# PETROFINA EXPLORATION AUSTRALIA S. A.

FINA

# MUDSKIPPER - 1

W1032

# WELL COMPLETION REPORT

## VOLUME 1
## ( BASIC DATA ) AND
## VOLUME 2
## ( INTERPRETATIVE DATA )

W1032

PETROFINA EXPLORATION AUSTRALIA S.A.



# MUDSKIPPER-1

## WELL COMPLETION REPORT

## VOLUME I

## BASIC DATA

GL/90/059
AH/JMQ/PhL/kl
29 November 1990

# MUDSKIPPER-1
# WELL COMPLETION REPORT
# BASIC DATA
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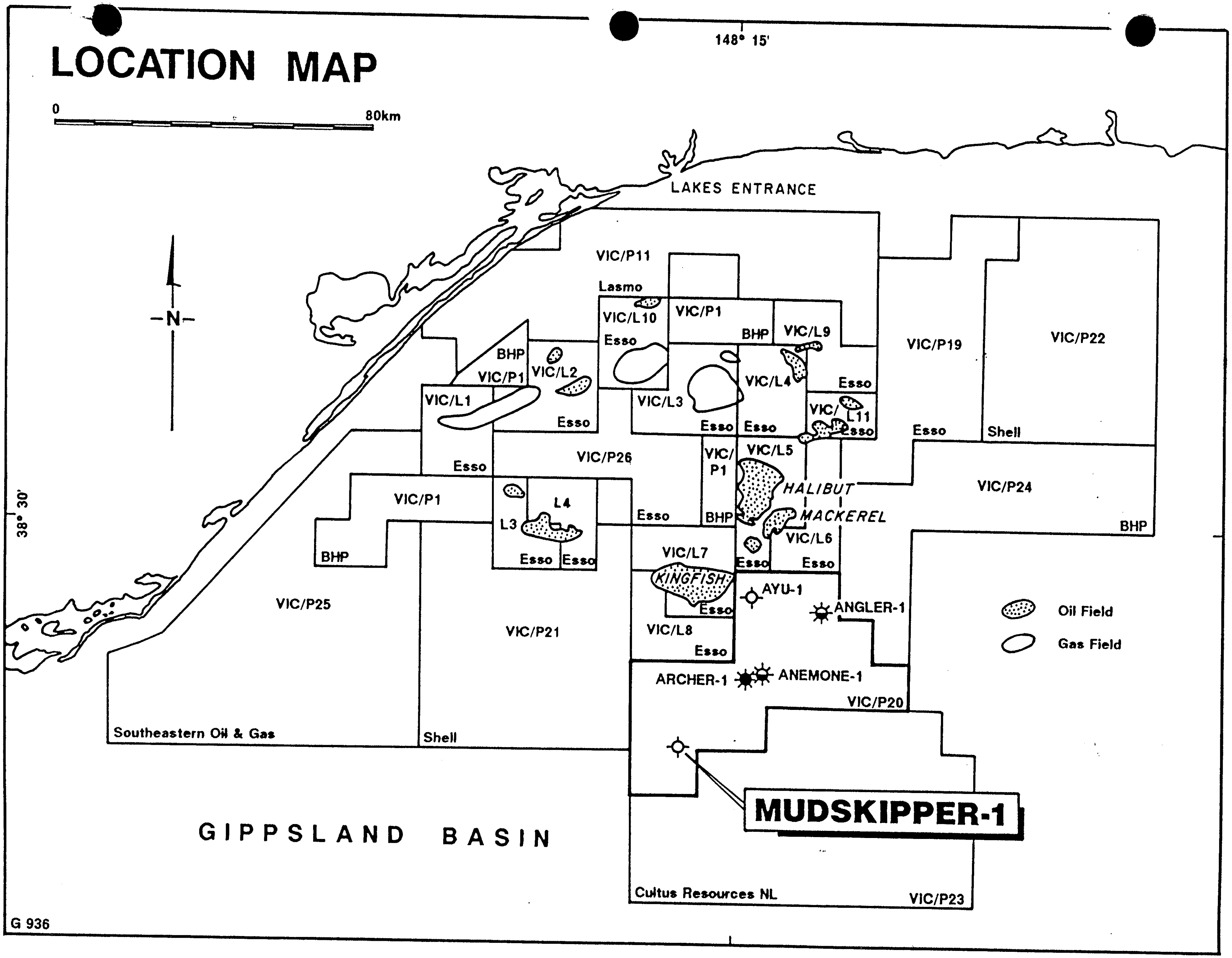
## SUMMARY

Exploration well Mudskipper-1 was drilled in Permit VIC/P20 in the Gippsland Basin, offshore Victoria, south-eastern Australia. The Joint Venture partners for the operation were:

| | | |
|---|---|---|
| Petrofina Exploration Australia S.A. | 30% | (Operator) |
| Japex Gippsland Limited | 30% | |
| Overseas Petroleum and Investment Corporation | 30% | |
| Bridge Oil Limited | 10% | |

Mudskipper-1 was spudded on 11 June 1990 using the semi-submersible rig Zapata Arctic. It reached a total depth of 1631m (drillers) on 20 June 1990. No hydrocarbon zones were encountered and Mudskipper-1 was plugged and abandoned on 25 June 1990 as a dry well.



LOCATION MAP
0
80km
N
148° 15'
38° 30'
LAKES ENTRANCE
VIC/P11
Lasmo
VIC/L10
Esso
VIC/P1
BHP
VIC/L9
VIC/P19
VIC/P22
BHP
VIC/P1
VIC/L2
VIC/L1
Esso
VIC/L3
Esso
Esso
VIC/L4
Esso
VIC/ L11
Esso
Esso
Shell
VIC/P26
VIC/ P1
VIC/L5
HALIBUT
MACKEREL
VIC/P24
VIC/P1
L4
L3
Esso
Esso
Esso
BHP
VIC/L6
Esso
BHP
BHP
VIC/L7
KINGFISH
Esso
Esso
AYU-1
ANGLER-1
VIC/P25
VIC/P21
VIC/L8
Esso
Oil Field
Gas Field
ARCHER-1
ANEMONE-1
VIC/P20
Southeastern Oil & Gas
Shell
MUDSKIPPER-1
GIPPSLAND BASIN
Cultus Resources NL
VIC/P23
G 936


FIGURE 1

# WELL DATA SUMMARY: MUDSKIPPER-1

| | |
|---|---|
| **Well:** | Mudskipper-1 |
| **Permit:** | VIC/P20, Gippsland Basin, Australia |
| **Operator:** | Petrofina Exploration Australia S.A. |
| **Latitude:** | 38°54'31.6" S |
| **Longitude:** | 148°07'58.2" E |
| **UTM:** | X = 598,173.2 E |
| | Y = 5,692,721.7 N |
| **KBE:** | 27m |
| **WD:** | 74m |
| **Type of Rig:** | Semi-Submersible |
| **Name:** | Zapata Arctic |
| **Contractor:** | Zapata Offshore Company |
| **Spud Date:** | 11 June 1990 |
| **Date Reached TD:** | 20 June 1990 |
| **Date Plugged and Abandoned:** | 25 June 1990 |
| **Drilled Depth:** | 1631m (drillers) |
| | 1620m (loggers) |
| **Well Status:** | Plugged and abandoned. Dry well. |

## GEOLOGICAL SAMPLING

### CUTTINGS SAMPLES

| Sample Type | No. of Sets | Addressee | Sample Interval |
|---|---|---|---|
| Washed and dried | 3 | PEXAUS | 10,5* |
| | 1 | Japex, Tokyo | 10,5* |
| | 1 | OPIC, Taiwan | 10,5* |
| | 1 | Bridge Oil, Sydney | 10,5* |
| | 1 | DITR, Melbourne | 10,5* |
| | 1 | BMR, Canberra | 10,5* |
| Unwashed | 2 | PEXAUS | 10,5* |
| Canned Geochemical | 1 | Amdel | 10** |
| | 1 | PSA, Brussels | 10** |

* 10m intervals from 350-1450m, 5m intervals from 1450-1631m

** from 1450-1631m

## CUTTINGS DESCRIPTION
## MUDSKIPPER-1

| | |
|---|---|
| Seafloor-355m | Drilled without riser. Drill cuttings returned to seafloor. |
| 355-615m | CALCARENITE: off white to light grey, occasionally medium grey, loose, very friable, soft, common to abundant fossil fragments, trace glauconite, good porosity, amorphous. |
| 615-671m | Predominantly CALCARENITE: as above with common to abundant glauconite, and common pyrite, interbedded with very minor MARL: light grey, soft, sticky, dispersive in part, argillaceous, trace to common glauconite, amorphous, grades in part to Calcilutite. |
| 671-764m | Massive MARL: light olive grey, soft to moderately hard, dispersive in part, argillaceous, trace glauconite, trace pyrite, amorphous to subblocky, grades in part to Calcilutite. |
| 764-822m | MARL: predominantly as above, interbedded with CLAYSTONE: predominantly as for Marl, but becoming increasingly argillaceous. |
| 822-937m | CLAYSTONE: light olive grey, soft to firm, silty in part, very calcareous, trace fossil fragments, trace fine disseminated pyrite, amorphous to subblocky, grading to Marl, as above. |
| 937-1050m | Predominantly MARL: light to medium grey, dispersive, soft to moderately firm, common pyrite, grading to Claystone, as above, interbedded with minor CLAYSTONE: light to medium grey as above, |
| 1050-1120m | Massive CLAYSTONE: as above with abundant glauconite. |
| 1120-1175m | CLAYSTONE: as above interbedded with minor MARL: as above. |

| | |
|---|---|
| 1175-1222m | Predominantly CLAYSTONE: medium grey, firm to hard, very calcareous, common pyrite, common glauconite, silty in part, blocky to subfissile, with minor interbedded SILTSTONE: medium grey, firm to moderately hard, very argillaceous, very calcareous, subblocky to subfissile. |
| 1222-1362m | CLAYSTONE: as above with very minor SILTSTONE: as above. |
| 1362-1475m | Predominantly CLAYSTONE: as above, becoming shaley, with trace to very minor LIMESTONE: off white to light grey, firm to hard, argillaceous in part, microcrystalline, grading in part to Calcarenite. |
| 1475-1504.5m | SILTSTONE: red brown, soft to firm, very dispersive, very argillaceous, sandy in part, abundant ferruginous material, amorphous, with interbedded SANDSTONE: clear to red brown, medium to coarse, subrounded to well rounded, moderately sorted, common argillaceous material, common ferruginous material, calcareous in part, loose, poor porosity, no shows. |
| 1504.5-1586m | Massive SANDSTONE: clear, translucent to light brown, fine to very coarse, subangular to rounded, poorly sorted, occasional pyrite, loose, friable, no shows. |
| 1586-1612m | SANDSTONE: light to medium grey, fine to pebbly, soft to firm, poorly to well sorted, subangular to subrounded, common argillaceous matrix, abundant mica and altered feldspars interbedded with SILTSTONE: light to medium brown, firm to hard, common argillaceous matrix, sandy in parts, common mica. |
| 1612-1631m | GRANITE: clear to light brown, pink, hard to very hard, abundant quartz, feldspars and biotite, common chlorite and muscovite, very angular grains, weathered in part. |

## SIDEWALL CORE DESCRIPTION

| WELL: MUDSKIPPER | LOCATION: VIC/P20 | GEOLOGIST: A. HODGSON |
|---|---|---|
| RUN NUMBER: 1 | TYPE: | HOLE SIZE: 8½" |

| DEPTH (m) | RECOVERY (inches) | LITHOLOGICAL DESCRIPTION | | VISIBLE POROSITY | SHOWS |
|---|---|---|---|---|---|
| 1615 | ½" | GRANITE: | red brown, hard, abundant weathered white feldspar, abundant quartz, common muscovite and biotite. | | Nil |
| 1613.5 | 1 | GRANITE: | off white, light grey, black, hard, brittle, abundant altered feldspars, abundant quartz, common biotite. | Nil | Nil |
| 1607.5 | 3/4 | SANDSTONE: | light grey, fine to pebbly, poorly sorted, subangular to subrounded, common well rounded pebbles, abundant light grey argillaceous matrix, abundant very fine mica, nil porosity, soft, no shows. | Nil | Nil |
| 1603.5 | ½" | SANDSTONE: | light to medium grey, very fine, well sorted, subangular to subrounded, common argillaceous matrix, abundant mica, firm, poor porosity, no shows. | Nil-Poor | Nil |
| 1600.5 | 1 | SANDSTONE: | off white, medium grey, fine to very coarse, subangular to subrounded, abundant altered feldspars, abundant mica. | Nil | Nil |
| 1598.5 | ½" | SANDSTONE: | medium to dark grey, predominantly as above with abundant argillaceous matrix. | Nil | Nil |
| 1597 | 1 | SANDSTONE: | light grey, very fine to very coarse, poorly sorted, subangular to subrounded, common argillaceous matrix, common biotite and muscovite. | Nil-Poor | Nil |
| 1590.5 | ½" | SANDSTONE: | as above. | Nil | Nil |
| 1587.5 | ½" | SILTSTONE: | medium brown, firm to hard, common argillaceous matrix, sandy in parts, common mica. | Nil | Nil |
| 1557 | ½" | SANDSTONE: | light brown, medium grey, fine to coarse, subangular to subrounded, poorly sorted, abundant argillaceous matrix, common mica, soft. | Nil | Nil |
| 1525.5 | 1 | SANDSTONE: | as above. | | |
| 1524.5 | 1 | SANDSTONE: | light grey, fine, well sorted, subangular to subrounded, common biotite, common glauconite, common chlorite, trace argillaceous matrix, hard | Moderate-Poor | Nil |

## SIDEWALL CORE DESCRIPTION

| **WELL:** MUDSKIPPER-1 | **LOCATION:** VIC/P20 | **GEOLOGIST:** A. HODGSON |
|---|---|---|
| **RUN NUMBER:** 1 | **TYPE:** | **HOLE SIZE:** 8½" |

| DEPTH (m) | RECOVERY (inches) | LITHOLOGICAL DESCRIPTION | VISIBLE POROSITY | SHOWS |
|---|---|---|---|---|
| 1524 | EMPTY | | | |
| 1511 | ½" | SANDSTONE: light grey, light brown, fine to coarse, subangular to subrounded, poorly sorted, common argillaceous matrix, common weathered feldspars, firm. | Nil-Poor | Nil |
| 1506 | 1½" | SANDSTONE: as above with abundant fine mica, hard. | Nil-Poor | Nil |
| 1503.5 | 1 | SANDSTONE: as above. | Moderate | Nil |
| 1500 | 1½" | SILTSTONE: medium to dark red brown, argillaceous, abundant very fine mica, sandy in parts, ferruginous, hard. | Nil | Nil |
| 1498.5 | 1 | SANDSTONE: off white, light grey, fine to very coarse, predominantly coarse, moderately sorted, subangular to subrounded, common argillaceous matrix, common muscovite, firm. | Moderate-Good | Nil |
| 1477.5 | 2 | SILTSTONE: dark red brown, firm to hard, very argillaceous, common quartz sand grains, ferruginous, common mica. | Nil | Nil |
| 1472 | 2 | SILTSTONE: as above. | Nil | Nil |
| 1450 | 2 | SILTSTONE: as above. | Nil | Nil |
| 1300 | 2 | SILTSTONE: as above. | Nil | Nil |
| 1235 | 1½" | SILTSTONE: light grey, light brown, argillaceous, micromicaceous, laminated, common chlorite, calcareous, hard. | Nil | Nil |
| 1210 | 2 | CLAYSTONE: light to medium grey, firm to hard, very calcareous, massive. | Nil | Nil |
| 1180 | 2 | CLAYSTONE: as above. | Nil | Nil |
| 1165 | Lost | | | |
| 1000 | 2 | CLAYSTONE: as above. | Nil | Nil |
| 950 | 2 | CLAYSTONE/MARL: light to medium grey, hard massive, argillaceous, calcareous. | Nil | Nil |
| 850 | 2 | MARL: as above. | Nil | Nil |
| 800 | 2 | MARL: as above. | Nil | Nil |

Fired 30 bullets
Recovered 28 cores
Lost 1
One empty

## HYDROCARBON SHOWS
## MUDSKIPPER-1

### GAS READINGS (%)

| DEPTH | C1 | C2 | C3 | IC4 | NC4 |
|---|---|---|---|---|---|
| 355-620m | nil | nil | nil | nil | nil |
| 620-681m | nil-1.00 | nil | nil | nil | nil |
| 681-780m | Tr-0.20 | nil | nil | nil | nil |
| 780-820m | Tr-0.02 | nil | nil | nil | nil |
| 820-937m | Tr-0.12 | nil | nil | nil | nil |
| 937-1030m | Tr-0.70 | nil | nil | nil | nil |
| 1030-1120m | Tr-0.32 | nil | nil | nil | nil |
| 1120-1180m | Tr-0.50 | nil | nil | nil | nil |
| 1180-1225m | Tr-0.50 | nil | nil | nil | nil |
| 1225-1344m | Tr-0.03 | nil | nil | nil | nil |
| 1344-1473m | nil-0.03 | nil | nil | nil | nil |
| 1473-1502m | nil-0.03 | nil | nil | nil | nil |
| 1502-1612m | nil-0.03 | nil | nil | nil | nil |
| 1612-1631m | nil-0.03 | nil | nil | nil | nil |

### FLUORESCENCE

No hydrocarbon shows were recorded in Mudskipper-1.

## WIRELINE LOGS

| SUITE NO. | LOG | INTERVAL |
|---|---|---|
| 1 | DLL/AS/GR/CAL/SP | 679-341m |
| 2 | AS/DLL/MSFL/GR | 1615.5-668m |
| | LDL/CNL/NGT/GR | 1617-1370m |
| | FMS/GR | Failed at Surface |
| | VSP | 1620-250m |
| | CST/GR | Shot 30 bullets<br>Recovered 28 |

# APPENDIX 1

APPENDIX 1

WELL COMPLETION REPORT

MUDSKIPPER-1

BASIC DATA

# APPENDIX 1

MICROPALAEONTOLOGY

# MICROPALAEONTOLOGICAL ANALYSIS, MUDSKIPPER-1, GIPPSLAND BASIN

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August, 1990.

## II. INTRODUCTION

A total of 10 sidewall core samples have been scrutinized for foraminifera from the interval 800m to 1472m in Mudskipper-1. Fossil assemblages identified in the well section have been plotted on the distribution chart (Appendix No. 2).

## APPENDIX NO. 1: SUMMARY OF MICROPALAEONTOLOGICAL DATA, MUDSKIPPER-1

| SAMPLE (mKB) | FORAM YIELD | FORAM PRESERV. | FORAM DIVERSITY |
|---|---|---|---|
| SWC30, 800 | moderate/low | moderate/good | moderate |
| SWC29, 850 | high | good | high |
| SWC28, 950 | high | moderate | moderate/high |
| SWC27, 1000 | high | moderate/good | high |
| SWC25, 1180 | high | moderate/good | moderate |
| SWC24, 1210 | high | moderate/good | high |
| SWC23, 1235 | very low | very poor | low |
| *SWC22, 1300 | very low | poor | very low |
| *SWC21, 1450 | very low | poor | low |
| #SWC20, 1472 | very low | poor | very low |

* sample comprises contaminants only.

# sample includes both in-situ taxa and contaminants.

| SAMPLE TYPE OR NO. | SWC | SWC | SWC | SWC | SWC | SWC | SWC | SWC | SWC | SWC |
|---|---|---|---|---|---|---|---|---|---|---|
| FOSSIL NAMES / DEPTHS | 800m | 850m | 950m | 1000m | 1180m | 1210m | 1235m | 1300m | 1450m | 1472m |
| BENTHONIC FORAMINIFERA | | | | | | | | | | |
| Cibicides spp. | / | / | | 0 | 0 | 0 | • | | | |
| Fissurina spp. | / | 0 | 0 | 0 | | 0 | | | c• | |
| Bulimina pupoides | • | | | • | ● | | | | | |
| Siphouvigerina proboscidea | ● | | / | | | | | | | |
| Brizalina spp. | 0 | ● | ● | ● | ● | ● | | | c• | |
| Dentalina spp. | / | | • | | • | | | | | |
| Nodosaria spp. | 0 | | | | | | | | | |
| Lenticulina spp. | / | 0 | / | / | | 0 | | | | / |
| Globocassidulina subglobosa | / | / | • | 0 | 0 | 0 | • | c• | | |
| Lagenonodosaria scalaris | / | 0 | | • | | • | | | | |
| Martinottiella communis | / | 0 | / | • | | / | | | | |
| Sphaeroidina bulloides | / | 0 | / | 0 | | / | | | c/ | |
| Cibicides spp. (small) | • | ● | ● | 0 | ■ | 0 | | | c/ | |
| Siphonina australis | • | | • | / | | / | | | | |
| Quinqueloculina spp. | • | / | / | / | | / | | | | |
| Cassidulina delicata/laevigata | / | 0 | 0 | ● | / | 0 | | | | |
| Pullenia aff. bulloides | • | | | | | | | | | |
| Cibicides mediocris | • | / | 0 | / | | 0 | | | c/ | |
| Pleurostomella spp. | | / | | | | | | | | |
| Lagena apiculata | | 0 | • | | | | | | | |
| Heronallenia lingulata | | / | | • | • | • | | | | |
| Textularia spp. | | • | | | | | | | | |
| Euuvigerina schwageri | | 0 | | • | | | | | | |
| Gyroidina spp. | | / | | | | / | | | | |
| Ramulina spp. | | / | | | | | | | | |
| Anomalina spp. | | / | | / | | | | | | |
| Gyroidina zelandica | | / | • | • | / | • | | | | |
| Gaudryina spp. | | • | • | • | | • | | | | |
| Cassidulinoides bradyi | | • | | | | | | | | |
| Pullenia quinqueloba | | • | | / | | | | | | |
| Nonionella spp. | | • | | | | | | | | |
| Lagena spp. | | • | | • | | • | | | | |
| Hanzawaia spp. | | / | • | / | 0 | / | | | | |
| Pyrulina aff. cylindroides | | • | | | | / | | | | |
| Cassidulina spp. | | / | | | | | | | | |
| Quadrimorphina spp. | | • | | • | | | | | | |
| Textularia semicarinata | | | / | | | • | | | | |
| Pullenia bulloides | | | • | / | • | 0 | | | | |
| Anomalinoides procolligera | | | / | | | | | | | |
| Indeterminate nodosarids | | | • | | | | | | | |
| Lagena sulcata | | | • | | • | | | | | |
| Lagena acuticostata | | | • | 0 | | / | | | | |
| Globocassidulina spp. | | | | • | | | | | | |
| Trifarina bradyi | | | | • | / | / | | | | |
| Dorothia spp. | | | | / | | | • | | | |
| Bulimina aff. aculeata | | | | • | | | | | | |
| Textularia aff. semicarinata | | | | / | | | | | | |
| Buliminella spp. | | | | • | | | | | | |
| Euuvigerina aff. flintii | | | | / | | / | | | | |
| Glandulina spp. | | | | • | | | | | | |
| Karreria maoria | | | | • | | | | | | |
| Eponides praecinctus | | | | | • | | | | | |
| Marssonella spp. | | | | | • | | | | | |
| Parrelina spp. | | | | | | / | | | | |

• Single / Rare 0 Few ● Common ■ Dominant B Barren C Contamination

| SAMPLE TYPE OR NO. | SWC | SWC | SWC | SWC | SWC | SWC | SWC | SWC | SWC | SWC |
|---|---|---|---|---|---|---|---|---|---|---|
| FOSSIL NAMES / DEPTHS | 800m | 850m | 950m | 1000m | 1180m | 1210m | 1235m | 1300m | 1450m | 1472m |
| Indeterminate agglutinates | | | | | | · | / | | | · |
| Heronallenia spp. | | | | | | · | | | | |
| Ammodiscus spp. | | | | | | · | | | | |
| ?Guttelina spp. | | | | | | | · | | | |
| Hyperammina spp. | | | | | | | · | | | |
| ?Marssonella spp. | | | | | | | · | | | |
| Haplophragmoides spp. | | | | | | | | | | / |
| Indeterminate rotalids | | | | | | | | | | c· |
| | | | | | | | | | | |
| PLANKTONIC FORAMINIFERA | | | | | | | | | | |
| Globorotalia miozea miozea | / | 0 | / | 0 | | / | | | | |
| Praeorbulina glomerosa | / | | | | | | | | | |
| Globigerina woodi woodi | / | 0 | 0 | ■ | 0 | ● | | | | |
| Globigerinoides trilobus | / | 0 | 0 | 0 | 0 | 0 | | | c· | |
| Globigerina praebulloides | / | ● | 0 | ■ | 0 | ● | / | | | |
| Globigerinoides sicanus | / | 0 | | | c/ | | | | | |
| Turborotalia bella | / | | | / | · | · | | | | |
| Globorotalia praescitula | / | ● | 0 | ■ | 0 | 0 | | | c/ | |
| Small planktonics | 0 | ■ | ■ | ■ | ● | ● | | c· | c/ | c· |
| Globoquadrina dehiscens s.s. | | / | · | · | | / | | | | |
| Globoquadrina advena | | · | | · | | · | | | | |
| Globigerinoides spp. | | · | | | | | | | | |
| Orbulina universa | | | c· | | c· | c· | | | | c· |
| Globigerinoides aff. sicanus | | | · | | | | | | | |
| Turborotalia mayeri | | | | 0 | · | 0 | | | | |
| Globigerina woodi connecta | | | | / | / | / | | | | |
| Turborotalia spp. | | | | | / | | | | c/ | |
| Globigerina venezuelana | | | | | | 0 | | | | |
| Indeterminate planktonics | | | | | | | / | | c· | |
| Globigerina spp. | | | | | | | · | c· | c/ | |
| Turborotalia aff. mayeri | | | | | | | | c· | | |
| | | | | | | | | | | |
| OTHER SKELETAL MATERIAL | | | B | | | | | B | | B |
| Ostracods | · | / | | / | · | / | | | | |
| Fish teeth | | · | | | | | · | | · | |
| Sponge spicules | | / | | | / | / | | | | |

· Single / Rare 0 Few ● Common ■ Dominant B Barren C Contamination

# APPENDIX 2

WELL COMPLETION REPORT

MUDSKIPPER-1

BASIC DATA

# A P P E N D I X 2

PALYNOLOGY

# PALYNOLOGY OF PETROFINA MUDSKIPPER-1, GIPPSLAND BASIN, AUSTRALIA

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## II INTRODUCTION

Seventeen samples were submitted by Nick Grollmann of Petrofina for palynology. Raw data is presented in Appendix I.

The palynostratigraphic framework for the Cretaceous is most recently reviewed by Helby, Morgan and Partridge (1987). In the Tertiary, the zonal scheme was most recently published by Partridge (1976), but significant new data exists in privately circulated studies, in Harris (1985), Morgan (1988), and in Marshall and Partridge (1988). The zonal scheme used here is shown in Fig. 1 and is a combination of Helby, Morgan and Partridge (1987) and Partridge (1976). The data is easily discussed against this framework.

Organic maturity data was generated in the form of the Spore Colour Index and plotted on Fig. 2. The oil and gas windows follow the general consensus of geochemical literature. The oil window corresponds to spore colours of light-mid brown (2.7) to dark brown (3.6). This would correspond to Vitrinite Reflectance values of 0.6% to 1.3%. However, factors such as detailed kerogen type, basin type, basin history and heating curves all affect precise interpretation, and analytical machine-based maturity parameters are probably more reliable.

| | AGE | SPORE – POLLEN ZONES | DINOFLAGELLATE ZONES |
|---|---|---|---|
| Early Tertiary | Early Oligocene | P. tuberculatus | |
| Early Tertiary | Late Eocene | upper N. asperus | P. comatum |
| Early Tertiary | Late Eocene | middle N. asperus | V. extensa |
| Early Tertiary | Middle Eocene | lower N. asperus | D. heterophlycta<br>W. echinosuturata |
| Early Tertiary | Middle Eocene / Early Eocene | P. asperopolus | W. edwardsii<br>W. thompsonae |
| Early Tertiary | Early Eocene | upper M. diversus | W. ornata<br>W. waipawaensis |
| Early Tertiary | Early Eocene | middle M. diversus | |
| Early Tertiary | Early Eocene | lower M. diversus | W. hyperacantha |
| Early Tertiary | Paleocene | upper L. balmei | A. homomorpha |
| Early Tertiary | Paleocene | lower L. balmei | E. crassitabulata<br>T. evittii |
| Late Cretaceous | Maastrichtian | T. longus | M. druggii |
| Late Cretaceous | Campanian | T. lillei | I.korojonense |
| Late Cretaceous | Campanian | N. senectus | X. australis |
| Late Cretaceous | Santonian | T. pachyexinus | N. aceras<br>I. cretaceum<br>O. porifera |
| Late Cretaceous | Coniacian | C. triplex | |
| Late Cretaceous | Turonian | C. triplex | C. striatoconus |
| Late Cretaceous | Cenomanian | A. distocarinatus | P. infusorioides |
| Early Cretaceous | Albian – Late | P. pannosus | |
| Early Cretaceous | Albian – Middle | upper C. paradoxa | |
| Early Cretaceous | Albian – Early | lower C. paradoxa | |
| Early Cretaceous | Albian – Early | C. striatus | |
| Early Cretaceous | Aptian | upper C. hughesi | |
| Early Cretaceous | Aptian | lower C. hughesi | |
| Early Cretaceous | Barremian | F. wonthaggiensis | |
| Early Cretaceous | Hauterivian | F. wonthaggiensis | |
| Early Cretaceous | Valanginian | upper C. australiensis | |
| Early Cretaceous | Berriasian | lower C. australiensis | |
| Juras. | Tithonian | R. watherooensis | |

FIGURE 1 ZONATION FRAMEWORK

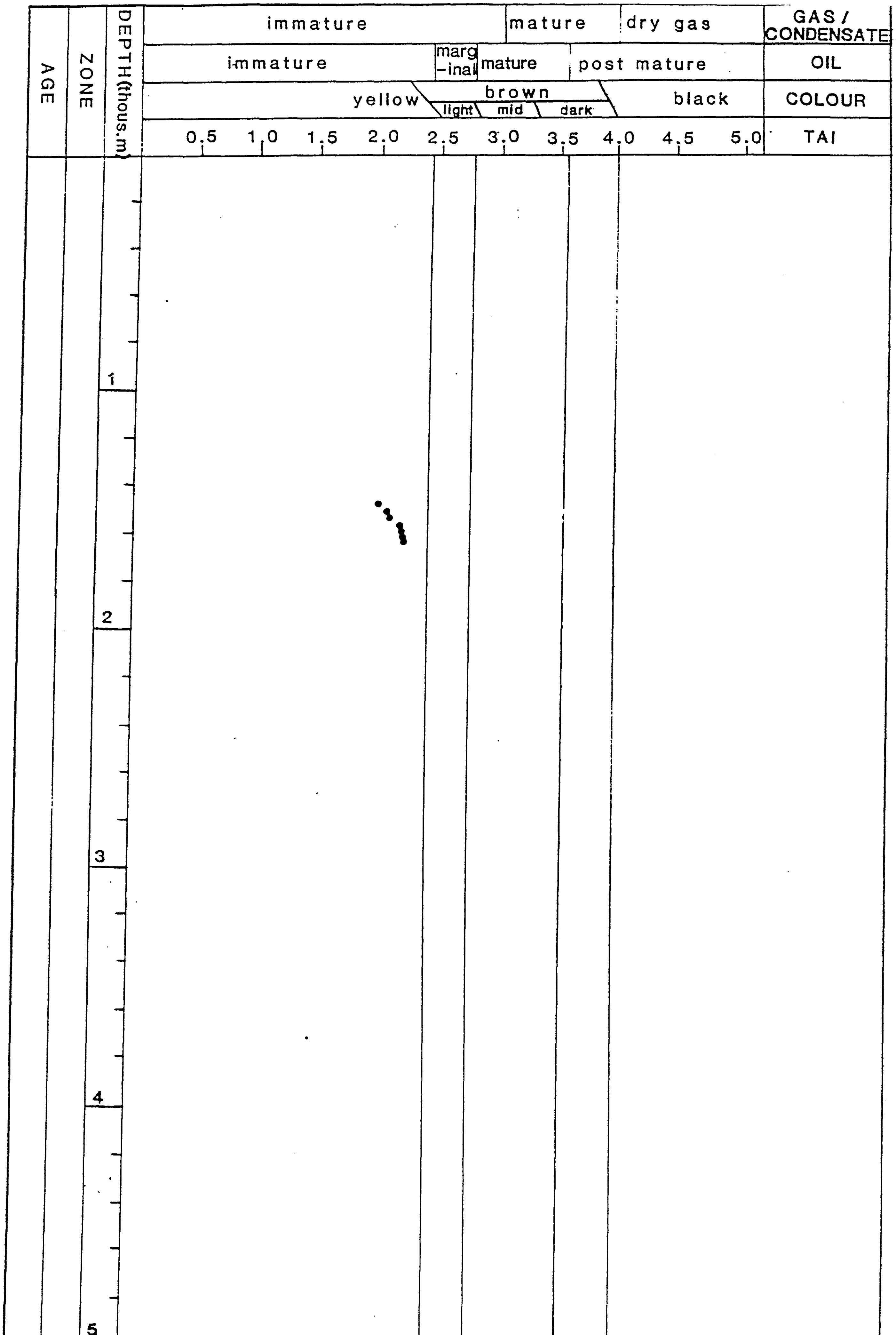



FIGURE 2 MATURITY PROFILE MUDSKIPPER 1

# MUDSKIPPER #1 palynological data

Roger Morgan, PALYNOLOGICAL CONSULTANT
Box 161, Maitland, South Australia, 5573.
phone (088) 32 2795.. ..fax (088) 32 2658

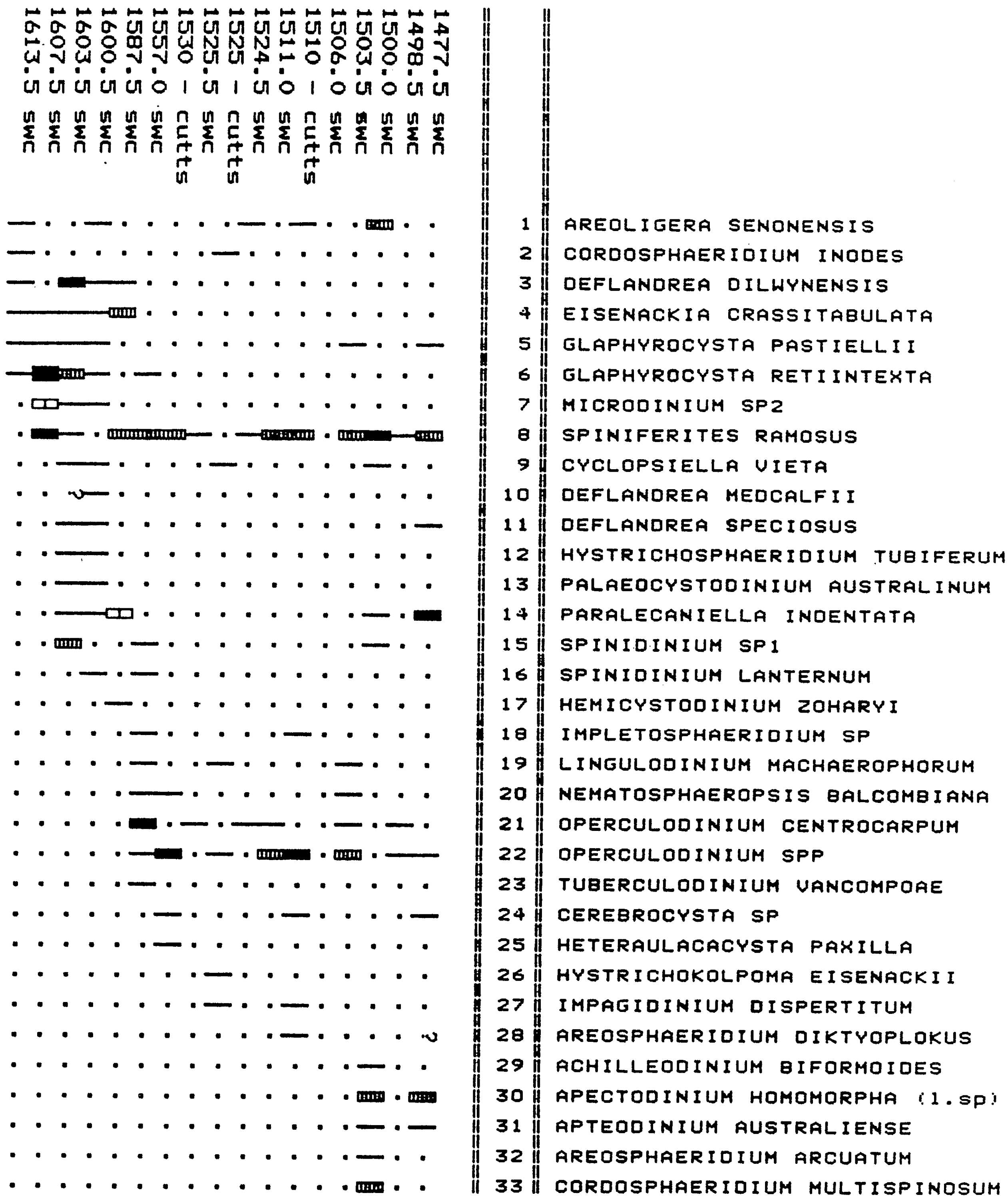
C L I E N T: PETROFINA
W E L L: Mudskipper #1
F I E L D / A R E A: Gippsland Basin

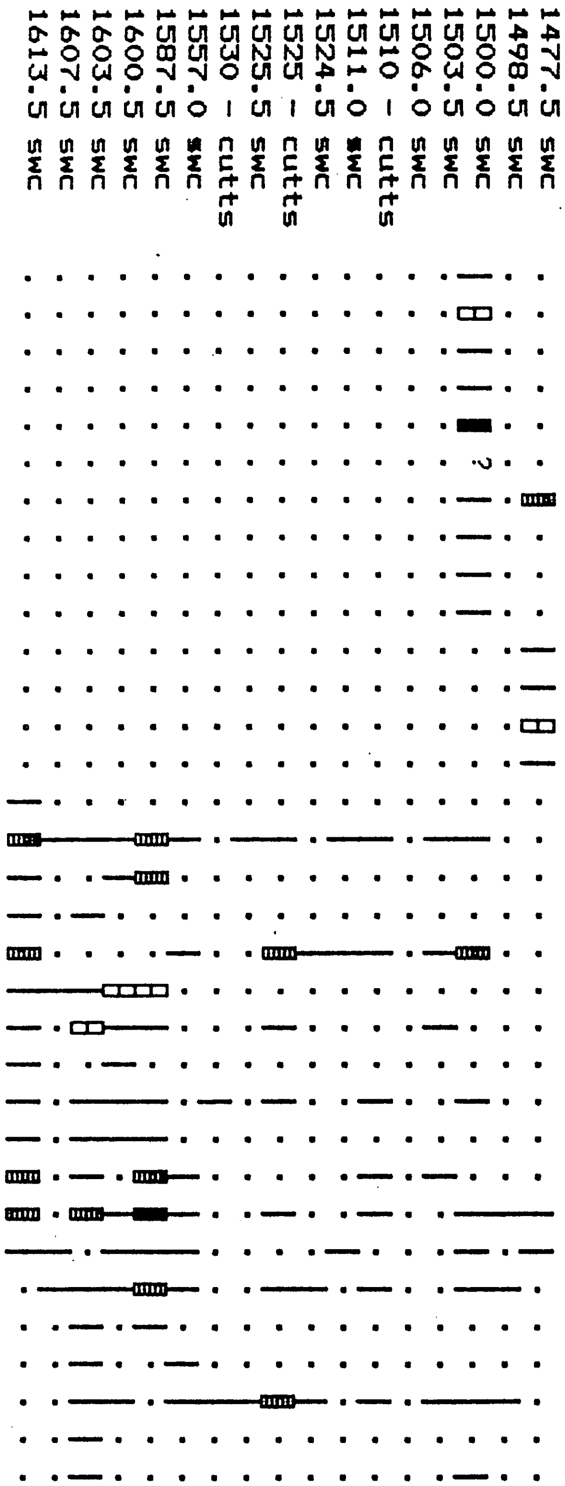
A N A L Y S T: Roger Morgan D A T E : July '90
N O T E S: all sample depths are in metres

