

MILTON NO. 1

WELL COMPLETION REPORT

DEPT. NAT. RES & ENV



PE902835

ASHBURTON OIL N.L.

WCR
MILTON-1
(W564)

MILTON NO. 1

WELL COMPLETION REPORT

by

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May, 1970

Ashburton Oil N.L.

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I SUMMARY

(1) Drilling

The well was drilled using a Cardwell H.L. rig owned and operated by W.L. Sides and Son Pty. Ltd.. From surface to 846 feet the hole was drilled with air and from 846 feet to T.D. a lightly treated polymer mud was used. The hole was spudded on the 13th November, 1969 and the rig released 59 days later on the 13th January, 1970. The hole sizes were 12¼ inch to 445 feet, 8½ inch to 4088 feet, 4³/₄ inch to 4098 feet. Casing of 9⁵/₈ inch diameter was set to 440 feet and cemented.

The hole was plugged and abandoned.

(2) Geology

Milton No.1 was located in the Buchan Synclinorium (Enclosure 1) in which the only prospective sediments appear to be of Devonian age. It has been described as the remnant of a much more extensive unmetamorphosed middle Devonian sedimentary succession preserved by faulting and downwarping. The structure consists of a series of narrow N-S anticlines within the main Synclinorium.

The well was sited on one of these surface anticlines with the possible targets of primary or secondary porosity in the Buchan Caves Limestone, secondary porosity in the Snowy River Volcanics, or reef developments in the Taravale Formation.

Milton No.1 was spudded in the Taravale Formation, which consists of calcilutite with irregular lenses of limestone in the upper part, whilst at depth limestone is predominant. Fossils are rare but Tentaculites and ostracods were noted.

Porosity and permeability are generally lacking, the majority of fractures being healed by coarsely crystalline calcite. Minor gas kicks were recorded and circulation losses occurred presumably from small fracture or fault zones.

From 2663 feet to 4030 feet the Buchan Caves Limestone was drilled. This is typically a tan-medium greyish brown limestone, argillaceous, very finely crystalline, and very fossiliferous. Below 3470 feet a dolomite member was encountered. Both these rock types are dense and tight, almost completely lacking in porosity and permeability except for minor fractures.

The Snowy River Volcanics was drilled from 4030 feet to total depth. These were described as chloritic tuffs with minor amounts of pyrite and galena. No shows were recorded.

Interpretation of electric logs and dipmeter charts confirmed the fact that the section drilled was dense and tight. Moderately steep dips were recorded and faulting was obvious. No formation testing was considered to be justified. The section drilled was as predicted in the previous geological investigations but the lack of porosity and permeability have downgraded the petroleum potential of this area.

II INTRODUCTION

Until the drilling of Milton No.1 the Buchan area had not been tested by a deep well. Extensive surface mapping had been carried out and the exposed section had been studied in some detail by a number of people.

It seemed likely that a reasonably thick section of Devonian sediments existed in this area and their geological history was such that it was probable that they had not been subjected to metamorphism.

It was postulated that possible source rocks were the Taravale Formation or the Buchan Caves Limestone; Talent (1956) has recorded hydrocarbon indications in the latter formation. These two formations were also regarded as possibly reservoirs in company with the Snowy River Volcanics. In outcrop none of these formations appeared to have primary porosity therefore it was hoped to encounter an accumulation of oil either in fractures in the Taravale, Buchan Caves Limestone, or Snowy River Volcanics with the secondary chance that the reservoir characteristics of either the Taravale or Buchan Caves might alter with depth. Furthermore the presence of reefs in the Taravale Formation to the north and in the Buchan Caves Limestone to the south suggests the subsurface reefs may occur in the area. In either event the characteristics of the upper portion of the Taravale Formation as known from outcrop would make an ideal cap rock.

The size of the Buchan Synclinorium and the nature of the probable section were such that it was considered uneconomic to carry out detailed geophysical work in an attempt to site the well. In view of the fact that the sediments at depth were completely unknown it was considered that a combined structural stratigraphic test would contribute more to the assessment of the area. Accordingly the well was sited on a surface anticline in the hope that this structure would persist at depth.

The validity of this approach was confirmed by the nature and structural attitude of the section drilled. In view of the density and steep dips of the Devonian sediments it seems unlikely that seismic methods would prove satisfactory in this area.

III WELL HISTORY

(1) General Data

(i) Well Name and Number:

Milton No.1

(ii) Name and Address of Operator:

Ashburton Oil N.L.,
184 Adelaide Terrace,
PERTH, W.A. 6000

Victorian Address:

Ashburton Management Pty. Ltd.,
B & R Agents Pty. Ltd.,
120 William Street,
MELBOURNE, Vic. 3000

(iii) Name and Address Title Holder:

George Milton,
C/- Heine Bros. Aust. Pty. Ltd.,
473 Bourke Street,
MELBOURNE, Vic. 3000

(iv) Details of Title:

The area is held under farmout from George Milton according to an agreement dated the 26th May, 1969. Milton is the holder of Petroleum Exploration Permit No.65 issued pursuant to the Petroleum Act 1958 of the State of Victoria relating to certain lands in the State of Victoria comprising approximately 197 square miles. Ashburton has agreed to drill certain test wells within that area and thereby earn an interest in the concession.

