PLANET CASTERTON No. 1 WELL

Completion Report

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CASTERTON
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PLANET EXPLORATION COMPANY PTY. LTD.

EXPLORATION

PLANET CASTERTON NO. 1

COMPLETION REPORT

for

PLANET EXPLORATION COMPANY

by

J. R. CUNDILL

of

CUNDILL, MEYERS AND ASSOCIATES

CONTENTS

Jurassic age is
questioned by G.S.V.
See Appendix 2.

PLANET EXPLORATION COMPANY PTY LTD

CASTERTON NO. 1 WELL, VICTORIA

WELL COMPLETION REPORT

I. SUMMARY

Planet Exploration Company's Casterton No. 1 Well is located approximately four miles south-west of Casterton in the Western District of Victoria in Petroleum Exploration Permit No. 26. It was drilled to a depth of 8185' using a Drilling Contractors (Aust) National-Ideal 50A rig. The location is in an area known either as the Gambier Sunklands of the Murray Basin or as the Gambier-Portland sub-basin of the Otway Basin.

The well was sited on a structure defined by a structure drilling programme. After passing through a thin surface veneer of Recent and probable Tertiary sediments, the well encountered Mesozoic sediments, first definitely identified at a depth of 60'.

The well drilled through Lower Cretaceous Merino Group possibly to a depth of 6776'. The first porous sandstone was encountered at 1959' (the "Heathfield Sandstone"). This sandstone was 66' thick and yielded 1650' of very slightly gassy salt water on drill stem test. About 30' of net porosity was present.

Between 4655' and 6776' a number of thick sandstones, most of them porous, were encountered. The porous sands are between 5028' and 5098' (62' net porosity), 5276' and 5616' (290' net effective porosity), 5698' and 5710' (11' net effective porosity), and between 5830' and 6417' (454' net effective porosity). These are all salt water sands.

At a depth of 6776' it is probable that the hole passed into sediments of Jurassic age. A sandstone with poor porosity was encountered between 6900' and 7225', in which net porosity totals approximately 175'. The Jurassic sequence persisted to a depth of 8038' and consists of a number of discrete units of various lithologies including conglomerates, orthoquartzites, sandstones, siltstones and shales. Two dolerite sills 28' and 63' thick respectively were encountered near the base of this unit.

The well passed into phyllitic slate possibly of lower Palaeozoic age at a depth of 8038' and remained in same until total depth of 8185'.

Technical control at the well site was provided by J. Cundill and B. Hill of Cundill, Meyers & Associates, assisted by F. Baarda. The latter part of the well was supervised by M. Wiltshire and B. Hill of Cundill, Meyers & Associates. Electric logging was carried out by Schlumberger SEACO Inc, drill stem testing by Halliburton Ltd, and Core Laboratories of Australia Ltd provided a gas detector.

II. INTRODUCTION

The Casterton No. 1 well was planned to test an anticlinal structure located by a structure drilling programme. Subsequent to the structure drilling a limited refraction seismic survey indicated the presence of a sedimentary section between 6000' and 9000' thick, overlying a refractor with a velocity comparable to that of metamorphic or granitic basement present at very shallow depths elsewhere in the area. The seismic work suggested a substantial fault down-thrown to the south-west, between the shallow basement area and the well location.

The well was spudded in at 12 noon on February 13, 1965. After setting conductor pipe, a 17-1/4" hole was drilled ahead to 469' at which depth a string of 13-3/8" 48 lb H-40 casing was run and cemented to surface. An 8-3/4" hole was drilled to 4144', reamed to 12-1/4" to a depth of 3000' and a string of 9-5/8" 36 lb J-55 casing was run to 2999' and cemented at that depth with 210 sacks of cement. An 8-3/4" hole was then drilled ahead to 8185'.

Electric logs, micrologs, sonic-gamma ray logs and a continuous dipmeter survey were run prior to cementing the intermediate string of casing. The electric and microlog were run from 4144' up to the 13-3/8" casing shoe (469'), the dipmeter up to 1340' and the sonic gamma ray log was run through the surface casing up to 50' from the surface.

At 6779' run 2 of the logs was made, the electric log being taken up to 3837', the microlog up to 4032' and the sonic gamma ray to 4030'. The continuous dipmeter was run up to 3840'. Run 3 of the logs was made at a depth of 7959'. The electric log was taken up to 6578', the microlog to 6572', and the sonic gamma ray log to 6560'. The caliper was run back up to the intermediate casing shoe. The continuous dipmeter was run between 6580' and 7955'. At total depth (8185') run 4 of the logs was made over the remaining unlogged interval of the hole. Electric logs were run between 7858' and 8184', microlog-caliper between 7854' and 8184', caliper between 6700' and 7400', and sonic gamma ray between 7850' and 8177'. A velocity survey was run at total depth.

A total of 24 cores was cut using a Reed K-675 Kor King 20' barrel and one core was cut using a Truco diamond core head. Core cuts were distributed to the Bureau of Mineral Resources, the remainder of the cores being shipped to the Mines Department of Victoria. Cuttings were collected at 10' intervals and at smaller intervals where the lithology warranted it. Drilling breaks were circulated and bottom hole samples were also circulated up before tripping. No cuttings were obtained between 210' and 469' as there was no circulation over this interval. Sets of cuttings were distributed to the Bureau of Mineral Resources, the Mines Department of Victoria and Planet Exploration Company.

Nine drill stem tests were run in the open hole. Packer seats were obtained in each case except for a partial failure on test No. 2. Apart from some slight mechanical difficulty in several of the tests, the tests were generally mechanically successful. The best fluid recovery was from drill stem test No. 6 in which 4750' of salt water was obtained. Water recoveries ranging from 900' to 2160' were obtained in drill stem tests Nos. 7, 1 and 9. Recoveries of salt water cut mud were obtained in drill stem tests Nos. 2, 5 and 8. In drill stem test No. 1 the water was very slightly gassy.

A Core Lab. gas detector employing a hot wire Johnson-Williams type filament was used throughout. A few very minor readings up to a maximum of seven units of methane were obtained in the interval between 570' and 1650' and a very low reading of ten units of methane was obtained between 2380' and 2390'.

The well was abandoned on May 3, 1965, by running cement plugs over the following intervals -

7000' - 7150'; 6720' - 6820'; 5650' - 5750'; 5150' - 5250'; 4450' - 4550'; & 2930' - 3030'.

An 18 sack surface plug was set, a steel plate was welded on the top of the casing, and a plaque with a name, depth and drilling dates of the well affixed thereto.

III. WELL HISTORY

(1) General Data

(a) Well Name and Number: Casterton No. 1.

(b) Location: Latitude 37° 36' 54" S.
Longitude 141° 20' 6" E.
County of Follett, State of Victoria.

(c) Tenement Holder: Planet Exploration Co Pty Ltd,
2 O'Connell Street,
Sydney. New South Wales.

(d) Details of Petroleum Tenement:
Petroleum Exploration Permit No. 26.
State of Victoria.
Expiring on December 31, 1965.

(e) District: Casterton, Victoria.

(f) Total Depth: 8183' (Driller).
8185' (Schlumberger).

(g) Date Drilling Commenced: February 13, 1965.

(h) Date Drilling Completed: April 28, 1965.

(i) Date Well Abandoned: May 3, 1965.

(j) Date Rig Released: May 3, 1965.

(k) Drilling time in days to Total Depth: 75 days.

(l) Kelly Bushing Elevation (Datum for drilling depths): 472' ASL.
Ground Elevation: 461' ASL.

(m) Status: Dry and abandoned.

(2) Drilling Data

(a) Drilling Contractor: Drilling Contractors (Aust) Pty Ltd,
383 George Street,
Sydney. New South Wales.

(b) Drilling Plant:

Make:	National Ideal.
Type:	50 A1.
Rated Capacity:	9000' with 4-1/2" drill pipe.
Motors:	Waukesha 6LRDBSU. 450 HP.

(c) Mast:

Make:	Lee C. Moore.
Capacity:	480, 000 lb.

(d) Pumps:

Make	Type	Size
National Ideal	E 500	8" x 14"

(e) Blow Out Preventor Equipment:

Make	Model	Size	Working Pressure
Cameron	SS	12"	3000 psi
Hydril	GK	10"	3000 psi
Cameron	SS	10"	3000 psi.

(f) Hole Sizes and Depths: 17-1/4" to 469'
12-1/4" to 3000'
8-3/4" to 8185'.

(g) Casing Details:

Sizes:	13-3/8"	9-5/8"
Weight:	48 lb	36 lb
Grade:	H 40	J 55
Setting Depth:	469'	2999'.

(h) Casing Cementing Details:

Casing Sizes:	13-3/8"	9-5/8"
Setting Depth:	469'	2999'
Sacks Cement:	360	210
Rise of Cement behind Casing:	To surface	Not to surface.
Method Used:	Pumped	Pumped.

(i) Drilling Fluids:
A freshwater bentonite mud was used. Additions included "Supercol" (a high-yield bentonite), "Unical" (lignosulfonate thinner and inhibitor), "Milcon" (water loss agent and dispersant) and "Synergic" (pH controller). For daily mud properties see Appendix 5.

(j) Water Supply: -
A water well was drilled about 140' from the location to a depth of 100'. Water was produced from this well at about 800 gallons per hour, using a pump jack and electric motor.

(k) Perforating and Shooting Record: Nil.

(l) Plugging Back and Squeeze Cementation Jobs:
The only plugs run were those for the abandonment programme and as an anchor seat for the drill stem test No. 9.

Interval	Length	Sacks of Cement
7000' - 7150'	150'	55
6720' - 6820'	100'	35
5650' - 5750'	100'	35
5150' - 5250'	100'	35
4450' - 4550'	100'	35
2930' - 3030'	100'	35

(m) Fishing Jobs:
The drill string became stuck when pulling out of hole at 8039' after cutting core No. 23 at 1.00 p.m. on April 14, 1965. The core head was at 7547' and the top of the collars at 6944'. The string had dragged from bottom before sticking at this point. 2000 gallons of diesel fuel were spotted without success and 2000 gallons of diesel fuel with 1/4 bbl. of lubricating additive were also spotted, again without success. The Schlumberger free-point indicator was run on April 19 and indicated that the string was stuck at the base of the third collar from the top (at 7035'). The pipe was backed off at the base of the second collar (7005'). The subsequent pipe whip caused the breaking of the Schlumberger line and 7100' of Schlumberger line was lost in the pipe. Fishing with sand

line inside the pipe was not successful, and the backed off pipe was tripped out of the hole. The top of the Schlumberger line was then located inside the casing at 1800' and, after several runs with a spear, the cable was recovered from the hole. The hole was cleaned out to the top of the fish and nine collars, a bumper sub and jars were run and screwed into the fish. Jarring was carried out for five to six hours but was unsuccessful. With circulation recovered 2000 gallons of diesel fuel with a 1.5% content of Halliburton additive were spotted and jarring resumed. The fish was freed after a further five hours of jarring on April 5.

(n) Side Tracked Hole: Nil.

(3) Logging and Testing:

(a) Cuttings:

The samples were collected at 10' intervals and at closer intervals where the lithology warranted. Examination of the cuttings as they were collected over the shaker was maintained on a 24-hour-day basis. Drilling breaks were circulated up and bottom hole circulation samples obtained before tripping.

(b) Coring: A total of 24 cores was cut, as follows -

Core No.	Interval	Recovery	%age Recovery
1	2016'-2027'	8' 0"	75%
2	2420'-2430'	10' 0"	100%
3	3142'-3152'	0' 4"	3%
4	3596'-3606'	7' 2"	72%
5	4189'-4194'	No Recovery	-
6	4194'-4200'	0' 1"	2%
7	4497'-4507'	No Recovery	-
8	4507'-4512'	13' (including 8' from Core No. 7)	100%
9	4908'-4919'	11' 0"	100%
10	5084'-5090'	2' 4"	37%
11	5270'-5280'	10' 0"	100%
12	5609'-5618'	5' 0"	56%
13	5958'-5968'	10' 0"	100%
14	6396'-6406'	4' 0"	40%
15	6763'-6769'	5' 6"	100%
16	6853'-6859'	5' 6"	100%
17	7253'-7263'	6' 0"	60%
18	7385'-7395'	10' 0"	100%
19	7739'-7749'	10' 0"	100%
20	7858'-7862'	1' 6"	38%
21	7895'-7905'	9' 6"	100%
22	7947'-7957'	9' 0"	90%
23	8029'-8039'	8' 6"	85%
24	8176'-8183'	7' 0"	100%

Cuts from the cores were distributed to the Bureau of Mineral Resources. The remainder of the cores was shipped to the Mines Department of Victoria. With the exception of core No. 20, cores were cut using a Reid hard formation conventional 7-7/8" core head. Core No. 20 was cut with a Truco 6" diamond core head.

(c) Side Wall Sampling: Nil.

(d) Electric and Other Logs:

The hole was logged by Schlumberger SEACO as follows -

Electric Logs:

Run 1		469' - 4137'
Run 2		3837' - 6778'
Run 3		6578' - 7958'
Run 4		7858' - 8184'

Microlog-Caliper:

Run 1		469' - 4136'
Run 2		4032' - 6776'
Run 3		6572' - 7957'
	Caliper alone	3002' - 6572'
Run 4		7854' - 8184'
	Caliper alone	6700' - 7400'

Gamma Ray Sonic:

Run 1		469' - 4130'
	Gamma Ray alone	50' - 469'
Run 2		4030' - 6770'
Run 3		6560' - 7950'
Run 4		7850' - 8177'

Continuous Dipmeter Survey:

Run 1	1340' - 4133'
Run 2	3999' - 6773'
Run 3	6599' - 7952'

Velocity Survey:

A velocity survey was run at completion of drilling (see Enclosure 2).

(e) Drilling Time and Gas Log:

A geolograph drilling rate recorder was used to record the drilling rate. The drilling time log was prepared from this data and appears on the composite log. A Core Lab. hot wire type gas detector was used on the well. The gas log appears on the composite log and is discussed under "Occurrence of Hydrocarbons".

(f) Formation Testing:

Nine drill stem tests were run during the drilling of the well. All tests were run using a Halliburton Hydrospring single packer tester using a 5/8" bottom hole choke. Two pressure bombs were used in each test. These were both Amerada (BT) type devices, one of which was run inside the tester 10' above the packer, and one run at the base of the tail pipe. There were no misruns or packer seat failures, except for a partial misrun on Test No. 2, when the packer failed intermittently and then completely after 15 minutes.

Details are as follows (for charts, see Appendix 4) -

DST No. 1

Interval:	1951' -2016'
Initial Shut In Period:	30 mins.
Valve Open:	30 mins.
Final Shut In Period:	15 mins.

Good initial displaced air blow, dying to poor after 20 mins.

Bottom Hole Choke: 5/8"

Recovered 200' salt water, cut water mud and 1450' muddy very slightly gassy salt water (R_w = 0.53 ohm at 70°F)

Pressure: No pressure recordings obtained. Sand in tool.

DST No. 2

Interval:	2365' -2430'
Initial Shut In Period:	15 mins.
Valve Open:	15 mins.

Packer failed intermittently and then finally after 15 mins.

Bottom Hole Choke: 5/8"

Recovered 1200' salty mud. Packer failed intermittently and after 15 mins. failed completely.

Pressure: No pressure recordings obtained. Sand and mudstone in tool.

DST No. 3

Interval:	3822' -3858'
Initial Shut In Period:	15 mins.
Valve Open	30 mins.
Final Shut In Period	15 mins.

Weak initial displaced air blow, dying to very weak after 5 mins.

Bottom Hole Choke: 5/8"

Recovered 20' mud.

Pressures:

	Top Gauge	Bottom Gauge
Initial hydrostatic	2027 psi	1939 psi
Initial Shut In	1326 psi	1351 psi
Initial Flow	19 psi	48 psi
Final Flow	35 psi	59 psi
Final Shut In	1059 psi	1083 psi
Final hydrostatic	1980 psi	1917 psi

DST No. 4

Interval:	4605' -4670'
Initial Shut In Period:	15 mins.
Valve Open:	30 mins.
Final Shut In Period:	15 mins.

Weak initial displaced air blow, dying to very faint after 15 mins.

Bottom Hole Choke: 5/8"

Recovered 40' mud.

Pressures:

	Top Gauge	Bottom Gauge
Initial Hydrostatic	2484 psi	2511 psi
Initial Shut In	1253 psi	1296 psi
Initial Flow	38 psi	92 psi
Final Flow	43 psi	88 psi
Final Shut In	720 psi	843 psi
Final Hydrostatic	2484 psi	2522 psi

DST No. 5

Interval: 4828' -4919'
Valve Open: 75 mins.
Final Shut In Period: 20 mins.
Poor displaced air blow, dying to very weak after 1 hour.
Bottom Hole Choke: 5/8"
Recovered 120' salt water, cut mud.

Pressures:	Top Gauge	Bottom Gauge
Initial Hydrostatic	2701 psi	2763 psi
Initial Flow	15 psi	78 psi
Final Flow	84 psi	145 psi
Final Shut In	1313 psi	1416 psi
Final Hydrostatic	2587 psi	2676 psi

DST No. 6

Interval: 5018' -5084'
Initial Shut In Period: 20 mins.
Valve Open: 45 mins.
Final Shut In Period: 20 mins.
Very strong displaced air blow dying to weak after 40 mins.
Bottom Hole Choke: 5/8"
Recovered 4750' salt water (R_w = 0. 24 ohms @ 73°F)

Pressures:	Top Gauge	Bottom Gauge
Initial Hydrostatic	2720 psi	2763 psi
Initial Shut In Period	2068 psi	2100 psi
Initial Flow	1696 psi	1781 psi
Final Flow	2062 psi	2091 psi
Final Shut In	?2074 psi	2106 psi
Final Hydrostatic	2714 psi	2747 psi

DST No. 7

Interval: 5244' -5282'
Initial Shut In Period: 30 mins.
Valve Open: 45 mins.
Final Shut In Period: 20 mins.
Weak initial displaced air blow increasing to strong. Blow decreased to faint after 40 mins.
Bottom Hole Choke: 5/8"
Recovered 2160' muddy salt water (R_w = 0. 24 ohms @ 73°F)

Pressures:	Top Gauge	Bottom Gauge
Initial Hydrostatic	2877 psi	2997 psi
Initial Shut In Period	2197 psi	2221 psi
Initial Flow	175 psi	204 psi
Final Flow	747 psi	770 psi
Final Shut In	2163 psi	2185 psi
Final Hydrostatic	2877 psi	2997 psi

DST No. 8

Interval:	6409' -6442'
Initial Shut In Period:	15 mins.
Valve Open:	30 mins.
Final Shut In Period:	15 mins.
Weak initial air blow dying to very faint after 10 mins.	
Bottom Hole Choke:	5/8"
Recovered 120' salt water cut mud.	

Pressures:	Top Gauge	Bottom Gauge
Initial Hydrostatic	3756 psi	(
Initial Shut In Period	2415 psi	(
Initial Flow	38 psi	(No
Final Flow	74 psi	(Read-
Final Shut In	1994 psi	(ings
Final Hydrostatic	3756 psi	(

DST No. 9

Interval:	6939' -6995'
Initial Shut In Period:	30 mins.
Valve Open:	34 mins.
Final Shut In Period:	33 mins.
Good initial displaced air blow with fair air blow throughout.	
Bottom Hole Choke:	5/8"
Recovered 270' mud, 900' muddy salt water.	

Pressures:	Top Gauge	Bottom Gauge
Initial Hydrostatic	3748 psi	3749 psi
Initial Shut In	2839 psi	3860 psi
Initial Flow	349 psi	686 psi
Final Flow	554 psi	739 psi
Final Shut In	2751 psi	2771 psi
Final Hydrostatic	3729 psi	3735 psi.

(g) Deviation Surveys:
The following deviation surveys were run -

Depth (Feet)	Deviation from Vertical (Degrees)
60	1/2
188	1/2
299	1/4
930	1/8
1420	1/2
1941	1/2
2016	1/8
2420	7/8
3142	1-
3606	7/8
4184	1/2
4497	1-
4650	1-
5084	1-1/4
5780	3/4
6065	1-
6396	1-
6442	1
6597	Misrun

Depth (Feet)	Deviation from Vertical (Degrees)
6763	1-1/4
6934	Misrun
7062	3-1/2
7150	3-
7250	2-
7321	1-1/4
7451	2-
7528	1-3/4
7588	1-1/4
7673	2-
7739	1-1/4
7805	2-
7947	1-3/4
8101	2-

(h) Temperature Surveys:
Bottom hole temperatures taken in the course of logging by Schlumberger SEACO were as follows -

Depth (Feet)	Temperature (Degrees F.)
4130	123
6778	159
7958	177
8184	179

These figures indicate average geothermal gradients of :-

0.99°F per 100' for the interval 4130' - 6778';
0.53°F per 100' for the interval 6778' - 7958'.

IV. GEOLOGY

(1) Summary of Previous Work:
Petroleum Exploration Permit No. 26 of Planet Exploration Company adjoins the Victorian-South Australian border and consequently has enjoyed the advantages of the attention from both Victorian and South Australian geologists. The area is considered by some workers to be a portion of the Murray Basin and by others to be a part of the Otway Basin of Victoria.

Early workers on the Victorian side of the border included Caldwell (1937-1941) and Kenny and McEachern (1937), who were involved with the reconnaissance mapping of the parishes of Killara, Bahgallah, Dergholm, Roseneath and Myaring, between the years about 1927 and 1932.

In 1945 the Nelson bore, located about 32 miles to the south-south-west of the Casterton No. 1 well was drilled to a depth of 7315'.

A regional airborne magnetometer survey was carried out in 1949 and Boutakoff (1952) published a paper discussing the structural pattern of the area. An important contribution was made by Kenley (1954) who recognised Cretaceous rocks in the area. In 1961 a paper on the sediments of the Nelson Bore was published by G. Baker.

In the meantime, regional ground gravity surveys had been undertaken by Frome-Broken Hill Company since 1957, and these included work at the western end of the Otway Basin. During 1962 this company conducted seismic surveys in the area of Orford and Bessiebelle, north-east of Port Fairy, and towards the close of 1962 and early 1963 drilled two wells in the area. The first of these wells, which were located about 60 miles south-east of Casterton No. 1, was Frome-Broken Hill Pretty Hill No. 1, which was drilled to a depth of 8129'. The second was Eumeralla No. 1 which was taken to a depth of 10,308'.

Seismic work on Planet's P.E.P. No. 26 was carried out by Geoseismic and Namco in 1962, and by Austral Geo Prospectors in 1963.

In the meantime, across the border in South Australia, the Murray Basin had been under geological investigation for a great number of years. A large amount of information on the Recent, Pleistocene and Tertiary sequence was accumulating from surface work and the numerous water wells drilled in the area. In 1952 R. C. Sprigg published a bulletin on the Geology of the South-East Province of South Australia, and in 1953 R. C. Sprigg and N. Boutakoff published a summary report on the petroleum possibilities of the Gambier Sunklands. In 1960 E. P. D. O'Driscoll published a bulletin on the Hydrology of the Murray Basin Province in South Australia. The area has been the subject of a number of aeromagnetic and seismic surveys.

A few deep wells have added greatly to the knowledge of the pre-Tertiary on the South Australian side of the border. The first of these was O.D.N.L. Penola No. 1 which was drilled in 1961 to a depth of 4985' and which was located about 26 miles north-west of Casterton No. 1. This well was followed in 1961-62 by the South East Oil Syndicate Beachport No. 1 well which was taken to a depth of 3963'. In 1962 the O.D.N.L. Mount Salt No. 1 well (about 36 miles south-west of Casterton No. 1) was drilled to a depth of 10,044'. In the same year R. C. Sprigg was the author of a paper on the oil and gas prospects of the Gambier-Portland Basin (A.P.E.A. Conference papers 1962). In 1963 the Beach Petroleum Geltwood No. 1 well was drilled to a depth of 12,300'.

A gread deal of palynological work has been carried out on these wells in the area by officers of the South Australian Mines Department (N. H. Ludbrook), the Bureau of Mineral Resources (P. R. Evans) and the Victorian Mines Department (J. Douglas). In the absence of much in the way of marine fossils in the area, this palynological work has contributed much in the way of establishing age divisions.

Reflection seismic work on the South Australian side of the border has not met with notable success and refraction seismic surveys have more lately been carried out in the Penola-Millicent-Mt Gambier areas.

In March and April of 1964, Planet Heathfield No. 1 well, located about 9-1/2 miles west-south-west of Casterton No. 1, was drilled to a depth of 7500'. This well was still in Merino Group sediments at total depth. In August and September of 1964, Planet Tullich No. 1 well located about 12-1/2 miles north-west of Casterton No. 1,

was drilled to a depth of 5363'. This well also remained in Merino Group sediments at total depth.

The Heathfield and Tullich wells provided much new information in the area, and several correlatable units were apparent between the two wells. In addition, dipmeter surveys on both wells contributed to the structural understanding of the area. A porous sand encountered in the Heathfield well (the "Heathfield Sandstone") was found to be also present in the Tullich well. Another sand in the Tullich well yielded a large very gassy water recovery on drill stem test and a small flare was lit for a few seconds.

Over a 19-day period commencing on September 10, 1964, an 18 well structure hole programme was conducted on a portion of P. E. P. 26 by Cundill, Meyers & Associates. This programme outlined the Casterton structure.

Following the structure drilling programme, about ten miles of refraction profiles were shot by Namco International Inc. in the area of the structure, indicating the presence of between 6,000' and 9,000' of section above basement.

(2) Summary of Regional Geology:

Casterton No. 1 was drilled in the Otway Basin, which is an extensive area of Mesozoic and Tertiary sedimentation covering the south-western part of Victoria and the south-eastern part of South Australia. The Otway Basin is connected through a narrow area defined by the Mt Lofty Range and the Padthaway granite ridge on the west and the "Dundas Peninsular" on the east, to the Murray Basin which is a large area of shallow sediments, mainly Tertiary, which covers parts of South Australia, Victoria and south-western New South Wales.

The Otway Basin can be divided into a number of sub-basins or provinces, known as the Port Campbell Embayment, the Portland Embayment, and the Gambier Sunkland, in which Casterton No. 1 is sited. The Portland Embayment is separated from the Gambier Sunkland by the Dartmoor Ridge. The Mesozoic section attains its maximum thickness in the Gambier Sunklands, where rapid thickening to the south-west is probably related to a system of faults downthrown on the seaward side, which may have been active prior to and during sedimentation.

As well as a thick Tertiary section, both Upper and Lower Cretaceous sediments are present, although the area occupied by Upper Cretaceous is more limited than that occupied by the Lower Cretaceous. The maximum thickness of the Mesozoic section has not yet been established, but may be in excess of 16,000'. The rocks underlying the Lower Cretaceous Merino Group (or its eastern equivalent, the Otway Group) had been encountered only twice in drilling. Frome-Broken Hill Pretty Hill No. 1 struck (?)Cambrian diabase at 7874', and Frome-Broken Hill Fergusons' Hill No. 1 drilled through schist, believed to be of Cambro-Ordovician age, between 11,513' and 11,633'.

Casterton No. 1 made a major contribution to the understanding of the regional geology of the area, in that it indicated the presence of a section at the base of the Mesozoic sequence which was hitherto unknown in the area. This section, in excess of 1000' thick, was

made up of a number of discrete units with a wide range of lithologies and included some minor Jurassic volcanics.

Although the well is located very close to the margin of the Basin, it encountered over 8000' of sediments overlying basement. Basement was encountered at 8038' and consists of phyllitic slate of probable Lower Paleozoic age.

(3) Stratigraphic Table:

KB 472' A. S. L.
Ground 461' A. S. L.

Age	Formation	Informal Rock Unit	Tops Below KB	Subsea	Thickness
		Kelly bushing to surface			11'
		Quartz sand, fossil fragments and clay	11'	+ 461'	49'
Lower Cretaceous	Merino Group	Siltstone, mudstone and minor sandstone	60'	+ 412'	1001'
		Mudstone, siltstone and sandstone	1061'	- 589'	898'
		"Heathfield Sandstone"	1959'	-1487'	66'
		Siltstone, mudstone and sandstone	2025'	-1553'	653'
		Siltstone and mudstone with some sandstone and coal seams	2678'	-2206'	644'
		Mudstones, sandstones and siltstones	3322'	-2850'	348'
		Mudstones, sandstones and siltstones with a few coal seams	3670'	-3198'	175'
		Sandstone	3845'	-3373'	18'
		Siltstone, mudstone, sandstone and shale	3863'	-3391'	325'
		Shale, siltstone and minor sandstone	4188'	-3716'	467'
		Sandstone	4655'	-4183'	33'
		Shale, some minor siltstone and sandstone interbeds	4688'	-4216'	142'
		Sandstones with shale and siltstone interbeds	4830'	-4358'	273'
		Shale with minor siltstones and sandstones	5103'	-4631'	170'
		Sandstone	5273'	-4801'	344'
		Shale, some minor sandstone	5617'	-5145'	213'

Age	Formation	Informal Rock Unit	Tops Below KB	Subsea	Thickness
		Sandstone	5830'	-5358'	587'
		Sandstone and shale	6417'	-5945'	340'
		Conglomerate and shale	6757'	-6285'	19'
Jurassic		Orthoquartzite	6776'	-6304'	124'
		Sandstone	6900'	-6428'	325'
		Conglomerate sandstone	7225'	-6753'	42'
		Shale and siltstone?	7267'	-6795'	7'
		Siltstone	7284'	-6812'	43'
		Shale	7317'	-6845'	298'
		Siltstone	7615'	-7143'	185'
		Shale and siltstone	7800'	-7328'	20'
		Shale	7820'	-7348'	32'
		Dolerite	7852'	-7380'	28'
		Shale	7880'	-7408'	11'
		Dolerite	7891'	-7419'	63'
		Siltstone and shale	7954'	-7482'	84'
Lower Palaeozoic		Phyllitic slate	8038'	-7566'	147'+

Total Depth - 8185'.

(4) Stratigraphy

(a) Recent and Tertiary
(Glenelg Group in part?)

11'-60' (49'): Unit consisting of quartz sand, fossil fragments and clay.

The sand occurs as loose grains of coarse clear, light brown, grey polished sub-angular to sub-rounded quartz. Fossil fragments are abundant, consisting of bryozoans and some forams, and white, light grey, yellow and brown shell fragments. Yellow soft sticky clay is also present.

Electrical Characteristics: No electric logs were run over this unit.

(b) Lower Cretaceous
Merino Group.

60'-1061' (1001'): Unit consisting of siltstone, mudstone and minor sandstone.

The siltstone is predominantly light to medium grey, varying occasionally to light green near the bottom of the unit. It is

argillaceous, micaceous, carbonaceous, slightly sandy, and contains pellets of grey mudstone and siltstone in places, as well as occasional quartz grains. The siltstone is generally firm, calcareous in part, and contains traces of pyrite.

The mudstone is predominantly light grey and light greenish grey, varying occasionally to greyish-brown. It is silty, micaceous, firm, blocky, and generally contains traces of carbonaceous material.

The sandstone is light grey, very fine to fine-grained, silty, clayey, slightly carbonaceous in part, micaceous and occasionally pyritic, consists of fairly sorted sub-angular, clear, cloudy and dark quartz grains, with minor mica, carbonaceous material and feldspars, in a clayey matrix.

Electrical Characteristics: Electrically this unit shows a fairly featureless S. P. curve with a few minor positive shifts of up to 10 mv. The 16" normal resistivity curve shows values between 2 and 5 ohm M^2/M, with a few sandstone beds reading to 9 ohm M^2/M. These sandstone beds generally are associated with positive shifts of the S. P. curve, suggesting that the formation water is fresher than the mud filtrate.

The gamma ray curve shows a mean reading of 90 API units with variations above and below this value not exceeding 10 API units.

The average sonic velocity for the unit is around 140 microseconds per foot with an increase near the base to about 125 microseconds per foot.

1061'-1959' (898'): Unit consisting of mudstone, siltstone and sandstone.

The mudstone is predominantly light grey and light greenish-grey, varying occasionally to light green or dark brown. It is silty, micaceous, generally slightly carbonaceous, slightly calcareous in part, and locally slightly bentonitic. It is generally firm and blocky, but is occasionally soft, and contains an occasional trace of pyrite.

The siltstone is light medium grey, varying occasionally to brown. It is argillaceous, micaceous, carbonaceous, generally calcareous, commonly sandy and occasionally sideritic. It contains occasional siltstone pellets and common traces of pyrite.