RANGE CHART OF GRAPHIC ABUNDANCES BY LOWEST APPEARANCE..dinos & s/p

Key to Symbols

= Very Rare
= Rare
= Few
= Common
= Abundant
? = Questionably Present
. = Not Present


1477.5 SWC
1498.5 SWC
1500.0 SWC
1503.5 SWC
1506.0 SWC
1510 - cutts
1511.0 SWC
1524.5 SWC
1525 - cutts
1525.5 SWC
1530 - cutts
1557.0 SWC
1587.5 SWC
1600.5 SWC
1603.5 SWC
1607.5 SWC
1613.5 SWC
1 AREOLIGERA SENONENSIS
2 CORDOSPHAERIDIUM INODES
3 DEFLANDREA DILWYNENSIS
4 EISENACKIA CRASSITABULATA
5 GLAPHYROCYSTA PASTIELLII
6 GLAPHYROCYSTA RETIINTEXTA
7 MICRODINIUM SP2
8 SPINIFERITES RAMOSUS
9 CYCLOPSIELLA VIETA
10 DEFLANDREA MEDCALFII
11 DEFLANDREA SPECIOSUS
12 HYSTRICHOSPHAERIDIUM TUBIFERUM
13 PALAEOCYSTODINIUM AUSTRALINUM
14 PARALECANIELLA INDENTATA
15 SPINIDINIUM SP1
16 SPINIDINIUM LANTERNUM
17 HEMICYSTODINIUM ZOHARYI
18 IMPLETOSPHAERIDIUM SP
19 LINGULODINIUM MACHAEROPHORUM
20 NEMATOSPHAEROPSIS BALCOMBIANA
21 OPERCULODINIUM CENTROCARPUM
22 OPERCULODINIUM SPP
23 TUBERCULODINIUM VANCOMPOAE
24 CEREBROCYSTA SP
25 HETERAULACACYSTA PAXILLA
26 HYSTRICHOKOLPOMA EISENACKII
27 IMPAGIDINIUM DISPERTITUM
28 AREOSPHAERIDIUM DIKTYOPLOKUS
29 ACHILLEODINIUM BIFORMOIDES
30 APECTODINIUM HOMOMORPHA (1.sp)
31 APTEODINIUM AUSTRALIENSE
32 AREOSPHAERIDIUM ARCUATUM
33 CORDOSPHAERIDIUM MULTISPINOSUM




| | |
|---|---|
| 34 | DEFLANDREA HETEROPHLYCTA |
| 35 | FIBROCYSTA BIPOLARE |
| 36 | HOMOTRYBLIUM ABBREVIATUM |
| 37 | HOMOTRYBLIUM SCABROSA |
| 38 | HOMOTRYBLIUM TASMANIENSE |
| 39 | KENLEYIA SP |
| 40 | PHTHANOPERIDINIUM COMATUM |
| 41 | RHOMBODINIUM GLABRUM |
| 42 | TURBIOSPAERA MAGNIFICA |
| 43 | TURBIOSPHAERA SP |
| 44 | APECTODINIUM HOMOMORPHA (sh.sp) |
| 45 | DEFLANDREA PHOSPHORITICA |
| 46 | PALAEOCYSTODINIUM GOLZOWENSE |
| 47 | SYSTEMATOPHORA PLACACANTHA |
| 48 | CAMEROZONOSPORITES OHAIENSIS |
| 49 | CYATHIDITES SPP |
| 50 | FALCISPORITES SIMILIS |
| 51 | GAMBIERINA EDWARDSII |
| 52 | HALORAGACIDITES HARRISII |
| 53 | LYGISTEPOLLENITES BALMEI |
| 54 | LYGISTEPOLLENITES FLORINII |
| 55 | MICROCACHRYIDITES ANTARCTICUS |
| 56 | NOTHOFAGIDITES BRACHYSPINULOSUS |
| 57 | PERIPOROPOLLENITES POLYORATUS |
| 58 | PHYLLOCLADIDITES MAWSONII |
| 59 | PROTEACIDITES SP |
| 60 | STEREISPORITES ANTIQUISPORITES |
| 61 | GLEICHENIIDITES CIRCINIDITES |
| 62 | AUSTRALOPOLLIS OBSCURUS |
| 63 | ERICIPITES SCABRATUS |
| 64 | NOTHOFAGIDITES EMARCIDUS/HETERUS |
| 65 | RETITRILETES AUSTROCLAVATIDITES |
| 66 | TRICOLPITES GILLII |

| 1613.5 SWC | 1607.5 SWC | 1603.5 SWC | 1600.5 SWC | 1587.5 SWC | 1557.0 SWC | 1530 - cutts | 1525.5 SWC | 1525 - cutts | 1524.5 SWC | 1511.0 SWC | 1510 - cutts | 1506.0 SWC | 1503.5 SWC | 1500.0 SWC | 1498.5 SWC | 1477.5 SWC | No. | Species |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| . | . | — | . | . | . | . | . | . | . | . | . | . | . | . | . | . | 67 | TRICOLPITES SP |
| . | . | — | . | . | . | . | . | . | . | . | . | . | . | . | . | . | 68 | TRICOLPORITES |
| . | . | . | — | . | . | . | . | . | . | . | . | . | . | . | . | . | 69 | PODOSPORITES MICROSACCATUS |
| . | . | . | . | — | . | . | . | . | . | . | . | . | . | . | . | . | 70 | CLAVIFERA TRIPLEX |
| . | . | . | . | — | . | . | . | — | . | . | . | . | . | . | . | . | 71 | DILWYNITES GRANULATUS |
| . | . | . | . | ▥ | . | . | . | . | . | . | . | . | . | . | . | . | 72 | NOTHOFAGIDITES ENDURUS |
| . | . | . | . | — | . | . | . | . | . | . | . | . | . | . | . | . | 73 | PHYLLOCLADIDITES VERRUCOSUS |
| . | . | . | . | — | . | . | . | . | . | . | . | . | . | . | . | . | 74 | POLYPODIISPORITES SPP |
| . | . | . | . | — | . | . | . | . | . | . | . | . | . | . | . | . | 75 | STEREISPORITES (TRIPUNCTISPORIS) PUNCTATUS |
| . | . | . | . | . | — | . | . | . | . | . | — | . | . | . | . | . | 76 | CYATHEACIDITES ANNULATUS |
| . | . | . | . | . | ? | — | . | — | . | . | . | . | . | . | . | . | 77 | NOTHOFAGIDITES FALCATUS |
| . | . | . | . | . | . | . | . | — | . | . | — | . | . | . | . | . | 78 | HERKOSPORITES ELLIOTTII |
| . | . | . | . | . | . | . | . | . | . | . | — | . | . | . | . | . | 79 | CERATOSPORITES EQUALIS |
| . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | ? | — | 80 | NOTHOFAGIDITES ASPERUS |
| . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | — | 81 | CYATHIDITES GIGANTIS |

1613.5 SWC
1607.5 SWC
1603.5 SWC
1600.5 SWC
1587.5 SWC
1557.0 SWC
1530 - cutts
1525.5 SWC
1525 - cutts
1524.5 SWC
1511.0 SWC
1510 - cutts
1506.0 SWC
1503.5 SWC
1500.0 SWC
1498.5 SWC
1477.5 SWC

SPECIES LOCATION INDEX

Index numbers are the columns in which species appear.

| INDEX NUMBER | SPECIES |
|---|---|
| 29 | ACHILLEODINIUM BIFORMOIDES |
| 30 | APECTODINIUM HOMOMORPHA (l.sp) |
| 44 | APECTODINIUM HOMOMORPHA (sh.sp) |
| 31 | APTEODINIUM AUSTRALIENSE |
| 1 | AREOLIGERA SENONENSIS |
| 32 | AREOSPHAERIDIUM ARCUATUM |
| 28 | AREOSPHAERIDIUM DIKTYOPLOKUS |
| 62 | AUSTRALOPOLLIS OBSCURUS |
| 48 | CAMEROZONOSPORITES OHAIENSIS |
| 79 | CERATOSPORITES EQUALIS |
| 24 | CEREBROCYSTA SP |
| 70 | CLAVIFERA TRIPLEX |
| 2 | CORDOSPHAERIDIUM INODES |
| 33 | CORDOSPHAERIDIUM MULTISPINOSUM |
| 76 | CYATHEACIDITES ANNULATUS |
| 81 | CYATHIDITES GIGANTIS |
| 49 | CYATHIDITES SPP |
| 9 | CYCLOPSIELLA VIETA |
| 3 | DEFLANDREA DILWYNENSIS |
| 34 | DEFLANDREA HETEROPHLYCTA |
| 10 | DEFLANDREA MEDCALFII |
| 45 | DEFLANDREA PHOSPHORITICA |
| 11 | DEFLANDREA SPECIOSUS |
| 71 | DILWYNITES GRANULATUS |
| 4 | EISENACKIA CRASSITABULATA |
| 63 | ERICIPITES SCABRATUS |
| 50 | FALCISPORITES SIMILIS |
| 35 | FIBROCYSTA BIPOLARE |
| 51 | GAMBIERINA EDWARDSII |
| 5 | GLAPHYROCYSTA PASTIELLII |
| 6 | GLAPHYROCYSTA RETIINTEXTA |
| 61 | GLEICHENIIDITES CIRCINIDITES |
| 52 | HALORAGACIDITES HARRISII |
| 17 | HEMICYSTODINIUM ZOHARYI |
| 78 | HERKOSPORITES ELLIOTTII |
| 25 | HETERAULACACYSTA PAXILLA |
| 36 | HOMOTRYBLIUM ABBREVIATUM |
| 37 | HOMOTRYBLIUM SCABROSA |
| 38 | HOMOTRYBLIUM TASMANIENSE |
| 26 | HYSTRICHOKOLPOMA EISENACKII |
| 12 | HYSTRICHOSPHAERIDIUM TUBIFERUM |
| 27 | IMPAGIDINIUM DISPERTITUM |
| 18 | IMPLETOSPHAERIDIUM SP |
| 39 | KENLEYIA SP |
| 19 | LINGULODINIUM MACHAEROPHORUM |
| 53 | LYGISTEPOLLENITES BALMEI |
| 54 | LYGISTEPOLLENITES FLORINII |
| 55 | MICROCACHRYIDITES ANTARCTICUS |
| 7 | MICRODINIUM SP2 |
| 20 | NEMATOSPHAEROPSIS BALCOMBIANA |
| 80 | NOTHOFAGIDITES ASPERUS |
| 56 | NOTHOFAGIDITES BRACHYSPINULOSUS |
| 64 | NOTHOFAGIDITES EMARCIDUS/HETERUS |
| 72 | NOTHOFAGIDITES ENDURUS |
| 77 | NOTHOFAGIDITES FALCATUS |
| 21 | OPERCULODINIUM CENTROCARPUM |
| 22 | OPERCULODINIUM SPP |
| 13 | PALAEOCYSTODINIUM AUSTRALINUM |
| 46 | PALAEOCYSTODINIUM GOLZOWENSE |
| 14 | PARALECANIELLA INDENTATA |
| 57 | PERIPOROPOLLENITES POLYORATUS |
| 40 | PHTHANOPERIDINIUM COMATUM |
| 58 | PHYLLOCLADIDITES MAWSONII |
| 73 | PHYLLOCLADIDITES VERRUCOSUS |
| 69 | PODOSPORITES MICROSACCATUS |
| 74 | POLYPODIISPORITES SPP |
| 59 | PROTEACIDITES SP |
| 65 | RETITRILETES AUSTROCLAVATIDITES |
| 41 | RHOMBODINIUM GLABRUM |
| 16 | SPINIDINIUM LANTERNUM |
| 15 | SPINIDINIUM SP1 |
| 8 | SPINIFERITES RAMOSUS |
| 75 | STEREISPORITES (TRIPUNCTISPORIS) PUNCTATUS |
| 60 | STEREISPORITES ANTIQUISPORITES |
| 47 | SYSTEMATOPHORA PLACACANTHA |
| 66 | TRICOLPITES GILLII |
| 67 | TRICOLPITES SP |
| 68 | TRICOLPORITES |
| 23 | TUBERCULODINIUM VANCOMPOAE |
| 42 | TURBIOSPAERA MAGNIFICA |
| 43 | TURBIOSPHAERA SP |

# APPENDIX 3

APPENDIX 3

WELL COMPLETION REPORT

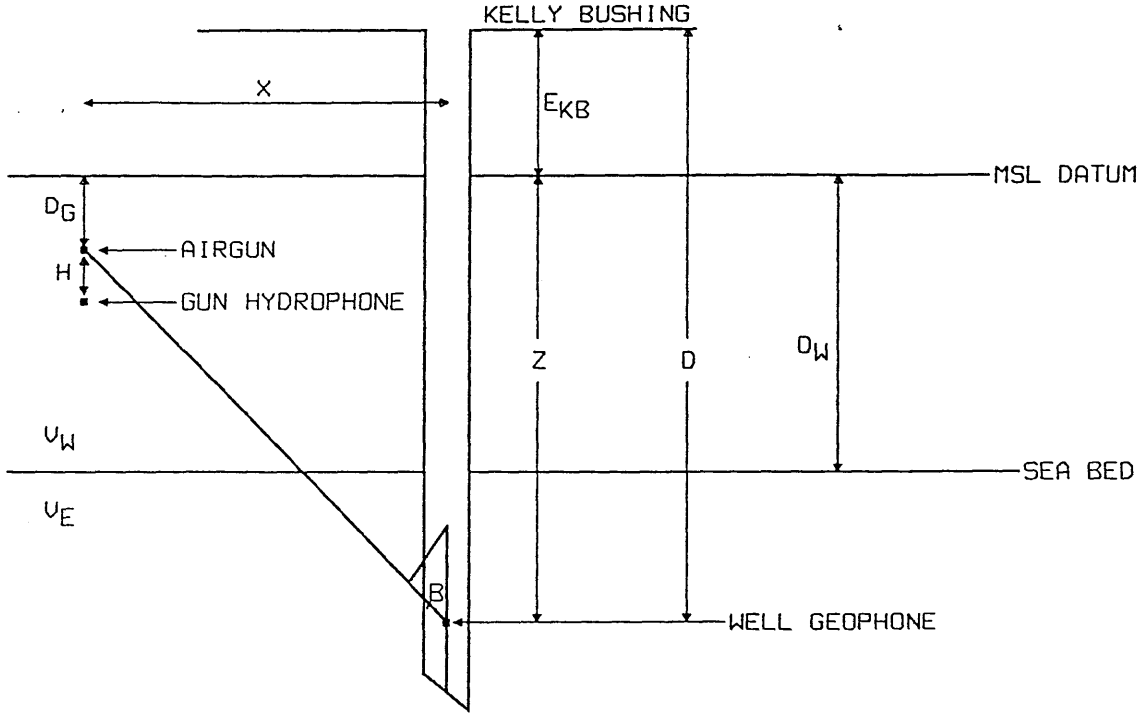
MUDSKIPPER-1

BASIC DATA

# APPENDIX 3

VELOCITY SURVEY

# SCHEMATIC CROSS-SECTION




## KEY

KB - KELLY BUSHING

$E_{KB}$ - ELEVATION OF KB ABOVE DATUM

D* - MEASURED DEPTH OF WELL GEOPHONE BELOW KB

D - VERTICAL DEPTH OF WELL GEOPHONE BELOW KB

Z - VERTICAL DEPTH OF WELL GEOPHONE BELOW DATUM

$D_G$ - DEPTH OF GUN BELOW M.S.L.

H - DISTANCE BETWEEN GUN AND GUN HYDROPHONE

X - HORIZONTAL DISTANCE BETWEEN WELL GEOPHONE AND GUN

β - INCIDENT ANGLE AT WELL GEOPHONE LEVELS

T - TRAVEL-TIME FROM GUN HYDROPHONE TO WELL GEOPHONE

$T_V$ - TIME FROM GUN TO WELL GEOPHONE CORRECTED TO VERTICAL

[1] BY ASSUMING STRAIGHT LINE TRAVEL PATHS $\left[\left[T + \frac{H}{V_W}\right]\cos\beta\right]$

OR [2] BY ESTIMATING THE TRUE REFRACTED TRAVEL PATHS

$T_E$ - TIME CORRECTION FROM GUN TO DATUM $\left[= \frac{\text{GUN DEPTH}}{V_W}\right]$

$T_C$ - CORRECTED TRAVEL-TIME BETWEEN DATUM AND WELL GEOPHONE = $T_V + T_E$

$V_A$ - $Z/T_C$ [AVERAGE VELOCITY]

$V_I$ - $\Delta Z/\Delta T_C$ [INTERVAL VELOCITY]

$D_W$ - DEPTH OF WATER

$V_W$ - WATER VELOCITY

$V_E$ - ELEVATION VELOCITY

COMPANY: PETROFINA EXPLORATION AUSTRALIA S.A.

WELL:MUDSKIPPER-1 EKB= 27.0 M KB= 27.0 M AMSL GUN DEPTH 5.0 M

AIRGUN COMPUTATION VW= 1524 M/S ED= MSL GUN HYDROPHONE DEPTH 10.0 M

GUN OFFSET 60.8 M

T IS THE TIME MEASURED FROM THE FIRST TROUGH ON THE GUN HYDROPHONE SIGNAL TO THE FIRST TROUGH ON THE WELL GEOPHONE SIGNAL USING AN AUTOMATED TRACE ALIGNMENT PROCEDURE

A TIME CORRECTION FOR THE DISTANCE BETWEEN GUN AND GUN HYDROPHONE AT WATER VELOCITY IS ADDED TO T BEFORE CORRECTION TO THE VERTICAL

TV IS THE TIME FROM THE GUN TO THE WELL GEOPHONE CORRECTED TO THE VERTICAL

TE = GUN DEPTH/VW

| RECORD NO | D' | D | Z | X | T | TV | TE | TC | AVERAGE VELOCITY | INTERVAL DEPTH | INTERVAL TIME | INTERVAL VELOCITY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | M | M | M | M | S | S | S | S | M/S | M | S | M/S |
| 18 | 425.0 | 425.0 | 398.0 | 60.8 | 0.1951 | 0.1960 | 0.0033 | 0.1993 | 1997 | | | |
| | | | | | | | | | | 75.0 | 0.0289 | 2595 |
| 17 | 500.0 | 500.0 | 473.0 | 60.8 | 0.2235 | 0.2249 | 0.0033 | 0.2282 | 2073 | | | |
| | | | | | | | | | | 110.0 | 0.0394 | 2794 |
| 16 | 610.0 | 610.0 | 583.0 | 60.8 | 0.2625 | 0.2643 | 0.0033 | 0.2676 | 2179 | | | |
| | | | | | | | | | | 170.0 | 0.0688 | 2471 |
| 15 | 780.0 | 780.0 | 753.0 | 60.8 | 0.3309 | 0.3331 | 0.0033 | 0.3364 | 2239 | | | |
| | | | | | | | | | | 184.0 | 0.0820 | 2244 |
| 14 | 964.0 | 964.0 | 937.0 | 60.8 | 0.4127 | 0.4151 | 0.0033 | 0.4184 | 2240 | | | |
| | | | | | | | | | | 107.0 | 0.0513 | 2086 |
| 13 | 1071.0 | 1071.0 | 1044.0 | 60.8 | 0.4639 | 0.4664 | 0.0033 | 0.4697 | 2223 | | | |
| | | | | | | | | | | 105.0 | 0.0437 | 2404 |
| 12 | 1176.0 | 1176.0 | 1149.0 | 60.8 | 0.5075 | 0.5101 | 0.0033 | 0.5133 | 2238 | | | |
| | | | | | | | | | | 121.0 | 0.0459 | 2633 |
| 11 | 1297.0 | 1297.0 | 1270.0 | 60.8 | 0.5534 | 0.5560 | 0.0033 | 0.5593 | 2271 | | | |
| | | | | | | | | | | 103.0 | 0.0357 | 2886 |
| 10 | 1400.0 | 1400.0 | 1373.0 | 60.8 | 0.5890 | 0.5917 | 0.0033 | 0.5950 | 2308 | | | |
| 9 | 1425.0 | 1425.0 | 1398.0 | 60.8 | 0.5972 | 0.5999 | 0.0033 | 0.6032 | 2318 | | | |
| 8 | 1450.0 | 1450.0 | 1423.0 | 60.8 | 0.6057 | 0.6084 | 0.0033 | 0.6117 | 2326 | | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7 | 1475.0 | 1475.0 | 1448.0 | 60.8 | 0.6142 | 0.6169 | 0.0033 | 0.6202 | 2335 | | | |
| 6 | 1500.0 | 1500.0 | 1473.0 | 60.8 | 0.6230 | 0.6258 | 0.0033 | 0.6290 | 2342 | 100.0 | 0.0340 | 2937 |
| 5 | 1525.0 | 1525.0 | 1498.0 | 60.8 | 0.6306 | 0.6334 | 0.0033 | 0.6367 | 2353 | | | |
| 4 | 1550.0 | 1550.0 | 1523.0 | 60.8 | 0.6352 | 0.6380 | 0.0033 | 0.6413 | 2375 | | | |
| 3 | 1575.0 | 1575.0 | 1548.0 | 60.8 | 0.6421 | 0.6449 | 0.0033 | 0.6481 | 2388 | | | |
| 2 | 1600.0 | 1600.0 | 1573.0 | 60.8 | 0.6479 | 0.6507 | 0.0033 | 0.6539 | 2405 | | | |
| 1 | 1617.0 | 1617.0 | 1590.0 | 60.8 | 0.6520 | 0.6548 | 0.0033 | 0.6581 | 2416 | 117.0 | 0.0291 | 4026 |

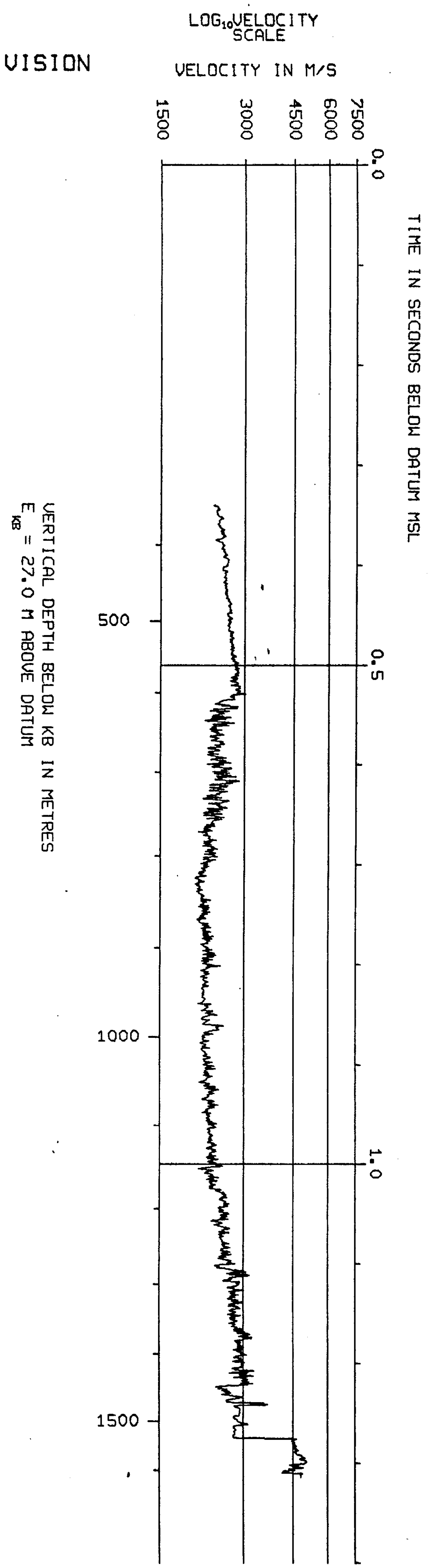
SEISMOGRAPH SERVICE - BOREHOLE GEOPHYSICS DIVISION

TWO-WAY TRAVEL TIME LOG

COMPANY: PETROFINA EXPLORATION
AUSTRALIA S.A.

WELL: MUDSKIPPER-1

1 S = 20.00 CMS



PE601574

This is an enclosure indicator page.
The enclosure PE601574 is enclosed within the container PE902074 at this location in this document.

The enclosure PE601574 has the following characteristics:

```
     ITEM_BARCODE = PE601574
CONTAINER_BARCODE = PE902074
             NAME = Velocity Log
            BASIN = GIPPSLAND
           PERMIT = VIC/P20
             TYPE = WELL
          SUBTYPE = VELOCITY_CHART
      DESCRIPTION = Velocity Log, scale 1:1000, (enclosure
                    from appendix 3 of WCR vol.1) for
                    Mudskipper-1
          REMARKS =
     DATE_CREATED = 20/06/90
    DATE_RECEIVED = 2/08/90
             W_NO = W1032
        WELL_NAME = MUDSKIPPER-1
       CONTRACTOR = SEISMOGRAPH SERVICE
     CLIENT_OP_CO = PETROFINA EXPLORATION AUSTRALIA S.A.
```

(Inserted by DNRE - Vic Govt Mines Dept)

PE601575

This is an enclosure indicator page.
The enclosure PE601575 is enclosed within the container PE902074 at this location in this document.

The enclosure PE601575 has the following characteristics:

| | |
|---|---|
| ITEM_BARCODE = | PE601575 |
| CONTAINER_BARCODE = | PE902074 |
| NAME = | Velocity Log |
| BASIN = | GIPPSLAND |
| PERMIT = | VIC/P20 |
| TYPE = | WELL |
| SUBTYPE = | VELOCITY_CHART |
| DESCRIPTION = | Velocity Log, scale 1:500, (enclosure from appendix 3 of WCR vol.1) for Mudskipper-1 |
| REMARKS = | |
| DATE_CREATED = | 20/06/90 |
| DATE_RECEIVED = | 2/08/90 |
| W_NO = | W1032 |
| WELL_NAME = | MUDSKIPPER-1 |
| CONTRACTOR = | SEISMOGRAPH SERVICE |
| CLIENT_OP_CO = | PETROFINA EXPLORATION AUSTRALIA S.A. |

(Inserted by DNRE - Vic Govt Mines Dept)

PE601578

This is an enclosure indicator page.
The enclosure PE601578 is enclosed within the container PE902074 at this location in this document.

The enclosure PE601578 has the following characteristics:

| | |
|---|---|
| ITEM_BARCODE = | PE601578 |
| CONTAINER_BARCODE = | PE902074 |
| NAME = | Vertical Seismic Profile |
| BASIN = | GIPPSLAND |
| PERMIT = | VIC/P20 |
| TYPE = | WELL |
| SUBTYPE = | SYNTH_SEISMOGRAM |
| DESCRIPTION = | Vertical Seismic Profile, VG1, SEG Normal Polarity, 10cm/s, (enclosure from appendix 3 of WCR vol.1) for Mudskipper-1 |
| REMARKS = | |
| DATE_CREATED = | 31/07/90 |
| DATE_RECEIVED = | 2/08/90 |
| W_NO = | W1032 |
| WELL_NAME = | MUDSKIPPER-1 |
| CONTRACTOR = | |
| CLIENT_OP_CO = | PETROFINA EXPLORATION AUSTRALIA S.A. |

(Inserted by DNRE - Vic Govt Mines Dept)

PE601579

This is an enclosure indicator page.
The enclosure PE601579 is enclosed within the container PE902074 at this location in this document.

The enclosure PE601579 has the following characteristics:

| | |
|---|---|
| ITEM_BARCODE = | PE601579 |
| CONTAINER_BARCODE = | PE902074 |
| NAME = | Vertical Seismic Profile |
| BASIN = | GIPPSLAND |
| PERMIT = | VIC/P20 |
| TYPE = | WELL |
| SUBTYPE = | SYNTH_SEISMOGRAM |
| DESCRIPTION = | Vertical Seismic Profile,VG1, SEG Reverse Polarity, 10cm/s, (enclosure from appendix 3 of WCR vol.1) for Mudskipper-1 |
| REMARKS = | |
| DATE_CREATED = | 31/07/90 |
| DATE_RECEIVED = | 2/08/90 |
| W_NO = | W1032 |
| WELL_NAME = | MUDSKIPPER-1 |
| CONTRACTOR = | |
| CLIENT_OP_CO = | PETROFINA EXPLORATION AUSTRALIA S.A. |

(Inserted by DNRE - Vic Govt Mines Dept)

PE601580

This is an enclosure indicator page.
The enclosure PE601580 is enclosed within the container PE902074 at this location in this document.

The enclosure PE601580 has the following characteristics:

| | |
|---|---|
| ITEM_BARCODE = | PE601580 |
| CONTAINER_BARCODE = | PE902074 |
| NAME = | Vertical Seismic Profile |
| BASIN = | GIPPSLAND |
| PERMIT = | VIC/P20 |
| TYPE = | WELL |
| SUBTYPE = | SYNTH_SEISMOGRAM |
| DESCRIPTION = | Vertical Seismic Profile,VB2, SEG Normal & Reverse Polarity,10cm/s, (enclosure from appendix 3 of WCR vol.1) for Mudskipper-1 |
| REMARKS = | |
| DATE_CREATED = | 31/07/90 |
| DATE_RECEIVED = | 2/08/90 |
| W_NO = | W1032 |
| WELL_NAME = | MUDSKIPPER-1 |
| CONTRACTOR = | |
| CLIENT_OP_CO = | PETROFINA EXPLORATION AUSTRALIA S.A. |

(Inserted by DNRE - Vic Govt Mines Dept)

PE601581

This is an enclosure indicator page.
The enclosure PE601581 is enclosed within the container PE902074 at this location in this document.

The enclosure PE601581 has the following characteristics:

ITEM_BARCODE = PE601581
CONTAINER_BARCODE = PE902074
NAME = Vertical Seismic Profile
BASIN = GIPPSLAND
PERMIT = VIC/P20
TYPE = WELL
SUBTYPE = SYNTH_SEISMOGRAM
DESCRIPTION = Vertical Seismic Profile,VB2, SEG Normal & Reverse Polarity, 20cm/s, (enclosure from appendix 3 of WCR vol.1) for Mudskipper-1
REMARKS =
DATE_CREATED = 31/07/90
DATE_RECEIVED = 2/08/90
W_NO = W1032
WELL_NAME = MUDSKIPPER-1
CONTRACTOR =
CLIENT_OP_CO = PETROFINA EXPLORATION AUSTRALIA S.A.

(Inserted by DNRE - Vic Govt Mines Dept)

PE601582

This is an enclosure indicator page.
The enclosure PE601582 is enclosed within the container PE902074 at this location in this document.

The enclosure PE601582 has the following characteristics:

| | |
|---|---|
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| CONTAINER_BARCODE = | PE902074 |
| NAME = | Vertical Seismic Profile |
| BASIN = | GIPPSLAND |
| PERMIT = | VIC/P20 |
| TYPE = | WELL |
| SUBTYPE = | SYNTH_SEISMOGRAM |
| DESCRIPTION = | Vertical Seismic Profile,VG1, SEG Reverse Polarity, 20cm/s, (enclosure from appendix 3 of WCR vol.1) for Mudskipper-1 |
| REMARKS = | |
| DATE_CREATED = | 31/07/90 |
| DATE_RECEIVED = | 2/08/90 |
| W_NO = | W1032 |
| WELL_NAME = | MUDSKIPPER-1 |
| CONTRACTOR = | |
| CLIENT_OP_CO = | PETROFINA EXPLORATION AUSTRALIA S.A. |

(Inserted by DNRE - Vic Govt Mines Dept)

PE601583

This is an enclosure indicator page.
The enclosure PE601583 is enclosed within the container PE902074 at this location in this document.

The enclosure PE601583 has the following characteristics:

| | |
|---|---|
| ITEM_BARCODE = | PE601583 |
| CONTAINER_BARCODE = | PE902074 |
| NAME = | Vertical Seismic Profile |
| BASIN = | GIPPSLAND |
| PERMIT = | VIC/P20 |
| TYPE = | WELL |
| SUBTYPE = | SYNTH_SEISMOGRAM |
| DESCRIPTION = | Vertical Seismic Profile,VG1, SEG Normal Polarity, 20cm/s, (enclosure from appendix 3 of WCR vol.1) for Mudskipper-1 |
| REMARKS = | |
| DATE_CREATED = | 31/07/90 |
| DATE_RECEIVED = | 2/08/90 |
| W_NO = | W1032 |
| WELL_NAME = | MUDSKIPPER-1 |
| CONTRACTOR = | |
| CLIENT_OP_CO = | PETROFINA EXPLORATION AUSTRALIA S.A. |

(Inserted by DNRE - Vic Govt Mines Dept)

PE601584

This is an enclosure indicator page.
The enclosure PE601584 is enclosed within the container PE902074 at this location in this document.

The enclosure PE601584 has the following characteristics:

| | |
|---|---|
| ITEM_BARCODE = | PE601584 |
| CONTAINER_BARCODE = | PE902074 |
| NAME = | Vertical Seismic Profile |
| BASIN = | GIPPSLAND |
| PERMIT = | VIC/P20 |
| TYPE = | WELL |
| SUBTYPE = | SYNTH_SEISMOGRAM |
| DESCRIPTION = | Vertical Seismic Profile,VI, SEG Normal Polarity, 10cm/s, (enclosure from appendix 3 of WCR vol.1) for Mudskipper-1 |
| REMARKS = | |
| DATE_CREATED = | 31/07/90 |
| DATE_RECEIVED = | 2/08/90 |
| W_NO = | W1032 |
| WELL_NAME = | MUDSKIPPER-1 |
| CONTRACTOR = | |
| CLIENT_OP_CO = | PETROFINA EXPLORATION AUSTRALIA S.A. |

(Inserted by DNRE - Vic Govt Mines Dept)

PE601585

This is an enclosure indicator page.
The enclosure PE601585 is enclosed within the container PE902074 at this location in this document.

The enclosure PE601585 has the following characteristics:

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CONTAINER_BARCODE = PE902074
             NAME = Synthetic Seismogram
            BASIN = GIPPSLAND
           PERMIT = VIC/P20
             TYPE = WELL
          SUBTYPE = SYNTHETIC_SEISMOGRAM
      DESCRIPTION = Synthetic Seismogram, Zero Phase,
                    20cm/s, acoustic impedence is a white
                    trough, (enclosure from appendix 3 of
                    WCR vol.1) for Mudskipper-1
          REMARKS =
     DATE_CREATED = 31/07/90
    DATE_RECEIVED = 2/08/90
             W_NO = W1032
        WELL_NAME = MUDSKIPPER-1
       CONTRACTOR =
     CLIENT_OP_CO = PETROFINA EXPLORATION AUSTRALIA S.A.
```

(Inserted by DNRE - Vic Govt Mines Dept)

PE601586

This is an enclosure indicator page.
The enclosure PE601586 is enclosed within the container PE902074 at this location in this document.

The enclosure PE601586 has the following characteristics:

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     ITEM_BARCODE = PE601586
CONTAINER_BARCODE = PE902074
             NAME = Synthetic Seismogram
            BASIN = GIPPSLAND
           PERMIT = VIC/P20
             TYPE = WELL
          SUBTYPE = SYNTHETIC_SEISMOGRAM
      DESCRIPTION = Synthetic Seismogram, Zero Phase,
                    10cm/s,acoustic impedence is a white
                    trough (enclosure from appendix 3 of
                    WCR vol.1) for Mudskipper-1
          REMARKS =
     DATE_CREATED = 31/07/90
    DATE_RECEIVED = 2/08/90
             W_NO = W1032
        WELL_NAME = MUDSKIPPER-1
       CONTRACTOR =
     CLIENT_OP_CO = PETROFINA EXPLORATION AUSTRALIA S.A.
```

(Inserted by DNRE - Vic Govt Mines Dept)

PE601587

This is an enclosure indicator page.
The enclosure PE601587 is enclosed within the container PE902074 at this location in this document.

The enclosure PE601587 has the following characteristics:

| | |
|---|---|
| ITEM_BARCODE = | PE601587 |
| CONTAINER_BARCODE = | PE902074 |
| NAME = | Synthetic Seismogram |
| BASIN = | GIPPSLAND |
| PERMIT = | VIC/P20 |
| TYPE = | WELL |
| SUBTYPE = | SYNTHETIC_SEISMOGRAM |
| DESCRIPTION = | Synthetic Seismogram, Minimum Phase, 10cm/s,acoustic impedence is a white trough, (enclosure from appendix 3 of WCR vol.1) for Mudskipper-1 |
| REMARKS = | |
| DATE_CREATED = | 31/07/90 |
| DATE_RECEIVED = | 2/08/90 |
| W_NO = | W1032 |
| WELL_NAME = | MUDSKIPPER-1 |
| CONTRACTOR = | |
| CLIENT_OP_CO = | PETROFINA EXPLORATION AUSTRALIA S.A. |

(Inserted by DNRE - Vic Govt Mines Dept)

PE601588

This is an enclosure indicator page.
The enclosure PE601588 is enclosed within the container PE902074 at this location in this document.

The enclosure PE601588 has the following characteristics:

ITEM_BARCODE = PE601588
CONTAINER_BARCODE = PE902074
NAME = Synthetic Seismogram
BASIN = GIPPSLAND
PERMIT = VIC/P20
TYPE = WELL
SUBTYPE = SYNTHETIC_SEISMOGRAM
DESCRIPTION = Synthetic Seismogram, Zero Phase, 10cm/s,acoustic impedence is a black peak, (enclosure from appendix 3 of WCR vol.1) for Mudskipper-1
REMARKS =
DATE_CREATED = 31/07/90
DATE_RECEIVED = 2/08/90
W_NO = W1032
WELL_NAME = MUDSKIPPER-1
CONTRACTOR =
CLIENT_OP_CO = PETROFINA EXPLORATION AUSTRALIA S.A.

(Inserted by DNRE - Vic Govt Mines Dept)

PE601589

This is an enclosure indicator page.
The enclosure PE601589 is enclosed within the container PE902074 at this location in this document.

The enclosure PE601589 has the following characteristics:

| | |
|---|---|
| ITEM_BARCODE = | PE601589 |
| CONTAINER_BARCODE = | PE902074 |
| NAME = | Synthetic Seismogram |
| BASIN = | GIPPSLAND |
| PERMIT = | VIC/P20 |
| TYPE = | WELL |
| SUBTYPE = | SYNTHETIC_SEISMOGRAM |
| DESCRIPTION = | Synthetic Seismogram, Minimum Phase, 10cm/s,acoustic impedence is a black peak, (enclosure from appendix 3 of WCR vol.1) for Mudskipper-1 |
| REMARKS = | |
| DATE_CREATED = | 31/07/90 |
| DATE_RECEIVED = | 2/08/90 |
| W_NO = | W1032 |
| WELL_NAME = | MUDSKIPPER-1 |
| CONTRACTOR = | |
| CLIENT_OP_CO = | PETROFINA EXPLORATION AUSTRALIA S.A. |

(Inserted by DNRE - Vic Govt Mines Dept)

PE601590

This is an enclosure indicator page.
The enclosure PE601590 is enclosed within the container PE902074 at this location in this document.

