1

PPL2
IONA-2

WELL COMPLETION REPORT

September
1994

GFE

GFE Resources Ltd

WELL COMPLETION REPORT

PPL2

OTWAY BASIN VICTORIA

IONA-2

K. LANIGAN / V. AKBARI / D. GRANT

SEPTEMBER, 1994

TEXT AND APPENDICES

VOLUME 1

KL/aj:iona-2wcrcover

Level 6, 6 Riverside Quay, South Melbourne Victoria 3205 Telephone: (03) 684 4888 Facsimile: (03) 684 4897

Address all mail to Box 629, Market Street Post Office, Melbourne Victoria 8007 A.C.N. 005 469 581

GFE RESOURCES LTD

PPL2

OTWAY BASIN VICTORIA

IONA-2

WELL COMPLETION REPORT

K. LANIGAN / V. AKBARI / D. GRANT

SEPTEMBER, 1994

KL/aj:iona-2/wcr

CONTENTS

VOLUME 1

TABLES *Page*

FIGURES

APPENDICES

VOLUME 2

ENCLOSURES

SUMMARY

SUMMARY

WELL DATA SUMMARY

IONA-2

Permit: PPL2 Otway Basin, Victoria
Lat./Long.: Surface 38° 34' 30.989"S 143° 02' 01.585"E
TD 38° 34' 36.135"S 143° 02' 05.982"E
AMG: Surface 677165.0mE 5728378mN
TD 677267.9mE 5728217mN
Seismic: Line Iona 93-01 VP 248.2
Elevation: Ground Level 128.5m AHD
Kelly Bushing (well datum) 134.2m AHD

Total Depth: Drilled 1650.0mKB (driller) 1650.0mKB (logger)
True Vertical TD 1626.4mKB (-1492.2mSS)

Pre-drill Status: Development well
Post-drill Status: Gas Producer

Participants: GFE Resources Ltd 100% (Operator)

Rig: Century Rig 11

Spud Date: 1200 hrs 14/2/94
TD Reached: 1915 hrs 24/2/94
Rig Released: 1000 hrs 06/3/94

Engineering

Hole Size	Casing	Plugs
12¼ " to 640m	16" Conductor to 16m (pre-spud)	1. 1650-1471m
8½ " to 1650m	$9^5/_8$" 36lb/ft BTC K55 R3 to 636m	(not tested)
	7" 26lb/ft L80 NEWVAM-RS to 1448.24m	

Stratigraphy

Group	Formation/Unit	Depth Drilled (mKB)	Depth TVD (mKB)	Depth TVD (mSS)	Thickness (m) Drilled	Thickness (m) True Vertical	High/Low to Prognosis
Heytesbury	Port Campbell Limestone	5.7	5.7	128.5	-	-	-
	Gellibrand Marl	not differentiated		-	-	-	-
Nirranda	Narrawaturk Marl	not differentiated		-	-	-	-
	Mepunga Formation	284.5	284.5	-150.3	52.2	52.2	3.8m Low
Wangerrip	Dilwyn Formation	336.7	336.7	-202.5	211.1	206.4	1.0 m Low
	Pember Mudstone	547.8	543.1	-408.9	71.8	67.9	1.4 m Low
	Pebble Point Formation	619.6	611.0	-476.8	52.4	49.8	0.3 m Low
Sherbrook	Paaratte Formation	672.0	660.8	-526.6	360.7	349.1	1.1 m Low
	Skull Creek Mudstone	1032.7	1009.9	-875.7	130.3	129.7	5.2 m Low
	Nullawarre Greensand	1163.0	1139.6	-1005.4	95.0	94.9	3.1 m Low
	Belfast Mudstone	1258.0	1234.5	-1100.3	39.0	38.9	2.2 m High
	Waarre Formation Unit D	1297.0	1273.4	-1139.2	19.5	19.5	1.3 m High
	Unit C	1316.5	1292.9	-1158.7	31.5	31.5	6.8 m High
	Unit B	1348.0	1324.4	-1190.2	24.0	24.0	-
	Unit A	1372.0	1348.4	-1214.2	29.5	29.5	-
Otway	Eumeralla Formation	1401.5	1377.9	-1243.7	248.5	248.5	2.8 m High
	TD	1650.0	1626.4	-1492.2			

Key Hydrocarbon Indications

Nullawarre Greensand: 3 - 32.4 units Total Gas
Waarre Formation Unit D: 6 - 8 units, with 32 unit peak at 1305 m
Waarre Formation Unit C: 21.5 - 255 units, mostly above 100 units
Waarre Formation Unit B: 9 - 13.5 units, with broad 35 unit peak 1356 - 1362 m
Waarre Formation Unit A: 159 units at top, dropping quickly towards base
Eumeralla Formation: 1405 - 1435 m, 9.5 - 390 units, with trace -2% moderately bright yellow-orange pinpoint-patchy fluorescence.
1435 - TD, 4 - 46 units with peak 60 - 175 units at 1468 - 1470 m

Logging

Logging	
DLL-MSFL-GR-SP-Cal	1645.5 - 5.5
LDL-CNL-GR-Cal	1649 - 1000
AS/BHC-GR-Cal	1645.5 - 625
WSS (Checkshots)	20 levels
RFT-GR	26 pressure points, 1 fluid sample
CST-GR	Shot 30, Recovered 29

Coring

No cores were cut

Completion Logging

Completion Logging	
CBL-VDL-CCL-GR	1435 - 850
Perforating & Packer Setting Record	1340.5 - 1334.5

Formation Tests

No formation tests were conducted

Log Analysis (Pay Zones)

Interval	Thickness (m)	Net Sand (m)	Net Pay (m)	Av. Eff. ∅ (%)	S_w (%)	V_{cl} (%)
1316.43 - 1347.98	31.55	27.9	27.58	23.81	16.71	5.29
1347.98 - 1371.91	23.93	5.60	5.03	23.08	17.94	8.81

KL/aj:IONA2-WCR:welldata

INTRODUCTION

1. INTRODUCTION

The Iona structure was initially delineated by Beach Petroleum NL from the 1981 Curdie Seismic Survey and the 1986 Sherbrook Seismic Survey. Discovery of the gas accumulation within it occurred with the drilling of Iona-1 in March, 1988 in what was then part of PEP108. Beach Petroleum NL were the permit operators and Iona-1 was the final farmin commitment for Bridge Oil Limited to earn a 50% equity. The well encountered a 26-metre gross gas column within sandstone in the top half of the Late Cretaceous Waarre Formation which flowed at 8.1 MMCFD prior to being cased and suspended.

An area containing the Iona field was then acquired by the Gas and Fuel Corporation of Victoria (GFCV) in July, 1989 and this excised acreage became Petroleum Production Licence Two (PPL2) in December, 1990.

Iona-1 was brought on-stream in December, 1992 via a pipeline to the North Paaratte production facility in the adjacent PPL1, and since then has produced around 1.2 BCF per year to supply markets in Warrnambool and other local towns.

Ownership of PPL2 was transferred to GFE Resources Ltd on 1 July, 1993.

Further development of the Iona field was considered beneficial for a variety of reasons, mainly;

- to maintain security of supply to the existing gas market;
- to provide deliverability of the gas for the projected peak level;
- to ensure efficient reservoir management and optimum field drainage; and
- to investigate the hydrocarbon potential and reservoir characteristics of the Eumeralla Formation in this area.

Additional seismic was acquired in 1993 (the Iona Seismic Survey) and from the subsequent mapping a location for the Iona-2 development well was selected to penetrate the apex of the structure at the Top Waarre Formation level.

WELL HISTORY

WELL HISTORY

2. WELL HISTORY

2.1 LOCATION (see Figures 1 and 2)

Surface Location:	Latitude:	38°	34'	30.989"S
	Longitude:	143°	02'	01.585"E
	AMG:	677165.0mE		
		5728378.0mN		
Bottom Hole Location:	Latitude:	38°	34'	36.135"S
	Longitude:	143°	02'	05.982"E
	AMG:	677267.9mE		
		5728217.0mN		
Seismic:	Line:	Iona 93-01		
	Vibe Point:	248.2		
Property Title:	County:	Heytesbury		
	Parish:	Paaratte		
	Section:	2		
	Allotment:	12A		
Property Owner:	J. & G.J. Bognar			
	S. Meek			

2.2. GENERAL DATA

Well Name: Iona-2

Permit: PPL2 Otway Basin, Victoria

Operator: GFE Resources Ltd
Level 6, 6 Riverside Quay
South Melbourne Victoria 3205

Participants: GFE Resources Ltd 100%

Elevation: Ground Level (GL): 128.5m AHD
Kelly Bushing (KB): 134.2m AHD *(datum)*

(All depths are Drilled/Measured Depths relative to KB unless otherwise stated)

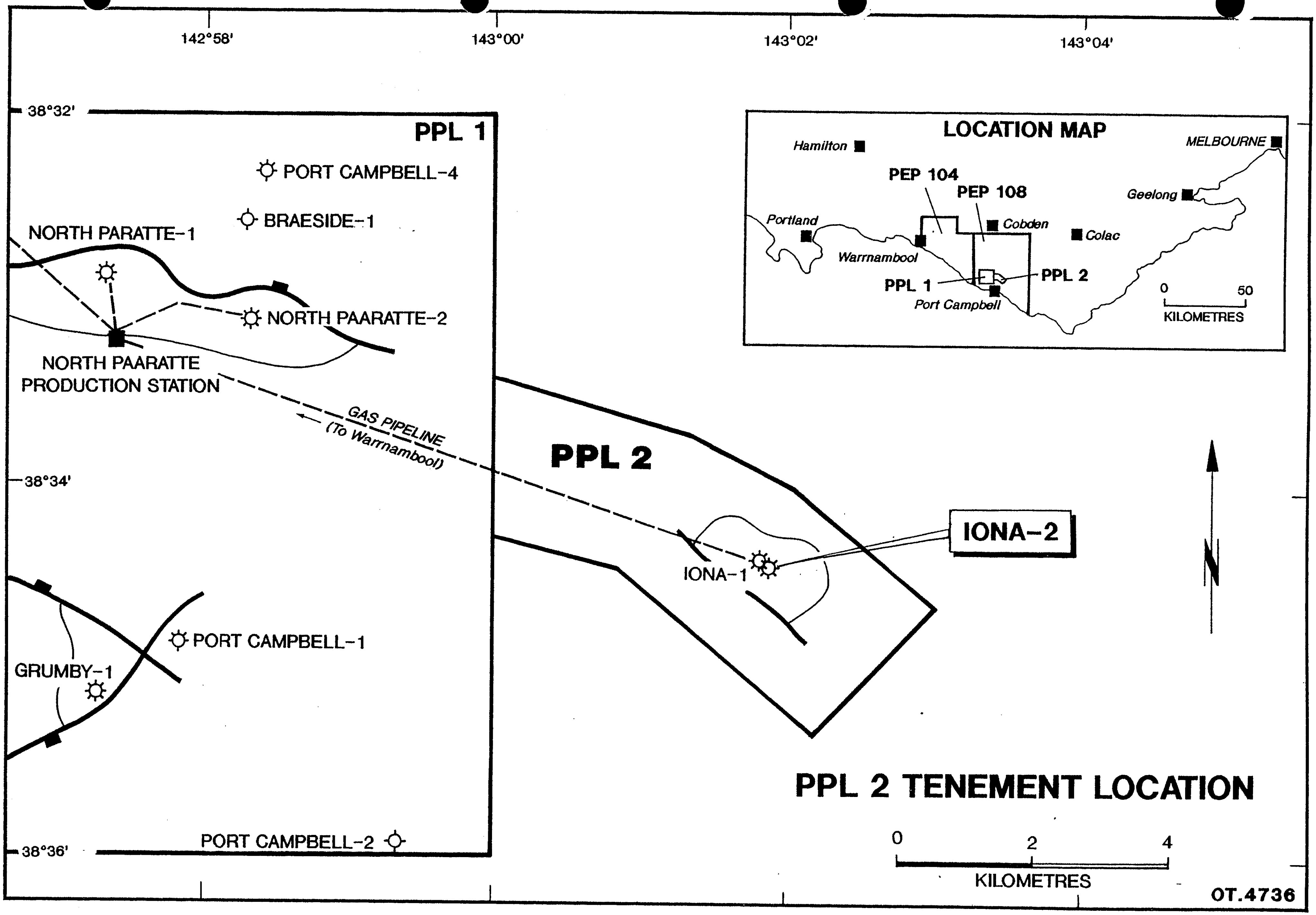
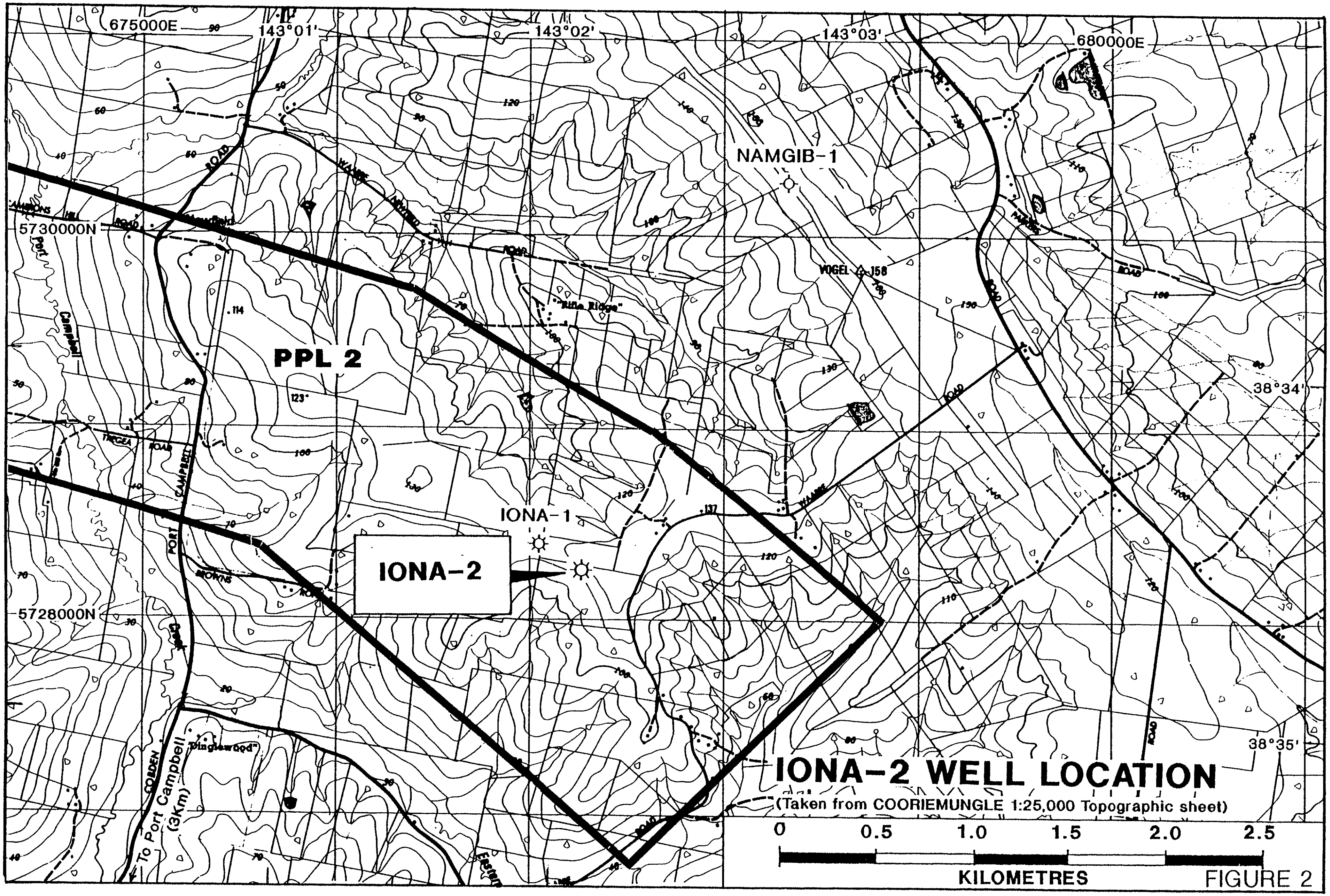

142°58'
143°00'
143°02'
143°04'
38°32'
38°34'
38°36'
PPL 1
PORT CAMPBELL-4
BRAESIDE-1
NORTH PARATTE-1
NORTH PAARATTE-2
NORTH PAARATTE
PRODUCTION STATION
GAS PIPELINE
(To Warrnambool)
PORT CAMPBELL-1
GRUMBY-1
PORT CAMPBELL-2
PPL 2
IONA-1
IONA-2
LOCATION MAP
Hamilton
MELBOURNE
PEP 104
PEP 108
Geelong
Portland
Cobden
Colac
Warrnambool
PPL 1
PPL 2
Port Campbell
0
50
KILOMETRES
PPL 2 TENEMENT LOCATION
0
2
4
KILOMETRES
OT.4736

FIGURE 1



675000E
143°01'
143°02'
143°03'
680000E
5730000N
5728000N
38°34'
38°35'
NAMGIB-1
VOGEL 158
"Rifle Ridge"
PPL 2
IONA-1
IONA-2
"Dinglewood"
To Port Campbell (3Km)
IONA-2 WELL LOCATION
(Taken from COORIEMUNGLE 1:25,000 Topographic sheet)
0
0.5
1.0
1.5
2.0
2.5
KILOMETRES

FIGURE 2

Total Depth (Measured/Drilled):	Driller:	1650.0mKB
	Logger:	1650.0mKB
Total Depth (True Vertical):	1626.4mKB (1492.2mSS)	
Drilling Commenced:	1200 hours, 14 February, 1994	
Total Depth Reached:	1915 hours, 24 February, 1994	
Rig Released:	1000 hours, 6 March, 1994	
Well Status:	Gas producer	

2.3. DRILLING DATA

2.3.1 Drilling Contractor

Century Drilling Limited

2.3.2 Drilling Rig

Century Rig 11 (see Appendix 1)

2.3.3 Casing and Cementing Details

A 16" Conductor pipe was cemented at 16m prior to rig up

Surface Casing

Size:	$9^{5}/_{8}$"
Weight & Grade:	36 lb/ft BTC K55 R3 (54 Joints)
Centralizers:	634m, 612m, 589m, 565m, 519m, 473m, 426m, 339m, 333m and 287m
Float Collar:	624.4m
Shoe:	636m (logger depth)
Cement:	644 sacks Class "A" cement mixed with 140bbls 2% prehydrated gel followed by 162 sacks Class "A" cement mixed with 20bbls water with 0.15% HR4
Method:	Single plug displacement (top plug only)
Equipment:	Halliburton Services

Production Casing

Size:	7"
Weight and Grade:	26lb/ft L80 NEWVAM-RS (120 Joints)
Centralizers:	1442m, 1399m, 1363m, 1345m, 1330m, 1315m, 1291m, 1255m, 1219m, 1184m, 1143m, 1112m, 1040m, 1004m, 960m, 933m, 897m and 861m
Float Collar:	1436.26m (driller depth)
Shoe:	1448.24m (driller depth)
Cement:	170 sacks Class "G" cement mixed with 100 bbls 4% prehydrated gel followed by 200 sacks Class "G" cement mixed with 40 bbls water with 3% Halad 322
Method:	Single plug displacement (top plug only)
Equipment:	Halliburton Services

Cement plugs

Plug No.1	Interval:	1650-1471m
	Cement:	60 sacks class "A" cement neat mixed with 3% HR4
	Method:	Balanced
	Tested:	No

2.3.4 Drilling Fluid

The drilling fluid program used was that designed and recommended by Baroid. Details of the mud system used and assessment of its performance is contained in the Drilling Fluid Recap (Appendix 2).

2.3.5 Drilling Bits

Four drilling bits were used during the drilling of Iona-2, and a record of their pertinent details is shown in Table 1.

2.3.6 Water Supply

Drilling water was obtained from an existing dam down hill from the lease and stored in a pit dug near the wellsite.

2.3.7 Drilling History

A summary of wellsite operations can be found in Appendix 3A, and a compilation of the operations summaries from daily reports issued during the drilling and completion of the well is provided in Appendix 3B.

2.4 FORMATION SAMPLING AND TESTING

2.4.1 Cuttings

No cutting samples were collected from surface to 150 metres. Cutting samples were then collected at ten-metre intervals from 150 to 640 metres ($9^5/_8$" casing depth) and at 2.5-metre intervals down to total depth. Each sample was washed and air dried and divided into four splits, three of which were stored in labelled plastic bags and the fourth in "Samplex" trays.

Additionally, one set of 500 gram unwashed samples were collected at ten-metre intervals from 640 metres to total depth and stored in labelled cloth bags. All samples were retained by the operator.

Lithological descriptions of cuttings by the wellsite geologist during the drilling of Iona-2 are compiled in Appendix 4A, along with a compilation of the lithological descriptions from daily reports issued during the drilling of the well in Appendix 4B.

2.4.2 Cores

2.4.2.1 Conventional Core

No conventional cores were cut in Iona-2.

TABLE 1

BIT RECORD

Contractor:	Century Drilling	**GFE Representative:**	Ken Smith	**Rig:**	# 11
State:	Victoria	**Permit:**	PPL2	**Well:**	Iona-2
Spud:	14/2/94	**Reached T.D.:**	24/2/94		

No.	Size	Make	Type	IADC Code	Serial	Depth Out (m)	Metres Drilled	Hours	Av. Rate (m/hr)	Accum Drlg Hours	Wt. on 000 lbs	RPM	Vert Dev. (°)	Pump Press. (psi)	Jets	GPM	Mud			Dull. Cond.			Remarks
																	WT	VIS	WL	T	B	G	
1RR	12¼"	Varel	L-114	1.1.4	26776	320	304	12½	24.3	12.5	5/20	120	0	550	1x18 2x20	450	8.9	41	N/C	1	3	1	POOH to kick off
2	12¼"	Sec	S33SF	1.1.6	629176	640	320	20	16	32.5	15/20	down hole motor	18.5	1400	3x16	508	9.3	47	11.8	2	1	1	12¼ T.D.
2RR	12¼"	Sec	S33SF	1.1.6	629176	640	(178)	5	36	-	0	40	18.5	1100	3x20	508	9.0	43	N/C	2	1	1	Reaming
3	8½"	Varel	ETD417	4.1.7	88736	781	141	5	28	37.5	5/8	130	20.0	1400	2x10 1x11	305	8.9	38	13.9	1	1	1	BHA Change
3RR	8½"	Varel	ETD417	4.1.7	88736	1052	271	13½	20	57.5	10/20	down hole motor	8.0	1425	2x12 1x10	305	8.9	42	11.3	1	1	1	BHA Change
3RR	8½"	Varel	ETD417	4.1.7	88736	1268	216	32	6.75	89.5	20	110	1.5	1225	2x12 1x10	305	9.4	44	6.8	1	1	1	Bit Change
							648*	**50½***	**12.8***														
	Not really a good enough run to properly evaluate potential. Slightly under gauge but would still be drilling full gauge hole.																						
4	8½"	Varel	ETD417	4.1.7	88735	1650	382	31½	12.1	12.1	25	90	¾	1225	3x12	305	9.4	40	6.4	1	1	1	T.D.
	Hole average penetration 13.6. A relatively short and easy run for this type of bit.																						

* *Totals for Bit No.3*

2.4.2.2 Sidewall Cores

A total of 30 sidewall cores were attempted (Enclosure 9), of which 29 were recovered.

All recovered sidewall core samples were checked for lithology and hydrocarbon shows and then stored in sealed plastic jars. Sidewall core jars 1 through 19 subsequently had their head-space checked for hydrocarbons (see Section 3.3.2). Descriptions of the sidewall cores are contained in Appendix 5 and a summary of subsequent analyses is given in Section 2.4.4.

2.4.3 Testing

2.4.3.1 Drill Stem Testing

No Drill Stem Tests were carried out on Iona-2.

2.4.3.2 Wireline Formation Testing

Repeat Formation Test (RFT) pressure readings were carried out at 26 points spanning the Nullawarre, Waarre and Eumeralla Formations (Enclosure 7).

A summary of the RFT results is presented in Table 2 and the pressure points in the Waarre Formation are plotted in Figure 3, along with similar data from Iona-1.

While the Iona-1 data indicates a gas column in Unit C with a Gas/Water Contact (GWC) at around -1195.0mSS, the Iona-2 data is less straightforward, indicating one gas column in Unit C and a separate gas column in Unit B. Pressure points from beneath the gas column in Unit B and from Unit A are thought to be from water wet zones, but some points appear to be affected by supercharging, so GWC's could not be confidently identified.

A sample was taken in the Waarre Formation at 1361.8m (below the inferred GWC) to obtain a water sample on which R_w and salinity measurements could be made for possible use in log analysis. The resulting analysis is shown in Table 3, but the sample is unlikely to be pristine and thus not truly representative of R_w.

TABLE 2

SUMMARY OF RFT RESULTS

Test No.	Depth (mKB)	Depth (mTVD)	Depth (mSS)	Pressure (psia)	Comment
1	1171.5	1147.5	1013.3	1501.1	Good Test
2	1175.0	1151.0	1016.8	1504.0	Good Test
3	1173.0	1149.0	1014.8	1501.1	Good Test
4	1318.0	1294.4	1160.2	1718.6	Good Test
5	1324.5	1300.9	1166.7	1719.0	Good Test
6	1329.5	1305.9	1171.7	1719.8	Good Test
7	1336.0	1312.4	1178.2	1720.5	Good Test
8	1340.0	1316.4	1182.2	1721.1	Dry Test
9	1346.0	1322.4	1188.2	1721.9	Good Test
10	1355.0	1331.4	1197.2	1738.0	Good Test
11	1358.0	1334.4	1200.2	1738.9	Good Test
12	1361.5	1337.9	1203.7	1747.5	Super charged
13	1361.8	1338.2	1204.0	1742.8	Good Test
14	1381.0	1357.4	1223.2	1776.9	Good Test
15	1386.5	1362.9	1228.7	1781.6	Good Test
16	1388.5	1364.9	1230.7	1784.4	Good Test
17	1395.0	1371.4	1237.2	1793.5	Good Test
18	1407.5	1383.9	1249.7	-	Dry Test
19	1412.5	1388.9	1254.7	-	Dry Test
20	1404.5	1380.9	1246.7	-	Dry Test
21	1418.0	1394.4	1260.2	-	Dry Test
22	1423.5	1399.9	1265.7	-	Dry Test
23	1468.5	1444.9	1310.7	-	Lost Seal
24	1414.5	1390.9	1256.7	-	Lost Seal
25	1414.5	1390.9	1255.8	-	Dry Test
26	1361.8	1338.2	1204.0	-	Sample
27	1347.5	1323.9	1189.7	1722.0	Good Test

GFE RESOURCES LTD
PPL2 - OTWAY BASIN

IONA RFT DATA

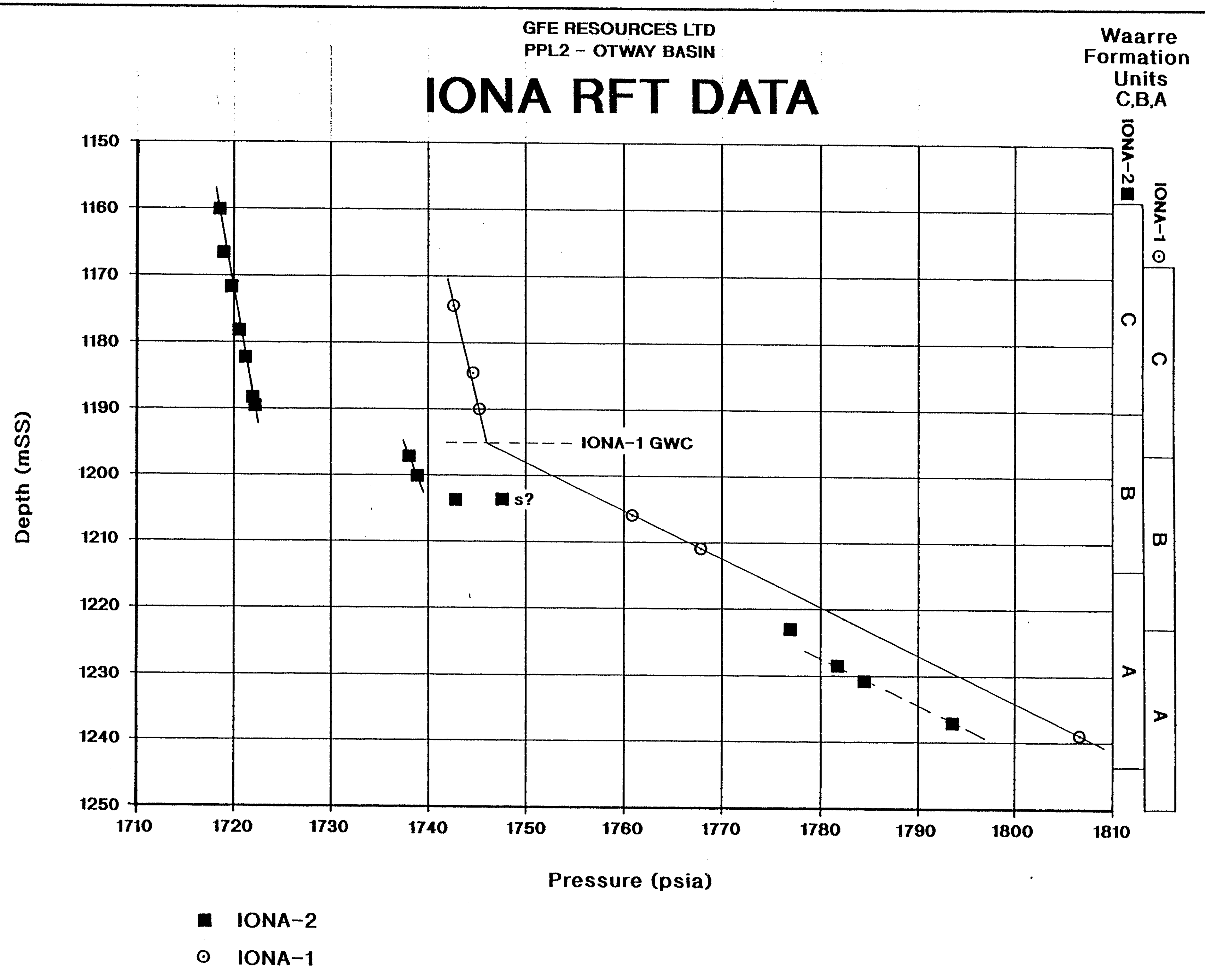


FIGURE 3

TABLE 3

WATER ANALYSIS OF RFT SAMPLE

Ph			**6.05**
Conductivity @ 25°C (μmho/cm)			**29400**
Resistivity (ohm.m)			**0.34**
Density @ 25°C (g/cm³)			**1.012**
Total Dissolved Solids (mg/l) (calculated)			**18815**
		(mg/l)	**(me/l)**
Sodium	Na	3180	138.26
Potassium	K	3350	85.90
Calcium	Ca	100	5.00
Magnesium	Mg	35.5	2.96
Soluble Iron	Fe(s)	5.0	-
Chloride	Cl	7300	205.63
Carbonate	CO_3	Nil	-
Bicarbonate	HCO_3	1205	19.75
Sulphate	SO_4	42	0.88
Nitrate	NO_3	4.9	0.08
Sum of Ions		**15217**	

2.4.4 Sample Analysis

Analysis of selected cuttings and sidewall core samples from Iona-2 comprised organic geochemistry, palynology and petrography. Table 4 lists the analyses performed on each sample, details of which can be found in the appropriate Section/Appendix.

Palynology	see Section 3.6	and Appendix 6
Petrography	see Section 3.2.4.1	and Appendix 7
Geochemistry	see Section 3.4	and Appendix 8

2.5 LOGGING AND SURVEYS

2.5.1 Mud Logging

A standard skid-mounted unit equipped for continuous recording of depth, penetration rate, mud gas, pump rate and mud volume data, as well as intermittent mud and cuttings gas (blender) analysis was operative from 150m hole depth until the well was completed. The Formation Evaluation Log ("Mud Log") comprises Enclosure 2a, and a Gas Ratio Analysis Log comprises Enclosure 2b.

2.5.2 Wireline Logging

Wireline logging was performed by the Schlumberger Seaco using a standard truck-mounted unit. The logging suite carried out at total depth consisted of the following logs:-

Log	*Interval (mKB)*	*Enclosure Number*
Dual Laterolog - Micro-Spherically Focussed Log - Gamma Ray - Spontaneous Potential - Caliper (DLL-MSFL-GR-SP-Cal)	1645.5 - 5.5	3
Lithodensity Log - Compensated Neutron Log - Gamma Ray - Caliper (LDL-CNL-GR-Cal)	1649 - 1000	4
Sonic - Gamma Ray - Caliper (AS-GR-Cal) *	1645.5 - 625 1645.5 -1000	5

TABLE 4

SIDEWALL CORES AND CUTTINGS ANALYSES

Sample	Depth (mKB)	SWC Recovery (cm)	Palynology	Geochemistry	Petrography
SWC#30	1034.5	5.0	✓		
SWC#29	1090.5	4.0	✓		
SWC#28	1129.0	4.0	✓		
SWC#27	1161.0	4.0	✓		
SWC#26	1260.0	3.0	✓		
SWC#25	1281.0	3.5	✓		
SWC#24	1290.0	4.0	✓		
SWC#23	1303.5	5.0	✓		
SWC#22	1315.0	2.0	✓		
SWC#21	1353.0	3.0	✓		
SWC#20	1358.0	2.0		✓	
SWC#19	1362.0	2.5		✓	
SWC#18	1371.0	3.0	✓		
SWC#17	1374.0	3.0			
SWC#16	1381.0	4.5		✓	
SWC#15	1386.0	4.5			
SWC#14	1392.0	3.5		✓	
SWC#13	1402.0	2.5	✓		
SWC#12	1408.5	3.5		✓	✓
SWC#11	1412.0	5.0	✓		✓
SWC#10	1418.0	3.5			✓
SWC#9	1426.0	3.5		✓	✓
SWC#8	1437.5	2.5	✓		
SWC#7	1457.5	5.0	✓		
SWC#6	1469.0	3.5		✓	✓
SWC#5	1516.5	6.5	✓		✓
SWC#4	1537.0	no recovery	-	-	-
SWC#3	1550.5	3.0		✓	✓
SWC#2	1590.0	1.5	✓		
SWC#1	1599.0	1.5	✓		
Cuttings	1365 - 1370			✓	
Cuttings	1385 - 1390			✓	
Cuttings	1410 - 1415			✓	
Cuttings	1347 - 1350		✓		
Cuttings	1332 - 1335		✓		
Cuttings	1312 - 1315		✓		
Cuttings	1292 - 1295		✓		

(BHC-GR)	1000 - 625	
Well Seismic Survey (WSS Checkshot)	1570 - 530	8
Repeat Formation Tester - Gamma Ray (RFT-GR)	1650 - 1171.5	7
Cement Bond Log - Variable Density Log - Casing Collar Locator - Gamma Ray (CBL-VDL-CCL-GR)	1435 - 850	6
Perforation and Packer Setting Record	1340.5 - 1334.5	10
Sidewall Core Sampler (CST-GR)	1599 - 1034.5	9

* *An array sonic was requested but, due to operator error, the full waveform was not recorded, and this was not noticed until after the hole was cased. Schlumberger subseqently ran the array sonic through casing in an attempt to obtain some meaningful data, but this was not successful.*

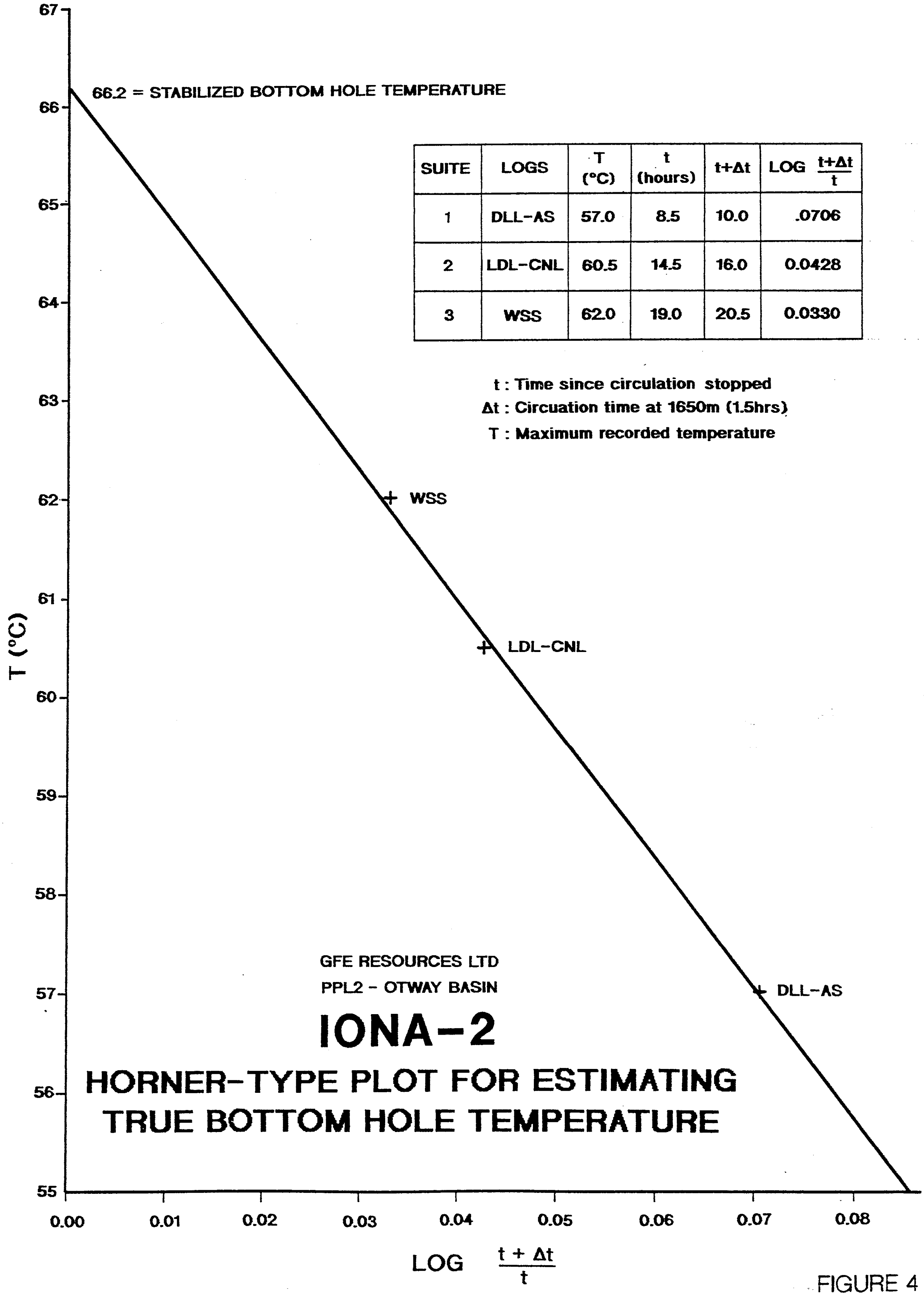
2.5.3 Bottom Hole Temperature

Maximum temperatures recorded during wireline logging were as follows:

Log	(mKB) Depth	(mTVD)	Temperature (°C)
DLL-MSFL-AS-GR	1645.5	1624.9	57.0
LDL-CNL-GR	1649.0	1625.4	60.5
WSS	1649.5	1625.9	62.0
RFT	1468.5	-	56.1

The first three of these were plotted on a modified Horner plot and, using a straight line best-fit extrapolated back to the Temperature axis, a stabilised bottom hole temperature of 66.2°C was obtained (Figure 4). The RFT maximum recorded temperature was not used because the depth it was recorded at was well above T.D., and thus not valid for this purpose.

Assuming a mean surface temperature of 18°C, the stabilised bottom hole temperature of 66.2°C at 1625mTVD yields a temperature gradient of 3.0°C per 100 metres.



SUITE	LOGS	T (°C)	t (hours)	t+Δt	LOG $\frac{t+\Delta t}{t}$
1	DLL-AS	57.0	8.5	10.0	.0706
2	LDL-CNL	60.5	14.5	16.0	0.0428
3	WSS	62.0	19.0	20.5	0.0330

t : Time since circulation stopped

Δt : Circuation time at 1650m (1.5hrs)

T : Maximum recorded temperature

GFE RESOURCES LTD

PPL2 - OTWAY BASIN

IONA-2

HORNER-TYPE PLOT FOR ESTIMATING TRUE BOTTOM HOLE TEMPERATURE

FIGURE 4

2.5.4 Deviation Surveys

Totco deviation surveys were carried out while drilling straight hole to 320m, with results as shown in Table 5.

TABLE 5

Totco Deviation Surveys

Depth (mKB)	*Deviation (°)*
48.70	3/4
84.70	1/2
119.50	1/2
155.80	1/2
229.00	1/4
257.00	1/4

From 320m the hole was directionally drilled with deviation angles being continually monitored by means of Measurement While Drilling (MWD) equipment, to a maximum of 20° (reached at 774m). Below 774m the drift angle was gradually decreased, falling to less than 2° below 1300m and less then 1° below 1530m. During drilling this was monitored with single-shot surveys, and at total depth, a multi-shot survey was performed. Results of these surveys are included in the Directional Drilling Report (Appendix 9).

The calculated true vertical depth (TVD) and horizontal departure (HD) at total depth are as follows:

TVD: 1626.4mKB (1492.2mSS)
HD: 191metres towards 148° from the surface location.

2.5.5 Velocity Surveys

A Velocity Survey (WSS-Checkshot) was carried out by Schlumberger Seaco, and the raw data (Enclosure 8) was corrected to obtain time versus depth values below the seismic reference datum. The procedure used in this correction and the resulting values are presented in Appendix 10 and the resulting time-depth velocity-depth curves and synthetic seismogram are shown with the Iona 93-01 seismic line in Figure 5.

PE906674

This is an enclosure indicator page.
The enclosure PE906674 is enclosed within the container PE900963 at this location in this document.

The enclosure PE906674 has the following characteristics:

ITEM_BARCODE = PE906674
CONTAINER_BARCODE = PE900963
NAME = Time-Depth Curve
BASIN = OTWAY
PERMIT = PPL2
TYPE = WELL
SUBTYPE = VELOCITY_CHART
DESCRIPTION = Time-Depth Curve for Iona-2
REMARKS =
DATE_CREATED =
DATE_RECEIVED = 19/01/95
W_NO = W1095
WELL_NAME = IONA-2
CONTRACTOR =
CLIENT_OP_CO = GFE RESOURCES LTD

(Inserted by DNRE - Vic Govt Mines Dept)

PE906675

This is an enclosure indicator page.
The enclosure PE906675 is enclosed within the container PE900963 at this location in this document.

The enclosure PE906675 has the following characteristics:

ITEM_BARCODE = PE906675
CONTAINER_BARCODE = PE900963
NAME = Seismic Section and Synthetic Seismogram
BASIN = OTWAY
PERMIT = PPL2
TYPE = WELL
SUBTYPE = MONTAGE
DESCRIPTION = Interpreted Seismic Section with Synthetic Seismogram and Time-Depth Curve for Iona-2
REMARKS =
DATE_CREATED = 30/09/94
DATE_RECEIVED = 19/01/95
W_NO = W1095
WELL_NAME = IONA-2
CONTRACTOR =
CLIENT_OP_CO = GFE RESOURCES LTD

(Inserted by DNRE - Vic Govt Mines Dept)

GEOLOGY

GEOLOGY

3. GEOLOGY

3.1 STRATIGRAPHY

The section penetrated in Iona-2 is interpreted to have formation tops as shown in Table 6 based on consideration of rate of penetration, cuttings descriptions, palynology and wireline logs (primarily the latter).

Iona-2 was drilled as a deviated hole below 320 metres, so Table 6 shows both Drilled (or Measured) and True Vertical Depths and Thicknesses. The True Vertical Depths have been calculated from the Measured Depths via interpolation of the Directional Drilling data (Appendix 9). Unless stated otherwise, depths mentioned in this report will be the Measured Depth (MD) below the well datum, the kelly bushing (KB). True Vertical Depths are used where correlation away from the well bore is required, i.e. to other wells or to integrate into seismic data.

Comparison with a selection of nearby wells was undertaken, particularly Iona-1, which was drilled only a few hundreds metres away. Due to a lack of cuttings samples above 150 metres and a lack of distinguishing gamma ray character, tops for the Gellibrand Marl and Narrawaturk Marl could not be satisfactorily identified in Iona-2, but are thought likely to be at similar depths to those picked in Iona-1. A correlation between the two Iona field wells is shown in Figure 6, and it is important to note that the Iona-2 log shown there has been variably compressed in proportion to the degree of hole deviation so that it is a True Vertical Depth (TVD) profile.

It should also be noted that some minor changes have been made to the Iona-1 picks given in the Well Completion Report (Buffin, 1989), most notably the shift of the top of the Waarre Formation Unit A from 1366 metres to 1354 metres, which is currently thought to be a more appropriate position based on the Iona-2 logs.

PE906676

This is an enclosure indicator page.
The enclosure PE906676 is enclosed within the container PE900963 at this location in this document.

The enclosure PE906676 has the following characteristics:

ITEM_BARCODE = PE906676
CONTAINER_BARCODE = PE900963
NAME = Stratigraphic Correlation
BASIN = OTWAY
PERMIT = PPL2
TYPE = WELL
SUBTYPE = STRAT_COLUMN
DESCRIPTION = Stratigraphic Correlation of Iona-1 and Iona-2
REMARKS =
DATE_CREATED = 31/08/94
DATE_RECEIVED = 19/01/95
W_NO = W1095
WELL_NAME = IONA-2
CONTRACTOR =
CLIENT_OP_CO = GFE RESOURCES LTD

(Inserted by DNRE - Vic Govt Mines Dept)

TABLE 6

Stratigraphic Unit	Drilled * Depth	Drilled Thickness	True Vertical Depth [TVD]		True Vertical Thickness [TVT]
	(mKB)	(m)	(mKB)	(mSS)	(m)
Heytesbury Group	5.7	-	5.7	128.5	-
Port Campbell Limestone	5.7	-	5.7	128.5	-
Gellibrand Marl	not differentiated	-	-	-	-
Nirranda Group	not differentiated	-	-	-	-
Narrawaturk Marl	not differentiated	-	-		
Mepunga Formation	284.5	52.2	284.5	-150.3	52.2
Wangerrip Group	336.7	335.3	336.7	-202.5	324.1
Dilwyn Formation	336.7	211.1	336.7	-202.5	206.4
Pember Mudstone	547.8	71.8	543.1	-408.9	67.9
Pebble Point Formation	619.6	52.4	611.0	-476.8	49.8
Sherbrook Group	672.0	729.5	660.8	-526.6	717.1
Paaratte Formation	672.0	360.7	660.8	-526.6	349.1
Skull Creek Mudstone	1032.7	130.3	1009.9	-875.7	129.7
Nullawarre Greensand	1163.0	95.0	1139.6	-1005.4	94.9
Belfast Mudstone	1258.0	39.0	1234.5	-1100.3	38.9
Waarre Formation	1297.0	104.4	1273.4	-1139.2	104.4
Unit D †	1297.0	19.5	1273.4	-1139.2	19.5
Unit C	1316.5	31.5	1292.9	-1158.7	31.5
Unit B	1348.0	24.0	1324.4	-1190.2	24.0
Unit A	1372.0	29.5	1348.4	-1214.2	29.5
Otway Group	1401.5	248.5	1377.9	-1243.7	248.5
Eumeralla Formation	1401.5	248.5	1377.9	-1243.7	248.5
Total Depth (Driller)	1650.0		1626.4	-1492.2	
Total Depth (Logger)	1650.0		1626.4	-1492.2	

* *Also referred to as Measured Depth (MD)*

† *Also known as the Flaxman Formation*

3.2 LITHOLOGY

The following is a summary of the lithological units observed in Iona-2. More detailed descriptions are included in Appendix 4, as well as on the Mud Log (Enclosure 2a). Additional lithological information can be found in the Sidewall Core Description (Appendix 5) and the associated petrography report (Appendix 7).

3.2.1 Heytesbury and Nirranda Groups (Surface - 336.7m)

3.2.1.1 Port Campbell Limestone

Due to no cuttings samples being collected above 150 metres and a lack of gamma ray character this unit could not be identified in Iona-2. It is recorded as occurring from surface to 39 metres in Iona-1.

3.2.1.2 Gellibrand/Narrawaturk Marls (undifferentiated)

From the start of sampling (150m) down to about 280 metres the observed lithology was;
Marl; medium greenish grey to brownish grey, very soft, sticky, occasionally silty, common to abundant fossil fragments (including bryozoa, gastropods and sponge spicules), massive, with trace pyrite and coaly fragments below about 200 metres and trace to occasionally common glauconite towards the base.
The Gellibrand/Narrawaturk contact may be around 200 metres in Iona-2 (it was picked at 202m in Iona-1), but could not be positively identified from the available data.

3.2.1.3 Mepunga Formation (284.5 - 336.7m)

Sandstone; medium to dark brownish-grey; fine to coarse, dominantly coarse; poorly sorted; subangular to subrounded, dominantly subrounded quartz; common iron oxide; rare glauconite; trace pyrite, trace mica; moderate calcareous cement; fair visual porosity.

3.2.2 Wangerrip Group (336.7 - 672.0m)

3.2.2.1 Dilwyn Formation (336.7 - 547.8m)

Sandstone; off white; translucent; fine to coarse, dominantly coarse; poorly to moderately sorted; subangular to subrounded, dominantly subrounded quartz; common brown and orange iron oxide stain, occasional pyrite; occasional glauconite; trace mica; good intergranular porosity, interbedded with
Claystone; dark greyish to brown; very silty; micromicaceous; massive; soft; dispersive.

3.2.2.2 Pember Mudstone (547.8 - 619-6m)

Claystone; medium to dark brownish to grey; moderately silty; trace to common glauconite; trace pyrite; micromicaceous; massive; soft; dispersive.

3.2.2.3 Pebble Point Formation (619.6 - 672.0m)

Sandstone; medium to dark brown; very fine to very coarse, occasionally pebbly, dominantly coarse; poorly sorted; subangular to subrounded, dominantly subrounded quartz; common iron oxide; moderate iron oxide cement; common to abundant argillaceous matrix; soft; poor visual porosity, interbedded with
Claystone; dark brownish-grey, occasionally light to medium brown; trace volcanic lithics; trace pyrite; trace fossil fragments; massive; moderately firm.

3.2.3 Sherbrook Group (672.0 - 1401.5m)

3.2.3.1 Paaratte Formation (672.0 - 1032.7m)

Sandstone; white to light grey, translucent; very fine to coarse, occasionally pebbly, dominantly coarse; poorly sorted; subangular to subrounded, dominantly subrounded; quartz; trace multi-colour lithics; trace mica; trace pyrite; weak brownish-grey silty matrix; poor visual porosity, soft, interbedded with
Claystone; light to medium grey; silty; micromicaceous; carbonaceous; soft; dispersive and minor
Coal; dark brown to black, soft.

3.2.3.2 Skull Creek Mudstone (1032.7 - 1163.0m)

Claystone; medium to dark grey-brownish; very silty, occasionally grading into argillaceous siltstone; micromicaceous; carbonaceous; very soft; dispersive, interbedded with thin
Sandstone; light grey, translucent; fine to medium, dominantly fine; moderately sorted; subangular to subrounded, dominantly subrounded quartz; common multi-colour lithics; rare mica; rare pyrite; rare to common argillaceous matrix; poor visual porosity; soft.

3.2.3.3 Nullawarre Greensand (1163.0 - 1258.0m)

Sandstone; very light green, translucent; very fine to medium, dominantly fine; moderately sorted; subangular to subrounded, dominantly subrounded quartz; rare to common dark green glauconite; rare coloured lithics; no apparent matrix; good intergranular porosity; loose.

3.2.3.4 Belfast Mudstone (1258.0 - 1297.0m)

Claystone; dark grey-greenish; silty; common to abundant glauconite nodules increasing with depth; common carbonaceous detritus; rare pyrite; soft.

3.2.3.5 Waarre Formation (1297.0 - 1401.5m)

3.2.4.5.1 Unit D (1297.0 - 1316.5m)

Claystone; dark grey; silty; carbonaceous; rare to common glauconite; rare pyrite; soft; dispersive, interbedded with thin
Sandstone; light grey to tan; fine to medium, dominantly medium; poorly to moderately sorted; subangular to subrounded, dominantly subrounded quartz; rare to common glauconite; common pyrite; weak calcareous cement; poor visual porosity; soft to moderately hard.

3.2.3.5.2 Unit C (1316.5 - 1348.0m)

Sandstone; light brownish-grey, translucent; very fine to coarse, dominantly medium; poorly to moderately sorted;

subangular to subrounded, dominantly subrounded quartz; trace pyrite; trace glauconite; trace to common multi-colour lithics; weak silica cement; weak calcareous cement; good intergranular porosity; soft to moderately firm, interbedded with minor

Claystone; dark grey; silty; carbonaceous; rare glauconite and pyrite, soft.

3.2.3.5.3 Unit B (1348.0 - 1372.0m)

Claystone; dark grey; silty; carbonaceous; rare glauconite, rare pyrite; soft; dispersive, interbedded with thin

Sandstone; light brownish-grey; very fine to coarse, dominantly medium; poorly sorted; subangular to subrounded, dominantly subrounded quartz; trace pyrite; trace glauconite; common lithics; weak silica cement; good intergranular porosity; soft.

3.2.3.5.4 Unit A (1372.0 - 1401.5m)

Sandstone; white to light grey, translucent; very fine to coarse; dominantly fine; moderately sorted; subangular to subrounded, dominantly subrounded quartz; common to rare multi-colour lithics; common carbonaceous detritus; rare mica; moderate calcareous cement; poor to fair visible porosity; moderately hard.

3.2.4 Otway Group (1401.5 - 1650.0m)

3.2.4.1 Eumeralla Formation (1401.5 - 1650.0m)

Sandstone; White to very light grey; very fine to medium, dominantly fine; moderately sorted; subangular to subrounded, dominantly subrounded quartz; common multi-colour lithics; rare to common altered feldspars; common carbonaceous detritus; moderate silica cement poor to fair visual porosity; moderately hard, interbedded with

Claystone; light to medium grey, brownish; silty; common multi-colour lithics; micromicaceous; carbonaceous; soft and sticky.

3.3 HYDROCARBON INDICATIONS

3.3.1 Mud Gas Readings

The mud gas detection equipment was operational from a hole depth of 150 metres until the 7" casing was run. The levels of gas detected during drilling are plotted on the Mud Log (Enclosure 2a) and can be summarised as follows:

- Down to 540 metres no gas was detected.

- Over the interval 540 - 641 metres (which encompasses the Pember Mudstone and upper Pebble Point Formation) mud gas readings ranged;

Total Gas	:	0.1 - 1.6 units
C_1	:	1 - 180 ppm
C_2	:	BDL* - 35 ppm
C_3	:	BDL* - 22 ppm

* *Note: BDL denotes Below Detection Limit.*

with the maximum encountered at 575 metres.

- From 641 metres down to 740 metres (the middle and lower Pebble Point Formation and the uppermost Paaratte Formation) no gas was detected.

- From 740 metres down to about 1085 metres (covering most of the Paaratte Formation and the top half of the Skull Creek Mudstone) mud gas readings were low and stayed relatively flat, ranging;

Total Gas	:	BDL - 0.1 units
C_1	:	1 - 6 ppm

- Through the lower half of the Skull Creek Mudstone (1085 - 1159 metres) gas readings began to increase fairly steadily, ranging;

Total Gas	:	0.1 - 6.5 units	
C_1	:	9 - 1240 ppm	
C_2	:	1 - 38 ppm	
C_3	:	BDL - 22 ppm	
C_4	:	BDL - 3 ppm	(only in lowest 5 metres)

and over the interval 1160 - 1238 metres (broadly corresponding to the Nullawarre Greensand) ranged;

Total Gas	:	3 - 32.4 units	(mostly above 5 units)
C_1	:	600 - 6000 ppm	(mostly above 1200ppm)
C_2	:	1 - 38 ppm	(mostly above 20ppm)
C_3	:	2 - 45 ppm	(mostly above 5ppm)
C_4	:	1 - 20 ppm	

- From 1240 metres down to 1317 metres (broadly corresponding to the Belfast Mudstone and the Waarre Formation Unit D) mud gas readings dropped off, ranging;

Total Gas	:	1 - 8.8 units
C_1	:	208 - 1540 ppm
C_2	:	2 - 59 ppm
C_3	:	BDL -32 ppm
C_4	:	BDL - 4 ppm

except for a peak (within the Unit D interval) centred on 1305 metres which ranged up to;

Total Gas	:	32 units
C_1	:	5073 ppm
C_2	:	425 ppm
C_3	:	126 ppm
C_4	:	28 ppm

- In the interval 1317 - 1349 metres (corresponding to the Waarre Formation Unit C - the main reservoir unit) gas readings ranged;

Total Gas	:	21.5 - 255 units	(mostly above 100 units)
C_1	:	3680 - 43200 ppm	(mostly above 18000ppm)
C_2	:	147 - 2478 ppm	(mostly above 800ppm)
C_3	:	57 - 945 ppm	(mostly above 300ppm)
C_4	:	30 - 332 ppm	(mostly above 100ppm)
C_5	:	1 - 66 ppm	(mostly above 10ppm)

notably including the first detection of C_5.

- Throughout the interval 1350 - 1373 metres (corresponding to Waarre Formation Unit B) gas readings dropped markedly to a background of;

Total Gas	:	9 - 13.5 units
C_1	:	1468 - 2200 ppm
C_2	:	60 - 118 ppm
C_3	:	41 - 65 ppm
C_4	:	8 - 25 ppm
C_5	:	BDL - 2 ppm

with a broad peak at 1356 - 1362 metres ranging;

Total Gas	:	35 - 36.5 units
C_1	:	6000 - 6240 ppm
C_2	:	250 - 263 ppm
C_3	:	110 - 120 ppm
C_4	:	35 - 40 ppm

- Gas readings rose sharply again at 1375 metres (corresponding to the top of Waarre Formation Unit A);

Total Gas	:	159 units
C_1	:	31000 ppm
C_2	:	310 ppm
C_3	:	57 ppm
C_4	:	33 ppm

but then dropped quickly towards the base, falling to 3.2 units of Total Gas at 1400 metres.

- Within the Eumeralla Formation gas readings divide readily into two intervals. The uppermost, 1405 - 1434 metres, corresponds to a dominantly sandy interval where values ranged:;

Total Gas	:	9.5 - 390 units	(mostly above 50 units)
C_1	:	1720 - 61000 ppm	(mostly above 7000 ppm)
C_2	:	44 - 3150 ppm	(mostly above 400 ppm)
C_3	:	40 - 2150 ppm	(mostly above 260 ppm)
C_4	:	7 - 960 ppm	(mostly above 60 ppm)
C_5	:	1 - 70 ppm	(mostly above 7 ppm)

- Below 1434 metres mud gas readings through the rest of the Eumeralla Formation ranged;

Total Gas	:	4 - 46 units	
C_1	:	720 - 8000 ppm	
C_2	:	19 - 398 ppm	
C_3	:	13 - 200 ppm	
C_4	:	1 - 75 ppm	
C_5	:	BDL - 15 ppm	(mostly BDL)

except for one notable peak at 1468 - 1470 metres (corresponding to the top of a thick sandstone unit) which ranged:

Total Gas	:	60 - 175 units
C_1	:	7200 - 21600 ppm
C_2	:	730 - 2190 ppm
C_3	:	530 - 1630 ppm
C_4	:	280 - 860 ppm
C_5	:	50 - 150 ppm

3.3.2 Sidewall Core Gas Reading

Shortly after recovering the sidewall cores, each was placed in a sealed container and subsequently the air within each container was sampled via syringe and analysed in the Baker-Hughes Inteq chromatograph. Results of these analyses are included with the sidewall core descriptions in Appendix 5.

3.3.3 Fluorescence

Cuttings samples and sidewall cores were routinely inspected for shows with the following results;

3.3.3.1 Cuttings

No significant fluorescence or oil staining was observed down to 1360 metres (the middle of Waarre Formation Unit B).

Within sandstones from 1360 to 1400 metres, 10 - 30% moderately bright, medium yellow pin-point fluorescence with instant bright yellow to milky white cut was observed.

In the Eumeralla Formation down to 1435 metres, trace to 20% moderately bright, pin-point to patchy, medium to light yellow fluorescence with slow streaming, light-medium yellow cut was observed.

Cuttings samples from 1365, 1385 and 1410 metres were submitted during drilling for a "quick look" evaluation of hydrocarbons and the results are included in the Geochemistry section.

No fluorescence or staining were observed from 1435 metres to Total Depth.

3.3.3.2 Sidewall Cores

Fluorescence was observed in six sidewall cores, two each from the Waarre Formation Units A and B and the upper Eumeralla Formation. Descriptions of the fluorescence and cut for each are included in Appendix 5. Five of these were submitted for geochemical analysis via extraction, liquid chromatography and gas chromatography of the saturates fraction, and two were then selected for GC-MS. In addition to these, three sandstone sidewall cores which did not exhibit fluorescence were analysed by whole extract gas chromatography. Results from all these analyses are included in the Geochemistry section.

3.3.4 Clean-up Flow Gas Sample

No sampling of gas was attempted during the drilling of Iona-2. Subsequent to the completion of the well a clean-up flow was conducted prior to connection to the North Paaratte production facility. Analysis of a gas sample taken during this flow is shown in Table 7 and, as expected, it closely resembles analyses of the Waarre Formation gas sampled in Iona-1.

TABLE 7

Iona-2 Gas Analysis

Component	*Mole Percent Concentration*
Methane	84.300
Ethane	3.070
Propane	1.260
Iso-Butane	0.293
Normal-Butane	0.324
Neo-Pentane	0.005
Iso-Pentane	0.122
Normal-Pentane	0.094
Hexanes	0.190
Heptanes+	0.280
Carbon Dioxide	6.490
Oxygen+Argon	0.025
Nitrogen	3.470
Helium	0.059

Calculated Properties for the dry gas at M.S.C	
Gross Heating Value	37.1 MJ/m^3
Wobbe Index	44.8 MJ/ m^3
Relative Density	0.685

Analyst:	I. Strudwick
Laboratory:	Gas and Fuel Corporation of Victoria, Scientific Services Division
Report Reference Number:	94/0608
Procedure References:	SSS-11-006 ISO 6976

3.4 GEOCHEMISTRY

3.4.1 Analyses

A total of 11 samples (8 sidewall cores and 3 cuttings) from Waarre Formation Units A and B and the Eumeralla Formation were analysed to identify and characterise their hydrocarbon content. No source rock studies were undertaken due to a perceived lack of source potential throughout the penetrated section.

The three cuttings samples from intervals exhibiting fluorescence were submitted for thermal extract gas chromatography (GC_{therm}) using Geotech's Geo-Fina Hydrocarbon Meter (GHM). All of the eight sidewall cores were sandstone; but three did not show any fluorescence, and so were only analysed by whole-extract gas chromatography (GC_{whole}). Extracts from the remaining five underwent liquid chromatographic separation followed by gas chromatography of the saturates fraction (GC_{sats}) and two of these were then selected for gas chromatography-mass spectrometry (GC-MS) work. One was also run in the GHM to attempt to provide a comparison with (and thereby integration of) the cuttings GHM data.

Also for comparison, extraction of SWC 7 (1391.5m) from Iona-1 was undertaken followed by liquid chromatographic separation and gas chromatography of the saturates fraction.

Data from all these analyses, as well as interpretation by Geotech, are collated into a report included here as Appendix 8.

3.4.2 Results

GC_{therm} was performed on cuttings from the Waarre and Eumeralla Formations (1365m, 1385m an 1410m) during drilling to characterize the nature of the shows, notably oberved fluorescence. The chromatograms of the three samples indicate the presence of a hydrocarbon rich in n-alkanes above C_{17} and also in the gasoline fraction. The n-alkane content below C_{17} is severely depleted. All three chromatograms also show a baseline hump peaking at approximately $C_{25.}$

The baseline hump has a strong signature indicative of pipe dope. This renders interpretation of the chromatograms somewhat speculative. Ignoring this hump, these samples have similar characteristics and are most likely the same oil. The moderate odd-over-even preference around C_{23}/C_{25} is indicative of a strong terrestrial origin. This is in agreement with both the high pristane/n-C_{17} and pristane/phytane ratios, 3.3 and 4.9, respectively (Table 8).

Sidewall core 20 (1358m) was also thermally extracted to verify the probable pipe contamination in the cuttings samples and its GC_{therm} profile is similar to those of the three cutting samples, but without the baseline hump, indicating that the contaminant is absent. Also missing is much of the gasoline fraction, which may be attributable to flushing from mud in the well bore.

Solvent extraction was performed on eight sidewall cores primarily to obtain more reliable results and secondly to enable biomarker studies to be performed if later required.

Of the four solvent extracted sidewall cores from the Waarre Formation (1358m, 1362m, 1381m and 1392m) the shallowest three yielded excellent quantities of free hydrocarbons from 10, 700 to 5,600ppm (Table 8), while the deepest sidewall core yielded only a small amount of hydrocarbon (69ppm).

The saturate chromatograms from the top three sidewall cores characterize the same oil which is depleted in n-alkanes below C_{17} with a unimodal distribution centred at approximately C_{23}. (Note: due to having been extracted with solvent these saturate chromatograms will not display the light ends below approximately C_{12} like the thermally extracted chromatograms do). The odd-over-even preference indicates a terrestrial origin, as do the pristane/phytane ratios (4.81-5.39). The pristane/n-C_{17} ratio also indicates a coaly origin, however, this parameter may be unreliable due to the possible depletion of the n-C_{17}. These chromatograms also indicate the possibility of biodegradation. The low yield from the SWC 14 (1392m) probably indicates that there is a negligible quantity of oil present in the lower part of the Waarre Formation Unit A.

TABLE 8

SUMMARY OF EXTRACTION AND CHROMATOGRAPHY

SWC No.	DEPTH (M)	FORMATION	TOTAL EXTRACT (PPM)	PRIS/PHYT	PRIS/n-C_{17}	PHYT/n-C_{18}	MPI-1	V_R
20	1358.0	Waarre	10724.0	5.37	2.86	0.37	1.06	1.04
19	1362.0	Waarre	6849.4	5.39	3.02	0.38	ND	-
16	1381.0	Waarre	5636.4	4.81	1.17	0.15	ND	-
14	1392.0	Waarre	69.4	ND	ND	ND	ND	-
12	1408.5	Eumeralla	1414.5	5.12	0.37	0.07	1.17	1.10
9	1426.0	Eumeralla	143.3	4.73	0.34	0.07	ND	-
6	1469.0	Eumeralla	41.2	ND	ND	ND	ND	-
3	1550.5	Eumeralla	31.3	ND	ND	ND	ND	-
7*	1391.5	Eumeralla	2452.2	2.80	0.53	0.08	ND	-

* *Iona-1*

Of the four sidewall cores from the Eumeralla Formation which were solvent extracted (1408.5m, 1426m, 1469m and 1550.5m) the two shallowest yielded moderate quantities of free hydrocarbons (1414ppm and 143 ppm), while the deepest two yielded negligible amounts of free hydrocarbons (41ppm and 31ppm).

Saturate chromatograms for the 1408.5m and 1426m samples characterize an early to peak mature oil with n-alkanes from at least C_9 to C_{31}. It has a bimodal distribution with maxima at approximately C_{18} and C_{23}, similar to Tuna-4 oil (Burns *et al.*, 1987*) which has an API of 39°. A slight odd-over-even preference not only indicates input from higher plant waxes, but also that the oil is not late mature. The pristane/phytane ratios (5.12 and 4.73) also suggest oxic conditions.

Hydrocarbon yields from the 1461m and 1550.5m sidewall cores indicate that there is neglible oil present in this zone of the Eumeralla Formation. The whole oil chromatograms characterize an oil with only a small proportion of n-alkanes.

Biomarker distributions were determined for the branched/cyclic and aromatic fractions for sidewall cores 20 and 12 (1358m and 1408.5m). A detailed interpretation and the mass fragmentograms are included in Appendix 8 and indicate that the degraded (biodegraded?) oil is genetically related to the deeper undegraded oil and that they probably have a common source. The oil was sourced from terrestrial, coaly organic matter. This was indicated by the presence of codalene and retene, a predominance of C_{29} over C_{27} diasteranes and steranes together with the presence of bi-, tri- and tetra-diterpenoids, markers for resinous matter in higher plants.

The methylphenanthrene index (MPI) was measured for both samples for the purposes of calculation of the maturity at which the oil was generated. MPI values of 1.06 and 1.17 indicate vitrinite equivalent values of approximately 1.0 to 1.1% using the Radke and Welte (1983†) method. Although this typically would be considered very late mature, the work of Burns *et. al.* (1987) on Gippsland crudes (also of a coaly origin) would indicate the Iona oil is early to peak mature. Again, this is consistent with the odd-over-even preference, and the n-alkane distribution.

* *APEA J., v.27, p.63-72.*
† *see references list Appendix 8*

3.4.3 Discussion

3.4.3.1 Waarre Formation

Extraction of samples from the Waarre Formation in Iona-2 has clearly shown the presence of a degraded oil in at least Units A and B. Similar studies of a sample from Unit C in Iona-1 have also indicated the presence of a degraded oil. (Note: the chromatograms for the Iona-1 samples display neglible hydrocarbons below C_{17} probably due to poor storage). It is likely that degraded oil is present across the Iona field within the Waarre Formation. The base of this zone occurs approximately midway through Unit A in Iona-2, which is below the lowest known gas.

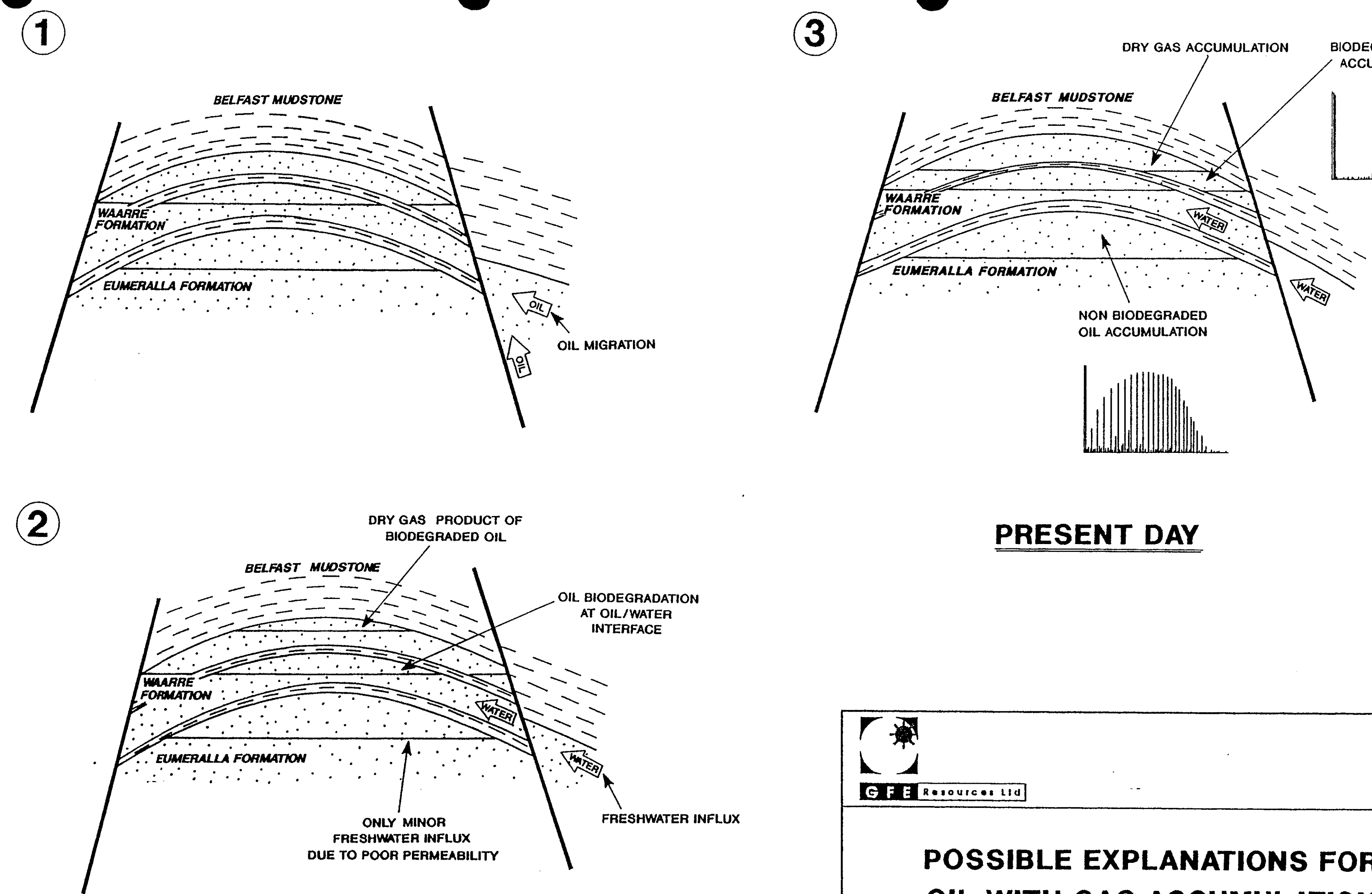
At least three explanations (Figure 7), or a combination thereof, are possible in relation to the presence and origin of this degraded oil;

1. Subsequent to the trap being filled with oil fault reactivation resulted in leakage of most of the oil with a heavy residual component remaining. The structure was then later filled by gas.

2. The original oil column was displaced by gas, leaving only a heavy residual component. This scenario does not adequately explain the presence of the degraded oil below the gas water contact.

3. The original oil column was biodegraded leaving a relatively dry gas (with C_1 being 85% of total gas or 93% of hydrocarbon gas) and a residual oil. This phenomenon has been proposed for many of the dry gas/biodegraded oil fields on the Northwest Shelf with examples at West Muiron, Wandoo, Roller, Skate, Leatherback and many others.

Whichever is the case, the extent of this degraded oil highlights the oil potential of this region. It also raises the possibility of the presence of a degraded oil column (rather than residual) being present within Unit A. This unit has not been tested in either Iona wells except for RFT pressure measurement in Iona-2. This pressure, if valid, does not conflict with the possiblitiy of oil being present. Gas readings while drilling through this interval show reasonable increases in both C_1 and



Possible explanations for the presence of dry gas, biodegraded and non-biodegraded oil (illustrating possible oil accumulations)

GFE Resources Ltd

POSSIBLE EXPLANATIONS FOR OIL WITH GAS ACCUMULATION IN IONA FIELD

AUTHOR :	N.NEWELL	APPROVED :	
DATE :	MAY 1994	FIGURE :	7
SCALE :			
DRAWN BY :	D.R.	DRG No.	OT.4723

C_2. No C_5 was recorded over this interval, however, this could be expected with a degraded oil depleted in short chain alkanes. Fluorescence is also recorded through this interval, consisting of 10-30% bright yellow pinpoint fluorescence with instant blooming cut. The fluorescence was strongest between 1375 to 1385 within Unit A of the Waarre Formation.

3.4.3.2 Eumeralla Formation

Extraction of samples from the Eumeralla Formation in Iona-2 has shown the presence of a whole oil (non-degraded) in the sandstone unit immediately below the unconformity. The deepest of these samples is at 1426m, indicating the possibility of an at least 23m oil column. The fact that the hydrocarbon yields are not high (1414.5ppm and 143.3ppm) may suggest that oil saturation is low.

Biomarker studies indicate that the Eumeralla Formation oil is genetically related to the Waarre Formation oil, while gas chromatograms of both indicate they have had different histories since generation. The most obvious explanation for the difference in physical properties is that the Waarre Formation oil has undergone biodegradation while the Eumeralla Formation oil has not. This can be further explained by the low permeability of the Eumeralla Formation relative to the Waarre Formation and a lack of freshwater influx into the former. The low permeability of the Eumeralla Formation below the unconformity was further indicated by the inability to sample with the RFT.

A sidewall core from Iona-1 from the equivalent Eumeralla Formation section was thermally extracted to ascertain the lateral extent of this non-degraded oil. The GC_{sats} trace of this sample from 1391.3 metres characterizes a degraded oil almost completely lacking in n-alkanes below C_{17}, which is unlike the degraded samples from Iona-2, where residual components below C_{17} are present. However, the lack of components below C_{17} in the Iona-1 sample may be all or partly due to six years of storage at ambient conditions, thus making the validity of the comparison questionable.

The presence of oil in the Eumeralla Formation is also indicated by both fluorescence and the gas chromatogram while drilling. Between 1400 and 1435 metres the sandstone had approximately 2% bright yellow pinpoint fluorescence with a slow streaming cut. Total gas reached 390 units at 1423 metres, with up to 2180ppm of C_3 and 960ppm of C_4. The gas levels in this interval were actually higher than while drilling through the gas zone in the Waarre Formation.

Within Iona-2 two possible oil columns have been identified by geochemical analysis and other supportive drilling data (ie. fluorescence, gas and pressure data). A degraded oil column may present within Unit A of the Waarre Formation between 1372m and 1385m, and a non-degraded oil column may be present within the Eumeralla Formation between 1403m and 1434m.

Due to uncertainty about the Waarre Formation accumulation and the poor permeability of the Eumeralla Formation another well would be difficult to justify to test these zones alone. However, if another well is to be drilled for future gas drainage, the well should be engineered such that these zones can be fully evaluated. These tests might also be considered in either Iona-1 or Iona-2 after the completion of gas production.

3.5 LOG ANALYSIS

Log analysis was performed on the wireline logs using Crocker Data Processing's PETROLOG software. The interval 1160.1 - 1627.9m was subdivided into eight zones covering stratigraphic units from the Nullawarre Greensand to the Eumeralla Formation and each zone was analysed independently with the input parameters and cut-offs as shown in Appendix 6. A three-metre interval at the base of the Waare Formation was excluded from analysis due to anomalous log responses (thought to be due to carbonate bands), and the top 37m of the Eumeralla Formation was treated separately from the remainder due to the better shows observed during drilling.

Only zones 4 and 5 (covering the Waarre Formation Units C and B, respectively) indicated any net pay, and a complete listing of the calculated results for these two zones is given in Appendix 6. An intepretive log spanning all eight zones is provided as Enclosure 11, and summary of results is shown in Table 9.

TABLE 9

IONA-2 LOG ANALYSIS RESULTS SUMMARY

ZONE #	1	2	3	4	5	6	7	8	IONA-1
FORMATION	Nullawarre	Belfast	Waarre Unit D	Waarre Unit C	Waarre Unit B	Waarre Unit A	Eumeralla	Eumeralla	Waarre Unit C
From (m)	1160.07	1260.04	1296.92	1316.43	1347.98	1371.91	1401.47	1438.50	1299.21
To (m)	1260.04	1296.92	1316.43	1347.98	1371.91	1398.58	1438.50	1627.94	1328.01
Interval (m)	99.97	36.88	19.51	31.55	23.93	26.67	37.03	189.43	28.80
Net Sand† (m)	74.9	0.0	0.5	27.9	5.6	3.7	4.9	6.9	23.0
Sand Average $\varnothing_{eff.}$ † (%)	23.1	0.0	18.2	23.7	22.8	23.3	10.9	16.9	23.3
Average $\varnothing_{eff.}$ Cut off	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
S_w Cut off	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
V_{clay} Cut off	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Net Pay (m)	0.00	0.00	0.00	27.58	5.03	0.00	0.00	0.00	20.27
Pay Average $\varnothing_{eff.}$ (%)	n/a	n/a	n/a	23.81	23.08	n/a	n/a	n/a	23.87
Pay Average S_w (%)	n/a	n/a	n/a	16.71	17.94	n/a	n/a	n/a	19.69 ?
Pay Average V_{clay} (%)	n/a	n/a	n/a	5.29	8.81	n/a	n/a	n/a	4.04
Integrated $\varnothing$ (m)	n/a	n/a	n/a	6.57	1.16	n/a	n/a	n/a	4.84
Sum $\varnothing$*(1-S_w) (m)	n/a	n/a	n/a	5.48	0.96	n/a	n/a	n/a	3.87

†Obtained by doing analysis with $S_w = 100\%$

n/a denotes not applicable due to not pay being zero

For comparison, Table 9 also includes results from the Waarre Formation Unit C in Iona-1, which shows that this formation in Iona-2 is almost three metres thicker, has about five metres more net sand and about seven metres more net pay. The average effective porosity for the Unit C pay sand in both wells is almost 24 per cent, which closely compares with the average overburden porosities measured in core plugs from Iona-1.

The pay zones in Units C and B are readily apparent in Enclosure 11, but the significance of the smaller indications of gas shown in the other zones is less certain. During drilling, increases in mud gas were observed in some of the non-pay zones shown in Enclosure 11, as well as some fluorescence in the lower Waarre Formation and the upper Eumeralla Formation. However, it is thought likely that most of the apparent "hydrocarbon" response displayed is an artefact of clay content, mineralogy and inappropriate estimates of some key input parameters (such as R_w).

3.6 PALYNOLOGY

Eighteen sidewall cores and four cuttings samples were submitted for palynological analysis and the resulting report comprises Appendix 6.

The samples ranged from 1034.5 metres (near top Skull Creek Mudstone) down to 1599 metres (Eumeralla Formation) and spanned from basal Campanian to Lake Albian in age.

As in Iona-1, it appears that the *A. Distocarinatus* zone (and thus the Cenomanian) is not present in Iona-2, its absence comprising part of the mid-Cretaceous unconformity.

Around the base Belfast Mudstone/top Waarre Formation contact the Iona-2 palynological data compliments Iona-1 in that; (i) whereas the *O. Porifera* dinoflagellate zone was not seen in Iona-1 (due to lack of sampling in the basal Belfast Formation?) it is present at this same stratigraphic level in Iona-2, and (ii) conversely, the *C. Striatoconus* zone was observed in the top of Waarre Unit D in Iona-1, but was not observed in Iona-2, either due to insufficient sampling and/or because the uppermost part of Unit D in Iona-1 may be absent in Iona-2.

All of the Sherbrook Group samples are considered to be marine but, in the Waarre Formation, not necessarily the restricted marine units proposed by Buffin (1989*), whilst all Eumeralla Formation samples are attributed to non-marine lacustrine environments.

* ***Iona-1 Well Completion Report***

3.7 STRUCTURE

The Iona structure was first identified by Beach Petroleum NL from the 1981 Curdie Seismic Survey, and subsequently better constrained by the 1986 Sherbrook Seismic Survey. In March, 1988 Iona-1 was drilled and discovered the gas accumulation in the Waarre Formation Unit C. Iona-1 was drilled slightly off structure (at Shot Point 235 on line OB81A-C62) due to surface topography and the structure was originally mapped as a four-way dip closure with only $0.44km^2$ closure at Waarre Formation level. The thickness of the gas column in Iona-1 demonstrated that the bounding faults sealed, providing closure down to about 1195mSS and thereby indicating a larger areal extent of closure (approximately $3km^2$).

A small amount of additional seismic was obtained over the Iona structure as part of the 1988 Vogel Seismic Survey and a re-interpretation of the feature indicated a rotated fault block bounded to the northeast and southwest by northwest-trending faults.

From this mapping the apex of the structure was interpreted to be about 250 metres east-southeast of Iona-1. The Iona 93-01 seismic line was acquired to confirm the location of this crest and, having done so, the location of Iona-2 updip from Iona-1 was assured.

The formation top depths encountered in Iona-2 were well within the error limits of the prognosed depths (Figure 8), with the biggest discrepancy being the top of the Waarre Formation Unit C coming in 6.8 metres high. Thus, the pre-drill structural interpretation remains unchanged (Figures 9 and 10).

ERA	PERIOD	GROUP	PREDICTED	FORMATION	ACTUAL (TVD)	Difference
CAINOZOIC	TERTIARY	HEYTESBURY	5.5	PORT CAMPBELL LIMESTONE	5.7	
			39.7	GELLIBRAND MARL	Undiffer-entiated	
		NIRRANDA	202.7	NARRAWATURK MARL		
			280.7	MEPUNGA FORMATION	284.5	3.8m Low (+1.4%)
		WANGERRIP	335.7	DILWYN FORMATION	336.7	1.0m Low (+0.3%)
			541.7	PEMBER MUDSTONE	543.1	1.4m Low (+0.3%)
			610.7	PEBBLE POINT FORMATION	611.0	0.3m Low (+0.05%)
MESOZOIC	LATE CRETACEOUS	SHERBROOK	659.7	PAARATTE FORMATION	660.8	1.1m Low (+0.2%)
			1004.7	SKULL CREEK MUDSTONE	1009.9	5.2m Low (+0.5%)
			1136.7	NULLAWARRE GREENSAND	1139.6	3.1m Low (+0.3%)
			1236.7	BELFAST MUDSTONE	1234.5	2.2m High (−0.2%)
			1274.7	WAARRE FORMATION Unit D	1273.4	1.3m High (−0.1%)
			1299.7	WAARRE FORMATION Units C,B,A,	1292.9	6.8m High (−0.5%)
	EARLY CRETACEOUS	OTWAY	1380.7	EUMERALLA FORMATION	1377.9	2.8m High (−0.2%)
			TD 1630.7		TVTD 1626.4	

Note: Predicted KB-GL distance was 5.5m. Actual was 5.7m, so all prognosed tops have 0.2m added to them in this comparision.

GFE RESOURCES LTD
PPL2 OTWAY BASIN

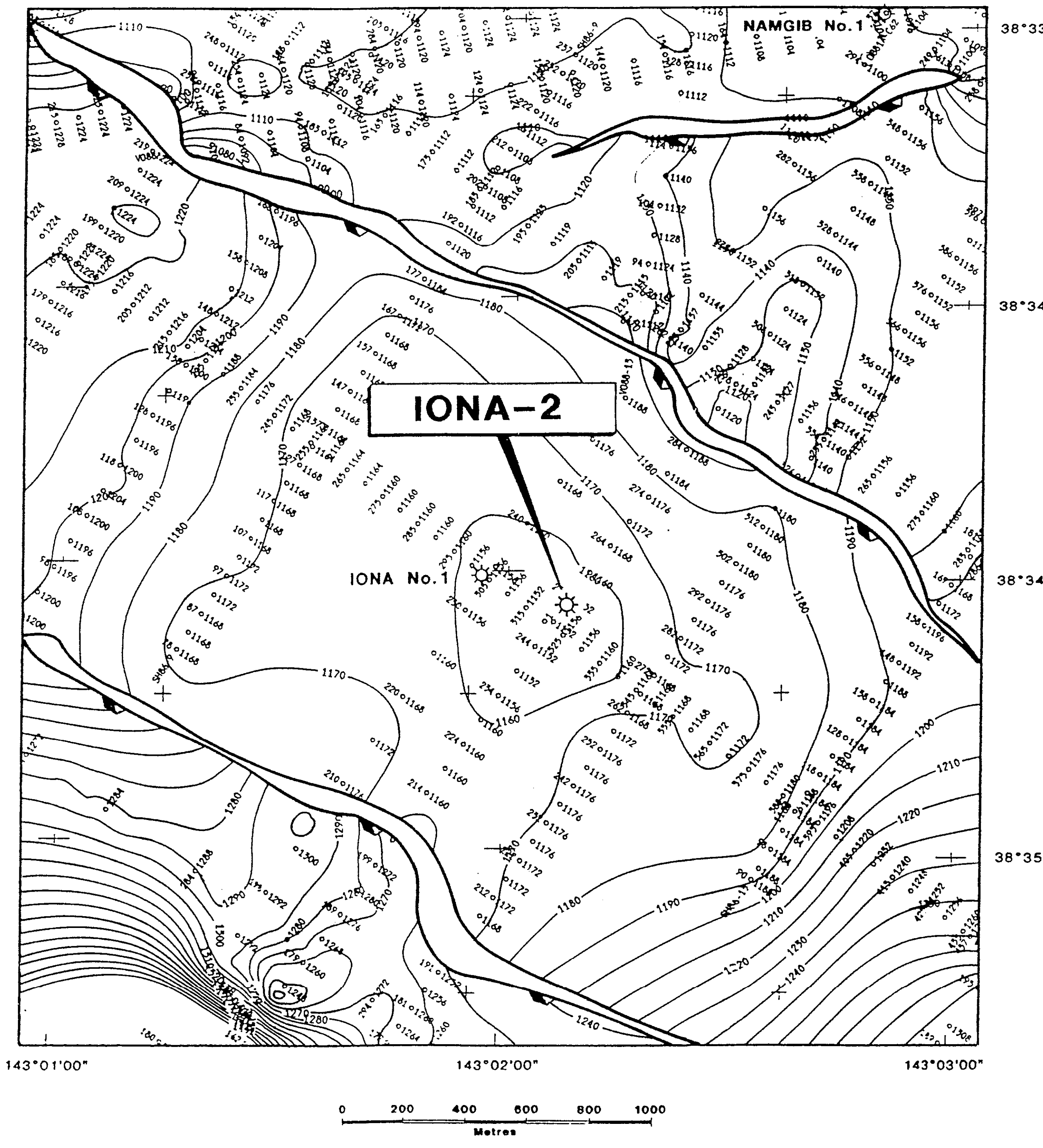
IONA-2

PREDICTED vs ACTUAL FORMATION TOPS

OT.4740
FIGURE 8

TOP WAARRE UNIT C

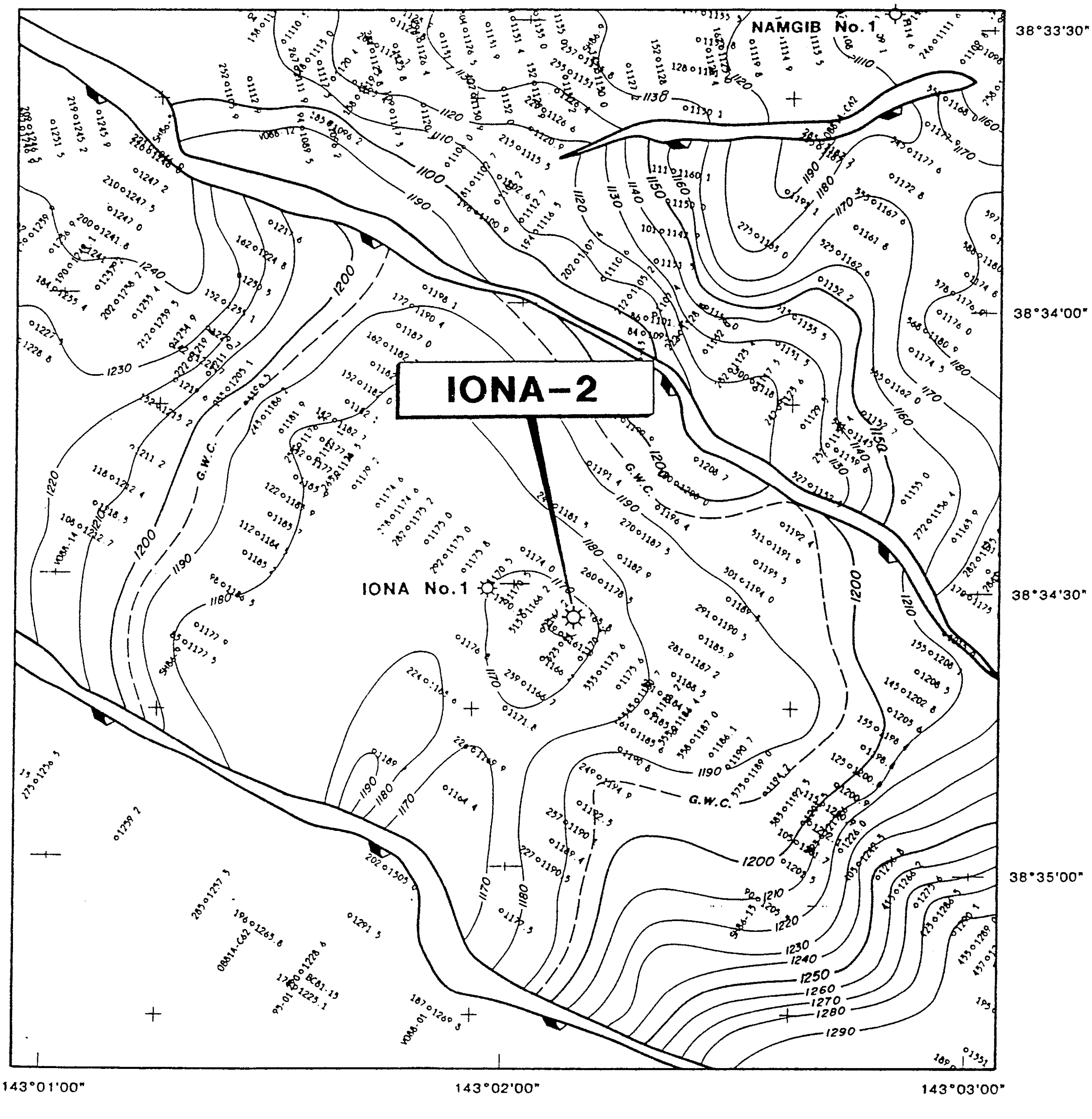
TIME MAP (msTWT) (DATUM 150mSS)



OT.4721

FIGURE 9

TOP WAARRE UNIT C
DEPTH MAP (mSS)



OT.4722

FIGURE 10

CONCLUSIONS

CONCLUSION

4. CONCLUSIONS

4.1 OBJECTIVES *VERSUS* PERFORMANCE

From an engineering perspective the drilling and completion of Iona-2 fully met the set objectives. As shown on the Drilling Progress Chart (Figure 11), the well was completed in the anticipated time, after having reached the prognosed depth about two days early, but then taking almost that same time longer to be completed..

Also, (as shown in Figure 12) the directional drilling was successful in steering the hole towards the desired subsurface location, with the actual bottom hole location being only 11.3 metres southeast of the proposed location. More importantly, the actual top of the Waarre Formation Unit C primary target was only 5.2 metres southeast of the proposed location.

As outlined in Section 3.7 and Figure 8, the prediction of formation tops was very successful, with all but one horizon coming in $\leq \pm 0.5\%$ of the prognosis. In terms of metres, the largest discrepancy was the top Waarre Formation Unit C being 6.8 metres high, which was a favourable outcome that contributed to the gas column being larger than expected.

The Waarre Formation Unit C primary reservoir target was not expected to differ greatly from the section drilled in Iona-1 (only 270 metres away). However, there were some significant differences, which provided a more beneficial outcome than had been anticipated;

(i) Unit C is 2.7 metres thicker in Iona-2; and
(ii) Unit C contains more clean sand, resulting in 27.6 metres of net pay and an average effective porosity of 23.8% (cf. 20.3 metres and 23.9% in Iona-1).

Also unexpected, logs and RFT pressures indicate that in the Waarre Unit B sand there is an additional (and separate) gas column with 5.0 metres of net pay and an average effective porosity of 23.1%.

Thus, Iona-2 has been found to contain significantly more gas-filled reservoir than was predicted based on Iona-1, and has therefore surpassed its main technical and commercial objectives.

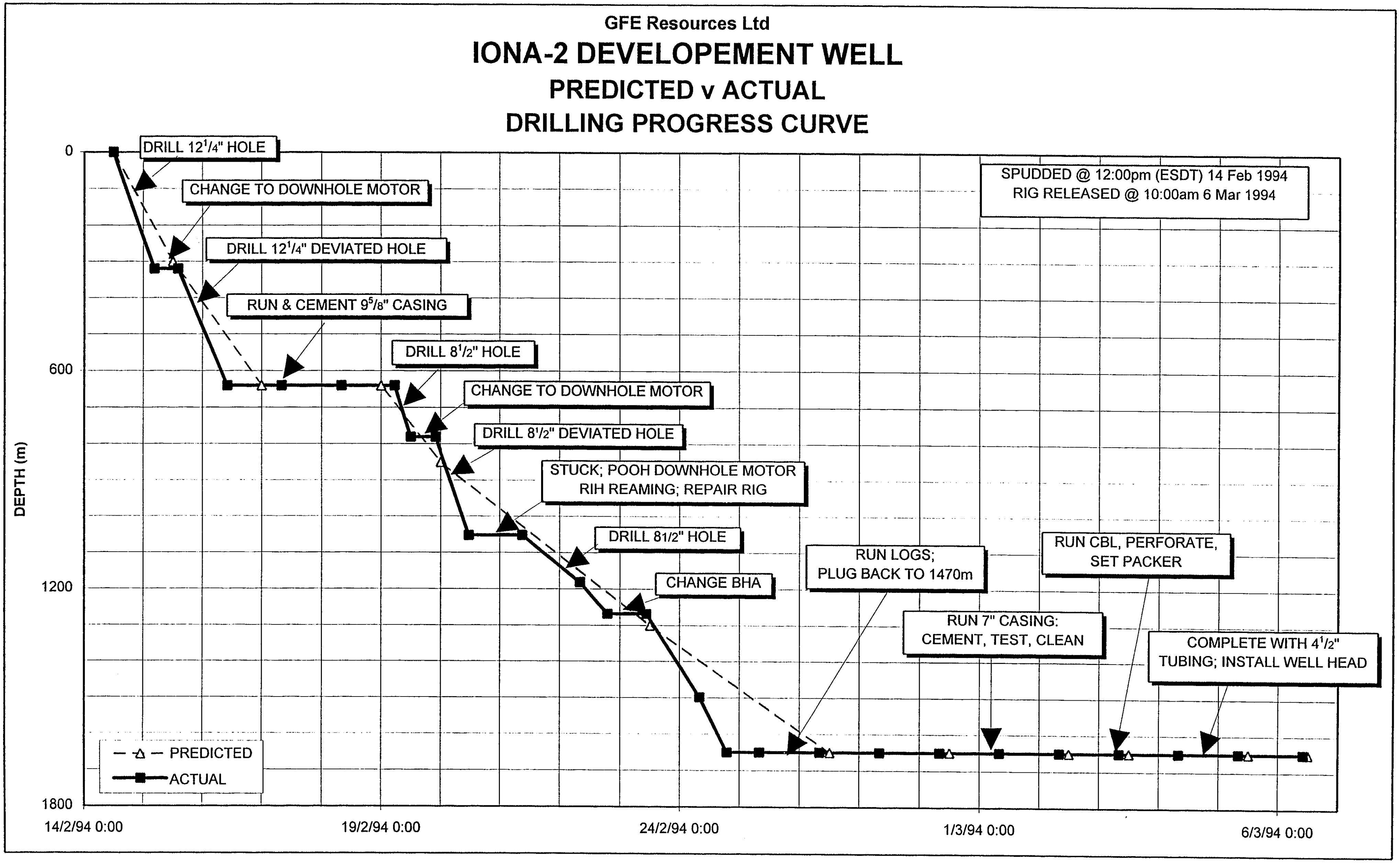

GFE Resources Ltd
IONA-2 DEVELOPEMENT WELL
PREDICTED v ACTUAL
DRILLING PROGRESS CURVE
DEPTH (m)
0
600
1200
1800
14/2/94 0:00
19/2/94 0:00
24/2/94 0:00
1/3/94 0:00
6/3/94 0:00
PREDICTED
ACTUAL
SPUDDED @ 12:00pm (ESDT) 14 Feb 1994
RIG RELEASED @ 10:00am 6 Mar 1994
DRILL 12 1/4" HOLE
CHANGE TO DOWNHOLE MOTOR
DRILL 12 1/4" DEVIATED HOLE
RUN & CEMENT 9 5/8" CASING
DRILL 8 1/2" HOLE
CHANGE TO DOWNHOLE MOTOR
DRILL 8 1/2" DEVIATED HOLE
STUCK; POOH DOWNHOLE MOTOR
RIH REAMING; REPAIR RIG
DRILL 81/2" HOLE
CHANGE BHA
RUN LOGS;
PLUG BACK TO 1470m
RUN 7" CASING:
CEMENT, TEST, CLEAN
RUN CBL, PERFORATE,
SET PACKER
COMPLETE WITH 4 1/2"
TUBING; INSTALL WELL HEAD

FIGURE 11

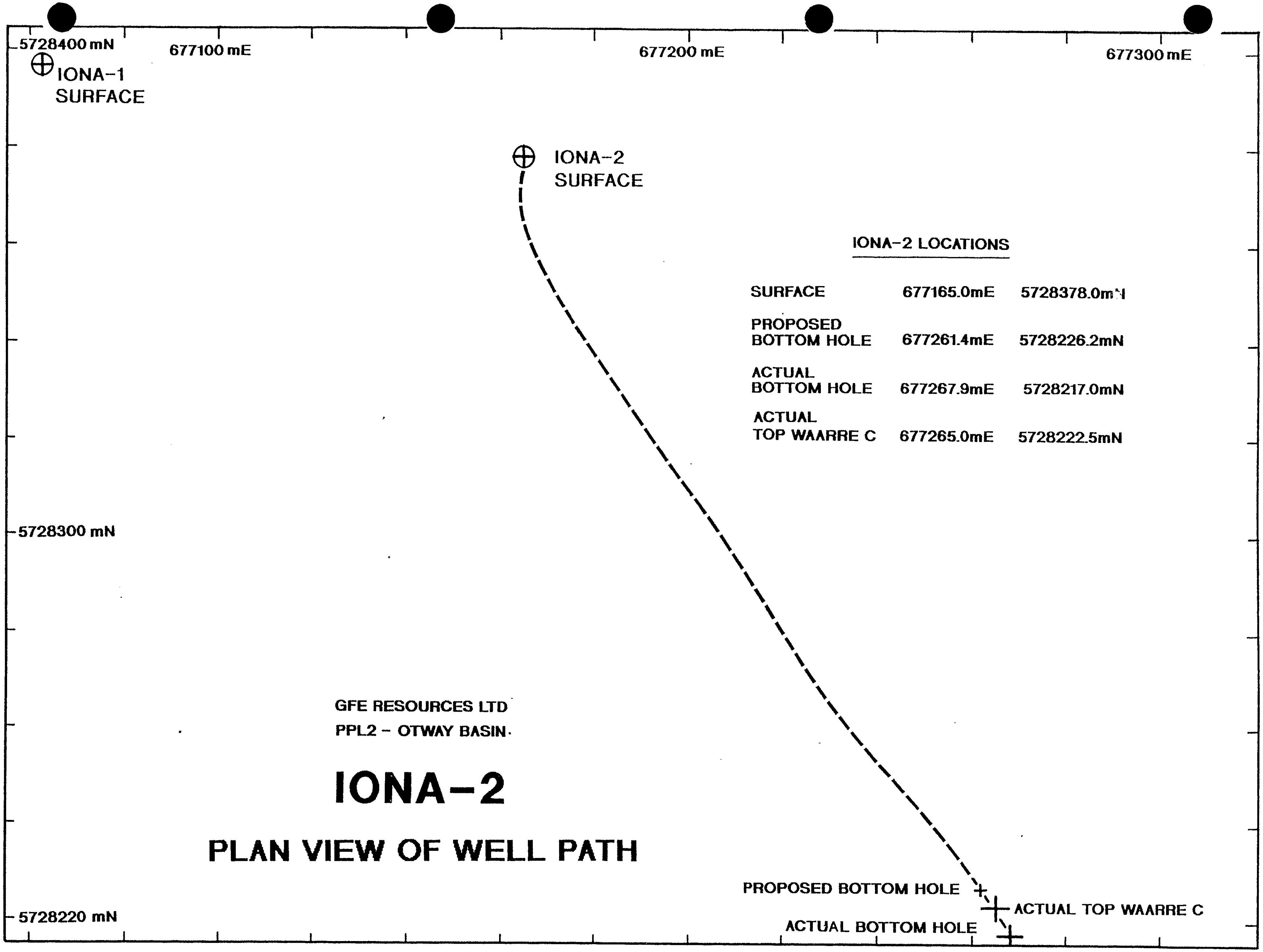


FIGURE 12
OT.4741

One objective which could be regarded as not being completely fulfilled was the investigation of the Eumeralla Formation. Mud gas readings and fluorescence observed in sands at the top of the drilled Eumeralla Formation section were of considerable interest. However, in not wanting to jeopardise the main objective of Iona-2 (to be completed as a Waarre Formation gas producer) no Drill Stem Test (DST) was conducted. Although a DST would have been the most definitive means of evaluating the Eumeralla Formation's prospectivity at this location, the inability to obtain any indication of significant permeability with the RFT (despite eight attempts) and the conclusion from log analysis that the zone was water wet and has generally low effective porosity (also supported by SWC petrography) suggests that a DST may not have been worthwhile. However, if another well is drilled on the Iona structure, a DST should be considered for the Eumeralla Formation.

4.2 CONTRIBUTION TO GEOLOGICAL KNOWLEDGE AND HYDROCARBON PROSPECTIVITY

Having been drilled as a development well, there was no great expectation that Iona-2 would significantly alter or add to the knowledge gained from the Iona-1 discovery well. It has instead mainly supported (and provided additional information for) the results from Iona-1.

Some aspects which have gained greater emphasis from Iona-2 are:

- facies variation within the Waarre Formation. While lateral variation in thickness and sand content of units in the Waarre Formation is clearly evident in many wells, it is interesting to note the small but significant differences between the Iona-1 and Iona-2 sections (which are only 270 metres apart), especially the thicker sand in Unit C in Iona-2, which yields a much thicker net pay than Iona-1.

- the gas column in the Unit B sand. This sand is below the Gas/Water Contact and Lowest Known Gas determined in Iona-1, and thus was not expected to contain gas in Iona-2. As well as adding 5.0 metres to the total net pay, it is noteworthy because the RFT data suggests it is not in direct communication with the main pay interval, and therefore is an example of isolated, stacked reservoirs in the Waarre Formation.

- hydrocarbon shows in the Eumeralla Formation. Mud gas and fluorescence were both observed more commonly and at higher levels in Iona-2 than in Iona-1.

Although not fully tested in Iona-2, these shows suggest the Eumeralla Formation in this area is prospective.

- more detailed organic geochemistry. In addition to gas chromatography of extracted hydrocarbons (as was done in Iona-1) one Waarre and one Eumeralla sample were analysed by GC-MS. The results indicated the samples were virtually identical, fully mature oil sourced from terrestrial (coaly) organic matter.

- palynological work suggests that all Sherbrook Group samples are from marine environments, while all Eumeralla Formation samples are from non-marine environments.

- a water sample obtained by RFT from the Waarre Formation Unit B has provided a R_w of 0.34 ohm.m at 25°C, but this is thought to be at least partially diluted with filtrate.

APPENDIX 1

APPENDIX 1

GFE RESOURCES LTD

APPENDIX 1

RIG SPECIFICATIONS

IONA-2

INVENTORY - RIG #11

CARRIER	Cooper LTO 750 Carrier with triple front and rear axles 54000lb front and 70000lb rear. All necessary highway equipment. Unit levelled with hydraulic jacks when stationery.
SUBSTRUCTURE	17' floor height - 14' below table beams with plates in base.
DRAWWORKS	Cooper 750 H.P. Drawworks. 42" x 12" main drum with Fawick 28VC 1000 clutch and 3000 metres $^9/_{16}$" sandline. Driven by 2 each Cat D3406TA Diesel Engines.
ROTARY TABLE	National Rotary Table Model C-175
DERRICK	Cooper Derrick Model 118-365. Ground height 118'. Maximum rated static hook load 350000 lbs with 10 lines. Mast raised, lowered and telescoped hydraulically.
CROWN BLOCK	Cooper Crown Block with 4 working sheaves. Fast line sheave and dead line sheave. All grooved for 1- $^1/_8$" line. Sandline sheave grooved for $^9/_{16}$" line.
HOOK BLOCK	National Hook Block Model 435 G-175. 175 ton capacity. 4-35" sheaves grooved for 1-$^1/_8$" line.
SWIVEL	P-200 National.
KELLY SPINNER	Foster Model K-77
SLUSH PUMPS	No. 1: National 8-P-80 Slush Pump. 6$^1/_4$" x 8$^1/_2$" Triplex single acting driven by Cat. D398TA Diesel Engine. No. 2: National 7-P-50 Slush Pump driven by Cat D379TA Diesel Engine.
PULSATION DAMPENER	1 each Hydril Pulsation Dampener type K20-3000.
MUD SYSTEM	2 x 300 bbl tanks incorporating 80 bbl pill tank and 40 bbl trip tank.
SHAKERS	Triton NNF Screening Machine (Linear Motion).
DEGASSER	Drilco Atmosheric Degasser Standard Pit. 7$^1/_2$ H.P. 60 Hz 230v.
DESANDER	Demco Model 122. Two, 12" cone with Warman 6" x 4" Centrifugal pump driven by 50 H.P. Electric Motor.

DESILTER	Pioneer Economaster Model T12-E4. 12 x 4" cones with Warman 6" x 4" Centrifugal pump, driven by a 50 H.P. Electric Motor.
MUD MIXING PUMP	Warman 6" x 4" Centrifugal pump driven by a 50 H.P. Electric Motor.
MUD AGITATORS	4 only Brandt Mud Agitator Model MA 7.5.
B.O.P'S & ACCUMULATOR	10" x 3000 P.S.I. Shaffer Double Gate B.O.P. with $2^3/_8$", $2^7/_8$", $3^1/_2$", $4^1/_2$", $5^1/_2$", 7" and Blind. 10" x 3000 P.S.I. Hydril GK Annular B.O.P. Koomey B.O.P. Control Unit. Accumulator Unit Model 100-11S.
CHOKE MANIFOLD	Cameron 5000 psi.
SPOOL	10" x 3000 x 10" x 3000 Flanged Drilling Spool with 3" x 3000 flanged choke and kill outlets.
INSTRUMENTATION	Martin-Decker 6 pen Rcord-O-Graph Martin-Decker Weight Indicator Type F.S. Martin-Decker Mud Pressure Gauge Martin-Decker Rotary R.P.M. Indicator Martin-Decker Stroke Indicator (2 off) Martin-Decker Rota Torque Indicator Martin-Decker Tong Torque Indicator Martin-Decker Mud Flow Sensor Martin-Decker Mud Flow Fill System Martin-Decker Mud Volume Totaliser (M.V.T.)
AUTOMATIC DRILLER	Satellite Automatic Driller Model SA100-50-1500.
WIRELINE STRIPPER	Guiberson Oil Saver Type H-4.
SURVEY UNIT	Totco 8 Deg Recorder.
MUD LAB	Baroid Rig Laboratory Model 821.
KELLY	$5^1/_4$" HEX Kelly. $2^{13}/_{16}$" I.D. x 40' long with $6^5/_8$" API Reg. L.H. Box up 4" I.F. Pin down.
UPPER KELLY VALVE	Upper Kelly Cock. 10000 test $6^5/_8$" API Reg. L.H. Connections.
LOWER KELLY VALVE	Hydril Kelly Guard. $4^1/_4$" - 10000 P.S.I. 4" I.F. Pin and Box.
KELLY DRIVE BUSHING	Varco Type 4 KRS Kelly Drive Bushing.
DRILL PIPE	7000' Drill Pipe $4^1/_2$" O.D. 16.60 lb. Grade E Range 2 with 4" I.F. x 18 degree taper tool joints.
DRILL COLLARS	20 each Drill Collars $6^1/_4$" O.D. slick $2^{13}/_{16}$" I.D. x 30' long with $4^1/_2$" XH pin and box connections.

FISHING TOOLS	To suit pipe, collars and tubing.
SUBSTITUTES	To suit drill string.
HANDLING TOOLS	Farr Hydraulic Power Tongs, $13^3/_8$" Varco SSW-10 spinning wrench. Manual tongs, elevators and slips to handle pipe, collars, casing and tubing.
WELDING EQUIPMENT	Lincoln Electric Welder Model 400AS.
AIR COMPRESSORS	Sullair compressor Package Model 10-30.
AC GENERATOR	2 each Caterpillar 3408TA AC Generator model SR-4. 1800 rpm 60 hz 275 kw.
FUEL TANKS	2 each 10,000 litre - Skid Mounted.
WATER TANK	400 bbl tank with two Warman 3 x 2 pumps driven by 24 hp electric motors
PIPE RACKS	5 sets 30" in length
CATWALKS	2 piece Catwalk drill pipe construction 42" height.
RADIO	Codan Mobile Transceiver.
TRANSPORTATION	International 530 Payloader. Toyota 4 x 4 Pickup. Toyota 4 x 4 Crew Vehicle.
RIG ACCOMMODATION	2 Skid Mounted Toolpusher/Company Man Units.

CAMP

1- Camp Generator House 31' long x 10' wide skid mounted complete with 2 -3304 T 80 Kw, 50 Hz, 200 - 400 volt generators, camp distribution panel. 6,794 litres fuel storage, 12,000 litres fresh water storage and 24,000 litres shower water storage.

1 Kitchen/Dining Room	40' x 10' x 10'
1 Recreation Room	40' x 10' x 10'
1 Ablution/Laundry	40' x 10' x 10'
3 12 Man Bunkhouses	40' x 10' x 10'
1 Cooler/Freezer	20' x 8' x 8'

APPENDIX 2

GFE RESOURCES LTD

APPENDIX 2

DRILLING FLUID RECAP

IONA-2

G.F.E. RESOURCES LTD
DRILLING FLUID RECAP
IONA-2
PPL 2, OTWAY BASIN
VICTORIA

Prepared by : A. Searle / M. Olejniczak

Date : March 1994

TABLE OF CONTENTS

WELL SUMMARY

Operator	:	G.F.E. Resources Ltd
Well Name	:	Iona-2
Average Angle	:	Deviated to 19°, then dropped to vertical
Location	:	PPL 2, Otway Basin, Victoria
Contractor	:	Century Drilling
Rig	:	Rig 11
Rig On Location	:	13 Febuary 1994
Start Date	:	14 Febuary 1994
RKB Elevation	:	5.2 m
Total Depth	:	1650 m MD
Date Reached T.D	:	24 Febuary 1994
Total Days Drilling	:	11 Days
Rig Release	:	5 March 1994
Total Days On Well	:	21 Days

Drilling Fluid Type	**Interval**	**Hole Size**	**Cost (A$)**
AQUAGEL/CMC	16 - 640 m	12- 1/4"	$ 2,992.18
AQUAGEL/CMC to KCL/Polymer	640 - 1650 m	8-1/2"	$ 22,369.17
Mud Materials Charged To Drilling		**TOTAL**	$ 25,361.35

Engineer On Location From :	14/2/94 To 3/3/94	
Drilling Fluid Engineering :	18 Days @ $ 530/Day	$ 9,540.00
Total Cost Of Drilling Materials & Engineering		$ 34,901.35
Mud Materials Not Charged To Drilling		$ 5,171.40

Casing Program	:	20 " Conductor	@	16 m
	:	9-5/8"	@	631.1 m
	:	7" Production	@	1443.5 m

Drilling Supervisors : Ken Smith

Baroid Mud Engineers : Alan Searle, Manfred Olejniczak

INTRODUCTION

Iona-2 was spudded in on 14 Febuary using Century rig 11, drilling 12 -1/4" hole out of the surface conductor set at 16 m.

Water was used initially, with 1% KCl added at 125 m to inhibit dispersion through the Gellibrand Marl and reduce water consumption. From 320 m the system was converted to an AQUAGEL/CMC mud to provide hole stability through the sands of the Dilwyn Formation. The hole was also deviated from the vertical to a maximum of 19 degrees from this point. After reaching 640 m the 9-5/8" casing was run and cemented to 631.1 m.

This same AQUAGEL/CMC system was then continued in the 8-1/2" hole through the sands of the Paraate Formation down to 1000 m. The hole angle was allowed to gradually drop back towards the vertical from about 800 m reaching 8 degrees by 1000 m and 0.75 degrees by TD.

From 1000 m the mud was converted to a 3%KCl/CMC/DEXTRID system to provide increased inhibition and improved log separation through the lower part of the Sherbrook Group and into the Eumeralla Formation.

After reaching the 1650 m TD on 24 Febuary, the hole was successfully logged and completed with a 7" production string set at 1443.5 m.

The final cost of $25,361.35 for materials used for drilling, (not including cementing and completion) was 18% higher than programmed. The additional costs came from a higher polymer consumption than estimated in the 12-1/4" section. The actual dilution rates were close to that estimated.

G.F.E. RESOURCES LTD
IONA-2
PPL 2, OTWAY BASIN, VICTORIA

DISCUSSION BY INTERVAL

12 1/4" Hole : 16 m to 640 m (624 m drilled - 4 Days)
Port Campbell Limestone to Pebble Point Formations

Mud System : Native Clay converting to AQUAGEL/CMC from 320 m

1. DRILLING FLUID

Iona-2 was spudded using water, with native clays relied upon to provide viscosity while drilling ahead. The clays of the Gellibrand Marl formation were expected to be highly dispersive, requiring heavy dilution to control solids build up and viscosity increase. In fact, cuttings remained relatively firm and discrete down to 125 m.

Despite a low funnel viscosity of 30 secs/qt, and a yield point of 8 lb/100 ft^2, there was sufficient carrying capacity to lift cuttings in excess of 2" diameter and good hole cleaning was achieved. It was considered unnecessary to add Lime to flocculate the system, other than for one sack used just after drilling into the Gellibrand Marl.

As the depth increased, the marl cuttings became softer. At 125 m 1% KCl (by weight) was added to the system to minimise dispersion and reduce dilution requirements. This also flocculated the mud system, resulting in a funnel viscosity in the range of 40 secs/qt with a PV/YP ratio of 4/39. As drilling continued the KCl content was allowed to deplete to 0.4% by the time casing point was reached.

At the 320 m kick-off point a trip was made to pick up the directional drilling assembly. AQUAGEL/CMC-EHV premix was added to the system gradually reducing the filtrate through the sands of the Dilwyn Formation to 11.8 ml/30 mins by casing point. The addition of the CMC-EHV also deflocculated the system, reducing the Yield Point to the 10-14 lb/100 ft^2, and the funnel viscosity to 38 to 43 secs/qt.

Dilution was generally required for volume maintenance only. Solids build up resulted in the mud weight increasing to 9.0 ppg, where it stabilised while drilling the sands. While making wiper trips and reaming prior to running casing, the mud weight increased to a maximum of 9.3 ppg. No downhole losses were recorded at any time.

2. TYPICAL PROPERTIES

Depth	:	216	640	m
Mud weight	:	8.85	9.0	ppg
Viscosity	:	31	43	secs/qt
Plastic Viscosity	:	4	9	cPs
Yield point	:	39	12	lbs/100 ft^2
API Filtrate	:	N.C.	11.8	ml/30 min
Solids	:	3.5	4.3	%
M.B.C.	:	13	15	ppb equiv.
Chlorides	:	5400	740	mg/L
KCl	:	1.0	0.4	% wt soln

G.F.E. RESOURCES LTD
IONA-2
PPL 2, OTWAY BASIN, VICTORIA

3. HOLE CONDITIONS

No hole problems were experienced down to 125 m. Hole cleaning was good and cuttings load in the annulus was not a problem. From 125 to 151m, in the Gellibrand Marl, three singles were drilled particularly quickly. This resulted in the annulus becoming overloaded with clay solids. The flowline became blocked and a mud ring had to be circulated out, resulting in lost time. When drilling resumed the weight on bit was reduced to control the drilling rate and no further problems were encountered with the clays.

At 320 m a trip was made to pick up a directional drilling assembly. The trip out was trouble free, however, when running back in a bridge was reamed from 293 to 305 m. Drilling continued using the downhole motor without rotating pipe, while building and then maintaining hole angle at 18.5°.

At the 640 m casing point the hole was circulated clean, and a wiper run to surface. The hole was tight at 475 m and it was necessary to pump out one single. Continued pulling all the way out of the hole, with tight hole experienced over the interval 456 - 379 m.

The directional tools were laid out before running back in. The bit would not pass through the kick-off point at 320 m and tight hole had to be reamed from 320 - 351 m (Dilwyn Formation). Further tight sections were reamed from 408 -529 m (Dilwyn) and 609 -640 m (Pebble Point). There was only 3 m of fill on bottom.

After circulating out another wiper trip was made. This time only minimal drag was recorded, with 2 m of fill on bottom. The hole was again circulated and conditioned before pulling out to run casing.

The 9 5/8" casing was then run and cemented to 631.12 m, without problems. A 644 sx 2% bentonite lead slurry and a 162 sx 0.15% HR4 tail slurry were used. The cement was displaced with 159 bbls of water. Good cement returns were observed at surface.

4. SOLIDS CONTROL

The Triton shale shaker was run throughout the interval with 50 mesh screens. Heavy cuttings loads, particularly through the Dilwyn, dictated this screen mesh size. Fitting finer screens would have resulted in mud losses over the shaker.

Both the desander and desilter were run continuously while drilling. The sand content in the suction was successfully controlled to less than 0.25% while drilling, increasing to 1% while reaming tight hole at TD.

The addition of 1% KCl at 125 m reduced clay dispersion, so that the cuttings remained quite firm and discrete and were easily removed by the solids control equipment.

The sands of the Dilwyn Formation were coarse and, again, solids equipment was able to remove these without difficulty. Dilution was required for volume maintenance rather than solids control.

5. CONCLUSIONS AND RECOMMENDATIONS

- Very high penetration rates can be achieved through the Gellibrand Marl. However, the time lost cleaning out mud rings and flowline blockages tends to negate any advantage gained. Controlled drilling of the Gellibrand Marl prevents the occurrence of these problems and minimises any risk of packing off the hole.

- The one-off addition of 1% KCl by weight assisted in maintaining firm discrete cuttings through the Gellibrand Marl. Dilution requirements were reduced, with mud weight and solids content easier to control. This practice is recommended for future wells.

- The tight hole problems wiper tripping were most likely due to key-seating over the angle building interval.

- The mud used in this interval produced a reasonable quality hole at minimal cost. It is recommended if drilling other wells in the area.

to drilling into the Waare formation. This mud weight was then maintained to TD.

2. TYPICAL PROPERTIES

		GEL/CMC	KCl/Polymer	
Mud weight	:	8.8	8-9 to 9.4	ppg
Viscosity	:	35 to 38	37 to 42	sec/qt
Plastic Vis	:	5 to 6	11 to 15	cP
Yield point	:	9 to10	8 to 12	lb/100 ft^2
API Filtrate	:	25 to14	6.8 to 6.2	ml/30 min
Solids	:	3.4	3.6 to 6.2	% Vol
M.B.C.	:	11to 8	10 to 15	ppb equiv.
pH	:	11 to 9	9.0 to 10	
Chlorides	:	1200	13,500 to 16,200	mg/l
KCl	:		2.7 to 3.1	% wt soln

2. HOLE CONDITIONS

After drilling out from casing, 5 m of new hole was drilled and a leak-off test performed, giving an equivalent mud weight of 10.1 ppg.

A conventional drilling assembly had been used to drill out from casing, however, this would not drop angle as required while drilling ahead. At 781m a trip was made to pick up the downhole motor and MWD to achieve better directional control.

Drilled through the Paaratte and into the Skull Creek Mudstone with no hole problems. At 1052 m, while making a connection at 1039 m, the drill collars became differentially stuck above the jars. Initial attempts to work the pipe free were unsuccessful, including spotting 40 bbl of water above the jars. To further reduce hydrostatic pressure the entire annulus was displaced to water and the pipe came free. After displacing back to mud the hole was circulated before pulling out to lay out the directional tools.

While running back in with a new assembly, a bridge was encountered at 1034 m. While reaming the interval 1024 - 1043 m the kelly hose blew out and it was necessary to pull back to the casing shoe for repairs. The bit was then run back in with no problems other than 8 m of fill on bottom.

Drilling continued with the mud weight allowed to increase naturally in preparation for drilling the Waare Formation. While taking a survey at 1162 m, in the Nullawaare Greensand, the pipe became differentially stuck again, but was pulled free with 137,000 lbs overpull. The mud weight at this time was 9.1 ppg.

Hole conditions were good for the remainder of the well, with the mud weight increased to the 9.3 to 9.4 ppg range. Trips run at 1286 m and at the 1650 m TD encountered only slight tight hole coming out and no problems going back to bottom. Schlumberger logs and RFT's were run without significant problems. The 7" production casing was run without problems but became differentially stuck while reciprocating at its setting depth, indicating differential sticking was still a problem.

3. SOLIDS CONTROL

Initially the shaker was fitted with 3x110 mesh screens. As sand blinding occurred through the Paaratte, the screens were changed to 2x110,1x50 and later to 110,84,50 mesh. This combination eliminated mud losses from the shakers and was retained for the remainder of the 8 1/2" interval.

The desander and desilter were run while drilling down to approximately 1150 m. The desilter was then shut off to allow the drill solids content to increase, raising the mud weight to 9.3+ ppg prior to the top of the Waare Formation.

After a trip at 1268 m, the mud weight rose to 9.4 ppg. The desilter was then run intermittently through the Waare, to maintain the mud weight at 9.3+ to 9.4 ppg. After drilling into the Eumeralla the mud weight began to increase and it became necessary to run the desilter continuously. The dilution rate was also increased to control the mud weight at 9.3 to 9.4 ppg.

4. CONCLUSIONS AND RECOMMENDATIONS

- The mud program recommended that AQUAGEL and CMC-EHV be added in a 15:1 ratio through the Paraate Formation. These two products work together well at this ratio to provide good viscosity and yield point with moderate filtration control. During the drilling of this section insufficient AQUAGEL was actually added. This resulted in the viscosity and yield point being a little less than programmed through the Paraate Formation. This may have been a contributing factor in the calliper log through this section being slightly worse than on the Iona-1 well. The need to maintain the AQUAGEL content will need to be stressed more for the next well.

- The drill pipe was differentially stuck at 1039 m, again temporarily stuck at 1181 m, and the 7" production casing also became stuck just prior to cementing. This showed that the hole was prone to differential sticking, most likely in the Paraate formation. Possible means of reducing this tendency would be to :
    - (i) Ensure a higher AQUAGEL content is maintained while drilling through the Paraate to provide better wall sealing.
    - (ii) Consider adding BARACARB 110 and BARACARB 35 (Crushed Limestone) as additional plugging agents through the Paraate.

- As mentioned above the large increase in viscosity and filtration that occurred when KCl additions began at 1000 m, may have been a factor in the pipe becoming differentially stuck at 1039 m. Extra care needs to be taken by the engineer to reduce the mud clay content and begin adding polymers to act as deflocullants before beginning the KCl additions. The KCl additions also need to start slowly so that the effects on the system are minimised. This approach will most likely result in a lower viscosity for some time, but this is preferable to an excessively flocculated system.

- During logging at TD the mud began to show some signs of bacterial degradation with a significant smell, a slowly worsening API Filtrate, and reducing viscosity. The DEXTRID used for filtration control is prone to bacterial attack. One can of BARACIDE bactericide was added at TD, but this was probably too late. I would recommend that BARACIDE additions begin as soon as DEXTRID is added.

- Mud costs for the interval were about 18% higher than programmed. The estimate may actually have been just a little too low for the interval, but programs are meant to give the engineer a target to aim for.

G.F.E. RESOURCES LTD
IONA-2
PPL 2, OTWAY BASIN, VICTORIA

Completion : 7" Production String to 1443.5 m (4 Days)
9.1 ppg NaCl Inhibited Brine

After Schlumberger logging was successfully completed a 60 sx cement plug was set at 1520 m. The top of the cement was tagged at 1471 m, and the 7" production string then run and cemented to 1443.5 m. Mud was used to displace the cement.

The mud tanks were then all dumped and cleaned. 320 bbls of 9.1 ppg NaCl brine inhibited with BARACOR-100 was mixed up for the completion fluid. In addition 40 bbls of high viscosity, low solids fluid was mixed in the pill tank using two sxs of XCD Polymer , for use as sweeps.

The casing was displaced to the 9.1 ppg inhibited brine after the first casing scraper run. Water was initially pumped to displace the mud until clean returns were observed at the shakers. A 15 bbl high viscosity sweep was then pumped chased with the completion brine, with the returning sweep dumped at surface.

After perforating the casing, a second casing scraper was run with a second 15 bbl high viscosity sweep pumped and dumped when returned to surface. At this stage the mud engineer was released. The rest of the completion was then run without any further circulation. As the formation was taking about 1 bbl/hr through the perforations, additional 9.1 ppg NaCl brine was mixed by the rig crew following instructions left behind by the Baroid engineer to maintain the casing volume.

G.F.E. RESOURCES LTD
IONA-2
PPL 2, OTWAY BASIN, VICTORIA

APPENDIX 1.

FORMATION TOPS (From Schlumberger Logs)

FORMATION	DEPTH m	PROGNOSED DEPTH m
Paaratte	672	659.5
Skull Creek Mudstone	1032	1004.5
Nullawaare Greensand	1163	1136.5
Belfast Mudstone	1258	1236.5
Waare Sandstone	1297	1274.5
Eumeralla	1400	1380.5
T.D.	1650	1625

G.F.E. RESOURCES LTD
IONA-2
PPL 2, OTWAY BASIN, VICTORIA

APPENDIX 2.

8-1/2" HOLE CALLIPER DATA (Averaged every 25 m)

IONA-2 COMPARED WITH IONA-1

DEPTH	IONA-2 HOLE SIZE ins	IONA-1 HOLE SIZE ins
650	9-1/4	8-3/4
675	10-1/2	8-3/4
700	10-1/4	8-1/2
725	10-1/4	8-1/2
750	12	8-1/2
775	15	8-1/2
800	11	8-1/2
825	9-1/4	8-1/2
850	9-1/4	8-1/2
875	9-1/4	8-1/2
900	9-1/4	8-1/2
925	8-3/4	8-1/2
950	8-1/2	8-1/2
975	8-1/2	8-1/2
1000	8-3/4	8-1/2
1025	8-3/4	8-1/2
1050	8-1/2	8-1/2
1075	8-3/4	8-1/2
1100	9	8-1/2
1125	9-3/4	8-3/4
1150	9-1/2	8-1/2
1175	9-1/4	8-1/2
1200	8-3/4	8-1/2
1225	9-1/4	9
1250	9-1/2	10
1275	9-3/4	8-1/2
1300	9	8-3/4
1325	8-1/2	8-1/2
1350	8-1/2	8-1/2
1375	8-1/2	8-1/2
1400	8-1/2	8-1/2
1425	8-1/2	8-1/2
1450	9	8-1/2
1475	9	8-3/4
1500	8-3/4	
1525	8-3/4	
1575	8-1/2	
1600	8-1/2	
1625	8-3/4	
1650	8-1/2	

Baroid Australia Pty Ltd

DAILY ACTIVITY SUMMARY

COMPANY G.F.E. RESOURCES LTD.
WELL IONA - 2
LOCATION OTWAY BASIN, VICTORIA
CONT/RIG CENTURY DRILLING / RIG - 11

1994	ACTIVITY
14-Feb	Complete rigging up. Rig inspection by Mines Dept. Spud in at 12:00 hours. Drilled 12 1/4" hole from 16 - 232m, taking surveys approx every 35m. High ROP through Gelibrand Marl caused annulus to load up with cuttings, resulted in mud rings and blocked flowline at 151m; circulated hole clean, reduced weight on bit to lower ROP from 151m.
15-Feb	Drilled to kick-off point at 320m, taking surveys every 35m. Circulated bottoms up. POOH. Changed bit and made up kick-off assembly with downhole motor and MWD tool; 1.15 deg bent angle in motor. RIH, hit bridge at 293m. Reamed to 305m, ran to bottom. Criculated and oriented motor. Drilled to 500m building angle; no rotation.
16-Feb	Drilled 12 1/4" hole from 500 -640m, buiilding angle and then maint- aining at 18.5 deg. Reached casing point at 640m, circulated bottoms up. POOH, tight spot at 475m, pick up kelly and pumped out 1 single. Continued pulling out with tight hole from 456 - 379m. Service down- hole assembly, laid out directional tools. Made up BHA for clean out trip. RIH, unable to get through kickoff point. Reamed from 320 - 351, 408 - 524 and 609 -640m; recorded 3m of fill. Circulate hole clean.
17-Feb	Wiper trip to top of 8" drill collars; slight drag, 2m of fill, washed 2m to bottom. Circulated hole clean. POOH, cut drill line, laid out 8" drill collars, stabilisers and directional tools. Rigged up and ran 9 5/8" casing. Rigged up Howco surface equipment. Circulated casing. Cemented 9 5/8" casing; 10 bbls water, 644 sx 2% gel lead slurry, 162 sx 0.15% HR4 tail slurry. Released plug and displaced with 159 bbls water. Wait on cement.
18-Feb	Wait on cement. Install Braden head and nipple up BOP's. Pressure test BOP's with HOWCO. Made up bit and BHA, RIH to drill out.
19-Feb	Continue RIH, tagged cement at 623.8m. Pressure test kelly cocks, stabbing valve and flare line. Drilled float and shoe, made 5m of new hole. Circulate to condition mud and clean hole. Ran F.I.T. Circulated, repeat F.I.T. Drilled 8 1/2" hole from 645 - 781m, taking single shot surveys every 38m. Building angle, circulated hole clean. POOH, no tight hole recorded. Pick up downhole motor and MWD. RIH, no fill. Orientated motor and then drilled 8 1/2" hole from 781 - 823m.
20-Feb	Drilled 8 1/2" directional hole from 823 - 1052m, surveys run with MWD tool. Became differentially stuck while making connection at 1039m; collars stuck above jars. Worked stuck pipe, spotted 40 bbls water above jars, unsucccesfully. Displaced annulus to water to reduce hydrostatic, pulled free. Displaced hole back to mud while working pipe. POOH, laid out downhole motor and MWD. Made up new BHA and RIH.
21-Feb	Continued RIH. Hit bridge at 1034m, ream/wash 1024 - 1043m, one jet partially blocked. Blew kelly hose while reaming. POOH to casing shoe. Replaced kelly hose. RIH, washed 8m to bottom, no fill. Drilled 8 1/2" hole from 1080 - 1133m; survey at 1096m.
22-Feb	Drilled 8 1/2" hole from 1133 - 1181m. Circulate and survey at 1165m. Pipe became stuck while taking survey. Worked differentially stuck pipe, pulling 137000 lbs over, before rotating free. Worked pipe and circulated hole clean. Continued drilling from 1165 - 1268m. Circ- ulated bottoms up. Short trip from 1268 - 900m, no fill. Circulated bottoms up. Survey, pump pill and circulate. Survey again. POOH.
23-Feb	POOH for bit and BHA change. Laid out 6 x 6 1/4" drill collars. Made up new BHA. RIH to 1245m, wash/ream to 1268m, no fill. Drilled 8 1/2" hole from 1268 - 1404m. Survey at 1345 m.

