Geochemical data (lithology, source rock parameters, and hydrocarbons data) of cuttings from the Union Oil Company OCS Y-0849-1 (Hammerhead No. 1) well

Received 27 February 1989

Total of 44 pages in report
and 4 pages in Supplement A
(Total of 48 pages in all)

Geologic Materials Center Data Report No. 116

February 21, 1989

Dr. J. Reeder
Alaska Division of Geological
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P. O. Box 772116
Eagle River, AK 99577

Dear John:

Please find attached the geochemical data for Hammerhead-1 cuttings samples. Most of the analytic data are industry standard and a glossary is attached to explain any BP specific terminology. In general, the samples were poor yielding small amounts of cutting material when the mudcake had been washed off. There is also some doubt as to whether drilling additive contamination has occurred but this cannot be conclusively demonstrated.

GLOSSARY OF TERMS

1. Source Rock Parameters

P1, P2 = Pyrolysis yields obtained from Rock Eval type pyrolysis, equivalent to IFP S_1 and S_2.

HI = Hydrogen index derived from

$$\frac{P2}{TOC} \times 100$$

units of mg hydrocarbon/g organic carbon.

GOGI = Gas Oil Generation Index. This is a measurement of source proneness from pyrolysis - GC (pyrograms included) analysis.

$$GOGI = \frac{(\Sigma C_1 - C_5)}{(\Sigma C_6 - C_{36})}$$

Empirically:	GOGI ≤ 0.2	= Oil Prone
	GOGI 0.2 - 0.5	= Oil + Gas Prone
	GOGI ≥ 0.5	= Gas Only prone.

2. Hydrocarbons Data

TSE = Total Soluble Extract, obtained by soxhlet extraction in refluxing dichloromethane.

FRACTIONS:

SAC = Saturate Alkane Content
AROM = Aromatic Hydrocarbon Content
RES = Residue (Equivalent to NSO Content)

All Obtained by HPLC Separation.

Asph = Asphaltene Fraction by precipitation from n-hexane, prior to HPLC separation.

$\delta^{13}C_{KER}$ = Stable carbon isotope composition of kerogen.

$\delta^{13}C_{TSE}$ = Stable carbon isotope composition of Total Soluble Extract.

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
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
π	C_{30} PENTACYCLIC TRITERPANE
A	17β(H),21α(H)-30-NORMORETANE
B	18α(H)-OLEANANE
G	17α(H),21β(H)-HOPANE
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

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
F1	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	C20METHYL TRIAROMATIC STERANE
F15	C21METHYL TRIAROMATIC STERANE
F16	C26(20S)METHYL TRIAROMATIC STERANE
F17	C26(20R)METHYL TRIAROMATIC STERANE
F18	C27(20S)METHYL TRIAROMATIC STERANE
F19	C28(20S)METHYL TRIAROMATIC STERANE
F20	C27(20R)METHYL TRIAROMATIC STERANE
F21	C28(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

TABLE

DEPTH CONVERSION TABLE

WELL: HAMMERHEAD-1

LOCATION: UNITED STATES

METRES	FEET
886.97	2910
896.11	2940
905.26	2970
914.40	3000
932.69	3060
932.69	3060
941.83	3090
941.83	3090
960.12	3150
969.26	3180
978.41	3210
987.55	3240
996.70	3270
1005.84	3300
1014.98	3330
1024.13	3360
1033.27	3390
1042.42	3420
1051.56	3450
1060.70	3480
1069.85	3510
1088.14	3570
1115.57	3660
1179.58	3870
1225.30	4020
1234.44	4050
1243.58	4080
1252.73	4110
1271.02	4170
1298.45	4260
1316.74	4320
1344.17	4410
1380.74	4530
1417.32	4650

TABLE

DEPTH CONVERSION TABLE

WELL: HAMMERHEAD-1

LOCATION: UNITED STATES

METRES	FEET
1444.75	4740
1472.18	4830
1517.90	4980
1527.05	5010
1554.48	5100
1572.77	5160
1591.06	5220
1609.34	5280
1618.49	5310
1627.63	5340
1636.78	5370
1664.21	5460
1673.35	5490
1700.78	5580
1728.22	5670
1755.65	5760
1792.22	5880
1801.37	5910
1810.51	5940
1874.52	6150
1874.52	6150
1892.81	6210
1901.95	6240
1947.67	6390
1956.82	6420
1993.39	6540
2039.11	6690
2066.54	6780
2139.70	7020
2148.84	7050
2176.27	7140
2258.57	7410
2414.02	7920

TABLE

LITHOLOGY AND STRATIGRAPHY

WELL: HAMMERHEAD-1

LOCATION: UNITED STATES

DEPTH (m)	DEPTH RANGE	FORMATION	AGE	LITHOLOGY
886.97	877.82-886.97		TERTIARY	MUDSTONE-BLK 90%:SANDSTONE-GY 10%
896.11	886.97-896.11		TERTIARY	SILTSTONE-CALC BUFF 100%
905.26	896.11-905.26		TERTIARY	SILTSTONE-CALC BUFF 100%
914.40	905.26-914.40		TERTIARY	MUDSTONE-GY 15%:SANDSTONE-GY/BUFF 85%:QUARTZ-PICKED OUT
932.69	923.54-932.69		TERTIARY	SILTSTONE-CALC BUFF 5%:MUDSTONE-BLK 95%:COAL-TR
932.69	923.54-932.69		TERTIARY	SILTSTONE-CALC BUFF 5%:MUDSTONE-BLK 95%:COAL-TR
941.83	932.69-941.83		TERTIARY	MUDSTONE-BLK 100%:COAL-TR
941.83	932.69-941.83		TERTIARY	MUDSTONE-BLK 100%:COAL-TR
960.12	950.98-960.12		TERTIARY	MUDSTONE-BLK 100%
969.26	960.12-969.26		TERTIARY	MUDSTONE-BLK 70%:QUARTZ-30% PICKED OUT
978.41	969.26-978.41		TERTIARY	MUDSTONE-BLK 70%:QUARTZ-30% PICKED OUT
987.55	978.41-987.55		TERTIARY	MUDSTONE-BLK 70%:QUARTZ-30% PICKED OUT
996.70	987.55-996.70		TERTIARY	MUDSTONE-BLK 70%:QUARTZ-30% PICKED OUT
1005.84	996.70-1005.84		TERTIARY	MUDSTONE-BLK 50%:QUARTZ-50% PICKED OUT
1014.98	1005.84-1014.98		TERTIARY	MUDSTONE-BLK 40%:QUARTZ-60% PICKED OUT
1024.13	1014.98-1024.13		TERTIARY	MUDSTONE-BLK 40%:QUARTZ-60% PICKED OUT
1033.27	1024.13-1033.27		TERTIARY	MUDSTONE-GY 20%:QUARTZ-80% PICKED OUT
1042.42	1033.27-1042.42		TERTIARY	MUDSTONE-GY 20%:QUARTZ-80% PICKED OUT
1051.56	1042.42-1051.56		TERTIARY	MUDSTONE-GY 30%:QUARTZ-70% PICKED OUT:SANDSTONE-TR
1060.70	1051.56-1060.70		TERTIARY	SANDSTONE-BUFF 25%:MUDSTONE-GY 75%:QUARTZ-TR PICKED OUT
1069.85	1060.70-1069.85		TERTIARY	SANDSTONE-BUFF 30%:MUDSTONE-GY 70%:QUARTZ-TR PICKED OUT
1088.14	1078.99-1088.14		TERTIARY	SANDSTONE-BUFF 30%:MUDSTONE-GY 70%:QUARTZ-TR PICKED OUT
1115.57	1106.42-1115.57		TERTIARY	SANDSTONE-BUFF 70%:MUDSTONE-GY 30%:QUARTZ-TR PICKED OUT
1179.58	1170.43-1179.58		TERTIARY	SANDSTONE-BUFF 90%:MUDSTONE-GY 10%:QUARTZ-TR PICKED OUT
1225.30	1216.15-1225.30		TERTIARY	SANDSTONE-BUFF 90%:MUDSTONE-GY 10%:QUARTZ-TR PICKED OUT

TABLE

LITHOLOGY AND STRATIGRAPHY

WELL: HAMMERHEAD-1

LOCATION: UNITED STATES

DEPTH (m)	DEPTH RANGE	FORMATION	AGE	LITHOLOGY
1234.44	1225.30-1234.44		TERTIARY	MUDSTONE-BLK/COAL 50%:SANDSTONE-BUFF 50%:QUARTZ-PICKED OUT
1243.58	1234.44-1243.58		TERTIARY	MUDSTONE-BLK 40%:SANDSTONE-BUFF 60%:QUARTZ-PICKED OUT
1252.73	1243.58-1252.73		TERTIARY	MUDSTONE-BLK 30%:SANDSTONE-BUFF 70%:QUARTZ-PICKED OUT
1271.02	1261.87-1271.02		TERTIARY	MUDSTONE-BLK 30%:SANDSTONE-BUFF 70%:QUARTZ-PICKED OUT
1298.45	1289.30-1298.45		TERTIARY	MUDSTONE-BLK 30%:SANDSTONE-BUFF 70%:QUARTZ-PICKED OUT
1316.74	1307.59-1316.74		TERTIARY	SANDSTONE-BUFF/GY 95%:MUDSTONE-5%:QUARTZ-PICKED OUT
1344.17	1335.02-1344.17		TERTIARY	SANDSTONE-BUFF/GY 100%:MUDSTONE-TR:QUARTZ-PICKED OUT
1380.74	1371.60-1380.74		TERTIARY	SANDSTONE-GY 100%:MUDSTONE-GY TR:QUARTZ-PICKED OUT
1417.32	1408.18-1417.32		TERTIARY	SANDSTONE-GY 100%:MUDSTONE-GY TR:QUARTZ-PICKED OUT
1444.75	1435.61-1444.75		TERTIARY	SANDSTONE-GY 100%:MUDSTONE-GY TR:QUARTZ-PICKED OUT
1472.18	1463.04-1472.18		TERTIARY	SANDSTONE-GY 95%:MUDSTONE-GY 5%:QUARTZ-PICKED OUT
1517.90	1508.76-1517.90		TERTIARY	SANDSTONE-GY 90%:MUDSTONE-DK GY 10%:QUARTZ-PICKED OUT
1527.05	1517.90-1527.05		TERTIARY	MUDSTONE-DK GY 40%:SANDSTONE-GY 60%:QUARTZ-PICKED OUT
1554.48	1545.34-1554.48		TERTIARY	MUDSTONE-DK GY 30%:SANDSTONE-GY 70%:QUARTZ-PICKED OUT
1572.77	1563.62-1572.77		TERTIARY	MUDSTONE-DK GY 45%:SANDSTONE-GY 55%:QUARTZ-PICKED OUT
1591.06	1581.91-1591.06		TERTIARY	MUDSTONE-DK GY 30%:SANDSTONE-GY 70%:QUARTZ-PICKED OUT
1609.34	1600.20-1609.34		TERTIARY	MUDSTONE-GY 30%:SANDSTONE-GY/BUFF 70%:QUARTZ-PICKED OUT
1618.49	1609.34-1618.49		TERTIARY	MUDSTONE-GY 30%:SANDSTONE-GY 70%:QUARTZ-PICKED OUT

TABLE

LITHOLOGY AND STRATIGRAPHY

WELL: HAMMERHEAD-1

LOCATION: UNITED STATES

DEPTH (m)	DEPTH RANGE	FORMATION	AGE	LITHOLOGY
1627.63	1618.49-1627.63		TERTIARY	MUDSTONE-GY 30%:SANDSTONE-GY/BUFF 70%:QUARTZ-PICKED OUT
1636.78	1627.63-1636.78		TERTIARY	MUDSTONE-GY 30%:SANDSTONE-GY 70%:QUARTZ-PICKED OUT
1664.21	1655.06-1664.21		TERTIARY	MUDSTONE-GY 30%:SANDSTONE-GY 70%:QUARTZ-PICKED OUT
1673.35	1664.21-1673.35		TERTIARY	MUDSTONE-GY 20%:SANDSTONE-GY 80%:QUARTZ-PICKED OUT
1700.78	1691.64-1700.78		TERTIARY	MUDSTONE-LT GY 20%:SANDSTONE-BUFF/GY 80%:QUARTZ-PICKED OUT
1728.22	1719.07-1728.22		TERTIARY	MUDSTONE-GY 30%:SANDSTONE-GY/BUFF 70%:QUARTZ-PICKED OUT
1755.65	1746.50-1755.65		TERTIARY	MUDSTONE-GY 30%:SANDSTONE-GY/BUFF 70%:QUARTZ-PICKED OUT
1792.22	1783.08-1792.22		TERTIARY	MUDSTONE-GY 15%:SANDSTONE-GY/BUFF 85%:QUARTZ-PICKED OUT
1801.37	1792.22-1801.37		TERTIARY	MUDSTONE-GY 20%:SANDSTONE-GY/BUFF 80%:QUARTZ-PICKED OUT
1810.51	1801.37-1810.51		TERTIARY	MUDSTONE-GY 25%:SANDSTONE-GY/BUFF 80%:QUARTZ-PICKED OUT
1874.52	1865.38-1874.52		TERTIARY	MUDSTONE-GY 30%:SANDSTONE-BUFF 70%:QUARTZ-PICKED OUT
1892.81	1883.66-1892.81		TERTIARY	SANDSTONE-BUFF/GY 100%:QUARTZ-PICKED OUT
1901.95	1892.81-1901.95		TERTIARY	SANDSTONE-BUFF/GY 100%:QUARTZ-PICKED OUT
1947.67	1938.53-1947.67		TERTIARY	SANDSTONE-BUFF/GY 100%:QUARTZ-PICKED OUT
1956.82	1947.67-1956.82		TERTIARY	SANDSTONE-BUFF/GY 100%:QUARTZ-PICKED OUT
1993.39	1984.25-1993.39		TERTIARY	SANDSTONE-GY/BUFF 100%:MUDSTONE-GY TR:QUARTZ-PICKED OUT
2039.11	2029.97-2039.11		TERTIARY	SANDSTONE-GY 100%:QUARTZ-PICKED OUT
2066.54	2057.40-2066.54		TERTIARY	SANDSTONE-GY/BUFF 85%:MUDSTONE-DK GY 15%:QUARTZ-PICKED OUT
2139.70	2130.55-2139.70		TERTIARY	MUDSTONE-DK GY 30%:SANDSTONE-BUFF 70%:COAL-TR:QUARTZ-PICKED OUT

TABLE

LITHOLOGY AND STRATIGRAPHY

WELL: HAMMERHEAD-1

LOCATION: UNITED STATES

DEPTH (m)	DEPTH RANGE	FORMATION	AGE	LITHOLOGY
2148.84	2139.70-2148.84		TERTIARY	COAL-100%(MDST-BLK)
2176.27	2167.13-2176.27		TERTIARY	MUDSTONE-GY 15%:MUDSTONE-BLK TR:SANDSTONE-BUFF 85%
2258.57	2249.42-2258.57		TERTIARY	MUDSTONE-DK GY 15%:COAL-TR:SANDSTONE-GY/BUFF 85%:QUARTZ-PICKED OUT
2414.02	2313.43-2414.02		TERTIARY	MUDSTONE-GY 20%:SANDSTONE-BUFF 80%:QUARTZ-PICKED OUT

TABLE

SOURCE ROCK QUALITY INDICATORS

WELL: HAMMERHEAD-1

LOCATION: UNITED STATES

DEPTH (m)	DEPTH RANGE (m)	FORMATION/AGE	PICKED LITHOLOGY	P1 (kg/t)	P1 (mg/gC)	P2 (kg/t)	GOGI	HI	TOC (%)	CARBT (%)	S (%)
886.97	877.82-886.97	TERTIARY	BULKED	0.6	3.0	19.1		95	20.2	16.8	8.1
896.11	886.97-896.11	TERTIARY	BULKED	0.1		1.0					
905.26	896.11-905.26	TERTIARY	BULKED	0.2		1.7					
914.40	905.26-914.40	TERTIARY	BULKED	0.3		2.2					
914.40	886.97-914.40	TERTIARY	BULKED						1.4	63.2	0.4
932.69	923.54-932.69	TERTIARY	BULKED	0.5	1.8	36.3		134	27.0	28.6	4.3
932.69	923.54-932.69	TERTIARY	COAL	1.4		46.4					
941.83	932.69-941.83	TERTIARY	BULKED	1.9		29.3					
941.83	932.69-941.83	TERTIARY	COAL	1.6		73.4	0.44				
960.12	950.98-960.12	TERTIARY	BULKED	1.9		57.2					
969.26	960.12-969.26	TERTIARY	BULKED	1.1		16.6					
978.41	969.26-978.41	TERTIARY	BULKED	0.2		1.0					
978.41	950.98-978.41	TERTIARY	BULKED						31.3	13.5	1.7
987.55	978.41-987.55	TERTIARY	BULKED	0.1		5.3					
996.70	987.55-996.70	TERTIARY	BULKED	0.7		40.3					
1005.84	996.70-1005.8	TERTIARY	BULKED	0.7		28.8					
1014.98	1005.84-1014.9	TERTIARY	BULKED	1.8		43.9	0.32				
1024.13	1014.98-1024.1	TERTIARY	BULKED	0.7		22.7					
1024.13	978.41-1024.13	TERTIARY	BULKED						13.0	23.7	1.6
1033.27	1024.13-1033.2	TERTIARY	BULKED	0.6		27.7					
1042.42	1033.27-1042.4	TERTIARY	BULKED	1.0		8.1					
1042.42	1024.13-1042.4	TERTIARY	BULKED						14.7	15.3	3.5
1051.56	1042.42-1051.5	TERTIARY	BULKED	0.6		17.7					
1060.70	1051.56-1060.7	TERTIARY	BULKED	0.5		6.6					
1069.85	1060.70-1069.8	TERTIARY	BULKED	0.3		4.3					
1088.14	1078.99-1088.1	TERTIARY	BULKED	0.3		7.3					
1088.14	1042.42-1088.1	TERTIARY	BULKED						11.2	13.8	3.4
1115.57	1106.42-1115.5	TERTIARY	BULKED	0.2		3.1					
1179.58	1170.43-1179.5	TERTIARY	BULKED	0.2		1.6					
1225.30	1216.15-1225.3	TERTIARY	BULKED	0.2		1.9					
1225.30	1106.42-1225.3	TERTIARY	BULKED						3.4	20.9	2.3
1234.44	1225.30-1234.4	TERTIARY	BULKED	0.6		51.9					
1243.58	1234.44-1243.5	TERTIARY	BULKED	0.4		37.5	0.65				
1252.73	1243.58-1252.7	TERTIARY	BULKED	0.5		22.9					
1271.02	1261.87-1271.0	TERTIARY	BULKED	0.3		19.9					
1298.45	1289.30-1298.4	TERTIARY	BULKED	0.3		19.2					
1298.45	1225.30-1298.4	TERTIARY	BULKED						25.2	24.8	3.4
1316.74	1307.59-1316.7	TERTIARY	BULKED	0.1	1.6	4.4		70	6.3	17.2	2.3

