W932

BEACH PETROLEUM N.L.

(Incorporated in South Australia)

WCR vol. 1

Princes-1
(W932)

PRINCES-1 W.C.R.

TEXT

BEACH PETROLEUM N.L.

PRINCES NO. 1 - PEP 108

WELL COMPLETION REPORT

BY:

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AUGUST 1986

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SUMMARY

Princes No. 1 was drilled as a wildcat exploration well in PEP 108, central Otway Basin, Victoria, approximately 1.5 km SE of the township of Timboon.

The prospect was a seismically defined horst block. Principle target horizons were the Pebble Point Formation sandstone and the Waarre Formation sandstone. Secondary targets were the intra-Paaratte Formation sands, particularly the Nullawarre Greensand Member.

Participants in the well were Beach Petroleum N.L. (Operator) and Bridge Oil Limited (subject to farmin obligations).

Drilling commenced on the 29th March 1986 and reached a TD of 1150m (KB) on the 3rd April 1986.

The primary objectives proved to have poor to fair porosity and were water saturated. The secondary objectives appeared to have fair to good porosity but were also water saturated.

A trace of fluorescence, associated with dead oil, was observed at 1006m, within the Flaxmans/Waarre Formation.

Prior to abandonment, one wireline logging run comprising the DLL/MSFL, LDL/CNL, SLS, WSS and CST was completed.

Princes No. 1 was plugged and abandoned as a dry hole on the 6th April 1986.

1. INTRODUCTION

The Princes No. 1 prospect was identified by interpretation of the Timboon Extension Seismic Survey.

The structure was seismically defined as an assymetric horst block, 7 km north of the North Paaratte gas wells. Geologically the prospect is sited on the Rowans Platform, the northwestern extension of the Port Campbell Embayment. In this area the Timboon Fault, a major down-to-basin normal fault, splinters into two prominent faults separated by a fault-dissected platform. The Princes prospect is centrally located on this platform. Hydrocarbons are thought to have been sourced in the Eumeralla Formation and migrated vertically via prominent down-to-basin faults eg. the Timboon Fault.

The nature of reservoir and seal rocks was based largely on Timboon No. 5, drilled 1.1 km to the north-west by the Victorian Government, and on North Paaratte No. 1, drilled 7.3 km to the south-west by Beach Petroleum N.L. Reference was also made to regional isopach maps.

The well was designed to test the hydrocarbon prospectivity of the basal Tertiary Pebble Point Formation and the basal Upper Cretaceous Waarre Formation. Secondary targets were the porous horizons towards the base of the Tertiary Dilwyn Formation, and the Upper Cretaceous Nullawarre Greensand Member of the Paaratte Formation.

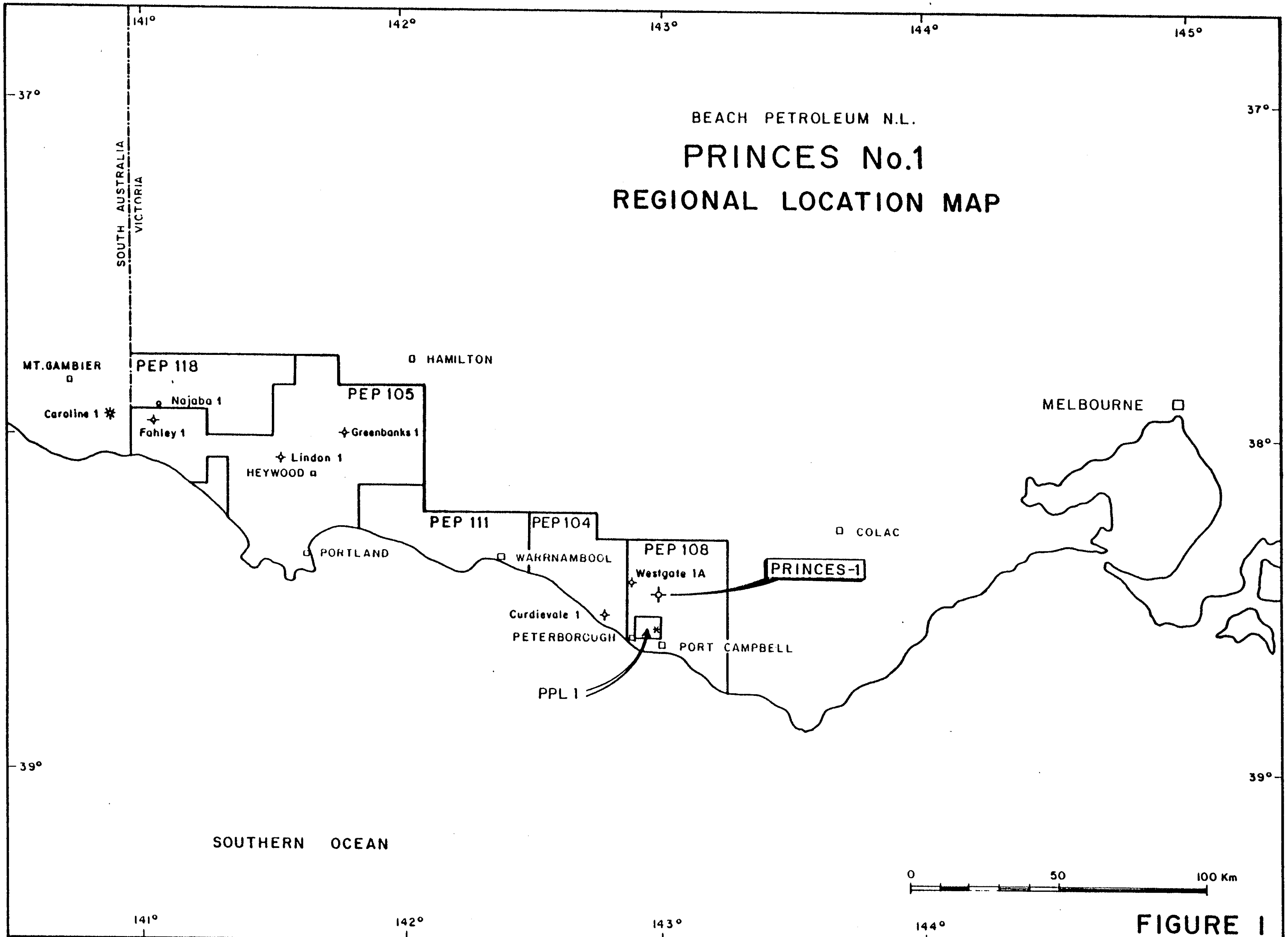
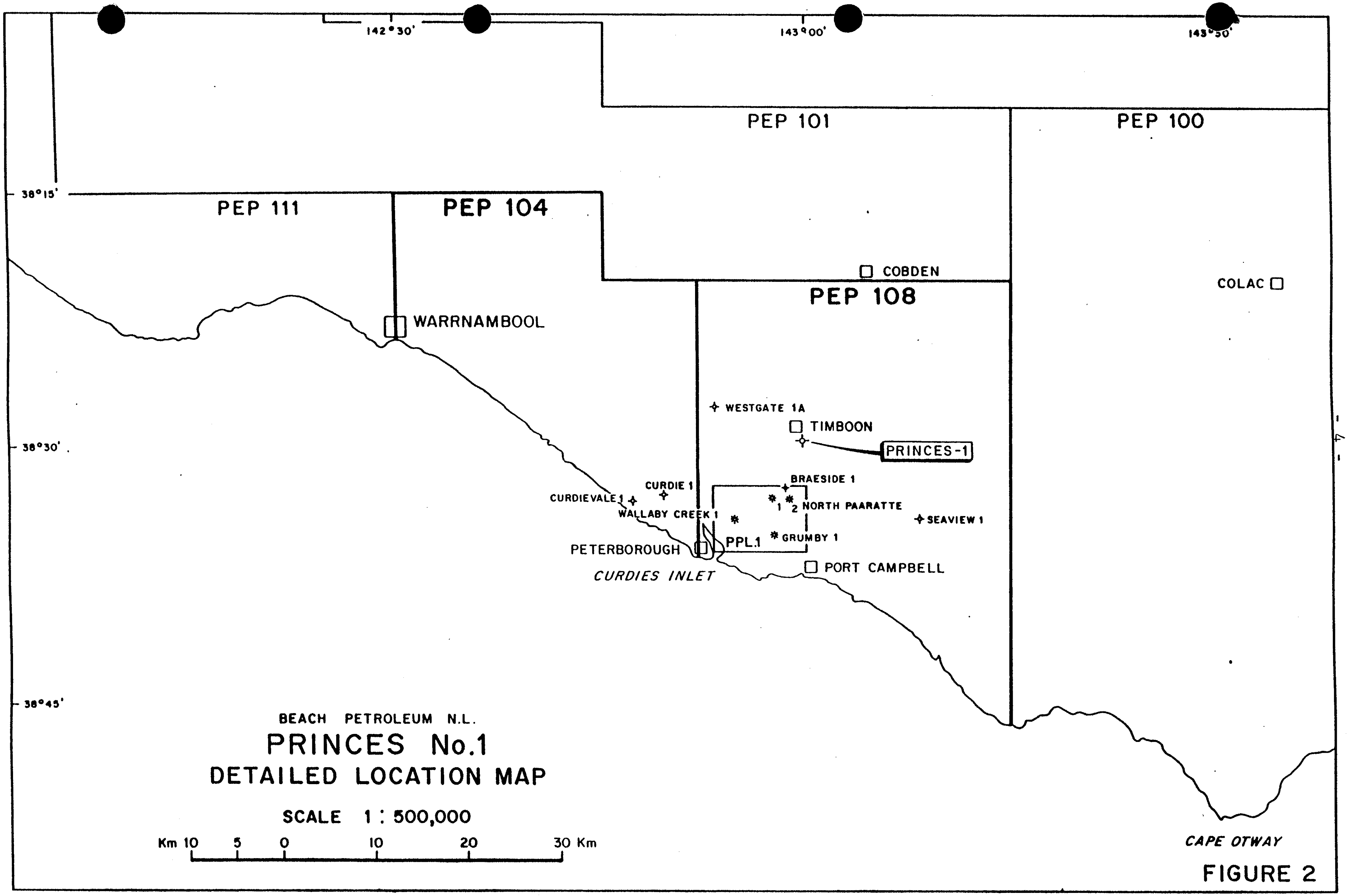


FIGURE I

OT. 3531



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PRINCES No.1

DETAILED LOCATION MAP

FIGURE 2

OT. 3532

2. WELL HISTORY

2.1 Location (see Figure 1)

Co-ordinates:	Latitude 38° 29' 32" S Longitude 142° 59' 20" E
Geophysical Control:	Line TM12 Shotpoint 82m NNW 905 Beach Petroleum N.L. TME85 Seismic Survey
Real Property Description:	Parish of Timboon Shire of Heytesbury County of Heytesbury
Property Owner:	J.F. Deppeler

2.2 General Data (see Figure 2)

Well Name and Number:	Princes No. 1
Tenement:	PEP 108
Operator:	Beach Petroleum N.L., 685 Burke Road, CAMBERWELL, VIC., 3124.
Participants:	Beach Petroleum N.L. Bridge Oil Limited, Level 33, CBA Centre, 60 Margaret Street, SYDNEY, N.S.W., 2000.

Elevation:	Ground Level 109.5m Kelly Bushing 115.5m (Unless otherwise stated, all depths refer to KB.)
Total Depth:	Driller 1150m Logger 1152m
Date Drilling Commenced:	29th March 1986 @ 12.00
Reached Total Depth:	3rd April 1986 @ 07.30
Date Rig Released:	6th April 1986 @ 12.00
Drilling Time to Total Depth:	5 days
Status:	Plugged and abandoned.

2.3 Drilling Data (see also Appendix 1 and 2)

2.3.1 Drilling Contractor

Richter Drilling Pty. Ltd.,
14 Cribb Street,
MILTON, QLD., 4064.

2.3.2 Drilling Rig

Richter Rig No. 8, National 80B

2.3.3 Casing and Cementing Details

Conductor

A 13-3/8" conductor pipe was set at 10.36m KB.

Surface Casing

Size:	9-5/8"
Weight:	36 lb/ft and 40 lb/ft
Grade:	J55 and N80
Connection:	BTC
Centralizers:	At 30.2m, 254.2m, 266.1m, 285m
Float Collar:	278.4m
Shoe:	291.0m
Cement:	Preflush: 20bbl of water. Lead: 258.8 sacks of Class "A" with 51.7 bbl of water and 2% Gel prehydrated in mix water - 13.7 ppg. Tail: 161 sacks of Class "A" cement with 1.45% CaCl2 mixed in water.
Cemented to:	Surface
Method:	Water displacement
Equipment:	Twin mounted HT400 skid mounted Halliburton Unit.

Cement Plugs

- Plug No. 1

Interval:	1050m - 975m
Cement:	82.2 sacks Class "A" cement.
Tested:	No

- Plug No. 2

Interval:	675m - 615m
Cement:	65.8 sacks Class "A" cement.
Tested:	No

- Plug No. 3

Interval:	325m - 260m
Cement:	74 sacks Class "A" cement.
Tested:	Yes

2.3.4 Drilling Fluid (see Appendix 3 for details)

- 12¼" Hole (10.36m - 291m)

The well was spudded using water, the viscosity was built up from native solids.

- 8½" Hole (291m - 1150m)

The 8½" hole was drilled using a KCl-polymer mud system. Throughout drilling mud properties were kept fairly constant, (although initial viscosities were low and water loss was high). Mud parameters ranged between:

Weight:	8.7 - 8.9 ppg from 291m to TD
Viscosity:	50 - 55 sec/qt from 591m to TD
Filtrate:	7.8 - 9.0 ml from 591m to TD
KCl:	4.0 - 5.1% from 291m to TD

No tight hole was recorded during bit trips.

2.3.5 Water Supply

Fresh water was transported to the wellsite by a water carrier.

2.4 Formation Sampling and Testing

2.4.1 Cuttings

Cuttings samples were collected at 10m intervals from 10m to 290m, and at 5m intervals from 290m to 1150m. Each sample was washed, oven dried, divided into four splits and stored in labelled polythene bags. Three complete sample sets were distributed as follows:

- one set to Beach Petroleum N.L.,
- one set to Bridge Oil Ltd.,
- one set to the Victorian Government.

One spare set was retained by Beach Petroleum N.L.

In addition, every 10m from surface to TD an unwashed cuttings sample was collected, stored in a labelled calico bag and allowed to air dry. This set of samples has been retained by Beach Petroleum for possible further analysis.

2.4.2 Cores

(i) No conventional coring operations were performed.

(ii) Thirty sidewall cores were attempted prior to plugging and abandoning the well. Twenty-nine cores were recovered and one lost in the hole. Listed overleaf are the depths and recovery of the sidewall cores. (See Appendix 4 for descriptions.)

SWC No.	Depth (m)	Recovery (mm)
1 V	1132.0	30
2	1120.0	45
3	1093.0	Lost
4 V A	1046.0	50
5 P	1041.5	45
6 V A	1023.0	50
7	1008.0	50
8 P	1006.5	50
9 A	1002.0	40
10 V	995.0	47
11	927.0	52
12	890.0	54
13	861.0	26
14 V	857.0	54
15	810.0	48
16	803.5	34
17 V	772.5	52
18	685.5	57
19	665.0	50
20	657.0	28
21 P	650.5	45
22	646.5	45
23 A	643.0	48
24	635.0	47
25 P	629.0	48
26 A	603.0	50
27	579.0	40
28	560.0	48
29 P	542.0	48
30	525.0	36

Note:

V - Vitrinite Reflectance Data Available (see Appendix 7).

P - Petrological Data Available (see Appendix 8).

A - Age Dating and Thermal Alteration Data Available (see Appendix 6).

2.4.3 Tests

No testing was performed.

2.5 Logging and Surveys (see Enclosure 1)

2.5.1 Mud Logging (see Enclosure 2)

A standard skid-mounted Exlog unit was used to provide penetration rate, continuous mud gas monitoring, intermittent mud and cuttings gas analysis, pump rate and mud volume data. The masterlog is included as Enclosure 2.

2.5.2 Wireline Logging (see Enclosure 3)

Wireline logging was performed by Schlumberger Seaco Inc. using a Cyber Service Unit (CSU). One run was performed and the details are listed below:

Dual Laterolog (DLL/SP/CAL/GR)	291m - 1150m
Micro-spherically focused log (MSFL)	545m - 1150m
Sonic Log (SLS/GR)	291m - 1150m
Litho-density/Compensated Neutron Log (LDL/CNL/GR)	515m - 675m 800m - 1075m
Stratigraphic Dipmeter Tool (SHDT/GR)	291m - 1150m (GR run to surface)

In addition the following CSU products were generated at the wellsite:

Cyberdip	855m-1150m
Cyberlook (Pass I & II)	550m - 675m
	800m - 875m
	975m - 1075m

The SHDT data was further processed at the Schlumberger Log Interpretation Centre, Sydney, to produce a dip meter computation.

Mean Square Dip	291m - 1150m

2.5.3 Deviation Surveys

A Totco double recorder was used to measure hole deviation, the results of which are listed below:

Depth (m)	Deviation (°)
71	3/4
136	1/2
191	1/4
256	0
387	1/4
531	0
684	0
834	1/4
991	1

2.5.4 Velocity Survey (see Enclosure 4)

A velocity survey was performed by Schlumberger Seaco Inc. The results of which are included as Appendix 5.

3. RESULTS OF DRILLING

3.1 Stratigraphy

The following stratigraphic intervals have been delineated using the penetration rate, cuttings analysis and wireline log interpretation. All formations were present as predicted, although most formation tops were higher than prognosed and the Waarre/Flaxmans Formations were not distinguishable as two separate units (see Figure 3 and Figure 4).

Group	Formation	Depth (m) (KB)	Depth (m) (Subsea)	Thickness (m)
Heytesbury	Pt Campbell Limestone	Surface	+ 109.5	49.0
	Gellibrand Marl	49.0	+ 66.5	218.0
	Clifton	267.0	- 151.5	15.0
Nirranda	Narrawaturk Marl	282.0	- 166.5	45.5
	Mepunga	327.5	- 212.0	52.0
Wangerrip	Dilwyn	377.5	- 262.0	170.5
	Pember Mudstone	548.0	- 432.5	54.0
	Pebble Point	602.0	- 486.5	45.0
Sherbrook	Paaratte	647.0	- 531.5	160.0
	Skull Ck Member	807.0	- 691.5	51.5
	Nullawarre Greensand	858.5	- 743.0	135.5
	Belfast Mudstone	994.0	- 878.5	12.5
	Flaxmans/Waarre	1006.5	- 891.0	38.5
Otway	Eumeralla	1045.0	- 929.5	+105.0
	TD	1150.0	-1034.5	

PRINCES No.1

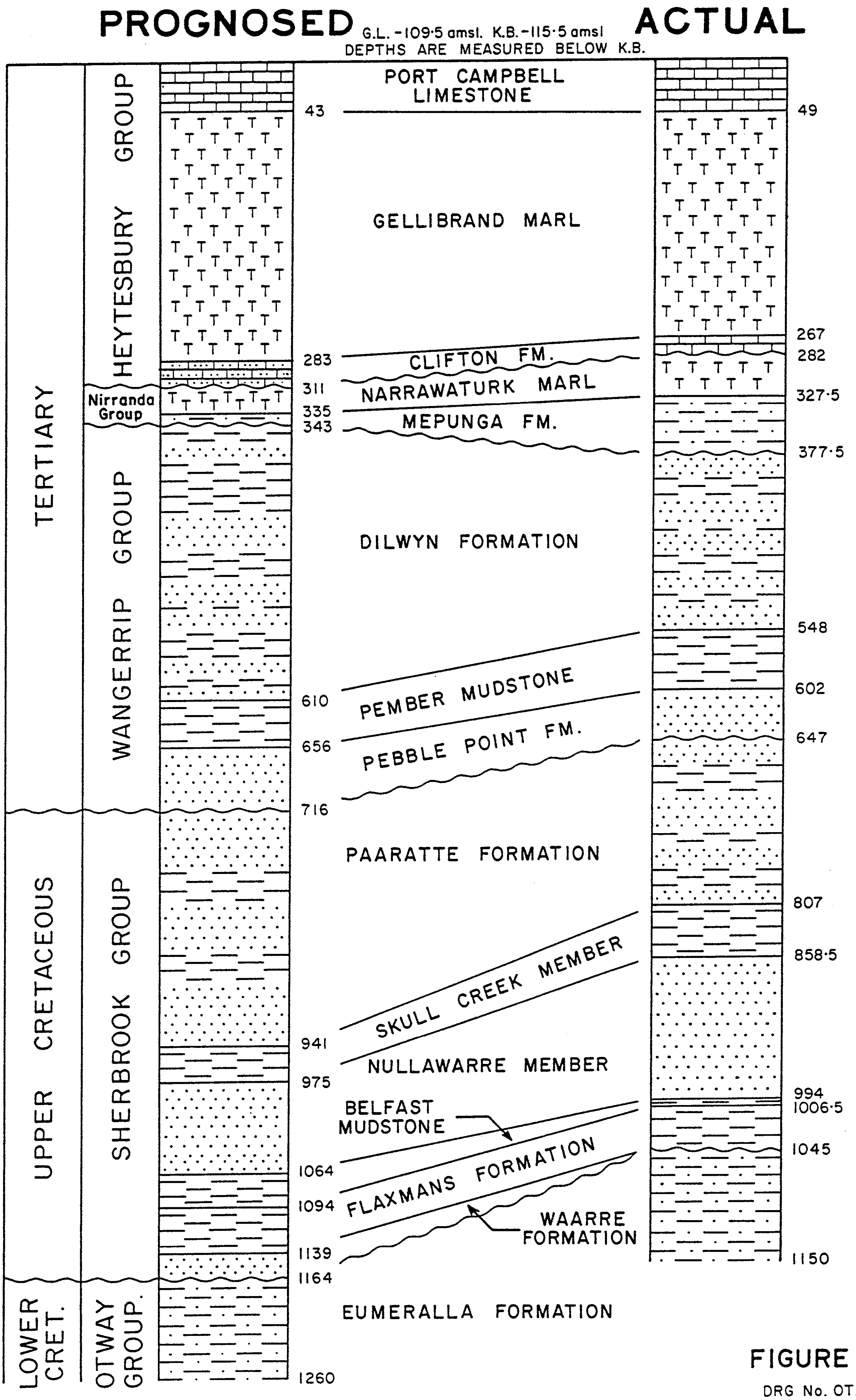

FIGURE 3

DRG No. OT.3453

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OTWAY BASIN STRATIGRAPHIC TABLE

GENERAL TIME SCALE: Period	GENERAL TIME SCALE: Age	GROUP	FORMATION	MEMBER	GENERAL LITHOLOGY	OIL/GAS
Q.		POST-HEYTESBURY	NEWER VOLCANIC WHALERS BLUFF FM., ETC.		NEWER VOLCANIC	
TERTIARY	Pliocene	POST-HEYTESBURY	NEWER VOLCANIC WHALERS BLUFF FM., ETC.			
TERTIARY	Miocene	HEYTESBURY	PORT CAMPBELL			
TERTIARY	Oligocene	HEYTESBURY	GELLIBRAND			
TERTIARY	Oligocene	HEYTESBURY	CLIFTON		Fe	
TERTIARY	Eocene	NIRRANDA	NARRAWATURK			
TERTIARY	Eocene	NIRRANDA	MEPUNGA		Fe Fe Fe	
TERTIARY	Eocene	WANGERRIP	DILWYN	Burrungule	OLDER VOLCANIC	
TERTIARY	Palaeocene	WANGERRIP	DILWYN	Pember	? ?	
TERTIARY	Palaeocene	WANGERRIP	? PEBBLE POINT	?	Fe Fe Fe	LINDON-1
CRETACEOUS UPPER	Maastrichtian	SHERBROOK	PAARATTE	Timboon Sand		
CRETACEOUS UPPER	Campanian	SHERBROOK	PAARATTE	Undifferentiated part		
CRETACEOUS UPPER	Santonian	SHERBROOK	PAARATTE	Skull Creek Mudstone and Nullawarre Greensand		
CRETACEOUS UPPER	Coniacian	SHERBROOK	PAARATTE	Belfast		
CRETACEOUS UPPER	Turonian	SHERBROOK	FLAXMAN		L Fe Fe	North Paaratte Wallaby Creek Grumby
CRETACEOUS UPPER	Cenomanian	SHERBROOK	WAARRE		Fe Fe	
CRETACEOUS LOWER	Albian	OTWAY	EUMERALLA	Heathfield		Port Campbell No.4
CRETACEOUS LOWER	Aptian	OTWAY	EUMERALLA ?	?		
CRETACEOUS LOWER	Neocamian	OTWAY	CRAYFISH	Geltwood Beach / Pretty Hill	?	
JURASSIC	Late	? —	? CASTERTON	?	BASAL VOLCANIC	
JURASSIC	Middle	—	CASTERTON		BASAL VOLCANIC	
PALAEOZOIC		BASEMENT				

BASE MAP OT.2088. OT.3188

FIGURE 4

3.2 Lithological Descriptions

3.2.1 HEYTESBURY GROUP (surface to 282m)

Port Campbell Formation	Surface to 49m CALCARENITE, light brown to off white, occasionally orange, becoming light to medium grey with depth, friable to hard, dominantly moderate hard, fine to occasionally medium grained, common argillaceous matrix, abundant bryozoa, trace shell fragments and forams, rare echinoid spines, sponge spicules and gastropods, trace glauconite, trace coarse, clear, subrounded quartz sand grains with occasional iron staining. Interbedded with minor MARL, medium grey to medium olive green, very soft, moderate to very dispersive.
Gellibrand Marl	49m to 267m MARL, medium grey to medium olive grey, soft becoming sticky with depth, moderate to very dispersive, moderate to very calcareous in part, common bryzoa and shell fragments, gastropods, forams and echinoid spines, trace pyrite and glauconite, very occasional iron nodules.

Clifton Formation

267m to 282m

CALCARENITE, off white to medium brown, light yellow brown in part, occasionally green, medium to very coarse grained, friable to medium hard, well cemented, common well rounded interstitial iron oxide pellets, common coarse to very coarse iron oxide stained quartz sand grains, abundant fossil fragments, trace glauconite.

3.2.2 NIRRANDA GROUP (282m to 377.5m)

Narrawaturk Marl

282m to 327m

MARL, medium brown to grey, dominantly medium grey, very soft, very dispersive, abundant fossil fragments including bryzoa, forams, shell fragments, gastropods, trace pyrite, trace glauconite.

Mepunga Formation

327m to 377.5m

SANDSTONE, light brown to light grey brown, loose, very fine to medium grained, dominantly fine grained, subangular to rounded, dominantly subangular, moderate to poor sorting, poor visual porosity, common iron stained quartz grains, decreasing with depth, trace iron oxide pellets, trace medium brown lithics, good to trace medium brown argillaceous matrix, trace glauconite, trace pyrite. Interlaminated and finely interbedded with CLAYSTONE, light to medium brown grey, very dispersive, calcareous in part, grading to MARL, which becomes the dominant lithology at the base, light to medium brown grey, very soft, sticky, occasionally very finely arenaceous, trace glauconite, trace pyrite, trace fossil fragments.

3.2.3 WANGERRIP GROUP (377.5m to 647m)

Dilwyn Formation

377.5m to 548m

From 377.5m to 435m, SANDSTONE, medium to dark brown, loose to occasionally hard, very fine to coarse grained, dominantly medium grained, subrounded, poorly sorted, quartz grains strongly stained by medium to dark brown iron oxide decreasing with depth, abundant medium to dark brown argillaceous matrix, moderately calcareous, trace dark brown iron oxide pellets, trace glauconite, trace fine to medium muscovite flakes, poor to occasionally good visual porosity. Interbedded with and grading into, CLAYSTONE, medium to dark brown, rapidly oxidizing to dark green on contact with air, soft, dispersive, slightly carbonaceous, trace pyrite, trace glauconite, nil to abundant very fine to coarse quartz sand grains.

From 435m to 548m. Interbedded SANDSTONE and CLAYSTONE. SANDSTONE, light brown to light grey, clear in part, loose, very fine to coarse grained, dominantly medium grained, subrounded, poorly sorted, occasional weak iron staining, abundant dark brown clay matrix, common pyrite, trace glauconite, poor visual porosity, interbedded with stringers of SANDSTONE, off white to dark brown, very hard, very fine to medium grained, dominantly fine grained, subrounded, poorly sorted, very strong calcareous cement, no visual porosity. CLAYSTONE, as CLAYSTONE from 377.5m to 435m.

Pember Mudstone Member

548m to 602m
CLAYSTONE, medium grey, becoming medium to dark brown grey with depth, very soft,

sticky, massive, common to abundant glauconite increasing with depth, common pyrite, trace very fine to coarse quartz sand grains, moderately calcareous.

Pebble Point Formation

602m to 643m

CLAYSTONE, dark green, becoming medium grey with depth, very soft to soft, massive, very glauconitic, slightly calcareous, common pyrite decreasing to trace with depth. Abundant SAND and CONGLOMERATIC grains, clear to white, often stained green, very fine to pebble, well rounded.

3.2.4 SHERBROOK GROUP (647m to 1145m)

Paaratte Formation

647m to 807m

From 647m to 700m, SANDSTONE, light grey, loose to friable, very fine grained to pebbly, dominantly very coarse grained, subangular to rounded, very poorly sorted, quartzose, occasional coally detritus increasing with depth, common grey cherty lithics, trace red, brown and green lithics, abundant medium grey silt and clay matrix, trace pyrite, poor visual porosity.

From 700m to 807m, SANDSTONE, light grey to off white, loose, very fine to very coarse grained, dominantly coarse grained, subangular to subrounded, poorly sorted. Up to 5% coally detritus, black, hard, fissil, pyritic, trace grey cherty lithics, abundant medium grey brown argillaceous matrix, trace pyrite, nil to poor visual porosity. Interbedded with and grading into SILTY CLAYSTONE, medium brown grey, soft, moderately dispersive, massive to subfissil, trace micromicaceous, trace very fine quartz sand, very fine coally detritus, common pyrite with CLAYSTONE, light to medium brown grey, occasionally dark grey, soft to moderate soft, very sticky, very dispersive moderately calcareous, common pyrite, occasionally glauconitic.