The sandstone is generally grey, light grey or greenish in colour, varying occasionally to brownish-grey or white. It is very fine-grained to medium-grained, commonly argillaceous, feldspathic, and occasionally micaceous and slightly carbonaceous. It consists of sub-angular to sub-rounded light grey quartz, carbonaceous material, traces of dark grey chert, white feldspar, mica and lithic fragments and occasional traces of pyrite in a calcareous to kaolinitic matrix. It may be calcareous and hard, or non-calcareous and soft.

Very minor amounts of carbonaceous shale and coal are also present. The shale is soft, coaly and grades to a black, soft, dirty, shaley coal.

Electrical Characteristics: This unit can be electrically sub-divided into two sub-units as follows -

(i) 1061' -1441'
The S. P. curve in this sub-unit shows little variation from the above unit with fluctuations up to 5 mv, whilst the 16" resistivity curve also shows little variation with readings from 2 - 7 ohm M^2/M. The gamma ray shows fluctuations from 110 - 60 API units, the lower readings corresponding with increasing sand content.

The sonic velocity ranges from 140 to 120 microseconds per foot with several sandstone interbeds showing velocities of up to 82 microseconds per foot.

(ii) 1441' -1959'
Electrically this sub-unit differs from the one above in that the 16" resistivity values are lower with average readings of 2 - 3 ohm M^2/M. Occasional more resistive streaks read up to 5 ohm M^2/M. The S. P. curve also shows some character in this unit with several negative shifts of up to 10 M. V. over sandstone interbeds, suggesting that the formation water is now more saline than the mud filtrate.

The level of natural radioactivity is relatively constant between 75 and 100 API units.

The sonic log shows an average velocity of about 125 microseconds per foot with a few thin sandstone bands having a velocity up to 86 microseconds per foot.

1959' -2025' (66') - "Heathfield Sandstone": The sandstone contains interbeds of siltstone and mudstone.

The sandstone is medium to very coarse-grained and is obtained in the cuttings as loose grains, and occasional pebbles, of angular to sub-rounded clear, cloudy and white quartz grains showing some frosting and polishing. Traces of pyrite are also present.

The siltstone is light grey and greenish-grey. It is generally sandy, argillaceous, micaceous, carbonaceous, and locally slightly calcareous. The siltstone is occasionally in pellet form and contains traces of pyrite. It is very dirty in part, and is generally fairly hard.

The mudstone is light grey or light green in colour, slightly silty, slightly calcareous, micaceous and carbonaceous, and is generally rather soft. Core No. 1 (2016' -2027') was cut over the basal part of the unit where the section consisted mainly of interlaminated siltstones and mudstones. The core indicated flat dips.

Electrical Characteristics: This unit constitutes a good electrical marker. The S. P. shows a negative shift of up to 30 mv above the shale line of the adjacent units. The 16" resistivity curve also shows an increase in resistivity with values to 6-1/2 ohm M^2/M. Porosity is shown by the

microlog-caliper and by the sonic log. (See under "Porosity and Permeability".)

Gamma ray readings vary from 38 A. P. I. units for the cleaner sandstone to 120 A. P. I. units for the mudstone interbeds.

The sonic velocity of the porous sandstone ranges down to 105 microseconds per foot (see under "Porosity and Permeability"), whilst the velocity of the thin mudstone interbeds is as low as 135 microseconds per foot.

2025' -2678' (653'): Unit consisting of siltstone, mudstone and sandstone.

The siltstone is predominantly light and medium-grey, but varies to light grey and green at the top of the unit with some traces of greyish-brown, and whitish-grey siltstone. It is sandy, carbonaceous, micaceous, generally feldspathic, argillaceous and calcareous and ranges from soft to hard.

The mudstone is predominantly light grey or greenish-grey, medium-grey and brown. It is micaceous, slightly bentonitic in part and slightly carbonaceous. It contains occasional plant fragments.

The sandstone is predominantly light grey, varying to greyish-white, and is fine-grained to very fine-grained. A kaolinitic, soft variety and a calcareous, hard variety of the sandstone alternate throughout the unit. The sandstone consists of poorly sorted sub-angular to sub-rounded quartz, coaly flecks and grains, and occasional plant fragments, mica, white feldspars, occasional red lithic grains, and plant resin in a kaolinitic or calcareous matrix. The sandstone is occasionally friable. Minor amounts of shale are present in this unit, which consists of a black, dark grey or brown carbonaceous, coaly soft variety, and a dark grey, micaceous variety.

Core No. 2 was cut in this unit and consisted of generally flat bedded, interlaminated mudstone, siltstone and minor sandstone with some cross-bedding, lensing and current structures.

Electrical Characteristics: Electrically this unit has little character. The S. P. maintains a near shale line value, with several minor negative shifts up to 15 mv corresponding in part to sandstone interbeds. The 16" normal resistivity curve also maintains a relatively steady value of 1-1/2 to 2-1/2 ohm M^2/M with several thin resistive beds with readings up to 6.5 ohm M^2/M. The microlog does not indicate porosity, and the caliper indicates that the unit as a whole is close to gauge.

The gamma ray log shows an average value of 95 A. P. I. units with values varying from 70 A. P. I. units for sandstones to 110 A. P. I. units for shales.

The velocity of the unit shows a gradual overall increase downwards from 120 to 100 microseconds per foot. A number of thin sandstone bands show velocities of up to 75 microseconds per foot.

2678' -3322' (644'): Unit consisting of siltstone and mudstone, with some sandstone and coal seams.

The siltstone is light to medium-grey, micaceous, carbonaceous, commonly sandy, occasionally feldspathic and occasionally argillaceous. It is locally lithic and slightly calcareous in part.

The mudstone is light to medium-grey and occasionally brown, greenish-grey or bluish-grey. It is slightly micaceous, silty in part, fairly soft, and contains common carbonaceous specks.

The sandstone is light to medium-grey, and occasionally light brownish-grey. It is predominantly fine-grained but occasionally ranges to very fine-grained or medium-grained. It is calcareous, generally feldspathic, firm to soft, occasionally lithic, locally tuffaceous and consists of poorly to fairly sorted sub-angular to sub-rounded dark grey and colourless quartz, white feldspar, occasional carbonaceous specks, plant remains, yellow clay pellets, yellow and red lithic fragments, and reworked green mudstone, in a light grey, kaolinitic, clayey and/or calcareous matrix.

About a dozen impure seams of probably low quality coal are present, between one and three feet thick.

The coal is black to dark grey, or occasionally brown in colour, shaley (occasionally it grades to coaly shale), dirty and soft. An attempt was made to core a coal seam (Core 3, 3142' -3152') but only a 4" recovery of carbonaceous mudstone was obtained.

Electrical Characteristics: The electrical logs in this unit lack character, the S. P. log showing only several negative shifts of up to 10 mv. and slight positive shifts over the coal seams. The resistivity curve reads values of between 2 and 4 ohm M^2/M with several thin streaks of coal reading up to 9 ohm M^2/M. The microlog illustrates the thinly interbedded nature of the unit.

The gamma ray log shows an average value of 96 A. P. I. units with a spread of values from 60 to 115 A. P. I. units. Sandstones and coal seams show the lower readings.

The sonic log shows a downwards increase in velocity from 115 to 100 microseconds per foot. The coal seams read higher velocities with several thin seams having velocities up to 72 microseconds per foot.

3322' -3670' (348'): Unit consisting of mudstone, sandstone and siltstone.

The mudstone is light greenish-grey, bluish-grey or brown. It is slightly micaceous, silty and varies from fairly soft to fairly hard.

The sandstone is white, light grey and medium-grey, fine to coarse-grained and occasionally very coarse and pebbly. It is feldspathic, occasionally lithic, and ranges from soft, friable to hard, calcareous in places. It is slightly micaceous and slightly carbonaceous in part. Generally it consists of poor to fairly sorted angular to rounded, light grey, colourless, clear,

frosted and sometimes polished quartz grains and also rare pink and yellow quartz, lithic fragments of clay, mudstone and shale, mica, coaly grains, white feldspar, occasional mudstone pellets and traces of chlorite and phyllite in a kaolinitic or calcareous matrix.

The siltstone is light to medium-grey, micaceous, generally carbonaceous, feldspathic and soft. At the bottom of the unit there is some white, firm calcareous and sandy siltstone.

Traces of dark carbonaceous shale and traces of coal occur throughout the unit, but no discrete seams could be identified.

A core cut in this unit showed the thin bedded nature of the unit. Bedding was flat with some cross-bedding up to 10^{o}.

Electrical Characteristics: The S. P. curve of this unit shows several negative shifts of up to 15 mv across sandstone interbeds. Values of the 16" resistivity curve range from 2 to 7 ohm M^2/M, the higher values corresponding with the negative shifts of the S. P. curve.

The gamma ray log of the unit shows a variable radioactivity for the unit, ranging from 70 to 140 A. P. I units.

The sonic velocity of the unit varies from 110 to 75 microseconds per foot, with an average sonic velocity between 95 - 100 microseconds per foot.

The microlog shows generally higher resistivities than the overlying unit, with numerous resistive streaks.

3670' - 3845' (175'): Unit consisting of mudstone, sandstone and siltstone with a few thin dirty coal seams.

The mudstone is light greenish-grey to grey, slightly micaceous, slightly silty and fairly soft.

The sandstone is light grey, fine to medium-grained, generally feldspathic, calcareous, occasionally slightly silty, slightly micaceous, slightly carbonaceous, and generally firm. It consists of fairly sorted sub-rounded, light grey and frosted quartz, some white feldspars, and occasional traces of carbonaceous shale, biotite and chlorite, in a kaolinitic to calcareous matrix.

The siltstone is white, light grey or medium-grey. It is commonly calcareous, slightly micaceous, generally sandy, sometimes argillaceous and contains common carbonaceous specks. It may be friable or firm.

The coal is black, dirty and shaley, brittle and fissile. It grades to dark grey, soft, coaly shale.

Electrical Characteristics: The S. P. curve for this unit shows a near shale line value with a few negative shifts of up to 8 mv over sandy sections. The resistivity curve also shows a few highs corresponding with the S. P. curve, values ranging from 2 - 7 ohm M^2/M.

The gamma ray log indicates values ranging from 80 - 120 A. P. I. units with a mean of approximately 105 A. P. I. units.

The lower values correspond to sandstone interbeds or coal seams.

The sonic velocity shows little change from the unit above except for thin coal seams and thin sandstone interbeds with sonic velocities up to 78 microseconds per foot and of mudstones with sonic velocities as low as 115 microseconds per foot.

3845' -3863' (18'): Unit consisting of sandstone.

This sandstone was fast drilling and obtained partly as loose grains in the sample. The loose grains consisted mainly of coarse to very coarse, angular to sub-rounded, clear vitreous and some frosted light grey quartz, with about a 25% admixture of lithic grains including pale green quartzite, green-grey phyllites and white claystone. Some white feldspars are also present.

About 50% of the sandstone was of a different type (rather similar to those in the overlying units) and was recovered in the sample as chips rather than as loose grains. This sandstone is white, whitish-grey and light green, fine-grained, consisting of moderately sorted sub-angular quartz and white, partly kaolinized feldspars in a kaolinitic to calcareous matrix.

Some light grey, medium-grey, sandy carbonaceous, micaceous, fairly hard siltstone, and some light grey to brown, fairly hard, micaceous and carbonaceous mudstone, occur in this unit.

Electrical Characteristics: The unit has considerable electrical character with an S. P. negative shift of 26 mv and resistivity values from 5 to 8-1/2 ohm M^2/M.

Gamma ray values show relatively low readings over the sandstone of between about 70 and 80 A. P. I. units.

The sonic log shows a mean velocity of 92 microseconds per foot, with one sandstone bed near the top of the unit having a sonic velocity of 72 microseconds per foot. The microlog indicates positive separation and some filter cake build up. Drill Stem Test No. 3, however, indicated no effective porosity is present.

3863' -4188' (325'): Unit consisting of siltstone, mudstone, sandstone and shale.

The siltstone is light to medium-grey, argillaceous, micaceous, carbonaceous, occasionally sandy, and fairly hard to fairly soft.

The mudstone is light grey, light greenish-grey and brownish grey. It is slightly micaceous, silty and firm to soft and contains carbonaceous specks and occasional plant fragments.

The sandstone is light grey and white-grey. It is fine to very coarse-grained with occasional granules and pebbles, calcareous in part, occasionally micaceous and occasionally feldspathic. It consists of poorly to fairly sorted angular to sub-rounded light brown, grey, clear, frosted and polished quartz,

occasional white feldspars, common traces of greyish-green phyllite, carbonaceous and coaly flecks, biotite, green quartzite and dark grey chert with some minor green pellets and yellow claystone grains in a kaolinitic and/or calcareous matrix.

Scattered sub-angular to sub-rounded coarse to very coarse quartz grains are common in this unit.

The shale is black to grey and dark brown, carbonaceous or coaly, soft and contains common plant fragments. Traces of coal are also present in this unit.

Electrical Characteristics: The S. P. curve over this unit shows numerous negative shifts of up to 15 mv across sandstone interbeds, with corresponding increases in the electrical resistivity. The resistivity values range from 2 ohm M^2/M with high values to 9 ohm M^2/M.

The gamma ray log for this unit shows an increase in radioactivity with respect to the overlying unit. Mean value is about 115 A. P. I. units.

The sonic velocity for the unit shows an average value of about 95 microseconds per foot with a range from 72 - 115 microseconds per foot.

4188' -4655' (467'): Unit consisting of shale, siltstone and minor sandstone.

The shale is dark brown, medium to dark grey in colour, and generally carbonaceous, slightly micaceous, silty in part, fairly soft to hard, and is rather blocky in places. Also present is black, carbonaceous, coaly shale, which grades to shaley coal in places.

The siltstone is light grey, medium-grey, green-grey or light brown in colour, containing carbonaceous specks and some coaly flecks and laminations. It is generally micaceous, sandy and argillaceous in part, fairly soft to hard and locally feldspathic.

The sandstone is light to dark grey, white speckled or light brown, very fine to coarse-grained, calcareous, lithic, occasionally feldspathic, locally friable, fairly soft to hard, consisting of poorly to well sorted sub-angular to sub-rounded, occasionally rounded, clear, grey, white, light brown and frosted quartz, white and pink feldspars, mica, lithic fragments including phyllites, carbonaceous and coaly specks, dark grey shale and carbonaceous shale fragments, red and green indeterminate specks and some yellow claystone, together with minor brown clayey inclusions, in a kaolinitic to calcareous matrix.

Some very minor mudstone is also present in the unit. It is light grey, medium-grey or green-grey, slightly micaceous, silty in part, shaley in part, contains some carbonaceous specks, and ranges from fairly soft to hard.

The unit is rather slow drilling compared to the units above and below.

Cores Nos. 7 and 8 were cut in this unit and obtained a combined recovery of 13'. The cores indicate the interbedded nature of the unit and show dips of between 0^{o} and 5^{o}.

Electrical Characteristics: The S.P. curve shows little variation in values with only several small (to 10 mv) negative shifts over sandstone interbeds. The resistivity curve shows several readings to 9 ohm M^2/M, corresponding with the S.P. negative shifts, and overall readings ranging from 2 to 9 ohm M^2/M.

Gamma ray values show a mean of 120 A.P.I. units with a range from 70 - 140 A.P.I. units.

The sonic velocity for the unit is very variable with a range from 125 to 70 microseconds per foot.

The microlog illustrates the interbedded nature of the unit, and the caliper indicates that the unit has a tendency to cave, particularly compared to the underlying unit.

4655'-4688' (33'): This unit consists of sandstone with minor interbeds of siltstone and shale.

The sandstone is white to light grey, very fine to coarse-grained, lithic, calcareous, kaolinitic, friable, consisting of sub-angular to sub-rounded, clear to light grey quartz, partly kaolinized feldspars, mica, carbonaceous specks and lithics (including dark grey shale, carbonaceous shale, phyllite and red lithic specks) in a kaolinitic matrix.

The siltstone is light grey, firm, micaceous, sandy in part, and contains carbonaceous specks.

The shale is light grey to medium-grey, firm to hard, argillaceous in part, silty in part, micaceous. A black, coaly, brittle variety of shale is also present.

Electrical Characteristics: The S.P. curve for this unit shows a marked negative shift varying from 20 - 28 mv above the shale base line. The resistivity 16" normal curve shows values of 5 to 8-1/2 ohm M^2/M. In places the microlog caliper shows a build up of mud cake and some positive separation (see under "Porosity and Permeability"). Drill Stem Test No. 4, however, indicated that no effective porosity is present.

The gamma ray log for the unit shows a decrease in radioactivity compared to the overlying and underlying units with values ranging from 60 to 90 A.P.I. units.

The sonic log shows velocities between 90 and 75 microseconds per foot.

4688'-4830' (142'): Unit consisting of shale, with some minor siltstone and sandstone interbeds.

The shale is medium to dark grey or in places light grey, slightly micaceous, silty, occasionally argillaceous, generally fairly hard.

Some dark grey to black, carbonaceous to coaly shale is also present.

The siltstone is light to medium-grey, carbonaceous, sandy and argillaceous in parts.

The sandstone is light grey to white, predominantly fine-grained, but varying in places to coarse-grained, kaolinitic, feldspathic, micaceous, slightly carbonaceous, occasionally calcareous, lithic in part, occasionally friable, fairly soft and clayey in places. It consists of fairly to poorly sorted, clear to light grey, rounded to sub-angular and occasionally angular quartz with a trace of rounded frosted white quartz, white and pink partly-kaolinized feldspars, biotite and muscovite, occasional carbonaceous fragments and numerous lithic metamorphic fragments (schist and phyllites) and rare traces of siltstone and green quartzite grains and dark grey chert in a kaolinitic and/or calcareous matrix.

Electrical Characteristics: The S. P. curve for this unit shows a near steady shale line value with a few minor negative shifts of up to 5 mv, whilst the resistivity curve shows corresponding highs of up to 9-1/2 ohm M^2/M. Most resistivity values are between 2 and 4-1/2 ohm M^2/M.

The gamma ray shows a mean value of 115 A. P. I. units with a range of between 75 and 120 A. P. I. units.

The sonic velocity for the unit varies from 70 to 110 micro-seconds per foot with a mean velocity of around 90 micro-seconds per foot.

4830' -5103' (273'): Unit consisting of sandstone with shale and siltstone interbeds.

This is an important unit as the lower portion of the sandstone showed good reservoir characteristics, a recovery of 4750' of salt water being obtained on Drill Stem Test No. 6 (see under "Porosity and Permeability").

The sandstones are garnetiferous and were commonly recovered in the samples as loose grains. The grains are dominantly light brown, light grey, white, clear and occasionally yellow, fine to coarse-grained sub-angular to sub-rounded quartz. Also present are minor amounts of grains of reworked grey shale, green quartzite, grey mica, schist, phyllites and serpentines, as well as calcite and orange and red garnets.

Where the sandstones were obtained as consolidated chips in the samples, they are light grey to white-grey in colour, very fine to very coarse-grained, kaolinitic to feldspathic, vitreous and brittle, in places garnetiferous, slightly calcareous in part, and may be fairly soft to hard. They consist of poorly to well sorted sub-angular to sub-rounded light brown, light grey and clear quartz, some frosted quartz grains, common mica schist and phyllite fragments, garnets, partially kaolinized feldspars with occasional mica and partly carbonaceous shale fragments in a siliceous, to calcareous or kaolinitic matrix.

The shale is predominantly medium to dark grey, silty, slightly micaceous, slightly carbonaceous, firm and blocky. Some dark grey-black, carbonaceous to coaly fissile shale, and rare traces of brown, hard ferruginous shale are also present.

The siltstones are light to medium-grey, very micaceous, sandy in part, occasionally argillaceous and fairly hard. They contain fairly abundant carbonaceous specks and rare traces of pyrite. Occasional traces of black, dirty, shaley coal are present in the unit.

The unit is fairly fast drilling, particularly in comparison with the underlying unit.

Two cores were cut in the sandstones of this unit. The sandstone in Core No. 9, near the top, contained some coaly inclusions and plant fragments. Core No. 10, cut near the bottom of the unit, indicates the presence of a few scattered pebbles including chlorite schists and phyllites. Dips in the two cores ranged between 5^{o} and 20^{o}.

Electrical Characteristics: Electrically this unit shows considerable character. The S. P. curve over the sandstone shows negative shifts up to 42 mv over the shale base line. The resistivity 16" normal curve shows values ranging from 3 to 11-1/2 ohm M^2/M. The microlog caliper shows mud cake build up over most of the unit, with several caves out to 12" in the shale interbeds. The microlog resistivity curve indicates porosity over most of the sandstone in the unit, but drill stem testing indicated that only the porosity in the lower part was effective (see under "Porosity and Permeability").

The gamma ray log shows values in the sandstone decreasing from 95 A. P. I. units to 50 A. P. I. units from the top to the bottom of the unit, indicating that the sandstone becomes cleaner towards the base of the unit. The readings over the shale and siltstone interbeds range from 90 to 120 A. P. I. units.

The sonic velocity of the unit shows a mean of 85 microseconds per foot, with a range from 67 to 113 microseconds per foot.

5103' -5273' (170'): Unit consisting of shale, with minor siltstones and sandstones.

The unit drills fairly slowly, in comparison with the underlying and overlying units.

The shale is predominantly medium-grey varying to green-grey, light grey and dark grey. It is micaceous, silty, chloritic in part with carbonaceous specks fairly common. It is generally fairly hard and blocky. Some soft, brown, carbonaceous shale is present as well as traces of hard, brown, ferruginous shale and black, brittle coal.

The siltstone is predominantly light grey with some green-grey and white-grey siltstone. It is micaceous, generally sandy, feldspathic in part, generally firm but soft in places. Carbonaceous specks are common.

Minor amounts of loose grains of medium to coarse-grained quartz, as well as some garnets, traces of reworked phyllites and quartzites are present in the samples. These may be cavings. Minor amounts of brownish-grey, hard, ferruginous, fine to medium-grained sandstone are also present. This sandstone consists of lithic grains of mica schist, carbonaceous shale, brown claystone, and sub-angular clear quartz and some feldspars in a brown to brownish-red ferruginous, siliceous, calcareous matrix.

Near the base of the unit there is a similar type of sandstone to that in the underlying unit. Core No. 11 indicates that the unit boundary is coincident with an increase in porosity. It also indicates the presence of gentle current bedding, overall flat dips, and the presence of graphite in the sandstone.

Electrical Characteristics: The electrical logs of this unit resemble those of the predominantly shale unit between 4680' and 4830'. The S.P. curve shows a few negative shifts of up to 8 mv, but is generally close to the shale line. The resistivity curve shows readings generally between 3 and 8 ohm M^2/M, while some sandstone and siltstone interbeds read out to as much as 12 ohm M^2/M.

The gamma ray log shows a mean value of about 120 A.P.I. units with a range of 85 - 144 A.P.I. units.

The sonic velocity of the unit is very variable, varying from 67 to 118 microseconds per foot. The unit has a considerably slower sonic velocity than the overlying and underlying units. The caliper log shows cavings out to as much as 13" in some of the shale sections.

5273' -5617' (344'): Unit consisting of sandstone.

The discovery of this thick potential sandstone reservoir, with 290' of net effective porosity, represents a major contribution to petroleum exploration in the area.

Rather more than half of the sandstone was obtained as loose grains in the samples. These were evidently derived from a sandstone which, as seen in consolidated chips, is light brown, fine to coarse-grained, generally friable, occasionally hard, and calcareous in part. It consists of fairly well sorted light brown, light grey, clear and some frosted angular to sub-angular quartz, with common traces of feldspar (generally kaolinized), garnets, occasional grey lithics, sideritic material, and rare traces of graphite, serpentine, phyllite in a kaolinitic, siliceous or calcareous matrix.

Very minor siltstones are possibly present in this unit. These are light to medium-grey, micaceous, occasionally argillaceous and contain carbonaceous specks. A high proportion of dark grey shales was obtained in the cuttings, but these, along with possibly some of the siltstones, were probably cavings.

Core No. 11 was cut in the top of the unit. Carbonaceous and micaceous laminations are present, indicating some cross-bedding mostly between 5^o and 15^o. The overall dip, however, appears flat.

Electrical Characteristics: The electrical logs for this unit have a great deal of character, in particular the S. P. curve which shows a negative shift of from 37 to 52 mv above the shale base line. The 16" normal resistivity curve varies between 5 and 9 ohm M^2/M, with several streaks having values up to 17-1/2 ohm M^2/M. The 64" normal reads about 2 ohm lower than the 16" normal, due to the greater influence of the salty formation water further away from the bore hole. The microlog caliper shows good mud cake build up over the whole unit. The microlog resistivity curves show positive separation (see under "Porosity and Permeability").

The gamma ray log for the unit shows a mean value of 60 A. P. I. units corresponding to a relatively clean sandstone, with several shale streaks showing readings up to 120 A. P. I. units.

The sonic velocity of the unit shows an overall slight downwards increase from 83 to 77 microseconds per foot, with several beds near the base showing readings to 55 microseconds per foot.

5617' -5830' (213'): Unit consisting of shale with very minor sandstone interbed.

The shale is predominantly medium-grey to, in places, dark grey, micaceous, carbonaceous, silty, sandy in part, and moderately hard.

The sandstone is largely restricted to a 12' interbed in the middle of the unit. Mostly loose grains were obtained in the cuttings. These were of fine to medium-grained sub-angular, clear quartz with occasional sub-rounded frosted quartz. Some consolidated sandstone was obtained which, in addition to grains as above, contained some partly kaolinized white feldspars, scattered dark grey chert grains, occasional green-grey schists, and trace garnets in a kaolinitic to calcareous matrix.

Very minor siltstones are present, probably as laminations in the shale. These are light to medium grey, micaceous, argillaceous, occasionally sandy, feldspathic. Carbonaceous specks are common.

The Core No. 12 recovery was from the top of this unit. The core indicated dips close to flat in the shale with some very minor swirling, lensing and depositional slumping evident in silt laminations.

Electrical Characteristics: The S. P. curve over this unit shows an almost straight shale line with one negative shift of 30 mv across the single sandstone interbed in the middle of the unit. The resistivity curve shows values varying from 4 to 10 ohm M^2/M. The microlog caliper shows a mud cake build up over the middle sandstone bed and the microlog resistivity curve shows porosity over the same interval (see under "Porosity and Permeability").

The gamma ray log shows a mean reading over the shale beds of 130 A. P. I. units with a reading of 60 A. P. I. units over the middle sandstone bed.

The sonic velocity is very variable over the unit with a range of 63 to 102 microseconds per foot and a mean of about 83 microseconds per foot. The unit has a considerably slower velocity than the overlying and underlying units.

5830'-6417' (587'): Unit consisting of sandstone, with some very minor shale and siltstone interbeds. Near the base some thin conglomerate bands are present. This thick unit contains 454' of net porosity. Porosity is poorer than in the previous sandstones (see under "Porosity and Permeability").

The sandstone was recovered in the samples largely as loose grains, consisting of clear, frosted, milky, cloudy, brown (siderite or limonite stained), light grey, whitish and pink quartz with rare traces of yellow quartz. The quartz grains range from fine to very coarse-grained, and from angular to sub-rounded (predominantly sub-angular). Occasionally kaolinitic clay is present adhering to the quartz grains. Lithic grains are also present, consisting of phyllite, mica schist, grey and green shale fragments, serpentine, green and grey quartzite, diorite, chlorite schist, grey-green slate and rare traces of tuff. Common pink garnets, pink feldspar, occasional dark grey chert, occasional trace pyrite, and rare traces of graphite are also present.

Where the sandstone was recovered as consolidated chips, it is predominantly light brown to light grey, fine to medium-grained, occasionally coarse-grained, slightly calcareous and hard in part. It consists of poorly to well sorted, generally sub-angular, and some sub-rounded, light grey, light brown, clear and some frosted quartz, partly decomposed white feldspar, occasional grey chert and biotite and rare traces of graphite. Also present are common traces of garnets and lithic grains (mainly grey and green shale, phyllite, serpentine, and traces of chlorite schist) in a siliceous to kaolinitic and occasionally calcareous matrix.

The siltstone is light to medium-grey, and occasionally whitish-grey. It is micaceous, feldspathic, argillaceous, dirty in part and lithic in part. Carbonaceous specks are common.

The shale is medium and dark grey, micaceous, silty, carbonaceous and coaly in places. It is generally fairly hard.

Core No. 13 cut near the top of the unit showed the very coarse-grained, cross-bedded nature of the sandstones, and also the presence of clayey, silty, micaceous laminations.

Core No. 14 was cut near the bottom of the unit, and indicated the presence of thin, conglomerate bands (about 2" thick) in the sandstone. Pebbles varying from 1/4" to 3" in diameter were present in these bands and consisted of quartz, shale and phyllite and sandstone. One shale interbed was present in the core which showed pebble load casting on its upper surface. It is possible that the conglomerate bands are also present higher in the unit than in the cored interval. Core No. 14 indicated that bedding was approximately horizontal.

Electrical Characteristics: Electrically this unit has a character similar to the sandstone unit between 5273' and 5617', except for clayey streaks and increased resistivity near the base. The S. P. curve shows negative readings mostly ranging from 25 to 45 mv above the shale base line. The 16" resistivity curve shows a steady overall increase from top to bottom of the unit, of from 7 to 13 ohm M^2/M. There are several streaks showing readings up to 23 ohm M^2/M. The microlog caliper shows good mud cake build up over the unit. The microlog resistivity shows porosity over most of the unit (see under "Porosity and Permeability") with numerous streaks of high resistivity corresponding to very thin zones of no mud cake build up.

The gamma ray log shows a mean of 65 A. P. I. units with the shale streaks giving readings up to 120 A. P. I. units.

The sonic velocity of the unit shows an overall slight increase from top to bottom the average velocity values increasing from 75 to 70 microseconds per foot.

6417'-6757' (340'): Unit consisting of interbedded sandstones and shales.

The sandstones are recovered in the samples partly as loose grains, although the proportion of sandstone recovered as consolidated chips is slightly higher than in the preceding sandstone units. The loose grains consist of fine to coarse-grained, occasionally very fine or very coarse, sub-angular to sub-rounded, clear, milky and frosted quartz, and occasional lithic grains of serpentine, phyllite, chlorite schist as well as occasional feldspars and garnets. Where it is obtained as consolidated chips the sandstone is predominantly light grey, fine to medium-grained, calcareous, lithic, dirty, clayey, friable to fairly hard in part, occasionally micaceous (biotite and muscovite), occasionally feldspathic and consists of poorly to fairly sorted sub-angular and some sub-rounded clear, glassy, milky, light grey or light brown quartz with white, partly kaolinized feldspars, mica, lithics (including dark grey shale, grey-green phyllite and carbonaceous shale) and traces of pink garnets, in a predominantly kaolinitic to occasionally siliceous or calcareous matrix.

The shales are medium-grey, dark grey, greenish-grey, or black in colour, micaceous, slightly silty in places and generally moderately hard.

Electrical Characteristics: The electrical character of this unit reflects the interbedded nature of the sandstone and shale. The S. P. curve of this unit shows negative shifts of up to 37 mv with the curve occasionally returning to the shale base line. The 16" resistivity curve varies between 5 and 11 ohm M^2/M with a zone in the middle of the unit showing values 7 to 15 ohm M^2/M. The microlog caliper shows mud cake build up on the sandstone beds while the microlog resistivity curve indicates positive separation across these beds (see under "Porosity and Permeability").

The gamma ray log over the unit shows variable radioactivity with readings from 40 to 80 A. P. I. units for the sandstone beds, and between 100 and 150 A. P. I. units for the shale beds.

The sonic velocity is also variable, ranging from 90 to 55 microseconds per foot. Above 6544' the sonic velocity is slower, averaging about 80 microseconds per foot. There is an increase at 6544' and readings below this depth average about 70 microseconds per foot.

6757'-6776' (19'): Unit consisting of conglomerate and shale.

This interesting zone may represent a conglomerate associated with an unconformity, or a fault zone or both. The cuttings from the upper part of the unit suggest the presence of a conglomerate in which pebbles of siliceous sandstone and orthoquartzite are common. The reader is referred to the description of Core No. 15 for the lithology of portion of the lower part of the unit, which consists of heavily slickensided fractured shale and conglomerates. The conglomerates consist mostly of dark grey shale pebbles, show graded bedding, and dip probably at between 25° and 40°. Cuttings indicate that orthoquartzite pebbles are again common near the base.

