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Planet Exploration

Tullich N°1
Completion Report

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C O M P L E T I O N R E P O R T

for

PLANET EXPLORATION COMPANY

by

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of

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No velocity survey run.

PLANET EXPLORATION COMPANY PTY. LTD.

TULLICH NO. 1, VICTORIA

WELL COMPLETION REPORT

I. SUMMARY

Planet Exploration Company's Tullich No. 1 well is located about 17 miles west north west of Casterton, Victoria, and was drilled to a depth of 5363' by an Australian Drilling Company T32 rig.

The well was located on a seismic structure, 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 hole was drilled in a Crown forest reserve. It encountered Recent, Pleistocene and Tertiary sediments to a depth of 418' when it entered the Lower Cretaceous Merino Group. The well remained in the Merino Group at total depth of 5363'.

A total of four groups of sandstones with effective porosity were encountered in the Merino section. In two cases large recoveries of gassy water were obtained on drill stem test. In one of these two cases the water was reverse circulated out through the flow line, and an eight foot flare was lit for a few seconds. In the remaining two cases small recoveries of muddy, gassy salt water were obtained.

The two groups of sands from which the large fluid recoveries were obtained are between 2979' - 3096' and between 3759' - 3787' respectively. These sands showed excellent reservoir characteristics of permeability and porosity. Net porosity in the former amounted to 44' and in the latter, 8'.

The two groups of sands from which the small fluid recoveries were obtained are between 4831' and 4890', and between 5028' and 5119'. Net porosity is 32' and 41' respectively. Porosity is poor.

Dipmeter results indicated that the unconformity which was encountered below Unit IV in the Planet Heathfield No. 1 well, was again encountered about 300' below Unit IV (about 3380'), in the Tullich No. 1 well. Dips below the unconformity were again to the south west.

Technical control of the well site was provided by J. Cundill of Cundill, Meyers & Associates, assisted by G. Brown of Planet Exploration Company. 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 Planet Tullich No. 1 well was planned to test the apparent crest of a closed anticlinal structure, located and defined by seismic methods and which was expected to have an estimated closure of about 250'.

The well was spudded in at 9.15 p.m. August 4th 1964 after running and cementing 9' of 20' conductor pipe. A 17 $\frac{1}{4}$ " hole was drilled ahead to 322' at which depth a string of 322' of 13 $\frac{3}{8}$ " of 48 lb. H40 casing was run and cemented to surface. A 12 $\frac{1}{4}$ " hole was drilled ahead to 1557' and a string of 9 $\frac{5}{8}$ " 36 lb. J55 casing was cemented at that depth with 160 sacks. An 8 $\frac{3}{4}$ " hole was then drilled ahead to 5363'.

Electric logs, microlog caliper, and a gamma ray log were run from 1524' prior to setting the 9 $\frac{5}{8}$ " intermediate string. The electric and microlog were taken up to the 13 $\frac{3}{8}$ " casing shoe (322'), but the gamma ray log was taken up to a depth of 150'. At total depth (5363') run two of the logs were made. Electric, gamma ray sonic, microlog caliper and dipmeter were run from this depth up to the shoe of the 9 $\frac{5}{8}$ " intermediate string (1557').

A total of 15 cores was cut between 538' and 5363' using a 15' Reed barrel and 7 $\frac{7}{8}$ " conventional hard formation core heads. 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 from 24' to total depth. Sets of cuttings were distributed to the Bureau of Mineral Resources, the Mines Department of Victoria and Planet Exploration Company.

Seven drill stem tests were run on the hole. Packer seats were obtained on each occasion, and each test was mechanically successful. The best fluid recoveries were from D.S.T. No. 4 (3160' of very gassy salt water and 500' of very gassy salt water cut mud) and D.S.T. No. 3 (1500' of gassy salt water). The interval for D.S.T. No. 4 was 3721' - 3786', and of D.S.T. No. 3, 2947' - 2982'.

A Core Lab. gas detector, employing a hot wire Johnson-Williams type filament, was used throughout. A few very minor readings of methane trip gas were obtained between 1050' and 3479', and 20 units of methane trip gas was recorded after D.S.T. No. 3. A few very small readings were obtained while drilling minor amounts of coal between 3670' and 3715', and 40 units of methane trip gas was obtained after D.S.T. No. 4. Minor trip gas and minor readings from coaly sections were obtained as drilling proceeded and 56 units of methane trip gas was obtained after D.S.T. No. 6 (4815' - 4880'). A reading of 5 units was obtained while drilling the sandstone tested in D.S.T. No. 7 (4980' - 5045') and a trip gas reading of 101 units methane was obtained after the test.

The well was abandoned on September 3rd 1964 by running plugs over the intervals 4550-4650, 3550-3650, 2800-2900, 1800-1900, 1500-1600, and 0-100, welding a steel plate over the top of the casing and erecting a plaque with the name, depth and drilling dates of the well.

III. WELL HISTORY

(1) General Data

- (a) Well Name and Number: Planet Tullich
No. 1 well
- (b) Location: Latitude 37° 31' S. 29" S
Estimated to nearest second of Longitude 141° 09' E 2" E
arc from Enclosure 1. Locality map. County of Follett, State
of Victoria.
- (c) Tenement Holder: Planet Exploration
Co. Pty. Ltd.,
196 Grey Street,
South Brisbane, Queensland.
- (d) Details of Petroleum Tenement:
Petroleum Exploration Permit
No. 26, State of Victoria,
expiring on Dec. 31, 1964.
- (e) District: Casterton, Victoria.
- (f) Total Depth: 5363' (driller)
Schlumberger did not
reach bottom.
- (g) Date Drilling Commenced: August 4th 1964
- (h) Date Drilling Completed: September 2nd 1964
- (i) Date Well Abandoned: September 3rd 1964
- (j) Date Rig Released: September 4th 1964
- (k) Drilling time in days to total depth: 30 days
- (l) Kelly Bushing Elevation (Datum for
drilling depths): 272' A.S.L.
Ground Elevation: 258' A.S.L.
- (m) Status: Dry and Abandoned.

(2) Drilling Data

- (a) Drilling Contractor: Australian Drilling
Company Pty. Ltd.,
11th Floor,
Wynyard House,
291 George Street,
Sydney, N.S.W.
- (b) Drilling Plant: Make: National
Type: T32
Rated Capacity:
6000' with 4½" Drill Pipe
7500' with 3½" Drill Pipe
Motors: Caterpillar
DV8-364 275 HP diesel.
- (c) Mast: Make: Lee C. Moore
Type: 126' Cantilever
Capacity: 450,000 lbs.

(d)	Pumps:	Make	Type	Size	Motors
		Emsco	MM600	7 $\frac{3}{4}$ x 16	Superior PTDS-6
		Ideco	D175	6 $\frac{3}{4}$ x 12	GMC Twin 471

(e) Blowout Preventor Equipment:

Make	Type	Size	Working Pressure
Schaffer	B Double Gate	10"	3000 psi
Hydril	G.K.	10"	3000 psi

(f) Hole Sizes and Depths:

30"	to	9'
17 $\frac{1}{4}$ "	to	322'
12 $\frac{1}{4}$ "	to	1557'
8 $\frac{3}{4}$ "	to	5363'

(g) Casing Details

Size:	20"	13 $\frac{3}{8}$ "	9 $\frac{5}{8}$ "
Weight:	-	48 lb.	36 lb.
Grade:	-	H40	J55
Setting Depth:	9'	322'	1557'

(h) Casing Cementing Details:

Casing sizes:	20"	13 $\frac{3}{8}$ "	9 $\frac{5}{8}$ "
Setting Depth:	9'	322	1557'
Sacks Cement:	35	300	160
Rise of cement behind casing:	To Surface	To Surface	Not to Surface
Method used:	Dumped	Pumped	Pumped

(i) Drilling fluids:

A fresh water bentonite mud was used. Additives included "supercol" (a high yield bentonite), "Unical" (lignosulfonate thinner and inhibitor), "Milicon" (Water loss agent and dispersant) and "Synergic" (pH controller). For average daily properties of the mud see Appendix C.

(j) Water Supply: A water well was drilled about 170' from the location to a depth of 75'. Water was produced from this well at a rate of about 1000 gallons/hour using a National Pump Jack and a 3HP electric motor.

(k) Perforating and shooting records: Nil

(l) Plugging back and squeeze cementation jobs: The only plugs run were those for the abandonment programme.

Interval	Length	Sacks of Cement
4550 - 4650'	100	35
3550 - 3650'	100	35
2800 - 2900'	100	35
1800 - 1900'	100	35
1500 - 1600'	100	35
0 - 100	100	35

- (m) Fishing jobs: Nil
- (n) Side tracked hole: Nil

(3) Logging and Testing

(a) Cuttings: Samples were collected at 10' intervals and at closer intervals where the lithology warranted it. Cuts were distributed to the Bureau of Mineral Resources, the Mines Department of Victoria and Planet Exploration Company. Examination of the cuttings as they were collected over the shaker was maintained on a 24 hour a day basis. Drilling breaks were circulated up and bottom hole circulation samples obtained before tripping.

(b) Coring: A total of 15 cores was cut as follows:

<u>Core No.</u>	<u>Interval</u>	<u>Recovery</u>	<u>% Recovery</u>
1	538'-548'	10'	100%
2	1041'-1051'	Nil	0%
3	1051'-1053'	2'	100%
4	1540'-1551'	11'	100%
5	2051'-2061'	9'	90%
6	2556'-2566'	5'9"	58%
7	2982'-2992'	7'8"	77%
8	3479'-3489'	4'	40%
9	3987'-3994'	Nil	0%
10	3994'-3997'	2'4"	78%
11	4491'-4500'	Nil	0%
12	4500'-4505'	13' (including 8'0" of Core 11)	93%
13	4841'-4855'	9'	64%
14	5355'-5360'	Nil	0%
15	5360'-5363'	5'4" (includes portion of Core 14)	100%

Samples from the cores were distributed to the Bureau of Mineral Resources and the remainder were shipped to the Mines Department of Victoria.

(c) Side wall sampling: Nil

- (d) Electric and other logs: The hole was logged by Schlumberger SEACO as follows:

Electric Logs: Run 1 - 322'-1524'
Run 2 - 1558'-5353'

Microlog-Caliper: Run 1 - 322'-1524'
Run 2 - 1558'-5303'

Gamma Ray: Run 1 - 150'-1522'

Gamma Ray-Sonic: Run 1 - 1558'-5340'

Dipmeter Survey: Run 1 - 1558'-5353'

5" = 100', and 1" = 100' scale logs were run in each case.

- (e) Drilling Time and Gas Log:

An Eastman Oilwell Survey Co. Ltd. Star recorder was used to record the drilling rate. A Core Laboratories Australia (Queensland) Ltd. hot wire type gas detector, using a Johnson-Williams filament was used on the well. The gas log appears on the composite log and is discussed under "Occurrence of Hydrocarbons".

- (f) Formation Testing:

Seven drill stem tests were run during the drilling of the well. All tests were run using a Halliburton Hydro-spring single packer tester using a $\frac{5}{8}$ " 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.

D.S.T. No. 1 Interval: 1596-1631
Initial shut in period 20 mins.
Valve open 45 mins.
Final shut in period 20 mins.
Bottom hole choke $\frac{5}{8}$ "
Recovered 130' of brackish water cut mud.

D.S.T. No. 2 Interval: 2075-2110
Initial shut in period 20 mins.
Valve open 60 mins.
Final shut in period 20 mins.

Weak initial air puff, followed by weak air blow for duration of test.

Bottom hole choke $\frac{5}{8}$ "

Recovered 130' of brackish water cut mud.

Pressures: Initial hydrostatic 1079 psi
Initial shut in 823 psi
Initial flow 44 psi
Final flow 82 psi
Final shut in 665 psi
Final hydrostatic 1073 psi

D.S.T. No. 3 Interval: 2947-2982
Initial shut in period 20 mins.
Valve open 45 mins.
Final shut in period 20 mins.

Bottom hole choke $\frac{5}{8}$ "

Strong initial air puff, followed by a strong air blow dying slightly after 35 minutes.

Recovered 1500' of gassy salt water.

Pressures: Initial hydrostatic 1489 psi
Initial shut in 1237 psi
Initial flow 77 psi
Final flow 696 psi
Final shut in 1220 psi
Final hydrostatic 1468 psi

D.S.T. No. 4 Interval: 3721-3786
Initial shut in period 20 mins.
Valve open 45 mins.
Final shut in period 20 mins.

Bottom hole choke $\frac{5}{8}$ "

Good initial air puff, followed by strong air blow, dying to weak after 30 minutes.

Recovered 3660' of fluid consisting of 500' of very gassy salt water cut mud and 3160' of very gassy salt water. Circulated out gassy water through flow line and lit 8' flare for 20 seconds.

Pressures: Initial hydrostatic 1954 psi
Initial shut in 1651 psi
Initial flow 1521 psi
Final flow 1649 psi
Final shut in 1649 psi
Final hydrostatic 1915 psi

D.S.T. No. 5 Interval: 4120-4185
Initial shut in period 15 mins.
Valve open 30 mins.
Final shut in period 15 mins.

Bottom hole choke $\frac{5}{8}$ "

Weak initial air puff, dying to very weak after 10 minutes.

Recovered 15' of drilling mud.

Pressures: Initial hydrostatic 2223 psi
Initial shut in 160 psi
Initial flow 60 psi
Final flow 60 psi
Final shut in 72 psi
Final hydrostatic 2166 psi

D.S.T. No. 6 Interval: 4815-4880
Initial shut in period 20 mins.
Valve open 40 mins.
Final shut in period 15 mins.

Bottom hole choke $\frac{5}{8}$ "

Fair initial air puff, dying to weak after 30 minutes.

Recovered 450' of muddy gassy salt water.

Pressures: Initial hydrostatic 2489 psi
Initial shut in 2042 psi
Initial flow 129 psi
Final flow 237 psi
Final shut in 1807 psi
Final hydrostatic 2343 psi

D.S.T. No. 7 Interval: 4980-5045
Initial shut in period 20 mins.
Valve open 120 mins.
Final shut in period 20 mins.

Bottom hole choke $\frac{5}{8}$ "

Weak initial air puff, increasing to fair, and dying to very weak after 50 mins. Detected extremely weak gas air mixture at surface on detector after 55 mins. Too small to measure.

Recovered 400' of muddy gassy salt water.

Pressures: Initial hydrostatic 2677 psi
Initial shut in 2046 psi
Initial flow 109 psi
Final flow 203 psi
Final shut in 1512 psi
Final hydrostatic 2451 psi

(g) Deviation Surveys:

The following deviation surveys were run:

<u>Depth</u>	<u>Deviation from vertical</u>
100'	$\frac{3}{4}^{\circ}$
200'	$\frac{1}{4}^{\circ}$
300'	1°
390'	$\frac{1}{4}^{\circ}$
627'	$\frac{3}{4}^{\circ}$
730'	$\frac{3}{4}^{\circ}$
833'	$\frac{1}{4}^{\circ}$
952'	$\frac{3}{4}^{\circ}$
1041'	1°
1160'	$\frac{1}{2}^{\circ}$
1279'	$\frac{3}{4}^{\circ}$
1368'	$\frac{1}{4}^{\circ}$
1750'	$\frac{1}{2}^{\circ}$
2051'	$\frac{1}{4}^{\circ}$
2566'	$\frac{1}{4}^{\circ}$
2982'	$\frac{3}{4}^{\circ}$
3479'	$\frac{1}{4}^{\circ}$
3987'	$\frac{1}{4}^{\circ}$
4491'	1°
4841'	$2\frac{1}{4}^{\circ}$
4880'	$1\frac{1}{4}^{\circ}$
5045'	2°
5355'	$2\frac{1}{2}^{\circ}$

(h) Temperature Surveys:

Bottom hole temperatures taken in the course of logging by Schlumberger SEACO, were as follows:

<u>Depth</u>	<u>Temperature</u>
1524	94°F 34.5°C → <i>Corr. 37.5</i>
5353	134°F 56.7°C → <i>62.2</i>
	<i>24.7%</i>

These figures indicate an average geothermal gradient of 0.95°F per 100' between 1524' and 5353'. *1166.4m*

IV. GEOLOGY

(1) Summary of Previous Work

Petroleum Exploration Permit No. 26 of Planet Exploration Company adjoins the Victoria-South Australia border and consequently has enjoyed the advantages of 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.

It was during this period that the Kanawinka Fault was recognised.

In 1945 the Nelson Bore, about 37 miles to the south of the Tullich 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, which 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 in early 1963 drilled two wells in the area. The first of these wells, which were located about 67 miles south-east of the Planet Tullich No. 1 well, was Frome-Broken Hill Pretty Hill No. 1 which was drilled to a depth of 8129'. The second well was Eumeralla No. 1 well, 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. A review of the seismic work by E. A. Krieg in 1963 resulted in the selection of the site for the Heathfield No. 1 well by the Planet Exploration Company.

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 S. E. 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 the O.D.N.L. Penola No. 1 well, which was drilled in 1961 to a depth of 4985' and which was located about 19 miles north-west of Tullich 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 42 miles to the south-west of the Planet Heathfield No. 1 well) 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 great deal of palynological work has been carried out on the wells in this area by the 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 1963, Dettmann published a comprehensive paper on the microfloras of the area. 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 been carried out in the Penola-Millicent-Mt.Gambier areas.

In March and April of 1964 Planet Heathfield No.1., located 7 miles south-south east of Tullich No.1., was drilled to a depth of 7,500'. This well remained in Merino Group sediments at total depth, and yielded valuable sub-surface stratigraphic and structural information in P.E.P. 26.

(2) Summary of Regional Geology

Tullich 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 pass 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 mainly Tertiary, shallow sedimentation covering 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 Tullich No.1. is sited. The Portland Embayment is separated from the Gambier Sunkland by the Dartmoor Ridge, which is a structural high lying to the south of Tullich No.1. and which may define the northern limit of Upper Cretaceous marine sedimentation. 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 are present, although the area occupied by Upper Cretaceous is much 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) have been penetrated only twice in drilling. Frome-Broken Hill Pretty Hill No.1. struck (?) Cambrian diabase at 7,874' and, Frome-Broken Hill Ferguson's Hill struck basement of unspecified type at 11,508'.

Although the Tullich No. 1 well is located close to the margin of the basin a total of 5363' of sediments was penetrated without encountering basement. The well was located on a structure believed to be part of a high structural ridge paralleling the Kanawinka Fault on the downthrown side.

(3) Stratigraphic Table (Note: KB 272' ASL)
Ground 258' ASL)

Age	Formation	Informal Rock Unit	Tops Below KB	Subsea	Thickness
		Kelly bushing to surface			14'
Recent		Sand and clay	14'	+258'	7'
Pleistocene	Whaler's Bluff Formation	Shelly sand and quartz sand	21'	+251'	119'
Eocene-Palaeocene	Dartmoor Formation (Knight Group)	Pyritic quartz sand	140'	+132'	20'
		Clay	160'	+112'	90'
	Bahgallah Formation (Knight Group)	Quartz sand, glauconitic clay, glauconitic pellets, shell fragments	250'	+ 22'	94'
		Quartz sand and very minor glauconitic limestone	344'	- 72'	74'
Lower Cretaceous	Merino Group	Grey & green clay, limestone, quartz sand and lignite	418'	-146'	52'
		Green grey clay, mudstone, fine grained sandstone, minor limestone, Unconsolidated coarse quartz sand	470'	-198'	164'
		618'-634'			
		"Unit I" Siltstones with minor mudstones and sandstones	634'	-362'	674'
		"Unit II" Mudstones, siltstones and minor sandstones	1308'	-1036'	694'
		"Unit III" Mudstones, siltstones with increased sandstone interbeds	2002'	-1730'	978'

Age	Formation	Informal Rock Unit	Below KB	Tops Subsea	Thick-ness
Lower Cretaceous	Merino Group	"Unit IV" Poorly consolidated quartz sandstones, with siltstone interbeds. A sand 2979'-2991' (12') B sand 3009'-3018' (9') C sand 3030'-3046' (16') D sand 3079'-3094' (15')	2980'	-2708'	114'
		Siltstone & Mudstone	3094'	-2822'	675'
		Sandstone, Shale and siltstone Unit (Sandstone partly coarse, poorly consolidated)	3769'	-3497'	55'
		Mudstone, Siltstone and Shale Unit	3814'	-3542'	1027'
		Shale, Sandstone and Siltstone Unit	4841'	-4569'	522'

Total Depth - 5363'

(4) Stratigraphy

- (a) Recent. 14 - 21? (??) Sand and clay.
- (b) Pliocene. Whaler's Bluff Formation
21 - 140 (119)

Lithology:

Shelly sandstones, shelly sands, quartz sands and very minor clays near base.

