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BRANCH

ETB/128/91

DECEMBER 1991

GEOCHEMICAL DATA FOR A RESERVOIR EXTRACT FROM WELL 7/12-10, ULA FIELD, NOCS

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R A Sedivy

B P E X P L O R A T I O N

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INDEX SHEET

Report Number (internal only): ETB/128/91

Title: Geochemical Data for a Reservoir Extract from Well 7/12-10, Ula Field, NOCS

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Date of Report: December 1991

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Country or Area (if applicable): NOCS

Well Names (if applicable): 7/12-10

Oil/Gas Field Names (if applicable): Ula

PLEASE COMPLETE IF REPORT REFERS TO GEOGRAPHICAL/GEOLOGICAL AREA

Area Covered:	Northernmost Latitude	d	m	s
	Westernmost Longitude	d	m	s
	Southernmost Latitude	d	m	s
	Easternmost Longitude	d	m	s

Sedimentary Basin:

Stratigraphy (Youngest Age)

(Oldest Age)

Indexer: S.A.BAYLIS Date:12/91

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SUMMARY

This report presents the geochemical data for oil extracted from a carbonate reservoir side wall core at 3062m in well 7/12-10, drilled on the 7/12-JU2 prospect, 6 km north of the Ula field, offshore Norway.

The oil was extracted from the side wall core using dichloromethane, deasphaltened and analysed by HPLC, GC and high resolution GCMS. Stable carbon isotope ratios were determined on the extract and each of its constituent fractions.

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TABLE 1

OIL ANALYSIS

SAMPLE 7/12-10

DEPTH(m) 3062.0

SAMPLE TYPE	EXTRACT
LOCATION	OFFSHORE NORWAY
DRILL STEM TEST	
FIELD	ULA

API GRAVITY @ 15 deg C	
DENSITY @ 15 deg C	
WAX % wt	
WAX MPT deg C	
POUR POINT	
ASPHALTENES %wt	6.80
SULPHUR %wt	
NITROGEN ppm	
NICKEL ppm	
VANADIUM ppm	
KINEMATIC VISCOSITY cST @ 20deg C	

TYPE ANALYSIS BY HPLC ON DE-ASPHALTENED RESIDUE >200 C

SATURATES %wt	51.3
AROMATICS %wt	39.4
RESIDUE %wt	9.3

CARBON ISOTOPE RATIOS per mil

TOTAL OIL	-30.1
ASPHALTENES	-29.1
SATURATES	-30.6
AROMATICS	-29.6
RESIDUE	-28.6
STANDARD NBS 22	-29.8

n-ALKANE CPI	1.01
PRISTANE/PHYTANE	1.54
PR/nC17	0.60
PH/nC18	0.43
R22	1.04
ALKANE INDEX	76

LIGHT HYDROCARBONS

MCH %	
HER	
HXR	

BIOMARKER RATIOS

H1	0.55	S1		A1	0.56
H2	0.51	S2		A2	0.61
H3	0.92	S3		A3	0.77
H4	ABS	S4	41:32:27	A4	0.48
H5	100:86:46:29:10:5	S5	19.0	A5	0.50
H6	0.50	S6		A6	1.13
H7	0.64	S7	92		
H10		S8			
H11	29	S9		M2	0.59
H12	14	S10		M3	0.60
H13	8			M4	34.00
H14	21				
H15	0			MDR	3.08
H16	6			MBP	2.86
H17	35				

QUANTITATIVE ANALYSIS

SATURATE FRACTION	QSNALK	94926	ppm
	QSNC20	5507	ppm
	QSC29ST		ppm
	QSC30HO		ppm
	QSC32HO		ppm
AROMATIC FRACTION	QAMONAR		ppm
	QATRIAR		ppm
	QAMEPH		ppm