Electrical Characteristics: From the top of the unit the S. P. curve moves towards a reading near the shale line while the 16" resistivity curve shows values ranging from 11 to 16 ohm M^2/M. The microlog resistivity shows values below 1 ohm M^2/M probably due to the presence of a large (17") cave as seen on the caliper log. The cave may be associated with a faulted and fractured shale section.

The gamma ray log shows values between 110 and 120 A. P. I. units.

The sonic velocity of the upper half of the unit shows slow value reading up to 88 microseconds per foot, markedly slower than the overlying and underlying sections, and making this part of the unit appear as a distinct sonic marker.

(c) Jurassic

6776'-6900' (124'): Unit consisting of orthoquartzite which grades downward to kaolinitic sandstone.

This unit is hard and slow drilling. It is cream, white or pale brown in colour, medium to coarse-grained, occasionally fine-grained, vitreous in part, consisting of fairly to poorly sorted sub-angular to sub-rounded clear glassy, milky, frosted and rare pink quartz, minor kaolinitized white feldspar, garnets, mica, occasional dark grey chert, occasional green lithic grains, dark grey shale fragments, and a trace of pyrite in the matrix, which consists of silica at the top of the unit but which grades into a partly kaolinitic matrix towards the bottom of the unit.

Some minor shale is present in the cuttings from near the base of the unit and is possibly derived from shale pebbles in the sandstone. The shale is dark grey, silty in part, slightly micaceous, fairly hard, slickensided in places. Slickensided shale with talc and chlorite, which appears in the samples from higher in the unit, is probably caved from the overlying unit.

Core No. 16 was cut in this unit and was found to consist of sandstone grading to orthoquartzite. Bedding planes are irregular and undulose, dipping from 20° to 35°. Slickensided surfaces dip between 30° and 40°. A few pebbles of hard dark grey shale, soft light grey shale, and quartz up to 3/4" long are scattered throughout as well as occasionally very coarse, very poorly preserved carbonized plant fragments.

Electrical Characteristics: The electrical resistivity and the sonic velocity reflect the hardness of this unit. The 16" normal reads values between 18 and 25 ohm M^2/M, while the sonic log reads velocities between 58 and 72 microseconds per foot. The S. P. curve shows a gradual negative bulge in the middle of the unit to 24 mv above the shale base line. The gamma ray curve shows varying natural radioactivity levels ranging from 40 to 115 A. P. I. units, possibly due to variation of shale pebble content of the sandstone. The microlog caliper indicates the unit holds close to gauge, apart from a caved section near the base. No positive separate is evident, except where the tool is reading mud values in the caved section.

6900' -7225' (325'): Unit consisting of sandstone with very minor shale and siltstone interbeds.

The sandstone was recovered to a large extent as loose grains in the samples. These consist of clear, milky, frosted and pale brown, poorly to fairly sorted, fine to coarse-grained, occasionally very coarse, and generally sub-angular to occasionally sub-rounded quartz. Also common are salmon-coloured feldspar, garnets, reworked lithics (phyllite and serpentine), coal, and a trace of pyrite. Where the recovered sandstone was consolidated, it was light brown, cream or occasionally grey in colour, fine to medium-grained, occasionally coarse-grained, partly silicified and vitreous, and partly calcareous. It was friable ot hard, brittle in places and consisted of fairly well sorted angular to sub-rounded (predominantly sub-angular) clear, glassy, milky and frosted quartz, partly kaolinized feldspar, reworked lithic fragments (including green and grey shale fragments, grey and green phyllites), common pink and red garnets, occasional mica flakes, coaly fragments and traces of pyrite in a kaolinitic and/or siliceous or partly calcareous matrix.

The shale occurs in two main varieties; a carbonaceous occasionally coaly dark grey variety, and a silty medium-grey variety. They are micaceous, fairly hard, with some slickensides and a trace of pyrite. There is also present some greenish-grey and pale green, soft, micaceous, and slightly carbonaceous shale.

The siltstone is light grey to greenish-grey. It is slightly micaceous, soft, argillaceous in part, locally slightly calcareous, slightly sandy and contains carbonaceous specks.

The unit as a whole drills faster than the overlying and underlying units.

Electrical Characteristics: This unit has an S. P. curve with negative shifts up to 40 mv, with a range of values from 20 to 40 mv. The resistivity 16" normal curve shows values ranging from 9 to 17-1/2 ohm M^2/M, with the part of the unit above 7120' having a mean of 15 ohm M^2/M and the part below 7120' having a mean of 11 ohm M^2/M. The microlog caliper for the unit shows several zones of mud cake build up and the microlog resistivity shows positive separation in these zones (see under "Porosity and Permeability").

The gamma ray log shows very variable readings, with a range of 40 to 120 A. P. I. units.

The sonic velocity varies from 63 to 76 microseconds per foot. Above 7120' mean value is about 67 microseconds per foot, while below 7120' the mean value is about 72 microseconds per foot.

7225' -7267' (42'): Unit consisting of conglomeratic sandstone.

The sandstone was recovered to a large extent as loose grains of fine to coarse-grained, angular to sub-angular, clear to milky quartz. In addition, grains of a variety of quartzites, chert, some feldspar and lithic fragments including slate, shale, pyrite, phyllite and serpentine were recovered. Where the recovered sandstone was consolidated, it consisted of pebbles and granules of phyllite, quartzite and chert with medium to coarse-grained sub-angular, clear and milky quartz grains in a clayey matrix.

Some shale was recovered in the cuttings which was medium to dark grey, and carbonaceous, with occasional included rounded fragments of soft green shale.

Core No. 17 (7253' -7263', Recovered 6') was cut in this interval and confirmed the conglomeratic nature of the sandstone. The sandstone exhibited some cross-bedding with dips of 0^o to 20^o.

Electrical Characteristics: The S. P. curve shows similar readings to the overlying unit, while the 16" resistivity curve shows about a 3 to 5 ohm M^2/M increase over the basal part of the overlying unit. The caliper does not suggest any significant filter cake build up, and the section tends to cave a little. Both the gamma ray and sonic log curves are similar to those over the lower part of the overlying unit.

7267' -7284' (17'): Shale and siltstone?

The logs indicate that this is a distinct unit, different from the overlying unit and markedly different from the underlying unit.

The lithology of the unit itself is not certain. The samples are heavily contaminated with loose quartz grains caving from the overlying unit.

It is possible that the unit consists of pale green and medium-grey shale which is occasionally micaceous or carbonaceous, as well as light brownish-grey, very micaceous, hard siltstone.

Electrical Characteristics: The S. P. curve shows lower readings than the overlying unit, but slightly higher readings than the underlying unit. Values are about -14 mv over the shale base line. The 16" normal resistivity curve reads down to 10 ohm M^2/M, lower than both overlying and underlying units. The gamma ray and sonic logs do not indicate any marked difference from the overlying unit, but at the base of the unit the gamma ray values show a marked increase. The unit is characterised by considerable caving as seen in the caliper log, while micro-log readings are influenced by mud readings in the caved section.

7284' -7317' (43'): Unit consisting of siltstone.

The siltstone is light grey to medium-grey, micaceous and firm to hard. It contains carbonaceous specks and streaks. The cuttings for this unit contain common loose quartz grains which are fine to very coarse-grained, sub-angular to sub-rounded, clear to milky, occasionally cemented with silica or kaolin. Also present are occasional traces of coal, serpentine and weathered feldspars. The loose grains are probably largely cavings.

Minor shale occurs in this unit. It is medium-grey, firm to hard, occasionally micaceous and carbonaceous.

Minor consolidated sandstone also occurs in the cuttings. The sandstone is pale brown, fine to coarse-grained and hard in part. It consists of poorly sorted, angular to sub-angular, glassy, clear and frosted quartz, occasional white feldspars, some mica and chert, with lithic fragments including slate (?), dark grey shale grains and coaly flecks in a mostly silica matrix.

Electrical Characteristics: The S. P. curve is considerably closer to the shale base line than across the overlying unit. It shows a reading of -5 mv near the top and near the base of the unit. The upper part of the unit shows 16" normal resistivity readings of about 16 ohm M^2/M.

The caliper shows a smooth hole no more than 1" over gauge. The microlog readings are largely off scale. The sonic log has average values similar to the unit above, but the gamma ray curve shows a remarkably sharp marked increase in radio-activity from 54 to 140 units at the top of the unit, and readings remain very high within the unit itself.

7317' -7615' (298'): Unit consisting of shale.

This slatey shale unit is very slow drilling, and resistive electrically.

The shale is grey, grey-brown, brown and black. It is mostly slatey, occasionally foliated, firm to hard, occasionally brittle, and silty in places. Some dark grey carbonaceous and greenish-grey softer shale with slickenslides is also present in the cuttings.

Sandstone is fairly common in the cuttings, but the logs and core suggest this is mostly cavings.

It is predominantly cream, also light brown or grey in colour, fine to coarse-grained, and pebbly near the top of the unit. It is generally hard and siliceous, in places grading to an ortho-quartzite and consists of poor to fairly sorted angular to sub-rounded, clear, milky and glassy quartz, kaolinized feldspar, common garnets, lithic fragments including grey, slatey shale, phyllites, and pyrite in a kaolinitic to siliceous matrix. Cuttings in this interval contained traces of loose quartz grains and siltstone. The loose quartz grains are commonly fine to coarse-grained, clear, milky and angular to sub-rounded.

The siltstone is light brown and micaceous.

Core No. 18 (7385' -7395') was cut in this unit, consisting of 10' of hard slatey shale with a few silty bands and numerous plant fragments. Dips ranged from 5° to 10°. Palaeo-botanical work indicates a Jurassic age (see Appendix 2).

Electrical Characteristics: This unit can be electrically sub-divided into two sub-units :-

(i) 7317' -7480':
The S. P. curve of this unit has a value close to the shale line, varying between 0 and -7 mv. The resistivity of the unit is high, with readings from 20 to 35 ohm M^2/M.

The gamma ray log shows a mean value of about 120 A. P. I. units with a range from 145 to 100 A. P. I. units.

The sonic velocity shows a slight increase in average values from 75 microseconds per foot in the top half of the unit to 70 microseconds per foot in the lower half. Readings are fairly variable however.

The caliper indicates a smooth hole, close to gauge. Microlog readings are off scale.

(ii) 7480' -7615':
The S. P. curve of this unit remains on the shale base line. The resistivity curve shows lower values than the unit above, with values ranging from 15 to 19 ohm M^2/M.

The gamma ray log shows an increase in radioactivity levels relative to the sub-unit above. Average values decrease from 145 A. P. I. units near the top to 130 A. P. I. units near the base.

The sonic log shows a slight decrease in velocity compared to the sub-unit above. The caliper indicates a smooth hole with some slight caving to 1-1/2". Microlog readings are off scale.

7615' -7800' (185'): Unit consisting dominantly of siltstone.

This unit is rather faster drilling than the shale unit above, but is more resistive electrically.

The siltstone is light to medium-brown, brownish-grey and light grey. It is micaceous, partly argillaceous, partly sandy, locally calcareous and generally firm to hard. It contains carbonaceous specks and traces of yellow specks of tuffaceous material.

The unit has minor laminations of sandstone, shale and coal and coaly shale. Coal is fairly common in the cuttings between 7730' and 7760', but electric logs do not reveal any clear discrete seams. The sandstone is predominantly cream, light brown or greyish-brown. It is fine to coarse-grained, occasionally very coarse, mostly hard and siliceous. It consists of poor to fairly sorted sub-angular to sub-rounded, milky and clear quartz, some kaolinized feldspars, occasional mica and fairly common garnets together with lithic fragments including shale grains and yellow tuffaceous(?) material in a kaolinitic but predominantly siliceous matrix. The lithics are locally coarse to pebbly and suggest that some conglomerate bands may be present. The shale is grey, greenish-grey, brownish-dark grey and reddish-brown, ferruginous, micaceous, generally slatey, slightly carbonaceous, generally silty and ranges from fairly hard to soft. It contains occasional floating quartz grains and plant fragments. The carbonaceous to coaly shale exhibits some slickensliding.

The coal is black, bright, brittle and clean to shaley. Core No. 19 (7739'-7749', Recovered 10') was cut in this unit, and consisted of siltstone and shale with very minor laminations of sandstone and coal. Cross-bedding showed dips up to 20°. Palaeobotanical work on Core No. 19 indicates a Jurassic Age (see Appendix 2).

Electrical Characteristics: The S.P. curve shows a little character with small readings of up to -7 mv above the shale base line. The resistivity curve shows higher values than the overlying unit, with readings ranging up to 30 ohm M^2/M.

The gamma ray log shows a decrease in mean values from 125 A.P.I. units at the top of the unit to 95 at the base, the range of readings being 135 - 75 A.P.I. units. At 7756' there is a thin radioactive marker reading out to 152 units.

The sonic velocity shows a mean of 73 microseconds per foot and a range of values of 67 to 87 microseconds per foot. Slower velocities are present between 7684' and 7697'.

7800'-7820' (20'): Unit consisting of shale and siltstone.

The shale is brownish-grey, dark grey and brown, firm to soft. Near the base the shale is brown in colour and contains fine to medium-grained brown to reddish-brown sideritic or limonitic clay pellets. These also commonly occur loose in the sample. The siltstone is light to medium-brown, light grey and slightly micaceous.

Minor sandstone recovered in this interval is cream coloured, fine to medium-grained, siliceous, and consists of sub-angular to angular clear quartz, occasional kaolinized feldspars, and garnets in a siliceous matrix. Lithic granules in a brown silty matrix are also occasionally present.

Electrical Characteristics: The S.P. curve shows a drop off from the above unit to about the shale base line. The 16" resistivity values are variable, ranging from 7-1/2 to 17-1/2 ohm M^2/M.

The gamma ray log shows high radioactivity levels ranging up to a maximum of 144 units.

The sonic log of the unit shows a slight decrease in sonic velocity from top to bottom, from 78 to 84 microseconds per foot.

The caliper log indicates some moderate caving.

7820' -7852' (32'): Unit consisting of shale.

The shale is bright green, firm to fairly soft, silty in part, with inclusions of angular and rounded green shaley material and traces of white, fibrous calcite (fracture filling?). The shale tends to hydrate and disperse in water, and has a somewhat ashy, tuffaceous appearance. Some of the shale contains carbonaceous flecks, sideritic and limonitic pellets and a trace of pyrite.

Common traces of cream-coloured sandstone and loose quartz grains were recovered in this interval.

Electrical Characteristics: The S. P. curve for this unit is close to the shale base line. The 16" resistivity normal curve shows low values from 1-1/2 to 4 ohm M^2/M.

The gamma ray log for this unit shows distinctly lower readings than the overlying units. Values range between 63 and 79 A. P. I. units.

The sonic log shows distinctly lower velocities for this unit, which range between 80 and 113 microseconds per foot.

The caliper indicates that this unit caves rather badly, out to a maximum of 14-1/2" from a bit size of 8-3/4". The micro-log reads largely mud values.

7852' -7880' (28'): Unit consisting of dolerite.

Initial binocular microscope examination of the cuttings indicated that the rock consisted of very dark grey to black, finely crystalline, very hard dolerite, with occasional calcite veinlets. Red jasper-like material was present, occurring as part of zoned veins along with calcite and pyrite.

Core No. 20 (7858' -7862', Recovered 18") consisted entirely of dolerite. Binocular examination revealed the presence of occasional visible grains of lemon-yellow olivine. The core was broken up by vertical, horizontal and irregular fractures. Where these fractures have undergone movement, slickensides were present associated with chloritic calcite.

Subsequent thin section examination by the Bureau of Mineral Resources verified the determination of rock type (see Appendix 8).

Samples of the dolerite submitted to the Australian National University for radioactive dating indicated a minimum age of 120 million years $\pm$ 10 million years, equivalent to Lower Cretaceous (see Appendix 3).

Samples submitted to Geochron indicated an age of 153 million years, placing it in the Middle Jurassic (see Appendix 3).

Electrical Characteristics: Electrically this unit has marked character. The S. P. curve shows a distinct (12 mv) positive shift from the overlying shale unit. The 16" resistivity curve shows a high reading of 50 ohm M^2/M.

The gamma ray log of this unit shows a rather similar character to that of the overlying unit.

The sonic log indicates fast sonic velocities in the range of 50 to 65 microseconds per foot.

The caliper indicates that the dolerite ranges between being under-gauge to showing caves out to 10-1/2". Some positive separation is apparent in the microlog associated with both gauge and under-gauge hole. This may be due to fracturing.

7880' -7891' (11'): Unit consisting of shale.

The shale is pale green and soft. It hydrates readily and has a rather ashy, tuffaceous appearance. It contains dark green shaley inclusions and hard green and reddish-brown silty and argillaceous pellets. Near the base is a sandstone comprised of these pellets.

Electrical Characteristics: The S. P. curve of this unit remains close to the base shale line. The resistivity curve shows sharp boundaries with the adjacent units and reads relatively low readings of 4 to 7 ohm M^2/M.

The gamma ray log shows a high radioactivity level with a reading of 150+ A. P. I. units, in sharp contrast to the low readings of the overlying and underlying dolerites.

The sonic log of this unit also shows marked boundaries with the overlying and underlying units, with relatively low velocities in the range 65 to 87 microseconds per foot.

The microlog reads low values with some slight positive separation due probably to minor cavings.

7891' -7954' (63'): Unit consisting of dolerite.

The dolerite is similar to that between 7852' and 7880'. It shows, however, a higher degree of alteration, the colour varying to green where epidotized adjacent to fractures, or to whitish or greenish-grey when it is very calcareous and relatively soft. In places the dolerite is mottled white with calcite crystals, and phenocrysts of dark plagioclase up to 1/2 mm long and smaller crystals of pyroxene are also present. Towards the lower part of the unit the dolerite is generally more coarsely crystalline.

Core No. 21 (7895' -7905', Recovered 9' 6") was cut in this unit. It shows that alteration in the dolerite has proceeded outward from fractures which are largely now filled with calcite, haematite and chlorite. The core shows fracturing with some slickensides as in Core No. 20 (7858' -7862').

Electrical Characteristics: Electrically this unit resembles the dolerite unit above. The S. P. curve shows a gradual positive shift from the shale line to above +8 mv near the base of the unit. The resistivity curve shows values from 9 to 55 ohm M^2/M generally increasing downward.

The gamma ray curve reads values in the range of 38 to 48 A. P. I. units, with unit boundaries contrasting well with the higher values of the overlying and underlying shale.

The sonic velocity of this unit shows a gradual downward increase from 67 to 48 microseconds per foot, reflecting again the dense nature of the unit. There is a marked contrast with the lower velocities of the underlying and overlying units.

7954' -8038' (84'): Unit consisting of siltstone and shale.

The siltstone is light to dark grey and brownish-grey. It is very micaceous, carbonaceous, argillaceous in part, fairly hard and brittle. It contains a trace of pyrite.

The shale is medium to dark grey, hard, brittle, micaceous, carbonaceous (with some plant remains). It is slickensided in places and occasionally grades into a light grey phyllite. Chips of mica schist were also obtained in the cuttings. Near the base of the unit are greenish-brown, brownish-green and grey shales, with irregular dark green inclusions and pebbles of shaley material. The shale has a slightly tuffaceous appearance. Loose grains of fine to medium-grained quartz were commonly obtained in the cuttings of this unit. These are probably mainly cavings. Core No. 22, which was cut in this unit, consisted of fractured black shale and medium to dark silty shale. Dip was variable, averaging between 10^{o} - 15^{o}. Part of the basal beds of the unit (grey and brownish-green shales) was recovered in the top 18" of Core No. 23. No bedding was apparent.

Palaeobotancial work on Core No. 22, from which excellent plant fossils were obtained, indicated a Jurassic age, and the fossil horizon is equated with the Walloon series of Queensland.

Electrical Characteristics: The S. P. curve of this unit remains close to the shale base line, except near the base where it shows a negative shift of 10 mv. The 16" resistivity curve shows low values generally increasing downwards. Readings range from 5 to 11 ohm M^2/M.

The gamma ray log for this unit shows fairly high values ranging from 110 to 140 A. P. I. units and averaging about 130 A. P. I. units, contrasting to the low readings of the overlying dolerite.

The microlog caliper indicates a few minor caved sections, and variable resistivity readings. This is in contrast to the underlying unit, which remains to gauge, and which shows off scale resistivity readings.

(d) Lower Palaeozoic?

8038' -8185' (Total Depth) (147'+): Unit consisting of phyllitic slate.

In the cuttings the slate appears to be dark grey, hard and brittle, foliated, micaceous, pyritic, generally silty, phyllitic occasionally calcareous with some calcite and quartz probably occurring as fracture filling.

Cores Nos. 23 and 24 were cut in this unit. Dips were indicated between 50° and 65°. A well developed joint system is present with pyrite, quartz and calcite associated with joint planes. The slate is speckled and contains dark indeterminate mineral aggregates.

Electrical Characteristics: The S. P. curve is close to the shale base line except for a -20 mv shift around 8096' and a -10 mv shift around 8150'. The resistivity values are fairly high, the 16" normal reading a maximum of 22 ohm M^2/M, decreasing to 10 and 12-1/2 ohm M^2/M at about 8096' and 8150'. The caliper indicates a gauge hole except for a slight filter cake build up over a 2' zone at 8096' along with some positive separation in the microlog.

The gamma ray curve shows a fairly steady mean value of about 127 A. P. I. units, with one thin zone at 8078' reading out to 150 units.

The sonic velocity of this unit maintains the high value of the base of the overlying unit, with a mean of 52 microseconds per foot and a range of 62 to 46 microseconds per foot. The zone with the lowest sonic velocity (up to 62 microseconds per foot) is between 8090' and 8095'.

(5) Structure

A structure hole programme in the Casterton area indicated the presence of a large structure, probably of Tertiary age, with a probable closure of 300'.

Casterton No. 1 well was drilled at the crest of this structure. The magnitude of dip as indicated by the core cut on this well can not be regarded as reliable, as only a very small percentage of the total section is represented by the 24 cores which were cut, and cross-bedding is evident in a number of the cores.

With these strong reservations, the cores indicate that the bedding down to and including Core No. 14 (6396' -6406') is generally flat.

Core No. 15 (6763' -6769') and No. 16 (6853' -6859') indicate possible dips between 20° and 40°.

Cores Nos. 18 to 22, representing the section between 7385' and 7957', indicate shallow dips between 5° and 15°, while the two bottom cores between 8029' and T. D. (8183') indicate steep dips between 50° and 65°.

The cores suggest that the well may have remained on structure down to about 6700'.

The first dipmeter run (1340' -4133') does not indicate any very clear pattern. Direction of dip is very variable, but there is a tendency for a slight preponderance of north-west dips. There are very few dips in the opposite (south-east) direction. Dips are generally of low angle (mostly between 0° and 10°). There is a slight decrease in the magnitude of dips at about 2650', which may be possibly related to the unconformity below the "Heathfield Sand" at the Tullich and Heathfield wells.

The second dipmeter run overlapped the first run across the interval 4000' -4100', and the results of the first and second runs over the duplicated section are unfortunately somewhat at variance. The validity of indicated change of dip in the second run to the south-west is therefore not known, as a plot of values in the overlapped section indicates Run 1 dips largely in the north or north-east quadrants, and Run 2 dips largely in the south-west or south quadrants.

Run 2 dips, down to 5400', show a preponderance of shallow values (less than 5°) to the south-west, with a scattering of higher values (generally between 5° and 20°) mostly to the south-west, north-west and north-east.

Few values are indicated between 5400' and 5600', but from 5600' to 6500' (in the basal Merino sandstone) there is a distinct change in direction of dip, with very shallow dips to the south-east varying downward to east and north-east. A possible unconformity is thus indicated at the top of the basal Merino sandstone. An unconformity was also suspected as being present above the basal Merino sandstone at Frome Pretty Hill Well No. 1, both from dipmeter and seismic evidence.

From 6500' -6771', the section immediately above the Jurassic, the dips appear to be to the north-west in Run 2. Run 3, however, overlapped Run 2 from 6600' to 6770' and again a lack of agreement is evident in the two runs North-east dips are evident in the Jurassic section, values being particularly reliable and frequent below 7300'.

Summarising we have: 1340' -4100' (Merino) possibly slightly north-west dip.

4100' -5400' (Merino) slightly south-west dip

Unconformity?

5600' -6500' (Basal Merino sand) slightly south-east dip varying downward to east and north-east. Reliable.

6800' -7300' (Jurassic) possible north-east dip.

7300' -7900' (Jurassic) reliable north-east dip.

7900' -T. D. Dipmeter not run below 7952'.

(6) Occurrence of Hydrocarbons:

D. S. T. No. 1, 1951' -2016' recovered 1450' of muddy very slightly gassy salt water on drill stem test. The quantity of gas was too small to collect for analysis.

No fluorescence due to hydrocarbons, or any traces of oil staining, were detected in any of the samples or cores.

A few insignificant readings of methane were obtained on the gas detector between 570' and 2390'. The largest of these was 10 units between 2380' and 2390'.

(7) Porosity and Permeability:

Good reservoir characteristics are evident in a number of Merino Group sandstones.

These sandstones are as follows -

(a) The "Heathfield Sand". This unit is present between 1959' and 2025'. The good displaced air blow and the large water recovery (1650' of fluid) on drill stem test suggests good reservoir characteristics. Net effective porosity in the sand totals 30'. Porosity calculates out from the logs at 27%.

(b) Sandstone between 5028' and 5103'. A total of 62' of net effective porosity is present in this sand. Porosities from the logs calculate out generally between 15% and 20%, but range up to 25%. A drill stem test of the interval indicated good permeability. A recovery of 4750' of salt water was obtained.

(c) Sandstone between 5273' and 5617'. A total of 290' of net effective porosity is present in this sandstone, making it a very important reservoir rock. The figure of 290' is conservative. Based on the microlog caliper alone, 327' of net porosity is indicated. Average porosity calculates out at between 15% and 21%. DST No. 7 was run over the top of the sand and yielded 2160' of muddy salt water. Porosities are better elsewhere, however, than at the top of the unit, where the test was run.

(d) Sandstone between 5698' and 5710' with about 11' of net porosity. The porosity calculates out at about 20%, and the sandstone is salt water bearing.

(e) Sandstone between 5830' and 6417'. A total of 454' of net porosity is present in this unit. The porosity is considerably poorer, however, than in the previous units, calculating out between 10% and 14%. Using the R_W obtained from DST No. 7, the whole of the interval contains 100% salt water.

(f) It is possible that between 6436' and 6757' marginal types of reservoir sandstones may be present. The porosity and permeability is probably poor. The uppermost of these sands yielded only 120' of salt water cut mud on drill stem tests.

(g) Between 6900' and 7225' a further sandstone with rather poor porosity was encountered in the Casterton No. 1 well. This sandstone is probably of Jurassic age. Net porosity totals 175', and is mostly between 7% and 11% with only occasional beds up to 13%.

The upper part of the sandstone was drill stem tested, but even at this depth and without a water cushion, only 900' of muddy salt water was recovered.

(8) Contributions to Geologic Knowledge:

The Casterton No. 1 is the first well in the area to be drilled to basement and has yielded a great deal of completely new information.

In particular, the following contributions have been made -

(a) The discovery of a number of thick porous sandstones in the lower portion of the Lower Cretaceous Merino Group.

(b) The discovery of a sequence of probable Jurassic age containing a variety of rock types, including a thin section of volcanics. A thick sandstone with poor porosity is present near the top of this sequence.

(c) The intersection of effective basement in the area, which consists of fairly steeply dipping mineralised slates.

(d) The easterly extension of the porous Merino sandstone known as the "Heathfield Sand" from the Heathfield No. 1 well and Tullich No. 1 well to the Casterton No. 1 well has been established. It occurs in the Casterton well at an elevation 1220' higher than at the Tullich well and 2380' higher than at the Heathfield well.

(e) Unit III as well as unit IV of the Heathfield and Tullich wells can be correlated with similar units in the Casterton well. The section about unit III at Casterton would be equivalent to an indifferentiated unit I and II at Heathfield and Tullich.

(f) Drill stem tests have provided useful information from porous sands on pressures, reservoir characteristics and water resistivities.

(g) Dipmeter surveys indicate a possible unconformity at the top of the "Basal Merino Sandstone".

V. ACKNOWLEDGEMENTS

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This report was prepared by J. R. Cundill of Cundill, Meyers and Associates.

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APPENDIX NO. 1

CORE DESCRIPTIONS

PLANET CASTERTON NO. 1

CORE DESCRIPTIONS

CORE NO. 1 2016'-2027' Recovered 8' (75%)

Macro Description

Interlaminated siltstones and mudstones.
Siltstones - light green-grey, light grey, slightly sandy in part, fissile in part, argillaceous, micaceous, carbonaceous.
Mudstones - dark grey to black, rarely slightly sandy, very carbonaceous.
These occur as very fine laminations showing good bedding, cross bedding, current structures and mottling. Occasional beds of mudstones up to $\frac{1}{2}$" in thickness.

Micro Description

Interlaminations of siltstone, light grey, sandy to very sandy in part, argillaceous, micaceous, with carbonaceous specks, grading to very fine grained sandstone, argillaceous, micaceous, carbonaceous specks; and
Mudstone - grey to dark grey, slightly silty, firm, blocky, slightly carbonaceous, micaceous.

Laminations range from very fine (less than $\frac{1}{2}$ m.m.) to interbeds 2 cms thick. Well bedded, cross bedded with occasional siltstone lensing. Occasional mottling due to pods of siltstone, very fine grained sandstone.

Core dip flat.

No hydrocarbon shows. Tight.

CORE NO. 2 2420'-2430' Recovered 10' (100%)

Macro Description

Top 9' Interlaminated mudstone, dark grey, grey slightly silty and argillaceous, micaceous, firm, blocky, with occasional carbonaceous specks and lignite; and
Siltstone - light grey, green-grey, slightly sandy in part, argillaceous, micaceous, carbonaceous, occasionally grading to very fine grained sandstone, light grey, argillaceous micaceous, carbonaceous, tight..
The laminations are very thin with occasional interbeds 1 cm. thick. Core shows good bedding, cross bedding, lensing, current structures. Some small scale cross bedding and minor slumps and balling.

Core dips 0.3° - flat. Overall dip appears to be flat.

Bottom 1' Mudstone, very dark grey to black, occasionally slightly silty, with occasional plant remains. No bedding apparent.

CORE NO. 2 (cont)

Micro Description

Top 2'5"	Finely laminated mudstone, dark grey, slightly silty in part, firm, carbonaceous, micaceous, and siltstone, light grey, sandy, occasionally very sandy, firm, argillaceous, micaceous, carbonaceous specks. Laminations generally thin with occasional mudstone beds to 1 cm. thick. Current bedded with current structures. Minor slumping, siltstone lenses.
Next 1'3"	Mudstone, as above with beds ½" thick; and thin interbeds of finely laminated mudstone and siltstone, as above.
Next 3'	Finely laminated mudstone, siltstone, as above showing large scale current bedding dip to 20°.
Next 1"	Siltstone, light grey, green-grey, sandy, soft, friable, slightly fissile, argillaceous, carbonaceous. Thinly bedded, well bedded.
Next 3'3"	Finely laminated mudstone and siltstone, as above. Soft in places.
Next 1'	Mudstone, dark grey to black, slightly silty, especially in bottom 2", soft, slightly argillaceous, micaceous, carbonaceous, contains plant remains. Massive.
	No hydrocarbon shows.
	No porosity.
Total 10'	

CORE NO. 3 3142'-3152' Recovery 4" (3%)

Drilling rate about 20 minutes/feet.

Description:

Consists entirely of medium grey, soft, non-calcareous, micaceous, carbonaceous mudstone, massive with sub-conchoidal fracture, rather brittle, fossiliferous with plant fossils small but visible with naked eye.

CORE NO. 4 3596'-3606' Recovery 7'2" (72%)

Top 8½"	Light to medium grey interbedded fine sandstone and siltstone
5"	Light to medium grey interbedded medium to coarse grained sandstone
½"	Grey brown mudstone with well preserved plant leaf
7"	Light grey interbedded fine sandstone and siltstone
28"	Interbedded light grey coarse to fine sandstone and medium grey siltstones
2"	Light grey, very coarse sandstone
5"	Light grey coarse to medium grained sandstone
4"	Light grey, very coarse sandstone
5½"	Medium grey, medium grained sandstone
5½"	Light grey, very coarse sandstone
1½"	Grey brown mudstone
1½"	Light grey coarse to medium grained sandstone
6½"	Light grey, very coarse sandstone
1"	Medium grey, medium grained sandstone
2"	Interbedded brown mudstone and grey siltstone
10½"	Light grey, very coarse sandstone with very thin brown mudstone bands.