Sample Type=CUTTINGS unless marked: *=SIDE WALL CORE,+=CORE

TABLE

SOURCE ROCK QUALITY INDICATORS

WELL: HAMMERHEAD-1

LOCATION: UNITED STATES

DEPTH (m)	DEPTH RANGE (m)	FORMATION/AGE	PICKED LITHOLOGY	P1 (kg/t)	P1 (mg/gC)	P2 (kg/t)	GOGI	HI	TOC (%)	CARBT (%)	S (%)
1344.17	1335.02-1344.1	TERTIARY	BULKED	0.4		9.5					
1380.74	1371.60-1380.7	TERTIARY	BULKED	0.1		2.3					
1417.32	1408.18-1417.3	TERTIARY	BULKED	0.1		0.5					
1417.32	1335.02-1417.3	TERTIARY	BULKED						1.8	46.9	0.8
1444.75	1435.61-1444.7	TERTIARY	BULKED	0.2		0.5					
1472.18	1463.04-1472.1	TERTIARY	BULKED	0.1		0.5					
1472.18	1435.61-1472.1	TERTIARY	BULKED						0.78	45.5	1.1
1517.90	1508.76-1517.9	TERTIARY	BULKED	0.2		1.9					
1527.05	1517.90-1527.0	TERTIARY	BULKED	2.9		31.3	0.24				
1554.48	1545.34-1554.4	TERTIARY	BULKED	0.3		13.1					
1572.77	1563.62-1572.7	TERTIARY	BULKED	0.6		28.3					
1572.77	1508.76-1572.8	TERTIARY	BULKED						25.1	19.0	3.6
1591.06	1581.91-1591.0	TERTIARY	BULKED	0.3		16.8					
1609.34	1600.20-1609.3	TERTIARY	BULKED	0.2		2.6					
1636.78	1627.63-1636.7	TERTIARY	BULKED	0.7		12.3					
1700.78	1691.64-1700.7	TERTIARY	BULKED	0.1		3.9					
1728.22	1719.07-1728.2	TERTIARY	BULKED	0.2		4.7					
1728.22	1691.64-1728.2	TERTIARY	BULKED						10.6	25.5	3.3
1755.65	1746.50-1755.6	TERTIARY	BULKED	0.1		3.2					
1792.22	1783.08-1792.2	TERTIARY	BULKED	0.1		1.3					
1792.22	1746.50-1792.2	TERTIARY	BULKED						2.1	26.3	1.9
1801.37	1792.22-1801.3	TERTIARY	BULKED	0.1	6.8	1.2		82	1.5	32.5	1.7
1810.51	1801.37-1810.5	TERTIARY	BULKED	0.1		3.4					
1874.52	1865.38-1874.5	TERTIARY	BULKED	0.2		5.5					
1874.52	1801.37-1874.5	TERTIARY	BULKED						8.2	27.2	2.4
1892.81	1883.66-1892.8	TERTIARY	BULKED	0.2		1.7					
1901.95	1892.81-1901.9	TERTIARY	BULKED	0.1		1.3					
1901.95	1883.66-1901.9	TERTIARY	BULKED						2.3	28.2	1.7
1947.67	1938.53-1947.6	TERTIARY	BULKED	0.1		0.6					
1956.82	1947.67-1956.8	TERTIARY	BULKED	0.1		0.9					
1956.82	1938.53-1956.8	TERTIARY	BULKED						1.1	18.3	2.0
1993.39	1984.25-1993.3	TERTIARY	BULKED	0.2		0.8					
2039.11	2029.97-2039.1	TERTIARY	BULKED	0.2		1.2					
2066.54	2057.40-2066.5	TERTIARY	BULKED	0.2		1.6					
2066.54	1984.25-2066.5	TERTIARY	BULKED						2.0	27.6	3.9
2139.70	2130.55-2139.7	TERTIARY	BULKED	0.3		28.9					
2148.84	2139.70-2148.8	TERTIARY	BULKED	0.0		107.4	0.22				
2176.27	2167.13-2176.2	TERTIARY	BULKED	0.2		5.7					
2258.57	2249.42-2258.5	TERTIARY	BULKED	0.8		21.0					
2258.57	2130.55-2258.6	TERTIARY	BULKED						10.0	28.1	3.5
2414.02	2313.43-2414.0	TERTIARY	BULKED	0.6		9.2					

TABLE

PYROLYSIS-GC DATA

WELL: HAMMERHEAD-1

LOCATION: UNITED STATES

DEPTH (m)	FORMATION/AGE	C1-C5 (%)	C6-C9 (%)	C10-C13 (%)	C14-C22 (%)	C23-C36 (%)	GOGI	HI	TOC (%)
941.83	TERTIARY	30	11	17	23	18	0.44		
1014.98	TERTIARY	24	11	21	23	19	0.32		
1243.58	TERTIARY	39	11	23	16	9	0.65		
1527.05	TERTIARY	19	11	14	28	25	0.24		
2148.84	TERTIARY	18	14	13	25	27	0.22		

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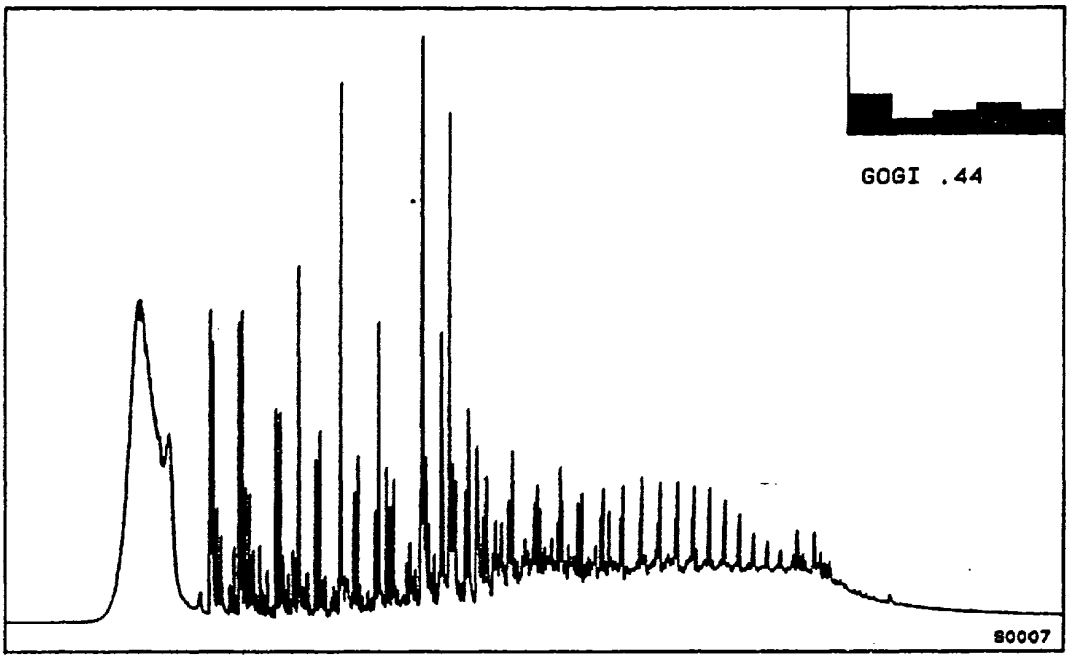
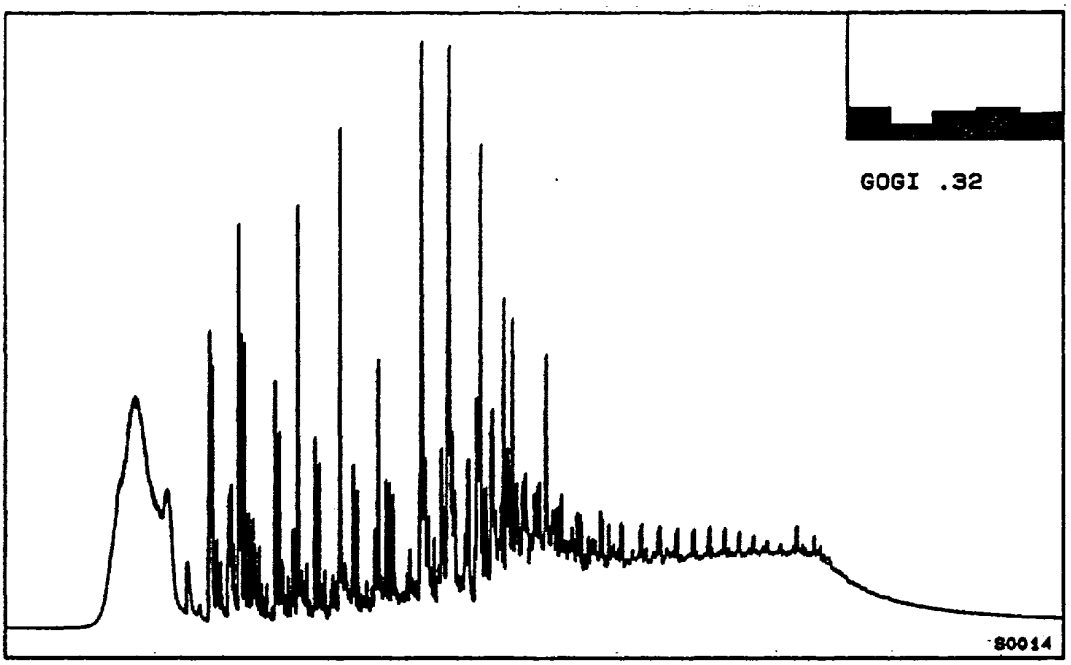


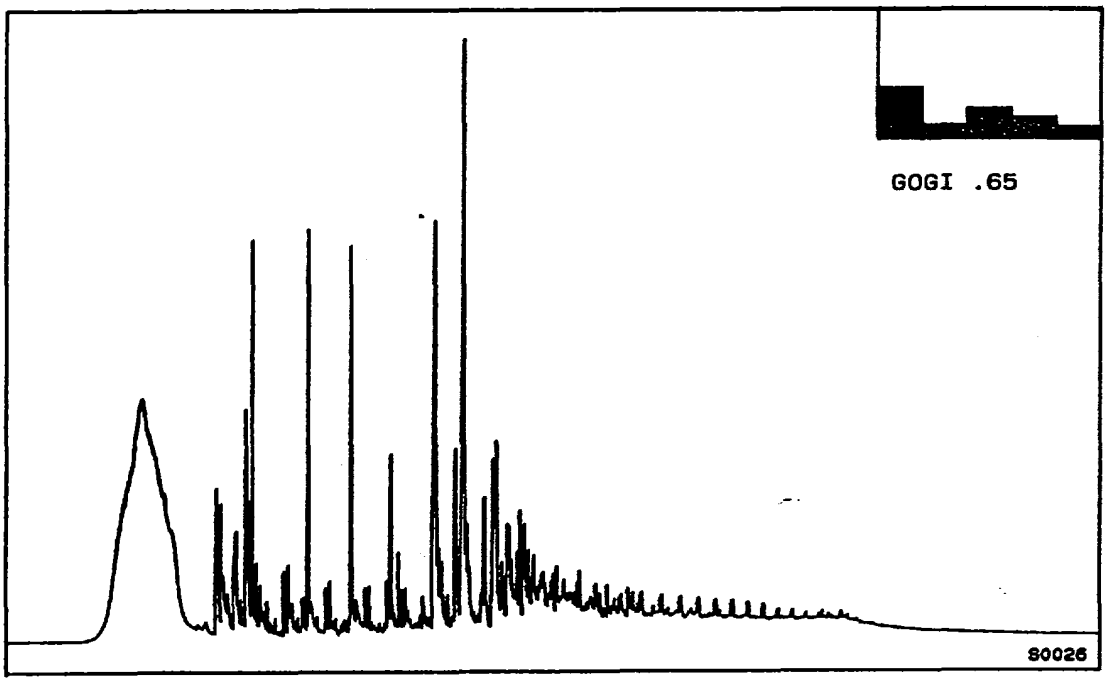
941.83m (CUT)



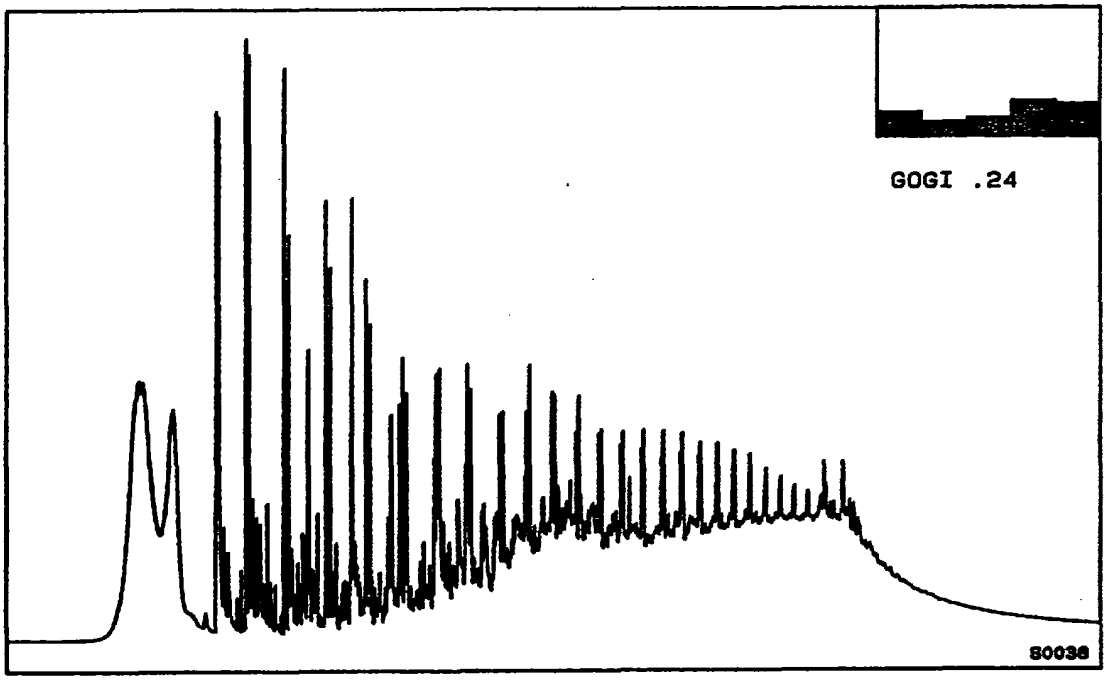
1014.98m (CUT)

KEROGEN PYROLYSATE (P2) DISTRIBUTIONS

WELL_NAME : HAMMERHEAD-1



1243.58m (CUT)

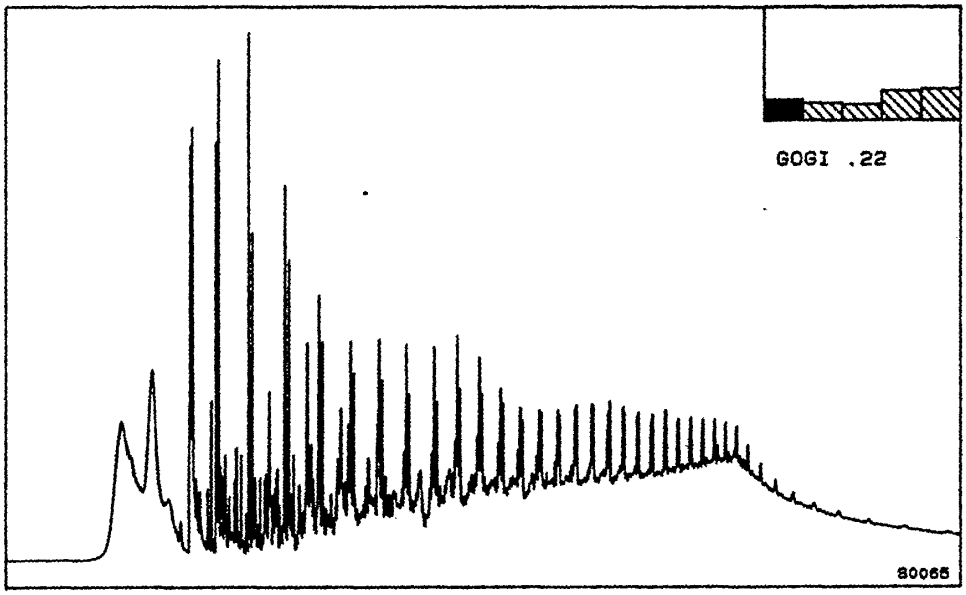


1527.05m (CUT)

KEROGEN PYROLYSATE (P2) DISTRIBUTIONS

WELL_NAME : HAMMERHEAD-1

GCB ref. 8812SFD007



2148.84m (CUT)

KEROGEN PYROLYSATE (P2) DISTRIBUTIONS

WELL_NAME : HAMMERHEAD-1

GCB ref. 8812SED007

TABLE

SOLUBLE EXTRACT DATA-1

WELL: HAMMERHEAD-1

LOCATION: UNITED STATES

DEPTH (m)	FORMATION/AGE	TOC (%)	TSE (%)	TSE (mg/gC)	SAC (mg/gC)	SAC (%)	AROM (%)	RES (%)	ASPH (%)
941.83	TERTIARY		0.449			23.8	24.8	51.5	
1014.98	TERTIARY		0.633			18.4	20.1	61.5	
1243.58	TERTIARY		0.286			19.4	22.8	57.7	
1627.63	TERTIARY		0.202			22.8	38.5	38.8	
1673.35	TERTIARY		0.249			32.6	42.3	25.1	

TABLE

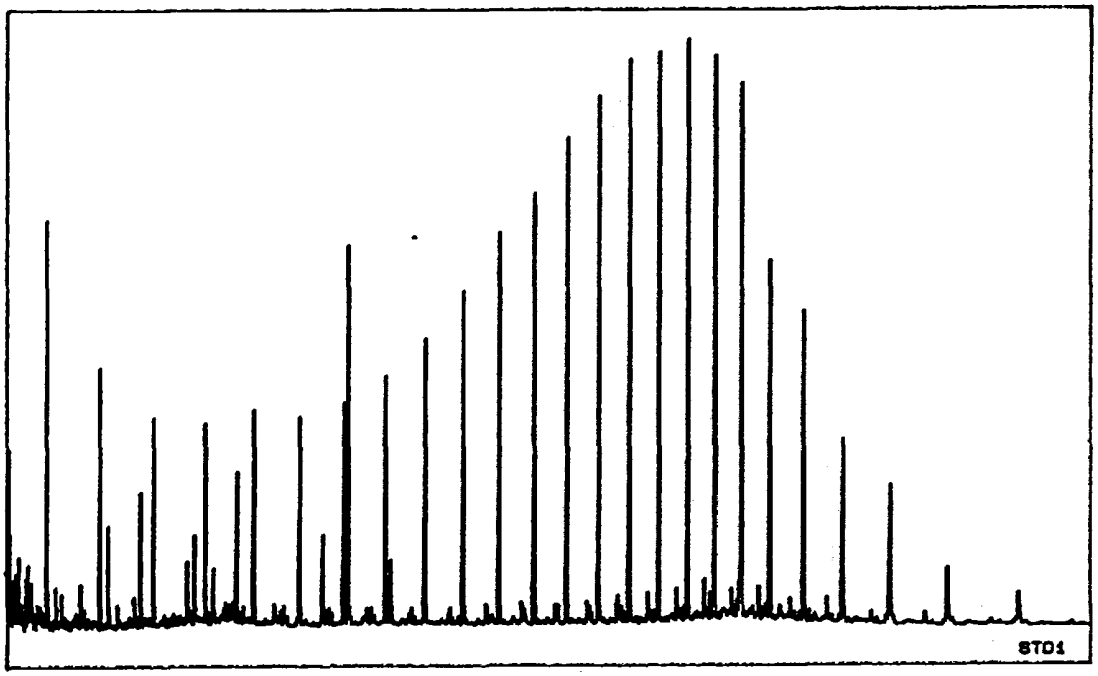
CARBON ISOTOPE RATIOS

WELL: HAMMERHEAD-1

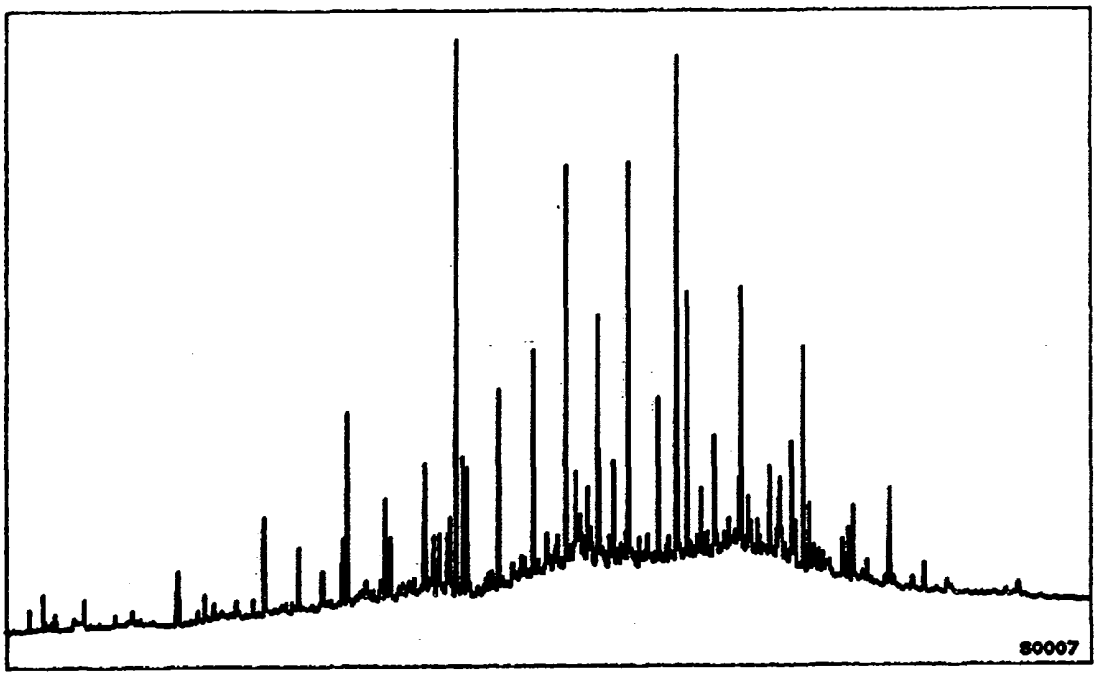
LOCATION: UNITED STATES

DEPTH (m)	PICKED LITHOLOGY	SAMPLE	ISOTOPE RATIO (per mil)
941.83	BULKED	TSE	-28.8
941.83	BULKED	KER	-25.0
1014.98	BULKED	TSE	-27.6
1014.98	BULKED	KER	-25.0
1243.58	BULKED	TSE	-28.4
1243.58	BULKED	KER	-25.2

