PETROLEUM GEOLOGY AND GEOCHEMISTRY

# BMR

GEOLOGY AND GEOPHYSICS

AUSTRALIA

# NORTHWEST SHELF

AUSTRALIA

VOLUME 2
WELL SUMMARY REPORTS PART 2

CONSTITUTION AVE. CANBERRA ACT 2601

BMR record 1990/82

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## PEPPER-1 WELL


### SUMMARY

Geochemical analysis of the interval 1073m to 2616m of the Pepper-1 well shows that the well section is immature to 1150m, early mature between 1150m and 1800m and middle mature between 1800m and 2743m TD. The maturity gradients do not show any major amounts of missing section at unconformities within the section analysed. Extrapolation of the gradients to the seabed also suggests that around 800m of Early Cretaceous and younger sediments are missing above 1073m and that the sediments penetrated are presently at or near their maximum depths of burial.

The intervals 1945m to 2058m in the Barrow Group and 2607m to 2616m in the Upper Dingo Claystone have fair and poor oil source potential respectively. Mudstones in the interval 1073m to 1241m in the Muderong Shale will have poor gas source potential at optimum maturity.

Extraction of samples at 1659m to 1674m, 1945m to 1951m, 2369m to 2387m and 2445m to 2460m yielded migrant hydrocarbons derived from mature waxy kerogens which were deposited under strongly anoxic conditions.


### GENERAL COMMENTS

Basin: Northern Carnarvon Basin.

Location: 115° 18' 04"E, 21° 03' 28"S.

Operator and date of drilling: West Australian Petroleum Pty Ltd, 1970.

Well Status: Plugged and abandoned with gas shows.

TD: 2743m.

Mud data: Sea water system: Seabed to 1327m.
Sea water/gel system: 1327m to 2743m TD.

Casing data: 26" at 47.5m, 13 5/8" at 463m, 9 5/8" at 1314m, 7" at 2600m.

BHT data: 75°C at 1327m, after 3½ hours stopped circulation.
110°C at 2607m, after 5 hours stopped circulation.

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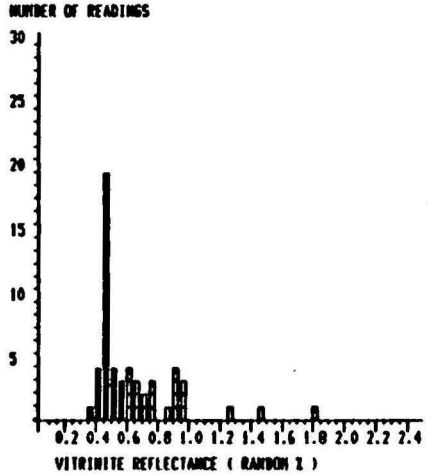
OBSERVATION-1

SAMPLE 1997-2012M

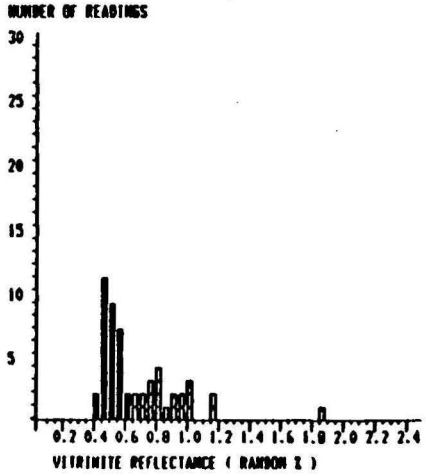
0.39 0.41 0.42 0.43 0.44 0.45 0.45 0.46 0.46 0.46
0.47 0.47 0.47 0.48 0.48 0.48 0.48 0.48 0.48 0.49 0.49
0.49 0.49 0.49 0.49 0.50 0.50 0.53 0.53 0.56 0.56
0.58 0.62 0.62 0.64 0.64 0.66 0.67 0.68 0.71 0.73
0.77 0.77 0.79 0.86 0.92 0.92 0.93 0.94 0.95 0.96
0.96 1.26 1.45 1.82




| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.39-0.58 | 31 | 0.48 | 0.04 |
| INERTINITE/REWORKED | 0.62-1.82 | 23 | 0.88 | 0.29 |

SAMPLE 2162-2171M

0.40 0.42 0.45 0.45 0.46 0.46 0.46 0.47 0.47 0.48
0.48 0.48 0.49 0.50 0.50 0.50 0.51 0.51 0.51 0.52
0.53 0.54 0.55 0.56 0.57 0.57 0.58 0.58 0.59 0.60
0.61 0.65 0.67 0.70 0.71 0.76 0.76 0.77 0.80 0.80
0.82 0.83 0.89 0.90 0.91 0.96 0.97 1.00 1.00 1.02
1.16 1.17 1.85




| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.40-0.61 | 31 | 0.51 | 0.05 |
| INERTINITE/REWORKED | 0.65-1.85 | 22 | 0.91 | 0.25 |

Appendix 2

PEPPER-1 WELL

Interval analysed: 1073m to 2616m.

Age of interval analysed:

| | Depths (in metres) |
|---|---|
| Early Cretaceous | 1073-2391 |
| Late Jurassic | 2391-2616 |

Sample type and quality: Dried ditch cuttings of good quality for geochemical analysis.

Maturation data quality:

a) Vitrinite Reflectance: The samples yielded small quantities of indigenous vitrinite and considerable reworked and/or contaminant vitrinite. Results: Fair.

b) Spore Colour Index: The samples yielded sufficient quantities of indigenous sporomorphs for accurate measurement. Results: Good.

Source rock data quality: Poor.

Gas chromatography run at: 1256m to 1265m, 1659m to 1674m, 1860m to 1863m, 1945m to 1951m, 2369m to 2387m and 2445m to 2460m.

MATURATION (Table 1, Figures 1 ad 2, Appendices 1 and 2).

Vitrinite reflectance values over the interval analysed increase from an interpreted value of around 0.40% at 1073m to 0.70% at 2616m. Spore colour index values increase steadily over the same interval from 3 to 3.5 SCI units to 6.5 to 7 SCI units. Interpretation of both vitrinite reflectance and spore colour index maturity gradients indicates that the interval analysed is immature to a depth of about 1150m, early mature between 1150m and 1800m, and middle mature below 1800m to 2743m TD. Both sets of data suggest that there are no major erosional unconformities in the interval analysed. Extrapolation of the interpreted gradients to the seabed suggests that around 800m of Early Cretaceous and younger section is missing above 1073m and that the sediments penetrated are presently at or near their maximum depths of burial.

OIL AND GAS SOURCE ROCKS (Tables 1 and 2, Figure 3)

Preliminary analysis of samples showed them to contain heavy migrant oil residues. TOC and rock-eval pyrolysis were therefore run on extracted residues.

Samples in the intervals 1945m to 2058m and 2607m to 2616m in the Barrow Group and Upper Dingo Claystone respectively contain average organic carbon contents of between 1.22% and 1.76%. Pyrolysis analysis of these samples shows that they contain small quantities of oil-prone kerogen. The mudstones in these intervals have fair and poor oil source potential respectively. Organically rich mudstones in the interval 1073m to 1241m in the Muderong Shale with TOC contents of between 2.00% and 2.90% may have poor gas source potential at optimum maturity.

GEOCHEMICAL CHARACTERISTICS OF THE REMAINING SEDIMENTS (Tables 1 and 2, Figure 3)

The remaining mudstones analysed in the intervals 1588m to 1863m and 2213m to 2460m contain average organic carbon content of between 0.82% and 1.76%. Pyrolysis analysis of these samples shows that they contain only humic kerogens and therefore have no oil source potential. They are too organically lean to have significant gas source potential.

Extraction, fractionation and gas chromatography analysis of samples at 1659m to 1674m, 1945m to 1951m, 2369m to 2387m and 2445m to 2460m shows that these samples contain migrant hydrocarbons derived from a mature source containing mostly waxy kerogens. The high phytane content relative to pristane suggests that the kerogens were deposited in strongly anoxic conditions. These extracts may also represent small quantities of a crude oil like contaminant possibly added whilst drilling.

WELL: PEPPER-1

| SAMPLE DEPTH (METRES) | SAMPLE TYPE | GENERALISED LITHOLOGY | SPORE COLOUR INDEX (1-10) | VITRINITE REFLECTIVITY (R oil av %) | KEROGEN COMPOSITION (% vol) (By microscopic examination) | | | KEROGEN COMPOSITION (% wt) (By calculation from pyrolysis data) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | INERTINITE | VITRINITE | SAPROPEL | INERTINITE | VITRINITE | ALGAL SAPROPEL | WAXY SAPROPEL |
| **1039.4** | | **Muderong Shale** | | | | | | | | | |
| 1073-1088 | Ctg | MDST, med gy | 3.0-3.5 | 0.45(12) | 75 | 25 | mnr | 55 | 40 | * | 5 |
| 1137-1152 | " | MDST, med gy | | | | | | 55 | 40 | * | 5 |
| 1195-1210 | " | MDST, med gy | | | | | | | | | |
| | " | After extraction | | | | | | 60 | 40 | * | * |
| **1234.1** | | **Hardie Greensand Mbr** | | | | | | | | | |
| 1226-1241 | " | MDST, a/a | 3.5 | 0.44(23) | 60 | 35 | 5 | 65 | 35 | * | * |
| **1256.7** | | **Barrow Gp** | | | | | | | | | |
| 1588-1601 | " | MDST, yel-gy, calc | 4.5-5.0 | 0.39(8)cvd | 40 | 50 | 10 | | | | |
| 1659-1674 | " | MDST, yel gy, calc | | | | | | | | | |
| | " | After extraction | | | | | | 40 | 50 | * | 10 |
| 1860-1863 | " | MDST, yel gy, sl calc | ?6.0rew | ?0.55(1) | 60 | 40 | mnr | | | | |
| | " | After extraction | | | | | | 50 | 50 | * | * |
| 1945-1951 | " | MDST, lt ol gy | | | | | | | | | |
| | " | After extraction | | | | | | 50 | 40 | * | 10 |
| 1997-2006 | " | MDST, lt ol-gy | 5.0-6.0 | 0.39(9)cvd | 65 | 20 | 15 | | | | |
| | " | After extraction | | | | | | 60 | 30 | * | 10 |
| 2213-2223 | " | MDST, lt ol gy | 5.5-6.0 | * | 35 | 60 | 5 | | | | |
| | " | After extraction | | | | | | 35 | 60 | * | 5 |
| 2369-2387 | " | MDST, a/a + 60% MDST, med gy + 10% SND | 6.0-6.5 | 0.56(5) | 30 | 65 | 5 | | | | |
| | P | MDST, med gy | | | | | | | | | |
| | P | After extraction | | | | | | 25 | 75 | * | * |
| **2391.1** | | **Upper Dingo Claystone : Dupuy Sandstone Mbr** | | | | | | | | | |
| 2445-2460 | Ctg | MDST, yel-gy | 6.0-6.5 | 0.65(6) | 40 | 30 | 30 | | | | |
| 2607-2616 | " | MDST, yel-gy, sl calc + 40% MDST, med gy | 6.5-7.0 | 0.71(5) | 30 | 60 | 10 | | | | |
| | P | MDST, yel-gy, sl calc | | | | | | | | | |
| | P | After extraction | | | | | | 25 | 65 | * | 10 |

Table 1 Maturity and Kerogen Composition Data

WELL: PEPPER-1

| GENERAL DATA | | | CHEMICAL ANALYSIS DATA | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PYROLYSIS | | | | | SOLVENT EXTRACTION | | | | | | |
| | | | | | | | | | | | | | EXTRACT COMPOSITION [%] | | |
| SAMPLE DEPTH (METRES) | SAMPLE TYPE | ANALYSED LITHOLOGY | ORGANIC CARBON % OF ROCK | TEMPERATURE C | HYDROGEN INDEX | OXYGEN INDEX | PRODUCTION INDEX | POTENTIAL YIELD (kg Tonne) | TOTAL EXTRACT (ppm) | TOTAL EXTRACT (mg g TOC) | HYDROCARBONS (ppm) | HYDROCARBONS (mg g TOC) | SATURATED HYDROCARBONS | AROMATIC HYDROCARBONS | POLAR COMPOUNDS |
| **1039.4** | | **Muderong Shale** | | | | | | | | | | | | | |
| 1073-1088 | Ctg | MDST, med gy | 2.90 | 420 | 133 | 42 | 0.06 | 4.11 | | | | | | | |
| 1137-1152 | " | MDST, a/a | 2.15 | 420 | 135 | 62 | 0.07 | 3.14 | | | | | | | |
| 1195-1210 | " | MDST, a/a | 2.15 | 421 | 169 | 58 | 0.07 | 3.90 | | | | | | | |
| | " | After extraction | 2.07 | 424 | 105 | 59 | 0.02 | 2.21 | | | | | | | |
| **1234.1** | | **Hardie Greensand Mbr** | | | | | | | | | | | | | |
| 1226-1241 | " | MDST, a/a | 2.00 | 416 | 86 | 54 | 0.09 | 1.87 | | | | | | | |
| **1256.7** | | **Barrow Gp** | | | | | | | | | | | | | |
| 1256-1265 | " | SST, wht + 10% MDST, yel-gy | 0.58 | | | | | | 950 | 164 | 270 | 47 | 24 | 4 | 72 |
| 1588-1601 | " | MDST, yel-gy, calc | 0.82 | | | | | | | | | | | | |
| 1659-1674 | " | MDST, a/a, calc | 1.62 | 425 | 281 | 162 | 0.27 | 6.26 | 2340 | 144 | 1450 | 90 | 59 | 3 | 38 |
| | " | After extraction | 1.53 | 426 | 147 | 170 | 0.08 | 2.45 | | | | | | | |
| 1860-1863 | " | MDST, a/a, sl calc | 1.31 | 423 | 293 | 186 | 0.27 | 5.27 | 2105 | 161 | 1080 | 82 | 47 | 4 | 49 |
| | " | After extraction | 1.23 | 426 | 102 | 185 | 0.07 | 1.34 | | | | | | | |
| 1945-1951 | " | MDST, lt ol-gy | 1.50 | 421 | 277 | 125 | 0.28 | 5.76 | 2185 | 146 | 1120 | 75 | 47 | 4 | 49 |
| | " | After extraction | 1.46 | 427 | 140 | 114 | 0.06 | 2.18 | | | | | | | |
| 1997-2006 | " | MDST, a/a | 1.73 | 422 | 268 | 172 | 0.29 | 6.56 | | | | | | | |
| | " | After extraction | 1.48 | 428 | 128 | 185 | 0.07 | 2.04 | | | | | | | |
| 2213-2223 | " | MDST, a/a | 1.87 | 426 | 252 | 126 | 0.20 | 5.90 | | | | | | | |
| | " | After extraction | 1.76 | 428 | 125 | 134 | 0.04 | 2.29 | | | | | | | |
| 2369-2387 | " | MDST, a/a + 60% MDST, med gy + 10% SND | 1.35 | | | | | | 7090 | 525 | 2770 | 205 | 35 | 4 | 61 |
| | P | MDST, a/a | 1.65 | 420 | 265 | 188 | 0.17 | 5.26 | | | | | | | |
| | P | After extraction | 1.38 | 424 | 136 | 206 | 0.07 | 2.01 | | | | | | | |
| | P | MDST, med gy | 1.26 | 429 | 340 | 178 | 0.12 | 4.87 | | | | | | | |
| | P | After extraction | 1.58 | 431 | 135 | 147 | 0.06 | 2.27 | | | | | | | |
| **2391.1** | | **Upper Dingo Claystone: Dupuy Sst Mbr** | | | | | | | | | | | | | |
| 2445-2460 | Ctg | MDST, yel-gy | 0.90 | | | | | | 8800 | 978 | 3350 | 372 | 35 | 3 | 62 |
| 2607-2616 | Ctg | MDST, yel-gy, sl calc + 40% MDST, med gy | - | | | | | | | | | | | | |
| | P | MDST, med gy | 0.70 | | | | | | | | | | | | |
| | P | MDST, yel-gy, sl calc | 1.43 | 432 | 145 | 57 | 0.01 | 1.79 | | | | | | | |
| | P | After extraction | 1.22 | 432 | 145 | 57 | 0.01 | 1.79 | | | | | | | |

Table 2 Chemical Analysis Data

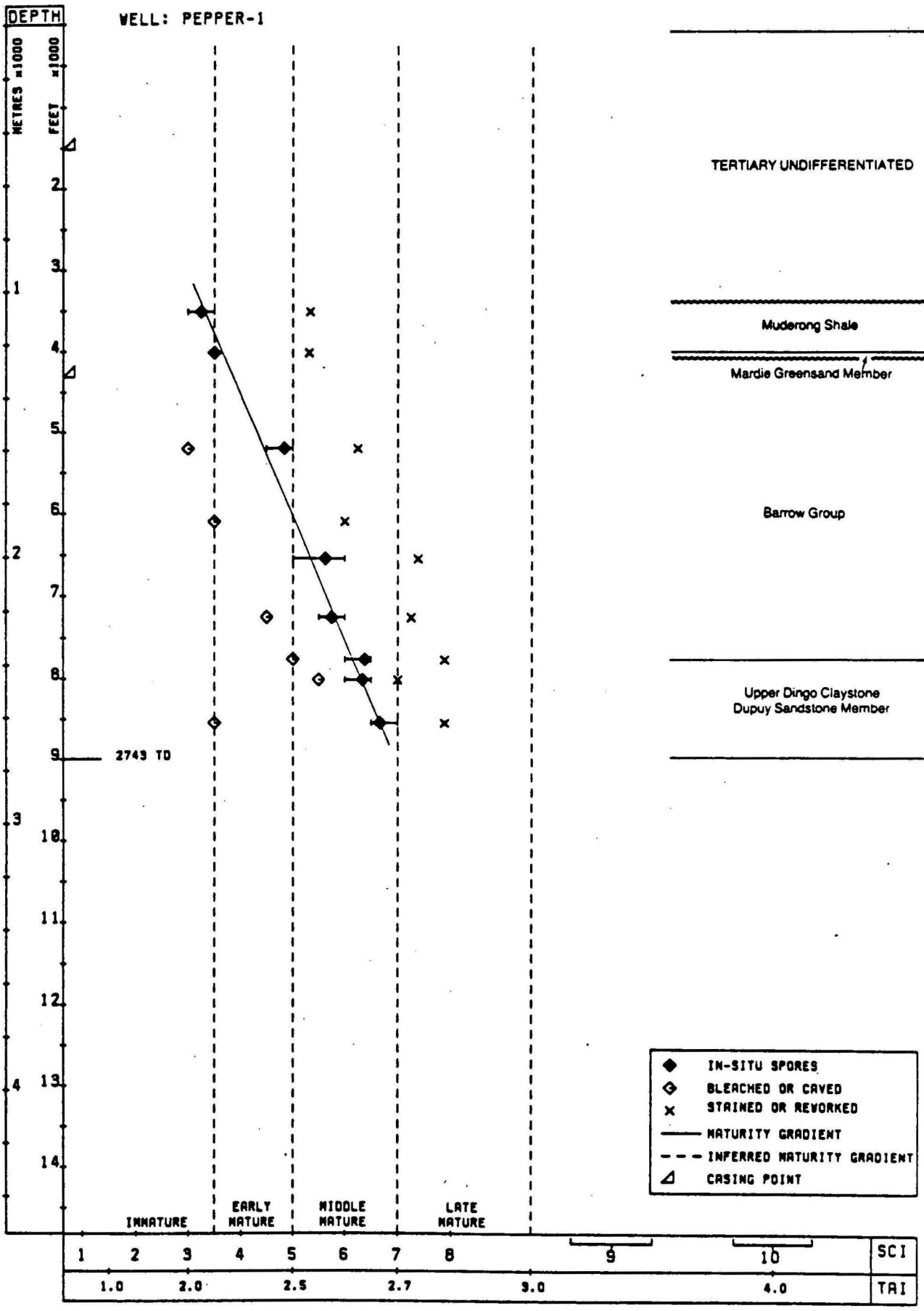



FIGURE 1 SPORE COLOUR INDEX AGAINST DEPTH

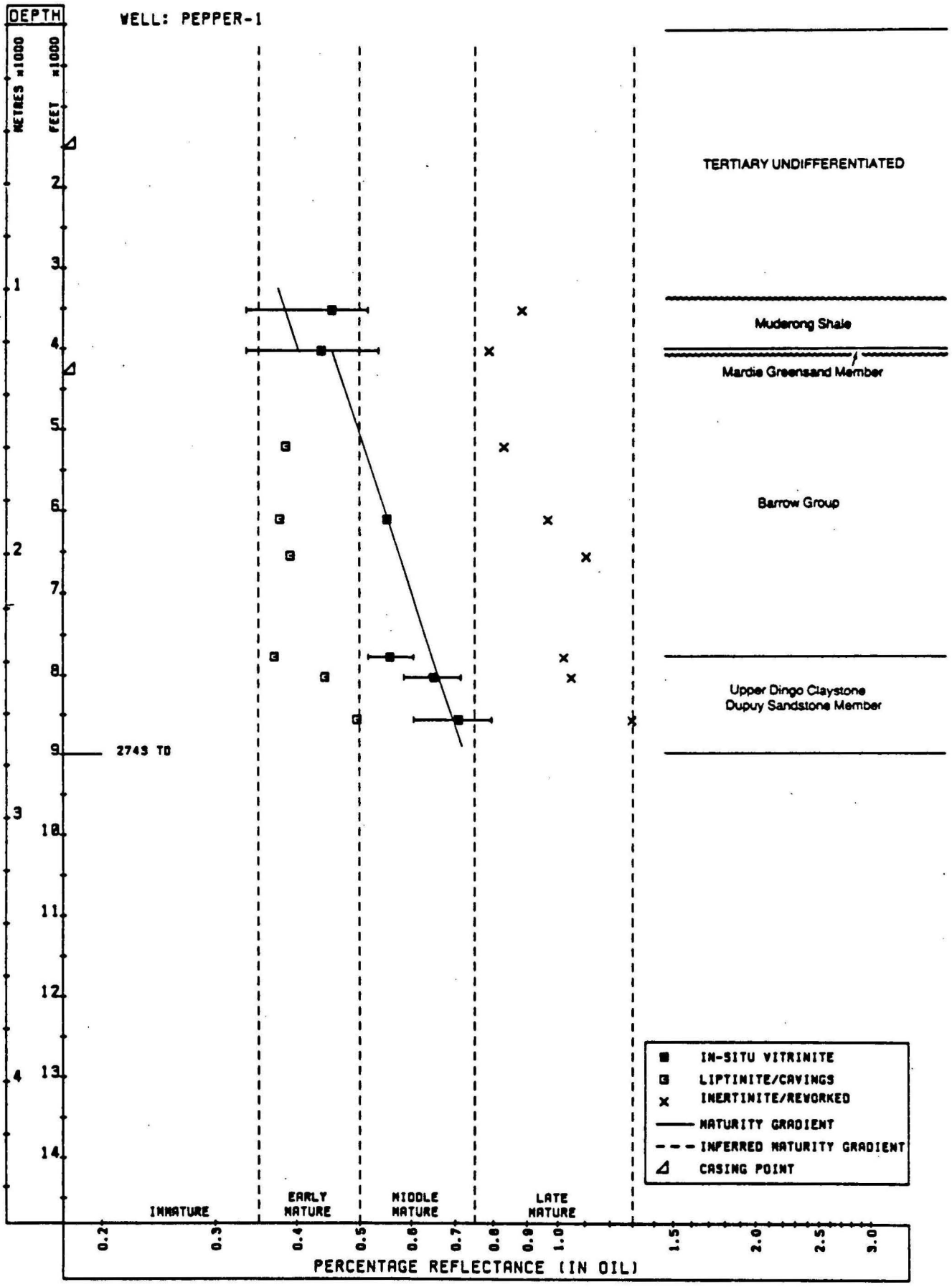
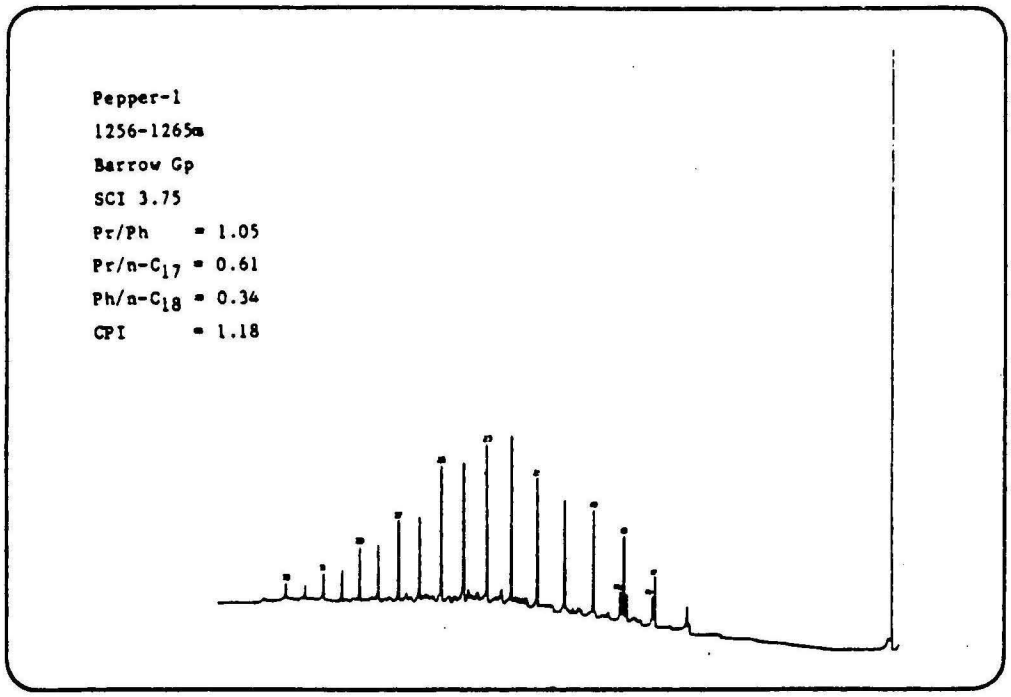
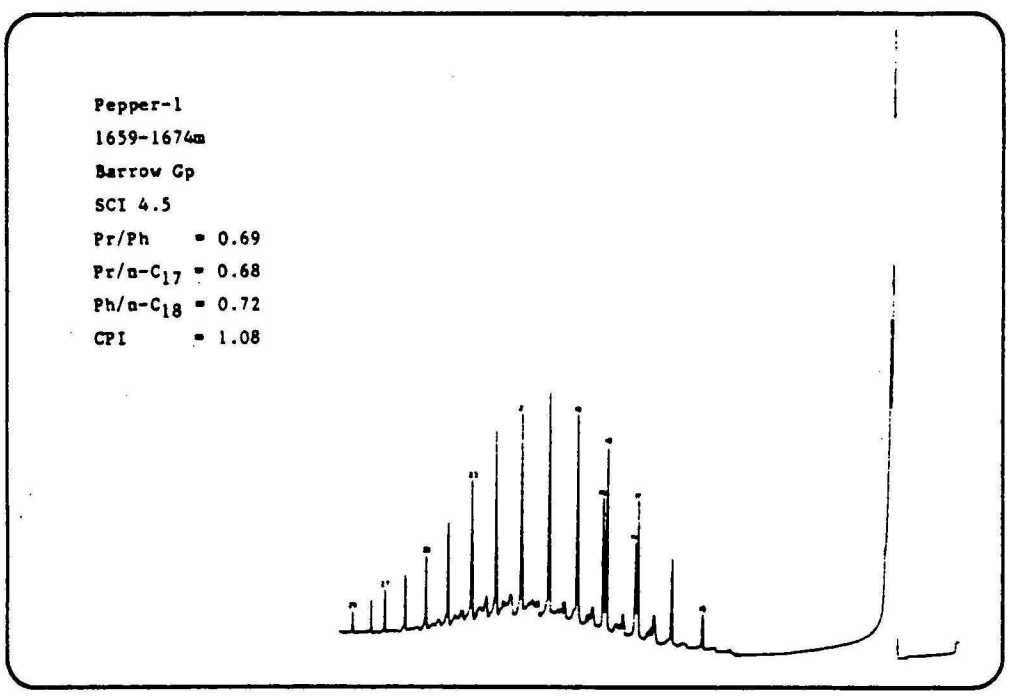



FIGURE 2 VITRINITE REFLECTANCE AGAINST DEPTH


Pepper-1
1256-1265m
Barrow Gp
SCI 3.75
Pr/Ph = 1.05
Pr/n-C17 = 0.61
Ph/n-C18 = 0.34
CPI = 1.18


Pepper-1
1659-1674m
Barrow Gp
SCI 4.5
Pr/Ph = 0.69
Pr/n-C17 = 0.68
Ph/n-C18 = 0.72
CPI = 1.08

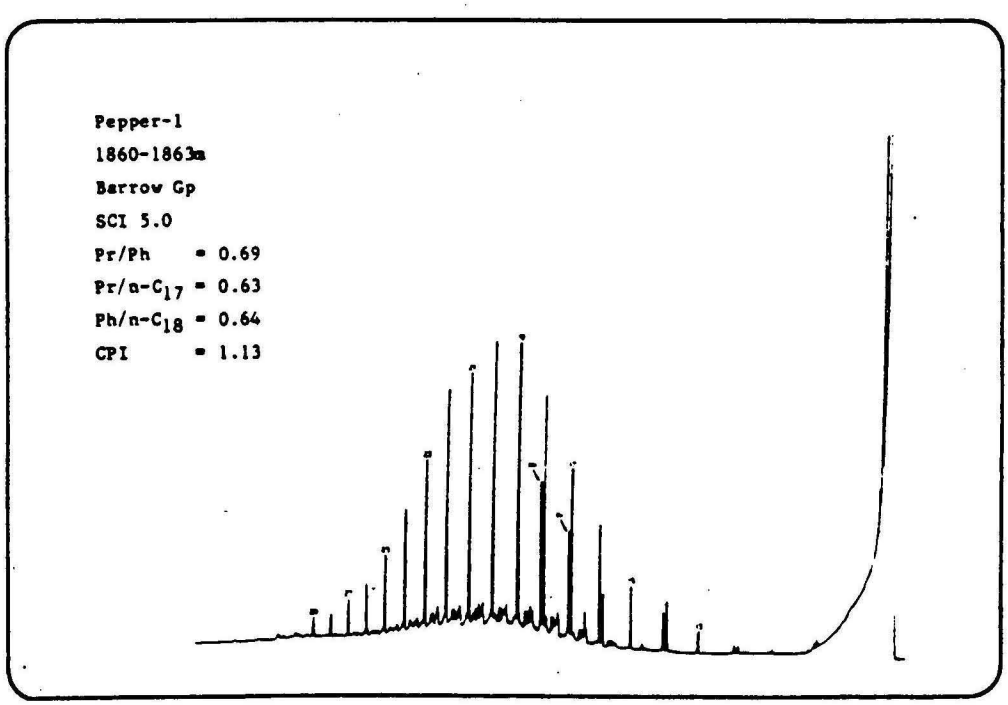
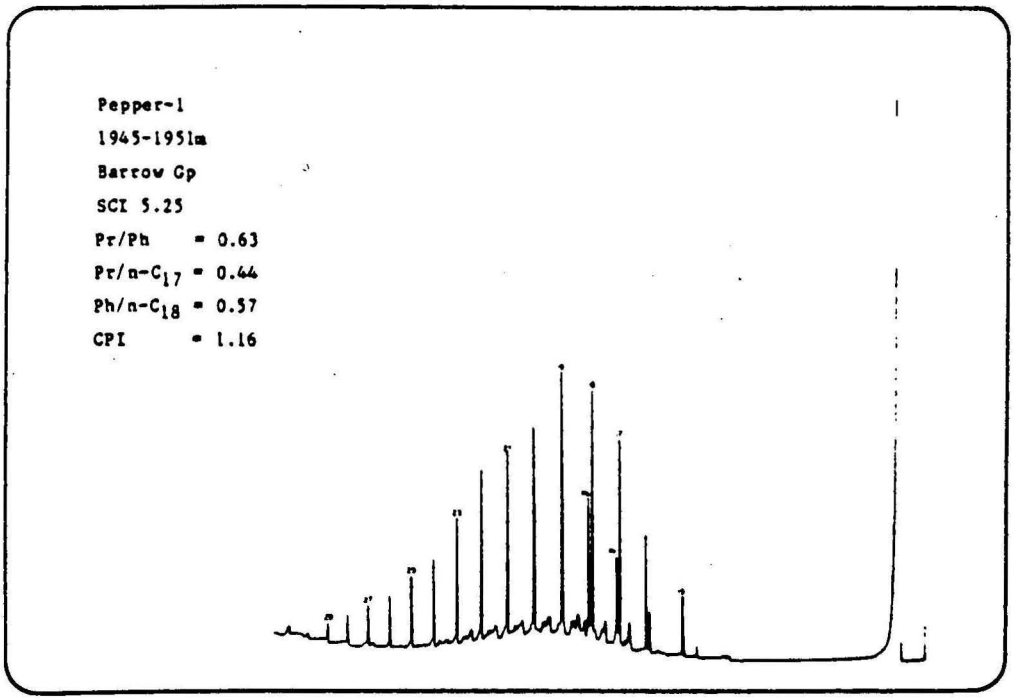
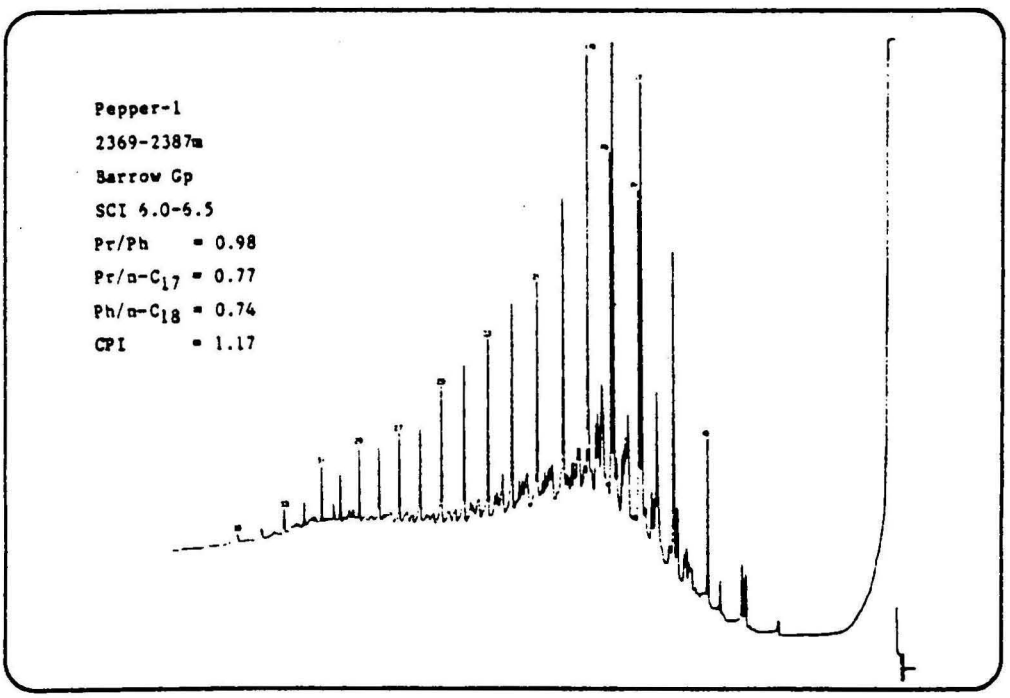

Pepper-1
1860-1863m
Barrow Gp
SCI 5.0
Pr/Ph = 0.69
Pr/n-C17 = 0.63
Ph/n-C18 = 0.64
CPI = 1.13

Figure 3a


Pepper-1
1945-1951m
Barrow Gp
SCI 5.25
Pr/Ph = 0.63
Pr/n-C17 = 0.44
Ph/n-C18 = 0.57
CPI = 1.16


Pepper-1
2369-2387m
Barrow Gp
SCI 6.0-6.5
Pr/Ph = 0.98
Pr/n-C17 = 0.77
Ph/n-C18 = 0.74
CPI = 1.17

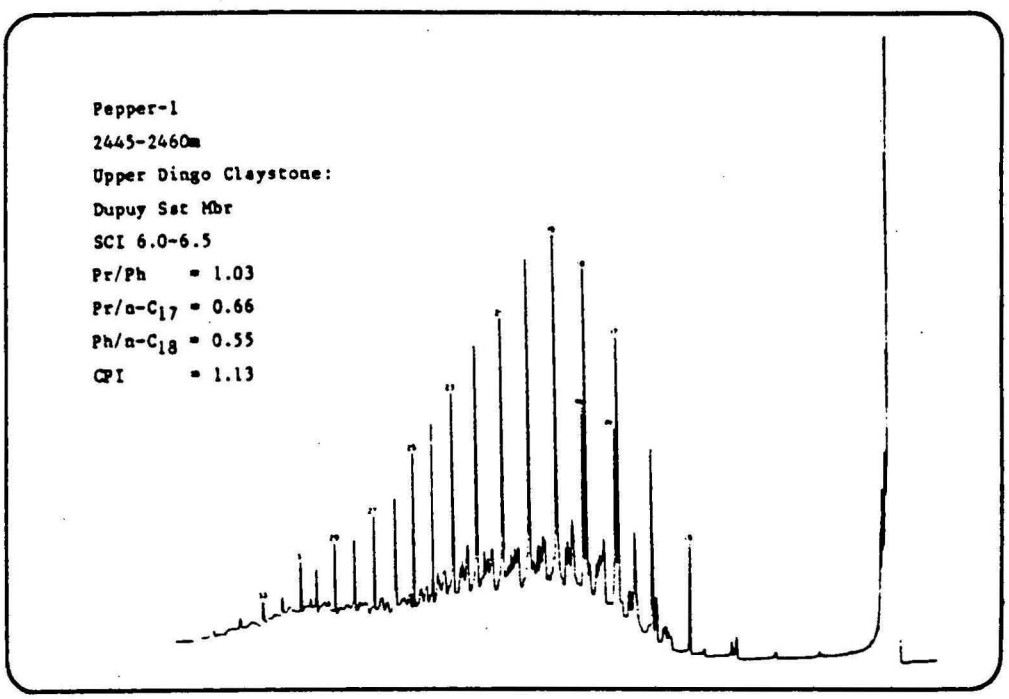

Pepper-1
2445-2460m
Upper Dingo Claystone:
Dupuy Sst Mbr
SCI 6.0-6.5
Pr/Ph = 1.03
Pr/n-C17 = 0.66
Ph/n-C18 = 0.55
CPI = 1.13

Figure 3b

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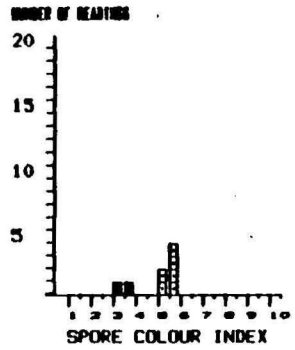
PEPPER-1

IN SITU POPULATION

SAMPLE 1073-1088M

3.0 3.5 5.0 5.0 5.5 5.5 5.5 5.5

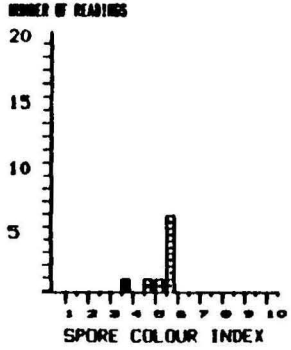
| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 3.0-3.5 | 2 |
| BLEACHED OR CAVED | - | 0 |
| STAINED OR REWORKED | 5.0-5.5 | 6 |




SAMPLE 1226-1241M

3.5 4.5 5.0 5.5 5.5 5.5 5.5 5.5 5.5

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 3.5-3.5 | 1 |
| BLEACHED OR CAVED | - | 0 |
| STAINED OR REWORKED | 4.5-5.5 | 8 |



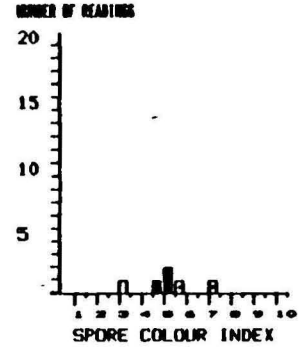

PEPPER-1

IN SITU POPULATION

SAMPLE 1588-1601M

3.0 4.5 5.0 5.0 5.5 7.0

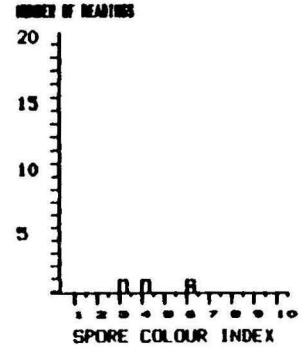
| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 4.5-5.0 | 3 |
| BLEACHED OR CAVED | 3.0-3.0 | 1 |
| STAINED OR REWORKED | 5.5-7.0 | 2 |




SAMPLE 1860-1863M

3.0 4.0 6.0

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | - | 0 |
| BLEACHED OR CAVED | 3.0-4.0 | 2 |
| STAINED OR REWORKED | 6.0-6.0 | 1 |




Appendix 1a

Robertson Research

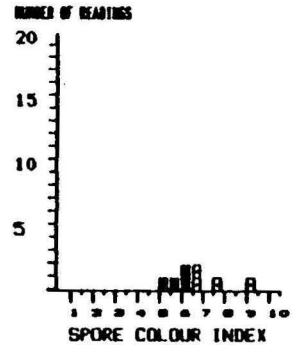
PEPPER-1

IN SITU POPULATION

SAMPLE 1997-2006M

5.0 5.5 6.0 6.0 6.5 6.5 7.5 9.0

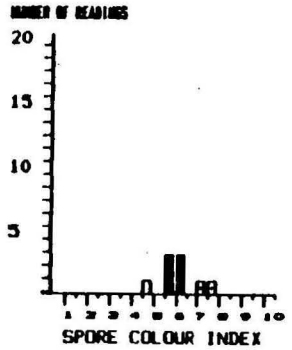
| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 5.0-6.0 | 4 |
| BLEACHED OR CAVED | - | 0 |
| STAINED OR REWORKED | 6.5-9.0 | 4 |




SAMPLE 2213-2223M

4.5 5.5 5.5 5.5 6.0 6.0 6.0 7.0 7.5

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 5.5-6.0 | 6 |
| BLEACHED OR CAVED | 4.5-4.5 | 1 |
| STAINED OR REWORKED | 7.0-7.5 | 2 |



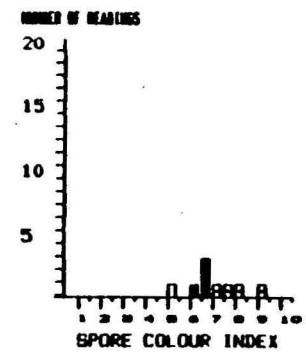

PEPPER-1

IN SITU POPULATION

SAMPLE 2369-2387M

5.0 6.0 6.5 6.5 6.5 7.0 7.5 8.0 9.0

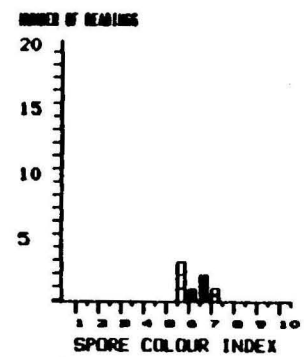
| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 6.0-6.5 | 4 |
| BLEACHED OR CAVED | 5.0-5.0 | 1 |
| STAINED OR REWORKED | 7.0-9.0 | 4 |




SAMPLE 2445-2460M

5.5 5.5 5.5 6.0 6.5 6.5 7.0

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 6.0-6.5 | 3 |
| BLEACHED OR CAVED | 5.5-5.5 | 3 |
| STAINED OR REWORKED | 7.0-7.0 | 1 |




Appendix 1b

Robertson Research

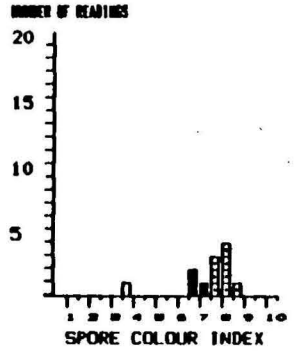
PEPPER-1

IN SITU POPULATION

SAMPLE 2607-2616M

3.5 6.5 6.5 7.0 7.5 7.5 7.5 8.0 8.0 8.0 8.0 8.5

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 6.5-7.0 | 3 |
| BLEACHED OR CAVED | 3.5-3.5 | 1 |
| STAINED OR REWORKED | 7.5-8.5 | 8 |




Appendix 1c

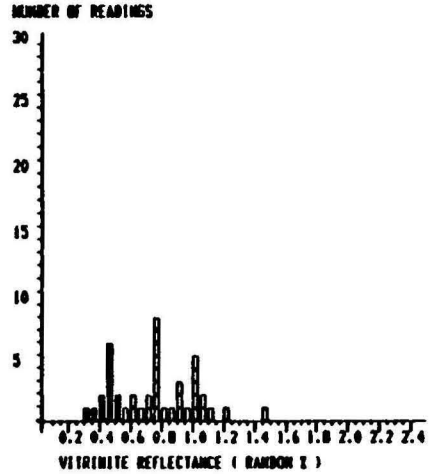
Robertson Research

PEPPER-1

SAMPLE 1073-1089M

0.34 0.39 0.41 0.43 0.46 0.47 0.48 0.48 0.48 0.49
0.50 0.51 0.58 0.61 0.64 0.68 0.72 0.72 0.75 0.75
0.76 0.76 0.76 0.77 0.77 0.79 0.84 0.87 0.90 0.93
0.94 0.97 1.00 1.01 1.01 1.01 1.02 1.05 1.06 1.10
1.22 1.45

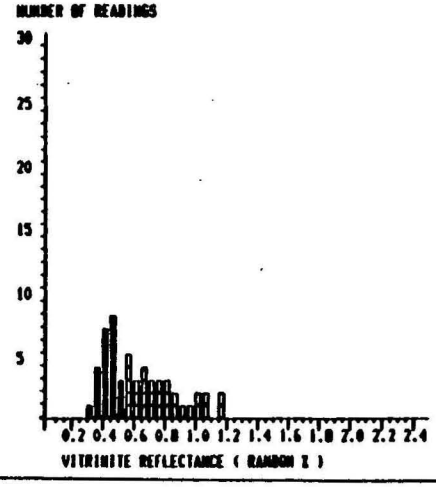
| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.34-0.51 | 12 | 0.45 | 0.05 |
| INERTINITE/REWORKED | 0.58-1.45 | 30 | 0.88 | 0.19 |




SAMPLE 1226-1241M

0.34 0.35 0.35 0.38 0.38 0.40 0.40 0.41 0.41 0.41
0.42 0.42 0.45 0.46 0.47 0.48 0.49 0.49 0.49 0.49
0.51 0.51 0.53 0.55 0.55 0.57 0.58 0.58 0.60 0.62
0.63 0.66 0.66 0.67 0.67 0.72 0.73 0.74 0.75 0.75
0.76 0.81 0.82 0.82 0.88 0.89 0.93 0.96 1.01 1.03
1.05 1.09 1.15 1.16

| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.34-0.53 | 23 | 0.44 | 0.06 |
| INERTINITE/REWORKED | 0.55-1.16 | 31 | 0.79 | 0.18 |



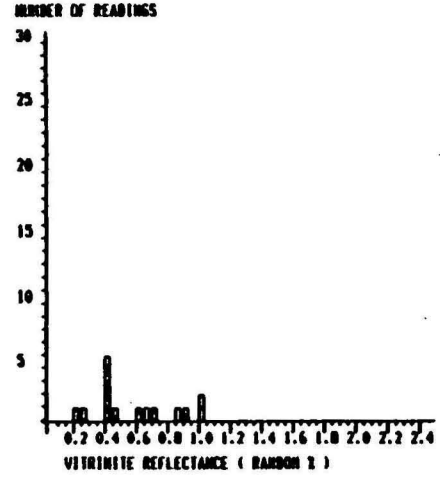

Appendix 2a

PEPPER-1

SAMPLE 1500-1601M

0.24 0.26 0.41 0.42 0.43 0.43 0.44 0.45 0.62 0.65
0.73 0.85 0.90 1.02 1.03

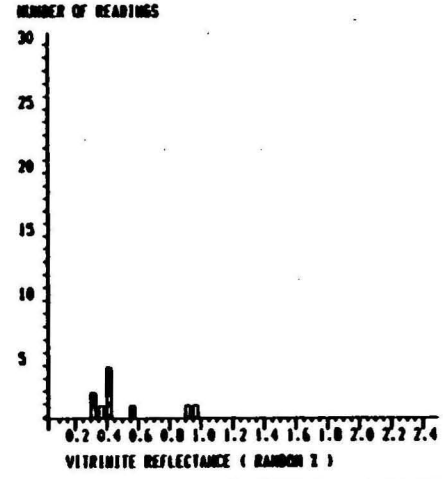
| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| LIPTINITE/CAVINGS | 0.24-0.45 | 8 | 0.39 | 0.08 |
| INERTINITE/REWORKED | 0.62-1.03 | 7 | 0.83 | 0.17 |




SAMPLE 1860-1863M

0.30 0.34 0.37 0.40 0.40 0.41 0.42 0.55 0.94 0.99

| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.55-0.55 | 1 | 0.55 | |
| LIPTINITE/CAVINGS | 0.30-0.42 | 7 | 0.38 | 0.04 |
| INERTINITE/REWORKED | 0.94-0.99 | 2 | 0.97 | 0.04 |



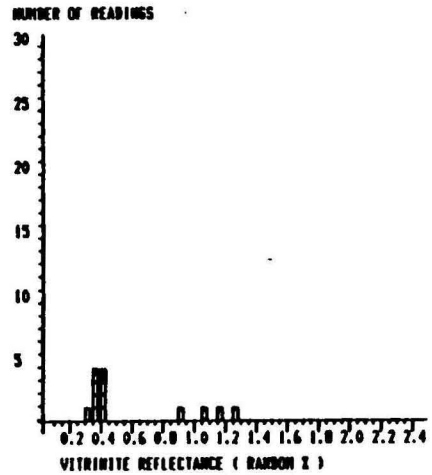
Robertson Research

PEPPER-1

SAMPLE 1997-2006M

0.33 0.35 0.37 0.37 0.38 0.42 0.43 0.43 0.44 0.90
1.09 1.16 1.26

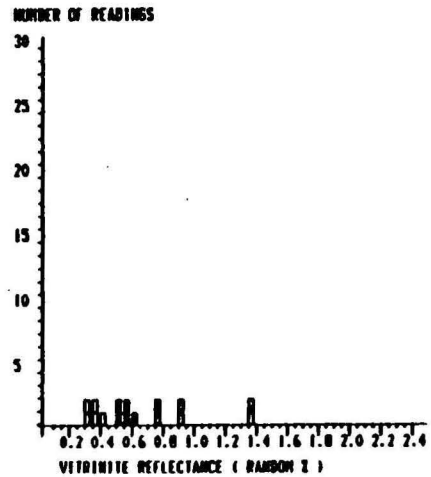
| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| LIPTINITE/CAVINGS | 0.33-0.44 | 9 | 0.39 | 0.04 |
| INERTINITE/REWORKED | 0.90-1.26 | 4 | 1.10 | 0.15 |




SAMPLE 2369-2387M

0.33 0.34 0.36 0.39 0.43 0.52 0.53 0.56 0.57 0.60
0.76 0.79 0.90 0.94 1.36 1.37

| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.52-0.60 | 5 | 0.56 | 0.03 |
| LIPTINITE/CAVINGS | 0.33-0.43 | 5 | 0.37 | 0.04 |
| INERTINITE/REWORKED | 0.76-1.37 | 6 | 1.02 | 0.20 |

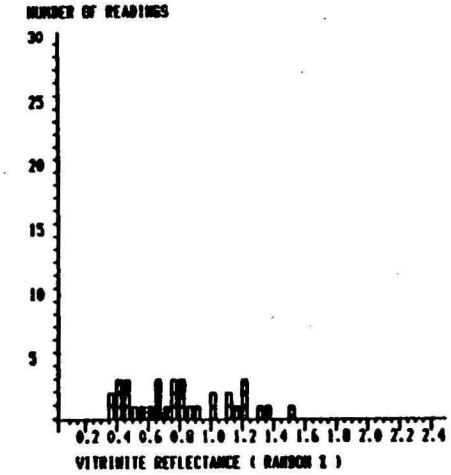



PEPPER-1

SAMPLE 2445-2460M

0.36 0.38 0.42 0.43 0.44 0.48 0.48 0.48 0.51 0.59
0.60 0.65 0.66 0.69 0.71 0.75 0.77 0.79 0.82 0.82
0.83 0.85 0.91 1.00 1.01 1.10 1.14 1.19 1.20 1.23
1.24 1.33 1.36 1.54

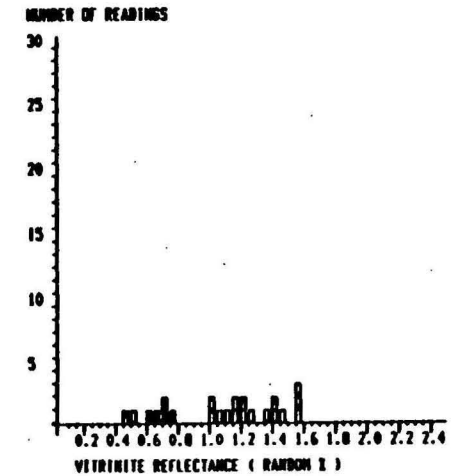
| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.59-0.71 | 6 | 0.65 | 0.05 |
| LIPTINITE/CAVINGS | 0.36-0.51 | 9 | 0.44 | 0.05 |
| INERTINITE/REWORKED | 0.75-1.54 | 19 | 1.05 | 0.23 |




SAMPLE 2607-2616M

0.47 0.52 0.61 0.69 0.72 0.73 0.79 1.00 1.03 1.08
1.13 1.17 1.19 1.20 1.24 1.27 1.37 1.41 1.43 1.46
1.55 1.58 1.59

| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.61-0.79 | 5 | 0.71 | 0.07 |
| LIPTINITE/CAVINGS | 0.47-0.52 | 2 | 0.50 | 0.04 |
| INERTINITE/REWORKED | 1.00-1.59 | 16 | 1.29 | 0.19 |



# PICARD-1 WELL

## SUMMARY

Geochemical analysis of the interval 534m to 4216m TD of the Picard-1 well shows that the well section is immature to 1850m, early mature between 1850m and 2900m and reaches middle maturity at 2900m. Extrapolation of the maturity gradients to surface indicates that the sediments penetrated in the well section are at or near their maximum burial depths. Extrapolation of the vitrinite reflectance gradient to the surface indicates possibly a cumulative total of 800m of missing Tertiary section above 1524m. The reference gradient also indciates 600m of missing Jurassic to Cretaceous section at 2325m and 500m of Early to Late Cretaceous section is missing at the unconformity at 2038m.

The intervals 2588m to 2942m in the Learmonth Formation and 3256m to 3860m in the Learmonth Formation and Lower Dingo Claystone have good and very good oil source potential and poor to fair gas source potential respectively. The deeper interval is presently middle mature and will have already generated significant quantities of oil.

## GENERAL COMMENTS

Basin: Northern Carnarvon Basin.

Location: 18° 57' 59.7"S, 117° 37' 20.4"E.

Operator and date of drilling: Bocal, 1972.

Well Status: Plugged and abandoned.

TD: 4216m.

Mud data: Seawater/gel and seawater/gel/polymer mud system: Seabed to 1686.5m.
Seawater/gel/Dextrid system: 1686.5m to 4216m TD.
2% to 5% oil added below 1588.5m.

Casing data: 30" at 175m, 20" at 430m, $13^3/_8$" at 1673m, $9^5/_8$" at 2328m.

BHT data: 55°C at 1683m, stopped circulation time unknown.
67.5°C at 2336m, stopped circulation time unknown.
119°C at 4003m, stopped circulation time unknown.
122.5°C at 4210m, stopped ciruculation time unknown.

PICARD-1 WELL

Elevation: RT 9.5m ASL.

Water depth: 141m.

Interval analysed: 534m to 4216m TD.

Age of interval analysed:

| | Depths (in metres) |
|---|---|
| Tertiary | 534 -1891 |
| Late Cretaceous | 1891 -2038.5 |
| Early-Late Cretaceous | 2038.5-2077 |
| Early Cretaceous | 2077 -2325 |
| Early-Middle Jurassic | 2325 -3615 |
| Early Jurassic | 3615 -4216 TD |

Sample type and quality: Dried ditch cuttings and core pieces of generally good quality for geochemical analysis. Sample quality was poor to fair between 1677m to 1707m, 1753m to 1905.5m, 2058m to 2241m and 2780.5 to 3433m. Samples analysed in Phase II were of good quality.

Maturation data quality:

a) Vitrinite Reflectance: The results used are taken from the Phase I study, data quality unknown.

b) Spore Colour Index: The results used are taken from the Phase I study, data quality unknown.

Source rock data quality: The bulk of the results used have been taken from the Phase I study, data quality for these samples is unknown. Data for samples analysed in the Phase II study are good.

Gas chromatography run at: 2588m to 2601m, 2930m to 2942m and 3360m to 3372m.

MATURATION (Table 1, Figures 1 and 2)

Spore colour index values are interpreted as rising steadily from around 3 to 3.5 units at 1524m to around 6 to 6.5 units at 4212m. Extrapolation of the spore colour index gradient to the surface indicates that the sediments drilled in the well section are presently at or near their maximum depths of burial.

The vitrinite reflectance gradient increases from around 0.4% at 1524m to around 0.75% at 4212m. There is marked non-linearity in the gradient between 2150m and 2350m due to overpressuring, but possibly also compounded by small discontinuities in the gradient across the unconformities at 2077m and 2325m. Extrapolation of the reflectance gradient to the surface indicates that a cumulative total of 800m of Tertiary section is missing above 1524m. The reflectance gradient also indicates 600m of missing Jurassic to Cretaceous section and 500m of missing Early to Late Cretaceous section at the unconformities at 2325m and 2038m respectively.

The results show the well section is immature to around 1850m, early mature between 1850m and 2900m and middle mature from 2900m to 4216m TD.

## OIL AND GAS SOURCE ROCKS (Tables 1 and 2, Figure 3)

The Early to Middle Jurassic section below 2325m contains interbedded argillaceous siltstones, mudstones and sandstones. The mudstones and siltstones contain mostly inertinitic kerogen but are organically rich containing between 2.01% and 6.56% organic carbon. Mudstone and siltstone interbeds in the intervals 2588m to 2942m and 3256m to 3860m contain significant quantities of waxy sapropel with moderate hydrogen indices of between 90 and 191, which associated with low oxygen indices, indicates good to very good oil source potential and poor to fair gas source potential respectively. Sediments in the lower interval are middle mature and will already have generated significant quantities of oil.

Extraction, fractionation and gas chromatography analysis of potential source rocks at 2588m to 2601m, 2930m to 2942m and 3360m to 3372m shows the samples to contain moderate quantities of indigenous extract derived from early mature waxy sapropel at 2588m to 2601m and 2930m to 2942m. The sample at 3360m to 3372m contains a mature extract derived from a source rich in waxy sapropel. This extract may be indigenous but could also represent small quantities of oil stain.

## GEOCHEMICAL CHARACTERISTICS OF THE REMAINING SEDIMENTS (Tables 1 and 2, Figure 3)

Samples from the Tertiary section contain below average to average content of organic carbon (0.06% to 1.48%). Pyrolysis analysis of

samples with average TOC reveals content of only humic kerogen. The Cretaceous section contains generally average to above average organic carbon contents of between 0.25% and 3.37%. Pyrolysis analysis of samples with higher TOC values revealed only humic kerogen content. These sediments have no oil or gas source potential.

The remaining sediments in the Middle Jurassic section between 2325m and 2588m, 2942m to 3256m and 3860m to 4216m TD, although generally organically rich, contain mostly inertinitic kerogen. These intervals have no oil source potential, but may possibly have poor gas source potential at optimum maturity.

WELL: PICARD-1

| SAMPLE DEPTH (METRES) | SAMPLE TYPE | GENERALISED LITHOLOGY | SPORE COLOUR INDEX (1-10) | VITRINITE REFLECTIVITY (R oil av %) | KEROGEN COMPOSITION (% vol) (by microscopic examination) | | | KEROGEN COMPOSITION (% wt) (by calculation from pyrolysis data) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | INERTINITE | VITRINITE | SAPROPEL | INERTINITE | VITRINITE | ALGAL SAPROPEL | WAXY SAPROPEL |
| **150.3** | | **Tertiary (undiff)** | | | | | | | | | |
| 1524-1540 | Ctg | LST, lt gy, v arg | 2.5 | * | 20 | 80 | tr | | | | |
| 1601-1616 | " | LST, a/a | * | 0.38(7) | 20 | 80 | * | | | | |
| 1677-1692 | " | LST, ol-gy | 3.0 | 0.37(4) | 20 | 80 | tr | | | | |
| 1784-1799 | " | MDST, med-dk gy + 50% MDST, med gy | ?3.0 | * | 20 | 80 | tr | | | | |
| 1860-1875 | " | MDST, med gy, v calc + mnr MDST, med dk gy | 3.0 | | 30 | 70 | * | | | | |
| **1891.3** | | **Miria Marl** | | | | | | | | | |
| 1936-1951 | " | MDST, med-dk gy + 15% MDST, med gy | 3.5-4.0 | * | 80 | 20 | * | | | | |
| **2004.1** | | **Tooloogа Calcilutite** | | | | | | | | | |
| **2038.5** | | **Gearle Siltstone/ Haycock Marl** | | | | | | | | | |
| 2043-2058 | " | MDST, gn-gy/med-dk gy | 3.5-4.0 | 0.43(6) | 90 | 10 | * | | | | |
| **2077.2** | | **Muderong Shale** | | | | | | | | | |
| 2134-2149 | " | LST, v lt gy, v arg + 50% MDST, med gy/med-dk gy + mnr MDST, gy-rd/gn-gy | 3.5-4.0 | 0.48(8) | 80 | 20 | * | | | | |
| 2226-2241 | " | MDST, med gy/med-dk gy | 4.0 | 0.49(17) | 80 | 20 | tr | | | | |
| 2241-2256 | P | MDST, med dk gy | | | | | | 70 | 30 | * | * |
| 2302-2317 | Ctg | MDST, a/a + mnr MDST, gy-rd/gn-gy | | | | | | 80 | 20 | * | * |
| 2325 | Core | MDST, med-dk gy | 4.0 | 0.51(14)cvd | 70 | 20 | 10 | 55 | 45 | * | * |
| **2325.3** | | **Learmonth Fm** | | | | | | | | | |
| 2338-2354 | P | MDST, med dk gy | | | | | | 60 | 40 | * | * |
| 2494-2509 | P | COAL | | 0.59(30) | | | | | | | |
| 2588-2601 | P | SLTST, med-med dk gy | | | | | | 60 | 20 | * | 20 |
| 2588-2604 | P | COAL | | 0.59(28) | | | | | | | |
| 2646-2662 | P | COAL | | 0.62(25) | | | | | | | |
| 2765-2780 | Ctg | SST, lt ol gy/pal yel brn + 30% MDST, med dk gy | 5.0 | 0.62(11) | 70 | 20 | 10 | | | | |
| 2768-2780 | P | SLTST, a/a | | | | | | 50 | 40 | * | 10 |
| 2866-2881 | Ctg | SST, a/a + 50% MDST, a/a + mnr COAL | 5.0 | 0.58(3) | 55 | 40 | 5 | | | | |
| 2930-2942 | P | SLTST, med gy | | | | | | 85 | 15 | * | * |
| | P | MDST, med-dk gy, carb | | | | | | 60 | 20 | 5 | 15 |
| 2933-2948 | Ctg | SST, a/a + 50% MDST, med dk gy + mnr COAL | 5.0 | * | 65 | 30 | 5 | | | | |
| 3003-3015 | P | SLTST, med gy | | | | | | 90 | 10 | * | * |
| | P | MDST, med-dk gy, carb | | | | | | 70 | 30 | * | * |

Table 1a Maturity and Kerogen Composition Data

WELL: PICARD-1

| SAMPLE DEPTH (METRES) | SAMPLE TYPE | GENERALISED LITHOLOGY | SPORE COLOUR INDEX (1-10) | VITRINITE REFLECTIVITY (R oil av %) | KEROGEN COMPOSITION (% vol) (by microscopic examination) | | | KEROGEN COMPOSITION (% wt) (by calculation from pyrolysis data) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | INERTINITE | VITRINITE | SAPROPEL | INERTINITE | VITRINITE | ALGAL SAPROPEL | WAXY SAPROPEL |
| 3088-3104 | Ctg | SST, lt ol gy/pal yel brn + 50% MDST, med dk gy + mnr COAL | 5.0-5.5 | * | 60 | 30 | 10 | | | | |
| 3247-3262 | " | SST, a/a + 50% MDST, a/a + mnr COAL | 5.0-5.5 | 0.65(10) | 60 | 30 | 10 | | | | |
| 3256-3268 | P | MDST, med gy, silty | | | | | | 65 | 25 | * | 10 |
| 3360-3372 | P | MDST, dk gy, carb | | | | | | 55 | 20 | 5 | 20 |
| 3360-3375 | P | COAL | | 0.70(30) | | | | | | | |
| 3433-3448 | P | MDST, med-dk gy | | | | | | 60 | 25 | * | 15 |
| 3561-3576 | Ctg | SST, gy + 40% MDST, a/a + mnr COAL | 5.5 | * | 70 | 20 | 10 | | | | |
| ?3614.9 | | **Lower Dingo Claystone** | | | | | | | | | |
| 3613-3628 | " | SST, a/a + 40% MDST, a/a + mnr COAL | 5.5 | 0.71(3) | 70 | 20 | 10 | | | | |
| 3628-3643 | P | MDST, med-dk gy | | | | | | 60 | 30 | * | 10 |
| 3695-3710 | Ctg | MDST, med-dk gy + 40% SND/SST, lt ol gy + mnr COAL | ?5.0cvd | 0.71(16) | 50 | 50 | tr | | | | |
| | P | MDST, a/a | | | | | | 45 | 40 | * | 15 |
| 3768-3784 | P | COAL | | 0.71(22) | | | | | | | |
| 3784-3799 | Ctg | MDST, med-dk gy + 30% SST, lt ol-gy + mnr COAL | 6.0 | | 50 | 50 | tr | 55 | 30 | * | 15 |
| 3814-3829 | P | MDST, med-dk gy | | | | | | 55 | 30 | * | 15 |
| 3845-3860 | Ctg | MDST, a/a + 10% SND/ SST, a/a + mnr COAL | | | | | | 40 | 30 | 5 | 25 |
| 3860-3875 | " | MDST, a/a + 15% SND/ SST, a/a + mnr COAL | 6.0 | 0.72(14) | 40 | 60 | tr | | | | |
| 3939.5 | | **?North Rankin Beds** | | | | | | | | | |
| 3936-3951 | " | MDST, a/a + 40% SND/ SST, a/a | 6.0 | 0.73(17) | 70 | 20 | 10 | | | | |
| 3997.1 | | **?Brigadier Beds** | | | | | | | | | |
| 4040-4055 | " | MDST, a/a + 50% SND/ SST, a/a + mnr COAL | 6.0 | 0.70(20) | 60 | 30 | 10 | 75 | 20 | * | 5 |
| 4073-4088 | P | MDST, med-dk gy | | | | | | 65 | 30 | 5 | * |
| 4125-4140 | Ctg | MDST, a/a + 40% SST, a/a + 10% MDST, gy-rd + mnr COAL | 6.0 | 0.74(17) | 50 | 40 | 10 | | | | |
| 4212 | Core | MDST, dk gy | 5.5cvd | * | 60 | 35 | 5 | 75 | 25 | * | * |

Table 1b Maturity and Kerogen Composition Data

WELL: PICARD-1

| GENERAL DATA | | | CHEMICAL ANALYSIS DATA | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PYROLYSIS | | | | | SOLVENT EXTRACTION | | | | | | |
| SAMPLE DEPTH (METRES) | SAMPLE TYPE | ANALYSED LITHOLOGY | ORGANIC CARBON % OF ROCK | TEMPERATURE C | HYDROGEN INDEX | OXYGEN INDEX | PRODUCTION INDEX | POTENTIAL YIELD (kg Tonne) | TOTAL EXTRACT (ppm) | TOTAL EXTRACT (mg g T O C) | HYDROCARBONS (ppm) | HYDROCARBONS (mg g T O C) | EXTRACT COMPOSITION % | | |
| | | | | | | | | | | | | | SATURATED HYDROCARBONS | AROMATIC HYDROCARBONS | POLAR COMPOUNDS |
| 150.3 | | Tertiary (undiff) | | | | | | | | | | | | | |
| 534-549 | Ctg | MDST, lt ol gy, slty v calc + mnr SST | 0.33 | | | | | | | | | | | | |
| 610-625 | " | LST, wht/yel-gy + mnr MDST, lt ol-gy, v calc | 0.12 | | | | | | | | | | | | |
| 686-701 | " | MDST, a/a | 0.48 | | | | | | | | | | | | |
| 793-808 | " | MDST, a/a | 0.51 | | | | | | | | | | | | |
| 838-854 | " | MDST, a/a | 0.39 | | | | | | | | | | | | |
| 915-930 | " | MDST, a/a | 0.67 | | | | | | | | | | | | |
| 991-1006 | " | MDST, a/a | 0.15 | | | | | | | | | | | | |
| 1006-1021 | " | MDST, a/a | 0.14 | | | | | | | | | | | | |
| 1021-1037 | " | MDST, a/a | 0.07 | | | | | | | | | | | | |
| 1037-1052 | " | MDST, a/a | 0.11 | | | | | | | | | | | | |
| 1052-1067 | " | MDST, a/a | 0.14 | | | | | | | | | | | | |
| 1143-1159 | " | MDST, a/a | 0.13 | | | | | | | | | | | | |
| 1220-1235 | " | MDST, a/a | 0.06 | | | | | | | | | | | | |
| 1338-1354 | " | LST, yel-gy, arg + mnr SST, dk yel brn | 0.25 | | | | | | | | | | | | |
| 1372-1387 | " | LST, a/a + mnr SST, a/a | 0.19 | | | | | | | | | | | | |
| 1448-1463 | " | LST, lt gy, v arg | 0.19 | | | | | | | | | | | | |
| 1524-1540 | " | LST, a/a | 0.24 | | | | | | | | | | | | |
| 1601-1616 | " | LST, a/a | 0.72 | | | | | | | | | | | | |
| 1616-1631 | " | LST, a/a | 0.84 | | | | | | | | | | | | |
| 1631-1646 | " | LST, ol-gy, glauc, slty + mnr LST, lt gy/lt ol-gy, v arg | 0.59 | | | | | | | | | | | | |
| 1646-1662 | " | LST, a/a + mnr LST, a/a | 0.59 | | | | | | | | | | | | |
| 1662-1677 | " | LST, a/a + mnr SST, a/a | 0.59 | | | | | | | | | | | | |
| 1677-1692 | " | LST, a/a + mnr MDST, med gy, v calc | 0.88 | | | | | | | | | | | | |
| 1692-1707 | " | MDST, med gy, v calc + 50% MDST, med gy/med-dk gy, slty, glauc | 1.21 | | | | | | | | | | | | |
| 1707-1723 | " | MDST, a/a + 50% MDST, a/a | 1.24 | | | | | | | | | | | | |
| 1723-1738 | " | MDST, med-dk gy + 40% MDST, med gy, v calc | 1.48 | | | | | | | | | | | | |
| 1738-1753 | " | MDST, a/a + 40% MDST, a/a | 1.34 | | | | | | | | | | | | |
| 1753-1768 | " | MDST, med-dk gy + 50% MDST, med gy, v calc | 0.91 | | | | | | | | | | | | |
| 1784-1799 | " | MDST, a/a + 50% MDST, a/a | 0.83 | | | | | | | | | | | | |

Table 2a Chemical Analysis Data

WELL: PICARD-1

| GENERAL DATA | | | CHEMICAL ANALYSIS DATA | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PYROLYSIS | | | | | SOLVENT EXTRACTION | | | | | | |
| SAMPLE DEPTH (METRES) | SAMPLE TYPE | ANALYSED LITHOLOGY | ORGANIC CARBON % OF ROCK | TEMPERATURE C | HYDROGEN INDEX | OXYGEN INDEX | PRODUCTION INDEX | POTENTIAL YIELD (kg/Tonne) | TOTAL EXTRACT (ppm) | TOTAL EXTRACT (mg/g T.O.C.) | HYDROCARBONS (ppm) | HYDROCARBONS (mg/g T.O.C.) | EXTRACT COMPOSITION % | | |
| | | | | | | | | | | | | | SATURATED HYDROCARBONS | AROMATIC HYDROCARBONS | POLAR COMPOUNDS |
| 1799-1814 | Ctg | MDST, med-dk gy + 50% MDST, med gy, v calc | 0.61 | | | | | | | | | | | | |
| 1814-1829 | " | MDST, med-dk gy + 50% MDST, med gy, v calc | 0.62 | | | | | | | | | | | | |
| 1829-1845 | " | MDST, med gy, v calc + 25% MDST, med-dk gy + 25% MDST, med gy | - | | | | | | | | | | | | |
| | P | MDST, med-dk gy | 1.59 | * | * | 140 | * | * | | | | | | | |
| | " | MDST, med-gy | 0.77 | * | * | 261 | * | * | | | | | | | |
| 1845-1860 | Ctg | MDST, med gy/med-dk gy + 50%, MDST, med gy, v calc | 0.46 | | | | | | | | | | | | |
| 1860-1875 | " | MDST, med gy, v calc + mnr MDST, med-dk gy | 0.62 | | | | | | | | | | | | |
| 1875-1890 | " | MDST, med gy | 0.42 | | | | | | | | | | | | |
| 1891.3 | | Miria Marl | | | | | | | | | | | | | |
| 1890-1905 | " | MDST, a/a | 0.56 | | | | | | | | | | | | |
| 1905-1921 | " | MDST, med-dk gy + 15% MDST, med gy | 1.11 | | | | | | | | | | | | |
| 1921-1936 | " | MDST, med-dk gy + 15% MDST, med gy | 0.92 | | | | | | | | | | | | |
| 1936-1951 | " | MDST, a/a + 15% MDST, a/a | 0.81 | | | | | | | | | | | | |
| 1951-1966 | " | MDST, a/a + 15% MDST, a/a | 0.80 | | | | | | | | | | | | |
| 1966-1982 | " | MDST, med-dk gy + 20% MDST, med gy + 10% MDST, gn-gy | 1.15 | | | | | | | | | | | | |
| 2004.1 | | Toolonga Calcilutite | | | | | | | | | | | | | |
| 2038.5 | | Gearle Siltst/Haycock Marl | | | | | | | | | | | | | |
| 2043-2058 | Ctg | MDST, med-dk gy + 30% MSDT, med gy + 20% MDST, gn-gy | - | | | | | | | | | | | | |
| | P | MDST, med-dk gy | 2.45 | * | * | 76 | * | * | | | | | | | |
| | P | MDST, med gy | 0.68 | * | * | 261 | * | * | | | | | | | |
| | P | MDST, gn-gy | 0.25 | | | | | | | | | | | | |
| 2058-2073 | Ctg | MDST, med/med-dk gy + mnr LST, lt gy, chalky + mnr MDST, varicol | 0.50 | | | | | | | | | | | | |
| 2077.2 | | Maderong Shale | | | | | | | | | | | | | |
| 2073-2088 | " | LST, v lt gy, v arg + 30% MDST, med gy/med-dk gy + mnr MDST, gy-rd | 0.48 | | | | | | | | | | | | |
| 2088-2104 | " | LST, a/a + 30% MDST, a/a + mnr MDST, a/a | 0.82 | | | | | | | | | | | | |
| 2104-2119 | " | LST, v lt gy, v arg + 30% MDST, med gy, med-dk gy + mnr MDST, gy-rd | 0.77 | | | | | | | | | | | | |

Table 2b Chemical Analysis Data

WELL: PICARD-1

| GENERAL DATA | | | CHEMICAL ANALYSIS DATA | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PYROLYSIS | | | | | SOLVENT EXTRACTION | | | | | | |
| | | | | | | | | | | | | | EXTRACT COMPOSITION (%) | | |
| SAMPLE DEPTH (METRES) | SAMPLE TYPE | ANALYSED LITHOLOGY | ORGANIC CARBON % OF ROCK | TEMPERATURE °C | HYDROGEN INDEX | OXYGEN INDEX | PRODUCTION INDEX | POTENTIAL YIELD (kg/Tonne) | TOTAL EXTRACT (ppm) | TOTAL EXTRACT (mg/g TOC) | HYDROCARBONS (ppm) | HYDROCARBONS (mg/g TOC) | SATURATED HYDROCARBONS | AROMATIC HYDROCARBONS | POLAR COMPOUNDS |
| 2119-2134 | Ctg | LST, v lt gy, v arg + 50% MDST, med gy/med-dk gy + mnr MDST, gy-rd/gn-gy | 1.04 | | | | | | | | | | | | |
| 2134-2149 | " | LST, v lt gy, v arg + 50% MDST, med gy/med dk gy + mnr MDST, gy-rd/gn-gy | 0.99 | | | | | | | | | | | | |
| 2149-2165 | " | LST, a/a + 50% MDST, a/a + mnr MDST, a/a | 1.05 | | | | | | | | | | | | |
| 2165-2180 | " | MDST, med gy/med-dk gy + mnr MDST, gy-rd/gn-gy | 1.49 | | | | | | | | | | | | |
| 2180-2195 | " | MDST, a/a + mnr MDST, a/a | 1.53 | | | | | | | | | | | | |
| 2195-2210 | " | MDST, a/a + mnr MDST, a/a | 1.37 | | | | | | | | | | | | |
| 2210-2226 | " | MDST, a/a + mnr MDST, a/a | 2.09 | | | | | | | | | | | | |
| 2226-2241 | " | MDST, a/a + mnr MDST, a/a | 1.78 | | | | | | | | | | | | |
| 2241-2256 | " | MDST, med dk gy + mnr MDST, gy-rd/gn-gy | - | | | | | | | | | | | | |
| | P | MDST, med dk gy-dk gy | 2.10 | 419 | 67 | 74 | 0.60 | 3.50 | | | | | | | |
| 2256-2271 | Ctg | MDST, med-dk gy + mnr MDST, gy-rd/gn-gy | 2.06 | | | | | | | | | | | | |
| 2271-2287 | " | MDST, a/a + mnr MDST, a/a | 1.63 | | | | | | | | | | | | |
| 2287-2302 | " | MDST, a/a + mnr MDST, a/a | 2.14 | | | | | | | | | | | | |
| 2302-2317 | " | MDST, a/a + mnr MDST, a/a | 3.37 | 444 | 36 | 66 | 0.6 | 3.00 | | | | | | | |
| 2325 | Core | MDST, med dk gy | 2.66 | 420 | 95 | 81 | 0.1 | 2.78 | | | | | | | |
| 2325.3 | | **Learmouth Fm** | | | | | | | | | | | | | |
| 2338-2354 | Ctg | SST, multicol + 20% MDST, med-dk gy + mnr LST, med gy + mnr COAL | - | | | | | | | | | | | | |
| 2338-2354 | " | 80% SST, multicol | - | | | | | | | | | | | | |
| | P | MDST, med-dk gy | 3.01 | | | | | | | | | | | | |
| | P | LST, med gy | 0.62 | 426 | 73 | 42 | 0.2 | 2.75 | | | | | | | |
| 2439-2454 | Ctg | SST, multicol + 20% MDST, med-dk gy + 10% COAL | 4.88 | | | | | | | | | | | | |
| 2494-2509 | " | SST, a/a + 20% MDST, a/a + mnr COAL | 0.19 | | | | | | | | | | | | |
| 2588-2601 | " | SND + SST, wht-lt gy + 30% MDST + mnr COAL | 2.53 | | | | | | 1420 | 56 | 860 | 34 | 47 | 14 | 39 |
| | P | MDST, a/a, med-med dk gy med dk gy | 3.91 | 434 | 172 | 14 | 0.02 | 6.88 | | | | | | | |
| 2588-2604 | Ctg | SST, wht/lt gy + 15% COAL + mnr MDST, med-dk gy | 4.75 | | | | | | | | | | | | |
| 2646-2662 | " | SST, a/a + 5% COAL + mnr MDST, a/a | 1.64 | | | | | | | | | | | | |
| 2662-2677 | " | SST, a/a + 15% COAL + mnr MDST, a/a | 4.06 | | | | | | | | | | | | |

Table 2c Chemical Analysis Data

WELL: PICARD-1

| GENERAL DATA | | | CHEMICAL ANALYSIS DATA | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PYROLYSIS | | | | | SOLVENT EXTRACTION | | | | | | |
| | | | | | | | | | | | | | EXTRACT COMPOSITION | | |
| SAMPLE DEPTH (METRES) | SAMPLE TYPE | ANALYSED LITHOLOGY | ORGANIC CARBON % OF ROCK | TEMPERATURE C | HYDROGEN INDEX | OXYGEN INDEX | PRODUCTION INDEX | POTENTIAL YIELD (kg Tonne) | TOTAL EXTRACT (ppm) | TOTAL EXTRACT (mg g T O C) | HYDROCARBONS (ppm) | HYDROCARBONS (mg g T O C) | SATURATED HYDROCARBONS | AROMATIC HYDROCARBONS | POLAR COMPOUNDS |
| 2735-2750 | Ctg | SST, lt ol-gy/pal yel-brn + 10% MDST, med-dk gy + mnr COAL | 0.73 | | | | | | | | | | | | |
| 2765-2780 | " | SST, lt-ol-gy/pal yel-brn + 30% MDST, med-dk gy | 2.52 | | | | | | | | | | | | |
| 2768-2780 | " | SND + SST, wht-lt gy + 40% MDST, med-med dk gy | - | | | | | | | | | | | | |
| | P | MDST, med-med dk gy | 2.98 | 436 | 133 | 18 | 0.05 | 4.14 | | | | | | | |
| 2780-2796 | Ctg | SST, lt ol-gy/pal yel-brn + 50% MDST, med-dk gy + mnr COAL | 1.83 | | | | | | | | | | | | |
| 2866-2881 | " | SST, lt ol gy/pal yel-brn + 40% MDST, med-dk gy + mnr COAL | 1.98 | | | | | | | | | | | | |
| 2930-2942 | " | SND + SST, wht-lt gy + 30% MDST, med gy + 20% MDST, med-dk gy, carb | 2.61 | | | | | | 1430 | 55 | 665 | 26 | 32 | 14 | 54 |
| | P | MDST, med gy | 5.23 | 430 | 12 | 9 | 0.24 | 0.82 | | | | | | | |
| | " | MDST, med-dk gy, carb | 5.51 | 433 | 163 | 13 | 0.05 | 9.47 | | | | | | | |
| 2933-2948 | Ctg | SST, lt ol-gy/pal yel-brn + 50% MDST, med-dk gy + mnr COAL | 2.70 | | | | | | | | | | | | |
| 3003-3015 | " | SND + SST, wht-lt gy + 30% MDST, med gy + 40% MDST, med-dk gy, carb | - | | | | | | | | | | | | |
| | P | MDST, med gy | 2.30 | 430 | 8 | 44 | 0.47 | 0.36 | | | | | | | |
| | P | MDST, med-dk gy, carb | 0.62 | 432 | 54 | 19 | 0.23 | 2.76 | | | | | | | |
| 3088-3104 | Ctg | SST, lt ol-gy/pal yel-brn + 50% MDST, med-dk gy + mnr COAL | 4.33 | | | | | | | | | | | | |
| 3119-3134 | " | SST, a/a + 50% MDST, a/a + mnr COAL | 1.01 | | | | | | | | | | | | |
| 3247-3262 | " | SST, a/a + MDST, a/a + mnr COAL | 2.61 | | | | | | | | | | | | |
| 3256-3268 | " | SST, dk yel-brn + 10% SST, wht + 50% MDST, med -gy, slty | - | | | | | | | | | | | | |
| | P | MDST, med-gy, slty | 6.56 | 435 | 101 | 18 | 0.06 | 7.03 | | | | | | | |
| 3360-3372 | Ctg | SND + SST, wht, lt gy + 10% MDST, dk gy, carb | 0.79 | | | | | | 745 | 94 | 460 | 58 | 42 | 19 | 39 |
| | P | MDST, dk gy, carb | 4.81 | 429 | 190 | 12 | 0.09 | 10.05 | | | | | | | |
| 3433-3448 | Ctg | SST, lt ol-gy-med gy + 40% MDST, med-dk gy + mnr COAL | - | | | | | | | | | | | | |
| | P | SST, lt ol-gy-med gy | 1.66 | | | | | | | | | | | | |
| | | MDST, med-dk gy | 2.69 | 424 | 132 | 23 | 0.50 | 7.00 | | | | | | | |

Table 2d Chemical Analysis Data

WELL: PICARD-1

| GENERAL DATA | | | CHEMICAL ANALYSIS DATA | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PYROLYSIS | | | | | SOLVENT EXTRACTION | | | | | | |
| | | | | | | | | | | | | | EXTRACT COMPOSITION | | |
| SAMPLE DEPTH (METRES) | SAMPLE TYPE | ANALYSED LITHOLOGY | ORGANIC CARBON % OF ROCK | TEMPERATURE C | HYDROGEN INDEX | OXYGEN INDEX | PRODUCTION INDEX | POTENTIAL YIELD (kg/Tonne) | TOTAL EXTRACT (ppm) | TOTAL EXTRACT (mg/g TOC) | HYDROCARBONS (ppm) | HYDROCARBONS (mg g TOC) | SATURATED HYDROCARBONS | AROMATIC HYDROCARBONS | POLAR COMPOUNDS |
| 3561-3576 | Ctg | SST, lt ol-gy/med gy + 40% MDST, med-dk gy + mnr COAL | 1.83 | | | | | | | | | | | | |
| 3576-3591 | " | SST, lt ol-gy/med gy + 40% MDST, med dk gy + mnr COAL | 2.45 | | | | | | | | | | | | |
| ?3614.9 | | **Lower Dingo Claystone** | | | | | | | | | | | | | |
| 3613-3628 | " | SST, a/a + 40% MDST, a/a + mnr COAL | 0.70 | | | | | | | | | | | | |
| 3628-3643 | Ctg | MDST, gy-rd, slty + 40% MDST, med-dk gy + mnr SND /SST | - | | | | | | | | | | | | |
| | P | MDST, gy-rd, slty | 0.85 | * | * | 119 | * | * | | | | | | | |
| | P | MDST, med-dk gy | 2.41 | 427 | 98 | 26 | 0.2 | 3.00 | | | | | | | |
| 3665-3680 | Ctg | MDST, med-dk gy + 40% SND /SST, lt ol-gy + mnr COAL | 1.92 | | | | | | | | | | | | |
| 3680-3695 | " | MDST, a/a + 40% SND/SST, a/a + mnr COAL | 1.65 | | | | | | | | | | | | |
| 3695-3710 | " | MDST, a/a + 40% SND/SST, lt ol-gy + mnr COAL | 3.15 | 445 | 140 | 57 | 0.6 | 11.00 | | | | | | | |
| 3710-3726 | " | MDST, med-dk gy + 40% SND /SST, lt ol-gy + mnr COAL | 1.95 | | | | | | | | | | | | |
| 3752-3768 | " | MDST, a/a + 40% SND/SST, a/a + mnr COAL | 2.85 | | | | | | | | | | | | |
| 3768-3784 | " | MDST, a/a + 30% SND/SST, a/a + mnr COAL | 2.36 | | | | | | | | | | | | |
| 3784-3799 | " | MDST, a/a + 30% SND/SST, a/a + mnr COAL | 4.18 | 440 | 146 | 29 | 0.60 | 15.25 | | | | | | | |
| 3799-3814 | " | MDST, a/a + 30% SND/SST, a/a + mnr COAL | 2.18 | | | | | | | | | | | | |
| 3814-3829 | " | MDST, med-dk gy + 30% SND /SST, lt ol gy + mnr COAL | - | | | | | | | | | | | | |
| | P | MDST, med-dk gy | 4.83 | 441 | 144 | 13 | 0.2 | 8.63 | | | | | | | |
| | P | SND/SST, lt ol-gy | 0.58 | | | | | | | | | | | | |
| 3829-3845 | Ctg | MDST, med-dk gy + 20% SND /SST, lt ol-gy + mnr COAL | 3.56 | | | | | | | | | | | | |
| 3845-3860 | " | MDST, a/a + 10% SND/SST, a/a + mnr COAL | 5.92 | 436 | 191 | 16 | 0.4 | 18.83 | | | | | | | |
| 3860-3875 | " | MDST, a/a + 15% SND/SST, a/a + mnr COAL | 3.69 | | | | | | | | | | | | |
| 3875-3890 | " | MDST, a/a + 50% SND/SST, a/a + mnr MDST, gy-rd/ med-gy | 2.50 | | | | | | | | | | | | |
| 3890-3905 | " | MDST, med-dk gy + 50% SND /SST, lt ol-gy + mnr MDST, gy-rd/med gy | 2.18 | | | | | | | | | | | | |
| 3905-3921 | " | MDST, a/a + 50% SND/SST, a/a + mnr MDST, a/a | 2.12 | | | | | | | | | | | | |

Table 2e Chemical Analysis Data

WELL: PICARD-1

| GENERAL DATA | | | CHEMICAL ANALYSIS DATA | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PYROLYSIS | | | | | SOLVENT EXTRACTION | | | | | | |
| | | | | | | | | | | | | | EXTRACT COMPOSITION % | | |
| SAMPLE DEPTH (METRES) | SAMPLE TYPE | ANALYSED LITHOLOGY | ORGANIC CARBON % OF ROCK | TEMPERATURE C | HYDROGEN INDEX | OXYGEN INDEX | PRODUCTION INDEX | POTENTIAL YIELD (kg/Tonne) | TOTAL EXTRACT (ppm) | TOTAL EXTRACT (mg g T O C) | HYDROCARBONS (ppm) | HYDROCARBONS (mg g T O C) | SATURATED HYDROCARBONS | AROMATIC HYDROCARBONS | POLAR COMPOUNDS |
| 3921-3936 | Ctg | MDST, med-dk gy + 50% SND /SST, lt ol-gy + mnr MDST, gy-rd/med gy | 1.94 | | | | | | | | | | | | |
| 3939.5 | | ?North Rankin Beds | | | | | | | | | | | | | |
| 3936-3951 | " | MDST, a/a + 40% SND/SST, a/a + mnr MDST, a/a | 1.48 | | | | | | | | | | | | |
| 3997.1 | | ?Brigadier Beds | | | | | | | | | | | | | |
| 4024-4040 | " | MDST, a/a + 40% SND/SST, a/a + mnr MDST, a/a + mnr COAL | 2.12 | | | | | | | | | | | | |
| 4040-4055 | Ctg | MDST, med-dk gy + 50% SND/SST, lt-ol gy + mnr MDST, gy-rd/med gy + mnr COAL | 2.02 | 436 | 64 | 53 | 0.6 | 3.25 | | | | | | | |
| 4073-4088 | " | MDST, med-dk gy + 50% SST, lt ol-gy + mnr MDST, gy rd + mnr COAL | - | | | | | | | | | | | | |
| | P | MDST, med-dk gy | 2.30 | 4400 | 90 | 31 | 0.00 | 2.10 | | | | | | | |
| | " | SST, lt ol-gy | 0.37 | | | | | | | | | | | | |
| 4125-4140 | Ctg | MDST, med-dk gy + 40% SST, lt ol gy + 10% MDST, gy-rd + mnr COAL | 2.12 | | | | | | | | | | | | |
| 4201-4216 | " | MDST, a/a + 50% SST, a/a + 10% MDST, a/a + mnr COAL | 1.73 | | | | | | | | | | | | |
| 4212 | Core | MDST, dk gy | 1.85 | 433 | 70 | 93 | 0.2 | 1.63 | | | | | | | |

Table 2f Chemical Analysis Data

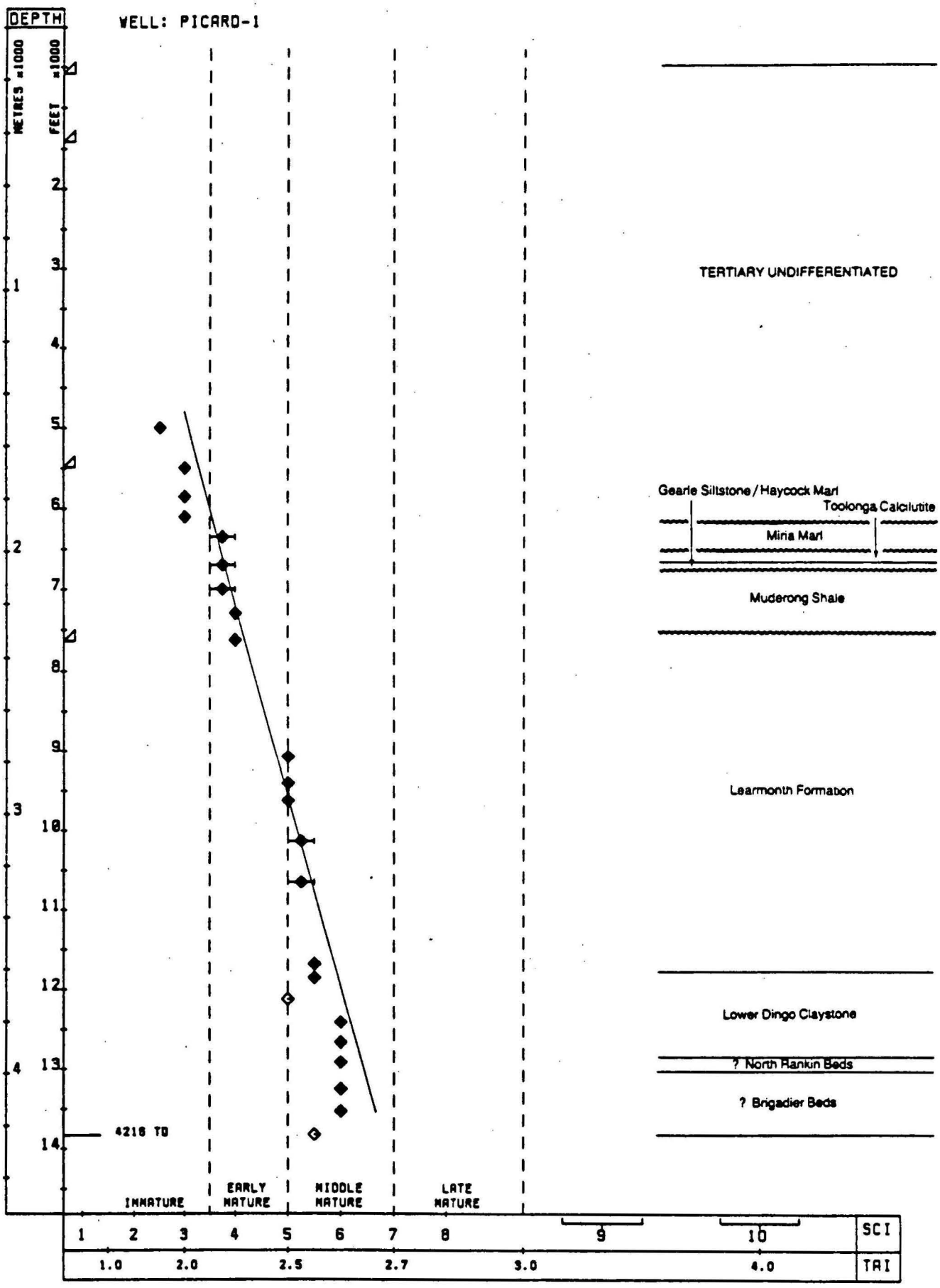



FIGURE 1 SPORE COLOUR INDEX AGAINST DEPTH

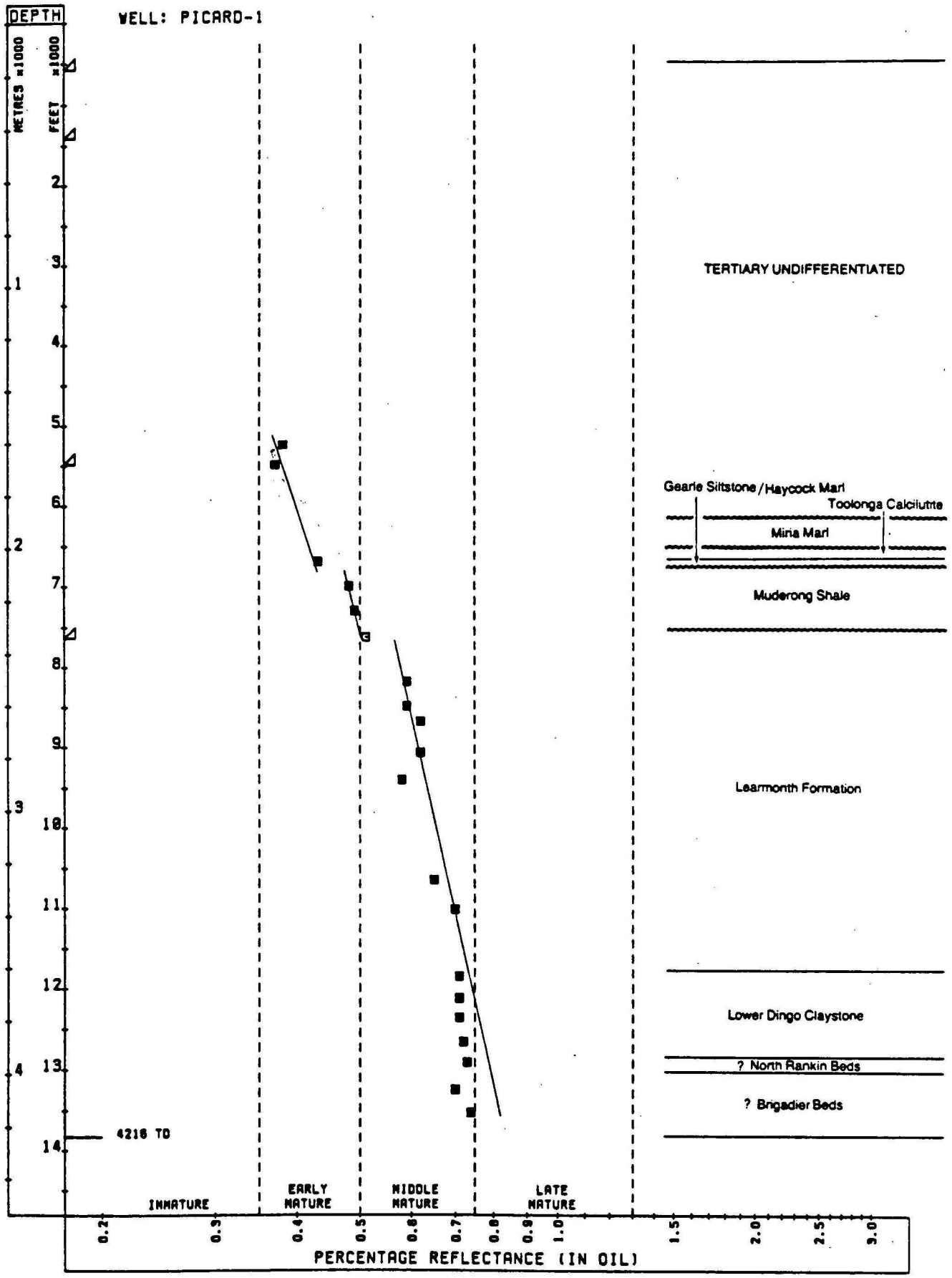
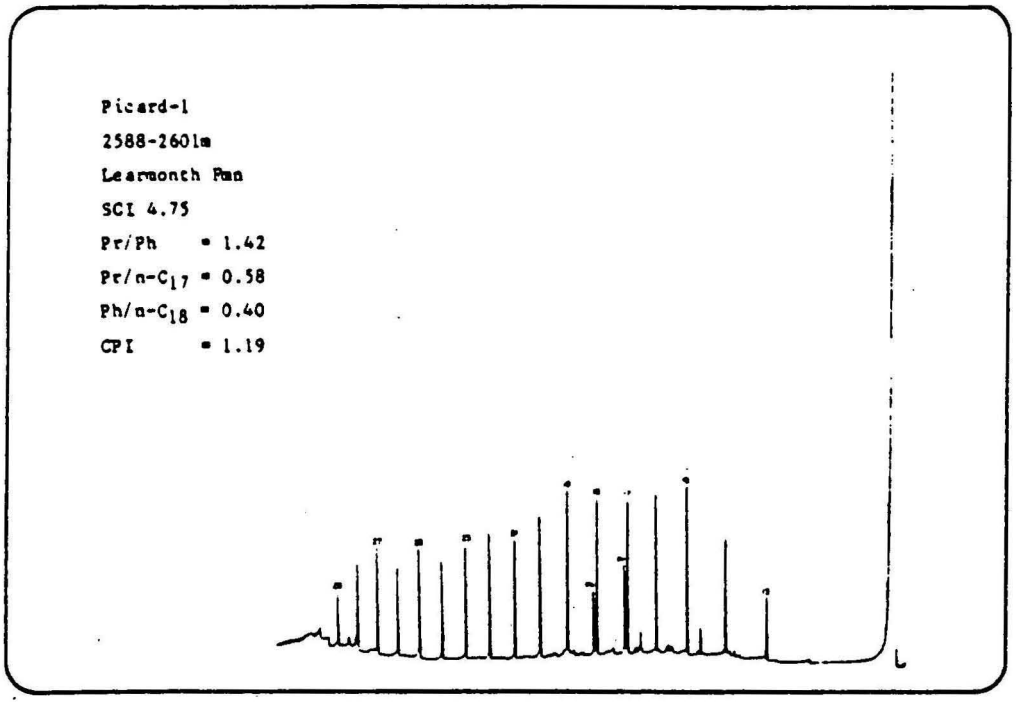
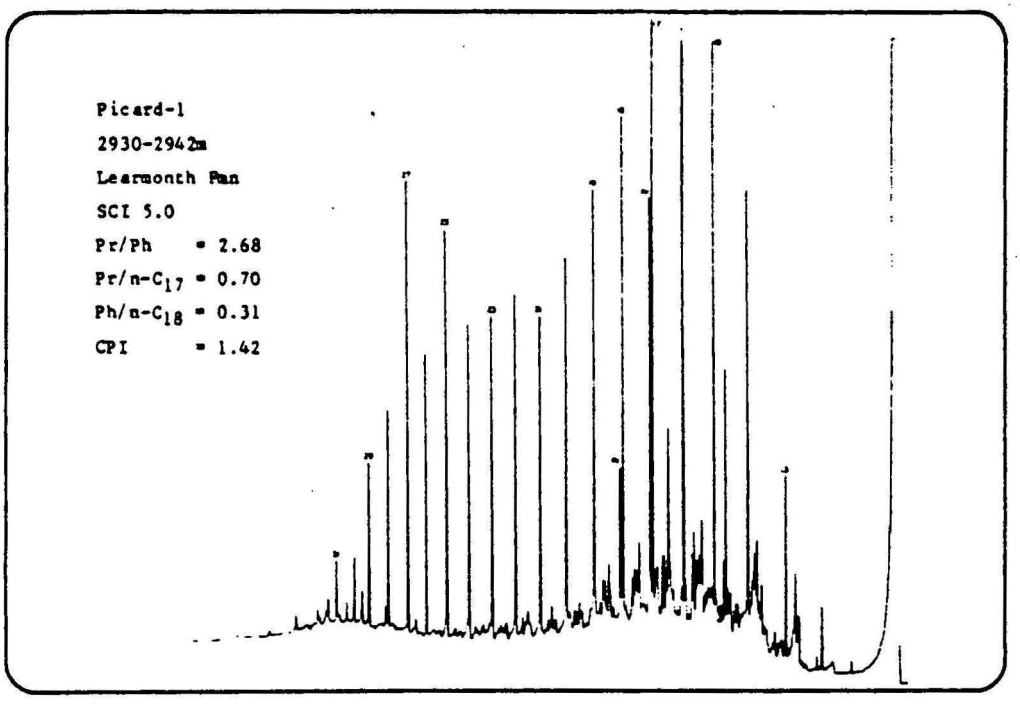



FIGURE 2 VITRINITE REFLECTANCE AGAINST DEPTH


Picard-1
2588-2601m
Learmonth Fm
SCI 4.75
Pr/Ph = 1.42
Pr/n-C17 = 0.58
Ph/n-C18 = 0.40
CPI = 1.19


Picard-1
2930-2942m
Learmonth Fm
SCI 5.0
Pr/Ph = 2.68
Pr/n-C17 = 0.70
Ph/n-C18 = 0.31
CPI = 1.42

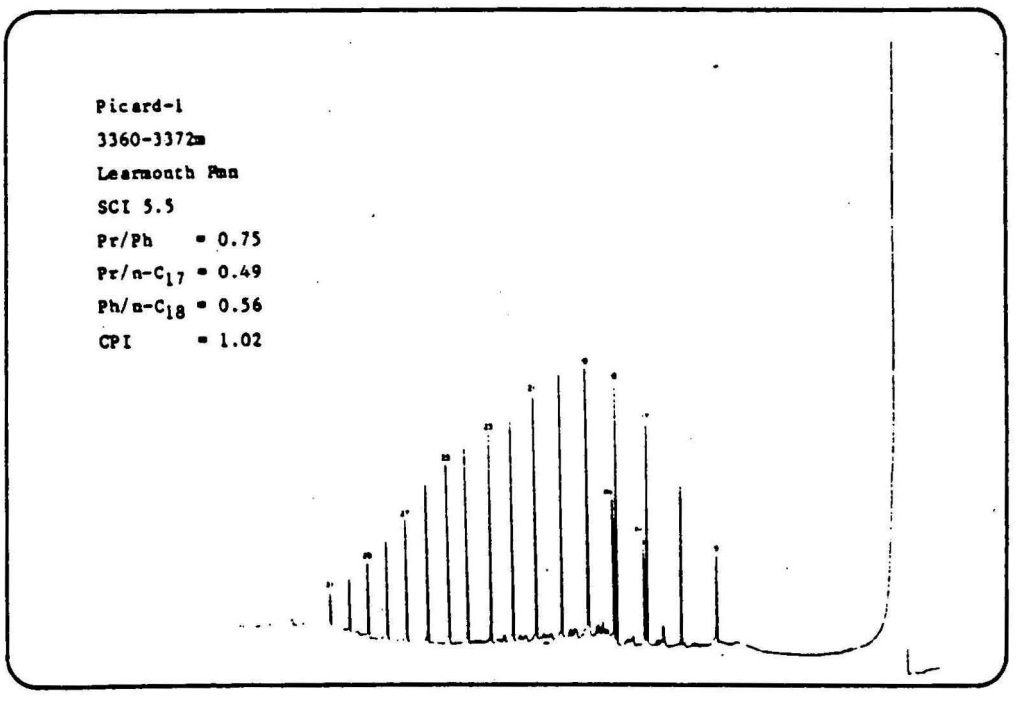

Picard-1
3360-3372m
Learmonth Fm
SCI 5.5
Pr/Ph = 0.75
Pr/n-C17 = 0.49
Ph/n-C18 = 0.56
CPI = 1.02

Figure 3

# RONSARD-1 WELL

## SUMMARY

Geochemical analysis of samples from the interval 2030m to 2843m of the Ronsard-1 well shows that the well section becomes middle mature at around 2500m. The spore colour index gradient indicates that the well section is presently at or near its maximum burial depth.

The section analysed contains no significant oil or gas source rocks.

## GENERAL COMMENTS

Basin: Northern Carnarvon Basin.

Location: 19° 08' 30.6"S, 117° 09' 38.7"E.

Operator and date of drilling: Bocal, 1973.

Well status: Plugged and abandoned.

TD: 2848m.

Mud data: Seawater based system: Seabed to 1301m.
Brine/polymer system: 1301m to 2848m TD.

Casing data: 30" at 194m, 20" at 489m, $13^3/_8$ at 1298m.

B.H.T. data: 43°C at 1301m, stopped circulation time unknown.
83°C at 2836m, stopped circulation time unknown.

Elevation: RT 10m ASL.

Water depth: 160m.

Interval analysed: 2030m to 2843m.

Age of interval analysed:

| | Depths (in metres) |
|---|---|
| Late Cretaceous | 2030-2256 |
| Early Cretaceous | 2256-2294 |
| Early Jurassic | 2294-2843 |

## RONSARD-1 WELL

Sample type and quality: Dried ditch cuttings and core samples of good quality to 2310m and poor to fair quality between 2310m and 2820m.

Maturation data quality:

a) Vitrinite Reflectance: The samples analysed yielded sufficient vitrinitic kerogen for analysis. Results: good.

b) Spore Colour Index: The samples analysed yielded sufficient sporomorphs for measurements. Results: good.

Source rock data quality: Samples mainly analysed in Phase I, data quality unknown.

### MATURATION (Table 1, Figures 1 and 2, Appendices 1 and 2)

Spore colour index values rise from 5 to 5.5 SCI units at 2480m to around 6 to 6.5 SCI units at 2825m. Vitrinite reflectance values rise from 0.51% to 0.58% over the same interval. The results show that the well section becomes middle mature at around 2500m.

The spore colour index gradient indicates that the sediments analysed are currently at their maximum depths of burial.

### OIL AND GAS SOURCE ROCKS (Tables 1 and 2)

The section analysed contains no oil or gas source rocks.

### GEOCHEMICAL CHARACTERISTICS OF THE REMAINING SEDIMENTS (Tables 1 and 2)

The interval analysed consists of thickly interbedded sandstones and dark grey mudstones. Analysis of the mudstone lithologies shows them to contain average to above average organic carbon contents of between 1.00% and 3.74%. Pyrolysis analysis of the mudstones shows them to have low hydrogen indices of between 8 and 75, indicating that they contain predominantly inertinitic kerogen.

WELL: RONSARD-1

| SAMPLE DEPTH (METRES) | SAMPLE TYPE | GENERALISED LITHOLOGY | SPORE COLOUR INDEX (1-10) | VITRINITE REFLECTIVITY (R oil av %) | KEROGEN COMPOSITION (% vol.) (by microscopic examination) | | | KEROGEN COMPOSITION (% wt.) (by calculation from pyrolysis data) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | INERTINITE | VITRINITE | SAPROPEL | INERTINITE | VITRINITE | ALGAL SAPROPEL | WAXY SAPROPEL |
| **2133** | | **Toolonga Calcilutite** | | | | | | | | | |
| **2215** | | **Gearle Siltstone/ Haycock Marl** | | | | | | | | | |
| 2210-2230 | P | MDST, med dk gy, calc | | | | | | 90 | 10 | * | * |
| **2256** | | **Muderong Shale** | | | | | | | | | |
| **2294** | | **Learmonth Fm** | | | | | | | | | |
| 2340-2360 | " | MDST, med gy/med dk gy, calc | | | | | | 90 | 10 | * | * |
| 2480-2495 | Ctg | MDST, med-dk gy, carb + mnr SND | 5.0-5.5 | 0.51(30) | 35 | 60 | 5 | 60 | 40 | * | * |
| 2605-2620 | " | MDST, dk gy, carb + 20% SLTST, lt-med gy | 5.5-6.0 | 0.53(19) | 45 | 55 | * | 60 | 40 | * | * |
| 2700-2720 | P | MDST, med gy/med dk gy, calc | | | | | | 60 | 40 | * | * |
| **?2766** | | **Lower Dingo Claystone** | | | | | | | | | |
| 2810-2825 | Ctg | MDST, pal brn + 50% LST, gy-org pnk-lt gy, arg | 6.0-6.5 | 0.58(8) | 45 | 55 | * | 50 | 50 | * | * |
| 2843 | Core | MDST, med gy/ol-gy, lam | | | | | | 60 | 40 | * | * |

Table 1 Maturity and Kerogen Composition Data

WELL: RONSARD-1

| GENERAL DATA | | | CHEMICAL ANALYSIS DATA | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PYROLYSIS | | | | | SOLVENT EXTRACTION | | | | | | |
| | | | | | | | | | | | | | EXTRACT COMPOSITION (%) | | |
| SAMPLE DEPTH (METRES) | SAMPLE TYPE | ANALYSED LITHOLOGY | ORGANIC CARBON % OF ROCK | TEMPERATURE C | HYDROGEN INDEX | OXYGEN INDEX | PRODUCTION INDEX | POTENTIAL YIELD (kg Tonne) | TOTAL EXTRACT (ppm) | TOTAL EXTRACT (mg g T O C) | HYDROCARBONS (ppm) | HYDROCARBONS (mg g T O C) | SATURATED HYDROCARBONS | AROMATIC HYDROCARBONS | POLAR COMPOUNDS |
| **1959** | | **Miria Marl** | | | | | | | | | | | | | |
| 2030-2050 | Ctg | MDST, med dk gy, calc + 30% MDST, lt gy, v calc | 1.04 | | | | | | | | | | | | |
| 2100-2120 | " | MDST, med dk gy, calc + 30% MDST, lt gy, v calc | - | | | | | | | | | | | | |
| | P | MDST, med dk gy, calc | 1.18 | * | * | 157 | * | * | | | | | | | |
| | P | MDST, lt gy, v calc | 0.42 | | | | | | | | | | | | |
| **2133** | | **Toolonga Calcilutite** | | | | | | | | | | | | | |
| **2215** | | **Gearle Siltst/Haycock Marl** | | | | | | | | | | | | | |
| 2210-2230 | Ctg | MDST, med dk gy, calc + 50% MDST, lt-med gy | - | | | | | | | | | | | | |
| | P | MDST, med dk gy, calc | 1.65 | 429 | 8 | 104 | 0.00 | 0.10 | | | | | | | |
| **2256** | | **Muderong Shale** | | | | | | | | | | | | | |
| 2270-2290 | Ctg | MDST, med dk gy, calc + 20% MDST, lt gy, v calc | 1.49 | | | | | | | | | | | | |
| **2294** | | **Learmonth Fm** | | | | | | | | | | | | | |
| 2290-2310 | " | MDST, med dk gy, calc + 20% MDST, lt-med gy + tr COAL | - | | | | | | | | | | | | |
| | P | MDST, med dk gy, calc | 1.18 | | | | | | | | | | | | |
| 2340-2360 | Ctg | MDST, med gy/med-dk gy, calc + 50% SST, lt ol-gy + mnr LST, wht + tr COAL | - | | | | | | | | | | | | |
| | P | MDST, med gy/med dk gy, calc | 1.46 | 431 | 11 | 135 | 0.00 | 0.20 | | | | | | | |
| 2480-2495 | Ctg | MDST, med-dk gy, carb + mnr SND | 2.64 | 430 | 53 | 78 | 0.07 | 1.51 | | | | | | | |
| 2600-2620 | " | MDST, med gy/med-dk gy, calc + 30% SST, lt ol-gy + tr COAL | - | | | | | | | | | | | | |
| | P | MDST, med gy/med-dk gy, calc | 0.98 | | | | | | | | | | | | |
| 2605-2620 | Ctg | MDST, dk gy, carb + 20% SLTST, lt-med gy | 2.77 | 431 | 75 | 121 | 0.05 | 2.18 | | | | | | | |
| 2700-2720 | " | MDST, dk yel-brn + 40% MDST, dk gy, carb + mnr SST, lt ol-gy + tr COAL | - | | | | | | | | | | | | |
| | P | MDST, dk gy, carb | 1.93 | 430 | 45 | 96 | 0.00 | 0.90 | | | | | | | |
| **?2766** | | **Lower Dingo Claystone** | | | | | | | | | | | | | |
| 2800-2820 | Ctg | MDST, dk yel-brn + 40% MDST, dk gy, carb + mnr SST, lt ol-gy, tr COAL | 3.13 | | | | | | | | | | | | |
| 2810-2825 | Ctg | MDST, pal brn + 50% LST, gy-org pnk-lt gy, arg | 1.73 | 430 | 60 | 192 | 0.06 | 1.11 | | | | | | | |
| 2843 | Ctg | MDST, med gy/ol-gy, lam + mnr SST, lt gy | 3.07 | 429 | 35 | 43 | 0.00 | 1.10 | | | | | | | |

Table 2 Chemical Analysis Data

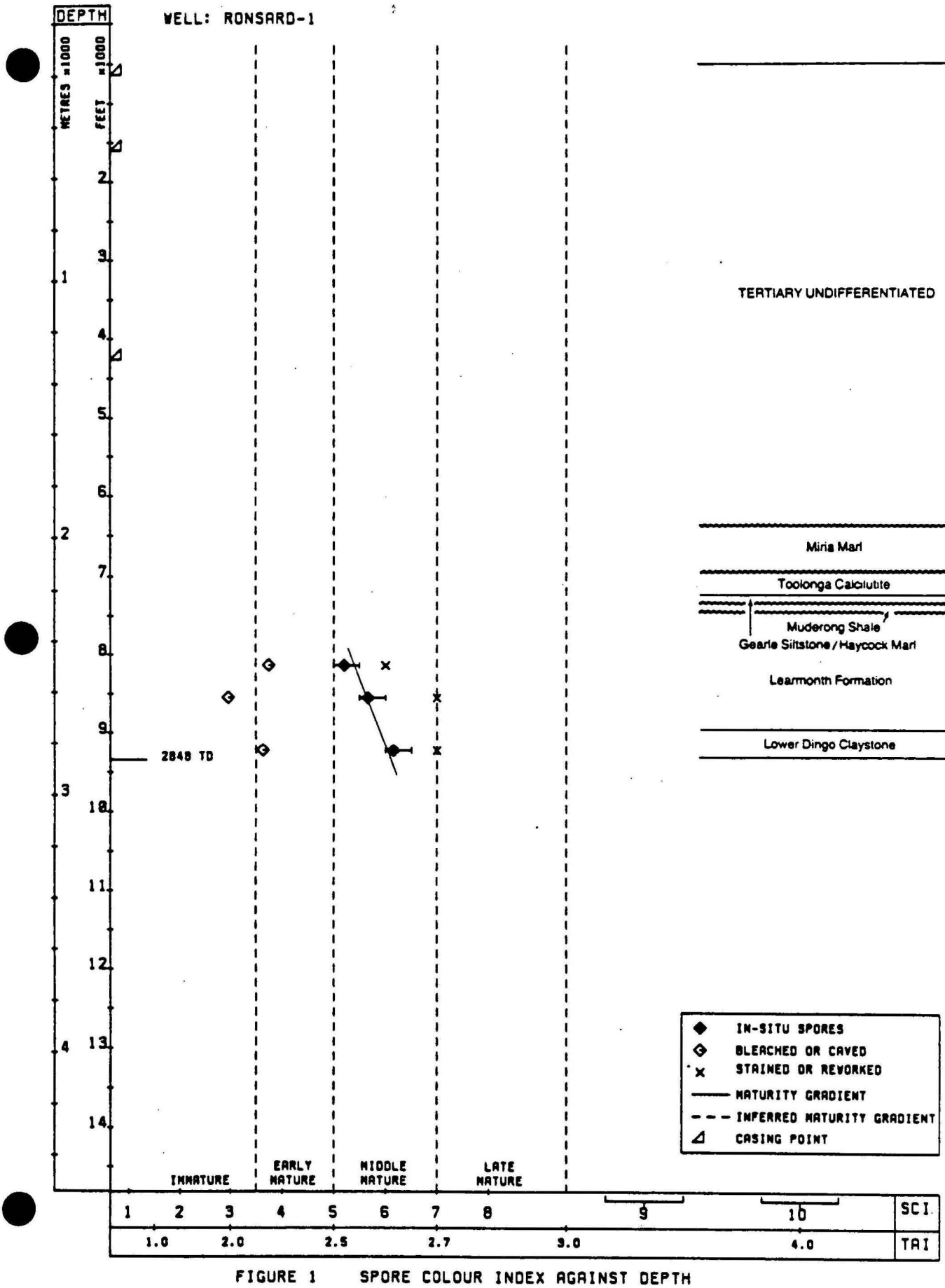



FIGURE 1 SPORE COLOUR INDEX AGAINST DEPTH

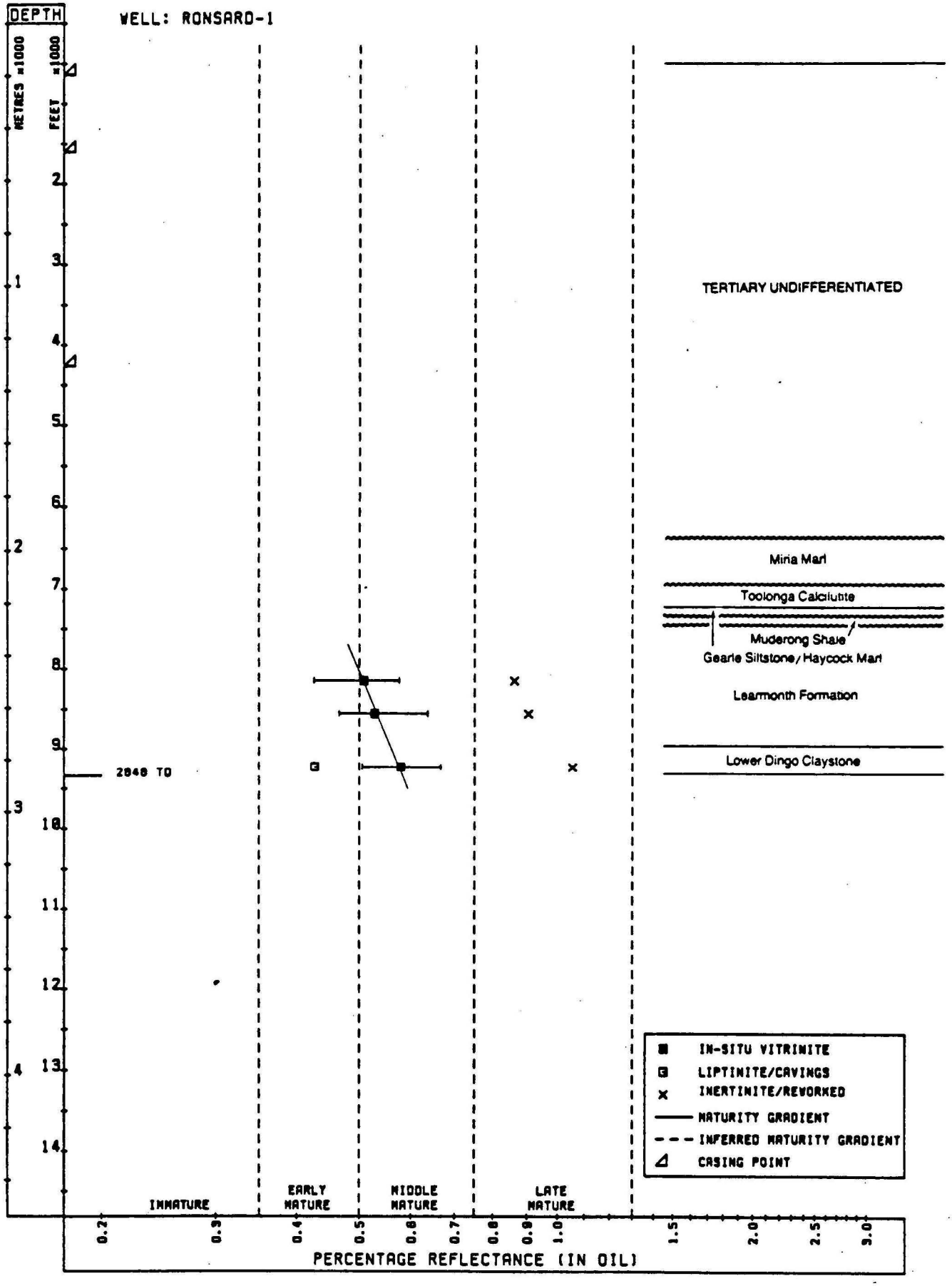



FIGURE 2 VITRINITE REFLECTANCE AGAINST DEPTH

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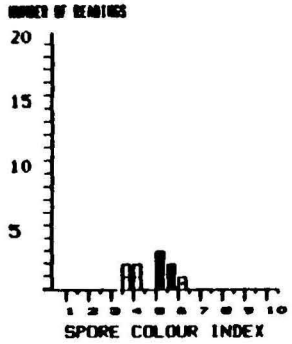
RONSARD-1

IN SITU POPULATION

SAMPLE 2480-2495M

3.5 3.5 4.0 4.0 5.0 5.0 5.0 5.5 5.5 6.0

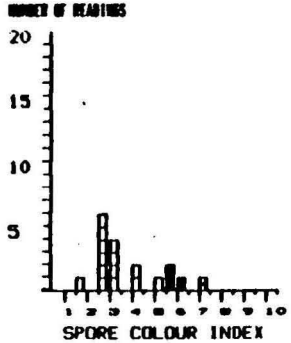
| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN SITU SPORES | 5.0-5.5 | 5 |
| CONTAMINANT/CAVED | 3.5-4.0 | 4 |
| STAINED/REWORKED | 6.0-6.0 | 1 |




SAMPLE 2605-2620M

1.5 2.5 2.5 2.5 2.5 2.5 2.5 3.0 3.0 3.0
3.0 4.0 4.0 5.0 5.5 5.5 6.0 7.0

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN SITU SPORES | 5.5-6.0 | 3 |
| CONTAMINANT/CAVED | 1.5-5.0 | 14 |
| STAINED/REWORKED | 7.0-7.0 | 1 |



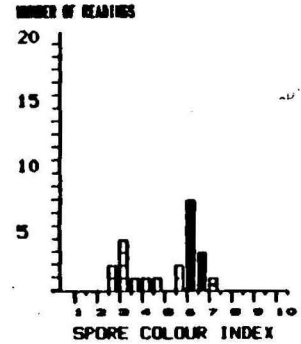

RONSARD-1

IN SITU POPULATION

SAMPLE 2810-2825M

2.5 2.5 3.0 3.0 3.0 3.0 3.5 4.0 4.5 5.5
5.5 6.0 6.0 6.0 6.0 6.0 6.0 6.0 6.5 6.5
6.5 7.0

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN SITU SPORES | 6.0-6.5 | 10 |
| CONTAMINANT/CAVED | 2.5-5.5 | 11 |
| STAINED/REWORKED | 7.0-7.0 | 1 |




Appendix 1

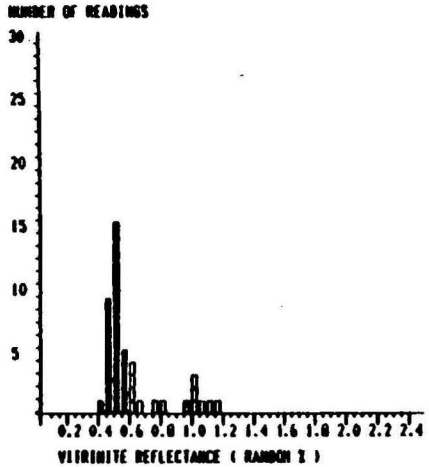
Robertson Research

ROWSARD-1

SAMPLE 2480-2495M

0.43 0.45 0.46 0.47 0.47 0.48 0.48 0.48 0.48 0.49
0.50 0.50 0.50 0.50 0.50 0.51 0.51 0.51 0.51 0.51
0.51 0.52 0.53 0.54 0.54 0.56 0.56 0.56 0.57 0.57
0.60 0.61 0.61 0.63 0.65 0.75 0.80 0.99 1.01 1.03
1.04 1.07 1.10 1.15

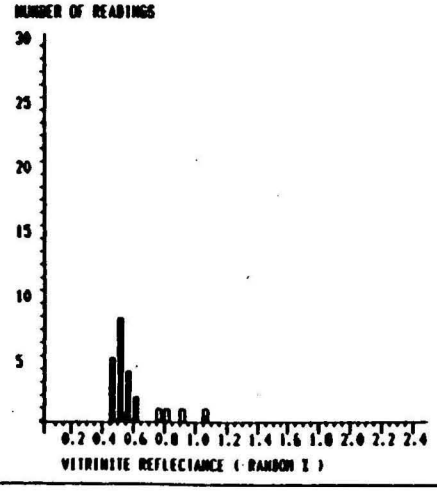
| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.43-0.57 | 30 | 0.51 | 0.04 |
| INERTINITE/REWORKED | 0.60-1.15 | 14 | 0.86 | 0.21 |




SAMPLE 2605-2620M

0.47 0.48 0.48 0.48 0.49 0.50 0.50 0.51 0.51 0.52
0.52 0.53 0.54 0.55 0.55 0.56 0.59 0.60 0.63 0.79
0.84 0.91 1.07

| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.47-0.63 | 19 | 0.53 | 0.04 |
| INERTINITE/REWORKED | 0.79-1.07 | 4 | 0.90 | 0.12 |

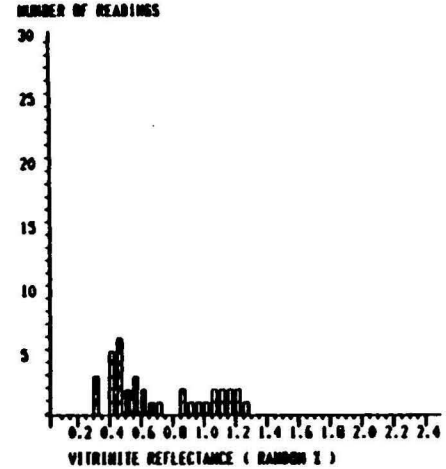



ROWSARD-1

SAMPLE 2810-2825M

0.32 0.34 0.34 0.41 0.42 0.43 0.44 0.44 0.45 0.46
0.47 0.47 0.49 0.49 0.51 0.52 0.55 0.57 0.58 0.61
0.62 0.66 0.71 0.85 0.89 0.91 0.96 1.03 1.05 1.06
1.13 1.13 1.18 1.19 1.23 1.23 1.26

| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.51-0.66 | 8 | 0.58 | 0.05 |
| LIPTINITE/CAVINGS | 0.32-0.49 | 14 | 0.43 | 0.06 |
| INERTINITE/REWORKED | 0.71-1.26 | 15 | 1.05 | 0.16 |




Appendix 2

# ROSEMARY-1 WELL

## SUMMARY

Geochemical analysis of samples from the interval 2165m to 3887m from the Rosemary-1 well has shown that the well section becomes early mature at around 2100m and middle mature at around 3300m. Extrapolation of the maturity gradients to the surface suggests that there is only a minor thickness of Early Cretaceous and younger section missing and that sediments in the well are presently at or near their maximum depths of burial.

The intervals 2165m to 2207m and 2504m to 2762m in the Barrow Group and Upper Dingo Claystone contain poor to good oil and poor gas source rocks respectively. These intervals are early mature. Fair oil and poor gas sources are also present in mudstones in the Learmonth Formation between 3500m and 3800m.

Samples at 3342m to 3354m and 3659m to 3671m in the Early to Middle Jurassic section contain small quantities of a migrant oil derived from a mature source rich in terrestrially derived waxy sapropel.

## GENERAL COMMENTS

Basin: Northern Carnarvon Basin.

Location: 19° 57' 16.3"S, 116° 20' 41.1"E.

Operator and date of drilling: Bocal, 1973.

Well Status: Plugged and abandoned.

TD: 3909m.

Mud data: Seawater/gel system: Seabed to 1067m.
Fully dispersed seawater/gel/dextrid system used: 1067m to 3909m TD. Oil added below 663m.

Casing data: 30" at 99m, 20" at 457m, $13^3/_8$" at 1854m, $9^5/_8$" at 3270m.

BHT data: 60°C at 1802m, stopped circulation time unknown.
97°C at 2924m, stopped circulation time unknown.
108°C at 3275m, stopped circulation time unknown.
120°C at 3909m TD, after 11 hours stopped circulation.

Elevation: RT 9.5 ASL.

## ROSEMARY-1 WELL

Water depth: 65m.

Interval analysed: 2165m to 3887m.

Age of interval analysed:

| | Depths (in metres) |
|---|---|
| Early Cretaceous | 2165-2206 |
| Late Jurassic | 2206-2503 |
| Middle-Late Jurassic | 2503-3264 |
| Early-Middle Jurassic | 3264-3887 |

Sample type and quality: Dried ditch cuttings and a core piece. Sample quality good to fair.

Maturation data quality:

a) Vitrinite Reflectance: The data used are taken from the Phase I report, data quality unknown.

b) Spore Colour Index: The data used are taken from the Phase I report, data quality unknown.

Source rock data quality: The bulk of the analysed data is from the Phase I report and is of unknown quality.

Gas chromatography run at: 3342m to 3354m and 3659m to 3671m.

### MATURATION (Table 1, Figures 1 and 2)

Spore colour index values rise steadily from 3.5 SCI units at 2165m to 6 SCI units at 3887m. Interpreted vitrinite reflectance values rise from 0.4% to 0.65% over the same interval. The results show that the well section becomes early mature at around 2100m and middle mature at around 3300m.

Extrapolation of the reflectance gradient to the surface indicates that there is only a minor thickness of Early Cretaceous and younger section missing above 2165m. Extrapolation of the spore colour index gradient to the surface indicates that the well section is probably at or near its maximum depth of burial.

### OIL AND GAS SOURCE ROCKS (Tables 1 and 2, Figure 3)

Medium dark grey siltstones in the intervals 2165m to 2207m and

2504m to 2762m of the Barrow Group and Upper Dingo Claystone respectively contain above average organic carbon contents of between 1.75% and 2.16% and contain significant quantities of waxy sapropel, with pyrolysis hydrogen indices of between 139 and 191. These intervals have poor and good oil source potential respectively at optimum maturity. At their present level of maturity they will not have generated significant quantities of hydrocarbons.

The Learmonth Formation, below 3265m, contains predominantly thick sandstones interbedded with thinner beds of medium to dark grey mudstones and occasional very thin coal seams. The mudstones are organically rich betwen 3500m and 3800m and contain significant amounts of waxy sapropel. These mudstones have fair oil and poor gas source potential and will have generated significant quantities of hydrocarbons below 3800m.

GEOCHEMICAL CHARACTERISTICS OF THE REMAINING SEDIMENTS (Tables 1 and 2, Figure 3)

The remaining sediments between 2800m and 3500m consist of predominantly medium to dark grey mudstones and light olive grey mudstones, interbedded with thinner sandstone beds. The medium to dark grey mudstones have average organic carbon contents of between 1.96% and 1.47% and contain small quantities of waxy sapropel. The light olive grey mudstones contain below average organic carbon contents of between 0.51% and 0.57% comprising mostly inertinitic kerogen. These mudstones have no oil or gas source potential.

Extraction of samples at 3342m to 3354m and 3659m to 3671m shows them to contain small amounts of migrant oil derived from a mature source containing predominantly terrestrially derived, waxy sapropel.

WELL: ROSEMARY-1

| SAMPLE DEPTH (METRES) | SAMPLE TYPE | GENERALISED LITHOLOGY | SPORE COLOUR INDEX (1-10) | VITRINITE REFLECTIVITY (R oil av %) | KEROGEN COMPOSITION (% vol) (By microscopic examination) | | | KEROGEN COMPOSITION (% wt) (By calculation from pyrolysis data) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | INERTINITE | VITRINITE | SAPROPEL | INERTINITE | VITRINITE | ALGAL SAPROPEL | WAXY SAPROPEL |
| **2062** | | **Barrow Gp** | | | | | | | | | |
| 2165-2180 | Ctg | MDST, lt ol-gy/med-dk gy | 3.5 | 0.37(18) | 80 | 20 | tr | 65 | 20 | * | 15 |
| **2206** | | **Upper Dingo Claystone :Dupuy Sandstone Mbr** | | | | | | | | | |
| **2503** | | **Upper Dingo Claystone** | | | | | | | | | |
| 2515-2530 | " | MDST, a/a | 3.5-4.0 | 0.39(4) | 70 | 30 | tr | 60 | 25 | * | 15 |
| 2591-2607 | " | MDST, a/a | 4.0 | 0.40(6) | 70 | 25 | 5 | 50 | 35 | * | 15 |
| 2652-2668 | " | MDST, a/a | | | | | | 55 | 25 | * | 20 |
| 2713-2729 | " | MDST, a/a | 4.0 | 0.43(6) | 60 | 40 | tr | | | | |
| 2803 | Core | MDST, med-dk gy | 4.0-4.5 | 0.42(22) | 30 | 60 | 10 | 55 | 30 | * | 15 |
| 2866-2881 | Ctg | MDST, a/a | 4.5 | 0.46(10) | 45 | 50 | 5 | 80 | 20 | * | * |
| 3049-3064 | " | MDST, med dk gy + 40% MDST, lt ol gy | 4.5-5.0 | 0.47(14) | 30 | 70 | tr | | | | |
| | P | MDST, med dk gy | | | | | | 65 | 25 | * | 10 |
| | P | MDST, lt ol-gy | | | | | | 80 | 20 | * | * |
| 3201-3216 | Ctg | MDST, med-dk gy + 40% MDST, ol-gy | 5.0 | 0.53(22) | 20 | 75 | 5 | | | | |
| | P | MDST, med dk gy | | | | | | 65 | 15 | * | 20 |
| **3264** | | **Learmonth Fm** | | | | | | | | | |
| 3342-3354 | P | MDST, dk-gy | | | | | | 70 | 20 | * | 10 |
| 3341-3357 | Ctg | SST + 50% MDST, lt ol-gy/med-dk gy | 5.0-5.5 | 0.51(17) | 40 | 60 | tr | | | | |
| 3537-3552 | " | SST + 30% MDST, a/a + mnr COAL | 5.5 | 0.62(30)rew | 20 | 70 | 10 | | | | |
| | P | MDST, a/a | | | | | | 50 | 35 | * | 15 |
| 3616-3625 | Ctg | MDST, dk gy blk | | | | | | 55 | 40 | * | 5 |
| 3659-3671 | " | MDST, dk gy blk | | | | | | 60 | 35 | * | 5 |
| 3659-3674 | " | SST + 20% MDST, med-dk gy + mnr COAL | 5.5 | 0.61(12) | 25 | 70 | 5 | | | | |
| 3713-3729 | P | MDST, med dk gy | | | | | | 55 | 25 | * | 20 |
| 3811-3826 | Ctg | SST + 10% MDST, a/a + mnr COAL | 5.5 | 0.70(18)rew | 35 | 65 | tr | | | | |
| 3872-3887 | " | MDST, a/a + 20% SST + mnr COAL | 5.5-6.0 | 0.68(13)rew | 35 | 60 | 5 | | | | |
| | P | MDST, a/a | | | | | | 60 | 35 | * | 5 |

Table 1 Maturity and Kerogen Composition Data

WELL: ROSEMARY-1

| GENERAL DATA | | | CHEMICAL ANALYSIS DATA | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PYROLYSIS | | | | | SOLVENT EXTRACTION | | | | | | |
| | | | | | | | | | | | | | EXTRACT COMPOSITION | | |
| SAMPLE DEPTH (METRES) | SAMPLE TYPE | ANALYSED LITHOLOGY | ORGANIC CARBON % OF ROCK | TEMPERATURE C | HYDROGEN INDEX | OXYGEN INDEX | PRODUCTION INDEX | POTENTIAL YIELD (kg Tonne) | TOTAL EXTRACT (ppm) | TOTAL EXTRACT (mg g T O C) | HYDROCARBONS (ppm) | HYDROCARBONS (mg g T O C) | SATURATED HYDROCARBONS | AROMATIC HYDROCARBONS | POLAR COMPOUNDS |
| **2062** | | **Barrow Gp** | | | | | | | | | | | | | |
| 2165-2180 | Ctg | MDST, lt ol-gy/med-dk gy | 2.07 | 433 | 140 | 70 | 0.30 | 4.14 | | | | | | | |
| **2206** | | **Upper Dingo Claystone: Dupuy Sst Mbr** | | | | | | | | | | | | | |
| **2503** | | **Upper Dingo Claystone** | | | | | | | | | | | | | |
| 2515-2530 | " | MDST, a/a | 1.92 | 431 | 139 | 75 | 0.40 | 4.50 | | | | | | | |
| 2591-2607 | " | MDST, a/a | 1.98 | 432 | 141 | 89 | 0.30 | 4.00 | | | | | | | |
| 2652-2668 | " | MDST, a/a | 2.16 | 437 | 191 | 69 | 0.20 | 5.13 | | | | | | | |
| 2713-2729 | " | MDST, a/a | 1.97 | | | | | | | | | | | | |
| 2803 | " | MDST, med-dk gy | 1.75 | 432 | 165 | 19 | 0.09 | 3.19 | | | | | | | |
| 2805-2820 | " | MDST, med-dk gy + mnr MDST, ol-gy | 1.63 | | | | | | | | | | | | |
| 2866-2881 | " | MDST, med-dk gy + mnr MDST, ol-gy | 1.96 | 435 | 48 | 98 | 0.20 | 0.13 | | | | | | | |
| 2927-2942 | " | MDST, med-dk gy + mnr MDST, ol-gy + LCM + bit | - | | | | | | | | | | | | |
| 2988-3003 | " | MDST, med-dk gy, mic | 1.96 | | | | | | | | | | | | |
| 3049-3064 | Ctg | MDST, med-dk gy, mic + 40% MDST, lt ol-gy + mnr SND + mnr LCM | - | | | | | | | | | | | | |
| | P | MDST, med-dk gy, mic | 1.59 | 443 | 106 | 109 | 0.10 | 1.89 | | | | | | | |
| | P | MDST, lt ol-gy | 0.57 | 440 | 47 | 377 | 0.00 | 0.30 | | | | | | | |
| 3110-3125 | Ctg | MDST, med-dk gy + 40% MDST, lt ol-gy + mnr SND + mnr LCM | 1.68 | | | | | | | | | | | | |
| 3201-3216 | " | MDST, med-dk gy + 40% MDST, ol-gy + mnr SND + mnr LCM | - | | | | | | | | | | | | |
| | P | MDST, med-dk gy | 1.55 | 446 | 151 | 64 | 0.10 | 2.56 | | | | | | | |
| | P | MDST, ol-gy | 0.55 | | | | | | | | | | | | |
| **3264** | | **Learmonth Fm** | | | | | | | | | | | | | |
| 3342-3354 | Ctg | MDST, dk gy + 10% SST | 2.15 | | | | | | 2030 | 94 | 1440 | 67 | 58 | 13 | 29 |
| | P | MDST, dk gy | 6.13 | 436 | 94 | 12 | 0.11 | 6.49 | | | | | | | |
| 3341-3357 | Ctg | SND/SST, wht/varicol + 50% MDST, lt ol-gy/ med-dk gy | 2.88 | | | | | | | | | | | | |
| 3457-3473 | " | SND/SST, wht/varicol + mnr MDST + mnr COAL + LCM | - | | | | | | | | | | | | |
| 3537-3552 | " | SST, varicol + 20% MDST, med-dk gy + 10% MDST, lt ol-gy + mnr COAL + LCM | - | | | | | | | | | | | | |
| | P | MDST, med-dk gy | 4.15 | 447 | 124 | 25 | 0.30 | 7.43 | | | | | | | |
| | P | MDST, lt ol-gy | 0.51 | | | | | | | | | | | | |

Table 2a Chemical Analysis Data

WELL: ROSEMARY-1

| GENERAL DATA | | | CHEMICAL ANALYSIS DATA | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PYROLYSIS | | | | | SOLVENT EXTRACTION | | | | | | |
| | | | | | | | | | | | | | EXTRACT COMPOSITION (%) | | |
| SAMPLE DEPTH (METRES) | SAMPLE TYPE | ANALYSED LITHOLOGY | ORGANIC CARBON OF ROCK | TEMPERATURE C | HYDROGEN INDEX | OXYGEN INDEX | PRODUCTION INDEX | POTENTIAL YIELD (kg Tonne) | TOTAL EXTRACT (ppm) | TOTAL EXTRACT (mg g T O C) | HYDROCARBONS (ppm) | HYDROCARBONS (mg g T O C) | SATURATED HYDROCARBONS | AROMATIC HYDROCARBONS | POLAR COMPOUNDS |
| 3552-3567 | Ctg | SND/SST, wht/yel-gy + 20% MDST, med-dk gy + COAL + LCM | - | | | | | | | | | | | | |
| 3598-3607 | Ctg | Mica contam + mnr SST | - | | | | | | | | | | | | |
| 3616-3625 | " | SST, wht + 50% MDST, dk gy-blk, abunt mica contam | - | | | | | | | | | | | | |
| | P | MDST, dk gy-blk | 5.39 | 442 | 85 | 16 | 0.11 | 5.15 | | | | | | | |
| 3659-3671 | Ctg | SST, wht + 60% MDST, dk gy-blk | 1.42 | | | | | | 1170 | 82 | 820 | 58 | 59 | 11 | 30 |
| | P | MDST, dk gy-blk | 5.27 | 440 | 80 | 17 | 0.15 | 5.00 | | | | | | | |
| 3659-3674 | Ctg | SND/SST, wht/yel-gy + 20% MDST, med-dk gy + COAL + LCM | - | | | | | | | | | | | | |
| 3713-3729 | " | SST, wht/yel-gy + 10% MDST, med-dk gy + mnr COAL | - | | | | | | | | | | | | |
| | P | MDST, med-dk gy | 4.64 | 449 | 145 | 12 | 0.30 | 9.57 | | | | | | | |
| 3811-3826 | Ctg | SND/SST, wht/yel-gy + 10% MDST, med-dk gy + mnr COAL | 1.55 | | | | | | | | | | | | |
| 3857-3872 | " | MDST, med-dk gy + 30% SND/SST, wht/yel-gy + mnr COAL | 2.19 | | | | | | | | | | | | |
| 3872-3887 | " | MDST, med-dk gy + 20% SST, wht/yel-gy + mnr COAL | - | | | | | | | | | | | | |
| | P | MDST, a/a | 2.48 | 445 | 71 | 32 | 0.70 | 6.00 | | | | | | | |

Table 2b Chemical Analysis Data

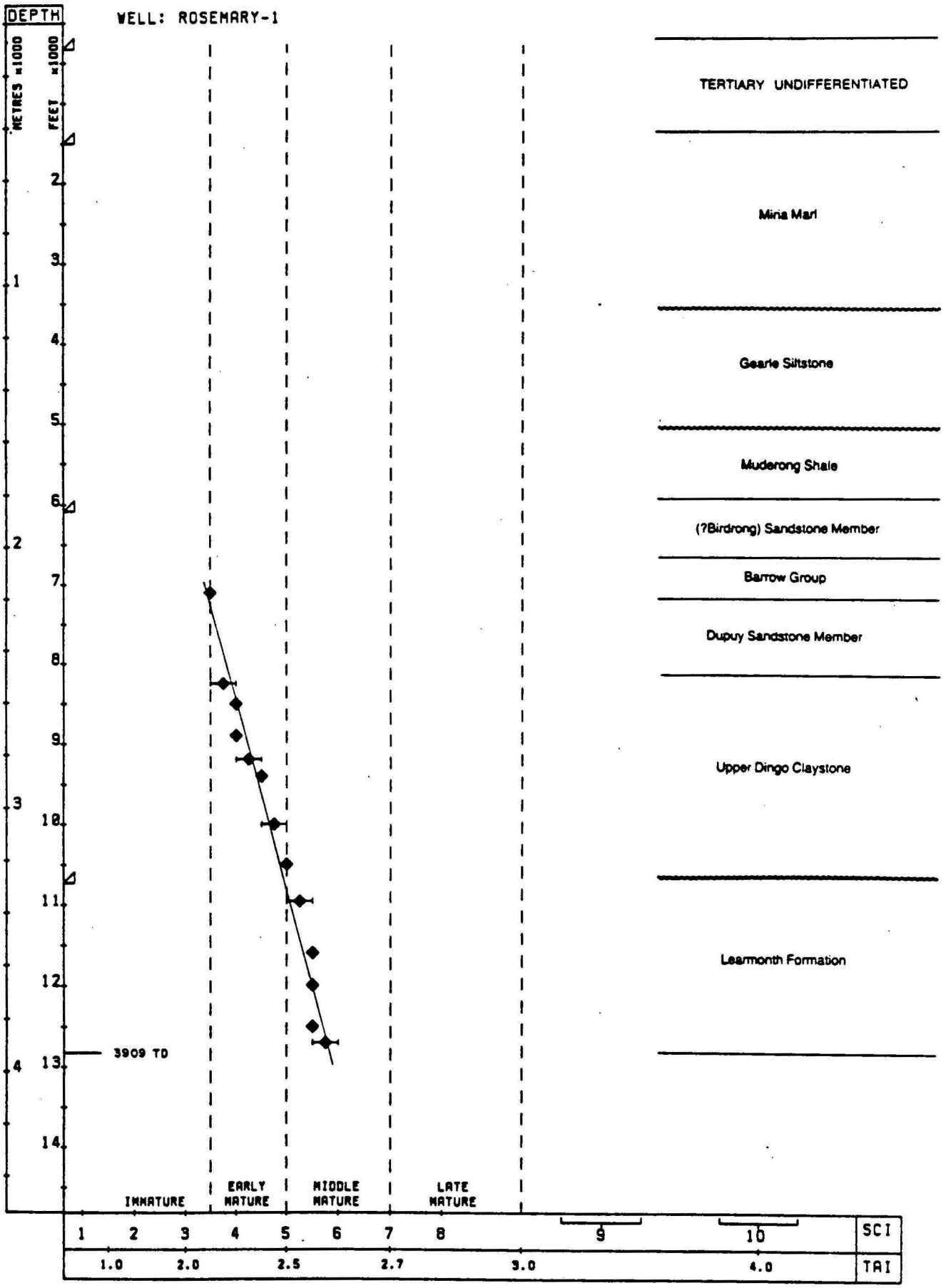



FIGURE 1 SPORE COLOUR INDEX AGAINST DEPTH

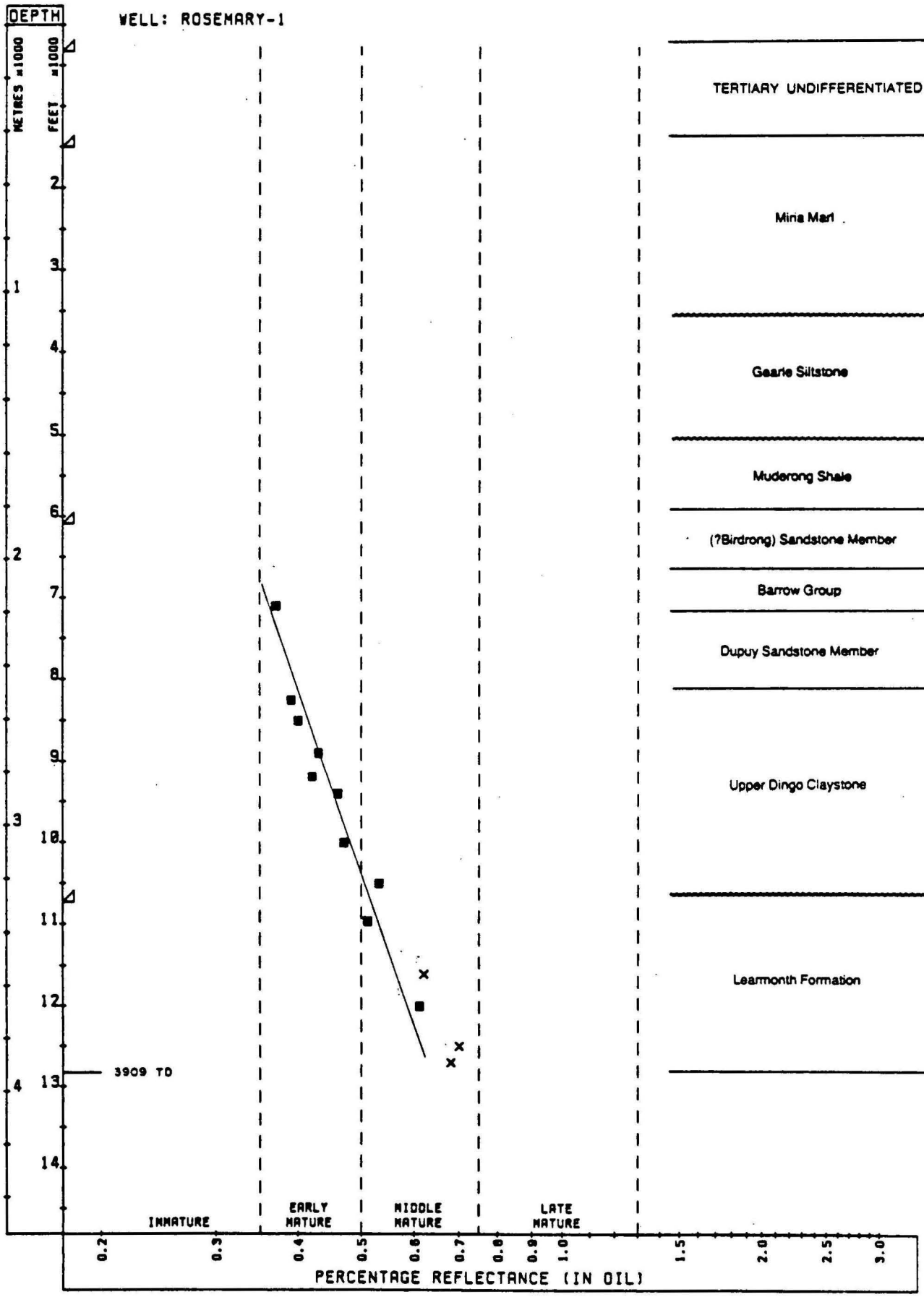
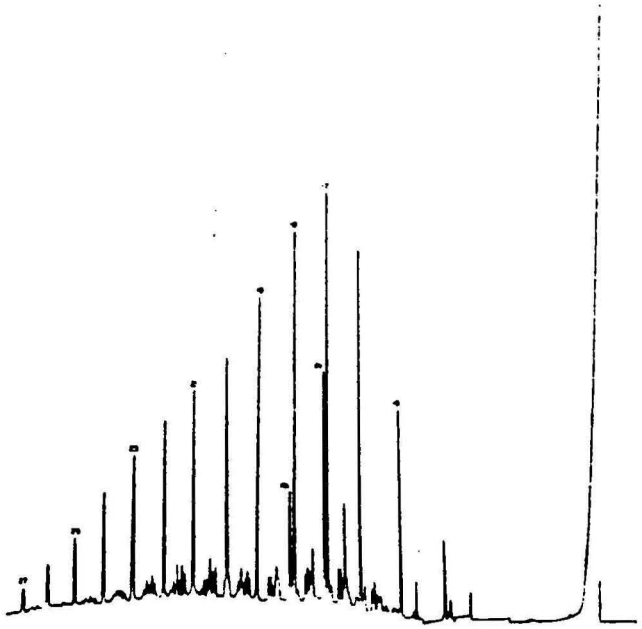



FIGURE 2 VITRINITE REFLECTANCE AGAINST DEPTH

Rosemary-1
3342-3354m
Learmonth Fm
SCI 5.0
Pr/Ph = 2.10
Pr/n-$C_{17}$ = 0.56
Ph/n-$C_{18}$ = 0.30
CPI = 1.05



Rosemary-1
3659-3671m
Learmonth Fm
SCI 5.5
Pr/Ph = 1.16
Pr/n-$C_{17}$ = 0.39
Ph/n-$C_{18}$ = 0.37
CPI = 1.18

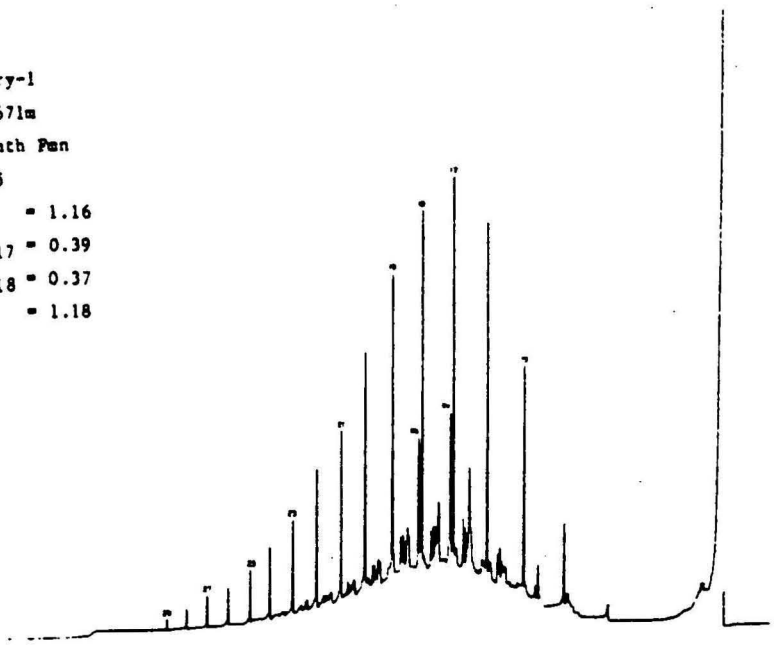


Figure 3

# SANDY POINT-1 WELL

## SUMMARY

Geochemical analyses of samples in the interval 1250m to 2930m of the Sandy Point-1 well shows that the well section is early mature to around 1300m, middle mature between 1300m and 2900m and late mature from 2900m to 3045m TD. Extrapolation of the reflectance gradient back to the surface indicates that up to 1500m of Middle Jurassic and younger section is missing at unconformities above 1250m. Extrapolation of the spore colour index gradient to the surface suggests that the sediments penetrated are not at their maximum depths of burial. The maximum depth of burial of the sediments analysed is around 1000m greater than the present day and was reached sometime during the Middle Jurassic to Recent.