The shelly sandstones are brown and white, fine to medium grained, and consist of finely broken, abraded shell fragments and scattered well rounded quartz grains in calcareous cement. Below about 80' the calcareous cement is not evident, and the shell fragments are much coarser, fragments up to 1/2" across being recovered loose in the cuttings as well as whole small gastropods, pelecypods, forams, etc.

The quartz sand is only a minor constituent near the top, but becomes increasingly dominant downward. The quartz grains are recovered loose in the cuttings. They are medium to coarse grained, very well rounded and frosted. In the basal 50' they are very coarse to pebbly, well rounded, frosted or polished, poorly sorted and may be clear, white, grey or pink in colour.

Very minor clay is present, particularly near the base. The clay is dark grey to black, soft, sandy, and contains shell fragments.

Electrical Characteristics

No electric logs were run over this unit.

(c) Eocene-Palaeocene.

Knight Group. Dartmoor Formation 140 - 250 (110).

Lithology:

An upper pyritic quartz sand unit 15' thick overlying a dark brown to dark grey clay unit 95' thick.

The upper pyritic sand unit consists of poorly sorted, coarse grained, rounded, polished, grey, clear and white quartz commonly cemented into sandstone with pyrite. Near the base it is pebbly and very pyritic.

The Clay unit consists of dark brown to dark grey clay, which is soft, sticky, slightly micaceous, and in places very sandy, occasionally containing coarse grains and pebbles of quartz. Traces of shell fragments are generally present. Below 200' the clay is dark greenish grey in colour when wet, shell fragments are more common and sand is less common.

Bahgallah Formation (250-418) (168')

Lithology:

An upper unit of quartz sand, glauconitic clay, glauconite pellets and shell fragments, 84' thick, overlies a unit, also 84' thick, which consists of quartz sand and very minor glauconitic limestone.

In the upper unit the sand consists of loose, coarse to very coarse and pebbly, sub-angular, sub-rounded and rounded, poorly sorted brown, light grey, reddish brown, occasionally yellow, frosted, polished quartz. The clay is dark greenish grey, with glauconite pellets fairly common in some intervals. At the top of the unit a minor amount of medium to dark grey shale is present. The shale is sandy, silty, micaceous and contains abundant glauconite pellets, some of which are limonitized. Shell fragments are generally present, ranging up to a maximum of 20% of the sample between 300' and 310'. They are in places discoloured green with glauconite.

In the lower unit the quartz sand and very minor limestone was encountered close below the surface casing shoe. The cuttings from this section therefore are heavily diluted with casing cement cavings. The quartz sand is white to grey, generally medium grained, and consists of loose grains of sub-angular

to rounded quartz with trace pyrite, mica and feldspars. The limestone is generally dark brown to black, contains ferruginous oolites and ferruginous clay in places and a trace of quartz grains and mica. In places it is glauconitic and may grade to a calcareous glauconitic siltstone. Near the base it is pyritic. The limestone nowhere exceeds 10% of the samples.

Electrical Characteristics of Knight Group:

1) Dartmoor Formation

No electric or gamma ray logs were run over the upper pyritic quartz sand unit of the Dartmoor Formation. The gamma ray log was run through the surface casing over the lower, clay unit. The readings probably reflect the variably sandy nature of this clay, and vary from 15 to 27 API units.

2) Bahgallah Formation

The gamma ray was run over the upper unit of the Bahgallah (250-334'), most of which was cased off. Readings were generally lower than the overlying Dartmoor Formation. The small unshielded section below the casing shoe (casing shoe: 322') reads higher. Electric logs and microlog caliper were also run across this unshielded section. The 16" normal reads out to 20 ohms M²M, and the caliper indicates washing out under the shoe to about 17".

The lower unit of the Bahgallah (334-418') is entirely below the casing shoe, and both electric and gamma ray logs were run. The unit shows high resistivities (15 ohms M²M on the 16" normal) due probably to the fresh water content of the sands. The SP is rather featureless but there is some evidence of reversal due to the formation water being slightly fresher than the drilling mud. The gamma ray reads rather high, with readings ranging from 37 to 70 API units.

(d) Lower Cretaceous
Merino Group

The Merino Group has, for ease of discussion, been broken down into a number of informal rock units. These are listed on the Stratigraphic table. The terms "Unit I", "Unit II", "Unit III" and "Unit IV" are used as these are units which are the recognizable equivalents of similarly named units in the Planet Heathfield No. 1 well. Other units, which cannot be readily correlated, are referred to by their dominant lithologies, i.e., Sandstone and shale unit, etc.

Some formal naming of units will be necessary in the future. It is felt, however, that this should be delayed until more wells are drilled and a greater understanding of the geology, stratigraphic relationships and relative importance of the units, is obtained.

- 1) 418' - 470' (52') Unit consisting of grey and green clay, limestone, quartz sand and lignite.

The clay is light grey, medium and dark grey, occasionally light green, soft, slightly calcareous in places, slightly silty, slightly micaceous.

The limestone is light grey, medium grey, very fine to finely crystalline, finely silty, slightly to moderately marly, with some finely disseminated pyrite in places. The limestone ranges from fairly soft to moderately hard and brittle.

The sand consists of loose, coarse, sub-rounded, polished, light grey, white and clear quartz. The sand is occasionally pyritic.

The lignite is a minor constituent, generally constituting about 10% of the cuttings. It is dark grey-black and brown-black, soft, fissile, argillaceous, with occasional fine laminations of marcasite. Its cellular structure is generally evident.

Electrical Characteristics:

Electrically, this unit shows a marked drop in resistivity compared to the overlying Tertiary section, with the 16" normal reading about 4 ohms M²M. The SP curve shows a gradual positive shift of about 5mv magnitude from the top to the bottom of the unit. The gamma ray curve shows slightly lower average readings than across the overlying unit, and range from 40 to 60 API units.

- 2) 470' - 634' (164') Unit consisting of green grey clay, mudstone, fine grained sandstone and minor limestone. Includes a 14' bed of unconsolidated coarse quartz sandstone at base.

The clay and mudstone is light greenish grey, light grey, whitish grey or brownish grey, fine grained to very fine grained, calcareous, kaolinitic, feldspathic, fairly soft and consists of fairly to occasionally poorly sorted sub-angular light grey and white quartz, some feldspars, fairly common coaly grains, dark grey shale grains, trace green, black and white cherty grains, trace mica and trace reddish brown lithic fragments in a calcareous, kaolinitic or dirty clay matrix.

The limestone is light whitish grey, chalky, fairly soft and contains brecciated fragments of coal, carbonaceous shale and green mudstones. Some light grey, fine crystalline, slightly silty limestone is also present.

From 618' - 634' is a 16' thick bed of unconsolidated medium and coarse grained, quartz sand, consisting of sub-angular, fairly well sorted, partly polished quartz grains, and occasional grains of chert, feldspars and light green siltstones.

Electrical Characteristics:

Electrically, the unit is more resistive than both the underlying and overlying units. The 16" normal reads between about $3\frac{1}{2}$ to $9\frac{1}{2}$ ohms M^2M , with the higher values near the base. Several thin coaly streaks read out to about 14 ohms M^2M . Elsewhere the higher resistivities are probably associated with the fresh water content of the sandstone. The self potential curve is fairly featureless, indicating a similarity in the salinities of the formation water and the drilling mud.

The gamma ray curve shows a decrease from 60 API units near the top, to about 30 API units near the base, the variations being due to increasing sand content downward.

- 3) 634' - 1308' (674') "Unit I" consists of Siltstones, with minor mudstones and sandstones.

The siltstones are light grey or greenish grey or dark grey in colour, micaceous, contain specks of carbonaceous material in places, occasional feldspars, and fairly common re-worked mudstone grains. They are commonly rather sandy and contain lenses of very fine grained sandstone. Some traces of lignite are also present.

The mudstones are light greenish grey or light grey in colour, commonly silty, and contain carbonaceous specks. Some lenses of sandstone are present in the mudstone, as well as a few scattered coarse quartz grains. The mudstones are slightly micaceous and contain rare pyrite.

The sandstones are grey, light grey, green grey, medium grey and brown in colour and are either fine grained or very fine grained. They are generally feldspathic, friable, slightly micaceous, and calcareous in places, and consist of fairly to poorly sorted, angular to sub-angular quartz, minor feldspars, mica and lithic fragments (green mudstone, clay pellets, carbonaceous grains and coaly fragments), some chert grains and occasionally fine red and green specks, in a kaolinitic or, in places, calcareous, clay matrix. Rarely a brown siliceous cement is present, which may be cherty or calcareous.

Traces of pyrite are fairly common, and a few traces of lignite are also present.

Electrical Characteristics:

A fair amount of character is evident on the resistivity curves over Unit I, with values ranging from 2 ohms M^2M up to $8\frac{1}{2}$ ohms M^2M . The readings are lower than across the sandstones of the overlying unit, but are slightly higher than in the underlying mudstone and siltstone unit. Variation in the self potential curve is not very marked, and does not exceed about 8 millivolts. However, readings are negative over the sandstone interbeds, indicating that the formation water is now slightly more saline than the drilling mud. The caliper log indicates that the hole stood up fairly well during the short interval between drilling and logging. The microlog shows a great deal of character due to thin interbedding. No highly resistive streaks, however, appear to be present, and the readings vary only between 2 and $5\frac{1}{2}$ ohms M^2M .

Porosity as indicated by the microlog is discussed under "Porosity and Permeability".

The gamma ray curve shows a very marked increase in the level of radio activity at the top of this unit, with a rise in values from 30 API Units to 62 API Units. The remainder of the unit shows a great deal of variation in gamma ray readings, which range from 32 - 75 API Units.

- 4) 1308' - 2002' (694') "Unit II" consists of mudstones, siltstones and minor sandstones.

The mudstones are generally light greenish grey in colour but may vary to light green, light brown or light grey. They are soft, slightly bentonitic, silty in places, and contain occasional flecks of carbonaceous material.

The siltstone is light greenish grey, light grey, or medium grey in colour. It is micaceous in places, and contains fairly common specks of carbonaceous material and a few coaly inclusions. It may be argillaceous or calcareous, and in places is rather sandy, slightly feldspathic and contains traces of pyrite and red specks.

The sandstones are generally light grey in colour but may vary to medium grey, brown or green. They may be calcareous, feldspathic, and are generally fairly soft. They are normally fine grained to very fine grained and consist of sub-angular - sub-rounded quartz, minor feldspars, some coaly grains and lithic fragments, chert, yellow clayey inclusions, traces of mica, pyrite and chlorite in a kaolinitic, calcareous or bentonitic clay matrix. The sandstone occasionally has a faintly tuffaceous appearance.

Electrical Characteristics:

The resistivity readings over this unit are slightly lower than in the overlying unit, and decrease from about $1\frac{1}{2}$ ohms M^2M at the top, to about 1 ohm M^2M at the base (16" normal). The resistivity curves lack the variation in reading seen in both the overlying Unit I, and the underlying Unit III. The self potential curve shows rather more character than in Unit I, due probably to a slight increase in the salinity of the formation water. Sandstone sections show a maximum negative reading of about 18 millivolts. The caliper log shows that a fair amount of washing out, up to a maximum of $12\frac{1}{2}$ " (bit size $8\frac{3}{4}$ ") has taken place, mainly in the mudstone interbeds. The microlog indicates the presence of a few thin resistive streaks near the base of the unit. Porosity is discussed later in this report.

The gamma ray readings over Unit II are, on the average, slightly higher than over Unit I. Readings range from 48 - 75 API Units.

Below the intermediate casing shoe (1556') a sonic log was also run. This shows an interval transit time, which varies from about 140 microseconds per foot below the casing shoe, to about 125 microseconds per foot at the base of Unit II.

- 5) 2002' - 2980' (978') "Unit III" consists of mudstones, siltstones with increased sandstone interbeds.

The mudstones are generally greenish grey or greyish green in colour, but vary locally to medium grey and occasionally to green and greyish brown. They are commonly blocky, fairly soft, but in places the medium grey variety may be rather hard. They are slightly micaceous, silty in places, contain specks of black carbonaceous material and plant fragments, and in places are slightly bentonitic and occasionally kaolinitic.

The siltstones are generally medium grey in colour but may vary to light grey, light greenish grey, light greyish brown or medium greyish brown. They grade occasionally to very fine grained sandstone or to mudstone. They are commonly moderately hard, blocky, argillaceous, slightly micaceous, and contain fairly common specks or carbonaceous material. The siltstone may have a laminated appearance in places, due to varying argillaceous content. It may be feldspathic and occasionally contains coaly laminations.

The sandstones are generally light grey in colour but may vary locally to light brown, light greenish grey, or medium grey. In places it has a speckled appearance. It is generally fine grained to very fine grained, but is occasionally medium grained. It varies from soft to friable to fairly hard in cases where there is a calcareous matrix. The softer varieties normally have a kaolin matrix, although locally the matrix may vary between siliceous material, bentonitic clay, dirty white and grey clays, and silty argillaceous material. The fabric of the sandstones consists of fairly to poorly sorted, sub-angular to sub-rounded, clear, light grey, and occasionally white quartz, black and dark grey chert grains, minor white and occasionally pink and grey feldspars, carbonaceous grains and specks, greenish grey and dark grey reworked mudstone grains, traces of mica, a few lithic grains of quartzite, rare traces of red specks, pyrite and plant resin in a matrix of the type discussed above. The cores show depositional swirling and cross bedding which is indicated largely by the disposition of carbonaceous material and mica flakes.

Shale occurs as interbeds ranging up to a maximum of 20% of the sample between 2330' and 2420', and also as thin interbeds ranging up to 10% of the sample between 2566' and 2610'. The shale is dark grey, black, or dark brown in colour, very carbonaceous, coaly, soft and fissile.

A few thin seams of coal are present which constitute 10% of the cuttings between 2140' and 2150', 2330' and 2340', and also 30% of the cuttings between 2920' and 2930'. The coal is generally black, dirty and dull but varies in places within the latter interval to brittle, vitreous and moderately hard. Brownish black lignite also occurs as occasional traces except between 2500' and 2550' where it constitutes 10% of the cuttings.

Traces are present of pyrite, and grey, very fine grained, silty and argillaceous limestone.

Electrical Characteristics:

The self potential curve shows a fair amount of character over this unit, reflecting the increased salinity of the formation water, and an increased number of sandstone interbeds. Negative readings between 10 and 25 millivolts are common. The resistivity curves also reflect the increased number of sandstone interbeds. A number of the sandstones contain calcareous streaks, which give readings out to as much as 14 ohms M²M. These resistant streaks are also seen in the microlog. Porosity is discussed in a separate section "Porosity and Permeability". The caliper log again shows washing out of mudstone interbeds up to 3" or 4" in excess of bit size.

There is a very slight fall in the level of natural radioactivity at the top of the unit from about 70 - 55 API units. Elsewhere, however, a fair amount of variation is indicated with readings ranging from 38 - 85 API units.

There is rather a distinctive sonic break at 2165' with a velocity increase up to 115 microseconds per foot.

The average velocity for the unit as a whole is about 120 microseconds per foot. The increase in velocity compared to Unit II is no doubt at least partly due to the presence of the sandstones.

- 6) 2980' - 3094' (114') "Unit IV" consists of poorly consolidated quartz sandstones with siltstone interbeds.

Unit IV consists of four main porous sandstone beds separated by siltstone, minor mudstone, tight calcareous sandstone and sandy limestone interbeds. The four main sandstones are as follows: For the purposes of discussion they are referred to as A, B, C and D sandstones.

A	2979' - 2991'	(12')
B	3009' - 3018'	(9')
C	3030' - 3046'	(16')
D	3079' - 3094'	(15')

A, B and C sands are essentially similar except that A is fine grained, B is fine, medium and coarse grained, and C is coarse grained. A sand is well sorted, B and C sands are less well sorted. All the sands are poorly to moderately consolidated, and are obtained in the cuttings largely as the loose constituent grains.

They consist of sub-angular to, in places, angular or sub-rounded, clear, grey and milky quartz, with minor grey and greenish grey, greyish green and brownish grey lithic grains of quartzite and cherty fragments with only very minor feldspars and traces of brown and white mica in a minimal amount of kaolinitic and calcareous matrix. A core of A sandstone indicates some cross bedding up to 15° and some dark grey carbonaceous laminations.

D sand appears to consist partly of coarse quartz grains as in C sand, but the dominant lithologic type appears to be a light greenish grey, fine to medium grained sandstone, consisting of fairly well sorted sub-angular light grey quartz, white feldspars, grey, green and black lithic fragments of mudstone, siltstone and shale, and some carbonaceous and coaly grains in a kaolin to occasionally calcareous cement.

The siltstone interbeds are light to medium grey, moderately hard, blocky, carbonaceous, micaceous and, in places, are argillaceous. Mudstones are associated with the siltstones between A and B sands, and are greyish green, moderately hard, micaceous and blocky.

A thin bed (about 3' thick) is present between A and B sands, of yellowish brown, hard, sandy limestone.

Porosity and permeability of the sands of Unit IV are discussed under the section "Porosity and Permeability" later in this report.

The self potential curves of the sandstones in this unit are very distinctive, and show a negative reading over a siltstone baseline of up to 47 millivolts. The resistivity and microlog curves are similar to Unit III with the exception that there are a greater number of resistive streaks shown in the microlog. Porosity is indicated by positive separation on the microlog.

The gamma ray curve shows a low reading of 24 API units over the sandstone interbeds, while the sonic log shows a number of high velocity streaks reading as fast as 65 microseconds per foot.

- 7) 3094' - 3769' (675') Unit consisting of siltstone and mudstone.

This unit consists dominantly of siltstone and mudstone with a few minor sandstone interbeds, very minor carbonaceous shales, and traces of coal.

The siltstones are generally medium grey in colour, varying commonly to light grey and occasionally to greenish grey and brownish grey. They are generally micaceous, argillaceous and contain flecks and specks of carbonaceous material. Generally moderately hard and blocky, the siltstones may be calcareous in places. Occasional traces of green mudstone pellets, plant resin and pyrite are present and occasionally the siltstone is rather sandy.

The mudstones may be greenish grey, grey or green in colour. They are generally blocky and may vary from moderately hard to rather soft. They are commonly micaceous, silty and contain in places specks of carbonaceous material. A slightly shaley habit is exhibited in a few places.

The sandstones are mostly light grey in colour, with a speckled appearance in places. They are generally fine grained, although they may vary in places to very fine grained or medium grained. They may be recovered in the cuttings as loose constituent grains or as chips of moderately hard sandstone. The sandstone consists of fairly sorted, sub-angular to, in places, sub-rounded light grey, clear or white quartz, very minor white feldspars, dark grey, grey, green, black or brown lithic fragments generally of reworked mudstone, siltstone or shale, very minor amounts of carbonaceous and coaly grains and some mica in a generally calcareous and/or kaolinitic matrix.

