

CONTINENTAL SHELF INSTITUTE

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<small>REPORT TITLE/ TITTEL</small> Analysis of Core Samples from 7120/8-3. Correlation with Data from 7120/8-2.			
<small>CLIENT/ OPPDRAGSGIVER</small> Statoil			
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SUMMARY/ SAMMENDRAG

The report includes extraction, GC and GC-MS data of 4 core samples from well 7120/8-3. These data together with previously reported data have been used in an attempt to correlate oil shows and possible source rocks in 7120/8-2 and 7120/8-3. All the analysed shows were seen to be very similar, possibly originating from the shale represented by the sample at 2205m in 7120/8-3.

<small>KEY WORDS/ STIKKORD</small> Oil Show	Source Rock
Correlation	GC-MS

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EXPERIMENTAL

Extractable Organic Matter

Approximately 50gm of powdered rock was extracted by a ultrasonic probe for 3 minutes using dichloromethane (DCM) as solvent. The DCM used was of organic geochemical grade and blank analyses showed the occurrence of negligible amounts of contaminating hydrocarbons.

Activated copper fillings were used to remove any free sulphur from the samples.

The shale sample was extracted by careful washing with DCM, prior to the use of the ultrasonic probe on crushed sample.

After extraction the solvent was removed on a Buchi Rotavapor and the amount of extractable organic matter (EOM) was determined.

Chromatographic Separation

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

Gas Chromatographic Analysis

The saturated hydrocarbon fractions were each diluted with n-hexane and analysed on a HP 5730A gas chromatograph, fitted with a 25m OV-101 fused silica capillary column. Hydrogen (0.7ml/min) was used as carrier gas. The aromatic fractions were after dilution with n-hexane, analysed on a Carlo Erba Fractovap Series 2150 GC fitted with a 20mm SE-54 fused silica column.

Injections on both systems were performed in the split mode (1:20). The temperature program applied was 80°C (2 min) to 260°C at 4°C/min.

The data processing for all the GC analyses was performed on a VG Multi-chrom System.

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Gas chromatography - mass spectrometry (GC-MS)

GC-MS analyses were performed on a VG Micromass 70-70H GC-MS-DS system. The Varian Series 3700 GC was fitted with a fused silica OV-1 capillary column (30m x 0.3mm i.d.). Helium (0.7kg/cm^2) was used as carrier gas and the injections were performed in split mode (1:15). The GC oven was programmed from 120°C to 280°C at $4^{\circ}\text{C}/\text{min}$. after an initial isothermal period of 2 minutes.

The saturated hydrocarbons were analysed in multiple ion mode (MID) at a scan cycle time of approximately 2 secs. The mass spectrometer operated at 70eV electron energy and an ion source temperature of 200°C . Data acquisition was done by a GC data system.

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

CORRELATION OF OIL SHOWS AND CONDENSATE WITH POSSIBLE SOURCE ROCKS IN WELLS 7120/8-2 AND 7120/8-3

Table A summarises all GC-MS data obtained on samples from 7120/8-2 and 7120/8-3. Four samples (A-8246 - 49) were analysed in this study (see Figures 3 and 4 for chromatograms). For chromatograms of the other samples we refer to P.B. Hall et al., 1983 (IKU report 05.0137) and S. Betts et al., 1983 (IKU report 05.0101).

The data indicate that the hydrocarbon shows in the sandstones are very similar, in both wells, suggesting they all originate from the same type of source rock. Significant amounts of the bisnorhopane (Z) are not seen in any of the samples. The molecular weight distribution of C_{27} to C_{29} steranes (a+b/h+k) and the C_{29} rearranged to regular steranes (h+k/q+r+s+t) are also very similar. The GC analyses of the saturated hydrocarbons show that the sandstones contain paraffinic type hydrocarbons. Correlation of condensates by GC-MS is difficult, since they contain low amounts of steranes and terpanes, and thus are liable to contamination. However, the distribution in sample A-4205 is fairly similar to the shows in the sandstones, suggesting that the same main source could be responsible for the condensate and the shows.

By referring to the source rock report on well 7120/8-3 only one of the samples analysed by GC-MS may be considered as a source rock. Sample A-6014 at 2205m representing the Kimmeridge Clay equivalent in the Troms area, shows the same general distribution in the mass chromatograms as do the oil shows. This indicates that the shale at this depth could be representative of the main source of the shows and the condensate. In well 7120/8-2 the Upper Jurassic claystones were believed to be representative of the most promising source rock (P.B. Hall et al., 1983). The maturity is, however, slightly lower in this well and direct comparison of the biomarker ratios is more difficult. The coal sample is clearly different to the shows.

As a conclusion it may be said that one main source is responsible for the oil shows and condensate in both 7120/8-2 and 7120/8-3. The most likely source rock is the Upper Jurassic claystones represented by the sample at 2205m in 7120/8-3.

Table A: Summary of GC-MS data of well 7120/8-2 and 7120/8-3

<u>7120/8-3</u>			TRI/E	B/A	Z/E	X/E	$\alpha\beta/\alpha\beta+\beta\alpha$	%22S	%20S	% $\beta\beta$	a+b/h+k	h+k/q+r+s+t
A-5970	sh.	1545m	0.29	3.3	-	-	0.78	54.8	44.5	69.2	1.3	0.6
A-5887	sh.	1795m	0.03	7.9	-	-	0.69	59.3	32.3	50.8	0.7	0.4
A-5995	sh.	1920m	0.03	3.7	-	-	0.69	59.0	42.3	54.8	0.9	0.3
A-6000	sh.	1995m	0.04	7.5	-	-	0.74	59.7	44.8	62.4	0.8	0.5
A-6014	sh.	2205m	0.07	1.4	-	0.06	0.90	59.7	51.3	77.0	1.1	1.2
A-8246	sst.	2212.99-.93m	0.12	0.8	-	0.11	0.93	65.4	54.7	74.7	0.9	1.0
A-8247	sst.	2216.83-.89m	0.13	0.8	-	0.10	0.89	60.0	56.8	76.4	1.0	1.0
A-8248	sh.	2220.45-.48m	0.12	2.8	-	0.09	0.86	63.6	45.2	67.6	0.8	0.9
A-8248	w.	2220.45-.48m	0.08	1.7	-	0.07	0.89	62.7	47.3	68.6	1.0	0.6
A-8249	sst.	2232.70-.75m	0.09	0.9	-	0.17	0.90	54.5	52.8	73.1	0.8	0.9
A-6018	sh.	2295m	0.04	6.2	-	0.07	0.65	57.5	51.0	58.3	1.0	0.7
<u>7120/8-2</u>												
M-6984	sh.	1995m	0.03	3.7	-	0.08	0.83	64.0	50	59	1.1	0.5
M-6987	sh.	2040m	0.04	2.6	-	0.07	0.87	53.3	52	69	1.1	0.6
M-6989	sh.	2070m	0.05	6.3	-	0.09	0.87	52.5	50	69	0.8	0.8
A-4199	sst.	2100m	0.12	0.8	-	0.16	0.93	60.5	59	79	1.0	1.0
A-4200	w.	2113m	0.10	1.7	0.10	0.05	0.88	65.2	45	76	1.1	0.5
A-4200	sh.	2113.76m	0.06	8.3	-	0.09	0.77	61.3	32	59	0.8	0.6
A-4201	sst	2178m	0.13	0.8	-	0.20	0.91	58.9	60	73	0.8	0.9
A-4202	sst.	2191m	0.06	0.8	-	0.12	0.89	65.0	55	80	1.1	0.7
A-4203	coal	2213.85m	0.04	5.3	0.38	0.08	0.88	60.9	63	51	0.3	0.8
A-4204	sst.	2217m	0.04	0.8	-	0.12	0.88	56.0	51	74	0.8	0.7
M-6996	sh.	2331m	0.02	4.8	0.05	0.10	0.78	62.5	48	71	0.5	0.7
M-7005	sh.	2361m	-	7.7	-	0.07	0.79	54.5	40	55	0.7	0.5