Total 7'2"

All sandstones are tight. All beds are carbonaceous with abundant plant and wood remains throughout the entire core (including even the very coarse sandstone).

Bedding flat and moderately constant with only minor development of cross bedding. Dip of cross bedding when developed is about 10^{0} (maximum).

In general the core is coarsest at the base and finest at the top, with the most abundant carbonaceous to fossiliferous section from 4' - 6' below top of core.

Description of typical coarse sandstone

Light grey, coarse grained sandstone consisting of poorly sorted, sub-angular fragments of colourless to grey quartz, white, very kaolinised feldspar, dark grey and blue green waxy claystone, brown and grey schist with abundant coarse white mica, green grey phyllite with abundant fine mica, light grey siltstone, black shiny coal, brown mudstones, all set in a light grey to white, very kaolinitic, calcareous matrix. Tight.

The coarsest sandstone contained fragments up to 1 c.m. long.

CORE NO. 5 4189' - 4194' No recovery.

CORE NO. 6 4194' - 4200' Recovered 1"

Mudstone, medium grey, firm, silty, slightly micaceous, with common sinuous hair line, carbonaceous inclusions, randomly oriented, and plant fragments.

CORE NO. 7 4497'-4507' No Recovery.

CORE NO. 8 4507'-4512' Recovered 13'
(includes 8' from Core No. 7)

Top 2' Interbedded Mudstone and carbonaceous shale. The mudstone is medium grey, silty, micaceous, and contains a few fairly finely macerated plant fragments, most of which are parallel to the bedding, but a few of which are normal to the bedding, as indicated by the shale interbeds. The shale occurs as several interbeds 2" - 3" thick. It is black, fissile, carbonaceous and contains abundant fine laminations of bright, clean, coal and common plant fragments. Dips range from 0^{o} - 5^{o}.

Next 4'6" Mudstone, medium grey, micaceous (both brown and white mica) and contains a few scattered fine green lithic grains, traces of yellowish specks, carbonaceous flecks and a few scattered small plant fragments. It is silty to very silty and grades to siltstone. Siltstone is slightly calcareous and tends to be light grey in colour with coarser mica and plant fragments than in the mudstone.

No bedding is apparent, and variation in silt content is gradational. The core however, breaks into horizontal tablets. In addition, two opposing sets of fractures (open) are apparent each tipping at about 20^{o}.

Next 2'6" Shale, dark grey to black, blocky, only slightly fissile, slightly micaceous, slightly carbonaceous. Dense texture. The shale is brittle, firm and breaks with a rubbly fracture, roughly in two opposing directions each dipping at about 20^{o}, sub-vertical fractures (open) are also present.

Bedding planes are slightly nodulose, with dips of about 5^{o}. Some dark brown shale is also present. Plant fossils are present, but are not abundant.

Next 3'6" Siltstone, grading to mudstone. Siltstone is light to medium grey, argillaceous, grades to mudstone, very micaceous, contains abundant carbonaceous and coaly fragments, particularly near the base. Also present are scattered feldspars, yellow clayey flecks, occasional fine green pelletoidal grains, traces specks of white gypsum, traces plant resin. No bedding is apparent but core breaks into horizontal tablets. Some low angle fractures are present.

Bottom 6" Shale, dark grey to black, coaly, fissile, contains abundant plant fragments. Coal occurs as abundant fine laminae up to a maximum of 1/16" thick, and is generally black, bright, clean and brittle. Dip is approximately flat. A few low angle slickensided fractures are present.

Overall dip of Core 0^{o}-5^{o}, possibly closer to 0^{o}.

Total 13'

CORE NO. 9 4908'-4919' Recovered 11'

The entire core consists of sandstone. The sandstone is whitish grey, medium grained,

CORE NO. 9 (continued)

lithic, feldspathic, slightly calcareous, slightly micaceous, garnetiferous, friable. It consists of well sorted, sub-angular, light grey frosted quartz, common partly or wholly kaolinized feldspars, grains of soft light grey and greenish grey reworked shale, dark grey carbonaceous shale grains occasional grains of mica ahd chlorite schist, dark grey chert grains, muscovite, biotite and a common scattering of red, pink and orange garnets in a kaolinitic (altered feldspars) to slightly calcareous matrix. Traces of very poor porosity are present in a few places.

The bottom 2' of the core is harder, more calcareous and more micaceous, containing coarse flakes of muscovite and biotite.

A few rare coaly inclusions laminations and some coalified plant fragments and plant resin are present in the core. The coal is black, fairly clean and bright. The inclusions reach a maximum thickness of 1/8".

Some dips from 5^{o}-10^{o} are present, but these may be due to cross bedding.

CORE NO. 10 5084'-5090' Recovered 2'4"

The entire core consists of sandstone. The sandstone is light grey, medium to coarse grained, lithic, calcareous, slightly friable, consisting of moderately well sorted, sub-angular light brown to light grey quartz, partly kaolinized feldspars, lithic grains of pale grey and pale brown phyllites, grey mica schists, green serpentines and chlorite schists, abundant red, pink, orange and violet (spessartite ?) garnets, trace yellow clay inclusions, black and brownish black carbonaceous shale and coaly shale grains in a calcareous, kaolinitic matrix.

A few scattered pebbles of green chlorite schists, phyllites about 3/8" in diameter, are present, as well as a few fine grains of hard black vitreous material.

One cobble (about 70 mm + in diameter) and one pebble is present in the core, of what is now a blue-grey, soft, claystone, with fine soft white inclusions, and which may be the weathering product of some other rock type.

Traces of very poor porosity are present in the sandstone.

Darker laminations in the sandstones indicate dips of 10^{o}- 20^{o}

CORE NO. 11 5270' - 5280' Recovered 10'

Top 2'4" Sandstone, very light grey, fine to medium grained friable, consists of well sorted, sub-angular, light brown quartz, kaolinized white feldspars, scattered fine black soft, carbonaceous shale, coaly grains and graphite, traces muscovite, chlorit and garnets in a kaolonitic matrix.

CORE NO. 11 (continued)

Traces of poor porosity present. No fluorescence. Some dark laminations show dips of 5°-10° which appear to be due to cross-bedding.

Next 8" Sandstone, with abundant dark laminations. The laminations consists of concentrations of coarse biotite and muscovite flakes, soft, brown to black, coaly grains and traces of plant resin. The sandstone is as in the unit 5270'-5272'4" except that it is fine grained, less friable and biotite and muscovite are common.

The dark laminations are gently current bedded, with dips to 5°. Overall dip, however, is flat.

Sandstone is tight, no fluorescence.

Next 5'6" Sandstone, as in 5270'-5272'4". Porosity is poor to very occasionally fair.

Some dark laminations show dips up to 15° and rarely up to 25°. These appear to be due to cross-bedding.

Bottom 1'6" Sandstone, as in 5270'-5272'4" except that it is fine grained, more micaceous (biotite and muscovite) garnets are more common (pink and red), traces of hornblende ? are present, and the sandstone contains a few coarse inclusions of brown, clayey, finely micaceous siltstone.

In places the clayey siltstone occurs as laminations, which appear as dark shaly partings to the naked eye.

The laminations show some gently current bedding up to 5°-10°. The overall dip, as well as that of the thick laminations, is flat.

The sandstone is tight, and there is no fluorescence.

CORE NO. 12 5609'-5550' Recovered 5'.

The entire core consists of shale, dark grey to black, micromicaceous, fairly hard, silty in places. A few scattered well preserved plant fragments are present as well as some rare coaly inclusions.

A few siltstone laminations are present, particularly in the lower 2'. The siltstone in these laminations contains common fairly coarse biotite and muscovite flakes, and minor scattered carbonaceous flecks.

The silt laminations show very minor swirling, lensing and depositional slumping. Dip of laminae however is consistently close to flat.

The shale tends to break along the bedding into flat discs.

CORE NO. 13 5958'-5968' Recovered 10' (100%)

Top 9' Sandstone, very light grey, very friable, very coarse grained to very coarse grained, gritty. Colour on surface of core is brown. This colour was acquired after the core was dried, subsequent on washing. Possibly the colour is due to mud chemicals being deposited on the surface of the core during the drying process.

The sandstone consists of coarse to very coarse grained, angular to sub-angular, occasionally enhedral, fairly well sorted, clear to light grey vitreous quartz, with minor scattered dark grey chert grains, white part kaolinized feldspars, and very minor lithic grains of reworked dark grey shale, soft brown-black coal; garnets occasional pink quartz and pink feldspars, and trace of fine indeterminate green specks, dark brown chert and are angular quartz pebble $\frac{3}{4}$" long.

The angular of the quartz grains is due partly to quartz overgrowths, and is responsible for imparting a sparkling appearance to the core in sunlight.

Garnets are locally very abundant, but elsewhere almost absent. A range of colour is present, suggesting the presence of spessartite, pyrope, and almandite.

Darker laminations are present in the sandstone. These laminations are clayey, silty and micaceous, and with garnets slightly more common than in the rest of the sandstone.

The cementing material of the sandstone is variously siliceous or kaolinitic. Where siliceous, the sorting and porosity is also better.

The porosity ranges from very poor, to fair in places to occasionally good.

A few very coarse coaly plant fragments are present these are $\frac{1}{8}$" - $\frac{1}{2}$" across and extend to the full width of the core. They lie approximately in the plane of bedding.

The sandstone is fairly strongly cross-bedded, with the darker lamination showing dips of between 5^{o} - 30^{o}. The steeper dips are less common than the shallower dips.

Bottom 1' Sandstone as above, but is harder, less friable, less porous, and exhibits little brown chemical stain on the outside of the core. The grain size is slightly finer, and the matrix is mostly kaolinitic. Coaly grains are a little more common, and there is a trace of brown quartz, siderite and biotite. Clayey, silty, micaceous laminations described in the unit above, are a little more common.

The sandstone is cross-bedded, with dips up to 15^{o}.

CORE NO. 14 6396'-6406' Recovered 4'

Top 2" Conglomerate. Contains pebbles from ¼"-3" diameter, mostly well rounded, but occasionally angular. Pebbles are of quartz, greenish and medium grey shale, diorite and weathered sandstone, different to sandstone of matrix. Matrix sandstone is calcareous, tight and consists of medium to coarse sub-angular quartz grains.

There is a sharp contact between this conglomerate and the underlying sandstone.

Next 1'6" Sandstone, medium to coarse grained, calcareous in part, consisting of sub-angular quartz, with some scattered garnets, granules of reworked shale and phyllites, and laminations of coaly material. The sandstone is coarser and tends to be friable, near the base. Porosity is fair, improving toward the base. Bedding is approximately horizontal.

Next 2" Conglomerate. Contains pebbles from ¼"-¾" diameter, of quartz, dark grey shale, greenish grey shale and phyllite in a sandstone matrix as previously.

Next 7" Shale, medium dark grey, micaceous, with silty, undulose laminations. Upper contact irregular, partly because of load casting. Otherwise bedding is approximately horizontal.

Bottom 1'7" Sandstone, coarse to very coarse, consisting of sub-angular quartz with occasional garnets and common pebbles of medium grey shale up to ¼" diameter. (Shale resembles that in unit above). The sandstone is friable, and porosity ranges from poor to fair coaly laminations and plant fragments are present.

Total 4'

CORE NO. 15 6763'-6769' Recovered 5'6"

Top 2'6" Shale. This unit consists of dark grey dense shale with little apparent fissility. The shale is badly fractured by intersecting fault planes. The fault planes are heavily slickensided with a development present of talc and chlorite. Two prominent fault planes are present, one sub-vertical and the other dipping at 40°-60°. Other fault planes are probably present, but the shale is too fractured for their determination.

Next 1'10" Shale, Sandstone and Conglomerate
Shale is present at the top of the unit similar to that described above. It grades gradually downward into a dark greenish grey sandstone consisting of grains of dark grey shale and rather minor quartz in a greenish chloritic matrix. The grains gradually increase in size downward and the rock type grades into a conglomerate. Near the bottom of the unit they appear as pebbles 1" to

Core No. 15 (continued)

1½" in diameter. The pebbles are elongated in a preferential direction of alignment. These planes, which probably represent bedding dip at between 25° and 40°.

The pebbles are about 70% dark grey shale, 10% quartz and quartzite plus light grey shale, greenish shale and serpentine. At the base of the unit the largest pebbles rest directly on the irregular upper surface of a sandstone of a similar type to that present at the top of the unit.

The unit, which shows graded bedding (fine at the top, coarse at the base) appears to overlie an earlier unit, in which again a similar type of graded bedding appears to be present.

The pebbles in the bottom 4" do not show any preferential direction of elongation.

The matrix throughout consists of greenish grey dirty medium grey sandstone consisting dominantly of reworked shale grains.

Bottom 1'2"

Conglomerate. Immediately below the contact at the base of the unit described above, a medium grey to greenish grey sandstone is present. This is similar to the sandstone at the top of the overlying unit, with pebbles gradually increasing in size downward for the first 8" where they reach a maximum diameter of ½"-¾". The size then decreases to about ¼"-1/8" diameter for the next 6". The pebbles in this unit are of the same types and is about the same proportion as those in the unit above.

The pebbles are elongated ina plane dipping at 40°, and this probably indicates the attitude of the bedding. One fracture plane is also present showing about the same dip.

Total 5'6"

CORE NO. 16 6853'-6859' Recovered 5'6"

The core consists of light grey, fine to medium grained, hard, silicified quartz sandstone, grading in places to an orthoquartzite.

The sandstone consists of sub-angular, poorly to fairly sorted, clear to milky or grey, occasionally frosted quartz, some partly kaolinized feldspars, plus occasional pink garnets, biotite, muscovite magnetite, black carbonaceous flecks, and greenish grey lithic grains in a matrix ranging from silica to kaolin. Some slight to moderate recrystallization has taken place.

A few reworked pebbles of hard, dark grey shale, soft light grey and light greenish grey shale, and quartz pebbles up to ¾" long

Core No. 16
(continued)

are scattered throughout, as well as occasional very coarse, very poorly preserved, carbonized plant remains. The sandstone of the lower 5" of the core is medium to coarse grained.

Irregular, slightly undulose, bedding planes are evident. These are slightly darker coloured, due to concentration of mica, and to the presence of flecks of carbonized plant material. Dips range from 20° to 35°. There is also some evidence of weak current bedding. Slickensided surfaces are present, dipping between 30° and 40°. These are not consistently parallel to bedding. The slickensided surfaces are characterized by the presence of mica and mica talc.

No Porosity is present in the core.

CORE NO. 17 7253'-7263' Recovered 6'

Top 10" Conglomeratic Sandstone. Sandstone is medium grey, medium to coarse grained, hard, consistso of sub-angular, fairly sorted, light grey to clear quartz, minor white kaolinized feldspars, abundant coarse biotite, muscovite and chlorite. Some coaly grains and traces of plant resin, ragged inclusions of soft, yellow, clayey ashy tuffaceous ? material, trace soft green shaly grains in a dirty, clayey matrix. Flat pebbles of dark grey, micaceous slaty, shale are present in the sandstone. Pebbles are up to 2½" long and ½" thick, but are generally less than ¼" long. Long axes are aligned along the bedding.

Dark laminations are present in the sandstone. These are due to concentrations of dark coloured mica flakes.

Sandstone is tight. The lower contact of this unit is undulose, the sand having settled between pebbles at the top of the underlying unit.

Next 2'5" Conglomeratic, very coarse grained sandstone. Sandstone is grey, coarse to very coarse, lithic slightly friable, and consists of poorly sorted sub-angular, clear and light grey quartz, minor white part kaolinized feldspars, abundant flat sub-rounded, lithic grains of medium to dark grey black, carbonaceous micaceous shale and slate, some reworked phyllite, serpentine, light greenish grey soapy, textured shale, as well as coarse biotite, muscovite and chlorite, in a dirty, clayey matrix.

The Sandstone contains abundant flat pebbles of dark grey to black slaty shale, occasionally up to 2" long and ⅛" thick. A few of these slaty pebbles are very hard, very micaceous and contain some finely disseminated pyrite.

There are no laminations in the sandstone, but the orientation of the long pebble axes suggest a dip of about 10°.

Next 1'5" Slightly pebbly, medium to coarse grained Sandstone Sandstone is similar lithologically to the overlying unit except for the presence of dark laminations and the relative scarcity of pebbles.

The laminations are partly due to concentrations of mica flakes, and partly due to the presence of coaly and carbonaceous material. Caolified coarse plant fragments are also present. The coal is generally black, bright and brittle, and very occasionally has a slight reddish brown colour.

Cross bedding is indicated by these laminations with dips ranging from 0°-20°.

Sandstone is tight.

Bottom 1'4" Very coarse, grained conglomeratic Sandstone. This unit is similar to the 2'5" unit, record from the top of the core. Granule sized to

CORE NO. 17 (continued)

small pebble sized quartz grains are common, and this size of feldspar grains are also present.

Sandstone is tight.

Some vague cross-bedding is evident, with dips from 5°-20°.

Total 6'

CORE NO. 18 7385'-7395' Recovered 10'

The core consists of dense, hard, medium grey, slaty, micaceous shale, with numerous carbonized plant fragments in the bedding plane. The only variation in lithology appears to be occasional silty bands from 2" - 6" thick which occur at 2' from the top, 3' from the top 6 feet from the top and in the bottom 6" of the core.

There is no fissility or cleavage.

The bedding planes dip 5° - 10°.

Total 10'

CORE NO. 19, 7739'-7749' Recovered 10+

7739'-7739'1" Sandstone, light to medium grey, lithic, very dirty, fine, medium and coarse grained. Consists of poorly sorted, reworked dark grey hard, micaceous shale grains, sub-rounded to angular, medium to coarse grained, glassy quartz grains (one quartz pebble $\frac{3}{8}$" diameter noted), carbonaceous and coaly grains, silver grey mica schist grains, yellowish ashy tuffaceous ? grains, trace grains of serpentine and dark grey dolerite, occasional soft, green shaley grains, ina brown grey dirty, clayey, micaceous silty matrix. Sandstone is tight.

Medium to dark grey laminations present which consist of micaceous siltstone with common carbonaceous and coaly flecks, poorly preserved plant fragments and fine lithic grains.

Dip 20° crossbedded.

7730'1"-7747'6" Siltstone, brown grey, grey, argillaceous Consists of silt size quartz, lithic grains of light brown and grey clayey and shaley material carbonaceous and coaly grains and other fine indeterminate, probably lithic material, along with fairly common biotite and yellowish to white specks.

The siltstone contains common dark laminations and thin interbeds. These are of more argillaceous siltstone, dark grey, micaceous silty shale, concentrations of mica flakes, and concentrations of macerated plant fragments.

Scattered very coarse poorly preserved coalified leaf fragments are commonly present.

A few rare soft blue grey flat pebbles of shale, up to a maximum $\frac{1}{2}$" long and 1/8" thick are present, as well as a few rare thin laminations of coarse pebbly sandstone. Pebbles in these laminations are both of pale brown quartz (sub-rounded) and blue grey shale (flat).

Fairly gently small scale current bedding and lensing is present throughout. Overall dip about 15°.

7747'6"-7747'11" Shale, dark grey to black, carbonaceous, very micaceous. Some coaly laminations and one coal seam $\frac{3}{8}$" thick consisting of black, brittle, shaley, laminated coal. Silty laminations present in shale.

7747'11"-7749' Siltstone, as in 7739'1" to 7748'6" except that it is more argillaceous with slightly more carbonaceous, and coaly material.

Total 10'

CORE NO. 20 7858'-7862' Recovered 18"

The entire core consists of a dark grey dolerite. The rock is aplianitic but

contains occasional visible grains of lemon-yellow olivine. Also visible are small lesser than 0.5 m.m. angular flakes of a unidentified white material and larger 1 - 2 m.m. pale green soft, waxy, transparent flakes of what might be a zeolite.

Scattered abundantly throughout the core are very dark grey angular fragments about 1 m.m. These are soft, have a white streak and occasionally appear to be altering to a reddish-brown material. They may be devitrified glass shardo.

These are occasional vesicles which are lined with a red jasper-like material and filled with calcite or quartz. Fractures which have not suffered movement contain zoned veinlets similar to vesicles, in both cases the wall rock shows slight evidence of alteration.

The entire core is broken into fragments 3" or less by fractures. Where these have undergone movement the sides are slickensided and the fracture is filled with chloritic calcite. Vertical, horizontal and irregular fractures are present.

CORE NO. 21 7895'-7905' Recovered 9'6"

The core consists of dolerite, which is dark greenish grey, fine xtalline, hard. The dolerite is slightly coarserthan that in Core No. 20. Some dark plagioclases (probably calcic) up to $\frac{1}{8}$ m.m. or rarely $\frac{3}{4}$ m.m. are visible, and pyroxenes can be distinguished with difficulty under the binocula microscope. Occasional greenish-yellow olivine is also present.

Alteration has proceeded outward from fractures imparting a green colour to the rock in these areas. The fractures themselves are now largely filled with calcite haematite and chlorite. Epidotization has proceeded outward from the fractures to a depth of $\frac{3}{4}$" in some cases, the epidote appearing as irregular blebs of vaguely radiating xtals, or as scattered neddle like xtals. Some actinolite may also be present. Calcite, in addition to being present in tabular form in the fractures also appears to be present as xtals in the zone of alteration. Haematite occurs as fracture filling up to 1/8" thick but traces of haematite appear to be present adjacent to fractures.

Three main direction of fractures appear to be present. These are sub vertical, dipping 45° - 60°, and sub horizontal. Some undulating fractures of random orientation are also present. The fractures are open tension fractures (cooling ?) which have been subsequently filled with calcite etc., and from which alteration of the dolerite has proceeded. Movement subsequent to fracture filling is evidenced by the presence of slickensides on the calcite and haematite in some places.

The whole core is strongly fractured and was recovered as assorted small and large angular fragments in the core barrel.

Total 9'6"

CORE NO. 22 7947'-7957' Recovered 9'0"

The core consists of shale two types, black massive brittle fractured bituminous shale, and a medium to dark grey silty shale.

The black shale is hard, brittle, blocky, generally badly broken along its fractures and slick surfaces. It is slightly carbonaceous with plant fragments.

The medium to dark grey silty shale is hard, brittle, moderately blocky to moderately fissile, micaceous, carbonaceous and shaly. The silty phases have scattered thin layers of shale pebbles, brown, grey, green shale in sub-angular to sub-rounded pellets up to

CORE NO. 22
(continued)

grit size set in a silty matrix.

The silty phases have some well preserved plant remains of various types scattered throughout. Shaly bedding surfaces are generally carbonaceous with plant fragments.

The silty shale is jointed and fractured along vertical joints and along bedding in contract to the randomly fractured dark shale. The entire core is badly broken up. The vertical joint system has common green to white chloritic calcite coating.

Bedding dip is variable, averaging between 10^{o} - 15^{o}.

CORE NO. 23 8029'-8039' Recovered 8'6"

The core consists of two units.

Top 1.5" Shale (?) light grey and brown green, hard, dense, massive, brittle, containing traces of very fine white mica and dark green flecks and fragments of dark green shaly material. No plant remains. No bedding. Possibly tuffaceous, altered shale.

Rest of Core Shale, medium to dark grey, hard, brittle, dense, fissile, very micaceous with foliated very fine white mica spotted throughout with aggregates of brown, mica pyrite, feldspars (?) and dark indeterminate mineral aggregates, set in a dark grey slatey and pyritic matrix.

Bedding dips at 50 - 55°, with prominent parting.

A prominent joint is perpendicular to bedding, dips at about 45°.

Both planes have very common pyritization, with pyrite replacing shale in parts.

Joints are slickensided, chlorite and micaceous.

Total 8'6"

CORE NO. 24 8176'-8183' Recovered 7'

Core consists of one unit - Slatey Shale

It is dark grey, hard and brittle, fissile with good slatey clearage parrallel to bedding which dips at 60 - 65°, and two joint systems one subvertical, with fillings to 1/16" thick of white quartz and calcite with some pyrite and one dipping 30° perpendicular to bedding. This joint plane has common fine pyrite coating.

The slate is speckled, with a wide and even distribution of dark mica, mineral aggregates and some light mineral grains (?) (calcite-feldspar ?) set in a dark shaly, finely micaceous and occasionally slightly pyritic matrix. Pyrite is abundant on joints throughout the rock, but particularly so on the joint dipping at 30°, perpendicular to bedding.

Total 7'

APPENDIX NO. 2

GEOBOTANICAL REPORTS

Palaeobotanical Report on Samples from the Planet Casterton No. 1 Bore, Cores 17, 18 and 19.

Summary: Cores 17, 18 and 19 from the Casterton No.1 Bore containing plant fragments were submitted for examination. The fragments in Core 17 are indeterminate. Plants with Jurassic to Lower Cretaceous range are identified in cores 18 and 19 (7385 - 7749 feet.)

Introduction:

The fossils in Cores 18 and 19 are in the form of carbonised impressions. Most of the plant material is finely dissected and indeterminate. However, some portions of leaf lamina up to 1.5cm long and 1cm wide, in which the venation can be discerned under correct illumination, occur, and also a few determinate pinnule fragments and a small frond.

The six specimens in which determinate plant material occurs have been numbered 1 - 6 and the determinate forms ringed. These specimens are packed separately in case it is desired to retain them when the bulk of the samples (which contain no worth while plant evidence) are sent to Dr Evans for Palynological examination.

Descriptions of specimens 1 - 6 , determination of plant species and information on the range and occurrence of the species follows :-

I. Core 18. 7385 - 7395 feet.

Specimen 1: (a). Three portions of lamina 1.5cm X 1cm , 1cm X .8 cm , and 1 cm X .6 cm (ringed B and D) are referred to Taeniopteris spatulata Mc Clell. They show the prominent midrib of the species with fine lateral veins parallel to each other at right angles to the midrib.
(b). A leaf fragment with .5 cm of midrib and maximum width .4 cm preserved is ringed at A. The fine midrib gives rise to lateral veins at an acute angle which bifurcate close to the midrib. This fragment is too incomplete for positive identification but is possibly part of a leaf of Phyllopteris sp.
(c). At C , two lobes of a very small lamina .4 cm long and .15 cm wide (half width only preserved) occurs. This is too fragmentary for positive identification but may be referable to Microphyllopteris sp.
(d). Terminal pinnules of Coniopteris delicatula Shirley (impression .7 cm long, maximum width .3 cm) are seen ringed at E.

Specimen 2: Part of a lamina of Taeniopteris spatulata McClell. 1.5 cm long and .9 cm wide is ringed on this specimen. The midrib is prominent and the parallel lateral veins at right angles to it can be seen under side illumination.

Specimen 3 :Portions of three smaller laminae of

Taeniopteris spatulata McClell. are ringed on this specimen. A is .5 cm wide and both laminae ringed B show approximately 1.5 cm of lamina which tapers from .4 cm wide to .25 cm wide.

Specimen 4 : shows Coniopteris delicatula Shirley (the counterpart of the impression on specimen 1 (E).

II. Core 19. 7739 - 7749 feet.

Specimens 5 and 6 show impression and counterpart of a small frond with two-ranked, somewhat falcate leaves. The frond is 1.25cm long, its width is .4 cm below and it tapers to .2 cm at the apex. The venation of the leaves can be discerned by careful examination under correct lighting and appears to consist of a number of divergent veins to each pinnule. This venation, together with the mode of arrangement of the pinnules on the rachis, identifies the frond as an Otozamites or similar Bennetitalean frond and precludes it from Coniferae and other groups which have fronds which look similar as impressions. A young, terminal portion of frond such as this is difficult to assign to a species. Often mature fronds have less acutely pointed pinnules, etc.

Also ringed on specimen 6 is part of a lamina of Taeniopteris spatulata McClell.

Notes on Species of Plants Identified:

Taeniopteris spatulata McClell. is the most characteristic plant of the Jurassic in Australia. It occurs also in Lower Cretaceous horizons.

Phyllopteris occurs in Jurassic and Lower Cretaceous.

Micropnyllopteris occurs in Lower Cretaceous.

Coniopteris delicatula Shirley is recorded from Triassic and Jurassic strata.

Otozamites and other Bennetitalean fronds occur in Jurassic and Lower Cretaceous horizons.

AGE of Plant assemblage in Casterton No.1 Bore:-

Plant evidence indicates a Jurassic or Lower Cretaceous age for the plant fossil horizon between 7385 and 7749 feet.

Mary E. White.

13 th April, 1965.

Report on Plant Fossils in Core 22 (7947 - 7957 feet) of the Planet Casterton No. 1 Bore.

Summary: Core 22 was submitted for examination. Excellently preserved fossils are present and seven plants are identified. The plant assemblage indicates a Jurassic age and the fossil horizon is equated with the Walloon Series of Queensland.

Introduction: Core 22 contains carbonised impressions of plant fragments. Small detail of venation and form are clearly visible and close determination of the plants is possible.

Specimens containing good examples of the species identified have been numbered 1 - 9 and packed separately from the bulk of the samples which contain no additional evidence and can be used for palynological investigations if so desired.

Details of specimens 1 - 9 and information on the range and occurrence of the plants concerned follows :-

Description of specimens:

Specimen 1. (a). A frond of conifer foliage 4.5 cm long is referred to Elatocladus planus (Feist.) Maximum pinnule length is 1.5 cm at the base of the frond, tapering to 1 cm near the tip. (Frond marked "A" on specimen) Each pinnule shows a median vein. The rachis of the frond is fine.

Elatocladus planus is a form species erected to include such sterile Conifer fragments which cannot be assigned to genera whose cones are known. It is a most characteristic Jurassic form but ranges from Upper Triassic to Lower Cretaceous. It occurs abundantly in the Walloon Series in Queensland; also in the Burrum Series, Queensland; Talbragar Fish Beds, N.S.W; Julia and Nanutarra Formations in W.A.; Lower Cretaceous horizons in the Northern Territory; (and Kota and Jabalpur Series in India) etc.

(b). Portion of a frond of Ptilophyllum pecten (Phill.) 2 cm long, .75 cm wide with 5 pairs of pinnules per cm is marked "B". This form is abundant in Jurassic and Lower Cretaceous strata in Australia, and in the Jurassic of Europe, Turkestan, India, Grahamland etc. It is the dominant form in the "Ptilophyllum flora" of the Upper Gondwanas in India (now classified as Lower Cretaceous).

Specimen 2 shows Ptilophyllum pecten (B) and a fragment of Elatocladus planus (A).

Specimen 3.(a). At "A" a frond of Otozamites sp. is seen. 3.5 cm of fine rachis averages 5 pinnules per cm. Each pinnule is approximately .2 cm wide at its base and tapers to a point. Pinnules are falcate and average .5 cm long. The frond has a somewhat lax appearance when contrasted with the compact, almost overlapping arrangement of pinnules seen in the common species O. bengalensis, O. bechei, and O. feistmanteli. As the delineation between even the common species is arbitrary, and there is characteristically much variation of pinnule form within each "species" no attempt has been made to refer this specimen to a recorded species. All the Otozamites fronds in Core 22 can be referred to one species which is probably a new species not as yet recorded in Australia. It resembles a form illustrated by Douglas (1962) from the Upper Jurassic in Victoria.

The range of Otozamites in Australia is Jurassic and Lower Cretaceous. It has been stated repeatedly in literature that distribution of the genus was limited to the northern areas of Australia as it was recorded in north W.A., Northern Territory and Queensland but not in Victoria, South Australia and Tasmania. Douglas recorded and illustrated some poorly preserved specimens from Boola Boola Forest in S.E. Victoria. The present examples in Core 22 are therefore the first good specimens obtained in Victoria. There seems little doubt that the genus will be found to occur in N.S.W. as well.

(b). At "B" on specimen 3 are two small fragments of a delicate fern - Coniopteris delicatula (Shirley) This species occurs in Triassic and Jurassic strata in Queensland.

Specimen 4. At "A" are further fronds of Otozamites sp., at "B" portions of fronds of Ptilophyllum pecten and at "C" Elatocladus planus.

Specimen 5. A frond of Otozamites sp. "A" and a fragment of Coniopteris delicatula at "B".

Specimen 6. The frond of Otozamites sp. marked "A" on this specimen is 3 cm long and .4 cm wide. There are 4 pinnules per cm. and their arrangement is more compact than in the larger fronds. Pinnules are blunter and less falcate.

Specimen 7. Portion of a frond of the fern Cladophlebis australis (Morr.) 4 cm long is marked "A". The alternate pinnules are up to 1.5 cm long and show the characteristic venation of the species.

Cladophlebis australis is a most characteristic plant of the Jurassic of Australia. It ranges from Upper Triassic to Lower Cretaceous.