Skull Creek Member

807m to 858.5m
CLAYSTONE, medium grey to medium brown grey, becoming dark grey with depth, dark greenish grey in part, soft, moderately dispersive, massive to subfissil, trace pyrite,

trace to common coally material, trace glauconite, with trace DOLOMITE, medium brown, very hard, cryptocrystalline, moderately argillaceous.

Nullawarre Greensand Member	858.5m to 994m SANDSTONE, medium green, becoming light green to yellow with depth, friable, very fine to coarse grained, dominantly fine grained, subangular to subround, poor to moderate sorting, quartz grains show light green staining, abundant green clay matrix, poor visual porosity, common yellow to orange quartz grains, trace grey, green and red lithics, common glauconitic pellets, trace pyrite. Sandstone becoming finer with depth with increasing medium to dark green clay matrix.
Belfast Mudstone	994m to 1006.5m SILTY CLAYSTONE, medium to dark grey, soft, massive to subfissil, common carbonaceous flecks, moderately silty, common glauconite, trace pyrite, trace micromicaceous.

Flaxmans/Waarre Formation

1006.5 to 1045m

A distinguishable separation of these two formations cannot be determined at Princes #1. Both formations are therefore grouped together and described as a single unit.

SANDY CLAYSTONE, medium grey to medium grey brown, moderately soft, occasionally friable, slightly carbonaceous, rare coally laminae, trace pyrite, interbedded with occasional SANDSTONE, light grey to off white, very fine to coarse grained, dominantly medium grained, subangular to subrounded, poor sorting, poor to moderate visual porosity.

3.2.5 OTWAY GROUP (1045m to 1150m)

Eumeralla Formation

1045m to 1150m

SANDSTONE, light to medium blue grey to green grey, becoming light grey to off white with depth, very fine to medium grained, dominantly fine grained, loose to friable, subangular to subrounded, poor to moderate sorting, dominantly light green, to grey stained quartz grains, occasionally clear to off white, common multicoloured lithic fragments, abundant light grey argillaceous matrix, trace calcareous cement, trace black carbonaceous detritus, trace pyrite, nil to poor visual porosity interbedded with CLAYSTONE, light to medium green grey, moderately dispersive, silty in part, common micromicaceous, trace pyrite, trace carbonaceous detritus.

3.3 Hydrocarbons

3.3.1 Mud Gas Readings

Background gas readings rose from nil to 100 ppm C1 in the initial part of the well (from 0 - 550m), and remained stable between 50 - 80 ppm C1 to 800m. From 800 - 850m gas readings dropped off to 20 ppm C1 before rising again to 60 ppm C1 through the Belfast Mudstone.

The top of the Flaxmans/Waarre Formation was penetrated at 1006.5m, at which point gas levels rose to a reading level of 110 ppm C1. Gas levels remained high at 110 ppm C1 for the interval 1006.5-1014m and dropped slightly to 90 - 100 ppm C1 over the remaining Flaxmans/Waarre unit. From 1035m to 1150m the gas levels gradually dropped off reaching 40 ppm C1 at TD.

3.3.2 Sample Fluorescence

Fluorescence was recorded in one cuttings sample associated with a drilling break at 1006m, the top Flaxmans/Waarre sand body. A trace of moderate bright, patchy, yellow to orange fluorescence, with a trace of crush cut fluorescence was recorded. This show was apparently associated with dead oil. A sidewall core taken at 1006.5m showed no fluorescence.

Oil staining and odour was not associated with this zone of fluorescence nor any other portion of the well.

There was no appreciable change in gas levels over the zone of fluorescence rising from 50 - 60 ppm C1 in the Belfast Mudstone to 110 ppm C1 in the Flaxmans/Waarre sand body.

PRINCES No. 1

APPROX. 82m NNW FROM SP905

MIGRATED LINE TM12

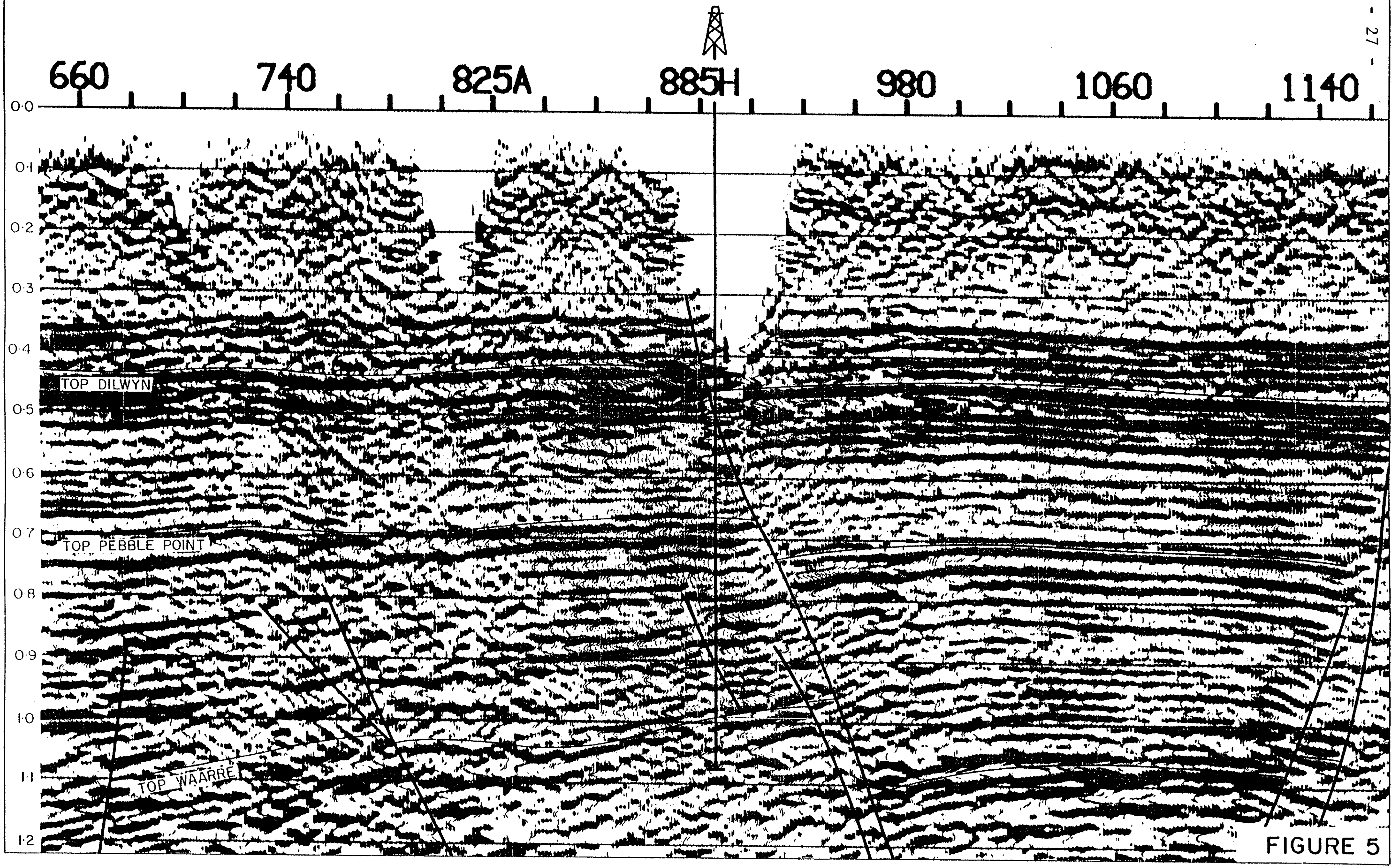


FIGURE 5

OT. 3526

4. GEOLOGY

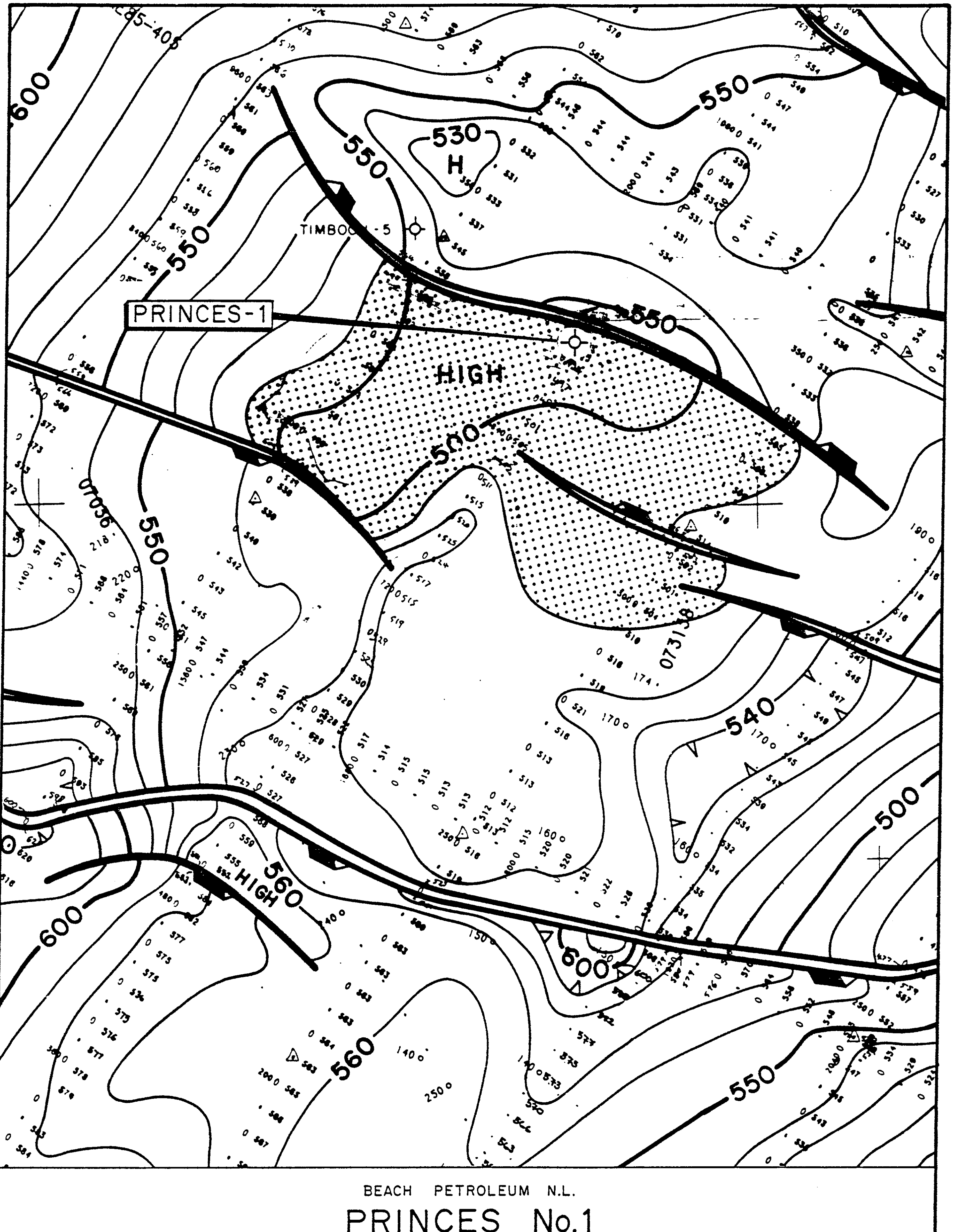
4.1 Princes Structure.

The Princes Structure was delineated after the OB84B Timboon Seismic Survey and subsequently refined after the TME 85 Timboon Extension Seismic Survey.

Within this portion of the Port Cambell Embayment the Timboon Fault, a major down-to-basin normal fault splinters into two prominent faults, these are separated by a fault-dissected platform. Princes #1 was centrally located on this faulted platform.

Princes #1 was designed to test the hydrocarbon prospectivity of both the basal Tertiary Pebble Point Formation and the basal Upper Cretaceous Waarre Formation. The structure is a seismically defined assymetric horst block with the high points of the Pebble Point Formation and Waarre Formation offset by approximately 330m (Figure 5). The area of closure at the Pebble Point level is 2.77Km^2 with 20m of vertical closure (Figure 6). At the Waarre level areal closure is 4.16Km^2 with 108m of vertical closure (Figure 7). Princes #1 was drilled 82m NNW from SP 905, Line TM12 in an attempt to test both prospective levels. (Figure 5).

A comparison between the Schlumberger computer generated synthetic seismogram and the original migrated seismic profile at SP 905, line TM12, indicated a good tie for seismic events at top Dilwyn and top Pebble Point. The top Waarre however, was picked several milliseconds too low, though in this area, the Waarre was difficult to pick accurately due to a poor seismic character.



BEACH PETROLEUM N.L.

PRINCES No.1
NEAR TOP UPPER CRETACEOUS
(PEBBLE POINT)

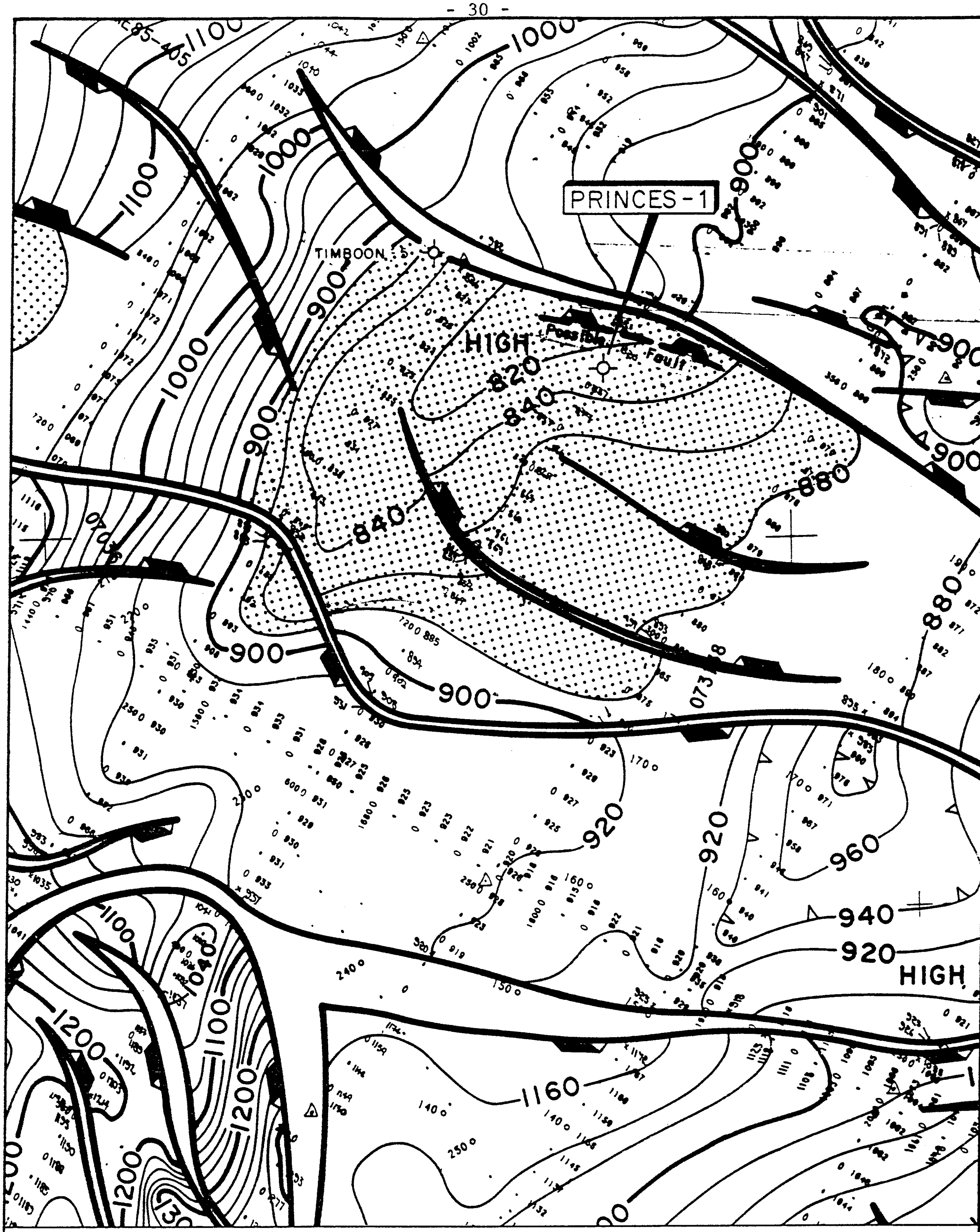
CONTOUR INTERVAL : 10 MILLISECONDS

Scale 1 : 25,000

metres 500 250 0 500 1000 metres

FIGURE 6

OT. 3534



BEACH PETROLEUM N.L.

PRINCES No.1
TOP WAARRE SANDSTONE

CONTOUR INTERVAL : 20 MILLISECONDS

Scale 1 : 25,000

metres 500 250 0 500 1000 metres

FIGURE 7

OT. 3533

The prognosed formation tops were deeper than actual formation tops as velocity data from North Paaratte #1 (7km to the south) was used to determine a time-depth correlation. Had velocity data from Timboon # 5 been incorporated, a closer prognosis may have been possible although at the time the older data was regarded as unreliable.

4.2 Porosity and Water Saturation

A Cyberlook Pass I and II was generated at the wellsite and a wireline log evaluation performed by a Schlumberger log analyst. The attached Cyberlook log (enclosure 3) is based on the dual-water method, resulting in values of R_{WB} (boundwater) and R_{WF} (freewater).

- Pebble Point Formation

  The Pebble Point Formation was primarily an argillaceous unit with common fine to coarse sand quartz grains and conglomeratic pebbles. An apparent clean sandstone unit between 627 - 631m has a maximum porosity of 31%. This sandstone unit appeared to be water saturated with salinities in the range of 800 ppm NaCl equivalent.

- Paaratte Formation (Undifferentiated)

  The Paaratte Formation consists of interbedded sandstone, siltstone and shale. The sandstones within the unit were relatively clean, with less than 10% clay volume and have porosities of 25% to 30%. The formation was water saturated with salinities of 1100 ppm NaCl equivalent.

- Nullawarre Greensand Member

The Nullawarre Greensand Member was dominantly sandstone with very minor clay interbeds. The sands appear to be relatively clean with less than 10% clay volume and porosity values of 25% to 30% The formation was water saturated with salinities of 4000 ppm NaCl equivalent.

- Flaxmans/Waarre Formation

The Flaxmans/Waarre Formation consists of a upper sandstone body from 1006.5m, overlying an argillaceous sandstone/claystone sequence. The upper sandstone appeared to be clean with less than 10% clay volume. Fluorescence was noted in the cuttings sample circulated up at 1006.5m, however no oil saturation could be identified by the wireline logs. Porosity estimates within the upper sand package between 1006.5 to 1011m vary from 30% to 32%, however within the more argillaceous sandstone sequences porosities decrease from 10% to 5%. The upper sand was water saturated with salinity values 12000 ppm NaCl equivalent.

- Eumeralla Formation

The Eumeralla Formation was a sequence of interbedded argillaceous sandstones and shales. The sandstones have a high clay volume of up to 50% and low porosity values with maximum readings of 15%. The formation was water saturated with salinity values of 12000 ppm. NaCl equivalent.

4.3 Maturation and Source Rock Analysis.

Vitrinite reflectance estimates and total organic carbon analyses (TOC) were carried out on six sidewall cores from Princes #1. Four samples were from the Basal Cretaceous sediments (Sherbrook Group) and two from the Top Eumeralla Formation (Otway Group).

Results of the study (see appendix 7 and figure 8) were poor and to a large extent inconclusive with vitrinite macerals absent in two samples. Reference can be made to the palynological studies of Dr. M. Dettman (see appendix 6) for a brief resume of the source rock potential and maturation, however, in both cases conclusive results within the Eumeralla were lacking. The vitrinite reflectance/TOC profile can be divided into two zones:

1. Basal Upper Cretaceous: - Dispersed organic matter (DOM) was common and, with the exception of the Belfast Mudstone, inertinite was common whilst the macerals exinite and vitrinite were sparse. Vitrinite particles were present in reliable numbers to warrant good interpretive results that suggests the basal Upper Cretaceous sediments were immature (less than 0.5% R_V), poor to fair gas source rocks, with moderate TOC values. The Belfast Mudstone, a notable exception within the basal Upper Cretaceous, was characterized by an apparent lack of vitrinite macerals. (It should be noted however, that the palynological studies of Dr. M. Dettman, highly rated the Belfast Mudstone as a potential source rock - see Appendix 6).

PRINCES No.1

VITRINITE REFLECTANCE AND TOTAL ORGANIC CARBON PROFILE

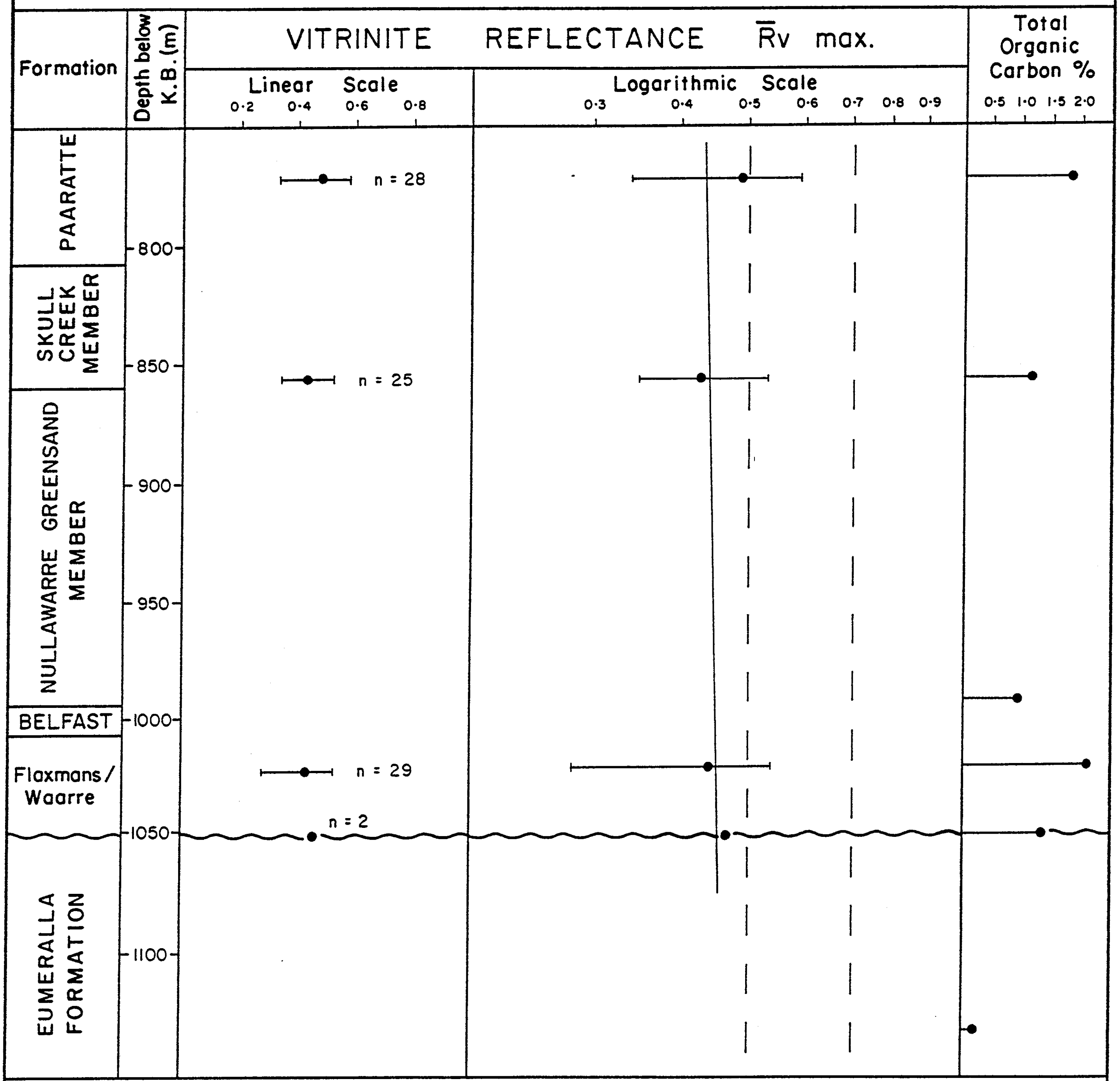


FIGURE 8

DRG No. OT. 3455

2. Top Eumeralla Formation:- Insufficient or poor data quality was characteristic within the Eumeralla Formation. However, one sample at 1132m, confidently representing Eumeralla, was typified by sparse to rare amounts of DOM, a complete absence of vitrinite and low TOC readings. Such qualities in a sediment suggests it possesses little or no potential as a source rock. The questionable presence of green fluoresing oil droplets may hint towards a source potential at greater depths.

In conclusion, the study shows the basal Upper Cretaceous sediments (except the Belfast Mudstone) were immature and gas prone, whilst the source rock quality of the Eumeralla Formation was doubtful due to poor quality data.

4.4 Relevance to Occurrence of Hydrocarbons.

Princes No. 1 was plugged and abandoned as a dry hole. The primary targets the basal Tertiary Pebble Point Formation and the basal Upper Cretaceous Waarre Formation appeared to have good porosity. Although the Pebble Point was a predominantly argillaceous unit, an intra Pebble Point sand body within the formation and the Waarre/Flaxman sands were all shown to be water saturated. Hydrocarbon indications were noted as residual traces within an Upper Waarre/Flaxman sand unit.

Listed below are some considerations pertinent to future hydrocarbon exploration in the area.

1. All potential reservoirs were present with good porosities ranging between 10-25%. Interstial clays were present in variable quantities throughout all the reservoirs commonly coating individual quartz grains, though generally the sands were described

as clean. All sands appeared texturally immature with moderate amounts of detrital feldspars and lithics showing very little alteration.

2. The Flaxman and Waarre Formations were indistinguishable at Princes No. 1 and subsequently grouped together as one unit. The basal sequence appeared very immature with several features showing a strong resemblance toward the characteristic Eumeralla Formation. The immature nature of the sequence and the high percentage of fresh lithoclasts and feldspars may suggest that the basal Waarre/Flaxman Formation is locally reworked Eumeralla suffering from only a very short transportation.

3. High yields of organic matter were recorded in both the Waarre/Flaxman Formation and the Pember Mudstone suggesting a potential to support significant hydrocarbon generation, though in both cases the source rocks were immature. A moderate source potential was also recorded in the Skull Creek Member of the Paaratte Formation.

4. The basal Dilwyn, described as a weakly cemented, quartz-rich detrital sediment, has very good reservoir characteristics. Clay, though present, was seen as a very fine kaolinite coating the quartz grains (see plate 6 - Appendix 8). Pore spaces were abundant with estimated visual porosities of 25%. At basal Dilwyn level however, structural traps with four-way closure would be far better than fault dependent closure as seen at Princes No. 1, as only thin shales were present as potential seals. Indeed, the presence of a thick basal Dilwyn shale bed would greatly enhance the reservoir potential of an underlying sand unit.

5. The Pebble Point Formation, though predominantly argillaceous, was characterized by an intra Pebble Point sand, described as a quartz-rich, detrital sediment, with an abundant clay coating on the quartz grains and an estimated visual porosity of 20%. The lateral extent of the sand unit however may be limited, severly reducing the reservoir potential of the sandstone.

   The Pebble Point Formation was further characterized by a dominance of chlorite, whilst in all other reservoir sand bodies kaolinite was identified as the dominant clay mineral.

6. Initial differentiation between the Pember Mudstone and the argillaceous Pebble Point was difficult, though a subtle change in clay colouration from the medium grey or medium to dark brown of the Pember Mudstone to the dark green of the Pebble Point was observed in the cuttings. Wire line log responses in both formations showed similar very high gamma-ray peaks, though the top Pebble Point was characterized by typical sonic and resistivity responses (see enclosure 1).

7. Dip-meter interpretation to establish the presence of two recognised basin-wide unconformities at top Eumeralla (Lower/Upper Cretaceous) and top Paaratte (Upper Cretaceous/Tertiary) was difficult. The Upper Cretaceous/Tertiary unconformity, or more correctly -disconformity (with no apparent angularity present), was marked by a zone of low confidence "tadpoles" representing weathering at the hiatus. Age dating above and below the break confirmed the presence of Tertiary Palaeocene sediments above, and Upper Cretaceous, Campanian - Maastrichtian sediments below.