T A B L E : 1.1

CONCENTRATION OF EOM AND CHROMATOGRAPHIC FRACTIONS
Well 7120/8-3

IKU-No	DEPTH (m)	Rock Extr. (g)	EOM (mg)	Sat. (mg)	Aro. (mg)	HC (mg)	Non HC (mg)	TOC (%)
A 8246	2212.90 -.93	9.4	12.6	5.6	1.2	6.8	5.8	0.20
A 8247	2216.83 -.89	100.6	123.6	27.2	8.7	35.9	87.7	0.09
A 8248	2220.46 -.48	68.3	81.9	5.8	5.4	11.2	70.7	1.26
A 8249	2232.70 -.75	103.8	504.5	211.5	67.6	279.1	225.4	0.41
A 8248	2220.46		2.5	0.7	0.5	1.2	1.3	
DCM-washings	-.48							

DATE : 4 - 10 - 83.

T A B L E : 1.2

WEIGHT OF EOM AND CHROMATOGRAPHIC FRACTIONS

(Weight ppm OF rock)

Well 7120/8-3

IKU-No	DEPTH (m)	EOM	Sat.	Aro.	HC	Non HC
A 8246	2212.90 -.93	1340	596	128	723	617
A 8247	2216.83 -.89	1229	270	86	357	872
A 8248	2220.46 -.48	1199	85	79	164	1035
A 8249	2232.70 -.75	4860	2038	651	2689	2171
A 8248	2220.46					
DCM-washings	-.48					

DATE : 4 - 10 - 83.

T A B L E : 1.3

CONCENTRATION OF EOM AND CHROMATOGRAPHIC FRACTIONS

(mg/g TOC)

Well 7120/8-3

I	IKU-No	DEPTH	EOM	Sat.	Aro.	HC	Non HC	I
I		(m)						I
I	A 8246	2212.90	670.2	297.9	63.8	361.7	308.5	I
I		-.93						I
I	A 8247	2216.83	1365.1	300.4	96.1	396.5	968.6	I
I		-.89						I
I	A 8248	2220.46	95.2	6.7	6.3	13.0	82.2	I
I		-.48						I
I	A 8249	2232.70	1185.4	497.0	158.8	655.8	529.6	I
I		-.75						I
I	A 8248	2220.46						I
I	DCM-washings	-.48						I

DATE : 4 - 10 - 83.

T A B L E : 1.4

COMPOSITION IN % OF MATERIAL EXTRACTED FROM THE ROCK

IKU-No	DEPTH (m)	Sat EOM	Aro EOM	HC EOM	SAT Aro	Non HC EOM	HC Non HC
A 8246	2212.90 -.93	44.4	9.5	54.0	466.7	46.0	117.2
A 8247	2216.83 -.89	22.0	7.0	29.0	312.6	71.0	40.9
A 8248	2220.46 -.48	7.1	6.6	13.7	107.4	86.3	15.8
A 8249	2232.70 -.75	41.9	13.4	55.3	312.9	44.7	123.8
A 8248	2220.46	28.0	20.0	48.0	140.0	52.0	92.3
DCM-washings	-.48						

DATE : 4 - 10 - 83.

Table 1.5: Weights of NSO and asphaltene fractions
Well 7120/8-3

IKU No.	Depth	NSO (mg)	Asphaltenes (mg)
A-8246	2212.90-.93	1.2	0.4
A-8247	2216.83-.89	16.0	0.3
A-8248	2220.46-.48	2.0	2.4
A-8249	2232.70-.75	24.6	0.9

T A B L E 2

TABULATION OF DATAS FROM THE GASCHROMATOGRAMS
Well 7120/8-3

I	:	DEPTH	:	PRISTANE	:	PRISTANE	:	CPI	I
I	IKU No.	:	:	-----	:	-----	:		I
I	:	(m)	:	n-C17	:	PHYTANE	:		I
I	:	:	:	:	:	:	:	:	I
I	A 8246	2212.90	:	0.5	:	1.9	:	1.0	I
I	:	-.93	:	:	:	:	:	:	I
I	A 8247	2216.83	:	0.5	:	2.0	:	1.1	I
I	:	-.89	:	:	:	:	:	:	I
I	A 8248	2220.46	:	0.5	:	3.5	:	1.2	I
I	:	-.48	:	:	:	:	:	:	I
I	A 8249	2232.70	:	0.5	:	1.8	:	1.1	I
I	:	-.75	:	:	:	:	:	:	I
I	A 8248	2220.46	:	0.4	:	2.5	:	1.1	I
I	DCM-washings	-.48	:	:	:	:	:	:	I

DATE : 4 - 10 - 83.