CODING LISTS FOR BIOMARKERS CAN BE FOUND AT THE BACK OF THIS REPORT

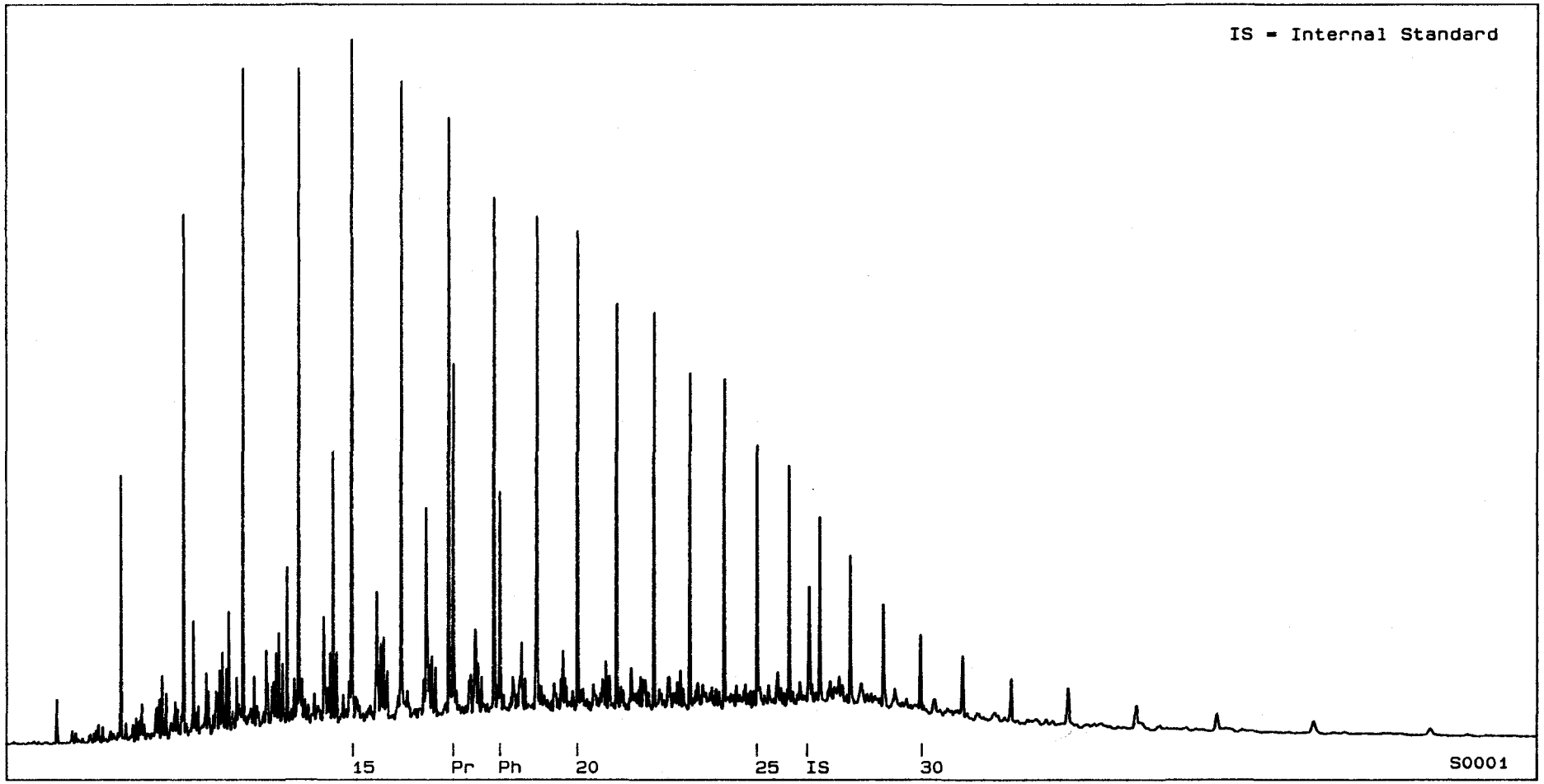

Figure 1

7/12-10 (EXT) 3062m

SAC FRACTION CHROMATOGRAMS

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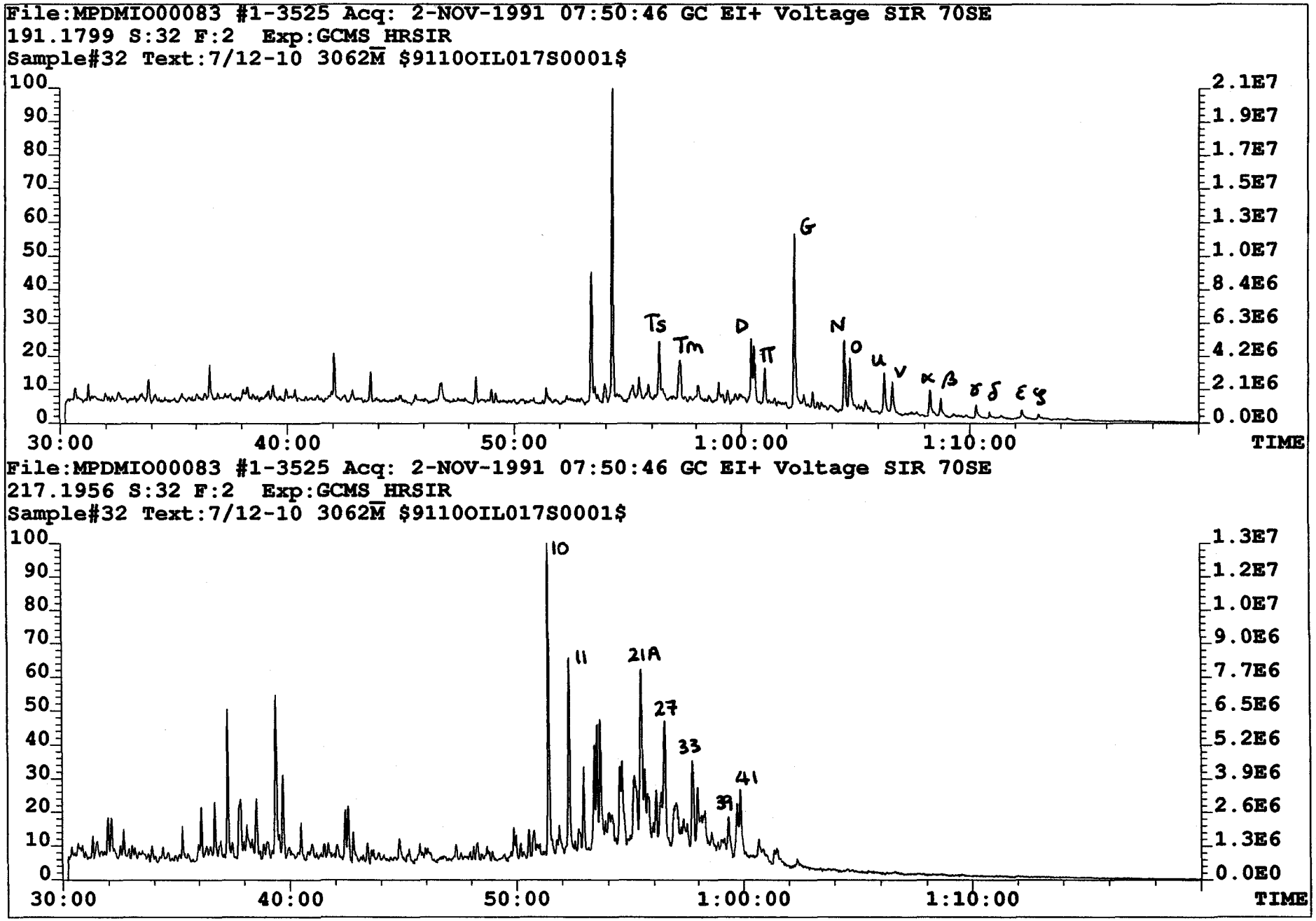
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100
90
80
70
60
50
40
30
20
10
0
2.1E7
1.9E7
1.7E7
1.5E7
1.3E7
1.0E7
8.4E6
6.3E6
4.2E6
2.1E6
0.0E0
Ts
Tm
D
π
G
N
O
u
V
κ
β
σ
δ
ε
ζ
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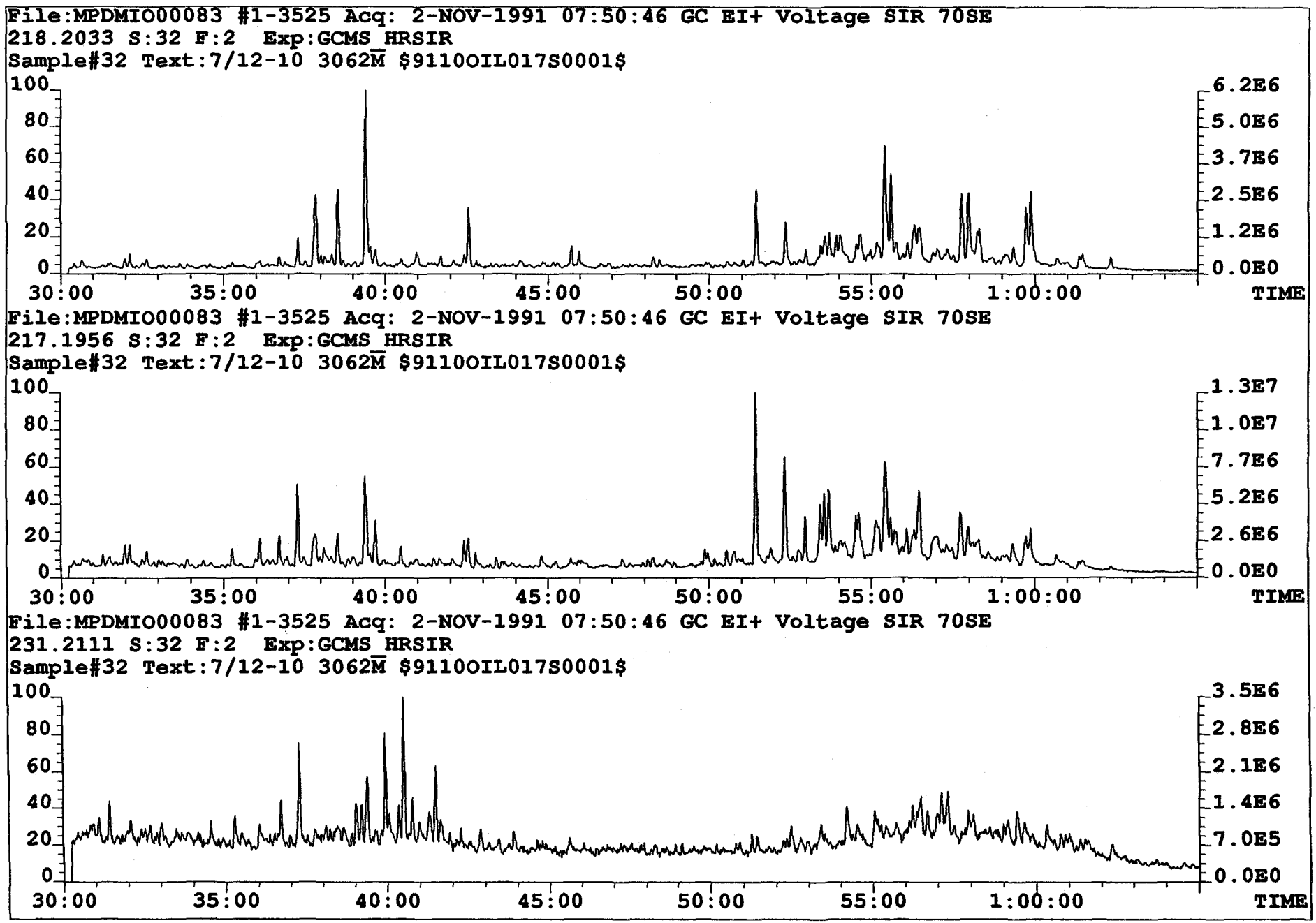
90
80
70
60
50
40
30
20
10
0
1.3E7
1.2E7
1.0E7
9.0E6
7.7E6
6.5E6
5.2E6
3.9E6
2.6E6
1.3E6
0.0E0
10
11
21A
27
33
39
41
30:00
40:00
50:00
1:00:00
1:10:00
TIME