Baroid Australia Pty Ltd

DAILY ACTIVITY SUMMARY

COMPANY G.F.E. RESOURCES LTD.
WELL IONA - 2
LOCATION OTWAY BASIN, VICTORIA
CONT/RIG CENTURY DRILLING / RIG - 11

1994	ACTIVITY
24-Feb	Drilled to 1650 m TD. Circulated bottoms up. Began running wiper trip back to casing shoe.
25-Feb	Continued wiper trip. Hole only slightly tight coming out at 1050 m. Ran back to bottom, precautionary washing and reaming last 5 m. Circulated out, pumped slug and strapped out with multi-shot survey. Ran Schlumberger logs.
26-Feb	Continued logging. Rigged down Schlumberger. RIH with BHA. Slipped line at shoe. Continued RIH. Precautionary washed and reamed last 21 m to bottom. Circulated and conditioned mud for 2 hrs. POH and continued logging with Schlumbereger.
27-Feb	Completed Logging. Rigged down Schlumberger. Ran BOP test. RIH open ended to 1520 m and set 60 sx cement plug. Pulled back 5 stands and flushed pipe. POH, picked up bit and BHA. RIH and tagged cement plug at 1471 m. Pulled back to 1457 m and began circulating hole clean.
28-Feb	Continued circulating hole clean till 01:00 hrs. POH, laying out pipe. Rigged up and ran 7" production casing to 1449 m. Rigged up cement head and began circulating casing.
01-Mar	Cemented 7" casing displacing with mud. After waiting on cement, lifted BOP off and cut casing. Replaced BOP and pressure tested. Unable to test seal assembly. Lifted BOP and removed "B" section. Wait on casing spear to reset casing slips.
02-Mar	Ran casing scraper. Displaced mud from casing with water. Pumped 15 bbl hi-vis XCD Polymer sweep. Displaced hole to inhibited 9.1 ppg NaCl brine.
03-Mar	POH with casing scraper. Rigged up Schlumberger. Ran cement bond log. Perforated casing. Rigged down Schlumberger. Ran in casing scraper, Pumped 15 bbl hi-vis sweep and circulated casing clean with brine.
04-Mar	

RECAP TABLES

Baroid Australia Pty Ltd

MATERIAL RECAP

COMPANY G.F.E. RESOURCES LTD.
WELL IONA – 2
LOCATION OTWAY BASIN, VICTORIA

HOLE SIZE 12 1/4"
CONTRACTOR/RIG CENTURY DRILLING / RIG – 11
MUD TYPE AQUAGEL/CMC

INTERVAL TO (m)	640	DRILLING DAYS	4	COST/DAY	A$748.05
FROM (m)	16	ROTATING HRS	16	COST/m	A$4.80
DRILLED (m)	624			COST/bbl	A$2.45
DATE	17–Feb–94			CONSUMPTION FACTOR (bbl/m)	1.96

MATERIAL	UNIT SIZE	UNIT COST	QUANTITY EST	QUANTITY ACT	CONC (lb/bbl) EST	CONC (lb/bbl) ACT	TOTAL COSTS ESTIMATE	TOTAL COSTS ACTUAL
AQUAGEL,sx	25 kg	14.33	226	52	9.8	2.3	3,238.58	745.16
Caustic Soda	25 kg	32.43	11	10	0.5	0.5	356.73	324.30
CMC–EHV	25 kg	106.61	14	12	0.6	0.5	1,492.54	1,279.32
KCL,Tech(sx)	25 kg	14.44		10		0.5		144.40
KCL,Tech(sx)	50 kg	28.88		17		1.5		490.96
Lime	25 kg	8.04	7	1	0.3	0.0	56.28	8.04
COST LESS BARITE :							A$5,144.13	A$2,992.18
COST WITH BARITE :							A$5,144.13	A$2,992.18

VOLUMES

		EST	ACT
Sea W.	bbl		
Drill W.	bbl	1250	1213
other	bbl		
other	bbl		
Chemical	bbl	16.9	9
Salvaged Mud	bbl		
TOTAL MUD USED	bbl	1267	1222

COMMENTS Commenced drilling from 16m with water, relying on native clay from Gellibrand Marl to build viscosity. Lime was added as required to flocculate the system and increase viscosity. At approximately 125m, KCl was addded to give 1% by weight and improve cuttings quality, this was allowed to deplete as drilling progressed. Premix additions were commenced from 320m and the mud system converted to AQUAGEL/CMC–EHV while building angle

The actual mud cost was approximately 60% of that programmed, due to lower dilution requirements and a significantly lower AQUAGEL useage.

Baroid Australia Pty Ltd

MATERIAL RECAP

COMPANY G.F.E. RESOURCES LTD.
WELL IONA – 2
LOCATION OTWAY BASIN, VICTORIA

HOLE SIZE 8 1/2"
CONTRACTOR/RIG CENTURY DRILLING / RIG – 11
MUD TYPE AQUAGEL/CMC to 3% KCl/Polymer

INTERVAL TO (m) 1650
FROM (m) 640
DRILLED (m) 1010
DATE 28–Feb–94

DRILLING DAYS 11
ROTATING HRS 82

COST/DAY A$2,033.56
COST/m A$22.15
COST/bbl A$10.51
CONSUMPTION FACTOR (bbl/m) 2.11

MATERIAL	UNIT SIZE	UNIT COST	QUANTITY EST	QUANTITY ACT	CONC (lb/bbl) EST	CONC (lb/bbl) ACT	TOTAL COSTS ESTIMATE	TOTAL COSTS ACTUAL
Barite,sx	50 kg	15.96		36		1.9		574.56
Barite,sx	25 kg	7.98	248	82	5.9	2.1	1,979.04	654.36
AQUAGEL.sx	25 kg	14.33	142	232	3.4	6.0	2,034.86	3,324.56
BARACIDE	25 kg	549.92	1	1	0.0	0.0	549.92	549.92
Caustic Soda	25 kg	32.43	18	21	0.4	0.5	583.74	681.03
CMC–EHV	25 kg	106.61	35	59	0.8	1.5	3,731.35	6,289.99
DEXTRID LT	50 lb	59.88	71	80	1.5	1.9	4,251.48	4,790.40
KCL,Tech(sx)	25 kg	14.44	213	269	5.1	7.0	3,075.72	3,884.36
Lime	25 kg	8.04	4	2	0.1	0.1	32.16	16.08
Soda Ash	25 kg	16.15	7	2	0.2	0.1	113.05	32.30
BARACOR 129	25 kg	64.96		2		0.1		129.92
CONDET	208 lt	417.25		1		0.2		417.25
PAC–R	50 lb	170.74		6		0.1		1,024.44

	ESTIMATE	ACTUAL
COST LESS BARITE :	A$14,372.28	A$21,140.25
COST WITH BARITE :	A$16,351.32	A$22,369.17

VOLUMES		EST	ACT
Sea W.	bbl		
Drill W.	bbl	1922	1700
other	bbl		
other	bbl		
Chemical	bbl	47.3	59
Salvaged Mud	bbl	350	370
TOTAL MUD USED	bbl	2319	2129

COMMENTS
370 bbl of AQUAGEL/CMC mud carried over from previous 12–1/4" interval.

Baroid Australia Pty Ltd

MATERIAL RECAP
NON-DRILLING

COMPANY G.F.E. RESOURCES LTD.
WELL IONA - 2
LOCATION OTWAY BASIN, VICTORIA

HOLE SIZE
CONTRACTOR/RIG CENTURY DRILLING / RIG - 11
USED FOR Cementing & Completion

MATERIAL	UNIT SIZE	UNIT COST	QUANTITY EST	QUANTITY ACT	CONC (lb/bbl) EST	CONC (lb/bbl) ACT	TOTAL COSTS ESTIMATE	TOTAL COSTS ACTUAL
AQUAGEL,sx	25 kg	14.33	40	20			573.20	286.60
BARACOR-100	208 lt	583.35	1	1			583.35	583.35
SALT	25 kg	7.71	240	387			1,850.40	2,983.77
XCD Polymer	25 kg	499.14	1	2			499.14	998.28
BARAFILM 415	25 lt	159.7		2				319.40
					COST LESS BARITE :		A$3,506.09	A$5,171.40
					COST WITH BARITE :		A$3,506.09	A$5,171.40

VOLUMES		EST	ACT
Sea W.	**bbl**		
Drill W.	**bbl**	320	523
other	**bbl**		
other	**bbl**		
Chemical	**bbl**	21.3	31
Salvaged Mud	**bbl**		
TOTAL MUD USED	**bbl**	341	554

COMMENTS
20 sxs AQUAGEL used in cement mix water for 9-5/8" casing.
2 sxs XCD Polymer used to mix Hi-Vis sweeps used to clean 7" production casing after casing scraper runs.
387 sxs salt and 1 drum of BARACOR-100 mixed in 523 bbls water to make up completion brine.
2 cans of BARAFILM 415 used to coat drill pipe as anti-corrosion measure, while laying out pipe.

Baroid Australia Pty Ltd

MATERIAL SUMMARY

COMPANY G.F.E. RESOURCES LTD.
WELL IONA – 2

LOCATION OTWAY BASIN, VICTORIA
CONTRACTOR/RIG CENTURY DRILLING / RIG – 11

INTERVAL MUD TYPES	SIZE	m	DAYS	HOURS
AQUAGEL/CMC	12 1/4"	624	4	16
AQUAGEL/CMC to 3% KCl/Polyme	8 1/2"	1010	11	82
TOTALS		1634	15	98

WELL DURATION
FROM : 14–Feb–94
TO : 04–Mar–94

COST/DAY	A$1,690.76
COST/m	A$15.52
COST/bbl	A$8.51
CONSUMPTION FACTOR (bbl/m)	1.82

RECAP BY A. Searle, M. Olejniczak

MATERIAL	UNIT SIZE	UNIT COST	QUANTITY ESTIMATE	QUANTITY ACTUAL	TOTAL COSTS ESTIMATE	TOTAL COSTS ACTUAL
Barite,sx	50 kg	15.96		36		574.56
Barite,sx	25 kg	7.98	248	82	1,979.04	654.36
AQUAGEL,sx	25 kg	14.33	368	284	5,273.44	4,069.72
BARACIDE	25 kg	549.92	1	1	549.92	549.92
Caustic Soda	25 kg	32.43	29	31	940.47	1,005.33
CMC–EHV	25 kg	106.61	49	71	5,223.89	7,569.31
DEXTRID LT	50 lb	59.88	71	80	4,251.48	4,790.40
KCL,Tech(sx)	25 kg	14.44	213	279	3,075.72	4,028.76
KCL,Tech(sx)	50 kg	28.88		17		490.96
Lime	25 kg	8.04	11	3	88.44	24.12
Soda Ash	25 kg	16.15	7	2	113.05	32.30
BARACOR 129	25 kg	64.96		2		129.92
CONDET	208 lt	417.25		1		417.25
PAC–R	50 lb	170.74		6		1,024.44

	ESTIMATE	ACTUAL
COST LESS BARITE :	A$19,516.41	A$24,132.43
COST WITH BARITE :	A$21,495.45	A$25,361.35

VOLUMES		ESTIMATE	ACTUAL
Sea W.	bbl		
Drill W.	bbl	3172	2913
other	bbl		
other	bbl		
Chemical	bbl	64.2	68
Salvaged Mud	bbl		
TOTAL MUD USED	bbl	3236	2981

COMMENTS
Above materials are those used only for drilling.

Baroid Australia Pty Ltd

COMPANY G.F.E. RESOURCES LTD.

WELL IONA - 2

WEEKLY INVENTORY

Page 1

YEAR 1994

MATERIAL	DATE Size	14/02			15/02			16/02			17/02			18/02			19/02			20/02		
		Used	Rec	Bal	Used	Rec	Bal	Used	Rec	Bal	Used	Rec	Bal	Used	Rec	Bal	Used	Rec	Bal	Used	Rec	Bal
Barite,sx	50 kg			236			236			236			236			236			236			236
Barite,sx	25 kg			402			402			402			402			402			402			402
AQUAGEL,sx	25 kg			520	32		488	20		468	25		443			443	61		382	30		352
BARACIDE	25 kg			1			1			1			1			1			1			1
Caustic Soda	25 kg			40	7		33	3		30			30			30			30	1		29
CMC-EHV	25 kg			80	10		70	2		68			68			68	5		63	10		53
DEXTRID LT	50 lb			80			80			80			80			80			80	10		70
KCL,Tech(sx)	25 kg	10		109			109			109			109		160	269			269	60		209
KCL,Tech(sx)	50 kg	17																				
Lime	25 kg	1		19			19			19			19			19			19			19
Soda Ash	25 kg			20			20			20			20			20			20			20
EZ SPOT	208 lt								2	2			2			2			2			2
BARACOR-100	208 lt														1	1			1			1
SALT	25 kg														600	600			600			600
XCD Polymer	25 kg														10	10			10			10
BARACOR 129	25 kg																					
BARAFILM 415	25 lt																					
CONDET	208 lt																					
PAC-R	50 lb																					
BARACARB 110	25 kg																					
BARACARB 600	25 kg																					

Baroid Australia Pty Ltd

COMPANY G.F.E. RESOURCES LTD.
WELL IONA - 2

WEEKLY INVENTORY

Page 2
YEAR 1994

MATERIAL	DATE / Size	21/02			22/02			23/02			24/02			25/02			26/02			27/02		
		Used	Rec	Bal	Used	Rec	Bal	Used	Rec	Bal	Used	Rec	Bal	Used	Rec	Bal	Used	Rec	Bal	Used	Rec	Bal
Barite,sx	50 kg			236			236			236			236			236	23		213	13		200
Barite,sx	25 kg			402	40		362			362			362	40		322	2		320			320
AQUAGEL,sx	25 kg	67		285	6		279	6		273	29		244			244			244			244
BARACIDE	25 kg			1			1			1			1	1								
Caustic Soda	25 kg	5		24	4		20	3		17	6		11			11	1		10			10
CMC-EHV	25 kg	16		37	14		23	7		16	7		9			9			9			9
DEXTRID LT	50 lb	9		61	10		51	22		29	29											
KCL,Tech(sx)	25 kg	63		146	30		116	26	80	170	49		121	18		103	15		88	5		83
KCL,Tech(sx)	50 kg																					
Lime	25 kg			19			19			19	2		17			17			17			17
Soda Ash	25 kg			20			20			20			20			20			20			20
EZ SPOT	208 lt			2		3	5			5			5			5			5			5
BARACOR-100	208 lt			1			1			1			1			1			1			1
SALT	25 kg			600			600			600			600			600			600			600
XCD Polymer	25 kg			10			10			10			10			10			10			10
BARACOR 129	25 kg							1	10	9	1		8			8			8			8
BARAFILM 415	25 lt								2	2			2			2			2			2
CONDET	208 lt							1	1													
PAC-R	50 lb								20	20			20	3		17	2		15			15
BARACARB 110	25 kg														48	48			48			48
BARACARB 600	25 kg														48	48			48			48

Baroid Australia Pty Ltd

COMPANY G.F.E. RESOURCES LTD.

WELL IONA - 2

WEEKLY INVENTORY

YEAR 1994

MATERIAL	DATE / Size	28/02 Used	28/02 Rec	28/02 Bal	01/03 Used	01/03 Rec	01/03 Bal	02/03 Used	02/03 Rec	02/03 Bal	03/03 Used	03/03 Rec	03/03 Bal	04/03 Used	04/03 Rec	04/03 Bal
Barite,sx	50 kg			200			200			200			200			200
Barite,sx	25 kg			320			320			320			320			320
AQUAGEL,sx	25 kg	27		217			217	1		216			216			216
BARACIDE	25 kg															
Caustic Soda	25 kg			10			10	1		9			9			9
CMC-EHV	25 kg			9			9			9			9			9
DEXTRID LT	50 lb															
KCL,Tech(sx)	25 kg			83			83	3		80			80			80
KCL,Tech(sx)	50 kg															
Lime	25 kg			17			17			17			17			17
Soda Ash	25 kg			20			20			20			20	2		18
EZ SPOT	208 lt			5			5			5			5			5
BARACOR-100	208 lt			1			1	1								
SALT	25 kg			600	240		360	40		320	80		240	27		213
XCD Polymer	25 kg			10			10	2		8			8			8
BARACOR 129	25 kg			8			8			8			8			8
BARAFILM 415	25 lt			2	2											
CONDET	208 lt															
PAC-R	50 lb			15			15			15			15	1		14
BARACARB 110	25 kg			48			48			48			48			48
BARACARB 600	25 kg			48			48			48			48			48

Baroid Australia Pty Ltd

MATERIAL RECONCILIATION

COMPANY G.F.E. RESOURCES LTD.
WELL IONA - 2

LOCATION OTWAY BASIN, VICTORIA
CONT/RIG CENTURY DRILLING / RIG - 11

DATES : FROM 14-Feb-94
TO 04-Mar-94

MATERIAL	UNIT SIZE	START STOCK	TOTAL DELIV	TOTAL START +DEL.	INTERVAL USEAGE (1) 12 1/4"	(2) 8 1/2"	(3)	(4)	(5)	(6)	(7)	(8) NON DRLG	VAR-IANCE	TOTAL USED	FINAL INVEN TORY	COMMENTS
Barite,sx	50 kg	236		236		36								36	200	
Barite,sx	25 kg	402		402		82								82	320	
AQUAGEL,sx	25 kg	520		520	52	232						20		304	216	
BARACIDE	25 kg	1		1		1								1		
Caustic Soda	25 kg	40		40	10	21								31	9	
CMC-EHV	25 kg	80		80	12	59								71	9	
DEXTRID LT	50 lb	80		80		80								80		
KCL,Tech(sx)	25 kg	119	240	359	10	269								279	80	
KCL,Tech(sx)	50 kg	17		17	17									17		
Lime	25 kg	20		20	1	2								3	17	
Soda Ash	25 kg	20		20		2								2	18	
EZ SPOT	208 lt		5	5											5	3 of the EZ SPOT were not
BARACOR-100	208 lt		1	1								1		1		Baroid stock, but from Nelson's
SALT	25 kg		600	600								387		387	213	warehouse.
XCD Polymer	25 kg		10	10								2		2	8	
BARACOR 129	25 kg		10	10		2								2	8	
BARAFILM 415	25 lt		2	2								2		2		
CONDET	208 lt		1	1		1								1		
PAC-R	50 lb		20	20		6								6	14	
BARACARB 110	25 kg		48	48											48	
BARACARB 600	25 kg		48	48											48	

Baroid Australia Pty Ltd

SOLIDS CONTROL and MUD VOLUME ANALYSIS

COMPANY	G.F.E. RESOURCES LTD.
WELL	IONA – 2
LOCATION	OTWAY BASIN, VICTORIA
CONT/RIG	CENTURY DRILLING / RIG – 11

1994

SOLIDS CONTROL		14–Feb	15–Feb	16–Feb	17–Feb	18–Feb	19–Feb	20–Feb	21–Feb	22–Feb	23–Feb
Shaker 1	Screens	3 x 50	3 x 50	3 x 50	3 x 50	3 x 110	2x110,1x5	110/84/50	110/84/50	110/84/50	110/84/50
TRITON	Hrs	12	14.5	16	3.5		10	12	15	21	14
Shaker 2	Screens										
	Hrs										
Shaker 3	Screens										
	Hrs										
Shaker 4	Screens										
	Hrs										
Desander	U/F ppg	9.4	14.3	12.1			13.8	12.9	11.7	12.7	10.9
2 x 12"	bbl/hr	6	7.5	7.5			7.45	6.5	2.5	1.5	2
	Hrs	12	13.5	10			8.5	12	15	20	14.5
	bbl	72	101	75			63	78	38	30	29
Desilter 1.	U/F ppg	10.7	14.6	12.6			10.7	10.9	11.4	10.2	10.9
12 x 4"	bbl/hr	3.5	3.5	3.5			5.75	5	3	6	5
	Hrs	12	14	10			8.5	12	3	4.5	8.5
	bbl	42	49	35			49	60	9	27	43
Desilter 2.	U/F ppg										
	bbl/hr										
	Hrs										
	bbl										
Centrifuge 1	Feed ppg										
	O/F ppg										
	U/F ppg										
	bbl/hr										
	Hrs										
	bbl										
Centrifuge 2	Feed ppg										
	O/F ppg										
	U/F ppg										
	bbl/hr										
	Hrs										
	bbl										

VOLUMES bbl		14–Feb	15–Feb	16–Feb	17–Feb	18–Feb	19–Feb	20–Feb	21–Feb	22–Feb	23–Feb
Downhole Volume		91	207	271	164	131	170	219	236	265	298
Initial Reserve				27		101	33	41		71	37
Added:	Act Mud				101						
	Seawater										
	Drill–Water		203	130		33	250	125	330	100	250
	other										
	other										
	Chemical		3.5	2			4	9	12	3	6
Final Reserve			27		101	33	41		71	37	37
Initial Active			465	360	322	322	407	355	330	386	338
Added:	Res Mud		180	159		101	246	175	271	137	256
	Seawater										
	Drill–Water	800	45	35		115	115				
	other										
	other										
	Chemical	4	0.5		2					5	1
Losses:	Solids Control	114	150	110			112	138	47	57	72
	Lost/Dumped	134	65	58	172		262	13	151	104	136
	DownHole										
Final Active		465	360	322	322	407	355	330	386	338	354
Total Final Volume		465	387	322	423	440	396	330	457	375	391

DILUTION	14–Feb	15–Feb	16–Feb	17–Feb	18–Feb	19–Feb	20–Feb	21–Feb	22–Feb	23–Feb
Interval Type	SYS1	SYS1	SYS1	SYS1	SYS–2	SYS–2	SYS–2	SYS–2	SYS–2	SYS–2
Depth m	232	500	640	640	640	823	1052	1133	1268	1404
Daily drilled m	216	268	140			183	229	81	135	136
Daily Dilution bbl	248	215	168	172		374	151	198	161	208
Daily Consumption bbl	804	252	167	2	148	369	134	342	108	257
Interval Drilled m	216	484	624	624		183	412	493	628	764
Interval Dilution bbl	248	463	631	803		374	525	723	884	1092
Rate bbl/m	1.15	0.96	1.01	1.29		2.04	1.27	1.47	1.41	1.43
Interval Consumption bbl	804	1056	1223	1225	148	517	651	993	1101	1358
Rate bbl/m	3.72	2.18	1.96	1.96		2.83	1.58	2.01	1.75	1.78

Baroid Australia Pty Ltd

SOLIDS CONTROL and MUD VOLUME ANALYSIS

1994

COMPANY	G.F.E. RESOURCES LTD.
WELL	IONA – 2
LOCATION	OTWAY BASIN, VICTORIA
CONT/RIG	CENTURY DRILLING / RIG – 11

SOLIDS CONTROL		24–Feb	25–Feb	26–Feb	27–Feb	28–Feb	01–Mar	02–Mar	03–Mar	04–Mar
Shaker 1	Screens	110/84/50								
TRITON	Hrs	19								
Shaker 2	Screens									
	Hrs									
Shaker 3	Screens									
	Hrs									
Shaker 4	Screens									
	Hrs									
Desander	U/F ppg	11.3								
2 x 12"	bbl/hr	1.5								
	Hrs	18								
	bbl	27								
Desilter 1.	U/F ppg	11.3								
12 x 4"	bbl/hr	4								
	Hrs	18								
	bbl	72								
Desilter 2.	U/F ppg									
	bbl/hr									
	Hrs									
	bbl									
Centrifuge 1	Feed ppg									
	O/F ppg									
	U/F ppg									
	bbl/hr									
	Hrs									
	bbl									
Centrifuge 2	Feed ppg									
	O/F ppg									
	U/F ppg									
	bbl/hr									
	Hrs									
	bbl									
VOLUMES bbl		**24–Feb**	**25–Feb**	**26–Feb**	**27–Feb**	**28–Feb**	**01–Mar**	**02–Mar**	**03–Mar**	**04–Mar**
Downhole Volume		351	395	395	365	395	239	239	239	239
Initial Reserve		37	34	87	27	44	23	23	37	47
Added:	Act Mud				16			14	10	
	Seawater									
	Drill–Water	200	110					40		
	other									
	other									
	Chemical	10	4	4	1					
Final Reserve		34	87	27	44	23	23	37	47	47
Initial Active		354	342	254	254	238	256	324	119	120
Added:	Res Mud	213	61	64		21		40		
	Seawater									
	Drill–Water				5	40	347	43	50	70
	other									
	other									
	Chemical						18	5	6	2
Losses:	Solids Control	99								
	Lost/Dumped	73	55	39	15	13	692	40	45	72
	DownHole		50	25	20					
Final Active		342	254	254	238	256	324	119	120	120
Total Final Volume		376	341	281	282	279	347	156	167	167
DILUTION										
Interval Type		SYS–2	SYS–2	SYS–2	SYS–2	SYS–2	Complet	Complet	Complet	Complet
Depth m		1650	1650	1650	1650	1650	1650	1650	1650	1650
Daily drilled m		246								
Daily Dilution bbl		172	105	64	35	13	692	40	45	72
Daily Consumption bbl		210	114	4	6	40	365	88	56	72
Interval Drilled m		1010	1010	1010	1010	1010				
Interval Dilution bbl		1264	1369	1433	1468	1481	692	732	777	849
Rate bbl/m		1.25	1.36	1.42	1.45	1.47				
Interval Consumption bbl		1568	1682	1686	1692	1732	365	453	509	581
Rate bbl/m		1.55	1.67	1.67	1.68	1.71				

Baroid Australia Pty Ltd

COMPANY G.F.E. RESOURCES LTD.

WELL IONA – 2

WATER BASE MUD PROPERTIES

YEAR 1994

		14/02		15/02		16/02		17/02		18/02		19/02		20/02		21/02		22/02		23/02		24/02		25/02	
Sample Location	IN or OUT	IN	IN	IN	IN	IN	IN	IN			IN	IN	IN	IN	PIT	IN	IN	IN	IN	IN	IN	IN	IN	IN	
Time Sample Taken	hrs	17:45	24:00	15:00	23:00	10:15	23:40				04:30	11:00	24:00	11:15	24:00	12:45	23:30	11:40	19:30	13:00	24:00	10:45	24:00	24:00	
Depth	m	125	216	344	482	640	640	640			645	762	823	1045	1052	1094	1133	1215	1268	1297	1404	1520	1650	1650	
Hole Size	ins	12.2	12.2	12.2	12.2	12.2	12.2	12.2			8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	
Flowline Temp	°C	29.4	31.1	34.4	38.9	42.8	38.3				33	33.3	34	37.2		34.4	42.8	42.8	43.9	37.8	42.2	42	40		
Weight	ppg	8.7	8.85	8.9	8.9	9	9.3	9.3			8.8	8.85	8.8	8.9	8.9	8.95	9.1	9.2	9.3	9.4	9.35	9.4	9.4	9.4	
Funnel Viscosity	sec/qt	30	41	39	37	43	47	47			35	35	38	51	38	37	38	39	39	39	39	38	40	40	
600 rpm	lb/100 ft²	12	47	27	22	30	38	38			21	20	21	48	35	29	30	32	35	40	32	31	36	36	
300 rpm	lb/100 ft²	10	43	18	16	21	26	26			16	15	15	38	23	18	19	20	22	25	20	20	24	24	
200 rpm	lb/100 ft²																								
100 rpm	lb/100 ft²																								
6 rpm	lb/100 ft²																								
3 rpm	lb/100 ft²																								
Plastic Viscosity	cP	2	4	9	6	9	12	12			5	5	6	10	12	11	11	12	13	15	12	11	12	12	
Yield Point	lb/100 ft²	8	39	9	10	12	14	14			11	10	9	28	11	7	8	8	9	10	8	9	12	12	
Gel – 10 sec	lb/100 ft²	4	25	4	8	7	9	9			9	10	4	8	2	1	1	1	2	2	1	2	6	6	
Gel – 10 min	lb/100 ft²	7	31	7	22	25	37	37			21	25	14	16	5	2	3	5	7	8	5	8	12	12	
Gel – 30 min	lb/100 ft²																						21	21	
API Filtrate	ml/30min	N.C.	N.C.	N.C.	20	12.8	11.8	11.8			N.C.	25	13.9	21	11.3	9.6	8.2	7.5	6.8	6.2	6.1	6.6	6.7	6.7	
API Filter Cake	32nd ins				3	2	2	2				3	2	3	2	1	1	1	1	1	1	1	1	1	
HPHT Filtrate	ml/30min																								
HPHT Filter Cake	32nd ins																								
HPHT Temp	°F																								
Solids	% Vol	2.5	3.5	3.7	3.7	4.3	6.8	6.8			3.4	3.9	3.4	3.6	3.6	3.3	4.5	5.3	6	6.5	6.1	6.2	6.2	6.2	
Oil	0.84% Vol																								
Water	% Vol	97.5	96	96	96	95.5	93	93			96.5	96	96.5	95.7	95.7	95.5	94.2	93.5	92.7	92.2	92.5	92.5	92.5	92.5	
Sand	% Vol	Tr	Tr	0.25	Tr	Trace	1	1			0.1	Trace	0.25	0.15	0.1	0.25	0.25	0.15	0.1	0.1	Trace	0.1	Tr	Tr	
Methylene Blue cap	ppb		13	15	15	15	16	16			11	11	8	10	9	9	12	14	16	17	16	11	13	13	
pH	meter	8.1	8	8.1	9	9	9	9			11.5	11	9	8.7	8.3	9	9.5	9.5	10	9.5	10	9	9.6	9.6	
Alk. Mud Pm	ml	0.28	0.34	0.5	0.86	0.74	0.69	0.69			1.98	1.04	0.26	0.22	0.2	0.38	0.74	0.55	0.7	0.51	0.46	0.2	0.35	0.35	
Alk. Filtrate Pf	ml	0.02		0.01	0.03	0.03	0.02	0.02			0.43	0.25	0.06	0.02	0.01	0.06	0.1	0.07	0.15	0.14	0.21	0.1	0.1	0.1	
Alk. Mf	ml	0.12	0.1	0.06	0.08	0.1	0.12	0.12			0.52	0.31	0.16	0.07	0.04	0.16	0.22	0.36	0.48	0.38	0.46	0.3	0.2	0.2	
Chlorides	mg/Lx10³	0.5	5.4	3.85	3.35	2.8	2.5	2.5			1.5	1.2	1.2	8.2	8.6	13.6	15	14.0	16	15	16.1	16	15	15	
Total Hardness	mg/L	20	370	160	40	10	15	15			80	40	10	160	180	120	40	25	20	25	20	40	40	40	
Calcium	mg/L		150	100	30	10	10	10			70	25	10	130	140	100	32	20	16	20	16	20	30	30	
KCL	% Wt Soln		1	0.75	0.6	0.5	0.4	0.4			0.2	0.1		1.5	1.65	2.65	2.9	2.75	3.1	2.9	3.1	3	3	3	
K+ Ion Conc	mg/Lx10³			4.3	3.4	2.9	2.3	2.3			1.1	0.6		8.6	9.5	15.2	16.6	15.8	17.8	16.6	17.8	17.2	17.2	17.2	
Sulphite Residual	mg/L																					50	40	40	

Baroid Australia Pty Ltd

COMPANY G.F.E. RESOURCES LTD.

WELL IONA - 2

WATER BASE MUD PROPERTIES

YEAR 1994

		26/02		27/02		28/02		01/03		02/03		03/03		03/03	
Sample Location	IN or OUT	IN		IN	IN	IN									
Time Sample Taken	hrs	09:00		12:00	24:00	24:00									
Depth	m	1650		1650	1650	1650									
Hole Size	ins	8.5		8.5	8.5	8.5									
Flowline Temp	°C														
Weight	ppg	9.35		9.3	9.3	9.3									
Funnel Viscosity	sec/qt	38		36	34	34									
600 rpm	lb/100 ft²	30		27	25	25									
300 rpm	lb/100 ft²	20		17	16	16									
200 rpm	lb/100 ft²														
100 rpm	lb/100 ft²														
6 rpm	lb/100 ft²														
3 rpm	lb/100 ft²														
Plastic Viscosity	cP	10		10	9	9									
Yield Point	lb/100 ft²	10		7	7	7									
Gel - 10 sec	lb/100 ft²	2		2	1	1									
Gel - 10 min	lb/100 ft²	8		6	5	4									
Gel - 30 min	lb/100 ft²	12		9	8	7									
API Filtrate	ml/30min	6.8		6.8	6.8	6.9									
API Filter Cake	32nd ins	1		1	1	1									
HPHT Filtrate	ml/30min														
HPHT Filter Cake	32nd ins														
HPHT Temp	°F														
Solids	% Vol	5.8		5.9	5.9	5.9									
Oil	0.84% Vol														
Water	% Vol	93		93	93	93									
Sand	% Vol	0.1		0.1	0.1	0.1									
Methylene Blue cap	ppb	10		10	10	10									
pH	meter	9.7		9	8.7	8.5									
Alk. Mud Pm	ml	0.4		0.2	0.1	0.1									
Alk. Filtrate Pf	ml	0.3		0.1	0.05	0.05									
Alk. Mf	ml	0.6		0.2	0.15	0.15									
Chlorides	mg/Lx10³	14		13.5	13.5	13.5									
Total Hardness	mg/L	20		20	20	20									
Calcium	mg/L	20		20	20	20									
KCL	% Wt Soln	2.8		2.7	2.7	2.7									
K+ Ion Conc	mg/Lx10³	16.1		15.5	15.5	15.5									
Sulphite Residual	mg/L	40													

Baroid Australia Pty Ltd BIT RECORD

COMPANY G.F.E. RESOURCES LTD.
WELL IONA – 2
LOCATION OTWAY BASIN, VICTORIA
CONT/RIG CENTURY DRILLING / RIG – 11

DATES : FROM 14–Feb–94
TO 04–Mar–94

BIT NO.	BIT SIZE ins	MAKE	TYPE	JETS	DPTH IN m	DPTH OUT m	DRLD m	HRS ON BIT	RATE m/hr	ACC DRLG HRS	WOB x1000 lb	RPM	VERT DEV. deg.	PUMP PRES psi	PUMP RATE bbl/min	MUD WT ppg	MUD VIS sec	CONDITION & REMARKS
1	12.25	Varel	L114	1 x 18, 2 x 20	16	320	304	12	25.3	12	15/20	120	0.25	550	9.89	8.8	40	1–3–In (RR bit) Kick–off pt. Change bit and BHA.
2	12.25	Security	S33SF	3 x 16	320	640	320	20	16	32	15/20		18.5	1575	11.58	9	43	1–2–1/8 Casing point.
2RR	12.25	Security	S33SF	3 x 20	640	640								1100	12.1	9.3	47	1–2–1/8 Clean out trip. Ream tight hole. Set 9 5/8"
3	8.5	Varel	ETD 417	2 x 10, 1 x 11	640	781	141	5	28.2	37	5/8	130	19.2	1400	7.19	8.8	35	1–1–In Change BHA. P/up motor and MWD.
3RR	8.5	Varel	ETD 417	1 x 10, 2 x 12	781	1052	271	13.5	20.1	50.5	0/20	40		1425	7.26	8.9	38	 Lay out directional tools.
3RR	8.5	Varel	ETD 417	1 x 10, 2 x 12	1052	1268	216	32	6.8	82.5	0/15	110	2.5	1325	7.4	9.3	39	1–1–In Change bit and BHA to drill Waare.
4	8.5	Varel	ETD 417	3x12	1268	1650	382	31.5	12.1	114	25	90	0.75	1225	7.4	9.4	39	1–1–1 T.D.

Baroid Australia Pty Ltd

DIRECTIONAL SURVEYS

COMPANY G.F.E. RESOURCES LTD.
WELL IONA – 2
LOCATION OTWAY BASIN, VICTORIA
CONT/RIG CENTURY DRILLING / RIG – 11

PAGE–1

MD m	TVD m	INCL°	DIR °	DISP m
48.7		0.75		
84.7		0.5		
119.5		0.5		
155.8		0.5		
191.9		0.5		
229		0.25		
257		0.25		
286		Zero		
393	392.8	6.7	188.9	
422	421.5	10.1	179.8	
461	459.6	14.8	159.9	
499	496.2	15.8	148.6	
538	533.6	17.6	145.9	
586	579.1	18.7	145.2	
622	613.3	18.5	143.1	
660		17.75	142.5	
698		18.25	142.5	
736		19.25	145.4	
813	795	18.5	148.4	
851.4	833	15.5	144.5	
889.7	872	12.4	139.1	
918.3	900	11.1	137.5	
965	947	10	138.7	
986	9.2	9.2	140.1	
1042	1024	8.2	143.1	
1096		5.5	140	
1165		3.25	136	
1250		2.5	143	
1345		1.5	153	
1450		1	151	
1632		0.75	136	

GRAPHS

DAILY MUD REPORTS

MUD REPORT NO. 1 up to 24:00 hrs, 14/2/94	
DATE 15/2/94	**DEPTH–m** MD 232 TVD 232
START DATE 14–Feb–94	**ACTIVITY** Drilling 12 1/4" hole

Baroid Australia Pty Ltd

OPERATOR G.F.E. RESOURCES LTD.	**CONTRACTOR / RIG** CENTURY DRILLING / RIG – 11	**COUNTRY** AUSTRALIA
REPORT FOR KEN SMITH	**REPORT FOR** RICK GIDDENS	**TOWNSHIP** PORT CAMPBELL
WELL NAME AND NO. IONA – 2	**FIELD OR BLOCK NO.** PPL – 2	**LOCATION** OTWAY BASIN, VICTORIA

BIT DATA

Size 12.250 ins		
Type Varel L114		
Nozzles 32nds		
18	20	20
Noz Area 0.86 ins²		
TFA ins²		
NV m/sec 47.0		
Impact lb f 293		

DRILLING STRING

	OD ins	ID ins	Length m
Pipe 1	4.5	3.826	12.9
Pipe 2	4.5	2.75	55.4
Pipe 3			
Col 1	6.25	2.25	163.7
Col 2			

OPEN HOLE SECTIONS

Sect 1		
Sect 2		
Current	12.25	232

CASINGS

Size ins		Depth m
Riser	Set @	
	Set @	
	Set @	
	Set @	
	Set @	
	Set @	
	Set @	
Liner	Set @	
	Top @	

PUMP DATA

Pump Make	ins x	ins	Eff %	bbl/stk	spm	bbl/min
National 7–P	5.5	7.75	95	0.0523	92	4.812
National 8–P	6	8.5	95	0.0705	72	5.076

Pump Press 550 psi — TOTAL bbl/min 9.888

MUD VOL	bbl	CIRCULATING DATA		AV m/min	
Downhole	91	Total circ 56 mins			
Active	465	Bottoms up 9 mins		DP	23.9
Total Circ	556	Surface–bit – mins		DC	27.9
Reserve		ECD ppg	8.96	Riser	

MUD PROPERTIES

Sample Location	IN or OUT	IN		IN	
Time Sample Taken	hrs	17:45		24:00	
Depth	m	125		216	
Flowline Temp	°C	29		31	
Weight	ppg	8.70		8.85	
Funnel Viscosity	sec/qt	30		41	
Plastic Viscosity	cP	2		4	
Yield Point	lb/100 ft²	8		39	
Gels 10 sec/10min/30 min	lb/100 ft²	4/7/–		25/31/–	
API Filtrate	ml/30min	N.C.		N.C.	
HPHT Filtrate	ml/30min				
API/HPHT Filter Cake	32nd ins				
Solids	% Vol	2.5		3.5	
Dissolved Salts	% Vol			0.5	
Oil/Water Content	% Vol	–/97.5		–/96.0	
Sand	% Vol	Tr		Tr	
Methylene Blue cap	ppb			13	
pH	meter	8.1		8.0	
Alk. Mud Pm	ml	0.28		0.34	
Alk. Filtrate, Pf/Mf	ml	0.02/0.12		–/0.10	
Chlorides	mg/Lx10³	0.5		5.4	
Total Hardness/Calcium	mg/L	20/–		370/150	
KCL	% Wt Soln			1.0	
Rheometer	600 rpm/300 rpm	12/10		47/43	
lb/100 ft²	200 rpm/100 rpm				
	6 rpm/3 rpm				

MUD PROPERTY SPECIFICATIONS

WEIGHT <9.2 ppg VIS 40–50 sec YP 0–25 lb/100 ft²
API Filt N.C. ml HTHP ml KCL 0.75 %
BY AUTHORITY

REMARKS

Commenced drilling with water, relying on native clays for viscosity. Cuttings remained relatively firm and discrete through Gellibrand Marl down to 125m, delayed addition of KCl to this depth.
High ROP between 125 and 151m resulted in cuttings overload in annulus – flowline blocked, mud rings forming. Lowered ROP by reducing weight on bit, no further problems.
KCl caused clays to flocculate, no need to add lime other than one sack used higher up hole. pH low due to minimal lime use, will add caustic soda to increase pH to 9+.
Ran desander and desilter while circulating, dumping and diluting as necessary. Clay and solids content gradually increasing.
Cuttings quality improved after addition of KCl.

ACTIVITY

Complete rigging up. Rig inspection by Mines Dept. Spud in at 12:00 hours. Drilled 12 1/4" hole from 16 – 232m, taking surveys approx every 35m. High ROP through Gelibrand Marl caused annulus to load up with cuttings, resulted in mud rings and blocked flowline at 151m; circulated hole clean, reduced weight on bit to lower ROP from 151m.

INVENTORY AND CONSUMPTION

PRODUCT DESCRIPTION		USED	REC	BAL	COST
Barite,sx	50 kg			236	
Barite,sx	25 kg			402	
KCL,Tech(sx)	25 kg	10		109	144.4
KCL,Tech(sx)	50 kg	17			490.96
Lime	25 kg	1		19	8.04

MUD TYPE Native Clay

SOLIDS CONTROL EQUIPMENT

	Make	screen size	hrs
Shaker 1	TRITON	3 x 50	12
Shaker 2			
Shaker 3			
Shaker 4			

	ppg	bbl/hr	hrs	bbl
Desander	9.4	6	12	72
Desilter 1.	10.7	3.5	12	42
Desilter 2.				
Centrifuge 1				
Centrifuge 2				

Solids Control Effic. %

CONSUMPTION

Additions	bbl
Sea W.	
Drill W.	800
other	
other	
Barite	
Chemicals	4
Losses	**bbl**
Sol. Con.	114
Lost/Dumped	134
Down Hole	
Newhole	103
NET GAIN	556
Discharged	248

BAROID Engineer	OFFICE	WAREHOUSE
ALAN SEARLE	MELBOURNE	
Tel. 03 – 787 1502	03 – 621 3311	

DAILY COST A$ 643.40 — **CUMULATIVE COST** A$ 643.40

RESERVE PITS

NO	TYPE	bbl
6	Pill Tank	
7	Trip Tank	

SURVEY DATA

MD m	TVD m	INCL°	DIR °	DISP m
48.7		0.75		
84.7		0.5		
119.5		0.5		
155.8		0.5		
191.9		0.5		

SOLIDS ANALYSIS

Low Grav. Solids	% Vol	3.5
Low Grav. Solids	ppb	31.8
High Grav. Solids	% Vol	0.3
High Grav. Solids	ppb	4.4
ASG of Solids	g/cc	2.60
Cuttings Volume	bbl	103.0
Interval Dilution	bbl/m	1.2
Interval Consumption	bbl/m	3.7

TIME BREAKDOWN

	hrs
Drilling	9
Circulating	0.5
Reaming In	
Reaming out	
Tripping	
Survey	2.5
Rig up	9
Other	3
AVE ROP m/hr	24

Baroid Australia Pty Ltd	MUD REPORT NO. 2 up to 24:00 hrs, 15/2/94	
	DATE 16/2/94	DEPTH–m MD 500 TVD 497
	START DATE 14–Feb–94	ACTIVITY Drilling 12 1/4" hole, building angle.

OPERATOR	CONTRACTOR / RIG	COUNTRY
G.F.E. RESOURCES LTD.	CENTURY DRILLING / RIG – 11	AUSTRALIA
REPORT FOR	**REPORT FOR**	**TOWNSHIP**
KEN SMITH	RICK GIDDENS	PORT CAMPBELL
WELL NAME AND NO.	**FIELD OR BLOCK NO.**	**LOCATION**
IONA – 2	PPL – 2	OTWAY BASIN, VICTORIA

BIT DATA / DRILLING STRING / CASINGS

BIT DATA			DRILLING STRING	OD ins	ID ins	Length m	CASINGS Size ins	Depth m
Size 12.250 ins								
Type Sec S33SF			Pipe 1	4.5	3.826	254.7	Riser	Set @
Nozzles 32nds			Pipe 2	4.5	2.75	55.4		Set @
16	16	16	Pipe 3					Set @
			Col 1	6.25	2.25	125.3		Set @
			Col 2	8	2.25	64.6		Set @
Noz Area 0.59 ins²			OPEN HOLE SECTIONS					Set @
TFA ins²			Sect 1					Set @
NV m/sec 80.5			Sect 2				Liner	Set @
Impact lb f 591			Current		12.25	500		Top @

PUMP DATA

Pump Make	ins x ins		Eff %	bbl/stk	spm	bbl/min
National 7–P	5.5	7.75	95	0.0523	100	5.23
National 8–P	6	8.5	95	0.0705	90	6.345

Pump Press 1475 psi TOTAL bbl/min 11.575

MUD VOL	bbl	CIRCULATING DATA	AV m/min	
Downhole	207	Total circ 49 mins		
Active	360	Bottoms up 16 mins	DP	28
Total Circ	567	Surface–bit 1 mins	DC	42.2
Reserve	27	ECD ppg 8.92	Riser	

MUD PROPERTIES

Sample Location	IN or OUT	IN		IN	
Time Sample Taken	hrs	15:00		23:00	
Depth	m	344		482	
Flowline Temp	°C	34		39	
Weight	ppg	8.90		8.90	
Funnel Viscosity	sec/qt	39		37	
Plastic Viscosity	cP	9		6	
Yield Point	lb/100 ft²	9		10	
Gels 10 sec/10min/30 min	lb/100 ft²	4/7/–		8/22/–	
API Filtrate	ml/30min	N.C.		20.0	
HPHT Filtrate	ml/30min				
API/HPHT Filter Cake	32nd ins			3/–	
Solids	% Vol	3.7		3.7	
Dissolved Salts	% Vol	0.3		0.3	
Oil/Water Content	% Vol	–/96.0		–/96.0	
Sand	% Vol	0.3		Tr	
Methylene Blue cap	ppb	15		15	
pH	meter	8.1		9.0	
Alk. Mud Pm	ml	0.50		0.86	
Alk. Filtrate, Pf/Mf	ml	0.01/0.06		0.03/0.08	
Chlorides	mg/Lx10³	3.9		3.4	
Total Hardness/Calcium	mg/L	160/100		40/30	
KCL	% Wt Soln	0.8		0.6	
K+ Ion Conc	mg/Lx10³	4.3		3.4	
Rheometer	600 rpm/300 rpm	27/18		22/16	
lb/100 ft²	200 rpm/100 rpm				
	6 rpm/3 rpm				

MUD PROPERTY SPECIFICATIONS

WEIGHT <9.2 ppg VIS 40–50 sec YP 0–25 lb/100 ft²
API Filt <15 ml HTHP ml KCL .75 %
BY AUTHORITY Mud program

REMARKS

Relied on native clays for viscosity prior to tripping. After trip began adding premix with AQUAGEL and CMC–EHV to maintain viscosity and reduce filtrate through Dilwyn sands.
Caustic soda added to raise pH to 9.
Hydraulic parameters determined by directional drillers requirements; 3 x 16/32 nozzles, 550 gpm circulating rate. Actual gpm lower due to pressure limtations.
Running desnder and desilter while circulating. Sand content only a trace, despite quantity of sand removed from hole. Some losses over shaker screens due to heavy sand load.

ACTIVITY

Drilled to kick–off point at 320m, taking surveys every 35m. Circulated bottoms up. POOH. Changed bit and made up kick–off assembly with downhole motor and MWD tool; 1.15 deg bent angle in motor. RIH, hit bridge at 293m. Reamed to 305m, ran to bottom. Cricualted and oriented motor. Drilled to 500m building angle; no rotation.

INVENTORY AND CONSUMPTION

PRODUCT DESCRIPTION		USED	REC	BAL	COST
Barite,sx	50 kg			236	
Barite,sx	25 kg			402	
AQUAGEL,sx	25 kg	32		488	458.56
Caustic Soda	25 kg	7		33	227.01
CMC–EHV	25 kg	10		70	1066.1

MUD TYPE AQUAGEL/CMC

SOLIDS CONTROL EQUIPMENT

	Make	screen size	hrs
Shaker 1	TRITON	3 x 50	14.5
Shaker 2			
Shaker 3			
Shaker 4			

	ppg	bbl/hr	hrs	bbl
Desander	14.3	7.5	13.5	101
Desilter 1.	14.6	3.5	14	49
Desilter 2.				
Centrifuge 1				
Centrifuge 2				

Solids Control Effic. %

CONSUMPTION

Additions	bbl
Sea W.	
Drill W.	248
other	
other	
Barite	
Chemicals	4
Losses	**bbl**
Sol. Con.	150
Lost/Dumped	65
Down Hole	
Newhole	128
NET GAIN	37
Discharged	215

BAROID Engineer	OFFICE	WAREHOUSE
ALAN SEARLE	MELBOURNE	
Tel. 03 – 787 1502	03 – 621 3311	

DAILY COST **A$ 1751.67** CUMULATIVE COST **A$ 2395.07**

RESERVE PITS

NO	TYPE	bbl
6	Pill Tank	27
7	Trip Tank	

SURVEY DATA

MD m	TVD m	INCL°	DIR °	DISP m
229		0.25		
257		0.25		
286		Zero		
393	392.8	6.7	188.9	
422	421.5	10.1	179.8	
461	459.6	14.8	159.9	
499	496.2	15.8	148.6	

SOLIDS ANALYSIS

Low Grav. Solids	% Vol	3.5
Low Grav. Solids	ppb	31.8
High Grav. Solids	% Vol	0.2
High Grav. Solids	ppb	2.9
ASG of Solids	g/cc	2.70
Cuttings Volume	bbl	128.0
Interval Dilution	bbl/m	1.0
Interval Consumption	bbl/m	2.2

TIME BREAKDOWN

	hrs
Drilling	13
Circulating	1
Reaming In	0.5
Reaming out	
Tripping	4.5
Survey	1.5
Other	3.5
AVE ROP m/hr	20.62

Baroid Australia Pty Ltd

MUD REPORT NO. 3 up to 24:00 hrs, 16/2/94	
DATE 17/2/94	DEPTH–m MD 640 TVD 631
START DATE 14–Feb–94	ACTIVITY Circulating hole.

OPERATOR G.F.E. RESOURCES LTD.	CONTRACTOR / RIG CENTURY DRILLING / RIG – 11	COUNTRY AUSTRALIA
REPORT FOR KEN SMITH	REPORT FOR RICK GIDDENS	TOWNSHIP PORT CAMPBELL
WELL NAME AND NO. IONA – 2	FIELD OR BLOCK NO. PPL – 2	LOCATION OTWAY BASIN, VICTORIA

BIT DATA

Size	12.250 ins
Type	Sec S33SF
Nozzles 32nds	20 / 20 / 20
Noz Area	0.92 ins²
TFA ins²	
NV m/sec	53.8
Impact lb f	432

DRILLING STRING

	OD ins	ID ins	Length m
Pipe 1	4.5	3.826	384.3
Pipe 2	4.5	2.75	55.4
Pipe 3			
Col 1	6.25	2.25	148.5
Col 2	8	2.25	51.8

OPEN HOLE SECTIONS

Sect 1		
Sect 2		
Current	12.25	640

CASINGS

Size ins		Depth m
Riser	Set @	
	Set @	
	Set @	
	Set @	
	Set @	
	Set @	
	Set @	
Liner	Set @	
	Top @	

PUMP DATA

Pump Make	ins x ins		Eff %	bbl/stk	spm	bbl/min
National 7–P	5.5	7.75	95	0.0523	110	5.753
National 8–P	6	8.5	95	0.0705	90	6.345

Pump Press 1100 psi — TOTAL bbl/min 12.098

MUD VOL	bbl	CIRCULATING DATA		AV	m/min
Downhole	271	Total circ 49 mins		DP	29.2
Active	322	Bottoms up 21 mins		DC	44.1
Total Circ	593	Surface–bit 2 mins		Riser	
Reserve		ECD ppg	9.32		

MUD PROPERTIES

Sample Location	IN or OUT	IN		IN	
Time Sample Taken	hrs	10:15		23:40	
Depth	m	640		640	
Flowline Temp	°C	43		38	
Weight	ppg	9.00		9.30	
Funnel Viscosity	sec/qt	43		47	
Plastic Viscosity	cP	9		12	
Yield Point	lb/100 ft²	12		14	
Gels 10 sec/10min/30 min	lb/100 ft²	7/25/–		9/37/–	
API Filtrate	ml/30min	12.8		11.8	
HPHT Filtrate	ml/30min				
API/HPHT Filter Cake	32nd ins	2/–		2/–	
Solids	% Vol	4.3		6.8	
Dissolved Salts	% Vol	0.2		0.2	
Oil/Water Content	% Vol	–/95.5		–/93.0	
Sand	% Vol	Trace		1.0	
Methylene Blue cap	ppb	15		16	
pH	meter	9.0		9.0	
Alk. Mud Pm	ml	0.74		0.69	
Alk. Filtrate, Pf/Mf	ml	0.03/0.10		0.02/0.12	
Chlorides	mg/Lx10³	2.8		2.5	
Total Hardness/Calcium	mg/L	10/10		15/10	
KCL	% Wt Soln	0.5		0.4	
K+ Ion Conc	mg/Lx10³	2.9		2.3	
Rheometer	600 rpm/300 rpm	30/21		38/26	
lb/100 ft²	200 rpm/100 rpm				
	6 rpm/3 rpm				

MUD PROPERTY SPECIFICATIONS

WEIGHT <9.2 ppg VIS 40–50 sec YP 0–25 lb/100 ft²
API Filt <15 ml HTHP ml KCL 0.75 %
BY AUTHORITY Mud Program

REMARKS

Added AQUAGEL/CMC–EHV premix to maintain rheology and reduce filtrate to < 15 ml by casing point.
Tight hole in Dilwyn formation while running in, from kickoff point at 320 – 351m and again from 408 – 524m. Tight hole again through Pebble Point from 609 –640m.
Emptied and cleaned out pill tank and suction tank, in preparation to mix gel water for cement job. Small leak between desilter tank and suction tank. Solids content and mud weight up after trip, also sand content increased; desander/desilter not run while reaming to minimse aeration and in case agitation in desilter suction pit aggravates leak.
No downhole losses recorded while out of hole.

ACTIVITY

Drilled 12 1/4" hole from 500 –640m, buiilding angle and then maintaining at 18.5 deg. Reached casing point at 640m, circulated bottoms up. POOH, tight spot at 475m, pick up kelly and pumped out 1 single. Continued pulling out with tight hole from 456 – 379m. Service downhole assembly, laid out directional tools. Made up BHA for clean out trip. RIH, unable to get through kickoff point. Reamed from 320 – 351, 408 – 524 and 609 –640m; recorded 3m of fill. Circulate hole clean.

INVENTORY AND CONSUMPTION

PRODUCT DESCRIPTION		USED	REC	BAL	COST
Barite,sx	50 kg			236	
Barite,sx	25 kg			402	
AQUAGEL,sx	25 kg	20		468	286.6
Caustic Soda	25 kg	3		30	97.29
CMC–EHV	25 kg	2		68	213.22
EZ SPOT	208 lt		2	2	

MUD TYPE AQUAGEL/CMC

SOLIDS CONTROL EQUIPMENT

	Make	screen size	hrs
Shaker 1	TRITON	3 x 50	16
Shaker 2			
Shaker 3			
Shaker 4			

	ppg	bbl/hr	hrs	bbl
Desander	12.1	7.5	10	75
Desilter 1.	12.6	3.5	10	35
Desilter 2.				
Centrifuge 1				
Centrifuge 2				

Solids Control Effic. %

CONSUMPTION

Additions	bbl
Sea W.	
Drill W.	165
other	
other	
Barite	
Chemicals	2
Losses	**bbl**
Sol. Con.	110
Lost/Dumped	58
Down Hole	
Newhole	67
NET LOSS	1
Discharged	168

BAROID Engineer	OFFICE	WAREHOUSE
ALAN SEARLE	MELBOURNE	
Tel. 03 – 787 1502	03 – 621 3311	

DAILY COST **A$ 597.11** CUMULATIVE COST **A$ 2992.18**

RESERVE PITS

NO	TYPE	bbl
6	Pill Tank	
7	Trip Tank	

SURVEY DATA

MD m	TVD m	INCL°	DIR °	DISP m
538	533.6	17.6	145.9	
586	579.1	18.7	145.2	
622	613.3	18.5	143.1	

SOLIDS ANALYSIS

Low Grav. Solids	% Vol	6.4
Low Grav. Solids	ppb	58.2
High Grav. Solids	% Vol	0.4
High Grav. Solids	ppb	5.9
ASG of Solids	g/cc	2.70
Cuttings Volume	bbl	67.0
Interval Dilution	bbl/m	1.0
Interval Consumption	bbl/m	2.0

TIME BREAKDOWN

	hrs
Drilling	10
Circulating	1
Reaming In	5
Reaming out	
Tripping	7
Other	1
AVE ROP m/hr	14

Baroid Australia Pty Ltd		
MUD REPORT NO. 4 up to 24:00 hrs, 17/2/94		
DATE 18/2/94	DEPTH–m MD 640 TVD 631	
START DATE 14–Feb–94	ACTIVITY Wait on cement.	

OPERATOR G.F.E. RESOURCES LTD.	CONTRACTOR / RIG CENTURY DRILLING / RIG – 11	COUNTRY AUSTRALIA
REPORT FOR KEN SMITH	REPORT FOR RICK GIDDENS	TOWNSHIP PORT CAMPBELL
WELL NAME AND NO. IONA – 2	FIELD OR BLOCK NO. PPL – 2	LOCATION OTWAY BASIN, VICTORIA

BIT DATA / DRILLING STRING / CASINGS

BIT DATA	DRILLING STRING	OD ins	ID ins	Length m	CASINGS Size ins		Depth m
Size 12.250 ins							
Type Sec S33SF	Pipe 1	4.5	3.826		Riser	Set @	
Nozzles 32nds	Pipe 2	4.5	2.75		9.625	Set @	631.12
20 / 20 / 20	Pipe 3					Set @	
	Col 1	6.25	2.25			Set @	
	Col 2	8	2.25			Set @	
Noz Area 0.92 ins²	OPEN HOLE SECTIONS					Set @	
TFA ins²	Sect 1					Set @	
NV m/sec	Sect 2				Liner	Set @	
Impact lb f	Current		12.25	8.9		Top @	

PUMP DATA

Pump Make	ins x ins		Eff %	bbl/stk	spm	bbl/min
National 7–P	5.5	7.75	95	0.0523		
National 8–P	6	8.5	95	0.0705		

Pump Press – psi TOTAL bbl/min

MUD VOL	bbl	CIRCULATING DATA		AV m/min
Downhole	164	Total circ – mins		
Active	322	Bottoms up – mins		DP
Total Circ		Surface–bit – mins		DC
Reserve	101	ECD ppg	9.3	Riser

MUD PROPERTIES

Sample Location	IN or OUT	IN			
Time Sample Taken	hrs				
Depth	m	640			
Flowline Temp	°C				
Weight	ppg	9.30			
Funnel Viscosity	sec/qt	47			
Plastic Viscosity	cP	12			
Yield Point	lb/100 ft²	14			
Gels 10 sec/10min/30 min	lb/100 ft²	9/37/–			
API Filtrate	ml/30min	11.8			
HPHT Filtrate	ml/30min				
API/HPHT Filter Cake	32nd ins	2/–			
Solids	% Vol	6.8			
Dissolved Salts	% Vol	0.2			
Oil/Water Content	% Vol	–/93.0			
Sand	% Vol	1.0			
Methylene Blue cap	ppb	16			
pH	meter	9.0			
Alk. Mud Pm	ml	0.69			
Alk. Filtrate, Pf/Mf	ml	0.02/0.12			
Chlorides	mg/Lx10³	2.5			
Total Hardness/Calcium	mg/L	15/10			
KCL	% Wt Soln	0.4			
K+ Ion Conc	mg/Lx10³	2.3			
Rheometer	600 rpm/300 rpm	38/26			
lb/100 ft²	200 rpm/100 rpm				
	6 rpm/3 rpm				

MUD PROPERTY SPECIFICATIONS

WEIGHT <9.2 ppg VIS 40–50 sec YP 0–25 lb/100 ft²
API Filt <15 ml HTHP ml KCL 0.75 %
BY AUTHORITY

REMARKS

Hole condition improved after reaming.
Mixed 200 bbls of 2% gel water for cementing; actually 140 bbls reqd, excess mixed to allow for dead volume in tanks – incorporated into mud system. Used 25 sx AQUAGEL.
Cement contaminated mud returns almost immediately after dropping plug, indicating hole near gauge. Dumped contaminated mud and cement.

Total of 25 sx AQUAGEL used to mix 200 bbls of cement water, of this 140 bbls used for cement job and the balance used in mud system. AQUAGEL used split as follows:
To cement water 20 sx @$14.33 = $286.60
To mud system 7 sx @ $14.33 = $71.65
Total cost $358.25

ACTIVITY

Wiper trip to top of 8" drill collars; slight drag, 2m of fill, washed 2m to bottom. Circulated hole clean. POOH, cut drill line, laid out 8" drill collars, stabilisers and directional tools. Rigged up and ran 9 5/8" casing. Rigged up Howco surface equipment. Circulated casing. Cemented 9 5/8" casing; 10 bbls water, 644 sx 2% gel lead slurry, 162 sx 0.15% HR4 tail slurry. Released plug and displaced with 159 bbls water. Wait on cement.

INVENTORY AND CONSUMPTION

PRODUCT DESCRIPTION		USED	REC	BAL	COST
Barite,sx	50 kg			236	
Barite,sx	25 kg			402	
AQUAGEL,sx	25 kg	25		443	358.25

MUD TYPE AQUAGEL/CMC

SOLIDS CONTROL EQUIPMENT

	Make	screen size	hrs
Shaker 1	TRITON	3 x 50	3.5
Shaker 2			
Shaker 3			
Shaker 4			

	ppg	bbl/hr	hrs	bbl
Desander				
Desilter 1.				
Desilter 2.				
Centrifuge 1				
Centrifuge 2				

Solids Control Effic. %

CONSUMPTION

Additions	bbl
Sea W.	
Drill W.	
other	
other	
Barite	
Chemicals	2
Losses	**bbl**
Sol. Con.	
Lost/Dumped	172
Down Hole	
Newhole	
NET LOSS	170
Discharged	172

BAROID Engineer	OFFICE	WAREHOUSE
ALAN SEARLE	MELBOURNE	
Tel. 03 – 787 1502	03 – 621 3311	

DAILY COST A$ 358.25 CUMULATIVE COST A$ 3350.43

RESERVE PITS / SURVEY DATA

NO	TYPE	bbl	MD m	TVD m	INCL°	DIR °	DISP m
6	Pill Tank	68					
7	Trip Tank	33					

SOLIDS ANALYSIS

Low Grav. Solids	% Vol	6.4
Low Grav. Solids	ppb	58.2
High Grav. Solids	% Vol	0.4
High Grav. Solids	ppb	5.9
ASG of Solids	g/cc	2.70
Cuttings Volume	bbl	
Interval Dilution	bbl/m	1.3
Interval Consumption	bbl/m	2.0

TIME BREAKDOWN

	hrs
Drilling	
Circulating	1.5
Reaming In	
Reaming out	
Tripping	9.5
Run & cmt. csg.	6.5
Wait on cmt.	4
Other	2.5
AVE ROP m/hr	

Baroid Australia Pty Ltd		
MUD REPORT NO. 5 up to 24:00 hrs, 18/2/94		
DATE 19/2/94	DEPTH–m MD 640 TVD 631	
START DATE 14–Feb–94	ACTIVITY RIH to drill out from casing.	

OPERATOR G.F.E. RESOURCES LTD.	CONTRACTOR / RIG CENTURY DRILLING / RIG – 11	COUNTRY AUSTRALIA
REPORT FOR KEN SMITH	REPORT FOR RICK GIDDENS	TOWNSHIP PORT CAMPBELL
WELL NAME AND NO. IONA – 2	FIELD OR BLOCK NO. PPL – 2	LOCATION OTWAY BASIN, VICTORIA

BIT DATA

Size	8.500 ins
Type	Varel ETD417
Nozzles 32nds	10 / 10 / 11
Noz Area	0.25 ins²
TFA ins²	
NV m/sec	
Impact lb f	

DRILLING STRING

	OD ins	ID ins	Length m
Pipe 1	4.5	3.826	381.6
Pipe 2	4.5	2.75	55.38
Pipe 3			
Col 1	6.25	2.25	203.02
Col 2			

OPEN HOLE SECTIONS

Sect 1		
Sect 2		
Current	8.5	8.9

CASINGS

Size ins		Depth m
Riser	Set @	
9.625	Set @	631.12
	Set @	
	Set @	
	Set @	
	Set @	
	Set @	
Liner	Set @	
	Top @	

PUMP DATA

Pump Make	ins	x ins	Eff %	bbl/stk	spm	bbl/min
National 7–P	5.5	7.75	95	0.0523		
National 8–P	6	8.5	95	0.0705		

Pump Press – psi TOTAL bbl/min

MUD VOL	bbl	CIRCULATING DATA			
Downhole	131	Total circ – mins		AV m/min	
Active	407	Bottoms up – mins		DP	
Total Circ	538	Surface–bit – mins		DC	
Reserve	33	ECD ppg	8.8	Riser	

MUD PROPERTIES

Sample Location	IN or OUT			IN	
Time Sample Taken	hrs			04:30	
Depth	m			645	
Flowline Temp	°C			33	
Weight	ppg			8.80	
Funnel Viscosity	sec/qt			35	
Plastic Viscosity	cP			5	
Yield Point	lb/100 ft²			11	
Gels 10 sec/10min/30 min	lb/100 ft²			9/21/–	
API Filtrate	ml/30min			N.C.	
HPHT Filtrate	ml/30min				
API/HPHT Filter Cake	32nd ins				
Solids	% Vol			3.4	
Dissolved Salts	% Vol			0.1	
Oil/Water Content	% Vol			–/96.5	
Sand	% Vol			0.1	
Methylene Blue cap	ppb			11	
pH	meter			11.5	
Alk. Mud Pm	ml			1.98	
Alk. Filtrate, Pf/Mf	ml			0.43/0.52	
Chlorides	mg/Lx10³			1.5	
Total Hardness/Calcium	mg/L			80/70	
KCL	% Wt Soln			0.2	
K+ Ion Conc	mg/Lx10³			1.1	
Rheometer	600 rpm/300 rpm			21/16	
lb/100 ft²	200 rpm/100 rpm				
	6 rpm/3 rpm				

MUD PROPERTY SPECIFICATIONS

WEIGHT <9.2 ppg VIS 38–45 sec YP 10–20 lb/100 ft²
API Filt <15 ml HTHP ml KCL %
BY AUTHORITY

REMARKS

Changed shaker screens to 3 x 110 mesh for 8 1/2" hole.
Diluted surface mud with 40 bbls water to reduce solids and viscosity prio to drilling cement. 75 bbls of water inside casing also blended into system.

In addition to mud products shown as received on inventory today, also received : 48 x 25 kg sx BARACARB–110
48 x 25 kg sx BARACARB–600
Waiting on pricing before including these on computer's Master Product List.

Mud check actually taken at 04:30 hrs, 19–Feb–94 after drilling out cement and shoe. Cement contamination flocculated clays, dramatic increase in filtrate.

ACTIVITY

Wait on cement. Install Braden head and nipple up BOP's. Pressure test BOP's with HOWCO. Made up bit and BHA, RIH to drill out.

INVENTORY AND CONSUMPTION

PRODUCT DESCRIPTION		USED	REC	BAL	COST
Barite,sx	50 kg			236	
Barite,sx	25 kg			402	
KCL,Tech(sx)	25 kg		160	269	
BARACOR–100	208 lt		1	1	
SALT	25 kg		600	600	
XCD Polymer	25 kg		10	10	

MUD TYPE AQUAGEL/CMC

SOLIDS CONTROL EQUIPMENT

	Make	screen size	hrs
Shaker 1	TRITON	3 x 110	
Shaker 2			
Shaker 3			
Shaker 4			

	ppg	bbl/hr	hrs	bbl
Desander				
Desilter 1.				
Desilter 2.				
Centrifuge 1				
Centrifuge 2				

Solids Control Effic. %

CONSUMPTION

Additions	bbl
Sea W.	
Drill W.	148
other	
other	
Barite	
Chemicals	
Losses	**bbl**
Sol. Con.	
Lost/Dumped	
Down Hole	
Newhole	
NET GAIN	148
Discharged	

BAROID Engineer	OFFICE	WAREHOUSE
ALAN SEARLE	MELBOURNE	
Tel. 03 – 787 1502	03 – 621 3311	

DAILY COST	CUMULATIVE COST
A$ 0.00	A$ 3350.43

RESERVE PITS

NO	TYPE	bbl
6	Pill Tank	
7	Trip Tank	33

SURVEY DATA

MD m	TVD m	INCL°	DIR °	DISP m

SOLIDS ANALYSIS

Low Grav. Solids	% Vol	3.4
Low Grav. Solids	ppb	30.9
High Grav. Solids	% Vol	
High Grav. Solids	ppb	
ASG of Solids	g/cc	2.60
Cuttings Volume	bbl	
Interval Dilution	bbl/m	
Interval Consumption	bbl/m	

TIME BREAKDOWN hrs

Drilling	
Circulating	
Reaming In	
Reaming out	
Tripping	6
Wait on cmt.	4
Nipple up BOP	10
Test BOP	4
AVE ROP m/hr	

Baroid Australia Pty Ltd

MUD REPORT NO. 6 up to 24:00 hrs, 19/2/94	
DATE 20/2/94	DEPTH–m MD 823 TVD 804
START DATE 14–Feb–94	ACTIVITY Drilling 8 1/2" hole.

OPERATOR G.F.E. RESOURCES LTD.	CONTRACTOR / RIG CENTURY DRILLING / RIG – 11	COUNTRY AUSTRALIA
REPORT FOR KEN SMITH	REPORT FOR RICK GIDDENS	TOWNSHIP PORT CAMPBELL
WELL NAME AND NO. IONA – 2	FIELD OR BLOCK NO. PPL – 2	LOCATION OTWAY BASIN, VICTORIA

BIT DATA

Size 8.500 ins			
Type Varel ETD417			
Nozzles 32nds			
10	12	12	
Noz Area 0.30 ins²			
TFA ins²			
NV m/sec 98.0			
Impact lb f 438			

DRILLING STRING

	OD ins	ID ins	Length m
Pipe 1	4.5	3.826	561.4
Pipe 2	4.5	2.75	55.38
Pipe 3			
Col 1	6.25	2.25	206.22
Col 2			
OPEN HOLE SECTIONS			
Sect 1			
Sect 2			
Current		8.5	191.9

CASINGS

Size ins		Depth m
Riser	Set @	
9.625	Set @	631.12
	Set @	
	Set @	
	Set @	
	Set @	
	Set @	
Liner	Set @	
	Top @	

PUMP DATA

Pump Make	ins	x ins	Eff %	bbl/stk	spm	bbl/min
National 7–P	5.5	7.75	95	0.0523		
National 8–P	6	8.5	95	0.0705	101	7.121
Pump Press 1400 psi				TOTAL bbl/min		7.121

MUD VOL	bbl	CIRCULATING DATA		
Downhole	170	Total circ 74 mins	AV	m/min
Active	355	Bottoms up 19 mins	DP	37.6
Total Circ	525	Surface–bit 4 mins	DC	67.3
Reserve	41	ECD ppg 8.85	Riser	

MUD PROPERTIES

Sample Location	IN or OUT	IN		IN	
Time Sample Taken	hrs	11:00		24:00	
Depth	m	762		823	
Flowline Temp	°C	33		34	
Weight	ppg	8.85		8.80	
Funnel Viscosity	sec/qt	35		38	
Plastic Viscosity	cP	5		6	
Yield Point	lb/100 ft²	10		9	
Gels 10 sec/10min/30 min	lb/100 ft²	10/25/–		4/14/–	
API Filtrate	ml/30min	25.0		13.9	
HPHT Filtrate	ml/30min				
API/HPHT Filter Cake	32nd ins	3/–		2/–	
Solids	% Vol	3.9		3.4	
Dissolved Salts	% Vol	0.1		0.1	
Oil/Water Content	% Vol	–/96.0		–/96.5	
Sand	% Vol	Trace		0.3	
Methylene Blue cap	ppb	11		8	
pH	meter	11.0		9.0	
Alk. Mud Pm	ml	1.04		0.26	
Alk. Filtrate, Pf/Mf	ml	0.25/0.31		0.06/0.16	
Chlorides	mg/Lx10³	1.2		1.2	
Total Hardness/Calcium	mg/L	40/25		10/10	
KCL	% Wt Soln	0.1			
K+ Ion Conc	mg/Lx10³	0.6			
Rheometer	600 rpm/300 rpm	20/15		21/15	
lb/100 ft²	200 rpm/100 rpm				
	6 rpm/3 rpm				

MUD PROPERTY SPECIFICATIONS

WEIGHT <9.2 ppg VIS 38–45 sec YP 10–20 lb/100 ft²
API Filt <15 ml HTHP ml KCL %
BY AUTHORITY

REMARKS

Running desander and desilter while circulating.
Large quantites of sand at shakers while drilling with conventional BHA. Quantity of cuttings lower with downhole motor; hydraulics?
Some increase in viscosity due to flocculation when drilling out cement but not severe, due to dilution of mud prior to drilling out. Filtrate increased due to dilution and cement. pH up to 11.5, but no major increase in calcium.
Treated with CMC–EHV to lower filtrate.
Changed shaker screens from 3 x 110, to 110/110/84 and then 110/110/50 to reduce losses due to sand blinding. Used water spray to aid in keeping screens clean; dilution reduced MBC from 11 to 8.
Adding AQUAGEL via premix.
Checked sump water for use in mud : pH = 9.5, chlorides = 1650 total hardness = 64. Okay for mud mixing.

ACTIVITY

Continue RIH, tagged cement at 623.8m. Pressure test kelly cocks, stabbing valve and flare line. Drilled float and shoe, made 5m of new hole. Circulate to condition mud and clean hole. Ran F.I.T. Circulated, repeat F.I.T. Drilled 8 1/2" hole from 645 – 781m, taking single shot surveys every 38m. Building angle, circulated hole clean. POOH, no tight hole recorded. Pick up downhole motor and MWD. RIH, no fill. Orientated motor and then drilled 8 1/2" hole from 781 – 823m.

INVENTORY AND CONSUMPTION

PRODUCT DESCRIPTION		USED	REC	BAL	COST
Barite,sx	50 kg			236	
Barite,sx	25 kg			402	
AQUAGEL,sx	25 kg	61		382	874.13
CMC–EHV	25 kg	5		63	533.05

MUD TYPE AQUAGEL/CMC

SOLIDS CONTROL EQUIPMENT

	Make	screen size	hrs	
Shaker 1	TRITON	2x110,1x50	10	
Shaker 2				
Shaker 3				
Shaker 4				
	ppg	bbl/hr	hrs	bbl
Desander	13.8	7.45	8.5	63
Desilter 1.	10.7	5.75	8.5	49
Desilter 2.				
Centrifuge 1				
Centrifuge 2				
Solids Control Effic.			%	

CONSUMPTION

Additions	bbl
Sea W.	
Drill W.	365
other	
other	
Barite	
Chemicals	4
Losses	**bbl**
Sol. Con.	112
Lost/Dumped	262
Down Hole	
Newhole	42
NET LOSS	5
Discharged	374

BAROID Engineer	OFFICE	WAREHOUSE
ALAN SEARLE	MELBOURNE	
Tel. 03 – 787 1502	03 – 621 3311	

DAILY COST A$ 1407.18 **CUMULATIVE COST** A$ 4757.61

RESERVE PITS

NO	TYPE	bbl
6	Pill Tank	41
7	Trip Tank	

SURVEY DATA

MD m	TVD m	INCL°	DIR °	DISP m
660		17.75	142.5	
698		18.25	142.5	
736		19.25	145.4	
813	795	18.5	148.4	

SOLIDS ANALYSIS

Low Grav. Solids	% Vol	3.4
Low Grav. Solids	ppb	30.9
High Grav. Solids	% Vol	
High Grav. Solids	ppb	
ASG of Solids	g/cc	2.60
Cuttings Volume	bbl	42.0
Interval Dilution	bbl/m	2.0
Interval Consumption	bbl/m	2.8

TIME BREAKDOWN

	hrs
Drilling	7
Circulating	1.5
Reaming In	
Reaming out	
Tripping	9
Survey	1.5
Other	5
AVE ROP m/hr	26.14

Baroid Australia Pty Ltd

MUD REPORT NO. 7	up to 24:00 hrs, 20/2/94
DATE 21/2/94	DEPTH–m MD 1052 TVD 1028
START DATE 14–Feb–94	ACTIVITY Running in hole

OPERATOR	CONTRACTOR / RIG	COUNTRY
G.F.E. RESOURCES LTD.	CENTURY DRILLING / RIG – 11	AUSTRALIA
REPORT FOR	**REPORT FOR**	**TOWNSHIP**
KEN SMITH	RICK GIDDENS	PORT CAMPBELL
WELL NAME AND NO.	**FIELD OR BLOCK NO.**	**LOCATION**
IONA – 2	PPL – 2	OTWAY BASIN, VICTORIA

BIT DATA

Size 8.500 ins		
Type Varel ETD417		
Nozzles 32nds		
10	12	12
Noz Area 0.30 ins²		
TFA ins²		
NV m/sec 100.0		
Impact lb f 461		

DRILLING STRING

	OD ins	ID ins	Length m
Pipe 1	4.5	3.826	795.7
Pipe 2	4.5	2.75	55.38
Pipe 3			
Col 1	6.25	2.25	200.88
Col 2			

OPEN HOLE SECTIONS

Sect 1		
Sect 2		
Current	8.5	420.9

CASINGS

Size ins		Depth m
Riser	Set @	
9.625	Set @	631.12
	Set @	
	Set @	
	Set @	
	Set @	
	Set @	
Liner	Set @	
	Top @	

PUMP DATA

Pump Make	ins x	ins	Eff %	bbl/stk	spm	bbl/min
National 7–P	5.5	7.75	95	0.0523		
National 8–P	6	8.5	95	0.0705	103	7.262

Pump Press 1425 psi TOTAL bbl/min 7.262

MUD VOL	bbl	CIRCULATING DATA		AV	m/min
Downhole	219	Total circ 76 mins			
Active	330	Bottoms up 24 mins		DP	43.8
Total Circ	549	Surface–bit 6 mins		DC	68.6
Reserve		ECD ppg	8.96	Riser	

MUD PROPERTIES

Sample Location	IN or OUT	IN		PIT	
Time Sample Taken	hrs	11:15		24:00	
Depth	m	1045		1052	
Flowline Temp	°C	37			
Weight	ppg	8.90		8.90	
Funnel Viscosity	sec/qt	51		38	
Plastic Viscosity	cP	10		12	
Yield Point	lb/100 ft²	28		11	
Gels 10 sec/10min/30 min	lb/100 ft²	8/16/–		2/5/–	
API Filtrate	ml/30min	21.0		11.3	
HPHT Filtrate	ml/30min				
API/HPHT Filter Cake	32nd ins	3/–		2/–	
Solids	% Vol	3.6		3.6	
Dissolved Salts	% Vol	0.7		0.7	
Oil/Water Content	% Vol	–/95.8		–/95.8	
Sand	% Vol	0.2		0.1	
Methylene Blue cap	ppb	10		9	
pH	meter	8.7		8.3	
Alk. Mud Pm	ml	0.22		0.20	
Alk. Filtrate, Pf/Mf	ml	0.02/0.07		0.01/0.04	
Chlorides	mg/Lx10³	8.2		8.6	
Total Hardness/Calcium	mg/L	160/130		180/140	
KCL	% Wt Soln	1.5		1.7	
K+ Ion Conc	mg/Lx10³	8.6		9.5	
Rheometer	600 rpm/300 rpm	48/38		35/23	
lb/100 ft²	200 rpm/100 rpm				
	6 rpm/3 rpm				

MUD PROPERTY SPECIFICATIONS

WEIGHT <9.2 ppg VIS 38–45 sec YP 10–20 lb/100 ft²
API Filt <15 ml HTHP ml KCL 3 %
BY AUTHORITY

REMARKS

Began adding KCl from 1000m. KCl caused mud to flocculate. Filtrate increased to 20+, cake thickness increased; possible contributing factor in pipe sticking.
While tripping to change BHA, treated surface mud with CMC–EHV and DEXTRID. CMC acted as deflocculant, reduced filtrate and improved cake quality. Mud from hole to be treated with CMC when circulation resumed.
Freed pipe by displacing annulus to water and reducing hydrostatic pressure. Water dumped when displacing back to mud.
pH to be increased when circulating, to 9 – 9.5

ACTIVITY

Drilled 8 1/2" directional hole from 823 – 1052m, surveys run with MWD tool. Became differentially stuck while making connection at 1039m; collars stuck above jars. Worked stuck pipe, spotted 40 bbls water above jars, unsucccesfully. Displaced annulus to water to reduce hydrostatic, pulled free. Displaced hole back to mud while working pipe. POOH, laid out downhole motor and MWD. Made up new BHA and RIH.

INVENTORY AND CONSUMPTION

PRODUCT DESCRIPTION		USED	REC	BAL	COST
Barite,sx	50 kg			236	
Barite,sx	25 kg			402	
AQUAGEL,sx	25 kg	30		352	429.9
Caustic Soda	25 kg	1		29	32.43
CMC–EHV	25 kg	10		53	1066.1
DEXTRID LT	50 lb	10		70	598.8
KCL,Tech(sx)	25 kg	60		209	866.4

MUD TYPE AQUAGEL/CMC

SOLIDS CONTROL EQUIPMENT

	Make	screen size	hrs
Shaker 1	TRITON	110/84/50	12
Shaker 2			
Shaker 3			
Shaker 4			

	ppg	bbl/hr	hrs	bbl
Desander	12.9	6.5	12	78
Desilter 1.	10.9	5	12	60
Desilter 2.				
Centrifuge 1				
Centrifuge 2				

Solids Control Effic. %

CONSUMPTION

Additions	bbl
Sea W.	
Drill W.	125
other	
other	
Barite	
Chemicals	9
Losses	**bbl**
Sol. Con.	138
Lost/Dumped	13
Down Hole	
Newhole	53
NET LOSS	17
Discharged	151

BAROID Engineer	OFFICE	WAREHOUSE
ALAN SEARLE	MELBOURNE	
Tel. 03 – 787 1502	03 – 621 3311	

DAILY COST **A$ 2993.63** CUMULATIVE COST **A$ 7751.24**

RESERVE PITS

NO	TYPE	bbl
6	Pill Tank	
7	Trip Tank	

SURVEY DATA

MD m	TVD m	INCL°	DIR °	DISP m
851.4	833	15.5	144.5	
889.7	872	12.4	139.1	
918.3	900	11.1	137.5	
965	947	10	138.7	
986	9.2	9.2	140.1	
1042	1024	8.2	143.1	

SOLIDS ANALYSIS

Low Grav. Solids	% Vol	3.6
Low Grav. Solids	ppb	32.8
High Grav. Solids	% Vol	
High Grav. Solids	ppb	
ASG of Solids	g/cc	2.60
Cuttings Volume	bbl	53.0
Interval Dilution	bbl/m	1.3
Interval Consumption	bbl/m	1.6

TIME BREAKDOWN

	hrs
Drilling	11.5
Circulating	0.5
Reaming In	
Reaming out	
Tripping	7.5
Work stuck pipe	4
Oyher	0.5
AVE ROP m/hr	19.91

Baroid Australia Pty Ltd

MUD REPORT NO.	8 up to 24:00 hrs, 21/2/94
DATE	22/2/94
DEPTH–m	MD 1133 TVD
START DATE	14–Feb–94
ACTIVITY	Drilling 8 1/2" hole.

OPERATOR G.F.E. RESOURCES LTD.	CONTRACTOR / RIG CENTURY DRILLING / RIG – 11	COUNTRY AUSTRALIA
REPORT FOR KEN SMITH	REPORT FOR RICK GIDDENS	TOWNSHIP PORT CAMPBELL
WELL NAME AND NO. IONA – 2	FIELD OR BLOCK NO. PPL – 2	LOCATION OTWAY BASIN, VICTORIA

BIT DATA

Size 8.500 ins			
Type Varel ETD417			
Nozzles 32nds			
10	12	12	
Noz Area 0.30 ins²			
TFA ins²			
NV m/sec 101.9			
Impact lb f 490			

DRILLING STRING

	OD ins	ID ins	Length m
Pipe 1	4.5	3.826	876.7
Pipe 2	4.5	2.75	55.38
Pipe 3			
Col 1	6.25	2.25	200.88
Col 2			

OPEN HOLE SECTIONS

Sect 1		
Sect 2		
Current	8.5	501.9

CASINGS

Size ins		Depth m
Riser	Set @	
9.625	Set @	631.12
	Set @	
	Set @	
	Set @	
	Set @	
	Set @	
Liner	Set @	
	Top @	

PUMP DATA

Pump Make	ins x	ins	Eff %	bbl/stk	spm	bbl/min
National 7–P	5.5	7.75	95	0.0523		
National 8–P	6	8.5	95	0.0705	105	7.403

Pump Press 1250 psi TOTAL bbl/min 7.403

MUD VOL	bbl	CIRCULATING DATA		
Downhole	236	Total circ 84 mins	AV	m/min
Active	386	Bottoms up 26 mins	DP	44.7
Total Circ	622	Surface–bit 6 mins	DC	70
Reserve	71	ECD ppg ERR	Riser	

MUD PROPERTIES

Sample Location	IN or OUT	IN		IN	
Time Sample Taken	hrs	12:45		23:30	
Depth	m	1094		1133	
Flowline Temp	°C	34		43	
Weight	ppg	8.95		9.10	
Funnel Viscosity	sec/qt	37		38	
Plastic Viscosity	cP	11		11	
Yield Point	lb/100 ft²	7		8	
Gels 10 sec/10min/30 min	lb/100 ft²	1/2/–		1/3/–	
API Filtrate	ml/30min	9.6		8.2	
HPHT Filtrate	ml/30min				
API/HPHT Filter Cake	32nd ins	1/–		1/–	
Solids	% Vol	3.3		4.5	
Dissolved Salts	% Vol	1.2		1.3	
Oil/Water Content	% Vol	–/95.5		–/94.3	
Sand	% Vol	0.3		0.3	
Methylene Blue cap	ppb	9		12	
pH	meter	9.0		9.5	
Alk. Mud Pm	ml	0.38		0.74	
Alk. Filtrate, Pf/Mf	ml	0.06/0.16		0.10/0.22	
Chlorides	mg/Lx10³	13.6		15.0	
Total Hardness/Calcium	mg/L	120/100		40/32	
KCL	% Wt Soln	2.7		2.9	
K+ Ion Conc	mg/Lx10³	15.2		16.6	
Rheometer	600 rpm/300 rpm	29/18		30/19	
lb/100 ft²	200 rpm/100 rpm				
	6 rpm/3 rpm				

MUD PROPERTY SPECIFICATIONS

WEIGHT <9.2 ppg VIS 38–45 sec YP 10–20 lb/100 ft²
API Filt 5–7 ml HTHP ml KCL 3 %
BY AUTHORITY Mud program/G.F.E. rep.

REMARKS

Rebuilt pit volume.
Treated with CMC–EHV and DEXTRID to reduce filtrate and improve filter cake after getting stuck. Filtrate reduced to 8.2 ml.
AQUAGEL added to increase Yield Point and funnel vis. CMC–EHV not sufficient to maintain viscosity by itself.
Desilter shut off for two hours, repairing electrical fault. Decided not to run desilter after repaired, to reduce mud losses and allow solids and weight to build up prior to Waare formation. Ran desander only, to control sand content.
Low ROP, little or no viscosity from formation solids/clays.

ACTIVITY

Continued RIH. Hit bridge at 1034m, ream/wash 1024 – 1043m, one jet partially blocked. Blew kelly hose while reaming. POOH to casing shoe. Replaced kelly hose. RIH, washed 8m to bottom, no fill. Drilled 8 1/2" hole from 1080 – 1133m; survey at 1096m.

INVENTORY AND CONSUMPTION

PRODUCT DESCRIPTION		USED	REC	BAL	COST
Barite,sx	50 kg			236	
Barite,sx	25 kg			402	
AQUAGEL,sx	25 kg	67		285	960.11
Caustic Soda	25 kg	5		24	162.15
CMC–EHV	25 kg	16		37	1705.76
DEXTRID LT	50 lb	9		61	538.92
KCL,Tech(sx)	25 kg	63		146	909.72

MUD TYPE 3% KCl/Polymer

SOLIDS CONTROL EQUIPMENT

	Make	screen size	hrs
Shaker 1	TRITON	110/84/50	15
Shaker 2			
Shaker 3			
Shaker 4			

	ppg	bbl/hr	hrs	bbl
Desander	11.7	2.5	15	38
Desilter 1.	11.4	3	3	9
Desilter 2.				
Centrifuge 1				
Centrifuge 2				

Solids Control Effic. %

CONSUMPTION

Additions	bbl
Sea W.	
Drill W.	330
other	
other	
Barite	
Chemicals	12
Losses	**bbl**
Sol. Con.	47
Lost/Dumped	151
Down Hole	
Newhole	19
NET GAIN	144
Discharged	198

BAROID Engineer	OFFICE	WAREHOUSE
ALAN SEARLE	MELBOURNE	
Tel. 03 – 787 1502	03 – 621 3311	

DAILY COST A$ 4276.66 CUMULATIVE COST A$ 12027.90

RESERVE PITS

NO	TYPE	bbl
6	Pill Tank	71
7	Trip Tank	

SURVEY DATA

MD m	TVD m	INCL°	DIR °	DISP m
1096		5.5	140	

SOLIDS ANALYSIS

Low Grav. Solids	% Vol	4.2
Low Grav. Solids	ppb	38.2
High Grav. Solids	% Vol	0.3
High Grav. Solids	ppb	4.4
ASG of Solids	g/cc	2.70
Cuttings Volume	bbl	19.0
Interval Dilution	bbl/m	1.5
Interval Consumption	bbl/m	2.0

TIME BREAKDOWN

	hrs
Drilling	14
Circulating	
Reaming In	1
Reaming out	
Tripping	0.5
Rig repair	7.5
Survey	0.5
Other	0.5
AVE ROP m/hr	5.79

Baroid Australia Pty Ltd

MUD REPORT NO. 9	up to 24:00 hrs, 22/2/94
DATE 23/2/94	DEPTH–m MD 1268 TVD
START DATE 14–Feb–94	ACTIVITY Trip to change bit and BHA.

OPERATOR G.F.E. RESOURCES LTD.	CONTRACTOR / RIG CENTURY DRILLING / RIG – 11	COUNTRY AUSTRALIA
REPORT FOR KEN SMITH	REPORT FOR RICK GIDDENS	TOWNSHIP PORT CAMPBELL
WELL NAME AND NO. IONA – 2	FIELD OR BLOCK NO. PPL – 2	LOCATION OTWAY BASIN, VICTORIA

BIT DATA

Size	8.500 ins
Type	Varel ETD417
Nozzles 32nds	10 / 12 / 12
Noz Area	0.30 ins²
TFA	ins²
NV m/sec	101.9
Impact lb f	500

DRILLING STRING

	OD ins	ID ins	Length m
Pipe 1	4.5	3.826	1011.7
Pipe 2	4.5	2.75	55.38
Pipe 3			
Col 1	6.25	2.25	200.88
Col 2			

OPEN HOLE SECTIONS

Sect 1		
Sect 2		
Current	8.5	636.9

CASINGS

Size ins		Depth m
Riser	Set @	
9.625	Set @	631.12
	Set @	
	Set @	
	Set @	
	Set @	
	Set @	
Liner	Set @	
	Top @	

PUMP DATA

Pump Make	ins	x ins	Eff %	bbl/stk	spm	bbl/min
National 7–P	5.5	7.75	95	0.0523		
National 8–P	6	8.5	95	0.0705	105	7.403

Pump Press 1325 psi TOTAL bbl/min 7.403

MUD VOL	bbl	CIRCULATING DATA	AV	m/min
Downhole	265	Total circ 81 mins		
Active	338	Bottoms up 29 mins	DP	44.7
Total Circ	603	Surface–bit 7 mins	DC	70
Reserve	37	ECD ppg ERR	Riser	

MUD PROPERTIES

Sample Location	IN or OUT	IN		IN	
Time Sample Taken	hrs	11:40		19:30	
Depth	m	1215		1268	
Flowline Temp	°C	43		44	
Weight	ppg	9.20		9.30	
Funnel Viscosity	sec/qt	39		39	
Plastic Viscosity	cP	12		13	
Yield Point	lb/100 ft²	8		9	
Gels 10 sec/10min/30 min	lb/100 ft²	1/5/–		2/7/–	
API Filtrate	ml/30min	7.5		6.8	
HPHT Filtrate	ml/30min				
API/HPHT Filter Cake	32nd ins	1/–		1/--	
Solids	% Vol	5.3		6.0	
Dissolved Salts	% Vol	1.2		1.3	
Oil/Water Content	% Vol	–/93.5		–/92.8	
Sand	% Vol	0.2		0.1	
Methylene Blue cap	ppb	14		16	
pH	meter	9.5		10.0	
Alk. Mud Pm	ml	0.55		0.70	
Alk. Filtrate, Pf/Mf	ml	0.07/0.36		0.15/0.48	
Chlorides	mg/Lx10³	14.1		16.0	
Total Hardness/Calcium	mg/L	25/20		20/16	
KCL	% Wt Soln	2.8		3.1	
K+ Ion Conc	mg/Lx10³	15.8		17.8	
Rheometer	600 rpm/300 rpm	32/20		35/22	
lb/100 ft²	200 rpm/100 rpm				
	6 rpm/3 rpm				

MUD PROPERTY SPECIFICATIONS

WEIGHT 9.3min ppg VIS 38–45 sec YP 10–20 lb/100 ft²
API Filt 5–7 ml HTHP ml KCL 3 %
BY AUTHORITY

REMARKS

Continued treating with CMC–EHV and DEXTRID to gradually reduce filtrate below 7 ml.
Desilter shut off to allow solids to build and increase mud weight to 9.3+ lb/gal prior to drilling Waare.
Funnel viscosity okay, but YP still realtively low despite treatments with CMC and AQUAGEL. No problems with hole cleaning however.
Pumped weighted pill to POOH for bit change, Barite intended to help raise mud weight to required 9.3+

ACTIVITY

Drilled 8 1/2" hole from 1133 – 1181m. Circulate and survey at 1165m. Pipe became stuck while taking survey. Worked differentially stuck pipe, pulling 137000 lbs over, before rotating free. Worked pipe and circulated hole clean. Continued drilling from 1165 – 1268m. Circulated bottoms up. Short trip from 1268 – 900m, no fill. Circulated bottoms up. Survey, pump pill and circulate. Survey again. POOH.

INVENTORY AND CONSUMPTION

PRODUCT DESCRIPTION		USED	REC	BAL	COST
Barite,sx	50 kg			236	
Barite,sx	25 kg	40		362	319.2
AQUAGEL,sx	25 kg	6		279	85.98
Caustic Soda	25 kg	4		20	129.72
CMC–EHV	25 kg	14		23	1492.54
DEXTRID LT	50 lb	10		51	598.8
KCL,Tech(sx)	25 kg	30		116	433.2
EZ SPOT	208 lt		3	5	

MUD TYPE 3% KCl/Polymer

SOLIDS CONTROL EQUIPMENT

	Make	screen size	hrs
Shaker 1	TRITON	110/84/50	21
Shaker 2			
Shaker 3			
Shaker 4			

	ppg	bbl/hr	hrs	bbl
Desander	12.7	1.5	20	30
Desilter 1.	10.2	6	4.5	27
Desilter 2.				
Centrifuge 1				
Centrifuge 2				

Solids Control Effic. %

CONSUMPTION

Additions	bbl
Sea W.	
Drill W.	100
other	
other	
Barite	2
Chemicals	6
Losses	**bbl**
Sol. Con.	57
Lost/Dumped	104
Down Hole	
Newhole	31
NET LOSS	53
Discharged	161

BAROID Engineer	OFFICE	WAREHOUSE
ALAN SEARLE	MELBOURNE	
Tel. 03 – 787 1502	03 – 621 3311	

DAILY COST A$ 3059.44 CUMULATIVE COST A$ 15087.34

RESERVE PITS

NO	TYPE	bbl
6	Pill Tank	
7	Trip Tank	37

SURVEY DATA

MD m	TVD m	INCL°	DIR °	DISP m
1165		3.25	136	
1250		2.5	143	

SOLIDS ANALYSIS

Low Grav. Solids	% Vol	5.6
Low Grav. Solids	ppb	50.9
High Grav. Solids	% Vol	0.4
High Grav. Solids	ppb	5.9
ASG of Solids	g/cc	2.70
Cuttings Volume	bbl	31.0
Interval Dilution	bbl/m	1.4
Interval Consumption	bbl/m	1.8

TIME BREAKDOWN

	hrs
Drilling	18
Circulating	2
Reaming In	
Reaming out	
Tripping	2
Survey	1.5
Other	0.5
AVE ROP m/hr	7.5

Baroid Australia Pty Ltd

MUD REPORT NO. 11	up to 24:00 hrs, 24/2/94
DATE 25/2/94	DEPTH–m MD 1650 TVD
START DATE 14–Feb–94	ACTIVITY Wiper Trip

OPERATOR	CONTRACTOR / RIG	COUNTRY
G.F.E. RESOURCES LTD.	CENTURY DRILLING / RIG – 11	AUSTRALIA
REPORT FOR	**REPORT FOR**	**TOWNSHIP**
KEN SMITH	S. KELLY	PORT CAMPBELL
WELL NAME AND NO.	**FIELD OR BLOCK NO.**	**LOCATION**
IONA – 2	PPL – 2	OTWAY BASIN, VICTORIA

BIT DATA / DRILLING STRING / CASINGS

BIT DATA				DRILLING STRING	OD ins	ID ins	Length m	CASINGS Size ins		Depth m
Size 8.500 ins										
Type Varel ETD417				Pipe 1	4.5	3.826	1439.9	Riser	Set @	
Nozzles 32nds				Pipe 2	4.5	2.75	63.83	9.625	Set @	631.12
12	12	12		Pipe 3					Set @	
				Col 1	6.25	2.25	146.32		Set @	
				Col 2					Set @	
Noz Area 0.33 ins²				OPEN HOLE SECTIONS					Set @	
TFA ins²				Sect 1					Set @	
NV m/sec 92.4				Sect 2				Liner	Set @	
Impact lb f 463				Current		8.5	1018.9		Top @	

PUMP DATA

Pump Make	ins	x ins	Eff %	bbl/stk	spm	bbl/min
National 7–P	5.5	7.75	95	0.0523		
National 8–P	6	8.5	95	0.0705	106	7.473

Pump Press 1225 psi TOTAL bbl/min 7.473

MUD VOL	bbl	CIRCULATING DATA	AV m/min	
Downhole	351	Total circ 93 mins		
Active	342	Bottoms up 37 mins	DP	45.1
Total Circ	693	Surface–bit 10 mins	DC	70.6
Reserve	34	ECD ppg ERR	Riser	

MUD PROPERTIES

Sample Location	IN or OUT	IN	IN	IN	
Time Sample Taken	hrs	10:45	18:45	24:00	
Depth	m	1520	1650	1650	
Flowline Temp	°C	42	42	40	
Weight	ppg	9.40	9.40	9.40	
Funnel Viscosity	sec/qt	38	40	40	
Plastic Viscosity	cP	11	14	12	
Yield Point	lb/100 ft²	9	12	12	
Gels 10 sec/10min/30 min	lb/100 ft²	2/8/–	6/15/–	6/12/21	
API Filtrate	ml/30min	6.6	6.6	6.7	
HPHT Filtrate	ml/30min				
API/HPHT Filter Cake	32nd ins	1/–	1/–	1/–	
Solids	% Vol	6.2	6.2	6.2	
Dissolved Salts	% Vol	1.3	1.3	1.3	
Oil/Water Content	% Vol	–/92.5	–/92.5	–/92.5	
Sand	% Vol	0.1	0.1	Tr	
Methylene Blue cap	ppb	11	12	13	
pH	meter	9.0	9.5	9.6	
Alk. Mud Pm	ml	0.20	0.35	0.35	
Alk. Filtrate, Pf/Mf	ml	0.10/0.30	0.15/0.30	0.10/0.20	
Chlorides	mg/Lx10³	16.0	15.0	15.0	
Total Hardness/Calcium	mg/L	40/20	40/20	40/30	
KCL	% Wt Soln	3.0	3.0	3.0	
K+ Ion Conc	mg/Lx10³	17.2	17.2	17.2	
Sulphite Residual	mg/L	50	40	40	
Rheometer	600 rpm/300 rpm	31/20	40/26	36/24	
lb/100 ft²	200 rpm/100 rpm				
	6 rpm/3 rpm				

MUD PROPERTY SPECIFICATIONS

WEIGHT 9.3+ ppg VIS 38–45 sec YP 10–20 lb/100 ft²
API Filt 5–7 ml HTHP ml KCL 3 %
BY AUTHORITY Mud Program

REMARKS

Increased dilution rate by dumping of 5 bbl sandtrap each connection to stabilise mud weight. (Tending to go over 9.4 ppg)
Stopped use of CMC–EHV and added extra AQUAGEL via pre–mixes to increase viscosity and yield point. (MBT still low at 11 ppb)
Added 2 sxs Lime and extra Caustic Soda to increase Pm and pH.

ACTIVITY

Drilled to 1650 m TD. Circulated bottoms up. Began running wiper trip back to casing shoe.

INVENTORY AND CONSUMPTION

PRODUCT DESCRIPTION		USED	REC	BAL	COST
Barite,sx	50 kg			236	
Barite,sx	25 kg			362	
AQUAGEL,sx	25 kg	29		244	415.57
KCL,Tech(sx)	25 kg	49		121	707.56
Caustic Soda	25 kg	6		11	194.58
CMC–EHV	25 kg	7		9	746.27
DEXTRID LT	50 lb	29			1736.52
Lime	25 kg	2		17	16.08
BARACOR 129	25 kg	1		8	64.96

MUD TYPE 3% KCl/Polymer

SOLIDS CONTROL EQUIPMENT

	Make	screen size	hrs	
Shaker 1	TRITON	110/84/50	19	
Shaker 2				
Shaker 3				
Shaker 4				
	ppg	**bbl/hr**	**hrs**	**bbl**
Desander	11.3	1.5	18	27
Desilter 1.	11.3	4	18	72
Desilter 2.				
Centrifuge 1				
Centrifuge 2				

Solids Control Effic. %

CONSUMPTION

Additions	bbl
Sea W.	
Drill W.	200
other	
other	
Barite	
Chemicals	10
Losses	**bbl**
Sol. Con.	99
Lost/Dumped	73
Down Hole	
Newhole	57
NET GAIN	38
Discharged	172

BAROID Engineer	OFFICE	WAREHOUSE
M. Olejniczak	MELBOURNE	ADELAIDE
Tel. 059–787 103	03 – 621 3311	

DAILY COST A$ 3881.54 **CUMULATIVE COST** A$ 22073.43

RESERVE PITS / SURVEY DATA

NO	TYPE	bbl	MD m	TVD m	INCL°	DIR °	DISP m
6	Pill Tank	27	1450		1	151	
7	Trip Tank	7	1632		0.75	136	

SOLIDS ANALYSIS

Low Grav. Solids	% Vol	5.4
Low Grav. Solids	ppb	49.1
High Grav. Solids	% Vol	0.8
High Grav. Solids	ppb	11.8
ASG of Solids	g/cc	2.80
Cuttings Volume	bbl	57.0
Interval Dilution	bbl/m	1.3
Interval Consumption	bbl/m	1.6

TIME BREAKDOWN

	hrs
Drilling	18.5
Circulating	1
Reaming In	
Reaming out	
Tripping	3.5
Survey	1
Other	
AVE ROP m/hr	13.3

Baroid Australia Pty Ltd

MUD REPORT NO.	12 up to 24:00 hrs, 25/2/94
DATE	26/2/94
DEPTH–m	MD 1650 TVD
START DATE	14–Feb–94
ACTIVITY	Logging

OPERATOR: G.F.E. RESOURCES LTD.	CONTRACTOR / RIG: CENTURY DRILLING / RIG – 11	COUNTRY: AUSTRALIA
REPORT FOR: KEN SMITH	REPORT FOR: S. KELLY	TOWNSHIP: PORT CAMPBELL
WELL NAME AND NO.: IONA – 2	FIELD OR BLOCK NO.: PPL – 2	LOCATION: OTWAY BASIN, VICTORIA

BIT DATA

Size ins	
Type	
Nozzles 32nds	
Noz Area ins²	
TFA ins²	
NV m/sec	
Impact lb f	

DRILLING STRING

	OD ins	ID ins	Length m
Pipe 1	4.5	3.826	
Pipe 2	4.5	2.75	
Pipe 3			
Col 1	6.25	2.25	
Col 2			

OPEN HOLE SECTIONS

Sect 1		
Sect 2		
Current	8.5	1018.9

CASINGS

Size ins		Depth m
Riser	Set @	
9.625	Set @	631.12
	Set @	
	Set @	
	Set @	
	Set @	
	Set @	
Liner	Set @	
	Top @	

PUMP DATA

Pump Make	ins	x ins	Eff %	bbl/stk	spm	bbl/min
National 7–P	5.5	7.75	95	0.0523		
National 8–P	6	8.5	95	0.0705		

Pump Press – psi TOTAL bbl/min

MUD VOL bbl		CIRCULATING DATA		
Downhole	395	Total circ – mins		AV m/min
Active	254	Bottoms up – mins		DP
Total Circ	649	Surface–bit – mins		DC
Reserve	87	ECD ppg	ERR	Riser

MUD PROPERTIES

Sample Location	IN or OUT	IN			
Time Sample Taken	hrs	24:00			
Depth	m	1650			
Flowline Temp	°C				
Weight	ppg	9.40			
Funnel Viscosity	sec/qt	40			
Plastic Viscosity	cP	12			
Yield Point	lb/100 ft²	12			
Gels 10 sec/10min/30 min	lb/100 ft²	6/12/21			
API Filtrate	ml/30min	6.7			
HPHT Filtrate	ml/30min				
API/HPHT Filter Cake	32nd ins	1/–			
Solids	% Vol	6.2			
Dissolved Salts	% Vol	1.3			
Oil/Water Content	% Vol	–/92.5			
Sand	% Vol	Tr			
Methylene Blue cap	ppb	13			
pH	meter	9.6			
Alk. Mud Pm	ml	0.35			
Alk. Filtrate, Pf/Mf	ml	0.10/0.20			
Chlorides	mg/Lx10³	15.0			
Total Hardness/Calcium	mg/L	40/30			
KCL	% Wt Soln	3.0			
K+ Ion Conc	mg/Lx10³	17.2			
Sulphite Residual	mg/L	40			
Rheometer	600 rpm/300 rpm	36/24			
lb/100 ft²	200 rpm/100 rpm				
	6 rpm/3 rpm				

MUD PROPERTY SPECIFICATIONS

WEIGHT 9.3+ ppg VIS 38–45 sec YP 10–20 lb/100 ft²
API Filt 5–7 ml HTHP ml KCL 3 %
BY AUTHORITY Mud Program

REMARKS

Lost 40 bbls active mud through leaking valve, while tripping out. While logging had steady seepage losses of about 2 bbl/hr downhole. Had to mix additional pre–mixes to maintain enough volume to circulate on next wiper trip, because of these losses. Schlumberger had no hole problems logging, getting to bottom on first run.

ACTIVITY

Continued wiper trip. Hole only slightly tight coming out at 1050 m. Ran back to bottom, precautionary washing and reaming last 5 m. Circulated out, pumped slug and strapped out with multi–shot survey. Ran Schlumberger logs.

INVENTORY AND CONSUMPTION

PRODUCT DESCRIPTION		USED	REC	BAL	COST
Barite,sx	50 kg			236	
Barite,sx	25 kg	40		322	319.2
AQUAGEL,sx	25 kg			244	
KCL,Tech(sx)	25 kg	18		103	259.92
BARACIDE	25 kg	1			549.92
PAC–R	50 lb	3		17	512.22
BARACARB 110	25 kg		48	48	
BARACARB 600	25 kg		48	48	

MUD TYPE 3% KCl/Polymer

SOLIDS CONTROL EQUIPMENT

	Make	screen size	hrs
Shaker 1	TRITON		
Shaker 2			
Shaker 3			
Shaker 4			

	ppg	bbl/hr	hrs	bbl
Desander				
Desilter 1.				
Desilter 2.				
Centrifuge 1				
Centrifuge 2				

Solids Control Effic. %

CONSUMPTION

Additions	bbl
Sea W.	
Drill W.	110
other	
other	
Barite	2
Chemicals	2
Losses	**bbl**
Sol. Con.	
Lost/Dumped	55
Down Hole	50
Newhole	
NET GAIN	9
Discharged	55

BAROID Engineer	OFFICE	WAREHOUSE
M. Olejniczak	MELBOURNE	ADELAIDE
Tel. 059–787 103	03 – 621 3311	

DAILY COST A$ 1641.26 CUMULATIVE COST A$ 23714.69

RESERVE PITS

NO	TYPE	bbl
6	Pill Tank	74
7	Trip Tank	13

SURVEY DATA

MD m	TVD m	INCL°	DIR°	DISP m

SOLIDS ANALYSIS

Low Grav. Solids	% Vol	5.4
Low Grav. Solids	ppb	49.1
High Grav. Solids	% Vol	0.8
High Grav. Solids	ppb	11.8
ASG of Solids	g/cc	2.80
Cuttings Volume	bbl	
Interval Dilution	bbl/m	1.4
Interval Consumption	bbl/m	1.7

TIME BREAKDOWN

	hrs
Drilling	
Circulating	1.5
Reaming In	
Reaming out	
Tripping	8
Logging	14.5
Other	
AVE ROP m/hr	

Baroid Australia Pty Ltd	**MUD REPORT NO.** 13 up to 24:00 hrs, 26/2/94	
	DATE 27/2/94	**DEPTH–m** MD 1650 TVD
	START DATE 14–Feb–94	**ACTIVITY** Logging

OPERATOR G.F.E. RESOURCES LTD.	**CONTRACTOR / RIG** CENTURY DRILLING / RIG – 11	**COUNTRY** AUSTRALIA
REPORT FOR KEN SMITH	**REPORT FOR** S. KELLY	**TOWNSHIP** PORT CAMPBELL
WELL NAME AND NO. IONA – 2	**FIELD OR BLOCK NO.** PPL – 2	**LOCATION** OTWAY BASIN, VICTORIA

BIT DATA

Size ins	
Type	
Nozzles 32nds	
Noz Area ins²	
TFA ins²	
NV m/sec	
Impact lb f	

DRILLING STRING

	OD ins	ID ins	Length m
Pipe 1	4.5	3.826	
Pipe 2	4.5	2.75	
Pipe 3			
Col 1	6.25	2.25	
Col 2			

OPEN HOLE SECTIONS

Sect 1		
Sect 2		
Current	8.5	1018.9

CASINGS

Size ins		Depth m
Riser	Set @	
9.625	Set @	631.12
	Set @	
	Set @	
	Set @	
	Set @	
	Set @	
Liner	Set @	
	Top @	

PUMP DATA

Pump Make	ins x ins		Eff %	bbl/stk	spm	bbl/min
National 7–P	5.5	7.75	95	0.0523		
National 8–P	6	8.5	95	0.0705		

Pump Press – psi TOTAL bbl/min

MUD VOL bbl		CIRCULATING DATA		
Downhole	395	Total circ – mins	AV m/min	
Active	254	Bottoms up – mins	DP	
Total Circ	649	Surface–bit – mins	DC	
Reserve	27	ECD ppg	ERR	Riser

MUD PROPERTIES

Sample Location	IN or OUT	IN			
Time Sample Taken	hrs	09:00			
Depth	m	1650			
Flowline Temp	°C				
Weight	ppg	9.35			
Funnel Viscosity	sec/qt	38			
Plastic Viscosity	cP	10			
Yield Point	lb/100 ft²	10			
Gels 10 sec/10min/30 min	lb/100 ft²	2/8/12			
API Filtrate	ml/30min	6.8			
HPHT Filtrate	ml/30min				
API/HPHT Filter Cake	32nd ins	1/–			
Solids	% Vol	5.8			
Dissolved Salts	% Vol	1.2			
Oil/Water Content	% Vol	–/93.0			
Sand	% Vol	0.1			
Methylene Blue cap	ppb	10			
pH	meter	9.7			
Alk. Mud Pm	ml	0.40			
Alk. Filtrate, Pf/Mf	ml	0.30/0.60			
Chlorides	mg/Lx10³	14.0			
Total Hardness/Calcium	mg/L	20/20			
KCL	% Wt Soln	2.8			
K+ Ion Conc	mg/Lx10³	16.1			
Sulphite Residual	mg/L	40			
Rheometer	600 rpm/300 rpm	30/20			
lb/100 ft²	200 rpm/100 rpm				
	6 rpm/3 rpm				

MUD PROPERTY SPECIFICATIONS

WEIGHT 9.3+ ppg VIS 38–45 sec YP 10–20 lb/100 ft²
API Filt 5–7 ml HTHP ml KCL 3 %
BY AUTHORITY

REMARKS

Increased active pit volume and stabilised mud weight on wiper trip. Hole remaining in satisfactory condition. Taking only about 1 bbl/hr today. Schlumbereger wireline temporarily stuck about 5 mins during RFT run, but pulled free.

Log run 4. – RFT–GR–AMS

ACTIVITY

Continued logging. Rigged down Schlumberger. RIH with BHA. Slipped line at shoe. Continued RIH. Precautionary washed and reamed last 21 m to bottom. Circulated and conditioned mud for 2 hrs POH and continued logging with Schlumbereger.

INVENTORY AND CONSUMPTION

PRODUCT DESCRIPTION		USED	REC	BAL	COST
Barite,sx	50 kg	23		213	367.08
Barite,sx	25 kg	2		320	15.96
AQUAGEL,sx	25 kg			244	
KCL,Tech(sx)	25 kg	15		88	216.6
Caustic Soda	25 kg	1		10	32.43
PAC–R	50 lb	2		15	341.48

MUD TYPE 3% KCl/Polymer

SOLIDS CONTROL EQUIPMENT

	Make	screen size	hrs
Shaker 1	TRITON		
Shaker 2			
Shaker 3			
Shaker 4			

	ppg	bbl/hr	hrs	bbl
Desander				
Desilter 1.				
Desilter 2.				
Centrifuge 1				
Centrifuge 2				

Solids Control Effic. %

CONSUMPTION

Additions	bbl
Sea W.	
Drill W.	
other	
other	
Barite	2
Chemicals	2
Losses	**bbl**
Sol. Con.	
Lost/Dumped	39
Down Hole	25
Newhole	
NET LOSS	60
Discharged	39

BAROID Engineer	OFFICE	WAREHOUSE
M. Olejniczak	MELBOURNE	ADELAIDE
Tel. 059–787 103	03 – 621 3311	

DAILY COST A$ 973.55 **CUMULATIVE COST** A$ 24688.24

THE RECOMMENDATIONS MADE HEREON SHALL NOT BE CONSTRUED AS AUTHORIZING THE INFRINGEMENT OF ANY VALID PATENT, AND ARE MADE WITHOUT ASSUMPTION OF ANY LIABILITY BY BAROID DRILLING FLUIDS, INC OR IT'S AGENTS, AND ARE STATEMENTS OF OPINION ONLY.

RESERVE PITS

NO	TYPE	bbl
6	Pill Tank	7
7	Trip Tank	20

SURVEY DATA

MD m	TVD m	INCL°	DIR °	DISP m

SOLIDS ANALYSIS

Low Grav. Solids	% Vol	4.7
Low Grav. Solids	ppb	42.8
High Grav. Solids	% Vol	1.1
High Grav. Solids	ppb	16.2
ASG of Solids	g/cc	2.90
Cuttings Volume	bbl	
Interval Dilution	bbl/m	1.4
Interval Consumption	bbl/m	1.7

TIME BREAKDOWN hrs

Drilling	
Circulating	2
Reaming In	
Reaming out	
Tripping	9.5
Logging	12.5
Other	
AVE ROP m/hr	

Baroid Australia Pty Ltd

MUD REPORT NO.	14 up to 24:00 hrs, 27/2/94
DATE	28/2/94
DEPTH–m	MD 1650 TVD
START DATE	14–Feb–94
ACTIVITY	Wiper Trip

OPERATOR G.F.E. RESOURCES LTD.	CONTRACTOR / RIG CENTURY DRILLING / RIG – 11	COUNTRY AUSTRALIA
REPORT FOR KEN SMITH	REPORT FOR S. KELLY	TOWNSHIP PORT CAMPBELL
WELL NAME AND NO. IONA – 2	FIELD OR BLOCK NO. PPL – 2	LOCATION OTWAY BASIN, VICTORIA

BIT DATA

Size ins	
Type	
Nozzles 32nds	
Noz Area ins²	
TFA ins²	
NV m/sec	
Impact lb f	

DRILLING STRING

	OD ins	ID ins	Length m
Pipe 1	4.5	3.826	1650
Pipe 2	4.5	2.75	
Pipe 3			
Col 1	6.25	2.25	
Col 2			

OPEN HOLE SECTIONS

Sect 1		
Sect 2		
Current	8.5	1018.9

CASINGS

Size ins		Depth m
Riser	Set @	
9.625	Set @	631.12
	Set @	
	Set @	
	Set @	
	Set @	
	Set @	
Liner	Set @	
	Top @	

PUMP DATA

Pump Make	ins x ins		Eff %	bbl/stk	spm	bbl/min
National 7–P	5.5	7.75	95	0.0523		
National 8–P	6	8.5	95	0.0705		

Pump Press – psi TOTAL bbl/min

MUD VOL	bbl	CIRCULATING DATA		
Downhole	365	Total circ – mins		AV m/min
Active	238	Bottoms up – mins		DP
Total Circ	603	Surface–bit – mins		DC
Reserve	44	ECD ppg	ERR	Riser

MUD PROPERTIES

Sample Location	IN or OUT	IN		IN	
Time Sample Taken	hrs	12:00		24:00	
Depth	m	1650		1650	
Flowline Temp	°C				
Weight	ppg	9.30		9.30	
Funnel Viscosity	sec/qt	36		34	
Plastic Viscosity	cP	10		9	
Yield Point	lb/100 ft²	7		7	
Gels 10 sec/10min/30 min	lb/100 ft²	2/6/9		1/5/8	
API Filtrate	ml/30min	6.8		6.8	
HPHT Filtrate	ml/30min				
API/HPHT Filter Cake	32nd ins	1/–		1/–	
Solids	% Vol	5.9		5.9	
Dissolved Salts	% Vol	1.1		1.1	
Oil/Water Content	% Vol	–/93.0		–/93.0	
Sand	% Vol	0.1		0.1	
Methylene Blue cap	ppb	10		10	
pH	meter	9.0		8.7	
Alk. Mud Pm	ml	0.20		0.10	
Alk. Filtrate, Pf/Mf	ml	0.10/0.20		0.05/0.15	
Chlorides	mg/Lx10³	13.5		13.5	
Total Hardness/Calcium	mg/L	20/20		20/20	
KCL	% Wt Soln	2.7		2.7	
K+ Ion Conc	mg/Lx10³	15.5		15.5	
Sulphite Residual	mg/L				
Rheometer	600 rpm/300 rpm	27/17		25/16	
lb/100 ft²	200 rpm/100 rpm				
	6 rpm/3 rpm				

MUD PROPERTY SPECIFICATIONS

WEIGHT 9.3+ ppg VIS 38–45 sec YP 10–20 lb/100 ft²
API Filt 5–7 ml HTHP ml KCL 3 %
BY AUTHORITY

REMARKS

Logs completed without problems.
Log Run 5. – Sidewall Cores
Mud viscosity and pH dropping, but filtrate and weight reasonably steady. Allowing viscosity to stay low for increased turbulence during casing cementing. Didn't gain any noticeable contamination from setting cement plug.

ACTIVITY

Completed Logging. Rigged down Schlumberger. Ran BOP test. RIH open ended to 1520 m and set 60 sx cement plug. Pulled back 5 stands and flushed pipe. POH, picked up bit and BHA. RIH and tagged cement plug at 1471 m. Pulled back to 1457 m and began circulating hole clean.

INVENTORY AND CONSUMPTION

PRODUCT DESCRIPTION		USED	REC	BAL	COST
Barite,sx	50 kg	13		200	207.48
Barite,sx	25 kg			320	
AQUAGEL,sx	25 kg			244	
KCL,Tech(sx)	25 kg	5		83	72.2

MUD TYPE 3% KCl/Polymer

SOLIDS CONTROL EQUIPMENT

	Make	screen size	hrs
Shaker 1	TRITON		
Shaker 2			
Shaker 3			
Shaker 4			

	ppg	bbl/hr	hrs	bbl
Desander				
Desilter 1.				
Desilter 2.				
Centrifuge 1				
Centrifuge 2				

Solids Control Effic. %

CONSUMPTION

Additions	bbl
Sea W.	
Drill W.	5
other	
other	
Barite	1
Chemicals	
Losses	**bbl**
Sol. Con.	
Lost/Dumped	15
Down Hole	20
Newhole	
NET LOSS	29
Discharged	15

BAROID Engineer	OFFICE	WAREHOUSE
M. Olejniczak	MELBOURNE	ADELAIDE
Tel. 059–787 103	03 – 621 3311	

DAILY COST A$ 279.68

CUMULATIVE COST A$ 24967.92

RESERVE PITS

NO	TYPE	bbl
6	Pill Tank	34
7	Trip Tank	10

SURVEY DATA

MD m	TVD m	INCL°	DIR °	DISP m

SOLIDS ANALYSIS

Low Grav. Solids	% Vol	5.5
Low Grav. Solids	ppb	50.0
High Grav. Solids	% Vol	0.4
High Grav. Solids	ppb	5.9
ASG of Solids	g/cc	2.70
Cuttings Volume	bbl	
Interval Dilution	bbl/m	1.5
Interval Consumption	bbl/m	1.7

TIME BREAKDOWN

	hrs
Drilling	
Circulating	1.5
Reaming In	
Reaming out	
Tripping	12.5
Logging	5.5
Other	5
AVE ROP m/hr	

Baroid Australia Pty Ltd

MUD REPORT NO.	15 up to 24:00 hrs, 28/2/94
DATE	1/3/94
DEPTH–m	MD 1650 TVD
START DATE	14–Feb–94
ACTIVITY	Circulating prior to cementing.

OPERATOR: G.F.E. RESOURCES LTD.	CONTRACTOR / RIG: CENTURY DRILLING / RIG – 11	COUNTRY: AUSTRALIA
REPORT FOR: KEN SMITH	REPORT FOR: S. KELLY	TOWNSHIP: PORT CAMPBELL
WELL NAME AND NO.: IONA – 2	FIELD OR BLOCK NO.: PPL – 2	LOCATION: OTWAY BASIN, VICTORIA

BIT DATA / DRILLING STRING / CASINGS

BIT DATA	DRILLING STRING	OD ins	ID ins	Length m	CASINGS Size ins		Depth m
Size ins							
Type	Pipe 1				Riser	Set @	
Nozzles 32nds	Pipe 2				9.625	Set @	631.12
	Pipe 3					Set @	
	Col 1					Set @	
	Col 2					Set @	
Noz Area ins²	OPEN HOLE SECTIONS					Set @	
TFA ins²	Sect 1					Set @	
NV m/sec	Sect 2				Liner	Set @	
Impact lb f	Current		8.5	1018.9		Top @	

PUMP DATA

Pump Make	ins x ins		Eff %	bbl/stk	spm	bbl/min
National 7–P	5.5	7.75	95	0.0523		
National 8–P	6	8.5	95	0.0705		

Pump Press – psi TOTAL bbl/min

MUD VOL bbl		CIRCULATING DATA		
Downhole	395	Total circ – mins	AV m/min	
Active	256	Bottoms up – mins	DP	
Total Circ	651	Surface–bit – mins	DC	
Reserve	23	ECD ppg ERR	Riser	

MUD PROPERTIES

Property	Unit				
Sample Location	IN or OUT	IN			
Time Sample Taken	hrs	24:00			
Depth	m	1650			
Flowline Temp	°C				
Weight	ppg	9.30			
Funnel Viscosity	sec/qt	34			
Plastic Viscosity	cP	9			
Yield Point	lb/100 ft²	7			
Gels 10 sec/10min/30 min	lb/100 ft²	1/4/7			
API Filtrate	ml/30min	6.9			
HPHT Filtrate	ml/30min				
API/HPHT Filter Cake	32nd ins	1/–			
Solids	% Vol	5.9			
Dissolved Salts	% Vol	1.1			
Oil/Water Content	% Vol	–/93.0			
Sand	% Vol	0.1			
Methylene Blue cap	ppb	10			
pH	meter	8.5			
Alk. Mud Pm	ml	0.10			
Alk. Filtrate, Pf/Mf	ml	0.05/0.15			
Chlorides	mg/Lx10³	13.5			
Total Hardness/Calcium	mg/L	20/20			
KCL	% Wt Soln	2.7			
K+ Ion Conc	mg/Lx10³	15.5			
Sulphite Residual	mg/L				
Rheometer	600 rpm/300 rpm	25/16			
lb/100 ft²	200 rpm/100 rpm				
	6 rpm/3 rpm				

MUD PROPERTY SPECIFICATIONS

WEIGHT ppg VIS sec YP lb/100 ft²
API Filt ml HTHP ml KCL %
BY AUTHORITY

REMARKS

Mixed 100 bbl of 4% Gel mixwater for 7" casing lead slurrey.
Used 27 sxs AQUAGEL at $386.91 for cementing.

Mixed 40 bbl Halad 223 mixwater in pill tank for tail slurrey.

ACTIVITY

Continued circulating hole clean till 01:00 hrs. POH, laying out pipe. Rigged up and ran 7" production casing to 1449 m. Rigged up cement head and began circulating casing.

INVENTORY AND CONSUMPTION

PRODUCT DESCRIPTION		USED	REC	BAL	COST
Barite,sx	50 kg			200	
Barite,sx	25 kg			320	
AQUAGEL,sx	25 kg	27		217	386.91
KCL,Tech(sx)	25 kg			83	

MUD TYPE 3% KCl/Polymer

SOLIDS CONTROL EQUIPMENT

	Make	screen size	hrs
Shaker 1	TRITON		
Shaker 2			
Shaker 3			
Shaker 4			

	ppg	bbl/hr	hrs	bbl
Desander				
Desilter 1.				
Desilter 2.				
Centrifuge 1				
Centrifuge 2				

Solids Control Effic. %

CONSUMPTION

Additions	bbl
Sea W.	
Drill W.	40
other	
other	
Barite	
Chemicals	2
Losses	**bbl**
Sol. Con.	
Lost/Dumped	13
Down Hole	
Newhole	
NET GAIN	29
Discharged	13

BAROID Engineer	OFFICE	WAREHOUSE
M. Olejniczak	MELBOURNE	ADELAIDE
Tel. 059–787 103	03 – 621 3311	

DAILY COST A$ 386.91
CUMULATIVE COST A$ 25354.83

RESERVE PITS / SURVEY DATA

NO	TYPE	bbl	MD m	TVD m	INCL°	DIR °	DISP m
6	Pill Tank						
7	Trip Tank	23					

SOLIDS ANALYSIS

Low Grav. Solids	% Vol	5.5
Low Grav. Solids	ppb	50.0
High Grav. Solids	% Vol	0.4
High Grav. Solids	ppb	5.9
ASG of Solids	g/cc	2.70
Cuttings Volume	bbl	
Interval Dilution	bbl/m	1.5
Interval Consumption	bbl/m	1.7

TIME BREAKDOWN

	hrs
Drilling	
Circulating	2
Reaming In	
Reaming out	
Tripping	
Logging	
Other	22
AVE ROP m/hr	

Baroid Australia Pty Ltd

MUD REPORT NO. 16	up to 24:00 hrs, 1/3/94
DATE 2/3/94	DEPTH–m MD 1650 TVD
START DATE 14–Feb–94	ACTIVITY Completion

OPERATOR	CONTRACTOR / RIG	COUNTRY
G.F.E. RESOURCES LTD.	CENTURY DRILLING / RIG – 11	AUSTRALIA
REPORT FOR	REPORT FOR	TOWNSHIP
KEN SMITH	S. KELLY	PORT CAMPBELL
WELL NAME AND NO.	FIELD OR BLOCK NO.	LOCATION
IONA – 2	PPL – 2	OTWAY BASIN, VICTORIA

BIT DATA / DRILLING STRING / CASINGS

BIT DATA	DRILLING STRING	OD ins	ID ins	Length m	CASINGS Size ins		Depth m
Size ins	Pipe 1				Riser	Set @	
Type	Pipe 2				9.625	Set @	631.12
Nozzles 32nds	Pipe 3				7	Set @	1449
	Col 1					Set @	
	Col 2					Set @	
Noz Area ins²	OPEN HOLE SECTIONS					Set @	
TFA ins²	Sect 1					Set @	
NV m/sec	Sect 2				Liner	Set @	
Impact lb f	Current		8.5	201		Top @	

PUMP DATA

Pump Make	ins	x ins	Eff %	bbl/stk	spm	bbl/min
National 7–P	5.5	7.75	95	0.0523		
National 8–P	6	8.5	95	0.0705		

Pump Press – psi TOTAL bbl/min

MUD VOL	bbl	CIRCULATING DATA		AV m/min
Downhole	239	Total circ – mins		
Active	324	Bottoms up – mins		DP
Total Circ		Surface–bit – mins		DC
Reserve	41	ECD ppg		Riser

MUD PROPERTIES

Sample Location	IN or OUT				
Time Sample Taken	hrs				
Depth	m				
Flowline Temp	°C				
Weight	ppg				
Funnel Viscosity	sec/qt				
Plastic Viscosity	cP				
Yield Point	lb/100 ft²				
Gels 10 sec/10min/30 min	lb/100 ft²				
API Filtrate	ml/30min				
HPHT Filtrate	ml/30min				
API/HPHT Filter Cake	32nd ins				
Solids	% Vol				
Dissolved Salts	% Vol				
Oil/Water Content	% Vol				
Sand	% Vol				
Methylene Blue cap	ppb				
pH	meter				
Alk. Mud Pm	ml				
Alk. Filtrate, Pf/Mf	ml				
Chlorides	mg/Lx10³				
Total Hardness/Calcium	mg/L				
KCL	% Wt Soln				
K+ Ion Conc	mg/Lx10³				
Sulphite Residual	mg/L				
Rheometer	600 rpm/300 rpm				
lb/100 ft²	200 rpm/100 rpm				
	6 rpm/3 rpm				

MUD PROPERTY SPECIFICATIONS

WEIGHT 9 ppg VIS sec YP lb/100 ft²
API Filt ml HTHP ml KCL %
BY AUTHORITY

REMARKS

Mud tanks dumped and washed out with all mixing and suction lines flushed with clean water. Flowline lined up to sump via sandtrap to dump mud from hole.
Mixed 320 bbl 9.0 ppg NaCl brine for completion. Leaving addition of corrosion inhibitor and mixing of hi–vis pill till later.

240 sxs salt for completion brine.
2 cans Barafilm used for coating drill pipe laying out pipe prior to cementing.

ACTIVITY

Cemented 7" casing displacing with mud. After waiting on cement, lifted BOP off and cut casing. Replaced BOP and pressure tested. Unable to test seal assembly. Lifted BOP and removed "B" section. Wait on casing spear to reset casing slips.

INVENTORY AND CONSUMPTION

PRODUCT DESCRIPTION		USED	REC	BAL	COST
Barite,sx	50 kg			200	
Barite,sx	25 kg			320	
AQUAGEL,sx	25 kg			217	
KCL,Tech(sx)	25 kg			83	
SALT	25 kg	240		360	1850.40
BARAFILM 415	25 lt	2			319.40

MUD TYPE NaCl Brine

SOLIDS CONTROL EQUIPMENT

	Make	screen size	hrs
Shaker 1	TRITON		
Shaker 2			
Shaker 3			
Shaker 4			

	ppg	bbl/hr	hrs	bbl
Desander				
Desilter 1.				
Desilter 2.				
Centrifuge 1				
Centrifuge 2				

Solids Control Effic. %

CONSUMPTION

Additions	bbl
Sea W.	
Drill W.	347
other	
other	
Barite	
Chemicals	18
Losses	**bbl**
Sol. Con.	
Lost/Dumped	692
Down Hole	
Newhole	
NET LOSS	327
Discharged	692

DAILY COST	CUMULATIVE COST
A$ 2169.80	A$ 27524.63

BAROID Engineer	OFFICE	WAREHOUSE
M. Olejniczak	MELBOURNE	ADELAIDE
Tel. 059–787 103	03 – 621 3311	

RESERVE PITS / SURVEY DATA

NO	TYPE	bbl	MD m	TVD m	INCL°	DIR °	DISP m
6	Pill Tank	41					
7	Trip Tank						

SOLIDS ANALYSIS

Low Grav. Solids	% Vol
Low Grav. Solids	ppb
High Grav. Solids	% Vol
High Grav. Solids	ppb
ASG of Solids	g/cc
Cuttings Volume	bbl
Interval Dilution	bbl/m
Interval Consumption	bbl/m

TIME BREAKDOWN hrs

Drilling	
Circulating	
Reaming In	
Reaming out	
Tripping	
Logging	
Other	
AVE ROP m/hr	

Baroid Australia Pty Ltd

MUD REPORT NO. 17	up to 24:00 hrs, 2/3/94		
DATE 3/3/94	DEPTH–m MD 1650 TVD		
START DATE 14–Feb–94	ACTIVITY Completion		

OPERATOR G.F.E. RESOURCES LTD.	CONTRACTOR / RIG CENTURY DRILLING / RIG – 11	COUNTRY AUSTRALIA
REPORT FOR KEN SMITH	REPORT FOR S. KELLY	TOWNSHIP PORT CAMPBELL
WELL NAME AND NO. IONA – 2	FIELD OR BLOCK NO. PPL – 2	LOCATION OTWAY BASIN, VICTORIA

BIT DATA

Size ins	
Type	
Nozzles 32nds	
Noz Area ins²	
TFA ins²	
NV m/sec	
Impact lb f	

DRILLING STRING

	OD ins	ID ins	Length m
Pipe 1			
Pipe 2			
Pipe 3			
Col 1			
Col 2			

OPEN HOLE SECTIONS

Sect 1		
Sect 2		
Current	8.5	201

CASINGS

Size ins		Depth m
Riser	Set @	
9.625	Set @	631.12
7	Set @	1449
	Set @	
	Set @	
	Set @	
	Set @	
Liner	Set @	
	Top @	

PUMP DATA

Pump Make	ins	x ins	Eff %	bbl/stk	spm	bbl/min
National 7–P	5.5	7.75	95	0.0523		
National 8–P	6	8.5	95	0.0705		

Pump Press – psi TOTAL bbl/min

MUD VOL bbl		CIRCULATING DATA		
Downhole	239	Total circ – mins	AV m/min	
Active	119	Bottoms up – mins	DP	
Total Circ	358	Surface–bit – mins	DC	
Reserve	37	ECD ppg	Riser	

MUD PROPERTIES

Sample Location	IN or OUT				
Time Sample Taken	hrs				
Depth	m				
Flowline Temp	°C				
Weight	ppg				
Funnel Viscosity	sec/qt				
Plastic Viscosity	cP				
Yield Point	lb/100 ft²				
Gels 10 sec/10min/30 min	lb/100 ft²				
API Filtrate	ml/30min				
HPHT Filtrate	ml/30min				
API/HPHT Filter Cake	32nd ins				
Solids	% Vol				
Dissolved Salts	% Vol				
Oil/Water Content	% Vol				
Sand	% Vol				
Methylene Blue cap	ppb				
pH	meter				
Alk. Mud Pm	ml				
Alk. Filtrate, Pf/Mf	ml				
Chlorides	mg/Lx10³				
Total Hardness/Calcium	mg/L				
KCL	% Wt Soln				
K+ Ion Conc	mg/Lx10³				
Sulphite Residual	mg/L				
Rheometer	600 rpm/300 rpm				
lb/100 ft²	200 rpm/100 rpm				
	6 rpm/3 rpm				

MUD PROPERTY SPECIFICATIONS

WEIGHT 9–9.1 ppg VIS sec YP lb/100 ft²
API Filt ml HTHP ml KCL %
BY AUTHORITY

REMARKS

Mixed 40 bbl hi–vis XCD Polymer for sweeps. Increased volume of brine to 365 bbl.
Hi– vis sweep dumped on returning to surface.
System currently set up to take returns from hole down trough for circulating.
Still have sufficient hi–vis available for one more sweep.

ACTIVITY

Ran casing scraper. Displaced mud from casing with water. Pumped 15 bbl hi–vis XCD Polymer sweep. Displaced hole to inhibited 9.1 ppg NaCl brine.