Well 7120/8-3

FIGURE 1

GC of saturated hydrocarbons

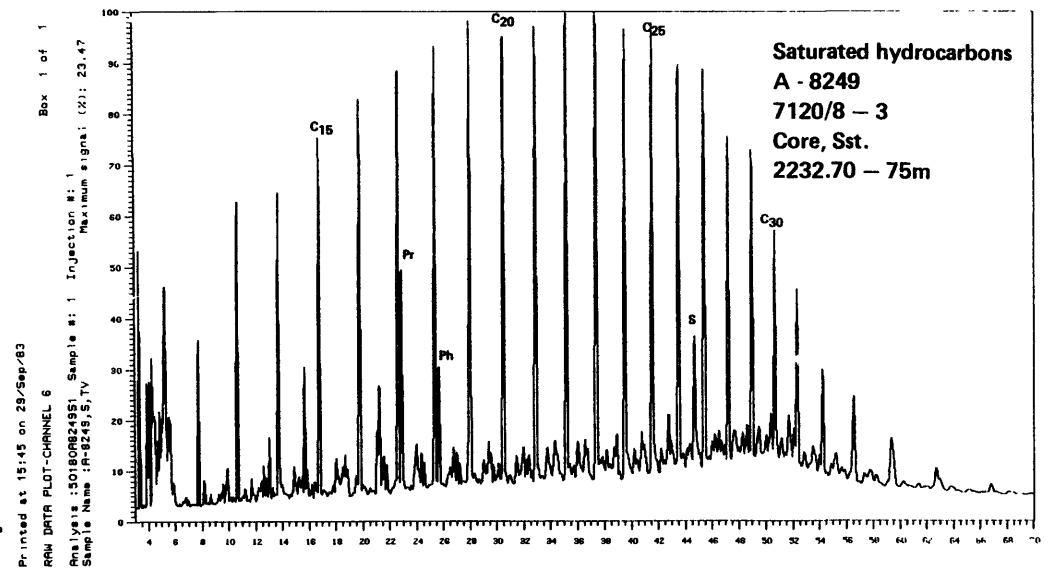
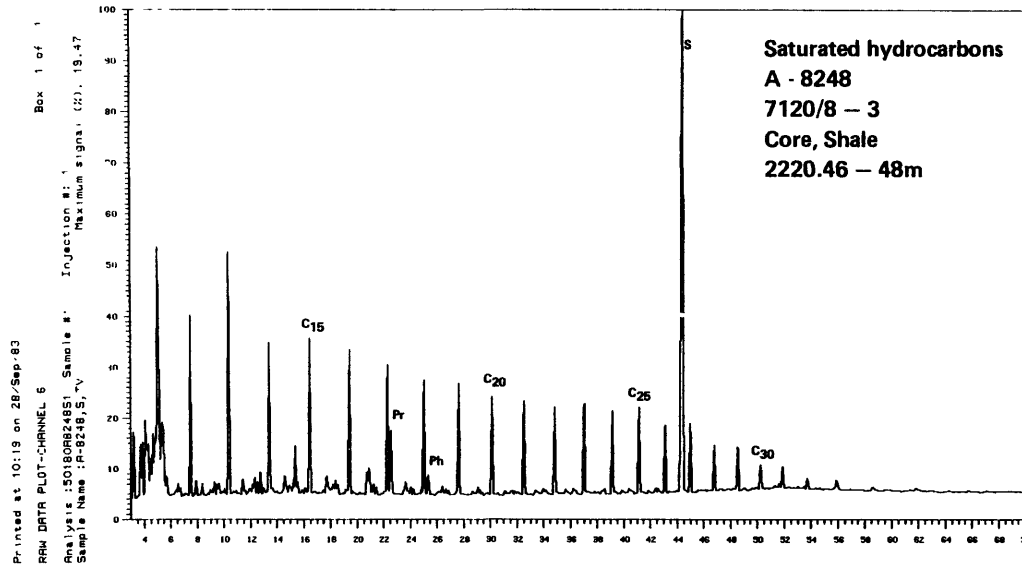
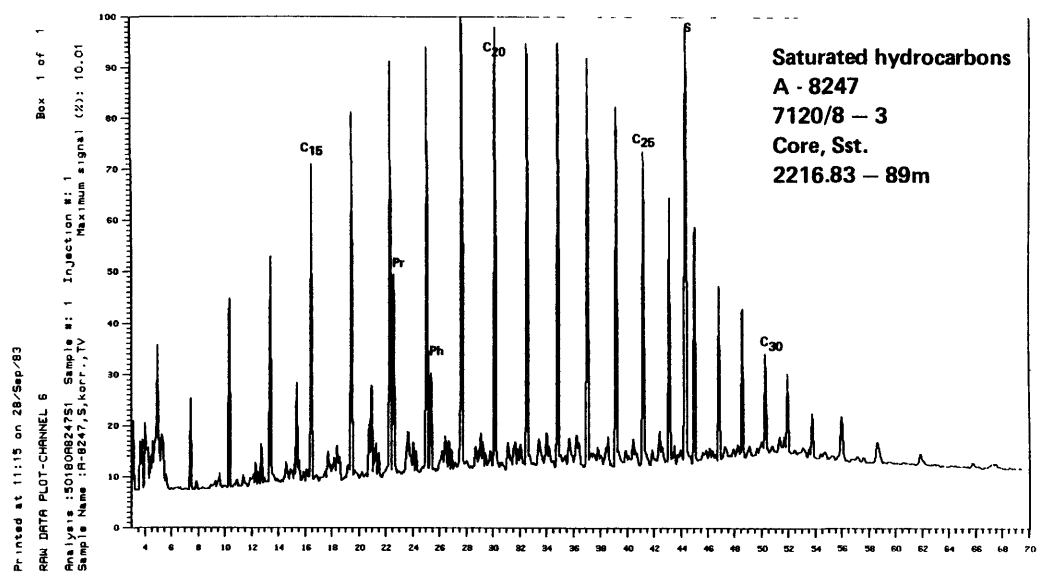
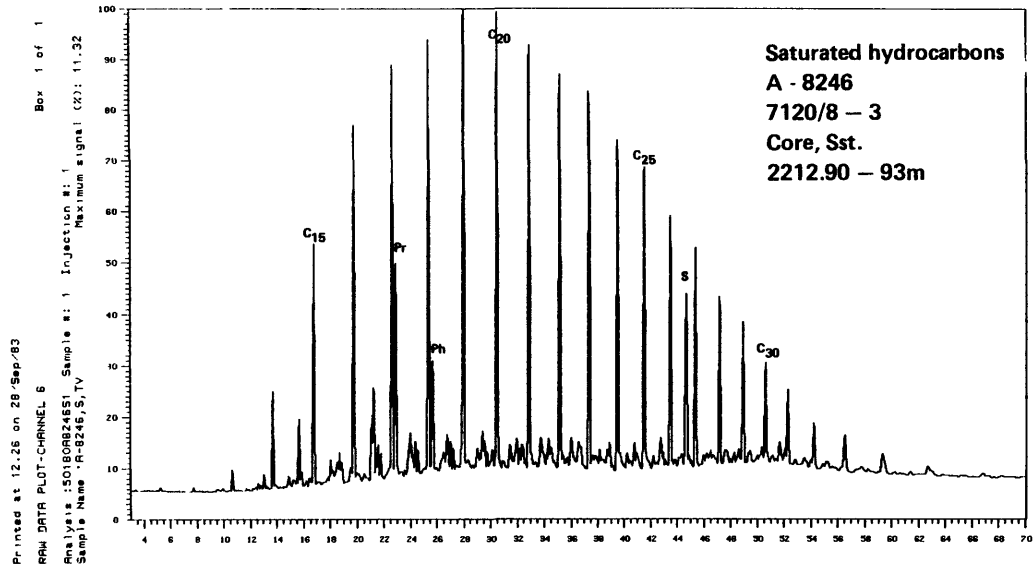
Pr - pristane

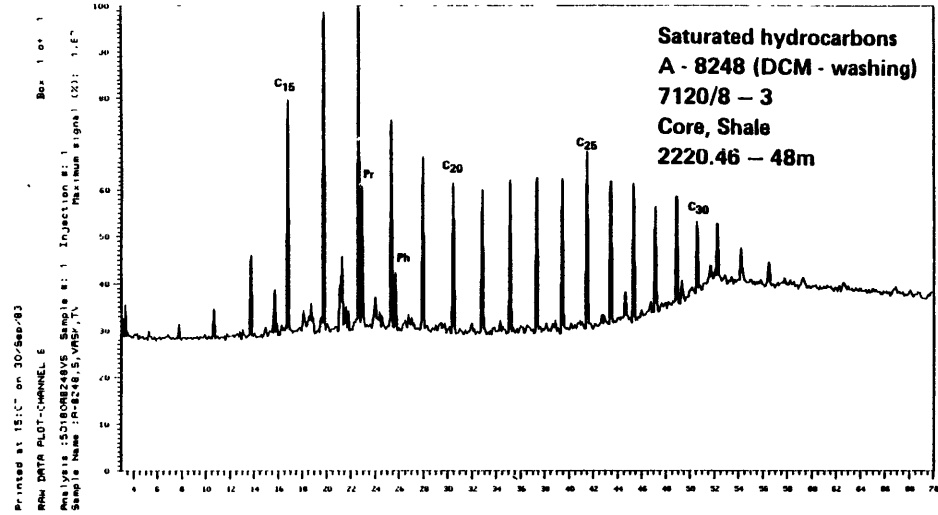
Ph - phytane

C₁₅-C₃₀ normal alkanes

S - squalane (internal standard)