Specimen 8. (a). At "A" is a terminal portion of a pinna of the fern Sphenopteris superba Shirley . It is 1.5 cm long and the pinnules are .25cm long at the base of the specimen and barely .05 cm long at the tip. Each pinnule shows Sphenopteroid venation.

Sphenopteris superba ranges from Upper Triassic through Jurassic. It is a characteristic plant of the Walloon Series.

Specimen 9. (a). At "A" part of frond of Ptilophyllum pecten is seen.

(b). At "B" is part of a frond of Pterophyllum abnorme Eth fil. Part of a strong rachis 2.5 cm long gives rise to four pinnules at right angles to the rachis. Each pinnule is attached by its entire base, and each has about 20 fine parallel veins. Preservation is not complete and it is impossible to see the decurrent portions of lamina. The determination of this specimen as P. abnorme is made on the following criteria :- It is assigned to Pterophyllum as the attachment of pinnules is lateral; to P. abnorme as the veins enter each pinnule at right angles to the rachis and the number per pinnule is in accordance with the vein density in P. abnorme; and the size of pinnules etc. is consistent with that sp.

Pterophyllum abnorme is recorded from the Walloon Series of Queensland.

Conclusions.

The following plants have been identified in Core 22:-

Elatocladus planus (Feist).

Ptilophyllum pecten (Phill.)

Otozamites sp. (possibly sp. nov.)

Cladophlebis australis (Morr.)

Sphenopteris superba Shirley.

Coniopteris delicatula (Shirley)

Pterophyllum abnorme Eth. fil.

The weight of plant evidence indicates a Jurassic age for the assemblage and it is equated with the Walloon Series in Queensland. (Walkom, 1917). The unidentified species of Otozamites may be a new species, and it differs from the typical Lower Cretaceous forms which occur in abundance in N.T. collections from horizons proved to be Neocomian.(White, 1961)

References:

Douglas, J.G. 1962. The occurrence of Otozamites in S.E. Victoria. Proc.Roy.Soc.Vic. 75,1; 41 - 43.

Walkom, A.B. 1917. Mesozoic floras of Queensland. Flora of the Ipswich and Walloon Series. Qld.geol.Surv. Publ. 257, 259.

White, M.E. 1961. Report on 1960 collections of Mesozoic plant fossils from the Northern Territory. Bur.Miner.Res. Records 1961/146.

Mary E. White.

26th April. '65.

PE800743

This is an enclosure indicator page.
The enclosure PE800743 is enclosed within the container PE902945 at this location in this document.

The enclosure PE800743 has the following characteristics:

ITEM_BARCODE	= PE800743
CONTAINER_BARCODE	= PE902945
NAME	= Spore/Pollen Distribution Chart
BASIN	= OTWAY
PERMIT	= PEP 26
TYPE	= WELL
SUBTYPE	= DIAGRAM
DESCRIPTION	= Spore/Pollen Distribution Chart, Species Checklist (enclosure from WCR) for Casterton-1
REMARKS	=
DATE_CREATED	=
DATE_RECEIVED	=
W_NO	= W488
WELL_NAME	= Casterton-1
CONTRACTOR	=
CLIENT_OP_CO	= Planet Exploration Company Pty Ltd

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PE800748

This is an enclosure indicator page.
The enclosure PE800748 is enclosed within the container PE902945 at this location in this document.

The enclosure PE800748 has the following characteristics:

ITEM_BARCODE	= PE800748
CONTAINER_BARCODE	= PE902945
NAME	= Spore/Pollen Distribution Chart
BASIN	= OTWAY
PERMIT	= PEP 26
TYPE	= WELL
SUBTYPE	= DIAGRAM
DESCRIPTION	= Spore/Pollen Distribution Chart, Oldest Occurrence List (enclosure from WCR) for Casterton-1
REMARKS	=
DATE_CREATED	=
DATE_RECEIVED	=
W_NO	= W488
WELL_NAME	= Casterton-1
CONTRACTOR	=
CLIENT_OP_CO	= Planet Exploration Company Pty Ltd

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PE800758

This is an enclosure indicator page.
The enclosure PE800758 is enclosed within the container PE902945 at this location in this document.

The enclosure PE800758 has the following characteristics:

ITEM_BARCODE	= PE800758
CONTAINER_BARCODE	= PE902945
NAME	= Spore/Pollen Distribution Chart
BASIN	= OTWAY
PERMIT	= PEP 26
TYPE	= WELL
SUBTYPE	= DIAGRAM
DESCRIPTION	= Spore/Pollen Distribution Chart, Phylo-Group Diversity(enclosure from WCR) for Casterton-1
REMARKS	=
DATE_CREATED	=
DATE_RECEIVED	=
W_NO	= W488
WELL_NAME	= Casterton-1
CONTRACTOR	=
CLIENT_OP_CO	= Planet Exploration Company Pty Ltd

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PE800760

This is an enclosure indicator page.
The enclosure PE800760 is enclosed within the container PE902945 at this location in this document.

The enclosure PE800760 has the following characteristics:

ITEM_BARCODE	= PE800760
CONTAINER_BARCODE	= PE902945
NAME	= Spore/Pollen Distribution Chart
BASIN	= OTWAY
PERMIT	= PEP 26
TYPE	= WELL
SUBTYPE	= DIAGRAM
DESCRIPTION	= Spore/Pollen Distribution Chart, Phylo-Group Abundance (enclosure from WCR) for Casterton-1
REMARKS	=
DATE_CREATED	=
DATE_RECEIVED	=
W_NO	= W488
WELL_NAME	= Casterton-1
CONTRACTOR	=
CLIENT_OP_CO	= Planet Exploration Company Pty Ltd

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PE800755

This is an enclosure indicator page.
The enclosure PE800755 is enclosed within the container PE902945 at this location in this document.

The enclosure PE800755 has the following characteristics:

ITEM_BARCODE	= PE800755
CONTAINER_BARCODE	= PE902945
NAME	= Spore/Pollen Distribution Chart
BASIN	= OTWAY
PERMIT	= PEP 26
TYPE	= WELL
SUBTYPE	= DIAGRAM
DESCRIPTION	= Spore/Pollen Distribution Chart, Morpho-Group Diversity (enclosure from WCR) for Casterton-1
REMARKS	=
DATE_CREATED	=
DATE_RECEIVED	=
W_NO	= W488
WELL_NAME	= Casterton-1
CONTRACTOR	=
CLIENT_OP_CO	= Planet Exploration Company Pty Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

APPENDIX NO. 3

AGE DETERMINATIONS

Geochron Laboratories, Inc.

24 Blackstone Street, Cambridge, Mass. 02139
Telephone TRowbridge 6-3691

16 April 1965

J.G.F.	
M.G.M	✓
X J.K.F.	
F.M.C.	
G.A.B	✓
K.K.	

Mr. Malcolm McKellar, Chief Geologist
Planet Exploration Company
2 O'Connell Street
Sydney, New South Wales
Australia

Dear Mr. McKellar:

I am enclosing our written report on the Potassium-Argon age determination performed on your sample of basalt from Casterton # 1 Well in Australia. This result was transmitted by cable last evening.

The calculated age of this sample is 153 million years which would place it approximately in the middle Jurassic. For purposes of comparison, I might note that a number of dolomites from Tasmania and Antartica have very similar ages.

I hope this result has reached you in time to make any necessary decisions regarding this particular well. Most of the time elapsed was a result of a slower delivery to us than I would have expected. As a result, we performed the analysis as readily as possible and submitted it by cable 29 hours after we had received the sample. Should you have occasion to use our priority service in the future or to recommend it to others, I would suggest transporting samples by Air Express and a cable to us giving us the Airline Waybill number. This will often save as much as one or two days in transit from distant points.

If you have any questions about this date, please do not hesitate to contact me. Meanwhile, I hope we will have the pleasure of serving you and the Planet Exploration Company in the near future.

Sincerely,

GEOCHRON LABORATORIES, INC.

Harold W. Krueger
Technical Director

HWK:ja

Enclosures

CC: Mr. Robert Schroeder
Degolyer & MacNaughton
5625 Daniels Avenue
Dallas, Texas

Geochron Laboratories, Inc.

24 Blackstone Street, Cambridge, Mass. 02139
Telephone TRowbridge 6-3691

16 April 1965

REPORT OF ANALYTICAL WORK

Our Sample # R0508

Your reference: Call:: 9 April 1965

Description: Basalt, crushed to -20/+200 mesh, and analyzed as a whole rock. From Planet Casterton # 1 Well.

Ar^{40*}/K^{40} = 0.00935

AGE = 153 (±5) x 10^6 years

Argon Analyses:

Ar^{40*}, ppm.	Ar^{40*}/Total Ar^{40}	Ave. Ar^{40*}, ppm.
0.0141	0.650	0.0142
0.0143	0.634	

Potassium Analyses:

%K	Ave. %K	K^{40}, ppm.
1.24	1.25	1.52
1.26		

Constants Used:

$$\lambda_\beta = 4.72 \times 10^{-10}/\text{year}$$

$$\lambda_e = 0.585 \times 10^{-10}/\text{year}$$

$$K^{40}/K = 1.22 \times 10^{-4}\ \text{g./g.}$$

$$\text{AGE} = \frac{1}{\lambda_e + \lambda_\beta} \ln\left[\frac{\lambda_e + \lambda_\beta}{\lambda_e} \times \frac{Ar^{40*}}{K^{40}} + 1\right].$$

Ar^{40*} refers to radiogenic Ar-40

AGE DETERMINATION
by
Australian National University

K - Ar Measurements on Core 20, Casterton No. 1 Well

We have dated the sample of basaltic rock from Casterton No. 1 Well, core 20, 7858'. The date found was 120 ± 10 m.y. which can be regarded as a reliable minimum age. This is Lower Cretaceous on Kulp's (1961) time scale. The rock is an olivine basalt (or dolerite) in which the olivine phenocrysts are extensively altered to calcite and other minerals. The groundmass consists of plagioclase, clinopyroxene and about 10% intersertal isotropic glass. Because the rock is quite strongly altered the measured K-Ar date may be low owing to loss of radiogenic argon by diffusion.

K - Ar data

Sample No. GA 1512

K content	1.29%
Ar^{40}/K^{40}	7.30×10^{-3}
Air Ar content	8%

Rubidium - Strontium Measurements

The analytical data for the Rb-Sr work on a whole-rock sample is as follows :

Rb	45.9 ppm
Sr	848 ppm
Rb^{87}/Sr^{86}	0.1557
Sr^{87}/Sr^{86}	0.7071

From the observed value for Rb^{87}/Sr^{86}, and enrichment of approximately 0.0005 in Sr^{87}/Sr^{86} would be produced in 250 m.y., the latter being the minimum difference in age between pre-Permian and Tertiary (which was your original question). This

enrichment is too small to be detected without a considerable number of repeat analyses, and in view of the K-Ar work which was then underway we did not continue. The strontium content of this rock is rather high and probably associated with the calcite. Had it been lower by a factor of three, it would have been worth proceeding to measure the greater enrichment in Sr^{87}/Sr^{86} by further analyses on the separated calcite and on a calcite-leached total-rock sample.

See Evernden & Richards. (1962).
Jour. Geol. Soc. Aust. Vol. 9
for references to Kulp (1961) & Holmes (1960)
Above authors

APPENDIX NO. 4

DRILL STEM TESTS

Flow Time	1st Min. 25	2nd Min. 30	Date 2-18-65	Ticket Number 344102	
Closed In Press.	1st Min. 30	2nd Min. 15	Kind of Job OPEN HOLE	Halliburton District AUSTRALIA	
Pressure Readings	Field	Office Corrected	Tester CARTER	Witness CUNDILL	
Depth Top Gauge	1941' Ft.	NO Blanked Off	Drilling Contractor A.D.C.	BM	
BT. P.R.D. No.	1043	24 Hour Clock	Elevation 472'	Top Packer 1951'	
Initial Hydro Mud Pressure		989	Total Depth 2016'	Bottom Packer -	
Initial Closed In Pres.		749	Interval Tested 1951' - 2016'	Formation Tested -	
Initial Flow Pres.	1	370	Casing or Hole Size 8 3/4"	Casing Top - / Perfs. Bot. -	
	2	749			
Final Flow Pres.	1	746	Surface Choke 1"	Bottom Choke 5/8"	
	2	749			
Final Closed In Pres.		749	Size & Kind Drill Pipe 4½" F.H.	Drill Collars Above Tester I.D. 2¼" - LENGTH 270'	
Final Hydro Mud Pressure		989	Mud Weight 9.2	Mud Viscosity 38	
Depth Cen. Gauge	Ft.	Blanked Off	Temperature 120 °F Est. / °F Actual	Anchor Size & Length ID - / OD 27 X 5"	
BT. P.R.D. No.		Hour Clock	Depths Mea. From KELLY BUSHING	Depth of Tester Valve 1935' Ft.	
Initial Hydro Mud Pres.			Cushion TYPE NONE AMOUNT Ft.	Depth Back Pres. Valve Ft.	
Initial Closed In Pres.			Recovered Feet of	Mea. From Tester Valve	
Initial Flow Pres.	1		Recovered Feet of		
	2				
Final Flow Pres.	1		Recovered Feet of		
	2				
Final Closed In Pres.			Recovered Feet of		
Final Hydro Mud Pres.			Oil A.P.I. Gravity	Water Spec. Gravity	
Depth Bot. Gauge	2012' Ft.	YES Blanked Off	Gas Gravity	Surface Pressure psi	
BT. P.R.D. No.	1040	24 Hour Clock	Tool Opened 2:30 PM A.M. P.M.	Tool Closed 4:10 PM A.M. P.M.	
Initial Hydro Mud Pres.		1055	Remarks Tool plugged - with shale and sand -		
Initial Closed In Pres.		-	spudded tool in and out of the hole.		
Initial Flow Pres.	1				
	2	-			
Final Flow Pres.	1				
	2	-			
Final Closed In Pres.	HYDROSTATIC	RELEASE: 836			
Final Hydro Mud Pres.		1055			

Legal Location Sec. - Twp. - Rng. -

Lease Name CASTERTON Well No. 1 Test No. 1

Lease Owner/Company Name PLANET EXPLORATION COMPANY

Owner's District AUSTRALIA

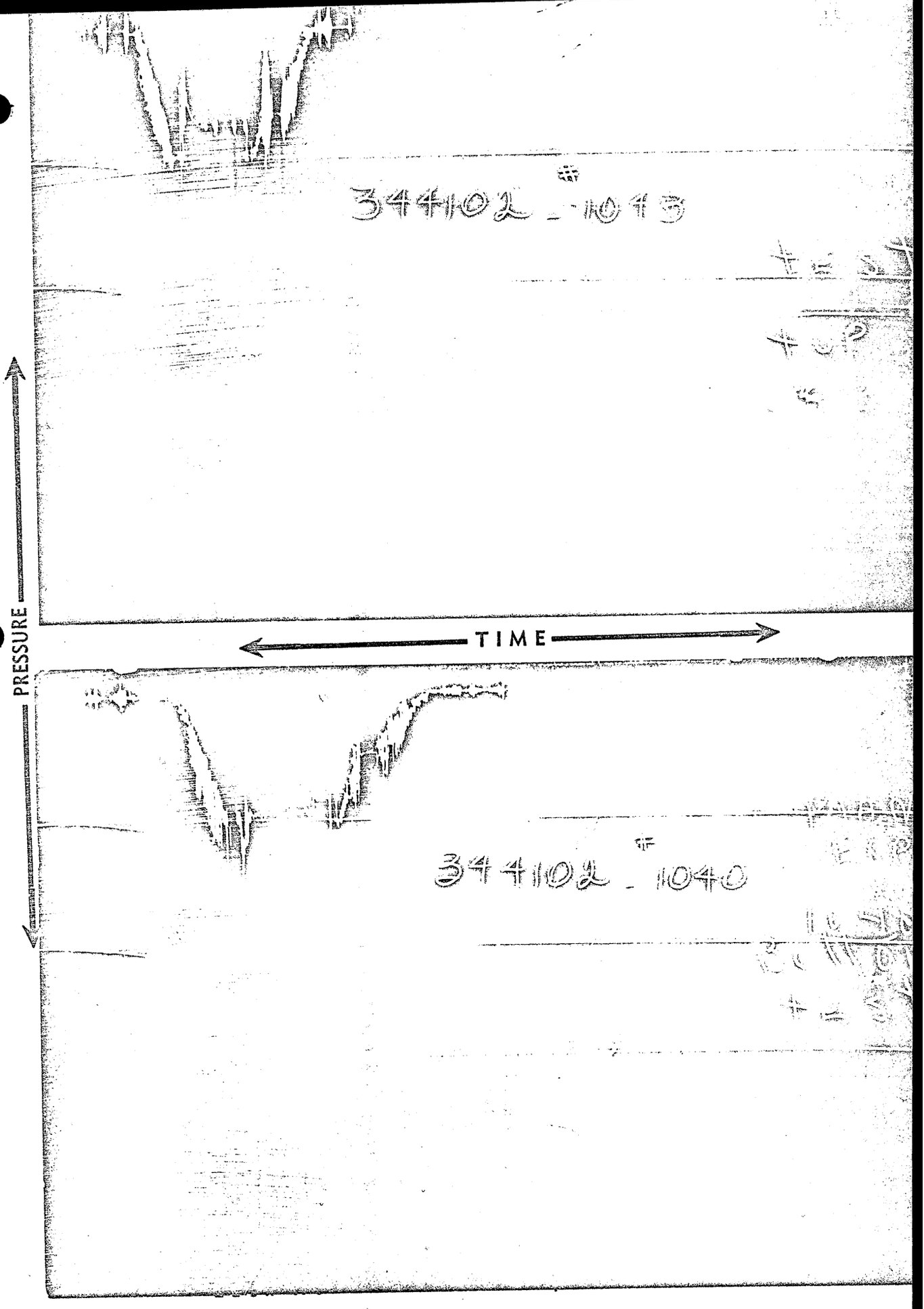
Field Area WILDCAT County - State VICTORIA

FORMATION TEST DATA

3

* Potentiometric Surface Reference to Rotary Table When Elevation Not Given, Fresh Water Corrected to 100° F.

Form No. 1296-B2


3441021 - 1013
PRESSURE
TIME
3441021 - 1040

Flow Time	1st Min. –	2nd Min. 15	Date	2-20-65	Ticket Number	344103	Legal Location Sec. - Twp. - Rng. –
Closed In Press. Time	1st Min. –	2nd Min. –	Kind of Job	OPEN HOLE	Halliburton District	AUSTRALIA	
Pressure Readings	Field	Office Corrected	Tester	CARTER	Witness	CUNDILL	
Depth Top Gauge	2355' Ft.	NO Blanked Off	Drilling Contractor	A. D. C.		BM	
BT. P.R.D. No.	1043	24 Hour Clock	Elevation	472'	Top Packer	2365'	
Initial Hydro Mud Pressure		1241	Total Depth	2430'	Bottom Packer	–	
Initial Closed in Pres.		–	Interval Tested	2365' - 2430'	Formation Tested	–	
Initial Flow Pres.	1 2 583		Casing or Hole Size	8 3/4"	Casing Perfs. Top – Bot. –		
Final Flow Pres.	1 2 583		Surface Choke	1"	Bottom Choke	5/8"	
Final Closed in Pres.		–	Size & Kind Drill Pipe	4½" F.H.	Drill Collars Above Tester I.D. - LENGTH	2¼" - 270'	
Final Hydro Mud Pressure		1241	Mud Weight	10	Mud Viscosity	50	
Depth Cen. Gauge	Ft.	Blanked Off	Temperature °F Est. 120 °F Actual		Anchor Size & Length ID – OD 5"	x 65'	Field Area WILDCAT
BT. P.R.D. No.		Hour Clock	Depths Mea. From	KELLY BUSHING	Depth of Tester Valve	2349' Ft.	
Initial Hydro Mud Pres.			Cushion TYPE NONE AMOUNT Ft.		Depth Back Pres. Valve	– Ft.	
Initial Closed Flow Pres.			Recovered	1200' Feet of	salty mud		Mea. From Tester Valve
Initial Flow Pres.	1 2		Recovered	Feet of			
Final Flow Pres.	1 2		Recovered	Feet of			County –
Final Closed in Pres.			Recovered	Feet of			
Final Hydro Mud Pres.			Oil A.P.I. Gravity		Water Spec. Gravity		
Depth Bot. Gauge	2430' Ft.	YES Blanked Off	Gas Gravity		Surface Pressure	psi	
BT. P.R.D. No.	1040	24 Hour Clock	Tool Opened	6:30 A.M. P.M.	Tool Closed	7:30 AM A.M. P.M.	
Initial Hydro Mud Pres.		1284	Remarks	Tool plugged with sand and shale - could			
Initial Closed in Pres.		–	not pick any pressures. Tool drug going in and				State VICTORIA
Initial Flow Pres.	1 2 638		coming out of the hole.				
Final Flow Pres.	1 2 638						
Final Closed in Pres.		–					
Final Hydro Mud Pres.		1284					

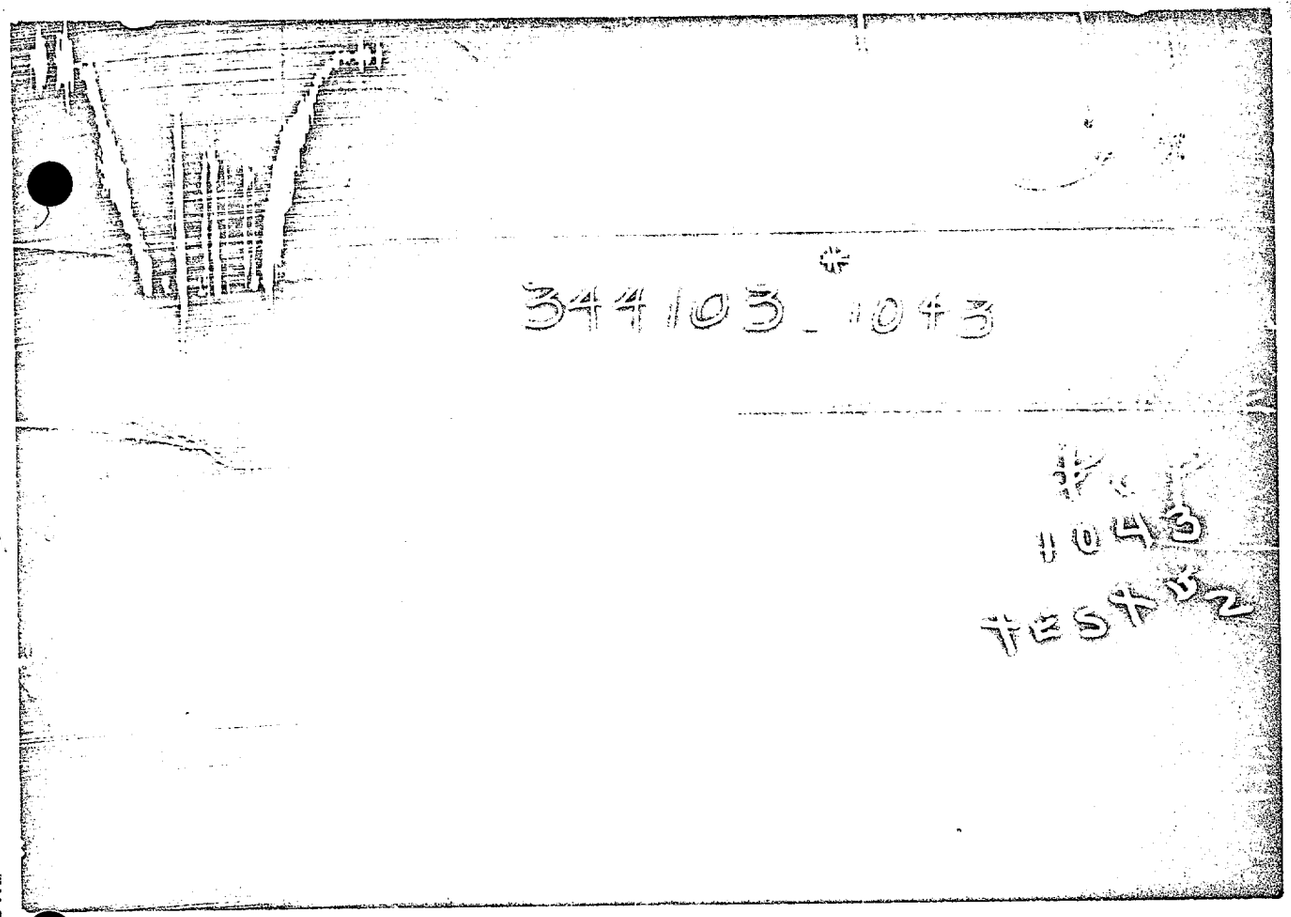
Lease Name: CASTERTON Well No. 1 Test No. 2 Lease Owner/Company Name: PLANET EXPLORATION COMPANY Owner's District: AUSTRALIA

FORMATION TEST DATA

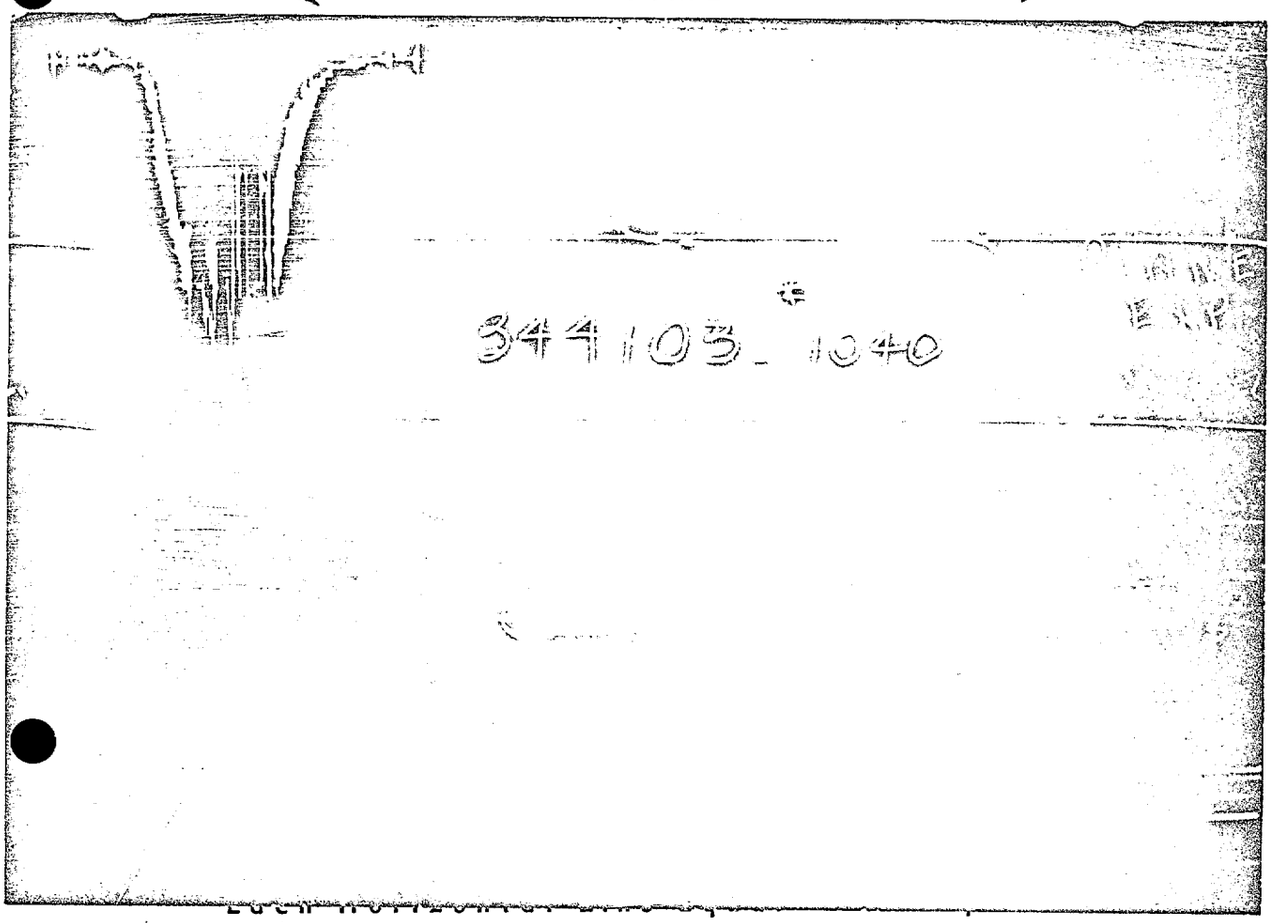
2

* Potentiometric Surface Reference to Rotary Table When Elevation Not Given, Fresh Water Corrected to 100° F.

Form No. 1296-R2



TIME



New Time	1st Min. 5	2nd Min. 30	Date 2-24-65	Ticket Number 34404 - S	Legal Location Sec. - Twp. - Rng.
Closed In Press. Time	1st Min. 15	2nd Min. 15	Kind of Job OPEN HOLE	Halliburton District AUSTRALIA	
Pressure Readings	Field	Office Corrected	Tester MR. CARTER	Witness MR. CUNDELL	
Depth Top Gauge	3810 Ft.	NO Blanked Off	Drilling Contractor A. D. C.	IC	
BT. P.R.D. No.	1043	24 Hour Clock	Elevation 472'	Top Packer 3822'	
Initial Hydro Mud Pressure	2358	2027	Total Depth 3858'	Bottom Packer -	
Initial Closed in Pres.	260	1326	Interval Tested 3822'-3858'	Formation Tested -	
Initial Flow Pres.	3 1	13	Casing or Hole Size 8 3/4"	Casing Perfs. Top - Bot. -	
	3 2	19			
Final Flow Pres.	6 1	15	Surface Choke 1"	Bottom Choke 5/8"	
	6 2	35			
Final Closed in Pres.	208	1059	Size & Kind Drill Pipe 4 1/2" F.H.	Drill Collars Above Tester I.D. - LENGTH 2 1/2" x 270'	
Final Hydro Mud Pressure	2589	1980	Mud Weight 10	Mud Viscosity 48	
Depth Cen. Gauge	Ft.	Blanked Off	Temperature °F Est. 119 °F Actual	Anchor Size & Length ID 5" OD X 36'	
BT. P.R.D. No.		Hour Clock	Depths Mea. From KELLY BUSHINGS	Depth of Tester Valve 3806' Ft.	
Initial Hydro Mud Pres.			Cushion TYPE - AMOUNT - Ft.	Depth Back Pres. Valve - Ft.	
Initial Closed in Pres.			Recovered 20 Feet of Drilling mud		Mea. From Tester Valve
Initial Flow Pres.	1		Recovered Feet of		
	2				
Final Flow Pres.	1		Recovered Feet of		
	2				
Final Closed in Pres.			Recovered Feet of		
Final Hydro Mud Pres.			Oil A.P.I. Gravity -	Water Spec. Gravity -	
Depth Bot. Gauge	3854 Ft.	YES Blanked Off	Gas Gravity -	Surface Pressure - psi	
BT. P.R.D. No.	1040	24 Hour Clock	Tool Opened 6:30 AM A.M. P.M.	Tool Closed 7:35 AM A.M. P.M.	
Initial Hydro Mud Pres.	2654	1939	Remarks Opened tool for 5 minute 1st flow. Closed		
Initial Closed in Pres.	267	1351	tool for 15 minute initial closed in pressure.		
Initial Flow Pres.	3 1	44	Reopened tool for 30 minute 2nd flow with a weak		
	3 2	48			
Final Flow Pres.	3 1	44	blow decreasing to very weak after 5 minutes.		
	6 2	59			
Final Closed in Pres.	208	1083	Closed tool for 15 minute final closed in pressure.		
Final Hydro Mud Pres.	2713	1917			

Lease Name CASTERTON | Well No. 1 | Test No. 3

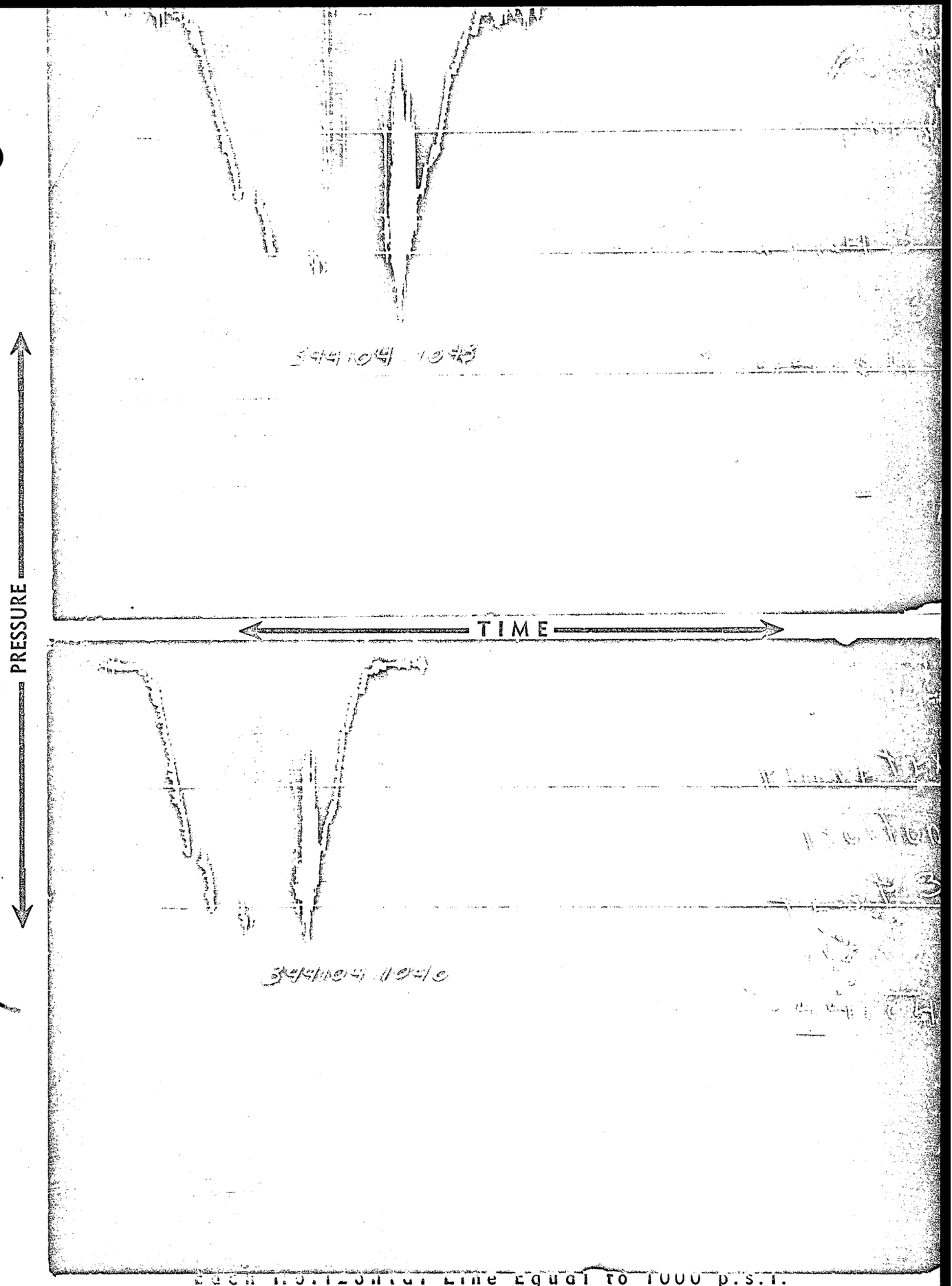
Lease Owner/Company Name PLANET EXPLORATION COMPANY

Owner's District AUSTRALIA

Field Area WILDCAT | County | State VICTORIA

FORMATION TEST DATA

3



Each H.S.I.Horizontal Line Equal to 1000 p.s.i.