The enclosure PE601590 has the following characteristics:

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CONTAINER_BARCODE = PE902074
             NAME = Synthetic Seismogram
            BASIN = GIPPSLAND
           PERMIT = VIC/P20
             TYPE = WELL
          SUBTYPE = SYNTHETIC_SEISMOGRAM
      DESCRIPTION = Synthetic Seismogram, Minimum Phase,
                    20cm/s,acoustic impedence is a black
                    peak, (enclosure from appendix 3 of WCR
                    vol.1) for Mudskipper-1
          REMARKS =
     DATE_CREATED = 31/07/90
    DATE_RECEIVED = 2/08/90
             W_NO = W1032
        WELL_NAME = MUDSKIPPER-1
       CONTRACTOR =
     CLIENT_OP_CO = PETROFINA EXPLORATION AUSTRALIA S.A.
```

(Inserted by DNRE - Vic Govt Mines Dept)

PE601591

This is an enclosure indicator page.
The enclosure PE601591 is enclosed within the container PE902074 at this location in this document.

The enclosure PE601591 has the following characteristics:

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     ITEM_BARCODE = PE601591
CONTAINER_BARCODE = PE902074
             NAME = Synthetic Seismogram
            BASIN = GIPPSLAND
           PERMIT = VIC/P20
             TYPE = WELL
          SUBTYPE = SYNTHETIC_SEISMOGRAM
      DESCRIPTION = Synthetic Seismogram, Zero Phase,
                    20cm/s,acoustic impedence is a black
                    peak, (enclosure from appendix 3 of WCR
                    vol.1) for Mudskipper-1
          REMARKS =
     DATE_CREATED = 31/07/90
    DATE_RECEIVED = 2/08/90
             W_NO = W1032
        WELL_NAME = MUDSKIPPER-1
       CONTRACTOR =
     CLIENT_OP_CO = PETROFINA EXPLORATION AUSTRALIA S.A.
```

(Inserted by DNRE - Vic Govt Mines Dept)

PE601592

This is an enclosure indicator page.
The enclosure PE601592 is enclosed within the container PE902074 at this location in this document.

The enclosure PE601592 has the following characteristics:

| | |
|---|---|
| ITEM_BARCODE = | PE601592 |
| CONTAINER_BARCODE = | PE902074 |
| NAME = | Synthetic Seismogram |
| BASIN = | GIPPSLAND |
| PERMIT = | VIC/P20 |
| TYPE = | WELL |
| SUBTYPE = | SYNTHETIC_SEISMOGRAM |
| DESCRIPTION = | Synthetic Seismogram, Minimum Phase, 20cm/s,acoustic impedence is a white trough, (enclosure from appendix 3 of WCR vol.1) for Mudskipper-1 |
| REMARKS = | |
| DATE_CREATED = | 31/07/90 |
| DATE_RECEIVED = | 2/08/90 |
| W_NO = | W1032 |
| WELL_NAME = | MUDSKIPPER-1 |
| CONTRACTOR = | |
| CLIENT_OP_CO = | PETROFINA EXPLORATION AUSTRALIA S.A. |

(Inserted by DNRE - Vic Govt Mines Dept)

# APPENDIX 4

WELL COMPLETION REPORT

MUDSKIPPER-1

BASIC DATA

# APPENDIX 4

GEOCHEMISTRY

26 July 1990

Petrofina Exploration Australia SA
Level 2
476 St Kilda Road
MELBOURNE VIC 3004

Attention: Jean-Marie Questiaux

**REPORT: 009/394**

**CLIENT REFERENCE:** Fax 27 June 1990

**MATERIAL:** Canned Cuttings

**LOCALITY:** Mudskipper -1

**WORK REQUIRED:** Source Rock Analyses

Please direct technical enquiries regarding this work to the signatory below under whose supervision the work was carried out.

**BRIAN L WATSON**
Laboratory Supervisor
on behalf of Amdel Core Services Pty Ltd

## 1. INTRODUCTION

Source rock analyses were requested on thirteen cuttings samples from Mudskipper -1 to determine their maturity, source richness and source quality and to compare this data to that from the nearby wells drilled by Petrofina.

## 2. ANALYTICAL PROCEDURES

### 2.1 Sample Preparation

Cuttings samples (as received) were ground in a Siebtechnik mill for 20-30 seconds.

### 2.2 Total Organic Carbon (TOC)

Total organic carbon was determined by digestion of a known weight (approximately 0.2 g) of powdered rock in 50% HCl to remove carbonates, followed by combustion in oxygen and measurement of the resultant $CO_2$ by infra-red detection.

### 2.3 Vitrinite Reflectance and Organic Petrology

Representative portions of each sample (crushed to -14+35 BSS mesh) were obtained with a sample splitter and then mounted in cold setting Glasscraft resin using a 2.5 cm diameter mould. Each block was ground flat using diamond impregnated laps and carborundum paper. The surface was then polished with aluminium oxide and finally magnesium oxide.

Reflectance measurements were made with a Leitz MPV1.1 microphotometer fitted to a Leitz Ortholux microscope and calibrated against synthetic standards. All measurements were taken using oil immersion (n = 1.518) and incident monochromatic light (wavelength 546 nm) at a temperature of 23∓ 1°C. Fluorescence observations were made on the same microscope utilising a 3 mm BG3 excitation filter, a TK400 dichroic mirror and a K510 suppression filter.

## 3. RESULTS

Total organic carbon data are presented in Table 1. Rock-Eval pyrolysis was not performed on these samples due to their low organic richness (TOC < 0.25%). The TOC threshold used for Rock-Eval analyses is 0.4%. Pyrolysis on samples with less than this level of organic richness will yield unreliable data.

Organic petrology data is presented in Tables 2 and 3. Vitrinite reflectance analyses could not be performed on these samples due to the absence of vitrinite.

TABLE 1

TOTAL ORGANIC CARBON CONTENTS, MUDSKIPPER -1

| Depth (m) | Total Organic Carbon (%) |
|---|---|
| 1450 - 1460 | 0.23 |
| 1460 - 1470 | 0.25 |
| 1470 - 1480 | 0.12 |
| 1480 - 1490 | 0.09 |
| 1490 - 1500 | 0.07 |
| 1500 - 1510 | - |
| 1520 - 1530 | 0.03 |
| 1540 - 1550 | - |
| 1550 - 1560 | 0.02 |
| 1570 - 1580 | - |
| 1590 - 1600 | 0.03 |
| 1610 - 1620 | 0.10 |
| 1620 - 1630 | 0.04 |

- not determined

TABLE 2

PERCENTAGE OF VITRINITE, INERTINITE AND EXINITE IN

DISPERSED ORGANIC MATTER, MUDSKIPPER -1

| Depth (m) | Percentage of | | |
|---|---|---|---|
| | Vitrinite | Inertinite | Exinite |
| 1460 - 1470 | - | > 95 | < 5 |
| 1490 -1500 | - | > 95 | < 5 |

TABLE 3

## ORGANIC MATTER TYPE AND ABUNDANCE

| Depth (m) | Estimated Volume of DOM | Estimated Volume of Exinites | Exinite Macerals |
|---|---|---|---|
| 1460 - 1470 | < 0.5 | Vr | lipto, ?cut |
| 1490 - 1500 | << 0.5 | Tr | lipto |



Amdel Core Services Pty Limited
Incorporated in South Australia

PE601576

This is an enclosure indicator page.
The enclosure PE601576 is enclosed within the container PE902074 at this location in this document.

The enclosure PE601576 has the following characteristics:

ITEM_BARCODE = PE601576
CONTAINER_BARCODE = PE902074
NAME = Two-Way Travel Time Log
BASIN = GIPPSLAND
PERMIT = VIC/P20
TYPE = WELL
SUBTYPE = VELOCITY_CHART
DESCRIPTION = Two-Way Velocity Chart, 20cm/s, (enclosure from appendix 3 of WCR vol.1) for Mudskipper-1
REMARKS =
DATE_CREATED =
DATE_RECEIVED =
W_NO = W1032
WELL_NAME = MUDSKIPPER-1
CONTRACTOR =
CLIENT_OP_CO = PETROFINA EXPLORATION AUSTRALIA S.A.

(Inserted by DNRE - Vic Govt Mines Dept)

PE601577

This is an enclosure indicator page.
The enclosure PE601577 is enclosed within the container PE902074 at this location in this document.

The enclosure PE601577 has the following characteristics:

| | |
|---|---|
| ITEM_BARCODE = | PE601577 |
| CONTAINER_BARCODE = | PE902074 |
| NAME = | Two-Way Travel Time Log |
| BASIN = | GIPPSLAND |
| PERMIT = | VIC/P20 |
| TYPE = | WELL |
| SUBTYPE = | VELOCITY_CHART |
| DESCRIPTION = | Two-Way Velocity Chart, 10cm/s, (enclosure from appendix 3 of WCR vol.1) for Mudskipper-1 |
| REMARKS = | |
| DATE_CREATED = | |
| DATE_RECEIVED = | |
| W_NO = | W1032 |
| WELL_NAME = | MUDSKIPPER-1 |
| CONTRACTOR = | |
| CLIENT_OP_CO = | PETROFINA EXPLORATION AUSTRALIA S.A. |

(Inserted by DNRE - Vic Govt Mines Dept)

# PETROFINA EXPLORATION AUSTRALIA S. A.

FINA

# MUDSKIPPER - 1

# WELL COMPLETION REPORT

## VOLUME 2
## ( INTERPRETATIVE DATA )

W.C.R. Volume 2 (Interpretative Data)

PETROFINA EXPLORATION AUSTRALIA S.A.



# MUDSKIPPER-1

# WELL COMPLETION REPORT

# VOLUME II

# INTERPRETATIVE DATA

GL/90/059
AH/JMQ/PhL/kl
29 November 1990

# MUDSKIPPER-1

## WELL COMPLETION REPORT

## INTERPRETATIVE DATA

## CONTENTS



## LIST OF APPENDICES



## LIST OF TABLES



## ATTACHMENTS

## 1. INTRODUCTION

Exploration well Mudskipper-1 is located in the southern part of Permit VIC/P20, 8.2 km southeast of Moray-1. The well was drilled as the commitment well for Year 4 in the Permit, ending 22 July 1991. The Joint Venture partners for the well were:

| | | |
|---|---|---|
| Petrofina Exploration Australia S.A. | 30% | (Operator) |
| Japex Gippsland Limited | 30% | |
| Overseas Petroleum and Investment Corporation | 30% | |
| Bridge Oil Limited | 10% | |

The objective of Mudskipper-1 was a possible stratigraphic trap resulting from the onlap of Maastrichtian Sandstones onto a basement nose, with topseal provided by transgressive Palaeocene siltstones and shales. Additional traps related to inter-fingering of sandstone and shale units within the Palaeocene section were considered as secondary objectives. The main exploration risks perceived were the integrity of the top and base seal and the continuity of migration paths within the Latrobe Group from the Central Deep to the north.

Mudskipper-1 was spudded on 11 June 1990 and reached a total depth of 1631m (drillers) on 20 June 1990 after having intersected the basement at 1612m bkb. Predicted and actual lithology and stratigraphy are shown on Figure 1.

## 2. GEOLOGICAL SUMMARY

(a) Mudskipper-1 was designed to test a Maastrichtian pinch-out in the Latrobe Group resulting from onlap onto a basement nose with top seal provided by Palaeocene transgressive deposits.

(b) The well was plugged and abandoned as a dry hole on 25 June 1990 after 14 days on location. Total depth was 1631m bkb (-1604m bsl).

(c) The well did not intersect the Cretaceous section of the Latrobe Group before reaching granite basement at 1612m bkb (1585m bsl).

(d) Tie-back of well results to the seismic shows that the Top Maastrichtian pick from Moray-1 was miscorrelated just north of the well location to a strong reflector which actually represents the top of the transgressive Palaeocene interval at 1586m bkb (-1559m bsl) in Mudskipper-1.

(e) The Maastrichtian section does pinch-out north of Mudskipper-1, and the play concept may still be valid, but the size of the closure is expected to be substantially smaller than originally predicted at Mudskipper-1.

(f) The vertical sealing potential of the Palaeocene section must now be severely downgraded because:

(i) the Palaeocene section (1525-1586m bkb) is much sandier than originally predicted from correlation with Moray-1,

(ii) a large section of the basal Palaeocene transgressive cycle is lost by onlap onto basement between Moray-1 and Mudskipper-1. The part of the sequence still present at Mudskipper-1 comprises reworked basement, siltstones and sandstones with extremely poor sealing potential.

(g) The complete absence of any shows in Mudskipper-1 creates doubt that migrating hydrocarbons ever reached the basal reservoirs along the Southern Platform margin.

(h) Although the Mudskipper play concept still exists, the perceived risk is now significantly higher than before the drilling of Mudskipper-1. Critical aspects of stratigraphy and hydrocarbon migration must be reviewed before further drilling on the play can be considered.

# TABLE 1

## FORMATION AND SEISMIC TOPS, MUDSKIPPER-1

| Horizon | Depth (RKB)m | Depth (SS)m | TWT sec |
|---|---|---|---|
| Sea Level | 27.0 | 0 | |
| Seafloor/Gippsland Limestone | 101.0 | (-74.0) | - |
| Lakes Entrance Formation | 615.5 ? | (-588.5?) | 0.561 ? |
| Intra Lakes Entrance | 1175.0 | (-1148.0) | 1.025 |
| Top Radioactive Shales (Late Eocene-Early Oligocene) | 1475.0 | (-1448.0) | 1.242 |
| Top Gurnard Formation (Middle Eocene) | 1499.0 ? | (-1472.0?) | 1.258 |
| Top Latrobe Group (Early Eocene) | 1504.5 | (-1477.5) | 1.262 |
| Top Palaeocene Regressive Cycle | 1525.0 | (-1498.0) | 1.276 |
| Top Palaeocene Transgressive Cycle (Radioactive Siltstone) | 1586.0 | (-1559.0) | 1.302 |
| Top Basement | 1612.0 | (-1585.0) | 1.312 |
| Total Depth | 1631.0 | (-1604.0) | |

WELL RESULTS :

# MUDSKIPPER-1

SCALE 1 : 10,000 LOCATION : GF88C-19 SP 850

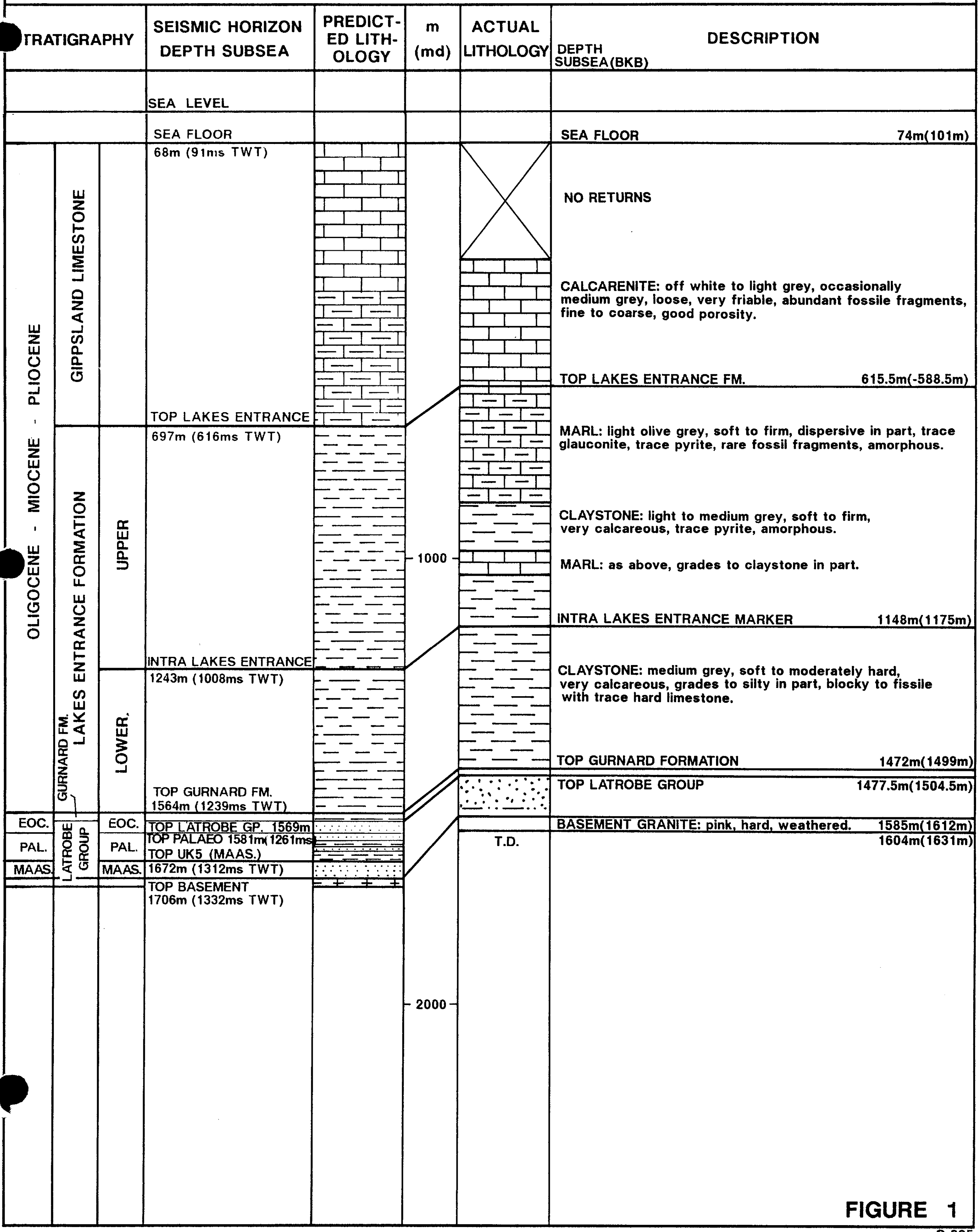


FIGURE 1

G 935

# APPENDIX 1

# WELL COMPLETION REPORT

## MUDSKIPPER-1

INTERPRETATIVE DATA

APPENDIX 1

STRATIGRAPHY

# MUDSKIPPER-1

## STRATIGRAPHY

Formations and seismic horizons intersected during the drilling of Muskipper-1 are listed in Table 1.

Mudskipper-1 penetrated 1403.5m of limestone, marls, calcareous claystones and siltstones of the Pliocene to Middle Eocene Seaspray Group which directly overlies the Latrobe Group. The base of the Seaspray Group is represented by a 29.5m thick red, radioactive silty to sandy claystone of Middle Eocene to early Oligocene age (N.asperus zone). The basal part of these red claystones is equivalent to the Gurnard Formation (Lower N.asperus zone of Middle Eocene age).

The Top Latrobe unconformity was intersected at 1504.5m bkb (1477.5m bsl). The Latrobe Group is represented by 107.5m of Tertiary sediments directly overlying a granitic basement. The upper 81.5m of Latrobe Group consists of very clean, fine to coarse, light grey sandstones deposited in a beach environment. The basal 26m are mainly sandstones and radioactive siltstones with abundant argillaceous and micaceous matrix, corresponding to reworked basement. The low to moderate dinoflagellate content and diversity, associated with abundant glauconite, indicates a near-shore marine environment. The basal 26m has been interpreted as a transgressive facies while the upper part (from 1504.5-1586m bkb) represents a regressive facies.

The youngest Latrobe Group sediments are inferred from log correlations with Moray-1 to be at least early Eocene age.

The oldest sediments found overlying the basement belong to the Palaeocene Lower L.balmei zone and the presence of the dinoflagellate E.crassitabulata confirms that Middle Palaeocene sediments are also present.

Granitic basement was intersected at 1612m bkb (-1585m bsl) and was drilled from 19m to TD at 1631m bkb. The first two metres comprised an altered granite wash rich in clays, containing L.balmei spores.

There were no palynological indications of Cretaceous section within Mudskipper-1. This lack of Cretaceous section is further confirmed from log correlations between Moray-1 and Mudskipper-1.

# TABLE 1

## FORMATION AND SEISMIC TOPS, MUDSKIPPER-1

| Horizon | Depth (RKB)m | Depth (SS)m | TWT sec |
|---|---|---|---|
| Sea Level | 27.0 | 0 | |
| Seafloor/Gippsland Limestone | 101.0 | (-74.0) | - |
| Lakes Entrance Formation | 615.5 ? | (-588.5?) | 0.561 ? |
| Intra Lakes Entrance | 1175.0 | (-1148.0) | 1.025 |
| Top Radioactive Shales (Late Eocene-Early Oligocene) | 1475.0 | (-1448.0) | 1.242 |
| Top Gurnard Formation (Middle Eocene) | 1499.0 ? | (-1472.0?) | 1.258 |
| Top Latrobe Group (Early Eocene) | 1504.5 | (-1477.5) | 1.262 |
| Top Palaeocene Regressive Cycle | 1525.0 | (-1498.0) | 1.276 |
| Top Palaeocene Transgressive Cycle (Radioactive Siltstone) | 1586.0 | (-1559.0) | 1.302 |
| Top Basement | 1612.0 | (-1585.0) | 1.312 |
| Total Depth | 1631.0 | (-1604.0) | |

# TABLE 2

## MUDSKIPPER-1

## PROGNOSED AND ACTUAL DEPTHS AND SEISMIC TOPS

| | PROGNOSED DEPTH (m bsl) | PROGNOSED THICKNESS | PROG TWT (ms) | ACTUAL DEPTH (m bsl) | ACTUAL THICKNESS | ACT TWT (ms) | THICKNESS DISCREPANCY (m) |
|---|---|---|---|---|---|---|---|
| | | 68 | | | 74.0 | | +6.0 |
| Sea Floor | 68 | | 91 | 74.0 | | - | |
| | | 629 | | | 514.5? | | -114.5 |
| Base Gippsland Limestone | 697 | | 616 | 588.5 | | 561 | |
| | | 546 | | | 559.5? | | +13.5 |
| Intra Lakes Entrance Unconformity | 1243 | | 1008 | 1148.0 | | 1025 | |
| Top Radioactive Shale | NOT | | | 1448.0 | | 1242 | - |
| (Late Eocene-Early Oligocene) | PICKED | 321 | | | 324.0 | | +3.0 |
| Top Gurnard Formation | 1564 | | 1239 | 1472.0 | | 1258 | |
| | | 5 | | | 5.5 | | +0.5 |
| Top Latrobe Group | 1569 | | - | 1477.5 | | 1262 | |
| (Early to Mid Eocene) | | 12 | | | 20.5 | | +8.5 |
| Top Palaeocene | 1581 | | 1261 | 1498.0 | | 1276 | |
| Top Palaeocene Transgressive | NOT | | | 1559.0 | | 1302 | |
| Cycle | PICKED | 91 | | | 87.0 | | -4.0 |
| Top Maastrichtian | 1672 | | 1312 | NOT | | | - |
| | | 34 | | PRESENT | 0 | | -34.0 |
| Top Basement | 1706 | | 1332 | 1585.0 | | 1312 | |
| | | 14 | | | 19.0 | | +5.0 |
| Total Depth | 1720 | | - | 1604.0 | | | |

# TABLE 3

## CORRELATIONS BETWEEN MUDSKIPPER-1 AND MORAY-1

| HORIZON | MUDSKIPPER-1 DEPTH mbkb | MUDSKIPPER-1 DEPTH mbsl | MUDSKIPPER-1 THICKNESS | MORAY-1 DEPTH mbkb | MORAY-1 DEPTH mbsl | MORAY-1 THICKNESS |
|---|---|---|---|---|---|---|
| Sea Level | 27.0 | 0 | | 10.0 | 0 | |
| Water Depth | | | 74.0 | | | 76.0 |
| Seabed Floor/Gippsland Limestone | 101.0 | 74.0 | | 86.0 | 76.0 | |
| Gippsland Limestone | | | 514.5? | | | 550.0? |
| Top Lakes Entrance Formation | 615.5? | 588.5? | | 636.0? | 626.0? | |
| Upper Lakes Entrance | | | 559.5? | | | 645.0? |
| Intra Lakes Entrance Unconformity | 1175.0 | 1148.0 | | 1281.0 | 1271.0 | |
| Lower Lakes Entrance | | | 300.0 | | | 367.0 |
| Top Red Shales | 1475.0 | 1448.0 | | 1648.0 | 1638.0 | |
| Late Eocene | | | 24.0 | | | 25.0 |
| Top Gurnard | 1499.0? | 1472.0? | | 1673.0 | 1663.0 | |
| Mid Eocene | | | 5.5 | | | 5.0 |
| Top Latrobe Group | 1504.5 | 1477.5 | | 1678.0 | 1668.0 | |
| Early to Mid Eocene | | | 20.5 | | | 18.0 |
| Top Palaeocene Regressive Cycle | 1525.0 | 1498.0 | | 1696.0 | 1686.0 | |
| Palaeocene Regressive Cycle | | | 61.0 | | | 65.5 |
| Top Palaeocene Transgressive Cycle | 1586.0 | 1559.0 | | 1761.5 | 1751.5 | |
| Palaeocene Transgressive Cycle | | | 26.0 | | | 75.5 |
| Top Cretaceous | Absent | Absent | | 1837.0 | 1827.0 | |
| Cretaceous Section | | | 0 | | | >833.0 |
| Top Basement | 1612.0 | 1585.0 | | Not Reached | Not Reached | |
| | | | >19.0 | | | |
| Total Depth | 1631.0 | 1604.0 | | 2670.0 | | ? |

PE906525

This is an enclosure indicator page.
The enclosure PE906525 is enclosed within the container PE902074 at this location in this document.

The enclosure PE906525 has the following characteristics:

| | |
|---|---|
| ITEM_BARCODE = | PE906525 |
| CONTAINER_BARCODE = | PE902074 |
| NAME = | Stratigraphic Table |
| BASIN = | GIPPSLAND |
| PERMIT = | VIC/P20 |
| TYPE = | WELL |
| SUBTYPE = | STRAT_COLUMN |
| DESCRIPTION = | Stratigraphic Table for Mudskipper-1 |
| REMARKS = | |
| DATE_CREATED = | 29/06/90 |
| DATE_RECEIVED = | 11/12/90 |
| W_NO = | W1032 |
| WELL_NAME = | MUDSKIPPER-1 |
| CONTRACTOR = | |
| CLIENT_OP_CO = | PETROFINA EXPLORATION AUSTRALIA |

(Inserted by DNRE - Vic Govt Mines Dept)

# APPENDIX 2

APPENDIX 2

WELL COMPLETION REPORT

MUDSKIPPER-1

INTERPRETATIVE DATA

# APPENDIX 2

# MICROPALAEONTOLOGICAL ANALYSIS

# MICROPALAEONTOLOGICAL ANALYSIS, MUDSKIPPER-1, GIPPSLAND BASIN

J.P. Rexilius
INTERNATIONAL STRATIGRAPHIC CONSULTANTS PTY LTD
Unit 2, 10 Station Street
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August, 1990.

# C O N T E N T S

## I. SUMMARY

Mudskipper-1 was drilled in offshore petroleum permit Vic P/20, Gippsland Basin to a depth of 1632mKB. Ditch cuttings from 800m to 1472m have been examined for foraminifera. A summary of the biostratigraphic and environmental sub-division is given below:-

Planktonic Foraminiferal Subdivision

| | | | |
|---|---|---|---|
| 800m | : | Zone E2 | latest Early Miocene |
| 850m | : | Zone F | upper Early Miocene |
| 950m | : | Zones F & G | upper-mid Early Miocene |
| 1000m-1210m | : | Zone G | mid Early Miocene |
| 1235m-1472m | : | Indeterminate | |

Environment of Deposition

| | | |
|---|---|---|
| Samples 800m-1210m inclusive | : | outer neritic-upper bathyal |
| 1235m | : | outer neritic or deeper |
| 1300m & 1450m inclusive | : | undifferentiated neritic |
| 1472m | : | ?proximal neritic |

## II. INTRODUCTION

A total of 10 sidewall core samples have been scrutinized for foraminifera from the interval 800m to 1472m in Mudskipper-1. Fossil assemblages identified in the well section have been plotted on the distribution chart (Appendix No. 2).

## III. BIOSTRATIGRAPHIC ANALYSIS

The planktonic foraminiferal letter zonal scheme of Taylor (in prep.) is used for biostratigraphic subdivision.

1. 800m : Zone E2 (latest Early Miocene)

   Assignment to Zone E2 is based on the occurrence of Praeorbulina glomerosa and lack of Orbulina species.

2. 850m : Zone F (upper Early Miocene)

   The occurrence of Globigerinoides sicanus without Praeorbulina glomerosa is consistent with assignment to Zone F.

3. 950m : Zones F & G (upper-mid Early Miocene)

   The association of rare Globigerinoides aff. sicanus and Globigerinoides trilobus indicates that the sample at 950m is assignable to Zones F & G.

4. 1000m-1210m : Zone G (mid Early Miocene)

   The samples at 1000m and 1210m contain rich planktonic foraminiferal faunas which include Globigerinoides trilobus (frequent) and Globorotalia miozea miozea (few-frequent), and lack Globigerinoides sicanus. This assemblage is consistent with an upper Zone G age. The sidewall core sample at 1180m, which includes several specimens of the Zone F index species Globigerinoides sicanus, may be out of place with respect to the the other sidewall core samples or the sample may be contaminated.

5. 1235m : Indeterminate (no older than Oligocene)

   The recrystallised limestone at 1235m contains a very impoverished ans very poorly preserved foraminiferal fauna. The occurrence of minor Globigerina praebulloides indicates an age no older than Oligocene.

6. 1300m-1472m : Indeterminate

   The samples in the interval lack in-situ planktonic foraminifera.

IV. ENVIRONMENT OF DEPOSITION

1. Samples 800m-1210m inclusive : Outer neritic-upper bathyal

The samples in the interval are interpreted to have been deposited in an outer neritic to upper bathyal environment. The moderate to high yielding foraminiferal faunas in the interval comprise between 50% and 80% planktonics. The moderately diverse benthonic assemblages include Siphouvigerina proboscidea (few-common from 800m to 950m), Globocassidulina subglobosa (rare-common), Siphonina australis (rare-few), Cassidulina laevigata/delicata (few-common), Gyroidina zelandica (rare-few), Euuvigerina schwageri (rare-frequent with sporadic distribution), Sphaeroidina bulloides (few-frequent), Pullenia bulloides (rare-frequent from 950m to 1210m) and Euuvigerina aff. flintii (few).

2. 1235m : Outer neritic or deeper

The very impoverished and very poorly preserved foraminiferal fauna in the recrystallised limestone at 1235m includes minor planktonics together with the following benthonic taxa: Globocassidulina subglobosa (rare), Hyperammina (rare) and ?Marssonella (rare). Deposition in an outer neritic or deeper environment seems probable.

3. 1300m & 1450m : Undifferentiated neritic

The oxidised (limonitic) glauconitic sandstones at 1300m and 1450m are barren of in-situ foraminifera. The sample at 1450m contains rare fish teeth. The occurrence of abundant oxidised glauconite is consistent with deposition in an undifferentiated neritic environment.

4. 1472m : ?Proximal neritic

The slightly oxidised glauconitic sandstone at 1472m contains a very low yielding agglutinated benthonic foraminiferal fauna including Haplophragmoides (few). Deposition is suspected to have occurred in a proximal neritic setting.

## V. REFERENCES

TAYLOR, D.J., (in prep.). Observed Gippsland biostratigraphic sequences of planktonic foraminiferal assemblages.

## APPENDIX NO. 1: SUMMARY OF MICROPALAEONTOLOGICAL DATA, MUDSKIPPER-1

| SAMPLE (mKB) | FORAM YIELD | FORAM PRESERV. | FORAM DIVERSITY |
|---|---|---|---|
| SWC30, 800 | moderate/low | moderate/good | moderate |
| SWC29, 850 | high | good | high |
| SWC28, 950 | high | moderate | moderate/high |
| SWC27, 1000 | high | moderate/good | high |
| SWC25, 1180 | high | moderate/good | moderate |
| SWC24, 1210 | high | moderate/good | high |
| SWC23, 1235 | very low | very poor | low |
| *SWC22, 1300 | very low | poor | very low |
| *SWC21, 1450 | very low | poor | low |
| #SWC20, 1472 | very low | poor | very low |

* sample comprises contaminants only.
# sample includes both in-situ taxa and contaminants.

| SAMPLE TYPE OR NO. | SWC | SWC | SWC | SWC | SWC | SWC | SWC | SWC | SWC | SWC |
|---|---|---|---|---|---|---|---|---|---|---|
| FOSSIL NAMES / DEPTHS | 800m | 850m | 950m | 1000m | 1180m | 1210m | 1235m | 1300m | 1450m | 1472m |
| BENTHONIC FORAMINIFERA | | | | | | | | | | |
| Cibicides spp. | / | / | | 0 | 0 | 0 | • | | | |
| Fissurina spp. | / | 0 | 0 | 0 | | 0 | | | c• | |
| Bulimina pupoides | • | | | • | ● | | | | | |
| Siphouvigerina proboscidea | ● | | / | | | | | | | |
| Brizalina spp. | 0 | ● | ● | ● | ● | ● | | | c• | |
| Dentalina spp. | / | | • | | • | | | | | |
| Nodosaria spp. | 0 | | | | | | | | | |
| Lenticulina spp. | / | 0 | / | / | | 0 | | | | / |
| Globocassidulina subglobosa | / | / | • | 0 | 0 | 0 | • | c• | | |
| Lagenonodosaria scalaris | / | 0 | | • | | • | | | | |
| Martinottiella communis | / | 0 | / | • | | / | | | | |
| Sphaeroidina bulloides | / | 0 | / | 0 | | / | | | c/ | |
| Cibicides spp. (small) | • | ● | ● | 0 | ■ | 0 | | | c/ | |
| Siphonina australis | • | | • | / | | / | | | | |
| Quinqueloculina spp. | • | / | / | / | | / | | | | |
| Cassidulina delicata/laevigata | / | 0 | 0 | ● | / | 0 | | | | |
| Pullenia aff. bulloides | • | | | | | | | | | |
| Cibicides mediocris | • | / | 0 | / | | 0 | | | c/ | |
| Pleurostomella spp. | | / | | | | | | | | |
| Lagena apiculata | | 0 | • | | | | | | | |
| Heronallenia lingulata | | / | | • | • | • | | | | |
| Textularia spp. | | • | | | | | | | | |
| Euuvigerina schwageri | | 0 | | • | | | | | | |
| Gyroidina spp. | | / | | | | / | | | | |
| Ramulina spp. | | / | | | | | | | | |
| Anomalina spp. | | / | | / | | | | | | |
| Gyroidina zelandica | | / | • | • | / | • | | | | |
| Gaudryina spp. | | • | • | • | | • | | | | |
| Cassidulinoides bradyi | | • | | | | | | | | |
| Pullenia quinqueloba | | • | | / | | | | | | |
| Nonionella spp. | | • | | | | | | | | |
| Lagena spp. | | • | | • | | • | | | | |
| Hanzawaia spp. | | / | • | / | 0 | / | | | | |
| Pyrulina aff. cylindroides | | • | | | | / | | | | |
| Cassidulina spp. | | / | | | | | | | | |
| Quadrimorphina spp. | | • | | • | | | | | | |
| Textularia semicarinata | | | / | | | • | | | | |
| Pullenia bulloides | | | • | / | • | 0 | | | | |
| Anomalinoides procolligera | | | / | | | | | | | |
| Indeterminate nodosarids | | | • | | | | | | | |
| Lagena sulcata | | | • | | • | | | | | |
| Lagena acuticostata | | | • | 0 | | / | | | | |
| Globocassidulina spp. | | | | • | | | | | | |
| Trifarina bradyi | | | | • | / | / | | | | |
| Dorothia spp. | | | | / | | | • | | | |
| Bulimina aff. aculeata | | | | • | | | | | | |
| Textularia aff. semicarinata | | | | / | | | | | | |
| Buliminella spp. | | | | • | | | | | | |
| Euuvigerina aff. flintii | | | | / | | / | | | | |
| Glandulina spp. | | | | • | | | | | | |
| Karreria maoria | | | | • | | | | | | |
| Eponides praecinctus | | | | | • | | | | | |
| Marssonella spp. | | | | | • | | | | | |
| Parrelina spp. | | | | | | / | | | | |

• Single / Rare 0 Few ● Common ■ Dominant B Barren C Contamination

| SAMPLE TYPE OR NO. | SWC | SWC | SWC | SWC | SWC | SWC | SWC | SWC | SWC | SWC |
|---|---|---|---|---|---|---|---|---|---|---|
| FOSSIL NAMES / DEPTHS | 800m | 850m | 950m | 1000m | 1180m | 1210m | 1235m | 1300m | 1450m | 1472m |
| Indeterminate agglutinates | | | | | | · | / | | | · |
| Heronallenia spp. | | | | | | · | | | | |
| Ammodiscus spp. | | | | | | · | | | | |
| ?Guttelina spp. | | | | | | | · | | | |
| Hyperammina spp. | | | | | | | · | | | |
| ?Marssonella spp. | | | | | | | · | | | |
| Haplophragmoides spp. | | | | | | | | | | / |
| Indeterminate rotalids | | | | | | | | | | c. |
| | | | | | | | | | | |
| PLANKTONIC FORAMINIFERA | | | | | | | | | | |
| Globorotalia miozea miozea | / | 0 | / | 0 | | / | | | | |
| Praeorbulina glomerosa | / | | | | | | | | | |
| Globigerina woodi woodi | / | 0 | 0 | ■ | 0 | ● | | | | |
| Globigerinoides trilobus | / | 0 | 0 | 0 | 0 | 0 | | | c. | |
| Globigerina praebulloides | / | ● | 0 | ■ | 0 | ● | / | | | |
| Globigerinoides sicanus | / | 0 | | | c/ | | | | | |
| Turborotalia bella | / | | | / | · | · | | | | |
| Globorotalia praescitula | / | ● | 0 | ■ | 0 | 0 | | | c/ | |
| Small planktonics | 0 | ■ | ■ | ■ | ● | ● | | c. | c/ | c. |
| Globoquadrina dehiscens s.s. | | / | · | · | | / | | | | |
| Globoquadrina advena | | · | | · | | · | | | | |
| Globigerinoides spp. | | · | | | | | | | | |
| Orbulina universa | | | c. | | c. | c. | | | | c. |
| Globigerinoides aff. sicanus | | | · | | | | | | | |
| Turborotalia mayeri | | | | 0 | · | 0 | | | | |
| Globigerina woodi connecta | | | | / | / | / | | | | |
| Turborotalia spp. | | | | | / | | | | c/ | |
| Globigerina venezuelana | | | | | | 0 | | | | |
| Indeterminate planktonics | | | | | | | / | | c. | |
| Globigerina spp. | | | | | | | · | c. | c/ | |
| Turborotalia aff. mayeri | | | | | | | | c. | | |
| | | | | | | | | | | |
| OTHER SKELETAL MATERIAL | | | B | | | | | B | | B |
| Ostracods | · | / | | / | · | / | | | | |
| Fish teeth | | · | | | | | · | | · | |
| Sponge spicules | | / | | | / | / | | | | |

· Single / Rare O Few ● Common ■ Dominant B Barren C Contamination

# APPENDIX 3

APPENDIX 3

# WELL COMPLETION REPORT

## MUDSKIPPER-1

## INTERPRETATIVE DATA

## A P P E N D I X   3

## PALYNOLOGY

# PALYNOLOGY OF PETROFINA MUDSKIPPER-1, GIPPSLAND BASIN, AUSTRALIA

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for PETROFINA EXPLORATION AUSTRALIA SA JULY 1990

# PALYNOLOGY OF PETROFINA MUDSKIPPER-1, GIPPSLAND BASIN, AUSTRALIA

BY

ROGER MORGAN

CONTENTS | PAGE

## I SUMMARY

1477.5m (swc) : very lean but apparently upper N. asperus Zone (P. comatum Dinoflagellate Zone) : late Eocene : offshore marine : immature

1498.5m (swc) : extremely lean - almost barren : apparently marine but may be minor mud contamination

1500m (swc) : lower N. asperus Zone (D. heterophlycta zone) : Middle Eocene : offshore marine : immature

1503.5 (swc)-1506m (swc) : Indeterminate : These samples are all extremely lean with traces of caved Oligocene, presumably present as very minor mud contamination into these sandy swcs

1510m (cutts) : lower N. asperus Zone (W. echinosuturata Dinoflagellate Zone) : Middle Eocene : marine : immature

1511m (swc)-1557m (swc) : Indeterminate : these samples contain lean caved Oligocene and Miocene, clearly mud contamination into barren sands

1587.5m (swc)-1613.5m (swc) : lower L. balmei Zone (E. crassitabulata Dinoflagellate Zone) : mid Paleocene : nearshore marine : immature

## II INTRODUCTION

Seventeen samples were submitted by Nick Grollmann of Petrofina for palynology. Raw data is presented in Appendix I.