Very minor shales are present. These are generally dark brown to black, carbonaceous, coaly, soft, fissile, and contain plant fragments.

Traces of coal are present, as well as a few very thin seams. The coal varies from black, soft, dull, dirty shaley, to black, vitreous, bright, brittle, in a few places.

Traces of pyrite and a few rare traces of gypsum are also present.

Electrical Characteristics:

Electrically this unit is characterised by a fairly flat self potential curve, an extremely large number of thin, highly resistive streaks on the micro-log, and thin high velocity streaks on the sonic log, out to 65 microseconds per foot, and averaging about 110 microseconds per foot for the whole unit. The resistivity curves are generally within the $1\frac{1}{2}$ - 3 ohm range, but with the 16" normal curve reading some of the thicker resistive streaks.

The gamma ray log shows readings between 48 and 84 API units.

- 8) 3759' - 3814' (55') Unit consisting of sandstone, coarse quartz sands, siltstones and carbonaceous shale.

The unit consists of fine grained consolidated sandstone and minor poorly consolidated coarse quartz sandstone, interbedded with siltstone, carbonaceous shale and mudstone.

The consolidated sandstone is light grey, fine grained calcareous and consists of clear, grey and white quartz, feldspars, green and grey mudstone and other lithic grains, carbonaceous specks, some coaly grains and yellow clay inclusions in a kaolin to calcareous cement. The sandstones are generally moderately hard but in places are friable.

Minor poorly consolidated coarse quartz sandstones are also present. The porous sections appear to be of this type, which consist of coarse to very coarse (up to and including granule size) of fairly sorted, angular to sub-angular, clear and frosted, light grey and brownish quartz, which are recovered loose in the samples. A finer grained variety is also present; it is well sorted, slightly better rounded and, in addition, carries some white quartz and grey, brown and green lithic fragments.

The shale is dark grey, dark grey brown or black, carbonaceous, micaceous, slightly silty and ranges from moderately hard to soft and coaly.

The siltstone is grey, micaceous and contains carbonaceous specks. It is moderately hard and blocky. Some minor light brown siltstone is also present.

The mudstone, which is present in minor amounts, is light green or light grey, silty, slightly micaceous and fairly soft.

Porosity and permeability of the sandstone in this unit are discussed later in this report under "Porosity and Permeability".

Electrical Characteristics:

Electrically this unit is characterized by marked fluctuations in the self potential curve, with readings up to 60 millivolts over the shale base line. A dense calcareous bed results in a high resistivity reading of 18 ohms M²M in one instance.

Some positive separation is apparent on the microlog and is discussed under "Porosity and Permeability". It was from this unit that a very large, very gassy, salt water recovery was obtained on drill stem test, and a gas flare was able to be lit for a very short period.

The gamma ray curve indicates that a good radioactive marker is present at the top of this unit, with values reading in excess of 120 API units. These high readings appear to be associated with the shale and siltstone above the main sand.

The sandstones of the unit give sonic velocities up to 66 microseconds per foot, but these faster readings are associated with the tight calcareous beds.

- 9) 3814' - 4841' (1027') Unit consisting of mudstone, siltstone and shale.

This unit consists of mudstone, siltstone, with shale interbeds increasing downward, and minor sandstones.

The mudstones are generally grey in colour but vary locally to greenish grey, light green or brown. They are blocky, moderately hard, silty, micaceous and contain fairly common specks and flecks of carbonaceous material. Very rare specks of gypsum are present in one or two places. The cored section shows sub-vertical slickensided surfaces and the mudstones disintegrate rapidly in air.

The siltstone is generally medium grey in colour but may vary to light grey or dark grey, as well as to occasional light brown, light greenish grey or black. Siltstones are commonly micaceous and contain fairly abundant carbonaceous material. They may be argillaceous and occasionally grade to mudstone. They are moderately hard, blocky, are occasionally sandy and contain a few traces of plant resin, siderite pellets, pyrite, chlorite, indeterminate green specks, and a rare trace of gypsum. Cross bedding is evident in the cores.

The shale is black, dark grey, or dark brown in colour, is carbonaceous micaceous, coaly in places, silty in a few places and ranges from soft and fissile to moderately hard. Cores show abundant leaf fragments, and some specks of gypsum.

The sandstones are generally light grey, varying to very light grey, white or light brown. They are generally fine grained to very fine grained although occasionally loose, coarse grains occur in the sample. They are commonly moderately hard and calcareous, and consist of fairly sorted, sub-angular to sub-rounded quartz, with minor white feldspars, fairly common muscovite and biotite, some green reworked mudstone grains and pellets, chert grains with specks and fragments of carbonaceous material, grey green and brown lithic fragments, occasional coaly flecks and green chlorite, rare indeterminate red and green specks, and some yellow clayey inclusions, in a light grey-white calcareous or kaolinitic matrix.

Traces of gypsum occur in a few places over the unit, as well as traces of coal, pyrite, and a rare trace of sandy, sideritic limestone and calcite.

Electrical Characteristics:

The self potential curve is fairly featureless over this unit, with no readings over 2 or 3 millivolts. The resistivity curves do not show very much character, and the 16" normal gives a maximum reading of 5 ohms M²M over several calcareous sandstone interbeds.

The caliper log shows that the hole was in slightly better condition in this unit than in the underlying and overlying units. The hole size was generally between 9" and 10" with only occasional washouts in excess of 11".

The microlog indicates that the number of dense resistive streaks is noticeably fewer than in both the overlying and underlying units.

The gamma ray curve does not show a great deal of character. Readings vary from 48 - 84 API units.

There is a gradual average increase in the sonic velocity from about 115 microseconds per foot near the top of the unit to about 100 microseconds per foot near the base, although locally there is considerable variation in readings.

- 10) 4841' - 5363' (TD) (522') Unit consisting of shale, sandstone and siltstone.

The shale is generally dark grey - black in colour, but varies locally to dark brown. It is carbonaceous, micaceous and commonly silty. It is generally moderately hard, but is fissile in places.

The sandstone is generally light grey, light brown or white in colour. It is fine grained to occasionally medium grained and ranges from moderately hard to rather friable. It is variably calcareous, kaolinitic or, in a few places, rather dirty and argillaceous. It consists dominantly of well sorted to fairly sorted sub-angular, sub-rounded, clear, light grey and, occasionally, white quartz. Also present are minor white feldspars often in a partly kaolinized condition. Mica is fairly common, both muscovite and biotite being represented. Minor lithic fragments are fairly general and consist of grey, black, brown and green mudstone, shale, claystone and siltstone fragments as well as some indeterminate orange and green specks.

Specks of carbonaceous material are present in places as well as a few coaly grains. Rare traces of garnets are present as well as chert, phyllite and chlorite. These above constituents are present in a generally white to occasionally light brown, calcareous to kaolinitic, clay matrix.

The siltstone is generally medium grey in colour but may vary to dark grey or light grey. It is micaceous and contains fairly common specks of carbonaceous material. In places it is argillaceous and may grade to a silty shale or occasionally to a very fine grained sandstone. It is moderately hard, blocky, and contains a rare trace of pyrite and chlorite.

Very minor amounts of mudstone are present, which is medium to dark grey in colour, micaceous, silty, slightly carbonaceous, blocky and hard.

Some traces of hard brown sideritic siltstone are present, as well as a few traces of coal in the carbonaceous shale, and a few traces of gypsum.

Electrical Characteristics:

Electrically this unit is very distinctive. The self potential curve shows a great deal of character with numerous readings out to as much as 65 millivolts over the shale base line.

Resistivity curves are markedly higher than in the overlying unit. Values range from 3 - 11 ohms M²M, with occasional calcareous beds reading out to in excess of 20 ohms M²M.

Although a number of the sandstone beds have held up very well and are in fact undergauge (8" compared with bit size 8 $\frac{3}{4}$ ") the intervening shale sections have washed out badly, up to a maximum of 13".

The microlog shows a great number of dense, resistive streaks, as well as showing good positive separation over the porous sandstone.

Porosity and permeability are discussed in the appropriate section later in the report.

The gamma ray curve shows more character than in the overlying unit. This is due to lower readings in the sandstone sections (down to 40 API units) and the higher readings in some of the shale units (in one case up to 120 API units).

The sonic log shows an average increase in velocity compared with the overlying unit. The readings, which average about 90 microseconds per foot, vary mainly from 115 to 60 microseconds per foot. Some of the slower readings are associated with porosity in the sandstones, and the higher readings with dense calcareous sandstones.

(5) Structure

A review of the seismic work, after the drilling of the Planet Heathfield No. 1 well, and the running of a velocity survey at that location, indicated the presence of a structure in the Tullich area, with a closure of several hundred feet, and covering an area about $5\frac{1}{2}$ miles long and about $1\frac{1}{4}$ miles wide. The long axis of the structure runs in a north west-south east direction. The Tullich No. 1 well was drilled on a culmination at the south east end of this structure.

The magnitude of dip as indicated in the cores cut on the Tullich No. 1 well cannot be regarded as reliable, as less than $1\frac{1}{2}\%$ of the total section is represented by cores, and slumping and cross bedding is indicated.

Preliminary figures from the dipmeter survey indicate that the section above about 3380' dips generally between 5 and 10 degrees to the north east. Below this depth dips are generally between 5 and 10 degrees to the south west.

This suggests the presence of an important unconformity about 300' below the porous sands of Unit IV.

It is very significant that a marked unconformity was present in the Planet Heathfield well about 150' below Unit IV. In each case the dips below the unconformity were to the south west.

This information is very important as it allows us to conclude that, with south west dips, there could be more units lost to erosion beneath this unconformity at Tullich No. 1, than at Heathfield No. 1.

The difficulty in correlating units beneath this unconformity at the two wells could be due to this reason.

(6) Occurrence of Hydrocarbons

The best indication of hydrocarbons was obtained from D.S.T. No. 4 (3721'-3786'). A recovery of 3160' of very gassy salt water, and 500' of very gassy salt water cut mud was recovered. The water was gassy to the extent that it had to be reverse circulated out the flow line, where an 8' flare was lit for a few seconds. An analysis of this gas is given in Appendix B.

A recovery of 1500' of gassy salt water was obtained in D.S.T. No. 3. This test was over the interval 2947-2982'. Samples of gas were obtained from the water and the analyses are given in Appendix B.

Small gassy water recoveries were obtained in D.S.T. No. 6 (4815'-4880') and in D.S.T. No. 7 (4980'-5045'). The recoveries consisted of 450' and 400' of muddy gassy water respectively. Samples of the gas were collected for analysis and the results appear in Appendix B.

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

A few minor readings of methane trip gas were obtained between 1050' and 3479', and 20 units of methane trip gas was recorded after D.S.T. No. 3. A few very small readings were obtained while drilling minor amounts of coal between 3670' and 3715', and 40 units of methane trip gas was obtained after D.S.T. No. 4. Minor trip gas and minor readings from coaly sections were obtained as drilling proceeded, and 56 units of methane trip gas was obtained after D.S.T. No. 6 (4815'-4880'). A reading of 5 units was obtained while drilling the sandstone tested in D.S.T. No. 7 (4980'-5045') and a trip gas reading of 101 units methane was obtained after this test.

(7) Porosity and Permeability

The porosity and permeability of the unconsolidated Recent, Pleistocene and Knight Group type sands down to the top of the Merino Group, is probably very high. The sands appear to be lacking almost entirely in cement material, cave badly and are recovered in the cuttings entirely as loose constituent grains.

Good reservoir characteristics are exhibited by a number of Merino sandstones.

- (a) A group of 4 porous sandstones are present in Unit IV, between 2980 and 3094 feet. The sandstones are lettered from the top down, and are followed by the net porosity in each case.

A sandstone	12'
B sandstone	8'
C sandstone	15'
D sandstone	5'
Odd stringers	<u>2'</u>

Total Net Porosity 42'

Porosity is excellent and calculates out in A, B, and C sand at 29%. D sand calculates out at 24%. The drill stem test charts indicate good permeability.

Only two feet of the top sand was drilled when drilling was halted. A test was immediately run to obtain any gas that may have been present if a thin gas zone were present above a gas water interface, and 1500' of gassy salt water was obtained, the pressure curves indicating good permeabilities. Shut in pressure was 1660 psi. A core was cut after the test and most of the rest of A sandstone was recovered in the barrel. The logs indicate that B, C and D sands were also water saturated.

This group of sandstones corresponds to the Unit IV sandstones at Planet Heathfield No. 1 well, and has been referred to informally as the "Heathfield sand" in company discussions.

- (b) Several sandstones are present in a sandstone, shale and siltstone unit between 3769 and 3814 feet. Net porosity totals 8 feet and is present between 3769'-3770' and 3779'-3786'. Porosity is excellent and calculates out at 28%. The drill stem tests charts indicate that permeability is excellent.
- (c) A number of porous sandstones are present in the shale, sandstone and siltstone unit, 4841'-5363'. Small gassy muddy water recoveries were obtained from two drill stem tests over two of the better of these sandstones. Unrealistically high porosities calculate out on the logs, this being possibly a function of the type of matrix in sandstone. Visual examinations of cores and cuttings indicate

that porosity, where present, is poor. Permeabilities are also low. A net aggregate figure of 100' of poor porosity of this type is present as thin interbeds over the middle and upper part of the shale, sandstone and siltstone unit 4841'-5363'.

- (d) Minor porosity, generally very poor, is present in places in some of the other units in the well. Some scattered porosity is present in the mudstone and fine grained sandstone unit (470-634'). The best porosity in the unit is in the unconsolidated quartz sand at the base of the unit (618-634'). Some scattered poor ineffective porosity is present in Unit I (634-1308').

Some slightly better, but still very poor porosity is present in Unit II 1308-2002'. A D.S.T. of one of these sands yielded only 220' of fresh water cut mud. An aggregate of 103' of sandstone with traces of poor porosity is present in Unit III 2002-2980'. A D.S.T. of one of these sands yielded only 130' of brackish water cut mud.

A few traces of very poor, ineffective porosity, in thin stringers aggregating 41' are present in the dominantly mudstone, siltstone and shale unit between 3814 and 4841'.

(8) Contributions to Geologic Knowledge

The Planet Tullich No. 1 well has added significantly to the stratigraphic knowledge, and also contributed to the structural knowledge, in an area where drilling has been very sparse.

In particular, the following contributions have been made:

- (a) The north-northwesterly extension, and thickening, of porous Merino reservoir beds encountered in the Planet Heathfield No. 1 well (Unit IV) has been indicated and gassy water was obtained from these sands on drill stem test.
- (b) Units I, II, III and IV may be correlated with these units at the Heathfield No. 1 well.

- (c) The unconformity below Unit IV at Heathfield No. 1 is shown to be also present at Tullich No. 1, and the dip of the beds below the unconformity is shown to be to the south west in each case.
- (d) The section below the unconformity cannot be correlated with certainty with the Heathfield No. 1 well. New porous units, from which gassy water was obtained, are present in this section. A flare was lit for a few seconds at the flow line, with gas from the gassy water recovery, from one of these sands.
- (e) Drill stem tests have provided useful information from porous sands on pressures, reservoir characteristics, gas analyses, and water resistivities.
- (f) The Tullich No. 1 well has provided a useful link in the correlation between the O.D.N.L. Penola No. 1 well to the north west and the Heathfield well to the south, south east.

V. ACKNOWLEDGEMENTS

Acknowledgements are due to the various authorities and individuals whose reports appear as appendices of this report, and for the assistance rendered by officers of the Mines Department of Victoria and the Bureau of Mineral Resources.

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

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APPENDIX A

CORE DESCRIPTIONS

CORE NO. 1 538' to 548' Recovered 10 ft.

The entire core consists of sandstone. The sandstone is greenish/grey, fine to medium grained, feldspathic, soft and friable. It consists of fairly well sorted sub-angular to sub-rounded light grey to clear quartz, white feldspars, re-worked grains of green mudstone, coaly grains, brown to very dark brown micas, soft, red, ferruginous grains, chert grains, occasional glauconite(?) and rare chlorite in a kaolinitic matrix. A few rare irregular laminations and inclusions of brownish/black carbonaceous material up to an $\frac{1}{8}$ " thick are present. Some porosity is generally present. It is generally poor, but improves to fair locally. Bedding is vague, but appears to be flat. The bedding traces are due to slightly variations in grain size, as well as increases in proportion of the darker coloured constituents. No fluorescence. No cut.

CORE NO. 2 1041' to 1051' Recovery nil.

CORE NO. 3 1051' to 1053' Recovery 2 ft.

Top 4" Mudstone, dark grey, with abundant lignitic plant remains.

Next 8" Mudstone, dark green, no carbonaceous material.

Next 6" Sandstone, light grey, fine grained, consisting of quartz, feldspar, lithic grains (green mudstone dominant), and carbonaceous grains in a matrix of calcareous pale grey clay. Scattered carbonaceous streaks. Cross bedded. Tight.

Next 6" Siltstone, dark grey containing scattered mica and carbonaceous specks, streaks and fragments. Sandy in places, with small lenses up to 3" by 1" of fine grained sandstone consisting of quartz sandstone and lithic grains apparently mainly green mudstone. Rare lenses of intraformational conglomerate consisting of green mudstone and siltstone pellets in a white sandy clay matrix. Cross bedded in sandy areas which also show porosity in places.

CORE NO. 4 1540'-1551' Recovered 11 ft.

Top 5'4" Mudstone, grey, with coaly fragments, conchoidal fracture, flat bedding. Towards bottom are small lenses of calcareous oolites, medium sand size, well sorted, with calcareous outer shells and silicified inner shells and nuclei in a mudstone matrix. Some lenses are completely silicified and cemented in part by chalcedony. Some possible vertical worm burrows.

Next 2" Siltstone, dark grey, carbonaceous, with very fine grained sandy lenses and mica.

Next 1'11" Mudstone, as above, with thin bedding plane layers of fine grained micaceous sand.

CORE NO. 4
continued

Next 3'7"

Siltstone, as above, with layers of mudstone and thin bedding plane layers and some lenses of sand.
Bedding flat.

CORE NO. 5

2051'-2061'

Recovered 9 feet

Top 2'

Mudstone, medium to dark grey, silty, firm, sub-conchoidal fracture, contains abundant black and reddish, black plant fragments and coaly fragments to 1" x 1/8". Slightly micaceous slightly silty. Contains abundant fine white, gypsiferous? specks and some white kaolinised feldspars. No bedding apparent. Near the base contains lenses of the underlying sandstone, giving a gradational contact.

Next 2'

Sandstone, light greenish/grey, fine grained, soft, fairly friable, feldspathic, consists of well sorted, sub-rounded to sub-angular light grey and clear quartz. Common white feldspars, some dark grey chert grains, black coaly grains, scattered soft red shale? grains. Some greenish and yellowish quartz. Minor biotite and muscovite, trace chlorite in kaolinitic matrix. Very poor to poor porosity present throughout this sandstone. Some small scale current bedding is evident. Bedding unreliable, overall appears to be flat.

Next 8"

Siltstone, is light to medium grey, slightly to very argillaceous, very micaceous, (biotite and muscovite) contains a few red specks and traces of chlorite and fairly common white feldspars. Siltstone has a laminated to interlaminated appearance, due to dark grey, very argillaceous siltstone (grading to silty mudstone and some laminations) and light grey, slightly argillaceous siltstone. Because of these laminations siltstone is quite fissile. Dip of laminations is irregular ranging from 0° to 10° but overall dip appears flat, upper contact is gradational.