INVENTORY AND CONSUMPTION

PRODUCT DESCRIPTION		USED	REC	BAL	COST
Barite,sx	50 kg			200	
Barite,sx	25 kg			320	
AQUAGEL,sx	25 kg	1		216	14.33
KCL,Tech(sx)	25 kg	3		80	43.32
Caustic Soda	25 kg	1		9	32.43
BARACOR–100	208 lt	1			583.35
SALT	25 kg	40		320	308.4
XCD Polymer	25 kg	2		8	998.28

MUD TYPE NaCl Brine

SOLIDS CONTROL EQUIPMENT

	Make	screen size	hrs
Shaker 1	TRITON		
Shaker 2			
Shaker 3			
Shaker 4			

	ppg	bbl/hr	hrs	bbl
Desander				
Desilter 1.				
Desilter 2.				
Centrifuge 1				
Centrifuge 2				

Solids Control Effic. %

CONSUMPTION

Additions	bbl
Sea W.	
Drill W.	83
other	
other	
Barite	
Chemicals	5
Losses	**bbl**
Sol. Con.	
Lost/Dumped	40
Down Hole	
Newhole	
NET GAIN	48
Discharged	40

BAROID Engineer	OFFICE	WAREHOUSE
M. Olejniczak	MELBOURNE	ADELAIDE
Tel. 059–787 103	03 – 621 3311	

DAILY COST A$ 1980.11 **CUMULATIVE COST** A$ 29504.74

RESERVE PITS

NO	TYPE	bbl
6	Pill Tank	27
7	Trip Tank	10

SURVEY DATA

MD m	TVD m	INCL°	DIR °	DISP m

SOLIDS ANALYSIS

Low Grav. Solids	% Vol	
Low Grav. Solids	ppb	
High Grav. Solids	% Vol	
High Grav. Solids	ppb	
ASG of Solids	g/cc	
Cuttings Volume	bbl	
Interval Dilution	bbl/m	
Interval Consumption	bbl/m	

TIME BREAKDOWN hrs

Drilling	
Circulating	
Reaming In	
Reaming out	
Tripping	
Logging	
Other	
AVE ROP m/hr	

Baroid Australia Pty Ltd

MUD REPORT NO. 18	up to 24:00 hrs, 3/3/94		
DATE 4/3/94	DEPTH–m MD 1650 TVD		
START DATE 14–Feb–94	ACTIVITY Completion		

OPERATOR G.F.E. RESOURCES LTD.	CONTRACTOR / RIG CENTURY DRILLING / RIG – 11	COUNTRY AUSTRALIA
REPORT FOR KEN SMITH	REPORT FOR S. KELLY	TOWNSHIP PORT CAMPBELL
WELL NAME AND NO. IONA – 2	FIELD OR BLOCK NO. PPL – 2	LOCATION OTWAY BASIN, VICTORIA

BIT DATA / DRILLING STRING / CASINGS

BIT DATA	DRILLING STRING	OD ins	ID ins	Length m	CASINGS Size ins		Depth m
Size ins	Pipe 1				Riser	Set @	
Type	Pipe 2				9.625	Set @	631.12
Nozzles 32nds	Pipe 3				7	Set @	1443.5
	Col 1					Set @	
	Col 2					Set @	
Noz Area ins²	OPEN HOLE SECTIONS					Set @	
TFA ins²	Sect 1					Set @	
NV m/sec	Sect 2				Liner	Set @	
Impact lb f	Current	8.5		206.5		Top @	

PUMP DATA

Pump Make	ins	x ins	Eff %	bbl/stk	spm	bbl/min
National 7–P	5.5	7.75	95	0.0523		
National 8–P	6	8.5	95	0.0705		

Pump Press – psi TOTAL bbl/min

MUD VOL	bbl	CIRCULATING DATA		AV m/min
Downhole	239	Total circ	– mins	
Active	120	Bottoms up	– mins	DP
Total Circ	359	Surface–bit	– mins	DC
Reserve	47	ECD ppg		Riser

MUD PROPERTIES

Sample Location	IN or OUT				
Time Sample Taken	hrs				
Depth	m				
Flowline Temp	°C				
Weight	ppg				
Funnel Viscosity	sec/qt				
Plastic Viscosity	cP				
Yield Point	lb/100 ft²				
Gels 10 sec/10min/30 min	lb/100 ft²				
API Filtrate	ml/30min				
HPHT Filtrate	ml/30min				
API/HPHT Filter Cake	32nd ins				
Solids	% Vol				
Dissolved Salts	% Vol				
Oil/Water Content	% Vol				
Sand	% Vol				
Methylene Blue cap	ppb				
pH	meter				
Alk. Mud Pm	ml				
Alk. Filtrate, Pf/Mf	ml				
Chlorides	mg/Lx10³				
Total Hardness/Calcium	mg/L				
KCL	% Wt Soln				
K+ Ion Conc	mg/Lx10³				
Sulphite Residual	mg/L				
Rheometer	600 rpm/300 rpm				
lb/100 ft²	200 rpm/100 rpm				
	6 rpm/3 rpm				

MUD PROPERTY SPECIFICATIONS

WEIGHT 9–9.1 ppg VIS sec YP lb/100 ft²
API Filt ml HTHP ml KCL %
BY AUTHORITY

REMARKS

Mixed an additional 55 bbl brine to maintain sufficient volume.
Minor losses to formation after casing perforated, of about 10 bbl.
Dumped hi–vis pill as ir returned to surface.

Left instructions with derrickmen to use about 8 sxs salt for every 10 bbls of water if they need to mix more 9.0 to 9.1 ppg brine.

Engineer released.

ACTIVITY

POH with casing scraper. Rigged up Schlumberger. Ran cement bond log. Perforated casing. Rigged down Schlumberger. Ran in casing scraper. Pumped 15 bbl hi–vis sweep and circulated casing clean with brine.

INVENTORY AND CONSUMPTION

PRODUCT DESCRIPTION		USED	REC	BAL	COST
Barite,sx	50 kg			200	
Barite,sx	25 kg			320	
AQUAGEL,sx	25 kg			216	
KCL,Tech(sx)	25 kg			80	
SALT	25 kg	80		240	616.80

MUD TYPE NaCl Brine

SOLIDS CONTROL EQUIPMENT

	Make	screen size	hrs
Shaker 1	TRITON		
Shaker 2			
Shaker 3			
Shaker 4			

	ppg	bbl/hr	hrs	bbl
Desander				
Desilter 1.				
Desilter 2.				
Centrifuge 1				
Centrifuge 2				

Solids Control Effic. %

CONSUMPTION

Additions	bbl
Sea W.	
Drill W.	50
other	
other	
Barite	
Chemicals	6
Losses	**bbl**
Sol. Con.	
Lost/Dumped	45
Down Hole	
Newhole	
NET GAIN	11
Discharged	45

DAILY COST	CUMULATIVE COST
A$ 616.80	A$ 30121.54

BAROID Engineer	OFFICE	WAREHOUSE
M. Olejniczak	MELBOURNE	ADELAIDE
Tel. 059–787 103	03 – 621 3311	

RESERVE PITS / SURVEY DATA

NO	TYPE	bbl	MD m	TVD m	INCL°	DIR °	DISP m
6	Pill Tank	14					
7	Trip Tank	33					

SOLIDS ANALYSIS

Low Grav. Solids	% Vol
Low Grav. Solids	ppb
High Grav. Solids	% Vol
High Grav. Solids	ppb
ASG of Solids	g/cc
Cuttings Volume	bbl
Interval Dilution	bbl/m
Interval Consumption	bbl/m

TIME BREAKDOWN hrs

Drilling	
Circulating	
Reaming In	
Reaming out	
Tripping	
Logging	
Other	
AVE ROP m/hr	

Baroid Australia Pty Ltd	MUD REPORT NO. 19 up to 24:00 hrs, 4/3/94	
	DATE 5/3/94	DEPTH–m MD 1650 TVD
	START DATE 14–Feb–94	ACTIVITY

OPERATOR G.F.E. RESOURCES LTD.	**CONTRACTOR / RIG** CENTURY DRILLING / RIG – 11	**COUNTRY** AUSTRALIA
REPORT FOR KEN SMITH	**REPORT FOR** S. KELLY	**TOWNSHIP** PORT CAMPBELL
WELL NAME AND NO. IONA – 2	**FIELD OR BLOCK NO.** PPL – 2	**LOCATION** OTWAY BASIN, VICTORIA

BIT DATA / **DRILLING STRING** / **CASINGS**

BIT DATA	DRILLING STRING	OD ins	ID ins	Length m	CASINGS Size ins		Depth m
Size ins							
Type	Pipe 1				Riser	Set @	
Nozzles 32nds	Pipe 2				9.625	Set @	631.12
	Pipe 3				7	Set @	1443.5
	Col 1					Set @	
	Col 2					Set @	
Noz Area ins²	OPEN HOLE SECTIONS					Set @	
TFA ins²	Sect 1					Set @	
NV m/sec	Sect 2				Liner	Set @	
Impact lb f	Current	8.5		206.5		Top @	

PUMP DATA

Pump Make	ins	x ins	Eff %	bbl/stk	spm	bbl/min
National 7–P	5.5	7.75	95	0.0523		
National 8–P	6	8.5	95	0.0705		

Pump Press – psi TOTAL bbl/min

MUD VOL	bbl	CIRCULATING DATA		AV m/min
Downhole	239	Total circ – mins		
Active	120	Bottoms up – mins		DP
Total Circ	359	Surface–bit – mins		DC
Reserve	47	ECD ppg		Riser

MUD PROPERTIES

Sample Location	IN or OUT				
Time Sample Taken	hrs				
Depth	m				
Flowline Temp	°C				
Weight	ppg				
Funnel Viscosity	sec/qt				
Plastic Viscosity	cP				
Yield Point	lb/100 ft²				
Gels 10 sec/10min/30 min	lb/100 ft²				
API Filtrate	ml/30min				
HPHT Filtrate	ml/30min				
API/HPHT Filter Cake	32nd ins				
Solids	% Vol				
Dissolved Salts	% Vol				
Oil/Water Content	% Vol				
Sand	% Vol				
Methylene Blue cap	ppb				
pH	meter				
Alk. Mud Pm	ml				
Alk. Filtrate, Pf/Mf	ml				
Chlorides	mg/Lx10³				
Total Hardness/Calcium	mg/L				
KCL	% Wt Soln				
K+ Ion Conc	mg/Lx10³				
Sulphite Residual	mg/L				
Rheometer	600 rpm/300 rpm				
lb/100 ft²	200 rpm/100 rpm				
	6 rpm/3 rpm				

MUD PROPERTY SPECIFICATIONS

WEIGHT ppg VIS sec YP lb/100 ft²
API Filt ml HTHP ml KCL %
BY AUTHORITY

REMARKS

Stock correction to match returns to Adelaide warehouse after the end of the well. (DT 334865 and DT 334857)

27 sxs salt used during remainder of completion after engineer release
1 PAC–R and 2 Soda Ash most likely used during 8–1/2" hole.

ACTIVITY

INVENTORY AND CONSUMPTION

PRODUCT DESCRIPTION		USED	REC	BAL	COST
Barite,sx	50 kg			200	
Barite,sx	25 kg			320	
AQUAGEL,sx	25 kg			216	
KCL,Tech(sx)	25 kg			80	
Soda Ash	25 kg	2		18	32.3
SALT	25 kg	27		213	208.17
PAC–R	50 lb	1		14	170.74

MUD TYPE NaCl Brine

SOLIDS CONTROL EQUIPMENT

	Make	screen size	hrs
Shaker 1	TRITON		
Shaker 2			
Shaker 3			
Shaker 4			

	ppg	bbl/hr	hrs	bbl
Desander				
Desilter 1.				
Desilter 2.				
Centrifuge 1				
Centrifuge 2				

Solids Control Effic. %

CONSUMPTION

Additions	bbl
Sea W.	
Drill W.	70
other	
other	
Barite	
Chemicals	2
Losses	**bbl**
Sol. Con.	
Lost/Dumped	72
Down Hole	
Newhole	
NET GAIN	
Discharged	72

BAROID Engineer	OFFICE	WAREHOUSE
M. Olejniczak	MELBOURNE	ADELAIDE
Tel. 059–787 103	03 – 621 3311	

DAILY COST A$ 411.21 **CUMULATIVE COST** A$ 30532.75

RESERVE PITS / **SURVEY DATA**

NO	TYPE	bbl	MD m	TVD m	INCL°	DIR °	DISP m
6	Pill Tank	14					
7	Trip Tank	33					

SOLIDS ANALYSIS

Low Grav. Solids	% Vol
Low Grav. Solids	ppb
High Grav. Solids	% Vol
High Grav. Solids	ppb
ASG of Solids	g/cc
Cuttings Volume	bbl
Interval Dilution	bbl/m
Interval Consumption	bbl/m

TIME BREAKDOWN hrs

Drilling	
Circulating	
Reaming In	
Reaming out	
Tripping	
Logging	
Other	
AVE ROP m/hr	

APPENDIX 3

APPENDIX 3

GFE RESOURCES LTD

APPENDIX 3

A. DRILLING AND COMPLETION SUMMARY

IONA-2

DRILLING SUMMARY

Iona-2 was designed as a development well to better access the Waarre Formation reservoir discovered in Iona-1. The downhole location was approximately 270 metres from Iona-1, however the surface location was situated only approximately 50 metres away for operational reasons. The well was deviated to hit the target at the required location. The following is a short history of the well:

- Iona-2 was spudded at 1200 hrs on 14/2/94.
- 12¼" hole was drilled to 320mKB.
- At this depth the downhole assembly was changed and a downhole motor, bent sub and Measured While Drilling (MWD) equipment were added. The hole was drilled to 640mKB building angle from 0° to 18.5° at a rate of 1.5°/30m.
- 54 joints of 9 $^5/_8$" 36 lb/ft, K55, BTC casing was run and cemented at 637mKB with lead slurry of 644 sacks of class 'A' cement and 2% pre-hydrated gel (13.2ppg) and tail slurry of 162 sacks of class 'A' cement (15.6ppg).
- After waiting on cement the Blow Out Preventers were nippled up and pressure tested. The shoe was drilled out and a leak off test was performed.
- 8½" hole was drilled to 774mKB. Deviation was monitored using single shot surveys.
- At this stage the bottom hole assembly was changed again, with a downhole motor and MWD equipment installed to bring the deviation angle back at the approximate rate of 2°/30m.
- 8½" hole was drilled to 1052mKB at which stage the pipe became differentially stuck.
- Water was spotted in the hole and the pipe was freed.
- The bottom hole assembly was then changed and a pendulum assembly was installed to bring back the deviation which, at this stage was 8°.
- 8½" hole was drilled to 1250mKB. Deviation was monitored using single shot surveys.
- The well was on target at this stage and the angle was 2½° so a bit and BHA change were made to control the angle and keep the well on target.
- 8½" hole was drilled to TD at 1650mKB at which stage a multi-shot survey was run.
- At this stage logs were run.
- A plug was run from 1470-1520mKB with 60 sacks class 'A' and 3% HR4.

- 120 joints of 7" 26 1b/ft, L80 NEWVAM-RS casing was run to 1448.8m KB and cemented with lead slurry of 439 cu ft of class 'G' cement with 4% pre-hydrated gel and tail slurry of 230 cu ft of class 'G' cement with 1% Halad 322. The cement was displaced with 180 bbls of mud.

COMPLETION SUMMARY

The well was completed in the Waarre Formation as a gas producer. There are two separate zones in the Waarre Unit C, both are in the same pressure regime. The bottom zone was perforated (overbalance) using a 4½" casing gun with Ultrapack 51B, 37 gram charges at 5spf run on wireline.

A permanent packer was set between the two zones and the completion was with 4½" NEWVAM-RS, L80 12.6 ppf tubing and hydraulic set permanent packer set above the top zone. The top zone was left unperforated. However, there is provision to blank off the lower zone and perforate the top zone on wireline at a later date. The downhole completion diagram is shown in Figure A. The well head diagram is shown in Figure B.

A third gas zone was encountered in the Waarre Unit B. With no equivalent in Iona-1, this five-metre zone was not anticipated, and thus did not figure in the planned completion. However, it does represent an additional reserve, and how best to exploit it is still being investigated.

GFE Resources Ltd

IONA-2
SOLID BLOCK VALVE

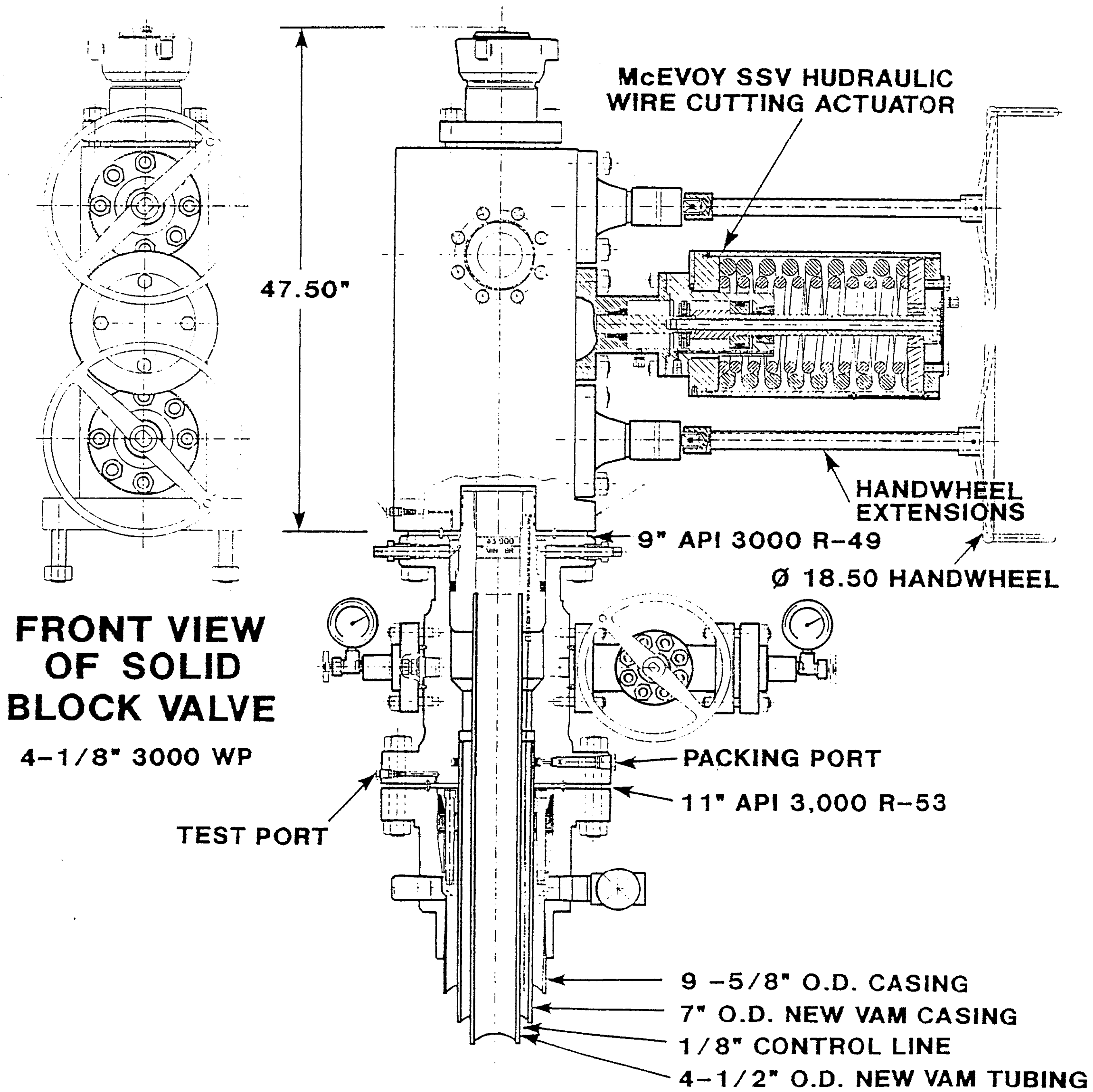
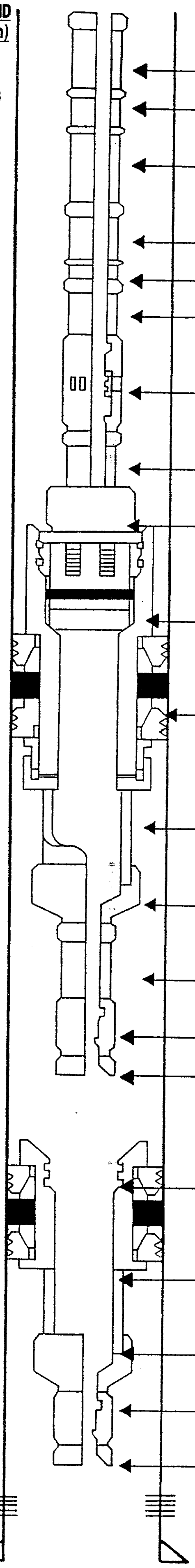


FIGURE A

GFE RESOURCES LIMITED - IONA -2 WELL SCHEMATIC

KB = 5.70m



Max OD (Inch)	Min ID (Inch)	Component	LENGTH (m)	DEPTH (m)
		4-1/2" 12.6 ppf L-80 New Vam RS Tubing (1 joint - #131)	9.320	15.020
4.892	3.958	4-1/2" 12.6 ppf L-80 New Vam RS Pup Joint	1.890	16.910
4.892	3.958	4-1/2" 12.6 ppf L-80 New Vam RS Tubing (130 joints #1-130)	1241.540	1258.450
4.892	3.958	4-1/2" 12.6 ppf 13% Cr New Vam RS Tubing (1 joint)	9.085	1267.535
4.990	2.992	4-1/2" x 3-1/2" New Vam RS Crossover 9 Cr 1 Mo (469-10-7886)	0.225	1267.760
3.900	2.992	3-1/2" 9.2 ppf 13% Cr New Vam RS Tubing (1 joint)	9.598	1277.358
4.580	2.813	3-1/2" x 2.813" XD SSD with 2.813" X profile (121 XD 28163) and 3-1/2" 9.2 ppf New Vam box x pin (9 Cr 1Mo)	1.274	1278.632
3.900	2.992	3-1/2" 9.2 ppf 13% Cr New Vam RS Tubing (1 joint)	9.602	1288.234
[illegible]50	3.250	Size 80 DA 40 K-22S Anchor Tubing Seal Nipple with one V-Ryte Seal Unit and 3-1/2" 9.2 ppf New Vam box x blank chamfered bottom 9 Cr 1 Mo material & commodity number: 443-60-5000	0.317 (above packer)	1288.551
5.687	3.250	Size 84 SAB 40x32 Model SAB-3 Hydro-Set Packer with 4-1/2" 12.6 ppf New Vam box guide 70H Nitrile packing element and 9 Cr 1 Mo material & commodity number: 409-07-8426	1.506	1290.057
7.656	6.276 6.151 (drift)	7"26.0 ppf L-80 Casing (Setting Depth = 1450 m)		
4.510	3.960	Size 80 - 32 Millout Extension with 4-1/2" 12.6 ppf New Vam pin x pin, 9 Cr 1 Mo material & commodity number: 01-84643-1G	1.649	1291.706
4.510	3.960	Crossover with 4-1/2" 12.6 ppf New Vam box x 3-1/2" 9.2 ppf New Vam pin, 9 Cr 1 Mo material & commodity number: 469-10-898C	0.220	1291.926
4.920	2.992	3-1/2" 9.2 ppf 13% Cr New Vam RS Tubing (1 joint)	9.610	1301.536
[illegible]20	2.635 (no-go)	3-1/2" x 2.750" XN no-go Landing Nipple with 3-1/2" 9.2 ppf New Vam box x pin & 9 Cr 1 Mo material Serial Number:931001 0126	0.436	1301.972
3.980	3.010	3-1/2" Wireline Re-Entry Guide with 3-1/2" 9.2 ppf New Vam(RS) box x blank chamferred bottom, 9 Cr 1 Mo material & commodity number 469-21-355J	0.161	1302.133
5.687	2.688	Size 84 - 26 Model DB Packer with 70H Nitrile packing element, 3.406" 8 Sub Acme box, 9 Cr 1 Mo material & commodity number: 415-05-8710	DB Packer Setting Depth = 1330.000 1.106	1331.106
3.610	2.688	Size 80 - 26 Seal Bore Extension with 3.406" 8 Stub Acme box x box, 9 Cr 1 Mo material & commodity number: 02-47470-83	1.637	1332.743
3.990	2.390	Crossover with 3.406" 8 Stub Acme box x 2-7/8" 6.4 ppf New Vam pin 9 Cr 1 Mo material & commodity number: 02-43277-54	0.189	1322.932
3.220	2.205 (no-go)	2-7/8" x 2.313" XN no-go Landing Nipple (11 XN 23187 04T-H4) with 2-7/8" 6.4 ppf New Vam box x pin & 9 Cr 1 Mo material	0.369	1333.328
3.350	2.380	2-7/8" Wrieline Re-Entry Guide with 2-7/8" 6.4 ppf New Vam RS box x blank chamferred bottom & 9 Cr 1 Mo material	0.134	1333.462

Lower Perforation : 1334.5 - 1341.5m

All Depths along the hole in mKB

Revision : 0 Date : 5th March 1994

OT 4703

FIGURE B

GFE RESOURCES LTD

APPENDIX 3

B. SUMMARY OF WELLSITE OPERATIONS

IONA-2

DAILY DRILLING OPERATIONS SUMMARY

Date	Time	Hours		Operations
14/2/94	0800-0900	1	-	Finalise rigging up
	0900-1200	3	-	Rig inspection by DME. Pre-spud meeting conducted by Rod Harris with all contractor personnel and service company personnel. Pre-spud safety meeting with rig crews by R. Giddens and K. Smith.
	1200-1530	3½	-	Spud in and drill 12¼" hole from 16m to 61.7m
	1530-1600	½	-	Circulate and Survey @ 48.7m
	1600-1700	1	-	Drill 12¼" hole from 61.7m to 97.7m
	1700-1730	½	-	Circulate and Survey @ 84.7m
	1730-1800	½	-	Drill 12¼" hole from 97.7m to 132.4m
	1800-1830	½	-	Circulate and Survey @ 119.45m
	1830-1900	½	-	Drill 12¼" hole from 132.4m to151m
	1900-1930	½	-	Clear mud ring from conductor and flow-line
	1930-2100	1½	-	Drill 12¼" hole from 151m to 168.7m with reduced bit weight
	2100-2130	½	-	Circulate and Survey @ 155.7m
	2130-2300	1½	-	Drill 12¼" hole from 168.7m to 204.8m
	2300-2330	½	-	Circulate and Survey @ 191.8m
	2330-2400	½	-	Drill 12¼" hole from 204.8m to 232m
15/2/94	2400-0030	½	-	Drill 12¼" hole from 232m to 242m
	0030-0100	½	-	Circulate and Survey @ 229m
	0100-0200	1	-	Drill 12¼" hole from 242m to 270m
	0200-0230	½	-	Circulate and Survey @ 257m
	0230-0330	1	-	Drill 12¼" hole from 270m to 299m
	0330-0400	½	-	Circulate and Survey @ 286m
	0400-0430	½	-	Drill 12¼" hole from 299m to 320m
	0430-0500	½	-	Circulate hole clean
	0500-0700	2	-	Pull out of hole to pick up kick-off assembly
	0700-0800	1	-	Make up kick-off assembly
	0800-1000	2	-	Pick up and make up kick-off assembly
	1000-1200	2	-	Run in hole with kick-off assembly. Install jars. Test run mud motor
	1200-1230	½	-	Continue RIH - Hole bridged @ 293m
	1230-1300	½	-	Repair shear-relief valve on pump - plugged bit jet
	1300-1330	½	-	Ream bridge from 293m to 305m. Continue to RIH
	1330-1400	½	-	Circulate and orientate motor
16/2/94	1400-0800	18	-	Drill deviated 12¼" hole from 320m to 615m with Austoil, taking MWD surveys
	0800-1000	2	-	Drill deviated hole from 615m to 640m taking MWD surveys.

	1000-1030	½	-	Circulate bottoms up and work pipe. POOH, tight from 475m - pick up kelly and wash. Continue POOH, tight from 456m to 579m.
	1030-1530	5	-	Work pipe @ 20,000lbs over-pull maximum - lay out jars.
	1530-1630	1	-	Service down-hole assembly and lay out same.
	1630-1830	2	-	Make up reaming BHA and run in hole
	1830-2330	5	-	Hang-up at kick-off point. Ream from 320m to 351m. Ream from 408m to 524m. Ream from 609m to 640m. (Run stand where possible) 3m of fill.
	2330-2400	½	-	Circulate hole clean.
17/2/94	2400-0500	5	-	Wiper trip to 8" drill collars. Strap out. Maximum drag 15,000lbs over. RIH. Maximum hold-up 10,000lbs. 2m of fill.
	0500-0530	½	-	Break circulation, wash and light ream to bottom.
	0530-0600	½	-	Circulate hole clean prior to running casing.
	0600-0800	2	-	Pull out of hole to run 9⅝" casing.
	0800-0830	½	-	Lay out jars and slip 20' of drill-line.
	0830-1100	2½	-	Continue POOH, lay out 8" DC's, stabilisers, Monel, hang-off sub, break bit and recover MWD tool.
	1100-1300	2	-	Rig up to run 9⅝" casing - conduct safety meeting.
	1300-1700	4	-	Run 9⅝" casing - loosen top casing collar.
	1700-1730	½	-	Safety meeting. Rig up Halliburton and load head.
	1730-1800	½	-	Circulate 1½ times casing volume.
	1800-2000	2	-	Pressure test lines, mix and displace cement with Halliburton.
			-	Wait on cement.
18/2/94	2000-0400	8	-	Head Halliburton. Lay out landing joint and conductor and
	0400-0800	4		nipple up BOP's.
			-	Nipple up BOP's.
	0800-1200	4	-	Install choke manifold and float line. Function test BOP's.
	1200-1400	2		Flush choke and BOP's.
			-	Pressure test. Blind rams to 300psi and 100psi. Pick up cup
	1400-1800	4		tester and test stack and pipe rams and all manifold valves to 2000psi. As well as HCR valve, manual choke line valve and both kill line valves. Repaired all leaks and re-tested until okay. Pressure test pipe rams to 300psi low and pressure tested angular preventor to 300psi and 1000psi.
19/2/94	1800-0030	6½	-	Rig up floor. Pick up and clean and make up 8½: BHA and run in hole. Install casing protector rubbers every second joint and down pipe.
	0030-0100	½	-	Break circulation and tag cement @ 623-83m.
	0100-0230	1½	-	Pressure test upper and lower Kelly cocks stabbing valve and flare line to 1000psi and secure flare line.
	0230-0300	½	-	Drill out cement and 5m of new hole.
	0300-0530	2½	-	Circulate hole and run formation integrity tests -2.
	0530-0630	1	-	Drill 8½" hole from 645m to 666m.
	0630-0700	½	-	Run Single Shot Survey @ 660m.
	0700-0730	½	-	Drill 8½" hole from 666m to 705m.
	0730-0800	½	-	Run Single Shot Survey @ 660m.

	0800-0900	1	-	Drill 8½" hole from 705m to 743m.
	0900-0930	½	-	Circulate and survey @ 736m. Single Shot.
	0930-1200	2½	-	Drill 8½" hole from 743m to 781m.
	1200-1230	½	-	Circulate and survey @ 774m. Single Shot.
	1230-1300	½	-	Circulate hole clean.
	1300-1630	3½	-	POOH. Lay out Jars, Stabiliser and Pony DC.
	1630-2130	5	-	Pick up stabiliser, Drillex motor, HO tool Jars and make up. Function Drillex motor. Run in hole.
	2130-2200	½	-	Pick up Kelly, Break circulation, tag bottom (no fill), orientate motor.
20/2/94	2200-0800	10	-	Drill 8½" hole from 781m to 985m, taking mud surveys.
	0800-1130	3½	-	Drill 8½" hole from 823m to 1052m with MWD surveys.
	1130-1530	4	-	Work differentially stuck pipe. Spot water in hole and free pipe.
	1530-1600	½	-	Circulate water out of hole. Work pipe.
	1600-2030	4½	-	Pull out of hole. Lay out jars, stabiliser and Drillex motor.
	2030-2300	2½	-	Make up pendulum assembly and run in hole.
	2300-2330	½	-	Slip 20' of drill line.
21/2/94	2330-0030	1	-	Run in hole. Bridge @ 1034m.
	0030-0130	1	-	Break circulation, ream and wash from 1024m to 1045m.
	0130-0230	1	-	Pull back to shoe to change out blown Kelly hose.
	0230-0530	3	-	Change out Kelly hose.
	0530-0600	½	-	Pressure test Kelly hose and fittings. Leaked @ goose neck nipple @ 1800psi.
	0600-0730	1½	-	Remove goose neck for welding of new nipple to goose neck and re-install and pressure test to 1800psi.
	0730-0800	½	-	Install Kelly spinner, hose and Exlog depth measures.
	0800-0900	1	-	Run in hole from casing shoe. Clean to bottom 8m. No fill.
	0900-1830	9½	-	Drill 8½" hole from 1052m to 1114m.
	1830-1900	½	-	Circulate and survey @ 1096m.
	1900-2030	1½	-	Drill 8½" hole from 1114m to 1124m.
	2030-2100	½	-	Centre crown of mast over rotary table. Moved while working stuck pipe.
22/2/94	2100-0730	10½	-	Drill 8½" hole 1124m to 1181m.
	0730-0800	½	-	Circulate and survey @ 1180m.
	0800-0830	½	-	Work pipe free - grabbed while working pipe on survey.
	0830-1900	10½	-	Drill 8½" hole from 1181m to 1268m.
	1900-1930	½	-	Circulate hole clean prior to wiper trip.
	1930-2100	1½	-	Wiper trip back to 900m. Hole okay. No fill.
	2100-2200	1	-	Circulate hole clean.
	2200-2230	½	-	Survey @ 1250m.
	2230-2300	½	-	Displace Barite pill.
	2300-2330	½	-	Re-run survey @ 1250m.
23/2/94	2330-0200	2½	-	Pull out of hole for new bit and BHA change. Flow check.
	0200-0330	1½	-	Lay out 6 x 6¼" DC's, Jars and key seat wiper.
	0330-0430	1	-	Continue pulling out of hole, lay out stabilisers, cross overs and Monel.
	0430-0600	1½	-	Make up new BHA.
	0600-0800	2	-	Run in hole.

	0800-0830	½	-	Slip 20ft of drill-line.
	0830-0930	1	-	Continue running in hole.
	0930-1030	1	-	Pick up drill pipe. Break circulation. Wash and light ream 1245 to 1268m.
	1030-1830	8	-	Drill 8½" hole from 1268m to 1363m with flow checks.
	1830-1900	½	-	Circulate and survey @ 1345m.
24/2/94	1900-0530	10½	-	Drill 8½" hole from 1363 to 1468m.
	0530-0600	½	-	Circulate and survey @ 1450m.
	0600-0800	2	-	Drill 8½" hole from 1468m to 1498m.
	0800-1900	11	-	Drill 8½" hole from 1498m to 1650m TD.
	1900-2000	1	-	Circulate bottoms up for geological sample.
	2000-2030	½	-	Single Shot Survey @ 1632m.
	2030-2400	3½	-	Wiper trip from 1650m to 631m - hole tight through Eumeralla Fm. after pulling two stands.
25/2/94	2400-0200	2	-	Run in hole to T.D. - hole good.
	0200-0330	1½	-	Break circulation and circulate prior to logging - 5m of fill.
	0330-0400	½	-	Pump barite pill and drop multi-shot survey barrel.
	0400-0600	2	-	Pull out of hole to log - strap pipe.
	0600-0630	½	-	Recover survey barrel.
	0630-0800	1½	-	Pull out of hole.
	0800-0930	1½	-	Pull out of hole.
26/2/94	0930-0100	16½	-	Hold safety meeting with Schlumberger. Rig up and run logs with Schlumberger. Run #1 DLT, SDT, SRT, GR and AMS. Run #2 LDL, CNL, GR and AMS. Run #3 WST. Rig down Schlumberger.
	0100-0300	2	-	Made up BHA and RIH to shoe.
	0300-0400	1	-	Slip 26 ft and cut 130 ft of drill line.
	0400-0630	1½	-	Continue running in hole - Hole good - 1m of fill.
	0630-0800	1½	-	Circulate hole and condition mud. Hole took 27.5 bbl while logging.
	0800-0900	1	-	Condition mud while circulating - flow check.
	0900-1230	3½	-	Pull out of hole.
27/2/94	1230-0530	17	-	Rig up Schlumberger and run RFT-GR-AMS. Run CST.
	0530-0700	1½	-	Pick up cup-tester and test BOP stack and manifold to 2000 psi and 300 psi.
	0700-0800	1	-	Run in hole with BHA.
	0800-1030	2½	-	Lay out 8½" BHA.
	1030-1330	3	-	Run in hole with open end down pipe to 1520m.
	1330-1430	1	-	Circulate bottoms up from 1520m.
	1430-1530	1	-	Rig up Halliburton and run Plug #1 at 1520-1470m with 60 sacks Class 'A' and 3% HR-4.
	1530-1830	3	-	Pull out of hole.
	1830-2030	2	-	Pick up 4 DC, make up bit and RIH to casing shoe.
	2030-2200	1½	-	Wait on cement.
	2200-2330	1½	-	RIH. Tag top of plug at 1471m. Pull back to 1459m.
28/2/94	2330-0100	1½	-	Circulate hole clean.
	0100-0500	4	-	Lay out drill pipe.
	0500-0700	2	-	Lay out Kelly and swivel.
	0700-0730	½	-	Run extra pipe from derrick in hole.
	0730-0800	½	-	Lay out drill pipe.

	0800-0930	1½	-	Lay out down pipe and 4 drill collars.
	0930-1000	½	-	Re-centre crown of derrick over rotary table.
	1000-1300	3	-	Change pipe rams to 7". Make up cup tester and test ram door seals to 600 psi. Rig up Enterra equipment and trial. Rig up to run 7" casing. Safety meeting with Enterra crew.
	1300-2230	9½	-	Run 7" casing.
	2230-2400	1½	-	Head up Halliburton and circulate casing - casing differentially stuck while heading up.
1/3/94	2400-0230	2½	-	Safety meeting with Halliburton. Pressure test lines, pump pre-flush, mix and displace cement as per programme.
	0230-0330	1	-	Flush BOP's and set slip and seal assembly in bowl.
	0330-0800	4½	-	Tear out and lift BOP. cut casing, remove spacer, spool and make final cut and trim on casing.
	0800-1330	5½	-	Install 'B' section and nipple up BOP's.
	1330-1530	2	-	Energise secondary seal and try to pressure test - unable to pressure test secondary seal - bypassing slip and seal assembly.
	1530-1700	1½	-	Lift stack and remove 'B' section.
	1700-2400	7	-	Wait on casing spear to re-set slip and seal assembly.
2/3/94	2400-0300	3	-	Make up casing spear. engage casing and pull to 175,000lbs (70,000lbs over casing weight) and re-set slips. Lay out casing spear and drill collars.
	0300-0600	3	-	Make final cut and trim to casing, nipple up 'B' section, energise secondary seal and test to 3,000 psi - Okay.
	0600-0800	2	-	Nipple up BOP's.
	0800-0830	½	-	Nipple up BOP. Function rams.
	0830-1030	2	-	Make up cup-tester on $2\frac{7}{8}$" tubing, hang power tong and Enterra tong to make-up tools.
	1030-1130	1	-	Rig up North Paaratte pump and attempt to pressure test - nil pressure.
	1130-1200	½	-	Pressure test with Halliburton - unable to hold pressure.
	1200-1230	½	-	Remove rams and inspect - one ram block installed upside down - replace correctly.
	1230-1330	1	-	Pressure test $2\frac{7}{8}$" pipe rams to 300psi and 2000psi; HCR and manual choke line valves to 2000psi; flare line to 1500psi.
	1330-2200	8½	-	Lay out cup tester. make up casing scraper and 6" bit and run in hole picking up $2\frac{7}{8}$" tubing.
	2200-2330	1½	-	Displace hole to water by reverse circulation, pump Hi-vis sweep and displace hole to brine. Pull out of hole with casing scraper.
3/3/94	2330-0200	2½	-	Slip 40' of drill line and change $2\frac{7}{8}$" rams to 7" rams.
	0200-0800	6	-	Rig up Schlumberger, install 7" joint of casing in rams for line wiper and run logs with Schlumberger.

	0800-0930	1½	-	Run CBL, VDL, GR and CCL with Schlumberger and rig down.
	0930-1100	1½	-	Make up and fit safety chain pad eyes to 7" lubricator prior to running perforating gun.
	1100-1530	4½	-	Load perforating gun, install 7" lubricator, perforate 7" casing at 1340.5m to 1334.5m and rig down Schlumberger.
	1530-1630	1	-	Make up cup-tester, change 7" rams to 2⁷/₈". Pressure test rams to 350psi and 1800psi with rig pump.
	1630-2000	3½	-	Run in hole with casing scraper on 2⁷/₈" tubing. Flow-check, work scraper from 1325.23m to 1354.17m.
	2000-2030	½	-	Pump Hi-vis sweep and circulate back to surface.
4/3/94	2030-2330	3	-	Pull out of hole with work string and scraper.
	2330-0530	6	-	Rig up Schlumberger and run gauge rings and junk basket - Run #1. Set production packer at 1330m - Run #2.
	0530-0600	½	-	Break out bit and scraper and make up seal assembly on work string.
	0600-0800	2	-	Run in hole with seal assembly on work string.
	0800-0930	1½	-	Run in hole with seal assembly on work string.
	0930-1000	½	-	Pressure test annulus and packer to 1000psi with Halliburton.
	1000-1530	5½	-	Lay out 2⁷/₈" work string.
	1530-1900	3½	-	Rig up Enterra and rig up to run 4½" tubing. Change pipe rams, test to 400psi low and 1800psi high. Held safety meeting with Enterra and Baker prior to running 4½" tubing.
5/3/94	1900-0600	11	-	Make up upper assembly with Baker and run in hole on 4½" production tubing with Enterra. Land 131 Joints and 1 Pup at 1288.80m.
	0600-0730	1½	-	Rig up Expertest and make up Pup Joints to mount Expertest lubricator.
	0730-0800	½	-	Run PXX plug in hole on wire-line with Expertest.
				Hole began taking on fluid following perforating at 1240hrs on 3 March, 1994 at a rate of 2.3bbl/hr.
				It took 34bbl's in 22hrs and 5bbl's in the next 14 hrs.
				It displaced a calculated 17bbl's while running 4½" tubing.
	0800-0900	1	-	Set PXX Plug with Expertest and pull out of hole and run prong.
	0900-1000	1	-	Pressure up on tubing to set packer - pressure drop from 500psi. Increase up to 2500psi and maintain with pump - pressure still droping with pump off.
	1000-1230	2½	-	Run in hole with Expertest to retrieve prong - washed due to shallow engagement - RIH with shorter prong, failed to shear, changed shear pin and located.
	1230-1300	½	-	Re-run packer setting routine to 2500psi - no leak.
	1300-1330	½	-	Pressure test annulus to 1000psi - no leak.
	1330-1430	1	-	Run in hole with Expertest and open 3½" SSD.

	1430-1500	½	-	Install back pressure valve and pressure test annulus and underside of BPV to 1000psi - no leak.
	1500-1800	3	-	Nipple down BOP's and lay out.
	1800-2230	4½	-	Install Christmas Tree and pressure test with Cooper Oil Tools engineer as per completion program.
	2230-2300	½	-	Rig up Expertest and pressure test lubricator.
	2300-2400	1	-	Displace hole with 62bbl of diesel fuel.
6/3/94	2400-0030	½	-	RIH with Expertest and close SSD. Rig up Halliburton and pressure test tubing to 2000psi.
	0030-0230	3	-	Bleed pressure back to 200psi and run in hole with Expertest and recover 3½" OTIS PXX plug and prong.
	0230-0300	½	-	Pressure test annulus to 1000psi.
	0300-0330	½	-	Rig down Expertest and dismantle lubricator.
	0330-0430	1	-	Rig up and displace 62bbl of diesel fuel into production tubing.
	0430-0600	1½	-	Wait on day-light to flow well.
	0600-0800	2	-	Bring well on stream, recover at much diesel fuel as possible, divert to flare-line and flow well.

Note: Change from Daylight Saving (Eastern Summer time) to Eastern Standard Time at 0200hrs 6/3/94. (i.e., gain extra hour by shifting clock back.)

	0800-0830	½	-	Flow and burn off gas to clean up well.
	0830-1000	1½	-	Install BPV, bleed-off pressure to check BPV holding, bleed trapped pressure from master valve and rig down Cooper Oil Tools' equipment and chicksans. Release Rig.

Rig released at 1000hrs Eastern Standard Time 6 March, 1994

APPENDIX 4

APPENDIX 4

GFE RESOURCES LTD

APPENDIX 4

A. SAMPLE DESCRIPTIONS

IONA-2

GFE RESOURCES LTD

WELL:	IONA NO.2	DATE:	14/02/94 to 19/02/94
GEOLOGIST:	MUD LOGGERS	PAGE:	1 of 9

DEPTH (m)	%	SAMPLE DESCRIPTION	SHOWS						
			TOTAL GAS UNITS	GAS COMPONENTS (PPM)				FLUOR	
				C1	C2	C3	C4	NAT.	CUT
150-280	100	**Marl;** medium green-grey, brownish-grey; very fossiliferous with abundant bryozoa, gastropods, spong spicules, shell fragments; foraminifera; soft, massive	-	-	-	-	-	-	-
280-290	30	**Marl;** as above	-	-	-	-	-	-	-
	70	**Sandstone;** dark brown, orange-brown; vf-pebbly, dom. cse-v cse; poorly sorted; subang-subrndd, dom. subrndd qtz; abdt. brown FeO; strong calcite cement grading to sandy limestone							
290-300	80	**Sandstone;** as for 280-290	-	-	-	-	-	-	-
	20	**Marl;** as for 150-280							
300-450	100	**Sandstone;** as for 280-290	-	-	-	-	-	-	-
450-460	80	**Sandstone;** as for 280-290	-	-	-	-	-	-	-
	10	**Siltstone;** med.-dark brown; tr. micromicaceous; occ. arenaceous grading into very fine sandstone							
	10	**Claystone;** dark brown, dark grey; very silty; micromicaceous; soft; dispersive							
460-470	70	**Sandstone** as for 450-460	-	-	-	-	-	-	-
	10	**Siltstone** as for 450-460							
	20	**Claystone** as for 450-460							
470-490	80	**Sandstone** as for 450-460	-	-	-	-	-	-	-
	10	**Siltstone** as for 450-460							
	10	**Claystone** as for 450-460							
490-500	90	**Sandstone** as for 450-460	-	-	-	-	-	-	-
	10	**Claystone** as for 450-460							

GFE RESOURCES LTD

				SHOWS						
WELL:	IONA NO.2	**DATE:** 14/02/94 to 19/02/94								
GEOLOGIST:	MUD LOGGERS	**PAGE:** 2 of 9			GAS COMPONENTS (PPM)				FLUOR	

DEPTH (m)	%	SAMPLE DESCRIPTION	TOTAL GAS UNITS	C1	C2	C3	C4	NAT.	CUT
500-510	20	**Claystone** as for 450-460	-	-	-	-	-	-	-
	80	**Sandstone;** off white, very light grey-brownish; fine-very fine, dom. very fine; ang-subrndd; very strong calcite cement; com. white argillaceous matrix; mod. Silty; com. dark brown and red lithics; occ. vf glauconite; poor vis. porosity; mod. hard							
510-520	90	**Sandstone** as for 500-510	-	-	-	-	-	-	-
	10	**Claystone** as for 500-510							
520-530	100	**Sandstone** as for 500-510	-	-	-	-	-	-	-
530-540	40	**Sandstone** as for 500-510	0.1	1	-	-	-	-	-
530-540	60	**Claystone;** med.-dark brownish grey; occ. mod. silty; tr. vf-cse subang qtz grains; tr. glauconite; tr. dolomite nodules; tr. common pyrite and maracsite; tr. micromicaceous; massive; soft, sticky							
540-550	80	**Claystone** as for 530-540	0.1	15	1	1	-	-	-
	20	**Sandstone** as for 530-540							
550-570	10	**Sandstone** as for 530-540	1.0	120	15	11	-	-	-
	90	**Claystone** as for 530-540							
570-610	100	**Claystone** as for 530-540	1.6	180	35	22	-	-	-

GFE RESOURCES LTD

WELL: IONA NO.2 **DATE:** 19/02/94 to 25/02/94

GEOLOGIST: V. AKBARI **PAGE:** 3 of 9

DEPTH (m)	%	SAMPLE DESCRIPTION	SHOWS						
			TOTAL GAS UNITS	GAS COMPONENTS (PPM)				FLUOR	
				C1	C2	C3	C4	NAT.	CUT
610-620	80	**Claystone**as for 530-540	0.4	35	2	1		-	-
	20	**Sandstone;** light brown; vf-pebbly at top becoming vf-cse, dom. cse with depth; mod. sorted; subang-rndd; weak silica cement; abdt. med.-dark brownish grey argillaceous and silty matrix; trace volcanic lithics, tr. brown FeO stain; dom. Loose; very poor to good visual porosity	0.6	55	3	2	-	-	-
620-630	80	**Sandstone** as for 610-620, dom. fine grained							
	20	**Claystone** as for 530-540							
630-640	30	**Claystone** as for 530-540	0.1	10	1	-	-	-	-
	70	**Sandstone** as for 610-620							
640-675	100	**Sandstone;** light brown; vf-cse-pebbly, dom. med; poorly sorted; subang-subrndd, dom. subrndd qtz; abdt. dark brown silty matrix; tr. lithics; tr. FeO; loose; poor vis. porosity	0.1	1	-	-	-	-	-
	tr.	**Coal;** dark brown-black. firm							
705-745	90	**Sandstone;** light-med grey; vf-cse-pebbly, dom. cse.; poorly sorted; subang-subrndd, dom. subrndd qtz; tr. multi-colour lithics; tr. mica; tr. pyrite; no apparent cement; unconsolidated; good vis. porosity							
	tr.	**Coal;** dark brown-black; firm							
	tr.	**Claystone;** dark brown-greyish; silty, soft and dispersive							
745-775	100	**Sandstone;** as for 705-745 becoming f-med., dom. med. grained	0.1	5	-	-	-	-	-
775-820	100	**Sandstone;** as for 745-775m becoming coarse and pebbly with depth	0.1	4	-	-	-	-	-

GFE RESOURCES LTD

WELL:	IONA NO.2	DATE:	19/02/94 to 25/02/94
GEOLOGIST:	V. AKBARI	PAGE:	4 of 9

DEPTH (m)	%	SAMPLE DESCRIPTION	SHOWS						
			TOTAL GAS UNITS	GAS COMPONENTS (PPM)				FLUOR	
				C1	C2	C3	C4	NAT.	CUT
820-930	90	**Sandstone;** light-med. grey; vf-cse-pebbly, dom. coarse; poorly-mod.sorted; subang-subrndd dom. subrndd qtz; tr. mica; tr. pyrite, common multi-coloured lithics; no apparent cement Good intergranular porosity; soft; unconsolidated	0.1	4	-	-	-	-	-
	5	**Coal** dark brown-black; firm with conchoidal fracture							
	5	**Claystone**; med. grey; silty; micaceous; carbonaceous; soft, dispersive							
930-965	90	**Sandstone** as for 820-930	0.1	3	-	-	-	-	-
	5	**Claystone** as for 820-930							
	5	**Coal** as for 820-930							
965-985	80	**Sandstone**; light grey; vf-cse; often pebbly, dom. fine; poorly-mod. sorted; subang-subrndd; dom. subrndd. qtz, com. pyrite, com. lithics, com. carb. detritus; rare mica; com. clay matrix; poor porosity; soft							
	20	**Claystone**; light grey; micromic; carbonaceous silty, soft, dispersive							
985-1030	90	**Sandstone;** light grey, translucent; f-cse often pebbly, dom. med; poorly-mod. sorted; subang-subrndd, dom. subrndd qtz; rare pyrite, rare-com. multi-colour lithics; rare mica; com. dark grey argill. matrix increasing with depth; poor vis. porosity; soft; friable							
	10	**Claystone**; med-dark grey, silty; com. carb. detritus; micromicaceous; soft; dispersive							
	tr.	**Coal;** dark brown-black; firm							
1030-1505	80	**Sandstone;** as 985-1030 becoming very fine often grading into argillaceous	0.1	5	1	-	-	-	-
	20	**Claystone** as 985-1030							

VA/ac:ionasd.dsk

GFE RESOURCES LTD

WELL: IONA NO.2
GEOLOGIST: V. AKBARI
DATE: 19/02/94 to 25/02/94

DEPTH (m)	%	SAMPLE DESCRIPTION	SHOWS						
			TOTAL GAS UNITS	GAS COMPONENTS (PPM)				FLUOR	
				C1	C2	C3	C4	NAT.	CUT
1050-1060	20	**Sandstone;** light-medium grey, brownish; vf-cse, dom. f; mod. sorted; subang-subrndd, dom. subrndd. qtz; rare lithics; rare mica; rare-com. carb. detritus; tr-com. argillaceous matrix; rare silica cement; poor porosity; soft	0.1	3	-	-	-		
	80	**Claystone;** medium-dark grey, brownish; very silty; often grading to siltstone; com. carb. detritus; micromicaceous; very soft and dispersive							
1060-1080	90	**Claystone** as 1050-1060	0.1	5					
	10	**Sandstone** as 1050-1060							
1080-1090	30	**Sandstone** as 1050-1060	0.1	9					
	70	**Claystone** as 1050-1060							
1090-1105	90	**Claystone** as 1050-1060	0.2	36	2				
	10	**Sandstone** as 1050-1060							
1105-1115	100	**Claystone;** dark grey, greenish; silty; carbonaceous; micromicaceous; rare glauconite; soft, dispersive	0.4	75	3	1			
1115-1120	80	**Claystone** as 1105-1115	1.9	350	5	4			
	20	**Sandstone**; light grey; transl; f.-med; dom.f; subang-subrndd, dom. subrndd; qtz; com.f. multi-colour lithics; rare mica; rare pyrite; rare-com. carbonaceous detritus; com. argillaceous matrix; poor vis. porosity; soft							
1120-1140	100	**Claystone** as for 1105-1115 beocming more silty with depth grading into argillaceous siltstone	2.8	500	10	8			
1140-1145	100	**Siltstone;** light-med. grey, brownish; carbonaceous, micromicaceous; abdt. argillaceous matrix; soft, dispersive	6.5	1240	12	8	1		
1145-1163	100	**Siltstone** as 1140-1145	9.9	1765	48	30	4		

GFE RESOURCES LTD

WELL: IONA NO.2		DATE: 19/02/94 to 25/02/94	SHOWS						
GEOLOGIST: V. AKBARI		PAGE: 6 of 9		GAS COMPONENTS (PPM)				FLUOR	
DEPTH (m)	%	SAMPLE DESCRIPTION	TOTAL GAS UNITS	C1	C2	C3	C4	NAT.	CUT
1163-1175	100	**Sandstone;** greenish, translucent; vf-med; dom.f; subang-subrndd, dom. subrndd. qtz; rare-com. dark green glauconite, no apparent matrix; good intergranular porosity, loose	32.4	6000	160	40	10		
1175-1180	100	**Sandstone**; very light green; vf-med., dom. med; mod-sorted; subang-subrndd, dom. subrndd qtz; rare com dark green glauconite; rare coloured lithics; no apparent matrix; good vis. porosity; soft; loose	28	5185	105	45	20		
1180-1190	80	**Sandstone;** as 1175-1180	6.5	1240	12	8			
	20	**Claystone;** med-dark grey; silty grading to argillaceous siltstone; micromicaceous; carbonaceous; soft and dispersive							
1190-1245	90	**Sandstone** as 1175-1180 becoming more glauconitic with depth	26.4	5050	80	18	4		
	10	**Claystone** as 1180-1190							
1245-1250	20	**Claystone** as 1180-1190							
	80	**Sandstone** as 1190-1245	6.5	1280	8	3	1		
1250-1265	80	**Claystone;** dark grey-greenish; silty; com.-abdt. glauconite nodules; com. carbonaceous detritus; rare pyrite; very soft and dispersive	2.3	448	6	2			
	15	**Sandstone** as for 1175-1180							
	5	**Coal**; dark brown-black; firm							
1265-1270	90	**Claystone** as for 1250-1265 24/02/94	1.7	312	9	3	0		
	10	**Sandstone** as for 1190-1245							
1270-1295	95	**Claystone**; dark grey, silty; very glauconite. abdt. fine-med. nodules of dark green glauconite, decreasing with depth; com. pyrite; carbonaceous, very soft; dispersive	6.7	1200	30	23	2		
	6	**Sandstone** as for 1190-1245							

GFE RESOURCES LTD

WELL:	IONA NO.2	DATE:	19/02/94 to 25/02/94
GEOLOGIST:	V. AKBARI	PAGE:	7 of 9

DEPTH (m)	%	SAMPLE DESCRIPTION	SHOWS						
			TOTAL GAS UNITS	GAS COMPONENTS (PPM)				FLUOR	
				C1	C2	C3	C4	NAT.	CUT
1295-1300	80	**Claystone** as for 1270-12950 rare-com. glauconite	8	1400	59	23	2		
	20	**Sandstone**; light grey-tan-brownish; f.-med.; dom. med.; poorly-mod. sorted; subang-subrndd dom. subrndd qtz; rare-com. glauconite; com. pyrite; weak calc. cement; poor vis. porosity; soft-mod. hard **TOP WARRE FM. UNIT D 1299m**							
1300-1317.5	90	**Claystone;** dark grey, silty; carbonaceous rare-com. glauconite; rare pyrite, soft; dispersiv	32	5073	425	126	28		
	10	**Sandstone** as 1295-1300 **TOP UNIT C: 1317.5m**							
1317.5-1350	90	**Sandstone**; light-brownish-grey; translucent; vf-cse, dom. med; poorly -med sorted; subang-subrndd; dom-subrndd qtz; weak silica cement; slightly calc; tr. pyrite; tr. glauconite; tr-com. multi-colour lithics; good intergranular porosity; soft-mod. firm	255	43200	2006	794	279		
	10	**Claystone** as for 1300-1317.5							
		TOP UNIT -B: 1349.5							
1350-1355	50	**Claystone** as for 1300-1317.5	10.7	1840	60	47	9		
	50	**Sandstone** as for 1317.5-1350							
1355-1365	40	**Sandstone** as for 1317.5-1350	36.5	6240	263	120	40		
	60	**Claystone** as 1300-1317.5							
1365-1375	70	**Claystone** as 1300-1317.5	159	31000	310	57	33		
	30	**Sandstone** 1317.5-1350 tr. mod. bright yellow fluor with instant milky cut with thin residue **TOP UNIT A; 13082m**						10-30 mod br yell	milk white

VA/ac:ionasd.dsk

GFE RESOURCES LTD

WELL:	IONA NO.2	**DATE:** 19/02/94 to 25/02/94	**SHOWS**						
GEOLOGIST:	V. AKBARI	**PAGE:** 8 of 9		**GAS COMPONENTS (PPM)**				**FLUOR**	
DEPTH (m)	%	**SAMPLE DESCRIPTION**	**TOTAL GAS UNITS**	C1	C2	C3	C4	NAT.	CUT
1375-1400	90	**Sandstone;** white-light grey; tansl; vf-cse, dom. f; mod. sorted; subang-subrndd, dom. subrndd qtz; com-rare multi-colour lithics; rare mica; com. carb-detritus; mod. calc. cement; poor fair vis. porosity mod. hard **TOP EUMERALLA; 1400m**	77	1500	133	22	6	br yell	residue
1400-1415	80	**Sandstone;** white-light grey; vf-med, dom. med; mod. sorted; subang-subrndd, dom. subrndd qtz; com. multi-colour lithics; rare-com. altered feldspars. com. carb. detritus; mod. silica cement; slightly. calc.; poor vis. porosity; mod. firm	12.4	2200	60	40	8	10-30	residue
	20	**Claystone**; light-med grey, brownish; silty; com. multi-colour lithics; micromicaceous; carbonaceous; soft and sticky							
1415-1435	70	**Sandstone** as 1400-1415	390	61000	3150	960	70	10	milky white
	30	**Claystone** as 1400-1415							
1435-1460	90	**Claystone** as 1400-1415							
	10	**Sandstone** as 1400-1415							
1460-1485	60	**Sandstone** as 1400-1415							
	40	**Claystone** as 1400-1415							
1485-1500	80	**Sandstone** as for 1400-1415	175	21600	2190	1630	860	tr.	
	20	**Claystone** as for 1400-1415							
1500-1520	70	**Claystone;** very light grey-bluish; silty; micromicaceous; carbonaceous; rare-com. coloured lithics; very soft, sticky	41	7600	135	90	22		
	30	**Sandstone;** off white-light grey-greenish; vf-med, dom. f; poorly-mod. sorted; subang-subrndd, dom. subrndd qtz; com. multi-colour lithics, tr. white and brown mica; com. altered feldspars; mod. silica cement; poor vis. porosity, mod. firm							
1520-1530	60	**Sandstone** as 1500-1520	33	6080	115	80	17		
	40	**Claystone** as 1500-1520							

GFE RESOURCES LTD

WELL: IONA NO.2		DATE: 19/02/94 to 25/02/94	SHOWS						
GEOLOGIST: V. AKBARI		PAGE: 9 of 9		GAS COMPONENTS (PPM)				FLUOR	
DEPTH (m)	%	SAMPLE DESCRIPTION	TOTAL GAS UNITS	C1	C2	C3	C4	NAT.	CUT
1530-1545	80	**Claystone** as 1500-1520	15.5	2720	105	57	14		
	20	**Sandstone** as 1500-1520							
1545-1590	90	**Sandstone**; light grey-greenish; vf-med; dom. f; mod. sorted; subang-subrndd; dom. subrndd qtz; com.-abdt. multi-colour lithics; rare white and black mica; tr. altered feldspars; weak silica cement; slightly calcareous; poor porosity; mod. firm	46	800	398	119	30		
1590-1600	60	**Claystone** as 1545-1590	39	6960	260	94	24		
	40	**Sandstone** as 1545-1590							
1600-1615	80	**Sandstone** as 1545-1590	31	5440	254	63	9		
	20	**Claystone** as 1545-1590							
1615-1625	70	**Claystone** as1545-1590	31.2	5400	265	82	16		
	30	**Sandstone** as 1545-1590							
1625-1630	50	**Sandstone** as for 1545-1590	13	2280	106	44	3		
	50	**Claystone** as 1545-1590							
1630-1645	70	**Claystone** as 1545-1590	18.8	2960	177	69	16		
	30	**Sandstone** as 1545-1590							
1645-1650	90	**Claystone** as 1545-1590	6	1032	40	20	2		
	10	**Sandstone** as 1545-1590							

TOTAL DEPTH: 1650m REACHED AT 1915 HOURS ON 24 FEBRUARY 1994

GFE RESOURCES LTD

APPENDIX 4

B. DAILY LITHOLOGICAL DESCRITPIONS

IONA-2

DAILY LITHOLOGICAL DESCRIPTIONS

Interval		Description	Total Gas (units)	R.O.P. (m/hr)
320-336	-	SANDSTONE: light to occasionally dark brown, medium brown to orange, fine to occasionally very coarse, dominantly subrounded, occasionally round, poor sorting, occasional brown to orange marl matrix, commonly brown iron oxide stain quartz, occasionally glauconitic, trace pyrite, micaceous flakes, fossil fragments, loose grains with occasional brittle aggregates, poor to fair visual porosity, no oil fluor.	NIL	40-120 (Av. 75)
336-541	-	SANDSTONE: grading to and interbedded SILTY CLAYSTONE. SANDSTONE: light grey to light brownish grey, clear to translucent quartz grains occasionally with brown iron oxide stain, very fine to very coarse, dominantly fine to coarse, subangular to subrounded, moderately sorted, very weak silica cement, occasional streaks calcareous cement, trace to abundant medium to dark brownish grey argillaceous and silica matrix, trace glauconite, micacaeous flakes, fossil fragments, black coal, brown to reddish lithics, pyrite, loose to friable, poor to good visual porosity, no oil fluor. SILTY CLAYSTONE: dark brown, often very fine to coarse dispersive, quartz grains in place, non calcareous, commonly metamorphic, soft, sticky, moderately to very dispersive, massive.	NIL	3.5-260 (Av. 100)
541-612	-	MASSIVE CLAYSTONE. CLAYSTONE: medium to dark brown to dark brownish grey, occasionally moderately silty, trace dispersed very fine to coarse quartz grains, trace glauconite, dolomitic nodules, pyrite marcasite and metamorphics, soft, sticky, massive.	0.1 - 1.6	22-55 (Av. 40)

DAILY LITHOLOGICAL DESCRIPTIONS

Interval		Description	Total Gas (units)	R.O.P. (m/hr)
612-640	-	SANDSTONE: interbedded with and grading to CLAYSTONE. SANDSTONE: light brown, very fine to pebbly, becoming coarse with depth, subangular to rounded, very poor sorting at top becoming moderately sorted with depth, weak siliceous cement, abundant medium to dark brown grey argillaceous and silty matrix in place, rare volcanic lithics, commonly brown argillaceous and iron oxide rich lithics in part, trace brown iron oxide stain on quartz grains, friable to dominantly loose, very poor to good visual porosity, no oil fluorescence. CLAYSTONE: medium brown, trace brick red, occasional quartz pebbles, trace volcanic lithics, trace brown limestone, trace fossil fragments, trace pyrite, firm, massive.	0.1 - 1.6	6-240 (Av. 75)
640-675	-	SANDSTONE: light brown, very fine to coarse to pebbly, dominantly medium, poorly sorted, subangular to subrounded quartz, trace lithics, trace iron oxide, abundant brown, silty matrix, poor visual porosity, friable.	NIL	40-240 (Av. 100)
675-705	-	SANDSTONE: white to light grey, translucent, very fine to coarse to pebbly, dominantly coarse, poorly sorted, subangular to subrounded, dominantly subrounded quartz, trace multi-color lithics, trace mica, trace pyrite, trace brownish to grey silty matrix, poor visual porosity, soft unconsolidated, trace COAL: dark brown to black, firm.	NIL	80-300 (Av. 160)
705-745	-	SANDSTONE: light to medium grey, very fine to coarse to pebbly, dominantly coarse, poorly sorted, subangular to subrounded, dominantly subrounded quartz, trace mica, trace multi-color lithics, no apparent cement, good inter-granular porosity unconsolidated, interbedded with thin COAL: dark brown to black, firm and CLAYSTONE: medium grey silty, dispersive.	NIL	50-30 (Av. 120)
745-775	-	SANDSTONE: as from 705-775, becoming fine to medium, dominantly medium.	0.1	20-50 (Av. 30)
775-820	-	SANDSTONE: as from 745-775 becoming coarse and pebbly with depth.	0.1	40-220 (Av. 120)

DAILY LITHOLOGICAL DESCRIPTIONS

Interval		Description	Total Gas (units)	R.O.P. (m/hr)
820-930	-	SANDSTONE: light to medium grey, very fine to pebbly, dominantly coarse, poorly to moderately sorted, subangular to subrounded, dominantly subrounded quartz, trace mica, trace pyrite, commonly multi-color lithics, good inter-granular porosity, soft, unconsilidatd interbedded with COAL: dark brown to black, firm and CLAYSTONE: medium grey, silty, micaceous, carbonaceous, soft, dispersive.	0.1	20-260 (Av. 120)
930-962	-	SANDSTONE: as from 920-930	0.1	80-280
962-985	-	SANDSTONE: as above, becoming dominantly fine with increasing clay matrix, interbedded with CLAYSTONE: medium grey, silty, carbonaceous, micromicaceous.	0.1	60-280
985-1030	-	SANDSTONE: light grey, translucent, fine to coarse, often pebbly, dominantly medium, poorly to moderately sorted, subangular to subrounded, dominantly subrounded quartz, rare pyrite, rare to common multi-color lithics, rare mica, common and argillaceous matrix increasing with depth, poor visual porosity, soft, interbedded with CLAYSTONE: medium to dark grey, silty, common carbonaceous detritus, micromicaceous, soft, dispersive and minor COAL: dark brown to black, firm.	0.1	20-260 (Av. 120)
1030-1050	-	SANDSTONE: as 985-1030 becoming very fine with depth, oftern grading into argillaceous SILTSTONE interbedded with CLAYSTONE and minor COAL as above.	0.1	20-140 (Av. 60)
1050-1060	-	SANDSTONE: light to medium grey, brownish, very fine to coarse, dominantly fine, moderately sorted, subangular to subrounded, dominantly subrounded quartz, rare lithics, rare mica, rare to common carbonaceous detritus, trace to common argillaceous matrix, rare silica cement, poor porosity, soft interbedded with CLAYSTONE: medium to dark grey brownish, very silty often grading to SILTSTONE: common carbonaceous detritus, micromicaceous, soft, very dispersive.	0.1	

DAILY LITHOLOGICAL DESCRIPTIONS

Interval		Description	Total Gas (units)	R.O.P. (m/hr)
1060-1080	-	SILTY CLAYSTONE: interbedded with thin SANDSTONE: as 1050-1060.	0.1	5-10 (Av. 4)
1080-1100	-	SANDSTONE interbedded with thin SILTY CLAYSTONE: as 1060-1080.	0.1	20-80 (Av. 40)
1100-1115	-	SILTY CLAYSTONE: as 1060-1080.	0.1-0.4	5-15 (Av. 4)
1115-1120	-	SANDSTONE: light grey, translucent, fine to medium dominantly fine, subangular to subrounded, dominantly subrounded quartz, common lithics, rare mica, rare pyrite, rare to common carbonaceous detritus, common argillaceous matrix, poor visual porosity, soft interbedded with CLAYSTONE: as from 1050-1060.	0.4-1.9	5
1120-1163	-	CLAYSTONE: medium to dark grey, greenish silty, carbonaceous, micromicaceous becoming increasingly silty with depth grading into argillaceous SILTSTONE.	0.7-9.9	4-20 (Av. 8)
1163-1175	-	SANDSTONE: translucent, greenish, very fine to medium, dominantly fine, subangular to subrounded, dominantly subrounded quartz, rare to common dark green glauconite, no apparent cement, good intergranular porosity, loose.	8.7-32.4	40-50 (Av. 45)
1175-1250	-	SANDSTONE: very light grey; very fine to medium, dominantly medium; moderately sorted; subangular to subrounded, dominantly subrounded quartz; rare to common dark green glauconite; rare multi-colored lithics, no apparent matrix, good intergranular porosity; loose, interbedded with thin CLAYSTONE; medium to dark grey; silty; grading to argillaceous SILTSTONE; micromicaceous; carbonaceous; soft and dispersive.	3-26.4	8-50 (Av. 20)
1250-1265	-	CLAYSTONE: dark grey to greenish; common to abundant glauconite nodules; common carbonaceous detritus; rare pyrite, very soft and dispersive. Interbedded with thin SANDSTONE; as in 1170-1250m and minor COAL; dark brown to black; firm.	1.0-2.3	2-8 (Av. 4)

DAILY LITHOLOGICAL DESCRIPTIONS

Interval		Description	Total Gas (units)	R.O.P. (m/hr)
1265-1300	-	CLAYSTONE: dark grey; silty; very glauconitic; abundant dark green, fine to medium glauconite grains decreasing with depth; common pyrite; carbonaceous; very soft; dispersive.	1.0-8.0	3-30 (Av. 17)
1300-1317.5	-	1299m Top Waarre Unit D (1275m TVD) CLAYSTONE: as for 1265-1300m interbedded with SANDSTONE; light grey to tan to brownish; fine to medium (dominantly medium); poorly to moderately sorted; subangular to subrounded (dominantly subrounded quartz); rare to common glauconite; common pyrite; weak calcareous cement; poor porosity; soft to moderately hard.	5.6-32	6-33 (Av. 10)
1317.5-1350	-	1317.5m Top Waarre Unit C (1293m TVD) SANDSTONE: light to brownish to grey; translucent, very fine to coarse (dominantly medium); poorly to moderately sorted; subangular to subrounded (dominantly subrounded quartz); trace pyrite; trace glauconite; trace lithics; weak silica cement (slightly calcareous); good inter-granular porosity; soft to moderately firm.	13.5-255	40-60 (Av. 50)
1350-1382	-	1349-5m Top Waarre Unit B (1326m TVD) CLAYSTONE: dark grey; silty; rare to common dark green glauconite; rare pyrite; soft and dispersive. Interbedded with SANDSTONE; white to light grey; very fine to coarse (dominantly fine); moderately sorted; subangular to subrounded (dominantly subrounded quartz); common to rare lithics; rare mica; moderately calcareous cement, poor visible porosity.	9.0-159	7-35 (Av. 10)
1382-1400	-	1382 Top Waarre Unit A (1356.5m TVD) SANDSTONE interbedded with thin CLAYSTONE; as for 1350-1382m.	3.2-77	30-60 (Av. 45)

DAILY LITHOLOGICAL DESCRIPTIONS

Interval		Description	Total Gas (units)	R.O.P. (m/hr)
1400-1435	-	1400m Top Eumeralla (1376m TVD) SANDSTONE: white to light grey; very fine to medium (dominantly medium); moderately sorted; subangular to subrounded (dominantly subrounded quartz); common multi-colored lithics; common altered feldspar; common carbonaceous detritus; moderate silica cement (slightly calcareous); poor visible porosity; moderately firm. Interbedded with CLAYSTONE; light to medium grey to brownish; silty; common multi-colored lithics; micromicaceous; carbonaceous; soft and sticky.	3.2-390	5-25 (Av. 15)
1435-1460	-	CLAYSTONE: interbedded with thin SANDSTONE; as for 1400-1435m	10.5-20.0	
1460-1485	-	Interbedded SANDSTONE and thin CLAYSTONE	11.0-175	
1485-1510	-	Interbedded SANDSTONE and CLAYSTONE as for 1400-1415m.	8-34	10-45 (Av. 20)
1510-1530	-	SANDSTONE: off white to light grey greenish; very fine to medium (dominantly fine); poorly to moderately sorted; subangular to subrounded (dominantly subrounded quartz); common multi-colored lithics; trace white mica and biotite; commonly altered feldspar; moderately silica cement; poor porosity; firm. Interbedded with CLAYSTONE; light grey to bluish; silty; micromicaceous; carbonaceous; rare to common lithics; soft; dispersive.	8-41	20-45 (Av. 40)
1530-1550	-	CLAYSTONE: interbedded with thin SANDSTONE; as for 1510-1530m.	6.5-46	10-20 (Av. 12)
1550-1590	-	SANDSTONE: as for 1510-1530m, interbedded with thin CLAYSTONE.	6.4-39.0	20-60 (Av. 40)
1590-1600	-	CLAYSTONE: as for 1510-1530m, interbedded with thin SANDSTONE.	4-23	5-40 (Av. 15)
1600-1615	-	SANDSTONE: as for 1510-1530m, interbedded with thin CLAYSTONE.	31	20-50 (Av. 45)
1615-1645	-	Interbedded SANDSTONE and CLAYSTONE as for 1510-1530m.	6-31.2	10-45 (Av. 20)

DAILY LITHOLOGICAL DESCRIPTIONS

Interval	Description	Total Gas (units)	R.O.P. (m/hr)
1645-1650	- CLAYSTONE: as for 1510-1530m	6.0-7.0	10-12 (Av. 11)

- **TOTAL DEPTH: 1650m MD**
  Reached at 1915hrs on 24 / 2 / 1994

APPENDIX 5

APPENDIX 5

GFE RESOURCES LTD

APPENDIX 5

SIDEWALL CORE DESCRIPTIONS

IONA-2

SIDEWALL CORE DESCRIPTION

WELL NAME: IONA No. 2 **GEOLOGIST:** V. AKBARI **DATE:** 28/02/94

SWC No.	DEPTH (m)	REC'D (cm)	LITHOLOGY *(FLUORESCENCE)*	GAS * (ppm)				
				C_1	C_2	C_3	iC_4	nC_4
1	1599.0	1.5	**CLAYSTONE:** grey to bluish grey, micromicaceous very soft, sticky	75	3	3	1	nd
2	1590.0	1.5	**CLAYSTONE:** as for SWC 1	26	2	1	nd	nd
3	1550.5	3.0	**SANDSTONE:** white to light grey,bluish, very fine to medium, dominantly medium, moderately sorted, subangular to subrounded, dominantly subrounded, quartz, abundant dark coloured lithics, rare to common biotite, common altered feldspar, common silica cement, poor visual porosity, moderately firm	26	3	2	nd	nd
4	1537.0	-	**NO RECOVERY**					
5	1516.5	6.5	**SANDSTONE:** medium to dark grey, greenish, very fine to medium, dominantly fine, moderately sorted, subangular to subrounded, dominantly subrounded quartz, common silt, common dark green lithics, rare reddish lithics, rare to common biotite, common altered feldspar, strong silica cement, poor visual porosity, firm to moderately hard	137	5	2	nd	nd
6	1469.0	3.5	**SANDSTONE:** as for SWC 5	31	2	nd	nd	nd
7	1457.5	5.0	**CLAYSTONE:** light to medium grey, bluish, slightly calcareous, micromicaceous, massive, soft	851	108	72	15	16
8	1437.5	2.5	**CLAYSTONE:** as for SWC 7	713	95	74	10	18

SIDEWALL CORE DESCRIPTION

WELL NAME: IONA No. 2 **GEOLOGIST:** V. AKBARI **DATE:** 28/02/94

SWC No.	DEPTH (m)	REC'D (cm)	LITHOLOGY *(FLUORESCENCE)*	GAS * (ppm)				
				C_1	C_2	C_3	iC_4	nC_4
9	1426.0	3.5	**SANDSTONE**: medium greenish-grey, very fine to coarse, dominantly medium, moderately sorted, subangular to subrounded, dominantly subrounded, quartz, common dark green and red lithics, rare muscovite and biotite, common altered feldspar, very weak calcareous cement, strong silica cement, poor visual porosity, moderately firm. ***Moderately bright yellow fluorescence, with a slow streaming dull yellow milky cut***	2328	492	761	644	752
10	1418.0	3.5	**SANDSTONE:** as for SWC 9	62	17	61	69	80
11	1412.0	5.0	**SILTSTONE:** medium greenish-grey, common greenish lithics, rare biotite, rare red lithics, argillaceous, moderately calcareous, often grading to very fine **SANDSTONE**	845	77	87	60	76
12	1408.5	3.5	**SANDSTONE:** medium to dark grey, greenish, very fine to coarse, dominantly medium, poorly to moderately sorted, subangular to subrounded, dominantly subrounded quartz, common dark green lithics, rare biotite, rare carbonaceous detritus, moderate to strong calcareous cement, poor visual porosity, soft. ***Bright to moderately bright yellow cut with an instant bright milky cut***	3823	1612	94	295	276
13	1402.0	2.5	**CLAYSTONE:** light to medium grey, bluish to grey, slightly calcareous, micromicaceous, massive, soft	134	8	12	8	14
14	1392.0	3.5	**SANDSTONE:** off white to light grey, translucent, fine to coarse, dominantly coarse, poorly sorted, subangular to subrounded, dominantly subrounded quartz, rare lithics, rare to common carbonaceous detritus, weak argillaceous cement, very weak calcareous matrix, good intergranular porosity, soft, friable	284	7	6	nd	nd
15	1386.0	4.5	**SANDSTONE:** as for SWC 14	133.5	23	5	nd	nd

SIDEWALL CORE DESCRIPTION

WELL NAME: IONA No. 2 **GEOLOGIST:** V. AKBARI **DATE:** 28/02/94

SWC No.	DEPTH (m)	REC'D (cm)	LITHOLOGY *(FLUORESCENCE)*	GAS * (ppm)				
				C_1	C_2	C_3	iC_4	nC_4
16	1381.0	4.5	**SANDSTONE:** off white to brownish, very fine to medium, dominantly fine, moderately sorted, subangular to subrounded quartz, rare green lithics, rare mica, rare cabonaceous detritus, pyritic with small bands of micritic pyrite, common argillaceous matrix, weak calcareous cement, good visual porosity, soft. ***70% banded bright to moderately bright yellow fluorescence with an instant bright to milky white cut***	63	6	2	nd	nd
17	1374.0	3.0	**SANDSTONE:** off white to brownish, very fine to fine, dominantly very fine, well sorted, subangular to subrounded, dominantly subrounded quartz, rare lithics, rare mica, rare pyrite, common to abundant fine carbonaceous detritus, strong silica matrix, very weak calcareous cement, poor visual porosity. ***Trace patchy, moderately bright medium yellow fluorescence with a slow streaming dull milky white cut***	-	-	-	-	-
18	1371.0	3.0	**CLAYSTONE:** dark grey to brownish, silty, micromicaceous, carbonaceous, blocky, soft	1290	98	25	17	9
19	1362.0	2.5	**SANDSTONE:** off white to brownish, translucent, fine to medium, dominantly fine, well sorted, subangular to subrounded, dominantly subrounded quartz, rare lithics, abundant argillaceous matrix, very weak calcareous cement, poor visual porosity, soft. ***Band of 90% solid moderately bright yellow fluorescence with an instant bright, milky white cut***	205	13	24	10	9
20	1358	2.0	**SANDSTONE:** off white, translucent, very fine to pebbly, dominantly coarse, poorly to moderately sorted, subangular to subrounded, dominantly subrounded quartz, rare pyrite, rare to common carbonaceous detritus, weak argillaceous cement, good visual porosity, soft, friable. ***100% bright, medium yellow fluorescence with an instant moderately bright milky white cut***	-	-	-	-	-
21	1353	3.0	**CLAYSTONE:** dark grey, greenish, carbonaceous, weakly calcareous, abundant light green to dark green glauconite, massive, soft, sticky	-	-	-	-	-

SIDEWALL CORE DESCRIPTION

WELL NAME: IONA No. 2 **GEOLOGIST:** V. AKBARI **DATE:** 28/02/94

SWC No.	DEPTH (m)	REC'D (cm)	LITHOLOGY *(FLUORESCENCE)*	GAS * (ppm)				
				C_1	C_2	C_3	iC_4	nC_4
22	1315	2.0	**SILTSTONE:** medium to dark grey, very argillaceous, grading to silty **CLAYSTONE:** rare pyrite, very carbonaceous with common to abundant carbonaceous detritus, micromicaceous, weakly calcareous, massive, soft	-	-	-	-	-
23	1303.5	5.0	**CLAYSTONE:** dark grey, greenish, micromicaceous, rare lithics, common white altered feldspar, very glauconitic with abundant fine to medium glauconite nodules, rare pyrite, massive, soft	-	-	-	-	-
24	1290	4.0	**CLAYSTONE:** as for SWC 23	-	-	-	-	-
25	1281	3.5	**CLAYSTONE:** medium to dark grey, micromicaceous, very glauconitic with abundant fine to medium glauconite nodules, massive, soft	-	-	-	-	-
26	1260	3.0	**CLAYSTON:** as for SWC 25, with more glauconite	-	-	-	-	-
27	1161	4.0	**CLAYSTONE:** medium to dark grey, micromicaceous, common carbonaceous detritus, sub-fissile, soft to moderately firm	-	-	-	-	-
28	1129	4.0	**SILTSTONE:** dark grey to brownish, argillaceous, weakly to moderately calcareous, carbonaceous, micromicaceous, massive, soft	-	-	-	-	-
29	1090.5	4.0	**SANDSTONE:** off white to very light brown, very fine to fine, dominantly fine, well sorted, subangular to subrounded, dominantly subrounded quartz, rare to common pyritic cement, rare lithics, rare carbonaceous detritus, strong argillaceous matrix, no visual porosity, soft	-	-	-	-	-
30	1034.5	5.0	**SANDSTONE:** as for SWC 29, with very thin bands of carbonaceous material	-	-	-	-	-

APPENDIX 6

APPENDIX 6

GFE RESOURCES LTD

APPENDIX 6

PALYNOLOGY REPORT

IONA-2

Palynological Analysis
of Iona-2
in Port Campbell Embayment
Otway Basin

by

Alan D. Partridge
Biostrata Pty Ltd
A.C.N. 053 800 945

Biostrata Report 1994/4
Submitted 14 April 1994
Revised 20 June 1994

INTERPRETATIVE DATA

Introduction

Eighteen sidewall cores samples and four cutting samples between 1034.5-1599m were analysed in Iona-2. The selected sidewall cores where forwarded for processing to Laola Pty Ltd in Perth in early March and an initial version of this report was submitted on 14 April. It was then decided to analyse four cuttings samples between 1292.5-1350m to improve the dating on the Waarre Formation and at the same time additional palynological slides were prepared and examined from remaining palynological residues from sidewall cores in this interval. These new preparations provided new information necessitating revision of the original report. The changes were needed once it was realised SWC-22 at 1325m was significantly contaminated, due either to drilling mud which could not be cleaned from the sample or cross-contamination during laboratory preparation. The contamination from higher in the section resulted in assignment of an erroneous younger age to this sample in the original report.

Between 6.5 to 15.8 grams (average 11.2 g) of the sidewall cores, and 10 to 24 grams (average 16.9 g) of the cuttings, were processed for palynological analysis. Residue yields vary from very low to very high while the palynomorphs are mostly present in low to moderate concentrations on the slides. Preservation of palynomorphs varies from poor to good but overall is fair. A problem with the preservation is that many of the dinoflagellates are broken which means that some species may only be represented by fragments rather than complete specimens. Spore-pollen diversity is consistently high through the Sherbrook Group averaging 33+ species per sample, but rather bimodal in the Eumeralla Formation where it is either very low (1-3 species) or moderate to high (17-38 species). Average spore-pollen diversity through the Eumeralla Formation was 19+ species per sample. Microplankton diversity is low to moderate (9-18 species) in the Sherbrook Group with an average of 12+ species, and very low in the Eumeralla Formation with and average of 2+ species per sample.

Geological ages, formations and palynological zones for the interval sampled in Iona-2 are given in Table-1. Additional interpretative data with zone identification and Confidence Ratings are recorded in Table-4, whilst basic data on residue yields, preservation and diversity are recorded on Tables-5 and 6. For the sidewall cores all species which have been identified with binomial names are tabulated on the palynomorph range charts which present the recorded assemblages on separate charts in order of highest and lowest appearances. The assemblages recorded from the cuttings samples are recorded in Appendix-1.

Geological Comments

1. The sequence sampled in Iona-2, with only minor modifications, can be readily assigned to the Mesozoic spore-pollen and microplankton zones defined by Helby, Morgan & Partridge (1987). The time interval sampled is from the Late Albian to basal Campanian.

2. The spore-pollen zone nomenclature of Helby *et al.* (1987) used in this report is a modification of an earlier zonation scheme proposed by Dettmann & Playford (1969). This earlier scheme over the interval analysed here was originally erected upon wells in the Port Campbell Embayment and is still widely used in the Otway Basin. The equivalence between the two zonation schemes, for those zones applicable to Iona-2 is as follows:

Dettmann & Playford (1969)	**Helby *et al.* (1987)**
Nothofagidites Microflora (in part only)	*N. senectus* Zone
T. pachyexinus Zone	*T. apoxyexinus* Zone
C. triplex Zone	*P. mawsonii* Zone
A. distocarinatus Zone	*A. distocarinatus* Zone
P. pannosus Zone	*P. pannosus* Zone

Explanations of the reasons for the zone name changes can be found in Helby *et al.* (1987).

3. Of the microplankton or dinoflagellate zones identified in Iona-2 the *Nelsoniella aceras* and *Isabelidinium* (al. *Deflandrea*) *cretaceum* Zones were originally established in the Otway Basin by Evans (1966), while the older *Odontochitina porifera* Zone is an Australia-wide zone defined in Helby *et al.* (1987). At the base of the marine sequence the new local *Cribroperidinium edwardsii* Acme Zone is recognised. The current preferred correlation of this zone is with all or part of the Turonian *Palaeohystrichophora infusorioides* Zone of Helby *et al.* (1987). However, as exact equivalence cannot yet be convincingly demonstrated, new terminology is preferred to avoid possible ambiguity.

4. The spore-pollen succession in Iona-2 lacks clear evidence for the presence of the *A. distocarinatus* Zone. This is supported by the ages derived from the microplankton assemblages, and is identical to the results reported by Morgan (1988) from the adjacent Iona-1.

Table-1: Palynological Summary Iona-2

<table>
<tr><th>AGE</th><th>UNIT</th><th>SPORE-POLLEN ZONES</th><th>MICROPLANKTON ZONES</th></tr>
<tr><td>CAMPANIAN</td><td rowspan="3">SKULL CREEK MUDSTONE</td><td>N. senectus
1034.5m</td><td rowspan="2">N. aceras
1034.5-1129m</td></tr>
<tr><td rowspan="5">SANTONIAN</td><td rowspan="5">T. apoxyexinus
1090-1295m</td></tr>
<tr><td rowspan="3">I. cretaceum
1161-1281m</td></tr>
<tr><td>NULLAWAARE GREENSAND</td></tr>
<tr><td rowspan="2">BELFAST MUDSTONE</td></tr>
<tr><td>O. porifera
1290-1295m</td></tr>
<tr><td>TURONIAN</td><td>WAARRE FORMATION</td><td>P. mawsonii
1303.5-1371m</td><td>C. edwardsii
1303.5-1371m</td></tr>
<tr><td>LATE ALBIAN</td><td>EUMERALLA FORMATION</td><td>P. pannosus
1402-1590m</td><td></td></tr>
</table>

5. The dinoflagellates succession in the sidewall cores is incomplete because the *Conosphaeridium striatoconus* dinoflagellate Zone was not recognised in Iona-2 although present in Iona-1 (Table-2). The possibility that the zone might be present was subsequently tested by analysis of four cuttings samples below the base of the *O. porifera* Zone. Unfortunately neither *Conosphaeridium striatoconus* nor any other index species for the zone were recorded and it is therefore concluded this zone is not present in Iona-2.

6. Between 1290m and the shallowest sample at 1034.5m the microplankton succession displays a normal sequence for the Senonian consisting of in ascending order the *O. porifera*, *I. cretaceum* and *N. aceras* Zones.

7. Table-2 provides a correlation of sidewall core samples between Iona-1 and Iona-2 with comments on the key species events used for the correlations. The striking feature is that while the *C. striatoconus* Zone is missing or not sampled in Iona-2 the overlying *O. porifera* Zone is missing or not sampled in Iona-1. The proposed correlations are based solely on the palynological data and have not been verified by electric log correlation. They do however suggest that further resolution is still possible in both wells using palynology.

Table-2: Correlation of samples between Iona-1 and Iona-2.

Spore-Pollen and (Microplankton) Zones	Iona-1 (Depths m)	Iona-2 (Depths m)	Key species datums
N. senectus (*N. aceras*)	1018-1054	1034.5	FAD for *N. senectus* and *F. sabulosus* with dinoflagellates *N. aceras* and/or *N. tuberculatus* together with questionable *X. australis*.
T. apoxyexinus (*N. aceras*)	1075.5	1090-1129	FAD of *N. aceras* without presence of *N. senectus*.
T. apoxyexinus (*I. cretaceum*)	1240-1254	1161-1281	FAD of *I. cretaceum* associated with increased dominance of *Proteacidites* spp.
T. apoxyexinus (*O. porifera*)	NOT SAMPLED	1290	FAD of *O. porifera* and FAD of *P. gillii*.
(*C. striatoconus*)	1276.5	NOT SAMPLED	FAD & LAD of *C. striatoconus* with consistent *P. mawsonii* and *C. triplex*.
P. mawsonii (*C. edwardsii*)	1287-1347.5	1303.5-1371	Total local range of *C. edwardsii* with rare but consistent *P. mawsonii* and *C. triplex*.
P. pannosus	1383-1481	1402-1590	Assemblage containing non-marine algae with FAD for *P. pannosus*.

LAD = Last Appearance Datum.
FAD = First Appearance Datum.

8. All samples analysed from the Sherbrook Group are considered to be marine based on the abundance and diversity of their contained microplankton. Abundance of microplankton expressed as a percentage varies from 6% to 32% (Table-3). The palynomorphs in the count include spores, pollen and microplankton, but exclude fungal spores and hyphae and any palynomorphs that are obviously reworked or contaminants.

Microplankton species diversity is low to moderate with between 9-18 species recorded from individual samples. As the total diversity recorded for the interval is 50+ species it is suspected the true diversity of the samples is higher than recorded being limited by low recoveries and only moderate palynomorph concentrations in individual samples. Even though the microplankton abundances of three of the four samples from Units B and D of the Waarre Formation are lower than the other samples the species diversity is consistent (Table-6). Overall, whilst the species diversity is consistently less than the diversity found in equivalent age marine rocks on the western margin of Australia, as for example recorded by Marshall (1984), it is nevertheless consistent with the style of most other marine microplankton assemblages found in the Late Cretaceous basins along the southern margin of Australia.

Table-3: Microplankton Abundance for Selected Samples.

Sample Type	Depth (m)	Microplankton Zone	Microplankton Abundance as % Relative to total Spore-pollen	Most abundant microplankton species as % of total microplankton
SWC-30	1034.5	*N. aceras*	12%	*Heterosphaeridium* spp. >40%.
SWC-29	1090	*N. aceras*	19%	*Heterosphaeridium* spp. >45%.
SWC-28	1129	*N. aceras*	25%	*Heterosphaeridium* spp. >60% *Nelsoniella aceras* 16%
SWC-26	1260	*I. cretaceum*	26%	*Heterosphaeridium* spp. >42% *Hexagonifera* spp. 25%.
SWC-25	1281	*I. cretaceum*	21%	*Heterosphaeridium* spp. >50%.
SWC-24	1290	*O. porifera*	21%	*Heterosphaeridium* spp. >52% *Odontochitina* spp. 6%.
SWC-23	1303.5	*C. edwardsii*	11%	*Spiniferites* spp. 30% *Heterosphaeridium* spp. >15%.
SWC-22	1315	*C. edwardsii*	32%	*Heterosphaeridium* spp. >35% *Odontochitina* spp. 13%
SWC-21	1353	*C. edwardsii*	11%	*Cribroperidinium edwardsii* 24%.
SWC-18	1371	*C. edwardsii*	6%	*Amosopollis cruciformis* 14%.
SWC-13	1402		5%	*Sigmopollis carbonis* 50%.
SWC-11	1412		2%	*Sigmopollis carbonis* 33%.
SWC- 8	1437.5		5%	*Sigmopollis carbonis* 70%.
SWC- 7	1457.5		4%	*Sigmopollis* spp. 90%.
SWC- 2	1590		0.5%	*Sigmopollis carbonis* 100%.

9. Buffin (1989) has proposed a depositional model for units identified in the Waarre Formation in which significant restricted marine units including back-water lagoons, swamps, tidal channels and tidal deltas are deposited behind or associated with a beach-barrier. None of the four assemblages recorded from the Waarre Formation in Iona-2 could be considered typical of these environments, which would be expected to have microplankton "blooms" consisting of the very abundant occurrence (microplankton typically >75% of total count) of one or just a few species. Instead the samples contain moderate diversity assemblages without any particular species being dominant.

10. The organic microplankton recorded from the Eumeralla Formation would generally be classed as acritarchs and are here all considered to be derived from non-marine lacustrine environments. The deposition of the Otway Group at high latitudes in the Early Cretaceous can be compared to modern deposition environments above the Arctic Circle where there are typically thousands of lakes of all sizes in the modern depositional basins as a consequence of low temperatures and low evaporation. It is easy to envisage algal cysts deposited in such lakes being reworked by fluvial processes throughout the depositional basin. These microplankton in the Otway Group have been recorded and discussed by other palynologists dating back to Evans (1966, p.31).

11. Nearly all of the samples analysed contained reworked palynomorphs. The commonest or most distinctive reworked spore-pollen are from the Permian with a minor component of distinctive Triassic spores and pollen. The Sherbrook Group contains obvious reworked Early Cretaceous spores the most distinctive of which are *Cyclosporites hughesii* and *Pilosisporites notensis*. The counts suggest the assemblages contain between 1% to 5% reworked palynomorphs. This is likely to be a conservative estimate because of the difficulty with long ranging species, which dominate all assemblages, of deciding which specimens are reworked and which insitu. Making such a distinction is only possible where there are clear differences in the maturation colour of the reworked palynomorphs.

Biostratigraphy

Zone and age determinations are based on the Australia wide spore-pollen and microplankton zonation schemes described by Helby, Morgan & Partridge (1987). As applied to the Otway Basin these schemes modified and improved on the spore-pollen zonation scheme of Dettmann & Playford (1969) and the microplankton zonation scheme of Evans (1966). An additional local microplankton association called the *Cribroperidinium edwardsii* Acme Zone is recognised in this report to better express local correlations.

Author citations for most spore-pollen species can be sourced from Helby, Morgan & Partridge (1987), Dettmann (1963) or other references cited herein. Author citations for dinoflagellates can be found in the indexes of Lentin & Williams (1985, 1989) or other references cited herein. Species names followed by "ms" are unpublished manuscript names.

Spore-Pollen Zones

***Nothofagidites senectus* Zone.**
Interval: 1034.5 metres
Age: Basal Campanian

The shallowest sample analysed is assigned to this zone on the occurrence of a single specimen of the eponymous species *N. senectus*. A position low in the zone is suggested by presence of *Forcipites* (al. *Tricolpites*) *sabulosus* with *Tricolporites apoxyexinus* but without the presence of *Gambierina rudata* (see range chart in Helby *et al.* 1987, fig. 33). Other noteworthy species are *Tricolpites waipawaensis* and *Forcipites stipulatus*. The commonest elements in the assemblage are *Proteacidites* spp. (17%) and *Podocarpidites* spp. (13%).

***Tricolporites apoxyexinus* Zone** (formerly the *Tricolpites pachyexinus* Zone).
Interval: 1090.0-1295.0 metres (200+ metres).
Age: Santonian

Of the six sidewall core samples assigned to this zone the eponymous species *T. apoxyexinus* is recorded from only three, and then usually only as a single specimen. A variety of accessory species indicative of the zone are more common. These include the first appearance datums (FADs) in this well for *Peninsulapollis gillii* (at 1290m), *Forcipites stipulatus* (1281m), *Lygistepollenites balmei* (1161m), *Camarozonosporites bullatus* (1161m, with a questionable specimen at 1303.5m), *Latrobosporites ohaiensis* (1161m) and *L. amplus* (1260m).

The species *Australopollis obscurus*, *Clavifera triplex* and *Phyllocladidites mawsonii* although known to range into older zones are consistently recorded in most samples in this zone.

On overall composition this zone can be characterised as the level in the Late Cretaceous when angiosperm pollen first became common in the assemblage counts. They range in abundance from 11% to 28% with an average of 18%. *Proteacidites* spp. and other triporate pollen are also conspicuous ranging from 4% to 16%. Thus, these assemblages readily conform to characteristic of *Proteacidites* Superzone of Helby *et al.* (1987).

The cuttings samples suggests the zone extends at least as deep as 1295m.

***Phyllocladidites mawsonii* Zone** (formerly the *Clavifera triplex* Zone).
Interval: 1303.5-1371.0 metres (68+ metres).
Age: Turonian (Coniacian absent or not sampled).

The eponymous species *P. mawsonii*, whose FAD defines the base of this zone was recorded in three of the four sidewall cores and all of the cuttings within this interval. The formerly used zone species *Clavifera triplex* was also consistently recorded in most of the samples.

Important accessory species are rare but include *Cyatheacidites tectifera* at 1353m and 1371m. This species is considered to range no older than this zone on the southern margin (Helby *et al.* 1987, fig.33). Other species are *Cicatricosisporites cuneiformis* and *C. pseudotripartitus* which are considered to range no younger than this zone by Dettmann & Playford (1969, table 9.4). *Appendicisporites distocarinatus* was also recorded from most samples and its occurrence is consistent with its range given by Helby *et al.* (1987, fig.33), but is a younger extension of the original range given by Dettmann & Playford (1969).

There are also several new species or variety previously recorded from the *P. mawsonii* Zone in the Gippsland and Bass Basins but hitherto not recorded from the Otway Basin. These include *Densoisporites muratus* ms, *Rugulatisporites admirabilis* ms, *Hoegisporis trinalis* ms, *Laevigatosporites musa* ms, *Cupressacites* sp. and *Dilwynites granulatus* (small variety).

Counts of the two assemblages show they can be characterised by frequent to abundant *Dilwynites granulatus* (3%-39%; average 21%) with frequent to common *Cupressacites* sp. (3%-10%) and *Glecheniidites/Clavifera* spp. (6%-9%). The abundance of these three species groups clearly distinguish these samples from those assigned to the underlying *P. pannosus* Zone.

The absence of the *C. striatoconus* dinoflagellate Zone in Iona-2 suggests the upper part of the *P. mawsonii* Zone of Coniacian age may not to be present in Iona-2.

Upon initial examination the sample at 1315m was assigned to the overlying *T. apoxyexinus* Zone on the presence of the eponymous species and *Forcipites* sp. and the supporting evidence of the associated dinoflagellates. Examination of additional slides showed that these younger index species were extremely rare and the bulk of the assemblage was more similar to the other *P. mawsonii* Zone samples. It is concluded therefore that this sample has been contaminated.

***Appendicisporites distocarinatus* Zone.**
Interval: Not recorded in Iona-2.
Age: Cenomanian.

Assemblages characteristic of this zone were not recorded in Iona-2 but may be present in the 31 metre unsampled interval between 1371-1402m. The zone was also lacking in Iona-1 where there is a similar unsampled interval of 35 metres lying between 1347.5m-1383m (Morgan 1988).

***Phimopollenites pannosus* Zone.**
Interval: 1402.0-1599.0 metres (197+ metres).
Age: Late Albian.

Six of the seven samples from the Eumeralla Formation could be assigned to the *P. pannosus* Zone. The seventh and deepest sample in the well was virtually barren and could not be assigned to any age.

Phimopollenites pannosus was only recorded from the samples at 1457.5m and 1516.5m, while *Perotrilites jubatus* which Dettmann & Playford (1969) considers as also having its FAD within this zone was recorded in the four samples at 1412m, 1437.5m, 1457.5m and 1590m.

Other significant species recorded include *Tricolpites cooksoniae* at 1437.5m and 1457.5m, a poorly preserved specimen of *Trilobosporites purverulentus* at 1412m and a interpreted reworked specimen of *Pilosisporites notensis* at 1402m.

Overall the species diversity recorded is not high for the zone and certain species which would have been expected were either absent or very rare. These include *Coptospora paradoxa* and *Trilobosporites trioreticulosus* which were not recorded and *Crybelosporites striatus* which was only seen at 1437.5m.

Confidence in assigning all the samples to the zone is based mainly on the assemblage count. These clearly differ from the overlying *P. mawsonii* and younger Zones by the increased abundance of *Corollina* spp., *Retitriletes* spp. and spores of the *Baculatisporites / Osmundacidites* complex, and lack of any significant abundances of *Gleicheniidites* spp., *Dilwynites* spp. and *Cupressacites* sp.

The sample at 1590m was considered to be a particularly favourable lithology and duly gave a good yield. Unfortunately the spore-pollen assemblage was overwhelmingly dominated by *Baculatisporites-Osmundacidites* style spores which comprise 85% of the count, amongst which index species were very difficult to find.

A single specimen of *Amosopollis cruciformis* was recorded at 1457.5m which is flagged as a possible new downward extension of its range or alternatively evidence of downhole contamination which is indicated as possible problem with this sample (Table-5). Significant contamination was interpreted as present in the shallowest sample at 1402m which could only be assigned to this zone after counting the limited residue recovered.

Microplankton Zones

***Nelsoniella aceras* Zone.**
Interval: 1034.5-1129.0 metres (95+ metres).
Age: Late Santonian - Early Campanian.

The three samples conform to this zone by containing either *Nelsoniella aceras* or *N. tuberculata* and lacking *Xenikoon australis*. A possible specimen of the latter species was recorded in the shallowest sample but additional searching did not reveal further specimens. It is noted that Morgan (1988) also records a questionable specimen of *X. australis* at 1018m in Iona-1 but still assigns the sample to the *N. aceras* Zone.

The associated dinoflagellates disappointingly only displayed a low diversity. Of potential local correlative value is consistent present of *Heterosphaeridium evansii* ms Marshall 1984 (= *H. laterobrachius* as recorded by Morgan 1988). The LAD of *Odontochitina porifera* was also recorded for the well at 1129m.

All three assemblages are dominated by *Heterosphaeridium* spp. (Table-3).

***Isabelidinium cretaceum* Zone.**
Interval: 1161.0-1281.0 metres (120+ metres).
Age: Santonian.

Three samples with low to moderate diversity microplankton assemblages are assigned to the *I. cretaceum* Zone on the presence of the eponymous species and lack of the succeeding zone indicator. The shallowest sample is the most problematical assignment as the specimens of *I. cretaceum* recorded are like the variety illustrated by Cookson & Eisenack (1961, p.11, figs 1,2) from the Belfast No. 4 bore. This variety is larger and characteristically circumcavate rather than simply cavate at the apices like the holotype and most of the paratypes of

I. cretaceum. This sample also contains a folded specimen which could be *N. aceras*.

The assemblages are dominated by *Heterosphaeridium* spp. One significant occurrence is the first record for the Otway Basin of *Odontochitina indigena* described from the Santonian in the Gippsland Basin by Marshall (1988).

***Odontochitina porifera* Zone.**
Interval: 1290.5-1295.0 metres (25+ metres).
Age: Santonian.

The sidewall core assemblage can be characterised by abundant *Heterosphaeridium heteracanthum* with common *Odontochitina porifera* and the cuttings sample is very similar. Most specimens of *Odontochitina porifera* found in this zone and in younger samples in Iona-2 can be characterised by a constricted and non-perforate ring at the bases to both the apical and antapical horns. In this the specimens are closer to the holotype of *O. porifera* illustrated by Cookson (1956, pl.1, fig.17) rather than the specimen illustrated by Helby *et al.* (1987, fig.41C) which lack this non-perforate ring. Some specimens where the non-perforate parts of the horns become broader have been compared to *O. cribropoda* Deflandre & Cookson 1955 but no specimens were recorded which could be considered conspecific with this latter species, as originally erroneously suggested in the provisional reports.

Although both the sidewall core and cuttings contain moderate diversity assemblages none of the other recorded species can be considered age diagnostic for this zone.

***Conosphaeridium striatoconus* Zone.**
Interval: Not recorded in Iona-2.
Age: Coniacian.

Assemblages assignable to the *C. striatoconus* Zone were not found in Iona-2, but one was recorded from a single sample at 1276.5m in Iona-1 (Morgan, 1988). Although it was suggested after the initial examination of the sidewall cores that the zone may be present in the unsampled gap between samples the subsequent analysis of cuttings found no insitu or caved specimens of the eponymous species, or any other diagnostic species, suggesting strongly that the zone is not present in Iona-2.

***Cribroperidinium edwardsii* Acme Zone.**
Interval: 1303.5-1371.0 metres (68+ metres).
Age: Turonian.

The four sidewall core samples from the Waarre Formation are assigned to a new local acme zone which is characterised by the rare to common occurrence of the dinoflagellate *Cribroperidinium edwardsii*. Microplankton are considered to be present in the samples in low abundance (6% to 11%). The higher abundance at 1315m of 32% is considered to reflect the contamination of that sample with microplankton from higher in the well. Although samples are of moderate diversity, all species are either long ranging forms or species whose ranges are imprecisely known. In particular the diagnostic zone species of the standard zonation of Helby *et al.* (1987) are absent. As well as *C. edwardsii* the main elements in the assemblages comprise species of *Cyclonephelium* spp., *Odontochitina costatae* and *O. operculata*, and *Oligosphaeridium pulcherrimum* and *O. complex*. *Heterosphaeridium* spp. although present is noticeably less common than recorded from younger zones in Iona-2. Although *Palaeohystrichophora infusorioides* is recorded in three of the four samples it is certainly not prominent.

Cribroperidinium edwardsii was considered by Helby *et al.* (1987, fig.37) to have a prominent occurrence in the upper part of the *D. multispinum* Zone and through most of the *P. infusorioides* Zone and to be inconsistent above this last zone. This is currently the strongest evidence for an assignment no younger than the *P. infusorioides* Zone and hence a Turonian age. An age no older than the *P. infusorioides* Zone is based on the absence of species that become extinct in the underlying *D. multispinum* Zone yet have been recorded in basins along the southern margin rift. The most significant of these are *Pseudoceratium ludbrookiae, Litosphaeridium siphoniphorum* and *Canninginopsis denticulata*. Direct assignment of the samples to the *P. infusorioides* Zone cannot be confidently made in the absence of any prominent occurrence of the eponymous species as well as absence of other index species. The assignment of the samples to the *P. mawsonii* spore-pollen Zone also supports the Turonian age.

The sample at 1315m is considered to be contaminated with material from the *O. porifera* Zone because of the presence of the eponymous species and the related morphotype *Odontochitina* sp. cf. *O. cribropoda* and lack of younger zone indicators. Because the samples at 1290m and 1315m were both in the initial batch of four samples processed it is speculated that the sample at 1315m was cross contaminated with the shallower sample at 1290m during laboratory preparation.

Non-marine microplankton in Eumeralla Formation.
Interval: 1402.0-1599.0 metres (197+ metres).
Age: Late Albian.

Samples from the Eumeralla Formation are characterised by a limited suite of microplankton comprising *Sigmopollis carbonis*, *S. hispidus*, *Micrhystridium* sp. A of Marshall (1989) and *Veryhachium reductum*. Most of the other forms recorded over this interval can be dismissed as caved.

The most abundant cyst is *S. carbonis* which occurs in all but the barren sample at 1590m and the very low yielding sample at 1516.5m. This form has been compared to Holocene microfossil algae occurring in eutrophic and mesotrophic freshwater environments by Pals *et al.* (1980, p.407) and Srivastava (1984, p.528).

Notwithstanding that all of the above species are also recorded in overlying marine section in Iona-2 their association in the Eumeralla Formation is interpreted to indicate deposition in freshwater, most likely lacustrine environments. Abundant shallow and ephemeral lakes are to be expected in the high latitude setting suggested for deposition of the Otway Group. These types of deposits would be readily reworked by fluviatile processes to subsequently distribute the algal microfossils throughout the sedimentary section.

References

BUFFIN, A.J., 1989. Waarre Sandstone development within the Port Campbell Embayment. *APEA J. 29* (1), 299-311.

BURGER, D., 1980. Palynology of the Lower Cretaceous in the Surat Basin. *Bull. Bur. Miner. Resour. Geol. Geophys. Aust. 189*, 1-106.

COOKSON, I.C. & EISENACK, A., 1961. Upper Cretaceous microplankton from the Belfast No. 4 bore, south-western Victoria. *Proc. Roy. Soc. Vict. 74* (1), 69-76, pls 11-12.

COOKSON, I.C., 1956. Additional microplankton from Australian Late Mesozoic and Tertiary sediments. *Aust. J. Mar. Freshwater Res. 7* (10), 183-191.

DEFLANDRE, G. & COOKSON, I.C., 1955. Fossil microplankton from Australian Late Mesozoic and Tertiary sediments. *Aust. J. Mar. Freshwater Res. 6*, 242-313.

DETTMANN, M.E., 1963. Upper Mesozoic microfloras from southeastern Australia. *Proc. R. Soc. Vict. 77*, 1-148.

DETTMANN, M.E. & PLAYFORD, G., 1969. Palynology of the Australian Cretaceous: a review. In stratigraphy and palaeontology. *Essays in honour of Dorothy Hill*, K.S.W. Campbell, ed., A.N.U. Press Canberra, 174-210.

EVANS, P.R., 1966. Mesozoic stratigraphic palynology of the Otway Basin. *Rec. Bur. Miner. Resour.* Geol. Geophys. Aust. 1966/69, 1-45, pls 1-4 (unpubl.).

HELBY, R., MORGAN, R. & PARTRIDGE, A.D., 1987. A palynological zonation of the Australian Mesozoic. *Mem. Ass. Australas. Palaeontols 4,* 1-94.

LENTIN, J.K. & WILLIAMS, G.L., 1985. Fossil Dinoflagellates: Index to genera and species, 1985 Edition. *Canadian Tech. Rep. Hydrog. Ocean Sci. 60,* 1-451.

LENTIN, J.K. & WILLIAMS, G.L., 1989. Fossil Dinoflagellates: Index to genera and species, 1989 Edition. *AASP Contribution Series No. 20,* 1-473.

MARSHALL, N.G., 1984. Late Cretaceous dinoflagellates from the Perth Basin, Western Australia. PhD thesis, University of Western Australia (unpubl.).

MARSHALL, N.G., 1988. A Santonian dinoflagellate assemblage from the Gippsland Basin, southeastern Australia. *Mem. Ass. Australas. Palaeontols* 5, 195-215.

MARSHALL, N.G., 1989. An unusual assemblage of algal cysts from the Late Cretaceous of the Gippsland Basin, southeastern Australia. *Palynology 13*, 21-56.

MARSHALL, N.G., 1990. Campanian dinoflagellates from southeastern Australia. *Alcheringa 14*, 1-38.

MORGAN, R., 1988. Palynology of Beach Iona-1, Otway Basin, Victoria. *Report for Beach Petroleum*, 19p., range chart (May).

PALS, J.P., Van GEEL, B. & DELFOS, A., 1980. Palaeoecological studies in the Klokkeweel bog Hoogkarspel (Prov. of Noord-Holland). *Rev. Palaeobot. Palynol. 30*, 371-418.

SRIVASTAVA, S.K., 1984. Genus *Sigmopollis* from the Maastrichtian Scollard Formation, Alberta (Canada), and its algal affinity. *Pollen et Spores 26*, 519-530.

Table-4: Interpretative Palynological Data for Iona-2, Otway Basin.

Sample Type	Depth (m)	Spore-Pollen Zone	CR	Microplankton Zone	CR	Comments or Key Species
SWC-30	1034.5	*N. senectus*	B1	*N. aceras*	B3	Only single specimens of *Nothofagidites senectus*, and *Nelsoniella tuberculata*.
SWC-29	1090	*T. apoxyexinus*	B1	*N. aceras*	B2	FAD *Lygistepollenites florinii*
SWC-28	1129	*T. apoxyexinus*	B4	*N. aceras*	B3	FAD *Nelsoniella aceras*.
SWC-27	1161	*T. apoxyexinus*	B1	*I. cretaceum*	B2	*Isabelidinium thomasii*. FAD *Lygistepollenites balmei*.
SWC-26	1260	*T. apoxyexinus*	B1	*I. cretaceum*	B2	*Canningia rotundata*.
SWC-25	1281	*T. apoxyexinus*	B2	*I. cretaceum*	B2	FAD *Isabelidinium cretaceum*.
SWC-24	1290	*T. apoxyexinus*	B1	*O. porifera*	B3	Abundant *Cupressacites* sp.
Cuttings	1292.5 -1295	*T. apoxyexinus*	D3	*O. porifera*	D3	*T. apoxyexinus* and *F. stipulatus* present.
SWC-23	1303.5	*P. mawsonii*	B1	*C. edwardsii*	B2	Abundant *Dilwynites granulatus* (small variety).
Cuttings	1312.5 -1315	*P. mawsonii*	D1	*C. edwardsii*		LAD *Laevigatosporites musa*.
SWC-22	1315	*P. mawsonii*	B2	*C. edwardsii*	B3	Sample contaminated with assemblage from SWC-24 at 1290m.
Cuttings	1332.5 -1335	*P. mawsonii*	D2			Frequent *P. mawsonii*.
Cuttings	1347.5 -1350	*P. mawsonii*	D2	*C. edwardsii*	D3	*Densoisporites muratus* ms present.
SWC-21	1353	*P. mawsonii*	B4	*C. edwardsii*	B2	LAD *Hoegisporis trinalis*.
SWC-18	1371	*P. mawsonii*	B1	*C. edwardsii*	B2	FAD *Phyllocladidites mawsonii*, *Clavifera triplex* and *Cribroperidinium edwardsii*.
SWC-13	1402	*P. pannosus*	B5			Low yielding contaminated sample assigned to zone on basis of assemblage count.
SWC-11	1412	*P. pannosus*	B5			Reworking conspicuous.
SWC- 8	1437.5	*P. pannosus*	B2			*Perotrilites jubatus*.
SWC- 7	1457.5	*P. pannosus*	B1			*Amosopollis cruciformis* with *P. pannosus*.
SWC- 5	1516.5	*P. pannosus*	B3			FAD *Phimopollenites pannosus*.
SWC- 2	1590	*P. pannosus*	B2			Dominated by *Baculatisporites* spp. with *P. jubatus*.
SWC- 1	1599	Indeterminate				Virtually barren.

Abbreviations:

CR = Confidence Ratings
LAD = Last Appearance Datum
FAD = First Appearance Datum

Confidence Ratings

The Confidence Ratings assigned to the zone identifications on Table-4 are quality codes used in the STRATDAT relational database being developed by the Australian Geological Survey Organisation (AGSO) as a National Database for interpretive biostratigraphic data. Their purpose is to provide a simple relative comparison of the quality of the zone assignments. The alpha and numeric components of the codes have been assigned the following meanings:

Alpha codes: Linked to sample type

- **A** Core
- **B** Sidewall core
- **C** Coal cuttings
- **D** Ditch cuttings
- **E** Junk basket
- **F** Miscellaneous/unknown
- **G** Outcrop

Numeric codes: Linked to fossil assemblage

1	**Excellent confidence:**	High diversity assemblage recorded with key zone species.
2	**Good confidence:**	Moderately diverse assemblage recorded with key zone species.
3	**Fair confidence:**	Low diversity assemblage recorded with key zone species.
4	**Poor confidence:**	Moderate to high diversity assemblage recorded without key zone species.
5	**Very low confidence:**	Low diversity assemblage recorded without key zone species.

BASIC DATA

Table 5: Basic Sample Data - Iona-2, Otway Basin.

SAMPLE TYPE	DEPTH (metres)	LITHOLOGY	SAMPLE WT (g)	RESIDUE YIELD
SWC 30	1034.5	Med. gry, f. gn. sandstone with laminae ~1mm, some with carbonaceous flecks <1mm.	12.1	Moderate
SWC 29	1090	Med. gry, f. gn. sandstone with laminae <1mm with 4mm layer of chocolate coloured claystone on one edge.	15.4	High
SWC 28	1129	Carbonaceous dk gry claystone with med. gry mottled sandstone.	10.6	High
SWC 27	1161	Dk gry-blk claystone with faint mottling of sandy claystone.	12.0	Very High
SWC 26	1260	Dk grn-blk glauconite (<25%) claystone.	12.9	Moderate
SWC 25	1281	Med.-dk grn-gry glauconite (<30%) claystone.	13.2	Moderate
SWC 24	1290	Med. dk gry mottled, glauc. (<20%) claystone.	7.8	High
Cuttings	1292.5-1295	Medium gry shale, very fine grained with >50% less than 1mm.	10.2	High
SWC 23	1303.5	Mottled med. gry claystone with lt. gry sandstone. Accessory mica (<2mm) and white clay or feldspar flecks.	15.8	Low
Cuttings	1312.5-1315	Claggy dk gry claystone, very f.grn. with >70% less than 1mm.	18.8	High
SWC 22	1315	Dk gry-blk homogeneous soft claystone which is contaminated by drilling mud.	8.3	High
Cuttings	1332.5-1335	Coarse grn. quartz sandstone with <5% shale fragments.	23.8	Low
Cuttings	1347.5-1350	Lt-med. gry shale & siltstone mixed with crs qtz sand (50%).	14.6	Low
SWC 21	1353	Mottled gry claystone with f. gn. micaceous sandstone. Possible glauconite, some drilling mud contamination.	11.2	High
SWC 18	1371	Faintly laminated dk gry claystone and mottled med. gry carbonaceous/micaceous sandstone. Laminae up to 11mm.	10.2	High
SWC 13	1402	Soft Lt.-med. gry mottled claystone.	9.6	Low
SWC 11	1412	Med. gry, med. grained homogeneous sandstone with white clay flecks.	12.0	Very Low
SWC 8	1437.5	Med. gry claystone with occasional laminae.	10.0	Moderate
SWC 7	1457.5	Med. gry homogeneous claystone with subconcoidal fractures. Some drilling mud contamination.	11.0	Moderate
SWC 5	1516.5	Dk gry med. gn homogeneous sandstone. Drilling mud could not be cleaned off sample.	15.2	Very Low
SWC 2	1590	Med. gry claystone with drilling mud contamination.	7.0	Moderate
SWC 1	1599	Med. grn-gry homogeneous claystone.	6.5	Very Low

Table-6: Basic Palynomorph Data for Iona-2, Otway Basin

Sample Type	Depth (m)	Palynomorph Concentration	Palynomorph Preservation	Number S-P Species*	Microplankton Abundance	Number MP Species*
SWC-30	1034.5	Moderate	Good	43+	Common	9+
SWC-29	1090	Moderate	Fair-good	37+	Common	14+
SWC-28	1129	Low	Fair-good	28+	Very Common	9+
SWC-27	1161	Moderate	Fair-good	32+	Common	9+
SWC-26	1260	Moderate	Fair-good	31+	Abundant	18+
SWC-25	1281	Moderate	Poor-good	26+	Common	14+
SWC-24	1290	Moderate	Fair	32+	Common	12+
Cuttings	1292.5-1295	Moderate	Fair-good	19+	Frequent	12+
SWC-23	1303.5	Moderate	Poor-fair	34+	Frequent	15+
Cuttings	1312.5-1315	Moderate	Fair	27+	Frequent	10+
SWC-22	1315	Low	Poor-fair	26+	Abundant	12+
Cuttings	1332.5-1335	Low	Fair	26+	Rare	4+
Cuttings	1347.5-1350	Low	Fair	23+	Rare	5+
SWC-21	1353	High	Poor-fair	36+	Common	13+
SWC-18	1371	Low	Fair	38+	Frequent	16+
SWC-13	1402	Low	Poor-fair	24+	Rare	4+
SWC-11	1412	High	Poor-fair	17+	Rare	3
SWC- 8	1437.5	High	Poor-fair	34+	Rare	2
SWC- 7	1457.5	High	Poor-fair	38+	Very rare	5
SWC- 5	1516.5	Very low	Fair	3+		
SWC- 2	1590	High	Fair-good	20+	Very rare	1
SWC- 1	1599	Very low	Very poor	1+		

Diversity:
Very low = 1-5 species
Low = 6-10 species
Moderate = 11-25 species
High = 26-74 species
Very high = 75+ species

APPENDIX 1

Species Lists for Cuttings Samples.

Cuttings at 1292.5 to 1295 metres

Spore-pollen species	
Australopollis obscurus	Rare
Baculatisporites comaumensis	Rare
Cicatricosisporites australiensis	Rare
Clavifera triplex	Frequent
Coptospora pileolus ms	Rare
Cyathidites australis	Rare
Forcipites stipulatus	Rare
Granulatisporites trisinus **RW**	Rare
Herkosporites elliottii	Rare
Latrobosporites ohaiensis	Rare
Microcachryidites antarticus	Frequent
Phyllocladidites mawsonii	Frequent
Plicatipollenites spp. **RW**	Rare
Podocarpidites/Falcisporites spp.	Rare
Proteacidites spp.	Frequent
Retitriletes austroclavatidites	Rare
Retitriletes spp.	Rare
Tricolpites spp.	Rare
Tricolporites apoxyexinus	Rare

Microplankton species	
Amosopollis cruciformis	Common
Gillinia sp.	Rare
Heterosphaeridium conjunctum	Rare
Heterosphaeridium heteracanthum	Common
Hexagonifera glabra	Frequent
Hexagonifera vermiculata	Rare
Isabelidinium cretaceum	Frequent
Micrhystridium spp.	Rare
Odontochitina costata	Rare
Odontochitina porifera	Rare
Spiniferites furcatus/ramosus	Rare

Cuttings at 1312.5 to 1315 metres.

Spore-pollen species	
Aequitriradites spinulosus	Rare
Australopollis obscurus	Frequent
Baculatisporites comaumensis	Rare
Cicatricosisporites cuneiformis	Rare
Cicatricosisporites n.sp.	Rare
Cicatricosisporites pseudotripartitus	Rare
Clavifera triplex	Rare
Cupressacites sp.	Rare
Cyathidites australis	Rare
Densoisporites velatus	Rare
Dilwynites echinatus ms	Rare
Dilwynites granulatus (small variety)	Rare
Dilwynites granulatus sensus strictus	Rare
Foraminisporis wonthaggiensis	Rare
Gleicheniidites circinidites	Rare
Haloragacidites harrisii	Rare/caved
Laevigatosporites major	Rare
Laevigatosporites musa ms	Rare
Microcachryidites antarticus	Rare
Nothofagidites emarcidus	Frequent/caved
Peninsulapollis gillii	Rare/caved
Perotrilites jubatus	Rare
Phyllocladidites mawsonii	Frequent
Plicatipollenites spp. **RW**	Rare
Podosporites microsaccatus	Rare
Proteacidites spp.	Common/mostly caved
Protohaploxypinus spp. **RW**	Rare
Retitriletes circolumenus	Rare
Retitriletes spp.	Rare
Rugulatisporites mallatus	Rare
Stereisporites antiquisporites	Rare
Stereisporites pocockii	Rare

Microplankton species	
Amosopollis cruciformis	Common
Apteodinium sp.	Rare
Chlamydophorella nyei	Rare
Heterosphaeridium heteracanthum	Common
Isabelidinium belfastense	Rare
Odontochitina operculata	Rare
Odontochitina porifera	Frequent
Oligosphaeridinium complex	Rare
Spiniferites furcatus/ramosus	Rare
Wuroia? sp.	Rare

Cuttings at 1332.5 to 1335 metres.

Spore-pollen species	
Aequitriradites spinulosus	Rare
Appendicisporites distocarinatus	Rare
Araucariacites australis	Rare
Asteropollis asteroides	Rare
Baculatisporites comaumensis	Rare
Ceratosporites equalis	Rare
Cicatricosisporites cuneiformis	Rare
Cicatricosisporites pseudotripartitus	Rare
Clavifera triplex	Rare
Cyathidites australis	Rare
Dilwynites granulatus (small variety)	Rare
Dilwynites granulatus sensus strictus	Rare
Gleicheniidites circinidites	Rare
Laevigatosporites musa ms	Rare
Laevigatosporites ovatus	Rare
Microcachryidites antarticus	Rare
Nothofagidites senectus	Rare/caved
Phyllocladidites eunuchus ms	Rare
Phyllocladidites mawsonii	Frequent
Plicatipollenites spp. **RW**	Rare
Podocarpidites/Falcisporites spp.	Rare
Podosporites microsaccatus	Rare
Proteacidites spp.	Rare
Rugulatisporites admirabilis ms	Frequent
Schizea fromensis	Rare
Stereisporites antiquisporites	Rare
Tricolporites apoxyexinus	Rare/caved
Fungal fruiting bodies	Rare
Microplankton species	
Amosopollis cruciformis	Common
Heterosphaeridium heteracanthum	Common
Isabelidinium sp. cf. I. belfastense	Rare
Isabelidinium cretaceum	Rare
Spiniferites furcatus/ramosus	Rare

Cuttings at 1347.5 to 1350 metres.

Spore-pollen species	
Aequitriradites spinulosus	Rare
Appendicisporites distocarinatus	Rare
Araucariacites australis	Rare
Australopollis obscurus	Rare
Camarozonosporites apiculatus ms	Rare/caved
Cicatricosisporites pseudotripartitus	Rare
Cupressacites sp.	Rare
Cyathidites australis	Rare
Densoisporites muratus	Rare
Dictyophyllidites spp.	Rare
Dictyotosporites speciosus	Rare
Forcipites stipulatus	Rare/caved
Gleicheniidites circinidites	Rare
Laevigatosporites ovatus	Rare
Lygistepollenites florinii	Rare
Microcachryidites antarticus	Rare
Phyllocladidites mawsonii	Rare
Podocarpidites/Falcisporites spp.	Rare
Podosporites microsaccatus	Rare
Proteacidites spp.	Rare
Rugulatisporites admirabilis ms	Rare
Stereisporites antiquisporites	Rare
Tricolporites apoxyexinus	Rare/caved
Fungal fruiting bodies	Rare
Microplankton species	
Amosopollis cruciformis	Common
Cribroperidinium edwardsii	Frequent
Heterosphaeridium heteracanthum	Frequent
Odontochitina porifera	Rare/caved
Spiniferites furcatus/ramosus	Rare

PE900757

This is an enclosure indicator page.
The enclosure PE900757 is enclosed within the container PE900963 at this location in this document.

The enclosure PE900757 has the following characteristics:

ITEM_BARCODE = PE900757
CONTAINER_BARCODE = PE900963
NAME = Palynomorph Range Chart, 1 of 2
BASIN = OTWAY
PERMIT = PPL2
TYPE = WELL
SUBTYPE = DIAGRAM
DESCRIPTION = Palynomorph Range Chart, 1 of 2, Iona-2
REMARKS =
DATE_CREATED = 20/06/94
DATE_RECEIVED = 19/01/95
W_NO = W1095
WELL_NAME = IONA-2
CONTRACTOR =
CLIENT_OP_CO = GFE RESOURCES LTD

(Inserted by DNRE - Vic Govt Mines Dept)

PE900758

This is an enclosure indicator page.
The enclosure PE900758 is enclosed within the container PE900963 at this location in this document.

The enclosure PE900758 has the following characteristics:

ITEM_BARCODE = PE900758
CONTAINER_BARCODE = PE900963
NAME = Palynmorph Range Chart, 2 of 2
BASIN = OTWAY
PERMIT = PPL2
TYPE = WELL
SUBTYPE = DIAGRAM
DESCRIPTION = Palynomorph Range Chart, 2 of 2, Iona-2
REMARKS =
DATE_CREATED = 20/06/94
DATE_RECEIVED = 19/01/95
W_NO = W1095
WELL_NAME = IONA-2
CONTRACTOR =
CLIENT_OP_CO = GFE RESOURCES LTD

(Inserted by DNRE - Vic Govt Mines Dept)

APPENDIX 7

APPENDIX 7

GFE RESOURCES LTD

APPENDIX 7

PETROGRAPHY REPORT

IONA-2

ACS

LABORATORIES

AUSTRALIA

PETROLOGY REPORT

IONA #2

OTWAY BASIN

ACS
LABORATORIES
AUSTRALIA

PETROLOGY REPORT

IONA #2

OTWAY BASIN

Report prepared for GFE Resources Ltd

by

Dr J KEENE

on behalf of

ACS LABORATORIES PTY LTD
Unit 1, 167 Richmond Rd
Richmond SA 5033

June 1994

CONTENTS

1. INTRODUCTION

GFE Resources Ltd submitted 7 sidewall cores from Iona #2 in the Otway Basin, for detailed petrological analysis. No interpretation of the data was requested.

The following samples were examined:

Swc	Depth (m)	Thin section	XRD
12	1408.5	*	*
11	1412	*	-
10	1418	*	-
9	1426	*	-
6	1469	*	-
5	1516.5	*	-
3	1550.5	*	-

2. METHODS

Sidewall cores were impregnated with araldite prior to thin section preparation. Blue dye was used in the araldite to facilitate description of porosity and permeability. Thin sections were systematically scanned to determine lithology, composition, porosity and textural relationships. All percentages given in thin section descriptions are based on visual estimates, not point counts. Rock classifications are based on the work of Folk (1974) for clastics and Dunham (1962) for carbonates.

To determine bulk mineralogy by X-ray diffraction, one sample was ground in a Siebtechnick mill and back mounted into an aluminium holder. A continuous scan was run of this powder pressing from 3° to 75° 2 theta, at 1°/minute, using Co K alpha radiation, 50kV and 35mA, on a Philips PW1050 diffractometer. For detailed clay mineralogy a less than 5 micron size fraction was separated. This was done by hand crushing, addition of dispersion solution, mechanical shaking for 10 minutes and settling of the dispersed material in a water column according to Stokes' Law. The less than 5 micron fraction was pipetted off and prepared as an oriented sample on ceramic plates held under vacuum. Samples were saturated with Mg solution and treated with glycerol. Continuous scans of oriented clay samples were run from 3° to 35° 2 theta at 1°/minute. Peaks were identified by comparison with JCPDS files stored in a computer program called XPLOT.

3. PETROLOGY

3.1 Iona #2, Swc 12, depth 1408.5m

Thin section description

Rock classification: Feldspathic litharenite

Texture:
This feldspathic litharenite is moderately to well sorted, mineralogically immature and texturally submature to mature. Detrital grains range in diameter from approximately 0.05mm (coarse silt) to 0.75mm (coarse sand) and have an average size of 0.3mm (medium sand). Typically the grains of quartz and feldspar are angular with moderate to high sphericity whereas the lithics are rounded to subrounded with low sphericity (Fig. 1a). Texturally the feldspathic litharenite is grain supported with concavo-convex and sutured grain contacts dominant. Bent micas and deformed lithic grains indicate that there has been considerable mechanical compaction. Elongate lithic grains and micas give the rock a slight fabric. No sedimentary structures are evident.

Porosity:
Porosity is mainly primary with only a minor contribution from secondary pores. Primary pores are intergranular in nature but do not appear to be interconnected in thin section. Rare fracturing of feldspar and quartz and possible solution of carbonate cement has enhanced the interconnections. There is no evidence of dissolution of lithic grains.

Visual Estimate of Composition		%
Framework grains	Quartz	12
	Feldspar	18
	Lithics	47
	Mica	2
	Accessory minerals	tr
Matrix		nd
Authigenic minerals and cements	Chlorite	8
	Carbonate	2
	Kaolin	2
	Glaucony	tr
	Pyrite	tr
Porosity	Intergranular	8
	Dissolution	tr
	Fractures	tr

Framework grains:
Quartz is mostly monocrystalline with a minor amount of polycrystalline grains. Monocrystalline quartz has straight extinction, is water clear and some grains are subhedral indicating a volcanic source. Polycrystalline quartz has undulose extinction and is often as elongate grains suggesting a metamorphic origin. Feldspars are generally very fresh and display a variety of twinning and zoning (Fig. 1a). Plagioclase dominates with minor amounts of perthite and microcline. Rare grains have a dusty appearance due to alteration and sericitisation while others have been partly replaced by carbonate. More than half the framework grains are lithics and these are mostly a variety of volcanic rock fragments and fine grained metasediments and a small amount of chert. Lithics are deformed and squashed to fill the pore spaces and

include some larger shale clasts (up to 1mm). Biotite stacks and flakes are typically bent and replaced in part by chlorite and FeO.

Authigenic minerals and cements:
A green chlorite forms a rim cement throughout the rock (Fig. 1b). It lines all pores and has a fairly uniform thickness of 5-10 microns. This early cement was followed by isolated patches of clear carbonate spar. Where it occurs it is a pore filling cement and has also replaced feldspar. The lack of exposed crystal faces may indicate that it has undergone some dissolution. A minor amount of authigenic kaolin is also present and postdates the chlorite. The books of kaolin fill or partly fill pores. A trace of euhedral to subhedral opaque grains are most likely pyrite. A few green sand size grains are composed of clay and have been interpreted as glaucony. Most of the detrital grains have a brownish staining due to organic matter (hydrocarbons?).

X-ray diffraction

Bulk XRD (Fig. 2a) indicates that quartz (Q) and feldspars (F) are the dominant minerals with lesser amounts of mica (M), chlorite (C) and kaolinite (K). The trace also indicates a very small amount of calcite (Ca), however the composition of the carbonate should be confirmed by other techniques because the optical properties are similar to siderite. The clay fraction (Fig. 2b) is dominated by chlorite/mixed layer clay mineral (C/S) and kaolinite with a minor amount of mica (illite?).

PE906677

This is an enclosure indicator page.
The enclosure PE906677 is enclosed within the container PE900963 at this location in this document.