C-12/C-13 ISOTOPIC RATIOS ARE RELATIVE TO
PDB STANDARD:NBS-22 AT -29.8 per mil



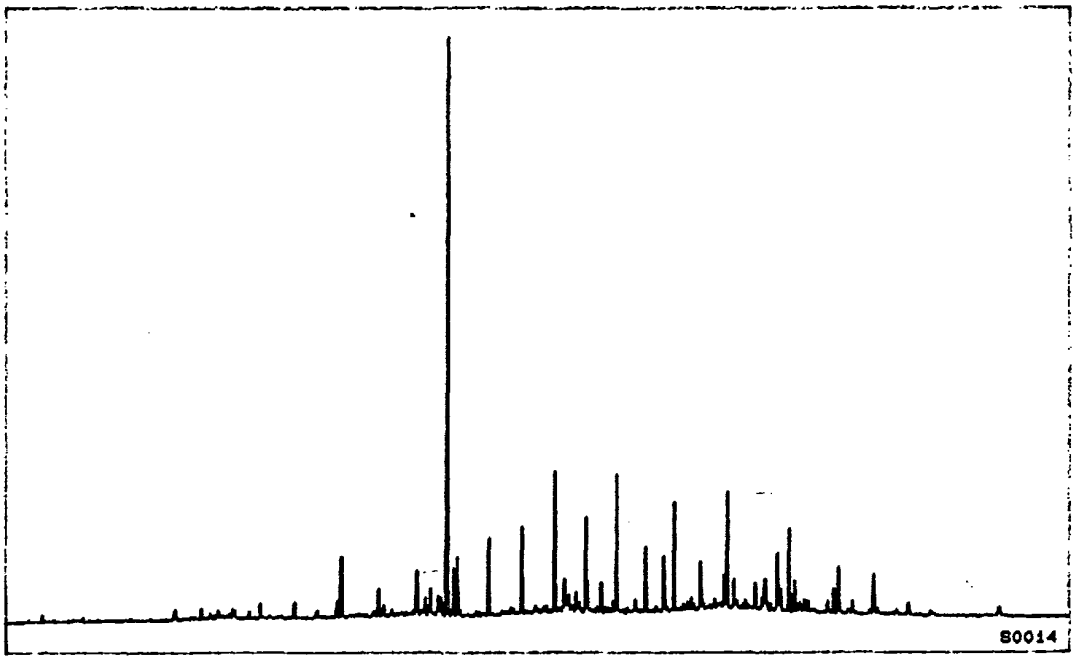
STANDARD



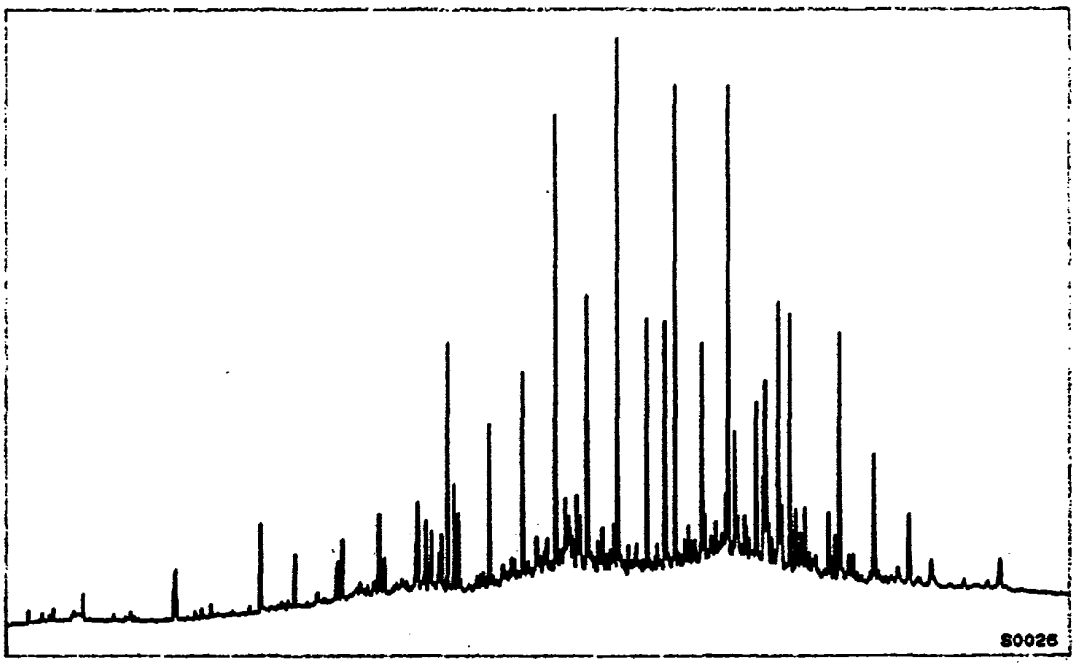
941.83m (CUT)

SAC FRACTION CHROMATOGRAMS

WELL_NAME : HAMMERHEAD-1



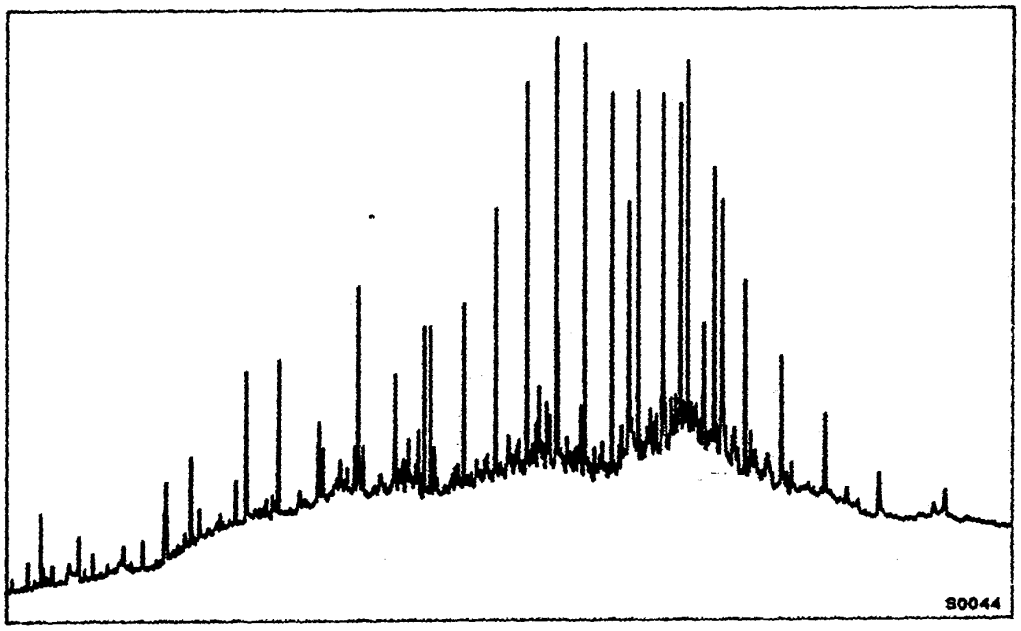
1014.98m (CUT)



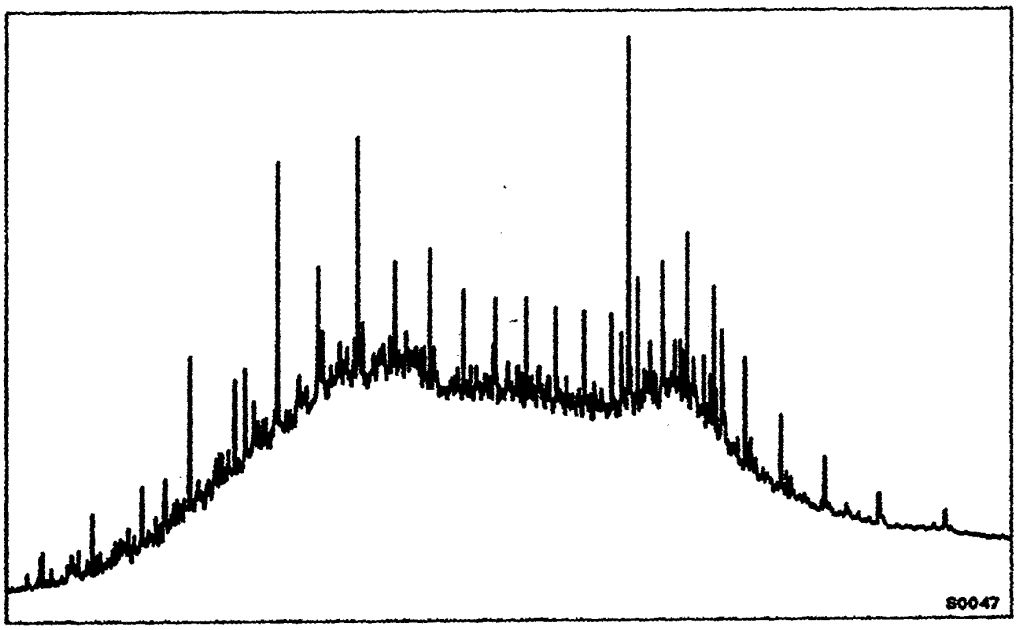
1243.58m (CUT)

SAC FRACTION CHROMATOGRAMS

WELL_NAME : HAMMERHEAD-1



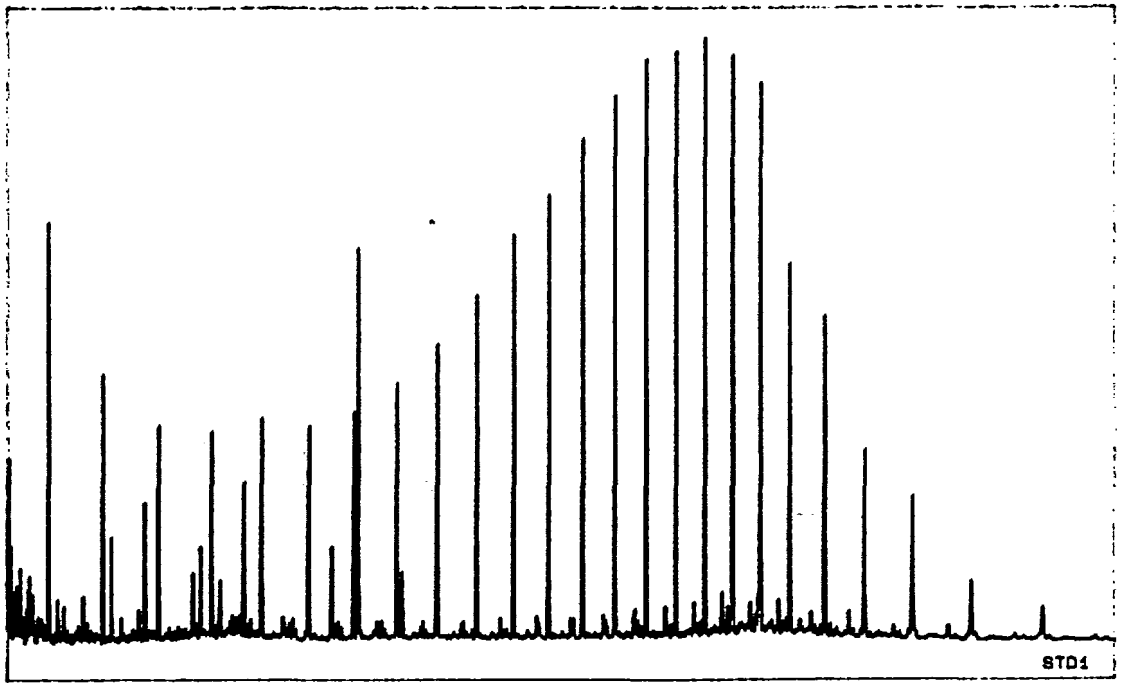
1627.63m (CUT)



1673.35m (CUT)

SAC FRACTION CHROMATOGRAMS

WELL_NAME : HAMMERHEAD-1



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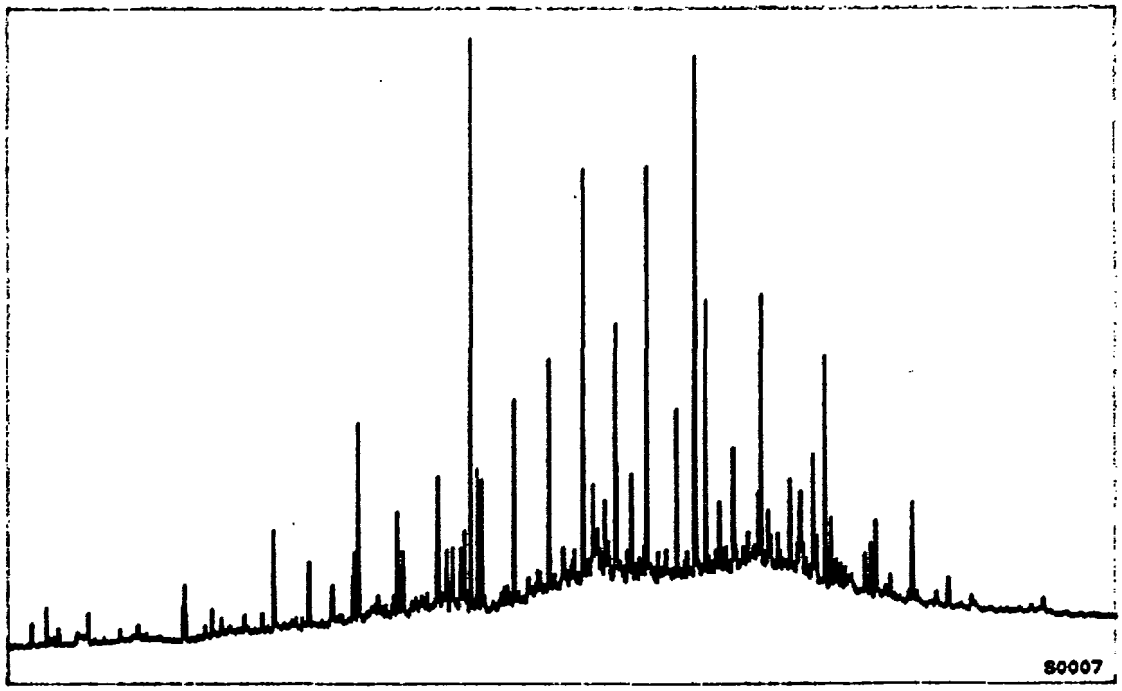
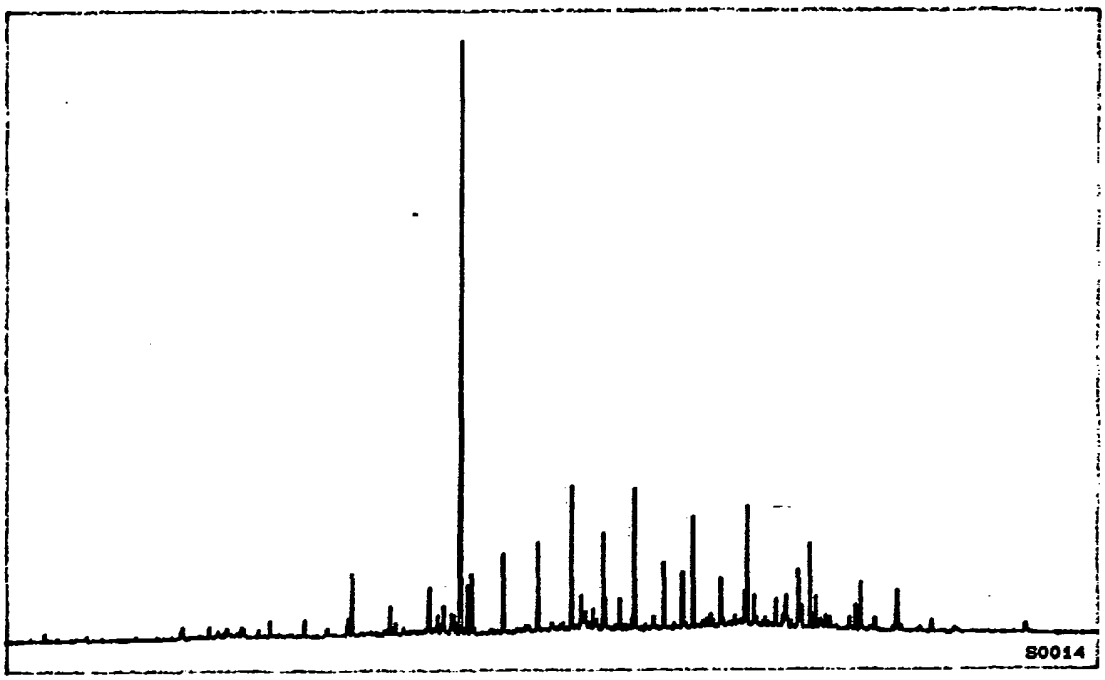