Next 4'4"

Sandstone, is light greenish/grey, fairly friable fine to medium grained, feldspathic, and consists of fairly well sorted sub-angular to sub-rounded light grey and clear quartz. Some white feldspars reworked, dark grey and green/grey mudstone grains, minor dark grey chert grains, soft indeterminate red grains. Trace muscovite and biotite. Sandstone contains a few coaly grains, and irregular inclusions of soft, dark reddish/brown to black poor quality coal, up to 1/8" thick and 1 1/2" long. Poor to fair porosity is generally present. The sandstone is characterised by very irregular dark swirls of carbonaceous material and some concentrations of coarse biotite flakes. Irregular current bedding and depositional swirling is evident and no reliable dips could be obtained from the sandstone section.

CORE NO. 6

2556'-2566'

Recovered 5'9"

Top 5'3"

Siltstone, grey with laminae of pale green/grey mudstone and very fine grained sandstone. Mostly lense like, rarely as thin interbeds. Bedding flat. Laminae rarely contorted or slumped. Plant fragments rare. Occasional vertical "wormburrows" structures, contains carbonaceous specks, orange plant resin with fragments, white clay pellets or decomposed feldspars.

Core No. 6 (cont)

Bottom 6" Sandstone, grey very fine grained to fine grained, non calcareous with cross-bedding, scour and fill slump and animal burrow structures. Consists of generally fine grained quartz, feldspar, mica, green clay pellets and carbonaceous specks, in a grey clay matrix.

CORE NO. 7 2982'-2992' Recovery 7' 8"

Top 3' 2" Core consists of 1 unit light grey sandstone. Sandstone is light grey, soft, poorly to moderately consolidated, well sorted, fine grained. It consists of sub-angular, clear, grey and white quartz, minor white feldspar and common grey/green, grey, brownish/grey quartzite and cherty fragments and traces of black/brown mica, set in a minor white, clay matrix. The dark constituents make up about 10% of the detrital grains. The matrix varies in amount, controlling porosity. In general sandstone has fair to good porosity, with good to excellent patches, a fine grain size is a restricting factor.

4' 6" Dark grey/black carbonaceous layers, consisting of plant remains, are prominently developed as fine layers in the sandstone, bedding is apparently flat or nearly so, but cross bedding dips about 15°

Total 7' 8"

CORE NO. 8 3478'-3489' Recovered 4'

Top 9" Sandstone, light and dark grey, massive with internal laminae and lenses, cross bedded in part and showing scour-and-fill and depositional slumping, the upper 6" are darker and more silty than the lower 3" Sandstone consists of quartz, feldspar, mudstone pellets, mica and carbonaceous grains in a white to grey clayey matrix. Very slightly calcareous in part. Tight. Dark grey bands are silty.

2' 3" Sandstone, light grey, cross bedded, carbonaceous with flat lying bedding plains of carbonaceous flakes and plant remains, constituents, as above Tight, but friable in places.

5" Mudstone, dark grey, massive, with a large silt content and abundant carbonaceous specks, streaks and fragments.

CORE NO. 8 (continues)

5" (cont)

The upper part of the interval represents a bedding plane which has been subjected to a burrowing action by some organism and sand mudstone pellets and pebbles and coaly fragments have been deposited in the burrows. The large burrows measures 4" deep by 1½" across, and contains mudstone pebbles up to ½" across. Dark Mudstone, contains small flakes of mica and small irregular areas of finely divided white gypsum. In places the gypsum is associated with marcasite and appears to be filling worm burrows or other tube like cavities perpendicular to the bedding. Some cavities are surrounded by a halo of dark discolouration.

7"

Mudstone, as above, highly fractured with a small scale, blocky fracture, strongest parallel to the bedding

Total 4'

CORE NO. 9

3987'-3994'

No recovery

CORE NO. 10

3994'-3999'

Recovered 2' 4"

Top 1' 2"

Mudstone, greenish/grey, moderately soft, finely micaceous, slightly silty, occasional fine carbonaceous specks, occasional ovoid and sinuous inclusions of dark green/brown silt and mica free mudstone, up to ¼" across. The Mudstone is blocky, with no apparent bedding. It fractures readily of handling and disintegrates on drying into rubbly, blocky fragments, a very strongly slickensided surface with slickenside grooves up to 1/8" deep. Dips at 55° to 80° through this section of the core

4"

Shale, dark brownish/grey to black, very fissile, soft, carbonaceous, contains abundant leaf fragments, as well as some specks of gypsum and plant resin. The shale is commonly slickensided; generally planes at low angles to the bedding. The Shale disintegrates rapidly on handling, and on exposure to the air. Bedding vague and generally undulating but overall appears flat

10"

Mudstone, medium grey, abundant scattered mica flakes, and coalified plant fragments up to ¼" long, moderately hard. Blocky fracture disintegrates readily into blocky fracture on drying. Sub-vertical slickensided surfaces common and sub-horizontal non slickensided fractures. Trace gypsum specks along slickensides some vague bedding, apparently close to flat.

Total 2' 4"

CORE NO. 11

4491'4500'

Recovered Nil

CORE NO. 12

4500' - 4505' Recovered 13' (including 8' from
Core No. 11)

Top 6'

Mudstone, massive, dark grey, hard to moderately hard, brittle, blocky, finely micaceous (both white and brown mica) carbonaceous throughout but with occasional layers of coarse, coaly plant remains. In siltier portions the entire rock is speckled with fine carbonaceous fragments and there are occasional pyritic patches. This unit grades down into siltstone.

4' 6"

Siltstone, this unit is medium to dark grey, ranges from siltstone and mudstone to occasional lenses of very fine grained sandstone, becoming generally slightly coarser towards the base. Mudstone is as above, generally silty. The Siltstone is medium to dark grey, moderately hard, micaceous, carbonaceous, very slightly calcareous and grades occasionally into very fine grained sandstone, light to medium grained quartz sandstone, with similar properties. Bedding is irregular, slumped and cross bedded, so that dips range from flat to 30° but are not two true dips

Bottom 2' 6"

Shale, siltstone and sandstone, consists of the above siltstone and sandstone, very fine laminated with black carbonaceous shale with good fissility. Bedding dips at about 8° in this unit. The Sandstone is tight.

Total 13'

CORE NO. 13

4841' - 4855' Recovered 9'

The core consists of 1 unit of light grey, well sorted, fine to occasionally medium grained quartz sandstone, set in a white clay matrix. Sandstone contains numerous very fine and argillaceous, micaceous, carbonaceous, dark grey laminae, which define bedding. Sandstone is fine grained generally occasionally medium grained, light grey to white, moderately firm friable, slightly calcareous, and consists of clear, grey and light brown quartz, sub-rounded to sub-angular with minor grey phyllitic and quartzitic grains, occasional grey shale grains very minor green cherty fragments, black coaly specks and white feldspars, and trace to very common trace (in parts) of garnet, ranging from light honey brown to deep red in colour. The Sandstone contains common flakes of medium to coarse white and brown mica particularly on bedding surfaces.

Matrix is white, clayey, slightly calcareous, in part, which totally fills pore spaces so that the rock is tight throughout.

Bedding laminae are dark grey and generally consists of sandy silt or shale, the matrix becomes argillaceous, there is an increase in lithics, mica (including some green chlorite) carbonaceous material, and a decrease in the detritals to matrix ratio. Bedding dips at about 10° with local small and large scale cross bedding dips much more.

CORE NO. 14

5355'-5360'

Recovery Nil

CORE NO. 15

5460'-5363'

Recovery 5'4" (including 2'4" from
Core No. 14)

Core consists of 1 unit, medium to dark grey, moderately hard, brittle, silty shale. The rock is compact, poorly bedded, and generally non fissile, finely micaceous and slightly carbonaceous, bedding is flat, some slickensiding on joints dipping at 50° occurs at about 1ft. at the top of the Core. There are no hydrocarbon shows.

APPENDIX B

FLUID ANALYSES

Report on Sample No. 1021/64

Sample : Bore-hole Gas
Locality : Parish : Tullich
District : Casterton
Sender : The Exploration Manager,
Planet Oil Company,
2 O'Connell Street,
SYDNEY. N.S.W.

Description of Sample;

Tullich No.1 Well

One sample of bore-hole gas was received for analysis.

The sample was received in a rubber-sealed and waxed glass bottle containing water similar to previous samples of gas taken from Drill Stem Tests Nos. 3, 4 and 6.

Details of the sample are given as follows :-

Drilling Company	Planet Oil Company
Name of Well	Tullich No.1
Drill Stem Test No.	7
Interval (feet)	4980 - 5045

Results:

	%
Carbon Dioxide	0.7
Hydrogen	Nil
Nitrogen	62.0
Oxygen	14.8
Methane	22.2
Ethane	0.1
Propane	Nil
Butane	Nil

Notes were made on the analyses of three earlier samples of gas, Drill Stem Tests Nos. 3, 4 and 6, our Report on Samples Nos. 936 - 938/64.

These notes apply equally to the above analysis.

John C. Kennedy
Senior Chemist,
Mines Department.

13th October,

1964

Report on Samples Nos. 936 - 938/64

Samples : Bore-hole Gas
Locality : Parish : Tullich
District : Casterton
Sender : The Manager,
Planet Oil Co. N.L.,
2 O'Connell Street,
SYDNEY. NEW SOUTH WALES.

Tullich No.1

Three samples of bore-hole gas were received for analysis.

The gases were obtained from water recovered in three drill stem tests carried out at differing intervals in the Tullich No.1 Well.

Condition of Samples

The samples were received in small glass bottles closed with a spring-held rubber stopper, waxed, and containing water to act as an extra seal.

Particulars of Samples and Results:

Lab. No.	936	937	938
Drill Stem Test No.	3	4	. 6
Interval (feet)	2947 - 2982	3721 - 3786	4815-4880
	%	%	%
Carbon Dioxide	Nil	0.1	1.2
Hydrogen	0.4	Nil	Nil
Nitrogen	18.7	6.5	32.3
Oxygen	1.1	0.5	8.2
Methane	79.3	91.0	56.6
Ethane	Nil	0.4	0.4
Propane	Nil	Nil	Nil
Butane	Nil	Nil	Nil

Comment

Note. 1

The gases were analysed on our second gas chromatograph as our more sensitive instrument is still being serviced.

Our second instrument is designed to determine macro quantities of mixed hydrocarbon gases such as are found in town gas, and does not detect hydrocarbons above butane. Its limit of detection of any one gas is 0.1%.

Comments (cont.)

Note 2. Where carbon dioxide was present, the true figure would be somewhat higher than the analytical figure shown, as some of the gas would certainly have dissolved in the water in the sample bottle.

Note 3. While remembering that 0.1% was the lower limit of detection of the gas chromatograph used, it was disappointing to find no ethane content greater than 0.4% (D.S.T. 4 and 6), and either no propane or butane at all, or less than 0.1%.

John C. Kennedy

Senior Chemist,
Mines Department.

APPENDIX C

MUD DATA

DAILY MUD PROPERTIES

<u>Date</u>	<u>Weight lbs/gal.</u>	<u>Viscosity Sec/qt.</u>	<u>Water Loss cc/30 mins.</u>	<u>Filter Cake Inch/32"</u>	<u>pH</u>
4.8.64	Spudded				
5.8.64	10	46			
6.8.64	9.5	40			
7.8.64	13 ³ / ₈ " Casing	W.O.C.			
8.8.64	9.5	40	12	1/16	6
9.8.64	9.9	50	8.6	2/32	9.5
10.8.64	10	56	7	2/32	9.5
11.8.64	9.8	50	5.6	2/32	9.5
12.8.64	9-5/8" Casing	W.O.C.			
13.8.64	9.7	48	9	2/32	9.5
14.8.64	9.8	55	7.8	2/32	9.5
15.8.64	9.8	57	6.6	2/32	9.5
16.8.64	9.6	53	7	2/32	9.5
17.8.64	9.8	75	6.5	2/32	8.0
18.8.64	9.8	90	8.3	2/32	9
19.8.64	9.7	50	7.4	2/32	8.5
20.8.64	9.8	54	5.6	2/32	8
21.8.64	9.9	54	5.4	2/32	8
22.8.64	9.8	58	5.6	2/32	8
23.8.64	10	63	5.3	2/32	8
24.8.64	9.9	55	5.2	2/32	8
25.8.64	9.7	50	5.6	2/32	8
26.8.64	9.8	46	6.6	2/32	8
27.8.64	9.8	53	6	2/32	8
28.8.64	9.9	70	5	2/32	8
29.8.64	9.7	62	5.4	2/32	8
30.8.64	9.7	46	5.2	2/32	8
31.8.64	9.8	62	5.8	2/32	8
1.9.64	9.9	55	6	2/32	8
2.9.64	9.9	44	6	2/32	8

TOTAL ADDITIVES USED

Supercol	15,100 lbs.
Uni-cal	6,250 lbs.
Mil-con	3,100 lbs.
Synergic	2,200 lbs.
Myrtan Lovis	1,400 lbs.
Soda Ash	200 lbs.

APPENDIX D

REPORTS ON DRILL STEM TESTS

Flow Time	1st 5	Min.	2nd 45	Min.	Date	8-13-64	Ticket Number	344032	S	
Closed In Press. Time	1st 20	Min.	2nd 20	Min.	Kind of Job	OPEN HOLE	Halliburton District	CASTERTON		
Pressure Readings	Field		Office Corrected		Tester	R. HOUSE	Witness	J. CUNDALL		
Depth Top Gauge	1581 Ft.		No Blanked Off		Drilling Contractor	AUSTRALIAN DRILLING CONTRACTORS			JM	
BT. P.R.D. No.	1906		24 Hour Clock		Elevation	-	Top Packer	1596'		
Initial Hydro Mud Pressure	815		812		Total Depth	1631'		Bottom Packer	-	
Initial Closed in Pres.	645		621		Interval Tested	1596-1631'		Formation Tested	Merino Group	
Initial Flow Pres.	45	1	30		Casing or Hole Size	8 3/4"	Casing		Top	
	45	2	34				Perfs.		Bot.	
Final Flow Pres.	45	1	28				Surface Choke	Nil	Bottom Choke	5/8"
Final Closed in Pres.	515		540		Size & Kind Drill Pipe	4 1/2" FH	Drill Collars Above Tester	I.D. - LENGTH 2 7/8" - 253'		
Final Hydro Mud Pressure	815		812		Mud Weight	9.7	Mud Viscosity	52		
Depth Cen. Gauge	Ft.		Blanked Off		Temperature	70	Anchor Size & Length	ID 5"	X 35'	
BT. P.R.D. No.			Hour Clock		Depths Mea. From	Kelly Bushing	Depth of Tester Valve	1581' Ft.		
Initial Hydro Mud Pres.					TYPE AMOUNT		Depth Back Pres. Valve	Ft.		
Initial Closed in Pres.					Cushion	-	Med. From Tester Valve			
Initial Flow Pres.	1				Recovered	220	Feet of	Fresh water cut mud		
Final Flow Pres.	2				Recovered		Feet of			
Final Flow Pres.	1				Recovered		Feet of			
Final Flow Pres.	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	1628 Ft.		Yes Blanked Off		Gas Gravity		Surface Pressure	psi		
BT. P.R.D. No.	1907		24 Hour Clock		Tool Opened	12:45 PM	A.M. P.M.	Tool Closed	2:15 PM A.M. P.M.	
Initial Hydro Mud Pres.	840		834		Remarks	Tool opened for a 5 minute first flow.				
Initial Closed in Pres.	665		641		Rotated tool for a 20 minute initial closed in pressure. Reopened tool for a 45 minute second flow. Took a 20 minute final closed in pressure.					
Initial Flow Pres.	70	1	42							
	90	2	67							
Final Flow Pres.	70	1	51							
Final Flow Pres.	155		133		No gas or oil.					
Final Closed in Pres.	575		557							
Final Hydro Mud Pres.	840		834							

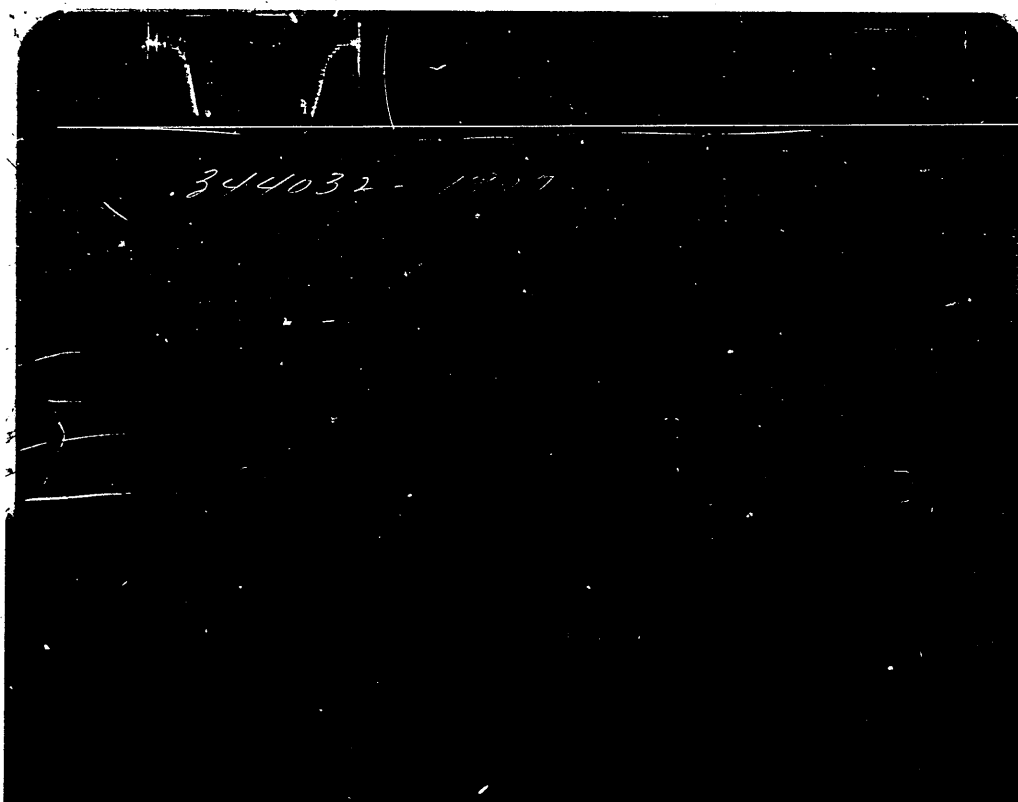
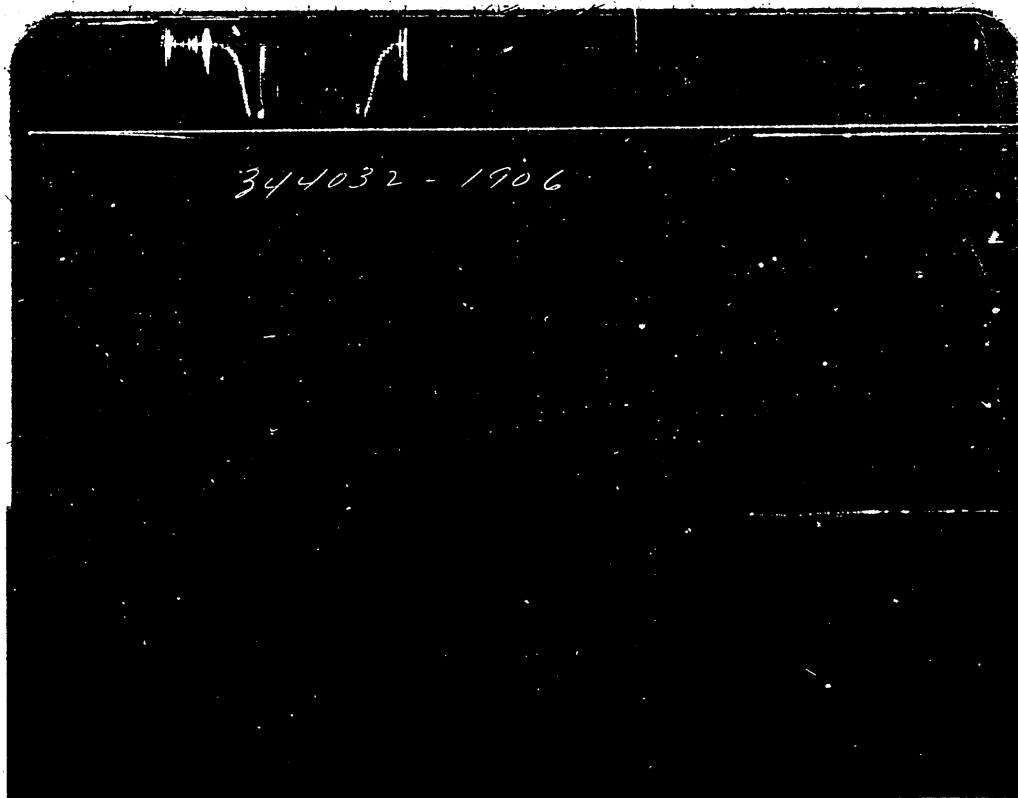
Legal Location Sec. - Twp. - Rng. TULLOCH
 Lease Name
 Well No. 1
 Test No. 1
 Field Area WILDCAT
 County
 State VICTORIA
 Owner's District CASTERTON
 PLANET EXPLORATION COMPANY
 Lease Owner/Company Name