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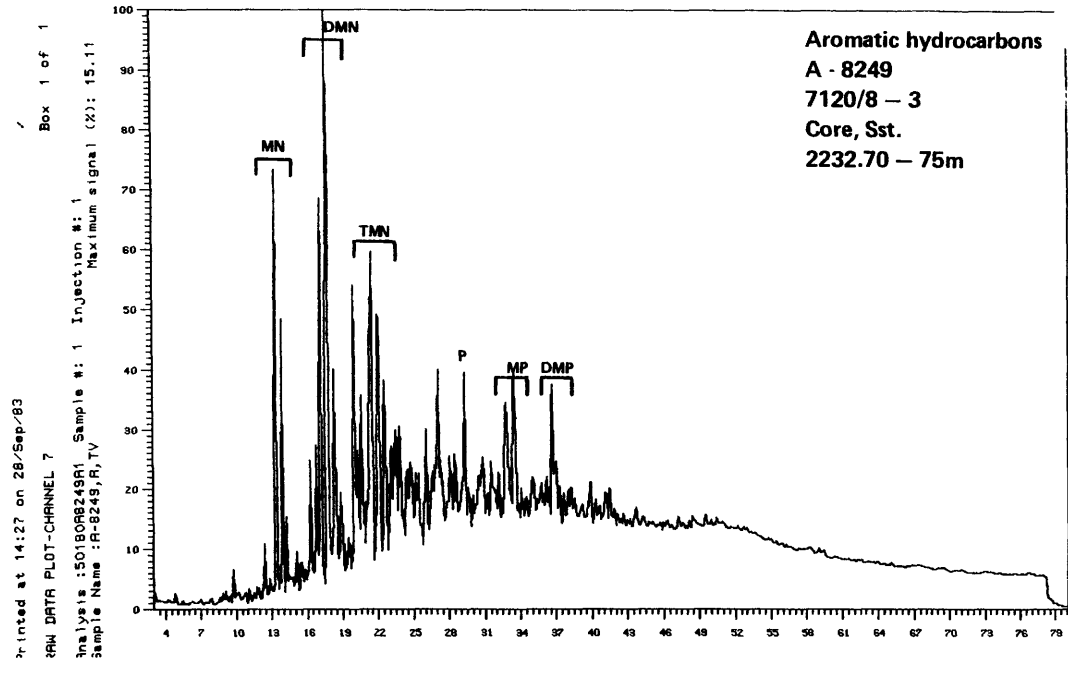
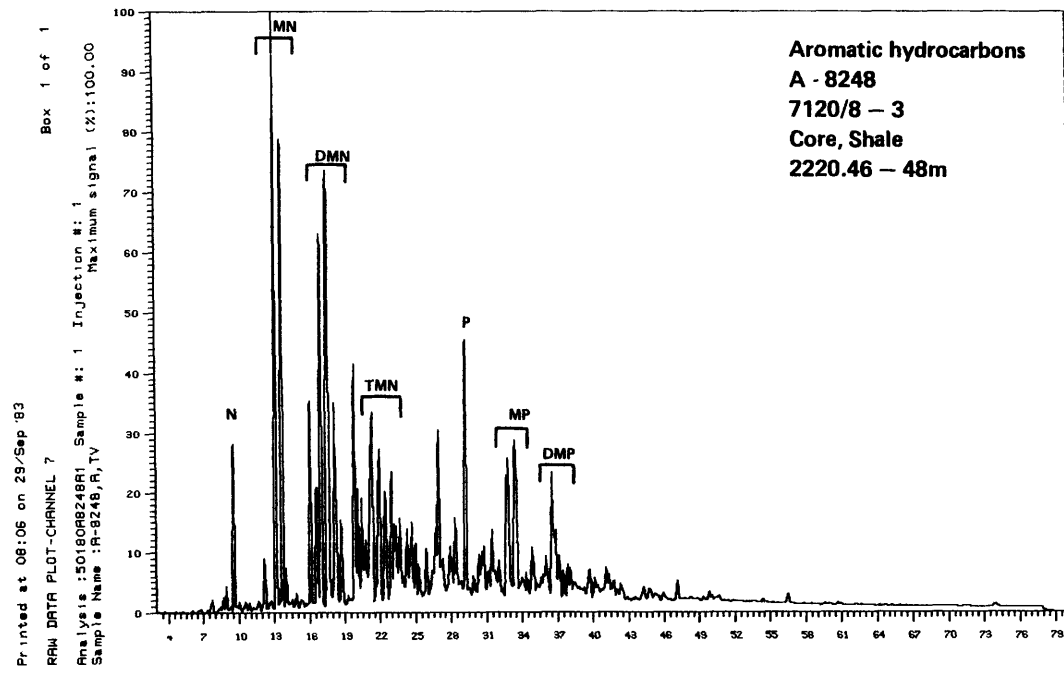
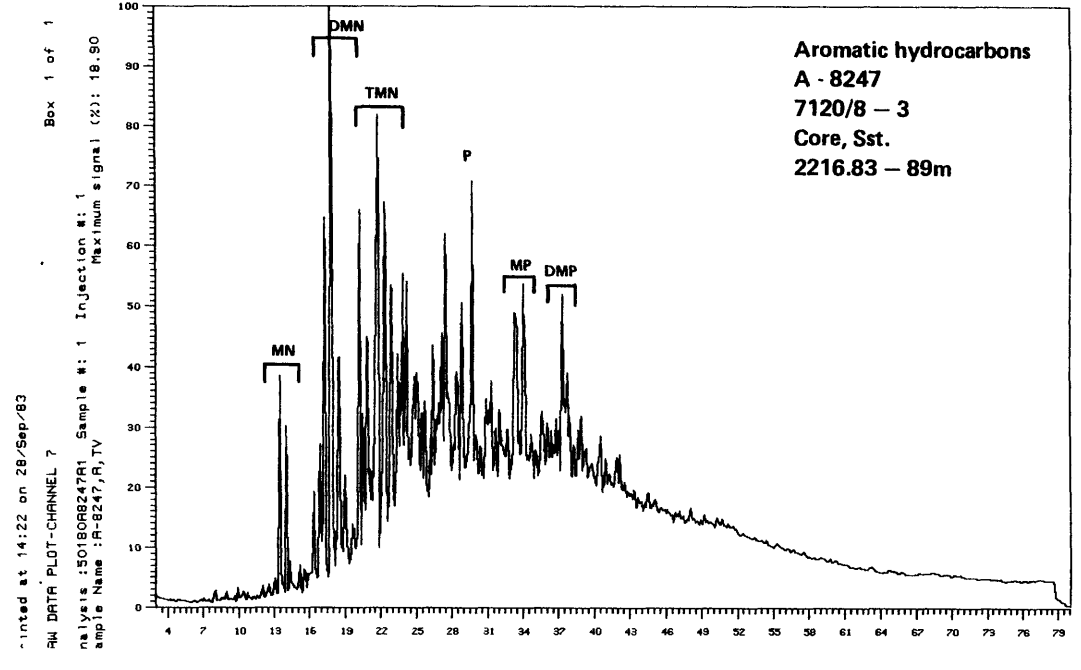
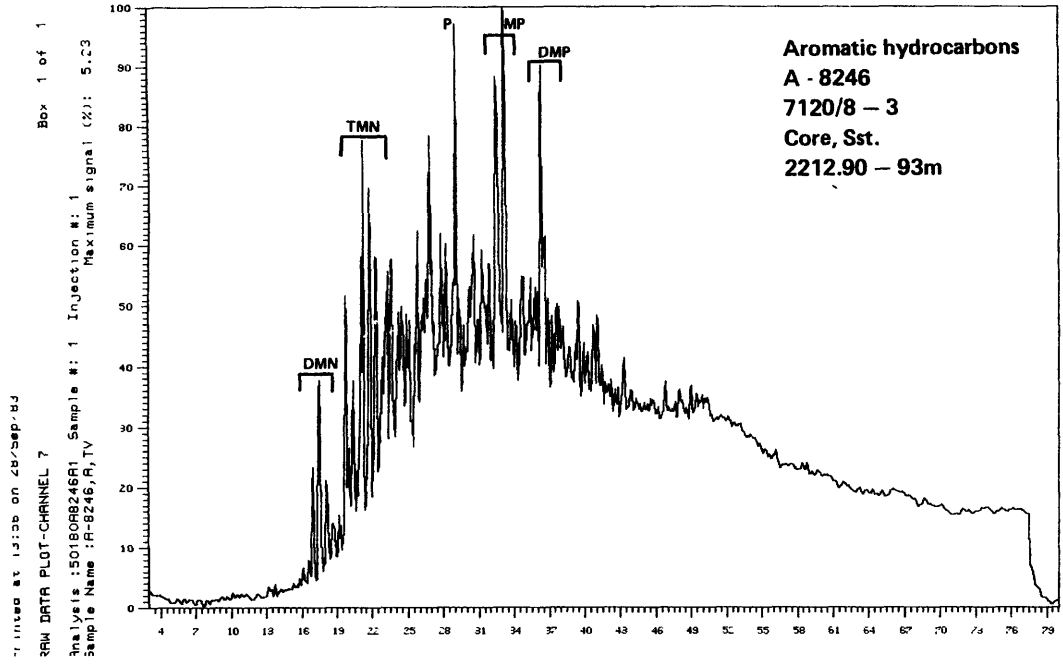
Well 7120/8-3