Coals present in the Learmonth Formation and Brigadier Beds between 2680m and 2950m may have very good oil and fair gas source potential. At their present level of maturity they will have generated significant quantities of oil.

## GENERAL COMMENTS

Basin: Northern Carnarvon Basin.

Location: 22° 25' 49"S, 133° 47' 49"E.

Operator and date of drilling: West Australian Petroleum Pty, 1968.

Well Status: Plugged and abandoned.

TD: 3045m.

Mud data: Fresh water/Gel system: Surface to 3045m TD.

Casing data: $13^3/_8$" at 199m, $9^5/_8$" at 1067m.

BHT data: 61°C at 1216m, stopped circulation time unknown.
101°C at 2467m, stopped circulation time unknown.
112°C at 3045m TD, stopped circulation time unknown.

Elevation: RT 115m ASL.

Ground level: 111.5m.

Interval analysed: 1250m to 2930m.

## SANDY POINT-1 WELL

Age of interval analysed:

| | Depths (in metres) |
|---|---|
| Early-Middle Jurassic | 1250-2830 |
| Early Jurassic-Late Triassic | 2830-2930 |

Sample type and quality: Dried ditch cuttings, samples of good quality for geochemical analysis.

Maturation data quality:

a) Vitrinite Reflectance: The samples analysed yielded sufficient vitrinite for measurements. Results: Good.

b) Spore Colour Index: The samples analysed yielded sufficient indigenous sporomorphs for measurements. Results: Good.

Source rock data quality: Good.

Gas chromatography run at: 2924m to 2930m.

### MATURATION (Table 1, Figures 1 and 2, Appendices 1 and 2)

Vitrinite reflectance values rise steadily from interpreted values of around 0.5% at 1250m to 0.75% at 2930m. Spore colour index values rise from around 5 SCI units to 7.5 SCI units over the same interval. These results suggest that the well section is early mature to around 1300m, middle mature between 1300m and 2900m and late mature from 2900m to 3045m TD.

Extrapolation of the reflectance gradient back to the surface indicates up to 1500m of missing Middle Jurassic and younger section above 1250m. Extrapolation of the spore colour index gradient to the surface indicates that sediments analysed are presently not at their maximum depths of burial, which was around 1000m greater than that of the present day and was reached sometime during the Middle Jurassic to Recent.

### OIL AND GAS SOURCE ROCKS (Tables 1 and 2, Figure 3)

Thin coal seams were recorded on the composite well log between 2680m and 2950m in the Learmonth Formation and Brigadier Beds. The composite well log indicates the presence of around 7m of coal

in this interval, although this estimate may not be accurate. Analysis of the coal at 2924 to 2930m shows a relatively high hydrogen index and low oxygen index, suggestive of at least 30% content of sapropelic material. If these coals still contain 30% sapropelic material at such high levels of maturity (6.5 to 7.0 SCI units) then they will have very good oil and fair gas source potential. At their present level of maturity they will have generated significant quantities of oil.

Solvent extraction data indicates the presence of relatively large quantities of extractable bitumen in the sample at 2924m to 2930m. Fractionation data shows that most of the extract is comprised of polar compounds. The alkane gas chromatogram of the sample shows abundant n-alkanes in the range $n\text{-}C_{15}$ to $n\text{-}C_{33}$ superimposed on a raised baseline hump of branched/cyclic alkanes. The $n\text{-}C_{17}$ to $n\text{-}C_{19}$ alkanes are especially prominent. Pristane is dominant over phytane and both are present in relatively large quantities relative to their neighbouring n-alkanes. This type of distribution is typical of hydrocarbons derived from coaly kerogens containing some waxy sapropel.

GEOCHEMICAL CHARACTERISTICS OF THE REMAINING SEDIMENTS (Tables 1 and 2, Figure 3)

The remaining mudstones and siltstones analysed contain below average to slightly above average organic carbon contents of between 0.46% and 2.03%. Both visual kerogen and pyrolysis analyses show these mudstones to contain mostly humic kerogen.

These mudstones have no significant oil or gas source potential.

WELL: SANDY POINT-1

| SAMPLE DEPTH (METRES) | SAMPLE TYPE | GENERALISED LITHOLOGY | SPORE COLOUR INDEX (1-10) | VITRINITE REFLECTIVITY (R oil av %) | KEROGEN COMPOSITION (% vol) (by microscopic examination) | | | KEROGEN COMPOSITION (% wt) (by calculation from pyrolysis data) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | INERTINITE | VITRINITE | SAPROPEL | INERTINITE | VITRINITE | ALGAL SAPROPEL | WAXY SAPROPEL |
| 1175.9 | | **Learmonth Fm** | | | | | | | | | |
| 1250-1265 | Ctg | MDST, med-dk gy, slty | 5.0-5.5 | 0.52(25) | 60 | 20 | 20 | 75 | 20 | 5 | * |
| 1366-1384 | " | MDST, med gy, slty | | | | | | 80 | 20 | * | * |
| 1482-1500 | " | MDST, a/a + 10% MDST, yel gy, v calc + mnr SND | 5.0-5.5 | 0.52(19) | 60 | 40 | mnr | | | | |
| | P | MDST, med gy, slty | | | | | | 50 | 45 | 5 | * |
| 1893-1909 | Ctg | SND + 20% SST, yel gy + 40% MDST, med-dk gy | 5.5-6.0 | 0.57(43) | 30 | 60 | 10 | | | | |
| 2034-2052 | " | MDST, med gy + mnr SLTST, yel gy | 6.0-6.5 | 0.63(15) | 70 | 30 | mnr | | | | |
| 2125-2140 | " | MDST, med dk gy + mnr SST | | | | | | 60 | 25 | 15 | * |
| 2220-2235 | " | SLTST, lt gy, arg + 30% MDST, med gy | 6.0-6.5 | 0.68(9) | 70 | 30 | mnr | | | | |
| 2500-2512 | " | SST, pnk gy + 20% MDST, med gy | 6.5-7.0 | 0.73(31) | 55 | 40 | 5 | | | | |
| | P | MDST, med gy | | | | | | 70 | 30 | * | * |
| 2570-2585 | P | MDST, med gy | | | | | | 70 | 30 | * | * |
| 2713-2732 | Ctg | SST, wht + 40% MDST, med dk gy | 6.5-7.0 | 0.78(9) | 65 | 30 | 5 | | | | |
| | P | MDST, a/a | | | | | | 60 | 40 | * | * |
| 2830.1 | | **Brigadier Beds** | | | | | | | | | |
| 2820-2835 | Ctg | SST, wht, pal yel brn + 20% MDST, a/a | 7.0 | 0.80(6) | 60 | 40 | mnr | | | | |
| 2924-2930 | P | COAL | | 0.84(27) | | | | | | | |
| | P | MDST, med dk gy | | | | | | 60 | 40 | * | * |

Table 1 Maturity and Kerogen Composition Data

WELL: SANDY POINT-1

| GENERAL DATA | | | CHEMICAL ANALYSIS DATA | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PYROLYSIS | | | | | SOLVENT EXTRACTION | | | | | | |
| | | | | | | | | | | | | | EXTRACT COMPOSITION % | | |
| SAMPLE DEPTH (METRES) | SAMPLE TYPE | ANALYSED LITHOLOGY | ORGANIC CARBON % OF ROCK | TEMPERATURE °C | HYDROGEN INDEX | OXYGEN INDEX | PRODUCTION INDEX | POTENTIAL YIELD (kg/Tonne) | TOTAL EXTRACT (ppm) | TOTAL EXTRACT (mg/g TOC) | HYDROCARBONS (ppm) | HYDROCARBONS (mg/g TOC) | SATURATED HYDROCARBONS | AROMATIC HYDROCARBONS | POLAR COMPOUNDS |
| 1175.9 | | **Learmonth Mbr** | | | | | | | | | | | | | |
| 1250-1265 | Ctg | MDST, med-dk gy, slty | 2.03 | 426 | 71 | 55 | 0.05 | 1.52 | | | | | | | |
| 1366-1384 | " | MDST, med gy, slty | 2.08 | 433 | 50 | 44 | 0.08 | 1.13 | | | | | | | |
| 1482-1500 | " | MDST, med g, + 10% MDST, yel-gy, v calc + mnr SND | - | | | | | | | | | | | | |
| | P | MDST, med gy | 1.49 | 434 | 95 | 30 | 0.07 | 1.52 | | | | | | | |
| | P | MDST, yel gy, v calc | 0.06 | | | | | | | | | | | | |
| 1576-1592 | Ctg | MDST, med gy + 40% MDST, pal yel brn + mnr SST | - | | | | | | | | | | | | |
| | P | MDST, med gy | 1.01 | 427 | 126 | 36 | 0.09 | 1.39 | | | | | | | |
| | P | MDST, pal yel brn | 0.46 | | | | | | | | | | | | |
| 1893-1909 | Ctg | SND + 40% MDST, med-dk gy + 20% SST, yel gy | - | | | | | | | | | | | | |
| | P | MDST, med-dk gy | 0.62 | | | | | | | | | | | | |
| 2034-2052 | Ctg | MDST, meg gy + mnr SLTST, yel gy | 0.49 | | | | | | | | | | | | |
| 2125-2140 | " | MDST, med-dk gy + mnr SST | 1.45 | 429 | 131 | 47 | 0.12 | 2.16 | | | | | | | |
| 2220-2235 | " | SLTST, lt gy, arg + 30% MDST, med gy | - | | | | | | | | | | | | |
| | P | SLTST, a/a | 0.09 | | | | | | | | | | | | |
| | P | MDST, a/a | 0.57 | | | | | | | | | | | | |
| 2500-2512 | Ctg | SST, pnk gy + 20% MDST, med gy | - | | | | | | | | | | | | |
| | P | MDST, a/a | 1.04 | 442 | 51 | 33 | 0.20 | 0.66 | | | | | | | |
| 2570-2585 | Ctg | SST, pnk gy + 20% MDST, med gy | - | | | | | | | | | | | | |
| | P | MDST, a/a | 1.43 | 450 | 41 | 17 | 0.15 | 0.69 | | | | | | | |
| 2713-2732 | Ctg | SST, wht + 40% MDST, med dk gy | - | | | | | | | | | | | | |
| | P | MDST, a/a | 1.75 | 454 | 69 | 14 | 0.08 | 1.30 | | | | | | | |
| 2830.1 | | **Brigadier Beds** | | | | | | | | | | | | | |
| 2820-2835 | Ctg | SST, wht, pal yel brn + 20% MDST, a/a | - | | | | | | | | | | | | |
| | P | MDST, a/a | 0.84 | | | | | | | | | | | | |
| 2924-2930 | Ctg | MDST, med dk gy + 10% COAL, blk + 20% SST, wht | 3.90 | | | | | | 1765 | 45 | 330 | 9 | 11 | 7 | 82 |
| | P | MDST, a/a | 1.01 | 446 | 73 | 24 | 0.13 | 0.85 | | | | | | | |
| | P | COAL, blk | 78.00 | 460 | 198 | 3 | 0.01 | 155.75 | | | | | | | |

Table 2 Chemical Analysis Data

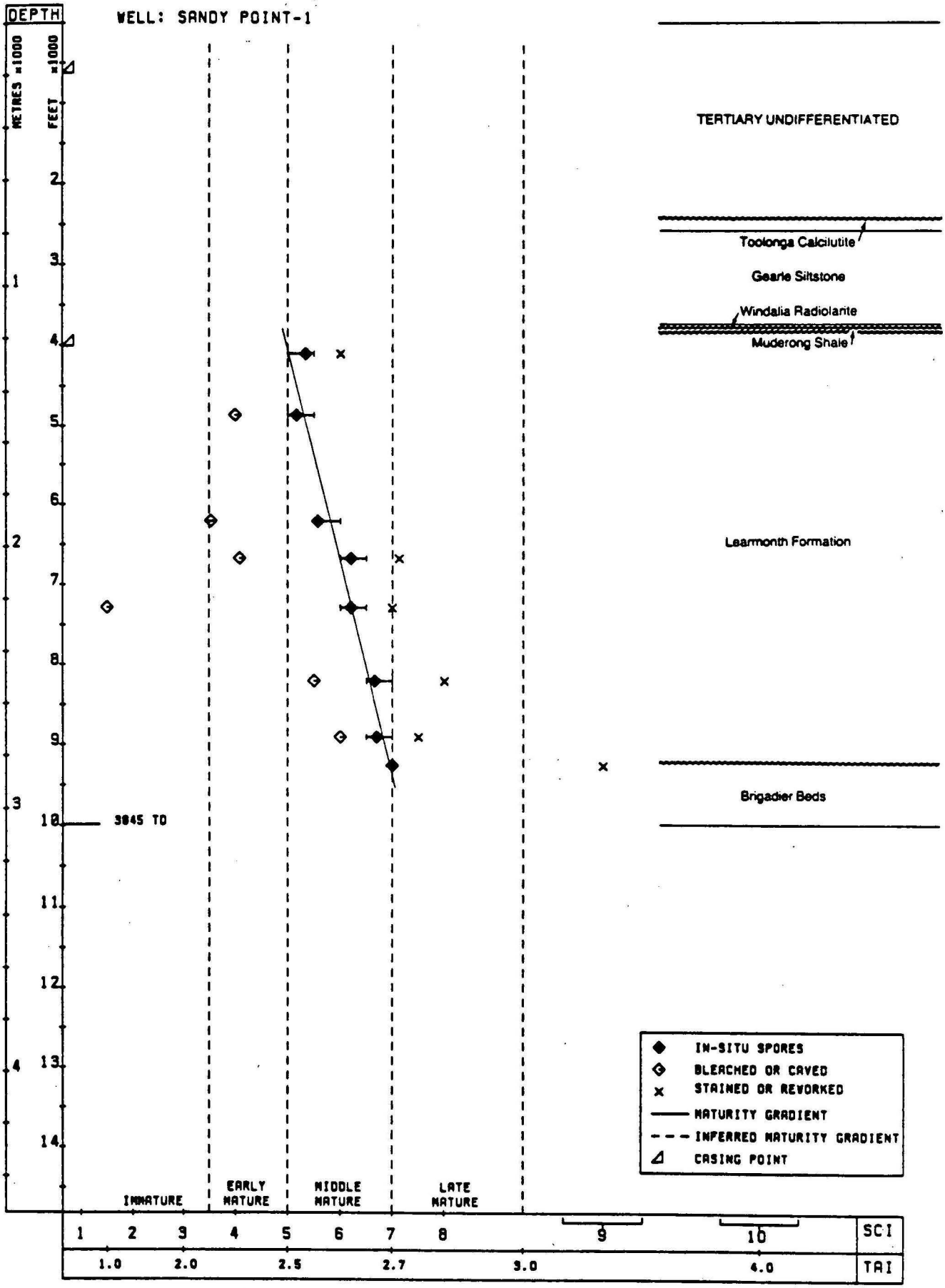



FIGURE 1 SPORE COLOUR INDEX AGAINST DEPTH

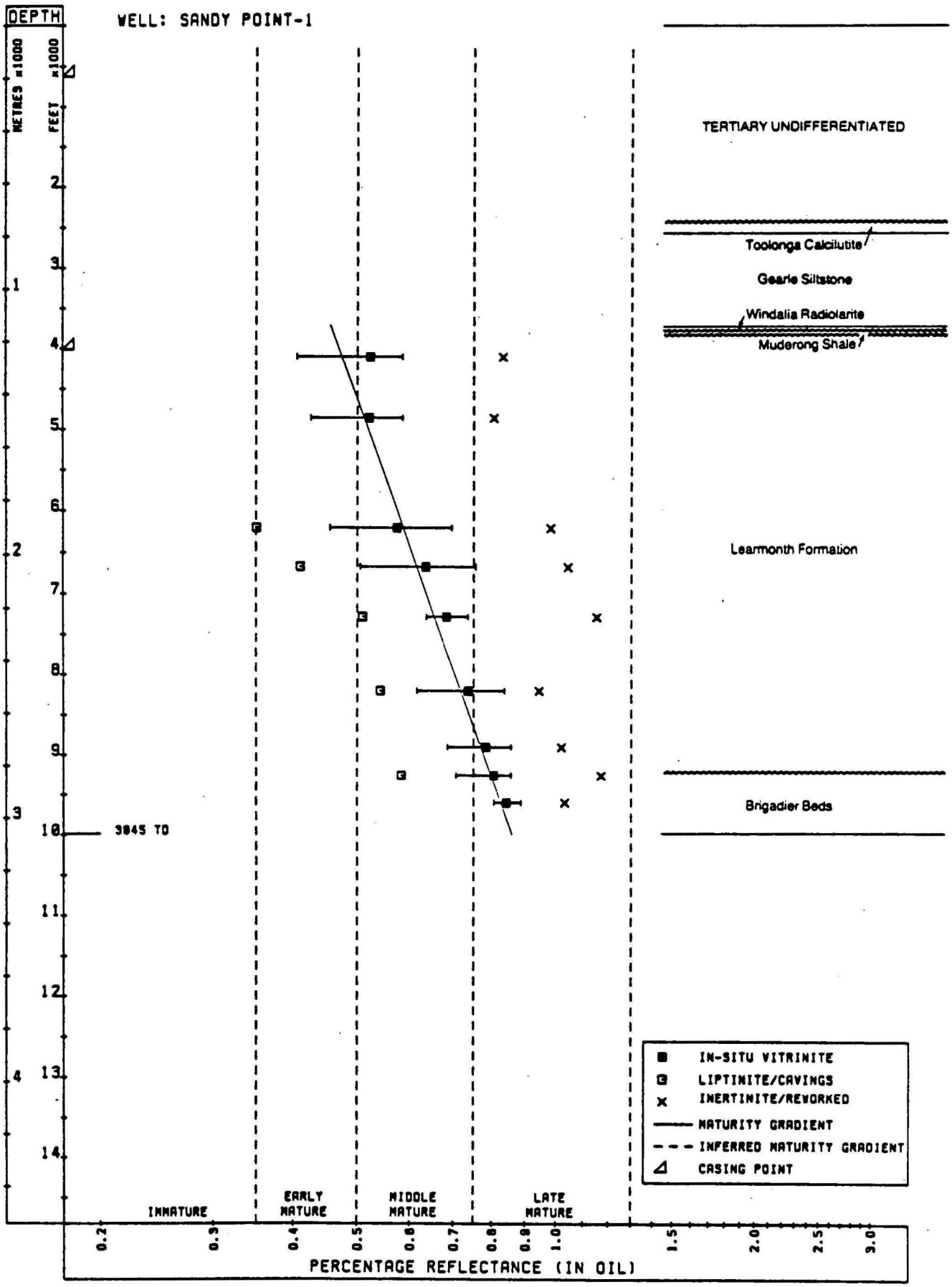



FIGURE 2 VITRINITE REFLECTANCE AGAINST DEPTH

Sandy Point-1
2924-2930m
Brigadier Beds
SCI 7.0
Pr/Ph = 3.51
$Pr/n\text{-}C_{17}$ = 1.62
$Ph/n\text{-}C_{18}$ = 0.50
CPI = 0.92

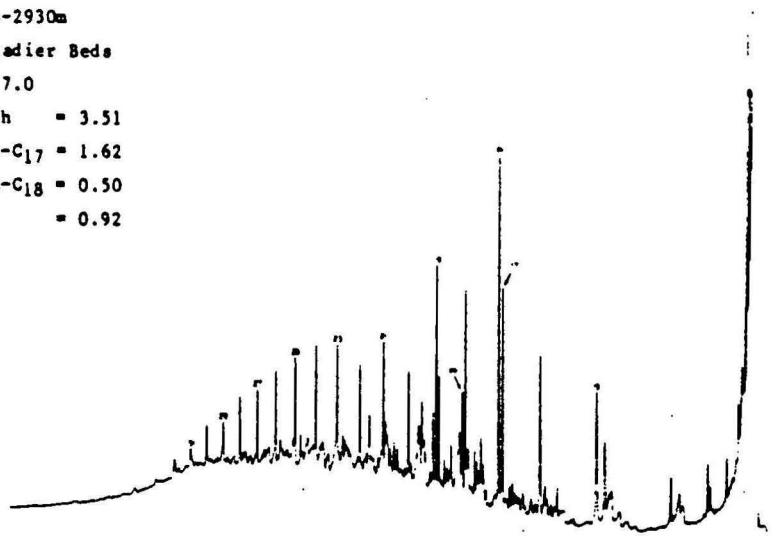


Figure 3

Robertson Research

Appendix 1a

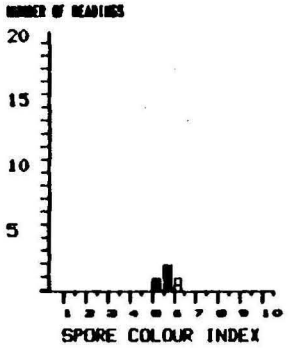
SANDY POINT-1

IN SITU POPULATION

SAMPLE 1250-1265M

5.0 5.5 5.5 6.0

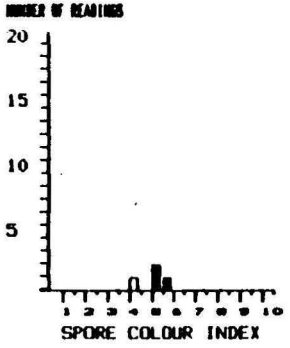
| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 5.0-5.5 | 3 |
| BLEACHED OR CAVED | - | 0 |
| STAINED OR REWORKED | 6.0-6.0 | 1 |




SAMPLE 1482-1500M

4.0 5.0 5.0 5.5

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 5.0-5.5 | 3 |
| BLEACHED OR CAVED | 4.0-4.0 | 1 |
| STAINED OR REWORKED | - | 0 |



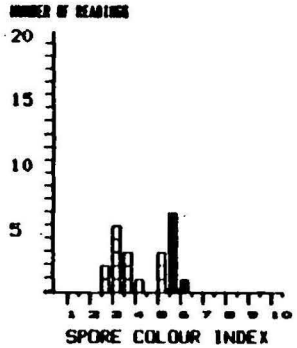

SANDY POINT-1

IN SITU POPULATION

SAMPLE 1893-1909M

2.5 2.5 3.0 3.0 3.0 3.0 3.0 3.5 3.5 3.5
4.0 5.0 5.0 5.0 5.5 5.5 5.5 5.5 5.5 5.5
6.0

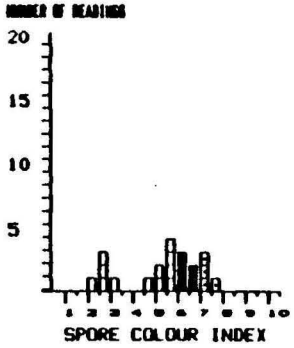
| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 5.5-6.0 | 7 |
| BLEACHED OR CAVED | 2.5-5.0 | 14 |
| STAINED OR REWORKED | - | 0 |




SAMPLE 2034-2052M

2.0 2.5 2.5 2.5 3.0 4.5 5.0 5.0 5.5 5.5
5.5 5.5 6.0 6.0 6.0 6.5 6.5 7.0 7.0 7.0
7.5

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 6.0-6.5 | 5 |
| BLEACHED OR CAVED | 2.0-5.5 | 12 |
| STAINED OR REWORKED | 7.0-7.5 | 4 |



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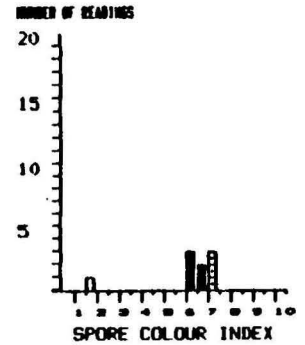
## SANDY POINT-1

IN SITU POPULATION

**SAMPLE 2220-2235M**

1.5 6.0 6.0 6.0 6.5 6.5 7.0 7.0 7.0

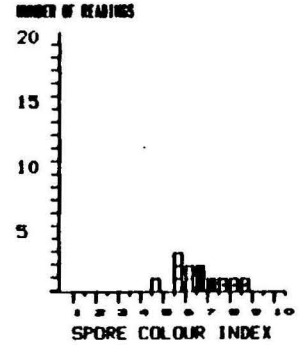
| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 6.0-6.5 | 5 |
| BLEACHED OR CAVED | 1.5-1.5 | 1 |
| STAINED OR REWORKED | 7.0-7.0 | 3 |




**SAMPLE 2500-2512M**

4.5 5.5 5.5 5.5 6.0 6.0 6.5 6.5 7.0 7.5 8.0 8.5

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 6.5-7.0 | 3 |
| BLEACHED OR CAVED | 4.5-6.0 | 6 |
| STAINED OR REWORKED | 7.5-8.5 | 3 |



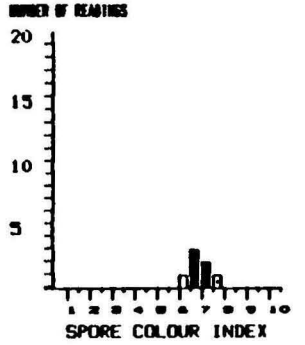

## SANDY POINT-1

IN SITU POPULATION

**SAMPLE 2713-2732M**

6.0 6.5 6.5 6.5 7.0 7.0 7.5

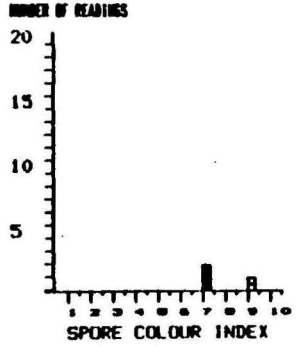
| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 6.5-7.0 | 5 |
| BLEACHED OR CAVED | 6.0-6.0 | 1 |
| STAINED OR REWORKED | 7.5-7.5 | 1 |




**SAMPLE 2820-2835M**

7.0 7.0 9.0

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 7.0-7.0 | 2 |
| BLEACHED OR CAVED | - | 0 |
| STAINED OR REWORKED | 9.0-9.0 | 1 |




Appendix 1b

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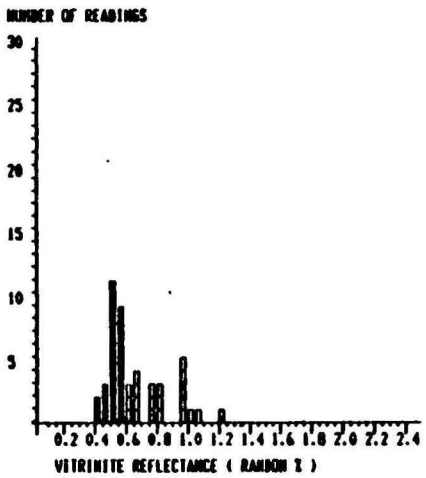
SANDY POINT-1

SAMPLE 1250-1265M

0.41 0.44 0.49 0.49 0.49 0.50 0.50 0.50 0.51 0.51
0.51 0.52 0.52 0.53 0.53 0.54 0.55 0.55 0.56 0.56
0.56 0.56 0.56 0.57 0.58 0.60 0.62 0.63 0.65 0.67
0.67 0.68 0.77 0.78 0.79 0.80 0.82 0.83 0.95 0.95
0.96 0.98 0.98 1.01 1.07 1.21

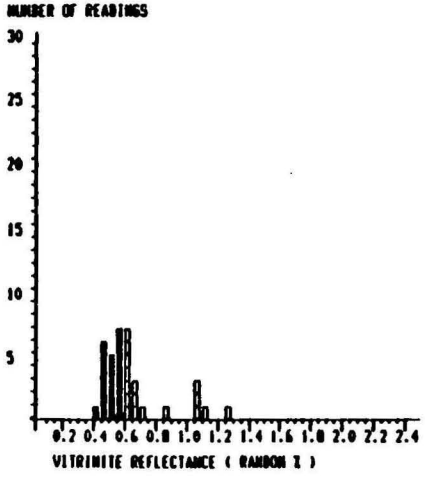
| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.41-0.58 | 25 | 0.52 | 0.04 |
| INERTINITE/REWORKED | 0.60-1.21 | 21 | 0.83 | 0.17 |




SAMPLE 1482-1500M

0.43 0.45 0.48 0.48 0.49 0.49 0.49 0.50 0.52 0.52
0.53 0.54 0.55 0.55 0.56 0.57 0.57 0.58 0.58 0.62
0.62 0.63 0.63 0.63 0.64 0.64 0.65 0.68 0.69 0.74
0.89 1.05 1.08 1.09 1.11 1.27

| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.43-0.58 | 19 | 0.52 | 0.04 |
| INERTINITE/REWORKED | 0.62-1.27 | 17 | 0.80 | 0.22 |

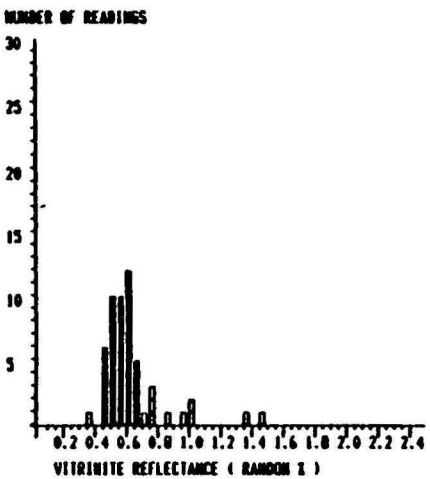



SANDY POINT-1

SAMPLE 1893-1909M

0.35 0.46 0.47 0.47 0.48 0.48 0.49 0.50 0.50 0.51
0.51 0.51 0.52 0.52 0.54 0.54 0.54 0.55 0.56 0.56
0.58 0.58 0.58 0.58 0.59 0.59 0.59 0.60 0.60 0.61
0.61 0.61 0.61 0.62 0.62 0.62 0.62 0.64 0.64 0.67
0.68 0.68 0.69 0.69 0.72 0.75 0.76 0.76 0.87 0.99
1.03 1.04 1.39 1.49

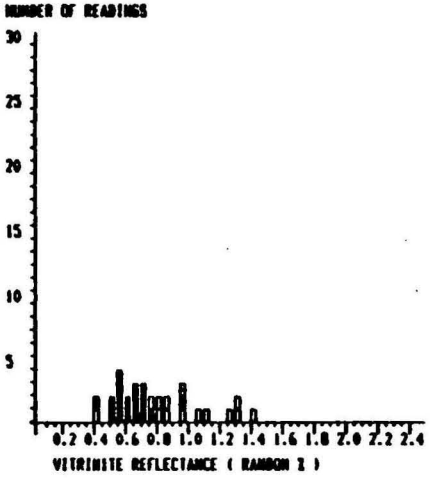
| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.46-0.69 | 43 | 0.57 | 0.06 |
| LIPTINITE/CAVINGS | 0.35-0.35 | 1 | 0.35 | |
| INERTINITE/REWORKED | 0.72-1.49 | 10 | 0.98 | 0.27 |




SAMPLE 2024-2052M

0.40 0.42 0.51 0.54 0.56 0.58 0.58 0.59 0.60 0.61
0.66 0.68 0.69 0.70 0.72 0.74 0.75 0.78 0.81 0.84
0.85 0.89 0.95 0.95 0.99 1.08 1.14 1.26 1.31 1.31
1.41

| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.51-0.75 | 15 | 0.63 | 0.08 |
| LIPTINITE/CAVINGS | 0.40-0.42 | 2 | 0.41 | 0.01 |
| INERTINITE/REWORKED | 0.78-1.41 | 14 | 1.04 | 0.21 |




Appendix 2a

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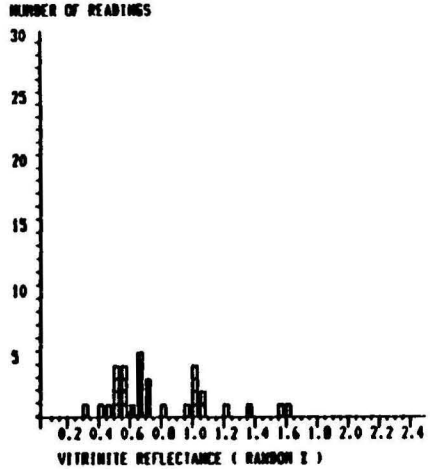
SANDY POINT-1

SAMPLE 2220-2235M

0.30 0.42 0.46 0.51 0.52 0.54 0.54 0.57 0.57 0.58
0.59 0.64 0.65 0.66 0.68 0.68 0.68 0.70 0.71 0.73
0.81 0.95 1.01 1.03 1.04 1.04 1.07 1.09 1.23 1.38
1.56 1.61

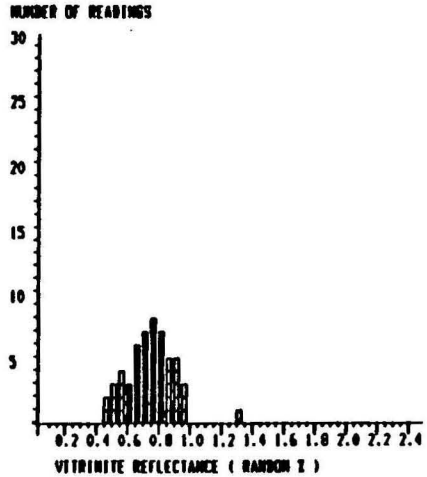
| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.64-0.73 | 9 | 0.68 | 0.03 |
| LIPTINITE/CAVINGS | 0.30-0.59 | 11 | 0.51 | 0.09 |
| INERTINITE/REWORKED | 0.81-1.61 | 12 | 1.15 | 0.25 |




SAMPLE 2590-2512M

0.47 0.49 0.53 0.53 0.54 0.56 0.57 0.59 0.59 0.62
0.63 0.64 0.66 0.67 0.68 0.68 0.69 0.69 0.70 0.70
0.71 0.71 0.71 0.72 0.74 0.75 0.76 0.76 0.76 0.76
0.77 0.77 0.79 0.80 0.80 0.81 0.82 0.82 0.83 0.83
0.85 0.86 0.86 0.87 0.89 0.91 0.91 0.92 0.93 0.94
0.95 0.98 0.99 1.32

| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.62-0.83 | 31 | 0.73 | 0.06 |
| LIPTINITE/CAVINGS | 0.47-0.59 | 9 | 0.54 | 0.04 |
| INERTINITE/REWORKED | 0.85-1.32 | 14 | 0.94 | 0.12 |

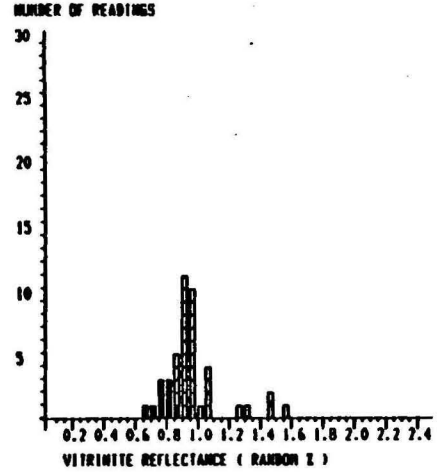



SANDY POINT-1

SAMPLE 2713-2732M

0.69 0.72 0.75 0.77 0.78 0.81 0.83 0.84 0.85 0.88
0.88 0.88 0.89 0.90 0.91 0.91 0.91 0.92 0.92 0.92
0.92 0.92 0.93 0.94 0.95 0.95 0.95 0.96 0.96 0.97
0.98 0.98 0.98 0.99 1.03 1.06 1.06 1.06 1.07 1.26
1.33 1.45 1.46 1.57

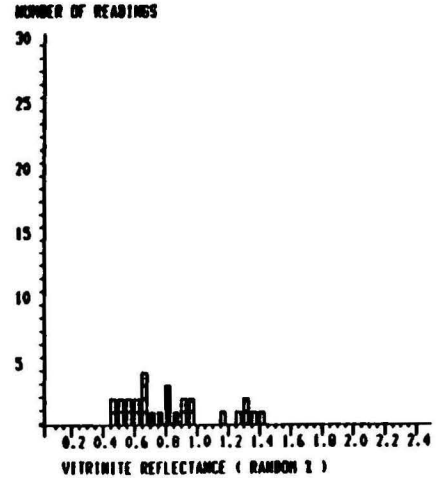
| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.69-0.85 | 9 | 0.78 | 0.06 |
| INERTINITE/REWORKED | 0.88-1.57 | 35 | 1.02 | 0.18 |




SAMPLE 2020-2035M

0.46 0.48 0.53 0.53 0.55 0.58 0.61 0.61 0.65 0.66
0.66 0.67 0.71 0.78 0.82 0.82 0.84 0.85 0.91 0.94
0.97 0.99 1.18 1.29 1.30 1.32 1.37 1.42

| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.71-0.85 | 6 | 0.80 | 0.05 |
| LIPTINITE/CAVINGS | 0.46-0.67 | 12 | 0.58 | 0.07 |
| INERTINITE/REWORKED | 0.91-1.42 | 10 | 1.17 | 0.20 |




Appendix 2b

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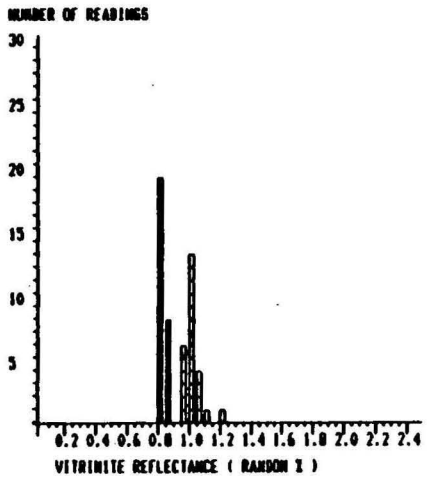
SANDY POINT-1

SAMPLE 2924-2930M

0.81 0.82 0.82 0.82 0.83 0.83 0.83 0.83 0.83 0.83
0.83 0.83 0.83 0.84 0.84 0.84 0.84 0.84 0.84 0.85
0.85 0.85 0.86 0.87 0.87 0.88 0.88 0.96 0.97 0.97
0.98 0.99 0.99 1.00 1.00 1.01 1.02 1.03 1.03 1.03
1.03 1.03 1.04 1.04 1.04 1.04 1.05 1.06 1.07 1.07
1.11 1.21




| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.81-0.88 | 27 | 0.84 | 0.02 |
| INERTINITE/REWORKED | 0.96-1.21 | 25 | 1.03 | 0.05 |

Appendix 2c

# SPAR-1 WELL

## SUMMARY

Geochemical analysis of samples from the interval 2400m to 3690m of the Spar-1 well has shown that the well section is early mature to 2550m and middle mature below 2550m to 3721m TD. The maturity gradients do not indicate any significant missing section within the interval analysed. Extrapolation of the gradients to the seabed also suggests that no major amount of Early Cretaceous or younger section has been removed above 2400m and that the sediments penetrated are currently at or near their maximum depths of burial.

Mudstones in the interval 2530m to 2595m in the Muderong Shale and 3135m to 3360m in the Barrow Group have fair and very good oil source potential respectively. The latter interval has poor gas source potential. The source interval in the Barrow Group is currently middle mature and will have generated significant quantities of hydrocarbons.

Samples at 2620m to 2640m, 2655m to 2665m and 3500m to 3510m contain small quantities of migrant hydrocarbons derived from a mature source containing abundant, terrestrially derived, waxy kerogens.

## GENERAL COMMENTS

Basin: Northern Carnarvon Basin.

Location: 20° 36' 51.7"S, 114° 53' 06.1"E.

Operator and date of drilling: West Australian Petroleum Pty Ltd, 1976.

Well Status: Plugged and abandoned.

TD: 3721m.

Mud data: Seawater with gel pills: Seabed to 520m.
Lightly treated sea water gel system: 520m to 1511m.
Lignosulphonate system: 1511m to 3721m TD.

Casing data: 30" at 168m, 20" at 518m, $13^3/_8$" at 1502m, $9^5/_8$" at 2600m.

BHT data: Not available.

## SPAR-1 WELL

Elevation: RT 30m ASL.

Water depth: 114m.

Interval analysed: 2400m to 3690m.

Age of interval analysed:

| | Depths (in metres) |
|---|---|
| Early Cretaceous | 2400-3690 |

Sample type and quality: Dried ditch cuttings of good quality for geochemical analysis.

Maturation data quality:

a) Vitrinite Reflectance: The samples yielded sufficient vitrinite for measurements. Results: Fair to good.

b) Spore Colour Index: The samples yielded poor to fair quantities of indigenous sporomorphs for measurement. Results: Fair to good.

Source rock data quality: Poor to fair.

Gas chromatography run at: 2585m to 2595m, 2620m to 2640m, 2655m to 2665m, 3135m to 3145m, 3350m to 3360m and 3500m to 3510m.

MATURATION (Table 1, Figures 1 and 2, Appendices 1 and 2)

Vitrinite reflectance results show values increasing steadily from 0.48% at 2400m to 2410m to 0.72% at 3680m to 3690m. Spore colour index data show values increasing from 5 SCI units to 6.5 to 7 SCI units over the same interval. The results indicate that the analysed interval is early mature to about 2550m and middle mature below 2550m to 3721m TD. Neither set of data suggests any significant missing section within the interval analysed. Extrapolation of the gradients to the seabed does not suggest that any major amounts of Early Cretaceous or younger section is missing above 2400m and also shows that the sediments penetrated are at or near their maximum depths of burial.

OIL AND GAS SOURCE ROCKS (Tables 1 and 2, Figure 3)

Mudstones in the interval 2530m to 2595m in the Muderong Shale and 3135m to 3360m in the Barrow Group contain average to above average organic carbon contents of between 1.74% and 2.45%. Pyrolysis analysis of these samples shows that they contain small but significant quantities of oil-prone kerogen mixed with humic kerogen. These intervals have fair and very good oil source potential respectively. The latter interval will have poor gas source potential at optimum maturity.

Extraction of samples in the Muderong Shale at 2585m to 2595m and in the Barrow Group at 3135m to 3145m and 3350m to 3360m shows that these samples contain indigenous hydrocarbons, derived from early to middle mature, terrestrially sourced waxy kerogens.

GEOCHEMICAL CHARACTERISTICS OF THE REMAINING SEDIMENTS (Tables 1 and 2, Figure 3)

The remaining mudstones analysed in the intervals 2400m to 2475m in the Muderong Shale and 2655m to 3055m and 3500m to 3690m in the Barrow Group contain average to above average organic carbon contents of between 1.19% and 3.07%. Pyrolysis analysis of these samples shows that they contain only humic kerogen and have no oil source potential.

Extraction of samples at 2620m to 2640m, 2655m to 2665m and 3500m to 3510m shows that these samples contain small quantities of migrant hydrocarbons derived from a mature source containing predominantly terrestrially derived waxy kerogens.

WELL: SPAR-1

| SAMPLE DEPTH (METRES) | SAMPLE TYPE | GENERALISED LITHOLOGY | SPORE COLOUR INDEX (1-10) | VITRINITE REFLECTIVITY (R oil av %) | KEROGEN COMPOSITION (% vol) (by microscopic examination) | | | KEROGEN COMPOSITION (% wt) (by calculation from pyrolysis data) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | INERTINITE | VITRINITE | SAPROPEL | INERTINITE | VITRINITE | ALGAL SAPROPEL | WAXY SAPROPEL |
| **2260** | | **Maderong Shale** | | | | | | | | | |
| 2400-2410 | Ctg | MDST, med gy | 5.0 | 0.48(7) | 50 | 40 | 10 | 45 | 45 | * | 10 |
| 2465-2475 | " | MDST, a/a | | | | | | 55 | 40 | * | 5 |
| 2530-2540 | " | MDST, a/a | | | | | | 45 | 45 | * | 10 |
| 2585-2595 | " | MDST, a/a | 5.0-5.5 | 0.48(27) | 65 | 35 | mnr | 30 | 50 | * | 20 |
| **2601** | | **Barrow Gp** | | | | | | | | | |
| 2655-2665 | " | MDST, yel-gy | | | | | | 45 | 50 | * | 5 |
| 2765-2775 | " | MDST, yel gy, calc | 2.5-3.0cvd | 0.53(34) | 40 | 50 | 10 | 40 | 50 | * | 10 |
| 2800-2810 | " | MDST, lt ol-gy | | | | | | 45 | 50 | * | 5 |
| 2910-2920 | " | MDST, a/a | 2.5-4.5cvd | 0.58(16) | 50 | 50 | mnr | 50 | 50 | * | * |
| 3010-3020 | " | MDST, ol-gy | | | | | | 50 | 50 | * | * |
| 3045-3055 | " | MDST, a/a | | | | | | 45 | 55 | * | * |
| 3135-3145 | " | MDST, lt ol-gy | | | | | | 20 | 60 | * | 20 |
| 3180-3190 | " | MDST, ol-gy | 6.0-6.5 | 0.63(20) | 30 | 60 | 10 | 20 | 70 | * | 10 |
| 3275-3280 | " | MDST, a/a + mnr SND | | | | | | 35 | 55 | * | 10 |
| 3350-3360 | " | MDST, a/a + mnr SLTST, v lt gy | 6.0-6.5 | 0.67(21) | 40 | 30 | 30 | 25 | 40 | * | 35 |
| 3500-3510 | " | MDST, yel-gy | 5.0cvd | 0.67(26) | 60 | 40 | * | 45 | 55 | * | * |
| 3565-3575 | " | MDST, ol gy | | | | | | 60 | 40 | * | * |
| 3615-3625 | " | MDST, a/a | | | | | | 60 | 40 | * | * |
| 3680-3690 | " | MDST, a/a | 6.5-7.0 | ?0.72(2) | 30 | 60 | 10 | 55 | 45 | * | * |

Table 1 Maturity and Kerogen Composition Data

WELL: SPAR-1

| GENERAL DATA | | | CHEMICAL ANALYSIS DATA | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PYROLYSIS | | | | | SOLVENT EXTRACTION | | | | | | |
| | | | | | | | | | | | | | EXTRACT COMPOSITION % | | |
| SAMPLE DEPTH (METRES) | SAMPLE TYPE | ANALYSED LITHOLOGY | ORGANIC CARBON % OF ROCK | TEMPERATURE °C | HYDROGEN INDEX | OXYGEN INDEX | PRODUCTION INDEX | POTENTIAL YIELD (kg/Tonne) | TOTAL EXTRACT (ppm) | TOTAL EXTRACT (mg/g TOC) | HYDROCARBONS (ppm) | HYDROCARBONS (mg/g TOC) | SATURATED HYDROCARBONS | AROMATIC HYDROCARBONS | POLAR COMPOUNDS |
| **2260** | | **Muderong Shale** | | | | | | | | | | | | | |
| 2400-2410 | Ctg | MDST, med gy | 2.27 | 431 | 144 | 74 | 0.04 | 3.39 | | | | | | | |
| 2465-2475 | " | MDST, a/a | 2.91 | 429 | 89 | 71 | 0.07 | 2.79 | | | | | | | |
| 2530-2540 | " | MDST, a/a | 2.45 | 426 | 139 | 36 | 0.05 | 3.58 | | | | | | | |
| 2585-2595 | " | MDST, a/a | 2.31 | 432 | 205 | 43 | 0.04 | 4.92 | 960 | 42 | 425 | 18 | 36 | 9 | 55 |
| **2601** | | **Barrow Gp** | | | | | | | | | | | | | |
| 2620-2640 | " | SND + SST, wht-lt-gy, v arg | 1.01 | | | | | | 515 | 51 | 260 | 26 | 40 | 11 | 49 |
| 2655-2665 | " | MDST, yel-gy, sl calc | 1.28 | 426 | 105 | 145 | 0.21 | 1.69 | 1255 | 98 | 545 | 43 | 36 | 8 | 56 |
| 2765-2775 | " | MDST, a/a, calc | 1.19 | 423 | 139 | 87 | 0.16 | 1.98 | | | | | | | |
| 2800-2810 | " | MDST, lt ol-gy, sl calc | 1.36 | 424 | 113 | 71 | 0.16 | 1.84 | | | | | | | |
| 2910-2920 | " | MDST, a/a | 1.58 | 427 | 91 | 72 | 0.14 | 1.68 | | | | | | | |
| 3010-3020 | " | MDST, ol-gy, sl calc | 2.18 | 424 | 92 | 87 | 0.15 | 2.36 | | | | | | | |
| 3045-3055 | " | MDST, a/a, calc | 2.53 | 428 | 117 | 52 | 0.11 | 3.34 | | | | | | | |
| 3135-3145 | " | MDST, lt ol-gy, sl calc | 2.06 | 430 | 194 | 83 | 0.11 | 4.49 | 1315 | 64 | 460 | 22 | 14 | 21 | 65 |
| 3180-3190 | " | MDST, ol-gy | 2.24 | 431 | 154 | 60 | 0.11 | 3.90 | | | | | | | |
| 3275-3280 | " | MDST, a/a, calc + mnr SND | 2.43 | 429 | 135 | 60 | 0.11 | 3.71 | | | | | | | |
| 3350-3360 | " | MDST, a/a, sl calc + mnr SLTST, v lt gy | 1.74 | 431 | 274 | 72 | 0.11 | 5.37 | 1630 | 94 | 920 | 53 | 40 | 16 | 44 |
| 3500-3510 | " | MDST, yel-gy, sl calc | 1.40 | 427 | 88 | 164 | 0.25 | 1.64 | 1585 | 113 | 850 | 61 | 49 | 5 | 46 |
| 3565-3575 | " | MDST, ol-gy, sl calc | 1.48 | 429 | 61 | 265 | 0.20 | 1.12 | | | | | | | |
| 3615-3625 | " | MDST, a/a | 3.07 | 425 | 60 | 86 | 0.19 | 2.28 | | | | | | | |
| 3680-3690 | " | MDST, a/a | 2.23 | 421 | 66 | 81 | 0.17 | 1.78 | | | | | | | |

Table 2 Chemical Analysis Data

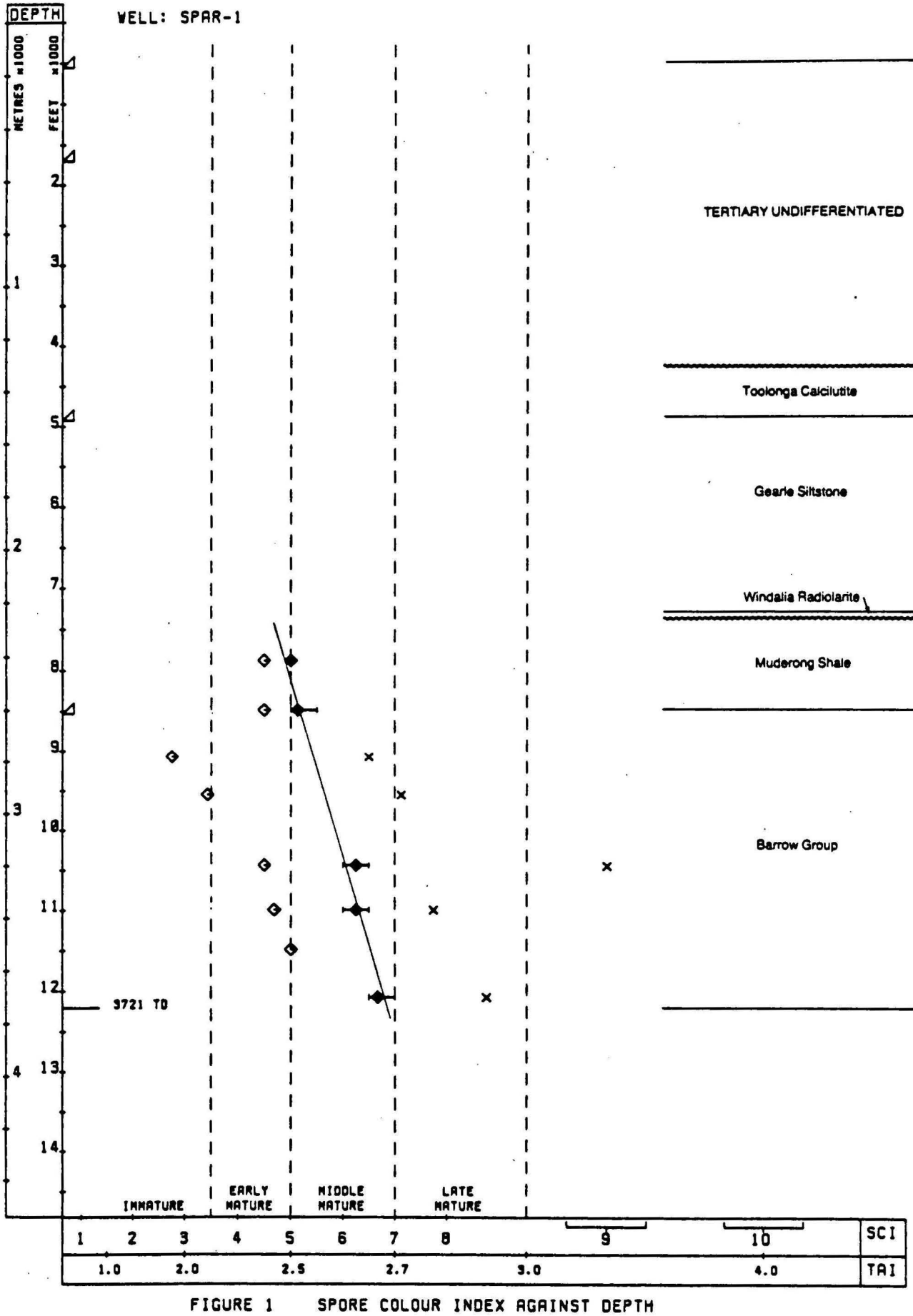



FIGURE 1 SPORE COLOUR INDEX AGAINST DEPTH

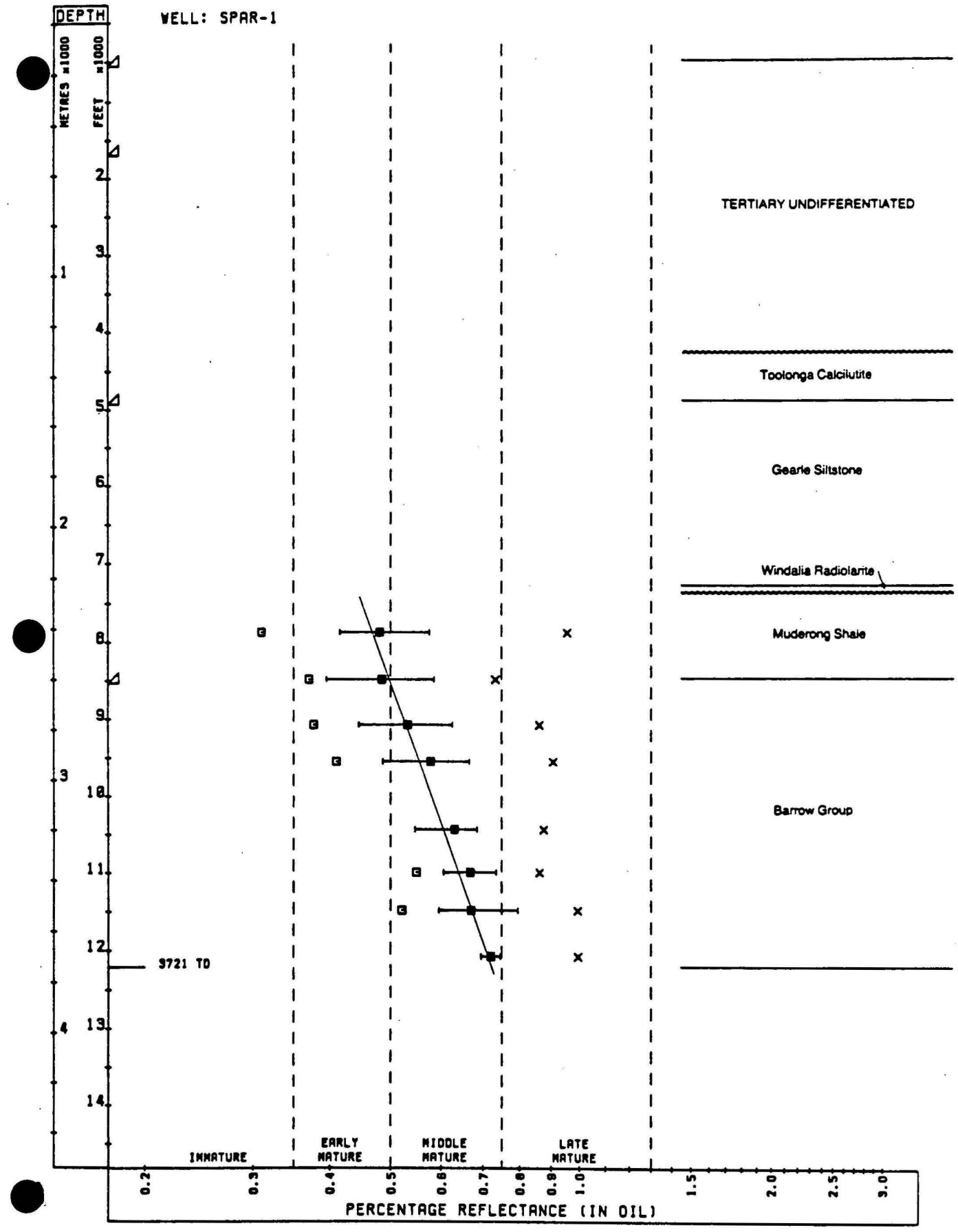
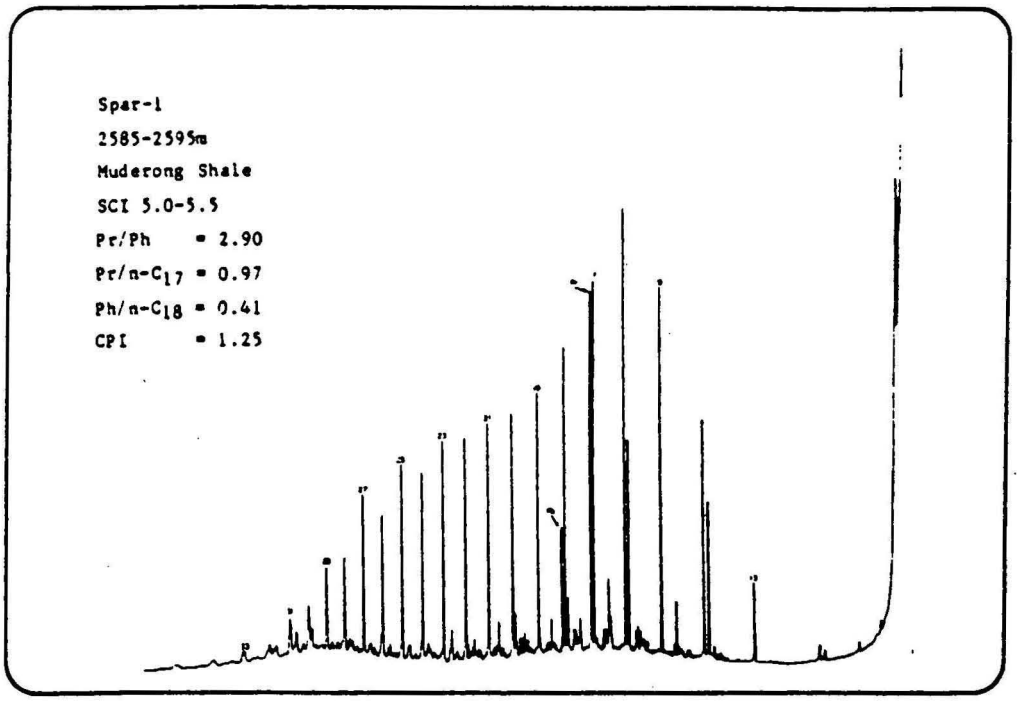
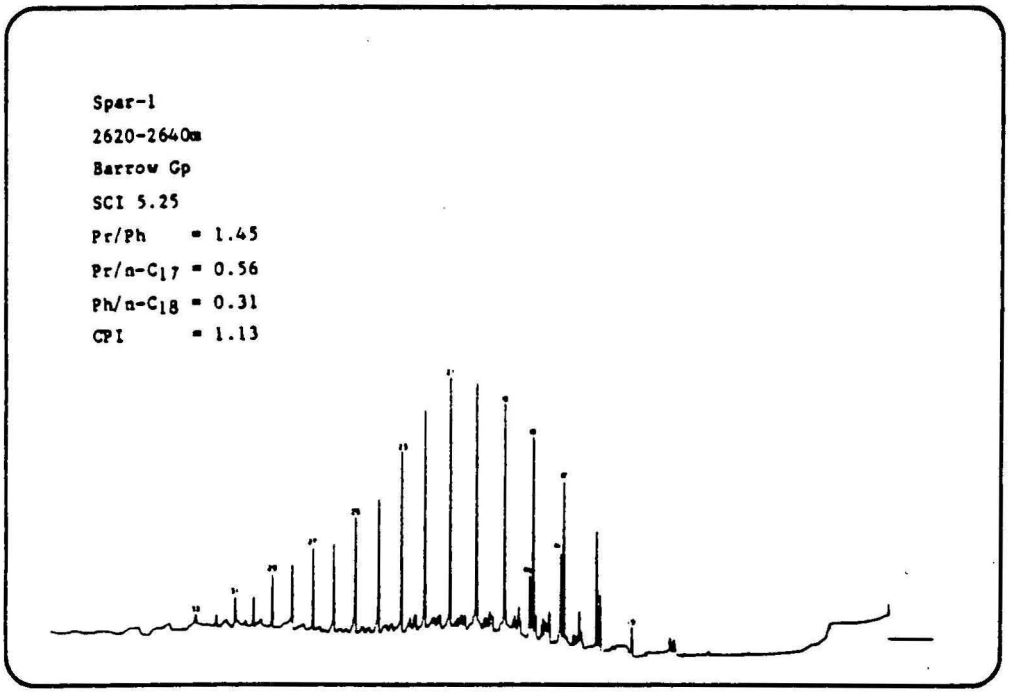



FIGURE 2 VITRINITE REFLECTANCE AGAINST DEPTH


Spar-1
2585-2595m
Muderong Shale
SCI 5.0-5.5
Pr/Ph = 2.90
Pr/n-C17 = 0.97
Ph/n-C18 = 0.41
CPI = 1.25


Spar-1
2620-2640m
Barrow Gp
SCI 5.25
Pr/Ph = 1.45
Pr/n-C17 = 0.56
Ph/n-C18 = 0.31
CPI = 1.13

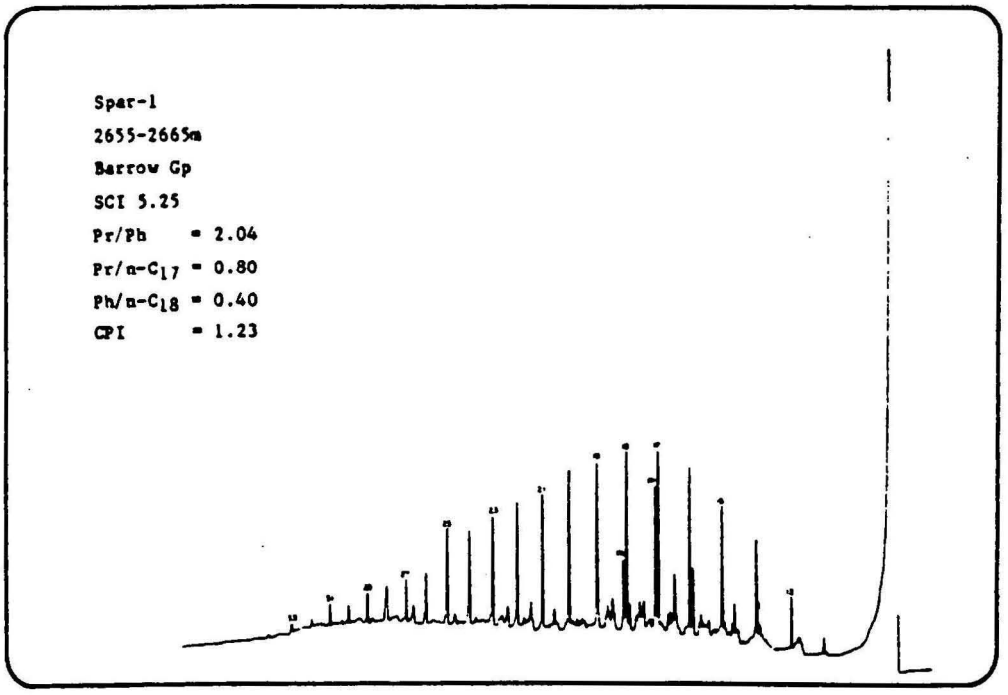
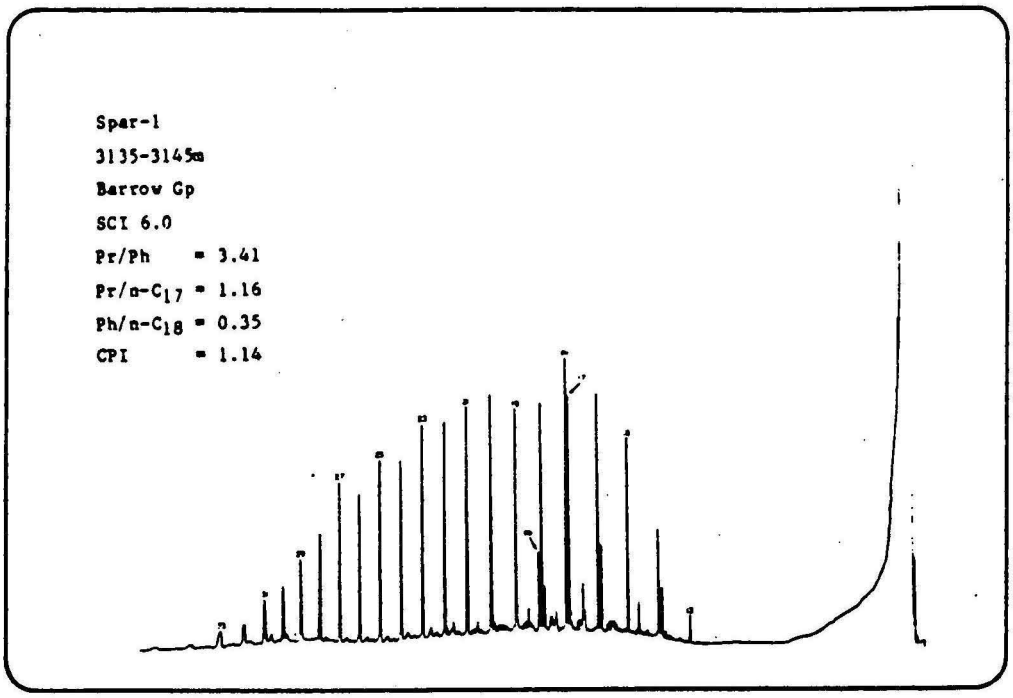
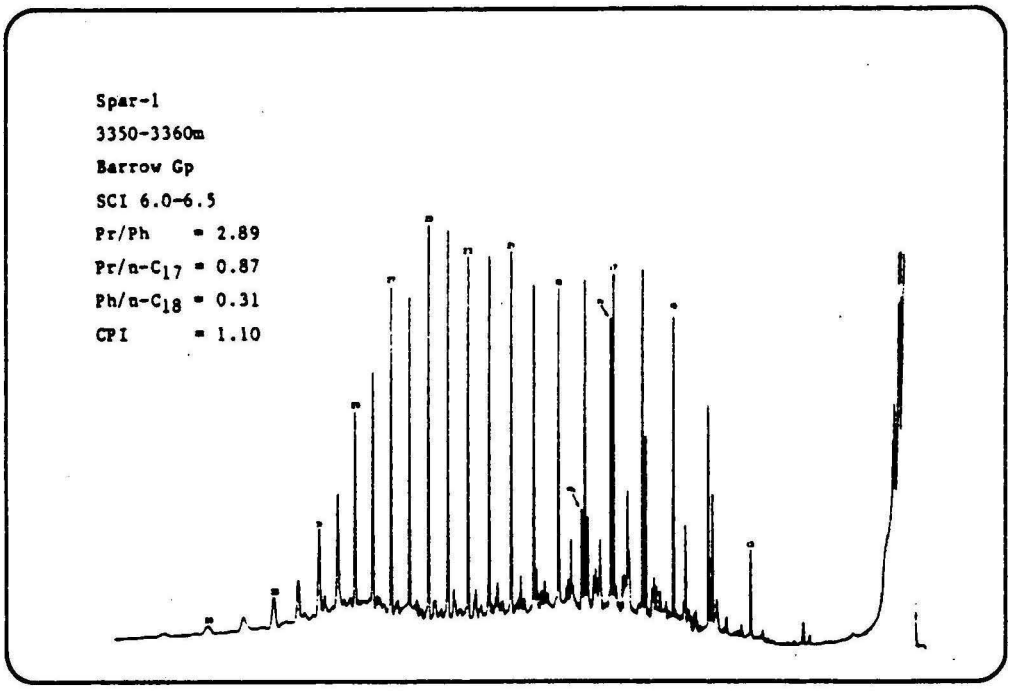

Spar-1
2655-2665m
Barrow Gp
SCI 5.25
Pr/Ph = 2.04
Pr/n-C17 = 0.80
Ph/n-C18 = 0.40
CPI = 1.23

Figure 3a


Spar-1
3135-3145m
Barrow Gp
SCI 6.0
Pr/Ph = 3.41
Pr/n-C17 = 1.16
Ph/n-C18 = 0.35
CPI = 1.14


Spar-1
3350-3360m
Barrow Gp
SCI 6.0-6.5
Pr/Ph = 2.89
Pr/n-C17 = 0.87
Ph/n-C18 = 0.31
CPI = 1.10

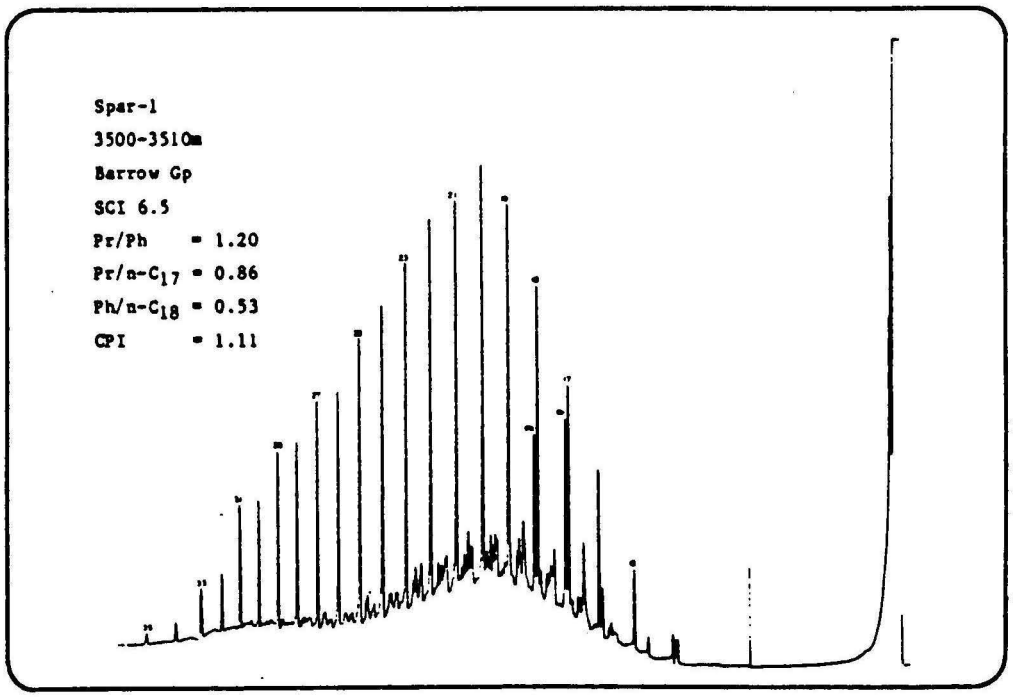

Spar-1
3500-3510m
Barrow Gp
SCI 6.5
Pr/Ph = 1.20
Pr/n-C17 = 0.86
Ph/n-C18 = 0.53
CPI = 1.11

Figure 3b

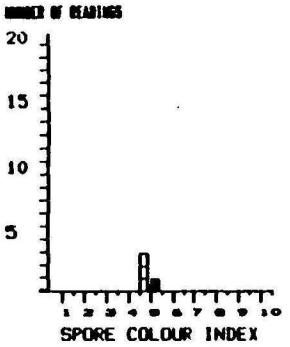
Robertson Research

SPAR-1

IN SITU POPULATION

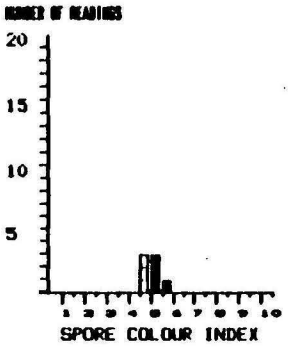
SAMPLE 2400-2410M
4.5 4.5 4.5 5.0

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 5.0-5.0 | 1 |
| BLEACHED OR CAVED | 4.5-4.5 | 3 |
| STAINED OR REWORKED | - | 0 |




SAMPLE 2585-2595M
4.5 4.5 4.5 5.0 5.0 5.0 5.5

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 5.0-5.5 | 4 |
| BLEACHED OR CAVED | 4.5-4.5 | 3 |
| STAINED OR REWORKED | - | 0 |

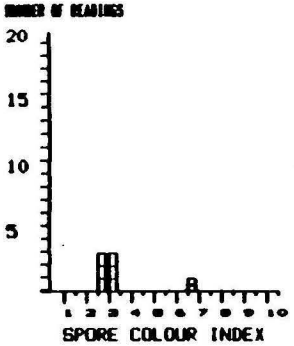



SPAR-1

IN SITU POPULATION

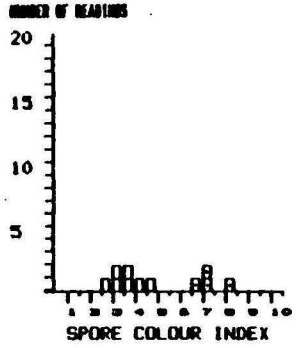
SAMPLE 2765-2775M
2.5 2.5 2.5 3.0 3.0 3.0 6.5

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | - | 0 |
| BLEACHED OR CAVED | 2.5-3.0 | 6 |
| STAINED OR REWORKED | 6.5-6.5 | 1 |




SAMPLE 2910-2920M
2.5 3.0 3.0 3.5 3.5 4.0 4.5 6.5 7.0 7.0 8.0

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | - | 0 |
| BLEACHED OR CAVED | 2.5-4.5 | 7 |
| STAINED OR REWORKED | 6.5-8.0 | 4 |




Appendix 1a

Robertson Research

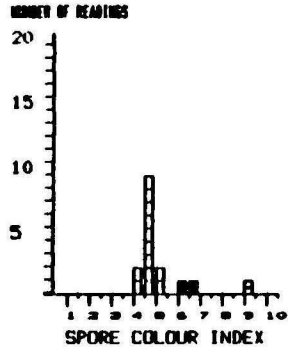
SPAR-1

IN SITU POPULATION

SAMPLE 3180-3190M

4.0 4.0 4.5 4.5 4.5 4.5 4.5 4.5 4.5 4.5
4.5 5.0 5.0 6.0 6.5 9.0

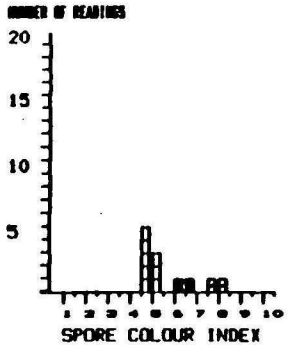
| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 6.0-6.5 | 2 |
| BLEACHED OR CAVED | 4.0-5.0 | 13 |
| STAINED OR REWORKED | 9.0-9.0 | 1 |




SAMPLE 3350-3360M

4.5 4.5 4.5 4.5 5.0 5.0 5.0 6.0 6.5
7.5 8.0

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 6.0-6.5 | 2 |
| BLEACHED OR CAVED | 4.5-5.0 | 8 |
| STAINED OR REWORKED | 7.5-8.0 | 2 |



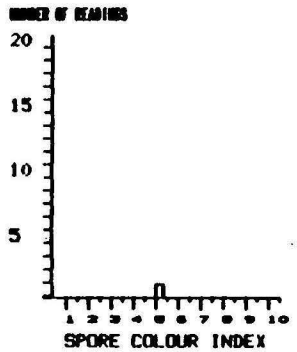

SPAR-1

IN SITU POPULATION

SAMPLE 3500-3510M

5.0

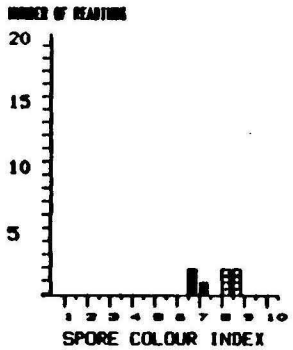
| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | - | 0 |
| BLEACHED OR CAVED | 5.0-5.0 | 1 |
| STAINED OR REWORKED | - | 0 |




SAMPLE 3680-3690M

6.5 6.5 7.0 8.0 8.0 8.5 8.5

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 6.5-7.0 | 3 |
| BLEACHED OR CAVED | - | 0 |
| STAINED OR REWORKED | 8.0-8.5 | 4 |




Appendix 1b

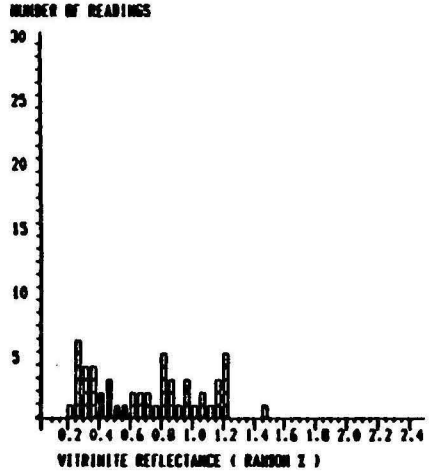
Robertson Research

SPAR-1

SAMPLE 2400-2410M

0.23 0.26 0.26 0.27 0.28 0.29 0.29 0.30 0.30 0.31
0.33 0.37 0.38 0.39 0.39 0.42 0.43 0.46 0.46 0.49
0.53 0.57 0.60 0.60 0.66 0.69 0.70 0.70 0.78 0.80
0.80 0.81 0.82 0.84 0.86 0.87 0.89 0.91 0.95 0.97
0.99 1.01 1.05 1.06 1.13 1.17 1.19 1.19 1.20 1.20
1.20 1.23 1.24 1.47

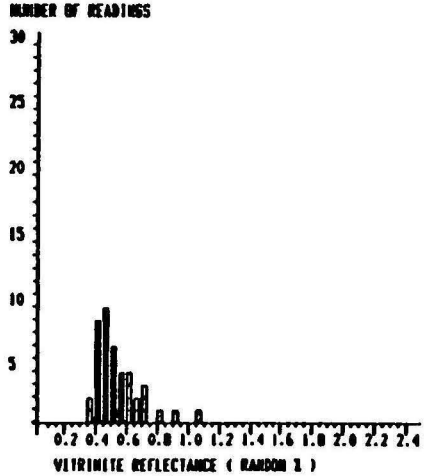
| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.42-0.57 | 7 | 0.48 | 0.05 |
| LIPTINITE/CAVINGS | 0.23-0.39 | 15 | 0.31 | 0.05 |
| INERTINITE/REWORKED | 0.60-1.47 | 32 | 0.96 | 0.22 |




SAMPLE 2585-2595M

0.37 0.37 0.40 0.41 0.42 0.43 0.44 0.44 0.44 0.44
0.45 0.45 0.47 0.47 0.48 0.48 0.48 0.49 0.49 0.51
0.51 0.51 0.52 0.53 0.54 0.55 0.56 0.58 0.58 0.60
0.61 0.62 0.63 0.68 0.69 0.71 0.71 0.74 0.81 0.91
1.00

| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.40-0.58 | 27 | 0.48 | 0.05 |
| LIPTINITE/CAVINGS | 0.37-0.37 | 2 | 0.37 | |
| INERTINITE/REWORKED | 0.60-1.00 | 12 | 0.73 | 0.14 |

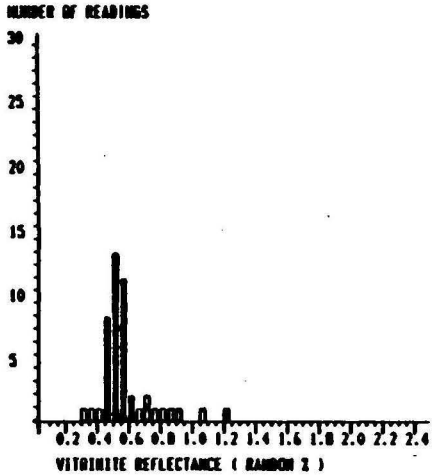



SPAR-1

SAMPLE 2765-2775M

0.34 0.37 0.42 0.45 0.46 0.47 0.48 0.48 0.48 0.49
0.49 0.50 0.50 0.51 0.51 0.52 0.52 0.53 0.53 0.53
0.53 0.54 0.54 0.54 0.55 0.55 0.55 0.56 0.56 0.57
0.57 0.58 0.58 0.58 0.59 0.60 0.62 0.66 0.71 0.71
0.79 0.84 0.89 0.90 1.05 1.20

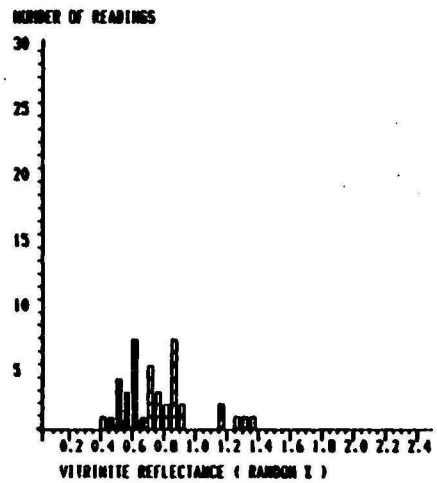
| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.45-0.62 | 34 | 0.53 | 0.04 |
| LIPTINITE/CAVINGS | 0.34-0.42 | 3 | 0.38 | 0.04 |
| INERTINITE/REWORKED | 0.66-1.20 | 9 | 0.86 | 0.17 |




SAMPLE 2910-2920M

0.41 0.49 0.51 0.52 0.53 0.54 0.55 0.56 0.56 0.60
0.60 0.60 0.61 0.62 0.64 0.64 0.66 0.71 0.72 0.72
0.73 0.73 0.76 0.76 0.77 0.82 0.83 0.85 0.85 0.86
0.88 0.89 0.89 0.89 0.90 0.91 1.16 1.18 1.26 1.32
1.37

| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.49-0.66 | 16 | 0.58 | 0.05 |
| LIPTINITE/CAVINGS | 0.41-0.41 | 1 | 0.41 | |
| INERTINITE/REWORKED | 0.71-1.37 | 24 | 0.91 | 0.20 |




Appendix 2a

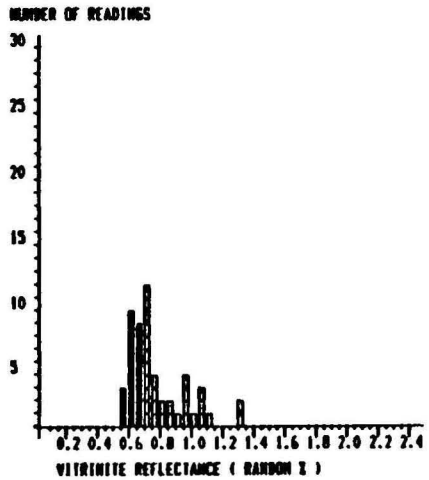
Robertson Research

SPAR-1

SAMPLE 3180-3190M

0.55 0.56 0.56 0.60 0.61 0.62 0.62 0.63 0.63 0.63
0.64 0.64 0.65 0.66 0.66 0.66 0.66 0.67 0.68 0.68
0.70 0.70 0.70 0.70 0.70 0.72 0.73 0.73 0.74 0.74
0.74 0.76 0.77 0.77 0.78 0.82 0.82 0.86 0.86 0.93
0.96 0.97 0.97 0.98 1.00 1.06 1.07 1.08 1.11 1.33
1.34

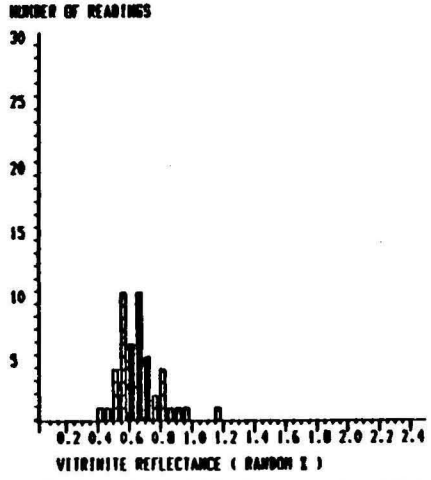
| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.55-0.68 | 20 | 0.63 | 0.04 |
| INERTINITE/REWORKED | 0.70-1.34 | 31 | 0.88 | 0.18 |




SAMPLE 3350-3360M

0.44 0.47 0.50 0.50 0.54 0.54 0.56 0.56 0.56 0.58
0.58 0.58 0.59 0.59 0.59 0.59 0.61 0.61 0.63 0.63
0.63 0.64 0.65 0.65 0.67 0.67 0.67 0.67 0.68 0.68
0.68 0.69 0.70 0.70 0.72 0.72 0.73 0.75 0.76 0.80
0.80 0.81 0.82 0.85 0.90 0.97 1.16

| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.61-0.73 | 21 | 0.67 | 0.04 |
| LIPTINITE/CAVINGS | 0.44-0.59 | 16 | 0.55 | 0.05 |
| INERTINITE/REWORKED | 0.75-1.16 | 10 | 0.86 | 0.12 |

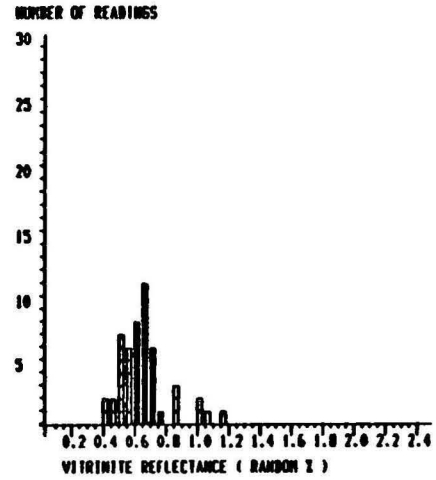



SPAR-1

SAMPLE 3500-3510M

0.41 0.44 0.47 0.49 0.50 0.50 0.50 0.52 0.52 0.52
0.53 0.56 0.56 0.57 0.58 0.59 0.59 0.60 0.61 0.62
0.63 0.63 0.64 0.64 0.64 0.65 0.65 0.65 0.66 0.67
0.67 0.67 0.68 0.68 0.69 0.69 0.70 0.70 0.70 0.70
0.72 0.74 0.79 0.88 0.89 0.89 1.02 1.03 1.06 1.19

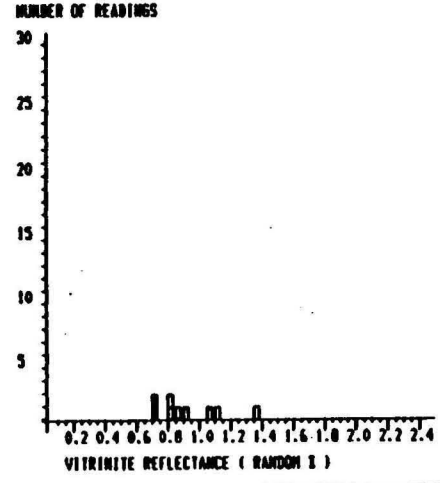
| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.60-0.79 | 26 | 0.67 | 0.04 |
| LIPTINITE/CAVINGS | 0.41-0.59 | 17 | 0.52 | 0.05 |
| INERTINITE/REWORKED | 0.88-1.19 | 7 | 0.99 | 0.12 |




SAMPLE 3600-3690M

0.70 0.74 0.82 0.83 0.89 0.91 1.06 1.11 1.35

| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.70-0.74 | 2 | 0.72 | 0.03 |
| INERTINITE/REWORKED | 0.82-1.35 | 7 | 1.00 | 0.19 |




Appendix 2b

# TRYAL ROCKS-1 WELL

## SUMMARY

Geochemical analyses of samples from the interval 2503m to 3659m of the Tryal Rocks-1 well have shown that the well section is middle mature to 3000m and is late mature between 3000m and 3695m TD. The maturity gradients show no evidence of any major erosional unconformities in the interval analysed. Extrapolation of the gradients to the surface indicates that the sediments penetrated are presently at or near their maximum depths of burial and that little Early Cretaceous or younger section is missing above 2503m.

Mudstones in the intervals 2503m to 2826m in the Muderong Shale and 3509m to 3659m in the Upper Dingo Claystone have very good oil source potential and will have generated significant quantities of hydrocarbons at their present levels of maturity. Samples in the intervals 2503m to 3472m and 3509m to 3695m TD have poor to fair gas source potential at optimum maturity. Samples in the interval 3092m to 3442m contain small quantities of migrant hydrocarbons derived from a mature source rich in terrestrially derived waxy kerogen.

## GENERAL COMMENTS

Basin: Northern Carnarvon Basin.

Location: 115° 09' 10"E, 20° 24' 48"S.

Operator and date of drilling: West Australian Petroleum Pty Ltd, 1970.

Well Status: Plugged and abandoned.

TD: 3695m.

Mud data: Sea water gel system: Seabed to 297m.
Sea water gel system and Diesel: 297m to 1213m.
Sea water gel system and 6% Diesel: 1213m to 2638m.
Sea water gel system and Diesel: 2638m to 3695m TD.

Casing data: 26" at 92m, 20" at 297m, $13^3/_8$" at 1213m, $9^5/_8$" at 2638m.

TRYAL ROCKS-1 WELL

BHT data: 46°C at 1220m, after 3 hrs stopped circulation.
75°C at 1923m, stopped circulation time unknown.
103°C at 3034m, after 5 hrs stopped circulation.
133°C at 3695m TD, after 3½ hrs stopped circulation.

Elevation: RT 28m ASL.

Water depth: 46m.

Interval analysed: 2503m to 3659m.

Age of interval analysed:

| | Depths (in metres) |
|---|---|
| Early Cretaceous | 2503-3409 |
| Middle-Late Jurassic | 3409-3659 |

Sample type and quality: Dried ditch cuttings of good quality for geochemical analysis.

Maturation data quality:

a) Vitrinite Reflectance: Samples yielded fair to poor quantities of vitrinite for measurements. Results were further complicated by the presence of reworked vitrinite. Results: Fair.

b) Spore Colour Index: Samples analysed yielded fair quantities of indigenous sporomorphs for measurement. Results: Good.

Source rock data quality: Poor.

Gas chromatography run at: 2588m to 2604m, 2808m to 2826m, 3092m to 3107m, 3229m to 3244m, 3427m to 3442m, 3509m to 3524m and 3643m to 3659m.

MATURATION (Table 1, Figures 1 and 2, Appendices 1 and 2)

Vitrinite reflectance values increase from 0.67% at 2662m to 2677m to 1.12% at 3643m to 3659m. These results show that the well section analysed is middle mature to about 3000m and late mature below this depth to 3695m TD. Spore colour index values rise from 6 SCI units at 2503m to 2512m to 8 to 8.5 SCI units at 3643m to 3659m, indicating that the analysed interval is middle mature to about 3000m and late mature below this depth. Both maturity

gradients suggest that there are no major erosional unconformities within the well section analysed. Extrapolation of the maturity gradients to the seabed suggests that there is little Early Cretaceous or younger section missing above 2503m and that the sediments penetrated in the well section are presently at or near their maximum depths of burial.

OIL AND GAS SOURCE ROCKS (Tables 1 and 2, Figure 3)

Mudstones in the interval 2503m to 2826m in the Muderong Shale and 3509m to 3659m in the Upper Dingo Claystone contain average to above average organic carbon contents of between 1.57% and 2.63%. Pyrolysis analysis of these mudstones shows that they contain mostly humic kerogen, mixed with smaller but significant quantities of oil-prone kerogen. Calculations suggest that these intervals of relatively thick uniform mudstones have very good oil source potential and poor to fair gas source potential.

Extraction, fractionation and gas chromatography analysis of samples in the Muderong Shale at 2588m to 2604m and 2808m to 2826m shows that these samples contain small amounts of indigenous hydrocarbons, mostly derived from terrestrially sourced waxy kerogens at middle maturity. Extraction of samples in the Upper Dingo Claystone at 3509m to 3524m and 3643m to 3659m shows that these samples contain mixed indigenous and migrant hydrocarbons derived from mature waxy kerogen. In the lower sample a small amount of contamination possibly from oil added to the mud is present in the $\underline{n}$-$C_{19}$ to $\underline{n}$-$C_{24}$ range.

GEOCHEMICAL CHARACTERISTICS OF THE REMAINING SEDIMENTS (Tables 1 and 2, Figure 3)

The remaining mudstones analysed in the interval 2997m to 3488m of the Barrow Group contain below average to above average organic carbon contents of between 0.84% and 2.33%. Pyrolysis analysis of these samples shows that they contain only humic kerogen and therefore have no significant oil source potential and only poor to fair gas source potential at optimum maturity.

Extraction of samples at 3092m to 3107m, 3229m to 3244m and 3427m to 3442m show that these samples contain migrant hydrocarbons derived from a mature source containing predominantly terrestrialy sourced waxy kerogen.

WELL: TRYAL ROCKS-1

| SAMPLE DEPTH (METRES) | SAMPLE TYPE | GENERALISED LITHOLOGY | SPORE COLOUR INDEX (1-10) | VITRINITE REFLECTIVITY (R oil av %) | KEROGEN COMPOSITION (% vol) (by microscopic examination) | | | KEROGEN COMPOSITION (% wt.) (by calculation from pyrolysis data) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | INERTINITE | VITRINITE | SAPROPEL | INERTINITE | VITRINITE | ALGAL SAPROPEL | WAXY SAPROPEL |
| ?2042.2 | | **Muderong Shale** | | | | | | | | | |
| 2503-2512 | Ctg | MDST, lt med gy | 6.0 | 1.20(10)rev | 35 | 35 | 30 | 25 | 50 | * | 25 |
| 2537-2549 | " | MDST, a/a | | | | | | | | | |
| | " | After extraction | | | | | | 25 | 50 | * | 25 |
| 2588-2604 | " | MDST, med gy | | | | | | 25 | 50 | * | 25 |
| 2662-2677 | " | MDST, lt med gy, calc | 6.0-6.5 | 0.67(5) | 40 | 40 | 20 | 30 | 50 | * | 20 |
| 2723-2741 | " | MDST, a/a | | | | | | | | | |
| | " | After extraction | | | | | | 30 | 55 | * | 15 |
| 2808-2826 | " | MDST, lt med gy | 6.5-7.0 | 1.28(30)rev | 30 | 40 | 30 | | | | |
| | " | After extraction | | | | | | 30 | 55 | * | 15 |
| 2852.8 | | **Barrow Gp** | | | | | | | | | |
| 2997-3015 | " | MDST, lt gy-yel gy, calc | 7.0 | 0.82(8) | 30 | 40 | 30 | | | | |
| | " | After extraction | | | | | | 35 | 60 | * | 5 |
| 3092-3107 | " | MDST, yel-gy, calc | | | | | | | | | |
| | " | After extraction | | | | | | 40 | 60 | * | * |
| 3229-3244 | " | MDST, yel-gy, calc | * | 0.86(19) | 35 | 60 | 5 | | | | |
| | " | After extraction | | | | | | 60 | 40 | * | * |
| 3369-3387 | " | MDST, a/a | 7.5-8.0 | 0.96(4) | 50 | 50 | tr | | | | |
| | " | After extraction | | | | | | 50 | 50 | * | * |
| 3408.9 | | **Upper Dingo Claystone** | | | | | | | | | |
| 3427-3442 | " | MDST, a/a | | | | | | | | | |
| | " | After extraction | | | | | | 50 | 50 | * | * |
| 3509-3524 | " | MDST, a/a + 60% MDST, med gy | 8.0 | 0.91(16) | 40 | 40 | 20 | | | | |
| | P | MDST, med gy | | | | | | 40 | 50 | * | 10 |
| 3582-3598 | Ctg | MDST, yel-gy, calc | | | | | | | | | |
| | " | After extraction | | | | | | 35 | 50 | * | 15 |
| 3643-3659 | " | MDST, yel-gy, calc | 8.0-8.5 | 1.12(6) | 45 | 45 | 10 | 35 | 50 | * | 15 |

Table 1 Maturity and Kerogen Composition Data

WELL: TRYAL ROCKS-1

| GENERAL DATA | | | CHEMICAL ANALYSIS DATA | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PYROLYSIS | | | | | SOLVENT EXTRACTION | | | | | | |
| | | | | | | | | | | | | | EXTRACT COMPOSITION (%) | | |
| SAMPLE DEPTH (METRES) | SAMPLE TYPE | ANALYSED LITHOLOGY | ORGANIC CARBON % OF ROCK | TEMPERATURE C | HYDROGEN INDEX | OXYGEN INDEX | PRODUCTION INDEX | POTENTIAL YIELD (kg/Tonne) | TOTAL EXTRACT (ppm) | TOTAL EXTRACT (mg g T O C) | HYDROCARBONS (ppm) | HYDROCARBONS (mg g T O C) | SATURATED HYDROCARBONS | AROMATIC HYDROCARBONS | POLAR COMPOUNDS |
| ?2042.2 | | **Haderong Shale** | | | | | | | | | | | | | |
| 2503-2512 | Ctg | MDST, lt med gy, sl calc | 2.20 | 424 | 226 | 48 | 0.06 | 5.28 | | | | | | | |
| 2537-2549 | " | MDST, a/a | 2.48 | 427 | 222 | 45 | 0.06 | 5.85 | | | | | | | |
| | " | After extraction | 2.63 | 427 | 207 | 38 | 0.01 | 5.50 | | | | | | | |
| 2588-2604 | Ctg | MDST, med gy, non calc | 2.31 | 426 | 215 | 42 | 0.06 | 5.26 | 1570 | 68 | 730 | 32 | 40 | 7 | 53 |
| 2662-2677 | " | MDST, lt med gy, calc | 2.34 | 426 | 180 | 57 | 0.07 | 4.51 | | | | | | | |
| 2723-2741 | " | MDST, a/a, calc | 2.29 | 427 | 186 | 41 | 0.08 | 4.64 | | | | | | | |
| | " | After extraction | 2.42 | 427 | 169 | 41 | 0.02 | 4.16 | | | | | | | |
| 2808-2826 | Ctg | MDST, a/a, sl calc | 2.37 | 428 | 155 | 49 | 0.07 | 3.95 | 1310 | 55 | 660 | 28 | 43 | 7 | 50 |
| | " | After extraction | 2.21 | 427 | 162 | 53 | 0.01 | 3.64 | | | | | | | |
| 2852.8 | | **Barrow Gp** | | | | | | | | | | | | | |
| 2997-3015 | " | MDST, lt gy-yel gy, calc | 1.88 | 430 | 148 | 77 | 0.18 | 3.39 | | | | | | | |
| | " | After extraction | 2.24 | 430 | 103 | 60 | 0.03 | 2.36 | | | | | | | |
| 3092-3107 | Ctg | MDST, yel-gy, calc | 2.07 | 429 | 177 | 61 | 0.22 | 4.72 | 2180 | 105 | 1770 | 86 | 72 | 9 | 19 |
| | " | After extraction | 2.33 | 434 | 99 | 70 | 0.05 | 2.42 | | | | | | | |
| 3229-3244 | Ctg | MDST, a/a | 1.51 | 422 | 157 | 134 | 0.36 | 3.69 | 2100 | 139 | 1530 | 101 | 69 | 4 | 27 |
| | " | After extraction | 2.05 | 424 | 65 | 102 | 0.13 | 1.54 | | | | | | | |
| 3369-3387 | Ctg | MDST, a/a | 1.56 | 424 | 153 | 90 | 0.30 | 3.41 | | | | | | | |
| | " | After extraction | 2.23 | 427 | 80 | 60 | 0.13 | 2.04 | | | | | | | |
| 3408.9 | | **Upper Dingo Claystone** | | | | | | | | | | | | | |
| 3427-3442 | Ctg | MSDT, a/a | 1.23 | NDP | 109 | 164 | 0.52 | 2.78 | 2300 | 187 | 1860 | 151 | 76 | 5 | 19 |
| | " | After extraction | 1.72 | 417 | 67 | 88 | 0.27 | 1.57 | | | | | | | |
| 3473-3488 | " | MDST, a/a, calc | 0.84 | | | | | | | | | | | | |
| 3509-3524 | Ctg | MDST, yel gy + 60% MDST, med gy, sl calc | 1.23 | | | | | | 1310 | 107 | 750 | 61 | 50 | 7 | 43 |
| | P | MDST, yel gy | 0.74 | | | | | | | | | | | | |
| | " | MDST, med gy, sl calc | 2.16 | 430 | 87 | 40 | 0.22 | 2.42 | | | | | | | |
| | " | After extraction | 2.51 | 432 | 137 | 28 | 0.02 | 3.50 | | | | | | | |
| 3582-3598 | Ctg | MDST, yel-gy, calc | 1.13 | NDP | 102 | 120 | 0.33 | 1.72 | | | | | | | |
| | " | After extraction | 1.57 | 426 | 85 | 70 | 0.12 | 1.51 | | | | | | | |
| 3643-3659 | Ctg | MDST, a/a | 1.84 | 430 | 81 | 81 | 0.32 | 2.20 | 1850 | 101 | 1330 | 72 | 68 | 4 | 28 |

Table 2 Chemical Analysis Data

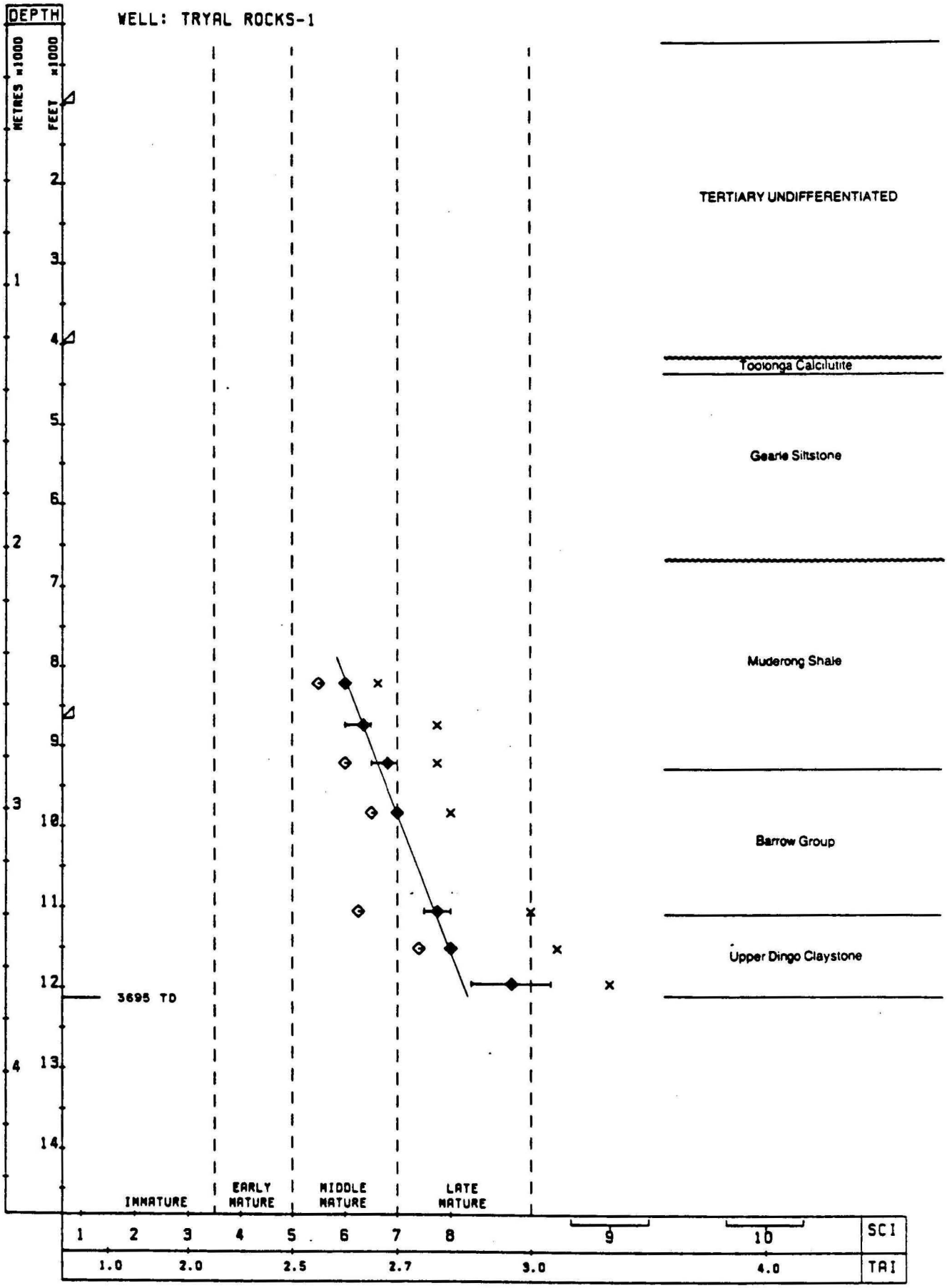



FIGURE 1 SPORE COLOUR INDEX AGAINST DEPTH

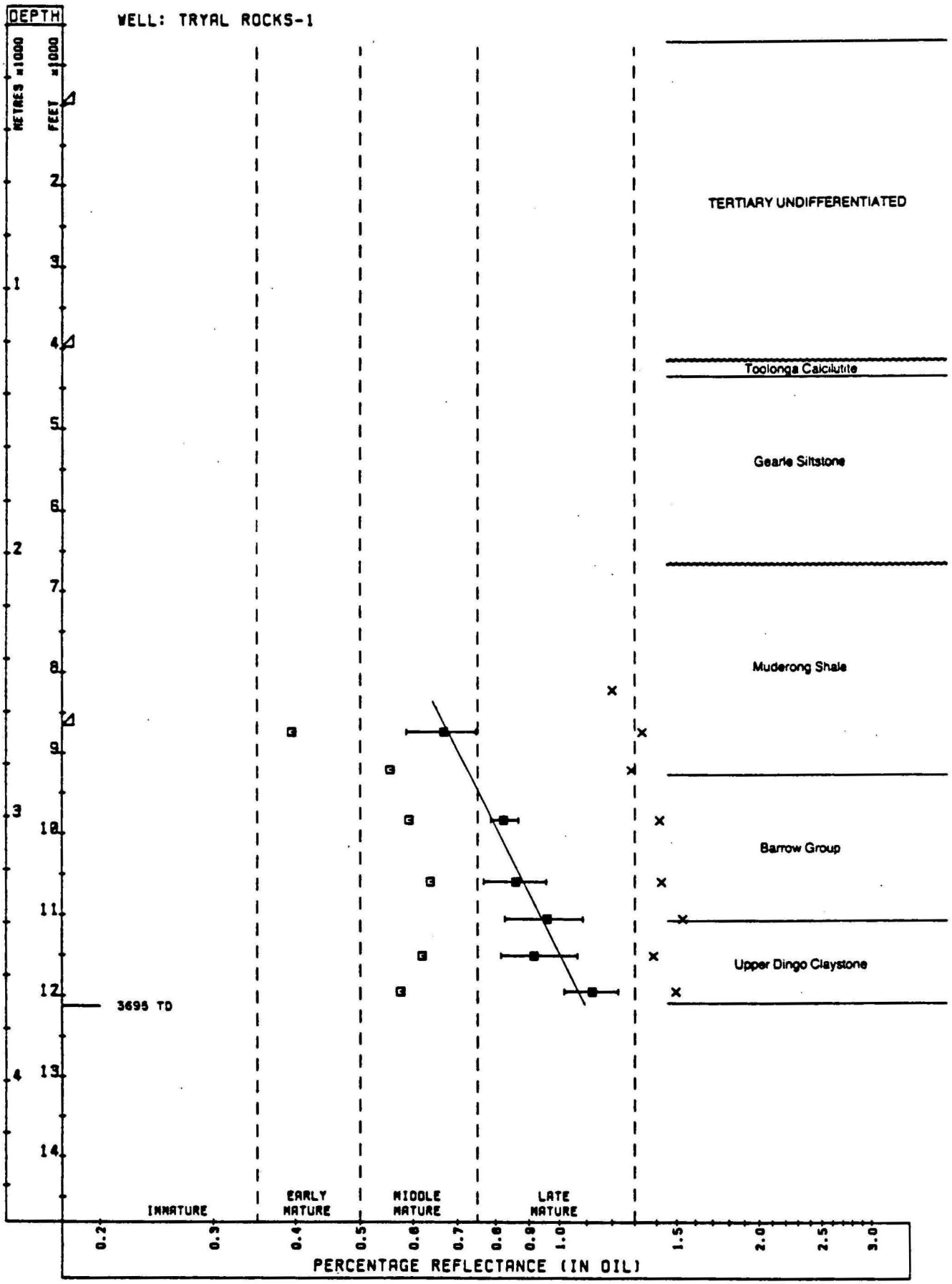
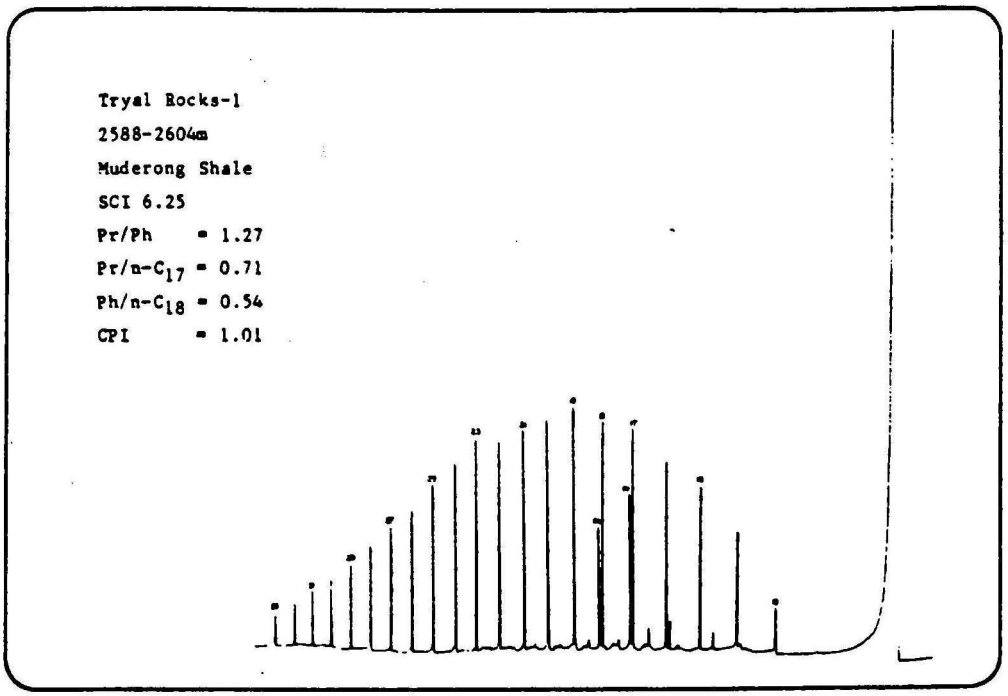
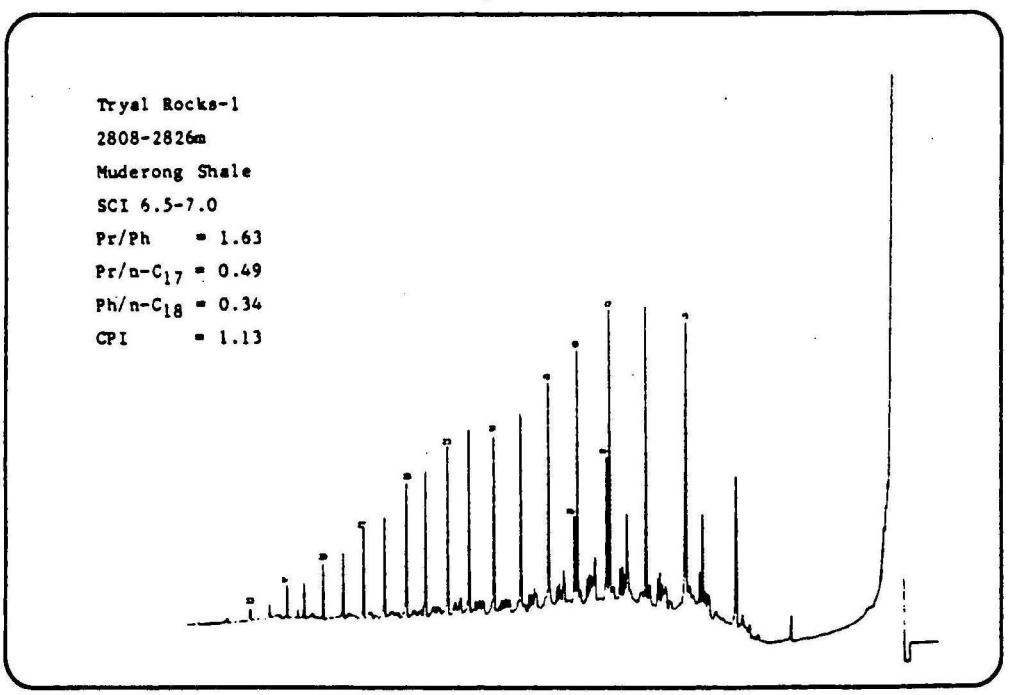



FIGURE 2 VITRINITE REFLECTANCE AGAINST DEPTH


Tryal Rocks-1
2588-2604m
Muderong Shale
SCI 6.25
Pr/Ph = 1.27
Pr/n-C17 = 0.71
Ph/n-C18 = 0.54
CPI = 1.01


Tryal Rocks-1
2808-2826m
Muderong Shale
SCI 6.5-7.0
Pr/Ph = 1.63
Pr/n-C17 = 0.49
Ph/n-C18 = 0.34
CPI = 1.13

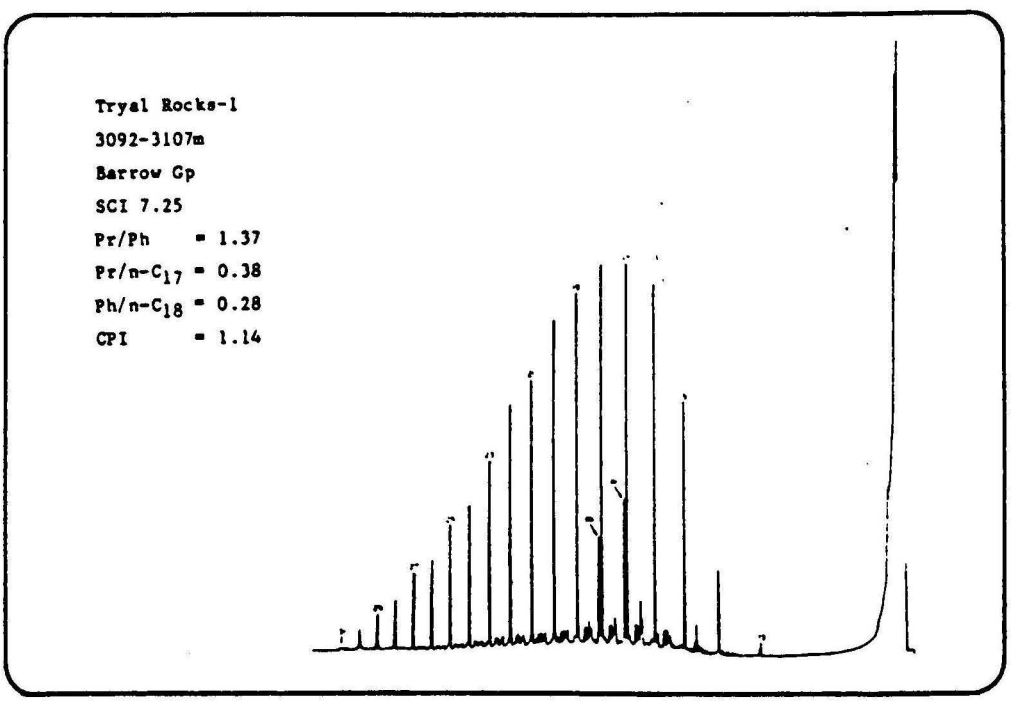
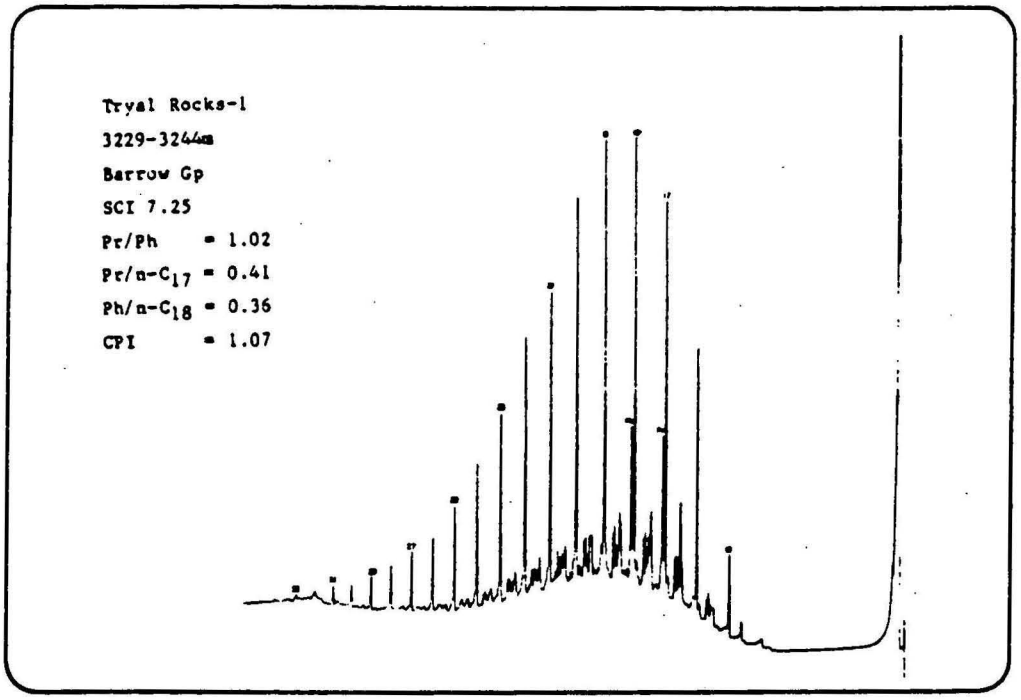
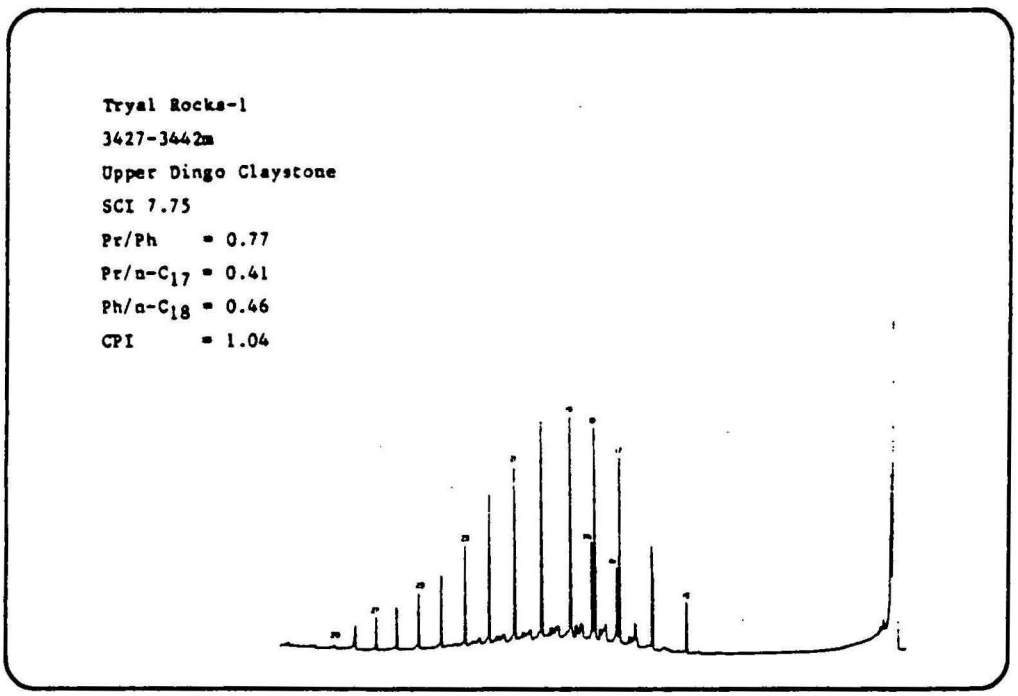

Tryal Rocks-1
3092-3107m
Barrow Gp
SCI 7.25
Pr/Ph = 1.37
Pr/n-C17 = 0.38
Ph/n-C18 = 0.28
CPI = 1.14

Figure 3a


Tryal Rocks-1
3229-3244m
Barrow Gp
SCI 7.25
Pr/Ph = 1.02
Pr/n-C17 = 0.41
Ph/n-C18 = 0.36
CPI = 1.07


Tryal Rocks-1
3427-3442m
Upper Dingo Claystone
SCI 7.75
Pr/Ph = 0.77
Pr/n-C17 = 0.41
Ph/n-C18 = 0.46
CPI = 1.04

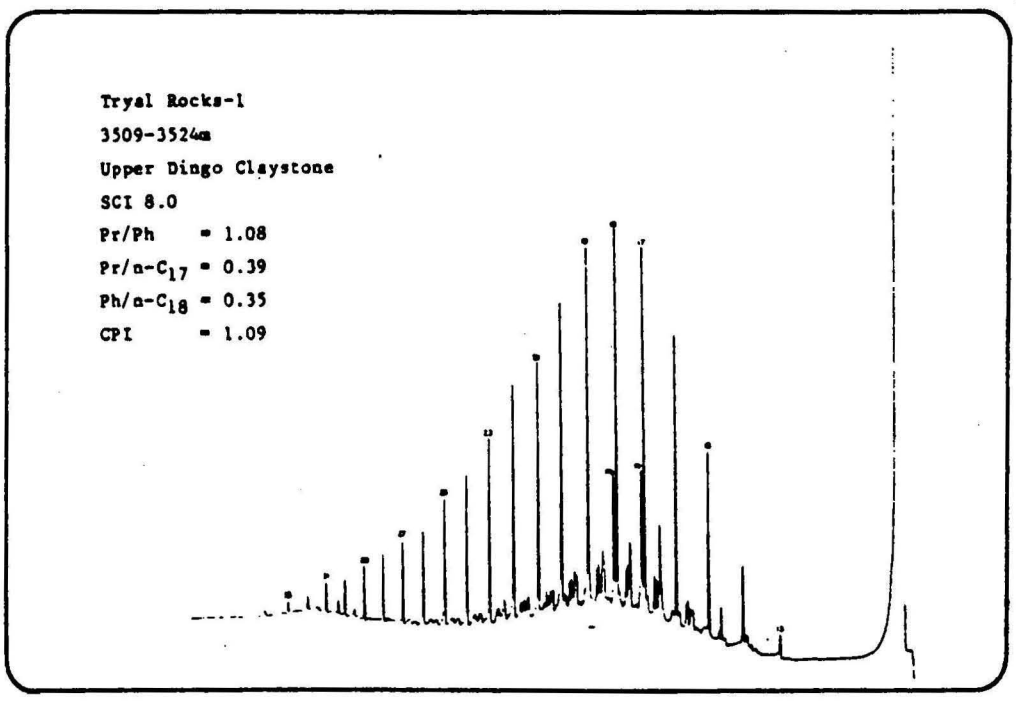

Tryal Rocks-1
3509-3524m
Upper Dingo Claystone
SCI 8.0
Pr/Ph = 1.08
Pr/n-C17 = 0.39
Ph/n-C18 = 0.35
CPI = 1.09

Figure 3b

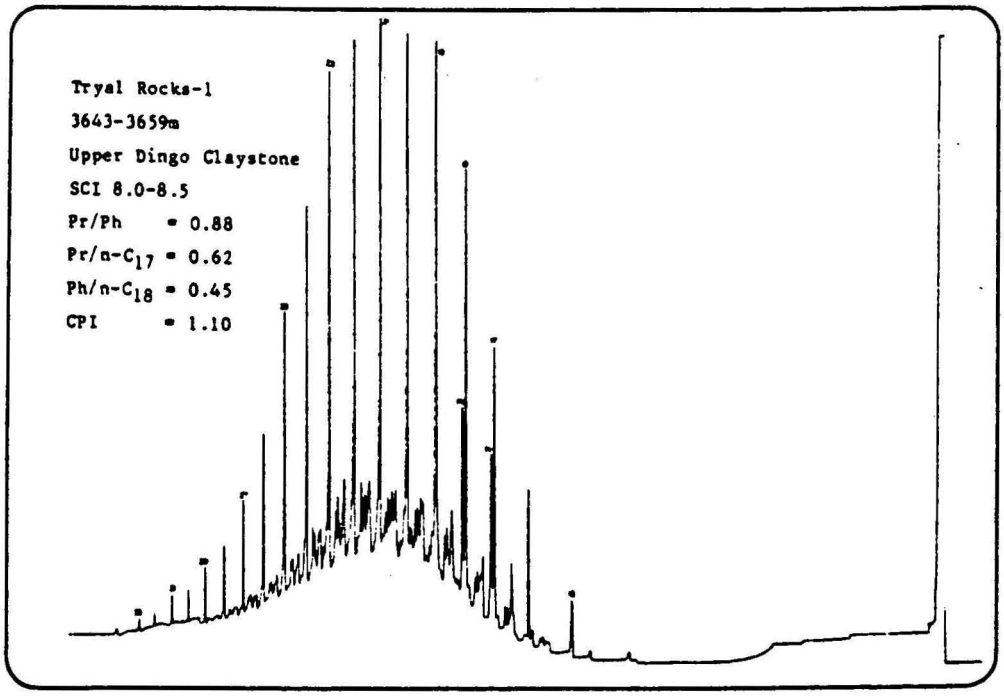

Tryal Rocks-1
3643-3659m
Upper Dingo Claystone
SCI 8.0-8.5
Pr/Ph = 0.88
Pr/n-C17 = 0.62
Ph/n-C18 = 0.45
CPI = 1.10

Figure 3c

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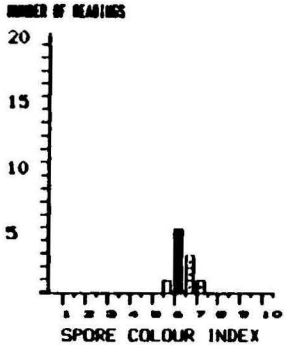
TRYAL ROCKS-1

IN SITU POPULATION

SAMPLE 2503-2512M

5.5 6.0 6.0 6.0 6.0 6.0 6.5 6.5 6.5 7.0

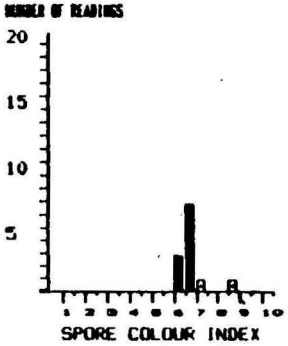
| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 6.0-6.0 | 5 |
| BLEACHED OR CAVED | 5.5-5.5 | 1 |
| STAINED OR REWORKED | 6.5-7.0 | 4 |




SAMPLE 2662-2677M

6.0 6.0 6.0 6.5 6.5 6.5 6.5 6.5 6.5 6.5
7.0 8.5

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 6.0-6.5 | 10 |
| BLEACHED OR CAVED | - | 0 |
| STAINED OR REWORKED | 7.0-8.5 | 2 |



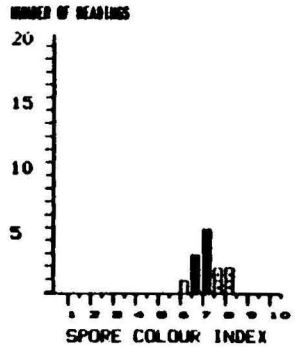

TRYAL ROCKS-1

IN SITU POPULATION

SAMPLE 2808-2826M

6.0 6.5 6.5 6.5 7.0 7.0 7.0 7.0 7.0 7.5
7.5 8.0 8.0

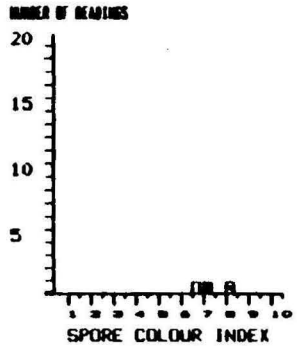
| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 6.5-7.0 | 8 |
| BLEACHED OR CAVED | 6.0-6.0 | 1 |
| STAINED OR REWORKED | 7.5-8.0 | 4 |




SAMPLE 2997-3015M

6.5 7.0 8.0

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 7.0-7.0 | 1 |
| BLEACHED OR CAVED | 6.5-6.5 | 1 |
| STAINED OR REWORKED | 8.0-8.0 | 1 |




Appendix 1a

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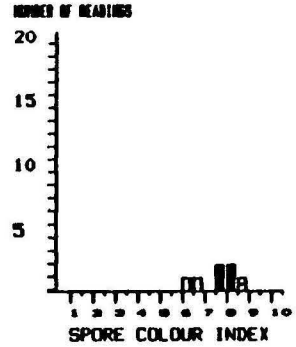
TRYAL ROCKS-1

IN SITU POPULATION

SAMPLE 3369-3387M

6.0 6.5 7.5 7.5 8.0 8.0 8.5

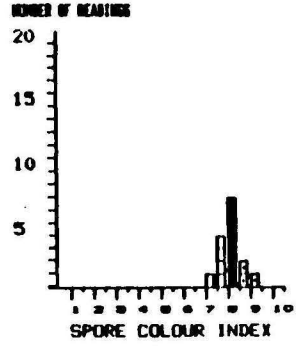
| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 7.5-8.0 | 4 |
| BLEACHED OR CAVED | 6.0-6.5 | 2 |
| STAINED OR REWORKED | 8.5-8.5 | 1 |




SAMPLE 3509-3524M

7.0 7.5 7.5 7.5 7.5 8.0 8.0 8.0 8.0 8.0
8.0 8.0 8.5 8.5 9.0

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 8.0-8.0 | 7 |
| BLEACHED OR CAVED | 7.0-7.5 | 5 |
| STAINED OR REWORKED | 8.5-9.0 | 3 |



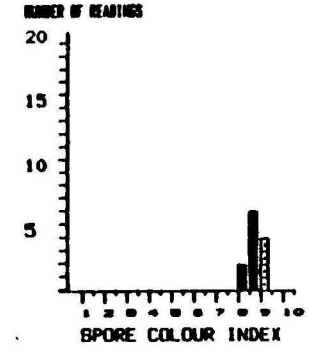

TRYAL ROCKS-1

IN SITU POPULATION

SAMPLE 3643-3659M

8.0 8.0 8.5 8.5 8.5 8.5 8.5 8.5 9.0 9.0
9.0 9.0

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 8.0-8.5 | 8 |
| BLEACHED OR CAVED | - | 0 |
| STAINED OR REWORKED | 9.0-9.0 | 4 |




Appendix 1b

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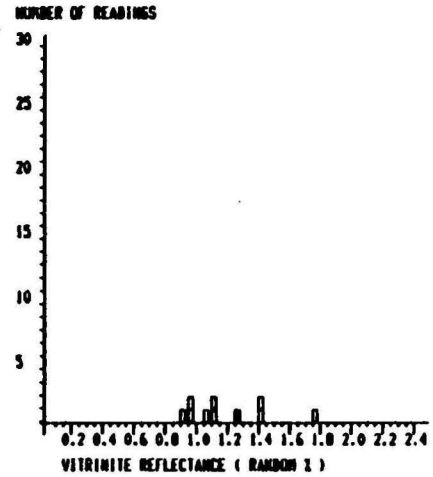
TRYAL ROCKS-1

SAMPLE 2503-2512M

0.93 0.95 0.96 1.08 1.10 1.10 1.29 1.40 1.44 1.75

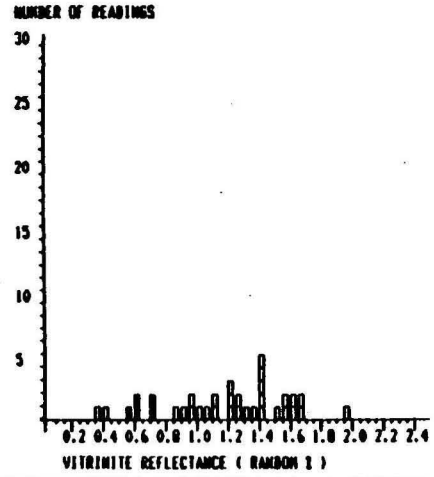
| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| INERTINITE/REWORKED | 0.93-1.75 | 10 | 1.20 | 0.27 |




SAMPLE 2662-2677M

0.39 0.40 0.59 0.63 0.64 0.73 0.74 0.87 0.91 0.98
0.99 1.03 1.06 1.10 1.13 1.20 1.22 1.22 1.26 1.29
1.30 1.38 1.40 1.41 1.43 1.44 1.44 1.54 1.59 1.59
1.60 1.63 1.65 1.65 1.98

| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.59-0.74 | 5 | 0.67 | 0.07 |
| LIPTINITE/CAVINGS | 0.39-0.40 | 2 | 0.40 | 0.01 |
| INERTINITE/REWORKED | 0.87-1.98 | 28 | 1.33 | 0.27 |

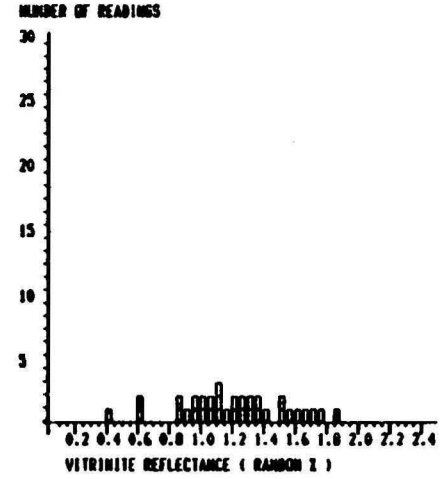



TRYAL ROCKS-1

SAMPLE 2808-2826M

0.42 0.61 0.63 0.88 0.89 0.94 0.97 0.99 1.01 1.04
1.06 1.09 1.11 1.12 1.14 1.17 1.21 1.24 1.26 1.28
1.30 1.32 1.38 1.38 1.40 1.53 1.54 1.56 1.61 1.69
1.73 1.76 1.89

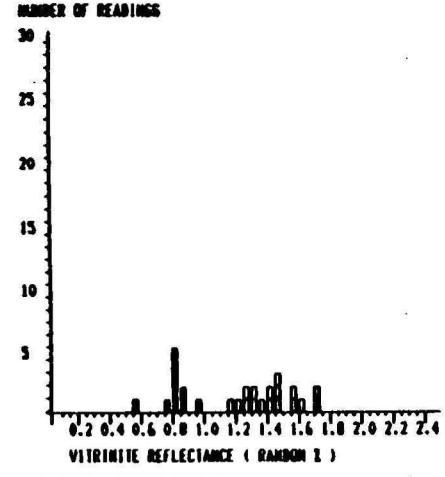
| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| LIPTINITE/CAVINGS | 0.42-0.63 | 3 | 0.55 | 0.12 |
| INERTINITE/REWORKED | 0.88-1.89 | 30 | 1.20 | 0.28 |




SAMPLE 2997-3015M

0.59 0.79 0.80 0.80 0.81 0.82 0.83 0.86 0.86 0.95
1.19 1.23 1.27 1.28 1.30 1.32 1.37 1.43 1.44 1.48
1.49 1.49 1.56 1.57 1.63 1.70 1.72

| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.79-0.86 | 8 | 0.82 | 0.03 |
| LIPTINITE/CAVINGS | 0.59-0.59 | 1 | 0.59 | |
| INERTINITE/REWORKED | 0.95-1.72 | 18 | 1.41 | 0.19 |




Appendix 2a

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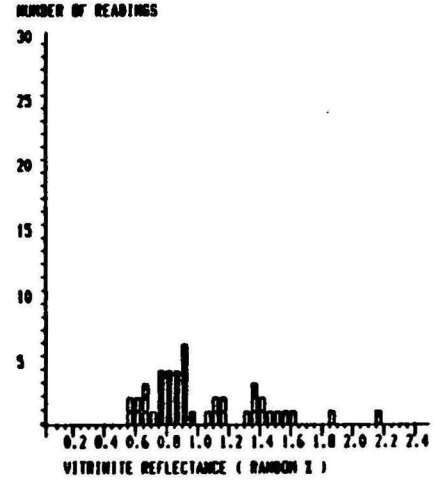
TRYAL ROCKS-1

SAMPLE 3229-3244M

0.57 0.58 0.61 0.63 0.65 0.66 0.68 0.71 0.77 0.78
0.79 0.79 0.80 0.81 0.81 0.83 0.85 0.87 0.88 0.89
0.90 0.90 0.91 0.92 0.92 0.92 0.95 1.09 1.12 1.14
1.15 1.16 1.34 1.35 1.37 1.38 1.40 1.44 1.46 1.51
1.58 1.63 1.89 2.18

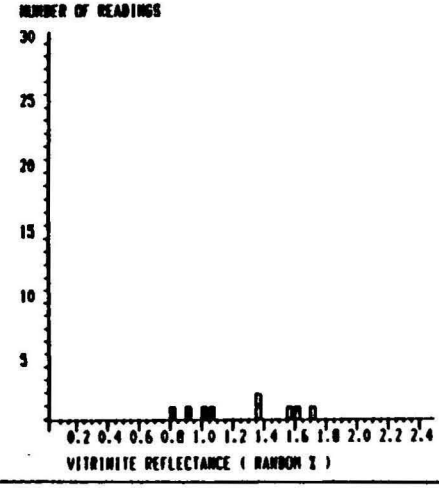
| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.77-0.95 | 19 | 0.86 | 0.06 |
| LIPTINITE/CAVINGS | 0.57-0.71 | 8 | 0.64 | 0.05 |
| INERTINITE/REWORKED | 1.09-2.18 | 17 | 1.42 | 0.29 |




SAMPLE 3369-3387M

0.83 0.90 1.02 1.08 1.37 1.39 1.56 1.61 1.72

| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.83-1.08 | 4 | 0.96 | 0.11 |
| INERTINITE/REWORKED | 1.37-1.72 | 5 | 1.53 | 0.15 |

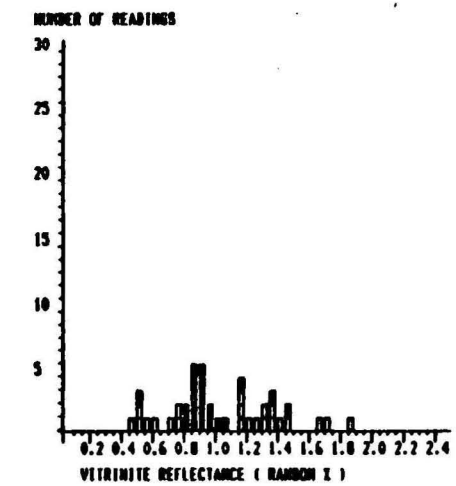



TRYAL ROCKS-1

SAMPLE 3509-3524M

0.48 0.52 0.54 0.54 0.58 0.63 0.71 0.77 0.79 0.82
0.83 0.85 0.88 0.88 0.88 0.89 0.90 0.90 0.90 0.91
0.94 0.97 0.99 1.01 1.06 1.16 1.17 1.18 1.19 1.23
1.27 1.31 1.33 1.35 1.36 1.38 1.42 1.45 1.46 1.65
1.72 1.89

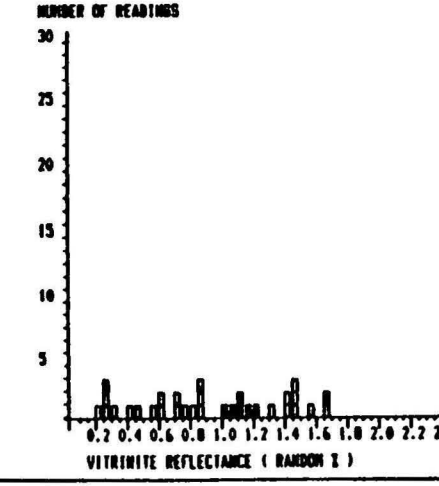
| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.82-1.06 | 16 | 0.91 | 0.07 |
| LIPTINITE/CAVINGS | 0.48-0.79 | 9 | 0.62 | 0.11 |
| INERTINITE/REWORKED | 1.16-1.89 | 17 | 1.38 | 0.21 |




SAMPLE 3643-3659M

0.23 0.26 0.28 0.28 0.30 0.41 0.47 0.57 0.64 0.64
0.73 0.73 0.79 0.83 0.85 0.86 0.87 1.02 1.06 1.12
1.13 1.17 1.22 1.32 1.40 1.40 1.48 1.48 1.49 1.55
1.66 1.66

| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 1.02-1.22 | 6 | 1.12 | 0.07 |
| LIPTINITE/CAVINGS | 0.23-0.87 | 17 | 0.57 | 0.24 |
| INERTINITE/REWORKED | 1.32-1.66 | 9 | 1.49 | 0.12 |




Appendix 2b

## WEST BARROW-2 WELL

### SUMMARY

Geochemical analysis of samples from the interval 2278m to 3355m of the the West Barrow-2 well have shown that the well section becomes middle mature at around 2100m and late mature at around 3000m. Extrapolation of the gradients to the surface shows that there is little Early Cretaceous and younger section missing above 2278m and that the sediments analysed are currently at their maximum or near maximum depths of burial.