FORMATION TEST DATA

3

Gauge No. 1906		Depth 1581'		Clock 21		hour		Ticket No. 311032		
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	30	.000		28	.000	34	.000		113
P ₁	.019	28	.006		475	.029	54	.0074		373
P ₂			.012		527	.058	71	.0148		422
P ₃			.018		552	.087	86	.0222		454
P ₄			.024		574	.116	98	.0296		475
P ₅			.030		587	.145	113	.0370		492
P ₆			.036		595			.0444		503
P ₇			.042		604			.0518		516
P ₈			.048		610			.0592		525
P ₉			.054		615			.0666		533
P ₁₀			.060		621			.0740		540
Gauge No. 1907		Depth 1628'		Clock 24		hour				
P ₀	.000	42	.000		51	.000	67	.000		133
P ₁	.003	44	.0062		455	.029	78	.0073		377
P ₂	.006	47	.0124		530	.058	93	.0146		428
P ₃	.009	49	.0186		563	.087	106	.0219		461
P ₄	.012	49	.0248		585	.116	120	.0292		486
P ₅	.015	51	.0310		603	.145	133	.0365		503
P ₆			.0372		619			.0438		517
P ₇			.0434		627			.0511		532
P ₈			.0496		630			.0584		543
P ₉			.0558		634			.0657		550
P ₁₀			.0620		641			.0730		557
Reading Interval 1		2			9		2		Minutes	
REMARKS:										

SPECIAL PRESSURE DATA



Flow Time	1st 5 Min.	2nd 60 Min.	Date	8-14-64	Ticket Number	344033 S	Legal Location Sec. - Twp. - Rng.
Closed In Press. Time	1st 20 Min.	2nd 20 Min.	Kind of Job	OPEN HOLE	Halliburton District	(AUSTRALIA) CASTERTON	
Pressure Readings	Field	Office Corrected	Tester	R. HOUSE	Witness	G. BROWN	
Depth Top Gauge	2060 Ft.	No Blanked Off	Drilling Contractor	AUSTRALIAN DRILLING CONTRACTORS		JM	Lease Name
BT. P.R.D. No.	1906	24 Hour Clock	Elevation	-	Top Packer	2075'	
Initial Hydro Mud Pressure	1055	1053	Total Depth	2110'	Bottom Packer	-	Well No.
Initial Closed in Pres.	815	809	Interval Tested	2075-2110'	Formation Tested	Merino Group	
Initial Flow Pres.	-	1 21	Casing or Hole Size	8 3/4"	Casing Perfs.	Top	Test No.
Final Flow Pres.	45	2 60	Surface Choke	Nil	Bottom Choke	5/8"	
Final Closed in Pres.	645	651	Size & Kind Drill Pipe	4 1/2" FH	Drill Collars Above Tester	I.D. - LENGTH 2 7/8" - 253'	Field Area
Final Hydro Mud Pressure	1055	1053	Mud Weight	9.5	Mud Viscosity	52	
Depth Cen. Gauge		Blanked Off	Temperature	100 °F Est.	Anchor Size ID & Length	5" X 35'	WILDCAT
BT. P.R.D. No.		Hour Clock	Depths Mea. From	Kelly Bushing	Depth of Tester Valve	2060' Fr.	
Initial Hydro Mud Pres.			Cushion		Depth Back Pres. Valve		County
Initial Closed in Pres.			Recovered	130 Feet of	Muddy Brackish Water		
Initial Flow Pres.			Recovered				State
Final Flow Pres.			Recovered				
Final Closed in Pres.			Recovered				VICTORIA
Final Hydro Mud Pres.			Oil A.P.I. Gravity		Water Spec. Gravity		
Depth Bot. Gauge	2106 Ft.	Yes Blanked Off	Gas Gravity		Surface Pressure	psi	Owner's District
BT. P.R.D. No.	1907	24 Hour Clock	Tool Opened	12:18 AM	A.M. P.M. Tool Closed	1:42- AM P.M.	
Initial Hydro Mud Pres.	1090	1079	Remarks	Tool opened for a 5 minute first flow.			
Initial Closed in Pres.	845	823		Rotated tool for a 20 minute initial closed in			
Initial Flow Pres.	48	1 44		pressure. Reopened tool for a 60 minute second			
Final Flow Pres.	48	1 44		flow. Took a 20 minute final closed in pressure.			
Final Closed in Pres.	665	665		No oil or gas.			
Final Hydro Mud Pres.	1090	1073					

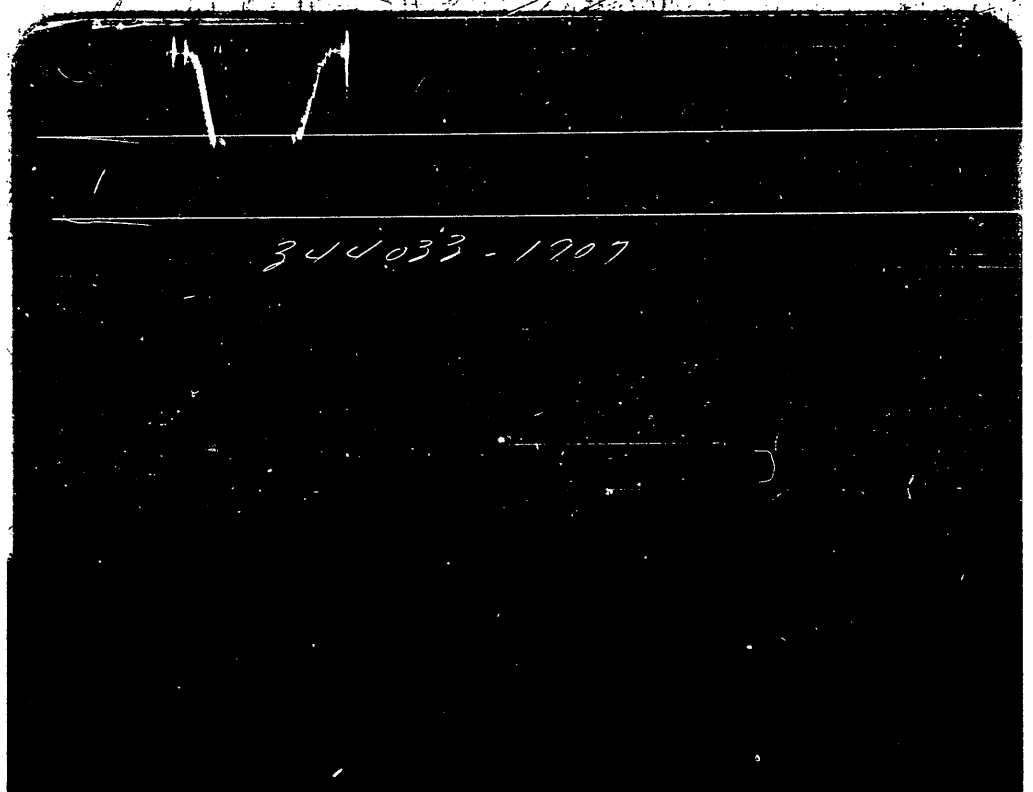
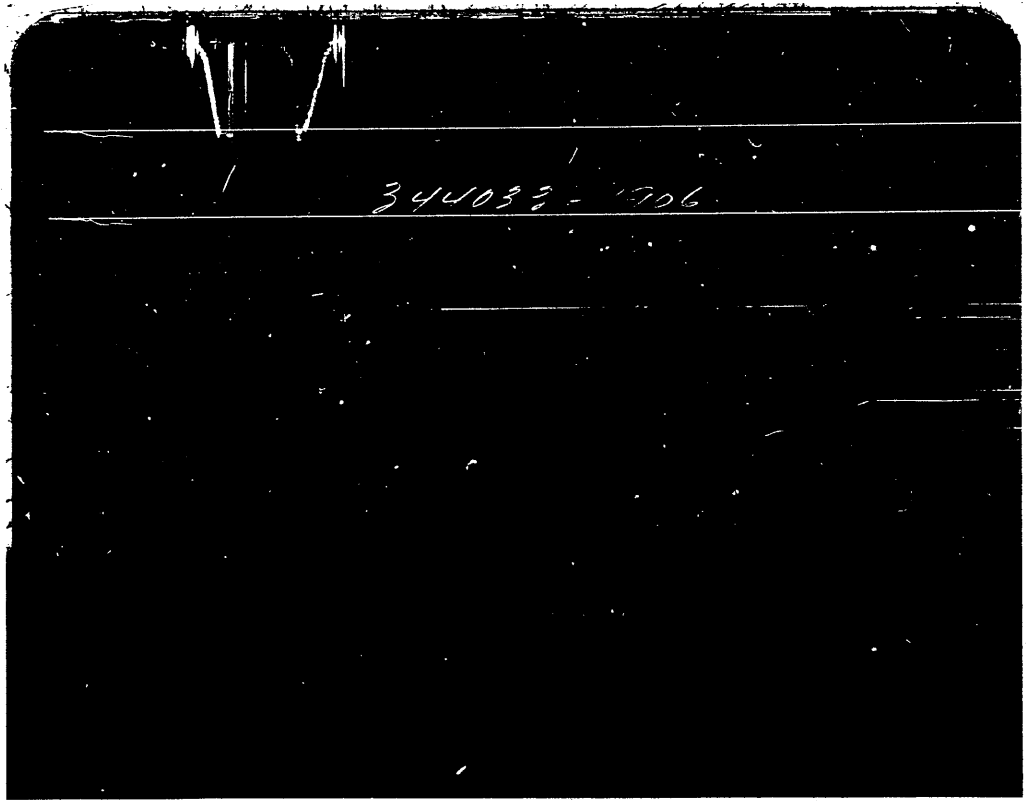
FORMATION TEST DATA

3

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

Gauge No. 1906		Depth 2060'			Clock 24 hour		Ticket No. 344033			
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	21	.000		17	.000	17	.000		60
P ₁	.014	17	.006		478	.050	30	.0062		338
P ₂			.012		627	.1010	41	.0124		443
P ₃			.018		694	.1515	51	.0186		503
P ₄			.024		730	.2020	60	.0248		546
P ₅			.030		754			.0310		571
P ₆			.036		771			.0372		600
P ₇			.042		784			.0434		617
P ₈			.048		792			.0496		632
P ₉			.054		801			.0558		647
P ₁₀			.060		809			.0620		651
Gauge No. 1907		Depth 2106'			Clock 24 hour					
P ₀	.000	44	.000		44	.000	58	.000		82
P ₁	.013	44	.0061		448	.0505	58	.0065		370
P ₂			.0122		603	.1010	64	.0130		441
P ₃			.0183		678	.1515	73	.0195		508
P ₄			.0244		728	.2020	82	.0260		552
P ₅			.0305		756			.0325		585
P ₆			.0366		778			.0390		610
P ₇			.0427		794			.0455		627
P ₈			.0488		807			.0520		641
P ₉			.0549		816			.0585		652
P ₁₀			.0610		823			.0650		665
Reading Interval		2			15		2 Minutes			
REMARKS:										

SPECIAL PRESSURE DATA



Flow Time	1st 5 Min.	2nd 45 Min.	Date	8-17-64	Ticket Number	344034 S	Legal Location Sec. - Twp. - Rng.
Closed In Press. Time	1st 20 Min.	2nd 20 Min.	Kind of Job	OPEN HOLE	Halliburton District	CASTERTON	
Pressure Readings	Field	Office Corrected	Tester	R. HOUSE	Witness	J. CUNDILL	
Depth Top Gauge	2932 Ft.	no Blanked Off	Drilling Contractor	AUSTRALIAN DRILLING CONTRACTORS		LC	
BT. P.R.D. No.	1906	24 Hour Clock	Elevation	--	Top Packer	2947'	
Initial Hydro Mud Pressure	1580	1489	Total Depth	2982'	Bottom Packer	--	
Initial Closed in Pres.	1245	1237	Interval Tested	2947' - 2982'	Formation Tested	Merino Group	
Initial Flow Pres.	0	1 77	Casing or Hole Size	8 3/4"	Casing Perfs. } Top		
Final Flow Pres.	0	1 139	Surface Choke	Nil	Bottom Choke	5/8"	
Final Closed in Pres.	1200	1220	Size & Kind Drill Pipe	4 1/2" FH	Drill Collars Above Tester	2 7/8" - 253'	
Final Hydro Mud Pressure	1455	1468	Mud Weight	9.8	Mud Viscosity	85	
Depth Cen. Gauge		Blanked Off	Temperature	110	*F Est. Anchor Size ID & Length	5" X 35'	
BT. P.R.D. No.		Hour Clock	Depths Mea. From	Kelly Bushing	Depth of Tester Valve	2932 Ft.	
Initial Hydro Mud Pres.			Cushion	--	Depth Back Pres. Valve	--	
Initial Closed in Pres.			Recovered	1500	Feet of	gassy salt water.	
Initial Flow Pres.			Recovered		Feet of		
Final Flow Pres.			Recovered		Feet of		
Final Closed Pres.			Recovered		Feet of		
Final Hydro Mud Pres.			Oil A.P.I. Gravity		Water Spec. Gravity		
Depth Bot. Gauge	2978 Ft.	yes Blanked Off	Gas Gravity		Surface Pressure	psi	
BT. P.R.D. No.	1907	24 Hour Clock	Tool Opened	12:00 A.M.	A.M. P.M. Tool Closed	1:10 P.M. A.M. P.M.	
Initial Hydro Mud Pres.	stylus not engaged		Remarks	Tool opened with a good blow on first flow			
Initial Closed in Pres.	no readings			of 5 minutes. Closed tool for a 20 minute initial			
Initial Flow Pres.	Charts not sent in			closed in pressure. Reopened tool for a 45 minute			
Final Flow Pres.				second flow with a good blow throughout test. Clos-			
Final Closed in Pres.				ed tool for a 20 minute final closed in pressure.			
Final Hydro Mud Pres.							

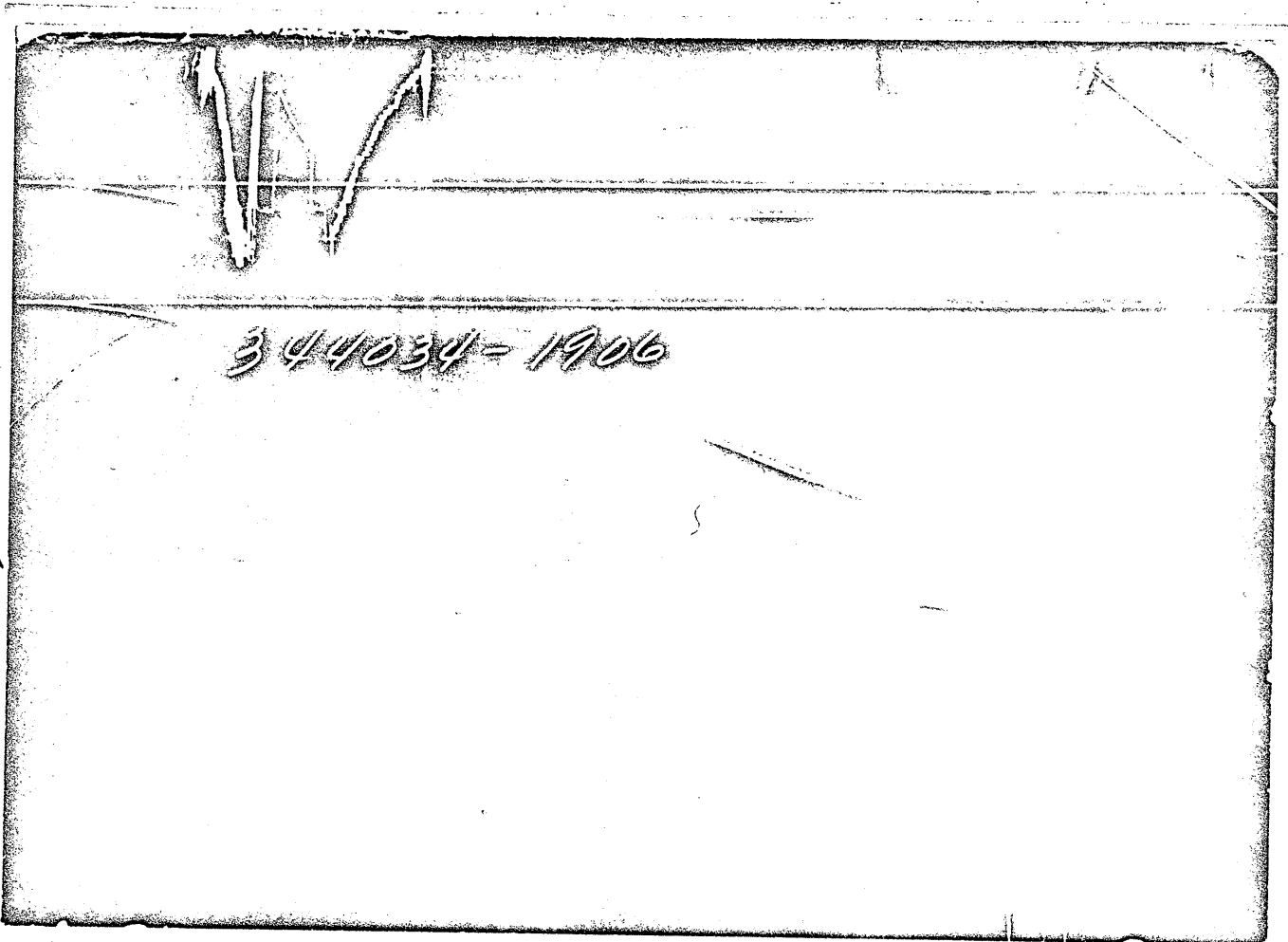
TULLICH
 Lease Name
 1
 Well No.
 3
 Test No.
 PLANET EXPLORATION
 Lease Owner/Company Name
 WILDCAT
 Field Area
 County
 State
 CASTERTON
 Owner's District
 VICTORIA