(v) District:

Bairnsdale 1: 250,000 map sheet

(vi) Location:

Latitude 37° 31' 31" S
Longitude 148° 10' 34" E

- (vii) Elevation:
 - (1) Ground level 757 feet
 - Rotary table 767 feet 234 m
 - (2) Datum for depth measurement
 - Rotary table
- (viii) Total Depth:
 - 4098 feet
- (ix) Date Drilling Commenced:
 - 13/11/69
- (x) Date Total Depth Reached:
 - 12/1/70
- (xi) Date Well Abandoned:
 - 13/1/70
- (xii) Date Rig Released:
 - 13/1/70
- (xiii) Drilling Time to Total Depth:
 - 59 days
- (xiv) Status:
 - Plugged and abandoned
- (xv) Total Cost:
 - \$139,205.00

(2) Drilling Data:

- (i) Drilling Contractor: W.L. Sides & Son Pty. Ltd.,
Wellington Road,
CLAYTON, Vic. 3168
- (ii) Drilling Plant:
 - Make: Cardwell Model HL.
 - Type: Trailer
 - Capacity: 4500 feet 3½ Drill Pipe
 - Engines: Two GMC 6 - 71 Diesels. 145 BHP each.

(iii) Mast.

Design: Cardwell
Type: Telescopic Mast.
Rated Capacity: 200000 lb.

(iv) Pumps No. 1 No. 2

Make:	Gardner Denver	National Ideal
Type:	FXO	D - 50
Size:	7½ x 10	5 x 10
Motors:	GMC 6 - 71 Diesel	Thornicroft Diesel
BHP:	145	93

(v) Blow Out Preventor Equipment:

Make:	Shaffer	Hydril
Type:	Double Gate (Mechanical)	Packer
Size:	10 inch	10 inch
Series:	900	900

(vi) Hole Sizes and Depth:

12¼ inch to 445 feet
8½ inch to 4088 feet
4³/₄ inch to 4098 feet

(vii) Casing and Liner and Cementing Details:

↘ Size: 9⁵/₈
Weight: 36 lb/ft.
Grade: J55
Range: 2
↘ Setting Depth: 440 feet
Float Shoe: Run on bottom
Float Collar: Top first joint
Centralizers: Top 1st, 2nd, 3rd joint
Cemented with: 180 sacks construction cement
Cement returns to surface
↘ Method used: Double plug

(viii) Drilling Fluid:

Surface to 846: Drilled with air
846 feet to TD: Drilled with lightly treated
polymer mud

Average Properties:

Weight 65 - 70 Viscosity 32 - 40 W.L. 8 - 20
Sand $\frac{1}{4}$ - 1% pH 8 - 9

Mud Used:

Super Col	250 sacks
Polymer	610 lbs.
Chrome Alum.	320 lbs.
Paraformaldehyde	396 lbs.
Cellucol	232 lbs.
Sawdust	80 sacks

(ix) Water Supply:

Carted from Buchan River

(x) Perforating etc.:

Nil

(xi) Plug Back:

Plug No. 1

80 sacks construction cement 2% calcium chloride
open ended pipe at 500 feet. Tagged top at 630 feet.

Plug No. 2

75 sacks construction cement 2% calcium chloride
open ended pipe at 500 feet. Tagged top at 380 feet.

Plug No. 3

20 sacks construction cement in top casing welded
plate on top casing.

(xii) Fishing Operations

Depth 37 feet; nature of fish drillhead from
Ingersoll-rand down hole hammer. 100% recovered

(xiii) Side Tracked Hole

Nil

(3) Location

(i) Site Investigations

The site was located in a lucerne paddock approximately $\frac{3}{4}$ mile from a bitumen road. Access was by way of a farm track which required some grading and metalling. This was carried out by local contractors who also constructed the mud pits, access gates etc..

(ii) Transportation

The rig was trailer mounted and no problems of transportation were encountered.

(4) Formation Sampling

(i) Ditch Cuttings

These were collected at 10 feet intervals throughout always from the shale shakers whilst drilling with water and from the end of the flow line when drilling with air. They were all depth corrected, dried and split at the well site. Cuts were made for the Bureau of Mineral Resources, Victorian Dept. of Mines, Ashburton Oil N.L., and George Milton. A larger sample of approximately 1 Kg was gathered at 50 feet intervals. Samplex trays were made up at the well site for the total hole depth. The Ashburton Oil samples are stored at the offices of: Mineral Investigators,
777a Beaufort Street,
MT. LAWLEY, W.A. 6050

The George Milton samples were delivered to the offices of: Rio de Janeiro Mines,
BUCHAN, Vic. 3892

(ii) Coring

The original programme called for only one bottom hole core to be cut. However in order to delineate the stratigraphy it was found necessary to cut six cores.

