of sediment extracts

The dried (40-50°C) and powdered sediment sample (5 g of <62 µm fraction) was extracted ultrasonically using 18 ml of n-hexane (UVASOL, 10 me). The emission fluorescence spectrum between 280 and 500 nm was recorded on a Perkin Elmer 204-A instrument using an excitation wavelength of 265 nm (scan rate 60 nm/n, slit 10 nm).

A set of standard solutions containing various amounts (0.01-100 mg/l) of Ekofisk crude oil in n-hexane (UVASOL) was used for quantification.

Extractable Organic Matter

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

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

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

Evaporation of the light components in fluid samples

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

The fraction of light components was determined as the weight difference between the original sample and the residuum left after heating.

Medium-pressure liquid chromatography (MPLC)

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

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

Pyrolysis Gas Chromatography (Py-GC Programmed)

Thermal extraction (S1)

The whole rock (20-30 mg) or kerogen sample (<1 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 pyrolyzer 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 onto the column by removing the nitrogen batch. 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: 30°C (2 min.) - 4°C/min. - 310°C (10 min.)

Vitrinite reflectance

Vitrinite reflectance measurements were carried out on whole-rock samples using the following method. The rock samples were broken up, if necessary, and mounted in a fast-setting, synthetic resin. Temperatures in excess of about 50°C were avoided as these can result in alteration of the organic material. Once the resin was set, the samples 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, water was used. The samples were then polished on Selvyt cloth using 5/20, 3/50 and gamma grade alumina powder. Following polishing, the surface of the samples was carefully cleaned to remove any traces of the polishing powders.

Reflectance measurements were carried out using a Leitz M.P.V. microscope and photomultiplier 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 particles of vitrinite and reflectance measurements were taken on these. The reflectance of the 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 were made on each rock sample. Coals and carbonaceous claystones generally provide the most reliable data, while sandstones and carbonates generally provide the least reliable data.

UV-fluorescence of liptinite

The samples were also examined in ultra-violet light in order to 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. A scale comparing vitrinite reflectance measurements and spore fluorescence to thermal maturity is shown below.

VITRINITE REFLECTANCE (% Ro)	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10
% CARBON CONTENT DAF.	57	62	70	73	76	79	80.5	82.5	84	85.5
LIPTINITE FLUOR. (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	

NOTE: The relationship between liptinite fluorescence colour, vitrinite reflectance and carbon content may vary with depositional environment and catagenic history. The above is only a guide.

Gas chromatographic analysis

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

The total aromatic fractions were diluted with n-hexane and analysed on an HP 5730A gas chromatograph, fitted with a DB-5 fused silica column (15 x 0.25 mm i.d.), using a hydrogen carrier gas with a flow rate of 2.5 ml/min. The injection split ratio was 1:10.

The temperature programme used was 80°C (2 min.) - 4°C/min - 280°C.

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

Gas chromatography - mass spectrometry (GC-MS)

GC-MS analysis were performed on a VG Micromass 70-70H GC-MS-DS system. The Varian Series 3700 GC was fitted with a fused silica OV-1 capillary column (30m x 0.3 mm i.d.). Helium (1.5 ml/min) was used as carrier gas and the injections were performed in split mode (1.5 l, split ratio 1:15).

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

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

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

¹³C isotope analysis

The ¹³C (and ²H) isotope analyses were performed by Geochemische Analysen, Manfred Schmitt (GCA) in Lehrte, F.R.G.

The samples were filled in a glass capillary and transferred into a combustion system filled with copper dioxide, heated to 900°C. A stream of ultrapure helium and oxygen flushed the reaction products through silver wool (450°C) to remove traces of halogens and sulphur.

H₂O and CO₂ were trapped in separate cooltraps. After removal of the carrier gas by high vacuum, CO₂ and H₂O were sealed off separately in 6 mm glass tubes. H₂O was reduced to H₂ by zinc at 460°C.

The $^{13}\text{C}/^{12}\text{C}$ - isotope ratio (and D/H- isotope ratio) was measured with a high precision mass spectrometer Finnigan MAT 251.

Precision of the preparation lines and the mass spectrometer was daily controlled by measurements of standard substances and by double analyses.

The isotope ratios are given as delta-values (del):

$$\text{del (\%)} = ((R \text{ sample} - R \text{ stand.}) / (R \text{ stand.})) * 1000$$

$^{13}\text{C}/^{12}\text{C}$ - isotope ratios are calculated versus PDB.

D/H-isotope ratios are calculated versus SMOW.