Flow Time	1st Min. 5	2nd Min. 30	Date	3-18-65	Ticket Number	344105 S	
Closed In Press. Time	1st Min. 15	2nd Min. 15	Kind of Job	OPEN HOLE	Halliburton District	AUSTRALIA	
Pressure Readings	Field	Office Corrected	Tester	CARTER	Witness	J. CUNDILL	
Depth Top Gauge	4995 Ft.	Blanked Off no	Drilling Contractor	DRILLING CONTRACTORS		LC	
BT. P.R.D. No.	1043	Hour Clock 24	Elevation	472'	Top Packer	4605'	
Initial Hydro Mud Pressure	2445	2484	Total Depth	4670'	Bottom Packer	-	
Initial Closed in Pres.	263	1253	Interval Tested	4605' - 4670'	Formation Tested	-	
Initial Flow Pres.	2.9 1	33	Casing or Hole Size	8 3/4"	Casing Top / Perfs. Bot.		
	2.9 2	38					
Flow Pres.	2.9 1	33	Surface Choke	1"	Bottom Choke	5/8"	
	2.9 2	43					
Final Closed in Pres.	144.5	720	Size & Kind Drill Pipe	4 ½" FH	Drill Collars Above Tester I.D. · LENGTH	2 ½" - 270'	
Final Hydro Mud Pressure	2443	2484	Mud Weight	9.2	Mud Viscosity	38	
Depth Cen. Gauge	Ft.	Blanked Off	Temperature	120 °F Est. / °F Actual	Anchor Size & Length	ID 27" X D.C. OD 5" 36'	
BT. P.R.D. No.		Hour Clock	Depths Mea. From	Kelly Bushing	Depth of Tester Valve	4589 Ft.	
Initial Hydro Mud Pres.			Cushion TYPE none AMOUNT Ft.		Depth Back Pres. Valve	- Ft.	
Initial Closed in Pres.			Recovered	40 Feet of mud.			Mea. From Tester Valve
Initial Flow Pres.	1		Recovered	Feet of			
	2						
Final Flow Pres.	1		Recovered	Feet of			
	2						
Final Closed in Pres.			Recovered	Feet of			
Final Hydro Mud Pres.			Oil A.P.I. Gravity		Water Spec. Gravity		
Depth Bot. Gauge	4670 Ft.	Blanked Off yes	Gas Gravity		Surface Pressure	psi	
BT. P.R.D. No.	1040	Hour Clock 24	Tool Opened	12:05 P.M. A.M. P.M.	Tool Closed	1:10 P.M. A.M. P.M.	
Initial Hydro Mud Pres.	2492	2522	Remarks	Opened tool for a 5 minute first flow. Closed tool for a 15 minute initial closed in pressure. Reopened tool for a 30 minute second flow. Closed tool for a 15 minute final closed in pressure.			
Initial Closed in Pres.	263.9	1296					
Initial Flow Pres.	8.8 1	92					
	8.8 2	92					
Final Flow Pres.	8.8 1	82					
	8.8 2	88					
Final Closed in Pres.	173	843					
Final Hydro Mud Pres.	2492	2522					

Legal Location Sec. - Twp. - Rng. -

Lease Name CASTERTON

Well No. 1

Test No. 4

Lease Owner/Company Name PLANET OIL COMPANY

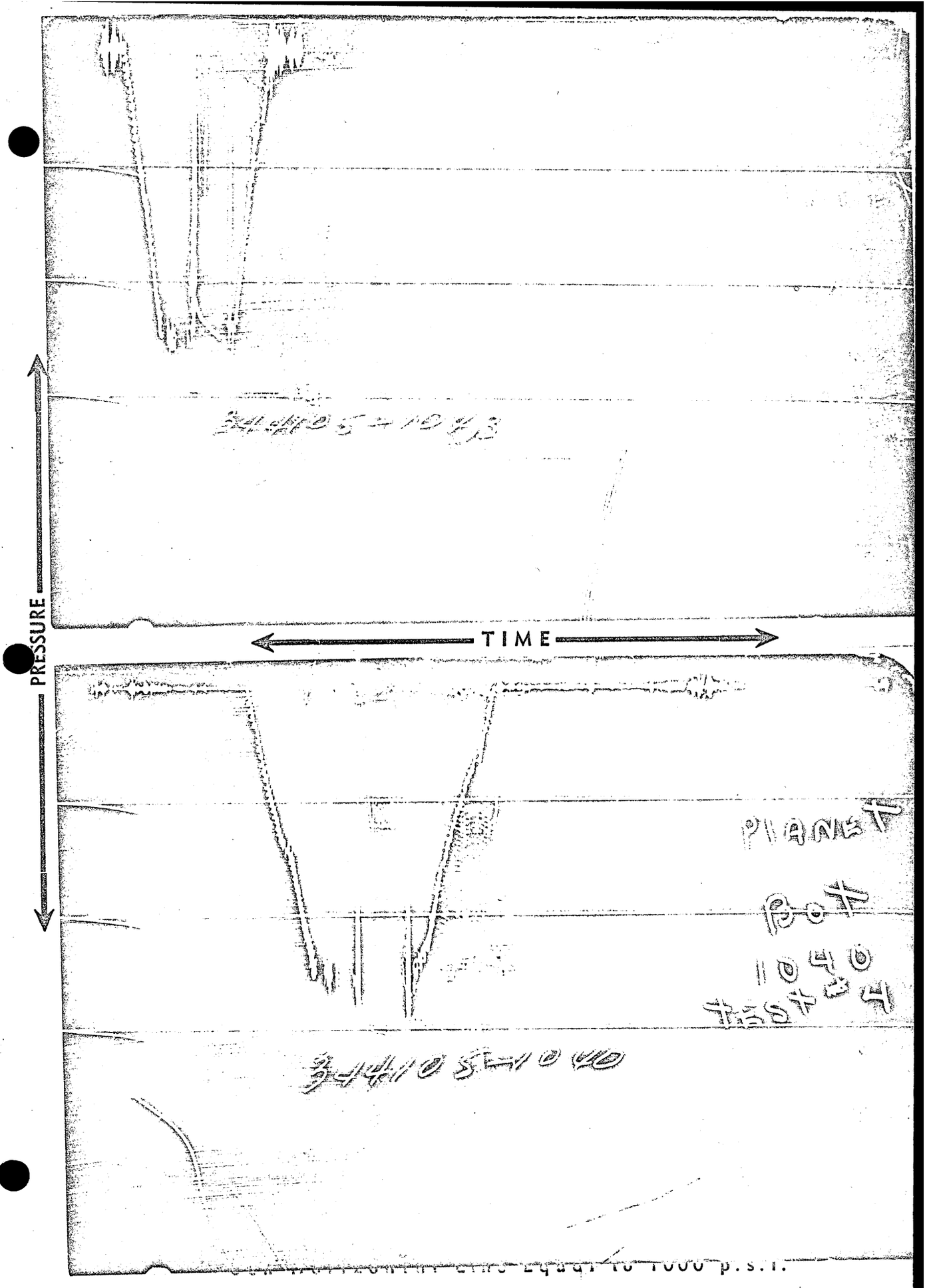
Field Area WILDCAT

County -

State VICTORIA

Owner's District AUSTRALIA

FORMATION TEST DATA



equal to 1000 p.s.i.

	1st Min.	2nd Min.				
Flow Time	-	90	Date	3-11-65	Ticket Number	344106
Closed In Press. Time	1st Min. -	2nd Min. 20	Kind of Job	OPEN HOLE	Halliburton District	AUSTRALIA
Pressure Readings	Field	Office Corrected	Tester	CARTER	Witness	CUNDILL
Depth Top Gauge	4818' Ft.	NO Blanked Off	Drilling Contractor	DRILLING CONTRACTOR		BM
BT. P.R.D. No.	1043	24 Hour Clock	Elevation	472'	Top Packer	4828'
Initial Hydro Mud Pressure	2589	2701	Total Depth	4919'	Bottom Packer	-
Initial Closed in Pres.	-	-	Interval Tested	4828' - 4919'	Formation Tested	-
Initial Flow Pres.	1 5.8	2 15	Casing or Hole Size	8 3/4"	Casing Top / Perfs. Bot.	- / -
Final Flow Pres.	1 12.6	2 84	Surface Choke	1"	Bottom Choke	5/8"
Final Closed in Pres.	260	1313	Size & Kind Drill Pipe	4½" F.H.	Drill Collars Above Tester I.D. - LENGTH	2½" - 270'
Final Hydro Mud Pressure	2589	2587	Mud Weight	9.8	Mud Viscosity	40
Depth Cen. Gauge	Ft.	Blanked Off	Temperature °F Est. / °F Actual	120	Anchor Size & Length ID / OD	2½" x 5" 55' D.C. 36'
BT. P.R.D. No.		Hour Clock	Depths Mea. From	KELLY BUSHING	Depth of Tester Valve	4811 Ft.
Initial Hydro Mud Pres.			Cushion TYPE / AMOUNT	NONE Ft.	Depth Back Pres. Valve	Ft.
Final Closed in Pres.			Recovered	Feet of		
Initial Flow Pres.	1 / 2		Recovered	120' Feet of	salt water cut mud	
Final Flow Pres.	1 / 2		Recovered	Feet of		
Final Closed in Pres.			Recovered	Feet of		
Final Hydro Mud Pres.			Oil A.P.I. Gravity		Water Spec. Gravity	
Depth Bot. Gauge	4919' Ft.	yes Blanked Off	Gas Gravity		Surface Pressure	psi
BT. P.R.D. No.	1040	24 Hour Clock	Tool Opened	12:00 AM A.M. P.M.	Tool Closed	1:15 AM A.M. P.M.
Initial Hydro Mud Pres.	2654	2763	Remarks	Tool opened for a 90 minute flow period.		
Initial Closed in Pres.	-	-		Took a 20 minute final closed in pressure.		
Initial Flow Pres.	1 8.8	2 78				
Final Flow Pres.	1 14.7	2 145				
Final Closed in Pres.	269.8	1416				
Final Hydro Mud Pres.	2654	2676				

Legal Location Sec. - Twp. - Rng. -

Lease Name: CASTERTON | Well No.: 1 | Test No.: 5

Lease Owner/Company Name: PLANET OIL COMPANY

Field Area: WILDCAT | County: - | State: Victoria | Owner's District: AUSTRALIA

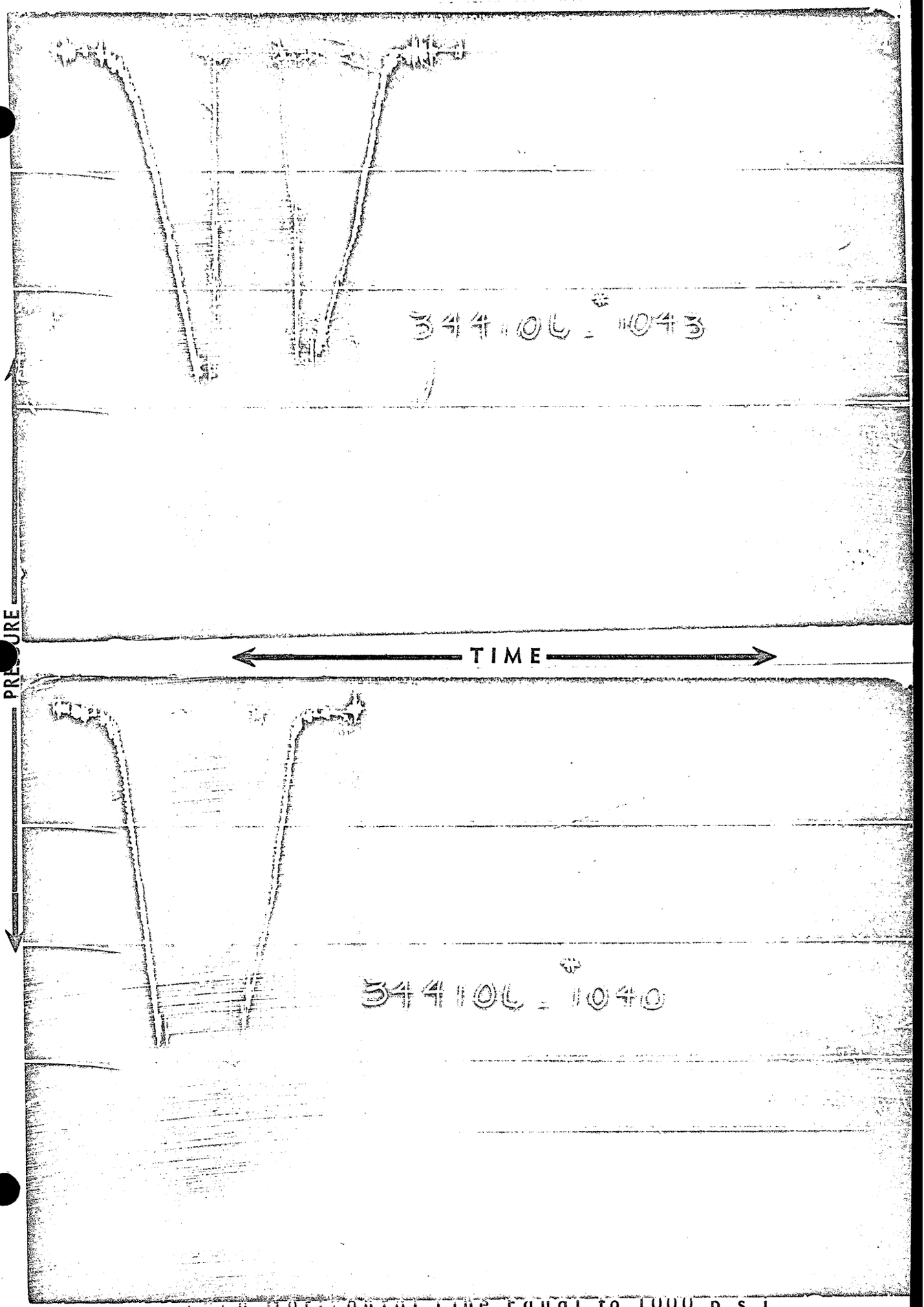
Meas. From Tester Valve

FORMATION TEST DATA

3

* Potentiometric Surface Reference to Rotary Table When Elevation Not Given, Fresh Water Corrected to 100° F.

Form No. 1296-R2



Each Horizontal Line Equal to 1000 p.s.i.

	1st Min.	2nd Min.
Flow Time	7	45
Closed in Press. Time	20	20
Pressure Readings	Field	Office Corrected
Depth Top Gauge	5008 Ft.	NO Blanked Off
BT. P.R.D. No.	2013	24 Hour Clock
Initial Hydro Mud Pressure	2734	2720
Initial Closed in Pres.	2027	2068
Initial Flow Pres.	1293 1	1381
	1868 2	1696
Final Flow Pres.	1609 1	1559
	2013 2	2062
Final Closed in Pres.	2013	2074*
Final Hydro Mud Pressure	2661	2714
Depth Cen. Gauge	Ft.	Blanked Off
BT. P.R.D. No.		Hour Clock
Initial Hydro Mud Pres.		
Initial Closed in Pres.		
Initial Flow Pres.	1	
	2	
Final Flow Pres.	1	
	2	
Final Closed in Pres.		
Final Hydro Mud Pres.		
Depth Bot. Gauge	5084 Ft.	YES Blanked Off
BT. P.R.D. No.	1040	24 Hour Clock
Initial Hydro Mud Pres.	2773	2763
Initial Closed in Pres.	2038	2100
Initial Flow Pres.	1455 1	1612
	1658 2	1781
Final Flow Pres.	1764 1	1717
	2067 2	2091
Final Closed in Pres.	2067	2106
Final Hydro Mud Pres.	2654	2747

Date	3-18-65	Ticket Number	344107 - S
Kind of Job	OPEN HOLE	Halliburton District	AUSTRALIA
Tester	MR. CARTER	Witness	MR. GUNDILL
Drilling Contractor	DRILLING CONTRACTORS		IC
Elevation	472'	Top Packer	5018'
Total Depth	5084'	Bottom Packer	-
Interval Tested	5018'-5084'	Formation Tested	-
Casing or Hole Size	8 3/4"	Casing Perfs. Top / Bot.	-
Surface Choke	1"	Bottom Choke	5/8"
Size & Kind Drill Pipe	4 1/2" F.H.	Drill Collars Above Tester (I.D. - LENGTH)	2 1/2" x 278'
Mud Weight	9.8	Mud Viscosity	70
Temperature	120 °F Est. / °F Actual	Anchor Size & Length (ID / OD)	5" x 36'
Depths Mea. From	KELLY BUSHINGS	Depth of Tester Valve	5068' Ft.
Cushion (TYPE / AMOUNT)	- Ft.	Depth Back Pres. Valve	- Ft.
Recovered	4750 Feet of	Saltwater	
Recovered	Feet of		
Recovered	Feet of		
Recovered	Feet of		
Oil A.P.I. Gravity	-	Water Spec. Gravity	-
Gas Gravity	-	Surface Pressure	- psi
Tool Opened	8:90 AM A.M. / P.M.	Tool Closed	9:32 AM A.M. / P.M.

Mea. From Tester Valve

Remarks: Opened tool for 7 minute 1st flow. Closed tool for 20 minute initial closed in pressure. Reopened tool for 45 minute 2nd flow. Closed tool for 20 minute final closed in pressure.

*QUESTIONABLE

Legal Location Sec. - Twp. - Rng.: —

Lease Name: CASTERTON

Well No.: 1

Test No.: 6

Field Area: WILDCAT

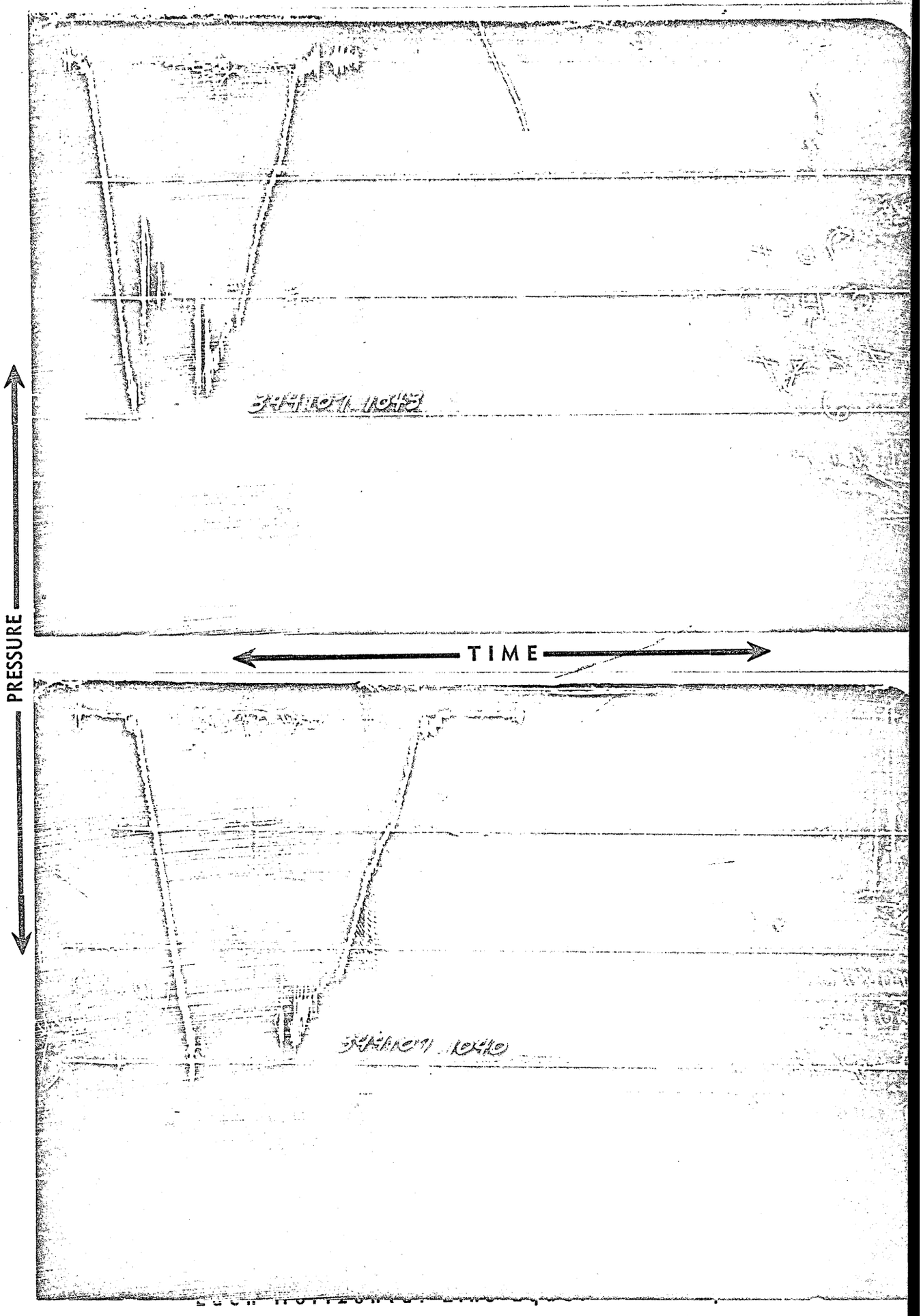
Lease Owner/Company Name:

County: —

State: VICTORIA

Owner's District:

FORMATION TEST DATA


PRESSURE
TIME

	1st Min.	2nd Min.
Flow Time	5	45
Closed In Press. Time	30	20
Pressure Readings	Field	Office Corrected
Depth Top Gauge	5008 Ft.	no Blanked Off
BT. P.R.D. No.	1043	24 Hour Clock
Initial Hydro Mud Pressure	2835	2877
Initial Closed in Pres.	2185	2197
Initial Flow Pres.	11.6 1	104
	13 2	175
Final Flow Pres.	14.5 1	159
	73.5 2	747
Final Closed in Pres.	2142.7	2163
Final Hydro Mud Pressure	2157	2877
Depth Cen. Gauge	Ft.	Blanked Off
BT. P.R.D. No.		Hour Clock
Initial Hydro Mud Pres.		
Initial Closed in Pres.		
Initial Flow Pres.	1	
	2	
Final Flow Pres.	1	
	2	
Final Closed in Pres.		
Final Hydro Mud Pres.		
Depth Bot. Gauge	5078' Ft.	yes Blanked Off
BT. P.R.D. No.	1040	24 Hour Clock
Initial Hydro Mud Pres.	2875	2997
Initial Closed in Pres.	2199	2221
Initial Flow Pres.	18.5 1	95
	18.5 2	204
Final Flow Pres.	14.7 1	242
	73.3 2	770
Final Closed in Pres.	2170	2185
Final Hydro Mud Pres.	2184	2997

Date	3-13-65	Ticket Number	344108 S
Kind of Job	OPEN HOLE	Halliburton District	AUSTRALIA
Tester	CARTER	Witness	J. CUNDILL
Drilling Contractor	DRILLING CONTRACTORS		LC
Elevation	472'	Top Packer	5018'
Total Depth	5282'	Bottom Packer	--
Interval Tested	5244' - 5282'	Formation Tested	--
Casing or Hole Size	8 3/4"	Casing Perfs. Top / Bot.	
Surface Choke	1"	Bottom Choke	5/8"
Size & Kind Drill Pipe	4 ½" FH	Drill Collars Above Tester (I.D. - LENGTH)	2 ½" - 270'
Mud Weight	10.5	Mud Viscosity	72
Temperature	°F Est. 140 °F Actual	Anchor Size & Length	ID / OD 5" X 36'
Depths Mea. From	Kelly Bushing	Depth of Tester Valve	5034 Ft.
Cushion TYPE / AMOUNT	none Ft.	Depth Back Pres. Valve	-- Ft.
Recovered	2160 Feet of salt muddy water.		
Recovered	Feet of		
Recovered	Feet of		
Recovered	Feet of		
Oil A.P.I. Gravity		Water Spec. Gravity	
Gas Gravity		Surface Pressure	psi
Tool Opened	7:00 A.M. / P.M.	Tool Closed	8:40 A.M. / P.M.

Remarks: Tool opened for a 5 minute first flow. Closed tool for a 30 minute initial closed in pressure. Re-opened tool for a 45 minute second flow with a weak blow increased to strong, decreased to very weak in 40 minutes. Closed tool for a 20 minute final closed in pressure.

Legal Location Sec. - Twp. - Rng.: -

Lease Name: CASTERTON

Well No.: 1

Test No.: 7

Lease Owner/Company Name: PLANET OIL COMPANY

Owner's District: AUSTRALIA

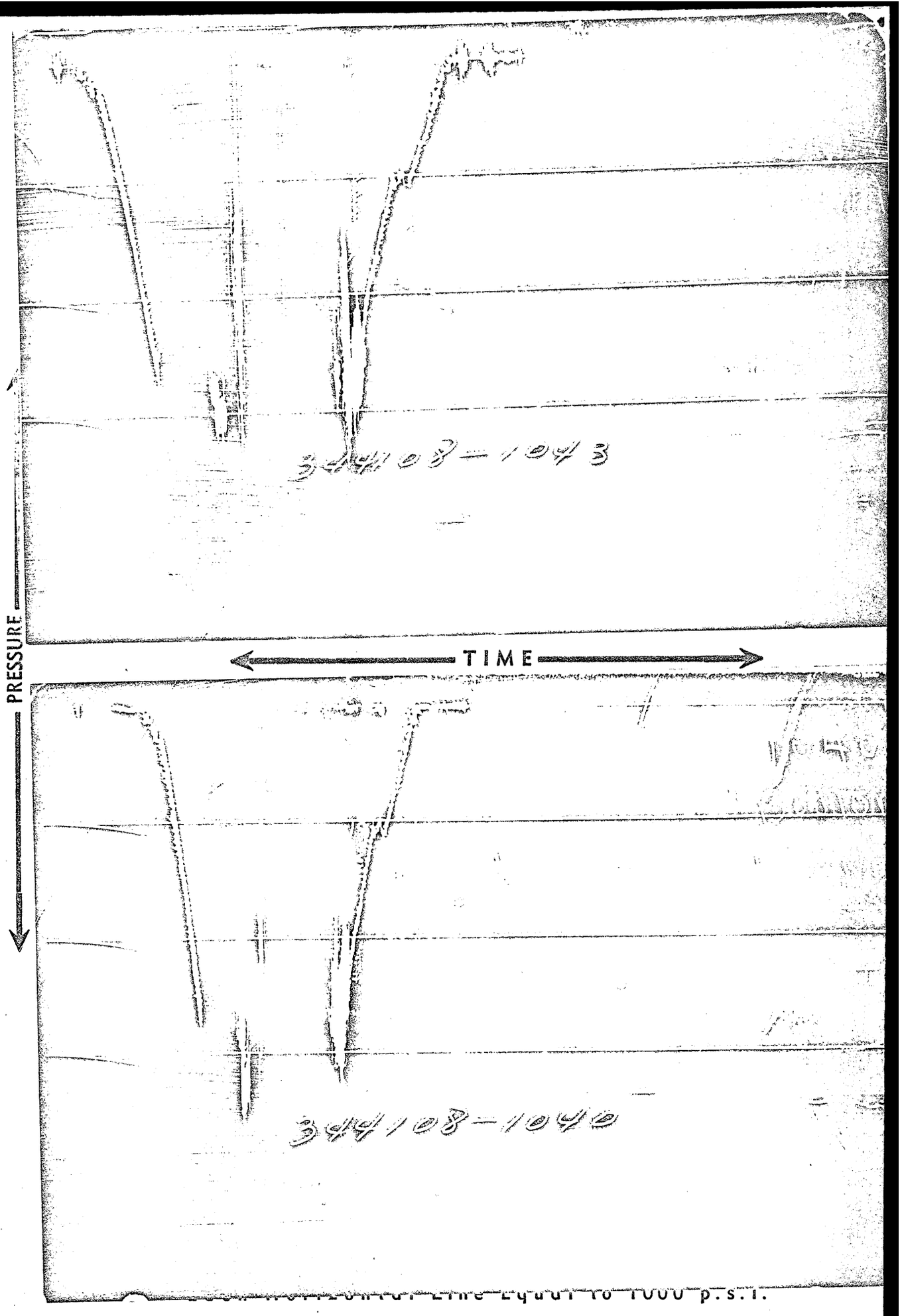
Field Area: WILDCAT

County: -

State: VICTORIA

Mea. From Tester Valve

FORMATION TEST DATA



Hydrostatic Line Equal to 1000 p.s.i.