Figure 2.1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80
60
40
20
0
6.2E6
5.0E6
3.7E6
2.5E6
1.2E6
0.0E0
30:00
35:00
40:00
45:00
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55:00
1:00:00
TIME
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217.1956 S:32 F:2 Exp:GCMS_HRSIR
Sample#32 Text:7/12-10 3062M $9110OIL017S0001$
100
80
60
40
20
0
1.3E7
1.0E7
7.7E6
5.2E6
2.6E6
0.0E0
30:00
35:00
40:00
45:00
50:00
55:00
1:00:00
TIME
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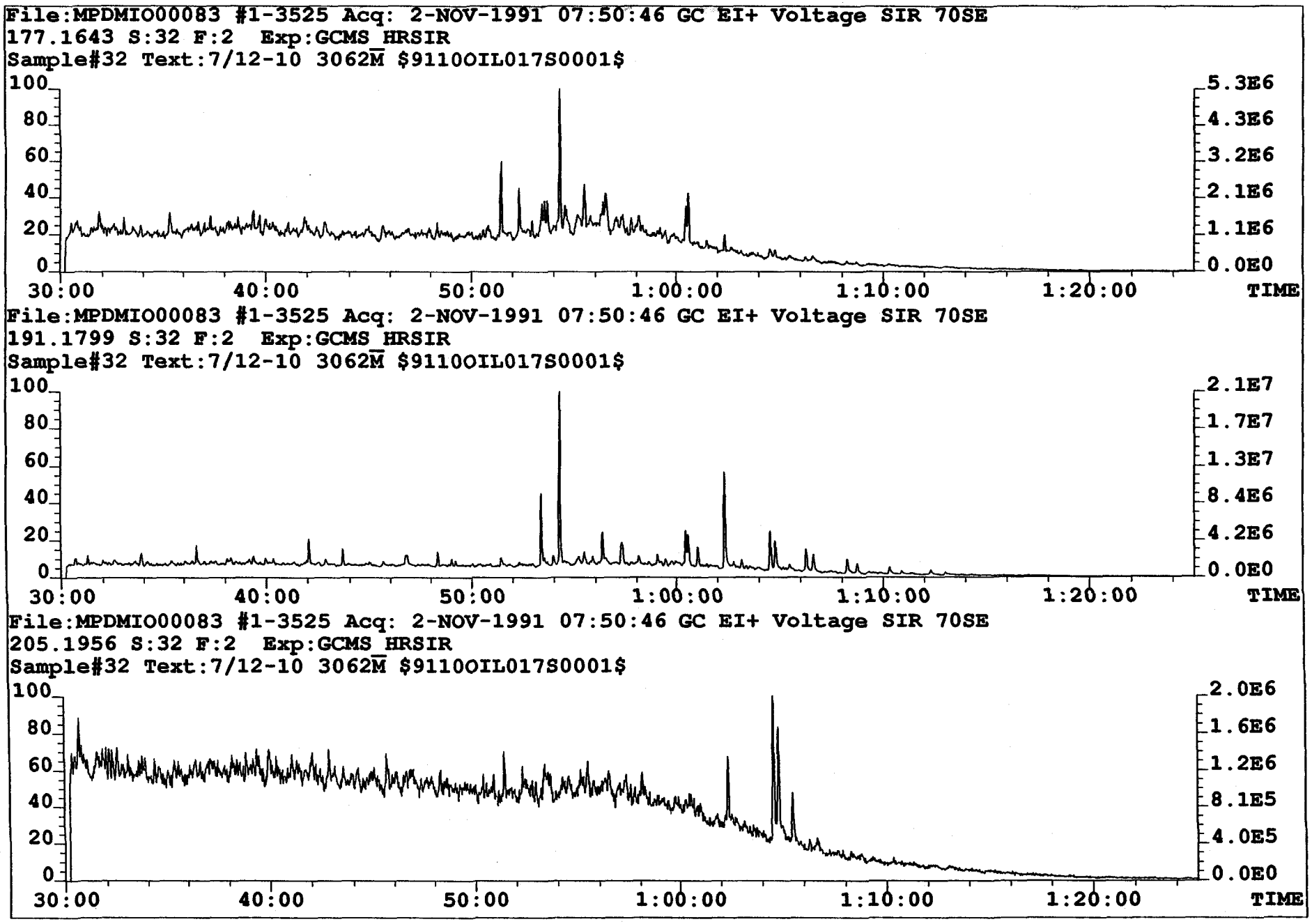
231.2111 S:32 F:2 Exp:GCMS_HRSIR
Sample#32 Text:7/12-10 3062M $9110OIL017S0001$
100
80
60
40
20
0
3.5E6
2.8E6
2.1E6
1.4E6
7.0E5
0.0E0
30:00
35:00
40:00
45:00
50:00
55:00
1:00:00
TIME