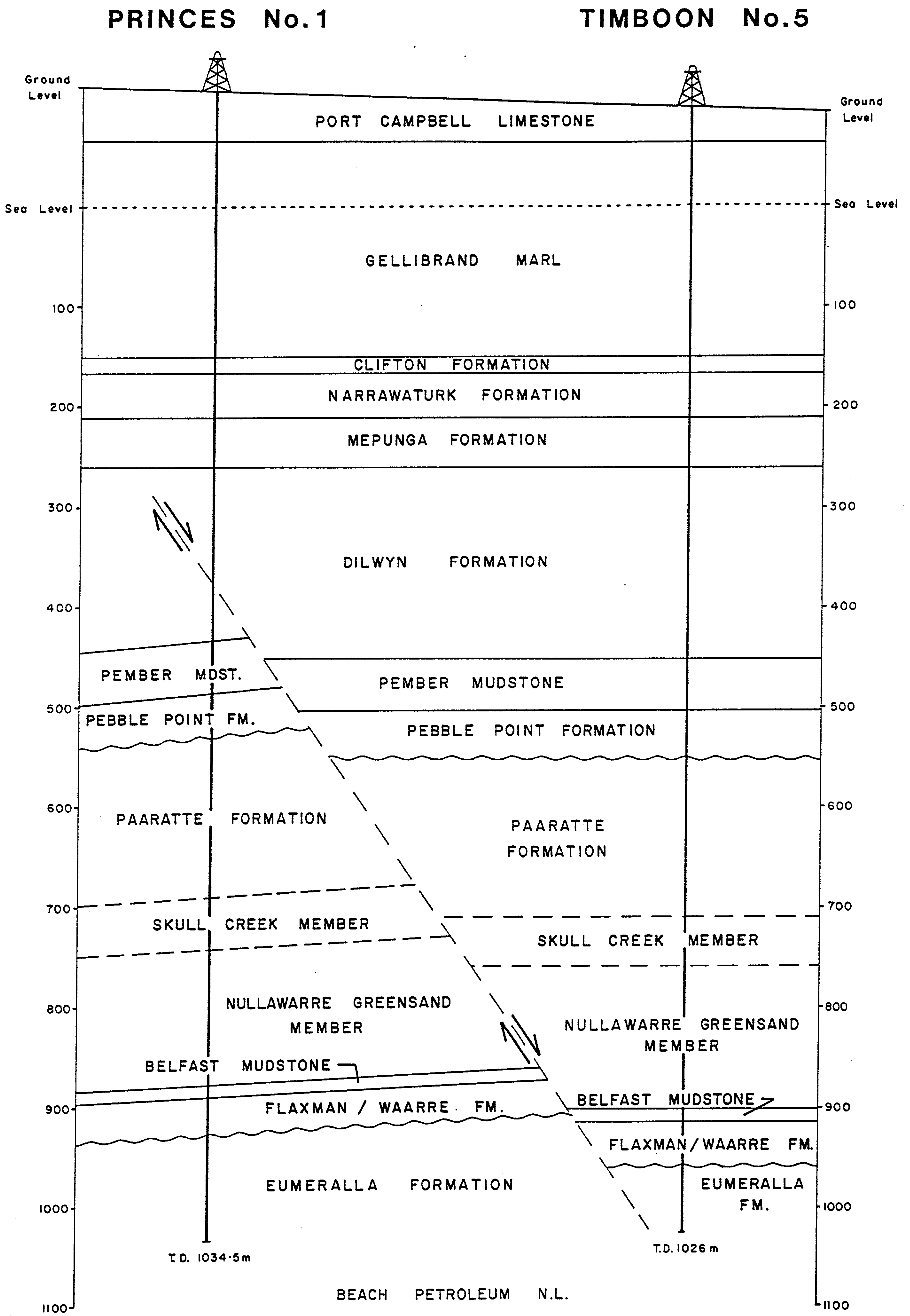
The Lower Cretaceous/Upper Cretaceous unconformity appeared to exhibit some angularity with Upper Cretaceous sediments dipping towards the south whilst Lower Cretaceous sediments dip towards the north west. (see Enclosure 3).

8. Hydrocarbon trapping was dependent upon fault closure and the thin Belfast Mudstone (up to 13m) does not form an effective seal for the Waarre/Flaxman Formation (see figure 9). Although a trace fluoresence was detected within an upper Waarre/Flaxman sand body, analysis indicated a presence of "dead" residual oil. A lack of hydrocarbon shows within the Upper Paaratte (Timboon) Sands was again due to an inadequate Fault closure leaving the Upper Paaratte laterally open to the porous intra Pebble Point sand body. Fault closure at Princes was dependent upon a thick monotonous shale bed, this was not present.

9. An apparent lack of near-by mature source rocks and the necessary long migratory pathways could hinder hydrocarbon accummulation. Intense faulting within the region may inhibit long distance lateral hydrocarbon migration with potential traps toward the basin margin remaining dry.

10. A check shot velocity survey confirmed that top Dilwyn and top Pebble Point seismic horizons were correct and therefore reliable "picks". The Waarre-Flaxman Formation however, with a poor seismic character, was picked low, and whilst this had no immediate effect on the outcome of the drilling, the poor quality of the Waarre/Flaxman should be recognised throughout the area.

In summary, whilst good reservoir bodies were present at Princes, the lack of hydrocarbons may be attributed to poorly developed seals, a reliance upon fault closure, and the possible dependence upon relatively long migratory pathways.



SCHEMATIC RELATIONSHIP BETWEEN PRINCES No.1 AND TIMBOON No.5

FIGURE 9

OT 3523

TABLE 1

COMPARISON OF FORMATION TOPS - (See Fig. 9).

PRINCES #1 AND TIMBOON #5

	PRINCES #1			TIMBOON #5			
FORMATIONS	K.B.	S.S.	Thickness	K.B.	S.S.	Thickness	AFT
Port Campbell Limestone	Surface	-	-	Surface	-	-	
Gellibrand Marl.	49	+ 66.5	218	32	+ 66	217	0.5
Clifton Formation	267	-151.5	15	250	-151	15	0.5
Narrawaturk Formation	282	-166.5	45.5	265	-166	44	0.5
Mepunga Formation	327.5	-212	52	309	-210	52.5	2
Dilwyn Formation	377.5	-262	170.5	361	-262	189	0
Pember Mudstone	548	-432.5	54	550	-451	52	18.5
Pebble Point Formation	602	-486.5	45	602	-503	47	16.5
Paaratte Formation	647	-531.5	160	649	-550	161	18.5
Skull Creek Member	807	-691.5	51.5	810	-711	49	19.5
Nullawarre Greensand	858.5	-743	135.5	859	-760	142	17
Belfast Mudstone	994	878.5	12.5	1001	-902	13	23.5
Flaxman/ Waarre Frm.	1006.5	-891	38.5	1014	-915	-	24
Eumeralla Formation	1045	-929.5	+105	-	-	-	-

K.B. = Depth below Kelly Bushing
S.S. = Depth Sub-Sea
AFT = Apparent Fault Throw

APPENDIX 1

DETAILS OF THE DRILLING PLANT

RICHTER DRILLING PTY. LTD.

NATIONAL 808 - RIG NO. 8

DRAWWORKS	National 808, 1-1/4" Drill Line. National type B1 Catheads, Parmac Hydromatic brake, driven off compound.
POWER	3 each Superior PTDS6, each rated at 600 HP at 900 RPM.
COMPOUND	National B24, 3 Section.
MUD PUMPS	2 each National 9-P-100 Triplex 1000 HP 6-3/4" X 9-1/4" equipped with 6-1/4" liners and pistons with hydril K20-5000 pulsation dampeners. Both with independent drive - CAT D399TA industrial engines.
MAST	Lee C. Moore, 142 ft. 860000 lbs. capacity. 1 x 60" - 5 x 48" sheaves in crown.
SUBSTRUCTURE	Main substructure 10' 6" high, plus pony substructure 11 ft. high for total height of 20'6". Motor substructure, total height 12' high composed of three subs, 5' plus 4'9".
MATTING	1 set sectionilized hardwood matting.
ROTARY TABLE	National C275, 27-1/2"
HOOK BLOCK	National Type G, 350 ton.
SWIVEL	Ideal RB3
KELLY DRIVE	Baash Ross, Type 2 RCH 6.
MUD AGITATORS	2 "Lightnin" Mixers. 2 Brandt MA 7.5

MUD TANKS	Shaker 37' x 8' x 4'6" Intermediate tank 34' x 8' x 5' Suction tank 37' x 8' x 5' 750 BBL capacity
SHALE SHAKER	Brandt Dual Tandem
DEGASSER	Drilco Standard Pit
DESANDER	Demco 4 cone, with BJ 5" x 6" pump
DESILTER	Pioneer-12 x 4" Cones, with pump
GENERATING PLANT	2 Cat D3408 Generator sets
CHOKE MANIFOLD	3" x 5000 psi wt 2" H2 chokes
BOP'S & ACCUMULATOR	. Annular, Stamco 13-5/8" 5000 psi . 2 - Cameron 13-5/8 x 5000 psi U Type . Accumulator, koomey 35120-35, 12 bottles . Hydril 10000 psi Upper Kelly Cock . Gray inside BOP, 4-1/2" XH . Hydril Lower Kelly Cock
DRILLING RECORDER	. Martin Decker 6 pen . Pit Volume/Automatic Driller/Flo Sho/Stroke Counter/Rotary RPM/Rotary Torque
RIG LIGHTING	Hutchinson system of 48" double tube fixtures
COMPRESSORS	. 1 x Atlas Copco BT4 (on compound) . Sullair Rotary Compressor (elec driven)
WELDING AND CUTTING	. Lincoln model 400AS electric welding machine . Oxy and acetylene cutting equipment
MUD LAB	Baroid model 821
DEVIATION SURVEY	Totco unit No. 6, 8° double recorder
KELLY	5-1/4" Hex, 4-1/2" IF Pin, 40 ft long, 37 ft working space.

DRILL PIPE	10000 ft 4-1/2" OD, 20 lb/ft, Grade E, Range 2 15 joints heavy wate drill pipe 42 lb/ft
PUP JOINTS	1 x 5' - 1 x 10' - 1 x 20' Gr "G" 4-1/2" OD
DRILL COLLARS	12 x 8" OD, 6-5/8" API Reg 24 x 6-1/4" OD, 4-1/2" XH
HANDLING TOOLS	. Power tongs, Farr 13-3/8 Jaws for 7", 9-5/8" and 13-3/8" . Varco SSW10 Spinning Wrench
TONGS	BJ type B with lug jaws, 3-1/2" to 13-3/8" BJ type SDD with jaws for 8-1/2" to 12" BJ/Wilson for 20" casing
ELEVATORS	BJ type BB 275 ton for 4-1/2 DP Elevators and single joint elevators for: 5-1/2" casing 7" casing 9-5/8" casing 13-3/8" casing 20" casing Varco type HS spider for 20" casing
SLIPS	. Varco SDML slips for 3-1/2" & 4-1/2" Drill Pipe . Drill collar slips, DCS-R . Casing slips, CMXL
FISHING TOOLS	Bowen model 150 overshots . 11-3/4" OD, FS . 9-5/8" OD, FS . 8-1/8" OD, FS Bowen type Z hydraulic jars, 6-1/4" OD Bowen reverse circ junk basket, 8-1/8" OD 1 Junk Sub for 8-1/2" hole 1 Junk Sub for 12-1/4" hole 1 Bowen magnet 7" OD #32300
GENERATOR HOUSE	40' x 10' x 9'

MECHANICS WORKSHOP	36' x 8'6" x 9'
FUEL TANK	6000 gallons, skid mounted
WATER TANK	400 barrel
WATER PUMP	Southern Cross 2 x 1-1/2" powered by Petters diesel
JUNK BOX	21' x 7' x 6'4"
TOOL HOUSE	27' x 9' x 9'
DOGHOUSE	26' x 9' x 9'
TRANSPORT	1 Oilfield rig truck 1 Toyota Landcruiser Utility 4WD 1 Toyota Landcruiser Wagon - 4WD (11 seater) 1 Clark 504 Forklift
CAMP	3 - 40' x 10' 10 man air-conditioned accommodation units 1 - 40' x 10' kitchen unit with freezer and cold unit 1 - 40' x 10' diner unit 1 - 40' x 10' ablution unit 1 - 40' x 10' canteen unit All skid mounted

APPENDIX 2

SUMMARY OF DRILLING OPERATIONS

SUMMARY OF DRILLING OPERATIONS

The Princes #1 drilling site was prepared by the earthmoving contractor, Gordon Rudolph of Curdievale Road, Timboon.

Prior to the rig arriving a 13-3/8" (OD) conductor pipe was installed to a depth of 10.36m (KB).

Richter Rig No. 8 was rigged up and Princes #1 spudded at 12.00 hours on the 29th March 1986.

A 12¼" hole was drilled to 295m. The hole was circulated clean and conditioned before 9-5/8" casing was run in and cemented.

The BOPs were installed and succesfully function tested to 1000 psi.

Drilling resumed with an 8½" hole to 298m, a leak-off test was performed and established a formation integrity of 14.1 ppg. The 8½" hole was continued to a TD of 1150m with one bit change at 730m. TD was reached at 0700 hours on the 3rd April 1986.

The following wireline logs were run prior to abandonment, DLL/MSFL/SP/GR/CAL, LDL/CNL/GR, SLS/GR, SHDT/GR, WSS and CST.

Cement plugs were then set over the intervals, 1050m to 975m, 675m to 615m and 325m to 260m, after which a wellhead cap was installed.

The rig was released at 12.00 hours on the 6th April 1986.

PRINCES No.1

ACTUAL PENETRATION PROFILE

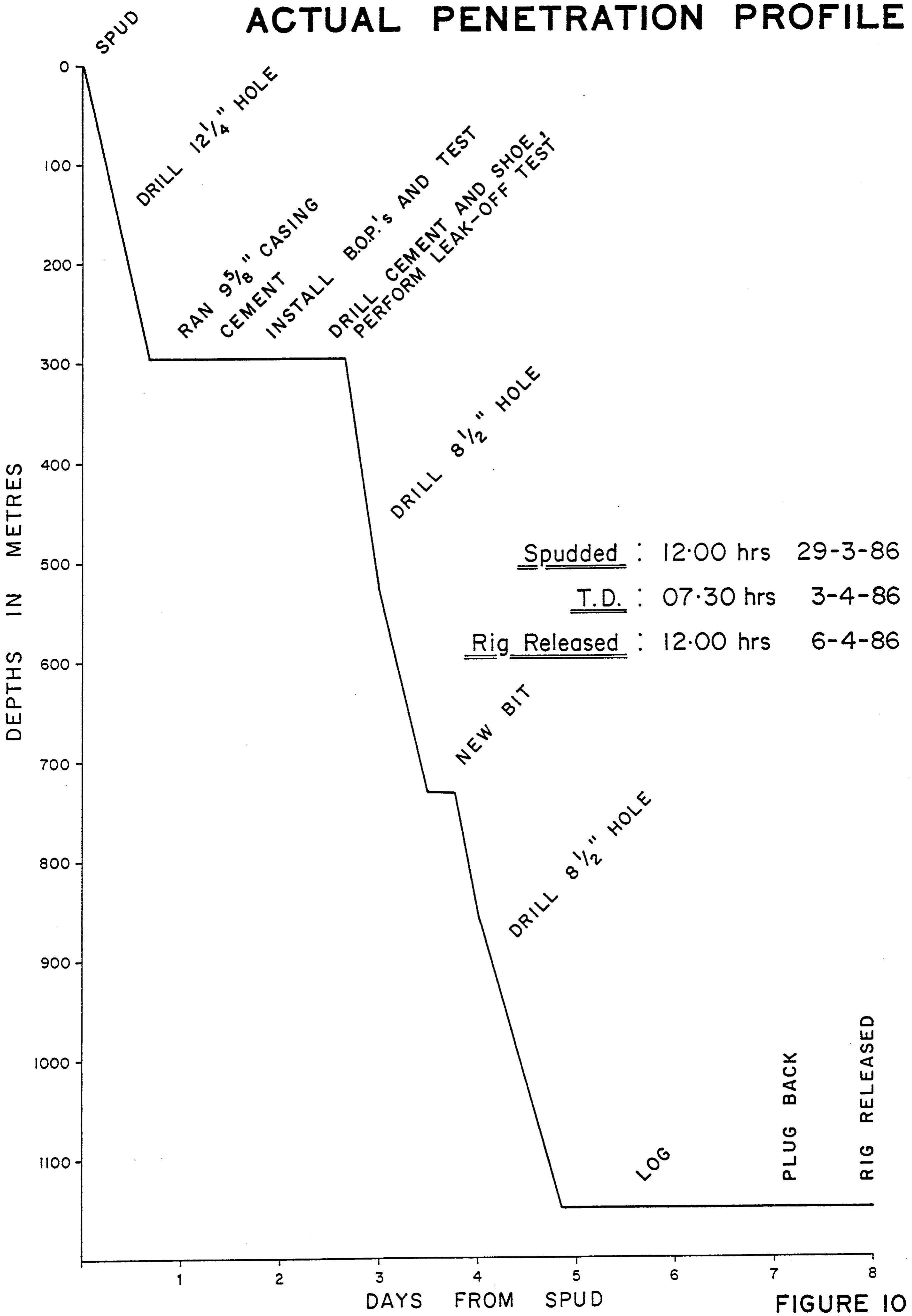


FIGURE 10

DRG No. OT.3454

APPENDIX 3

DRILLING FLUID RECAP

Geofluids

DRILLING FLUIDS REPORT

FOR

BEACH PETROLEUM N.L.

PRINCES #1

OTWAY BASIN

VICTORIA

PREPARED BY :

ANDRE SKUJINS
JOHN DANIELS

DATE :

APRIL, 1986

Geofluids

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2. RECOMMENDATIONS FOR FUTURE WELLS

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       Depth vs Mud Cost

   4.2 Depth vs Mud Weight
       Depth vs Funnel Viscosity
       Depth vs Filtrate

5. FLUID PROPERTIES SUMMARY

6. BIT RECORD

Geofluids

1. SUMMARY OF OPERATIONS

Princes #1 was spudded on the 29th March, 1986, using Richter #8, and reached a total depth of 1150m on the 3rd April, 1986.

12-1/4" surface hole was drilled with fresh water to 296m. Some mudding up occurred while drilling the Gellibrand Marl, and this was watered back. A minor mud ring occurred at 269m, probably due to poor hole cleaning with the watered back mud.

A high viscosity pill was circulated prior to a wiper trip. After running back in, another high viscosity pill was circulated, and prior to pulling out a high viscosity pill was spotted on bottom. 9-5/8" casing was then run in the hole and cemented.

While the blow out preventers were being installed, the mud tanks were dumped and cleaned. Fresh water was put into the tanks, to which Milpac and Milzan were added. After these polymers had yielded, KCl was added.

An 8-1/2" bit was run in the hole, and the old mud in the hole was displaced with the KCl polymer mud. The cement, float, and shoe were drilled out (the mud having been pretreated with Soda Bicarb and Soda Ash), and 3m of new hole was drilled. A pressure integrity test was conducted prior to drilling ahead.

While drilling, mud properties were refined so as to reduce the fluid loss to 8 mls/30min, and to maintain a KCl content of 4% w/v.

At 699m, the bit was tripped. Tight hole was worked from 572m to 543m, and 495m to 453m. When running in with a new bit, under-gauge hole was reamed from 690m to 699m.

Drilling continued to a total depth of 1150m, where a wiper trip was made.

While pulling out of the hole, tight hole was back-reamed from 1031m to 725m. When no more overpull was observed, the pipe was run back in the hole. The hole was circulated and the pipe was tripped out with no hole problems.

Electric logs were then run without any hole problems. The hole was then plugged and abandoned.

2. RECOMMENDATIONS FOR FUTURE WELLS

Princes #1 was drilled quickly and relatively trouble free. Some tight hole was experienced during the first trip through new hole in the 8-1/2" hole section. Tight hole was worked and/or back reamed, but after the initial trip no further problems were experienced. The tight hole may have been caused by a filter cake being built up on a near gauge hole.

The filtrate was maintained at around 8 mls which was at the low end of the filtrate specification of 8-12 mls. Some problems were experienced with high viscosities as the Milpac fluid loss agent is also a viscosifier. If filtrate values of 8 or below are required then it is recommended that Permalose, a low viscosity polymer, be used as a supplementary fluid loss agent. However a fluid loss of 9-10 mls in a vertical hole should be adequate to avoid problems.

The gauge of the Princes #1 well was good. This may have been due to the relatively high viscosity fluid. The mud was mixed prior to drilling out the casing and the fact that a viscosified fluid was used throughout and not water or a very thin mud may also have aided hole gauge.

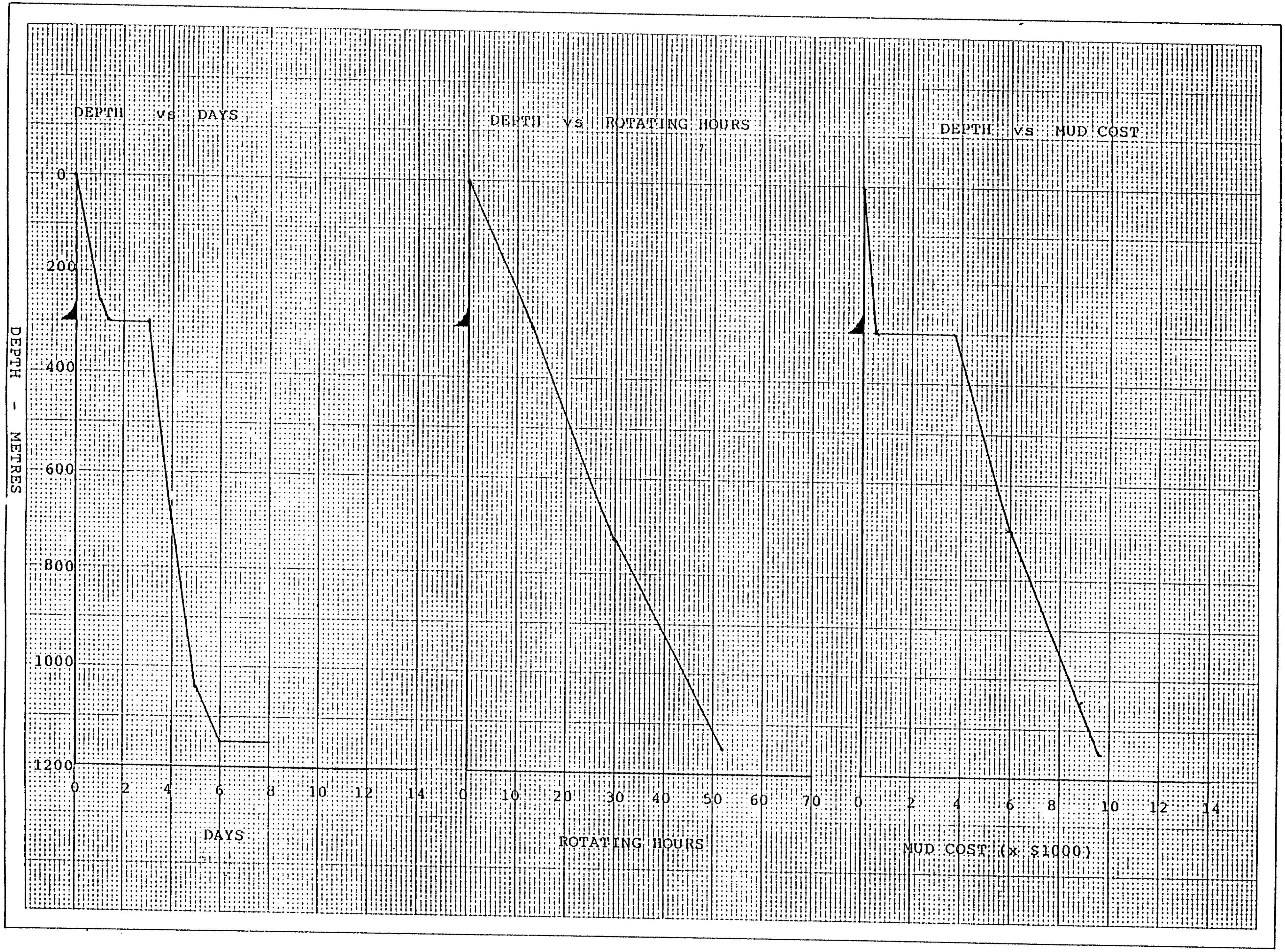
As on Westgate #1, mud losses downhole were noticeable, but not to the same extent. Since the desander and desilter were discharging an average of 6 gal/min combined, some of this could be reclaimed by pumping from the sump. This fluid was light and had a reasonable concentration of KCl and polymers. It is strongly recommended that on a longer well a biocide be used, especially if reclamation from the sump is contemplated.

Geofluids

3. COST ANALYSIS

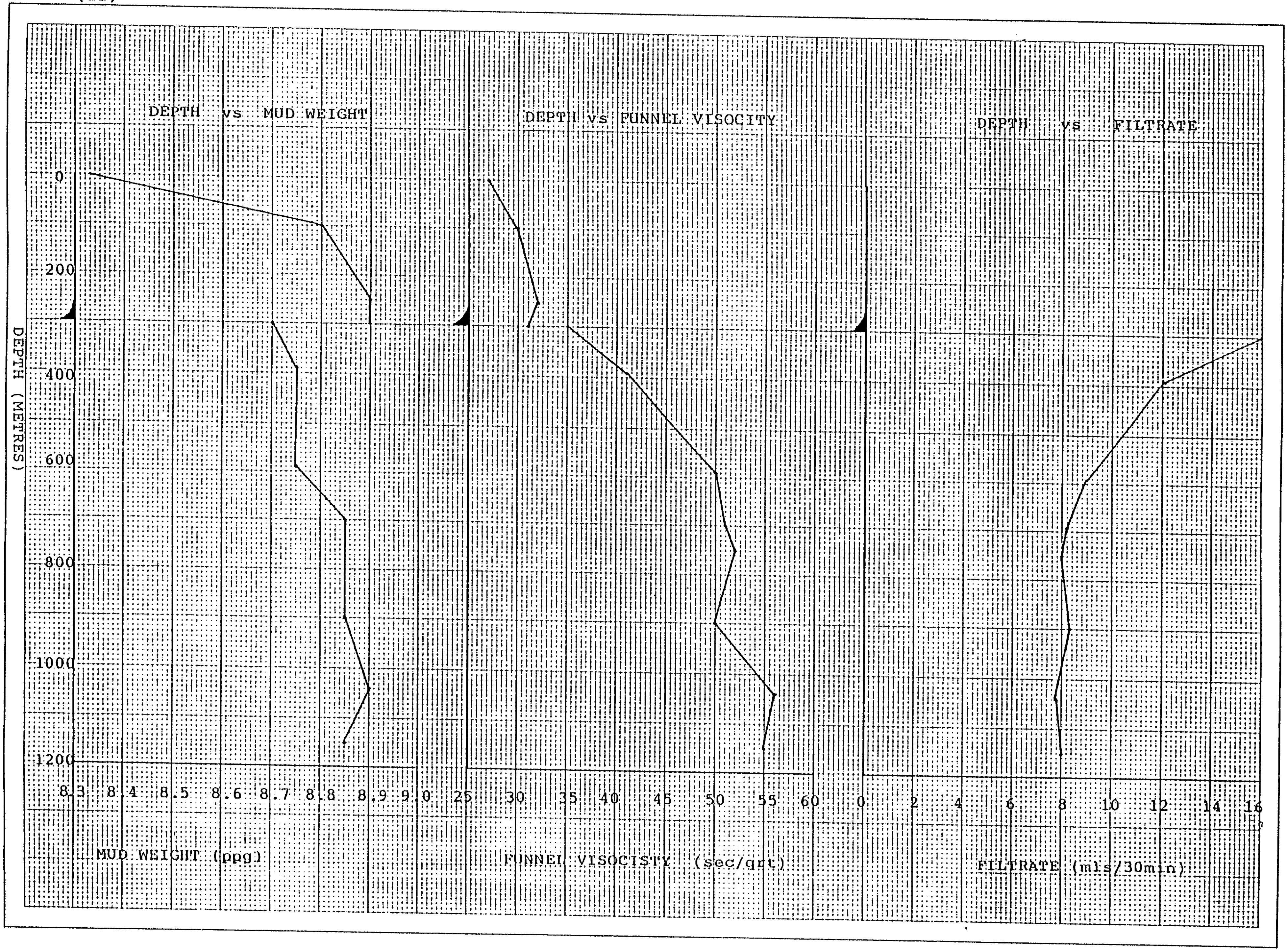
			12-1/4"			8-1/2"			TOTAL		
			0 m TO 296 m			296 m TO 1150 m			0m to 1150m		
PRODUCT	UNIT	UNIT COST	UNITS	COST	%	UNITS	COST	%	UNITS	COST	%
Calcium Chloride	25 kg	12.50	8	100.00	20.0	10	125.00	6.3	18	225.00	2.3
Caustic Soda	25 kg	22.37	1	22.37	4.5				1	22.37	0.2
KCl	50 kg	15.84				150	2376.00	25.3	150	2376.00	24.0
KOH	25 kg	32.29				7	226.03	2.4	7	226.03	2.2
Milgel	100 lb	14.02	27	378.54	75.5	1	14.02	0.1	28	392.56	4.0
Milpac	25 kg	78.33				67	5248.11	55.8	67	5248.11	53.0
Milzan	25 kg	222.41				6	1334.46	14.2	6	1334.46	13.4
Soda Ash	40 kg	17.42				2	34.84	0.4	2	34.84	0.4
Sodium Bicarb	40 kg	23.41				2	46.82	0.5	2	46.82	0.5
TOTAL INTERVAL COSTS $			500.91			9405.28			9906.19		
INTERVAL COST PER METRE			$1.69			$11.01			$8.61		

4 (i)



DEPTH vs DAYS
DEPTH vs ROTATING HOURS
DEPTH vs MUD COST
DEPTH - METRES
0
200
400
600
800
1000
1200
0 2 4 6 8 10 12 14
DAYS
0 10 20 30 40 50 60 70
ROTATING HOURS
0 2 4 6 8 10 12 14
MUD COST (x $1000)

4 (ii)



DEPTH vs MUD WEIGHT
DEPTH vs FUNNEL VISOCITY
DEPTH vs FILTRATE
DEPTH (METRES)
0
200
400
600
800
1000
1200
8.3 8.4 8.5 8.6 8.7 8.8 8.9 9.0
25 30 35 40 45 50 55 60
0 2 4 6 8 10 12 14 16
MUD WEIGHT (ppg)
FUNNEL VISOCISTY (sec/qrt)
FILTRATE (mls/30min)

5. FLUID PROPERTIES SUMMARY

5. FLUID PROPERTIES SUMMARY

MUD TYPE : FRESH WATER NATIVE SOLIDS
KCl POLYMER

INTERVAL : 0 m - 296 m
296 m - 1150 m

DATE 1986	DEPTH METRES	M.W. ppg	ECD ppg	VIS sec	PV cp	YP lb/100ft	GELS lb/100ft	pH	W.L. ml	FLOWLINE TEMP (Deg. C)	KCl (%w/v)	Pf	Mf	Cl- ppm	Ca/Mg ppm	SAND %	SOL %	WATER %	MBC lb/bbl
29/3	97	8.8		30												TR	3.5	96.5	-
29/3	256	8.9		32												TR	4.0	96.0	-
30/3	296	8.9		31												TR	4.0	96.0	-
01/4	300	8.7	8.9+	35	9	9	1/1	10.5	16.0		5.1	0.8	1.4	27000	120	TR	0.5	99.5	-
01/4	389	8.7+	9.0+	41	13	13	2/2	10.5	12.0	22	4.8	0.6	0.9	26000	120	TR	1.0	99.0	-
01/4	591	8.7+	9.0	50	15	17	2/4	10.0	9.0		4.4	0.2	0.6	24000	120	TR	1.0	99.0	5
01/4	699	8.8+	9.1	51	16	18	2/5	9.5	8.2		4.0	0.1	0.5	22000	120	TR	2.0	98.0	5
02/4	745	8.8+	9.1	52	16	19	2/5	9.0	8.0	26	4.0	0.1	0.4	22500	140	TR	2.0	98.0	-
02/4	899	8.8+	9.2	51	16	25	3/6	9.5	8.3		4.0	0.1	0.4	24000	140	TR	2.0	98.0	5
02/4	1041	8.9	9.3+	56	18	35	3/7	9.5	8.0		4.6	0.1	0.3	25500	120	TR	2.0	98.0	5
03/4	1145	8.8+	9.3	55	17	33	4/7	9.0	8.0	30	5.1	0.1	0.3	24000	140	TR	2.0	98.0	-
03/4	1150	8.9	9.4	57	19	38	5/7	9.5	8.5		3.9	0.1	0.4	21500	120	TR	2.5	97.5	5
05/4	circ after plug	8.8+		58	19	37	5/7	10.5	8.0		3.8	0.4	0.6	22500	200	TR	2.0	98.0	-

6. BIT RECORD

6..