The enclosure PE906677 has the following characteristics:

ITEM_BARCODE = PE906677
CONTAINER_BARCODE = PE900963
NAME = Photomicrograph, Appendix 7, 1 of 4
BASIN = OTWAY
PERMIT = PPL2
TYPE = WELL
SUBTYPE = PHOTOMICROGRAPH
DESCRIPTION = Photomicrograph, Appendix 7, Figure 1, 1 of 4, Iona-2
REMARKS =
DATE_CREATED = 30/06/94
DATE_RECEIVED = 19/01/95
W_NO = W1095
WELL_NAME = IONA-2
CONTRACTOR =
CLIENT_OP_CO = GFE RESOURCES LTD

(Inserted by DNRE - Vic Govt Mines Dept)

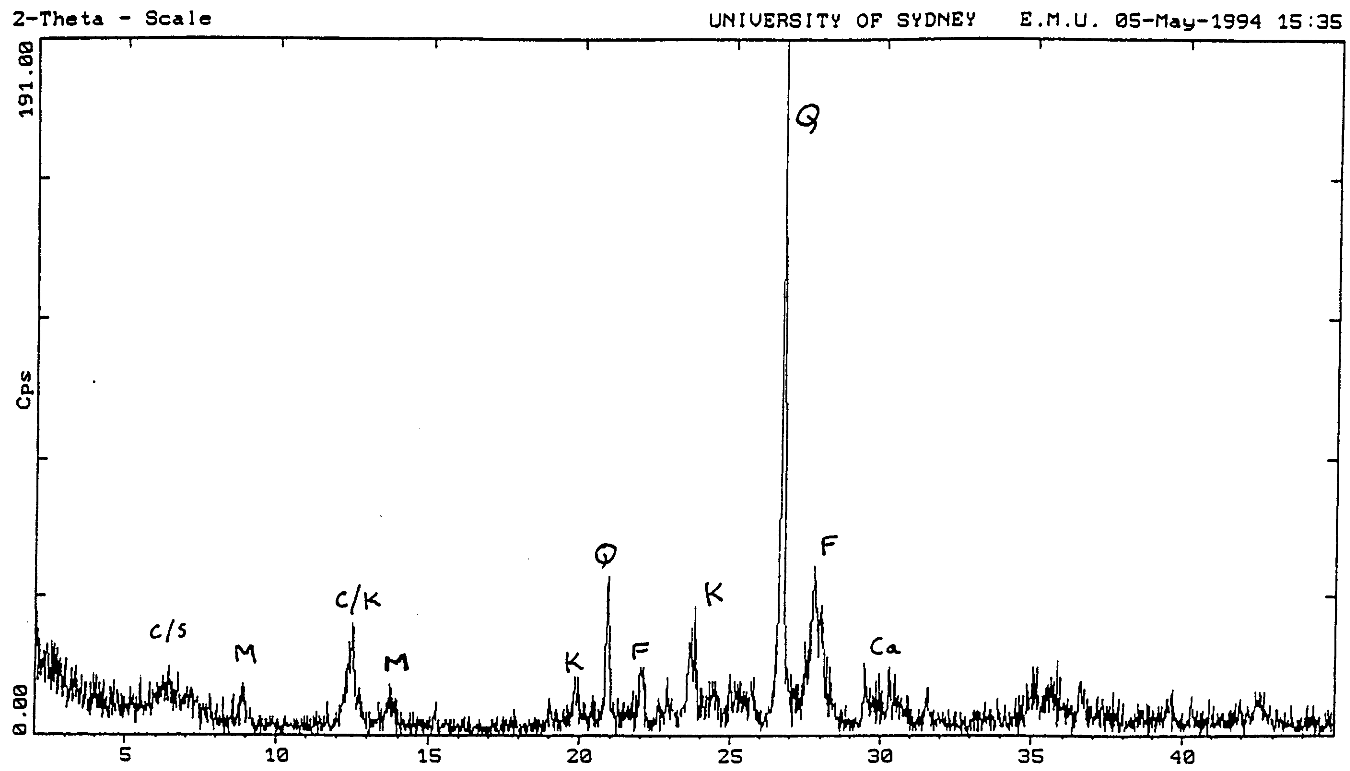


Figure 2a
Bulk XRD trace of Iona #2, Swc 12, depth 1408.5m.

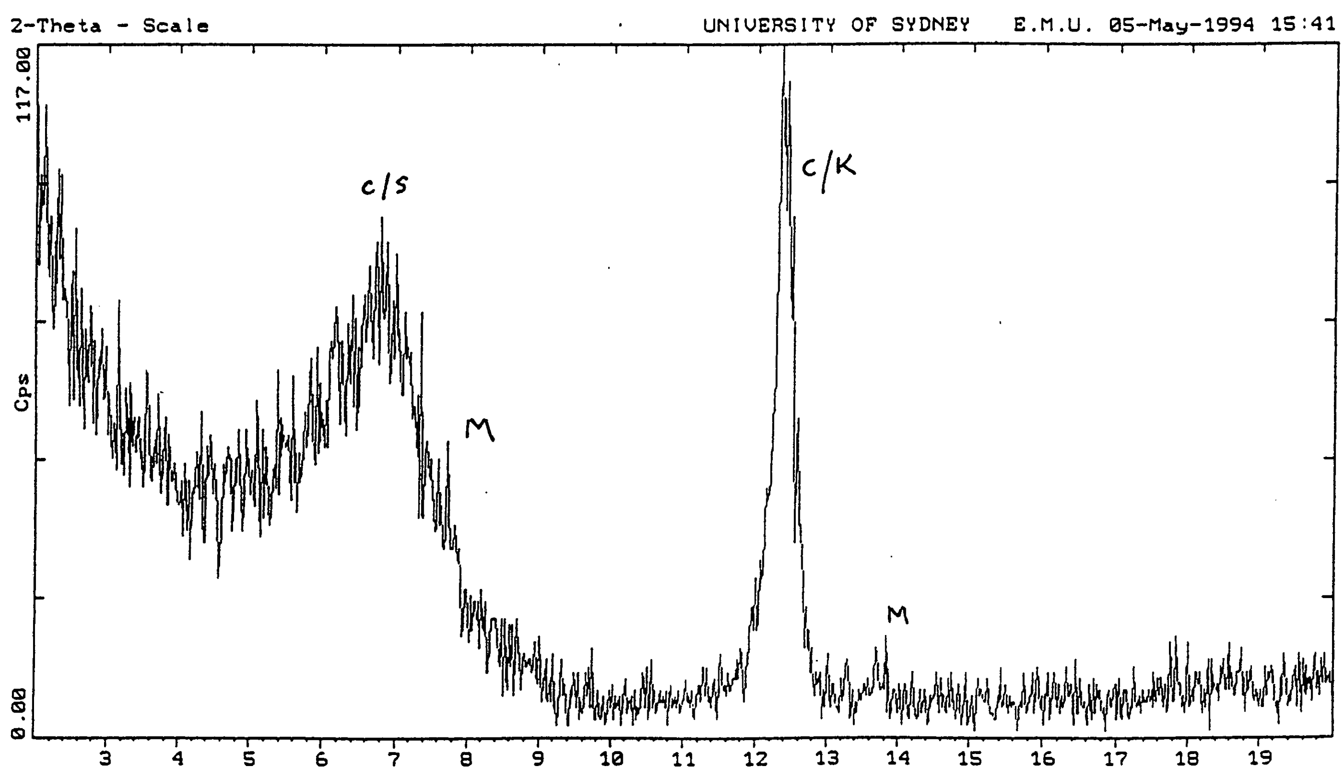


Figure 2b
XRD trace of the clay fraction from Iona #2, Swc 12, depth 1408.5m.

3.2 Iona #2, Swc 11, depth 1412m

Thin section description

Rock classification: Feldspathic litharenite

Texture:
This feldspathic litharenite is moderately sorted, mineralogically immature and texturely submature to immature. Detrital grains range in diameter from approximately 0.05mm (coarse silt) to 0.5mm (medium sand) and have an average size of 0.2mm (fine sand). Typically the grains of quartz and feldspar are angular with low to moderate sphericity whereas the lithics are rounded to subrounded with low sphericity (Fig. 3a). Texturally the feldspathic litharenite is grain supported with concavo-convex and sutured grain contacts dominant. Bent micas and deformed lithic grains indicate that there has been considerable mechanical compaction. Elongate lithic grains and micas give the rock an indistinct lamination with coarser, better sorted laminae (5mm) containing less mica. No other sedimentary structures are evident.

Porosity:
Porosity is mainly primary with only a minor contribution from secondary pores. Primary pores are intergranular in nature but do not appear to be interconnected in thin section. Rare dissolution of feldspar has had little effect on porosity. Micas lying parallel to bedding prevent interconnection of pores and squashed lithic fragments have deformed to fill most pores. There is no evidence of dissolution of lithic grains.

Visual Estimate of Composition		%
Framework grains	Quartz	16
	Feldspar	22
	Lithics	30
	Mica	10
	Accessory minerals	tr
Matrix		nd
Authigenic minerals and cements	Chlorite	10
	Zeolite	1
	Pyrite	tr
Porosity	Intergranular	10
	Dissolution	tr

Framework grains:
Quartz is mostly monocrystalline with a minor amount of polycrystalline. Monocrystalline quartz has straight extinction, is water clear and some grains are subhedral indicating a volcanic source. Polycrystalline quartz has undulose extinction and is often as elongate grains suggesting a metamorphic origin particularly since there are rock fragments of this quartz intergrown with muscovite. There are more feldspars than quartz and they are generally very fresh and display a variety of twinning and zoning. Plagioclase dominates with minor amounts of perthite and microcline. Rare grains have a dusty appearance due to alteration and sericitisation. Lithics are the most abundant clasts and are mostly a variety of volcanic rock fragments and fine grained metasediments and a small amount of chert. They are deformed and squashed to fill the pore spaces. Biotite is by far the most abundant detrital mica, forming stacks and flakes which are typically bent and replaced in part by chlorite and FeO. Muscovite is unaltered. Traces of accessory minerals are apatite, tourmaline and amphibole.

<u>Authigenic minerals and cements</u>:
A green chlorite forms a rim cement throughout the rock and is generally 5-10 microns thick. It lines most pores and in some cases fills the pores forming a pseudo-matrix. This early cement is followed by isolated crystals of a low birefringent zeolite (laumontite?). Where it occurs it is a pore filling cement. No carbonate is present in this sample.

PE906678

This is an enclosure indicator page.
The enclosure PE906678 is enclosed within the container PE900963 at this location in this document.

The enclosure PE906678 has the following characteristics:

ITEM_BARCODE =	PE906678
CONTAINER_BARCODE =	PE900963
NAME =	Photomicrograph, Appendix 7, 2 of 4
BASIN =	OTWAY
PERMIT =	PPL2
TYPE =	WELL
SUBTYPE =	PHOTOMICROGRAPH
DESCRIPTION =	Photomicrograph, Appendix 7, Figure 3, 2 of 4, Iona-2
REMARKS =	
DATE_CREATED =	30/06/94
DATE_RECEIVED =	19/01/95
W_NO =	W1095
WELL_NAME =	IONA-2
CONTRACTOR =	
CLIENT_OP_CO =	GFE RESOURCES LTD

(Inserted by DNRE - Vic Govt Mines Dept)

3.3 Iona #2, Swc 10, depth 1418m

Thin section description

Rock classification: Feldspathic litharenite

Texture:
This feldspathic litharenite is moderately to well sorted, mineralogically immature and texturely submature to mature. Detrital grains range in diameter from approximately 0.05mm (coarse silt) to 1mm (coarse sand) and have an average size of 0.3mm (medium sand). Typically the grains of quartz and feldspar are larger and angular with moderate to high sphericity whereas the lithics are rounded to subrounded with low sphericity. Texturally the feldspathic litharenite is grain supported with tangental and concavo-convex grain contacts dominant. This sandstone has an open framework, nevertheless bent micas and deformed lithic grains indicate that there has been some mechanical compaction. Elongate lithic grains and micas give the rock a weak fabric. No sedimentary structures are evident.

Porosity:
Porosity is mainly primary with only a minor contribution from secondary pores. Primary pores are intergranular in nature and do appear to be interconnected in thin section. This sample has a definite open framework which does not appear to be an artifact of the drilling process. Fracturing of feldspar and quartz is common and may enhance permeability. Some of the feldspar grains have undergone dissolution. There is no evidence of dissolution of lithic grains.

Visual Estimate of Composition		%
Framework grains	Quartz	15
	Feldspar	20
	Lithics	35
	Mica	2
	Accessory minerals	tr
Matrix		nd
Authigenic minerals and cements	Chlorite	5
	Carbonate	tr
	Pyrite	tr
Porosity	Intergranular	20
	Dissolution	1
	Fractures	1

Framework grains:
Quartz occurs mostly as monocrystalline clasts with a minor amount of polycrystalline. Monocrystalline quartz has straight extinction, is water clear and some grains are subhedral indicating a volcanic source. Polycrystalline quartz has undulose extinction and is often as elongate grains suggesting a metamorphic origin. Feldspars are generally very fresh and display a variety of twinning and zoning. Plagioclase dominates with minor amounts of perthite and microcline. Rare grains have a dusty appearance due to alteration and sericitisation. Lithics dominate the composition and are mostly a variety of volcanic rock fragments and fine grained metasediments and a small amount of chert. Some are deformed and squashed to fill the pore spaces. Biotite is the most abundant mica and its grains are typically bent and replaced in part by chlorite and FeO. Traces of accessory mineral are epidote.

<u>Authigenic minerals and cements</u>:
A green chlorite forms a rim cement throughout the rock 5-10 microns thick. It lines most pores and it fills some of the smaller pores to form a pseudo-matrix. A few green sand size grains are composed of clay and are the most squashed. They have been interpreted as glaucony. There is a trace of a subhedral opaque mineral, most likely pyrite. Carbonate fills some pores near a shale intraclast. Most of the grains have a brownish staining due to organic matter.

3.4 Iona #2, Swc 9, depth 1426m

Thin section description

Rock classification: Feldspathic litharenite

Texture:
This feldspathic litharenite is moderately sorted, mineralogically immature and texturely submature to mature. Detrital grains range in diameter from approximately 0.05mm (coarse silt) to 0.75mm (coarse sand) and have an average size of 0.25mm (fine to medium sand). Typically the grains of quartz and feldspar are larger and angular with moderate to high sphericity whereas the lithics are rounded to subrounded with low sphericity (Fig. 4). Texturally the feldspathic litharenite is grain supported with tangential and concavo-convex grain contacts dominant. This sandstone has an open framework, nevertheless bent micas and deformed lithic grains indicate that there has been some mechanical compaction. Elongate lithic grains and micas give the rock a weak fabric. No sedimentary structures are evident.

Porosity:
Porosity is mainly primary with only a minor contribution from secondary pores (Fig. 4). Primary pores are intergranular in nature and do appear to be interconnected in thin section. This sample has a definite open framework which does not appear to be an artefact of the drilling process. Fracturing of feldspar and quartz is common and may enhance permeability. Some of the feldspar grains have undergone dissolution. There is no evidence of dissolution of lithic grains.

Visual Estimate of Composition		%
Framework grains	Quartz	9
	Feldspar	20
	Lithics	38
	Mica	5
	Accessory minerals	tr
Matrix		nd
Authigenic minerals and cements	Chlorite	10
	Pyrite	tr
Porosity	Intergranular	15
	Dissolution	1
	Fractures	1

Framework grains:
Quartz is less than ten percent of the framework grains and occurs mostly as monocrystalline clasts with a minor amount of polycrystalline. Monocrystalline quartz has straight extinction, is water clear and some grains are subhedral indicating a volcanic source. Polycrystalline quartz has undulose extinction and is often as elongate grains suggesting a metamorphic origin. Feldspars form more than a quarter of the framework and are generally very fresh and display a variety of twinning and zoning. Plagioclase dominates with minor amounts of perthite and microcline. Rare grains have a dusty appearance due to alteration and sericitisation. Lithics dominate the composition and are mostly a variety of volcanic rock fragments and fine grained metasediments and a small amount of chert. Some are deformed and squashed to fill the pore spaces. Biotite is the most abundant mica and its grains (stacks and flakes) are typically bent and replaced in part by chlorite and FeO. Muscovite is rare and traces of accessory mineral are sphene and

pyroxene.

Authigenic minerals and cements:
A green chlorite forms a rim cement throughout the rock 5-10 microns thick. It lines all pores and it fills some of the smaller pores to form a pseudo-matrix. A few green sand size grains are composed of clay and are the most squashed. They have been interpreted as glaucony. There is a trace of a subhedral opaque mineral, most likely pyrite. Most of the grains have a brownish staining due to organic matter.

PE906679

This is an enclosure indicator page.
The enclosure PE906679 is enclosed within the container PE900963 at this location in this document.

The enclosure PE906679 has the following characteristics:

ITEM_BARCODE = PE906679
CONTAINER_BARCODE = PE900963
NAME = Photomicrograph, Appendix 7, 3 of 4
BASIN = OTWAY
PERMIT = PPL2
TYPE = WELL
SUBTYPE = PHOTOMICROGRAPH
DESCRIPTION = Photomicrograph, Appendix 7, Figure 4, 3 of 4, Iona-2
REMARKS =
DATE_CREATED = 30/06/94
DATE_RECEIVED = 19/01/95
W_NO = W1095
WELL_NAME = IONA-2
CONTRACTOR =
CLIENT_OP_CO = GFE RESOURCES LTD

(Inserted by DNRE - Vic Govt Mines Dept)

3.5 Iona #2, Swc 6, depth 1469m

Thin section description

Rock classification: Feldspathic litharenite

Texture:
This feldspathic litharenite is mineralogically immature and texturely submature to mature. The sorting of the sand fraction is variable ranging from well to poorly sorted (bioturbated?). Detrital grains range in diameter from approximately 0.05mm (coarse silt) to 0.4mm (medium sand) and have an average size of 0.3mm (medium sand). Typically the grains of quartz and feldspar are larger and angular with moderate to high sphericity whereas the lithics are rounded to subrounded with low sphericity. Texturally the feldspathic litharenite is grain supported with tangential and concavo-convex grain contacts dominant. This sandstone has an open framework, nevertheless bent micas and deformed lithic grains indicate that there has been some mechanical compaction.

Porosity:
Porosity is mainly primary with only a minor contribution from secondary pores. Primary pores are intergranular in nature and do appear to be interconnected in thin section. This sample has a definite open framework which does not appear to be an artifact of the drilling process. Fracturing of feldspar and quartz is common and may enhance permeability. Some of the feldspar grains have undergone dissolution. There is no evidence of dissolution of lithic grains.

Visual Estimate of Composition		%
Framework grains	Quartz	10
	Feldspar	23
	Lithics	33
	Mica	4
Matrix		nd
Authigenic minerals and cements	Chlorite	8
	Pyrite	tr
Porosity	Intergranular	20
	Fracture	1

Framework grains:
Quartz occurs mostly as monocrystalline clasts with a minor amount of polycrystalline. Monocrystalline quartz has straight extinction, is water clear and some grains are subhedral indicating a volcanic source. Polycrystalline quartz has undulose extinction and occurs as elongate grains suggesting a metamorphic origin. Feldspars are generally very fresh and display a variety of twinning and zoning. Plagioclase dominates with minor amounts of perthite and microcline. Rare grains have a dusty appearance due to alteration and sericitisation. Lithics dominate the composition and are mostly a variety of volcanic rock fragments and fine grained metasediments and a small amount of chert. Some are deformed and squashed to fill the pore spaces. Biotite is the most abundant mica and its grains are typically bent and replaced in part by chlorite and FeO.

Authigenic minerals and cements:
A green chlorite forms a rim cement throughout the rock 5-10 microns thick. It lines most pores and it fills some of the smaller pores to form a pseudo-matrix. There is a trace of a subhedral opaque mineral,

most likely pyrite.

3.6 Iona #2, Swc 5, depth 1516.5m

Thin section description

Rock classification: Feldspathic litharenite

Texture:
This feldspathic litharenite is moderately to well sorted, mineralogically immature and texturely submature to mature. Detrital grains range in diameter from approximately 0.05mm (coarse silt) to 0.5mm (medium sand) and have an average size of 0.35mm (medium sand). Typically the grains of quartz and feldspar are angular with moderate to high sphericity whereas the lithics are rounded to subrounded with low sphericity (Fig. 5a). Texturally the feldspathic litharenite is grain supported with concavo-convex and sutured grain contacts dominant. Bent micas, deformed lithic grains and fractured quartz and feldspar indicate that there has been considerable mechanical compaction. Elongate lithic grains and micas give the rock a weak fabric. No sedimentary structures are evident.

Porosity:
Porosity is mainly primary with only a minor contibution from secondary pores. Porimary pores are intergranular in nature but do not appear to be interconnected in thin section. Rare fracturing of feldspar and quartz has enhanced the interconnections and some dissolution of feldspars has occurred. There is no evidence of dissolution of lithic grains.

Visual Estimate of Composition		%
Framework grains	Quartz	18
	Feldspar	20
	Lithics	34
	Mica	2
	Accessory minerals	1
Matrix		nd
Authigenic minerals and cements	Chlorite	8
	Apatite	tr
	Glaucony	1
	Zeolite	1
Porosity	Intergranular	12
	Dissolution	1
	Fractures	1

Framework grains:
Quartz and feldspar are present in approximately equal amounts. Quartz is mostly monocrystalline with a minor amount of polycrystalline. Monocrystalline quartz has straight extinction, is water clear and some grains are subhedral indicating a volcanic source. Polycrystalline quartz has undulose extinction and is often as elongate grains suggesting a metamorphic origin. Feldspars are generally very fresh and display a variety of twinning and zoning. Plagioclase dominates with minor amounts of perthite and microcline. Rare grains have a dusty appearance due to alteration and sericitisation. Lithics form about half the framework grains and are mostly a variety of volcanic rock fragments and fine grained metasediments and a small amount of chert. They are deformed and squashed to fill the pore spaces and include some grains of devitrified volcanic glass. Biotite stakcs and flakes are typically bent and replaced in part by chlorite and FeO. Muscovite is rare. Accessory

minerals are sphene and epidote.

Authigenic minerals and cements:
A green chlorite cement forms a rim of fibres (plates) 5-15 microns thick coating the detrital grains throughout the rock. It lines all pores and fills many. This early cement is followed by clear zeolite, probably laumontite. Where the zeolite occurs it is a pore filling cement (Fig. 5b). A few green sand size grains are composed of clay and have been interpreted as glaucony. These grains could be devitrified volcanic glass. Euhedral apatite forms small (20 microns) prismatic crystals in one of the pores. Most of the detrital grains have a brownish staining due to organic matter. Opaque grains of pyrite are also present in trace amounts.

PE906680

This is an enclosure indicator page.
The enclosure PE906680 is enclosed within the container PE900963 at this location in this document.

The enclosure PE906680 has the following characteristics:

ITEM_BARCODE = PE906680
CONTAINER_BARCODE = PE900963
NAME = Photomicrograph, Appendix 7, 4 of 4
BASIN = OTWAY
PERMIT = PPL2
TYPE = WELL
SUBTYPE = PHOTOMICROGRAPH
DESCRIPTION = Photomicrograph, Appendix 7, Figure 5, 4 of 4, Iona-2
REMARKS =
DATE_CREATED = 30/06/94
DATE_RECEIVED = 19/01/95
W_NO = W1095
WELL_NAME = IONA-2
CONTRACTOR =
CLIENT_OP_CO = GFE RESOURCES LTD

(Inserted by DNRE - Vic Govt Mines Dept)

3.7 Iona #2, Swc 3, depth 1550.5m

Thin section description

Rock classification: Feldspathic litharenite

Texture:
This feldspathic litharenite is mineralogically immature and texturally submature. The sorting of the sand fraction is moderate. Detrital grains range in diameter from approximately 0.05mm (coarse silt) to 0.5mm (medium sand) and have an average size of 0.25mm (medium sand). Typically the grains of quartz and feldspar are larger and angular with moderate to high sphericity whereas the lithics are rounded to subrounded with low sphericity. Texturally the feldspathic litharenite is grain supported with tangential and concavo-convex grain contacts dominant. This sandstone has an open framework, nevertheless bent micas and deformed lithic grains indicate that there has been some mechanical compaction.

Porosity:
Porosity is mainly primary with only a minor contribution from secondary pores. Primary pores are intergranular in nature and do appear to be interconnected in thin section. This sample has a definite open framework which does not appear to be an artifact of the drilling process. Fracturing of feldspar and quartz is common and may enhance permeability. Some of the feldspar grains have undergone dissolution. There is no evidence of dissolution of lithic grains.

Visual Estimate of Composition		%
Framework grains	Quartz	12
	Feldspar	25
	Lithics	30
	Mica	tr
	Accessory	tr
Matrix		nd
Authigenic minerals and cements	Chlorite	8
	Pyrite	tr
Porosity	Intergranular	24
	Fracture	tr
	Solution	tr

Framework grains:
Quartz occurs mostly as monocrystalline clasts with a minor amount of polycrystalline. Monocrystalline quartz has straight extinction, is water clear and some grains are subhedral indicating a volcanic source. Polycrystalline quartz has undulose extinction and is often as elongate grains suggesting a metamorphic origin. Feldspars are generally very fresh and display a variety of twinning and zoning. Plagioclase dominates with minor amounts of perthite and microcline. Rare grains have a dusty appearance due to alteration and sericitisation. Lithics dominate the composition and are mostly a variety of volcanic rock fragments and fine grained metasediments and a small amount of chert. Some are deformed and squashed to fill the pore spaces. Biotite is present as squashed and bent flakes and accessory minerals are epidote and sphene.

Authigenic minerals and cements:
Well developed green chlorite rims form a cement throught the rock 5-10 microns thick. It lines most pores and it fills some of the smaller pores to form a pseudo-matrix. There is a trace of a subhedral opaque mineral, most likely pyrite.

4. GLOSSARY OF TERMS

Boehm lamellae
Parallel trails of vacuoles in quartz that are thought to form during deformation (metamorphism) of grains.

Framboid
A cluster of pyrite crystals with a spheroidal outline.

Glaucony
A term used to describe green minerals without any genetic connotations. If the green minerals can be identified, a specific mineral name is given.

Granophyric Texture
A variety of micrographic intergrowth of quartz and alkali feldspar that is either crudely radiate or is less regular than micrographic texture.

Honeycomb Porosity
Secondary porosity produced by the corrosion (etching) of detrital grains.

Hydrocarbon envelope
Solid bitumen surrounding a mineral containing radioactive elements. Radiation causes polymerisation of hydrocarbon chains within oil that rims grains.

Micrographic Intergrowth
A regular intergrowth of two minerals.

nd
Abbreviation meaning not detected.

Neomorphism
All transformations between a mineral and the same mineral, or another of the same general composition.

Poikilitic
A textural term for an igneous rock in which a relatively large crystal of one mineral encloses numerous smaller crystals of one, or more, other minerals which are randomly oriented and generally, but not necessarily, uniformly distributed.

Poikilotopic
A sedimentary textural term denoting a single crystal of carbonate enclosing more than one framework grain.

Radiate Texture
Textures in which elongate crystals diverge from a common nucleus.

Porphyritic
A textural term applied to igneous rocks in which there are two distinct grain sizes present.

Spherulitic
The presence of more or less globular masses of generally acicular crystals, having a radial arrangement. spherulites form as a result

of devitrification of volcanic glass.

Trachytic

A textural term applied to the groundmasses of volcanic rocks in which there is a subparallel arrangement of microcrystalline, lath shaped feldspars. The term is not restricted in use to rocks of trachyte composition.

Vacuole

Gas or liquid filled inclusion.

APPENDIX 8

APPENDIX 8

GFE RESOURCES LTD

APPENDIX 8

GEOCHEMISTRY REPORT

IONA-2

HYDROCARBON CHARACTERISATION STUDY IONA-2

Prepared for:

GFE Resources Limited

April 1994

GEOTECH GEOTECHNICAL SERVICES PTY LTD
125 Burswood Road, Victoria Park, Western Australia 6100

Telephone (09) 362 5222
Facsimile (09) 362 5908

ACN 050 543 194

HYDROCARBON CHARACTERISATION STUDY
IONA-2

Introduction

Hydrocarbon shows in the well Iona-2, drilled by GFE Resources Ltd in permit PPL-2 in the Otway Basin, were analysed geochemically.

The purpose of this study was to characterise these hydrocarbons in terms of source, maturity and possible biodegradation and to correlate them with hydrocarbons in Iona-1, SWC 7, 1391.5m.

Analytical Procedure

Three cuttings samples form 1365m, 1385m and 1410m depth were submitted for thermal extract GC during drilling (25.2.94) of the well in order to quickly characterise the hydrocarbons present, and SWC 1358m was analysed by the same method later (4.3.94).

Eight SWCs between 1358m and 1550.5m were solvent extracted and three whole extracts were subsequently analysed by GC (1392.0m, 1469.0m, 1550.5m). The five other extracts were submitted for liquid chromatography and GC of their saturate fractions and two of them (1358m and 1408.4m) also to GC-MS of their branched/cyclic saturates as well as their aromatic fractions.

One SWC from the well Iona-1 (SWC7, 1391.5m) was solvent extracted and analysed by LC and GC sat, and these data were compared with Iona-2 extracts.

Standard water analysis was carried out on a sample from Iona-2, 1361.8m.

Analytical results obtained are presented in the following figures and tables:

Type of Analysis	Figure	Table
Water analysis	-	1
Thermal extract GC	1	2
Solvent extraction/ liquid chromatography	-	3
GC (whole extract and saturate fraction)	2	4
GC-MS b/c	3	5
GC-MS arom	4	6

Water analysis

Analytical procedures applied are summarised in the "Theory and Methods" chapter in the back of this report.

General Information

Two copies of this report have been sent to Noel Newell from GFE Resources Ltd. Any queries related to it may be directed to Dr. Birgitta Hartung-Kagi of Geotechnical Services Pty Ltd.

All data and information are proprietary to GFE Resources Ltd and regarded as highly confidential by all Geotech personnel.

Geotechnical Services Pty Ltd shall not be responsible or liable for the results of any actions taken on the basis of the information contained in this study, nor for any errors or omissions in it.

Results and Interpretation

A. Gas chromatography

Thermal extract GC performed on four samples between 1358m and 1410m characterises the hydrocarbons in SWC at 1358.0m as an oil depleted in n-alkanes below C_{17} and rich in C_{23+} compounds. The reason for this lack of low molecular weight n-alkanes is probably a minor degree of biodegradation rather than the residual nature of the oil which would have resulted in a lack of all light saturates, not just n-alkanes.

An S_1 value of 20.10mg/g calculated for this depth indicates that the sediment is very rich in free hydrocarbons whereas the three deeper samples (cuttings at 1365m, 1385m, 1410m) are considerably leaner (S_1 values between 0.40 and 0.59).

The overall pictures of these three samples are characterised by considerable levels of hydrocarbons in the low molecular weight range and the presence of a baseline hump underneath the C_{18+} n-alkane profile. This hump is particularly strong at 1410m and believed to represent a pipe dope-like drilling additive rather than a natural part of the extracts.

Particularly the trace obtained at 1385m clearly characterises the terrestrial nature of the hydrocarbons superimposed on the baseline hump (odd-even predominances in the C_{23+} n-alkane range).

Differences between thermal extract GC data for sample 1358m on one hand and the three deeper samples on the other are probably (at least partly) due to reservoir properties, that is, the lack of light compounds at 1358m is believed to be secondary.

Upon solvent extaction, three SWCs between 1358m and 1381m yielded excellent amounts of free hydrocarbons, decreasing from 10700 to 5600ppm throughout this interval.

The overall picture of the GC traces obtained for these three samples are very similar and are believed to characterise the same mature, migrated oil. Odd-even predominances in the n-C_{23+} range reflect considerable input

from a terrestrial source, which is in agreement with high pristane/n-C_{17} ratios (1.17 to 3.02) usually found in coaly samples. Pristane/phytane ratios between 4.81 and 5.39 characterise an oxic environment during deposition of the organic source matter.

The sample at 1392m yielded very low amounts of total extract (69.4ppm), which might suggest that this depth is below the palaeo OWC. Liquid chromatography/GC saturate analyses were not possible due to the small amount of extract recovered. GC of the whole extract was performed instead but, because interference of non-alkanes, no meaningful results could be obtained.

SWCs at 1408.5m and 1426m yielded good and poor amounts of total extract, respectively (1414 and 143ppm), and GC sat traces with well developed n-alkanes between n-C_9 and n-C_{31} indicative of a mature, undegraded oil in both cases.

Slight odd-even predominances in the n-C_{23+} range suggest input from higher plant waxes, and pristane/phytane ratios of 5.12 and 4.73 reflect oxic conditions during deposition of the organic source matter.

The two deepest samples, at 1469m and 1550.5m, contain only very low amounts of extractable organic matter (approximately 40 and 30ppm, respectively) and the overall pictures of their GC traces are similar to the one obtained at 1392m. The decrease in extractable organic matter from 1408.5m to 1550.5m and the GC characteristics suggest that the two deeper samples may have been below the palaeo OWC.

A sample from Iona-1, 1391.5m, was also analysed by liquid chromatography and GC of the saturate fraction. The sediment is rich in total extract (2450ppm) and the overall picture of its GC trace is similar to traces obtained for Iona-2, 1358m to 1381m, ie appears to be mature and shows a lack of compounds below n-C_{17}, as well as slight odd-even predominances in the n-C_{23+} range. However, while GC traces for 1358m to 1381m are only depleted in light n-alkanes (believed to be caused by biodegradation), the almost total lack of compounds below C_{17} in this sample is probably due to long storage time and resulting evaporation effects.

The major differences between the two Iona-2 and the Iona-1 extracts are their pristane/n-C_{17} ratios which are high in Iona-2 (1.17 to 3.02) and low in Iona-1 (0.53). As bacterial attack suspected in Iona-2 would preferentially reduce n-C_{17} (straight chain), compared with pristane (isopenoid structure), the value for pristane/n-C_{17} in this well may be "artificially" high. In Iona-1, on the other hand, the loss of light ends due to storage would probably also have affected pristane, and the same ratio in the old well could be "artificially" low.

The predominance of pristane over n-C_{17} can be due to the coaly nature of organic material or to low maturity levels, the Iona-2 extracts, however, are believed to be fully mature to date (see below). It may therefore be possible that the source material which generated the hydrocarbons reservoired in Ion-1, 1391.5m was less coaly/terrestrial than the sediments which generated the Iona-2 oil. GC-MS analysis would be necessary to confirm this assumption.

B. GC-MS Analysis

Biomarker distributions were determined for the branched/cyclic and aromatic fractions of samples 1358m and 1408m and these patterns are virtually identical for the two samples which reflects their genetic relationship and which supports the GC-based assumptions that the lack of light ends in the shallower sample is secondary, probably due to biodegradational effects.

Oil recovered from 1358m and 1408.5m was sourced from very terrestrial, coaly organic matter characterised by the presence of codalene and retene, a strong predominance of C_{29} over C_{27} diasteranes and steranes and a suite of bi-, tri- and tetracyclic diterpenoids (19-norlabdane, isopimarane, beyerane, 17-nortetracyclane), markers for resinous matter in higher plants.

Though pristane/phytane ratios of around 5 appear to suggest oxic conditions during deposition of the source sediment, the presence of methylhopanes and C_{29} as well as C_{30} diahopanes characterise more sub-oxic depositional environments.

The oil is fully mature to date as reflected in C_{29} 20S/20R ratios of 0.94 and 0.95 and by MP1 values of between 1.06 and 1.21, equivalent to V_R values of approximately 1 to 1.1%.

9 March, 1994

GFE Resources Ltd
11th Floor
151 Flinders Street
Melbourne
VIC 3000

Table 1

WATER ANALYSIS
IONA # 2 RFT
1361.8m

Ph	6.05
Conductivity @ 25°C (µmho/cm)	29400
Resistivity (ohm.m)	0.34
Density @ 25°C (g/cm^3)	1.012
Total Dissolved Solids (mg/l) (calculated)	18815

		(mg/l)	(me/l)
Sodium	Na	3180	138.26
Potassium	K	3350	85.90
Calcium	Ca	100	5.00
Magnesium	Mg	35.5	2.96
Soluble iron	Fe(s)	5.0	-
Chloride	Cl	7300	205.63
Carbonate	CO_3	Nil	-
Bicarbonate	HCO_3	1205	19.75
Sulphate	SO_4	42	0.88
Nitrate	NO_3	4.9	0.08
Sum of Ions		15217	

GEOTECH GEOTECHNICAL SERVICES PTY LTD
125 Burswood Road, Victoria Park, Western Australia 6100
Telephone (09) 362 5222
Facsimile (09) 362 5908

TABLE 2

IONA 2 GHM Bulk Composition and Thermal Extraction Data

A. Bulk Compositional Data

Mar-94

DEPTH(m)	Sample Type	S1	S2	PI	S1/TOC	HI
1358.0	SWC	20.10	1.43	0.93	nd	nd
1365.0	Cuttings	0.47	1.09	0.30	nd	nd
1385.0	Cuttings	0.59	2.34	0.20	nd	nd
1410.0	Cuttings	0.40	0.51	0.44	nd	nd

TABLE 2

IONA 2 GHM Bulk Composition and Thermal Extraction Data

B. Thermal Extraction Data

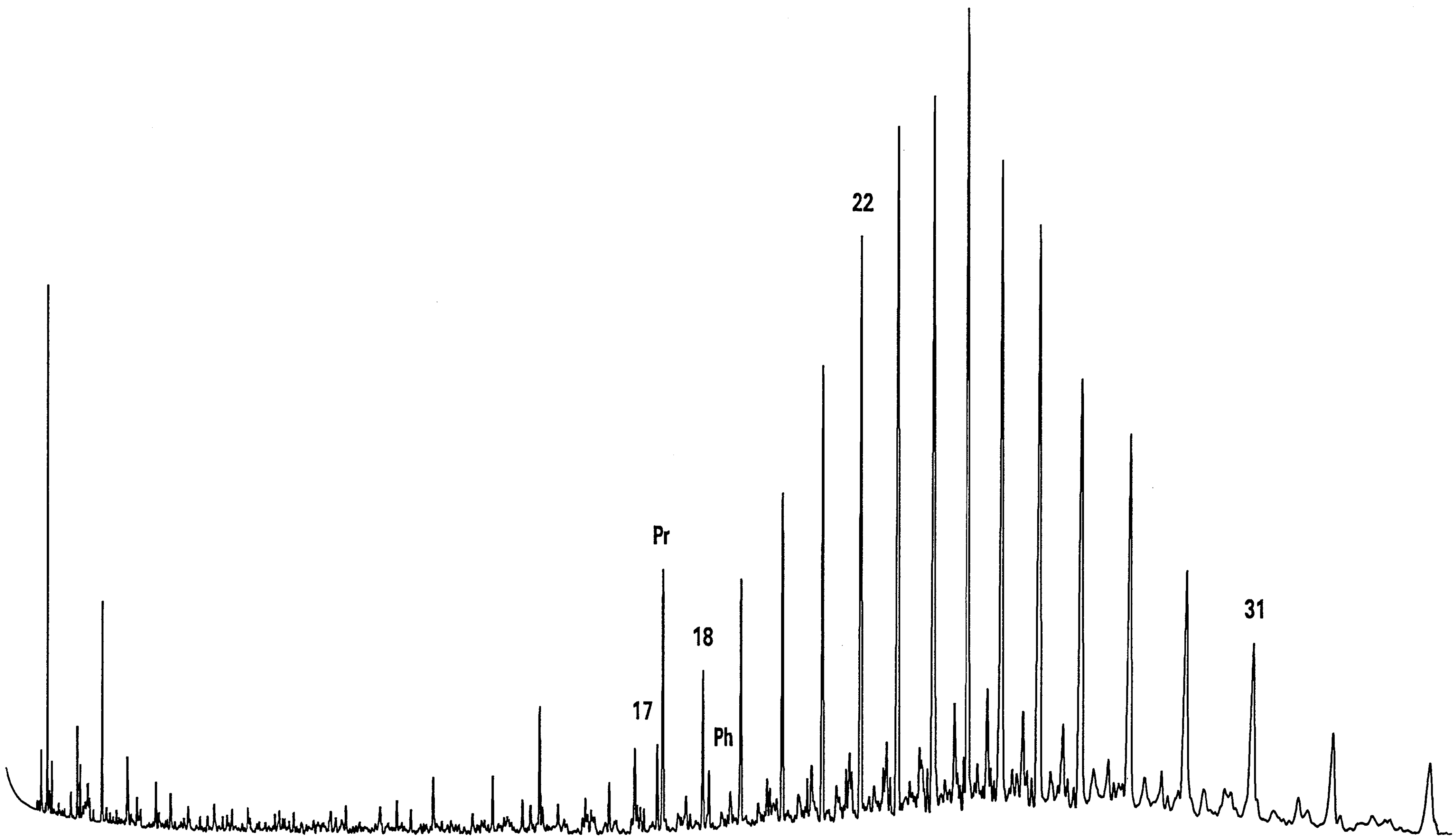
DEPTH(m)	Sample Type	Prist./Phyt.	Prist./n-C17	Phyt./n-C18
1358.0	SWC	4.9	3.3	0.4
1365.0	Cuttings	nd	nd	nd
1385.0	Cuttings	nd	nd	nd
1410.0	Cuttings	nd	nd	nd

Figure 1-1

IONA 2, 1358.0m, SWC

Thermal Extraction

C1-C36 GLC



A373

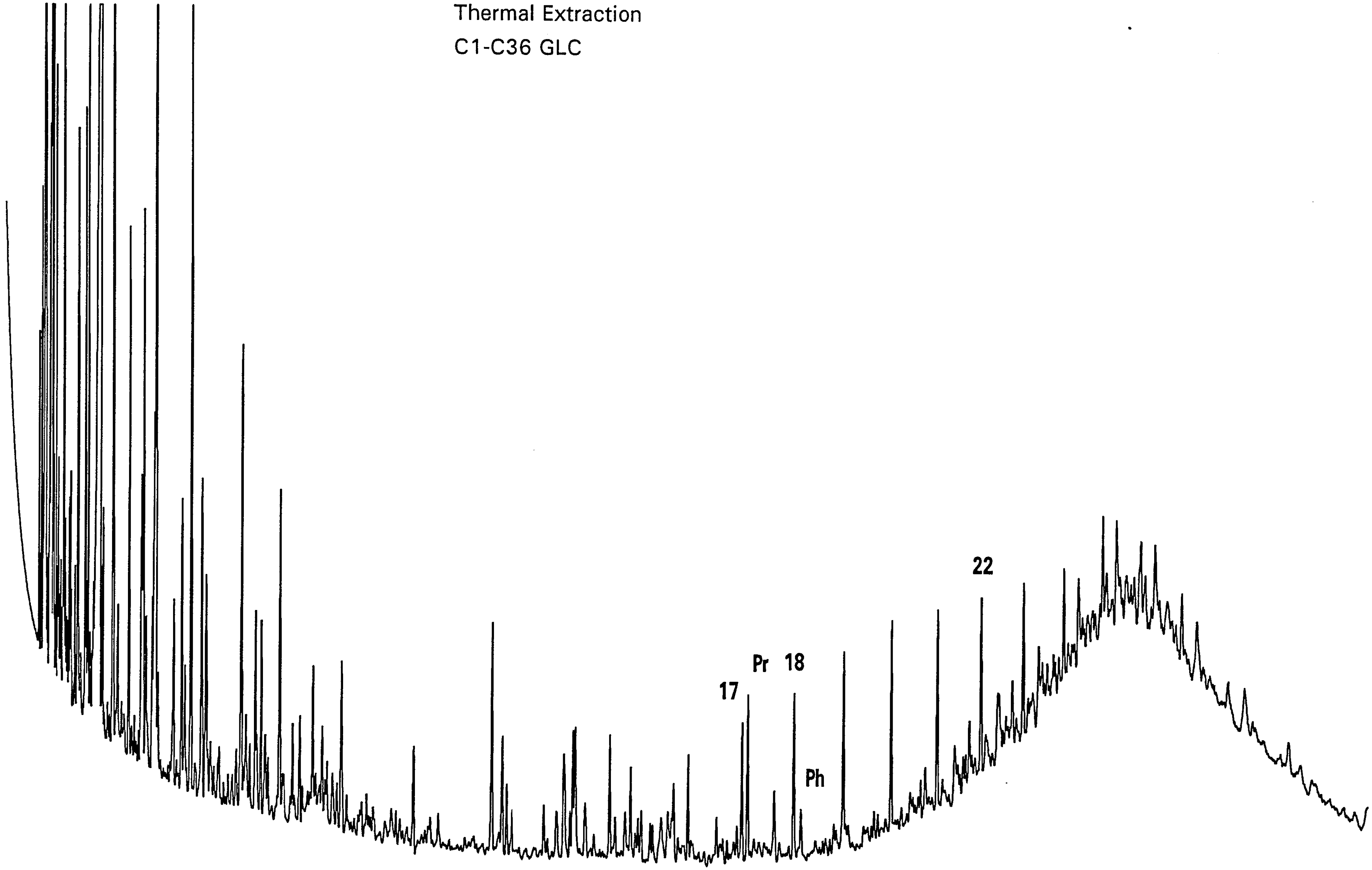
GEOTECHNICAL SERVICES PTY LTD

Figure 1-2

IONA 2, 1365m, Cuttings

Thermal Extraction

C1-C36 GLC



A369

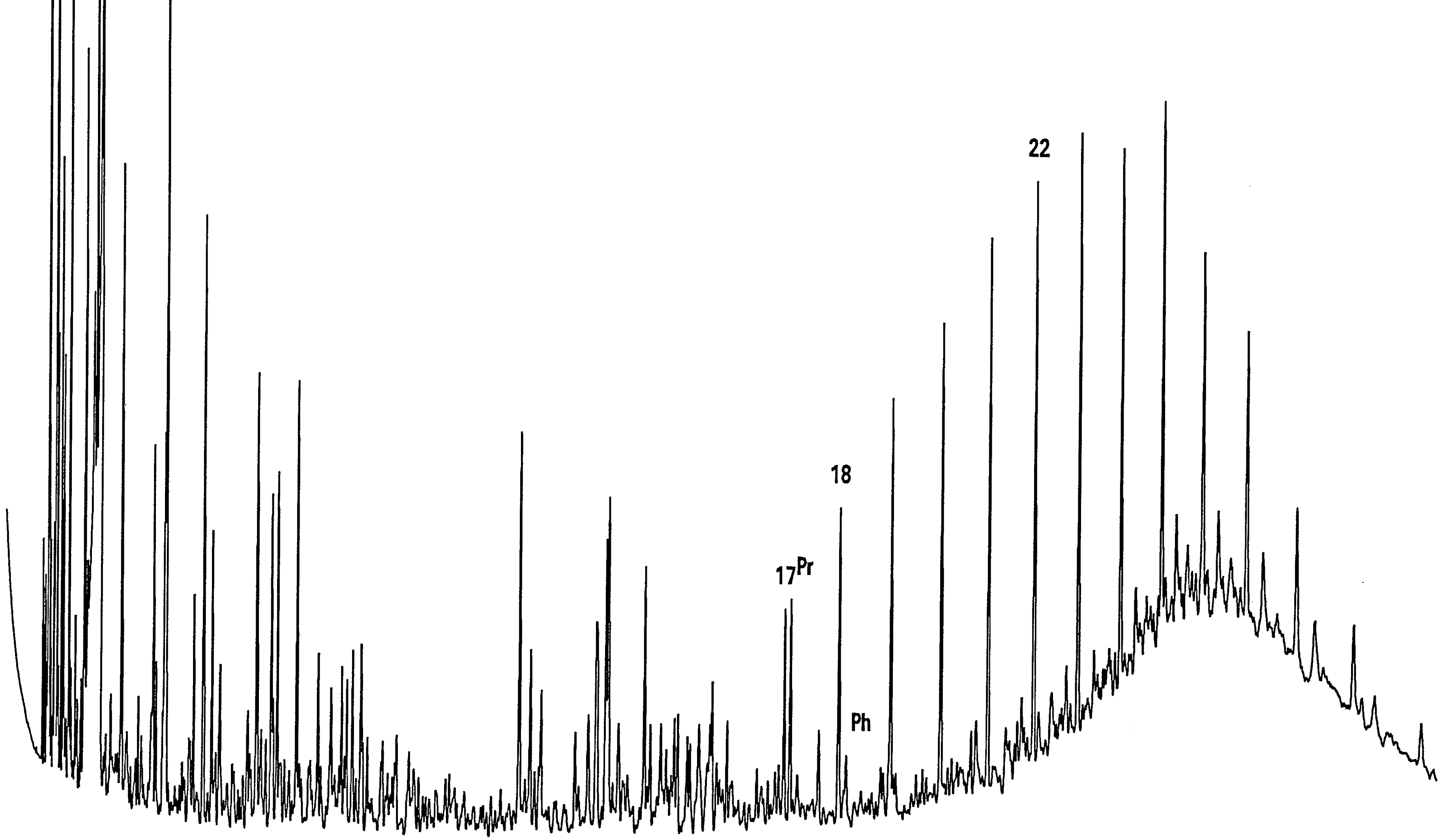
GEOTECHNICAL SERVICES PTY LTD

Figure 1-3

IONA 2, 1385m, Cuttings

Thermal Extraction

C1-C36 GLC



A370

Figure 1-4

IONA 2, 1410m, Cuttings

Thermal Extraction

C1-C36 GLC

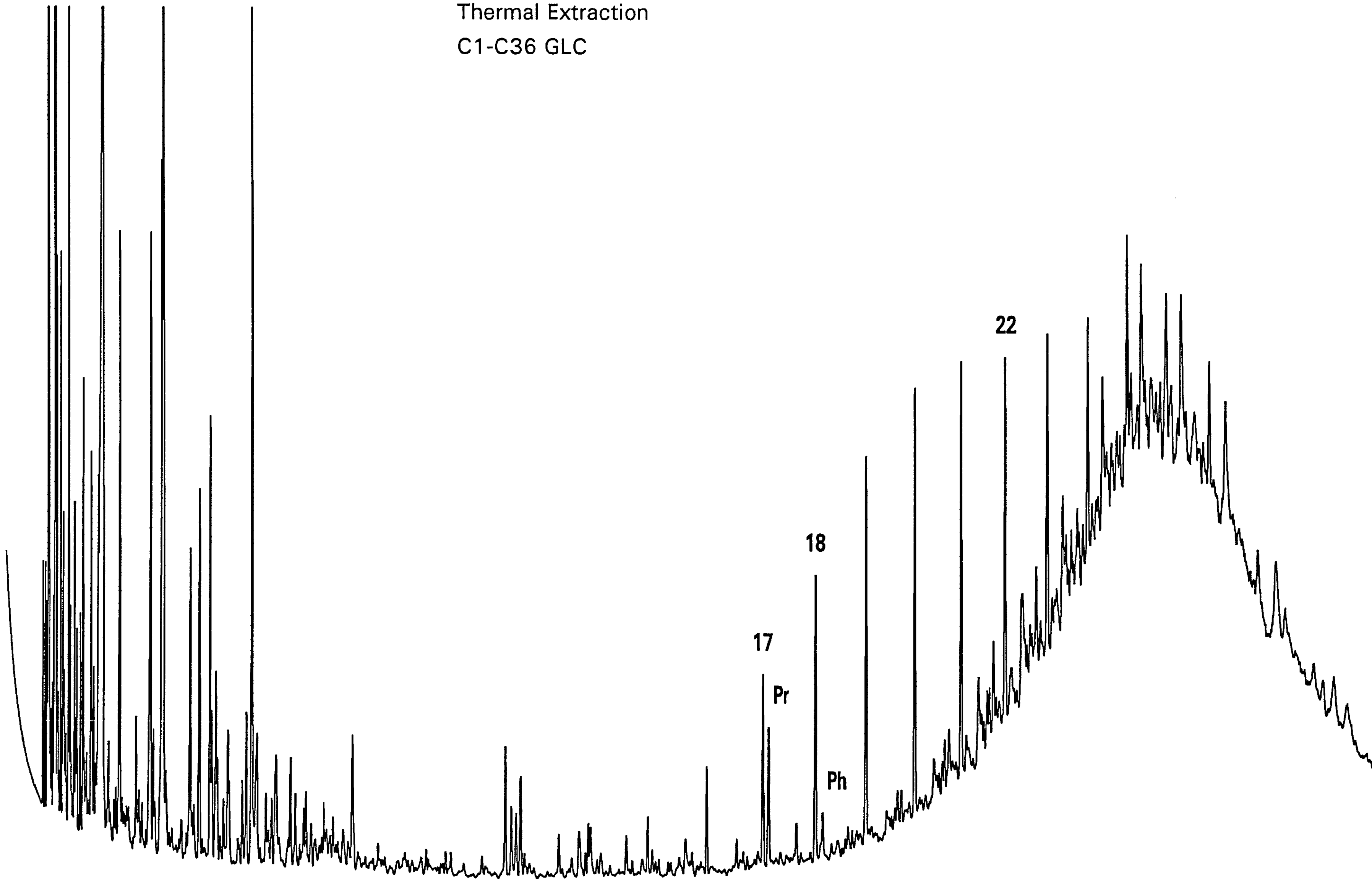
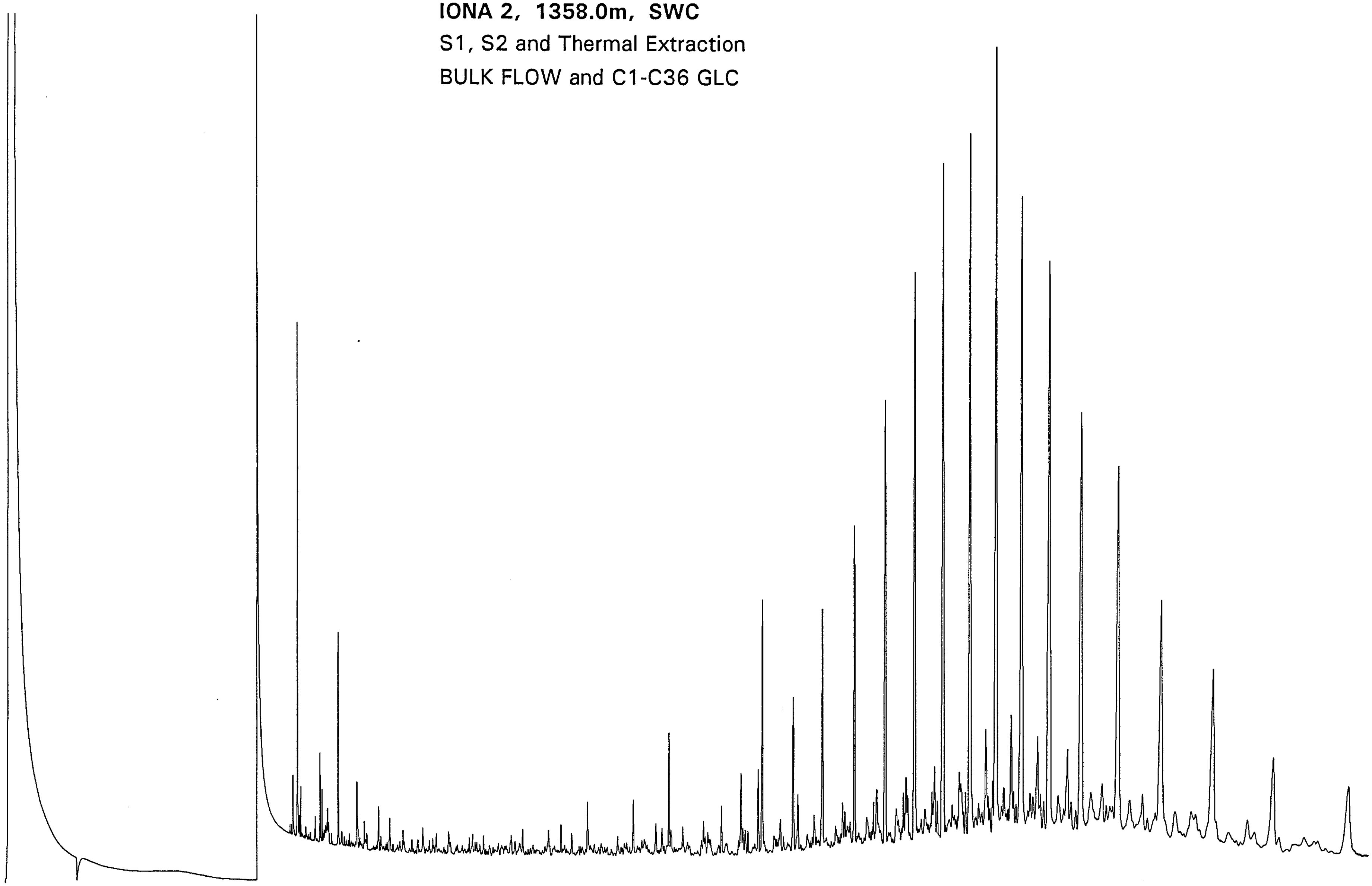


Figure 1-5

IONA 2, 1358.0m, SWC

S1, S2 and Thermal Extraction

BULK FLOW and C1-C36 GLC



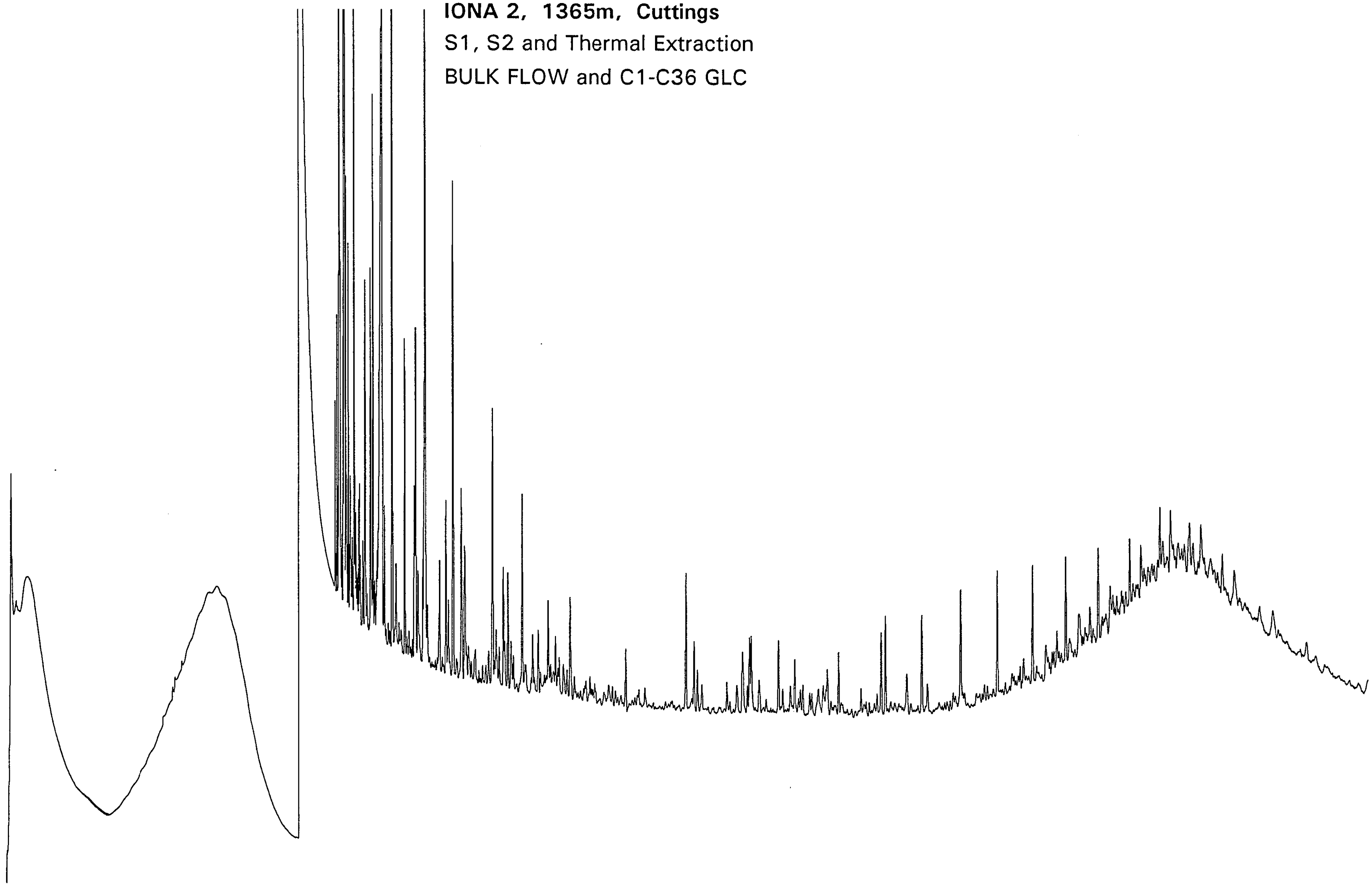
GEOTECHNICAL SERVICES PTY LTD

Figure 1-6

IONA 2, 1365m, Cuttings

S1, S2 and Thermal Extraction

BULK FLOW and C1-C36 GLC



GEOTECHNICAL SERVICES PTY LTD

Figure 1-7

IONA 2, 1385m, Cuttings

S1, S2 and Thermal Extraction

BULK FLOW and C1-C36 GLC

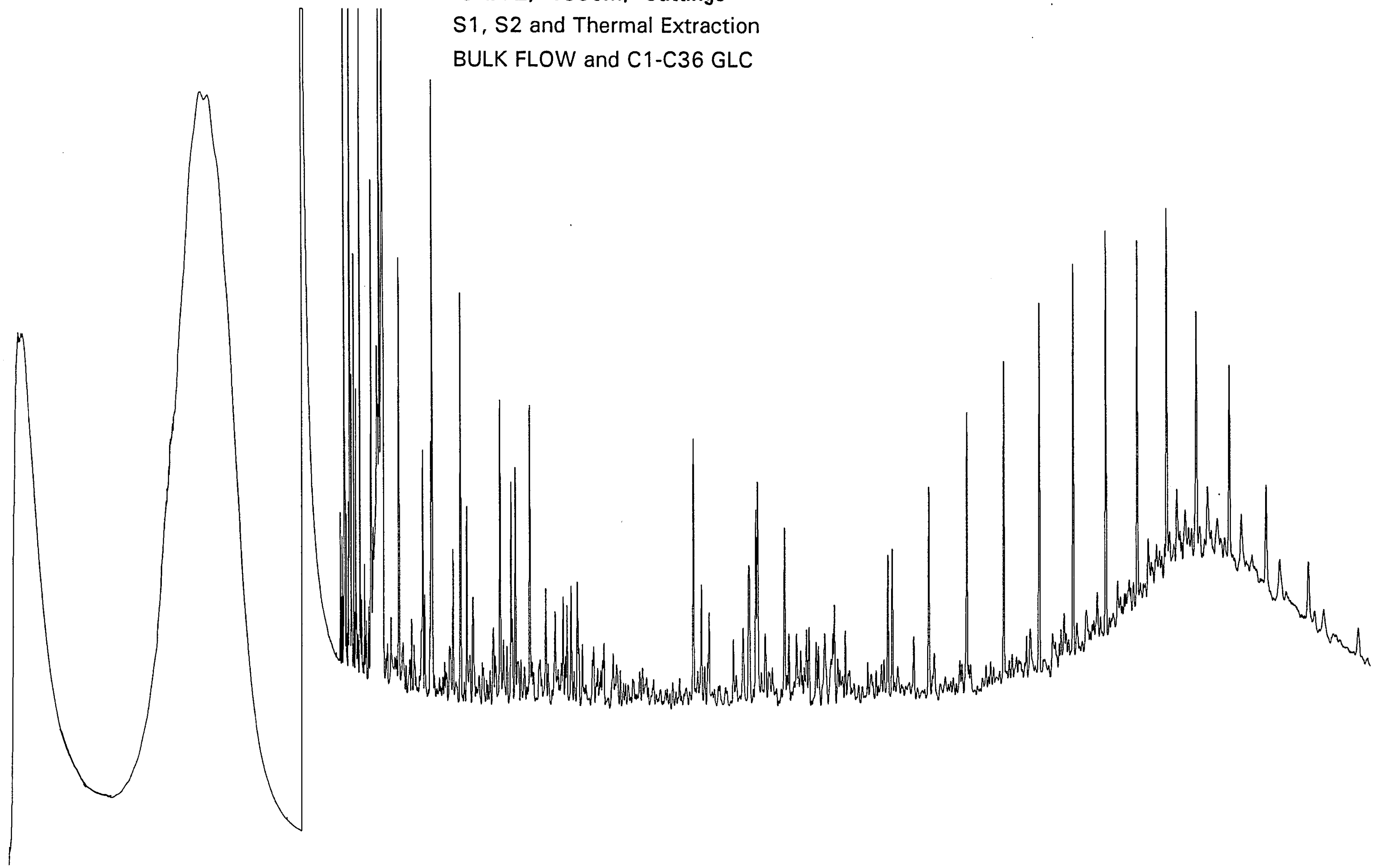
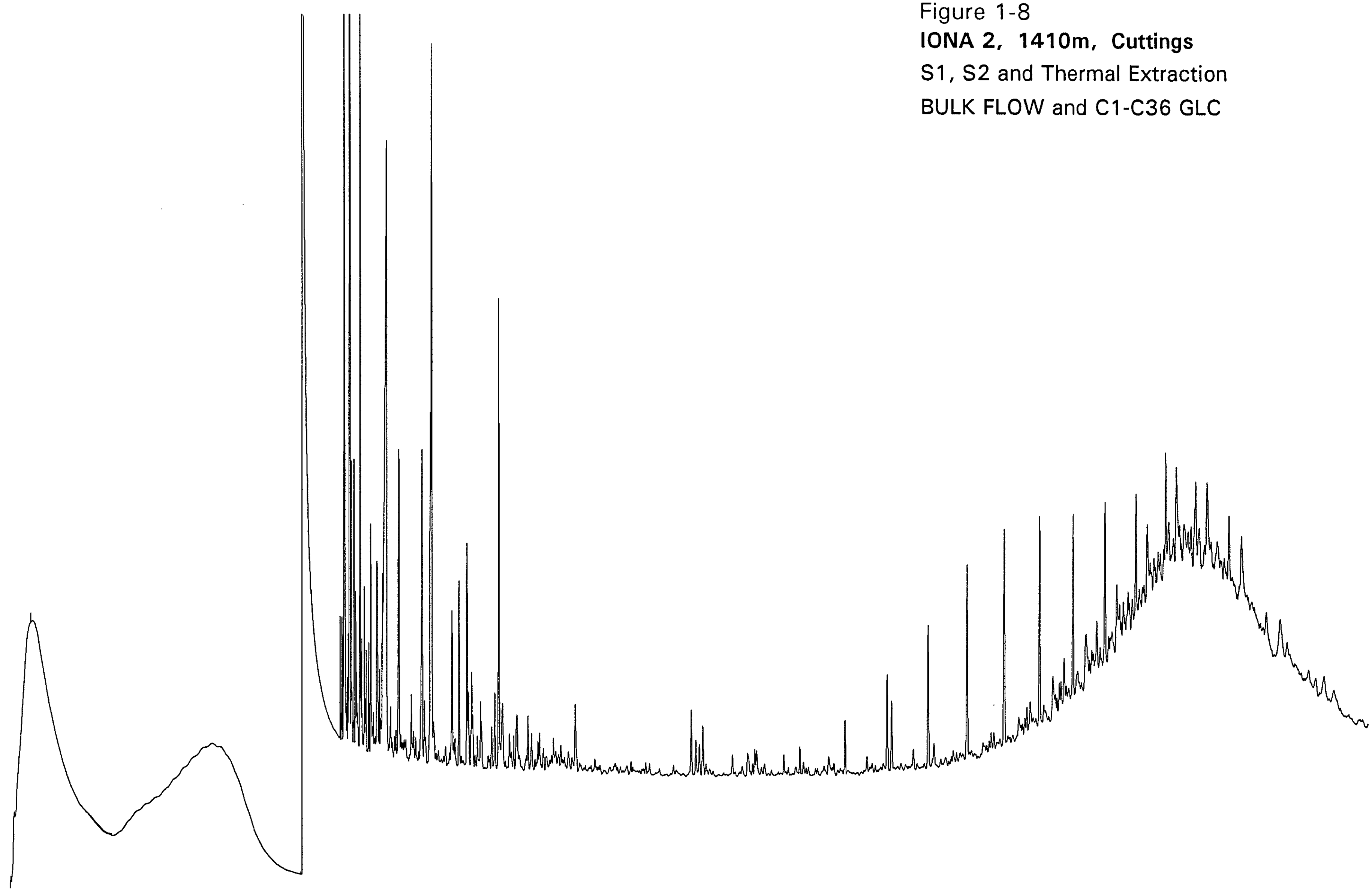


Figure 1-8
IONA 2, 1410m, Cuttings
S1, S2 and Thermal Extraction
BULK FLOW and C1-C36 GLC



GEOTECHNICAL SERVICES PTY LTD

TABLE 3

Summary of Extraction and Liquid Chromatography

IONA 2 Mar-94

A. Concentrations of Extracted Material

	Weight of	Total	Loss on	-------Hydrocarbons-------			----Nonhydrocarbons----		
	Rock Extd	Extract	Column	Saturates	Aromatics	HC Total	NSO's	Asphalt	NonHC Total
DEPTH(m)	(grams)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
1358.0	11.7	10724.0	1382.4	7121.4	1591.8	8713.3	628.4	nd	628.4
1362.0	10.8	6849.4	1384.8	4070.6	1040.9	5111.5	353.2	nd	353.2
1381.0	11.6	5636.4	484.8	3818.2	926.4	4744.6	406.9	nd	406.9
1392.0	13.0	69.4	nd	nd	nd	nd	nd	nd	nd
1408.5	12.2	1414.5	82.2	1019.7	189.1	1208.9	123.4	nd	123.4
1426.0	14.0	143.3	nd	nd	nd	nd	nd	nd	nd
1469.0	14.6	41.2	nd	nd	nd	nd	nd	nd	nd
1550.5	16.0	31.3	nd	nd	nd	nd	nd	nd	nd

TABLE 3

Summary of Extraction and Liquid Chromatography

IONA 2 Mar-94

B. Compositional Data

	---Hydrocarbons----			---Nonhydrocarbons-----			EOM(mg)	SAT(mg)	SAT	ASPH	HC
							--------	--------	--------	--------	--------
DEPTH(m)	%SAT	%AROM	%HC's	%NSO	%ASPH	%Non HC's	TOC(g)	TOC(g)	AROM	NSO	Non HC
1358.0	76.2	17.0	93.3	6.7	nd	6.7	nd	nd	4.5	nd	13.9
1362.0	74.5	19.0	93.5	6.5	nd	6.5	nd	nd	3.9	nd	14.5
1381.0	74.1	18.0	92.1	7.9	nd	7.9	nd	nd	4.1	nd	11.7
1392.0	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1408.5	76.5	14.2	90.7	9.3	nd	9.3	nd	nd	5.4	nd	9.8
1426.0	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1469.0	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1550.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

nd = no data

TABLE 4

IONA 2 Summary of Gas Chromatography Data

A. Alkane Compositional Data

DEPTH(m)	Prist./Phyt.	Prist./n-C17	Phyt./n-C18	CPI(1)	CPI(2)	(C21+C22)/(C28+C29)
1358.0	5.37	2.86	0.37	1.11	1.10	1.40
1362.0	5.39	3.02	0.38	1.10	1.09	1.49
1381.0	4.81	1.17	0.15	1.08	1.07	2.22
1392.0	nd	nd	nd	nd	nd	nd
1408.5	5.12	0.37	0.07	1.07	1.08	2.71
1426.0	4.73	0.34	0.07	1.07	1.07	2.78
1469.0	nd	nd	nd	nd	nd	nd
1550.5	nd	nd	nd	nd	nd	nd

TABLE 4

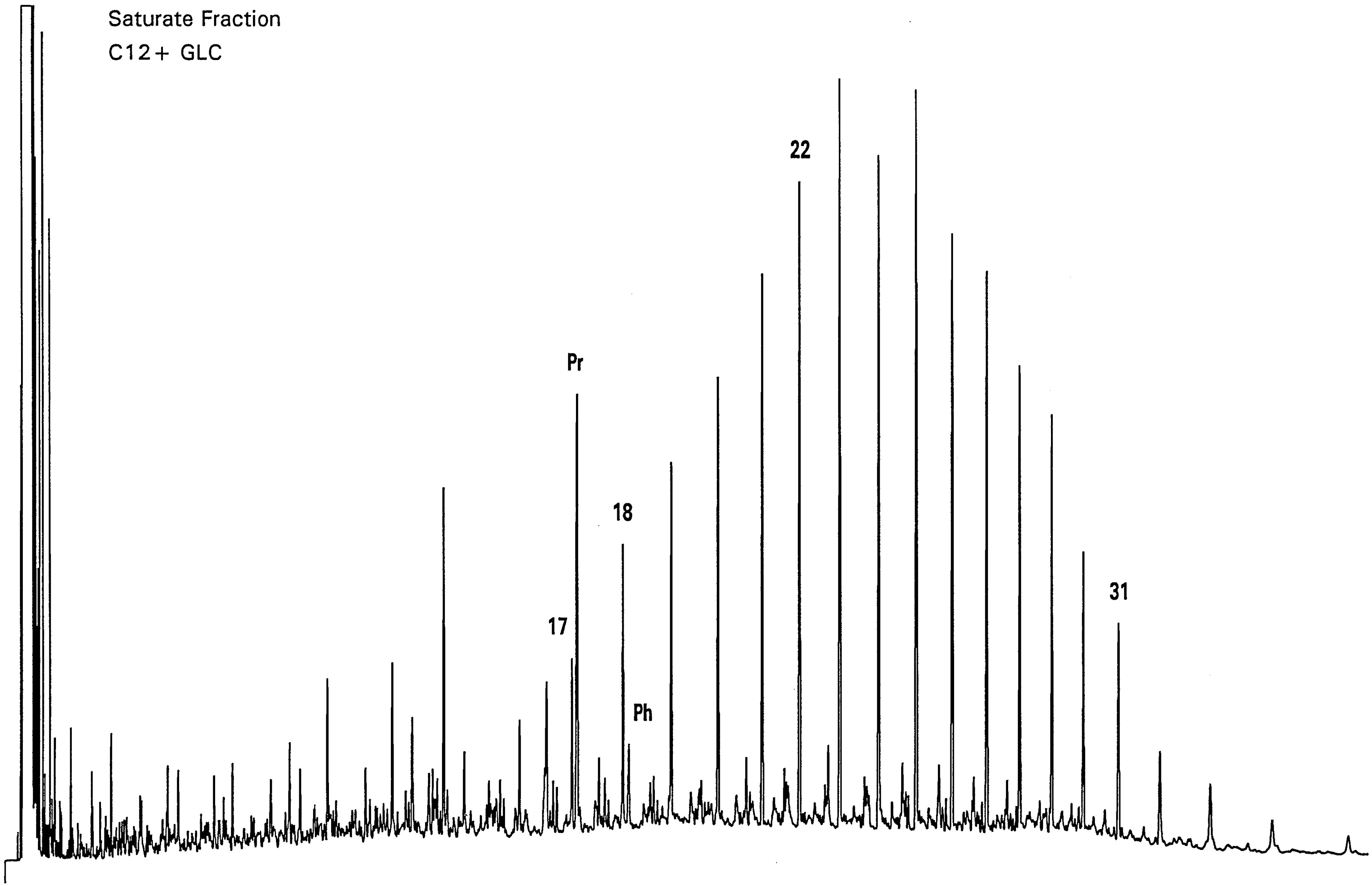
IONA 2 Summary of Gas Chromatography Data

B. n-Alkane Distributions

DEPTH(m)	nC12	nC13	nC14	nC15	nC16	nC17	iC19	nC18	iC20	nC19	nC20	nC21	nC22	nC23	nC24	nC25	nC26	nC27	nC28	nC29	nC30	nC31
1358.0	-	-	-	1.1	1.5	2.2	6.4	3.3	1.2	4.1	5.1	6.4	8.2	9.6	9.0	9.8	7.7	7.3	5.5	5.0	3.5	3.1
1362.0	-	-	-	1.1	1.4	2.1	6.4	3.2	1.2	4.0	5.1	6.6	8.3	9.8	9.6	10.0	7.7	7.1	5.2	4.8	3.2	2.8
1381.0	-	-	-	0.8	1.8	3.6	4.2	5.7	0.9	7.4	8.0	8.5	8.8	9.3	8.6	8.2	6.0	5.4	4.1	3.7	2.6	2.3
1392.0	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1408.5	4.2	4.8	5.4	5.9	6.1	6.4	2.4	6.6	0.5	6.8	6.5	6.3	6.3	6.3	5.6	5.2	3.8	3.4	2.5	2.2	1.7	1.3
1426.0	3.5	4.1	4.9	5.9	6.4	6.8	2.3	7.0	0.5	7.0	6.8	6.6	6.4	6.3	5.6	5.2	3.8	3.5	2.6	2.1	1.5	1.4
1469.0	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1550.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

nd = no data

Figure 2-1
IONA 2, 1358.0m, SWC
Saturate Fraction
C12+ GLC



2047ED1

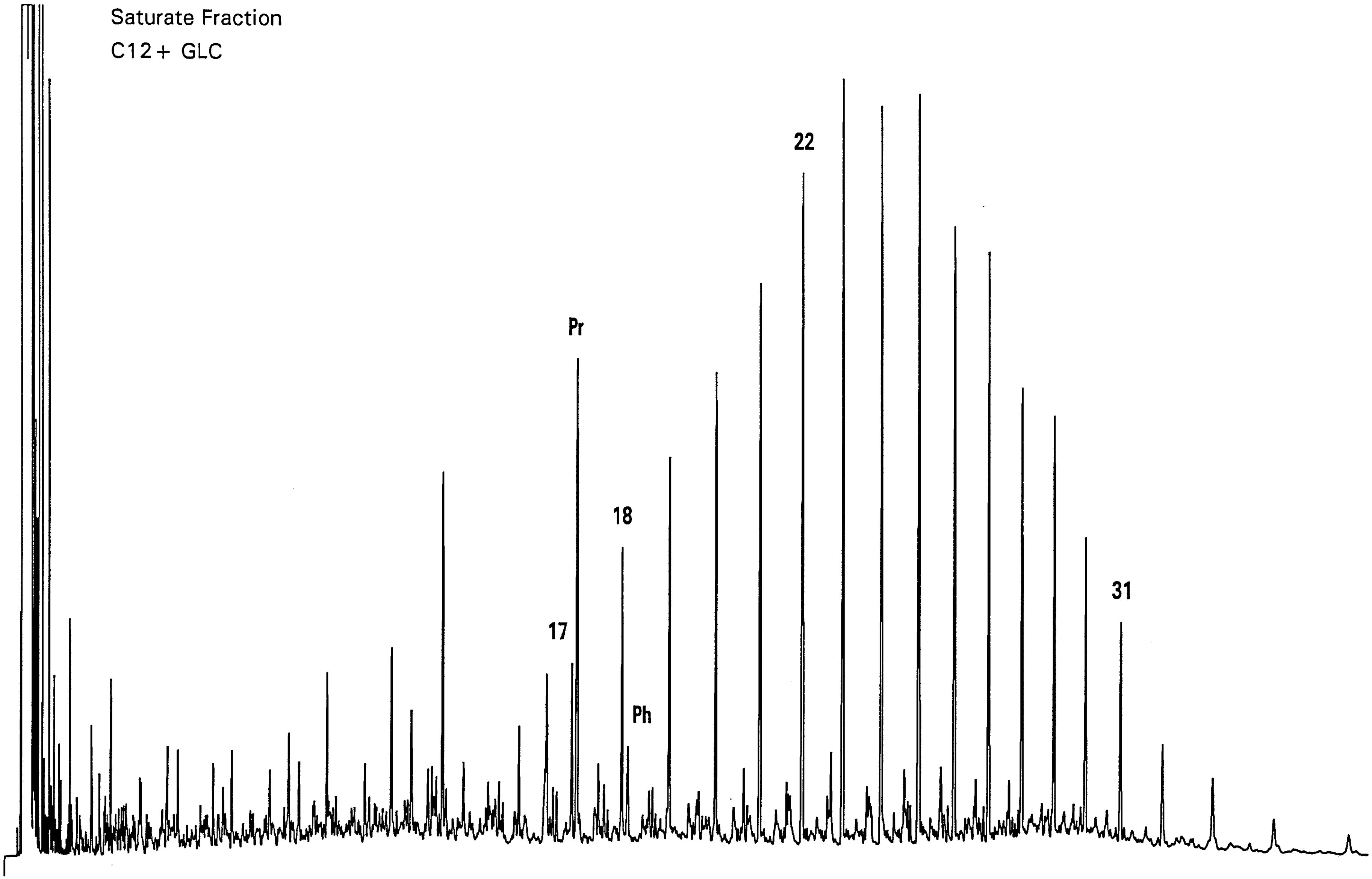
GEOTECHNICAL SERVICES PTY LTD

Figure 2-2

IONA 2, 1362.0m, SWC

Saturate Fraction

C12+ GLC



2047ED2

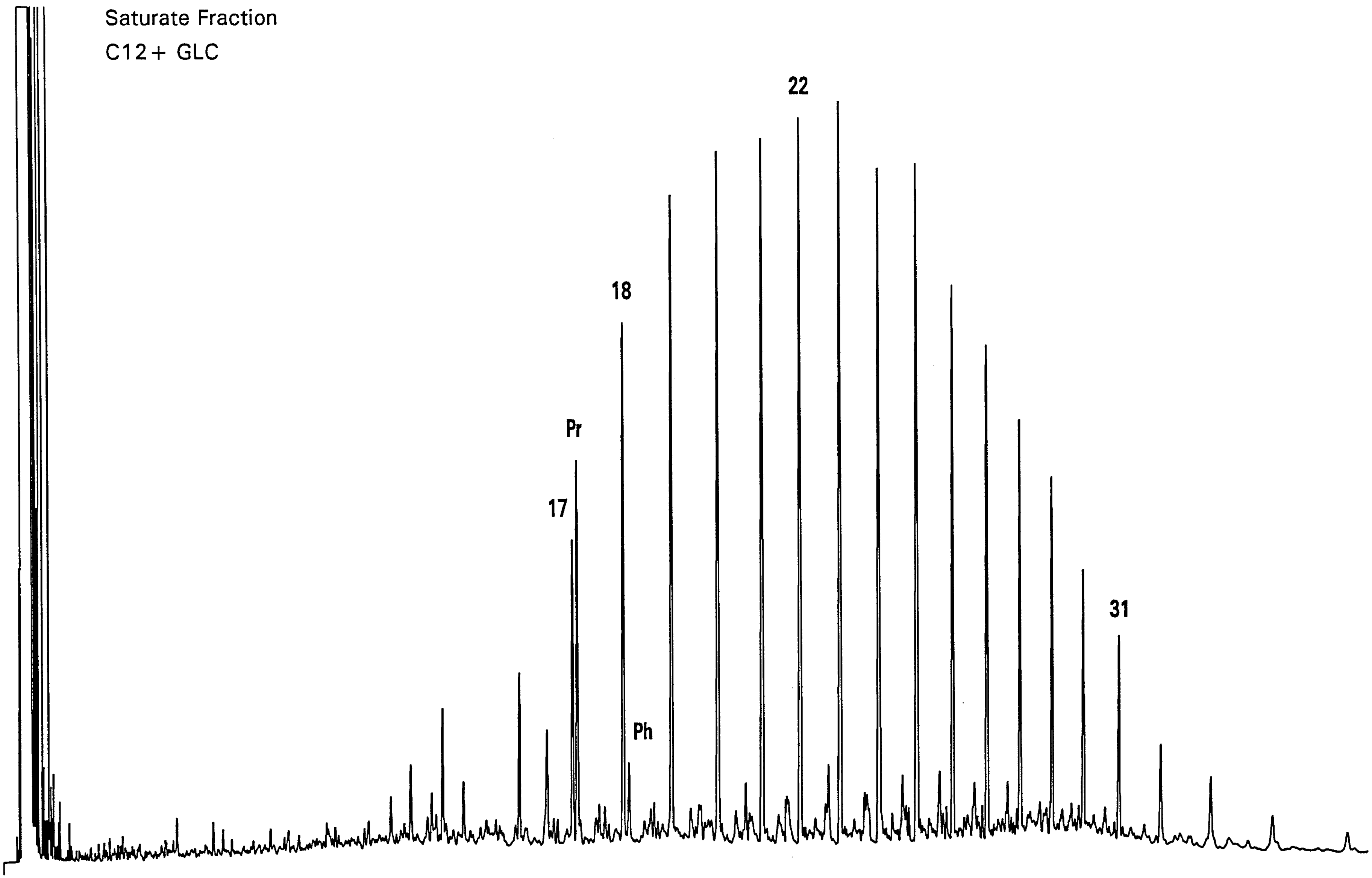
GEOTECHNICAL SERVICES PTY LTD

Figure 2-3

IONA 2, 1381.0m, SWC

Saturate Fraction

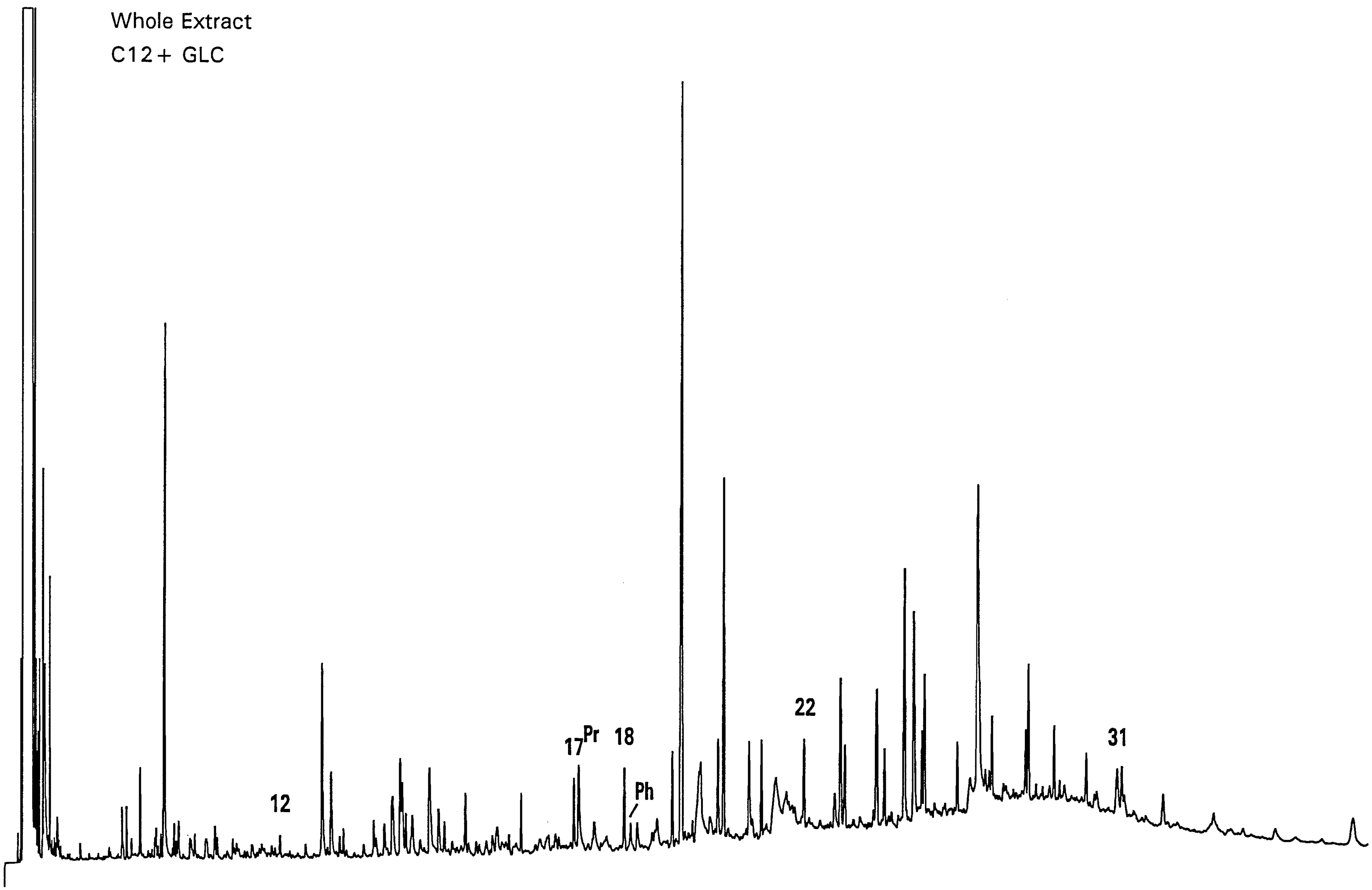
C12+ GLC



GEOTECHNICAL SERVICES PTY LTD

2047ED3

Figure 2-4
IONA 2, 1392.0m, SWC
Whole Extract
C12+ GLC



2047ED5

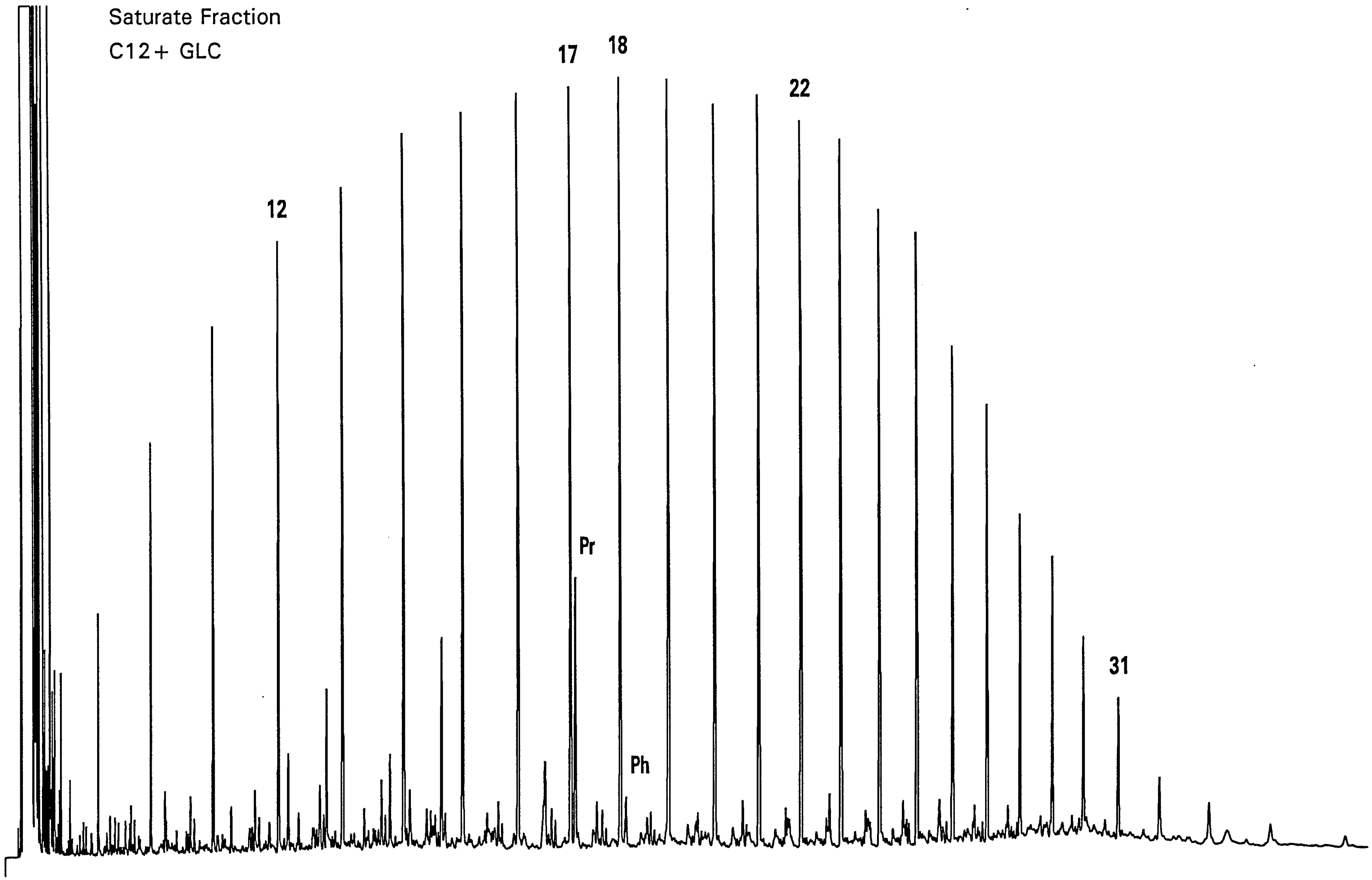
GEOTECHNICAL SERVICES PTY LTD

Figure 2-5

IONA 2, 1408.5m, SWC

Saturate Fraction

C12+ GLC



2047ED4

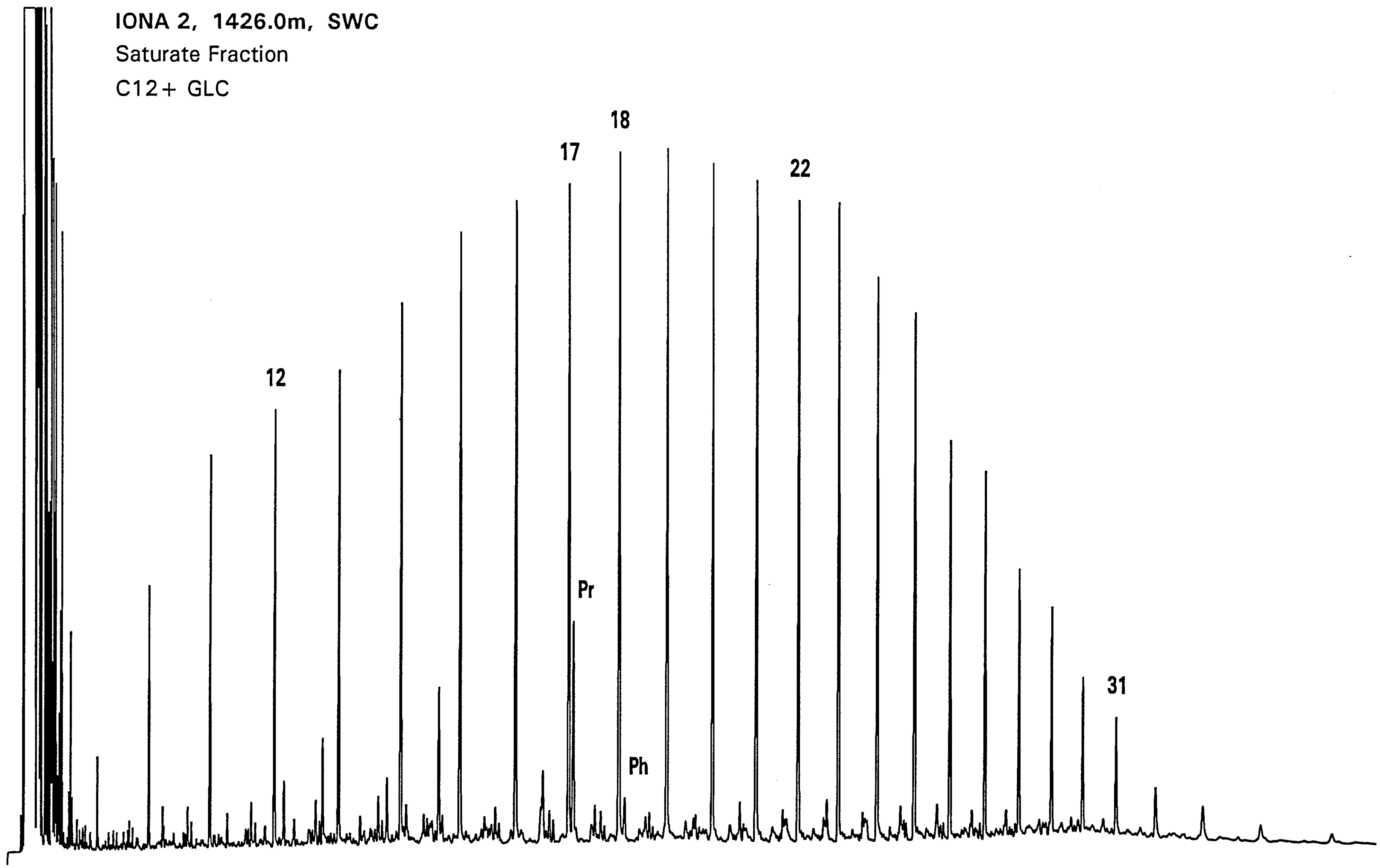
GEOTECHNICAL SERVICES PTY LTD

Figure 2-6

IONA 2, 1426.0m, SWC

Saturate Fraction

C12+ GLC



2047ED8

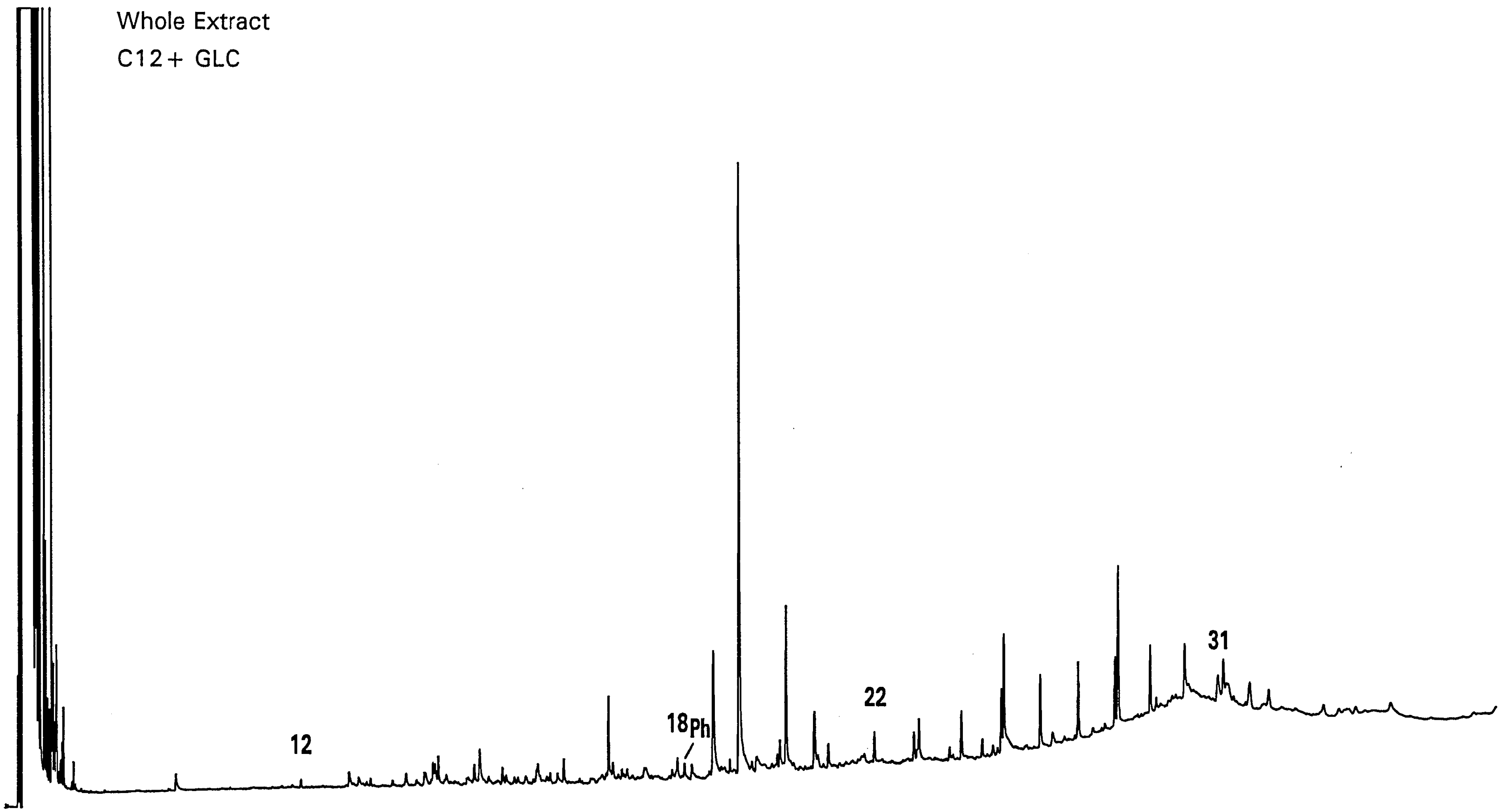
GEOTECHNICAL SERVICES PTY LTD

Figure 2-7

IONA 2, 1469.0m, SWC

Whole Extract

C12+ GLC



2047ED6

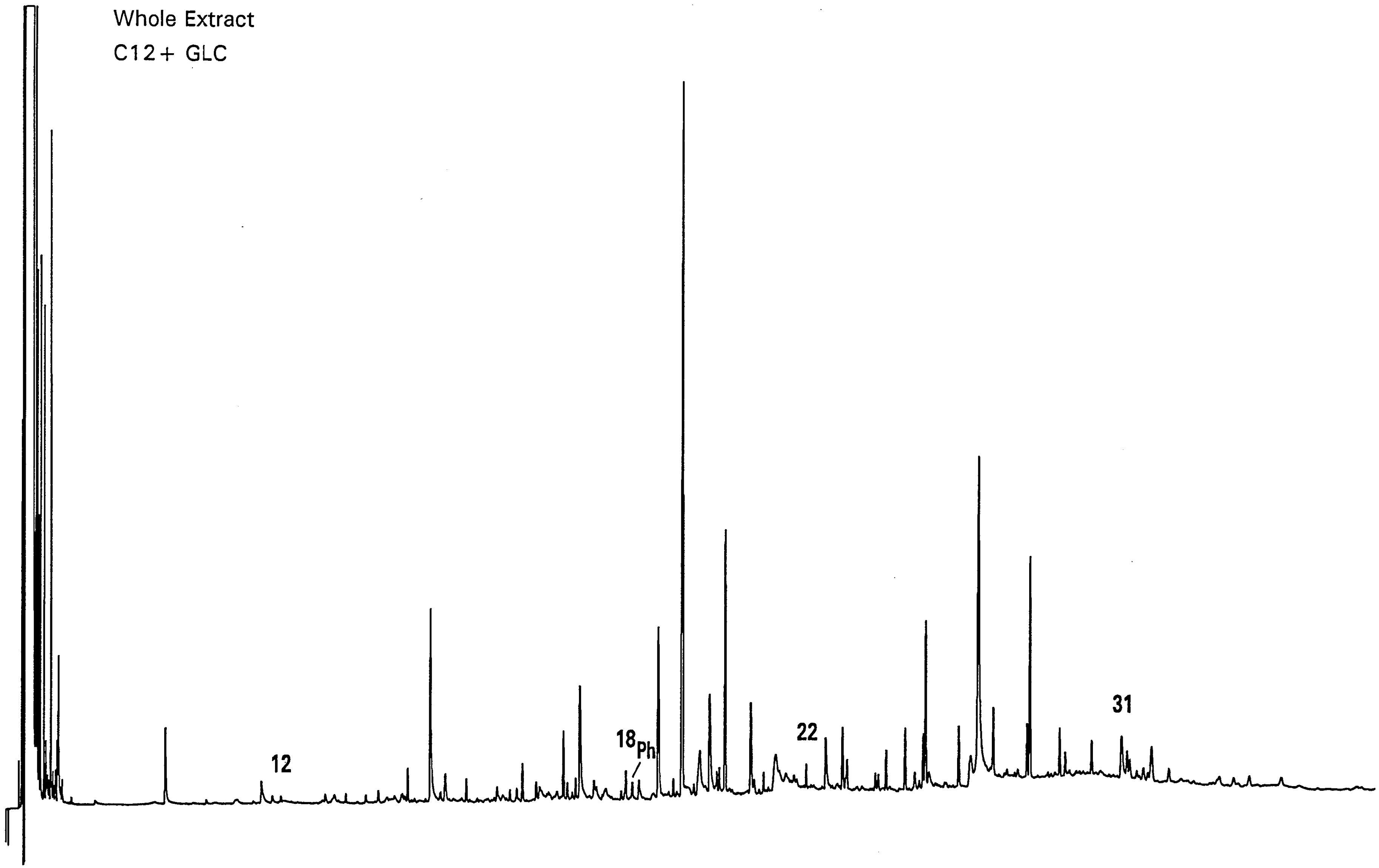
GEOTECHNICAL SERVICES PTY LTD

Figure 2-8

IONA 2, 1550.5m, SWC

Whole Extract

C12+ GLC



2047ED7

GEOTECHNICAL SERVICES PTY LTD

Table 3

Summary of Extraction and Liquid Chromatography

IONA 1 Mar-94

A. Concentrations of Extracted Material

				-------Hydrocarbons-------			----Nonhydrocarbons----		
	Weight of	Total	Loss on			HC			NonHC
	Rock Extd	Extract	Column	Saturates	Aromatics	Total	NSO's	Asphalt	Total
DEPTH(m)	(grams)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
1391.5	5.8	2452.2	295.7	1530.4	191.3	1721.7	434.8	nd	434.8

Table 3

Summary of Extraction and Liquid Chromatography

IONA 1 Mar-94

B. Compositional Data

	---Hydrocarbons----			---Nonhydrocarbons-----			EOM(mg)	SAT(mg)	SAT	ASPH	HC
							-------	-------	-------	-------	-------
DEPTH(m)	%SAT	%AROM	%HC's	%NSO	%ASPH	%Non HC's	TOC(g)	TOC(g)	AROM	NSO	Non HC
1391.5	71.0	8.9	79.8	20.2	nd	20.2	nd	nd	8.0	nd	4.0

nd = no data

Table 4

IONA 1 Summary of Gas Chromatography Data

A. Alkane Compositional Data

DEPTH(m)	Prist./Phyt.	Prist./n-C17	Phyt./n-C18	CPI(1)	CPI(2)	(C21+C22)/(C28+C29)
1391.5	2.80	0.53	0.08	1.07	1.07	2.54

Table 4

IONA 1 Summary of Gas Chromatography Data

B. n-Alkane Distributions

DEPTH(m)	nC12	nC13	nC14	nC15	nC16	nC17	iC19	nC18	iC20	nC19	nC20	nC21	nC22	nC23	nC24	nC25	nC26	nC27	nC28	nC29	nC30	nC31
1391.5	-	-	-	0.1	0.7	2.6	1.4	5.9	0.5	8.6	9.3	9.6	9.8	9.9	8.9	8.4	6.3	5.6	4.1	3.5	2.6	2.2

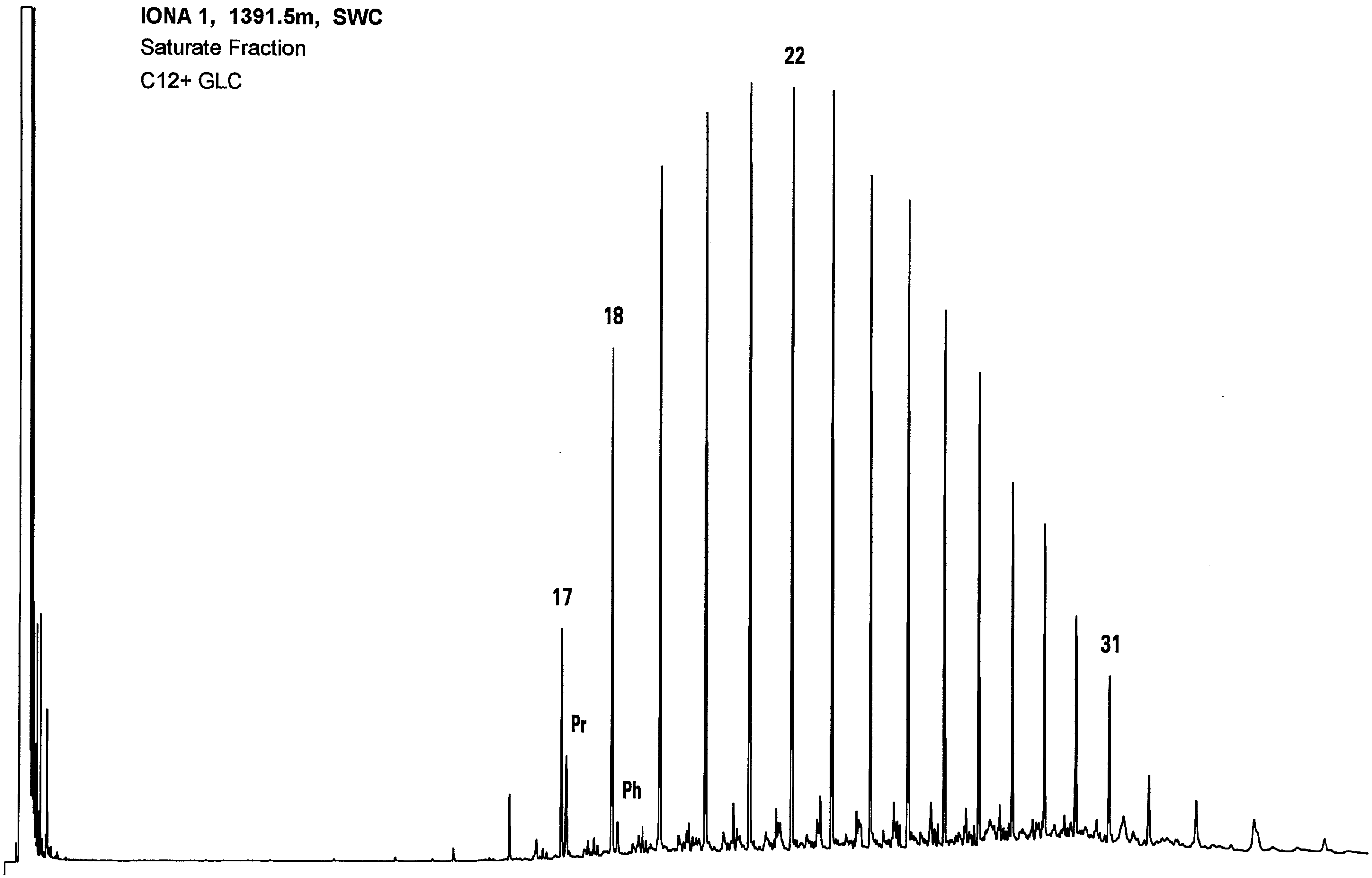
nd = no data

Figure 2-9

IONA 1, 1391.5m, SWC

Saturate Fraction

C12+ GLC



2047ED9

GEOTECHNICAL SERVICES PTY LTD

TABLE 5.1

SELECTED PARAMETERS FROM GC/MS ANALYSIS

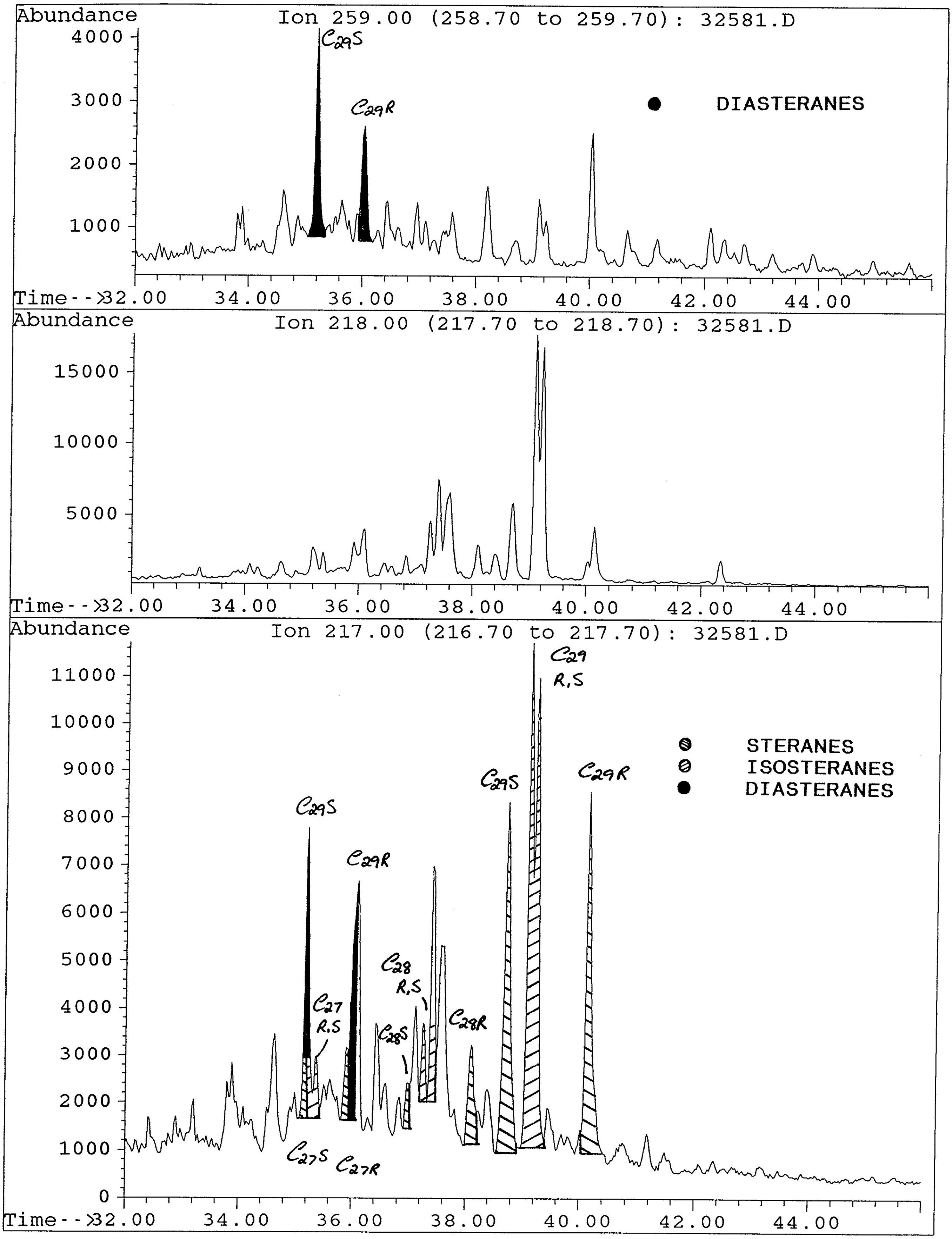
IONA 2, 1358.0m, SWC

	Parameter	Ion(s)	Value
1.	18 α (H)- hopane/17 α (H)-hopane (Ts/Tm)	191	0.81
2.	C30 hopane/C30 moretane	191	8.76
3.	C31 22S hopane/C31 22R hopane	191	1.39
4.	C32 22S hopane/C32 22R hopane	191	1.43
5.	C29 20S $\alpha\alpha\alpha$ sterane/C29 20R $\alpha\alpha\alpha$ sterane	217	0.94
6.	C29 $\alpha\alpha\alpha$ steranes (20S / 20S+20R)	217	0.49
7.	C29 $\alpha\beta\beta$ steranes / (C29 $\alpha\alpha\alpha$ steranes + C29 $\alpha\beta\beta$ steranes)	217	0.58
8.	C27/C29 diasteranes	259	nd
9.	C27/C29 steranes	217	0.24
10.	18 α (H)-oleanane/C30 hopane	191	nd
11.	C29 diasteranes / (C29 $\alpha\alpha\alpha$ steranes + C29 $\alpha\beta\beta$ steranes)	217	0.40
12.	C30 (hopane + moretane) / C29 (steranes + diasteranes)	191/217	0.94
13.	C15 drimane/C16 homodrimane	123	0.92
14.	Rearranged drimanes/normal drimanes	123	1.05

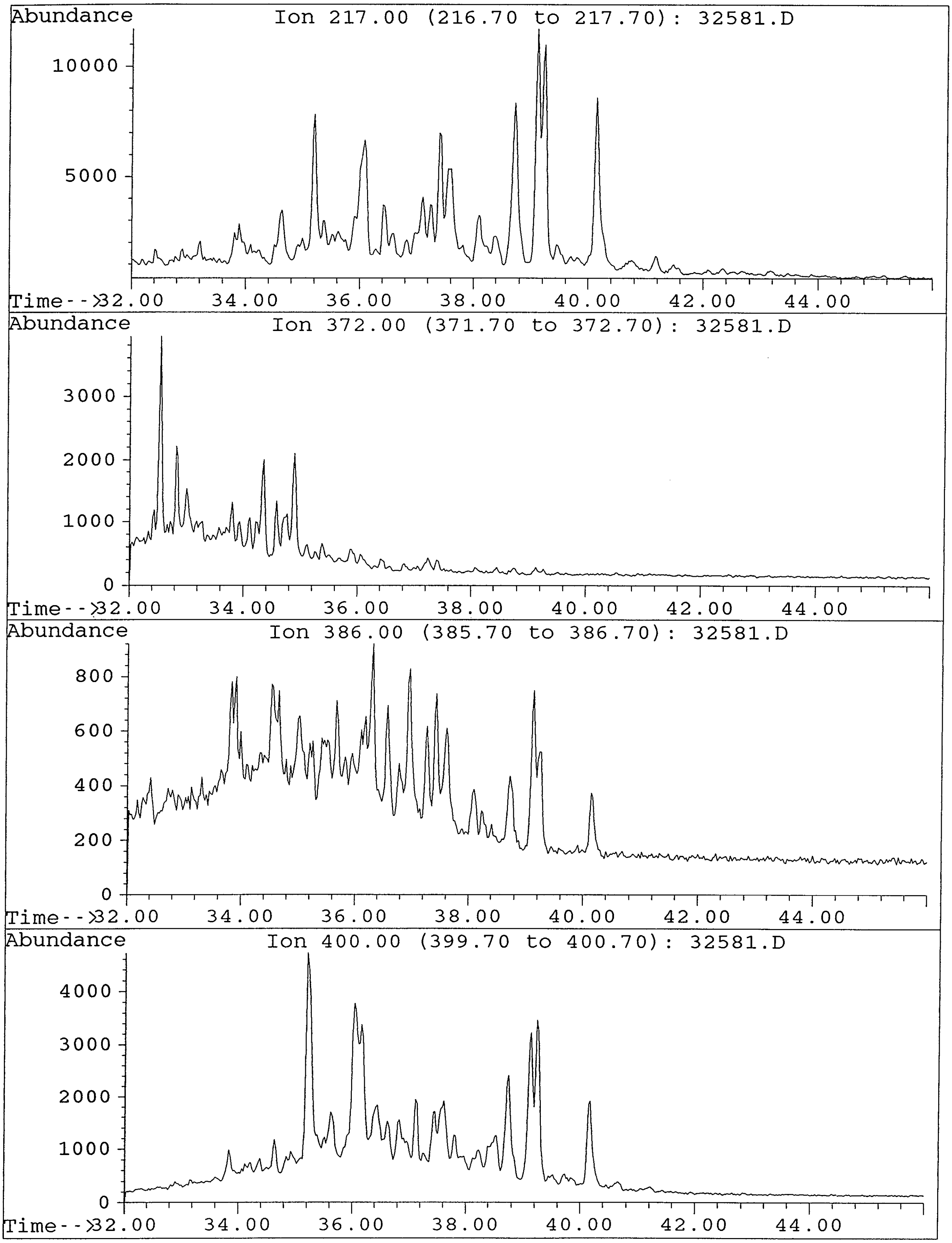
nd = not detectable

Figure 3-1

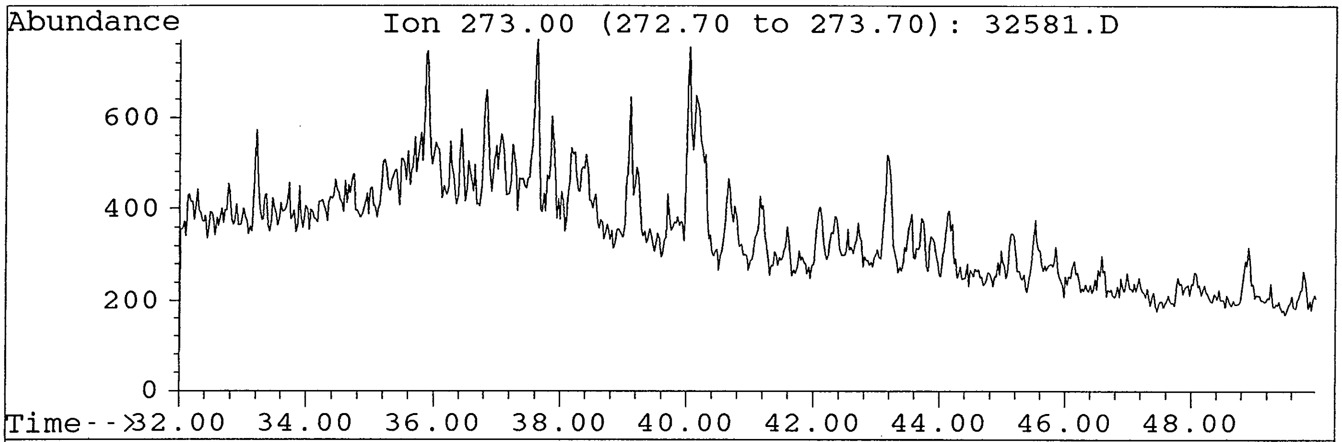
File : 32581.D
Sample : IONA-2 1358.0m B/C
Misc. Info : col#143, 18/3/94 SB

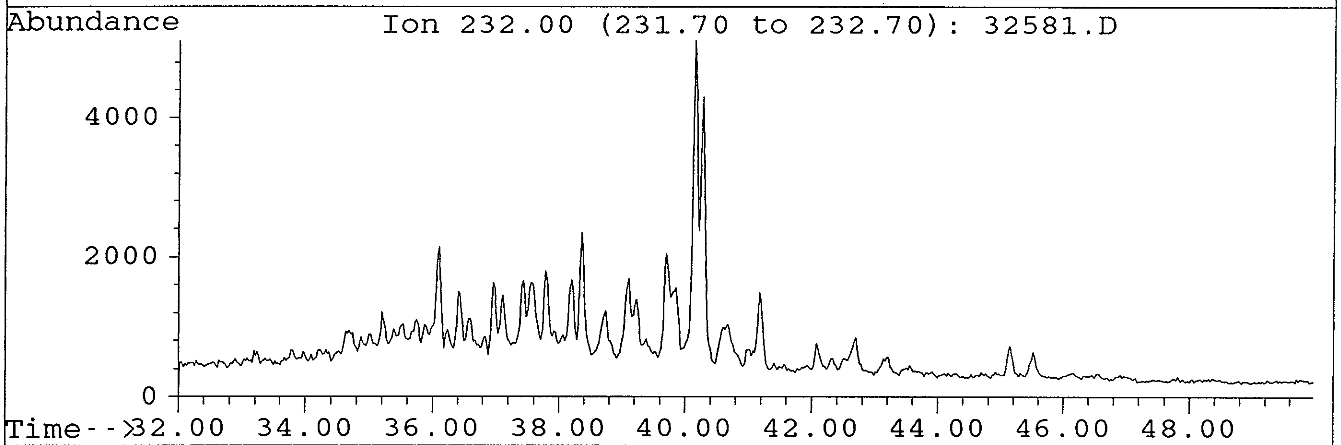


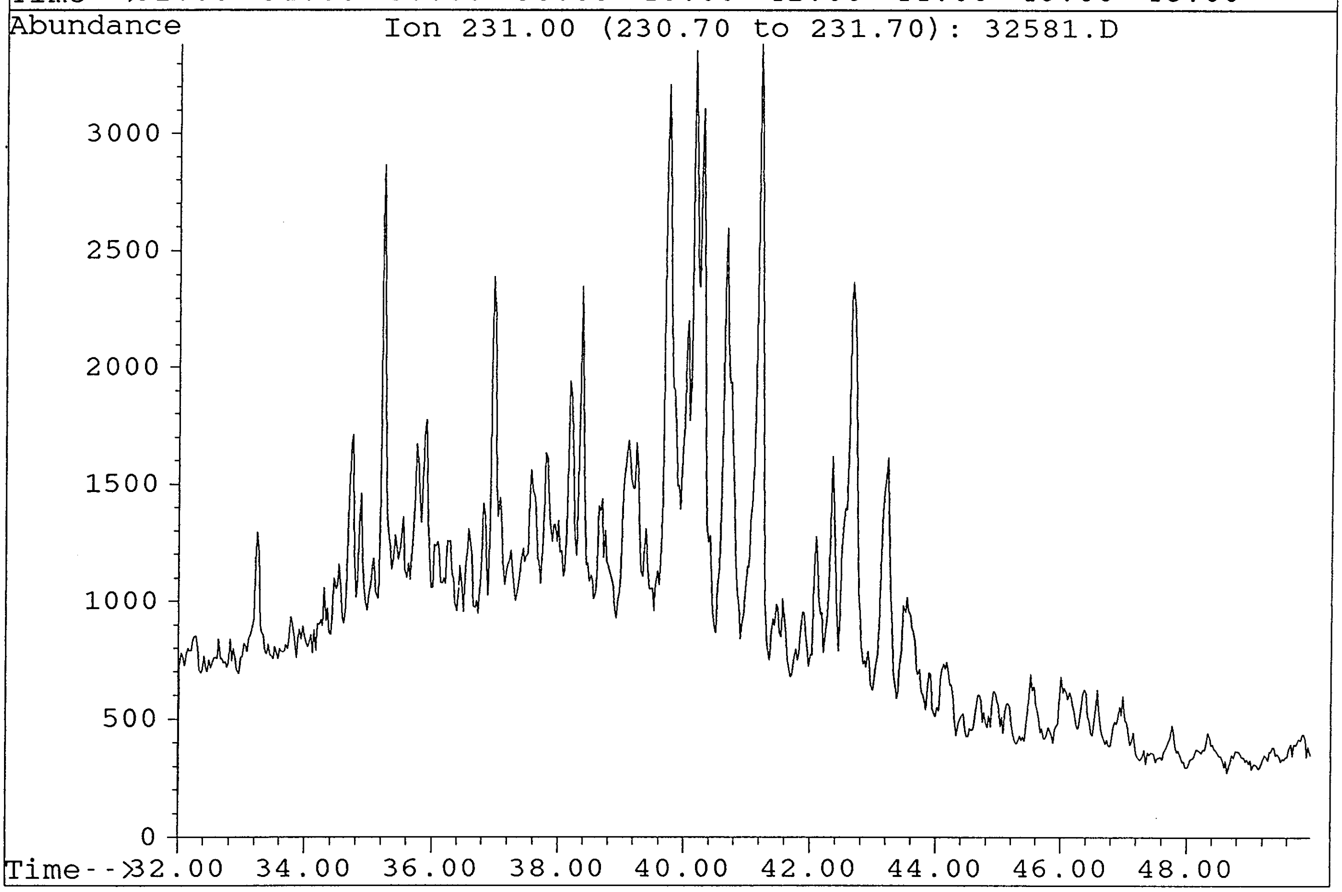
File : 32581.D
Sample : IONA-2 1358.0m B/C
Misc. Info : col#143, 18/3/94 SB



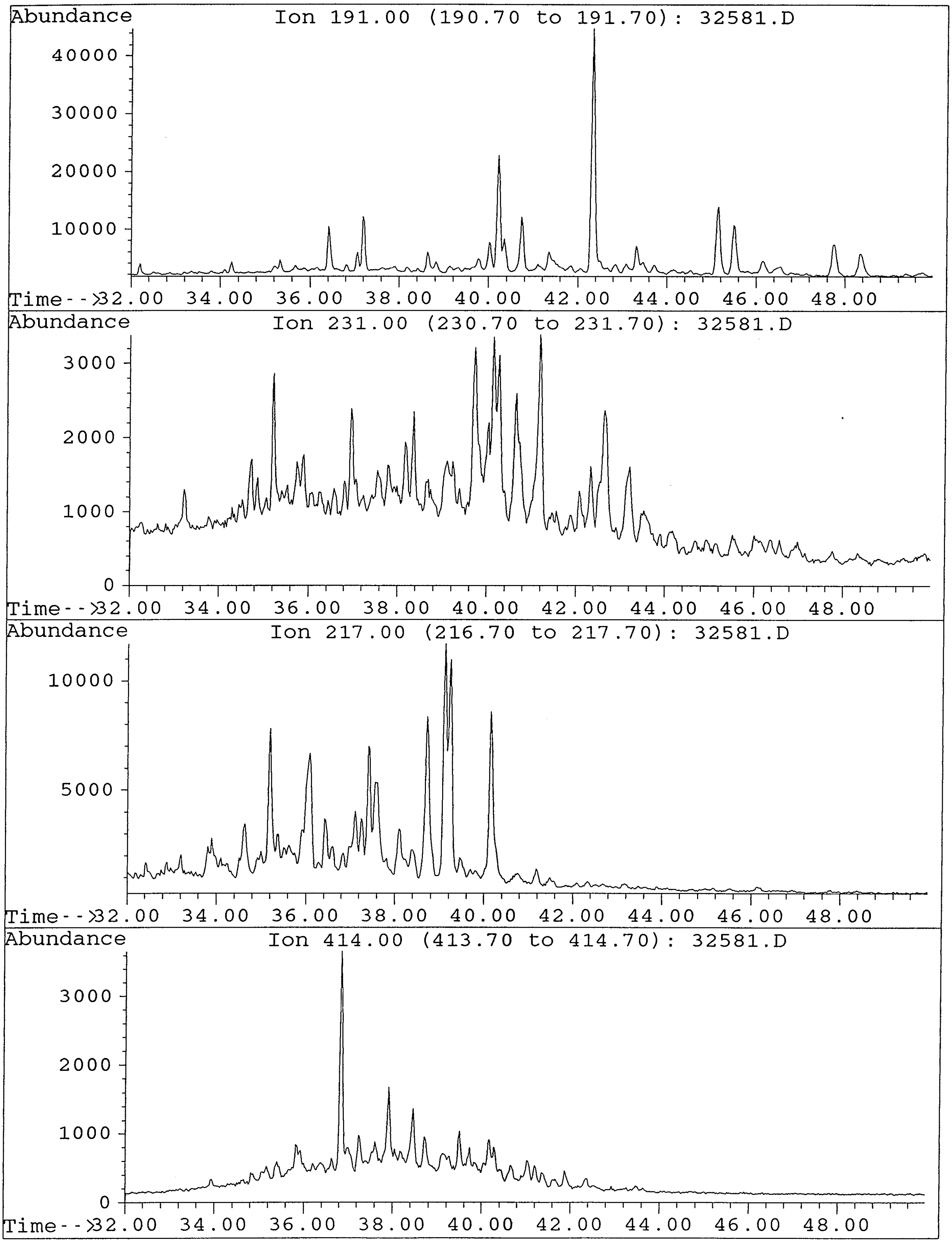
File : 32581.D
Sample : IONA-2 1358.0m B/C
Misc. Info : col#143, 18/3/94 SB



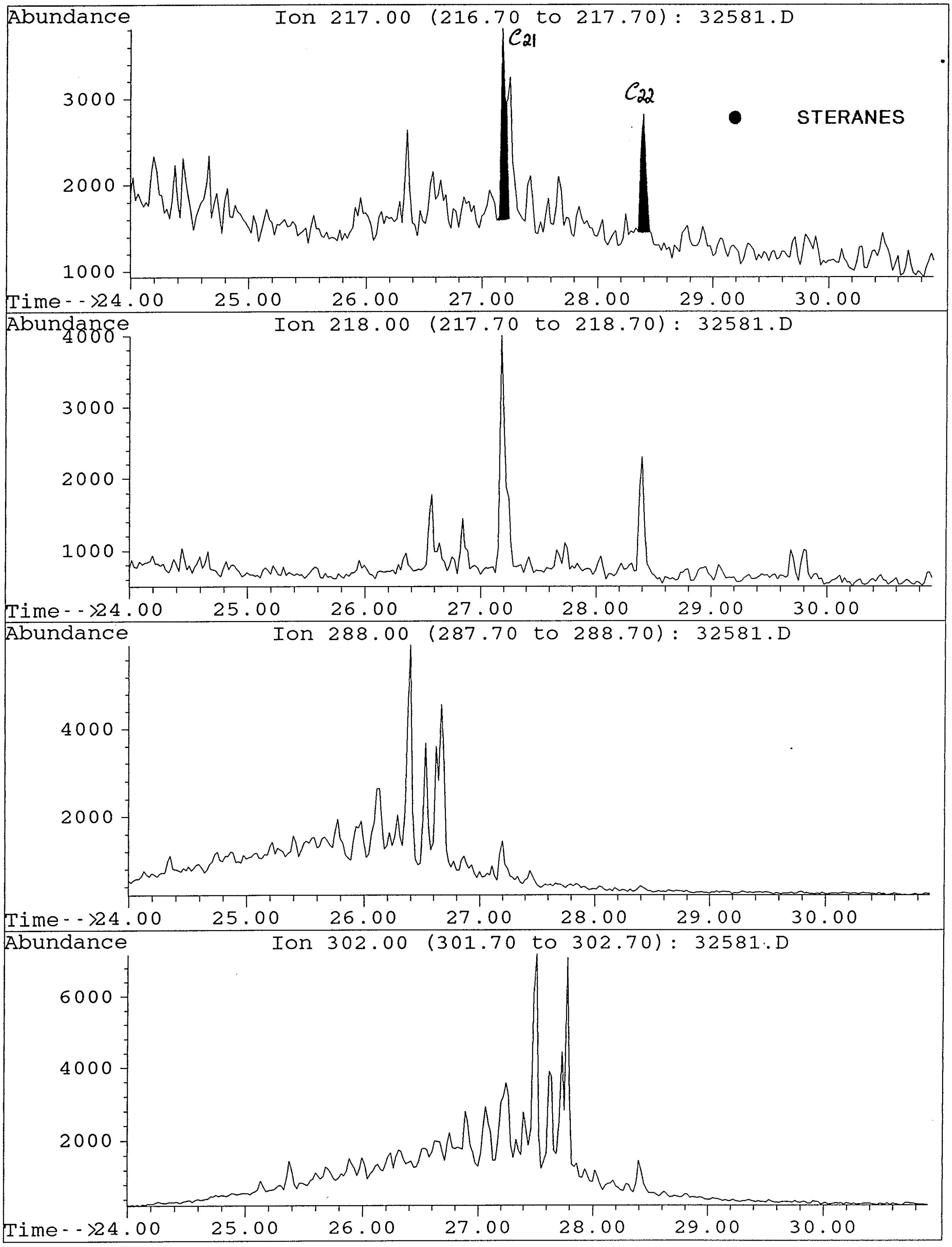




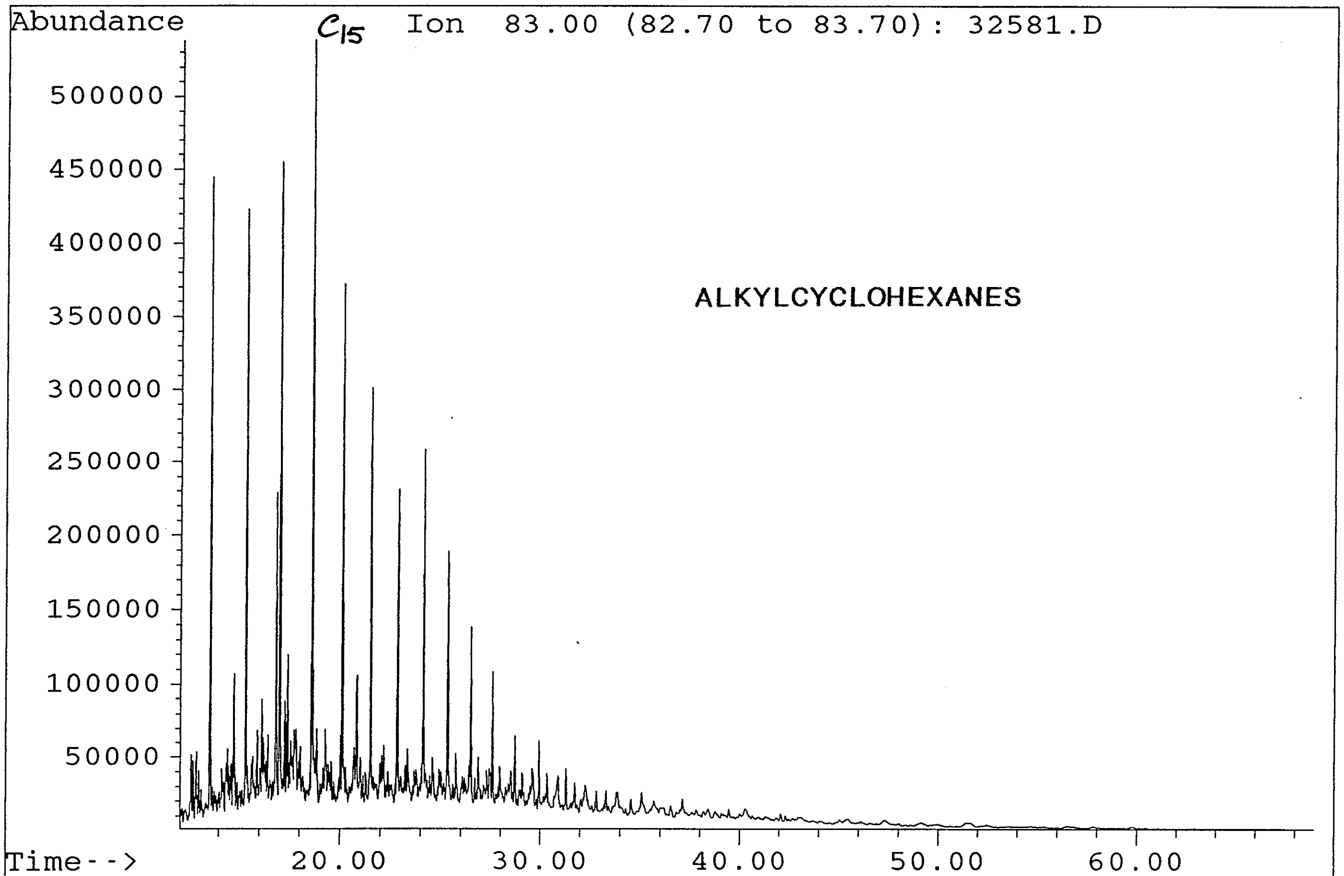
File : 32581.D
Sample : IONA-2 1358.0m B/C
Misc. Info : col#143, 18/3/94 SB