FIGURE 2

GC of aromatic hydrocarbons

- N - naphthalene
- MN - C₁-naphthalenes
- DMN - C₂-naphthalenes
- TMN - C₃-naphthalenes
- P - phenanthrene
- MP - C₁-phenanthrenes
- DMP - C₂-phenanthrenes

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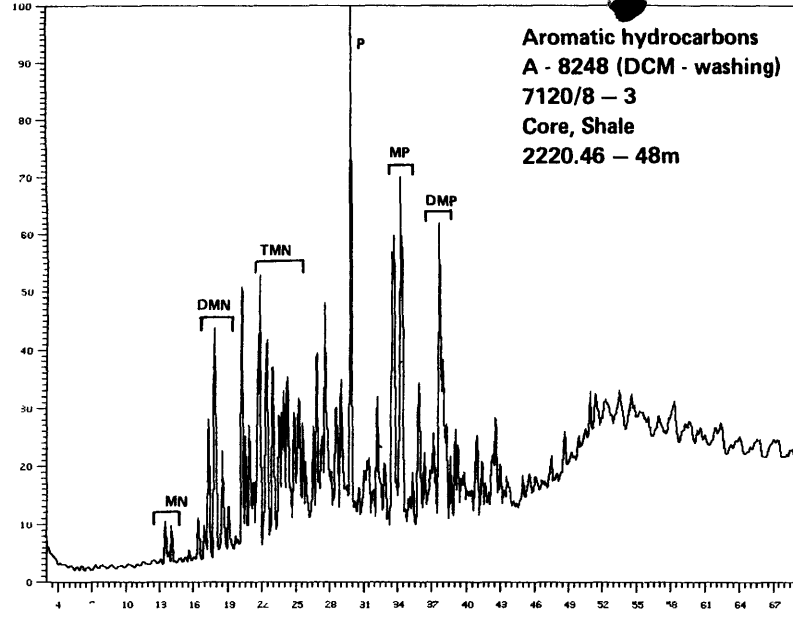