Figure 2.2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80
60
40
20
0
5.3E6
4.3E6
3.2E6
2.1E6
1.1E6
0.0E0
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40:00
50:00
1:00:00
1:10:00
1:20:00
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191.1799 S:32 F:2 Exp:GCMS_HRSIR
Sample#32 Text:7/12-10 3062M $9110OIL017S0001$
100
80
60
40
20
0
2.1E7
1.7E7
1.3E7
8.4E6
4.2E6
0.0E0
30:00
40:00
50:00
1:00:00
1:10:00
1:20:00
TIME
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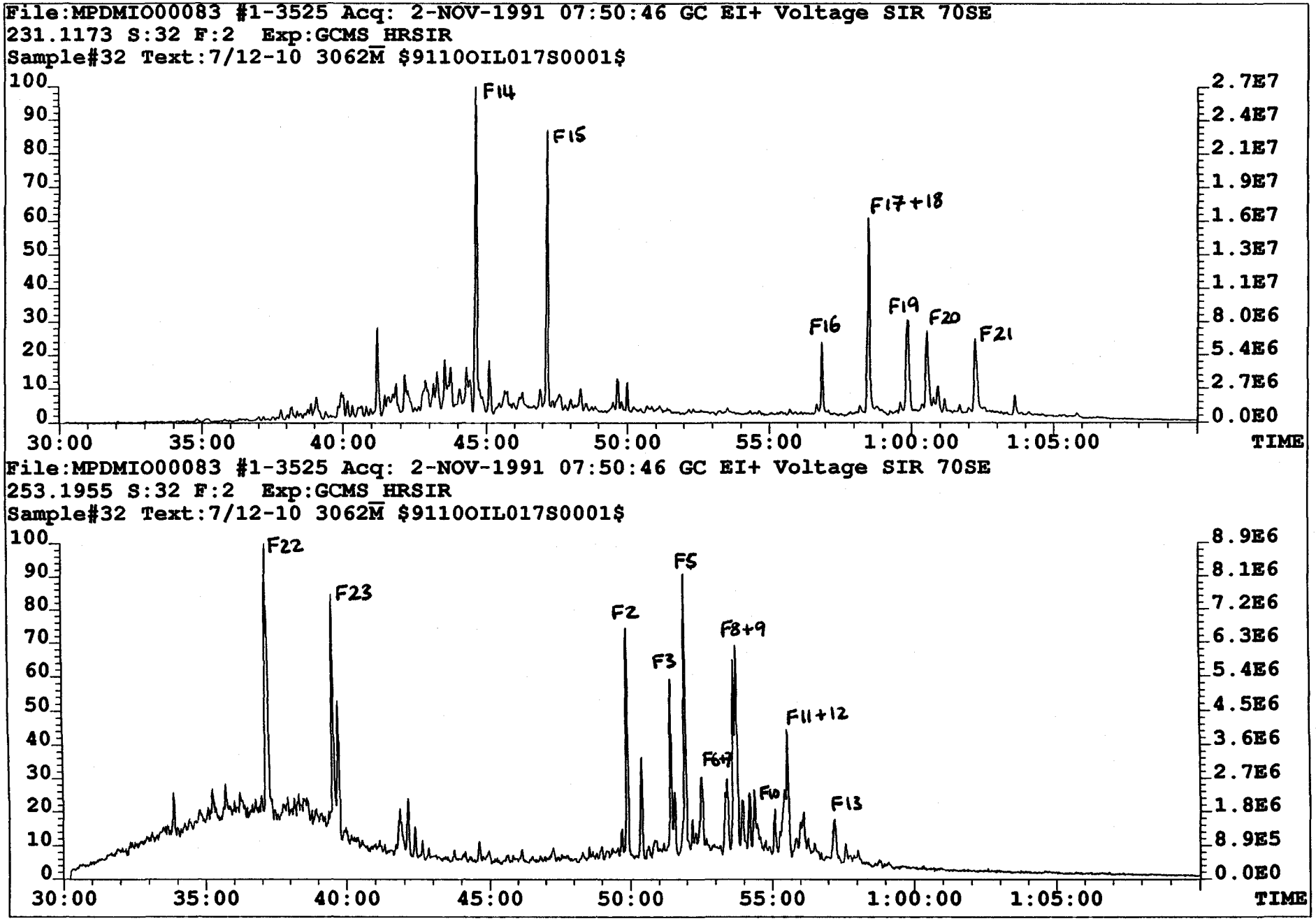
205.1956 S:32 F:2 Exp:GCMS_HRSIR
Sample#32 Text:7/12-10 3062M $9110OIL017S0001$
100
80
60
40
20
0
2.0E6
1.6E6
1.2E6
8.1E5
4.0E5
0.0E0
30:00
40:00
50:00
1:00:00
1:10:00
1:20:00
TIME

Figure 2.3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231.1173 S:32 F:2 Exp:GCMS_HRSIR
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F14
F15
F16
F17+18
F19
F20
F21
TIME
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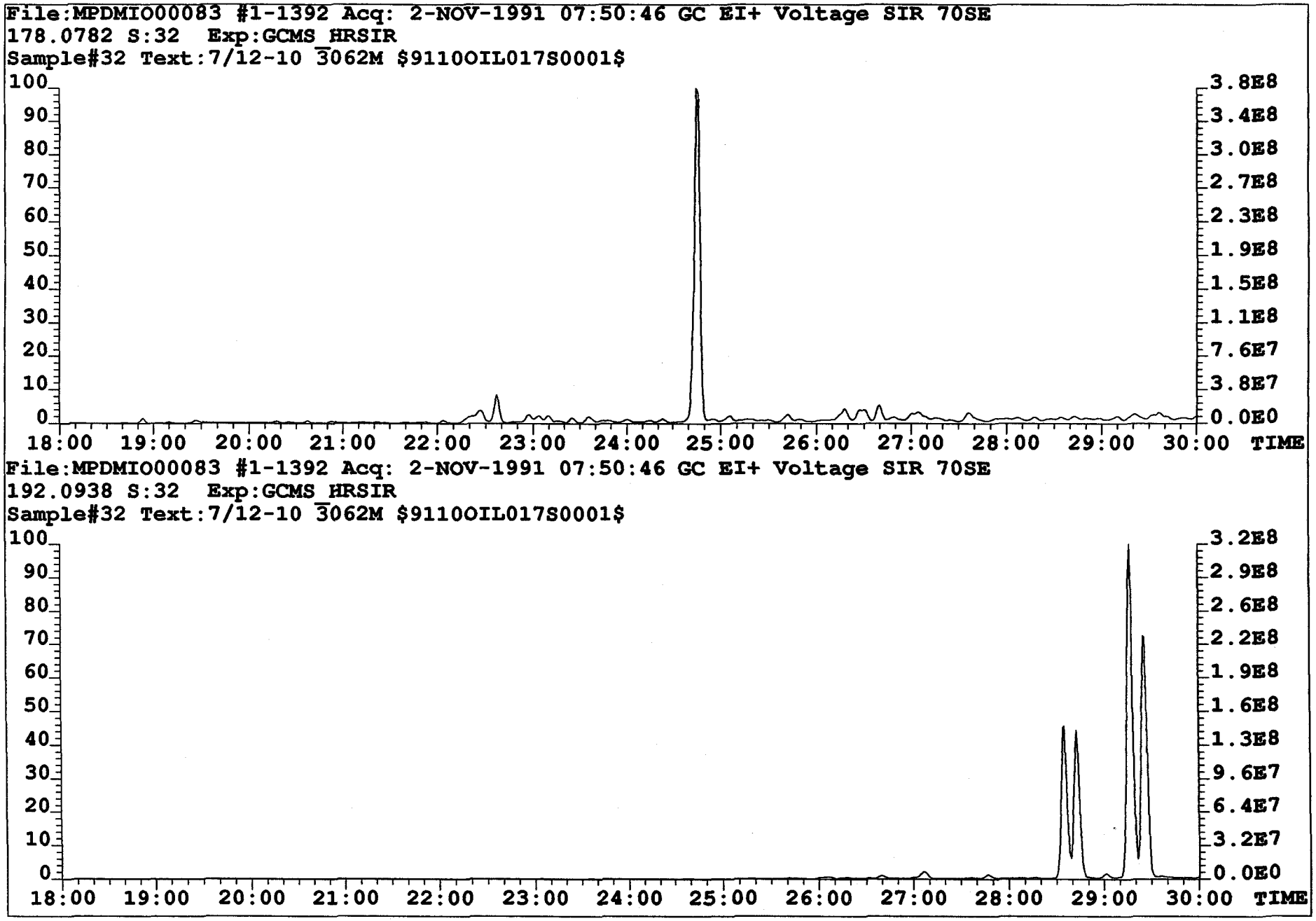
253.1955 S:32 F:2 Exp:GCMS_HRSIR
Sample#32 Text:7/12-10 3062M $9110OIL017S0001$
F22
F23
F2
F3
F5
F6+7
F8+9
F10
F11+12
F13
TIME