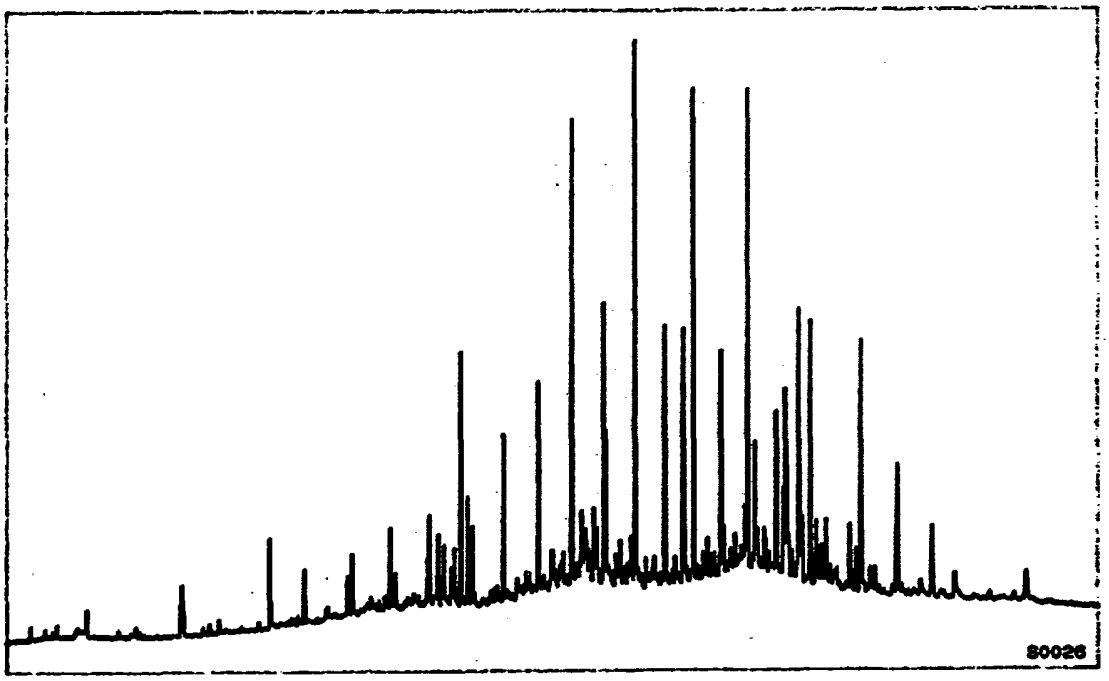
941.83m (CUT)

SAC FRACTION CHROMATOGRAMS

WELL_NAME : HAMMERHEAD-1



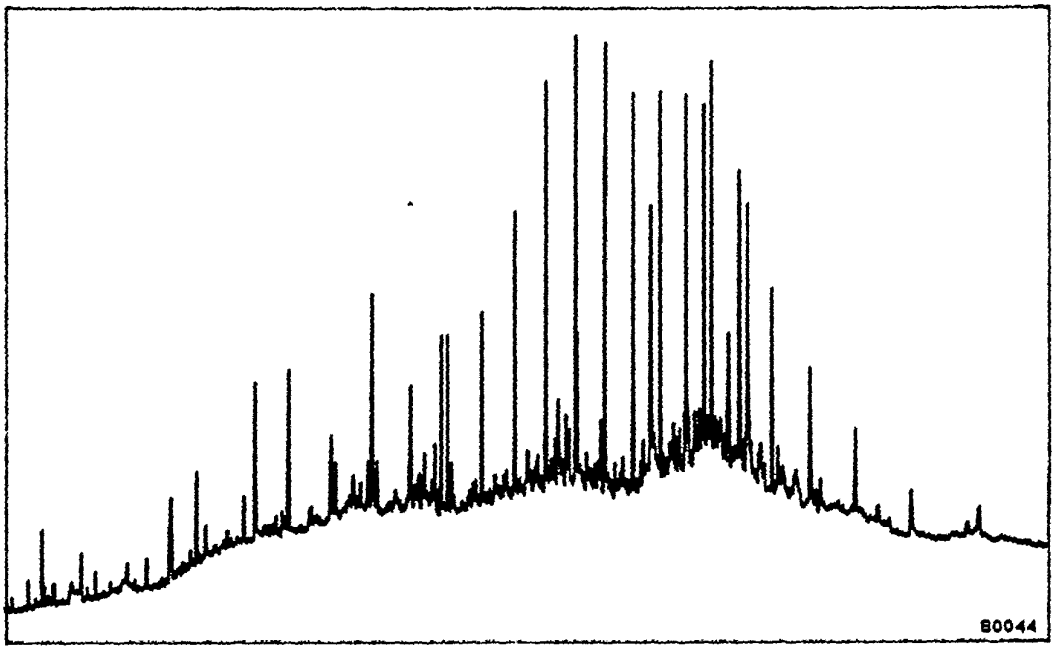
1014.98m (CUT)



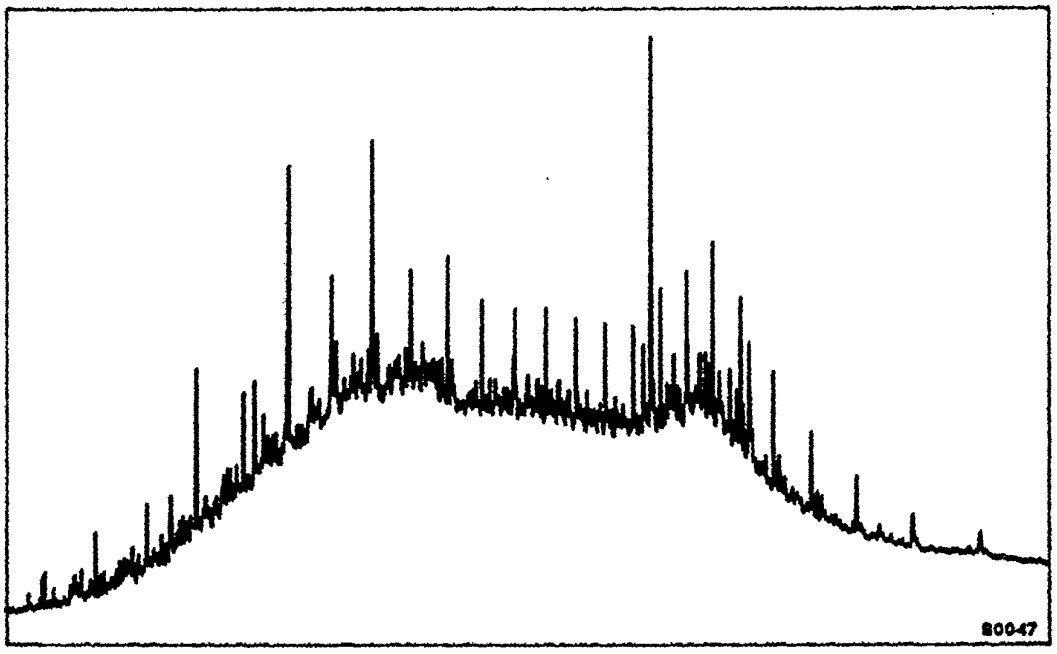
1243.58m (CUT)

SAC FRACTION CHROMATOGRAMS

WELL_NAME : HAMMERHEAD-1



1627.63m (CUT)



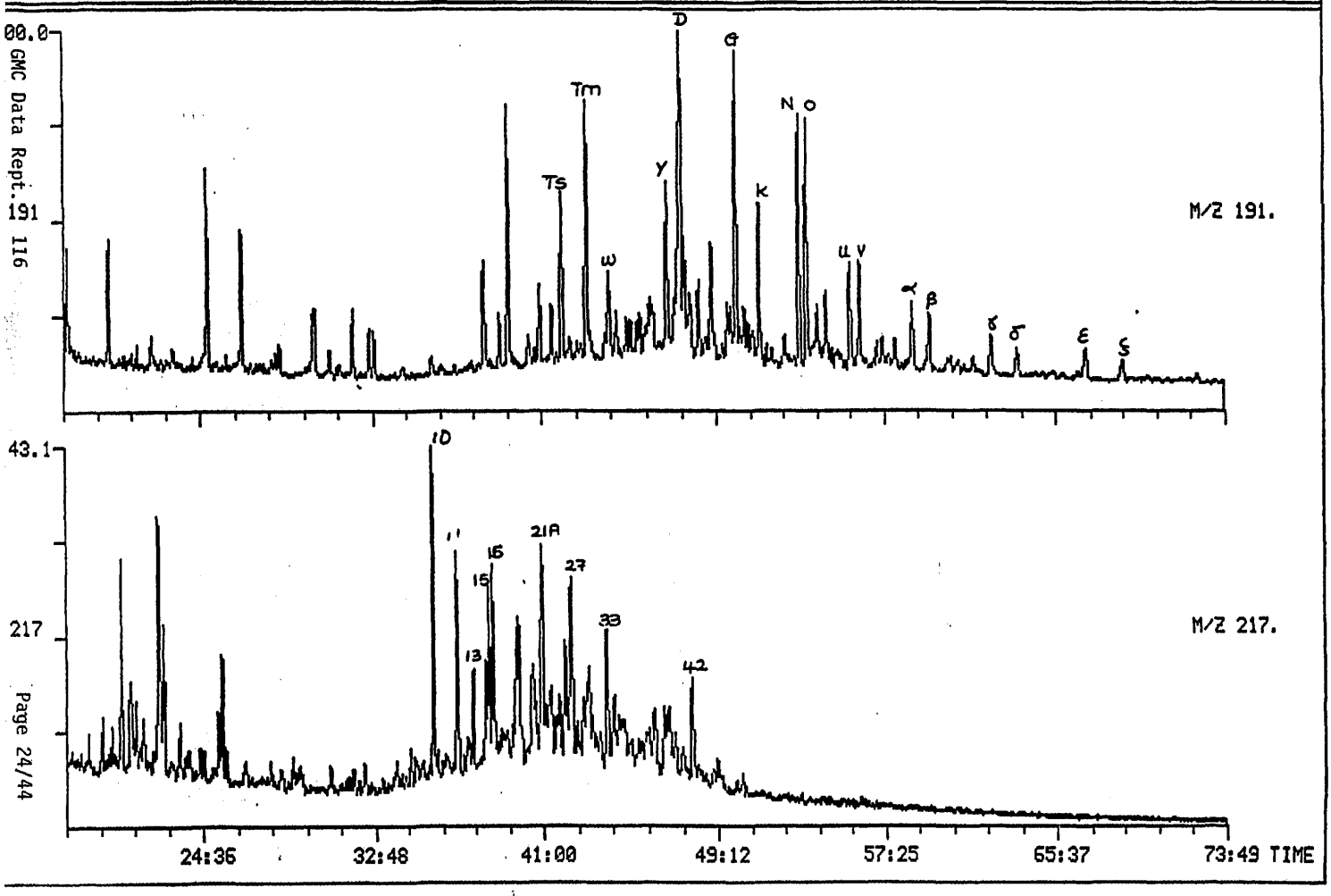
1673.35m (CUT)

SAC FRACTION CHROMATOGRAMS

WELL_NAME : HAMMERHEAD-1

BP GEOCHEMISTRY BRANCH GC/MS ANALYSIS

SAMPLE: SATS EX HAMMERHEAD-1 1673.4 $8812SED007S0047$
DATA FILE: AC078



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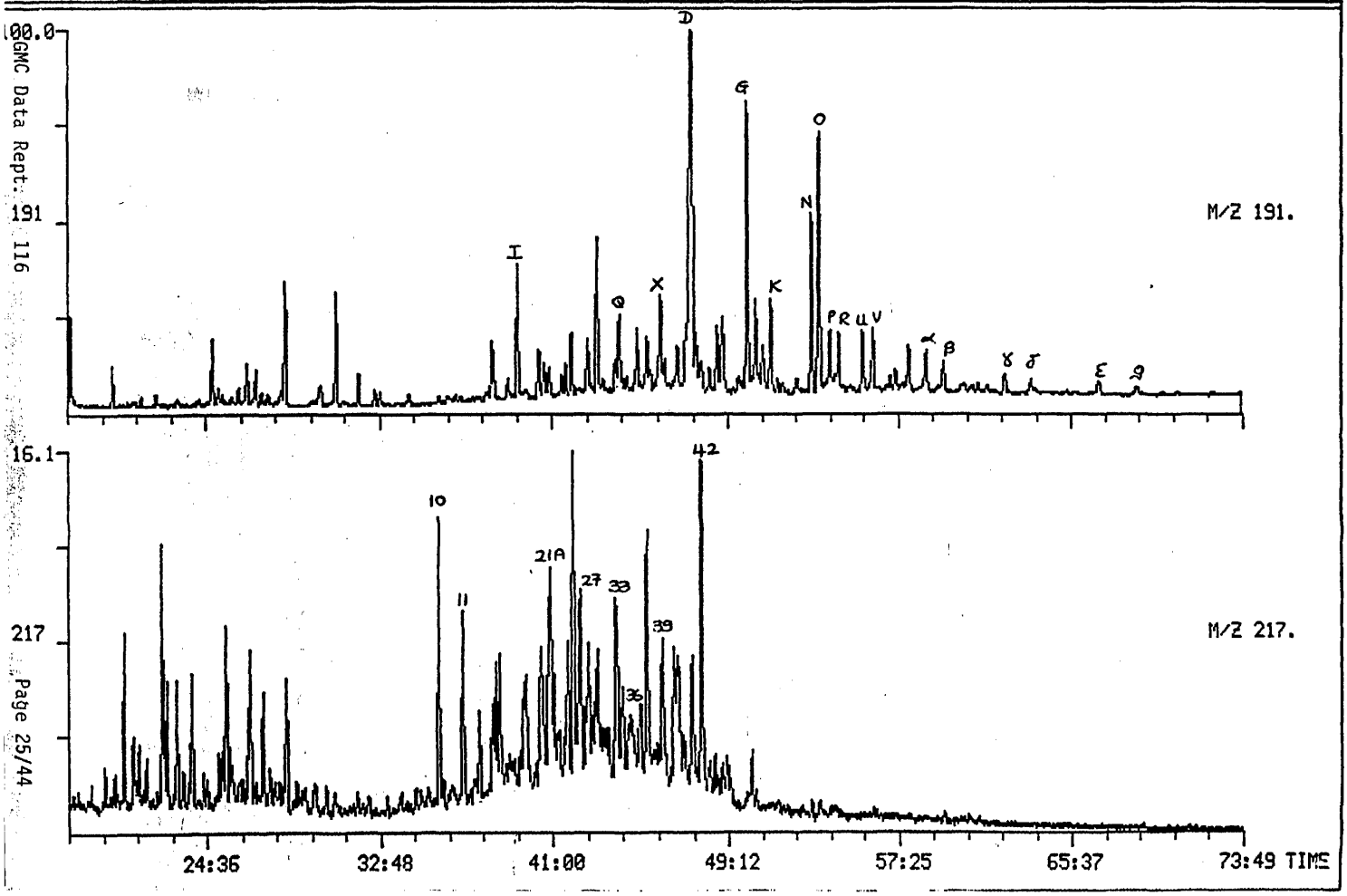
BP GEOCHEMISTRY BRANCH GC/MS ANALYSIS

SAMPLE: SATS EX HAMMERHEAD-1 1627.6 $8812SED007S0044$
DATA FILE: AC077



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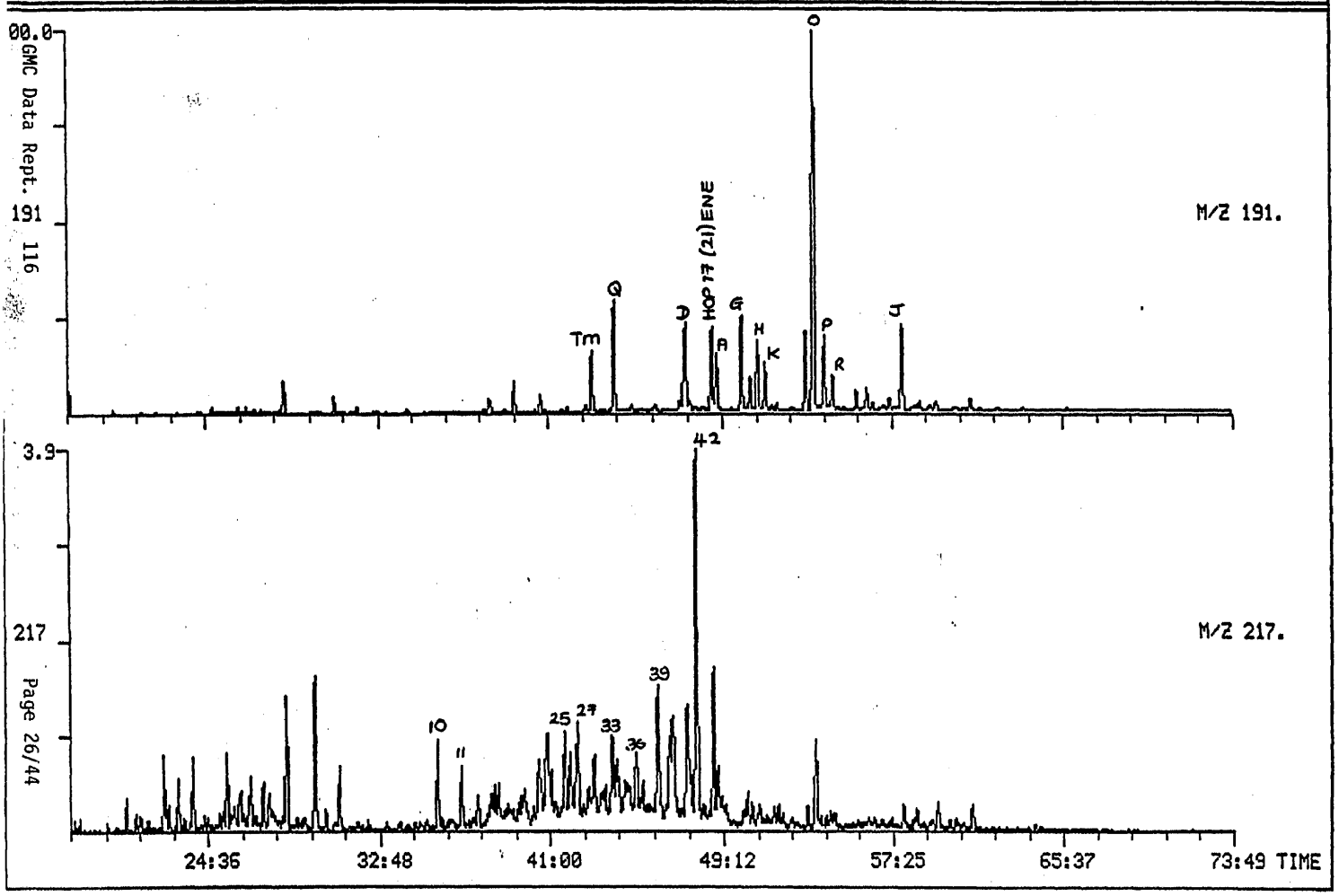
BP GEOCHEMISTRY BRANCH GC/MS ANALYSIS