The palynostratigraphic framework for the Cretaceous is most recently reviewed by Helby, Morgan and Partridge (1987). In the Tertiary, the zonal scheme was most recently published by Partridge (1976), but significant new data exists in privately circulated studies, in Harris (1985), Morgan (1988), and in Marshall and Partridge (1988). The zonal scheme used here is shown in Fig. 1 and is a combination of Helby, Morgan and Partridge (1987) and Partridge (1976). The data is easily discussed against this framework.

Organic maturity data was generated in the form of the Spore Colour Index and plotted on Fig. 2. The oil and gas windows follow the general consensus of geochemical literature. The oil window corresponds to spore colours of light-mid brown (2.7) to dark brown (3.6). This would correspond to Vitrinite Reflectance values of 0.6% to 1.3%. However, factors such as detailed kerogen type, basin type, basin history and heating curves all affect precise interpretation, and analytical machine-based maturity parameters are probably more reliable.

## III PALYNOSTRATGRAPHY

A. 1477.5m (swc) : apparently upper N. asperus Zone (P. cornatum Dinoflagellate Zone)

The sample is extremely lean and spore pollen zonal assignment is based on the dinoflagellates. The meagre spores and pollen include Nothofagidites asperus, but are otherwise not age diagnostic.

Microplankton are also rare, but are much more common than the spores and pollen. Paralecaniella indentata dominates with frequent Apectodinium homomorphum, Phthanoperidinium comatum and Spiniferites ramosus. This indicates assignment to the P. comatum dinoflagellate zone, correlative with the upper N. asperus spore pollen zone.

Dinoflagellate dominance indicates offshore marine environments.

Colourless palynomorphs indicate immaturity for hydrocarbon generation.

B. 1498.5m (swc)

This sample is almost barren and cannot be assigned to any zone. Operculodinium spp and Spiniferites spp occur, but may be minor mud contamination from the Oligocene above.

C. 1500m (swc) : lower N. asperus zone (D. heterophlycta Dinoflagellate Zone)

Spore pollen are quite rare (5% of palynomorphs) in this sample and are not age diagnostic.

Haloragacidites harrisii is frequent.

Dinoflagellates are abundant and diverse, dominated by Spiniferites and Homotriblium tasmaniense, with frequent Areoligera senonensis, A. homomorphum and Cordosphaeridium multispinosum. The presence of Deflandrea heterophlycta, Rhombodinium glabrum, Achilleodinium biformoides and common H. tasmaniense indicate assignment to the D. heterophlycta dinoflagellate zone.

Dinoflagellate dominance and diversity indicate offshore marine environments.

Pale yellow palynomorphs indicate immaturity for hydrocarbons.

D. 1503.5-1506m (swc) : indeterminate

These samples are extremely lean and indeterminate. The meagre assemblage at 1503.5m is dominated by Operculodinium spp and probably represents mud contamination from the Oligocene.

E. 1510m (cutts) : lower N. asperus Zone (W. echinosuturata Dinoflagellate Zone)

This cuttings sample is also extremely lean. The dominant elements include the spore Cyatheacidites annulatus and the frequent dinoflagellates Operculodinium spp and S. ramosus, indicating caving from the Oligocene P. tuberculatus Zone. However, a rare element is Areosphaeridium diktyoplokus indicating the W. echinosuturata dinoflagellate zone, and the correlative lower N. asperus spore pollen zone. It is probably caved a short distance from above 1504.5m.

Marine environments are indicated, and the pale yellow spore colours indicate immaturity for hydrocarbons.

F. 1511m (swc)-1557m (swc) : indeterminate

These very sandy samples all contain very meagre assemblages that are not age diagnostic, or are clearly caved. Most persistent are the frequent Operculodinium spp. caved from the Oligocene, but the Miocene indicator Tuberculodinium vancompae occurs at 1557m (swc).

G. 1587.5m (swc)-1613.5m (swc) : lower L. balmei Zone (E. crassitabulata Dinoflagellate Zone)

Although never really rich, these assemblages are much better than any above. The presence of Lygistepollenites balmei and Gambierina edwardsii without younger or older indicators enables assignment to the lower L. balmei Zone. Common forms throughout include Proteacidites, Nothofagidites and Cyathidites.

Dinoflagellates include the distinctive Eisenackia crassitabulata indicating the E. crassitabulata Dinoflagellate Zone of mid Paleocene age. Assemblages are of low to moderate diversity and include common Glaphyrocysta retiintexta, S. ramosus and Spinidinium spp.

Nearshore marine environments are indicated by the low to moderate dinoflagellate content and diversity.

Yellow to light brown spore colours indicate immaturity for hydrocarbon generation.

## IV CONCLUSIONS

A. The sandy facies at this location have precluded crisp zonal assignment of many intervals. Resolution of the late Paleocene and probably early Eocene is not possible.

B. Clearly the oldest fossiliferous section is of mid Paleocene age. No suggestion of Cretaceous section was seen at this location.

| | AGE | | SPORE - POLLEN ZONES | DINOFLAGELLATE ZONES |
|---|---|---|---|---|
| Early Tertiary | Early Oligocene | | P. tuberculatus | |
| Early Tertiary | Late Eocene | | upper N. asperus | P. comatum |
| Early Tertiary | Late Eocene | | middle N. asperus | V. extensa |
| Early Tertiary | Middle Eocene | | lower N. asperus | D. heterophlycta<br>W. echinosuturata |
| Early Tertiary | Middle Eocene / Early Eocene | | P. asperopolus | W. edwardsii<br>W. thompsonae |
| Early Tertiary | Early Eocene | | upper M. diversus | W. ornata<br>W. waipawaensis |
| Early Tertiary | Early Eocene | | middle M. diversus | |
| Early Tertiary | Early Eocene | | lower M. diversus | W. hyperacantha |
| Early Tertiary | Paleocene | | upper L. balmei | A. homomorpha |
| Early Tertiary | Paleocene | | lower L. balmei | E. crassitabulata<br>T. evittii |
| Late Cretaceous | Maastrichtian | | T. longus | M. druggii |
| Late Cretaceous | Campanian | | T. lilliei | I. korojonense |
| Late Cretaceous | Campanian | | N. senectus | X. australis |
| Late Cretaceous | Santonian | | T. pachyexinus | N. aceras<br>I. cretaceum<br>O. porifera |
| Late Cretaceous | Coniacian | | C. triplex | C. striatoconus |
| Late Cretaceous | Turonian | | C. triplex | P. infusorioides |
| Late Cretaceous | Cenomanian | | A. distocarinatus | |
| Early Cretaceous | Albian | Late | P. pannosus | |
| Early Cretaceous | Albian | Middle | upper C. paradoxa | |
| Early Cretaceous | Albian | Middle / Early | lower C. paradoxa | |
| Early Cretaceous | Albian | Early | C. striatus | |
| Early Cretaceous | Aptian | | upper C. hughesi | |
| Early Cretaceous | Aptian | | lower C. hughesi | |
| Early Cretaceous | Barremian | | F. wonthaggiensis | |
| Early Cretaceous | Hauterivian | | F. wonthaggiensis | |
| Early Cretaceous | Valanginian | | upper C. australiensis | |
| Early Cretaceous | Berriasian | | lower C. australiensis | |
| Juras. | Tithonian | | R. watherooensis | |

FIGURE 1 ZONATION FRAMEWORK

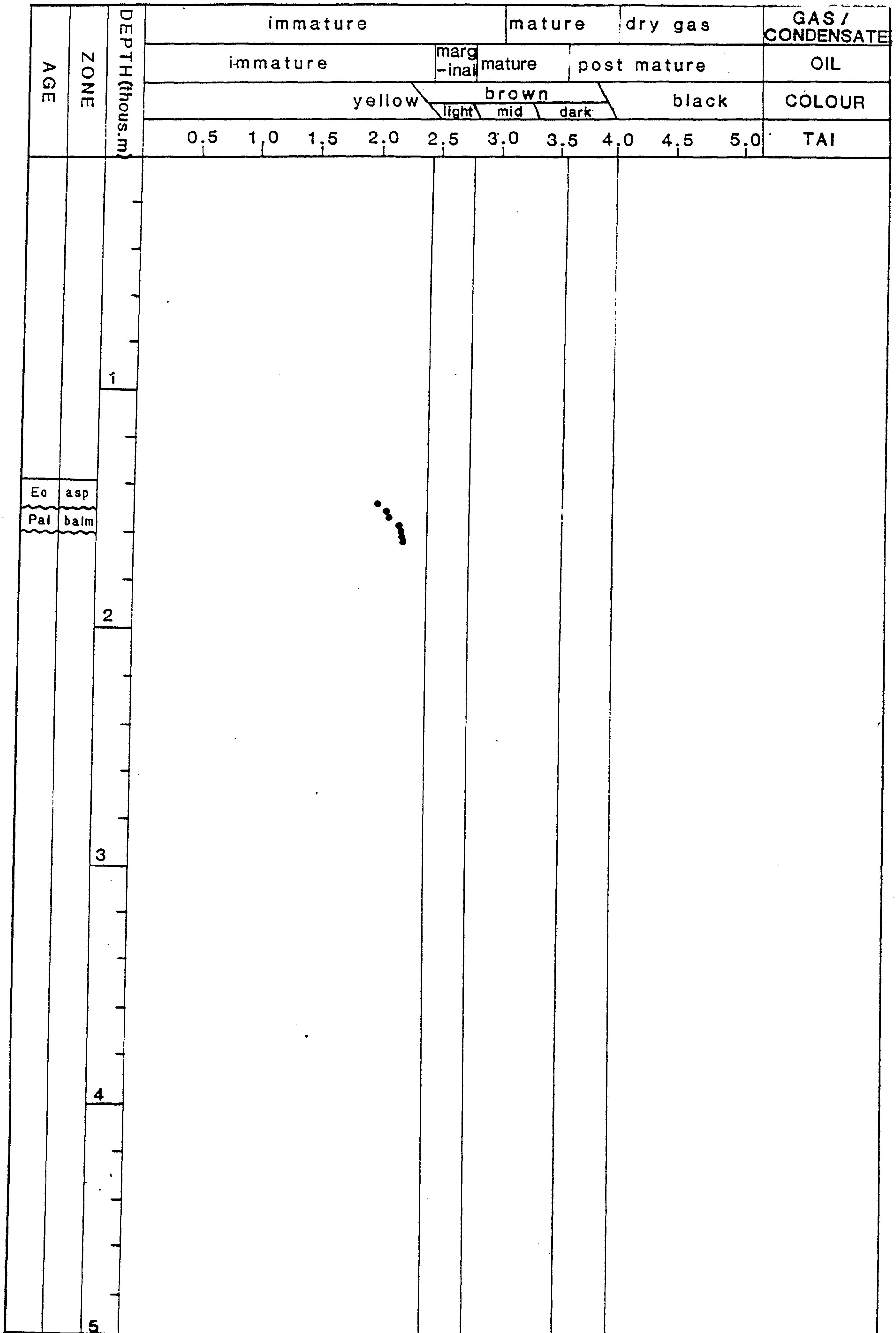



FIGURE 2 MATURITY PROFILE MUDSKIPPER 1

# MUDSKIPPER #1 palynological data

Roger Morgan, PALYNOLOGICAL CONSULTANT
Box 161, Maitland, South Australia, 5573.
phone (088) 32 2795.. ..fax (088) 32 2658

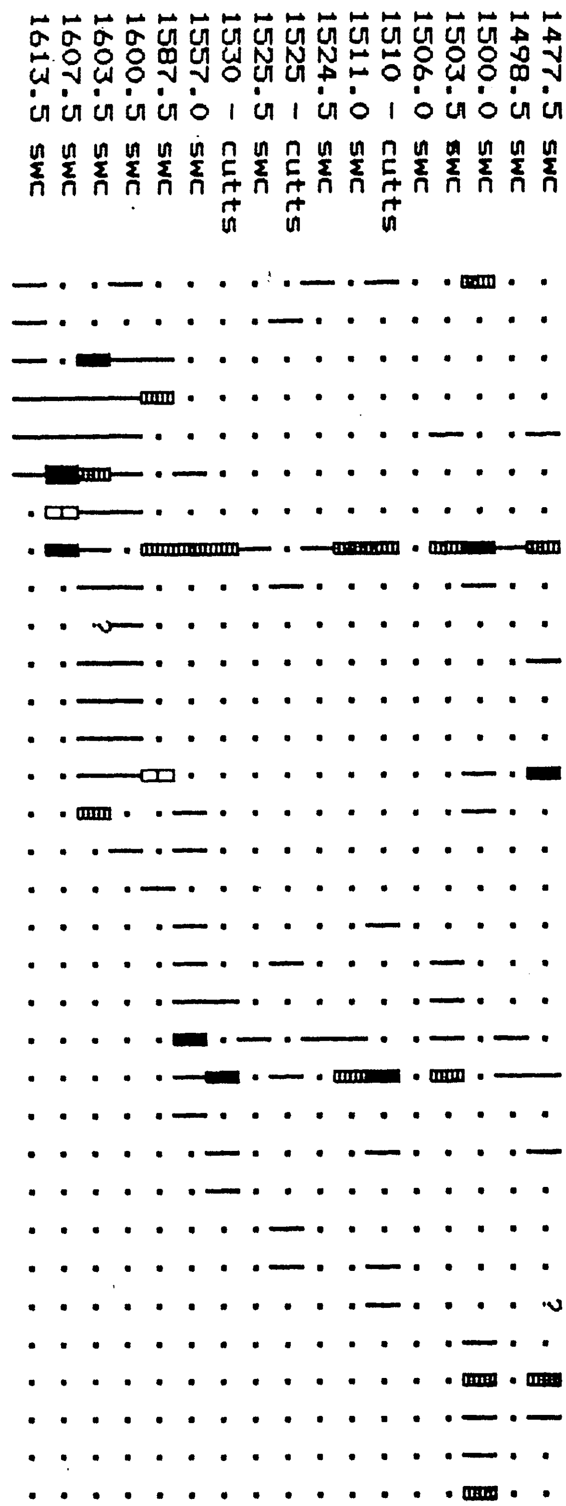
C L I E N T: PETROFINA
W E L L: Mudskipper #1
F I E L D / A R E A: Gippsland Basin

A N A L Y S T: Roger Morgan D A T E : July '90
N O T E S: all sample depths are in metres

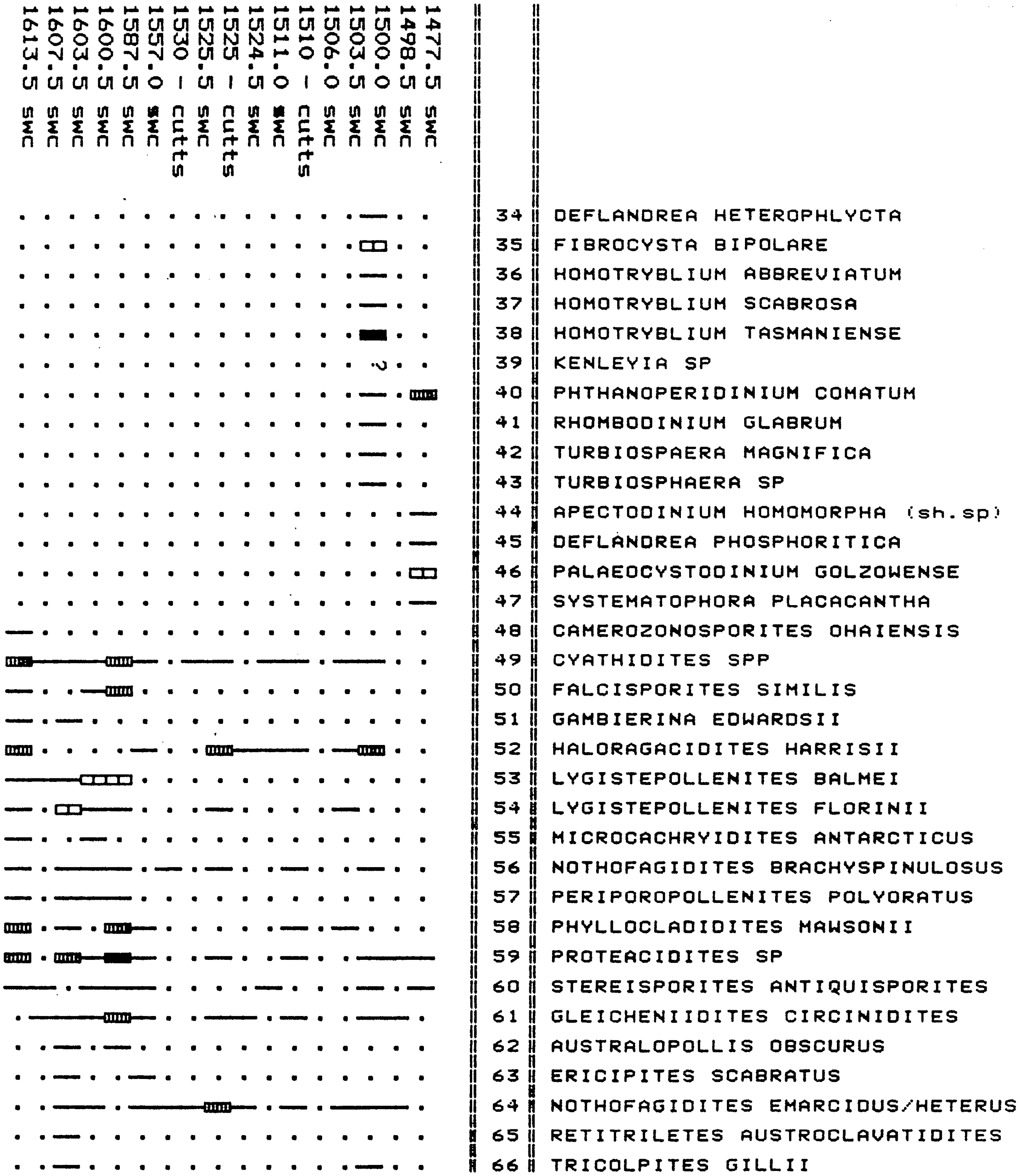
RANGE CHART OF GRAPHIC ABUNDANCES BY LOWEST APPEARANCE..dinos & s/p

Key to Symbols

= Very Rare
= Rare
= Few
= Common
= Abundant
? = Questionably Present
. = Not Present




1 AREOLIGERA SENONENSIS
2 CORDOSPHAERIDIUM INODES
3 DEFLANDREA DILWYNENSIS
4 EISENACKIA CRASSITABULATA
5 GLAPHYROCYSTA PASTIELLII
6 GLAPHYROCYSTA RETIINTEXTA
7 MICRODINIUM SP2
8 SPINIFERITES RAMOSUS
9 CYCLOPSIELLA VIETA
10 DEFLANDREA MEDCALFII
11 DEFLANDREA SPECIOSUS
12 HYSTRICHOSPHAERIDIUM TUBIFERUM
13 PALAEOCYSTODINIUM AUSTRALINUM
14 PARALECANIELLA INDENTATA
15 SPINIDINIUM SP1
16 SPINIDINIUM LANTERNUM
17 HEMICYSTODINIUM ZOHARYI
18 IMPLETOSPHAERIDIUM SP
19 LINGULODINIUM MACHAEROPHORUM
20 NEMATOSPHAEROPSIS BALCOMBIANA
21 OPERCULODINIUM CENTROCARPUM
22 OPERCULODINIUM SPP
23 TUBERCULODINIUM VANCOMPOAE
24 CEREBROCYSTA SP
25 HETERAULACACYSTA PAXILLA
26 HYSTRICHOKOLPOMA EISENACKII
27 IMPAGIDINIUM DISPERTITUM
28 AREOSPHAERIDIUM DIKTYOPLOKUS
29 ACHILLEODINIUM BIFORMOIDES
30 APECTODINIUM HOMOMORPHA (l.sp)
31 APTEODINIUM AUSTRALIENSE
32 AREOSPHAERIDIUM ARCUATUM
33 CORDOSPHAERIDIUM MULTISPINOSUM



1477.5 SWC
1498.5 SWC
1500.0 SWC
1503.5 SWC
1506.0 SWC
1510 - cutts
1511.0 SWC
1524.5 SWC
1525 - cutts
1525.5 SWC
1530 - cutts
1557.0 SWC
1587.5 SWC
1600.5 SWC
1603.5 SWC
1607.5 SWC
1613.5 SWC
34 DEFLANDREA HETEROPHLYCTA
35 FIBROCYSTA BIPOLARE
36 HOMOTRYBLIUM ABBREVIATUM
37 HOMOTRYBLIUM SCABROSA
38 HOMOTRYBLIUM TASMANIENSE
39 KENLEYIA SP
40 PHTHANOPERIDINIUM COMATUM
41 RHOMBODINIUM GLABRUM
42 TURBIOSPAERA MAGNIFICA
43 TURBIOSPHAERA SP
44 APECTODINIUM HOMOMORPHA (sh.sp)
45 DEFLANDREA PHOSPHORITICA
46 PALAEOCYSTODINIUM GOLZOWENSE
47 SYSTEMATOPHORA PLACACANTHA
48 CAMEROZONOSPORITES OHAIENSIS
49 CYATHIDITES SPP
50 FALCISPORITES SIMILIS
51 GAMBIERINA EDWARDSII
52 HALORAGACIDITES HARRISII
53 LYGISTEPOLLENITES BALMEI
54 LYGISTEPOLLENITES FLORINII
55 MICROCACHRYIDITES ANTARCTICUS
56 NOTHOFAGIDITES BRACHYSPINULOSUS
57 PERIPOROPOLLENITES POLYORATUS
58 PHYLLOCLADIDITES MAWSONII
59 PROTEACIDITES SP
60 STEREISPORITES ANTIQUISPORITES
61 GLEICHENIIDITES CIRCINIDITES
62 AUSTRALOPOLLIS OBSCURUS
63 ERICIPITES SCABRATUS
64 NOTHOFAGIDITES EMARCIDUS/HETERUS
65 RETITRILETES AUSTROCLAVATIDITES
66 TRICOLPITES GILLII

| 1613.5 SWC | 1607.5 SWC | 1603.5 SWC | 1600.5 SWC | 1587.5 SWC | 1557.0 SWC | 1530 - cutts | 1525.5 SWC | 1525 - cutts | 1524.5 SWC | 1511.0 SWC | 1510 - cutts | 1506.0 SWC | 1503.5 SWC | 1500.0 SWC | 1498.5 SWC | 1477.5 SWC | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| . | . | — | . | . | . | . | . | . | . | . | . | . | . | . | . | . | 67 | TRICOLPITES SP |
| . | . | — | . | . | . | . | . | . | . | . | . | . | . | . | . | . | 68 | TRICOLPORITES |
| . | . | . | — | . | . | . | . | . | . | . | . | . | . | . | . | . | 69 | PODOSPORITES MICROSACCATUS |
| . | . | . | . | — | . | . | . | . | . | . | . | . | . | . | . | . | 70 | CLAVIFERA TRIPLEX |
| . | . | . | . | — | . | . | . | — | . | . | . | . | . | . | . | . | 71 | DILWYNITES GRANULATUS |
| . | . | . | . | ▥ | . | . | . | . | . | . | . | . | . | . | . | . | 72 | NOTHOFAGIDITES ENDURUS |
| . | . | . | . | — | . | . | . | . | . | . | . | . | . | . | . | . | 73 | PHYLLOCLADIDITES VERRUCOSUS |
| . | . | . | . | — | . | . | . | . | . | . | . | . | . | . | . | . | 74 | POLYPODIISPORITES SPP |
| . | . | . | . | — | . | . | . | . | . | . | . | . | . | . | . | . | 75 | STEREISPORITES (TRIPUNCTISPORIS) PUNCTATUS |
| . | . | . | . | . | — | . | . | . | . | . | — | . | . | . | . | . | 76 | CYATHEACIDITES ANNULATUS |
| . | . | . | . | . | ? | — | . | — | . | . | . | . | . | . | . | . | 77 | NOTHOFAGIDITES FALCATUS |
| . | . | . | . | . | . | . | . | — | . | . | — | . | . | . | . | . | 78 | HERKOSPORITES ELLIOTTII |
| . | . | . | . | . | . | . | . | . | . | . | — | . | . | . | . | . | 79 | CERATOSPORITES EQUALIS |
| . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | ? | — | 80 | NOTHOFAGIDITES ASPERUS |
| . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | — | 81 | CYATHIDITES GIGANTIS |

1613.5 SWC 1607.5 SWC 1603.5 SWC 1600.5 SWC 1587.5 SWC 1557.0 SWC 1530 - cutts 1525.5 SWC 1525 - cutts 1524.5 SWC 1511.0 SWC 1510 - cutts 1506.0 SWC 1503.5 SWC 1500.0 SWC 1498.5 SWC 1477.5 SWC

## SPECIES LOCATION INDEX

Index numbers are the columns in which species appear.

| INDEX NUMBER | SPECIES |
|---|---|
| 29 | ACHILLEODINIUM BIFORMOIDES |
| 30 | APECTODINIUM HOMOMORPHA (l.sp) |
| 44 | APECTODINIUM HOMOMORPHA (sh.sp) |
| 31 | APTEODINIUM AUSTRALIENSE |
| 1 | AREOLIGERA SENONENSIS |
| 32 | AREOSPHAERIDIUM ARCUATUM |
| 28 | AREOSPHAERIDIUM DIKTYOPLOKUS |
| 62 | AUSTRALOPOLLIS OBSCURUS |
| 48 | CAMEROZONOSPORITES OHAIENSIS |
| 79 | CERATOSPORITES EQUALIS |
| 24 | CEREBROCYSTA SP |
| 70 | CLAVIFERA TRIPLEX |
| 2 | CORDOSPHAERIDIUM INODES |
| 33 | CORDOSPHAERIDIUM MULTISPINOSUM |
| 76 | CYATHEACIDITES ANNULATUS |
| 81 | CYATHIDITES GIGANTIS |
| 49 | CYATHIDITES SPP |
| 9 | CYCLOPSIELLA VIETA |
| 3 | DEFLANDREA DILWYNENSIS |
| 34 | DEFLANDREA HETEROPHLYCTA |
| 10 | DEFLANDREA MEDCALFII |
| 45 | DEFLANDREA PHOSPHORITICA |
| 11 | DEFLANDREA SPECIOSUS |
| 71 | DILWYNITES GRANULATUS |
| 4 | EISENACKIA CRASSITABULATA |
| 63 | ERICIPITES SCABRATUS |
| 50 | FALCISPORITES SIMILIS |
| 35 | FIBROCYSTA BIPOLARE |
| 51 | GAMBIERINA EDWARDSII |
| 5 | GLAPHYROCYSTA PASTIELLII |
| 6 | GLAPHYROCYSTA RETIINTEXTA |
| 61 | GLEICHENIIDITES CIRCINIDITES |
| 52 | HALORAGACIDITES HARRISII |
| 17 | HEMICYSTODINIUM ZOHARYI |
| 78 | HERKOSPORITES ELLIOTTII |
| 25 | HETERAULACACYSTA PAXILLA |
| 36 | HOMOTRYBLIUM ABBREVIATUM |
| 37 | HOMOTRYBLIUM SCABROSA |
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| 26 | HYSTRICHOKOLPOMA EISENACKII |
| 12 | HYSTRICHOSPHAERIDIUM TUBIFERUM |
| 27 | IMPAGIDINIUM DISPERTITUM |
| 18 | IMPLETOSPHAERIDIUM SP |
| 39 | KENLEYIA SP |
| 19 | LINGULODINIUM MACHAEROPHORUM |
| 53 | LYGISTEPOLLENITES BALMEI |
| 54 | LYGISTEPOLLENITES FLORINII |
| 55 | MICROCACHRYIDITES ANTARCTICUS |
| 7 | MICRODINIUM SP2 |
| 20 | NEMATOSPHAEROPSIS BALCOMBIANA |
| 80 | NOTHOFAGIDITES ASPERUS |
| 56 | NOTHOFAGIDITES BRACHYSPINULOSUS |
| 64 | NOTHOFAGIDITES EMARCIDUS/HETERUS |
| 72 | NOTHOFAGIDITES ENDURUS |
| 77 | NOTHOFAGIDITES FALCATUS |
| 21 | OPERCULODINIUM CENTROCARPUM |
| 22 | OPERCULODINIUM SPP |
| 13 | PALAEOCYSTODINIUM AUSTRALINUM |
| 46 | PALAEOCYSTODINIUM GOLZOWENSE |
| 14 | PARALECANIELLA INDENTATA |
| 57 | PERIPOROPOLLENITES POLYORATUS |
| 40 | PHTHANOPERIDINIUM COMATUM |
| 58 | PHYLLOCLADIDITES MAWSONII |
| 73 | PHYLLOCLADIDITES VERRUCOSUS |
| 69 | PODOSPORITES MICROSACCATUS |
| 74 | POLYPODIISPORITES SPP |
| 59 | PROTEACIDITES SP |
| 65 | RETITRILETES AUSTROCLAVATIDITES |
| 41 | RHOMBODINIUM GLABRUM |
| 16 | SPINIDINIUM LANTERNUM |
| 15 | SPINIDINIUM SP1 |
| 8 | SPINIFERITES RAMOSUS |
| 75 | STEREISPORITES (TRIPUNCTISPORIS) PUNCTATUS |
| 60 | STEREISPORITES ANTIQUISPORITES |
| 47 | SYSTEMATOPHORA PLACACANTHA |
| 66 | TRICOLPITES GILLII |
| 67 | TRICOLPITES SP |
| 68 | TRICOLPORITES |
| 23 | TUBERCULODINIUM VANCOMPOAE |
| 42 | TURBIOSPAERA MAGNIFICA |
| 43 | TURBIOSPHAERA SP |

# APPENDIX 4

APPENDIX 4

# WELL COMPLETION REPORT

## MUDSKIPPER-1

INTERPRETATIVE DATA

APPENDIX 4

GEOCHEMISTRY

AMDEL CORE SERVICES

26 July 1990

Petrofina Exploration Australia SA
Level 2
476 St Kilda Road
MELBOURNE VIC 3004

Attention: Jean-Marie Questiaux

**REPORT: 009/394**

| | |
|---|---|
| **CLIENT REFERENCE:** | Fax 27 June 1990 |
| **MATERIAL:** | Canned Cuttings |
| **LOCALITY:** | Mudskipper -1 |
| **WORK REQUIRED:** | Source Rock Analyses |

Please direct technical enquiries regarding this work to the signatory below under whose supervision the work was carried out.

Brian Watson.

**BRIAN L WATSON**
Laboratory Supervisor
on behalf of Amdel Core Services Pty Ltd



Please reply to: PO Box 109 Eastwood SA 5063 Ph: (08)372 2834

Amdel Core Services Pty Limited
Incorporated in South Australia

## 1. INTRODUCTION

Source rock analyses were requested on thirteen cuttings samples from Mudskipper -1 to determine their maturity, source richness and source quality and to compare this data to that from the nearby wells drilled by Petrofina.

## 2. ANALYTICAL PROCEDURES

### 2.1 Sample Preparation

Cuttings samples (as received) were ground in a Siebtechnik mill for 20-30 seconds.

### 2.2 Total Organic Carbon (TOC)

Total organic carbon was determined by digestion of a known weight (approximately 0.2 g) of powdered rock in 50% HCl to remove carbonates, followed by combustion in oxygen and measurement of the resultant $CO_2$ by infra-red detection.

### 2.3 Vitrinite Reflectance and Organic Petrology

Representative portions of each sample (crushed to -14+35 BSS mesh) were obtained with a sample splitter and then mounted in cold setting Glasscraft resin using a 2.5 cm diameter mould. Each block was ground flat using diamond impregnated laps and carborundum paper. The surface was then polished with aluminium oxide and finally magnesium oxide.

Reflectance measurements were made with a Leitz MPV1.1 microphotometer fitted to a Leitz Ortholux microscope and calibrated against synthetic standards. All measurements were taken using oil immersion (n = 1.518) and incident monochromatic light (wavelength 546 nm) at a temperature of 23∓ 1°C. Fluorescence observations were made on the same microscope utilising a 3 mm BG3 excitation filter, a TK400 dichroic mirror and a K510 suppression filter.

## 3. RESULTS

Total organic carbon data are presented in Table 1. Rock-Eval pyrolysis was not performed on these samples due to their low organic richness (TOC < 0.25%). The TOC threshold used for Rock-Eval analyses is 0.4%. Pyrolysis on samples with less than this level of organic richness will yield unreliable data.

Organic petrology data is presented in Tables 2 and 3. Vitrinite reflectance analyses could not be performed on these samples due to the absence of vitrinite.

## 4. INTERPRETATION

### 4.1 Maturity

The lack of vitrinite in these samples coupled with the absence of Rock-Eval data results in excludes the assessment of maturity from this data. In this situation it is probably best to measure the maturity of the overlying sediments (which may be more organic rich) and extrapolate the resultant maturity trend to this depth.

### 4.2 Organic Richness

Organic richness is uniformly poor in the sediments studied (TOC = 0.02 - 0.25%). Source Richness (although not determined) is also most likely to be poor ($S_1 + S_2 < 2$ kg of hydrocarbons/tonne).

### 4.3 Source Quality

Organic petrology data indicates that the organic matter present in the sediments examined consists almost entirely of inertinite. Therefore these sediments may be described as having poor source quality.

The organic richness and source quality data for this interval is similar to that for the section analysed from Ayu -1.

## TABLE 1

## TOTAL ORGANIC CARBON CONTENTS, MUDSKIPPER -1

| Depth (m) | Total Organic Carbon (%) |
|---|---|
| 1450 - 1460 | 0.23 |
| 1460 - 1470 | 0.25 |
| 1470 - 1480 | 0.12 |
| 1480 - 1490 | 0.09 |
| 1490 - 1500 | 0.07 |
| 1500 - 1510 | - |
| 1520 - 1530 | 0.03 |
| 1540 - 1550 | - |
| 1550 - 1560 | 0.02 |
| 1570 - 1580 | - |
| 1590 - 1600 | 0.03 |
| 1610 - 1620 | 0.10 |
| 1620 - 1630 | 0.04 |

\- not determined

## TABLE 2

### PERCENTAGE OF VITRINITE, INERTINITE AND EXINITE IN DISPERSED ORGANIC MATTER, MUDSKIPPER -1

| Depth (m) | Percentage of | | |
|---|---|---|---|
| | Vitrinite | Inertinite | Exinite |
| 1460 - 1470 | - | > 95 | < 5 |
| 1490 -1500 | - | > 95 | < 5 |

## TABLE 3

## ORGANIC MATTER TYPE AND ABUNDANCE

| Depth (m) | Estimated Volume of DOM | Exinites | Exinite Macerals |
|---|---|---|---|
| 1460 - 1470 | < 0.5 | Vr | lipto, ?cut |
| 1490 - 1500 | << 0.5 | Tr | lipto |



Amdel Core Services Pty Limited
Incorporated in South Australia

# APPENDIX 5

WELL COMPLETION REPORT

MUDSKIPPER-1

INTERPRETATIVE DATA

# APPENDIX 5

## PETROGRAPHY

PETROGRAPHIC ANALYSIS REPORT WILL BE FORWARDED

WHEN RECEIVED FROM AMDEL/CORE SERVICES

90/527



AMDEL
CORE
SERVICES

PETROLOGY REPORT

MUDSKIPPER #1

GIPPSLAND BASIN

Report prepared for Petrofina Exploration

by

**S E PHILLIPS and D L CATHRO**

Amdel Core Services
PO Box 109
Eastwood
SA 5063

December 1990





Please Reply To: P.O. Box 109 Eastwood SA 5063 Australia
Telephone: 61-8-372 2834 Facsimile: 61-8-372 2861
Amdel Core Services Pty Limited
(Incorporated in South Australia)

# INDEX

# 1. SUMMARY


Petrofina Exploration requested petrological descriptions and bulk X-ray diffraction analyses of 18 sidewall cores from Mudskipper #1 in the Gippsland Basin. The study was designed to ascertain the mineralogy, diagenetic alteration, and hence the likely influence of these characteristics on wireline logs.

Granitic basement is overlain by a sequence of subarkoses, quartzarenites, ironstones and micrites. Sediments were derived from igneous, sedimentary and metamorphic provenances. The abundance of feldspars, biotite and minor fragments of granite in the subarkoses reflects short distances of sediment transport from a granitic terrain. The most significant influence on wireline logs is likely to be in the granites and subarkoses because of high potassium contents.

Subarkoses and quartzarenites are very similar texturally and mineralogically, except for the proportion of feldspars. Mineralogical immaturity of the subarkoses directly above the granite basement suggests these sediments were derived from an active tectonic setting. Poor to moderate sorting, subangular to subrounded framework grains and the presence of glauconite in the subarkoses and quartzarenites indicates deposition in a shallow marine environment. Finer grain sizes in the quartzarenites may suggest a slightly quieter hydraulic regime. Repetition of the subarkose lithology and presence of granitic lithics at shallower depths probably relates to periods of renewed tectonic activity.

Ironstones at the top of the sequence may indicate a change in environment. Glauconite in both ironstone samples suggests they were initially deposited in a shallow marine environment and subsequent shallowing may have resulted in paralic conditions such as a coastal swamp. Oxygenated Fe-rich waters filtered through the marine sediment and resulted in the precipitation of goethite. Fluctuations between ironstones and quartzarenites may be a response to changes in sea level.

Diagenetic alteration was dominated by pore filling chlorite cement which concentrates in four distinct zones. There is no authigenic feldspar as noted in Archer #1 and Anemone #1A. Glauconite, pyrite, chert and goethite were the other authigenic minerals. Although the paragenetic sequence is uncertain, the following diagenetic events have been identified:

- Glauconite precipitation
- Micritisation of shell fragments & oxidation of glauconite
- Chert precipitation
- Mechanical compaction
- Chlorite precipitation
- Goethite precipitation
- Carbonate spar
- Feldspar dissolution
- Pyrite precipitation

The disturbed nature of the sidewall cores made it impossible to accurately estimate reservoir quality. Intragranular and secondary dissolution porosity are commonly observed in trace amounts. Dissolution of feldspars resulted in honeycomb pores. Minor amounts of smectite in sidewall cores 12 and 17 may cause drilling problems.

## 2. INTRODUCTION

This report contains brief petrological descriptions and bulk X-ray diffraction analyses of 18 sidewall cores from Mudskipper #1 in the Gippsland Basin. The study was requested by Petrofina Exploration to ascertain the mineralogy, diagenetic alteration, and hence the likely influence of these characteristics on wireline logs.