Figure 3.1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100
90
80
70
60
50
40
30
20
10
0
3.8E8
3.4E8
3.0E8
2.7E8
2.3E8
1.9E8
1.5E8
1.1E8
7.6E7
3.8E7
0.0E0
18:00 19:00 20:00 21:00 22:00 23:00 24:00 25:00 26:00 27:00 28:00 29:00 30:00 TIME
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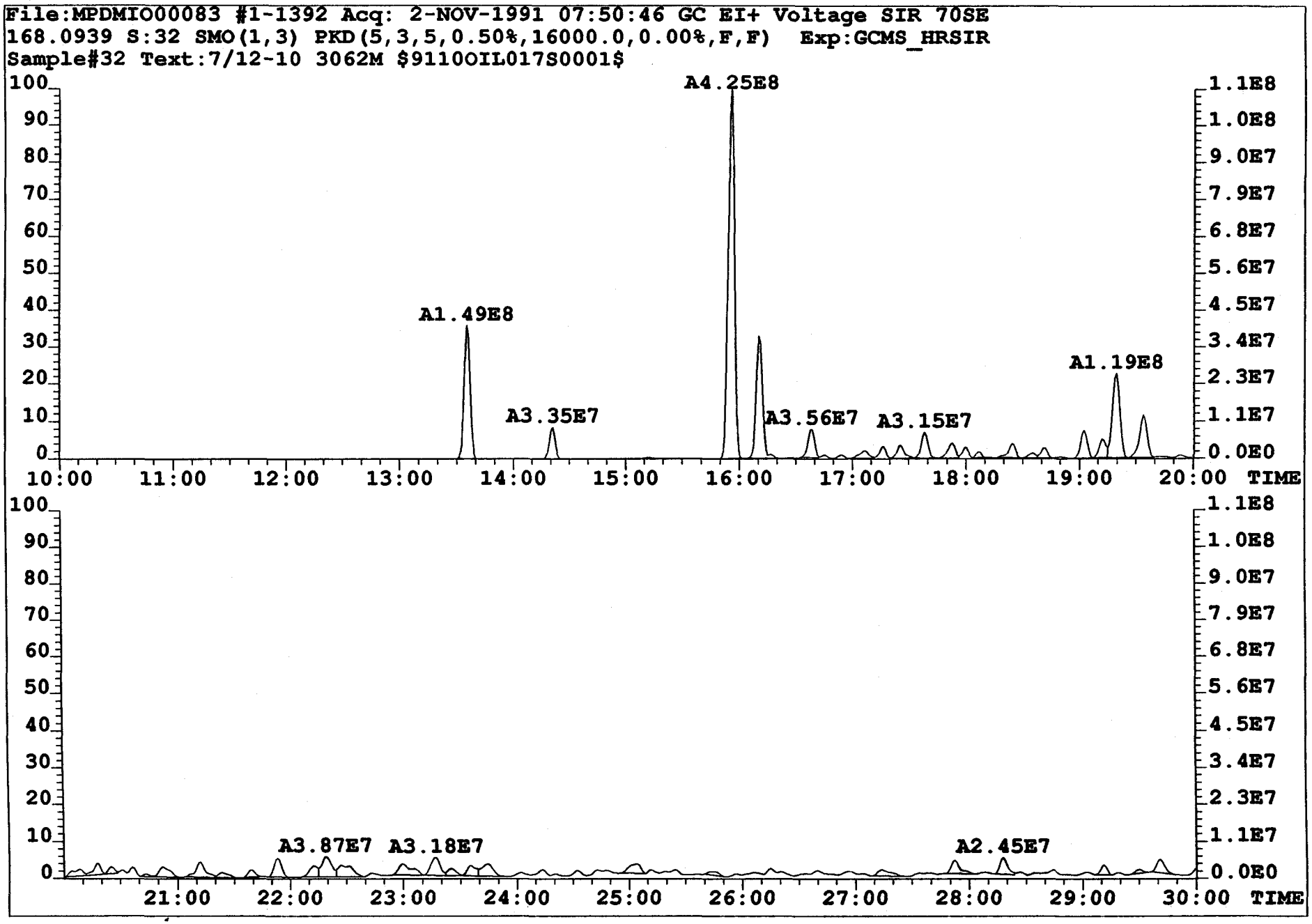
192.0938 S:32 Exp:GCMS_HRSIR
Sample#32 Text:7/12-10 3062M $9110OIL017S0001$
100
90
80
70
60
50
40
30
20
10
0
3.2E8
2.9E8
2.6E8
2.2E8
1.9E8
1.6E8
1.3E8
9.6E7
6.4E7
3.2E7
0.0E0
18:00 19:00 20:00 21:00 22:00 23:00 24:00 25:00 26:00 27:00 28:00 29:00 30:00 TIME

Figure 3.2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168.0939 S:32 SMO(1,3) PKD(5,3,5,0.50%,16000.0,0.00%,F,F) Exp:GCMS_HRSIR
Sample#32 Text:7/12-10 3062M $9110OIL017S0001$
A4.25E8
A1.49E8
A3.35E7
A3.56E7
A3.15E7
A1.19E8
A3.87E7
A3.18E7
A2.45E7
TIME
TIME