Mudstones in the interval 2341m to 2476m of the Muderong Shale have very good oil source potential and will have already generated significant quantities of oil. Mudstones and dark grey siltstones in the intervals 3016m to 3127m and 3142m to 3235m of the Barrow Group have good source potential and will have already generated significant quantities of oil. The latter interval may extend to 3355m. Organically rich sediments in the interval 2278m to 3355m are thick enough to constitute a fair gas source. However no significant quantities of gas will have been generated at their present levels of maturity.

The interval 3220m to 3355m is stained by a mixture of a biodegraded oil and a "live" oil derived from mature waxy kerogens.

### GENERAL COMMENTS

Basin: Northern Carnarvon Basin.

Location: 20° 53' 56.2"S, 114° 55' 35.7"E.

Operator and date of drilling: BHP Petroleum, 1985.

Well Status: Plugged and abandoned.

TD: 3437m.

Mud data: Seawater and KCL polymer mud system: Seabed to 3437m TD.

Casing data: 30" at 140m, 24" at 354m, $18^5/_8$" at 1062m, $13^3/_8$" at 2452m, $9^5/_8$" at 3192m.

BHT data: 105.5°C at 2463m, stopped circulation time unknown.
112.5°C at 3202m, stopped circulation time unknown.
141°C at 3437m TD, stopped circulation time unknown.

## WEST BARROW-2 WELL

Elevation: Not known.

Water depth: 98m.

Interval analysed: 2278m to 3355m.

Age of interval analysed:

| | Depths (in metres) |
|---|---|
| Early Cretaceous | 2278-3355 |

Sample type and quality: Dried ditch cuttings of good quality for geochemical analysis.

Maturation data quality:

a) Vitrinite Reflectance: The samples analysed contained abundant vitrinitic kerogen, but measurements were hindered by reworked material. Results: Fair to good.

b) Spore Colour Index: The samples analysed contained sufficient sporomorphs for analysis. Results: Good.

Source rock data quality: Good.

Gas chromatography run at: 2461m to 2476m, 3112m to 3127m, 3220m to 3235m, 3250m to 3265m, 3265m to 3280m and 3325m to 3340m.

### MATURATION (Table 1, Figures 1 and 2, Appendices 1 and 2)

Spore colour index values rise steadily from values of around 5 to 5.5 SCI units at 2278m to 7.5 to 8 SCI units at 3355m. Vitrinite reflectance values rise from around 0.55% to 0.9% over the same interval. Extrapolation of the maturity gradients to surface suggests that there are no major amounts of section missing above 2278m and that the well section is currently at or near its maximum depth of burial. The well section becomes middle mature at 2100m and late mature at 3000m.

### OIL AND GAS SOURCE ROCKS (Tables 1 and 2, Figure 3)

Mudstones in the interval 2341m to 2476m in the Muderong Shale Formation contain average to above average contents of organic

carbon (1.61% to 2.50%). Pyrolysis analysis of these samples shows relatively high hydrogen indices consistent with content of 15% to 20% oil-prone kerogen. This interval has very good oil source potential and is presently middle mature and will therefore have generated significant quantities of oil. Extraction, fractionation and gas chromatography analysis of the sample at 2461m to 2476m shows that the sample contains hydrocarbons derived from early to middle mature, terrestrially derived, waxy kerogens.

Dark grey siltstones and medium to dark grey mudstones in the intervals 3016m to 3127m and 3142m to 3235m of the Barrow Group contain average organic carbon contents of between 1.02% and 1.34%. Pyrolysis analysis suggests that these lithologies contain between 10% to 25% oil-prone kerogen. These intervals have good source potential and will have generated significant quantities of oil at their present level of maturity. Extraction, fractionation and gas chromatography analysis was performed on samples at 3112m to 3127m and 3220m to 3235m. The results show that the sample at 3112m to 3127m contains indigenous hydrocarbons derived from terrestrially sourced waxy sapropel and that the sample at 3220m to 3235m contains migrant oil derived from a mature source containing predominantly waxy kerogens.

The organically rich mudstones analysed over the interval 2278m to 3355m are sufficiently thick to be a fair gas source at optimum maturity. However, at their present level of maturity they will not have generated significant quantities of gas.

Samples in the interval 3220m to 3355m contain average to above average organic carbon contents but are stained by a mixture of a biodegraded and "live" oil derived from a source rich in waxy kerogens. TOC and pyrolysis analysis on extracted residues show that solvent extraction did not remove all of the heavy oil fraction. It is therefore possible that the source potential seen in the interval 3142m to 3235m continues to 3355m, although this cannot be confirmed by geochemical analysis due to heavy oil staining.

GEOCHEMICAL CHARACTERISTICS OF THE REMAINING SEDIMENTS (Tables 1 and 2, Figure 3)

The remaining sediments analysed in the intervals 2278m to 2341m, 2572m to 3016m and 3172m to 3187m contain above average to average organic carbon contents of between 2.23% and 0.79%. These sediments are either organically lean or contain predominantly humic kerogen. They have no significant oil or gas source potential.

WELL: WEST BARROW-2

| SAMPLE DEPTH (METRES) | SAMPLE TYPE | GENERALISED LITHOLOGY | SPORE COLOUR INDEX (1-10) | VITRINITE REFLECTIVITY (R oil av %) | KEROGEN COMPOSITION (% vol) (by microscopic examination) | | | KEROGEN COMPOSITION (% wt) (by calculation from pyrolysis data) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | INERTINITE | VITRINITE | SAPROPEL | INERTINITE | VITRINITE | ALGAL SAPROPEL | WAXY SAPROPEL |
| **2277** | | **Muderong Shale** | | | | | | | | | |
| 2278-2293 | Ctg | MDST, lt-med gy + 10% SLTST, v lt gy-lt gy | 5.0-5.5 | 0.56(16) | 70 | 15 | 15 | | | | |
| | P | MDST, a/a | | | | | | 65 | 25 | 10 | * |
| 2308-2323 | Ctg | MDST, med gy-med dk gy + mnr SLTST, a/a | | | | | | 55 | 40 | * | 5 |
| 2341-2356 | " | MDST, med gy + mnr DOL, mod-rd brn | | | | | | 45 | 40 | 5 | 10 |
| 2374-2389 | " | MDST, med gy-med dk gy + mnr LST, wht | 5.5 | 0.55(5) | 40 | 30 | 30 | 45 | 40 | * | 15 |
| 2404-2419 | " | MDST, med gy | | | | | | 40 | 40 | * | 20 |
| 2431-2446 | " | MDST, med dk gy + mnr LST, wht | | | | | | 35 | 45 | 5 | 15 |
| 2461-2476 | " | MDST, med lt gy-med gy, v slty + 10% SLTST, lt gy-med lt gy + mnr SND | 3.5-4.0cvd | 0.59(10) | 40 | 30 | 30 | | | | |
| | P | MDST, a/a | | | | | | 25 | 55 | 5 | 15 |
| **2479** | | **Mardie Greensand Mbr** | | | | | | | | | |
| **2520** | | **Barrow Gp "A" Unit** | | | | | | | | | |
| 2572-2578 | Ctg | SST, wht, v lt gy, arg + 20% MDST, dk gn-gy, carb, glauc | 5.5-6.0 | 0.61(14) | 35 | 50 | 15 | | | | |
| | P | MDST, a/a | | | | | | 30 | 65 | * | 5 |
| 2632-2644 | P | MDST, a/a | | | | | | 25 | 70 | 5 | * |
| **2834** | | **Barrow Gp "B" Unit** | | | | | | | | | |
| 3001-3016 | Ctg | SST, a/a + 40% SLTST, lt brn-gy, v sndy | 7.0 | 0.78(12) | 30 | 60 | 10 | | | | |
| 3016-3031 | P | SLTST, med dk gy, v sndy | | | | | | 10 | 65 | * | 25 |
| 3112-3127 | Ctg | SST, wht + 50% SLTST, brn-gy to med dk gy, v sndy, occ carb | 7.5 | 0.81(4) | 25 | 60 | 15 | | | | |
| | P | SLTST, a/a | | | | | | 5 | 70 | * | 25 |
| 3142-3157 | P | SLTST, yel gy, v sndy | | | | | | 35 | 65 | * | * |
| | P | MDST, med dk gy | | | | | | 25 | 65 | * | 10 |
| 3172-3187 | Ctg | SST, lt gy + lt brn-gy + 50% SLTST, yel-gy, v sndy | 7.0-7.5 | 0.85(21) | 30 | 65 | 5 | | | | |
| 3220-3235 | P | SLTST, wht-gy-pnk | | | | | | 15 | 65 | * | 20 |
| 3265-3280 | Ctg | MDST, yel-gy | 7.5-8.0 | 0.93(3) | 40 | 30 | 30bit | | | | |
| 3340-3355 | " | SLTST, gy-pnk + 20% SND | 7.5-8.0 | 0.89(12) | 30 | 60 | 10 | | | | |
| | | bit-Bitumen | | | | | | | | | |

Table 1 Maturity and Kerogen Composition Data

WELL: WEST BARROW-2

| GENERAL DATA | | | CHEMICAL ANALYSIS DATA | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PYROLYSIS | | | | | SOLVENT EXTRACTION | | | | | | |
| | | | | | | | | | | | | | EXTRACT COMPOSITION | | |
| SAMPLE DEPTH (METRES) | SAMPLE TYPE | ANALYSED LITHOLOGY | ORGANIC CARBON % OF ROCK | TEMPERATURE C | HYDROGEN INDEX | OXYGEN INDEX | PRODUCTION INDEX | POTENTIAL YIELD (kg Tonne) | TOTAL EXTRACT (ppm) | TOTAL EXTRACT (mg g T O C) | HYDROCARBONS (ppm) | HYDROCARBONS (mg g T O C) | SATURATED HYDROCARBONS | AROMATIC HYDROCARBONS | POLAR COMPOUNDS |
| 2277 | | **Muderong Shale** | | | | | | | | | | | | | |
| 2278-2293 | Ctg | MDST, lt-med gy, sl calc + 10% SLTST, v lt gy-lt gy, sl calc | - | | | | | | | | | | | | |
| | P | MDST, lt-med gy, sl calc | 1.09 | 427 | 114 | 120 | 0.17 | 1.50 | | | | | | | |
| 2308-2323 | Ctg | MDST, med gy-med dk gy, sl calc + mnr SLTST, a/a | 2.23 | 434 | 103 | 45 | 0.07 | 2.47 | | | | | | | |
| 2341-2356 | " | MDST, med gy, sl slty + mnr DOL, mod-rd brn | 1.67 | 435 | 157 | 80 | 0.08 | 2.86 | | | | | | | |
| 2374-2389 | " | MDST, med gy-med dk gy + mnr LST, wht | 1.83 | 440 | 156 | 67 | 0.06 | 3.04 | | | | | | | |
| 2404-2419 | " | MDST, med gy, sl slty | 1.65 | 438 | 193 | 69 | 0.08 | 3.46 | | | | | | | |
| 2431-2446 | " | MDST, med dk gy, sl slty + mnr LST, wht | 1.61 | 435 | 186 | 44 | 0.06 | 3.18 | | | | | | | |
| 2461-2476 | " | MDST, med-lt gy-med gy, v slty + 10% SLTST, lt gy-med lt gy + mnr SND | 2.26 | | | | | | 1505 | 67 | 590 | 26 | 28 | 11 | 61 |
| | P | MDST, med lt gy-med gy, v slty | 2.50 | 438 | 207 | 27 | 0.05 | 5.46 | | | | | | | |
| | " | SLTST, lt-gy med lt gy | 0.79 | | | | | | | | | | | | |
| 2479 | | **Mardie Greensand Mbr** | | | | | | | | | | | | | |
| 2520 | | **Barrow Group 'A' Unit** | | | | | | | | | | | | | |
| 2572-2578 | Ctg | SST, wht, v lt gy, arg + 20% MDST, dk gn gy, carb, glauc | - | | | | | | | | | | | | |
| | P | MDST, a/a | 2.66 | 438 | 134 | 37 | 0.08 | 3.88 | | | | | | | |
| 2632-2644 | Ctg | MDST, a/a + 40% SST, a/a | - | | | | | | | | | | | | |
| | P | MDST, a/a | 1.79 | 435 | 150 | 36 | 0.11 | 3.02 | | | | | | | |
| 2834 | | **Barrow Group 'B' Unit** | | | | | | | | | | | | | |
| 3001-3016 | Ctg | SST, wht, v lt gy, arg + 40% SLTST, lt brn gy, v sndy | - | | | | | | | | | | | | |
| | P | SLTST, a/a | 0.95 | | | | | | | | | | | | |
| 3016-3031 | Ctg | SST, wht, lt brn gy + 30% SLTST, med dk gy, v sndy | - | | | | | | | | | | | | |
| | P | SLTST, med dk gy, v sndy | 1.02 | 440 | 172 | 103 | 0.11 | 1.96 | | | | | | | |
| 3052-3067 | Ctg | SST, wht-med lt gy, arg + 20% SLTST, dk gy, sndy | - | | | | | | | | | | | | |
| | P | SLTST, dk gy, sndy | 0.91 | | | | | | | | | | | | |
| 3082-3097 | Ctg | SST, wht-lt gy + 60% SLTST, brn gy, v sndy, occ carb | - | | | | | | | | | | | | |
| | P | SLTST, brn gy, v sndy, occ carb | 0.94 | | | | | | | | | | | | |

Table 2a Chemical Analysis Data

WELL: WEST BARROW-2

| GENERAL DATA | | | CHEMICAL ANALYSIS DATA | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PYROLYSIS | | | | | SOLVENT EXTRACTION | | | | | | |
| | | | | | | | | | | | | | EXTRACT COMPOSITION (%) | | |
| SAMPLE DEPTH (METRES) | SAMPLE TYPE | ANALYSED LITHOLOGY | ORGANIC CARBON % OF ROCK | TEMPERATURE C | HYDROGEN INDEX | OXYGEN INDEX | PRODUCTION INDEX | POTENTIAL YIELD (kg Tonne) | TOTAL EXTRACT (ppm) | TOTAL EXTRACT (mg g T O C) | HYDROCARBONS (ppm) | HYDROCARBONS (mg g T O C) | SATURATED HYDROCARBONS | AROMATIC HYDROCARBONS | POLAR COMPOUNDS |
| 3112-3127 | Ctg | SST, wht + 50% SLTST, brn gy-med-dk gy, v sndy, occ carb | 0.61 | | | | | | 500 | 82 | 170 | 28 | 30 | 4 | 66 |
| | P | SLTST, brn gy-med dk gy, v sndy, occ carb | 1.08 | 443 | 183 | 81 | 0.12 | 2.24 | | | | | | | |
| 3142-3157 | Ctg | SST, lt gy + lt brn gy + 70% SLTST, yel gy, v sndy + 10% MDST, med dk gy | - | | | | | | | | | | | | |
| | P | SLTST, a/a | 1.07 | 442 | 107 | 148 | 0.14 | 1.33 | | | | | | | |
| | " | MDST, med dk gy | 1.12 | 443 | 140 | 123 | 0.14 | 1.83 | | | | | | | |
| 3172-3187 | Ctg | SST, a/a + 80% SLTST, a/a | - | | | | | | | | | | | | |
| | P | SLTST, yel gy, v sndy | 0.93 | | | | | | | | | | | | |
| 3220-3235 | Ctg | SLTST, wht-gy-pnk + 30% MDST, med-dk gy, v sndy | - | | | | | | 1730 | 129 | 700 | 52 | 34 | 6 | 60 |
| | P | SLTST, wht-gy-pnk | 1.09 | 445 | 162 | 77 | 0.13 | 2.04 | | | | | | | |
| | " | MDST, med-dk gy, v sndy | 1.34 | NDP | 507 | 210 | 0.07 | 7.27 | | | | | | | |
| | " | After extraction | 0.93 | NDP | 730 | 342 | 0.02 | 6.96 | | | | | | | |
| 3250-3265 | Ctg | MDST, lt gy-yel gy | 1.17 | 431 | 191 | 222 | 0.13 | 2.55 | 1745 | 149 | 1110 | 95 | 54 | 10 | 36 |
| | " | After extraction | 1.43 | 418 | 131 | 214 | 0.07 | 2.01 | | | | | | | |
| 3265-3280 | " | MDST, yel gy | 1.06 | 415 | 236 | 251 | 0.14 | 2.91 | 1965 | 185 | 1040 | 98 | 45 | 8 | 47 |
| | " | After extraction | 0.33 | | | | | | | | | | | | |
| 3325-3340 | " | SLTST, gy-pnk + 20% SND | 2.20 | NDP | 272 | 262 | 0.03 | 6.21 | 740 | 34 | 350 | 16 | 35 | 12 | 53 |
| | " | After extraction | 2.79 | NDP | 348 | 267 | 0.02 | 9.93 | | | | | | | |
| 3340-3355 | " | SLTST, a/a + 20% SND | - | | | | | | | | | | | | |
| | P | SLTST, gy-pnk | 1.91 | 435 | 82 | 110 | 0.19 | 1.93 | | | | | | | |

Table 2b Chemical Analysis Data

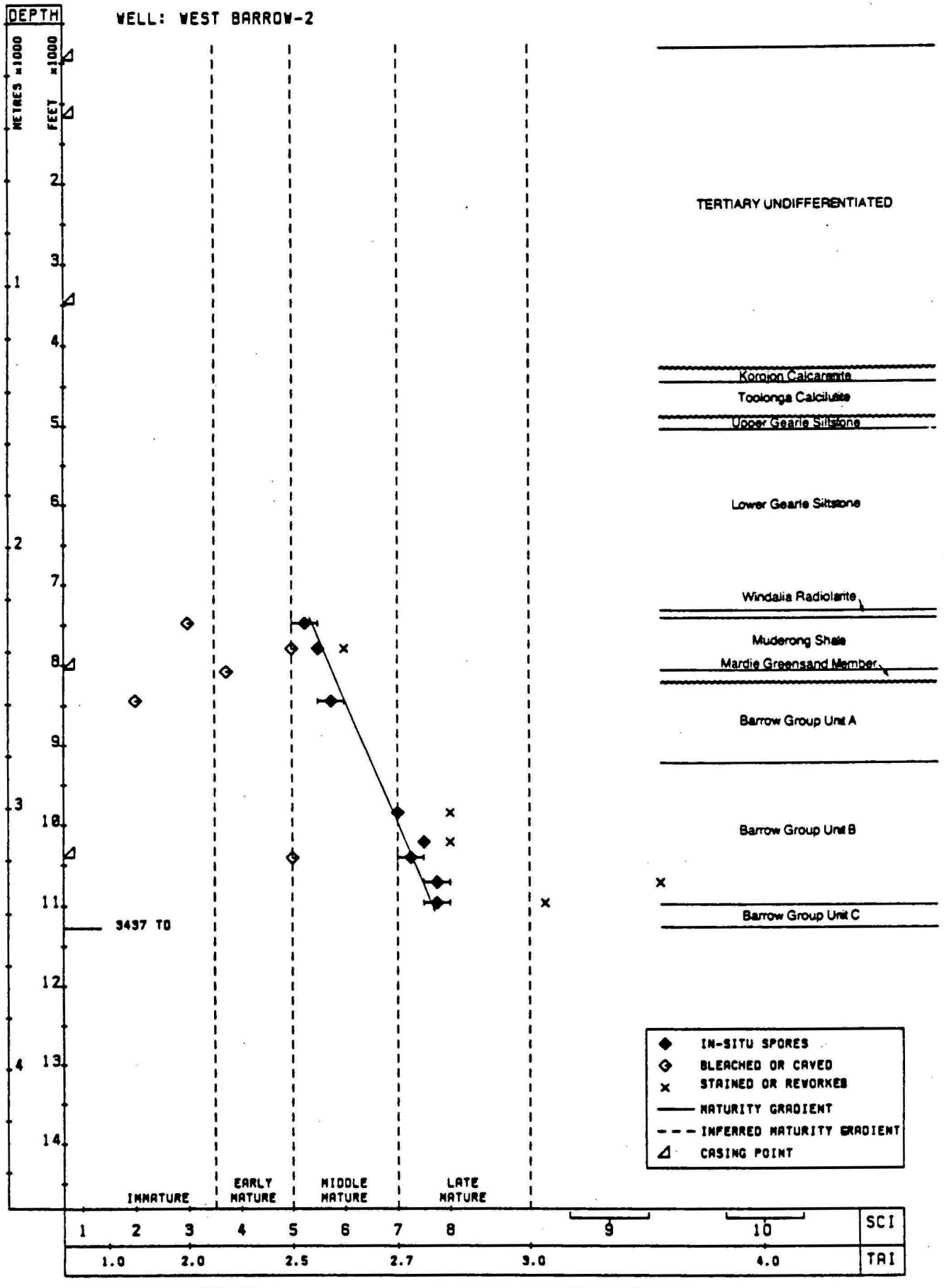



FIGURE 1 SPORE COLOUR INDEX AGAINST DEPTH

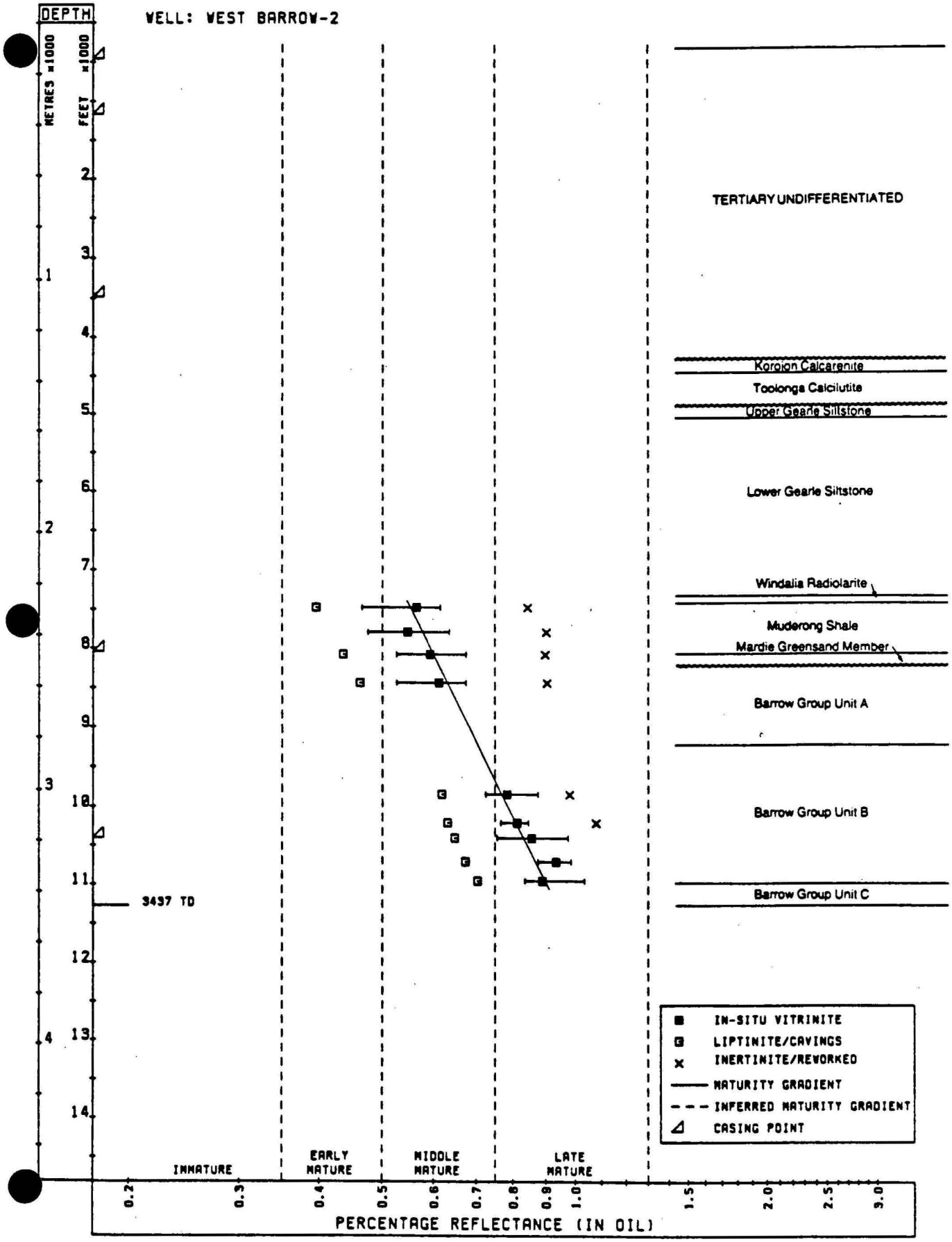
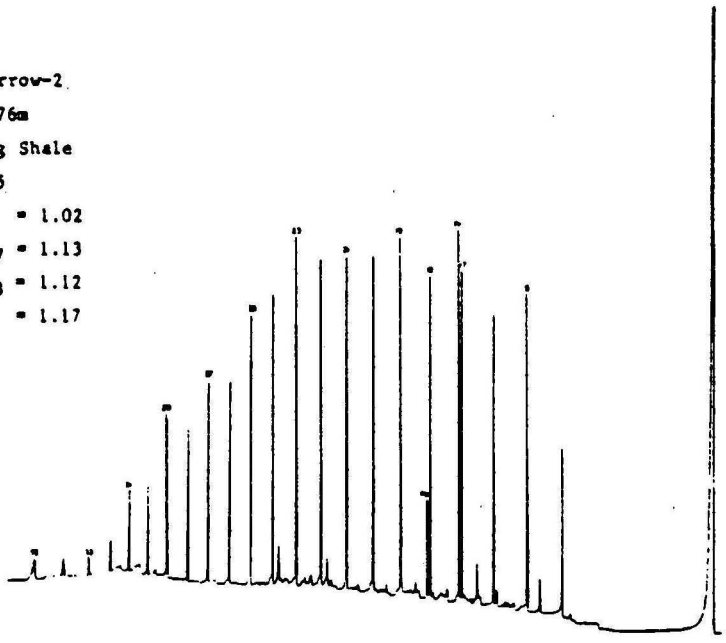
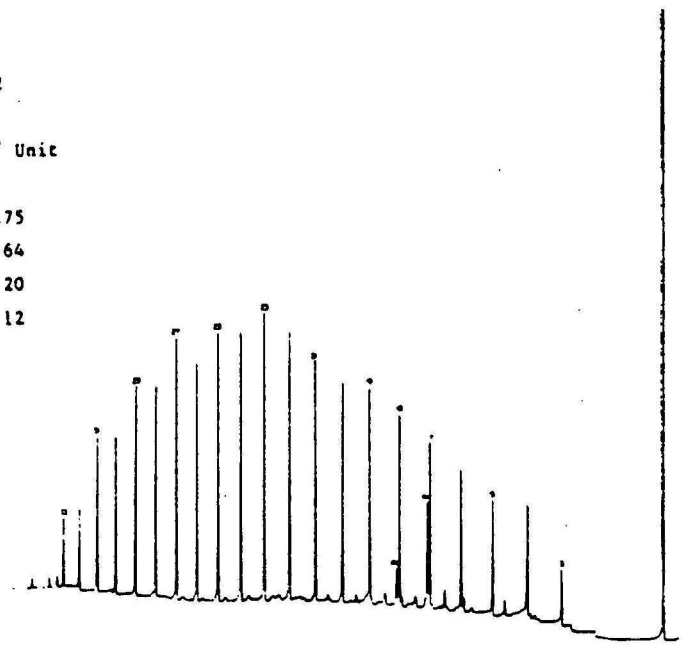



FIGURE 2 VITRINITE REFLECTANCE AGAINST DEPTH

West Barrow-2
2461-2476m
Muderong Shale
SCI 5.75
Pr/Ph = 1.02
Pr/n-$C_{17}$ = 1.13
Ph/n-$C_{18}$ = 1.12
CPI = 1.17



West Barrow-2
3112-3127m
Barrow Gp "B" Unit
SCI 7.5
Pr/Ph = 2.75
Pr/n-$C_{17}$ = 0.64
Ph/n-$C_{18}$ = 0.20
CPI = 1.12



West Barrow-2
3220-3235m
Barrow Gp "B" Unit
SCI 7.25
Pr/Ph = 2.01
Pr/n-$C_{17}$ = 0.69
Ph/n-$C_{18}$ = 0.30
CPI = 1.14

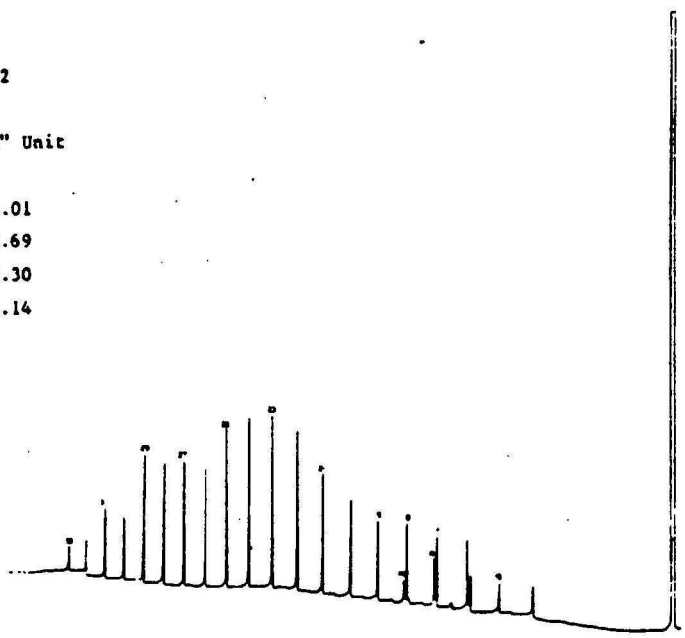
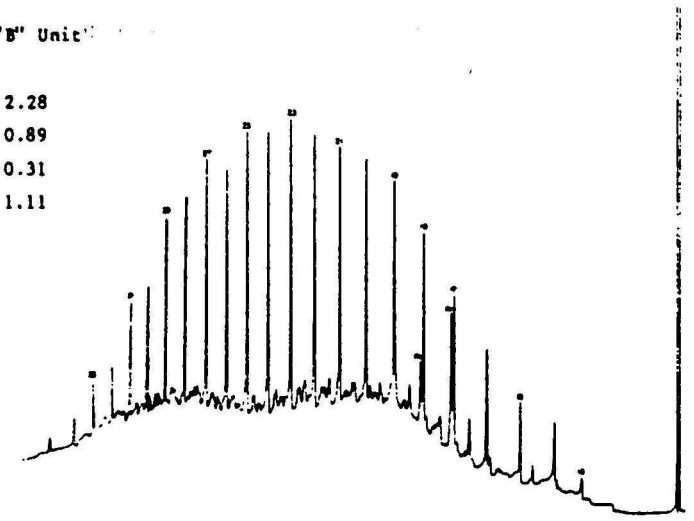
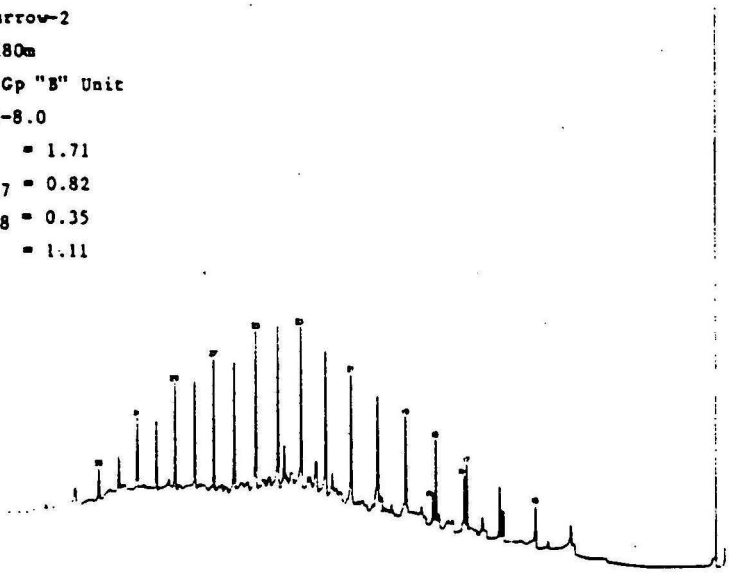


Figure 3a

West Barrow-2
3250-3265m
Barrow Gp "B" Unit
SCI 7.25
Pr/Ph = 2.28
$Pr/n\text{-}C_{17}$ = 0.89
$Ph/n\text{-}C_{18}$ = 0.31
CPI = 1.11



West Barrow-2
3265-3280m
Barrow Gp "B" Unit
SCI 7.5-8.0
Pr/Ph = 1.71
$Pr/n\text{-}C_{17}$ = 0.82
$Ph/n\text{-}C_{18}$ = 0.35
CPI = 1.11



West Barrow-2
3325-3340m
Barrow Gp "B" Unit
SCI 7.5
Pr/Ph = 2.09
$Pr/n\text{-}C_{17}$ = 0.94
$Ph/n\text{-}C_{18}$ = 0.36
CPI = 1.09

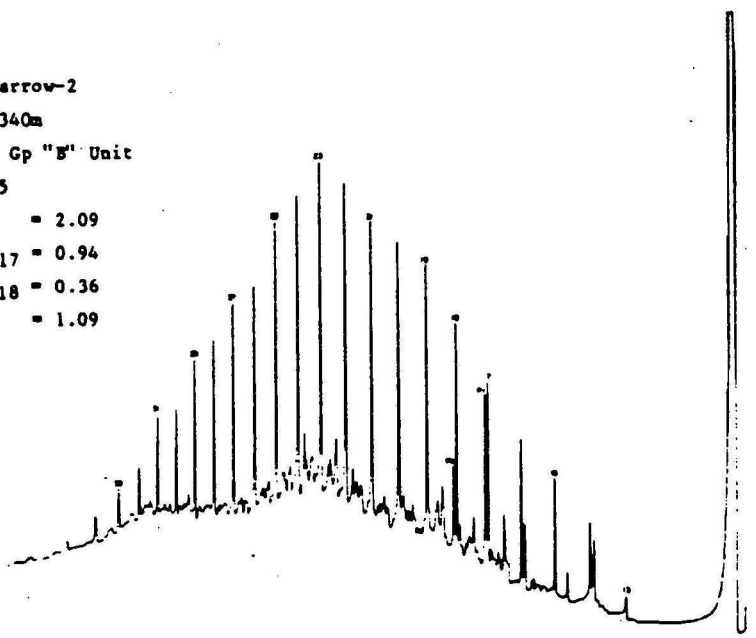


Figure 3b

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Appendix 1a

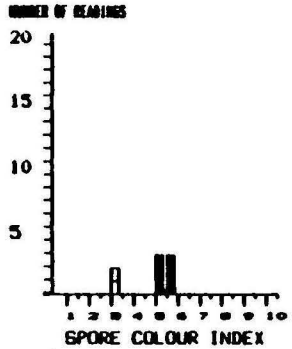
WEST BARROW-2

IN SITU POPULATION

SAMPLE 2270-2293M

3.0 3.0 5.0 5.0 5.0 5.5 5.5 5.5

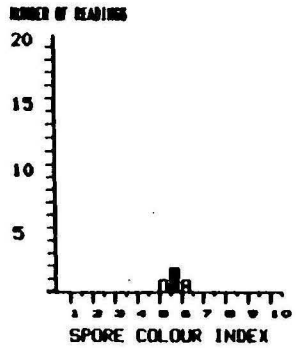
| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN SITU SPORES | 5.0-5.5 | 6 |
| BLEACHED/CAVINGS | 3.0-3.0 | 2 |
| STAINED/REWORKED | - | 0 |




SAMPLE 2374-2389M

5.0 5.5 5.5 6.0

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN SITU SPORES | 5.5-5.5 | 2 |
| BLEACHED/CAVINGS | 5.0-5.0 | 1 |
| STAINED/REWORKED | 6.0-6.0 | 1 |



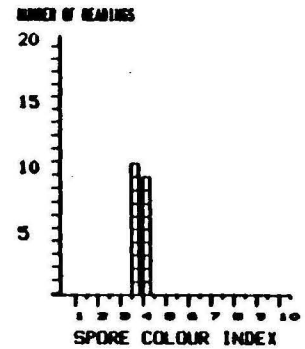

WEST BARROW-2

IN SITU POPULATION

SAMPLE 2461-2476M

3.5 3.5 3.5 3.5 3.5 3.5 3.5 3.5 3.5 3.5
4.0 4.0 4.0 4.0 4.0 4.0 4.0 4.0 4.0

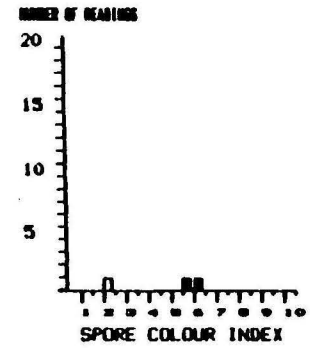
| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN SITU SPORES | - | 0 |
| BLEACHED/CAVINGS | 3.5-4.0 | 19 |
| STAINED/REWORKED | - | 0 |




SAMPLE 2572-2578M

2.0 5.5 6.0

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN SITU SPORES | 5.5-6.0 | 2 |
| BLEACHED/CAVINGS | 2.0-2.0 | 1 |
| STAINED/REWORKED | - | 0 |



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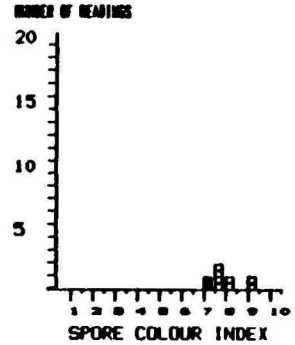
WEST BARROW-2

IN SITU POPULATION

SAMPLE 3001-3016M

7.0 7.5 7.5 8.0 9.0

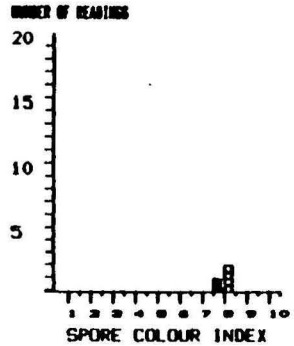
| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN SITU SPORES | 7.0-7.0 | 1 |
| BLEACHED/CAVINGS | - | 0 |
| STAINED/REWORKED | 7.5-9.0 | 4 |




SAMPLE 3112-3127M

7.5 8.0 8.0

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN SITU SPORES | 7.5-7.5 | 1 |
| BLEACHED/CAVINGS | - | 0 |
| STAINED/REWORKED | 8.0-8.0 | 2 |



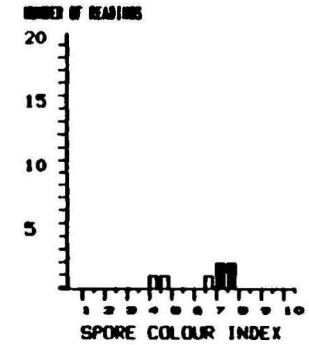

WEST BARROW-2

IN SITU POPULATION

SAMPLE 3172-3187M

4.0 4.5 6.5 7.0 7.0 7.5 7.5

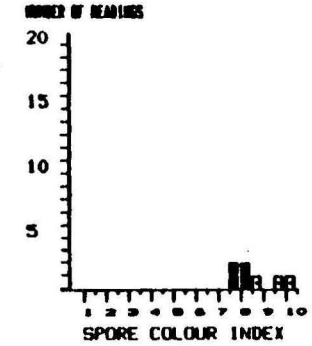
| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN SITU SPORES | 7.0-7.5 | 4 |
| BLEACHED/CAVINGS | 4.0-6.5 | 3 |
| STAINED/REWORKED | - | 0 |




SAMPLE 3265-3280M

7.5 7.5 8.0 8.0 8.5 9.5 10.0

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN SITU SPORES | 7.5-8.0 | 4 |
| BLEACHED/CAVINGS | - | 0 |
| STAINED/REWORKED | 8.5-10.0 | 3 |




Appendix 1b

Robertson Research

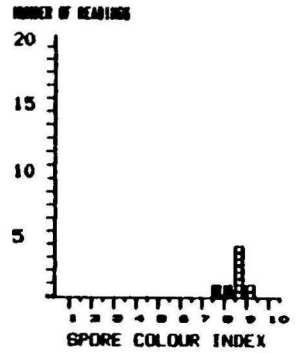
WEST BARROW-2

IN SITU POPULATION

SAMPLE 3340-3355M

7.5 8.0 8.5 8.5 8.5 8.5 9.0

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN SITU SPORES | 7.5-8.0 | 2 |
| BLEACHED/CAVINGS | - | 0 |
| STAINED/REWORKED | 8.5-9.0 | 5 |




Appendix 1c

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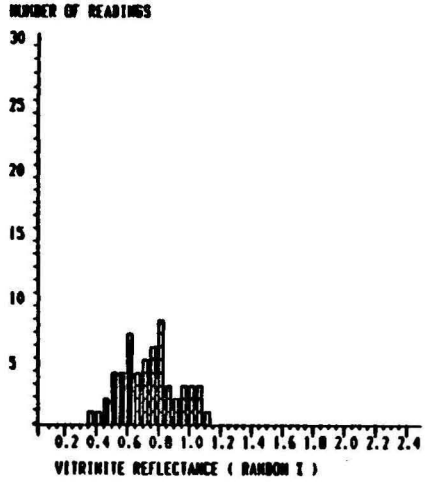
WEST BARROW-2

SAMPLE 2270-2293M

0.35 0.44 0.47 0.48 0.50 0.53 0.53 0.54 0.57 0.58
0.59 0.59 0.60 0.60 0.61 0.61 0.61 0.61 0.63 0.66
0.66 0.67 0.69 0.70 0.71 0.73 0.73 0.74 0.75 0.75
0.78 0.78 0.78 0.79 0.81 0.81 0.82 0.83 0.83 0.83
0.84 0.84 0.85 0.86 0.89 0.91 0.91 0.95 0.95 0.96
1.00 1.01 1.04 1.08 1.08 1.09 1.14

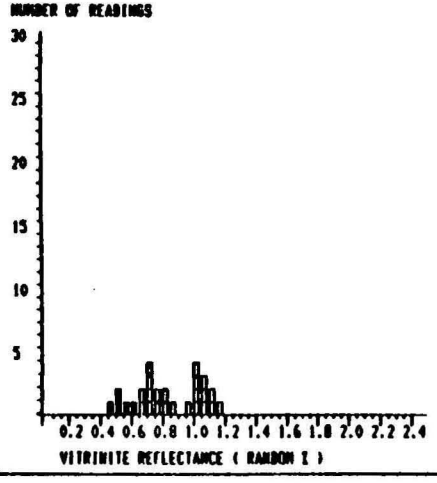
| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.47-0.61 | 16 | 0.56 | 0.05 |
| LIPTINITE/CAVINGS | 0.35-0.44 | 2 | 0.40 | 0.06 |
| INERTINITE/REWORKED | 0.63-1.14 | 39 | 0.84 | 0.13 |




SAMPLE 2374-2389M

0.48 0.52 0.52 0.58 0.63 0.65 0.66 0.70 0.70 0.71
0.72 0.75 0.75 0.83 0.84 0.85 0.99 1.00 1.01 1.02
1.03 1.07 1.08 1.09 1.10 1.12 1.16

| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.48-0.63 | 5 | 0.55 | 0.06 |
| INERTINITE/REWORKED | 0.65-1.16 | 22 | 0.90 | 0.17 |

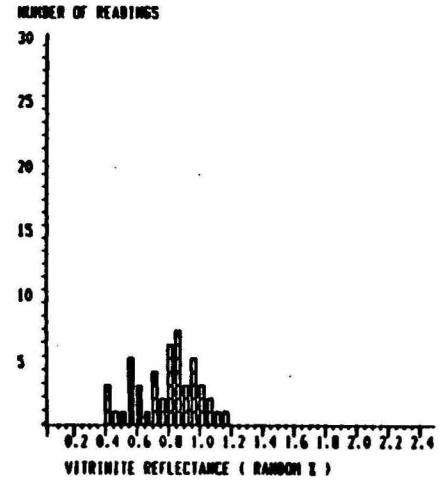



WEST BARROW-2

SAMPLE 2461-2476M

0.41 0.42 0.43 0.48 0.53 0.55 0.55 0.56 0.57 0.57
0.64 0.64 0.64 0.67 0.70 0.72 0.73 0.73 0.77 0.77
0.81 0.81 0.82 0.82 0.83 0.84 0.85 0.85 0.86 0.87
0.88 0.89 0.89 0.91 0.93 0.94 0.95 0.96 0.96 0.96
0.97 1.00 1.04 1.04 1.06 1.07 1.14 1.16

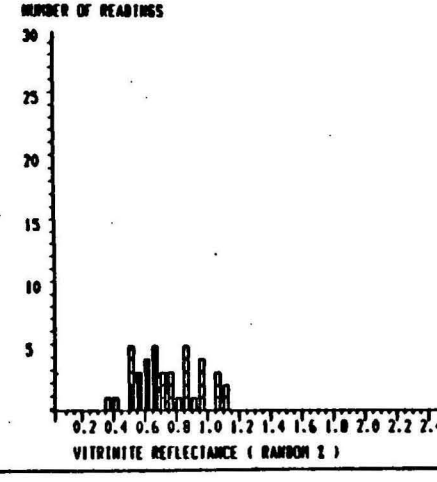
| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.53-0.67 | 10 | 0.59 | 0.05 |
| LIPTINITE/CAVINGS | 0.41-0.48 | 4 | 0.44 | 0.03 |
| INERTINITE/REWORKED | 0.70-1.16 | 34 | 0.90 | 0.12 |




SAMPLE 2572-2588M

0.36 0.42 0.51 0.51 0.51 0.53 0.54 0.56 0.57 0.57
0.60 0.61 0.63 0.64 0.65 0.66 0.66 0.67 0.67 0.72
0.72 0.74 0.78 0.79 0.79 0.80 0.85 0.85 0.86 0.87
0.88 0.94 0.95 0.96 0.97 0.98 1.05 1.05 1.08 1.11
1.14

| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.53-0.67 | 14 | 0.61 | 0.05 |
| LIPTINITE/CAVINGS | 0.36-0.51 | 5 | 0.46 | 0.07 |
| INERTINITE/REWORKED | 0.72-1.14 | 22 | 0.90 | 0.13 |




Appendix 2a

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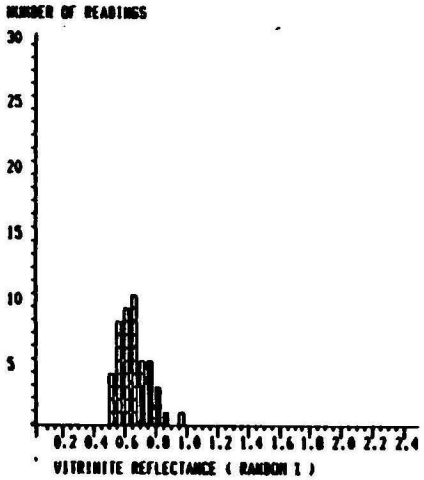
WEST BARROW-2

SAMPLE 3091-3016M

0.51 0.53 0.53 0.54 0.55 0.55 0.57 0.57 0.58 0.58
0.58 0.59 0.60 0.61 0.61 0.62 0.62 0.62 0.63 0.64
0.64 0.65 0.65 0.66 0.66 0.66 0.67 0.68 0.69 0.69
0.69 0.70 0.71 0.73 0.74 0.74 0.76 0.76 0.78 0.78
0.79 0.81 0.81 0.84 0.87 0.98

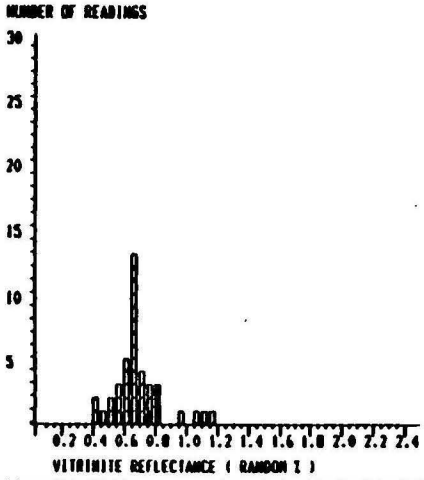
| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.73-0.87 | 12 | 0.78 | 0.04 |
| LIPTINITE/CAVINGS | 0.51-0.71 | 33 | 0.62 | 0.06 |
| INERTINITE/REWORKED | 0.98-0.98 | 1 | 0.98 | |




SAMPLE 3112-3127M

0.40 0.44 0.48 0.51 0.54 0.55 0.56 0.59 0.60 0.61
0.63 0.63 0.64 0.65 0.65 0.65 0.65 0.66 0.66 0.66
0.66 0.68 0.68 0.69 0.69 0.69 0.70 0.71 0.72 0.73
0.75 0.75 0.77 0.82 0.82 0.84 0.98 1.05 1.13 1.15

| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.77-0.84 | 4 | 0.81 | 0.03 |
| LIPTINITE/CAVINGS | 0.40-0.75 | 32 | 0.63 | 0.09 |
| INERTINITE/REWORKED | 0.98-1.15 | 4 | 1.00 | 0.08 |

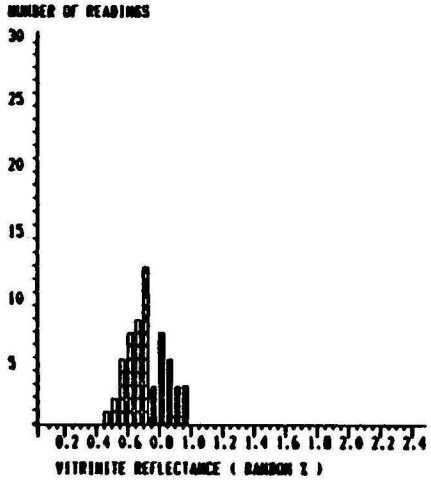



WEST BARROW-2

SAMPLE 3172-3187M

0.45 0.50 0.51 0.55 0.55 0.57 0.59 0.59 0.60 0.61
0.62 0.62 0.63 0.63 0.64 0.65 0.65 0.66 0.68 0.68
0.69 0.69 0.69 0.70 0.71 0.71 0.71 0.72 0.72 0.72
0.73 0.73 0.73 0.73 0.73 0.76 0.77 0.78 0.80 0.80
0.80 0.81 0.81 0.82 0.83 0.85 0.85 0.86 0.88 0.89
0.90 0.93 0.94 0.95 0.95 0.97

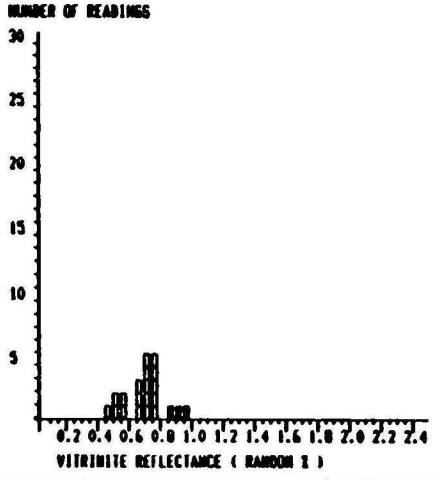
| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.76-0.97 | 21 | 0.85 | 0.07 |
| LIPTINITE/CAVINGS | 0.45-0.73 | 35 | 0.65 | 0.07 |




SAMPLE 3265-3280M

0.49 0.52 0.54 0.57 0.59 0.65 0.66 0.67 0.71 0.71
0.71 0.73 0.74 0.75 0.75 0.76 0.78 0.79 0.88 0.94
0.98

| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.88-0.98 | 3 | 0.93 | 0.05 |
| LIPTINITE/CAVINGS | 0.49-0.79 | 18 | 0.67 | 0.09 |



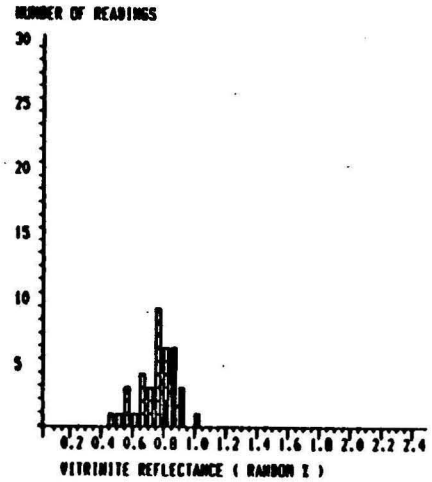

Appendix 2b

Robertson Research

WEST BARROW-2

SAMPLE 3340-3355M

0.49 0.53 0.56 0.56 0.57 0.62 0.63 0.66 0.67 0.67
0.71 0.72 0.73 0.75 0.76 0.76 0.77 0.77 0.77 0.78
0.79 0.79 0.80 0.80 0.81 0.82 0.84 0.84 0.85 0.85
0.86 0.86 0.87 0.89 0.91 0.93 0.94 1.03




| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.84-1.03 | 12 | 0.89 | 0.06 |
| LIPTINITE/CAVINGS | 0.49-0.82 | 26 | 0.70 | 0.10 |

Appendix 2c

# WEST MUIRON-2 WELL

## SUMMARY

Geochemical analysis of samples from the interval 1110m to 3290m of the West Muiron-2 well has shown that the well section is immature to 1700m, early mature between 1700m and 2500m, middle mature between 2500m and 3250m and late mature from 3250m to 3320m TD. The maturity gradients do not indicate the presence of any major erosional unconformities within the well section and suggest that the sediments penetrated are at or near their maximum depths of burial.

The intervals 1880m to 2000m and 2760m to 3000m in the Upper and Lower Dingo Claystones have good oil source potential.

The well section is extensively stained by a migrant oil derived from mature waxy kerogens deposited under strongly anoxic conditions.

## GENERAL COMMENTS

Basin: Northern Carnarvon Basin.

Location: 21° 35' 38.7"S, 114° 13' 31.2"E.

Operator and date of drilling: West Australian Petroleum Pty Ltd, 1975.

Well Status: Plugged and abandoned.

TD: 3320m.

Mud data: Sea water: Seabed to 198m.
Gel/sea water mud: 198m to 386m.
Sea water and high viscosity slugs: 386m to 980m.
Dispersed lignosulphonate system: 980m to 3320m TD.

Casing data: 30" at 129m, 20" at 182m, $13^3/_8$" at 266m, $9^5/_8$" at 960m, 7" at 3019m.

BHT data: 70°C at 960m, after 4 hrs stopped circulation.
83°C at 2163m, after 6 hrs stopped circulation.
120°C at 3312m, after 6½ hrs stopped circulation.

Elevation: RT 30m ASL.

Water depth: 61m.

WEST MUIRON-2 WELL

Interval analysed: 1110m to 3290m.

Age of interval analysed:

| | Depth (in metres) |
|---|---|
| Middle-Late Jurassic | 1110-2067 |
| Early-Middle Jurassic | 2067-2430 |
| Early Jurassic | 2430-3070 |
| Late Triassic-Early Jurassic | 3070-3290 |

Sample type and quality: Dried ditch cuttings of good quality for geochemical analysis.

Maturation data quality:

a) Vitrinite Reflectance: The samples yielded poor to fair amounts of indigenous vitrinite for measurement. Results: Fair.

b) Spore Colour Index: The samples yielded sufficient sporomorphs for measurement. Results: Good.

Source rock data quality: Poor to fair.

Gas chromatography run at: 1550m to 1560m, 2210m to 2220m, 2760m to 2770m and 3100m to 3110m.

MATURATION (Table 1, Figures 1 and 2, Appendices 1 and 2)

Vitrinite reflectance results show values increasing from interpreted values of 0.30% at 1110m to 0.79% at 3000m. Spore colour index values rise from 2.5 to 3 SCI units at 1110m to 7 SCI units at 3290m. The results obtained suggest that the analysed interval is immature to a depth of about 1700m, early mature from 1700m to about 2500m, middle mature below 2500m to 3250m and late mature from 3250m to 3320m TD. The maturity gradients do not indicate any significant amounts of missing section at unconformities within the section analysed. Extrapolation of the gradients to the seabed suggests that there is little Late Jurassic or younger section missing above 1110m and that the sediments analysed are currently at or near their maximum depths of burial.

WEST MUIRON-2 WELL

OIL AND GAS SOURCE ROCKS (Tables 1 and 2, Figure 3)

Initial analysis of samples showed that they contain the heavy oil residue of a migrant oil. Total organic carbon and rock-eval pyrolysis analyses were therefore carried out on extracted residues.

The mudstones analysed from the Dingo Claystone and the Brigadier Beds generally contain average to above average organic carbon contents of between 0.67% and 2.32%. Pyrolysis analysis of samples with TOC contents in excess of 1% shows that the samples contain generally humic kerogens with only minor content of oil-prone kerogen. Intervals with higher oil-prone kerogen contents at 1880m to 2000m and 2760m to 3000m in the Upper and Lower Dingo Claystone respectively have good oil source potential.

GEOCHEMICAL CHARACTERISTICS OF THE REMAINING SEDIMENTS (Table 1 and 2, Figure 3)

The remaining samples show relatively low hydrogen indices and contain humic kerogens with only traces of oil-prone kerogen. These samples have no significant oil source potential and are too organically lean to be significant gas source rocks.

Extraction, fractionation and gas chromatography of samples at 1550m to 1560m, 2210m to 2220m, 2760m to 2770m and 3100m to 3110m show that these samples contain migrant hydrocarbons derived from mature waxy kerogens, deposited under strongly anoxic conditions.

WELL: WEST MUIRON-2

| SAMPLE DEPTH (METRES) | SAMPLE TYPE | GENERALISED LITHOLOGY | SPORE COLOUR INDEX (1-10) | VITRINITE REFLECTIVITY (R oil av %) | KEROGEN COMPOSITION (% vol.) (by microscopic examination) | | | KEROGEN COMPOSITION (% wt.) (by calculation from pyrolysis data) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | INERTINITE | VITRINITE | SAPROPEL | INERTINITE | VITRINITE | ALGAL SAPROPEL | WAXY SAPROPEL |
| **1096** | | **Upper Dingo Claystone** | | | | | | | | | |
| 1110-1120 | Ctg | MDST, lt gy-yel gy | 2.5-3.0 | 0.35(4) | 55 | 45 | nnr | | | | |
| | " | After extraction | | | | | | 55 | 45 | * | * |
| 1220-1230 | " | MDST, lt gy | | | | | | | | | |
| | " | After extraction | | | | | | 55 | 45 | * | * |
| 1330-1340 | " | MDST, lt gy-lt yel-gy | 2.5-3.0 | 0.34(9) | 55 | 40 | 5 | | | | |
| | " | After extraction | | | | | | 60 | 40 | * | * |
| 1440-1450 | " | MDST, pal yel-brn, calc | | | | | | | | | |
| | " | After extraction | | | | | | 50 | 45 | * | 5 |
| 1550-1560 | " | MDST, a/a | 3.0-3.5 | 0.37(11) | 50 | 40 | 10 | | | | |
| | " | After extraction | | | | | | 50 | 45 | * | 5 |
| 1660-1670 | " | MDST, a/a | | | | | | | | | |
| | " | After extraction | | | | | | 45 | 45 | * | 10 |
| 1770-1780 | " | MDST, a/a | 3.5 | 0.39(24) | 60 | 25 | 15 | | | | |
| | " | After extraction | | | | | | 55 | 40 | * | 5 |
| 1880-1890 | " | MDST, a/a | | | | | | | | | |
| | " | After extraction | | | | | | 35 | 45 | * | 20 |
| 1990-2000 | " | MDST, a/a | 3.5 | 0.42(6) | 50 | 40 | 10 | | | | |
| | " | After extraction | | | | | | 40 | 45 | * | 15 |
| **2067** | | **Middle Dingo Claystone** | | | | | | | | | |
| 2100-2110 | " | MDST, lt gy | | | | | | | | | |
| | " | After extraction | | | | | | 70 | 30 | * | * |
| 2210-2220 | " | MDST, lt gy-pal yel-gy | 4.0-4.5 | 0.47(6) | 85 | 15 | tr | | | | |
| | " | After extraction | | | | | | 75 | 25 | * | * |
| 2320-2330 | " | MDST, a/a | | | | | | | | | |
| | " | After extraction | | | | | | 55 | 40 | * | 5 |
| **2430** | | **Lower Dingo Claystone** | | | | | | | | | |
| 2430-2440 | " | MDST, yel-gy | 5.0-5.5 | 0.56(6) | 55 | 40 | 5 | | | | |
| | " | After extraction | | | | | | 55 | 40 | * | 5 |
| 2540-2550 | " | MDST, med gy, calc | 5.0-5.5 | 0.58(4) | 70 | 30 | * | | | | |
| | " | After extraction | | | | | | 55 | 40 | * | 5 |
| 2650-2660 | " | MDST, med lt gy, v calc | | | | | | | | | |
| | " | After extraction | | | | | | 60 | 35 | * | 5 |
| 2760-2770 | " | MDST, med lt gy | 5.5-6.0 | * | 80 | 20 | * | | | | |
| | " | After extraction | | | | | | 55 | 30 | * | 15 |

Table 1a Maturity and Kerogen Composition Data

WELL: WEST MUTRON-2

| SAMPLE DEPTH (METRES) | SAMPLE TYPE | GENERALISED LITHOLOGY | SPORE COLOUR INDEX (1-10) | VITRINITE REFLECTIVITY (R oil av %) | KEROGEN COMPOSITION (% vol) (by microscopic examination) | | | KEROGEN COMPOSITION (% wt) (by calculation from pyrolysis data) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | INERTINITE | VITRINITE | SAPROPEL | INERTINITE | VITRINITE | ALGAL SAPROPEL | WAXY SAPROPEL |
| 2880-2890 | Ctg | MDST, lt gy, calc | | | | | | | | | |
| | " | After extraction | | | | | | 50 | 40 | * | 10 |
| 2990-3000 | " | MDST, lt gy, calc | 6.0 | ?0.79(4) | 55 | 45 | tr | | | | |
| | " | After extraction | | | | | | 40 | 50 | * | 10 |
| 3044 | | North Rankin Beds | | | | | | | | | |
| 3070 | | Brigadier Beds | | | | | | | | | |
| 3100-3110 | " | MDST, lt gy-yel gy, calc | | | | | | | | | |
| | " | After extraction | | | | | | 50 | 50 | * | * |
| 3160-3170 | " | MDST, a/a | 6.5-7.0 | * | 85 | 15 | tr | | | | |
| | " | After extraction | | | | | | 50 | 50 | * | * |
| 3220-3230 | " | MDST, lt med gy, calc | | | | | | | | | |
| | " | After extraction | | | | | | 65 | 35 | * | * |
| 3280-3290 | " | MDST, med gy, calc | 7.0 | * | 90 | 10 | * | | | | |
| | " | After extraction | | | | | | 70 | 20 | * | 10 |

Table 1b Maturity and Kerogen Composition Data

WELL: WEST MUIRON-2

| GENERAL DATA | | | CHEMICAL ANALYSIS DATA | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PYROLYSIS | | | | | SOLVENT EXTRACTION | | | | | | |
| | | | | | | | | | | | | | EXTRACT COMPOSITION (%) | | |
| SAMPLE DEPTH (METRES) | SAMPLE TYPE | ANALYSED LITHOLOGY | ORGANIC CARBON % OF ROCK | TEMPERATURE °C | HYDROGEN INDEX | OXYGEN INDEX | PRODUCTION INDEX | POTENTIAL YIELD (kg/Tonne) | TOTAL EXTRACT (ppm) | TOTAL EXTRACT (mg/g T O C) | HYDROCARBONS (ppm) | HYDROCARBONS (mg/g T O C) | SATURATED HYDROCARBONS | AROMATIC HYDROCARBONS | POLAR COMPOUNDS |
| **1096** | | **Upper Dingo Claystone** | | | | | | | | | | | | | |
| 1110-1120 | Ctg | MDST, lt gy-yel gy, sl calc | 1.28 | | | | | | | | | | | | |
| | " | After extraction | 0.75 | 423 | 140 | 204 | 0.09 | 1.15 | | | | | | | |
| 1220-1230 | Ctg | MDST, lt gy | 1.30 | | | | | | | | | | | | |
| | " | After extraction | 0.67 | 419 | 140 | 163 | 0.16 | 1.12 | | | | | | | |
| 1330-1340 | Ctg | MDST, lt gy-lt | 1.79 | | | | | | | | | | | | |
| | " | After extraction | 1.10 | 418 | 132 | 127 | 0.21 | 1.84 | | | | | | | |
| 1440-1450 | Ctg | MDST, pal yel-brn, calc | 2.41 | | | | | | | | | | | | |
| | " | After extraction | 1.56 | 423 | 142 | 108 | 0.06 | 2.36 | | | | | | | |
| 1550-1560 | Ctg | MDST, a/a | 2.32 | 418 | 257 | 69 | 0.39 | 9.74 | 6740 | 291 | 5840 | 252 | 80 | 7 | 13 |
| | " | After extraction | 1.73 | 421 | 156 | 74 | 0.07 | 2.89 | | | | | | | |
| 1660-1670 | Ctg | MDST, a/a | 3.09 | | | | | | | | | | | | |
| | " | After extraction | 2.23 | 424 | 174 | 58 | 0.08 | 4.21 | | | | | | | |
| 1770-1780 | Ctg | MDST, a/a | 2.05 | | | | | | | | | | | | |
| | " | After extraction | 1.55 | 422 | 139 | 82 | 0.07 | 2.33 | | | | | | | |
| 1880-1890 | Ctg | MDST, a/a | 2.54 | | | | | | | | | | | | |
| | " | After extraction | 1.79 | 420 | 208 | 81 | 0.05 | 3.93 | | | | | | | |
| 1990-2000 | Ctg | MDST, a/a | 2.83 | | | | | | | | | | | | |
| | " | After extraction | 2.16 | 425 | 180 | 82 | 0.05 | 4.10 | | | | | | | |
| **2067** | | **Middle Dingo Claystone** | | | | | | | | | | | | | |
| 2100-2110 | Ctg | MDST, lt gy | 2.70 | | | | | | | | | | | | |
| | " | After extraction | 2.22 | 424 | 52 | 61 | 0.07 | 1.25 | | | | | | | |
| 2210-2220 | Ctg | MDST, lt gy-pal, yel gy | 2.83 | 424 | 287 | 66 | 0.33 | 12.05 | 6635 | 234 | 5725 | 202 | 77 | 9 | 14 |
| | " | After extraction | 2.32 | NDP | 43 | 69 | 0.10 | 1.10 | | | | | | | |
| 2320-2330 | Ctg | MDST, a/a | 2.33 | | | | | | | | | | | | |
| | " | After extraction | 1.90 | 426 | 113 | 88 | 0.04 | 2.25 | | | | | | | |
| **2430** | | **Lower Dingo Claystone** | | | | | | | | | | | | | |
| 2430-2440 | Ctg | MDST, yel-gy, sl calc | 1.62 | | | | | | | | | | | | |
| | " | After extraction | 1.48 | 426 | 102 | 119 | 0.05 | 1.59 | | | | | | | |
| 2540-2550 | Ctg | MDST, med gy, calc | 2.04 | | | | | | | | | | | | |
| | " | After extraction | 1.67 | 423 | 99 | 119 | 0.08 | 1.81 | | | | | | | |
| 2650-2660 | Ctg | MDST, med lt gy, v calc | 2.31 | | | | | | | | | | | | |
| | " | After extraction | 1.92 | 422 | 92 | 103 | 0.11 | 1.98 | | | | | | | |
| 2760-2770 | Ctg | MDST, med lt gy, sl calc | 2.55 | 425 | 139 | 59 | 0.33 | 5.30 | 3995 | 157 | 3210 | 126 | 72 | 9 | 20 |
| | " | After extraction | 1.67 | 425 | 122 | 92 | 0.05 | 2.13 | | | | | | | |

Table 2a Chemical Analysis Data

WELL: WEST MUIRON-2

| GENERAL DATA | | | CHEMICAL ANALYSIS DATA | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PYROLYSIS | | | | | SOLVENT EXTRACTION | | | | | | |
| | | | | | | | | | | | | | EXTRACT COMPOSITION (%) | | |
| SAMPLE DEPTH (METRES) | SAMPLE TYPE | ANALYSED LITHOLOGY | ORGANIC CARBON % Of ROCK | TEMPERATURE °C | HYDROGEN INDEX | OXYGEN INDEX | PRODUCTION INDEX | POTENTIAL YIELD (kg/Tonne) | TOTAL EXTRACT (ppm) | TOTAL EXTRACT (mg/g TOC) | HYDROCARBONS (ppm) | HYDROCARBONS (mg/g TOC) | SATURATED HYDROCARBONS | AROMATIC HYDROCARBONS | POLAR COMPOUNDS |
| 2880-2890 | Ctg | MDST, lt gy, calc | 2.16 | | | | | | | | | | | | |
| | " | After extraction | 1.23 | 425 | 119 | 85 | 0.06 | 1.55 | | | | | | | |
| 2990-3000 | Ctg | MDST, lt gy, calc | 1.65 | | | | | | | | | | | | |
| | " | After extraction | 1.66 | 424 | 130 | 77 | 0.04 | 2.24 | | | | | | | |
| 3044 | | North Rankin Beds | | | | | | | | | | | | | |
| 3070 | | Brigadier Beds | | | | | | | | | | | | | |
| 3100-3110 | Ctg | MDST, lt gy-yel gy, calc | 1.62 | | | | | | 2085 | 129 | 1585 | 98 | 73 | 3 | 24 |
| | " | After extraction | 1.14 | NDP | 77 | 155 | 0.18 | 1.07 | | | | | | | |
| 3160-3170 | Ctg | MDST, a/a | 2.29 | | | | | | | | | | | | |
| | " | After extraction | 1.70 | 418 | 68 | 127 | 0.16 | 1.37 | | | | | | | |
| 3220-3230 | Ctg | MDST, lt med gy, calc | 1.64 | | | | | | | | | | | | |
| | " | After extraction | 1.33 | 429 | 60 | 118 | 0.15 | 0.94 | | | | | | | |
| 3280-3290 | Ctg | MDST, med gy, calc | 3.50 | | | | | | | | | | | | |
| | " | After extraction | 3.12 | 425 | 89 | 103 | 0.13 | 3.17 | | | | | | | |

Table 2b Chemical Analysis Data

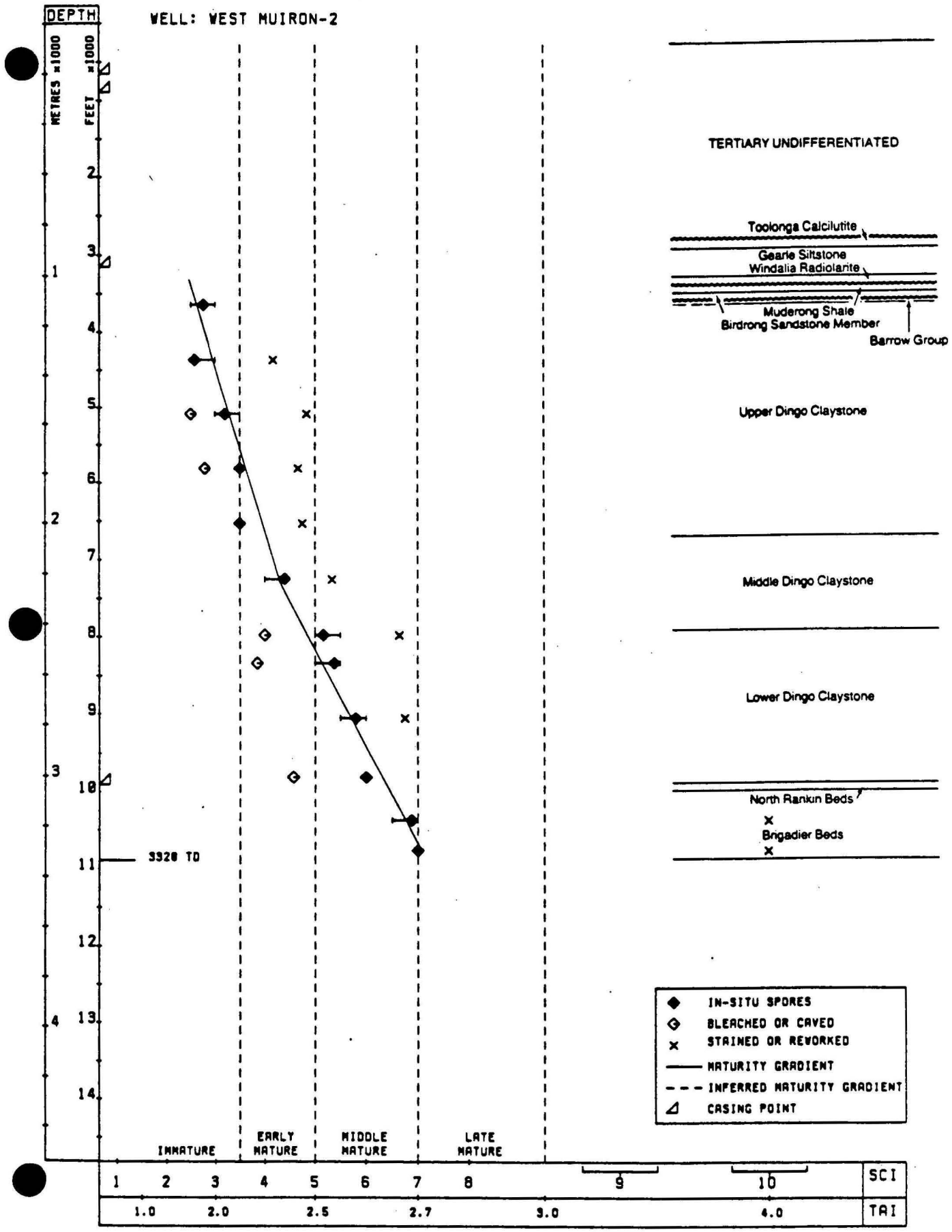



FIGURE 1 SPORE COLOUR INDEX AGAINST DEPTH

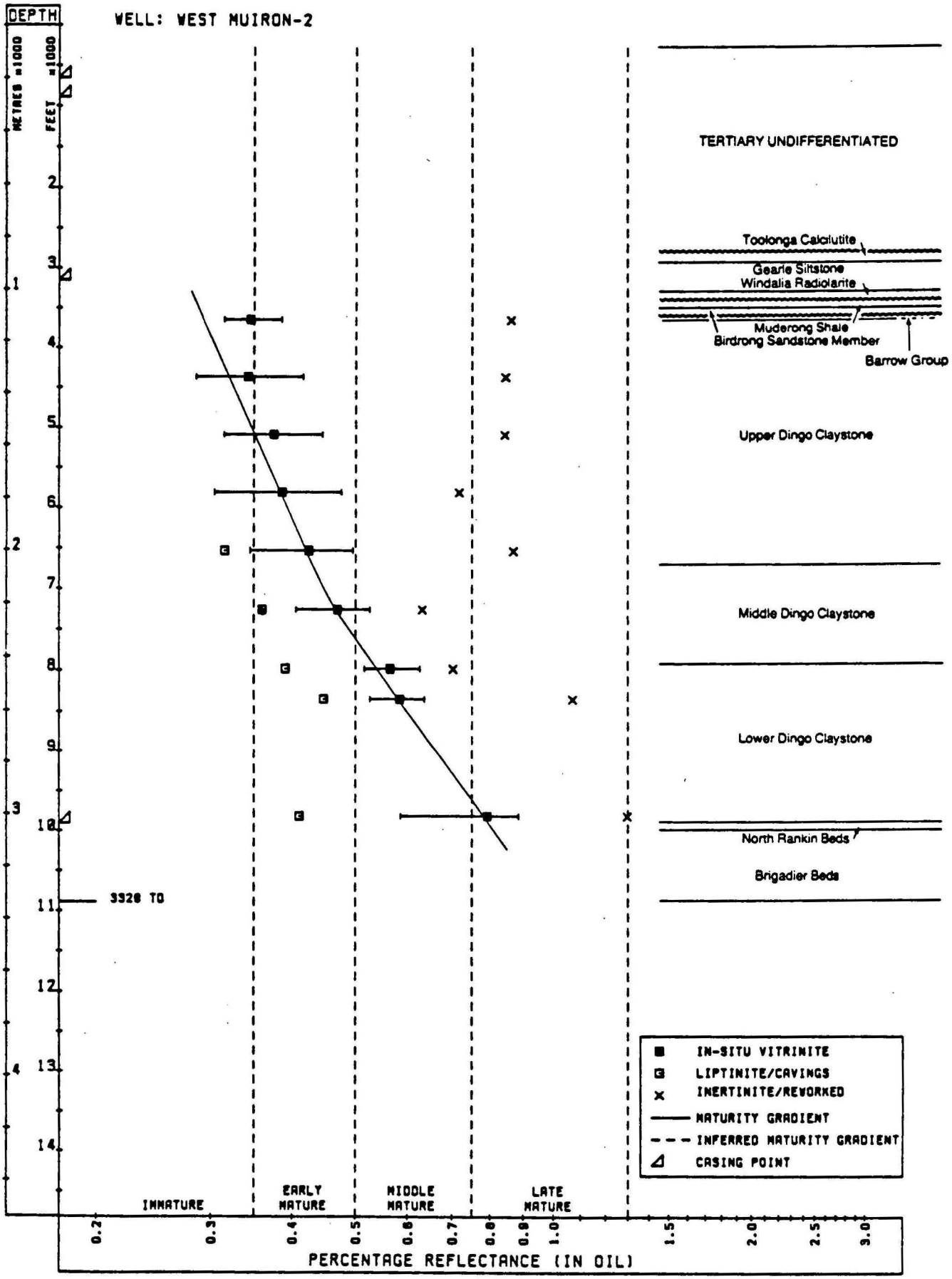
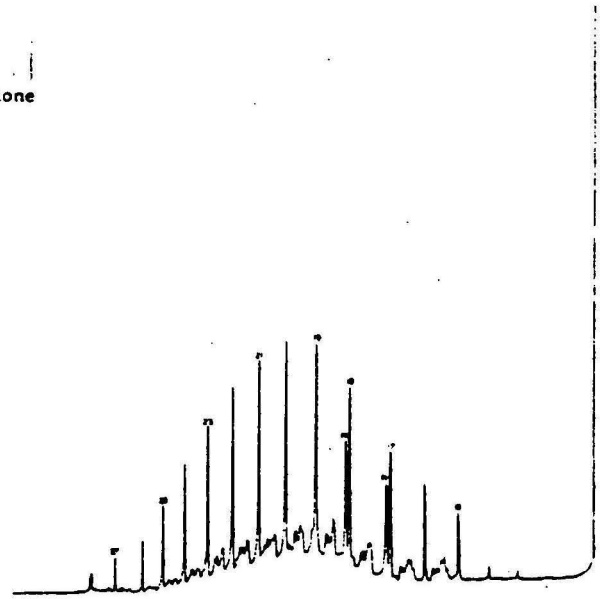
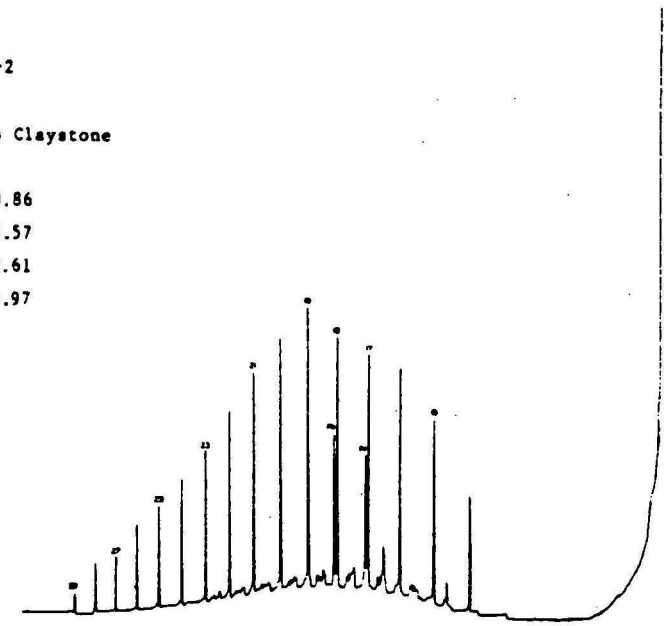



FIGURE 2 VITRINITE REFLECTANCE AGAINST DEPTH

West Muiron-2
1550-1560m
Upper Dingo Claystone
SCI 3.0-3.5
Pr/Ph = 0.80
Pr/n-$C_{17}$ = 0.74
Ph/n-$C_{18}$ = 0.68
CPI = 1.02



West Muiron-2
2210-2220m
Middle Dingo Claystone
SCI 4.0-4.5
Pr/Ph = 0.86
Pr/n-$C_{17}$ = 0.57
Ph/n-$C_{18}$ = 0.61
CPI = 0.97



West Muiron-2
2760-2770m
Lower Dingo Claystone
SCI 5.5-6.0
Pr/Ph = 1.07
Pr/n-$C_{17}$ = 0.44
Ph/n-$C_{18}$ = 0.42
CPI = 1.05

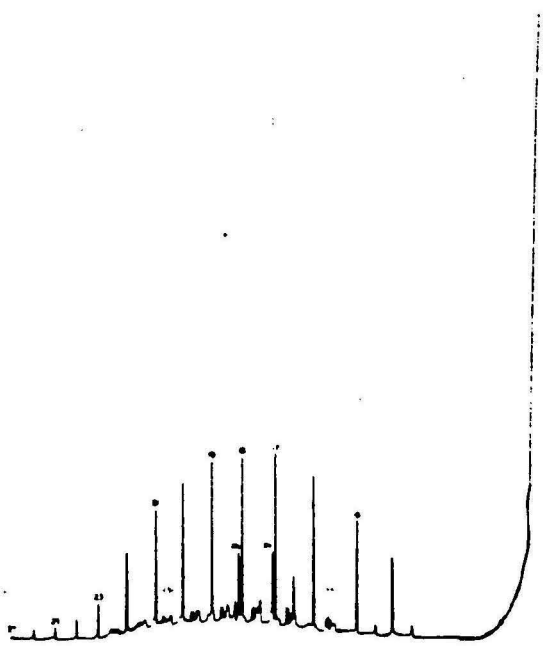


Figure 3a

West Muiron-2

3100-3110m

Brigadier Beds

SCI 6.75

Pr/Ph = 1.08

$Pr/n\text{-}C_{17}$ = 0.78

$Ph/n\text{-}C_{18}$ = 0.63

CPI = 0.99

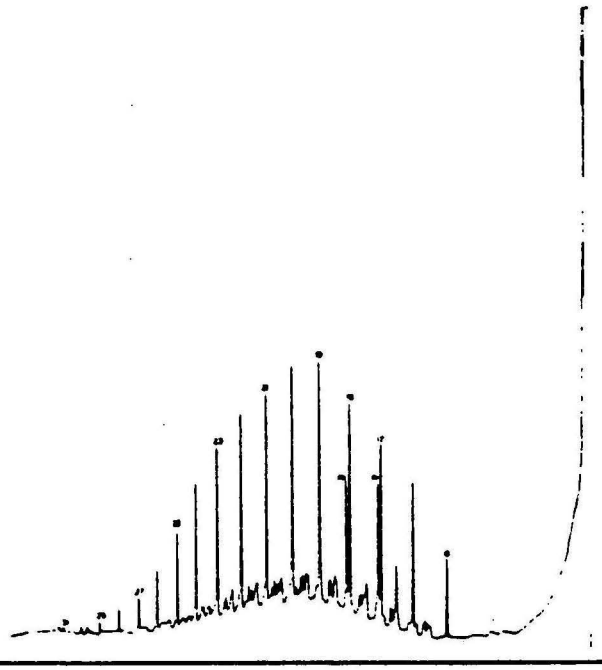


Figure 3b

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Appendix 1a

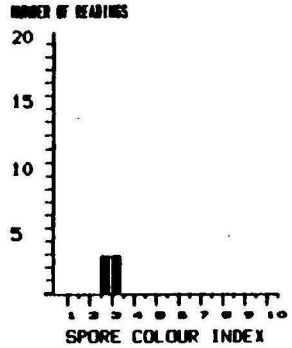
## WEST MUIRON-2

IN SITU POPULATION

SAMPLE 1110-1120M

2.5 2.5 2.5 3.0 3.0 3.0

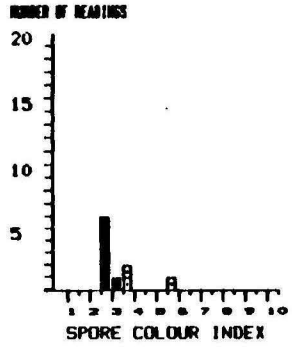
| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 2.5-3.0 | 6 |
| BLEACHED OR CAVED | - | 0 |
| STAINED OR REWORKED | - | 0 |




SAMPLE 1330-1340M

2.5 2.5 2.5 2.5 2.5 2.5 3.0 3.5 3.5 5.5

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 2.5-3.0 | 7 |
| BLEACHED OR CAVED | - | 0 |
| STAINED OR REWORKED | 3.5-5.5 | 3 |



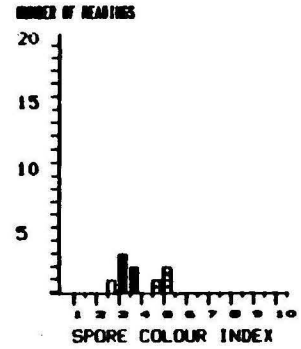

## WEST MUIRON-2

IN SITU POPULATION

SAMPLE 1550-1560M

2.5 3.0 3.0 3.0 3.5 3.5 4.5 5.0 5.0

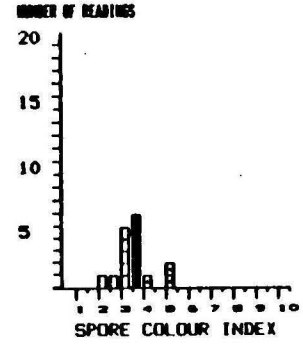
| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 3.0-3.5 | 5 |
| BLEACHED OR CAVED | 2.5-2.5 | 1 |
| STAINED OR REWORKED | 4.5-5.0 | 3 |




SAMPLE 1770-1780M

2.0 2.5 3.0 3.0 3.0 3.0 3.0 3.5 3.5 3.5
3.5 3.5 3.5 4.0 5.0 5.0

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 3.5-3.5 | 6 |
| BLEACHED OR CAVED | 2.0-3.0 | 7 |
| STAINED OR REWORKED | 4.0-5.0 | 3 |



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Appendix 1b

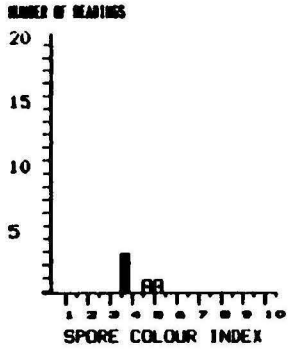
WEST MUIRON-2

IN SITU POPULATION

SAMPLE 1990-2000M

3.5 3.5 3.5 4.5 5.0

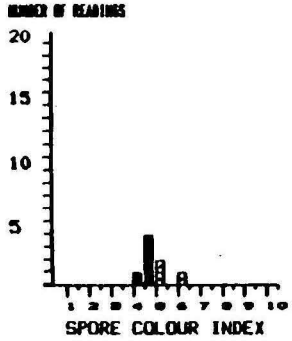
| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 3.5-3.5 | 3 |
| BLEACHED OR CAVED | - | 0 |
| STAINED OR REWORKED | 4.5-5.0 | 2 |




SAMPLE 2210-2220M

4.0 4.5 4.5 4.5 4.5 5.0 5.0 6.0

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 4.0-4.5 | 5 |
| BLEACHED OR CAVED | - | 0 |
| STAINED OR REWORKED | 5.0-6.0 | 3 |



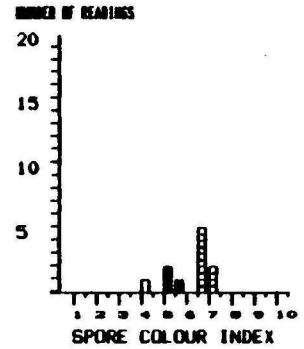

WEST MUIRON-2

IN SITU POPULATION

SAMPLE 2430-2440M

4.0 5.0 5.0 5.5 6.5 6.5 6.5 6.5 6.5 7.0
7.0

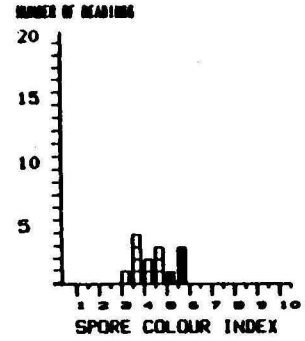
| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 5.0-5.5 | 3 |
| BLEACHED OR CAVED | 4.0-4.0 | 1 |
| STAINED OR REWORKED | 6.5-7.0 | 7 |




SAMPLE 2540-2550M

3.0 3.5 3.5 3.5 3.5 4.0 4.0 4.5 4.5 4.5
5.0 5.5 5.5 5.5

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 5.0-5.5 | 4 |
| BLEACHED OR CAVED | 3.0-4.5 | 10 |
| STAINED OR REWORKED | - | 0 |



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Appendix 1c

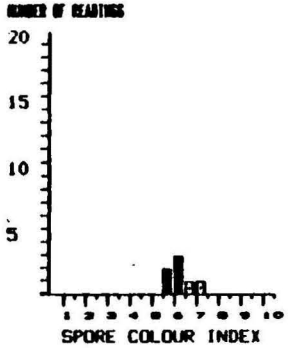
WEST MUIRON-2

IN SITU POPULATION

SAMPLE 2760-2770M

5.5 5.5 6.0 6.0 6.0 6.5 7.0

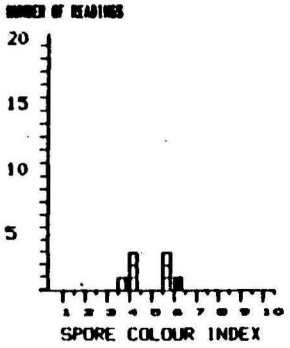
| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 5.5-6.0 | 5 |
| BLEACHED OR CAVED | - | 0 |
| STAINED OR REWORKED | 6.5-7.0 | 2 |




SAMPLE 2990-3000M

3.5 4.0 4.0 4.0 5.5 5.5 5.5 6.0

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 6.0-6.0 | 1 |
| BLEACHED OR CAVED | 3.5-5.5 | 7 |
| STAINED OR REWORKED | - | 0 |



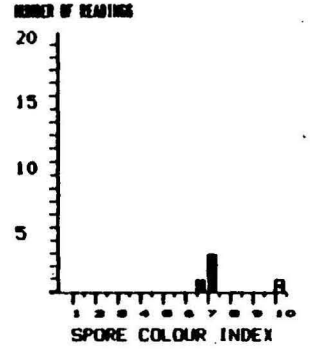

WEST MUIRON-2

IN SITU POPULATION

SAMPLE 3160-3170M

6.5 7.0 7.0 7.0 10.0

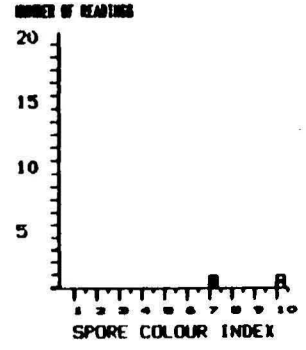
| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 6.5-7.0 | 4 |
| BLEACHED OR CAVED | - | 0 |
| STAINED OR REWORKED | 10.0-10.0 | 1 |




SAMPLE 3280-3290M

7.0 10.0

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 7.0-7.0 | 1 |
| BLEACHED OR CAVED | - | 0 |
| STAINED OR REWORKED | 10.0-10.0 | 1 |



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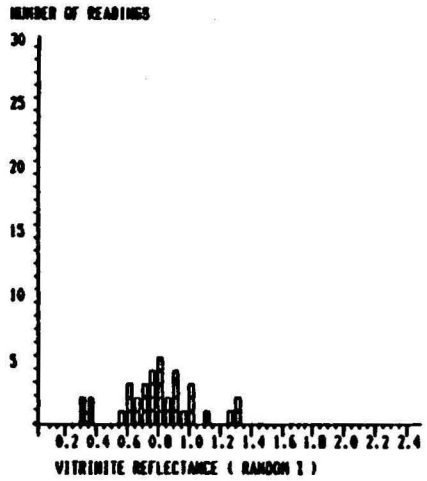
WEST MUIRON-2

SAMPLE 1110-1120M

0.32 0.33 0.35 0.38 0.56 0.62 0.64 0.64 0.66 0.68
0.70 0.73 0.74 0.75 0.75 0.75 0.79 0.80 0.82 0.83
0.84 0.84 0.87 0.88 0.90 0.91 0.91 0.92 0.97 1.02
1.02 1.03 1.11 1.27 1.32 1.33

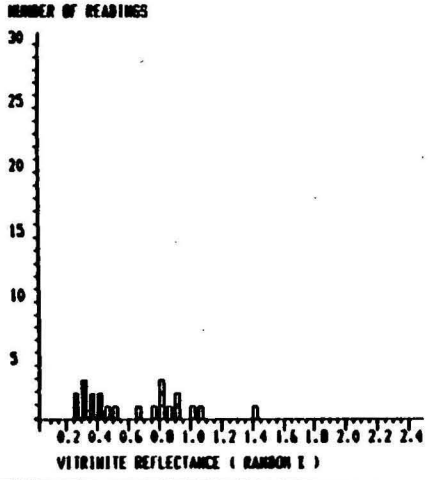
| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.32-0.38 | 4 | 0.35 | 0.03 |
| INERTINITE/REWORKED | 0.56-1.33 | 32 | 0.86 | 0.20 |




SAMPLE 1330-1340M

0.29 0.29 0.30 0.31 0.34 0.35 0.39 0.40 0.41 0.45
0.53 0.66 0.75 0.80 0.82 0.82 0.85 0.91 0.91 1.01
1.06 1.42

| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.29-0.41 | 9 | 0.34 | 0.05 |
| INERTINITE/REWORKED | 0.45-1.42 | 13 | 0.85 | 0.24 |

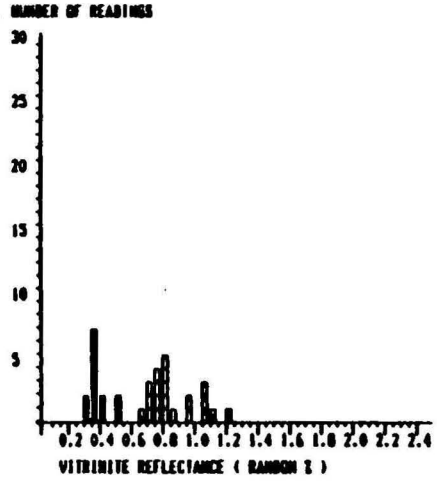



WEST MUIRON-2

SAMPLE 1550-1560M

0.32 0.33 0.35 0.36 0.37 0.37 0.38 0.38 0.38 0.44
0.44 0.53 0.53 0.66 0.71 0.72 0.74 0.75 0.75 0.76
0.77 0.82 0.82 0.83 0.83 0.84 0.88 0.96 0.97 1.05
1.05 1.09 1.11 1.21

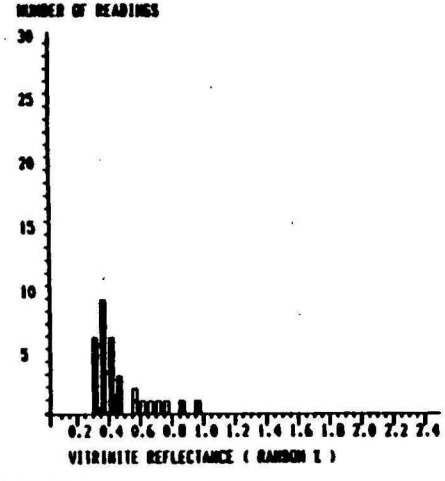
| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.32-0.44 | 11 | 0.37 | 0.04 |
| INERTINITE/REWORKED | 0.53-1.21 | 23 | 0.84 | 0.18 |




SAMPLE 1770-1780M

0.31 0.32 0.33 0.34 0.34 0.34 0.36 0.36 0.36 0.37
0.38 0.39 0.39 0.39 0.39 0.40 0.40 0.41 0.42 0.43
0.43 0.46 0.46 0.47 0.56 0.57 0.62 0.68 0.74 0.76
0.85 0.95

| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.31-0.47 | 24 | 0.39 | 0.04 |
| INERTINITE/REWORKED | 0.56-0.95 | 8 | 0.72 | 0.14 |




Appendix 2a

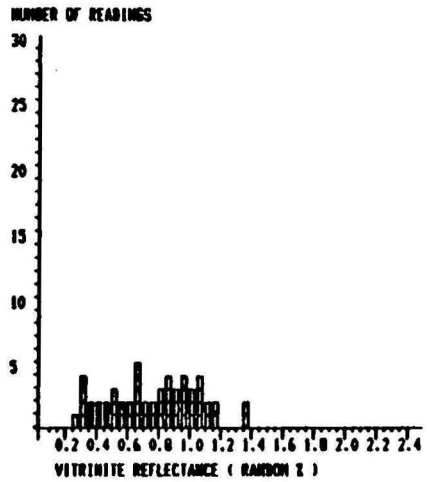
Robertson Research

WEST MUIRON-2

SAMPLE 1990-2000M

0.26 0.32 0.33 0.33 0.34 0.35 0.37 0.42 0.43 0.48
0.49 0.51 0.53 0.53 0.55 0.57 0.60 0.60 0.66 0.67
0.67 0.69 0.69 0.74 0.74 0.76 0.78 0.82 0.83 0.83
0.85 0.85 0.88 0.89 0.90 0.90 0.92 0.95 0.96 0.98
0.99 1.00 1.01 1.02 1.05 1.05 1.07 1.07 1.11 1.11
1.15 1.19 1.35 1.36

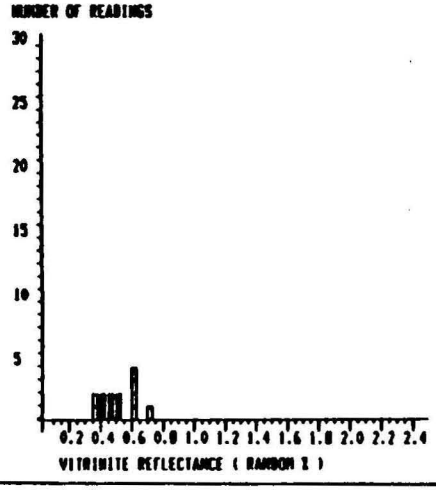
| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.35-0.49 | 6 | 0.42 | 0.06 |
| LIPTINITE/CAVINGS | 0.26-0.34 | 5 | 0.32 | 0.03 |
| INERTINITE/REWORKED | 0.51-1.36 | 43 | 0.87 | 0.22 |




SAMPLE 2210-2220M

0.35 0.37 0.41 0.41 0.47 0.49 0.51 0.52 0.60 0.60
0.60 0.63 0.72

| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.41-0.52 | 6 | 0.47 | 0.05 |
| LIPTINITE/CAVINGS | 0.35-0.37 | 2 | 0.36 | 0.01 |
| INERTINITE/REWORKED | 0.60-0.72 | 5 | 0.63 | 0.05 |

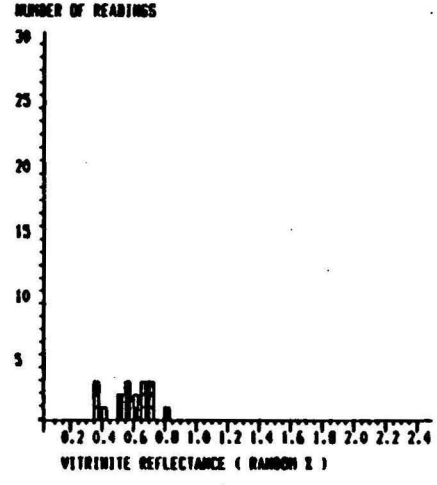



WEST MUIRON-2

SAMPLE 2430-2440M

0.36 0.39 0.39 0.42 0.52 0.53 0.56 0.57 0.58 0.62
0.64 0.65 0.66 0.69 0.71 0.73 0.73 0.80

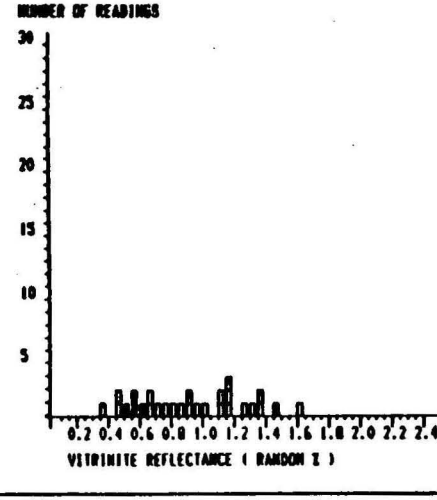
| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.52-0.62 | 6 | 0.56 | 0.04 |
| LIPTINITE/CAVINGS | 0.36-0.42 | 4 | 0.39 | 0.02 |
| INERTINITE/REWORKED | 0.64-0.80 | 8 | 0.70 | 0.05 |




SAMPLE 2540-2550M

0.39 0.46 0.49 0.53 0.58 0.59 0.63 0.65 0.66 0.73
0.76 0.81 0.85 0.93 0.94 0.95 1.01 1.10 1.11 1.15
1.17 1.18 1.26 1.30 1.37 1.38 1.49 1.64

| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.53-0.63 | 4 | 0.58 | 0.04 |
| LIPTINITE/CAVINGS | 0.39-0.49 | 3 | 0.45 | 0.05 |
| INERTINITE/REWORKED | 0.65-1.64 | 21 | 1.07 | 0.28 |




Appendix 2b

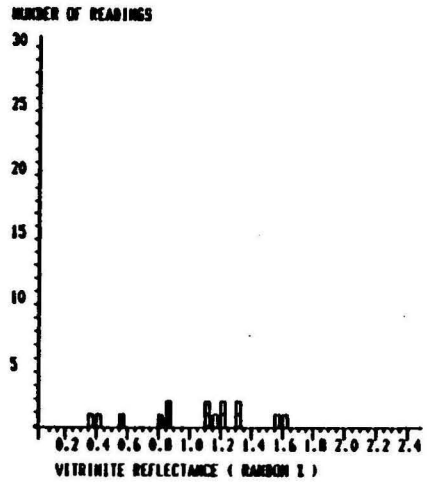
Robertson Research

WEST MUIRON-2

SAMPLE 2990-3000M

0.30 0.44 0.59 0.84 0.86 0.88 1.11 1.12 1.16 1.21
1.22 1.31 1.34 1.57 1.61

| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.59-0.88 | 4 | 0.79 | 0.14 |
| LIPTINITE/CAVINGS | 0.30-0.44 | 2 | 0.41 | 0.04 |
| INERTINITE/REWORKED | 1.11-1.61 | 9 | 1.29 | 0.18 |




Appendix 2c

# WEST TRYAL ROCKS-1 WELL

## SUMMARY

Geochemical analysis of samples from the interval 2957m to 3866m TD of the West Tryal Rocks-1 well has shown that the well section becomes middle mature at around 3000m and is middle mature below this depth to 3866m TD.

The maturity gradients indicate that around 200m of section has been removed from the unconformity at 3264m during Early Cretaceous to Late Triassic uplift and erosion. Extrapolation of the maturity gradients to the surface indicates that little Early Cretaceous and younger section is missing above 2988m and that the sediments analysed are presently at or near their maximum depths of burial.

Mudstones and coals in the intervals 3264m to 3613m and 3787m to 3845m of the Mungaroo Formation have good oil to very good and fair gas source potential. These sediments will have generated significant quantities of oil in reaching their present levels of maturity. The mudstone of the Muderong Shale may be a poor gas source.

## GENERAL COMMENTS

Basin: Northern Carnarvon Basin.

Location: 20° 13' 45.1"S, 115° 02' 04.3"E.

Operator and date of drilling: West Australian Petroleum Pty Ltd, 1973.

Well Status: Suspended gas discovery.

TD: 3866m.

Mud data: Seawater/Spersene/XP 20 system: 1646m to 3856m.

Casing data: 30" at 176m, 20" at 385m, $13^3/_8$" at 1645m, $9^5/_8$" at 3387m, 7" at 3857m.

BHT Data: 120°C at 3433m, after 35 hours stopped circulation.

Elevation: RT 12m ASL.

Water depth: 138m.

## WEST TRYAL ROCKS-1 WELL

Interval analysed: 2957m to 3866m TD.

Age of interval analysed:

| | Depths (in metres) |
|---|---|
| Early Cretaceous | 2957-3264 |
| Middle-Late Triassic | 3264-3866 TD |

Sample type and quality: Dried ditch cuttings of good quality for geochemical analysis.

Maturation data quality:

a) Vitrinite Reflectance: The samples analysed contained only small amounts of in situ vitrinite mixed with abundant reworked material. The coals analysed are inertinitic and gave anomalously high values. Data quality of Phase I results is unknown. Results: Poor.

b) Spore Colour Index: The samples analysed contained rare in situ sporomorphs. Phase I data quality is unknown. Results: Poor.

Source rock data quality: Phase II data is of good quality. Data quality of Phase I is unknown.

Gas chromatography run at: 3250m to 3262m, 3265m to 3277m, 3326m to 3338m, 3341m to 3354m, 3463m to 3476m, 3787m to 3799m, 3802m to 3814m, 3817m to 3829m and 3832m to 3845m.

### MATURATION (Table 1, Figures 1 and 2, Appendices 1 and 2)

Spore colour index values rise steadily from interpreted values of around 5.5 SCI units at 3264m to values of around 6 SCI units at 3866m TD. Vitrinite reflectance values rise steadily from 0.5% at 2988m to 0.55% at 3264m. The unconformity between the Early Cretaceous and Middle to Late Triassic sediments at 3264m is marked by a discontinuity in the interpreted vitrinite reflectance gradient, which is consistent with uplift and erosion of around 200m of Early Cretaceous to Late Triassic sediments. Below the unconformity values increase steadily from 0.6% at 3264m to around 0.7% at 3867m.

Extrapolation of the maturity gradients to seabed suggests that little Early Cretaceous and younger section is missing above 2988m and that the sediments analysed are currently at or near their maximum depths of burial.

The results show that the well section becomes middle mature at around 3000m and is middle mature below this depth to 3866m TD.

OIL AND GAS SOURCE ROCKS (Tables 1 and 2, Figure 3)

Dark grey mudstones and thin argillaceous coals in the interval 3264m to 3613m and black carbonaceous mudstones in the interval 3787m to 3845m of the Mungaroo Formation are organically rich. (TOC between 1.88% and 21.38% for mudstones and around 31% in the argillaceous coals). Pyrolysis analysis of the dark grey mudstones shows that they contain between 10% and 25% oil-prone kerogen. Analysis of the argillaceous coals and black mudstones in the interval 3787m to 3845m shows that these lithologies contain between 15% and 35% waxy kerogen. Visual analysis of polished blocks of the coals shows that they contain abundant sporinite and cutinite.

Extraction, fractionation and gas chromatography analysis shows that the samples contain indigenous hydrocarbons derived from mature terrestrially sourced waxy kerogens. Samples at 3250m to 3262m, 3265m to 3277m, 3326m to 3338m and 3832m to 3845m contain large quantities of migrant heteroatomic compounds. These may be derived from drilling additives.

The organically rich mudstones and coals in the intervals 3264m to 3613m and 3787m to 3845m have very good oil source potential and fair gas source potential. These sediments will have generated significant quantities of oil in reaching their present level of maturity but are not mature enough to have generated significant quantities of gas.

GEOCHEMICAL CHARACTERISTICS OF THE REMAINING SEDIMENTS (Tables 1 and 2, Figure 3)

The remaining mudstones analysed in the Muderong Shale between 2957m and 3264m contain average to above average organic carbon contents of between 1.80% and 3.25%. Pyrolysis analysis of samples from this interval shows that they contain mostly humic kerogens. These sediments have no significant oil source potential but may be a poor gas source.

WELL: WEST TRYAL ROCKS-1

| SAMPLE DEPTH (METRES) | SAMPLE TYPE | GENERALISED LITHOLOGY | SPORE COLOUR INDEX (1-10) | VITRINITE REFLECTIVITY (R oil av %) | KEROGEN COMPOSITION (% vol.) (by microscopic examination) | | | KEROGEN COMPOSITION (% wt.) (by calculation from pyrolysis data) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | INERTINITE | VITRINITE | SAPROPEL | INERTINITE | VITRINITE | ALGAL SAPROPEL | WAXY SAPROPEL |
| 2627.4 | | **Muderong Shale** | | | | | | | | | |
| 2988-3003 | Ctg | MDST, med dk gy | 4.0-4.5cvd | 0.50(4) | 30 | 60 | 10 | | | | |
| 3079-3095 | " | MDST, a/a | 4.5cvd | 0.52(4) | 50 | 45 | 5 | | | | |
| 3110-3125 | P | MDST, a/a | | | | | | 55 | 45 | * | * |
| 3201-3216 | Ctg | MDST, a/a, slty | 4.5cvd | * | 50 | 45 | 5 | | | | |
| 3232-3247 | P | COAL | | 0.61(12) | | | | | | | |
| | P | MDST, a/a | | | | | | 50 | 50 | * | * |
| 3247-3262 | P | COAL | | 0.56(1)cvd | | | | | | | |
| 3250-3262 | Ctg | MDST, dk gy | 5.5 | 0.62(4) | 40 | 60 | mnr | 40 | 40 | * | 20 |
| 3264.1 | | **Mungaroo Fm** | | | | | | | | | |
| 3262-3277 | " | MDST, med dk gy, slty + tr COAL | 5.5 | | 60 | 25 | 15 | | | | |
| 3265-3277 | P | MDST, dk gy | | | | | | 30 | 60 | * | 10 |
| 3280-3293 | P | MDST, dk gy | | | | | | 30 | 55 | * | 15 |
| 3296-3308 | P | MDST, dk gy | | | | | | 40 | 45 | 5 | 10 |
| 3311-3323 | P | MDST, a/a, occ coaly | | | | | | 45 | 40 | * | 15 |
| 3326-3338 | P | MDST, med dk gy | | | | | | 30 | 50 | * | 20 |
| | P | MDST, dk gy, carb | | | | | | 25 | 50 | 5 | 20 |
| 3341-3354 | Ctg | MDST, a/a + mnr SST, wht | | | | | | 40 | 45 | 5 | 10 |
| 3354-3369 | " | MDST, med dk gy + 20% SST, v lt gy + tr COAL | 5.5 | 0.62(14) | 60 | 30 | 10 | | | | |
| 3372-3384 | " | MDST, dk gy, carb + 10% MDST, lt gy gn + mnr SST, wht | 3.5-4.5cvd | 0.77(12)rew | 25 | 60 | 15 | | | | |
| | P | MDST, dk gy, carb | | | | | | 40 | 45 | 5 | 10 |
| | P | MDST, lt gy gn | | | | | | 40 | 55 | * | 5 |
| 3384-3399 | P | MDST, dk gy | | | | | | 50 | 35 | * | 15 |
| | P | MDST, gy gn | | | | | | 70 | 30 | * | * |
| 3402-3415 | P | MDST, dk gy | | | | | | 45 | 35 | 5 | 15 |
| 3415-3430 | P | MDST, med dk gy | | | | | | 70 | 20 | * | 10 |
| 3445-3460 | Ctg | MDST, a/a + 50% SST, v lt gy + tr COAL | 5.5 | | 70 | 20 | 10 | | | | |
| | P | MDST, a/a | | | | | | 30 | 45 | 5 | 20 |
| 3460-3476 | P | COAL | | 0.63(4) | | | | | | | |
| 3463-3476 | P | COAL, blk | | 0.91(36)rew | | | | 45 | 20 | * | 35 |
| 3555-3567 | P | MDST, dk gy-gy blk, carb | | | | | | 50 | 30 | * | 20 |
| 3567-3582 | P | COAL | | 0.60(1)cvd | | | | | | | |

Table 1a Maturity and Kerogen Composition Data

WELL: WEST TRYAL ROCKS-1

| SAMPLE DEPTH (METRES) | SAMPLE TYPE | GENERALISED LITHOLOGY | SPORE COLOUR INDEX (1-10) | VITRINITE REFLECTIVITY (R oil av %) | KEROGEN COMPOSITION (% vol) (by microscopic examination) | | | KEROGEN COMPOSITION (% wt) (by calculation from pyrolysis data) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | INERTINITE | VITRINITE | SAPROPEL | INERTINITE | VITRINITE | ALGAL SAPROPEL | WAXY SAPROPEL |
| 3585-3598 | P | MDST, lt med gy | | | | | | 50 | 45 | * | 5 |
| | P | MDST, dk gy | | | | | | 45 | 40 | 5 | 10 |
| 3598-3613 | Ctg | MDST, med dk gy, slty + 40% SST, v lt gy + tr COAL | 5.5-6.0 | | 70 | 25 | 5 | | | | |
| 3601-3613 | " | MDST, med gy + 30% MDST, dk gy, carb + 20% SST, wht | 5.0-6.0 | 0.69(21) | 30 | 60 | 10 | | | | |
| | P | MDST, dk gy, carb | | | | | | 40 | 45 | 5 | 10 |
| 3613-3628 | P | MDST, med dk gy, slty | | | | | | 50 | 50 | * | * |
| 3674-3689 | P | COAL | | 0.70(11) | | | | | | | |
| | P | MDST, med dk gy, slty | | | | | | 70 | 30 | * | * |
| 3704-3720 | Ctg | SST, yel gy + 30% MDST, med dk gy, slty + tr COAL | 6.0 | | 60 | 30 | 10 | | | | |
| 3720-3735 | P | MDST, a/a | | | | | | 70 | 30 | * | * |
| 3765-3780 | P | COAL | | 0.66(1)cvd | | | | | | | |
| 3787-3799 | P | COAL | | 1.05(40)rew | | | | | | | |
| | P | MDST, dk gy | | | | | | 40 | 50 | * | 10 |
| | P | MDST, blk, v carb | | | | | | 50 | 20 | * | 30 |
| 3796-3811 | P | MDST, med dk gy, slty | | | | | | 65 | 35 | * | * |
| 3802-3814 | P | MDST, med-med dk gy | | | | | | 60 | 35 | * | 5 |
| | P | MDST, dk gy | | | | | | 50 | 40 | * | 10 |
| | P | MDST, blk, v carb | | | | | | 45 | 25 | * | 30 |
| 3817-3829 | Ctg | MDST, med-med dk gy + 40% MDST, dk-gy-gy blk, carb + 10% MDST, blk, v carb + mnr SST, wht -lt gy | 6.0 | 0.71(11) | 30 | 70 | mnr | | | | |
| | P | MDST, dk gy-gy blk, carb | | | | | | 40 | 45 | 5 | 10 |
| | P | MDST, blk, v calc | | | | | | 45 | 20 | * | 35 |
| 3826-3841 | Ctg | MDST, med dk gy, slty + 20% SST, yel gy + tr COAL | 6.0-6.5 | | 50 | 25 | 25 | | | | |
| 3832-3845 | P | MDST, dk gy | | | | | | 40 | 50 | * | 10 |
| | P | MDST, blk, carb | | | | | | | | | |
| | P | After extraction | | | | | | 60 | 25 | * | 15 |
| 3857-3866 | P | COAL | | 0.74(12) | | | | | | | |
| | P | MDST, med dk gy, slty | | | | | | 45 | 55 | * | * |

Table 1b Maturity and Kerogen Composition Data

WELL: WEST TRYAL ROCKS-1

| GENERAL DATA | | | CHEMICAL ANALYSIS DATA | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PYROLYSIS | | | | | SOLVENT EXTRACTION | | | | | | |
| | | | | | | | | | | | | | EXTRACT COMPOSITION (%) | | |
| SAMPLE DEPTH (METRES) | SAMPLE TYPE | ANALYSED LITHOLOGY | ORGANIC CARBON % OF ROCK | TEMPERATURE C | HYDROGEN INDEX | OXYGEN INDEX | PRODUCTION INDEX | POTENTIAL YIELD (kg Tonne) | TOTAL EXTRACT (ppm) | TOTAL EXTRACT (mg g T O C) | HYDROCARBONS (ppm) | HYDROCARBONS (mg g T O C) | SATURATED HYDROCARBONS | AROMATIC HYDROCARBONS | POLAR COMPOUNDS |
| **2627.4** | | **Muderong Shale** | | | | | | | | | | | | | |
| 2957-2973 | Ctg | MDST, med-dk gy, sl slty + mnr LST, lt ol-gy | 2.56 | | | | | | | | | | | | |
| 2988-3003 | " | MDST, a/a + mnr LST, a/a | 3.25 | | | | | | | | | | | | |
| 3018-3034 | " | MDST, a/a + mnr LST, a/a | 2.38 | | | | | | | | | | | | |
| 3049-3064 | " | MDST, a/a + mnr LST, a/a | 2.29 | | | | | | | | | | | | |
| 3079-3095 | " | MDST, a/a + mnr LST, a/a | 2.22 | | | | | | | | | | | | |
| 3110-3125 | " | MDST, a/a + mnr LST, a/a | - | | | | | | | | | | | | |
| | P | MDST, a/a | 2.17 | 430 | 78 | 74 | 0.00 | 1.70 | | | | | | | |
| | " | LST, a/a | 0.54 | | | | | | | | | | | | |
| 3140-3155 | Ctg | MDST, a/a + mnr LST, a/a | 1.80 | | | | | | | | | | | | |
| 3171-3186 | " | MDST, a/a + mnr LST, a/a | 1.95 | | | | | | | | | | | | |
| 3201-3216 | " | MDST, med-dk gy, slty + mnr SST, v lt gy, glauc + tr COAL | 2.07 | | | | | | | | | | | | |
| 3232-3247 | " | MDST, med-dk gy, slty, mnr SST, v lt gy, glauc + tr COAL | - | | | | | | | | | | | | |
| | P | MDST, a/a | 2.27 | 436 | 88 | 110 | 0.00 | 2.00 | | | | | | | |
| 3250-3262 | Ctg | MDST, dk gy | 2.31 | 439 | 200 | 47 | 0.07 | 4.94 | 2515 | 109 | 1105 | 48 | 36 | 8 | 56 |
| **3264.1** | | **Mungaroo Fm** | | | | | | | | | | | | | |
| 3265-3277 | " | MDST, a/a + 10% SST, wht | 1.94 | | | | | | 4955 | 255 | 940 | 48 | 17 | 2 | 81 |
| | P | MDST, dk gy | 2.17 | 437 | 172 | 29 | 0.05 | 3.94 | | | | | | | |
| 3280-3293 | Ctg | MDST, dk gy | 1.88 | 437 | 199 | 44 | 0.06 | 3.98 | | | | | | | |
| 3296-3308 | " | MDST, dk gy + 10% SST, wht | - | | | | | | | | | | | | |
| | P | MDST, a/a | 2.31 | 434 | 158 | 30 | 0.05 | 3.85 | | | | | | | |
| 3311-3323 | Ctg | MDST, dk gy, occ coaly + 10% SST, wht | - | | | | | | | | | | | | |
| | P | MDST, dk gy, occ coaly | 2.20 | 437 | 164 | 38 | 0.06 | 3.83 | | | | | | | |
| 3326-3338 | Ctg | MDST, med-dk gy + 40% MDST, dk gy, carb + 30% SST, wht | 1.33 | | | | | | 1780 | 134 | 1130 | 85 | 59 | 5 | 36 |
| | P | MDST, med-dk gy | 1.97 | 438 | 202 | 45 | 0.11 | 4.46 | | | | | | | |
| | " | MDST, dk gy, carb | 2.39 | 436 | 225 | 44 | 0.10 | 5.99 | | | | | | | |
| 3341-3354 | Ctg | MDST, dk gy, carb + mnr SST, wht | 2.19 | 434 | 172 | 39 | 0.06 | 3.98 | 1780 | 81 | 715 | 33 | 36 | 4 | 60 |
| 3354-3369 | " | MDST, med dk gy + 20% SST, v lt gy, glauc + tr COAL | 1.79 | | | | | | | | | | | | |
| 3372-3384 | " | MDST, dk gy, carb + 10% MDST, lt gy gn + mnr SST, wht | - | | | | | | | | | | | | |
| | P | MDST, dk gy, carb | 2.26 | 434 | 176 | 40 | 0.05 | 4.17 | | | | | | | |
| | " | MDST, lt gy gn | 1.10 | 435 | 133 | 60 | 0.08 | 1.58 | | | | | | | |

Table 2a Chemical Analysis Data

WELL: WEST TRYAL ROCKS-1

| GENERAL DATA | | | CHEMICAL ANALYSIS DATA | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PYROLYSIS | | | | | SOLVENT EXTRACTION | | | | | | |
| | | | | | | | | | | | | | EXTRACT COMPOSITION (%) | | |
| SAMPLE DEPTH (METRES) | SAMPLE TYPE | ANALYSED LITHOLOGY | ORGANIC CARBON %, OF ROCK | TEMPERATURE C | HYDROGEN INDEX | OXYGEN INDEX | PRODUCTION INDEX | POTENTIAL YIELD (kg Tonne) | TOTAL EXTRACT (ppm) | TOTAL EXTRACT (mg g T O C) | HYDROCARBONS (ppm) | HYDROCARBONS (mg/g T O C) | SATURATED HYDROCARBONS | AROMATIC HYDROCARBONS | POLAR COMPOUNDS |
| 3384-3399 | Ctg | MDST, dk gy + 20% MDST, gy gn | - | | | | | | | | | | | | |
| | P | MDST, dk gy | 2.18 | 436 | 157 | 45 | 0.07 | 3.66 | | | | | | | |
| | " | MDST, gy-gn | 1.28 | 428 | 57 | 86 | 0.13 | 0.84 | | | | | | | |
| 3402-3415 | Ctg | MDST, dk gy + 20% SST, wht | - | | | | | | | | | | | | |
| | P | MDST, dk gy | 2.30 | 435 | 183 | 40 | 0.09 | 4.60 | | | | | | | |
| 3415-3430 | Ctg | MDST, med-dk gy, sl slty + 30% SST, v lt gy, glauc | - | | | | | | | | | | | | |
| | P | MDST, a/a | 2.44 | 441 | 94 | 45 | 0.10 | 2.56 | | | | | | | |
| | " | SST, a/a | 0.26 | | | | | | | | | | | | |
| 3430-3445 | Ctg | MDST, a/a + 30% SST, a/a + tr COAL | 2.55 | | | | | | | | | | | | |
| 3445-3460 | " | MDST, a/a + 50% SST, a/a + tr COAL | - | | | | | | | | | | | | |
| | " | MDST, a/a | 2.35 | 426 | 213 | 32 | 0.10 | 5.56 | | | | | | | |
| 3463-3476 | " | COAL, blk + 40% SST, lt-med gy, arg | 3.26 | | | | | | 1940 | 60 | 1305 | 40 | 48 | 19 | 33 |
| | P | COAL, blk | 31.05 | 440 | 251 | 10 | 0.04 | 81.40 | | | | | | | |
| 3476-3491 | Ctg | SST, yel-gy/ol-gy, oil stained + mnr MDST, med -dk gy + mnr COAL | - | | | | | | | | | | | | |
| 3491-3506 | " | SST, a/a + mnr MDST, a/a | - | | | | | | | | | | | | |
| 3506-3521 | " | SST, a/a + mnr MDST, a/a | - | | | | | | | | | | | | |
| 3521-3537 | " | SST, a/a + mnr MDST, a/a | - | | | | | | | | | | | | |
| 3537-3552 | " | SST, a/a + mnr MDST, a/a | 0.31 | | | | | | | | | | | | |
| 3555-3567 | " | MDST, med gy, slty + 20% MDST, dk gy-gy blk carb + 30% SST, lt-med gy | - | | | | | | | | | | | | |
| | P | MDST, med gy, slty | 0.78 | | | | | | | | | | | | |
| | " | MDST, dk gy-gy blk, carb | 2.60 | 446 | 149 | 20 | 0.11 | 4.34 | | | | | | | |
| 3567-3582 | Ctg | SST, yel-gy/ol-gy, oil stained + 40% MDST, med -dk gy, slty + tr COAL | 1.49 | | | | | | | | | | | | |
| 3582-3598 | " | SST, lt-med gy + 20% MDST, lt-med gy + 30% MDST, dk gy | - | | | | | | | | | | | | |
| | P | MDST, lt-med gy | 1.07 | 439 | 112 | 44 | 0.26 | 1.61 | | | | | | | |
| | " | MDST, dk gy | 2.93 | 436 | 166 | 26 | 0.13 | 5.58 | | | | | | | |
| 3601-3613 | Ctg | MDST, med gy + 30% MDST, dk gy, carb + 20% SST, wht | - | | | | | | | | | | | | |
| | P | MDST, med gy | 0.66 | | | | | | | | | | | | |
| | " | MDST, dk gy, carb | 5.60 | 438 | 153 | 19 | 0.09 | 9.43 | | | | | | | |

Table 2b Chemical Analysis Data

WELL: WEST TRYAL ROCKS-1

| GENERAL DATA | | | CHEMICAL ANALYSIS DATA | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PYROLYSIS | | | | | SOLVENT EXTRACTION | | | | | | |
| | | | | | | | | | | | | | EXTRACT COMPOSITION (%) | | |
| SAMPLE DEPTH (METRES) | SAMPLE TYPE | ANALYSED LITHOLOGY | ORGANIC CARBON % OF ROCK | TEMPERATURE °C | HYDROGEN INDEX | OXYGEN INDEX | PRODUCTION INDEX | POTENTIAL YIELD (kg/Tonne) | TOTAL EXTRACT (ppm) | TOTAL EXTRACT (mg/g TOC) | HYDROCARBONS (ppm) | HYDROCARBONS (mg/g TOC) | SATURATED HYDROCARBONS | AROMATIC HYDROCARBONS | POLAR COMPOUNDS |
| 3613-3628 | Ctg | MDST, med-dk gy, slty + 40% SST, yel-gy/ol-gy, oil stained + tr COAL | - | | | | | | | | | | | | |
| | P | MDST, med-dk gy, slty | 1.77 | 436 | 73 | 40 | 0.40 | 2.17 | | | | | | | |
| | " | SST, dk gy | 0.28 | | | | | | | | | | | | |
| 3628-3643 | Ctg | MDST, med-dk gy, slty + 50% SST, yel-gy/ol-gy, oil stained + tr COAL | 0.77 | | | | | | | | | | | | |
| 3643-3659 | " | MDST, a/a + 50% SST, a/a + mnr COAL | 1.28 | | | | | | | | | | | | |
| 3659-3674 | " | SST, a/a + 30% MDST, a/a + tr COAL | 0.64 | | | | | | | | | | | | |
| 3674-3689 | " | SST, a/a + 30% MDST, a/a + tr COAL | - | | | | | | | | | | | | |
| | P | SST, a/a | 0.11 | | | | | | | | | | | | |
| | " | MDST, a/a | 2.26 | 437 | 71 | 40 | 0.50 | 3.20 | | | | | | | |
| 3689-3704 | Ctg | SST, a/a + 40% MDST, a/a + tr COAL | 0.80 | | | | | | | | | | | | |
| 3704-3720 | " | SST, a/a + MDST, a/a + tr COAL | 0.97 | | | | | | | | | | | | |
| 3720-3735 | " | SST, a/a + 30% MDST, a/a + tr COAL | - | | | | | | | | | | | | |
| | P | MDST, a/a | 2.11 | 442 | 62 | 53 | 0.50 | 2.60 | | | | | | | |
| 3735-3750 | Ctg | SST, lt ol-gy + 10% MDST, slty, a/a + tr COAL | - | | | | | | | | | | | | |
| 3750-3765 | " | SST, a/a + 10% MDST, a/a | - | | | | | | | | | | | | |
| 3765-3780 | Ctg | SST, lt ol gy + 10% MDST, med-dk gy, slty | - | | | | | | | | | | | | |
| 3787-3799 | " | SST, wht-lt gy + 30% MDST, med gy + 20% MDST, dk gy + 10% COAL, blk | 4.16 | | | | | | 2040 | 49 | 1460 | 35 | 53 | 19 | 28 |
| | P | MDST, med gy | 0.88 | | | | | | | | | | | | |
| | " | MDST, dk gy | 2.41 | 442 | 141 | 17 | 0.18 | 4.15 | | | | | | | |
| | " | COAL, blk | 21.38 | 449 | 186 | 7 | 0.07 | 42.75 | | | | | | | |
| 3796-3811 | Ctg | MDST, med-dk gy, slty + 20% SST, lt ol gy + tr COAL | - | | | | | | | | | | | | |
| | P | MDST, a/a | 2.64 | 445 | 64 | 45 | 0.20 | 2.13 | | | | | | | |
| 3802-3814 | Ctg | MDST, med-med dk gy + 30% MDST, dk gy + 30% SST, wht-lt gy + 10% MDST, blk, v carb | 2.96 | | | | | | 1120 | 38 | 460 | 16 | 29 | 12 | 59 |
| | P | MDST, med-med dk gy | 1.11 | 449 | 80 | 21 | 0.16 | 1.06 | | | | | | | |
| | " | MDST, dk gy | 1.79 | 442 | 107 | 13 | 0.15 | 2.25 | | | | | | | |
| | " | MDST, blk, v carb | 12.73 | 442 | 206 | 8 | 0.05 | 27.55 | | | | | | | |

Table 2c Chemical Analysis Data

WELL: WEST TRYAL ROCKS-1

| GENERAL DATA | | | CHEMICAL ANALYSIS DATA | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PYROLYSIS | | | | | SOLVENT EXTRACTION | | | | | | |
| | | | | | | | | | | | | | EXTRACT COMPOSITION (%) | | |
| SAMPLE DEPTH (METRES) | SAMPLE TYPE | ANALYSED LITHOLOGY | ORGANIC CARBON % OF ROCK | TEMPERATURE C | HYDROGEN INDEX | OXYGEN INDEX | PRODUCTION INDEX | POTENTIAL YIELD (kg Tonne) | TOTAL EXTRACT (ppm) | TOTAL EXTRACT (mg g T O C) | HYDROCARBONS (ppm) | HYDROCARBONS (mg g T O C) | SATURATED HYDROCARBONS | AROMATIC HYDROCARBONS | POLAR COMPOUNDS |
| 3817-3829 | Ctg | MDST, med-med dk gy + 40% MDST, dk gy-gy blk, carb + 10% MDST, blk, v carb + mnr SST, a/a | 2.93 | | | | | | 910 | 31 | 450 | 15 | 37 | 12 | 51 |
| | P | MDST, med-med dk gy | 0.67 | | | | | | | | | | | | |
| | " | MDST, dk gy-gy-blk, carb | 1.75 | 442 | 137 | 13 | 0.11 | 2.70 | | | | | | | |
| | " | MDST, blk, v carb | 15.50 | 441 | 234 | 7 | 0.05 | 38.00 | | | | | | | |
| 3832-3845 | Ctg | MDST, med gy + 20% MDST, dk gy + mnr MDST, blk, v carb + mnr SST, wht | - | | | | | | | | | | | | |
| | P | MDST, med gy | 0.72 | | | | | | | | | | | | |
| | " | MDST, dk gy | 1.78 | 445 | 117 | 17 | 0.12 | 2.37 | | | | | | | |
| | " | MDST, blk, v carb | 21.43 | 452 | 139 | 9 | 0.04 | 31.10 | 22410 | 105 | 1950 | 9 | 6 | 3 | 91 |
| | " | After extraction | 19.23 | 452 | 105 | 9 | 0.01 | 20.40 | | | | | | | |
| 3841-3857 | Ctg | MDST, med-dk gy, slty + 20% SST, lt ol-gy + tr COAL | 2.43 | | | | | | | | | | | | |
| 3857-3866 | " | MDST, a/a + 30% SST, a/a + tr | - | | | | | | | | | | | | |
| | P | MDST, a/a | 2.42 | 440 | 87 | 27 | 0.30 | 3.00 | | | | | | | |
| | " | SST, a/a | 0.05 | | | | | | | | | | | | |

Table 2d Chemical Analysis Data

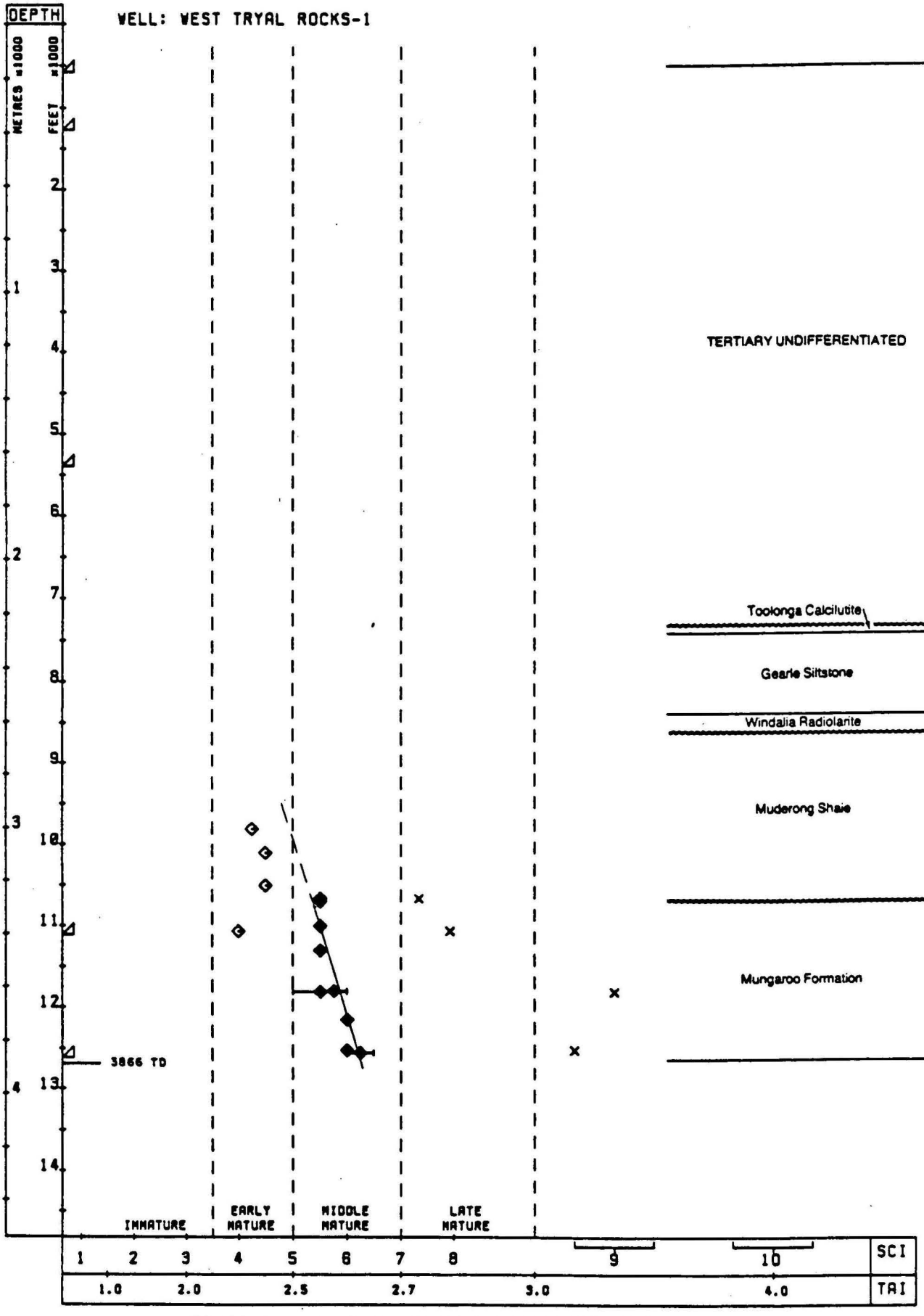



FIGURE 1 SPORE COLOUR INDEX AGAINST DEPTH

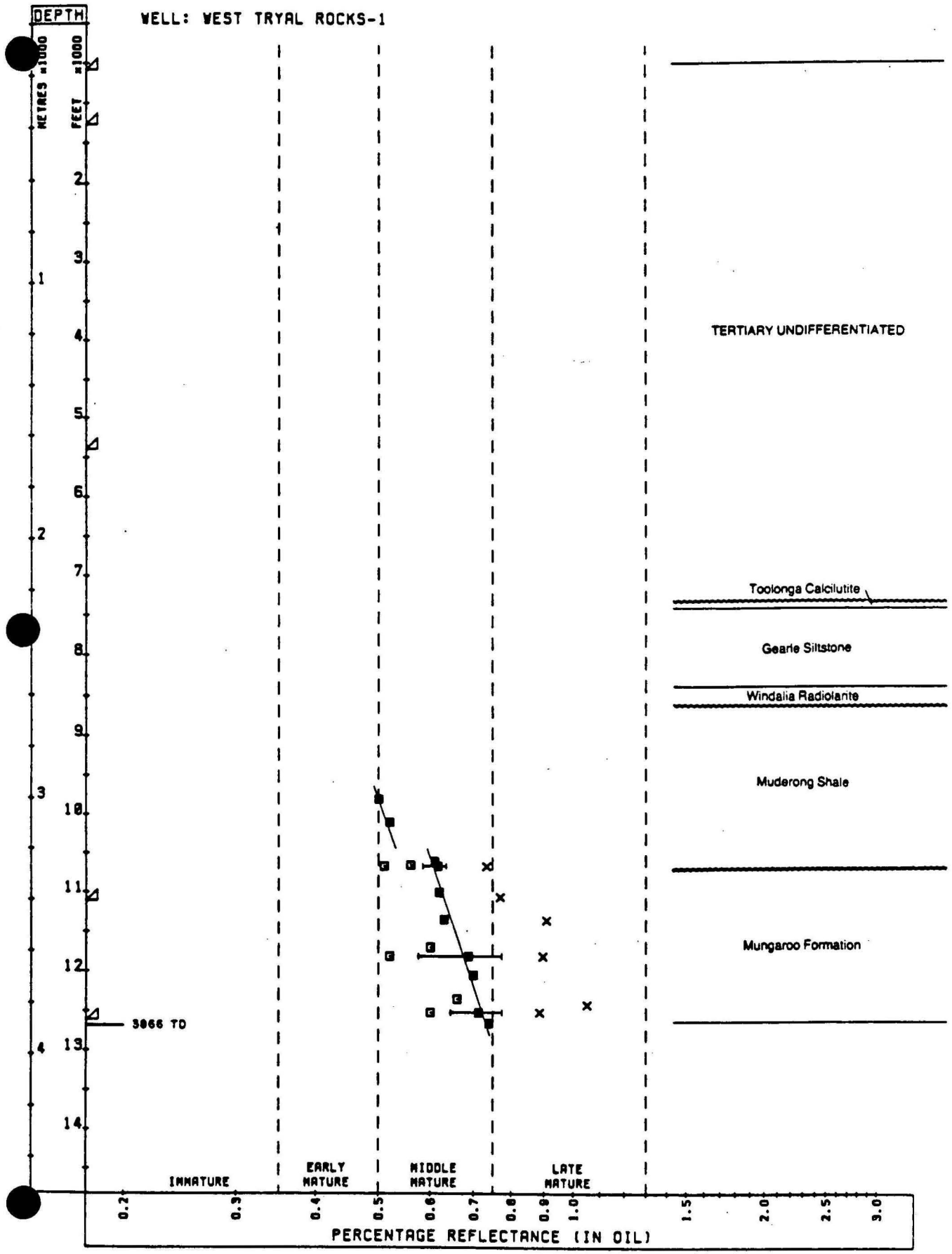
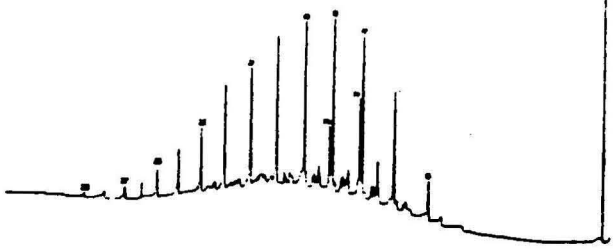
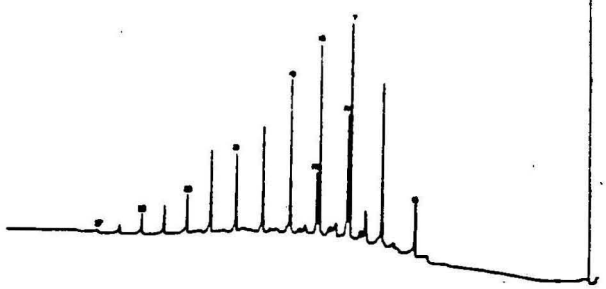



FIGURE 2 VITRINITE REFLECTANCE AGAINST DEPTH

West Tryal Rocks-1
3250-3262m
Muderong Shale
SCI 5.5
Pr/Ph = 1.44
Pr/n-$C_{17}$ = 0.61
Ph/n-$C_{18}$ = 0.38
CPI = 1.15



West Tryal Rocks-1
3265-3277m
Mungaroo Pmn
SCI 5.25
Pr/Ph = 1.90
Pr/n-$C_{17}$ = 0.57
Ph/n-$C_{18}$ = 0.34
CPI = 1.14



West Tryal Rocks-1
3326-3338m
Mungaroo Pmn
SCI 5.5
Pr/Ph = 1.14
Pr/n-$C_{17}$ = 0.62
Ph/n-$C_{18}$ = 0.42
CPI = 1.10

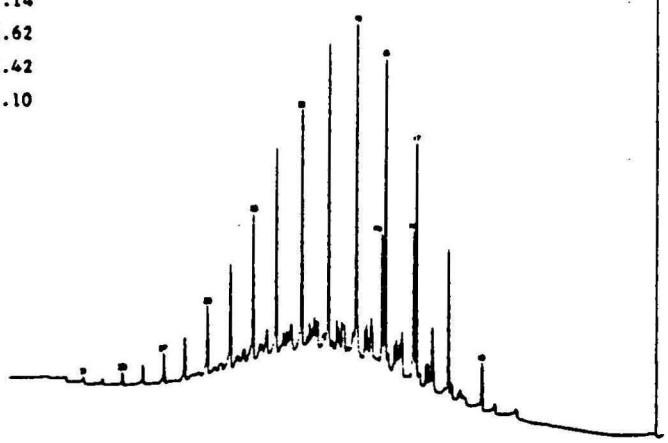
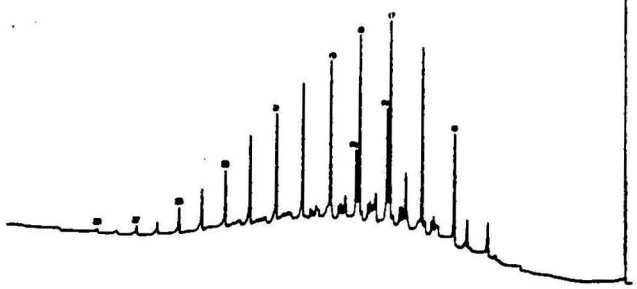
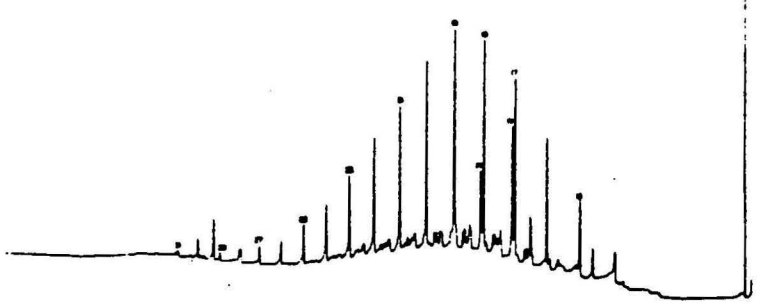


Figure 3a

West Tryal Rocks-1
3341-3354m
Mungaroo Fmn
SCI 5.5
Pr/Ph = 1.69
$Pr/n\text{-}C_{17}$ = 0.56
$Ph/n\text{-}C_{18}$ = 0.36
CPI = 1.20



West Tryal Rocks-1
3463-3476m
Mungaroo Fmn
SCI 5.75
Pr/Ph = 1.67
$Pr/n\text{-}C_{17}$ = 0.73
$Ph/n\text{-}C_{18}$ = 0.37
CPI = 1.03



West Tryal Rocks-1
3787-3799m
Mungaroo Fmn
SCI 6.0
Pr/Ph = 1.52
$Pr/n\text{-}C_{17}$ = 0.50
$Ph/n\text{-}C_{18}$ = 0.32
CPI = 1.03

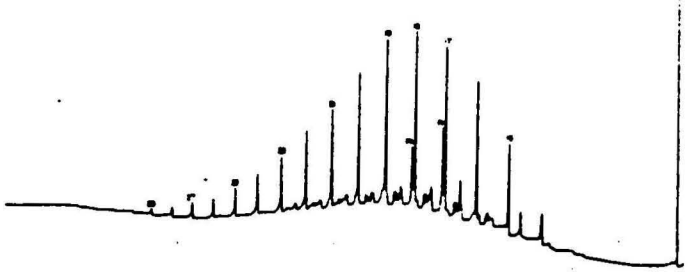
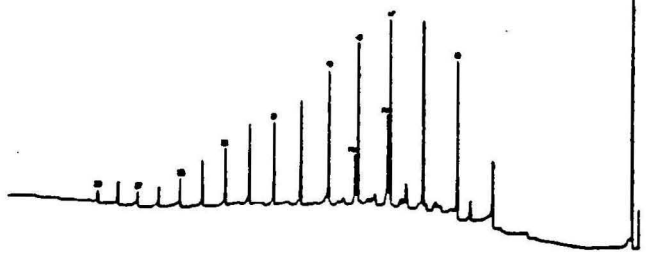
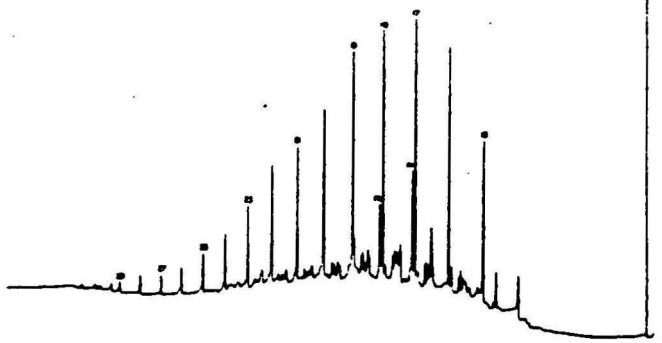


Figure 3b

West Tryal Rocks-1
3802-3814m
Mungaroo Fmn
SCI 6.0
Pr/Ph = 1.89
Pr/n-$C_{17}$ = 0.48
Ph/n-$C_{18}$ = 0.30
CPI = 0.96



West Tryal Rocks-1
3817-3829m
Mungaroo Fmn
SCI 6.0
Pr/Ph = 1.58
Pr/n-$C_{17}$ = 0.44
Ph/n-$C_{18}$ = 0.30
CPI = 1.09



West Tryal Rocks-1
3832-3845m (P)
Mungaroo Fmn
SCI 6.25
Pr/Ph = 2.48
Pr/n-$C_{17}$ = 0.86
Ph/n-$C_{18}$ = 0.26
CPI = 1.06

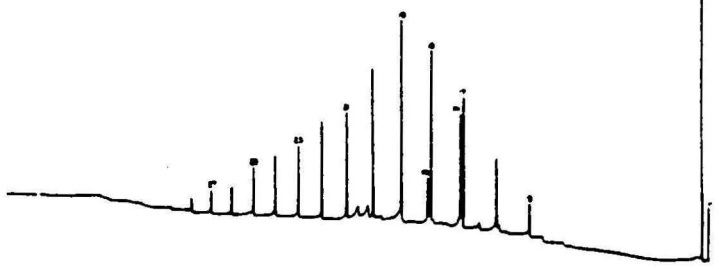


Figure 3c

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Appendix 1

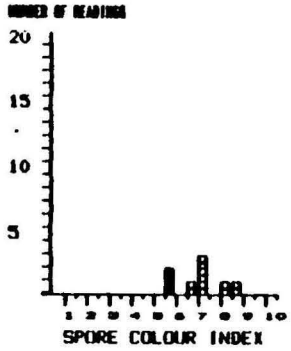
WEST TRYAL ROCKS-1

IN SITU POPULATION

SAMPLE 3250-3262M

5.5 5.5 6.5 7.0 7.0 7.0 8.0 8.5

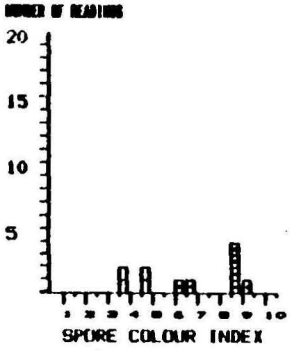
| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN SITU SPORES | 5.5-5.5 | 2 |
| BLEACHED/CAVINGS | - | 0 |
| STAINED/REWORKED | 6.5-8.5 | 6 |




SAMPLE 3372-3384M

3.5 3.5 4.5 4.5 6.0 6.5 8.5 8.5 8.5 8.5 9.0

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN SITU SPORES | - | 0 |
| BLEACHED/CAVINGS | 3.5-4.5 | 4 |
| STAINED/REWORKED | 6.0-9.0 | 7 |



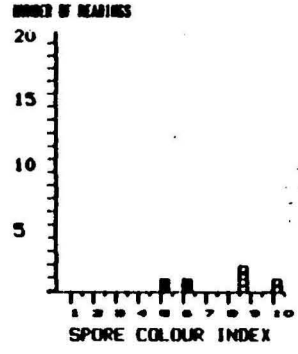

WEST TRYAL ROCKS-1

IN SITU POPULATION

SAMPLE 3601-3613M

5.0 6.0 8.5 8.5 10.0

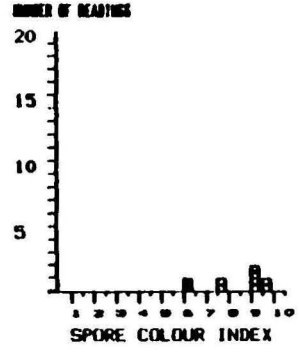
| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN SITU SPORES | 5.0-6.0 | 2 |
| BLEACHED/CAVINGS | - | 0 |
| STAINED/REWORKED | 8.5-10.0 | 3 |




SAMPLE 3817-3829M

6.0 7.5 9.0 9.0 9.5

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN SITU SPORES | 6.0-6.0 | 1 |
| BLEACHED/CAVINGS | - | 0 |
| STAINED/REWORKED | 7.5-9.5 | 4 |



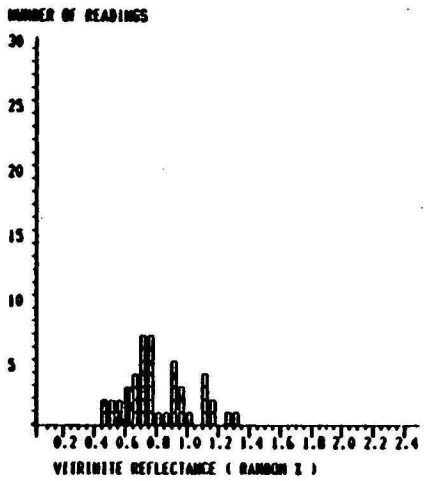
Robertson Research

WEST IRYAL ROCKS-1

SAMPLE 3259-3262M

0.48 0.49 0.51 0.52 0.55 0.59 0.62 0.63 0.63 0.67
0.68 0.69 0.69 0.71 0.72 0.72 0.72 0.72 0.73 0.74
0.75 0.75 0.76 0.76 0.76 0.77 0.79 0.81 0.89 0.90
0.90 0.93 0.93 0.94 0.97 0.98 0.98 1.04 1.10 1.12
1.12 1.14 1.15 1.19 1.26 1.34

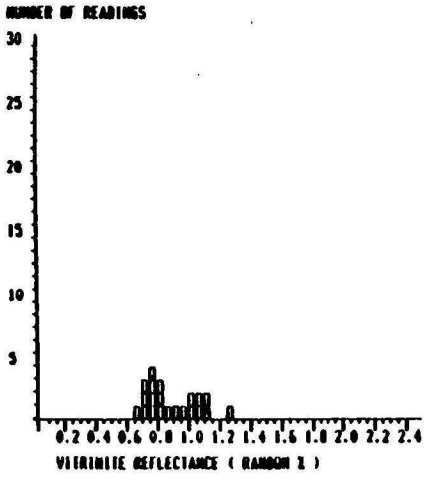
| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.59-0.63 | 4 | 0.62 | 0.02 |
| LIPTINITE/CAVINGS | 0.48-0.55 | 5 | 0.51 | 0.03 |
| INERTINITE/REWORKED | 0.67-0.81 | 19 | 0.73 | 0.04 |
| REWORKED | 0.89-1.34 | 10 | 1.05 | 0.13 |




SAMPLE 3372-3384M

0.67 0.71 0.73 0.74 0.76 0.77 0.78 0.78 0.80 0.81
0.82 0.88 0.93 0.95 1.02 1.02 1.08 1.08 1.10 1.13
1.26

| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| INERTINITE/REWORKED | 0.67-0.88 | 12 | 0.77 | 0.06 |
| REWORKED | 0.93-1.26 | 9 | 1.06 | 0.10 |

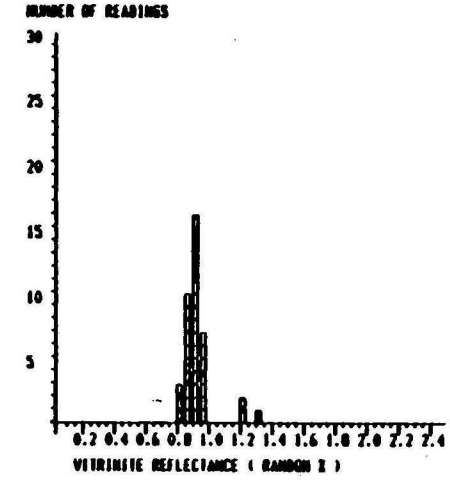



WEST IRYAL ROCKS-1

SAMPLE 3463-3476M COAL

0.80 0.83 0.83 0.85 0.86 0.87 0.88 0.88 0.88 0.88
0.88 0.88 0.89 0.90 0.90 0.91 0.91 0.91 0.92 0.92
0.92 0.93 0.94 0.94 0.94 0.94 0.94 0.94 0.94 0.95
0.95 0.95 0.95 0.96 0.96 0.97 1.23 1.24 1.30

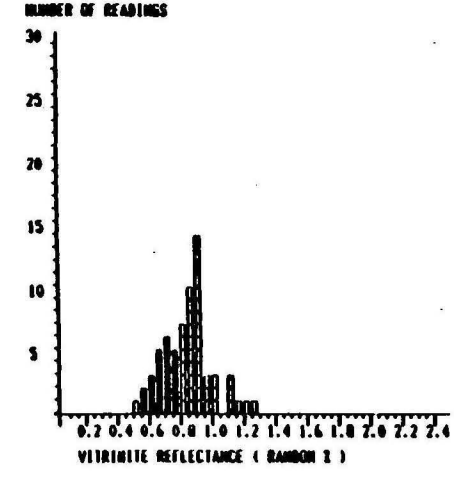
| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| INERTINITE/REWORKED | 0.80-0.97 | 36 | 0.91 | 0.04 |
| REWORKED | 1.23-1.30 | 3 | 1.26 | 0.04 |




SAMPLE 3601-3613M

0.52 0.58 0.58 0.61 0.62 0.62 0.65 0.65 0.66 0.67
0.67 0.71 0.71 0.72 0.73 0.73 0.74 0.75 0.75 0.76
0.76 0.77 0.80 0.80 0.81 0.82 0.82 0.83 0.84 0.85
0.85 0.85 0.85 0.86 0.86 0.88 0.88 0.89 0.89 0.90
0.90 0.90 0.91 0.91 0.91 0.91 0.92 0.92 0.92 0.93
0.94 0.94 0.94 0.95 0.97 0.99 1.00 1.02 1.04 1.10
1.10 1.12 1.16 1.23 1.29

| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.58-0.77 | 21 | 0.69 | 0.06 |
| LIPTINITE/CAVINGS | 0.52-0.52 | 1 | 0.52 | |
| INERTINITE/REWORKED | 0.80-1.04 | 37 | 0.90 | 0.06 |
| REWORKED | 1.10-1.29 | 6 | 1.17 | 0.08 |




Appendix 2a

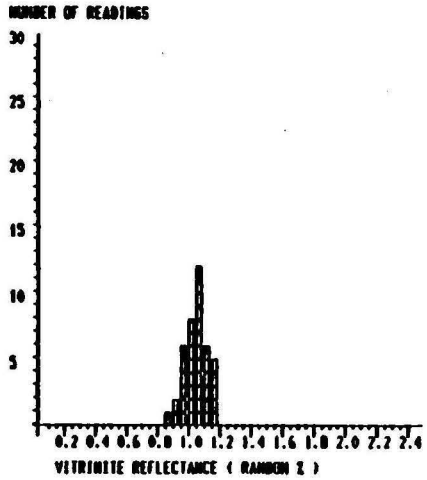
Robertson Research

WEST TRYAL ROCKS-1

SAMPLE 3787-3799M COAL

0.87 0.93 0.94 0.95 0.96 0.97 0.98 0.98 0.99 1.00
1.00 1.00 1.01 1.01 1.01 1.02 1.02 1.05 1.06 1.06
1.06 1.07 1.07 1.08 1.08 1.08 1.08 1.08 1.09 1.11
1.12 1.12 1.13 1.14 1.14 1.15 1.15 1.15 1.16 1.16

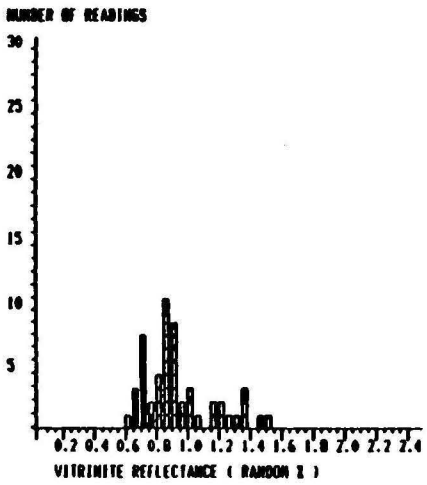
| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| INERTINITE/REWORKED | 0.87-1.16 | 40 | 1.05 | 0.07 |




SAMPLE 3817-3829M

0.60 0.65 0.66 0.69 0.71 0.72 0.72 0.72 0.73 0.73
0.74 0.77 0.79 0.80 0.80 0.81 0.82 0.86 0.86 0.87
0.88 0.88 0.88 0.88 0.88 0.88 0.89 0.91 0.92 0.93
0.93 0.93 0.93 0.94 0.94 0.97 0.98 1.01 1.01 1.02
1.09 1.15 1.17 1.20 1.21 1.25 1.33 1.35 1.35 1.37
1.48 1.50

| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.65-0.77 | 11 | 0.71 | 0.03 |
| LIPTINITE/CAVINGS | 0.60-0.60 | 1 | 0.60 | |
| INERTINITE/REWORKED | 0.79-0.98 | 25 | 0.89 | 0.05 |
| REWORKED | 1.01-1.50 | 15 | 1.23 | 0.16 |




Appendix 2b

# WITHNELL-1 WELL

## SUMMARY

Geochemical analyses of samples from the interval 2250m to 4625m of the Withnell-1 well have shown that the well section is early mature to 2700m, middle mature between 2700m and 3900m and late mature between 3900m and 4650m TD. The maturity gradients show no evidence of any major erosional unconformities within the section analysed and extrapolation of the gradients back to the seabed shows that little Early Cretaceous and younger section is missing above 2250m. The sediments analysed are currently at or near their maximum depths of burial.