The following sidewall cores were examined:

| Swc No. | Depth (m) |
|---|---|
| 1 | 1615.0 |
| 2 | 1613.5 |
| 3 | 1607.5 |
| 4 | 1603.5 |
| 5 | 1600.5 |
| 6 | 1598.5 |
| 7 | 1597.0 |
| 8 | 1590.5 |
| 9 | 1587.5 |
| 10 | 1557.0 |
| 11 | 1525.5 |
| 12 | 1524.5 |
| 14 | 1511.0 |
| 15 | 1506.0 |
| 16 | 1503.5 |
| 17 | 1500.0 |
| 18 | 1498.5 |
| 19 | 1477.5 |

## 3. METHODS

Sidewall cores were described in hand specimen and then impregnated with araldite prior to thin section preparation. Blue dye was used in the araldite to facilitate description of porosity and permeability. Thin sections were systematically scanned to determine lithology, composition, porosity and textural relationships. All percentages given in brief descriptions are based on visual estimates, not point counts.

To determine bulk mineralogy by X-ray diffraction, samples were prepared by hand grinding in acetone and then smeared onto a glass slide. Continuous scans were run from 3° to 75° 2 theta, at 1°/minute, using Co K alpha radiation, 50kV and 35mA, on a Philips PW1050 diffractometer. Peaks were identified by comparison with JCPDS files stored in a computer program called XPLOT.

# 4. CORE PETROLOGY

## 4.1 Mudskipper #1, sidewall core 1, depth 1615.0m

**Hand specimen description**
Sample received consisted of very disturbed and unconsolidated sidewall core. It was a medium to coarse grained, light brown (5YR 5/6), micaceous and heavily Fe-stained weathered granite. The crystals were subhedral to euhedral and there was a slight reaction with 10% HCl, suggesting the presence of carbonate. Minor to trace amounts of opaques were noted.

**Thin section description**
The sample is highly disturbed with considerable grain shattering and infiltration of drilling mud. Two lithologies are present, the relationships between which are difficult to ascertain. Holocrystalline, equigranular, altered granite (Fig. 1) is the dominant lithology with a minor amount of micritic carbonate mudstone.

Altered Granite
Crystals are dominantly fine to medium grained altered and fresh potassic feldspars and plutonic quartz, with trace to minor amounts of plagioclase, biotite, muscovite and rare amphibole. Authigenic minerals include fibrous chlorite which replaces micas and opaques (pyrite). Opaque contaminants are metallic grey in reflected light, very scratched and typically associated with drilling mud.

The granite is hypidiomorphic granular with slightly interdigitating crystal boundaries (consertal texture). Trace amounts of secondary (honeycomb) pores (Fig. 1a.) as a result of dissolution of feldspar are evident.

Micrite
This lithology is dominated by a homogeneous micritic matrix with trace amounts of terrigenous grains and allochems. Terrigenous grains include subangular, silt sized quartz and well rounded glaucony (glauconite) grains. Allochems consist of globular foraminiferal tests and fossil fragments up to 0.05mm in diameter. Authigenic minerals and cements include carbonate microspar and spar recrystallised from the matrix, and opaques (pyrite). Foraminiferal tests are partially filled by both carbonate spar and euhedral pyrite.

The micrite is matrix supported. A trace amount of primary intragranular porosity is preserved within the fossil tests.

Composition

| Framework grains/Crystals | | | % I | % II |
|---|---|---|---|---|
| | Quartz | | 35 | 1 |
| | Feldspar | - Potassic | 45 | - |
| | | - Plagioclase | 10 | - |
| | Micas | | 6 | - |
| | Glaucony grains | | - | tr |
| | Allochems | | - | 1 |
| | Others | - Amphibole | tr | - |
| | | - Opaque contaminant | 2 | - |
| Matrix/Groundmass | | | | |
| | Carbonate | - Micrite | - | 97 |

| | | | |
|---|---|---|---|
| Authigenic minerals and cements | | | |
| Clays | - Chlorite | 1 | - |
| Opaques | - Pyrite | tr | tr |
| Porosity | | | |
| Primary | - Intragranular | - | tr |
| Secondary | - Honeycomb | tr | - |

I=Altered granite
II=Micrite

**X-ray diffraction**
Bulk XRD (Fig. 2) indicates that quartz is dominant with trace to minor amounts of microcline (max), albite, illite/muscovite, clinochlore and calcite. The sharpness and height of the illite/muscovite peak suggests it is a response to mica rather that illite. Note that the vertical scale is expanded to accommodate for the illite/muscovite peak and allow separation of the microcline and albite peaks.

## 4.2 Mudskipper #1, sidewall core 2, depth 1613.5m

**Hand specimen description**
Sample received consisted of very disturbed and unconsolidated fragments of sidewall core, the largest was 0.5cm long with a thick coating of drilling mud. It was a coarse light olive grey (5Y 6/1) weathered granite. Crystals were subhedral and there was no reaction with 10% HCl. Minor to trace amounts of pyrite, opaques and Fe-staining were noted.

**Thin section description**
The sample is highly disturbed with considerable grain shattering and infiltration of drilling mud. It is a holocrystalline, equigranular, altered granite very similar to sidewall core 1.

Crystals are dominantly medium grained altered and fresh potassic feldspars and plutonic quartz, with trace to minor amounts of plagioclase, muscovite and biotite. Authigenic minerals consist of fibrous glaucony (chlorite) intergrown with biotite and opaques (pyrite).

The sample has slightly interdigitating crystal boundaries (consertal texture). Traces of secondary honeycomb porosity are evident as a result of feldspar dissolution.

Composition

| | | |
|---|---|---|
| Crystals | | % |
| Quartz | | 38 |
| Feldspar | - Plagioclase | 14 |
| | - Potassic | 40 |
| Mica | | 5 |
| Authigenic minerals | | |
| Clay | - Chlorite | 1 |
| Opaques | - Pyrite | 1 |
| Porosity | | |
| Secondary | - Honeycomb | tr |

**X-ray diffraction**
Bulk XRD (Fig. 3) indicates that quartz is dominant with trace to minor amounts of albite, microcline (max), illite/muscovite and clinochlore. The

sharpness and height of the illite/muscovite peak suggests it is a response to mica rather than illite. Note that the vertical scale is expanded to accommodate the illite/muscovite peak.

### 4.3 Mudskipper #1, sidewall core 3, depth 1607.5m

**Hand specimen description**
Sample received consisted of very disturbed sidewall core. It was a very fine sand to pebble sized, (bimodal), light olive grey (5Y 6/1) subarkose. The pebbles were well rounded with good sphericity and finer grain sizes were subangular with moderate to good sphericity. There was a slight reaction with 10% HCl, indicating the presence of carbonate. No sedimentary features were evident. Minor to trace amounts of mica, Fe-staining and opaques were observed.

**Thin section description**
The sample was disturbed by sidewall collection with extensive shattering of grains and infiltration of drilling mud. It is a bimodal, fine to medium grained (average fine) and granule to pebble sized (average granule), mineralogically immature, texturally inverted subarkose. Larger grains are well rounded to subrounded and finer grains are subangular to subrounded.

Framework grains are dominantly plutonic quartz with trace to minor amounts of metamorphic (strained polycrystalline) quartz, altered and fresh potassic and plagioclase feldspar, mica (dominantly biotite), glaucony grains, metamorphic lithics, zircon and tourmaline. Matrix is present as illite coating grains. Cements and authigenic minerals include one phase of quartz overgrowths, fibrous glaucony (chlorite), carbonate microspar and opaques (pyrite).

The sample is grain supported with common point and minor tangential contacts between framework grains. Porosity is dominantly primary and intergranular in nature (Fig. 4) with trace amounts of secondary dissolution (honeycomb) pores (Fig. 5).

Composition

| | | | % |
|---|---|---|---|
| Framework grains | | | |
| | Quartz | | 65 |
| | Feldspar | - Potassic | 15 |
| | | - Plagioclase | tr |
| | Mica | | 5 |
| | Glaucony grains | | 1 |
| | Lithics | | tr |
| | Others | - Tourmaline | 1 |
| | | - Zircon | 2 |
| Matrix | | | |
| | Clay | - Illite | 1 |
| Authigenic minerals and cements | | | |
| | Quartz | | tr |
| | Carbonate | | tr |
| | Clay | - Chlorite | 3 |
| | Pyrite | | 1 |
| Porosity | | | |
| | Primary | - Intergranular | 5 |
| | Secondary | - Honeycomb | tr |

**X-ray diffraction**
Bulk XRD (Fig. 6) indicates the dominance of quartz with trace to minor amounts of microcline (max), calcite, ankerite/ferroan dolomite, siderite, clinochlore IIB and illite/muscovite. A sodium carbonate drilling additive (natrite) is also present. The high background at low 2 theta angles indicates the presence of interstratified clays.

## 4.4 Mudskipper #1, sidewall core 4, depth 1603.5m

**Hand specimen description**
Sample received consisted of 1.0cm of poorly consolidated, full diameter sidewall core, with a thick coating of drilling mud. It was a fine grained, well sorted, light brownish grey (5YR 6/1) subarkose. Grains were subrounded with moderate sphericity. There was a slight reaction with 10% HCl, suggesting the presence of carbonate. No sedimentary features were recognised and there were trace to minor amounts of mica, opaques, glaucony and pyrite.

**Thin section description**
The sample was disturbed due to sidewall collection, with minor grain shattering, concentrating on the outer edges. It is a very fine to very coarse grained (average fine), moderately well sorted, mineralogically and texturally submature subarkose. Matrix concentrates in rare brown, irregularly shaped patches and discontinuous laminae. Irregular and discontinuous opaque stringers of organic matter and pyrite are also present.

Subrounded to subangular framework grains are dominantly plutonic quartz with trace to minor amounts of metamorphic quartz, fresh and altered potassic and plagioclase feldspar, glaucony grains, muscovite, biotite, metamorphic lithics, sedimentary chert, tourmaline and zircon. Authigenic minerals and cements include pore filling and grain replacing chlorite and pyrite.

The sample is grain supported with predominantly point and tangential contacts between framework grains. No primary porosity is evident. Fracture porosity is likely to have been induced by sidewall collection. Trace amounts of secondary honeycomb porosity is evident, and can be attributed to the dissolution of feldspars.

Composition

| | | | |
|---|---|---|---|
| Framework grains | | | % |
| | Quartz | | 69 |
| | Feldspar | - Potassic | 5 |
| | | - Plagioclase | tr |
| | Mica | | 2 |
| | Glaucony grains | | 1 |
| | Lithics | | 3 |
| | Others | - Tourmaline | tr |
| | | - Zircon | tr |
| Matrix | | | |
| | Illite | | 5 |
| | Organic matter | | 2 |
| Authigenic minerals and cements | | | |
| | Clay | - Chlorite | 5 |
| | Opaques | | 1 |

| | | |
|---|---|---|
| Porosity | | |
| Fracture | | 6 |
| Secondary | - Honeycomb | tr |

**X-ray diffraction**
Bulk XRD (Fig. 7) indicates that quartz is dominant, with trace to minor amounts of microcline (max), calcite, ankerite/ferroan dolomite illite/muscovite and clinochlore. Although carbonate was detected in XRD, it was not observed in thin section. The high background at low 2 theta angles indicates the presence of interstratified clays.

## 4.5 Mudskipper #1, sidewall core 5, depth 1600.5m

**Hand specimen description**
Sample received consisted of a 1.0cm fragment of poorly consolidated sidewall core thickly coated with drilling mud. It was a very fine to very coarse grained, poorly sorted, light brownish grey (5YR 6/1) subarkose with minor well cemented areas. Grains were subrounded to rounded with moderate to good sphericity. There was a slight reaction with 10% HCl, suggesting the presence of carbonate. No sedimentary features were observed and there were trace to minor amounts of mica, opaques and Fe-staining.

**Thin section description**
The sample is fragmented and disturbed by sidewall collection, with extensive grain shattering in the smaller fragments and along the edges of the larger fragments. It is a fine to pebble grained (average fine), poorly sorted, mineralogically and texturally submature, micaceous subarkose with rare discontinuous and irregular opaque laminae.

Framework grains are dominantly plutonic quartz with trace to minor amounts of metamorphic quartz, aligned mica (dominantly biotite), fresh and altered potassic and plagioclase feldspars, glaucony grains, metamorphic lithics, sedimentary chert, tourmaline and zircon. Matrix is composed of illite and micrite. Illite forms a thin coating on framework grains and micrite rarely fills disrupted pores. Organic matter may be included in the irregular opaque laminae associated with pyrite. Authigenic minerals and cements include pore filling (Fig. 8) and grain replacing chlorite and pyrite.

The sample is grain supported with common point and tangential contacts between framework grains. Primary intergranular pores are occluded by chlorite cement and pores observed are likely to have been induced by sidewall collection.

Composition

| | | |
|---|---|---|
| Framework grains | | % |
| Quartz | | 68 |
| Feldspar | - Potassic | 10 |
| | - Plagioclase | tr |
| Mica | | 4 |
| Lithics | | 1 |
| Glaucony grains | | tr |
| Others | - Tourmaline | tr |
| | - Zircon | tr |
| Matrix | | |
| Organic matter | | tr |

| | | |
|---|---|---|
| Authigenic minerals and cements | | |
| Pyrite | | 2 |
| Clay | - Chlorite | 12 |
| Porosity | | |
| Induced | | 2 |

**X-ray diffraction**
Bulk XRD (Fig. 9) indicates that quartz is dominant with trace to minor amounts of microcline (max), illite/muscovite, calcite, ankerite/ferroan dolomite and clinochlore. The high background at low 2 theta angles indicates the presence of interstratified clays.

### 4.6 Mudskipper #1, sidewall core 6, depth 1598.5m

**Hand specimen description**
Sample received consisted of 1cm of poorly consolidated, highly disturbed, full diameter sidewall core with a thick layer of drilling mud. It was a light brownish grey (5YR 6/1), very fine to granule sized, poorly sorted subarkose. Granules are well rounded with moderate to high sphericity. Finer grain sizes are subangular with moderate sphericity. There was a moderate reaction with 10% HCl, indicating the presence of carbonate. No sedimentary features were observed and trace to minor amounts of mica, opaques and Fe-staining were noted.

**Thin section description**
The sample is highly disturbed with considerable fracturing induced by sidewall collection and infiltration by drilling mud. It is a bimodal very fine to medium (average fine) and very coarse to granule (average very coarse), texturally inverted, mineralogically submature, micaceous subarkose (Fig. 10). The coarser grains are commonly composed of monocrystalline quartz and rare potassic feldspars.

Framework grains are dominantly plutonic quartz with trace to minor amounts of potassic feldspar, mica and tourmaline. Matrix is composed of illite and micrite. Illite forms a thin coating on framework grains and micrite is rarely Fe-rich and fills disrupted pores. Authigenic minerals and cements include pore filling (Fig. 10), and mica replacing chlorite, and irregular patches of pyrite.

The subarkose is grain supported with dominantly point and minor tangential contacts between framework grains. Compaction is indicated by bending and splaying of micas (biotite and muscovite). Primary porosity is not evident and fracture pores are thought to have been induced by sidewall coring. Pore spaces are secondary (honeycomb) in nature due to the dissolution of feldspars.

Composition

| | | |
|---|---|---|
| Framework grains | | % |
| Quartz | | 70 |
| Potassic Feldspar | | 5 |
| Mica | | 3 |
| Others | - Tourmaline | tr |
| Matrix | | |
| Illite | | 1 |
| Micrite | | tr |

| | | |
|---|---|---|
| Authigenic minerals and cements | | |
| Pyrite | | tr |
| Clay | - Chlorite | 15 |
| Porosity | | |
| Induced | | 5 |
| Secondary | - Honeycomb | tr |

**X-ray diffraction**
Bulk XRD (Fig. 11) indicates the dominance of quartz with subdominant microcline (max) and minor amounts of illite/muscovite, clinochlore IIB, ankerite/ferroan dolomite and calcite.

## 4.7 Mudskipper #1, sidewall core 7, depth 1597.0m

**Hand specimen description**
Sample received consisted of 1cm of poorly consolidated, highly disturbed full diameter sidewall core, with a thick layer of drilling mud. It was a fine to very coarse (average fine) grained, poorly sorted, light grey (N7) subarkose. Framework grains were subrounded with moderate sphericity. There was no reaction with 10% HCl and no sedimentary features were observed. Trace to minor amounts of glaucony, Fe staining, opaques and mica were noted.

**Thin section description**
Disruption due to sidewall collection is minor with grain shattering and infiltration of drilling mud restricted to the edges of the sample. It is a moderately to well sorted, very fine to coarse grained (average fine), mineralogically and texturally submature subarkose. Well rounded coarse grains are composed of plutonic and metamorphic quartz. However, the majority of the sample is composed of subangular to subrounded fine framework grains.

Framework grains are dominantly plutonic quartz with trace to minor amounts of metamorphic quartz, potassic feldspars, biotite, muscovite, glaucony (glauconite) grains, zircon and unzoned tourmaline. Matrix occurs as minor amounts of illite that surrounds grains. Chlorite is the dominant authigenic mineral, replacing micas and filling intergranular pores. Anhedral opaques (pyrite) are scattered randomly throughout the sample.

The sample is grain supported with dominantly point contacts between framework grains. Porosity is dominantly primary and intergranular in nature and accounts for only trace amounts of the total rock composition. Porosity has been reduced by cementation and compaction. The latter is indicated by bent and splayed micas.

Composition

| | | |
|---|---|---|
| Framework grains | | % |
| Quartz | | 75 |
| Feldspar | | 5 |
| Mica | | 3 |
| Glaucony grains | | tr |
| Others | - Zircon | 1 |
| | - Tourmaline | tr |
| Matrix | | |
| Clay | - Illite | tr |
| Authigenic minerals and cements | | |
| Clay | - Chlorite | 15 |
| Pyrite | | tr |

Porosity

| | | |
|---|---|---|
| Primary | - Intergranular | tr |

**X-ray diffraction**
Bulk XRD (Fig. 12) indicates the dominance of quartz with minor amounts of microcline (max), calcite and ankerite/ferroan dolomite, and traces of illite/muscovite and clinochlore IIB. Compositional variation is detected in the calcite which ranges from pure calcite to calcite with a Ca:Mg molecular ratio of 80:20. Although carbonates were detected in XRD they were not observed in thin section. This suggests the carbonate is a contaminant associated with the drilling mud.

## 4.8 Mudskipper #1, sidewall core 8, depth 1590.5m

**Hand specimen description**
Sample received consisted of a 0.25cm of poorly consolidated, highly disturbed, full diameter sidewall core with a thick layer of drilling mud. It was a fine grained, well sorted, light grey (N7) quartzarenite. Framework grains were subangular to subrounded with moderate sphericity. There was no reaction with 10% HCl and no sedimentary features were observed. Trace to minor amounts of glaucony, Fe staining and opaques were noted.

**Thin section description**
Damage to the sample includes grain shattering, infiltration of drilling mud up to 7mm from the edge and a fracture through the centre of the sample. It is a very fine to coarse (average fine) grained, moderately well sorted, texturally and mineralogically mature quartzarenite (Fig. 13).

Subrounded to subangular framework grains are predominantly plutonic quartz with minor amounts of metamorphic quartz, altered and fresh feldspars, mica (muscovite and biotite), zircon and metamorphic lithics. Matrix is present as trace amounts of illite that surrounds grains. Authigenic minerals and cements include pore filling and mica replacing chlorite, and irregular patches and single crystals of pyrite.

The sample is grain supported with predominantly point contacts between framework grains. Primary intergranular porosity is difficult to distinguish from that induced by sidewall collection. Porosity accounts for up to 10% of the total rock composition. Compaction is indicated by the presence of bent micas.

Composition

| | | | |
|---|---|---|---|
| Framework grains | | | % |
| | Quartz | | 70 |
| | Feldspar | | 4 |
| | Mica | | 2 |
| | Glaucony grains | | tr |
| | Lithics | | 1 |
| | Others | - Tourmaline | tr |
| | | - Zircon | 1 |
| Matrix | | | |
| | Clay | - Illite | tr |
| Authigenic minerals and cements | | | |
| | Clay | - Chlorite | 10 |
| | Opaques | | 1 |

| | |
|---|---|
| Porosity | |
| Induced | 10 |

**X-ray diffraction**
Bulk XRD (Fig. 14) indicates the dominance of quartz with minor amounts of microcline (max), illite/muscovite, clinochlore IIB, calcite and ankerite/ferroan dolomite. Although carbonates were detected in XRD they were not observed in thin section. This suggests the carbonate is a contaminant associated with the drilling mud.

## 4.9 Mudskipper #1, sidewall core 9, depth 1587.5m

**Hand specimen description**
Sample received consisted of several highly disturbed fragments of poorly consolidated sidewall core. It was a very fine to fine grained, well sorted, olive grey (5Y 4/1) quartzarenite. Framework grains were angular to subrounded with moderate sphericity. There was no reaction with 10% HCl and no sedimentary features were observed. Trace to minor amounts of glaucony and pyrite were noted.

**Thin section description**
The sample is highly disturbed with significant grain shattering. It is a very fine to coarse grained (average fine), moderately sorted, mineralogically submature, texturally mature quartzarenite.

Subangular framework grains are composed dominantly of plutonic quartz, aligned micas (muscovite and biotite), fresh and altered potassic and plagioclase feldspar, glaucony grains, sedimentary chert, metamorphic lithics and tourmaline. Illitic matrix coats grains and brown illitic material concentrates in irregular shaped patches. Authigenic minerals and cements include mica replacing and pore filling chlorite. Anhedral pyrite is scattered throughout the sample and rarely forms irregular and discontinuous stringers associated with organic matter.

The sample is grain supported with common point and minor tangential contacts between framework grains. No pores are evident except those induced by sidewall coring.

Composition

| | | |
|---|---|---|
| Framework grains | | % |
| Quartz | | 75 |
| Feldspar | | 4 |
| Mica | | 6 |
| Glaucony grains | | tr |
| Lithics | | tr |
| Others | - Tourmaline | tr |
| Matrix | | |
| Clay | | 3 |
| Organic matter | | tr |
| Authigenic minerals and cements | | |
| Clay | - Chlorite | 8 |
| Pyrite | | 1 |
| Porosity | | |
| Induced | | 2 |

**X-ray diffraction**
Bulk XRD (Fig. 15) indicates the dominance of quartz with trace to minor amounts of microcline (max), clinochlore IIB, calcite and ankerite/ferroan dolomite and trace amounts of illite/muscovite. Although carbonates were detected in XRD they were not observed in thin section. This suggests the carbonate is a contaminant associated with the drilling mud.

## 4.10 Mudskipper #1, sidewall core 10, depth 1557.0m

**Hand specimen description**
Sample received consisted of very poorly consolidated, highly disturbed sidewall core. It was a very muddy, medium to coarse grained, poorly sorted, pale yellowish brown (10YR 6/2) sandstone. Framework grains were subangular to well rounded with moderate to high sphericity. There was a moderate reaction with 10% HCl, suggesting the presence of carbonate. No sedimentary features were observed. Trace to minor amounts of opaques, mica and Fe staining were noted.

**Thin section description**
Two lithologies are present in this sample but the relationship between them is difficult to ascertain. It is a disrupted sandstone which is possibly interbedded with a fossiliferous micrite. The boundary between the micrite and sandstone is sharp.

Fossiliferous Micrite
This lithology is dominated by a homogeneous micritic matrix with trace to minor amounts of terrigenous grains and allochems. Terrigenous grains include silt sized quartz, glaucony grains, and lithics of granite and fossiliferous mudstone. Allochems consist of globular foraminiferal tests and rarely micritised fossil fragments, up to 0.25mm in diameter. Matrix consists of abundant micrite. Authigenic minerals and cements include euhedral carbonate spar, suggesting recrystallisation of the matrix, rare pyrite stringers and fine grained anhedral pyrite that is scattered throughout the micrite. Foraminiferal tests are partially filled by pyrite, ?barite, oxidised glauconite and carbonate spar.

The micrite is matrix supported with rare point contacts between grains. Primary intragranular pores (Fig. 16) are evident where fossils have not been completely filled. The remaining pore spaces observed are induced by sidewall collection.

Sandstone
The fine to coarse grained, moderately sorted sandstone is very disrupted with considerable grain shattering. Subrounded to well rounded framework grains are dominantly plutonic quartz with minor amounts of metamorphic quartz, potassic feldspars, well rounded glaucony (glauconite) grains, metamorphic lithics, biotite and tourmaline. The matrix is composed of trace amounts of micrite surrounding framework grains. Authigenic minerals are rare anhedral silt sized pyrite.

The sample is grain supported with contacts obscured by disruption. Pores are dominantly sidewall induced. Trace amounts of secondary honeycomb dissolution pores are evident in the larger feldspar grains. Angularity of the grains is probably an artifact of sample collection.

Composition

| Framework grains | | % I | % II |
|---|---|---|---|
| Quartz | | 3 | 64 |
| Feldspar | | - | 4 |
| Mica | | - | tr |
| Glaucony grains | | tr | tr |
| Lithics | | 1 | tr |
| Allochems | | 5 | - |
| Others | - Tourmaline | - | tr |
| **Matrix** | | | |
| Clay | | tr | - |
| Others | - Carbonate | 79 | 1 |
| **Authigenic minerals and cements** | | | |
| Carbonate | | 3 | - |
| Pyrite | | 1 | tr |
| **Porosity** | | | |
| Induced | | 7 | 30 |
| Primary | - Intragranular | tr | - |
| Secondary | - Honeycomb | - | tr |

I=Micrite
II=Sandstone

**X-ray diffraction**
Bulk XRD (Fig. 17) indicates the dominance of quartz with minor amounts of calcite, microcline (max) and albite, and possibly trace amounts of clinochlore IIB and ankerite/ferroan dolomite.

## 4.11 Mudskipper #1, sidewall core 11, depth 1525.5m

**Hand specimen description**
Sample received consisted of a very poorly consolidated, highly disturbed fragment of sidewall core. It was a medium to very coarse grained, moderately sorted, light brownish grey (5YR 6/1) to pinkish grey (5YR 8/1) subarkose. Very coarse grains were well rounded with moderate to good sphericity. There was no reaction with 10% HCl and no sedimentary features were observed. Trace to minor amounts of opaques and Fe staining were noted.

**Thin section description**
The sample is highly disrupted due to sidewall collection with extensive fracturing of framework grains. It is a medium to granule sized (average very coarse), poorly sorted, mineralogically and texturally submature subarkose. Medium sized grains are subangular to subrounded and very coarse grains are typically well rounded. Fine angular grains are probably due to sidewall collection.

Framework grains are composed dominantly of plutonic quartz with trace to minor amounts of metamorphic quartz, fresh and altered feldspars (potassic and plagioclase), sedimentary chert, metamorphic lithics, granite lithics, glaucony grains, mica (muscovite and biotite) and zoned tourmaline. The matrix is composed of trace amounts of illite surrounding grains and micritic carbonate that fills pores. Authigenic minerals and cements consist of chlorite which replaces mica and fills intergranular pores.

The sample is grain supported with contacts obscured by disruption due to sidewall core collection. Porosity is predominantly induced, but there are trace amounts of secondary honeycomb pores due to the dissolution of feldspar.

Composition

| | | |
|---|---|---|
| Framework grains | | % |
| Quartz | | 55 |
| Feldspar | | 8 |
| Mica | | tr |
| Glaucony grains | | tr |
| Lithics | | tr |
| Others | - Tourmaline | tr |
| Matrix | | |
| Clay | | 2 |
| Carbonate | | tr |
| Authigenic minerals and cements | | |
| Clay | - Chlorite | 4 |
| Porosity | | |
| Induced | | 30 |
| Secondary | - Honeycomb | tr |

**X-ray diffraction**
Bulk XRD (Fig. 18) indicates the dominance of quartz with minor amounts of microcline (max), ankerite/ferroan dolomite, siderite and halite. There are possibly trace amounts of clinochlore IIB and calcite. Halite is considered to be a contaminant.

## 4.12 Mudskipper #1, sidewall core 12, depth 1524.5m

**Hand specimen description**
Sample received consisted of 1cm of poorly consolidated, highly disturbed full diameter sidewall core with a thick coating of drilling mud. It was a fine grained, well sorted, yellowish grey (5Y 8/1) quartzarenite. Framework grains were subangular to subrounded with moderate to good sphericity. There was no reaction with 10% HCl and no sedimentary features were observed. Trace to minor amounts of glaucony and opaques were noted.

**Thin section description**
The sample is highly disturbed by sidewall coring with extensive grain shattering. It is a very fine to fine grained (average fine), mineralogically and texturally mature, well sorted chlorite cemented quartzarenite.

Framework grains are dominantly plutonic quartz with trace to minor amounts of muscovite, glaucony grains (rarely replacing mica), plagioclase feldspar, metamorphic lithics, sedimentary chert, tourmaline and zircon. Matrix consists of trace amounts of illite and micrite lining and partially filling pores. Authigenic minerals and cements include pore filling and mica replacing chlorite, pore filling glauconite, iron rich carbonate microspar and anhedral pyrite scattered throughout the sample.

The quartzarenite is grain supported with common point and minor tangential contacts between framework grains. Porosity is not evident apart from that induced during sample collection.

Composition

| | | |
|---|---|---|
| Framework grains | | % |
| Quartz | | 76 |
| Mica | | 1 |
| Feldspar | | tr |
| Glaucony grains | | tr |
| Lithics | | 2 |
| Others | - Tourmaline | tr |
| | - Zircon | tr |
| Matrix | | |
| Clay | | tr |
| Micrite | | tr |
| Authigenic minerals and cements | | |
| Clay | - Chlorite | 15 |
| Glauconite | | tr |
| Pyrite | | tr |
| Porosity | | |
| Induced | | 5 |

**X-ray diffraction**
Bulk XRD (Fig. 19) indicates the co-dominance of quartz and calcite, minor amounts of clinochlore IIB and contaminant halite, and possibly trace amounts of smectite (?montmorillonite). The very high proportion of calcite recorded in this XRD trace is inconsistent with observations from thin section. It is highly likely that the calcite is a micritic contaminant associated with the drilling mud.

## 4.13 Mudskipper #1, sidewall core 14, depth 1511.0m

**Hand specimen description**
Sample received consisted of very poorly consolidated and disturbed sidewall core. It was a fine to coarse, moderately sorted, very pale orange (10YR 8/2) subarkose. Framework grains were subangular to well rounded with moderate sphericity. There was a slight reaction with 10% HCl, suggesting the presence of carbonate. No sedimentary features were observed. Trace to minor amounts of opaques, Fe staining and glaucony were noted.

**Thin section description**
The sample was highly disturbed by sidewall collection resulting in extensive grain shattering. It is a medium to very coarse (average coarse) grained, mineralogically submature subarkose.

Framework grains are dominantly plutonic quartz with trace to minor amounts of metamorphic quartz, fresh twinned plagioclase feldspar, twinned and altered potassic feldspars, metamorphic lithics, muscovite and biotite. Matrix is composed of trace amounts of micritic carbonate partially filling disturbed pores. Authigenic minerals and cements include pore filling and mica replacing chlorite with anhedral very fine grained pyrite scattered throughout the sample.

The sample is grain supported with dominantly point contacts between framework grains. Porosity is dominantly sidewall collection induced, but trace amounts of secondary dissolution pores are evident within feldspars.

Composition

| Framework grains | | % |
|---|---|---|
| Quartz | | 67 |
| Feldspar | | 5 |
| Mica | | tr |
| Lithics | | tr |
| Matrix | | |
| Micrite | | 1 |
| Authigenic minerals and cements | | |
| Clay | - Chlorite | 1 |
| Pyrite | | tr |
| Porosity | | |
| Induced | | 25 |
| Secondary | - Dissolution | tr |

**X-ray diffraction**
Bulk XRD (Fig. 20) indicates the dominance of quartz with minor amounts of microcline (max), calcite and ankerite/ferroan dolomite and trace amounts of illite/muscovite.

## 4.14 Mudskipper #1, sidewall core 15, depth 1506.0m

**Hand specimen description**
Sample received consisted of 1.5cm of poorly consolidated, full diameter sidewall core. A thick layer of drilling mud had infiltrated the sample. It was a very fine to medium grained, well sorted, light brownish grey (5YR 6/1) quartzarenite. Framework grains were subrounded with moderate sphericity. There was no reaction with 10% HCl and no sedimentary features were observed. Trace to minor amounts of opaques, glaucony, mica and Fe staining were noted.

**Thin section description**
The sample is only moderately disturbed by sidewall collection and grain shattering is restricted to the outer edge. It is a very fine to very coarse grained (average fine), moderately to poorly sorted, mineralogically and texturally submature chlorite cemented quartzarenite.

Framework grains are dominantly plutonic quartz with trace to minor amounts of muscovite, biotite, metamorphic lithics, altered and fresh potassic and plagioclase feldspars, glaucony grains (replacing micas) and zircon. Matrix is composed of trace amounts of illite rarely surrounding framework grains. Authigenic minerals and cements include pore filling and mica replacing chlorite, pore filling glauconite (Fig. 21), and anhedral pyrite randomly scattered throughout the sample.

The sample is grain supported with dominantly point contacts between framework grains. Compaction is indicated by bent micas. Porosity is dominantly induced by sidewall collection with minor amounts of primary intergranular pores. Porosity is partially occluded by cementation.

Composition

| Framework grains | % |
|---|---|
| Quartz | 69 |
| Feldspar | 3 |
| Mica | 5 |
| Glaucony grains | 2 |

| | | |
|---|---|---|
| Lithics | | tr |
| Others | - Tourmaline | tr |
| | - Zircon | tr |
| Matrix | | |
| Clay | | tr |
| Authigenic minerals and cements | | |
| Clay | - Chlorite | 15 |
| Pyrite | | tr |
| Glauconite | | tr |
| Porosity | | |
| Induced | | 4 |
| Primary | - Intergranular | 1 |

**X-ray diffraction**
Bulk XRD (Fig. 22) indicates the dominance of quartz with minor amounts of microcline (max), calcite, illite/muscovite, siderite and ankerite/ferroan dolomite, and trace amounts of clinochlore IIB.

## 4.15 Mudskipper #1, sidewall core 16, depth 1503.5m

**Hand specimen description**
Sample received consisted of very poorly consolidated and very disturbed sidewall core. It was a medium to coarse grained, well sorted, pinkish grey (5YR 8/1) subarkose. Framework grains were subangular to subrounded with poor to moderate sphericity. There was no reaction with 10% HCl and no sedimentary features were observed. Moderate to trace amounts of opaques, glaucony and biotite were noted.

**Thin section description**
The sample is highly disturbed with considerable grain shattering, that has obscured the shape of detrital grains. Several lithologies are evident and the relationship between them is difficult to ascertain. Subarkose is the dominant lithology, it contains micrite that probably forms a lens.

Subarkose
It is a fine to granule sized, poorly sorted, texturally and mineralogically submature subarkose. A channel (Fig. 23) of possible organic origin cross cuts the subarkose, it contains micritic mud, quartz grains, globular foraminifera and is lined by iron rich material.

Detrital grains are dominantly plutonic quartz with trace to minor amounts of metamorphic lithics, chert, fresh and altered plagioclase and potassic feldspars, muscovite, biotite, glaucony (glauconite) grains, tourmaline and zircon. Matrix is irregularly distributed and weakly aligned illite. Authigenic minerals and cements include mica replacing and pore filling chlorite with subhedral pyrite scattered randomly throughout the sample.

The sandstone is grain supported with dominantly point contacts between framework grains. Primary intergranular pores could not be distinguished from those caused by sidewall collection. Secondary honeycomb porosity (Fig. 24) is evident due to the dissolution of feldspars.

Micrite
The ?lens has a micritic matrix with trace to minor amounts of terrigenous grains and allochems. Terrigenous grains are composed of silt sized, subrounded to subangular quartz, tourmaline, rare very coarse to granule sized fragments of granite and biosparite. Allochems are composed of broken shell

fragments and globular foraminifera partially filled with pyrite, carbonate spar and a low birefringent mineral. Authigenic minerals and cements include carbonate spar within the matrix and discontinuous pyrite stringers.

The sample is matrix supported with rare grain contacts. Primary intragranular pores are present within the foraminiferal tests. Other pores are probably induced by sidewall collection.

Composition

| | | % I | % II |
|---|---|---|---|
| Framework grains | | | |
| Quartz | | 80 | 3 |
| Feldspar | | 5 | - |
| Mica | | 2 | - |
| Lithics | | 1 | 4 |
| Allochems | | - | 2 |
| Others | - Zircon | tr | - |
| | - Tourmaline | - | tr |
| Matrix | | | |
| Clay | | 1 | - |
| Others | - Carbonate | - | 64 |
| Authigenic minerals and cements | | | |
| Carbonate | | - | tr |
| Clay | - Chlorite | tr | - |
| Opaques | | tr | 1 |
| Porosity | | | |
| Induced | | 10 | 25 |
| Primary | - Intragranular | - | tr |
| Secondary | - Honeycomb | tr | - |

I=Subarkose
II=Micrite

**X-ray diffraction**
Bulk XRD (Fig. 25) indicates the dominance of quartz with trace to minor amounts of microcline (max), ankerite/ferroan dolomite and calcite.

## 4.16 Mudskipper #1, sidewall core 17, depth 1500.0m

**Hand specimen description**
Sample received consisted of 2cm of moderately consolidated sidewall core with a thick coating of drilling mud. It was a muddy, fine grained, poorly sorted, dark yellowish brown (10YR 4/2) ironstone. There was no reaction with 10% HCl and no sedimentary features were observed. Trace to minor amounts of soft, yellowish brown patches, Fe staining and opaques were noted.

**Thin section description**
Disruption due to sidewall collection is minimal with minor grain fracturing restricted to the edge. The sample is a very fine to coarse grained (average very fine), moderately sorted ironstone with abundant iron rich pore filling and grain replacing goethite.

Framework grains are dominantly plutonic quartz with trace to minor amounts of fresh and altered plagioclase and potassic feldspars, metamorphic lithics, chert fragments, micas (muscovite), glaucony (glauconite) grains, oxidised glauconite and zircon. Matrix occurs as dark brown, randomly distributed irregular patches. Authigenic minerals and cements include mica replacing chlorite, goethite (Fig. 26) and patches of ?hydrated iron oxide. Goethite fills oversized pores.

The sample is grain supported with common tangential contacts between framework grains. Trace amounts of primary and intergranular porosity is preserved.

Composition

| | | |
|---|---|---|
| Framework grains | | % |
| Quartz | | 59 |
| Feldspar | | 2 |
| Mica | | 3 |
| Glaucony grains | | tr |
| Lithics | | 2 |
| Others | - Zircon | tr |
| Matrix | | |
| Clay | | 3 |
| Authigenic minerals and cements | | |
| Clay | - Chlorite | 5 |
| Goethite | | 25 |
| Porosity | | |
| Primary | - Intergranular | tr |

**X-ray diffraction**
Bulk XRD (Fig. 27) indicates the dominance of quartz with minor amounts of microcline (max), goethite, clinochlore IIB, calcite, illite/muscovite and possibly trace amounts of smectite (?montmorillonite).

## 4.17 Mudskipper #1, sidewall core 18, depth 1498.5m

**Hand specimen description**
Sample received consisted of very poorly consolidated and highly disturbed sidewall core. It was a medium to very coarse grained, well sorted, very pale orange (10YR 8/2) quartzarenite. Grains were subrounded to well rounded with moderate to good sphericity. There was a moderate reaction with 10% HCl and no sedimentary features were observed. Trace to minor amounts of opaques and mica were noted.

**Thin section description**
The sample is highly disturbed with considerable evidence of grain shattering. Several lithologies are present, the relationship between which is difficult to ascertain. It is possibly an interbedded quartzarenite and micrite with fragments of granite in both lithologies and a clast of sparite in the micrite.

Quartzarenite
Framework grains are medium to very coarse (average coarse), with finer grains probably due to sidewall coring. Sorting cannot be determined due to the disturbed nature of the sample. Framework grains are composed dominantly of plutonic quartz with trace to minor amounts of metamorphic quartz, granite lithics, mudstone clasts and altered and fresh potassic feldspar. Matrix consists of trace amounts of micrite. Authigenic minerals are not evident. Porosity is dominantly induced by sidewall collection although secondary honeycomb pores due to dissolution of feldspars are evident.