SAMPLE: SATS EX HAMMERHEAD-1 1243.6 $8812SED007S0026$
DATA FILE: AC076



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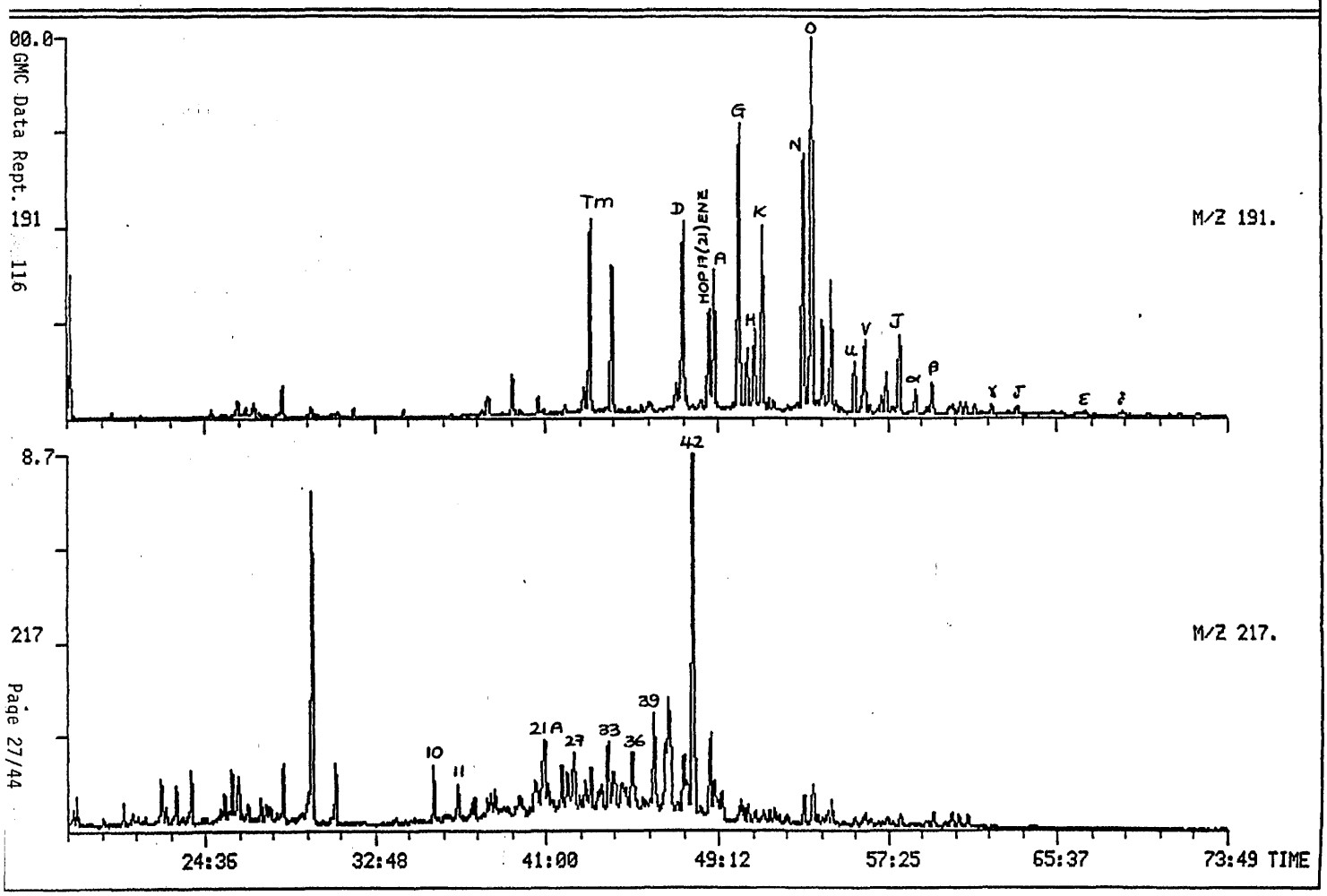
BP GEOCHEMISTRY BRANCH GC/MS ANALYSIS

SAMPLE: SATS EX HAMMERHEAD-1 1014.98 $8812SED007S0014$
DATA FILE: AC075



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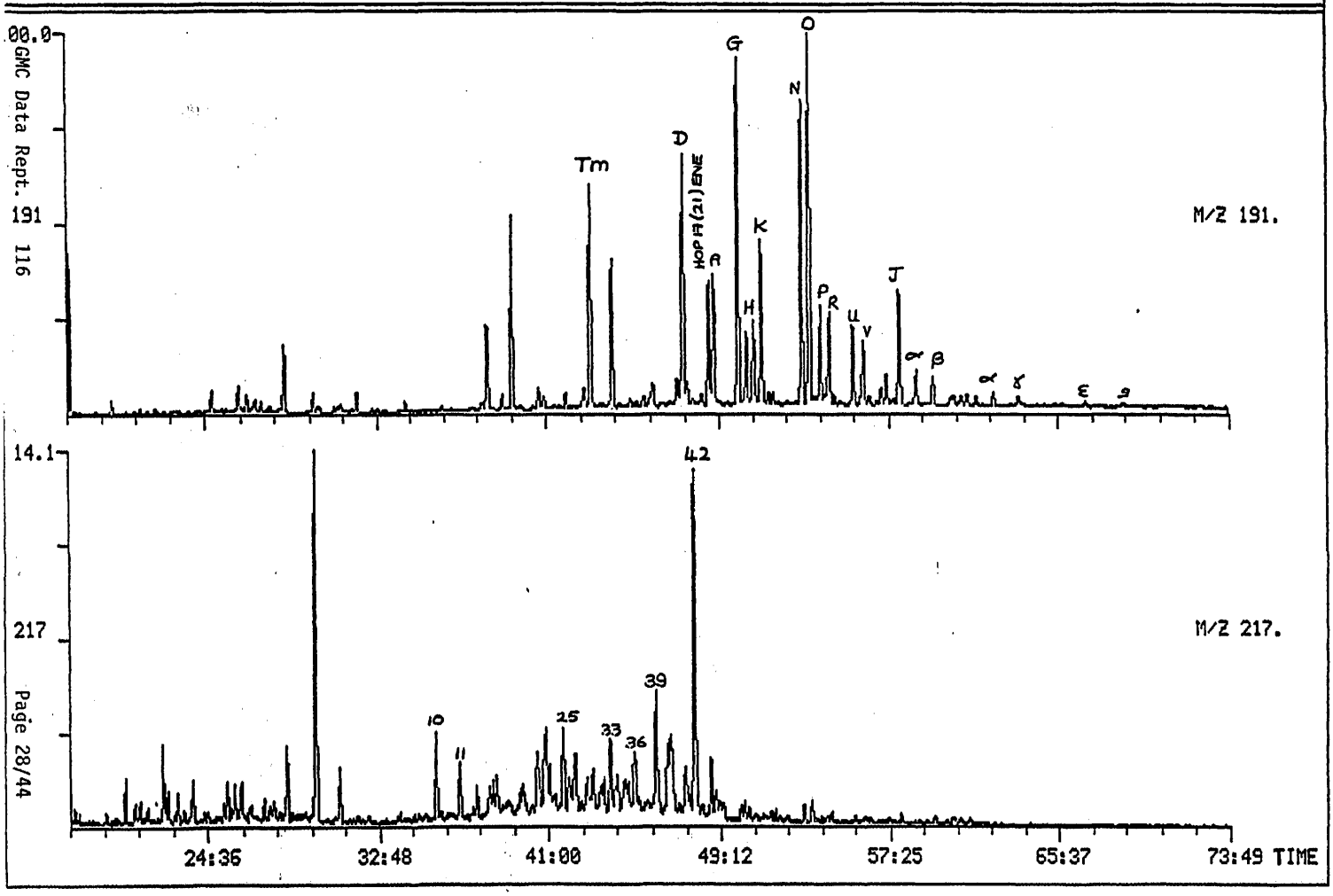
BP GEOCHEMISTRY BRANCH GC/MS ANALYSIS

SAMPLE: SATS EX HAMMERHEAD-1 941.8 $8812SED007S0007$
DATA FILE: AC074



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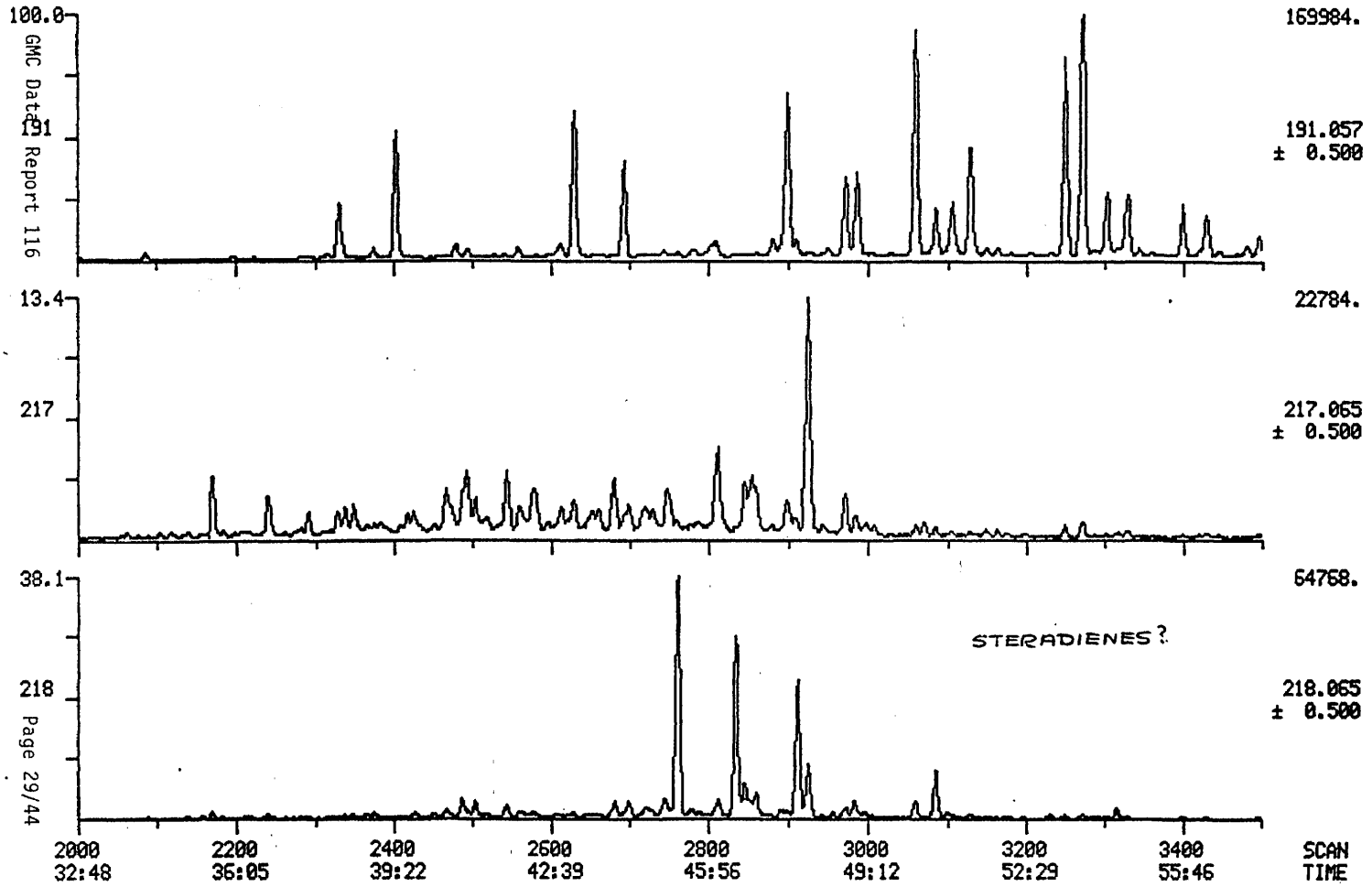
MIDMASS CHROMATOGRAMS DATA: AC074 #1 SCANS 2000 TO 3500
01/31/89 9:52:00 CALI: AC074 #2
SAMPLE: SATS EX HAMMERHEAD-1 941.8 $8812SED007S0007$
CONDS.:
RANGE: G 1,4500 LABEL: N 0,10.0 QUAN: A 2, 2.0 J 0 BASE: U 15, 3



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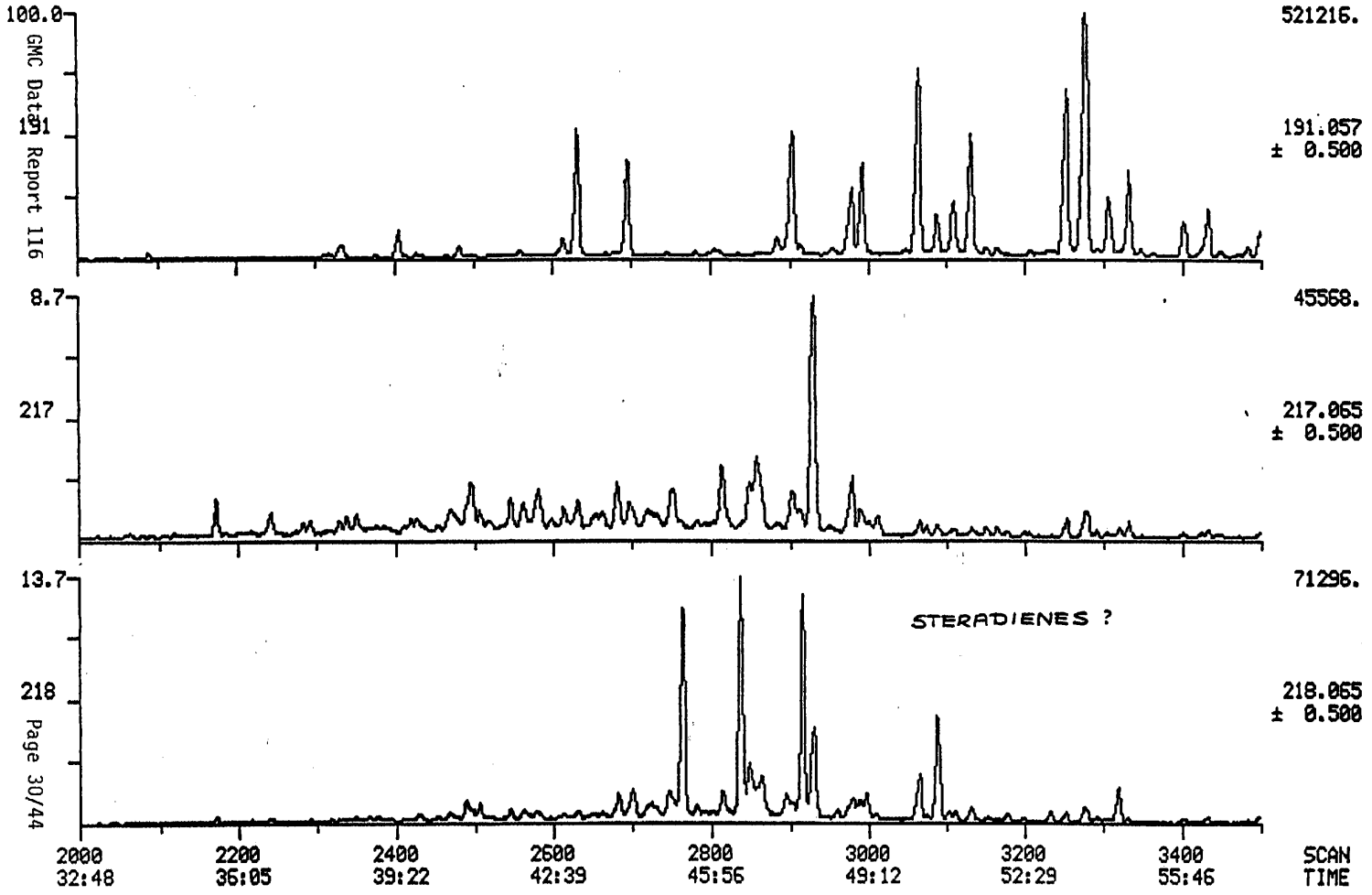
MIDMASS CHROMATOGRAMS DATA: AC075 #1 SCANS 2000 TO 3500
01/31/89 11:17:00 CALI: AC075 #2
SAMPLE: SATS EX HAMMERHEAD-1 1014.98 $8812SED007S0014$
CONDS.:
RANGE: G 1,4500 LABEL: N 0,10.0 QUAN: A 2, 2.0 J 0 BASE: U 15, 3



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MIDMASS CHROMATOGRAMS DATA: AC076 #1 SCANS 2000 TO 3500
01/31/89 12:42:00 CALI: AC076 #2
SAMPLE: SATS EX HAMMERHEAD-1 1243.6 $8812SED007S0026$
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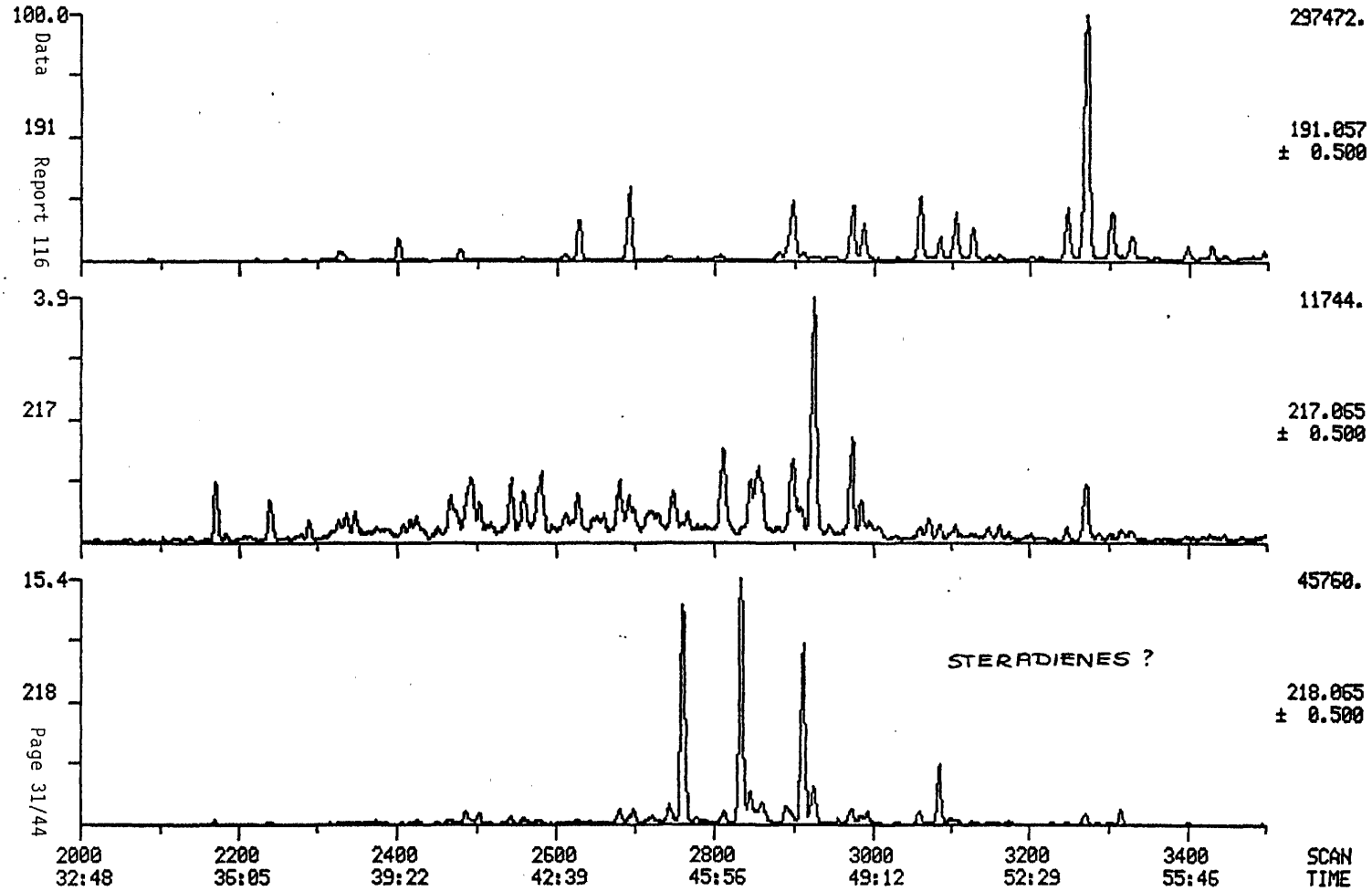