	1st Min.	2nd Min.
Flow Time	9	17
Closed In Press. Time	16	20
Pressure Readings	Field	Office Corrected
Depth Top Gauge	6393 Ft.	Blanked No Off
BT. P.R.D. No.	1043	Hour 24 Clock
Initial Hydro Mud Pressure	3747	3756
Initial Closed in Pres.	2430	2415
Initial Flow Pres.	15 (1)	25
	29 (2)	38
Final Flow Pres.	15 (1)	33
	43 (2)	74
Final Closed in Pres.	1984	1994
Final Hydro Mud Pressure	3747	3756
Depth Cen. Gauge	Ft.	Blanked Off
BT. P.R.D. No.		Hour Clock
Initial Hydro Mud Pres.		
Initial Closed in Pres.		
Initial Flow Pres.	(1)	
	(2)	
Final Flow Pres.	(1)	
	(2)	
Final Closed in Pres.		
Final Hydro Mud Pres.		
Depth Bot. Gauge	6438 Ft.	Blanked Yes Off
BT. P.R.D. No.	1040	Hour 24 Clock
Initial Hydro Mud Pres.	No Readings	
Initial Closed in Pres.	Stylus Disengaged	
Initial Flow Pres.	(1)	
	(2)	
Final Flow Pres.	(1)	
	(2)	
Final Closed in Pres.		
Final Hydro Mud Pres.		

Date	3-21-65	Ticket Number	344109 S
Kind of Job	OPEN HOLE	Halliburton District	AUSTRALIA
Tester	MR. CARTER	Witness	J. CUNDILL
Drilling Contractor	DRILLING CONTRACTORS		JM
Elevation	472'	Top Packer	6409'
Total Depth	6442'	Bottom Packer	-
Interval Tested	6409-6442'	Formation Tested	-
Casing or Hole Size	8 3/4"	Casing Top / Perfs. Bot.	
Surface Choke	1"	Bottom Choke	5/8"
Size & Kind Drill Pipe	4 1/2" FH	Drill Collars Above Tester (I.D. - LENGTH)	2 1/2" - 270'
Mud Weight	11	Mud Viscosity	50
Temperature	150 °F Est. / °F Actual	Anchor Size & Length (ID / OD)	5" X 33'
Depths Mea. From	Kelly Bushing	Depth of Tester Valve	6399' Ft.
Cushion (TYPE / AMOUNT)	- Ft.	Depth Back Pres. Valve	Ft.
Recovered	120 Feet of	Salty Mud	
Recovered	Feet of		
Recovered	Feet of		
Recovered	Feet of		
Oil A.P.I. Gravity		Water Spec. Gravity	
Gas Gravity		Surface Pressure	psi
Tool Opened	7:18 a.m. A.M. P.M.	Tool Closed	8:35 a.m. A.M. P.M.

Mea. From Tester Valve

Remarks: Tool opened with a puff blow, and decreasing

Closed tool for a 16 minute initial closed in

pressure. Reopened tool with no blow for a

17 minute final flow. Took a 20 minute final

closed in pressure.

Legal Location Sec. - Twp. - Rng.

Lease Name: CASTERTON

Well No.: 1

Test No.: 8

Field Area: WILDCAT

County

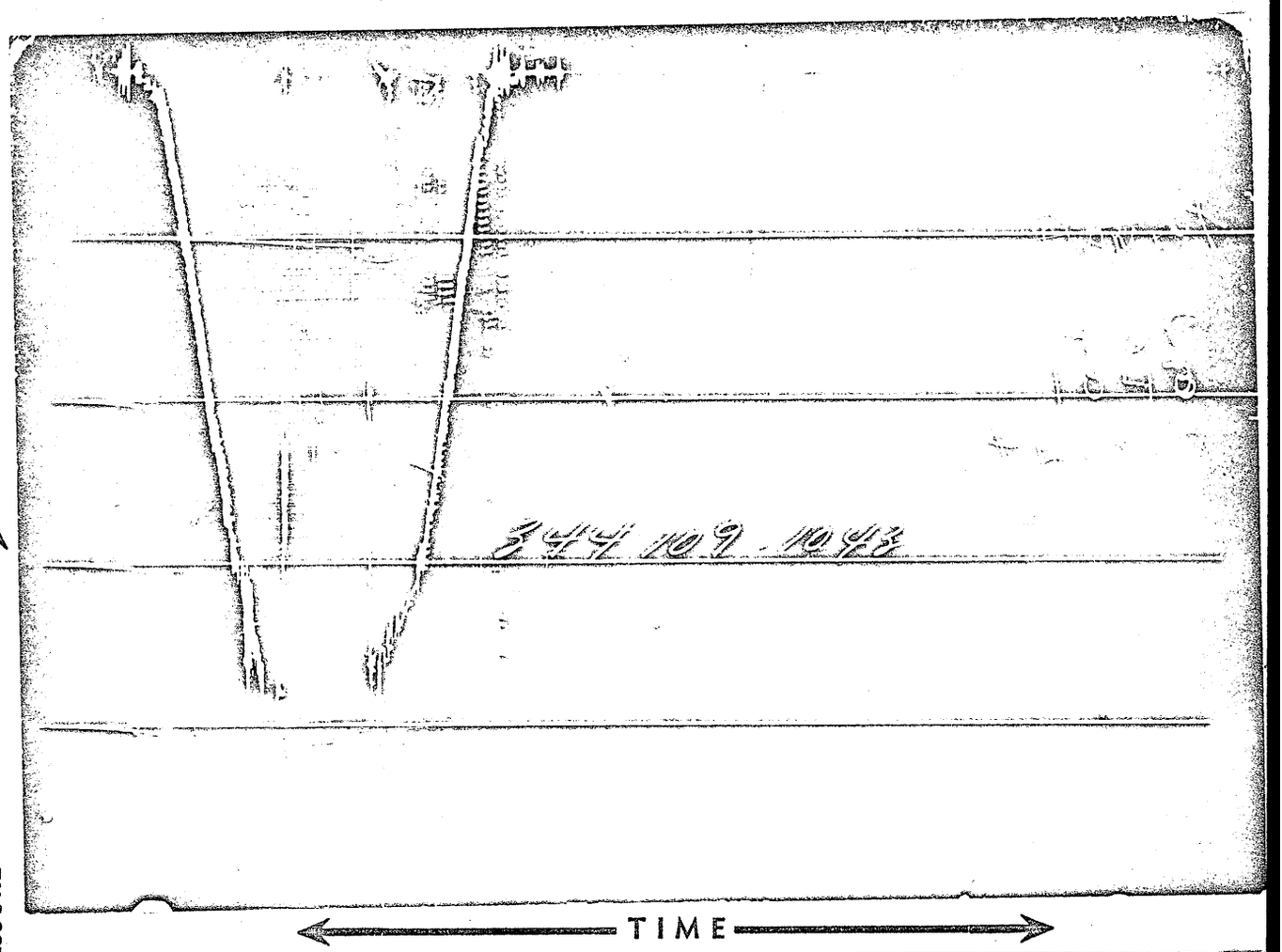
State: VICTORIA

Lease Owner/Company Name: PLANET OIL COMPANY

Owner's District: AUSTRALIA

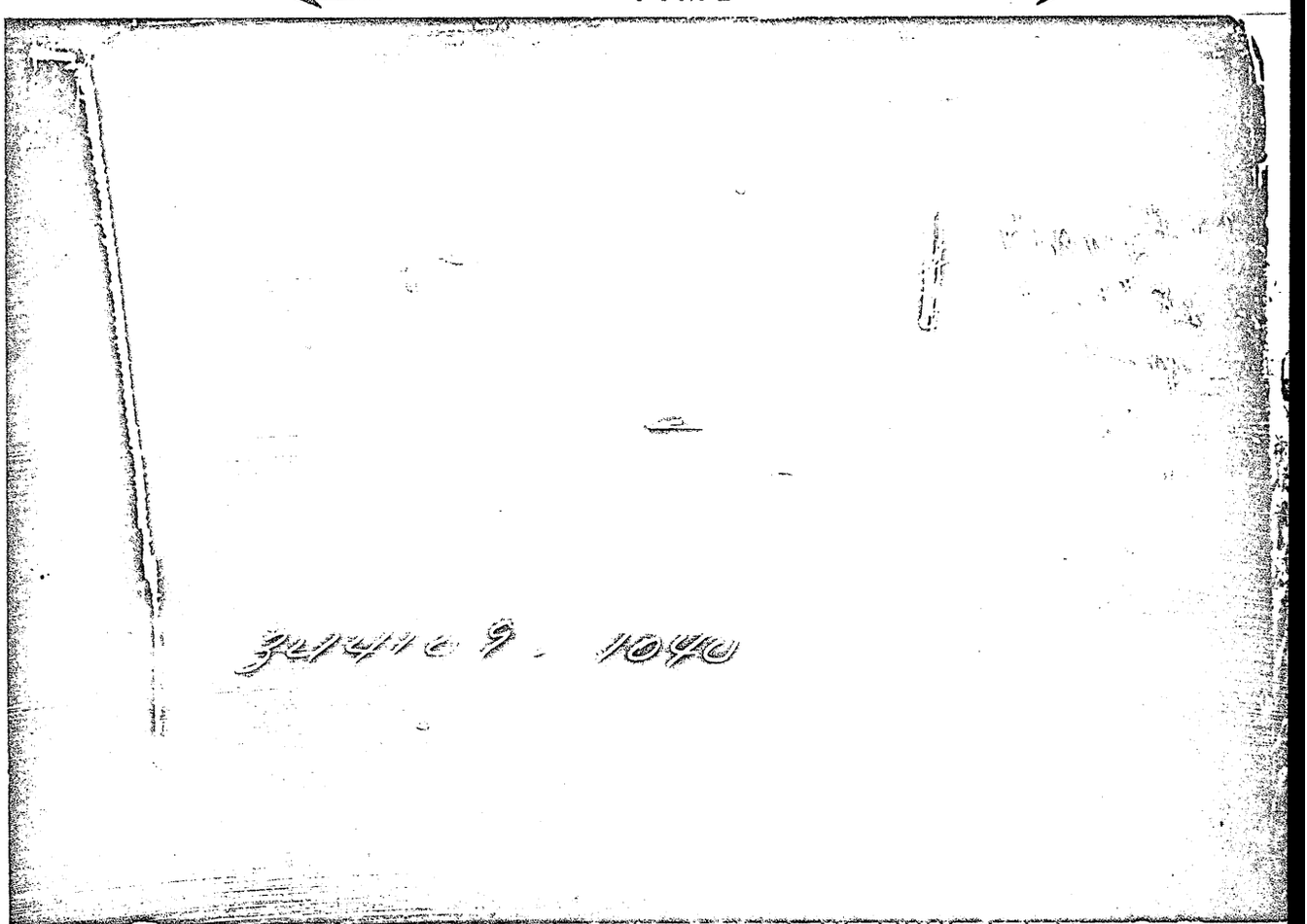
FORMATION TEST DATA

3-6



PRESSURE

TIME



	1st Min.	2nd Min.
Flow Time	30	30
Closed In Press. Time	30	45
Pressure Readings	Field	Office Corrected
Depth Top Gauge	6919 Ft.	no Blanked Off
BT. P.R.D. No.	1046	24 Hour Clock
Initial Hydro Mud Pressure	3631	3748
Initial Closed in Pres.	2857	2839
Initial Flow Pres.	29.7 1	262
	29.7 2	349
Final Flow Pres.	29.7 1	358
	55 2	554
Final Closed in Pres.	2772	2751
Final Hydro Mud Pressure	3572	3729
Depth Con. Gauge	Ft.	Blanked Off
BT. P.R.D. No.		Hour Clock
Initial Hydro Mud Pres.		
Initial Closed in Pres.		
Initial Flow Pres.	1	
	2	
Final Flow Pres.	1	
	2	
Final Closed in Pres.		
Final Hydro Mud Pres.		
Depth Bot. Gauge	6991 Ft.	yes Blanked Off
BT. P.R.D. No.	1406	24 Hour Clock
Initial Hydro Mud Pres.	3657	3749
Initial Closed in Pres.	3033	3860
Initial Flow Pres.	29.7 1	597
	29.7 2	686
Final Flow Pres.	55 1	575
	55 2	739
Final Closed in Pres.	2756	2771
Final Hydro Mud Pres.	3637	3735

Date	5-1-65	Ticket Number	344110 S
Kind of Job	OPEN HOLE	Halliburton District	AUSTRALIA
Tester	J.R. CARTER	Witness	M. WILTSHINE
Drilling Contractor	DRILLING CONT.		IC
Elevation		Top Packer	6777'
Total Depth	6995'	Bottom Packer	
Interval Tested	6995'-6939'	Formation Tested	
Casing or Hole Size	8 3/4"	Casing Top / Perfs. Bot.	
Surface Choke	1"	Bottom Choke	5/8"
Size & Kind Drill Pipe	4½" FH	Drill Collars Above Tester (I.D. - LENGTH)	2½" x 270'
Mud Weight	11	Mud Viscosity	55
Temperature	150 °F Est. / °F Actual	Anchor Size & Length (ID / OD)	5" x 25' / 6¼" x 31'
Depths Mea. From	Kelly bushing	Depth of Tester Valve	6915 Ft.
Cushion (TYPE / AMOUNT)	Ft.	Depth Back Pres. Valve	Ft.
Recovered	1070 Feet of	muddy water	
Recovered	Feet of		
Recovered	Feet of		
Recovered	Feet of		
Oil A.P.I. Gravity		Water Spec. Gravity	
Gas Gravity		Surface Pressure	psi
Tool Opened	7:00 am A.M. P.M.	Tool Closed	8:55 am A.M. P.M.
Remarks	Open tool with a good blow de-		
	decreasing to dead in 40 mins.		

Mea. From Tester Valve

Legal Location Sec. - Twp. - Rng.

Lease Name

Well No.

Test No.

Field Area: WILDCAT

County

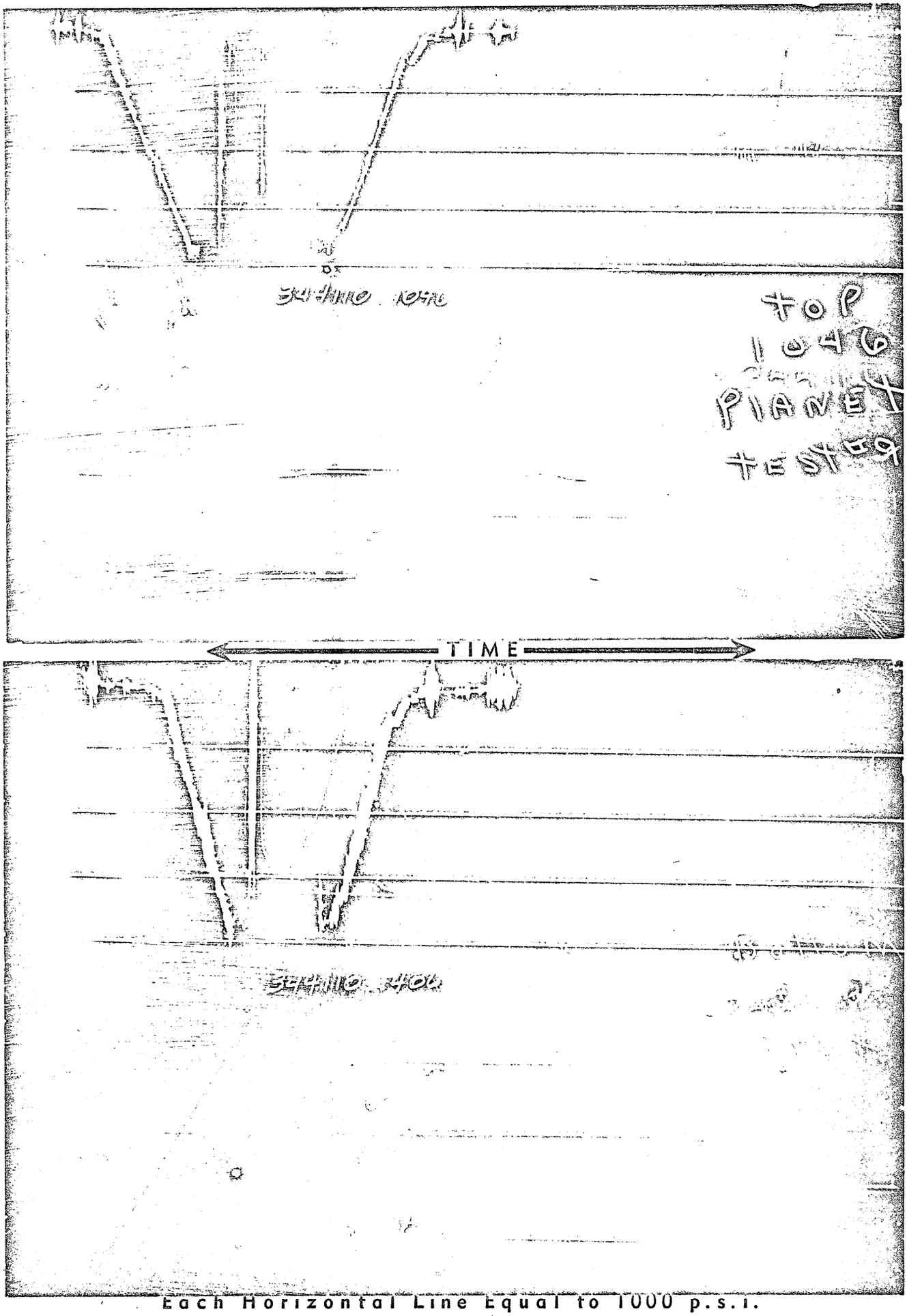
Lease Owner/Company Name

State: VICTORIA

Owner's District

FORMATION TEST DATA

3


PRESSURE
TIME
Each Horizontal Line Equal to 1000 p.s.i.

Flow Time	1st Min. 25	2nd Min. 30	Date 2-18-65	Ticket Number 344102	
Closed In Press. Time	1st Min. 30	2nd Min. 15	Kind of Job OPEN HOLE	Halliburton District AUSTRALIA	
Pressure Readings	Field	Office Corrected	Tester CARTER	Witness CUNDILL	
Depth Top Gauge	1941' Ft.	NO Blanked Off	Drilling Contractor A.D.C.	BM	
BT. P.R.D. No.	1043	24 Hour Clock	Elevation 472'	Top Packer 1951'	
Initial Hydro Mud Pressure		989	Total Depth 2016'	Bottom Packer -	
Initial Closed in Pres.		749	Interval Tested 1951' - 2016'	Formation Tested -	
Initial Flow Pres.	1	370	Casing or Hole Size 8 3/4"	Casing Top - / Perfs. Bot. -	
	2	749			
Final Flow Pres.	1	746	Surface Choke 1"	Bottom Choke 5/8"	
	2	749			
Final Closed in Pres.		749	Size & Kind Drill Pipe 4½" F.H.	Drill Collars Above Tester I.D. - LENGTH 2¼" - 270'	
Final Hydro Mud Pressure		989	Mud Weight 9.2	Mud Viscosity 38	
Depth Cen. Gauge	Ft.	Blanked Off	Temperature 120 °F Est. / °F Actual	Anchor Size & Length ID - / OD 27 X 5"	
BT. P.R.D. No.		Hour Clock	Depths Mea. From KELLY BUSHING	Depth of Tester Valve 1935' Ft.	
Initial Hydro Mud Pres.			Cushion TYPE NONE AMOUNT Ft.	Depth Back Pres. Valve Ft.	
Initial Closed in Pres.			Recovered Feet of		
Initial Flow Pres.	1		Recovered Feet of		
	2				
Final Flow Pres.	1		Recovered Feet of		
	2				
Final Closed in Pres.			Recovered Feet of		
Final Hydro Mud Pres.			Oil A.P.I. Gravity	Water Spec. Gravity	
Depth Bot. Gauge	2012' Ft.	YES Blanked Off	Gas Gravity	Surface Pressure psi	
BT. P.R.D. No.	1040	24 Hour Clock	Tool Opened 2:30 PM A.M. P.M.	Tool Closed 4:10 PM A.M. P.M.	
Initial Hydro Mud Pres.		1055	Remarks Tool plugged - with shale and sand -		
Initial Closed in Pres.		-	spudded tool in and out of the hole.		
Initial Flow Pres.	1				
	2	-			
Final Flow Pres.	1				
	2	-			
Final Closed in Pres.	HYDROSTATIC RELEASE:	836			
Final Hydro Mud Pres.		1055			

Mea. From Tester Valve

Legal Location Sec. - Twp. - Rng. -

Lease Name CASTERTON Well No. 1 Test No. 1

Lease Owner/Company Name PLANET EXPLORATION COMPANY

Owner's District AUSTRALIA

Field Area WILDCAT County - State VICTORIA

FORMATION TEST DATA

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* Potentiometric Surface Reference to Rotary Table When Elevation Not Given, Fresh Water Corrected to 100° F.

Form No. 1296-R2

Gauge No. 1043	Depth 3870'	Clock 24 hour	Ticket No. 344794

	First Flow Period		Initial Closed In Pressure			Second Flow Period		Final Closed In Pressure		
	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\Theta}{\Theta}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\Theta}{\Theta}$	PSIG Temp. Corr.
P_0	.000	13	.000		15	.000	19	.000		35
P_1	.034	15*	.0052		1137	.0336	22	.0062		123
P_2			.0104		1138	.0672	25	.0124		283
P_3			.0156		1139	.1008	26	.0186		523
P_4			.0208		1295	.1344	29	.0248		727
P_5			.0260		1299	.1680	35	.0310		839
P_6			.0312		1300			.0372		909
P_7			.0364		1302			.0434		956
[redacted]			.0416		1303			.0496		997
P_9			.0468		1326			.0558		1029
P_{10}			.0520		1326			.0620		1059

Gauge No. 1040	Depth 3854'	Clock 24 hour

P_0	.000	44	.000		44	.000	48	.000		59
P_1	.031	44*	.0038		529	.0258	48	.0047		331
P_2			.0076		1061	.0516	51	.0094		523
P_3			.0114		1138	.0774	56	.0141		675
P_4			.0152		1199	.1032	57	.0188		796
P_5			.0190		1241	.1290	59	.0235		888
P_6			.0228		1270			.0282		954
P_7			.0266		1297			.0329		990
P_8			.0304		1320			.0376		1029
[redacted]			.0342		1342			.0423		1062
P_{10}			.0380		1351			.0470		1083
Reading Interval			1.5			*		1.5		Minutes

REMARKS: * TIME GIVEN & TIME RECORDED DO NOT AGREE.

SPECIAL PRESSURE DATA

Gauge No.	1043	Depth	4995'	Clock	24 hour	Ticket No.	344'05

	First Flow Period		Initial Closed In Pressure			Second Flow Period		Final Closed In Pressure		
	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.
P_0	.000	33	.000		33	.000	38	.000		43
P_1	.020	33	.042		1253	.099	43	.046		720
P_2										
P_3										
P_4										
P_5										
P_6										
P_7										
P_8										
P_9										
P_{10}										

Gauge No.	1040	Depth	4670'	Clock	24 hour		
P_0	.000	92	.000	82	.000	92	.000	88
P_1	.028	82	.068	1296	.135	88	.073	843
P_2								
P_3								
P_4								
P_5								
P_6								
P_7								
P_8								
P_9								
P_{10}								

Reading Interval Minutes

REMARKS:

SPECIAL PRESSURE DATA

Gauge No. 1043	Depth 5008'	Clock 24 hour	Ticket No. 344107

	First Flow Period		Initial Closed In Pressure			Second Flow Period		Final Closed In Pressure		
	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\Theta}{\Theta}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\Theta}{\Theta}$	PSIG Temp. Corr.
P_0	.000	1381	.000		1559	.000	1696	.000		2062
P_1	.0041	1372	.0057		2055	.0294	1952	.070		2074**
P_2	.0082	1368	.0114		2059	.0588	2025			
P_3	.0123	1381	.0171		2062	.0882	2048			
P_4	.0164	1418	.0228		2066	.1176	2055			
P_5	.0205	1441	.0285		2066	.1470	2062			
P_6	.0246	1500	.0342		2068					
P_7	.0290	1559	.0399		2068					
P_8			.0456		2068					
P_9			.0513		2068					
P_{10}			.0570		2068					

Gauge No. 1040			Depth 5084'			Clock 24		hour		
P_0	.000	1612	.000		1717	.000	1781	.000		2091
P_1	.0062	1618	.0081		2048	.0384	1924	.010		2097
P_2	.0124	1634	.0162		2068	.0768	2031	.020		2098
P_3	.0186	1657	.0243		2070	.1152	2069	.030		2098
P_4	.0248	1685	.0324		2079	.1536	2084	.040		2100
P_5	.0310	1717*	.0405		2082	.1920	2091*	.050		2101
P_6			.0486		2088			.060		2103
P_7			.0567		2091			.070		2103
P_8			.0648		2094			.080		2104
P_9			.0729		2097			.090		2106
P_{10}			.0810		2100*			.100		2106*
Reading Interval	1		2			9				Minutes

REMARKS: *Time given & time recorded do not agree. Cut up in equal intervals of no time value on B.T.#1040. Clock running erratic. **Questionable

SPECIAL PRESSURE DATA

Form No. 1296-R2

Gauge No. 1043	Depth 5008'	Clock 24 hour	Ticket No. 344108

	First Flow Period		Initial Closed In Pressure			Second Flow Period		Final Closed In Pressure		
	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\theta}$	PSIG Temp. Corr.
P_0	.000	104	.000		159	.000	175	.000		747
P_1	.0036	104	.0234		2169	.0378	286	.0098		2065
P_2	.0072	108	.0468		2183	.0756	410	.0196		2102
P_3	.0108	117	.0702		2189	.1134	540	.0294		2121
P_4	.0144	142	.0936		2193	.1512	684	.0392		2133
P_5	.0180	159	.1170		2195	.1890	747	.0490		2140
P_6			.1404		2195			.0588		2147
P_7			.1638		2197			.0686		2153
P_8			.1872		2197			.0784		2157
P_9			.2106		2197			.0882		2160
P_{10}			.2340		2197			.0980		2163

Gauge No. 1040	Depth 5278'	Clock 24 hour	

P_0	.000	95	.000		242	.000	204	.000		770
P_1	.019	242	.0176		2183	.0282	315	.0075		1225
P_2	Plugging		.0352		2204	.0564	443	.0150		2103
P_3			.0528		2211	.0846	559	.0225		2135
P_4			.0704		2216	.1128	668	.0300		2151
P_5			.0880		2217	.1410	770	.0375		2161
P_6			.1056		2218			.0450		2169
P_7			.1232		2220			.0525		2174
P_8			.1408		2220			.0600		2179
P_9			.1584		2221			.0675		2183
P_{10}			.1760		2221			.0750		2185
Reading Interval	1		3			9		2		Minutes

REMARKS:

SPECIAL PRESSURE DATA

Form No. 1296-R2

Gauge No. 1043	Depth 6393'	Clock 24 hour	Ticket No. 344109

	First Flow Period		Initial Closed In Pressure			Second Flow Period		Final Closed In Pressure		
	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\Theta}{\Theta}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\Theta}{\Theta}$	PSIG Temp. Corr.
P_0	.000	25	.000		33	.000	38	.000		74
P_1	.0147	32	.015		1994	.0385	49	.010		270
P_2	.0294	33	.028		2307	.0770	58	.028		1556
P_3	.0440	33	.068		2415	.1155	68	.050		1863
P_4						.1540	74	.070		1994
P_5										
P_6										
P_7										
P_8										
P_9										
P_{10}										

Gauge No. 1040	Depth 6438'	Clock 24 hour

P_0			NO READINGS							
P_1										
P_2										
P_3										
P_4										
P_5										
P_6										
P_7										
P_8										
P_9										
P_{10}										
Reading Interval	3		*			4		*		Minutes

REMARKS: * UNEVEN INTERVALS

SPECIAL PRESSURE DATA

Gauge No. 1046	Depth 6919'	Clock 24 hour	Ticket No. 24770

	First Flow Period		Initial Closed In Pressure			Second Flow Period		Final Closed In Pressure		
	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\Theta}{\Theta}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\Theta}{\Theta}$	PSIG Temp. Corr.
P_0	.000	262	.000		358	.000	349	.000		554
P_1	.033	358	.0148		2462	.0296	361	.0164		2277
P_2	PLUGGING		.0296		2611	.0592	416	.0328		2444
P_3			.0444		2687	.0888	464	.0492		2547
P_4			.0592		2733	.1184	509	.0656		2602
P_5			.0740		2766	.1480	554	.0820		2647
P_6			.0888		2787			.0984		2684
P_7			.1036		2806			.1148		2721
P_8			.1184		2821			.1312		2733
P_9			.1332		2833			.1480		2757
P_{10}			.1480		2839					

Gauge No. 1106	Depth 6991'	Clock 24 hour

P_0	.000	697	.000		675	.000	686	.000		739
P_1	.050	675	.0108		2473	.104	732	.0121		2346
P_2	PLUGGING		.0216		2629	PLUGGING		.0242		2489
P_3			.0324		2709			.0363		2571
P_4			.0432		2758			.0484		2635
P_5			.0540		2789			.0605		2676
P_6			.0648		2810			.0726		2706
P_7			.0756		2830			.0847		2734
P_8			.0864		2843			.0968		2753
P_9			.0972		2854			.1090		2771
P_{10}			.1080		2860					
Reading Interval			3			6		*		Minutes

REMARKS: *Time given & time recorded do not agree.

SPECIAL PRESSURE DATA

APPENDIX NO. 5

MUD PROPERTIES

APPENDIX 5

DAILY MUD PROPERTIES

Date	Weight lb/gal.	Viscosity Sec/qt.	Water Loss cc/30 mins.	pH	Filter Cake "/32"	Sand Cont. %
Feb.						
13	8.8	33				
14	10.1	60				
15						
16						
17	9.5	39	18.0	8.8	3/32	
18	9.2	38	11.2		2/32	
19	10.0	48	9.0	8.5	2/32	
20	10.4	52	8.8	8.0	2/32	
21	10.3	71	8.1	8.0	2/32	
22	10.5	63	9.0	7.9	2/32	
23	10.2	53	8.9	7.5	2/32	
24	10.3	44	7.3	9.0	2/32	
25	10.3	55	5.3	9.0	2/32	
26		72	8.6	7.0	2/32	
27	10.3	58.55	6.7	9.0	2/32	
28	10.1	90	6.0	9.0	2/32	
Mar.						
1	10.2	100	8.6	9.0	2/32	
2						
3						
4	10.1	56	10.5	10.0	2/32	
5	10.2	50	9.0	11.1	2/32	
6	10.5	73	8.4	10.2	2/32	
7	10.3	65	9.8	10.0	2/32	
8	10.3	55	8.6	10.6	2/32	
9	10.1	80	8.2	10.0	2/32	
10	10.5	58	8.2	9.9	2/32	
11	10.5	58	8.8	10.8	2/32	
12	10.5	72	8.0	9.0	2/32	
13	10.9	48	7.8	9.5	2/32	
14	11.0	70	8.2	9.0	2/32	
15	10.9	52	7.0	9.5	2/32	
16	11.1	65	6.0	8.5	2/32	
17	11.2	70	7.0	8.5	2/32	
18	11.0	50	7.0	8.5	2/32	
19	11.0	50	7.6	9.0	2/32	
20	11.0	50	6.2	8.5	2/32	
21	11.2	50	5.8	8.5	2/32	
22	11.5	60	5.5	8.5	2/32	
23	11.5	65	5.4	8.5	2/32	
24	11.1	75	5.2	7.5	2/32	
25	11.5	60	5.0	8.5	2/32	
26	11.5	54	5.4	8.5	2/32	
27	11.4	49	4.9	8.5	2/32	5.4
28	11.5	54	4.6	7.0	2/32	4.5
29	11.8	53	4.4	7.0	2/32	9.0
30	11.4	58	5.2	7.5	2/32	5.5
31	11.8	55	3.8	7.0	2/32	9.0

Date	Weight lb/gal.	Viscosity Sec/qt.	Water Loss cc/30 mins.	pH	Filter Cake "/32"	Sand Cont. %
April						
1	11.7	61	4.4	7.0	2/32	4.5
2	11.7	56	4.4	8.0	2/32	3.0
3	11.6	52	5.2	7.0	2/32	3.25
4	11.6	52	4.8	7.0	2/32	2.5
5	11.5	53	4.8	7.0	2/32	3.0
6	11.6	55	5.8	8.0	2/32	3.0
7	11.6	48	5.6	7.5	2/32	2.6
8	11.7	53	5.2	7.5	2/32	3.0
9	11.7	50	5.2	8.0	2/32	2.5
10	11.7	60	4.8	8.0	2/32	2.6
11	11.6	56	4.6	7.5	2/32	2.5
12	11.6	60	5.0	8.0	2/32	2.0
13	11.6	52	5.0	8.0	2/32	3.0
14	11.6	60	4.8	8.0	2/32	2.5
15	11.6	60	4.5	8.0	2/32	3.0
16	11.5	54	3.2	7.5	2/32	3.0
17	10.3	46	4.4	8.0	2/32	
18	10.3	47	4.4	8.0	2/32	1/2
19	10.3	50	4.5	8.5	2/32	
20						
21						
22	10.1	53	4.2	8.5	2/32	1/4
23	10.6	74	4.0	8.0	2/32	
24	10.7	90	4.0	8.0	2/32	
25						
26	10.3	70	3.6	7.5	2/32	
27	10.4	65	3.6	8.0	2/32	
28	10.5	70	3.3	8.0	2/32	1/4
29	10.3	62	4.0	8.0	2/32	1/4
30	10.0	54	4.6	9.0	2/32	1/2
May						
1	10.2	58	4.3	9.0	2/32	

MUD CHEMICALS USED

According to the Tour Sheets the following mud chemicals were used in the drilling of the Planet Casterton No. 1 Well -

Supercol	..	302 sacks.
Unical	..	332 sacks.
Milcon	..	139 sacks.
Spersene	..	18 sacks.
Synergic	..	25 pails.
Caustic Soda	..	1325 lb.