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RAW DATA PLOT - CHANNEL 7

Box 1 of 1

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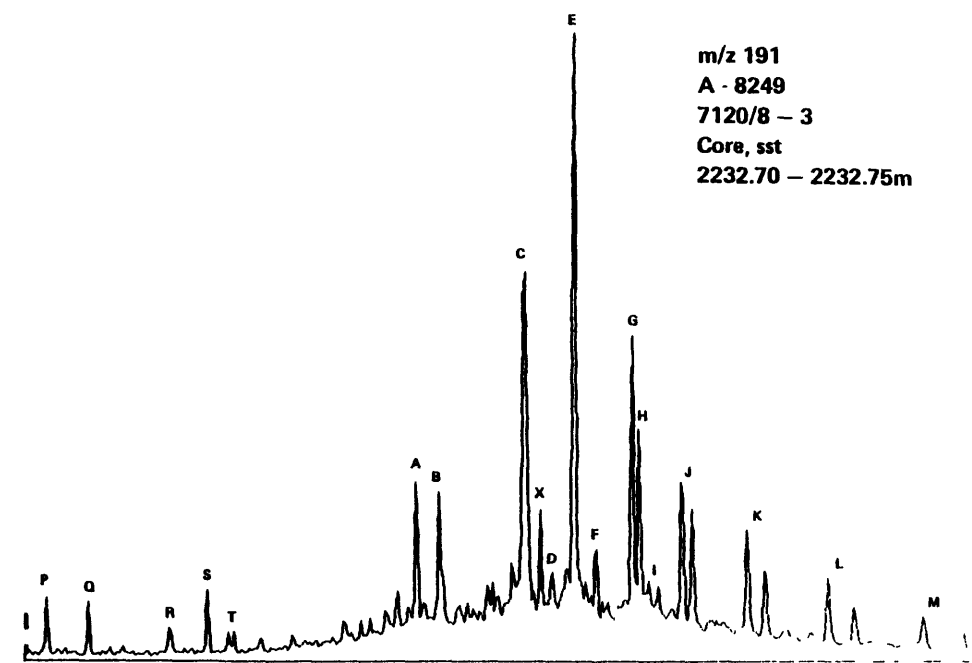
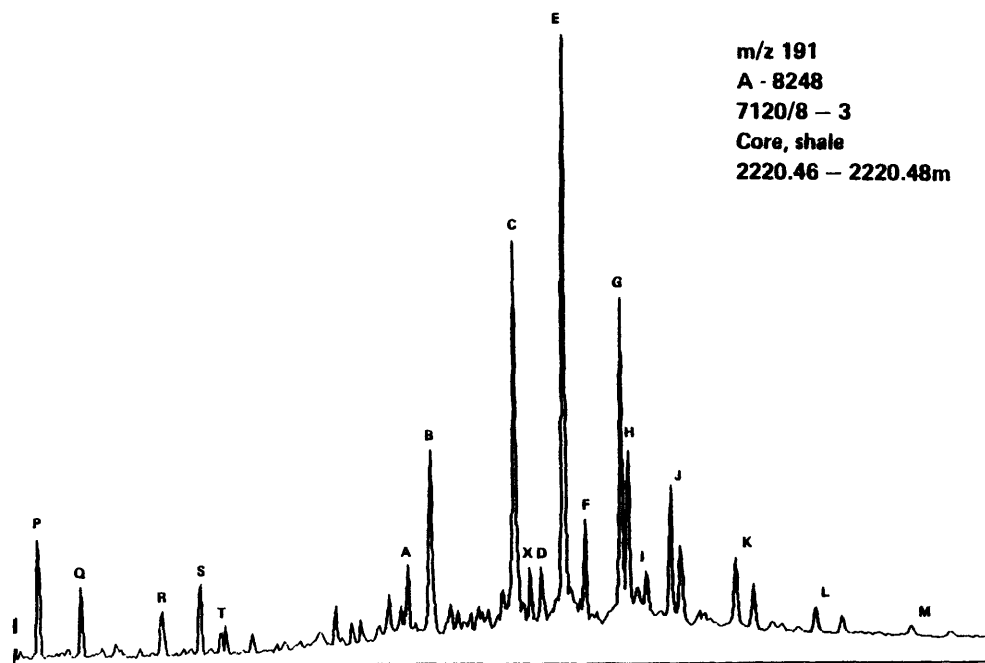
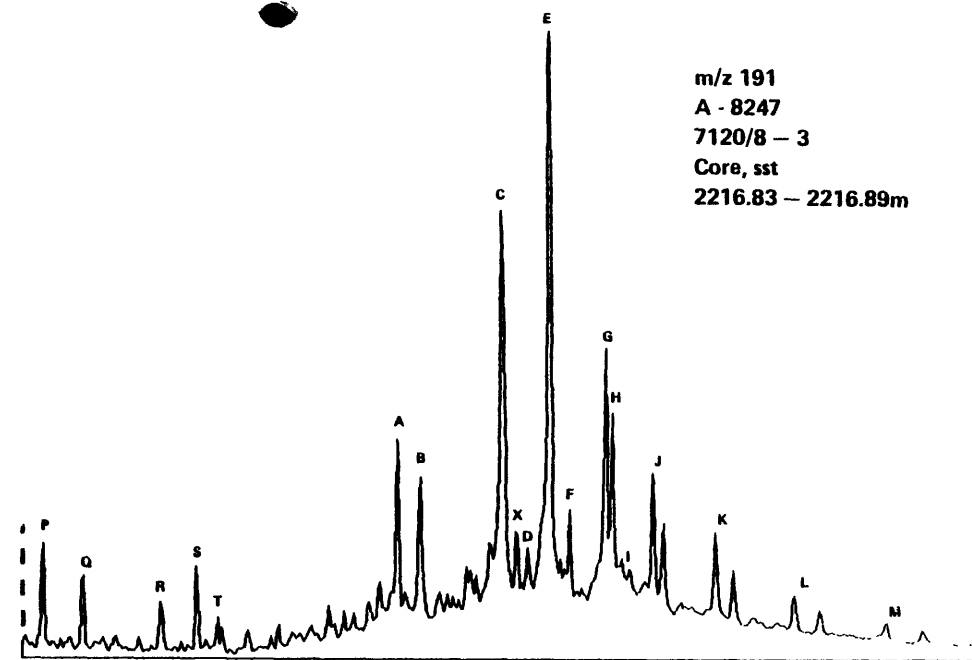
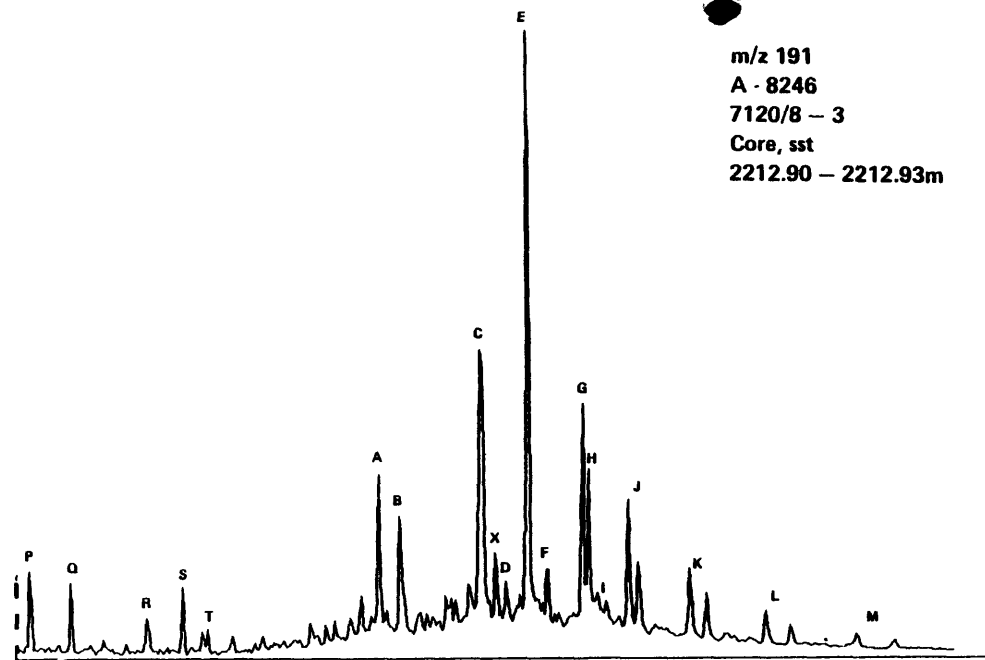