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MIDMASS CHROMATOGRAMS DATA: AC077 #1 SCANS 2000 TO 3500
01/31/89 14:08:00 CALI: AC077 #2
SAMPLE: SATS EX HAMMERHEAD-1 1627.6 $8812SED007S0044$
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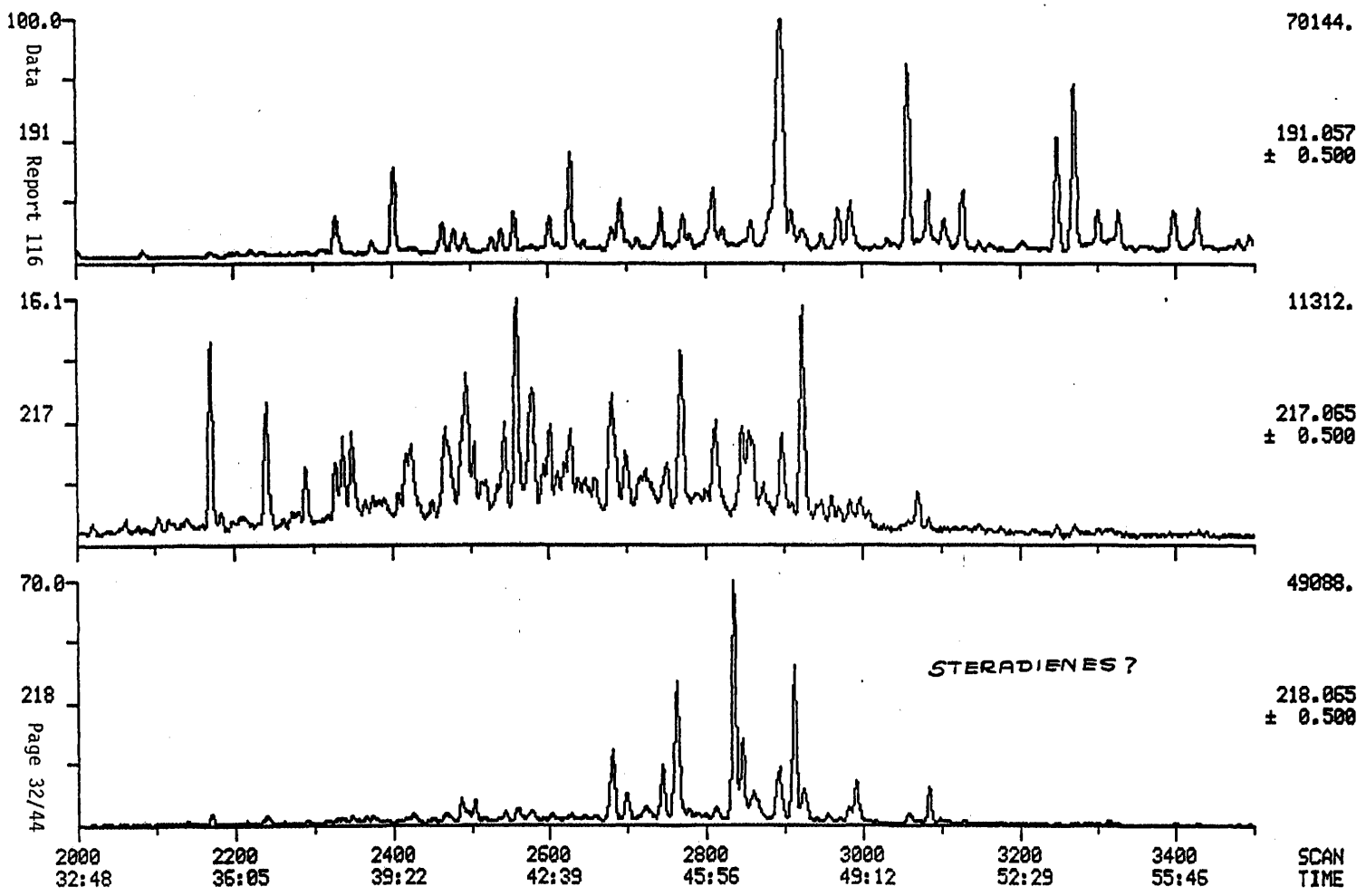

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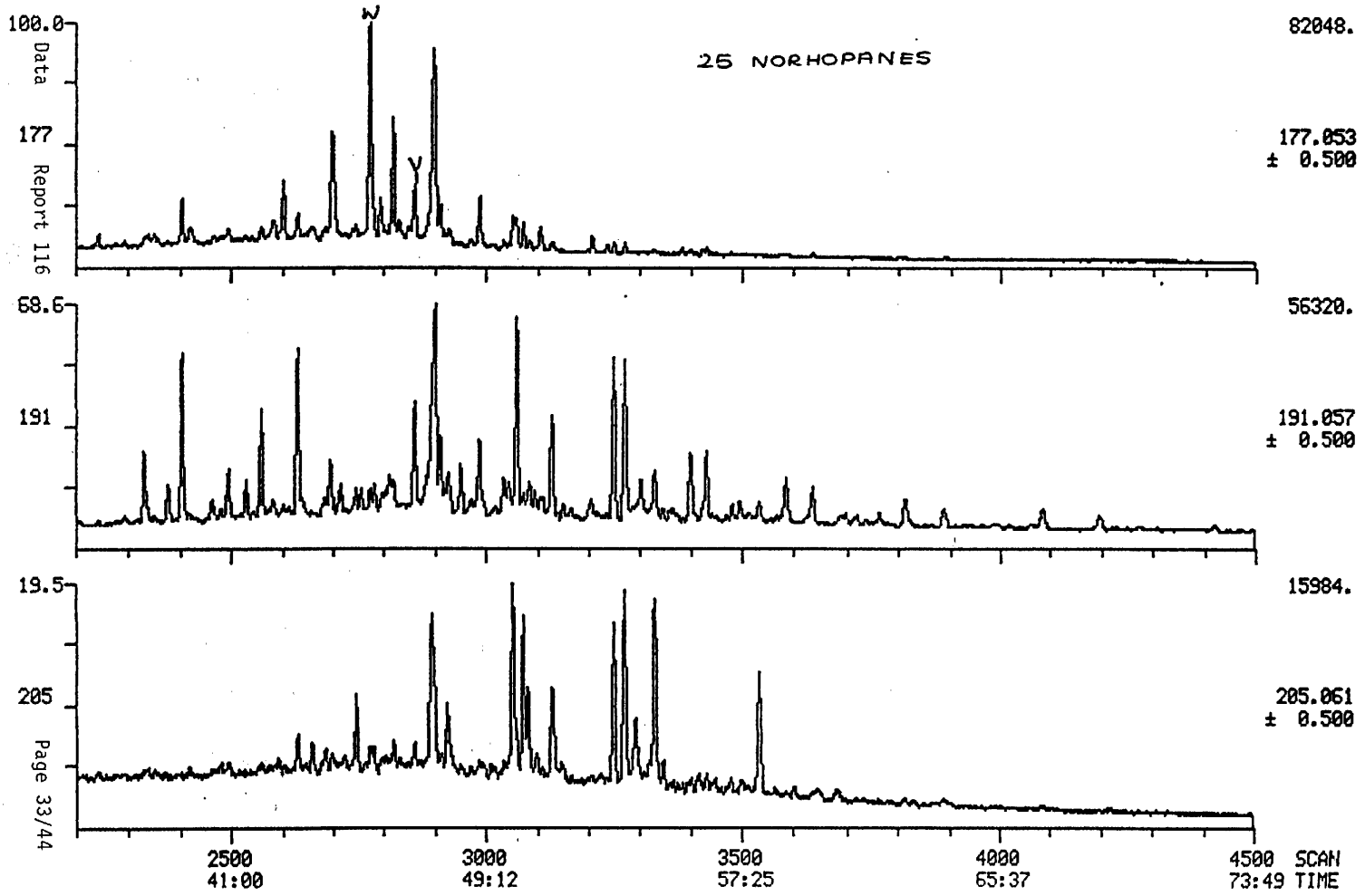
MIDMASS CHROMATOGRAMS DATA: AC078 #1 SCANS 2200 TO 4500
01/31/89 15:17:00 CALI: AC078 #2
SAMPLE: SATS EX HAMMERHEAD-1 1673.4 $8812SED00750047$
CONDS.:
RANGE: G 1,4500 LABEL: N 0,10.0 QUAN: A 2, 2.0 J 0 BASE: U 15, 3



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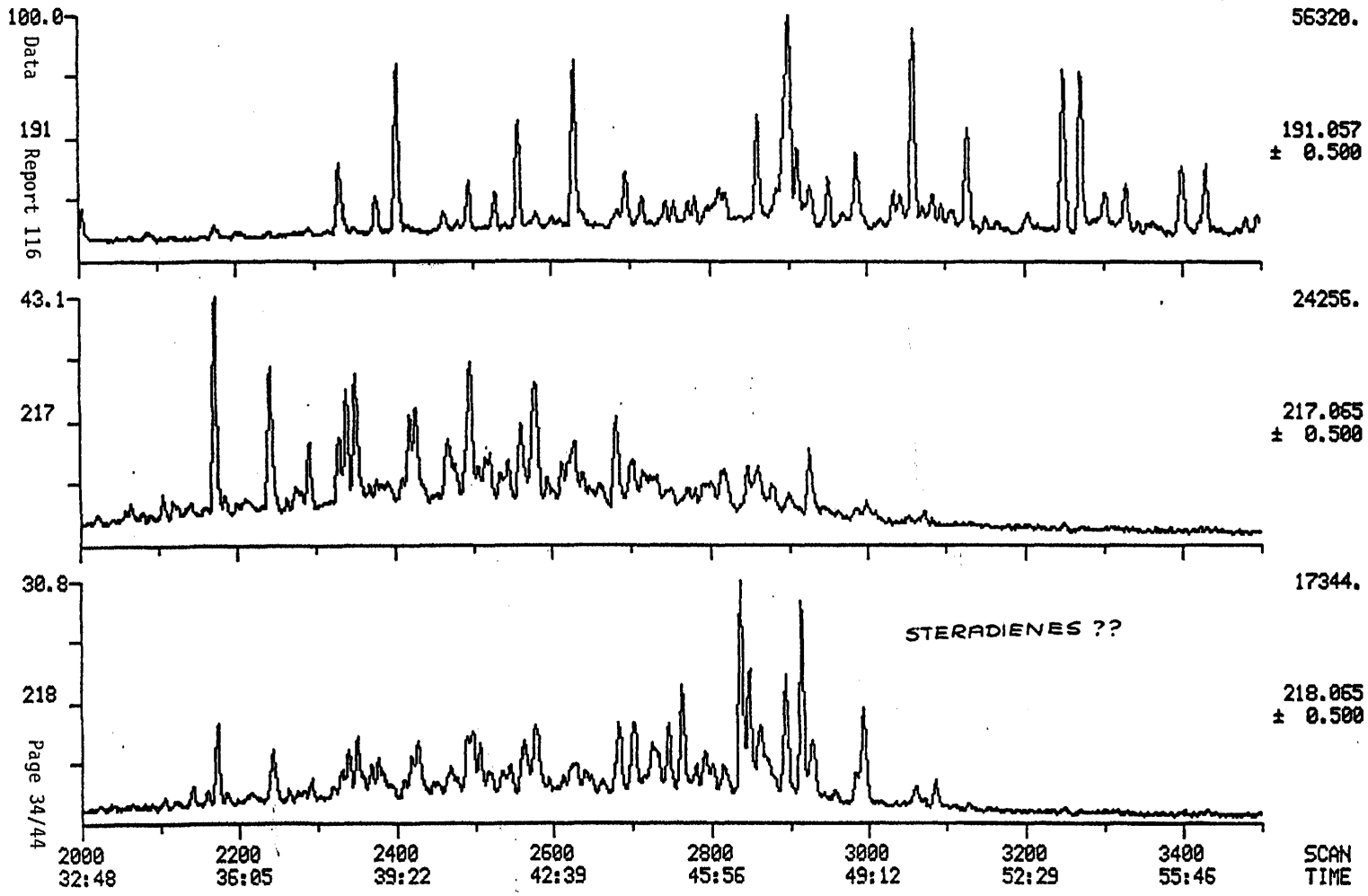
MIDMASS CHROMATOGRAMS DATA: AC078 #1 SCANS 2000 TO 3500
01/31/89 15:17:00 CALI: AC078 #2
SAMPLE: SATS EX HAMMERHEAD-1 1673.4 $8812SED007S0047$
CONDS.:
RANGE: G 1,4500 LABEL: N 0,10.0 QUAN: A 2, 2.0 J 0 BASE: U 15, 3



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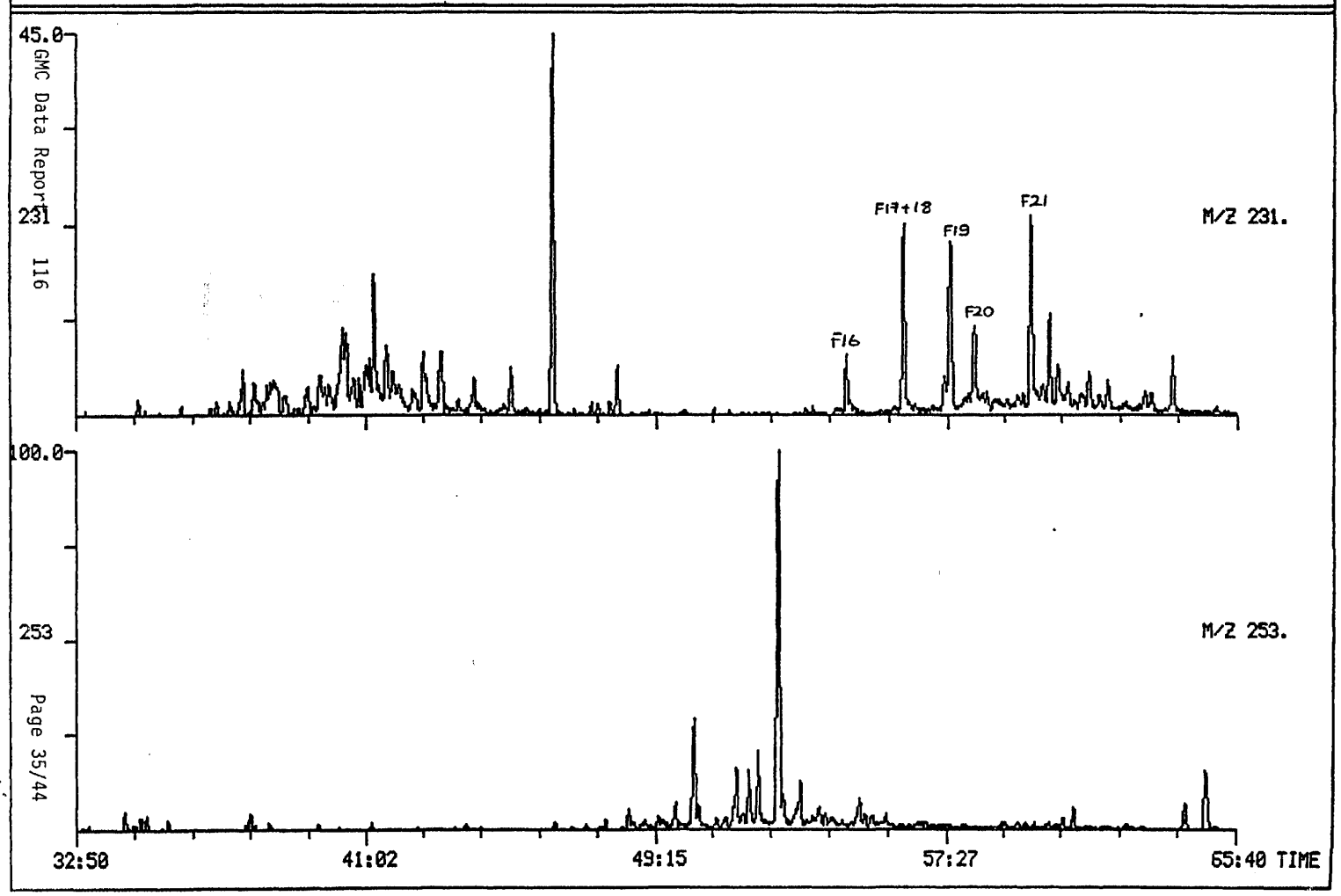
GMC Data Report 116 Page 34/44

BP GEOCHEMISTRY BRANCH GC/MS ANALYSIS

SAMPLE: AROMS EX HAMMERHEAD-1 941.8 $8812SED007S0007$
DATA FILE: AC079



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BP GEOCHEMISTRY BRANCH GC/MS ANALYSIS

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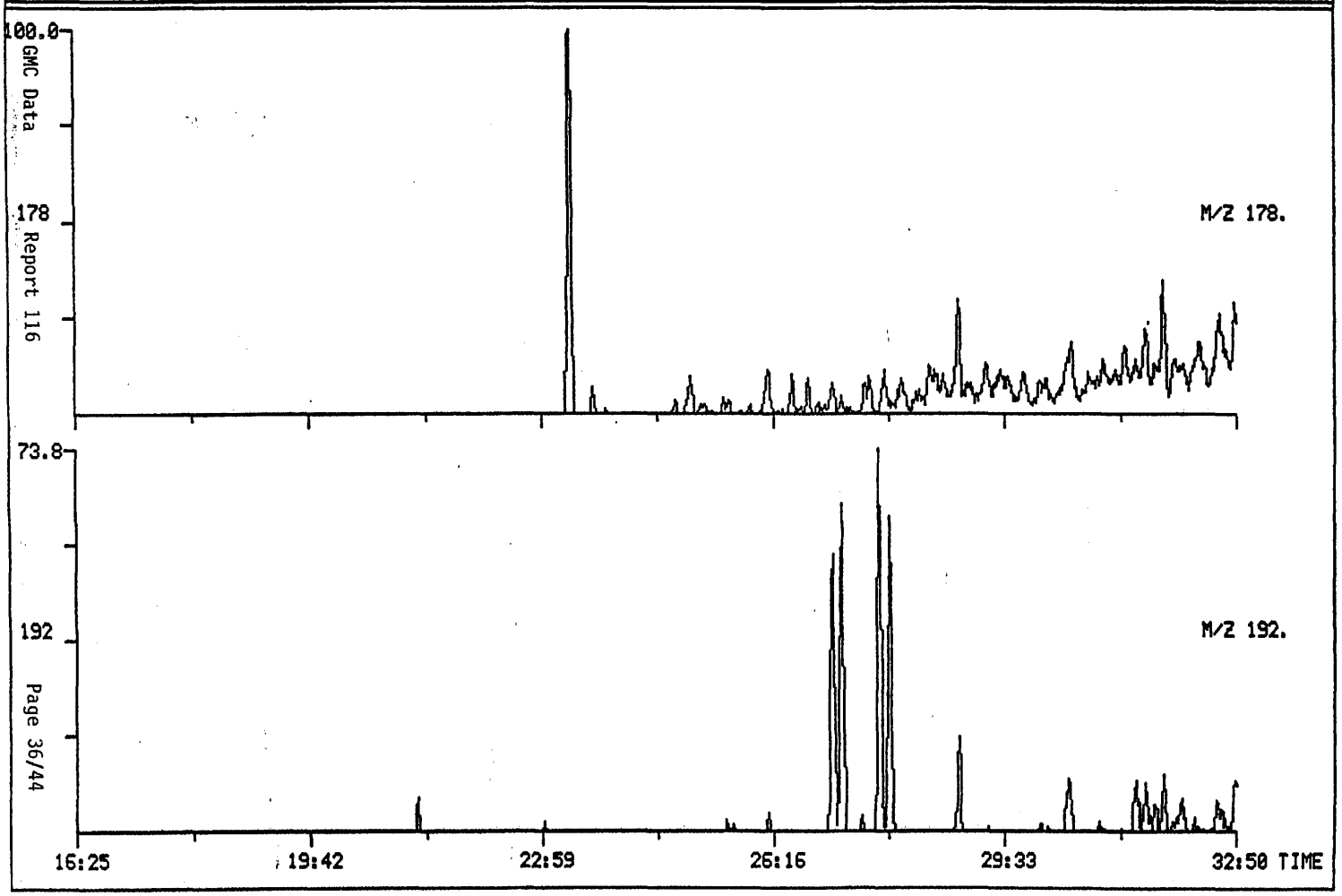
DATA FILE: AC079