Mudstones in the interval 2615m to 2710m in the Muderong Shale Formation and Barrow Group and 2910m to 4065m in the Upper Dingo Claystone have good and very good oil source potential respectively. These intervals will already have generated significant quantities of oil. The mudstones in the interval 2910m to 4625m are sufficiently thick and contain enough vitrinitic kerogen to constitute a fair gas source. These sediments, however, will not have generated significant quantities of gas in reaching their present level of maturity.

## GENERAL COMMENTS

Basin: Northern Carnarvon Basin.

Location: 20° 01' 11.4"S, 115° 48' 14.6"E.

Operator and date of drilling: Bocal, 1976.

Well Status: Plugged and abandoned.

TD: 4650m.

Mud data: Brine/Polymer mud used over the interval analysed.

Casing data: 20" at 491m, $13^3/_8$" at 1103m, $9^5/_8$" at 3003m.

BHT data: 84°C at 3017m, after 12 hours stopped circulation.
128°C at 4314m, after 16 hours stopped circulation.
141°C at 4650m, after 7 hours stopped circulation.

Elevation: RT 30m ASL.

Water depth: 75m.

WITHNELL-1 WELL

Interval analysed : 2250m to 4625m.

Age of interval analysed:

| | Depth (in metres) |
|---|---|
| Early Cretaceous | 2250-2948 |
| Middle-Late Jurassic | 2948-4442 |
| Middle Jurassic | 4442-4625 |

Sample type and quality: Dried ditch cuttings of good quality for geochemical analysis.

Maturation data quality:

a) Vitrinite Reflectance: The samples yielded fair quantities of indigenous vitrinite but were complicated by reworked and caved material. Results: Fair.

b) Spore Colour Index: The samples yielded sufficient quantities of indigenous sporomorphs but were complicated by reworked and stained material. Results: Good.

Source rock data quality: Good.

Gas chromatography run at: 2420m to 2430m, 2665m to 2670m, 3720m to 3730m and 4390m to 4400m.

MATURATION (Table 1, Figures 1 and 2, Appendices 1 and 2)

Vitrinite reflectance values over the analysed interval increase from an estimated 0.47% at 2250m to 2265m to 0.85% at 4615mto 4625m. Spore colour index values rise from 4.5 SCI units to 8 SCI units over the same interval. The maturity gradients indicate that the section analysed is early mature to 2700m, middle mature between 2700m and 3900m and late mature between 3900m and 4650m TD. The maturity gradients show no evidence of any major unconformities within the section analysed. Extrapolation of the maturity gradients to the seabed suggests that little Late Cretaceous and younger section is missing above 2250m. The sediments analysed are currently at or near their maximum depths of burial.

## OIL AND GAS SOURCE POTENTIAL (Tables 1 and 2, Figure 3)

Mudstones in the intervals 2615m to 2710m in the Muderong Shale and Barrow Group, and 2910m to 4065m in the Barrow Group and Upper Dingo Claystone contain average to above average organic carbon contents of between 1.12% and 4.28%. Initial pyrolysis of selected samples showed that they contain a bitumen-like substance which affected the pyrolysis $S_2$ peak. All samples were therefore extracted and total organic carbon and pyrolysis run on the extracted residues. Pyrolysis of extracted residues of the mudstones in the intervals 2615m to 2710m and 2910m to 4065m shows that these mudstones contain an average of between 10% and 20% oil-prone waxy kerogens in the intervals 2615m to 2710m, 2910m to 3720m and 3875m to 4065m and between 20% and 50% waxy kerogens in the interval 3720m to 3785m. The electric logs suggest that these intervals contain thick uniform mudstones and analytical data suggests that the mudstones have generally uniform geochemical characteristics. Source rock units do not appear to be present as thin beds. Extraction, fractionation and gas chromatography analyses of samples at 2420m to 2430m, 2665m to 2670m, 3720m to 3730m and 4390m to 4400m shows that these samples contain indigenous hydrocarbons derived from mature, terrestrially sourced waxy kerogens.

Mudstones from the intervals 2615m to 2710m of the Muderong Shale and Barrow Group and 2910m to 4065m of the Barrow Group and Upper Dingo Claystone have good and very good oil source potential respectively. These mudstones will have generated significant quantities of hydrocarbons in reaching their present levels of maturity.

The section between 2910m and 4650m TD contains thick mudstones which generally contain average to above average organic carbon contents. This interval will be a fair gas source at optimum maturity, but is not sufficiently mature enough to have generated oil on structure.

## GEOCHEMICAL CHARACTERISTICS OF THE REMAINING SEDIMENTS (Tables 1 and 2, Figure 3)

Mudstones in the interval 2250m to 2615m and 2710m to 2910m generally contain average to above average organic carbon contents of between 0.84% and 2.27%. Pyrolysis analysis shows that samples in these intervals contain mostly humic kerogen. These mudstones have no significant oil or gas source potential.

WELL: WITHNELL-1

| SAMPLE DEPTH (METRES) | SAMPLE TYPE | GENERALISED LITHOLOGY | SPORE COLOUR INDEX (1-10) | VITRINITE REFLECTIVITY (R oil av %) | KEROGEN COMPOSITION (% vol) (by microscopic examination) | | | KEROGEN COMPOSITION (% wt) (by calculation from pyrolysis data) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | INERTINITE | VITRINITE | SAPROPEL | INERTINITE | VITRINITE | ALGAL SAPROPEL | WAXY SAPROPEL |
| **2172** | | **Haycock Marl** | | | | | | | | | |
| 2250-2265 | Ctg | MDST, lt gy, lt ol gy, calc + mnr LST, v lt gy | 4.5 | ?0.47(1) | 70 | 30 | mnr | | | | |
| 2300-2310 | " | MDST, lt gy, calc + mnr LST, v lt gy | | | | | | | | | |
| | " | After extraction | | | | | | 60 | 40 | * | * |
| **2318** | | **Windalia Radiolarite** | | | | | | | | | |
| **2336** | | **Muderong Shale** | | | | | | | | | |
| 2370-2380 | " | MDST, lt ol gy, calc | 6.0-7.5rew | * | 55 | 45 | * | | | | |
| | " | After extraction | | | | | | 60 | 40 | * | * |
| 2420-2430 | " | MDST, a/a | | | | | | | | | |
| | " | After extraction | | | | | | 60 | 30 | * | 10 |
| 2525-2540 | P | MDST, ol gy, calc | | | | | | | | | |
| | P | After extraction | | | | | | 50 | 40 | * | 10 |
| | P | MDST, v lt gy, calc | | | | | | | | | |
| | P | After extraction | | | | | | 50 | 50 | * | * |
| 2615-2625 | Ctg | MDST, ol gy, calc | | | | | | | | | |
| | " | After extraction | | | | | | 45 | 45 | * | 10 |
| **2627** | | **Barrow Gp** | | | | | | | | | |
| 2665-2670 | " | MDST, lt ol gy, calc | 5.5-6.0 | 0.49(18) | 45 | 50 | 5 | | | | |
| | " | After extraction | | | | | | 50 | 30 | * | 20 |
| 2705-2710 | " | MDST, med gy-dk gy | | | | | | 45 | 45 | * | 10 |
| 2760-2770 | " | MDST, med gy | | | | | | | | | |
| | " | After extraction | | | | | | 50 | 45 | * | 5 |
| 2825-2835 | P | MDST, dk gy | | | | | | | | | |
| | P | After extraction | | | | | | 30 | 70 | * | * |
| 2860-2865 | P | MDST, dk gy | | | | | | | | | |
| | P | After extraction | | | | | | 30 | 70 | * | * |
| 2910-2915 | P | MDST, lt gy | | | | | | | | | |
| | P | After extraction | | | | | | 30 | 60 | * | 10 |
| | P | MDST, dk gy | | | | | | | | | |
| | P | After extraction | | | | | | 45 | 45 | * | 10 |
| **2948** | | **Upper Dingo Claystone** | | | | | | | | | |
| 2950-2960 | Ctg | MDST, yel gy, calc | 4.0cvd | * | 30 | 70 | * | | | | |
| | " | After extraction | | | | | | 35 | 60 | * | 5 |
| 3000-3010 | " | SLTST, v lt gy, sndy | | | | | | | | | |
| | " | After extraction | | | | | | 55 | 40 | * | 5 |
| 3170-3180 | " | MDST, yel gy, calc | 6.0 | 0.53(11) | 30 | 40 | 30 | | | | |

Table 1a Maturity and Kerogen Composition Data

WELL: WITHNELL-1

| SAMPLE DEPTH (METRES) | SAMPLE TYPE | GENERALISED LITHOLOGY | SPORE COLOUR INDEX (1-10) | VITRINITE REFLECTIVITY (R oil av %) | KEROGEN COMPOSITION (% vol) (by microscopic examination) | | | KEROGEN COMPOSITION (% wt) (by calculation from pyrolysis data) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | INERTINITE | VITRINITE | SAPROPEL | INERTINITE | VITRINITE | ALGAL SAPROPEL | WAXY SAPROPEL |
| 3265-3280 | Ctg | MDST, ol gy | | | | | | | | | |
| | " | After extraction | | | | | | 35 | 55 | * | 10 |
| 3280-3285 | " | MDST, med-dk gy | | | | | | | | | |
| | " | After extraction | | | | | | 60 | 35 | * | 5 |
| 3280-3290 | " | MDST, lt ol gy, calc | 6.0-6.5 | ?0.56(1) | 30 | 10 | 60 | | | | |
| | " | After extraction | | | | | | 35 | 50 | * | 15 |
| 3285-3290 | " | MDST, med gy | | | | | | | | | |
| | " | After extraction | | | | | | 35 | 55 | * | 10 |
| 3295-3305 | " | MDST, a/a | | | | | | | | | |
| | " | After extraction | | | | | | 50 | 35 | * | 15 |
| 3310-3320 | " | MDST, med gy-dk gy | | | | | | | | | |
| | " | After extraction | | | | | | 55 | 30 | * | 15 |
| 3325-3335 | " | MDST, med gy | | | | | | | | | |
| | " | After extraction | | | | | | 50 | 40 | * | 10 |
| 3340-3350 | " | MDST, med-dk gy, slty | | | | | | | | | |
| | " | After extraction | | | | | | 60 | 35 | * | 5 |
| 3355-3365 | " | MDST, med gy-dk gy | | | | | | | | | |
| | " | After extraction | | | | | | 45 | 35 | * | 20 |
| 3370-3380 | " | MDST, med gy-dk gy + mnr SST, lt gy | | | | | | | | | |
| | " | After extraction | | | | | | 35 | 55 | * | 10 |
| 3385-3395 | " | SLTST, med gy | | | | | | | | | |
| | " | After extraction | | | | | | 60 | 25 | * | 15 |
| 3395-3400 | " | SLTST, lt-med gy | | | | | | | | | |
| | " | After extraction | | | | | | 55 | 35 | * | 10 |
| 3400-3410 | " | MDST, med gy-dk gy | | | | | | | | | |
| | " | After extraction | | | | | | 60 | 30 | * | 10 |
| 3445-3455 | " | MDST, med-dk gy, sndy | | | | | | | | | |
| | " | After extraction | | | | | | 60 | 25 | * | 15 |
| 3460-3470 | " | MDST, med-dk gy, sndy | | | | | | | | | |
| | " | After extraction | | | | | | 50 | 35 | * | 15 |
| 3475-3485 | " | MDST, med-dk gy, slty | | | | | | | | | |
| | " | After extraction | | | | | | 50 | 30 | * | 20 |
| 3490-3495 | " | MDST, med gy, slty | | | | | | | | | |
| | " | After extraction | | | | | | 55 | 30 | * | 15 |
| 3505-3510 | " | MDST, med-dk gy, slty | | | | | | | | | |
| | " | After extraction | | | | | | 50 | 30 | * | 20 |

Table 1b Maturity and Kerogen Composition Data

WELL: WITHNELL-1

| SAMPLE DEPTH (METRES) | SAMPLE TYPE | GENERALISED LITHOLOGY | SPORE COLOUR INDEX (1-10) | VITRINITE REFLECTIVITY (R oil av %) | KEROGEN COMPOSITION (% vol) (by microscopic examination) | | | KEROGEN COMPOSITION (% wt.) (by calculation from pyrolysis data) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | INERTINITE | VITRINITE | SAPROPEL | INERTINITE | VITRINITE | ALGAL SAPROPEL | WAXY SAPROPEL |
| 3505-3515 | Ctg | MDST, lt ol gy, calc | 6.5-7.0 | 0.63(15) | 60 | 10 | 30 | | | | |
| | " | After extraction | | | | | | 60 | 30 | * | 10 |
| 3530-3540 | " | MDST, med-dk gy | | | | | | | | | |
| | " | After extraction | | | | | | 55 | 30 | * | 15 |
| 3545-3555 | " | MDST, a/a | | | | | | | | | |
| | " | After extraction | | | | | | 50 | 30 | * | 20 |
| 3560-3570 | " | MDST, a/a | | | | | | | | | |
| | " | After extraction | | | | | | 50 | 30 | * | 20 |
| 3575-3585 | " | MDST, med gy, slty | | | | | | | | | |
| | " | After extraction | | | | | | 40 | 30 | * | 30 |
| 3590-3600 | " | MDST, med dk gy, slty | | | | | | | | | |
| | " | After extraction | | | | | | 50 | 30 | * | 20 |
| 3605-3615 | " | MDST, med dk gy-dk gy, slty | | | | | | | | | |
| | " | After extraction | | | | | | 35 | 30 | * | 35 |
| 3615-3620 | " | MDST, med gy, slty | | | | | | | | | |
| | " | After extraction | | | | | | 45 | 30 | * | 25 |
| 3610-3620 | " | MDST, med gy, calc | | | | | | | | | |
| | " | After extraction | | | | | | 65 | 30 | * | 5 |
| 3620-3630 | " | MDST, med gy, slty | | | | | | | | | |
| | " | After extraction | | | | | | 50 | 30 | * | 20 |
| 3635-3645 | " | MDST, med-dk gy, slty | | | | | | | | | |
| | " | After extraction | | | | | | 55 | 30 | * | 15 |
| 3650-3660 | " | MDST, med gy, slty | | | | | | | | | |
| | " | After extraction | | | | | | 45 | 30 | * | 25 |
| 3665-3675 | " | MDST, med-dk gy, slty | | | | | | | | | |
| | " | After extraction | | | | | | 50 | 30 | * | 20 |
| 3680-3690 | " | MDST, a/a | | | | | | | | | |
| | " | After extraction | | | | | | 50 | 30 | * | 20 |
| 3695-3705 | " | MDST, med dk gy-dk gy, slty | | | | | | | | | |
| | " | After extraction | | | | | | 55 | 30 | * | 15 |
| 3710-3720 | " | MDST, med-dk gy, slty | | | | | | | | | |
| | " | After extraction | | | | | | 55 | 30 | * | 15 |
| 3720-3730 | " | MDST, ol gy, sl calc | 6.5-7.0 | 0.66(6) | 80 | 20 | mar | | | | |
| | " | After extraction | | | | | | 20 | 30 | * | 50 |
| 3725-3735 | " | MDST, med gy, slty | | | | | | | | | |
| | " | After extraction | | | | | | 35 | 30 | * | 35 |

Table 1c Maturity and Kerogen Composition Data

WELL: WITHNELL-1

| SAMPLE DEPTH (METRES) | SAMPLE TYPE | GENERALISED LITHOLOGY | SPORE COLOUR INDEX (1-10) | VITRINITE REFLECTIVITY (R oil av %) | KEROGEN COMPOSITION (% vol) (by microscopic examination) | | | KEROGEN COMPOSITION (% wt) (by calculation from pyrolysis data) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | INERTINITE | VITRINITE | SAPROPEL | INERTINITE | VITRINITE | ALGAL SAPROPEL | WAXY SAPROPEL |
| 3740-3750 | Ctg | MDST, med gy-dk gy | | | | | | | | | |
| | " | After extraction | | | | | | 45 | 30 | * | 25 |
| 3760-3770 | " | MDST, med dk gy, slty | | | | | | | | | |
| | " | After extraction | | | | | | 35 | 30 | * | 35 |
| 3775-3785 | " | MDST, med dk gy-dk gy, slty | | | | | | | | | |
| | " | After extraction | | | | | | 20 | 30 | * | 50 |
| 3790-3800 | " | MDST, a/a | | | | | | | | | |
| | " | After extraction | | | | | | 20 | 30 | * | 50 |
| 3805-3815 | P | MDST, dk gy | | | | | | | | | |
| | P | After extraction | | | | | | 30 | 20 | * | 50 |
| 3820-3830 | Ctg | MDST, med dk gy, slty | | | | | | | | | |
| | " | After extraction | | | | | | 45 | 30 | * | 25 |
| 3830-3835 | " | MDST, med-dk gy, slty | | | | | | | | | |
| | " | After extraction | | | | | | 20 | 30 | * | 50 |
| 3830-3840 | P | MDST, dk gy | | | | | | | | | |
| | P | After extraction | | | | | | 20 | 30 | * | 50 |
| | P | MDST, ol gy, calc | | | | | | | | | |
| | P | After extraction | | | | | | 30 | 30 | * | 40 |
| 3835-3845 | Ctg | MDST, dk gy-gy blk | | | | | | | | | |
| | " | After extraction | | | | | | 20 | 30 | * | 50 |
| 3850-3860 | " | MDST, med dk gy-dk gy | | | | | | | | | |
| | " | After extraction | | | | | | 50 | 30 | * | 20 |
| 3865-3875 | P | MDST, med-dk gy | | | | | | | | | |
| | P | After extraction | | | | | | 35 | 30 | * | 35 |
| | P | MDST, gy blk | | | | | | | | | |
| | P | After extraction | | | | | | 45 | 30 | * | 25 |
| 3880-3890 | Ctg | MDST, med-dk gy | | | | | | | | | |
| | " | After extraction | | | | | | 60 | 30 | * | 10 |
| 3895-3905 | " | MDST, med dk gy-dk gy | | | | | | | | | |
| | " | After extraction | | | | | | 60 | 30 | * | 10 |
| 3910-3920 | " | MDST, med dk gy + anr bit (blk) | | | | | | | | | |
| | " | After extraction | | | | | | 55 | 30 | * | 15 |
| 3925-3935 | " | MDST, med dk gy | | | | | | | | | |
| | " | After extraction | | | | | | 60 | 30 | * | 10 |
| 3940-3945 | " | MDST, med-dk gy, slty | | | | | | | | | |
| | " | After extraction | | | | | | 60 | 30 | * | 10 |

Table 1d Maturity and Kerogen Composition Data

WELL: WITHNELL-1

| SAMPLE DEPTH (METRES) | SAMPLE TYPE | GENERALISED LITHOLOGY | SPORE COLOUR INDEX (1-10) | VITRINITE REFLECTIVITY (R oil av %) | KEROGEN COMPOSITION (% vol) (by microscopic examination) | | | KEROGEN COMPOSITION (% wt) (by calculation from pyrolysis data) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | INERTINITE | VITRINITE | SAPROPEL | INERTINITE | VITRINITE | ALGAL SAPROPEL | WAXY SAPROPEL |
| 3940-3950 | Ctg | MDST, med-gy, lt ol gy, calc | 7.0-7.5 | * | 90 | 10 | * | | | | |
| | " | After extraction | | | | | | 60 | 30 | * | 10 |
| 3945-3950 | " | MDST, med-dk gy, slty | | | | | | | | | |
| | " | After extraction | | | | | | 60 | 30 | * | 10 |
| 3950-3955 | " | MDST, dk gy + mnr LST | | | | | | | | | |
| | " | After extraction | | | | | | 60 | 30 | * | 10 |
| 4050-4055 | " | MDST, a/a | | | | | | | | | |
| | " | After extraction | | | | | | 60 | 30 | * | 10 |
| 4050-4060 | " | MDST, med gy-lt ol gy | | | | | | | | | |
| | " | After extraction | | | | | | 60 | 30 | * | 10 |
| 4055-4060 | " | MDST, med gy-dk gy, slty | | | | | | | | | |
| | " | After extraction | | | | | | 65 | 30 | * | 5 |
| 4060-4065 | " | MDST, a/a | | | | | | | | | |
| | " | After extraction | | | | | | 60 | 30 | * | 10 |
| 4170-4180 | " | MDST, ol gy, calc | | | | | | | | | |
| | " | After extraction | | | | | | 70 | 30 | * | * |
| 4270-4280 | " | MDST, ol gy, calc | 8.5-9.0rew | * | 85 | 15 | * | | | | |
| | " | After extraction | | | | | | 70 | 30 | * | * |
| 4330-4340 | P | MDST, dk gy | | | | | | | | | |
| | P | After extraction | | | | | | 60 | 40 | * | * |
| | P | LST, wht | | | | | | | | | |
| | P | After extraction | | | | | | 80 | 20 | * | * |
| 4390-4400 | Ctg | MDST, dk gy | | | | | | | | | |
| | " | After extraction | | | | | | 60 | 40 | * | * |
| 4442 | | ?Middle Dingo Claystone | | | | | | | | | |
| 4455-4465 | P | MDST, dk gy | | | | | | | | | |
| | P | After extraction | | | | | | 60 | 40 | * | * |
| 4505-4515 | Ctg | MDST, ol gy, calc | 7.5-8.0 | * | 50 | 50 | * | | | | |
| | " | After extraction | | | | | | 70 | 30 | * | * |
| 4545-4555 | " | MDST, med dk gy-dk gy + mnr SND | | | | | | | | | |
| | " | After extraction | | | | | | 70 | 30 | * | * |
| 4585-4595 | P | MDST, med dk gy-dk gy | | | | | | | | | |
| | P | After extraction | | | | | | 85 | 15 | * | * |
| 4615-4625 | Ctg | MDST, ol gy, calc | 8.0 | 0.87(13) | 40 | 60 | * | | | | |
| | " | After extraction | | | | | | 60 | 40 | * | * |

Table 1e Maturity and Kerogen Composition Data

WELL: WITHNELL-1

| GENERAL DATA | | | CHEMICAL ANALYSIS DATA | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PYROLYSIS | | | | | SOLVENT EXTRACTION | | | | | | |
| | | | | | | | | | | | | | EXTRACT COMPOSITION (%) | | |
| SAMPLE DEPTH (METRES) | SAMPLE TYPE | ANALYSED LITHOLOGY | ORGANIC CARBON (% ROCK) | TEMPERATURE C | HYDROGEN INDEX | OXYGEN INDEX | PRODUCTION INDEX | POTENTIAL YIELD (kg Tonne) | TOTAL EXTRACT (ppm) | TOTAL EXTRACT (mg g T O C) | HYDROCARBONS (ppm) | HYDROCARBONS (mg g T O C) | SATURATED HYDROCARBONS | AROMATIC HYDROCARBONS | POLAR COMPOUNDS |
| **2172** | | **Haycock Marl** | | | | | | | | | | | | | |
| 2250-2265 | Ctg | MDST, lt gy, lt ol gy + mnr LST, v lt gy | 0.96 | | | | | | | | | | | | |
| 2300-2310 | " | MDST, lt gy, calc + mnr LST, v lt gy | 1.39 | | | | | | | | | | | | |
| | " | After extraction | 1.05 | 428 | 92 | 138 | 0.05 | 1.02 | | | | | | | |
| **2318** | | **Windalia Radiolarite** | | | | | | | | | | | | | |
| **2336** | | **Muderong Shale** | | | | | | | | | | | | | |
| 2370-2380 | Ctg | MDST, lt ol gy, calc | 1.43 | 429 | 85 | 107 | 0.18 | 1.48 | | | | | | | |
| | " | After extraction | 1.18 | 429 | 96 | 122 | 0.06 | 1.07 | | | | | | | |
| 2420-2430 | Ctg | MDST, a/a | 1.09 | | | | | | 910 | 83 | 625 | 57 | 64 | 5 | 31 |
| | " | After extraction | 1.40 | 436 | 121 | 126 | 0.02 | 1.72 | | | | | | | |
| 2525-2540 | Ctg | MDST, ol gy, calc + 60% MDST, v lt gy, calc | - | | | | | | | | | | | | |
| | P | MDST, ol gy, calc | 2.28 | | | | | | | | | | | | |
| | P | After extraction | 2.27 | 436 | 133 | 56 | 0.01 | 3.06 | | | | | | | |
| | P | MDST, v lt gy, calc | 1.41 | | | | | | | | | | | | |
| | P | After extraction | 1.59 | 435 | 96 | 82 | 0.01 | 1.54 | | | | | | | |
| 2615-2625 | Ctg | MDST, ol gy, calc | 2.54 | | | | | | | | | | | | |
| | " | After extraction | 2.65 | 433 | 147 | 54 | 0.02 | 3.96 | | | | | | | |
| **2627** | | **Barrow Gp** | | | | | | | | | | | | | |
| 2665-2670 | Ctg | MDST, a/a | 3.52 | 434 | 303 | 56 | 0.12 | 12.17 | 2965 | 84 | 1980 | 56 | 55 | 12 | 33 |
| | " | After extraction | 3.71 | 435 | 225 | 51 | 0.01 | 8.45 | | | | | | | |
| **2948** | | **Upper Dingo Claystone** | | | | | | | | | | | | | |
| 2705-2710 | " | MDST, med gy-dk gy | 3.20 | 437 | 131 | 63 | 0.01 | 4.24 | | | | | | | |
| 2760-2770 | " | MDST, med gy | 1.44 | 436 | 228 | 118 | 0.08 | 3.58 | | | | | | | |
| | " | After extraction | 1.99 | 430 | 112 | 105 | 0.03 | 2.29 | | | | | | | |
| 2825-2835 | " | MDST, med gy + 10% MDST dk gy | - | | | | | | | | | | | | |
| | P | MDST, med gy | 0.89 | | | | | | | | | | | | |
| | P | MDST, dk gy | 1.78 | | | | | | | | | | | | |
| | P | After extraction | 2.16 | 435 | 138 | 36 | 0.05 | 3.14 | | | | | | | |
| 2860-2865 | Ctg | MDST, lt gy, sndy + mnr MDST, dk gy | - | | | | | | | | | | | | |
| | P | MDST, lt gy, sndy mnr | 0.88 | | | | | | | | | | | | |
| | P | MDST, dk gy | 1.67 | | | | | | | | | | | | |
| | P | After extraction | 1.75 | 437 | 139 | 47 | 0.03 | 2.51 | | | | | | | |

Table 2a Chemical Analysis Data

WELL: WITHNELL-1

| GENERAL DATA | | | CHEMICAL ANALYSIS DATA | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PYROLYSIS | | | | | SOLVENT EXTRACTION | | | | | |
| SAMPLE DEPTH (METRES) | SAMPLE TYPE | ANALYSED LITHOLOGY | ORGANIC CARBON % Of ROCK | TEMPERATURE C | HYDROGEN INDEX | OXYGEN INDEX | PRODUCTION INDEX | POTENTIAL YIELD (kg Tonne) | TOTAL EXTRACT (ppm) | TOTAL EXTRACT (mg g TOC) | HYDROCARBONS (ppm) | HYDROCARBONS (mg g TOC) | EXTRACT COMPOSITION (%) | |
| | | | | | | | | | | | | | SATURATED HYDROCARBONS | AROMATIC HYDROCARBONS | POLAR COMPOUNDS |
| 2910-2915 | Ctg | MDST, lt gy, sndy + 10% MDST, dk gy | - | | | | | | | | | | | |
| | P | MDST, lt gy | 1.20 | | | | | | | | | | | |
| | P | After extraction | 1.42 | 435 | 188 | 77 | 0.04 | 2.79 | | | | | | |
| | P | MDST, dk gy | 1.67 | | | | | | | | | | | |
| | P | After extraction | 2.03 | 437 | 135 | 22 | 0.05 | 2.89 | | | | | | |
| 2950-2960 | Ctg | MDST, yel gy, calc | 1.75 | | | | | | | | | | | |
| | " | After extraction | 1.90 | 435 | 154 | 115 | 0.06 | 3.12 | | | | | | |
| 3000-3010 | " | SLTST, v lt gy, sndy | - | | | | | | | | | | | |
| | " | After extraction | 1.26 | 436 | 125 | 126 | 0.07 | 1.69 | | | | | | |
| 3060-3070 | Ctg | MDST, a/a | 0.56 | | | | | | | | | | | |
| 3100-3110 | " | SLTST, v lt gy, sndy | - | | | | | | | | | | | |
| | " | After extraction | 0.69 | | | | | | | | | | | |
| 3170-3180 | " | MDST, a/a | 0.75 | | | | | | | | | | | |
| 3265-3280 | " | MDST, ol gy | - | | | | | | | | | | | |
| | " | After extraction | 1.63 | 442 | 95 | 82 | 0.03 | 1.60 | | | | | | |
| 3280-3285 | " | MDST, med-dk gy | - | | | | | | | | | | | |
| | " | After extraction | 1.48 | 440 | 80 | 70 | 0.03 | 1.23 | | | | | | |
| 3280-3290 | " | MDST, lt ol gy, calc | 1.39 | | | | | | | | | | | |
| | " | After extraction | 1.59 | 438 | 152 | 87 | 0.03 | 2.50 | | | | | | |
| 3285-3290 | " | MDST, med gy | - | | | | | | | | | | | |
| | " | After extraction | 1.54 | 439 | 135 | 86 | 0.02 | 2.12 | | | | | | |
| 3295-3305 | Ctg | MDST, a/a | 1.19 | 433 | 308 | 129 | 0.12 | 4.19 | | | | | | |
| | " | After extraction | 1.68 | 439 | 151 | 111 | 0.05 | 2.67 | | | | | | |
| 3310-3320 | " | MDST, med gy-dk gy | - | | | | | | | | | | | |
| | " | After extraction | 1.33 | 442 | 131 | 141 | 0.04 | 1.81 | | | | | | |
| 3325-3335 | " | MDST, med gy | - | | | | | | | | | | | |
| | " | After extraction | 1.17 | 441 | 110 | 149 | 0.03 | 1.33 | | | | | | |
| 3340-3350 | " | MDST, med-dk gy, slty | 0.95 | | | | | | | | | | | |
| | " | After extraction | 1.26 | 439 | 87 | 268 | 0.02 | 1.12 | | | | | | |
| 3355-3365 | " | MDST, med gy-dk gy | - | | | | | | | | | | | |
| | " | After extraction | 1.51 | 440 | 175 | 113 | 0.03 | 2.74 | | | | | | |
| 3370-3380 | " | MDST, med gy-dk gy + mnr SST, lt gy | - | | | | | | | | | | | |
| | " | After extraction | 1.11 | 444 | 99 | 105 | 0.02 | 1.12 | | | | | | |
| 3385-3395 | " | SLTST, med gy | 1.73 | | | | | | | | | | | |
| | " | After extraction | 1.13 | 445 | 108 | 107 | 0.02 | 1.25 | | | | | | |

Table 2b Chemical Analysis Data

WELL: WITHNELL-1

| GENERAL DATA | | | CHEMICAL ANALYSIS DATA | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PYROLYSIS | | | | | SOLVENT EXTRACTION | | | | | | |
| SAMPLE DEPTH (METRES) | SAMPLE TYPE | ANALYSED LITHOLOGY | ORGANIC CARBON % OF ROCK | TEMPERATURE C | HYDROGEN INDEX | OXYGEN INDEX | PRODUCTION INDEX | POTENTIAL YIELD (kg/Tonne) | TOTAL EXTRACT (ppm) | TOTAL EXTRACT (mg·g T O C) | HYDROCARBONS (ppm) | HYDROCARBONS (mg/g T O C) | EXTRACT COMPOSITION (%) | | |
| | | | | | | | | | | | | | SATURATED HYDROCARBONS | AROMATIC HYDROCARBONS | POLAR COMPOUNDS |
| 3395-3400 | Ctg | SLTST, lt-med gy | - | | | | | | | | | | | | |
| | " | After extraction | 1.12 | 444 | 94 | 69 | 0.03 | 1.08 | | | | | | | |
| 3400-3410 | " | MDST, med gy-dk gy | - | | | | | | | | | | | | |
| | " | After extraction | 1.25 | 444 | 80 | 153 | 0.03 | 1.03 | | | | | | | |
| 3415-3425 | " | MDST, dk gy + 40% SLTST, med gy | - | | | | | | | | | | | | |
| | P | MDST, dk gy | 0.88 | | | | | | | | | | | | |
| | P | SLTST, med gy | 0.59 | | | | | | | | | | | | |
| 3430-3440 | Ctg | MDST, med-dk gy, slty + 20% SLTST, lt-med gy | - | | | | | | | | | | | | |
| | P | MDST, a/a | 0.86 | | | | | | | | | | | | |
| | P | SLTST, lt-med gy | 0.41 | | | | | | | | | | | | |
| 3445-3455 | Ctg | MDST, med-dk gy, sndy | - | | | | | | | | | | | | |
| | " | After extraction | 1.40 | 443 | 121 | 126 | 0.02 | 1.73 | | | | | | | |
| 3460-3470 | " | MDST, med-dk gy, sndy | 2.34 | 442 | 133 | 75 | 0.10 | 3.47 | | | | | | | |
| | " | After extraction | 1.57 | 441 | 166 | 104 | 0.08 | 2.82 | | | | | | | |
| 3475-3485 | " | MDST, med-dk gy, slty | - | | | | | | | | | | | | |
| | " | After extraction | 1.69 | 443 | 124 | 92 | 0.03 | 2.15 | | | | | | | |
| 3490-3495 | " | MDST, med gy, slty | - | | | | | | | | | | | | |
| | " | After extraction | 1.12 | 442 | 154 | 246 | 0.02 | 1.76 | | | | | | | |
| 3505-3510 | " | MDST, med-dk gy, slty | - | | | | | | | | | | | | |
| | " | After extraction | 0.98 | | | | | | | | | | | | |
| 3505-3515 | " | MDST, a/a, calc | 1.29 | | | | | | | | | | | | |
| | " | After extraction | 1.21 | 444 | 107 | 136 | 0.02 | 1.32 | | | | | | | |
| 3530-3540 | " | MDST, med-dk gy | 2.35 | 443 | 115 | 55 | 0.13 | 3.10 | | | | | | | |
| | " | After extraction | 1.42 | 441 | 160 | 95 | 0.05 | 2.39 | | | | | | | |
| 3545-3555 | " | MDST, a/a | - | | | | | | | | | | | | |
| | " | After extraction | 1.40 | 440 | 150 | 156 | 0.04 | 2.18 | | | | | | | |
| 3560-3570 | " | MDST, a/a | - | | | | | | | | | | | | |
| | " | After extraction | 1.40 | 439 | 134 | 99 | 0.04 | 1.95 | | | | | | | |
| 3575-3585 | " | MDST, med gy, slty | - | | | | | | | | | | | | |
| | " | After extraction | 1.71 | 439 | 190 | 135 | 0.04 | 3.39 | | | | | | | |
| 3590-3600 | " | MDST, med dk gy, slty | - | | | | | | | | | | | | |
| | " | After extraction | 1.83 | 441 | 160 | 54 | 0.01 | 2.95 | | | | | | | |
| 3605-3615 | " | MDST, med dk gy-dk gy, slty | 1.72 | 440 | 179 | 47 | 0.08 | 3.35 | | | | | | | |
| | " | After extraction | 1.71 | 443 | 225 | 50 | 0.04 | 4.00 | | | | | | | |
| 3615-3620 | " | MDST, med gy, slty | - | | | | | | | | | | | | |
| | " | After extraction | 1.62 | 443 | 170 | 65 | 0.01 | 2.78 | | | | | | | |

Table 2c Chemical Analysis Data

WELL: WITHNELL-1

| GENERAL DATA | | | CHEMICAL ANALYSIS DATA | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PYROLYSIS | | | | | SOLVENT EXTRACTION | | | | | | |
| | | | | | | | | | | | | | EXTRACT COMPOSITION | | |
| SAMPLE DEPTH (METRES) | SAMPLE TYPE | ANALYSED LITHOLOGY | ORGANIC CARBON % OF ROCK | TEMPERATURE C | HYDROGEN INDEX | OXYGEN INDEX | PRODUCTION INDEX | POTENTIAL YIELD (kg Tonne) | TOTAL EXTRACT (ppm) | TOTAL EXTRACT (mg g T O C) | HYDROCARBONS (ppm) | HYDROCARBONS (mg g T O C) | SATURATED HYDROCARBONS | AROMATIC HYDROCARBONS | POLAR COMPOUNDS |
| 3610-3620 | Ctg | MDST, med gy, calc | 1.70 | | | | | | | | | | | | |
| | " | After extraction | 1.52 | 443 | 89 | 65 | 0.04 | 1.40 | | | | | | | |
| 3620-3630 | " | MDST, med gy, slty | - | | | | | | | | | | | | |
| | " | After extraction | 1.49 | 444 | 154 | 67 | 0.03 | 2.36 | | | | | | | |
| 3635-3645 | " | MDST, med-dk gy, slty | - | | | | | | | | | | | | |
| | " | After extraction | 1.36 | 442 | 124 | 100 | 0.01 | 1.70 | | | | | | | |
| 3650-3660 | " | MDST, med gy, slty | - | | | | | | | | | | | | |
| | " | After extraction | 1.41 | 448 | 182 | 70 | 0.02 | 2.62 | | | | | | | |
| 3665-3675 | " | MDST, med-dk gy, slty | 1.34 | 437 | 49 | 99 | 0.12 | 0.74 | | | | | | | |
| | " | After extraction | 1.31 | 442 | 148 | 85 | 0.02 | 1.98 | | | | | | | |
| 3680-3690 | " | MDST, a/a | - | | | | | | | | | | | | |
| | " | After extraction | 1.62 | 444 | 147 | 86 | 0.01 | 2.40 | | | | | | | |
| 3695-3705 | " | MDST, med dk gy-dk gy, slty | - | | | | | | | | | | | | |
| | " | After extraction | 1.37 | 446 | 117 | 112 | 0.01 | 1.62 | | | | | | | |
| 3710-3720 | " | MDST, med-dk gy, slty | - | | | | | | | | | | | | |
| | " | After extraction | 1.55 | 446 | 112 | 87 | 0.01 | 1.75 | | | | | | | |
| 3720-3730 | " | MDST, ol gy, sl calc | 1.53 | | | | | | 2185 | 143 | 1410 | 92 | 54 | 11 | 35 |
| | " | After extraction | 1.91 | 443 | 260 | 77 | 0.02 | 5.08 | | | | | | | |
| 3725-3735 | " | MDST, med gy, slty | 2.51 | 440 | 251 | 51 | 0.10 | 7.00 | | | | | | | |
| | " | After extraction | 1.79 | 444 | 202 | 73 | 0.01 | 3.66 | | | | | | | |
| 3740-3750 | " | MDST, med gy-dk gy, slty | - | | | | | | | | | | | | |
| | " | After extraction | 1.73 | 443 | 162 | 67 | 0.01 | 2.83 | | | | | | | |
| 3760-3770 | " | MDST, med dk gy, slty | - | | | | | | | | | | | | |
| | " | After extraction | 1.85 | 447 | 197 | 59 | 0.01 | 3.68 | | | | | | | |
| 3775-3785 | " | MDST, med dk gy-dk gy, slty | - | | | | | | | | | | | | |
| | " | After extraction | 2.46 | 448 | 257 | 22 | 0.01 | 6.38 | | | | | | | |
| 3790-3800 | " | MDST, a/a | - | | | | | | | | | | | | |
| | " | After extraction | 3.59 | 443 | 268 | 43 | 0.00 | 9.65 | | | | | | | |
| 3805-3815 | " | MDST, dk gy + 10% LST, wht-lt gy | - | | | | | | | | | | | | |
| | P | MDST, dk gy | 4.42 | | | | | | | | | | | | |
| | P | After extraction | 4.28 | 444 | 329 | 18 | 0.01 | 14.19 | | | | | | | |
| 3820-3830 | Ctg | MDST, med dk gy, slty | - | | | | | | | | | | | | |
| | " | After extraction | 3.23 | 444 | 164 | 41 | 0.00 | 5.31 | | | | | | | |
| 3830-3835 | " | MDST, med-dk gy, slty | - | | | | | | | | | | | | |
| | " | After extraction | 3.42 | 443 | 265 | 45 | 0.01 | 9.15 | | | | | | | |

Table 2d Chemical Analysis Data

WELL: WITHNELL-1

| GENERAL DATA | | | CHEMICAL ANALYSIS DATA | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PYROLYSIS | | | | | SOLVENT EXTRACTION | | | | | | |
| SAMPLE DEPTH (METRES) | SAMPLE TYPE | ANALYSED LITHOLOGY | ORGANIC CARBON % Of ROCK | TEMPERATURE C | HYDROGEN INDEX | OXYGEN INDEX | PRODUCTION INDEX | POTENTIAL YIELD (kg Tonne) | TOTAL EXTRACT (ppm) | TOTAL EXTRACT (mg g T O C) | HYDROCARBONS (ppm) | HYDROCARBONS (mg g T O C) | EXTRACT COMPOSITION | | |
| | | | | | | | | | | | | | SATURATED HYDROCARBONS | AROMATIC HYDROCARBONS | POLAR COMPOUNDS |
| 3830-3840 | Ctg | MDST, dk gy + 20% MDST, ol gy, calc | - | | | | | | | | | | | | |
| | P | MDST, dk gy | 3.60 | | | | | | | | | | | | |
| | P | After extraction | 3.97 | 442 | 252 | 34 | 0.02 | 10.21 | | | | | | | |
| | P | MDST, ol gy, calc | 2.74 | | | | | | | | | | | | |
| | P | After extraction | 2.64 | 442 | 212 | 70 | 0.04 | 5.85 | | | | | | | |
| 3835-3845 | Ctg | MDST, dk gy-gy blk | 4.63 | 442 | 267 | 28 | 0.11 | 13.92 | | | | | | | |
| | " | After extraction | 3.50 | 446 | 253 | 34 | 0.01 | 8.98 | | | | | | | |
| 3850-3860 | " | MDST, med dk gy-dk gy | - | | | | | | | | | | | | |
| | " | After extraction | 3.07 | 444 | 127 | 51 | 0.00 | 3.91 | | | | | | | |
| 3865-3875 | " | MDST, med-dk gy + 10% MDST, gy blk | - | | | | | | | | | | | | |
| | P | MDST, med-dk gy | 2.94 | | | | | | | | | | | | |
| | P | After extraction | 3.09 | 442 | 204 | 36 | 0.03 | 6.51 | | | | | | | |
| | P | MDST, gy blk | 2.10 | | | | | | | | | | | | |
| | P | After extraction | 2.29 | 447 | 161 | 57 | 0.05 | 3.89 | | | | | | | |
| 3880-3890 | Ctg | MDST, med-dk gy | - | | | | | | | | | | | | |
| | " | After extraction | 2.62 | 448 | 102 | 47 | 0.01 | 2.69 | | | | | | | |
| 3895-3905 | " | MDST, med dk gy-dk gy | 2.81 | | | | | | | | | | | | |
| | " | After extraction | 2.33 | 445 | 106 | 33 | 0.02 | 2.52 | | | | | | | |
| 3910-3920 | " | MDST, med dk gy + mnr bit (blk) | 3.37 | 444 | 124 | 57 | 0.13 | 4.79 | | | | | | | |
| | " | After extraction | 2.51 | 445 | 112 | 59 | 0.05 | 2.94 | | | | | | | |
| 3925-3935 | " | MDST, med dk gy | - | | | | | | | | | | | | |
| | " | After extraction | 2.90 | 447 | 94 | 44 | 0.02 | 2.80 | | | | | | | |
| 3940-3945 | " | MDST, med-dk gy, slty | - | | | | | | | | | | | | |
| | " | After extraction | 3.06 | 447 | 76 | 60 | 0.03 | 2.39 | | | | | | | |
| 3940-3950 | " | MDST, med gy-lt ol gy, calc | 2.82 | | | | | | | | | | | | |
| | " | After extraction | 2.88 | 444 | 82 | 60 | 0.06 | 2.52 | | | | | | | |
| 3945-3950 | " | MDST, med-dk gy, slty | - | | | | | | | | | | | | |
| | " | After extraction | 3.13 | 444 | 85 | 54 | 0.05 | 2.82 | | | | | | | |
| 3950-3955 | " | MDST, dk gy + mnr LST | - | | | | | | | | | | | | |
| | " | After extraction | 2.39 | 453 | 76 | 36 | 0.01 | 1.82 | | | | | | | |
| 4050-4055 | " | MDST, a/a | - | | | | | | | | | | | | |
| | " | After extraction | 2.80 | 450 | 77 | 34 | 0.02 | 2.19 | | | | | | | |
| 4050-4060 | " | MDST, med gy-lt ol-gy | 2.89 | | | | | | | | | | | | |
| | " | After extraction | 3.09 | 449 | 71 | 40 | 0.05 | 2.30 | | | | | | | |

Table 2e Chemical Analysis Data

WELL: WITHNELL-1

| GENERAL DATA | | | CHEMICAL ANALYSIS DATA | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PYROLYSIS | | | | | SOLVENT EXTRACTION | | | | | |
| | | | | | | | | | | | | | EXTRACT COMPOSITION % | |
| SAMPLE DEPTH (METRES) | SAMPLE TYPE | ANALYSED LITHOLOGY | ORGANIC CARBON % OF ROCK | TEMPERATURE C | HYDROGEN INDEX | OXYGEN INDEX | PRODUCTION INDEX | POTENTIAL YIELD (kg Tonne) | TOTAL EXTRACT (ppm) | TOTAL EXTRACT (mg/g TOC) | HYDROCARBONS (ppm) | HYDROCARBONS (mg/g TOC) | SATURATED HYDROCARBONS | AROMATIC HYDROCARBONS | POLAR COMPOUNDS |
| 4055-4060 | Ctg | MDST, med gy-dk gy, slty | - | | | | | | | | | | | | |
| | " | After extraction | 2.66 | 456 | 75 | 32 | 0.01 | 2.02 | | | | | | | |
| 4060-4065 | " | MDST, med gy-dk gy, slty | - | | | | | | | | | | | | |
| | " | After extraction | 2.93 | 450 | 81 | 43 | 0.03 | 2.45 | | | | | | | |
| 4115-4125 | " | MDST, dk gy + 20% SLTST, lt-med gy | - | | | | | | | | | | | | |
| | P | MDST, dk gy | 2.36 | | | | | | | | | | | | |
| | P | After extraction | 2.02 | 458 | 93 | 20 | 0.01 | 1.90 | | | | | | | |
| | P | SLTST, lt med gy | 0.80 | | | | | | | | | | | | |
| 4170-4180 | Ctg | MDST, ol gy, calc | 3.77 | 439 | 93 | 45 | 0.21 | 4.40 | | | | | | | |
| | " | After extraction | 3.76 | 443 | 49 | 45 | 0.09 | 2.01 | | | | | | | |
| 4270-4280 | Ctg | MDST, a/a | 2.95 | | | | | | | | | | | | |
| | " | After extraction | 3.00 | 440 | 41 | 67 | 0.05 | 1.29 | | | | | | | |
| 4330-4340 | " | MDST, dk gy + 10% LST, wht | - | | | | | | | | | | | | |
| | P | MDST, dk gy | 2.07 | | | | | | | | | | | | |
| | " | After extraction | 2.61 | 445 | 50 | 32 | 0.13 | 1.49 | | | | | | | |
| | " | LST, wht | 1.87 | | | | | | | | | | | | |
| | " | After extraction | 3.23 | 442 | 29 | 51 | 0.11 | 1.05 | | | | | | | |
| 4390-4400 | Ctg | MDST, a/a | 1.65 | | | | | | 1370 | 83 | 1100 | 67 | 78 | 2 | 20 |
| | " | After extraction | 2.52 | 438 | 55 | 56 | 0.03 | 1.44 | | | | | | | |
| 4442 | | ?Middle Dingo Claystone | | | | | | | | | | | | | |
| 4455-4465 | Ctg | MDST, dk gy + 30% SND/SST, wht-med gy | - | | | | | | | | | | | | |
| | P | MDST, dk gy | 1.32 | | | | | | | | | | | | |
| | P | After extraction | 1.43 | 469 | 54 | 62 | 0.12 | 0.87 | | | | | | | |
| | P | SND/SST, wht, med gy | 0.35 | | | | | | | | | | | | |
| 4505-4515 | Ctg | MDST, a/a | 3.33 | | | | | | | | | | | | |
| | " | After extraction | 3.01 | 449 | 54 | 95 | 0.03 | 1.68 | | | | | | | |
| 4545-4555 | " | MDST, med dk gy-dk gy + mnr SND | 3.25 | | | | | | | | | | | | |
| | " | After extraction | 4.11 | 445 | 38 | 65 | 0.03 | 1.60 | | | | | | | |
| 4585-4595 | " | MDST, a/a + 50% SST/SND, wht-lt gy | - | | | | | | | | | | | | |
| | P | MDST, med dk gy-dk gy | 1.04 | | | | | | | | | | | | |
| | P | After extraction | 1.99 | 479 | 21 | 31 | 0.16 | 0.50 | | | | | | | |
| 4615-4625 | Ctg | MDST, a/a | 3.30 | | | | | | | | | | | | |
| | " | After extraction | 2.90 | 456 | 53 | 121 | 0.03 | 1.58 | | | | | | | |

Table 2f Chemical Analysis Data

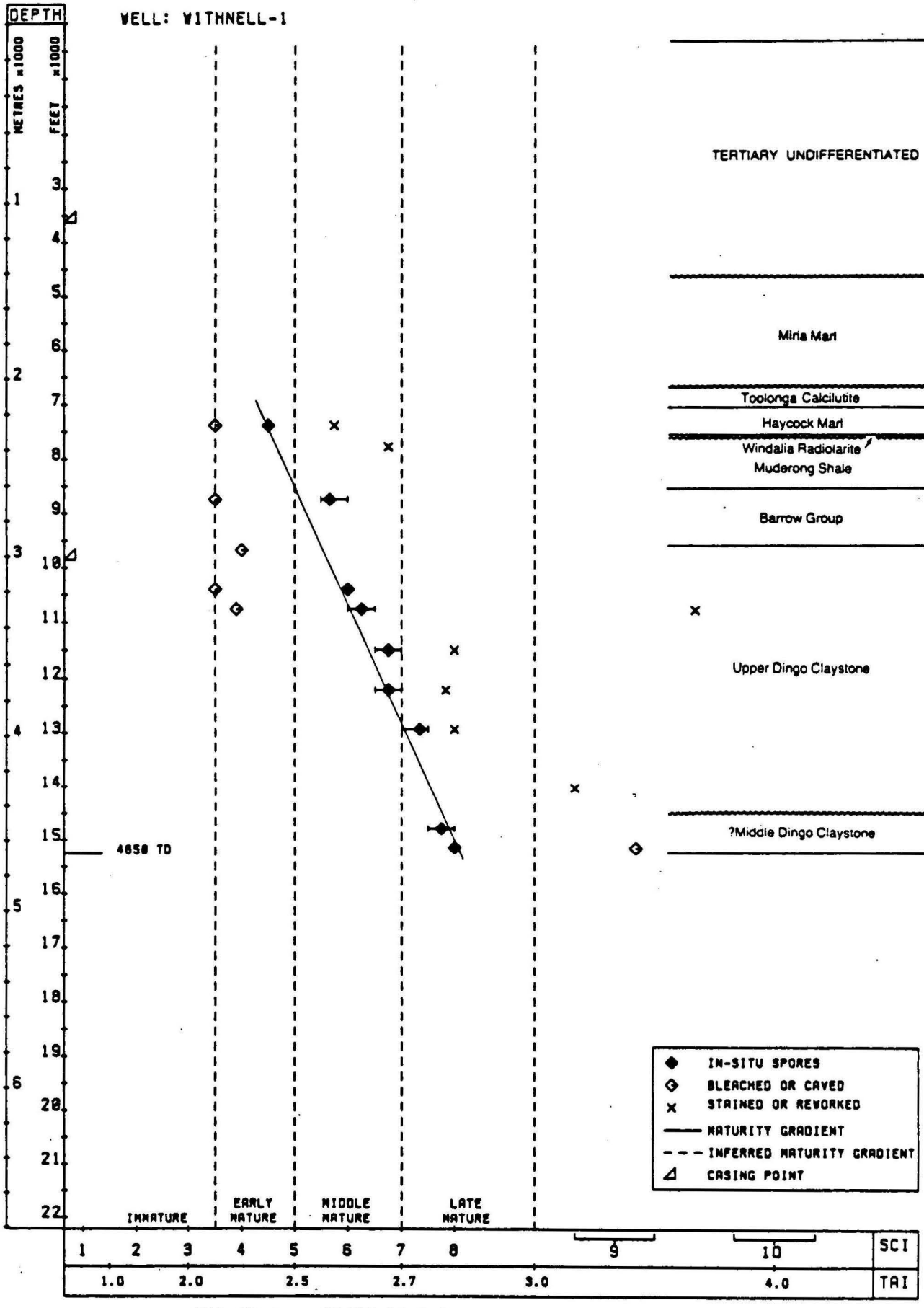



FIGURE 1 SPORE COLOUR INDEX AGAINST DEPTH

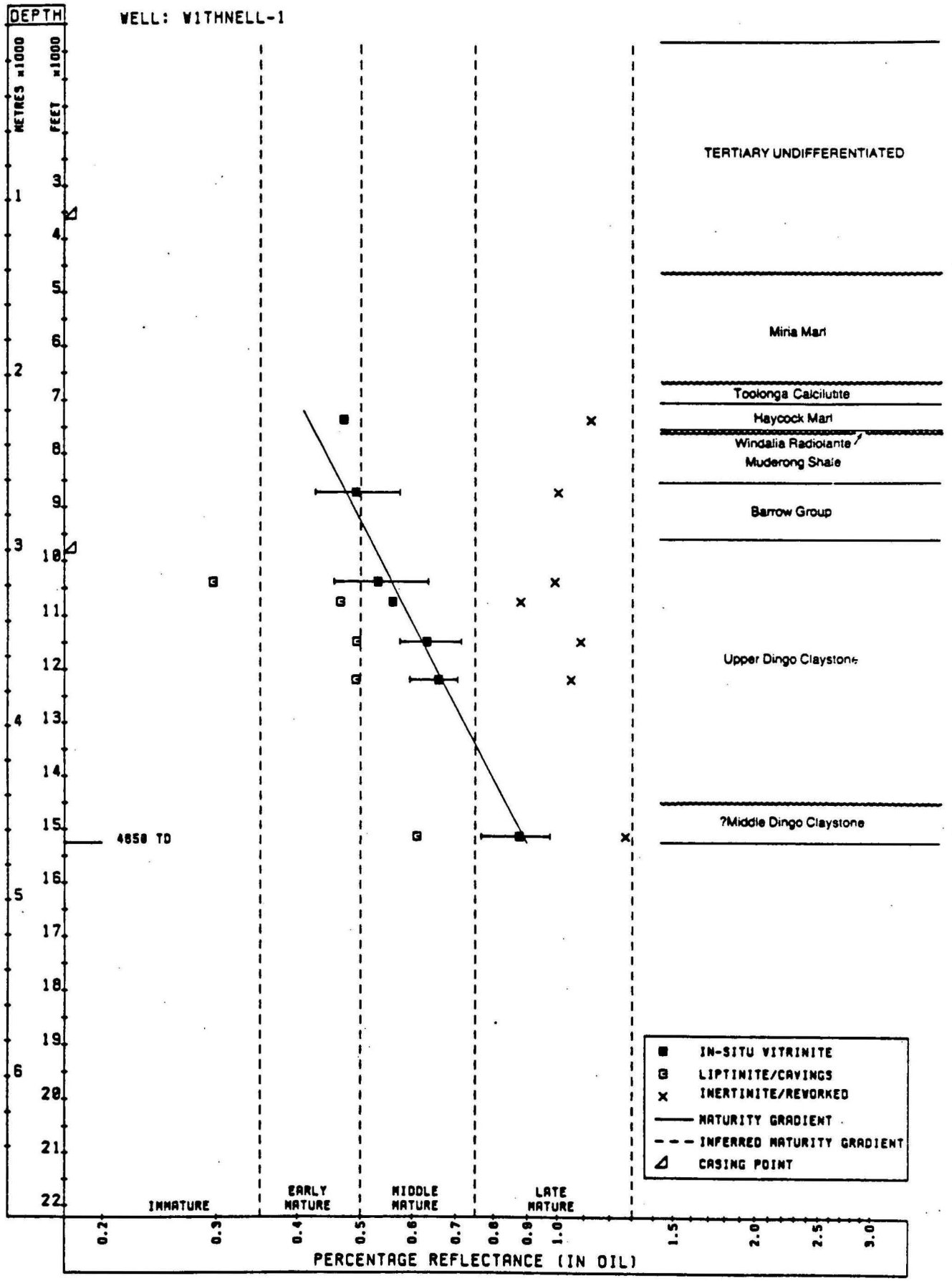
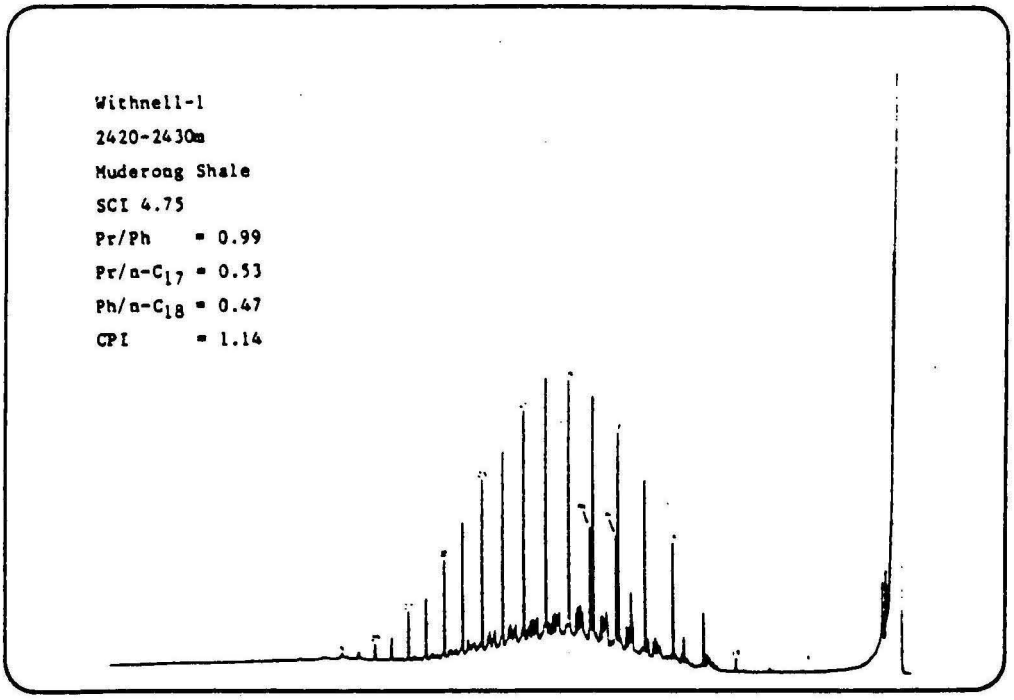
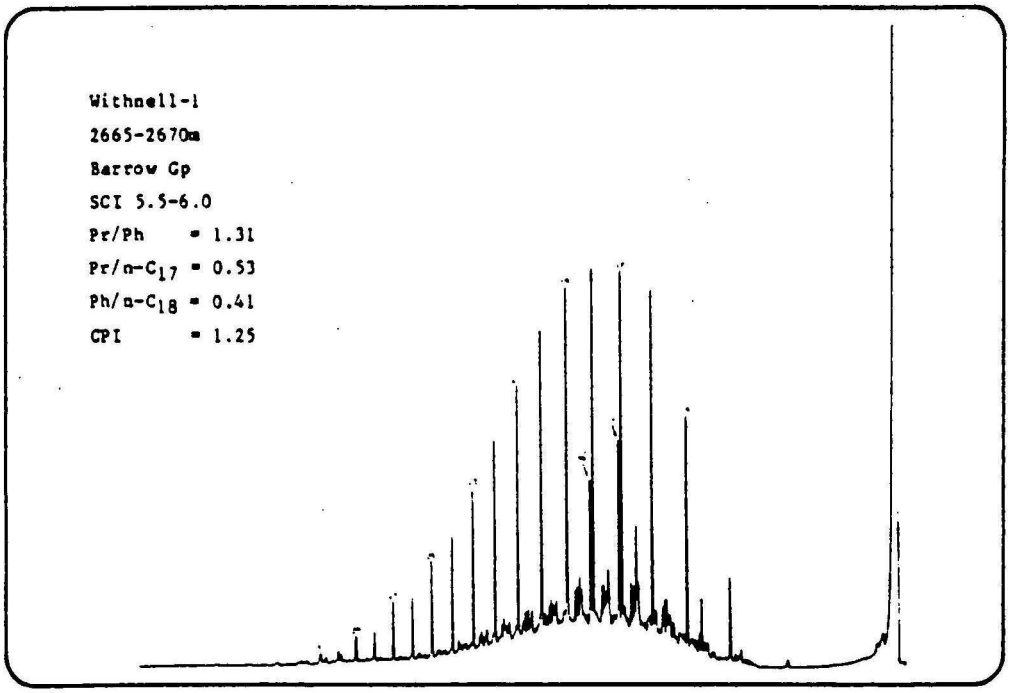



FIGURE 2 VITRINITE REFLECTANCE AGAINST DEPTH


Withnell-1
2420-2430m
Muderong Shale
SCI 4.75
Pr/Ph = 0.99
Pr/n-C17 = 0.53
Ph/n-C18 = 0.47
CPI = 1.14


Withnell-1
2665-2670m
Barrow Gp
SCI 5.5-6.0
Pr/Ph = 1.31
Pr/n-C17 = 0.53
Ph/n-C18 = 0.41
CPI = 1.25

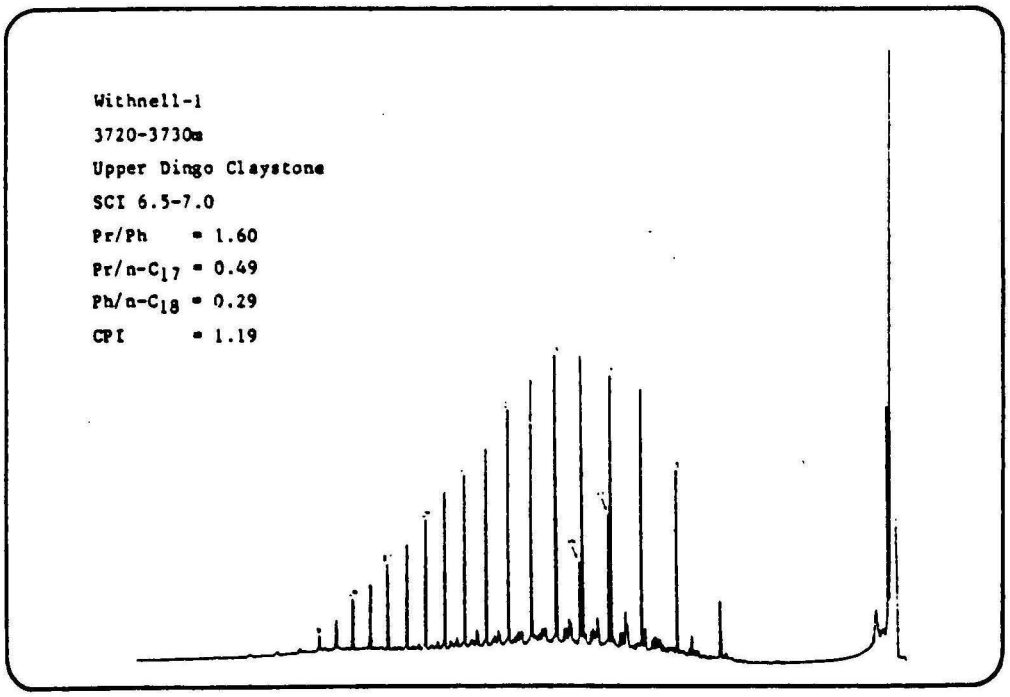

Withnell-1
3720-3730m
Upper Dingo Claystone
SCI 6.5-7.0
Pr/Ph = 1.60
Pr/n-C17 = 0.49
Ph/n-C18 = 0.29
CPI = 1.19

Figure 3a

Withnell-1

4390-4400m

Upper Dingo Claystone

SCI 7.25

Pr/Ph = 2.11

Pr/n-$C_{17}$ = 0.35

Ph/n-$C_{18}$ = 0.17

CPI = 1.07

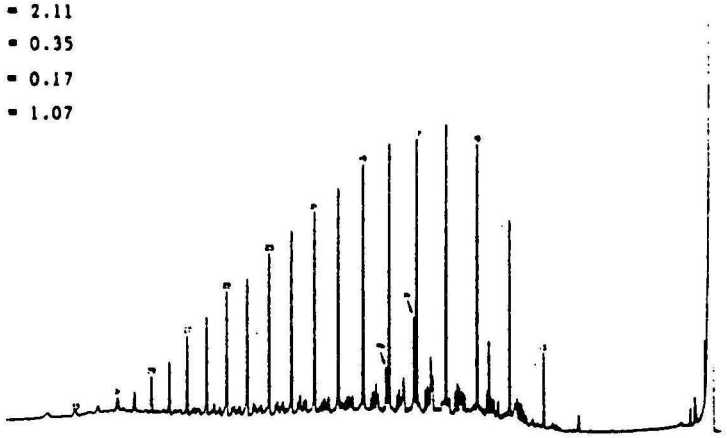


Figure 3b

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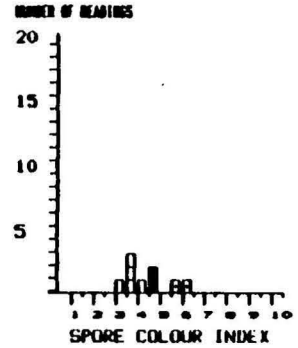
WITHNELL-1

IN SITU POPULATION

SAMPLE 2250-2265M

3.0 3.5 3.5 3.5 4.0 4.5 4.5 5.5 6.0

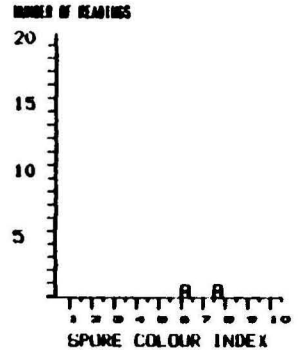
| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 4.5-4.5 | 2 |
| BLEACHED OR CAVED | 3.0-4.0 | 5 |
| STAINED OR REWORKED | 5.5-6.0 | 2 |




SAMPLE 2370-2380M

6.0 7.5

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | - | 0 |
| BLEACHED OR CAVED | - | 0 |
| STAINED OR REWORKED | 6.0-7.5 | 2 |



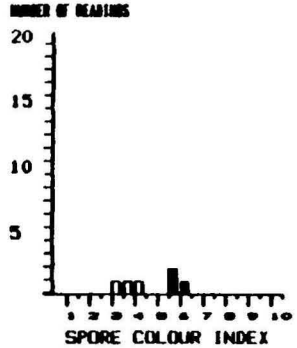

WITHNELL-1

IN SITU POPULATION

SAMPLE 2665-2670M

3.0 3.5 4.0 5.5 5.5 6.0

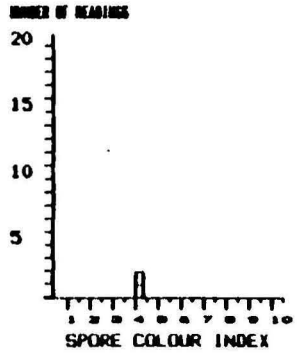
| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 5.5-6.0 | 3 |
| BLEACHED OR CAVED | 3.0-4.0 | 3 |
| STAINED OR REWORKED | - | 0 |




SAMPLE 2950-2960M

4.0 4.0

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | - | 0 |
| BLEACHED OR CAVED | 4.0-4.0 | 2 |
| STAINED OR REWORKED | - | 0 |




Appendix 1a

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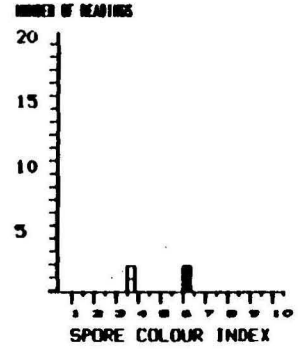
WITHNELL-1

IN SITU POPULATION

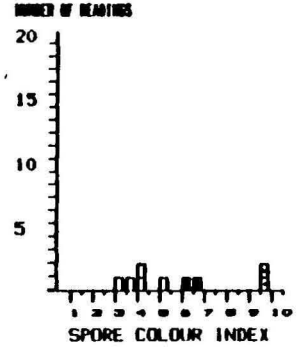
SAMPLE 3170-3180M
3.5 3.5 6.0 6.0

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 6.0-6.0 | 2 |
| BLEACHED OR CAVED | 3.5-3.5 | 2 |
| STAINED OR REWORKED | - | 0 |




SAMPLE 3280-3290M
3.0 3.5 4.0 4.0 5.0 6.0 6.5 9.5 9.5

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 6.0-6.5 | 2 |
| BLEACHED OR CAVED | 3.0-5.0 | 5 |
| STAINED OR REWORKED | 9.5-9.5 | 2 |

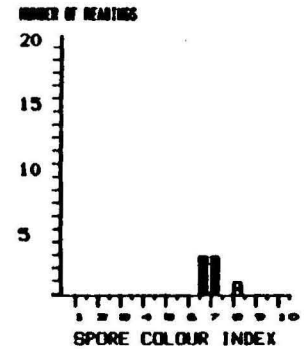



WITHNELL-1

IN SITU POPULATION

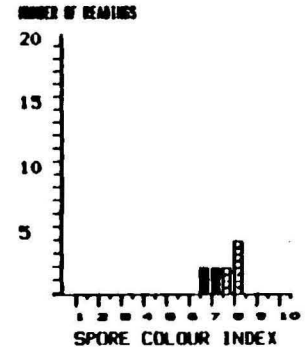
SAMPLE 3505-3515M
6.5 6.5 6.5 7.0 7.0 7.0 8.0

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 6.5-7.0 | 6 |
| BLEACHED OR CAVED | - | 0 |
| STAINED OR REWORKED | 8.0-8.0 | 1 |




SAMPLE 3720-3730M
6.5 6.5 7.0 7.0 7.5 7.5 8.0 8.0 8.0 8.0

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 6.5-7.0 | 4 |
| BLEACHED OR CAVED | - | 0 |
| STAINED OR REWORKED | 7.5-8.0 | 6 |




Appendix 1b

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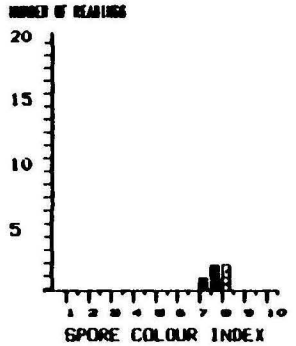
Appendix 1c

WITHNELL-1

IN SITU POPULATION

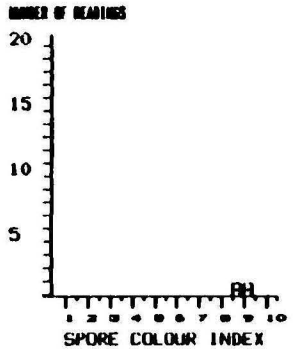
SAMPLE 3940-3950M
7.0 7.5 7.5 8.0 8.0

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 7.0-7.5 | 3 |
| BLEACHED OR CAVED | - | 0 |
| STAINED OR REWORKED | 8.0-8.0 | 2 |




SAMPLE 4270-4280M
8.5 9.0

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | - | 0 |
| BLEACHED OR CAVED | - | 0 |
| STAINED OR REWORKED | 8.5-9.0 | 2 |

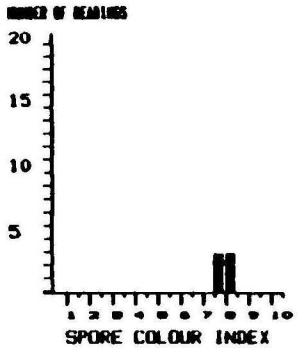



WITHNELL-1

IN SITU POPULATION

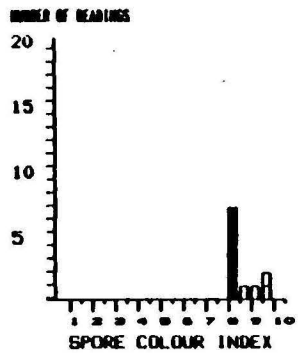
SAMPLE 4505-4515M
7.5 7.5 7.5 8.0 8.0 8.0

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 7.5-8.0 | 6 |
| BLEACHED OR CAVED | - | 0 |
| STAINED OR REWORKED | - | 0 |




SAMPLE 4615-4625M
8.0 8.0 8.0 8.0 8.0 8.0 8.0 8.5 9.0 9.5
9.5

| SELECTED CLASS | RANGE | COUNT |
|---|---|---|
| IN-SITU SPORES | 8.0-8.0 | 7 |
| BLEACHED OR CAVED | 8.5-9.5 | 4 |
| STAINED OR REWORKED | - | 0 |



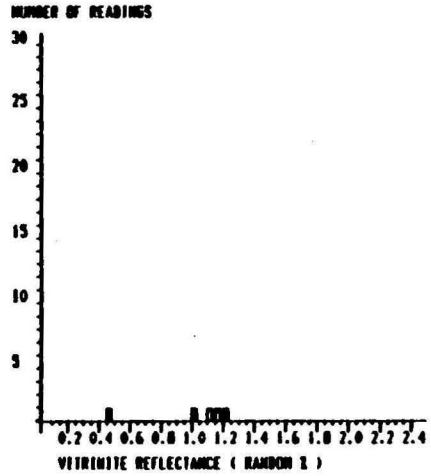
Robertson Research

WITHNELL-1

SAMPLE 2250-2265M

0.47 1.00 1.11 1.18 1.21

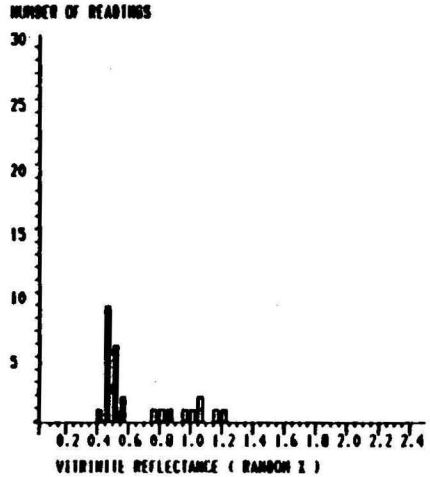
| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.47-0.47 | 1 | 0.47 | |
| INERTINITE/REWORKED | 1.00-1.21 | 4 | 1.13 | 0.09 |




SAMPLE 2665-2670M

0.43 0.45 0.45 0.46 0.46 0.47 0.47 0.47 0.48 0.48
0.50 0.50 0.51 0.51 0.54 0.54 0.55 0.57 0.78 0.84
0.87 0.99 1.03 1.05 1.09 1.17 1.21

| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.43-0.57 | 18 | 0.49 | 0.04 |
| INERTINITE/REWORKED | 0.78-1.21 | 9 | 1.00 | 0.15 |

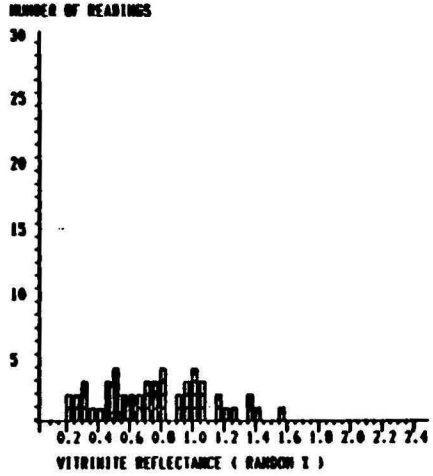



WITHNELL-1

SAMPLE 3170-3180M

0.22 0.24 0.25 0.25 0.30 0.31 0.31 0.37 0.42 0.46
0.47 0.47 0.50 0.51 0.52 0.52 0.55 0.59 0.62 0.63
0.68 0.68 0.72 0.73 0.73 0.75 0.76 0.76 0.82 0.83
0.84 0.84 0.94 0.94 0.95 0.97 0.99 1.01 1.02 1.04
1.04 1.05 1.07 1.09 1.17 1.17 1.21 1.23 1.35 1.36
1.42 1.55

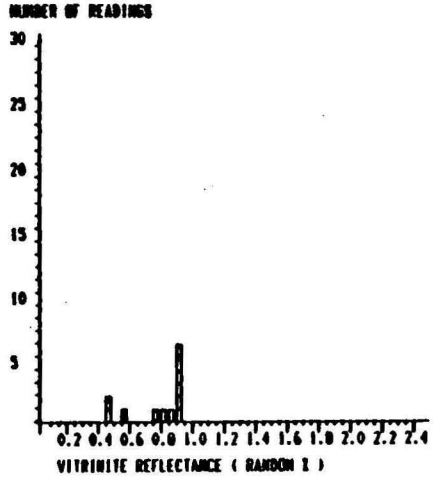
| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.46-0.63 | 11 | 0.53 | 0.06 |
| LIPTINITE/CAVINGS | 0.22-0.42 | 9 | 0.30 | 0.07 |
| INERTINITE/REWORKED | 0.68-1.55 | 32 | 0.99 | 0.23 |




SAMPLE 3280-3290M

0.45 0.48 0.56 0.75 0.80 0.87 0.90 0.90 0.91 0.91
0.93 0.94

| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.56-0.56 | 1 | 0.56 | |
| LIPTINITE/CAVINGS | 0.45-0.48 | 2 | 0.47 | 0.02 |
| INERTINITE/REWORKED | 0.75-0.94 | 9 | 0.88 | 0.06 |




Appendix 2a

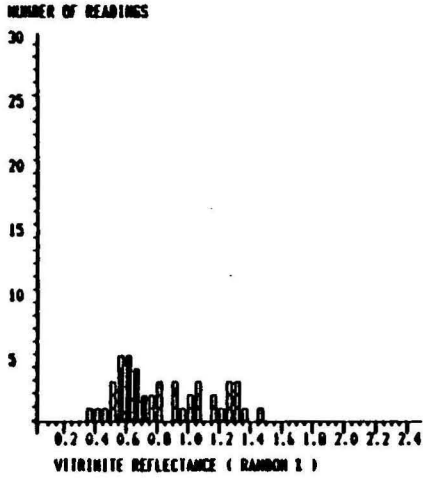
Robertson Research

VITHKELL-1

SAMPLE 3505-3515M

0.39 0.42 0.48 0.52 0.54 0.54 0.56 0.58 0.59 0.59
0.59 0.60 0.61 0.61 0.61 0.62 0.65 0.65 0.68 0.69
0.70 0.71 0.77 0.77 0.80 0.81 0.82 0.92 0.92 0.94
0.97 1.02 1.03 1.06 1.08 1.09 1.17 1.18 1.22 1.25
1.29 1.29 1.30 1.31 1.33 1.35 1.47

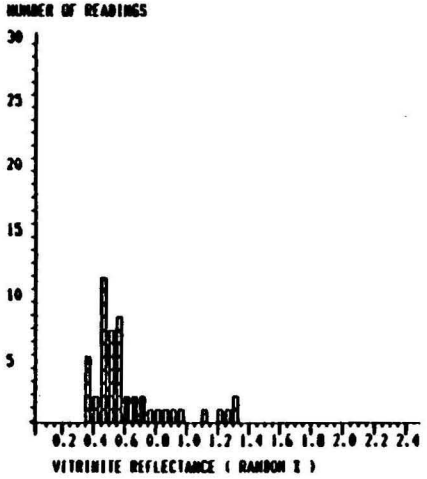
| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.58-0.71 | 15 | 0.63 | 0.04 |
| LIPTINITE/CAVINGS | 0.39-0.56 | 7 | 0.49 | 0.07 |
| INERTINITE/REWORKED | 0.77-1.47 | 25 | 1.09 | 0.21 |




SAMPLE 3720-3730M

0.35 0.36 0.37 0.38 0.39 0.42 0.43 0.47 0.47 0.48
0.48 0.48 0.48 0.48 0.48 0.48 0.49 0.49 0.50 0.50
0.51 0.51 0.54 0.54 0.54 0.56 0.56 0.57 0.58 0.58
0.58 0.58 0.59 0.60 0.64 0.65 0.66 0.70 0.70 0.77
0.82 0.86 0.92 0.95 1.10 1.21 1.25 1.30 1.32

| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.60-0.70 | 6 | 0.66 | 0.04 |
| LIPTINITE/CAVINGS | 0.35-0.59 | 33 | 0.49 | 0.07 |
| INERTINITE/REWORKED | 0.77-1.32 | 10 | 1.05 | 0.21 |

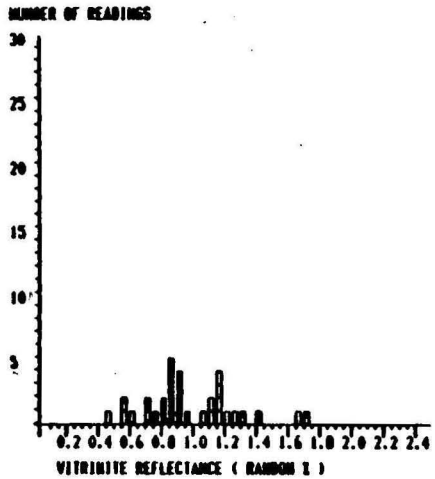



VITHKELL-1

SAMPLE 4615-4625M

0.48 0.57 0.59 0.61 0.70 0.71 0.77 0.80 0.82 0.85
0.86 0.87 0.87 0.88 0.90 0.91 0.93 0.94 0.97 1.06
1.10 1.11 1.15 1.15 1.16 1.19 1.20 1.25 1.33 1.41
1.67 1.70

| SELECTED CLASS | RANGE (%) | COUNT | AV(%) | ST.DEV |
|---|---|---|---|---|
| IN SITU VITRINITE | 0.77-0.97 | 13 | 0.87 | 0.06 |
| LIPTINITE/CAVINGS | 0.48-0.71 | 6 | 0.61 | 0.09 |
| INERTINITE/REWORKED | 1.06-1.70 | 13 | 1.27 | 0.21 |




Appendix 2b

WELL:

| GENERAL DATA | | | CHEMICAL ANALYSIS DATA | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PYROLYSIS | | | | | SOLVENT EXTRACTION | | | | | | |
| | | | | | | | | | | | | | EXTRACT COMPOSITION (%) | | |
| SAMPLE DEPTH (METRES) | SAMPLE TYPE | ANALYSED LITHOLOGY | ORGANIC CARBON % OF ROCK | TEMPERATURE C | HYDROGEN INDEX | OXYGEN INDEX | PRODUCTION INDEX | POTENTIAL YIELD (kg/Tonne) | TOTAL EXTRACT (ppm) | TOTAL EXTRACT (mg/g TOC) | HYDROCARBONS (ppm) | HYDROCARBONS (mg/g TOC) | SATURATED HYDROCARBONS | AROMATIC HYDROCARBONS | POLAR COMPOUNDS |
| | | **Barrow Deep-1** | | | | | | | | | | | | | |
| 3244-3256 | Ctg | SST, wht-lt brn + mnr MDST, med-dk gy | 1.03 | | | | | | 955 | 93 | 500 | 49 | 44 | 8 | 48 |
| 3329-3341 | " | SST, a/a + mnr MDST, a/a | 1.31 | | | | | | 860 | 66 | 415 | 32 | 43 | 5 | 52 |
| 3427-3439 | " | SND + SST, a/a + mnr MDST, med- dk gy | 1.11 | | | | | | 500 | 45 | 230 | 21 | 39 | 7 | 54 |
| | | **Delambre-1** | | | | | | | | | | | | | |
| 5380-5405 | Ctg | SST, wht, lt gy, calc in parts + 20% MDST, med-dk gy | 0.71 | | | | | | 720 | 101 | 220 | 31 | 20 | 10 | 70 |
| | | **Haycock-1** | | | | | | | | | | | | | |
| 1006-1007 | Core | SST, yel gy, arg + SST, gy-org | 0.62 | | | | | | 2180 | 352 | 1850 | 298 | 70 | 15 | 15 |
| 1018-1023 | " | SST, lt gy + 40% MDST, med gy | 1.30 | | | | | | 1070 | 82 | 620 | 48 | 42 | 16 | 42 |
| | | **Hilda-1A** | | | | | | | | | | | | | |
| 814-825 | Ctg | SLTST, yel gy-pal yel brn, v arg | 1.28 | | | | | | 1615 | 126 | 1440 | 113 | 79 | 10 | 11 |
| | | **Long Island-1** | | | | | | | | | | | | | |
| 1879 | Core | SST, wht-pal yel, arkosic | 0.27 | | | | | | 710 | 263 | 680 | 252 | 92 | 4 | 4 |
| | | **North Rankin-1** | | | | | | | | | | | | | |
| 2438 | Core | SST, yel gy, lam | 0.64 | | | | | | 5355 | 837 | 4410 | 689 | 61 | 21 | 17 |
| 2439 | Core | SST, a/a | 0.71 | | | | | | 6165 | 868 | 5185 | 730 | 63 | 21 | 16 |
| 2573-2588 | Ctg | LST, wht + 40% MDST, lt-med gy | 0.43 | | | | | | 3690 | 858 | 2925 | 680 | 62 | 17 | 21 |
| 3009-3015 | " | SND + SST, wht-lt gy + 40% MDST, med gy | 1.37 | | | | | | 770 | 56 | 480 | 35 | 49 | 13 | 38 |
| 3250-3256 | " | SND + SST, a/a + 40% MDST, lt-med gy, occ slty | 0.53 | | | | | | 470 | 89 | 270 | 51 | 47 | 10 | 43 |
| | | **Parker-1** | | | | | | | | | | | | | |
| 1271-1276 | Ctg | SLTST, dk ol gy, v arg | 2.14 | | | | | | 2150 | 101 | 1140 | 53 | 43 | 10 | 47 |
| | | **Poissonier-1** | | | | | | | | | | | | | |
| 1640-1665 | Ctg | MDST, lt gy, sndy, slty | 1.14 | | | | | | 670 | 59 | 375 | 33 | 52 | 4 | 44 |
| 1665-1690 | " | MDST, a/a | 1.14 | | | | | | 755 | 66 | 420 | 37 | 50 | 6 | 44 |
| | | **Pueblo-1** | | | | | | | | | | | | | |
| 2870-2885 | Ctg | LST, lt gy gn | 0.46 | | | | | | 955 | 208 | 610 | 133 | 53 | 11 | 36 |
| | | **Rankin-1** | | | | | | | | | | | | | |
| 2930-2942 | Ctg | SND + mnr MDST, lt-med dk gy | 0.78 | | | | | | 475 | 61 | 270 | 35 | 51 | 6 | 43 |

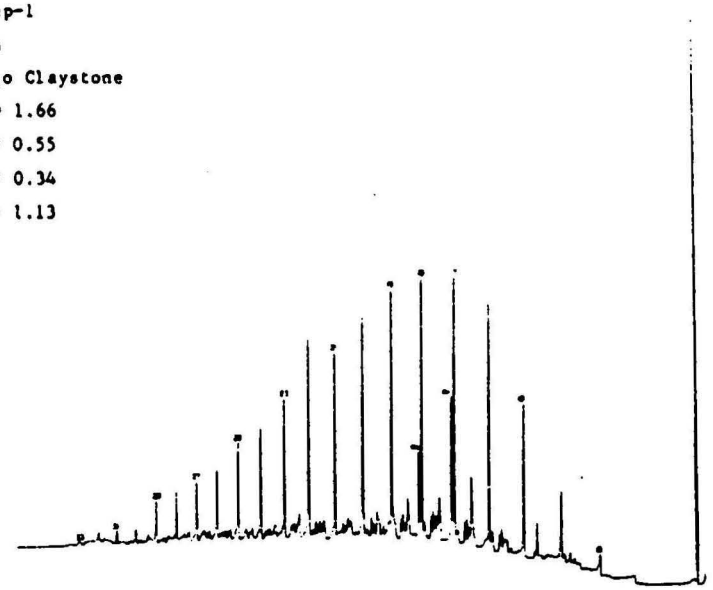
Table 2a Chemical Analysis Data

WELL:

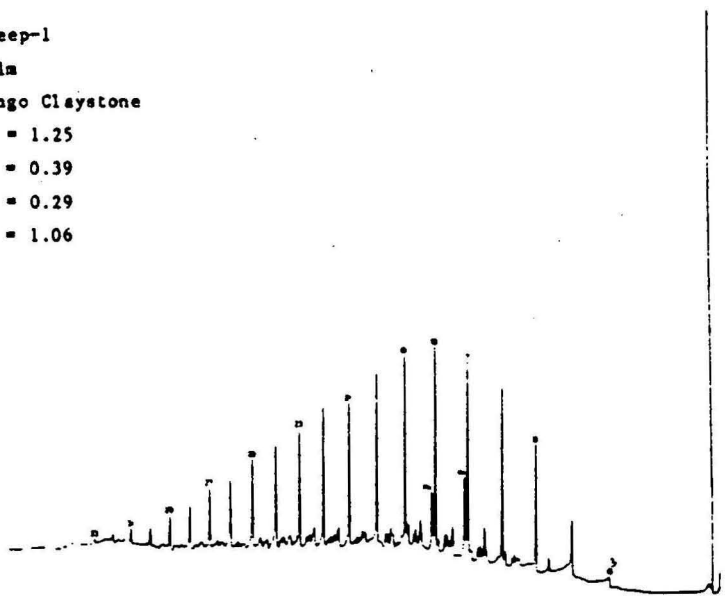
| GENERAL DATA | | | CHEMICAL ANALYSIS DATA | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PYROLYSIS | | | | | SOLVENT EXTRACTION | | | | | | |
| | | | | | | | | | | | | | EXTRACT COMPOSITION (%) | | |
| SAMPLE DEPTH (METRES) | SAMPLE TYPE | ANALYSED LITHOLOGY | ORGANIC CARBON % OF ROCK | TEMPERATURE C | HYDROGEN INDEX | OXYGEN INDEX | PRODUCTION INDEX | POTENTIAL YIELD (kg Tonne) | TOTAL EXTRACT (ppm) | TOTAL EXTRACT (mg g T O C) | HYDROCARBONS (ppm) | HYDROCARBONS (mg g T O C) | SATURATED HYDROCARBONS | AROMATIC HYDROCARBONS | POLAR COMPOUNDS |
| | | **West Tryal Rocks-2** | | | | | | | | | | | | | |
| 3295-3310 | Ctg | SND, wht-rd brn + 40% MDST, lt gy | 0.77 | | | | | | 1215 | 158 | 855 | 111 | 57 | 13 | 30 |
| 3355-3365 | " | SND, a/a + SST, rd brn, arg | 1.21 | | | | | | 2700 | 223 | 2360 | 195 | 78 | 9 | 13 |
| 3375-3385 | " | MDST, med gy | 0.46 | | | | | | 1070 | 233 | 845 | 184 | 64 | 15 | 21 |
| 3435-3450 | " | SND, wht + 30% MDST, med gy | 0.47 | | | | | | 500 | 106 | 330 | 70 | 58 | 8 | 34 |
| | | **Zeewulf-1** | | | | | | | | | | | | | |
| 3315-3330 | Ctg | SST, lt gy, v arg + 30% MDST, lt gy, slty + mnr COAL, blk | 5.42 | | | | | | 1060 | 20 | 270 | 5 | 20 | 6 | 74 |
| 3330-3345 | " | SST, a/a + 40% MDST, med-dk gy + mnr COAL, blk | 3.14 | | | | | | 765 | 24 | 365 | 12 | 43 | 5 | 52 |

Table 2b Chemical Analysis Data

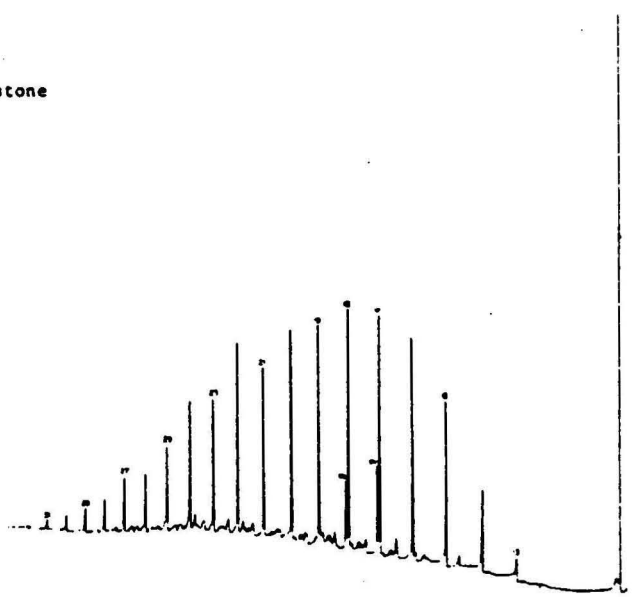
Barrow Deep-1
3244-3256m
Upper Dingo Claystone
Pr/Ph = 1.66
Pr/n-$C_{17}$ = 0.55
Ph/n-$C_{18}$ = 0.34
CPI = 1.13



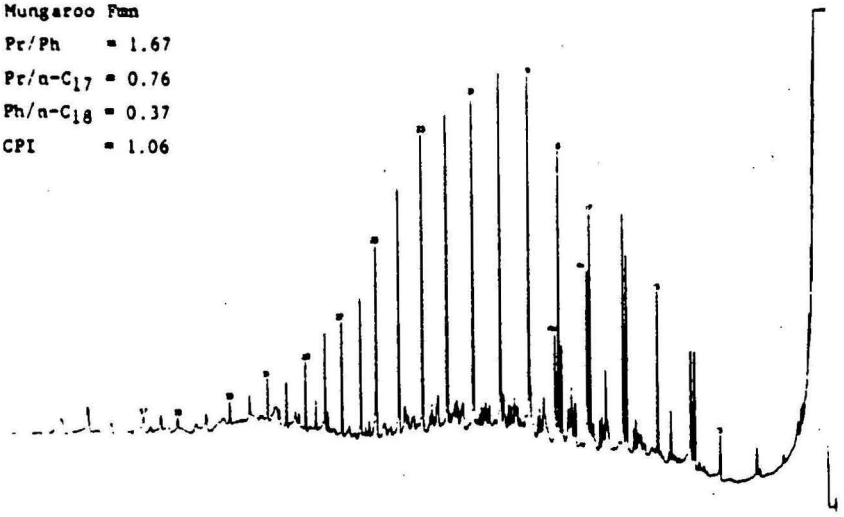
Barrow Deep-1
3329-3341m
Upper Dingo Claystone
Pr/Ph = 1.25
Pr/n-$C_{17}$ = 0.39
Ph/n-$C_{18}$ = 0.29
CPI = 1.06



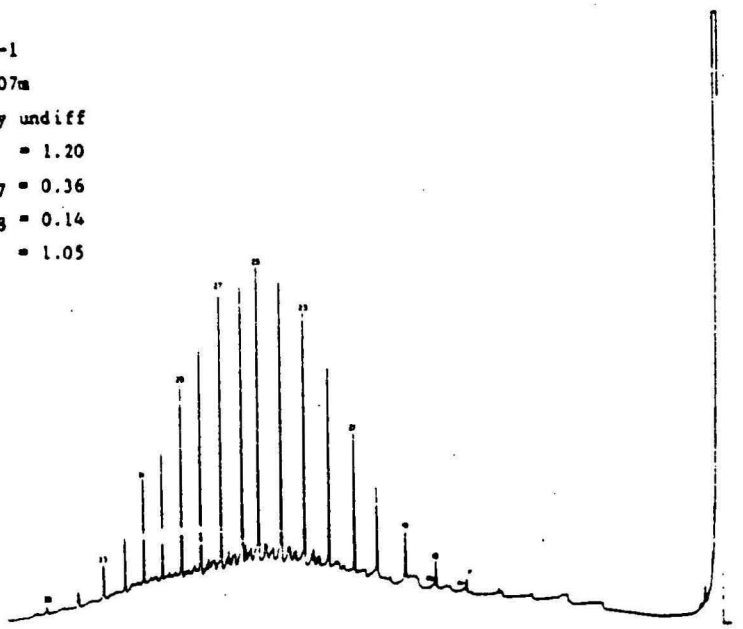
Barrow Deep-1
3427-3439m
Upper Dingo Claystone
Pr/Ph = 1.29
Pr/n-$C_{17}$ = 0.36
Ph/n-$C_{18}$ = 0.28
CPI = 1.01



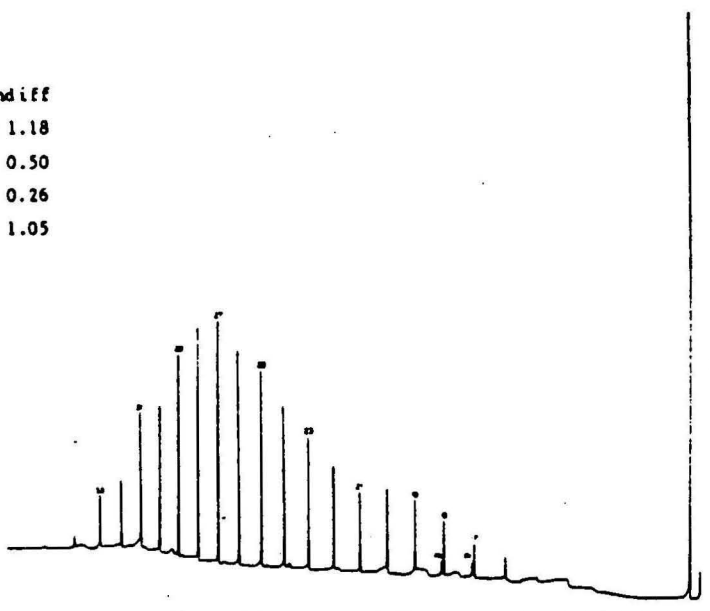
Delambre-1
5380-5405m
Mungaroo Fmn
Pr/Ph = 1.67
Pr/n-$C_{17}$ = 0.76
Ph/n-$C_{18}$ = 0.37
CPI = 1.06



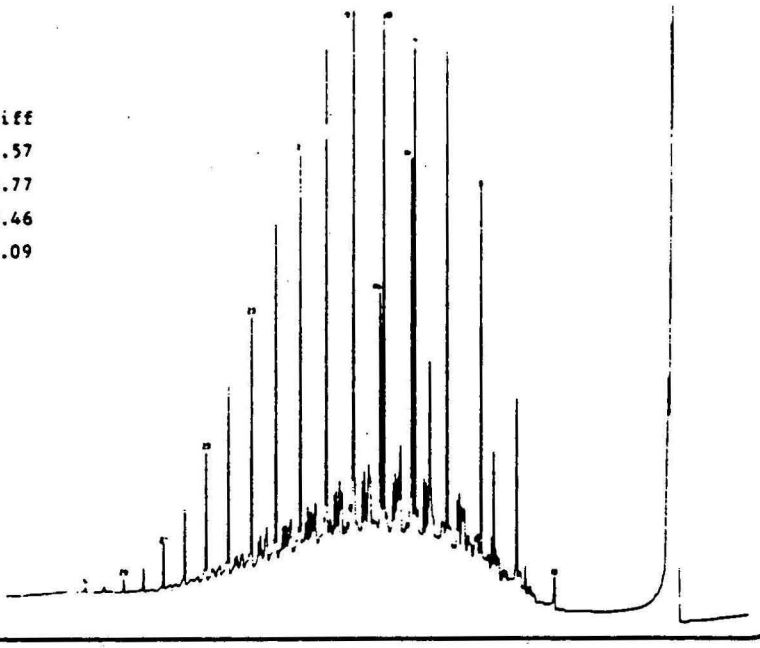
Haycock-1
1006-1007m
Tertiary undiff
Pr/Ph = 1.20
Pr/n-$C_{17}$ = 0.36
Ph/n-$C_{18}$ = 0.14
CPI = 1.05



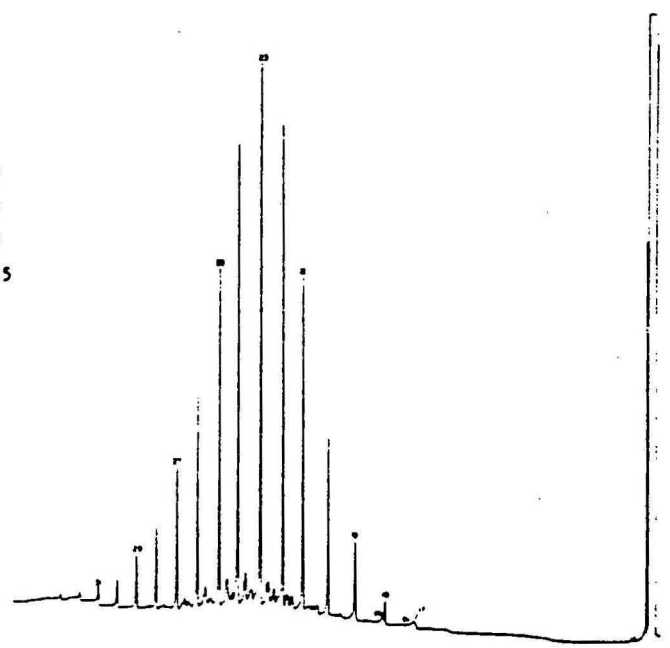
Haycock-1
1018-1023m
Tertiary undiff
Pr/Ph = 1.18
Pr/n-$C_{17}$ = 0.50
Ph/n-$C_{18}$ = 0.26
CPI = 1.05



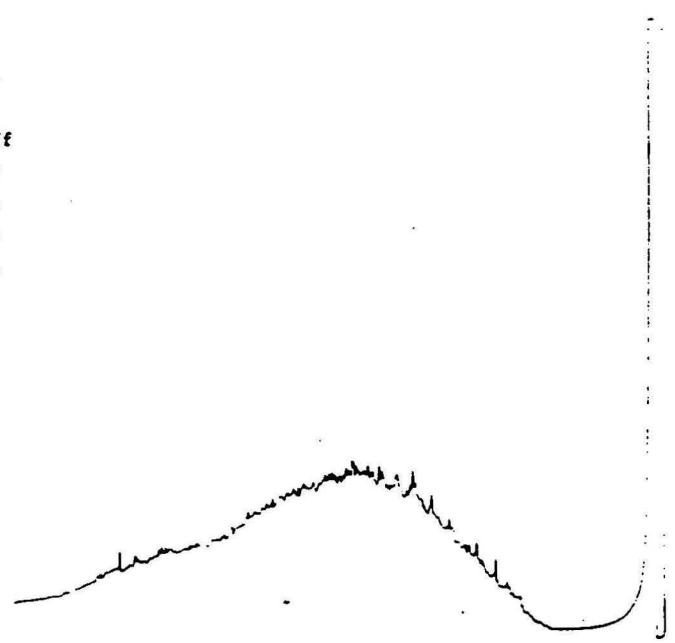
Hilda-1A
814-825m
Tertiary undiff
Pr/Ph = 1.57
Pr/n-$C_{17}$ = 0.77
Ph/n-$C_{18}$ = 0.46
CPI = 1.09



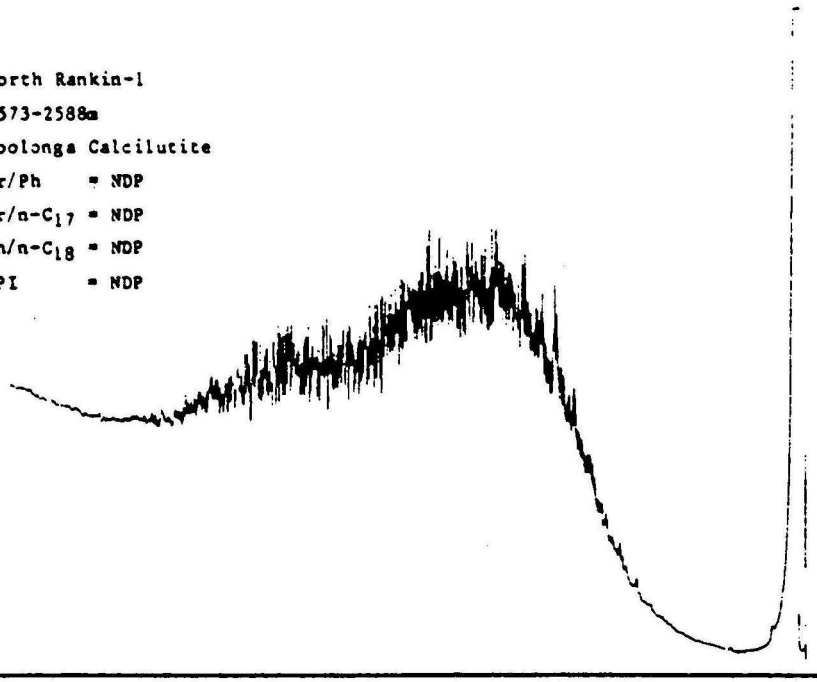
Long Island-1
1879m core
Mungaroo Fmn
Pr/Ph = NDP
Pr/n-$C_{17}$ = NDP
Ph/n-$C_{18}$ = NDP
CPI = 1.05



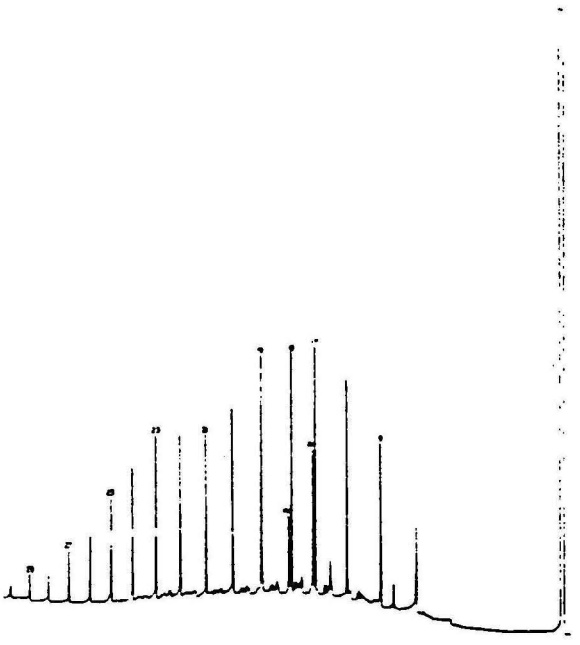
North Rankin-1
2438m
Tertiary undiff
Pr/Ph = NDP
Pr/n-$C_{17}$ = NDP
Ph/n-$C_{18}$ = NDP
CPI = NDP



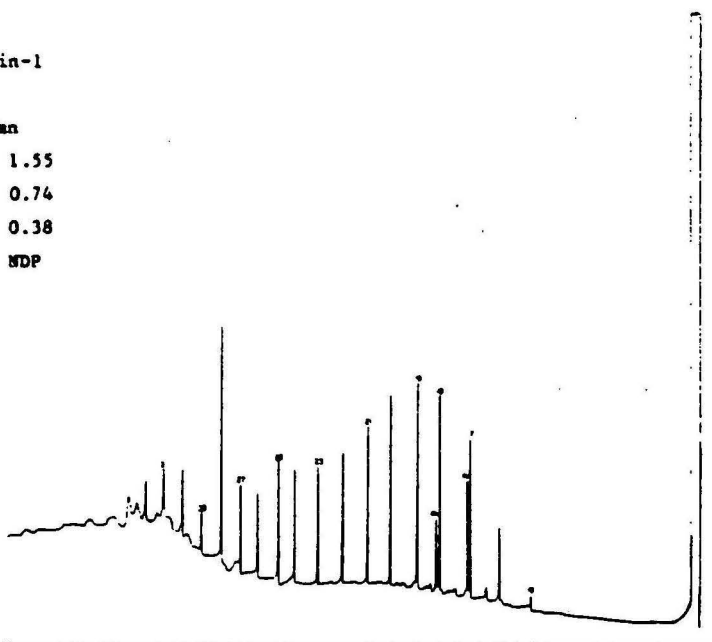
North Rankin-1
2573-2588m
Toolonga Calcilutite
Pr/Ph = NDP
Pr/n-$C_{17}$ = NDP
Ph/n-$C_{18}$ = NDP
CPI = NDP

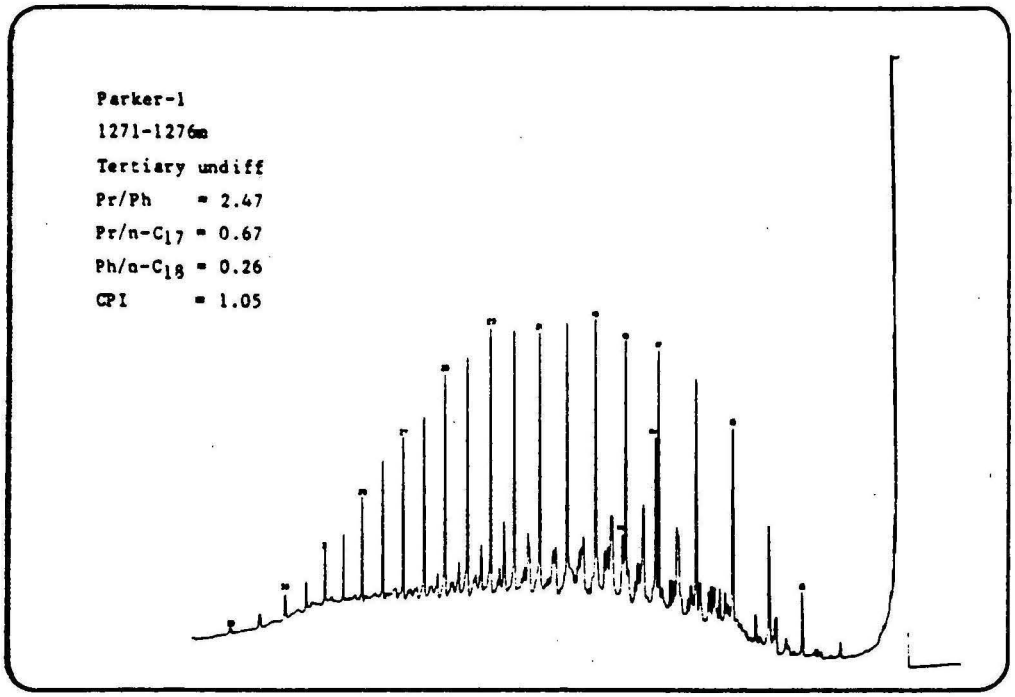


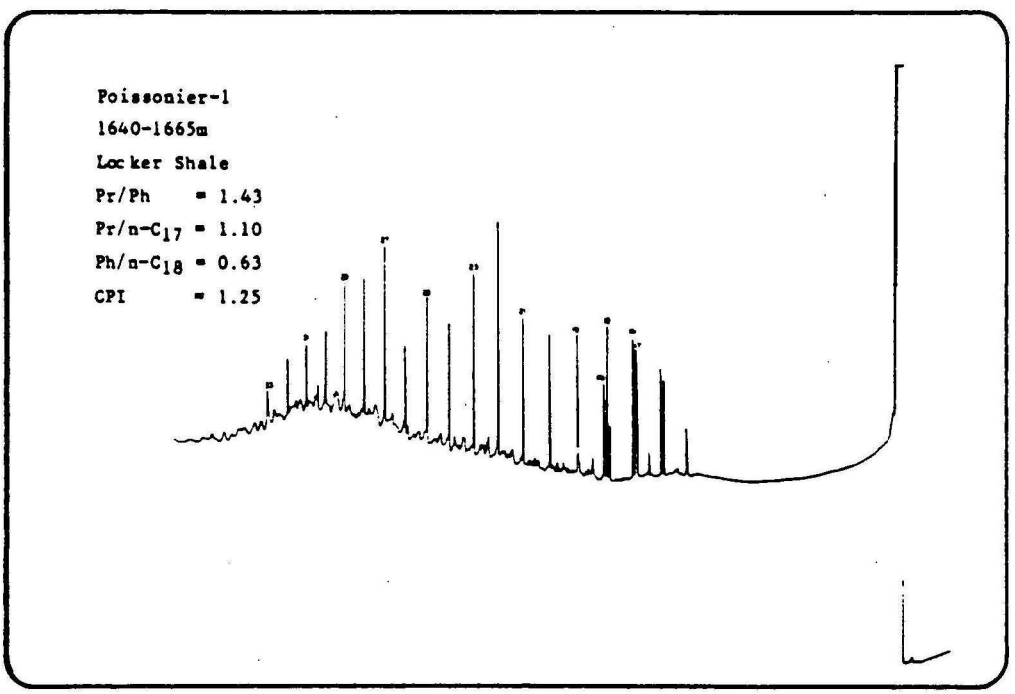
North Rankin-1
3009-3015m
Mungaroo Fm
Pr/Ph = 1.87
Pr/n-$C_{17}$ = 0.59
Ph/n-$C_{18}$ = 0.32
CPI = 1.08

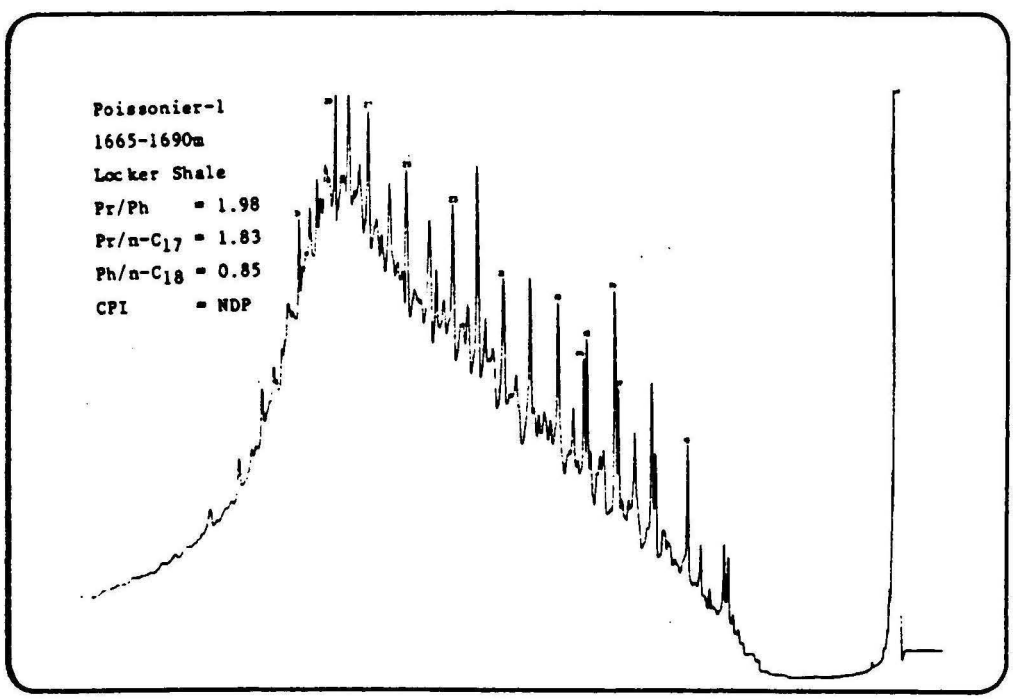


North Rankin-1
3250-3256m
Mungaroo Fm
Pr/Ph = 1.55
Pr/n-$C_{17}$ = 0.74
Ph/n-$C_{18}$ = 0.38
CPI = NDP

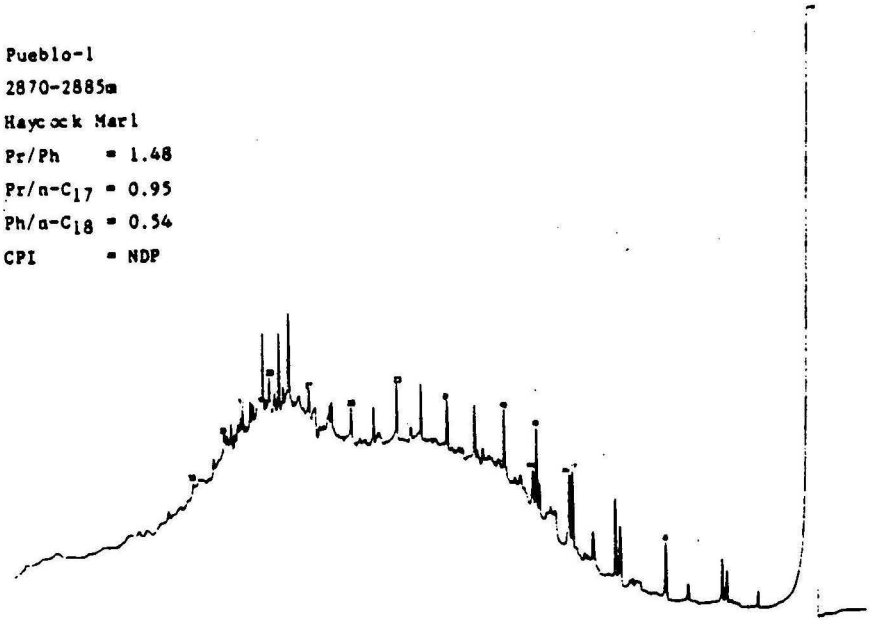



Parker-1
1271-1276m
Tertiary undiff
Pr/Ph = 2.47
Pr/n-C17 = 0.67
Ph/n-C18 = 0.26
CPI = 1.05

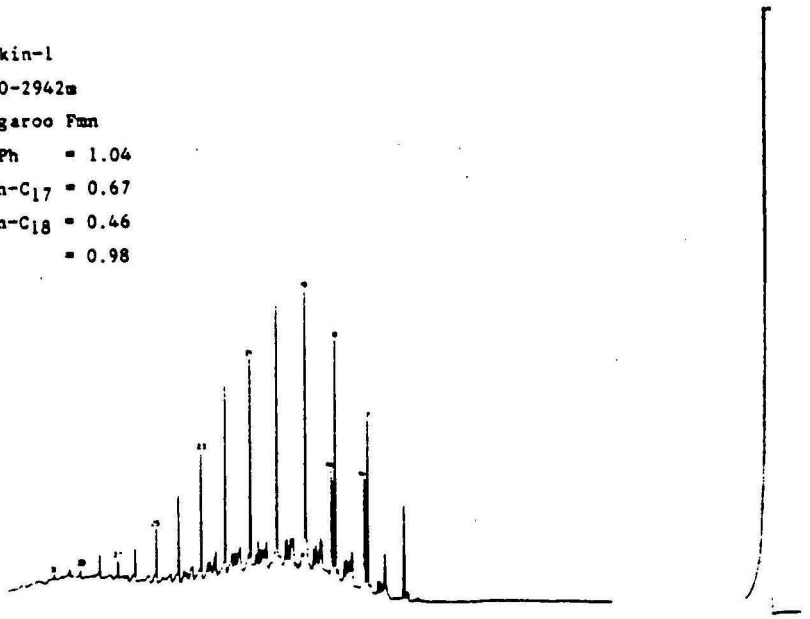

Poissonier-1
1640-1665m
Locker Shale
Pr/Ph = 1.43
Pr/n-C17 = 1.10
Ph/n-C18 = 0.63
CPI = 1.25


Poissonier-1
1665-1690m
Locker Shale
Pr/Ph = 1.98
Pr/n-C17 = 1.83
Ph/n-C18 = 0.85
CPI = NDP

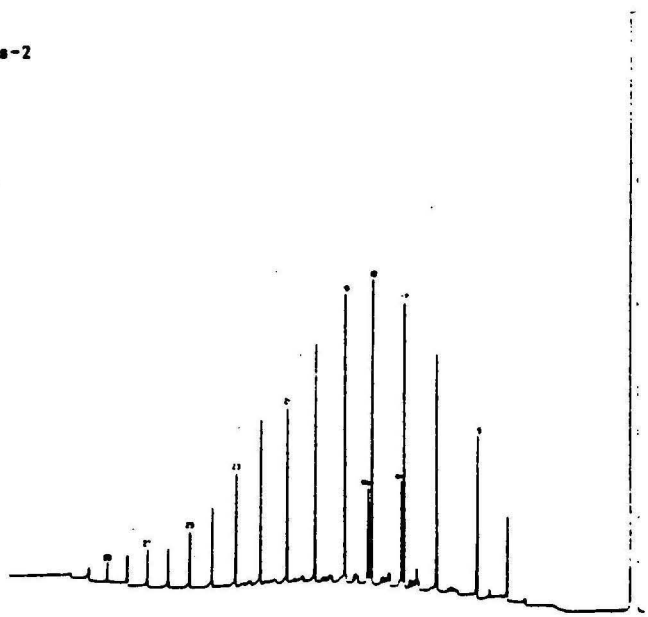
Pueblo-1
2870-2885m
Haycock Marl
Pr/Ph = 1.48
Pr/n-$C_{17}$ = 0.95
Ph/n-$C_{18}$ = 0.54
CPI = NDP



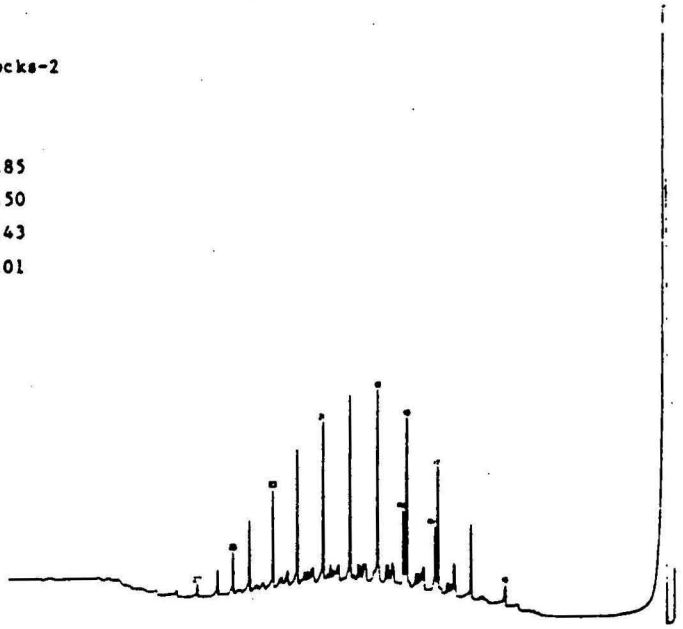
Rankin-1
2930-2942m
Mungaroo Fmn
Pr/Ph = 1.04
Pr/n-$C_{17}$ = 0.67
Ph/n-$C_{18}$ = 0.46
CPI = 0.98



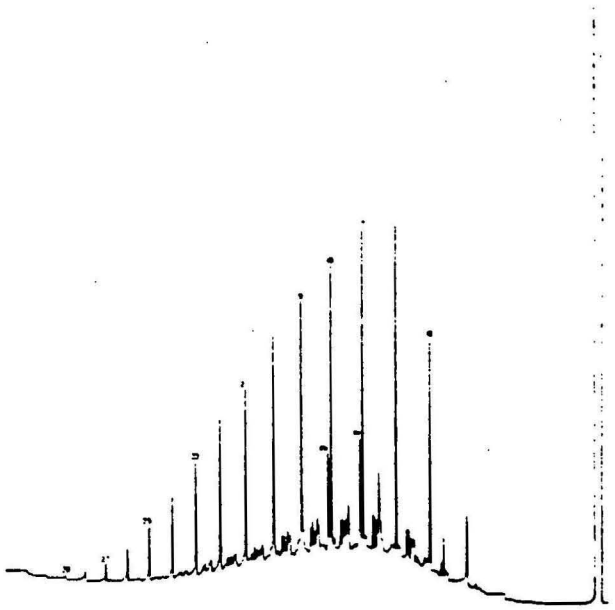
West Tryal Rocks-2
3295-3310m
Mungaroo Fmn
Pr/Ph = 1.11
Pr/n-$C_{17}$ = 0.38
Ph/n-$C_{18}$ = 0.32
CPI = 1.04



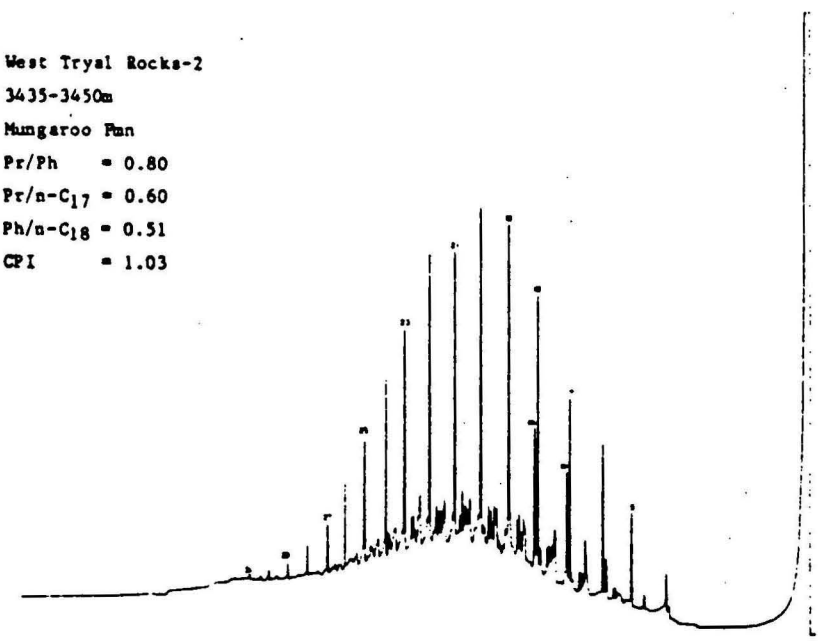
West Tryal Rocks-2
3355-3365m
Mungaroo Pmn
Pr/Ph = 0.85
$Pr/n\text{-}C_{17}$ = 0.50
$Ph/n\text{-}C_{18}$ = 0.43
CPI = 1.01



West Tryal Rocks-2
3375-3385m
Mungaroo Pmn
Pr/Ph = 1.14
$Pr/n\text{-}C_{17}$ = 0.34
$Ph/n\text{-}C_{18}$ = 0.34
CPI = 1.03



West Tryal Rocks-2
3435-3450m
Mungaroo Pmn
Pr/Ph = 0.80
$Pr/n\text{-}C_{17}$ = 0.60
$Ph/n\text{-}C_{18}$ = 0.51
CPI = 1.03



Zeewulf-1

3315-3330m

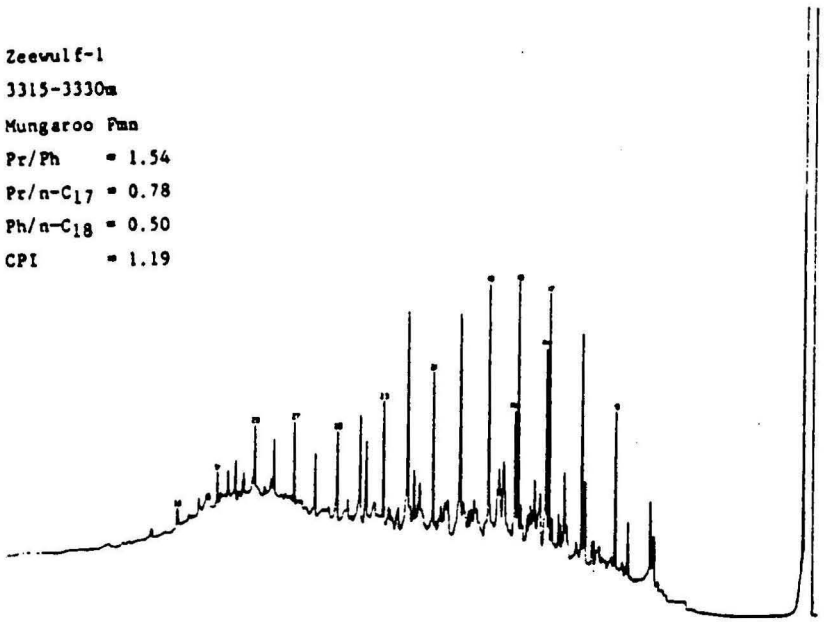
Mungaroo Fmn

Pr/Ph = 1.54

Pr/n-$C_{17}$ = 0.78

Ph/n-$C_{18}$ = 0.50

CPI = 1.19



Zeewulf-1

3330-3345m

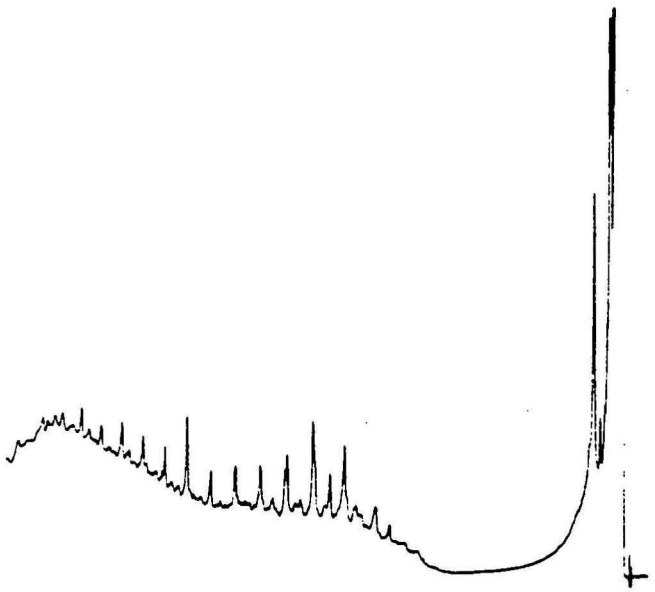
Mungaroo Fmn

Pr/Ph = NDP

Pr/n-$C_{17}$ = NDP

Ph/n-$C_{18}$ = NDP

CPI = NDP



# SECTION II

# OIL ANALYSIS DATA FROM

# THE NORTHERN CARNARVON BASIN

TABLE II.1a

| WELL | DEPTH (METRES) | DST | AGE | API | POUR POINT°C | SULPHUR CONTENT | VISUAL DESCRIPTION | OIL COMPOSITION | | | ALKANE PARAMETERS | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | SAT | AROM | NDS+ASPH | Pr/Ph | Pr/ $n\text{-}C_{17}$ | Ph/ $n\text{-}C_{18}$ | CPI |
| Angel-1 | 2686-2738 | 1-2 | Tithonian | 54 | -42 | 0.07 | light yellow, non viscous | 87 | 11 | 2 | * 2.00 | 0.50 | 0.20 | NDP |
| Bambra-2 | 2037-2038.5 | 2 | Neocomian | 35.9 | +12 | 0.06 | dark brown, slightly viscous | 79 | 20 | 1 | 2.62 | 0.40 | 0.17 | 1.04 |
| | | | | | | | | | | | * 2.22 | 0.40 | 0.17 | 1.07 |
| Barrow-1 | 1890.2 | Prod | L.Jur-E.Cret. | 36 | +8 | 0.08 | dark brown, non viscous | 65 | 24 | 11 | * 2.50 | 0.22 | 0.10 | NDP |
| Barrow-15 | 670.7 | Prod | Aptian- Albian | - | - | - | dark brown, non viscous | 75 | 19 | 6 | * NDP | NDP | NDP | NDP |
| Goodwyn-3 | 3015.8-3026.8 | ? | L.Triassic | 48 | - | 0.13 | dark brown, non viscous | 78 | 18 | 4 | * 3.00 | 0.33 | 0.14 | NDP |
| Goodwyn-4 | 2856.5-2906.5 | DST-2 | L.Triassic | - | - | 2.38 | light brown-yellow, non viscous | 74 | 20 | 6 | * NDP | NDP | NDP | NDP |
| Gorgon-1 (DST-6) | 3729-3766 | 6 | Middle-Late Triassic | 41.9 | - | - | light yellow, non viscous | 69 | 30 | 1 | 2.59 | 0.23 | 0.10 | 1.04 |
| | | | | | | | | | | | * 3.25 | 0.29 | 0.11 | 1.04 |
| Gorgon-1 (DST-7) | 3365-3375 | 7 | Early Cret. | 40.9 | - | - | light yellow, non viscous | 86 | 8 | 6 | 2.75 | 0.41 | 0.16 | 1.04 |
| | | | | | | | | | | | * 2.40 | 0.24 | 0.10 | 1.03 |
| Harriet-1 | 1942-1945 | 3-5 | Early Cret. | 36.9 | +9 | 0.04 | dark brown, slightly viscous | 78 | 21 | 1 | 1.70 | 0.47 | 0.30 | 0.97 |
| | | | | | | | | | | | * 2.41 | 0.31 | 0.14 | 1.00 |
| Lenita-1 | 1956.6-1958 | 1 | Early Cret. | 37.5 | +12 | 0.03 | dark brown, slightly viscous | 78 | 21 | 1 | 2.77 | 0.43 | 0.17 | 1.03 |
| | | | | | | | | | | | * 2.50 | 0.35 | 0.15 | 1.07 |
| North Herald-2 | 1201.8-1204.8 | Prod | Early Cret. | 46.0 | -18 | 0.04 | dark brown, non viscous | 83 | 15 | 2 | 2.50 | 0.34 | 0.15 | 1.06 |
| | | | | | | | | | | | * 2.92 | 0.32 | 0.13 | 1.07 |

* GC run on whole oil

TABLE II.1a : PHYSICAL ANALYSIS AND LIQUID AND GAS CHROMATOGRAPHY DATA FOR OILS FROM THE NORTHERN CARNARVON BASIN

TABLE II.1b

| WELL | DEPTH (METRES) | DST | AGE | API | POUR POINT°C | SULPHUR CONTENT | VISUAL DESCRIPTION | OIL COMPOSITION | | | ALKANE PARAMETERS | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | SAT | AROM | NOS+ASPH | Pr/Ph | Pr/ $n\text{-}C_{17}$ | Ph/ $n\text{-}C_{18}$ | CPI |
| Rankin-1 | 2954.3 | Fit 8 | U.Triassic | 54 | -10 | 0.12 | dark brown, non viscous | 69 | 25 | 6 | * 2.67 | 0.40 | 0.19 | NDP |
| Rough Range-1A | 1098-1103 | - | - | 39.8 | +37 | 0.28 | light brown, viscous | 94 | 5 | 1 | 3.58 | 0.38 | 0.10 | 1.04 |
| | | | | | | | | | | | * 3.09 | 0.29 | 0.09 | 1.04 |
| Saladin-1 | 1116-1123 | 1 | Lower Cret. | 46.9 | - | - | light brown, non viscous | 84 | 15 | 1 | 2.74 | 0.35 | 0.15 | 1.10 |
| | | | | | | | | | | | * 2.90 | 0.25 | 0.11 | 1.12 |
| South Pepper-4 | 1230.5-1236.5 | 1-2 | Lower Cret. | 42.3 | -9 | 0.34 | dark brown, non viscous | 82 | 17 | 1 | 2.89 | 0.35 | 0.14 | 1.06 |
| | | | | | | | | | | | * 3.03 | 0.38 | 0.14 | 1.06 |
| Wilcox-1 | 3498-3864 | Prod-1 | Mungaroo Fmn | 41.0 | 0 | 0.20 | light brown, non viscous | 80 | 18 | 2 | 2.77 | 0.32 | 0.12 | 1.07 |
| | | | | | | | | | | | * 3.00 | 0.35 | 0.12 | 1.05 |

* GC run on whole oil

TABLE II.1b : PHYSICAL ANALYSIS AND LIQUID AND GAS CHROMATOGRAPHY DATA FOR OILS FROM THE NORTHERN CARNARVON BASIN

TABLE II.2

| WELL | DEPTH (METRES) | AROMATICITY INDEX | LATE MATURE INDEX | HEPTANE INDEX | ISOHEPTANE INDEX | KEROGEN TYPE INDEX | COMPOSITION | | | $C_7$ COMPOSITION | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | NORMAL | ISO | CYCLIC | NORMAL | ISO | CYCLIC |
| Angel-1 | 2686-2738 | 0.65 | 0.05 | 18.48 | 1.54 | 9.38 | 27.9 | 25.6 | 46.8 | 21.5 | 19.9 | 58.6 |
| Bambra-2 | 2037-2038.5 | 1.39 | 0.09 | 18.07 | 1.55 | 9.09 | 24.8 | 21.3 | 53.9 | 21.4 | 16.4 | 62.2 |
| Barrow-1 | 1890.2 | 0.83 | 0.06 | 18.19 | 1.50 | 9.44 | 28.9 | 27.0 | 44.1 | 21.3 | 21.0 | 57.7 |
| Barrow-15 | 670.7 | 3.72 | 0.34 | 24.04 | 2.29 | 8.77 | 31.6 | 21.0 | 47.5 | 28.0 | 16.8 | 55.2 |
| Goodwyn-3 | 3015.8-3026.8 | 4.14 | 0.12 | 15.95 | 1.45 | 8.26 | 25.4 | 17.5 | 57.1 | 17.7 | 13.6 | 68.7 |
| Goodwyn-4 | 2856.5-2906.5 | 0.56 | 0.01 | 16.90 | 1.61 | 8.00 | 19.9 | 20.8 | 59.3 | 18.6 | 19.5 | 61.9 |
| Gorgon-1 (DST-6) | 3729-3766 | 2.33 | - | 16.66 | 4.78 | 4.78 | 96.9 | 0.5 | 2.6 | 17.1 | 12.9 | 70.0 |
| Gorgon-1 (DST-7) | 3365-3375 | 0.92 | 0.06 | 15.21 | 1.63 | 6.87 | 18.7 | 20.7 | 60.6 | 18.2 | 17.7 | 64.1 |
| Harriet-1 | 1942-1945 | 0.82 | 0.05 | 16.69 | 1.48 | 8.56 | 26.6 | 23.4 | 50.0 | 19.8 | 16.9 | 63.3 |
| Lenita-1 | 1956.6-1958 | 0.94 | 0.07 | 16.64 | 1.62 | 7.78 | 27.8 | 25.5 | 46.7 | 19.8 | 18.1 | 62.1 |
| North Herald-2 | 1201.8-1204.8 | 0.08 | 0.0004 | 19.63 | 2.14 | 7.31 | 26.5 | 29.8 | 43.7 | 21.9 | 22.8 | 55.3 |
| Rankin-1 | 2954.3 | 1.16 | 0.05 | 15.01 | 1.28 | 8.60 | 24.5 | 23.7 | 51.8 | 17.4 | 17.6 | 65.0 |
| Rough Range-1A | 1098-1103 | 0.06 | 0 | 20.70 | 1.98 | 8.43 | 29.6 | 38.9 | 31.5 | 22.1 | 27.8 | 50.1 |
| Saladin-1 | 1116-1123 | 2.93 | - | 22.17 | 2.05 | 8.88 | 65.6 | 5.4 | 29.0 | 22.9 | 12.3 | 64.8 |
| South Pepper-4 | 1230.5-1236.5 | 0.15 | 0.0004 | 16.48 | 1.96 | 6.38 | 25.1 | 28.7 | 46.2 | 19.0 | 21.0 | 60.0 |
| Wilcox-1 | 3498-3864 | 0.74 | 0.07 | 19.69 | 1.93 | 8.14 | 26.8 | 22.2 | 51.0 | 23.1 | 17.8 | 59.1 |

TABLE II.2 : GASOLINE RANGE HYDROCARBON RATIOS FOR OILS FROM THE NORTHERN CARNARVON BASIN

TABLE II.3

| WELL | DEPTH (METRES) | DST | API | GC-MS CALCUALTED RATIOS | | | | | | Dist. of ααα R Steranes | | | Carbon Isotope Data | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 18α / 17α $C_{27}$ | 17β 21α / 17α 21β $C_{30}$ | 22S / 22R $C_{31}$tr | %20S of $C_{29}$ | 17β 21α / 17α 21β $C_{29}$ | 20S / 20R $C_{29}$st | $C_{27}$ | $C_{28}$ | $C_{29}$ | Hopane/ Sterane | Alkanes | Arom. | CV Value |
| Angel-1 | 2686-2738 | 1-2 | 54 | 3.80# | 0.14 | 1.42 | 59 | 0.53 | 1.46 | 20 | 15 | 65 | 0.86* | - | - | - |
| Bambre-2 | 2037-2038.5 | 2 | 35.9 | 3.44# | 0.16 | 1.02 | 57 | 0.10 | 1.35 | 31 | 17x | 52 | 1.28 | -27.6 | -25.7 | 0.98 |
| Barrow-1 | 1890.2 | Prod | 36 | 1.14# | 0.09 | 1.40 | 49 | 0.54 | 0.94 | 22 | 22 | 56 | 1.30* | -26.8 | -26.2 | -2.01 |
| Barrow-15 | 670.7 | Prod | - | 2.55# | 0.14 | 1.34 | 50 | 0.23 | 0.89 | 28 | 25 | 47 | 2.07* | -28.3 | -25.9 | 2.45 |
| Goodwyn-3 | 3015.8-3026.8 | ? | 48 | 1.40# | 0.12 | 1.33 | 53 | 0.13 | 0.90 | 26 | 22 | 52 | 1.55* | -27.3 | -25.8 | 0.14 |
| Goodwyn-4 | 2856.5-2906.5 | DST-2 | - | 1.80# | 0.15 | 1.14 | 56 | 0.35 | 1.28 | 27 | 22 | 51 | 1.74* | - | - | - |
| Gorgon-1 (DST-6) | 3729-3766 | 6 | 41.9 | NDP | NDP | NDP | NDP | NDP | NDP | NDP | NDP | NDP | NDP | -26.6 | -26.0 | -1.03 |
| Gorgon-1 (DST-7) | 3365-3375 | 7 | 40.9 | 2.49# | 0.14 | 1.53 | NDP | NDP | NDP | NDP | NDP | NDP | NDP | -26.5 | -25.8 | -1.03 |
| Harriet-1 | 1942-1945 | 3-5 | 36.9 | 3.38# | 0.21 | 0.97 | 51 | NDP | 1.04 | 16 | 22x | 62 | 1.22 | -27.8 | -26.2 | 0.52 |
| Lenita-1 | 1956.6-1958 | 1 | 37.5 | 4.53# | 0.19 | 1.19 | 53 | NDP | 1.30 | 28 | 19x | 53 | 1.03 | -27.7 | -26.2 | 0.27 |
| North Herald-2 | 1201.8-1204.8 | Prod | 46.0 | No quantitation data | | | | | | | | | | -27.6 | -26.8 | -1.32 |
| Rankin-1 | 2954.3 | Fit 8 | 54 | 2.03# | 0.16 | 1.30 | 63 | 0.59 | 1.02 | 27 | 22 | 51 | 1.38* | -27.1 | -26.4 | -1.70 |
| Rough Range-1A | 1098-1103 | - | 39.8 | 1.87 | 0.21 | 1.71 | 46 | 0.04 | 0.85 | 22 | 19 | 59 | 1.05 | -24.7 | -23.2 | -0.66 |
| Saladin-1 | 1116-1123 | 1 | 46.9 | NDP | NDP | NDP | NDP | NDP | NDP | NDP | NDP | NDP | NDP | -27.7 | -27.0 | -1.51 |
| South Pepper-4 | 1230.5-1236.5 | 1-2 | 42.3 | No quantitation data | | | | | | | | | | -26.9 | -27.1 | -3.75 |
| Wilcox-1 | 3498-3864 | Prod-1 | 41.0 | 75.10 | - | - | 54 | 0.21 | 1.17 | 35 | 17 | 48 | 0.92 | -26.7 | -25.6 | -1.11 |

# = co-eluting compounds

* = No m/z 218 quantitative data

x = estimated peak area, no quantitation

TABLE II.3 : GAS CHROMATOGRAPHY - MASS SPECTROMETRY AND CARBON ISOTOPE DATA FOR OILS FROM THE NORTHERN CARNARVON BASIN

OIL SAMPLES

| SAMPLE | ANGEL -1 | BAMBRA -2 | BARROW -1 | BARROW -15 | GOODWYN -3 | GOODWYN -4 | GORGON-1 (DST 6) |
|---|---|---|---|---|---|---|---|
| GASOLINE HYDROCARBON COMPONENTS | RELATIVE GASOLINE HYDROCARBON COMPONENT ABUNDANCES (%) | | | | | | |
| i – BUTANE | 0.2 | 0 | 0.7 | 0.6 | 0.4 | Tr | - |
| n – BUTANE | 1.1 | 0.5 | 2.7 | 0.8 | 0.4 | Tr | - |
| i – PENTANE | 2.7 | 1.6 | 3.4 | 1.1 | 0.9 | 0.1 | - |
| n – PENTANE | 4.6 | 2.6 | 5.2 | 2.4 | 1.6 | 0.2 | 94.9 |
| 2.2 – DIMETHYL BUTANE | 0.3 | 0 | 0.3 | 0.1 | Tr | Tr | - |
| CYCLOPENTANE | 1.0 | 1.1 | 1.3 | 0.5 | 0.5 | 0.1 | - |
| 2.3 – DIMETHYL BUTANE | 0.7 | 0.4 | 0.7 | 0.2 | 0.5 | 0.2 | - |
| 2 – METHYL PENTANE | 3.7 | 2.6 | 3.7 | 1.6 | 1.3 | 1.4 | Tr |
| 3 – METHYL PENTANE | 2.6 | 2.0 | 2.6 | 1.1 | 1.1 | 1.3 | - |
| n – HEXANE | 9.1 | 6.8 | 8.5 | 5.2 | 6.3 | 4.8 | Tr |
| 2.2 – DIMETHYL PENTANE/ METHYL CYCLOPENTANE | 6.7 | 0.2<br>5.5 | 6.9 | 3.0 | 3.4 | 4.5 | Tr<br>Tr |
| 2.4 – DIMETHYL PENTANE | 0.6 | 0.4 | 0.5 | 0.2 | 0.4 | 0.6 | Tr |
| BENZENE | 1.2 | 2.2 | 1.3 | 5.7 | 3.0 | 0.5 | Tr |
| 3.3 – DIMETHYL PENTANE | 0.2 | 0 | 0.2 | Tr | Tr | 0.2 | Tr |
| CYCLOHEXANE | 8.9 | 9.6 | 8.7 | 6.1 | 5.3 | 8.0 | 0.1 |
| 2 – METHYL HEXANE/ 2.3 – DIMETHYL PENTANE | 4.3 | 3.1<br>0.1 | 4.2 | 2.8 | 2.3 | 6.0 | 0.2 |
| 1.1 – DIMETHYL CYCLOPENTANE | 0.8 | 0.8 | 1.0 | Tr | Tr | 1.1 | Tr |
| 3 – METHYL HEXANE | 3.6 | 3.3 | 3.5 | 2.1 | 2.2 | 5.2 | 0.2 |
| 1. cis – 3 – DIMETHYL CYCLOPENTANE | 1.5 | 1.5 | 1.4 | 0.7 | 1.1 | 2.0 | 0.1 |
| 1. trans – 3 – DIMETHYL CYCLOPENTANE | 1.4 | 1.4 | 1.4 | 0.7 | 1.0 | 1.9 | Tr |
| 1. trans – 2 – DIMETHYL CYCLOPENTHANE<br>3 – ETHYL PENTANE | 2.8 | 2.6 | 2.6 | 1.5 | 2.1 | 3.8 | 0.1 |
| n – HEPTANE | 10.8 | 10.7 | 9.8 | 9.8 | 7.8 | 13.3 | 0.6 |
| 1. cis – 2 – DIMETHYL CYCLOPENTANE / METHYL CYCLOHEXANE | 23.2 | 24.7 | 20.6 | 16.5 | 25.5 | 35.5 | 2.1 |
| ETHYL CYCLOPENTANE | 1.1 | 1.4 | 0.8 | 0.7 | 1.5 | 1.7 | 0.2 |
| TOLUENE | 7.1 | 14.9 | 8.1 | 36.6 | 32.2 | 7.5 | 1.4 |
| TOTAL ABUNDANCE (ppm) | 192800 | 29795 | 157160 | non-quant | 10160 | 84280 | 106960 |
| ORGANIC CARBON (%) | | | | | | | |
| GASOLINE ABUNDANCE AT 1% ORGANIC CARBON | | | | | | | |

Note: Total gasoline abundance values are expressed as weight of gas relative to weight of wet rock.