FORMATION TEST DATA

3-T

Gauge No. 1906		Depth 2932'			Clock 24 hour		Ticket No. 344034			
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	77	.000		139	.000	165	.000		696
P ₁	.0018	81	.007		1182	.0294	300	.0061		1167
P ₂	.0036	96	.014		1214	.0588	420	.0122		1191
P ₃	.0054	113	.021		1225	.0882	529	.0183		1201
P ₄	.0072	133	.028		1229	.1176	621	.0244		1208
P ₅	.0090	139	.035		1233	.1470	696	.0305		1212
P ₆			.042		1233			.0366		1214
P ₇			.049		1235			.0427		1216
P ₈			.056		1235			.0488		1218
P ₉			.063		1237			.0549		1220
P ₁₀			.070		1237			.0610		1220
Gauge No. 1907		Depth 2078'			Clock 24 hour					
P ₀	NOT SENT IN									
P ₁										
P ₂										
P ₃										
P ₄										
P ₅										
P ₆										
P ₇										
P ₈										
P ₉										
P ₁₀										
Reading Interval		1	2		9		2		Minutes	
REMARKS:										

SPECIAL PRESSURE DATA



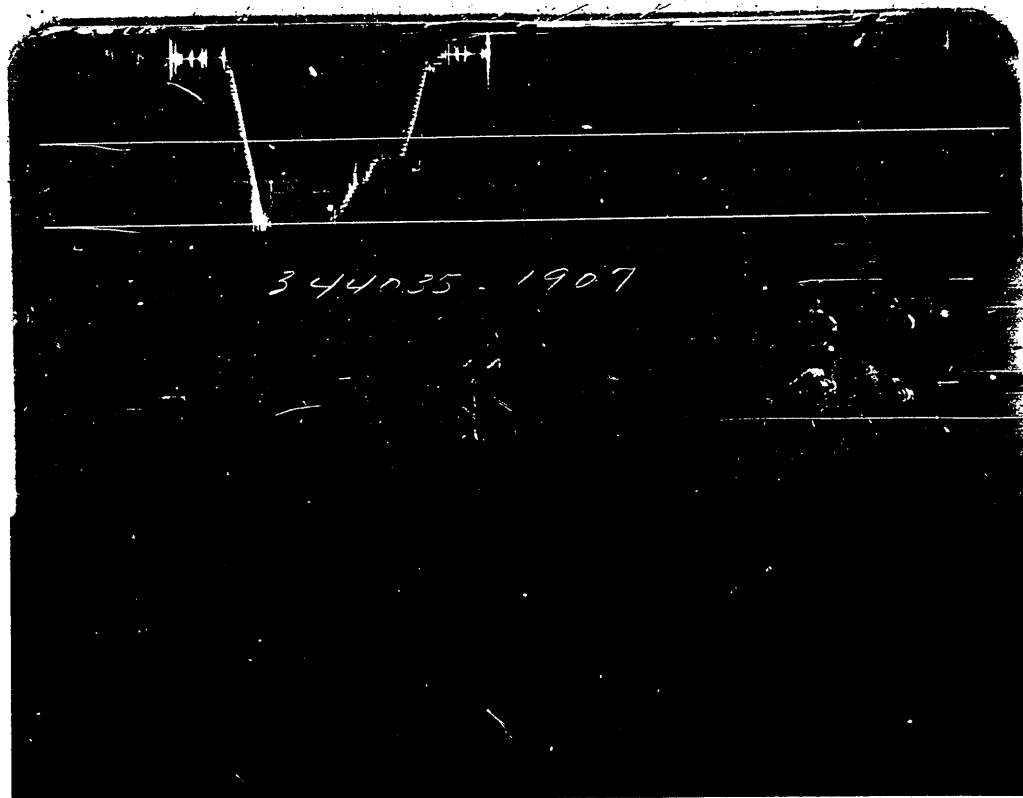
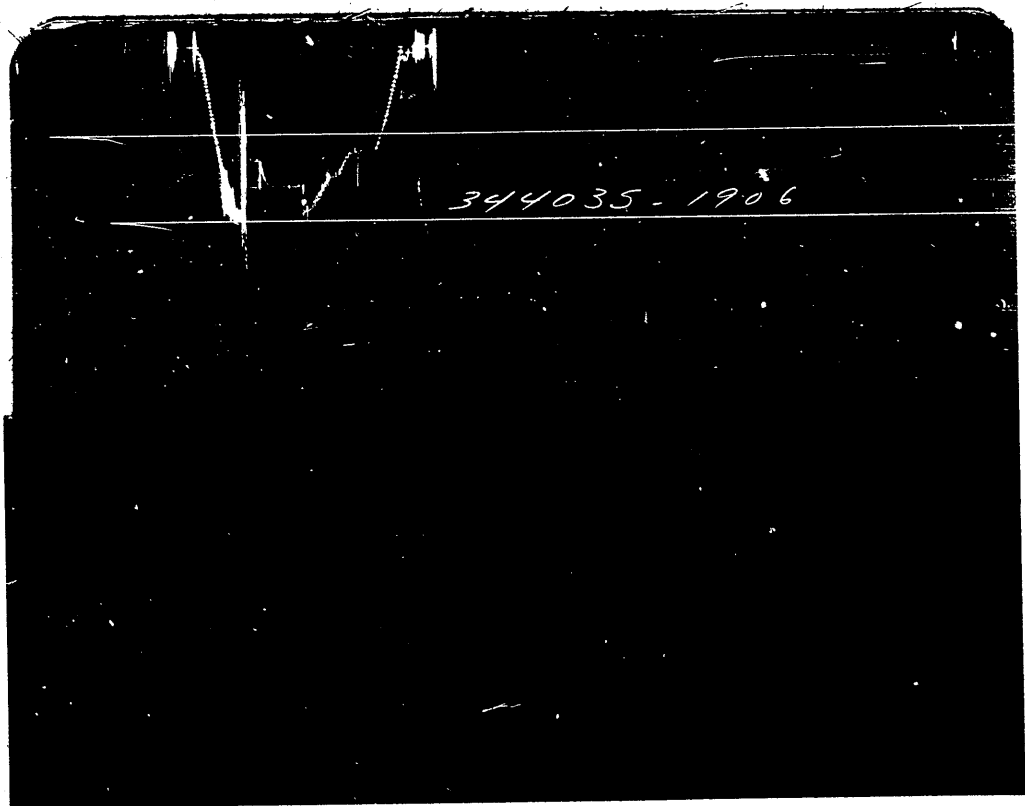
Flow Time	1st 5	Min.	2nd 45	Min.	Date	8-20-64	Ticket Number	344035	S	Legal Location Sec. - Twp. - Rng.	Lease Name	Well No.	Test No.	Field Area	WILDCAT	County	Lease Owner/Company Name	Owner's District	CASTERTON
Closed In Press. Time	1st 23	Min.	2nd 20	Min.	Kind of Job	OPEN HOLE	Halliburton District	CASTERTON											
Pressure Readings	Field		Office Corrected		Tester	R. HOUSE	Witness	J. CUNDILL											
Depth Top Gauge	3705	Ft.	No	Blanked Off	Drilling Contractor	AUSTRALIAN DRILLING CONTRACTORS		JM											
BT. P.R.D. No.	1906		24	Hour Clock	Elevation	-	Top Packer	3721'											
Initial Hydro Mud Pressure	1960		1943		Total Depth	3786'	Bottom Packer	-											
Initial Closed in Pres.	1620		1621		Interval Tested	3721-3786'	Formation Tested	Merino Group											
Initial Flow Pres.	240	1	865*		Casing or Hole Size	8 3/4"	Casing Perfs.	Top											
	1330	2	1347					Bot.											
Final Flow Pres.	-	1	1019*		Surface Choke	Nil	Bottom Choke	5/8"											
Final Closed in Pres.	1600		1621		Size & Kind Drill Pipe	4 1/2" FH	Drill Collars Above Tester	I.D. - LENGTH 2 7/8" - 225'											
Final Hydro Mud Pressure	1880		1875		Mud Weight	10	Mud Viscosity	54											
Depth Con. Gauge		Ft.		Blanked Off	Temperature	120	*F Est.	Anchor Size ID	65'										
BT. P.R.D. No.				Hour Clock	Depths Mea. From	Kelly Bushing	Depth of Tester Valve	3705' Ft.											
Initial Hydro Mud Pres.					TYPE AMOUNT		Depth Back Pres. Valve	Ft.											
Initial Closed in Pres.					Cushion	-													
Initial Flow Pres.		1			Recovered	500	Feet of Very gassy saltwater mud												
Final Flow Pres.		2			Recovered	3160	Feet of very gassy saltwater												
Final Closed in Pres.		1			Recovered		Feet of												
Final Hydro Mud Pres.					Recovered		Feet of												
Depth Bot. Gauge	3782	Ft.		Blanked Yes Off	Oil A.P.I. Gravity		Water Spec. Gravity												
BT. P.R.D. No.	1907		24	Hour Clock	Gas Gravity		Surface Pressure	psi											
Initial Hydro Mud Pres.	2040		1954		Tool Opened	10:30 p.m.	A.M. Tool Closed	11:43 p.m.	A.M. P.M.										
Initial Closed in Pres.	1680		1651		Remarks Tool opened for a 5 minute first flow,														
Initial Flow Pres.	1510	1	1508		rotated tool for a 23 minute initial closed in														
Final Flow Pres.	1530	2	1521		pressure. Reopened tool for a 45 minute second flow														
Final Closed in Pres.	1530	1	1525		Took a 20 minute final closed in pressure.														
Final Hydro Mud Pres.	1660	2	1649		No gas or water to the surface. Reversed through														
Final Closed in Pres.	1660		1649		pump out sub after pulling 700' of pipe.														

FORMATION TEST DATA * Questionable.

3

Gauge No. 1906			Depth 3705			Clock 24 hour		Ticket No. 344035			
First Flow Period		Initial Closed In Pressure			Second Flow Period		Final Closed In Pressure				
Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\phi}{\phi}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\phi}{\phi}$	PSIG Temp. Corr.		
P ₀	.000	865*	.000		1019	.000	1347	.000		1619	
P ₁	.012	1019*	.072		1621	.031	1557	.070		1621	
P ₂						.062	1614				
P ₃						.093	1617				
P ₄						.124	1619				
P ₅						.155	1619				
P ₆											
P ₇											
P ₈											
P ₉											
P ₁₀											
Gauge No. 1907			Depth 3782			Clock 24 hour					
P ₀	.000	1508	.000		1525	.000	1521	.000		1649	
P ₁	.011	1525	.0075		1645	.029	1594	.080		1649	
P ₂			.0150		1647	.058	1642				
P ₃			.0225		1649	.087	1647				
P ₄			.0300		1649	.116	1649				
P ₅			.0375		1649	.145	1649				
P ₆			.0450		1651						
P ₇			.0525		1651						
P ₈			.0600		1651						
P ₉			.0675		1651						
P ₁₀			.0750		1651						
Reading Interval			2.3			9		Minutes			
REMARKS:			* QUESTIONABLE.								

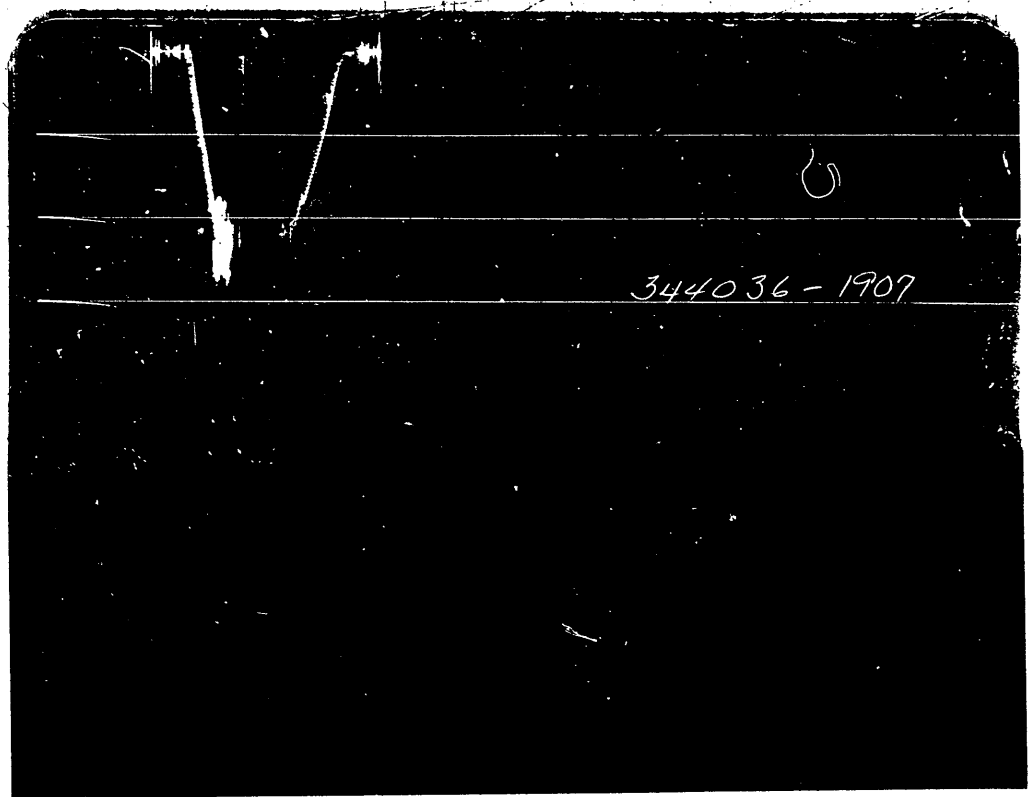
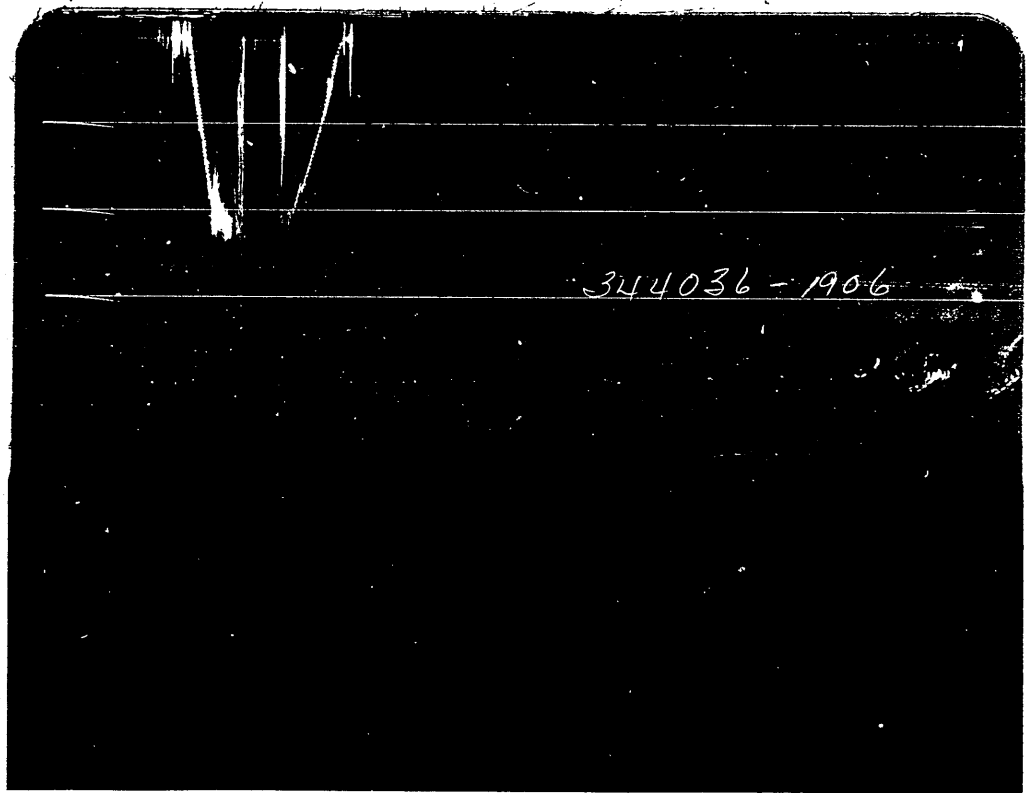
SPECIAL PRESSURE DATA



Flow Time	1st 5 Min.	2nd 30 Min.	Date	8-23-64	Ticket Number	344036	Legal Location Sec. - Twp. - Rng.
Closed In Press. Time	1st 15 Min.	2nd 15 Min.	Kind of Job	OPEN HOLE	Halliburton District	AUSTRALIA CASTERTON	
Pressure Readings	Field	Office Corrected	Tester	R. HOUSE	Witness	J. CUNDILL	Lease Name
Depth Top Gauge	4104 Ft.	no Blanked Off	Drilling Contractor	AUSTRALIAN DRILLING CONTRACTORS	BW		
BT. P.R.D. No.	1906	24 Hour Clock	Elevation		Top Packer	4120'	Well No.
Initial Hydro Mud Pressure	2150	2181	Total Depth	4185'	Bottom Packer		
Initial Closed in Pres.	110	123	Interval Tested	4120-4185'	Formation Tested	Merino Group	Test No.
Initial Flow Pres.	0	1 12 2 22	Casing or Hole Size	8 3/4"	Casing Perfs. Top Bot.		
Final Flow Pres.	0	1 12 2 22	Surface Choke	-	Bottom Choke	5/8"	Field Area
Final Closed in Pres.	25	32	Size & Kind Drill Pipe	4 1/2" FH	Drill Collars Above Tester	2 7/8" x 225'	
Final Hydro Mud Pressure	2150	2141	Mud Weight	10	Mud Viscosity	63	WILDCAT
Depth Cen. Gauge		Blanked Off	Temperature	120 °F Est. °F Actual	Anchor Size ID & Length OD	5" x 65'	
BT. P.R.D. No.		Hour Clock	Depths Mea. From	Kelly bushing	Depth of Tester Valve	4104 Ft.	County
Initial Hydro Mud Pres.			Cushion		Depth Back Pres. Valve		
Initial Closed in Pres.			Recovered	15 Feet of mud			State
Initial Flow Pres.		1	Recovered	Feet of			
Final Flow Pres.		2	Recovered	Feet of			VICTORIA
Final Closed in Pres.		1	Recovered	Feet of			
Final Hydro Mud Pres.			Oil A.P.I. Gravity		Water Spec. Gravity		Owner's District
Depth Bot. Gauge	4181 Ft.	yes Blanked Off	Gas Gravity		Surface Pressure	psi	
BT. P.R.D. No.	1907	24 Hour Clock	Tool Opened	12:35 pm A.M. P.M.	Tool Closed	1:25 pm A.M. P.M.	
Initial Hydro Mud Pres.	2230	2223	Remarks	Open tool for 5 mins first flow.			
Initial Closed in Pres.	155	160	Closed tool for 15 mins. Reopen tool with a				
Initial Flow Pres.	45	1 60	very weak blow throughout test. No oil or				
Final Flow Pres.	70	2 60	gas. Closed tool for 15 mins.				
Final Closed in Pres.	70	72	No special reading adaptable.				
Final Hydro Mud Pres.	2190	2166					

FORMATION TEST DATA

3



Flow Time	1st Min.	2nd Min.	Date	Ticket Number	Legal Location
5		40	8-28-64	344037 S	TULLICH Sec. - Typ. - Reg.
Closed In Press. Time	1st Min.	2nd Min.	Kind of Job	Halliburton District	
Pressure Readings	Field	Office Corrected	Tester	Witness	J. CUNDILL
Depth Top Gauge	4799 Ft.	Blanked No Off	Drilling Contractor	AUSTRALIAN DRILLING CONTRACTORS JM	
BT. P.R.D. No.	1906	24 Hour Clock	Elevation	Top Packer	4815'
Initial Hydro Mud Pressure	2430	2439	Total Depth	Bottom Packer	-
Initial Closed in Pres.	2030	2006	Interval Tested	Formation Tested	Merino Group
Initial Flow Pres.	-	1 32	Casing or Hole Size	Casing Perf.	Top Bot.
	90	2 82	8 3/4"		
Final Flow Pres.	65	1 67	Surface Choke	Bottom Choke	5/8"
	190	2 209	N.L.		
Final Closed in Pres.	1790	1794	Size & Kind Drill Pipe	Drill Collars Above Tester	I.D. - LENGTH 2 7/8" - 225'
Final Hydro Mud Pressure	2260	2309	Mud Weight	Mud Viscosity	74
Depth Cen. Gauge		Blanked Off	Temperature	Anchor Size & Length	ID 5" X 65'
			150	*F Est. *F Actual	
BT. P.R.D. No.		Hour Clock	Depths Mea. From	Depth of Tester Valve	4799' Ft.
			Kelly Bushing		
Initial Hydro Mud Pres.			TYPE AMOUNT	Depth Back Pres. Valve	Ft.
			Cushion	-	
Initial Closed in Pres.			Recovered	450	Feet of Gassy muddy water(Salt)
Initial Flow Pres.		1	Recovered		Feet of
		2			
Final Flow Pres.		1	Recovered		Feet of
		2			
Final Closed Pres.			Recovered		Feet of
Final Hydro Mud Pres.			Oil A.P.I. Gravity	Water Spec. Gravity	
Depth Bot. Gauge	4876 Ft.	Blanked Yes Off	Gas Gravity	Surface Pressure	psi
BT. P.R.D. No.	1907	24 Hour Clock	Tool Opened	A.M. P.M.	Tool Closed
			3:55 pm		5:00 pm
Initial Hydro Mud Pres.	2520	2489	Remarks Tool opened for a 5 minute first flow,		
Initial Closed in Pres.	2080	2042	rotated tool for a 20 minute initial closed in		
Initial Flow Pres.	90	1 78	pressure. Reopened tool for a 40 minute second		
	135	2 129	flow. Took a 15 minute final closed in pressure.		
Final Flow Pres.	135	1 103			
	270	2 237			
Final Closed in Pres.	1815	1807	Slight buildup on flow periods. No gas to the		
Final Hydro Mud Pres.	2430	2343	surface, No water to the surface.		