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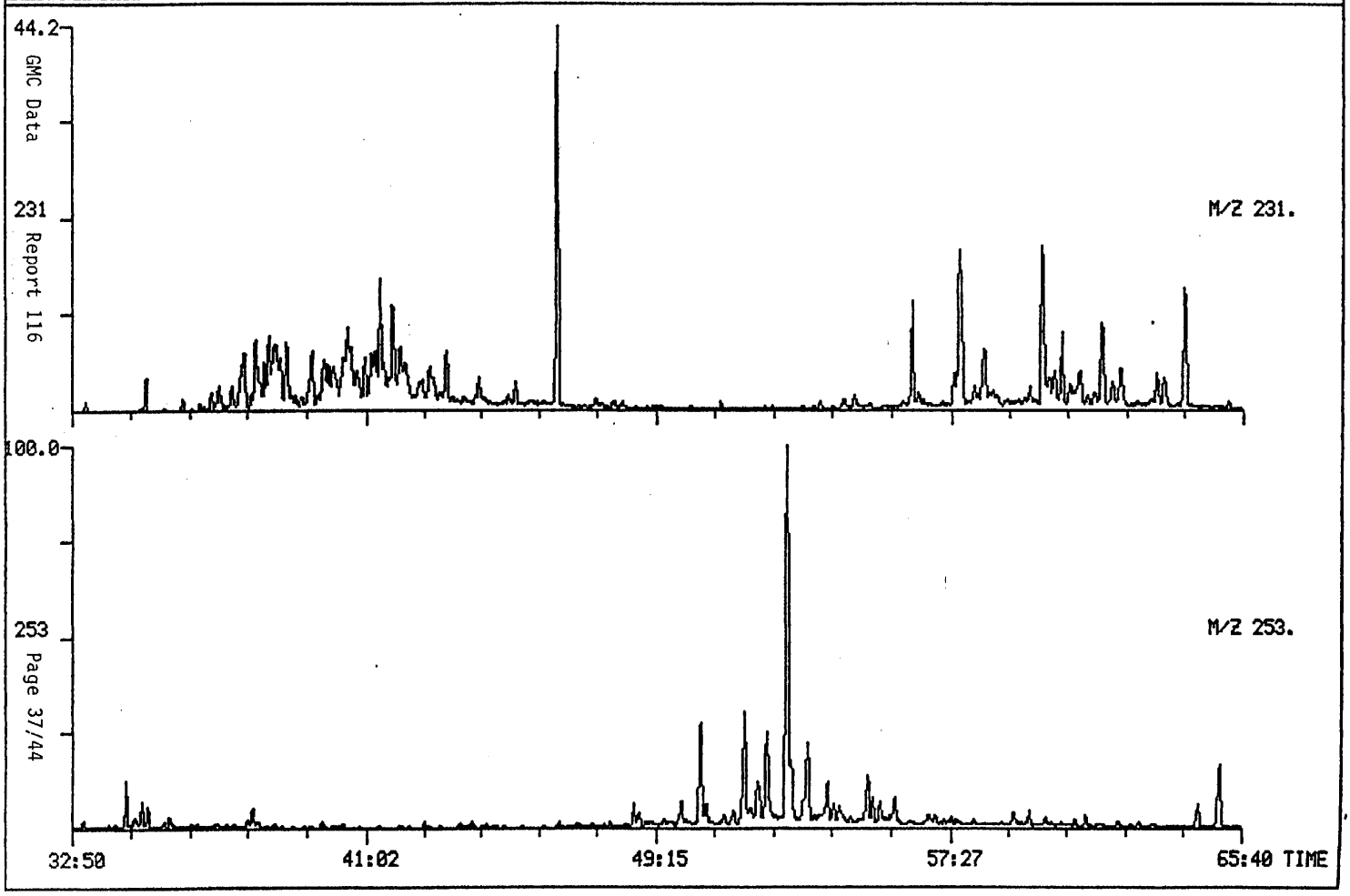

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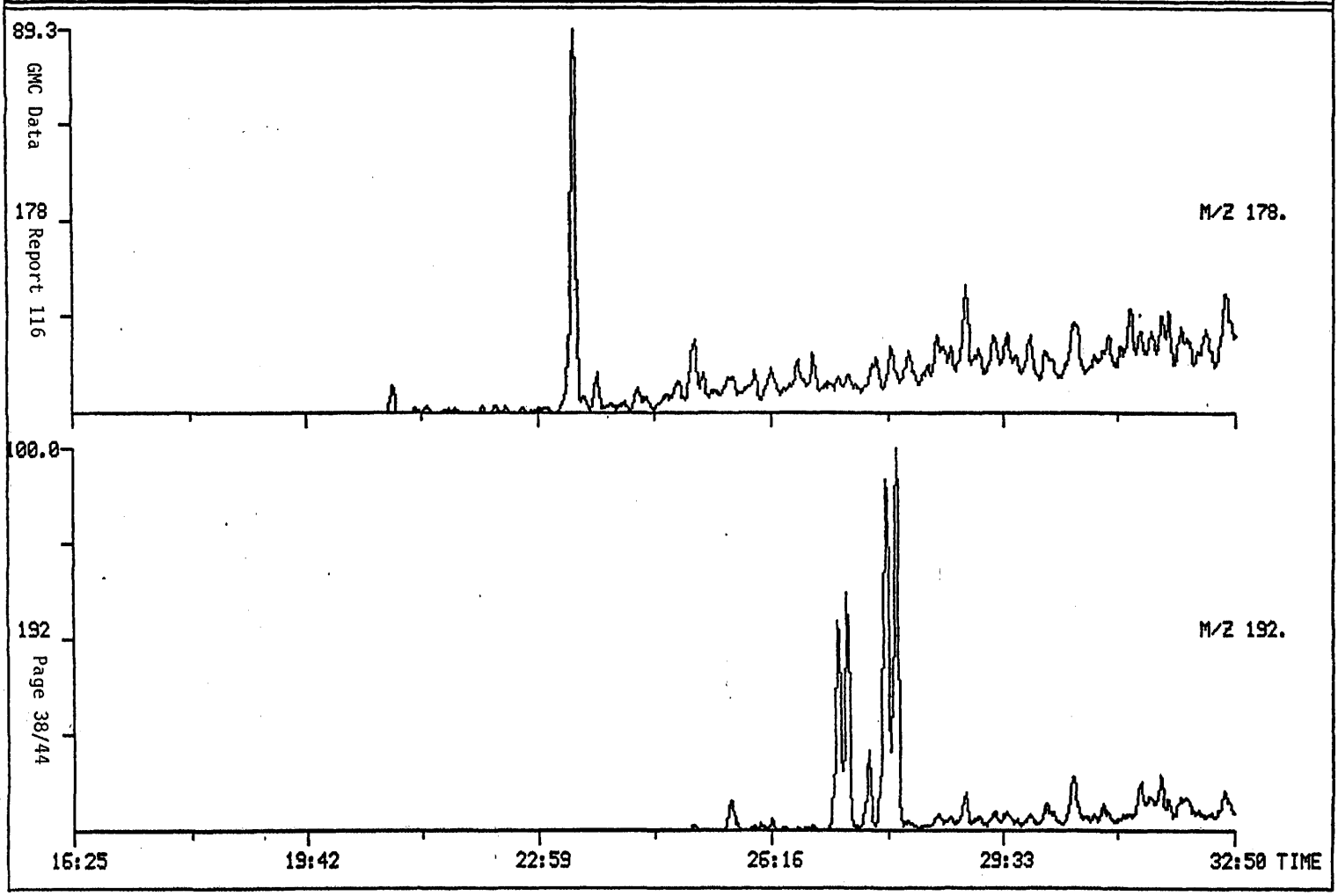

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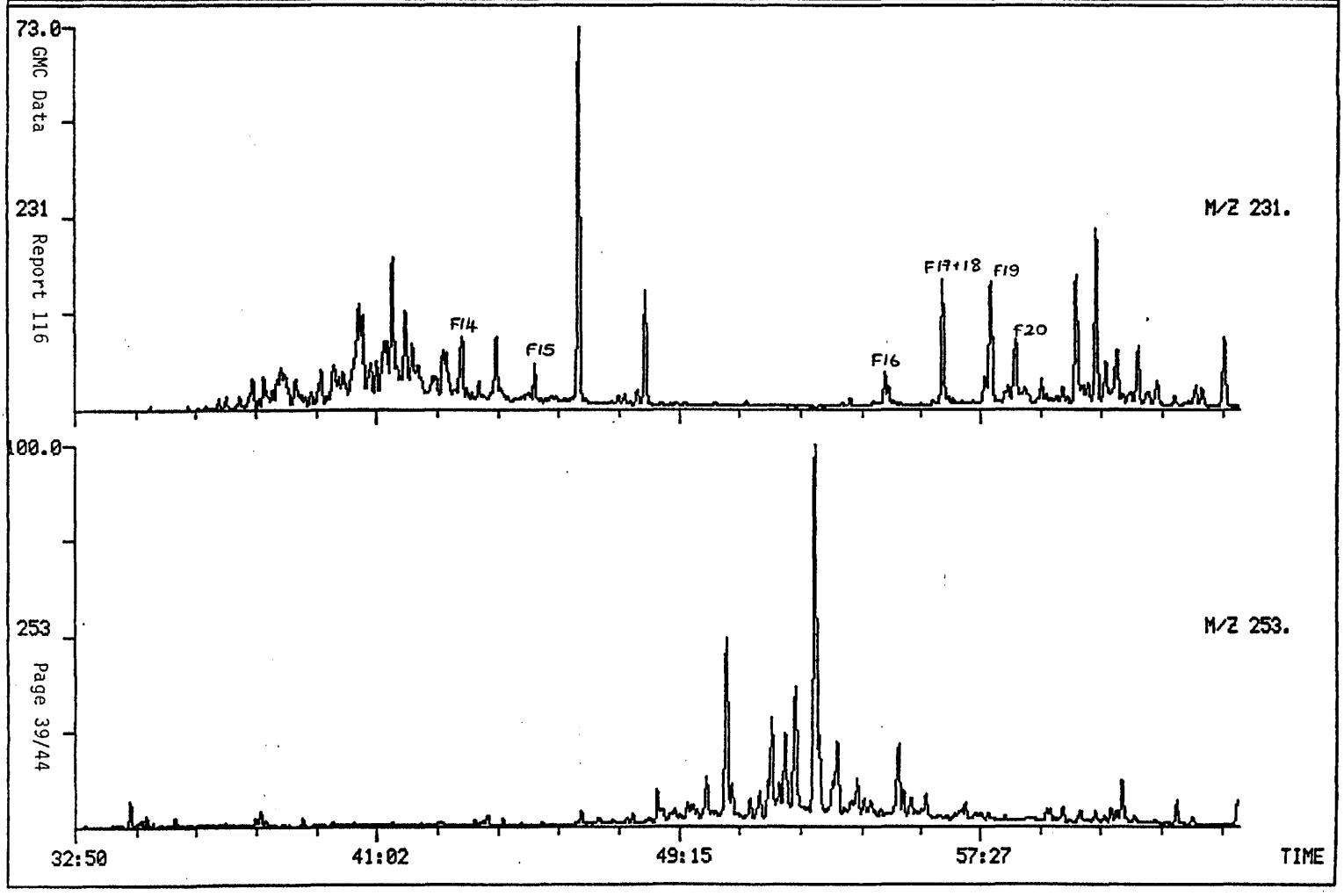

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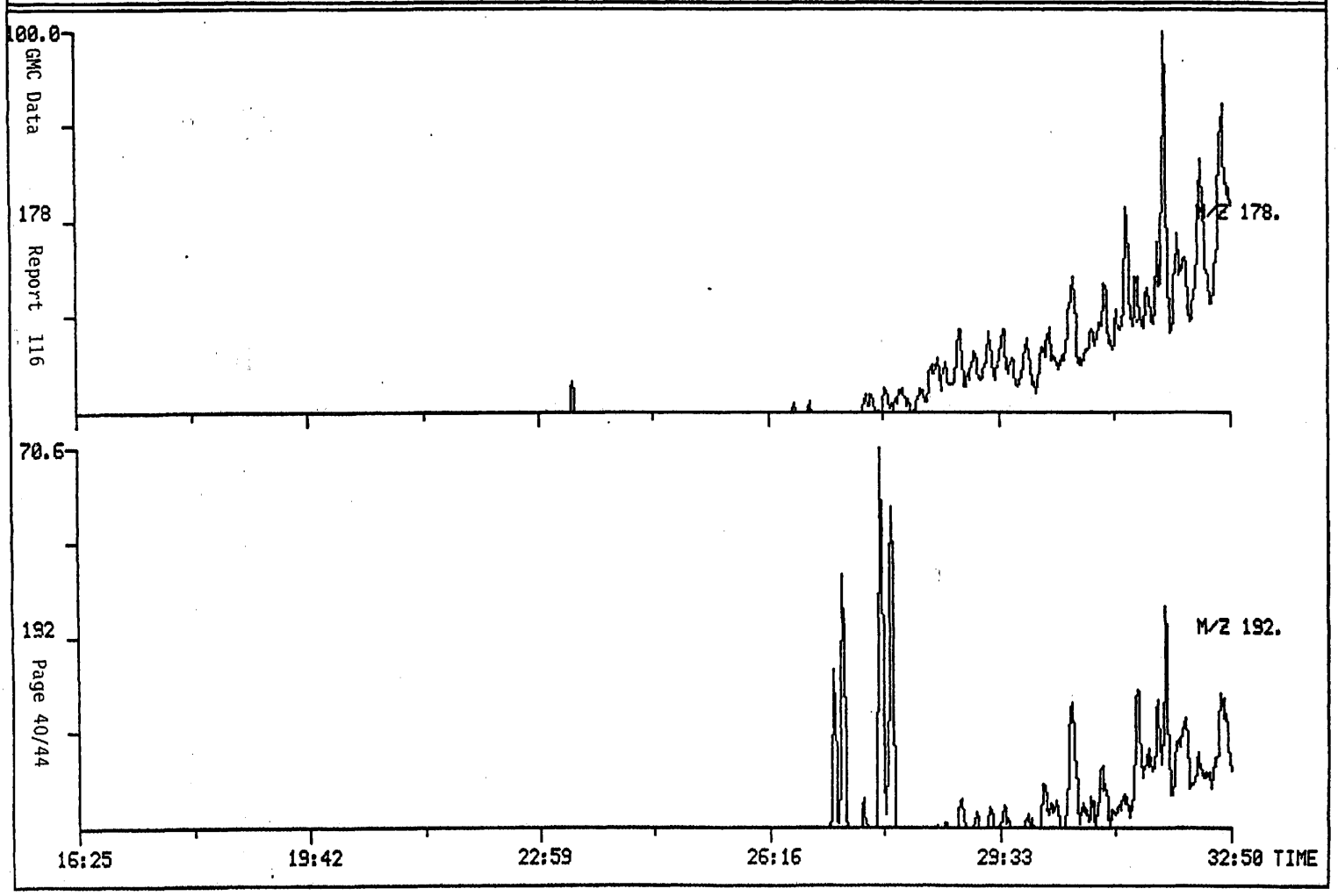

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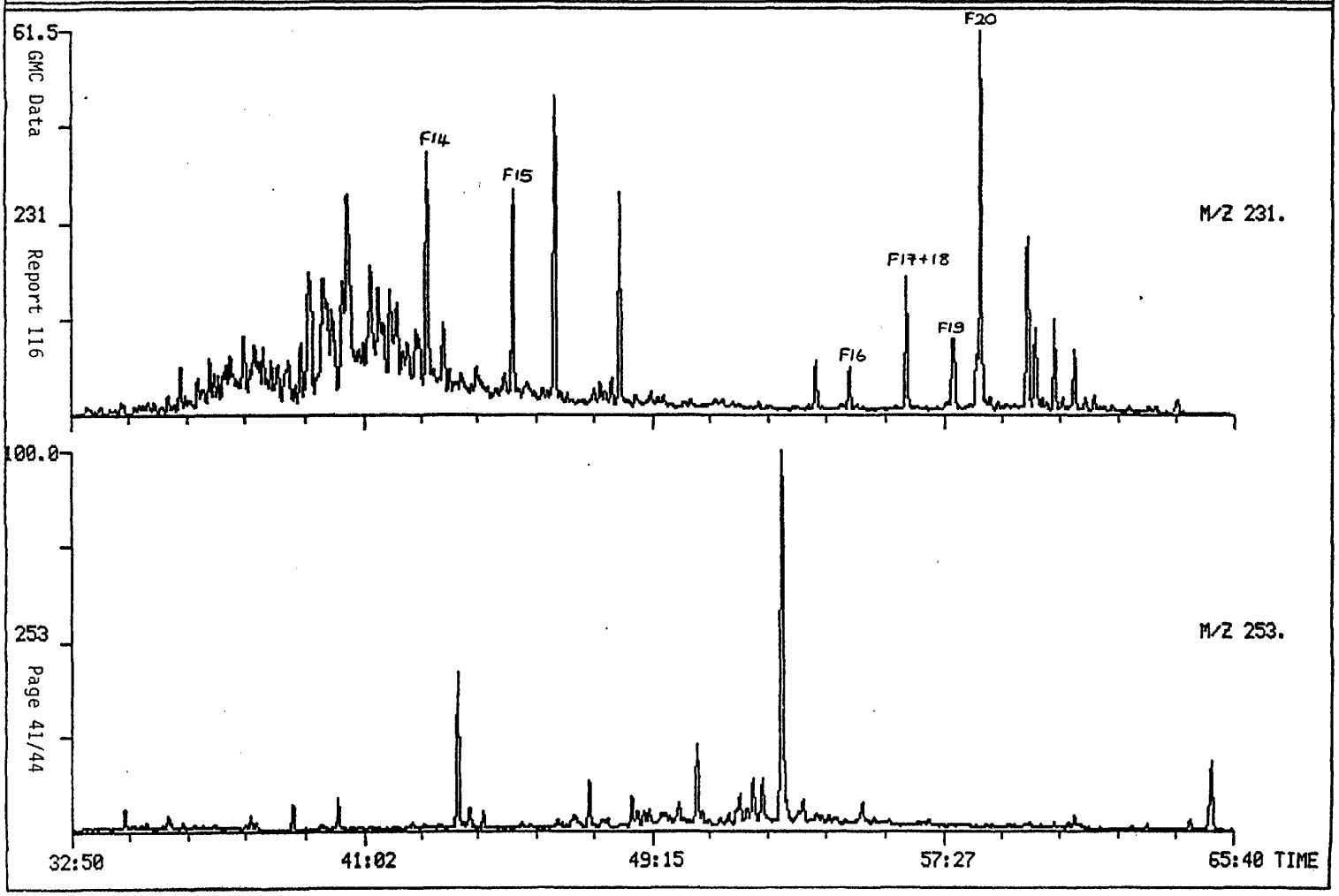