Figure 3.3

STABLE CARBON ISOTOPE GALIMOV CURVE

WELL NAME: 7/12-10

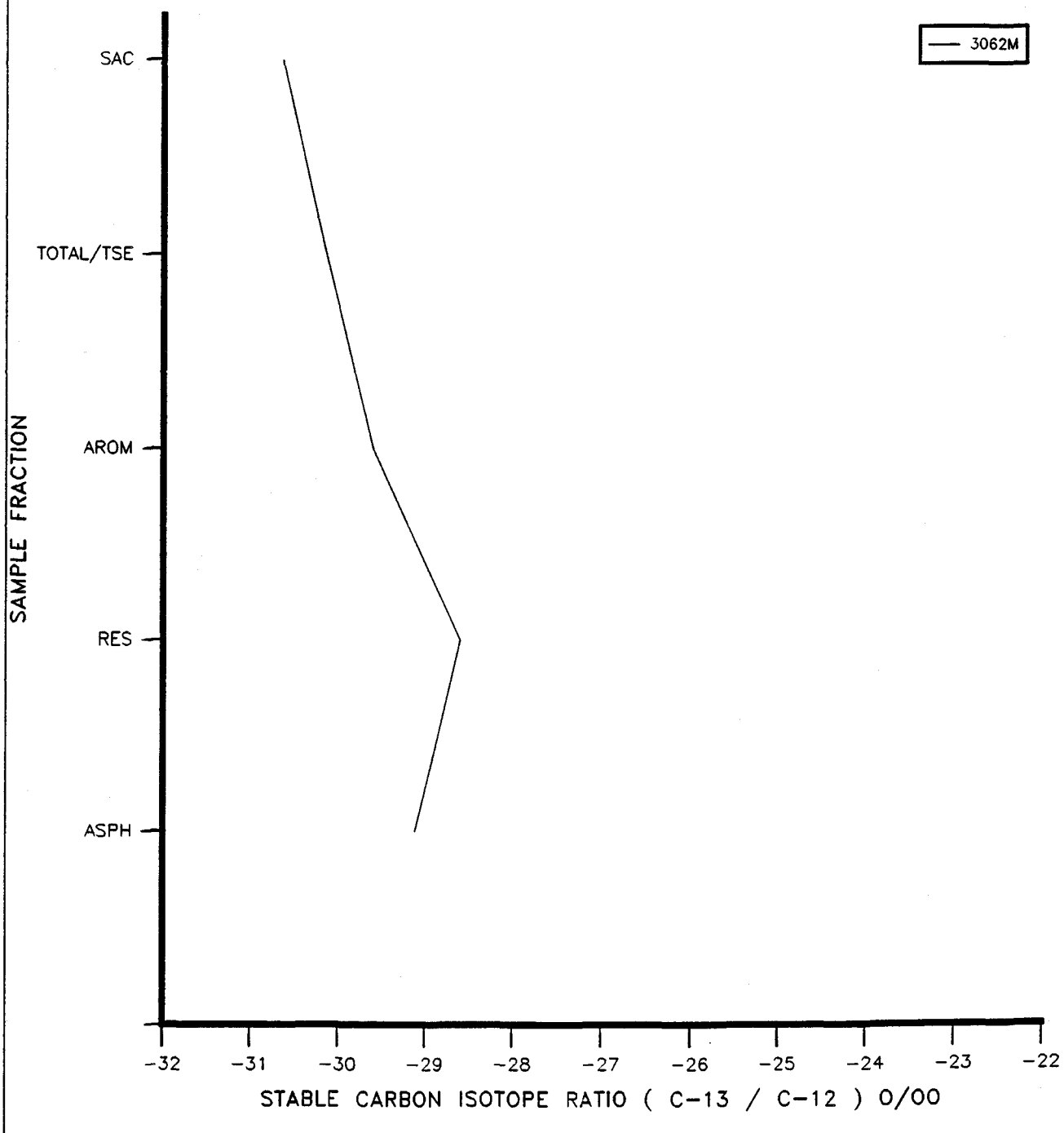


FIGURE 4

MOLECULAR PARAMETER LIST

BP CODE	PARAMETER	USE
H1	C_{32} HOPANE 22S/(22S+22R)	M
H2	C_{31} HOPANE 22S/(22S+22R)	M
H3	C_{30} HOPANE/(C_{30} HOPANE+C_{30} MORETANE)	MS
H4	$\beta\,\beta$ HOPANES PRESENT/ABSENT	M
H5	C_{30}:C_{31}:C_{32}:C_{33}:C_{34}:C_{35} HOPANE DISTRIBUTION	S
H6	C_{27} HOPANES $T_s/(T_s+T_m)$	MS
H7	C_{33} HOPANE 22S/(22S+22R)	M
H8	C_{34} HOPANE 22S/(22S+22R)	M
H9	C_{35} HOPANE 22S/(22S+22R)	M
H10	RESIN DITERPANES % RELATIVE TO C_{30} HOPANE (PEAK G)	S
H11	C_{23} EXT TRICYCLIC TERPANE % RELATIVE TO C_{30} HOPANE (PEAK G)	S
H12	C_{24} TETRACYCLIC TERPANE % RELATIVE TO C_{30} HOPANE (PEAK G)	S
H13	28,30 BISNORHOPANE (PEAK X) % RELATIVE TO C_{30} HOPANE (PEAK G)	S
H14	PENTACYCLANE II % RELATIVE TO C_{30} HOPANE (PEAK G)	S
H15	OLEANANE % RELATIVE TO C_{30} HOPANE (PEAK G)	S
H16	GAMMACERANE % RELATIVE TO (PEAK G)	S
H17	HOPANES $C_{35}/(C_{34}+C_{35})$ %	S
S1	C_{29} $\alpha\alpha\alpha$ STERANES 20S/(20S+20R)	M
S2	C_{29} STERANES $\alpha\beta\beta/(\alpha\beta\beta+\alpha\alpha\alpha)$	M
S3	STERANES $\alpha\alpha\alpha$ C_{27}:C_{28}:C_{29}	S
S4	STERANES $\alpha\beta\beta$ C_{27}:C_{28}:C_{29}	S
S5	$\beta\alpha$ DIASTERANES/(SAME+$\alpha\alpha\alpha$+$\alpha\beta\beta$ STERANES) %	SM
S6	LOW MOLECULAR WEIGHT STERANES RELATIVE TO C_{29} STERANES	S
S7	STERANE INDEX $C_{27}/(C_{27}+C_{29})$ % (FROM S3)	S
S8	4-ME C_{30} STERANE % RELATIVE TO C_{29} 20R $\alpha\alpha\alpha$ STERANE (PEAK 42)	S
S9	4-ME STERANES INDEX $C_{28}/(C_{28}+C_{30})$ %	S
S10	BICADINANES PRESENT/ABSENT	S
A1	C_{28} 20R TRIAROM. STERANE/(SAME+C_{29} 20R MONOAROM. STERANE)	M
A2	SUM TRIAROM. STERANES/(SAME+SUM MONOAROM. STERANES)	M
A3	C_{20} TRIAROM. STERANE/(SAME+C_{28} 20R TRIAROM. STERANE)	M
A4	C_{20}+C_{21} TRIAROM. STERANE/(SAME+SUM C_{26}-C_{28} TRIAROM. STERANES)	M
A5	C_{26} 20S TRIAROM. STERANE/C_{28} 20S TRIAROM. STERANE	S
A6	C_{27} 20R TRIAROM. STERANE/C_{28} 20R TRIAROM. STERANE	S
M2	PHENANTHRENES (3ME+2ME)/(9ME+1ME)	M
M3	MPI [(3ME+2ME)/(PHENANTHRENE+9ME+1ME)] * 1.5	M
M4	SUM C_{27}-C_{35} HOPANES/(SAME+ SUM C_{27}-C_{29} STERANES) %	S
ALKIND	ALKANE INDEX n-C_{17}/(n-C_{17}+n-C_{27}) %	S
R22	R22 INDEX (2 * n-C_{22})/(n-C_{21}+n-C_{23})	SM