TULLICH
 Lease Name
 1
 Well No.
 6
 Test No.
 WILDCAT
 Mea. From Tester Valve
 County
 State
 VICTORIA
 PLANET EXPLORATION
 Lease Owner/Company Name
 CASTERTON
 Owner's District

FORMATION TEST DATA

3

Gauge No. 1906		Depth 4799			Clock 24 hour		Ticket No. 344037			
First Flow Period		Initial Closed In Pressure			Second Flow Period		Final Closed In Pressure			
	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\phi}$	PSIG Temp. Corr.	Time Defl. .000"	PSIG Temp. Corr.	Time Defl. .000"	Log $\frac{t+\theta}{\phi}$	PSIG Temp. Corr.
P ₀	.000	32	.000		67	.000	82	.000		209
P ₁	.004	37	.0055		1693	.033	135	.0047		871
P ₂	.008	43	.0110		1805	.066	159	.0094		1333
P ₃	.012	52	.0165		1867	.099	181	.0141		1502
P ₄	.016	60	.0220		1905	.132	209	.0188		1578
P ₅	.020	67	.0275		1932			.0235		1640
P ₆			.0330		1953			.0282		1682
P ₇			.0385		1970			.0329		1712
P ₈			.0440		1983			.0376		1737
P ₉			.0495		1992			.0423		1761
P ₁₀			.0550		2006			.0470		1794
Gauge No. 1907		Depth 4876			Clock 24 hour					
P ₀	.000	78	.000		103	.000	129	.000		237
P ₁	.004	76	.0057		1646	.0335	179	.0048		650
P ₂	.008	80	.0114		1818	.0670	192	.0096		1086
P ₃	.012	87	.0171		1895	.1005	214	.0144		1457
P ₄	.016	96	.0228		1938	.1340	237	.0192		1569
P ₅	.020	103	.0285		1967			.0240		1637
P ₆			.0342		1991			.0288		1690
P ₇			.0399		2009			.0336		1727
P ₈			.0456		2022			.0384		1760
P ₉			.0513		2033			.0432		1785
P ₁₀			.0570		2042			.0480		1807
Reading Interval		1	2			10		1.5		Minutes
REMARKS:										

SPECIAL PRESSURE DATA

Gauge No.		1906		Depth		4964'		Clock		24 hour		Ticket No.		344038	
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	28	.000		41	.000	54	.000		174					
P ₁	.0042	32	.0056		1544	.0998	105	.0058		301					
P ₂	.0084	34	.0112		1720	.1996	133	.0116		550					
P ₃	.0126	37	.0168		1814	.2994	155	.0174		860					
P ₄	.0168	41	.0224		1875	.399	174	.0232		1047					
P ₅	.021	41	.0280		1917			.0290		1178					
P ₆			.0336		1949			.0348		1271					
P ₇			.0392		1970			.0406		1345					
P ₈			.0448		1989			.0464		1409					
P ₉			.0504		2006			.0522		1441					
P ₁₀			.056		2019			.058		1477					
Gauge No.		1907		Depth		5041'		Clock		24 hour					
P ₀	.000	78	.000		89	.000	109	.000		203					
P ₁	.0034	78	.0058		1490	.0995	138	.0063		379					
P ₂	.0068	78	.0116		1736	.1990	165	.0126		596					
P ₃	.0102	78	.0174		1840	.2985	185	.0189		833					
P ₄	.0136	89	.0232		1901	.398	203	.0252		1009					
P ₅	.017	89	.0290		1945			.0315		1176					
P ₆			.0348		1974			.0378		1295					
P ₇			.0406		2000			.0441		1369					
P ₈			.0464		2020			.0504		1431					
P ₉			.0522		2035			.0567		1481					
P ₁₀			.058		2046			.063		1512					
Reading Interval		1		2		30		2		Minutes					
REMARKS:															

SPECIAL PRESSURE DATA

Flow Time	1st 5 Min.	2nd 120 Min.	Date	8-30-64	Ticket Number	344038 - S	Legal Location Sec. - Twp. - Rng.
Closed In Press. Time	1st 20 Min.	2nd 20 Min.	Kind of Job	OPEN HOLE	Halliburton District	CASTERTON	
Pressure Readings	Field	Office Corrected	Tester	HOUSE	Witness	CUNDILL	
Depth Top Gauge	4964' Ft.	NO Blanked Off	Drilling Contractor	AUSTRALIAN DRILLING CONTRACTORS	BM		
BT. P.R.D. No.	1906	24 Hour Clock	Elevation	-	Top Packer	4980'	
Initial Hydro Mud Pressure	2550	2629	Total Depth	5045'	Bottom Packer	-	
Initial Closed in Pres.	1960	2019	Interval Tested	4980' - 5045'	Formation Tested	MERINA GROUP	
Initial Flow Pres.	00	1 28	Casing or Hole Size	8 3/4"	Casing } Top	-	
Final Flow Pres.	40	2 54	Surface Choke	-	Perfs. } Bot.	-	
Final Closed in Pres.	1450	1477	Size & Kind Drill Pipe	4 1/2" F.H.	Drill Collars Above Tester	2 7/8" - 225'	
Final Hydro Mud Pressure	2390	2426	Mud Weight	9.7	Mud Viscosity	59	
Depth Cen. Gauge		Blanked Off	Temperature	150 °F Actual	Anchor Size ID & Length	5" X 65'	
BT. P.R.D. No.		Hour Clock	Depths Mea. From	KELLY BUSHING	Depth of Tester Valve	4964' Ft.	
Initial Hydro Mud Pres.			Cushion	NONE	Depth Back Pres. Valve	- Ft.	
Initial Closed in Pres.			Recovered	400' Feet of muddy gassy water			
Initial Flow Pres.			Recovered	Feet of			
Final Flow Pres.			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	5041' Ft.	YES Blanked Off	Gas Gravity		Surface Pressure	psi	
BT. P.R.D. No.	1907	24 Hour Clock	Tool Opened	7:40 AM	Tool Closed	10	
Initial Hydro Mud Pres.	2650	2677	Remarks	Tool opened for a 5 minute first flow. Ro-			
Initial Closed in Pres.	2040	2046	tated tool for a 20 minute initial closed in press-				
Initial Flow Pres.	50	1 78	ure. Tool reopened with a slight initial displaced				
Final Flow Pres.	90	2 109	air blow - increasing to a moderate with a weak gas				
Final Closed in Pres.	1510	1512	air mixture to the surface after 1 hour - too small				
Final Hydro Mud Pres.	2430	2451	to measure. Blow died to a very weak blow after 1				
			hour and 45 minutes. Took a 20 minute final closed				
			in pressure.				

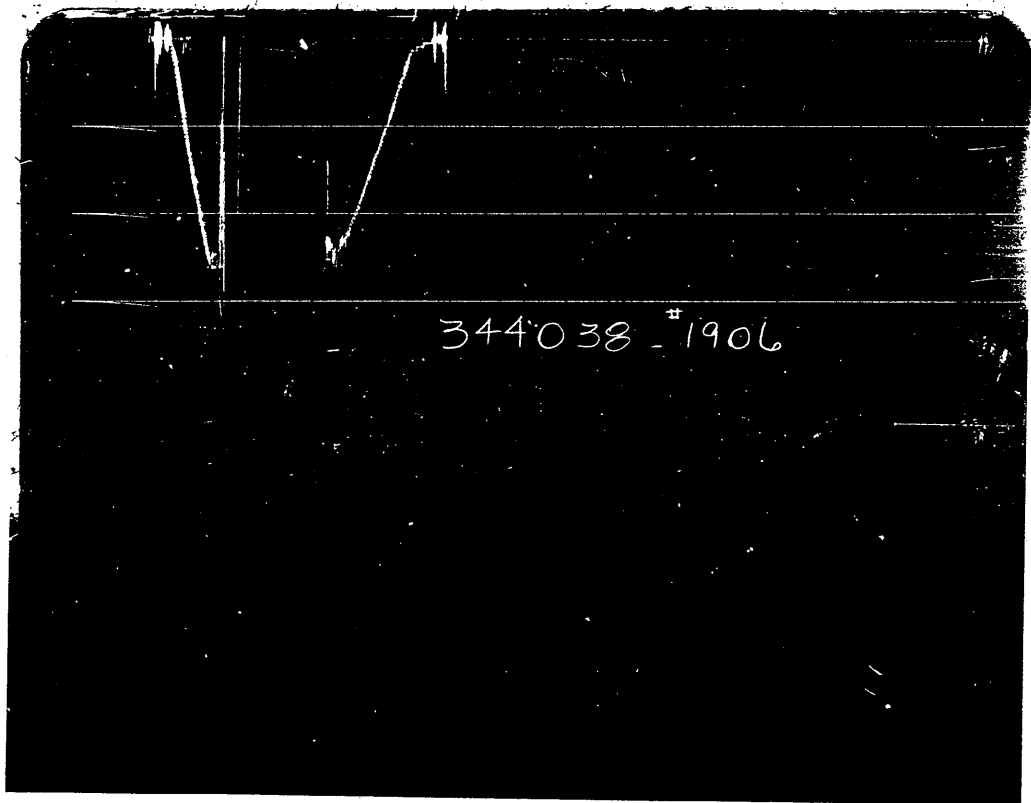
TULLOCH
 Lease Name
 1
 Well No.
 7
 Test No.
 CASTERTON
 Field Area
 Country
 VIC
 State
 VICTORIA
 Owner's District
 PLANET EXPLORATION COMPANY
 Lease Owner/Company Name

FORMATION TEST DATA

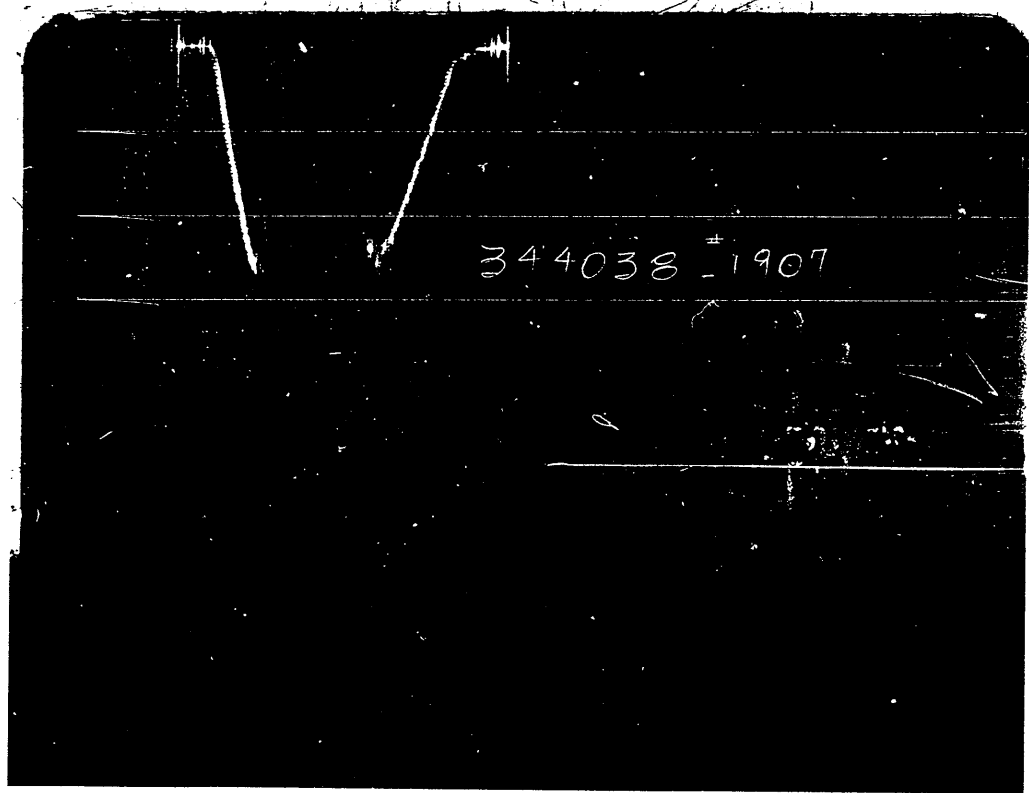
3

APPENDIX E

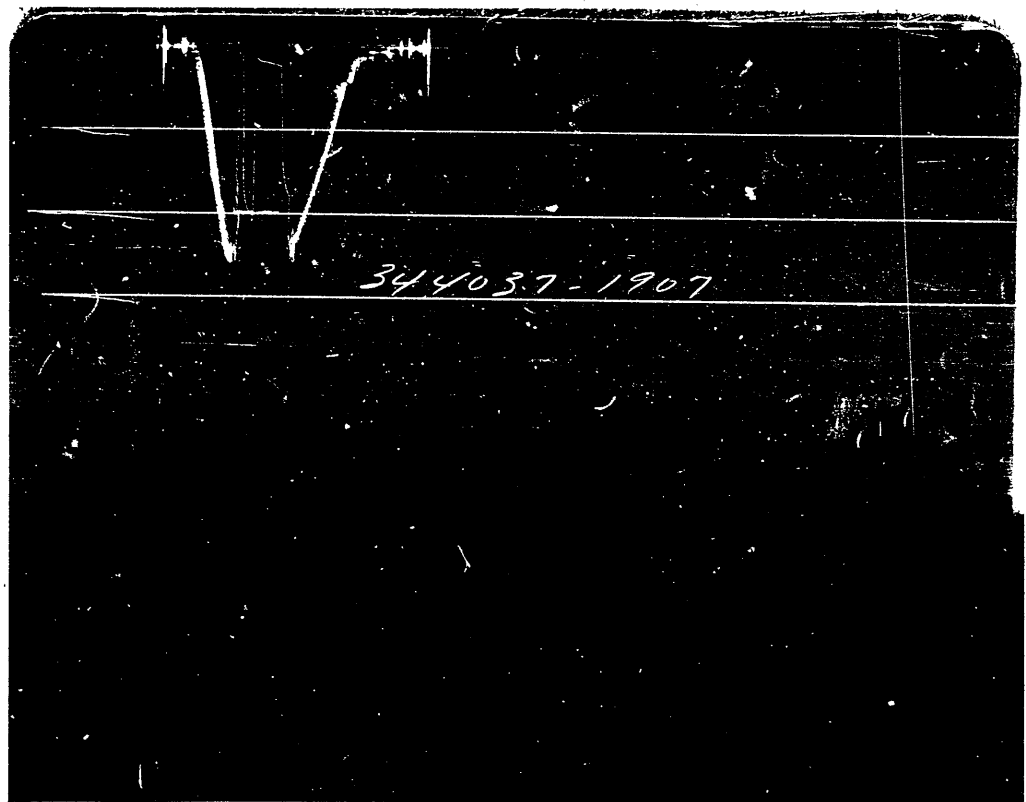
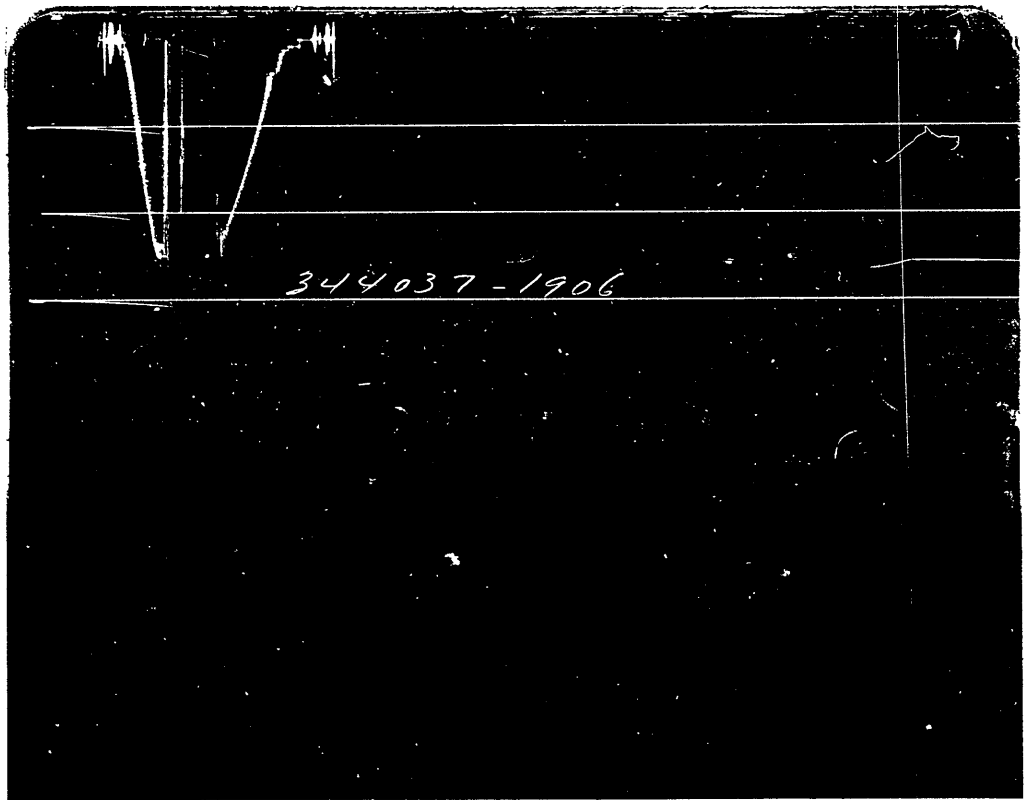
Plotted Dipmeter Results.