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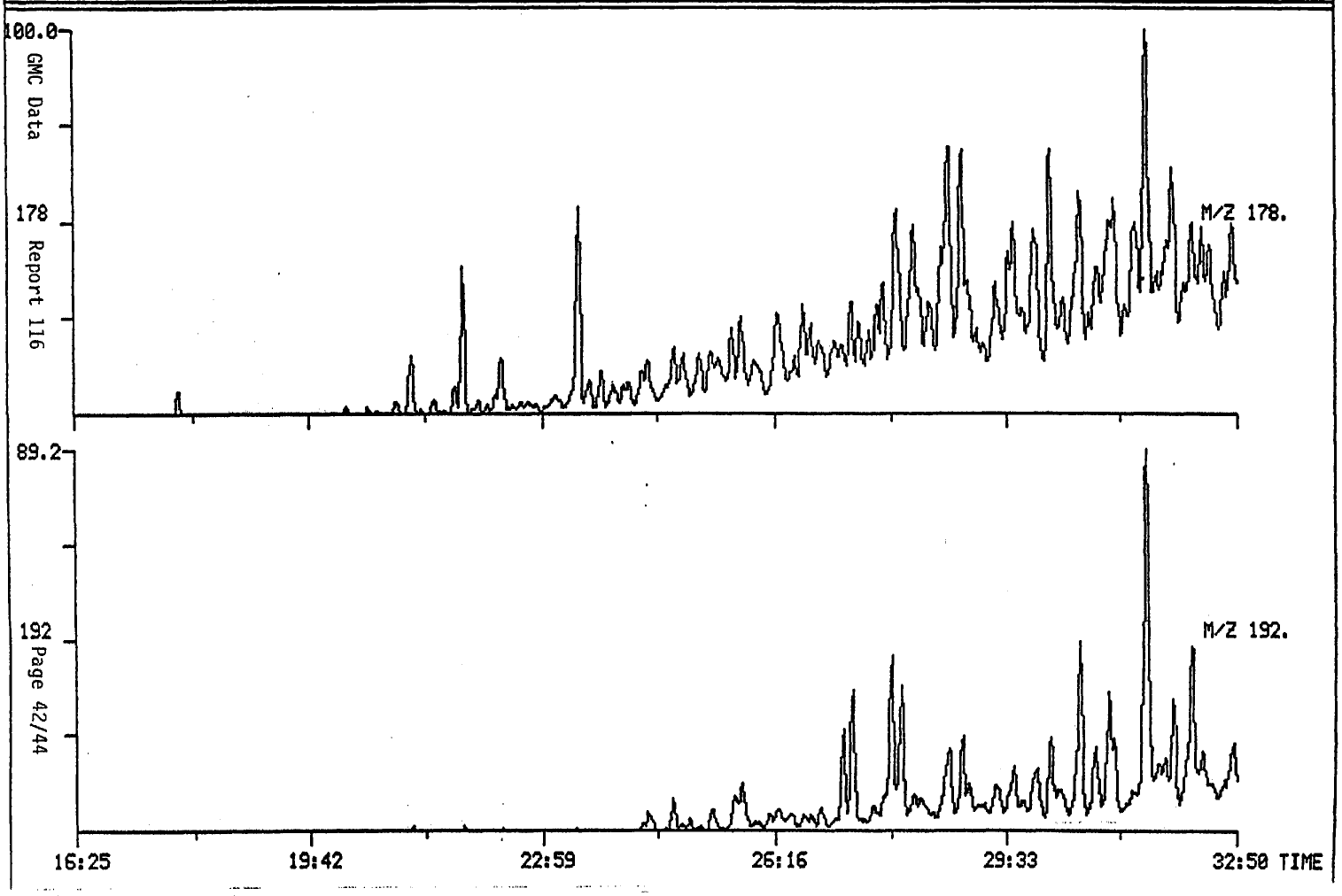

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BP GEOCHEMISTRY BRANCH GC/MS ANALYSIS

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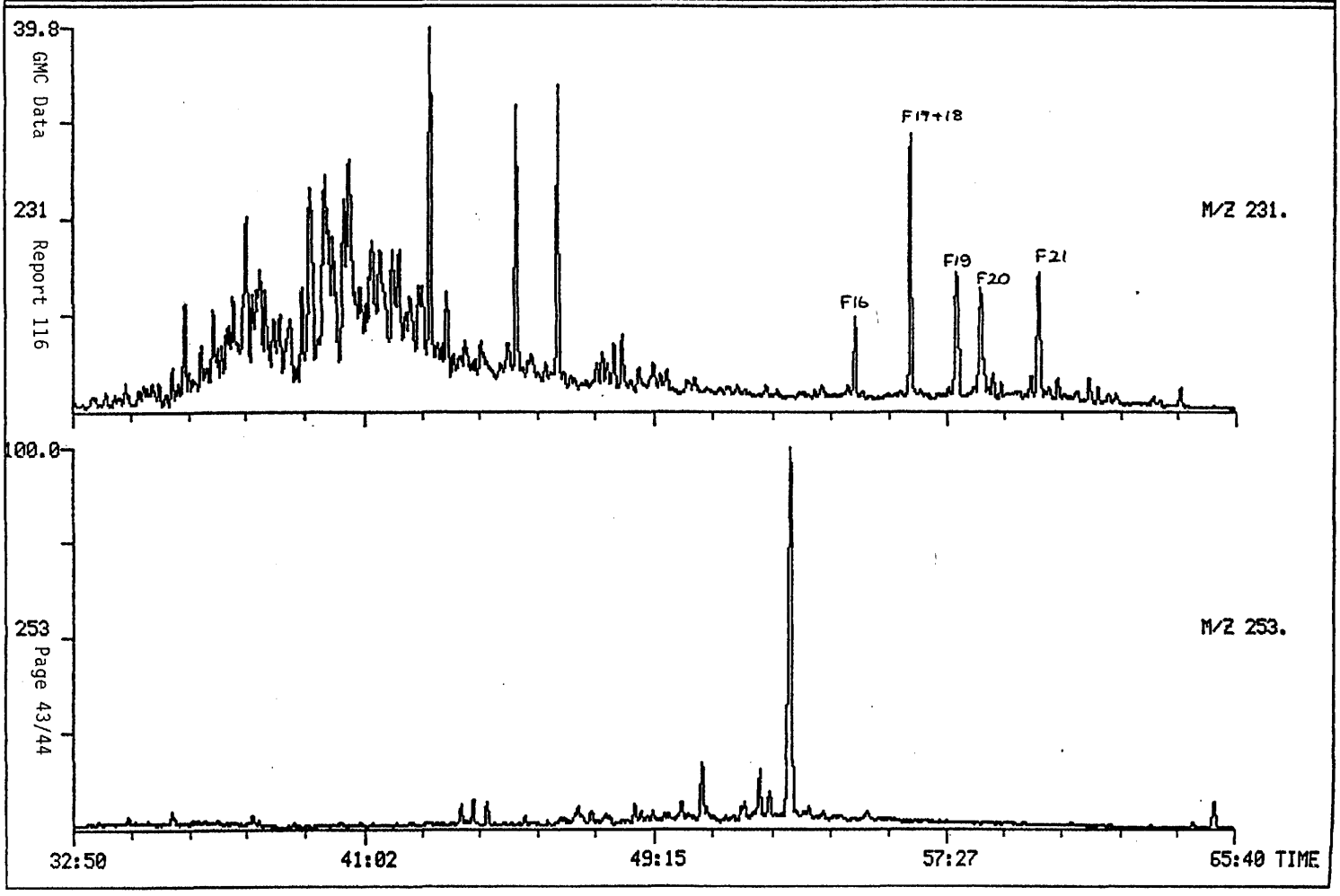

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BP GEOCHEMISTRY BRANCH GC/MS ANALYSIS

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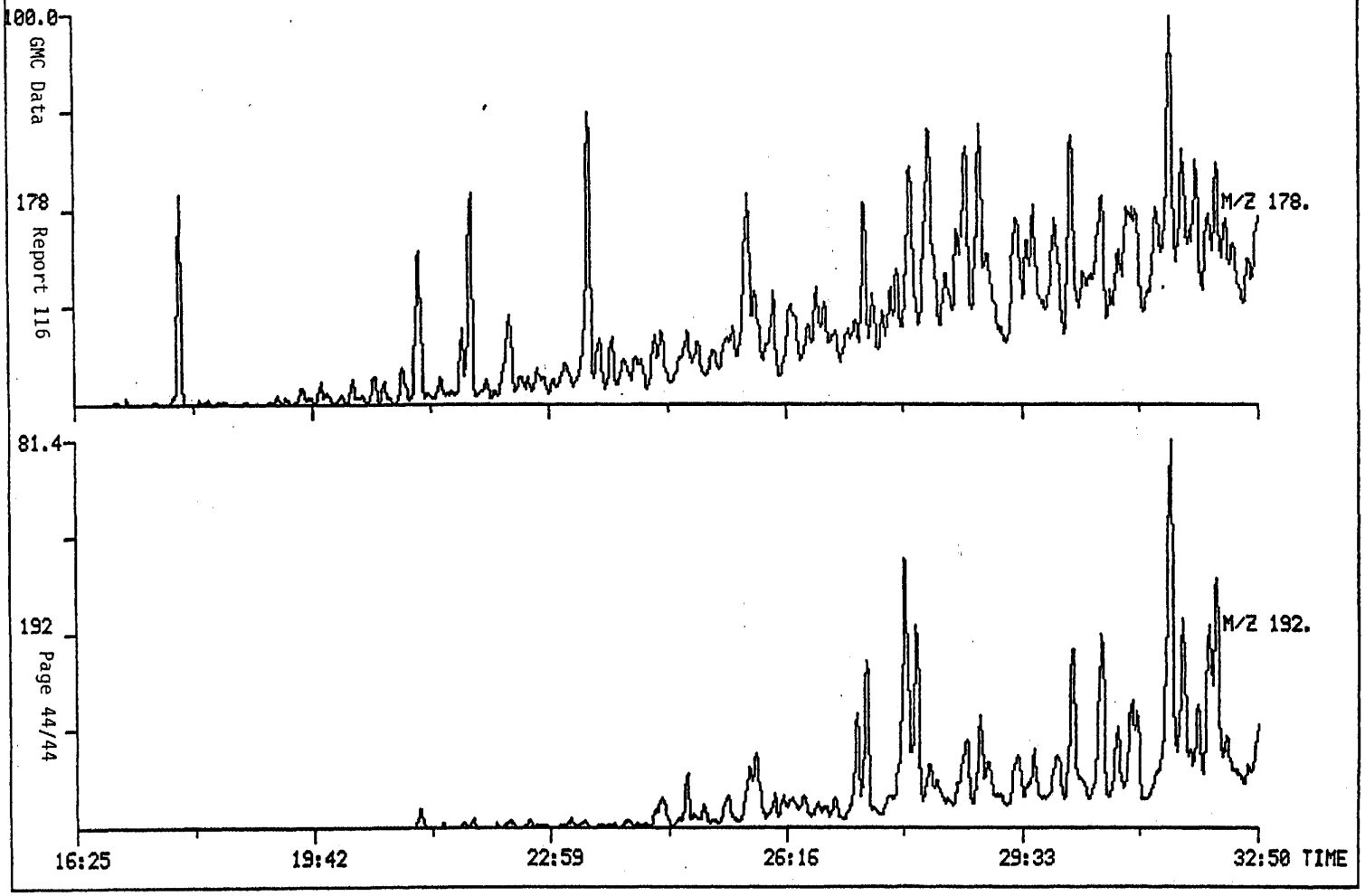

Geochemical data of cuttings and sidewall cores from the Union Oil Company OCS Y-0849-1 (Hammerhead No. 1) well

Supplement A to the Geologic Materials Center Data Report No. 116

This material is from the U. S. Minerals Management Service

Total of 4 pages in report (A-1 through A-4)

Unocal Oil & Gas Division
Unocal Corporation
P.O. Box 190247
Anchorage, Alaska 99519-0247
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Craig K. White
District Exploration Geologist - North
Alaska District

December 3, 1985

Mr. Brian F. Schoof
United States Department of Interior
Minerals Management Service
Alaska OCS Region
P.O. Box 101159
Anchorage, AK 99510

Dear Mr. Schoof:

Attached are the final results of geochemical work on samples from Union, OCS Y-0849#1. Table 1 includes data from cuttings samples. Table 2 includes sidewall core data. The contents of these two tables are described as follows:

Depth	Measured depth, in feet
TOC	Total organic carbon, in percent
S1	S1 Rockeval yields in mg/g
S2	S2 Rockeval yields in mg/g
S3	S3 Rockeval yields in mg/g
Tmax	Temperature at S2 maximum, in degrees C
VR	Vitrinite reflectance, measured on whole rock (%)

These comprise all the geochemical logging data Union has concerning the rock samples from this well. We would be willing to answer questions concerning these data at anytime.

Sincerely,

Craig K. White

CKW:rms
(2013e)

Attachment

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TABLE 1
OCS-Y-849-1 WELL, CUTTINGS SAMPLES

DEPTH	TOC	S1	S2	S3	TMAX	VR
360	1.67	.	.	.	.	.
420	1.41	.	.	.	.	.
480	0.68	.	.	.	.	.
540	2.35	0.17	1.51	4.83	437	.
720	0.57	.	.	.	.	0.33
870	0.82	.	.	.	.	.
930	0.11	.	.	.	.	.
990	0.39	.	.	.	.	0.34
2010	0.34	.	.	.	.	.
2070	0.54	.	.	.	.	.
2130	0.50	.	.	.	.	.
2190	0.60	.	.	.	.	0.45
2250	0.57	.	.	.	.	.
2310	0.71	.	.	.	.	.
2370	0.57	.	.	.	.	0.37
2460	0.45	.	.	.	.	.
2520	0.78	.	.	.	.	.
2580	0.70	.	.	.	.	.
2640	0.85	.	.	.	.	0.37
2700	0.53	.	.	.	.	.
2760	0.69	.	.	.	.	0.40
3060	15.82	1.00	19.15	11.04	428	.
3180	0.61	.	.	.	.	.
3240	29.53	2.37	25.41	19.37	376	0.44
3300	10.09	0.71	8.43	3.59	415	.
3360	6.93	0.34	5.10	5.15	423	.
3420	5.49	0.29	4.71	4.78	424	.
3480	1.44	.	.	.	.	0.36
3600	0.97	.	.	.	.	0.42
3720	0.86	.	.	.	.	0.34
3840	1.76	.	.	.	.	.
3900	1.47	.	.	.	.	0.35
3960	0.60	.	.	.	.	.
4020	20.27	1.02	19.14	11.02	412	.
4080	25.62	1.69	32.53	13.96	437	0.30
4140	5.30	0.27	3.78	4.49	411	.
4200	12.94	0.76	12.62	8.00	391	.
4201	3.41	0.11	1.75	3.30	415	.
4202	4.37	0.20	2.24	5.22	412	0.36
4320	3.95	0.19	2.60	5.20	424	.
4350	1.45	.	.	.	.	0.33
4500	0.67	.	.	.	.	.
4560	1.39	.	.	.	.	.
4620	2.09	0.24	1.36	2.86	426	0.34
4680	0.88	.	.	.	.	0.37
4890	1.90	.	.	.	.	.
5010	5.23	0.33	5.04	3.06	424	.
5070	1.55	.	.	.	.	.
5130	7.37	0.19	5.18	4.11	420	.
5190	3.17	0.11	1.97	2.64	426	.
5250	4.98	0.29	2.87	5.39	421	.
5310	2.48	0.12	1.61	1.54	425	0.39
5370	4.20	0.35	2.71	2.93	423	.
5430	8.83	1.11	9.45	5.50	399	.
5490	8.93	1.27	9.42	5.45	422	.

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TABLE 1
OCS-Y-849-1 WELL, CUTTINGS SAMPLES

DEPTH	TOC	S1	S2	S3	TMAX	VR
5520	3.17	1.16	6.94	5.70	425	0.36
5610	6.59	0.59	4.80	5.26	424	-
5670	3.07	0.23	2.16	2.58	429	-
5940	1.93	-	-	-	-	-
6000	1.28	-	-	-	-	-
6060	0.91	-	-	-	-	0.38
6210	0.64	-	-	-	-	-
6270	0.78	-	-	-	-	-
6330	1.03	-	-	-	-	0.35
6390	1.07	-	-	-	-	0.37
6600	1.38	-	-	-	-	0.39
6780	1.14	-	-	-	-	-
6870	1.23	-	-	-	-	-
7230	1.20	-	-	-	-	-
7380	0.97	-	-	-	-	-
7470	0.77	-	-	-	-	-
7680	1.14	-	-	-	-	-
7800	1.56	-	-	-	-	0.39

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TABLE 2
OCS-Y-849-1 WELL, SIDEWALL CORES

DEPTH	TOC	S1	S2	S3	TMAX	VR
3231	1.53	0.10	0.76	4.94	426	0.23
3334	0.95	0.05	0.45	8.97	430	0.35
3518	1.26	0.13	0.81	1.14	425	0.27
3666	1.79	0.11	1.27	8.16	427	0.25
3732	1.70	0.15	1.25	8.28	420	0.28
3780	1.64	0.11	1.11	6.42	428	0.34
3890	2.31	0.11	1.18	7.62	423	0.29
3902	1.65	0.09	0.87	5.70	424	0.25
3978	1.36	0.05	0.69	4.46	426	0.25
4120	1.51	0.10	0.97	6.09	425	0.24
4243	1.14	0.02	0.37	5.55	425	0.39
4426	1.77	0.10	1.43	11.88	426	0.29
4445	2.79	0.13	2.07	8.34	427	0.29
4495	1.52	0.05	0.63	5.97	424	0.31
4576	1.85	0.08	0.89	5.36	425	0.30
4620	2.24	0.10	1.50	10.95	425	0.31
4688	1.46	0.03	0.40	11.63	426	0.33
4764	1.58	0.07	0.80	6.72	425	0.30
4844	1.24	0.06	0.60	1.58	428	0.32
4910	1.05	0.07	0.89	7.05	427	0.36
4970	1.10	0.06	0.43	4.29	428	0.25
5004	1.55	0.08	1.10	5.47	427	0.26
5063	1.34	0.07	0.96	5.61	427	0.30
5100	2.03	0.08	1.33	3.83	426	0.24
5290	0.91	0.04	0.42	2.97	432	0.37
5335	0.89	0.09	0.56	4.68	426	0.38
5401	1.64	0.13	1.14	11.41	428	0.39
5662	1.25	0.04	0.71	6.67	425	0.38
5765	0.94	0.03	0.35	1.21	426	0.33
5903	3.88	0.24	3.06	5.54	424	0.37
6072	1.28	0.04	0.57	5.11	432	0.33
6074	1.69	0.14	0.96	8.27	425	0.41
6212	10.06	0.24	4.88	10.39	419	0.35
6380	1.28	0.04	0.68	4.08	429	0.38
6500	0.74	0.03	0.15	1.03	421	0.40
6600	2.68	0.07	1.53	5.11	427	0.37
6700	2.02	0.04	0.49	1.42	422	0.37
6900	0.96	0.07	0.57	3.39	428	0.36
7000	1.34	0.25	1.40	2.56	427	0.38
7200	1.09	0.13	1.23	5.44	427	0.42
7300	1.08	0.07	0.92	5.95	426	0.40
7450	1.06	0.03	0.69	6.86	430	0.43
7650	0.96	0.03	0.77	2.72	430	0.40
7750	1.04	0.07	0.83	4.91	426	0.44

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