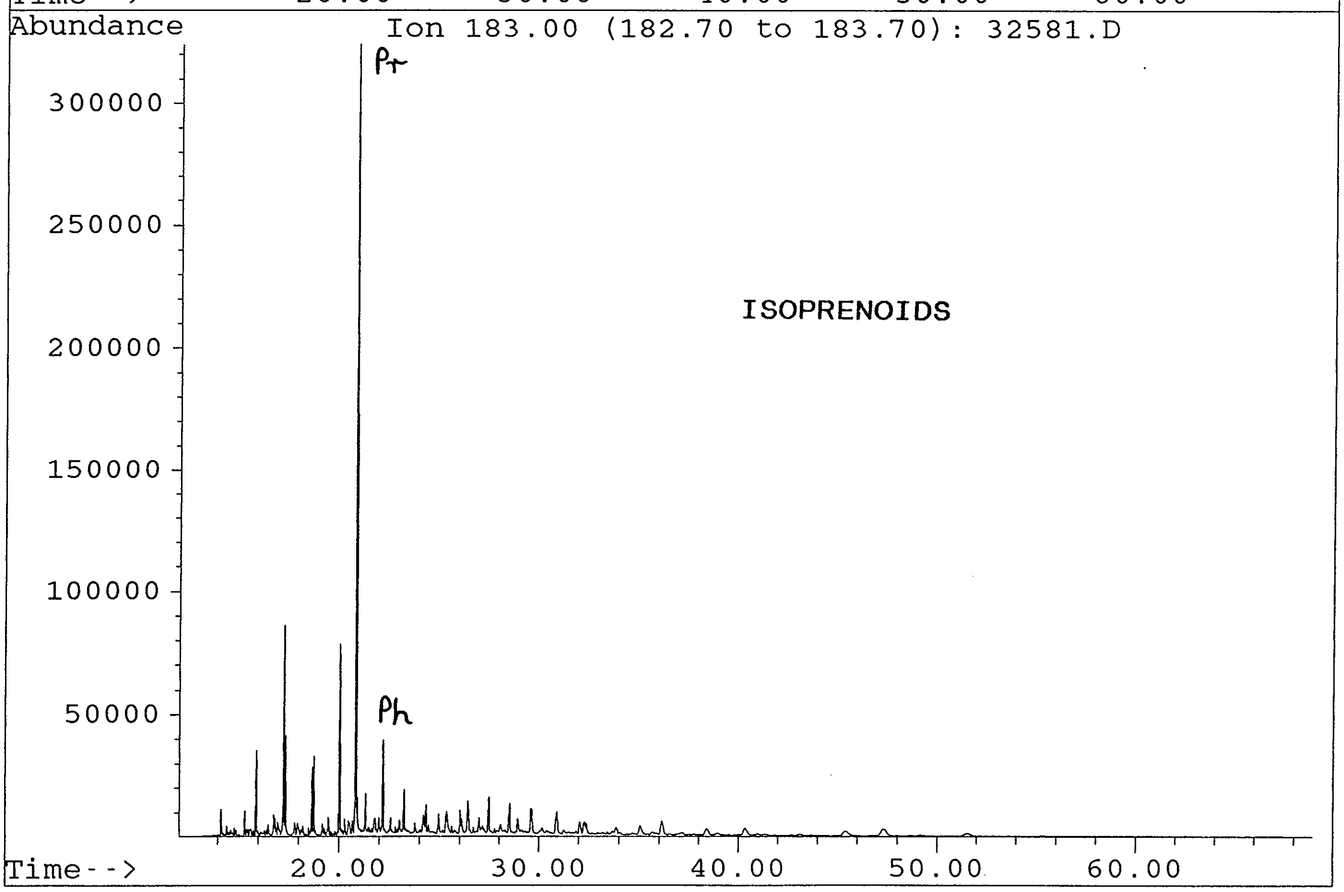


File : 32581.D
Sample : IONA-2 1358.0m B/C
Misc. Info : col#143, 18/3/94 SB

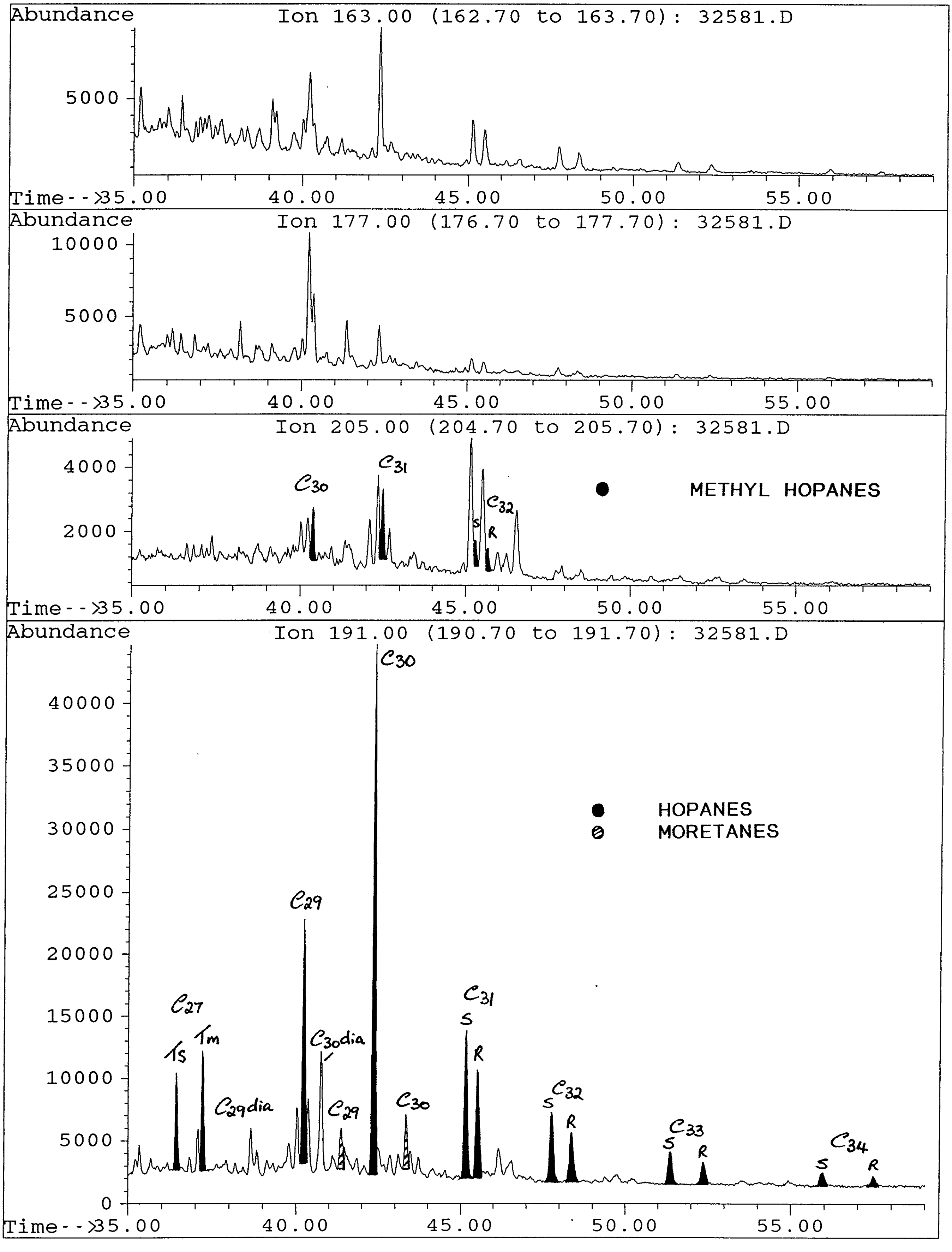


File : 32581.D
Sample : IONA-2 1358.0m B/C
Misc. Info : col#143, 18/3/94 SB

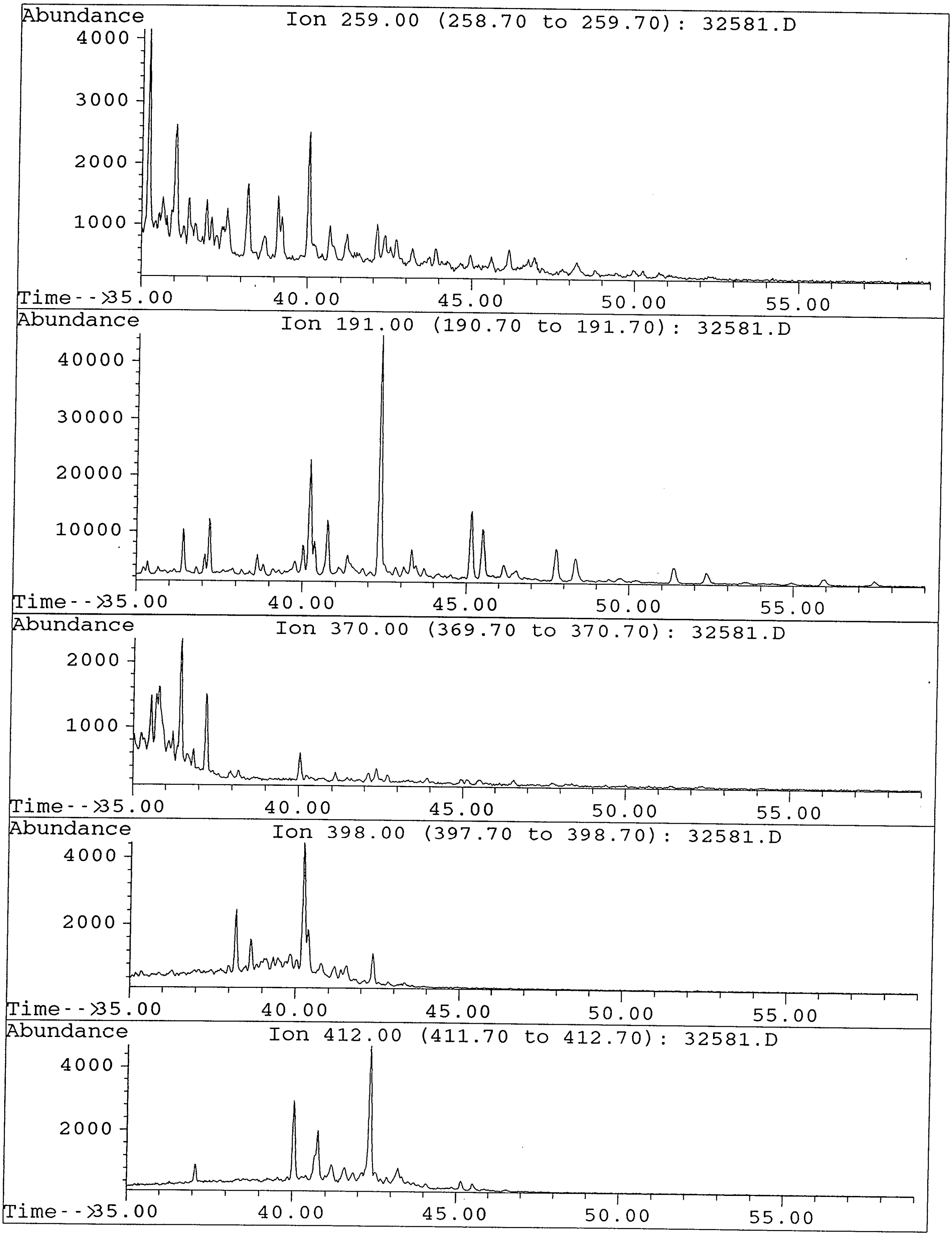




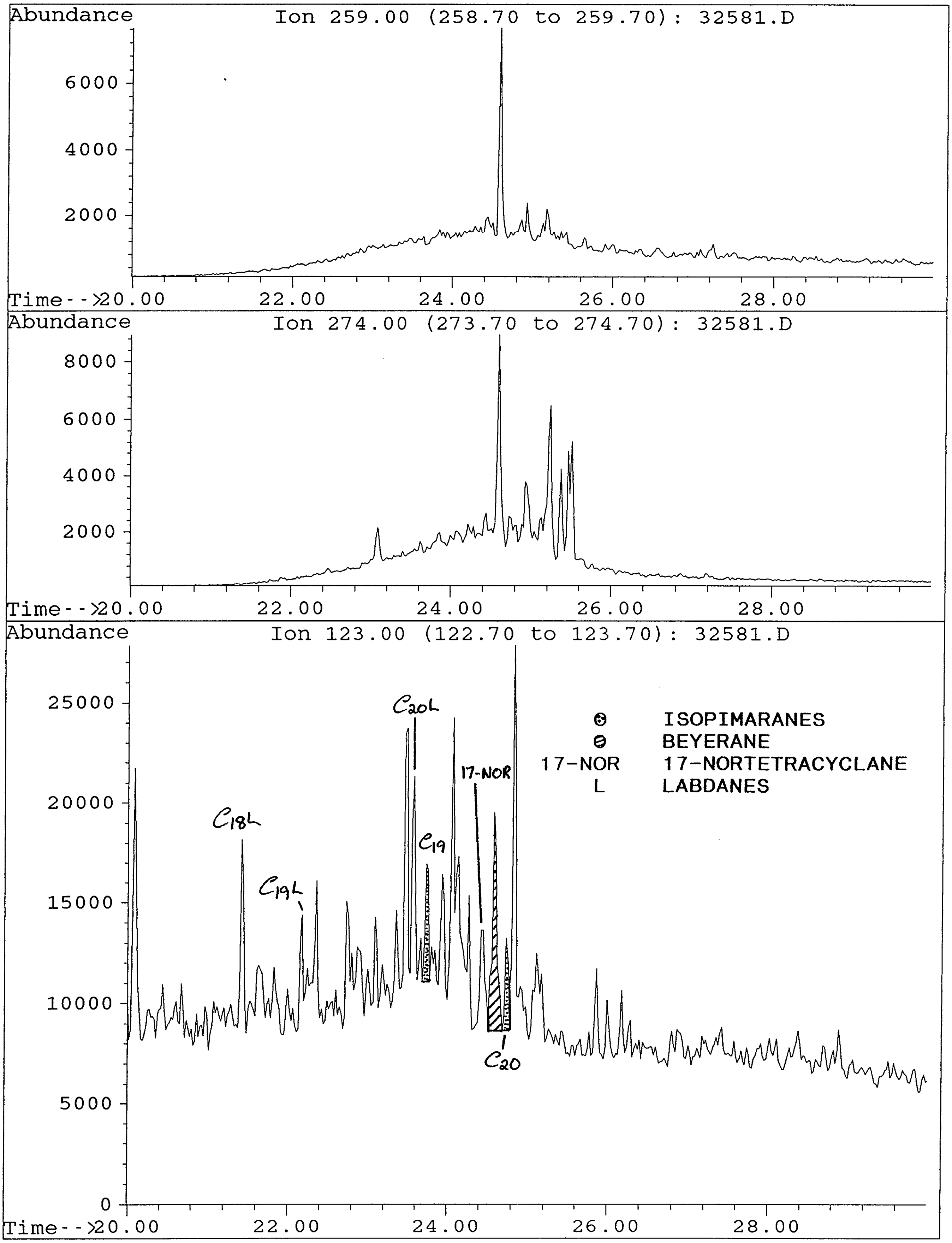
File : 32581.D
Sample : IONA-2 1358.0m B/C
Misc. Info : col#143, 18/3/94 SB



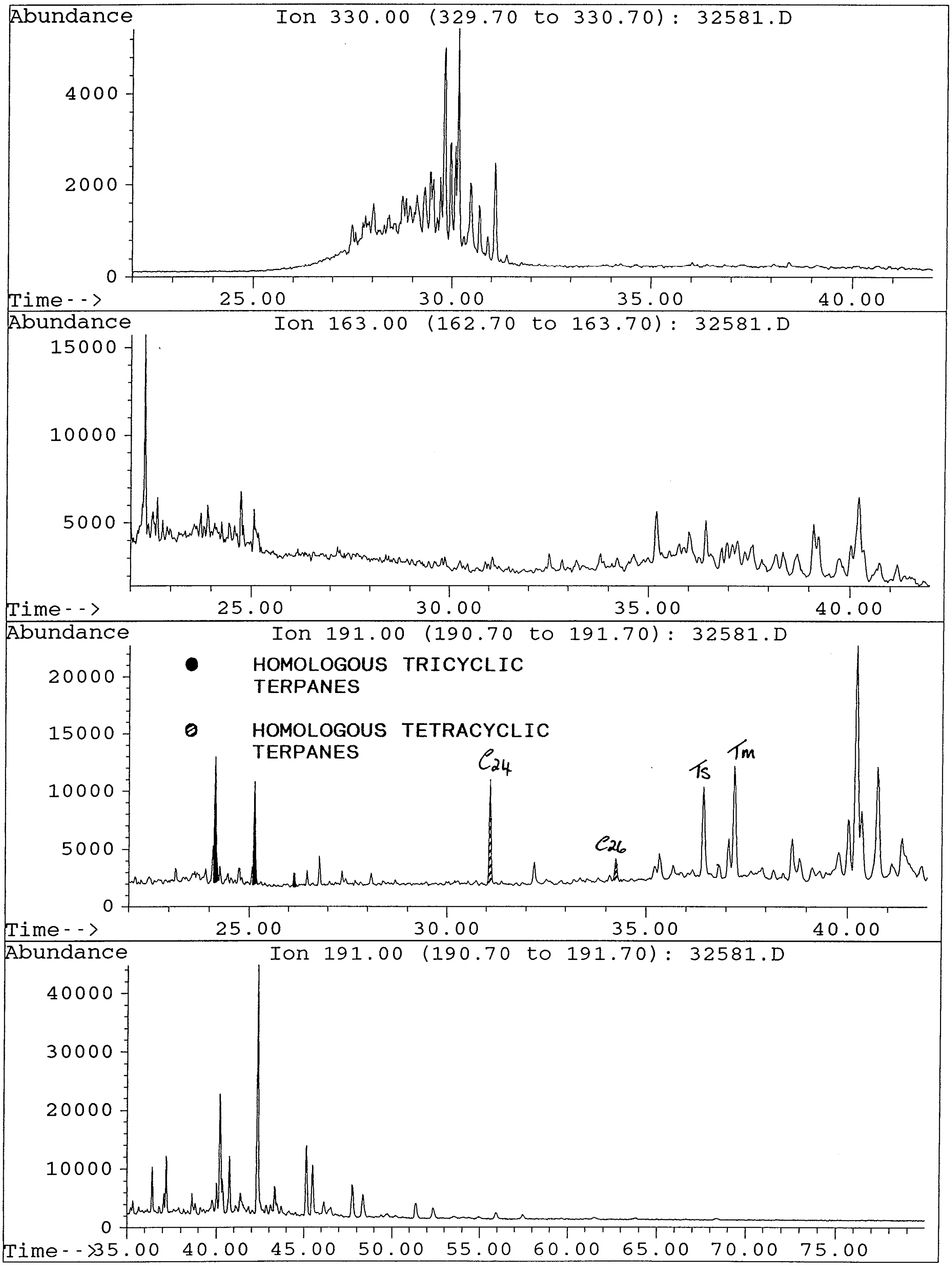
File : 32581.D
Sample : IONA-2 1358.0m B/C
Misc. Info : col#143, 18/3/94 SB



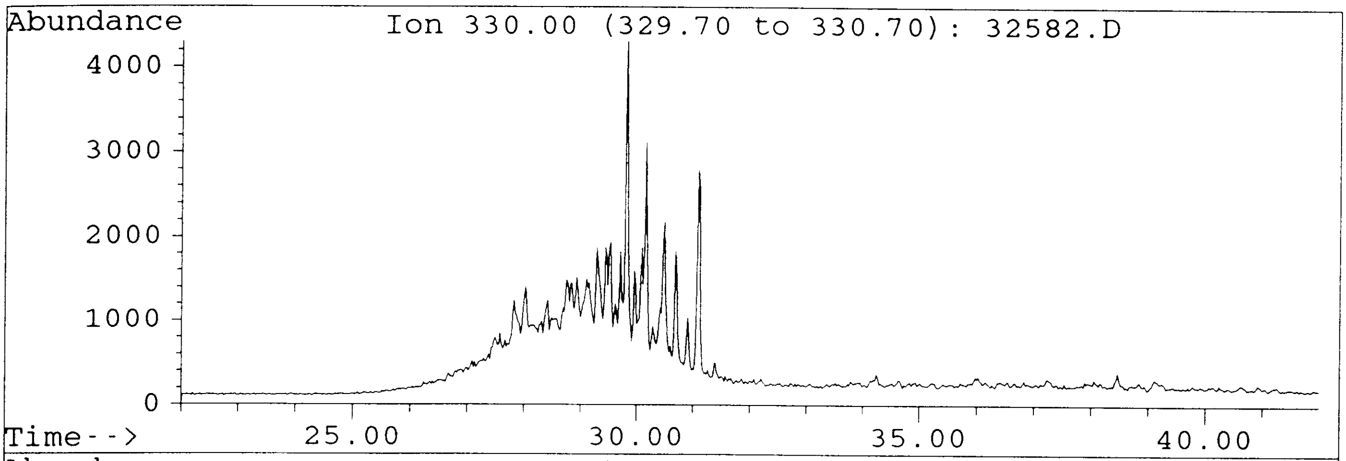
File : 32581.D
Sample : IONA-2 1358.0m B/C
Misc. Info : col#143, 18/3/94 SB

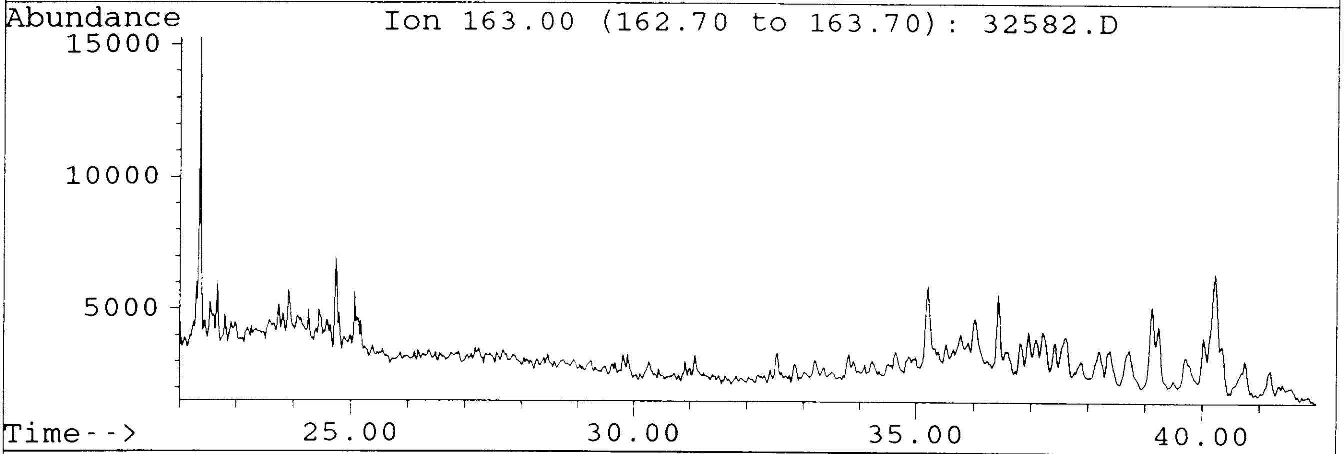


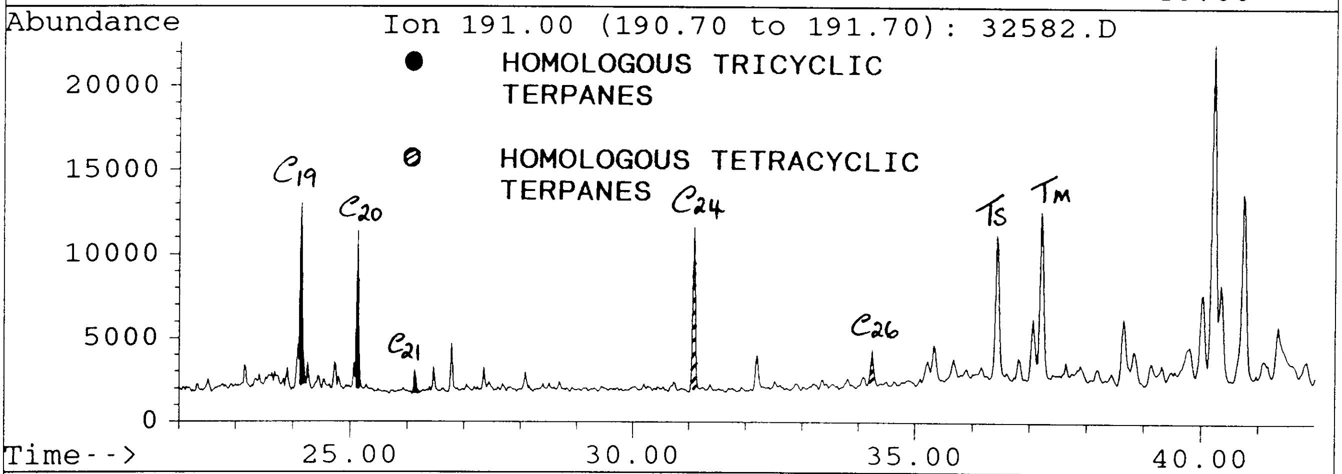
File : 32581.D
Sample : IONA-2 1358.0m B/C
Misc. Info : col#143, 18/3/94 SB

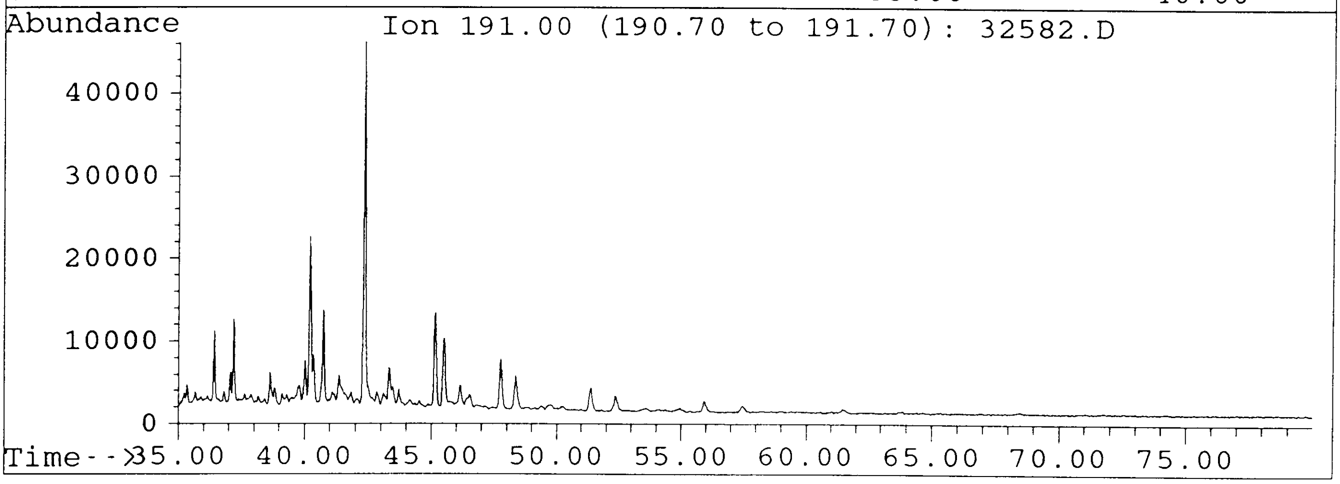


File : 32582.D
Sample : IONA-2 1408.5m B/C
Misc. Info : col#143, 18/3/94 SB

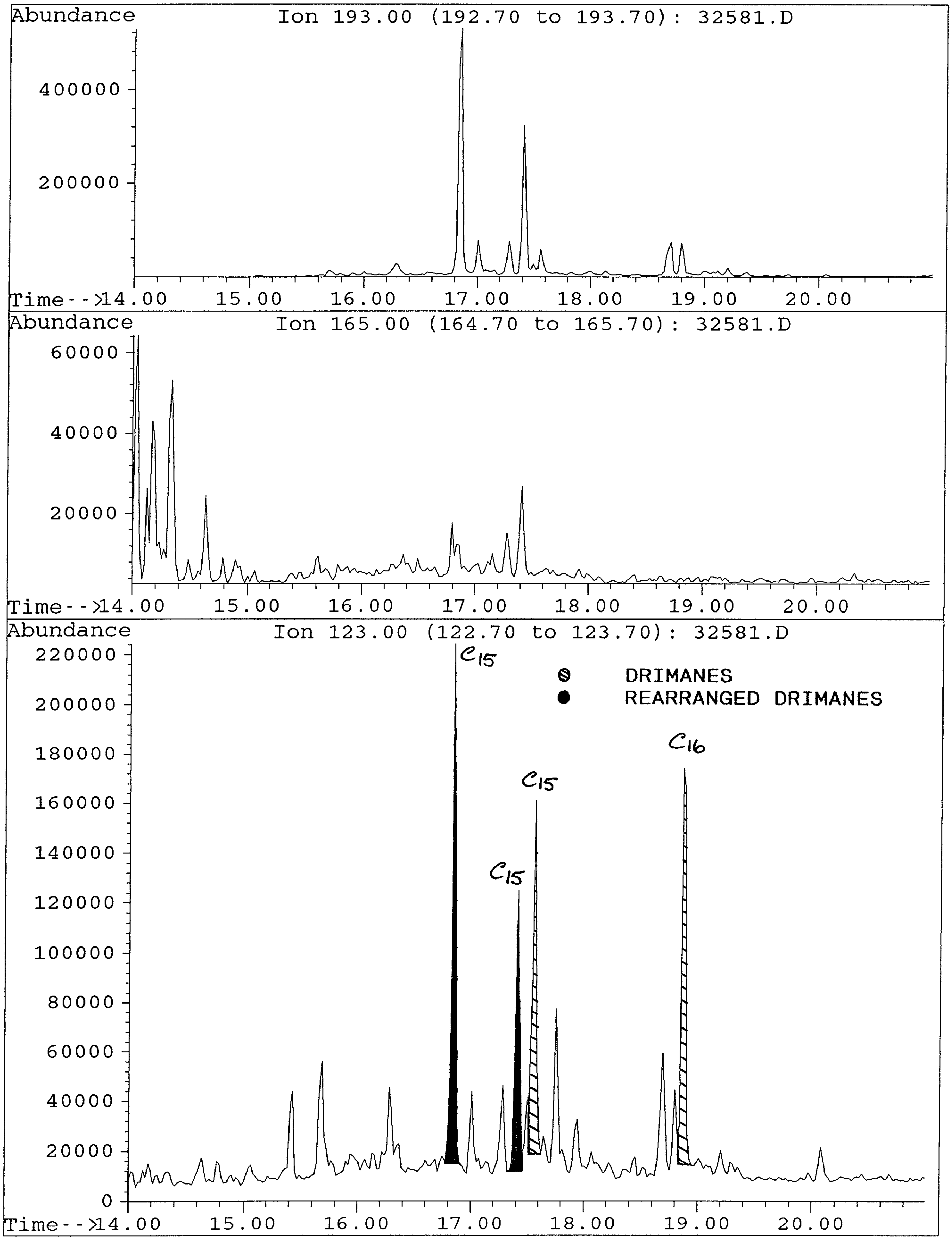




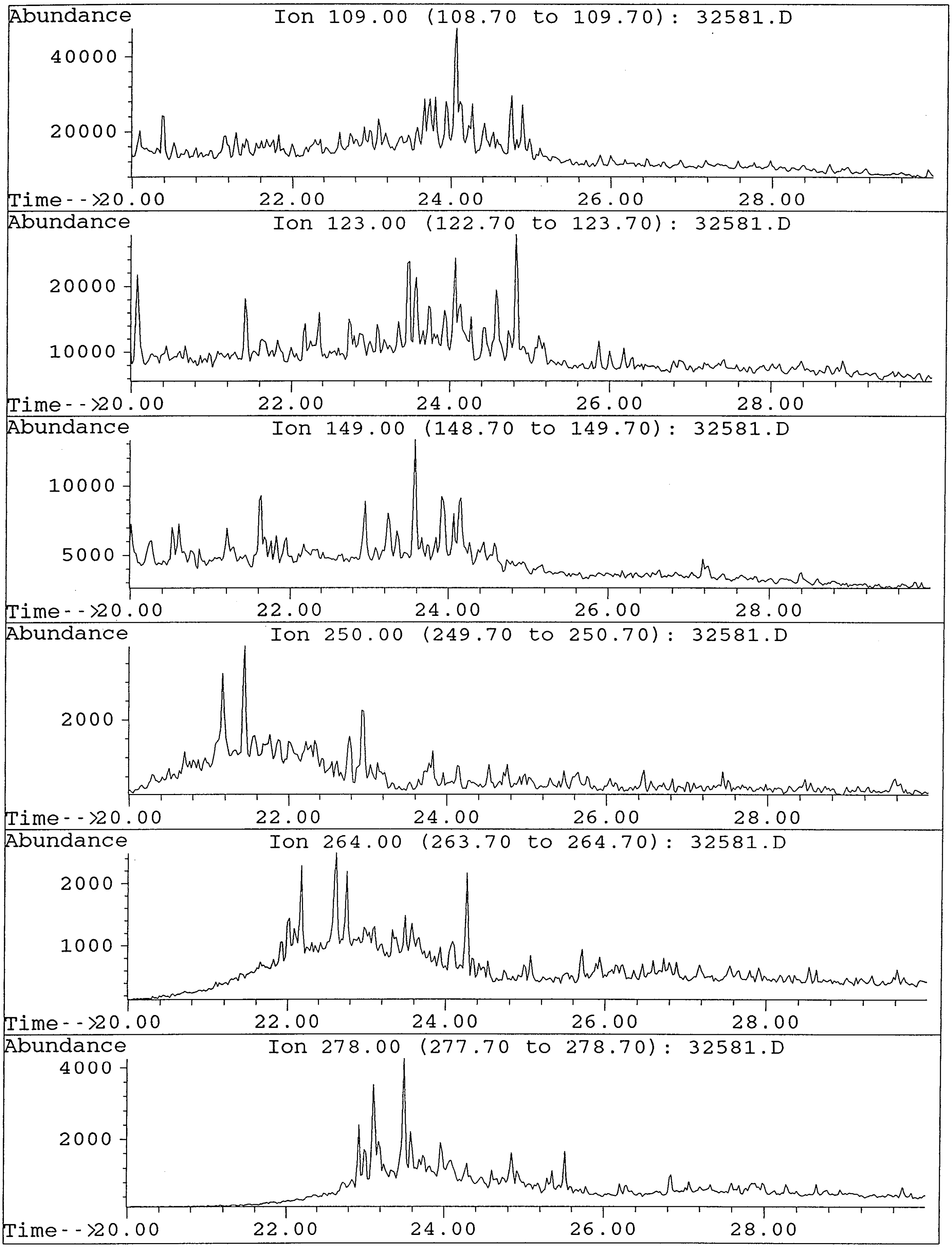




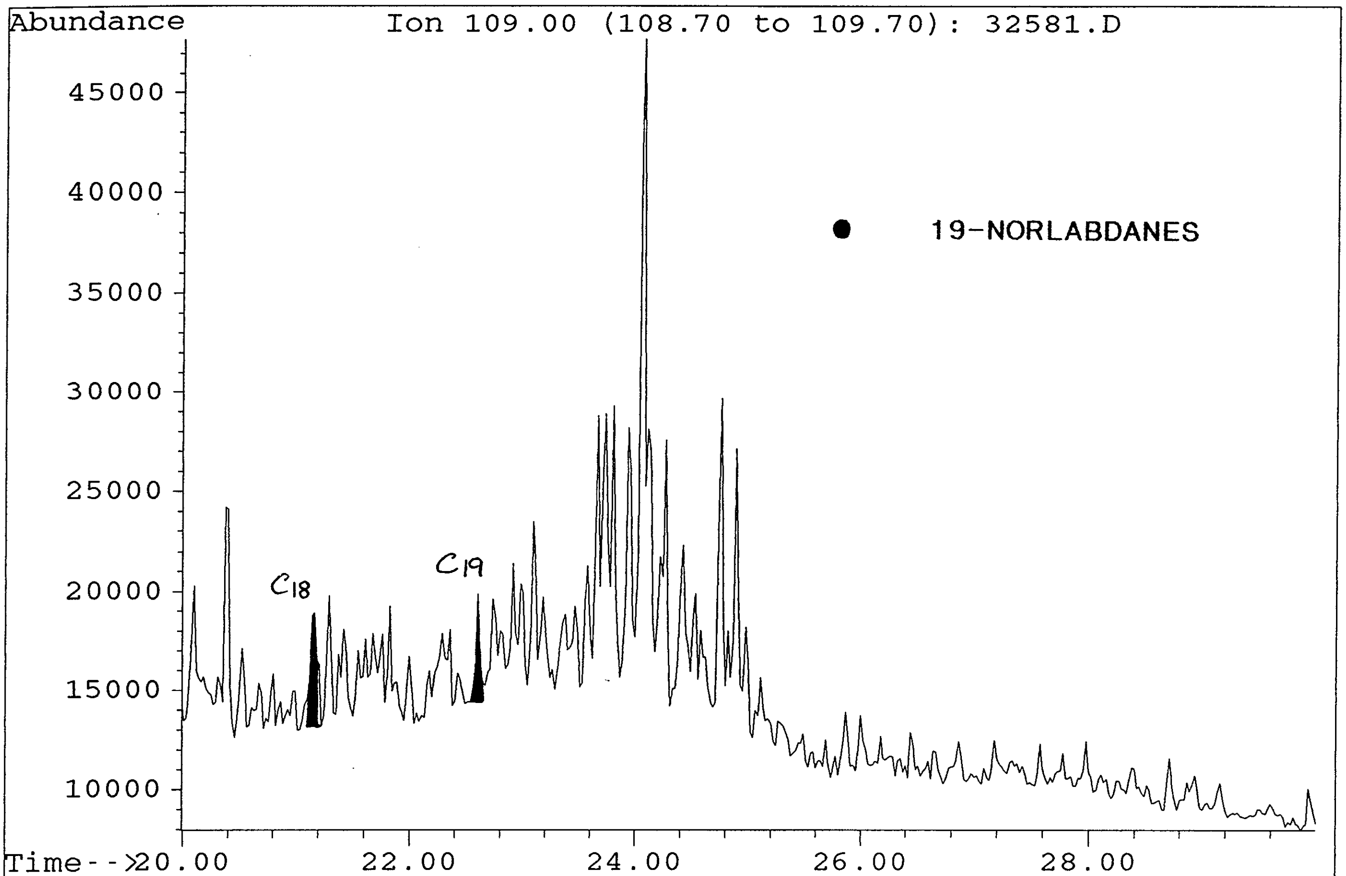
File : 32581.D
Sample : IONA-2 1358.0m B/C
Misc. Info : col#143, 18/3/94 SB

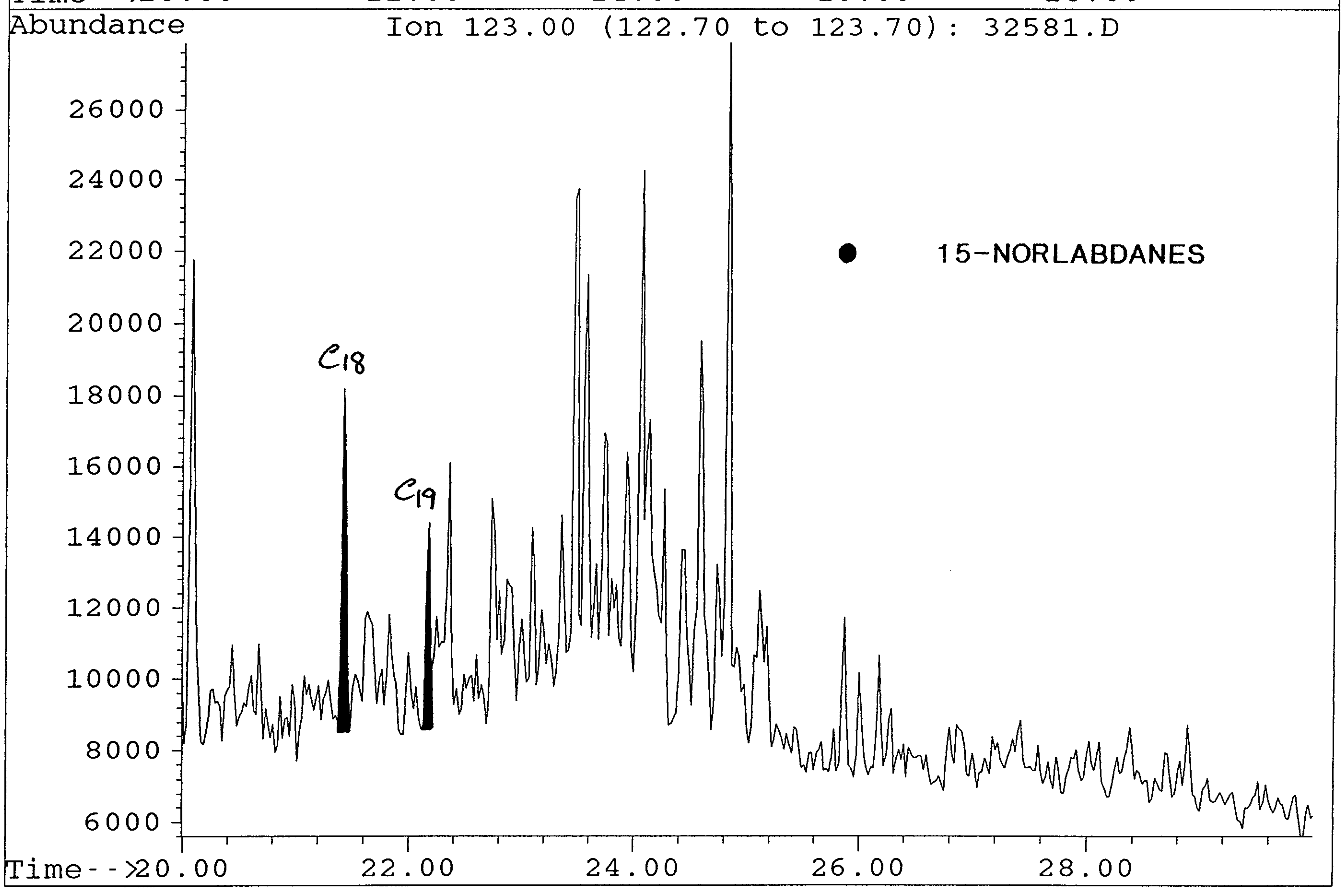


File : 32581.D
Sample : IONA-2 1358.0m B/C
Misc. Info : col#143, 18/3/94 SB

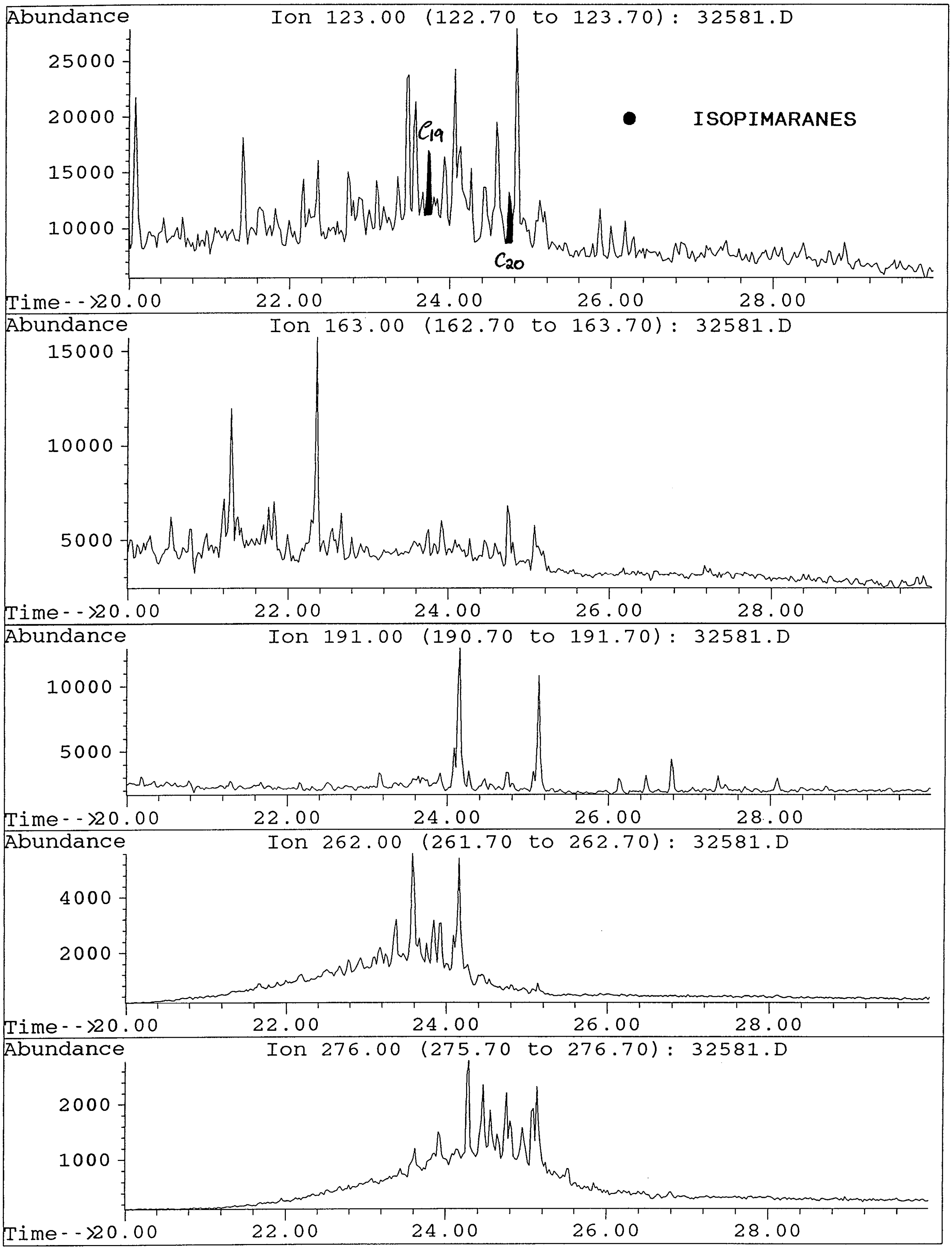


File : 32581.D
Sample : IONA-2 1358.0m B/C
Misc. Info : col#143, 18/3/94 SB

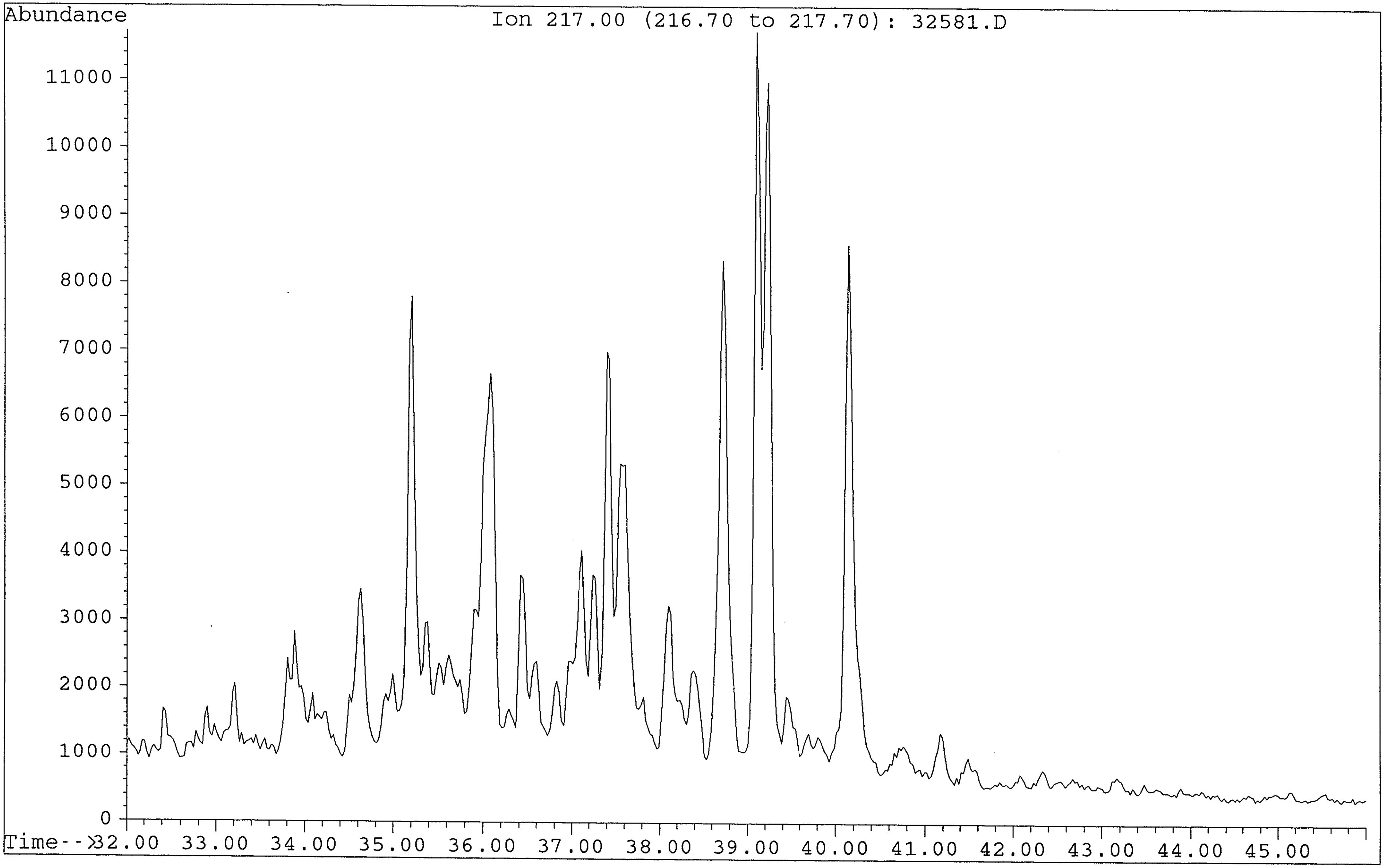




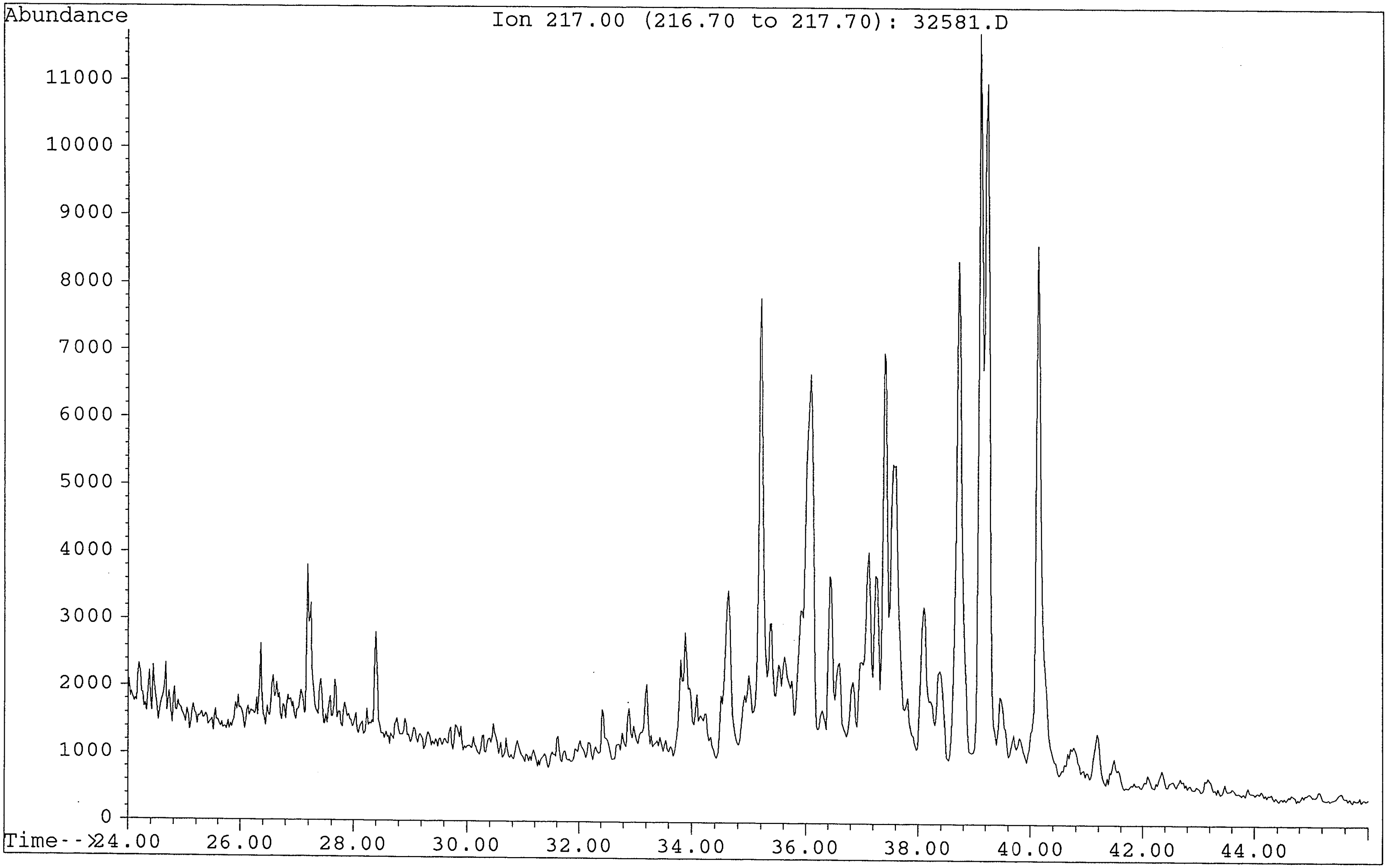
File : 32581.D
Sample : IONA-2 1358.0m B/C
Misc. Info : col#143, 18/3/94 SB



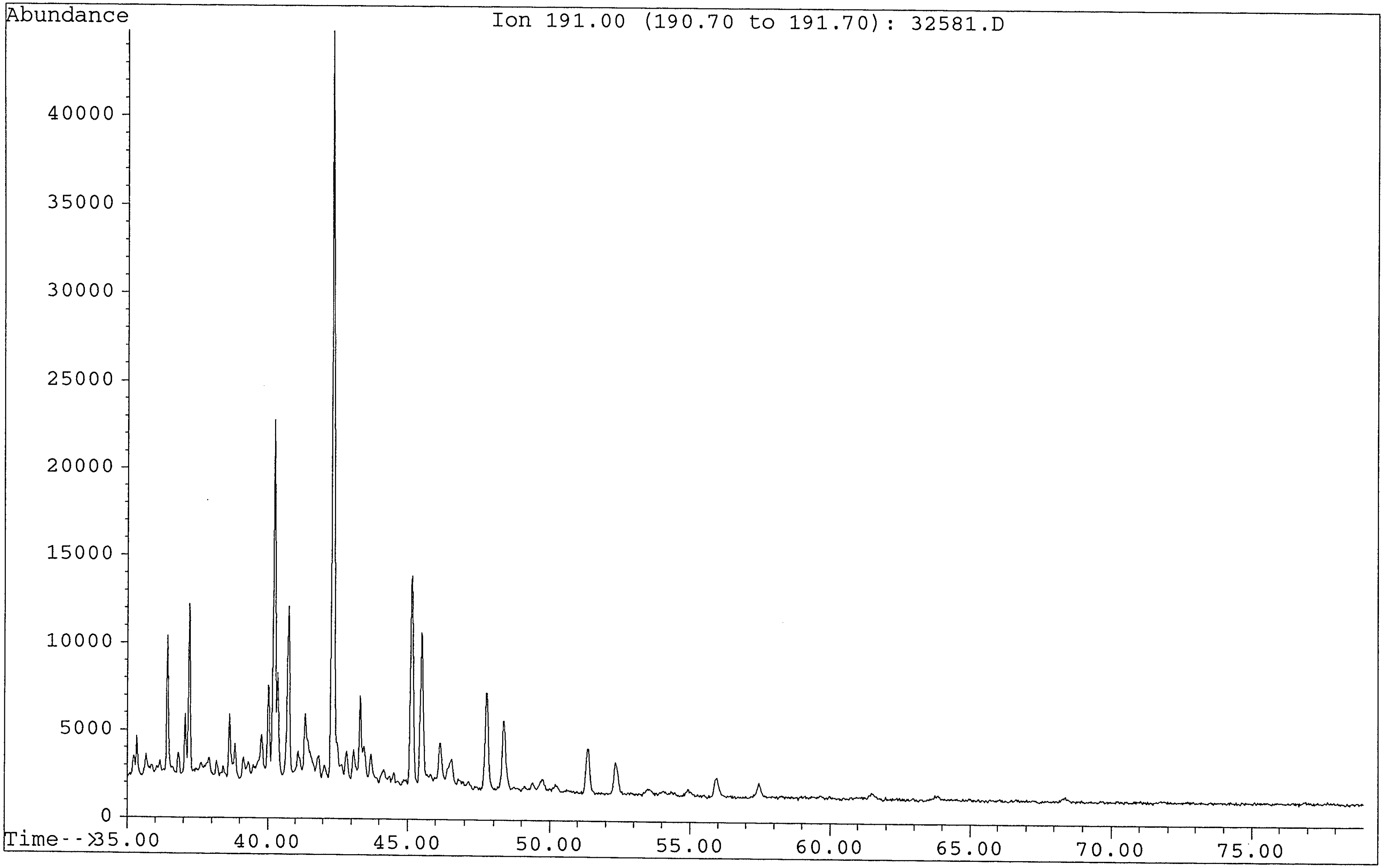
File : 32581.D
Sample : IONA-2 1358.0m B/C
Misc. Info : col#143, 18/3/94 SB



File : 32581.D
Sample : IONA-2 1358.0m B/C
Misc. Info : col#143, 18/3/94 SB



File : 32581.D
Sample : IONA-2 1358.0m B/C
Misc. Info : col#143, 18/3/94 SB



File : 32581.D
Sample : IONA-2 1358.0m B/C
Misc. Info : col#143, 18/3/94 SB

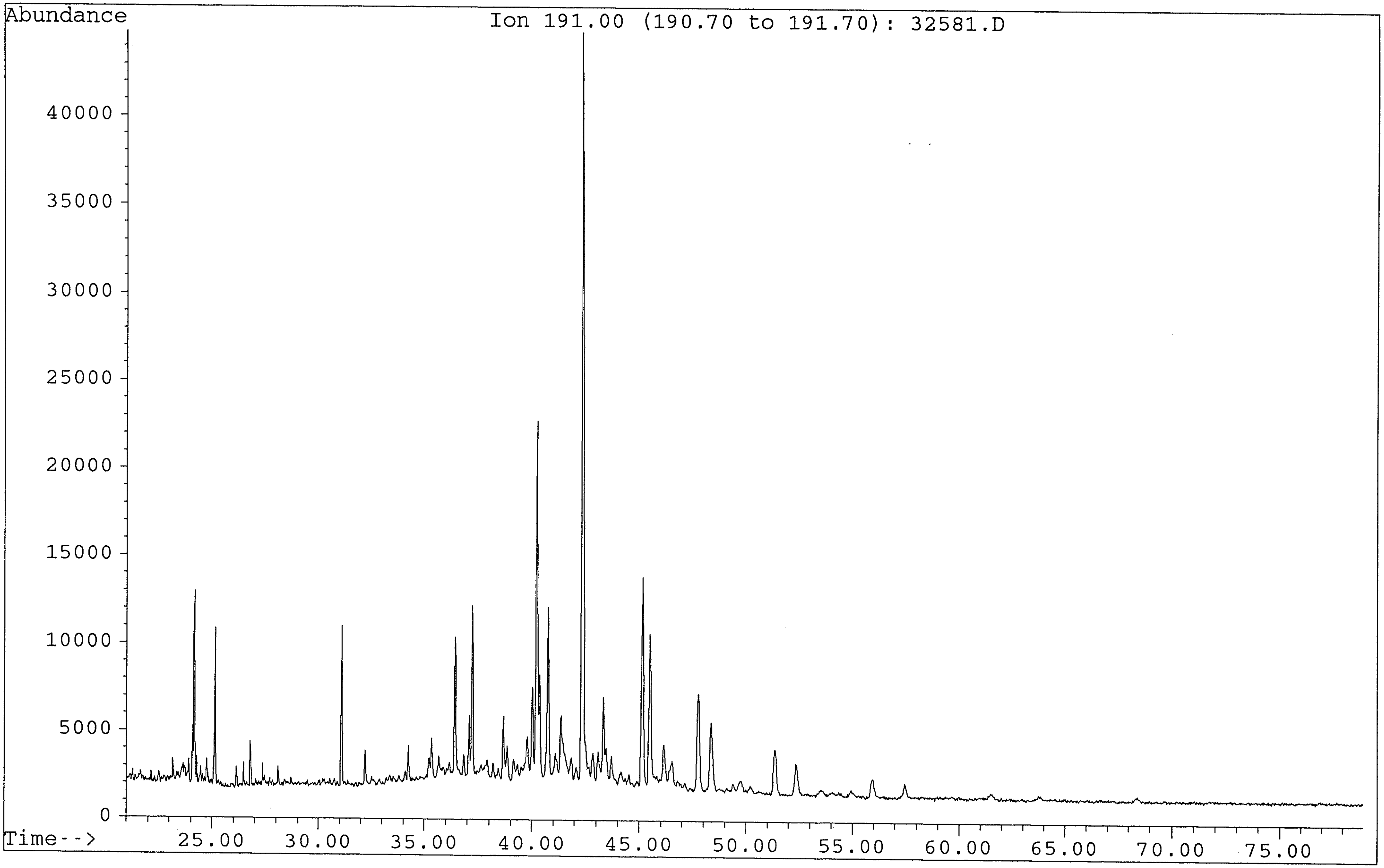


TABLE 5.2

SELECTED PARAMETERS FROM GC/MS ANALYSIS

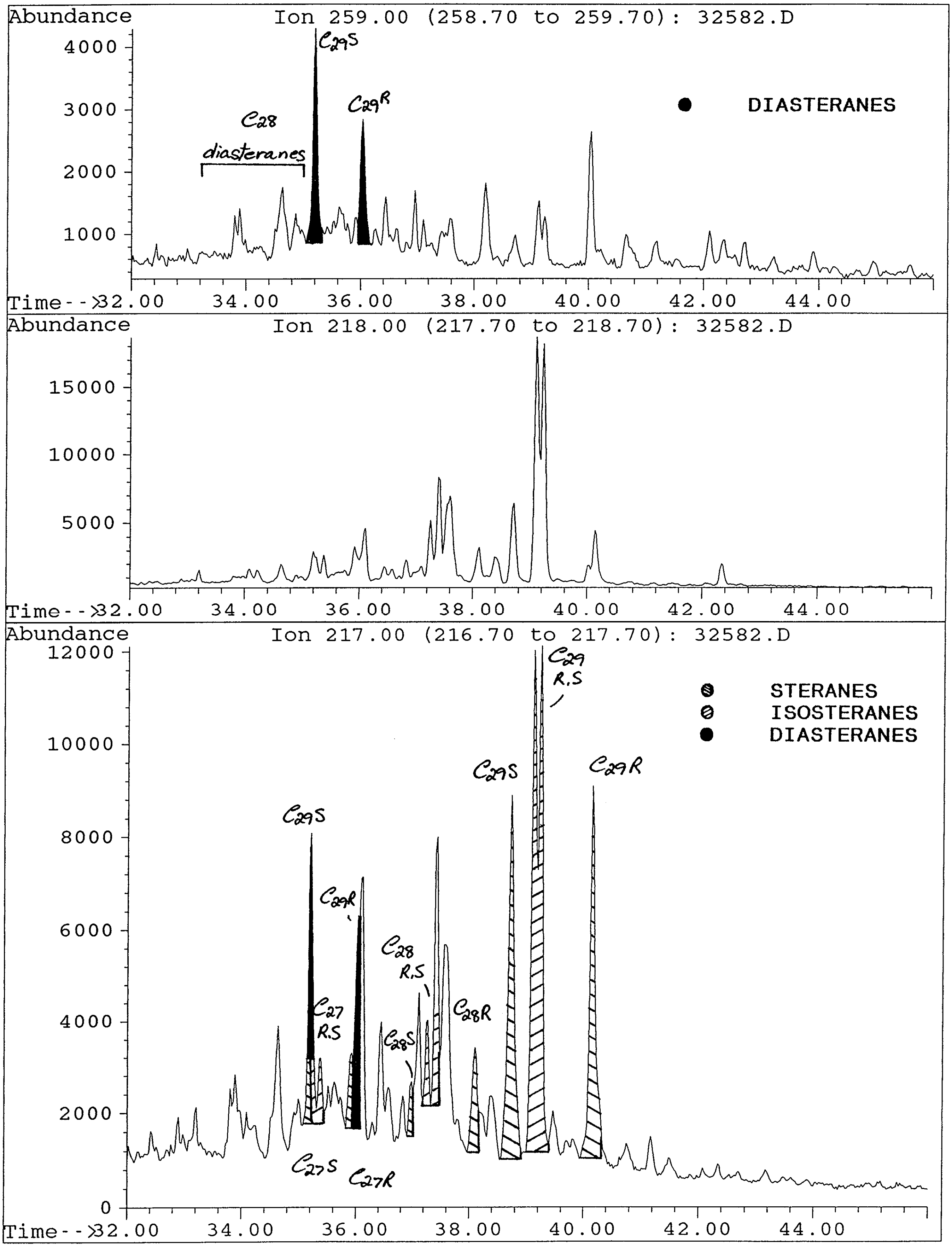
IONA 2, 1408.5m, SWC

	Parameter	Ion(s)	Value
1.	18 α (H)- hopane/17 α (H)-hopane (Ts/Tm)	191	0.85
2.	C30 hopane/C30 moretane	191	9.81
3.	C31 22S hopane/C31 22R hopane	191	1.39
4.	C32 22S hopane/C32 22R hopane	191	1.49
5.	C29 20S $\alpha\alpha\alpha$ sterane/C29 20R $\alpha\alpha\alpha$ sterane	217	0.95
6.	C29 $\alpha\alpha\alpha$ steranes (20S / 20S+20R)	217	0.49
7.	C29 $\alpha\beta\beta$ steranes / (C29 $\alpha\alpha\alpha$ steranes + C29 $\alpha\beta\beta$ steranes)	217	0.58
8.	C27/C29 diasteranes	259	nd
9.	C27/C29 steranes	217	0.23
10.	18 α (H)-oleanane/C30 hopane	191	nd
11.	C29 diasteranes / (C29 $\alpha\alpha\alpha$ steranes + C29 $\alpha\beta\beta$ steranes)	217	0.35
12.	C30 (hopane + moretane) / C29 (steranes + diasteranes)	191/217	0.94
13.	C15 drimane/C16 homodrimane	123	0.89
14.	Rearranged drimanes/normal drimanes	123	0.87

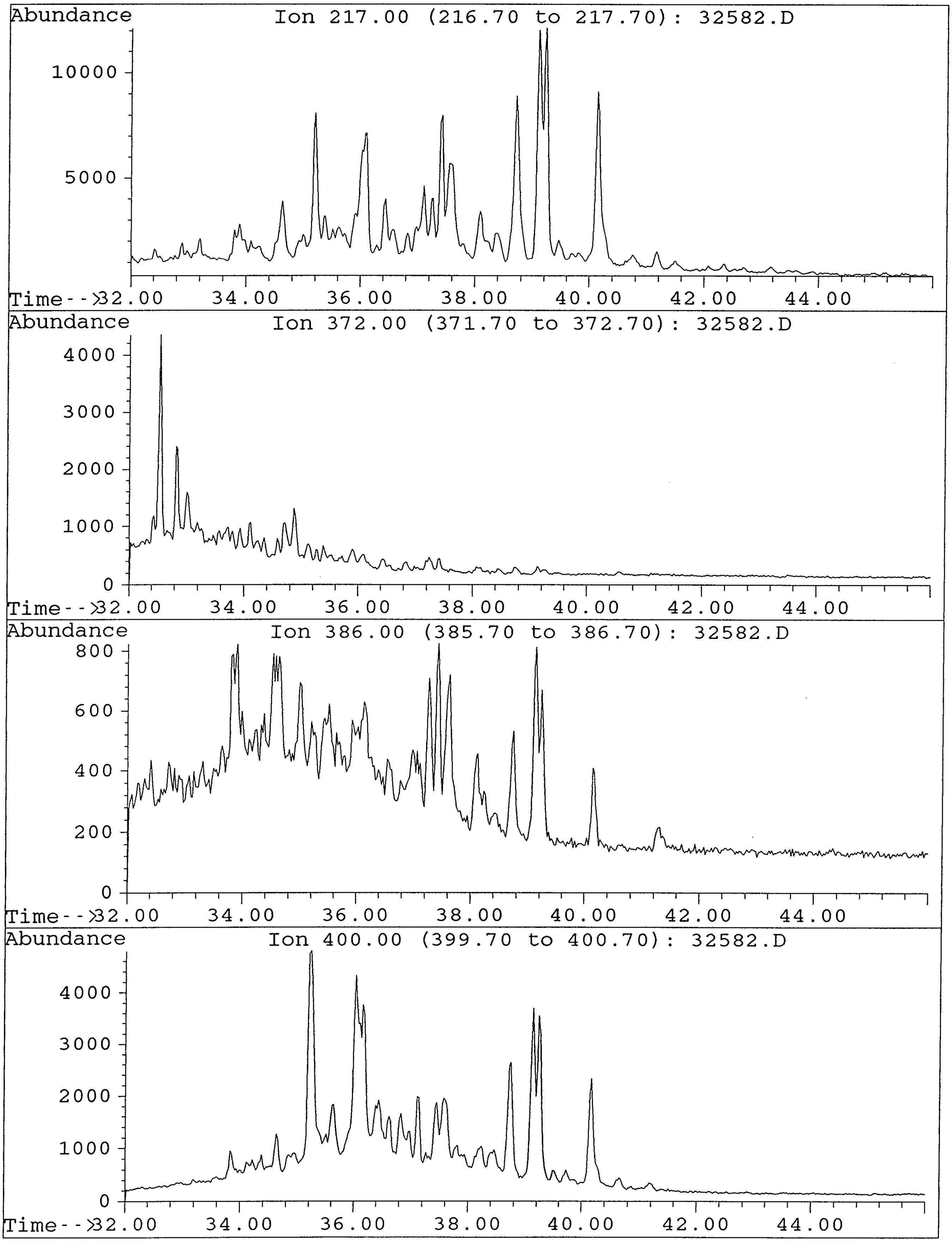
nd = not detectable

Figure 3-2

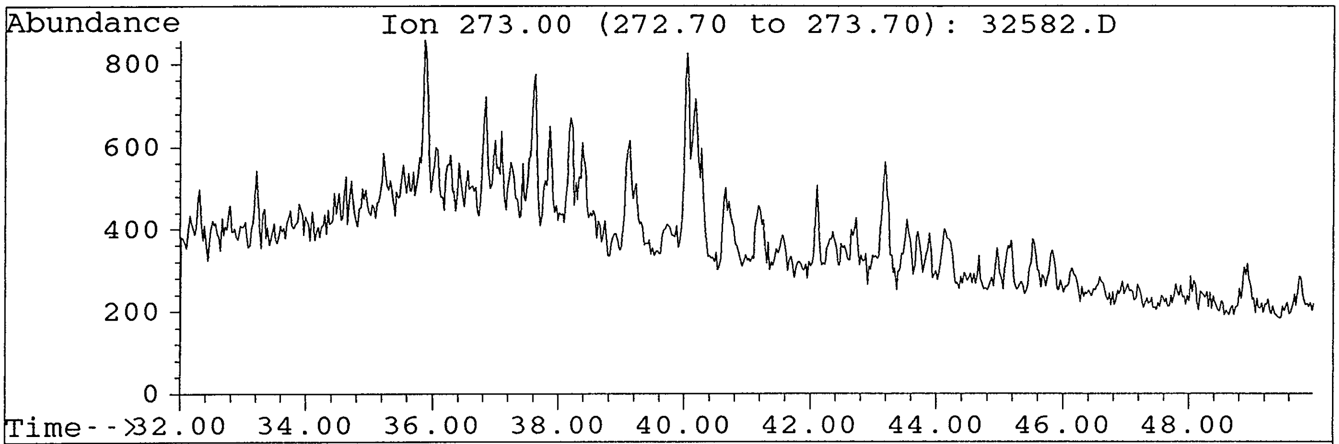
File : 32582.D
Sample : IONA-2 1408.5m B/C
Misc. Info : col#143, 18/3/94 SB

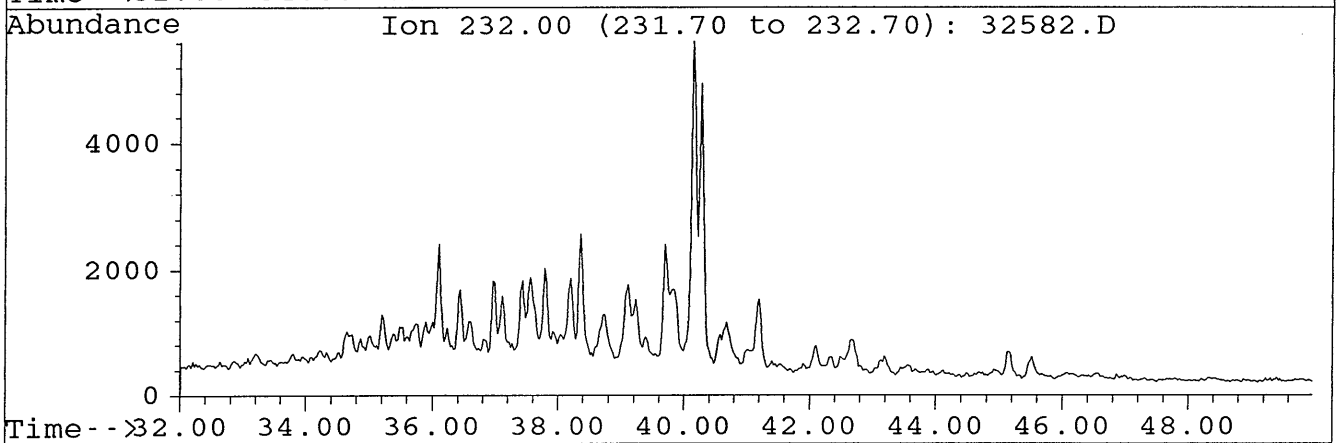


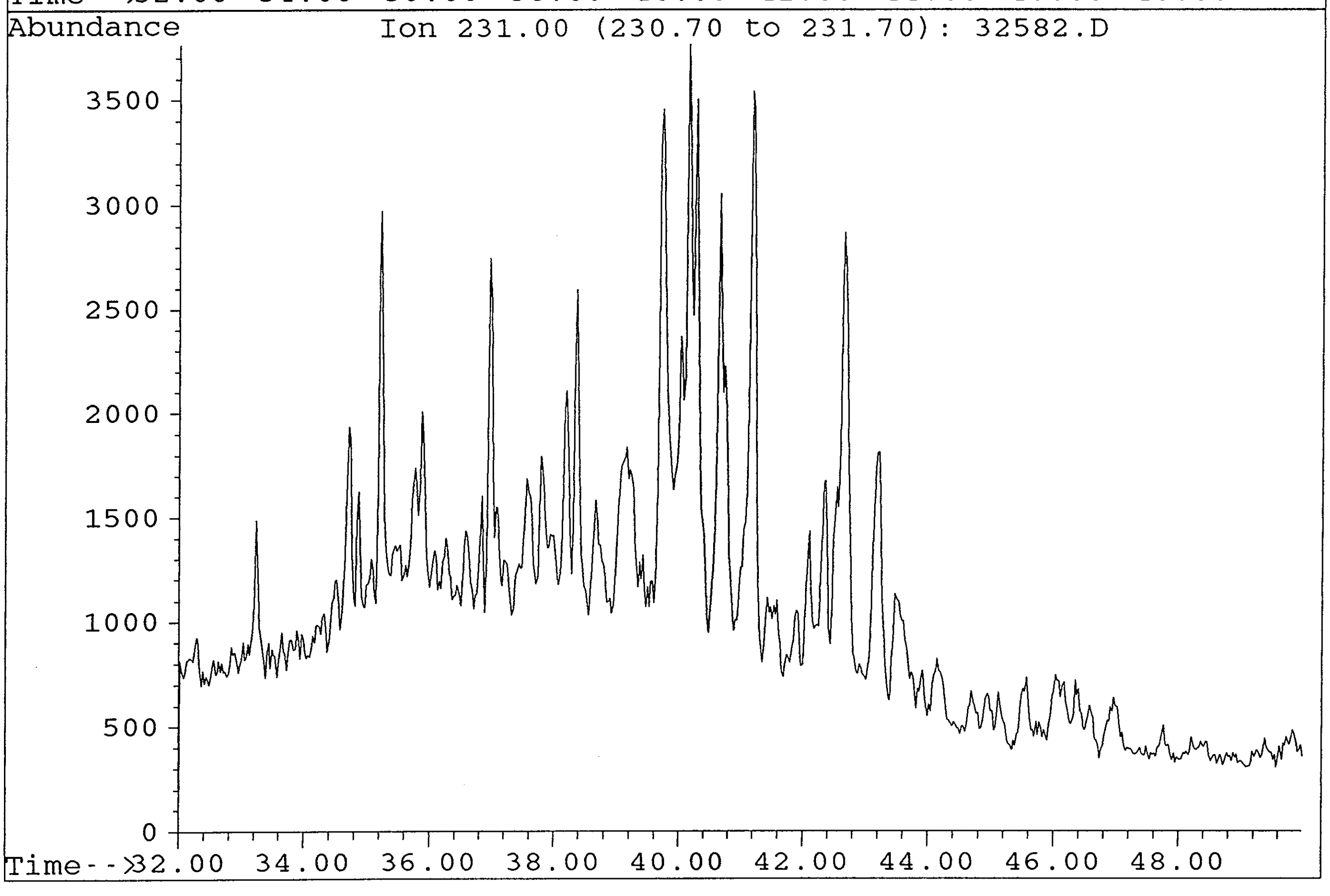
File : 32582.D
Sample : IONA-2 1408.5m B/C
Misc. Info : col#143, 18/3/94 SB



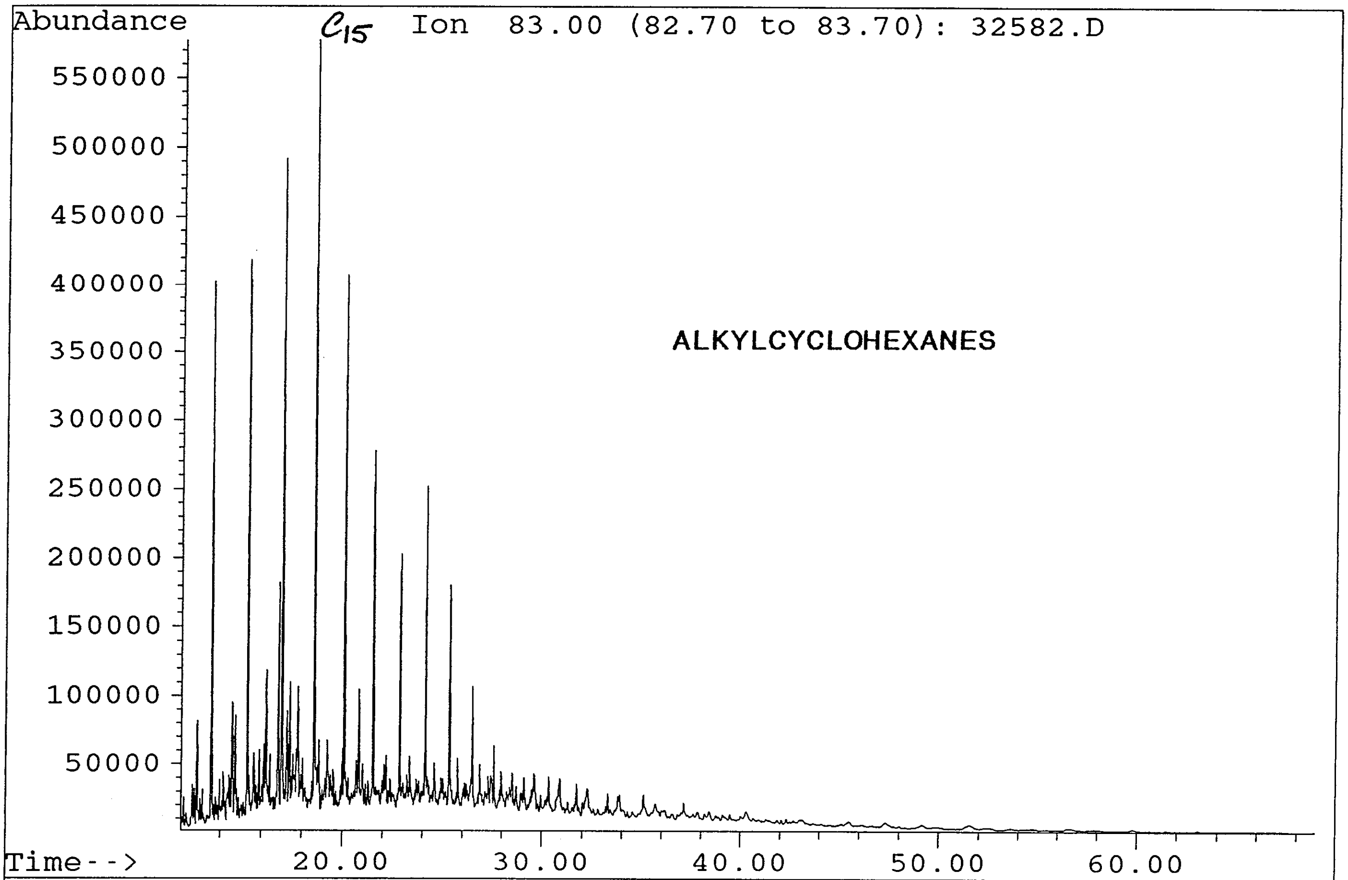
File : 32582.D
Sample : IONA-2 1408.5m B/C
Misc. Info : col#143, 18/3/94 SB

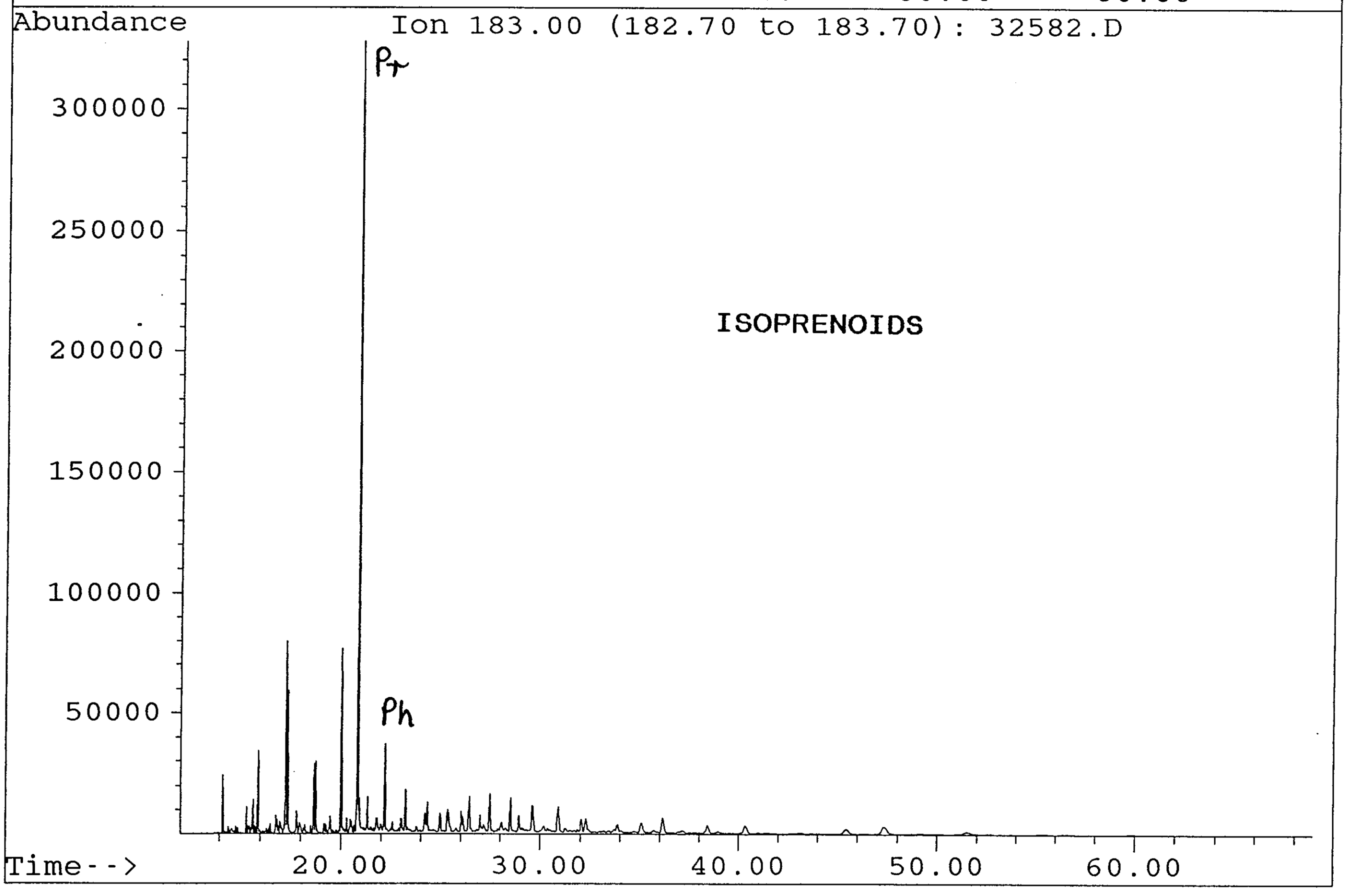




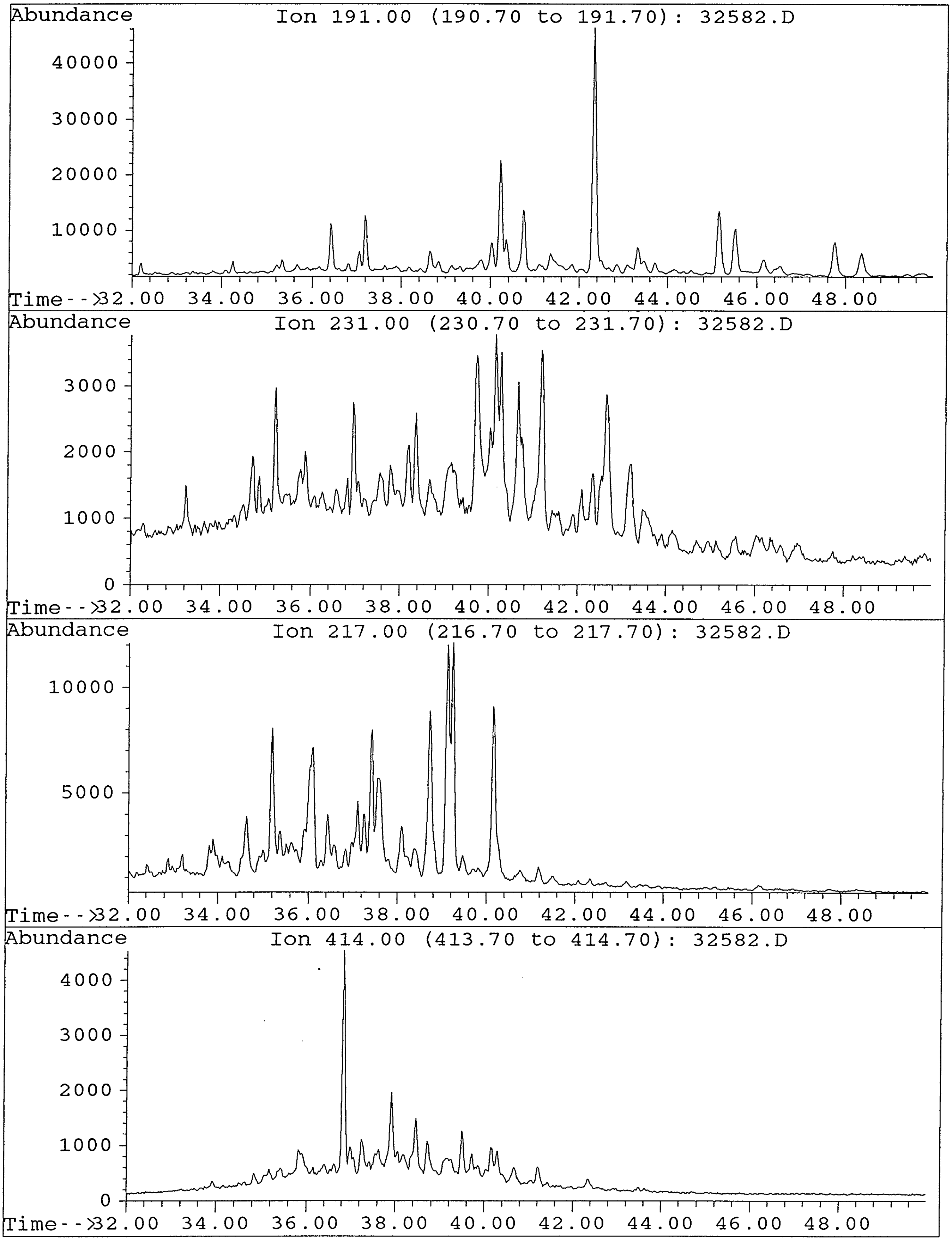


File : 32582.D
Sample : IONA-2 1408.5m B/C
Misc. Info : col#143, 18/3/94 SB

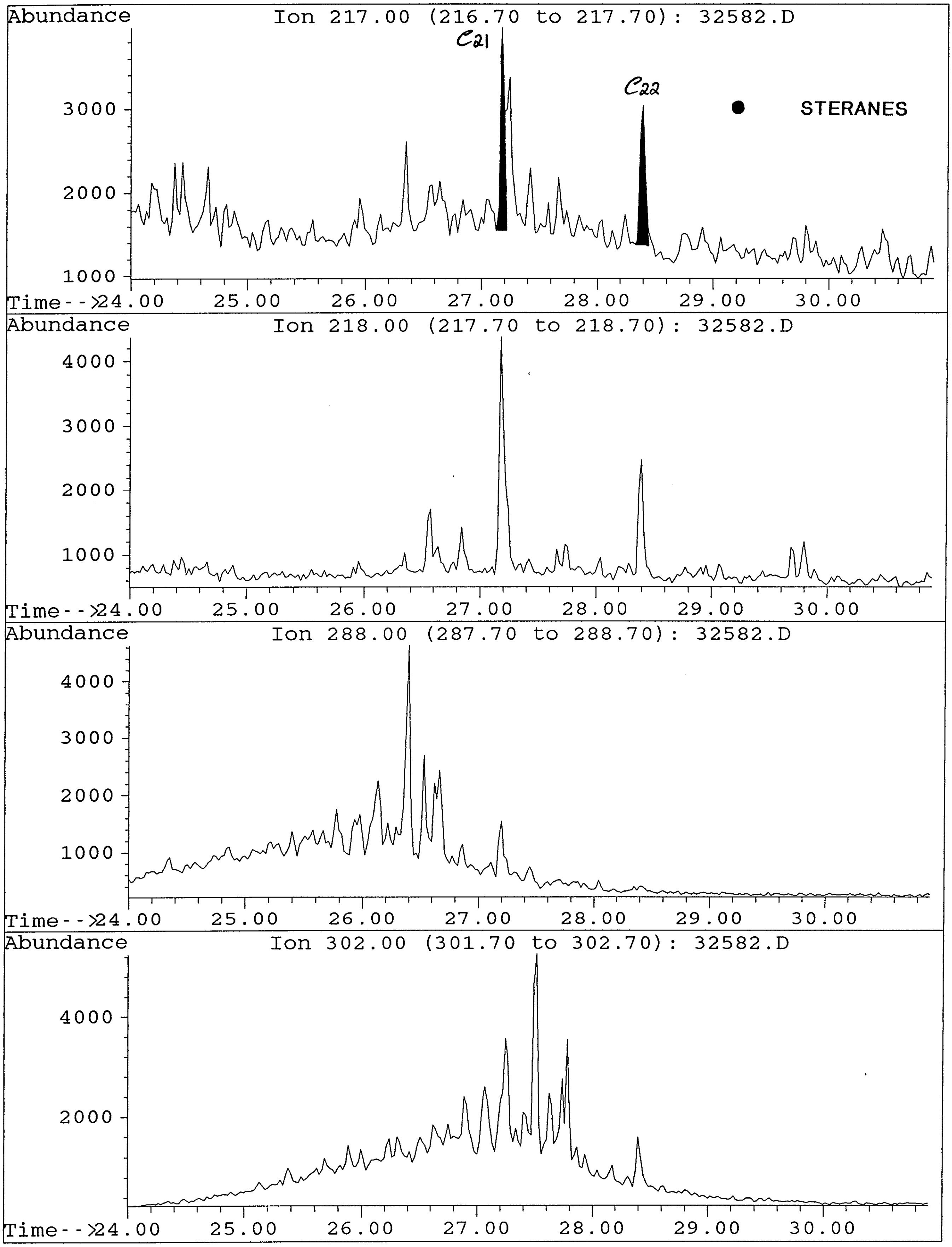




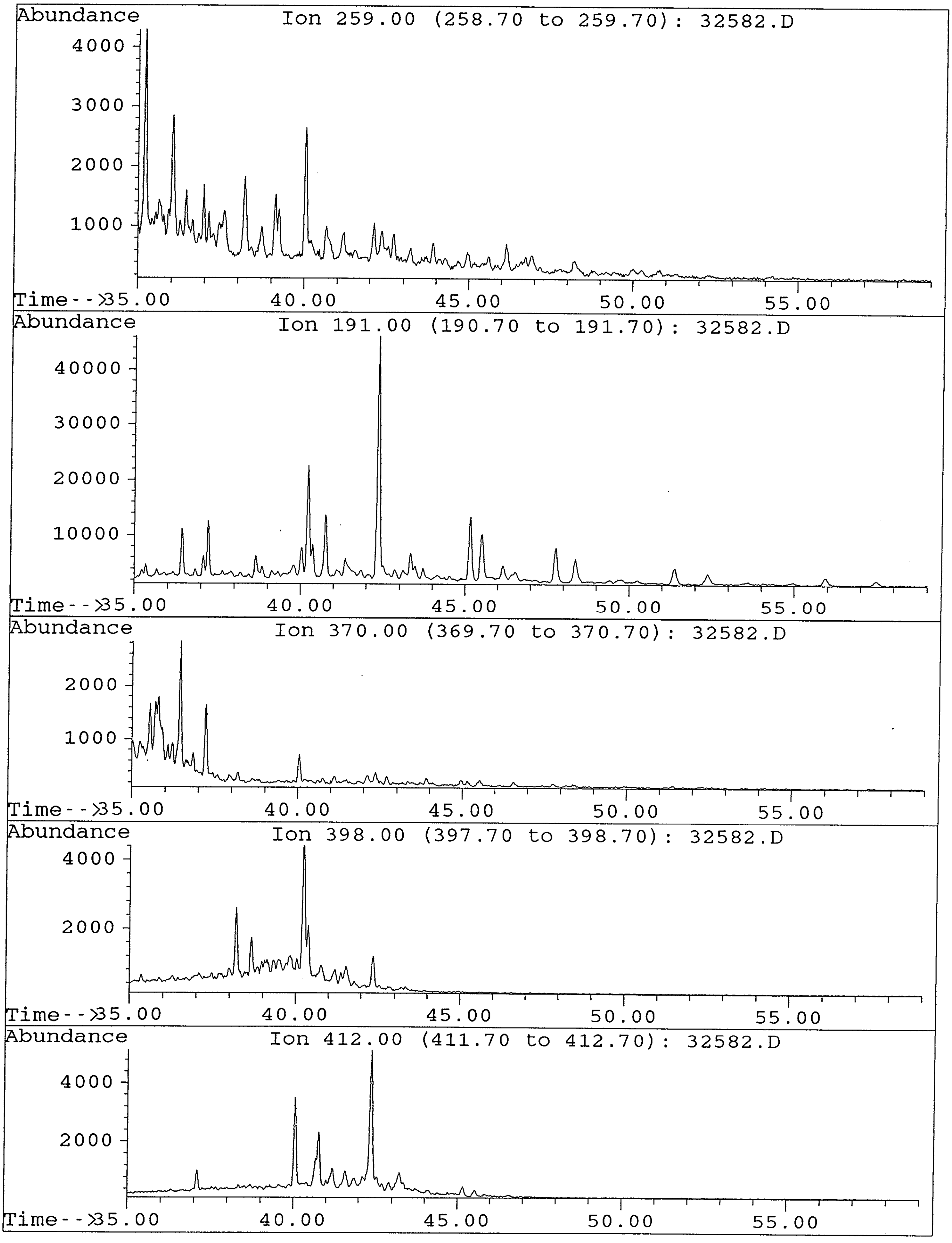
File : 32582.D
Sample : IONA-2 1408.5m B/C
Misc. Info : col#143, 18/3/94 SB



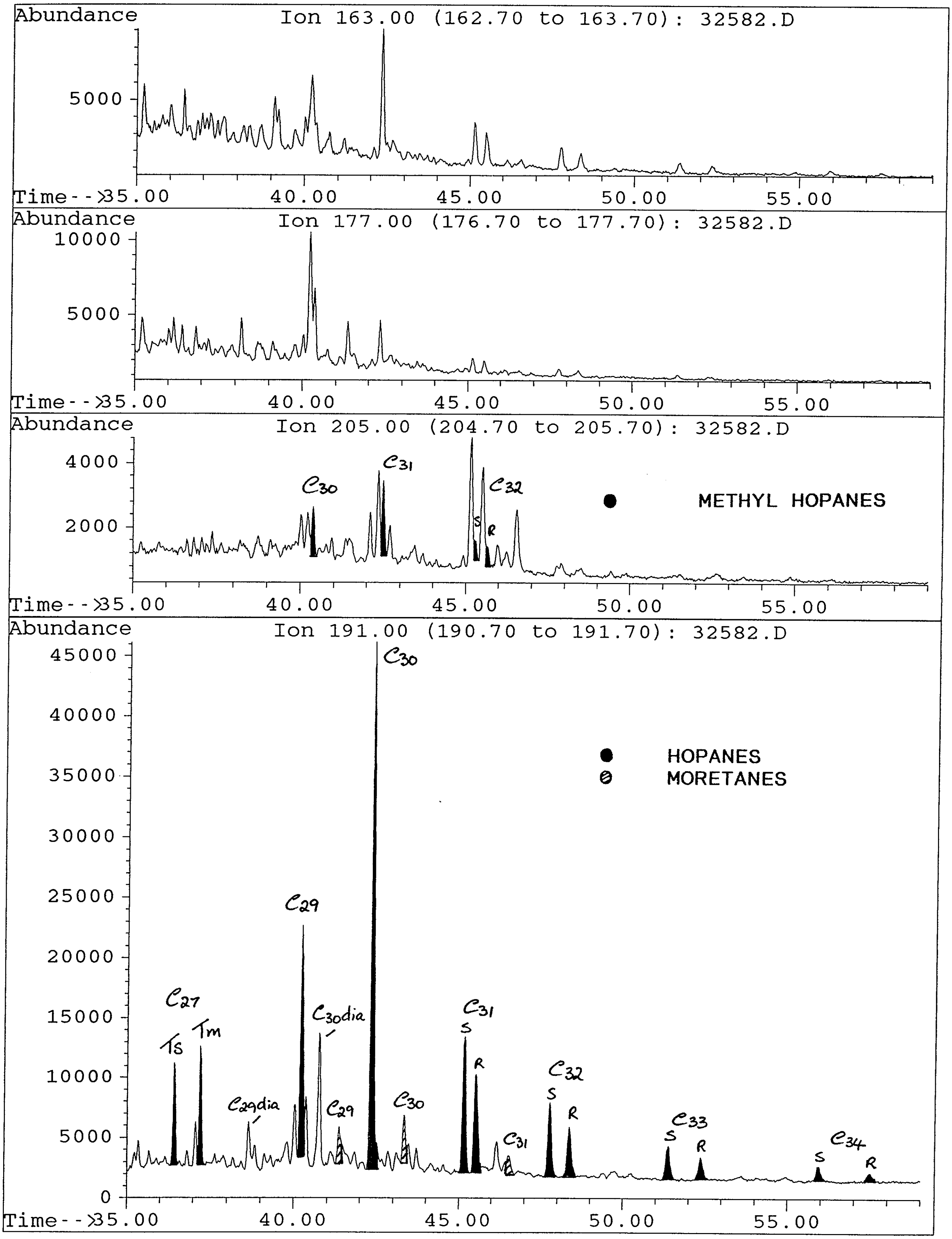
File : 32582.D
Sample : IONA-2 1408.5m B/C
Misc. Info : col#143, 18/3/94 SB



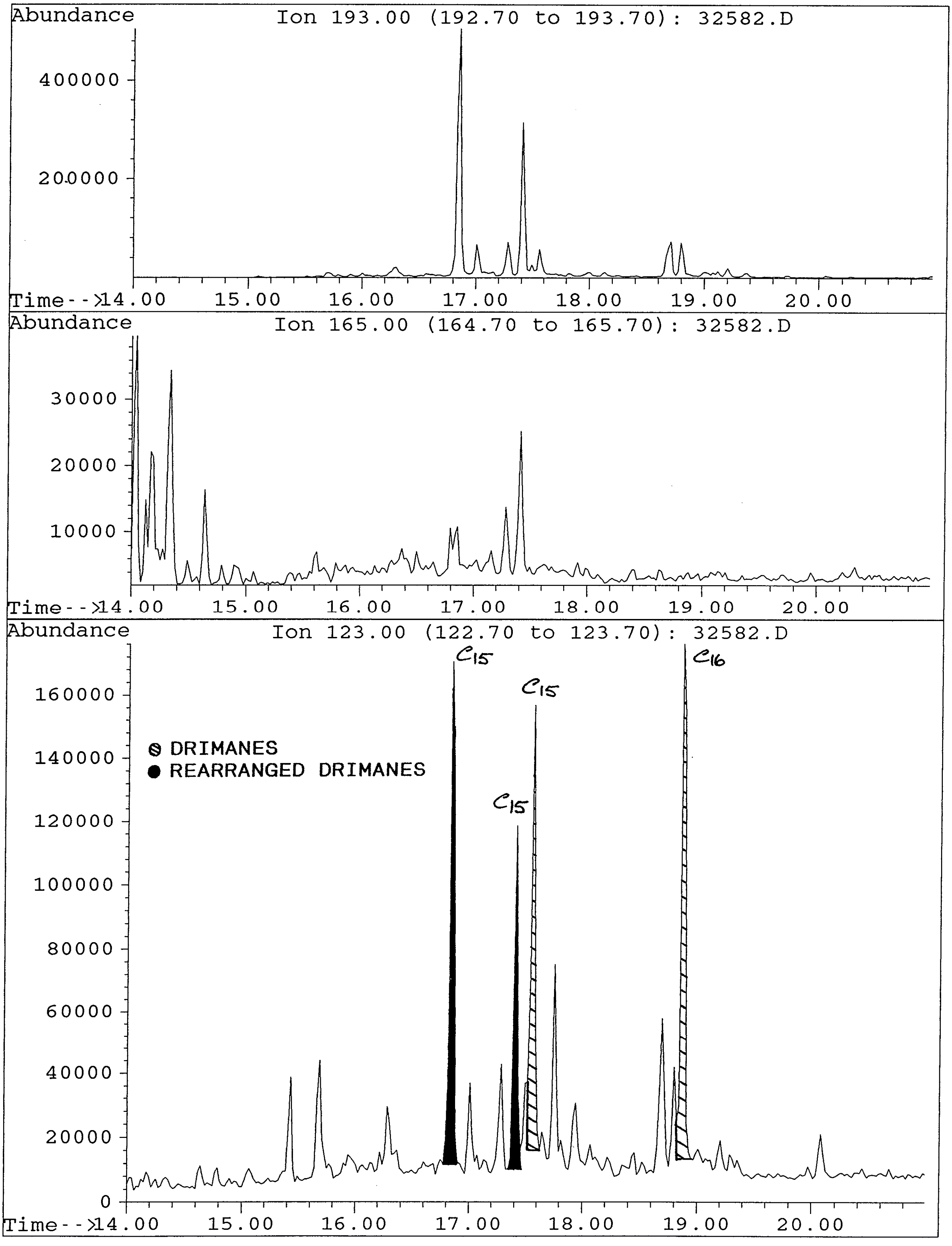
File : 32582.D
Sample : IONA-2 1408.5m B/C
Misc. Info : col#143, 18/3/94 SB



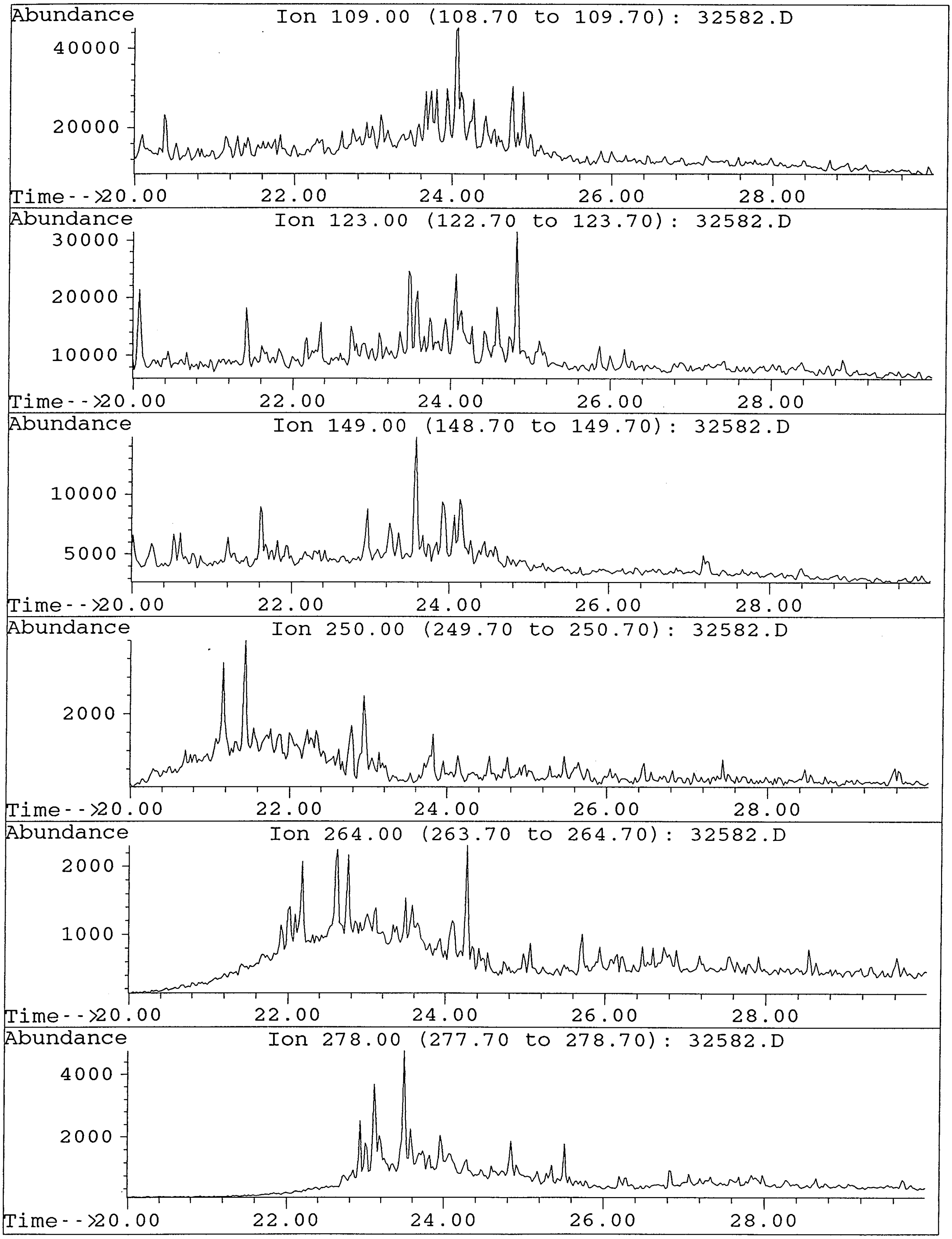
File : 32582.D
Sample : IONA-2 1408.5m B/C
Misc. Info : col#143, 18/3/94 SB



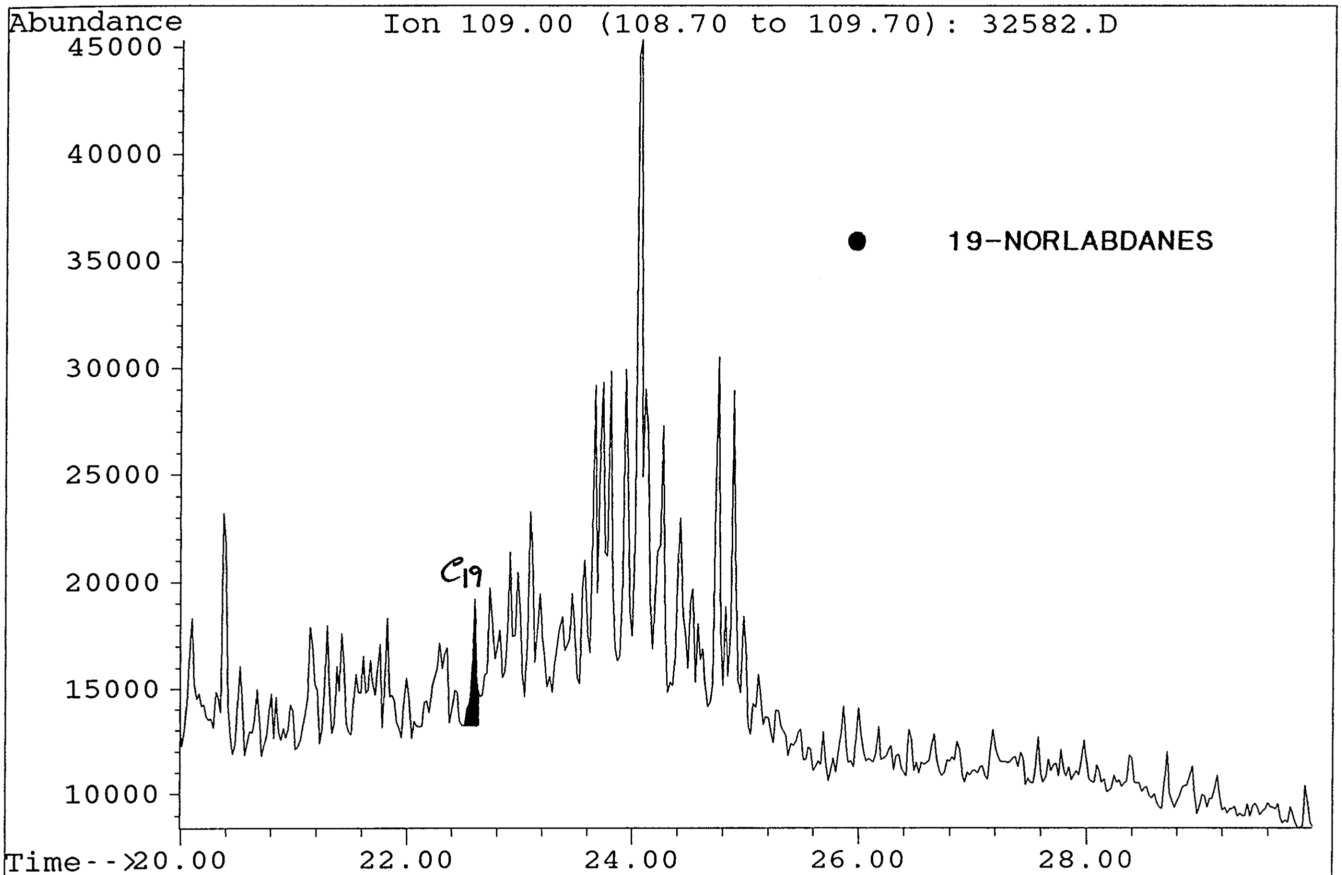
File : 32582.D
Sample : IONA-2 1408.5m B/C
Misc. Info : col#143, 18/3/94 SB

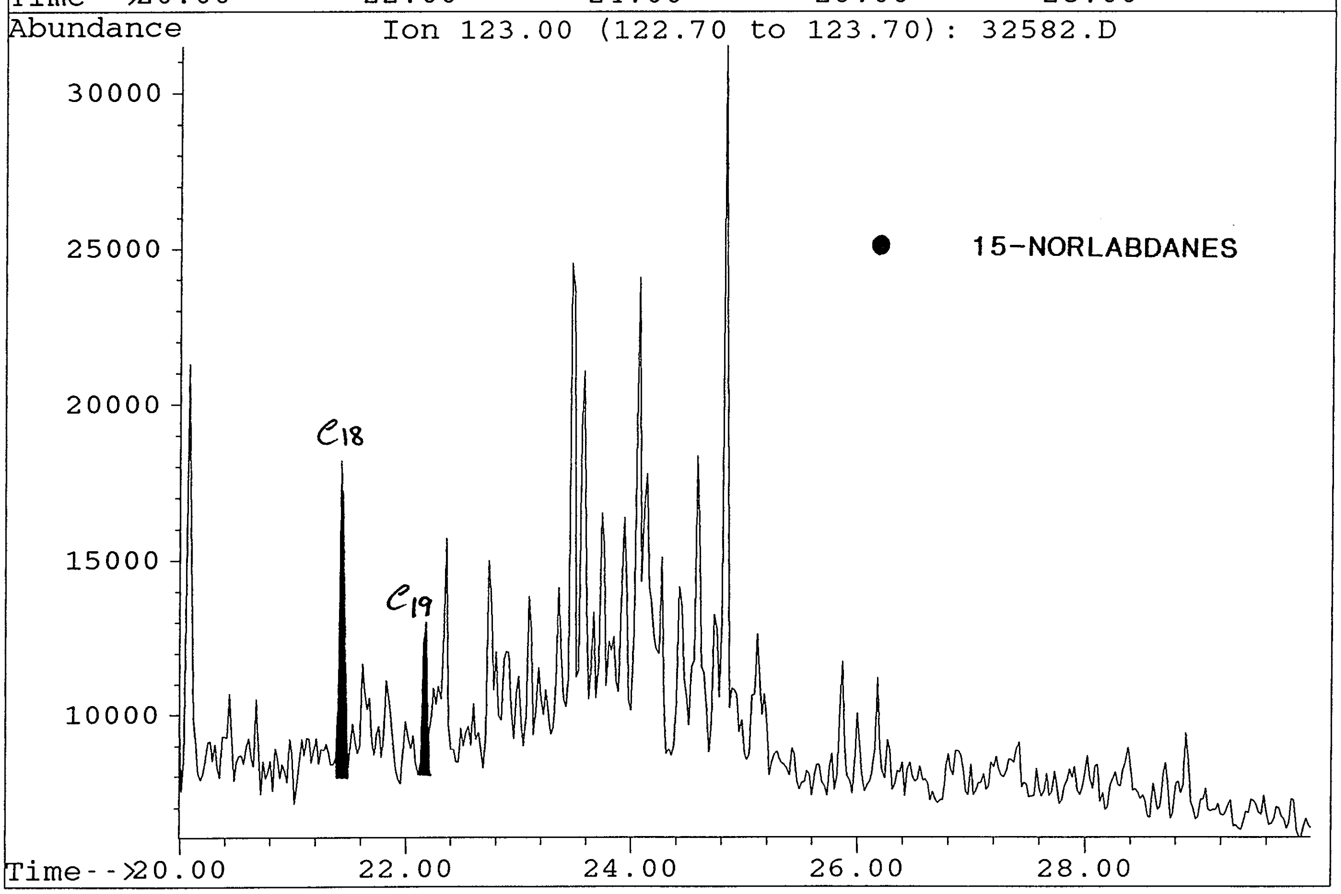


File : 32582.D
Sample : IONA-2 1408.5m B/C
Misc. Info : col#143, 18/3/94 SB

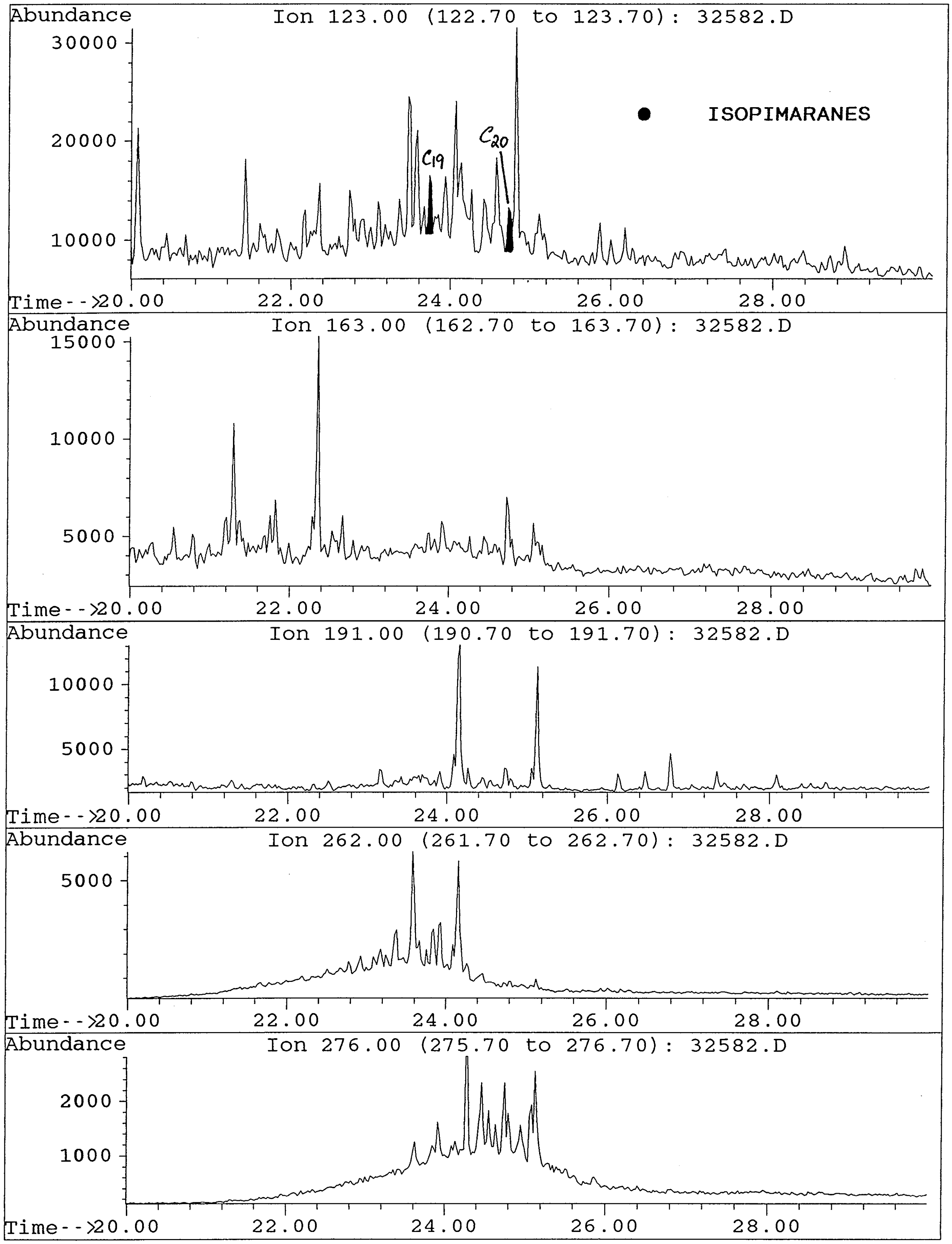


File : 32582.D
Sample : IONA-2 1408.5m B/C
Misc. Info : col#143, 18/3/94 SB

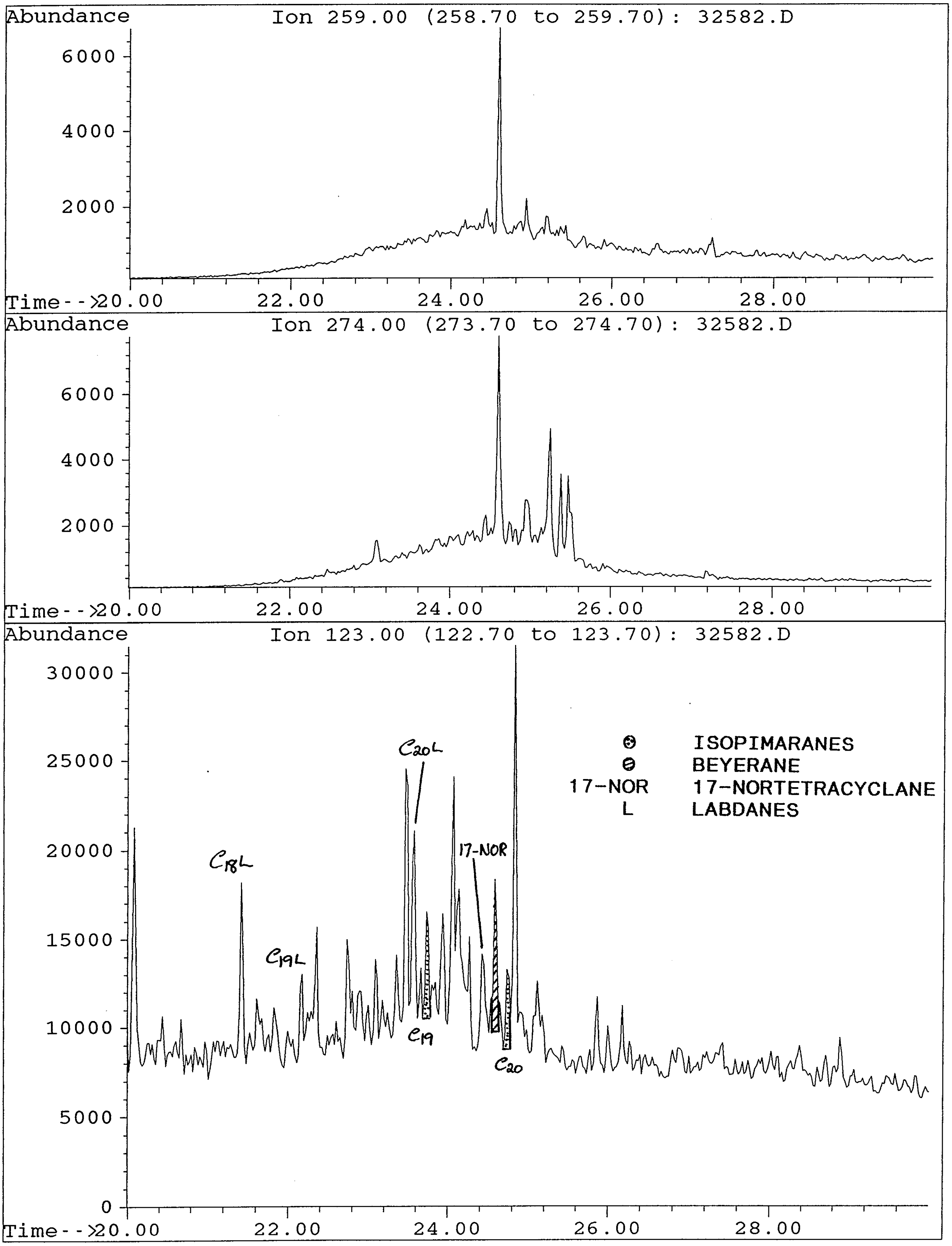




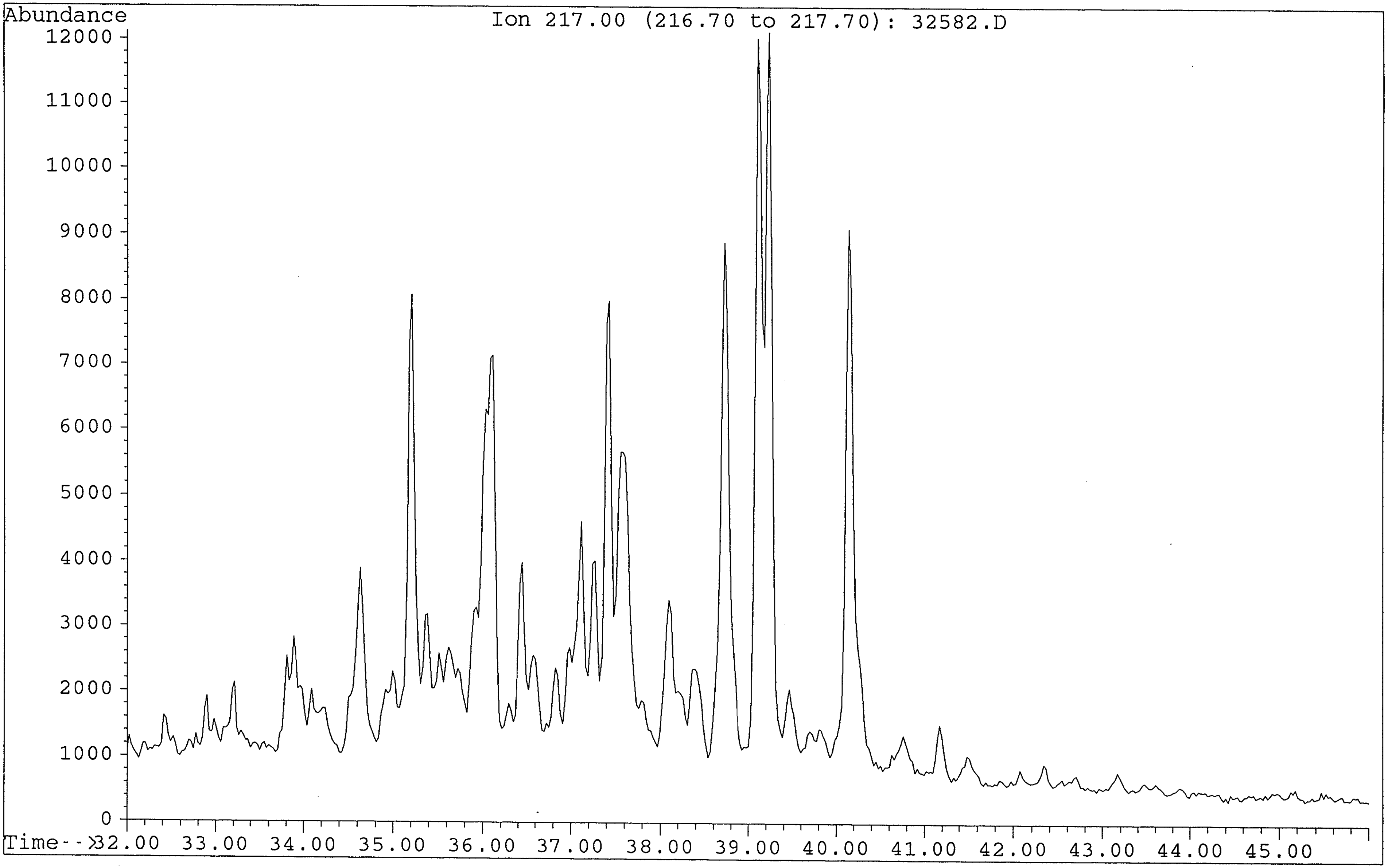
File : 32582.D
Sample : IONA-2 1408.5m B/C
Misc. Info : col#143, 18/3/94 SB



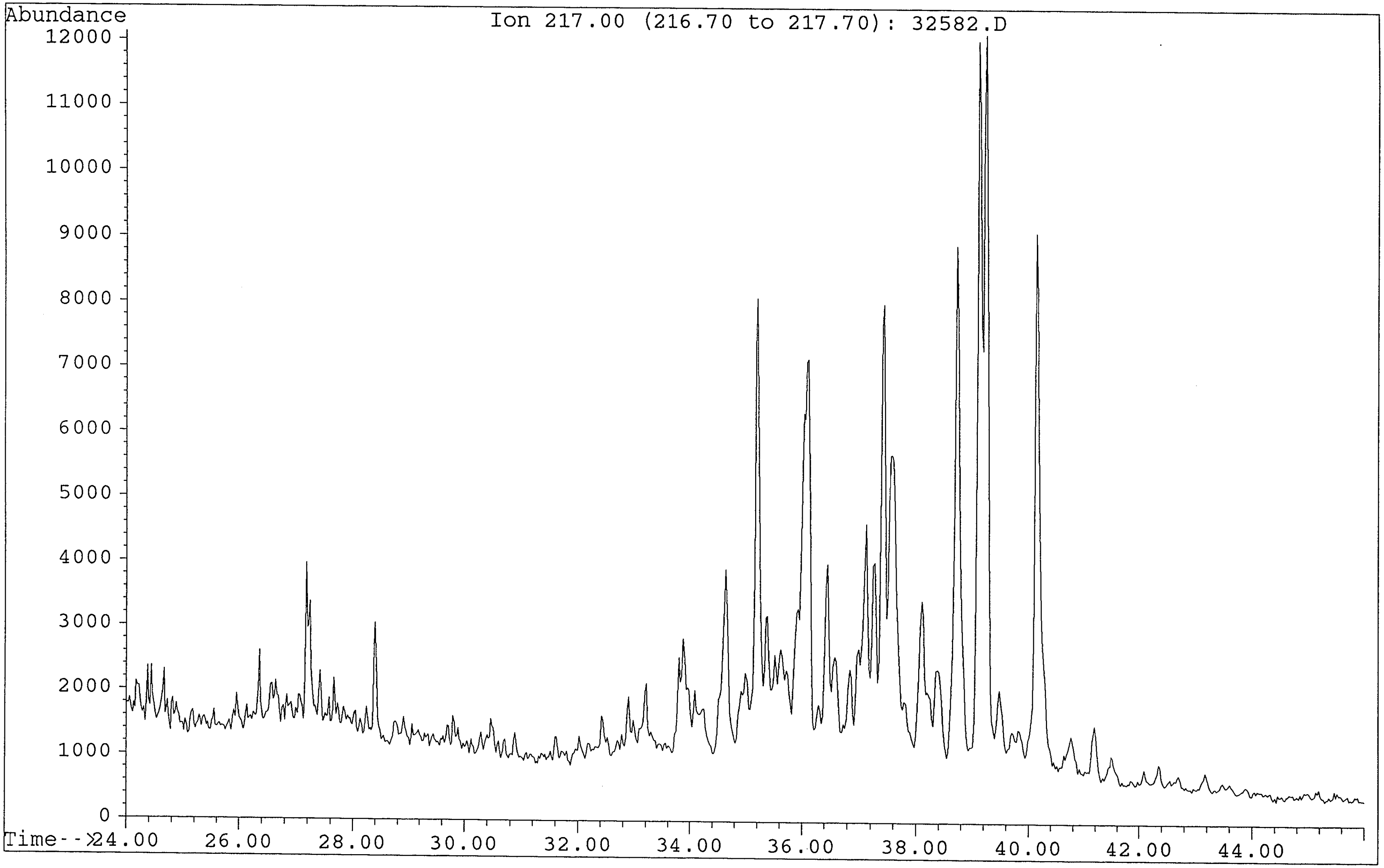
File :   32582.D
Sample :   IONA-2 1408.5m   B/C
Misc. Info :   col#143, 18/3/94 SB



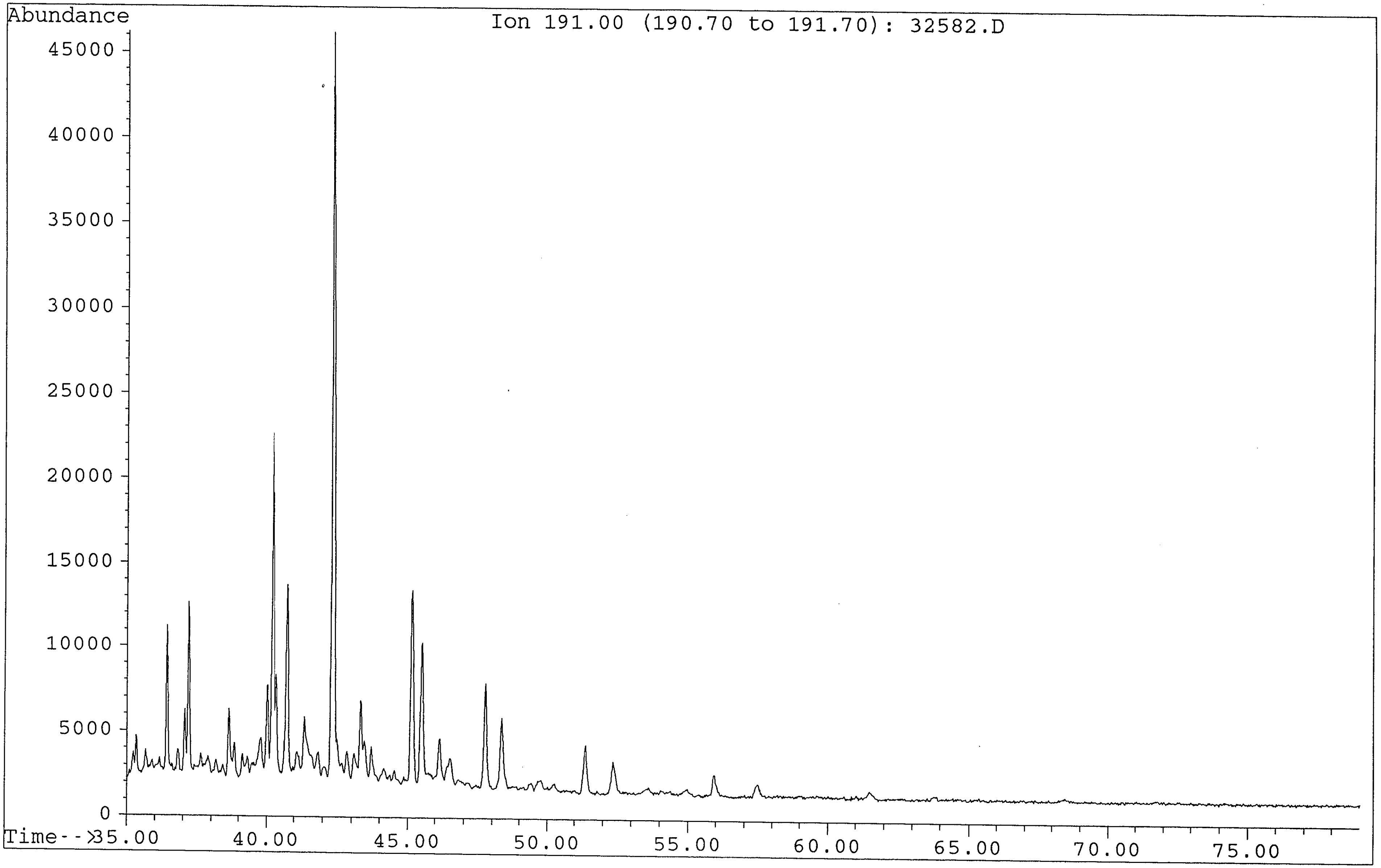
File : 32582.D
Sample : IONA-2 1408.5m B/C
Misc. Info : col#143, 18/3/94 SB



File : 32582.D
Sample : IONA-2 1408.5m B/C
Misc. Info : col#143, 18/3/94 SB



File : 32582.D
Sample : IONA-2 1408.5m B/C
Misc. Info : col#143, 18/3/94 SB



File : 32582.D
Sample : IONA-2 1408.5m B/C
Misc. Info : col#143, 18/3/94 SB

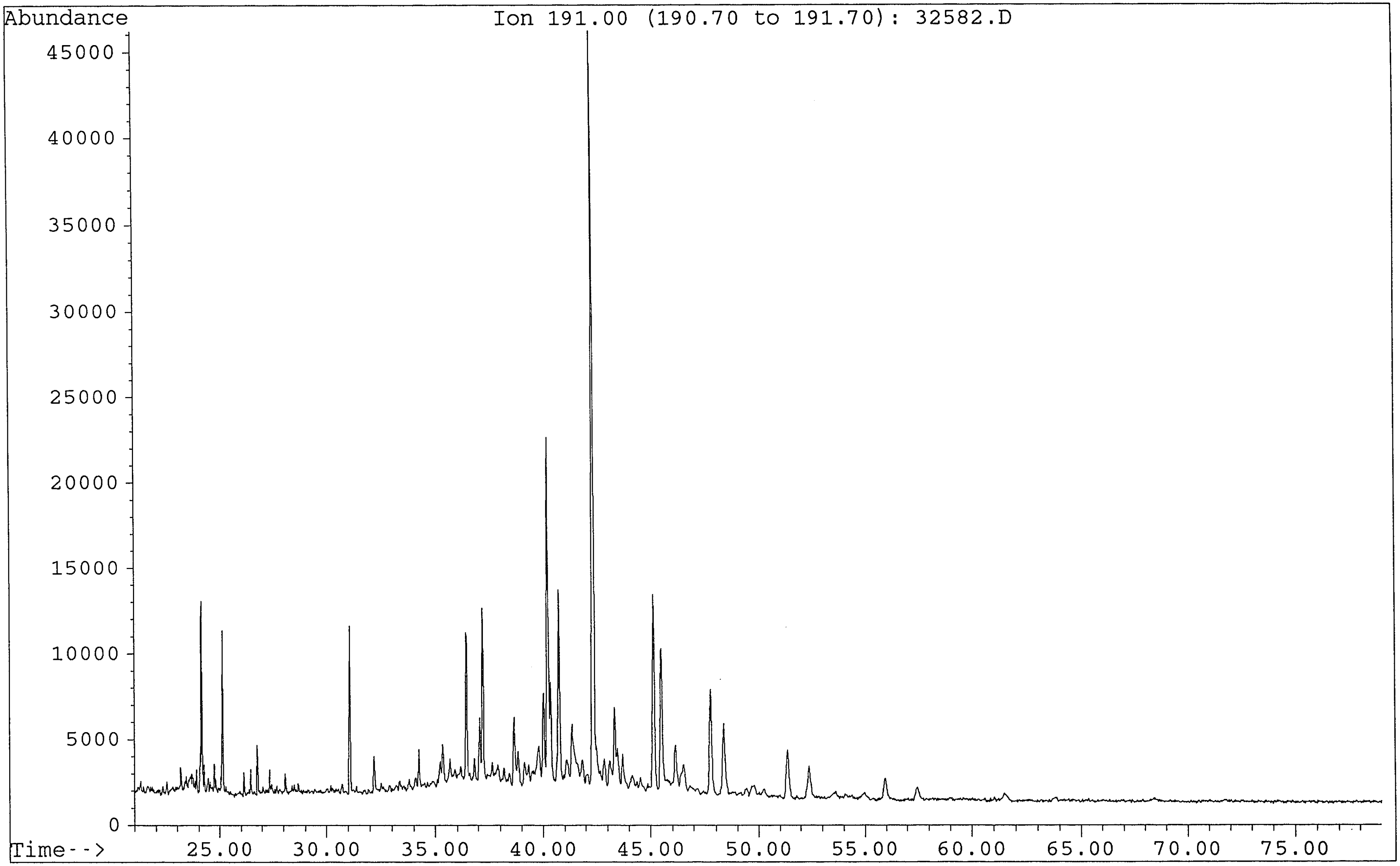


Table 6

SELECTED AROMATIC PARAMETERS

IONA 2 Mar-94

DEPTH	TYPE	DNR-1	DNR-5	DNR-6	TNR-1	TNR-5	TNR-6	MPR-1	MPI-1	MPI-2	Rc(a)	Rc(b)
1358.0m	SWC	5.94	194.4	3.09	0.60	0.74	nd	2.42	1.06	1.09	1.03	1.67
1408.5m	SWC	6.00	147.2	3.04	0.70	0.76	nd	2.34	1.17	1.21	1.10	1.60

response factors have been applied to DNR 6, TNR 1, TNR 5, MPI 1 and MPI 2

Table 6

SELECTED AROMATIC PARAMETERS CONT.