APPENDIX NO. 6

PETROLOGICAL REPORTS

PLANET CASTERTON NO.1

Three samples were received from Mr. Cundill, on 8th and 9th April, 1965. The results of the petrological examinations were phoned through to Casterton on 9th and 10th April, 1965.

The first sample consisted of chips from a depth of 7858 feet, the second was a core (No.29) from 7858 feet and 7862 feet, the third was of outcrop material classified as Cambro-Ordovician diabase.

All three samples were thin-sectioned, examined, compared with each other and with Tertiary basic volcanics from the Mount Gambier district.

Chip Sample: TS15692 and Core 20: TS15693

Both samples are of the same rock type, which may be classified as a porphyritic andesine-basalt (porphyritic hawaiite, Joplin, A Petrography of Australian Igneous Rocks, 1964, page 50).

Altered phenocrysts of olivine are set in a fine-grained groundmass of andesine laths and clinopyroxene, with euhedral opaques and a little interstitial brown glass. Vesicles are absent, and flow structure is not apparent. Chlorite-veining occurs, and the olivine phenocrysts are almost completely replaced by chlorite-antigorite.

The Cambro-Ordovician diabase (TS15694) differs greatly from the other two samples. It is a highly altered uralitised and epidotised dolerite, with a texture very different from the olivine-hawaiite of the drill-hole.

Conclusions

From textural and mineralogical considerations, it is concluded that the core and chip samples are Tertiary basalts, very similar indeed to some of the Mount Gambier outcrop occurrences. The samples are from a sill or dyke rather than a flow; it is probable that the sill or dyke is thin (because of grain size). Continuance of drilling has already been recommended verbally to Mr. Cundill.

H. W. Fander.
A.M.D.L.

nb:1

RESEARCH FOR INDUSTRY

THE AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES

CONYNGHAM STREET · PARKSIDE · SOUTH AUSTRALIA
TELEPHONE 791662 · TELEGRAMS 'AMDEL' ADELAIDE

Please quote this reference in your reply:

MP 3/130/0

28th April, 1965

The Chief Geologist,
Planet Exploration Co. Pty. Ltd.,
2 O'Connell Street,
SYDNEY, N.S.W.

REPORT MP2080-65

YOUR REFERENCE:	Letter dated 9/4/65
MATERIAL:	Core, Cuttings, Outcrop samples
LOCALITY:	Casterton, Vic.
IDENTIFICATION:	7858 ft, Core 20.
DATE RECEIVED:	8th, 9th April, 1965
WORK REQUIRED:	Petrology, Comparisons

Investigation and Report by: H.W. Fander

Officer in Charge, Mineralogy Section: H.W. Fander

H. W. Fander
for L. Wallace Coffer
Director.

c.c. Mr. J. Cundill,
Planet Oil Co.,
Post Office,
CASTERTON, Vic.

Copy forwarded 3/5/65

APPENDIX NO. 7

GEOLOGICAL MAP

APPENDIX NO. 8

CROSS SECTION BEFORE AND AFTER DRILLING

PE902947

This is an enclosure indicator page.
The enclosure PE902947 is enclosed within the container PE902945 at this location in this document.

The enclosure PE902947 has the following characteristics:

ITEM_BARCODE	= PE902947
CONTAINER_BARCODE	= PE902945
NAME	= Cross Sections
BASIN	= OTWAY
PERMIT	= PEP 26
TYPE	= WELL
SUBTYPE	= CROSS_SECTION
DESCRIPTION	= Cross Sections before & after drilling: Heathfeild-1, Casterton-1 & Tullich-1 (enclosure from WCR) for Casterton-1
REMARKS	=
DATE_CREATED	= 31/10/65
DATE_RECEIVED	=
W_NO	= W488
WELL_NAME	= Planet Casterton-1
CONTRACTOR	= Cundill, Meyers and Associates
CLIENT_OP_CO	= Planet Exploration Co P/L

(Inserted by DNRE - Vic Govt Mines Dept)

ENCLOSURE

(1) Composite Well log

PE602046

This is an enclosure indicator page.
The enclosure PE602046 is enclosed within the container PE902945 at this location in this document.

The enclosure PE602046 has the following characteristics:

ITEM_BARCODE	= PE602046
CONTAINER_BARCODE	= PE902945
NAME	= Composite Well Log
BASIN	= OTWAY
PERMIT	= PEP 26
TYPE	= WELL
SUBTYPE	= COMPOSITE_LOG
DESCRIPTION	= Composite Well Log, sheet 2 of 3, (enclosure from WCR) for Casterton-1
REMARKS	=
DATE_CREATED	= 3/05/65
DATE_RECEIVED	=
W_NO	= W488
WELL_NAME	= Planet Casterton-1
CONTRACTOR	= Planet Exploration Co P/L
CLIENT_OP_CO	= Planet Exploration Co P/L

(Inserted by DNRE - Vic Govt Mines Dept)

PE602047

This is an enclosure indicator page.
The enclosure PE602047 is enclosed within the container PE902945 at this location in this document.

The enclosure PE602047 has the following characteristics:

ITEM_BARCODE	= PE602047
CONTAINER_BARCODE	= PE902945
NAME	= Composite Well Log
BASIN	= OTWAY
PERMIT	= PEP 26
TYPE	= WELL
SUBTYPE	= COMPOSITE_LOG
DESCRIPTION	= Composite Well Log, sheet 1 of 3, (enclosure from WCR) for Casterton-1
REMARKS	=
DATE_CREATED	= 3/05/65
DATE_RECEIVED	=
W_NO	= W488
WELL_NAME	= Planet Casterton-1
CONTRACTOR	= Planet Exploration Co P/L
CLIENT_OP_CO	= Planet Exploration Co P/L

(Inserted by DNRE - Vic Govt Mines Dept)

PE602045

This is an enclosure indicator page.
The enclosure PE602045 is enclosed within the container PE902945 at this location in this document.

The enclosure PE602045 has the following characteristics:

ITEM_BARCODE	= PE602045
CONTAINER_BARCODE	= PE902945
NAME	= Composite Well Log
BASIN	= OTWAY
PERMIT	= PEP 26
TYPE	= WELL
SUBTYPE	= COMPOSITE_LOG
DESCRIPTION	= Composite Well Log, sheet 3 of 3, (enclosure from WCR) for Casterton-1
REMARKS	=
DATE_CREATED	= 3/05/65
DATE_RECEIVED	=
W_NO	= W488
WELL_NAME	= Planet Casterton-1
CONTRACTOR	= Planet Exploration Co P/L
CLIENT_OP_CO	= Planet Exploration Co P/L

(Inserted by DNRE - Vic Govt Mines Dept)

ENCLOSURE

(2) Velocity Survey

FINAL REPORT

on the

VELOCITY DETERMINATION SURVEY

CASTERTON No. 1 WELL

P.E.P. 26, Victoria

Submitted to

PLANET EXPLORATION COMPANY PTY. LTD.

by

NAMCO INTERNATIONAL INCORPORATED

C O N T E N T S

ABSTRACT

A seismic velocity determination survey was conducted on 29 April, 1965 for Planet Exploration Company Pty. Ltd. of Sydney, New South Wales in their Casterton No. 1 well located in P.E.P. 26 near Casterton, Victoria.

The survey was made by Namco International Incorporated of Dallas, Texas, with Australian headquarters at Adelaide, South Australia.

The results of the survey are considered reliable and indicate a gradual increase in seismic velocity with depth to a maximum average of 10,100 feet per second at total depth.

ABSTRACT

A seismic velocity determination survey was conducted on 29 April, 1965 for Planet Exploration Company Pty. Ltd. of Sydney, New South Wales in their Casterton No. 1 well located in P.E.P. 26 near Casterton, Victoria.

The survey was made by Namco International Incorporated of Dallas, Texas, with Australian headquarters at Adelaide, South Australia.

The results of the survey are considered reliable and indicate a gradual increase in seismic velocity with depth to a maximum average of 10,100 feet per second at total depth.

LOCATION MAP

CASTERTON No.1

P.E.P. 26 VICTORIA

PLANET EXPLORATION COMPANY PTY. LTD.

by

NAMCO INTERNATIONAL INCORPORATED

DALLAS

1. INTRODUCTION

A well velocity determination survey was conducted for Planet Exploration Company Pty. Ltd., with registered office at 2 O'Connell Street, Sydney, in their Casterton No. 1 well located near Casterton, Victoria in Petroleum Exploration Permit 26. Refer to Location Map, frontispiece.

The survey was conducted on 29 April, 1965 by Namco International Incorporated of Dallas, Texas with Australian headquarters at 15 Franklin Street, Adelaide, South Australia. Statistical data for the project is summarised in Appendix III.

2. PROCEDURE

Seismic times from shot position to the well geophone were recorded using National Geophysical Company instruments in conjunction with the equipment of Schlumberger (Seaco) Inc. The well geophone was a Gulf pressure sensitive type, number GCE 101 SN158.

National Geophysical Company 26 AA amplifiers with a National 5A oscillograph were used in the recording procedure. The electric wave filters of the amplifiers were adjusted to attenuate seismic frequencies below 3.2 cycles per second and above 108 cycles per second at 50% response, with a maximum response in a broad band at about 20 cycles per second.

The composition of each time-depth recording was as follows:

Trace 1	:	Time break
Trace 2	:	Up-hole time
Trace 3	:	Well geophone - High gain, No A.G.C.
Trace 4	:	Well geophone - Medium gain, No A.G.C.
Trace 5	:	Well geophone - Low gain, No A.G.C.
Trace 6	:	Well geophone - Low gain, No A.G.C. (Standard reflection filter, Low cutoff 17, High cutoff 90 at 50% response)
Trace 7	:	Reference geophone at rig.

All linkages from geophones to recording truck were by cable.

Shot points were drilled at approximate diametrically opposed positions, 660 feet from the well, although one shot hole at the SP 2 position was 550 feet from the well. Refer to Velocity Determination Layout, Figure 1.

Sixteen shots were recorded with the well geophone at depths from 1000 feet to 8180 measured from KB to top of phone. In positioning the geophone the last movement was always upwards. The effects of dip and hole deviation (less than 2 degrees) were considered by taking shots on either side of the well at most levels.

A reflection spread was laid out and recorded between the two offset shot points. Twelve seismometers per trace were distributed between the station pegs so that no ground overlap was involved. Charges were fired in holes at either end of the cable to obtain a completely reversed reflection spread. Reproduction of the reflection recordings is presented as Enclosure II.

3. RESULTS

The results of the survey are considered reliable, subject to the quality of data indicated in the grade column of the velocity determination sheet, Figure 2. Most of the breaks are strong and sharp except where the geophone was suspended within or near the casing (to 3000 feet). In addition, there is some possibility of a cable break occurring prior to the actual break at depths above 3840 feet. In most cases the premature break is not of sufficient strength to interfere with the main burst of true seismic energy.

The reference geophone at the well was disconnected for the four shallow level shots due to severe cross feed interference caused by wet ground and cable conditions.

The raw observed times have been corrected to a reference plane at 300 feet above sea level, with due consideration to the angularity of paths. Plotted curves of time-versus-depth, velocity-versus-depth, and interval velocity comparison between seismic paths and sonic logging runs appear on Enclosure I.

Enclosure II displays the seismograms obtained from the reflection spread shot with reversed coverage across the well. The data have been computed to the velocity reference surface at 300 feet above sea level. Good quality reflections were observed from shallow, intermediate, and deep zones; the deepest burst of energy has been correlated with the metamorphic shale basement encountered at an approximate depth of

7888 sub datum. The approximate depths of the well geophone positions have been noted at the mid point of the reflection layout. These were computed using the velocity distribution established by this survey after correcting the times for an empirically established filter delay of 0.030 second.

4. CONCLUSIONS

A reliable determination of seismic wave velocities at the Casterton No. 1 well location has been achieved by this survey. Assuming a 6000 foot per second zone between shot positions and a reference plane 300 feet above sea level, the average velocity to near total depth is 10,079 feet per second. The maximum interval velocity recorded was within the metamorphic basement and measured 19,160 feet per second although slightly higher or lower velocities could be determined depending on the interval used on the sonic log.

The reflection recordings show very gentle southwest dip at shallow and intermediate levels, increasing to strong dip at the deepest reflector. The major sand developments penetrated by the drill at this location yield strong seismic reflections. On the basis of this local observation, it appears that the reflection method might be utilized for a detailed study of the disposition of these sand bodies in the vicinity of the well. For such a study, it is recommended

that the data quality be enhanced by elaborate recording procedures, possibly including horizontal stacking to improve primary signals with reduction of noise and multiples.

NAMCO INTERNATIONAL INCORPORATED

H.E. Bowman - Geophysicist

W.J. Harkey - Supervisor

April, 1965.

APPENDIX I

EQUIPMENT

RECORDING:

1 Bedford J-1 recording truck, complete with instrument cab and cable reel.

1 Land Rover 4-wheel-drive cable truck, complete with seismometer racks and cable reels.

1 Complete set of 24 channel National Geophysical Company 26-A seismic instruments.

240 Electro-Tech EVS type geophones in strings of six.

1 1320-foot swing-trace type 12-channel reflection cable.

3 Complete sets of shooting equipment including multi-hole blasters, firing harnesses and explosives storage equipment.

1 Techno tape recorder and field playback unit.

DRILLING:

1 Heavy duty Mayhew 1000 combination air-water rig mounted on an International Model 190 4-wheel-drive truck, complete with 667 CFM air compressor and 5 x 6 Gardner-Denver mud pump.

1 International Model 190 6-wheel-drive water truck with 1200 gallon flat-type tank and stake body. This unit is equipped with explosives compartments and can serve as an auxiliary shooting vehicle.

SURVEYING:

1 Land Rover truck.

1 Complete set of surveying equipment and instruments.

1 Complete set of Office equipment.

APPENDIX II

PERSONNEL

Party Chief	R.L. Milliken
Observer	J.F. Lane
Shooter	S. McDermott
Driller	J. Payne
Surveyor	D. Alexander

The total complement of the field crew during the actual shooting operations was seven men. Surveying had been completed in advance.

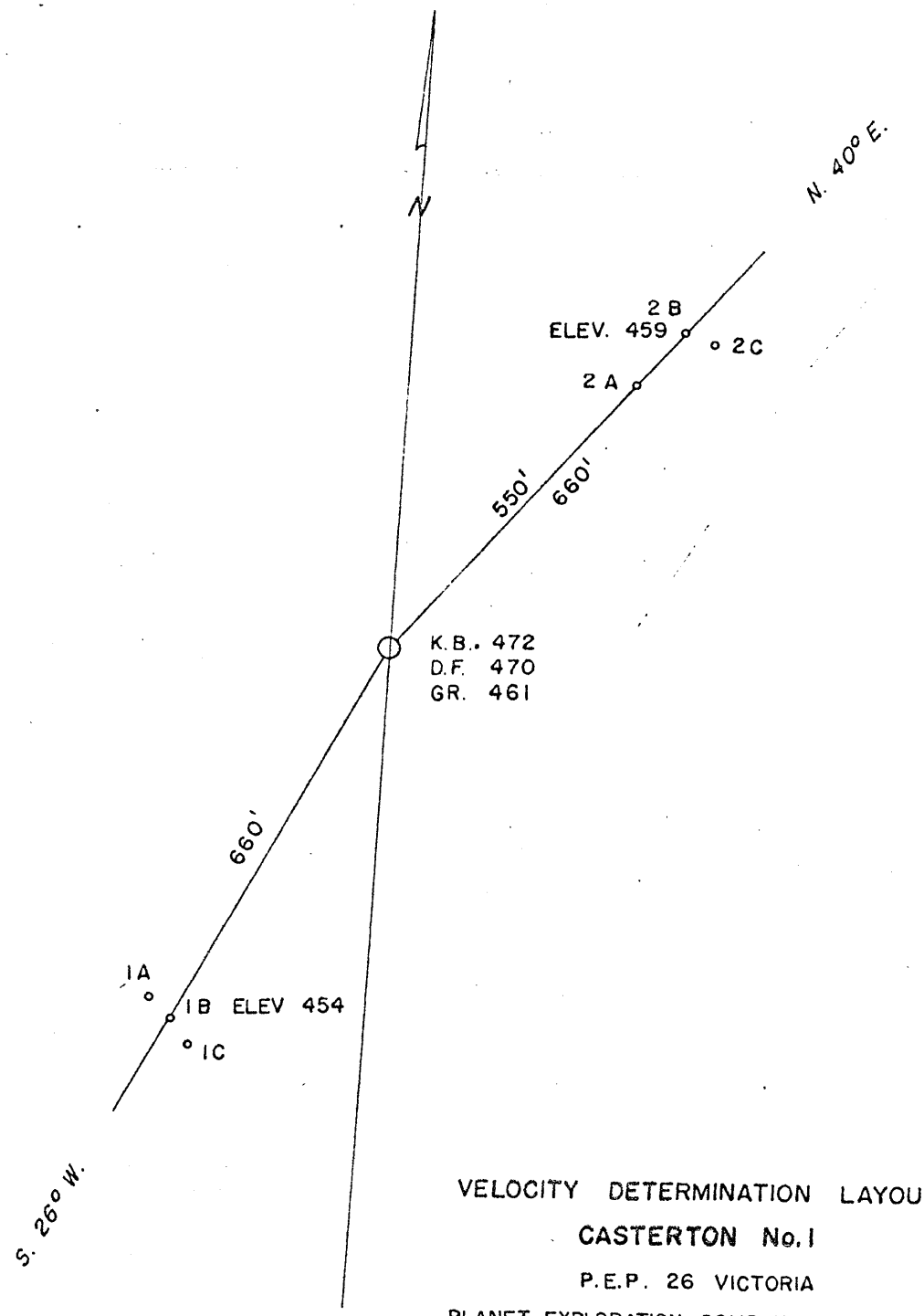
Technical and administrative supervision was provided by Mr W. Jarrott Harkey and Mr H.E. Bowman.

APPENDIX III

STATISTICAL DATA

Commencement time (Depart Lucindale)	6.00 p.m.	April 27,	1965.
Completion time (Arrive Lucindale)	2.00 p.m.	April 29,	1965.
Well Seismometer in hole	6.15 a.m.	April 29,	1965.
Well Seismometer out of hole	9.15 a.m.	April 29,	1965.

Total hours set up and survey, including reflections	5.9
Total hours driving time	6.5
Total hours standby time (7 a.m. to 5 p.m. April 28)	10.0
Shots recorded by well geophone	16
Shots recorded for reflection spread	3
Total pounds dynamite used	700
Total detonators used	34
Number of holes drilled, two groups	6
Total hours drilling time	15.5
Total hours drive time, drilling	6.5
Total hours standby time, drilling	5.9
Drilling mud used, pounds	500
Drilling bran used, bags	2
Insert bits used	2



VELOCITY DETERMINATION LAYOUT

CASTERTON No. 1

P.E.P. 26 VICTORIA

PLANET EXPLORATION COMPANY PTY. LTD.

by

NAMCO INTERNATIONAL INCORPORATED

DALLAS

FIGURE 1

Shot Point | Formation | Elevation | Distance & Direction from well

Elev. 459

660' 560' 2A' 2B'

660'

S. 25° W. N. 40° E. 2C'

Company: PLANET EXPLORATION COMPANY PTY. LTD.

Well: GAS... NO...

P.E.P. 26 VICTORIA

	Shot hole number	Dgm	Ds	tuh	thc	Reading	S P Sets	Grade	Dgs	H	tan i	cos i	
1	2A	1000	55/65	.019	.000	.138?	.019	?	928	550	.5927	.8602	118.7
2	2A	1000	55/65	.019	000	.148 .138	.019	?	928	550	.5927	.8602	12[illegible] .187
3	1A	8180	69/80	.022	000	.812 .820 R	.022	P	8088	660	.08160	.9967	8033 8173 R
4	2A	8180	42/55	.019	003	.815 .821 R	.016	P	8119	550	.06774	.9977	8131 8191
5	1A	6770	69/80	.022	002	.716	.024	G	6678	660	.09883	.9951	.712
6	2A	6770	55/65	.019	000	.714	.019	G	6698	550	.08211	.9967	.712
7	1B	5280	69/80	.022	003	.608	.025	G	5188	660	.12722	.9920	.603
8	2B	5280	69/80	.019	001	.602	.020	G	5193	660	.12709	.9920	.597
9	1B	4650	71/80	.022	003	.552	.025	G	4558	660	.14480	.9897	.5463
10	2B	4650	72/80	.019	003	.547	.022	G	4562	660	.14467	.9897	.5413
11	1B	3840	69/80	.022	000	.475	.022	P	3748	660	.17609	.9849	.4678
12	2B	3840	70/75	.019	003	.473	.022	F	3755	660	.17577	.9849	.4668
13	1B	3300	76/80	.022	003	.422	.025	F	3205	660	.20593	.9795	.4133
14	2C	2700	69/80	.019	001	.358	.020	P	2613	660	.25258	.9695	.3471
15	1B	1950	75/80	.022	002	.273	.024	F	1855	660	.35580	.9422	.2572
16	2C	1950	75/80	.019	003	.277	.022	P	1868	660	.35332	.9424	.2610
17	1B	1000	75/80	.022	001	.162	.023	?	904	660	.37009	.8076	.1308

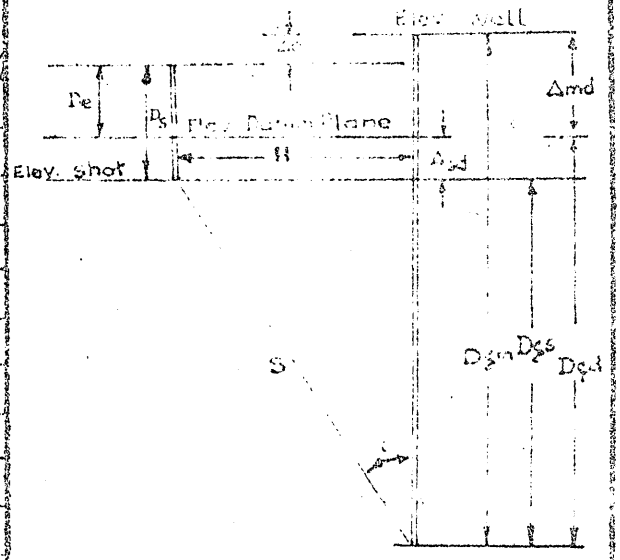
R = REVERSE BREAK

LOCATION

Coordinates Section, Township Range County Area or Field

8186

D_{gd}	ΔD_{gd}	ΔT_{gd}	V_i Interval Velocity	V_a Average Velocity
				6369*
828	828	130*	6369*	
8008				10.079
	1410	.0975	14462	
6598	1410	.106R	13302R	9466
	1490	.1105	13484	
5108				8709
	630	.0566	11150	
4478				8449
	810	076	10658	
3668				8079
	540	.054	10000	
3128	600	.067	8955	7820
2528	750	.0875	8571	7592
1778	950	120*	7917*	7242
	950	1315	7224	
828	828	114?	7263	7263



D_{gm} = Geophone depth measured from well elev.

D_{gs} = " " " " " shot

D_{gd} = " " " " " datum

Ds = Depth of reference shot

De = Shothole elevation to datum plane

H = Horizontal distance from well to S.P

S.P sets = Uphole time for given shot

t_{uh} = Uphole time for reference shot

T = Observed time from S.P to well geophone

Δe = Difference in elevat" between well & S.P

Δsd = " shot & datum plane

$\Delta sd = Ds - De$

$D_{gs} = D_{gm} - Ds \pm \Delta e$; $\tan i = \frac{H}{D_{gs}}$

$T_{gs} = \cos i \; T$ = Vertical travel time from Shot Point Elev to geophone

$T_{gd} = T_{gs} \pm \frac{\Delta sd}{V}$ = " " " " " Datum plane to geophone

$D_{gd} = D_{gm} - Amd$

V_i = Interval Velocity = $\frac{\Delta D_{gd}}{\Delta T_{gd}}$

V_{ci} = Average " = $\frac{D_{gd}}{T_{gd}}$

Surveyed by

namco INTERNATIONAL INC.

Date:

thc = correction to shot reference position

tec = " " datum plane

t = Total correction time

Weathering data: 6,000 '/SEC.

Casing record: 3,000'

ULTIMATE TRANSIT TIME

REC'D: 6770. - 567. 697 - 567 = 130

Well velocity calculation form FIG. 2

Well
CASTERTON
NO. 1.

Elevation
472

914

$T_{\frac{1}{2}}$	$t_{\frac{1}{2}}$	t	$T_{\frac{1}{2}d}$	$T_{\frac{1}{2}d}$ Average
118.7	017	017		
.1273 .1187	017	017	.110	
8093 .8173 R	013	013	796 R 804 R	7945 R 802 R
.8181 .8191	017	020	793 799 R	
.712	013	013	.699	.697
.712	017	017	.695	
.603	013	013	.590	.5865
.597	014	014	.583	
.5463	013	013	.533	.530
.5413	014	014	.527	
.4678	013	013	.455	.464
4668	014	014	.453	
.4133	013	013	.400	.400
.3471	014	014	.333	.333
.2572	013	013	.244	2455
.2619	014	014	.247	
.1308	013	013	.118	114

* FROM SONIC LOG ESTIMATE
0 – 1000' INTEGRATED TRANS.
INTERVAL TRANSIT TIME 1000

PE604067

This is an enclosure indicator page.
The enclosure PE604067 is enclosed within the container PE902945 at this location in this document.

The enclosure PE604067 has the following characteristics:

ITEM_BARCODE	= PE604067
CONTAINER_BARCODE	= PE902945
NAME	= Seismic Shot Data
BASIN	= OTWAY
PERMIT	= PEP/26
TYPE	= SEISMIC
SUBTYPE	= FEILD
DESCRIPTION	= Seismic feild Data from 2 Separate Shots near the well (from Velocity Survey Report--enclosure 2 to WCR) for Casterton-1
REMARKS	=
DATE_CREATED	=
DATE_RECEIVED	=
W_NO	= W488
WELL_NAME	= CASTERTON-1
CONTRACTOR	=
CLIENT_OP_CO	=

(Inserted by DNRE - Vic Govt Mines Dept)

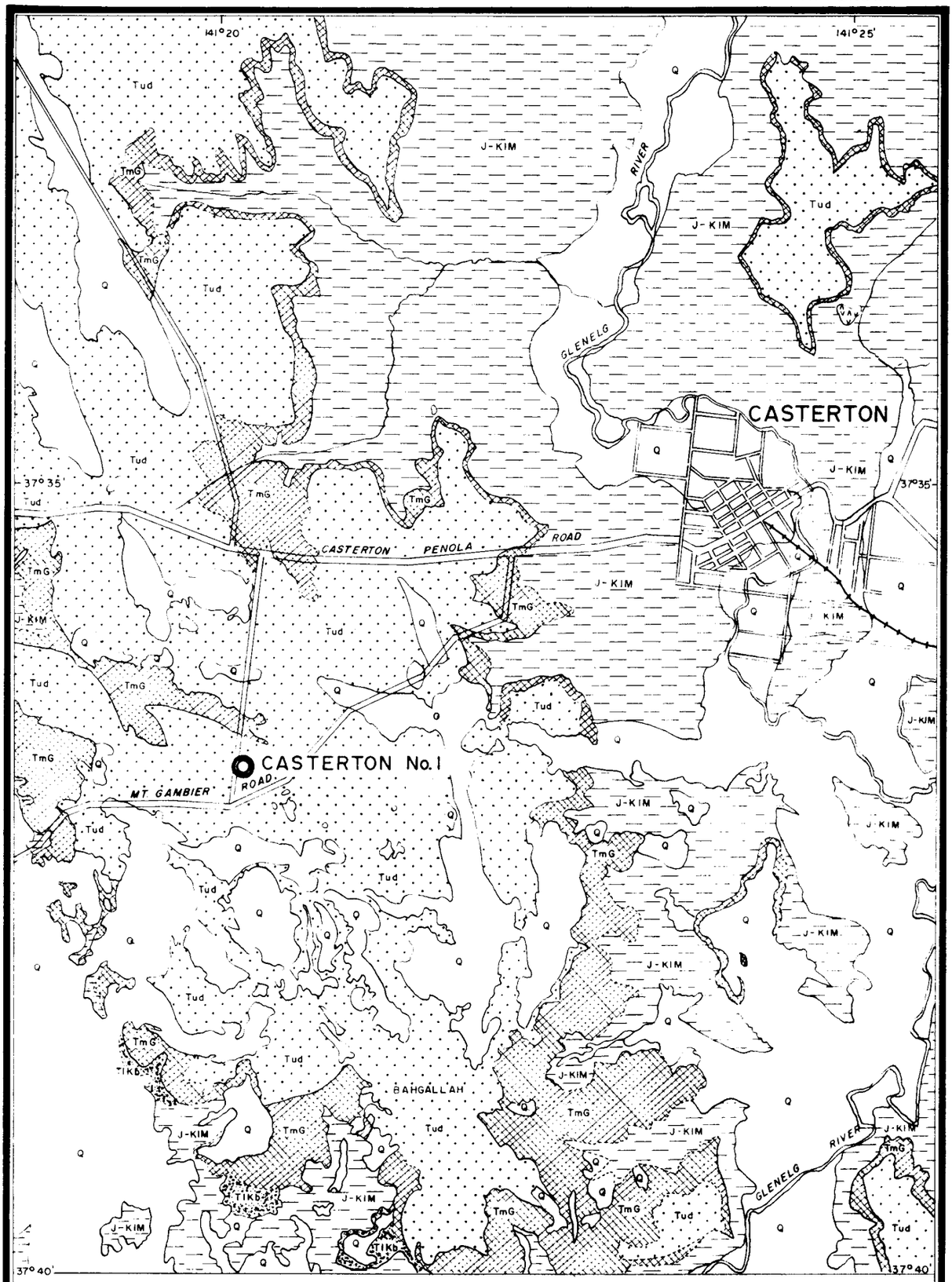
PE905714

This is an enclosure indicator page.
The enclosure PE905714 is enclosed within the container PE902945 at this location in this document.

The enclosure PE905714 has the following characteristics:

ITEM_BARCODE	= PE905714
CONTAINER_BARCODE	= PE902945
NAME	= Velocity Determination Graph
BASIN	= OTWAY BASIN
PERMIT	= PEP/26
TYPE	= WELL
SUBTYPE	= VELOCITY_CHART
DESCRIPTION	= Well Velocity Determination Chart (enclosure 2 of WCR) for Casterton-1
REMARKS	=
DATE_CREATED	=
DATE_RECEIVED	=
W_NO	= W488
WELL_NAME	= CASTERTON-1
CONTRACTOR	= NAMCO INTERNATIONAL INC.
CLIENT_OP_CO	= PLANET EXPLORATION COMPANY PTY. LTD.

(Inserted by DNRE - Vic Govt Mines Dept)



PLANET EXPLORATION COMPANY P.L.

GEOLOGICAL MAP

SHOWING LOCATION OF CASTERTON No.1 WELL

SCALE OF MILES

1 0 1 2

RECENT TO PLEISTOCENE	Q — Alluvium	EOCENE TO PALEOCENE Bahgallah Formation	TIKb — Glauconitic sand and clays, (greensands), sands, silts
L. PLIOCENE Dorodong Sands	Tud — Sand, sandstone, grit, conglomerate, clay	JURASSIC TO L. CRETACEOUS Merino Group	J-KIM — Mudstones, siltstones, sandstones, greywackes.
L. MIOCENE TO OLIGOCENE Glenelg Group	TmG — Polyzoal limestone marls, clay	UPPER DEVONIAN	Trachytes

Drafting by GEODRAFTING SERVICES
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