NOTES:

1. S=SOURCE PARAMETER, M=MATURITY PARAMETER.

2. TRIAROM. STERANE=MONOMETHYL TRIAROMATIC STERANES
   MONOAROM. STERANE=DIMETHYL MONOAROMATIC STERANES.

(5/6/89)

BIOMARKER IDENTIFICATION - PENTACYCLIC HYDROCARBONS

BP CODE	TENTATIVE ASSIGNMENT BASED ON MASS SPECTROMETRY (m/e 191)
I	9-DODECYLPERHYDROANTHRACENE [INTERNAL STANDARD]
T_s	18α(H)-22,29,30-TRISNORNEOHOPANE
T_m	17α(H)-22,29,30-TRISNORHOPANE
θ	17α(H)-29,30-BISNORHOPANE
Q	17β(H)-22,29,30-TRISNORHOPANE
W	17α(H)-25,30-BISNORHOPANE
X	17α(H),18α(H),21β(H)-28,30-BISNORHOPANE
Y	17α(H)-25-NORHOPANE
D	17α(H),21β(H)-30-NORHOPANE
D2	18α(H)-30-NORNEOHOPANE
π	17α(H),15α(Me)-27-NORHOPANE ("DIAHOPANE")
A	17β(H),21α(H)-30-NORMORETANE
B	18α(H)-OLEANANE
G	17α(H),21β(H)-HOPANE
φ	17α(H)-30NOR-29-METHYLHOPANE
H	17β(H),21β(H)-30-NORHOPANE
K	17β(H),21α(H)-MORETANE
N	(22S)-17α(H),21β(H)-30-METHYLHOPANE
O	(22R)-17α(H),21β(H)-30-METHYLHOPANE
S	GAMMACERANE
P	17β(H),21β(H)-HOPANE
R	17β(H),21α(H)-30-METHYLMORETANE
U	(22S)-17α(H),21β(H)-30-ETHYLHOPANE
V	(22R)-17α(H),21β(H)-30-ETHYLHOPANE
J	17β(H),21β(H)-METHYLHOPANE
α	(22S)-17α(H),21β(H)-30-n-PROPYLHOPANE
β	(22R)-17α(H),21β(H)-30-n-PROPYLHOPANE
L	17β(H),21β(H)-ETHYLHOPANE
γ	(22S)-17α(H),21β(H)-30-n-BUTYLHOPANE
δ	(22R)-17α(H),21β(H)-30-n-BUTYLHOPANE
ε	(22S)-17α(H),21β(H)-30-n-PENTYLHOPANE
ζ	(22R)-17α(H),21β(H)-30-n-PENTYLHOPANE

BIOMARKER IDENTIFICATION - STERANES

BP CODE	TENTATIVE ASSIGNMENT BASED ON MASS SPECTROMETRY (m/e 217)
10	(20S)-13β(H),17α(H)-DIACHOLESTANE
11	(20R)-13β(H),17α(H)-DIACHOLESTANE
13	(20S)-13α(H),17β(H)-DIACHOLESTANE
14	(20R)-13α(H),17β(H)-DIACHOLESTANE
15	(24S/R)-(20S)-13β(H),17α(H)-24-METHYLDIACHOLESTANE
16	(24S/R)-(20S)-13β(H),17α(H)-24-METHYLDIACHOLESTANE
18	(24S/R)-(20R)-13β(H),17α(H)-24-METHYLDIACHOLESTANE
19	(24R/S)-(20R)-13β(H),17α(H)-24-METHYLDIACHOLESTANE
20A	(24S/R)-(20S)-13α(H),17β(H)-24-METHYLDIACHOLESTANE
20B	(20S)-5α(H),14α(H),17α(H)-CHOLESTANE
21A	(24R+S)-(20S)-13β(H),17α(H)-24-ETHYLDIACHOLESTANE
21B	(20R)-5α(H),14β(H),17β(H)-ISOCHOLESTANE
22	(20S)-5α(H),14β(H),17β(H)-ISOCHOLESTANE
25	(20R)-5α(H),14α(H),17α(H)-CHOLESTANE
27	(24S+R)-(20R)-13β(H),17α(H)-24-ETHYLDIACHOLESTANE
29	(24S+R)-(20S)-13α(H),17β(H)-24-ETHYLDIACHOLESTANE
33A	(24S+R)-(20R)-5α(H),14β(H),17β(H)-24-METHYLISOCHOLESTANE
33B	(24S+R)-(20R)-13α(H),17β(H)-24-ETHYLDIACHOLESTANE
34	(24S+R)-(20S)-5α(H),14β(H),17β(H)-24-METHYLISOCHOLESTANE
36	(24S+R)-(20R)-5α(H),14α(H),17α(H)-24-METHYLCHOLESTANE
39	(24S+R)-(20S)-5α(H),14α(H),17α(H)-24-ETHYLCHOLESTANE
40	(24S+R)-(20S)-5α(H),14β(H),17β(H)-24-ETHYLISOCHOLESTANE
41	(24S+R)-(20R)-5α(H),14β(H),17β(H)-24-ETHYLISOCHOLESTANE
42	(24S+R)-(20R)-5α(H),14α(H),17α(H)-24-ETHYLCHOLESTANE
46	(24S+R)-(20R)C_{30} STERANE

BIOMARKER IDENTIFICATION - AROMATIC STEROIDAL HYDROCARBONS (AROMATIC STERANES)

BP CODE	TENTATIVE ASSIGNMENT BASED ON MASS SPECTROMETRY (m/e 253 mass fragmentogram)
F22	C_{21} DIMETHYL MONOAROMATIC STERANE
F23	C_{22} DIMETHYL MONOAROMATIC STERANE
F2	C_{27}(20S)5β(H)DIMETHYL MONOAROMATIC STERANE
F3	C_{27}(20R)5β(H)DIMETHYL MONOAROMATIC STERANE
F4	C_{27}(20S)5α(H)DIMETHYL MONOAROMATIC STERANE
F5	C_{28}(20S)5β(H)DIMETHYL MONOAROMATIC STERANE
F6	C_{27}(20R)5α(H)DIMETHYL MONOAROMATIC STERANE
F7	C_{28}(20S)5α(H)DIMETHYL MONOAROMATIC STERANE
F8	C_{28}(20R)5β(H)DIMETHYL MONOAROMATIC STERANE
F9	C_{29}(20S)5β(H)DIMETHYL MONOAROMATIC STERANE
F10	C_{29}(20S)5α(H)DIMETHYL MONOAROMATIC STERANE
F11	C_{28}(20R)5α(H)DIMETHYL MONOAROMATIC STERANE
F12	C_{29}(20R)5β(H)DIMETHYL MONOAROMATIC STERANE
F13	C_{29}(20R)5α(H)DIMETHYL MONOAROMATIC STERANE
Ω	$C_{20}H_{12}$ POLYAROMATIC HYDROCARBONS
	(m/e 231 mass fragmentogram)
F14	C_{20}METHYL TRIAROMATIC STERANE
F15	C_{21}METHYL TRIAROMATIC STERANE
F16	C_{26}(20S)METHYL TRIAROMATIC STERANE
F17	C_{26}(20R)METHYL TRIAROMATIC STERANE
F18	C_{27}(20S)METHYL TRIAROMATIC STERANE
F19	C_{28}(20S)METHYL TRIAROMATIC STERANE
F20	C_{27}(20R)METHYL TRIAROMATIC STERANE
F21	C_{28}(20R)METHYL TRIAROMATIC STERANE