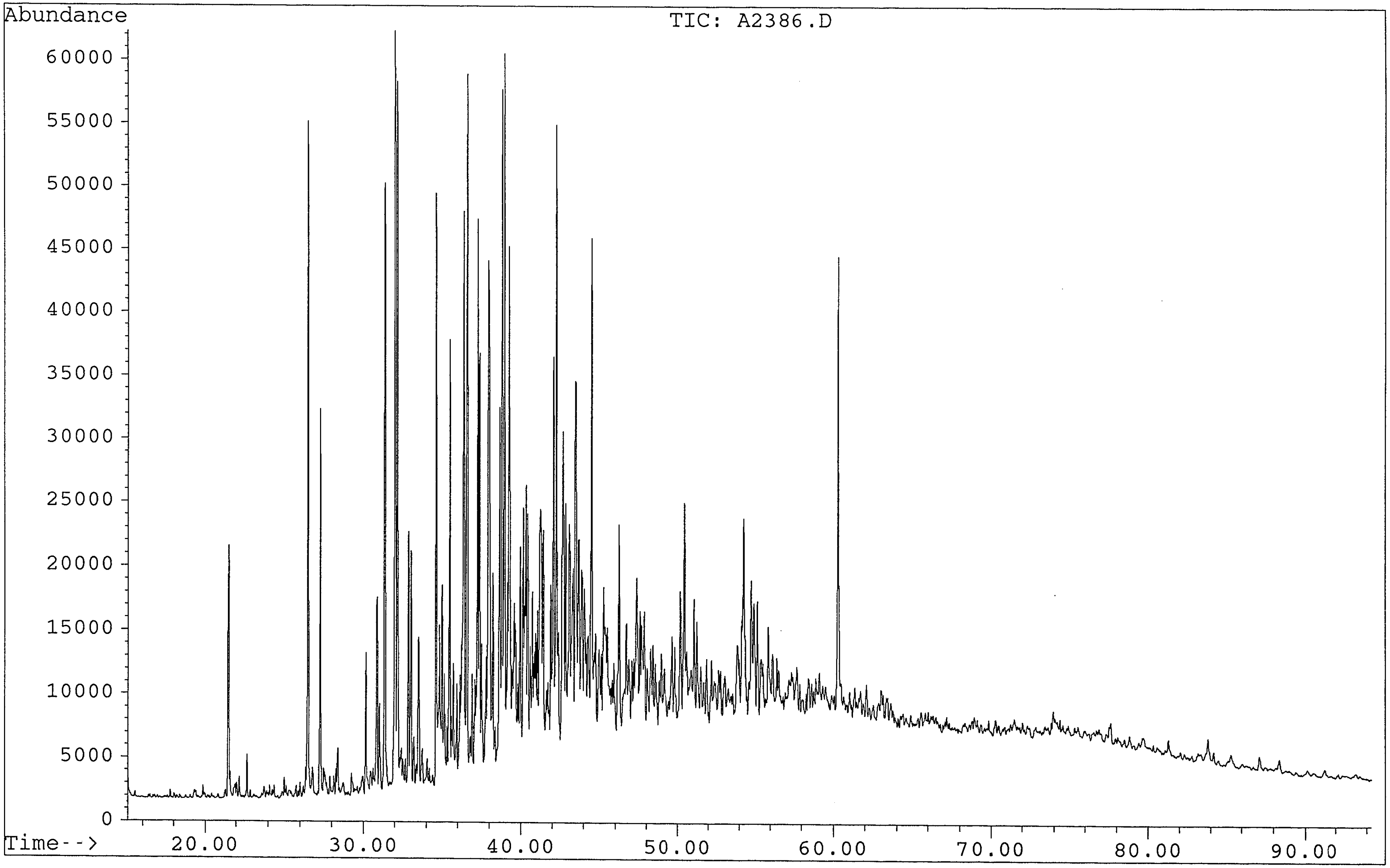
IONA 2 Mar-94

DEPTH	TYPE	1,7-DMP/X (m/z 206)	RETENE/9-MP (m/z 219,192)	1MP/9MP
1358.0m	SWC	0.59	2.20	0.90
1408.5m	SWC	0.67	0.92	1.00

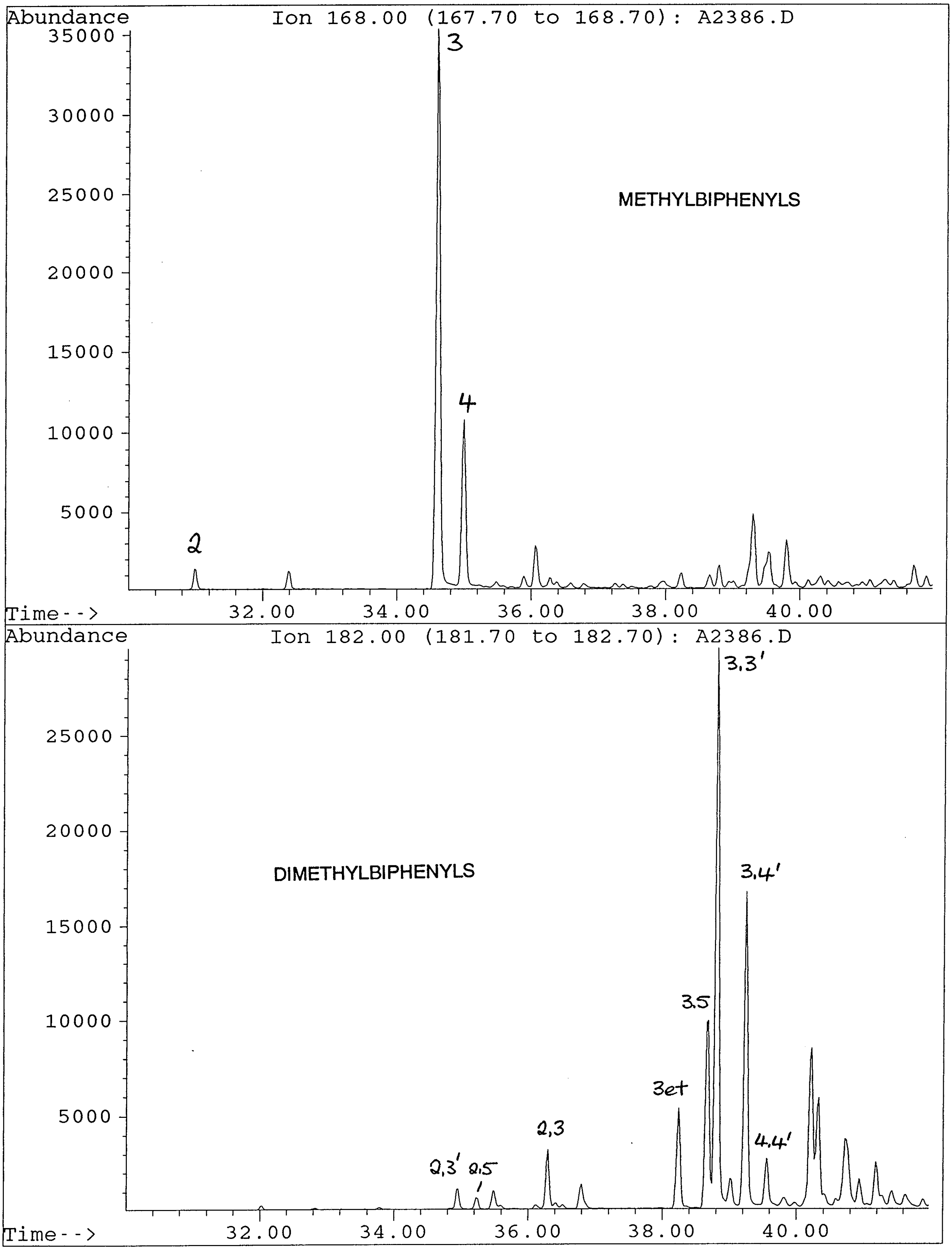
nd = no data

Figure 4-1

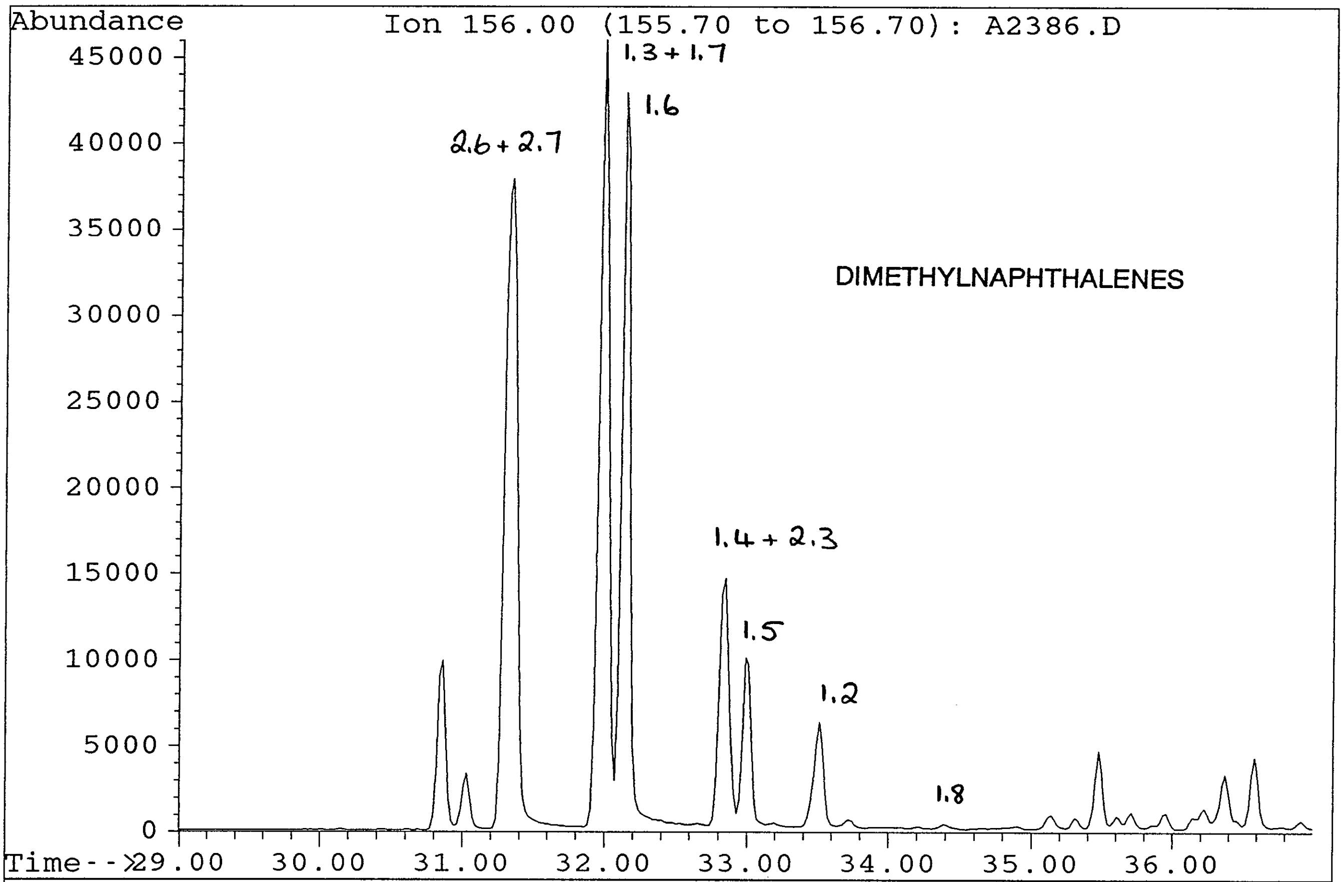
File : A2386.D
Sample : IONA-2, 1358. AROS
Misc. Info : COL#155. 16-3-94. SB

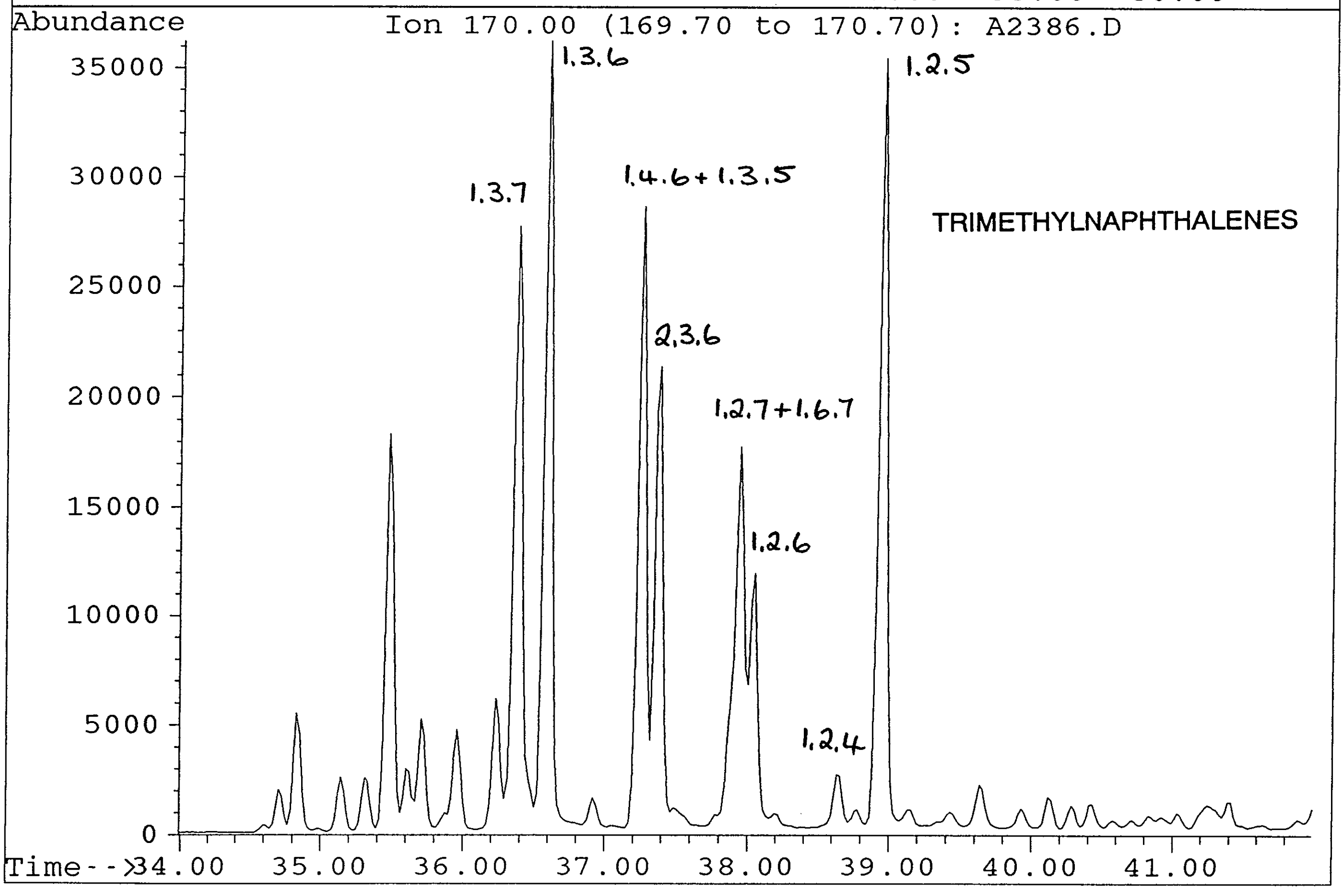


File : A2386.D
Sample : IONA-2, 1358. AROS
Misc. Info : COL#155. 16-3-94. SB



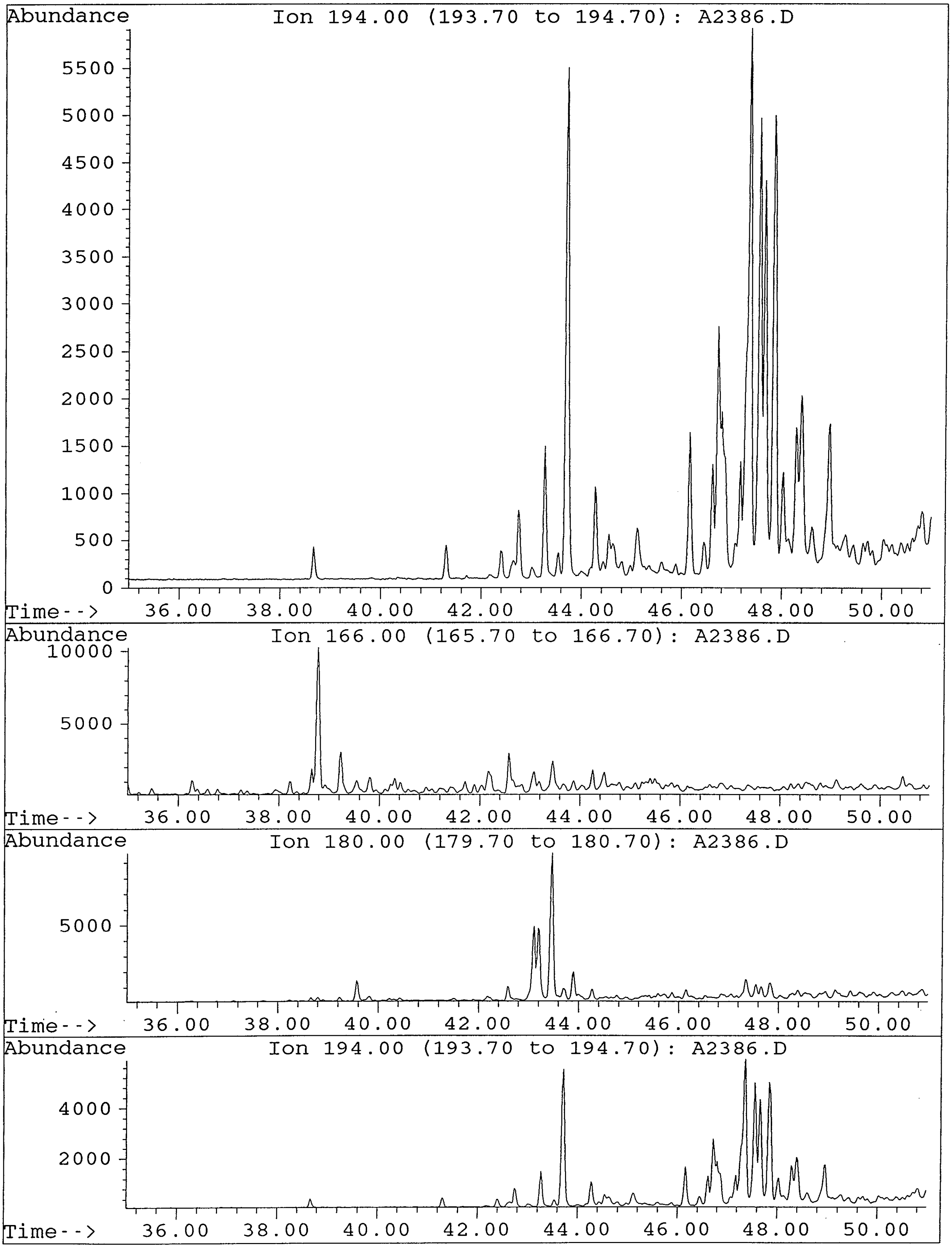
File : A2386.D
Sample : IONA-2, 1358. AROS
Misc. Info : COL#155. 16-3-94. SB



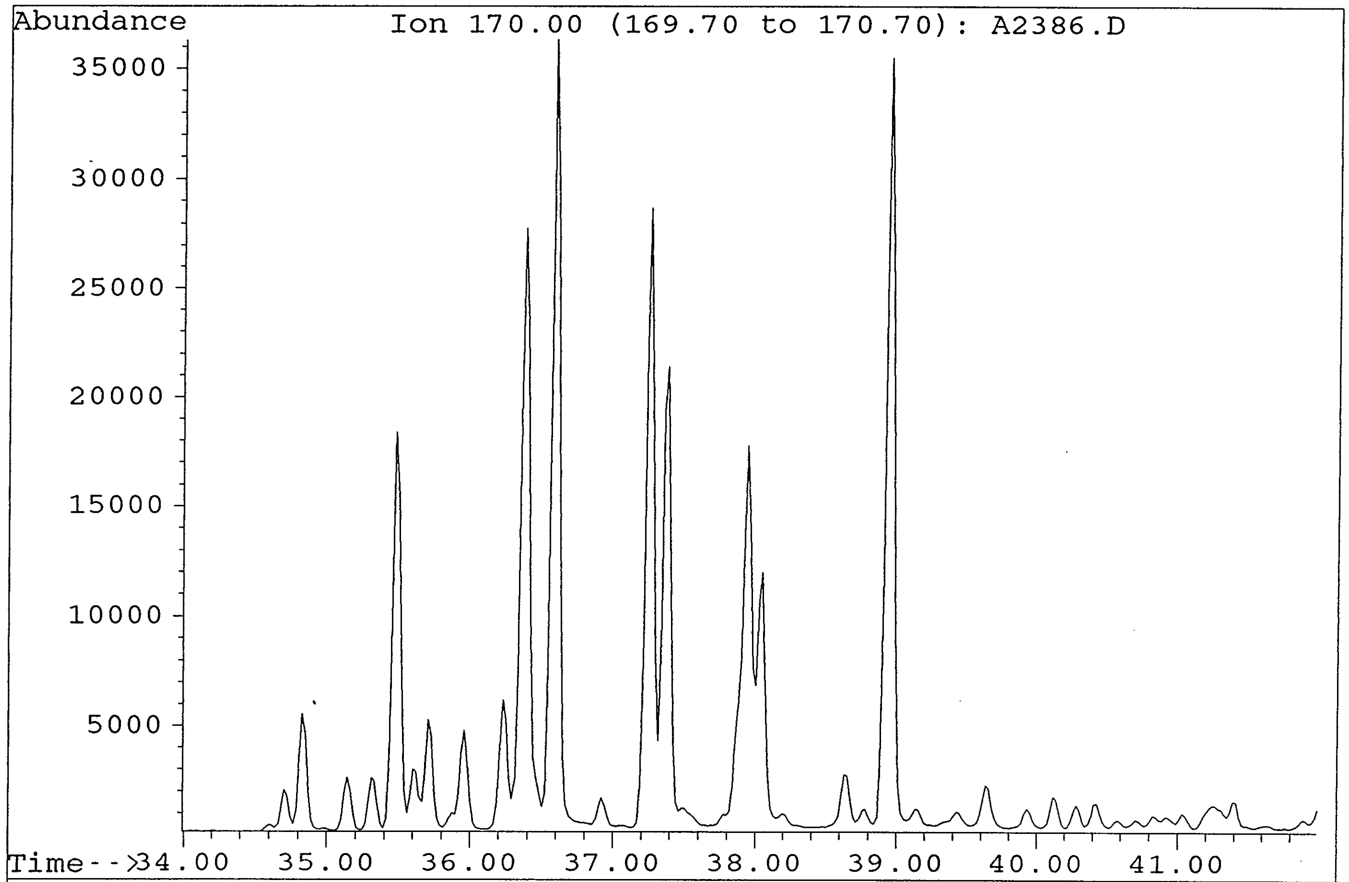


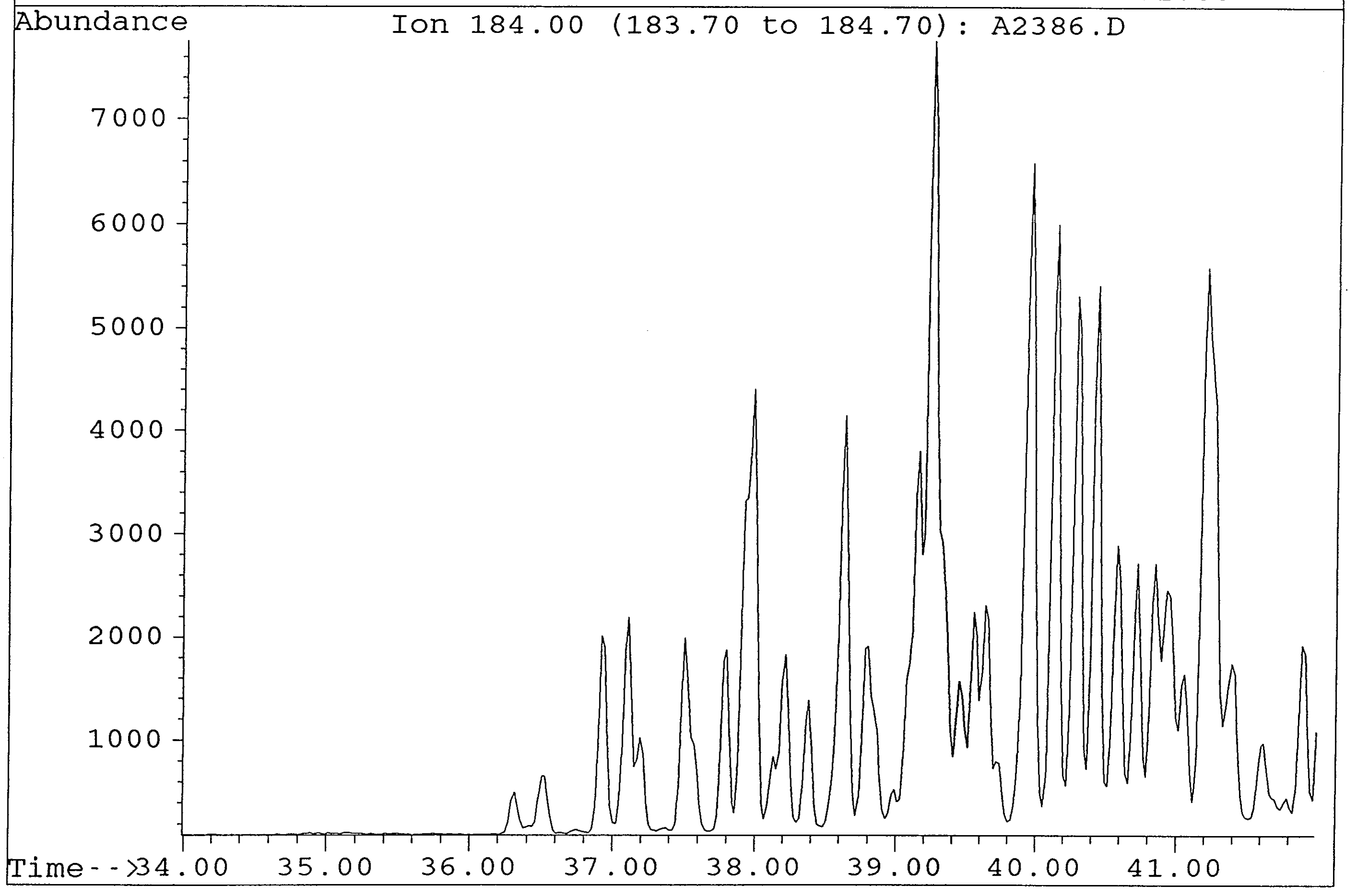
File : A2386.D
Sample : IONA-2, 1358. AROS
Misc. Info : COL#155. 16-3-94. SB

FLUORENES

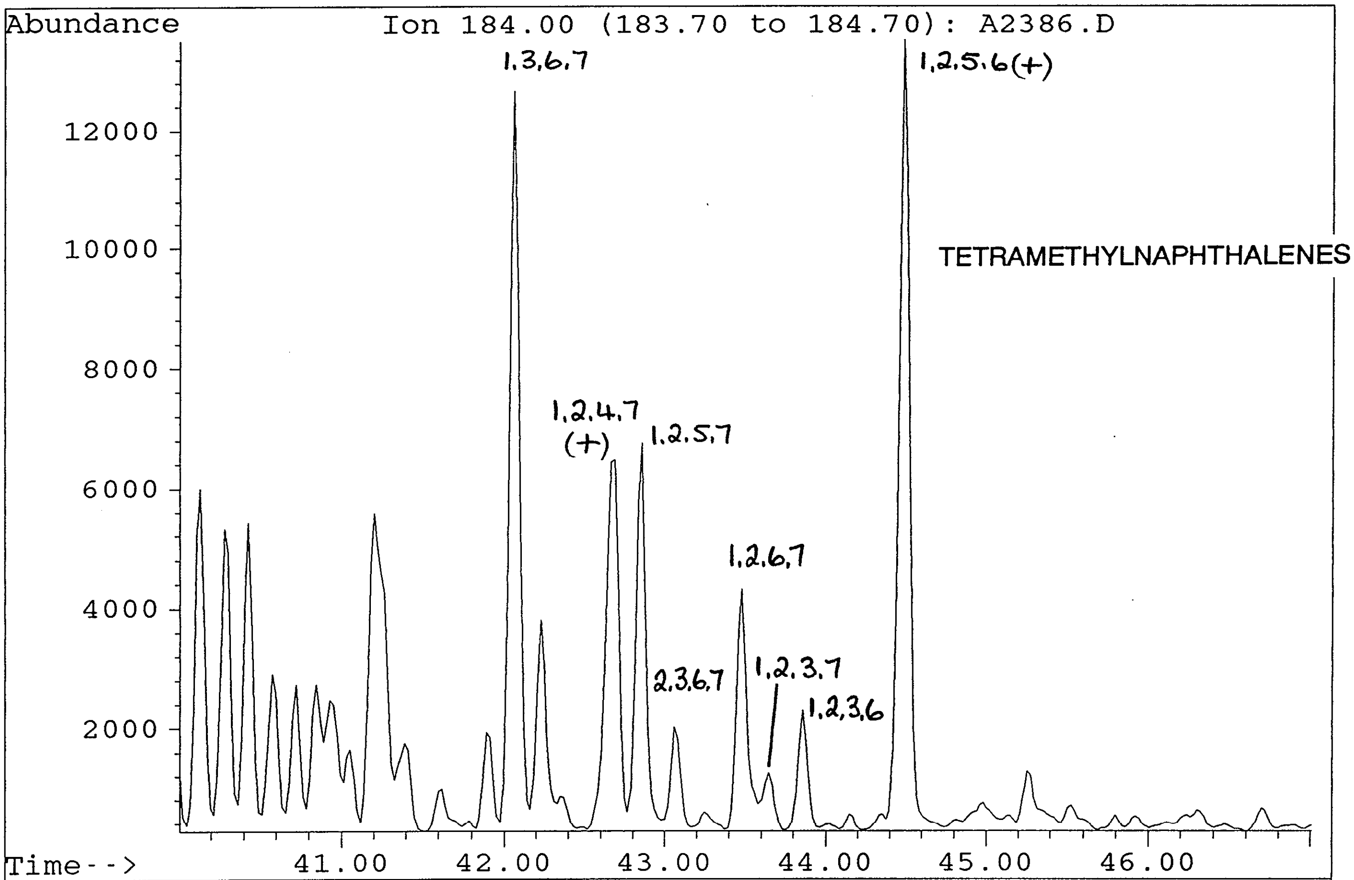


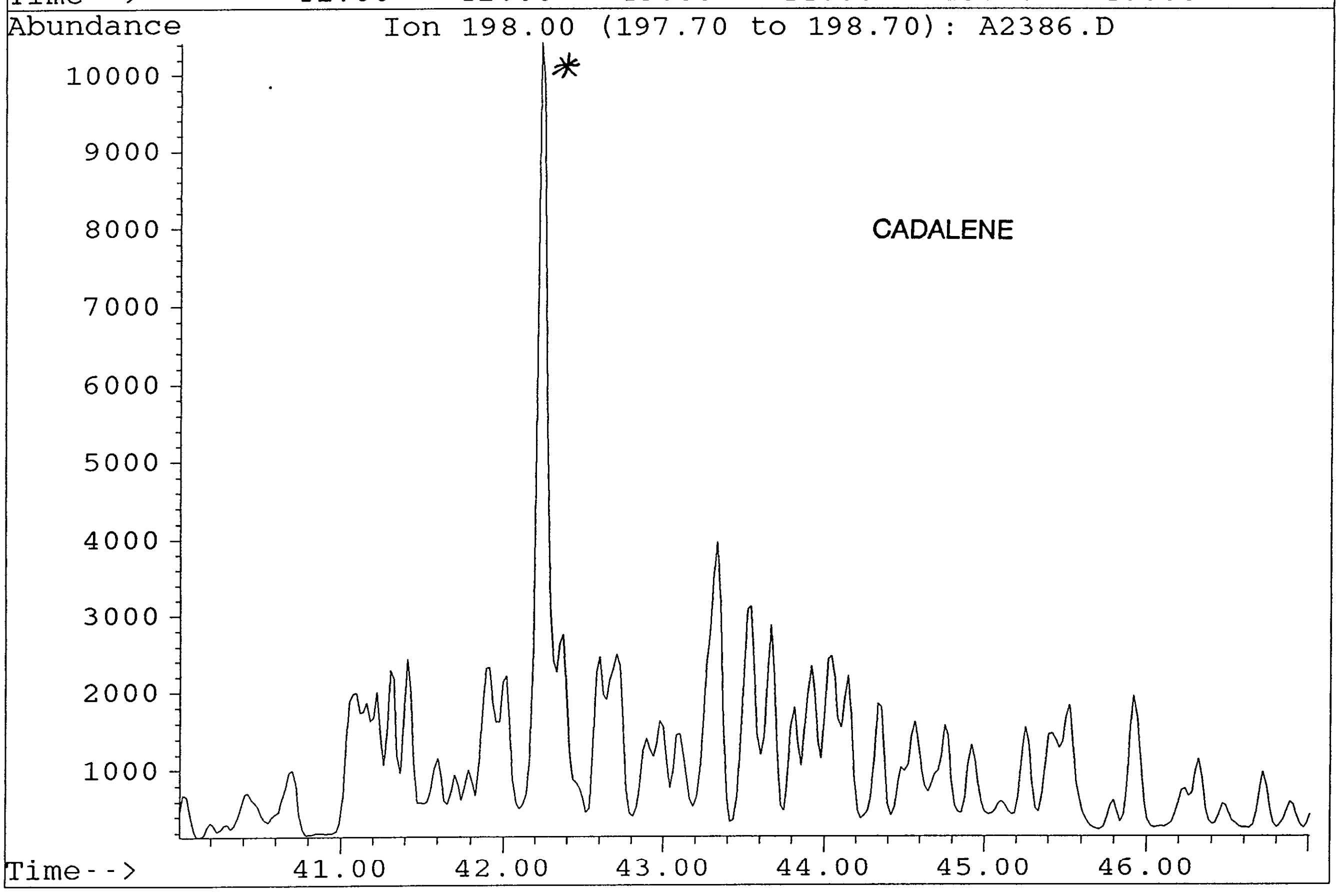
File : A2386.D
Sample : IONA-2, 1358. AROS
Misc. Info : COL#155. 16-3-94. SB



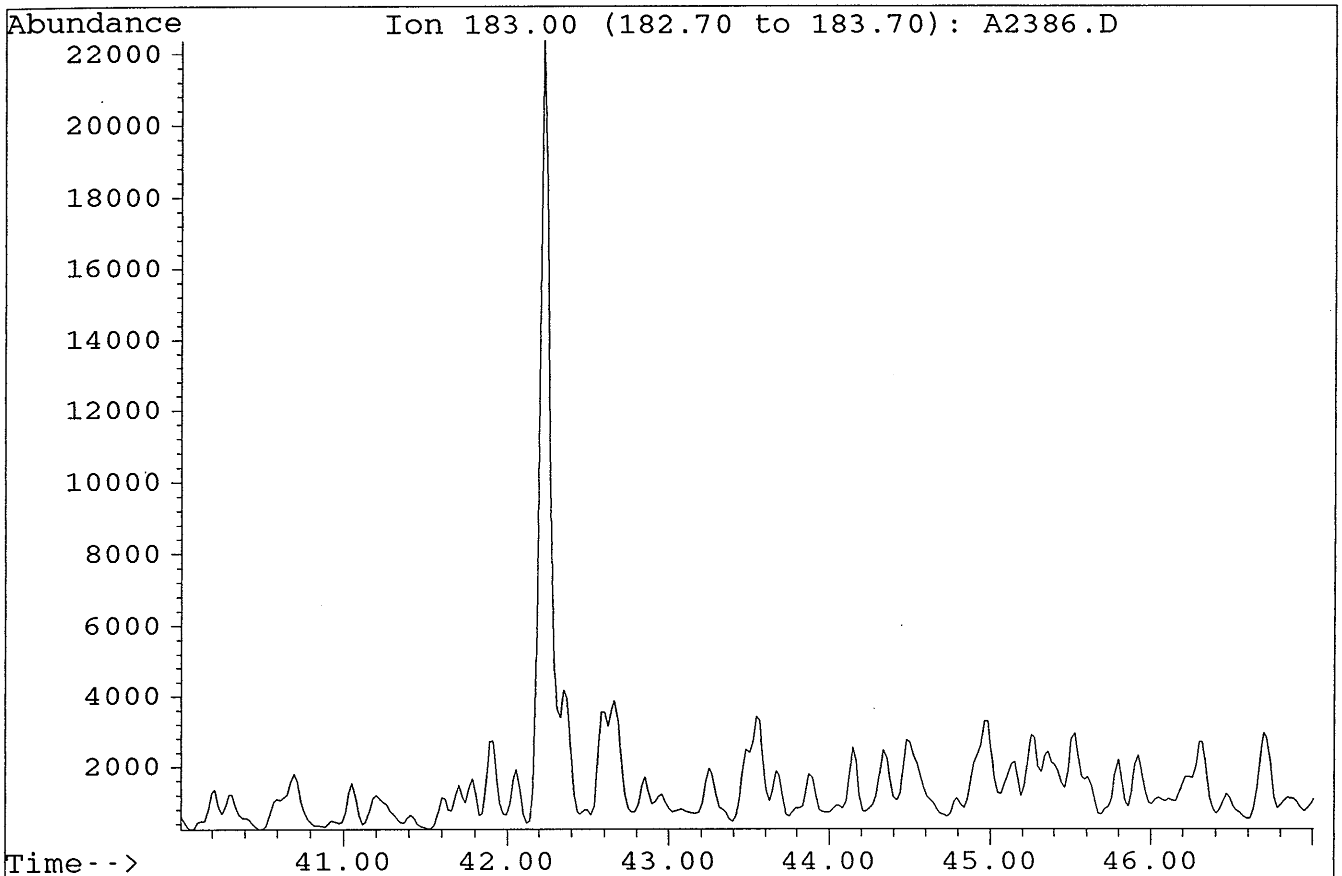


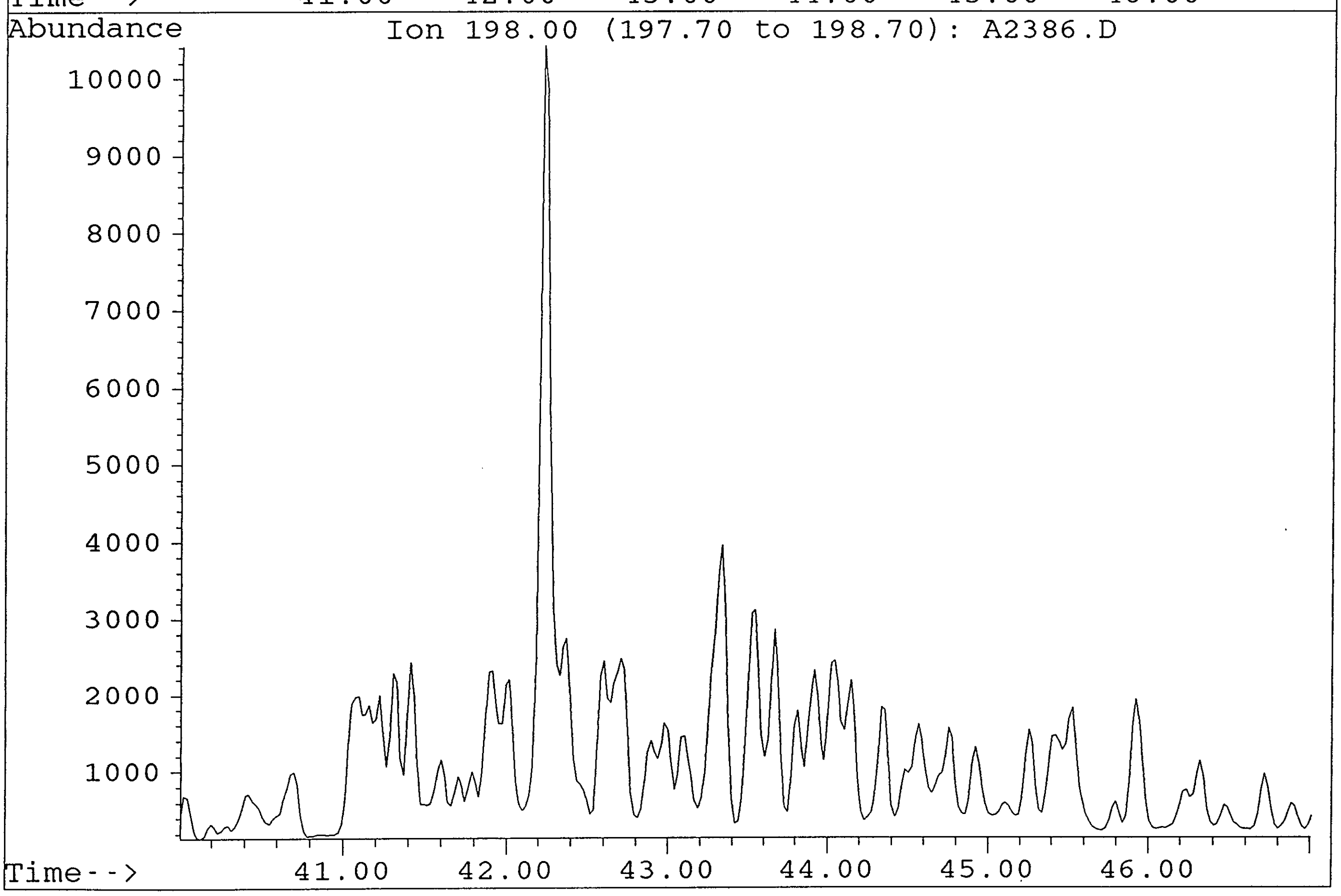
File : A2386.D
Sample : IONA-2, 1358. AROS
Misc. Info : COL#155. 16-3-94. SB



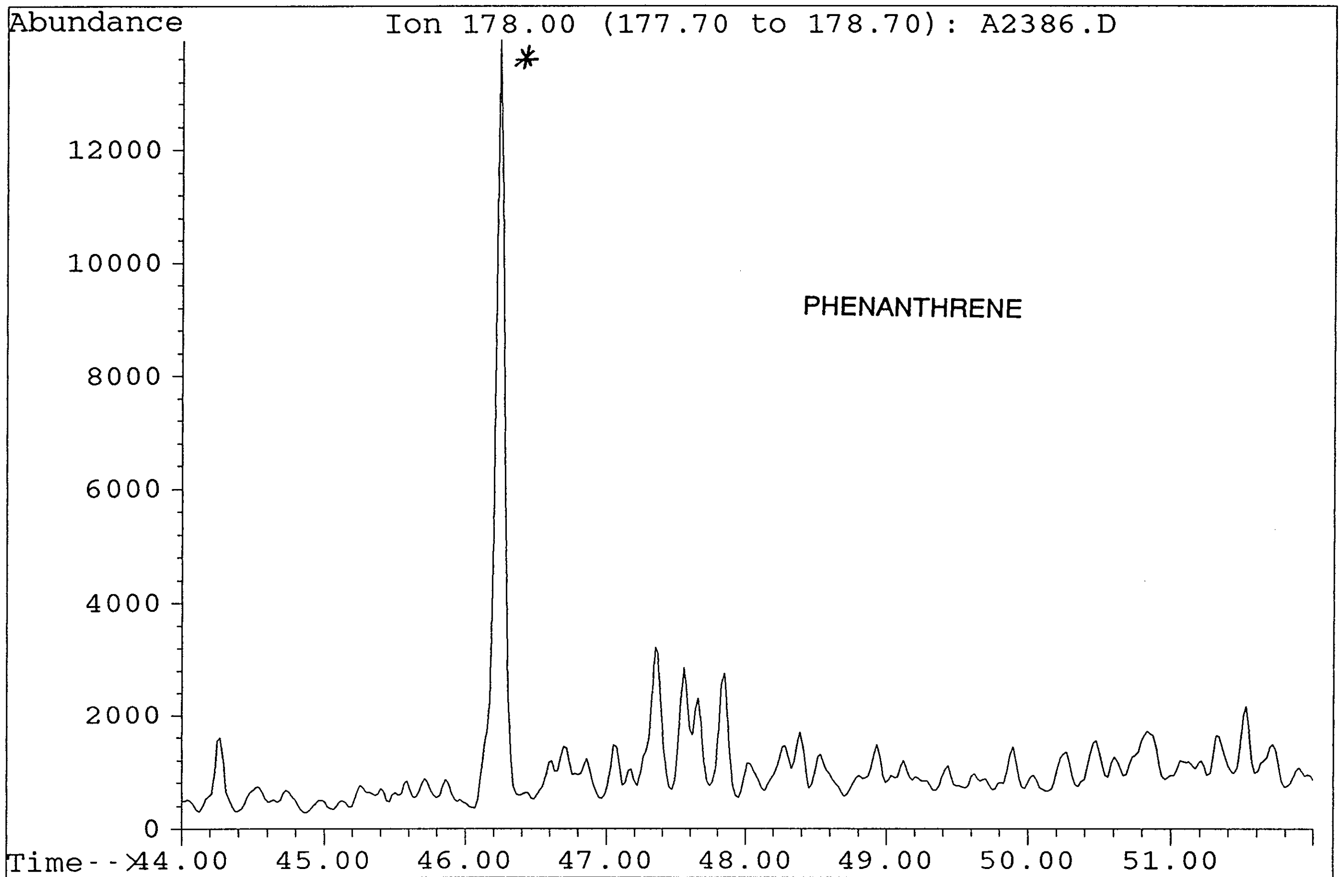


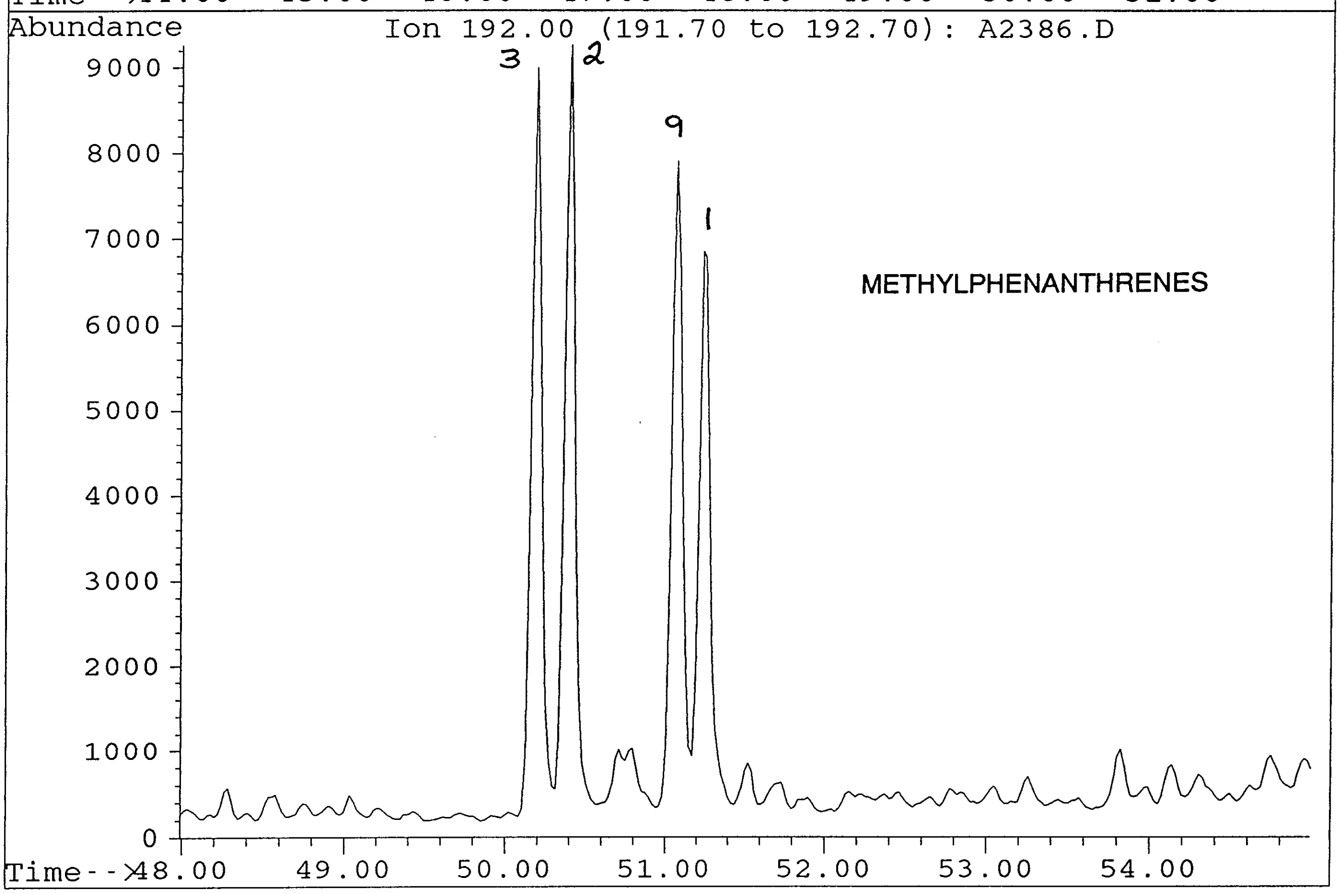
File : A2386.D
Sample : IONA-2, 1358. AROS
Misc. Info : COL#155. 16-3-94. SB



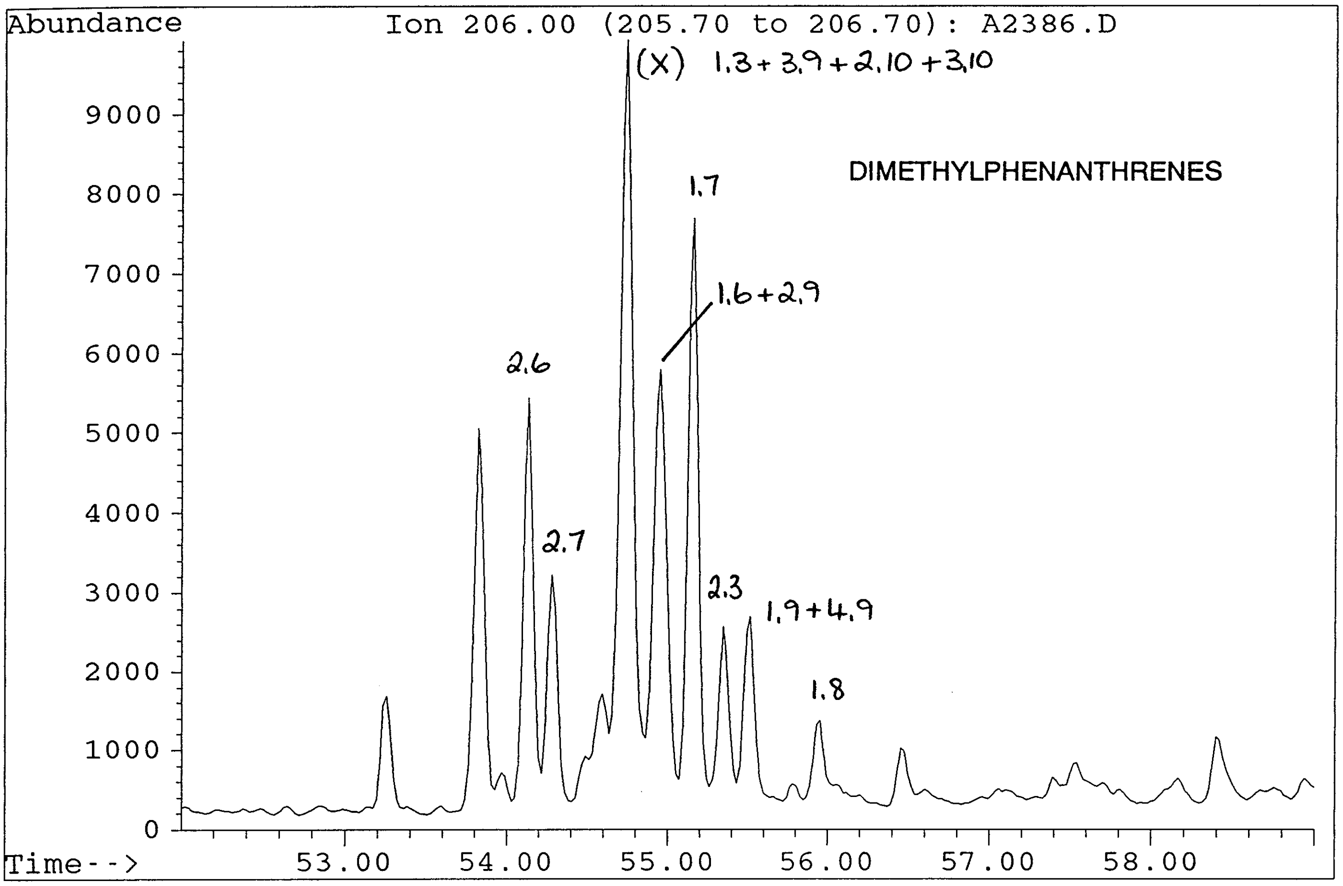


File : A2386.D
Sample : IONA-2, 1358. AROS
Misc. Info : COL#155. 16-3-94. SB





File : A2386.D
Sample : IONA-2, 1358. AROS
Misc. Info : COL#155. 16-3-94. SB



File : A2386.D
Sample : IONA-2, 1358. AROS
Misc. Info : COL#155. 16-3-94. SB

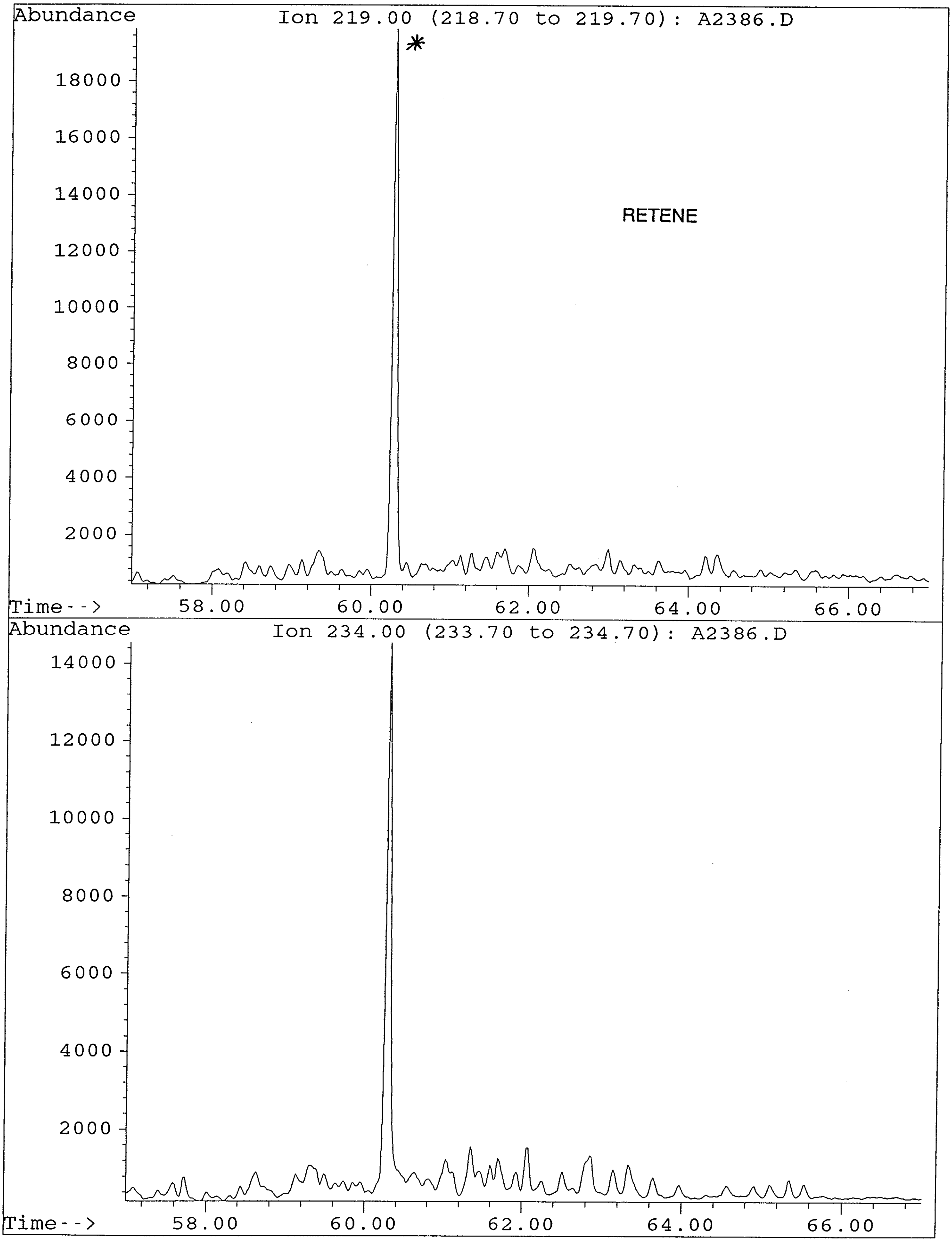
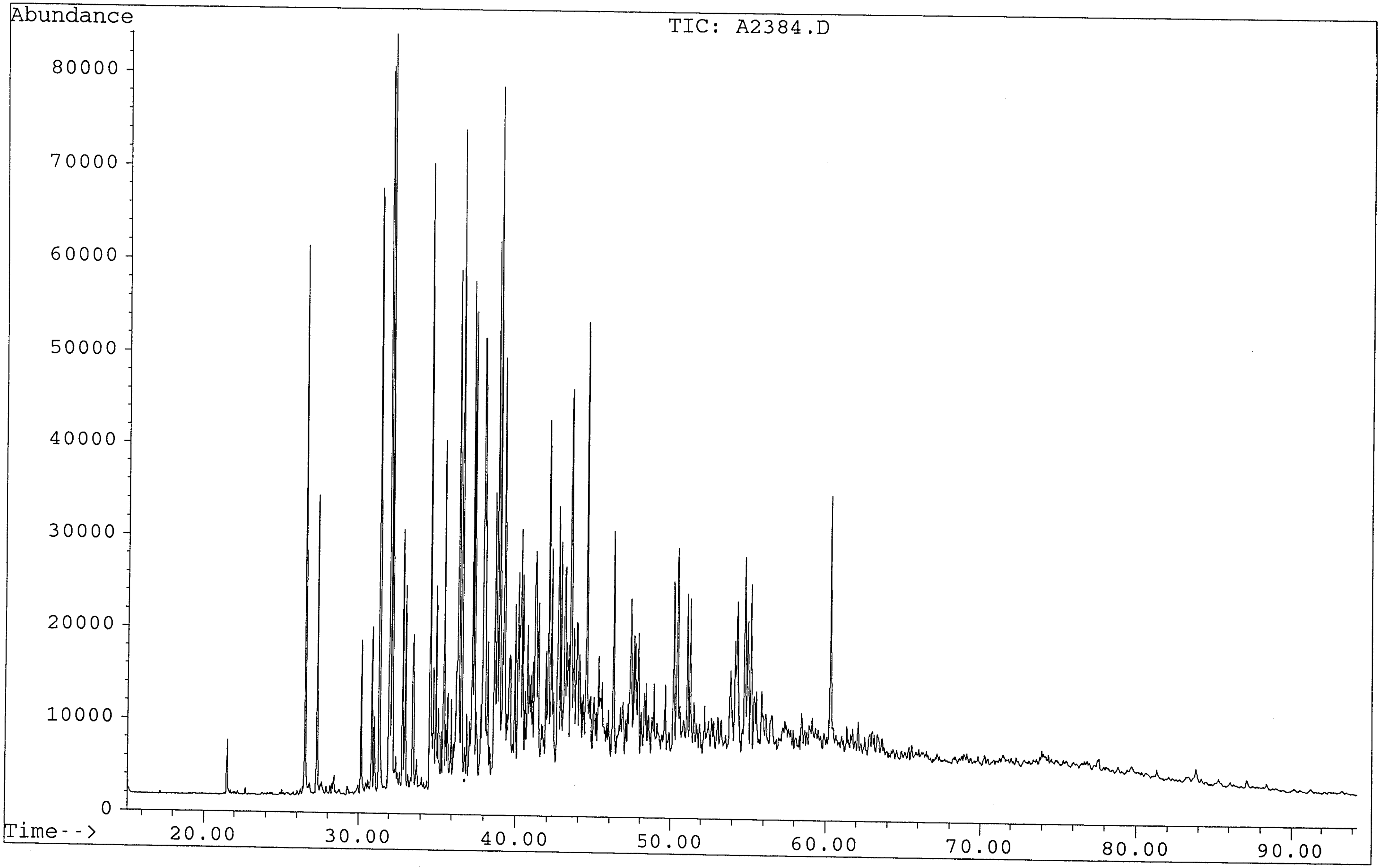
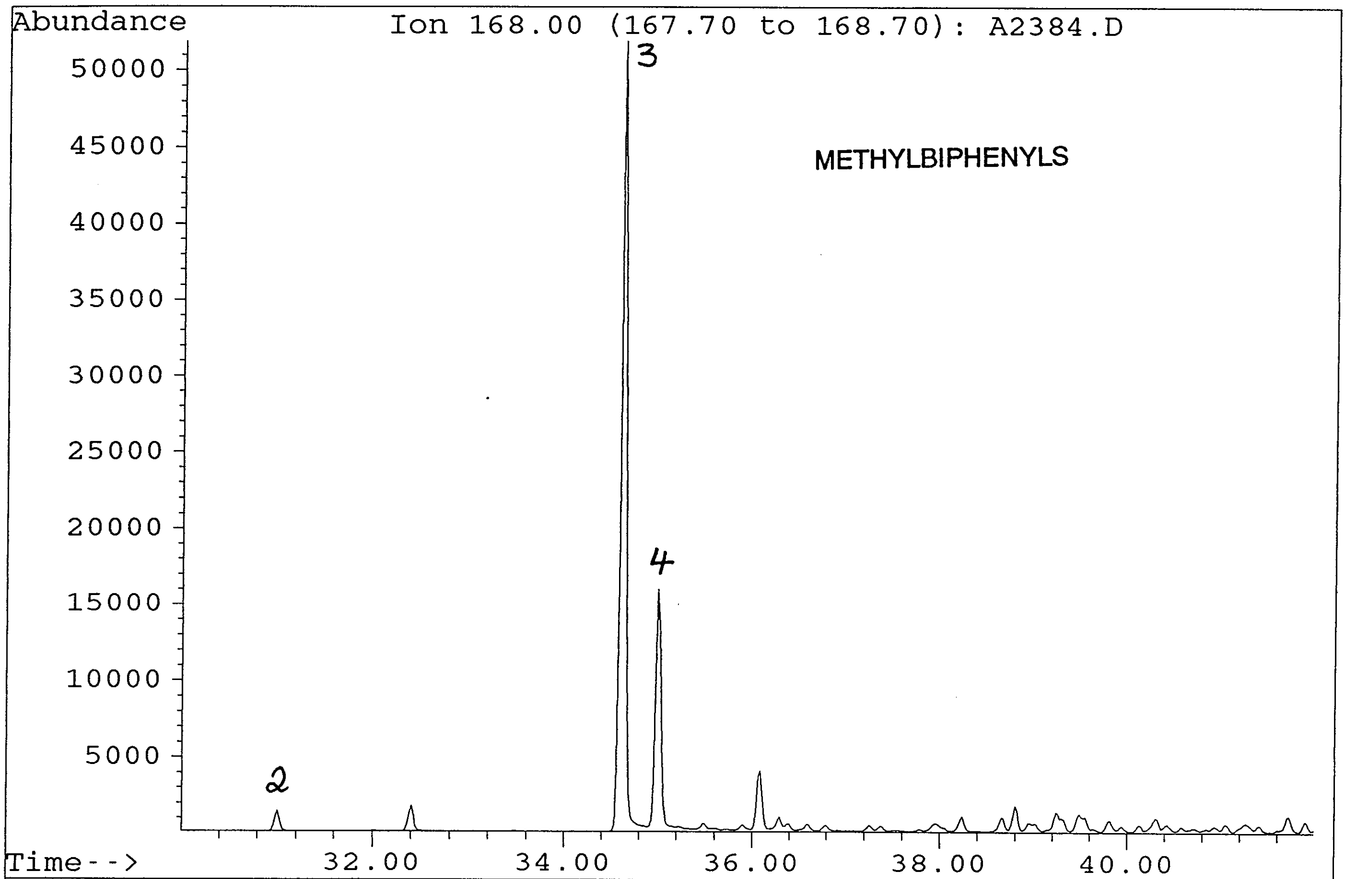


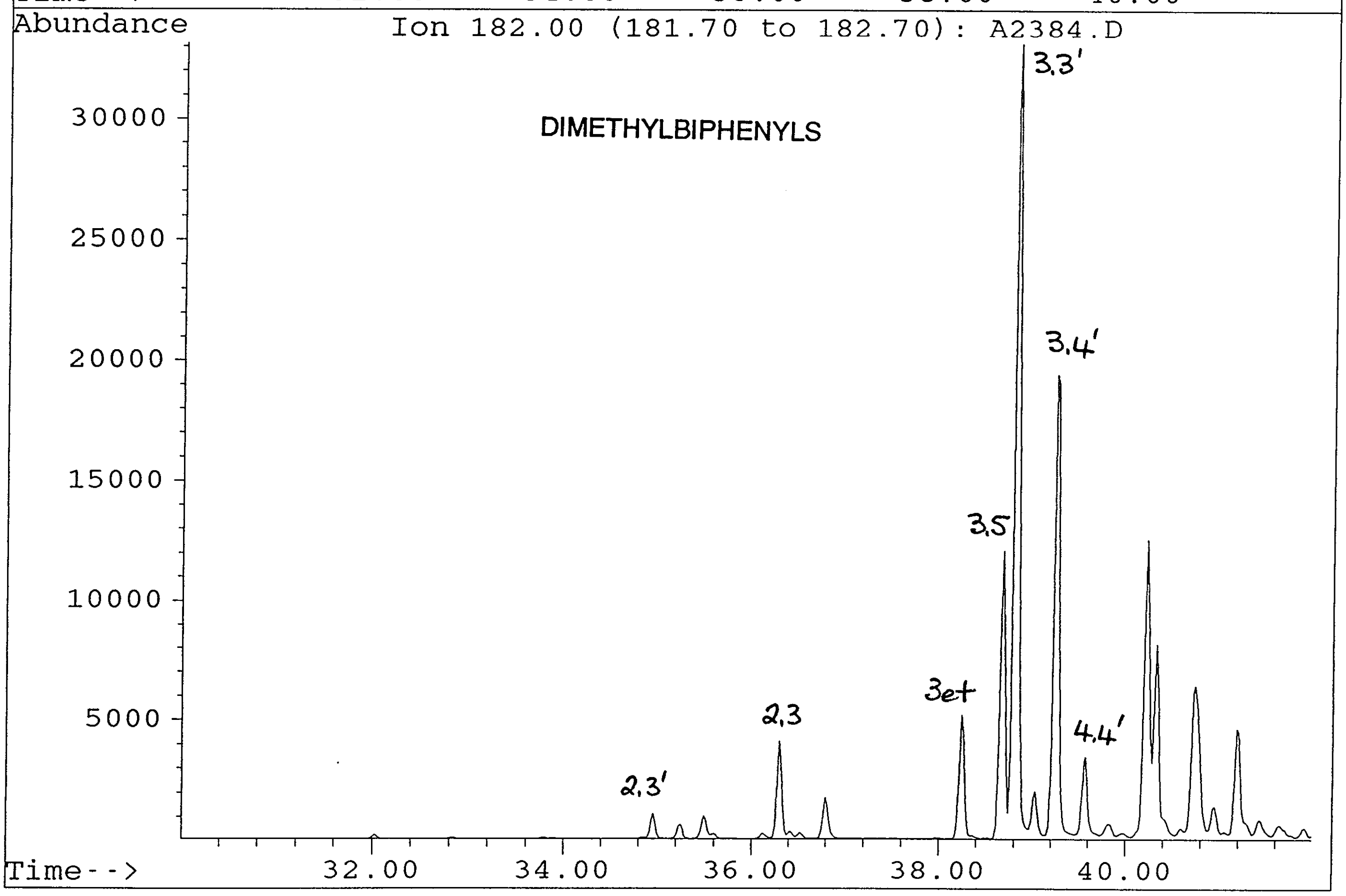
Figure 4-2

File : A2384.D
Sample : IONA-2, 1408.5. AROS
Misc. Info : COL#155. 16-3-94. SB

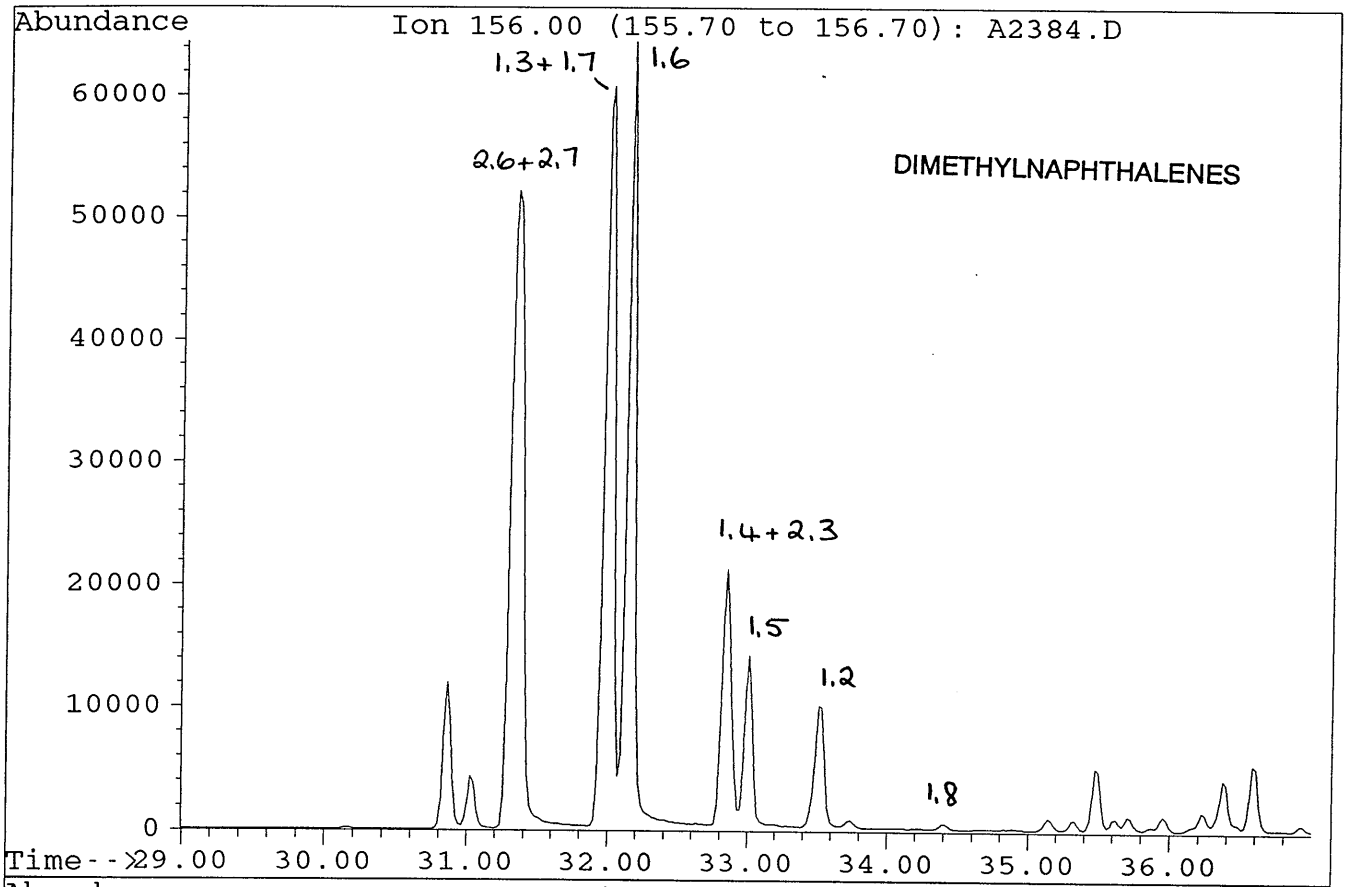


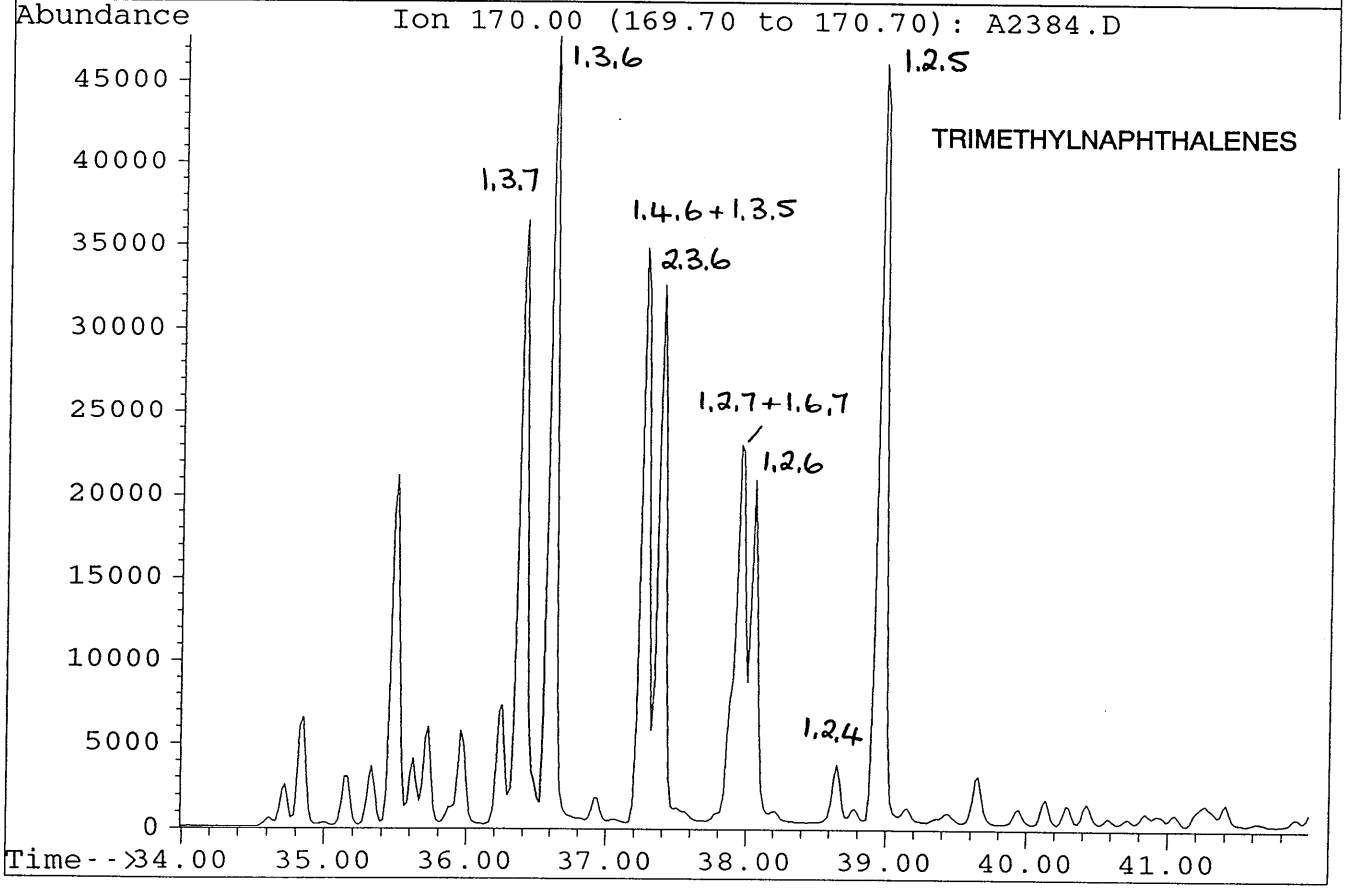
File : A2384.D
Sample : IONA-2, 1408.5. AROS
Misc. Info : COL#155. 16-3-94. SB





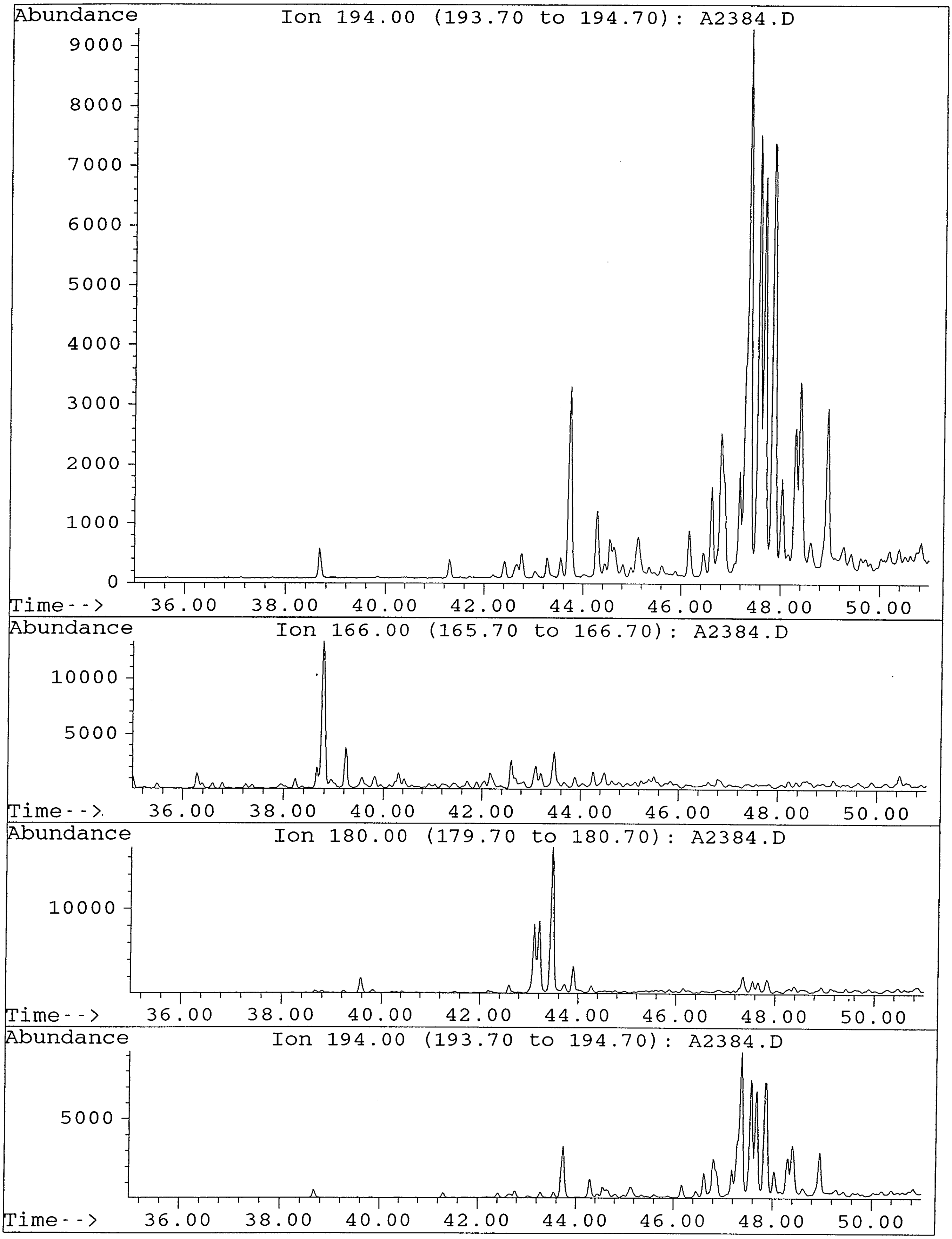
File : A2384.D
Sample : IONA-2, 1408.5. AROS
Misc. Info : COL#155. 16-3-94. SB



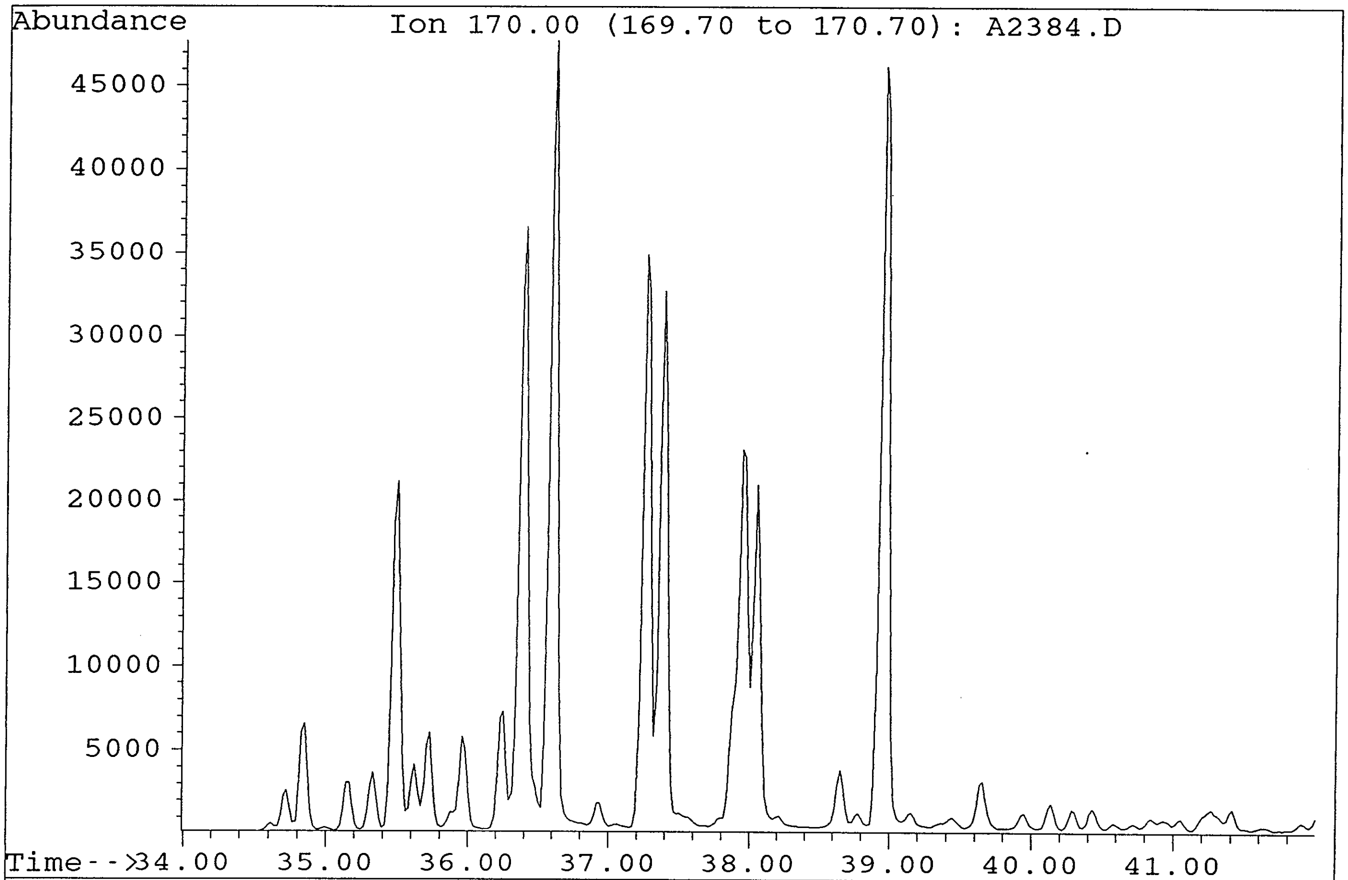


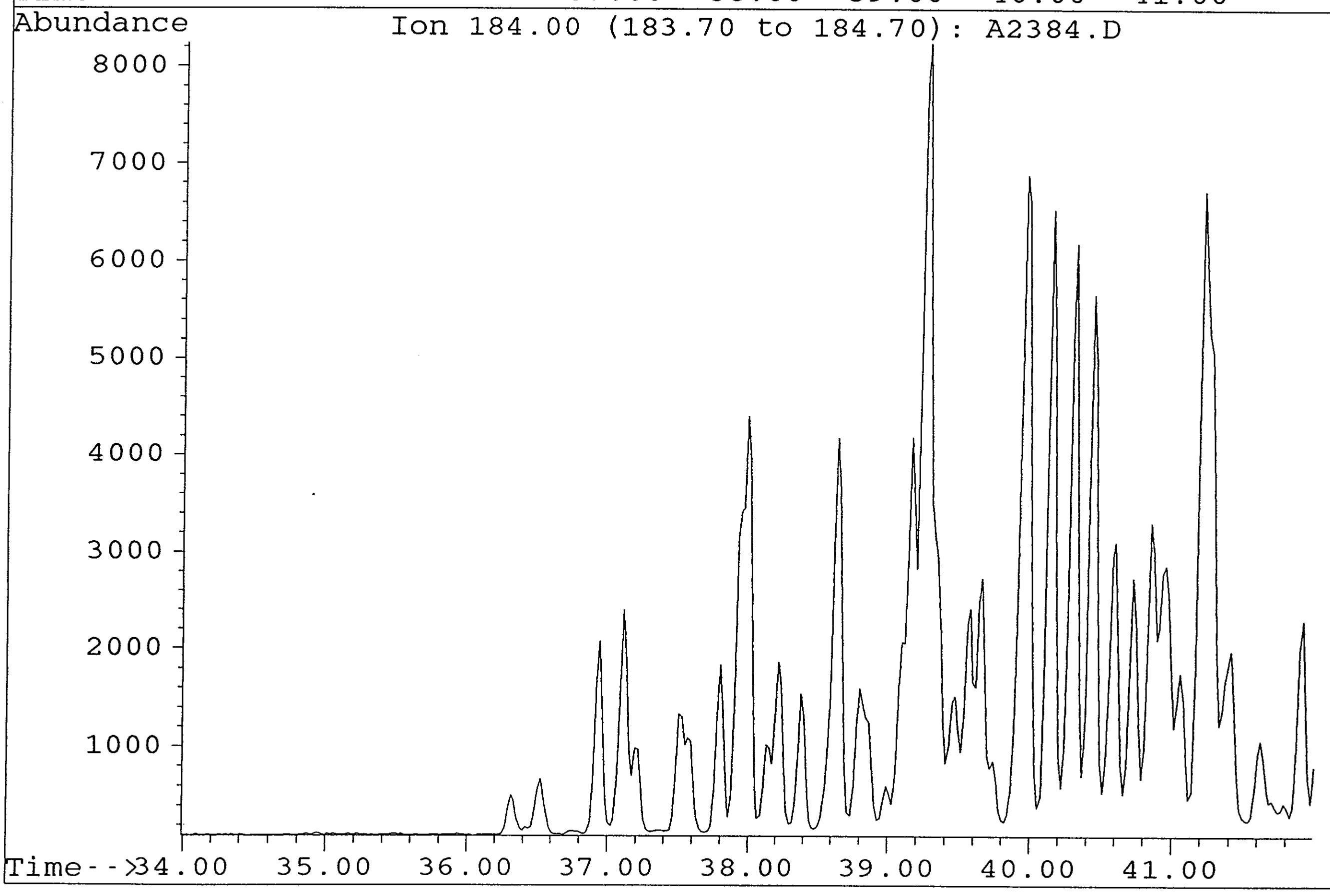
File : A2384.D
Sample : IONA-2, 1408.5. AROS
Misc. Info : COL#155. 16-3-94. SB

FLUORENES

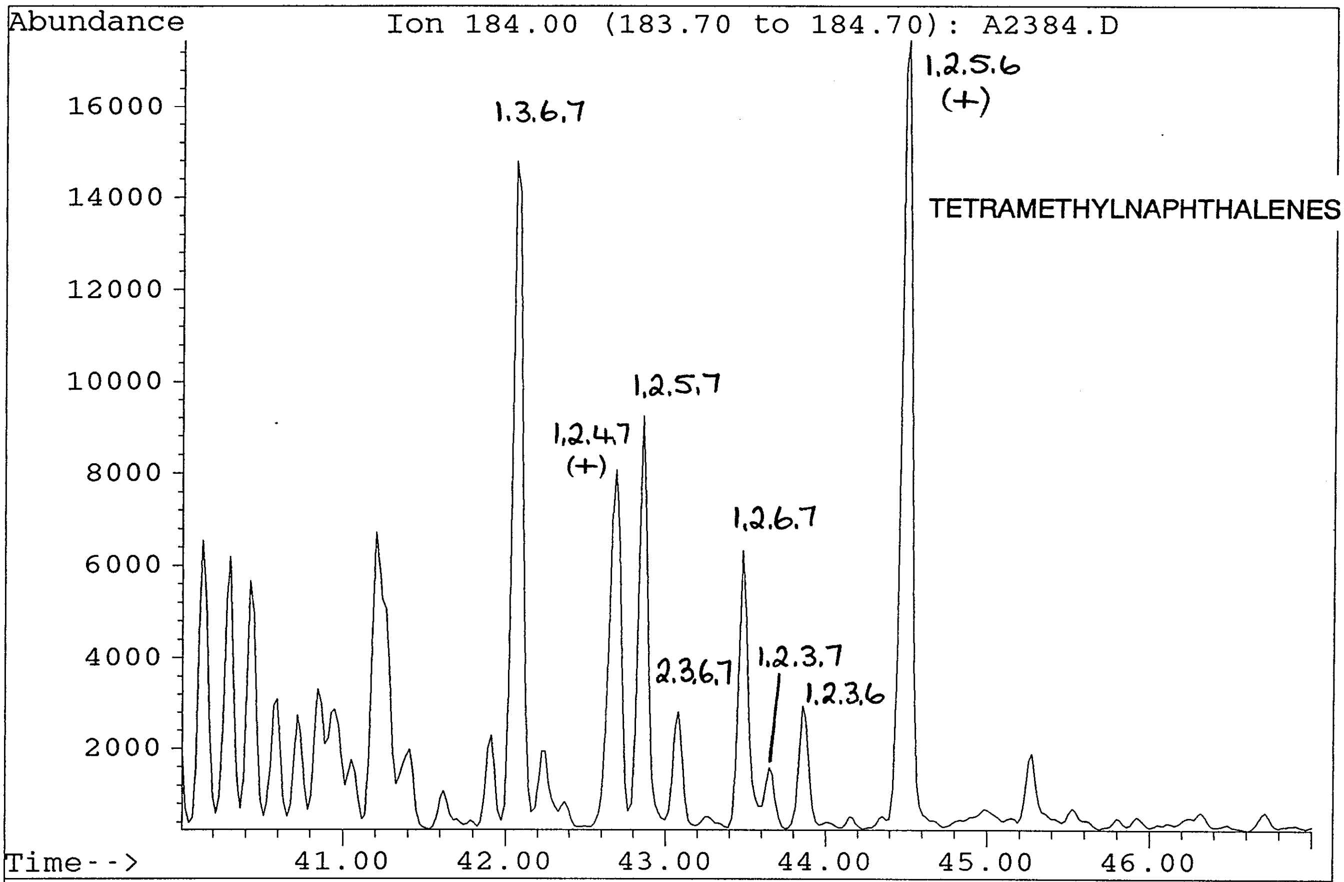


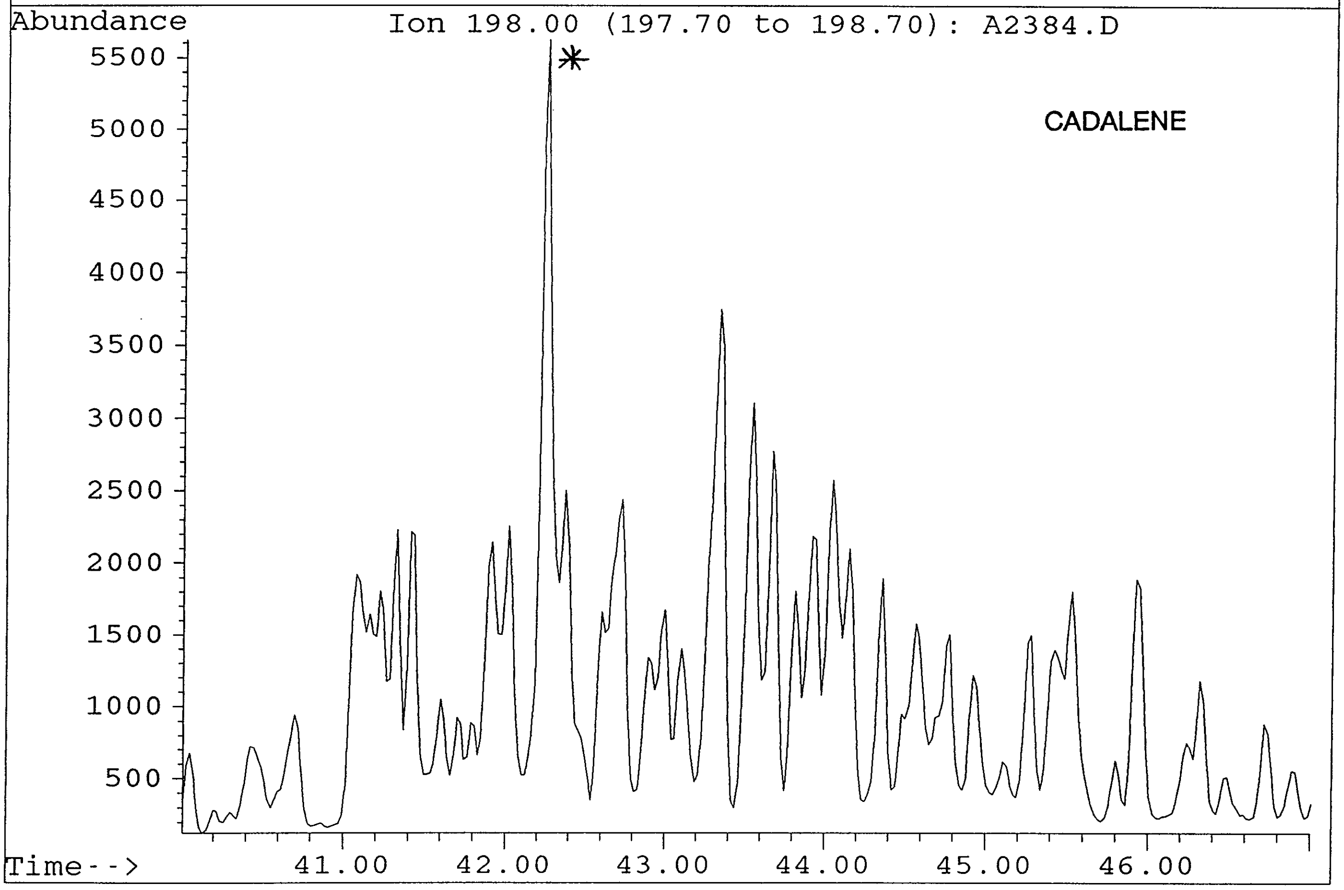
File : A2384.D
Sample : IONA-2, 1408.5. AROS
Misc. Info : COL#155. 16-3-94. SB



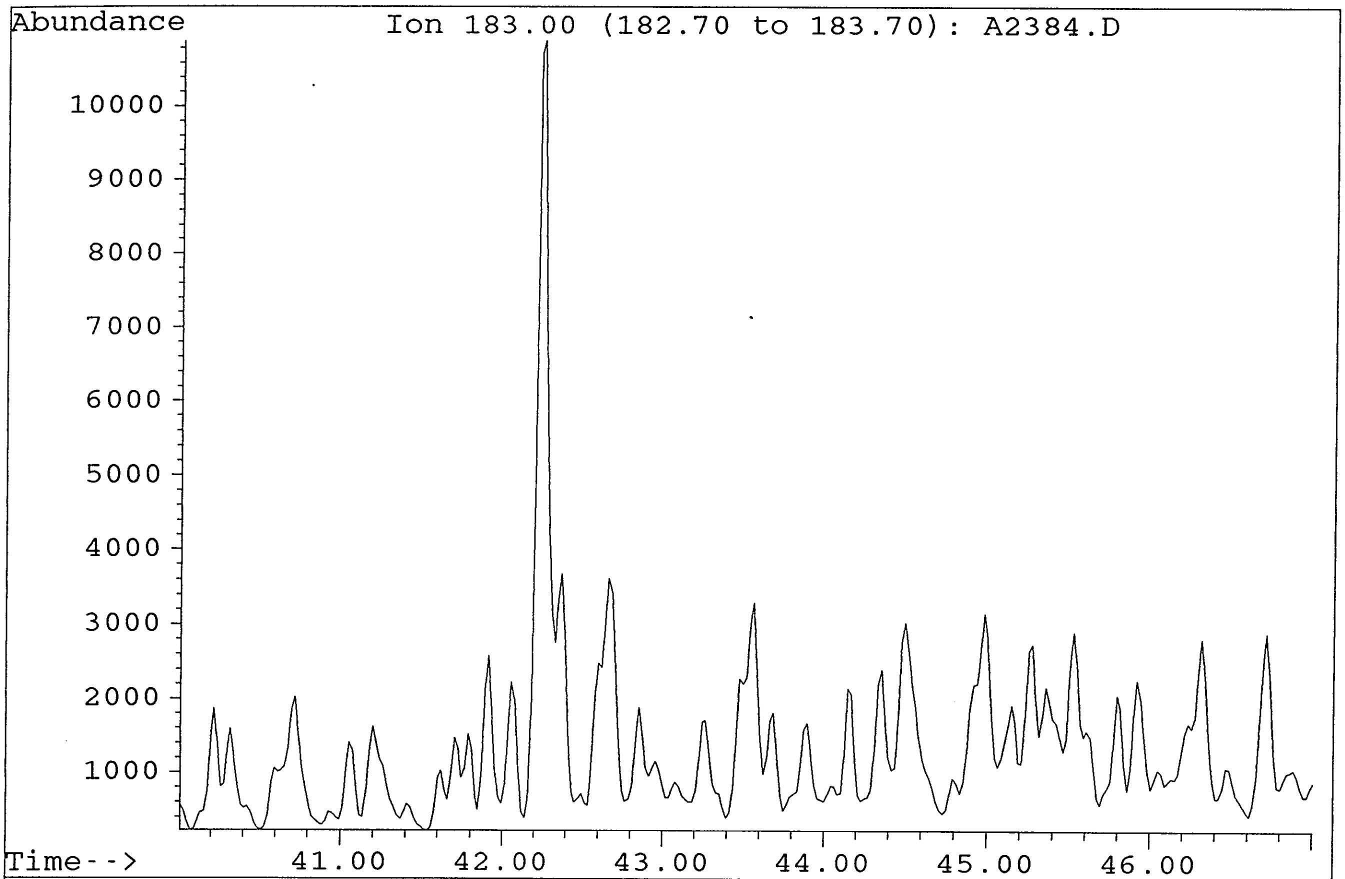


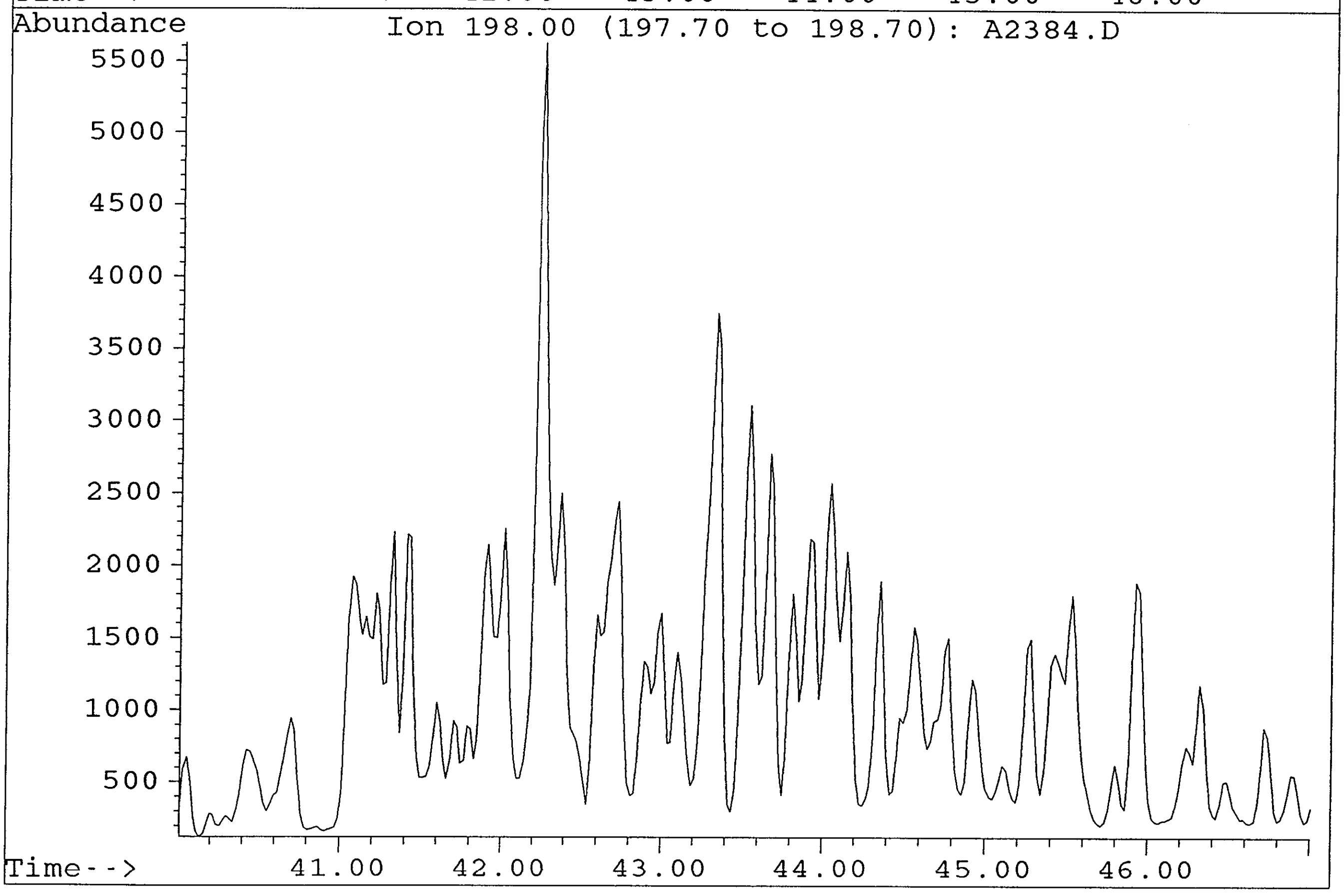
File : A2384.D
Sample : IONA-2, 1408.5. AROS
Misc. Info : COL#155. 16-3-94. SB



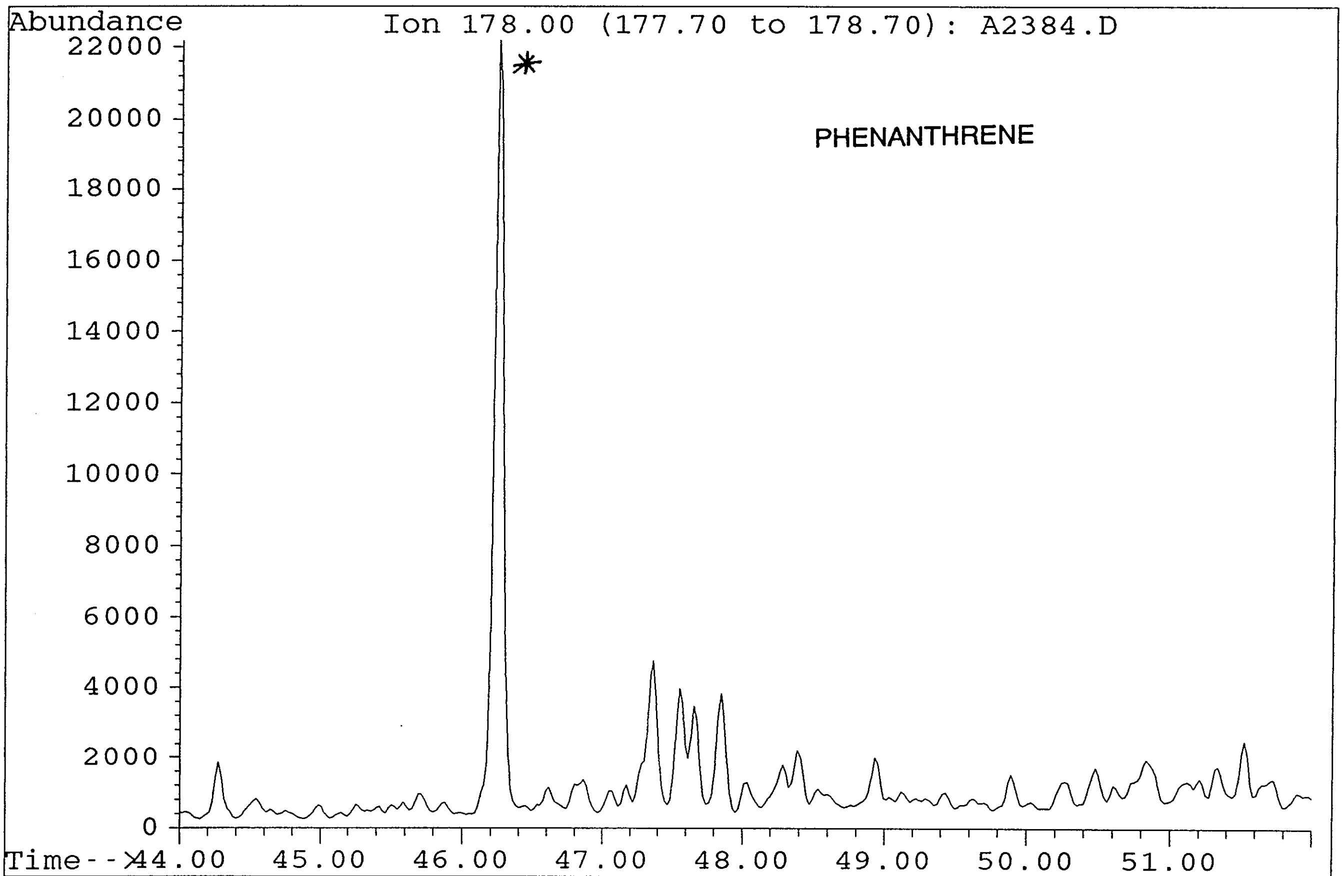


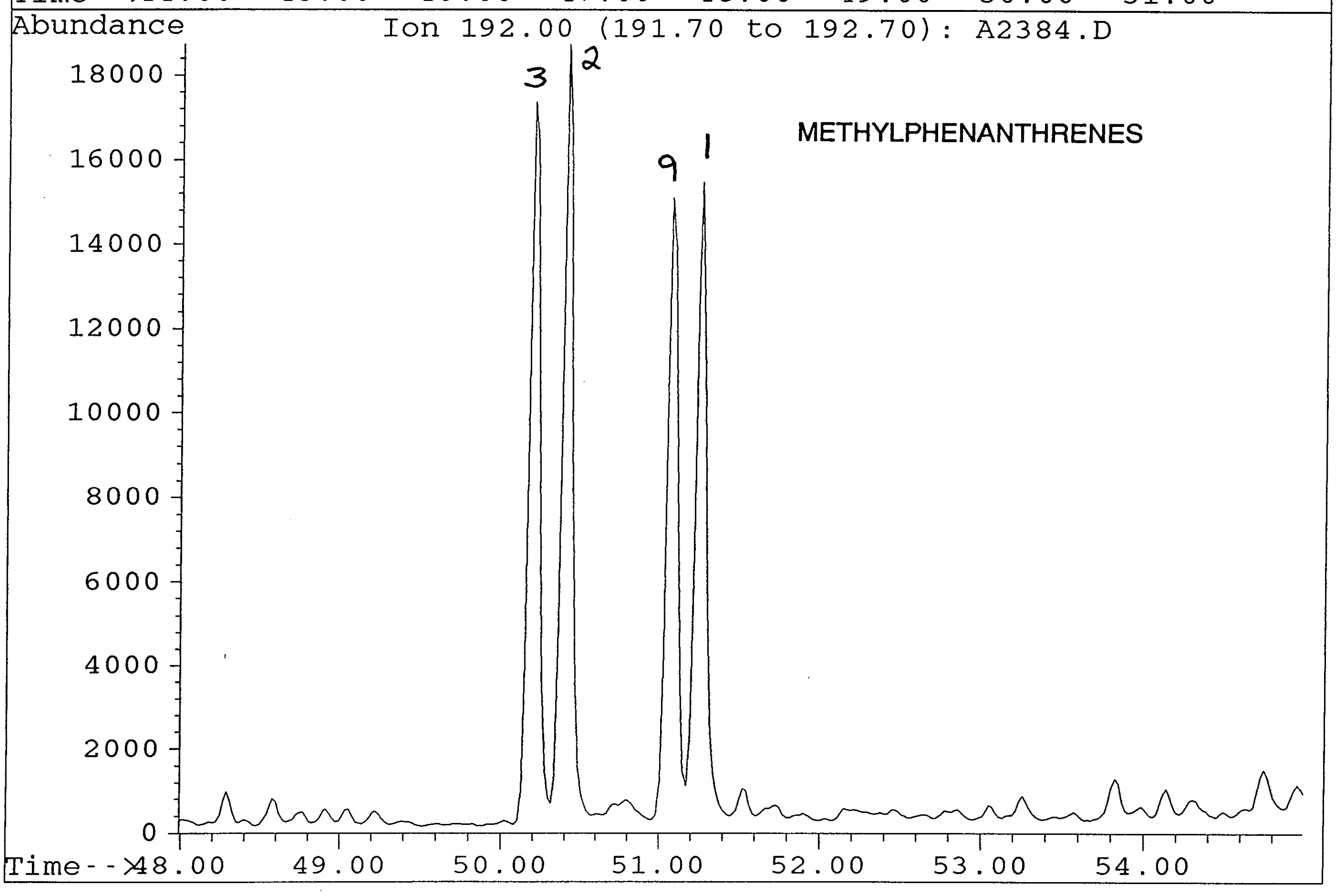
File : A2384.D
Sample : IONA-2, 1408.5. AROS
Misc. Info : COL#155. 16-3-94. SB



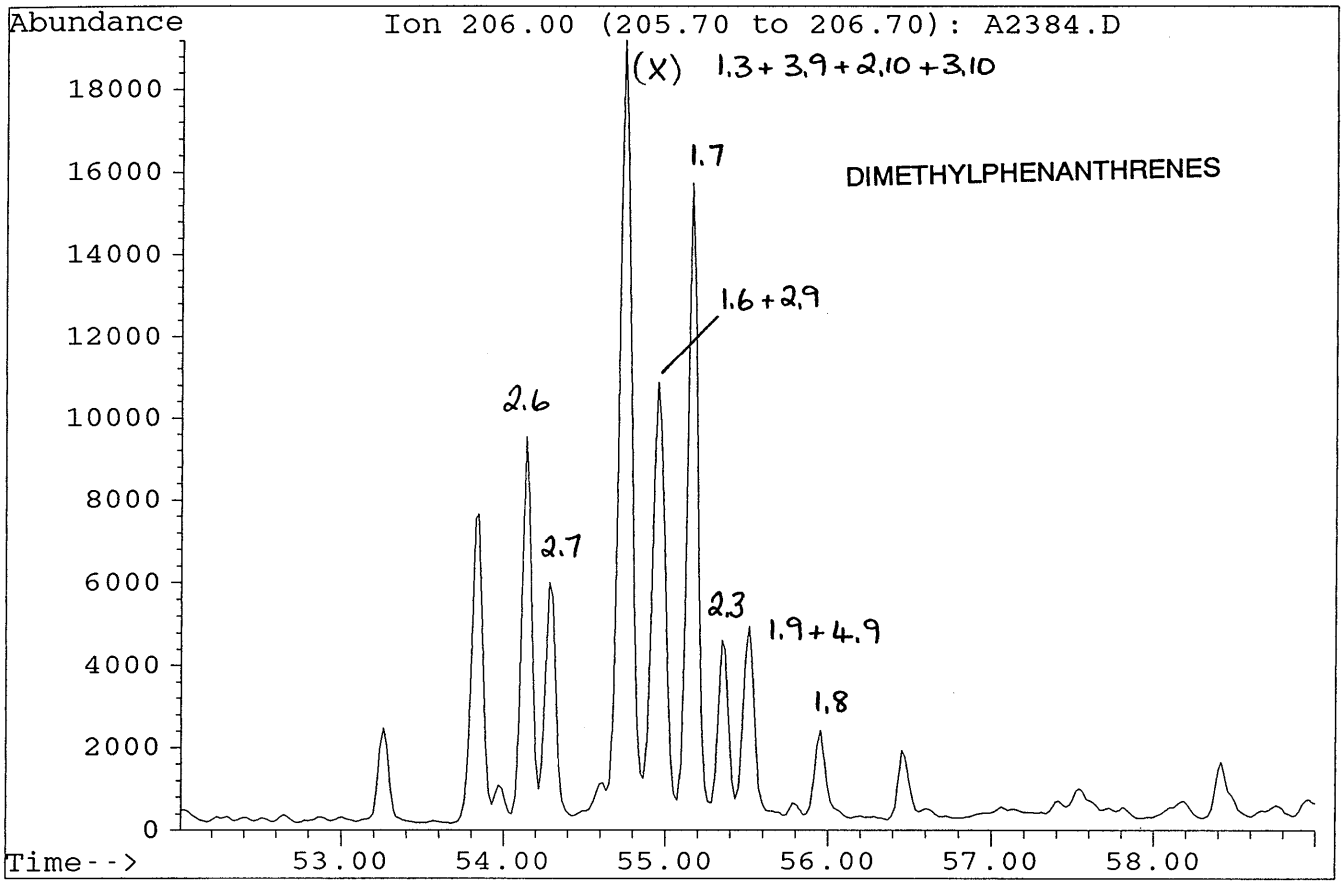


File : A2384.D
Sample : IONA-2, 1408.5. AROS
Misc. Info : COL#155. 16-3-94. SB

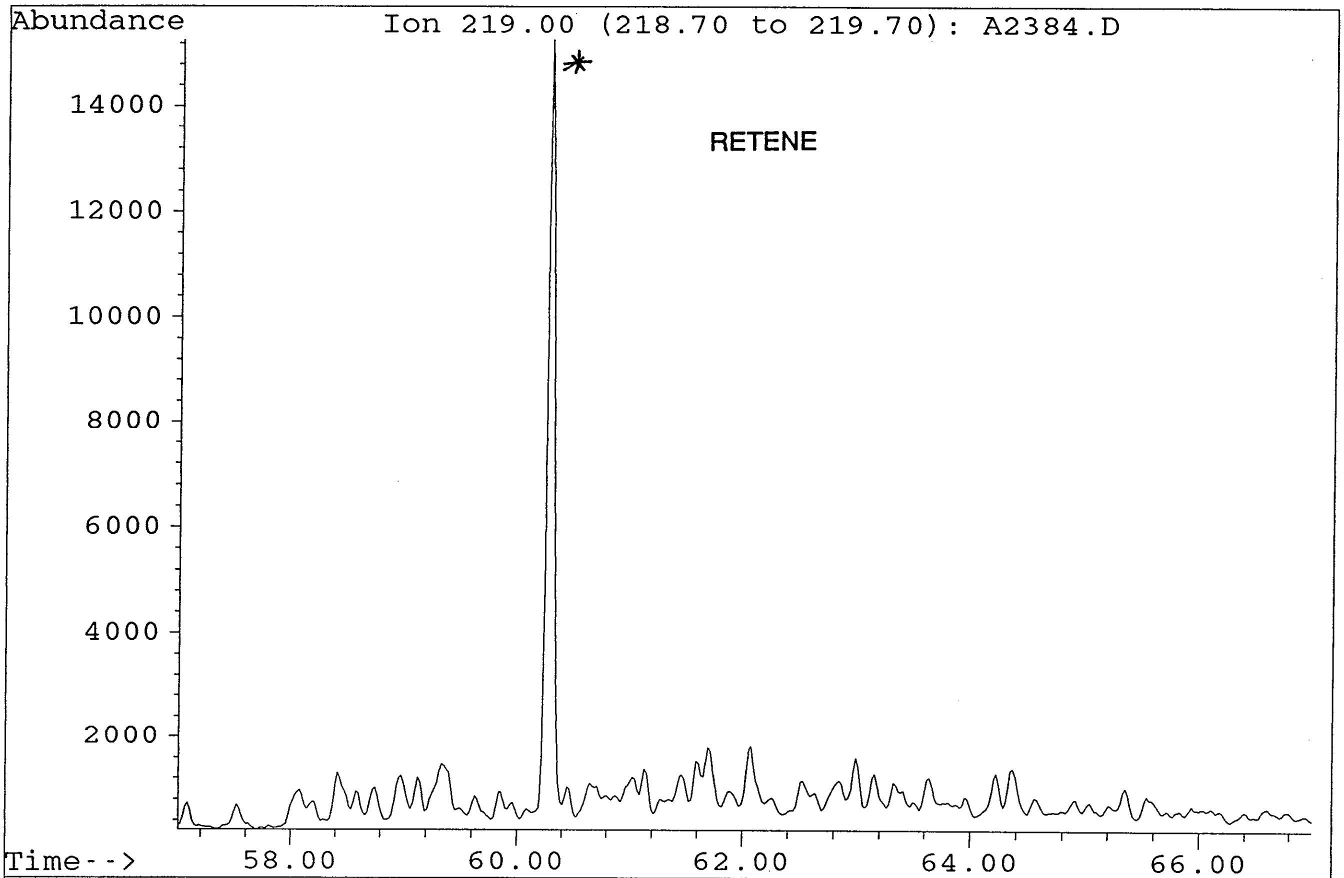


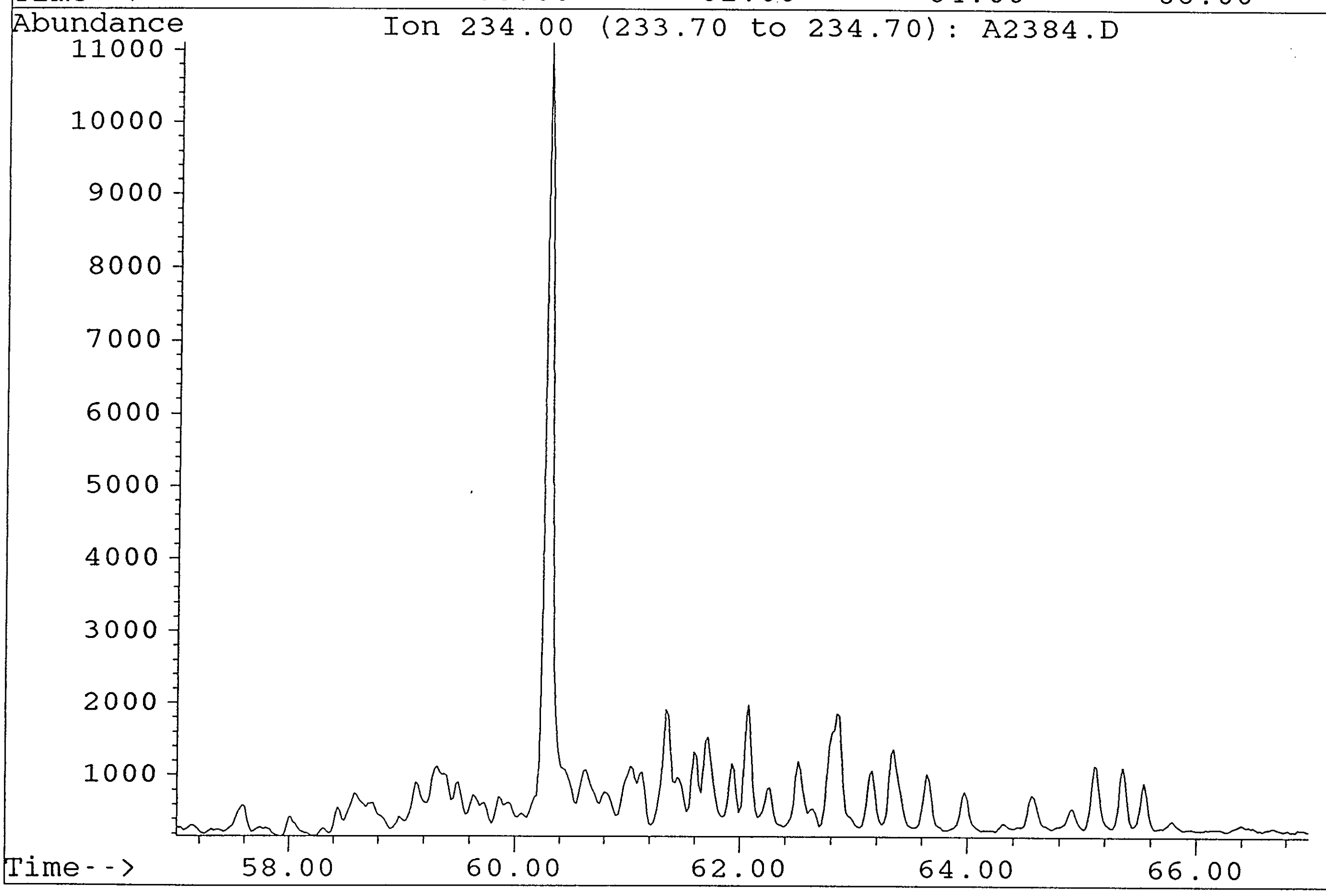


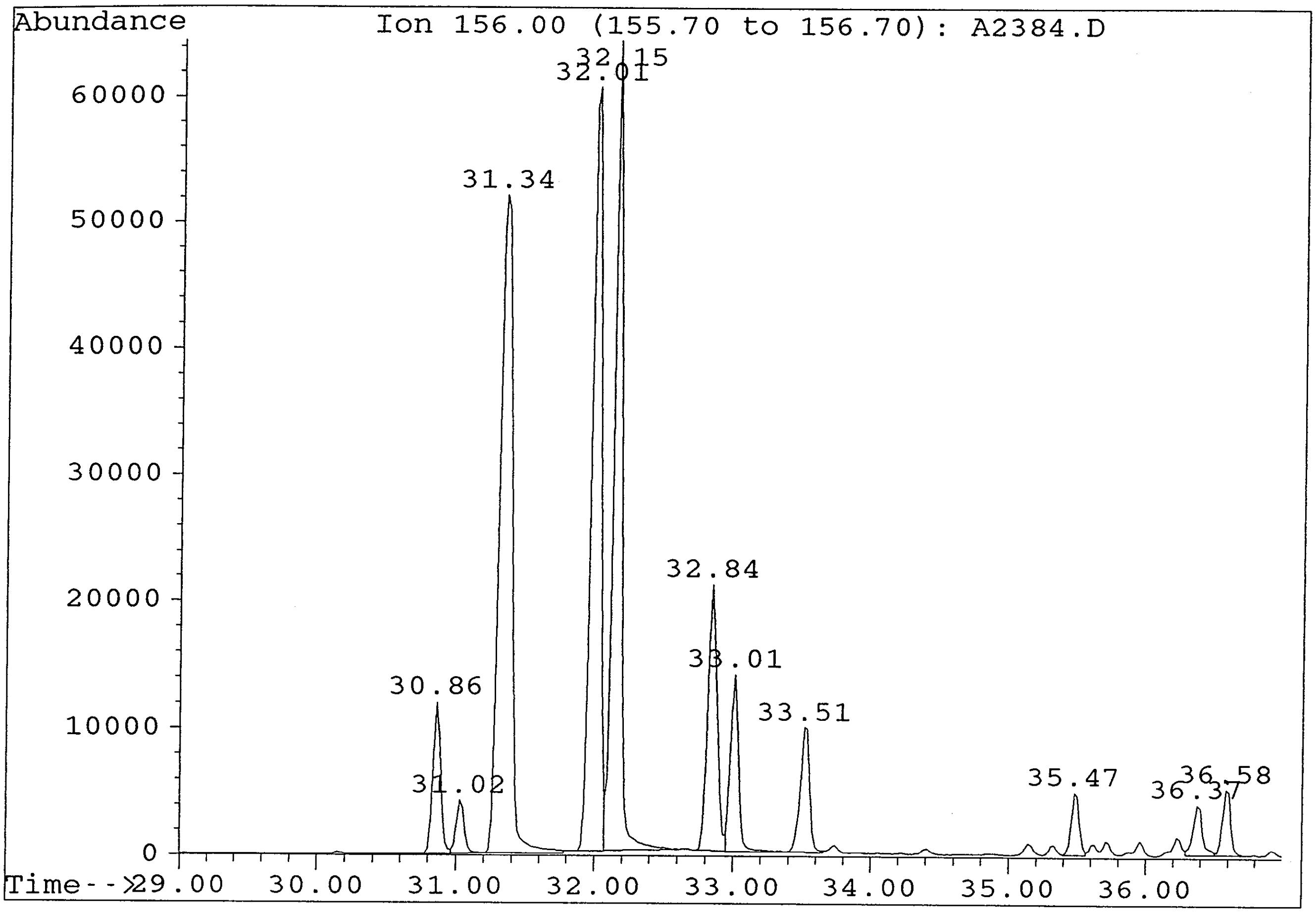
File : A2384.D
Sample : IONA-2, 1408.5. AROS
Misc. Info : COL#155. 16-3-94. SB



File : A2384.D
Sample : IONA-2, 1408.5. AROS
Misc. Info : COL#155. 16-3-94. SB

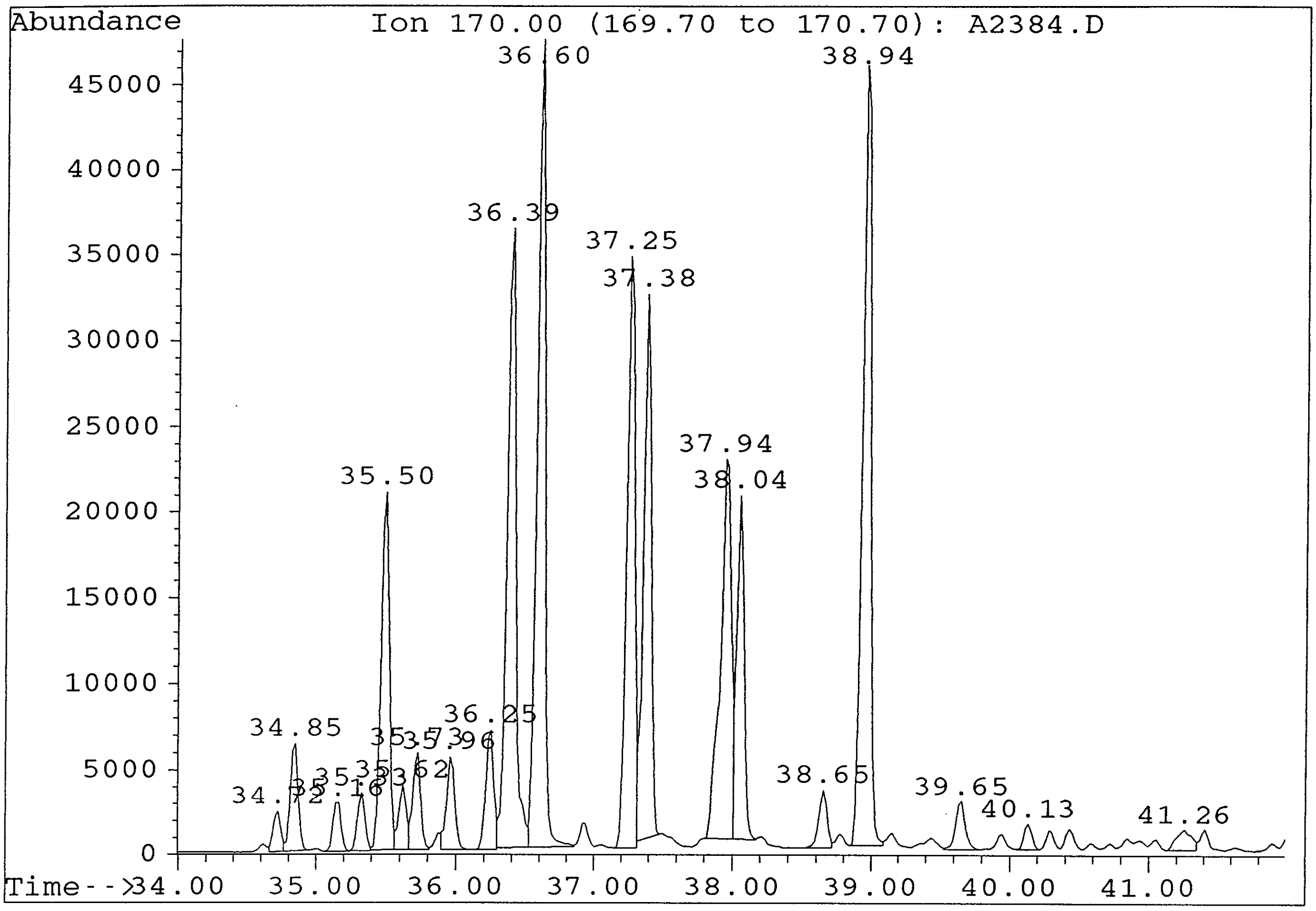






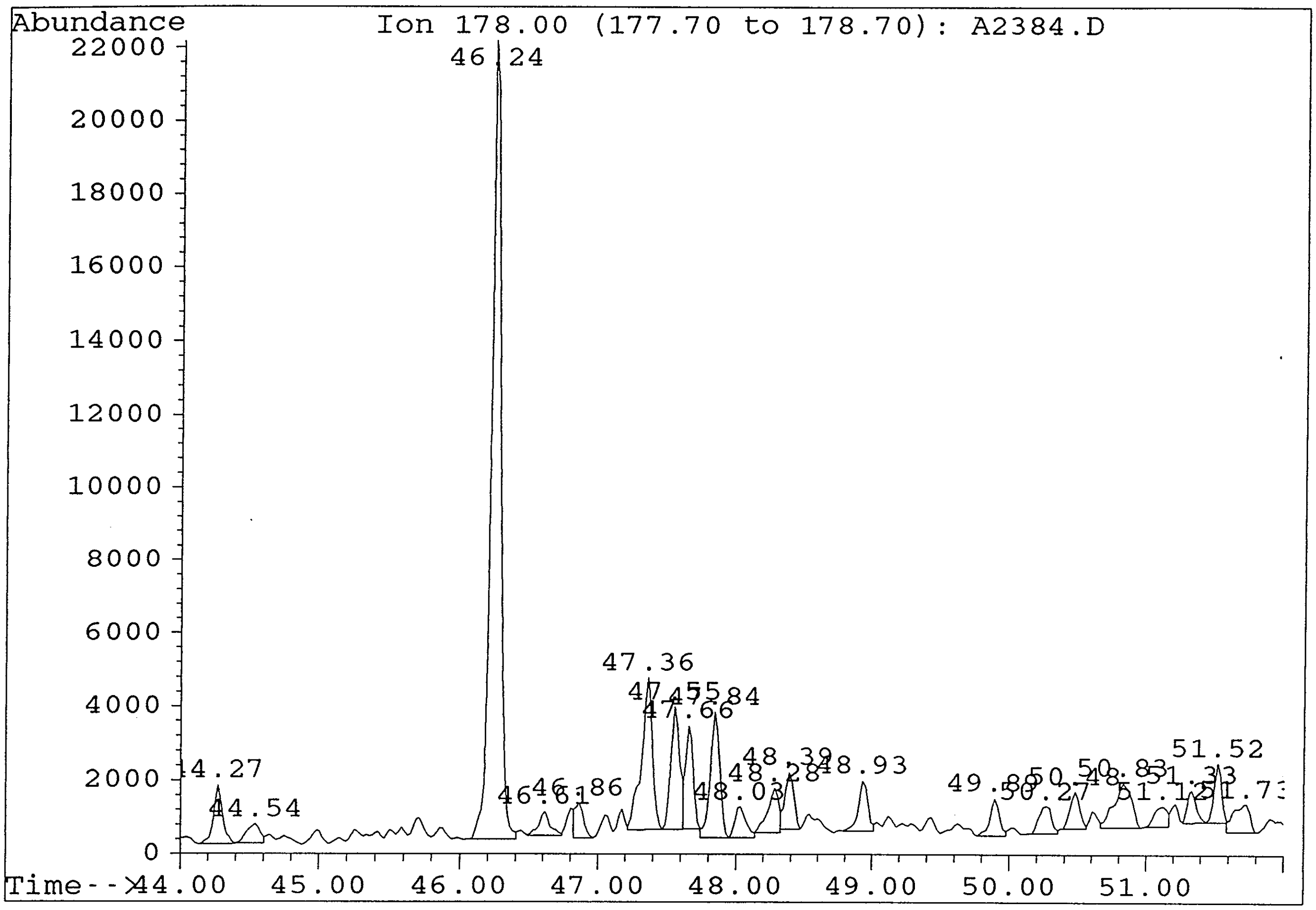
Sample : IONA-2, 1408.5. AROS

Peak	Ret.Time		Area		Height	Area %	Ratio %
1	30.86		46366		11949	3.84	13.97
2	31.02		16639		4211	1.38	5.01
3	31.34		331964	26+	52012	27.49	100.00
4	32.01		290726	–	60383	24.07	87.58
5	32.15		258280	16	63984	21.39	77.80
6	32.84		99459	14+	20874	8.24	29.96
7	33.01		55326	15	13908	4.58	16.67
8	33.51		47360		9821	3.92	14.27
9	35.47	0.7	* 20808	1,8	4957	1.72	6.27
10	36.37	8.3	19083		3978	1.58	5.75
11	36.58		21697		5171	1.80	6.54