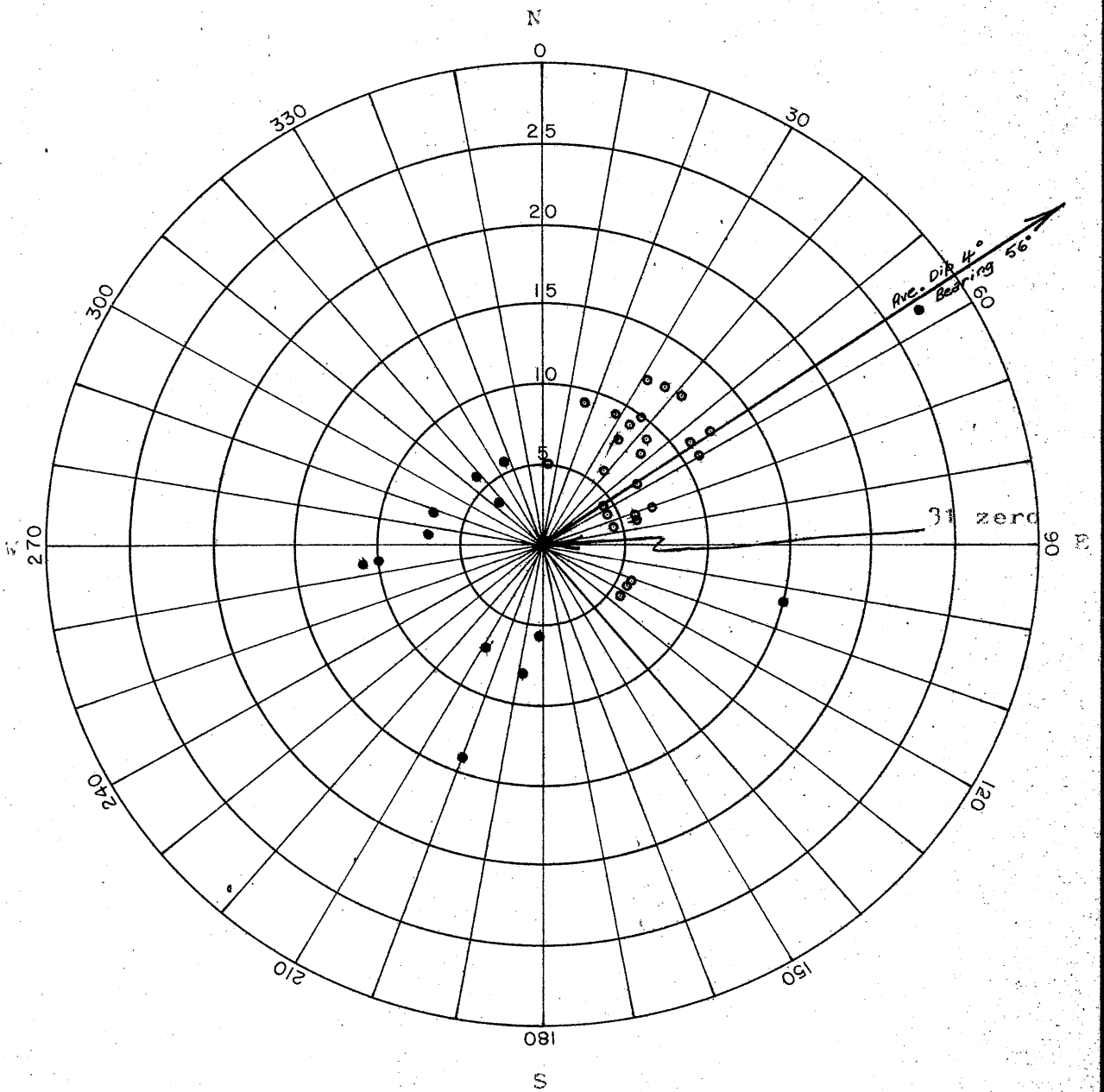


344038 #1906



344038 #1907





- Readings - Valid (25)
- Readings - Rejected (13)

TULLICH NO. 1.

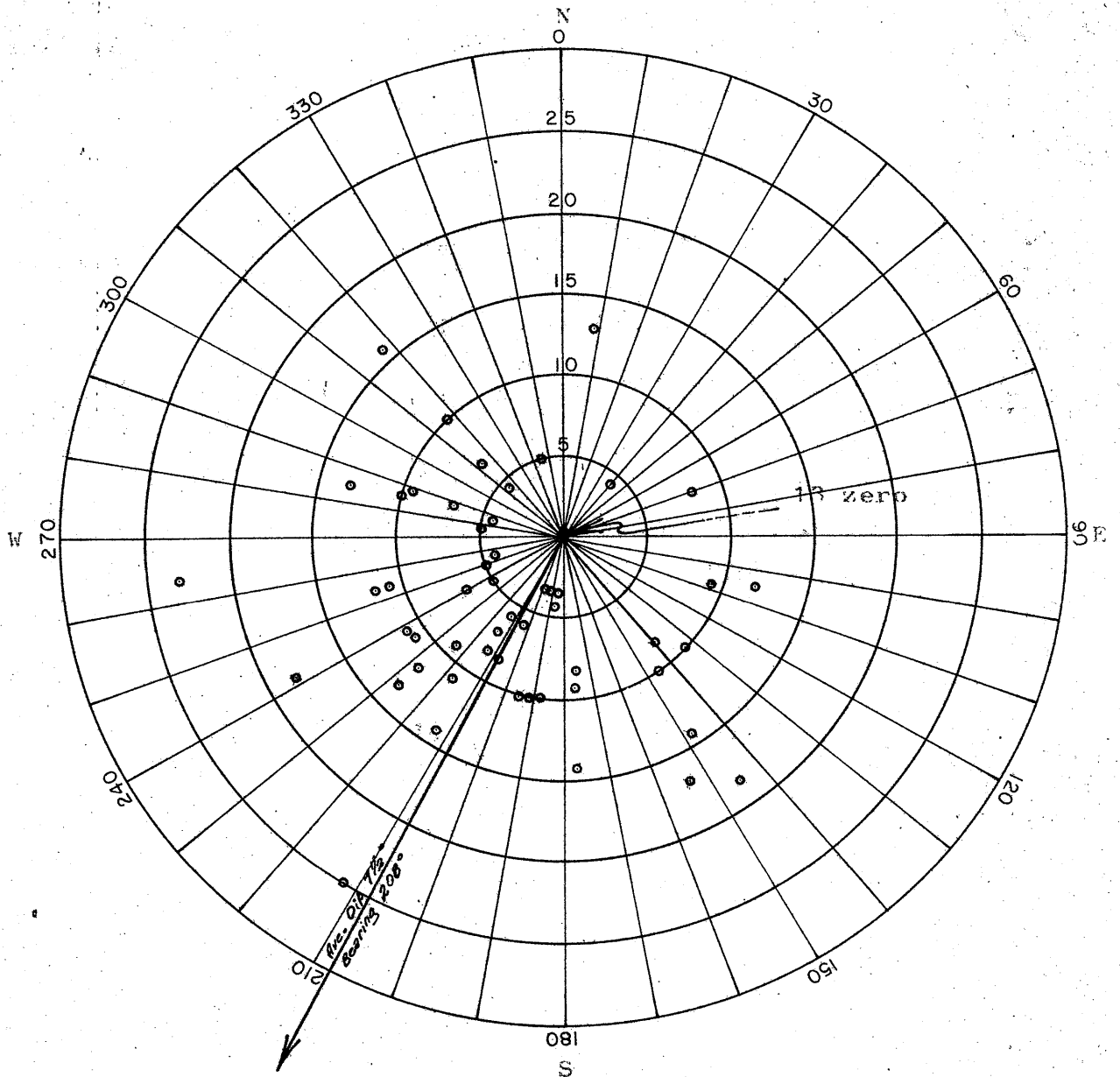
Continuous dipmeter Readings.

1580' - 3178'

Average Dip 4° , bearing 56° .

PLANET EXPLORATION COMPANY PTY. LTD.

P.E.P. 26 - VICTORIA.



TULLICH NO. 1.

Continuous Dipmeter Readings.

3221' - 5327'

Average Dip $7\frac{1}{2}^{\circ}$, bearing 208° .

55 readings - none rejected.

PLANET EXPLORATION COMPANY PTY. LTD.

P.E.P. 26 - VICTORIA.

APPENDIX F

Palaeontological Report.

510.

MGM.:

All communications should be addressed
SECRETARY FOR MINES

Telephone: 63 0321



DEPARTMENT OF MINES
TREASURY BUILDINGS
MELBOURNE, C.2

16th September, 1964

Mr. J. G. Fuller, ✓
Managing Director,
Planet Oil Company N.L.,
2 O'Connell Street,
SYDNEY N.S.W.

Dear Mr. Fuller,

Enclosed is a palaeontological report on
cores from the Tullich No. 1 Well by a Geologist
of this Department, Mr. J. Douglas.

Yours faithfully,

J. L. KNIGHT,
A/g. Director of Geological Survey

Encl.

Copy to Mr. Cundill, please.

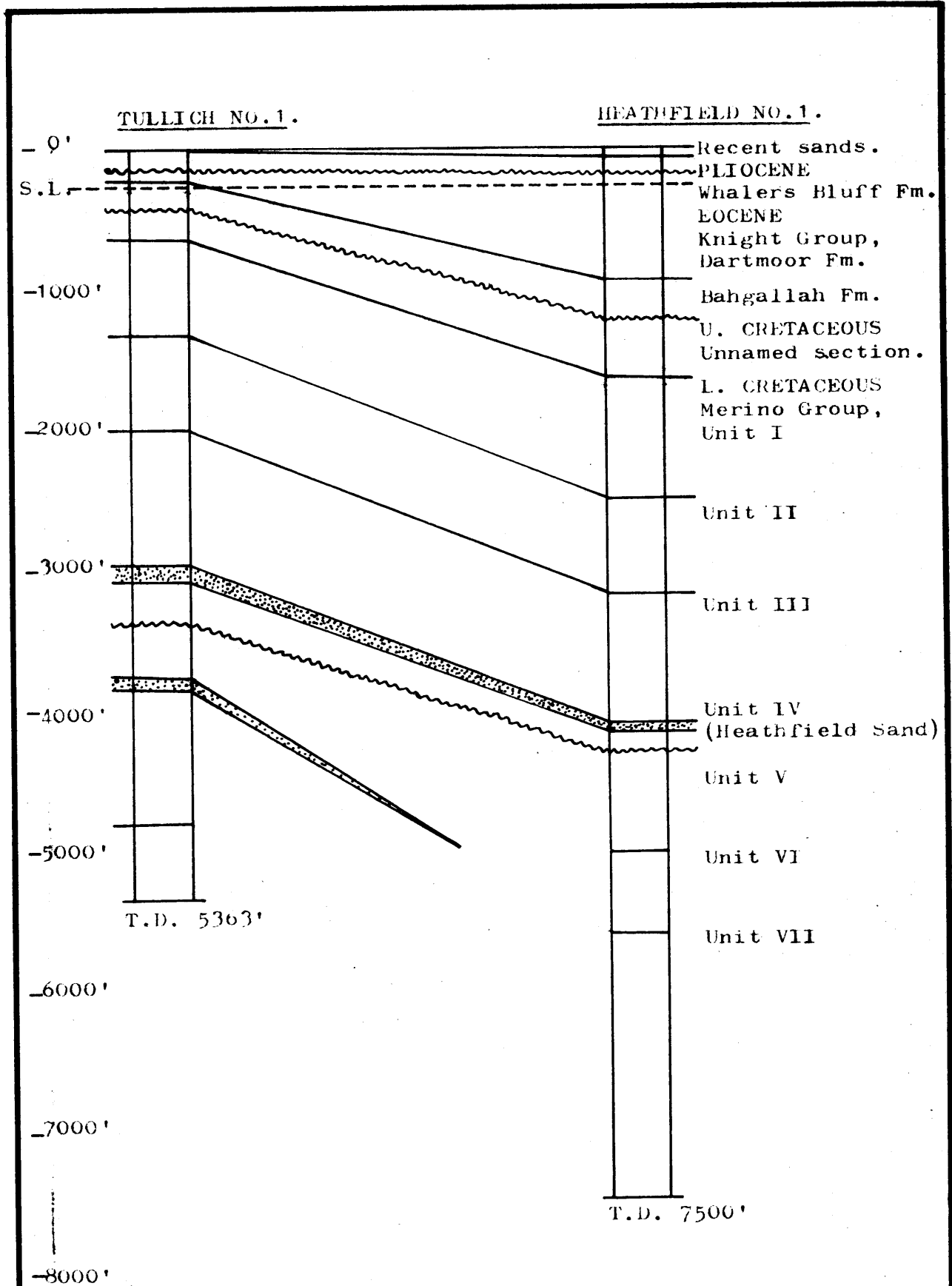
MICROFOSSILS AND PLANT REMAINS, TULLICH NO. 1. WELL

Cores from Planet Tullich No.1. Well were treated by hydrofluoric acid - Schulze's solution method, and the acid insoluble residues examined for microfossils. Other cores were treated by hydrofluoric acid, and then macerated to obtain plant cuticles.

Results of Examination.

- Core 1. (538' - 548')..... No microfossils observed.
- Core 3. (1051' - 1053')... No micro-fossils observed.
- Core 4. (1520' - 1551')... Two samplings. Dinoflagellates of an assemblage type not previously noted from Western Victoria were isolated with less frequent and gymnosperm pollens. Large dinoflagellates and acritarchs appeared to be absent, but due to my unfamiliarity with this assemblage I am unable to give a geological dating for the host sediments. From the associated plant microfossils I would consider the beds to be Cretaceous age, but cannot at this juncture, be more specific.
- The second sample treated (from a different piece of core) did not appear to contain microfossils.
- Core 5. (2051 - 2061') Prolific Lower Cretaceous microflora including Cicatricosisporites, Cyathidites, and Aequitriradites species, and gymnosperm pollens.
- Core 6. (2556' - 2566') No microfossils observed.
- Core 12. Maceration of samples from this core has resulted in a mass of cuticular remains, the most common form represented being Rievitsea ? variabitis ws. (Douglas Ms. and Mines Dept. Unpublished Report 1963/70). This form listed as Thinnfeldia pinnata Walkom was cursorily described (cuticle from upper surface of pinna only) from Core 15 (3917' - 3928') of the ODNL Penola No.1. Well (B.M.R. Well Completion Report, Publication No. 42, Appendix 4. Another portion of this core (12) showed mega remains, including leaf impressions of the form called Taeniopteris spatulata as well as isolated fruit and cone bodies, and pinnal from R ? variabitis as above. After further examination a more complete description will be made of this mega flora, and a report forwarded.

Original signed..... John Douglas, Geologist.



PLANET EXPLORATION COMPANY PTY. LIMITED

TULLICH NO. 1.

CROSS SECTION AFTER DRILLING

Scale : 1" = 1000' (Vert)

ENCLOSURE 4.

PE602051

This is an enclosure indicator page.
The enclosure PE602051 is enclosed within the
container PE903979 at this location in this
document.

The enclosure PE602051 has the following characteristics:

- ITEM_BARCODE = PE602051
- CONTAINER_BARCODE = PE903979
 - NAME = Composite Well Log
 - BASIN = OTWAY
 - PERMIT = PEP 26
 - TYPE = WELL
 - SUBTYPE = COMPOSITE_LOG
- DESCRIPTION = Composite Well Log, sheet 1 of 2,
(enclosure from WCR) for Tullich-1
- REMARKS =
- DATE_CREATED = 2/09/64
- DATE_RECEIVED =
 - W_NO = W485
 - WELL_NAME = Tullich-1
- CONTRACTOR =
- CLIENT_OP_CO = PLANET EXPLORATION COMPANY PTY LTD

(Inserted by DNRE - Vic Govt Mines Dept)

PE602052

This is an enclosure indicator page.
The enclosure PE602052 is enclosed within the
container PE903979 at this location in this
document.

The enclosure PE602052 has the following characteristics:

- ITEM_BARCODE = PE602052
- CONTAINER_BARCODE = PE903979
- NAME = Composite Well Log
- BASIN = OTWAY
- PERMIT = PEP 26
- TYPE = WELL
- SUBTYPE = COMPOSITE_LOG
- DESCRIPTION = Composite Well Log, sheet 2 of 2,
(enclosure from WCR) for Tullich-1
- REMARKS =
- DATE_CREATED = 2/09/64
- DATE_RECEIVED =
- W_NO = W485
- WELL_NAME = Tullich-1
- CONTRACTOR =
- CLIENT_OP_CO = PLANET EXPLORATION COMPANY PTY LTD

(Inserted by DNRE - Vic Govt Mines Dept)

PE907609

This is an enclosure indicator page.
The enclosure PE907609 is enclosed within the
container PE903979 at this location in this
document.

The enclosure PE907609 has the following characteristics:

- ITEM_BARCODE = PE907609
- CONTAINER_BARCODE = PE903979
- NAME = Geological Map
- BASIN = OTWAY
- PERMIT = PEP26
- TYPE = WELL
- SUBTYPE = GEOL_MAP
- DESCRIPTION = Geological Map, Otway Basin showing
proposed Tullich-1 (enclosure from WCR)
for Tullich-1
- REMARKS =
- DATE_CREATED = 31/07/64
- DATE_RECEIVED =
- W_NO = W485
- WELL_NAME = Tullich-1
- CONTRACTOR =
- CLIENT_OP_CO = Planet Exploration Company Pty Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

PE907610

This is an enclosure indicator page.
The enclosure PE907610 is enclosed within the
container PE903979 at this location in this
document.

The enclosure PE907610 has the following characteristics:

ITEM_BARCODE = PE907610
CONTAINER_BARCODE = PE903979
NAME = Well Correlation Chart
BASIN = OTWAY
PERMIT = PEP26
TYPE = WELL
SUBTYPE = WELL_CORRELATION
DESCRIPTION = Well Correlation, Structure Drilling
Program, Casterton Area, (enclosure
from WCR) for Tullich-1
REMARKS =
DATE_CREATED = 31/12/64
DATE_RECEIVED =
W_NO = W485
WELL_NAME = Tullich-1
CONTRACTOR =
CLIENT_OP_CO = Planet Exploration Company Pty Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

PE907611

This is an enclosure indicator page.
The enclosure PE907611 is enclosed within the
container PE903979 at this location in this
document.

The enclosure PE907611 has the following characteristics:

ITEM_BARCODE = PE907611
CONTAINER_BARCODE = PE903979
 NAME = Well Card
 BASIN = OTWAY
 PERMIT = PEP26
 TYPE = WELL
 SUBTYPE = WELL_CARD
DESCRIPTION = Well Card, 1 of 2, (enclosure from WCR)
 for Tullich-1
REMARKS =
DATE_CREATED = 2/09/64
DATE_RECEIVED =
 W_NO = W485
 WELL_NAME = Tullich-1
CONTRACTOR = Panet Exploration Company Pty Ltd
CLIENT_OP_CO = Planet Exploration Company Pty Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

PE907612

This is an enclosure indicator page.
The enclosure PE907612 is enclosed within the
container PE903979 at this location in this
document.

The enclosure PE907612 has the following characteristics:

ITEM_BARCODE = PE907612
CONTAINER_BARCODE = PE903979
NAME = Well Card
BASIN = OTWAY
PERMIT = PEP26
TYPE = WELL
SUBTYPE = WELL_CARD
DESCRIPTION = Well Card, 2 of 2, (enclosure from WCR)
for Tullich-1
REMARKS =
DATE_CREATED = 2/09/64
DATE_RECEIVED =
W_NO = W485
WELL_NAME = Tullich-1
CONTRACTOR = Panet Exploration Company Pty Ltd
CLIENT_OP_CO = Planet Exploration Company Pty Ltd

(Inserted by DNRE - Vic Govt Mines Dept)