The CV value is calculated after SOFER (1984) to differentiate between marine and terrestrial-sourced oils:

$$\text{CV} = (-2.53 * \text{del}^{13}\text{C}_{\text{sat}}) + (2.22 * \text{del}^{13}\text{C}_{\text{aro}}) - 11.65.$$

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APPENDIX

Molecular ratios from terpane and sterane mass chromatograms applied as maturity and source characteristic parameters

Geochemical fossil/biological marker compounds are characteristic of the type of organic matter present at the time the sediments were deposited. The biological isomers of these compounds are converted to the geochemical isomers with increasing maturity until a stable mixture of the isomers is attained. Migration and weathering processes also alter the distribution of biomarker compounds in a sample.

Hopanes, moretanes and tricyclic terpanes are the most common compounds in the m/z 191 mass chromatograms of most extracts and oils. Of the hopanes, the C_{27} and C_{29} - C_{35} homologs are ubiquitous, while 28,30-bisnorhopane is believed to be typical of certain types of source rocks. This is also thought to be true for a component, probably gammacerane, which sometimes coelutes with the 22S isomer of the C_{31} 17 α (H)-hopanes. The relative distribution of the C_{27} trisnorhopanes is thought to be both source- and maturity-dependant.

In the m/z 217 and 218 sterane mass chromatograms, the molecular weight distribution of the C_{27} - C_{30} regular steranes is thought to be representative of the original organic matter input. The C_{29} steranes are generally indicative of input from higher land plants, but, more recently, similar compounds have been reported from marine micro-organisms. Moldowan (1984) has also recently published data on C_{30} steranes that are thought to be characteristic of input from marine organisms. This is one of the few marine markers reported, and previously the indication of marine origin for mature geolipids was assessed on the basis of absence of nonmarine marker compounds.

The biological hopane isomers, the 17 β (H),21 β (H)-hopanes, undergo structural changes during maturation. These isomerisation reactions are believed to proceed through the 17 β (H),21 α (H)-hopane structure (moretanes) to the stable 17 α (H),21 β α (H)-hopane structure. With thermal maturity, 17 α (H)-hopanes account for 90-100% of the hopanes present. The ratio $\alpha\beta/\alpha\beta+\beta\alpha$ is used to describe this reaction. In the extended hopanes ($\geq C_{31}$), the thermally stable S configurations at C-22 become increasingly more abundant compared to the biologically preferred R configu-

rations with increased maturity. The ratio of the 22S:22R isomers stabilises at about 60:40 at thermal maturity. The Tm/Ts C₂₇ hopane ratio (Seifert et al, 1978) also varies with thermal maturity such that, with increasing maturity, 17 α (H)-trishnorhopane (Tm) is reduced in intensity relative to the more stable 18 α (H)-trishnorhopane (Ts), causing the Tm/Ts ratio to decrease. However, this ratio is also thought to be source-dependent, and this should be allowed for when using the ratio as a maturation indicator. The tricyclic terpanes vary in abundance with maturity (Schou et al., 1984a), as does 28,30-bishnorhopane (Cornford et al., 1983; Schou et al., 1984b).

Two sterane isomerisation reactions are commonly used for maturity determination based on data from the m/z 217 mass chromatogram. The biologically preferred 14 α (H),17 α (H) regular sterane isomers are gradually replaced by the more thermally stable 14 β (H),17 β (H)-sterane isomers. At thermal maturity, $\beta\beta$ isomers may account for 75-85% of the $\alpha\alpha/\beta\beta$ mixture. Mackenzie et al (1980) have observed a change from a dominance of the biological sterane epimer in recent sediments to the more stable S-configuration at C₂₀, such that this configuration accounts for 50% of the epimers at thermal maturity. The abundance of rearranged steranes relative to regular steranes has also been reported to increase with thermal maturity.

One of the reactions taking place at an early stage of diagenesis is the aromatisation of steranes, leading to the formation of mono- and triaromatic analogs. This process is measured by the abundance of triaromatic compounds relative to mono-aromatic compounds (% tri/tri+mono) from the m/z 231 and 253 mass chromatograms, respectively. Cracking processes also take place during early diagenesis, and may be used for maturity determination together with the %tri/tri+mono ratio (Mackenzie et al., 1980; 1981; 1982).

The effect of migration and weathering on the distribution of biological markers is less well understood than maturity-induced changes. Migration may be observed to cause an increase in the relative amounts of rearranged and 14 β (H),17 β (H) regular steranes (Seifert and Moldowan, 1978). Severe biological alteration leads to the formation of desmethyl-hopanes (Seifert and Moldowan, 1979).

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Main data report

Appendix:
Organic
Geochemical
Data



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