Bit Record

Geofluids

Operator: BEACH PETROLEUM	Well No.: 1	Location: PRINCES	Supervisors: IAN HOFMEIER
Contractor: RICHTER DRILLING	Rig No.: 8	Mud Pumps: NATIONAL 9-P-100	Drill Pipe: 4½"
Spud Date: 29TH MARCH 86	TD Date: 3RD APRIL '86	Surface Csg: 9⅝" @ 292m	Inter Csg: –
Prod Csg: –	Drill Collars: 6¼"	Mud Type: FW NATIVE SOLIDS / KCL POLYMER	

Run No.	Bit No.	Size	Make	Type	Jets 32nds	Depth Out	Depth Drilled	Hours Drilling	Cumulative Rotating Hours	W.T.	RPM	Vert. Dev.	Pump Press.	Bbl/M	Ann. Vel.	Mud Weight	Visc.	W.L.	Dull Cond T	Dull Cond B	Dull Cond G	Other	Formation
1	1	12¼"	SEC	S33S	15.15.18	296m	296m	13	13	5-10	70-120		150	14.3	113	8.9	31	N.C.	2	1	I		
2	2	8½"	SEC	S33S	3x12	730m	434m	17½	30½	5-20	90-140		600	6.1	121	8.8+	51	8.2	6	5	¼		
3	3	8½"	SEC	S84F	3x12	1150m	420m	22¼	52¾	15-28	80-90		700	6.1	121	8.8+	55	8.0	3	4	⅛		

Remarks

APPENDIX 4

SIDEWALL CORE STUDIES

PRINCES NO. 1

SIDEWALL CORE DESCRIPTIONS

SWC	Depth (m)	Rec (mm)	Description
1	1132.0	30	SILTY CLAYSTONE, light grey to light grey green, moderate hard to hard, massive, non calcareous. No fluorescence, no odour.
2	1120.0	45	SANDSTONE, light grey, light green to light grey green, very friable, fine to medium grained, dominantly fine grained, angular to subround, poorly sorted, quartzose, weak siliceous cement. Occasional pink and brown lithics. Nil to poor visual porosity. No fluorescence, no odour.
3	1093.0	-	Not recovered.
4	1046.0	50	SILTY CLAYSTONE, dark grey, soft to medium hard, sub-fissil, trace fine quartz grains. No fluorescence, no odour.
5	1041.5	45	SANDSTONE, grey green, very friable, fine to very coarse grained, dominantly medium grained, subangular to subround, poorly sorted, quartzose, no apparent matrix, occasional pink, yellow, brown and green lithics, poor to moderate visual porosity. No fluorescence. No odour.
6	1023.0	50	CLAYSTONE, dark grey, soft to medium hard, sub-fissil, interlaminated with SANDSTONE, very light grey, friable, very fine to fine grained, dominantly very fine grained, subangular to round, moderate sorting, weak siliceous cement, common glauconitic staining, non calcareous, poor visual porosity. No fluorescence, no odour.

Cont'd.

SWC	Depth (m)	Rec (mm)	Description
7	1008.0	50	SANDSTONE, light grey, friable, fine to medium grained, dominantly fine grained (occasionally coarse), subangular to subround, poorly sorted, no apparent matrix, moderate glauconitic staining, common carbonaceous laminae, poor to moderate visual porosity. No fluorescence, no odour.
8	1006.5	50	SANDSTONE, as above. No fluorescence, no odour.
9	1002.0	40	CLAYSTONE, dark grey green, soft to medium hard, massive, slightly silty. No fluorescence, no odour.
10	995.0	47	CLAYSTONE, very dark grey green, soft, massive, occasional fine quartz grains, occasional glauconite non-calcareous. No fluorescence, no odour.
11	927.0	52	SANDSTONE, dark green, soft to friable, fine to medium grained, dominantly medium grained, angular to subangular, poor sorting, abundant glauconite pellets, common yellow stained very fine quartz, nil to poor visual porosity. No fluorescence, no odour.
12	890.0	54	SANDSTONE, dark green, soft to friable, fine to coarse grained, dominantly medium grained, as above. No fluorescence, no odour.
13	861.0	48	SANDSTONE, light green, as above with abundant stained quartz grains. No fluorescence, no odour.
14	857.0	54	SILTY CLAYSTONE, medium to dark grey, soft, massive, abundant very fine grains of quartz, occasional glauconite staining, non calcareous. No fluorescence, no odour.

Cont'd.

SWC	Depth (m)	Rec (mm)	Description
15	810.0	48	SANDSTONE, medium to dark grey, friable, very fine to fine grained, dominantly very fine grained, subangular to subround, moderate sorting, medium grey to light grey mottled clay matrix, silty in part, common carbonaceous laminae, non calcareous, poor visual porosity. No fluorescence, no odour.
16	803.5	34	SANDSTONE, light grey to very light brown, loose, fine to medium grained, subangular to subround, moderate sorting, no apparent matrix, occasional black lithics, moderate to good visual porosity. No fluorescence, no odour.
17	772.5	52	CLAYSTONE, dark grey, medium hard, massive, abundant fine quartz grains with minor laminae of SANDSTONE, light grey, fine grained, subround to round, well sorted, no apparent matrix, moderate visual porosity. No fluorescence, no odour.
18	685.5	57	SANDSTONE, light grey, very fine grained to pebbly, angular to subround, dominantly angular, poor sorting, abundant medium to dark grey clay matrix, silty in part, very dispersive, trace cherty lithics, trace black lithics, very poor visual porosity. No fluorescence, no odour.
19	665.0	50	SANDSTONE, light grey, light grey brown, very fine to very coarse grained, subangular to round, dominantly round, poor sorting, minor light grey to brown clay matrix, silty in part, rare cherty lithics, trace coally detritus, fair to good visual porosity. No fluorescence, no odour.
20	657.0	28	SANDSTONE, light to medium grey, very fine grained to pebbly dominantly medium grained, angular to subround, poorly sorted, common medium grey clay matrix, common coally detritus, rare cherty fragments, poor visual porosity. No fluorescence, no odour.

Cont'd.

SWC	Depth (m)	Rec (mm)	Description
21	650.5	45	SANDSTONE, light grey, very fine grained, subangular to subround, moderate to well sorted, minor light grey matrix, common coally detritus, common mica flakes, trace white lithics, poor to fair visual porosity. No fluorescence, no odour.
22	616.5	45	SANDSTONE, medium to dark grey, light grey and mottled in part, very fine grained, subangular to subround, well sorted, abundant silty matrix, trace coally detritus pyritized in part, rare coarse quartz grains, poor visual porosity. No fluorescence, no odour.
23	643.0	48	SANDSTONE/CLAY, medium to dark green grey, medium grey, fine to coarse grained, dominantly medium grained, angular to subround, poorly sorted, very abundant dark grey clay matrix. Silty in part, trace carbonaceous material, trace mica flakes, trace white lithics, very poor visible porosity. No fluorescence, no odour.
24	635.0	47	SANDY CLAYSTONE, medium to dark grey becoming medium to dark grey brown, soft, dispersive, abundant brown stained quartz lithics, trace mica flakes, trace white lithics. No fluorescence, no odour.
25	629.0	48	SANDSTONE, light to medium grey brown, mottled in part, fine to coarse grained, dominantly medium grained, subangular to subround, poorly sorted, common dark grey brown clay matrix in part, slightly siliceous cement in part. Common carbonaceous detritus, poor to fair visual porosity. No fluorescence, no odour.
26	603.0	50	CLAYSTONE, medium to dark grey, medium to dark grey brown, soft, faint laminae, common quartz grains, trace micromicaceous. No fluorescence, no odour.

Cont'd.

SWC	Depth (m)	Rec (mm)	Description
27	579.0	40	CLAYSTONE, as above with minor mottled glauconitic matrix. No fluorescence, no odour.
28	560.0	48	SILTSTONE, buff, arenaceous in part, massive, firm to hard, occasional carbonaceous detritus, trace micromicaceous. No fluorescence, no odour.
29	542.0	48	SANDSTONE, medium grey to medium grey green, loose, fine to medium grained, dominantly medium grained, subangular to subround, occasionally round, moderate sorting, trace dark grey dispersive clay matrix, occasional black lithics, trace glauconite, moderate visual porosity. No fluorescence, no odour.
30	525.0	36	SANDSTONE, light grey, as above, with occasional iron stained quartz grains. No fluorescence, no odour.

APPENDIX 5

VELOCITY SURVEY

Schlumberger

BEACH PETROLEUM N.L.

GEOGRAM PROCESSING REPORT

PRINCES - 1

FIELD	:	WILDCAT
PERMIT	:	PEP 108
STATE	:	VICTORIA
COUNTRY	:	AUSTRALIA
LOCATION	:	OTWAY BASIN SP 905 LINE TM12
COORDINATES	:	038° 29' 32" S 142° 59' 20" E
DATE OF SURVEY	:	04-APRIL-1986
REFERENCE NO.	:	560406

CONTENTS

1 Introduction
2 Data Acquisition
3 Check Shot Data
4 Sonic Calibration
5 Sonic Calibration Processing
6 GEOGRAM Processing
7 Summary of Geophysical Listings

Fig. 1 : Wavelet polarity convention
Fig. 2 : Source geometry sketch
Fig. 3 : Stacked check shot data
Fig. 4 : Surface refraction survey

Geophysical Airgun Report
Drift Computation Report
Sonic Adjustment Parameter Report
Velocity Report
Time Converted Velocity Report
Synthetic Seismogram Table
Colour Velocity Profile

1.0 INTRODUCTION

A velocity check shot survey was conducted in the Princes - 1 well on 4 April 1986. Twenty one levels from 50 metres to 1140 metres below KB were shot using a dynamite source. All levels have been used in the calibration of the sonic log.

The shot times and calibrated sonic times have been corrected to the seismic reference datum at 150 metres above mean sea level.

2.0 DATA ACQUISITION

Table 1 Field Equipment and Survey Parameters

Elevation SRD	150.0 metres AMSL
Elevation KB	115.5 metres AMSL
Elevation DF	115.4 metres AMSL
Elevation GL	109.5 metres AMSL
No. of Levels	21
Well Deviation	Nil
Total Depth	1152 metres below KB
Energy Source	Dynamite
Source Offset	27.0 metres
Source Depth	1.0 metre below GL
Reference Sensor	Hydrophone
Sensor Offset	2.5 metres from source
Sensor Depth	1.0 metre below GL
Downhole Geophone	Geospace HS-1
	High Temp. ($350^\circ F$)
	Coil Resist. $225\Omega \pm 10$ %
	Natural Freq. 8-12 hertz
	Sensitivity 0.45 V/in/sec
	Maximum tilt angle 60°

Recording was made on the Schlumberger Cyber Service Unit (CSU) using LIS format.

2.1 Survey Details

The survey was shot using a dynamite source and hydrophone as the surface sensor. No major problems were noted during the survey.

3.0 CHECK SHOT DATA

A total of 21 check levels were shot during the survey. A plot of the stacked check shot data is displayed at figure 3. The levels at 269 and 1004 metres were shot both coming in and out of the well. The repeat shots give identical transit times.

Table 2 Checkshot levels

Level Depth (metres below KB)	Stacked Shots	Rejected Shots	Quality	Comments
50	3	0	Good	
115.5	1	0	Good	
269	2	0	Good	Shot going in
	2	0	Good	
290	1	0	Good	
330	3	0	Good	
378	1	0	Good	
448	1	0	Good	
503	1	0	Good	
566	1	0	Good	
610	1	0	Good	
648	1	0	Good	
710	1	0	Good	
765	1	0	Good	
815	2	0	Good	
859	1	0	Good	
925	2	0	Good	
994	1	0	Good	
1004	2	0	Good	Shot going in
	2	0	Good	
1047	1	0	Good	
1080	1	0	Good	
1140	3	0	Good	

Nine additional shots were made with a geophone located on the surface at offsets varying from 3 to 40 metres, in order to estimate the surface velocities (see figure 4).

4.0 SONIC CALIBRATION

A 'drift' curve is obtained using the sonic log and the vertical check level times. The term 'drift' is defined as the seismic time (from check shots) minus the sonic time (from integration of edited sonic). Commonly the word 'drift' is used to identify the above difference, or to identify the gradient of drift verses increasing depth, or to identify a difference of drift between two levels.

The gradient of drift, that is the slope of the drift curve, can be negative or positive.

For a negative drift $\frac{\Delta drift}{\Delta depth} < 0$, the sonic time is greater than the seismic time over a certain section of the log.

For a positive drift $\frac{\Delta drift}{\Delta depth} > 0$, the sonic time is less than the seismic time over a certain section of the log.

The drift curve, between two levels, is then an indication of the error on the integrated sonic or an indication of the amount of correction required on the sonic to have the TTI of the corrected sonic match the check shot times.

Two methods of correction to the sonic log are used.

1. **Uniform or block shift** This method applies a uniform correction to all the sonic values over the interval. This uniform correction is applied in the case of positive drift and is the average correction represented by the drift curve gradient expressed in μsec/ft.
2. **ΔT Minimum** In the case of negative drift a second method is used, called Δt minimum. This applies a differential correction to the sonic log, where it is assumed that the greatest amount of transit time error is caused by the lower velocity sections of the log. Over a given interval the method will correct only Δt values which are higher than a threshold, the Δt_{min}. Values of Δt which are lower than the threshold are not corrected. The correction is a reduction of the excess of Δt over Δt_{min}, Δt - Δt_{min}.

   $\Delta t - \Delta t_{min}$ is reduced through multiplication by a reduction coefficient which remains constant over the interval. This reduction coefficient, named G, can be be defined as:

   $$G = 1 + \frac{drift}{\int(\Delta t - \Delta t_{min})dZ}$$

   Where drift is the drift over the interval to be corrected and the value $\int(\Delta t - \Delta t_{min})dZ$ is the time difference between the integrals of the two curves Δt and Δt_{min}, only over the intervals where $\Delta t > \Delta t_{min}$.

   Hence the corrected sonic: $\Delta t = G(\Delta t - \Delta t_{min}) + \Delta t_{min}$.

5.0 SONIC CALIBRATION PROCESSING

5.1 Open Hole Logs

Both the sonic and density logs used have been edited prior to input into the Well Seismic Calibration processing chain.

Density data was available from 515 to 1075 metres below KB , with a gap from 675 to 800 metres. The density has been linearly interpolated across this gap. Above and below 515 to 1075 metres the density has been linearly extrapolated at 2.10 and 2.25gm/cc respectively. The overall log quality is good and only minor zones of cycle skipping have been edited from the sonic log.

Density log interval	:	515 to 1075 metres below KB
Sonic log interval	:	290 to 1148 metres below KB

5.2 Correction to Datum and Velocity Modelling

Seismic reference datum (SRD) is at 150 metres above mean sea level. The dynamite source was positioned 1.0 metre below GL at an offset of 27 metres from the wellhead. The reference hydrophone was at 1.0 metre depth and an offset of 2.5 metres from the source. Instananeous seismic detonators were used and a zero delay time has been assumed. A replacement velocity of 1750 metres/sec has been used from ground level to datum.

A surface refraction survey was shot. This suggested a two layer surface model with a lower layer velocity of approx 2000 metres/sec. The top layer velocity could not be determined accurately but is probably less than 1000 metres/sec. These velocities have not been used in the seismic calibration however, they are in agreement with the average velocity from ground level to the checkshot level at 50 metres below KB, from which an interval velocity of 1637 metres/sec was calculated.

5.3 Sonic Calibration Results

The top of the sonic log (290 metres below KB)is chosen as the origin for the calibration drift curve. The drift curve indicates a number of corrections to be made to the sonic log. A list of shifts used on the sonic data is given below.

Table 3 Sonic Drift

Depth Interval (metres below KB)	Block Shift μsec/ft	Δt_{min} μsec/ft	Equiv Block Shift μsec/ft
290-538	3.69	-	3.69
538-1140	0.61	-	0.61

The adjusted sonic curve is considered to be the best result using the available data.

6.0 GEOGRAM PROCESSING

GEOGRAM plots were generated using 10-60 and 12-80 hertz butterworth wavelets. The presentations include both normal and reverse polarity on a time scale of 5 in/sec.

GEOGRAM processing produces synthetic seismic traces based on reflection coefficients generated from sonic and density measurements in the well-bore. The steps in the processing chain are the following:

- Depth to time conversion
- Reflection coefficients
- Attenuation coefficients
- Convolution
- Output.

6.1 Depth to Time Conversion

Open hole logs are recorded from the bottom to top with a depth index. This data is converted to a two-way time index and flipped to read from the top to bottom in order to match the seismic section.

6.2 Primary Reflection Coefficients

Sonic and density data are averaged over chosen time intervals (normally 2 or 4 millisecs). Reflection coefficients are then computed using:

$$R = \frac{\rho_2.\nu_2 - \rho_1.\nu_1}{\rho_2.\nu_2 + \rho_1.\nu_1}$$

where

ρ_1 = density of the layer above the reflection interface
ρ_2 = density of the layer below the reflection interface
ν_1 = compressional wave velocity of the layer above the reflection interface
ν_2 = compressional wave velocity of the layer below the reflection interface

This computation is done for each time interval to generate a set of primary reflection coefficients without transmission losses.

6.3 Primaries with Transmission Loss

Transmission loss on two-way attenuation coefficients are computed using:

$$A_n = (1 - R_1^2).(1 - R_2^2).(1 - R_3^2)...(1 - R_n^2)$$

A set of primary reflection coefficients with transmission loss is generated using:

$$Primary_n = R_n.A_{n-1}$$

6.4 Primaries plus Multiples

Multiples are computed from these input reflection coefficients using the transform technique from the top of the well to obtain the impulse response of the earth. The transform outputs primaries plus multiples.

6.5 Multiples Only

By subtracting previously calculated primaries from the above result we obtain multiples only.

6.6 Wavelet

A theoretical wavelet is chosen to use for convolution with the reflection coefficients previously generated. Choices available include:

Klauder wavelet

Ricker zero phase wavelet

Ricker minimum phase wavelet

Butterworth wavelet

User defined wavelet.

Time variant butterworth filtering can be applied after convolution. Polarity conventions are shown in Figure 1. These GEOGRAMS were generated using butterworth wavelets.

6.7 Convolution

Standard procedure of convolution of wavelet with reflection coefficients. The output is the synthetic seismogram.

7.0 SUMMARY OF GEOPHYSICAL LISTINGS

Six geophysical data listings are appended to this report. Following is a brief description of the format of each listing.

7.1 Geophysical Airgun Report

1. Level number : the level number starting from the top level (includes any imposed shots).
2. Vertical depth from KB : *dkb*, the depth in metres from kelly bushing .
3. Vertical depth from SRD : *dsrd*, the depth in metres from seismic reference datum.
4. Vertical depth from GL : *dgl*, the depth in metres from ground level.
5. Observed travel time HYD to GEO : *tim0*, the transit time picked from the stacked data by subtracting the surface sensor first break time from the downhole sensor first break time.
6. Vertical travel time SRC to GEO : *timv*, is corrected for source to hydrophone distance and for source offset.
7. Vertical travel time SRD to GEO : *shtm*, is *timv* corrected for the vertical distance between source and datum.
8. Average velocity SRD to GEO : the average seismic velocity from datum to the corresponding checkshot level, $\frac{dsrd}{shtm}$.
9. Delta depth between shots : $\Delta depth$, the vertical distance between each level.
10. Delta time between shots : $\Delta time$, the difference in vertical travel time (*shtm*) between each level.
11. Interval velocity between shots : the average seismic velocity between each level, $\frac{\Delta depth}{\Delta time}$.

7.2 Drift Computation Report

1. Level number : the level number starting from the top level (includes any imposed shots).
2. Vertical depth from KB : the depth in metres from kelly bushing .
3. Vertical depth from SRD : the depth in metres from seismic reference datum.
4. Vertical depth from GL : the depth in metres from ground level.
5. Vertical travel time SRD to GEO : the calculated vertical travel time from datum to downhole geophone (see column 7, Geophysical Airgun Report).
6. Integrated raw sonic time : the raw sonic log is integrated from top to bottom and listed at each level. An initial value at the top of the sonic log is set equal to the checkshot time at that level. This may be an imposed shot if a shot was not taken at the top of the sonic.
7. Computed drift at level : the checkshot time minus the integrated raw sonic time.
8. Computed blk-shft correction : the drift gradient between any two checkshot levels ($\frac{\Delta drift}{\Delta depth}$).

7.3 Sonic Adjustment Parameter Report

1. Knee number : the knee number starting from the highest knee. (The first knees listed will generally be at SRD and the top of sonic. The drift imposed at these knees will normally be zero.)
2. Vertical depth from KB : the depth in metres from kelly bushing .
3. Vertical depth from SRD : the depth in metres from seismic reference datum.
4. Vertical depth from GL : the depth in metres from ground level.
5. Drift at knee : the value of drift imposed at each knee.
6. Blockshift used : the change in drift divided by the change in depth between any two levels.
7. Delta-T minimum used : see section 4 of report for an explanation of Δt_{min}.
8. Reduction factor : see section 4 of report.
9. Equivalent blockshift : the gradient of the imposed drift curve.

7.4 Velocity Report

1. Level number : the level number starting from the top level (includes any imposed shots).
2. Vertical depth from KB : the depth in metres from kelly bushing .
3. Vertical depth from SRD : the depth in metres from seismic reference datum
4. Vertical depth from GL : the depth in metres from ground level
5. Vertical travel time SRD to GEOPH : the vertical travel time from SRD to downhole geophone (see column 7, Geophysical Airgun Report)
6. Integrated adjusted sonic time : the adjusted sonic log is integrated from top to bottom. An initial value at the the top of the sonic is set equal the checkshot time at that level. (The adjusted sonic log is the drift corrected sonic log.)
7. Drift=shot time-raw son : the check shot time minus the raw integrated sonic time.
8. Residual=shot time-adj son : the check shot time minus the adjusted integrated sonic time. This is the difference between calculated drift and the imposed drift.
9. Adjusted interval velocity : the interval velocity calculated from the integrated adjusted sonic time at each level.

7.5 Time Converted Velocity Report

The data in this listing has been resampled in time.

1. Two way travel time from SRD : This is the index for the data in this listing. The first value is at SRD (0 millisecs) and the sampling rate is 2 millisecs.
2. Measured depth from KB : the depth from KB at each corresponding value of two way time.
3. Vertical depth from SRD : the vertical depth from SRD at each corresponding value of two way time.
4. Average velocity SRD to GEO : the vertical depth from SRD divided by half the two way time.
5. RMS velocity : the root mean square velocity from datum to the corresponding value of two way time.

   $$v_{rms} = \sqrt{\Sigma_1^n v_i^2 t_i / \Sigma_1^n t_i}$$

   where v_i is the velocity between each 2 millisecs interval.
6. First normal moveout : the correction time in millisecs to be applied to the two way travel time for a specified moveout distance (default = 3000 feet).

   $$\Delta t = \sqrt{t^2 + \left(\frac{X}{v_{rms}}\right)^2} - t$$

   where
   Δt = normal moveout (secs)
   X = moveout distance (metres)
   t = two way time (secs)
   v_{rms} = rms velocity (metres /sec)
7. Second normal moveout : the correction time in millisecs to be applied to the two way travel time for a specified moveout distance (default = 4500 feet).
8. Third normal moveout : the correction time in millisecs to be applied to the two way travel time for a specified moveout distance (default = 6000 feet).
9. Interval velocity : the velocity between each sampled depth. Typically, the sampling rate is 2 millisecs two way time, (1 millisec one way time) therefore the interval velocity will be equal to the depth increment divided by 0.001. It is equivalent to column 9 from the the Velocity Report.

7.6 SYNTHETIC SEISMOGRAM TABLE

1. Two way travel time from SRD : This is the index for the data in this listing. The first value is at the top of the sonic. The default sampling rate is 2 millisecs.
2. Vertical depth from SRD : the vertical depth from SRD at each corresponding value of two way time.
3. Interval velocity : the velocity between each sampled depth. Typically, the sampling rate is 2 millisecs two way time, (1 millisec one way time) therefore the interval velocity will be equal to the depth increment divided by 0.001. It is equivalent to column 9 from the the Velocity Report.

4. Interval density : the average density between two successive values of two way time.
5. Reflect. coeff. : the difference in acoustic impedance divided by the sum of the acoustic impedance between any two levels. The acoustic impedance is the product of the interval density and the interval velocity.
6. Two way atten. coeff. : is computed from the series

$$A_n = (1 - R_1^2).(1 - R_2^2).(1 - R_3^2)...(1 - R_n^2)$$

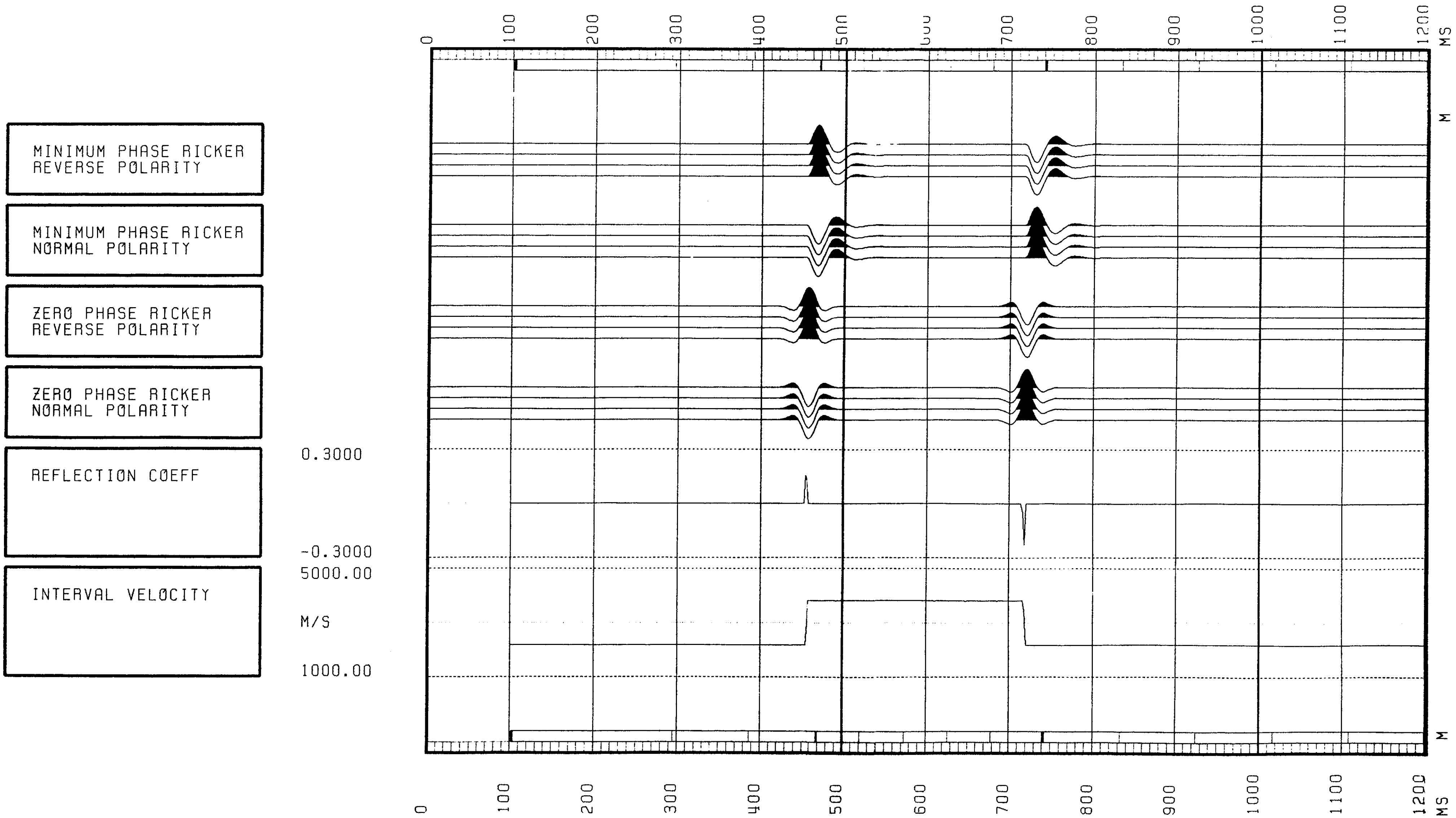
7. Sythetic seismo. primary : the product of the reflection coefficient at each depth and the two way attenuation coefficient up to that depth.

$$Primary_n = R_n.A_{n-1}$$

8. Primary + multiple : a transform technique is used to calculate multiples from the input reflection coefficients.
9. Multiples only : (Primary + multiple) - (Synthetic seismo. primary)