**TABLE II.4a Gasoline Hydrocarbon Analysis Data**

OIL SAMPLES

| SAMPLE | GORGON-1 (DST 7) | HARRIET -1 | LENITA -1 | NORTH HERALD-2 | RANKIN -1 | SALADIN -1 | SOUTH PEPPER-4 |
|---|---|---|---|---|---|---|---|
| GASOLINE HYDROCARBON COMPONENTS | RELATIVE GASOLINE HYDROCARBON COMPONENT ABUNDANCES (%) | | | | | | |
| i – BUTANE | – | 0.3 | 0.7 | 0.2 | 0.1 | – | 0.7 |
| n – BUTANE | – | 1.9 | 3.1 | 0.6 | 0.5 | – | 2.5 |
| i – PENTANE | 0.2 | 3.3 | 4.1 | 3.5 | 2.2 | – | 4.7 |
| n – PENTANE | 0.5 | 4.5 | 5.2 | 4.0 | 3.1 | 53.9 | 4.5 |
| 2.2 – DIMETHYL BUTANE | 0.1 | 0.4 | 0.3 | 0.5 | 0.3 | – | 0.5 |
| CYCLOPENTANE | – | 1.4 | 1.5 | 0.6 | 0.7 | – | 1.0 |
| 2.3 – DIMETHYL BUTANE | 0.9 | 0 | 0.6 | 1.0 | 0.9 | – | 0.9 |
| 2 – METHYL PENTANE | 1.9 | 3.4 | 3.5 | 4.7 | 3.0 | – | 4.0 |
| 3 – METHYL PENTANE | 1.5 | 2.4 | 2.4 | 3.3 | 2.1 | – | 2.9 |
| n – HEXANE | 5.2 | 7.9 | 7.7 | 8.9 | 9.1 | 0.2 | 7.5 |
| 2.2 – DIMETHYL PENTANE / METHYL CYCLOPENTANE | – 6.2 | 0.1 6.0 | 0.2 6.0 | 0.3 5.8 | 6.5 | – 0.3 | 0.3 6.3 |
| 2.4 – DIMETHYL PENTANE | 0.5 | 0.4 | 0.3 | 0.7 | 0.5 | – | 0.5 |
| BENZENE | 1.9 | 1.3 | 1.6 | 0.1 | 1.2 | – | 0.1 |
| 3.3 – DIMETHYL PENTANE | 0.2 | 0 | 0.2 | 0.1 | 0.2 | – | 0.2 |
| CYCLOHEXANE | 12.3 | 9.6 | 9.2 | 7.5 | 8.6 | 1.4 | 9.0 |
| 2 – METHYL HEXANE / 2.3 – DIMETHYL PENTANE | 4.6 | 2.8 0.7 | 2.8 0.8 | 4.8 1.2 | 3.7 | 2.3 | 3.9 1.1 |
| 1.1 – DIMETHYL CYCLOPENTANE | 0.7 | 0.7 | 0.8 | 0.8 | 0.9 | 0.3 | 0.8 |
| 3 – METHYL HEXANE | 3.8 | 3.1 | 2.9 | 4.9 | 3.1 | 2.1 | 4.1 |
| 1. cis – 3 – DIMETHYL CYCLOPENTANE | 1.9 | 1.6 | 1.4 | 1.9 | 1.6 | 0.8 | 1.7 |
| 1. trans – 3 – DIMETHYL CYCLOPENTANE | 1.8 | 1.5 | 1.4 | o.7 | 1.5 | 0.7 | 1.5 |
| 1. trans – 2 – DIMETHYL CYCLOPENTHANE ) 3 – ETHYL PENTANE ) | 2.9 | 2.7 | 2.4 | 3.0 | 2.8 | 1.3 | 2.9 |
| n – HEPTANE | 10.8 | 9.8 | 9.0 | 12.7 | 8.8 | 9.4 | 10.2 |
| 1. cis – 2 – DIMETHYL CYCLOPENTANE / METHYL CYCLOHEXANE | 30.0 | 25.1 | 22.1 | 24.3 | 27.1 | 22.2 | 25.0 |
| ETHYL CYCLOPENTANE | 2.2 | 1.1 | 1.3 | 1.9 | 1.3 | 1.9 | 1.7 |
| TOLUENE | 9.9 | 8.0 | 8.5 | 1.0 | 10.2 | 3.2 | 1.5 |
| TOTAL ABUNDANCE (ppm) | 37705 | 28325 | 31400 | 33270 | 80390 | 7310 | 30465 |
| ORGANIC CARBON (%) | | | | | | | |
| GASOLINE ABUNDANCE AT 1% ORGANIC CARBON | | | | | | | |

Note: Total gasoline abundance values are expressed as weight of gas relative to weight of wet rock.

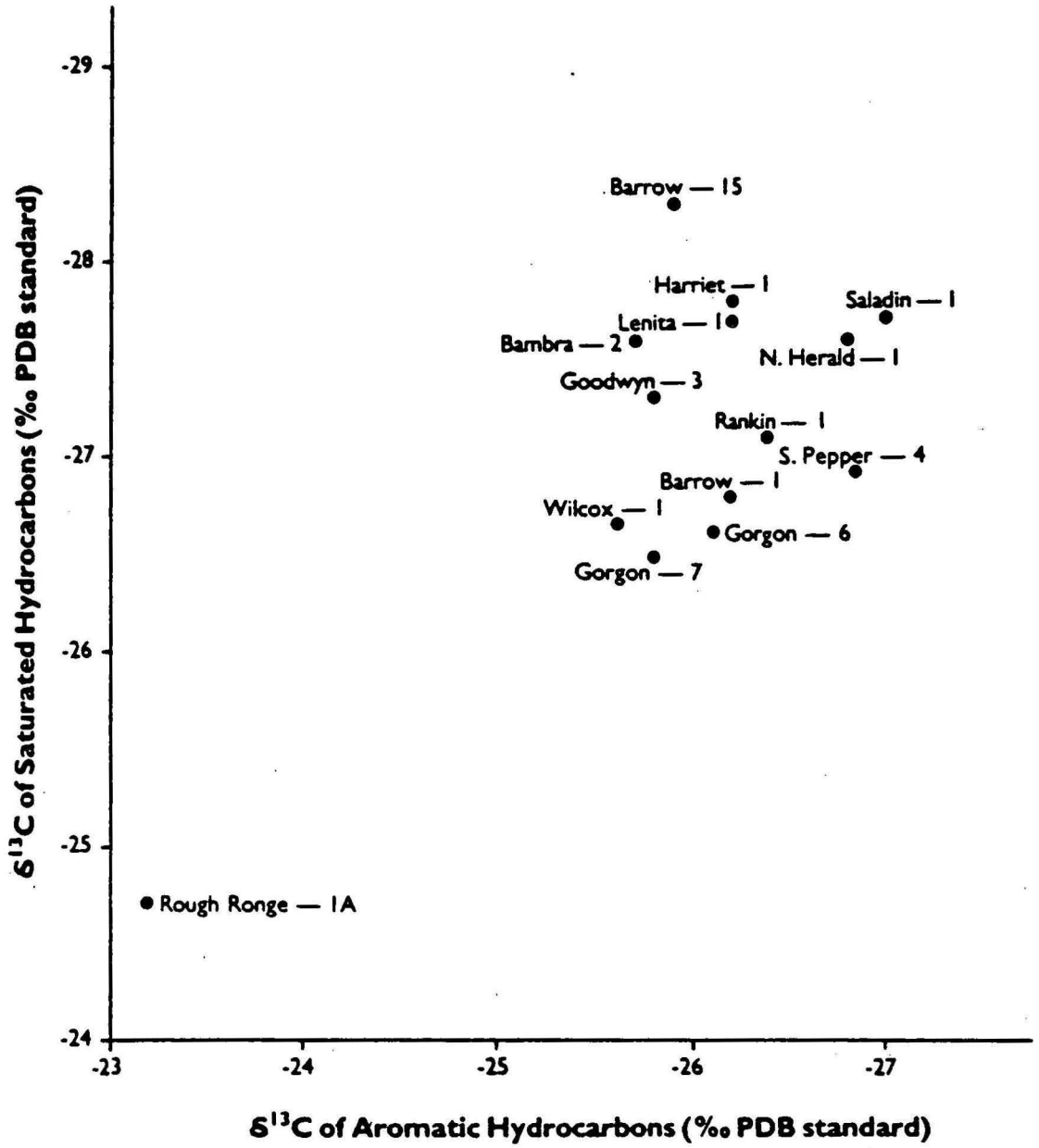
**TABLE II.4b Gasoline Hydrocarbon Analysis Data**

OIL SAMPLES

| SAMPLE | ROUGH RANGE-1A | WILCOX -1 | | | | | |
|---|---|---|---|---|---|---|---|
| GASOLINE HYDROCARBON COMPONENTS | RELATIVE GASOLINE HYDROCARBON COMPONENT ABUNDANCES (%) | | | | | | |
| i – BUTANE | 3.7 | 0 | | | | | |
| n – BUTANE | 6.9 | Tr | | | | | |
| i – PENTANE | 8.3 | 1.0 | | | | | |
| n – PENTANE | 4.8 | 2.5 | | | | | |
| 2.2 – DIMETHYL BUTANE | 0.7 | 0.1 | | | | | |
| CYCLOPENTANE | 0 | ) | | | | | |
| 2.3 – DIMETHYL BUTANE | 1.7 | ) 1.4 ) | | | | | |
| 2 – METHYL PENTANE | 5.6 | 3.3 | | | | | |
| 3 – METHYL PENTANE | 2.8 | 2.3 | | | | | |
| n – HEXANE | 7.1 | 8.8 | | | | | |
| 2.2 – DIMETHYL PENTANE / METHYL CYCLOPENTANE | 0.5<br>4.6 | 5.5 | | | | | |
| 2.4 – DIMETHYL PENTANE | 1.1 | 0.5 | | | | | |
| BENZENE | 0 | 1.8 | | | | | |
| 3.3 – DIMETHYL PENTANE | 0.4 | Tr | | | | | |
| CYCLOHEXANE | 4.7 | 10.0 | | | | | |
| 2 – METHYL HEXANE / 2.3 – DIMETHYL PENTANE | 4.9<br>0.2 | 4.4 | | | | | |
| 1.1 – DIMETHYL CYCLOPENTANE | 0.4 | 0.8 | | | | | |
| 3 – METHYL HEXANE | 5.1 | 3.5 | | | | | |
| 1. cis – 3 – DIMETHYL CYCLOPENTANE | 1.7 | 1.5 | | | | | |
| 1. trans – 3 – DIMETHYL CYCLOPENTANE | 1.8 | 1.4 | | | | | |
| 1. trans – 2 – DIMETHYL CYCLOPENTHANE | ) | 2.4 | | | | | |
| 3 – ETHYL PENTANE | ) 3.3 ) | 0 | | | | | |
| n – HEPTANE | 10.6 | 12.5 | | | | | |
| 1. cis – 2 – DIMETHYL CYCLOPENTANE / METHYL CYCLOHEXANE | 16.4 | 25.7 | | | | | |
| ETHYL CYCLOPENTANE | 2.1 | 1.3 | | | | | |
| TOLUENE | 0.6 | 9.2 | | | | | |
| TOTAL ABUNDANCE (ppm) | 990 | 940 | | | | | |
| ORGANIC CARBON (%) | | | | | | | |
| GASOLINE ABUNDANCE AT 1% ORGANIC CARBON | | | | | | | |

Note: Total gasoline abundance values are expressed as weight of gas relative to weight of wet rock.

**TABLE II.4c Gasoline Hydrocarbon Analysis Data**



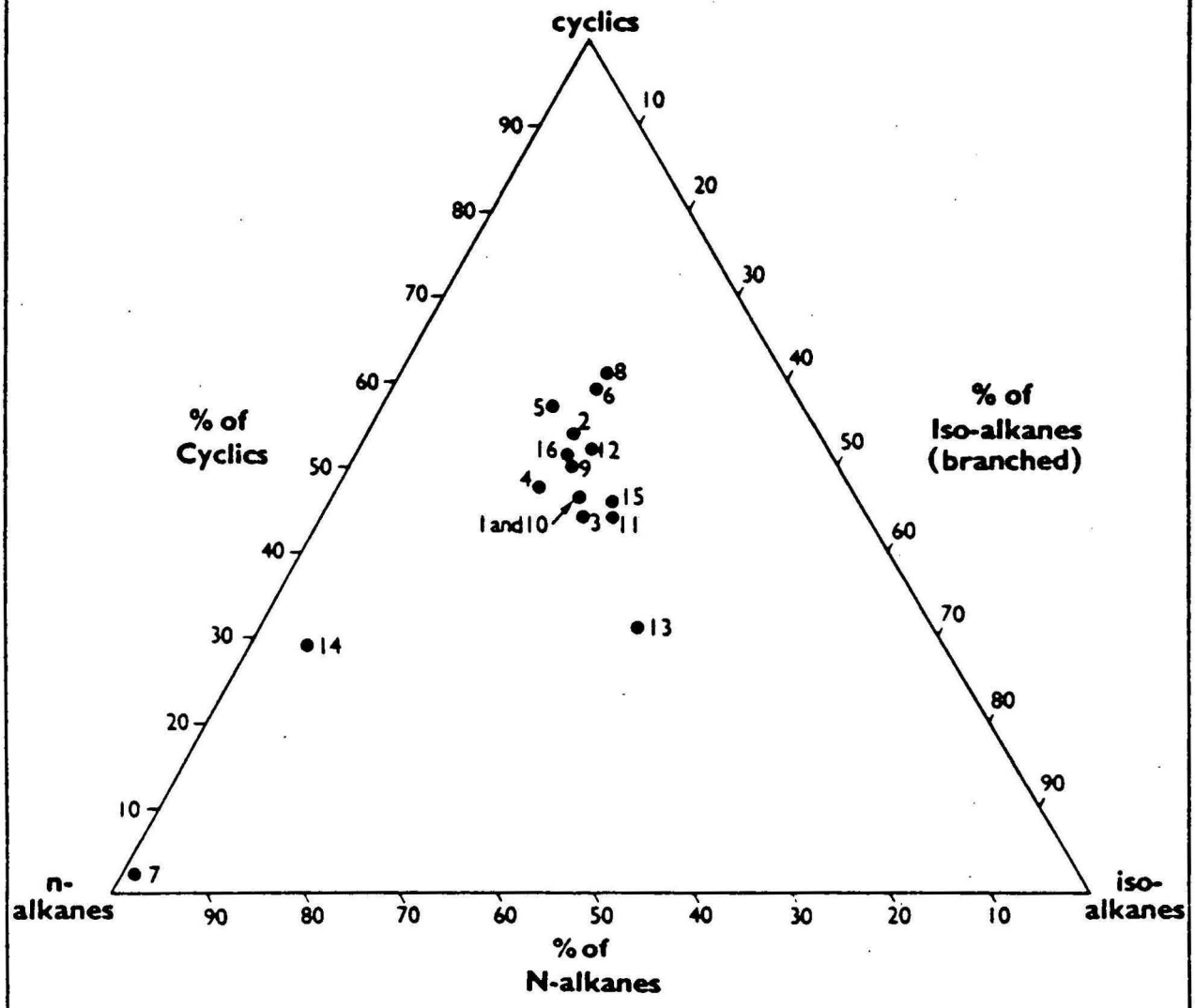

**$\delta^{13}C$ saturates against $\delta^{13}C$ aromatics for oils from the Northern Carnarvon Basin**

**Figure 11.1**

## KEY FOR FIGURES

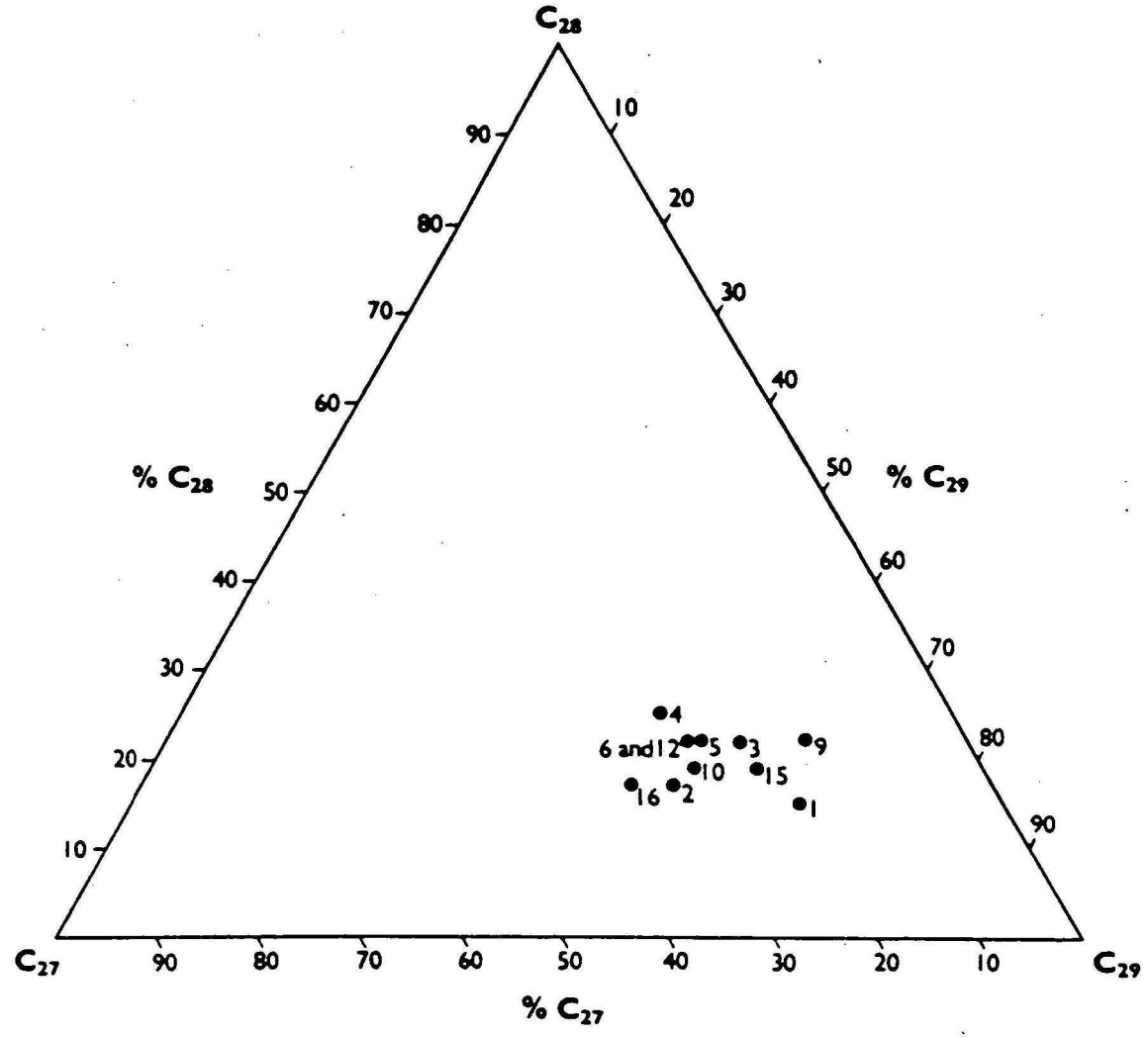
### SECTION II OILS (Figures II.2 and II.3)

1 = Angel-1
2 = Bambra-2
3 = Barrow-1
4 = Barrow-15
5 = Goodwyn-3
6 = Goodwyn-4
7 = Gorgon-1 (DST-6)
8 = Gorgon-1 (DST-7)
9 = Harriet-1
10 = Lenita-1
11 = North Herald-2
12 = Rankin-1
13 = Rough Range-1A
14 = Saladin-1
15 = South Pepper-4
16 = Wilcox-1



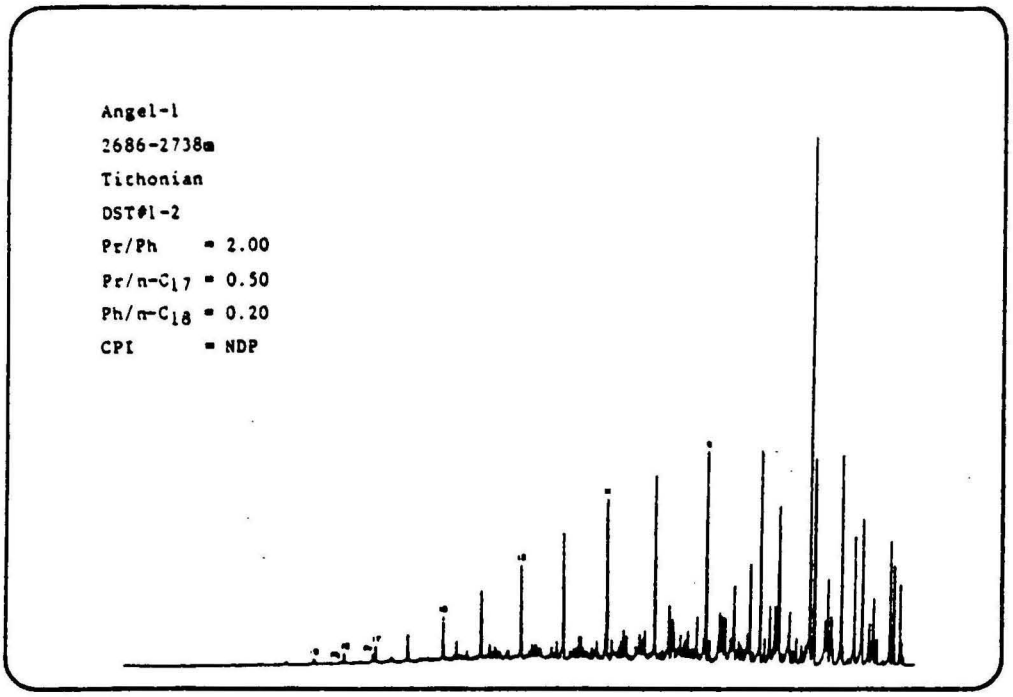

**Ternary diagram showing the relative percentages of n-alkanes, iso-alkanes and cyclo-alkanes for oils from the Northern Carnarvon Basin**

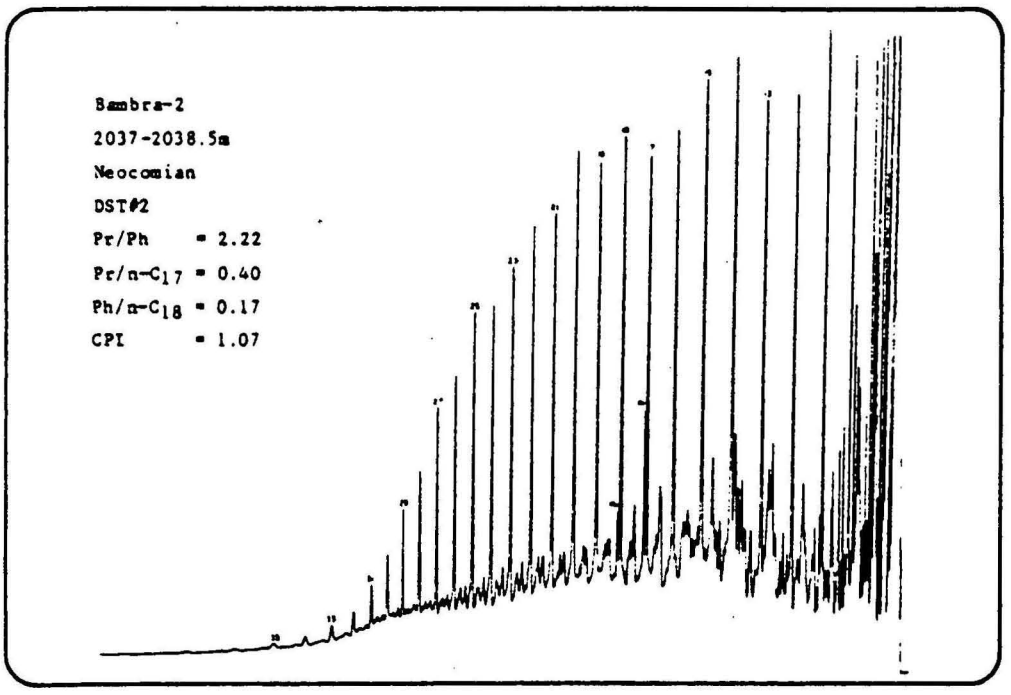
**Figure II.2**




**Ternary diagram showing the relative percentage of $C_{27}$, $C_{28}$ and $C_{29}$, 5α(H), 14 α (H), 17 α (H), 20R steranes in oils from the Northern Carnarvon Basin**

**Figure 11.3**


Angel-1
2686-2738m
Tithonian
DST#1-2
Pr/Ph = 2.00
Pr/n-C17 = 0.50
Ph/n-C18 = 0.20
CPI = NDP


Bambra-2
2037-2038.5m
Neocomian
DST#2
Pr/Ph = 2.22
Pr/n-C17 = 0.40
Ph/n-C18 = 0.17
CPI = 1.07

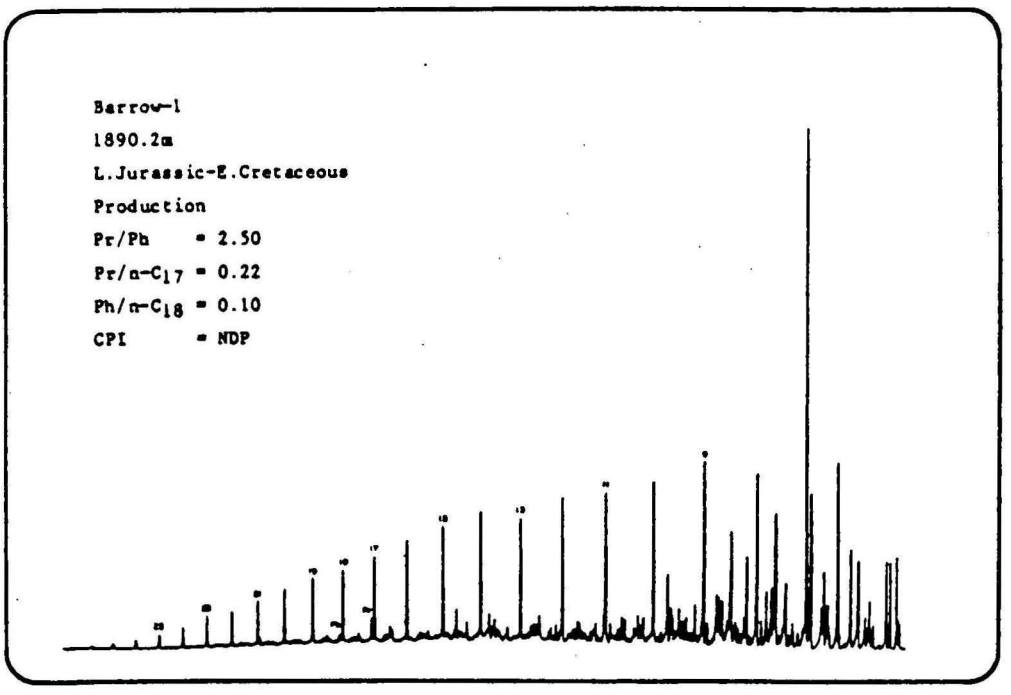
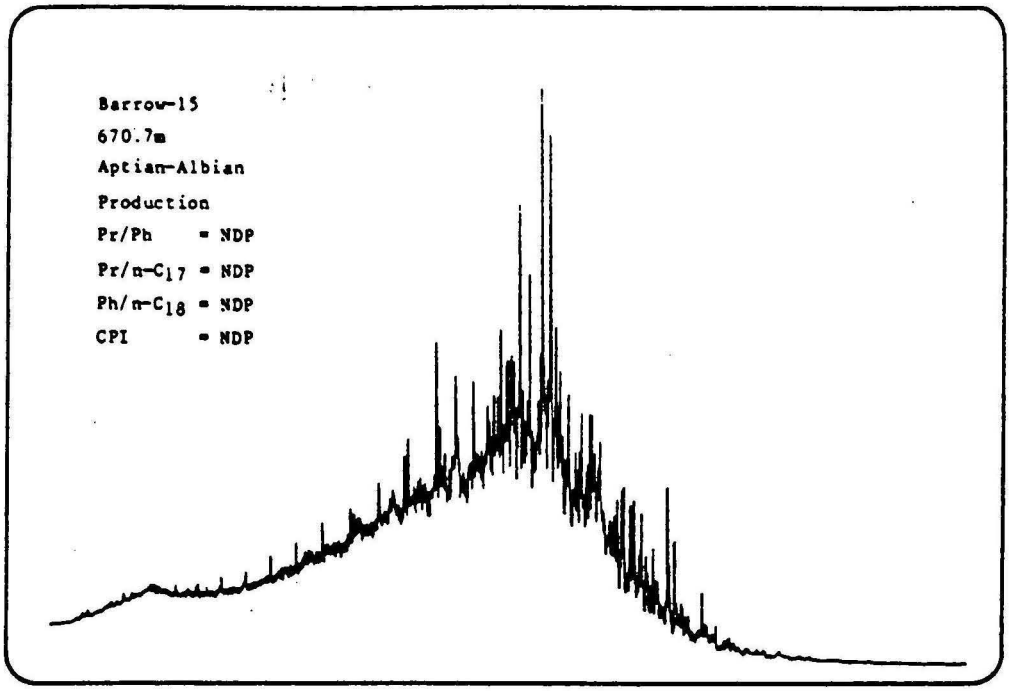
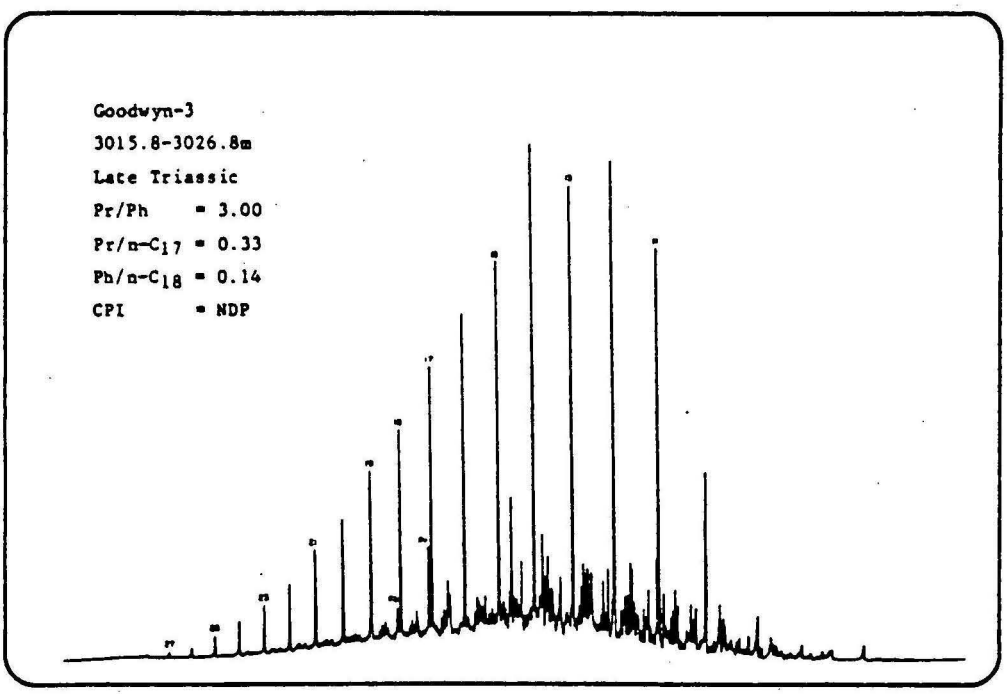

Barrow-1
1890.2m
L.Jurassic-E.Cretaceous
Production
Pr/Ph = 2.50
Pr/n-C17 = 0.22
Ph/n-C18 = 0.10
CPI = NDP

Figure II. 4.1


Barrow-15
670.7m
Aptian-Albian
Production
Pr/Ph = NDP
Pr/n-C17 = NDP
Ph/n-C18 = NDP
CPI = NDP


Goodwyn-3
3015.8-3026.8m
Late Triassic
Pr/Ph = 3.00
Pr/n-C17 = 0.33
Ph/n-C18 = 0.14
CPI = NDP

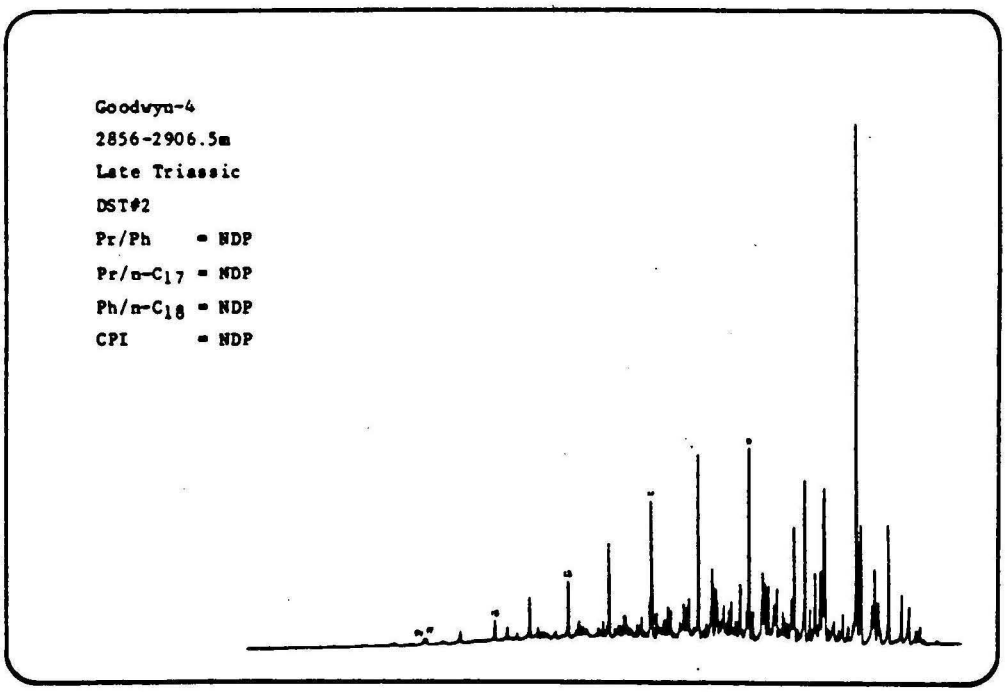
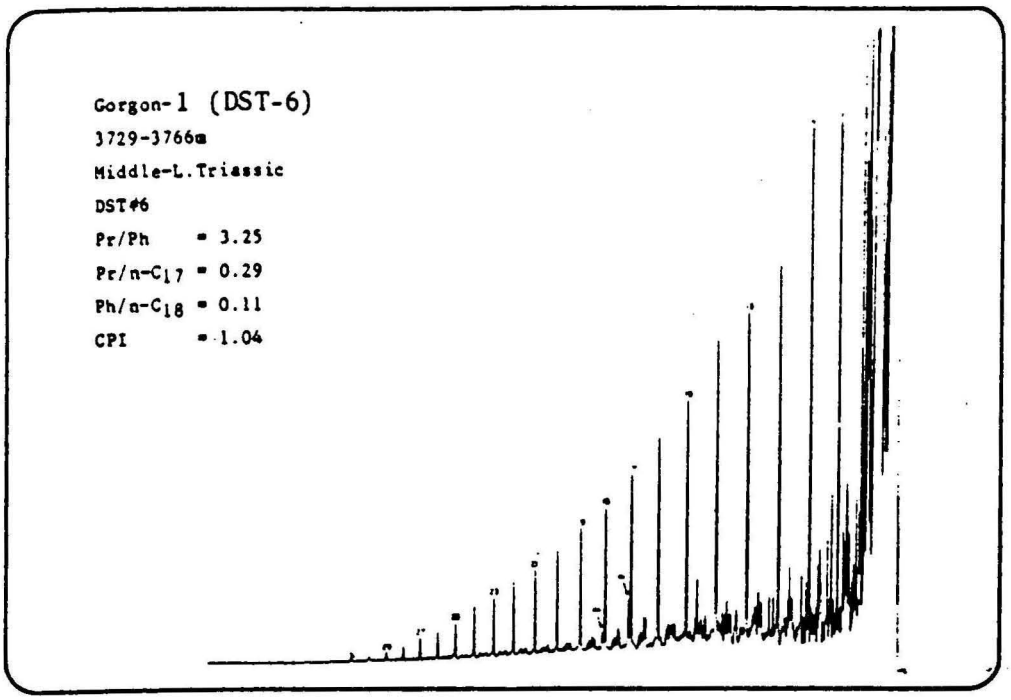
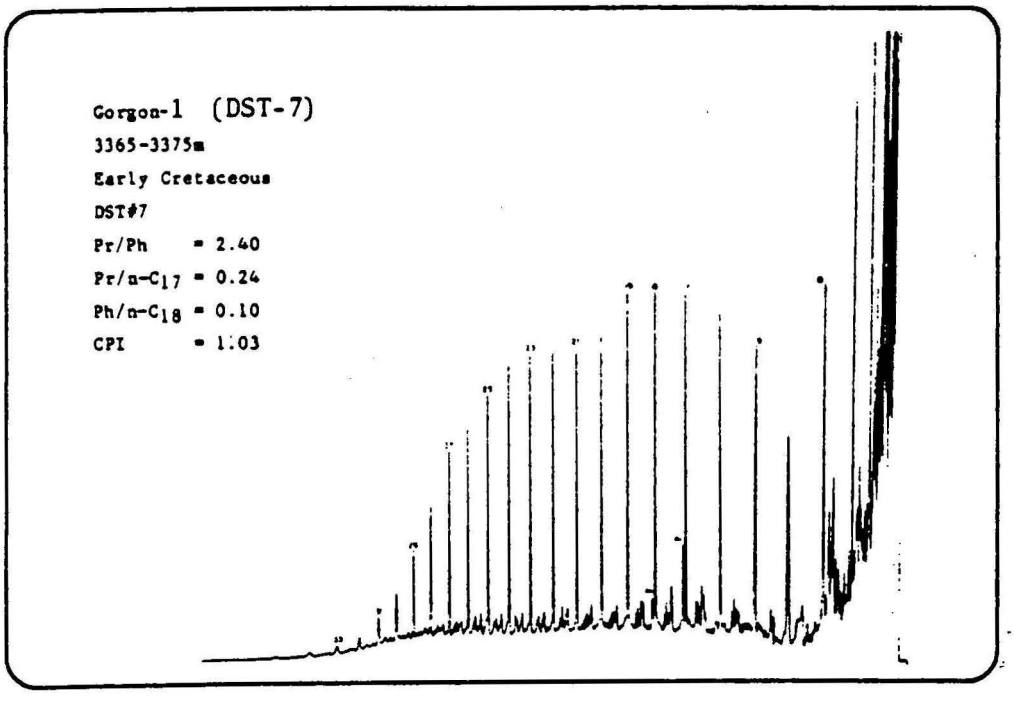

Goodwyn-4
2856-2906.5m
Late Triassic
DST#2
Pr/Ph = NDP
Pr/n-C17 = NDP
Ph/n-C18 = NDP
CPI = NDP

Figure II. 4.2


Gorgon-1 (DST-6)
3729-3766m
Middle-L.Triassic
DST#6
Pr/Ph = 3.25
Pr/n-C17 = 0.29
Ph/n-C18 = 0.11
CPI = 1.04


Gorgon-1 (DST-7)
3365-3375m
Early Cretaceous
DST#7
Pr/Ph = 2.40
Pr/n-C17 = 0.24
Ph/n-C18 = 0.10
CPI = 1.03

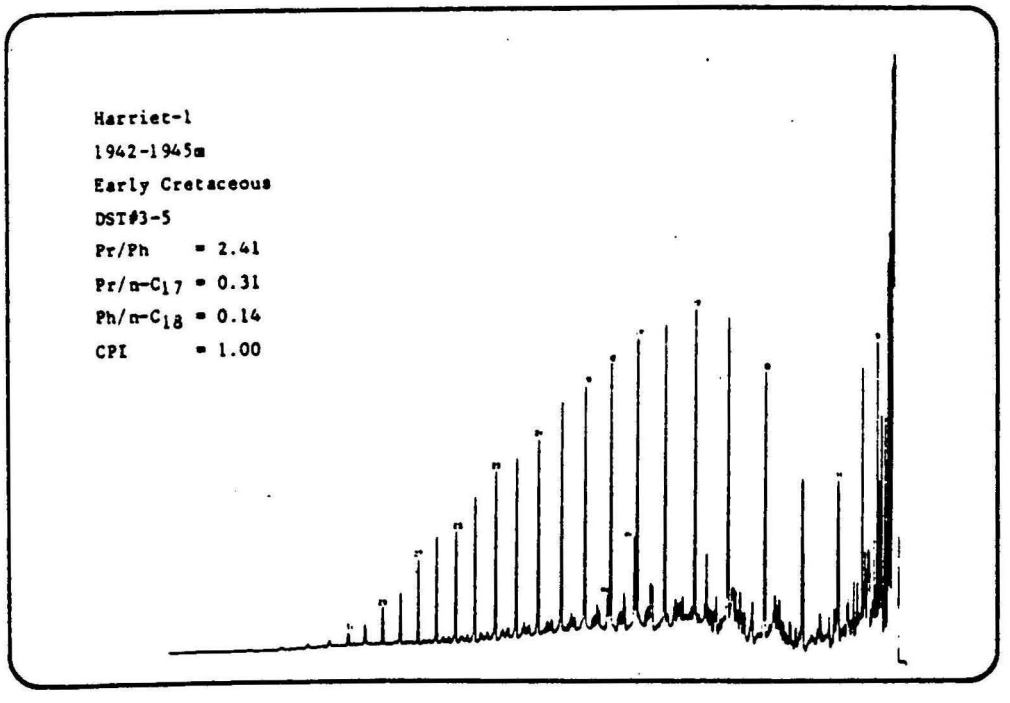
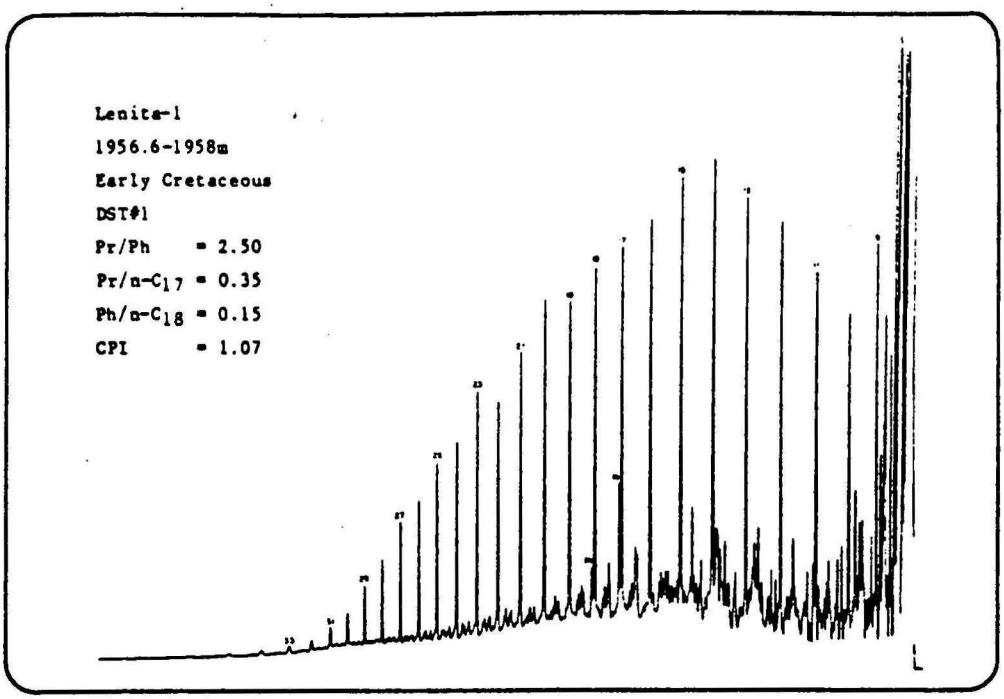
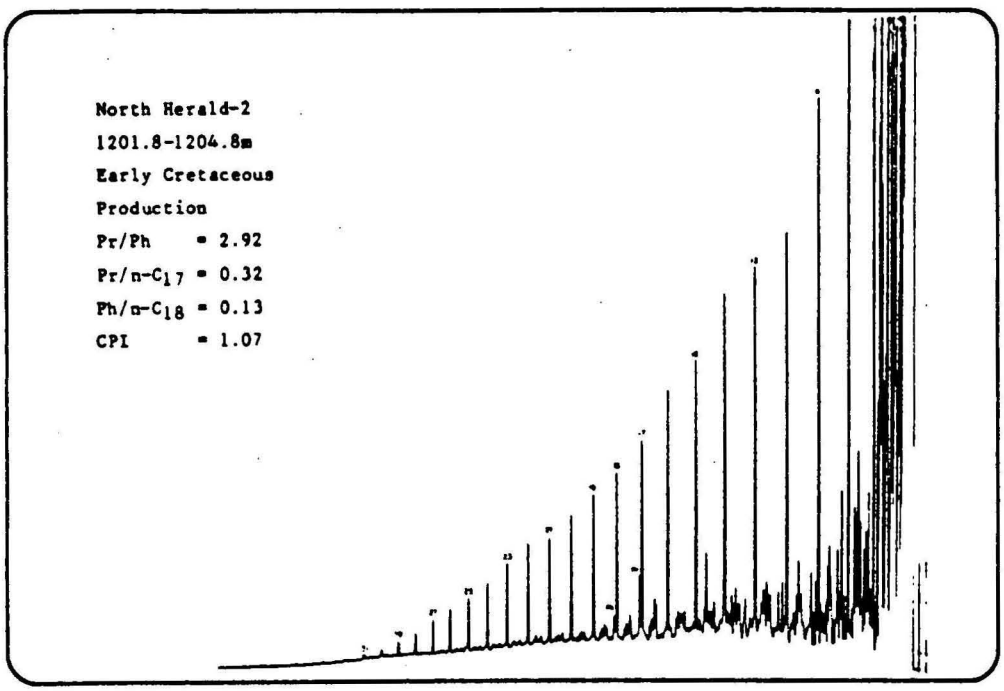

Harriet-1
1942-1945m
Early Cretaceous
DST#3-5
Pr/Ph = 2.41
Pr/n-C17 = 0.31
Ph/n-C18 = 0.14
CPI = 1.00

Figure II. 4.3


Lenita-1
1956.6-1958m
Early Cretaceous
DST#1
Pr/Ph = 2.50
Pr/n-C17 = 0.35
Ph/n-C18 = 0.15
CPI = 1.07


North Herald-2
1201.8-1204.8m
Early Cretaceous
Production
Pr/Ph = 2.92
Pr/n-C17 = 0.32
Ph/n-C18 = 0.13
CPI = 1.07

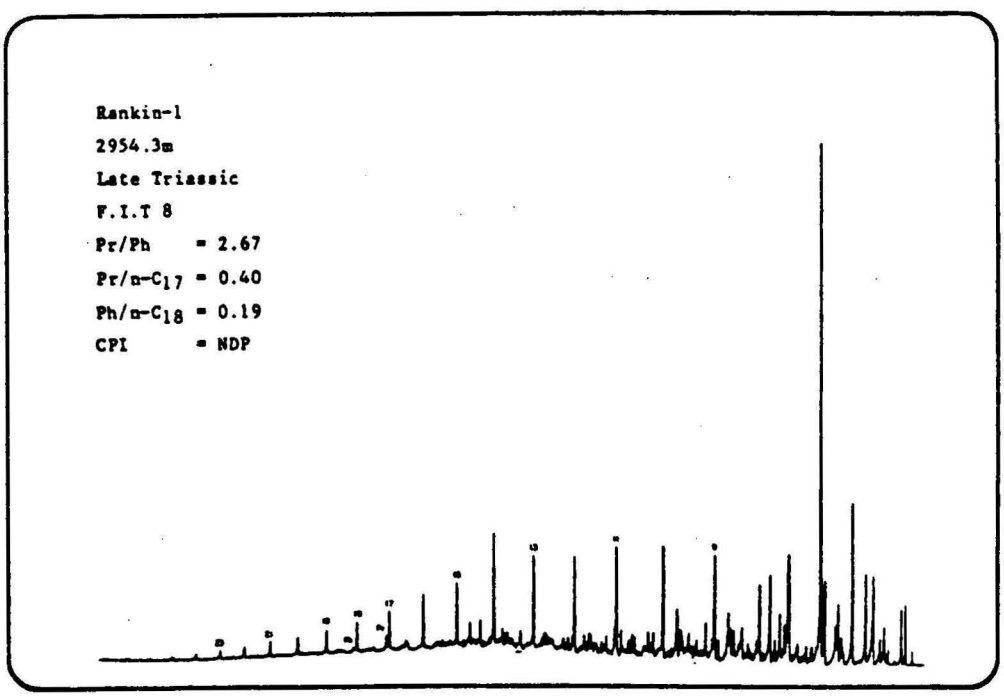
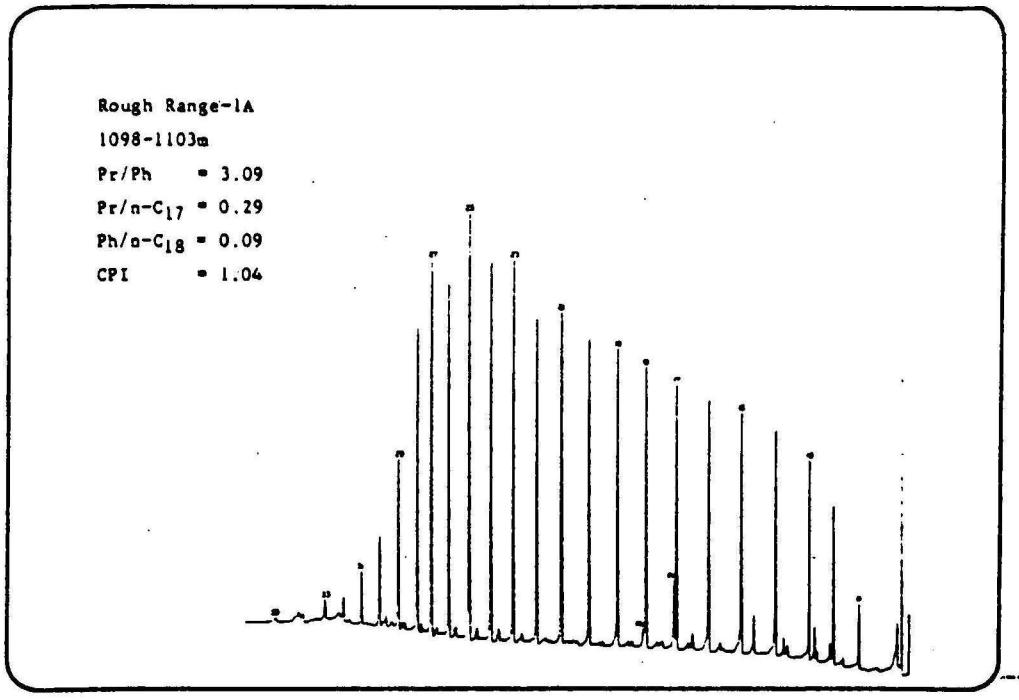
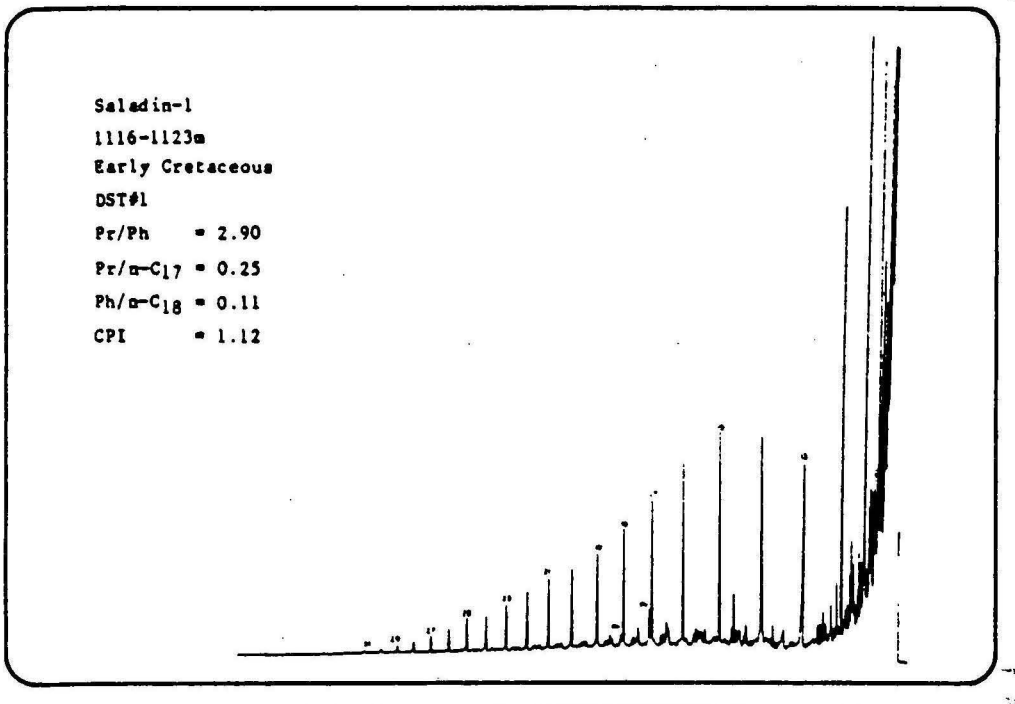

Rankin-1
2954.3m
Late Triassic
F.I.T 8
Pr/Ph = 2.67
Pr/n-C17 = 0.40
Ph/n-C18 = 0.19
CPI = NDP

Figure II. 4.4


Rough Range-1A
1098-1103m
Pr/Ph = 3.09
Pr/n-C17 = 0.29
Ph/n-C18 = 0.09
CPI = 1.04


Saladin-1
1116-1123m
Early Cretaceous
DST#1
Pr/Ph = 2.90
Pr/n-C17 = 0.25
Ph/n-C18 = 0.11
CPI = 1.12

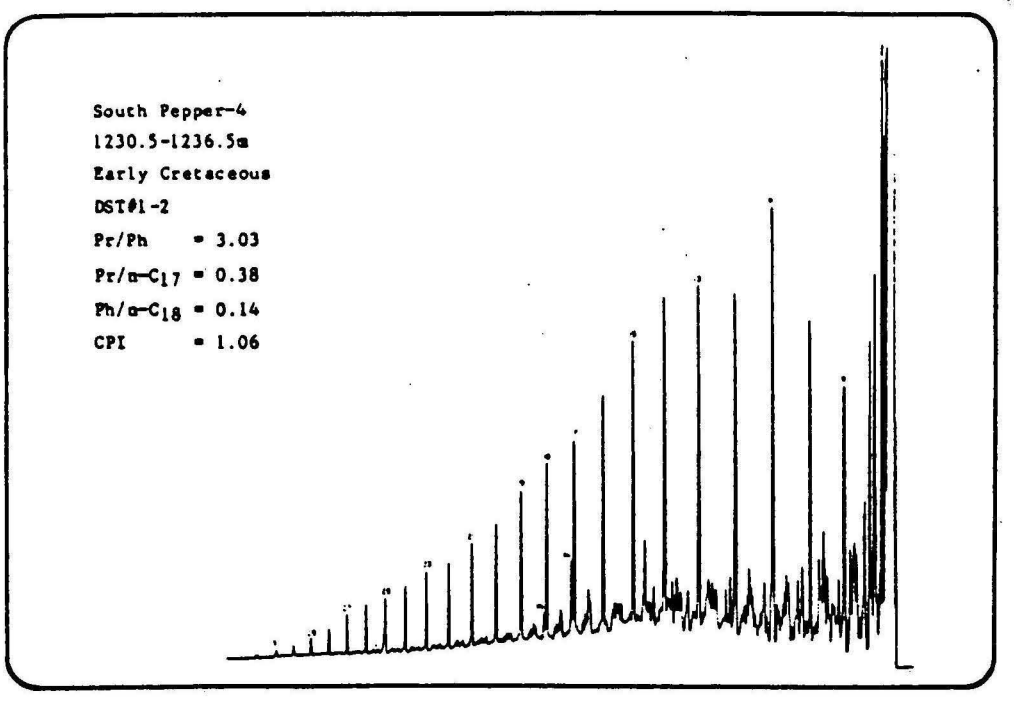

South Pepper-4
1230.5-1236.5m
Early Cretaceous
DST#1-2
Pr/Ph = 3.03
Pr/n-C17 = 0.38
Ph/n-C18 = 0.14
CPI = 1.06

Figure II. 4.5

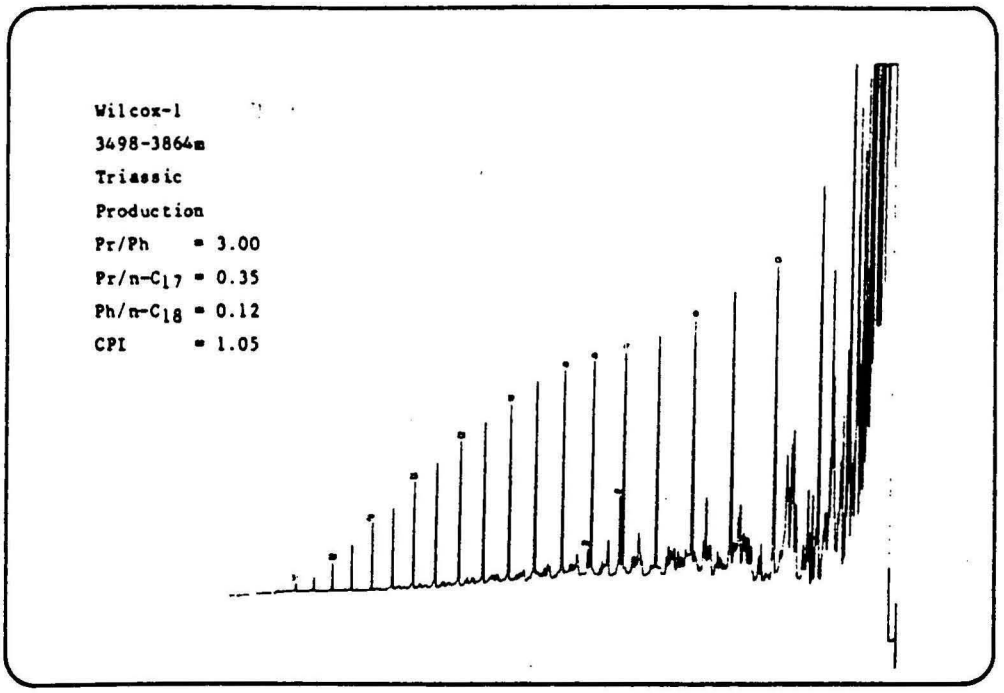
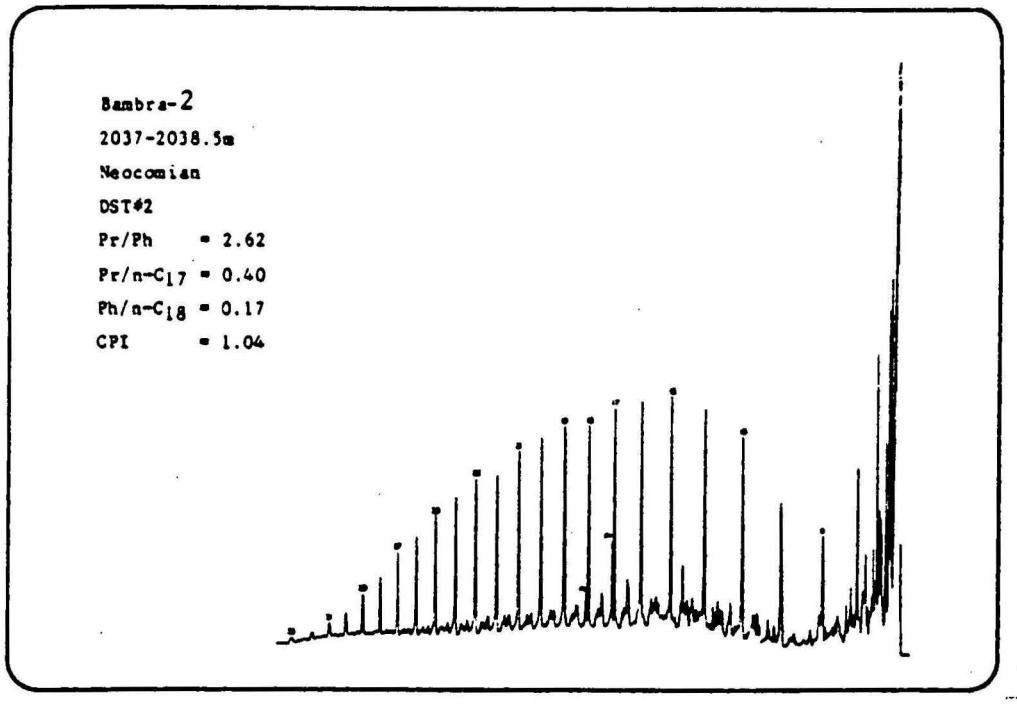
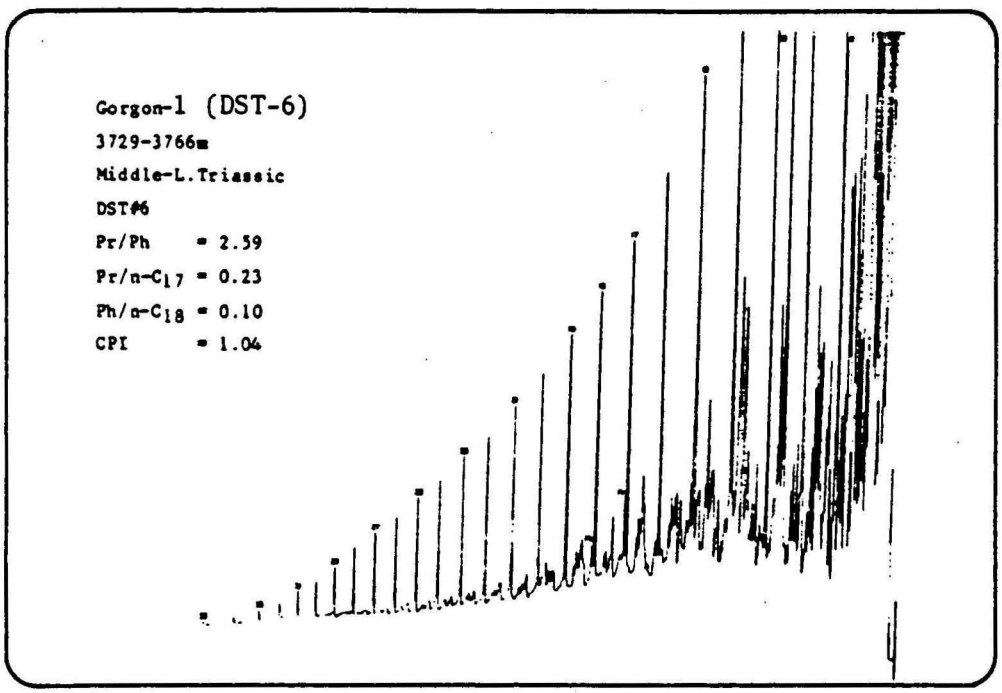

Wilcox-1
3498-3864m
Triassic
Production
Pr/Ph = 3.00
Pr/n-C17 = 0.35
Ph/n-C18 = 0.12
CPI = 1.05

Figure II. 4.6


Bambra-2
2037-2038.5m
Neocomian
DST#2
Pr/Ph = 2.62
Pr/n-C17 = 0.40
Ph/n-C18 = 0.17
CPI = 1.04


Gorgon-1 (DST-6)
3729-3766m
Middle-L.Triassic
DST#6
Pr/Ph = 2.59
Pr/n-C17 = 0.23
Ph/n-C18 = 0.10
CPI = 1.04

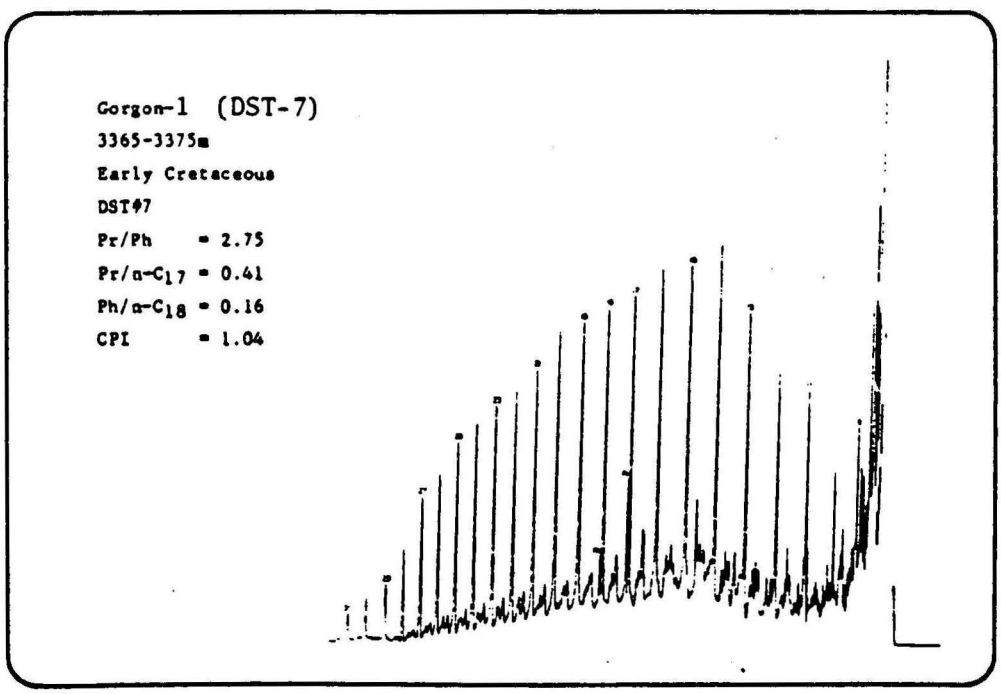
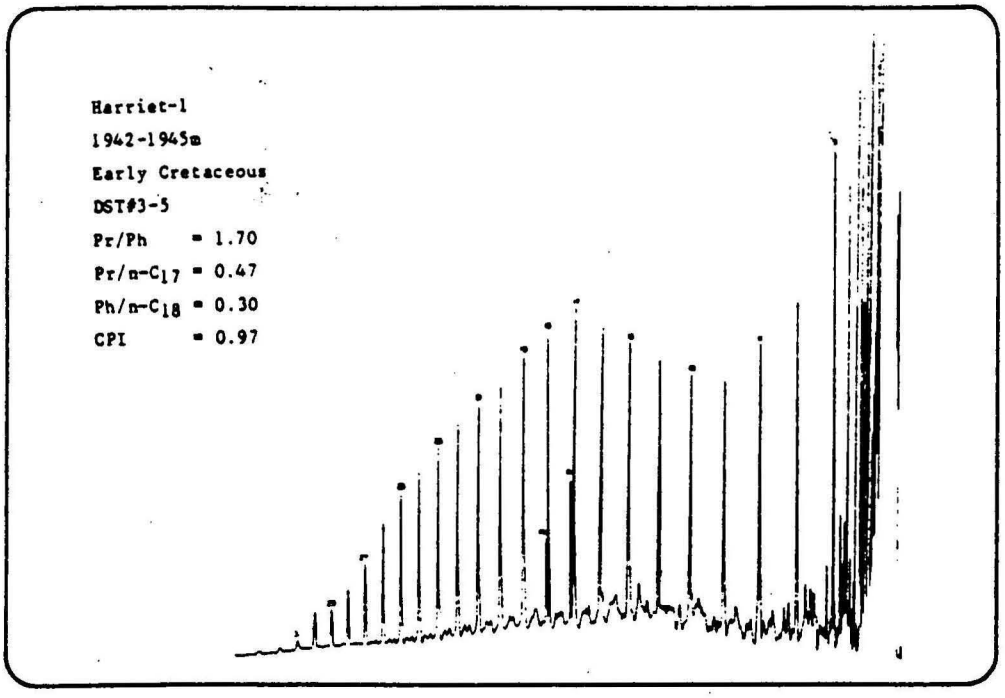
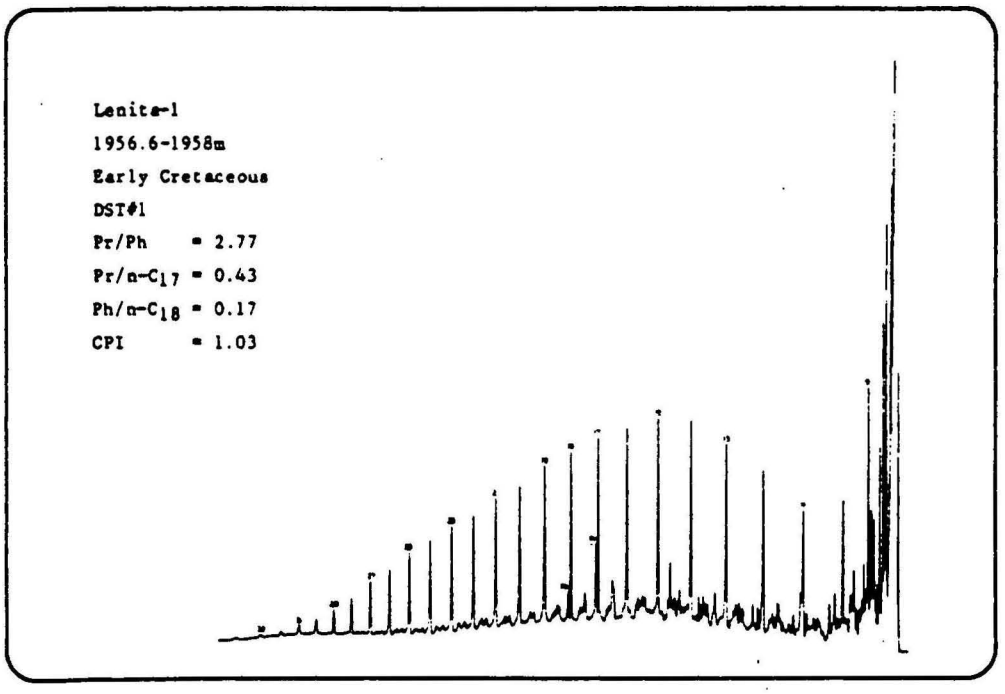

Gorgon-1 (DST-7)
3365-3375m
Early Cretaceous
DST#7
Pr/Ph = 2.75
Pr/n-C17 = 0.41
Ph/n-C18 = 0.16
CPI = 1.04

Figure II. 5.1


Harriet-1
1942-1945m
Early Cretaceous
DST#3-5
Pr/Ph = 1.70
Pr/n-C17 = 0.47
Ph/n-C18 = 0.30
CPI = 0.97


Lenita-1
1956.6-1958m
Early Cretaceous
DST#1
Pr/Ph = 2.77
Pr/n-C17 = 0.43
Ph/n-C18 = 0.17
CPI = 1.03

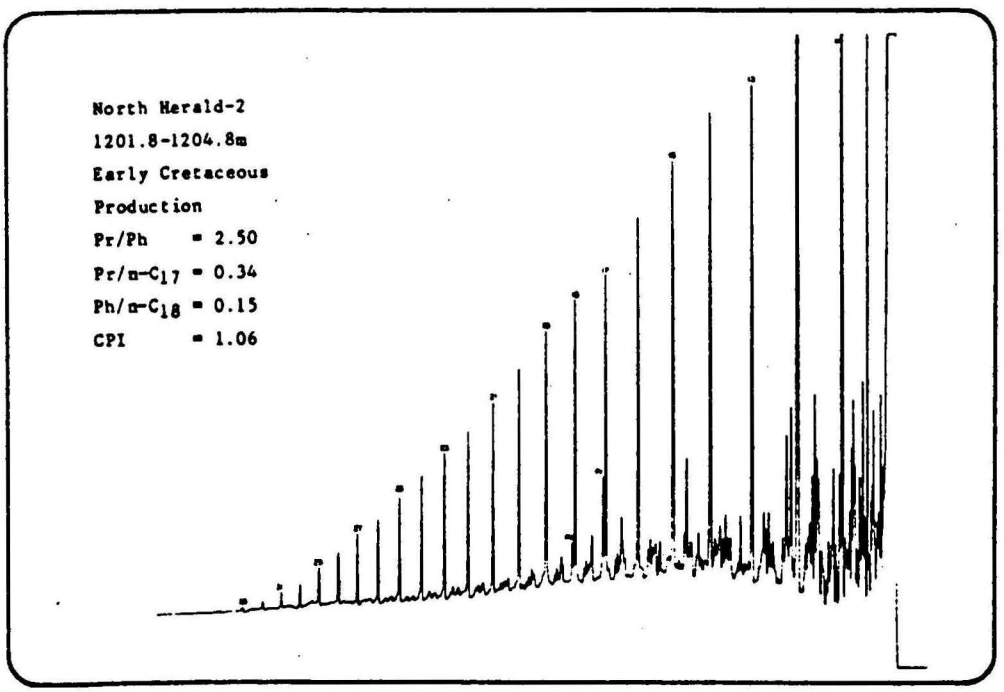
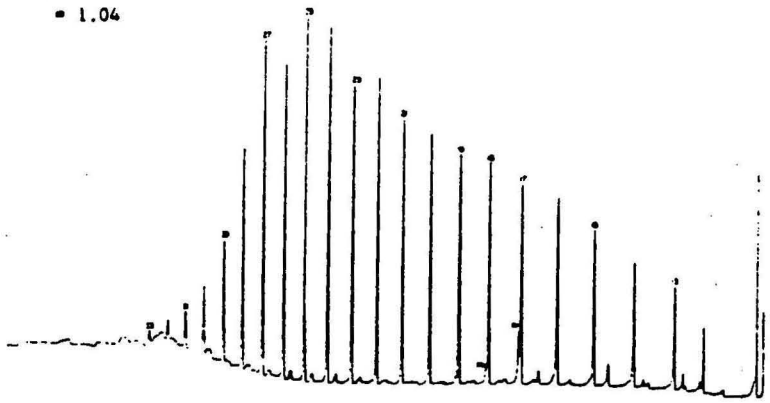
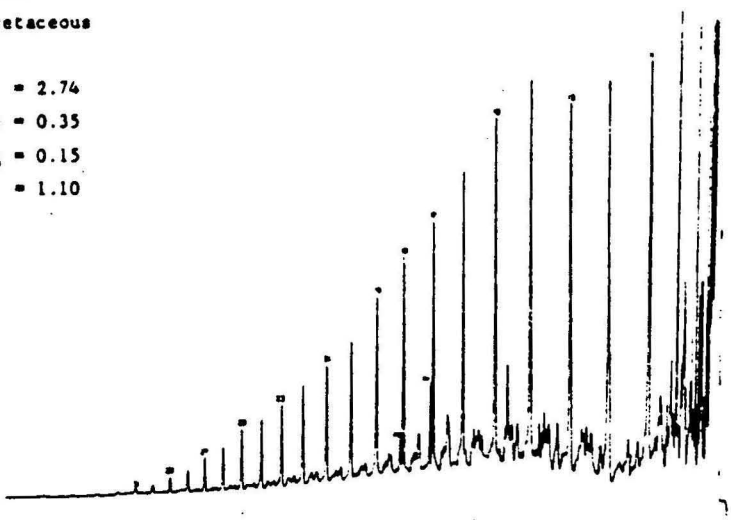

North Herald-2
1201.8-1204.8m
Early Cretaceous
Production
Pr/Ph = 2.50
Pr/n-C17 = 0.34
Ph/n-C18 = 0.15
CPI = 1.06

Figure II. 5.2

Rough Range-1A
1098-1103m
Pr/Ph = 3.58
$Pr/n\text{-}C_{17}$ = 0.38
$Ph/n\text{-}C_{18}$ = 0.10
CPI = 1.04



Saladin-1
1116-1123m
Early Cretaceous
DST#1
Pr/Ph = 2.74
$Pr/n\text{-}C_{17}$ = 0.35
$Ph/n\text{-}C_{18}$ = 0.15
CPI = 1.10



South Pepper-4
1230.5-1236.5m
Early Cretaceous
DST#1-2
Pr/Ph = 2.89
$Pr/n\text{-}C_{17}$ = 0.35
$Ph/n\text{-}C_{18}$ = 0.14
CPI = 1.06

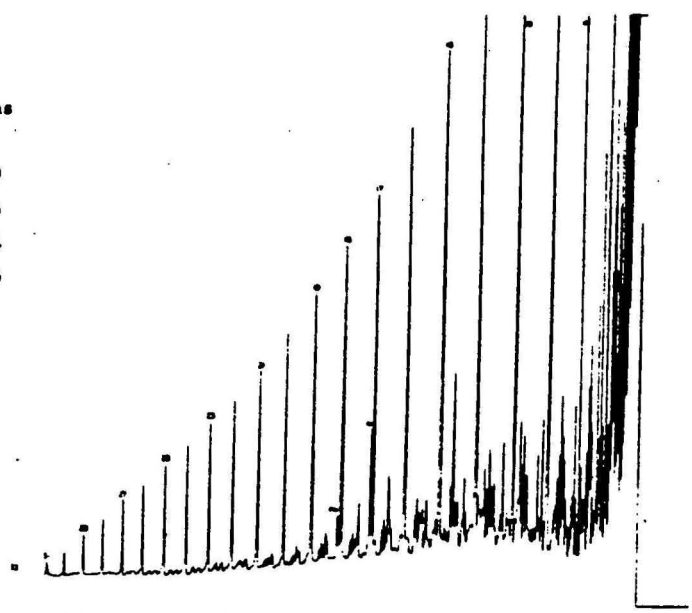


Figure II. 5.3

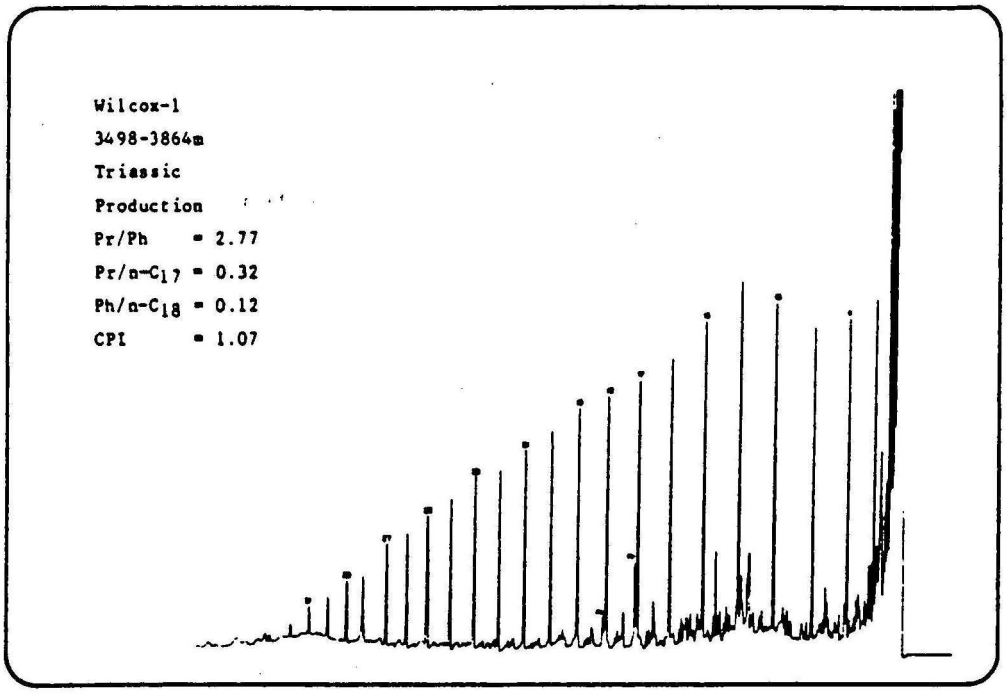

Wilcox-1
3498-3864m
Triassic
Production
Pr/Ph = 2.77
Pr/n-C17 = 0.32
Ph/n-C18 = 0.12
CPI = 1.07

Figure II. 5.4

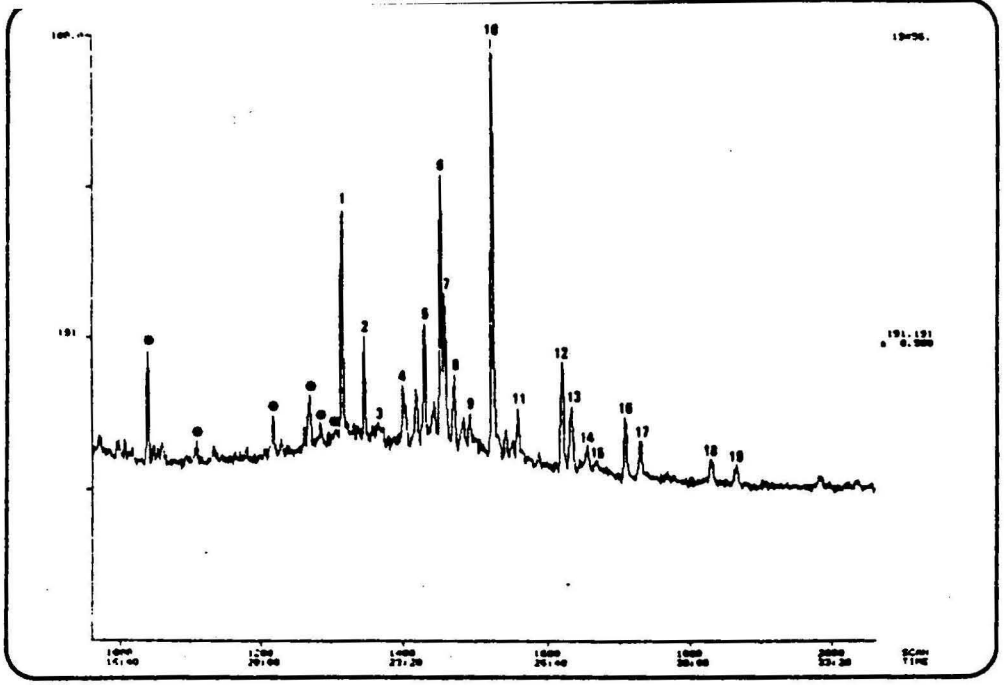
## PEAK IDENTIFICATION ON m/z 191 AND m/z 217 FRAGMENTOGRAMS PRESENTED IN VOLUME 2

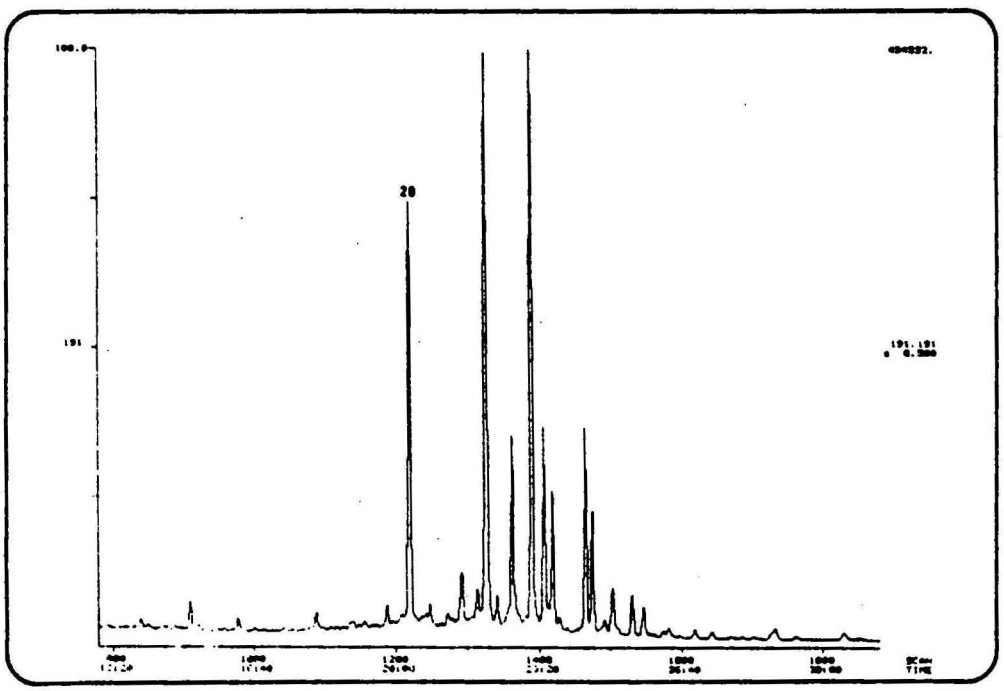
### I. TRITERPANES (m/z 191)

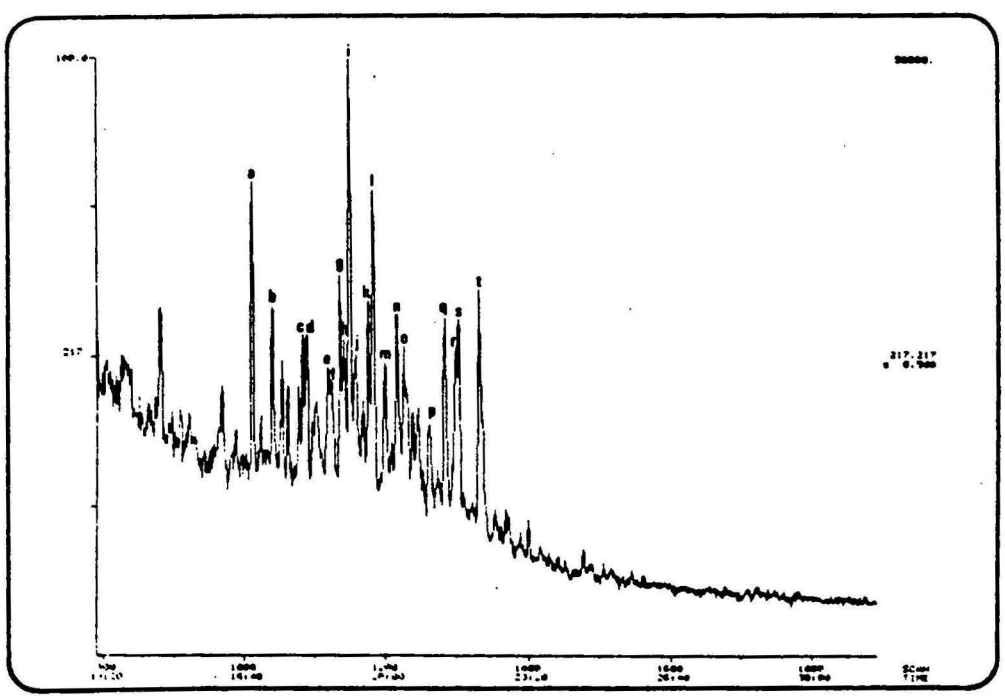
| PEAK NO | COMPOUND NAME |
|---|---|
| * | Tricyclic Terpanes |
| 1 | 18α(H)-22,29,30-trisnorhopane (Ts) |
| 2 | 17α(H)-22,29,30-trisnorhopane (Tm) |
| 3 | 17α(H)-25,30-bisnorhopane (Demethylated hopane) |
| 4(W) | 17α(H)-29,30-bisnorhopane |
| 5 | 17α(H)-25-norhopane (Demethylated hopane) |
| 6 | 17α(H)-30-norhopane |
| 7,8 | unidentified $C_{30}$ triterpanes |
| 9 | 17β(H),21α(H)-normoretane |
| 10 | 17α(H)-hopane |
| 11 | 17β(H)-moretane |
| 12 | (22S)-17α(H)-homohopane |
| 13 | (22R)-17α(H)-homohopane |
| 14&15 | (22S and 22R)-17β(H)-homomoretane |
| 16&17 | (22S and 22R)-17α(H)-bishomohopane |
| 18&19 | (22S and 22RO-17α(H)-trishomohopane |
| 20(V) | unknown Terpane co-eluted with 17α(H)-trisnorhopane |

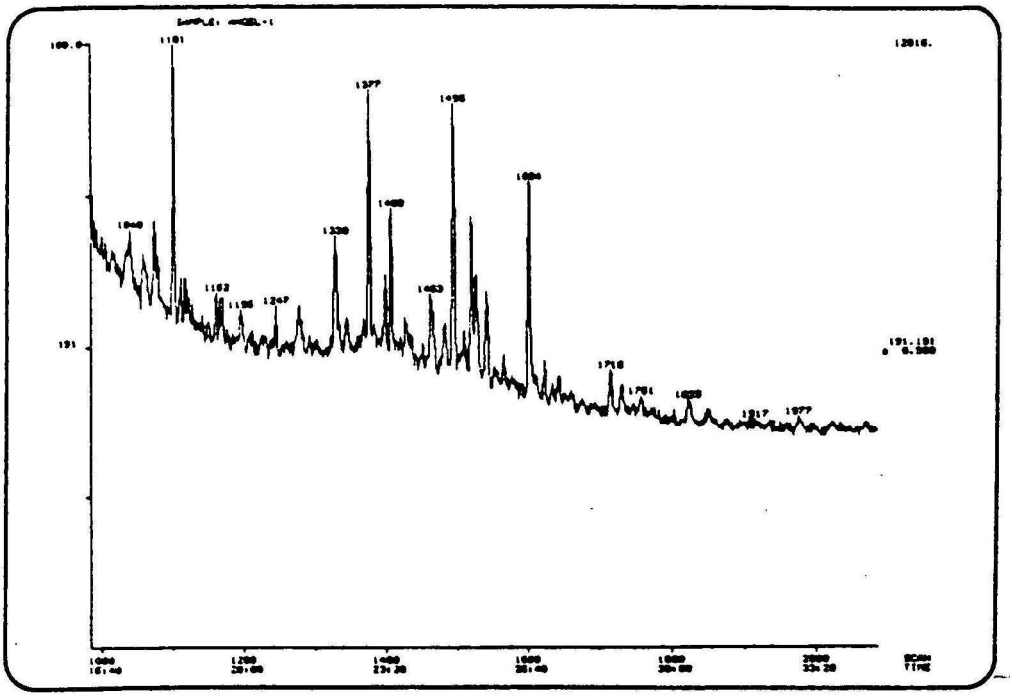
### II. STERANES (m/z 217)

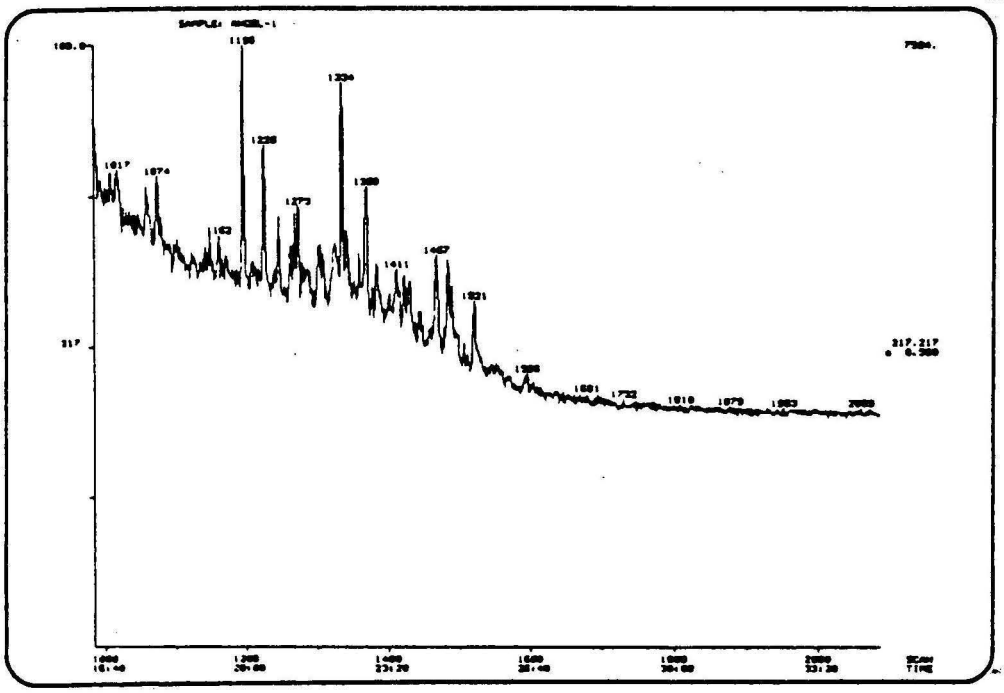
| PEAK NO | COMPOUND NAME |
|---|---|
| a | 13βH, 17αH rearranged cholestane 20S ($C_{27}$) |
| b | 13βH, 17αH rearranged cholestane 20R ($C_{27}$) |
| c-f | 13βH, 17αH rearranged 24-methyl-cholestanes ($C_{28}$) |
| g | 5αH, 14αH, 17αH cholestane 20S ($C_{27}$) |
| h,j | 5αH, 14βH, 17βH isocholestane 20R and 20S ($C_{27}$) |
| i | 13βH, 17αH rearranged 24-ethyl-cholestane 20S ($C_{29}$) |
| k | 5αH, 14αH, 17αH cholestane 20R ($C_{27}$) |
| l | 13βH, 17αH rearranged 24-ethyl-cholestane 20R ($C_{29}$) |
| m | 5αH, 14αH, 17αH 24-methyl-cholestane 20S ($C_{28}$) |
| n,o | 5αH, 14βH, 17βH iso-24-methyl-cholestane 20R and 20S ($C_{28}$) |
| p | 5αH, 14αH, 17αH 24-methyl-cholestane 20R ($C_{28}$) |
| q | 5αH, 14αH, 17αH 24-ethyl-cholestane 20S ($C_{29}$) |
| r,s | 5αH, 14βH, 17βH iso-24-ethyl-cholestane 20R and 20S ($C_{29}$) |
| t | 5αH, 14αH, 17αH 24-ethyl-cholestane 20R ($C_{29}$) |











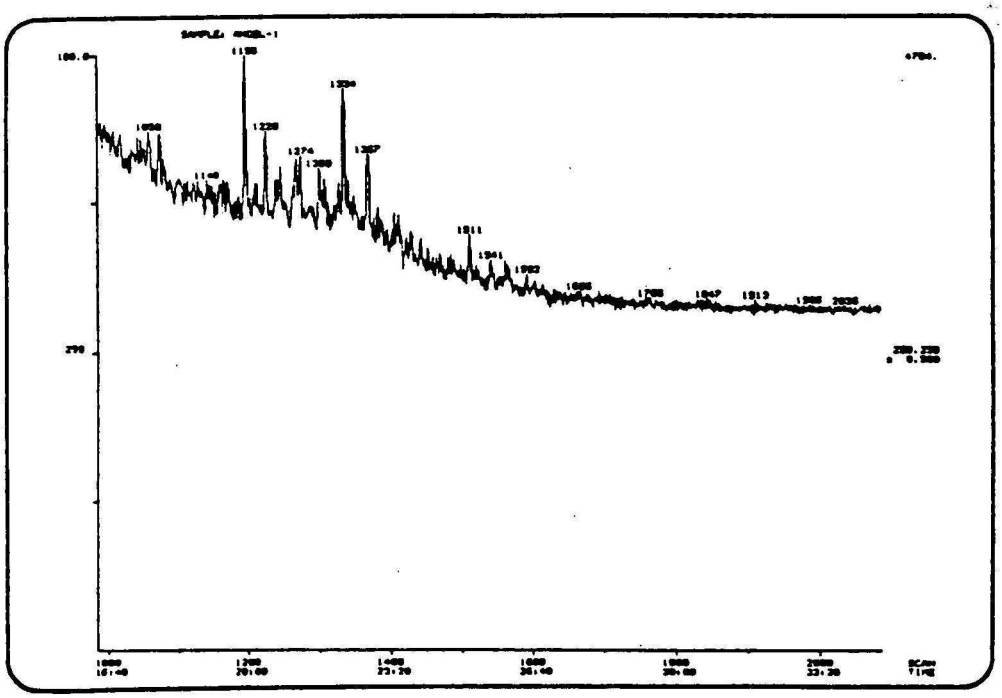
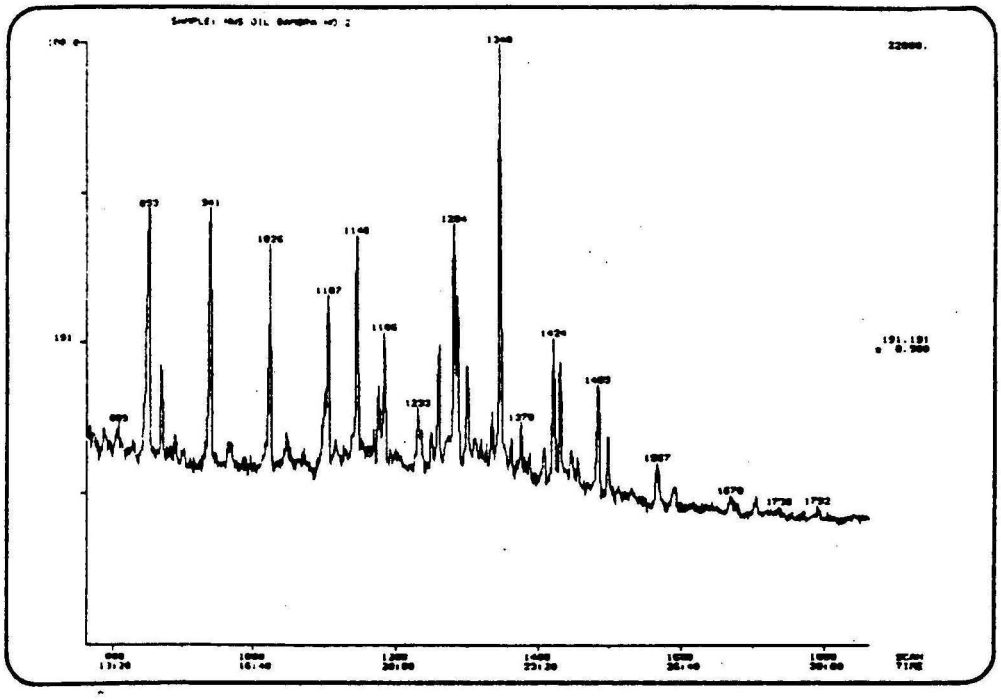
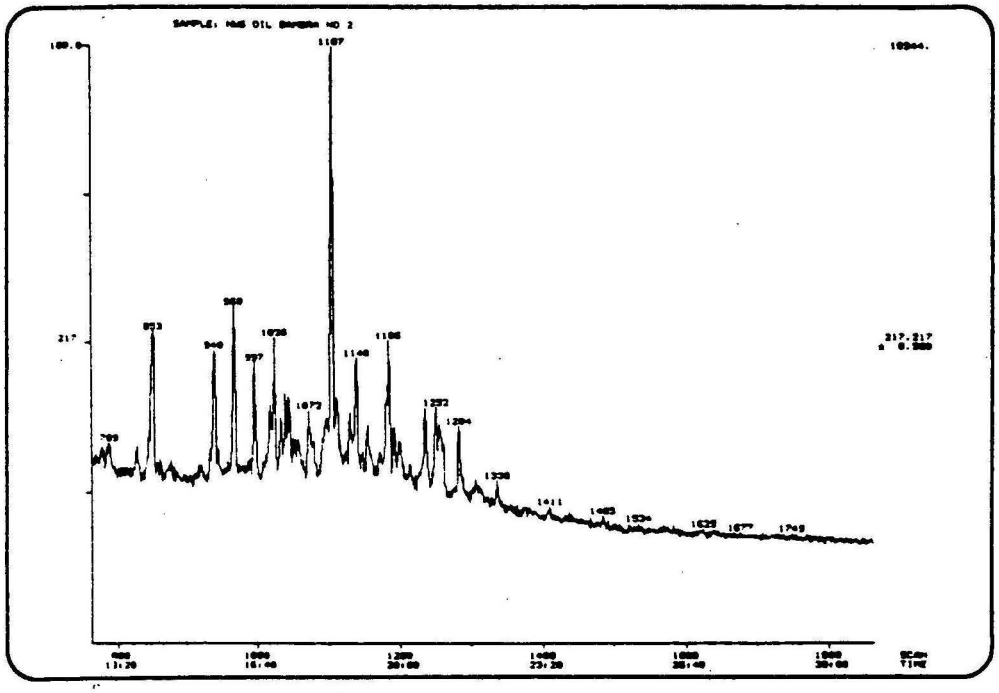


Figure II. 6.1





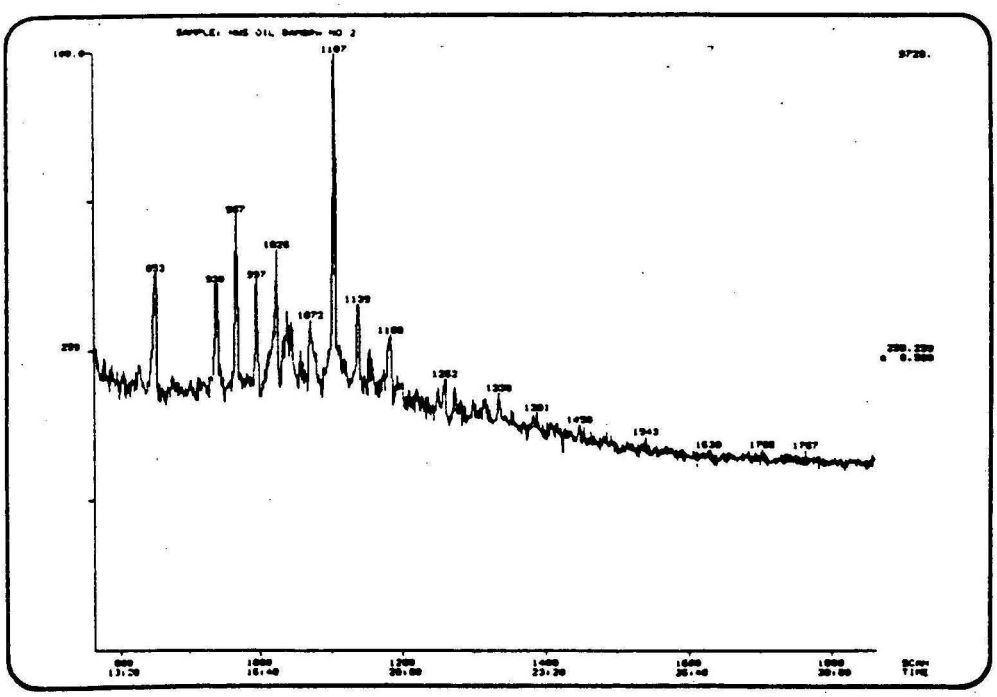
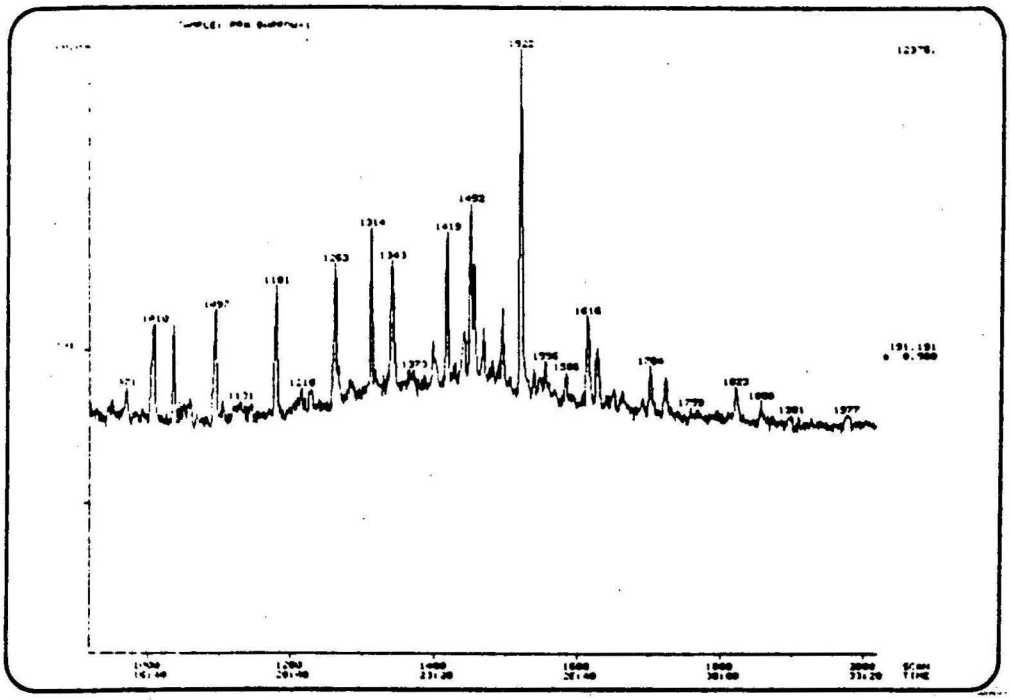
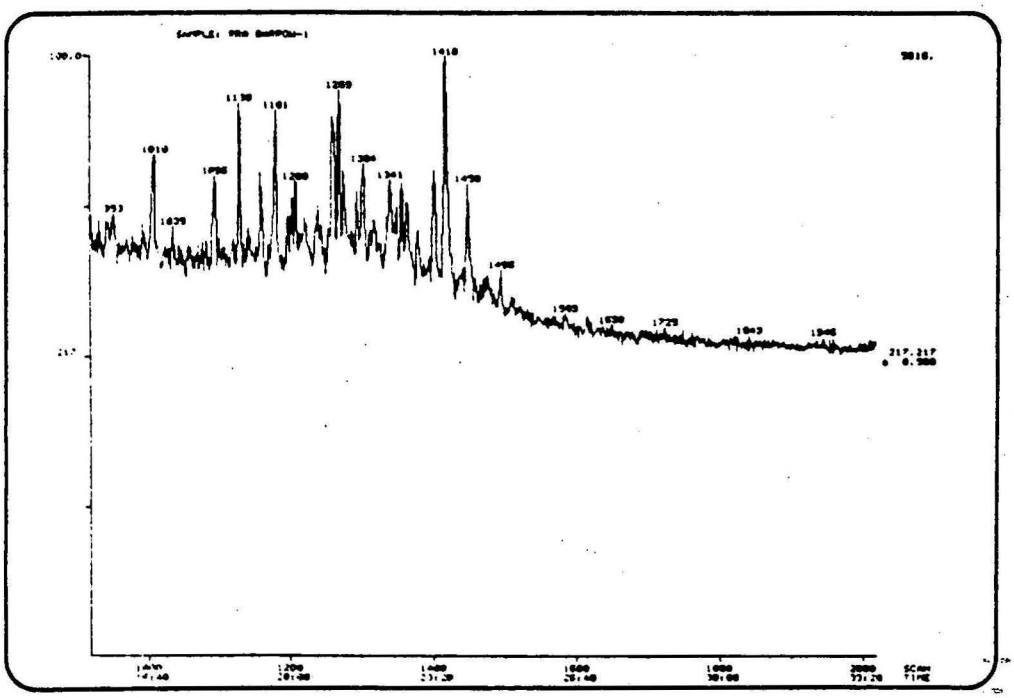


Figure II. 6.2





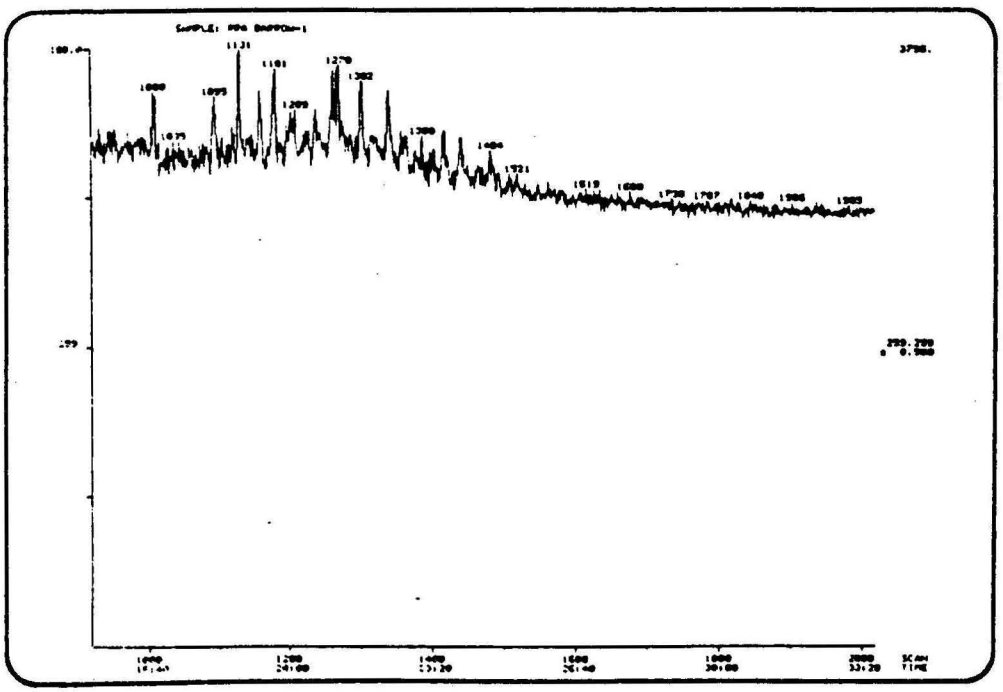
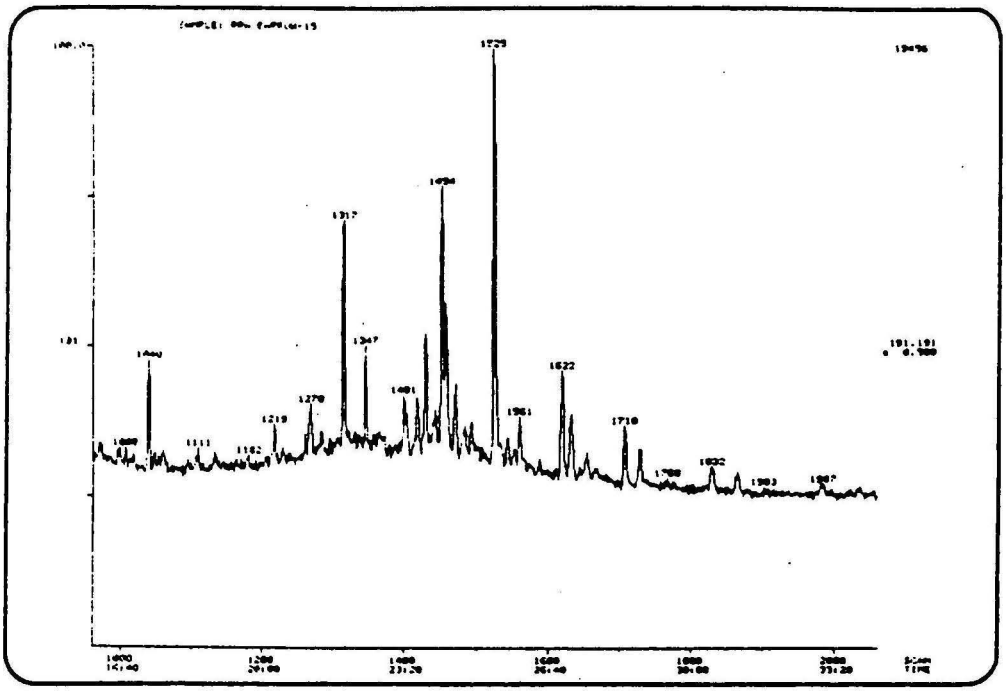
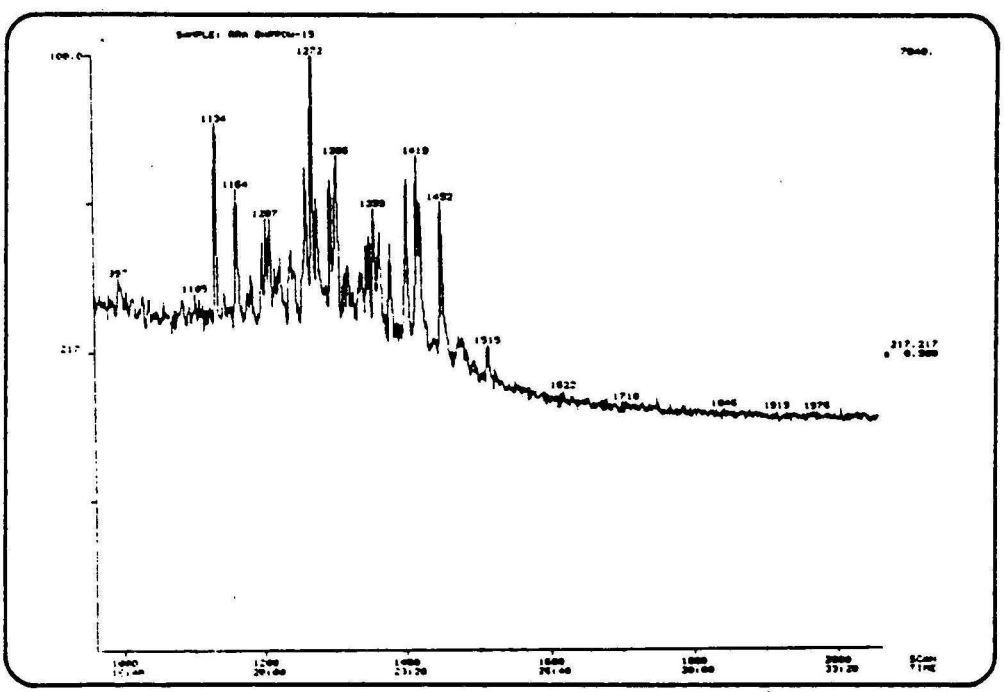


Figure II. 6.3





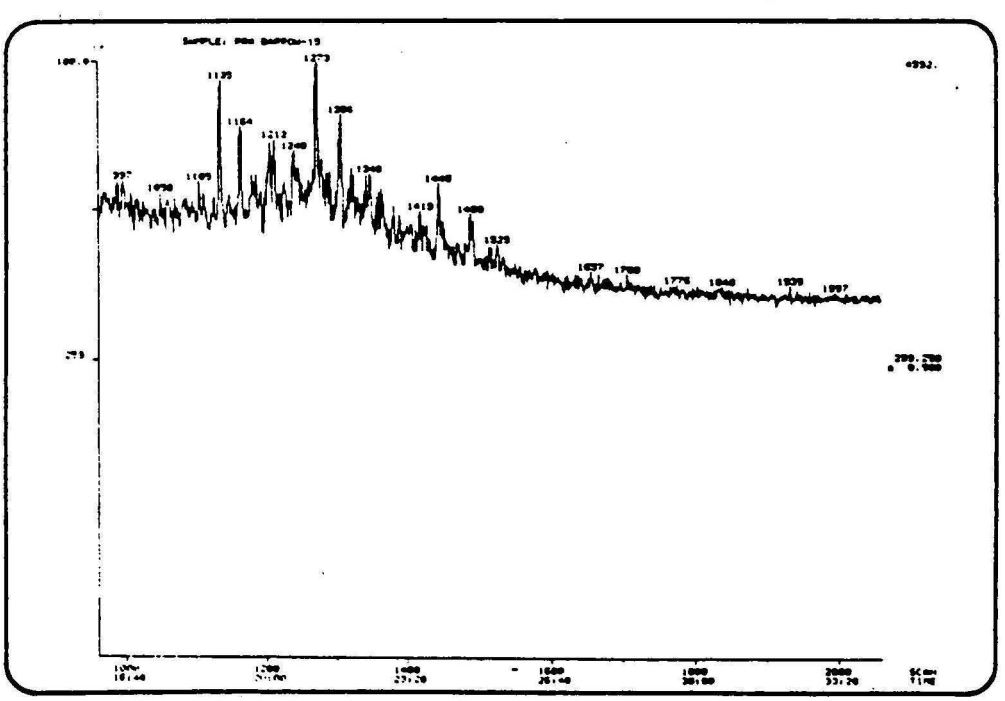
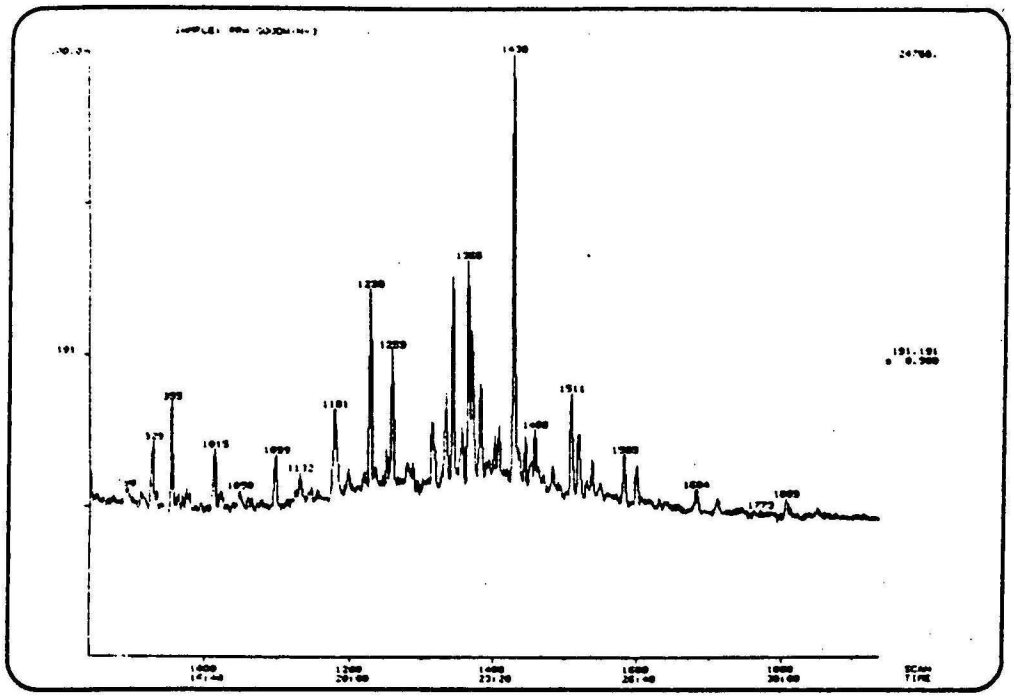
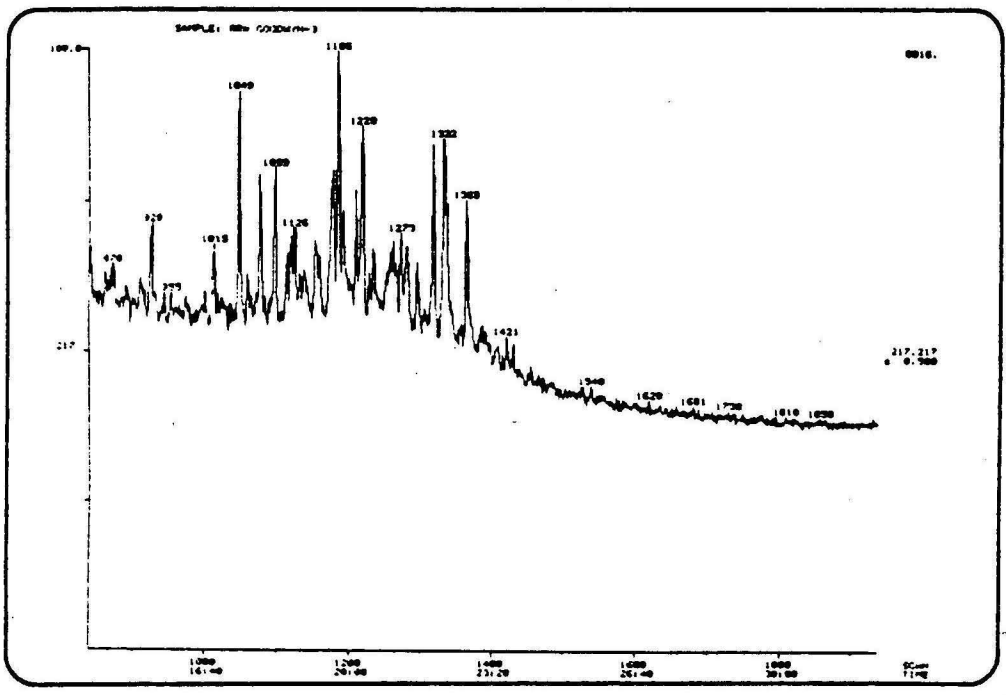


Figure II. 6.4





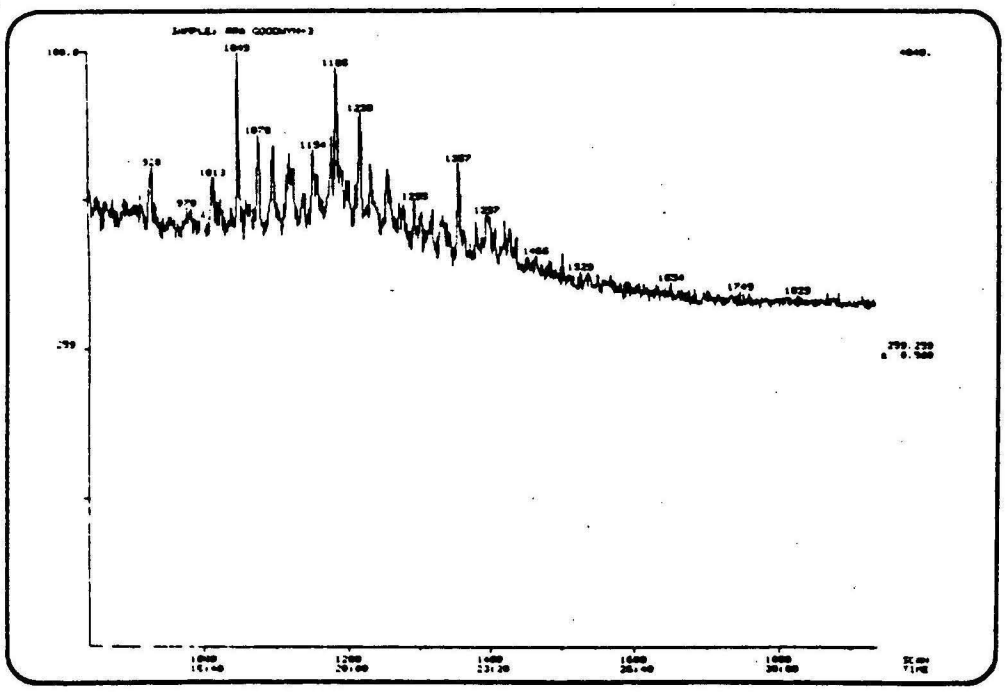
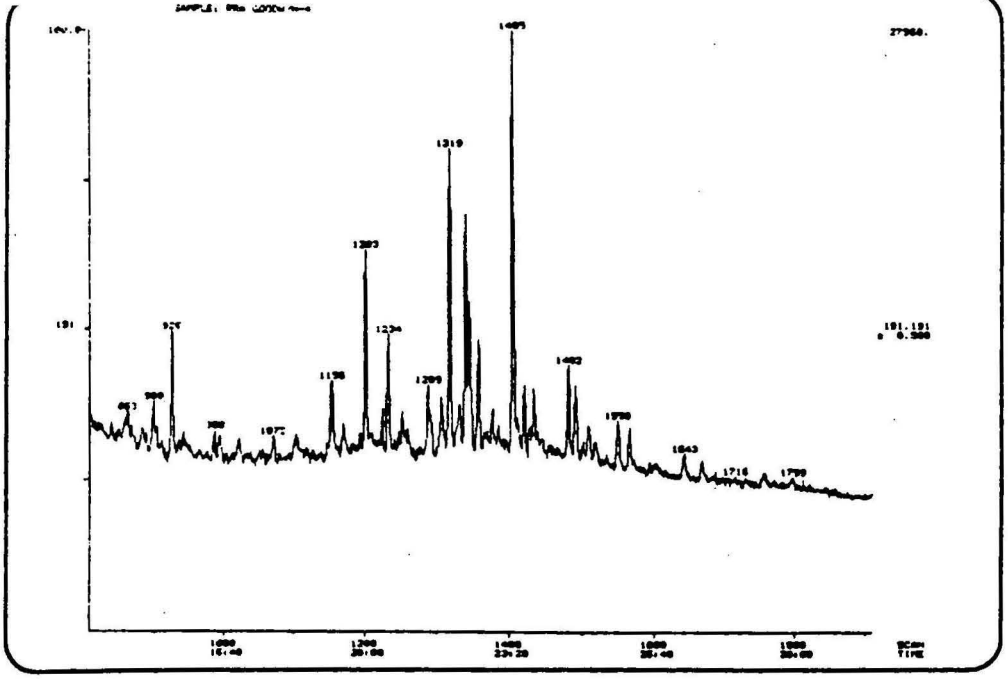
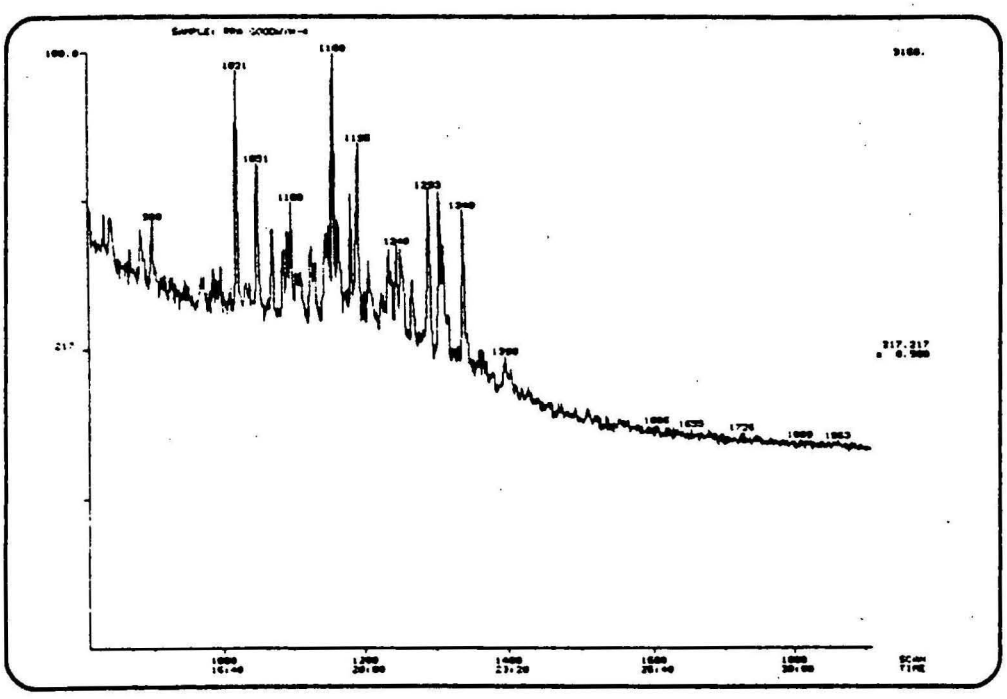
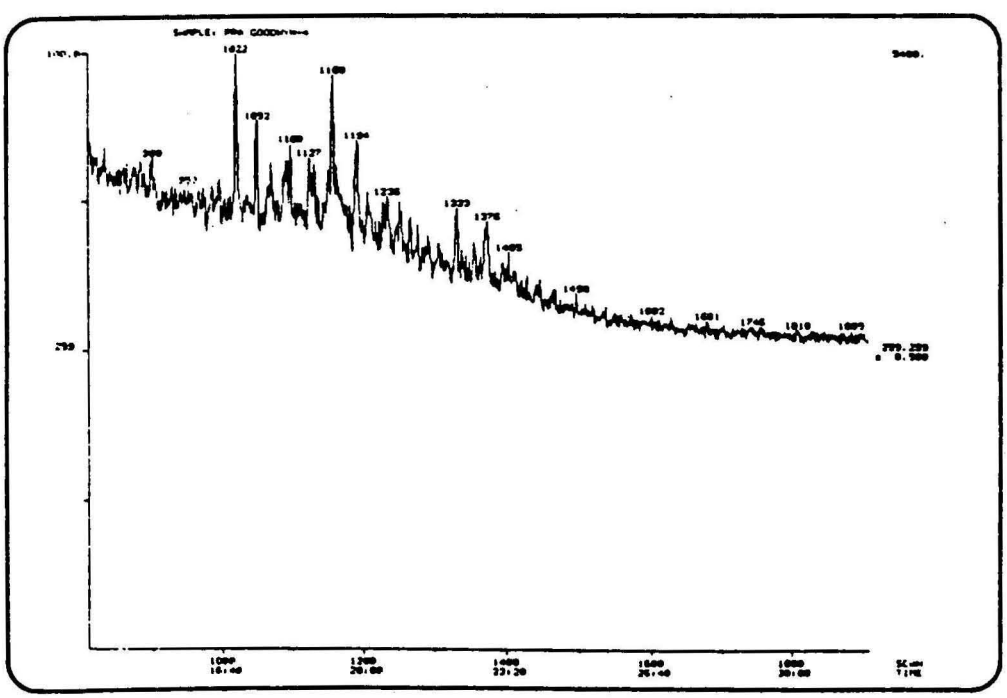


Figure II. 6.5







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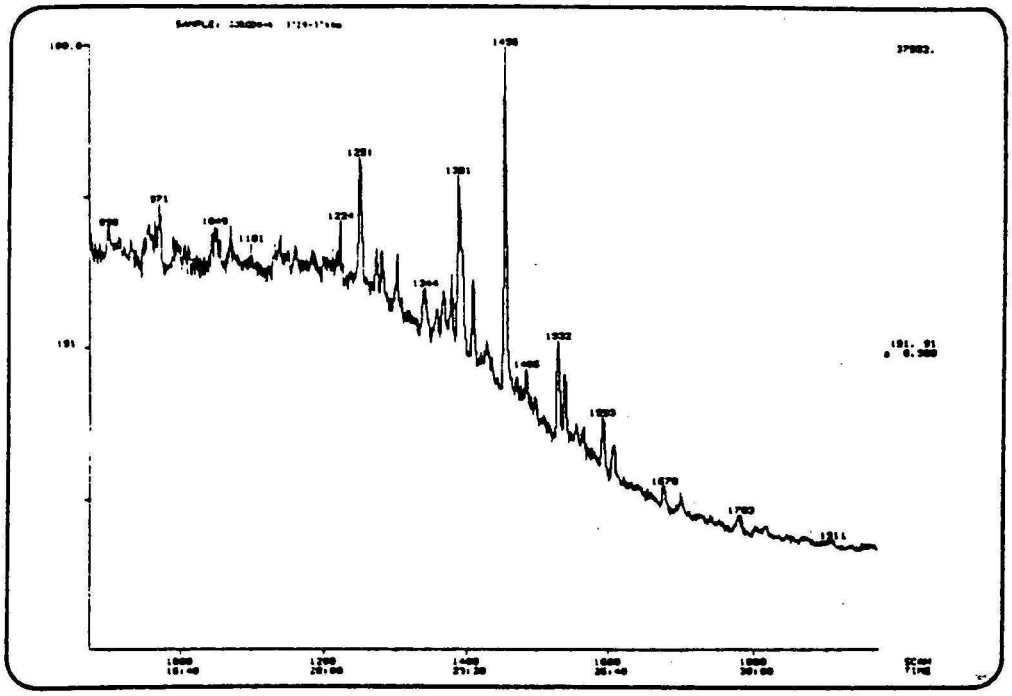