<u>Micrite</u>
This lithology is composed predominantly of a micritic matrix with trace to minor amounts of aligned terrigenous grains and allochems. Terrigenous grains are composed of quartz, glaucony (glauconite) grains, granite fragments and a clast of sparite. Allochems are composed of broken shell fragments and globular foraminiferal tests partially filled with spar and micrite. Authigenic minerals and cements include carbonate spar, chert nodules, pyrite and yellow brown amorphous chlorite.

The micrite is matrix supported with intragranular pores in the fossil tests. Fracture pore spaces are considered to have been induced by sidewall collection.

Composition

| | | % I | % II |
|---|---|---|---|
| Framework grains | | | |
| Quartz | | 73 | 2 |
| Feldspar | | 3 | - |
| Mica | | - | 1 |
| Glaucony grains | | - | tr |
| Lithics | | - | 5 |
| Allochems | | - | 3 |
| Others | - Zircon | - | 1 |
| Matrix | | | |
| Carbonate | | - | 81 |
| Organic matter | | - | tr |
| Authigenic minerals and cements | | | |
| Carbonate | | - | 1 |
| Clay | - Chlorite | - | tr |
| Pyrite | | - | tr |
| Chert | | - | tr |
| Porosity | | | |
| Induced | | 23 | 5 |
| Primary | - Intragranular | - | tr |
| Secondary | - Honeycomb | tr | - |

I=Quartzarenite
II=Micrite

**X-ray diffraction**
Bulk XRD (Fig. 28) indicates the dominance of quartz with minor amounts of microcline (max), calcite, dolomite and siderite. Calcite is represented by a doublet indicating two compositions. Pure calcite and calcite with a Ca:Mg molecular ratio of 90:10 are indicated.

## 4.18 <u>Mudskipper #1, sidewall core 19, depth 1477.5m</u>

**Hand specimen description**
Sample received consisted of 2cm of moderately consolidated sidewall core with a thick layer of drilling mud. It was a poorly sorted, greyish brown (5YR 3/2) sandy ironstone with minor amounts of well rounded pebbles and medium to very coarse grains. Framework grains were subrounded to well rounded with moderate to good sphericity. There was no reaction with 10% HCl and no sedimentary features were observed. Minor amounts of yellowish brown iron oxides, mica, opaques and feldspar were noted.

**Thin section description**

The sample is not as disturbed as previous samples. It is a fine to granule sized (average coarse), poorly sorted ironstone (Fig. 29).

Framework grains are angular to well rounded with the larger grain sizes typically better rounded. However, there are some subangular very coarse grains. Framework grains consist predominantly of plutonic quartz with trace to minor amounts of metamorphic quartz, potassic feldspar, glauconite grains and muscovite. No matrix is evident and authigenic minerals includes pore filling and grain replacing chlorite and goethite (Fig. 29). Goethite is rarely observed partially replacing grains.

The sample is grain supported with predominantly point contacts between framework grains. No porosity is evident except for that considered to be induced by sidewall collection.

Composition

| | | |
|---|---|---|
| Framework grains | | % |
| Quartz | | 40 |
| Feldspar | | 3 |
| Mica | | tr |
| Glauconite | | tr |
| Lithics | | 1 |
| Matrix | | - |
| Authigenic minerals and cements | | |
| Clay | - Chlorite | 14 |
| Pyrite | | - |
| Goethite | | 40 |
| Porosity | | |
| Induced | | 1 |

**X-ray diffraction**

Bulk XRD (Fig 30) indicates the dominance of quartz with trace to minor amounts of goethite, microcline (max), clinochlore and trace amounts of illite/muscovite.

# 5. TABLE 1. SUMMARY OF XRD RESULTS

| Swc No. | Qtz | Ill/ Musc | Alb | Sid | Mineralogy Mic | Sm | Cal | Ank | Clin | Others |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | *Peak height in counts* | | | | | |
| 1 | 8676 | 1136 | 1996 | - | 1936 | - | 321 | - | tr | - |
| 2 | 10180 | 1551 | 1973 | - | 1156 | - | - | - | 417 | - |
| 3 | 15048 | 485 | - | 172 | 841 | - | 371 | 302 | tr | Nat |
| 4 | 9726 | tr | - | - | 1031 | - | 1005 | 276 | 348 | - |
| 5 | 11558 | 507 | - | - | 1645 | - | 219 | 230 | 417 | - |
| 6 | 5304 | 237 | - | - | 1520 | - | 99 | 132 | 187 | - |
| 7 | 4941 | tr | - | - | 401 | - | 178 | 105 | tr | - |
| 8 | 4636 | 342 | - | - | 807 | - | 151 | 111 | 257 | - |
| 9 | 6143 | 229 | - | - | 621 | - | 122 | 109 | 191 | - |
| 10 | 4035 | - | 226 | - | 325 | - | 612 | 90 | tr | - |
| 11 | 6711 | - | - | tr | 462 | - | ?tr | 94 | tr | Hal |
| 12 | 1689 | - | - | - | - | tr | 1334 | - | tr | Hal |
| 14 | 8906 | 230 | - | - | 514 | - | 274 | 194 | - | - |
| 15 | 4629 | 232 | - | 91 | 898 | - | 179 | 107 | tr | - |
| 16 | 4533 | - | - | - | 471 | - | 233 | 126 | - | - |
| 17 | 5123 | 323 | - | - | 276 | 405 | 152 | - | 213 | Goe |
| 18 | 10016 | - | - | 92 | 267 | - | tr | 92 | - | - |
| 19 | 8140 | tr | - | - | tr | - | - | - | 245 | Goe |

Qtz = quartz
Ill/Musc = illite/muscovite-2M1
Alb = albite
Sid = siderite
Mic = microcline
Sm = smectite
Cal = calcite
Ank = ankerite/ferroan dolomite
Hal = halite
Clin = clinochlore IIB
Goe = goethite
Nat = natrite

All the XRD results are summarised in the table above. To facilitate between-sample comparisons of relative abundance for the same mineral, the results in Table 1 are given in counts of peak height. These figures are based on the strongest line for each mineral detected. Caution should be used in assessing relative abundance from these figures since peak height is also significantly affected by factors such as crystal size and crystallinity. For these reasons the figures are even more unreliable when comparing different minerals in the same sample. For example, based on peak height alone carbonate minerals will always appear less abundant than similar proportions of quartz because of differences in crystallinity. Clay minerals will also appear to be less abundant than quartz in a bulk XRD trace because of differences in crystal size. XRD will not detect minerals which represent less than approximately 5% of the total rock composition.

## 6. DISCUSSION AND CONCLUSIONS

**a) Lithology**

The suite of sidewall cores from Mudskipper #1 are comprised of granitic basement overlain by a sequence of subarkoses, quartzarenites, ironstones and micrites. The range of grain size of the subarkoses and quartzarenites is very fine to very coarse, however two samples have bimodal (Swcs 3 and 6) and three samples have pebble to granule (Swcs 5, 11 and 16) grain sizes. The quartzarenites and subarkoses of sidewall cores 10, 16 and 18 were also associated with micrite. Feldspars and micas in the granites and subarkoses are likely to influence wireline logs because of the high potassium contents.

**b) Sediment provenance**

Quartz is predominantly of the common granitic/plutonic variety with the presence of polycrystalline quartz indicating a metamorphic influence. Metamorphic, igneous and sedimentary rock fragments are common throughout the suite of samples, with metamorphic lithics dominant. The abundance of feldspars, biotite and minor fragments of granitic basement in the subarkoses reflects short distances of sediment transport from a granitic terrain.

**c) Depositional environments**

Mineralogical immaturity of the subarkoses (Swcs 3, 4, 5, 6 and 7) directly above the granite basement suggests these sediments were derived from an active tectonic setting. Poor to moderately good sorting, subangular to subrounded framework grains and the presence of glauconite in the subarkoses indicates deposition in a shallow marine environment possibly as a coastal alluvial fan. The absence of a significant proportion of matrix may be due to winnowing of fines in the marine environment. Repetition of the subarkose lithology (Swcs 11, 14 and 16) and presence of granitic lithics at shallower depths may suggest periods of renewed tectonic activity.

Quartzarenites (Swcs 8 and 9) overlying the subarkoses are very similar texturally and mineralogically to the subarkoses, except for the proportion of feldspars. This suggests the quartzarenites were deposited in a similar depositional environment possibly after longer distances of transport and hence dissolution of feldspars. Glauconite in the quartzarenites is attributed to a shallow marine environment and the slightly finer grain size possibly indicates a quieter hydraulic regime.

The presence of a channel in swc 16 and micritic lenses containing micritised shell fragments in both lithologies supports the shallow marine hypothesis. Micritisation of fossils occurs when endolithic algae bore through the walls of tests and the borings are later filled by micrite. Globular foraminiferal tests in the micrite and channel indicate the influence of an open marine environment.

Ironstones (swcs 17 and 19) at the top of the sequence probably indicate a change in environment. Glauconite in both ironstone samples suggests the samples were initially deposited in a shallow marine environment. Subsequent shallowing due to a marine regression may have resulted in paralic conditions, possibly a coastal swamp. In this environment oxygenated Fe-rich waters filtered through the marine sediment and resulted in the precipitation of goethite. Thus fluctuations between ironstone and quartzarenite lithologies may reflect changes in sea level.

**d) Diagenetic Alteration**
The dominant cement in the quartzarenites and subarkoses was pore filling chlorite. Chlorite abundance is variable and concentrates (above 10%) in four distinct zones 1600.5m-1590.5m, 1524.5m, 1506.0m and 1477.5m. Chlorite precipitation is favoured by a marine environment.

Other phases of authigenic minerals include glauconite, pyrite, chert, goethite and carbonate spar. Trace amounts of glauconite are probably the result of grain replacement at the sediment water interface in shallow marine conditions. Oxidised glauconite in some fossils suggests periods of reworking. Pyrite is not evident in the samples containing goethite and chert precipitation was restricted to the micrites. Typically pyrite forms in a reducing environment which may result from increased water depths or burial. Goethite may have formed as a direct precipitate and replacement of framework grains under oxidising conditions possibly in a paralic, swampy environment. Rare carbonate spar partially fills fossil tests and commonly occurs due to recrystallisation of micritic matrix.

Although the paragenetic sequence is uncertain, the following diagenetic events have been identified:

Glauconite precipitation
Micritisation of shell fragments & oxidation of glauconite
Chert precipitation
Mechanical compaction
Chlorite precipitation
Goethite precipitation
Carbonate spar
Feldspar dissolution
Pyrite precipitation

All phases are not necessarily present in each sample and the events probably overlap in time and should not be regarded as discrete. There was no evidence of feldspar overgrowths which characterised the diagenetic alteration observed in Archer #1 and Anemone #1A.

**e) Production problems and reservoir quality**
The disturbed nature of the samples made it impossible to accurately estimate reservoir quality. Intragranular and secondary dissolution porosity are commonly observed in trace amounts. Dissolution of feldspars has resulted in honeycomb pores. Minor amounts of smectite in sidewall cores 12 and 17 may cause drilling problems.

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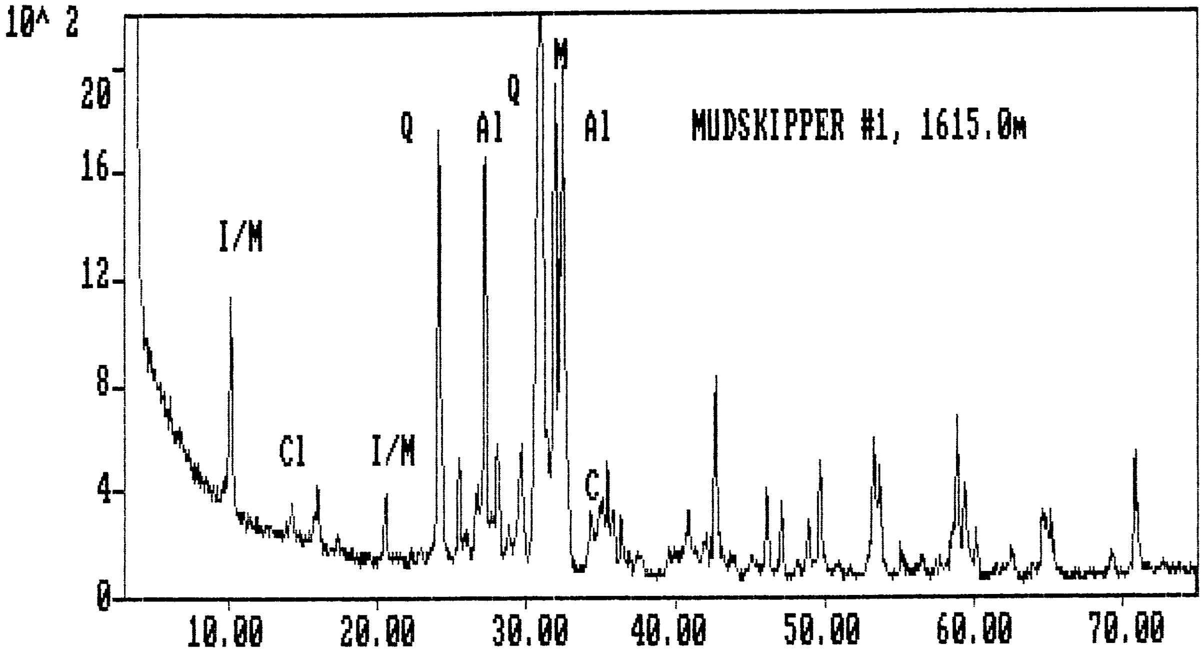


**Figure 2.** Bulk XRD trace of sidewall core 1, Mudskipper #1, depth 1615.0m. Only the strongest peaks for each mineral identified have been labelled. Q=quartz, M=microcline (max), Al=albite, Cl=clinochlore IIB, I/M=illite/muscovite and C=calcite.

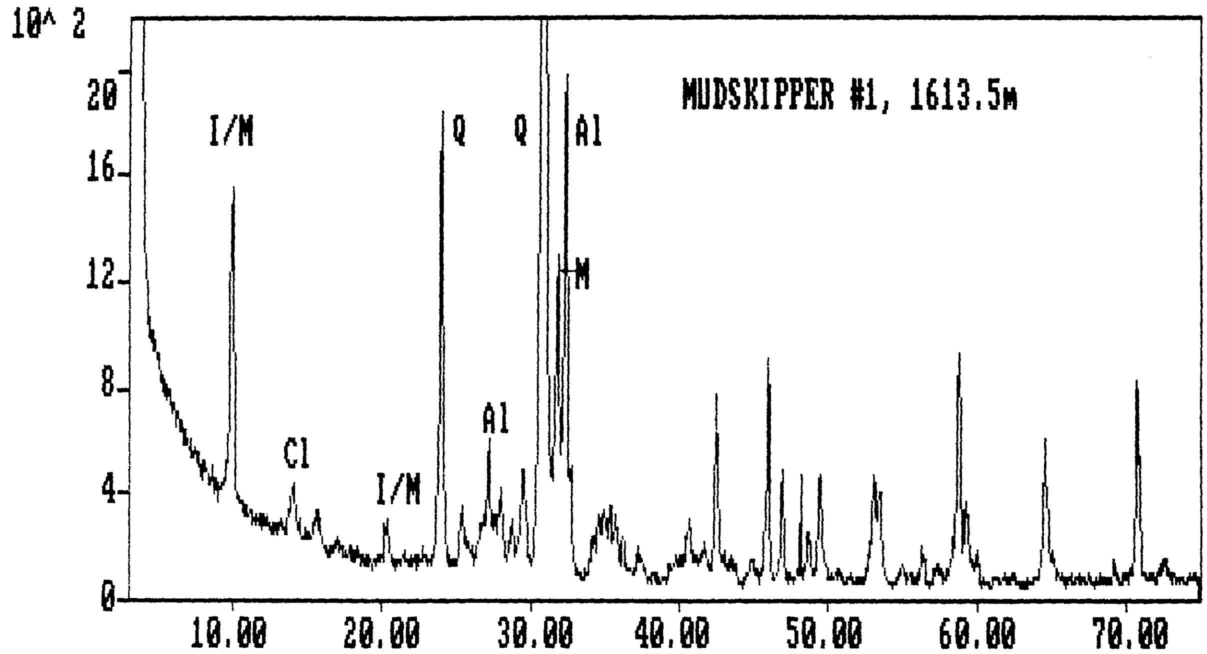


**Figure 3.** Bulk XRD trace of sidewall core 2, Mudskipper #1, depth 1613.5m. Only the strongest peaks for each mineral identified have been labelled. Q=quartz, M=microcline (max), Al=albite, Cl=clinochlore IIB and I/M=illite/muscovite.

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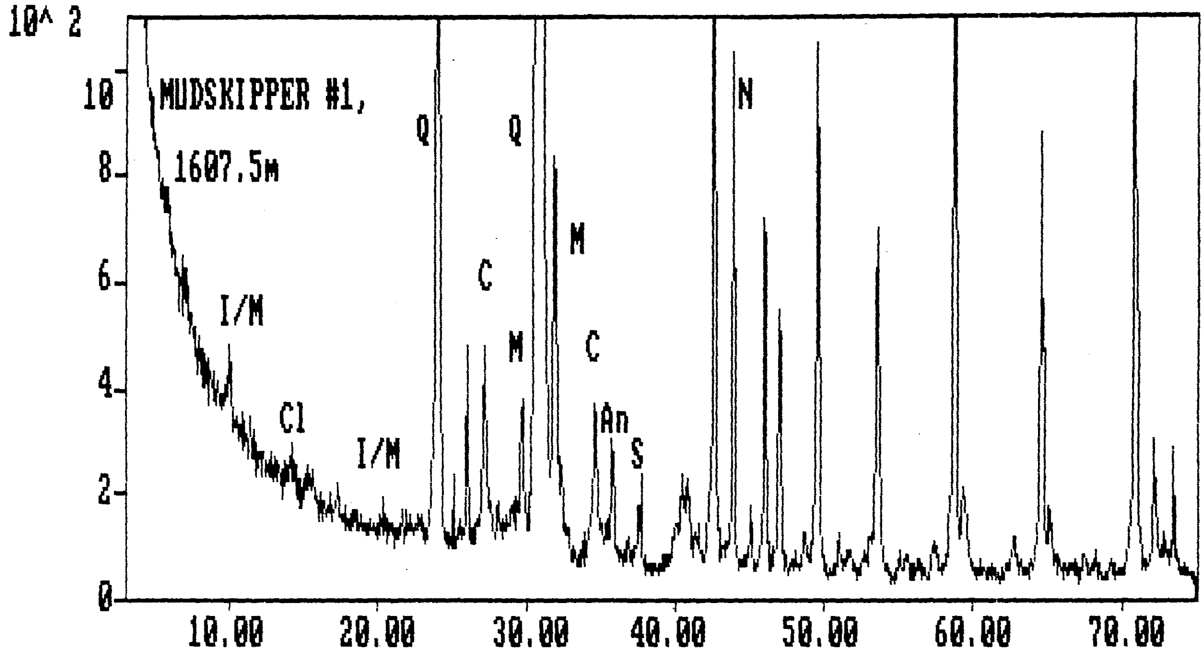


**Figure 6.** Bulk XRD trace of sidewall core 3, Mudskipper #1, depth 1607.5m. Only the strongest peaks for each mineral identified have been labelled. Q=quartz, M=microcline (max), Cl=clinochlore IIB, C=calcite, An=ankerite/ferroan dolomite, S=siderite, I/M=illite/muscovite and N=natrite.

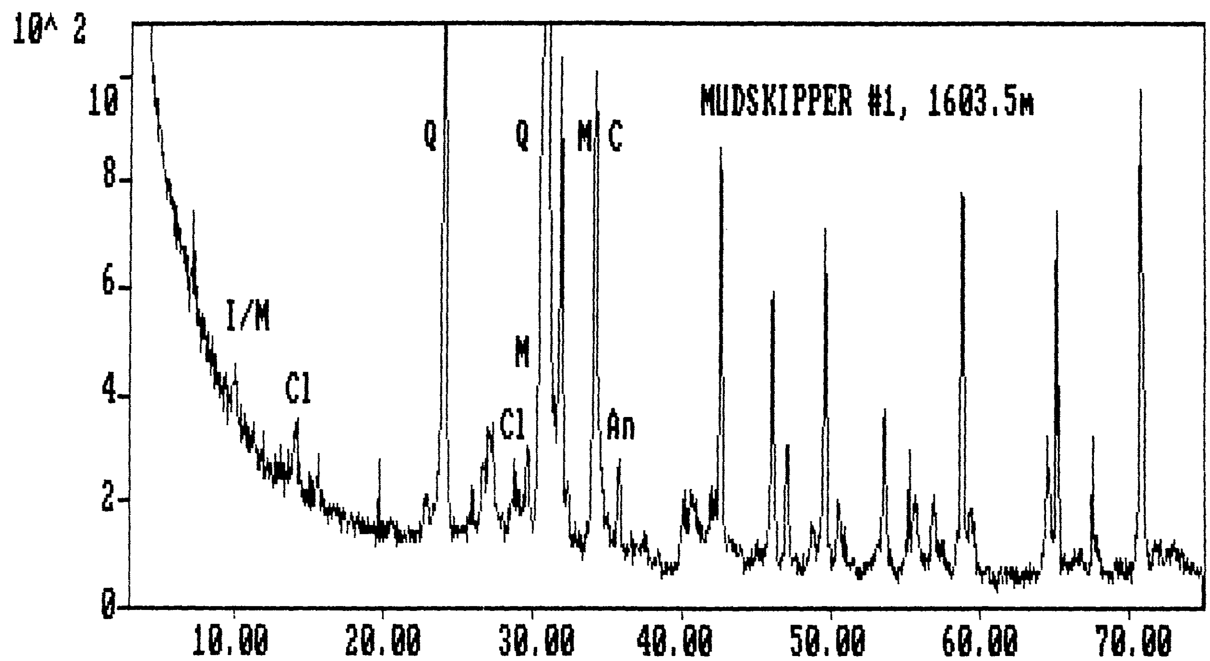


**Figure 7.** Bulk XRD trace of sidewall core 4, Mudskipper #1, depth 1603.5m. Only the strongest peaks for each mineral identified have been labelled. Q=quartz, M=microcline (max), Cl=clinochlore IIB, C=calcite, An=ankerite/ferroan dolomite and I/M=illite/muscovite.

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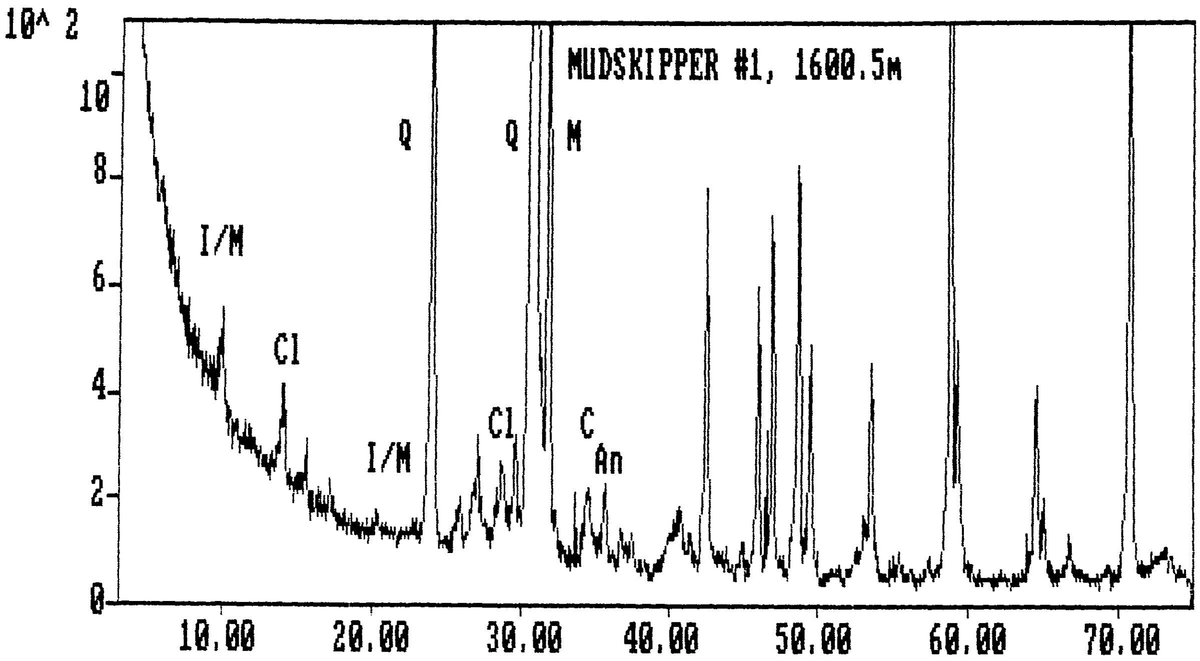


**Figure 9.** Bulk XRD trace of sidewall core 5, Mudskipper #1, depth 1600.5m. Only the strongest peaks for each mineral identified have been labelled. Q=quartz, M=microcline (max), Cl=clinochlore IIB, C=calcite, An=ankerite/ferroan dolomite and I/M=illite/muscovite.

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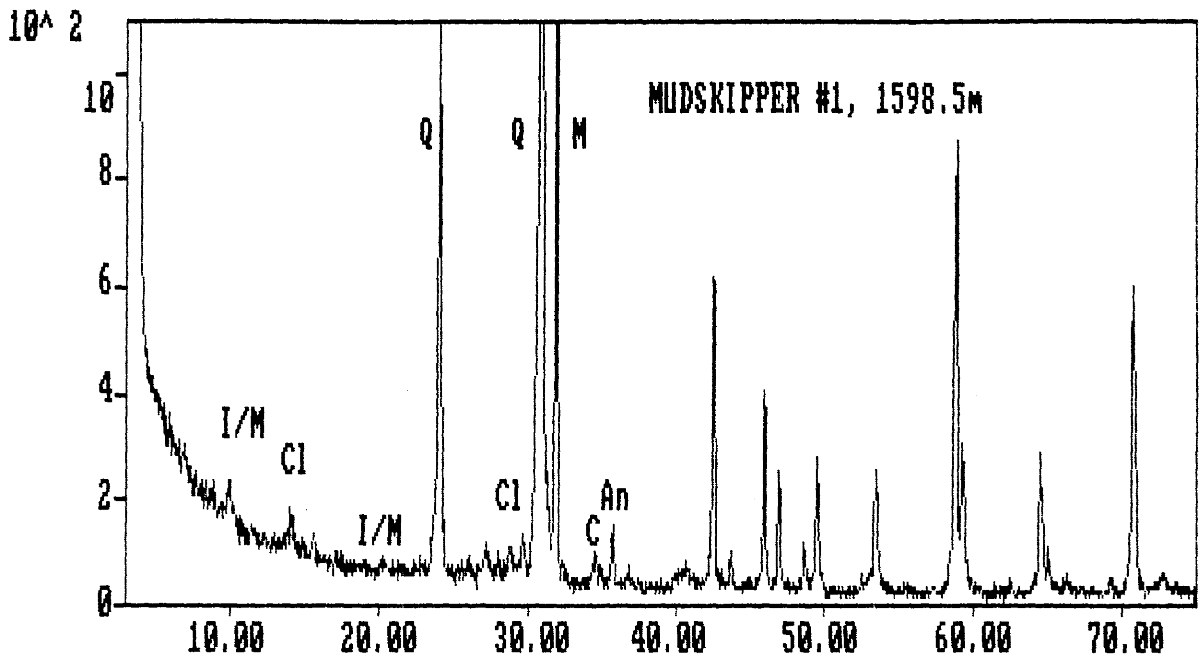


**Figure 11.** Bulk XRD trace of sidewall core 6, Mudskipper #1, depth 1598.5m. Only the strongest peaks for each mineral identified have been labelled. Q=quartz, M=microcline (max), Cl=clinochlore IIB, C=calcite, An=ankerite/ferroan dolomite and I/M=illite/muscovite.

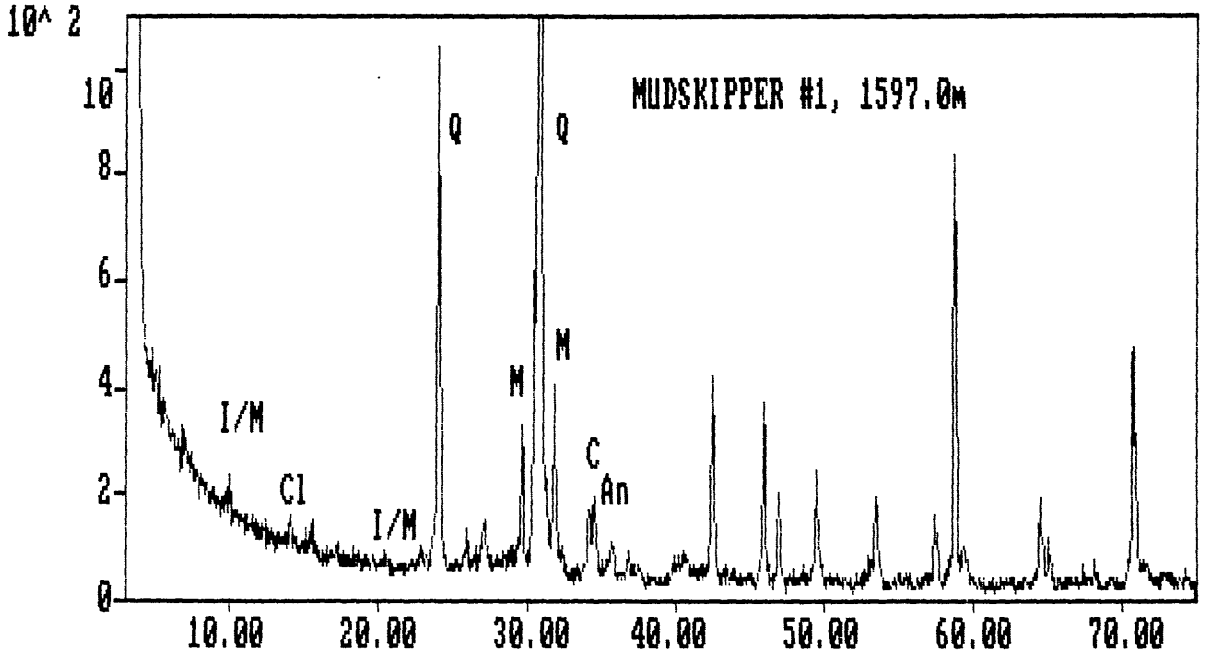


**Figure 12.** Bulk XRD trace of sidewall core 7, Mudskipper #1, depth 1597.0m. Only the strongest peaks for each mineral identified have been labelled. Q=quartz, M=microcline (max), Cl=clinochlore IIB, C=calcite, An=ankerite/ferroan dolomite and I/M=illite/muscovite.

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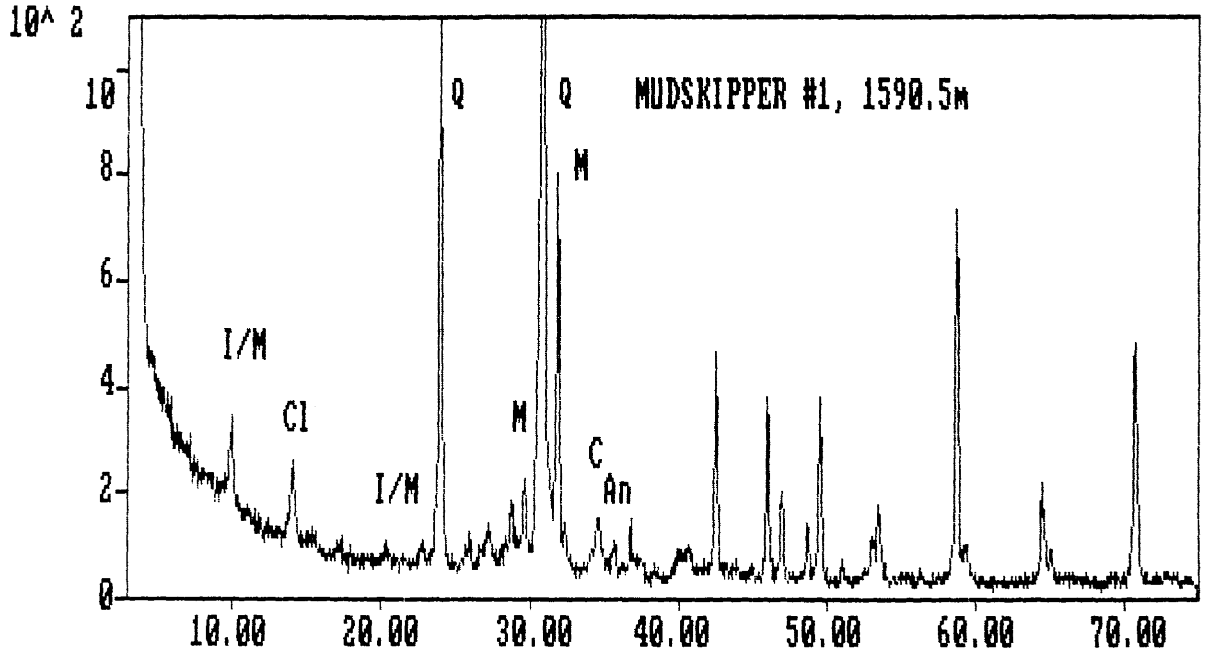


**Figure 14.** Bulk XRD trace of sidewall core 8, Mudskipper #1, depth 1590.5m. Only the strongest peaks for each mineral identified have been labelled. Q=quartz, M=microcline (max), Cl=clinochlore IIB, C=calcite, An=ankerite/ferroan dolomite and I/M=illite/muscovite.

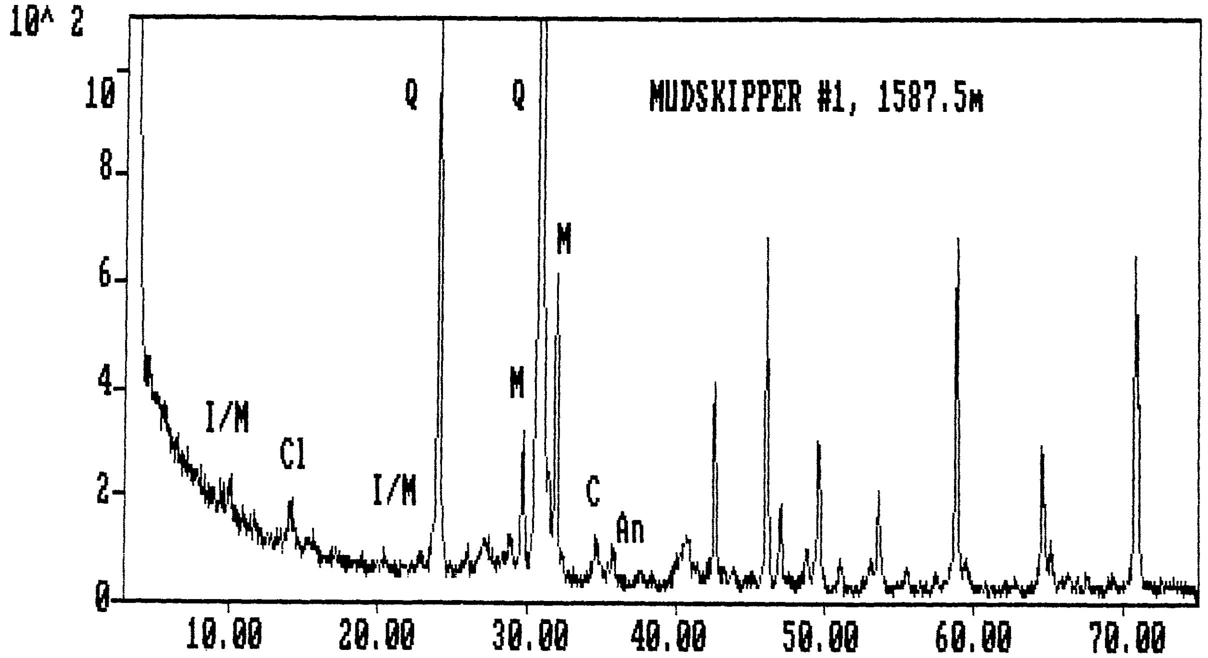


**Figure 15.** Bulk XRD trace of sidewall core 9, Mudskipper #1, depth 1587.5m. Only the strongest peaks for each mineral identified have been labelled. Q=quartz, M=microcline (max), Cl=clinochlore IIB, C=calcite, An=ankerite/ferroan dolomite and I/M=illite/muscovite.

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| W_NO = | W1032 |
| WELL_NAME = | MUDSKIPPER-1 |
| CONTRACTOR = | AMDEL CORE SERVICES |
| CLIENT_OP_CO = | PETROFINA EXPLORATION PTY LTD |

(Inserted by DNRE - Vic Govt Mines Dept)

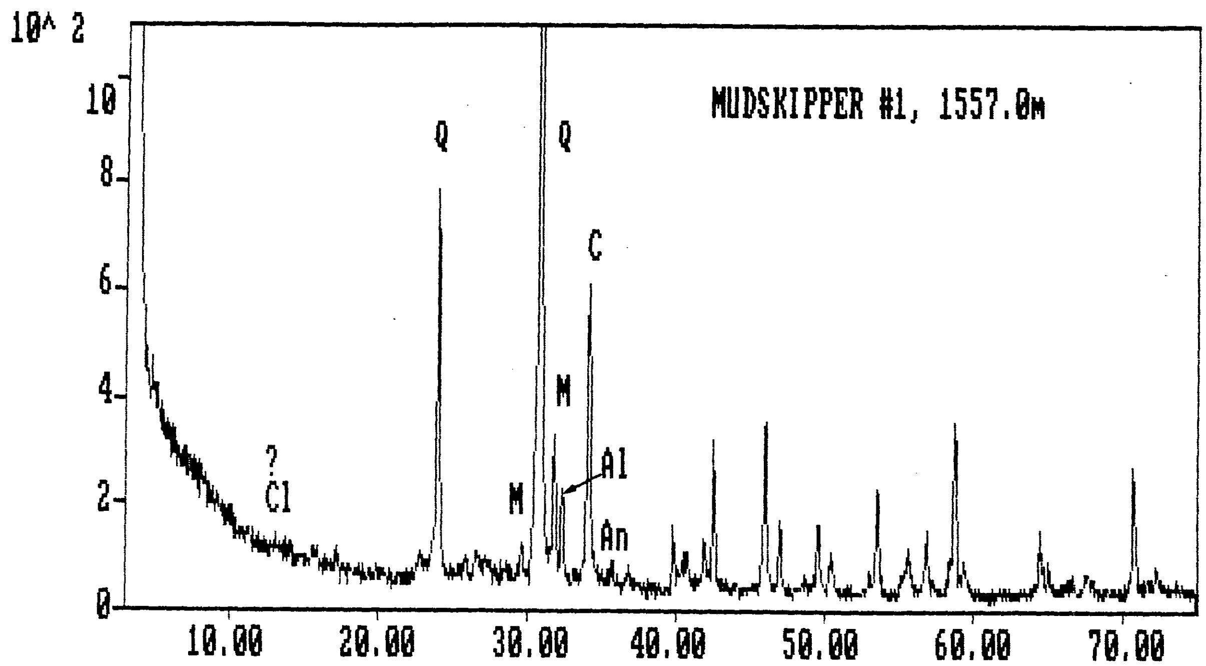


**Figure 17.** Bulk XRD trace of sidewall core 10, Mudskipper #1, depth 1557.0m. Only the strongest peaks for each mineral identified have been labelled. Q=quartz, M=microcline (max), Al=albite, ?Cl=?clinochlore IIB, C=calcite and An=ankerite/ferroan dolomite.