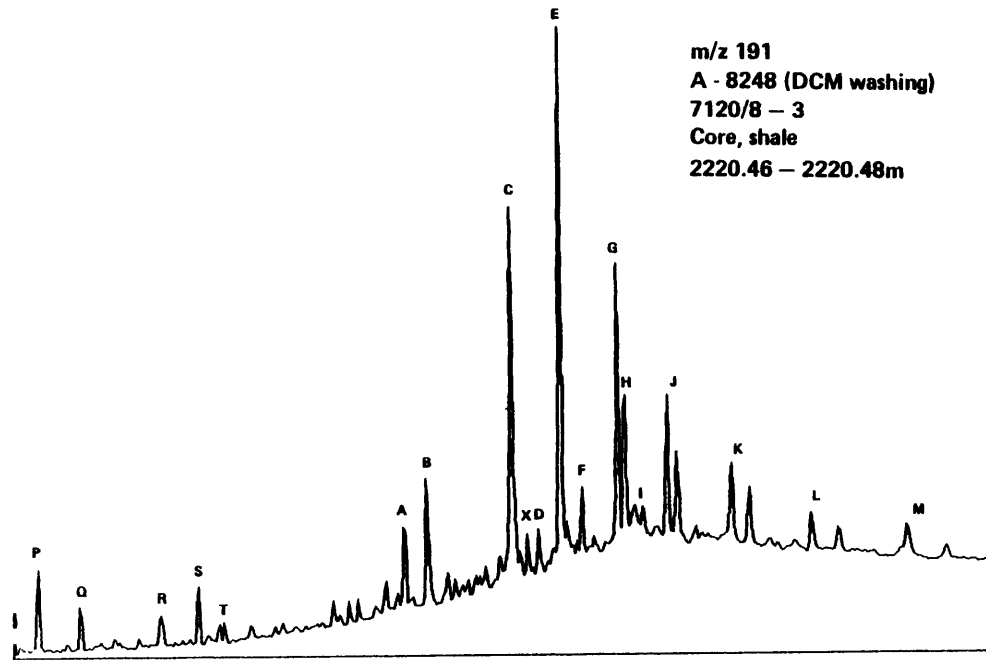
Well 7120/8-3

Figure 3.

Mass chromatograms representing terpanes (m/z 191)

A	T _s , 18 α (H)-trisorneohopane	C ₂₇ H ₄₆	(III)
B	T _m , 17 α (H)-trisorhopane	C ₂₇ H ₄₆	(I, R=H)
C	17 α (H)-norhopane	C ₂₉ H ₅₀	(I, R=C ₂ H ₅)
D	17 β (H)-normoretane	C ₂₉ H ₅₀	(II, R=C ₂ H ₅)
E	17 α (H)-hopane	C ₃₀ H ₅₂	(I, R=C ₃ H ₇)
F	17 β (H)-moretane	C ₃₀ H ₅₂	(II, R=C ₃ H ₇)
G	17 α (H)-homohopane (22S)	C ₃₁ H ₅₄	(I, R=C ₄ H ₉)
H	17 α (H)-homohopane (22R)	C ₃₁ H ₅₄	(I, R=C ₄ H ₉)
	+ unknown triterpane (gammacerane?)		
I	17 β (H)-homomoretane	C ₃₁ H ₅₄	(II, R=C ₄ H ₉)
J	17 α (H)-bishomohopane (22S,22R)	C ₃₂ H ₅₆	(I, R=C ₅ H ₁₁)
K	17 α (H)-trishomohopane (22S,22R)	C ₃₃ H ₅₈	(I, R=C ₆ H ₁₃)
L	17 α (H)-tetrakishomohopane (22S,22R)	C ₃₄ H ₆₀	(I, R=C ₇ H ₁₅)
M	17 α (H)-pentakishomohopane (22S,22R)	C ₃₅ H ₆₂	(I, R=C ₈ H ₁₇)
Z	bisorhopane	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)