SCHLUMBERGER (SEG-1976) WAVELET POLARITY CONVENTION

Figure 1

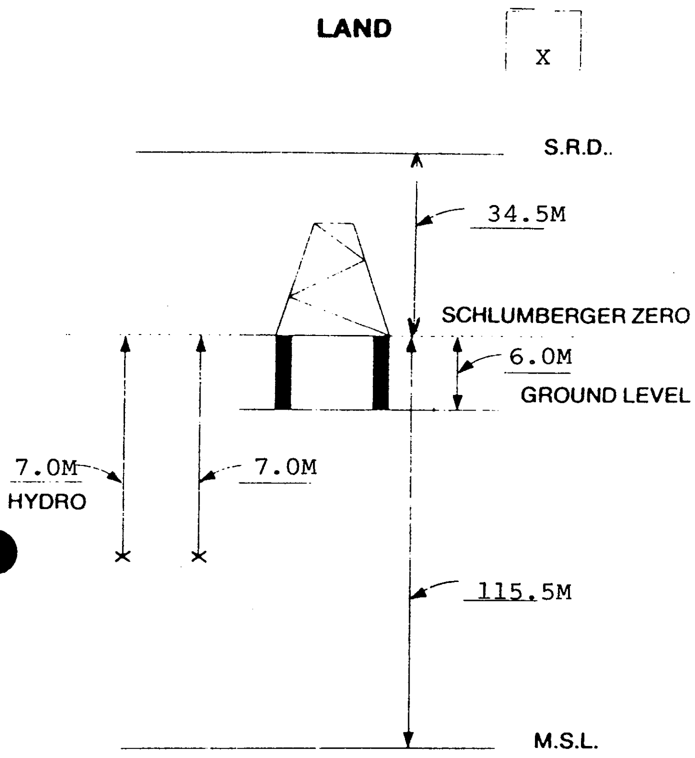


Schlumberger

GUN GEOMETRY SKETCH

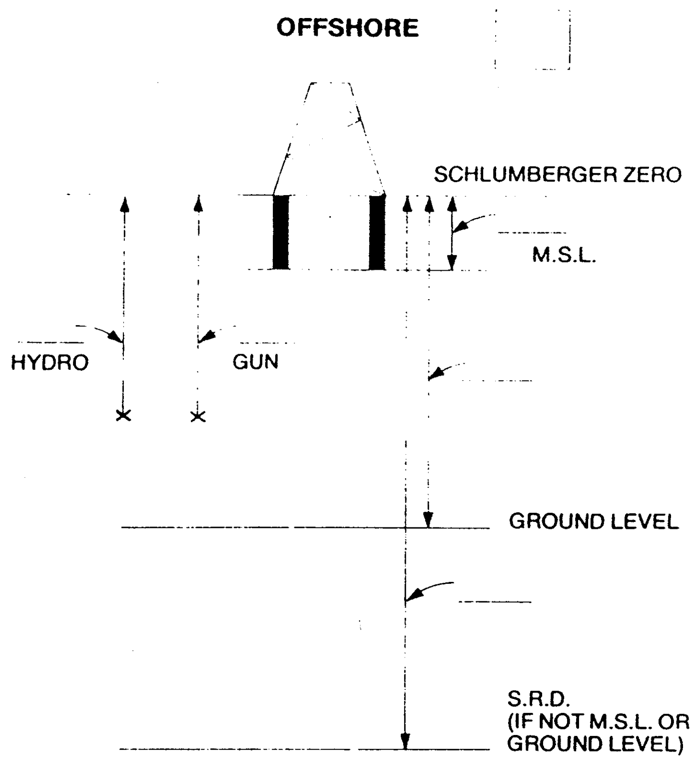
FIGURE 2

CLIENT: BEACH PETROLEUM N.L. WELL: PRINCES - 1 DATE: 04/04/1986



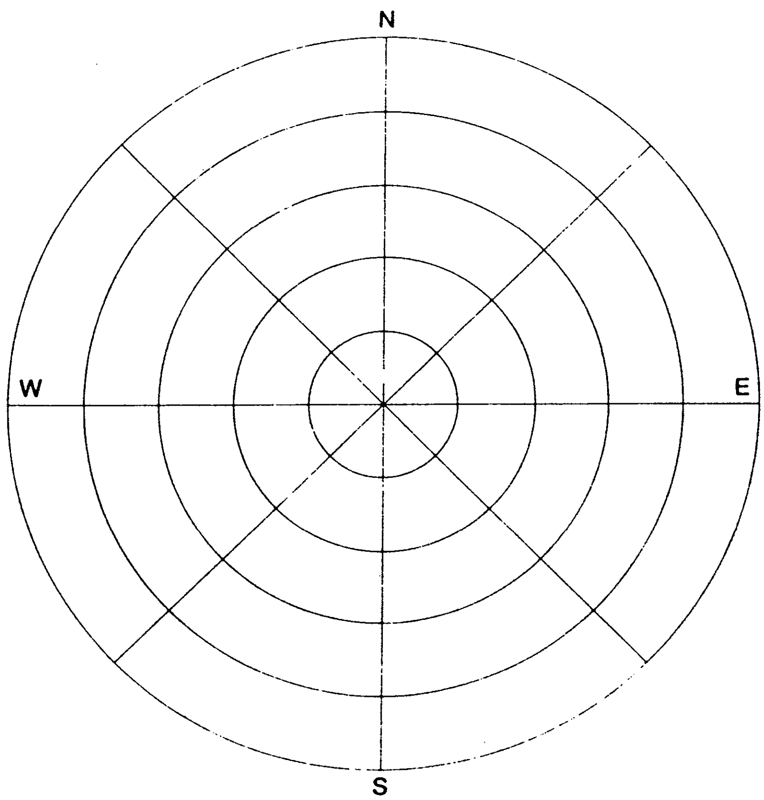
INDICATE ALL DISTANCES RELATIVE TO SCHLUMBERGER ZERO

* DELETE AS APPLICABLE



INDICATE ALL DISTANCES RELATIVE TO SCHLUMBERGER ZERO

SHOT POS'N	SOURCE OFFSET	HYDRO OFFSET	SOURCE DEPTH	HYDRO DEPTH
1	27M	2.5M FROM SOURCE	1M	1M
2				
3				
4				
5				
6				
7				



INDICATE GUN/VIBRO AND HYDROPHONE OFFSET AND AZIMUTH RELATIVE TO NORTH

istribution: White = Client; White = computing centre; Green = District; Pink = location

PRINCES-1 STACKED CHECKSHOT DATA

LEVEL	DEPTH M	TIME S	PEAK/PEAK
22	50.0	0.031	61984.00
21	115.5	0.069	27776.00
19	269.0	0.153	9582.00
18	290.0	0.163	14680.00
17	330.0	0.182	9820.[illegible]
16	378.0	0.205	6706.00
15	448.0	0.237	3672.00
14	503.0	0.264	4658.00
13	566.0	0.292	3618.00
12	610.0	0.310	4080.00
11	648.0	0.325	4398.00
10	710.0	0.350	3904.00
9	765.0	0.372	3282.00
8	815.0	0.394	3540.50
7	859.0	0.411	3725.00
6	925.0	0.434	2608.00
5	994.0	0.458	2524.00
4	1004.0	0.464	2340.50
3	1047.0	0.481	1991.00
2	1080.0	0.492	1738.00
1	1140.0	[illegible]	[illegible]

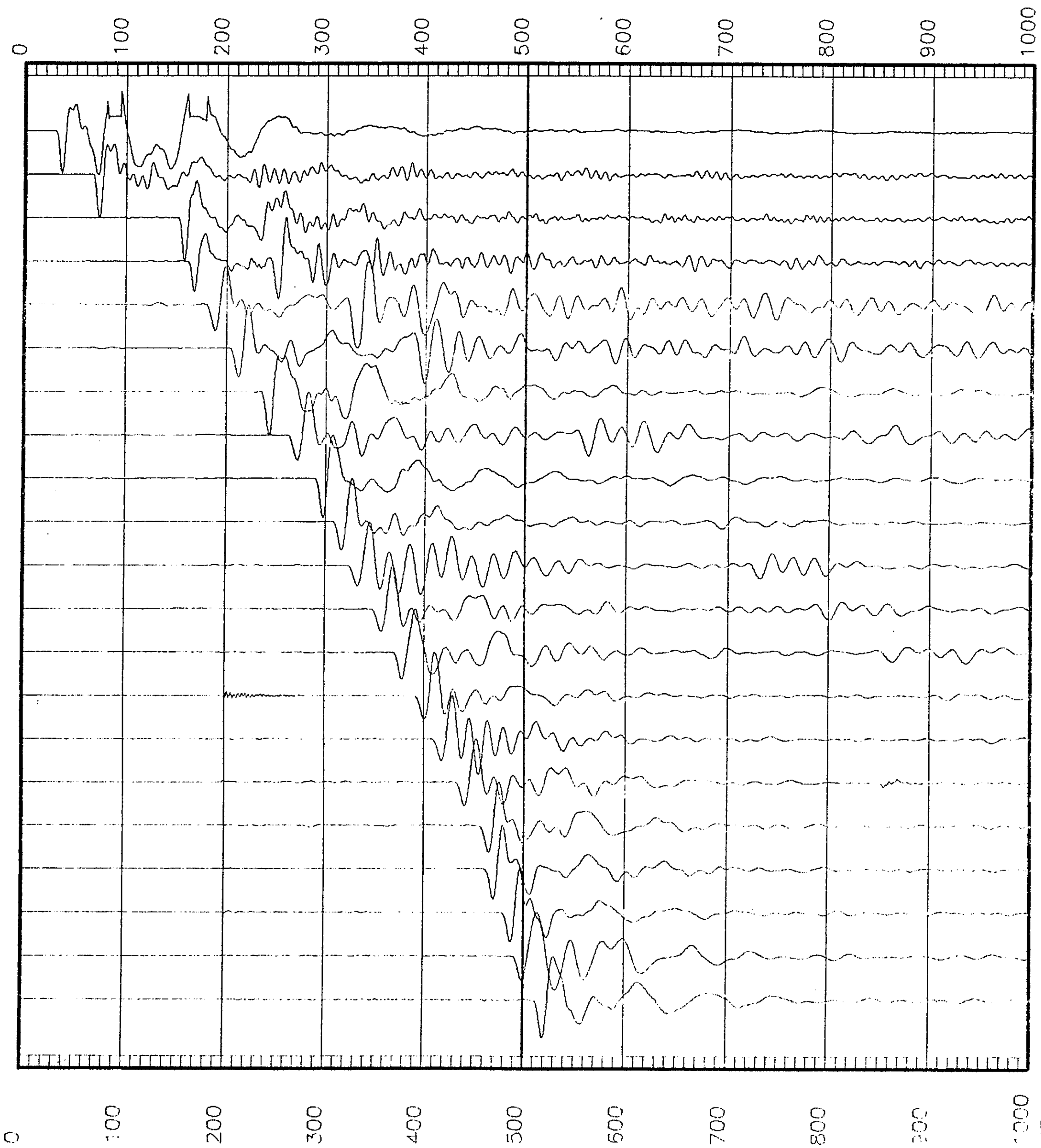


FIGURE 3

PRINCES-1 SURFACE REFRACTION SURVEY

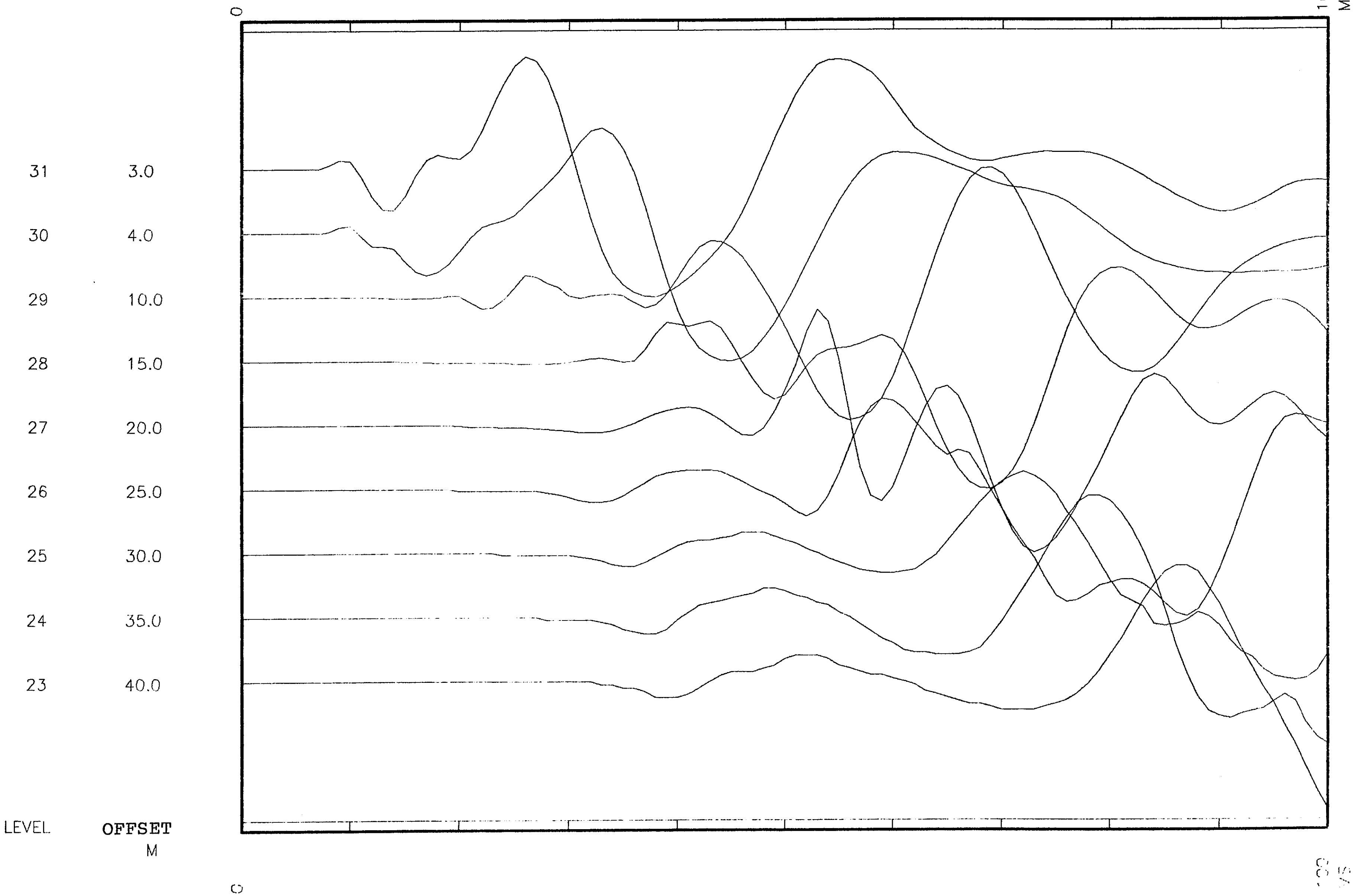


FIGURE 4

SHOTS

Shots

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*   SCHLUMBERGER  *
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GEOPHYSICAL AIRGUN REPORT

COMPANY : BEACH PETROLEUM N.L.
WELL : PRINCES-1
FIELD : WILDCAT
STATE : VICTORIA
COUNTRY : AUSTRALIA
REFERENCE: 560406

DRIFT

Drift

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*  SCHLUMBERGER  *
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DRIFT COMPUTATION REPORT

COMPANY : BEACH PETROLEUM N.L.
WELL : PRINCES-1
FIELD : WILDCAT
STATE : VICTORIA
COUNTRY : AUSTRALIA
REFERENCE: 560406

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*  SCHLUMBERGER   *
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GEOPHYSICAL AIRGUN REPORT

COMPANY : BEACH PETROLEUM N.L.
WELL : PRINCES-1
FIELD : WILDCAT
STATE : VICTORIA
COUNTRY : AUSTRALIA
REFERENCE: 560406

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*   SCHLUMBERGER   *
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SONIC ADJUSTMENT PARAMETER REPORT

COMPANY : BEACH PETROLEUM N.L.
WELL : PRINCES-1
FIELD : WILDCAT
STATE : VICTORIA
COUNTRY : AUSTRALIA
REFERENCE: 560406

LONG DEFINITIONS

GLOBAL

```
KB      - ELEVATION OF THE KELLY-BUSHING ABOVE MSL OR MWL
SRD     - ELEVATION OF THE SEISMIC REFERENCE DATUM ABOVE MSL OR MWL
EKB     - ELEVATION OF KELLY BUSHING
GL      - ELEVATION OF USER'S REFERENCE (GENERALLY GROUND LEVEL) ABOVE SRD
XSTART  - TOP OF ZONE PROCESSED BY WST
XSTOP   - BOTTOM OF ZONE PROCESSED BY WST
GAD001  - RAW SONIC CHANNEL NAME USED FOR WST SONIC ADJUSTMENT
UNFDEN  - UNIFORM DENSITY VALUE
```

ZONE

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LOFDEN  - LAYER OPTION FLAG FOR DENSITY : -1=NONE; 0=UNIFORM; 1=UNIFORM+LAYER
LAYDEN  - USER SUPPLIED DENSITY DATA
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SAMPLED

```
SHOT    - SHOT NUMBER
DKB     - MEASURED DEPTH FROM KELLY-BUSHING
DSRD    - DEPTH FROM SRD
DGL     - VERTICAL DEPTH RELATIVE TO GROUND LEVEL (USER'S REFERENCE)
SHTM    - SHOT TIME (WST)
RAWS    - RAW SONIC (WST)
SHDR    - DRIFT AT SHOT OR KNEE
BLSH    - BLOCK SHIFT BETWEEN SHOTS OR KNEE
```

(GLOBAL PARAMETERS)		(VALUE)	
ELEV OF KB AB. MSL (WST)	KB	: 115.500	M
ELEV OF SRD AB. MSL(WST)	SRD	: 150.000	M
ELEVATION OF KELLY BUSHI	EKB	: -34.5000	M
ELEV OF GL AB. SRD(WST)	GL	: -40.5000	M
TOP OF ZONE PROCD (WST)	XSTART	: 0	M
BOT OF ZONE PROCD (WST)	XSTOP	: 0	M
RAW SONIC CH NAME (WST)	GAD001	: DT.WST.003.IPA.FLP.*	
UNIFORM DENSITY VALUE	UNFDEN	: 2.30000	G/C3

(ZONED PARAMETERS)		(VALUE)		(LIMITS)		
LAYER OPTION FLAG DENS	LOFDEN	: 1.000000		30479.7	-	0
USER SUPPLIED DENSITY DA	LAYDEN	:-999.2500	G/C3	30479.7	-	0

LEVEL NUMBER	MEASURED DEPTH FROM KB M	VERTICAL DEPTH FROM SRD M	VERTICAL DEPTH FROM GL M	VERTICAL TRAVEL TIME SRD/GEO MS	INTEGRATED RAW SONIC TIME MS	COMPUTED DRIFT AT LEVEL MS	COMPUTED BLK-SHFT CORRECTION US/F
1	50.00	84.50	44.00	49.97	49.97	0	0
2	115.50	150.00	109.50	90.67	90.67	0	0
3	269.00	303.50	263.00	175.91	175.91	0	0
4	290.00	324.50	284.00	185.98	185.98	0	0
5	330.00	364.50	324.00	205.08	205.42	-.34	-2.57
6	378.00	412.50	372.00	228.17	227.13	1.05	8.78
7	448.00	482.50	442.00	260.27	257.77	2.50	6.32
8	503.00	537.50	497.00	287.32	284.00	3.33	4.59
9	566.00	600.50	560.00	315.37	312.13	3.24	-.42
10	610.00	644.50	604.00	333.40	329.90	3.50	1.80
11	648.00	682.50	642.00	348.43	344.48	3.95	3.59
12	710.00	744.50	704.00	373.46	370.05	3.41	-2.65
13	765.00	799.50	759.00	395.48	392.60	2.88	-2.93
14	815.00	849.50	809.00	417.49	413.28	4.21	8.10
15	859.00	893.50	853.00	434.51	430.77	3.73	-3.29
16	925.00	959.50	919.00	457.53	454.22	3.31	-1.97
17	994.00	1028.50	988.00	481.54	479.00	2.54	-3.39
18	1004.00	1038.50	998.00	487.54	483.16	4.38	56.08
19	1047.00	1081.50	1041.00	504.55	499.63	4.92	3.86
20	1080.00	1114.50	1074.00	515.56	511.37	4.19	-6.76
21	1140.00	1174.50	1134.00	537.57	531.98	5.59	7.11

LONG DEFINITIONS

GLOBAL

SRCDRF - ORIGIN OF ADJUSTMENT DATA
CONADJ - CONSTANT ADJUSTMENT TO AUTOMATIC DELTA-T MINIMUM = 7.5 US/F
UNERTH - UNIFORM EARTH VELOCITY (GTRFRM)

ZONE

ZDRIFT - USER DRIFT AT BOTTOM OF THE ZONE
ADJOPZ - TYPE OF ADJUSTMNENT IN THE DRIFT ZONE : 0=DELTA-T MIN, 1=BLOCKSHIFT
ADJUSZ - DELTA-T MINIMUM USED FOR ADJUSTMENT IN THE DRIFT ZONE
LOFVEL - LAYER OPTION FLAG FOR VELOCITY: -1=NONE; 0=UNIFORM; 1=UNIFORM+LAYER
LAYVEL - USER SUPPLIED VELOCITY DATA

SAMPLED

SHOT - SHOT NUMBER
VDKB - VERTICAL DEPTH RELATIVE TO KB
DSRD - DEPTH FROM SRD
DGL - VERTICAL DEPTH RELATIVE TO GROUND LEVEL (USER'S REFERENCE)
KNEE - KNEE
BLSH - BLOCK SHIFT BETWEEN SHOTS OR KNEE
DTMI - VALUE OF DELTA-T MINIMUM USED
COEF - DELTA-T MIN COEFFICIENT USED IN THE DRIFT ZONE
DRGR - GRADIENT OF DRIFT CURVE

(GLOBAL PARAMETERS)		(VALUE)	
ORIG OF ADJ DATA (WST)	SRCDRF	: 2.00000	
CONS SONIC ADJUST (WST)	CONADJ	: 7.50000	US/F
UNIFORM EARTH VELOCITY	UNERTH	: 2173.60	M/S

(ZONED PARAMETERS)		(VALUE)		(LIMITS)		
USER DRIFT ZONE (WST)	ZDRIFT	: 4.200000	MS	1140.00	-	538.000
		3.000000		538.000		290.000
		0		290.000		0
ADJUSMNT MODE (WST)	ADJOPZ	:-999.2500		30479.7	-	0
USER DELTA-T MIN (WST)	ADJUSZ	:-999.2500	US/F	30479.7	-	0
LAYER OPTION FLAG VELOC	LOFVEL	: 1.000000		30479.7	-	0
USER VELOC (WST)	LAYVEL	: 2086.000	M/S	290.000	-	269.000
		1901.000		269.000		115.500
		1609.000		115.500		50.0000

COMPANY : BEACH PETROLEUM N.L. WELL : PRINCES-1

KNEE NUMBER	VERTICAL DEPTH FROM KB M	VERTICAL DEPTH FROM SRD M	VERTICAL DEPTH FROM GL M	DRIFT AT KNEE MS	BLOCKSHIFT USED US/F	DELTA-T MINIMUM USED US/F	REDUCTION FACTOR G	EQUIVALENT BLOCKSHIFT US/F
1	0	34.50	-6.00	0				
					0			0
2	290.00	324.50	284.00	0				
					3.69			3.69
3	538.00	572.50	532.00	3.00				
					.61			.61
4	1140.00	1174.50	1134.00	4.20				

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*                *
*  SCHLUMBERGER  *
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VELOCITY REPORT

COMPANY : BEACH PETROLEUM N.L.

WELL : PRINCES-1

FIELD : WILDCAT

STATE : VICTORIA

COUNTRY : AUSTRALIA

REFERENCE: 560406

LONG DEFINITIONS

GLOBAL

KB - ELEVATION OF THE KELLY-BUSHING ABOVE MSL OR MWL
SRD - ELEVATION OF THE SEISMIC REFERENCE DATUM ABOVE MSL OR MWL
EKB - ELEVATION OF KELLY BUSHING
GL - ELEVATION OF USER'S REFERENCE (GENERALLY GROUND LEVEL) ABOVE SRD
UNERTH - UNIFORM EARTH VELOCITY (GTRFRM)

ZONE

LOFVEL - LAYER OPTION FLAG FOR VELOCITY: -1=NONE; 0=UNIFORM; 1=UNIFORM+LAYER
LAYVEL - USER SUPPLIED VELOCITY DATA

SAMPLED

SHOT - SHOT NUMBER
DKB - MEASURED DEPTH FROM KELLY-BUSHING
DSRD - DEPTH FROM SRD
DGL - VERTICAL DEPTH RELATIVE TO GROUND LEVEL (USER'S REFERENCE)
SHTM - SHOT TIME (WST)
ADJS - ADJUSTED SONIC TRAVEL TIME
SHDR - DRIFT AT SHOT OR KNEE
REST - RESIDUAL TRAVEL TIME AT KNEE
INTV - INTERNAL VELOCITY, AVERAGE

(GLOBAL PARAMETERS)			(VALUE)	
ELEV OF KB AB. MSL (WST)	KB	:	115.500	M
ELEV OF SRD AB. MSL(WST)	SRD	:	150.000	M
ELEVATION OF KELLY BUSHI	EKB	:	-34.5000	M
ELEV OF GL AB. SRD(WST)	GL	:	-40.5000	M
UNIFORM EARTH VELOCITY	UNERTH	:	2133.60	M/S

(ZONED PARAMETERS)			(VALUE)		(LIMITS)		
LAYER OPTION FLAG VELOC	LOFVEL	:	1.000000		30479.7	-	0
USER VELOC (WST)	LAYVEL	:	2086.000	M/S	290.000	-	269.000
			1801.000		269.000		115.500
			1609.000		115.500		50.0000

LEVEL NUMBER	MEASURED DEPTH FROM KB M	VERTICAL DEPTH FROM SRD M	VERTICAL DEPTH FROM GL M	VERTICAL TRAVEL TIME SRD/GEOPH MS	INTEGRATED ADJUSTED SONIC TIME MS	DRIFT = SHOT TIME - RAW SON MS	RESIDUAL = SHOT TIME - ADJ SON MS	ADJUSTED INTERVAL VELOCITY M/S
1	50.00	84.50	44.00	49.97	49.97	0	0	1691
2	115.50	150.00	109.50	90.67	90.67	0	0	1609
3	269.00	303.50	263.00	175.91	175.90	0	.01	1801
4	290.00	324.50	284.00	185.98	185.97	0	.01	2085
5	330.00	364.50	324.00	205.08	205.39	-.34	-.81	2008
6	378.00	412.50	372.00	228.17	228.13	1.05	-.01	2154
7	448.00	482.50	442.00	260.27	259.68	2.59	.59	2222
8	503.00	537.50	497.00	287.32	286.55	3.33	.77	2046
9	566.00	600.50	560.00	315.37	315.18	3.24	.19	2201
10	610.00	644.50	604.00	333.40	333.03	3.50	.37	2464
11	648.00	682.50	642.00	348.43	347.69	3.95	.74	2594
12	710.00	744.50	704.00	373.46	373.38	3.41	.08	2413
13	765.00	799.50	759.00	395.48	396.04	2.39	-.56	2427
14	815.00	849.50	809.00	417.49	416.83	4.21	.67	2406
15	859.00	893.50	853.00	434.51	434.40	3.73	.11	2503
16	925.00	959.50	919.00	457.53	457.98	3.31	-.45	2800
17	994.00	1028.50	988.00	481.54	482.90	2.54	-1.36	2768
18	1004.00	1038.50	998.00	487.54	487.08	4.38	.46	2392
19	1047.00	1081.50	1041.00	504.55	503.63	4.92	.92	2598
20	1080.00	1114.50	1074.00	515.56	515.43	4.19	.13	2796
21	1140.00	1174.50	1134.00	537.57	536.14	5.59	1.42	2897

Time / Depth

TIME/DEPTH

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*                 *
*   SCHLUMBERGER  *
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TIME CONVERTED VELOCITY REPORT

COMPANY : BEACH PETROLEUM N.L.
WELL : PRINCES-1
FIELD : WILDCAT
STATE : VICTORIA
COUNTRY : AUSTRALIA
REFERENCE: 560406

Synthetic

SYNTHETIC

APPENDIX 6

PALYNOLOGICAL STUDIES

PALYNOLOGY REPORT

BIOSTRATIGRAPHY, PALAEOENVIRONMENTS, AND HYDROCARBON SOURCE POTENTIAL OF PRINCES NO.1, 603m - 1046m (LATE CRETACEOUS - TERTIARY) OTWAY BASIN

by

MARY E. DETTMANN

Prepared for

BEACH PETROLEUM N.L.

May 1986

SUMMARY

Palynomorphs extracted from Princes No.1 between 603m and 1046m indicate that the section ranges in age from Cenomanian to Paleocene. Sediments examined were deposited in close-to-land, marginal marine to paralic situations. The organic component of the sediments is predominantly of land plant derivation and chiefly comprises hydrogen-lean macerals that are gas prone when mature. High yields of organic matter from samples at 603m, 1002m, and 1023m indicates good potential for hydrocarbon generation. The yellow colouration of the spores suggests that the section is immature and lies within the immature dry gas zone.

SAMPLE			SOURCE POTENTIAL				OIL SOURCE POTENTIAL				MATURATION					BIOSTRAT.	AGE	DEPOSITIONAL ENVIRONMENT			
type	depth	lithol.	low	mod.	high	v.high	poor	ltd.	fair	good	IM	EM	M	LM	OM			terr.	par.	m.mar.	mar.
swc	603	sst.			*		*				*					L. balmei	Paleoc.		*		
swc	643	cly/sst.	*				*				*					T. longus	Camp/Maast.			*	
swc	1002	clyst.			*		*				*					C. triplex	Tur.			*	
swc	1023	cly/sst.			*			*			*					C. triplex	Tur.			*	
swc	1046	cly/sst.	*					*			*					A. distocar.	Cen/Tur.			*	
			0.8	1.2	2.4		20	60	80		GY 1.8	Y 2.2	A 2.5	Br 3.0	Bl						
			(ml OM/10gm) KEROGEN YIELD				% H-RICH KEROGEN				SPORE COLOUR/ TAI VALUE										

TABLE 1. Summary of palynological results showing inferred hydrocarbon source potential, oil source potential, maturation age, and palaeoenvironments of sediments between 603m and 1046m in Princes No.1.