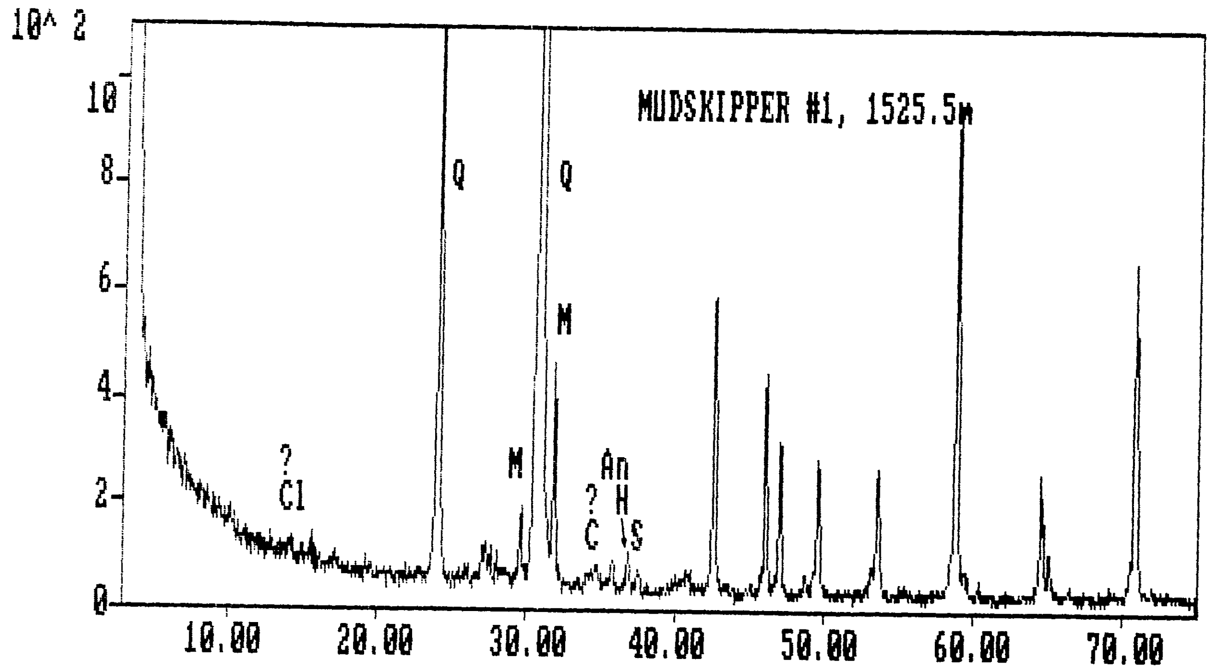


**Figure 18.** Bulk XRD trace of sidewall core 11, Mudskipper #1, depth 1525.5m. Only the strongest peaks for each mineral identified have been labelled. Q=quartz, M=microcline (max), ?Cl=?clinochlore IIB, C=calcite, An=ankerite/ferroan dolomite, S=siderite and H=halite.

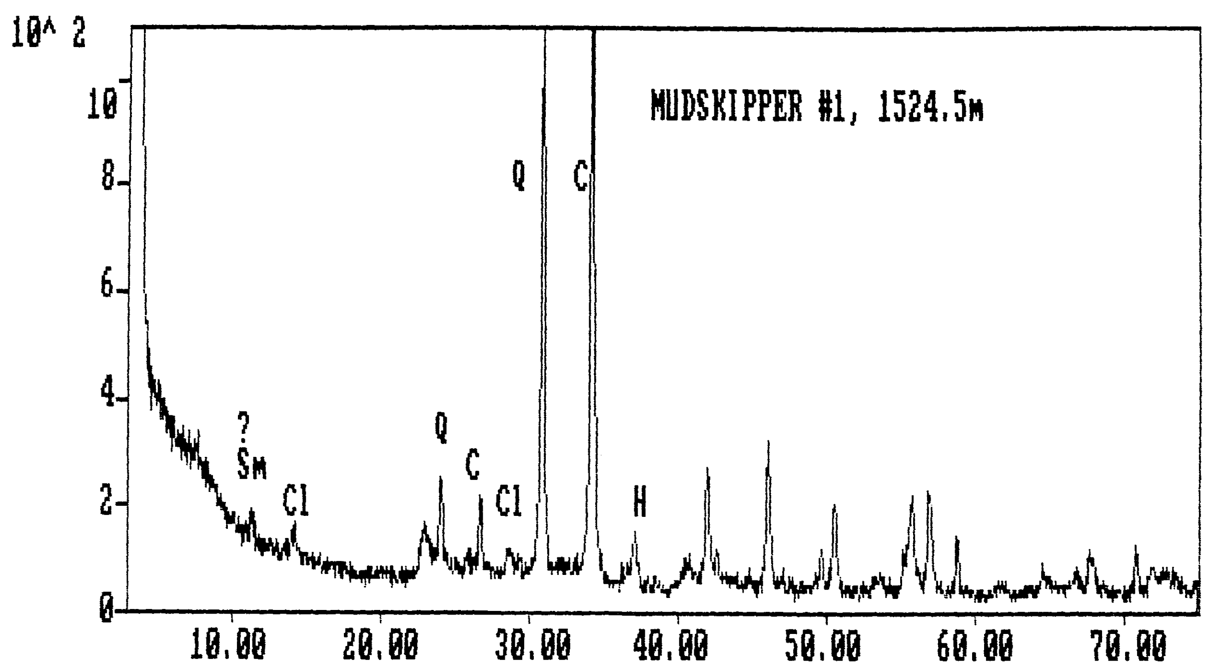


**Figure 19.** Bulk XRD trace of sidewall core 12, Mudskipper #1, depth 1524.5m. Only the strongest peaks for each mineral identified have been labelled. Q=quartz, Cl=clinochlore IIB, C=calcite, ?Sm=?smectite and H=halite.

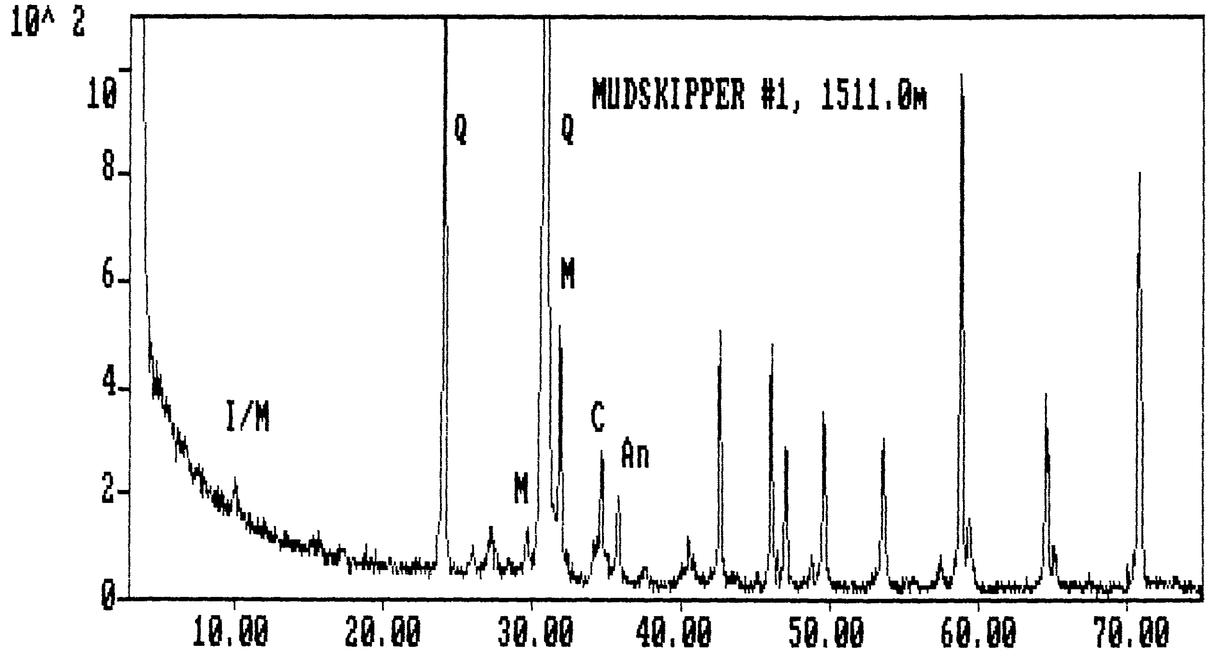


**Figure 20.** Bulk XRD trace of sidewall core 14, Mudskipper #1, depth 1511.0m. Only the strongest peaks for each mineral identified have been labelled. Q=quartz, I/M=illite/muscovite, M=microcline (max), C=calcite and An=ankerite/ferroan dolomite.

PE906931

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WELL_NAME = MUDSKIPPER-1
CONTRACTOR = AMDEL CORE SERVICES
CLIENT_OP_CO = PETROFINA EXPLORATION PTY LTD

(Inserted by DNRE - Vic Govt Mines Dept)

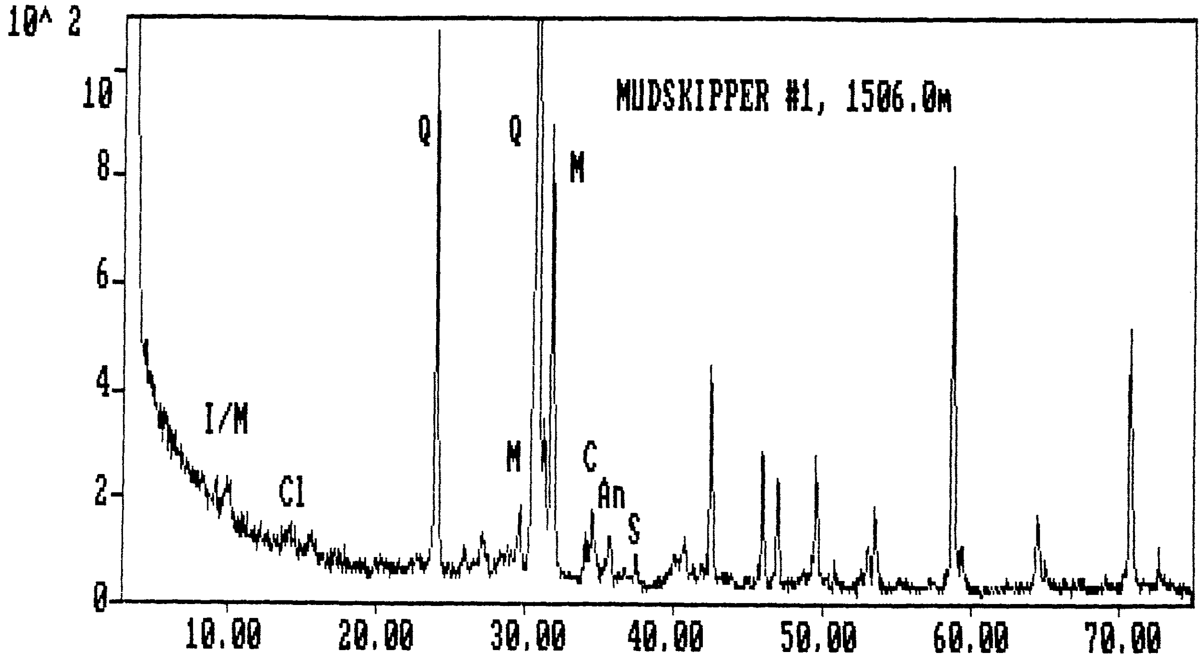


**Figure 22.** Bulk XRD trace of sidewall core 15, Mudskipper #1, depth 1506.0m. Only the strongest peaks for each mineral identified have been labelled. Q=quartz, I/M=illite/muscovite, M=microcline (max), C=calcite, An=ankerite/ferroan dolomite, S=siderite and Cl=clinochlore IIB.

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| WELL_NAME = | MUDSKIPPER-1 |
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(Inserted by DNRE - Vic Govt Mines Dept)

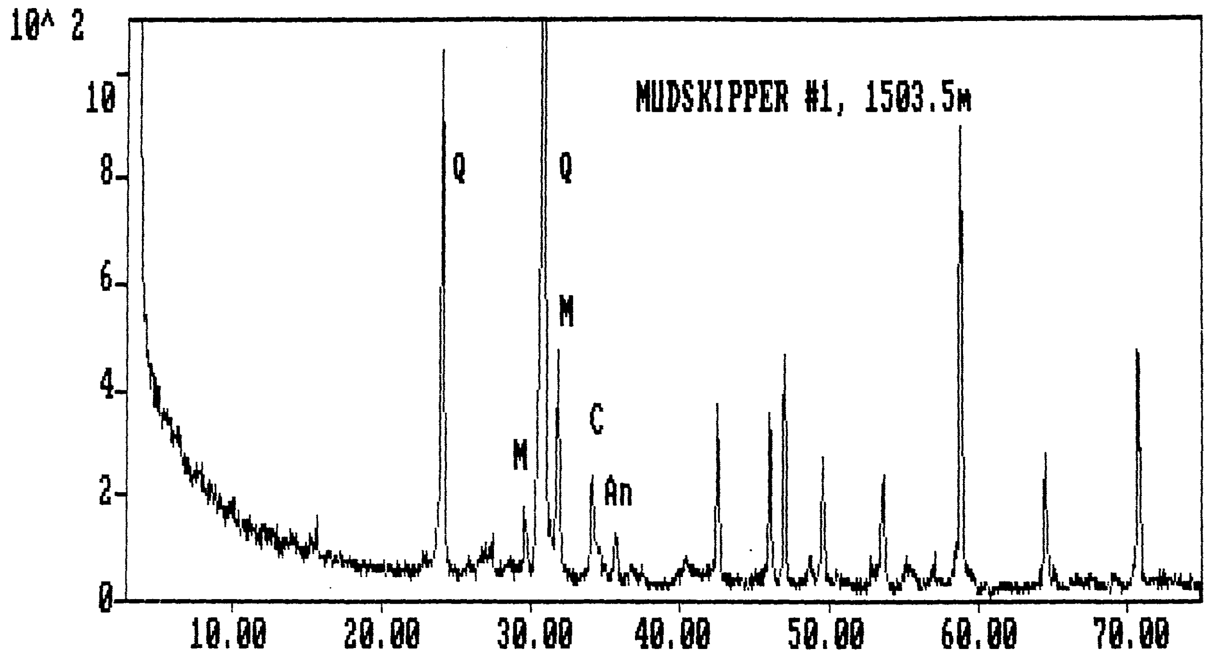


**Figure 25.** Bulk XRD trace of sidewall core 16, Mudskipper #1, depth 1503.5m. Only the strongest peaks for each mineral identified have been labelled. Q=quartz, M=microcline (max), C=calcite and An=ankerite/ferroan dolomite.

PE906933

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| WELL_NAME = | MUDSKIPPER-1 |
| CONTRACTOR = | AMDEL CORE SERVICES |
| CLIENT_OP_CO = | PETROFINA EXPLORATION PTY LTD |

(Inserted by DNRE - Vic Govt Mines Dept)

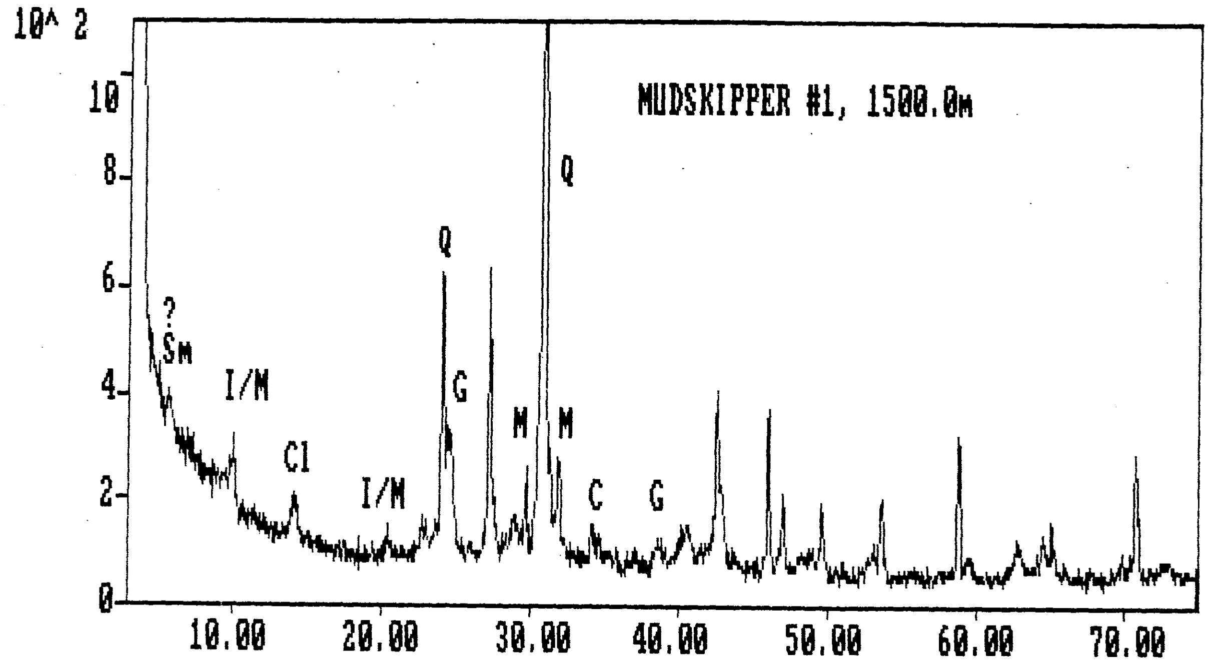


**Figure 27.** Bulk XRD trace of sidewall core 17, Mudskipper #1, depth 1500.0m. Only the strongest peaks for each mineral identified have been labelled. Q=quartz, M=microcline (max), C=calcite, G=goethite, I/M=illite/muscovite, Cl=clinochlore IIB and ?Sm=?smectite.

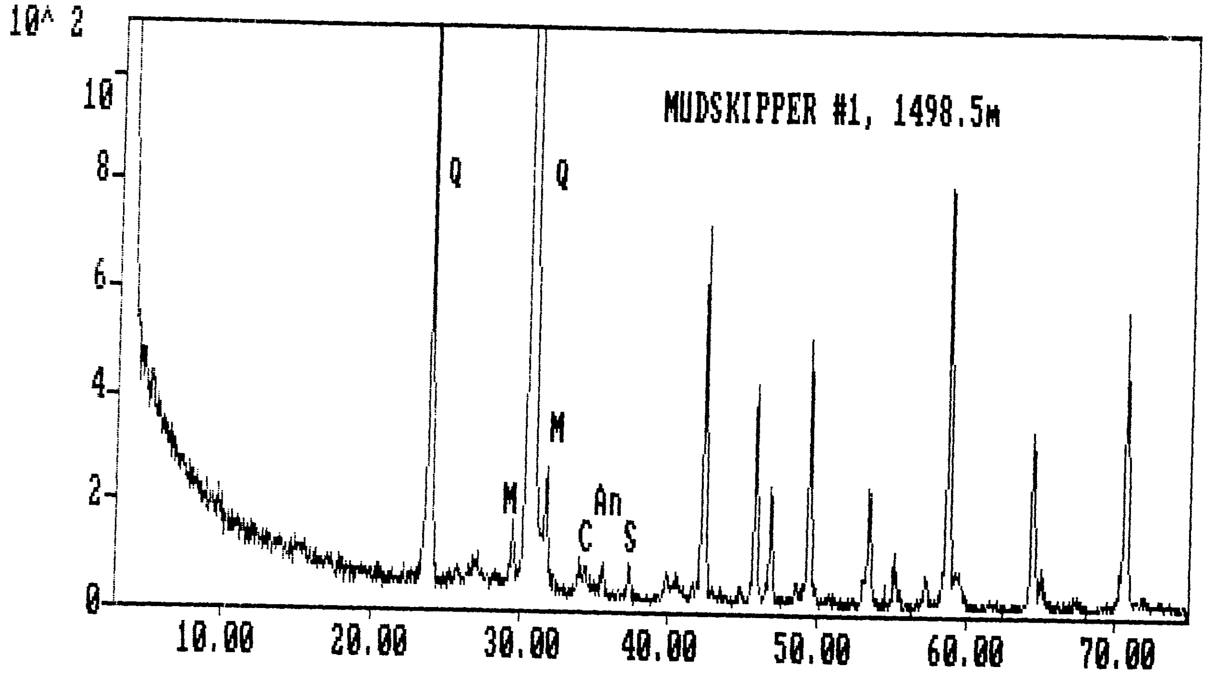


**Figure 28.** Bulk XRD trace of sidewall core 18, Mudskipper #1, depth 1498.5m. Only the strongest peaks for each mineral identified have been labelled. Q=quartz, M=microcline (max), C=calcite, An=ankerite/ferroan dolomite and S=siderite.

PE906934

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| WELL_NAME = | MUDSKIPPER-1 |
| CONTRACTOR = | AMDEL CORE SERVICES |
| CLIENT_OP_CO = | PETROFINA EXPLORATION PTY LTD |

(Inserted by DNRE - Vic Govt Mines Dept)

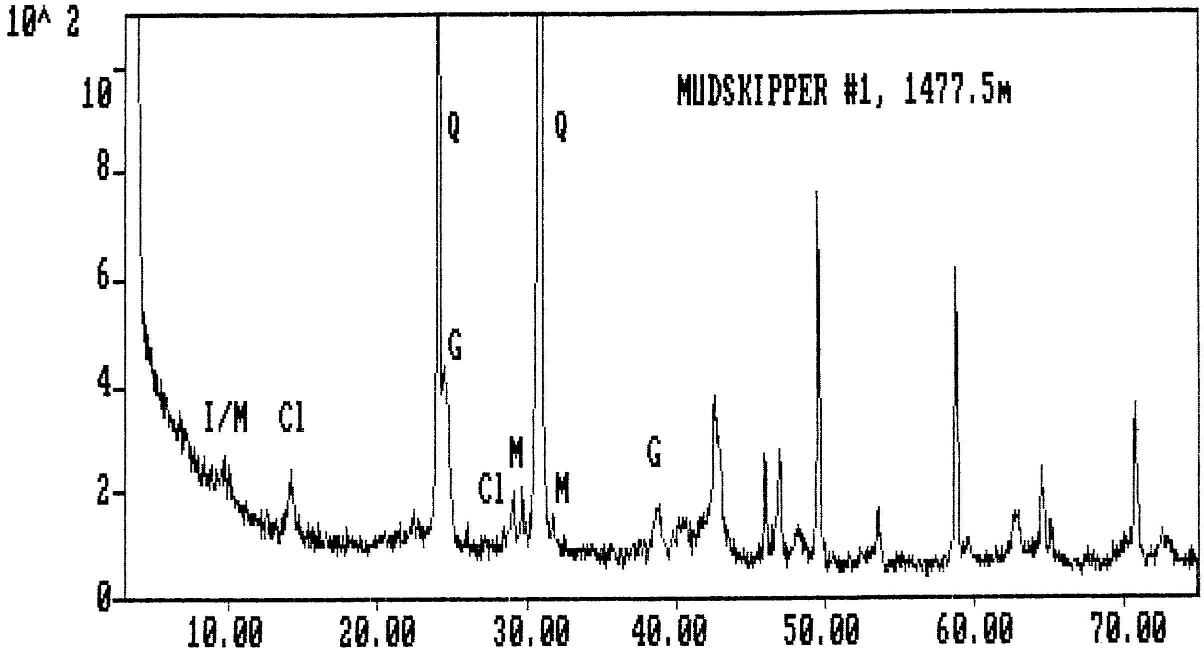


**Figure 30.** Bulk XRD trace of sidewall core 19, Mudskipper #1, depth 1477.5m. Only the strongest peaks for each mineral identified have been labelled. Q=quartz, M=microcline (max), Cl=clinochlore IIB, G=goethite and I/M=illite/muscovite.

APPENDIX 6

# APPENDIX 6

WELL COMPLETION REPORT

MUDSKIPPER-1

INTERPRETATIVE DATA

# APPENDIX 6

SEDIMENTARY INTERPRETATION LOG

PE600919

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WELL_NAME = Mudskipper-1
CONTRACTOR = Petrofina Exploration
CLIENT_OP_CO = Petrofina Exploration

(Inserted by DNRE - Vic Govt Mines Dept)

APPENDIX 7

# APPENDIX 7

WELL COMPLETION REPORT

MUDSKIPPER-1

INTERPRETATIVE DATA

# APPENDIX 7

## LOG ANALYSIS OF THE LATROBE GROUP

PETROFINA EXPLORATION AUSTRALIA S.A.

# Log Analysis of

# The Latrobe Group in

# Mudskipper-1

GL/90/063

JMQ/kl

17 August 1990

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## LIST OF APPENDICES

## 1. SUMMARY AND CONCLUSIONS

A total of 150m of wireline logs, covering the entire Latrobe Group at Mudskipper-1, have been evaluated. The analysis covers the interval from 1470m (5m above Top of Red Beds) to 1620m, the maximum depth to which the evaluation can be carried out (11m above TD).

The conclusions are:

(a) No hydrocarbons are present in any of the intersected sandstones.

(b) A total of 89.9m of excellent reservoir sandstones with average porosities of 20.9 to 28.6% were found in the interval 1504.5m (Top Latrobe/Top Palaeocene) to 1612m (Top of granitic basement).

(c) The Red Beds from 1475.5m to 1504.5m (Top Latrobe) is the only interval with any seal potential at Mudskipper. The 1m thick shale/siltstone separating the Eocene from the Palaeocene is too thin to have any significant seal or caprock potential. The transgressive Palaeocene interval, 1586m to 1612m, was expected to act as the seal for the underlying Maastrichtian Sandstones, but was found to consist of argillaceous sandstones and minor siltstones with no seal potential.

(d) The log analysis results are internally consistent and considered reliable in confirming that all the sandstones in the Latrobe Group are water bearing. The internal consistency of the results is mainly based on the following:

(i) The selected Rw of 0.075 ohm meter @ 167°F compares to the Rw of 0.072 ohm meter @ 185°F at Kingfish, and is further supported by Rwa computed at Mudskipper-1.

(ii) There is a close match between the various porosity curves.

(iii) Computed Vshale values range from 0% in the cleanest sandstones to near 100% in the most argillaceous intervals.

(iv) Ro and Rt overlie each other in zones where the Indonesian equation yields water saturation of 100%.

## 2. INTRODUCTION

This report presents the results of a log analysis over the Latrobe Group drilled at Mudskipper-1 (1504.5-1631m). Mud gas values in this interval were extremely low during drilling, ranging from traces (less than 0.001%) to 0.02% methane only. No fluorescence or cut was detected in any of the sandstones. The aim of this evaluation was to confirm the lack of hydrocarbons in the Latrobe Group, and assess the reservoir and seal potential of this interval.

The environmental corrections on the wireline logs, and the log evaluation computations, were performed using LOGCALC 2 software from Scientific Software Intercomp. As with the previous Petrofina log analysis work performed on other VIC/P20 wells, a shaley sand model was used, with water saturations derived from the Indonesian equation.

The Latrobe Group was divided into three zones, and reservoir parameters selected separately for each. Rw is based on a formation water salinity of 40,000 ppm NaCl equivalent, which is automatically corrected for changes in temperatures with depth by the software. Results are presented in Table 1, while a summary of the reservoir parameters used in the computations are listed on Table 2. A detailed listing of the reservoir and log analysis parameters is included in Appendix 1. Enclosure 1 shows a graphic output at a 1:500 scale of the raw and environmentally corrected logs together with a Rwa trace. Enclosure 2 displays the log analysis results on a 1:200 scale.

## 3. INPUT LOGS AND LOG QUALITY

The following logs were used in the analysis:

- GR (Gamma Ray)
- LLD (Deep Laterolog)
- LLS (Shallow Laterlog)

MSFL (Micro-spherically focussed log)
RHOB (Bulk Density)
NPHI (Neutron Density)
CAL (Caliper)
DT (Sonic Transit Time)

Hole condition as seen on the caliper log is excellent throughout, with no adverse affect on any of the logs. The very high Nphi values and concurrent high Rhob values in the Red Beds (1475m to 1504.5m bkb; Encl. 1) are related to the ironoxide content in the sediments and not an anomalous log response.

## 4. METHOD

(i) The log data was loaded into LOGCALC 2 and quality controlled, before being depth matched using the Gamma Ray and Sonic curves as reference traces.

(ii) The Gamma Ray, Density and Neutron logs were corrected for borehole effects and the deep Laterolog corrected for invasion to give a true Rt (Encls. 1 and 2).

(iii) The well was then zoned into three separate intervals on the basis of stratigraphic zonation and log response. These zones are:

| | |
|---|---|
| Eocene: | 1504.5-1525m |
| Upper Palaeocene: | 1525-1586m |
| Lower Palaeocene: | 1586-1612m |

The Eocene parameters were used in the Red Beds (1475-1504.5m) and the Lower Palaeocene parameters were used in Basement (1612-1631m).

(iv) Reservoir parameters were then selected for each zone and by means of an iterative process modified until results became internally consistent and satisfied the constraints from the wellsite data (Vshale, mineralogy, hydrocarbon shows, etc.).

## 5. PARAMETERS, CUTOFFS AND ANALYSIS OPTIONS

### 5.1 Formation Water Resistivities (Rw)

A Formation Water Salinity of 40,000 ppm NaCl equivalent was used in this analysis, yielding a Rw = 0.070 ohm metre at 167°F (bottom hole temperature). This value was determined from Rwa calculation in the cleanest sandstone intervals. Enclosure 1 shows the Rwa for the entire interval. The Rw selected for Mudskipper compares with Rw = 0.072 ohm meter @ 185°F for the formation water at Kingfish, a Formation Water Salinity of 40,000 ppm NaCl determined for Ayu-1 and 45,000 ppm NaCl for Roundhead-1 in the equivalent stratigraphic intervals.

### 5.2 Matrix and Reservoir Parameters

Selected matrix parameters for the three zones are the same, mainly 2.64 g/cc and 55 μs/ft, which are those of a typical quartz matrix. The shale parameters were selected directly from the logs, while mud properties and temperatures were taken from the log headers. Table 2 includes a list of the shale parameters for each zone.

### 5.3 Analysis

As for previous log evaluations in Permit VIC/P20, a shaley sand analysis model was selected because of the complete gradation of sandstone to shale within the Latrobe Group.

Vshale was calculated using the GR and Neutron-Density cross plots, with LOGCALC 2 selecting the lowest consistent Vshale from the two methods. For the lower zone (1586-1612m) where the sandstones are very radioactive, only the Density-Sonic cross plot was used for calculating Vshale.

Porosities were calculated using the three standard porosity curves. The porosity curves are displayed in Enclosure 2.

The Indonesian Formula was used for water saturation determination, using the Humble parameters of a = 0.62, m = 2.15 and n = 2.

As can be seen on Enclosure 2, the Ro curve (Deep Resistivity reading in 100% water saturated rock) and the Rt curve (true measured Resistivity) overlie each other in all the sandstone intervals, with the computed Sw values narrowly distributed around 100%. The Vshale curve is realistic, showing 0% opposite the cleanest sandstones and increasing to near 100% in the most shaley intervals with very few points above 100%. The Rwa curve (Encl. 1) shows that although there is some variation in formation water salinity over the entire Latrobe interval, an average Rw of 0.070 ohm meter is quite acceptable. The density and sonic porosity curves closely match indicating that no anomalous mineralogy exists in these sandstones, and confirms quartz as the principal matrix mineral. Note that as for the other VIC/P20 wells a compaction factor of Cp = 1.1 to 1.15 has been used in the Tertiary section of the Latrobe Group for determining the sonic porosity (Table 2).

### 5.4 Cutoffs

The cutoffs selected for accepting the log for computation are listed in Appendix 1.

Cutoff values used in defining gross reservoir sandstones are:

**Gross Reservoir = Sandstone with:**

(i) Effective Porosity greater than 6%

(ii) Vshale less than 40%

## 6. LOG ANALYSIS RESULTS

Overall, the Latrobe Group intersected at Mudskipper contains 89.9m of gross reservoir sandstone, representing a 83.6% gross reservoir to gross interval thickness ratio. The average porosities for the separate sandstone units range from 28.6% to 20.9%, while water saturations are close to 100% throughout the Latrobe Group (ranging from 100% to 97.6%), confirming that the sandstones are water bearing.

No intra-Latrobe sealing intervals were found in Mudskipper-1, as reflected by the very high gross reservoir to gross interval thickness ratio of nearly 84%. Basement was intersected at 1612m. This correlates with a significant decrease in ROP during drilling. Unfortunately this section is not well covered by the logs, with only the resistivity and density logs showing a sharp increase at 1612m bkb (Encl. 1). From cuttings descriptions and preliminary petrographic work, basement at Mudskipper-1 has been identified as weathered granite.

**TABLE 1**

**MUDSKIPPER-1 SUMMARY OF LOG ANALYSIS RESULTS**

| ZONE | INTERVAL (m) Top | INTERVAL (m) Bottom | THICKNESS (m) | GROSS RESERVOIR THICKNESS (m) | GROSS RESERVOIR THICKNESS/GROSS INTERVAL THICKNESS (%) | AVERAGE PHIE (%) | AVERAGE Sw (%) |
|---|---|---|---|---|---|---|---|
| RED BEDS | 1475.0 | 1504.5 | 29.5 | 0 | - | - | - |
| EOCENE | 1504.5 | 1525.0 | 20.5 | 19.4 | 95.0 | 28.6 | 99.9 |
| TOP PALAEOCENE (Regr. SST) | 1525.0 | 1586.0 | 61.0 | 61.0 | 100.0 | 23.1 | 99.6 |
| BASE PALAEOCENE (Trans. SST) | 1586.0 | 1612.0 | 26.0 | 9.5 | 37.0 | 20.9 | 97.6 |
| BASEMENT | 1612.0 | 1630.0 | 18.0 | 0 | - | - | - |

GROSS RESERVOIR = SST with: Phie > 6%
Vshale < 40%

## TABLE 2

## MUDSKIPPER-1 ZONATION AND KEY RESERVOIR PARAMETERS

| ZONE | INTERVAL (m) Top - Bottom | | PARAMETER SET NAME | Rw @ BOTTOM OF ZONE (ohm-m) | GR Matrix (API) | GR Shale (API) | Rho Shale (g/cc) | PhiN Shale (pu) | /\t Shale (µs/ft) | Res Shale (ohm-m) | Rho Matrix (g/cc) | /\t Matrix (µs/ft) | Cp | Rho Fluid (g/cc) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RED BEDS | 1475.0 | 1504.5 | EOCENE | 0.0772 | 45 | 150 | 2.40 | 28 | 85 | 1.5 | 2.64 | 55 | 1.15 | 1.0 |
| EOCENE | 1504.5 | 1525.0 | EOCENE | 0.0764 | 45 | 150 | 2.40 | 28 | 85 | 1.5 | 2.64 | 55 | 1.15 | 1.0 |
| TOP PALAEOCENE (Regr. SST) | 1525.0 | 1586.0 | TPALAEO | 0.0766 | 45 | 150 | 2.39 | 27 | 85 | 1.5 | 2.64 | 55 | 1.10 | 1.0 |
| BASE PALAEOCENE (Trans. SST) | 1586.0 | 1612.0 | BPALAEO | 0.0781 | 45 | 150 | 2.40 | 28 | 85 | 1.5 | 2.64 | 55 | 1.10 | 1.0 |
| BASEMENT | 1612.0 | 1631.0 | BPALAEO | 0.0786 | 45 | 150 | 2.40 | 28 | 85 | 1.5 | 2.64 | 55 | 1.10 | 1.0 |

```
*************************************************************
             LISTING OF ENVIRON PARAMETERS

ZONE        EOCENE         WELL        MUDSKIPPER-1

*************************************************************

TOP DEPTH       1470.0000      (METRES) TOP OF INTERVAL
BASE DEPTH      1525.0000      (METRES) BOTTOM OF INTERVAL

DESCRIPTION OF PARAMETERS      : MUDSKIPPER. EOCENE

*************************************************************
********************      FLUID VALUES      *******************
*************************************************************

RHOFR     1.00          (KG/M3 OR GR/CC)RECORDED FLUID DENSITY
SALFM   40000.          (PPM) FORMATION SALINITY (NACL)
SALMD   25000.          (PPM) MUD SALINITY (NACL)
RMM     0.1150          (OHM-M) RM
                        IF USING AN OIL BASED MUD SET TO > 100
RMMT      156.          (FARENHEIT) MEASURED TEMPERATURE FOR RM
RMFM    0.0990          (OHM-M) RMF
RMFMT     156.          (FARENHEIT) MEASURED TEMPERATURE FOR RMF
RMCM    0.1230          (OHM-M) RMC
RMCMT     156.          (FARENHEIT) MEASURED TEMPERATURE FOR RMC

*************************************************************
****************     HOLE AND MUD VALUES      ***************
*************************************************************

MW         9.30         (KG/M3 LBS/GAL LBS/FT3 OR SP. GRAV) MUD WT
                         ENTER 0 MW FOR AIR FILLED HOLE
BITSIZ    8.500         (INCHES) BIT SIZE
AMST       50.0         (FARENHEIT) ANNUAL MEAN SURFACE TEMP
BHT       160.0         (FARENHEIT) BOTTOM HOLE TEMPERATURE
TD        1630.         (METRES) TOTAL DEPTH OF BOREHOLE
RSTAND    1.500         ( INCHES ) STANDOFF SETTING ON INDUCTION

*************************************************************
******************      LIMITING VALUES      *****************
*************************************************************

RHOMIN    1.95          (KG/M3 OR GR/CC) MIN. VALID BULK DENSITY
DLTMIN     40.          (USEC/FT) MIN. VALID SONIC ITT
DLTMAX    190.          (USEC/FT) MAX. VALID SONIC ITT
PHNMAX     60.          (PERCENT) MAXIMUM VALID NEUTRON POROSITY
RUGMAX    6.00          (INCHES) MAX. RUGOSITY TO ACCEPT NEUTRON
STOMAX    3.00          (INCHES) MAX. NEUT. STANDOFF
STOMIN    0.00          (INCHES) MIN. NEUT. STANDOFF TO CORRECT
                        (SET TO STOMAX TO BYPASS STANDOFF LOGIC)
DROLIM    0.20          (KG/M3 OR GR/CC) MAXIMUM DENSITY CORRECTON
                           TO ACCEPT (+ OR -)
```

```
*****************************************************************
********   SWITCHES AND TOOL DESCRIPTIONS   *******************
*****************************************************************

DUNIT        1        DEPTH MEASUREMENT UNITS FLAG
                                0 = DEPTH IN FEET
                                1 = DEPTH IN METERS
MSI          0        LOG MEASUREMENT UNITS FLAG
                                0 = MEASURED IN STANDARD UNITS
                                1 = MEASURED IN MSI UNITS
                                2 = STANDARD BUT DEGREES C
COMPEC       1        SPECTRALOG ENVIRONMENTAL CORRECTIONS
                                1 = SCHLUMBERGER, GO, OR WELEX
                                2 = DRESSER (USE WITH CAUTION)
GRSIZE       0        GAMMA RAY TOOL SIZE:
                                0 = 3 5/8 INCH TOOL
                                1 = 1 11/16 INCH TOOL
GRXC         1        GAMMA RAY CENTERING
                                0 = CENTERED
                                1 = NOT CENTERED
MOPOFF       0        MOVEABLE OIL PLOT SWITCH
                                0 = COMPUTE RXO CURVE
                                1 = DO NOT COMPUTE RXO CURVE
RXLOG        1        SELECT RESISTIVITY FOR LITH DETERMINATION
                                0 = USE RT AT 75 DEGREES F
                                1 = USE RXO AT 75 DEGREES F
AUTOCA       1        NEUTRON AUTOMATIC CALIPER COMPENSATION:
                                0 = NOT COMPENSATED
                                1 = COMPENSATED
PANEL      8.0        NEUTRON PANEL SETTING, NEEDED IF AUTOCA
                            IS EQUAL TO 0
NEWCNL       1        CNL VINTAGE
                                0 = BEFORE 1-1-76
                                1 = AFTER 1-1-76
NSCALE     100        SET TO 100 IF THE NEUTRON IS FRACTIONAL
KSCALE     100        SET TO 100 IF THE K LOG IS FRACTIONAL

TMUD         1        TYPE OF MUD SYSTEM (0=NATURAL & 1=BARITE )
```

```
***************************************************************
             LISTING OF CALC PARAMETERS

ZONE         EOCENE          WELL         MUDSKIPPER-1

***************************************************************

TOP DEPTH       1470.0000      (METRES) TOP OF INTERVAL
BASE DEPTH      1525.0000      (METRES) BOTTOM OF INTERVAL

***************************************************************
********************     MATRIX VALUES    ********************
***************************************************************
GRMA         45.           (API) GAMMA RAY MATRIX
SPMA        -40.           (MV)  SP MATRIX (MV)
ATTMA       150.           (DB/M) ATTENUATIONOF THE MATRIX(DB/M)

DLTSS     55.00            (USEC/FT) DELTA T SANDSTONE
DLTLS     56.00            (USEC/FT) DELTA T LIMESTONE
DLTDOL    43.96            (USEC/FT) DELTA T DOLOMITE
DLTANH    50.00            (USEC/FT) DELTA T ANHYDRITE

RHOSS      2.64            (KG/M3 OR GR/CC) MATRIX DENS OF SANDSTONE
RHOLS      2.71            (KG/M3 OR GR/CC) MATRIX DENS OF LIMESTONE
RHODOL     2.87            (KG/M3 OR GR/CC) MATRIX DENS OF DOLOMITE
RHOANH     2.98            (KG/M3 OR GR/CC) MATRIX DENS OF ANHYDRITE

TPLSS      7.20            (NSEC/M) TPL OF SANDSTONE
TPLLS      9.10            (NSEC/M) TPL OF LIMESTONE
TPLDOL     8.70            (NSEC/M) TPL OF DOLOMITE
TPLANH     8.40            (NSEC/M) TPL OF ANHYDRITE

   VALUES FOR SOLO TOOLS

RHOMAB     2.64            (KG/CM OR GR/CC) MATRIX DENSITY
DLTMAB      55.            (KG/M3 OR GR/CC) TRANSIT TIME MATRIX
TPLMAB     8.50            (NSEC/M) TPL MATRIX
NEUMAB        0            NEUTRON MATRIX 0=LS 1=SS 2=DOL

   VALUES FOR COAL DETECTION

GRCOAL     180.            (API) MAXIMUM GR IN COAL.
DLTCOL      86.            (USEC/FT) MINIMUM SONIC IN COAL.
UCOAL      8.00            (PPM) MINIMUM URANIUM IN COAL.
RHOCOL     2.30            (KG/M3 OR GR/CC) MAXIMUM DENSITY OF COAL.
PNCOL       27.            (PERCENT) MINIMUM LS. NEUTRON POR. IN COAL
PECOL      3.00            (BARNS/ELEC.) MAXIMUM PEF IN COAL.
COALCK        6            NUMBER OF POSITIVE COAL CHECKS NEEDED TO
                           IDENTIFY COAL (COAL=1).

***************************************************************
********************     FLUID VALUES    *********************
***************************************************************

RHOF       1.00            (KG/M3 OR GR/CC)    FLUID DENSITY
DLTF       189.            (USEC/FT) TRANSIT TIME OF FLUID
RHOH       0.60            (KG/M3 OR GR/CC)    HYDROCARBON DENSITY
ANEUT      1.00            NEUTRON GAS FACTOR(USUAL RANGE 1 TO 1.4)
                           1=HIGH DENSITY AND 1.5 LOW DENSITY
RHOMF      1.00            (KG/M3 OR GR/CC)    MUD FILTRATE DENSITY
```

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TPLH        5.00        (NSEC/M)            HYDROCARBON TPL
SALMD    25000.         (PPM)       MUD SALINITY
RWM        0.070        (OHM-M)  RW AT MEASURED TEMPERATURE
RWMT        167.        (FARENHEIT) TEMPERATURE OF RW MEASUREMENT
RWBM        0.07        (OHM-M)  BOUND WATER RESISTIVITY
RWBMT       167.        (FARENHEIT) TEMPERATURE OF RWB MEASUREMENT

****************************************************************
****************      SHALE AND CLAY VALUES      ****************
****************************************************************
GRSH        150.        (API) GAMMA RAY VALUE IN SHALE
SPSH        -45.        (MV)  SP VALUE IN SHALE
ATTSH       600.        (DB/M) EPT ATTENUATION IN SHALE
RHOSH       2.40        (KG/M3 OR GR/CC) MATRIX DENSITY OF SHALE
PEFSH       2.30        (BARNS/ELECTRON) PEF IN SHALE
TPLSH       9.00        (NSEC/M)         TPL IN SHALE
PHINSH       28.        (PERCENT) NEUTRON LOG POROSITY OF SHALE
DLTSH        85.        (USEC/FT) TRANSIT TIME OF SHALE
RSH         1.50        (OHM-M) RESISTIVITY OF SHALE
PHIMAX     51.00        (PERCENT) MAX SHALE POROSITY IN INTERVAL

                        WAXMAN SMITS CONSTANTS

RHOCL       2.70        (KG/M3 OR GR/CC) DENS OF DRY CLAY
HICL       25.00        (PERCENT) HYDROGEN INDEX OF DRY CLAY
CEC        0.100        (MEQ/G) CATION EXCHANGE CAPACITY
                        NOTE: ALSO SUPPLY RSH, M (USED AS M*),
                              N (USED AS N*), RW, AND A.