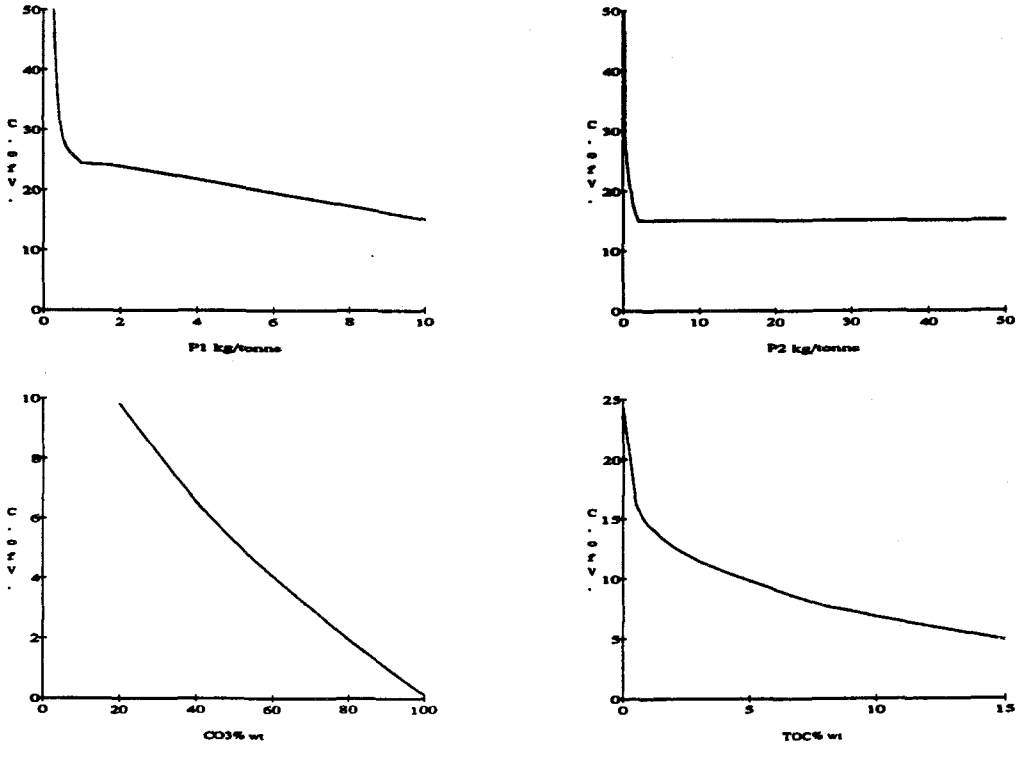
BIOMARKER IDENTIFICATION - NORHOPANES

BP CODE	TENTATIVE ASSIGNMENT BASED ON MASS SPECTROMETRY (m/e 177)
W	17α(H)-25,30-BISNORHOPANE
Y	17α(H)-25-NORHOPANE
D	17α(H),21β(H)-30-NORHOPANE
C1	(22S)-17α(H)-25-NOR-30-METHYLHOPANE
G	17α(H),21β(H)HOPANE
C2	(22R)-17α(H)-25-NOR-30-METHYLHOPANE
C3	(22S)-17α(H)-25-NOR-30-ETHYLHOPANE
C4	(22R)-17α(H)-25-NOR-30-ETHYLHOPANE
C5	(22S)-17α(H)-25-NOR-30-n-PROPYLHOPANE
C6	(22R)-17α(H)-25-NOR-30-n-PROPYLHOPANE
C7	(22S)-17α(H)-25-NOR-30-n-BUTYLHOPANE
C8	(22R)-17α(H)-25-NOR-30-n-BUTYLHOPANE
C9	(22S)-17α(H)-25-NOR-30-n-PENTYLHOPANE
C10	(22R)-17α(H)-25-NOR-30-n-PENTYLHOPANE

SUMMARY OF ANALYTICAL VARIATION - SEDIMENTS

These data were derived from the ETB QA programme. They are updated on a quarterly basis. This sheet is relevant only to data included in this report and should not be used in conjunction with other data.

Pyrolysis Parameters



Measurement	Valid Range	Coefficient of Variation
GOGI	>0.15	≤12%
Pyrolysate Distributions	10 - 35	≤12%

Extract Parameters

Measurement	Valid Range	Coefficient of Variation
%TSE	0.04 - 0.1	30%
%TSE	0.1 - 10	20%
%ASPH	10 - 30	<80%
%SATS,AROMS,RES	0 - 100	<30%

GC Parameters

Measurement	Valid Range	Coefficient of Variation
CPI	1 - 2	8%
Pr/Phy	0.6	9%
Others	-	<8%

GC-MS Parameters

Measurement	Valid Range	Coefficient of Variation
Hopanes	0.3 - 0.6	<15%
Steranes	0.3 - 0.6	<15%
Aromatics	-	Insufficient Data

Absolute Quantification by GC and GC-MS

Coefficient of Variation generally better than 50%.

Carbon Isotope Ratios

Data generally better that ±0.2 °/oo.

SUMMARY OF ANALYTICAL VARIATION - OILS

Type Analysis

Measurement	Valid Range	Coefficient of Variation
%ASPH	5 - 15%	<30%
%SATS	40 - 70%	<10%
%AROMS	25 - 40%	<12%
%RES	5 - 15%	<30%

GC Parameters

Measurement	Valid Range	Coefficient of Variation
CPI	1 - 1.2	<5%
Pr/Phy	0.6 - 10	<7%
Pr/nC17	0.4 - 5	<8%
Phy/nC18	0.4 - 0.7	2%
R22	0.95 - 1.05	2%
ALK	15 - 75	<10%

GC-MS Parameters

Measurement	Valid Range	Coefficient of Variation
H1	0.6	<5%
S1	0.4 - 0.55	<10%
A1	0.5 - 0.9	<12%
A3	0.2 - 0.5	<20%
M3	>0.8	5%

Absolute Quantification by GC and GC-MS

Coefficient of Variation generally around 25%.

Carbon Isotope Ratios

Data generally better than ±0.2 °/oo.