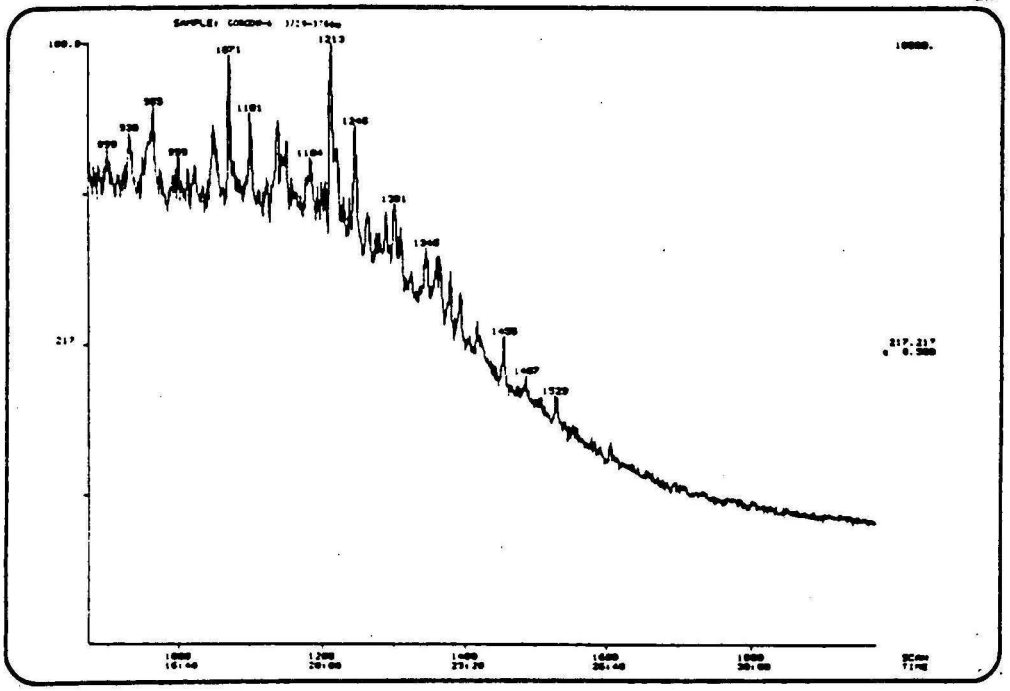

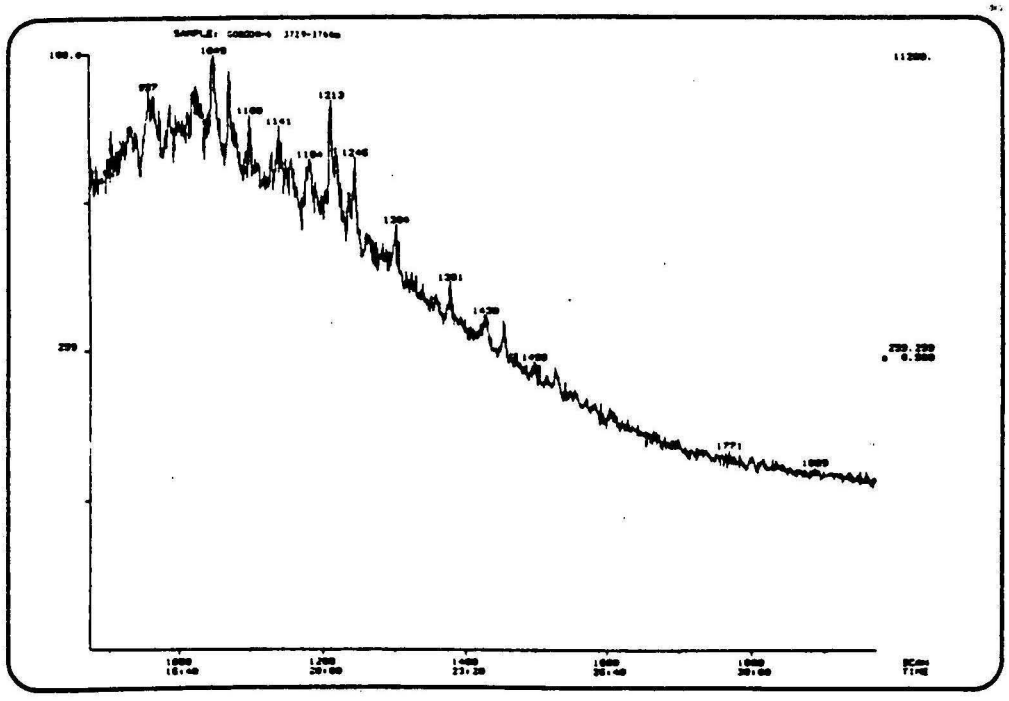

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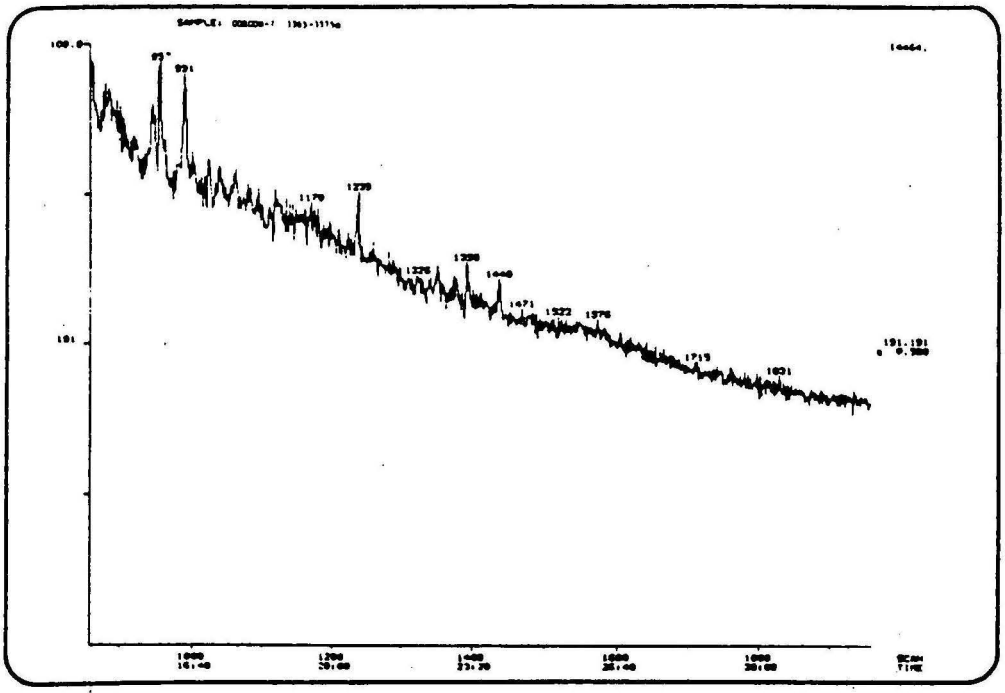

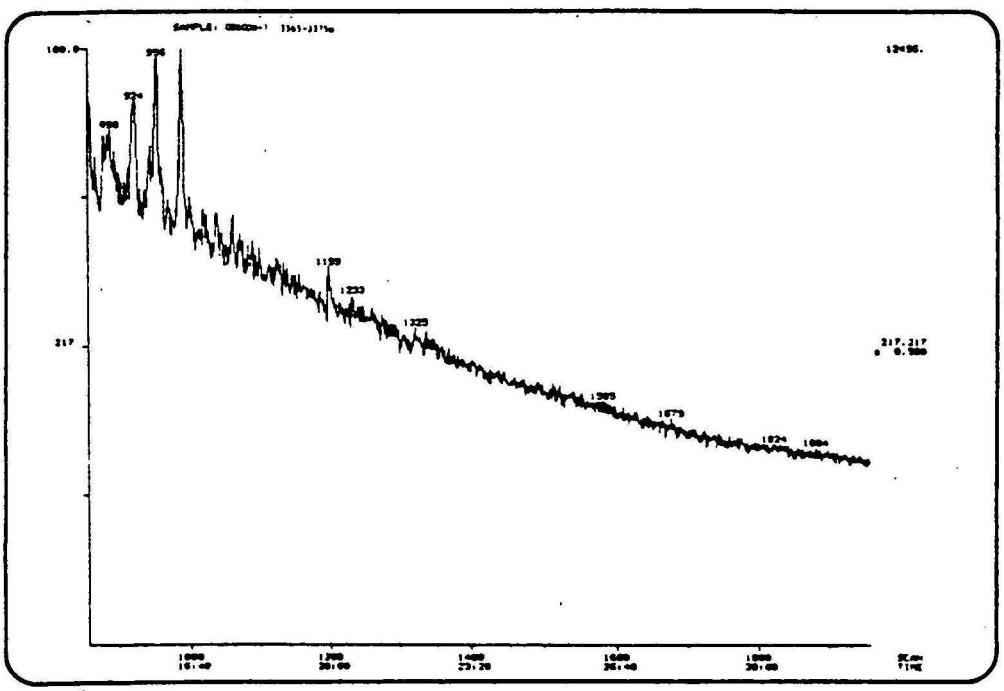

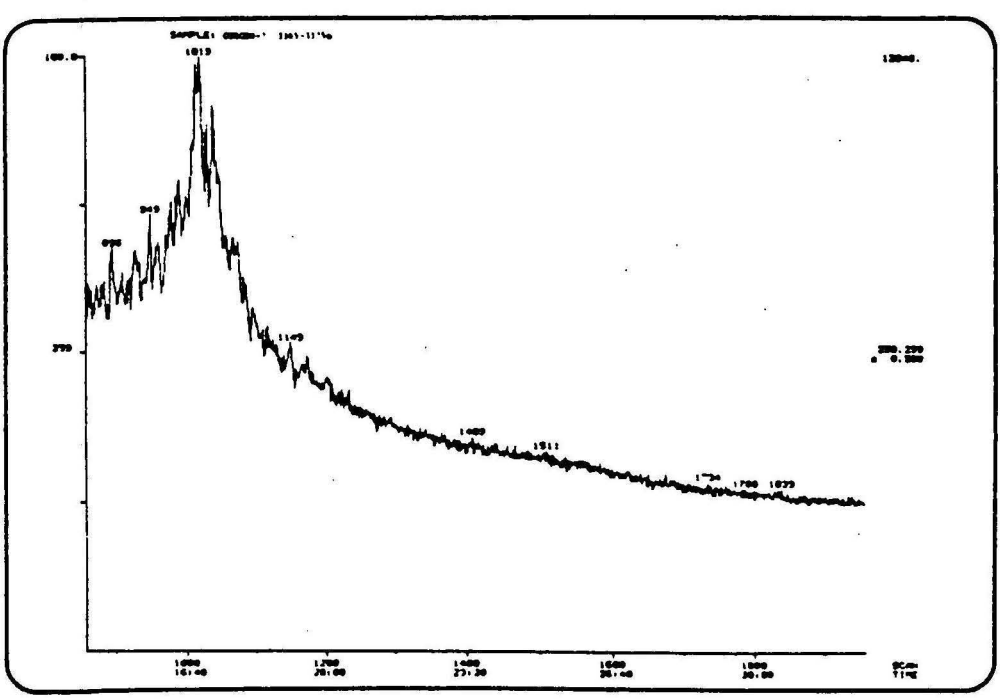

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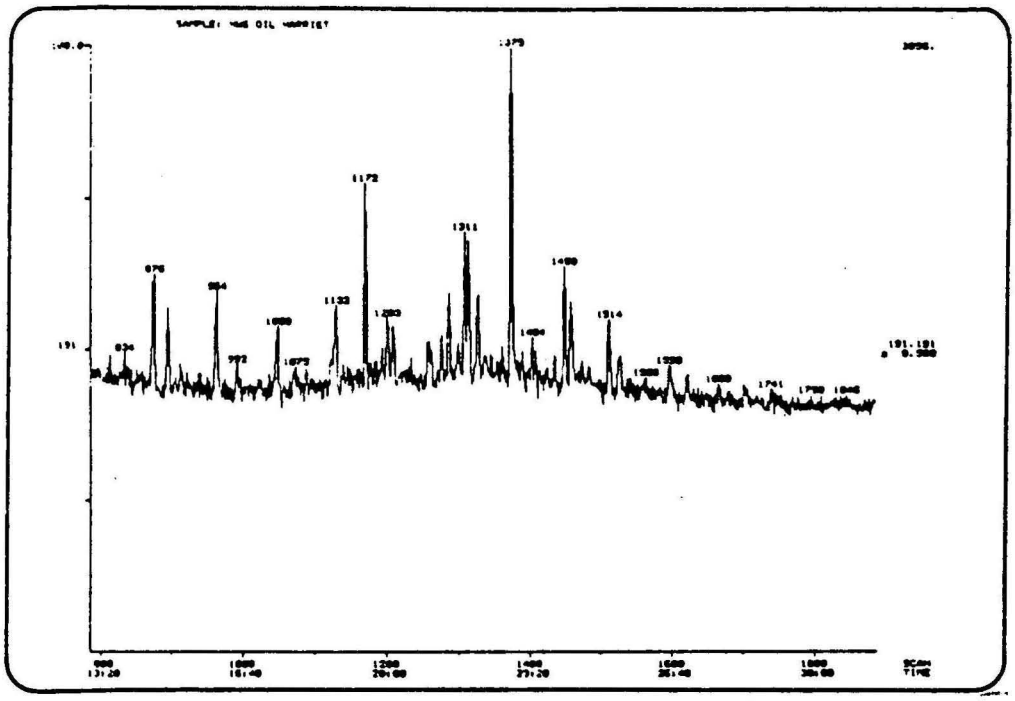

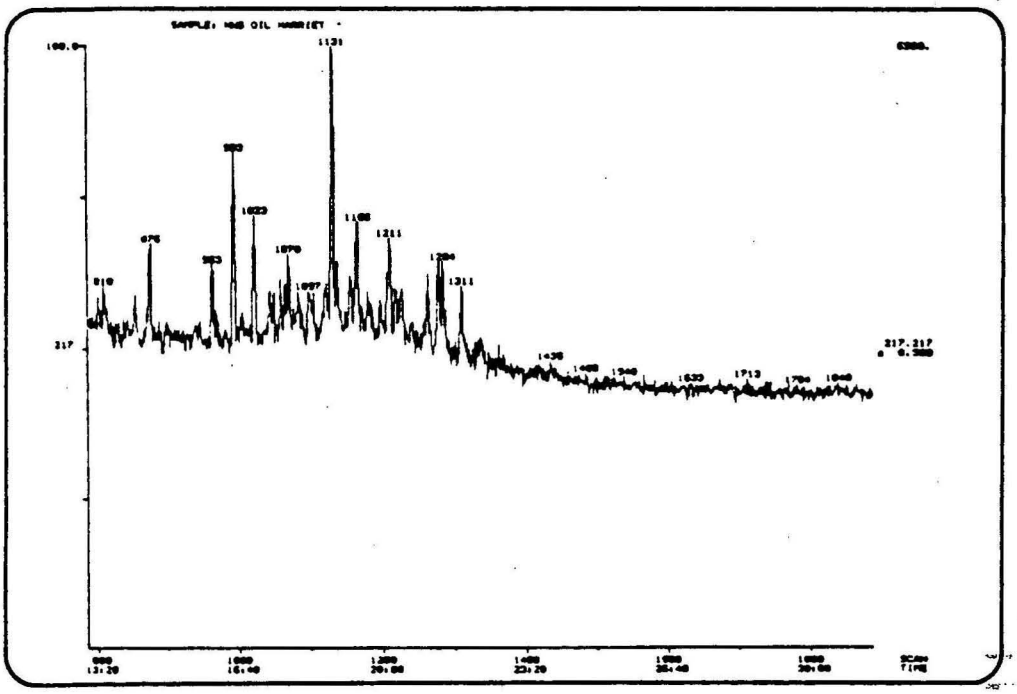

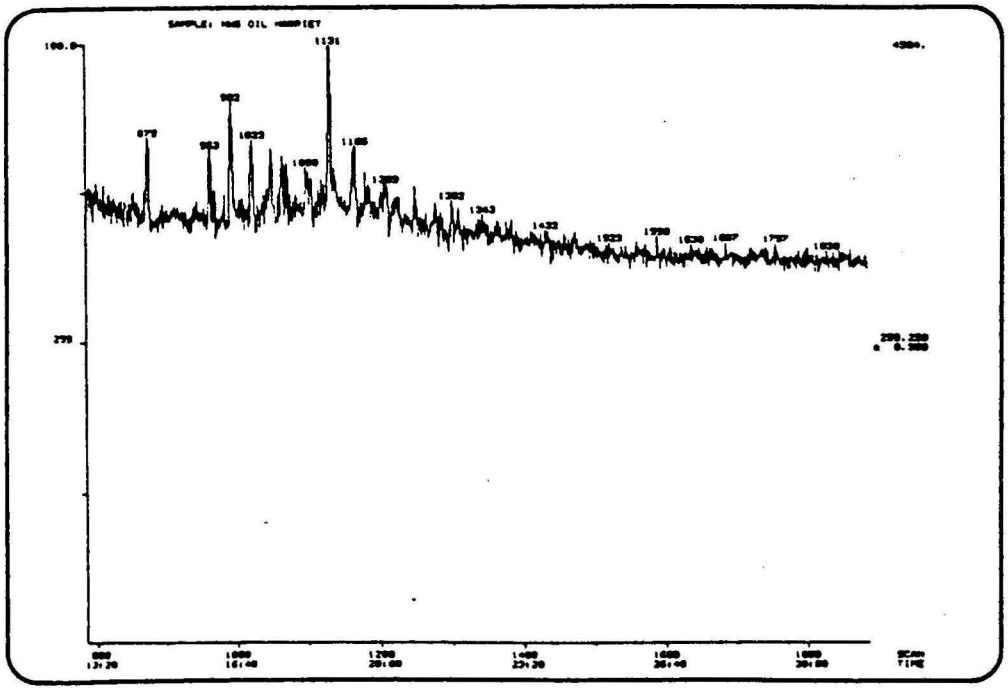

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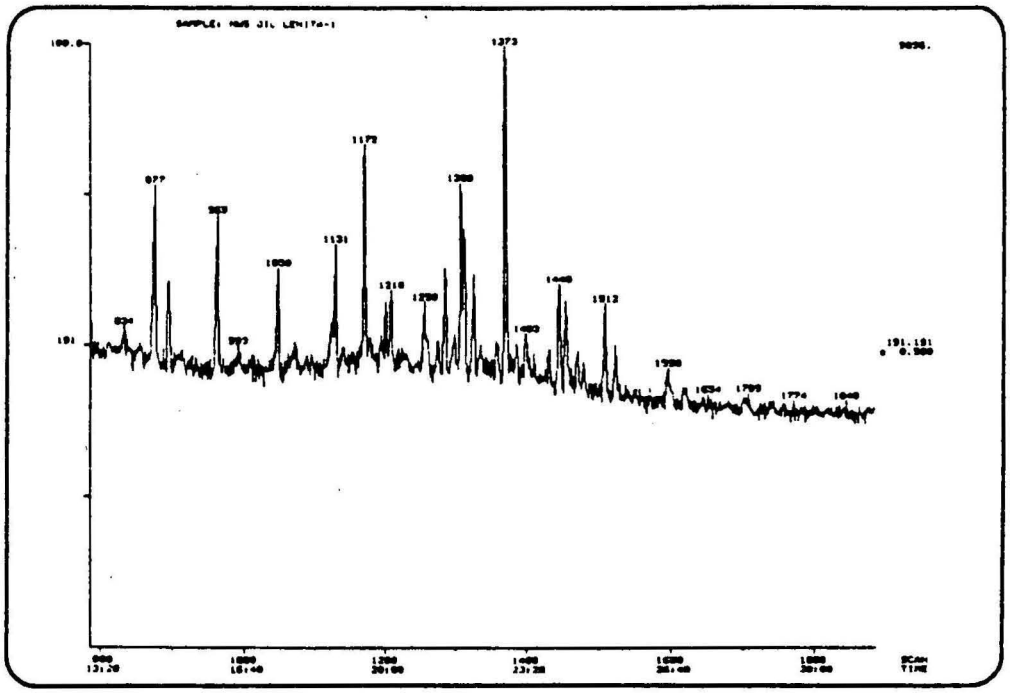
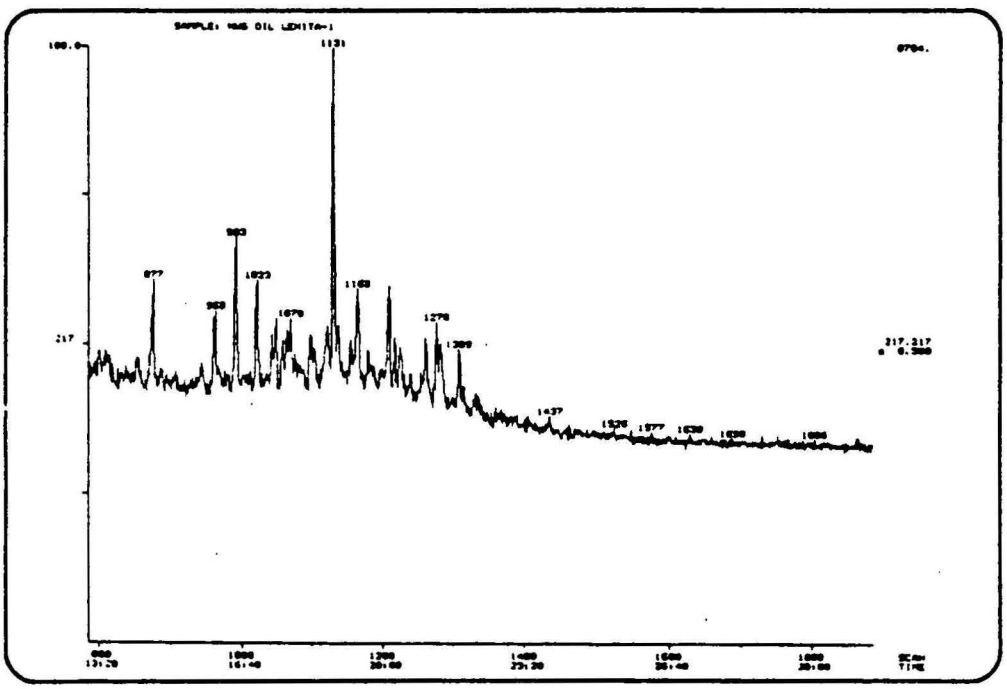




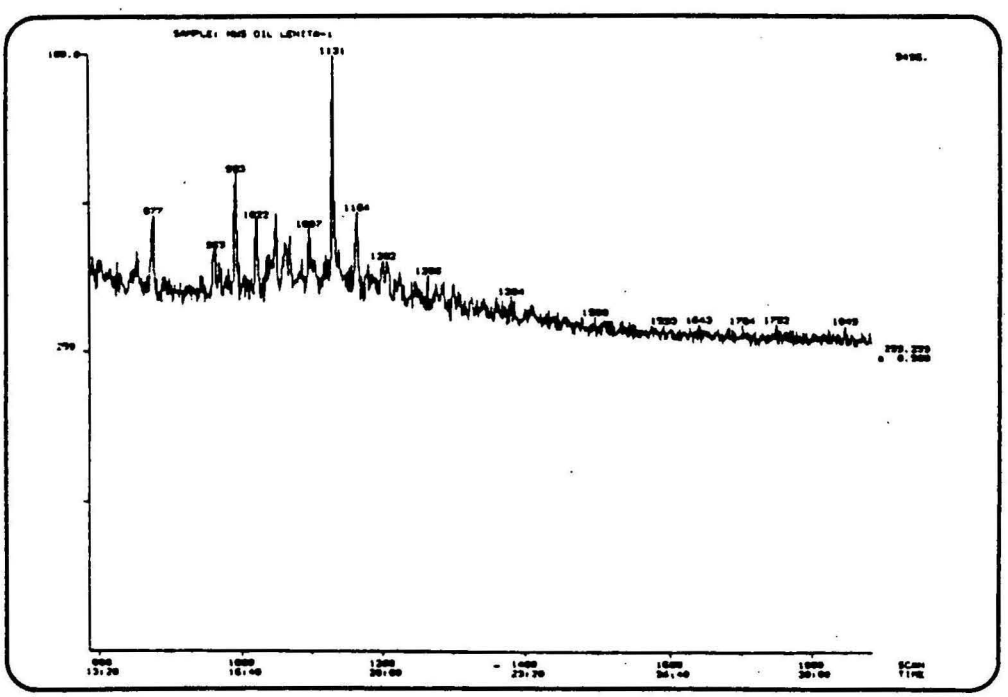
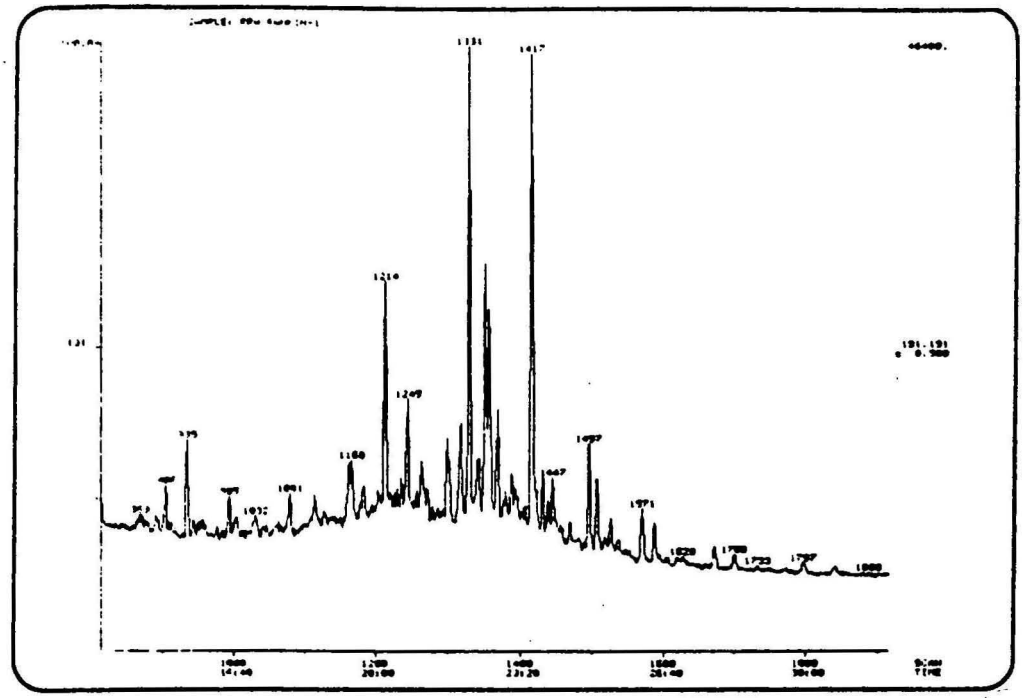
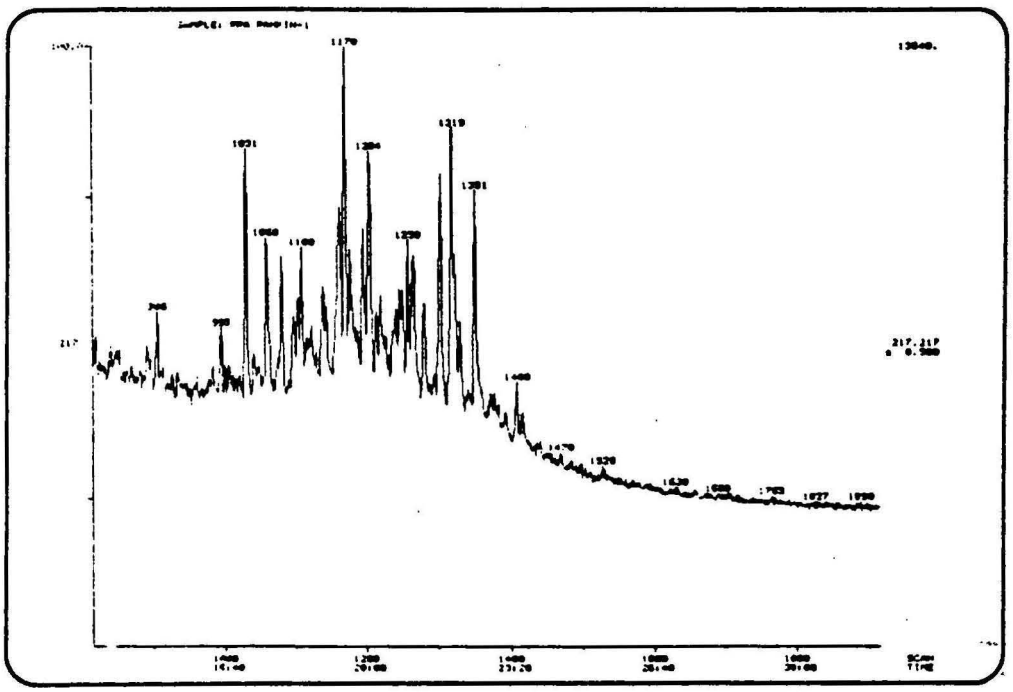
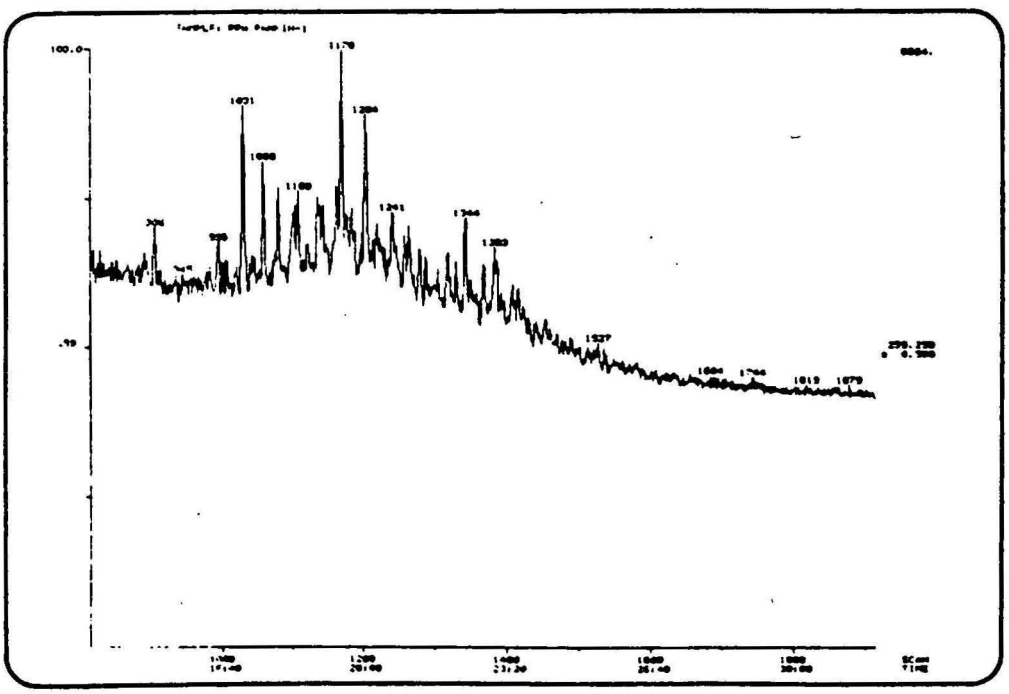


Figure II. 6.1(







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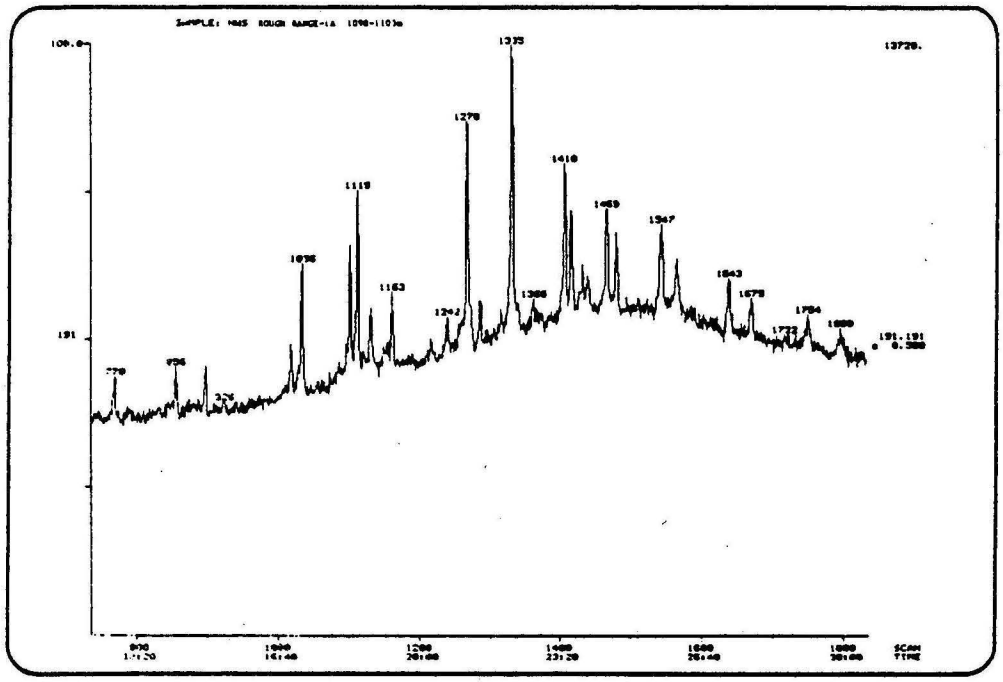

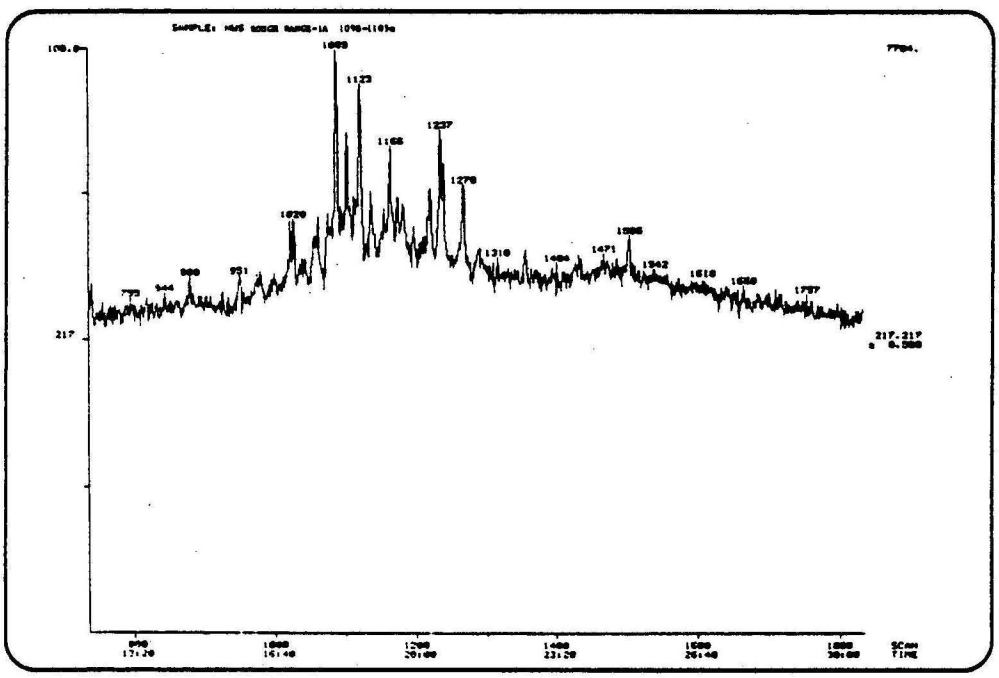

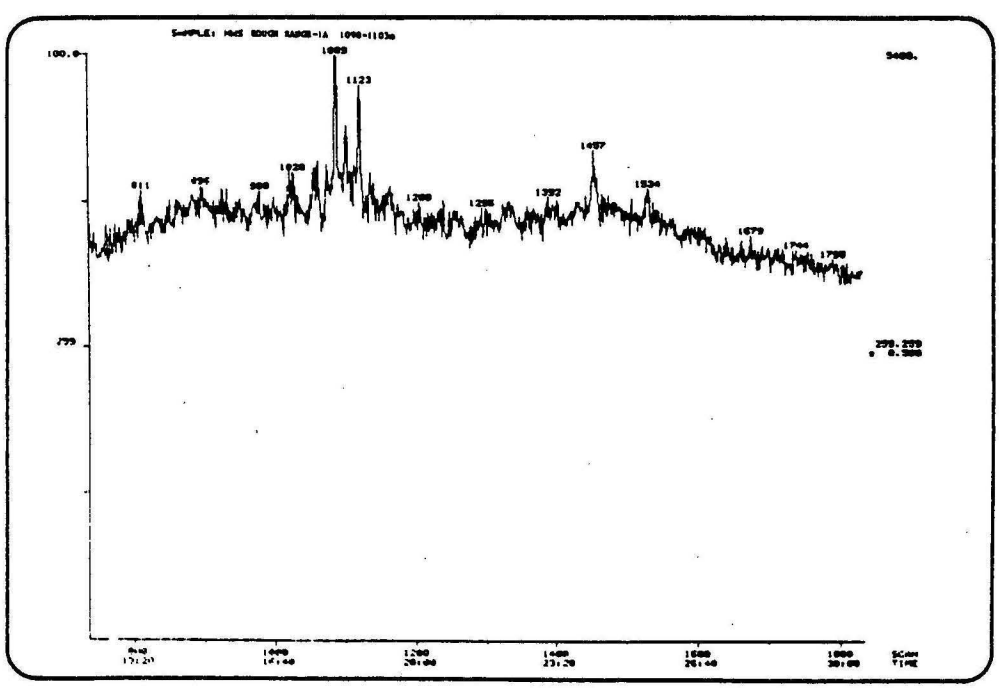

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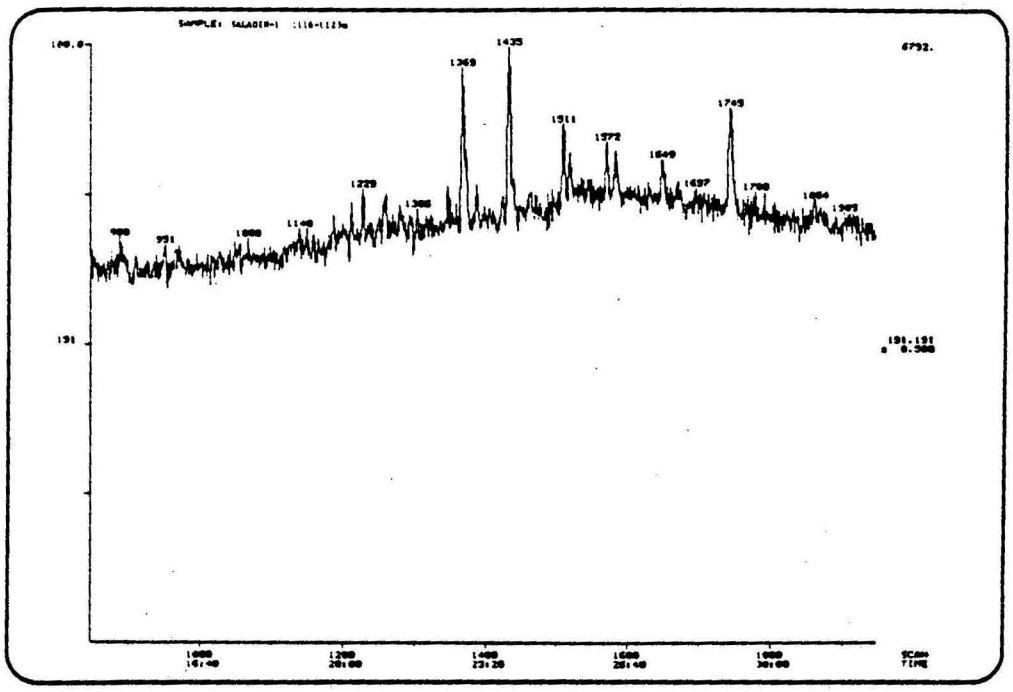

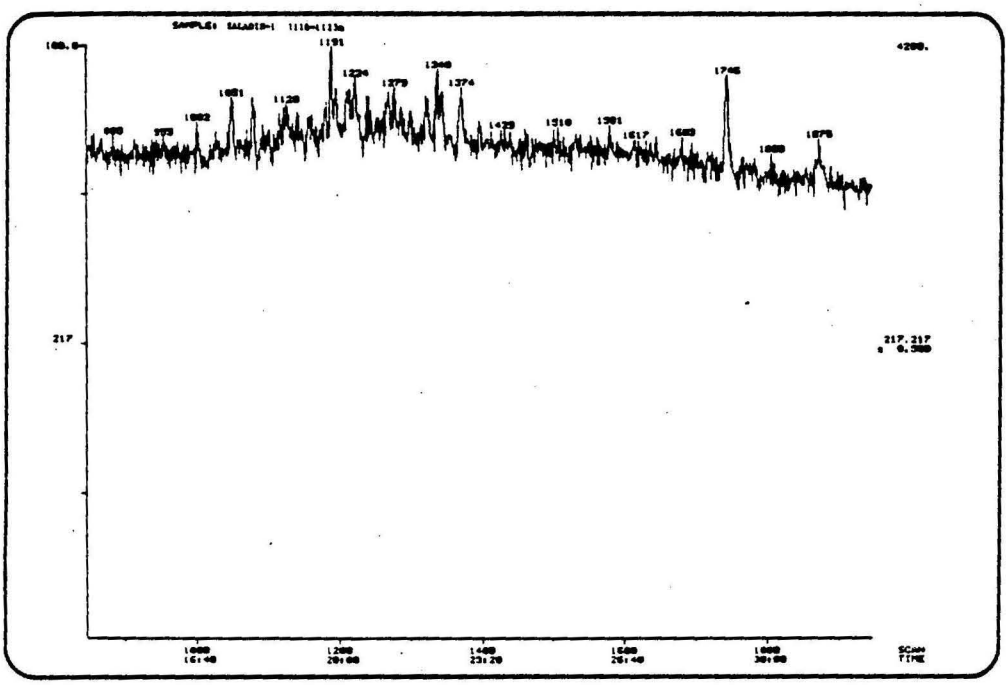

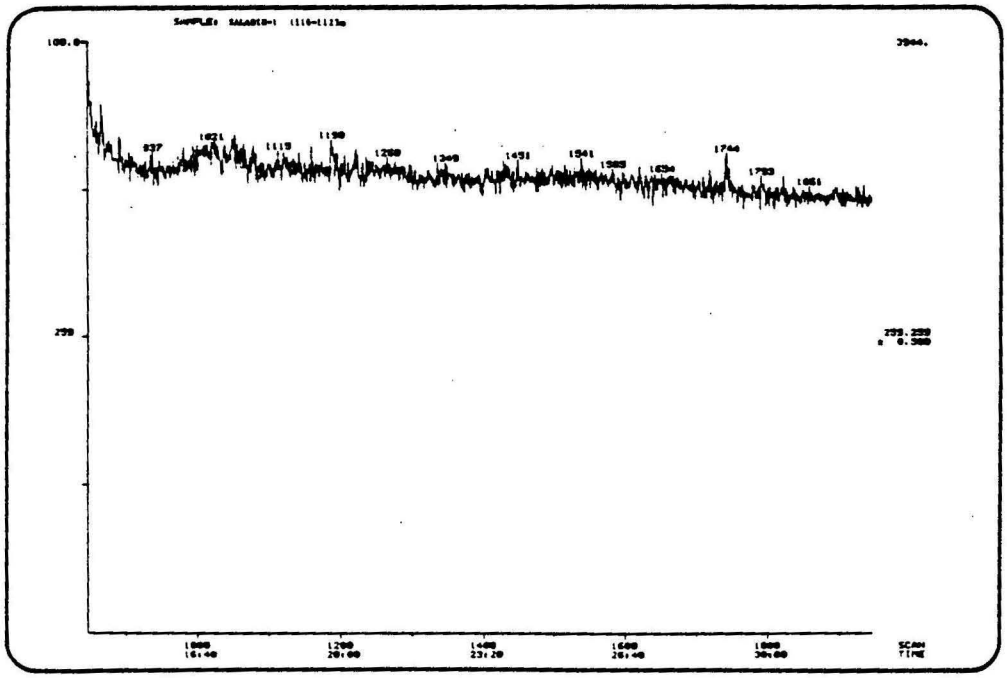

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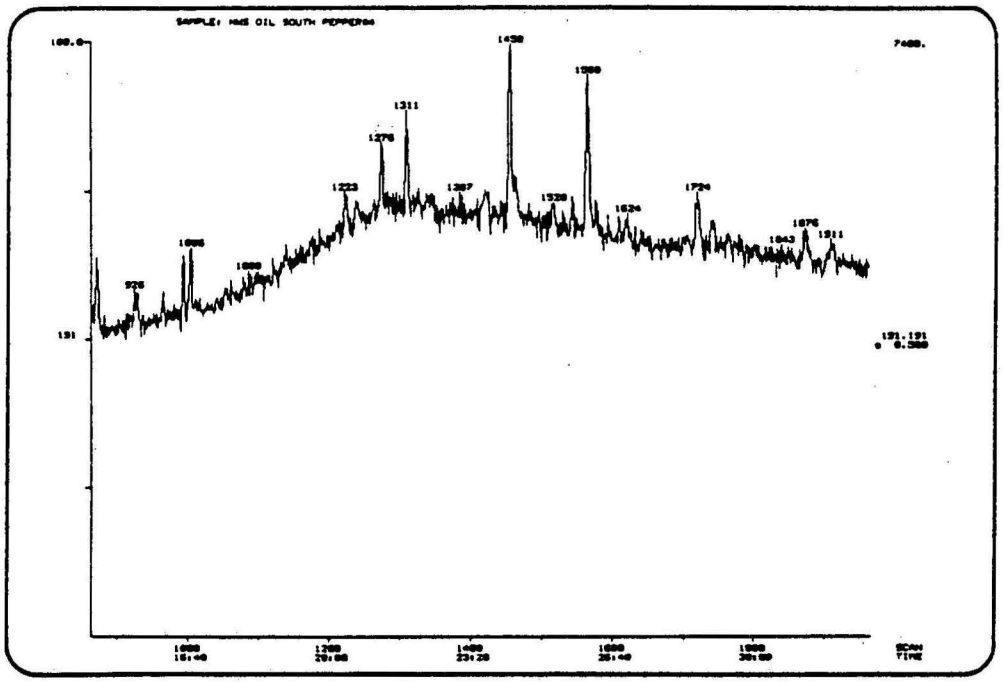
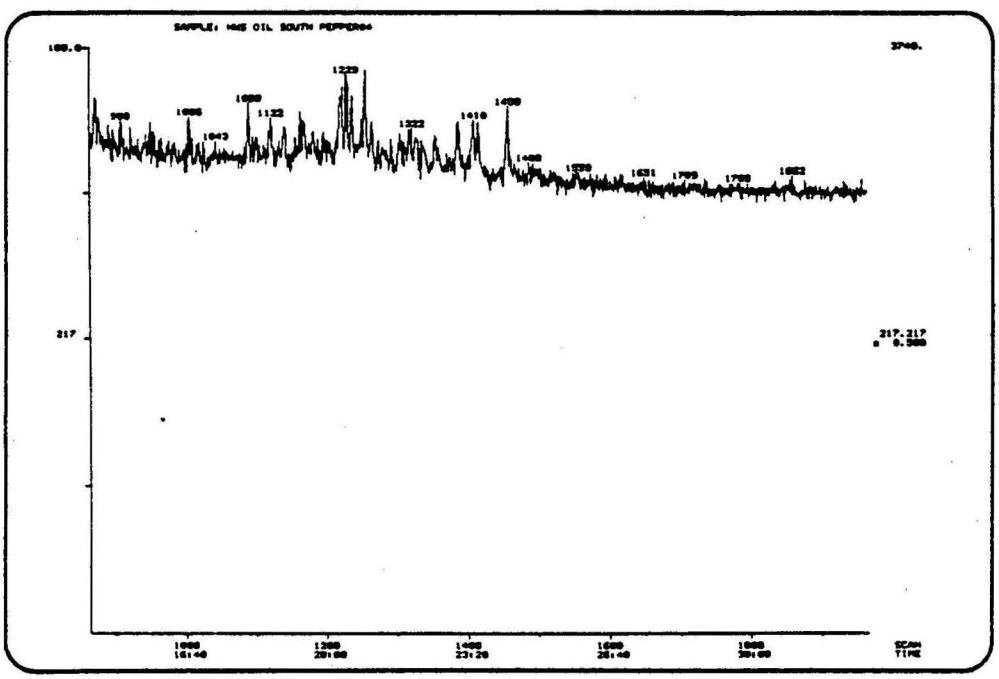


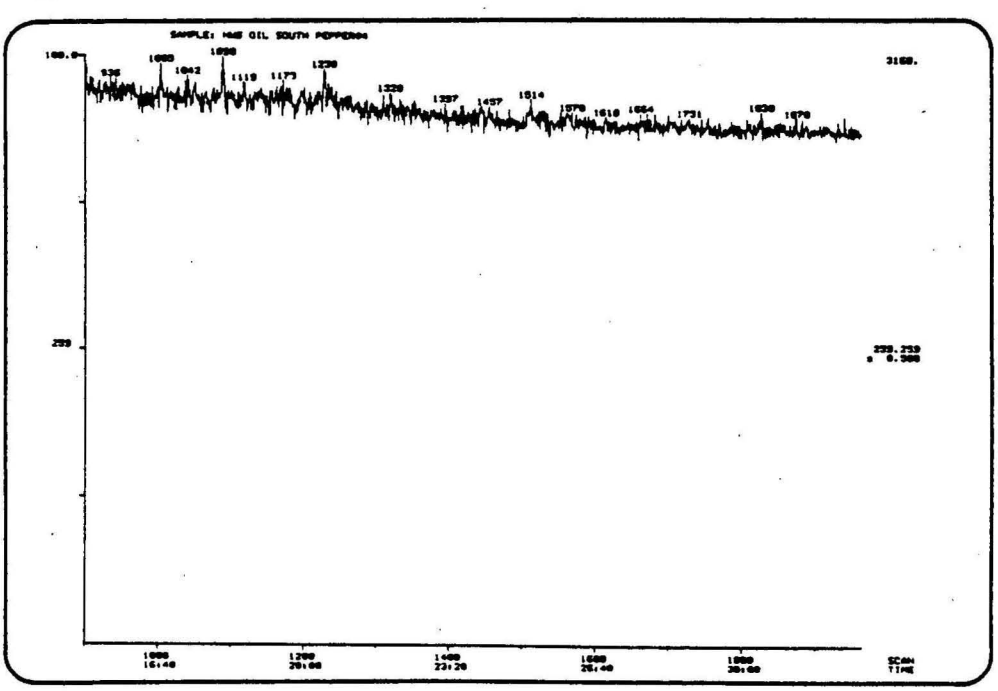
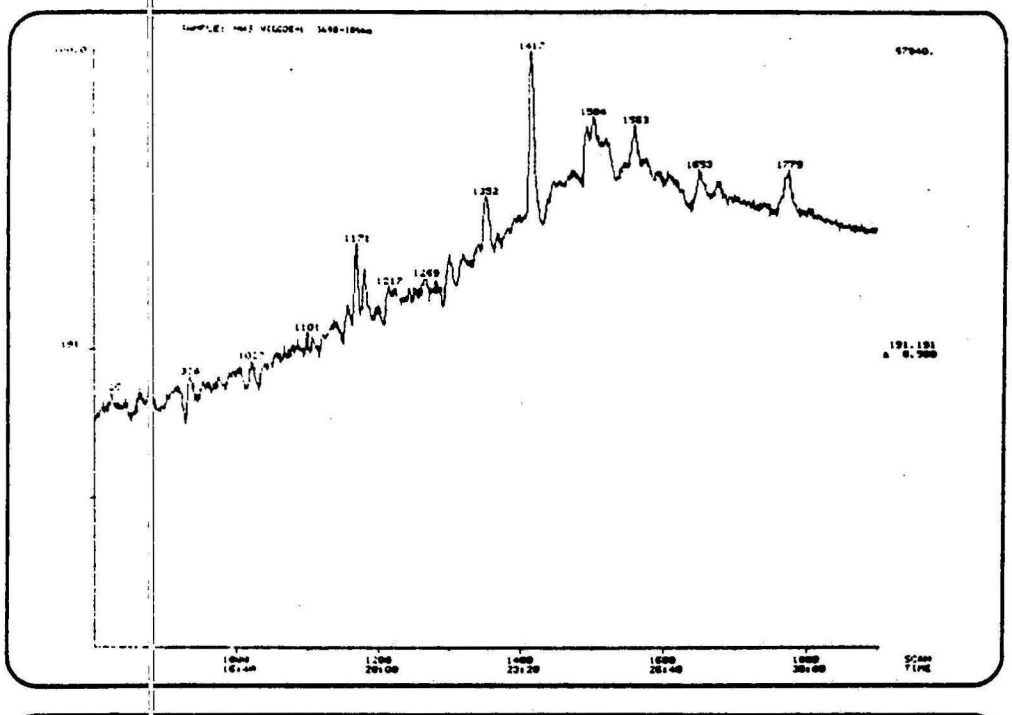
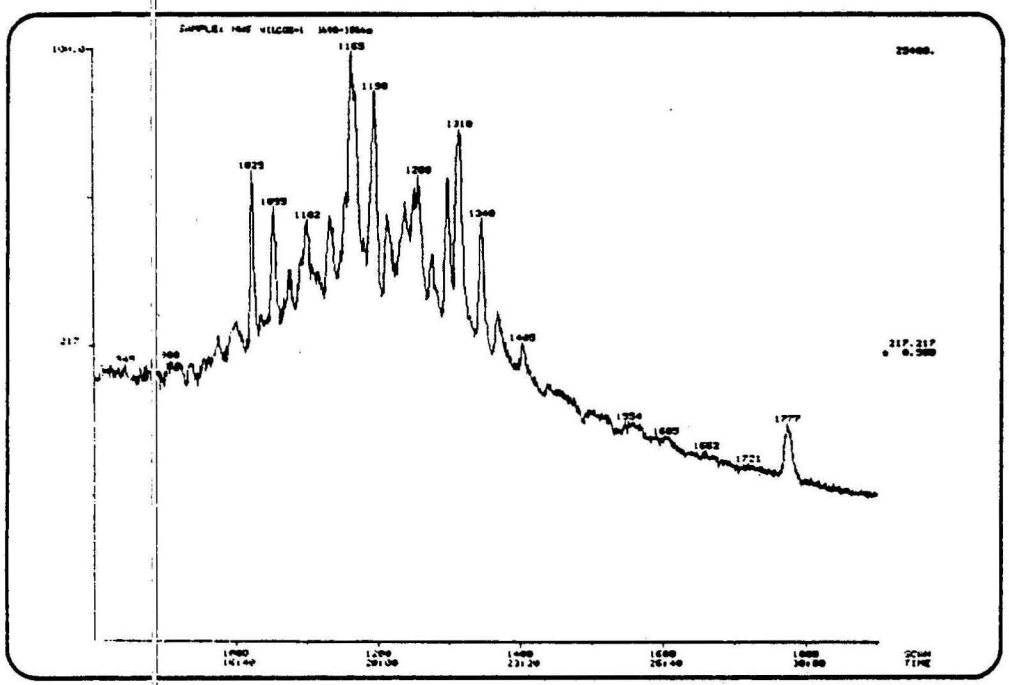




Figure II. 6.14





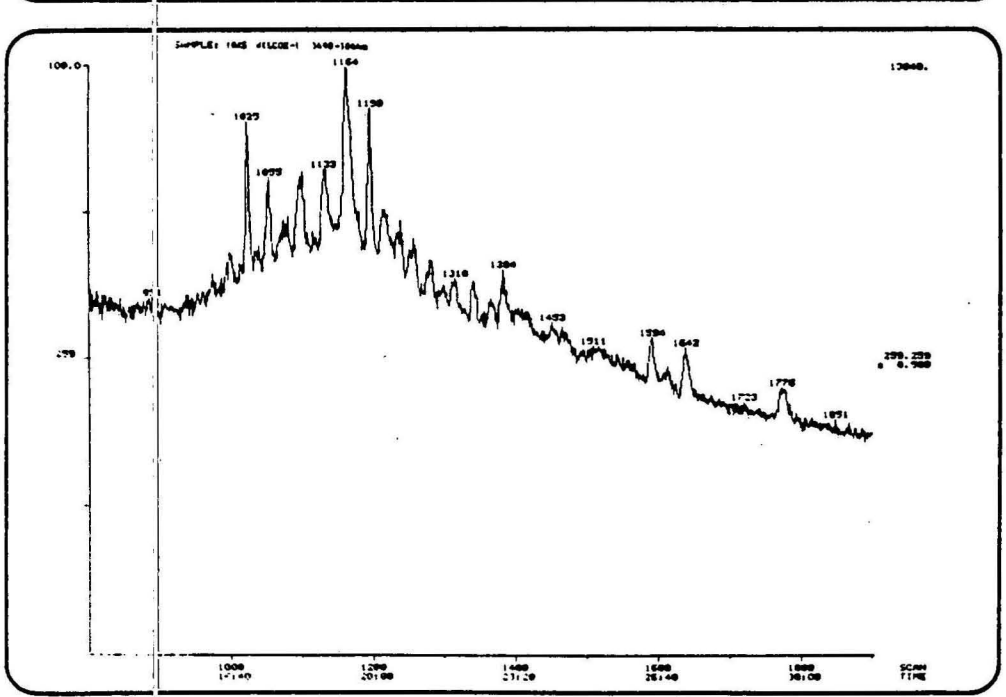


Figure II. 6.15

# SECTION III

# GAS CHROMATOGRAPHY-MASS SPECTROMETRY AND CARBON ISOTOPE DATA FOR MIGRANT OILS FROM THE NORTHERN CARNARVON BASIN

TABLE III.1

| WELL | DEPTH (metres) | FORMATION | EXTRACTION DATA | | | | | | GAS CHROMATOGRAPHY DATA | | | | GAS CHROMATOGRAPHY - MASS SPECTROMETRY RATIOS | | | | | | | | | | CARBON ISOTOPE DATA ($\delta^{13}C$ $^{0}/_{00}$ PDB STANDARD) | | CV VALUE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | EOM ppm | EOM mg/g | HC ppm | HC mg/g | %SATS | %AROMS | Pr/ Ph | Pr/ n-$C_{17}$ | Ph/ n-$C_{18}$ | CPI | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | SATURATES | AROMATICS | |
| Angel-2 | 3454-3473 | Learmonth Fm | 3085 | 185 | 930 | 56 | 23 | 7 | 2.55 | 1.09 | 0.25 | 1.49 | 0.32 | 0.18 | 0.09 | 1.27 | 2.13 | 0.46 | 47 | 42 | 14 | 44 | -26.25 | -25.00 | -0.74 |
| Delambre-1 | 5380-5405 | Hungaroo Fm | 720 | 101 | 220 | 31 | 20 | 11 | 1.67 | 0.76 | 0.37 | 1.06 | 0.36 | 0.16 | 0.22 | 1.29 | 1.80 | 0.68 | 45 | 24 | 17 | 59 | -27.89 | -26.34 | 0.44 |
| Egret-1 | 3323-3338 | Brigadier Beds | 2935 | 121 | 1425 | 59 | 41 | 8 | 1.04 | 0.43 | 0.37 | 1.31 | 0.20 | 0.12 | 0.17 | 1.66 | 2.99 | 0.67 | 37 | 33 | 22 | 45 | -27.19 | -26.27 | -1.18 |
| Flinders Shoal-1 | 1860-1875 | Upper Dingo Claystone: Dupuy Sst Mbr | 4675 | 250 | 3180 | 170 | 62 | 6 | 0.99 | 0.77 | 0.63 | NDP | 0.72 | 0.07 | 0.13 | 1.51 | 0.48 | 1.71 | 42 | 37 | 16 | 47 | -29.45 | -28.04 | 0.61 |
| Hilda-1A | 814-825 | Barrow Gp | 1615 | 126 | 1440 | 113 | 79 | 10 | 1.57 | 0.77 | 0.46 | 1.09 | 0.49 | 0.17 | 0.17 | 1.10 | 1.40 | 0.41 | 33 | 32 | 17 | 51 | -27.64 | -26.69 | -0.97 |
| Hampton-1 | 1410-1420 | Lower Dingo Claystone | 800 | 34 | 675 | 20 | 54 | 5 | 1.59 | 1.75 | 0.84 | NDP | 0.67 | 0.32 | 0.42 | 0.80 | 1.36 | 0.57 | 33 | 24 | 20 | 56 | -27.68 | -26.19 | 0.24 |
| Haycock-1 | 1006-1007 | Tertiary undiff | 2180 | 352 | 1850 | 298 | 70 | 15 | 1.20 | 0.36 | 0.14 | 1.05 | 0.83 | 0.04 | 0.14 | 1.16 | 3.00 | 0.44 | 53.5 | 16 | 14 | 70 | -27.45 | -25.25 | 1.74 |
| Legendre-1 | 2671-2686 | Learmonth Fm | 7995 | 359 | 6910 | 310 | 81 | 5 | 0.82 | 0.75 | 0.77 | 1.09 | 0.49 | 0.15 | 0.10 | 1.57 | 1.33 | 0.77 | 42 | 39 | 23 | 38 | -26.87 | -25.75 | -0.84 |
| Long Island -1 | 1879 | Hungaroo Fm | 710 | 263 | 680 | 252 | 92 | 4 | NDP | NDP | NDP | 1.05 | 0.79 | 0.14 | 0.097 | 1.66 | 1.25 | 0.76 | 48 | 20 | 45 | 35 | -27.62 | -26.62 | -0.87 |
| North Rankin -1 | 2438 | Tertiary undiff | 5355 | 837 | 4410 | 689 | 61 | 21 | NDP | NDP | NDP | NDP | 1.28 | 0.08 | 0.22 | 1.43 | 4.16 | 0.36 | 59 | 38 | 16 | 46 | -26.54 | -24.97 | 0.07 |
| Pepper-1 | 1860-1863 | Barrow Gp | 2105 | 161 | 1080 | 82 | 47 | 4 | 0.69 | 0.63 | 0.64 | 1.13 | 0.85 | 0.17 | 0.14 | 1.45 | 1.07 | 0.92 | 32 | 24 | 17 | 59 | -26.99 | -25.47 | 0.09 |
| | 2465-2460 | Upper Dingo Claystone: Dupuy Sst Mbr | 8800 | 978 | 3350 | 372 | 35 | 3 | 1.03 | 0.66 | 0.55 | 1.13 | 1.30 | 0.12 | 0.16 | 1.51 | 1.68 | 0.51 | 44 | 32 | 22 | 46 | -28.42 | -27.38 | -0.53 |
| Parker-1 | 1271-1276 | Tertiary undiff | 2150 | 101 | 1143 | 53 | 43 | 10 | 2.47 | 0.67 | 0.26 | 1.05 | 3.11 | 0.23 | 0.13 | 1.47 | 1.36 | 0.70 | 51 | 30 | 18 | 52 | -23.37 | -22.43 | -2.31 |
| Pueblo-1 | 2870-2885 | Haycock Mark | 955 | 208 | 610 | 133 | 53 | 11 | 1.48 | 0.95 | 0.54 | NDP | 0.07 | 1.01 | 0.32 | 0.10 | 22.87 | 0.08 | 73.5 | 34 | 14 | 48 | -27.89 | -26.34 | 0.44 |
| Poissonier-1 | 1665-1690 | Locker shale | 755 | 66 | 420 | 37 | 50 | 5 | 1.98 | 1.85 | 0.85 | NDP | 1.28 | 0.17 | 0.23 | 1.53 | 1.15 | 0.51 | 26.5 | 19 | 19 | 62 | -28.63 | -27.69 | -0.69 |
| Rosemary-1 | 3342-3354 | Learmonth Fm | 2030 | 94 | 1440 | 67 | 58 | 13 | 2.10 | 0.56 | 0.30 | 1.05 | 0.56 | 0.12 | 0.11 | 1.51 | 3.12 | 0.63 | 47.5 | 35 | 18 | 47 | -26.63 | -24.99 | 0.24 |
| Spar-1 | 3500-3510 | Barrow Gp | 1585 | 113 | 850 | 61 | 49 | 5 | 1.20 | 0.86 | 0.53 | 1.11 | 1.15 | 0.14 | 0.12 | 1.27 | 1.30 | 0.57 | 46 | 26 | 18 | 56 | -27.64 | -27.23 | -2.17 |
| Tryal Rocks -1 | 3092-3107 | Barrow Gp | 2180 | 105 | 1770 | 86 | 72 | 9 | 1.37 | 0.38 | 0.28 | 1.14 | 1.60 | 0.55 | 0.10 | 1.47 | 3.36 | 0.62 | 46 | 30 | 23 | 47 | -27.14 | -25.39 | 0.64 |
| West Muiron -2 | 1550-1560 | Upper Dingo Claystone | 6740 | 291 | 5840 | 252 | 80 | 7 | 0.80 | 0.74 | 0.68 | 1.02 | 0.89 | 0.14 | 0.27 | 0.72 | 0.83 | 1.13 | - | 41 | 20 | 39 | -27.00 | -26.36 | -1.86 |
| | 2760-2770 | Lower Dingo Claystone | 3995 | 157 | 3210 | 126 | 72 | 9 | 1.07 | 0.44 | 0.42 | 1.05 | 0.52 | 0.18 | 0.16 | 1.11 | 1.81 | 0.56 | 36.5 | 35 | 19 | 46 | -26.84 | -26.44 | -2.44 |
| West Barrow -2 | 3265-3280 | Barrow Gp "B" unit | 1965 | 185 | 1040 | 98 | 45 | 8 | 1.77 | 0.82 | 0.35 | 1.11 | 2.12 | 0.05 | 0.16 | 1.44 | 1.30 | 0.77 | 47 | 32 | 12 | 56 | -28.03 | -26.44 | 0.57 |
| Withnell-1 | 4390-4400 | Upper Dingo Claystone | 1370 | 83 | 1100 | 67 | 78 | 2 | 2.11 | 0.35 | 0.17 | 1.07 | 0.72 | 0.43 | 0.42 | 1.06 | 2.48 | 0.76 | 29 | 35 | 6 | 59 | -26.83 | -26.14 | -1.80 |

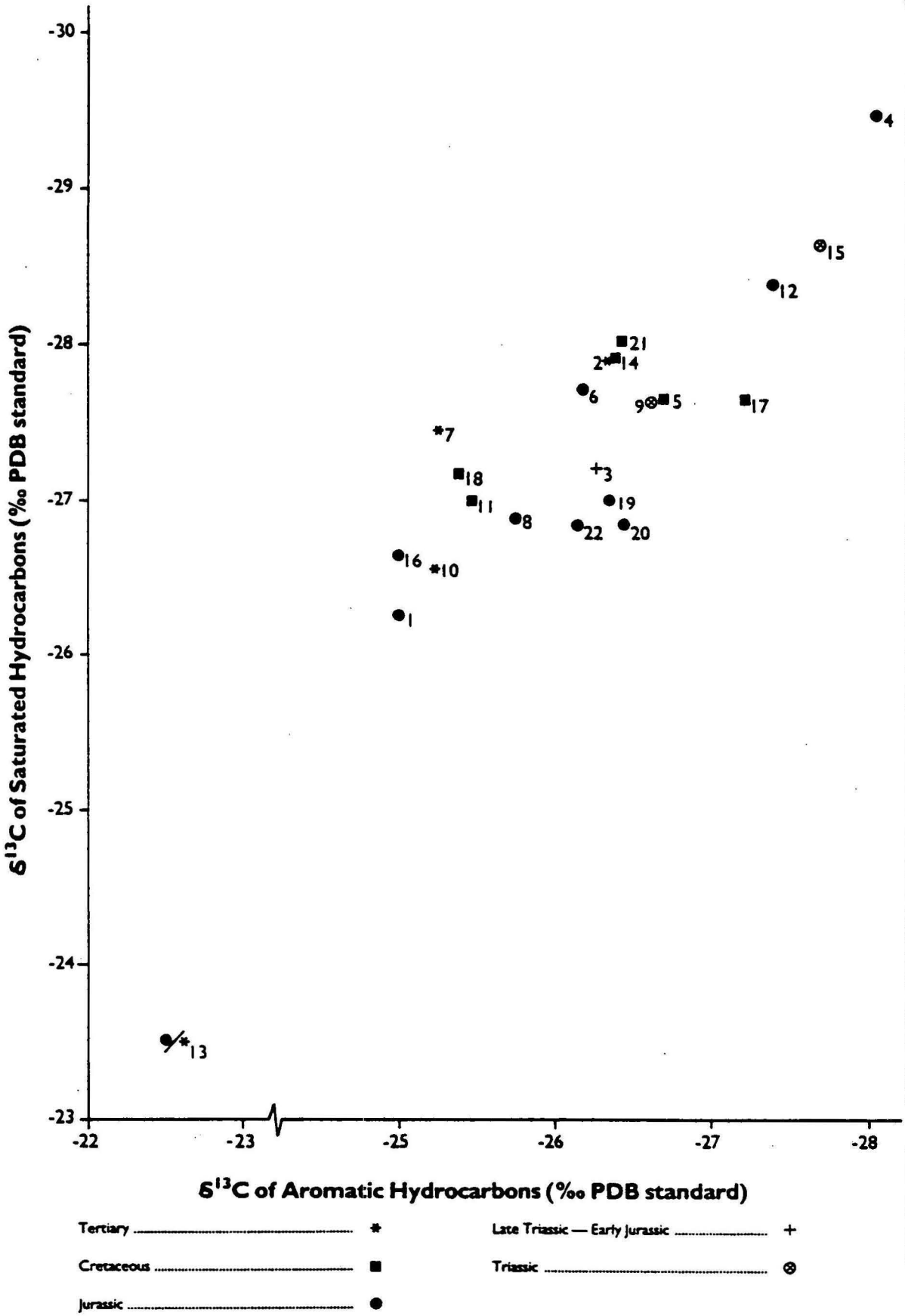
TABLE III.1 : EXTRACTION, GAS AND LIQUID CHROMATOGRAPHY, GAS CHROMATOGRAPHY-MASS SPECTROMETRY AND CARBON ISOTOPE DATA FOR SELECTED MIGRANT OIL STAINS FROM THE NORTHERN CARNARVON BASIN

# NORTHERN CARNARVON BASIN

## KEY FOR FIGURES

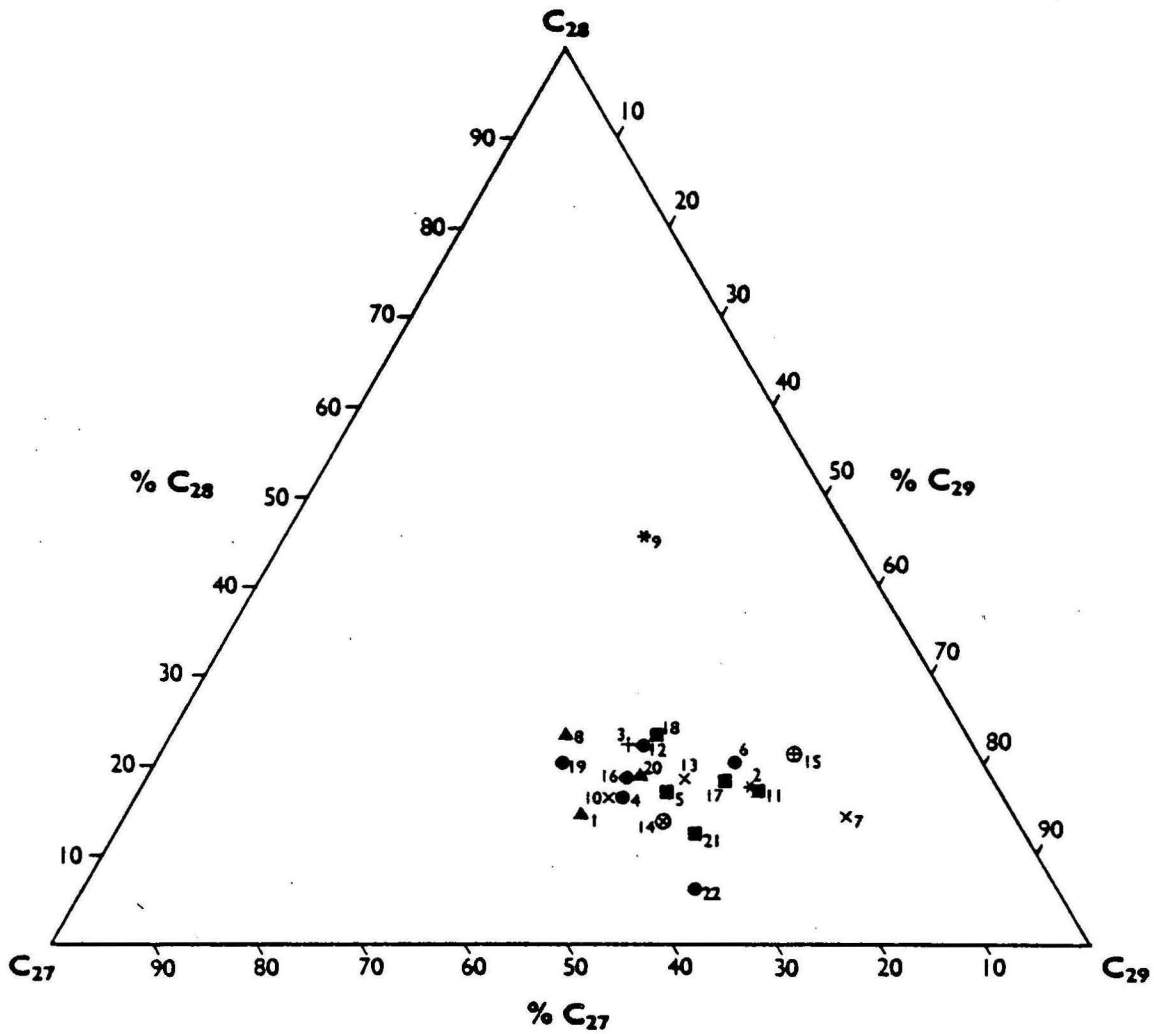
### SECTION III MIGRANT OIL STAINS (Figures III.1 and III.2)

| | | | |
|---|---|---|---|
| 1 | = | Angel-2 | (3454m-3473m) |
| 2 | = | Delandre-1 | (5280m-5403m) |
| 3 | = | Egret-1 | (3323m-3338m) |
| 4 | = | Flinders Shoal-1 | (1860m-1875m) |
| 5 | = | Hilda-1A | (814m-825m) |
| 6 | = | Hampton-1 | (1410m-1420m) |
| 7 | = | Haycock-1 | (1006m-1007m) |
| 8 | = | Legendre-1 | (2671m-2686m) |
| 9 | = | Long Island-1 | (1879m) |
| 10 | = | North Rankin-1 | (2438m) |
| 11 | = | Pepper-1 | (1860m-1863m) |
| 12 | = | Pepper-1 | (2445m-2460m) |
| 13 | = | Parker-1 | (1271m-1276m) |
| 14 | = | Pueblo-1 | (2870m-2885m) |
| 15 | = | Poissonier-1 | (1665m-1690m) |
| 16 | = | Rosemary-1 | (3342m-3354m) |
| 17 | = | Spar-1 | (3500m-3510m) |
| 18 | = | Tryal Rocks-1 | (3092m-3107m) |
| 19 | = | West Muiron-2 | (1550m-1560m) |
| 20 | = | West Muiron-2 | (2760m-2770m) |
| 21 | = | West Barrow-2 | (3265m-3280m) |
| 22 | = | Withnell-1 | (4390m-4400m) |




**δ13C saturates against δ13C aromatics for migrant oil stains from the Northern Carnarvon Basin**

Figure III.1




**Ternary diagram showing the relative percentage of $C_{27}$, $C_{28}$ and $C_{29}$, 5∝(H), 14∝(H), 17∝(H), 20R steranes in migrant oil stains from the Northern Carnarvon Basin.**

Figure III.2

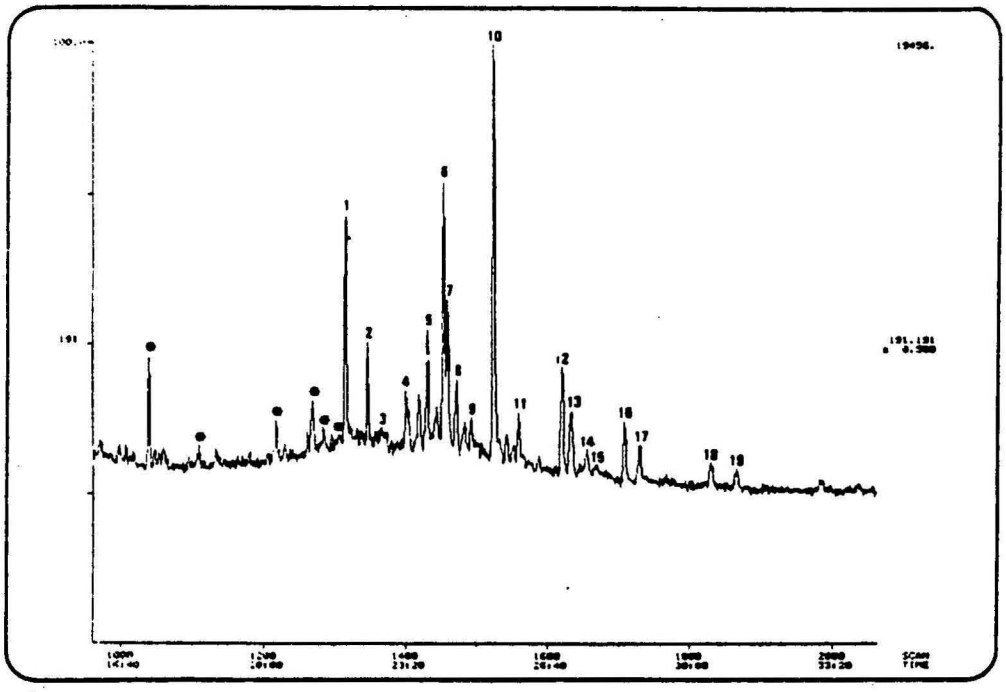
## PEAK IDENTIFICATION ON m/z 191 AND m/z 217 FRAGMENTOGRAMS PRESENTED IN VOLUME 2

### I. TRITERPANES (m/z 191)

| PEAK NO | COMPOUND NAME |
|---|---|
| * | Tricyclic Terpanes |
| 1 | 18α(H)-22,29,30-trisnorhopane (Ts) |
| 2 | 17α(H)-22,29,30-trisnorhopane (Tm) |
| 3 | 17α(H)-25,30-bisnorhopane (Demethylated hopane) |
| 4(W) | 17α(H)-29,30-bisnorhopane |
| 5 | 17α(H)-25-norhopane (Demethylated hopane) |
| 6 | 17α(H)-30-norhopane |
| 7,8 | unidentified $C_{30}$ triterpanes |
| 9 | 17β(H),21α(H)-normoretane |
| 10 | 17α(H)-hopane |
| 11 | 17β(H)-moretane |
| 12 | (22S)-17α(H)-homohopane |
| 13 | (22R)-17α(H)-homohopane |
| 14&15 | (22S and 22R)-17β(H)-homomoretane |
| 16&17 | (22S and 22R)-17α(H)-bishomohopane |
| 18&19 | (22S and 22RO-17α(H)-trishomohopane |
| 20(V) | unknown Terpane co-eluted with 17α(H)-trisnorhopane |

### II. STERANES (m/z 217)

| PEAK NO | COMPOUND NAME |
|---|---|
| a | 13βH, 17αH rearranged cholestane 20S ($C_{27}$) |
| b | 13βH, 17αH rearranged cholestane 20R ($C_{27}$) |
| c-f | 13βH, 17αH rearranged 24-methyl-cholestanes ($C_{28}$) |
| g | 5αH, 14αH, 17αH cholestane 20S ($C_{27}$) |
| h,j | 5αH, 14βH, 17βH isocholestane 20R and 20S ($C_{27}$) |
| i | 13βH, 17αH rearranged 24-ethyl-cholestane 20S ($C_{29}$) |
| k | 5αH, 14αH, 17αH cholestane 20R ($C_{27}$) |
| l | 13βH, 17αH rearranged 24-ethyl-cholestane 20R ($C_{29}$) |
| m | 5αH, 14αH, 17αH 24-methyl-cholestane 20S ($C_{28}$) |
| n,o | 5αH, 14βH, 17βH iso-24-methyl-cholestane 20R and 20S ($C_{28}$) |
| p | 5αH, 14αH, 17αH 24-methyl-cholestane 20R ($C_{28}$) |
| q | 5αH, 14αH, 17αH 24-ethyl-cholestane 20S ($C_{29}$) |
| r,s | 5αH, 14βH, 17βH iso-24-ethyl-cholestane 20R and 20S ($C_{29}$) |
| t | 5αH, 14αH, 17αH 24-ethyl-cholestane 20R ($C_{29}$) |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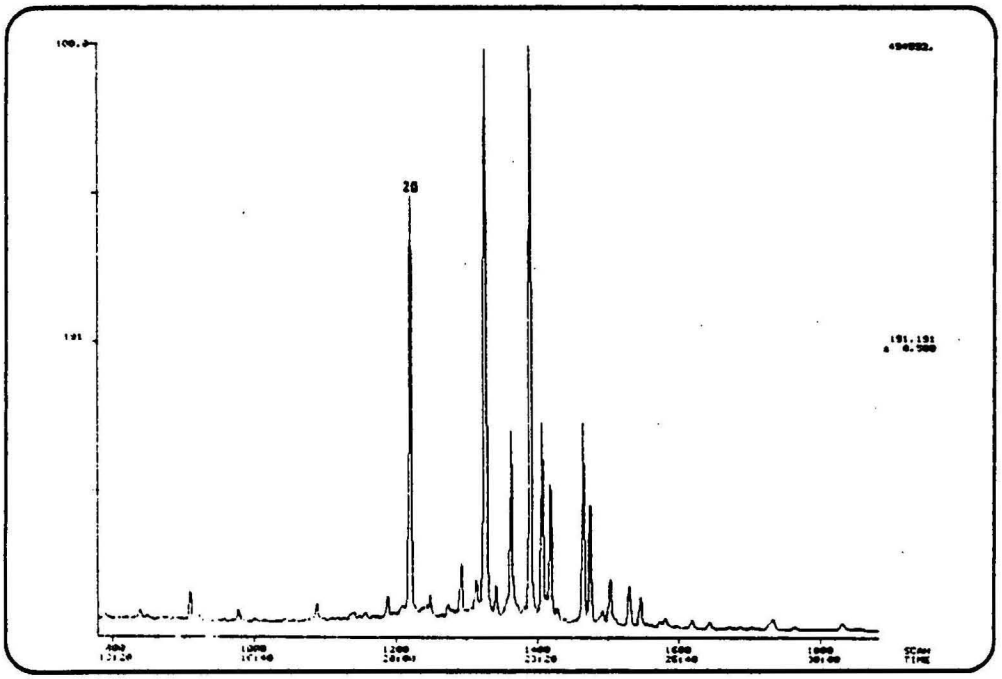
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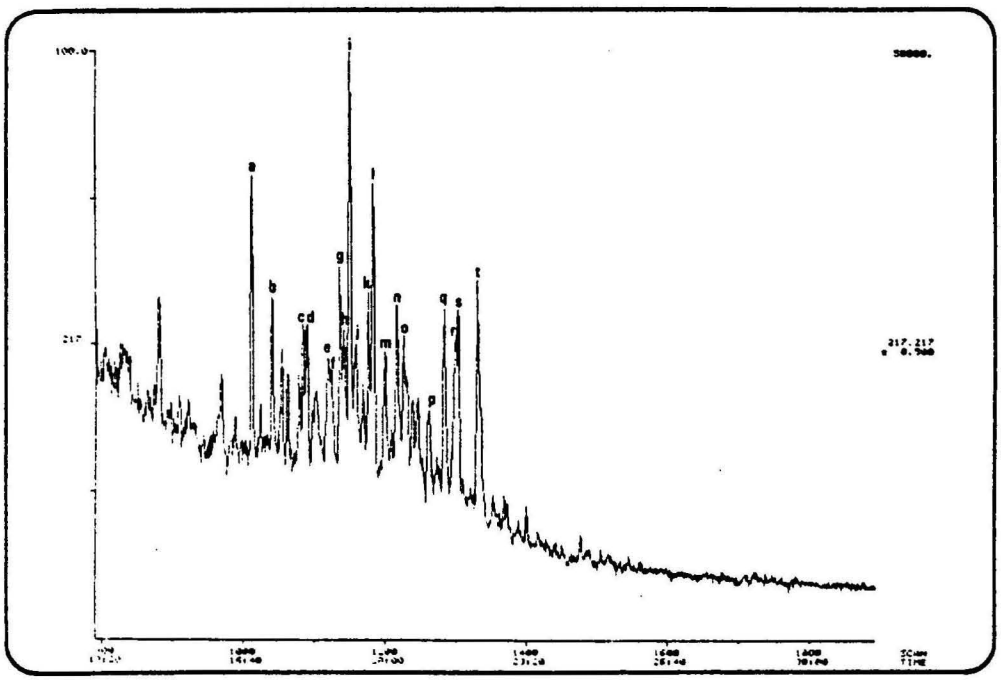
SCAN TIME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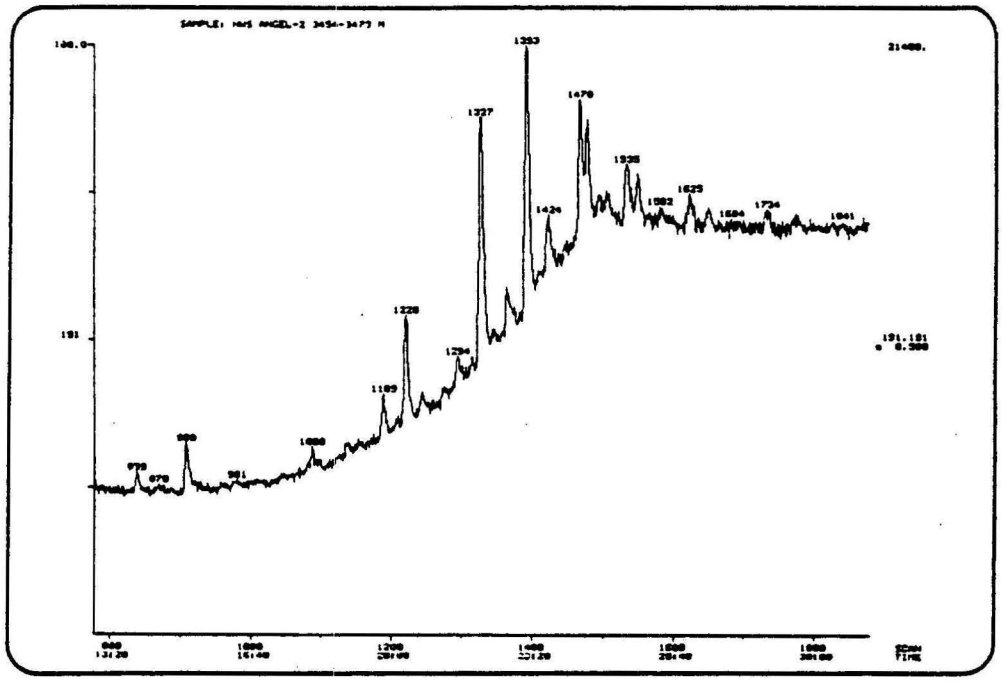
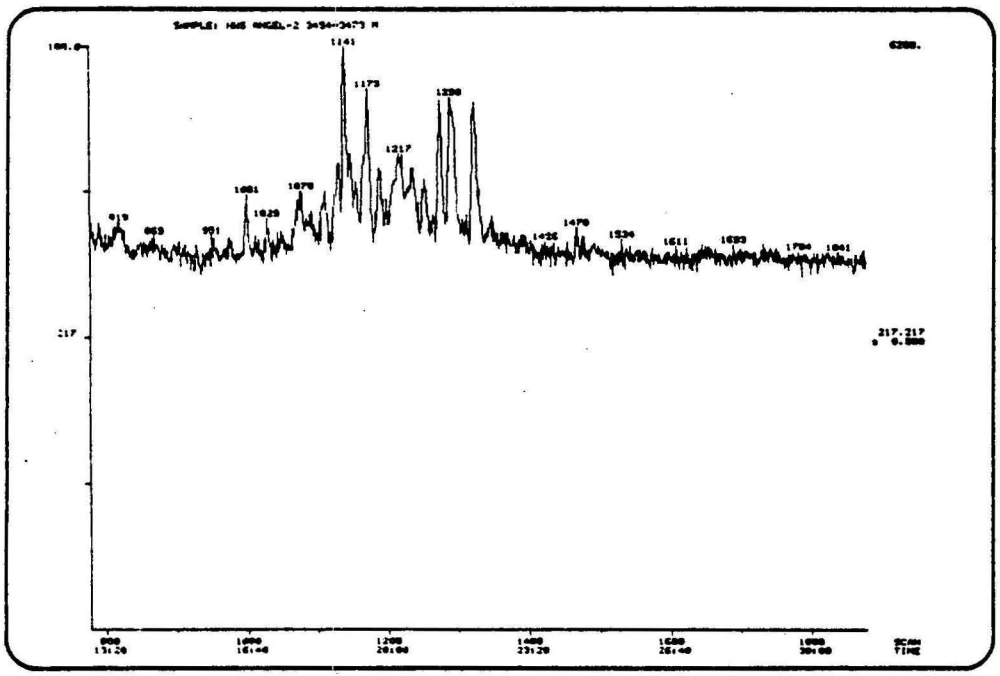
SCAN TIME





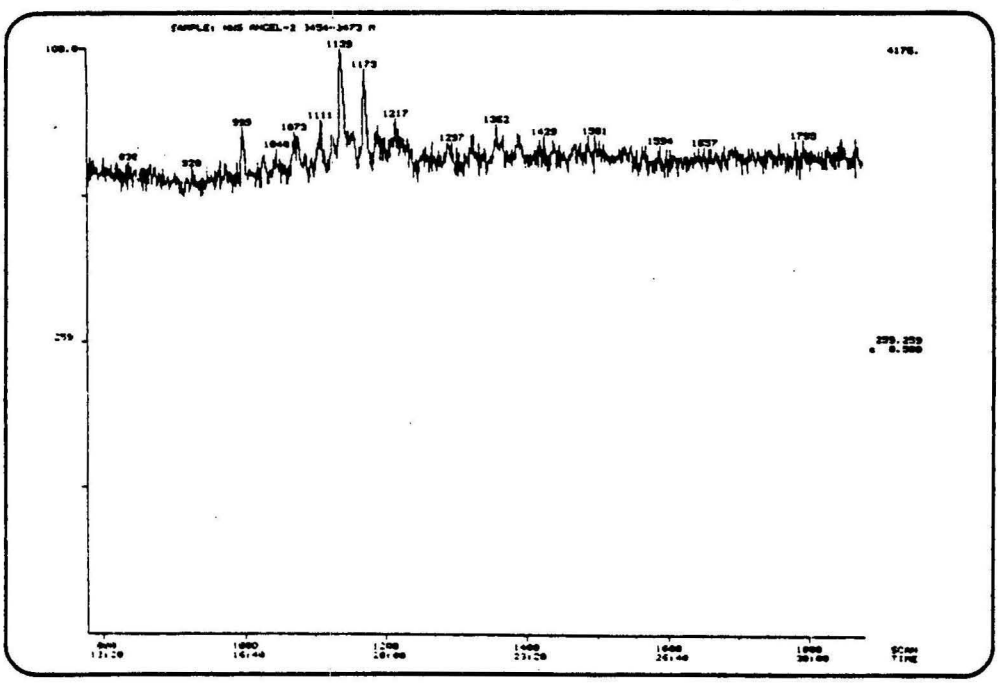
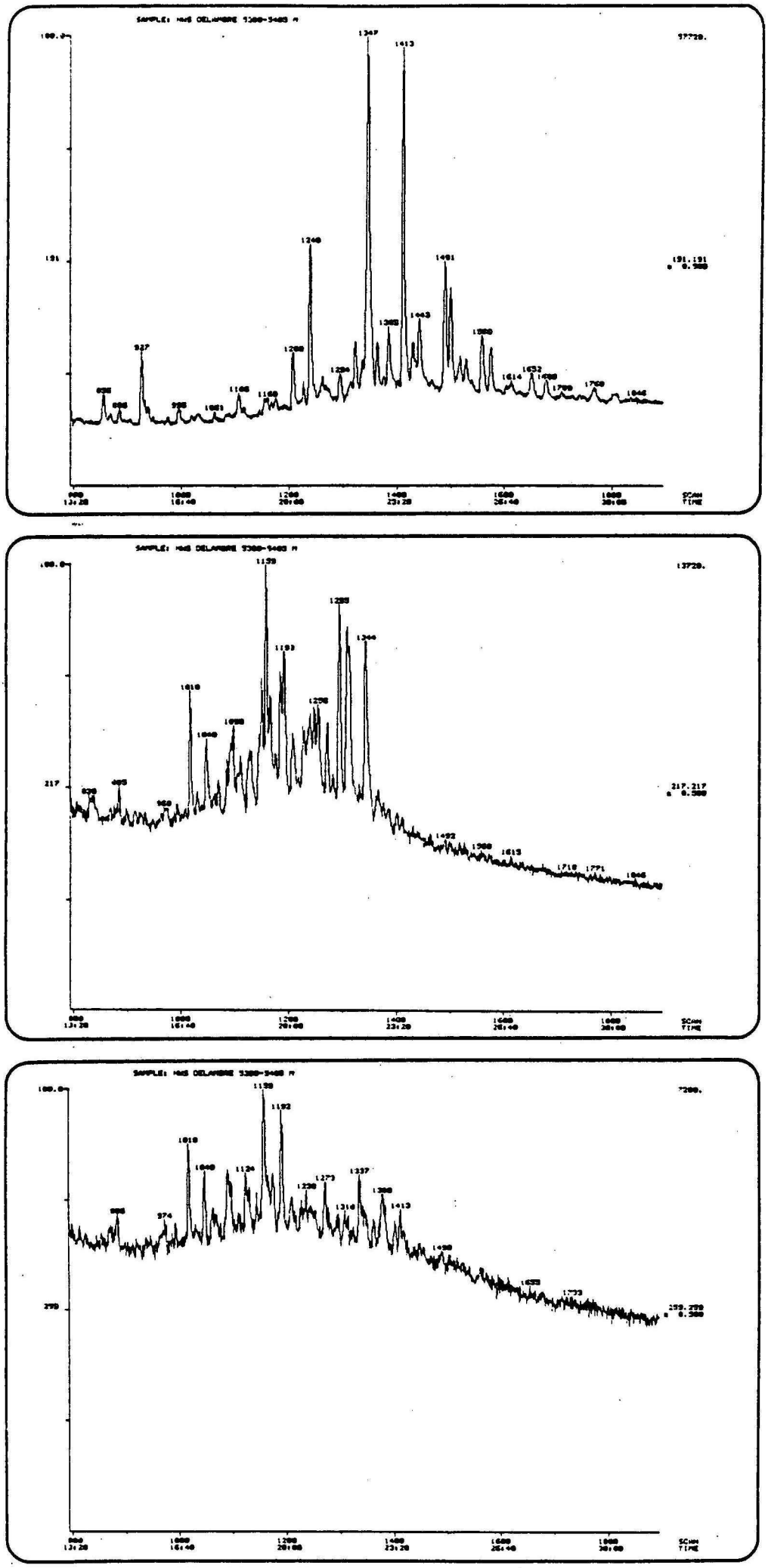


Figure III. 3.1



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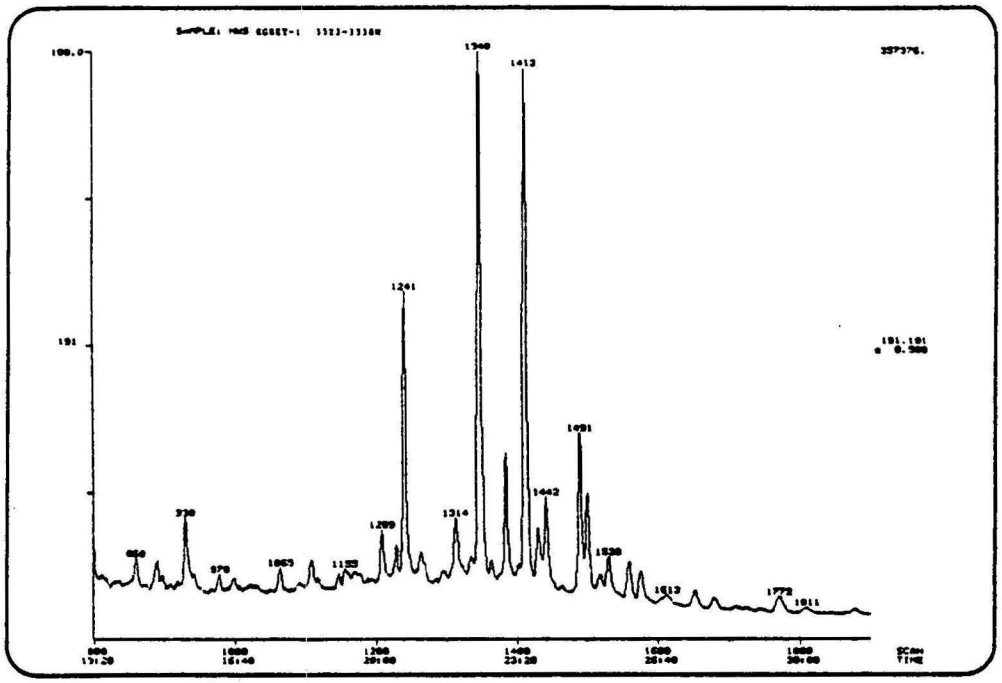


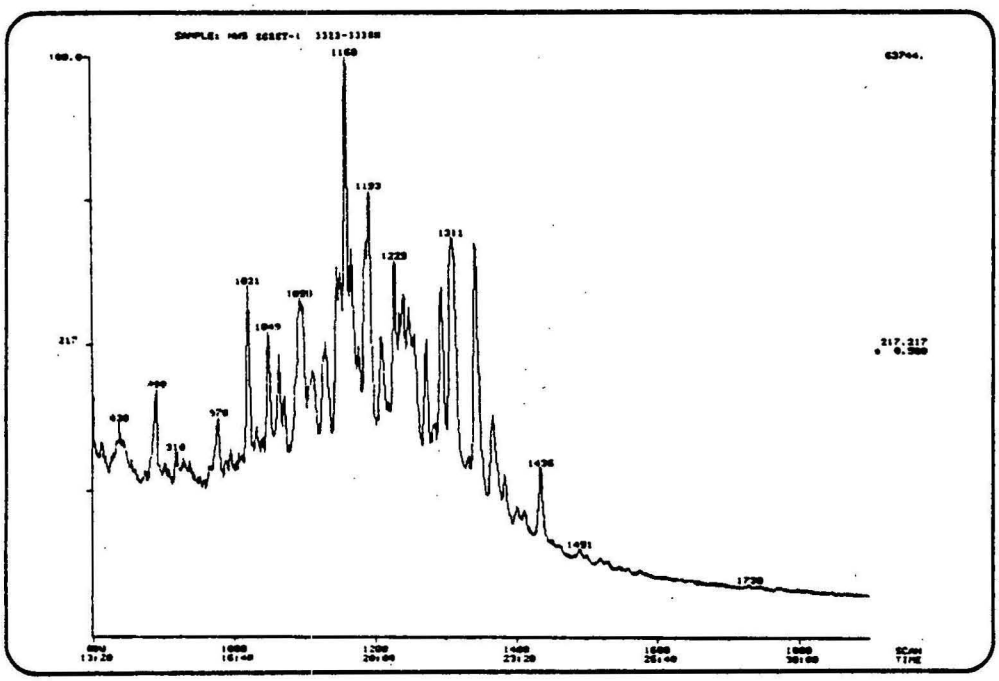


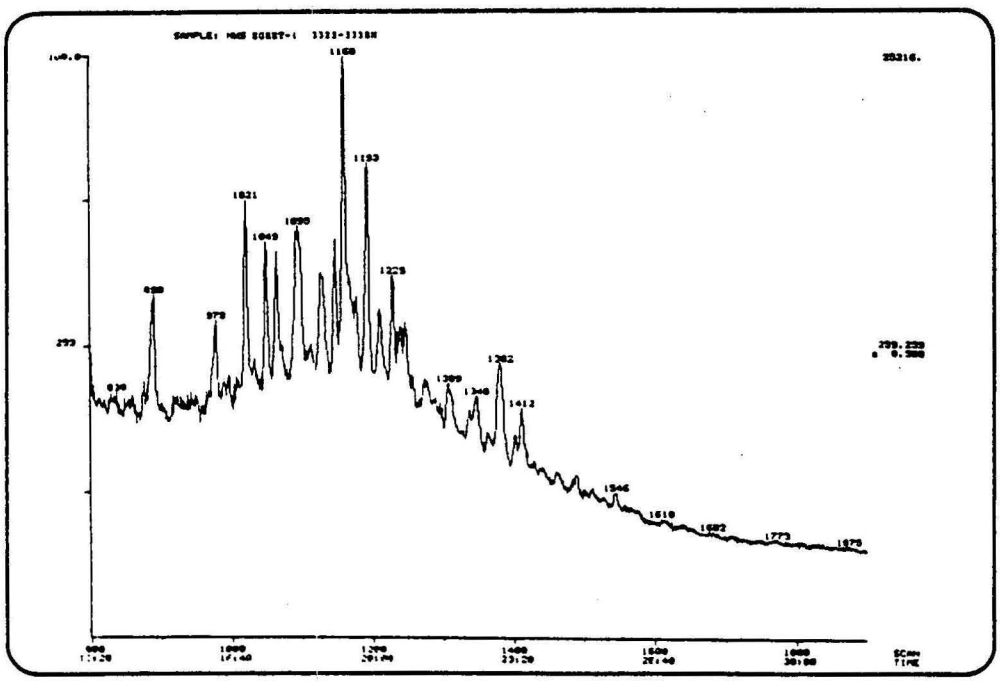


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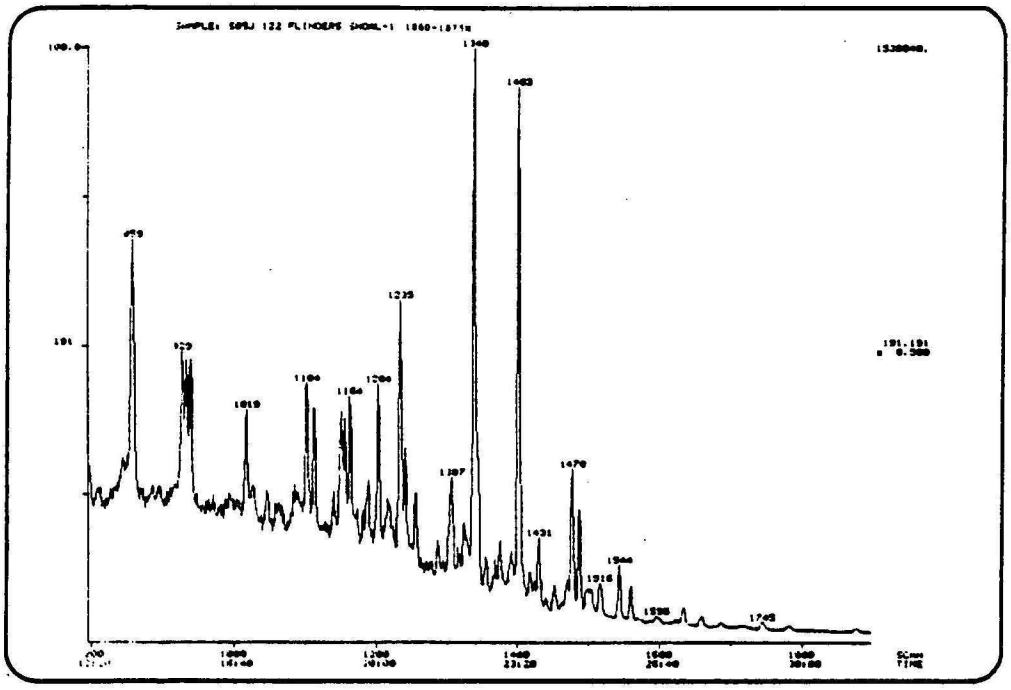

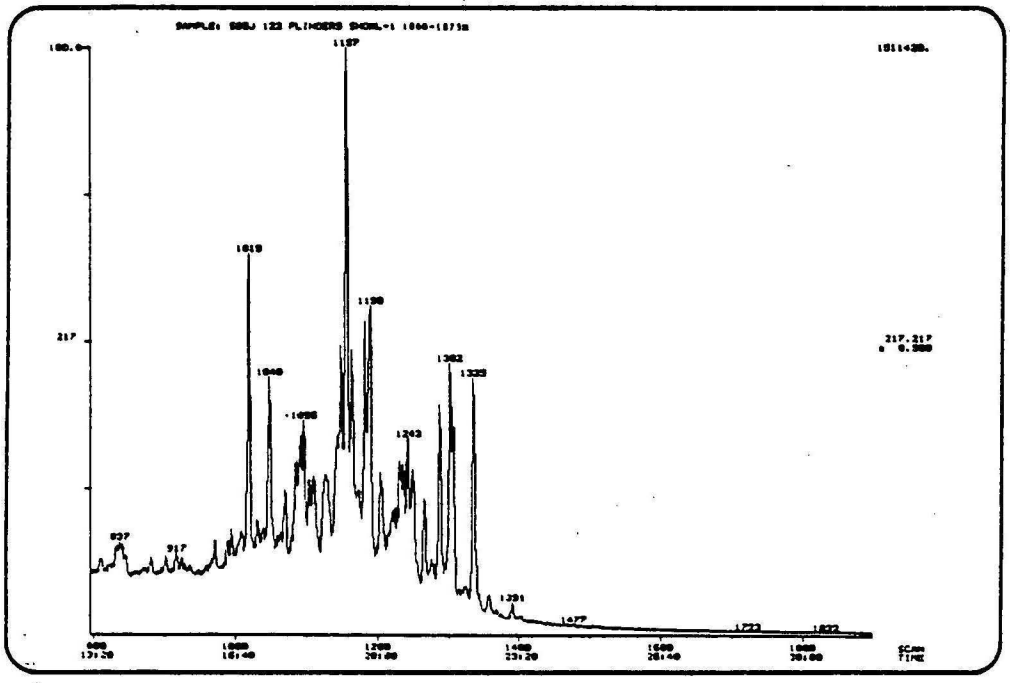

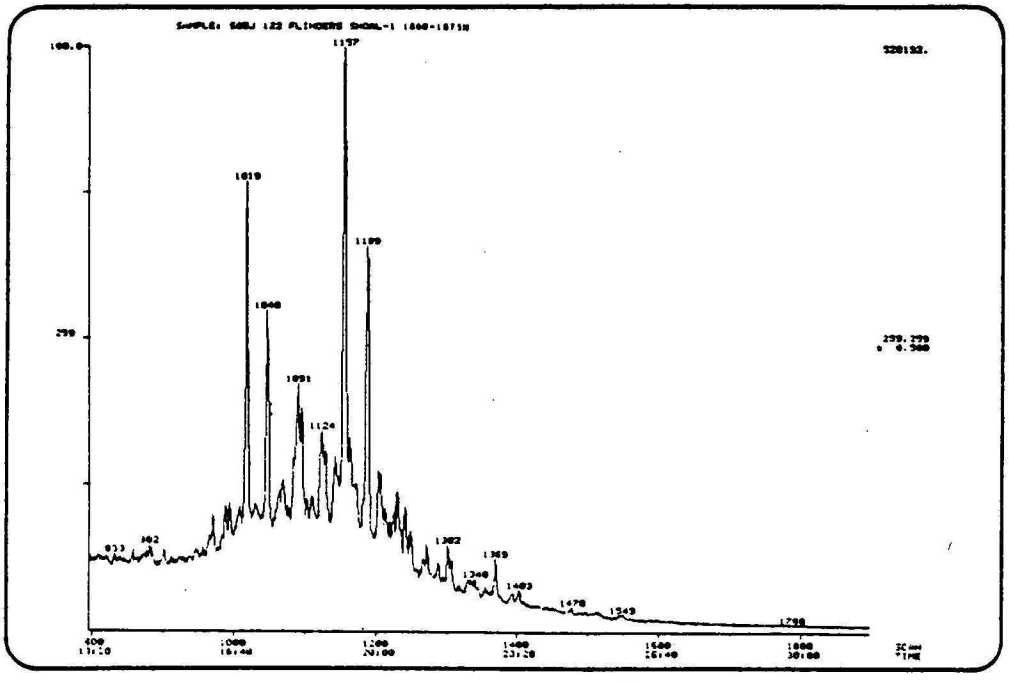

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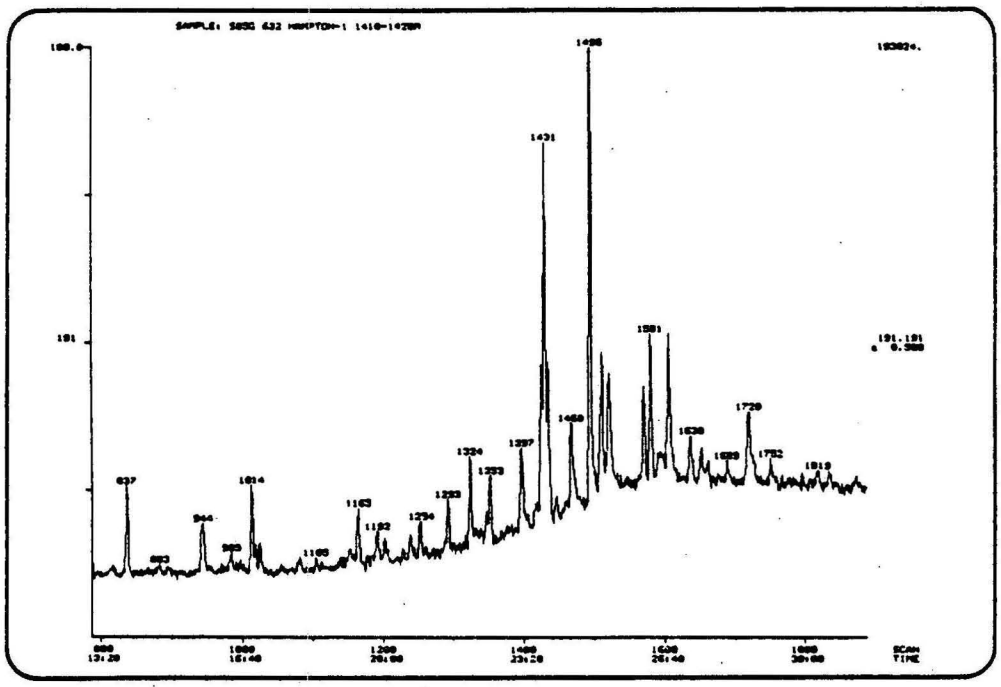


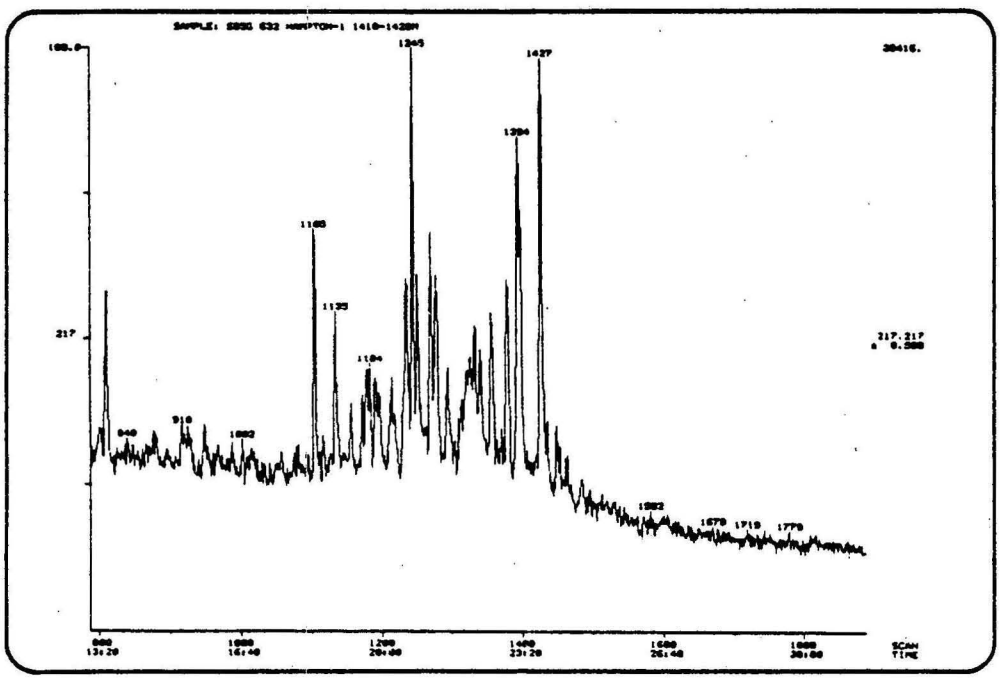


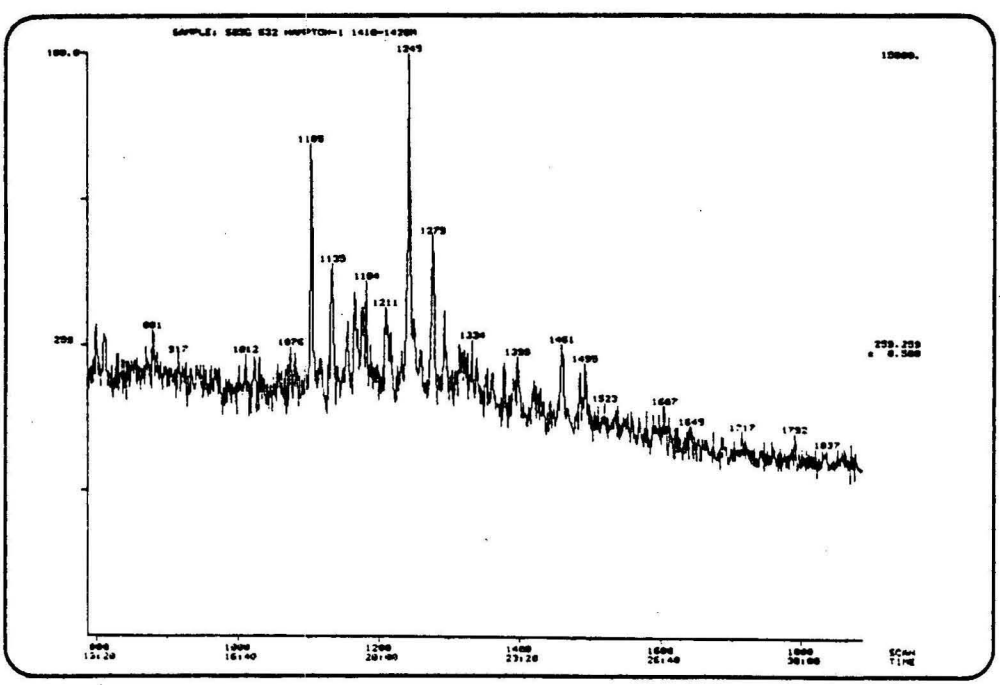


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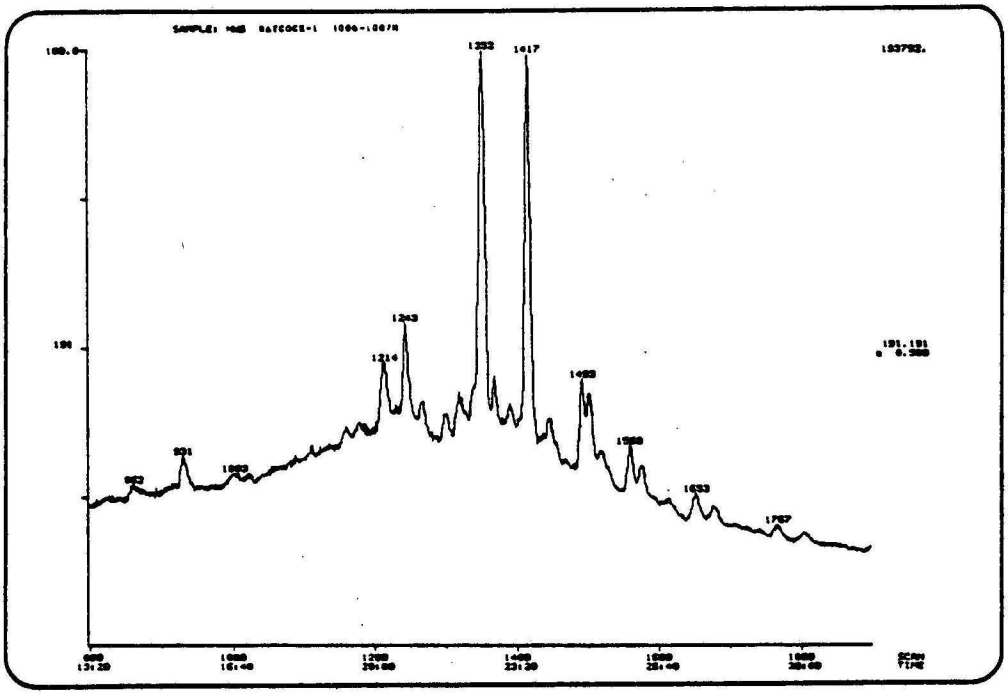


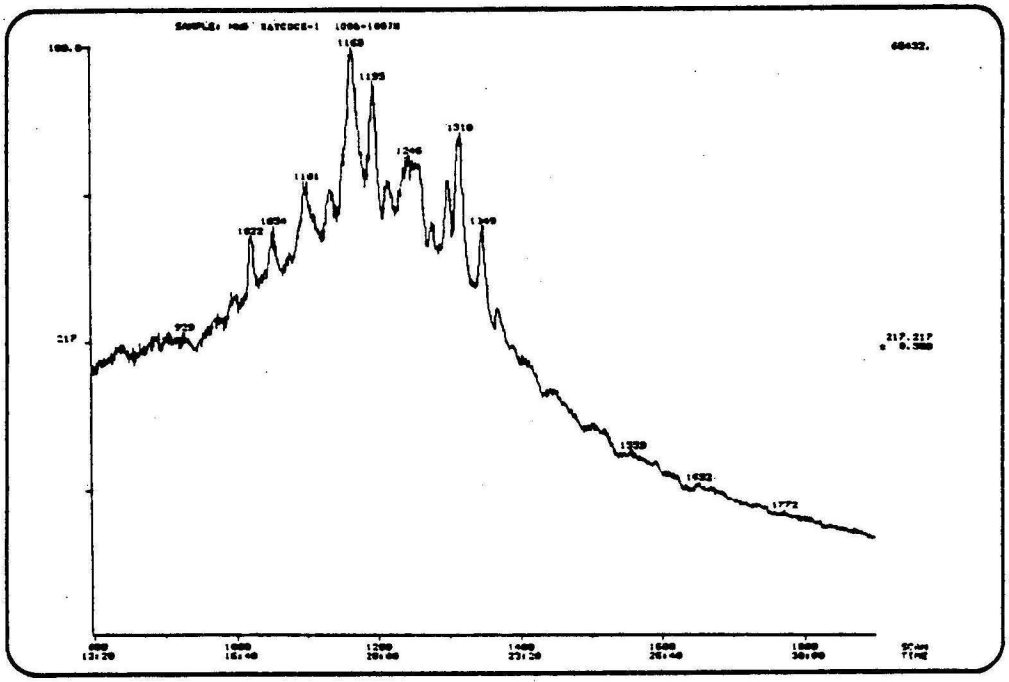


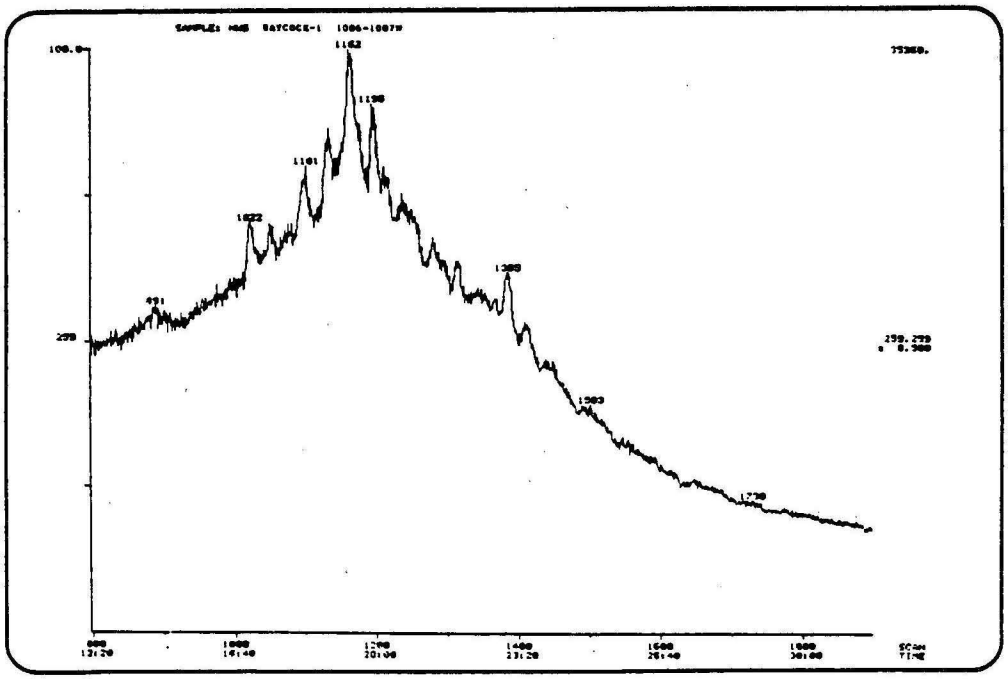


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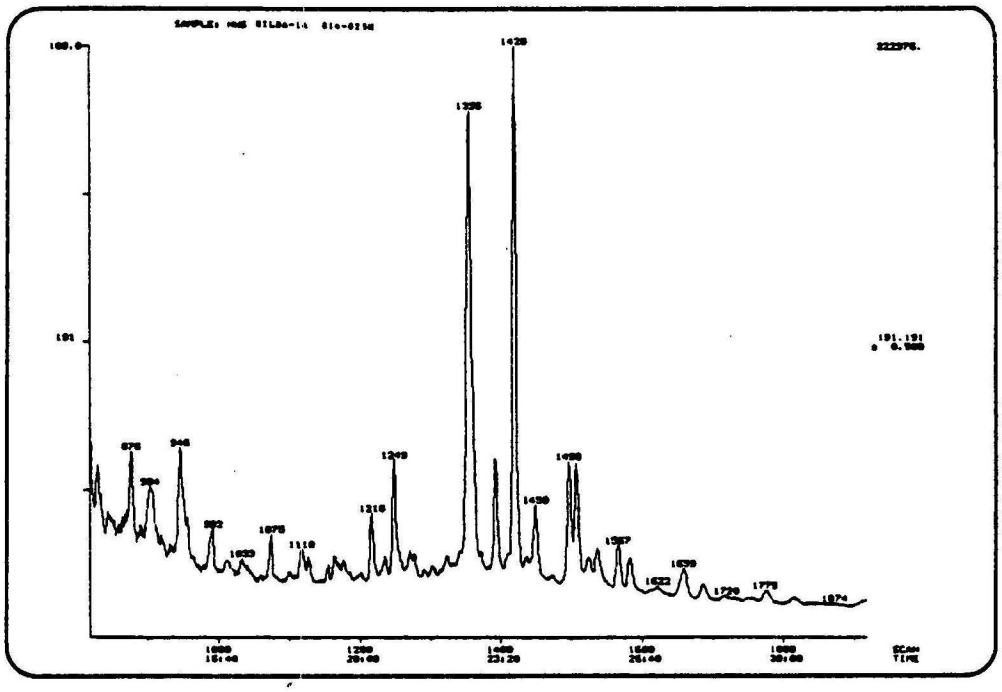

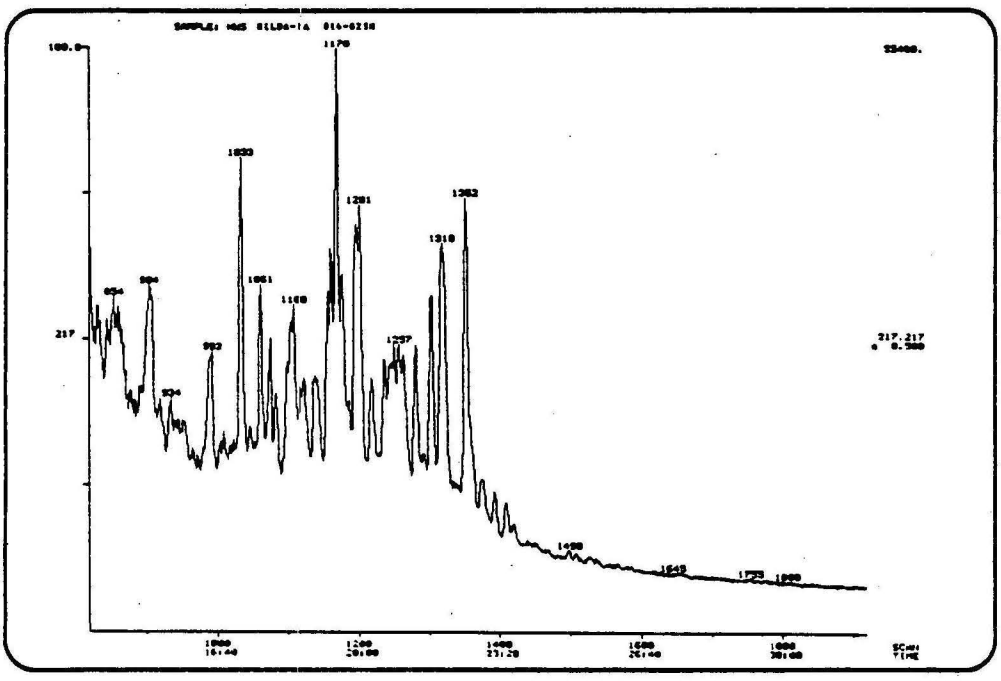

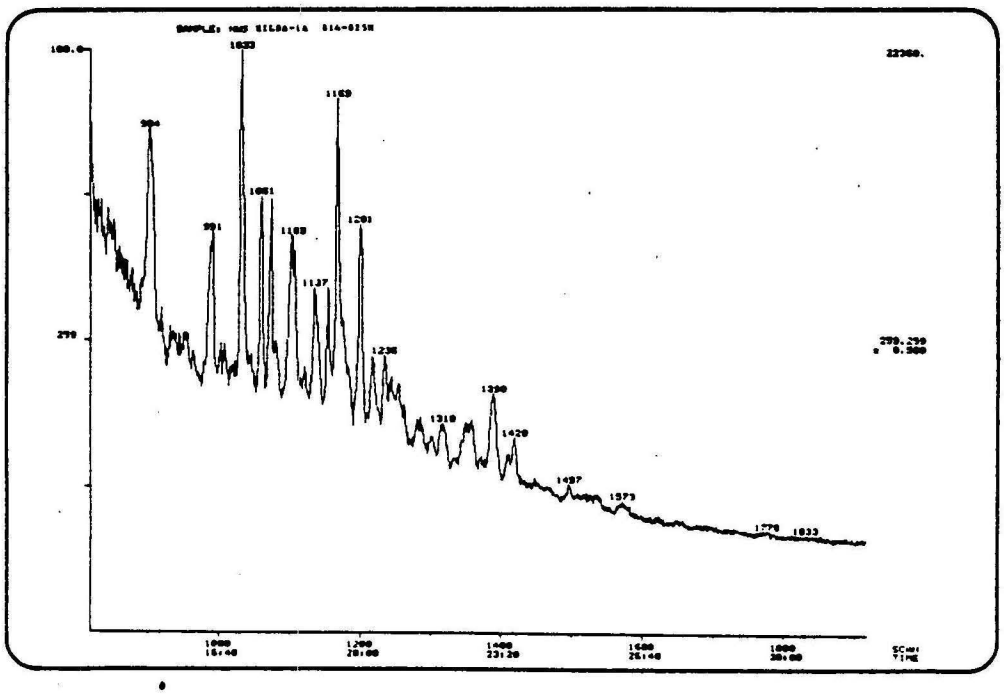

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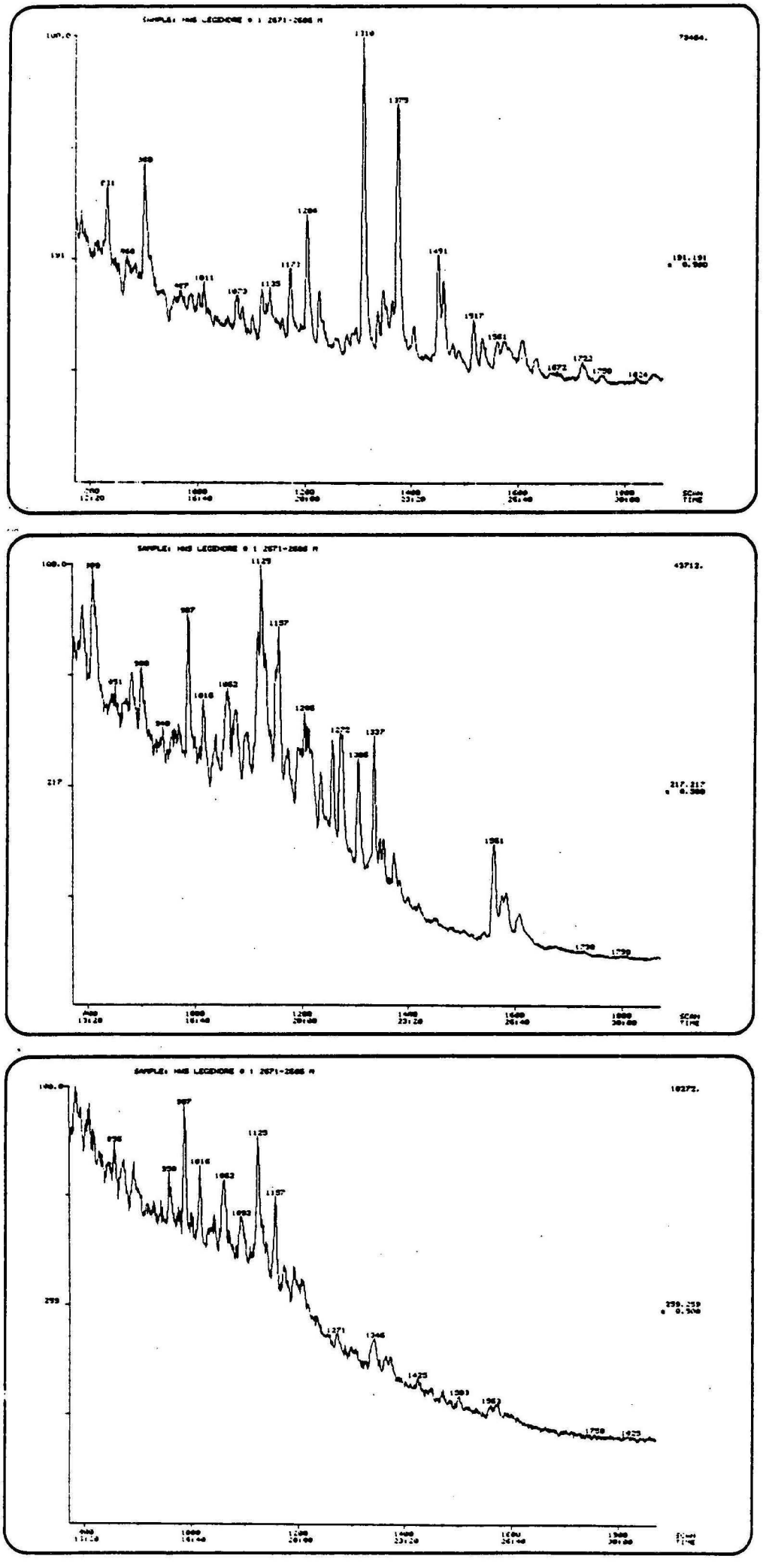

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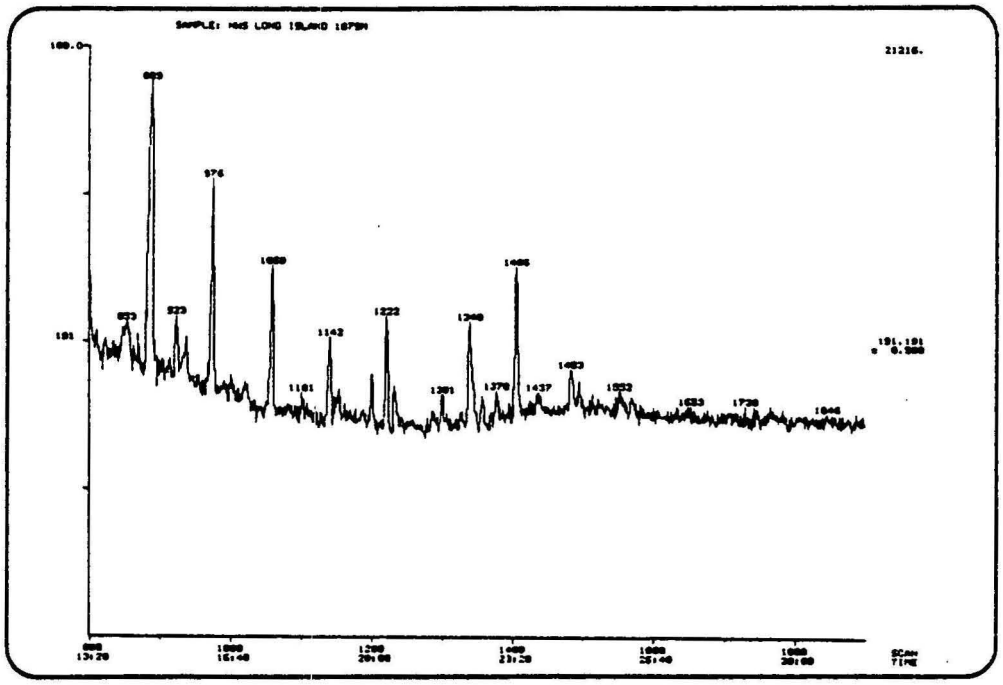


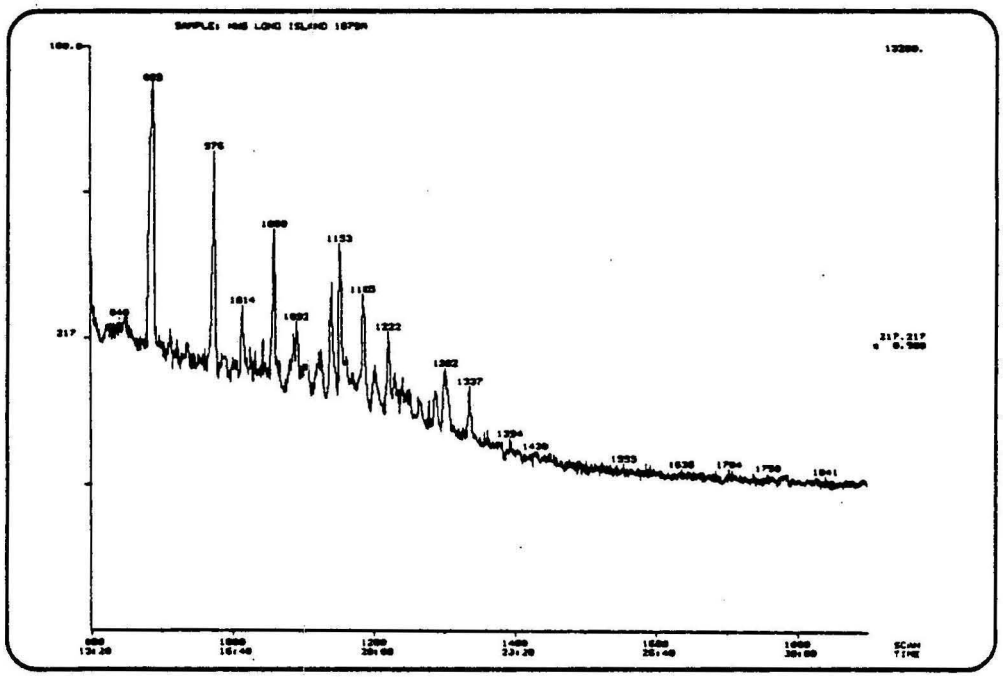


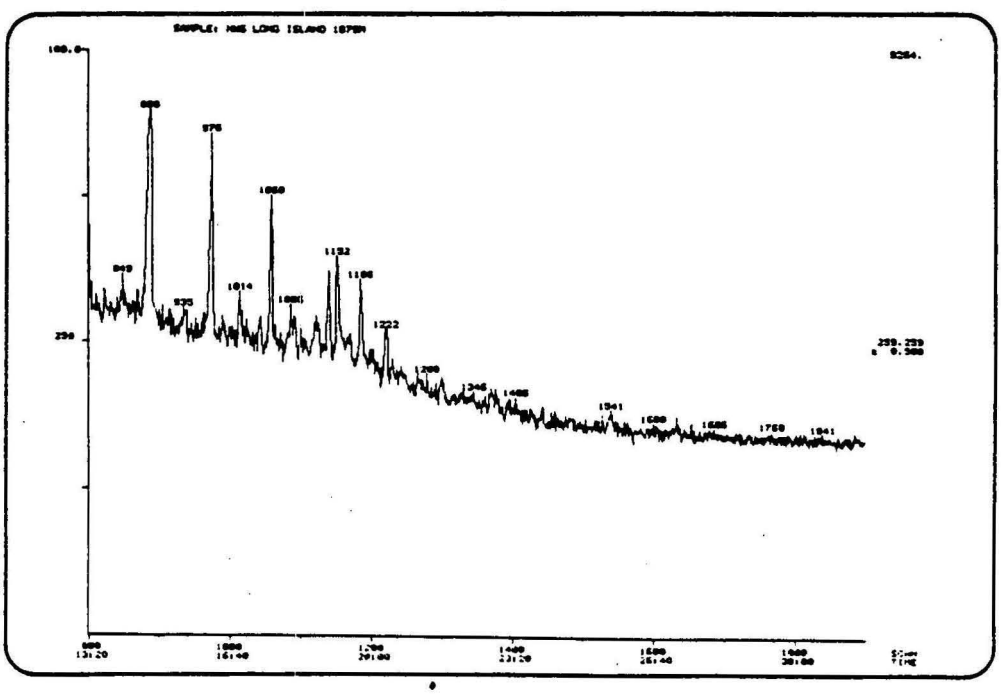


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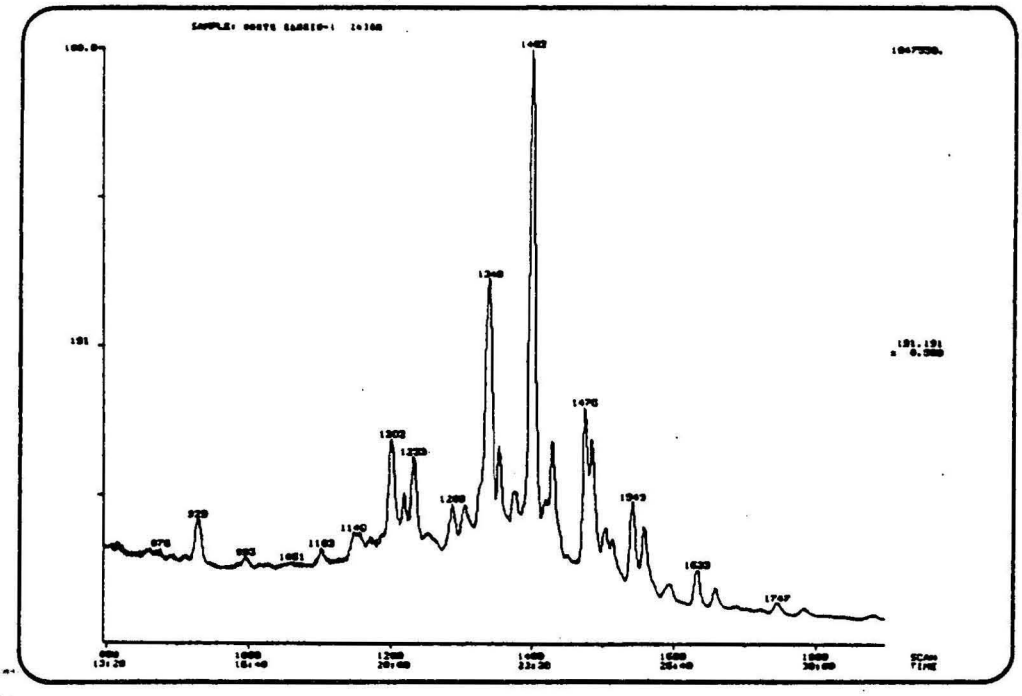

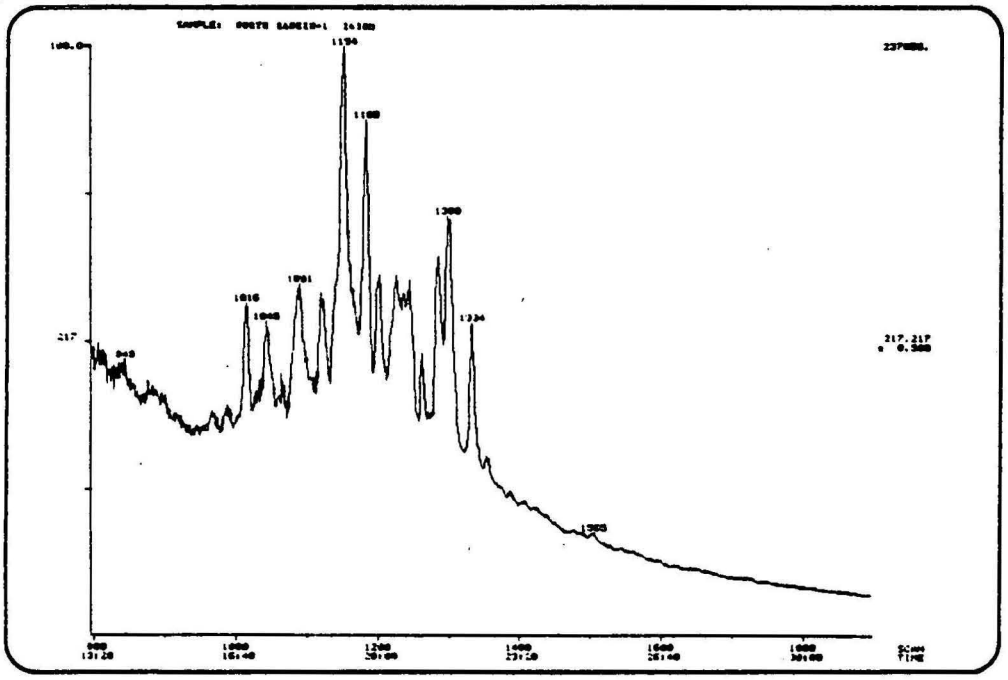

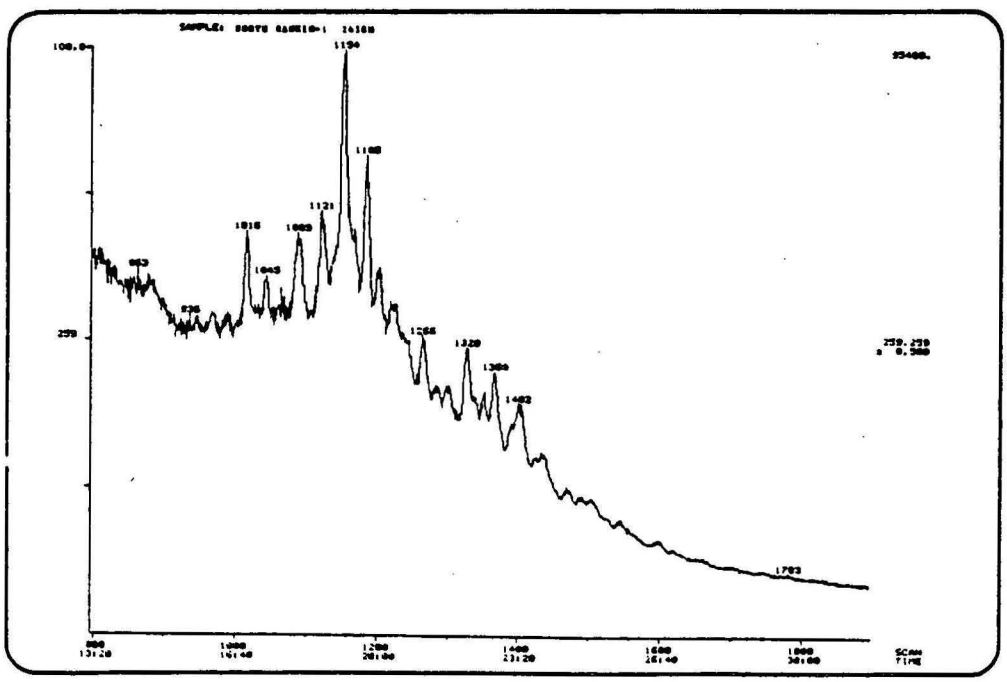

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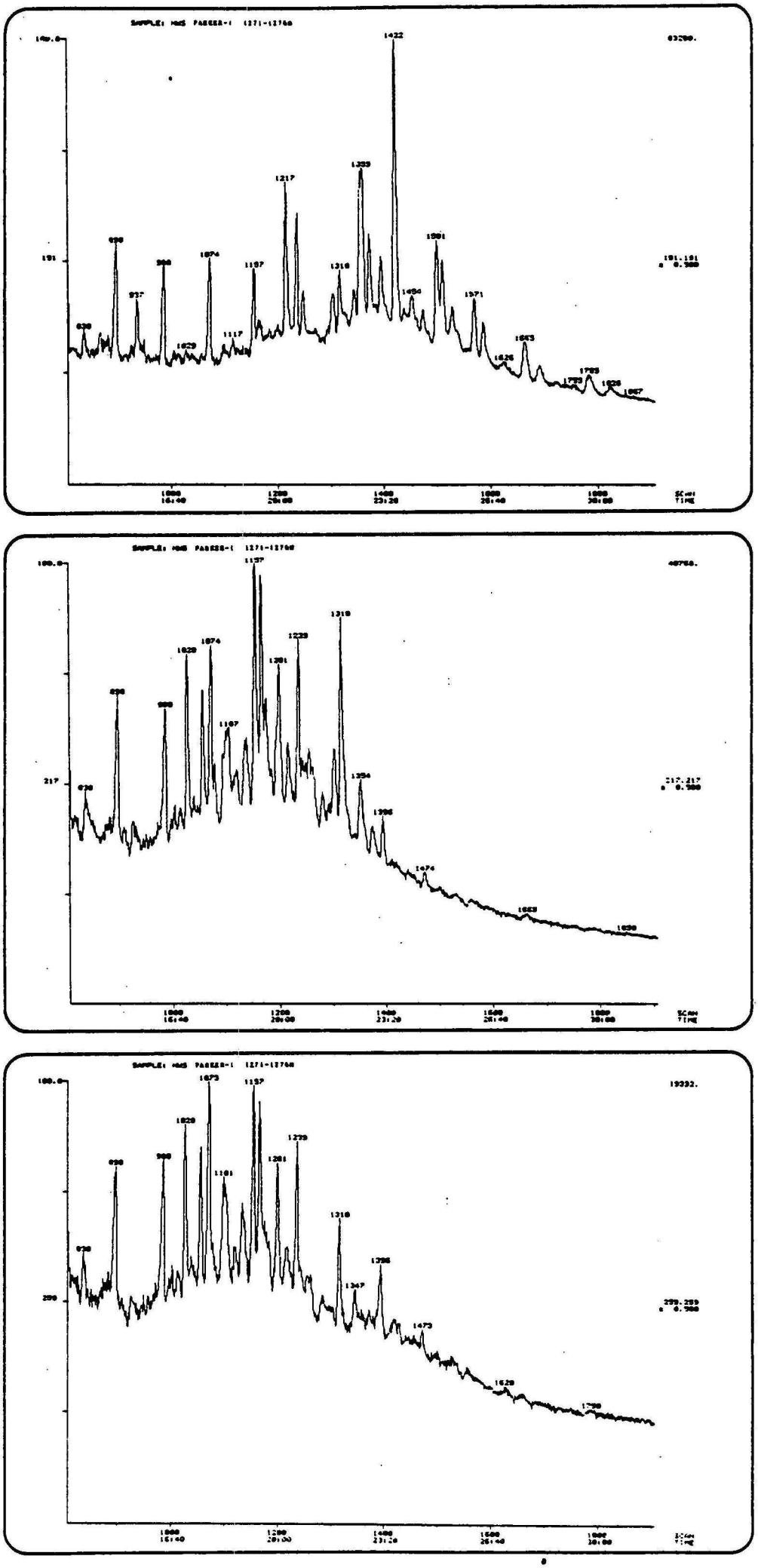