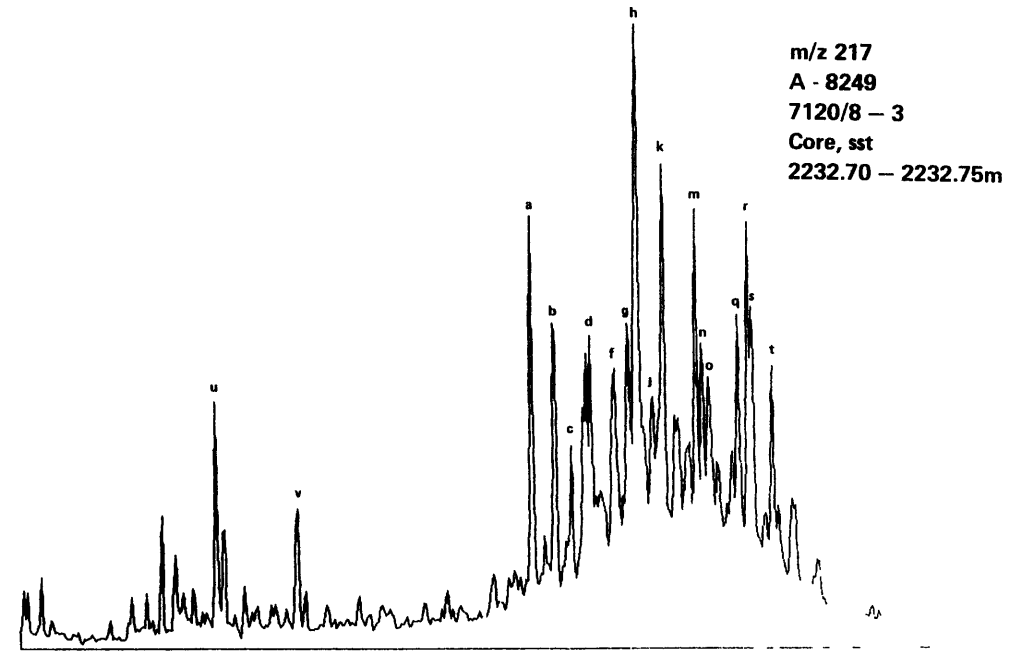
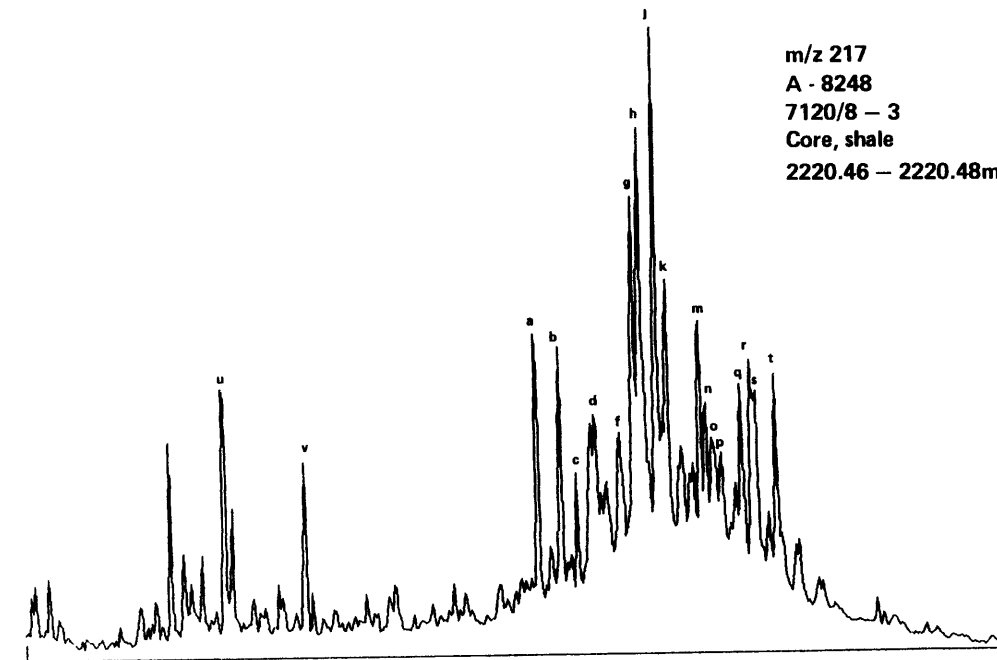
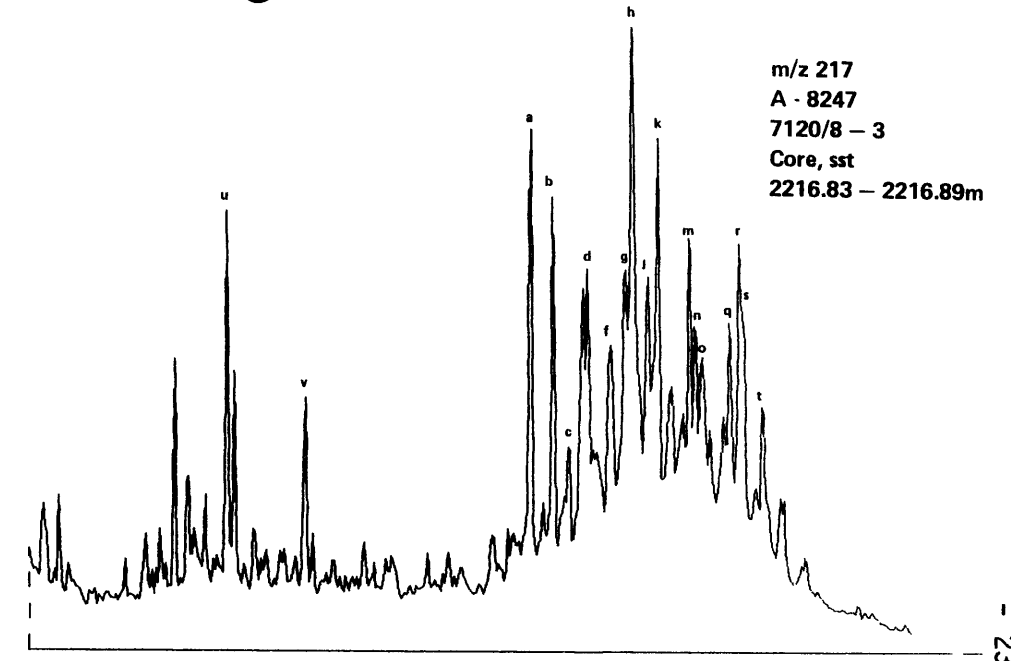
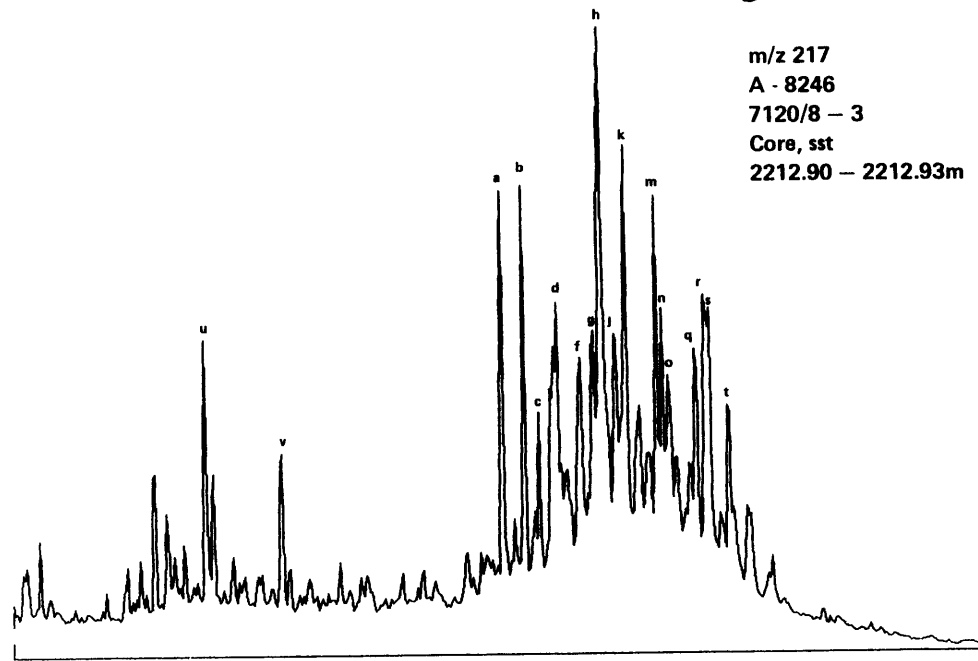
Well 7120/8-3

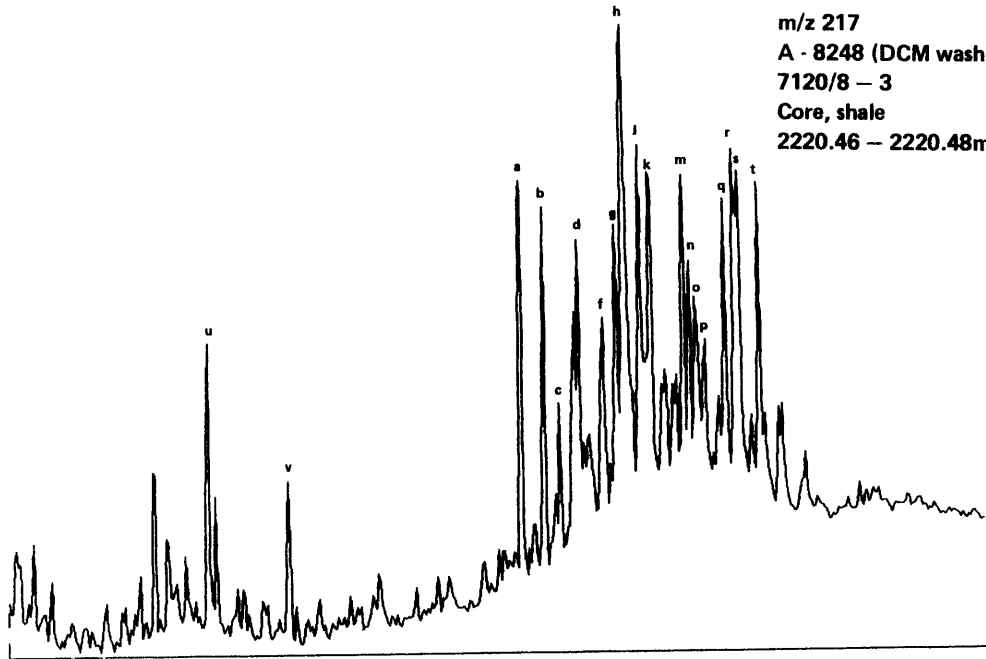
Figure 4.

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

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 α (H),17 α (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 β (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)

094/p/ah/9





m/z 217
A - 8248 (DCM washing)
7120/8 - 3
Core, shale
2220.46 - 2220.48m