****************************************************************
******    LOG CALCULATION CONSTANTS AND EXPONENTS      *******
****************************************************************

A           0.62        CONSTANT IN FORMATION FACTOR EQUATION
M           2.15        CEMENTATION EXPONENT
N           2.00        SATURATION EXPONENT
CP          1.15        COMPACTION FACTOR

****************************************************************
*****  LIMITING VALUES FOR NET AND GROSS PAY CALCULATIONS  ****
****************************************************************

PHILIM      6.00        (PERCENT) LOWER POROSITY LIMIT
VSHLIM      0.40        (FRACTION) VOLUME OF SHALE UPPER LIMIT
SWLIM      50.00        (PERCENT) WATER SATURATION LIMIT

****************************************************************
*********     LOG CALCULATION OPTIONS AND SWITCHES      ********
****************************************************************

MSI            0        0=STANDARD UNITS  1=MSI
VSHCIN         3        GR TO VOL. OF SHALE CURVATURE INDEX
VSHOFF         0        0=CALC VOL. OF SHALE - 1=VOL.OF SH=0
GROFF          0        GR AS SHALE INDICATOR (0-USE ,1-NO)
KTHOFF         1        TH & K AS SHALE INDICATOR (0-USE ,1-NO)
NEUOFF         0        NEUTRON AS SHALE INDICATOR (0-USE ,1-NO)
DLTOFF         1        SONIC AS SHALE INDICATOR (0-USE ,1-NO)
ATTOFF         1        EPT AS SHALE INDICATOR (0-USE ,1-NO)
SPOFF          1        SP AS SHALE INDICATOR (0-USE ,1-NO)
PEOFF          0        USE PEF?   (0-USE ,1-NO)
```

| | | |
|---|---|---|
| MINOPT | 3 | MINERAL OPTION SWITCH<br>0 = COMPLEX LITHOLOGY<br>1 = SANDSTONE AND DOLOMITEONLY<br>2 = LIMESTONE AND DOLOMITE ONLY<br>3 = SANDSTONE AND SHALE ONLY (CLASSICAL)<br>4 = SANDSTONE AND SHALE ONLY (MODERN)<br>5 = SANDSTONE AND LIMESTONE ONLY |
| MOPOFF | 0 | MOVEABLE OIL PLOT SWITCH 0-USE RXO<br>1-NO RXO |
| QOPT | 1 | SW OPTION - 0=SW FROM PHIT AND Q<br>1=SW FROM PHIE AND VSH |
| NOPRT | 0 | PRINT OPTION - 0=PRINT ALL VALUES<br>1=SKIP SHALE ZONES |
| SWOPT | 5 | 1 - ARCHIE; 2 - SIMANDOUX; 3 - SIMANDOUX LAMINAR; 4 - V2 SIMANDOUX; 5 - INDONESIAN<br>6 - DISPERSED CLAY 7 - DUAL WATER MODEL<br>8 - DUAL WATER Q=VSH MODEL<br>9 - NORMALIZED WAXMAN-SMITS<br>10 - WAXMAN-SMITS |
| SWIRR | 10.00 | (FRACTION)IRREDUCIBLE WATER SATURATION FOR PERMEABILITY EQUATION |

******************************************************************
LISTING OF ENVIRON PARAMETERS

ZONE TPALEO WELL MUDSKIPPER-1

******************************************************************

| | | |
|---|---|---|
| TOP DEPTH | 1525.0000 | (METRES) TOP OF INTERVAL |
| BASE DEPTH | 1586.0000 | (METRES) BOTTOM OF INTERVAL |

DESCRIPTION OF PARAMETERS : MUDSKIPPER. REGR. SANDSTONES

*****************************************************************
******************** FLUID VALUES *******************
*****************************************************************

| | | |
|---|---|---|
| RHOFR | 1.00 | (KG/M3 OR GR/CC)RECORDED FLUID DENSITY |
| SALFM | 40000. | (PPM) FORMATION SALINITY (NACL) |
| SALMD | 25000. | (PPM) MUD SALINITY (NACL) |
| RMM | 0.1150 | (OHM-M) RM |
| | | IF USING AN OIL BASED MUD SET TO > 100 |
| RMMT | 156. | (FARENHEIT) MEASURED TEMPERATURE FOR RM |
| RMFM | 0.0990 | (OHM-M) RMF |
| RMFMT | 156. | (FARENHEIT) MEASURED TEMPERATURE FOR RMF |
| RMCM | 0.1230 | (OHM-M) RMC |
| RMCMT | 156. | (FARENHEIT) MEASURED TEMPERATURE FOR RMC |

*****************************************************************
***************** HOLE AND MUD VALUES ****************
*****************************************************************

| | | |
|---|---|---|
| MW | 9.30 | (KG/M3 LBS/GAL LBS/FT3 OR SP. GRAV) MUD WT |
| | | ENTER 0 MW FOR AIR FILLED HOLE |
| BITSIZ | 8.500 | (INCHES) BIT SIZE |
| AMST | 50.0 | (FARENHEIT) ANNUAL MEAN SURFACE TEMP |
| BHT | 160.0 | (FARENHEIT) BOTTOM HOLE TEMPERATURE |
| TD | 1630. | (METRES) TOTAL DEPTH OF BOREHOLE |
| RSTAND | 1.500 | ( INCHES ) STANDOFF SETTING ON INDUCTION |

*****************************************************************
******************* LIMITING VALUES ******************
*****************************************************************

| | | |
|---|---|---|
| RHOMIN | 1.95 | (KG/M3 OR GR/CC) MIN. VALID BULK DENSITY |
| DLTMIN | 40. | (USEC/FT) MIN. VALID SONIC ITT |
| DLTMAX | 190. | (USEC/FT) MAX. VALID SONIC ITT |
| PHNMAX | 60. | (PERCENT) MAXIMUM VALID NEUTRON POROSITY |
| RUGMAX | 6.00 | (INCHES) MAX. RUGOSITY TO ACCEPT NEUTRON |
| STOMAX | 3.00 | (INCHES) MAX. NEUT. STANDOFF |
| STOMIN | 0.00 | (INCHES) MIN. NEUT. STANDOFF TO CORRECT |
| | | (SET TO STOMAX TO BYPASS STANDOFF LOGIC) |
| DROLIM | 0.20 | (KG/M3 OR GR/CC) MAXIMUM DENSITY CORRECTON |
| | | TO ACCEPT (+ OR -) |

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***************************************************************
********   SWITCHES AND TOOL DESCRIPTIONS   ******************
***************************************************************

DUNIT        1         DEPTH MEASUREMENT UNITS FLAG
                                 0 = DEPTH IN FEET
                                 1 = DEPTH IN METERS
MSI          0         LOG MEASUREMENT UNITS FLAG
                                 0 = MEASURED IN STANDARD UNITS
                                 1 = MEASURED IN MSI UNITS
                                 2 = STANDARD BUT DEGREES C
COMPEC       1         SPECTRALOG ENVIRONMENTAL CORRECTIONS
                                 1 = SCHLUMBERGER, GO, OR WELEX
                                 2 = DRESSER (USE WITH CAUTION)
GRSIZE       0         GAMMA RAY TOOL SIZE:
                                 0 = 3 5/8 INCH TOOL
                                 1 = 1 11/16 INCH TOOL
GRXC         1         GAMMA RAY CENTERING
                                 0 = CENTERED
                                 1 = NOT CENTERED
MOPOFF       0         MOVEABLE OIL PLOT SWITCH
                                 0 = COMPUTE RXO CURVE
                                 1 = DO NOT COMPUTE RXO CURVE
RXLOG        1         SELECT RESISTIVITY FOR LITH DETERMINATION
                                 0 = USE RT AT 75 DEGREES F
                                 1 = USE RXO AT 75 DEGREES F
AUTOCA       1         NEUTRON AUTOMATIC CALIPER COMPENSATION:
                                 0 = NOT COMPENSATED
                                 1 = COMPENSATED
PANEL      8.0         NEUTRON PANEL SETTING, NEEDED IF AUTOCA
                              IS EQUAL TO 0
NEWCNL       1         CNL VINTAGE
                                 0 = BEFORE 1-1-76
                                 1 = AFTER 1-1-76
NSCALE     100         SET TO 100 IF THE NEUTRON IS FRACTIONAL
KSCALE     100         SET TO 100 IF THE K LOG IS FRACTIONAL

TMUD         1         TYPE OF MUD SYSTEM (0=NATURAL & 1=BARITE )
```

*****************************************************************
LISTING OF CALC PARAMETERS

ZONE TPALEO WELL MUDSKIPPER-1

*****************************************************************

| | | | |
|---|---|---|---|
| TOP DEPTH | 1525.0000 | (METRES) | TOP OF INTERVAL |
| BASE DEPTH | 1586.0000 | (METRES) | BOTTOM OF INTERVAL |

CREATED 23-JUL-90 MODIFIED 23-JUL-90

*****************************************************************
******************** MATRIX VALUES *********************
*****************************************************************

| | | |
|---|---|---|
| GRMA | 45. | (API) GAMMA RAY MATRIX |
| SPMA | -40. | (MV) SP MATRIX (MV) |
| ATTMA | 150. | (DB/M) ATTENUATIONOF THE MATRIX(DB/M) |
| DLTSS | 55.00 | (USEC/FT) DELTA T SANDSTONE |
| DLTLS | 56.00 | (USEC/FT) DELTA T LIMESTONE |
| DLTDOL | 43.96 | (USEC/FT) DELTA T DOLOMITE |
| DLTANH | 50.00 | (USEC/FT) DELTA T ANHYDRITE |
| RHOSS | 2.64 | (KG/M3 OR GR/CC) MATRIX DENS OF SANDSTONE |
| RHOLS | 2.71 | (KG/M3 OR GR/CC) MATRIX DENS OF LIMESTONE |
| RHODOL | 2.87 | (KG/M3 OR GR/CC) MATRIX DENS OF DOLOMITE |
| RHOANH | 2.98 | (KG/M3 OR GR/CC) MATRIX DENS OF ANHYDRITE |
| TPLSS | 7.20 | (NSEC/M) TPL OF SANDSTONE |
| TPLLS | 9.10 | (NSEC/M) TPL OF LIMESTONE |
| TPLDOL | 8.70 | (NSEC/M) TPL OF DOLOMITE |
| TPLANH | 8.40 | (NSEC/M) TPL OF ANHYDRITE |

VALUES FOR SOLO TOOLS

| | | |
|---|---|---|
| RHOMAB | 2.64 | (KG/CM OR GR/CC) MATRIX DENSITY |
| DLTMAB | 55. | (KG/M3 OR GR/CC) TRANSIT TIME MATRIX |
| TPLMAB | 8.50 | (NSEC/M) TPL MATRIX |
| NEUMAB | 0 | NEUTRON MATRIX 0=LS 1=SS 2=DOL |

VALUES FOR COAL DETECTION

| | | |
|---|---|---|
| GRCOAL | 180. | (API) MAXIMUM GR IN COAL. |
| DLTCOL | 86. | (USEC/FT) MINIMUM SONIC IN COAL. |
| UCOAL | 8.00 | (PPM) MINIMUM URANIUM IN COAL. |
| RHOCOL | 2.30 | (KG/M3 OR GR/CC) MAXIMUM DENSITY OF COAL. |
| PNCOL | 27. | (PERCENT) MINIMUM LS. NEUTRON POR. IN COAL |
| PECOL | 3.00 | (BARNS/ELEC.) MAXIMUM PEF IN COAL. |
| COALCK | 6 | NUMBER OF POSITIVE COAL CHECKS NEEDED TO IDENTIFY COAL (COAL=1). |

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*****************************************************************
********************      FLUID VALUES     ********************
*****************************************************************

RHOF       1.00         (KG/M3 OR GR/CC)    FLUID DENSITY
DLTF       189.         (USEC/FT) TRANSIT TIME OF FLUID
RHOH       0.60         (KG/M3 OR GR/CC)    HYDROCARBON DENSITY
ANEUT      1.00         NEUTRON GAS FACTOR(USUAL RANGE 1 TO 1.4)
                        1=HIGH DENSITY AND 1.5 LOW DENSITY
RHOMF      1.00         (KG/M3 OR GR/CC)    MUD FILTRATE DENSITY
TPLH       5.00         (NSEC/M)            HYDROCARBON TPL
SALMD     25000.        (PPM)      MUD SALINITY
RWM        0.072        (OHM-M)  RW AT MEASURED TEMPERATURE
RWMT       167.         (FARENHEIT) TEMPERATURE OF RW MEASUREMENT
RWBM       0.07         (OHM-M)  BOUND WATER RESISTIVITY
RWBMT      167.         (FARENHEIT) TEMPERATURE OF RWB MEASUREMENT

*****************************************************************
****************     SHALE AND CLAY VALUES     ****************
*****************************************************************
GRSH       150.         (API) GAMMA RAY VALUE IN SHALE
SPSH       -45.         (MV)  SP VALUE IN SHALE
ATTSH      600.         (DB/M) EPT ATTENUATION IN SHALE
RHOSH      2.39         (KG/M3 OR GR/CC) MATRIX DENSITY OF SHALE
PEFSH      2.30         (BARNS/ELECTRON) PEF IN SHALE
TPLSH      9.00         (NSEC/M)        TPL IN SHALE
PHINSH      27.         (PERCENT) NEUTRON LOG POROSITY OF SHALE
DLTSH       85.         (USEC/FT) TRANSIT TIME OF SHALE
RSH        1.50         (OHM-M) RESISTIVITY OF SHALE
PHIMAX    51.00         (PERCENT) MAX SHALE POROSITY IN INTERVAL

                        WAXMAN SMITS CONSTANTS

RHOCL      2.70         (KG/M3 OR GR/CC) DENS OF DRY CLAY
HICL      25.00         (PERCENT) HYDROGEN INDEX OF DRY CLAY
CEC        0.100        (MEQ/G) CATION EXCHANGE CAPACITY
                        NOTE: ALSO SUPPLY RSH, M (USED AS M*),
                              N (USED AS N*), RW, AND A.

*****************************************************************
******     LOG CALCULATION CONSTANTS AND EXPONENTS      *******
*****************************************************************

A          0.62         CONSTANT IN FORMATION FACTOR EQUATION
M          2.15         CEMENTATION EXPONENT
N          2.00         SATURATION EXPONENT
CP         1.10         COMPACTION FACTOR

*****************************************************************
****  LIMITING VALUES FOR NET AND GROSS PAY CALCULATIONS  ****
*****************************************************************

PHILIM     6.00         (PERCENT) LOWER POROSITY LIMIT
VSHLIM     0.40         (FRACTION) VOLUME OF SHALE UPPER LIMIT
SWLIM     50.00         (PERCENT) WATER SATURATION LIMIT

*****************************************************************
*********     LOG CALCULATION OPTIONS AND SWITCHES     ********
*****************************************************************
```

| | | |
|---|---|---|
| MSI | 0 | 0=STANDARD UNITS 1=MSI |
| VSHCIN | 3 | GR TO VOL. OF SHALE CURVATURE INDEX |
| VSHOFF | 0 | 0=CALC VOL. OF SHALE - 1=VOL.OF SH=0 |
| GROFF | 0 | GR AS SHALE INDICATOR (0-USE ,1-NO) |
| KTHOFF | 1 | TH & K AS SHALE INDICATOR (0-USE ,1-NO) |
| NEUOFF | 0 | NEUTRON AS SHALE INDICATOR (0-USE ,1-NO) |
| DLTOFF | 1 | SONIC AS SHALE INDICATOR (0-USE ,1-NO) |
| ATTOFF | 1 | EPT AS SHALE INDICATOR (0-USE ,1-NO) |
| SPOFF | 1 | SP AS SHALE INDICATOR (0-USE ,1-NO) |
| PEOFF | 0 | USE PEF? (0-USE ,1-NO) |
| MINOPT | 3 | MINERAL OPTION SWITCH<br>0 = COMPLEX LITHOLOGY<br>1 = SANDSTONE AND DOLOMITEONLY<br>2 = LIMESTONE AND DOLOMITE ONLY<br>3 = SANDSTONE AND SHALE ONLY (CLASSICAL)<br>4 = SANDSTONE AND SHALE ONLY (MODERN)<br>5 = SANDSTONE AND LIMESTONE ONLY |
| MOPOFF | 0 | MOVEABLE OIL PLOT SWITCH 0-USE RXO<br>1-NO RXO |
| QOPT | 1 | SW OPTION - 0=SW FROM PHIT AND Q<br>1=SW FROM PHIE AND VSH |
| NOPRT | 0 | PRINT OPTION - 0=PRINT ALL VALUES<br>1=SKIP SHALE ZONES |
| SWOPT | 5 | 1 - ARCHIE; 2 - SIMANDOUX; 3 - SIMANDOUX LAMINAR; 4 - V2 SIMANDOUX; 5 - INDONESIAN<br>6 - DISPERSED CLAY 7 - DUAL WATER MODEL<br>8 - DUAL WATER Q=VSH MODEL<br>9 - NORMALIZED WAXMAN-SMITS<br>10 - WAXMAN-SMITS |
| SWIRR | 10.00 | (FRACTION)IRREDUCIBLE WATER SATURATION FOR PERMEABILITY EQUATION |

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*****************************************************************
             LISTING OF ENVIRON PARAMETERS

ZONE        BPALEO          WELL         MUDSKIPPER-1

*****************************************************************

TOP DEPTH        1586.0000      (METRES) TOP OF INTERVAL
BASE DEPTH       1630.0000      (METRES) BOTTOM OF INTERVAL

DESCRIPTION OF PARAMETERS     : MUDSKIPPER. TRANS. SST

*****************************************************************
*********************     FLUID VALUES     ********************
*****************************************************************

RHOFR     1.00         (KG/M3 OR GR/CC)RECORDED FLUID DENSITY
SALFM    40000.        (PPM) FORMATION SALINITY (NACL)
SALMD    25000.        (PPM) MUD SALINITY (NACL)
RMM      0.1150        (OHM-M) RM
                       IF USING AN OIL BASED MUD SET TO > 100
RMMT      156.         (FARENHEIT) MEASURED TEMPERATURE FOR RM
RMFM     0.0990        (OHM-M) RMF
RMFMT     156.         (FARENHEIT) MEASURED TEMPERATURE FOR RMF
RMCM     0.1230        (OHM-M) RMC
RMCMT     156.         (FARENHEIT) MEASURED TEMPERATURE FOR RMC


*****************************************************************
*****************     HOLE AND MUD VALUES     ****************
*****************************************************************

MW         9.30        (KG/M3 LBS/GAL LBS/FT3 OR SP. GRAV) MUD WT
                        ENTER 0 MW FOR AIR FILLED HOLE
BITSIZ    8.500        (INCHES) BIT SIZE
AMST       50.0        (FARENHEIT) ANNUAL MEAN SURFACE TEMP
BHT       160.0        (FARENHEIT) BOTTOM HOLE TEMPERATURE
TD        1630.        (METRES) TOTAL DEPTH OF BOREHOLE
RSTAND    1.500        ( INCHES ) STANDOFF SETTING ON INDUCTION

*****************************************************************
*******************     LIMITING VALUES     ******************
*****************************************************************

RHOMIN    1.95         (KG/M3 OR GR/CC) MIN. VALID BULK DENSITY
DLTMIN     40.         (USEC/FT) MIN. VALID SONIC ITT
DLTMAX    190.         (USEC/FT) MAX. VALID SONIC ITT
PHNMAX     60.         (PERCENT) MAXIMUM VALID NEUTRON POROSITY
RUGMAX    6.00         (INCHES) MAX. RUGOSITY TO ACCEPT NEUTRON
STOMAX    3.00         (INCHES) MAX. NEUT. STANDOFF
STOMIN    0.00         (INCHES) MIN. NEUT. STANDOFF TO CORRECT
                       (SET TO STOMAX TO BYPASS STANDOFF LOGIC)
DROLIM    0.20         (KG/M3 OR GR/CC) MAXIMUM DENSITY CORRECTON
                          TO ACCEPT (+ OR -)
```

```
******************************************************************
********   SWITCHES AND TOOL DESCRIPTIONS   *******************
******************************************************************

DUNIT        1          DEPTH MEASUREMENT UNITS FLAG
                                  0 = DEPTH IN FEET
                                  1 = DEPTH IN METERS
MSI          0          LOG MEASUREMENT UNITS FLAG
                                  0 = MEASURED IN STANDARD UNITS
                                  1 = MEASURED IN MSI UNITS
                                  2 = STANDARD BUT DEGREES C
COMPEC       1          SPECTRALOG ENVIRONMENTAL CORRECTIONS
                                  1 = SCHLUMBERGER, GO, OR WELEX
                                  2 = DRESSER (USE WITH CAUTION)
GRSIZE       0          GAMMA RAY TOOL SIZE:
                                  0 = 3 5/8 INCH TOOL
                                  1 = 1 11/16 INCH TOOL
GRXC         1          GAMMA RAY CENTERING
                                  0 = CENTERED
                                  1 = NOT CENTERED
MOPOFF       0          MOVEABLE OIL PLOT SWITCH
                                  0 = COMPUTE RXO CURVE
                                  1 = DO NOT COMPUTE RXO CURVE
RXLOG        1          SELECT RESISTIVITY FOR LITH DETERMINATION
                                  0 = USE RT AT 75 DEGREES F
                                  1 = USE RXO AT 75 DEGREES F
AUTOCA       1          NEUTRON AUTOMATIC CALIPER COMPENSATION:
                                  0 = NOT COMPENSATED
                                  1 = COMPENSATED
PANEL      8.0          NEUTRON PANEL SETTING, NEEDED IF AUTOCA
                              IS EQUAL TO 0
NEWCNL       1          CNL VINTAGE
                                  0 = BEFORE 1-1-76
                                  1 = AFTER 1-1-76
NSCALE     100          SET TO 100 IF THE NEUTRON IS FRACTIONAL
KSCALE     100          SET TO 100 IF THE K LOG IS FRACTIONAL

TMUD         1          TYPE OF MUD SYSTEM (0=NATURAL & 1=BARITE )
```

```
*****************************************************************
            LISTING OF CALC PARAMETERS

ZONE        BPALEO          WELL        MUDSKIPPER-1

*****************************************************************

TOP DEPTH       1586.0000       (METRES) TOP OF INTERVAL
BASE DEPTH      1630.0000       (METRES) BOTTOM OF INTERVAL

*****************************************************************
********************     MATRIX VALUES    ********************
*****************************************************************
GRMA        45.         (API) GAMMA RAY MATRIX
SPMA       -40.         (MV)  SP MATRIX (MV)
ATTMA      150.         (DB/M) ATTENUATIONOF THE MATRIX(DB/M)

DLTSS     55.00         (USEC/FT) DELTA T SANDSTONE
DLTLS     56.00         (USEC/FT) DELTA T LIMESTONE
DLTDOL    43.96         (USEC/FT) DELTA T DOLOMITE
DLTANH    50.00         (USEC/FT) DELTA T ANHYDRITE

RHOSS      2.64         (KG/M3 OR GR/CC) MATRIX DENS OF SANDSTONE
RHOLS      2.71         (KG/M3 OR GR/CC) MATRIX DENS OF LIMESTONE
RHODOL     2.87         (KG/M3 OR GR/CC) MATRIX DENS OF DOLOMITE
RHOANH     2.98         (KG/M3 OR GR/CC) MATRIX DENS OF ANHYDRITE

TPLSS      7.20         (NSEC/M) TPL OF SANDSTONE
TPLLS      9.10         (NSEC/M) TPL OF LIMESTONE
TPLDOL     8.70         (NSEC/M) TPL OF DOLOMITE
TPLANH     8.40         (NSEC/M) TPL OF ANHYDRITE

    VALUES FOR SOLO TOOLS

RHOMAB     2.64         (KG/CM OR GR/CC) MATRIX DENSITY
DLTMAB      55.         (KG/M3 OR GR/CC) TRANSIT TIME MATRIX
TPLMAB     8.50         (NSEC/M) TPL MATRIX
NEUMAB        0         NEUTRON MATRIX 0=LS 1=SS 2=DOL

    VALUES FOR COAL DETECTION

GRCOAL     180.         (API) MAXIMUM GR IN COAL.
DLTCOL      86.         (USEC/FT) MINIMUM SONIC IN COAL.
UCOAL      8.00         (PPM) MINIMUM URANIUM IN COAL.
RHOCOL     2.30         (KG/M3 OR GR/CC) MAXIMUM DENSITY OF COAL.
PNCOL       27.         (PERCENT) MINIMUM LS. NEUTRON POR. IN COAL
PECOL      3.00         (BARNS/ELEC.) MAXIMUM PEF IN COAL.
COALCK        6         NUMBER OF POSITIVE COAL CHECKS NEEDED TO
                        IDENTIFY COAL (COAL=1).

*****************************************************************
********************     FLUID VALUES    ********************
*****************************************************************

RHOF       1.00         (KG/M3 OR GR/CC)    FLUID DENSITY
DLTF       189.         (USEC/FT) TRANSIT TIME OF FLUID
RHOH       0.60         (KG/M3 OR GR/CC)    HYDROCARBON DENSITY
ANEUT      1.00         NEUTRON GAS FACTOR(USUAL RANGE 1 TO 1.4)
                        1=HIGH DENSITY AND 1.5 LOW DENSITY
RHOMF      1.00         (KG/M3 OR GR/CC)    MUD FILTRATE DENSITY
```

```
TPLH       5.00          (NSEC/M)           HYDROCARBON TPL
SALMD    25000.          (PPM)      MUD SALINITY
RWM       0.075          (OHM-M)  RW AT MEASURED TEMPERATURE
RWMT      167.           (FARENHEIT) TEMPERATURE OF RW MEASUREMENT
RWBM      0.08           (OHM-M)  BOUND WATER RESISTIVITY
RWBMT     167.           (FARENHEIT) TEMPERATURE OF RWB MEASUREMENT

**************************************************************
***************     SHALE AND CLAY VALUES     ***************
**************************************************************
GRSH      150.           (API) GAMMA RAY VALUE IN SHALE
SPSH      -45.           (MV)  SP VALUE IN SHALE
ATTSH     600.           (DB/M) EPT ATTENUATION IN SHALE
RHOSH     2.40           (KG/M3 OR GR/CC) MATRIX DENSITY OF SHALE
PEFSH     2.30           (BARNS/ELECTRON) PEF IN SHALE
TPLSH     9.00           (NSEC/M)        TPL IN SHALE
PHINSH     28.           (PERCENT) NEUTRON LOG POROSITY OF SHALE
DLTSH      85.           (USEC/FT) TRANSIT TIME OF SHALE
RSH       1.50           (OHM-M) RESISTIVITY OF SHALE
PHIMAX   51.00           (PERCENT) MAX SHALE POROSITY IN INTERVAL

                         WAXMAN SMITS CONSTANTS

RHOCL     2.70           (KG/M3 OR GR/CC) DENS OF DRY CLAY
HICL     25.00           (PERCENT) HYDROGEN INDEX OF DRY CLAY
CEC      0.100           (MEQ/G) CATION EXCHANGE CAPACITY
                         NOTE: ALSO SUPPLY RSH, M (USED AS M*),
                               N (USED AS N*), RW, AND A.

**************************************************************
*******    LOG CALCULATION CONSTANTS AND EXPONENTS    *******
**************************************************************

A         0.62           CONSTANT IN FORMATION FACTOR EQUATION
M         2.15           CEMENTATION EXPONENT
N         2.00           SATURATION EXPONENT
CP        1.10           COMPACTION FACTOR

**************************************************************
*****  LIMITING VALUES FOR NET AND GROSS PAY CALCULATIONS  ****
**************************************************************

PHILIM    6.00           (PERCENT) LOWER POROSITY LIMIT
VSHLIM    0.40           (FRACTION) VOLUME OF SHALE UPPER LIMIT
SWLIM    50.00           (PERCENT) WATER SATURATION LIMIT

**************************************************************
*********    LOG CALCULATION OPTIONS AND SWITCHES    ********
**************************************************************

MSI         0            0=STANDARD UNITS  1=MSI
VSHCIN      3            GR TO VOL. OF SHALE CURVATURE INDEX
VSHOFF      0            0=CALC VOL. OF SHALE - 1=VOL.OF SH=0
GROFF       0            GR AS SHALE INDICATOR (0-USE ,1-NO)
KTHOFF      1            TH & K AS SHALE INDICATOR (0-USE ,1-NO)
NEUOFF      0            NEUTRON AS SHALE INDICATOR (0-USE ,1-NO)
DLTOFF      1            SONIC AS SHALE INDICATOR (0-USE ,1-NO)
ATTOFF      1            EPT AS SHALE INDICATOR (0-USE ,1-NO)
SPOFF       1            SP AS SHALE INDICATOR (0-USE ,1-NO)
PEOFF       0            USE PEF?   (0-USE ,1-NO)
```

| | | |
|---|---|---|
| MINOPT | 3 | MINERAL OPTION SWITCH<br>0 = COMPLEX LITHOLOGY<br>1 = SANDSTONE AND DOLOMITEONLY<br>2 = LIMESTONE AND DOLOMITE ONLY<br>3 = SANDSTONE AND SHALE ONLY (CLASSICAL)<br>4 = SANDSTONE AND SHALE ONLY (MODERN)<br>5 = SANDSTONE AND LIMESTONE ONLY |
| MOPOFF | 0 | MOVEABLE OIL PLOT SWITCH 0-USE RXO<br>1-NO RXO |
| QOPT | 1 | SW OPTION - 0=SW FROM PHIT AND Q<br>1=SW FROM PHIE AND VSH |
| NOPRT | 0 | PRINT OPTION - 0=PRINT ALL VALUES<br>1=SKIP SHALE ZONES |
| SWOPT | 5 | 1 - ARCHIE; 2 - SIMANDOUX; 3 - SIMANDOUX LAMINAR; 4 - V2 SIMANDOUX; 5 - INDONESIAN<br>6 - DISPERSED CLAY 7 - DUAL WATER MODEL<br>8 - DUAL WATER Q=VSH MODEL<br>9 - NORMALIZED WAXMAN-SMITS<br>10 - WAXMAN-SMITS |
| SWIRR | 10.00 | (FRACTION)IRREDUCIBLE WATER SATURATION FOR PERMEABILITY EQUATION |

# APPENDIX 8

APPENDIX 8

WELL COMPLETION REPORT

MUDSKIPPER-1

INTERPRETATIVE DATA

APPENDIX 8

COMPOSITE LOG

PE600920

This is an enclosure indicator page.
The enclosure PE600920 is enclosed within the container PE902074 at this location in this document.

The enclosure PE600920 has the following characteristics:

```
     ITEM_BARCODE = PE600920
CONTAINER_BARCODE = PE902074
             NAME = Composite Well Log
            BASIN = GIPPSLAND
           PERMIT =
             TYPE = WELL
          SUBTYPE = COMPOSITE_LOG
      DESCRIPTION = Composite Well Log
          REMARKS =
     DATE_CREATED = 20/06/90
    DATE_RECEIVED = 11/12/90
             W_NO = W1032
        WELL_NAME = Mudskipper-1
       CONTRACTOR = Petrofina Exploration
     CLIENT_OP_CO = Petrofina Exploration
```

(Inserted by DNRE - Vic Govt Mines Dept)

PE600921

This is an enclosure indicator page.
The enclosure PE600921 is enclosed within the container PE902074 at this location in this document.

The enclosure PE600921 has the following characteristics:

| | |
|---|---|
| ITEM_BARCODE = | PE600921 |
| CONTAINER_BARCODE = | PE902074 |
| NAME = | Shaly Sand Interpretation |
| BASIN = | GIPPSLAND |
| PERMIT = | |
| TYPE = | WELL |
| SUBTYPE = | WELL_LOG |
| DESCRIPTION = | Shaly Sand Interpretation |
| REMARKS = | |
| DATE_CREATED = | 26/07/90 |
| DATE_RECEIVED = | 11/12/90 |
| W_NO = | W1032 |
| WELL_NAME = | Mudskipper-1 |
| CONTRACTOR = | Petrofina Exploration |
| CLIENT_OP_CO = | Petrofina Exploration |

(Inserted by DNRE - Vic Govt Mines Dept)

# ENCLOSURES

ENCLOSURES

PE600922

This is an enclosure indicator page.
The enclosure PE600922 is enclosed within the container PE902074 at this location in this document.

The enclosure PE600922 has the following characteristics:

ITEM_BARCODE = PE600922
CONTAINER_BARCODE = PE902074
NAME = Environmentally Corrected Logs RWA Log
BASIN = GIPPSLAND
PERMIT =
TYPE = WELL
SUBTYPE = WELL_LOG
DESCRIPTION = Environmentally Corrected Logs RWA Log
REMARKS =
DATE_CREATED = 26/07/90
DATE_RECEIVED = 11/12/90
W_NO = W1032
WELL_NAME = Mudskipper-1
CONTRACTOR = Petrofina Exploration
CLIENT_OP_CO = Petrofina Exploration

(Inserted by DNRE - Vic Govt Mines Dept)

PE601573

This is an enclosure indicator page.
The enclosure PE601573 is enclosed within the container PE902074 at this location in this document.

The enclosure PE601573 has the following characteristics:

| | |
|---|---|
| ITEM_BARCODE = | PE601573 |
| CONTAINER_BARCODE = | PE902074 |
| NAME = | Master log Mudskipper 1 |
| BASIN = | GIPPSLAND |
| PERMIT = | VIC/P20 |
| TYPE = | WELL |
| SUBTYPE = | MUD_LOG |
| DESCRIPTION = | Masterlog Geological Evaluation Mudskipper 1 |
| REMARKS = | |
| DATE_CREATED = | 20/06/90 |
| DATE_RECEIVED = | 3/07/90 |
| W_NO = | W1032 |
| WELL_NAME = | Mudskipper-1 |
| CONTRACTOR = | Geoservices |
| CLIENT_OP_CO = | Petrofina Exploration Australia S.A |

(Inserted by DNRE - Vic Govt Mines Dept)