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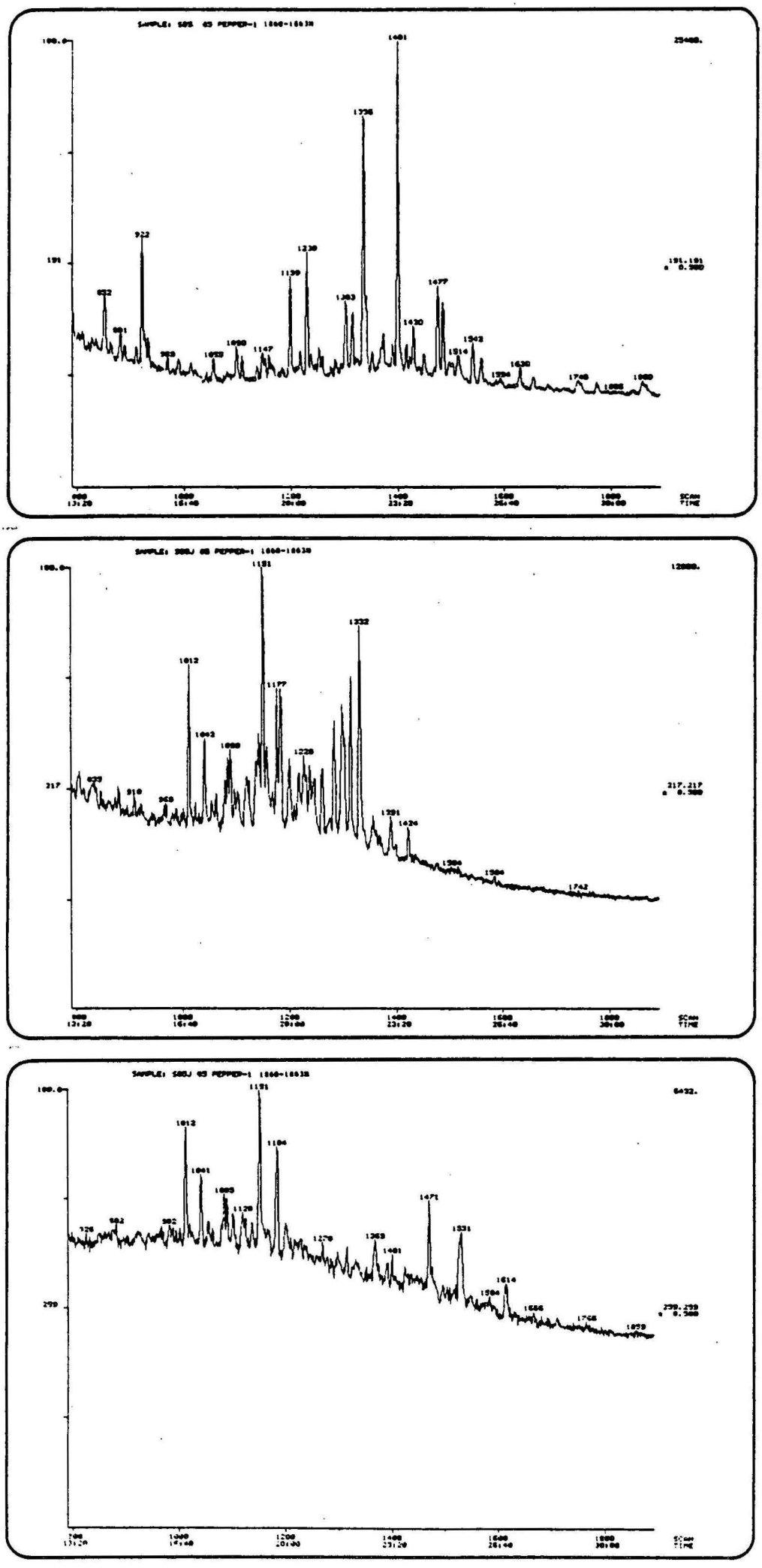

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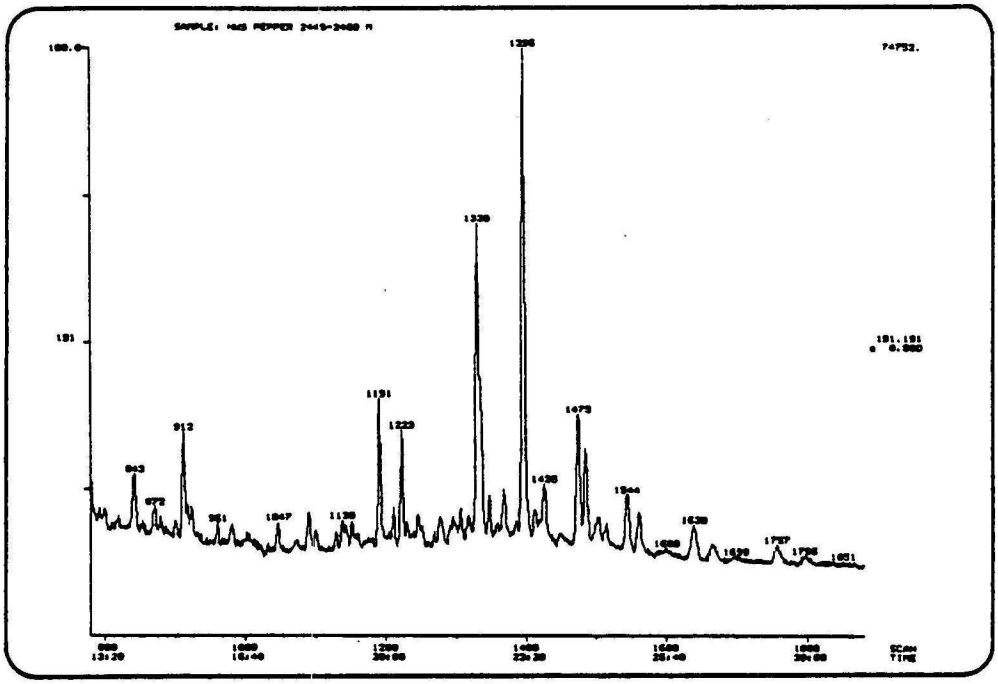

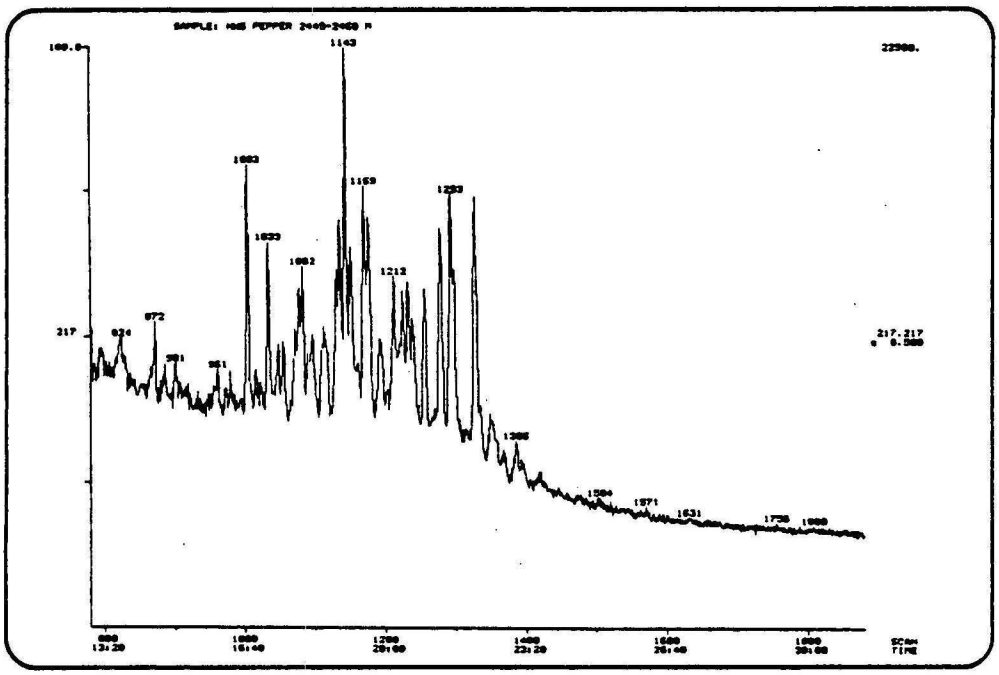

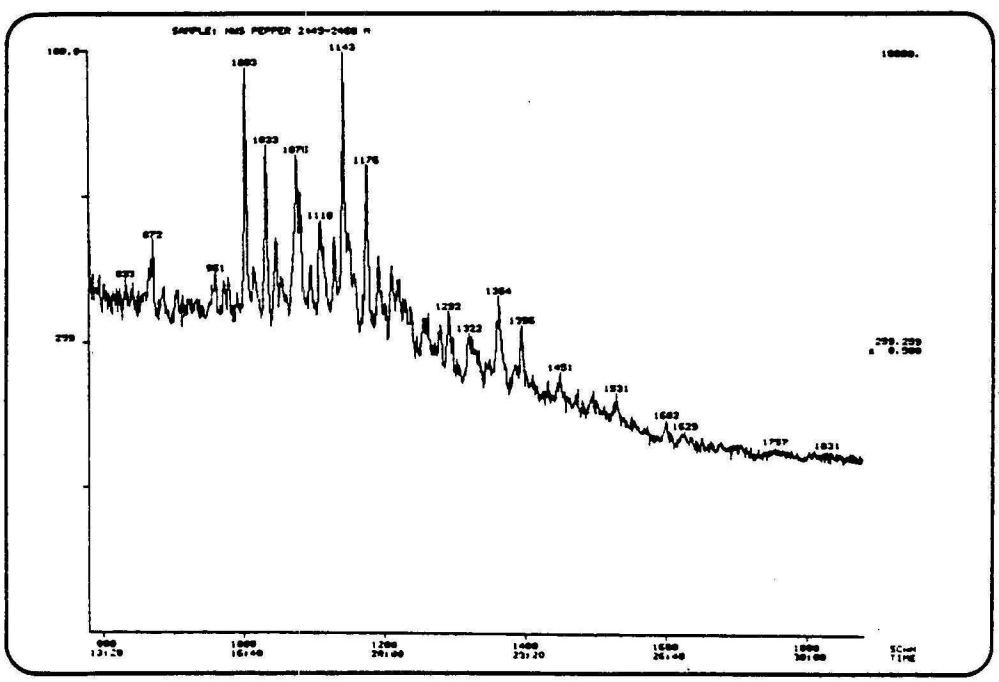

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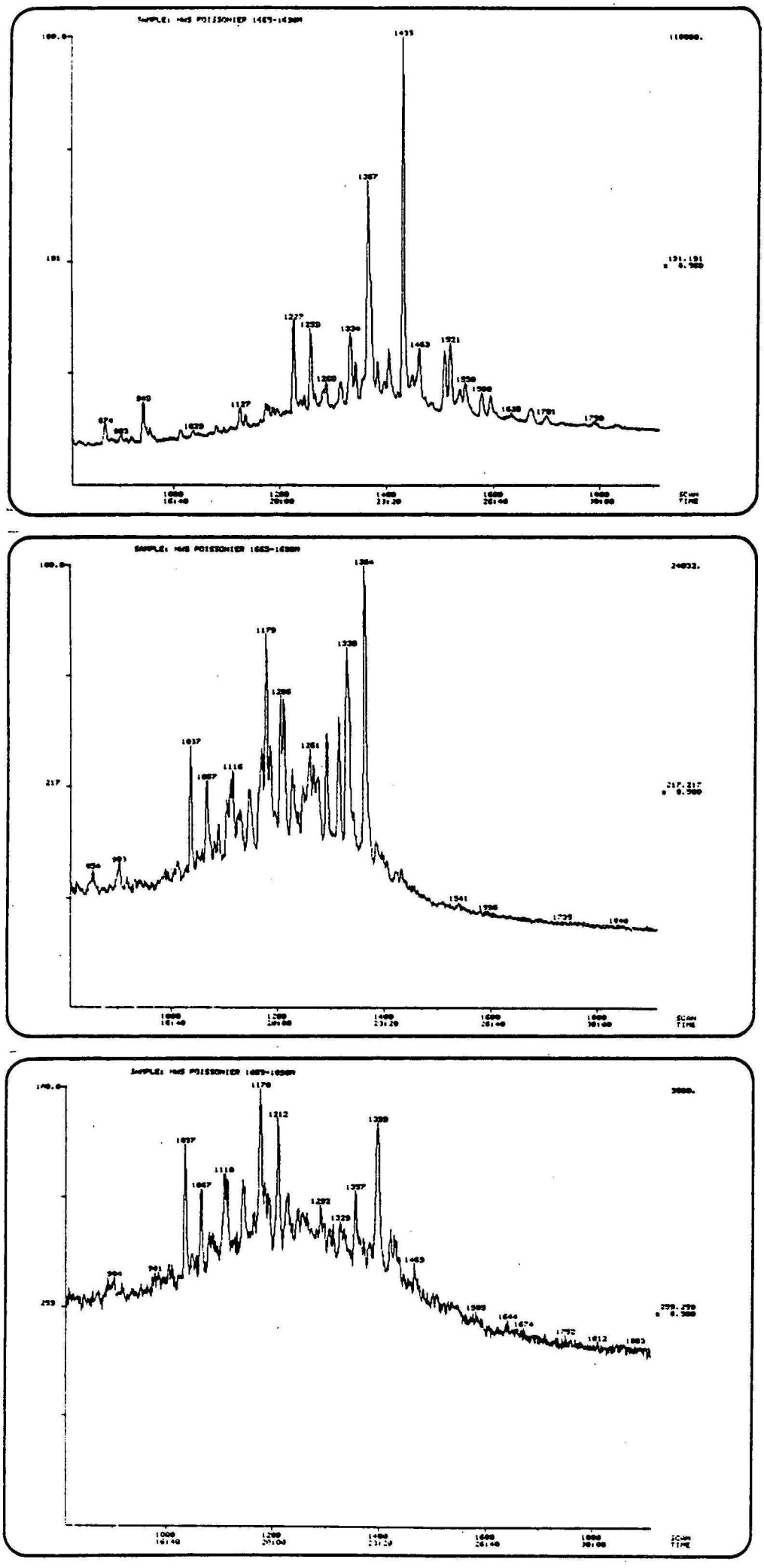

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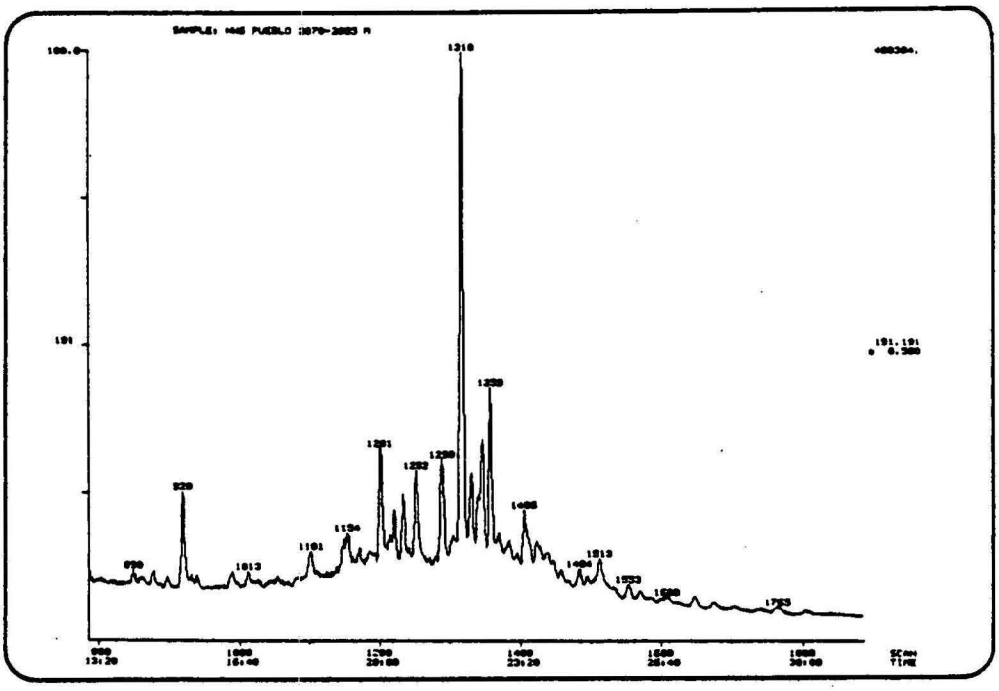


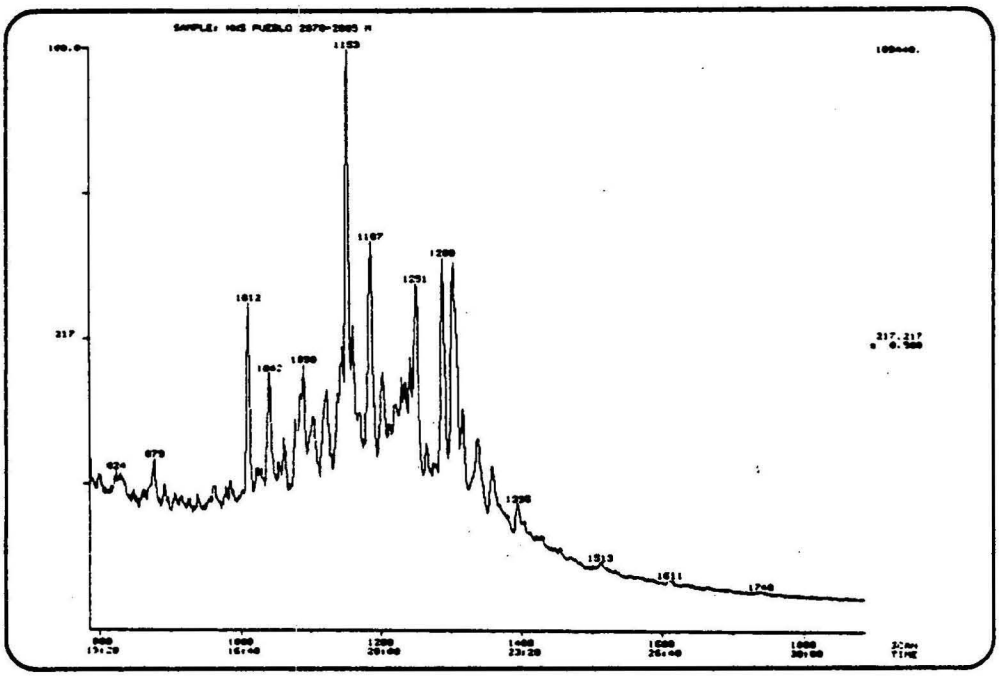


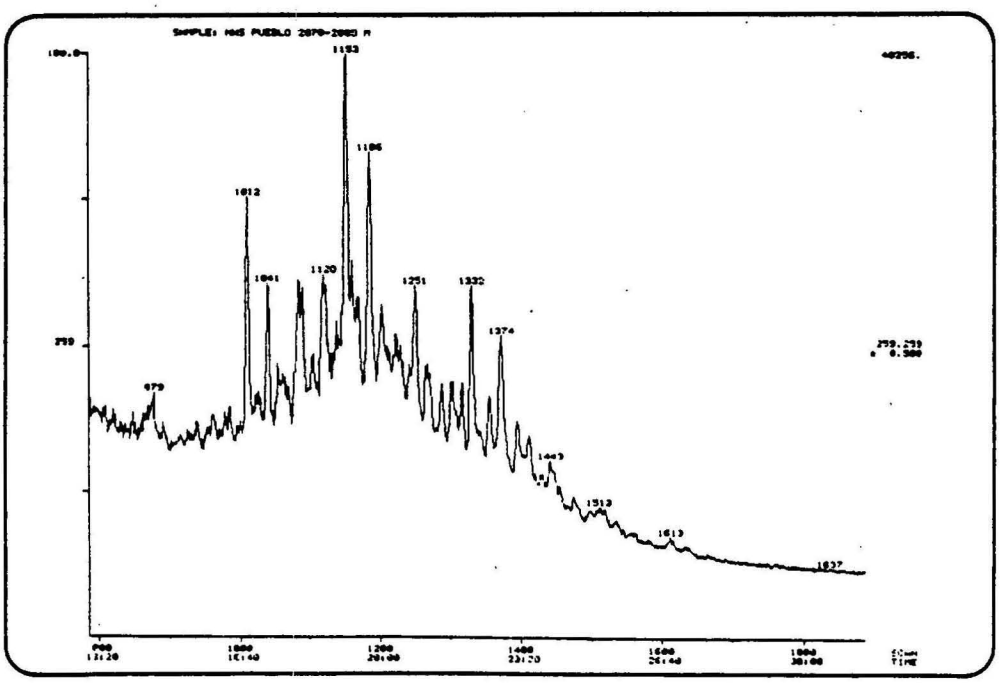


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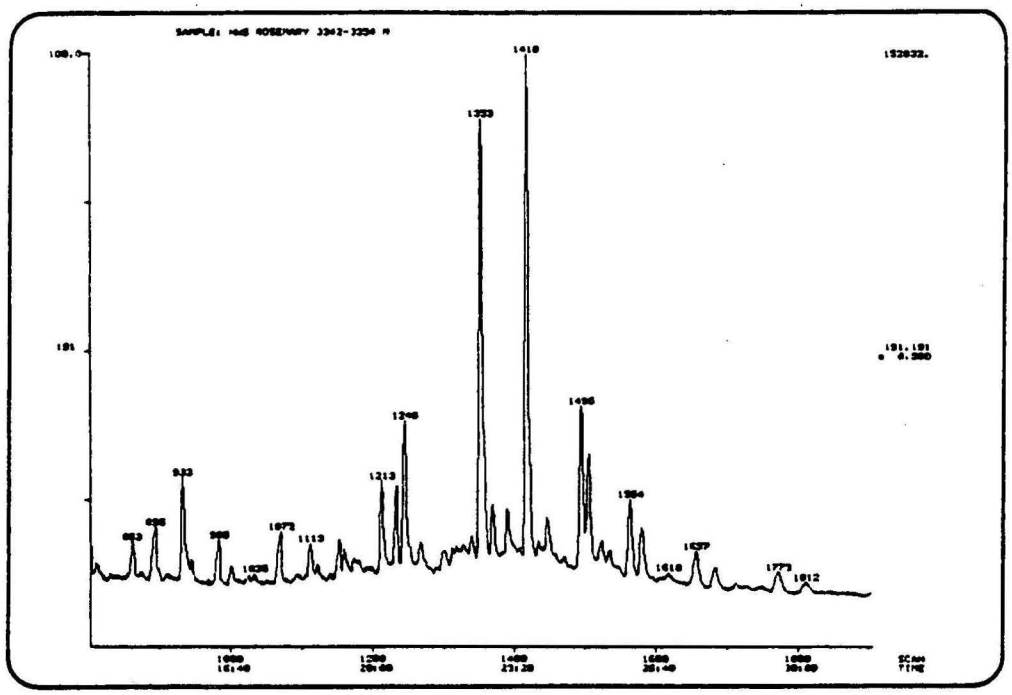


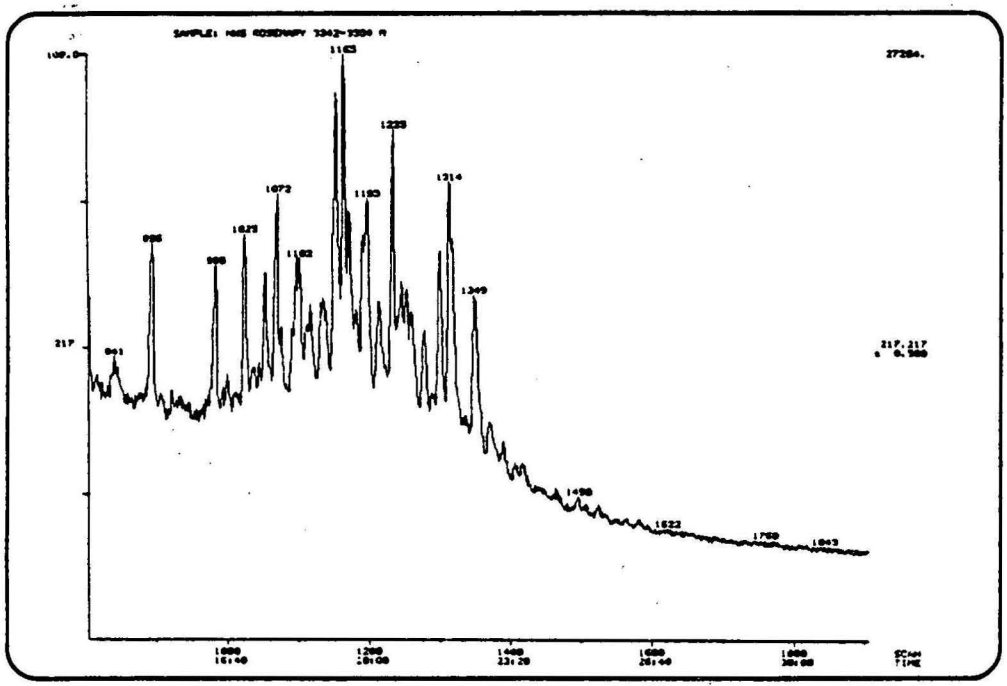


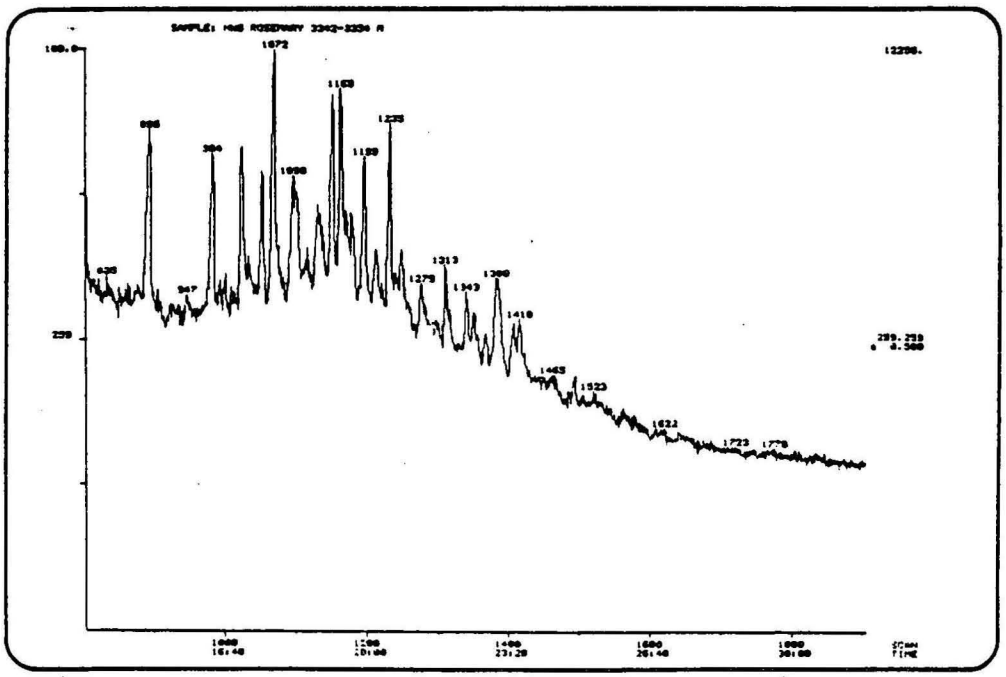


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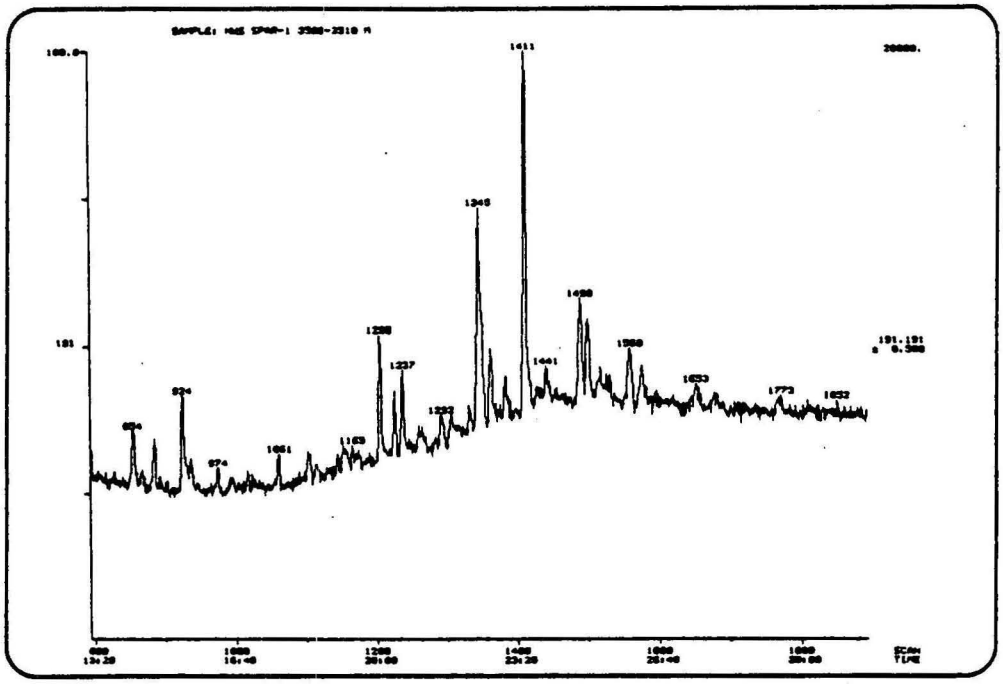

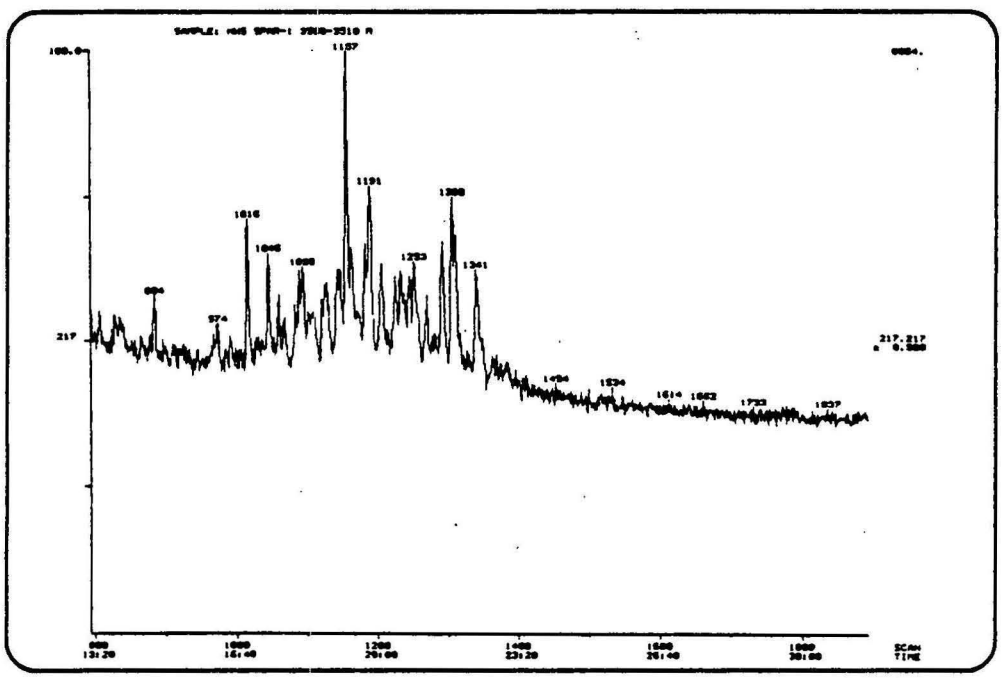

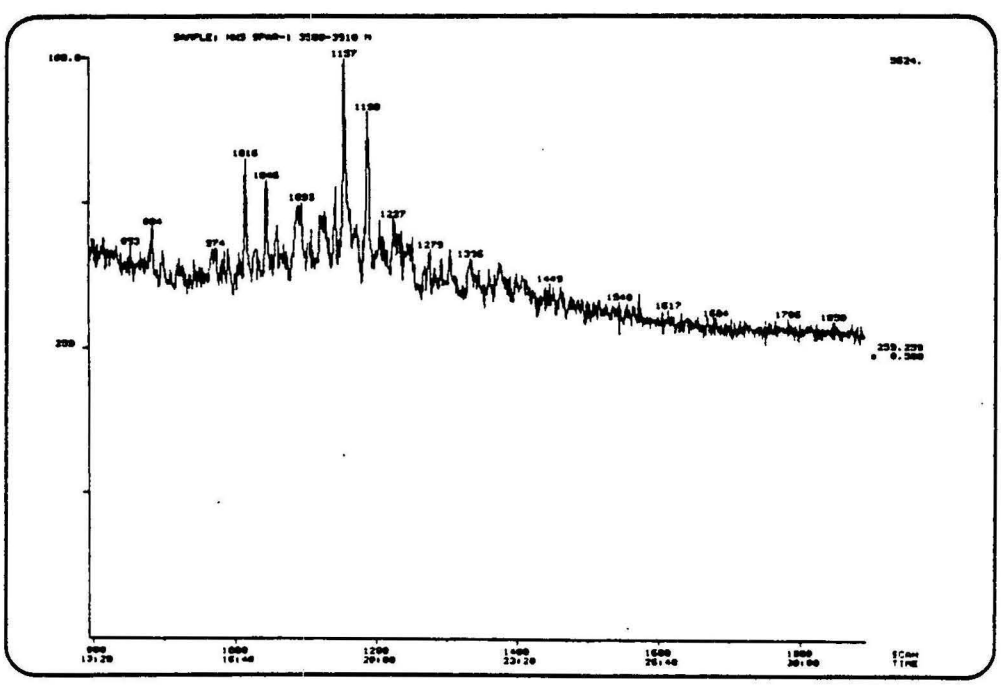

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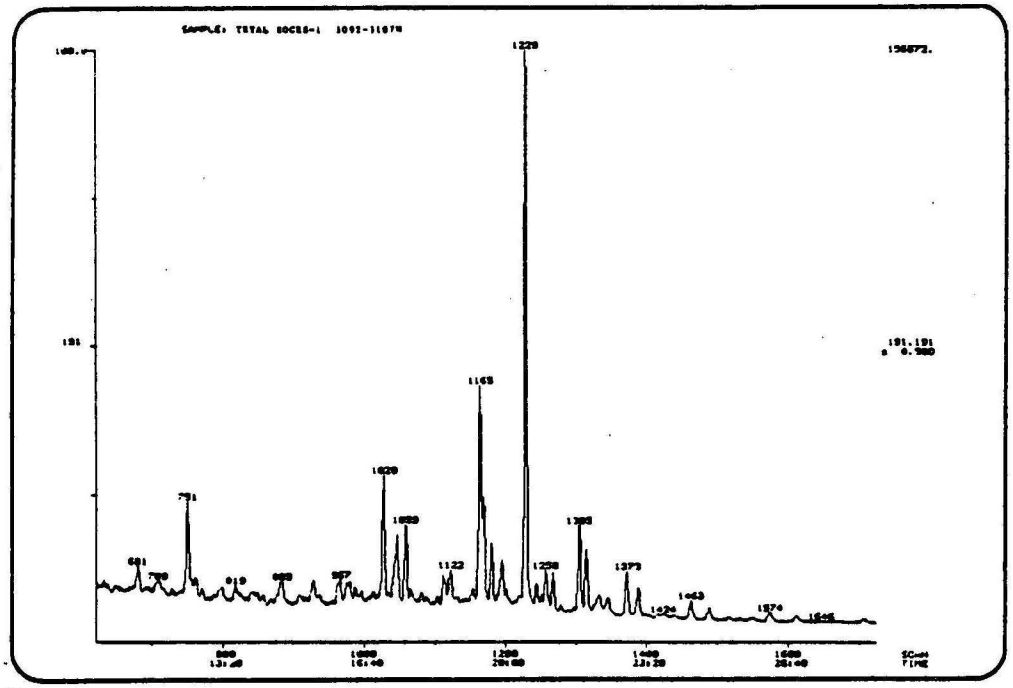

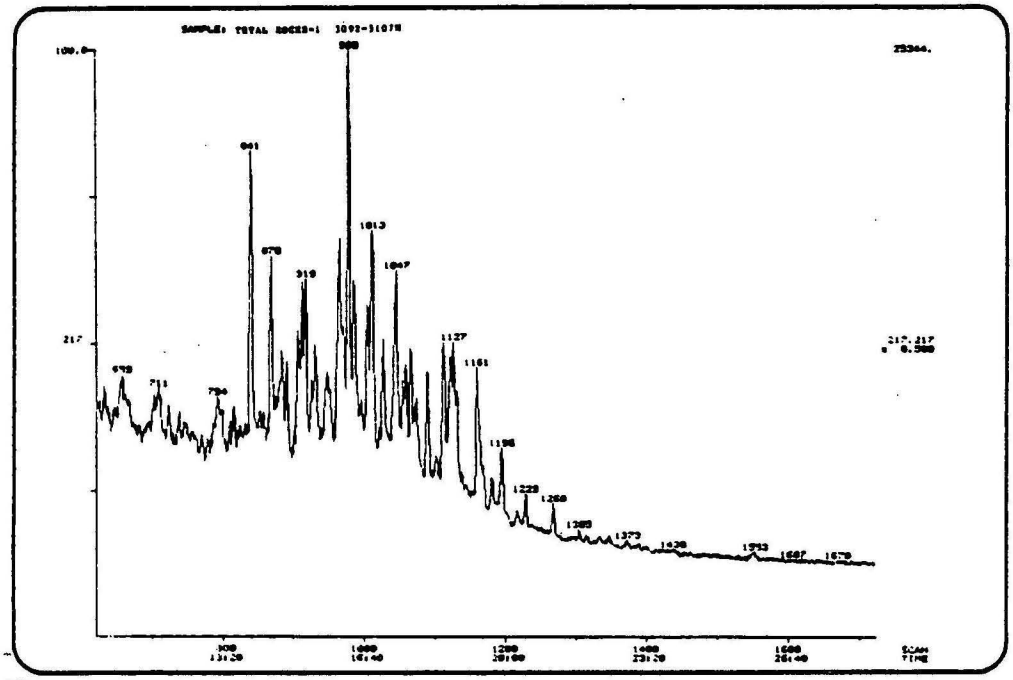

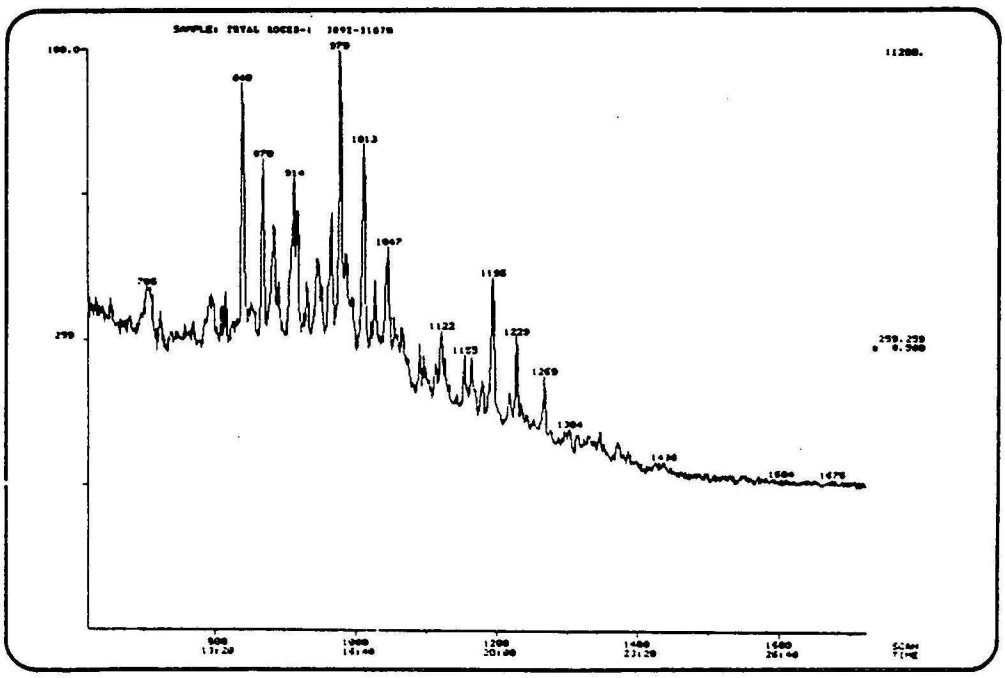

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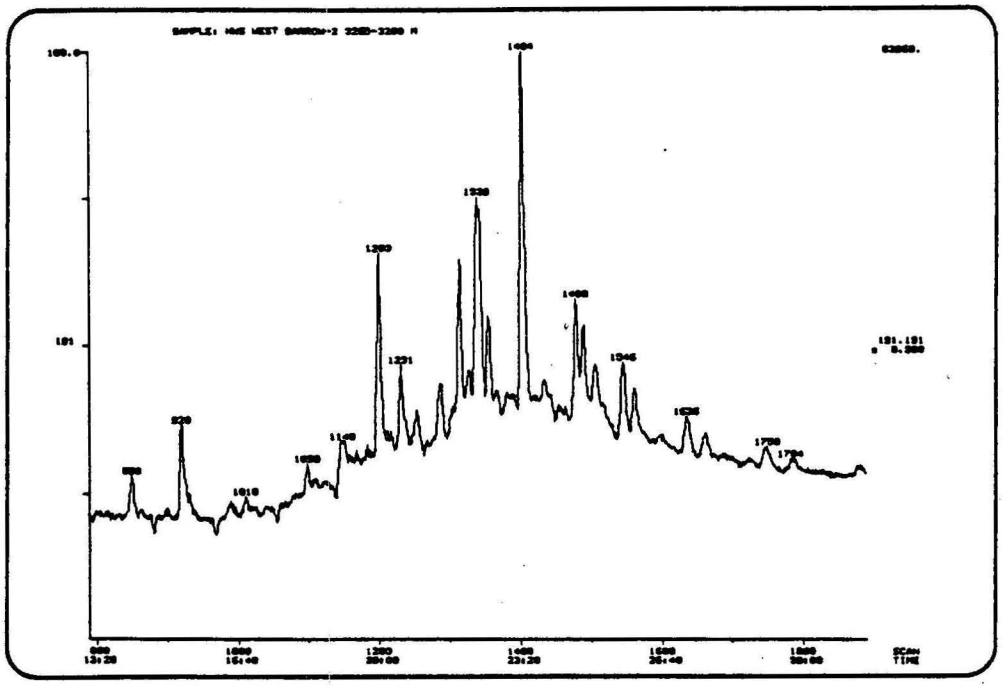

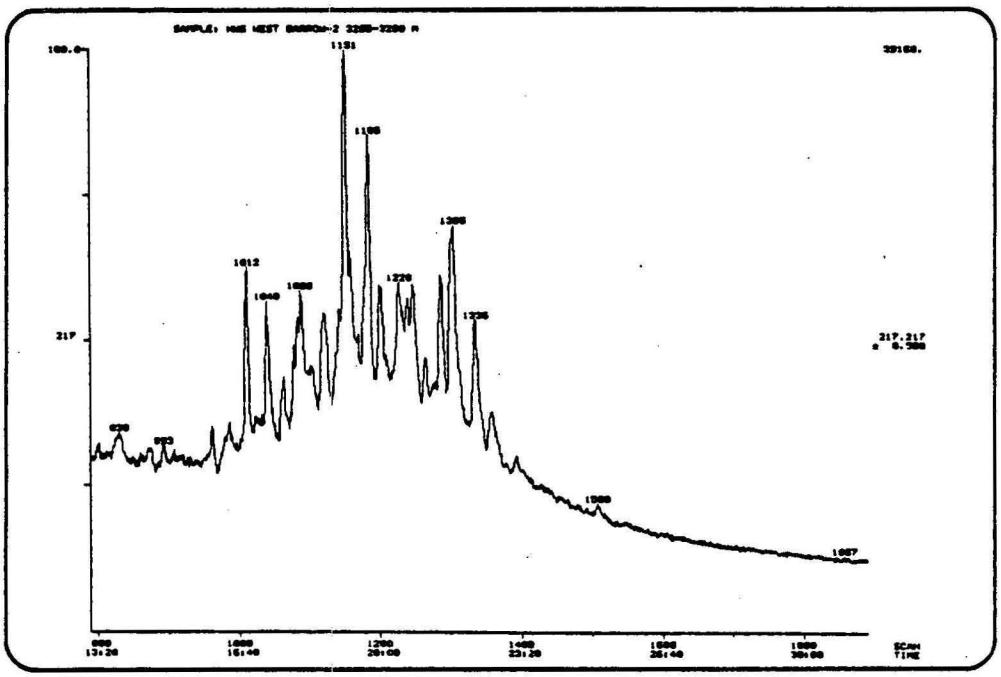

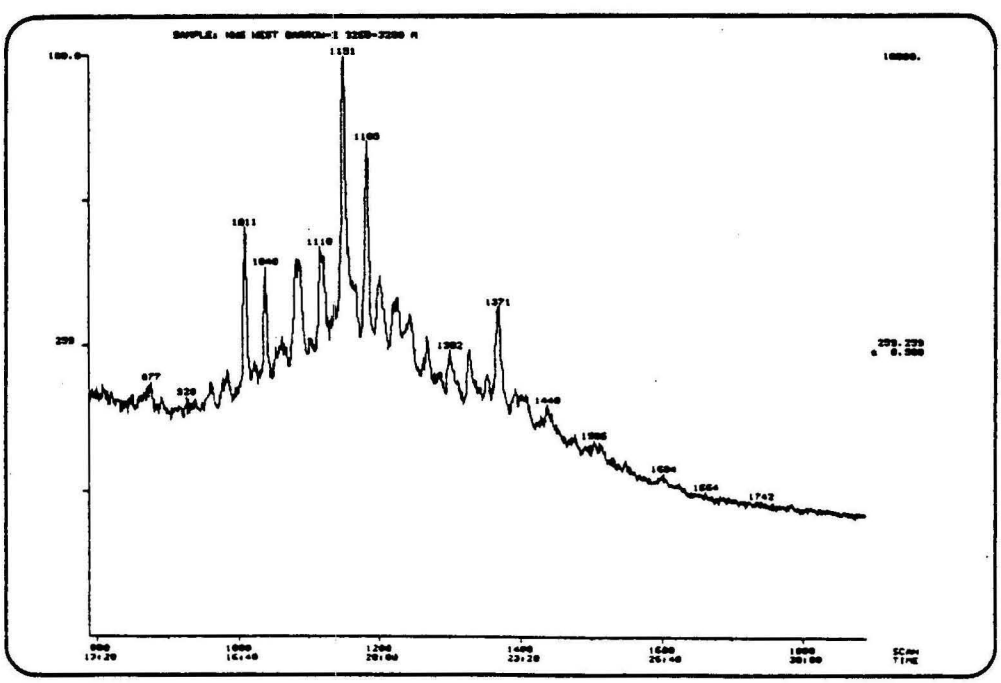

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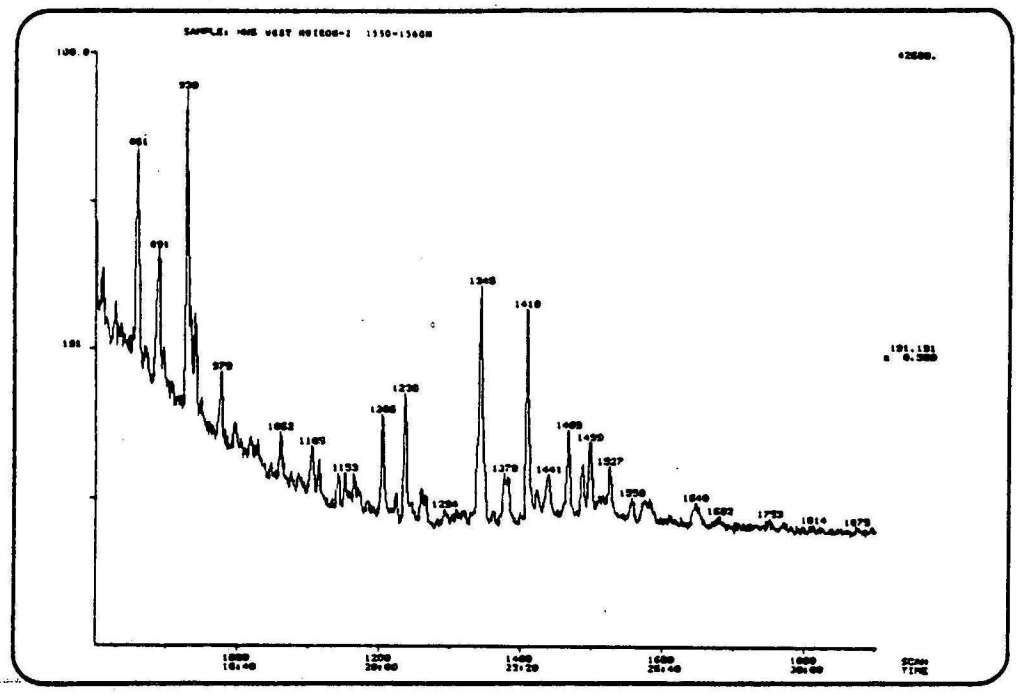
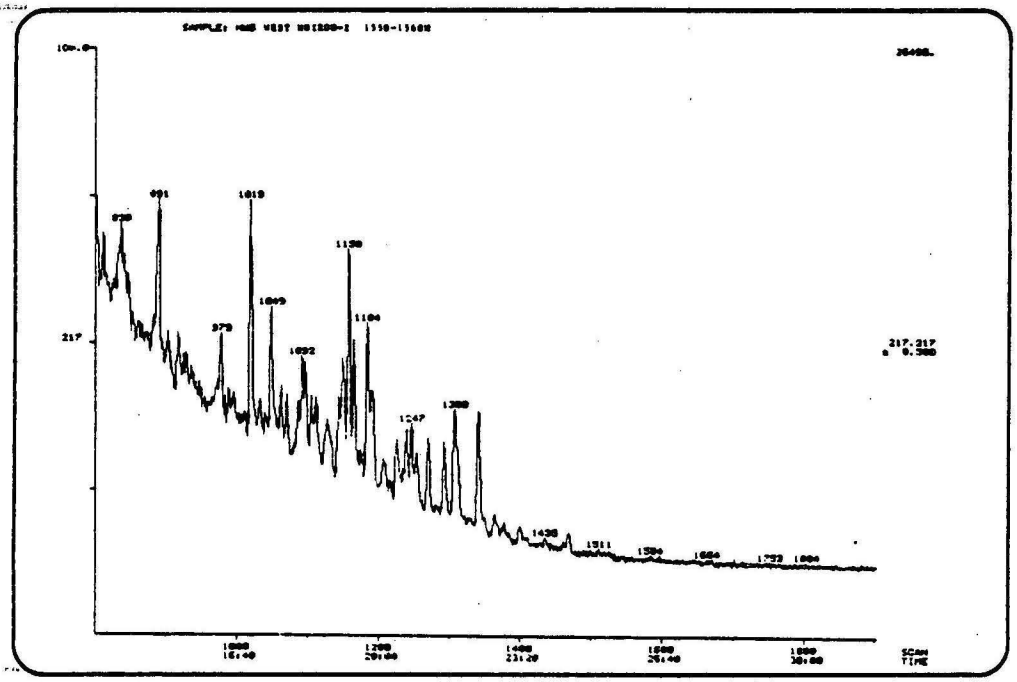




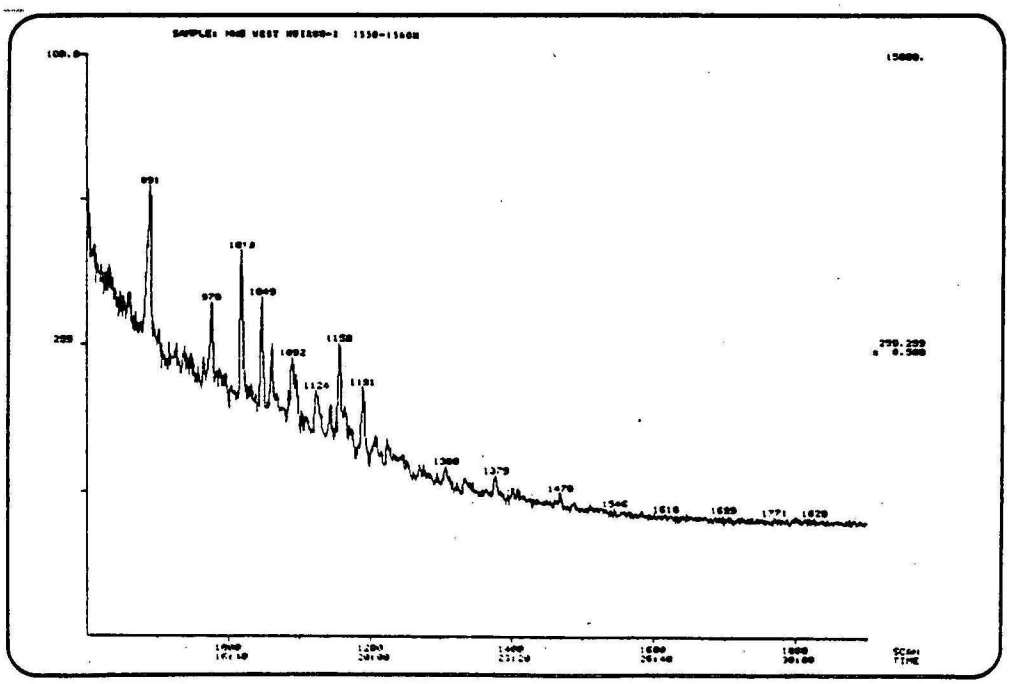
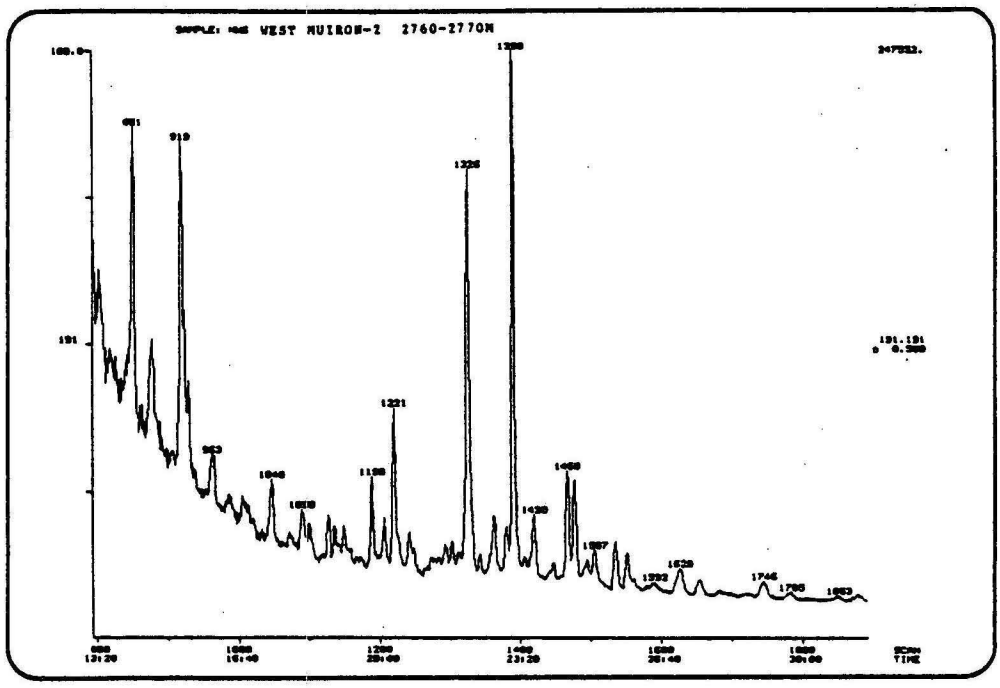
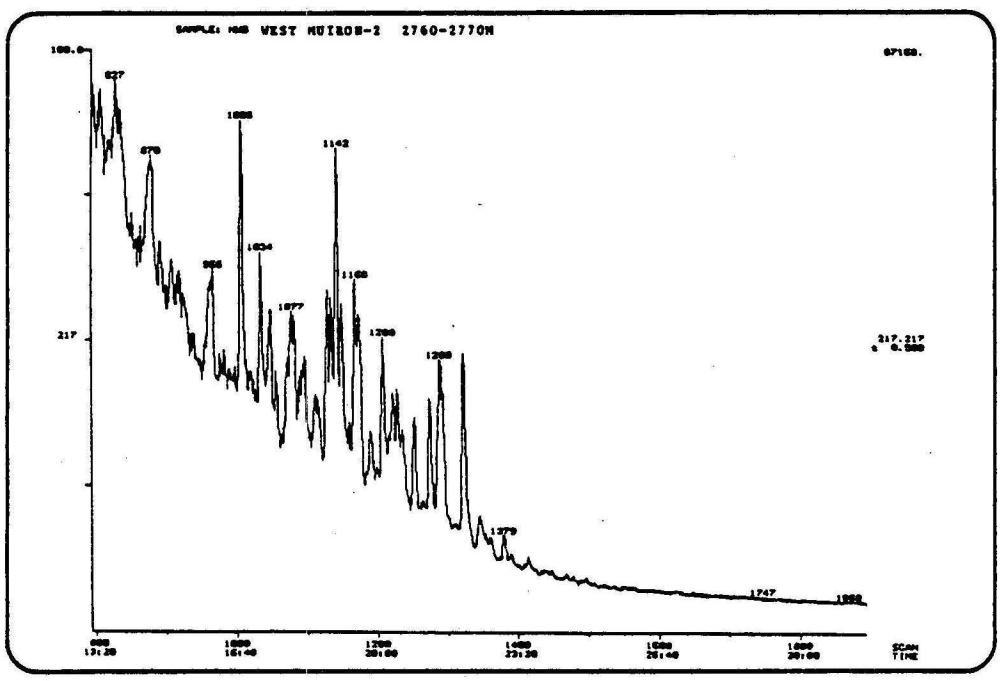


Figure III. 3.20



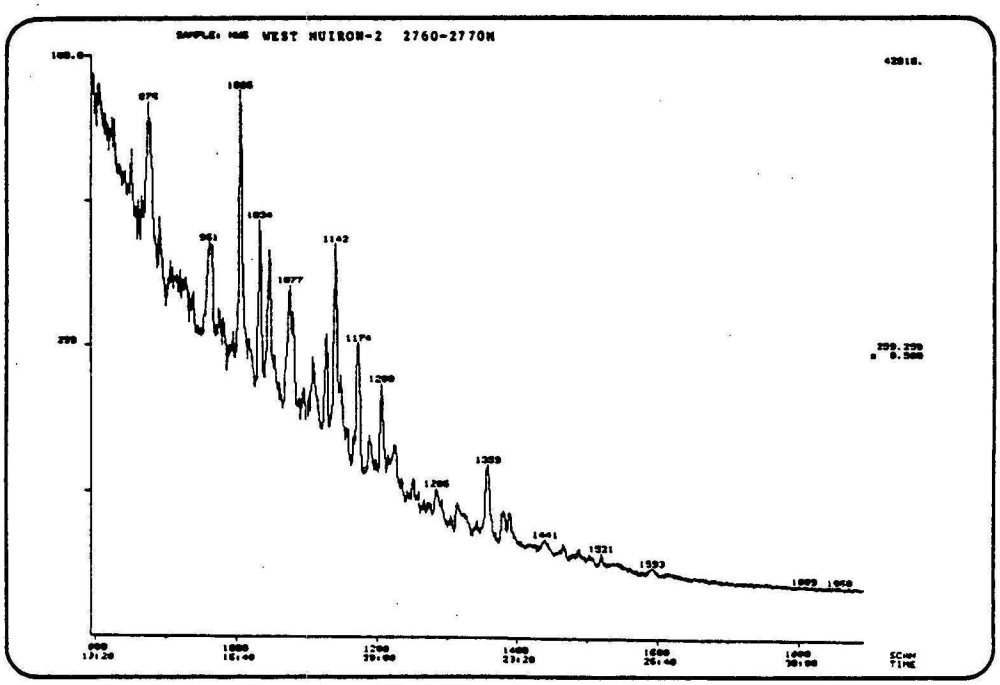
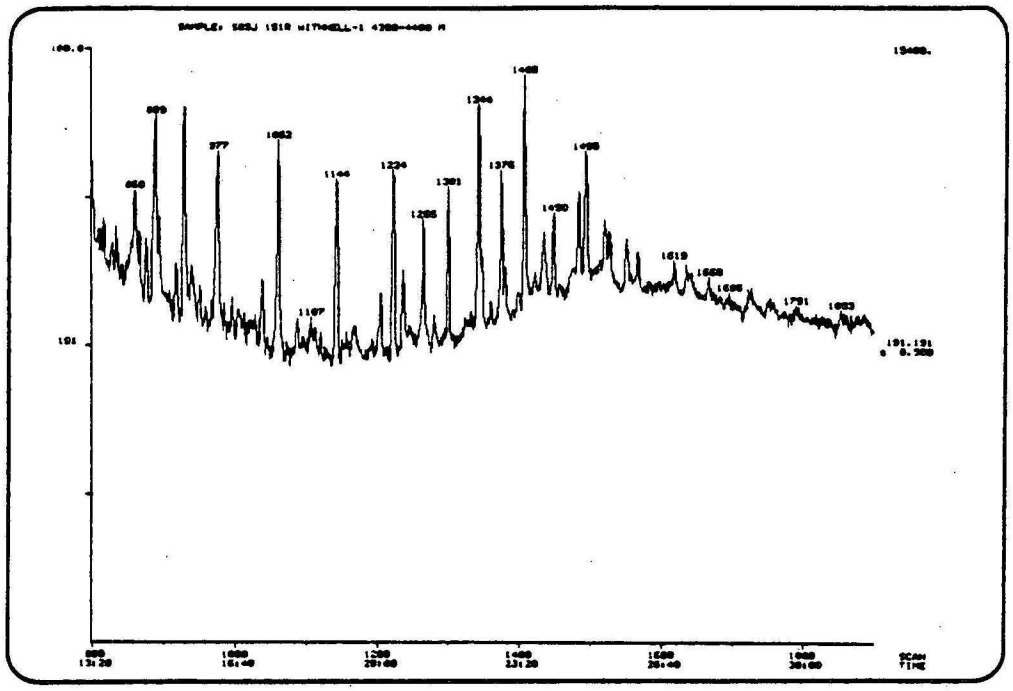
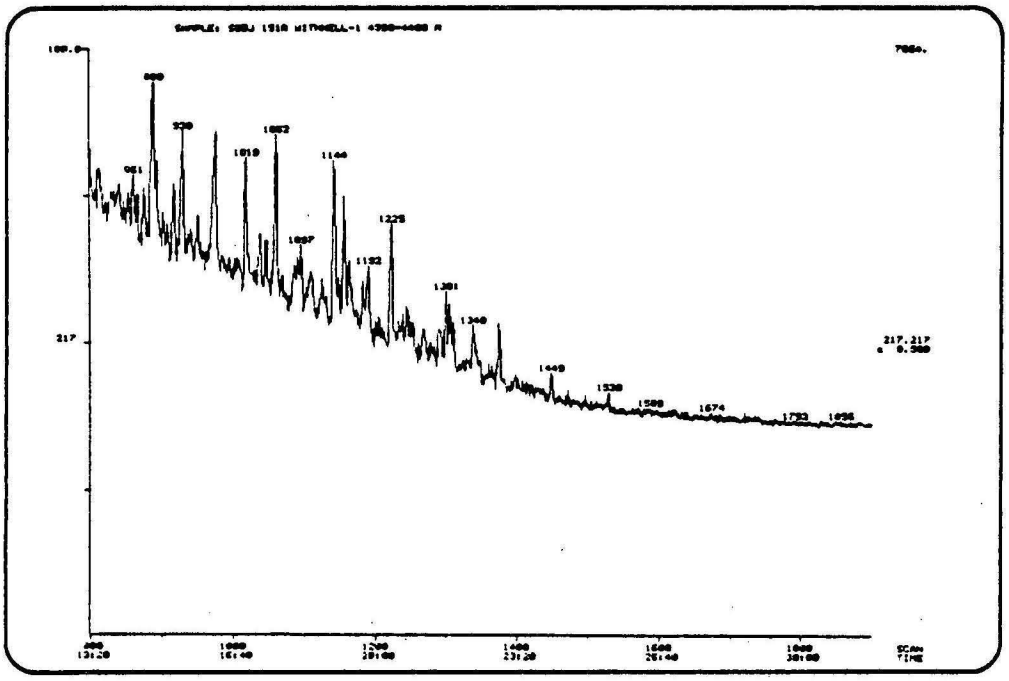




Figure III. 3.21





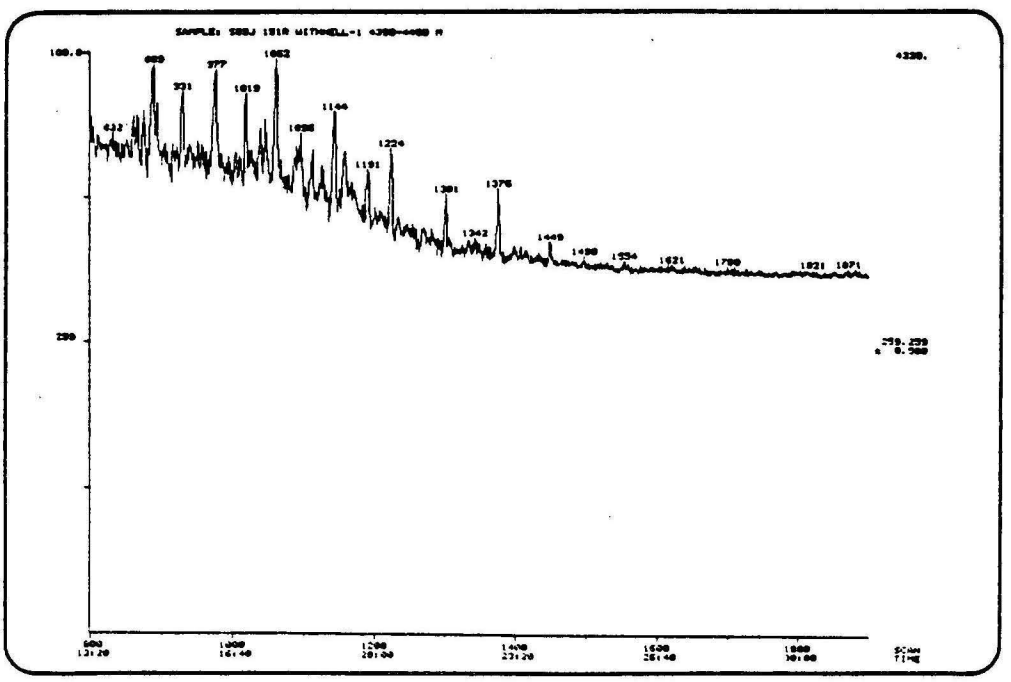


Figure III. 3.22

# SECTION IV

# GAS CHROMATOGRAPHY-MASS SPECTROMETRY AND CARBON ISOTOPE DATA FOR SOURCE ROCKS FROM THE NORTHERN CARNARVON BASIN

TABLE IV.1a

| WELL | DEPTH (Metres) | FORMATION | HI | SCI | KEROGEN COMPOSITION | | | | EXTRACTION DATA | | | | | | GAS CHROMATOGRAPHY DATA | | | | GAS CHROMATOGRAPHY - MASS SPECTROMETRY RATIOS | | | | | | | | | | CARBON ISOTOPE DATA ($\delta^{13}C$ $^0/_{00}$ PDB STANDARD) | | CV VALUE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | V | I | W | S | EOM ppm | EOM mg/g | HC ppm | HC mg/g | %SATS | %AROMS | Pr/ Ph | Pr/ n-$C_{17}$ | Ph/ n-$C_{18}$ | CPI | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | SATURATES | AROMATICS | |
| Anchor-1 | 2686-2701 | Middle Dingo Claystone | 103 | 7.5 | 55 | 40 | 5 | | 810 | 34 | 495 | 21 | 45 | 16 | 2.34 | 0.45 | 0.19 | 1.15 | 1.20 | 0.15 | 0.13 | 1.52 | 2.73 | 0.47 | 40 | 27 | 19 | 54 | -27.80 | -26.83 | -0.96 |
| Angel-2 | 3204-3220 | Learmonth Fm | 324 | 5.0 | 15 | 40 | 20 | 25 | 2650 | 71 | 1970 | 53 | 58 | 16 | 2.70 | 0.97 | 0.27 | 1.37 | 0.24 | 0.23 | 0.21 | 1.76 | 1.84 | 0.60 | 39 | 10 | 18 | 72 | -26.80 | -26.28 | -6.63 |
| | 4360-4375 | Lower Dingo Claystone | 228 | 6.25 | 50 | 20 | 30 | | 1350 | 52 | 760 | 29 | 39 | 18 | 3.09 | 0.85 | 0.22 | 1.19 | 0.62 | 0.07 | 0.16 | 1.27 | 2.65 | 0.55 | 45 | 19 | 28 | 53 | -26.32 | -25.49 | -1.65 |
| Bowers-1 | 2790-2805 | Nuderong shale | 137 | 7.5 | 65 | 20 | 15 | | 1775 | 54 | 1090 | 33 | 46 | 16 | 2.57 | 1.38 | 0.45 | 1.15 | 0.46 | 0.12 | 0.20 | 1.70 | 4.23 | 0.28 | 39 | 40 | 21 | 39 | -27.53 | -26.87 | -1.65 |
| | 3825-3840 | Middle Dingo Claystone | 33 | 8.75 | ? | ? | ? | | 905 | 36 | 595 | 24 | 57 | 9 | 2.01 | 0.77 | 0.35 | 1.14 | 0.57 | 0.06 | 0.04 | 1.05 | 1.88 | 0.40 | 51 | 30 | 19 | 51 | -28.16 | -26.59 | 0.56 |
| | 3970-3985 | Mungaroo Fm | 62(mdst) 88(coal) | 8.75 | ? | ? | ? | | 695 | 43 | 380 | 24 | 63 | 12 | 1.95 | 1.58 | 0.59 | 1.12 | 0.96 | 0.06 | 0.08 | 1.40 | 1.50 | 0.79 | 38 | 34 | 22 | 44 | -27.02 | -26.49 | -2.10 |
| Brigadier-1 | 3465-3475 | Middle Dingo Claystone | 183 | 5.25 | 45 | 40 | 15 | | 755 | 42 | 280 | 16 | 21 | 16 | 2.74 | 1.14 | 0.52 | 1.14 | 0.08 | 0.54 | 0.23 | 1.58 | 4.80 | 0.92 | 32 | 19 | 19 | 62 | -27.83 | -27.08 | -1.16 |
| | 3905-3925 | Brigadier Beds | 192 | 5.75 | 35 | 45 | 20 | | 805 | 42 | 240 | 12 | 15 | 15 | 2.37 | 0.89 | 0.42 | 1.30 | 0.19 | 0.31 | 0.26 | 1.52 | 2.85 | 0.72 | 25 | 17 | 15 | 68 | -27.58 | -26.69 | -1.12 |
| | 4155-4165 | Mungaroo Fm | 119 | 6.0 | 35 | 55 | 10 | | 1435 | 31 | 550 | 12 | 11 | 27 | 5.13 | 1.13 | 0.50 | 1.21 | 0.01 | 0.28 | 0.22 | 1.78 | 9.13 | 1.22 | 31 | 2 | 18 | 80 | -30.22 | -27.42 | 3.93 |
| Depuch-1 | 3230-3235 | Learmonth Fm | 389 | 5.25 | 10 | 30 | 45 | 15 | 10000 | 78 | 380 | 3 | 19 | 19 | 3.28 | 1.34 | 0.31 | 1.28 | 0.05 | 0.13 | 0.40 | 1.43 | 2.78 | 0.80 | 39 | 15 | 19 | 66 | -26.96 | -25.65 | -0.38 |
| | 4180-4190 (mdst) | Middle Dingo Claystone | 332 | 6.25 | 20 | 30 | 50 | | 3660 | 70 | 1210 | 23 | 26 | 8 | 2.85 | 1.02 | 0.31 | 1.11 | 0.17 | 0.09 | 0.30 | 1.00 | 4.37 | 0.55 | 39 | 23 | 19 | 58 | -27.91 | -26.19 | 0.82 |
| | 4180-4190 (coal) | Middle Dingo Claystone | 257 | 6.25 | 20 | 35 | 45 | | 28500 | 53 | 11830 | 22 | 13 | 28 | 4.48 | 0.96 | 0.18 | 1.11 | 0.07 | 0.07 | 0.34 | 1.32 | 7.50 | 0.40 | 46 | 23 | 17 | 60 | -26.63 | -25.33 | -0.51 |
| Flag-1 | 2317-2332 | Barrow Gp | 130 | 4.75 | 25 | 60 | 10 | 5 | 1455 | 18 | 400 | 5 | 22 | 5 | 1.12 | 0.45 | 0.40 | 1.19 | 0.63 | 0.14 | 0.16 | 1.53 | 2.05 | 0.51 | 30.5 | 31 | 22 | 47 | -27.23 | -26.52 | -1.63 |
| Flinders Shoal-1 | 3305-3323 | Byro Gp? | 56 | 7.5-8.0 | ? | ? | ? | | 2930 | 85 | 890 | 26 | 27 | 3 | 0.95 | 0.36 | 0.33 | 1.22 | 0.83 | 0.12 | 0.14 | 1.53 | 1.15 | 0.51 | 40 | 33 | 22 | 45 | -22.51 | -27.45 | -2.99 |
| | 3372-3387 | Byro Gp? | 162 | 8.0 | ? | ? | ? | ? | 4445 | 157 | 660 | 23 | 13 | 2 | 0.76 | 0.36 | 0.68 | 1.12 | 0.95 | 0.09 | 0.11 | 1.56 | 2.89 | 0.50 | 41 | 32 | 22 | 46 | -28.18 | -30.66 | -8.42 |
| Koolinda-1 | 2530-2540 | Upper Dingo Clay-stone | 119 | 7.5 | 25 | 55 | 20 | | 1650 | 94 | 1240 | 71 | 49 | 26 | 1.96 | 0.46 | 0.20 | 1.07 | 2.98 | 0.28 | 0.13 | 1.46 | 1.69 | 0.71 | 40 | 21 | 13 | 66 | -27.47 | -26.40 | -0.76 |
| Lambert-1 | 3685-3695 | Lower Dingo Claystone | 226 | 5.75 | 40 | 30 | 30 | | 1020 | 81 | 460 | 37 | 32 | 13 | 1.99 | 0.93 | 0.39 | 1.20 | 0.18 | 0.24 | 0.25 | 1.60 | 6.05 | 0.73 | 62 | 25 | 21 | 54 | -27.15 | -26.85 | -2.57 |
| Lowendal-1 | 3280-3295 | Mungaroo Fm | 106 | 6.0 | 30 | 60 | 10 | | 705 | 20 | 370 | 11 | 18 | 34 | 3.48 | 1.66 | 0.49 | 1.52 | 0.08 | 0.33 | 0.20 | 1.66 | 6.25 | 1.00 | 32 | 17 | 21 | 62 | -28.80 | -28.29 | -1.59 |
| Picard-1 | 2588-2601 | Learmonth Fm | 172 | 4.75 | 20 | 60 | 20 | | 1420 | 56 | 860 | 34 | 47 | 14 | 1.42 | 0.58 | 0.40 | 1.19 | 0.05 | 0.19 | 0.28 | 1.61 | 6.26 | 0.78 | 36 | 19 | 16 | 65 | -27.36 | -25.89 | 0.09 |
| | 2930-2942 | Learmonth Fm | 12(mdst med gy) | 5.0 | 15 | 85 | | | 1430 | 55 | 665 | 26 | 32 | 14 | 2.08 | 0.70 | 0.31 | 1.42 | 0.04 | 0.29 | 0.33 | 1.73 | 4.37 | 0.89 | 38.5 | 32 | 14 | 54 | -26.96 | -24.01 | 3.26 |
| | | | 163(mdst med-dk gy) | | 20 | 60 | 15 | 5 | | | | | | | | | | | | | | | | | | | | | | | |
| Spar-1 | 2655-2665 | Barrow Gp | 105 | 5.25 | 50 | 45 | 5 | | 1255 | 98 | 545 | 43 | 36 | 8 | 2.04 | 0.80 | 0.40 | 1.23 | 1.00 | 0.17 | 0.19 | 1.46 | 1.19 | 0.70 | 42 | 33 | 19 | 48 | -27.49 | -24.65 | 3.18 |
| Tryal Rocks-1 | 2588-2604 | Nuderong Shale | 215 | 6.25 | 50 | 25 | 25 | | 1570 | 68 | 730 | 32 | 40 | 7 | 1.27 | 0.71 | 0.54 | 1.01 | 0.83 | 0.22 | 0.24 | 1.45 | 2.16 | 1.68 | 34 | 26 | 41 | 33 | -28.42 | -28.39 | -2.75 |

TABLE IV.1a : SOURCE ROCK, EXTRACTION, GAS AND LIQUID CHROMATOGRAPHY, GAS CHROMATOGRAPHY-MASS SPECTROMETRY AND CARBON ISOTOPE DATA FOR SELECTED SAMPLES FROM SOURCE ROCK INTERVALS IN THE NORTHERN CARNARVON BASIN

TABLE IV.1b

| WELL | DEPTH (Metres) | FORMATION | HI | SCI | KEROGEN COMPOSITION | | | | EXTRACTION DATA | | | | | | GAS CHROMATOGRAPHY DATA | | | | GAS CHROMATOGRAPHY - MASS SPECTROMETRY RATIOS | | | | | | | | | | CARBON ISOTOPE DATA ($\delta^{13}C$ $^{0}/_{00}$ PDB STANDARD) | | CV VALUE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | V | I | W | S | EOM ppm | EOM mg/g | HC ppm | HC mg/g | %SATS | %AROMS | Pr/ Ph | Pr/ n-$C_{17}$ | Ph/ n-$C_{18}$ | CPI | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | SATURATES | AROMATICS | |
| West Tryal Rocks-1 | 3341-3354 | Hungaroo Fm | 172 | 5.5 | 45 | 40 | 10 | 5 | 1780 | 81 | 715 | 33 | 36 | 6 | 1.69 | 0.56 | 0.36 | 1.20 | 0.22 | 0.40 | 0.40 | 0.95 | 2.50 | 0.49 | 29 | 36 | 22 | 42 | -28.55 | -27.65 | -0.80 |
| | 3463-3476 | Hungaroo Fm | 251 | 5.75 | 20 | 45 | 35 | | 1940 | 60 | 1305 | 40 | 48 | 19 | 1.67 | 0.73 | 0.37 | 1.03 | 0.04 | 0.07 | 0.14 | 1.58 | 10.80 | 0.59 | 39 | 23 | 16 | 63 | -28.68 | -26.97 | 1.04 |
| | 3787-3799 | Hungaroo Fm | 141(mdst) 186(coal) | 6.0 | 50 20 | 40 50 | 10 30 | | )2040 ) | 49 | 1460 | 35 | 53 | 19 | 1.52 | 0.50 | 0.32 | 1.03 | 0.12 | 0.10 | 0.16 | 1.36 | 2.80 | 0.55 | 41 | 29 | 21 | 50 | -28.55 | -27.05 | 0.53 |
| | 3832-3845 | Hungaroo Fm | 117(mdst dk gy) 150(mdst gy blk) | 6.25 | 50 25 | 40 60 | 10 15 | | ) )22410 ) ) | 105 | 1950 | 9 | 6 | 3 | 2.48 | 0.86 | 0.26 | 1.06 | 0.09 | 0.10 | 0.27 | 1.24 | 2.73 | 0.54 | 43 | 18 | 17 | 65 | -28.60 | -27.86 | -1.14 |
| West Barrow -2 | 2461-2476 | Muderong Shale | 207 | 5.75 | 55 | 25 | 15 | 5 | 1505 | 67 | 590 | 26 | 27 | 11 | 1.02 | 1.13 | 1.12 | 1.17 | 0.48 | 0.16 | 0.24 | 1.54 | 2.36 | 0.60 | 40 | 31 | 28 | 41 | -29.06 | -28.47 | -1.33 |
| Withnell-1 | 2665-2670 | Barrow Gp | 225 | 5.5-6.0 | 30 | 50 | 20 | | 2965 | 84 | 1980 | 56 | 55 | 12 | 1.31 | 0.53 | 0.41 | 1.25 | 0.39 | 0.26 | 0.26 | 1.36 | 2.48 | 0.76 | 31 | 34 | 19 | 47 | -26.94 | -26.17 | -1.59 |
| | 3720-3730 | Upper Dingo Claystone | 260 | 6.5-7.0 | 30 | 20 | 50 | | 2185 | 143 | 1410 | 92 | 54 | 11 | 1.60 | 0.49 | 0.29 | 1.19 | 1.90 | 0.22 | 0.07 | 1.47 | 2.62 | 0.57 | 44 | 26 | 18 | 56 | -25.19 | -23.79 | -0.73 |
| Zeewulf-1 | 3315-3330 | Hungaroo Fm | No data | | NO DATA | | | | 1060 | 20 | 370 | 5 | 20 | 6 | 1.54 | 0.78 | 0.50 | 1.19 | 0.26 | 0.27 | 0.36 | 1.12 | 4.02 | 0.56 | 23 | 17 | 19 | 64 | -27.62 | -27.20 | -2.15 |

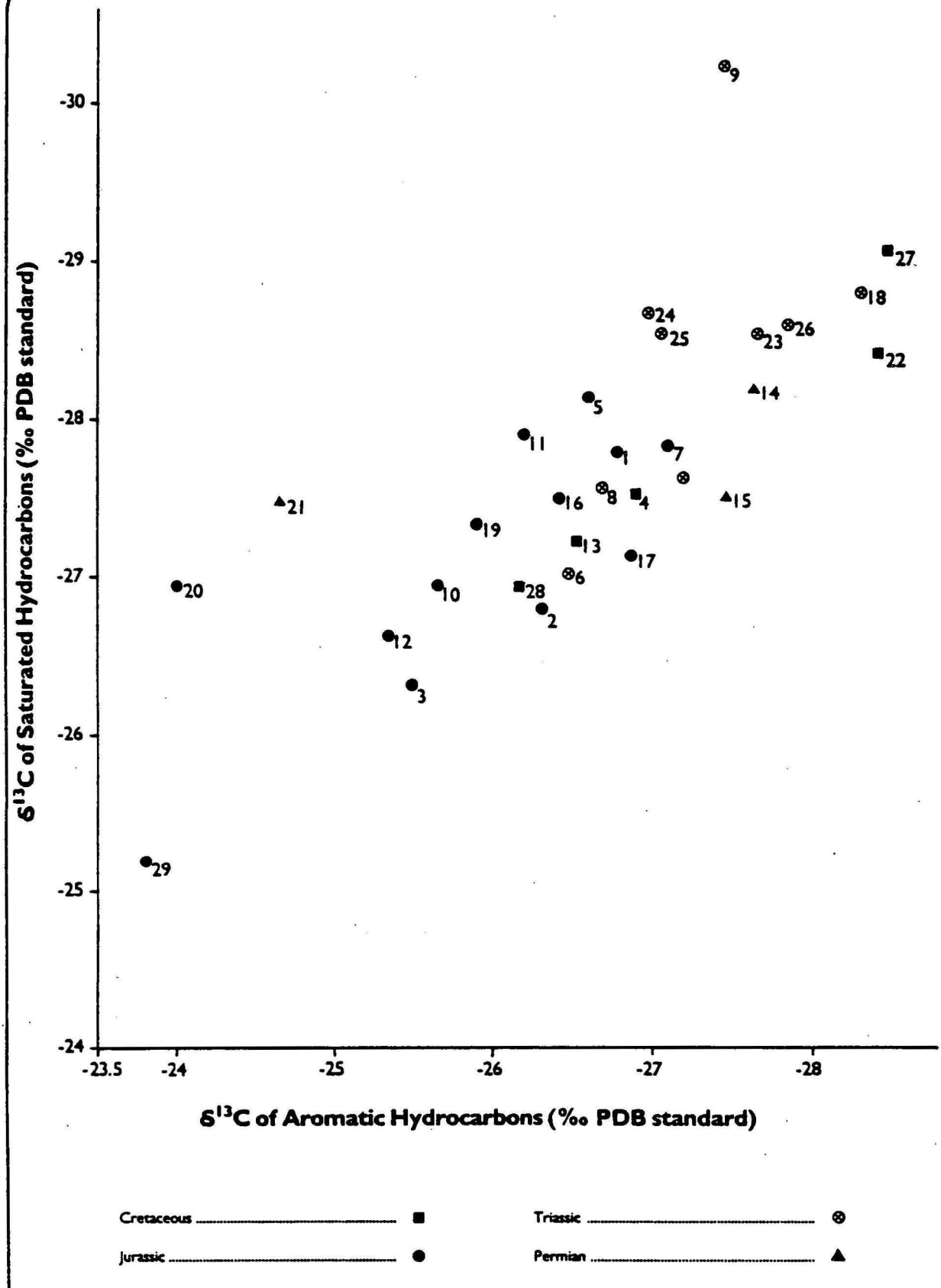
TABLE IV.1b : SOURCE ROCK, EXTRACTION, GAS AND LIQUID CHROMATOGRAPHY, GAS CHROMATOGRAPHY-MASS SPECTROMETRY AND CARBON ISOTOPE DATA FOR SELECTED SAMPLES FROM SOURCE ROCK INTERVALS IN THE NORTHERN CARNARVON BASIN

# NORTHERN CARNARVON BASIN

## KEY FOR FIGURES

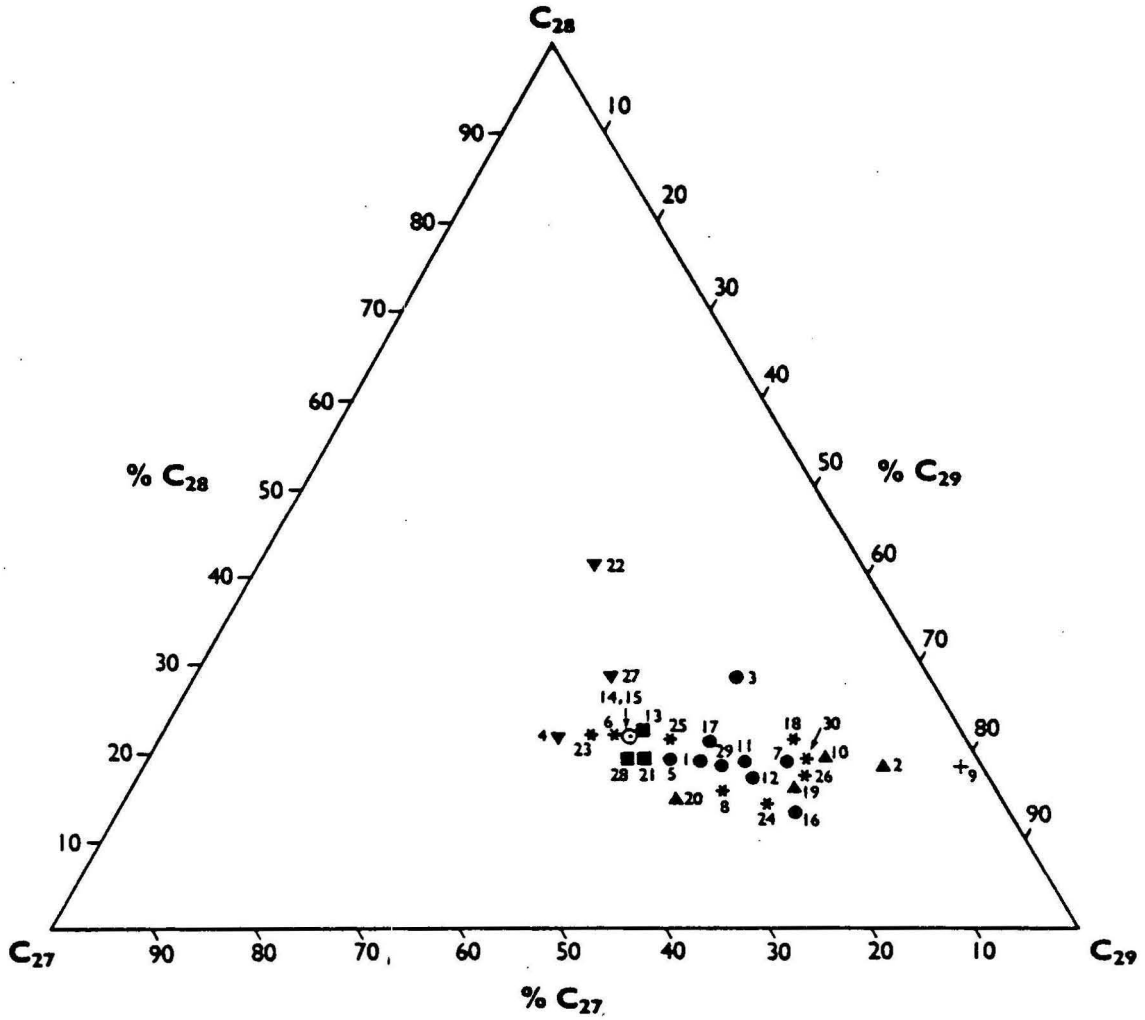
**SECTION IV** **SOURCE ROCK EXTRACTS** (Figures IV.1 and IV.2)

| | | | |
|---|---|---|---|
| 1 | = | Anchor-1 | (2686m-2701m) |
| 2 | = | Angel-2 | (3204m-3220m) |
| 3 | = | Angel-2 | (4360m-4375m) |
| 4 | = | Bowers-1 | (2790m-2805m) |
| 5 | = | Bowers-1 | (3825m-3840m) |
| 6 | = | Bowers-1 | (3970m-3985m) |
| 7 | = | Brigadier-1 | (3465m-3475m) |
| 8 | = | Brigadier-1 | (3905m-3925m) |
| 9 | = | Brigadier-1 | (4155m-4165m) |
| 10 | = | Depuch-1 | (3230m-3235m) |
| 11 | = | Depuch-1 | (4180m-4190m) |
| 12 | = | Depuch-1 | (4180m-4190m) |
| 13 | = | Flag-1 | (2317m-2332m) |
| 14 | = | Flinders Shoal-1 | (3305m-3323m) |
| 15 | = | Flinders Shoal-1 | (3372m-3377m) |
| 16 | = | Koolinda-1 | (2530m-2540m) |
| 17 | = | Lambert-1 | (3685m-3695m) |
| 18 | = | Lowendal-1 | (3280m-3295m) |
| 19 | = | Picard-1 | (2588m-2601m) |
| 20 | = | Picard-1 | (2930m-2942m) |
| 21 | = | Spar-1 | (2655m-2665m) |
| 22 | = | Tryal Rocks-1 | (2588m-2604m) |
| 23 | = | West Tryal Rocks-1 | (3341m-3354m) |
| 24 | = | West Tryal Rocks-1 | (3463m-3476m) |
| 25 | = | West Tryal Rocks-1 | (3787m-3799m) |
| 26 | = | West Tryal Rocks-1 | (3832m-3845m) |
| 27 | = | West Barrow-2 | (2461m-2476m) |
| 28 | = | Withnell-1 | (2665m-2670m) |
| 29 | = | Withnell-1 | (3720m-3730m) |
| 30 | = | Zeewulf-1 | (3315m-3330m) |




δ¹³ saturates against δ¹³ aromatics for source rock extracts from the Northern Carnarvon Basin

Figure IV.1




Muderong Shale ▼
Barrow Group ■
Dingo Claystone ○
Learmouth Formation ▲
Brigadier Beds ✱
Mungaroo Formation +
Byro Group ⊙

**Ternary diagram showing the relative percentage of $C_{27}$, $C_{28}$ and $C_{29}$, 5α(H), 14α (H), 17 α (H), 20R steranes in source rock extracts from the Northern Carnarvon Basin**

**Figure IV.2**

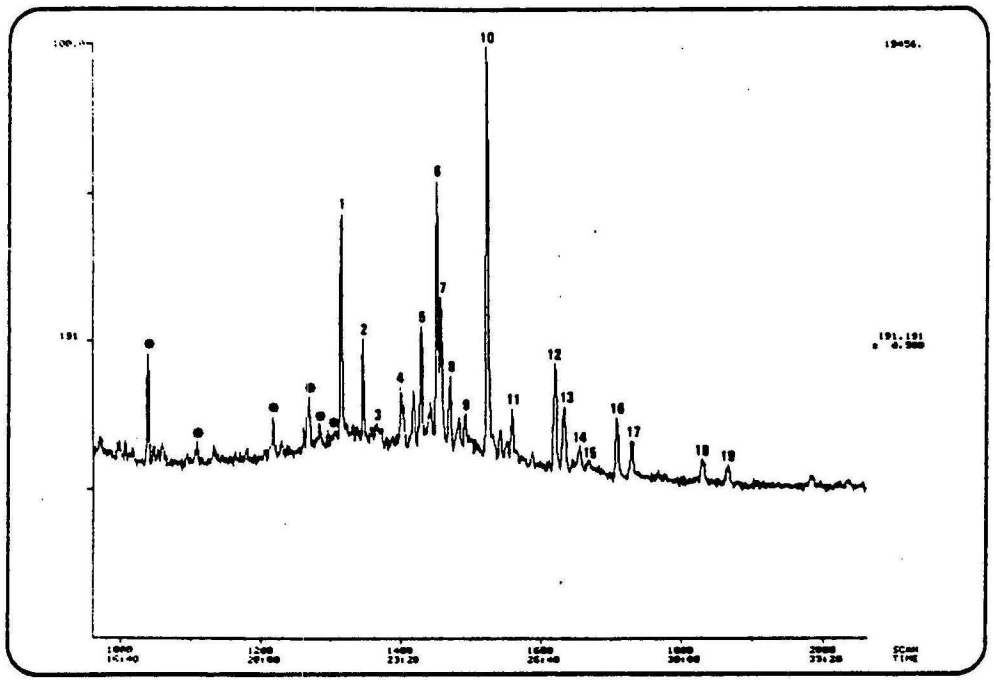
## PEAK IDENTIFICATION ON m/z 191 AND m/z 217 FRAGMENTOGRAMS PRESENTED IN VOLUME 2

### I. TRITERPANES (m/z 191)

| PEAK NO | COMPOUND NAME |
|---|---|
| * | Tricyclic Terpanes |
| 1 | 18α(H)-22,29,30-trisnorhopane (Ts) |
| 2 | 17α(H)-22,29,30-trisnorhopane (Tm) |
| 3 | 17α(H)-25,30-bisnorhopane (Demethylated hopane) |
| 4(W) | 17α(H)-29,30-bisnorhopane |
| 5 | 17α(H)-25-norhopane (Demethylated hopane) |
| 6 | 17α(H)-30-norhopane |
| 7,8 | unidentified $C_{30}$ triterpanes |
| 9 | 17β(H),21α(H)-normoretane |
| 10 | 17α(H)-hopane |
| 11 | 17β(H)-moretane |
| 12 | (22S)-17α(H)-homohopane |
| 13 | (22R)-17α(H)-homohopane |
| 14&15 | (22S and 22R)-17β(H)-homomoretane |
| 16&17 | (22S and 22R)-17α(H)-bishomohopane |
| 18&19 | (22S and 22RO-17α(H)-trishomohopane |
| 20(V) | unknown Terpane co-eluted with 17α(H)-trisnorhopane |

### II. STERANES (m/z 217)

| PEAK NO | COMPOUND NAME |
|---|---|
| a | 13βH, 17αH rearranged cholestane 20S ($C_{27}$) |
| b | 13βH, 17αH rearranged cholestane 20R ($C_{27}$) |
| c-f | 13βH, 17αH rearranged 24-methyl-cholestanes ($C_{28}$) |
| g | 5αH, 14αH, 17αH cholestane 20S ($C_{27}$) |
| h,j | 5αH, 14βH, 17βH isocholestane 20R and 20S ($C_{27}$) |
| i | 13βH, 17αH rearranged 24-ethyl-cholestane 20S ($C_{29}$) |
| k | 5αH, 14αH, 17αH cholestane 20R ($C_{27}$) |
| l | 13βH, 17αH rearranged 24-ethyl-cholestane 20R ($C_{29}$) |
| m | 5αH, 14αH, 17αH 24-methyl-cholestane 20S ($C_{28}$) |
| n,o | 5αH, 14βH, 17βH iso-24-methyl-cholestane 20R and 20S ($C_{28}$) |
| p | 5αH, 14αH, 17αH 24-methyl-cholestane 20R ($C_{28}$) |
| q | 5αH, 14αH, 17αH 24-ethyl-cholestane 20S ($C_{29}$) |
| r,s | 5αH, 14βH, 17βH iso-24-ethyl-cholestane 20R and 20S ($C_{29}$) |
| t | 5αH, 14αH, 17αH 24-ethyl-cholestane 20R ($C_{29}$) |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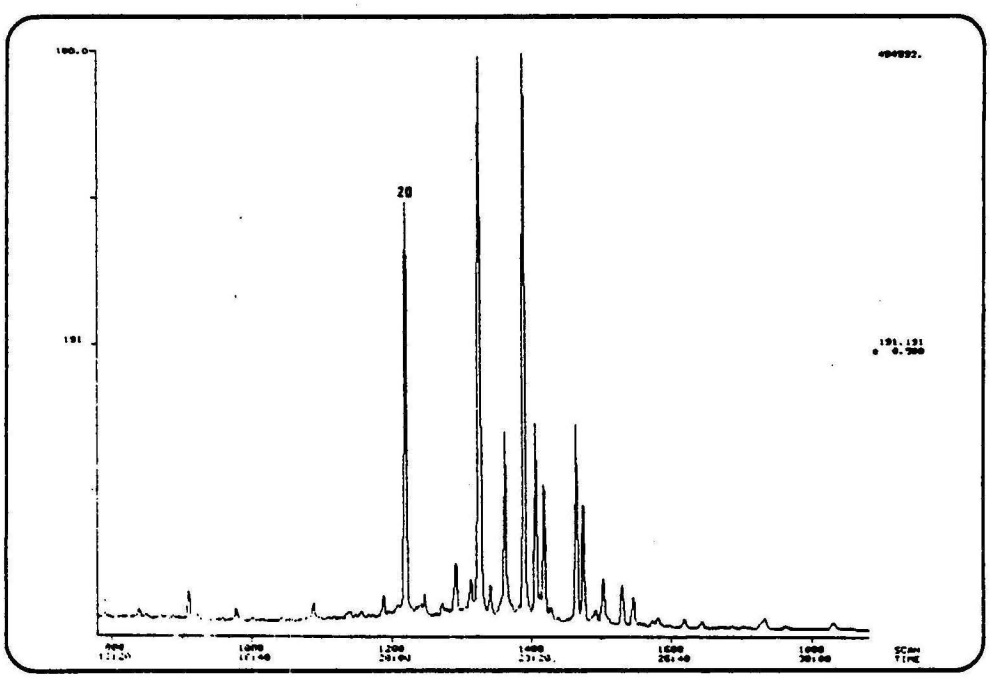
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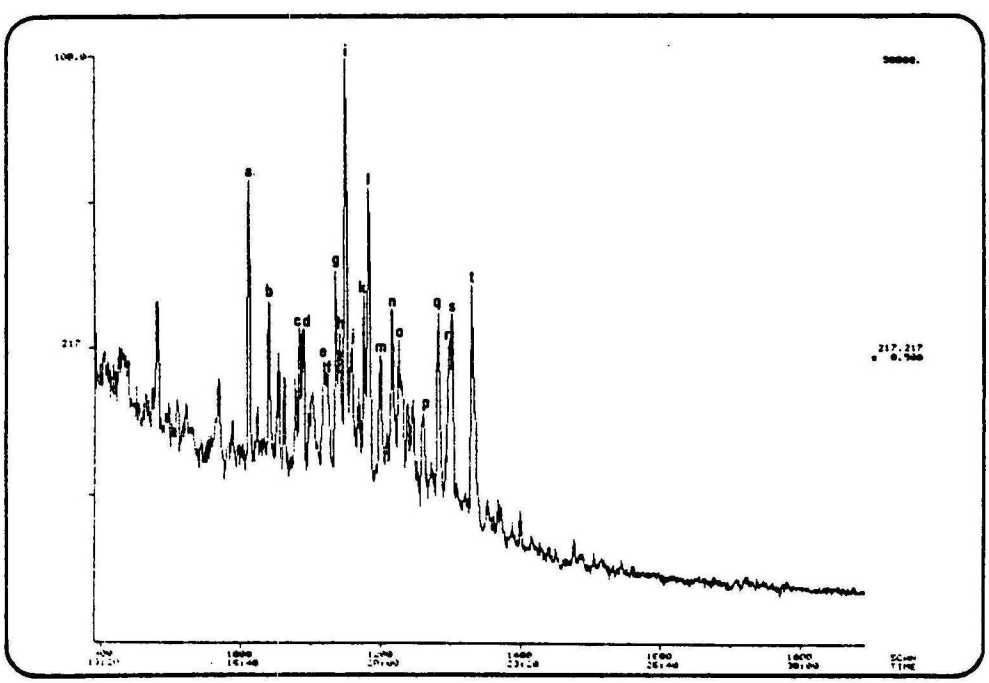
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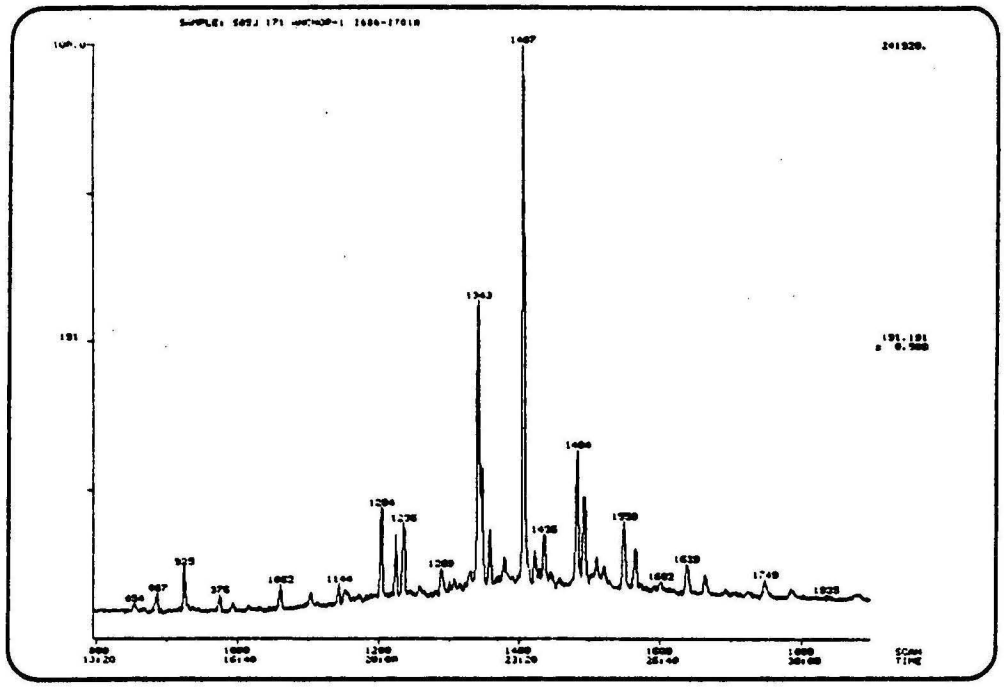
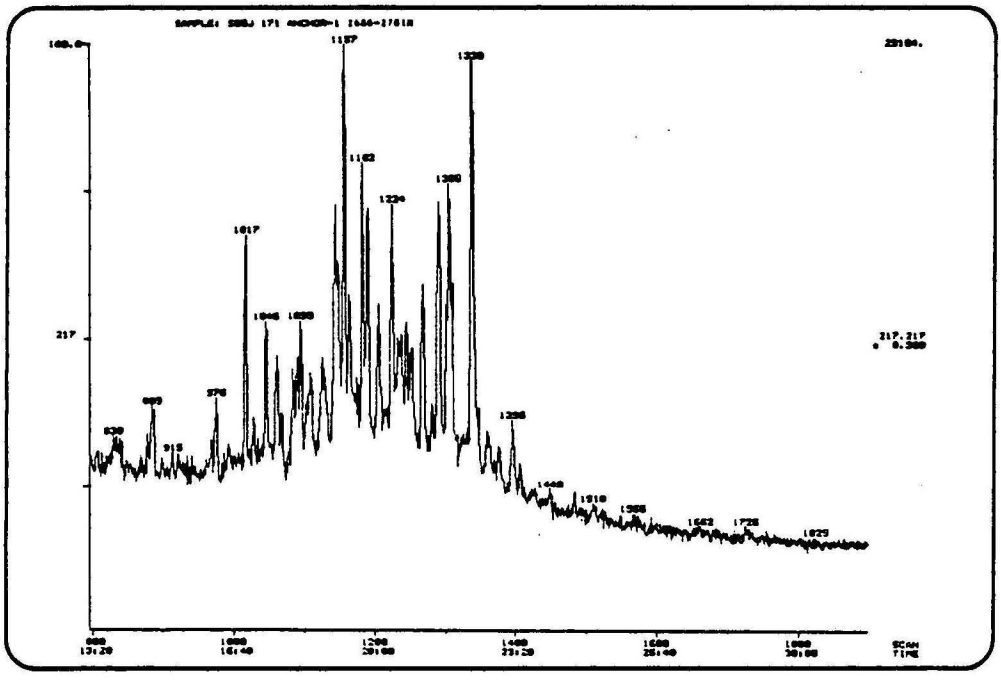




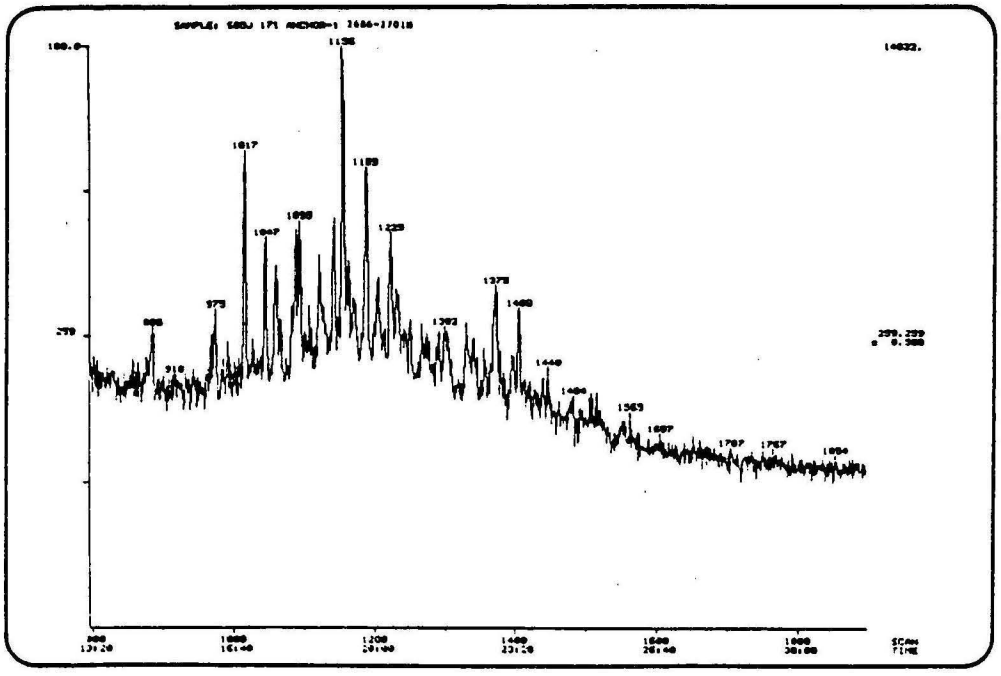
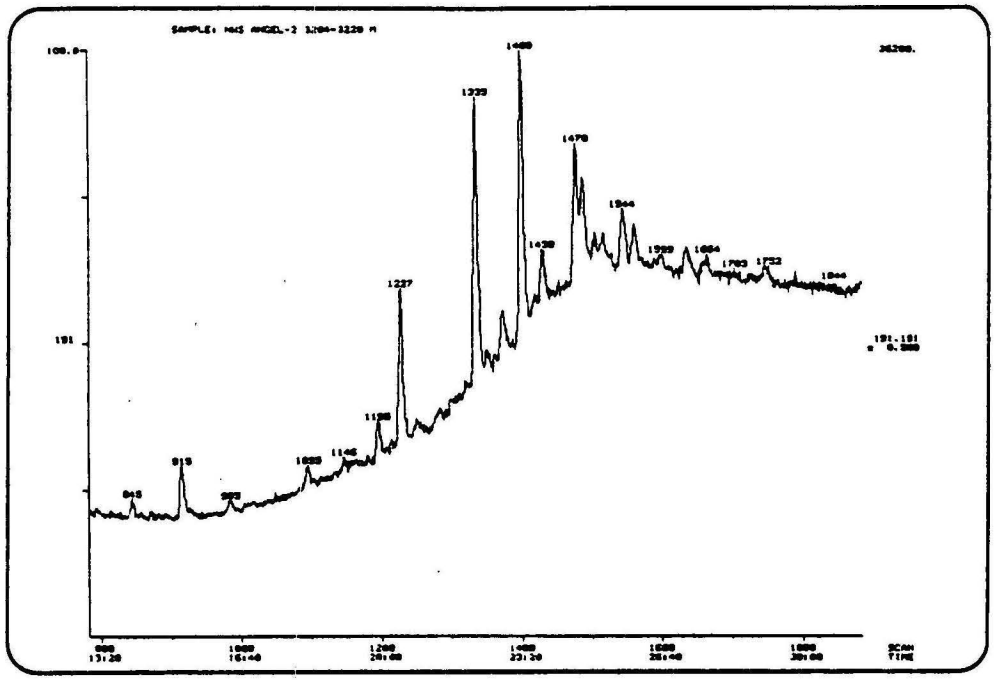
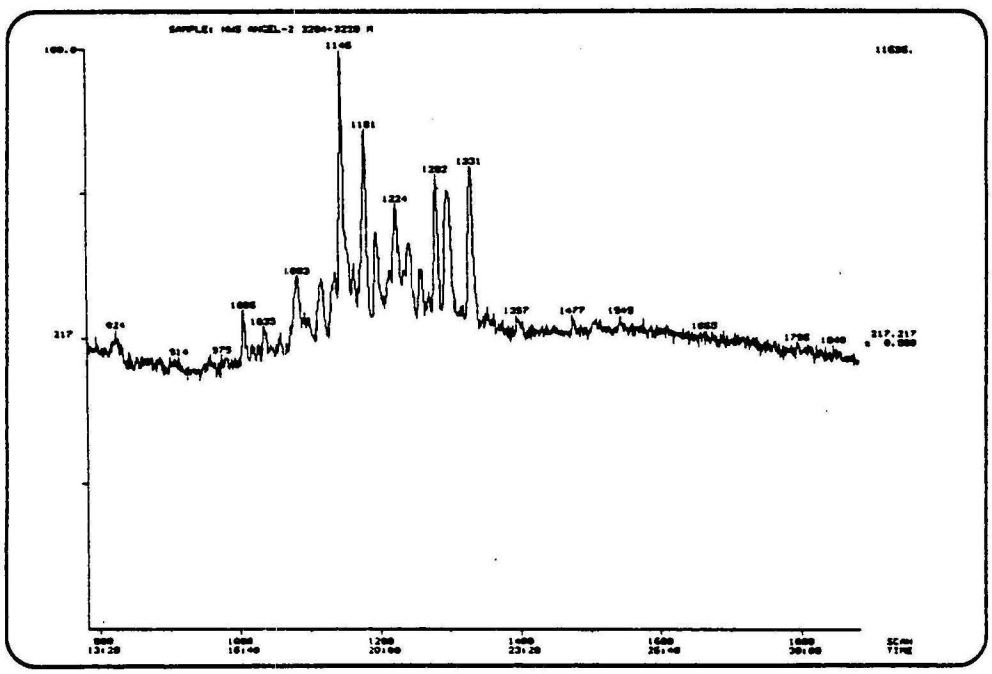
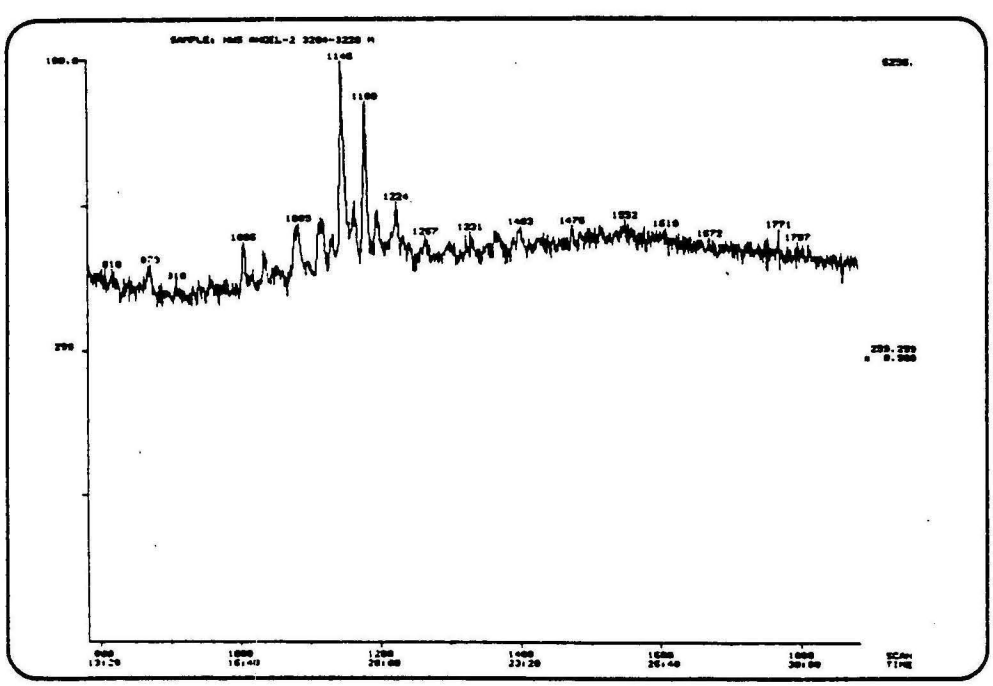


Figure IV. 3.1







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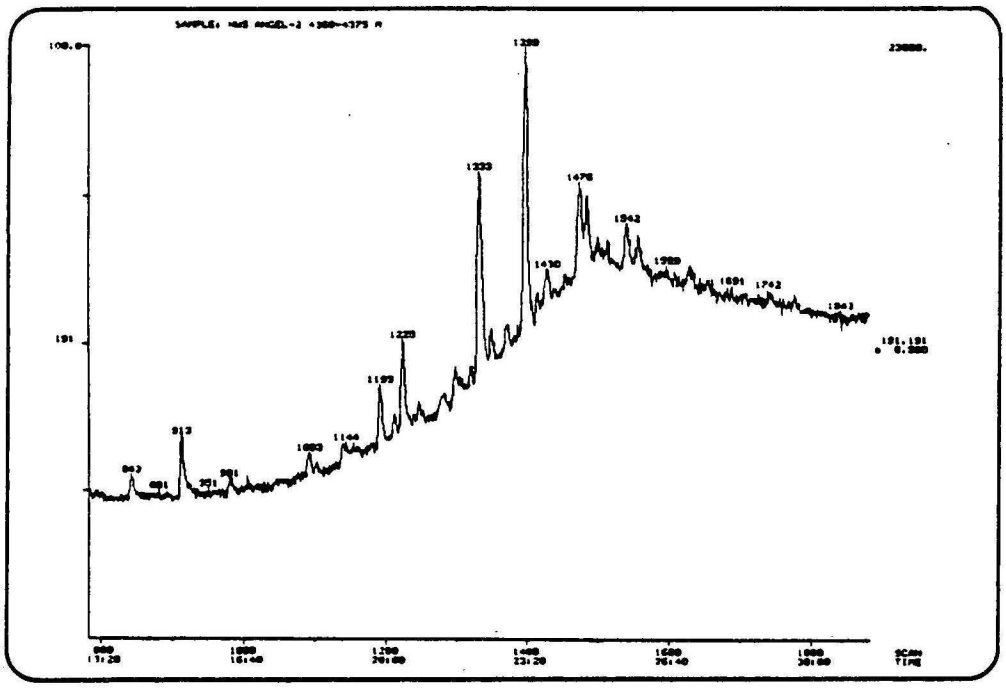

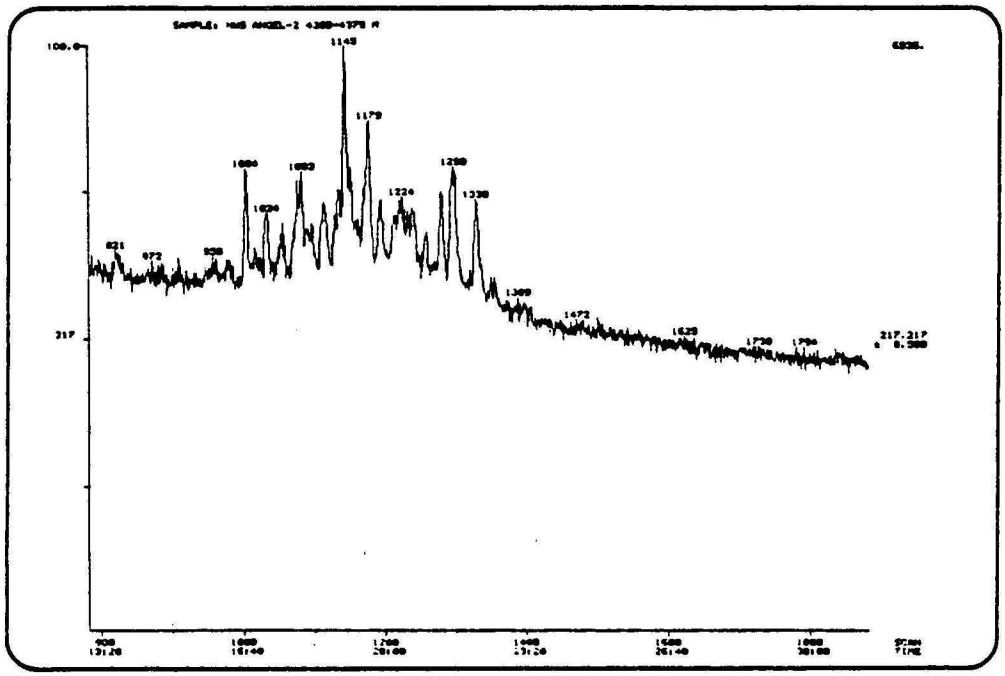

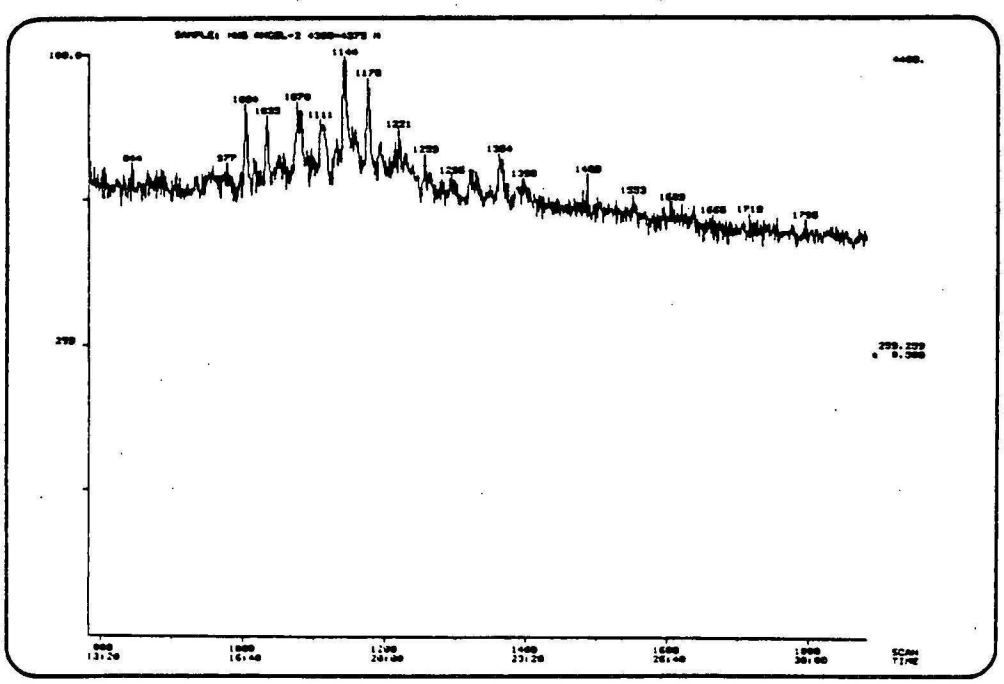

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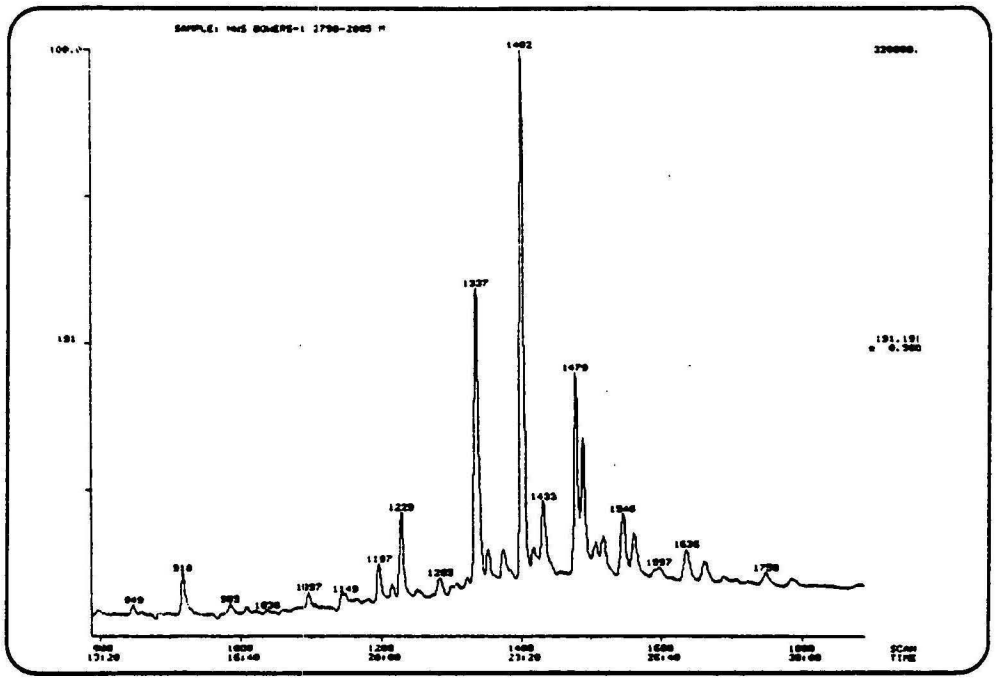

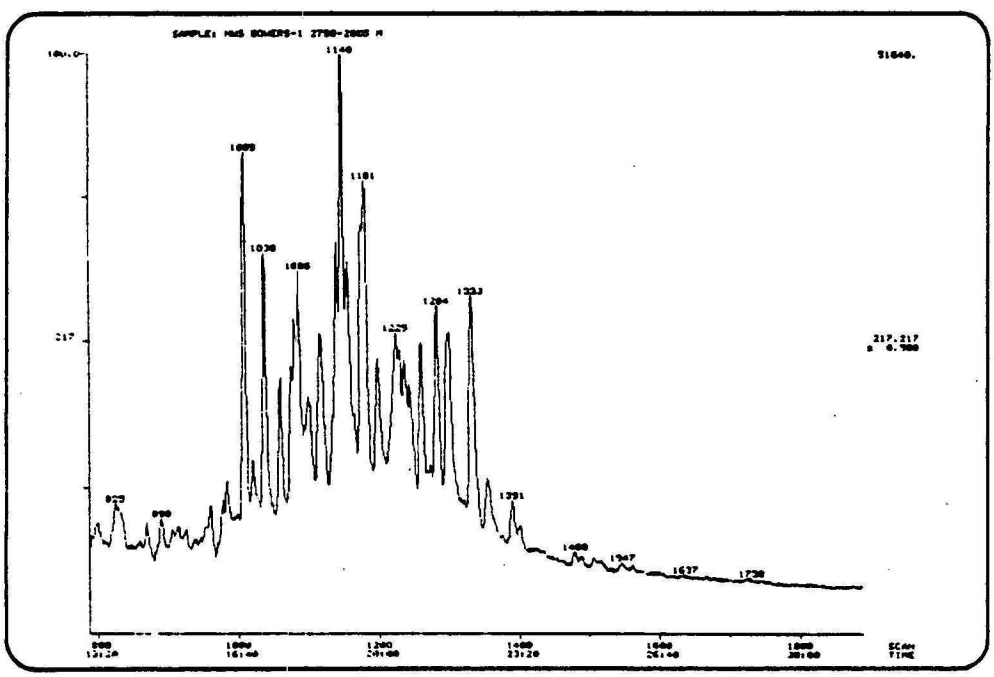

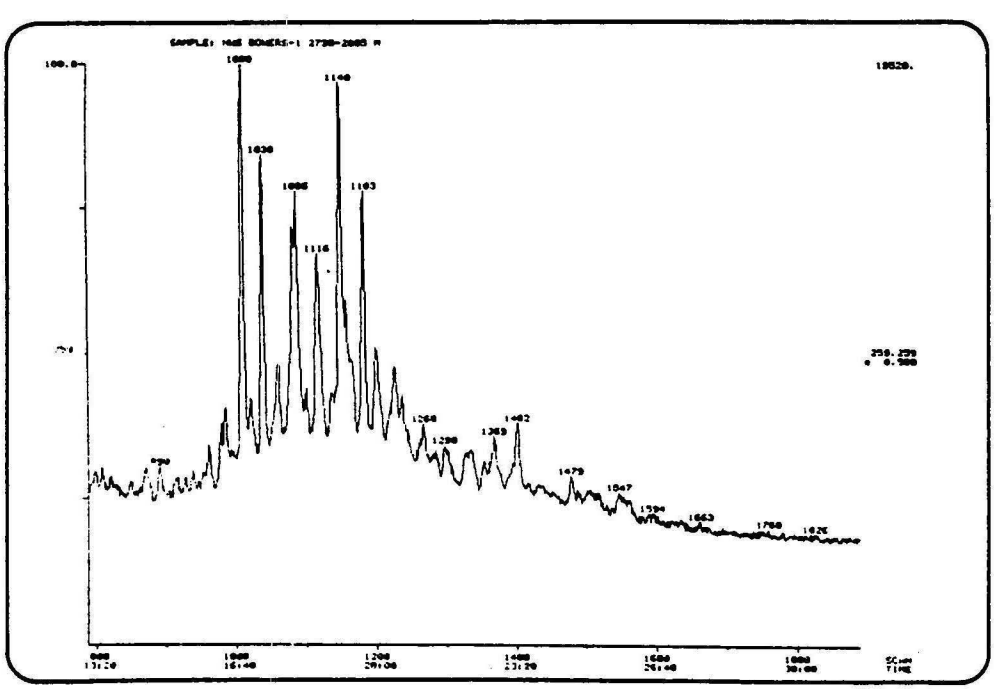

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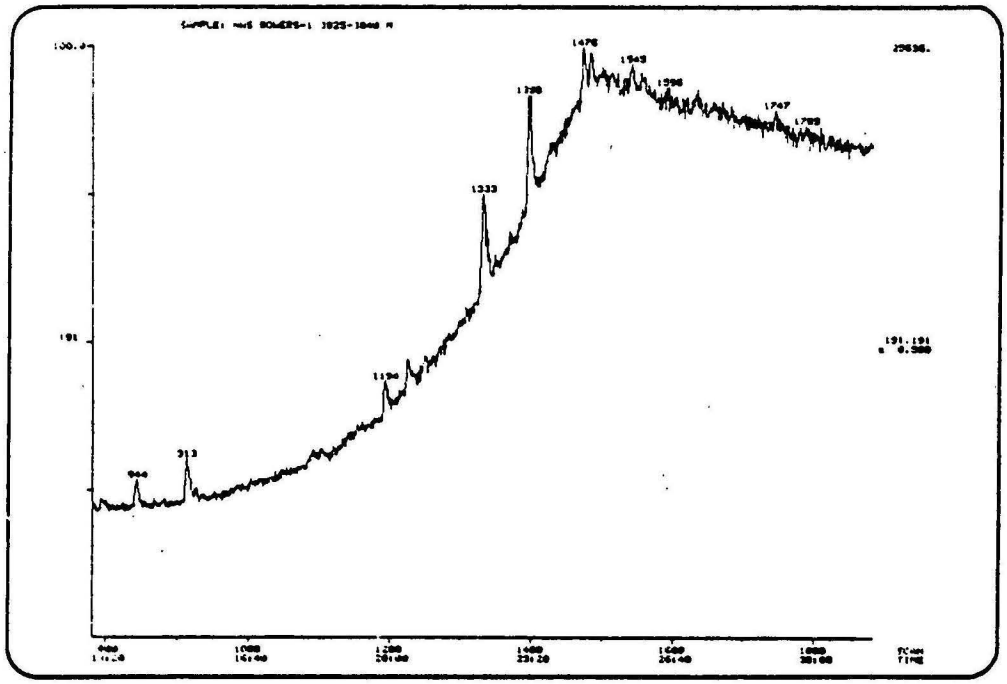

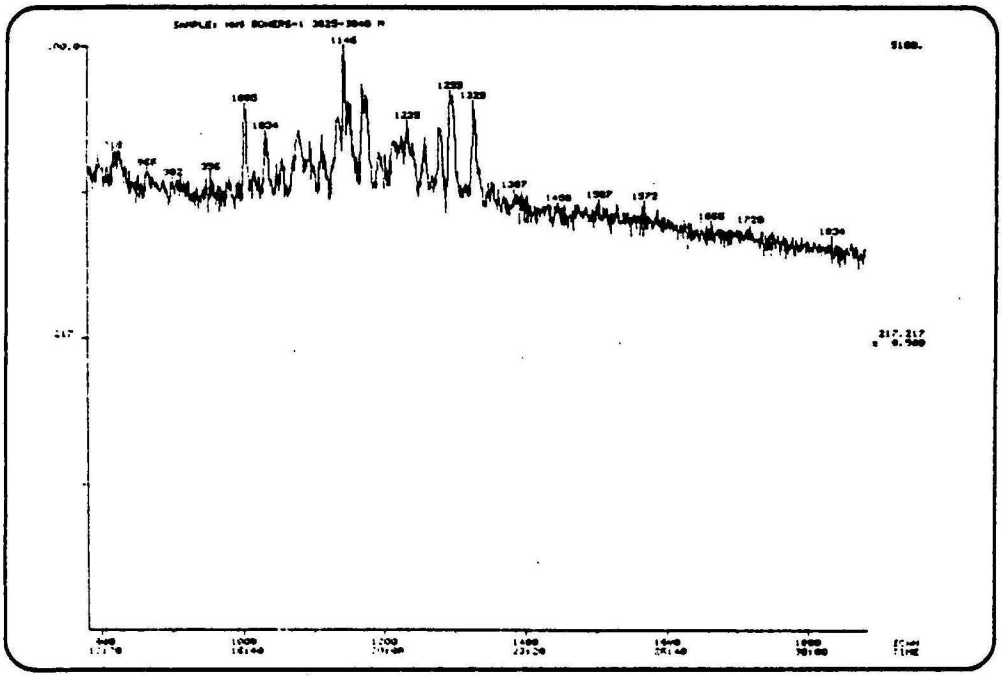

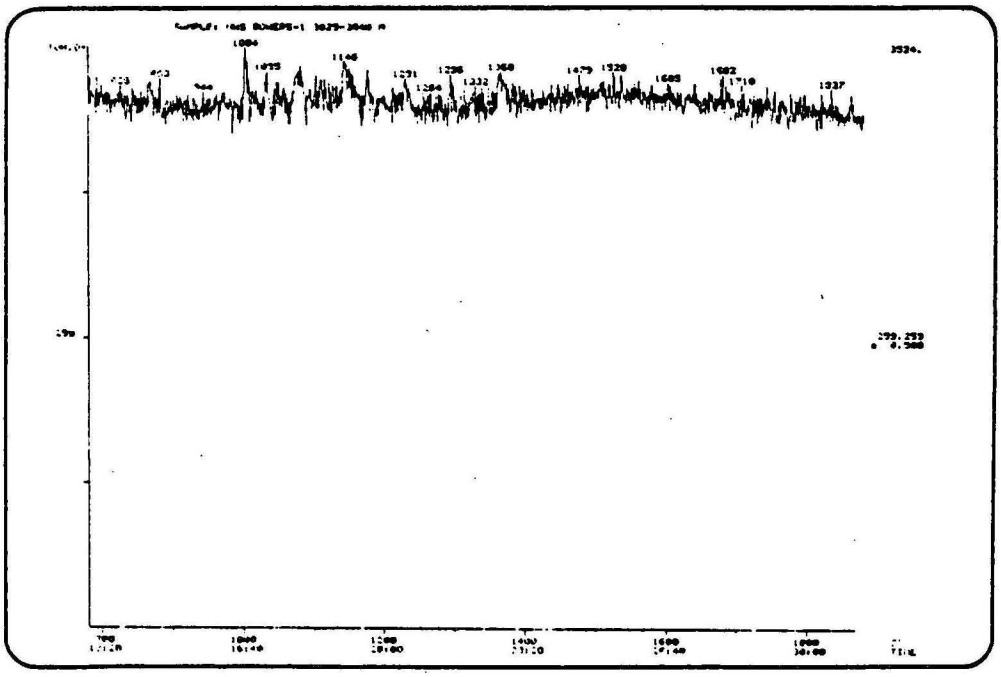

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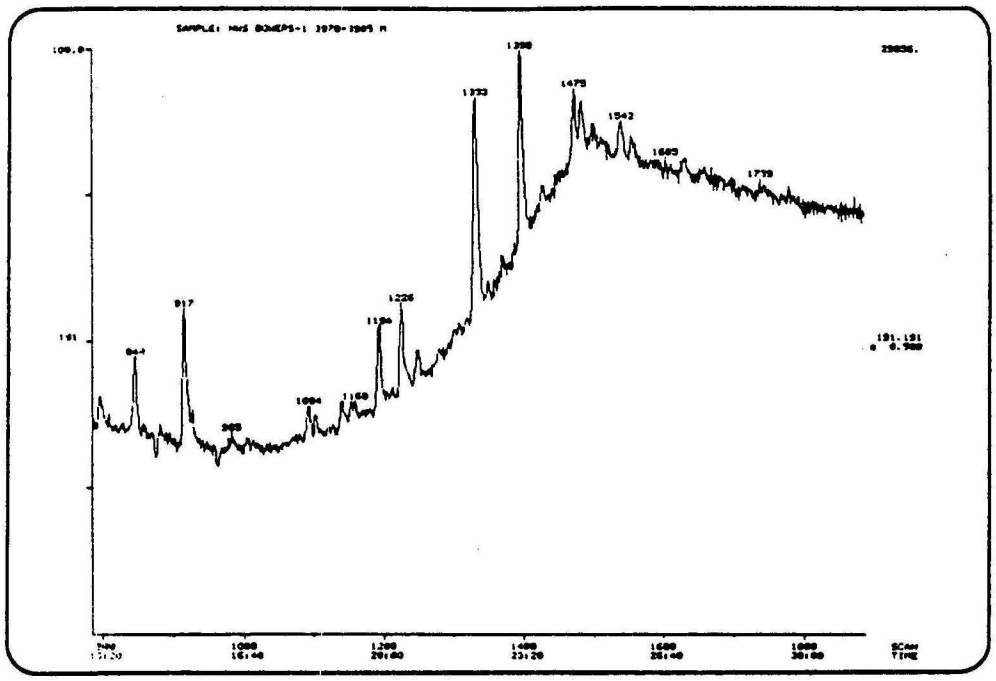

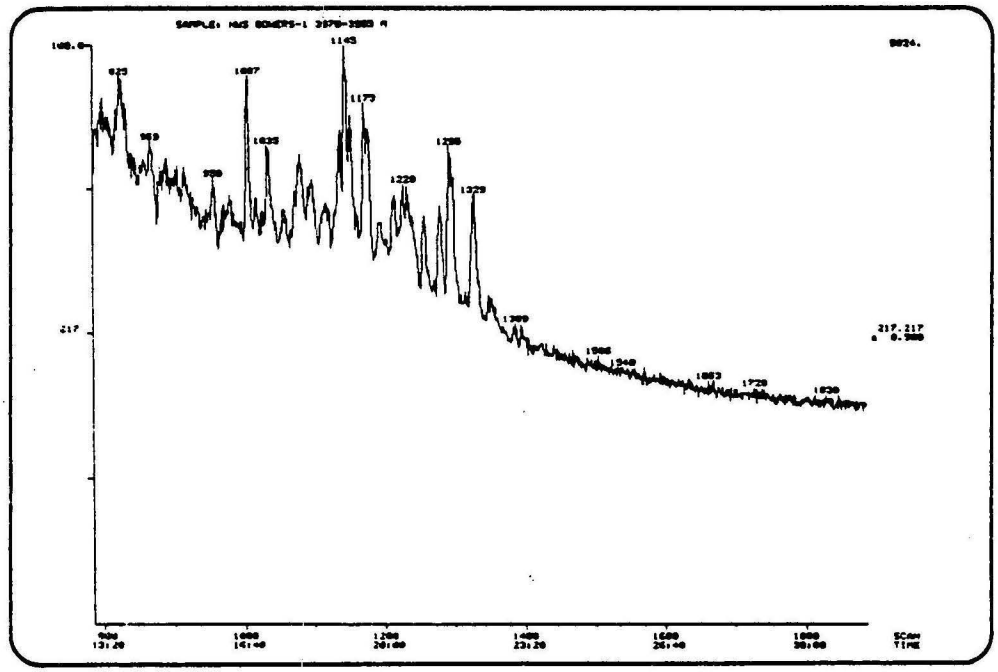

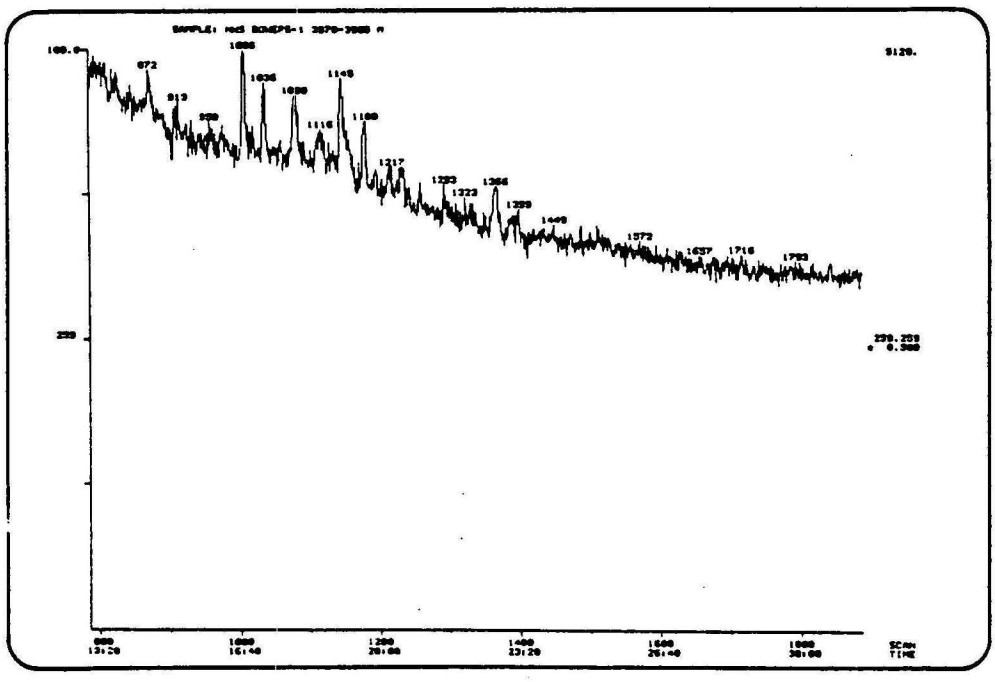

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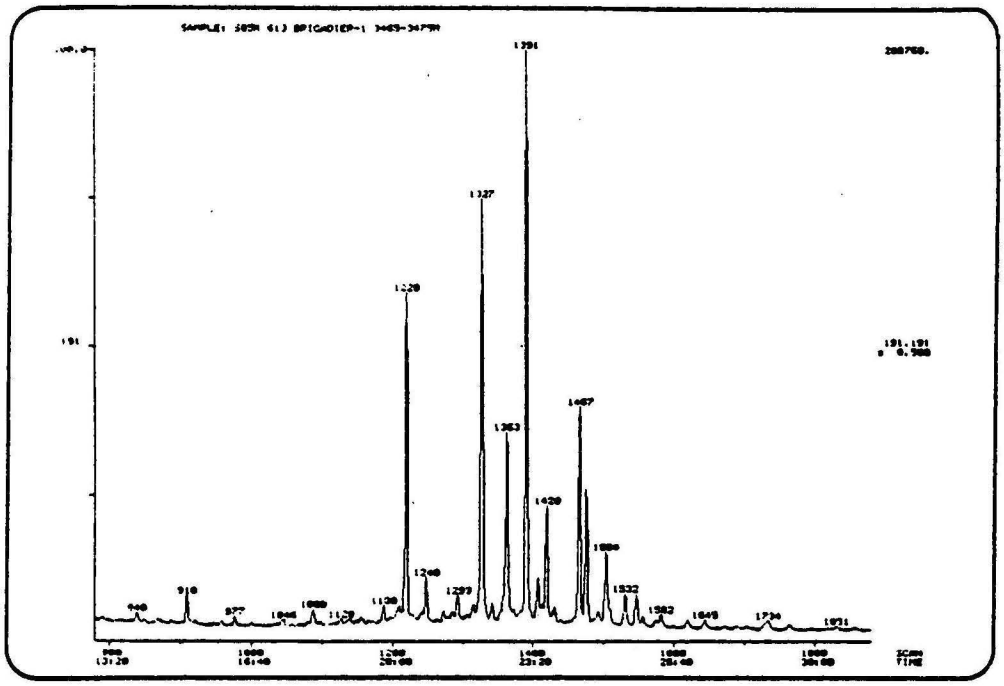