INTRODUCTION

Five sidewall cores from between 603m and 1046m in Princes No.1, Otway Basin have been palynologically analysed to ascertain the age and biostratigraphic relationships of the sediments, the palaeoenvironments at and around the depositional site, and the hydrocarbon source potential and maturation levels of the enclosed organic matter. Table 1 summarises these results. Species distributions are shown on Table 2 and source rock/maturation data, as determined palynologically, are incorporated in Table 3.

Sample processing and analyses follows procedures denoted in a previous report (Dettmann 1986).

BIOSTRATIGRAPHY AND AGE

All samples proved to be palynologically productive and the contained assemblages indicate an age range of Late Cretaceous to Early Tertiary. Biostratigraphic synthesis is in terms of the spore-pollen zones of Dettmann & Playford (1969), Stover & Evans (1973) and Stover & Partridge (1973) and the dinoflagellate zones of Helby et al. (in prep.) and Partridge (1976).

1. 603m; L. balmei Zone, Paleocene

The presence of Lygistepollenites balmei, Gambierina edwardsii and Malvacipollis diversus in an assemblage containing abundant proteaceous pollen and infrequent Nothofagidites indicate attribution to the L. balmei Zone of Stover & Evans (1973) and equivalent G. edwardsii Zone of Harris (1965).

A Paleocene age is indicated. The sampled horizon is thus equivalent in age to the basal part of the Pebble Point Formation studied by Harris (1965). Algal microfossils, although common, are taxonomically restricted and species observed lack resolution in terms of the latest Cretaceous and Early Tertiary zonal schemes of Helby *et al.* (in prep.) and Partridge (1976).

2. 643m; *T. longus* Zone/ *I. korojonense* Zone, late Campanian-Maastrichtian

The spore-pollen assemblage includes common *Gambierina* together with diverse proteaceous pollen and *Tricolpites longus* and is indicative of the *T. longus* Zone as delineated in the Gippsland Basin. The presence of common *Isabelidinium pellucida* and *Manumiella conoratum* in the restricted dinocyst assemblage supports reference to the *I. korojonense* Zone and illustrates that, in the Otway Basin, the latter zone correlates in part with the *T. longus* Zone (cf. Frakes *et al.* in press, Table 2). Sediments at 643m in Princes No.1 are thus of late Campanian or Maastrichtian age.

3. 1002m - 1023m; *C. triplex* Zone, Turonian

Samples examined from 1002m and 1023m contain *Phyllocladidites mawsonii* and *Clavifera triplex* and are referred to the *C. triplex* Zone of Turonian age. Dinoflagellates occur in both samples. Neither assemblage is sufficiently diagnostic for precise zonal attribution; they are, however, comparable to those reported from the mid Cretaceous of the Otway Basin.

The palynological evidence thus indicates that the section 1002m to 1023m in Princes No.1 is equivalent in age to sediments at 1832.5m in Westgate No.1A (Dettmann 1986).

4. 1046m; A. distocarinatus Zone, Cenomanian/Turonian

The diverse spore-pollen assemblage contains Appendicisporites distocarinatus in association with Phimopollenites pannosus and Liliacidites intermedius and lacks indices of the C. triplex Zone. Accordingly, the sample is referred to the A. distocarinatus Zone of Cenomanian/Turonian age. The dinoflagellate evidence provides general support for a mid Cretaceous age, but species encountered are not definitive with respect to the mid Cretaceous dinoflagellate zones delineated by Helby et al. (in prep.).

Similar palynomorph assemblages were reported from Westgate No.1A at 1848.5m indicating correlation of those sediments with Princes No.1, 1046m (Dettmann 1986).

PALAEOENVIRONMENTS

Organic matter extracted from the samples is dominantly of land plant derivation, with minor contributions of algal and fungal material. Additionally, recycled palynomorphs occur in all samples. The sediments are interpreted to have accumulated in close-to-land strandline situations subjected to marine influence. Further discussion of the palaeoenvironments is given below.

1. 603m; Paleocene

The sample provided a high volume of organic matter mostly derived from terrestrial sources. Algal microfossils include chlorophycean and dinophycean forms suggestive of fresh to brackish environments. Deposition occurred in a terrestrial situation subjected to minor marine influence and source sediments include the erosion products of Permian and possibly

Early Cretaceous sequences.

2. 643m; late Campanian-Maastrichtian

The low yield of organic matter recovered from the sample is mostly of land plant origin. Algal input is largely from Peridinium-type cysts suggestive of restricted marine influence. Sediment source included Permian and Early Cretaceous sequences.

3. 1002m - 1046m; Cenomanian-Turonian

Moderate to high volumes of organic matter extracted from the samples investigated is largely of terrestrial origin and derived from dryzone and rainforest vegetation. This was deposited in close-to-land situations subjected to marine influence. Source sediments included erosion products of Permian, Triassic and Early Cretaceous strata.

SOURCE ROCK POTENTIAL AND MATURATION

Source rock and maturation assessments are based on methods outlined in a previous report (Dettmann 1986).

Samples from 603m, 1002m, and 1023m provided high yields of organic matter and have potential to support significant hydrocarbon generation when mature. Samples from 645m and 1046m provided lesser volumes of OM and have limited source potential (Table 3).

OM of the samples is chiefly of opaque land plant detritus that is predominantly gas prone. Colouration of the spores indicates that the sequence is immature and lies within the immature dry gas zone (Table 3).

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University of Queensland
St. Lucia, Qld. 4067

19 May, 1986.

TABLE 2 PALYNOMORPH DISTRIBUTION

COMPANY: BEACH PETROLEUM N.L. Sheet 1 of 5

WELL: PRINCES No. 1 BASIN: OTWAY

Sample type	s	s	s	s	s
Palynomorph / Depth (m)	1046	1023	1002	643	603
CRYPTOGAM SPORES:					
Triporoletes reticulatus	+	+	+		
Dictyophyllidites crenatus	+				
Stoverisporites microverrucatus	+	+	+		
Biretisporites cf. potoniae	+			+	
Cicatricosisporites australiensis	+		+		
Gleicheniidites circinidites	+	+	+		+
Cyathidites australis/minor	+	+	+	+	+
Cyathidites punctatus	+	+	+		
Retitriletes austroclavatidites	+	+	+	+	
Ceratosporites equalis	+	+	+	+	+
Ornamentifera sp.	+				
Foraminisporis asymmetricus	+	+			
Klukisporites scaberis	+				
Coptospora paradoxa	+	+			
Foraminisporis dailyi	+	+			
Appendicisporites distocarinatus	+	+	+		
Matonisporites cooksoniae	+				
Arcellites sp.	+				
Crybelosporites sp.	+				
Baculatisporites comaumensis	+	+		+	+
Laevigatosporites ovatus	+	+		+	
Stereisporites antiquasporites	+	+	+	+	+
Leptolepidites verrucatus	+		+		
Punctatosporites sp.	+	+		+	
Trilites cf. tuberculiformis		+			
Camarazonosporites sp.		+			
Camarazonosporites ambigens		+			
'Foraminisporis' intraverrucatus		+	+		
Microfoveolatosporis canaliculatus		+	+		
Ischyosporites punctatus		+			
Sestrosporites pseudoalveolatus		+			
Foveogleicheniidites confossus		+	+		
Densoisporites velatus		+	+		
Balmeisporites holodictyus		+			

Sample type: S = Sidewall core; C = Conventional core;
D = Cuttings.

TABLE 2 PALYNOMORPH DISTRIBUTION

COMPANY: BEACH PETROLEUM N.L.

WELL: PRINCES No.1 **BASIN:** OTWAY

Sample type	S	S	S	S	S
Palynomorph / Depth (m)	1046	1023	1002	643	603
Cyatheacidites annulatus		+			
Trilobosporites trioreticulosus		+			
Cicatricosisporites cuneiformis		+	+		
Cicatricosisporites hughesii		+	+		
Stereisporites pocockii		+	+		
Clavifera triplex		+	+		+
Camarozonosporites australis			+		
Perotriletes laceratus			+		
Cicatricosisporites pseudotripartitus			+		
Dictyophyllidites pectinataeformis			+		
Reticulosporis punctatus				+	
Camarozonosporites ohaiensis				+	+
Foveosporites moretonensis				+	
Camarazonosporites amplus				+	
Grapnelispora sp.				+	
Camarazonosporites bullatus				+	+
Stereisporites sp.				+	+
Reticulosporis albertensis				+	
Verrucatosporites speciosus					+
Peromonolites densus					+
Kraeuselisporites pappilatus					+
GYMNOSPERMOUS POLLEN:					
Alisporites similis	+	+	+		
Alisporites grandis	+	+		+	
Cycadopites nitidus	+		+		
Classopollis chateaunovii	+	+	+		
Classopollis sp.	+	+			
Balmeisporites limbatus	+		+		
Hoegisporis sp.	+	+	+		
Microcachryidites antarcticus	+	+	+	+	+
Podocarpidites ellipticus	+	+	+	+	+
Araucariacites australis	+	+	+		+
Vitreisporites pallidus		+			
Trisaccites microsaccatus		+		+	
Phyllocladidites mawsonii		+	+	+	+

Sample type: S = Sidewall core; C = Conventional core; D = Cuttings.

TABLE 2 PALYNOMORPH DISTRIBUTION

COMPANY: BEACH PETROLEUM N.L.

WELL: PRINCES No. 1 BASIN: OTWAY

Sample type	S	S	S	S	S
Palynomorph / Depth (m)	1046	1023	1002	643	603
Phyllocladidites verrucosus				+	
Lygistepollenites balmei				+	+
Lygistepollenites florinii				+	+
Dilwynites granulatus					+
Lygistepollenites ellipticus					+
ANGIOSPERMOUS POLLEN:					
Phimopollenites pannosus	+	+	+		
Liliacidites intermedius	+	+	+		
Tricolpites sp.		+			
Nyssapollenites sp.			+		
Triorites minor			+		
Cranwellispollis sp.			+		
Propylipollis sp.			+		
'Proteacidites' amolosexinus				+	
Nothofagidites sp. fusca-type				+	
Tricolpites gillii				+	+
Gambierina edwardsii				+	+
Nothofagidites senectus				+	+
Proteacidites subscabratus				+	+
Proteacidites adenanthoides				+	
Propylipollis scaboratus				+	+
Tricolporites leuros				+	
Australopollis obscurus				+	+
Tricolpites sabulosus				+	
Tricolpites longus				+	
Tricolpites confessus				+	
Liliacidites lanceolatus				+	+
Cranwellipollis palisadus				+	
Tricolpites phillipsii				+	+
Triporopollenites sectilis					+
Myrtaceadites eugenioides					+
Nothofagidites endurus					+
Malvacipollis diversus					+
Proteacidites crassus					+
Haloragicidites harrisii					+

Sample type: S = Sidewall core; C = Conventional core; D = Cuttings.

TABLE 2 PALYNOMORPH DISTRIBUTION

COMPANY: BEACH PETROLEUM N.L. Sheet 4 of 5

WELL: PRINCES No. 1 BASIN: OTWAY

Sample type	s	s	s	s	s
Palynomorph / Depth (m)	1046	1023	1002	643	603
Proteacidites rectomarginus					+
Caryophyllidites polyoratus					+
Diporites sp.					+
Nothofagidites brachyspinulosus					+
Propylipollis reticuloscabratus					+
Bankseidites elongatus					+
Proteacidites ornatus					+
Anacolosidites acutulus					+
Ilexipollenites sp.					+
Nothofagidites flemingii					+
ALGAL MICROFOSSILS:					
Callialasphaeridium asymmetricum	+				
Cyclonephelium compactum	+	+			
Coronifera oceanica	+	+			
Oligosphaeridium pulcherinum	+	+			
Oligosphaeridium complex	+				
Cyclonephelium distinctum	+	+			
Palaeoperidinium sp.	+				
Spiniferites ramosus	+	+			
Odontochitina operculata	+	+			
Sigmopollis cf. carbonis	+				
Microdinium ornatum		+			
Odonotchitina striatoperforata		+			
Cribroperidinium edwardsii		+			
Ascodinium cf. acrophorum		+			
Amosopollis cruciformis		+	+		
Lecaniella ap.		+	+		
Heterosphaeridium heteracanthum			+		
Florentina sp.			+		
Hexagonifera glabrum			+		
Ascodinium ?parvum			+		
Isabelidinium pellucidum				+	
Manumiella conoratum				+	
Paralecaniella indentata					+
Alterbia sp.				+	

Sample type: S = Sidewall core; C = Conventional core;
D = Cuttings.

TABLE 2 PALYNOMORPH DISTRIBUTION

COMPANY: BEACH PETROLEUM N.L.

WELL: PRINCES No.1 BASIN: OTWAY

Sample type	S	S	S	S	S
Palynomorph / Depth (m)	1046	1023	1002	643	603
Ceratiopsis obliquipes					+
Renidinium vitilare					+
FUNGAL PALYNOMORPHS:					
Spores and/or hyphae	+	+	+	+	+
RECYCLED PALYNOMORPHS:					
Plicatipollenites gondwanensis	+		+	+	+
Pseudoreticulatospora pseudoretic.	+				
Rogalskaisporites cicatricosus	+				
Camarazonosporites ramosus	+				
Cyclosporites hughesii	+			+	
Contignisporites multimuratus	+				
Aratrisporites parvispinosus		+			
Dulhuntyispora parvithola			+		
Granulatisporites trisinus			+		
Didecitriletes ericianus			+		
Striatoabieites sp.					+

Sample type: S = Sidewall core; C = Conventional core;
D = Cuttings.

SAMPLE	DEPTH (m)	LITHOLOGY	ORGANIC MATTER																
			AMOUNT (ml/10gm)	TYPE (% composition)													MATURITY		
				Alginite			Sporin./Cutin.				Woody tissue	Humic		Vitr.		Inertinite	Spore Colour	T.A.I. (after Staplin 1982)	Interpreted Maturity Level
				Dispersed	Dense	Algal cysts	Fine (<10µm)	Spores	Leaf tissue	Other		<20µm	>20µm	<20µm	>20µm				
swc 26	603	sandstone, dk. grey, f. gr.	1.5	5	5	+	-	+	-	-	-	40	+	5	25	20	greenish yellow	1.5	immature
swc 23	643	claystone, dk. grey, & sand	0.5	5	-	+	-	+	-	-	-	20	+	10	40	20	greenish yellow	1.5	immature
swc 9	1002	claystone, dk. grey	1.3	10	-	+	-	5	+	5	-	25	+	10	30	15	greenish yellow	1.7	immature
swc 6	1023	interlam. claystone, dk. grey & f. gr. med. grey sandst	1.2	5	-	+	5	10	+	10	+	10	+	20	40	+	greenish yellow	1.7	immature
swc 4	1046	interlam. dk. grey claystone & sandstone, f. gr., l. grey	0.8	+	-	+	10	10	+	10	+	-	+	20	50	+	greenish yellow	1.7	immature

TABLE 3. Organic matter, Princes No.1, sidewall cores, 603m - 1046m.

APPENDIX 7

SOURCE ROCK STUDIES

PRINCES NO. 1

K.K. No.	Depth (m)	$\bar{R}_v$max	Range	N	Description including Exinite Fluorescence
					Dilwyn Formation 377.5 m
					Pember Mudstone 548.0 m
					Pebble Point Formation 602.0 m/625.0 m?
					Paaratte Formation 647.5 m
x5123	772.5 SWC 17	0.49	0.34–0.59	28	Sparse sporinite and liptodetrinite, yellow to orange yellow, rare resinite, greenish yellow and orange yellow, rare cutinite, yellow orange. (Sandy siltstone. Dom common, I>V>E. Inertinite common, vitrinite and exinite sparse. Pyrite sparse.)
	$\bar{R}_I$	0.91	0.60–1.82	19	
					Skull Creek Member 807.5 m
x5124	857 SWC 14	0.43	0.35–0.53	25	Sparse liptodetrinite and sporinite, yellow to yellow orange, rare cutinite, yellow orange, rare phytoplankton, greenish yellow, rare resinite, yellow. (Silty sandstone. Dom common, I>V>E. Inertinite common, vitrinite and exinite sparse. Some vitrinite shows weak brown fluorescence. Glauconite abundant. Pyrite sparse.)
	$\bar{R}_I$	1.05	0.82–1.38	14	
					Nullawarre Greensand Member 858.5 m
					Belfast Mudstone 994.0 m
x5125	995 SWC 10	-	-	-	Rare to sparse sporinite, bright yellow to orange, rare liptodetrinite, bright yellow to dull orange, rare phytoplankton, greenish yellow to yellow. (Siltstone>sandstone. Dom common, I>E. Inertinite and exinite sparse, vitrinite absent. Sand sized glauconite major. Pyrite common.)
	$\bar{R}_I$	1.06	0.70–1.66	10	
					Flaxmans/Waarre Formation 1000.5 m
x5126	1023 SWC 6	0.44	0.28–0.54	29	Sparse sporinite, yellow to orange, rare cutinite, yellow orange, rare resinite, yellow, rare ?phytoplankton, greenish yellow to yellow, rare bituminite, brown. (Siltstone> sandstone. Dom common, I>V>E. Inertinite common, vitrinite and exinite sparse. Pyrite common.)
					Eumeralla Formation 1045.0 m
x5127	1046 SWC 4	0.46	0.45–0.46	2	Rare to sparse liptodetrinite, yellow to orange, rare cutinite, yellow to orange, rare resinite, yellow, rare sporinite, yellow to orange. (Siltstone>claystone> sandstone. Dom common, I>E>V. Inertinite and exinite sparse, vitrinite rare. Pyrite abundant.)
	$\bar{R}_I$	1.18	0.86–1.62	15	
x5128	1132 SWC 1	-	-	-	Rare resinite, yellow, rare sporinite and liptodetrinite, yellow to orange. (Sandstone>claystone>carbonate. Dom rare to sparse, E>I. Exinite rare to sparse, inertinite rare, vitrinite absent. Green fluorescing ?oil droplets rare. Pyrite sparse.)
	$\bar{R}_I$	1.01	0.84–1.26	5	

PRINCES NO.1

KK No.	Depth (m)	TOC
x5123	772.5	2.02
x5124	857	1.30
x5125	995	1.05
x5126	1023	2.26
x5127	1046	1.38
x5128	1132	0.22

APPENDIX 8

PETROGRAPHY & X-RAY DIFFRACTION ANALYSIS

The Australian
[illegible]eral Development
Laboratories

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South Australia 5063
Phone Adelaide (08) 79 1662
Telex AA82520

Please address all
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P.O. Box 114 Eastwood
SA 5063
In reply quote:

amdel

26 May 1986

GS 3/944/0

Beach Petroleum,
P.O. Box 360,
CAMBERWELL, VIC. 3124

ATT: I. BUCKINGHAM - CHIEF GEOLOGIST

REPORT G 6679/86

YOUR REFERENCE:	Letter dated 16/4/86
IDENTIFICATION:	See report
MATERIAL:	Sidewall core samples
LOCALITY:	Princes No. 1 Well, 45 km east of Warrnambool, Vic.
DATE RECEIVED:	28 April 1986
WORK REQUIRED:	Petrography (5 Codes R5.1 and R5.2), X-ray Diffraction (5 Code R5.3) and SEM examination (5 Code R5.4).

Investigation and Report by: Frank Radke, Michael Till & C.M. Fanning

Manager - Geological Services Section: Dr Keith J Henley

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PETROLOGY OF FIVE SANDSTONES FROM THE PRINCES NO. 1 WELL

1. SUMMARY

Five sidewall core samples from the Princes No. 1 Well submitted by Beach Petroleum for petrologic examination were given the following rock names:

Sample Core No.	Sample Depth (m)	Thin Section No.	Sample Name
5	1041.5	TSC47275	Sandstone
8	1006.5	TSC47276	Sandstone
21	650.5	TSC47277	Fine Grained Sandstone
25	629.0	TSC47278	Sandstone
29	542.0	TSC47279	Sandstone

All of the above samples are quartz-rich sandstones with a relatively immature character containing at least moderate amounts of detrital feldspar and lithic clasts. In general the detrital feldspar grains and lithic clasts are quite fresh showing very little if any alteration. All of these samples have a high porosity ranging from approximately 10% to 25% pores and although the original rocks are thought to be highly porous at least some of this porosity has been produced during sampling.

The rocks contain minor interstitial clay which is generally comprised of kaolinite but in general have a relatively clean character which is indicated both in thin section and by the low proportions (between 1 and 6%) of minus 2 micron material. Although kaolinite is the major clay mineral in most samples, Core 25 (629.0m) has chlorite as the major clay mineral. Smectite and a mica/illite are also present in most samples. Minor siderite occurs as fine intergrowths with the interstitial clay in some samples and is thought to represent an authigenic product.

These samples are immature and well sorted, clay poor sands thought to represent a deposit from a high energy environment such as a channel sand or similar deposit.

2. X-RAY DIFFRACTION

Weighed subsamples were taken and dispersed in water with the aid of deflocculants and an electric blender, and allowed to sediment to produce -2 μm e.s.d. size fractions by the pipette method. The resulting dispersions were examined by plummet balance to determine their solids contents, and were than used to produce oriented clay preparations on ceramic plates. Two plates were prepared per sample, both being saturated with Mg^{++} ions, and one in addition being treated with glycerol. When air-dry, these were examined in the X-ray diffractometer. Various additional diagnostic examinations were carried out as required, including examination of the glycerol-free plate hot (~130°C) and after heating for one hour at 550°C.

The results are given in Table 1, which lists the following:

(a) The proportion of the sample found to separate into the -2 μm size fraction, as determined by the plummet balance. The figure obtained applies only to the pre-treatment and dispersion conditions used.

(b) The mineralogy of the -2 μm fraction with the minerals listed in approximate order of decreasing abundance, using the semiquantitative abbreviations given.

Table 1 shows that these samples contain a small proportion of -2 μm fraction indicating a relatively small clay component. This is further supported by petrographic examination which shows only small proportions of interstitial clay. The clay in most samples consists of kaolinite although chlorite is the major clay in Core 25 (629.0m). Chlorite is present at trace to accessory levels in all the other samples as is a mica/illite component. Smectite is present in all samples except for Core 21 (650.5m).

3. SCANNING ELECTRON MICROSCOPY

Small fractured pieces were mounted on aluminium stubs and coated with evaporated carbon and gold-palladium layers. The coated fragments were examined using a Philipps 505 SEM. Where appropriate mineral compositions were identified using a Tracor Northern TN5500 energy dispersive analytical system.

Polaroid positive/negative film was used to photograph lower-magnification overall views, and higher magnification photographs were taken to show details of interest. A selection of photographs is given as Plate 6-15. The length of the scale bar is in either millimetres (mm) or microns (μm) as indicated on each photograph.

4. PETROGRAPHY

All of the thin sections described in this report have been impregnated with a blue dyed resin to indicate porosity.

Photomicrographs showing typical fields in both plane light and crossed nicols are given in Plate 1-5. In these photomicrographs porosity is indicated by the blue dyed resin. The number in parentheses under each photomicrograph refers to the negative number. The 35 mm colour negatives and polaroid black and white negatives are enclosed with this report.

SAMPLE: Core 5, 1041.5m: TSC47275

Rock Name:
Sandstone

Thin Section:
An optical estimate of the constituents gives the following :

	%
Quartz	40
Lithic clasts	15
Feldspar	10
Clay	10
Mica	Tr
Opaques and semi-opaques	1
Pores	25

This sample consists mainly of quartz grains along with smaller amounts of lithic clasts and feldspar grains with an interstitial, argillaceous matrix. The quartz grains are generally between 0.15 and 2 mm in size and exhibit angular to subrounded shapes. The feldspar grains consist both of polysynthetically twinned plagioclase and grid-iron twinned microcline and tend to form angular grains up to about 1 mm in size. Some of the microcline exhibits perthitic intergrowths.

The lithic clasts typically have subrounded to subangular shapes and range up to about 1.5 mm in size. Most of the lithic clasts consist of fine grained argillaceous material comprised largely of muscovite/sericite and small biotite flakes and most likely represent shales or possibly low grade metamorphic rocks. Some volcanic rock clasts including finely granular, felsic rocks and fine grained feldspar-rich rocks (possible andesites) are also present.

The interstitial matrix consists mainly of weakly birefringent clay intergrown with smaller amounts of birefringent sericitic phyllosilicates. The weakly birefringent clay forms moderately well developed flakes with a fibrous texture or very finely divided flaky aggregates. This interstitial clay is concentrated in localised areas up to several millimetres in size which have a much less porous character. Other portions of the thin section contain very little interstitial clay and have a highly porous character containing interstitial voids typically between 0.3 and 0.5 mm wide. The high porosity of this rock is thought to be largely due to disturbance during sampling rather than original porosity.

The rock contains a small number of mica flakes up to 0.4 mm wide which are thought to be of detrital origin. These flakes typically have highly degraded appearing textures containing intergrowths of finely divided translucent iron and titanium minerals. Opaque to translucent iron and titanium oxides also form small disseminated grains and aggregates up to 0.3 mm wide which are typically intergrown with the argillaceous matrix or form irregular, interstitial patches.

This is an immature detrital sediment containing abundant quartz grains and relatively fresh lithic clasts and feldspar grains weakly cemented by an interstitial argillaceous matrix.

SAMPLE: Core 8, 1006.5m: TSC47276

Rock Name:
Sandstone

Thin Section:
An optical estimate of the constituents gives the following :

	%
Quartz	55
Clay	15
Feldspar	5
Lithic clasts	4
Mica	1
Tourmaline	Tr
Opaques and semi-opaques	5
Pores	15

This sample consists mainly of quartz grains and a much smaller proportion of feldspar grains and lithic clasts cemented by an interstitial, argillaceous matrix. Most of the quartz grains are between 0.1 and 0.5 mm in size although a very small number of larger quartz grains up to 2 mm wide are present. The feldspar grains are generally between 0.2 and 0.5 mm in size and consist of untwinned potash feldspar and small amounts of polysynthetically twinned plagioclase. A small proportion of the potash feldspar exhibits grid-iron twinning typical of microcline. All of the detrital quartz and feldspar grains typically exhibit angular shapes and a small proportion have slightly broken and fractured characters.

The lithic clasts consist mainly of very fine grained sedimentary rock clasts comprised of argillaceous material intergrown with minor amounts of silt-sized quartz grains. A small number of acid volcanic lithic clasts with felsic, granular textures are also disseminated through the rock. Some finely granular chert clasts were also noted.

The rock contains some well developed mica flakes up to 0.4 mm long which are thought to be of detrital origin. These mica flakes generally have fibrous, degraded appearing textures and consist both of pleochroic brown biotite and fibrous textured muscovite. Minor muscovite was also noted locally as small inclusions within some detrital quartz grains. Traces of tourmaline were noted as angular detrital grains up to 0.4 mm wide.

The detrital grains are cemented by an interstitial argillaceous matrix comprised mainly of weakly birefringent clay which locally has a pale green colour. More birefringent sericite is locally intergrown with the argillaceous matrix. In addition to the clay matrix clay also forms small pellets or lithic clasts up to 0.4 mm wide.

The rock exhibits a variable porosity with some areas having a highly porous character ranging up to about 25% pores whereas in other areas it has a much lower porosity. Most of the pores occur as irregular, interstitial voids of approximately 0.2 mm in size but some very large pores up to 1 mm in size are present. Where the porosity is lower the interstices between detrital grains are generally filled with a larger proportion of argillaceous matrix.

Within one area a band approximately 1 to 2 mm wide with a concentration of interstitial opaque material is also present. This opaque material also tends to decrease the porosity in these areas filling interstitial regions between detrital mineral grains.

In addition to the opaque bands, minor opaque to translucent iron oxides also form small disseminated grains and aggregates which are generally intergrown with the argillaceous matrix or lithic clasts.

This is an immature detrital sediment with a varying porosity produced by variations in proportions of interstitial clay and opaque material. At least some of the porosity could be due to disturbance produced during sampling.

SAMPLE: Core 21, 650.5m: TSC47277

Rock Name:
Fine Grained Sandstone

Thin Section:
An optical estimate of the constituents gives the following :

	%
Quartz	60
Clay	20
Feldspar	5
Mica	3
Tourmaline	Tr
Zircon	Tr
Opaques and semi-opaques	2
Pores	10

This sample consists mainly of angular to subangular detrital quartz grains with a typical grain size between 0.1 and 0.2 mm cemented by an interstitial argillaceous matrix. In addition to the detrital quartz grains minor detrital feldspar also forms angular to subangular grains up to 0.2 mm wide and includes both polysynthetically twinned plagioclase and potash feldspar. Mica flakes ranging up to 0.3 mm long are also present and are thought to be of detrital origin. These mica flakes include well developed muscovite flakes and a smaller proportion of pleochroic brown to reddish-brown biotite. The biotite flakes in particular tend to have a degraded character with a fibrous texture.

The rock contains a significant porosity comprised of interstitial pores which typically range up to 0.15 mm in size. The porosity is not evenly distributed through the rock but tends to be concentrated within localised areas. Elsewhere the interstitial regions are filled or partially filled with clay. In some areas clay forms irregular patches up to 1 mm in size which have a translucent, reddish-brown iron stained colour. Minor clay also forms vague bands up to 0.5 mm wide which also have a translucent, reddish-brown iron stained colour. In addition to the iron stained clay some weakly birefringent interstitial clay which locally forms well developed flakes is also present as is a small amount of birefringent sericite.

Traces of tourmaline and zircon form small, disseminated grains up to 0.15 mm wide. Opaques are disseminated through the rock as anhedral grains and aggregates up to 0.3 mm wide.

This is a detrital sediment comprised mainly of detrital quartz grains and minor detrital feldspar cemented by an interstitial argillaceous matrix. This sample has a much better sorted and finer grain size than the previously described sandstones.