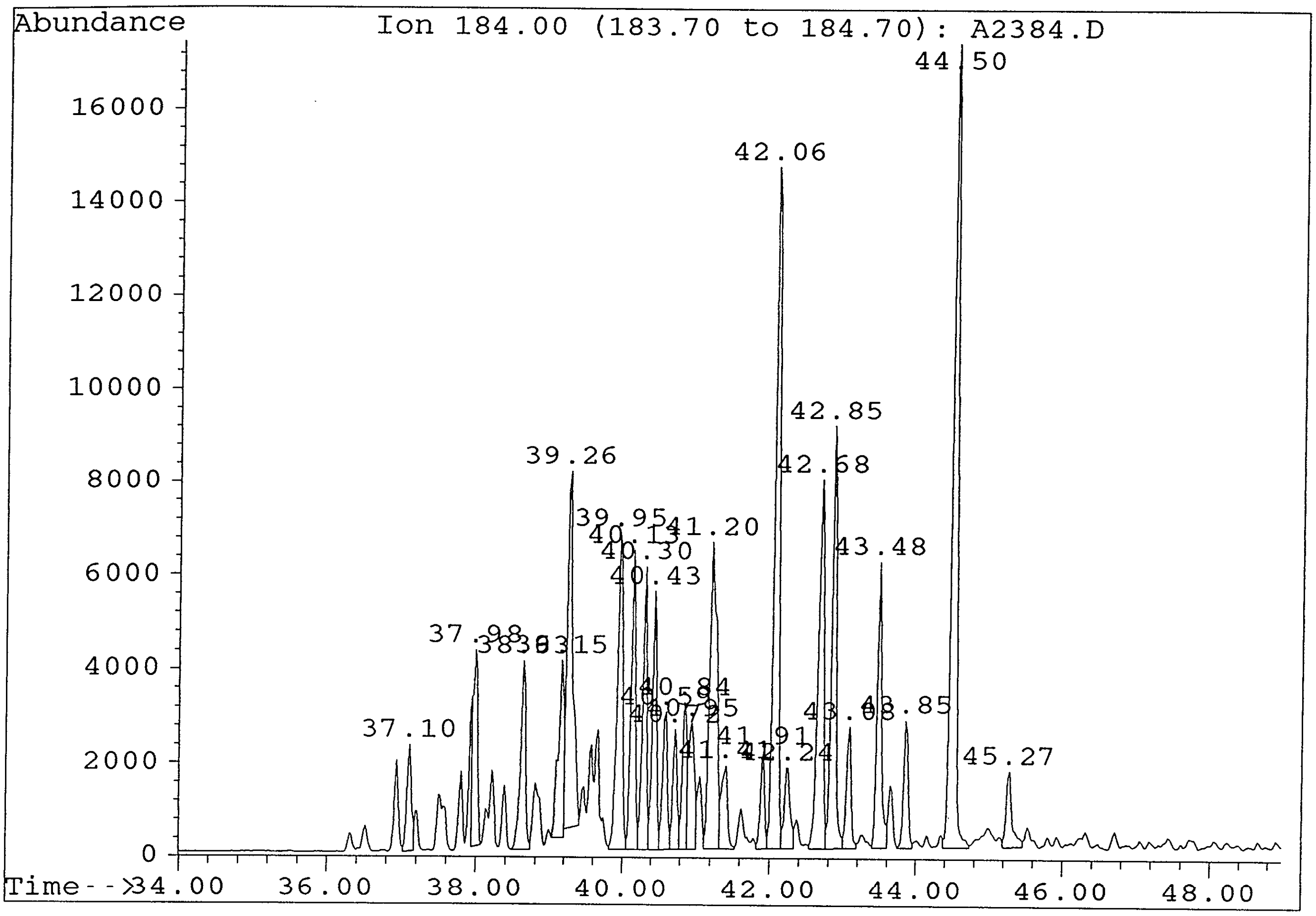
Sample : IONA-2, 1408.5. AROS

Peak	Ret.Time	Area	Height	Area %	Ratio %
1	34.72	9130	2406	0.71	4.71
2	34.85	24672	6316	1.93	12.72
3	35.16	11676	2871	0.91	6.02
4	35.33	13052	3462	1.02	6.73
5	35.50	85350	20928	6.68	44.00
6	35.62	14836	3855	1.16	7.65
7	35.73	21753	5724	1.70	11.21
8	35.96	21912	5489	1.71	11.30
9	36.25	29260	7032	2.29	15.08
10	36.39	159004 /37	36181	12.44	81.97
11	36.60	190782 /36	47284	14.93	98.35
12	37.25	143667 146+	34558	11.24	74.06
13	37.38	122198 236	31649	9.56	62.99
14	37.94	122922	22142	9.62	63.37
15	38.04	70355 –	20083	5.50	36.27
16	38.65	14472	3437	1.13	7.46
17	38.94	193984 125	45656	15.18	100.00
18	39.65	13336	2825	1.04	6.87
19	40.13	6014	1527	0.47	3.10
20	41.26	9731	1196	0.76	5.02



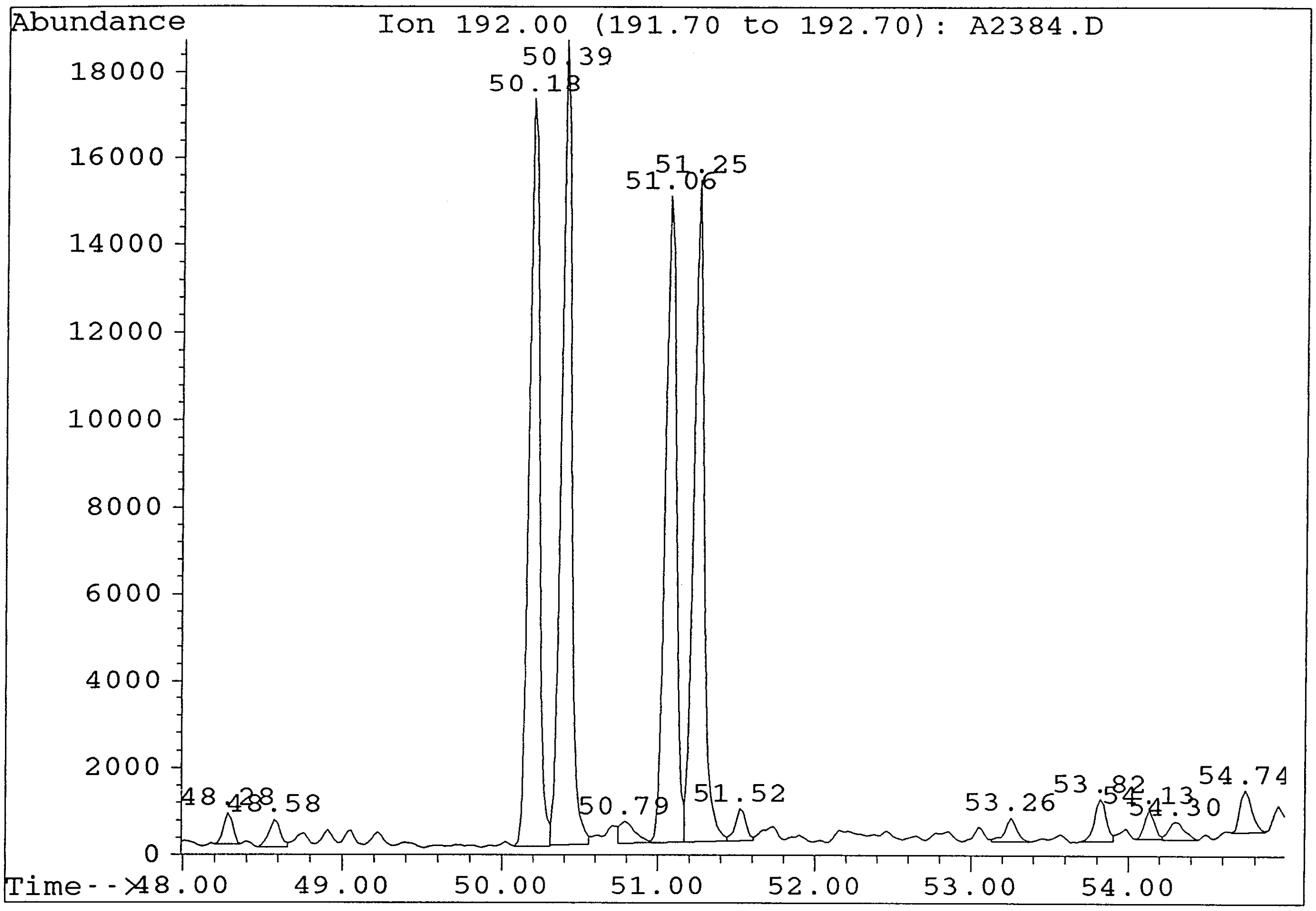
Sample : IONA-2, 1408.5. AROS

Peak	Ret.Time	Area	Height	Area %	Ratio %
1	44.27	7341	1597	2.81	6.97
2	44.54	3630	529	1.39	3.45
3	46.24	105284 P	21777	40.32	100.00
4	46.61	3909	667	1.50	3.71
5	46.86	3992	957	1.53	3.79
6	47.36	22792	4121	8.73	21.65
7	47.55	15831	3319	6.06	15.04
8	47.66	10560	2791	4.04	10.03
9	47.84	16398	3404	6.28	15.58
10	48.03	4904	842	1.88	4.66
11	48.28	6892	1193	2.64	6.55
12	48.39	6843	1525	2.62	6.50
13	48.93	6760	1365	2.59	6.42
14	49.89	4957	1015	1.90	4.71
15	50.27	4920	740	1.88	4.67
16	50.48	5070	1002	1.94	4.82
17	50.83	10755	1195	4.12	10.22
18	51.12	3835	544	1.47	3.64
19	51.33	3986	864	1.53	3.79
20	51.52	6196	1581	2.37	5.89
21	51.73	6273	761	2.40	5.96



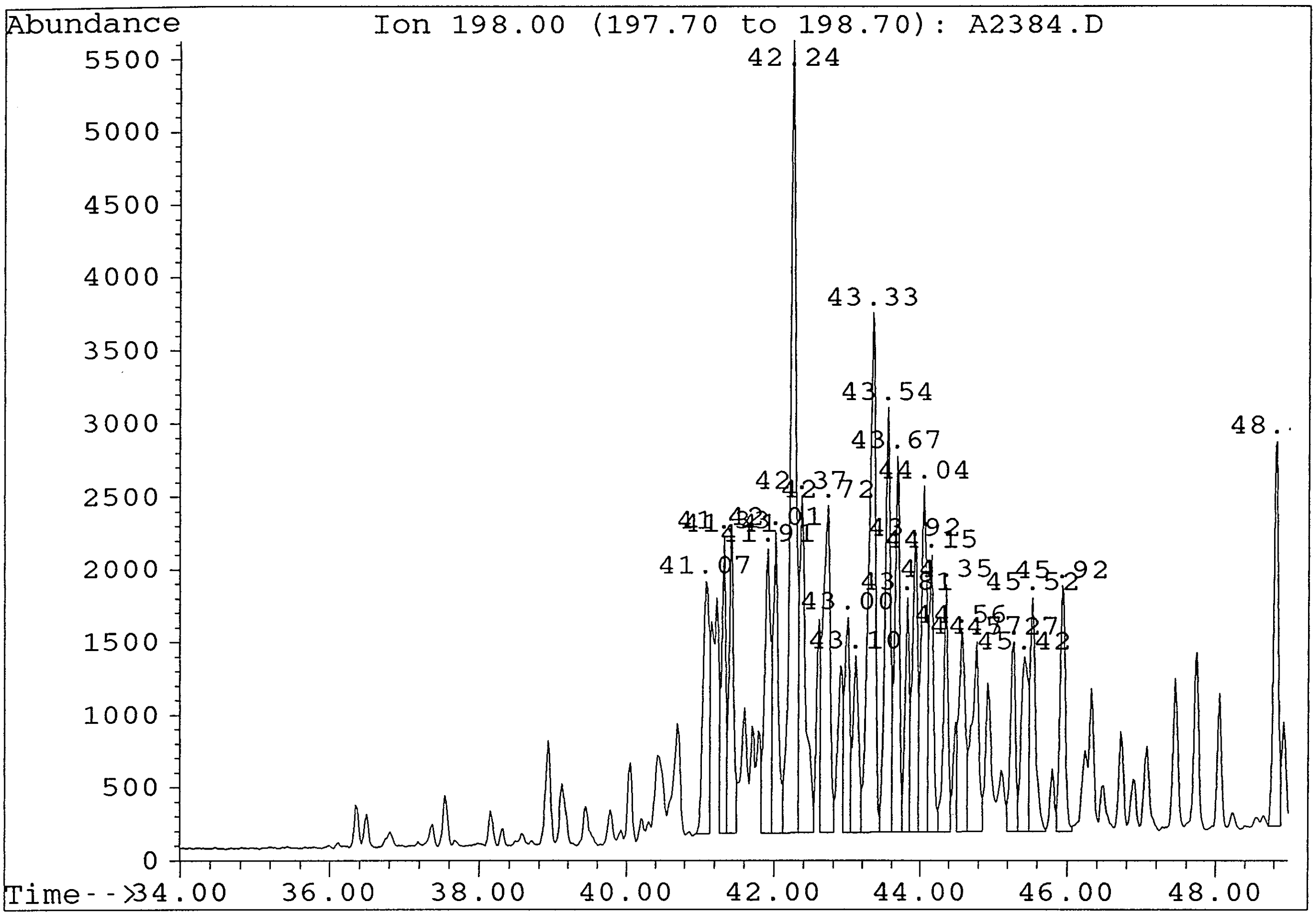
Sample : IONA-2, 1408.5. AROS

Peak	Ret.Time	Area	Height	Area %	Ratio %
1	37.10	9707	2278	1.54	11.93
2	37.98	16438	4196	2.61	20.20
3	38.63	19577	4022	3.10	24.06
4	39.15	20916	3783	3.32	25.70
5	39.26	42712	7577	6.77	52.48
6	39.95	35232	6728	5.58	43.29
7	40.13	26245	6373	4.16	32.25
8	40.30	24847	6019	3.94	30.53
9	40.43	22537	5494	3.57	27.69
10	40.59	13206	2934	2.09	16.23
11	40.72	10634	2562	1.69	13.07
12	40.84	13322	3136	2.11	16.37
13	40.95	15265	2684	2.42	18.76
14	41.20	43889	6535	6.96	53.93
15	41.41	10208	1787	1.62	12.54
16	41.91	8585	2087	1.36	10.55
17	42.06	66267	14585	10.50	81.43
18	42.24	9648	1733	1.53	11.86
19	42.68	42406	7867	6.72	52.11
20	42.85	38809	9024	6.15	47.69
21	43.08	11264	2596	1.79	13.84
22	43.48	26594	6097	4.22	32.68
23	43.85	11827	2720	1.87	14.53
24	44.50	81381	17205	12.90	100.00
25	45.27	9334	1625	1.48	11.47



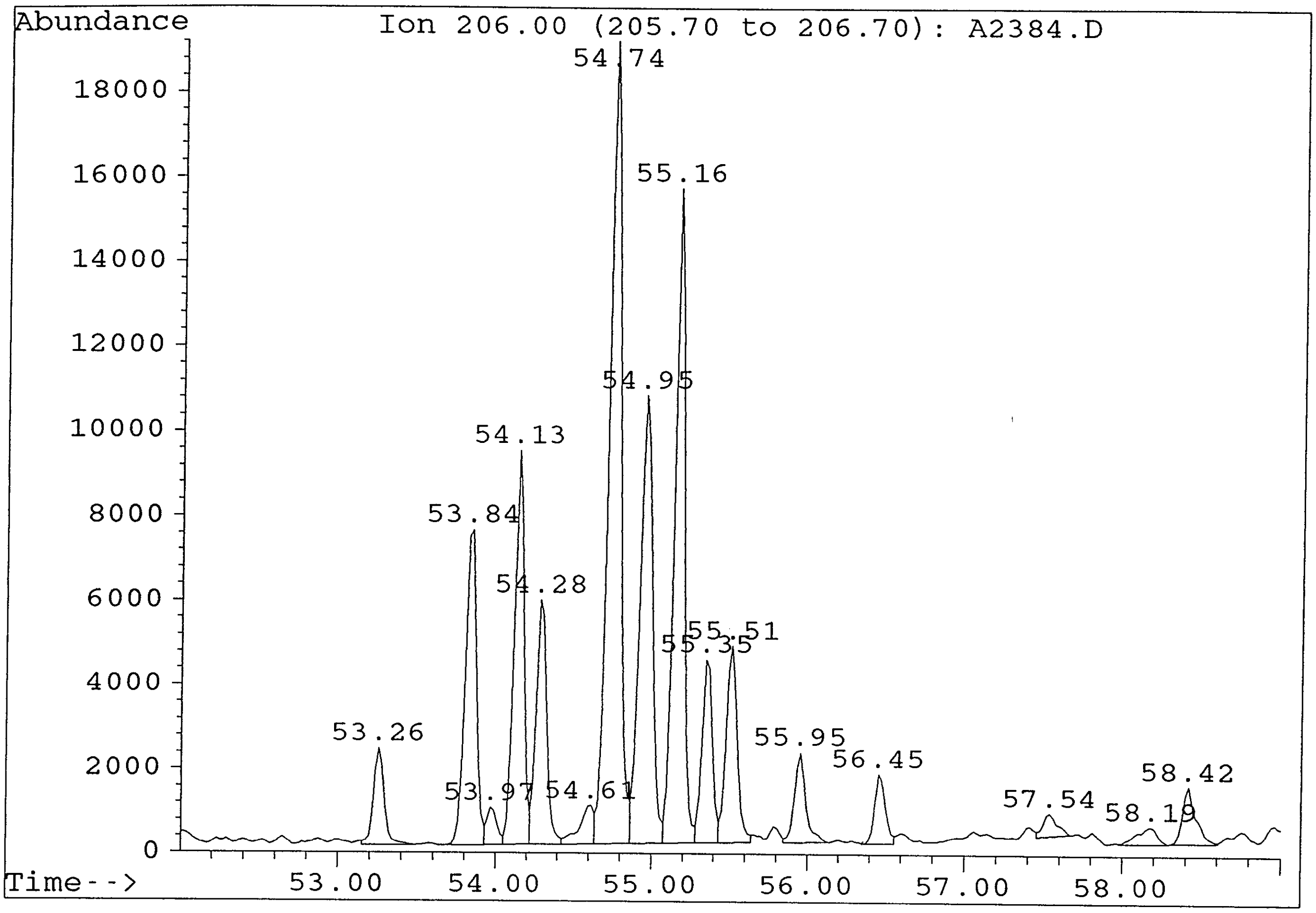
Sample : IONA-2, 1408.5. AROS

Peak	Ret.Time	Area	Height	Area %	Ratio %
1	48.28	2793	716	0.82	3.27
2	48.58	3190	628	0.94	3.74
3	50.18	81029 3	17172	23.81	94.90
4	50.39	85384 2	18522	25.09	100.00
5	50.79	3289	504	0.97	3.85
6	51.06	71152 9	14823	20.91	83.33
7	51.25	71115 1	15171	20.90	83.29
8	51.52	3404	725	1.00	3.99
9	53.26	3005	556	0.88	3.52
10	53.82	5116	977	1.50	5.99
11	54.13	3007	662	0.88	3.52
12	54.30	2734	405	0.80	3.20
13	54.74	5048	962	1.48	5.91



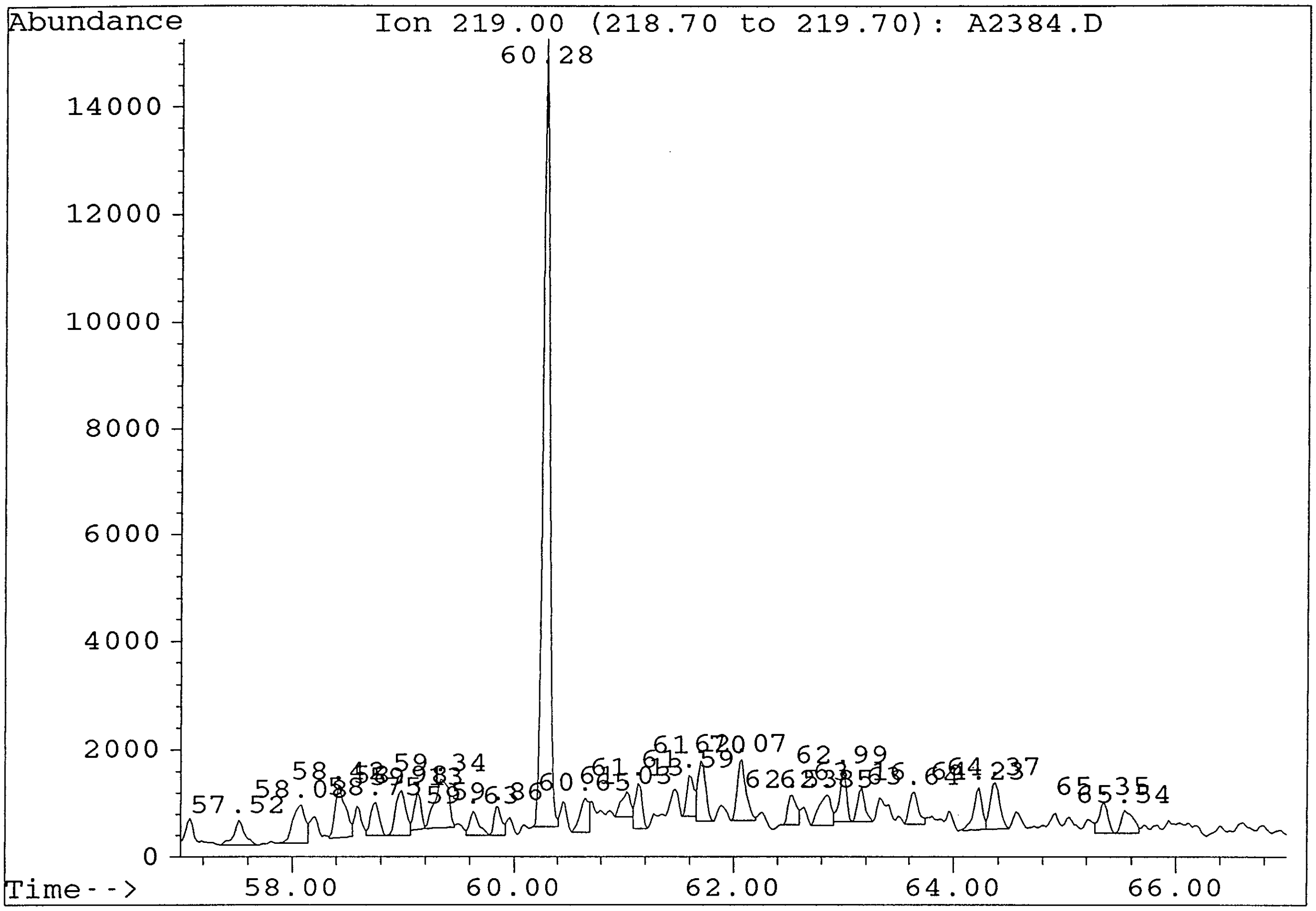
Sample : IONA-2, 1408.5. AROS

Peak	Ret.Time	Area	Height	Area %	Ratio %
1	41.07	11095	1735	3.95	36.21
2	41.33	8334	2045	2.97	27.20
3	41.41	8815	2026	3.14	28.77
4	41.91	12149	1956	4.33	39.65
5	42.01	9239	2068	3.29	30.16
6	42.24	30637	5439	10.92	100.00
7	42.37	12651	2315	4.51	41.29
8	42.72	15404	2251	5.49	50.28
9	43.00	6843	1481	2.44	22.34
10	43.10	6675	1215	2.38	21.79
11	43.33	23314	3564	8.31	76.10
12	43.54	15918	2915	5.67	51.96
13	43.67	12037	2585	4.29	39.29
14	43.81	6773	1613	2.41	22.11
15	43.92	10988	1992	3.92	35.87
16	44.04	13222	2380	4.71	43.16
17	44.15	8250	1905	2.94	26.93
18	44.35	7501	1701	2.67	24.48
19	44.56	8491	1386	3.03	27.71
20	44.77	8963	1310	3.19	29.26
21	45.27	6251	1304	2.23	20.40
22	45.42	8343	1202	2.97	27.23
23	45.52	7734	1606	2.76	25.24
24	45.92	8385	1689	2.99	27.37
25	48.83	12563	2641	4.48	41.01



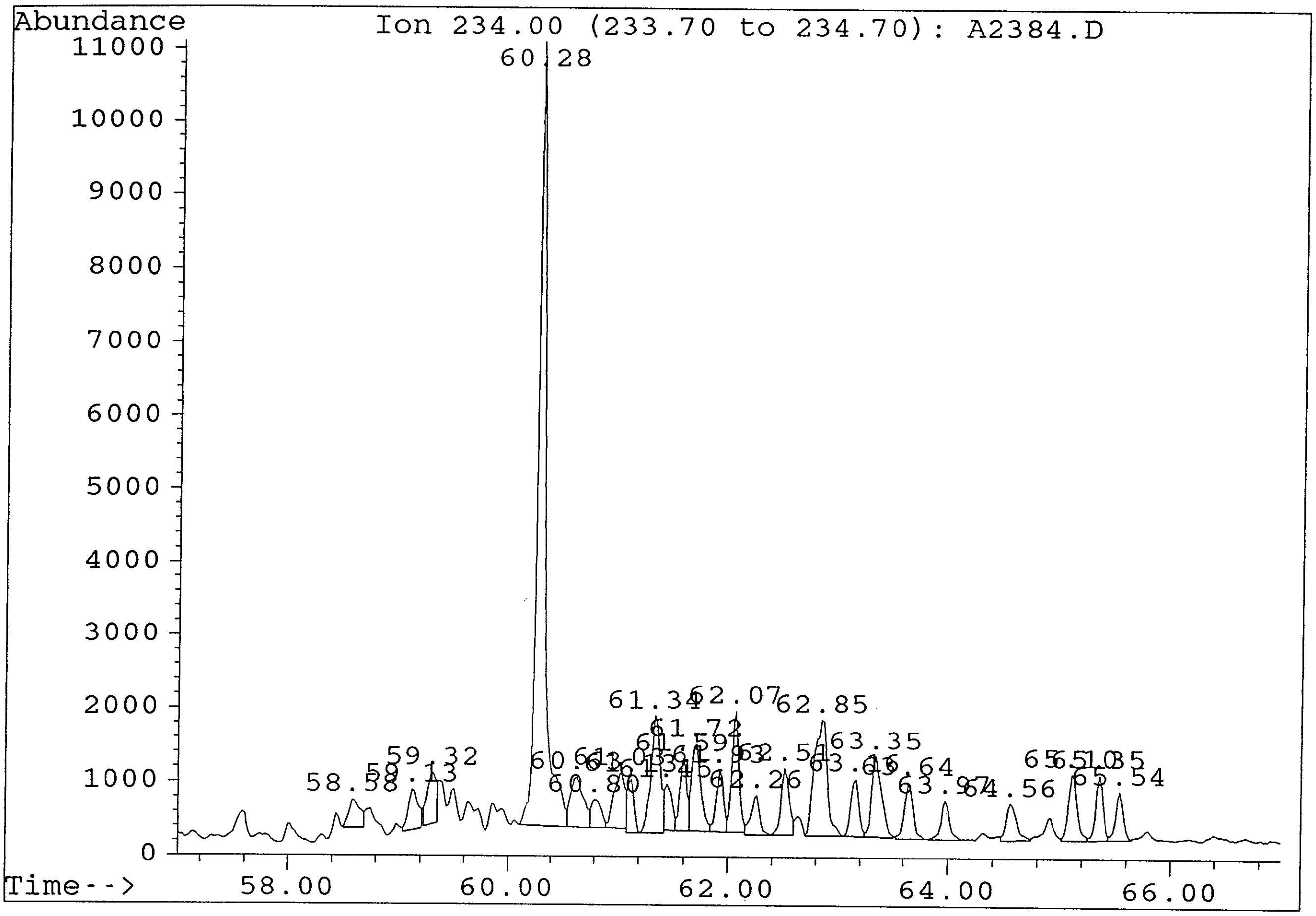
Sample : IONA-2, 1408.5. AROS

Peak	Ret.Time	Area	Height	Area %	Ratio %
1	53.26	10949	2317	2.49	10.52
2	53.84	37673	7506	8.56	36.20
3	53.97	4179	908	0.95	4.02
4	54.13	41662	9366	9.46	40.03
5	54.28	27663	5826	6.28	26.58
6	54.61	6117	936	1.39	5.88
7	54.74	104065 x	18989	23.64	100.00
8	54.95	60376	10629	13.71	58.02
9	55.16	69879 17	15501	15.87	67.15
10	55.35	20122	4365	4.57	19.34
11	55.51	23155	4686	5.26	22.25
12	55.95	10936	2136	2.48	10.51
13	56.45	8294	1669	1.88	7.97
14	57.54	3458	533	0.79	3.32
15	58.19	3577	406	0.81	3.44
16	58.42	8122	1356	1.84	7.80



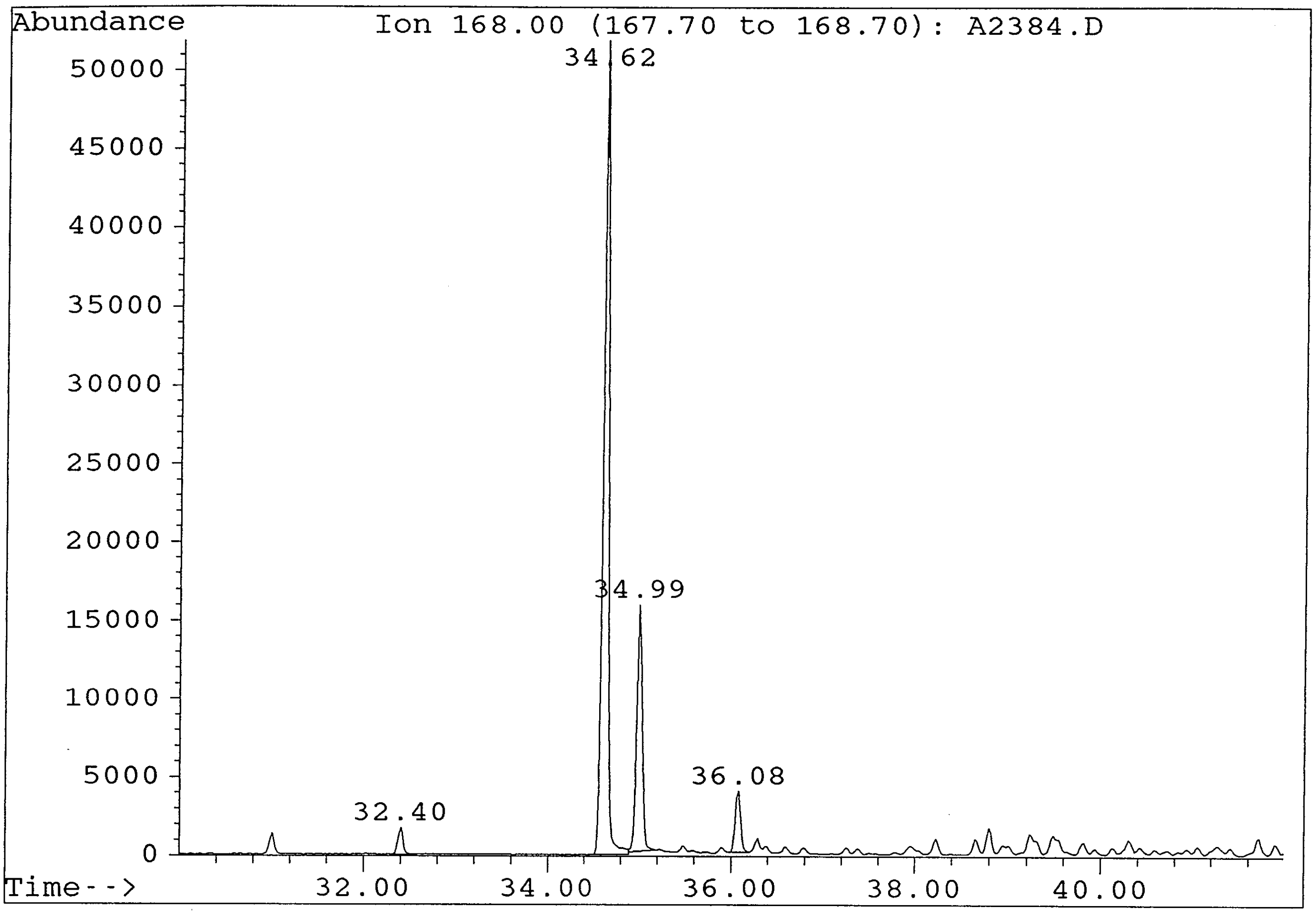
Sample : IONA-2, 1408.5. AROS

Peak	Ret.Time	Area	Height	Area %	Ratio %
1	57.52	3181	472	1.92	4.85
2	58.08	5938	727	3.58	9.05
3	58.42	6474	949	3.91	9.86
4	58.75	3151	619	1.90	4.80
5	58.98	5443	839	3.29	8.29
6	59.13	2878	685	1.74	4.38
7	59.34	8093	902	4.88	12.33
8	59.63	2570	458	1.55	3.91
9	59.86	2769	533	1.67	4.22
10	60.28	65649 R	14717	39.62	100.00
11	60.65	4020	647	2.43	6.12
12	61.03	2996	480	1.81	4.56
13	61.13	3360	849	2.03	5.12
14	61.59	3623	763	2.19	5.52
15	61.70	5284	1128	3.19	8.05
16	62.07	6350	1140	3.83	9.67
17	62.53	3199	558	1.93	4.87
18	62.85	4438	569	2.68	6.76
19	62.99	4160	954	2.51	6.34
20	63.16	2931	645	1.77	4.46
21	63.64	3467	610	2.09	5.28
22	64.23	4287	801	2.59	6.53
23	64.37	5139	867	3.10	7.83
24	65.35	3055	583	1.84	4.65
25	65.54	3235	432	1.95	4.93



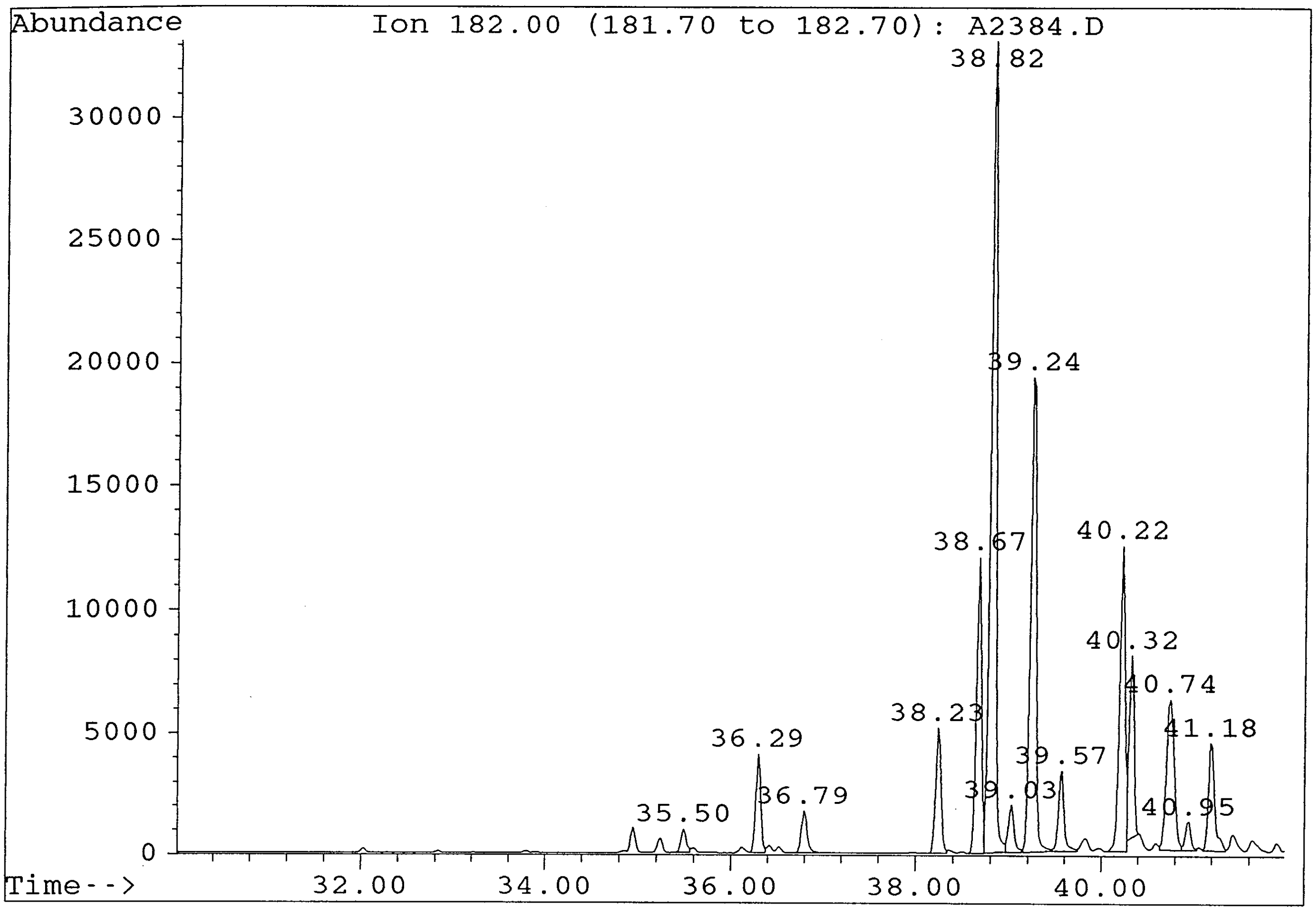
Sample : IONA-2, 1408.5. AROS

Peak	Ret.Time	Area	Height	Area %	Ratio %
1	58.58	2884	384	1.67	5.05
2	59.13	3422	562	1.99	5.99
3	59.32	4259	697	2.47	7.45
4	60.28	57140	10694	33.15	100.00
5	60.63	5700	671	3.31	9.98
6	60.80	2363	380	1.37	4.14
7	61.03	5603	747	3.25	9.81
8	61.13	2704	728	1.57	4.73
9	61.34	9419	1595	5.46	16.48
10	61.45	2658	618	1.54	4.65
11	61.59	4557	971	2.64	7.98
12	61.72	6746	1184	3.91	11.81
13	61.93	3711	832	2.15	6.49
14	62.07	7693	1649	4.46	13.46
15	62.26	3007	539	1.74	5.26
16	62.51	4876	904	2.83	8.53
17	62.85	12708	1568	7.37	22.24
18	63.16	3848	778	2.23	6.73
19	63.35	6840	1095	3.97	11.97
20	63.64	4050	765	2.35	7.09
21	63.97	2914	534	1.69	5.10
22	64.56	3202	501	1.86	5.60
23	65.10	4912	890	2.85	8.60
24	65.35	4045	876	2.35	7.08
25	65.54	3098	657	1.80	5.42



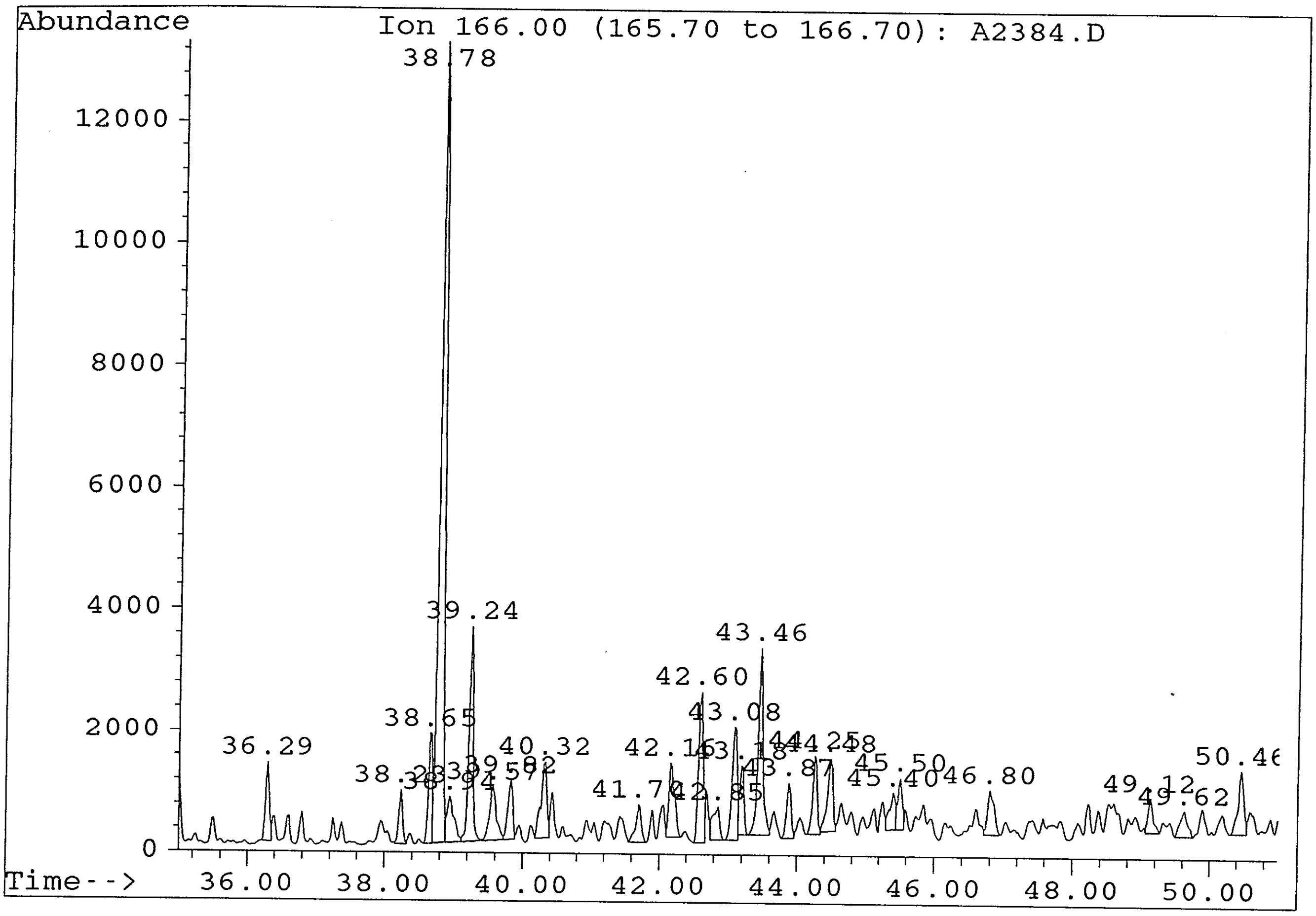
Sample : IONA-2, 1408.5. AROS

Peak	Ret.Time	Area	Height	Area %	Ratio %
1	32.40	6528	1687	2.21	3.13
2	34.62	208805	51797	70.76	100.00
3	34.99	63478	15687	21.51	30.40
4	36.08	16294	3903	5.52	7.80



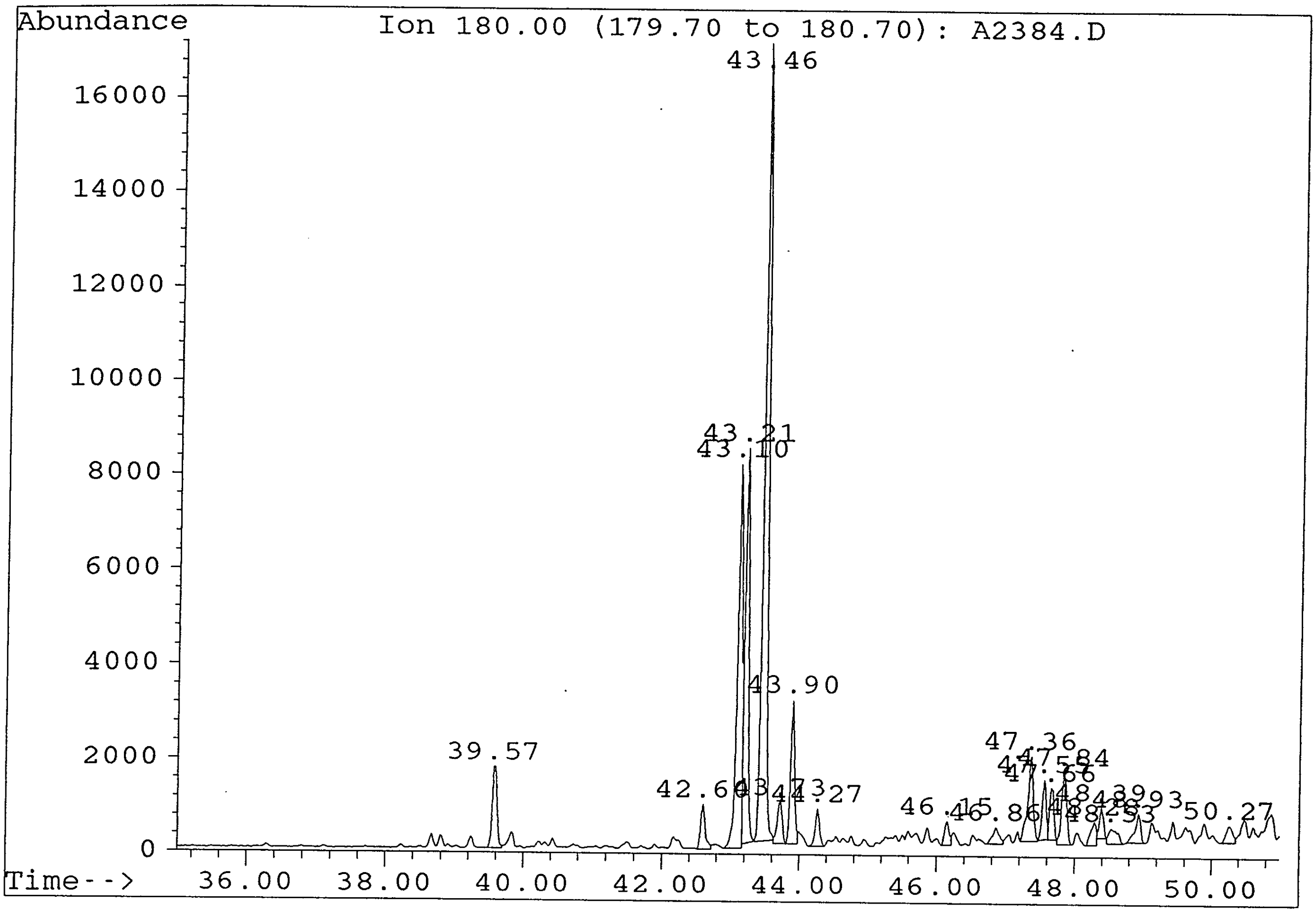
Sample : IONA-2, 1408.5. AROS

Peak	Ret.Time	Area	Height	Area %	Ratio %
1	35.50	4151	969	0.87	3.09
2	36.29	15416	4065	3.24	11.48
3	36.79	7213	1738	1.52	5.37
4	38.23	20109	5154	4.23	14.97
5	38.67	45930	12036	9.66	34.20
6	38.82	134302	33045	28.25	100.00
7	39.03	8087	1937	1.70	6.02
8	39.24	80863	19297	17.01	60.21
9	39.57	14889	3332	3.13	11.09
10	40.22	54219	12432	11.40	40.37
11	40.32	25740	7377	5.41	19.17
12	40.74	37652	6221	7.92	28.04
13	40.95	5270	1179	1.11	3.92
14	41.18	21583	4451	4.54	16.07



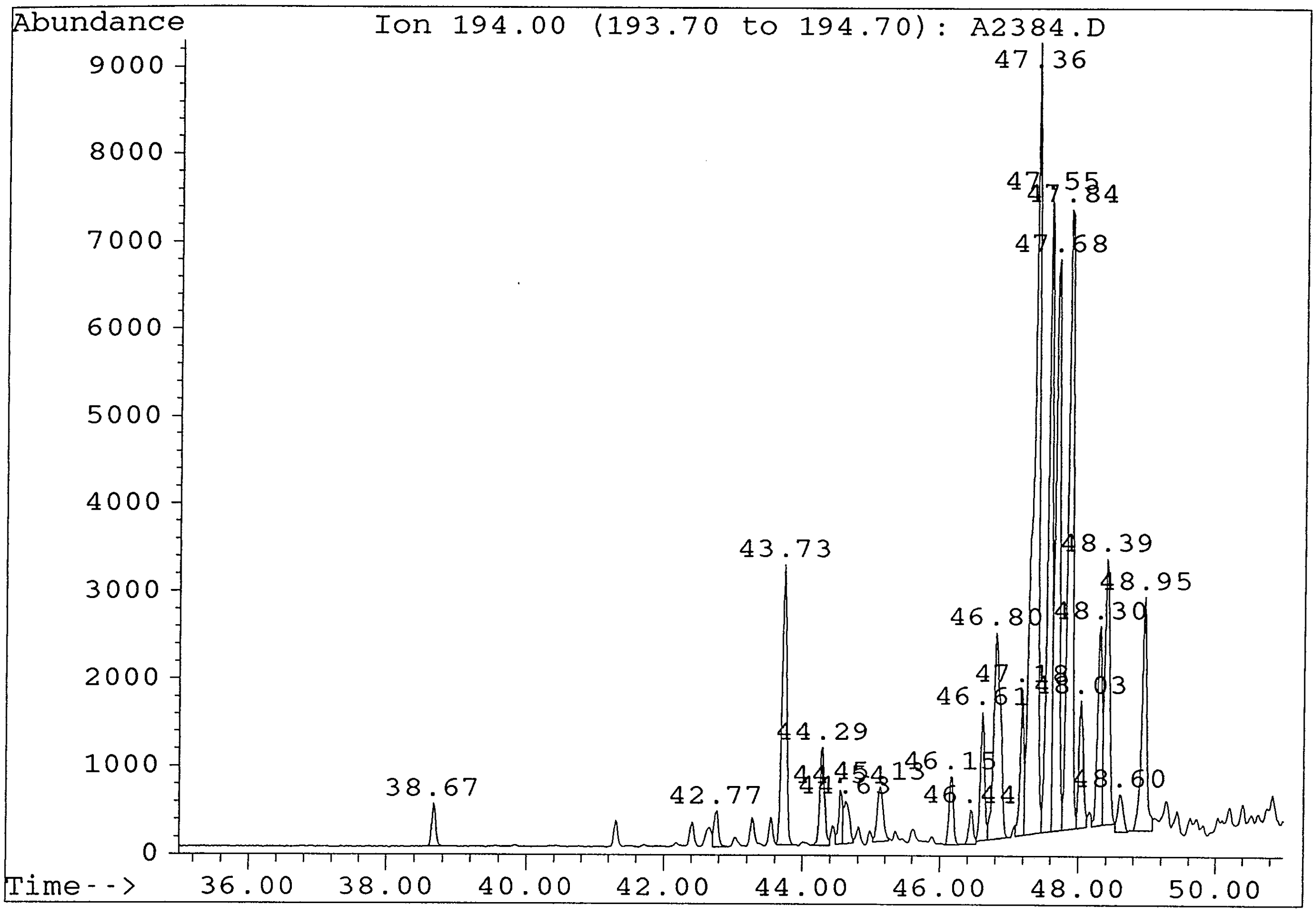
Sample : IONA-2, 1408.5. AROS

Peak	Ret.Time	Area	Height	Area %	Ratio %
1	36.29	5266	1303	2.44	8.08
2	38.23	3421	892	1.58	5.25
3	38.65	7346	1820	3.40	11.27
4	38.78	65189	13186	30.15	100.00
5	38.94	5199	751	2.40	7.98
6	39.24	14387	3543	6.65	22.07
7	39.57	6009	887	2.78	9.22
8	39.82	4801	970	2.22	7.36
9	40.32	7567	1249	3.50	11.61
10	41.70	3514	619	1.63	5.39
11	42.16	6788	1224	3.14	10.41
12	42.60	11618	2497	5.37	17.82
13	42.85	3460	538	1.60	5.31
14	43.08	10083	1868	4.66	15.47
15	43.18	4735	1137	2.19	7.26
16	43.46	15243	3076	7.05	23.38
17	43.87	4212	905	1.95	6.46
18	44.25	5891	1298	2.72	9.04
19	44.48	6681	1197	3.09	10.25
20	45.40	3582	600	1.66	5.49
21	45.50	4004	844	1.85	6.14
22	46.80	4852	736	2.24	7.44
23	49.12	2991	557	1.38	4.59
24	49.62	3232	419	1.49	4.96
25	50.46	6164	1046	2.85	9.46



Sample : IONA-2, 1408.5. AROS

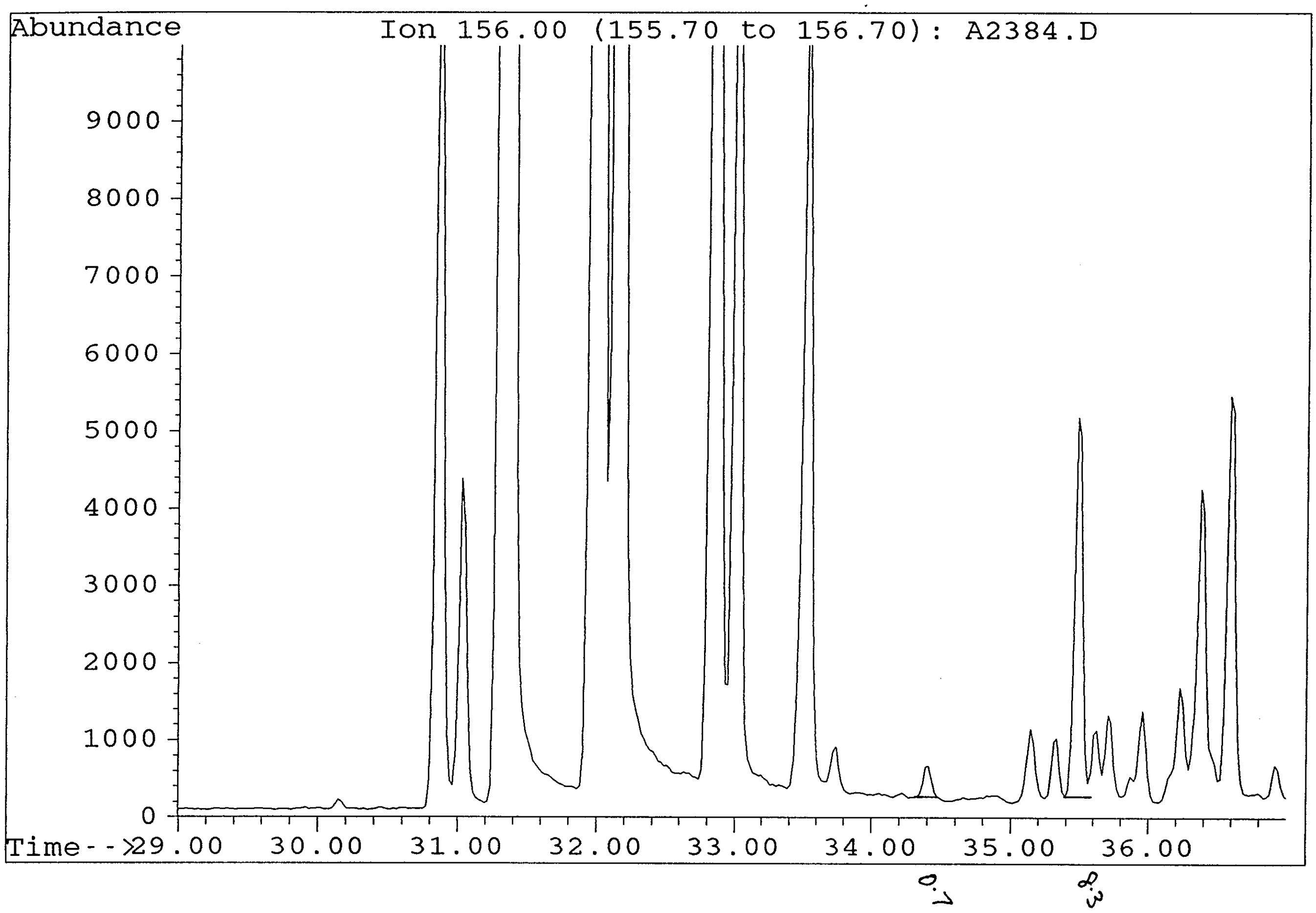
Peak	Ret.Time	Area	Height	Area %	Ratio %
1	39.57	7825	1746	3.48	10.65
2	42.60	4201	956	1.87	5.72
3	43.10	40773	8133	18.12	55.52
4	43.21	30307	8377	13.47	41.27
5	43.46	73443	16932	32.64	100.00
6	43.73	4657	891	2.07	6.34
7	43.90	12763	3060	5.67	17.38
8	44.27	3466	800	1.54	4.72
9	46.15	2533	504	1.13	3.45
10	46.86	2319	342	1.03	3.16
11	47.36	10209	1824	4.54	13.90
12	47.55	5555	1288	2.47	7.56
13	47.66	4206	1101	1.87	5.73
14	47.84	7786	1544	3.46	10.60
15	48.28	2936	501	1.30	4.00
16	48.39	2692	653	1.20	3.67
17	48.53	2992	330	1.33	4.07
18	48.93	3665	621	1.63	4.99
19	50.27	2676	360	1.19	3.64



Sample : IONA-2, 1408.5. AROS

Peak	Ret.Time	Area	Height	Area %	Ratio %
1	38.67	1952	490	0.73	3.66
2	42.77	1699	403	0.64	3.19
3	43.73	15359	3194	5.76	28.79
4	44.29	5275	1114	1.98	9.89
5	44.54	2564	605	0.96	4.81
6	44.63	2562	473	0.96	4.80
7	45.13	3978	616	1.49	7.46
8	46.15	3450	769	1.29	6.47
9	46.44	1776	387	0.67	3.33
10	46.61	6234	1464	2.34	11.69
11	46.80	16343	2345	6.13	30.64
12	47.18	6621	1668	2.48	12.41
13	47.36	53342	9047	20.00	100.00
14	47.55	34072	7257	12.78	63.87
15	47.68	28364	6533	10.64	53.17
16	47.84	34934	7079	13.10	65.49
17	48.03	6306	1449	2.36	11.82
18	48.30	11023	2276	4.13	20.66
19	48.39	14810	3028	5.55	27.76
20	48.60	2346	419	0.88	4.40
21	48.95	13684	2672	5.13	25.65

File : A2384.D
Sample : IONA-2, 1408.5. AROS
Misc. Info : COL#155. 16-3-94. SB



PETROLEUM GEOCHEMISTRY

1.0 INTRODUCTION

Petroleum geochemistry is primarily concerned with the application of organic chemistry to samples of geological interest in hydrocarbon exploration.

Analyses can be carried out on cuttings, sidewall cores, conventional cores, relatively unweathered outcrop samples and fluid hydrocarbons (oil, condensate, gas).

Source rock evaluation is best performed on sidewall cores, since cuttings are more susceptible to contamination from both cavings and organic additives in the mud system. In petroleum geochemical studies it is vitally important for the geochemist/geologist to be aware of the type of mud additives used and the stage at which they are used during the drilling program. Any anomalous results must be carefully considered in conjunction with mud system records.

Petroleum geochemistry in exploration is applied for three major purposes:

1. First identification of richness, maturity and type of kerogen in (a large number of) whole rock samples by screening analyses.

2. Semi-detailed characterisation of kerogen in sediments from selected source intervals, to determine maturity, source type and genetic potential.

3. Detailed characterisation of petroleum fluids (extracts, oils and condensates) by assessment of thermal maturity, source type and depositional environment to enable oil-to-oil and oil-to-source rock correlation studies.

2.0 THEORY & METHODS

Samples are analysed according to the scheme illustrated in Figure 1 which shows th order and type of analysis for both screening and detailed tests.

2.1 Screening Analyses of Whole Rock Samples

2.1.1 Headspace/Cuttings Gas Analysis

The headspace sample is usually provided in a sealed tin can which holds botl cuttings and water to approximately three quarters capacity. This allows th volatile hydrocarbons to diffuse easily into an appreciable headspace.

The gas is taken into a syringe through a silicone seal on the lid of the containe and analysed by packed column gas chromatography using the followin conditions:

Instrument:	Shimadzu GC-8APF
Column:	6'x ⅛" Chromosorb 102
Injector/Detector Temperature:	120°C
Column Temperature:	110°C
Carrier Gas:	Nitrogen

Cuttings gas analysis is performed in the same manner but on samples which do not liberate volatile gases readily. These sediments are subjected to very vigorous agitation prior to sampling.

Values are given as volume of gas per million volumes of sediment (ppm) for each hydrocarbon (methane, ethane, propane, iso- and n-butane), as composite values including C_5-C_7, and as ratios.

Headspace/cuttings gas analyses are used as a screening technique to identify zones of significant gas generation and out-of-place gas (Letran et al, 1974). The classification for gas content is listed below:

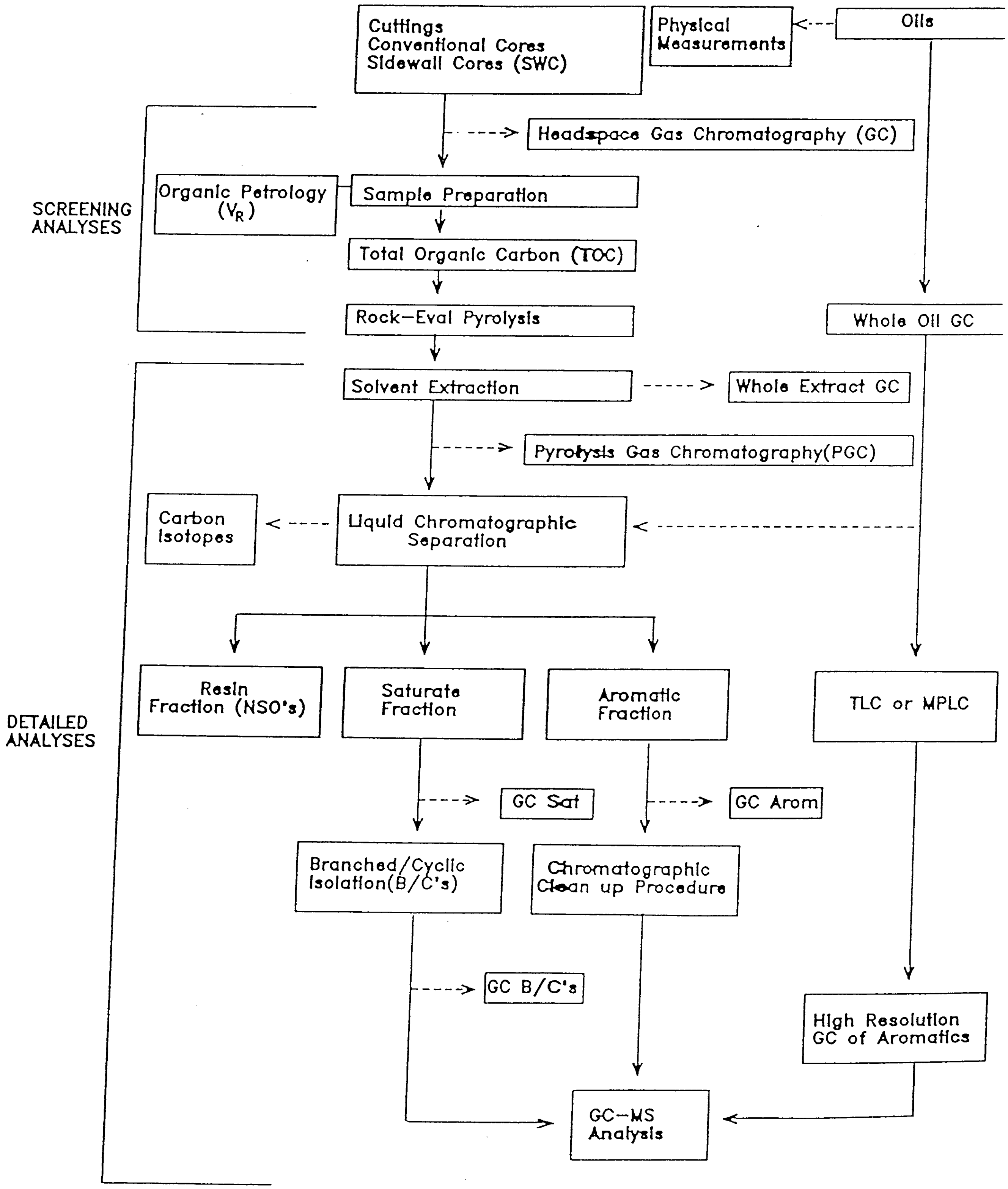
Total gas content (C_1; C_2-C_4; or C_5-C_7)	Description
10 - 100ppm	very lean - lean
100 - 1,000	lean - moderate
1,000 - 10,000	moderate - rich
10,000 - 100,000	rich - very rich

The abundance of C_2-C_4 components (wet gas) is used to locate the zone of oil generation, since wet gas is commonly associated with petroleum (Fuex, 1977).

It is important to ensure that the gases analysed are not of a biogenic origin, so an anti-bacterial agent must be added to the cuttings when they are stored in water.

FIGURE 1

FLOW DIAGRAM FOR PETROLEUM GEOCHEMICAL ANALYSES



2.1.2 Sample Preparation

Depending, on drilling mud content, cuttings samples may be water washed before they are air dried, picked free of contaminants and cavings, and then crushed to 0.1mm using a ring pulveriser.

Sidewall cores are freed of mud cake and other visible contaminants, sampled according to homogeneity, air dried and hand crushed to 0.1mm grain size.

Conventional core and outcrop samples are inspected for visible contaminants and crushed to 1/8" chips using a jaw crusher. After air drying, the chips are crushed with a ring pulveriser to small particle size (0.1mm).

Petroleum aqueous mixtures are separated into oil and water/mud fractions by decanting off the oil layer and producing a clean separation by gently centrifuging the oil. If separation by this method is not effective, the petroleum is solvent extracted.

2.1.3 Total Organic Carbon (TOC)

The TOC value is determined on crushed sediment. The minimum sample requirement is one gram, however, results may be obtained from as little as 0.2gm in very rich samples. Carbonate minerals are first removed by acid digest (HCl) and the remaining sample heated to 1700°C (Leco Induction Furnace) in an atmosphere of pure oxygen. The CO_2 produced is measured with an infra-red detector, and values calculated according to standard calibration.

TOC is expressed as % of rock and is used as a screening procedure to classify source rock richness:

Classification	Clastics	Carbonates
Poor	0.00 - 0.50	0.00 - 0.25
Fair	0.50 - 1.00	0.25 - 0.50
Good	1.00 - 2.00	0.50 - 1.00
Very Good	2.00 - 4.00	1.00 - 2.00
Excellent	> 4.00	> 2.00

2.1.4 Rock-Eval Pyrolysis

Although a preliminary source rock classification is made using TOC data, a more accurate assessment of organic source type and maturity is possible by Rock-Eval pyrolysis. Two types of Rock-Eval analyses are offered: "one run" which involves pyrolysis of the crushed but otherwise untreated sediment and "two run" which involves pyrolysis of both the crushed, untreatment sediment and the decarbonated sediment. The "two run" method provides more accurate S_3 values than the "one run" method. S_1 and S_2 values are of the same accuracy in both methods.

The method requires 0.4g of sample material, although reliable results can often be obtained from smaller amounts.

The crushed sediment is heated in an inert atmosphere of helium over a programmed temperature range. The resulting pyrogram is shown in Figure 2.

Hydrocarbons present in the free or adsorbed state (S_1) are thermally distilled at 300°C and measured by a flame ionisation detector (FID). Hydrocarbons are then cracked from the kerogen (S_2) during a temperature ramp from 300° to 550°C and also measured by FID. CO_2 released during the kerogen cracking process (S_3) is trapped and subsequently measured by a thermal conductivity detector.

The amount of free hydrocarbons in the sediment (S_1) represents milligrams of hydrocarbons distilled from one gram of rock and is a measure of both in situ and out-of-place petroleum.

Free hydrocarbon richness is described by the following:

S_1 (mg/g or kg/tonne)	
0.20 - 0.40	fair
0.40 - 0.80	good
0.80 - 1.60	very good
> 1.60	excellent

The total amount of hydrocarbons present in the free state and as kerogen is a measure of the potential yield (genetic potential) of the sample ($S_1 + S_2$) and is expressed as mg/g of rock.

Source rocks are classified accordingly:

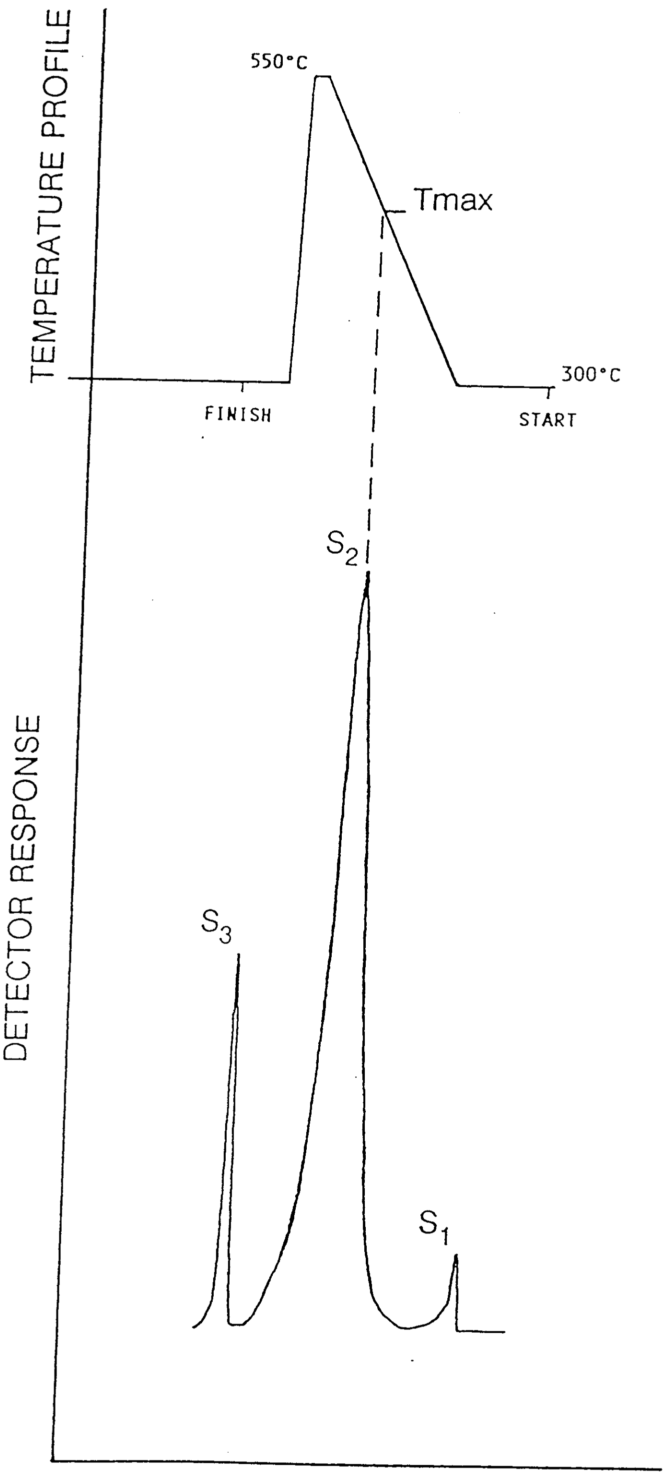
$S_1 + S_2$ (mg/g)	Source Rock Quality
0.00 - 1.00	poor
1.00 - 2.00	marginal
2.00 - 6.00	moderate
6.00 - 10.00	good
10.00 - 20.00	very good
> 20.00	excellent

The Production Index (PI) represents the amount of petroleum generated relative to the total amount of hydrocarbons present ($S_1/(S_1 + S_2)$). It is a measure of the level of maturity of the sample. For oil prone sediments PI ranges from 0.1 at the onset of oil generation to 0.4 at peak oil generation. For gas prone sediments, PI shows only a small change with increasing maturity.

The temperature at which the maximum amount of S2 hydrocarbons is generated is called Tmax (Figure 2). This temperature increases with the increasing maturity of sediments.

FIGURE 2

SCHEMATIC PYROGRAM OF ROCK-EVAL PYROLYSIS



The variation of Tmax is summarised as

< 430°C	immature
430/435° - 460°C	mature (oil window)
> 460°C	overmature

Hydrogen Index (HI = S2 x 100/TOC) and Oxygen Index (OI = S3 x 100/TOC) when plotted against one another, provide information about the type of kerogen and the maturity of the sample. Both parameters decrease in value with increasing maturity. Samples with high HI and low OI are dominantly oil prone and samples with low HI and high OI are gas prone.

2.2 Analysis of Kerogen

2.2.1 Organic Petrology - Vitrinite Reflectance

Vitrinite is a coal maceral which responds to increasing levels of thermal maturity. This response is measured microscopically by the percent of light reflected off the polished surface of a vitrinite particle immersed in oil.

Measurement of vitrinite reflectance can be carried out on uncrushed, washed and dried cuttings (10-50gms of sample material required), sidewall cores (2-10gms), conventional cores (2-10gms) or outcrop samples (2-10gms).

The values given are for standard lower size limits. In special cases, however, useful data may be obtained from as little as 0.1gm.

For each sample a minimum of 25 fields is measured in order to establish a range and mean for reflectance values.

Maturity classifications according to vitrinite reflectance values are:

% V_R (approx)	Maturity
0.2 - 0.55	immature
0.55 - 1.2	mature
1.2 - 1.8	overmature
> 1.8	severely altered

Following vitrinite reflectance measurements, microscopic examination in fluorescence mode allows the description of liptinite macerals and an estimate of their abundances. The amount of dispersed organic matter is reported and its composition described.

Vitrinite reflectance results and maceral descriptions are best obtained from coals or rocks deposited in environments which received large influxes of terrestrially derived organic matter. Vitrinite reflectance cannot be measured in rocks older than Devonian age, since land plants had not evolved prior to this time.

2.2.2 Pyrolysis Gas Chromatography

Pyrolysis gas chromatography (PGC) is performed on solvent extracted source rocks or isolated kerogens. The sample is pyrolysed by an SGE pyrojector which is coupled directly to a Hewlett Packard 5890 gas chromatograph. The operating conditions are:

Pyrolysis temperature:	600°C
Column:	25m x 0.22mm ID BP-1 (SGE)
Carrier gas:	helium
Oven conditions:	-20° to 280°C @ 4°/min

Data are collected and recovered using DAPA scientific software.

Pyrolysis GC allows the examination of kerogen on the molecular level and thereby a better classification of source rocks with regard to source type and generative capacity than conventional bulk pyrolysis (ie. Rock-Eval). Two analytical procedures are possible:

1. Semi quantitative (with yield related to S_2 of Rock-Eval)

2. Fully quantitative (with the inclusion of an internal standard)

Samples are characterised according to the amounts of aliphatic, aromatic and phenolic components in the kerogen. The aliphatic carbon content of a kerogen is the critical factor in determining catagenic hydrocarbon yields in the earth's crust, while the gas/oil ratio is dictated by the distribution of the various structural elements in the kerogen (Larter, 1985). Using pyrogram fingerprint data, it is possible to distinguish substantial variations between kerogens, even those of the same bulk chemical type.

A major strength of pyrolysis methods is that, while quantitative yields of kerogens are maturity related, the qualitative pyrogram fingerprints obtained are relatively rank independent over much of the oil window (Espitatlie et al, 1977; Van Graas et al, 1980; Larter, 1985). At high maturities (>1.2% V_R) characteristics for all kerogen types tend to converge (Horstfield, 1984).

Data are presented by percentage and mg/g of individual substances as well as groups of compounds.

Significant parameters are:

$(C_1 - C_5)/C_6$ + abundance	gas/oil ratio
$C_9 - C_{31}$ (alkenes + alkanes)	oil yield
Type Index R:	aromaticity

(Larter & Douglas 1979, Larter and Senftle, 1985).

2.3 Detailed Analyses of Petroleum Fluids

2.3.1 Solvent Extraction of Sediment

The finely crushed sample (up to 100g) is extracted with dichloromethane (300mL) using sonic vibration. After Buchner flask filtration, the filtrate is re-vibrated with activated copper powder (1g) to remove elemental sulphur. The extractable organic matter (EOM) is afforded by further filtration and fractional distillation of the solvent.

Source rock richness based upon EOM is classified accordingly:

Yield	ppm
Poor	< 500
Fair/Good	500 - 2000
Very Good	2000 - 4000
Excellent	> 4000

2.3.2 Liquid Chromatography Separation

Sediment extracts, crude oil and condensate samples are separated into fractions corresponding to three structural types:

saturated hydrocarbons	(SAT)
aromatic hydrocarbons	(AROM)
resins plus ashphaltenes	(NSO)

This separation is achieved by liquid column chromatography using activated silicic acid adsorbent and eluting solvents of varying polarity. Saturated, aromatic and NSO concentrates are recovered by fractional distillation/evaporation of the solvent and quantitative transfer to a small vial.

The amount of hydrocarbons (SAT plus AROM) can be used to classify source rock richness and the amount of saturates to classify oil source potential, according to the following criteria:

Classification	ppm HC	ppm SAT
Poor	0 - 300	0 - 200
Fair	300 - 600	200 - 400
Good	600 - 1200	400 - 800
Very Good	1200 - 2400	800 - 1600
Excellent	>2400	>1600

The composition of the extracts can also provide information about their levels of maturity and/or source type (LeTran et. al., 1974; Philippi, 1974). Generally, marine extracts have relatively low concentrations of saturated and NSO compounds at low levels of maturity, but these concentrations increase with increasing maturation. Terrestrially derived organic matter often has a low level of saturates and large amount of aromatic and NSO compounds, irrespective of the level of maturity.

Specific ratios are measured from solvent extraction and liquid chromatography data which give an indication of source type and maturity. EOM (mg)/TOC(g) can be used as a maturation indicator when plotted against depth for a given sedimentary sequence. Generally an EOM/TOC value of >100 indicates high maturity. If such a sample has a SAT (mg)/TOC (g) ratio <20, it is likely that the organic matter is gas prone. A value for SAT (mg)/TOC (g) >40 suggests an oil prone source type.

2.3.3 Capillary Gas Chromatography (GC)

$C_{12}+$ gas chromatography is most commonly carried out on saturate fractions, but in certain instances it is used to examine whole extracts/oils, aromatic or branched/cyclic fractions. It is also used as a tool to identify contamination. The analyses are performed under the following conditions:

Instruments:	Hewlett Packard 5890 Gas Chromatography
Injector:	SGE OCI-3 on column
Column:	25m x 0.2mm ID BP-1
Injector Temp:	280°C
Detector Temp:	320°C
Column Temp:	45°C to 280°C at 4°/min
Carrier Gas:	hydrogen

Data are collected using an IBM compatible PC and DAPA scientific software.

2.3.3.1 $C_{12}+$ Saturate Gas Chromatography

Saturate GC results provide information pertaining to source type, maturity and depositional environment.

The n-alkane distribution from n-C_{12} to n-C_{31} is determined from the area under the peaks representing each of these n-alkanes. The profile can yield information about maturity and source type and is quantified in the C_{21} + C_{22}/C_{28} + C_{29} ratio and Carbon Preference Indices (CPI 1 and 2).

$$CPI\ (1) = \frac{(C_{23}+C_{25}+C_{27}+C_{29})\ wt\% \ + \ (C_{25}+C_{27}+C_{29}+C_{31})\ wt\%}{2 \times (C_{25}+C_{26}+C_{28}+C_{30})\ wt\%}$$

$$CPI\ (2) = \frac{(C_{23}+C_{25}+C_{27})\ wt\% \ + \ (C_{25}+C_{27}+C_{29})\ wt\%}{2\ x\ (C_{24}+C_{26}+C_{28})\ wt\%}$$

- carbon preference indices are approximately 1 for marine samples, regardless of maturity
- decrease from 20 --> 1 for terrestrial samples as maturity increases

The C_{21} + C_{22}/C_{28} + C_{29} ratio is generally >1.5 for aquatic source material and <1.2 for terrestrial organic matter, however, the values increase with maturity.

Pristane/phytane (Pr/Ph) ratios can indicate depositional environments:

- <3.0 - relatively reducing depositional environments;
- 3.0-4.5 - mixed (reducing/oxidising) environments;
- >4.5 - relatively oxidising depositional environments.

2.3.3.2 C_1 - C_{31} Whole Oil Gas Chromatography

This analytical method is applied to oil and condensate samples. It provides a picture of the whole oil up to n-C_{31} and allows quantitation of components with more than 4 carbons atoms. Several parameters are measured which illustrate changes in the degree of biodegradation and water washing in the reservoir. Because these measurements are performed on very volatile components in the oil, care should be taken during sampling, transportation and storage of the fluid to minimise evaporation.

Whole oil analytical conditions are listed below:

Instrument:	Shimadzu GC-9A
Column:	25m x 0.2mm ID BP-1
Injector/Detector Temperature:	290°C
Column Temperature:	-20°C to 280°C at 4°/min
Carrier Gas:	hydrogen

2.3.4 Carbon Isotope Analysis

This measurement is normally carried out on one or more of the following mixtures: topped oil, saturate fraction, aromatic fraction, NSO fraction. The organic matter is combusted in oxygen to produce carbon dioxide which is purified and transferred to an isotope mass spectrometer. The carbon isotope ratio ($\delta C_{13}/\delta C_{12}$) is measured and compared to an international standard (the Peedee Belemnite Limestone - PDB).

Carbon isotope analysis is most commonly used to identify the source of methane according to the following criteria (Fuex 1977):

$\delta^{13}C$ ‰ PDB

-75 to -55	Biogenic methane
-58 to -40	Methane associated with oil
-40 to -25	Thermal methane

Source rock-crude oil correlations have been attempted by observing the change in $\delta^{13}C$ values of components of oils and rocks (Stahl 1977). Source rock extracts are usually isotopically heavier than the corresponding crude oil but are lighter than the asphaltenes of the oil and the kerogen of the rock (Hunt 1979). It has also been observed that marine organic carbon is generally isotopically heavier than contemporaneous terrestrial organic carbon (Tissot & Welte 1978). However, it should be noted that increasing maturity and biodegradation produce a shift toward heavier isotope values.

2.3.5 Gas Chromatography - Mass Spectrometry (GC/MS)

GC/MS analysis is normally performed on the branched and cyclic alkane fraction and/or the aromatic fraction of oils, condensates and sediment extracts. The specific fraction is first isolated and then injected into a gas chromatograph which is linked in series with a mass spectrometer. As compounds are eluted from the chromatography column they are bombarded with high energy electrons. This causes them to fragment into a number of ions each with a molecular weight less than that of the parent molecule. Individual compounds give a characteristic fragmentation pattern (mass spectrum), the major ions of which are presented in a series of mass fragmentograms [ie. plots of ion concentration against GC retention time].

GC/MS analysis can be carried out using one of the following modes of operation:

(i) Acquire mode - in which all ions (within a broad range) in each mass spectrum are memorised by the data system.

(ii) Selective Ion Monitoring (SIM) mode - in which only selected ions of interest are memorised by the data system.

2.3.5.1 GC/MS Analysis of Branched/Cyclic Alkanes

The group of compounds to be analysed is first isolated from the saturate fraction by refluxing the sample with activated 5Å molecular sieves in cyclohexane for 24 hours. Branched/cyclic alkanes, including alkylcyclohexanes, are recovered from the solvent by fractional distillation.
For condensates, and samples where information about alkylcyclochexanes is not required, the saturate fraction is passed through a small column packed with silicalite adsorbent. The branched/cyclic alkanes are recovered from the eluting solvent by fractional distillation.

Analysis is carried out in the SIM mode with a total of 33 ions being recorded over different time spans.

Operating conditions are:

Instrument:	5987HP GC mass spec data system
Column:	60m x 0.25mm ID cross linked methyl-silicone DB-1 (J&W) column of 0.25 micron film thickness connected directly to the ion source
Injector:	OCI-3 (SGE)
Carrier gas:	hydrogen
Oven Conditions:	50° to 274°C at 8°/min 274° to 280°C at 1°/min
EM Voltage:	2,000 - 2,300V
Electron Energy:	70eV
Source temperature:	250°C

GC/MS mass fragmentograms are examined for particular 'biomarker' compounds which can be related to biological precursors. These allow the characterisation of petroleum with regard to thermal maturity, source, depositional environment and biodegradation.

The significance of selected parameters from branched/cyclic GC/MS analysis is outlined below:

1. 18α (H)-hopane/17α (H)-hopane (Ts/Tm)

   Maturity indicator. The ratio of 18α (H) trisnorhopane to 17α (H) trisnorhopane increases exponentially with increasing maturity from approximately 0.2 at the onset to approximately 1.0 at the peak of oil generation, ie. Tm decreases with maturity. This parameter is not reliable in very immature samples.

2. C_{30} hopane/C_{30} moretane

   Maturity indicator. The conversion of C_{30} 17β, 21β hopane to 17β, 21α moretane is maturity dependent. Values increase from approximately 2.5 at the onset of oil generation to approximately 10. Once the hopane/moretane ratio has reached 10, no further changes occur. A value of 10 is believed to represent a maturity stage just after the onset of oil generation and hopane/moretane ratios are therefore useful mainly as indicators of immaturity in a qualitative sense.

3&4. C_{31} and C_{32} 22S/22R hopanes

   Maturity indicator. An equilibrium between the biological R- and the geological S- configuration occurs on mild thermal maturation. A ratio of S:R = 60:40, ie, a value of 1.5, characterises this equilibrium which occurs before the onset of oil generation. The C_{32} hopane pair is often more reliable for this purpose since co-elution sometimes affects the C_{31} ratio.

5. C_{29} 20S $\alpha\alpha\alpha/C_{29}$ 20R $\alpha\alpha\alpha$ steranes

<u>Maturity</u> indicator. Upon maturation, the biologically produced 20R stereoisomer is diminished relative to the 20S form and a stabilisation is reached at approximately 55% 20R and 45% 20S compounds. V_R equivalents are approximately 0.45% for a 20S/20R value of 0.2 and 0.8% for a 20S/20R value of 0.75. This parameter is most useful between maturity ranges equivalent to 0.4% to 1.0% V_R.

6. C_{29} 20S $\alpha\alpha\alpha/C_{29}$ 20R $\alpha\alpha\alpha$ + C_{29} 20S $\alpha\alpha\alpha$ steranes

<u>Maturity</u> indicator. This ratio is a different way of expressing the relative abundance of the biological 20R to the geological 20S normal sterane (see parameter 5). Expressed as a percentage, a value of about 25% indicates the onset of oil generation, and of about 50% the peak of oil generation.

7. C_{29} $\alpha\beta\beta/C_{29}$ $\alpha\alpha\alpha$ + C_{29} $\alpha\beta\beta$ steranes

<u>Maturity</u> indicator. The $\alpha\alpha$ form is produced biologically. Its abundance diminishes upon maturation until a mixture of 65% $\beta\beta$ (iso) steranes and 35% $\alpha\alpha$ (normal) steranes is reached, which is equivalent to approximately 0.9% V_R.

8&9. C_{27}/C_{29} diasteranes and steranes

<u>Source</u> indicator. It has been suggested that marine phytoplankton is characterised by a dominance of C_{27} steranes and diasteranes whereas a preponderance of C_{29} compounds indicates strong terrestrial contributions. Values smaller than 0.85 for C_{27}/C_{29} diasterane and sterane ratios are believed to be indicative for terrestrial organic matter, values between 0.85 and 1.43 for mixed organic material, and values greater than 1.43 for an input of predominantly marine organic matter.

It has been suggested, however, that marine sediments can also contain a predominance of C_{29} steranes, so the above rules have to be applied with caution. Any simplistic interpretation of C_{27}/C_{29} steranes and diasteranes can be dangerous and the interpretation of these data should be consistent with other geological evidence.

10. 18α (H) - oleanane/C_{30} hopane

<u>Source</u> indicator. Oleanane is a triterpenoid compound which has often been reported from deltaic sediments of Late Cretaceous to Tertiary age. It is thought to be derived from certain angiosperms which developed in the late Cretaceous. If the 18α (H) - oleanane/C_{30} hopane ratio is below 10, no significant proportions of oleanane are present. At higher values, it can be used as indicator for a reducing environment during deposition of land plant-derived organic matter.

11. C_{29} diasteranes/C_{29} $\alpha\alpha\alpha$ steranes + C_{29} $\alpha\beta\beta$ steranes

Source, indicator. This parameter is used to characterise the oxidity of depositional environments. High values (up to 10) indicate oxic conditions, low values (down to 0.1) indicate reducing environments.

12. C_{30} (hopanes + moretanes)/C_{29} (steranes + diasteranes)

Source indicator. Triterpanes are believed to be of prokariotic (bacterial) origin, whereas steranes are derived from eukariotic organisms. This ratio reflects the preservation of primary organic matter derived from eukariots, relative to growth and preservation of bacteria in the sediment after deposition.

13. C_{15} drimane/C_{16} homodrimane

Drimanes and homodrimanes are ubiquitous compounds most likely derived from microbial activity in sediments. The C_{15} drimane/C_{16} homodrimane ratio is a useful parameter for correlation purposes in the low molecular weight region, especially for condensates which lack most conventional biomarkers. Drimanes are also useful to assess the degree of biodegradation as the removal of C_{15} to C_{16} bicyclics characterises an extensive level of biodegradation.

14. Rearranged/normal drimanes

Like parameter 13, this ratio can be used for correlation purposes in samples without conventional biomarkers, and to assess levels of biodegradation.

15. C_{15} alkylcyclohexane/C_{16} homodrimane

Like parameters 13 and 14, this ratio is useful for correlation purposes.

2.3.5.2 GC/MS Analysis of Aromatics

The aromatic fraction or the oil to be analysed is first subjected to thin layer chromatography (TLC) or medium pressure liquid chromatography (MPLC), depending upon the analytical requirements.

1. Di- and tri- nuclear aromatic compounds are isolated by TLC. To effect this separation, the sample is applied to an alumina coated glass plate (0.6mm thickness). The plate is developed with hexane and the required band located using short wavelength UV light. The fraction is recovered by extraction and fractional distillation.

   This aromatic fraction may be analysed by GC-FID, but GC/MS is recommended because of possible co-elution problems during GC.

   Samples are analysed by GC/MS in the aquire mode scanning from 50 to 450 atomic mass units (amu).

Analytical conditions are:

Instrument:	HP5970 MSD
Column:	60m x 0.25mm ID, 0.25 micron film thickness, 5% phenylmethyl silicone column DB-5 (J&W) connected directly to the ion source
Injector:	automatic on-column
Carrier Gas:	helium
Oven Conditions:	70°C for 1min
	70°C --> 300°C at 3°/min

Data collection commences at 10 mins

Mass Spectrometry

Em Voltage	1500 - 1800V
Electron Energy	70eV

Mass fragmentograms are presented for alkylbiphenyls, alkylnaphthalenes, alkylfluorenes and alkylphenanthrenes from a comprehensive data base. Aromatic compounds provide valuable information concerning thermal maturity since they can be applied outside the dynamic range of saturate biomarker indicators and are particularly useful when conventional biomarkers are present in low amounts (Radke & Welte, 1983; Alexander et al, 1985). Maturity ratios are tabled below:

Aromatic Maturity Indicators

Abbrev.	Definition	Range oil onset	wet gas
DNR 1	(2,6DMN + 2,7DMN)/1,5DMN	1.5	10
DNR 2	2,7DMN/1,8DMN	50	2500
DNR 5	1,6DMN/1,8DMN	50	>3000
DNR 6	(2,6DMN + 2,7DMN)/(1,4DMN + 2,3 DMN)	0.8	2
TNR 1	(1,4,6TMN + 1,3,5TMN)/2,3,6TMN	0.5	4
MPR 1	(2MP + 3MP)/1MP	1.5	3
MPI 1	1.5 x (2MP + 3MP)/(PH + 1MP + 9MP)	0.3	1
MPI 2	(3 x 2MP)/(PH + 1MP + 9MP)	0.3	2
Rc(a)	0.6 (MPI-1) + 0.4 (for % Rm <1.35)		
Rc(b)	-0.6 (MPI-1) + 2.3 (for % Rm ≥ 1.35)		

(from Radke et al, 1982; Radke & Welte, 1983; Alexander et al, 1985)

Some aromatic marker compounds have specific natural product precursors and can be used as signatures for sediments of a particular source, depositional environment or geological age:

TNR 5	1,2,5TMN/1,3,6TMN	
TNR 6	1,2,7TMN/1,3,7TMN	(Strachan et al, 1988)
1,7/X	1,7DMP/(1,3 + 3,9 + 2,10 + 3,10 DMP)	
Retene/9MP		
1MP/9MP		(Alexander et al, 1988)

2. Mono- and triaromatic steranes are analysed by GC/MS under the same analytical conditions as used for di- and tri-nuclear aromatics. However, isolation of this fraction is performed by MPLC. To achieve this, the saturate plus aromatic mixture is injected onto a Merck Si60 column. The separation is monitored with a refractive index detector for saturates and a UV absorbance detector for aromatics.

As aromatic steranes are generally present in low abundances, especially in oils, samples are analysed in the SIM mode and 16 ions are recorded.

The conversion of monoaromatic steranes to triaromatic steranes and the dimethylation of triaromatic steranes in sediments are considered to be maturity dependent (Mackenzie et al, 1981; Mackenzie, 1984). The triaromatic sterane maturity indicator should, however, not be applied to crude oils because migration effects appear to selectively deplete the triaromatic steranes.

4.0 RECOMMENDED LITERATURE

ALEXANDER R., KAGI R.I., ROWLAND S.J., SHEPPARD P.N. and CHIRILA T.V. (1985) The effects of thermal maturity on distributions of dimethylnaphthalenes and trimethylnaphthalenes in some ancient sediments and petroleum. Geochim.Cosmochim.Acta 49, 385-395.

ALEXANDER R., KAGI R.I. and NOBLE R.A. (1987) Fossil resin biomarkers and their application in oil to source-rock correlation, Gippsland Basin, Australia. APEA J. 27, 63-72.

ALEXANDER R., LARCHER A.V., KAGI R.I. and PRICE P.L. (1988) The use of plant-derived biomarkers for correlation of oils with source rocks in the Cooper/Eromanga Basin system, Australia. APEA J 28, 310-324.

ALEXANDER R., MARZI R. and KAGI R.I. (1990) A new method for assessing the thermal history of sediments: A case study from the Exmouth Plateau in north Western Australia. APEA J., 30, 364-372.

CUMBERS K.M., ALEXANDER R. and KAGI R.I. (1987) Methylbiphenyl, ethylbiphenyl and dimethylbiphenyl isomer distributions in some sediments and crude oils. Geochem.Cosmochim.Acta 51, 3105-3111.

DEMBRICKI H., HORSFIELD B. and HO T.T.Y (1983) Source rock evaluation by pyrolysis-gas chromatography. AAPG Bull, 67, 1094-1103.

DIDYK B.M., SIMONEIT B.R.T, BRASSELL S.C. and EGLINTON G. (1978) Organic geochemical indicators of palaeoenvironmental conditions of sedimentation. Nature, 272, 216-222.

ESPITALIE' J., LAPORT J.L., MADEC M., MARQUIS F., LEPLAT P., PAULET J. and BOUTEFEU A. (1977) Méthode rapide de caractérisation des roches méres, de leur potential pétrolier et de leur degré d'évolution. Rev.Inst., 32, 23-43.

FUEX A.N. (1977) The use of stable carbon isotopes in hydrocarbon exploration. J.Geochem.Expl., 7, 155-188.

GRANTHAM P.J., POSTHUMA J. and BAAK A. (1983) Triterpanes in a number of Far-Eastern Crude Oils. In Advances in Organic Geochemistry, 1981 (eds. M.Bjorøy et al), pp 675-683. Wiley & Sons.

HORSFIELD B. (1984) Pyrolysis studies and petroleum exploration. In Advances in Petroleum Geochemistry, Vol 1 pp 247-292. Academic Press.

HUNT J.M. (1979) Petroleum Geochemistry and Geology. pp 488-491. W.H. Freeman & Co, San Francisco.

LARTER S.R. (1985) Integrated kerogen typing in the recognition and quantitative assessment of petroleum source rocks. In Petroleum Geochemistry in Exploration of the Norwegian Shelf, pp 269-286. Graham and Trotman, London.

LARTER S.R. (1989) Chemical models of vitrinite reflectance evolution. Geologische Rundschau 78/1, 349-355, Stuttgart.

LARTER S.R. and DOUGLAS A.G. (1980) A pyrolysis-gas chromatographic method for kerogen typing. In Advances in Organic Geochemistry, 1979 (eds. A.G. Douglas and J.R. Maxwell), pp 579-584. Pergamon Press, Oxford.

LARTER S.R. and SENFTLE J.T. (1985) Improved kerogen typing for petroleum source rock analysis. Nature, 318, 277-280.

LE TRAN K., CONNAN J. and VAN DER WEIDE B. (1974) Diagenesis of organic matter and occurrence of hydrocarbons and hydrogen sulphide in the S.W. Aquitaine Basin. Bull.Centre.Rech. Pau-SNPA, 8, 111.

MACKENZIE A.S. (1984) Applications of biological markers in petroleum geochemistry. In Advances in Petroleum Geochemistry, 1984 (eds. J.Brooks and D.Welte), pp 115-214. Academic Press.

MACKENZIE A.S., BRASSELL S.C., EGLINTON G. and MAXWELL J.R. (1982) Chemical fossils: the geological fate of steroids. Science, 217, 491-504.

MACKENZIE A.S., HOFFMANN C.F. and MAXWELL J.R. (1981) Molecular parameters of maturation in the Toarcian Shales, Paris Basin, France- III. Changes in aromatic steroid hydrocarbons. Geochim.Cosmochim.Acta 45, 1345-1355.

MUKHOPADHYAY P.K. (1989) Characterisation of amorphous and other organic matter types by microscopy and pyrolysis-gas chromatography. Org Geochem, 14, 269-284.

PETERS K.E. (1986) Guidelines for evaluating petroleum source rock using programmed pyrolysis. AAPG Bull, 70, 318-329.

PHILIPPI G.T. (1974) The influence of marine and terrestrial source material on the composition of petroleum. Geochim.Cosmochim.Acta 38, 947.

RADKE M., WELTE D.H. and WILLSCH H. (1982) Geochemical study on a well in the Western Canada Basin: relation of the aromatic distribution pattern to maturity of organic matter. Geochim.Cosmochim.Acta 46, 1-10.

RADKE M. and WELTE D.H. (1983) The methylphenanthrene Index (MPI): a maturity parameter based on aromatic hydrocarbons. In Advances in Organic Geochemistry, 1981 (eds. M.Bjorøy et al), pp 504-512. Wiley & Sons.

SIEFERT W.K. and MOLDOWAN J.M. (1978) Applications of steranes, terpanes and monoaromatics to the maturation, migration and source of crude oils. Geochim.Cosmochim.Acta, 42, 77-95.

STAHL W.J. (1977) Carbon and nitrogen isotopes in hydrocarbon research and exploration. Chem. Geol., 20, 121-149.

STRACHAN M.G., ALEXANDER R. and KAGI R.I. (1988) Trimethylnaphthalenes in crude oils and sediments: Effects of source and maturity. Geochim.Cosmochim.Acta, 52, 1255-1264.

STRACHAN M.G., ALEXANDER R., SUBROTO E.A. and KAGI R.I. (1989) Constraints upon the use of 24-ethylcholestane diastereomer ratios as indicators of the maturity of petroleum. Org Geochem, 14, 423-432.

SUMMONS R.E., VOLKMAN J.K. and BOREHAM C.J. (1987) Dinosterane and other steroidal Hydrocarbons of dinoflagellate origin in sediments and petroleum. Geochim.Cosmochim.Acta, 51, 3075-3082.

THOMPSON K.F.M. (1979) Light hydrocarbons in subsurface sediments. Geochim.Cosmochim.Acta, 43, 657-672.

THOMPSON K.F.M. (1983) Classification and thermal history of petroleum based on light hydrocarbons. Geochim.Cosmochim.Acta, 47, 303-316.

TISSOT B.P. and WELTE D.H. (1978) Petroleum Formation and Occurrence. Springer-Verlag pp 442-447.

VAN AARSSEN B.G.K., COX H.C., HOOGENDOORN P. and DE LEEUW J.W. (1990) A cadinene biopolymer present in Fossil and extant dammer resins as a source for cadinanes and bicadinanes in crude oils from South east Asia. Geochim.Cosmochim.Acta In press.

VAN GRAAS G., DE LEEUW J.W. and SHENK P.A. (1980) Analysis of coals of different ranks by Curie-point pyrolysis-gas chromatography - mass spectrometrey and Curie-point pyrolysis-mass spectrometry. In Advances in Organic Geochemistry, 1979 (eds. A.G. Douglas and J.R. Maxwell), p 485. Pergamon Press, Oxford.

VOLKMAN J.K., ALEXANDER R., KAGI R.I., NOBLE R.A. and WOODHOUSE G.W. (1983) A geochemical reconstruction of oil generation in the Barrow Sub-Basin of Western Australia. Geochim.Cosmochim.Acta, 47, 2091-2105

VOLKMAN J.K. (1986) A review of sterol markers for marine and terrigenous organic matter. Org. Geochem 9, 83-99.

ZUMBERGE J. (1987) Prediction of source rock characteristics based on terpane biomarkers in crude oils: A multivariate statistical approach. Geochim.Cosmochim.Acta, 51, 1625-1637.

APPENDIX 9

APPENDIX 9

GFE RESOURCES LTD

APPENDIX 9

DIRECTIONAL DRILLING REPORT

IONA-2

AUSTOIL DRILLING SERVICES PTY LTD

ACN 088 963 835

G.F.E.RESOURCES LTD

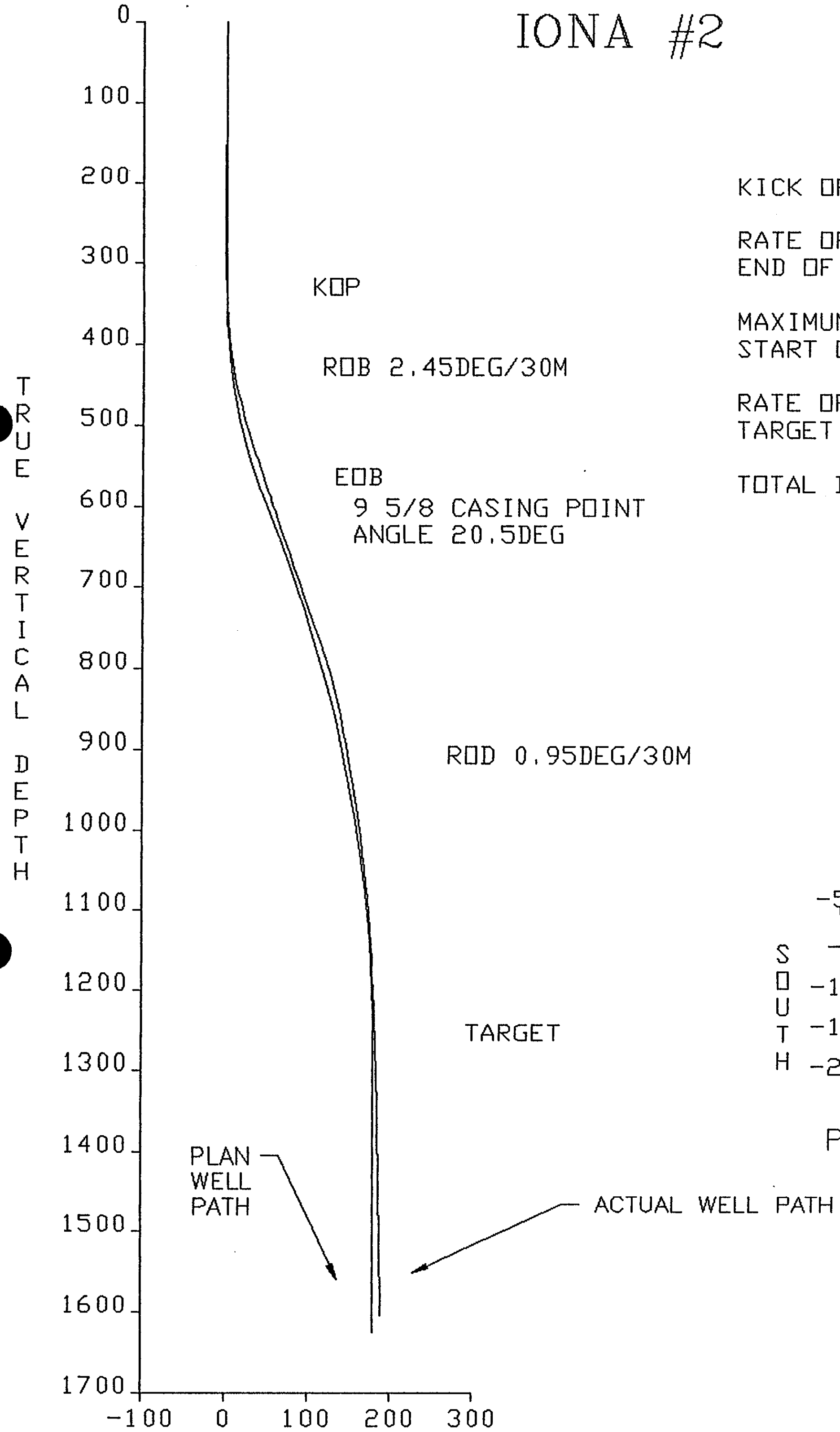
IONA 2

DIRECTIONAL DRILLING REPORT

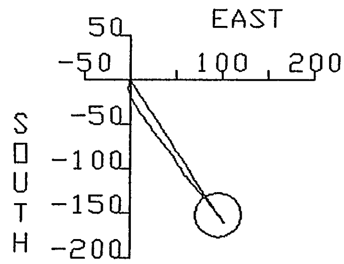
AUSTOIL DRILLING SERVICES

G F E Resources Ltd
IONA #2

KICK OFF POINT	340M MD
	340M TVD
RATE OF BUILD	2.45DEG/30M
END OF BUILD	591M MD
	585M TVD
MAXIMUM ANGLE	20.5DEG
START OF DROP	650M MD
	641M TVD
RATE OF DROP	0.95DEG/30M
TARGET	1298M MD
	1275M TVD
TOTAL DEPTH	1648M MD
	1625M TVD



SECTION ALONG 147.58 AZIMUTH

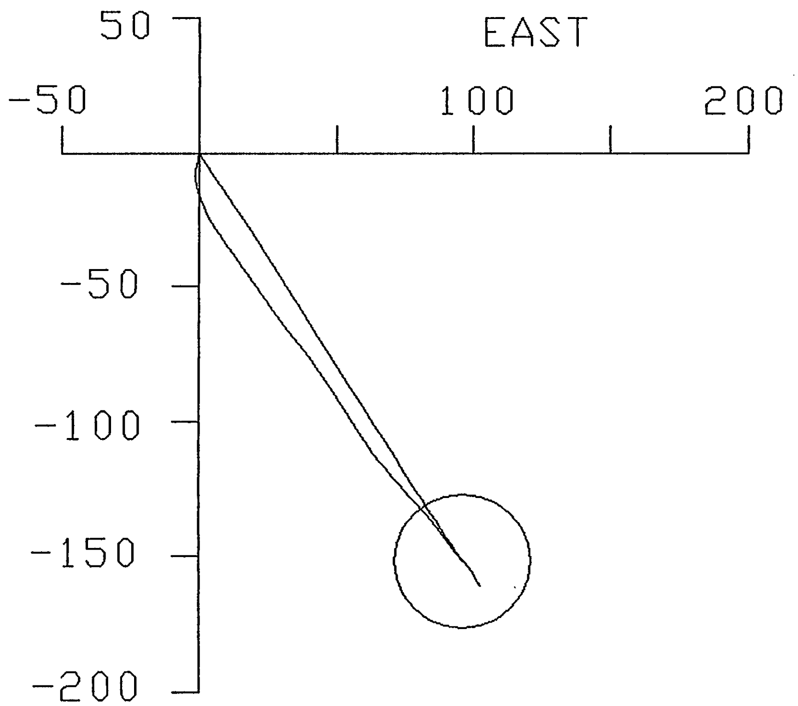


PLAN VIEW

AUSTOIL DRILLING SERVICES

G F E Resources Ltd
IONA #2

KICK OFF POINT	340M MD
	340M TVD
RATE OF BUILD	2.45DEG/30M
END OF BUILD	591M MD
	585M TVD
MAXIMUM ANGLE	20.5DEG
START OF DROP	650M MD
	641M TVD
RATE OF DROP	0.95DEG/30M
TARGET	1298M MD
	1275M TVD
TOTAL DEPTH	1648M MD
	1625M TVD



PLAN VIEW

AUSTOIL DRILLING SERVICES

FIELDNAME : IONA
FILENAME : IONA2
MAGNETIC DECL. : 10.74 DEG.

COMPANY : GFE RESOURCES LTD
SURVEY TYPE: DIFINITIVE
VERTICAL SECTION AZIMUTH : 147.58 DEG.

REC INS MD INCL AZIM NORTH EAST TVD DLS/ V/SECT NUM TYP
METRES-----DEG-----DEG----METRES----METRES----METRES----30M---METRES

REC	INS	MD (METRES)	INCL (DEG)	AZIM (DEG)	NORTH (METRES)	EAST (METRES)	TVD (METRES)	DLS/30M	V/SECT (METRES)
1	MW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	MW	302.00	0.20	354.80	0.52	-0.05	302.00	0.02	-0.47
3	MW	317.00	0.40	193.60	0.50	-0.06	317.00	1.19	-0.46
4	MW	326.00	1.20	199.40	0.38	-0.10	326.00	2.68	-0.38
5	MW	336.00	2.30	197.00	0.09	-0.19	335.99	3.31	-0.18
6	MW	355.00	4.70	194.30	-1.03	-0.50	354.96	3.80	0.60
7	MW	365.00	5.30	192.10	-1.88	-0.70	364.92	1.89	1.21
8	MW	374.00	5.80	190.60	-2.73	-0.87	373.88	1.74	1.84
9	MW	384.00	6.10	190.40	-3.75	-1.06	383.82	0.90	2.60
10	MW	393.00	6.70	188.90	-4.74	-1.22	392.77	2.08	3.34
11	MW	403.00	7.90	187.30	-6.00	-1.40	402.69	3.65	4.31
12	MW	413.00	9.10	184.40	-7.47	-1.55	412.58	3.82	5.47
13	MW	422.00	10.10	179.80	-8.97	-1.60	421.45	4.20	6.71
14	MW	441.00	11.90	167.00	-12.54	-1.15	440.10	4.77	9.97
15	MW	461.00	14.80	159.90	-16.95	0.19	459.56	4.99	14.41
16	MW	470.00	15.40	158.30	-19.14	1.02	468.25	2.44	16.71
17	MW	480.00	15.50	155.50	-21.59	2.07	477.89	2.26	19.34
18	MW	489.00	15.70	150.80	-23.75	3.16	486.56	4.26	21.74
19	MW	499.00	15.80	148.60	-26.09	4.53	496.18	1.82	24.45
20	MW	509.00	16.10	148.20	-28.43	5.97	505.80	0.96	27.20
21	MW	518.00	16.00	148.40	-30.55	7.28	514.45	0.38	29.69
22	MW	528.00	16.40	147.10	-32.91	8.77	524.05	1.62	32.48
23	MW	538.00	17.60	145.90	-35.35	10.38	533.61	3.75	35.40
24	MW	548.00	18.40	145.20	-37.89	12.13	543.12	2.49	38.49
25	MW	558.00	18.70	145.00	-40.50	13.95	552.60	0.92	41.67
26	MW	567.00	18.70	144.90	-42.86	15.61	561.13	0.11	44.55
27	MW	577.00	18.90	145.00	-45.50	17.46	570.59	0.61	47.77
28	MW	586.00	18.70	145.20	-47.88	19.12	579.11	0.70	50.67
29	MW	596.00	18.70	145.40	-50.52	20.94	588.59	0.19	53.87
30	MW	604.00	18.50	145.20	-52.62	22.40	596.17	0.79	56.42
31	MW	614.00	18.20	143.80	-55.18	24.22	605.66	1.60	59.57
32	MW	622.00	18.50	143.10	-57.20	25.72	613.25	1.40	62.08
33	SS	660.00	17.75	142.47	-66.62	32.87	649.37	0.61	73.86
34	SS	698.00	18.25	142.47	-75.93	40.03	685.51	0.39	85.55
35	SS	736.00	19.25	145.41	-85.80	47.21	721.49	1.09	97.74
36	SS	774.00	20.00	150.00	-96.59	54.01	757.29	1.35	110.49
37	MW	786.00	19.70	149.10	-100.10	56.08	768.57	1.07	114.57
38	MW	795.00	18.50	148.40	-102.62	57.61	777.08	4.07	117.51
39	MW	805.00	17.30	145.90	-105.20	59.27	786.59	4.27	120.58
40	MW	814.00	16.70	145.40	-107.38	60.75	795.20	2.06	123.21

AUSTOIL DRILLING SERVICES

FIELDNAME : IONA
FILENAME : IONA2
MAGNETIC DECL. : 10.74 DEG.

COMPANY : GFE RESOURCES LTD
SURVEY TYPE: DIFINITIVE
VERTICAL SECTION AZIMUTH : 147.58 DEG.

REC NUM	INS TYP	MD METRES	INCL DEG	AZIM DEG	NORTH METRES	EAST METRES	TVD METRES	DLS/ 30M	V/SECT METRES
41	MW	824.00	16.20	145.60	-109.71	62.36	804.79	1.51	126.04
42	MW	833.00	15.50	144.50	-111.72	63.77	813.45	2.54	128.50
43	MW	853.00	12.90	139.20	-115.59	66.78	832.84	4.36	133.38
44	MW	862.00	12.80	138.90	-117.10	68.09	841.61	0.40	135.36
45	MW	872.00	12.40	139.10	-118.75	69.52	851.37	1.21	137.51
46	MW	881.00	11.80	138.20	-120.17	70.77	860.17	2.10	139.38
47	MW	891.00	11.50	138.70	-121.68	72.11	869.96	0.95	141.37
48	MW	900.00	11.10	137.50	-122.99	73.28	878.79	1.55	143.11
49	MW	919.00	10.80	139.20	-125.69	75.68	897.44	0.70	146.67
50	MW	928.00	10.80	139.40	-126.96	76.78	906.28	0.12	148.34
51	MW	938.00	10.40	138.70	-128.35	77.99	916.11	1.26	150.16
52	MW	947.00	10.00	138.70	-129.55	79.04	924.97	1.33	151.73
53	MW	957.00	10.00	138.00	-130.85	80.19	934.82	0.36	153.45
54	MW	967.00	9.70	137.70	-132.12	81.34	944.67	0.91	155.13
55	MW	976.00	9.60	139.90	-133.25	82.33	953.55	1.27	156.62
56	MW	986.00	9.20	140.10	-134.50	83.38	963.41	1.20	158.24
57	MW	996.00	9.20	141.20	-135.74	84.40	973.28	0.53	159.83
58	MW	1005.00	8.90	142.40	-136.85	85.27	982.17	1.18	161.24
59	MW	1015.00	8.50	142.40	-138.05	86.20	992.05	1.20	162.74
60	MW	1024.00	8.20	143.10	-139.09	86.99	1000.96	1.06	164.05
61	MM	1052.00	7.00	144.00	-142.07	89.19	1028.71	1.29	167.74
62	MM	1071.00	6.50	144.00	-143.87	90.50	1047.58	0.79	169.97
63	MM	1090.00	6.00	145.00	-145.56	91.70	1066.47	0.81	172.04
64	MM	1109.00	5.25	141.00	-147.05	92.82	1085.38	1.34	173.89
65	MM	1129.00	4.50	139.00	-148.35	93.91	1105.30	1.15	175.58
66	MM	1148.00	4.00	138.00	-149.40	94.84	1124.25	0.80	176.97
67	MM	1167.00	3.50	135.00	-150.31	95.70	1143.21	0.85	178.19
68	MM	1187.00	3.00	136.00	-151.11	96.49	1163.18	0.75	179.29
69	MM	1206.00	2.75	141.00	-151.83	97.13	1182.16	0.56	180.23
70	MM	1225.00	2.75	144.00	-152.55	97.68	1201.13	0.23	181.14
71	MM	1244.00	2.75	140.00	-153.27	98.24	1220.11	0.30	182.05
72	MM	1264.00	2.50	141.00	-153.97	98.82	1240.09	0.38	182.96
73	MM	1283.00	2.25	145.00	-154.60	99.30	1259.07	0.47	183.74
74	MM	1301.00	2.00	150.00	-155.16	99.66	1277.06	0.52	184.41
75	MM	1321.00	1.75	148.00	-155.72	99.99	1297.05	0.39	185.06
76	MM	1340.00	1.50	153.00	-156.19	100.26	1316.04	0.45	185.60
77	MM	1359.00	1.25	160.00	-156.61	100.44	1335.04	0.47	186.05
78	MM	1377.00	1.25	161.00	-156.98	100.58	1353.03	0.04	186.43
79	MM	1397.00	1.25	159.00	-157.39	100.73	1373.03	0.07	186.86
80	MM	1417.00	1.25	153.00	-157.79	100.90	1393.02	0.20	187.29

AUSTOIL DRILLING SERVICES

FIELDNAME : IONA
FILENAME : IONA2
MAGNETIC DECL. : 10.74 DEG.

COMPANY : GFE RESOURCES LTD
SURVEY TYPE: DIFINITIVE
VERTICAL SECTION AZIMUTH : 147.58 DEG.

REC NUM	INS TYP	MD METRES	INCL DEG	AZIM DEG	NORTH METRES	EAST METRES	TVD METRES	DLS/ 30M	V/SECT METRES
81	MM	1435.00	1.25	148.00	-158.13	101.10	1411.02	0.18	187.68
82	MM	1455.00	1.25	151.00	-158.50	101.32	1431.02	0.10	188.12
83	MM	1474.00	1.00	151.00	-158.83	101.50	1450.01	0.39	188.49
84	MM	1493.00	1.00	145.00	-159.11	101.67	1469.01	0.17	188.82
85	MM	1512.00	1.00	151.00	-159.39	101.85	1488.01	0.17	189.15
86	MM	1531.00	1.00	151.00	-159.68	102.01	1507.00	0.00	189.48
87	MM	1550.00	0.75	154.00	-159.94	102.14	1526.00	0.40	189.77
88	MM	1570.00	0.75	149.00	-160.17	102.27	1546.00	0.10	190.03
89	MM	1589.00	0.75	141.00	-160.37	102.41	1565.00	0.17	190.28
90	MM	1608.00	0.75	143.00	-160.57	102.56	1584.00	0.04	190.53
91	MM	1627.00	0.75	148.00	-160.77	102.71	1602.99	0.10	190.78
92	PR	1650.00	0.75	136.00	-161.01	102.89	1625.99	0.20	191.07

Surveys computed using the MINIMUM CURVATURE method..

AUSTOIL DRILLING SERVICES

FIELDNAME : IONA　　COMPANY : GFE RESOUCES LTD
FILENAME : IONA2　　SURVEY TYPE : SINGLESHOT
MAGNETIC DECL. : 10.74 DEG.　　VERTICAL SECTION AZIMUTH : 147.58 DEG.

REC NUM	INS TYP	MD METRES	INCL DEG	AZIM DEG	NORTH METRES	EAST METRES	TVD METRES	DLS/ 30M	V/SECT METRES
1	MW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	MW	302.00	0.20	354.80	0.52	-0.05	302.00	0.02	-0.47
3	MW	317.00	0.40	193.60	0.50	-0.06	317.00	1.19	-0.46
4	MW	326.00	1.20	199.40	0.38	-0.10	326.00	2.68	-0.38
5	MW	336.00	2.30	197.00	0.09	-0.19	335.99	3.31	-0.18
6	MW	355.00	4.70	194.30	-1.03	-0.50	354.96	3.80	0.60
7	MW	365.00	5.30	192.10	-1.88	-0.70	364.92	1.89	1.21
8	MW	374.00	5.80	190.60	-2.73	-0.87	373.88	1.74	1.84
9	MW	384.00	6.10	190.40	-3.75	-1.06	383.82	0.90	2.60
10	MW	393.00	6.70	188.90	-4.74	-1.22	392.77	2.08	3.34
11	MW	403.00	7.90	187.30	-6.00	-1.40	402.69	3.65	4.31
12	MW	413.00	9.10	184.40	-7.47	-1.55	412.58	3.82	5.47
13	MW	422.00	10.10	179.80	-8.97	-1.60	421.45	4.20	6.71
14	MW	441.00	11.90	167.00	-12.54	-1.15	440.10	4.77	9.97
15	MW	461.00	14.80	159.90	-16.95	0.19	459.56	4.99	14.41
16	MW	470.00	15.40	158.30	-19.14	1.02	468.25	2.44	16.71
17	MW	480.00	15.50	155.50	-21.59	2.07	477.89	2.26	19.34
18	MW	489.00	15.70	150.80	-23.75	3.16	486.56	4.26	21.74
19	MW	499.00	15.80	148.60	-26.09	4.53	496.18	1.82	24.45
20	MW	509.00	16.10	148.20	-28.43	5.97	505.80	0.96	27.20
21	MW	518.00	16.00	148.40	-30.55	7.28	514.45	0.38	29.69
22	MW	528.00	16.40	147.10	-32.91	8.77	524.05	1.62	32.48
23	MW	538.00	17.60	145.90	-35.35	10.38	533.61	3.75	35.40
24	MW	548.00	18.40	145.20	-37.89	12.13	543.12	2.49	38.49
25	MW	558.00	18.70	145.00	-40.50	13.95	552.60	0.92	41.67
26	MW	567.00	18.70	144.90	-42.86	15.61	561.13	0.11	44.55
27	MW	577.00	18.90	145.00	-45.50	17.46	570.59	0.61	47.77
28	MW	586.00	18.70	145.20	-47.88	19.12	579.11	0.70	50.67
29	MW	596.00	18.70	145.40	-50.52	20.94	588.59	0.19	53.87
30	MW	604.00	18.50	145.20	-52.62	22.40	596.17	0.79	56.42
31	MW	614.00	18.20	143.80	-55.18	24.22	605.66	1.60	59.57
32	MW	622.00	18.50	143.10	-57.20	25.72	613.25	1.40	62.08
33	SS	660.00	17.75	142.47	-66.62	32.87	649.37	0.61	73.86
34	SS	698.00	18.25	142.47	-75.93	40.03	685.51	0.39	85.55
35	SS	736.00	19.25	145.41	-85.80	47.21	721.49	1.09	97.74
36	SS	774.00	20.00	150.00	-96.59	54.01	757.29	1.35	110.49
37	MW	786.00	19.70	149.10	-100.10	56.08	768.57	1.07	114.57
38	MW	795.00	18.50	148.40	-102.62	57.61	777.08	4.07	117.51
39	MW	805.00	17.30	145.90	-105.20	59.27	786.59	4.27	120.58
40	MW	814.00	16.70	145.40	-107.38	60.75	795.20	2.06	123.21

AUSTOIL DRILLING SERVICES

FIELDNAME : IONA COMPANY : GFE RESOUCES LTD
FILENAME : IONA2 SURVEY TYPE : SINGLESHOT
MAGNETIC DECL. : 10.74 DEG. VERTICAL SECTION AZIMUTH : 147.58 DEG.
REC INS MD INCL AZIM NORTH EAST TVD DLS/
V/SECT NUM TYP METRES-----DEG-----DEG----METRES----METRES----
METRES----30M---METRES

41	MW	824.00	16.20	145.60	-109.71	62.36	804.79	1.51	126.04
42	MW	833.00	15.50	144.50	-111.72	63.77	813.45	2.54	128.50
43	MW	853.00	12.90	139.20	-115.59	66.78	832.84	4.36	133.38
44	MW	862.00	12.80	138.90	-117.10	68.09	841.61	0.40	135.36
45	MW	872.00	12.40	139.10	-118.75	69.52	851.37	1.21	137.51
46	MW	881.00	11.80	138.20	-120.17	70.77	860.17	2.10	139.38
47	MW	891.00	11.50	138.70	-121.68	72.11	869.96	0.95	141.37
48	MW	900.00	11.10	137.50	-122.99	73.28	878.79	1.55	143.11
49	MW	919.00	10.80	139.20	-125.69	75.68	897.44	0.70	146.67
50	MW	928.00	10.80	139.40	-126.96	76.78	906.28	0.12	148.34
51	MW	938.00	10.40	138.70	-128.35	77.99	916.11	1.26	150.16
52	MW	947.00	10.00	138.70	-129.55	79.04	924.97	1.33	151.73
53	MW	957.00	10.00	138.00	-130.85	80.19	934.82	0.36	153.45
54	MW	967.00	9.70	137.70	-132.12	81.34	944.67	0.91	155.13
55	MW	976.00	9.60	139.90	-133.25	82.33	953.55	1.27	156.62
56	MW	986.00	9.20	140.10	-134.50	83.38	963.41	1.20	158.24
57	MW	996.00	9.20	141.20	-135.74	84.40	973.28	0.53	159.83
58	MW	1005.00	8.90	142.40	-136.85	85.27	982.17	1.18	161.24
59	MW	1015.00	8.50	142.40	-138.05	86.20	992.05	1.20	162.74
60	MW	1024.00	8.20	143.10	-139.09	86.99	1000.96	1.06	164.05
61	SS	1096.00	5.50	140.74	-145.87	92.26	1072.44	1.13	172.59
62	SS	1165.00	3.75	136.00	-150.05	95.92	1141.21	0.78	178.09
63	SS	1250.00	2.50	143.00	-153.53	98.96	1226.08	0.46	182.66
64	SS	1345.00	1.50	153.00	-156.30	100.77	1321.03	0.33	185.96
65	SS	1450.00	1.00	151.00	-158.32	101.84	1426.00	0.14	188.24
66	SS	1632.00	0.75	136.00	-160.57	103.44	1607.98	0.06	191.00
67	PR	1650.00	0.75	136.00	-160.74	103.60	1625.98	0.00	191.23

Surveys computed using the MINIMUM CURVATURE method..

Note: 11.00 used as approximation of 10.74

AUSTOIL DRILLING SERVICES

FIELDNAME : IONA — COMPANY : GFE RESOURCES LTD
FILENAME : IONA2 — SURVEY TYPE : MULTISHOT
MAGNETIC DECL. : 11.00 DEG. — VERTICAL SECTION AZIMUTH : 147.58 DEG.

REC NUM	INS TYP	MD METRES	INCL DEG	AZIM DEG	NORTH METRES	EAST METRES	TVD METRES	DLS/ 30M	V/SECT METRES
1	MW	622.00	18.50	143.10	-57.20	25.72	613.25	0.00	62.07
2	MM	648.00	17.75	142.00	-63.62	30.64	637.96	0.95	70.13
3	MM	668.00	18.00	142.00	-68.46	34.42	656.99	0.38	76.24
4	MM	688.00	18.25	143.00	-73.40	38.20	676.00	0.60	82.44
5	MM	707.00	19.00	144.00	-78.27	41.81	694.01	1.29	88.49
6	MM	726.00	19.25	145.00	-83.34	45.43	711.96	0.65	94.71
7	MM	764.00	20.00	150.00	-94.10	52.27	747.75	1.45	107.46
8	MM	783.00	19.00	149.00	-99.57	55.49	765.66	1.66	113.80
9	MM	802.00	17.00	146.00	-104.52	58.63	783.73	3.48	119.67
10	MM	821.00	15.75	146.00	-108.96	61.63	801.96	1.97	125.02
11	MM	860.00	12.75	138.00	-116.55	67.47	839.76	2.76	134.56
12	MM	879.00	11.75	138.00	-119.55	70.17	858.33	1.58	138.53
13	MM	898.00	10.75	138.00	-122.30	72.65	876.96	1.58	142.19
14	MM	917.00	10.25	138.00	-124.87	74.96	895.64	0.79	145.60
15	MM	936.00	10.00	138.00	-127.36	77.20	914.35	0.39	148.90
16	MM	975.00	9.00	140.00	-132.21	81.43	952.81	0.81	155.26
17	MM	994.00	8.25	140.00	-134.39	83.26	971.60	1.18	158.08
18	MM	1013.00	8.00	143.00	-136.49	84.93	990.41	0.78	160.75
19	MM	1032.00	7.25	143.00	-138.51	86.45	1009.24	1.18	163.26
20	MM	1052.00	7.00	144.00	-140.50	87.92	1029.09	0.42	165.74
21	MM	1071.00	6.50	144.00	-142.31	89.24	1047.95	0.79	167.97
22	MM	1090.00	6.00	145.00	-143.99	90.44	1066.84	0.81	170.03
23	MM	1109.00	5.25	141.00	-145.48	91.55	1085.75	1.34	171.89
24	MM	1129.00	4.50	139.00	-146.78	92.64	1105.68	1.15	173.57
25	MM	1148.00	4.00	138.00	-147.84	93.58	1124.62	0.80	174.96
26	MM	1167.00	3.50	135.00	-148.74	94.43	1143.58	0.85	176.18
27	MM	1187.00	3.00	136.00	-149.55	95.23	1163.55	0.75	177.29
28	MM	1206.00	2.75	141.00	-150.26	95.86	1182.53	0.56	178.23
29	MM	1225.00	2.75	144.00	-150.98	96.41	1201.51	0.23	179.14
30	MM	1244.00	2.75	140.00	-151.70	96.97	1220.48	0.30	180.05
31	MM	1264.00	2.50	141.00	-152.41	97.56	1240.46	0.38	180.96
32	MM	1283.00	2.25	145.00	-153.03	98.03	1259.45	0.47	181.74
33	MM	1301.00	2.00	150.00	-153.60	98.39	1277.43	0.52	182.41
34	MM	1321.00	1.75	148.00	-154.16	98.73	1297.42	0.39	183.06
35	MM	1340.00	1.50	153.00	-154.63	98.99	1316.42	0.45	183.60
36	MM	1359.00	1.25	160.00	-155.04	99.18	1335.41	0.47	184.05
37	MM	1377.00	1.25	161.00	-155.41	99.31	1353.41	0.04	184.43
38	MM	1397.00	1.25	159.00	-155.82	99.46	1373.40	0.07	184.86
39	MM	1417.00	1.25	153.00	-156.22	99.63	1393.40	0.20	185.29
40	MM	1435.00	1.25	148.00	-156.56	99.83	1411.39	0.18	185.68

AUSTOIL DRILLING SERVICES

FIELDNAME : IONA
FILENAME : IONA2
MAGNETIC DECL. : 11.00 DEG.

COMPANY : GFE RESOURCES LTD
SURVEY TYPE : MULTISHOT
VERTICAL SECTION AZIMUTH : 147.58 DEG.

REC NUM	INS TYP	MD METRES	INCL DEG	AZIM DEG	NORTH METRES	EAST METRES	TVD METRES	DLS/ 30M	V/SECT METRES
41	MM	1455.00	1.25	151.00	-156.94	100.05	1431.39	0.10	186.12
42	MM	1474.00	1.00	151.00	-157.26	100.23	1450.38	0.39	186.49
43	MM	1493.00	1.00	145.00	-157.54	100.41	1469.38	0.17	186.82
44	MM	1512.00	1.00	151.00	-157.82	100.58	1488.38	0.17	187.15
45	MM	1531.00	1.00	151.00	-158.11	100.74	1507.37	0.00	187.48
46	MM	1550.00	0.75	154.00	-158.37	100.88	1526.37	0.40	187.77
47	MM	1570.00	0.75	149.00	-158.60	101.00	1546.37	0.10	188.03
48	MM	1589.00	0.75	141.00	-158.80	101.14	1565.37	0.17	188.28
49	MM	1608.00	0.75	143.00	-159.00	101.30	1584.37	0.04	188.53
50	MM	1627.00	0.75	148.00	-159.21	101.44	1603.37	0.10	188.77

Surveys computed using the MINIMUM CURVATURE method..