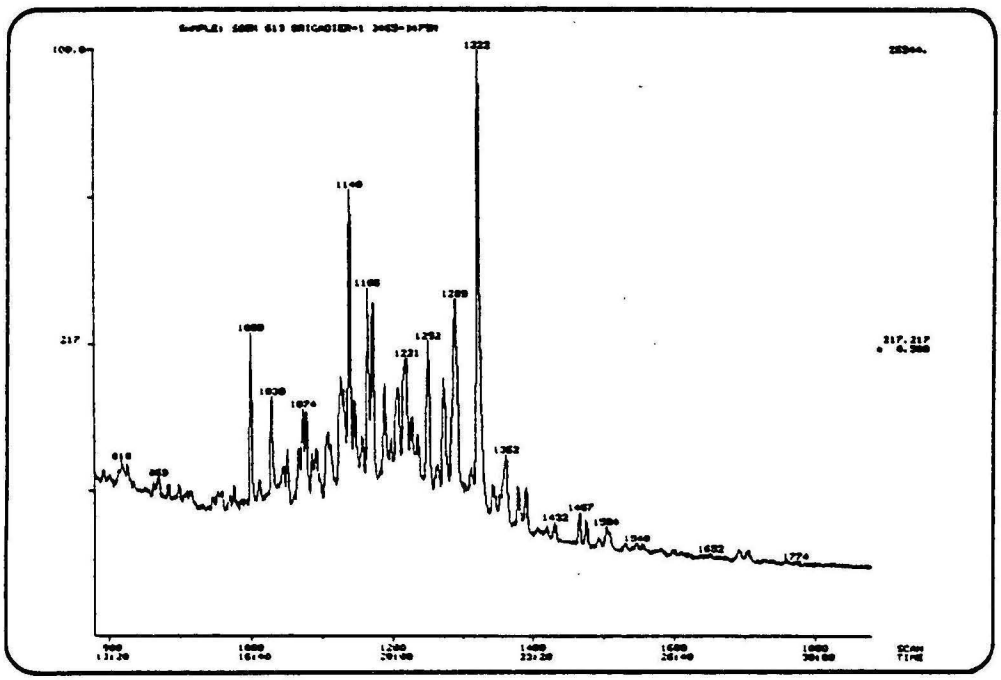

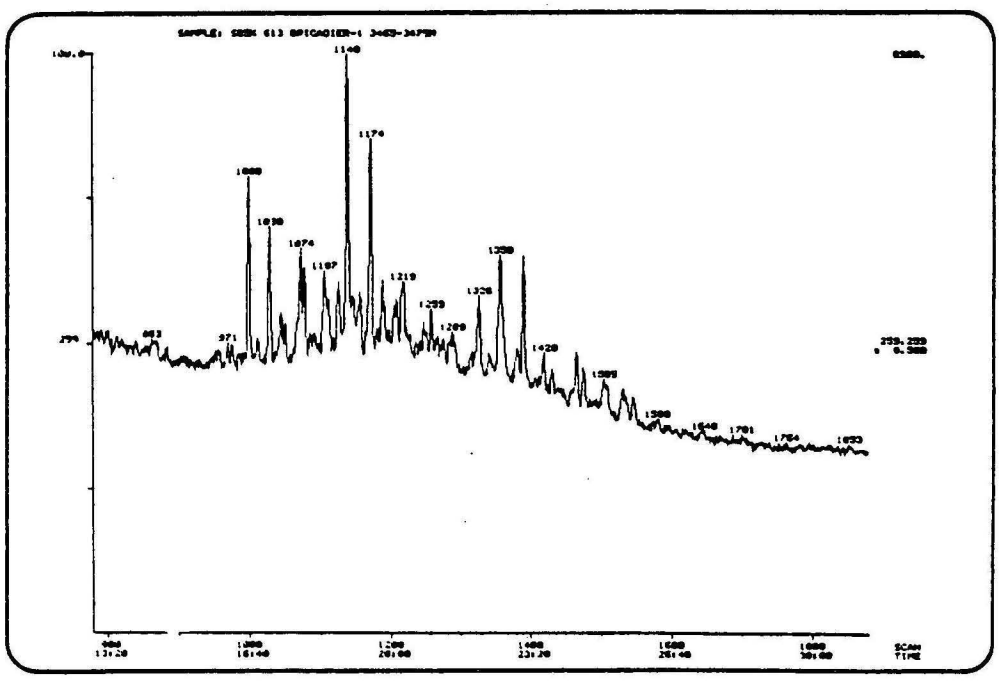

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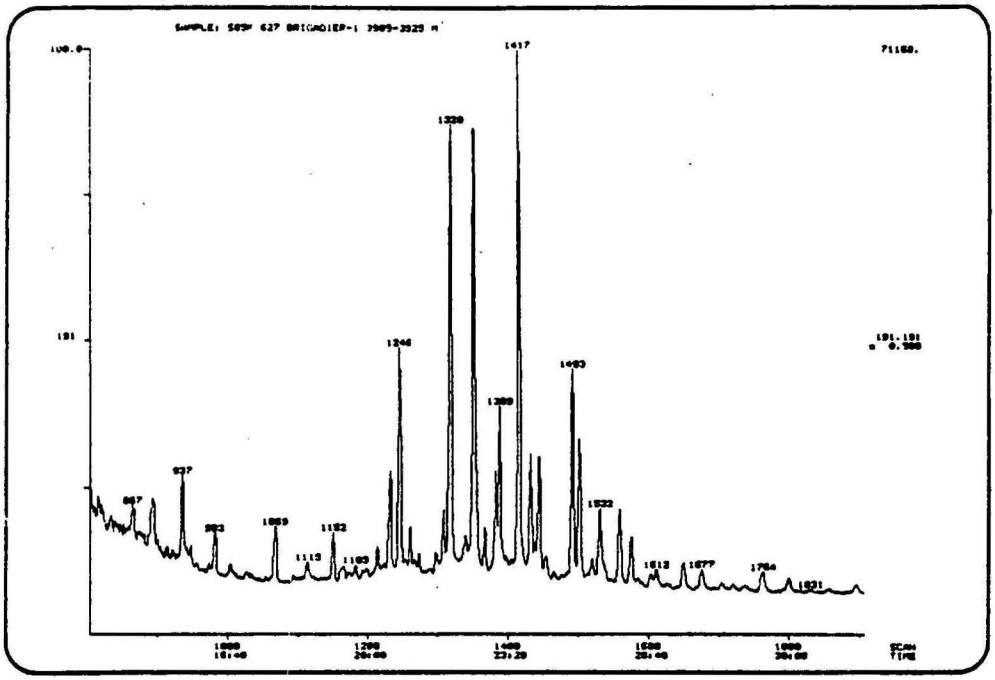

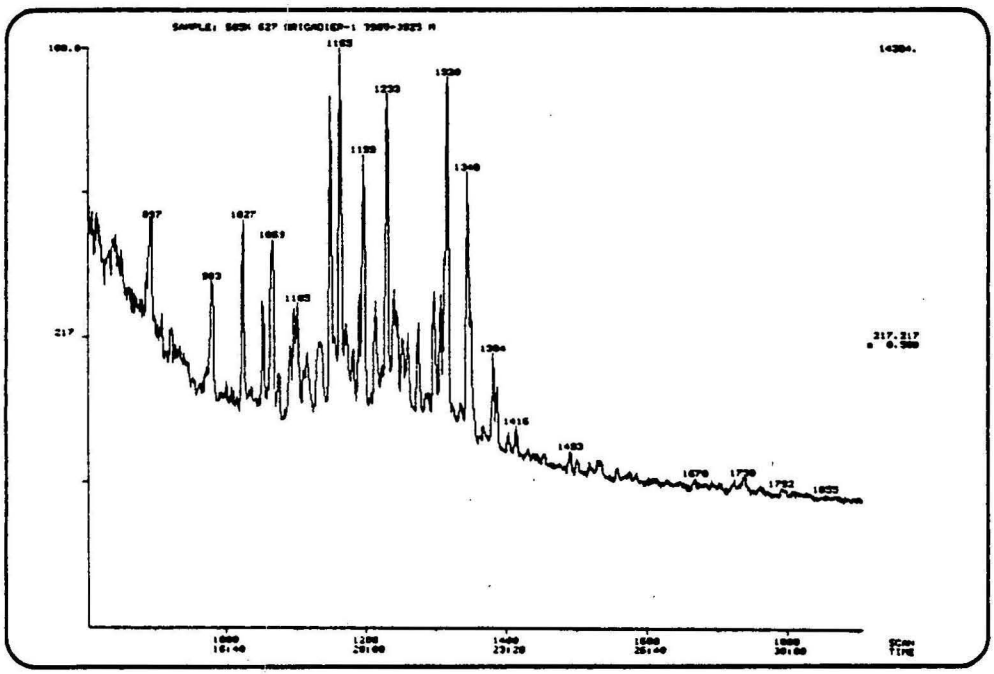

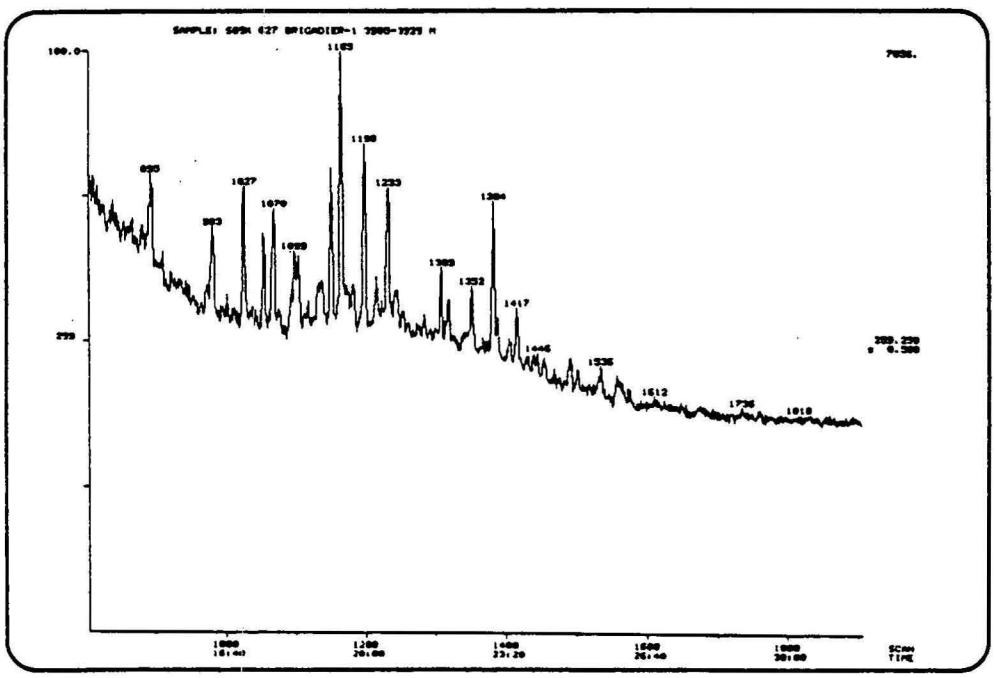

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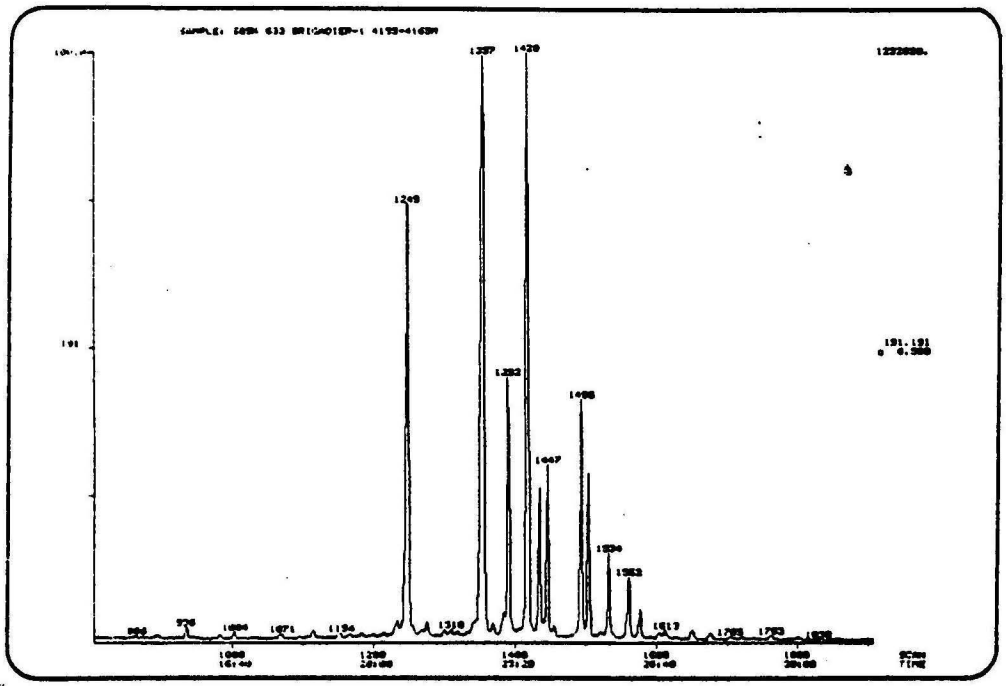

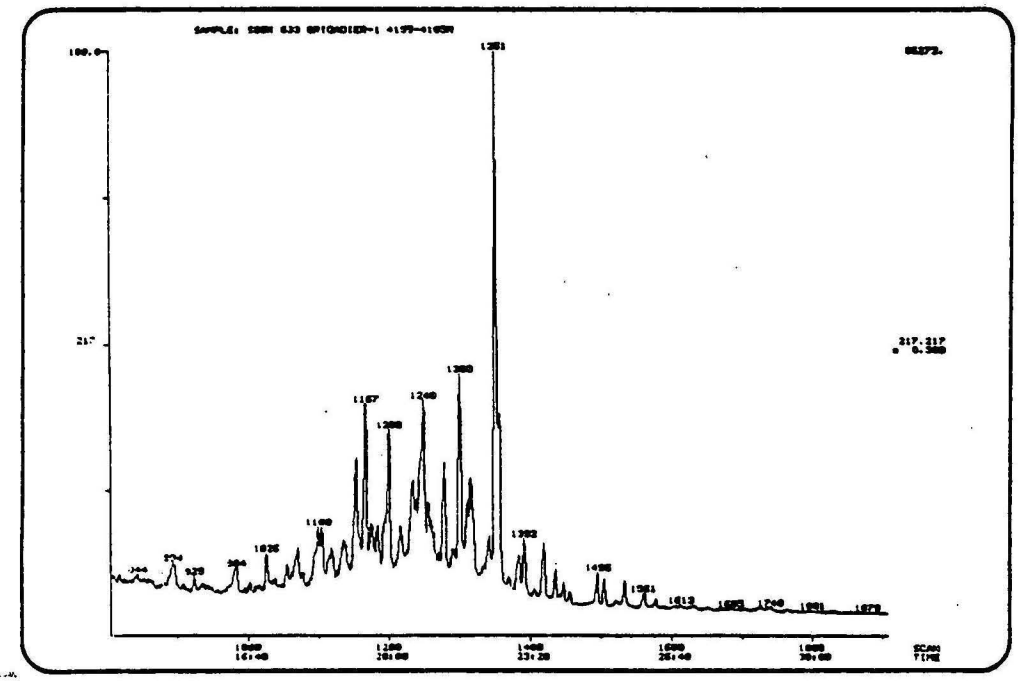

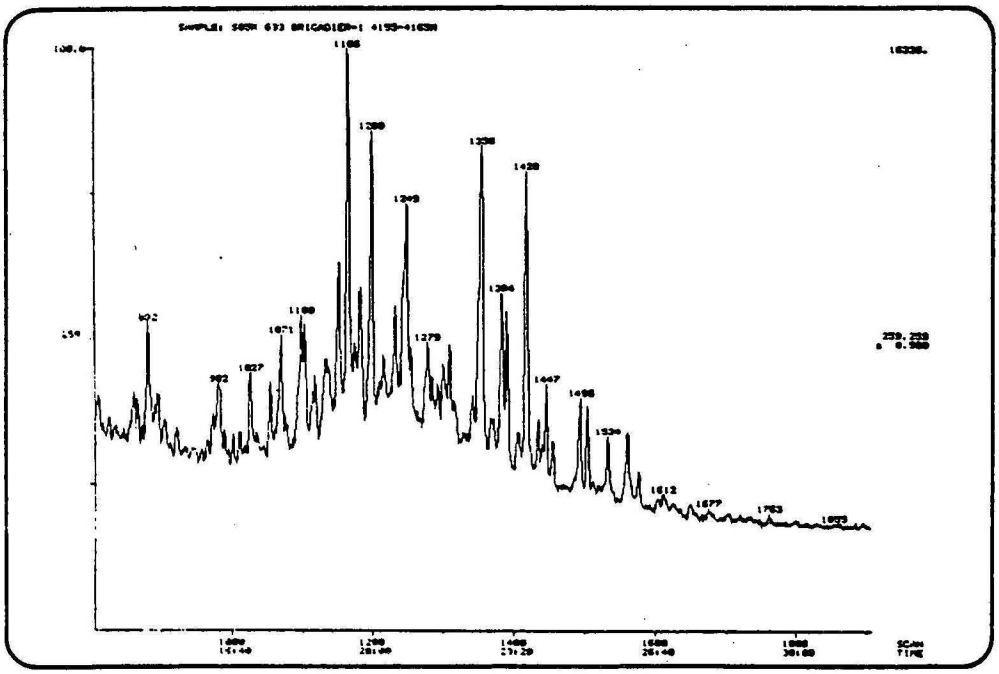

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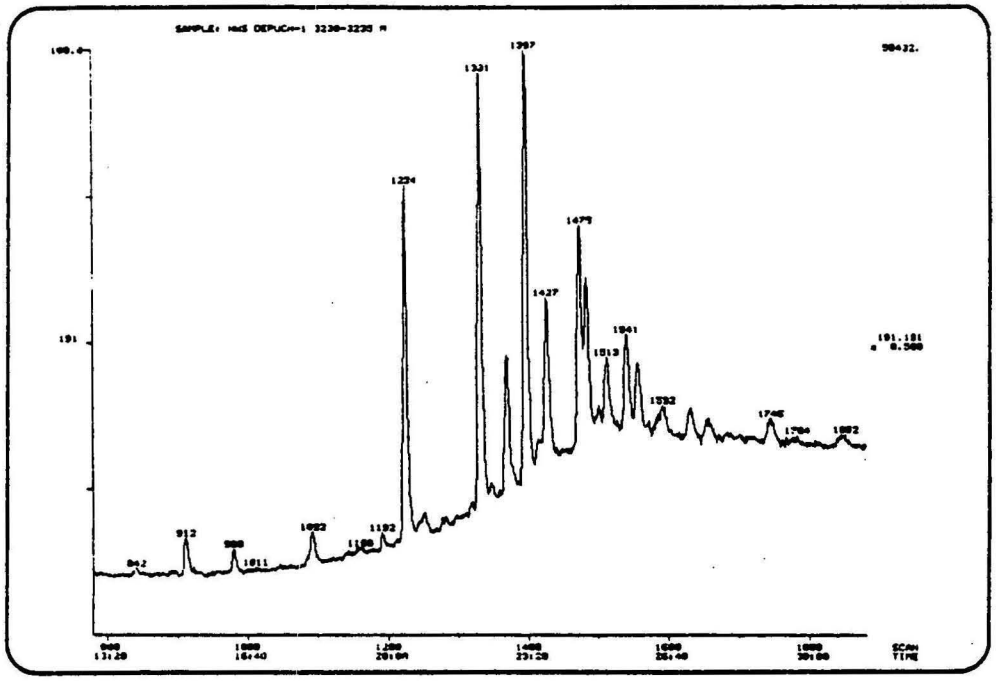


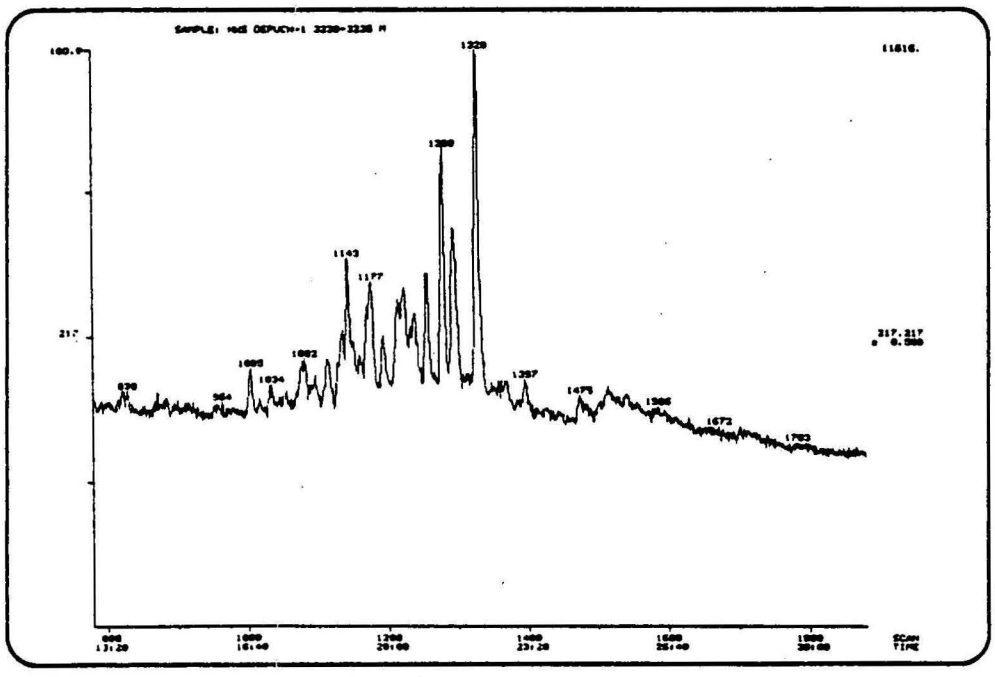


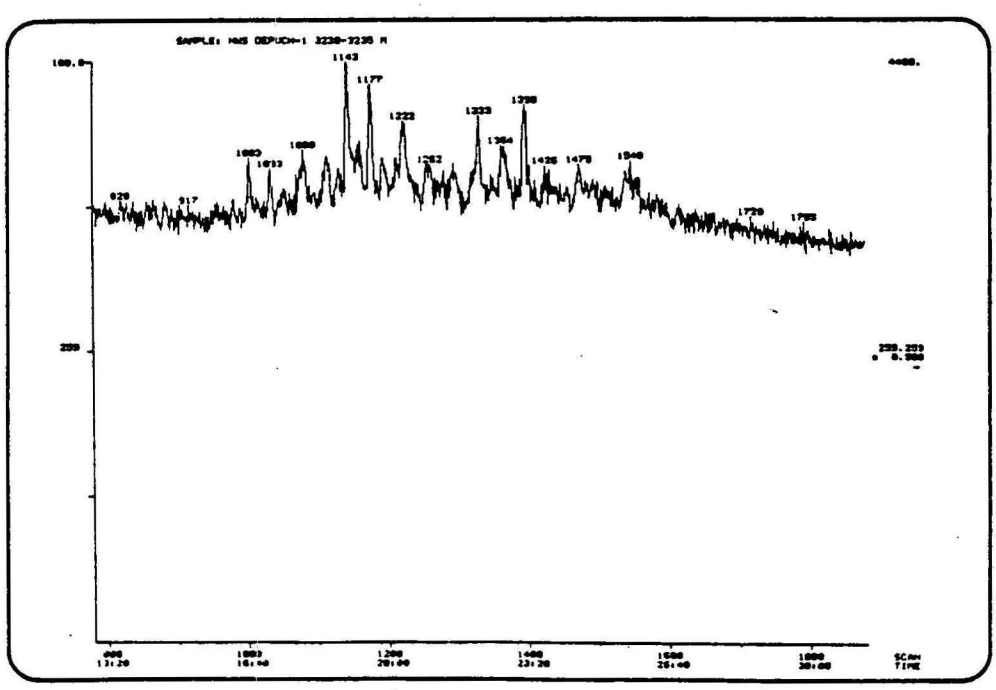


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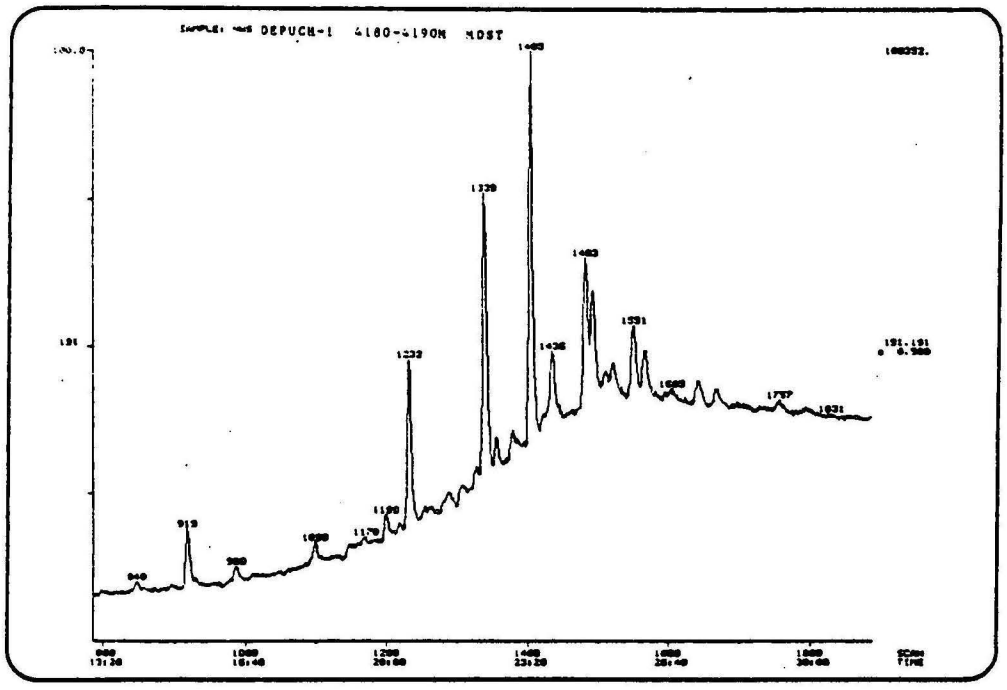


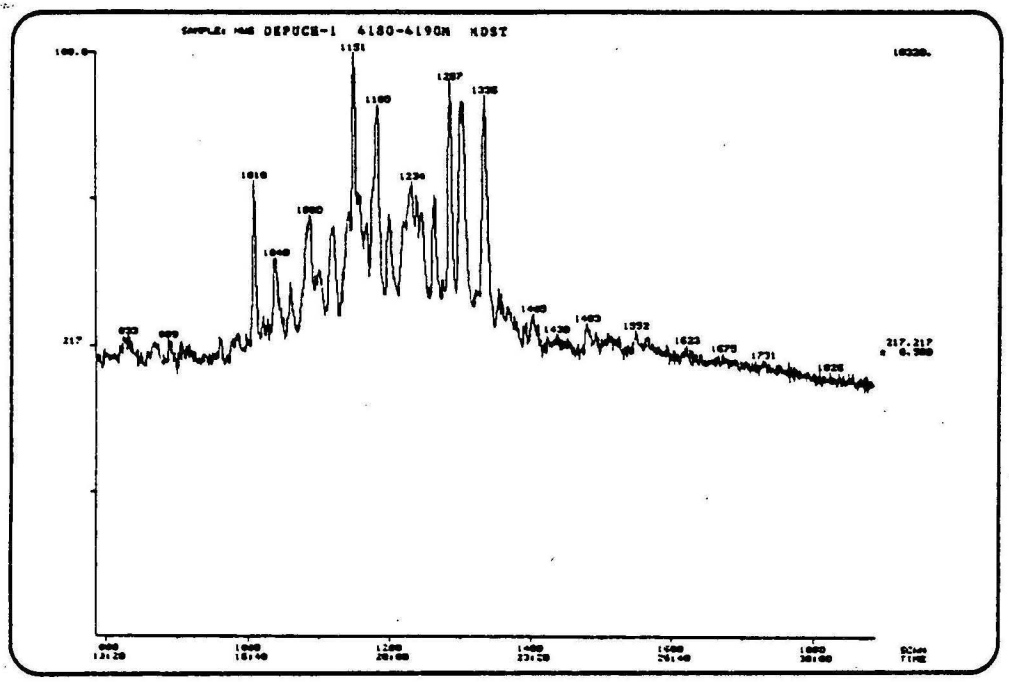


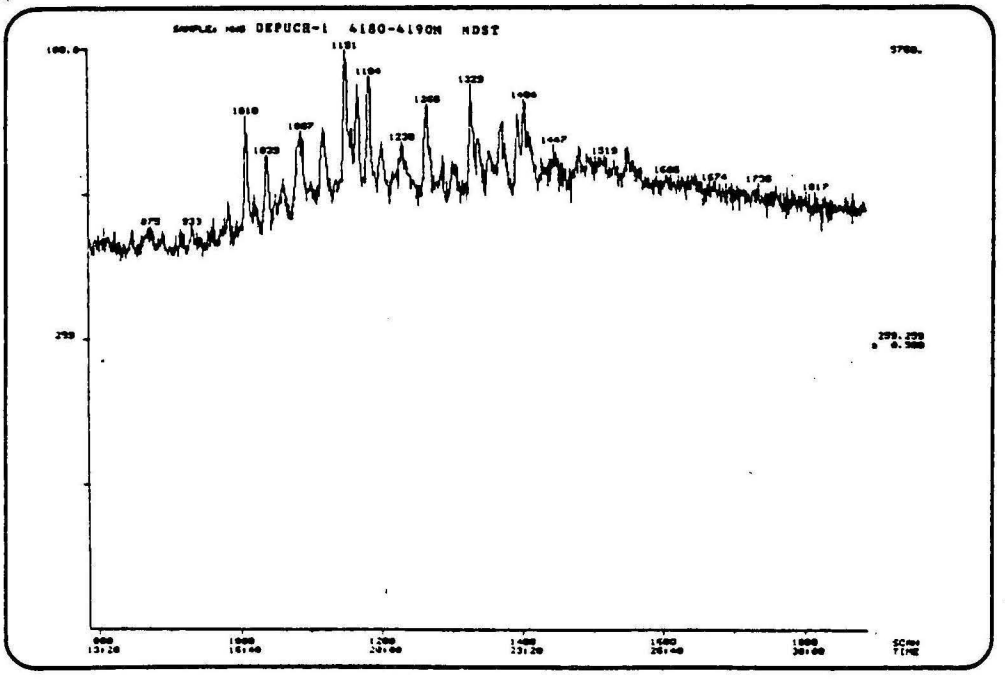


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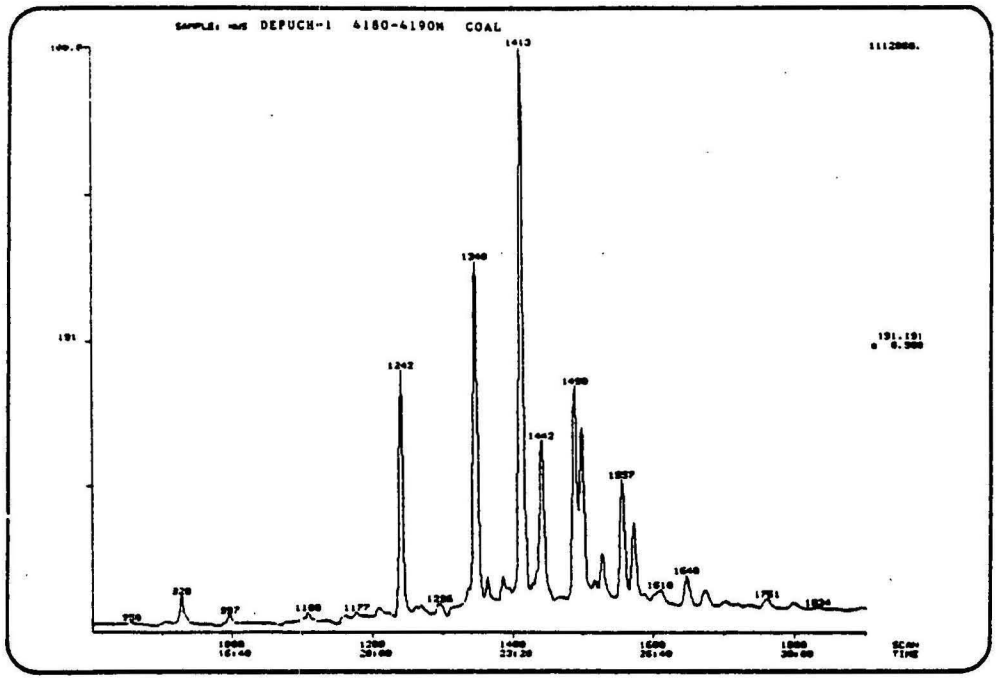
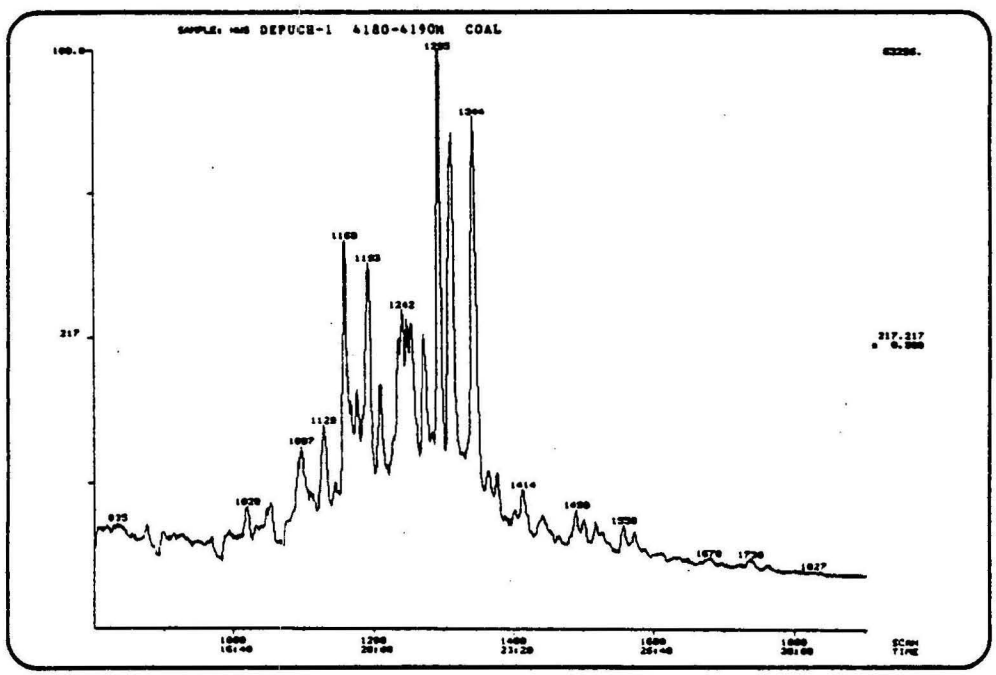


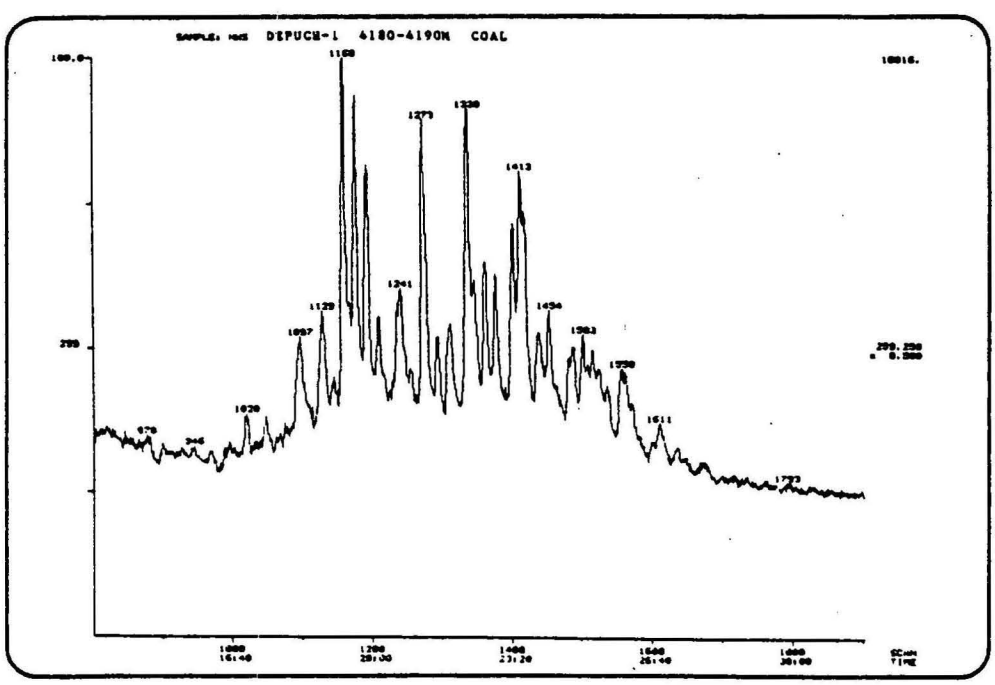
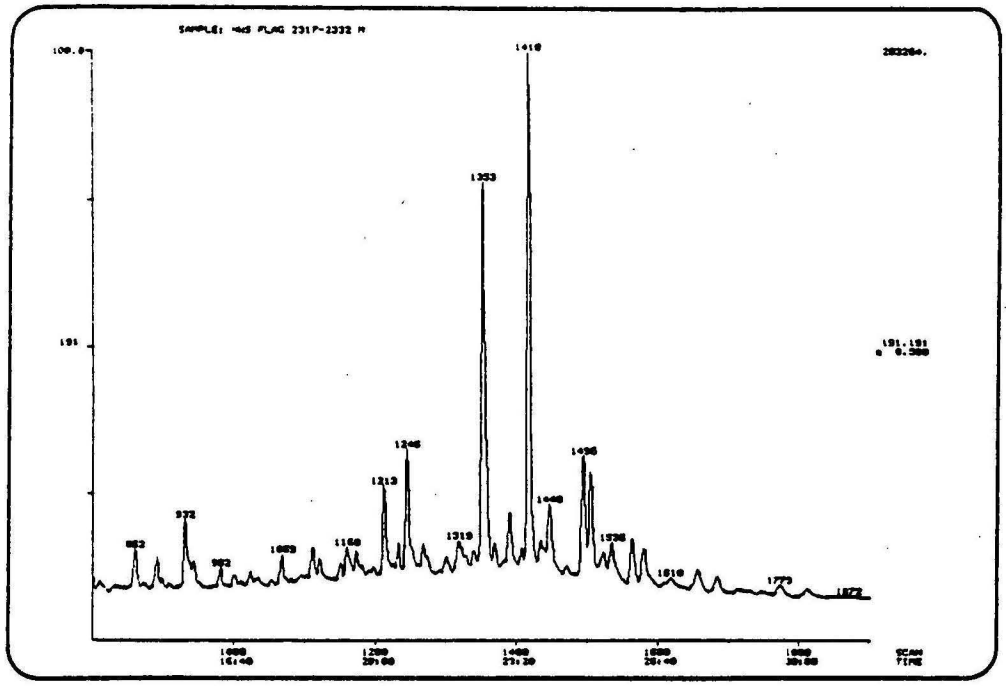
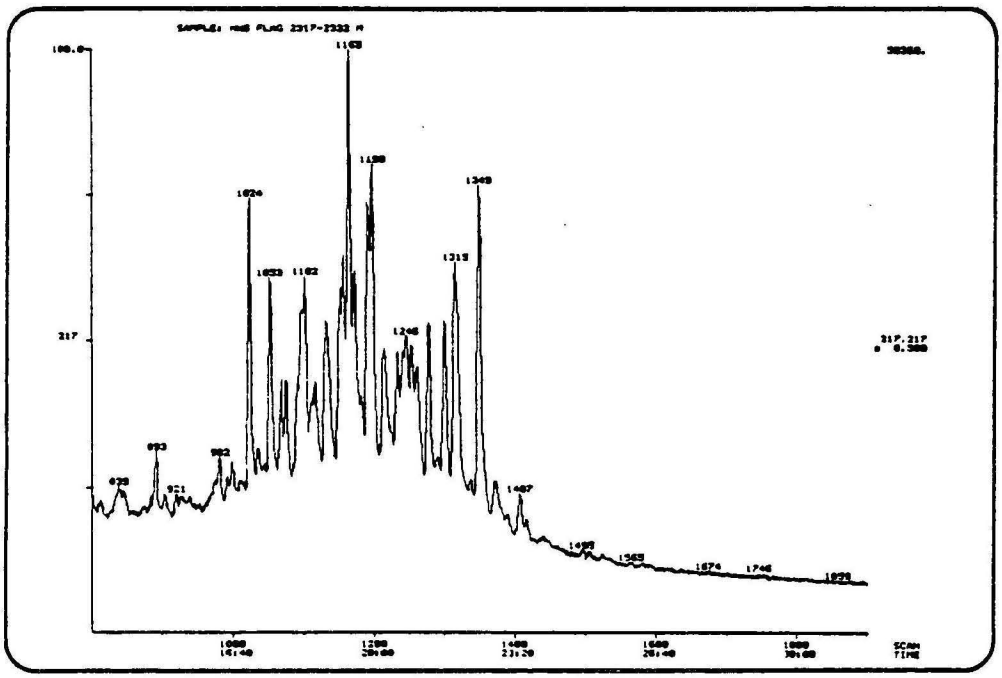
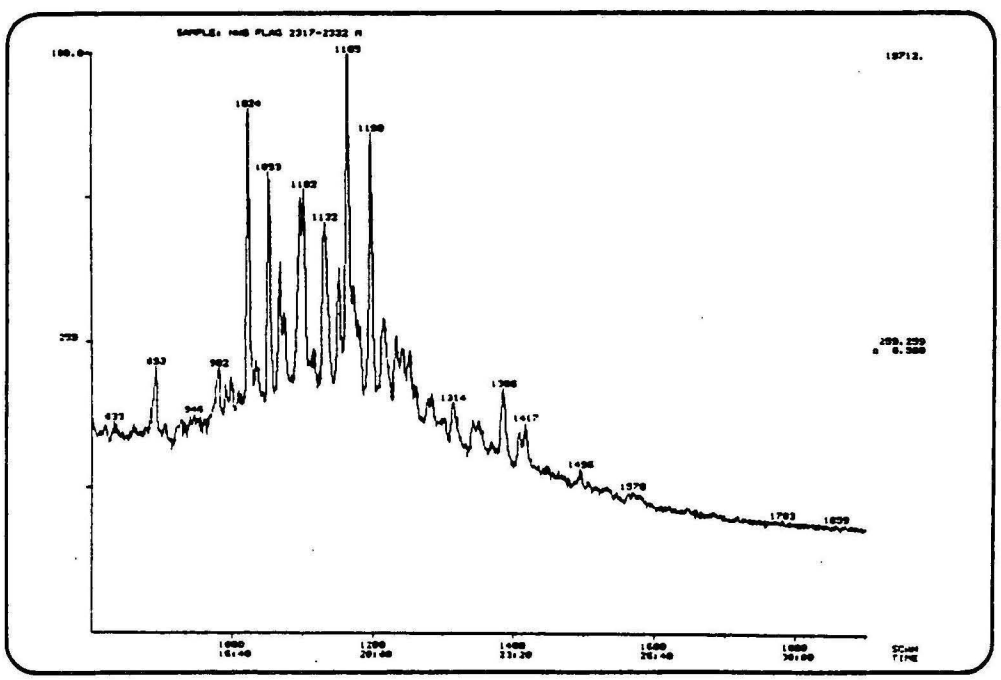




Figure IV. 3.12







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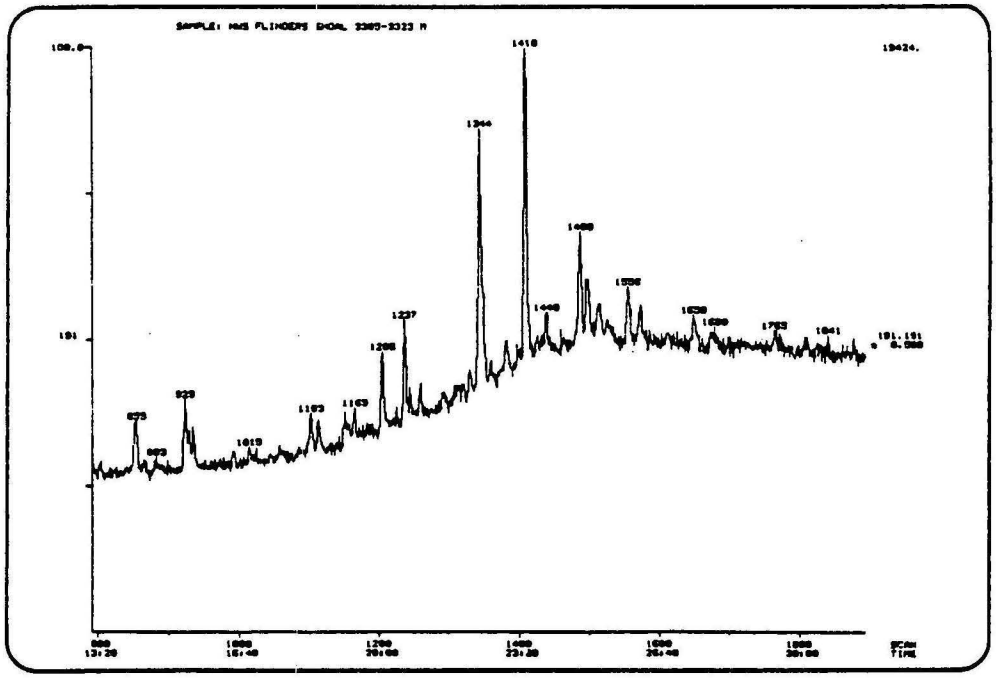

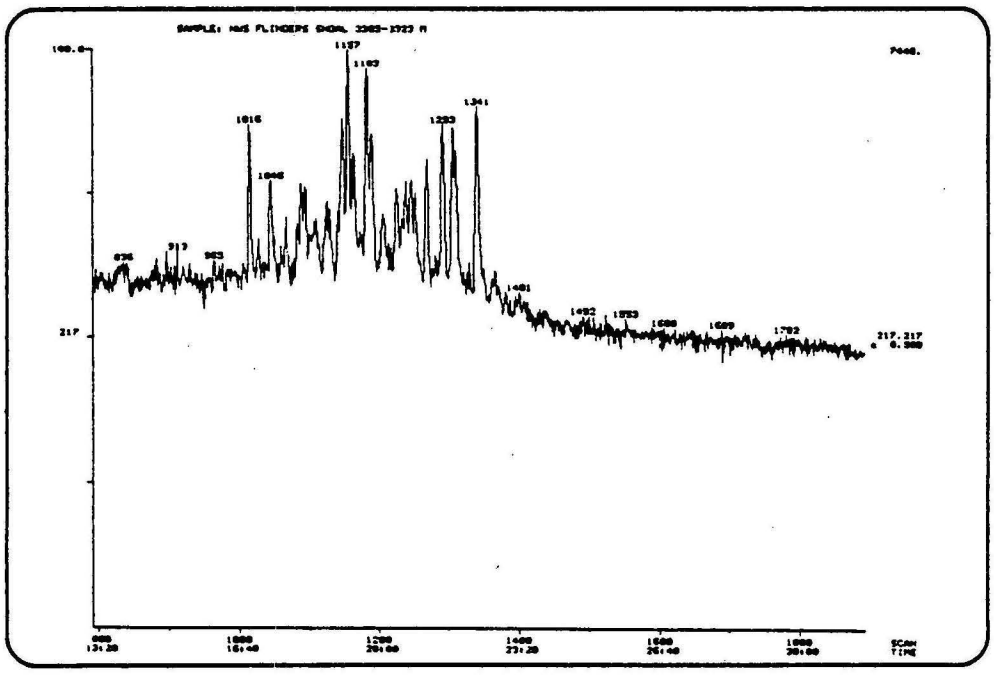

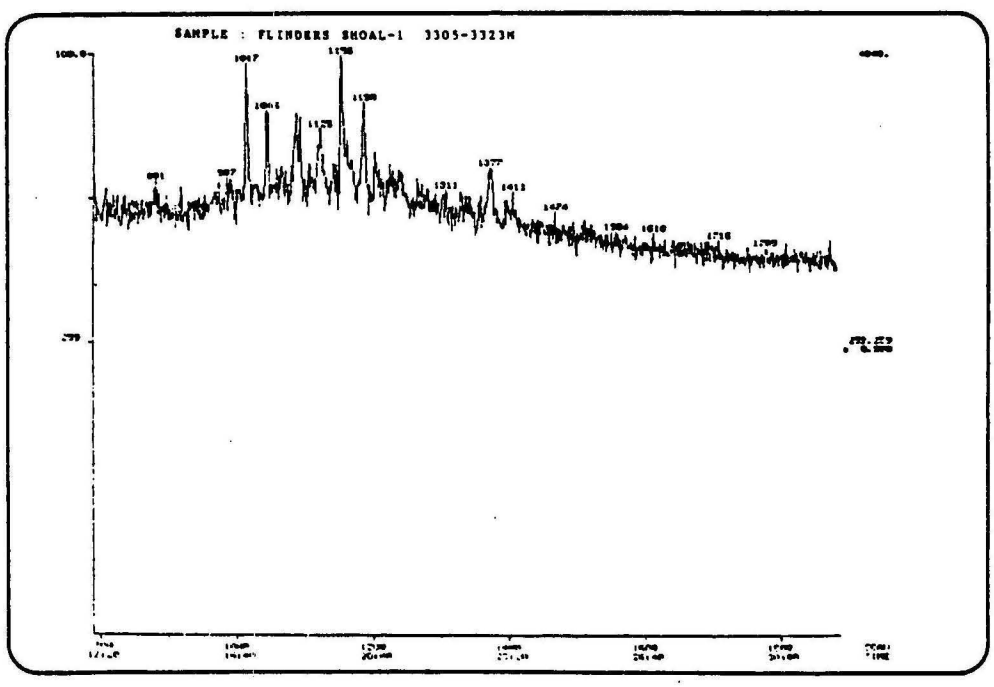


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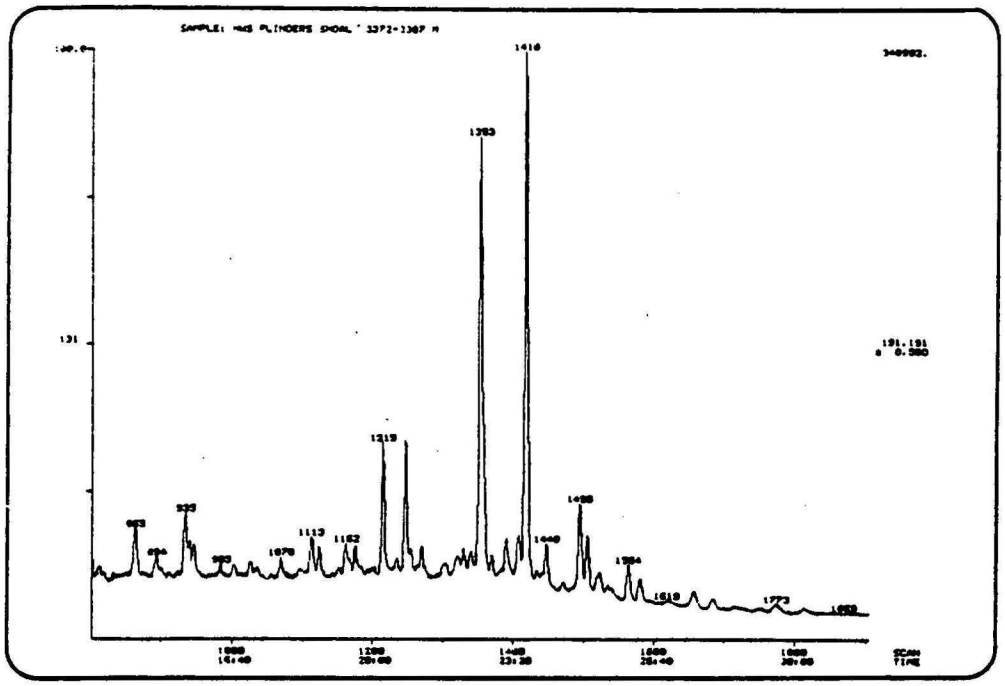


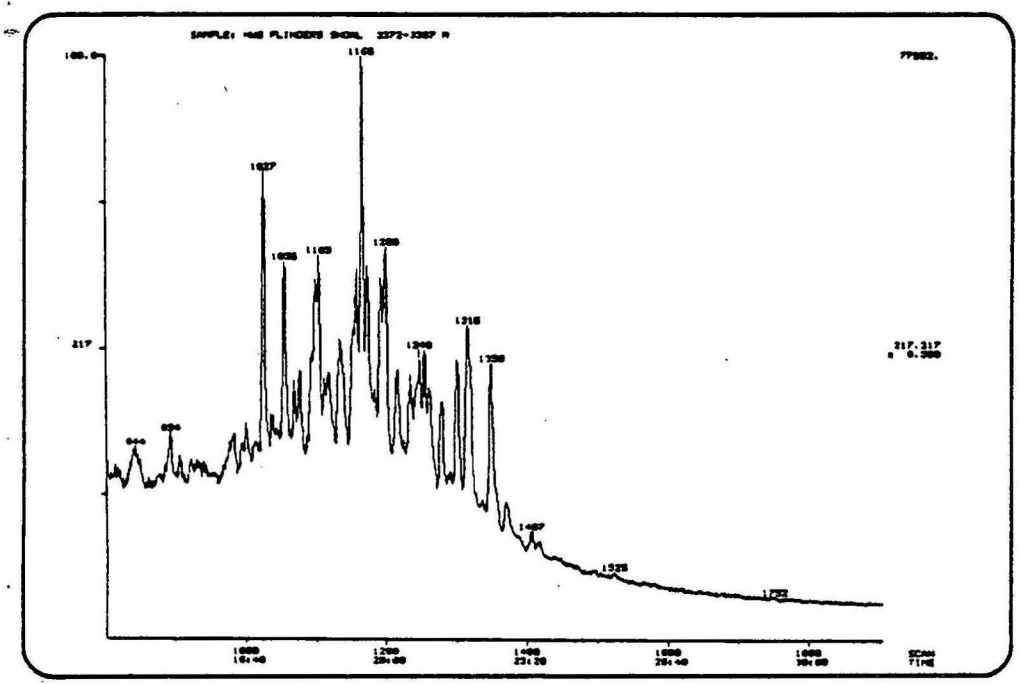


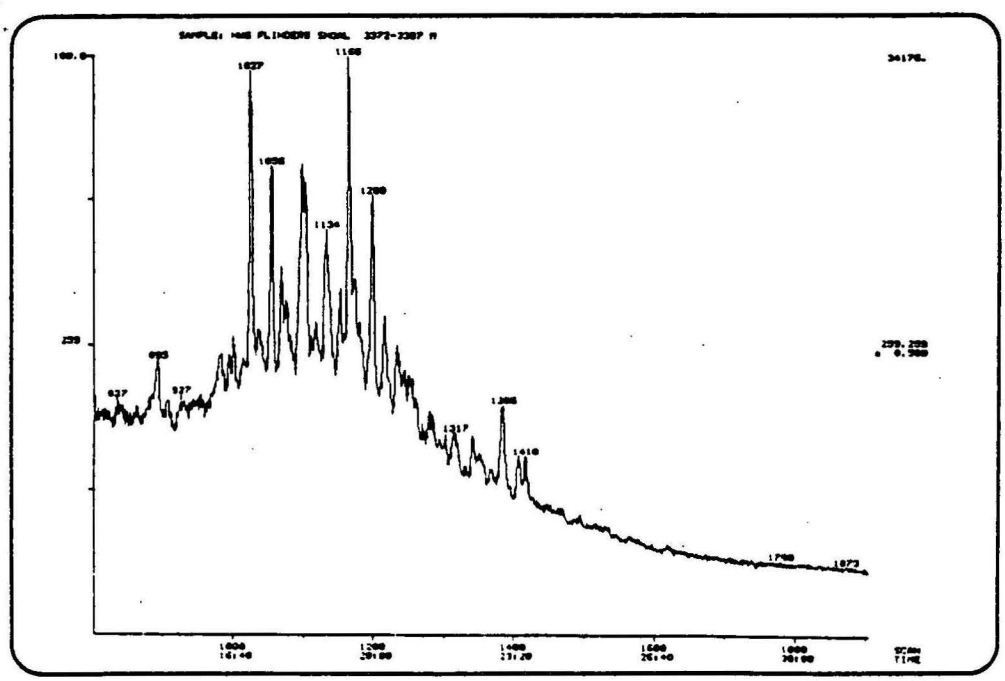


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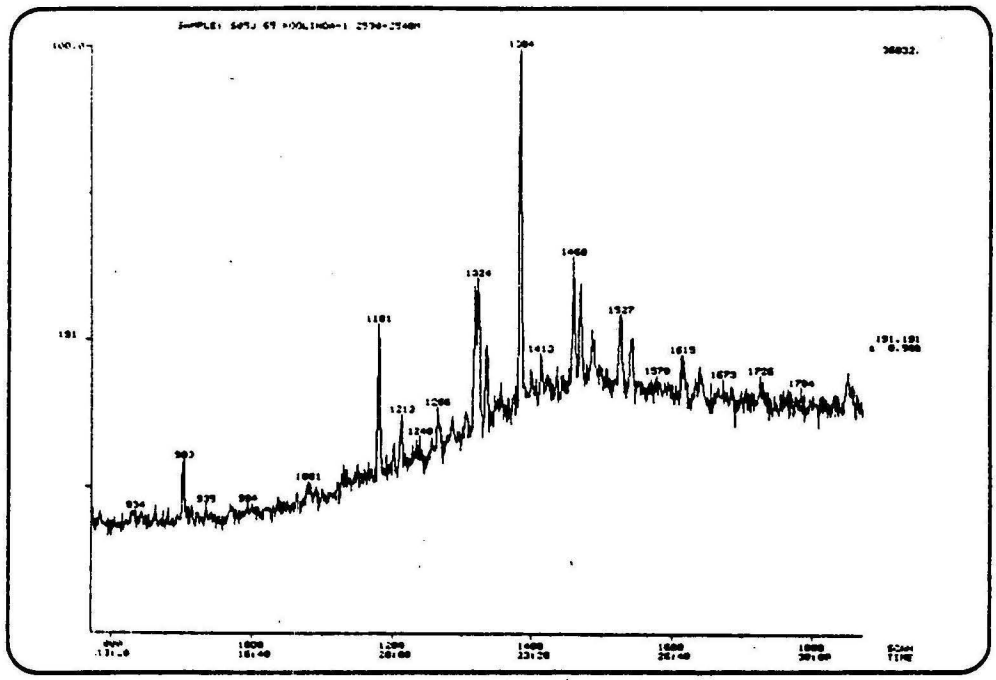

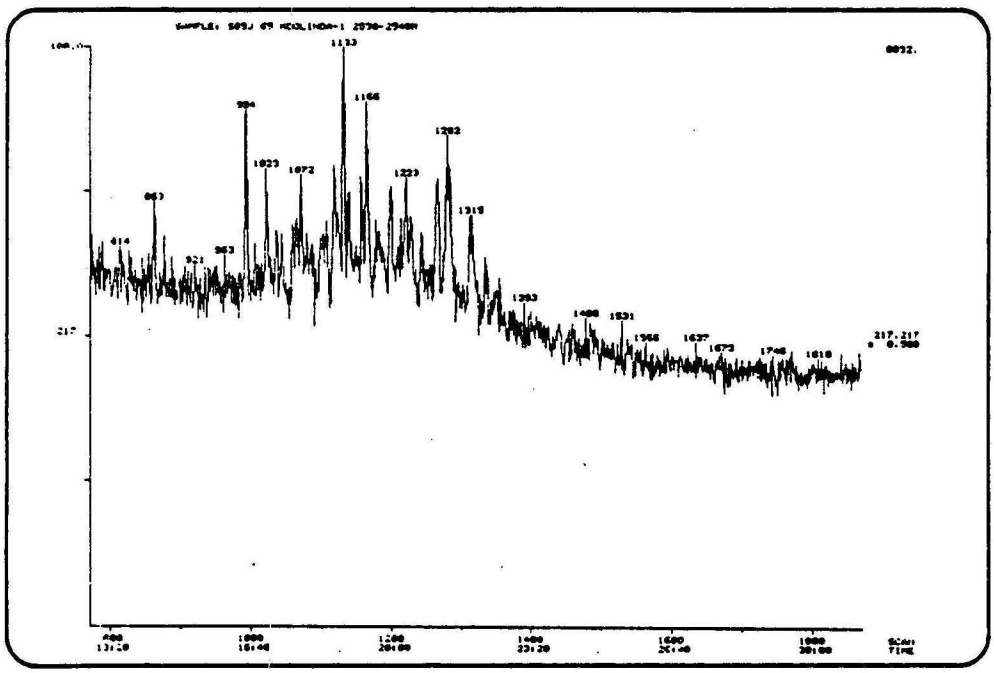

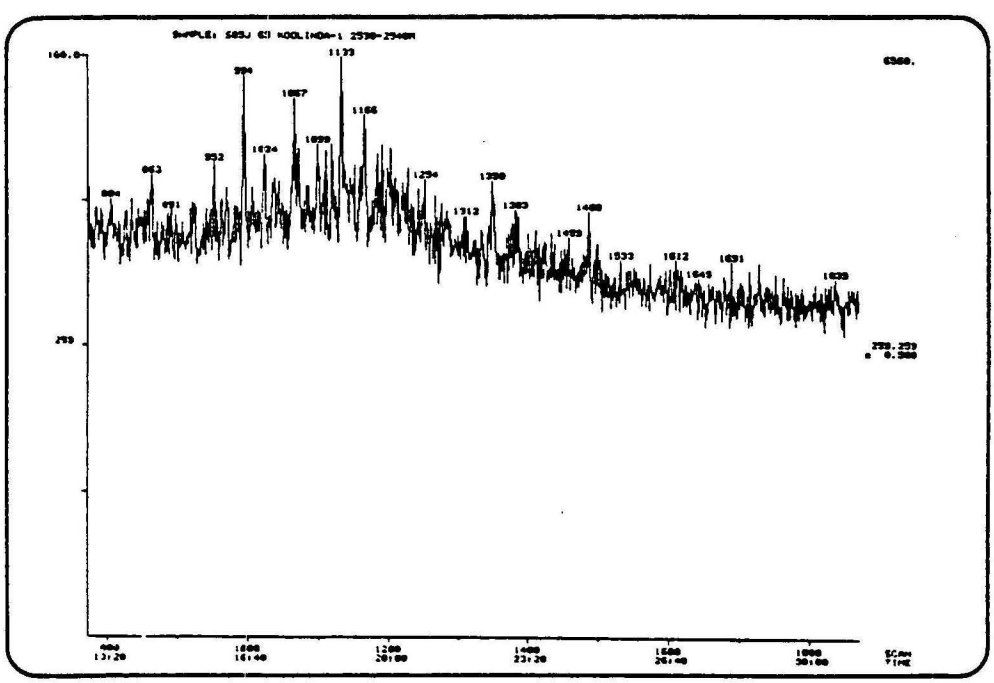

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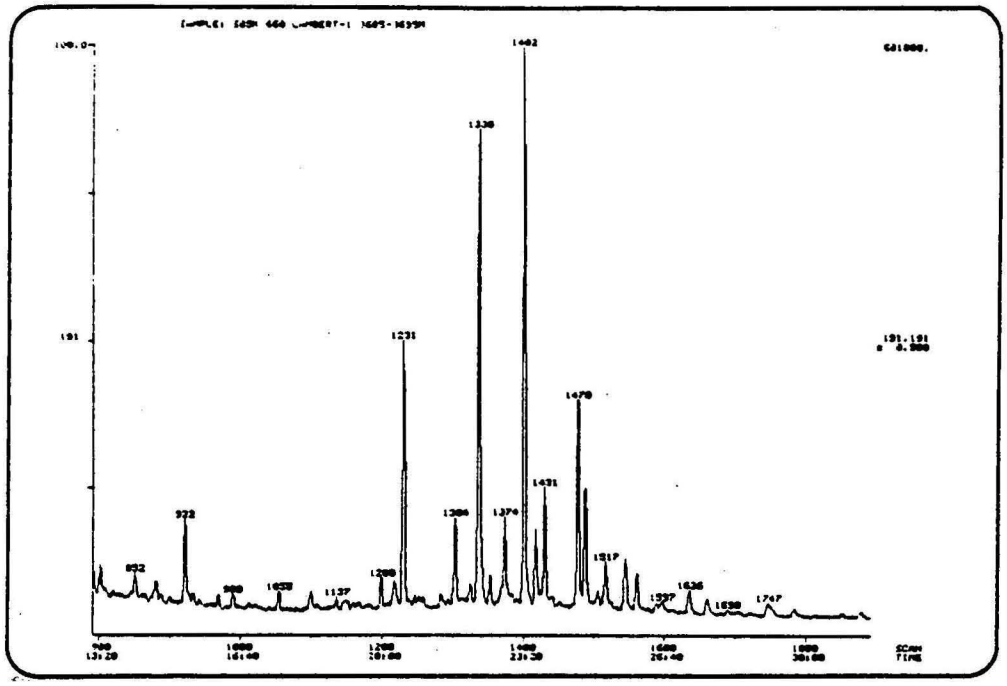


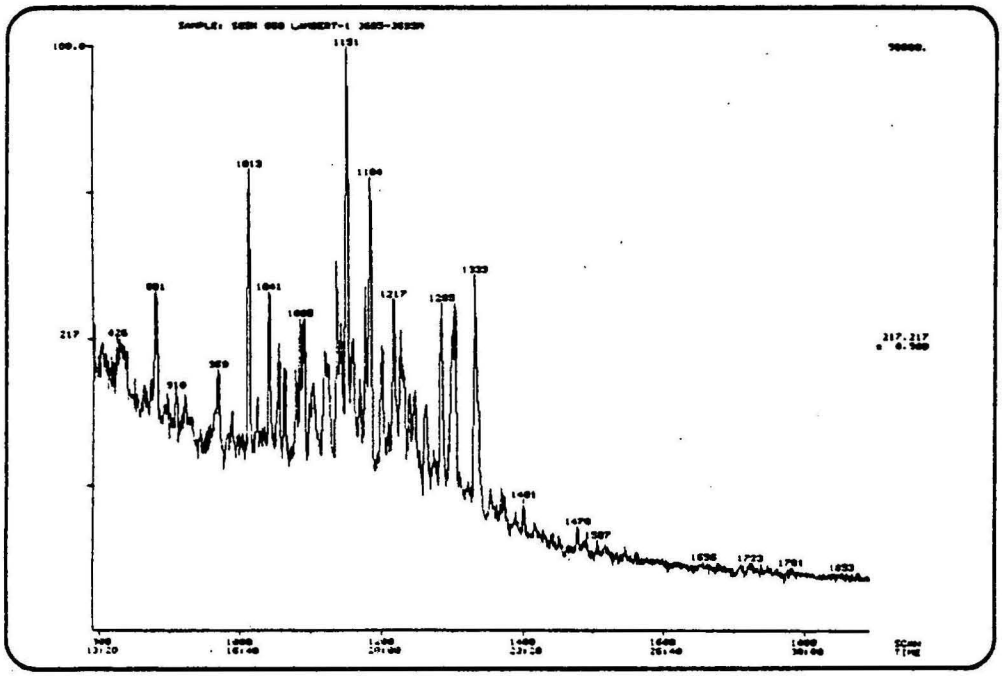


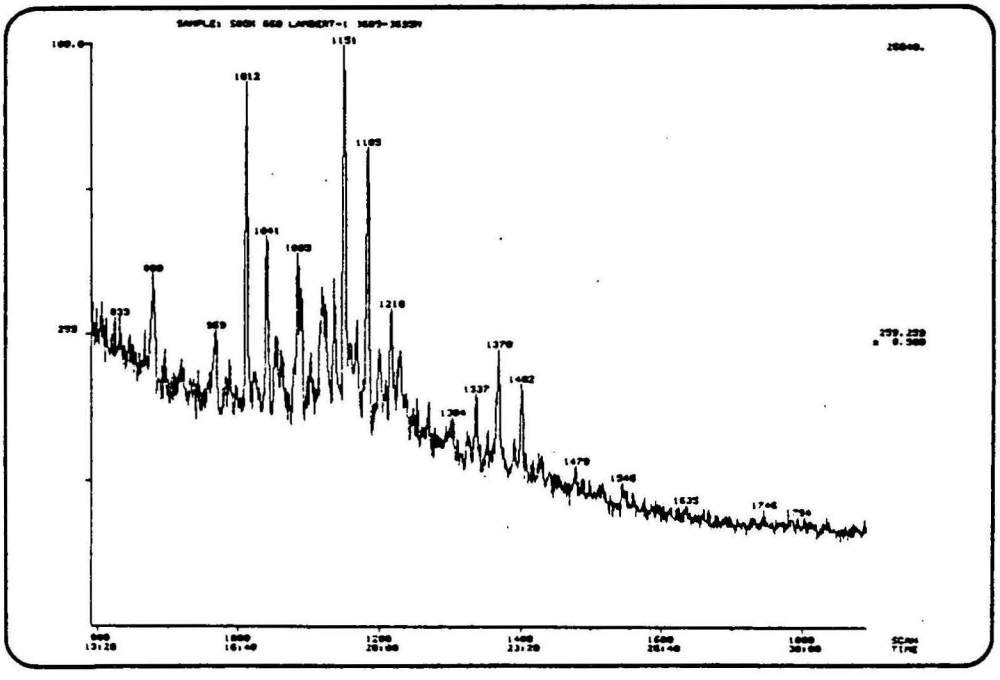


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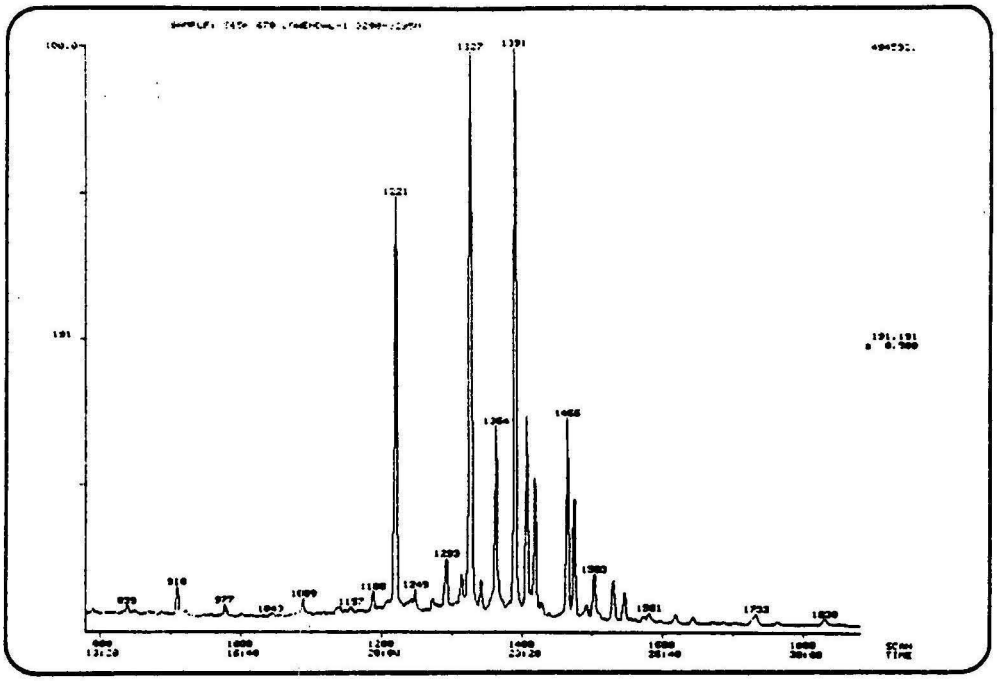


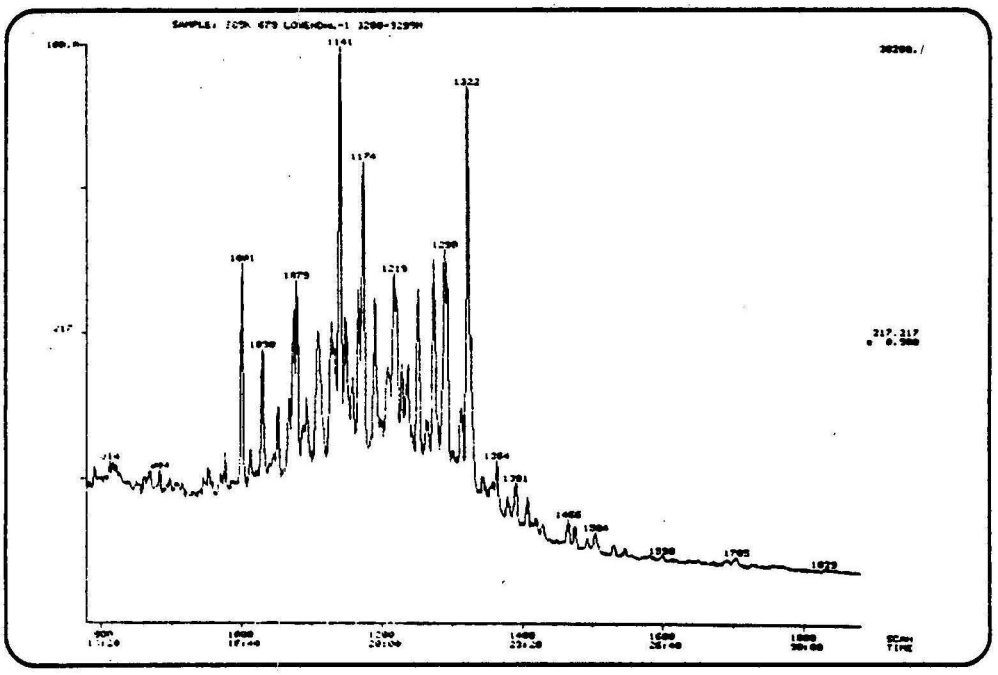


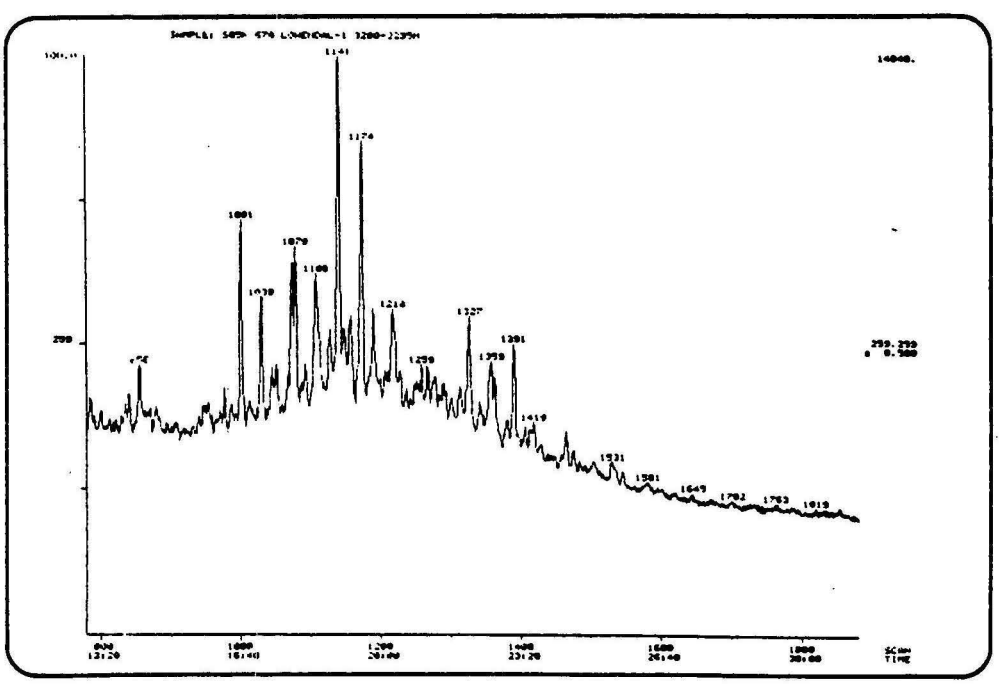


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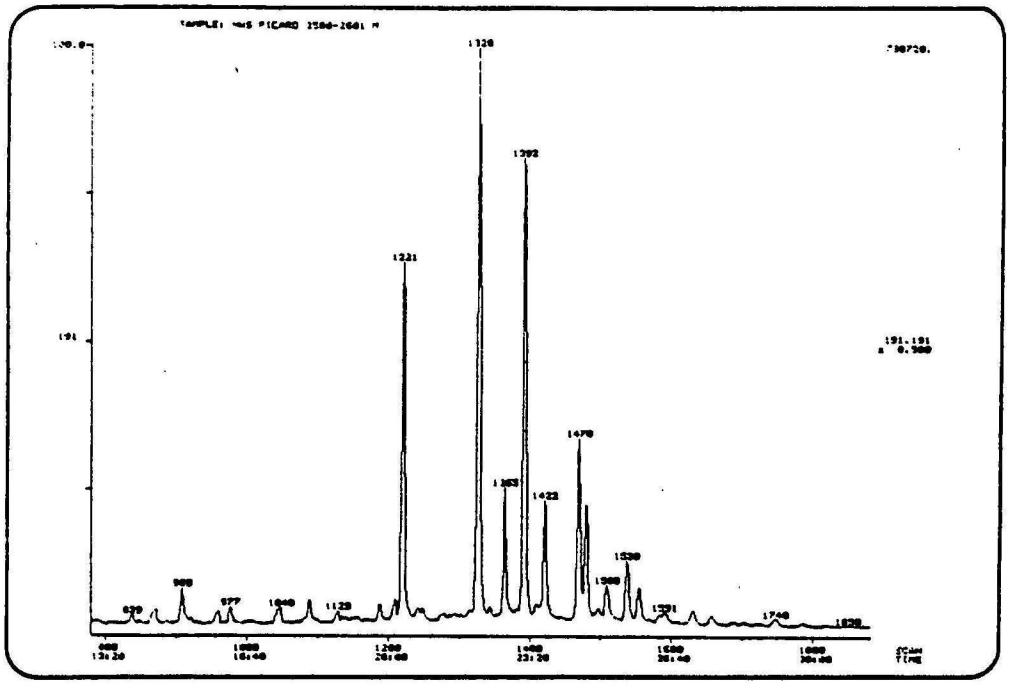
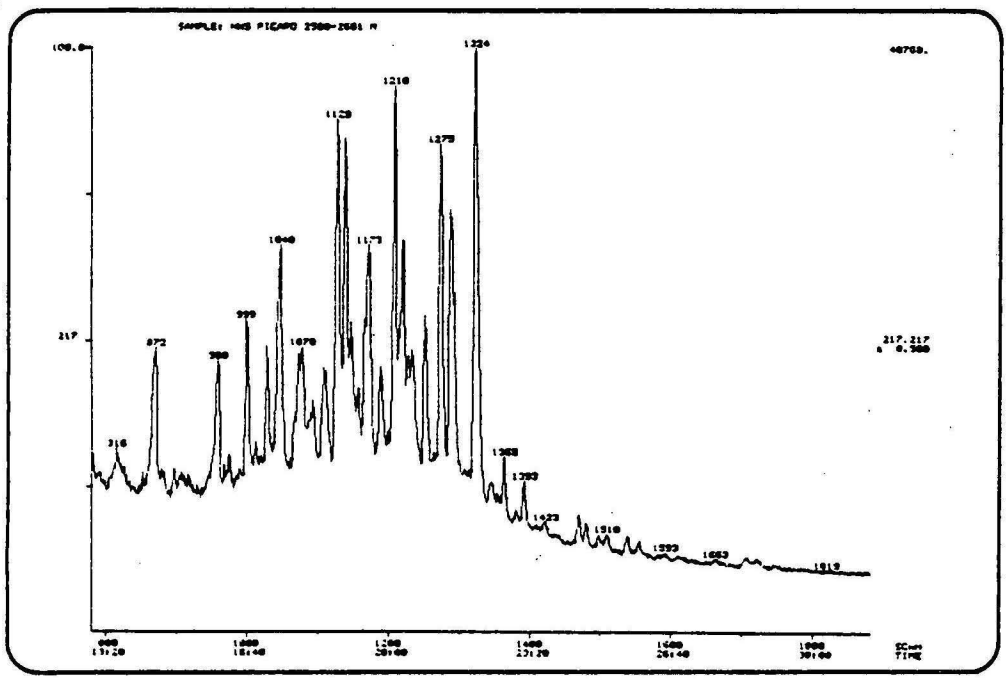




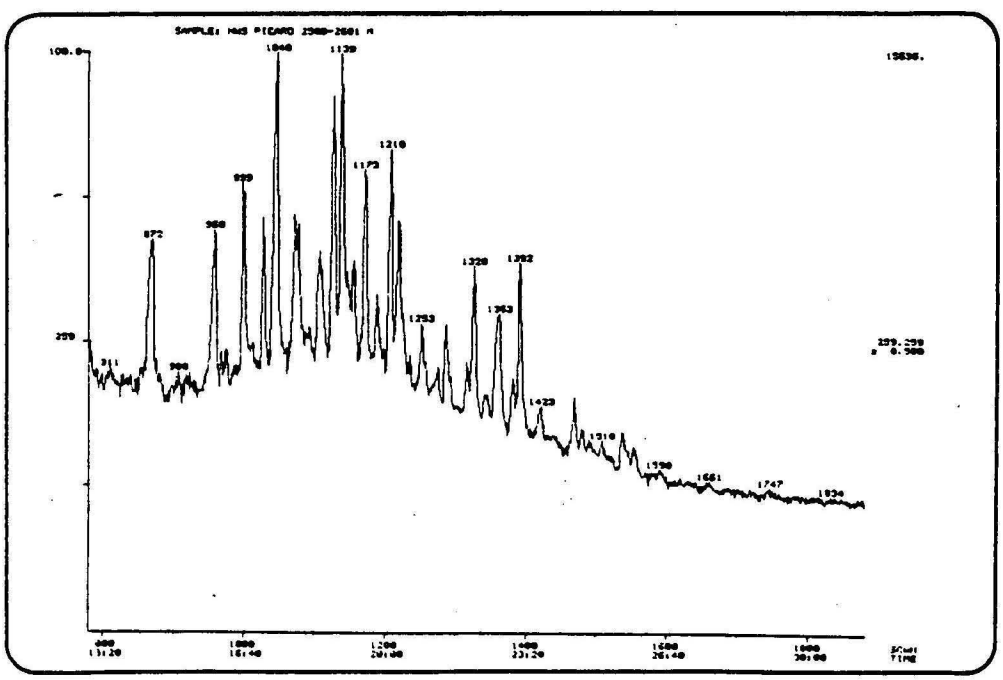
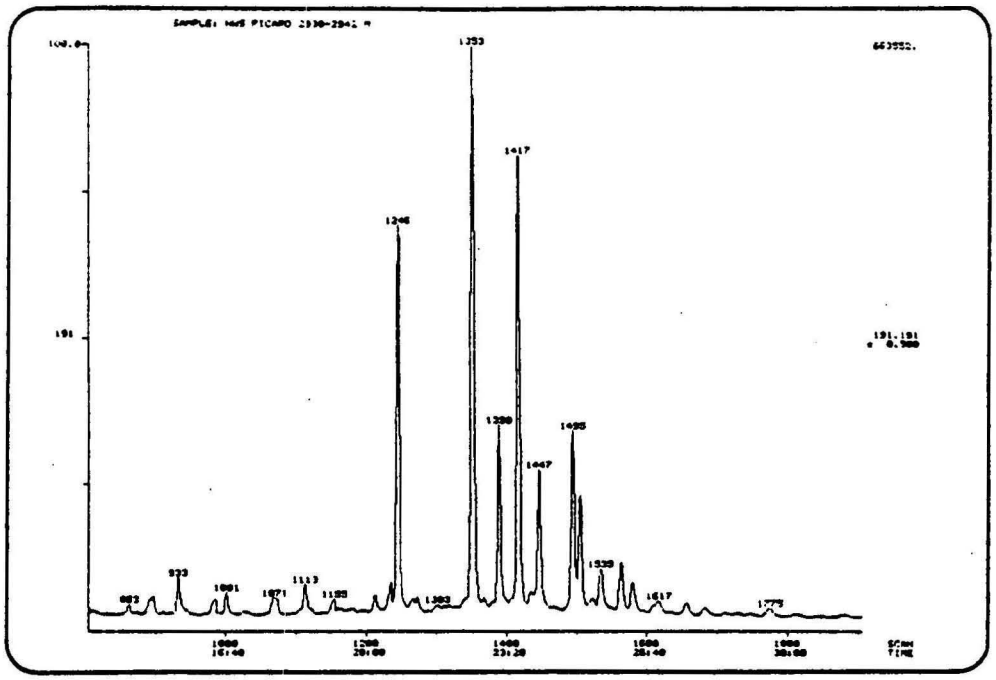
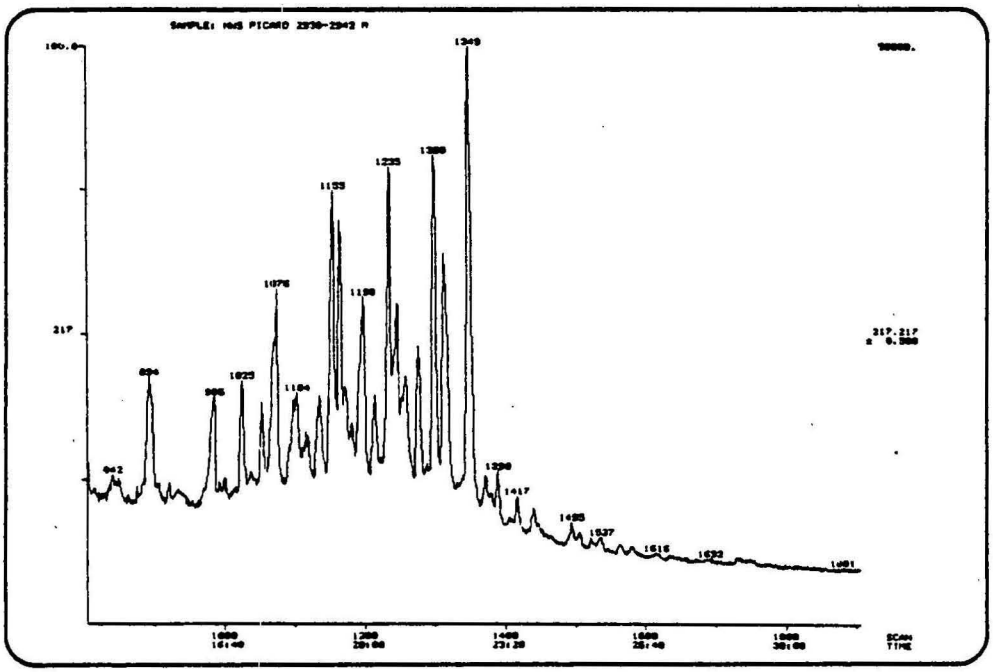


Figure IV. 3.19





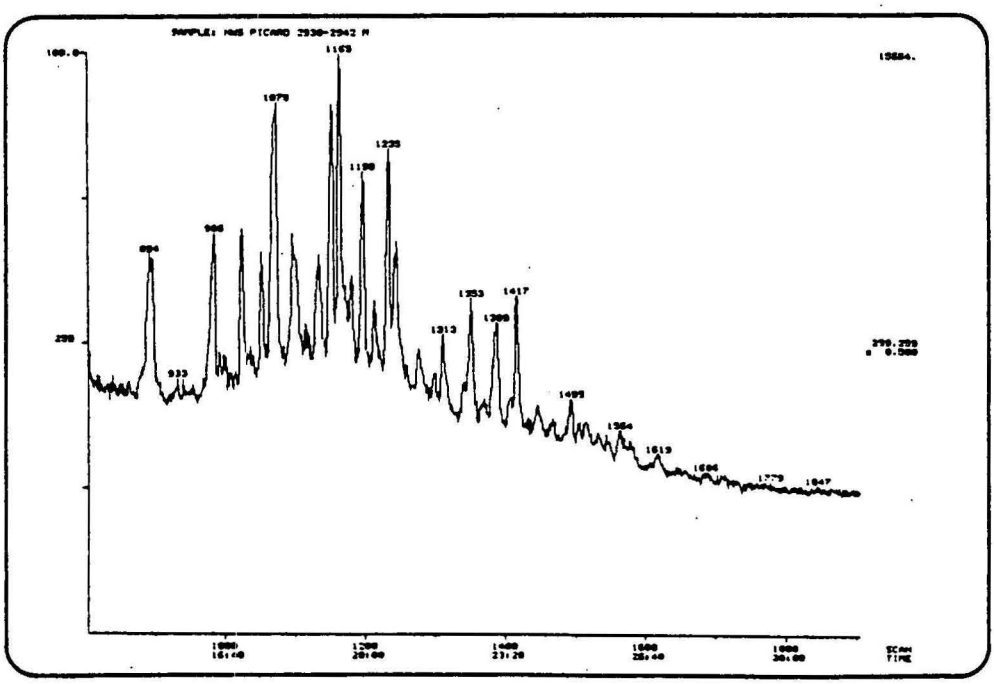
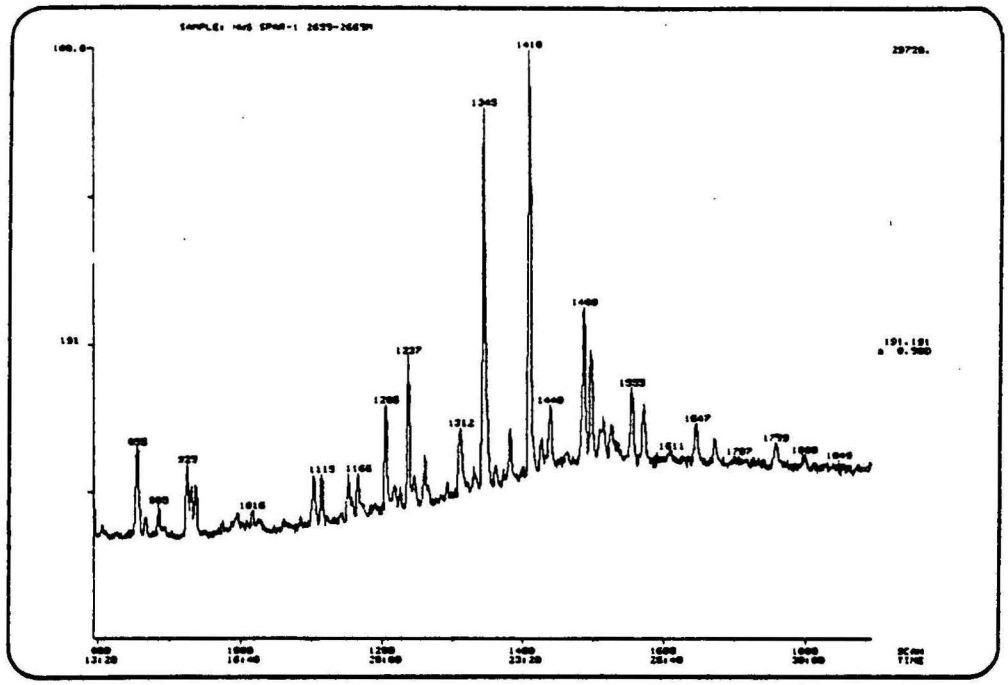
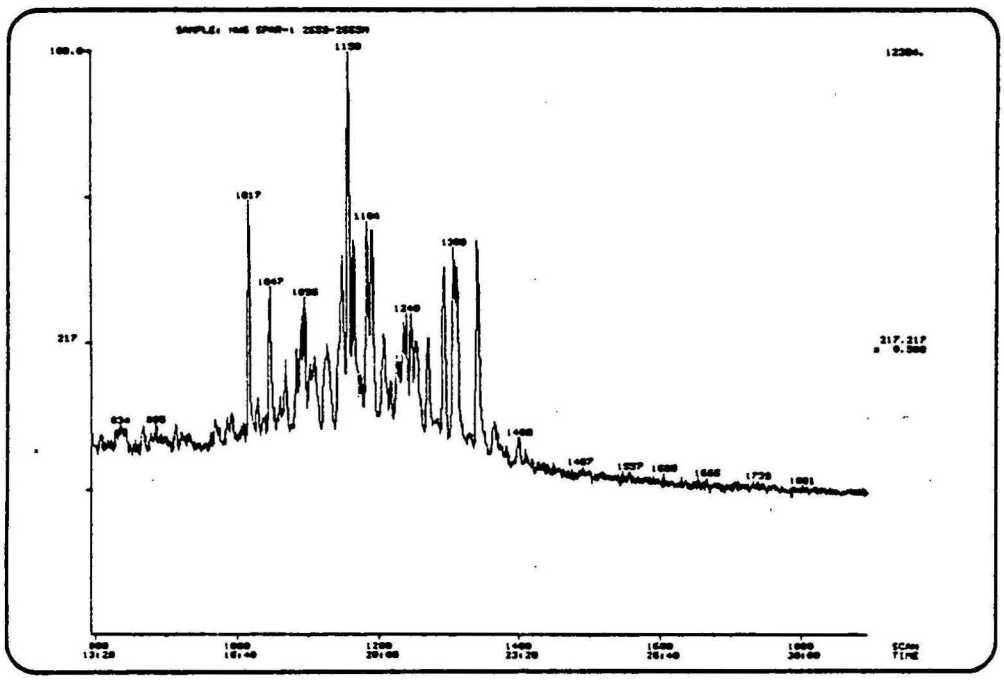
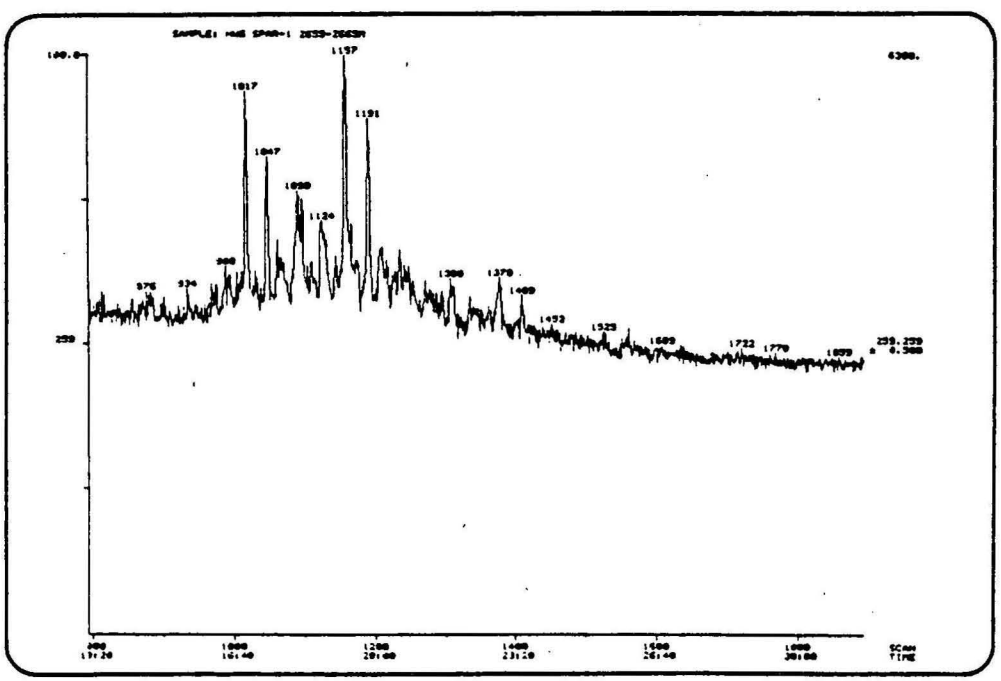


Figure IV. 3.2(

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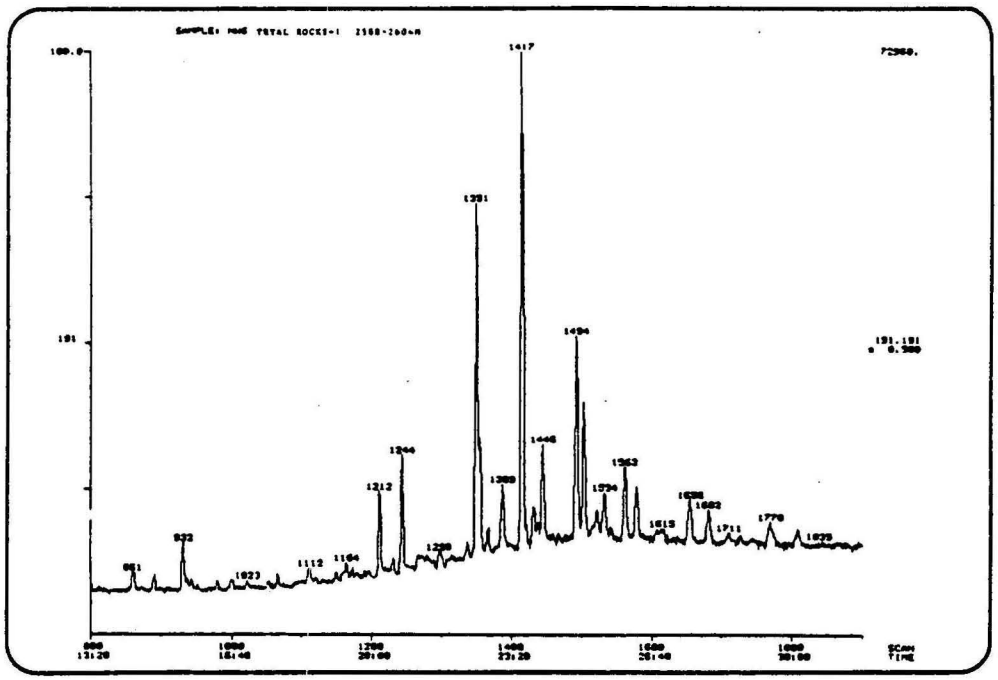


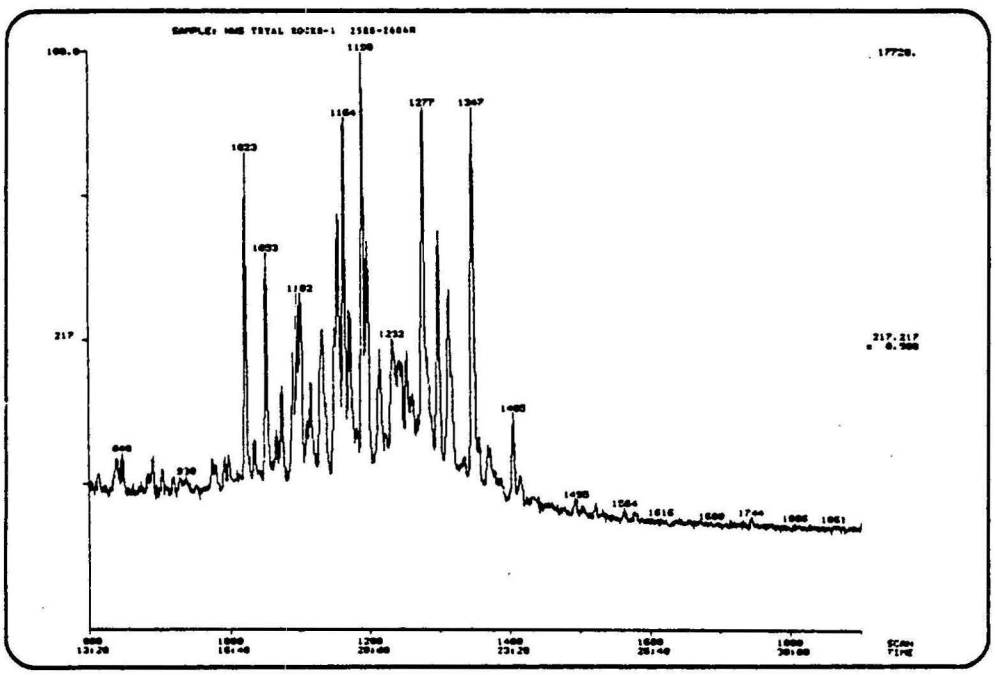


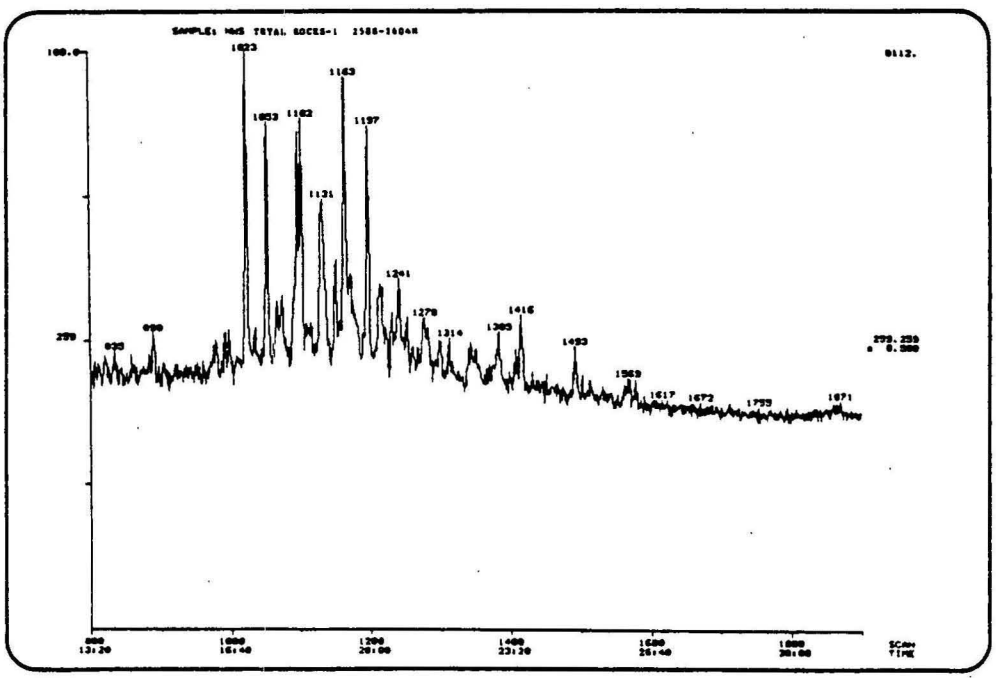


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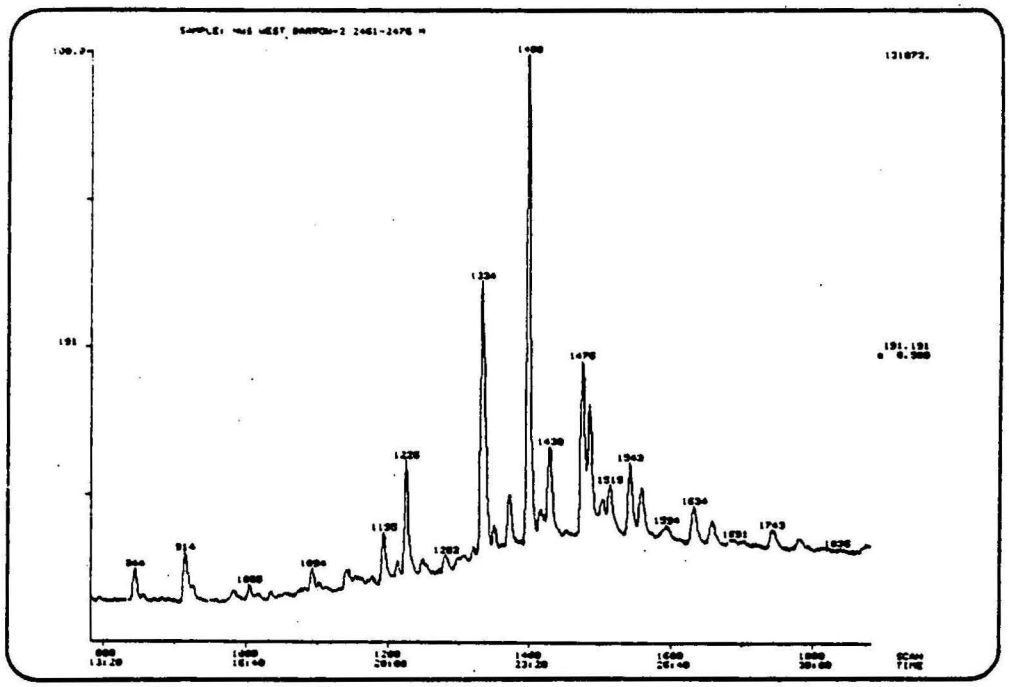
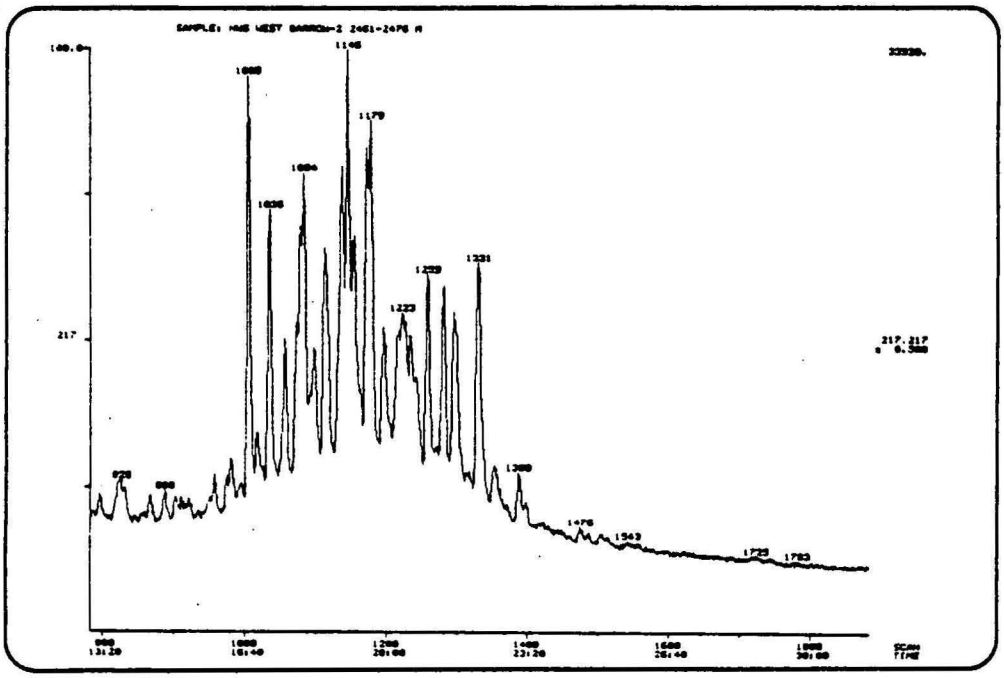




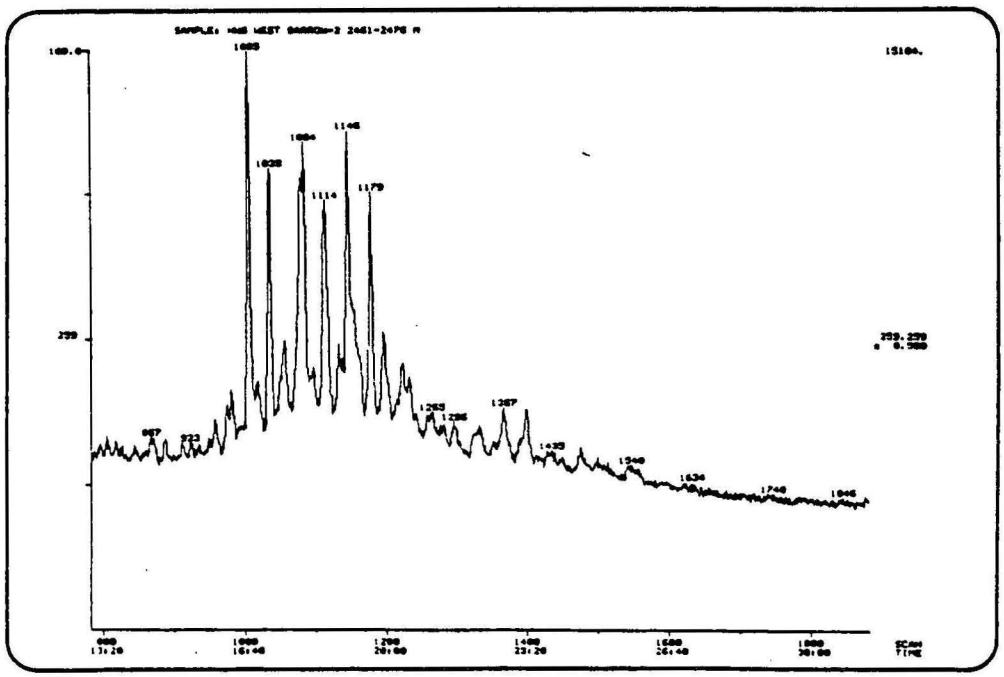
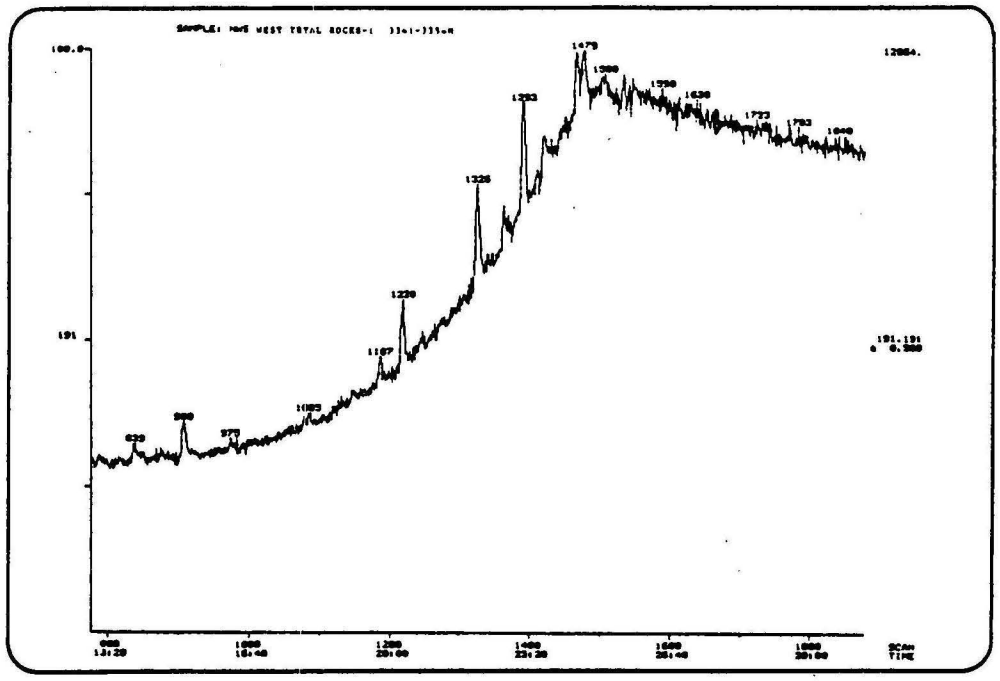
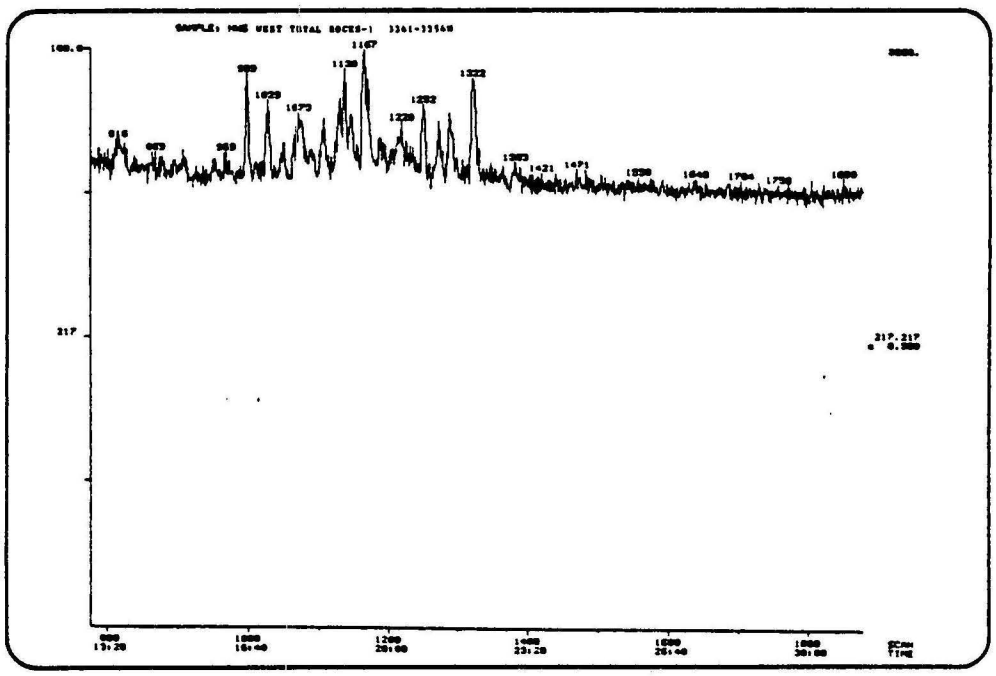


Figure IV. 3.23





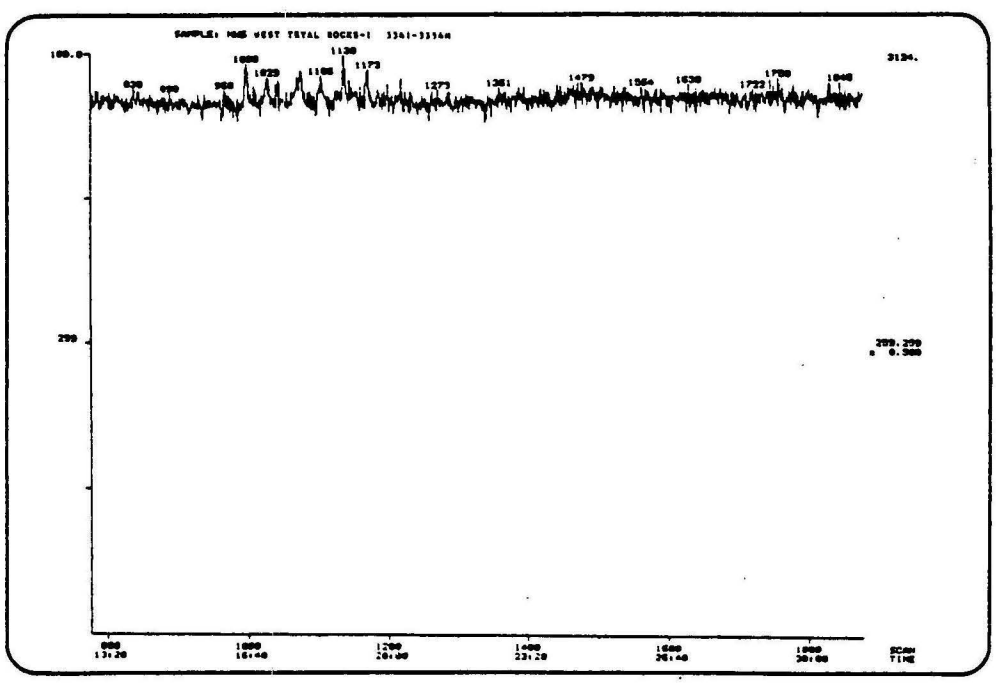
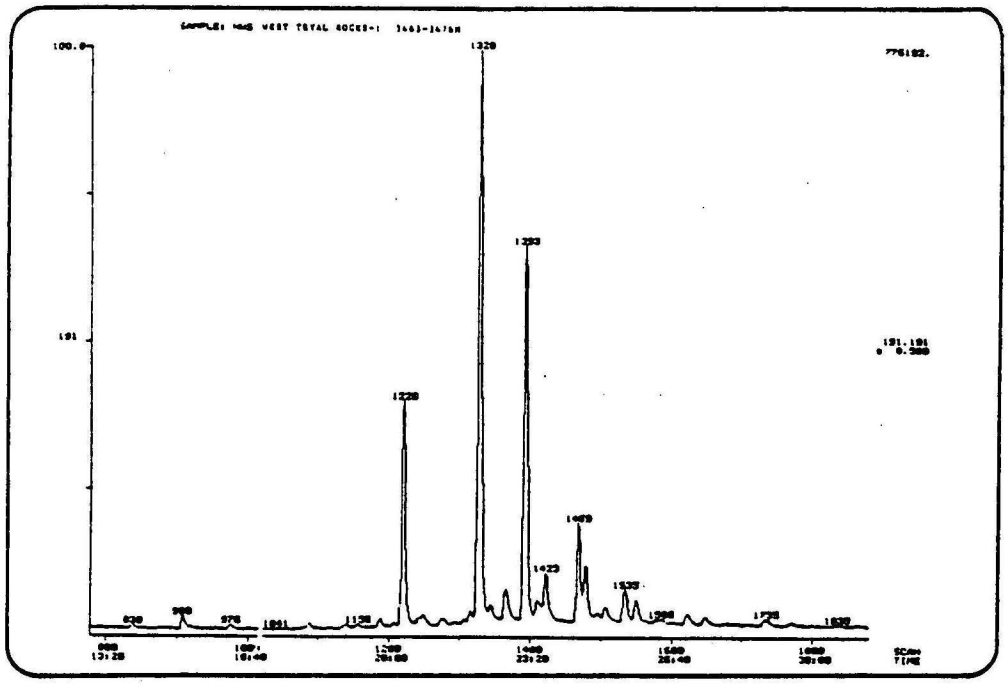
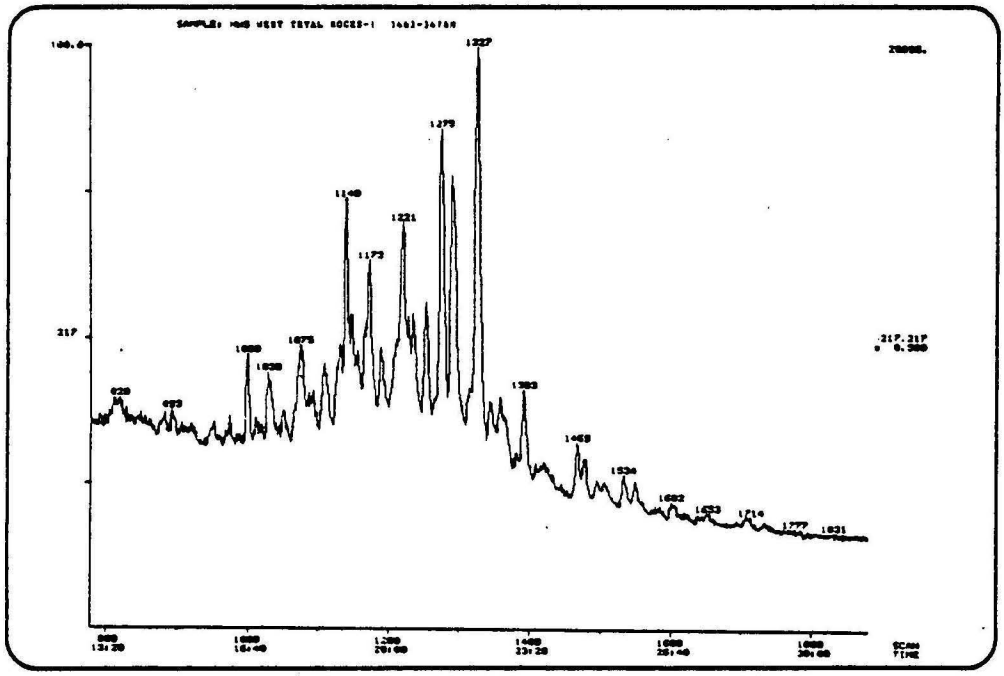


Figure IV. 3.24





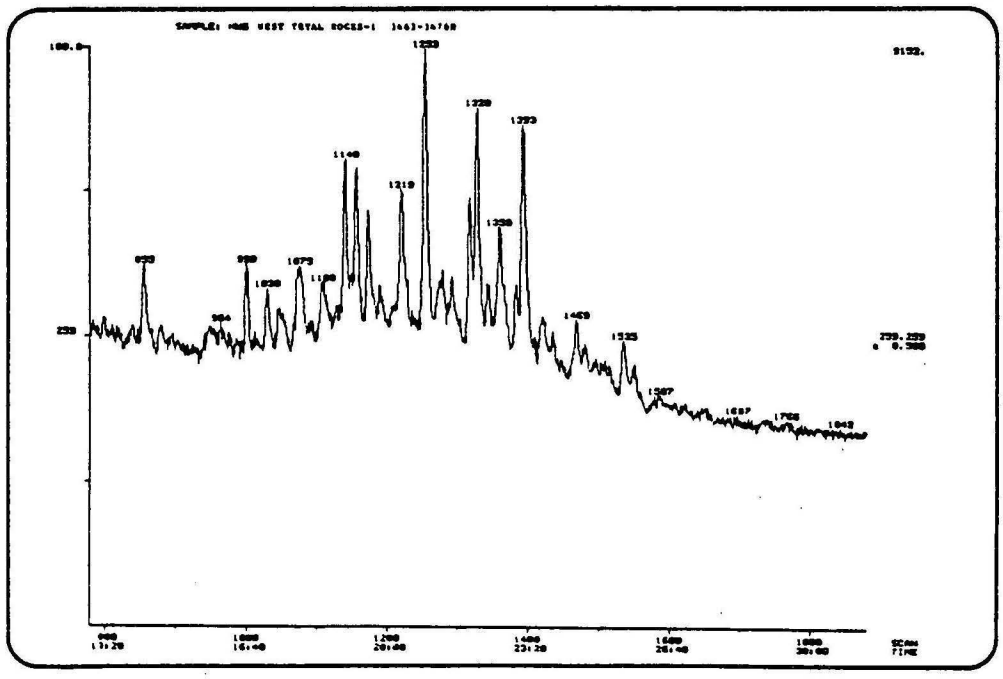
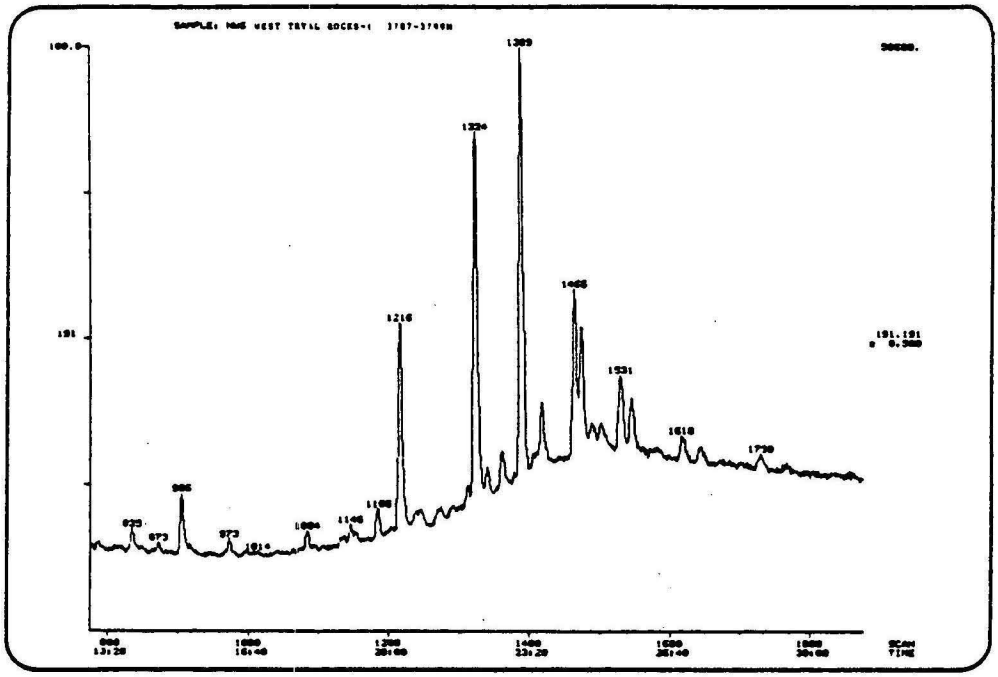
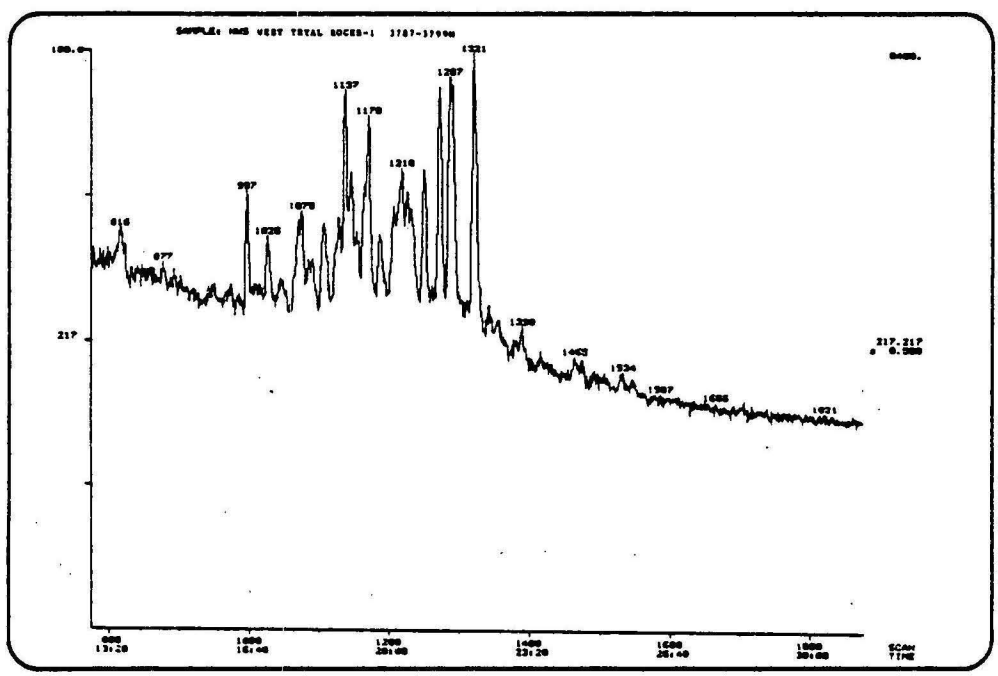


Figure IV. 3.25





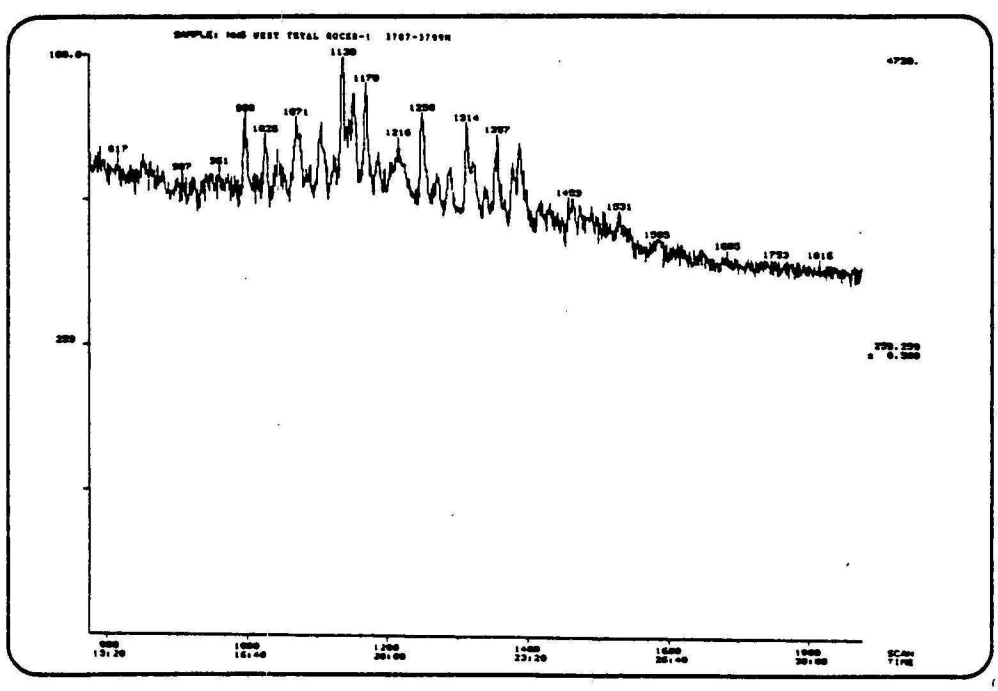
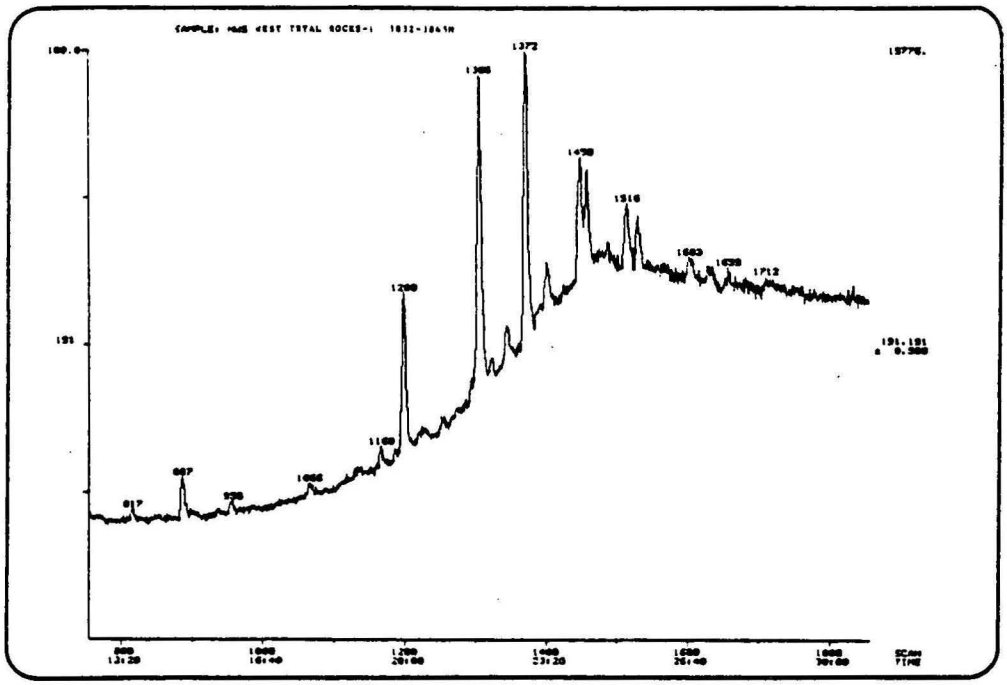
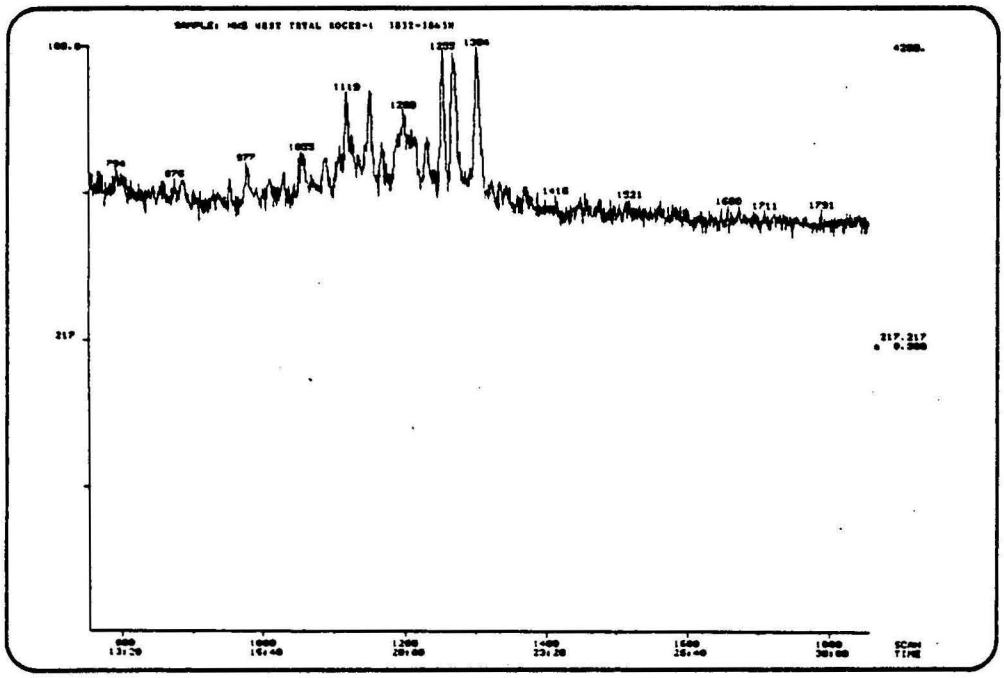


Figure IV. 3.26





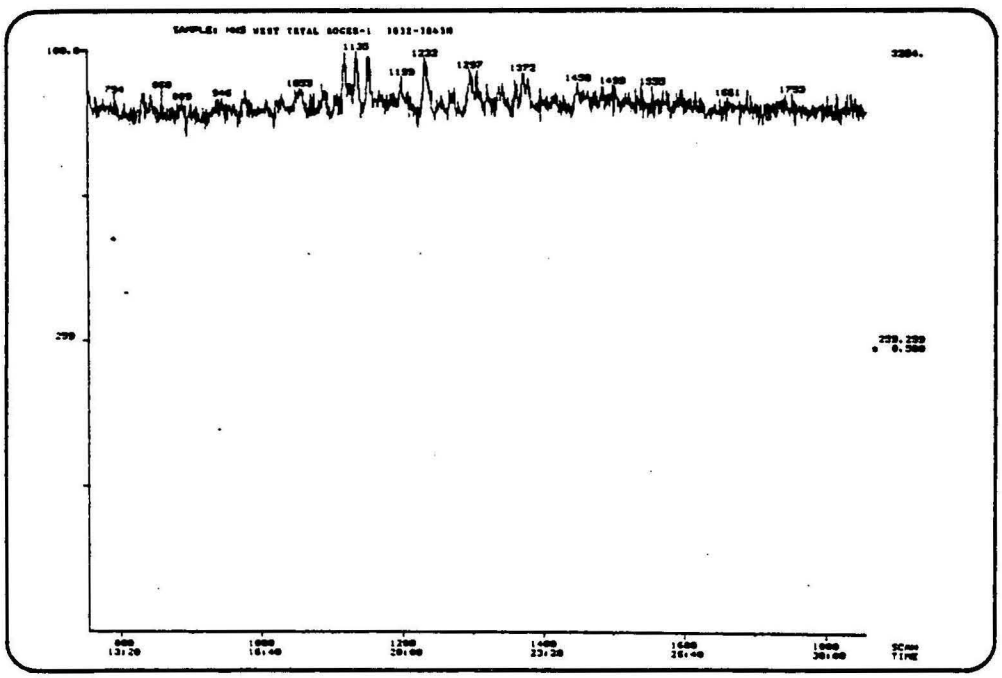
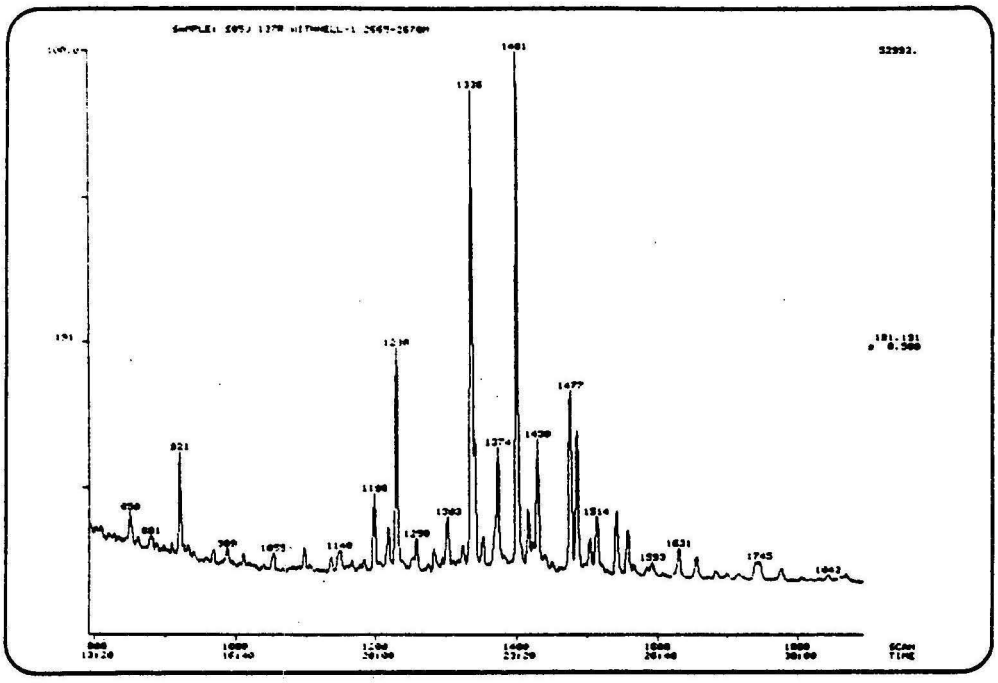
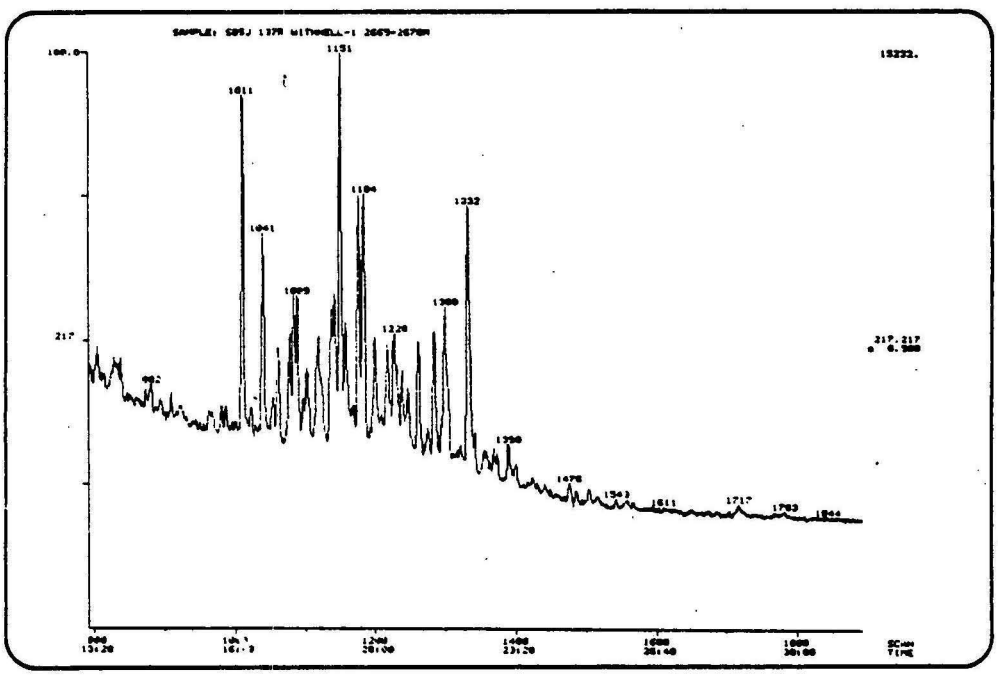


Figure IV. 3.27





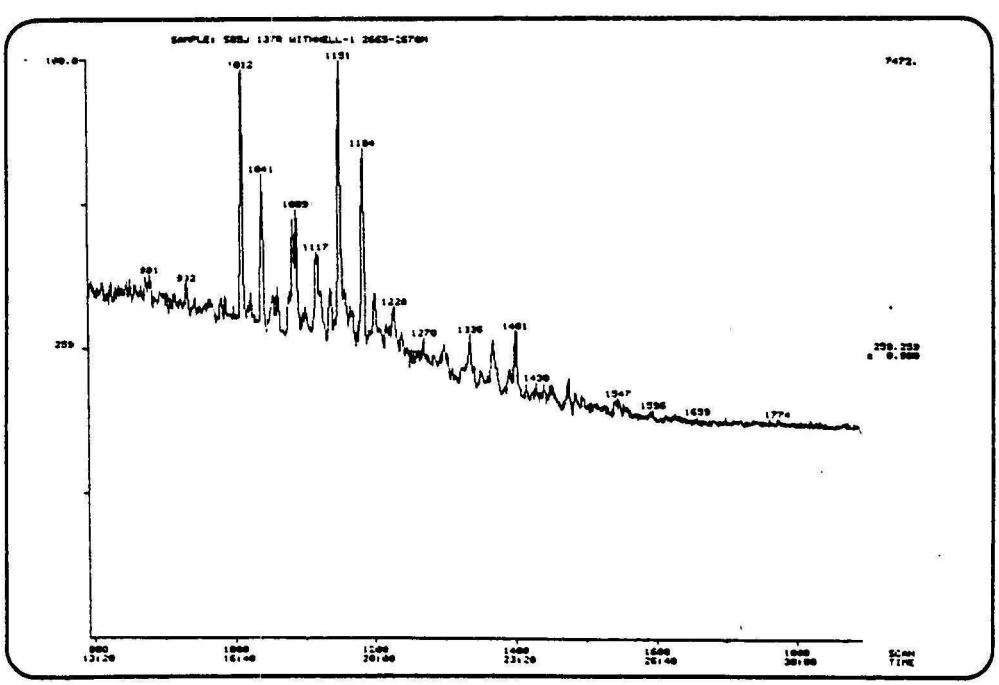


Figure IV. 3.28

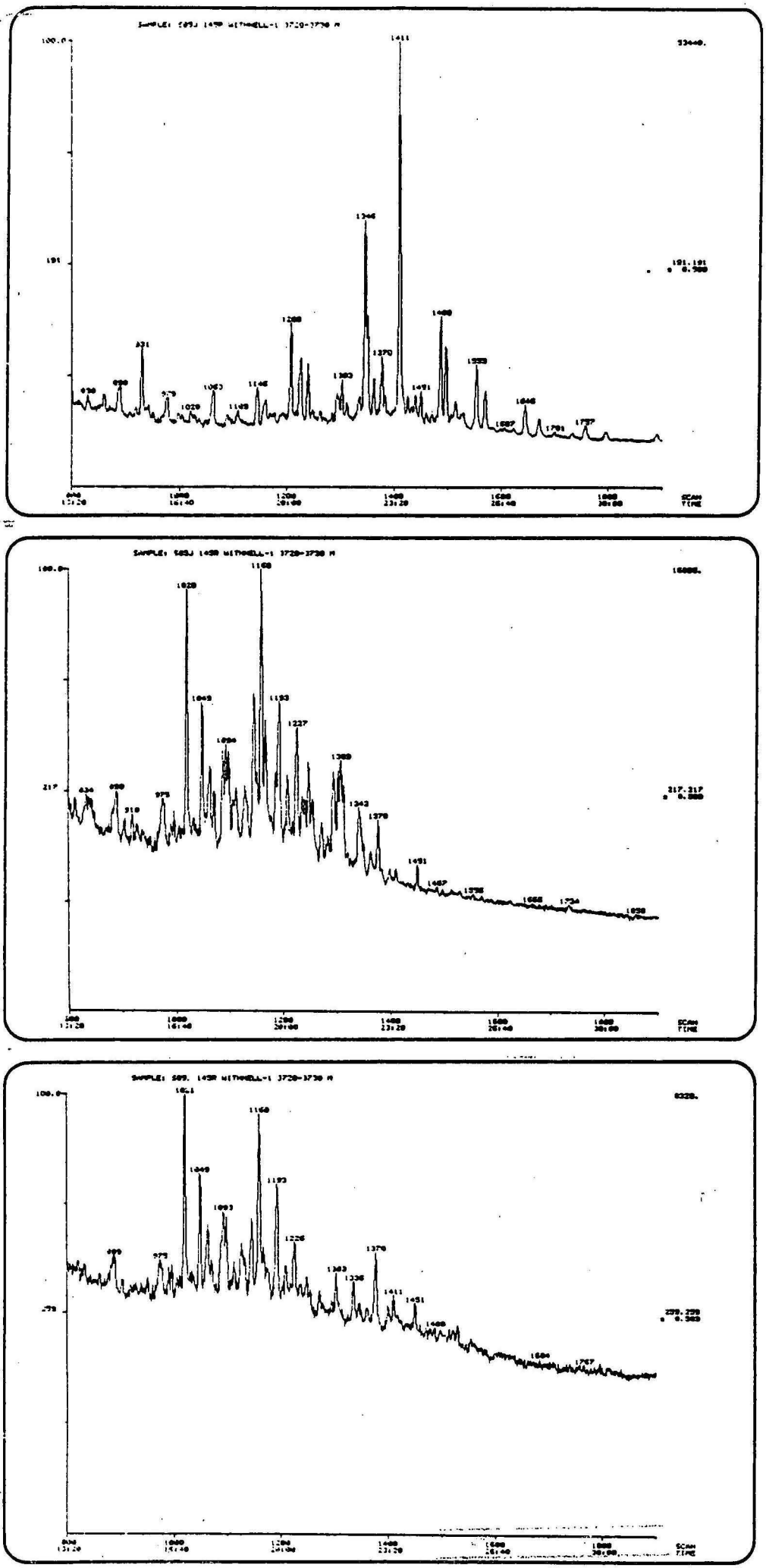


Figure IV. 3.29

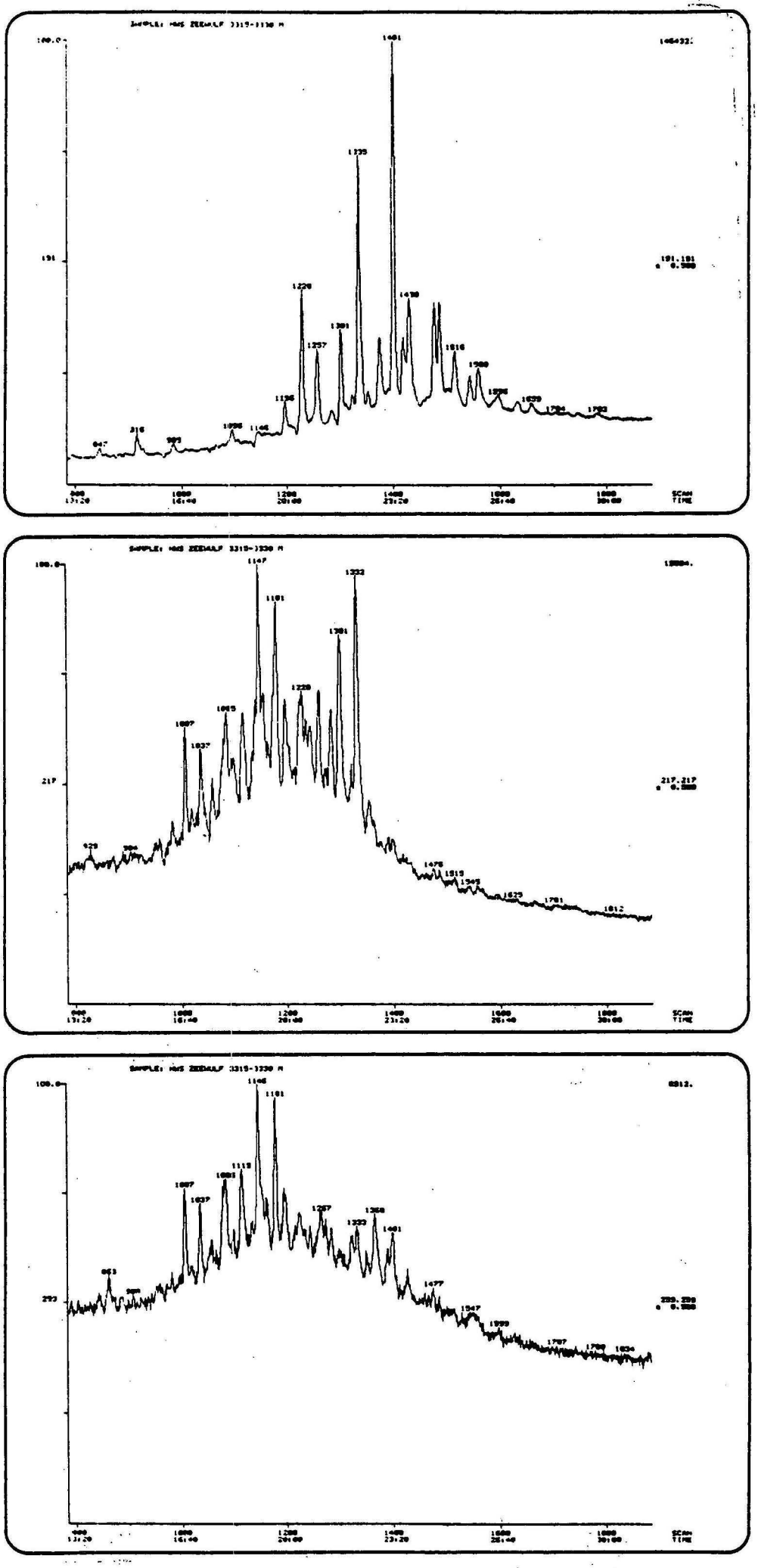


Figure IV. 3.30