SAMPLE: Core 25, 629.0m: TSC47278

Rock Name:
Sandstone

Thin Section:
An optical estimate of the constituents gives the following :

	%
Quartz	55
Clay	17
Siderite	3
Mica	2
Feldspar	2
Tourmaline	Tr
Zircon	Tr
Opaques and semi-opaques	1
Pores	20

This sample consists mainly of angular to subrounded, detrital quartz grains between 0.15 and 0.8 mm wide cemented by an argillaceous matrix. The matrix is comprised mainly of reddish-brown iron stained clay which has a low birefringence. Small, birefringent grains up to 0.05 mm wide believed to be siderite are disseminated through the argillaceous matrix.

Although quartz is the major detrital component, minor detrital feldspar also forms grains up to 0.6 mm wide and consists mainly of untwinned potash feldspar. The rock also contains some well developed mica flakes up to 1.2 mm long which consist mainly of long muscovite flakes. Minor biotite also forms detrital appearing flakes up to 1 mm long. The biotite flakes in particular tend to have highly degraded textures locally exhibiting turbid characters as well as fibrous textures. Within some areas the matrix contains well developed weakly birefringent flakes up to about 1 mm in size which have a dark reddish-brown iron stained colour and could represent either degraded mica flakes or possibly well developed kaolinite flakes which have been subjected to pervasive iron staining.

The porosity is unevenly distributed through this rock and tends to be concentrated as very large pores up to 3 mm wide within localised areas. Finer porosity is also distributed through the rock as interstitial pores generally between 0.1 and 0.2 mm in size which in some cases are partially filled with clay minerals.

Traces of tourmaline and zircon form small detrital grains up to 0.5 and 0.1 mm in size respectively. The detrital tourmaline grains tend to have a pleochroic orange to brown colour. Opaque to translucent iron oxides are disseminated through the rock as small grains and patches up to 0.3 mm wide which are generally intergrown with the argillaceous matrix.

This is a quartz-rich detrital sediment cemented by an argillaceous matrix which also contains some finely disseminated siderite.

SAMPLE: Core 29, 542.0m: TSC47279

Rock Name:
Sandstone

Thin Section:
An optical estimate of the constituents gives the following :

	%
Quartz	60
Clay	10
Feldspar	2
Siderite	1
Mica	Tr-1
Opaques and semi-opaques	1
Pores	25

This sample consists mainly of angular to subrounded detrital quartz grains ranging between 0.15 and 2 mm in size with a very weakly cemented character. Minor feldspar is also present as detrital grains with angular to subangular shapes and consists mainly of untwinned potash feldspar. Although most of the detrital grains are below 0.8 mm in size a few larger grains up to 2 mm in size are present.

The interstitial regions between the detrital grains consists mainly of pore space forming pores ranging up to 0.5 mm wide. The proportion of this porosity which is primary and the proportion which is caused by disturbance during sampling is difficult to determine although a significant proportion is thought to be primary porosity.

Clay is disseminated through the rock as localised interstitial fillings and large patches up to 3 mm wide. Some clay also forms rounded appearing pellets up to 0.8 mm wide which could be of detrital origin. Most of the clay has a translucent, reddish-brown iron stained colour although some clay patches have a greenish colour or a clear, almost colourless, character. The clear clay typically has very weak birefringence. Some iron stained clay patches contain fine, disseminated birefringent grains believed to be finely divided siderite.

Minor mica is disseminated through the rock as small flakes up to 0.2 mm long which have fibrous textures. Most of the mica consists of muscovite and a small proportion of the muscovite occurs as inclusions within detrital quartz grains. Opaque to translucent iron oxides form small disseminated grains and aggregates up to 0.3 mm wide which are generally intergrown with the clay or occur interstitially between the detrital grains.

This is a very weakly cemented quartz-rich detrital sediment.

TABLE 1 : CLAY MINERALOGY OF FIVE SIDEWALL CORES FROM PRINCES NO. 1 WELL

Core No.	5		8		21		25		29	
Depth	1041.5m		1006.5m		650.5m		629.0m		542.0m	
-2 µm, %	1		3		6		6		3	
Mineralogy	K	D	K	D	K	D	C	D	K	D
	C	A	Sm	SD	M	SD	M	A	Sm	A
	Sm	A	M	A	Q	A	Sm	Tr-A	Q	A
	Q	A	Q	A	C	Tr-A	Q	Tr	M	Tr-A
	M	A	C	Tr-A					C	Tr
	F	Tr	Py	Tr					Sid	Tr
			F	Tr					Gi	Tr

Mineral Key

C	Chlorite
F	Feldspar (plagioclase)
Gi	Gibbsite
K	Kaolinite
M	Mica/illite
Py	Pyrite
Q	Quartz
Sid	Siderite
Sm	Smectite

SEMIQUANTITATIVE ABBREVIATIONS:

D = Dominant. Used for the component apparently most abundant, regardless of its probable percentage level.

SD = Sub-dominant. The next most abundant component(s) providing its percentage level is judged above about 20.

A = Accessory. Components judged to be present between the levels of roughly 5 and 20%.

Tr = Trace. Components judged to be below about 5%.

PE907085

This is an enclosure indicator page.
The enclosure PE907085 is enclosed within the container PE902234 at this location in this document.

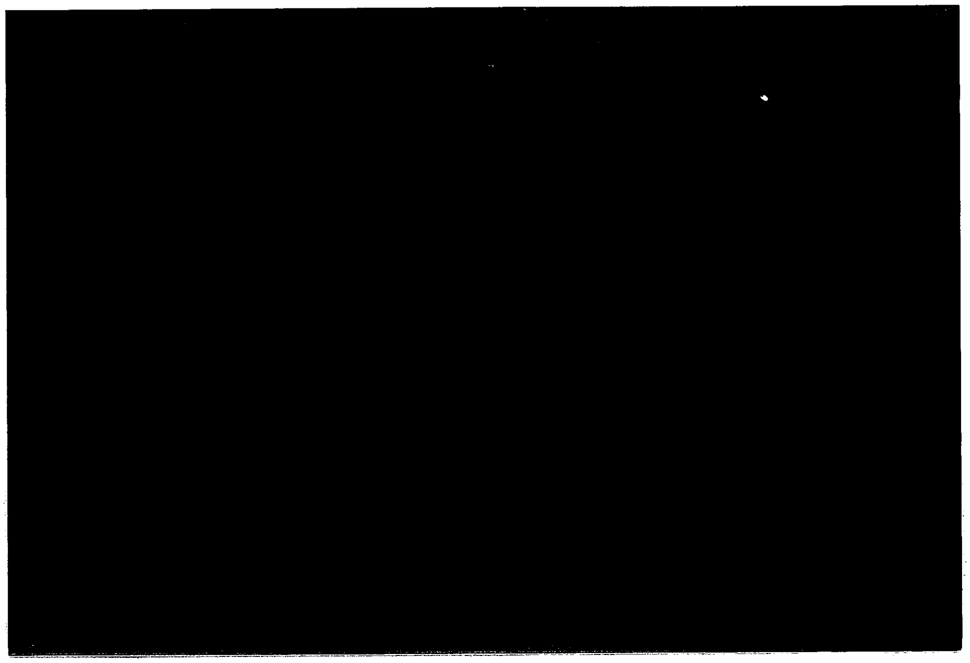
The enclosure PE907085 has the following characteristics:

ITEM_BARCODE =	PE907085
CONTAINER_BARCODE =	PE902234
NAME =	Core Photomicrographs
BASIN =	OTWAY
PERMIT =	PEP/108
TYPE =	WELL
SUBTYPE =	PHOTOMICROGRAPHS
DESCRIPTION =	Core Photomicrographs, Detrital Quartz and Feldspar Grains with Clay Porosity, Plate 1 a&b (enclosure from WCR vol.1) for Princes-1
REMARKS =	
DATE_CREATED =	
DATE_RECEIVED =	
W_NO =	W932
WELL_NAME =	Princes-1
CONTRACTOR =	
CLIENT_OP_CO =	BEACH PETROLEUM NL

(Inserted by DNRE - Vic Govt Mines Dept)

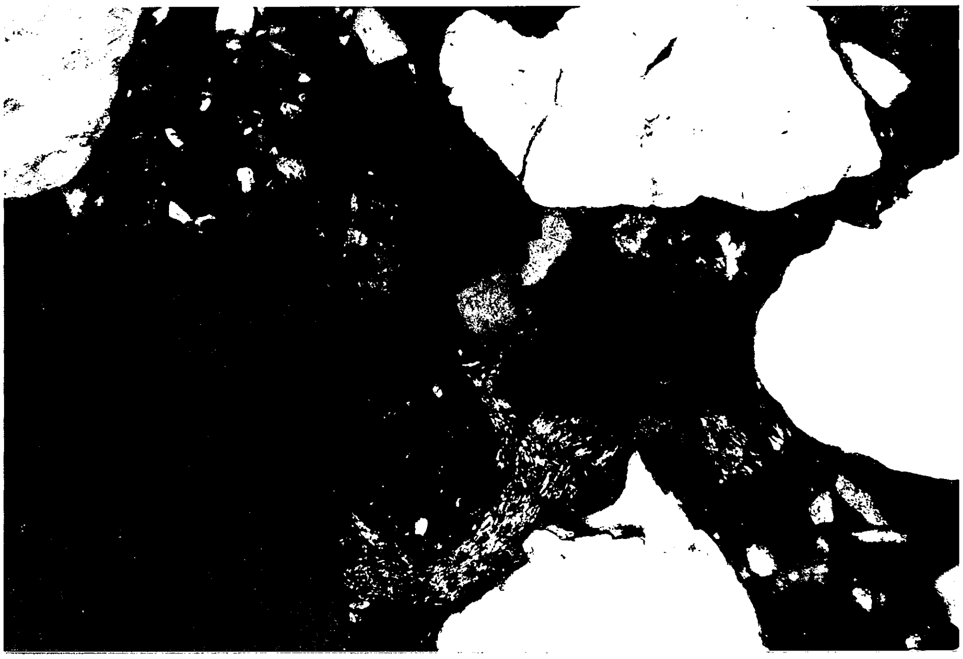
PLATE 1

SAMPLE: Core 5, 1041.5m: TSC47275



a. Plane Light (10)

0.5 mm



b. Crossed Nicols (11, 12)

Detrital quartz grains and feldspar grains (large grain in upper part of field) with interstitial clay and porosity. In this and all other photomicrographs the porosity will be represented by a blue impregnation medium.

PE907086

This is an enclosure indicator page.
The enclosure PE907086 is enclosed within the container PE902234 at this location in this document.

The enclosure PE907086 has the following characteristics:

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CONTAINER_BARCODE =	PE902234
NAME =	Core Photomicrographs
BASIN =	OTWAY
PERMIT =	PEP/108
TYPE =	WELL
SUBTYPE =	PHOTOMICROGRAPHS
DESCRIPTION =	Core Photomicrographs,Detrital Quartz and Feldspar Garins with Muscovite and Biotite Flakes, Plate 2 a&b (enclosure from WCR vol.1) for Princes-1
REMARKS =	
DATE_CREATED =	
DATE_RECEIVED =	
W_NO =	W932
WELL_NAME =	Princes-1
CONTRACTOR =	
CLIENT_OP_CO =	BEACH PETROLEUM NL

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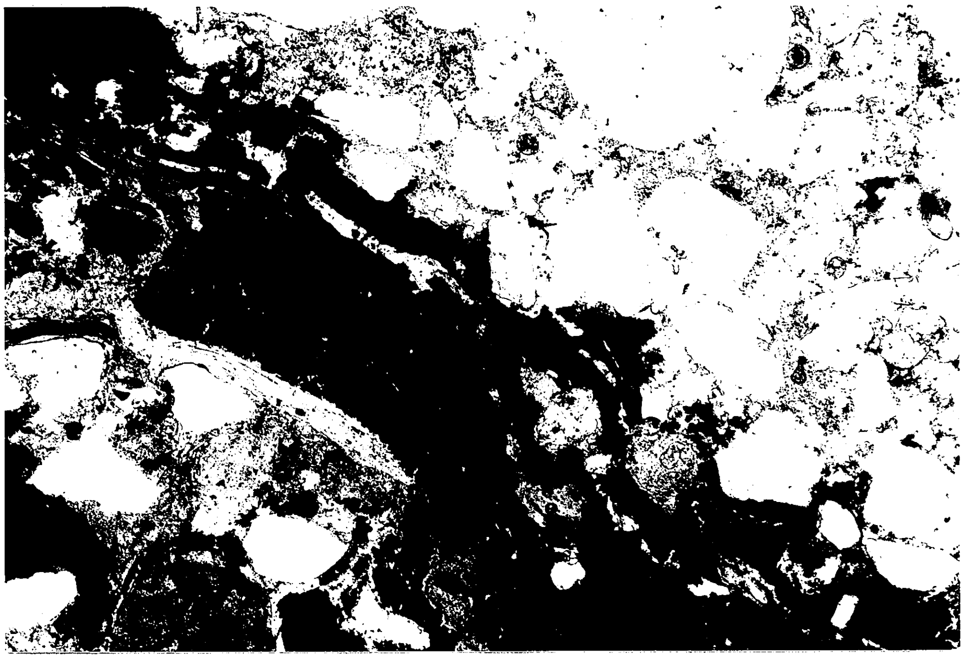
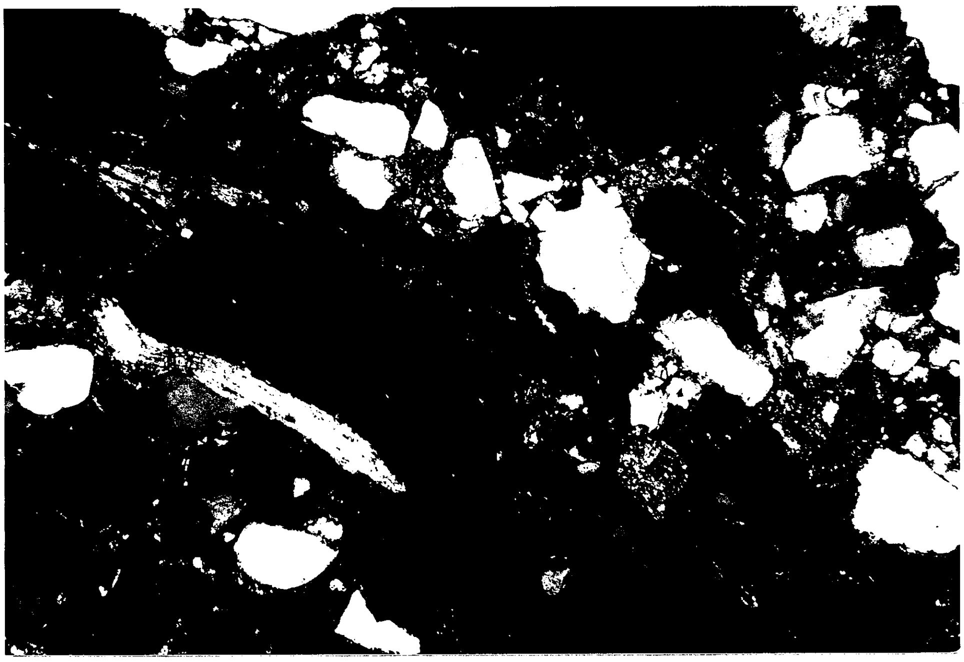
PLATE 2

SAMPLE: Core 8, 1006.5m: TSC47276



a. Plane Light (13)

0.5 mm



b. Crossed Nicols (14)

Detrital quartz grains with interstitial clay and porosity. Note opaque band which contains detrital appearing muscovite and biotite flakes.

PE907087

This is an enclosure indicator page.
The enclosure PE907087 is enclosed within the container PE902234 at this location in this document.

The enclosure PE907087 has the following characteristics:

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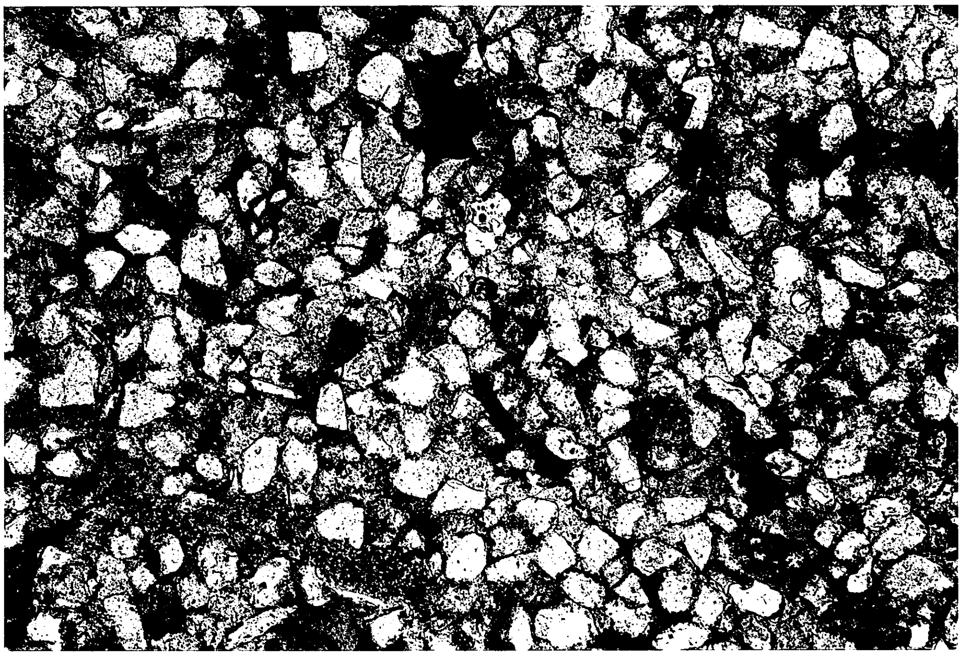
CONTAINER_BARCODE =	PE902234
NAME =	Core Photomicrographs
BASIN =	OTWAY
PERMIT =	PEP/108
TYPE =	WELL
SUBTYPE =	PHOTOMICROGRAPHS
DESCRIPTION =	Core Photomicrographs,Fined Grained Detritus of mainly Quartz, Plate 3 a&b (enclosure from WCR vol.1) for Princes-1
REMARKS =	
DATE_CREATED =	
DATE_RECEIVED =	
W_NO =	W932
WELL_NAME =	Princes-1
CONTRACTOR =	
CLIENT_OP_CO =	BEACH PETROLEUM NL

(Inserted by DNRE - Vic Govt Mines Dept)

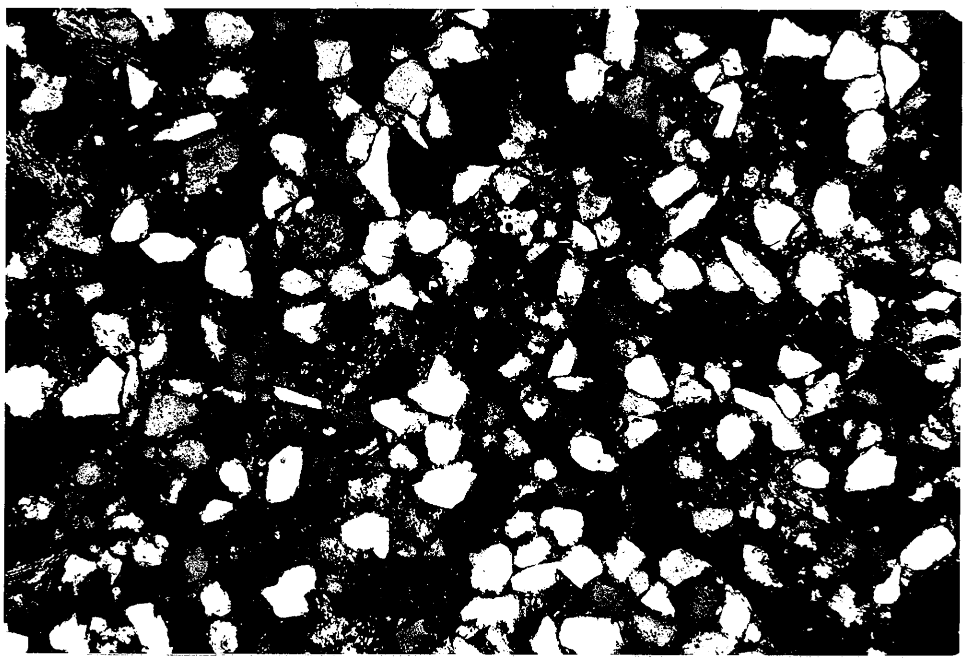
PLATE 3

SAMPLE: Core 21, 650.5m: TSC47277



a. Plane Light (15)

0.5 mm



b. Crossed Nicols (16)

Fine grained detritus comprised mainly of quartz with interstitla clay and porosity.

PE907088

This is an enclosure indicator page.
The enclosure PE907088 is enclosed within the container PE902234 at this location in this document.

The enclosure PE907088 has the following characteristics:

ITEM_BARCODE =	PE907088
CONTAINER_BARCODE =	PE902234
NAME =	Core Photomicrographs
BASIN =	OTWAY
PERMIT =	PEP/108
TYPE =	WELL
SUBTYPE =	PHOTOMICROGRAPHS
DESCRIPTION =	Core Photomicrographs, Detrital Quartz and Feldspar with Iron stained Clay, Plate 4 a&b (enclosure from WCR vol.1) for Princes-1
REMARKS =	
DATE_CREATED =	
DATE_RECEIVED =	
W_NO =	W932
WELL_NAME =	Princes-1
CONTRACTOR =	
CLIENT_OP_CO =	BEACH PETROLEUM NL

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PLATE 4

SAMPLE: Core 25, 629.0m: TSC47278

a. Plane Light (17)

0.5 mm

b. Crossed Nicols (18)

Detrital quartz and feldspar (e.g. centre of field) grains with interstitial iron stained clay and porosity. Note small birefringent siderite crystals disseminated through clay matrix.

PE907089

This is an enclosure indicator page.
The enclosure PE907089 is enclosed within the container PE902234 at this location in this document.

The enclosure PE907089 has the following characteristics:

ITEM_BARCODE =	PE907089
CONTAINER_BARCODE =	PE902234
NAME =	Core Photomicrographs
BASIN =	OTWAY
PERMIT =	PEP/108
TYPE =	WELL
SUBTYPE =	PHOTOMICROGRAPHS
DESCRIPTION =	Core Photomicrographs, Detrital Quartz Grains with high interstitual porosity, Plate 5 a&b (enclosure from WCR vol.1) for Princes-1
REMARKS =	
DATE_CREATED =	
DATE_RECEIVED =	
W_NO =	W932
WELL_NAME =	Princes-1
CONTRACTOR =	
CLIENT_OP_CO =	BEACH PETROLEUM NL

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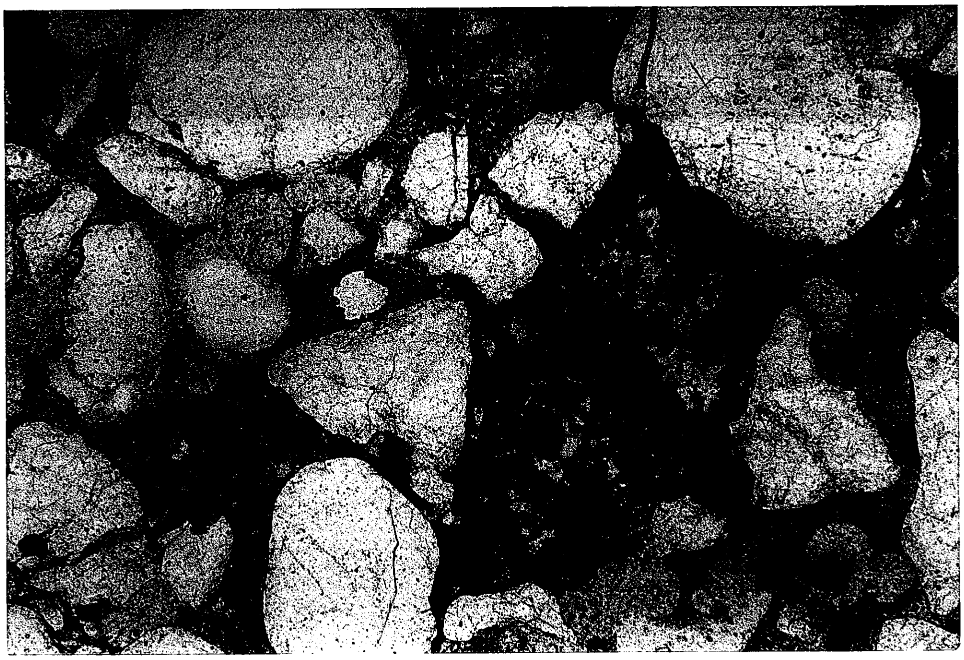
PLATE 5

SAMPLE: Core 29, 542.0m: TSC47279



a. Plane Light (19)

0.5 mm

b. Crossed Nicols (20)

Detrital quartz grains with a high interstitial porosity. Field includes significant clay which forms greenish-brown patches with finely disseminated siderite crystals best seen as small birefringent grains under crossed nicols.

PE907090

This is an enclosure indicator page.
The enclosure PE907090 is enclosed within the container PE902234 at this location in this document.

The enclosure PE907090 has the following characteristics:

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CONTAINER_BARCODE = PE902234
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            BASIN = OTWAY
           PERMIT = PEP/108
             TYPE = WELL
          SUBTYPE = PHOTOMICROGRAPHS
      DESCRIPTION = SEM Photograph, Framework Grains, Plate
                    6, (enclosure from WCR vol.1) for
                    Princes-1
          REMARKS =
     DATE_CREATED =
    DATE_RECEIVED =
             W_NO = W932
        WELL_NAME = Princes-1
       CONTRACTOR =
     CLIENT_OP_CO = BEACH PETROLEUM NL
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PLATE 6. SAMPLE: PRINCES #1 542.0m

General view of framework grains showing abundant pore spaces and variable clay coatings.

PE907091

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The enclosure PE907091 has the following characteristics:

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CONTAINER_BARCODE =	PE902234
NAME =	SEM Photograph
BASIN =	OTWAY
PERMIT =	PEP/108
TYPE =	WELL
SUBTYPE =	PHOTOMICROGRAPHS
DESCRIPTION =	SEM Photograph, Framework Quartz Grain, Plate 7, (enclosure from WCR vol.1) for Princes-1
REMARKS =	
DATE_CREATED =	
DATE_RECEIVED =	
W_NO =	W932
WELL_NAME =	Princes-1
CONTRACTOR =	
CLIENT_OP_CO =	BEACH PETROLEUM NL

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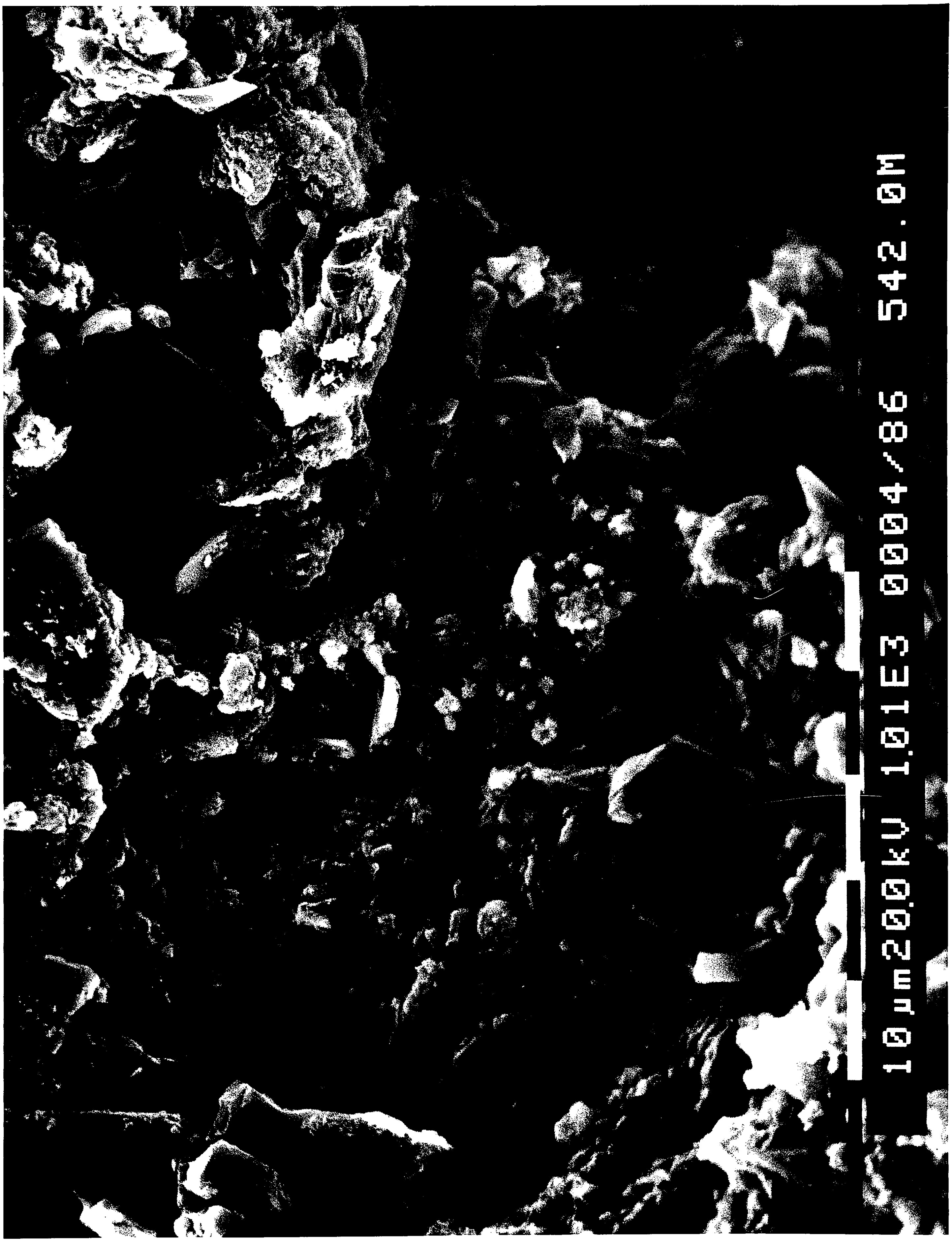

PLATE 7. SAMPLE: PRINCES #1 542.0m

Enlarged view of framework quartz grain adjacent to a pore space seen at top right. Irregular quartz and ?mica fragments are common whereas the very fine kaolinite is poorly developed.