AUSTOIL DRILLING SERVICES
Daily Directional Drilling Report

Date 15/2/94

Company	GFE Resources	Country	Australia	Rep.No	#1
District	Victoria	Lease/Block		Well No	Iona #2
Co.Man	Ken Smith	Cont.T.P.	Rick Giddens	Contr.	Century Drilling

OPERATIONS:

Continue drilling 12 1/4" hole to 320m , taking totco surveys
POOH and made up the kick off assembly – RIH to HWDP and tested equipment
Continue RIH reaming from 293m to 305m
Drilled deviated hole from 320m to 500m

BHA NO : out:–bit –dc–dc–stab–dc
in:– bit–motor 1.15deg–stab–monel–hos–4*8"dc's–2*6 1/4"dc's–jar–12*6 1/4"dc's–6*hwdp

Motor Make	Sperry Drill	Type	8" Adjustable Motor	Ser. No.	
Motor RPM	76	Press on btm	1575 psi	Off btm	1450 psi
		Pressure Drop Across Bit			970 psi
Motor Usage Information		Time In Hole	09:15 15/2/94	Out	
Depth In	320m	Depth Out		Footage	
Bit Make	Security (116)	Type	S33SF	Nozzles	16–16–16
Mud Weight	8.9ppg	PV / YP	6/10	Vis	37
Sand	tr	Annula Vel.	28 / 48.2 m/min	Gel	
Drilling Parameters		WOB	10,000 lbs	RPM	77
		Pump Press.	1450psi	GPM	480

SURVEYS :

NO.	Depth	Inc.	Azim.	REMARKS
				Formation very soft , having difficulty getting the
				weight on bit to maintain a constant toolface

DIRECTIONAL SUPERVISOR

COMPANY MAN

AUSTOIL DRILLING SERVICES

Daily Directional Drilling Report

Date 16/2/94

Company	GFE Resources	Country	Australia	Rep.No	#2
District	Victoria	Lease/Block		Well No	Iona #2
Co.Man	Ken Smith	Cont.T.P.	Rick Giddens	Contr.	Century Drilling

OPERATIONS:

Continue drilling deviated hole from 500m to 640m

POOH with kickoff assembly – working past tight spots at 475m , 456m to 379m

Made up reaming assembly and RIH – reamed from 320m to 351m,408m to 524m,609m to 640m

Circulate hole clean

BHA NO : out:– bit–motor 1.15deg–stab–monel–hos–4*8"dc's–2*6 1/4"dc's–jar–12*6 1/4"dc's–6*hwdp

in –bit–stab–monel–hos–dc–stab–3* 8"dc's–2* 6 1/4"dc's–jar–12* 6 1/4"dc's–6* hwdp

Motor Make	Sperry Drill		8" Adjustable Motor	Ser. No	800–050
Motor RPM	76	Press on btm	1575 psi	Off btm	1450 psi
		Pressure Drop Across Bit			970 psi
Motor Usage Information		Time In Hole	09:15 15/2/94	Out	15:20 16/2/94
Depth In	320m	Depth Out	640m	Footage	640m
Bit Make	Security (116)	Type	S33SF	Nozzles	16–16–16
Mud Weight	8.9ppg	PV / YP	6/10	Vis	37
Sand	tr	Annula Vel.	28 / 48.2 m/min	Gel	
Drilling Parameters		WOB	10 – 25000lbs	RPM	77
		Pump Press.	1450psi	GPM	480

SURVEYS :

NO.	Depth	Inc.	Azim.	REMARKS
				Run #1: motor and M.W.D
				Time in – 09:15 15/2/94
				Time out – 15:20 16/2/94

DIRECTIONAL SUPERVISOR

COMPANY MAN

AUSTOIL DRILLING SERVICES
Daily Directional Drilling Report

Date 17/2/94

Company	GFE Resources	Country	Australia	Rep.No	#3
District	Victoria	Lease/Block	PPL – 2	Well No	Iona #2
Co.Man	Ken Smith	Cont.T.P.	Rick Giddens	Contr.	Century Drilling

OPERATIONS:

POOH to 8" drill collars then RIH to bottom
Circulate hole clean – POOH for casing
Run 9 5/8" casing and cement same
W.O.C

BHA NO : in –bit–stab–monel–hos–dc–stab–3* 8"dc's–2* 6 1/4"dc's–jar–12* 6 1/4"dc's–6* hwdp

Motor Make				Ser. No.	
Motor RPM		Press on btm		Off btm.	
		Pressure Drop Across Bit			
Motor Usage Information		Time In Hole		Out	
Depth In		Depth Out		Footage	
Bit Make		Type		Nozzles	
Mud Weight	9.3ppg	PV / YP	12/14	Vis	47
Sand	1%	Annula Vel.	28 / 48.2 m/min	Gel	9/37
Drilling Parameters		WOB	0–5000lbs	RPM	50
		Pump Press.	1450psi	GPM	480

SURVEYS :

NO.	Depth	Inc.	Azim.	REMARKS
				Run #2 : M.W.D only
				Time in – 16:30 16/2/94
				Time out – 10:30 17/2/94

DIRECTIONAL SUPERVISOR

COMPANY MAN

AUSTOIL DRILLING SERVICES
Daily Directional Drilling Report

Date 18/2/94

Company	GFE Resources	Country	Australia	Rep.No	#4
District	Victoria	Lease/Block	PPL – 2	Well No	Iona #2
Co.Man	Ken Smith	Cont.T.P.	Rick Giddens	Contr.	Century Drilling

OPERATIONS:

W.O.C

Nipple up B.O.P – test same etc

Made up rotary assembly and R.I.H

BHA NO : bit–stab–pony–stab–monel–stab–6* dc's–jar–18* dc's–6* hwdp

Motor Make				Ser. No.	
Motor RPM		Press on btm		Off btm.	
		Pressure Drop Across Bit			
Motor Usage Information		Time In Hole		Out	
Depth In		Depth Out		Footage	
Bit Make	Varel	Type	ETD 417	Nozzles	10–10–11
Mud Weight	8.8ppg	PV / YP	5/11	Vis	35
Sand	tr	Annula Vel.		Gel	9/21
Drilling Parameters		WOB	0–5000lbs	RPM	50
		Pump Press.	1450psi	GPM	480

SURVEYS :

NO.	Depth	Inc.	Azim.	REMARKS

DIRECTIONAL SUPERVISOR

COMPANY MAN

AUSTOIL DRILLING SERVICES

Daily Directional Drilling Report

Date 19/2/94

Company	GFE Resources	Country	Australia	Rep.No	#5
District	Victoria	Lease/Block	PPL – 2	Well No	Iona #2
Co.Man	Ken Smith	Cont.T.P.	Rick Giddens	Contr.	Century Drilling

OPERATIONS:

RIH tagged cement

Drilled float,shoe and 5m of new hole – perform F.I.T test

Rotary drilled from 640m to 781m taking single shot surveys – the angle continues to build

POOH for assembly change

Made up motor and MWD – RIH

Orientate and drilled with motor to drop the well angle –781m to 823m

BHA NO : bit–stab–pony–stab–monel–stab–6* dc's–jar–18* dc's–6* hwdp

in–bit–motor–stab–monel–hos–2* dc's–jar–18* dc's–6* hwdp–ksw

Motor Make	Drilex	Type	D675	Ser. No	50218
Motor RPM	84	Press on btm	1550psi	Off btm	1400psi
		Pressure Drop Across Bit			861psi
Motor Usage Information		Time In Hole	18:30 19/2/94	Out	
Depth In	781m	Depth Out		Footage	
Bit Make	Varel	Type	ETD 417	Nozzles	10–10–11
Mud Weight	8.8ppg	PV / YP	6/8	Vis	38
Sand	tr	Annula Vel.	37.6 / 67.3 m/min	Gel	4/14
Drilling Parameters		WOB	10–15000lbs	RPM	40
		Pump Press.	1400psi	GPM	300

SURVEYS :

NO.	Depth	Inc.	Azim.	REMARKS

DIRECTIONAL SUPERVISOR

COMPANY MAN

AUSTOIL DRILLING SERVICES
Daily Directional Drilling Report

Date 20/2/94

Company	GFE Resources	Country	Australia	Rep.No	#6
District	Victoria	Lease/Block	PPL – 2	Well No	Iona #2
Co.Man	Ken Smith	Cont.T.P.	Rick Giddens	Contr.	Century Drilling

OPERATIONS:

Continue drilling with motor dropping off the angle – 823m to 1052m
The pipe stuck while making a connection
Displaced the mud with water and worked the pipe free
POOH laying out the motor MWD etc.
Made up a pendulum assembly and RIH

BHA NO : :out–bit–motor–stab–monel–hos–2* dc's–jar–18* dc's–6* hwdp–ksw
in– bit–monel–dc–stab–dc–stab–10* dc's–stab–6* dc–jar–2* dc's–6* hwdp–ksw

Motor Make	Drilex	Type	D675	Ser. No	50218
Motor RPM	84	Press on btm	1550psi	Off btm	1400psi
		Pressure Drop Across Bit			861psi
Motor Usage Information		Time In Hole	18:30 19/2/94	Out	20:00 20/2/94
Depth In	781m	Depth Out	1052m	Footage	271m
Bit Make	Varel	Type	ETD 417	Nozzles	12–12–10
Mud Weight	8.9ppg	PV / YP	12/11	Vis	38
Sand	tr	Annula Vel.	43.8/68.6 m/min	Gel	2/5
Drilling Parameters		WOB	10–15000lbs	RPM	40
		Pump Press.	1400psi	GPM	300

SURVEYS :

NO.	Depth	Inc.	Azim.	REMARKS
				Run #3 : motor and M.W.D
				Time in – 18:30 19/12/94
				Time out – 20:00 20/2/94

DIRECTIONAL SUPERVISOR

COMPANY MAN

AUSTOIL DRILLING SERVICES
Daily Directional Drilling Report

Date 21/2/94

Company	GFE Resources	Country	Australia	Rep.No	#7
District	Victoria	Lease/Block	PPL – 2	Well No	Iona #2
Co.Man	Ken Smith	Cont.T.P.	Rick Giddens	Contr.	Century Drilling

OPERATIONS:

RIH to 1024m – wash and reamed to 1043m

Blew the kelly hose – POOH to shoe

Replaced kelly hose etc

RIH and drilled from 1052m to 1133m

BHA NO : bit–monel–dc–stab–dc–stab–10* dc's–stab–6* dc–jar–2* dc's–6* hwdp–ksw

Motor Make		Type		Ser. No.	
Motor RPM		Press on btm		Off btm.	
		Pressure Drop Across Bit			
Motor Usage Information		Time In Hole		Out	
Depth In		Depth Out		Footage	
Bit Make	Varel	Type	ETD 417	Nozzles	12–12–10
Mud Weight	9.1ppg	PV / YP	11/8	Vis	38
Sand	0.3%	Annula Vel.	47.7/70 m/min	Gel	1/3
Drilling Parameters		WOB	10–15000lbs	RPM	110
		Pump Press.	1250psi	GPM	310

SURVEYS :

NO.	Depth	Inc.	Azim.	REMARKS

DIRECTIONAL SUPERVISOR

COMPANY MAN

AUSTOIL DRILLING SERVICES
Daily Directional Drilling Report

Date 22/2/94

Company	GFE Resources	Country	Australia	Rep.No	#8
District	Victoria	Lease/Block	PPL – 2	Well No	Iona #2
Co.Man	Ken Smith	Cont.T.P.	Rick Giddens	Contr.	Century Drilling

OPERATIONS:

Continue drilling 8 1/2" hole from 1133m to 1182m – circulate and took survey
While taking the survey the pipe stuck – worked same free
Drilled to 1268m – circulate and made short trip to 900m – no hole problems
Circulate bottoms up and took two surveys (one misrun)
POOH for bit and assembly change

BHA NO : bit–monel–dc–stab–dc–stab–10* dc's–stab–6* dc–jar–2* dc's–6* hwdp–ksw

Motor Make		Type		Ser. No.	
Motor RPM		Press on btm		Off btm.	
		Pressure Drop Across Bit			
Motor Usage Information		Time In Hole		Out	
Depth In		Depth Out		Footage	
Bit Make	Varel	Type	ETD 417	Nozzles	12–12–10
Mud Weight	9.3ppg	PV / YP	13/9	Vis	39
Sand	0.1%	Annula Vel.	47.7/70 m/min	Gel	2/7
Drilling Parameters		WOB	10–15000lbs	RPM	305
		Pump Press.	1250psi	GPM	310

SURVEYS :

NO.	Depth	Inc.	Azim.	REMARKS
62	1165	3.75	136	Continue reaming kellys etc. to keep
63	1250	2.5	143	the angle down.

DIRECTIONAL SUPERVISOR

COMPANY MAN

AUSTOIL DRILLING SERVICES

Daily Directional Drilling Report

Date 23/2/94

Company	GFE Resources	Country	Australia	Rep.No	#9
District	Victoria	Lease/Block	PPL – 2	Well No	Iona #2
Co.Man	Ken Smith	Cont.T.P.	S. Kelly	Contr.	Century Drilling

OPERATIONS:

POOH for bit and assembly change

Changed assembly , bit and jar

RIH to 1245m – broke circulation and washed to bottom

Drilled from 1268m to 1404m

BHA NO : bit–stab–pony–stab–monel–stab–7* dc's–stab–7* dc's–2* hwdp–jar–4* hwdp–32* dp–ksw

Motor Make		Type		Ser. No.	
Motor RPM		Press on btm		Off btm.	
		Pressure Drop Across Bit			
Motor Usage Information		Time In Hole		Out	
Depth In		Depth Out		Footage	
Bit Make	Varel	Type	ETD 417	Nozzles	12–12–12
Mud Weight	9.35ppg	PV / YP	12/8	Vis	39
Sand	tr	Annula Vel.	47.7/70 m/min	Gel	1/5
Drilling Parameters		WOB	20–25000ibs	RPM	90
		Pump Press.	1225psi	GPM	310

SURVEYS :

NO.	Depth	Inc.	Azim.	REMARKS
64	1345	1.5	153	Layed out six drill collars to help reduce
				differential sticking problems
				Bit out – Varel ETD 417
				Footage 628m
				Hours 50.5
				Condition 1–1–in

DIRECTIONAL SUPERVISOR

COMPANY MAN

AUSTOIL DRILLING SERVICES
Daily Directional Drilling Report

Date 24/2/94

Company	GFE Resources	Country	Australia	Rep.No	#10
District	Victoria	Lease/Block	PPL – 2	Well No	Iona #2
Co.Man	Ken Smith	Cont.T.P.	S. Kelly	Contr.	Century Drilling

OPERATIONS:

Continue drilling 8 1/2" hole to 1650m

Circulate bottoms up and took survey

Make wiper trip to shoe – hole swabbing in places

BHA NO : bit–stab–pony–stab–monel–stab–7* dc's–stab–7* dc's–2* hwdp–jar–4* hwdp–32* dp–ksw

Motor Make		Type		Ser. No.	
Motor RPM		Press on btm		Off btm.	
		Pressure Drop Across Bit			
Motor Usage Information		Time In Hole		Out	
Depth In		Depth Out		Footage	
Bit Make	Varel	Type	ETD 417	Nozzles	12–12–12
Mud Weight	9.35ppg	PV / YP	12/8	Vis	39
Sand	tr	Annula Vel.	47.7/70 m/min	Gel	1/5
Drilling Parameters		WOB	20–25000ibs	RPM	90
		Pump Press.	1225psi	GPM	310

SURVEYS :

NO.	Depth	Inc.	Azim.	REMARKS
65	1450	1	151	
66	1632	0.75	136	

DIRECTIONAL SUPERVISOR

COMPANY MAN

AUSTOIL DRILLING SERVICES

Daily Directional Drilling Report

Date 25/5/94

Company	GFE Resources	Country	Australia	Rep.No	#11
District	Victoria	Lease/Block	PPL – 2	Well No	Iona #2
Co.Man	Ken Smith	Cont.T.P.	S. Kelly	Contr.	Century Drilling

OPERATIONS:

RIH with wiper trip to bottom

Circulate bottoms up– pump pill – drop multishot

POOH to shoe at 631m and retrieve multishot instrument

Continue POOH to surface – rig up and start logging

BHA NO : bit–stab–pony–stab–monel–stab–7* dc's–stab–7* dc's–2* hwdp–jar–4* hwdp–32* dp–ksw

Motor Make		Type		Ser. No.	
Motor RPM		Press on btm		Off btm.	
		Pressure Drop Across Bit			
Motor Usage Information		Time In Hole		Out	
Depth In		Depth Out		Footage	
Bit Make	Varel	Type	ETD 417	Nozzles	12–12–12
Mud Weight	9.35ppg	PV / YP	12/8	Vis	39
Sand	tr	Annula Vel.	47.7/70 m/min	Gel	1/5
Drilling Parameters		WOB	20–25000ibs	RPM	90
		Pump Press.	1225psi	GPM	310

SURVEYS :

NO.	Depth	Inc.	Azim.	REMARKS
				Bit out Varel 417
66	1632	0.75	136	Footage 382m
				Condition 1–1–in
				Depart rig on 25/2/94

DIRECTIONAL SUPERVISOR

COMPANY MAN

AUSTOIL DRILLING SERVICES PTY LTD

COMPANY : GFE Resources
FIELD NAME :
WELL NAME : Iona #2
ASSEMBLY NO : #1

DATE IN : 14/2/94
DATE OUT : 15/2/94
DEPTH IN : 0
DEPTH OUT : 320M

THREAD	ITEM	O.D.	I.D.	FISH NECK	BLADE LENGTH	SERIAL NUMBER	TOOL LENGTH
	BIT	12 1/4					0.3
	2* 8"DC'S	7 7/8	3 1/8				17.98
	STAB	8	2 7/8			7790417	1.89
	2* 8"DC'S						18.12
						TOTAL ASSEMBLY LENGTH	38.29

AUSTOIL DRILLING SERVICES PTY LTD

COMPANY :	GFE Resources	DATE IN :	16/2/94
FIELD NAME :		DATE OUT :	17/2/94
WELL NAME :	Iona #2	DEPTH IN :	640m
ASSEMBLY NO :	#3	DEPTH OUT :	640m

THREAD	ITEM	O.D.	I.D.	FISH NECK	BLADE LENGTH	SERIAL NUMBER	TOOL LENGTH
	BIT	12 1/4					0.3
6 5/8REG BOX / BOX	STAB	8	2 13/16	0.50	0.61	248	1.55
6 5/8REG PIN / BOX	MONEL	8	2 7/8			51349AB	9.12
6 5/8REG PIN / BOX	H.O.S	8 1/8	3 5/16			SSDS 00026	1.95
6 5/8REG PIN / BOX	DC						9.11
6 5/8REG PIN / BOX	STAB	7 15/16	3	0.49	0.74	7790417	1.59
6 5/8REG PIN / BOX	3* 8" DC'S						27.3
[illegible]/8REG PIN / 4IF BOX	CROSS OVER						0.59
4IF PIN / BOX	2* 6 1/4" DC'S						17.98
4IF PIN / BOX	JAR	6 9/16	3 1/4			DJ6 65028	5.93
4IF PIN / BOX	14* 6 1/4" DC'S						124.9
4IF PIN / BOX	6 * HWDP						55.38
						TOTAL ASSEMBLY LENGTH	255.7

AUSTOIL DRILLING SERVICES PTY LTD

COMPANY : GFE Resources
FIELD NAME :
WELL NAME : Iona #2
ASSEMBLY NO : #4

DATE IN : 18/2/94
DATE OUT : 19/2/94
DEPTH IN : 640m
DEPTH OUT : 781m

THREAD	ITEM	O.D.	I.D.	FISH NECK	BLADE LENGTH	SERIAL NUMBER	TOOL LENGTH
	BIT	8 1/2					0.24
4 1/2REG BOX / 4IF PIN	STAB	6 3/8	2 7/8	0.36	0.51	1010	1.4
4"IF PIN / BOX	PONY DC	6 3/8	3			1540	3.5
4IF PIN / BOX	STAB	6 3/8	2 7/8	0.59	0.54	0185	1.71
4IFPIN / 4 1/2IF BOX	CROSS OVER	6 1/4	2 3/4			SSDS A-128	0.41
4 1/2 PIN / BOX	MONEL	6 3/4	2 7/8			SSDS C410	9.23
4 1/2IF PIN / 4IF BOX	CROSS OVER	6 1/4	2 7/8			SSDS A-125	0.49
4IF PIN / BOX	STAB	6 3/8	2 7/8	0.70	0.47	268	1.58
4IF PIN / BOX	2 * 6 1/4 DC'S						17.98
4IF PIN / BOX	JAR	6 9/16	3 1/4			DJ6 65028	5.93
4IF PIN / BOX	18 * 6 1/4 DC'S						160.55
4IF PIN / BOX	6 * HWDP						55.38
4IF PIN / 4 1/2IF BOX	CROSS OVER	6 3/8	2 7/8			1553	0.35
4 1/2IF PIN / BOX	K.S.W	6 3/8	3 1/8	0.76	0.51	7002	1.84
4 1/2IF PIN / 4IF BOX	CROSS OVER	6 3/16	2 7/8			AUS 210	0.47
						TOTAL ASSEMBLY LENGTH	261.06

AUSTOIL DRILLING SERVICES PTY LTD

COMPANY :	GFE Resources	DATE IN :	19/2/94
FIELD NAME :		DATE OUT :	20/2/94
WELL NAME :	Iona #2	DEPTH IN :	781m
ASSEMBLY NO :	#5	DEPTH OUT :	1052m

THREAD	ITEM	O.D.	I.D.	FISH NECK	BLADE LENGTH	SERIAL NUMBER	TOOL LENGTH
	BIT	8 1/2					0.24
4 1/2R BOX / 4 1/2IF BOX	DRILEX MOTOR	6 3/4				50218	7.17
4 1/2IF PIN / 4IF BOX	CROSS OVER	6 5/8	2 7/8			SSDS 3127	0.77
4IF PIN / BOX	STAB	6 3/8	2 7/8	0.76	0.51	D88911	1.72
4IFPIN / 4 1/2IF BOX	CROSS OVER	6 1/4	2 3/4			SSDS A-128	0.41
4 1/2 PIN / BOX	MONEL	6 3/4	2 7/8			SSDS C410	9.23
4 1/2IF PIN / BOB	H.O.S					SSDS 00030	1.83
4 1/2IF PIN / 4IF BOX	CROSS OVER	6 1/4	2 7/8			SSDS A-125	0.49
4IF PIN / BOX	2 * 6 1/4 DC'S						17.98
4IF PIN / BOX	JAR	6 9/16	3 1/4			DJ6 65028	5.93
4IF PIN / BOX	18 * 6 1/4 DC'S						160.55
4IF PIN / BOX	6 * HWDP						55.38
4IF PIN / 4 1/2IF BOX	CROSS OVER	6 3/8	2 7/8			1553	0.35
4 1/2IF PIN / BOX	K.S.W	6 3/8	3 1/8	0.76	0.51	7002	1.84
4 1/2IF PIN / 4IF BOX	CROSS OVER	6 3/16	2 7/8			AUS 210	0.47
						TOTAL ASSEMBLY LENGTH	264.36

AUSTOIL DRILLING SERVICES PTY LTD

COMPANY : GFE Resources
FIELD NAME :
WELL NAME : Iona #2
ASSEMBLY NO : #2

DATE IN : 15/2/94
DATE OUT : 16/2/94
DEPTH IN : 320M
DEPTH OUT : 640m

THREAD	ITEM	O.D.	I.D.	FISH NECK	BLADE LENGTH	SERIAL NUMBER	TOOL LENGTH
	BIT	12 1/4					0.3
6 5/8REG BOX / BOX	MOTOR 1.15DEG	8				800–050	8.38
6 5/8REG PIN / BOX	STAB 11 3/4"	7 7/8	3 1/8			7790594	1.88
6 5/8REG PIN / BOX	MONEL	8	2 7/8			51349AB	9.12
6 5/8REG PIN / BOX	H.O.S	8 1/8	3 5/16			SSDS 00026	1.95
6 5/8REG PIN / BOX	4* 8"DC'S						36.41
6 5/8REG PIN / 4IF BOX	CROSS OVER						0.59
4IF PIN / BOX	2* 6 1/4" DC'S						17.98
4IF PIN / BOX	JAR	6 9/16	3 1/4			DJ6 65028	5.93
4IF PIN / BOX	12* 6 1/4" DC'S						107.33
4IF PIN / BOX	6 * HWDP						55.38
						TOTAL ASSEMBLY LENGTH	245.25

AUSTOIL DRILLING SERVICES PTY LTD

COMPANY : GFE Resources
FIELD NAME :
WELL NAME : Iona #2
ASSEMBLY NO : #6

DATE IN : 20/2/94
DATE OUT : 23/2/94
DEPTH IN : 1052m
DEPTH OUT : 1268M

THREAD	ITEM	O.D.	I.D.	FISH NECK	BLADE LENGTH	SERIAL NUMBER	TOOL LENGTH
	BIT	8 1/2					0.24
4 1/2REG / 4IF	BIT SUB	6 3/8	2 13/16				0.92
4IF PIN / 4 1/2IF BOX	CROSS OVER	6 1/4	2 3/4			SSDS A-128	0.41
4 1/2IF PIN / BOX	MONEL	6 3/4	2 7/8			SSDS C410	9.23
4 1/2IF PIN / 4IF BOX	CROSS OVER	6 1/4	2 7/8			SSDS A-125	0.49
4IF PIN / BOX	DRILL COLLAR						9.39
4IF PIN / BOX	STAB	6 3/8	2 7/8	0.59	0.54	0185	1.71
4IF PIN / BOX	DRILL COLLAR						8.59
4IF PIN / BOX	STAB	6 3/8	2 7/8	0.70	0.47	268	1.58
4IF PIN / BOX	10 DC'S						89.38
4IF PIN / BOX	STAB	6 3/8	2 7/8	0.76	0.51	D88911	1.72
4IF PIN / BOX	6 DC'S						53.32
4IF PIN / BOX	JAR	6 9/16	3 1/4			DJ6 65028	5.93
4IF PIN / BOX	2 DC'S						17.85
4IF PIN / BOX	6 HWDP						55.38
4IF PIN / 4 1/2IF BOX	CROSS OVER	6 3/16	2 7/8			1553	0.35
4 1/2IF PIN / BOX	K.S.W	6 3/8	3 1/8	0.76	0.51	7002	1.84
4 1/2IF PIN / 4IF BOX	CROSS OVER	6 3/16	2 7/8			AUS 210	0.47
						TOTAL ASSEMBLY LENGTH	258.8

AUSTOIL DRILLING SERVICES PTY LTD

COMPANY :	GFE Resources	DATE IN :	23/2/94
FIELD NAME :		DATE OUT :	
WELL NAME :	Iona #2	DEPTH IN :	1268m
ASSEMBLY NO :	#7	DEPTH OUT :	1650m

THREAD	ITEM	O.D.	I.D.	FISH NECK	BLADE LENGTH	SERIAL NUMBER	TOOL LENGTH
	BIT	8 1/2					0.24
4 1/2REG / 4 1/2IF	STAB	6 3/8	2 7/8	0.63	0.52	237	1.32
4 1/2IF PIN / 4IF BOX	CROSS OVER	6 3/8	2 7/8			1569	0.8
4IF PIN / BOX	PONY DC	6 3/8	3			1540	3.5
4IF PIN / BOX	STAB	6 3/8	2 7/8	0.70	0.47	268	1.58
4IF PIN / 4 1/2IF BOX	CROSS OVER	6 1/4	2 3/4			SSDS A-128	0.41
4 1/2IF PIN / BOX	MONEL	6 3/4	2 7/8			SSDS C410	9.23
4 1/2IF PIN / 4IF BOX	CROSS OVER	6 1/4	2 7/8			SSDS A-125	0.49
4IF PIN / BOX	STAB	6 3/8	2 7/8	0.59	0.54	0185	1.71
4IF PIN / BOX	7* DC'S	6 1/4					63.31
4IF PIN / BOX	STAB	6 3/8	2 7/8	0.76	0.51	D88911	1.72
4IF PIN / BOX	7* DC'S	6 1/4					62.01
4IF PIN / BOX	2* HWDP						18.41
4IF PIN / BOX	JAR	6 7/16	3			DJ6 65003	5.79
4IF PIN / BOX	4* HWDP						36.97
4IF PIN / BOX	32* DP (16 STDS = 307m)						
4IF PIN / 4 1/2IF BOX	CROSS OVER	6 3/16	2 7/8			1553	0.35
4 1/2IF PIN / BOX	K.S.W	6 3/8	3 1/8	0.76	0.51	7002	1.84
4 1/2IF PIN / 4IF BOX	CROSS OVER	6 3/16	2 7/8			AUS 210	0.47
						TOTAL ASSEMBLY LENGTH	210.15

APPENDIX 10

APPENDIX 10

GFE RESOURCES LTD

APPENDIX 10

CHECK SHOT CALCULATIONS

IONA-2

IONA-2 CHECK SHOT CALCULATIONS

A WST survey was acquired in the Iona-2 well by Schlumberger on 25 February, 1994. A total of twenty levels were acquired with one shot per level. One level was acquired on the way into the hole with this level being repeated on the way out.

The raw data from the survey is as follows:

Depth (mMDKB)	Transit Time (ms)
530.0	273.4
620.0	309.7
675.0	330.2
675.0	328.1
725.0	348.6
810.0	382.5
930.0	428.1
1032.0	467.3
1163.0	513.7
1200.0	527.8
1258.0	547.2
1275.0	553.3
1297.0	561.9
1317.0	568.3
1348.0	581.1
1382.0	589.4
1400.0	595.4
1450.0	611.0
1500.0	627.5
1570.0	650.2
1649.5	675.1

The quality of the data is generally very good with only the data at 1348.0 mMDKB being questionable. The time pick has been made from a noisy signal and the result of this shows up clearly on the time-depth curve as an area of anomalous interval velocities.

Of the two shots at 675.0 mMDKB, the value of 330.2 ms was chosen as this belongs to the data acquired going up the hole.

A number of corrections had to be applied to the data to obtain a set of time versus depth values below seismic reference datum (SRD) and they consist of:

- correction for deviated hole,
- correction for difference between shot position and SRD,
- correction for shot and geophone geometry.

Correction for deviated hole

Iona-2 was a deviated hole so corrections had to be made to true vertical depth. These were made using the single-shot and multi-shot survey data shown in Appendix 9. Table 1 shows the calculations to correct measured depth to true vertical depth. Linear interpolation was used between surveyed points to calculate a true vertical depth for each of the check shot survey depths.

Correction to SRD

Seismic reference datum for the area is 150 metres above sea-level. The well was drilled close to VP 248 on seismic line IONA93-01. An uphole was acquired at VP 259, a distance of some 220 m from the well. The basic information for the uphole is:

Elevation = 129.9 metres above sea level

Base weathering = 121.9 metres above sea level
i.e. weathering is 8 metres thick

Weathering velocity = 650 metres/second

Sub-weathering velocity = 1591 metres/second

This produces a one-way time static shift of **-5.4 ms**, i.e. 5.4 ms needs to be added to one-way time values to shift data to a 150 m datum. The calculation of this value is shown in Appendix 10a.

The ground level at Iona-2 is at 130 m above sea level and this, therefore, equates to a static shift of **-5.3 ms**.

For the difference between shot depth and ground level (a difference of 2 m) a further static shift of **-3.1 ms** needs to be applied (i.e. 2 m at 650 m/s) resulting in a total one-way static shift of **-8.4 ms**.

Correction for shot and geophone geometry

This exercise is the standard procedure used for vertical hole calculations and this is outlined in Table 2.

CALCULATION OF GEOPHONE POSITION

	MDKB (m)	m N	m E	TVDKB (m)
Required MDKB	530	-33.40	9.09	525.96
Measured values	528	-32.91	8.77	524.05
	538	-35.35	10.38	533.61

	MDKB (m)	m N	m E	TVDKB (m)
Required MDKB	620	-56.70	25.35	611.35
Measured values	614	-55.18	24.22	605.66
	622	-57.20	25.72	613.25

	MDKB (m)	m N	m E	TVDKB (m)
Required MDKB	675	-70.19	35.74	663.64
Measured values	668	-68.46	34.42	656.99
	688	-73.40	38.20	676.00

	MDKB (m)	m N	m E	TVDKB (m)
Required MDKB	725	-83.07	45.24	711.02
Measured values	707	-78.27	41.81	694.01
	726	-83.34	45.43	711.96

	MDKB (m)	m N	m E	TVDKB (m)
Required MDKB	810	-106.39	59.89	791.41
Measured values	802	-104.52	58.63	783.73
	821	-108.96	61.63	801.96

	MDKB (m)	m N	m E	TVDKB (m)
Required MDKB	930	-126.57	76.49	908.44
Measured values	917	-124.87	74.96	895.64
	936	-127.36	77.20	914.35

	MDKB (m)	m N	m E	TVDKB (m)
Required MDKB	1032	-138.51	86.45	1009.24

	MDKB (m)	m N	m E	TVDKB (m)
Required MDKB	1163	-148.55	94.25	1139.59
Measured values	1148	-147.84	93.58	1124.62
	1167	-148.74	94.43	1143.58

	MDKB (m)	m N	m E	TVDKB (m)
Required MDKB	1200	-150.04	95.66	1176.54
Measured values	1187	-149.55	95.23	1163.55
	1206	-150.26	95.86	1182.53

	MDKB (m)	m N	m E	TVDKB (m)
Required MDKB	1258	-152.20	97.38	1234.47
Measured values	1244	-151.70	96.97	1220.48
	1264	-152.41	97.56	1240.46

	MDKB (m)	m N	m E	TVDKB (m)
Required MDKB	1275	-152.77	97.83	1251.45
Measured values	1264	-152.41	97.56	1240.46
	1283	-153.03	98.03	1259.45

	MDKB (m)	m N	m E	TVDKB (m)
Required MDKB	1297	-153.47	98.31	1273.43
Measured values	1283	-153.03	98.03	1259.45
	1301	-153.60	98.39	1277.43

	MDKB (m)	m N	m E	TVDKB (m)
Required MDKB	1317	-154.05	98.66	1293.42
Measured values	1301	-153.60	98.39	1277.43
	1321	-154.16	98.73	1297.42

	MDKB (m)	m N	m E	TVDKB (m)
Required MDKB	1348	-154.80	99.07	1324.42
Measured values	1340	-154.63	98.99	1316.42
	1359	-155.04	99.18	1335.41

	MDKB (m)	m N	m E	TVDKB (m)
Required MDKB	1382	-155.51	99.35	1358.41
Measured values	1377	-155.41	99.31	1353.41
	1397	-155.82	99.46	1373.40

	MDKB (m)	m N	m E	TVDKB (m)
Required MDKB	1400	-155.88	99.49	1376.40
Measured values	1397	-155.82	99.46	1373.40
	1417	-156.22	99.63	1393.40

	MDKB (m)	m N	m E	TVDKB (m)
Required MDKB	1450	-156.85	100.00	1426.39
Measured values	1435	-156.56	99.83	1411.39
	1455	-156.94	100.05	1431.39

	MDKB (m)	m N	m E	TVDKB (m)
Required MDKB	1500	-157.64	100.47	1476.38
Measured values	1493	-157.54	100.41	1469.38
	1512	-157.82	100.58	1488.38

	MDKB (m)	m N	m E	TVDKB (m)
Required MDKB	1570	-158.60	101.00	1546.37

	MDKB (m)	m N	m E	TVDKB (m)
Required MDKB	1649.5	-159.46	101.61	1625.87
Measured values	1608	-159.00	101.30	1584.37
	1627	-159.21	101.44	1603.37

TABLE 1

IONA-2 CHECK SHOT CALCULATIONS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	530	526.0	541.7	-33.4	9.1	519.9	519.7	273.4	273.3	281.7	1923			
												85.4	35.6	2398
2	620	611.4	627.1	-56.7	25.4	606.7	605.1	309.7	308.9	317.3	1976			
												52.2	19.9	2622
3	675	663.6	679.3	-70.2	35.7	660.1	657.3	330.2	328.8	337.2	2015			
												47.4	17.8	2670
4	725	711.0	726.7	-83.1	45.2	708.9	704.7	348.6	346.5	354.9	2047			
												80.4	32.6	2465
5	810	791.4	807.1	-106.4	59.9	792.0	785.1	382.5	379.2	387.6	2082			
												117.0	44.5	2628
6	930	908.4	924.1	-126.6	76.5	911.5	902.1	428.1	423.7	432.1	2139			
												100.8	38.7	2602
7	1032	1009.2	1024.9	-138.5	86.5	1013.5	1002.9	467.3	462.4	470.8	2177			
												130.4	46.3	2816
8	1163	1139.6	1155.3	-148.6	94.3	1144.4	1133.3	513.7	508.7	517.1	2234			
												36.9	14.2	2606
9	1200	1176.5	1192.2	-150.0	95.7	1181.2	1170.2	527.8	522.9	531.3	2244			
												58.0	19.5	2971
10	1258	1234.5	1250.2	-152.2	97.4	1239.0	1228.2	547.2	542.4	550.8	2270			
												17.0	6.1	2763
11	1275	1251.5	1267.2	-152.8	97.8	1255.9	1245.2	553.3	548.6	557.0	2275			
												22.0	8.6	2540
12	1297	1273.4	1289.1	-153.5	98.3	1277.8	1267.1	561.9	557.2	565.6	2279			
												20.0	6.5	3100
13	1317	1293.4	1309.1	-154.1	98.7	1297.7	1287.1	568.3	563.6	572.0	2288			
												31.0	12.9	2410
14	1348	1324.4	1340.1	-154.8	99.1	1328.6	1318.1	581.1	576.5	584.9	2291			
												34.0	8.4	4034
15	1382	1358.4	1374.1	-155.5	99.4	1362.4	1352.1	589.4	584.9	593.3	2316			
												18.0	6.1	2975
16	1400	1376.4	1392.1	-155.9	99.5	1380.3	1370.1	595.4	591.0	599.4	2323			
												50.0	15.7	3177
17	1450	1426.4	1442.1	-156.9	100.0	1430.1	1420.1	611.0	606.7	615.1	2344			
												50.0	16.6	3006
18	1500	1476.4	1492.1	-157.6	100.5	1479.8	1470.1	627.5	623.4	631.8	2362			
												70.0	22.9	3060
19	1570	1546.4	1562.1	-158.6	101.0	1549.5	1540.1	650.2	646.2	654.6	2386			
												79.5	25.1	3168
20	1649.5	1625.9	1641.6	-159.5	101.6	1628.7	1619.6	675.1	671.3	679.7	2415			

Additional data

KB = 134.3m asl

Ground level = 130m asl

SRD = 150m asl

Shot depth = 2m below GL

Shot location:
21 mS, 0 mE

Well location:
38 34' 30.989" S
143 02' 01.585" E

Seismic line:
IONA93-01 VP 248

Source to SRD time correction:
8.4 ms

Col. 1 Level number
Col. 2 Measured depth KB (m)
Col. 3 True vertical depth KB (m)
Col. 4 Depth below Seismic Reference Datum (m)
Col. 5 Metres North
Col. 6 Metres East
Col. 7 Distance source-geophone (m)
Col. 8 Vertical distance source-geophone (m)
Col. 9 Raw transit time source-geophone (ms)
Col. 10 Corrected vertical transit time source-geophone (ms)
Col. 11 Transit time corrected from source to SRD (ms)
Col. 12 Average velocity from SRD (m/s)
Col. 13 Depth differences (m)
Col. 14 Time differences (ms)
Col. 15 Interval velocity (m/s)

TABLE 2

APPENDIX 10a

Corrections for ground level to datum and shot depth

To calculate the static shift from ground level to SRD it is easiest to consider the problem in depth-time space with depth on the y-axis and time on the x-axis. The slope of any line in this space is then equal to the velocity.

The basic data for the calculations is shown in the figure below.

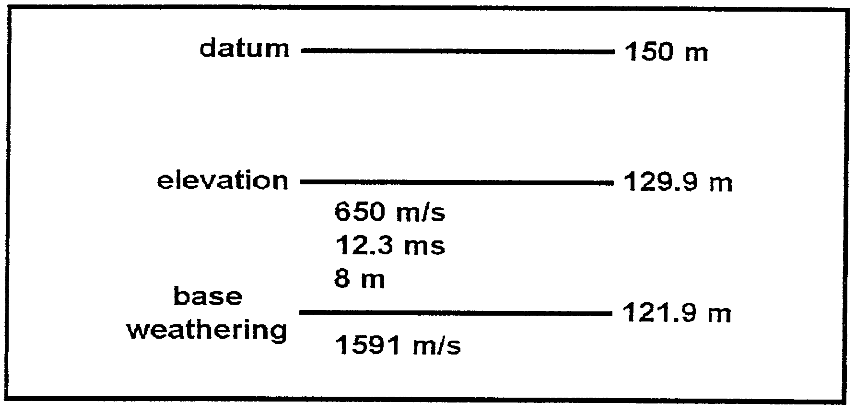


Figure 1 Basic data for static calculation for VP 248 on line IONA93-01

The equation for a straight line is:

$$y = mx + b \qquad \text{.... (1)}$$

where:

m = slope (or velocity)
b = y-intercept

This equation can be used to determine the one-way static shift by substituting in the sub-weathering velocity of 1591 m/s for m and 12 ms (0.0123 s) for x. This gives a b value, once equation (1) is rearranged, of:

$$\begin{aligned} b &= y - mx \qquad \text{.... (2)} \\ &= 121.9 + 1591 * 0.0123 \\ &= 141.47 \end{aligned}$$

The value of the time shift is then calculated by substituting in 141.47 for b and 150 (which is the seismic reference datum) for y into equation (1) to give:

$$x = \frac{y - b}{m} \qquad \text{.... (3)}$$

$$= \frac{150 - 141.47}{1591}$$

$$= 5.4 \text{ ms}$$

This infers that the replacement velocity is 3749 m/s (= 20.1m/5.4ms). Using this replacement velocity for the difference between ground level and SRD at the well location (= 20m), the static shift is:

$$= 20 / 3749$$

$$= \mathbf{5.3\ ms}$$

For the correction for shot depthto ground level , use the average weathering velocity from the uphole of 650 m/s, therefore the correction:

$$= 2 / 650$$

$$= \mathbf{3.1\ ms}$$

This gives the total shot to SRD static correction

$$= 5.3 + 3.1$$

$$= \mathbf{8.4\ ms}$$

APPENDIX 11

APPENDIX 11

GFE RESOURCES LTD

APPENDIX 11

LOG ANALYSIS DATA

IONA-2

GFE RESOURCES LTD

Company : GFE RESOURCES LTD

Well	:	IONA-2
Field	:	IONA
Nation	:	AUSTRALIA
State	:	VICTORIA
Location	:	PORT CAMPBELL
Latitude	:	38° 34′ 30.989″ S
Longitude	:	143° 02′ 01.585″ E
Well Datum	:	KELLY BUSHING
Elevation of Datum	:	134.2 mAMSL

Software by Crocker Data Processing Pty Ltd
Program revision no. 4.10 1 Mar 1993

Hole depth M	Temperature C	Gradient Deg C / 100 M
1650.0	66.20	2.9212
0.0	18.00	

Log data

Column Position	Logs Available	Logs Used	Column Position	Logs Available	Logs Used
1	DEPT	DEPT	14	DT	
2	DEVI	DEVI	15	CALS	
3	TVD	TVD	16	GR	GR
4	AZIM	AZIM	17	RHOB	RHOB
5	NORT		18	NPHI	NPHI
6	EAST		19	PEF	PEF
7	OFFS		20	DRHO	DRHO
8		GR	21	DRHO	
9	CALI	CALI	22	OFFS	
10	SP	SP	23	DT	DT
11	LLD	LLD			
12	LLS	LLS			
13	MSFL	MSFL			

```
Logs recorded by     : SCHLUMBERGER
Caliper recorded in  : Inches
Mud weight units     : Lbs/gal
Mud type             : KCl
Formation water type: NaCl
Density log units    : g/cc
DRHO    log units    : g/cc
Sonic   log units    : Us/ft
Neutron log type     : Compensated
Neutron log units    : LS POR
Density tool type    : LDT
Density-CNL Chart    : 1988
RHO (H,MA,f)  units  : g/cc
Dens. X-plots units  : g/cc
```

```
Permeability equation used
  a) SWirrcutoff <1.0
     Koil = Kcoef * PHIE ** Kexp / SW**2          Kcoef    Kexp
     Computed if SW<=SWirrcutoff          Coates  62500     6.0
                                          Timur    8581     4.4

   b) SWirrcutoff >=1
      Koil = Kcoef * 10**(PHIE * Kexp)

 CPX flag values
 ---------------

  1.  VCL greater than 0.95
  2.  VN  greater than 0.75
  3.  VS  greater than 0.75
  4.  Bad hole condition
  5.  Matrix density greater than Lithological model
  6.  Matrix density less than Lithological model
  7.  Porosity derived from Sonic Log
  8.  Porosity derived from or limited by PHIMAX
  9.  Porosity derived from Density Log
  $.  Pay zone
```

```
Water saturation equations
--------------------------
1.  Indonesia
2.  Simandoux
3.  Fertl & Hammock
4.  Laminar
5.  Bussian
6.  User defined

VGRTYPE :Vclay from GR Equations used

0.  Not Used
                        IGR=(GR-GRmin)/(GRmax-GRmin)
1.  Linear               VGR=IGR
2.  Asymetric (S shaped)
       Defined by 2 sets of intermediate points
       through which the S bend passes through.
       GR1, VGR1 and GR2, VGR2.
    Steiber equation:  VGR= IGR/(A + (A-1.0)*IGR)
3.  Stieber 1  A = 2.0
4.  Stieber 2  A = 3.0
5.  Stieber 3  A = 4.0
6.  Stieber 50%
      A is computed to give VGR= 0.5 when GR = GR50%)
7.  Larinov Old Rocks: VGR=  (2**(2*IGR)-1.0)/3.0
8.  Larinov Tertiary : VGR= 0.083*(2.0*(3.7058*IGR)-1.0)
9.  Clavier          : VGR= 1.7-SQRT(3.38-(IGR+0.7)**2.0)
```

Complex Lithology Results 24-10-94

	Zone no.	1	2	3	4	5	6	7	8
1.	Top depth	1160.069	1260.043	1296.924	1316.431	1347.978	1371.905	1401.470	1438.504
2.	Bottom depth	1260.043	1296.924	1316.431	1347.978	1371.905	1398.575	1438.504	1627.937
3.	No logs	SP	SP	SP	SP	SP	SP	SP	SP
4.	RM	0.340	0.340	0.340	0.340	0.340	0.340	0.340	0.340
5.	Temp. RM	19.000	19.000	19.000	19.000	19.000	19.000	19.000	19.000
6.	RMF	0.268	0.268	0.268	0.268	0.268	0.268	0.268	0.268
7.	Temp. RMF	21.000	21.000	21.000	21.000	21.000	21.000	21.000	21.000
8.	RMC	0.498	0.498	0.498	0.498	0.498	0.498	0.498	0.498
9.	Temp. RMC	19.000	19.000	19.000	19.000	19.000	19.000	19.000	19.000
10.	Bit size	8.500	8.500	8.500	8.500	8.500	8.500	8.500	8.500
11.	Mud wt	9.400	9.400	9.400	9.400	9.400	9.400	9.400	9.400
12.	SSP	28.000	28.000	28.000	32.000	28.000	28.000	28.000	28.000
13.	FT=Form temp	48.468	49.795	56.171	56.970	57.742	51.865	52.539	54.735
14.	RW @ FT	0.600	0.183	0.250	0.250	0.450	0.370	0.300	0.300
15.	KPPM (RW)	6.089	21.471	13.910	13.757	7.246	9.696	21.050	21.282
16.	RMF @ FT	0.163	0.160	0.147	0.145	0.144	0.155	0.154	0.149
17.	KPPM (RMF)	24.886	24.886	24.886	24.886	24.886	24.886	24.886	24.886
18.	RM @ FT	0.197	0.193	0.177	0.176	0.174	0.188	0.186	0.181
19.	RHO H	0.200	0.200	0.150	0.150	0.150	0.150	0.200	0.200
20.	RHO F	1.015	1.015	1.013	1.013	1.012	1.015	1.015	1.014
21.	t F	188.993	188.993	188.993	188.993	188.993	188.993	188.993	188.993
22.	RHOMA	2.650	2.650	2.650	2.680	2.680	2.650	2.650	2.650
23.	PHIN min	-0.035	-0.035	-0.035	-0.035	-0.035	-0.035	-0.035	-0.035
24.	t MA	55.500	55.500	55.500	55.500	55.500	55.500	55.500	55.500
25.	t MA min	48.000	48.000	48.000	48.000	48.000	48.000	48.000	48.000
26.	Sonic option	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
27.	Compact fact	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
28.	CAL cut off	16.000	16.000	16.000	10.000	10.000	16.000	16.000	16.000
29.	RUGO.cut off	1.000	1.000	1.000	0.750	0.750	1.000	1.000	1.000
30.	DRHO cut off	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150
31.	No clay	S MN SD	SN	SD SN	RT	RT			
32.	VclayGR type	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
33.	GR clean	33.059	26.297	21.789	18.809	18.182	20.000	45.000	45.000
34.	GR clay	117.209	117.585	122.093	119.749	119.749	121.000	125.000	124.765
35.	GR1	46.000	46.000	46.141	46.141	46.141	46.141	46.141	46.141
36.	VGR1	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100

Complex Lithology Results 24-10-94

	Zone no.	1	2	3	4	5	6	7	8
37.	GR2	60.000	60.000	60.000	60.000	60.000	60.000	60.000	60.000
38.	VGR2	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300
39.	GR50%	70.000	70.000	70.000	70.000	70.000	70.000	70.000	70.000
40.	R clay	2.500	2.500	7.000	8.000	6.000	7.000	5.000	3.000
41.	R limit	1000.000	1000.000	1000.000	1000.000	1000.000	1000.000	1000.000	1000.000
42.	RHOB clay	2.420	2.436	2.552	2.539	2.542	2.455	2.382	2.414
43.	PHIN clay	0.428	0.464	0.373	0.333	0.353	0.318	0.345	0.363
44.	t clay	111.709	110.533	92.218	89.373	91.254	91.724	104.803	98.792
45.	M clay	0.550	0.552	0.629	0.653	0.639	0.676	0.615	0.645
46.	N clay	0.407	0.378	0.407	0.437	0.423	0.473	0.479	0.455
47.	PHIN 2.2	0.207	0.307	0.142	-0.0085868	-0.014	0.173	0.235	0.235
48.	t 2.2	66.673	105.930	100.671	88.462	89.213	91.467	91.467	91.467
49.	COER (a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
50.	MXP (m)	1.800	1.800	1.740	1.740	1.740	1.740	1.800	1.800
51.	SXP (n)	2.000	2.000	2.080	2.080	2.080	2.080	2.000	2.000
52.	Lithomod	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
53.	SXO limit	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
54.	PHI max	0.400	0.378	0.347	0.400	0.370	0.350	0.250	0.250
55.	EXPX	1.500	1.500	1.500	1.500	1.500	1.500	1.500	1.500
56.	Clay cut off	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300
57.	Por. cut off	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
58.	SW cut off	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500
59.	Sat Equation	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
60.	SWirr.cutoff	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300
61.	Perm Expon.	6.000	6.000	6.000	6.000	6.000	6.000	6.000	6.000
62.	PERM K coef	62500.000	62500.000	62500.000	62500.000	62500.000	62500.000	62500.000	62500.000
63.	RHOMA 1	2.641	2.641	2.641	2.522	2.522	2.522	2.567	2.522
64.	RHOMA 2	2.817	2.817	2.817	2.829	2.829	2.829	2.901	2.882
65.	RHOMA 3	2.991	2.991	3.000	2.981	2.981	3.000	2.997	2.995
66.	UMA 1	6.179	6.179	6.179	5.152	5.152	5.152	6.955	5.152
67.	UMA 2	17.474	17.474	17.474	15.521	15.521	15.521	16.472	13.818
68.	UMA 3	11.388	11.388	8.959	7.606	7.606	8.558	9.660	8.959
69.	UF	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400
70.	UMACL	8.000	8.000	8.000	8.000	8.000	8.000	8.000	8.000

Zone No. 4 Complex Lithology Results 24-10-94

DEPTH M	GR	RT	RXO	PHIN	RHOB	DD	SPI	SWU	SXOU	PHIS	VCL	FVCL	RHOMAU	SXO	SW	PHIE	RHOMA	POR-M	HC-M	FLAGS	
1315.1	111	8.7	10.5	34.1	2.489	-0.1	00.0	90.0	79.1	26.3	89.8	SD	2.680	90.0	90.0	1.3	2.970	0.00	0.00	8	
1315.2	113	8.6	9.8	33.3	2.486	-0.1	00.0	90.4	81.6	26.4	89.6	SD	2.680	90.4	90.4	1.3	2.961	0.00	0.00	8	
1315.4	113	8.3	9.6	33.1	2.487	-0.1	00.0	88.9	78.9	25.7	86.5	SD	2.680	88.9	88.9	2.0	2.960	0.00	0.00	8	
1315.5	116	8.3	9.6	32.0	2.488	-0.1	00.0	90.3	80.5	25.9	87.8	SD	2.680	90.3	90.3	1.7	2.952	0.00	0.00	8	
1315.7	115	8.2	8.2	30.3	2.503	-0.1	00.0	93.3	90.1	26.9	90.6	SN	2.680	93.3	93.3	1.1	2.948	0.00	0.00	8	
1315.8	112	7.9	9.0	29.0	2.514	-0.1	00.0	91.9	82.2	26.0	87.2	SN	2.680	91.9	91.9	1.8	2.945	0.00	0.00	8	
1316.0	104	7.7	9.0	31.3	2.514	-0.1	00.0	90.6	79.5	25.5	84.8	GR	2.680	90.6	90.6	2.4	2.965	0.00	0.00	8	
1316.1	96	7.4	8.4	31.6	2.518	-0.1	00.0	85.1	73.0	22.6	76.6	GR	2.680	85.1	85.1	4.5	2.971	0.00	0.00	8	
1316.3	87	6.1	7.0	28.7	2.520	-0.1	00.0	93.2	78.3	21.9	68.0	GR	2.791	93.2	93.2	5.6	2.946	0.00	0.00		
1316.4	77	5.4	5.9	23.9	2.530	-0.1	00.0	112.2	96.9	21.1	57.8	GR	2.708	100.0	100.0	4.7	2.903	0.00	0.00		
1316.6	66	6.2	3.1	19.6	2.489	-0.3	00.0	105.6	129.6	25.4	46.5	GR	2.647	100.0	100.0	6.4	2.810	0.00	0.00		
1316.7	54	7.9	1.6	13.8	2.404	-0.4	00.0	89.8	157.8	32.2	20.2	DN	2.622	97.9	89.8	11.9	2.678	0.00	0.00		
1316.9	43	13.0	4.9	7.0	2.259	-0.5	00.0	61.3	76.4	36.0	4.5	DN	2.598	76.4	61.3	17.8	2.617	0.00	0.00	6	
1317.0	32	46.2	5.9	2.4	2.129	-0.5	00.0	28.8	59.6	37.5	0.4	DN	2.575	59.6	28.8	22.0	2.617	0.03	0.02	6	$
1317.2	27	207.6	4.7	1.7	2.046	-0.5	00.0	13.0	62.4	37.3	3.6	SN	2.487	62.4	13.0	23.4	2.632	0.07	0.05	6	$
1317.3	27	330.3	4.7	1.5	2.006	-0.5	00.0	9.8	58.6	37.5	2.6	SD	2.490	58.6	9.8	25.3	2.630	0.11	0.09	6	$
1317.5	27	273.8	4.2	1.5	1.984	-0.5	00.0	10.4	59.5	36.3	00.0	SD	2.502	59.5	10.4	26.8	2.622	0.15	0.13	6	$
1317.7	27	211.8	4.6	1.8	1.976	-0.5	00.0	11.6	56.4	41.8	2.5	SN	2.495	56.4	11.6	26.8	2.635	0.19	0.16	6	$
1317.8	29	206.0	5.7	2.3	1.988	-0.5	00.0	11.6	50.5	42.8	3.5	SN	2.538	50.5	11.6	27.0	2.624	0.23	0.20	6	$
1318.0	28	200.3	5.0	2.0	1.992	-0.5	00.0	12.0	54.7	42.1	3.1	SN	2.511	54.7	12.0	26.4	2.635	0.27	0.23	6	$
1318.1	30	201.2	4.4	1.6	1.983	-0.5	00.0	12.0	58.2	42.5	1.7	SN	2.494	58.2	12.0	26.5	2.627	0.31	0.27	6	$
1318.3	29	206.7	11.1	1.4	1.970	-0.5	00.0	10.9	34.4	41.6	1.4	SN	2.652	34.4	10.9	29.5	2.659	0.36	0.31		$
1318.4	29	206.0	7.3	1.7	1.978	-0.5	00.0	11.3	43.6	40.8	2.5	SN	2.583	43.6	11.3	28.1	2.623	0.40	0.35	6	$
1318.6	25	207.1	5.3	1.6	1.996	-0.5	00.0	11.9	53.7	41.3	2.1	SN	2.526	53.7	11.9	26.4	2.621	0.44	0.38	6	$
1318.7	25	199.8	4.4	1.8	1.999	-0.5	00.0	12.4	59.7	40.5	2.9	SN	2.483	59.7	12.4	25.5	2.625	0.48	0.42	6	$
1318.9	26	179.0	11.4	1.8	1.993	-0.5	00.0	12.0	34.7	41.6	2.6	SN	2.648	34.7	12.0	28.5	2.662	0.52	0.46		$
1319.0	28	137.6	5.8	2.3	1.983	-0.5	00.0	14.0	49.5	42.8	3.5	SN	2.543	49.5	14.0	27.3	2.629	0.56	0.49	6	$
1319.2	29	110.4	5.3	2.5	1.985	-0.5	00.0	15.7	52.4	44.4	3.6	SN	2.527	52.4	15.7	27.0	2.634	0.60	0.53	6	$
1319.3	30	116.9	9.6	2.3	2.003	-0.5	00.0	14.9	38.4	42.5	3.5	SN	2.628	38.4	14.9	27.8	2.649	0.65	0.56		$
1319.5	30	148.2	9.2	1.7	2.038	-0.5	00.0	14.1	41.5	41.0	2.5	SN	2.614	41.5	14.1	26.1	2.631	0.69	0.60	6	$
1319.6	29	239.7	8.4	1.1	2.058	-0.5	00.0	11.7	45.1	39.2	1.2	SN	2.600	45.1	11.7	25.0	2.627	0.72	0.63	6	$
1319.8	26	601.8	10.2	1.0	2.063	-0.5	00.0	7.4	40.8	39.1	0.9	SN	2.627	40.8	7.4	25.2	2.633	0.76	0.67		$
1319.9	22	1780.7	6.4	1.2	2.050	-0.5	00.0	4.5	52.1	39.5	1.4	SN	2.554	52.1	4.5	24.5	2.624	0.80	0.70	6	$
1320.1	19	2127.3	4.7	1.4	2.044	-0.5	00.0	4.1	59.3	39.7	0.5	GR	2.562	52.8	4.1	25.1	2.625	0.84	0.74	6	$
1320.2	18	1957.5	3.5	1.5	2.056	-0.5	00.0	4.3	69.3	40.3	00.0	GR	2.570	53.3	4.3	24.8	2.630	0.88	0.77	6	$
1320.4	19	1412.2	3.2	1.7	2.083	-0.5	00.0	5.2	75.9	40.0	0.5	GR	2.565	55.5	5.2	23.6	2.628	0.91	0.81	6	$
1320.5	21	1197.2	2.9	2.2	2.116	-0.5	00.0	5.9	82.9	38.0	1.9	GR	2.568	56.8	5.9	22.1	2.619	0.95	0.84	6	$
1320.7	23	1211.0	2.1	2.3	2.122	-0.5	00.0	6.0	97.6	37.2	3.8	GR	2.556	56.9	6.0	21.4	2.619	0.98	0.87	6	$

Zone No. 4 Complex Lithology Results 24-10-94

DEPTH M	GR	RT	RXO	PHIN	RHOB	DD	SPI	SWU	SXOU	PHIS	VCL	FVCL	RHOMAU	SXO	SW	PHIE	RHOMA	POR-M	HC-M	FLAGS	
1320.9	21	1145.8	2.1	2.3	2.113	-0.5	00.0	6.0	96.1	37.7	2.2	GR	2.565	57.0	6.0	22.2	2.618	1.01	0.90	6	$
1321.0	20	1042.7	2.8	1.9	2.092	-0.5	00.0	6.1	81.4	38.3	0.9	GR	2.563	57.2	6.1	23.2	2.629	1.05	0.94	6	$
1321.2	18	793.6	2.4	2.4	2.086	-0.5	00.0	6.9	85.7	39.6	00.0	GR	2.569	58.6	6.9	23.8	2.629	1.08	0.97	6	$
1321.3	18	582.8	3.1	2.7	2.086	-0.5	00.0	8.0	76.1	41.1	00.0	GR	2.563	60.3	8.0	23.8	2.623	1.12	1.00	6	$
1321.5	20	450.0	2.5	3.2	2.087	-0.5	00.0	9.0	84.6	40.7	0.8	GR	2.557	61.8	9.0	23.7	2.622	1.16	1.04	6	$
1321.6	20	276.9	2.4	3.5	2.072	-0.5	00.0	11.2	84.1	39.2	0.7	GR	2.538	64.6	11.2	24.2	2.623	1.19	1.07	6	$
1321.8	20	171.9	3.3	4.9	2.086	-0.5	00.0	14.1	73.2	38.2	0.7	GR	2.548	67.6	14.1	24.2	2.632	1.23	1.10	6	$
1321.9	21	131.4	2.4	5.7	2.115	-0.5	00.0	16.5	88.1	34.8	1.9	GR	2.554	69.8	16.5	23.2	2.625	1.27	1.13	6	$
1322.1	24	101.7	2.2	5.8	2.164	-0.5	00.0	19.9	97.0	30.4	0.6	DN	2.576	72.4	19.9	21.7	2.619	1.30	1.16	6	$
1322.2	26	81.9	3.3	5.6	2.199	-0.5	00.0	23.6	85.2	35.4	2.3	DN	2.570	74.9	23.6	19.7	2.621	1.33	1.18	6	$
1322.4	31	68.2	3.7	7.3	2.197	-0.5	00.0	24.8	77.5	39.3	1.9	DN	2.589	75.6	24.8	20.8	2.618	1.36	1.20	6	$
1322.5	34	57.5	4.5	9.1	2.155	-0.5	00.0	23.8	63.0	43.9	4.9	DN	2.632	63.0	23.8	23.5	2.653	1.40	1.23		$
1322.7	38	51.6	6.0	9.9	2.094	-0.5	00.0	22.6	49.5	46.2	8.8	DN	2.654	49.5	22.6	25.9	2.693	1.44	1.26		$
1322.8	38	55.9	4.1	8.6	2.047	-0.5	00.0	21.2	57.5	50.6	4.4	DN	2.611	57.5	21.2	27.7	2.638	1.48	1.29	6	$
1323.0	39	59.6	3.7	7.5	2.008	-0.5	00.0	19.8	58.0	55.0	0.1	DN	2.617	58.0	19.8	29.8	2.618	1.52	1.33		$
1323.1	38	75.3	2.5	8.5	1.973	-0.5	00.0	17.7	70.0	52.2	3.8	DN	2.496	70.0	17.7	29.2	2.625	1.57	1.37	6	$
1323.3	36	130.2	8.0	9.0	1.956	-0.5	00.0	12.4	37.1	57.4	11.9	DN	2.648	37.1	12.4	30.8	2.719	1.61	1.41		$
1323.4	31	181.8	2.8	8.2	1.970	-0.5	00.0	11.4	65.2	52.1	2.5	DN	2.537	64.7	11.4	30.0	2.635	1.66	1.45	6	$
1323.6	27	343.9	10.8	6.2	2.024	-0.5	00.0	8.6	35.5	54.0	7.7	GR	2.664	35.5	8.6	27.9	2.704	1.70	1.49		$
1323.7	23	542.7	5.0	4.9	2.087	-0.5	00.0	8.0	59.5	50.0	4.6	GR	2.560	59.5	8.0	23.8	2.629	1.74	1.52	6	$
1323.9	25	520.5	1.5	4.8	2.137	-0.5	00.0	8.7	109.6	41.9	0.9	DN	2.600	61.3	8.7	22.9	2.624	1.77	1.55	6	$
1324.1	25	550.3	1.6	3.4	2.149	-0.5	00.0	8.9	113.7	39.1	0.7	DN	2.586	61.6	8.9	21.6	2.629	1.81	1.58	6	$
1324.2	24	577.2	2.3	2.5	2.124	-0.5	00.0	8.5	94.5	37.9	0.4	DN	2.567	61.1	8.5	22.1	2.629	1.84	1.61	6	$
1324.4	23	538.9	4.3	1.7	2.122	-0.5	00.0	9.1	71.3	39.4	3.0	SN	2.532	61.9	9.1	20.9	2.629	1.87	1.64	6	$
1324.5	25	467.0	4.1	1.8	2.122	-0.5	00.0	9.7	73.3	39.5	3.3	SN	2.527	62.7	9.7	20.8	2.626	1.90	1.67	6	$
1324.7	27	404.1	2.5	2.0	2.137	-0.5	00.0	10.7	95.7	39.7	3.8	SN	2.528	63.9	10.7	20.1	2.630	1.94	1.70	6	$
1324.8	26	332.0	2.1	2.3	2.143	-0.5	00.0	11.8	105.9	39.0	4.6	SN	2.521	65.3	11.8	19.7	2.628	1.97	1.72	6	$
1325.0	24	238.1	1.8	2.4	2.148	-0.5	00.0	14.1	114.5	38.6	5.0	GR	2.513	67.6	14.1	19.3	2.622	1.99	1.75	6	$
1325.1	23	137.6	2.4	3.9	2.135	-0.5	00.0	17.4	94.2	37.5	3.9	GR	2.523	70.5	17.4	20.8	2.625	2.03	1.78	6	$
1325.3	24	112.9	2.7	7.9	2.121	-0.5	00.0	17.1	79.0	37.1	0.0	DN	2.596	70.2	17.1	24.7	2.616	2.06	1.81	6	$
1325.4	28	118.0	3.4	8.3	2.116	-0.5	00.0	16.7	71.2	37.5	3.9	DN	2.573	69.9	16.7	24.1	2.615	2.10	1.84	6	$
1325.6	29	130.9	5.6	5.7	2.114	-0.5	00.0	15.7	55.1	37.5	0.2	DN	2.642	55.1	15.7	25.0	2.642	2.14	1.87		$
1325.7	28	166.0	9.1	1.8	2.119	-0.5	00.0	15.2	47.6	37.4	3.9	SN	2.588	47.6	15.2	22.0	2.632	2.17	1.90	6	$
1325.9	25	216.5	10.7	1.3	2.129	-0.5	00.0	13.5	44.3	36.5	2.6	SN	2.612	44.3	13.5	22.0	2.627	2.21	1.93	6	$
1326.0	24	194.1	4.0	1.6	2.132	-0.5	00.0	15.4	77.1	37.3	3.3	SN	2.503	68.8	15.4	19.8	2.623	2.24	1.95	6	$
1326.2	24	116.2	4.0	2.2	2.103	-0.5	00.0	19.0	74.6	37.6	4.8	SN	2.470	71.7	19.0	20.5	2.620	2.27	1.98	6	$
1326.3	27	67.1	3.5	5.3	2.056	-0.5	00.0	21.4	68.4	38.3	2.9	DN	2.518	68.4	21.4	24.8	2.617	2.30	2.01	6	$
1326.5	29	58.1	2.7	8.7	2.036	-0.5	00.0	21.5	72.2	38.9	5.0	DN	2.512	72.2	21.5	26.6	2.625	2.35	2.04	6	$

Zone No. 4 Complex Lithology Results 24-10-94

DEPTH M	GR	RT	RXO	PHIN	RHOB	DD	SPI	SWU	SXOU	PHIS	VCL	FVCL	RHOMAU	SXO	SW	PHIE	RHOMA	POR-M	HC-M	FLAGS
1326.6	31	57.4	2.8	8.8	2.048	-0.5	00.0	21.5	70.4	39.5	1.8	DN	2.560	70.4	21.5	27.3	2.631	2.39	2.07	6 $
1326.8	29	59.5	3.8	5.1	2.052	-0.5	00.0	22.1	64.1	40.1	0.2	DN	2.562	64.1	22.1	26.1	2.623	2.43	2.10	6 $
1326.9	26	115.7	10.2	1.7	2.042	-0.5	00.0	15.8	39.2	40.9	2.5	SN	2.629	39.2	15.8	26.2	2.644	2.47	2.14	$
1327.1	23	207.7	7.8	1.2	2.032	-0.5	00.0	12.1	45.4	39.3	1.4	SN	2.589	45.4	12.1	25.9	2.619	2.51	2.17	6 $
1327.3	21	247.9	14.5	1.4	2.043	-0.5	00.0	10.9	33.0	39.8	1.9	SN	2.661	33.0	10.9	26.4	2.671	2.55	2.21	$
1327.4	23	265.7	6.7	1.6	2.066	-0.5	00.0	11.5	51.9	39.0	2.8	SN	2.555	51.9	11.5	23.8	2.633	2.58	2.24	6 $
1327.6	23	223.5	3.5	1.8	2.102	-0.5	00.0	13.7	78.9	35.2	4.4	GR	2.487	67.2	13.7	20.8	2.615	2.61	2.27	6 $
1327.7	26	147.4	5.6	2.4	2.117	-0.5	00.0	16.3	60.4	36.5	0.7	DN	2.564	60.4	16.3	22.3	2.628	2.65	2.30	6 $
1327.9	28	103.5	6.7	4.1	2.117	-0.5	00.0	18.5	53.5	37.4	4.0	DN	2.591	53.5	18.5	22.9	2.635	2.68	2.32	6 $
1328.0	32	72.0	6.6	5.7	2.113	-0.5	00.0	20.8	50.7	38.9	2.9	DN	2.642	50.7	20.8	24.6	2.655	2.72	2.35	$
1328.2	37	59.3	5.6	8.5	2.119	-0.5	00.0	22.5	54.3	41.3	8.3	DN	2.623	54.3	22.5	24.2	2.664	2.76	2.38	$
1328.3	42	59.5	8.8	8.6	2.133	-0.5	00.0	22.5	44.3	40.3	12.8	DN	2.639	44.3	22.5	23.1	2.697	2.79	2.41	$
1328.5	41	65.0	5.6	7.8	2.114	-0.5	00.0	21.5	54.3	39.2	5.7	DN	2.632	54.3	21.5	24.7	2.659	2.83	2.44	$
1328.6	35	65.7	9.0	5.4	2.071	-0.5	00.0	20.7	41.8	41.9	8.0	DN	2.629	41.8	20.7	25.3	2.671	2.87	2.47	$
1328.8	29	82.7	8.8	5.0	2.051	-0.5	00.0	18.0	41.1	42.3	5.3	DN	2.646	41.1	18.0	26.6	2.673	2.91	2.50	$
1328.9	30	89.2	7.9	5.2	2.068	-0.5	00.0	17.8	44.4	42.0	6.0	DN	2.630	44.4	17.8	25.7	2.661	2.95	2.53	$
1329.1	31	88.4	11.2	4.8	2.090	-0.5	00.0	18.4	38.7	39.6	6.9	DN	2.649	38.7	18.4	24.7	2.682	2.99	2.57	$
1329.2	32	93.1	11.7	4.6	2.088	-0.5	00.0	17.9	37.8	39.2	6.4	DN	2.653	37.8	17.9	24.8	2.684	3.02	2.60	$
1329.4	29	89.7	10.1	5.0	2.085	-0.5	00.0	18.1	40.1	38.0	5.1	DN	2.656	40.1	18.1	25.3	2.680	3.06	2.63	$
1329.5	28	74.1	9.4	6.9	2.093	-0.5	00.0	19.6	41.3	38.9	9.4	GR	2.647	41.3	19.6	24.8	2.692	3.10	2.66	$
1329.7	25	62.0	15.2	10.5	2.096	-0.5	00.0	19.3	29.5	39.2	6.4	GR	2.819	29.5	19.3	28.8	2.855	3.14	2.69	$
1329.8	28	48.5	12.7	15.0	2.099	-0.5	00.0	20.8	30.8	38.0	8.9	GR	2.861	30.8	20.8	30.0	2.902	3.19	2.73	$
1330.0	33	41.8	10.2	18.6	2.082	-0.5	00.0	21.5	33.2	39.5	13.9	GR	2.849	33.2	21.5	30.4	2.908	3.24	2.77	$
1330.1	38	47.2	18.9	16.1	2.080	-0.5	00.0	20.8	25.5	38.0	19.2	GR	2.797	25.5	20.8	28.2	2.901	3.28	2.80	$
1330.3	37	57.4	8.5	11.3	2.088	-0.5	00.0	20.8	41.3	38.9	18.0	GR	2.639	41.3	20.8	25.0	2.739	3.32	2.83	$
1330.5	33	62.6	13.7	7.4	2.113	-0.5	00.0	21.6	35.3	38.8	14.5	GR	2.643	35.3	21.6	23.3	2.715	3.35	2.86	$
1330.6	32	83.0	29.9	9.4	2.132	-0.5	00.0	18.2	23.3	39.8	12.9	GR	2.759	23.3	18.2	24.8	2.846	3.39	2.89	$
1330.8	38	58.0	19.1	14.1	2.161	-0.5	00.0	21.2	28.6	38.3	18.6	GR	2.767	28.6	21.2	24.2	2.876	3.43	2.92	$
1330.9	51	40.1	12.7	21.5	2.212	-0.5	00.0	25.0	35.2	35.8	32.2	GR	2.754	35.2	25.0	21.8	2.916	3.43	2.92	
1331.1	80	35.9	12.8	30.5	2.308	-0.3	00.0	27.5	38.2	33.0	60.9	GR	2.699	38.2	27.5	15.2	2.965	3.43	2.92	
1331.2	107	28.4	8.3	36.0	2.388	-0.2	00.0	48.2	82.4	31.5	84.3	SD	2.680	82.4	48.2	2.5	2.915	3.43	2.92	8
1331.4	117	25.6	7.3	34.7	2.440	-0.2	00.0			30.9	96.8	SD	2.680	100.0	100.0	00.0	2.940	3.43	2.92	1
1331.5	105	27.0	10.1	30.2	2.436	-0.3	00.0	50.1	76.1	31.2	85.7	GR	2.680	76.1	50.1	2.2	2.896	3.43	2.92	8
1331.7	90	24.8	6.4	27.7	2.408	-0.3	00.0	44.7	76.7	30.9	70.7	GR	2.680	76.7	44.7	6.3	2.848	3.43	2.92	8
1331.8	86	25.0	5.3	26.6	2.401	-0.3	00.0	40.2	73.6	29.7	61.8	DN	2.618	73.6	40.2	9.7	2.886	3.43	2.92	
1332.0	81	26.7	7.3	24.2	2.400	-0.3	00.0	40.1	64.3	27.9	56.6	DN	2.630	64.3	40.1	9.9	2.882	3.43	2.92	
1332.1	73	27.5	7.9	20.4	2.406	-0.5	00.0	42.6	66.4	29.8	48.8	DN	2.621	66.4	42.6	9.5	2.835	3.43	2.92	
1332.3	59	26.7	5.1	18.5	2.401	-0.5	00.0	44.5	83.1	30.0	40.0	GR	2.620	83.1	44.5	10.4	2.769	3.43	2.92	

Zone No. 4 Complex Lithology Results 24-10-94

DEPTH M	GR	RT	RXO	PHIN	RHOB	DD	SPI	SWU	SXOU	PHIS	VCL	FVCL	RHOMAU	SXO	SW	PHIE	RHOMA	POR-M	HC-M	FLAGS
1332.4	53	26.9	5.2	17.1	2.392	-0.5	00.0	44.6	81.4	30.6	33.6	GR	2.630	81.4	44.6	11.5	2.746	3.43	2.92	
1332.6	50	28.8	4.6	16.7	2.399	-0.5	00.0	43.9	87.6	30.4	31.1	GR	2.638	84.8	43.9	11.6	2.738	3.43	2.92	
1332.7	49	29.8	4.7	16.6	2.393	-0.5	00.0	42.7	85.9	30.0	29.8	GR	2.640	84.4	42.7	12.0	2.735	3.45	2.93	$
1332.9	52	32.1	4.3	16.9	2.399	-0.5	00.0	41.6	91.2	29.7	32.7	GR	2.634	83.9	41.6	11.3	2.742	3.45	2.93	
1333.0	52	34.6	4.7	16.4	2.405	-0.5	00.0	41.2	89.7	29.8	33.3	GR	2.627	83.8	41.2	10.7	2.738	3.45	2.93	
1333.2	52	34.4	4.7	15.7	2.387	-0.5	00.0	40.3	85.8	32.1	27.8	DN	2.636	83.4	40.3	12.2	2.719	3.46	2.94	$
1333.3	49	32.7	5.3	17.3	2.360	-0.5	00.0	37.6	73.8	34.6	29.8	GR	2.652	73.8	37.6	13.8	2.764	3.49	2.95	$
1333.5	52	29.6	4.4	20.0	2.328	-0.5	00.0	35.8	73.1	36.1	33.3	GR	2.651	73.1	35.8	15.5	2.787	3.49	2.95	
1333.7	61	26.6	3.5	23.3	2.333	-0.5	00.0	36.2	79.2	35.1	42.1	GR	2.636	79.2	36.2	14.8	2.807	3.49	2.95	
1333.8	77	26.4	3.5	25.7	2.344	-0.5	00.0	35.6	79.2	33.3	48.1	DN	2.646	79.2	35.6	14.2	2.841	3.49	2.95	
1334.0	87	29.0	4.4	29.4	2.371	-0.5	00.0	34.0	72.7	30.8	62.9	DN	2.644	72.7	34.0	11.9	2.905	3.49	2.95	
1334.1	95	33.7	4.6	27.4	2.390	-0.5	00.0	40.3	95.2	31.5	75.0	GR	2.680	83.4	40.3	5.0	2.829	3.49	2.95	8
1334.3	86	42.7	7.9	21.0	2.363	-0.5	00.0	31.4	59.7	33.3	46.3	DN	2.630	59.7	31.4	12.0	2.844	3.49	2.95	
1334.4	68	54.5	9.1	13.0	2.273	-0.5	00.0	27.1	51.3	36.0	22.2	DN	2.654	51.3	27.1	17.3	2.755	3.51	2.97	$
1334.6	46	67.2	4.6	8.7	2.170	-0.5	00.0	22.6	63.3	39.2	3.5	DN	2.640	63.3	22.6	23.1	2.653	3.55	3.00	$
1334.7	31	94.4	4.7	7.0	2.119	-0.5	00.0	18.4	60.3	41.7	1.8	DN	2.623	60.3	18.4	24.7	2.633	3.59	3.03	$
1334.9	24	142.8	4.0	4.7	2.096	-0.5	00.0	15.6	67.1	40.0	0.5	DN	2.557	67.1	15.6	23.9	2.620	3.62	3.06	6 $
1335.0	24	220.8	5.0	3.2	2.096	-0.5	00.0	13.1	63.1	39.8	4.8	GR	2.520	63.1	13.1	22.1	2.630	3.66	3.09	6 $
1335.2	23	423.7	6.8	2.9	2.096	-0.5	00.0	9.4	52.7	39.5	4.4	GR	2.568	52.7	9.4	22.9	2.615	3.69	3.12	6 $
1335.3	24	820.2	7.0	3.1	2.108	-0.5	00.0	6.7	51.0	38.6	0.3	DN	2.619	51.0	6.7	24.0	2.621	3.73	3.16	$
1335.5	24	973.7	5.5	3.5	2.121	-0.5	00.0	6.4	58.9	38.9	0.5	DN	2.597	57.7	6.4	23.1	2.620	3.76	3.19	6 $
1335.6	25	962.8	4.6	3.6	2.122	-0.5	00.0	6.4	64.8	37.8	1.5	DN	2.591	57.8	6.4	22.9	2.619	3.80	3.22	6 $
1335.8	24	984.0	3.9	3.4	2.134	-0.5	00.0	6.5	71.1	36.5	0.4	DN	2.601	57.8	6.5	22.6	2.623	3.83	3.25	6 $
1335.9	23	1034.6	3.5	3.2	2.150	-0.5	00.0	6.6	79.3	35.5	4.4	GR	2.570	58.1	6.6	20.7	2.634	3.86	3.28	6 $
1336.1	22	1156.8	4.3	2.9	2.170	-0.5	00.0	6.5	74.2	35.6	3.6	GR	2.581	57.8	6.5	20.0	2.620	3.89	3.31	6 $
1336.2	23	1351.7	5.2	3.1	2.166	-0.5	00.0	5.9	66.3	35.7	3.7	GR	2.585	56.8	5.9	20.3	2.625	3.92	3.34	6 $
1336.4	23	1471.3	4.9	2.9	2.169	-0.5	00.0	5.8	69.2	34.5	4.3	GR	2.581	56.5	5.8	20.0	2.623	3.95	3.37	6 $
1336.5	20	1540.6	4.5	2.6	2.190	-0.5	00.0	5.8	73.3	34.0	1.5	GR	2.605	56.5	5.8	19.8	2.632	3.98	3.40	6 $
1336.7	20	1644.8	5.5	2.4	2.219	-0.5	00.0	5.9	70.2	33.4	1.1	GR	2.614	56.7	5.9	18.8	2.619	4.01	3.43	6 $
1336.9	19	1527.1	6.3	2.4	2.237	-0.5	00.0	6.3	67.9	34.0	0.6	GR	2.620	57.5	6.3	18.2	2.623	4.04	3.45	$
1337.0	20	1304.6	7.6	2.7	2.227	-0.5	00.0	6.6	61.1	34.8	1.6	GR	2.612	58.1	6.6	18.4	2.619	4.07	3.48	6 $
1337.2	22	1089.9	6.5	2.8	2.215	-0.5	00.0	7.1	64.8	35.9	2.7	GR	2.598	59.0	7.1	18.5	2.631	4.10	3.50	6 $
1337.3	21	888.3	4.6	2.8	2.197	-0.5	00.0	7.7	74.2	37.4	2.0	GR	2.593	59.8	7.7	19.3	2.623	4.13	3.53	6 $
1337.5	21	812.2	4.3	2.6	2.165	-0.5	00.0	7.7	73.7	38.9	1.8	GR	2.580	59.8	7.7	20.4	2.629	4.16	3.56	6 $
1337.6	18	789.5	6.1	2.4	2.123	-0.5	00.0	7.2	57.5	38.7	00.0	GR	2.587	57.5	7.2	22.5	2.627	4.19	3.59	6 $
1337.8	19	777.0	4.6	2.0	2.098	-0.5	00.0	7.2	64.8	39.5	0.6	GR	2.560	59.0	7.2	22.9	2.624	4.23	3.62	6 $
1337.9	21	742.4	4.3	1.9	2.100	-0.5	00.0	7.4	67.9	39.2	2.1	GR	2.546	59.4	7.4	22.3	2.619	4.26	3.66	6 $
1338.1	22	664.1	5.7	2.3	2.106	-0.5	00.0	7.9	60.2	39.2	3.2	GR	2.539	60.2	7.9	21.9	2.618	4.29	3.69	6 $

Zone No. 4 | Complex Lithology Results | 24-10-94

DEPTH M	GR	RT	RXO	PHIN	RHOB	DD	SPI	SWU	SXOU	PHIS	VCL	FVCL	RHOMAU	SXO	SW	PHIE	RHOMA	POR-M	HC-M	FLAGS	
1338.2	22	499.6	5.9	2.8	2.109	-0.5	00.0	8.9	58.1	39.2	3.0	GR	2.561	58.1	8.9	22.4	2.619	4.33	3.72	6	$
1338.4	20	349.1	5.6	3.6	2.100	-0.5	00.0	10.2	57.0	40.0	1.1	GR	2.587	57.0	10.2	23.8	2.634	4.36	3.75	6	$
1338.5	21	267.8	4.8	4.7	2.124	-0.5	00.0	11.9	63.3	39.8	2.2	GR	2.574	63.3	11.9	22.7	2.627	4.40	3.78	6	$
1338.7	24	192.7	4.8	5.2	2.153	-0.5	00.0	14.2	64.9	39.3	0.2	DN	2.602	64.9	14.2	22.5	2.623	4.43	3.81	6	$
1338.8	29	150.5	5.2	5.8	2.177	-0.5	00.0	16.3	63.3	39.9	0.4	DN	2.625	63.3	16.3	22.1	2.627	4.47	3.84		$
1339.0	33	136.4	7.1	5.6	2.169	-0.5	00.0	16.7	53.4	39.6	3.7	DN	2.639	53.4	16.7	22.1	2.654	4.50	3.87		$
1339.1	33	119.3	5.1	5.2	2.162	-0.5	00.0	18.4	64.6	41.0	2.7	DN	2.587	64.6	18.4	21.4	2.621	4.53	3.89	6	$
1339.3	31	70.5	6.1	4.4	2.172	-0.5	00.0	23.8	59.5	40.5	0.4	DN	2.620	59.5	23.8	21.7	2.622	4.57	3.92		$
1339.4	31	51.9	5.8	4.8	2.200	-0.5	00.0	29.0	64.2	39.5	1.6	DN	2.607	64.2	29.0	20.2	2.634	4.60	3.94	6	$
1339.6	31	50.8	8.1	4.6	2.200	-0.5	00.0	28.4	53.0	38.9	1.5	DN	2.652	53.0	28.4	21.0	2.658	4.63	3.96		$
1339.7	30	53.8	4.0	3.8	2.179	-0.5	00.0	29.9	81.0	39.1	4.3	DN	2.513	78.6	29.9	18.6	2.616	4.66	3.98	6	$
1339.9	28	71.3	8.8	2.5	2.155	-0.5	00.0	24.1	51.0	40.3	4.9	SN	2.587	51.0	24.1	20.4	2.634	4.69	4.01	6	$
1340.1	25	162.3	8.1	2.0	2.158	-0.5	00.0	16.5	53.9	39.8	3.8	SN	2.580	53.9	16.5	20.2	2.620	4.72	4.03	6	$
1340.2	24	229.6	7.9	2.3	2.164	-0.5	00.0	14.1	55.3	39.5	4.5	SN	2.573	55.3	14.1	19.8	2.618	4.75	4.06	6	$
1340.4	24	149.5	7.0	3.6	2.173	-0.5	00.0	16.7	56.0	38.6	0.2	DN	2.628	56.0	16.7	21.6	2.629	4.78	4.08		$
1340.5	28	72.9	7.3	8.0	2.174	-0.5	00.0	21.9	51.7	38.6	9.0	GR	2.640	51.7	21.9	21.8	2.678	4.82	4.11		$
1340.7	33	44.4	6.5	13.4	2.177	-0.5	00.0	25.9	51.2	42.5	14.5	GR	2.675	51.2	25.9	22.8	2.746	4.85	4.14		$
1340.8	44	31.3	3.6	17.7	2.172	-0.5	00.0	29.0	65.2	44.1	20.3	DN	2.643	65.2	29.0	23.3	2.729	4.89	4.16		$
1341.0	52	25.3	2.3	20.1	2.168	-0.5	00.0	31.3	77.9	44.5	17.7	DN	2.634	77.9	31.3	24.7	2.697	4.92	4.19		$
1341.1	58	25.3	2.3	20.2	2.170	-0.5	00.0	31.4	79.1	44.8	18.4	DN	2.627	79.1	31.4	24.4	2.694	4.96	4.21		$
1341.3	55	27.6	2.5	19.2	2.194	-0.5	00.0	31.4	78.7	45.2	16.2	DN	2.641	78.7	31.4	23.5	2.696	5.00	4.24		$
1341.4	54	30.4	3.0	17.6	2.211	-0.5	00.0	31.3	75.1	45.3	19.5	DN	2.625	75.1	31.3	21.6	2.697	5.03	4.26		$
1341.6	50	35.1	3.4	14.6	2.209	-0.5	00.0	30.2	73.0	51.9	10.5	DN	2.647	73.0	30.2	22.4	2.683	5.06	4.28		$
1341.7	47	37.5	2.7	12.7	2.198	-0.5	00.0	29.8	81.5	47.6	3.0	DN	2.635	78.5	29.8	23.3	2.647	5.10	4.31		$
1341.9	46	43.0	2.8	9.3	2.214	-0.5	00.0	30.7	89.1	44.1	3.8	DN	2.596	79.0	30.7	20.6	2.633	5.13	4.33	6	$
1342.0	46	57.1	4.4	7.3	2.227	-0.5	00.0	28.1	74.9	44.5	2.8	DN	2.601	74.9	28.1	19.6	2.633	5.16	4.35	6	$
1342.2	44	80.5	7.1	5.3	2.175	-0.5	00.0	21.8	54.2	43.3	2.3	DN	2.642	54.2	21.8	22.0	2.652	5.19	4.38		$
1342.3	38	132.5	4.4	4.6	2.094	-0.5	00.0	16.3	65.3	45.3	4.5	DN	2.531	65.3	16.3	22.9	2.619	5.23	4.41	6	$
1342.5	35	197.1	5.3	4.9	2.031	-0.5	00.0	12.0	53.0	48.1	4.5	DN	2.573	53.0	12.0	26.5	2.624	5.27	4.44	6	$
1342.6	37	224.1	5.1	5.6	2.023	-0.5	00.0	10.9	51.9	46.7	2.1	DN	2.614	51.9	10.9	28.1	2.628	5.31	4.48	6	$
1342.8	37	172.4	4.8	7.5	2.037	-0.5	00.0	12.2	52.7	46.6	2.8	DN	2.639	52.7	12.2	28.4	2.652	5.36	4.52		$
1342.9	38	112.7	4.5	9.3	2.067	-0.5	00.0	15.2	55.5	47.5	4.4	DN	2.643	55.5	15.2	27.5	2.663	5.40	4.56		$
1343.1	39	79.9	3.2	11.3	2.090	-0.5	00.0	18.3	66.9	47.3	4.9	DN	2.615	66.9	18.3	26.8	2.641	5.44	4.59	6	$
1343.3	41	60.7	2.5	13.2	2.110	-0.5	00.0	20.9	74.5	47.7	2.4	DN	2.634	73.1	20.9	27.3	2.644	5.48	4.62		$
1343.4	44	48.3	2.2	14.6	2.115	-0.5	00.0	23.1	78.4	48.5	5.0	DN	2.629	74.6	23.1	27.0	2.650	5.52	4.65		$
1343.6	46	45.9	2.5	16.2	2.113	-0.5	00.0	23.1	72.3	44.3	7.1	DN	2.644	72.3	23.1	27.5	2.672	5.56	4.69		$
1343.7	50	46.4	2.7	16.0	2.129	-0.5	00.0	23.5	72.7	44.0	10.7	DN	2.626	72.7	23.5	25.9	2.670	5.60	4.72		$
1343.9	50	47.8	2.5	14.5	2.145	-0.5	00.0	24.1	78.0	44.2	5.7	DN	2.635	75.2	24.1	25.7	2.657	5.64	4.75		$

Zone No. 4 Complex Lithology Results 24-10-94

DEPTH M	GR	RT	RXO	PHIN	RHOB	DD	SPI	SWU	SXOU	PHIS	VCL	FVCL	RHOMAU	SXO	SW	PHIE	RHOMA	POR-M	HC-M	FLAGS
1344.0	49	52.2	3.0	12.3	2.141	-0.5	00.0	23.7	72.8	44.3	5.0	DN	2.619	72.8	23.7	25.0	2.643	5.68	4.77	$
1344.2	46	60.1	2.6	10.9	2.114	-0.5	00.0	22.0	77.0	44.9	1.5	DN	2.603	73.8	22.0	26.0	2.631	5.72	4.81	6 $
1344.3	43	71.9	2.8	10.9	2.092	-0.5	00.0	19.7	72.6	46.2	3.6	DN	2.587	72.3	19.7	26.3	2.627	5.76	4.84	6 $
1344.5	41	86.0	2.4	11.1	2.090	-0.5	00.0	17.8	76.1	45.8	1.9	DN	2.609	70.8	17.8	27.1	2.620	5.80	4.87	6 $
1344.6	42	82.7	3.1	12.0	2.085	-0.5	00.0	17.6	66.3	44.3	3.0	DN	2.638	66.3	17.6	27.9	2.651	5.84	4.91	$
1344.8	44	76.2	2.9	13.1	2.084	-0.5	00.0	18.1	67.3	44.1	4.8	DN	2.637	67.3	18.1	28.0	2.657	5.89	4.94	$
1344.9	43	71.6	2.3	13.1	2.091	-0.5	00.0	19.0	77.1	44.9	4.4	DN	2.615	71.7	19.0	27.4	2.638	5.93	4.98	6 $
1345.1	42	71.8	2.1	12.6	2.099	-0.5	00.0	19.2	80.9	44.9	3.2	DN	2.619	71.9	19.2	27.2	2.636	5.97	5.01	$
1345.2	42	78.4	2.3	11.0	2.092	-0.5	00.0	18.8	79.2	45.7	3.2	DN	2.594	71.6	18.8	26.5	2.632	6.01	5.04	6 $
1345.4	41	95.5	2.7	9.5	2.071	-0.5	00.0	17.1	72.7	46.2	2.3	DN	2.578	70.2	17.1	26.8	2.631	6.05	5.08	6 $
1345.5	41	114.0	2.7	8.5	2.052	-0.5	00.0	15.5	72.5	44.8	1.1	DN	2.570	68.9	15.5	27.3	2.617	6.09	5.11	6 $
1345.7	39	111.0	2.9	9.4	2.060	-0.5	00.0	15.8	71.1	44.3	4.9	DN	2.556	69.1	15.8	26.5	2.627	6.13	5.14	6 $
1345.8	39	91.9	2.6	11.6	2.082	-0.5	00.0	17.1	72.9	42.8	4.8	DN	2.593	70.2	17.1	26.9	2.621	6.17	5.18	6 $
1346.0	35	78.6	2.6	13.6	2.108	-0.5	00.0	18.4	74.0	44.2	6.4	DN	2.617	71.3	18.4	26.6	2.648	6.21	5.21	$
1346.1	35	70.2	2.4	14.2	2.133	-0.5	00.0	19.8	77.5	43.7	5.8	DN	2.639	72.3	19.8	26.1	2.661	6.25	5.24	$
1346.3	38	67.7	2.2	14.2	2.173	-0.5	00.0	21.2	86.4	43.0	8.8	DN	2.633	73.3	21.2	23.9	2.666	6.29	5.27	$
1346.5	39	73.0	2.4	13.6	2.226	-0.5	00.0	22.1	89.0	42.4	10.1	DN	2.640	74.0	22.1	21.3	2.675	6.32	5.30	$
1346.6	42	79.1	2.6	12.3	2.243	-0.5	00.0	22.2	89.7	40.4	7.9	DN	2.644	74.0	22.2	20.6	2.670	6.35	5.32	$
1346.8	41	73.7	3.8	13.4	2.208	-0.5	00.0	21.5	70.7	39.6	11.9	DN	2.632	70.7	21.5	21.6	2.677	6.39	5.35	$
1346.9	44	58.6	3.3	15.7	2.166	-0.5	00.0	22.0	69.4	41.3	14.5	DN	2.632	69.4	22.0	23.7	2.689	6.42	5.38	$
1347.1	46	45.4	3.8	19.7	2.159	-0.5	00.0	23.2	61.1	45.0	26.6	GR	2.637	61.1	23.2	23.5	2.767	6.46	5.40	$
1347.2	51	36.4	2.3	19.9	2.177	-0.5	00.0	26.6	79.7	46.3	16.6	DN	2.648	76.7	26.6	24.5	2.705	6.50	5.43	$
1347.4	57	28.3	2.4	20.2	2.180	-0.5	00.0	30.0	77.4	47.4	18.2	DN	2.641	77.4	30.0	24.2	2.704	6.53	5.46	$
1347.5	61	22.5	3.1	21.3	2.190	-0.5	00.0	33.2	68.9	43.6	26.6	DN	2.646	68.9	33.2	22.7	2.765	6.57	5.48	$
1347.7	63	19.2	2.7	23.9	2.219	-0.5	00.0	35.9	74.7	43.4	33.4	DN	2.633	74.7	35.9	21.2	2.777	6.57	5.48	
1347.8	64	16.8	3.3	25.6	2.265	-0.5	00.0	39.7	71.2	40.2	40.2	DN	2.655	71.2	39.7	18.8	2.832	6.57	5.48	
1348.0	68	15.7	3.2	27.9	2.313	-0.5	00.0	42.5	76.4	36.0	48.5	GR	2.661	76.4	42.5	16.2	2.860	6.57	5.48	
1348.1	77	16.1	3.9	31.1	2.358	-0.5	00.0	43.0	72.5	33.0	58.1	GR	2.708	72.5	43.0	13.9	2.921	6.57	5.48	
1348.3	84	16.5	3.9	34.1	2.408	-0.3	00.0	43.4	74.3	29.4	64.3	GR	2.822	74.3	43.4	12.4	2.965	6.57	5.48	
1348.4	92	18.8	6.4	34.0	2.430	-0.2	00.0	52.2	78.9	28.3	72.9	GR	2.680	78.9	52.2	5.6	2.927	6.57	5.48	8
1348.6	93	18.2	7.0	32.1	2.443	-0.1	00.0	53.7	76.7	26.8	74.0	GR	2.680	76.7	53.7	5.3	2.920	6.57	5.48	8
1348.7	92	17.8	7.8	30.7	2.450	-0.1	00.0	53.6	71.7	26.8	72.8	GR	2.680	71.7	53.6	5.7	2.912	6.57	5.48	8
1348.9	87	19.5	4.8	30.0	2.485	-0.1	00.0	48.6	85.0	26.2	67.8	GR	2.784	85.0	48.6	7.3	2.954	6.57	5.48	
1349.0	84	19.5	4.8	30.9	2.495	-0.1	00.0	49.8	77.8	26.5	64.7	GR	2.831	77.8	49.8	7.9	2.980	0.00	0.00	
1349.2	89	19.1	4.5	32.2	2.480	-0.1	00.0	49.0	78.6	26.9	69.4	GR	2.798	78.6	49.0	7.6	2.977	0.00	0.00	
1349.3	95	20.3	11.1	33.5	2.449	-0.1	00.0	53.6	62.6	28.0	75.6	GR	2.680	62.6	53.6	3.6	2.937	0.00	0.00	8
1349.5	97	19.9	10.5	35.0	2.456	-0.1	00.0	54.3	65.5	28.2	77.2	GR	2.680	65.5	54.3	3.2	2.953	0.00	0.00	8
1349.7	94	19.5	8.0	34.1	2.507	-0.1	00.0	54.5	72.7	26.1	74.3	GR	2.680	72.7	54.5	3.8	2.983	0.00	0.00	8

Zone No. 4 Complex Lithology Results 24-10-94

DEPTH M	GR	RT	RXO	PHIN	RHOB	DD	SPI	SWU	SXOU	PHIS	VCL	FVCL	RHOMAU	SXO	SW	PHIE	RHOMA	POR-M	HC-M	FLAGS
1349.8	94	17.2	6.3	32.6	2.527	-0.1	00.0	57.9	81.2	26.4	74.3	GR	2.680	81.2	57.9	3.8	2.986	0.00	0.00	8
1350.0	95	18.8	9.9	31.7	2.500	-0.1	00.0	55.6	66.3	26.2	75.9	GR	2.680	66.3	55.6	3.5	2.958	0.00	0.00	8
1350.1	94	19.2	9.9	32.2	2.481	-0.1	00.0	54.9	65.8	27.1	74.8	GR	2.680	65.8	54.9	3.7	2.949	0.00	0.00	8
1350.3	92	18.9	10.3	35.2	2.514	-0.1	00.0	55.1	63.7	27.1	73.1	GR	2.680	63.7	55.1	4.1	2.995	0.00	0.00	8
1350.4	86	19.1	10.7	35.5	2.544	-0.1	00.0	49.4	52.1	25.5	67.0	GR	3.067	52.1	49.4	7.9	3.064	0.00	0.00	5
1350.6	82	22.3	11.3	33.6	2.573	-0.1	00.0	47.6	52.6	23.4	63.2	GR	3.095	52.6	47.6	7.7	3.073	0.00	0.00	5
1350.7	74	25.0	10.0	30.9	2.649	-0.1	00.0	49.5	60.7	19.9	55.2	GR	3.151	60.7	49.5	7.2	3.102	0.00	0.00	5
1350.9	69	25.6	25.6	30.3	2.696	-0.1	00.0	51.4	40.2	20.7	50.3	GR	3.203	51.4	51.4	7.2	3.134	0.00	0.00	5
1351.0	75	19.6	19.2	30.8	2.629	-0.1	00.0	54.6	43.3	20.5	55.7	GR	3.129	54.6	54.6	7.5	3.094	0.00	0.00	5
1351.2	84	16.2	9.5	33.1	2.515	-0.1	00.0	52.9	53.6	23.8	64.4	GR	2.982	53.6	52.9	8.7	3.039	0.00	0.00	5
1351.3	94	11.7	8.3	33.4	2.449	-0.1	00.0	69.7	71.3	29.3	74.4	GR	2.680	71.3	69.7	3.8	2.936	0.00	0.00	8
1351.5	91	9.9	5.1	34.5	2.427	-0.1	00.0	74.8	88.4	29.4	71.7	GR	2.680	88.4	74.8	4.4	2.930	0.00	0.00	8
1351.6	89	10.1	2.3	32.8	2.407	-0.1	00.0	63.5	102.5	29.1	69.6	GR	2.647	91.3	63.5	9.0	2.915	0.00	0.00	8
1351.8	84	10.9	1.9	31.1	2.413	-0.1	00.0	61.0	108.4	28.2	65.2	GR	2.697	90.6	61.0	10.0	2.908	0.00	0.00	8
1351.9	85	11.9	13.4	30.3	2.422	-0.1	00.0	59.6	44.0	27.8	66.2	GR	2.686	59.6	59.6	9.2	2.956	0.00	0.00	8
1352.1	87	13.4	10.7	30.8	2.429	-0.1	00.0	56.3	49.3	26.4	67.6	SD	2.706	56.3	56.3	8.9	2.968	0.00	0.00	8
1352.2	91	13.2	9.0	31.4	2.449	-0.1	00.0	65.2	66.9	26.4	71.2	GR	2.680	66.9	65.2	4.5	2.918	0.00	0.00	8
1352.4	90	12.2	8.7	32.2	2.490	-0.1	00.0	67.6	67.7	23.6	71.1	GR	2.680	67.7	67.6	4.6	2.955	0.00	0.00	8
1352.6	88	12.0	5.2	32.2	2.522	-0.1	00.0	63.1	77.0	25.5	68.8	GR	2.912	77.0	63.1	6.9	3.005	0.00	0.00	5
1352.7	90	12.5	1.9	30.7	2.516	-0.1	00.0	66.9	140.1	24.3	70.8	GR	2.680	92.3	66.9	4.6	2.962	0.00	0.00	8
1352.9	96	13.2	6.1	30.4	2.498	-0.1	00.0	65.8	83.5	23.7	75.0	SD	2.680	83.5	65.8	3.7	2.946	0.00	0.00	8
1353.0	97	14.2	12.5	30.0	2.489	-0.2	00.0	63.7	59.3	24.5	75.7	SD	2.680	63.7	63.7	3.5	2.935	0.00	0.00	8

Complex Lithology Results 24-10-94

Zone No. 4

Hydrocarbon Volume Report

FROM	M	1316.431
TO	M	1347.978
INTERVAL	M	31.547
PHIE Cut off		0.050
SW Cut Off		0.500
Vclay Cut Off		0.300
Net Pay	M	27.584
Average PHIE	%	23.808
Average SW	%	16.705
Average Vclay	%	5.293
Integrated PHI	M	6.567
Sum PHI*(1-SW)	M	5.479

Zone No. 5

Complex Lithology Results 24-10-94

DEPTH M	GR	RT	RXO	PHIN	RHOB	DD	SPI	SWU	SXOU	PHIS	VCL	FVCL	RHOMAU	SXO	SW	PHIE	RHOMA	POR-M	HC-M	FLAGS
1349.0	84	19.5	4.8	30.9	2.495	-0.1	00.0	49.8	77.8	26.5	64.7	GR	2.831	77.8	49.8	7.9	2.980	0.00	0.00	
1349.2	89	19.1	4.5	32.2	2.480	-0.1	00.0	49.0	78.6	26.9	69.4	GR	2.798	78.6	49.0	7.6	2.977	0.00	0.00	
1349.3	95	20.3	11.1	33.5	2.449	-0.1	00.0	51.5	58.9	28.0	75.6	GR	2.680	58.9	51.5	4.5	2.937	0.00	0.00	8
1349.5	97	19.9	10.5	35.0	2.456	-0.1	00.0	52.4	61.9	28.2	77.2	GR	2.680	61.9	52.4	4.0	2.953	0.00	0.00	8
1349.7	94	19.5	8.0	34.1	2.507	-0.1	00.0	52.2	68.2	26.1	74.3	GR	2.680	68.2	52.2	4.8	2.983	0.00	0.00	8
1349.8	94	17.2	6.3	32.6	2.527	-0.1	00.0	55.5	76.1	26.4	74.3	GR	2.680	76.1	55.5	4.8	2.986	0.00	0.00	8
1350.0	95	18.8	9.9	31.7	2.500	-0.1	00.0	53.5	62.5	26.2	75.9	GR	2.680	62.5	53.5	4.4	2.958	0.00	0.00	8
1350.1	94	19.2	9.9	32.2	2.481	-0.1	00.0	52.6	61.8	27.1	74.8	GR	2.680	61.8	52.6	4.7	2.949	0.00	0.00	8
1350.3	92	18.9	10.3	35.2	2.514	-0.1	00.0	52.7	59.5	27.1	73.1	GR	2.680	59.5	52.7	5.2	2.995	0.00	0.00	8
1350.4	86	19.1	10.7	35.5	2.544	-0.1	00.0	49.4	52.1	25.5	67.0	GR	3.067	52.1	49.4	7.9	3.064	0.00	0.00	5
1350.6	82	22.3	11.3	33.6	2.573	-0.1	00.0	47.6	52.6	23.4	63.2	GR	3.095	52.6	47.6	7.7	3.073	0.00	0.00	5
1350.7	74	25.0	10.0	30.9	2.649	-0.1	00.0	49.5	60.7	19.9	55.2	GR	3.151	60.7	49.5	7.2	3.102	0.00	0.00	5
1350.9	69	25.6	25.6	30.3	2.696	-0.1	00.0	51.4	40.2	20.7	50.3	GR	3.203	51.4	51.4	7.2	3.134	0.00	0.00	5
1351.0	75	19.6	19.2	30.8	2.629	-0.1	00.0	54.6	43.3	20.5	55.7	GR	3.129	54.6	54.6	7.5	3.094	0.00	0.00	5
1351.2	84	16.2	9.5	33.1	2.515	-0.1	00.0	52.9	53.6	23.8	64.4	GR	2.982	53.6	52.9	8.7	3.039	0.00	0.00	5
1351.3	94	11.7	8.3	33.4	2.449	-0.1	00.0	66.8	66.9	29.3	74.4	GR	2.680	66.9	66.8	4.8	2.936	0.00	0.00	8
1351.5	91	9.9	5.1	34.5	2.427	-0.1	00.0	71.3	82.4	29.4	71.7	GR	2.680	82.4	71.3	5.6	2.930	0.00	0.00	8
1351.6	89	10.1	2.3	32.8	2.407	-0.1	00.0	61.3	97.7	29.1	69.6	GR	2.651	90.7	61.3	10.0	2.920	0.00	0.00	
1351.8	84	10.9	1.9	31.1	2.413	-0.1	00.0	61.0	108.4	28.2	65.2	GR	2.658	90.6	61.0	10.0	2.910	0.00	0.00	
1351.9	85	11.9	13.4	30.3	2.422	-0.1	00.0	59.6	44.0	27.8	66.2	GR	2.683	59.6	59.6	9.2	2.957	0.00	0.00	
1352.1	87	13.4	10.7	30.8	2.429	-0.1	00.0	56.2	49.3	26.4	67.6	SD	2.696	56.2	56.2	8.9	2.968	0.00	0.00	
1352.2	91	13.2	9.0	31.4	2.449	-0.1	00.0	62.1	62.3	26.4	71.2	GR	2.680	62.3	62.1	5.7	2.918	0.00	0.00	8
1352.4	90	12.2	8.7	32.2	2.490	-0.1	00.0	64.4	63.0	23.6	71.1	GR	2.680	64.4	64.4	5.7	2.955	0.00	0.00	8
1352.6	88	12.0	5.2	32.2	2.522	-0.1	00.0	63.1	77.0	25.5	68.8	GR	2.912	77.0	63.1	6.9	3.005	0.00	0.00	5
1352.7	90	12.5	1.9	30.7	2.516	-0.1	00.0	63.7	130.3	24.3	70.8	GR	2.680	91.4	63.7	5.8	2.962	0.00	0.00	8
1352.9	96	13.2	6.1	30.4	2.498	-0.1	00.0	63.2	78.4	23.7	75.0	SD	2.680	78.4	63.2	4.6	2.946	0.00	0.00	8
1353.0	97	14.2	12.5	30.0	2.489	-0.2	00.0	61.2	55.9	24.5	75.7	SD	2.680	61.2	61.2	4.4	2.935	0.00	0.00	8
1353.2	100	15.6	12.8	33.6	2.489	-0.2	00.0	52.8	46.1	23.4	69.7	MN	2.916	52.8	52.8	8.3	3.024	0.00	0.00	5
1353.3	97	18.1	12.3	29.0	2.487	-0.2	00.0	53.1	52.9	23.3	70.1	SD	2.680	53.1	53.1	6.1	2.924	0.00	0.00	8
1353.5	92	24.7	14.7	19.2	2.464	-0.2	00.0	54.7	54.5	23.2	46.8	DN	2.653	54.7	54.7	7.1	2.870	0.00	0.00	
1353.6	75	36.3	12.3	6.7	2.380	-0.4	00.0	57.9	61.1	25.9	12.0	DN	2.639	61.1	57.9	12.1	2.681	0.00	0.00	
1353.8	53	71.0	28.0	1.5	2.222	-0.5	00.0	34.1	31.9	30.6	6.7	SN	2.639	34.1	34.1	17.9	2.669	0.03	0.02	$
1353.9	42	260.1	13.9	0.9	2.101	-0.5	00.0	15.5	37.0	36.6	3.5	SN	2.626	37.0	15.5	23.1	2.647	0.06	0.05	$
1354.1	38	882.0	8.8	0.9	2.027	-0.5	00.0	7.9	42.5	38.7	3.0	SN	2.583	42.5	7.9	25.6	2.625	0.10	0.08	6 $
1354.2	40	1122.8	7.5	1.0	2.016	-0.5	00.0	7.0	45.7	40.1	3.0	SN	2.562	45.7	7.0	25.8	2.624	0.14	0.12	6 $
1354.4	41	1257.7	4.2	1.2	2.024	-0.5	00.0	7.0	63.5	39.2	3.8	SN	2.485	58.7	7.0	24.1	2.633	0.18	0.15	6 $
1354.5	40	1221.4	3.7	1.3	2.045	-0.5	00.0	7.3	69.1	39.3	4.0	SN	2.492	59.2	7.3	23.3	2.621	0.21	0.19	6 $
1354.7	42	1160.9	3.4	1.3	2.059	-0.5	00.0	7.6	73.6	39.3	4.0	SN	2.497	59.7	7.6	22.7	2.626	0.25	0.22	6 $

Zone No. 5 Complex Lithology Results 24-10-94

DEPTH M	GR	RT	RXO	PHIN	RHOB	DD	SPI	SWU	SXOU	PHIS	VCL	FVCL	RHOMAU	SXO	SW	PHIE	RHOMA	POR-M	HC-M	FLAGS	
1354.8	41	1090.0	3.1	1.2	2.066	-0.5	00.0	7.9	78.2	39.2	3.8	SN	2.497	60.2	7.9	22.4	2.623	0.28	0.25	6	$
1355.0	40	1118.2	4.0	1.1	2.066	-0.5	00.0	7.8	68.7	38.9	3.6	SN	2.501	60.1	7.8	22.5	2.626	0.32	0.28	6	$
1355.1	38	1101.4	3.5	1.1	2.049	-0.5	00.0	7.7	72.1	39.8	3.4	SN	2.494	59.9	7.7	23.2	2.618	0.35	0.31	6	$
1355.3	38	1070.1	3.1	1.2	2.050	-0.5	00.0	7.8	76.4	40.0	3.6	SN	2.493	60.1	7.8	23.1	2.619	0.39	0.35	6	$
1355.4	38	1027.0	2.7	1.3	2.050	-0.5	00.0	8.0	80.9	40.5	3.8	SN	2.492	60.3	8.0	23.1	2.619	0.42	0.38	6	$
1355.6	40	883.3	2.8	1.5	2.056	-0.5	00.0	8.6	81.5	40.7	4.3	SN	2.486	61.3	8.6	22.7	2.617	0.46	0.41	6	$
1355.8	41	578.7	3.1	1.9	2.054	-0.5	00.0	10.5	75.2	40.8	0.4	DN	2.515	63.7	10.5	24.0	2.618	0.49	0.44	6	$
1355.9	41	377.7	3.0	2.6	2.066	-0.5	00.0	13.1	78.1	40.4	2.3	DN	2.498	66.6	13.1	23.2	2.634	0.53	0.47	6	$
1356.1	42	287.3	3.4	3.0	2.075	-0.5	00.0	15.0	74.7	40.3	3.5	DN	2.489	68.5	15.0	22.6	2.633	0.56	0.50	6	$
1356.2	43	230.8	2.8	3.0	2.082	-0.5	00.0	16.9	82.5	39.5	3.7	DN	2.484	70.1	16.9	22.1	2.628	0.60	0.53	6	$
1356.4	42	215.2	3.8	2.7	2.084	-0.5	00.0	17.7	71.9	39.3	2.8	DN	2.486	70.7	17.7	22.1	2.624	0.63	0.56	6	$
1356.5	44	220.0	3.1	2.5	2.077	-0.5	00.0	17.4	78.5	38.4	2.4	DN	2.482	70.5	17.4	22.3	2.619	0.66	0.59	6	$
1356.7	44	221.4	3.8	2.4	2.080	-0.5	00.0	17.5	72.3	38.1	2.2	DN	2.485	70.6	17.5	22.2	2.620	0.70	0.62	6	$
1356.8	45	216.1	4.4	2.8	2.079	-0.5	00.0	17.2	65.3	38.3	3.3	DN	2.507	65.3	17.2	22.7	2.629	0.73	0.64	6	$
1357.0	44	205.9	3.8	3.9	2.087	-0.5	00.0	17.7	70.0	37.7	1.4	DN	2.517	70.0	17.7	23.1	2.626	0.77	0.67	6	$
1357.1	44	198.4	3.4	6.4	2.098	-0.5	00.0	17.3	71.3	38.2	3.2	DN	2.540	70.4	17.3	23.7	2.620	0.80	0.70	6	$
1357.3	44	147.4	3.1	11.0	2.120	-0.5	00.0	18.7	68.8	36.8	0.5	DN	2.641	68.8	18.7	26.5	2.643	0.84	0.74		$
1357.4	43	103.6	2.9	16.2	2.140	-0.5	00.0	20.6	70.6	35.6	14.4	DN	2.615	70.6	20.6	24.7	2.680	0.88	0.77		$
1357.6	44	74.2	2.8	19.8	2.166	-0.5	00.0	23.2	70.0	35.0	20.5	DN	2.639	70.0	23.2	24.1	2.726	0.92	0.79		$
1357.7	45	53.6	2.9	21.2	2.197	-0.5	00.0	27.1	71.1	34.7	26.1	GR	2.634	71.1	27.1	22.3	2.752	0.95	0.82		$
1357.9	45	42.0	3.0	21.7	2.217	-0.5	00.0	31.0	71.3	36.9	26.1	GR	2.650	71.3	31.0	21.7	2.768	0.99	0.84		$
1358.0	46	38.0	4.4	22.6	2.219	-0.5	00.0	32.0	58.4	37.4	27.2	GR	2.703	58.4	32.0	22.0	2.846	1.02	0.86		$
1358.2	43	35.6	4.0	22.7	2.203	-0.5	00.0	32.7	59.8	37.0	24.7	GR	2.708	59.8	32.7	23.1	2.840	1.05	0.89		$
1358.3	43	34.0	5.5	22.5	2.201	-0.5	00.0	32.7	50.1	37.0	24.4	GR	2.761	50.1	32.7	24.0	2.881	1.09	0.91		$
1358.5	42	28.2	5.9	21.8	2.200	-0.5	00.0	36.0	48.3	35.2	23.3	GR	2.769	48.3	36.0	24.1	2.884	1.13	0.94		$
1358.6	47	20.0	5.0	21.5	2.212	-0.5	00.0	43.6	55.0	36.4	28.2	GR	2.687	55.0	43.6	21.6	2.840	1.16	0.96		$
1358.8	53	15.2	4.8	21.7	2.251	-0.5	00.0	50.9	59.5	33.0	33.9	GR	2.656	59.5	50.9	19.0	2.830	1.16	0.96		
1359.0	61	11.9	4.0	25.2	2.296	-0.5	00.0	56.7	66.1	31.6	42.6	GR	2.654	66.1	56.7	16.8	2.857	1.16	0.96		
1359.1	69	10.1	3.4	29.2	2.355	-0.5	00.0	61.8	75.2	28.8	49.8	GR	2.694	75.2	61.8	14.5	2.898	1.16	0.96		
1359.3	74	9.9	4.6	30.8	2.405	-0.4	00.0	62.8	67.3	25.8	55.3	GR	2.778	67.3	62.8	12.8	2.957	1.16	0.96		
1359.4	69	11.9	3.1	25.2	2.440	-0.4	00.0	67.5	96.9	22.0	49.8	GR	2.669	92.4	67.5	9.6	2.861	1.16	0.96		
1359.6	60	16.3	4.2	18.5	2.476	-0.4	00.0	71.6	103.8	17.1	40.7	SD	2.642	93.5	71.6	7.2	2.796	1.16	0.96		
1359.7	50	23.1	8.9	16.7	2.525	-0.4	00.0	69.9	81.3	13.3	31.4	GR	2.704	81.3	69.9	7.0	2.836	1.16	0.96		
1359.9	48	26.2	52.5	20.1	2.576	-0.4	00.0	55.1	27.3	12.7	29.5	GR	2.944	55.1	55.1	11.0	3.006	1.16	0.96	5	
1360.0	51	21.2	12.9	24.4	2.557	-0.5	00.0	54.2	47.5	19.6	32.4	GR	3.008	54.2	54.2	13.0	3.046	1.16	0.96	5	
1360.2	53	13.6	4.7	26.8	2.478	-0.5	00.0	61.4	70.2	26.4	34.7	GR	2.914	70.2	61.4	14.7	2.981	1.16	0.96	5	
1360.3	59	9.7	4.5	27.8	2.401	-0.5	00.0	66.3	66.5	28.9	40.6	GR	2.827	66.5	66.3	15.5	2.949	1.16	0.96		
1360.5	65	8.3	2.8	28.8	2.351	-0.5	00.0	68.3	81.7	30.2	46.5	GR	2.689	81.7	68.3	15.1	2.875	1.16	0.96		

Zone No. 5 Complex Lithology Results 24-10-94

DEPTH M	GR	RT	RXO	PHIN	RHOB	DD	SPI	SWU	SXOU	PHIS	VCL	FVCL	RHOMAU	SXO	SW	PHIE	RHOMA	POR-M	HC-M	FLAGS
1360.6	73	7.8	2.5	29.5	2.332	-0.5	00.0	67.3	83.8	30.3	53.6	GR	2.631	83.8	67.3	14.7	2.860	1.16	0.96	
1360.8	80	8.0	3.0	31.1	2.331	-0.5	00.0	65.5	75.1	28.9	51.3	SD	2.699	75.1	65.5	15.9	2.904	1.16	0.96	
1360.9	85	8.4	2.9	32.4	2.345	-0.5	00.0	63.3	77.2	29.4	57.0	SD	2.692	77.2	63.3	14.7	2.914	1.16	0.96	
1361.1	81	8.2	3.2	32.3	2.357	-0.5	00.0	64.5	75.3	30.6	62.1	GR	2.665	75.3	64.5	13.2	2.919	1.16	0.96	
1361.2	69	7.2	3.6	31.0	2.344	-0.5	00.0	69.7	69.0	32.0	50.2	GR	2.741	69.7	69.7	15.8	2.927	1.16	0.96	
1361.4	51	6.0	2.7	29.0	2.299	-0.5	00.0	76.9	74.1	33.3	32.5	GR	2.761	76.9	76.9	20.6	2.880	1.16	0.96	
1361.5	46	5.5	1.8	28.8	2.250	-0.5	00.0	79.3	88.3	34.8	27.1	GR	2.693	88.3	79.3	22.7	2.798	1.16	0.96	
1361.7	43	5.4	1.4	29.1	2.235	-0.5	00.0	79.4	96.7	34.5	24.1	GR	2.672	95.5	79.4	23.8	2.752	1.16	0.96	
1361.8	50	5.5	1.8	30.3	2.255	-0.5	00.0	77.4	86.4	33.5	31.4	GR	2.704	86.4	77.4	22.2	2.827	1.16	0.96	
1362.0	53	6.2	2.3	30.2	2.292	-0.5	00.0	74.3	78.9	32.6	33.9	GR	2.758	78.9	74.3	20.9	2.879	1.16	0.96	
1362.2	56	6.4	2.0	29.3	2.301	-0.4	00.0	74.6	88.7	32.4	37.3	GR	2.688	88.7	74.6	19.0	2.830	1.16	0.96	
1362.3	56	6.7	2.0	28.8	2.304	-0.4	00.0	73.8	89.9	31.8	36.9	GR	2.681	89.9	73.8	18.7	2.821	1.16	0.96	
1362.5	63	7.3	2.7	30.1	2.317	-0.4	00.0	69.3	78.1	30.7	43.9	GR	2.708	78.1	69.3	17.4	2.885	1.16	0.96	
1362.6	72	7.9	3.2	35.1	2.341	-0.4	00.0	62.5	68.5	30.6	53.3	GR	2.816	68.5	62.5	17.1	2.959	1.16	0.96	
1362.8	84	8.9	3.9	37.8	2.357	-0.4	00.0	61.4	68.7	31.5	64.7	GR	2.800	68.7	61.4	13.1	2.966	1.16	0.96	8
1362.9	91	8.5	3.9	40.0	2.361	-0.3	00.0	77.1	93.4	32.6	72.1	GR	2.680	93.4	77.1	5.5	2.926	1.16	0.96	8
1363.1	96	8.2	6.5	38.5	2.400	-0.2	00.0	80.0	77.3	31.0	77.0	GR	2.680	80.0	80.0	4.1	2.941	1.16	0.96	8
1363.2	102	8.4	4.7	37.4	2.441	-0.2	00.0	81.0	96.2	30.8	82.5	GR	2.680	95.9	81.0	2.7	2.961	1.16	0.96	8
1363.4	107	8.3	4.7	36.0	2.470	-0.1	00.0	83.0	101.6	31.2	87.1	GR	2.680	96.3	83.0	1.7	2.971	1.16	0.96	8
1363.5	115	8.9	5.9	36.0	2.474	-0.1	00.0			30.1	95.1	GR	2.680	100.0	100.0	00.0	2.973	1.16	0.96	1
1363.7	113	9.9	7.5	35.6	2.481	-0.2	00.0	100.0	100.0	29.3	93.2	GR	2.680	100.0	100.0	0.6	2.975	1.16	0.96	8
1363.8	111	10.5	7.5	35.1	2.487	-0.2	00.0	74.5	82.2	27.6	88.5	SD	2.680	82.2	74.5	1.4	2.976	1.16	0.96	8
1364.0	105	11.0	8.5	32.8	2.489	-0.2	00.0	71.4	72.9	26.2	83.0	SD	2.680	72.9	71.4	2.6	2.960	1.16	0.96	8
1364.1	101	12.3	10.2	32.1	2.510	-0.2	00.0	67.3	65.8	25.2	81.6	GR	2.680	67.3	67.3	2.9	2.969	1.16	0.96	8
1364.3	95	13.4	10.4	32.0	2.550	-0.2	00.0	62.8	60.9	23.3	75.6	GR	2.680	62.8	62.8	4.5	2.997	1.16	0.96	8
1364.4	92	13.3	12.6	31.2	2.591	-0.2	00.0	65.5	57.8	23.9	72.6	GR	2.680	65.5	65.5	4.1	3.022	1.16	0.96	
1364.6	93	13.4	15.4	31.6	2.581	-0.2	00.0	64.5	51.8	22.4	73.5	GR	2.680	64.5	64.5	4.3	3.017	1.16	0.96	
1364.7	97	13.1	9.0	30.5	2.553	-0.2	00.0	65.1	68.2	23.5	77.3	GR	2.680	68.2	65.1	3.6	2.988	1.16	0.96	
1364.9	99	12.7	11.8	32.3	2.523	-0.2	00.0	65.6	59.7	24.0	79.3	GR	2.680	65.6	65.6	3.5	2.980	1.16	0.96	8
1365.0	102	12.9	11.5	33.4	2.514	-0.2	00.0	64.7	59.5	23.7	77.8	MN	2.680	64.7	64.7	3.9	2.982	1.16	0.96	8
1365.2	104	13.2	11.4	32.8	2.503	-0.2	00.0	63.5	58.6	23.7	76.0	MN	2.680	63.5	63.5	4.3	2.970	1.16	0.96	8
1365.4	99	12.5	9.7	32.3	2.525	-0.2	00.0	65.2	63.4	22.7	76.0	MN	2.680	65.2	65.2	4.3	2.982	1.16	0.96	8
1365.5	101	10.7	11.4	32.6	2.548	-0.2	00.0	71.8	62.6	24.3	81.8	GR	2.680	71.8	71.8	2.9	3.001	1.16	0.96	8
1365.7	100	10.0	12.6	35.4	2.544	-0.2	00.0	74.2	59.0	25.5	81.0	GR	2.680	74.2	74.2	3.1	3.017	1.16	0.96	8
1365.8	114	9.2	7.2	35.3	2.519	-0.2	00.0	100.0	100.0	27.8	94.4	GR	2.680	100.0	100.0	0.5	2.999	1.16	0.96	8
1366.0	118	8.3	4.2	35.1	2.507	-0.2	00.0			28.6	98.1	SD	2.680	100.0	100.0	00.0	2.989	1.16	0.96	1
1366.1	121	8.4	8.6	34.8	2.504	-0.2	00.0			28.3	96.0	SD	2.680	100.0	100.0	00.0	2.985	1.16	0.96	1
1366.3	121	8.5	8.3	36.6	2.508	-0.2	00.0			28.2	96.5	SD	2.680	100.0	100.0	00.0	3.000	1.16	0.96	1

Zone No. 5 Complex Lithology Results 24-10-94

DEPTH M	GR	RT	RXO	PHIN	RHOB	DD	SPI	SWU	SXOU	PHIS	VCL	FVCL	RHOMAU	SXO	SW	PHIE	RHOMA	POR-M	HC-M	FLAGS
1366.4	117	8.3	7.5	37.2	2.511	-0.2	00.0			28.3	97.3	GR	2.680	100.0	100.0	00.0	3.005	1.16	0.96	1
1366.6	119	8.2	7.7	38.0	2.511	-0.2	00.0			28.5	98.6	SD	2.680	100.0	100.0	00.0	3.009	1.16	0.96	1
1366.7	117	8.2	7.7	36.4	2.515	-0.2	00.0			27.5	95.5	SD	2.680	100.0	100.0	00.0	3.003	1.16	0.96	1
1366.9	116	8.1	8.0	34.8	2.520	-0.2	00.0			27.2	95.6	SD	2.680	100.0	100.0	00.0	2.996	1.16	0.96	1
1367.0	116	8.2	7.2	33.3	2.537	-0.2	00.0	100.0	100.0	27.4	94.2	SN	2.680	100.0	100.0	0.5	2.998	1.16	0.96	8
1367.2	107	8.1	6.8	32.9	2.530	-0.2	00.0	84.5	85.5	27.6	87.7	GR	2.680	85.5	84.5	1.6	2.990	1.16	0.96	8
1367.3	112	8.0	8.5	33.1	2.518	-0.2	00.0	85.9	80.2	27.8	92.1	GR	2.680	85.9	85.9	0.8	2.982	1.16	0.96	8
1367.5	109	8.1	7.6	33.1	2.508	-0.2	00.0	84.8	82.8	27.5	89.7	GR	2.680	84.8	84.8	1.2	2.975	1.16	0.96	8
1367.6	117	8.5	7.2	33.3	2.501	-0.2	00.0	82.5	83.7	26.7	88.5	SD	2.680	83.7	82.5	1.4	2.972	1.16	0.96	8
1367.8	111	9.0	8.0	32.5	2.530	-0.2	00.0	81.0	82.1	25.5	91.1	GR	2.680	82.1	81.0	1.0	2.987	1.16	0.96	8
1367.9	108	9.1	8.3	32.5	2.551	-0.2	00.0	79.7	78.1	24.9	88.0	GR	2.680	79.7	79.7	1.5	3.002	1.16	0.96	8
1368.1	101	8.9	9.6	32.5	2.559	-0.2	00.0	78.8	68.1	25.2	81.9	GR	2.680	78.8	78.8	2.9	3.008	1.16	0.96	8
1368.2	106	8.4	8.4	32.3	2.516	-0.2	00.0	82.2	76.0	25.8	86.0	GR	2.680	82.2	82.2	1.9	2.975	1.16	0.96	8
1368.4	110	7.8	7.5	31.8	2.492	-0.2	00.0	84.9	80.1	26.7	85.7	SD	2.680	84.9	84.9	2.0	2.953	1.16	0.96	8
1368.6	113	7.5	6.6	32.4	2.490	-0.2	00.0	87.2	86.4	27.2	87.4	SD	2.680	87.2	87.2	1.6	2.957	1.16	0.96	8
1368.7	115	7.6	7.4	33.4	2.499	-0.2	00.0	88.0	85.2	27.6	91.5	SD	2.680	88.0	88.0	0.9	2.971	1.16	0.96	8
1368.9	114	7.8	7.3	32.7	2.503	-0.2	00.0	86.7	85.9	27.3	91.6	SD	2.680	86.7	86.7	0.9	2.969	1.16	0.96	8
1369.0	117	7.9	7.4	31.6	2.519	-0.2	00.0	85.7	83.6	27.1	89.6	SN	2.680	85.7	85.7	1.2	2.971	1.16	0.96	8
1369.2	111	7.8	8.5	32.6	2.529	-0.2	00.0	85.9	77.9	25.0	88.9	SD	2.680	85.9	85.9	1.4	2.987	1.16	0.96	8
1369.3	112	6.6	8.9	33.6	2.538	-0.2	00.0	100.0	100.0	27.3	92.5	GR	2.680	100.0	100.0	0.8	3.001	1.16	0.96	8
1369.5	113	5.8	7.4	35.4	2.517	-0.2	00.0	100.0	100.0	29.1	93.4	GR	2.680	100.0	100.0	0.6	2.998	1.16	0.96	8
1369.6	116	5.5	6.6	34.8	2.474	-0.2	00.0			31.2	96.6	GR	2.680	100.0	100.0	00.0	2.964	1.16	0.96	1
1369.8	117	5.4	2.1	34.8	2.438	-0.2	00.0	100.0	100.0	32.1	93.9	SD	2.680	100.0	100.0	0.6	2.939	1.16	0.96	8
1369.9	118	5.7	5.2	35.7	2.431	-0.2	00.0			33.9	98.4	GR	2.680	100.0	100.0	00.0	2.942	1.16	0.96	1
1370.1	121	6.4	6.7	38.9	2.414	-0.2	00.0	100.0	100.0	33.7	94.3	SD	2.680	100.0	100.0	0.5	2.953	1.16	0.96	8
1370.2	119	6.5	6.8	40.5	2.383	-0.2	00.0	94.2	86.4	34.3	88.4	SD	2.680	94.2	94.2	1.5	2.943	1.16	0.96	8
1370.4	115	6.3	3.3	40.1	2.358	-0.2	00.0	93.8	115.1	34.8	83.5	SD	2.680	98.7	93.8	2.5	2.925	1.16	0.96	8
1370.5	112	6.1	3.0	36.7	2.381	-0.2	00.0	93.6	117.6	32.5	80.2	SD	2.680	98.7	93.6	3.2	2.915	1.16	0.96	8
1370.7	117	6.3	5.2	34.8	2.401	-0.2	00.0	93.9	94.8	32.4	85.1	SD	2.680	94.8	93.9	2.1	2.913	1.16	0.96	8
1370.8	117	6.8	5.6	34.2	2.410	-0.2	00.0	90.5	90.6	31.7	84.7	SD	2.680	90.6	90.5	2.2	2.915	1.16	0.96	8
1371.0	115	6.9	6.3	35.7	2.425	-0.2	00.0	91.1	88.2	31.4	87.5	SD	2.680	91.1	91.1	1.6	2.938	1.16	0.96	8
1371.1	112	6.8	7.3	38.3	2.447	-0.2	00.0	100.0	100.0	31.5	92.6	GR	2.680	100.0	100.0	0.7	2.970	1.16	0.96	8
1371.3	111	6.6	6.3	37.7	2.445	-0.2	00.0	94.5	92.3	31.5	91.7	GR	2.680	94.5	94.5	0.9	2.965	1.16	0.96	8
1371.4	113	6.4	6.2	35.5	2.452	-0.2	00.0	100.0	100.0	31.3	93.1	GR	2.680	100.0	100.0	0.7	2.955	1.16	0.96	8
1371.6	114	6.6	5.9	33.7	2.456	-0.2	00.0	93.9	95.0	30.3	91.2	SD	2.680	95.0	93.9	1.0	2.943	1.16	0.96	8
1371.8	114	7.0	6.4	32.5	2.452	-0.2	00.0	90.3	87.9	29.7	87.5	SD	2.680	90.3	90.3	1.6	2.930	1.16	0.96	8
1371.9	111	7.3	6.1	30.8	2.444	-0.2	00.0	90.7	90.3	29.3	81.2	SN	2.650	90.7	90.7	2.9	2.908	0.00	0.00	8

Complex Lithology Results 24-10-94

Zone No. 5

Hydrocarbon Volume Report

FROM	M	1347.978
TO	M	1371.905
INTERVAL	M	23.927
PHIE Cut off		0.050
SW Cut Off		0.500
Vclay Cut Off		0.300
Net Pay	M	5.029
Average PHIE	%	23.081
Average SW	%	17.943
Average Vclay	%	8.814
Integrated PHI	M	1.161
Sum PHI*(1-SW)	M	0.955

Hydrocarbon Volume Report

ZONE #	1	2	3	4	5	6	7	8
FROM M	1160.069	1260.043	1296.924	1316.431	1347.978	1371.905	1401.470	1438.504
TO M	1260.043	1296.924	1316.431	1347.978	1371.905	1398.575	1438.504	1627.937
INTERVAL M	99.974	36.881	19.507	31.547	23.927	26.670	37.033	189.433
PHIE Cut off	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
SW Cut Off	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500
Vclay Cut Off	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300
Net Pay M	0.000	0.000	0.000	27.584	5.029	0.000	0.000	0.000
Average PHIE %	n/a	n/a	n/a	23.808	23.081	n/a	n/a	n/a
Average SW %	n/a	n/a	n/a	16.705	17.943	n/a	n/a	n/a
Average Vclay %	n/a	n/a	n/a	5.293	8.814	n/a	n/a	n/a
Integrated PHI M	n/a	n/a	n/a	6.567	1.161	n/a	n/a	n/a
Sum PHI*(1-SW) M	n/a	n/a	n/a	5.479	0.955	n/a	n/a	n/a

n/a denotes not applicable due to net pay being zero