PE907092

This is an enclosure indicator page.
The enclosure PE907092 is enclosed within the container PE902234 at this location in this document.

The enclosure PE907092 has the following characteristics:

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CONTAINER_BARCODE = PE902234
NAME = SEM Photograph
BASIN = OTWAY
PERMIT = PEP/108
TYPE = WELL
SUBTYPE = PHOTOMICROGRAPHS
DESCRIPTION = SEM Photograph, Framework Grains with surficial coating, Plate 8, (enclosure from WCR vol.1) for Princes-1
REMARKS =
DATE_CREATED =
DATE_RECEIVED =
W_NO = W932
WELL_NAME = Princes-1
CONTRACTOR =
CLIENT_OP_CO = BEACH PETROLEUM NL

(Inserted by DNRE - Vic Govt Mines Dept)

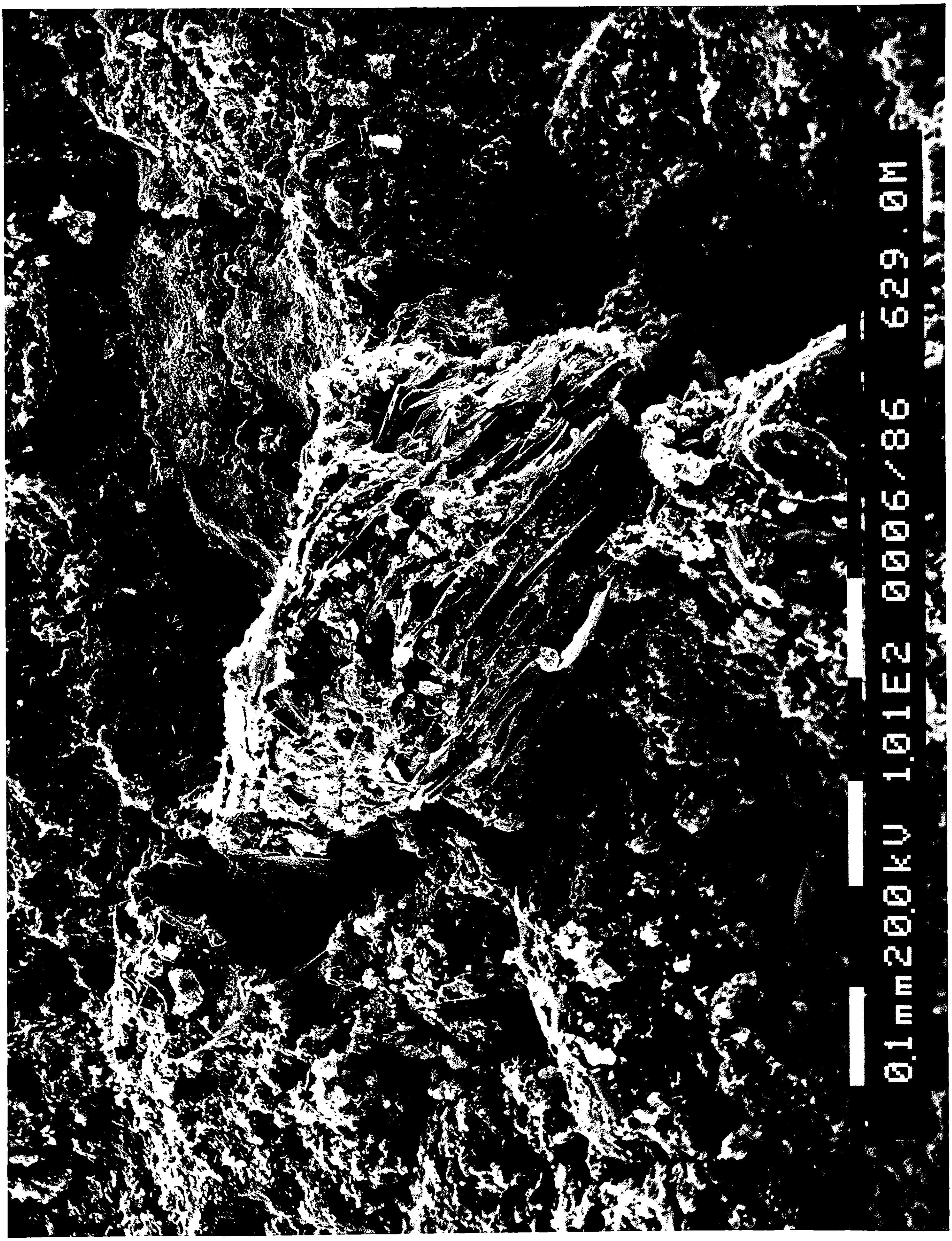

PLATE 8. SAMPLE: PRINCES #1 629.0m

General view showing more compacted nature of framework grains and higher abundance of finer surficial coatings. Prominent grain of ?biotite is seen at centre.

PE907093

This is an enclosure indicator page.
The enclosure PE907093 is enclosed within the container PE902234 at this location in this document.

The enclosure PE907093 has the following characteristics:

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CONTAINER_BARCODE =	PE902234
NAME =	SEM Photograph
BASIN =	OTWAY
PERMIT =	PEP/108
TYPE =	WELL
SUBTYPE =	PHOTOMICROGRAPHS
DESCRIPTION =	SEM Photograph, Framework Grains with Clay Coatings, Plate 9, (enclosure from WCR vol.1) for Princes-1
REMARKS =	
DATE_CREATED =	
DATE_RECEIVED =	
W_NO =	W932
WELL_NAME =	Princes-1
CONTRACTOR =	
CLIENT_OP_CO =	BEACH PETROLEUM NL

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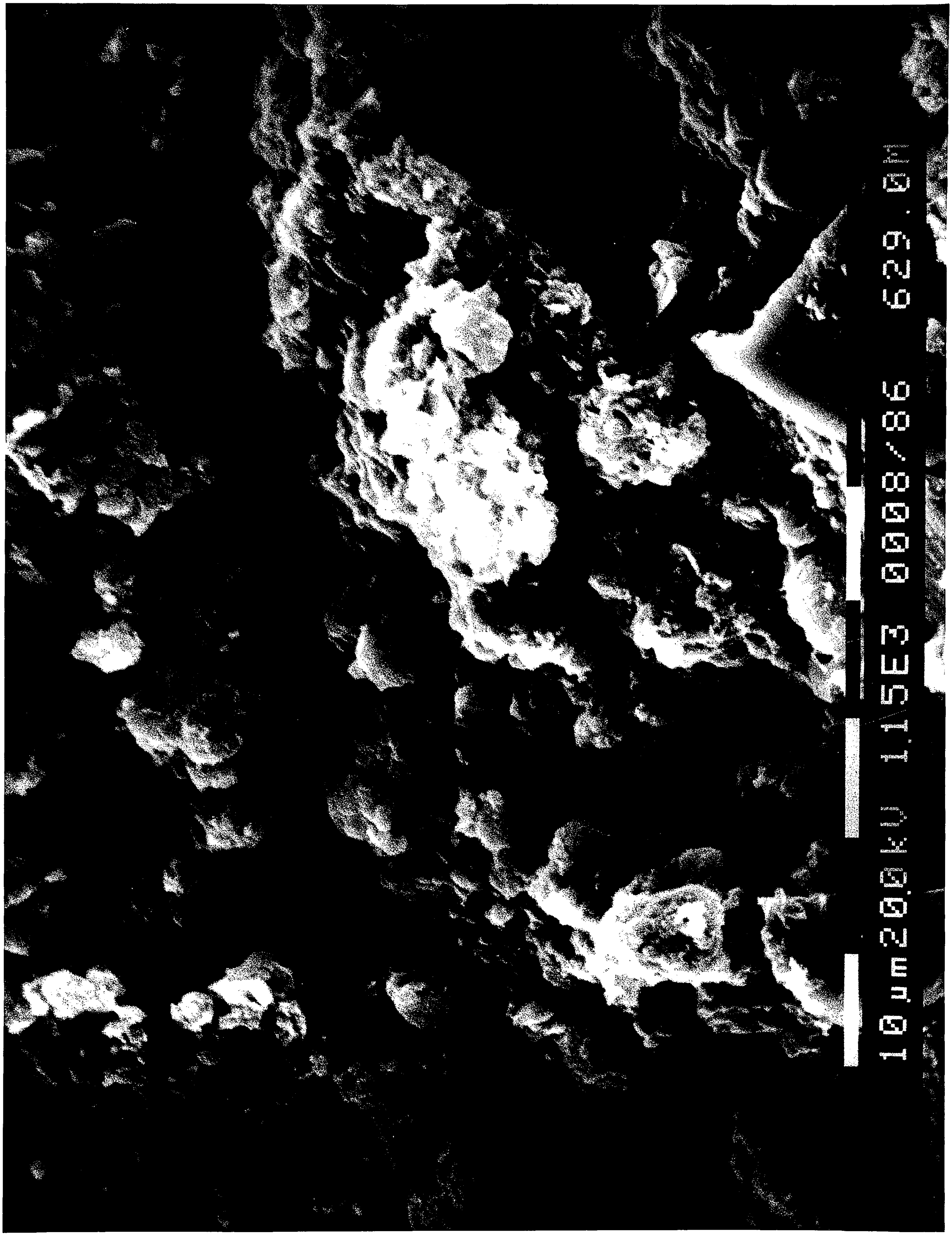

PLATE 9. SAMPLE: PRINCES #1 629.0m

Enlarged view of "clay" coatings. X-ray spectra indicate an iron-rich chlorite is the dominant component.

PE907094

This is an enclosure indicator page.
The enclosure PE907094 is enclosed within the container PE902234 at this location in this document.

The enclosure PE907094 has the following characteristics:

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CONTAINER_BARCODE = PE902234
             NAME = SEM Photograph
            BASIN = OTWAY
           PERMIT = PEP/108
             TYPE = WELL
          SUBTYPE = PHOTOMICROGRAPHS
      DESCRIPTION = SEM Photograph,Little Framework Grains
                    of Quartz and fine Micas and Clays,
                    Plate 10, (enclosure from WCR vol.1)
                    for Princes-1
          REMARKS =
     DATE_CREATED =
    DATE_RECEIVED =
             W_NO = W932
        WELL_NAME = Princes-1
       CONTRACTOR =
     CLIENT_OP_CO = BEACH PETROLEUM NL
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(Inserted by DNRE - Vic Govt Mines Dept)

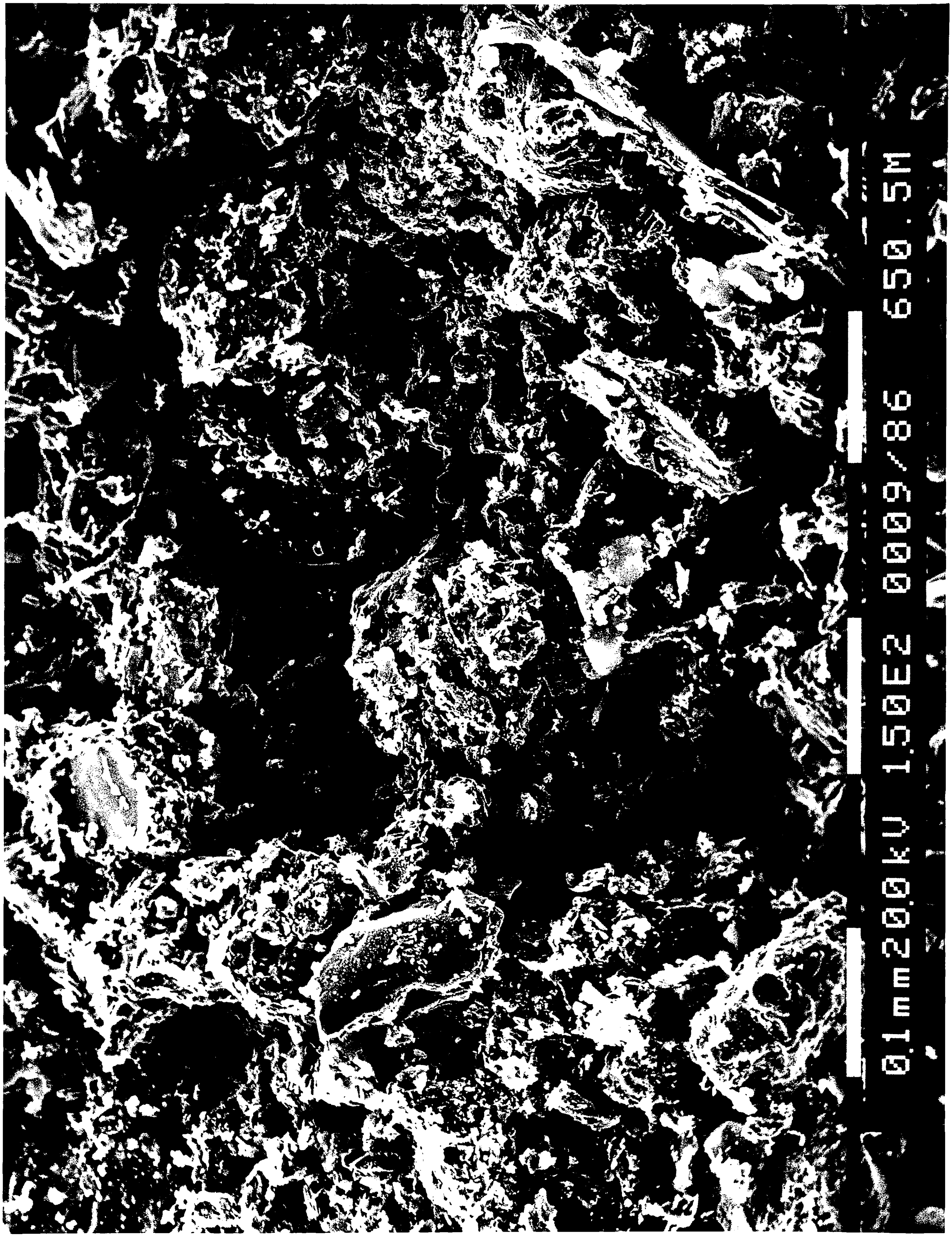

PLATE 10. SAMPLE: PRINCES #1 650.5m

General view of little compacted framework quartz grains and relatively common fine micas and clays.

PE907095

This is an enclosure indicator page.
The enclosure PE907095 is enclosed within the container PE902234 at this location in this document.

The enclosure PE907095 has the following characteristics:

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CONTAINER_BARCODE =	PE902234
NAME =	SEM Photograph
BASIN =	OTWAY
PERMIT =	PEP/108
TYPE =	WELL
SUBTYPE =	PHOTOMICROGRAPHS
DESCRIPTION =	SEM Photograph, Coarse Mica and finer Kaolinite, Plate 11, (enclosure from WCR vol.1) for Princes-1
REMARKS =	
DATE_CREATED =	
DATE_RECEIVED =	
W_NO =	W932
WELL_NAME =	Princes-1
CONTRACTOR =	
CLIENT_OP_CO =	BEACH PETROLEUM NL

(Inserted by DNRE - Vic Govt Mines Dept)

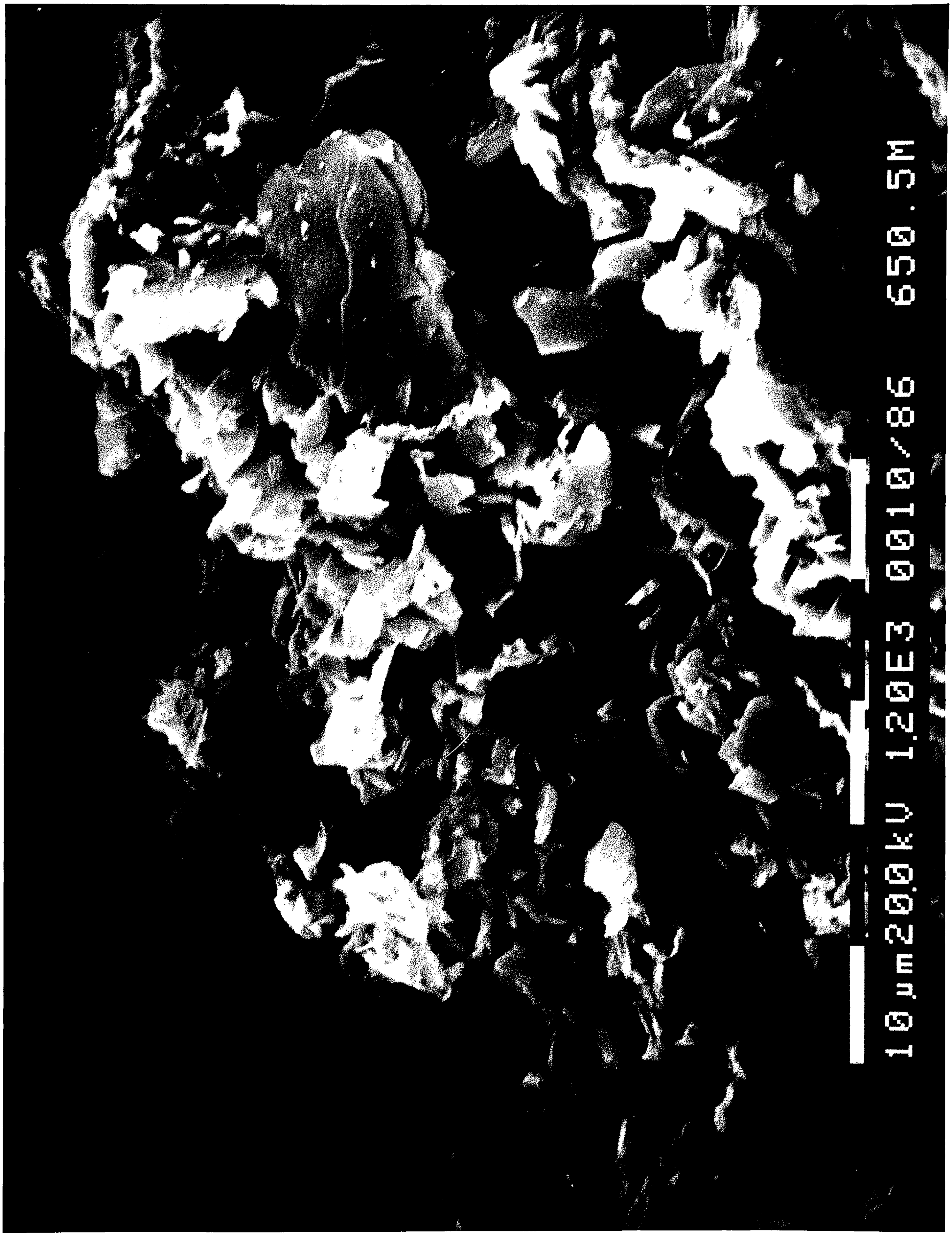

PLATE 11. SAMPLE: PRINCES #1 650.5m

Enlarged view adjacent to pore space.
The coarser platy material is mostly mica
(?muscovite) and there is finer not well
formed kaolinite.

PE907096

This is an enclosure indicator page.
The enclosure PE907096 is enclosed within the container PE902234 at this location in this document.

The enclosure PE907096 has the following characteristics:

ITEM_BARCODE =	PE907096
CONTAINER_BARCODE =	PE902234
NAME =	SEM Photograph
BASIN =	OTWAY
PERMIT =	PEP/108
TYPE =	WELL
SUBTYPE =	PHOTOMICROGRAPHS
DESCRIPTION =	SEM Photograph, Framework Grains which are poorly compacted, Plate 12, (enclosure from WCR vol.1) for Princes-1
REMARKS =	
DATE_CREATED =	
DATE_RECEIVED =	
W_NO =	W932
WELL_NAME =	Princes-1
CONTRACTOR =	
CLIENT_OP_CO =	BEACH PETROLEUM NL

(Inserted by DNRE - Vic Govt Mines Dept)

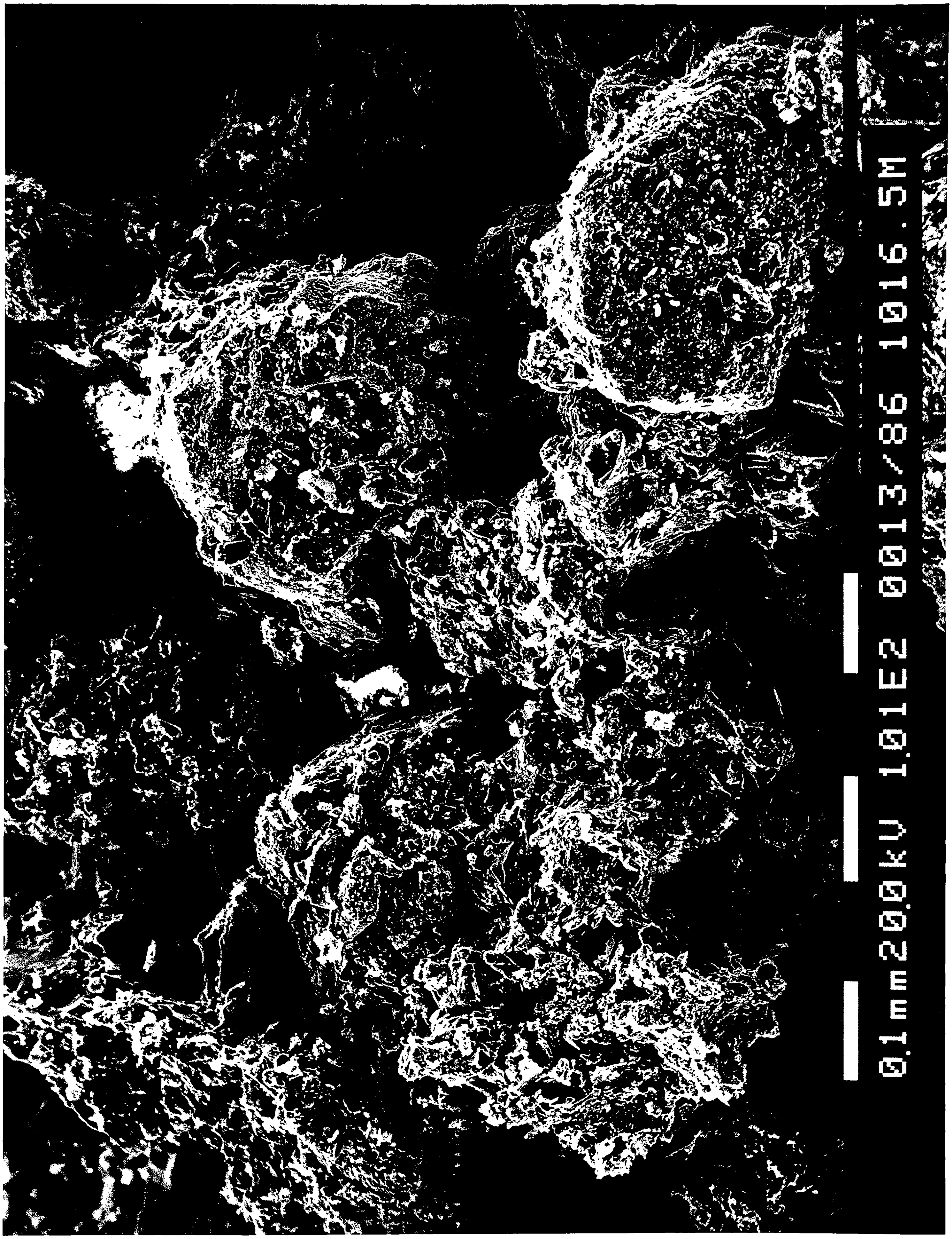

PLATE 12. SAMPLE: PRINCES #1 1006.5m

General view of poorly compacted nature of framework grains with moderate coating of fine micas and clays.

PE907097

This is an enclosure indicator page.
The enclosure PE907097 is enclosed within the container PE902234 at this location in this document.

The enclosure PE907097 has the following characteristics:

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CONTAINER_BARCODE =	PE902234
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BASIN =	OTWAY
PERMIT =	PEP/108
TYPE =	WELL
SUBTYPE =	PHOTOMICROGRAPHS
DESCRIPTION =	SEM Photograph, Mica-rich Clay size coating, Plate 13, (enclosure from WCR vol.1) for Princes-1
REMARKS =	
DATE_CREATED =	
DATE_RECEIVED =	
W_NO =	W932
WELL_NAME =	Princes-1
CONTRACTOR =	
CLIENT_OP_CO =	BEACH PETROLEUM NL

(Inserted by DNRE - Vic Govt Mines Dept)

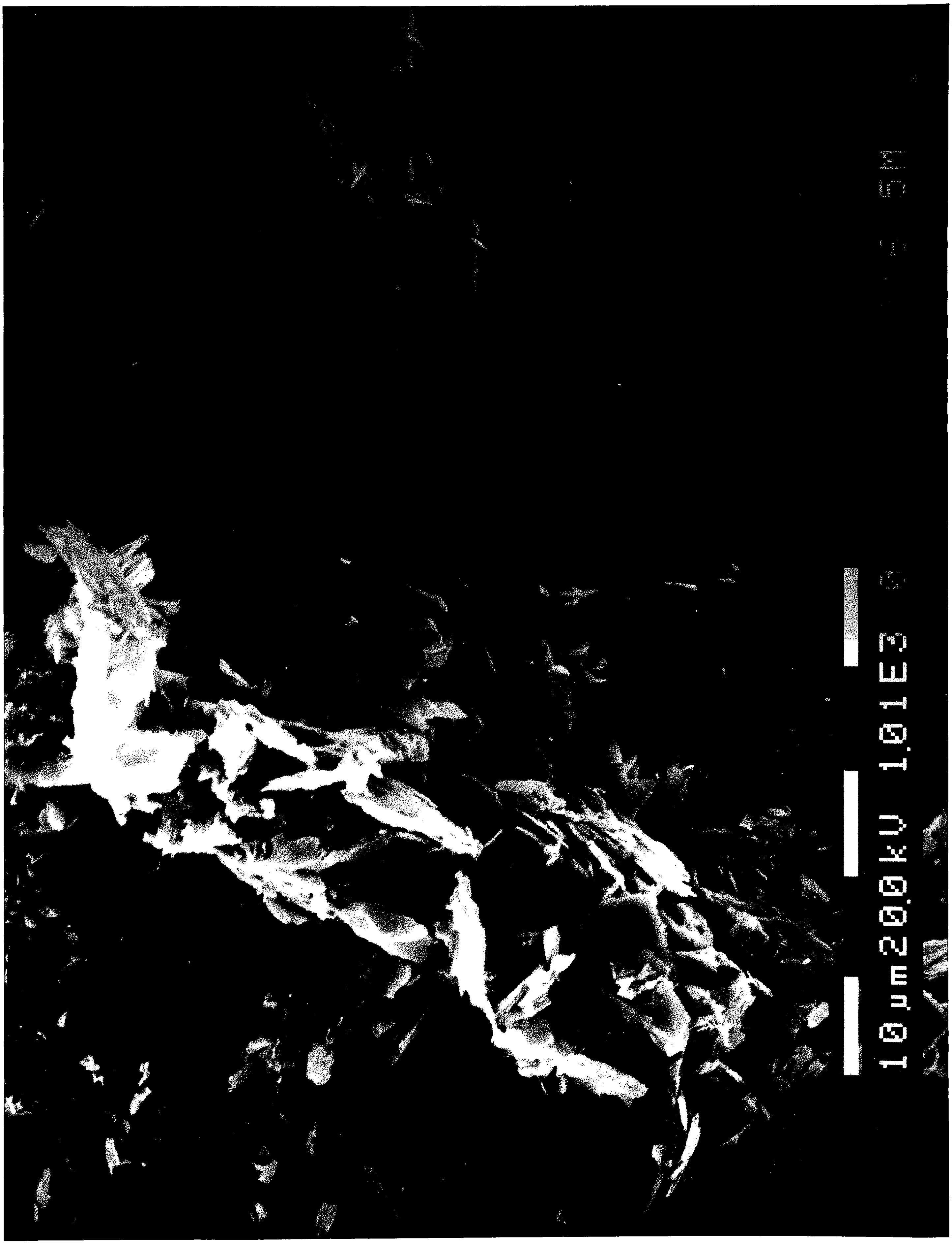

PLATE 13. SAMPLE: PRINCES #1 1006.5m

Enlarged view of a dominantly mica-rich clay size coating.

PE907098

This is an enclosure indicator page.
The enclosure PE907098 is enclosed within the container PE902234 at this location in this document.

The enclosure PE907098 has the following characteristics:

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CONTAINER_BARCODE =	PE902234
NAME =	SEM Photograph
BASIN =	OTWAY
PERMIT =	PEP/108
TYPE =	WELL
SUBTYPE =	PHOTOMICROGRAPHS
DESCRIPTION =	SEM Photograph, Framework Grains with abundant pore spaces, Plate 14, (enclosure from WCR vol.1) for Princes-1
REMARKS =	
DATE_CREATED =	
DATE_RECEIVED =	
W_NO =	W932
WELL_NAME =	Princes-1
CONTRACTOR =	
CLIENT_OP_CO =	BEACH PETROLEUM NL

(Inserted by DNRE - Vic Govt Mines Dept)

PLATE 14. SAMPLE: PRINCES #1 1041.5m

Typical view of framework grains (quartz) with abundant pore spaces and "clay" size surface coatings.

PE907099

This is an enclosure indicator page.
The enclosure PE907099 is enclosed within the container PE902234 at this location in this document.

The enclosure PE907099 has the following characteristics:

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CONTAINER_BARCODE =	PE902234
NAME =	SEM Photograph
BASIN =	OTWAY
PERMIT =	PEP/108
TYPE =	WELL
SUBTYPE =	PHOTOMICROGRAPHS
DESCRIPTION =	SEM Photograph, Irregular Siliceous developments, Mica and Kaolinite, Plate 15, (enclosure from WCR vol.1) for Princes-1
REMARKS =	
DATE_CREATED =	
DATE_RECEIVED =	
W_NO =	W932
WELL_NAME =	Princes-1
CONTRACTOR =	
CLIENT_OP_CO =	BEACH PETROLEUM NL

(Inserted by DNRE - Vic Govt Mines Dept)

PLATE 15. SAMPLE: PRINCES #1 1041.5m

Enlarged view showing irregular siliceous (s) developments, mica (m) and kaolinite (k).