Core No.	Interval Cored	Feet Cut	Recovery(ft.)	Recovery(%)
1	846-856	10	10	100
2	1855-1864	9	9	100
3	2921-2931	10	8	80
4	3420-3430	10	3½	35
5	3877-3882	5	2½	50
6	4088-4098	10	2	20

The core was quartered with cuts being distributed to Bureau of Mineral Resources, Victorian Department of Mines, George Milton and Ashburton Oil N.L. The Ashburton cut is stored at: Mineral Investigators, 777a Beaufort Street, MT. LAWLEY, W.A. 6050

A quarter was delivered to George Milton's representatives at: Rio de Janeiro Mines, BUCHAN, Vic. 3892

(iii) Side Wall Sampling
None carried out

(5) Logging and Surveys

(i) Electric and Other Logs

The following logs were run by Schlumberger Seaco Inc. and interpreted by R.J. Berven (Appendix 5).

Induction Electrical

Borehole Compensated Sonic

Compensated Density Gamma Ray

Continuous Dipmeter

The porosity tools confirmed the evidence gained from cuttings and cores that the porosities were low to zero. The continuous dipmeter was interesting in that it confirmed that the section drilled was moderately steeply dipping with well defined fault zones.

(ii) Penetration Rate and Gas Logs

The penetration rate log was compiled by the well site geologists and included in the composite log. Mud gas was logged by a portable gas detector; the resulting log has been included in the composite log.

(iii) Deviation Surveys

Deviation surveys were carried out approximately every 700 feet using a Totco drift indicator. The results are shown on the composite log.

(iv) Temperature Surveys

None carried out

(v) Other Well Surveys

None carried out

(6) Testing

(i) Formation Testing

None considered to be justified in view of the lack of porosity and the log interpretations

(ii) Production Testing

None carried out

IV GEOLOGY

(1) Summary of Previous Work

(i) Geological

A history of geological research in the Buchan area from the time McCoy first recognized the presence of Devonian fossils in 1867 up to the middle of the Twentieth Century is given by Teichert and Talent (1958). Teichert and Cottle mapped the region in detail in 1946 but the work was not published until later (Teichert and Talent 1958). The area to the south has been mapped by Bell and others (see Bell 1959). Subsequent work has been concerned mainly with the fauna of the area (e.g. Talent 1956, Philip 1966). A general review of the Devonian of Victoria is given by Talent (1967).

William Johnson and Associates have carried out surface mapping on behalf of George Milton as a result of which Milton No.1 was sited on a surface anticline and was designed to test an inferred Devonian sedimentary section in excess of 3500 feet (Johnson 1968, 1969).

(ii) Geophysics

The only geophysical work covering the Buchan area are two aeromagnetic surveys flown by the Bureau of Mineral Resources during 1956 and 1958.

(iii) Drilling

Ekberg NO.1 drilled by a percussion plant to a total depth of 1200 feet and without geological control was the deepest well drilled within the permit area prior to Milton No.1. No samples were available from this well but from the drillers log it bottomed in Taravale Formation. Reconnaissance drilling has taken place in the southern part of the permit and south of the southern boundary in Dome - Frome wells No's 1 to 4 and East Nowa Nowa No.1 (McQueen 1958). All penetrated the Tertiary and encountered rocks variously described as Silurian-Ordovician or Snowy River Volcanics.

(2) Regional Geology

The Buchan Synclinerium (Enclosure 1) represents a remnant of a once much more extensive unmetamorphosed sedimentary succession preserved by faulting and downwarping. Other remnants of this sequence occur at Bindi and rocks of the same age and facies as the Buchan Caves Limestone are present at Waratah Bay. Talent (1967) has shown that the Lower Devonian Snowy River Volcanics were block faulted and planed prior to deposition of the Buchan Group.

This Group consists of the Lower Buchan Caves Limestone comprising a basal transitional unit with dolomite and interbedded tuffs (Spring Creek Member), a dolomite member, a unit with algal pisoliths, and an upper ostracodal mudstone member (see Talent 1956). Overlying this is the Taravale Formation consisting of mudstone and nodular limestone beds. To the north the Taravale Formation passes into the Murrindal Limestone which contains reef limestone. Other small reefs occur in the south, possibly at the top of the Buchan Caves Limestone (Teichert and Talent 1958).

The Buchan Group is dated as Couvinian (Mid Devonian) with the possibility of the Buchan Caves Limestone extending into the uppermost Lower Devonian (Teichert and Talent 1958). Philip (1966), however, on the basis of conodonts has suggested a Lower Emsian age as more probable for the upper part of the sequence. Teichert and Talent's interpretation is followed in this report.

Deposition took place on a shallow shelf. Reefs were established from time to time with the greatest developments occurring in late Couvinian time when the reef of the Murrindal Limestone to the north passed south into the more basinal Taravale Mudstone.

Folding took place during the Middle Devonian Tabberabberan Orogeny which produced the basin like synclinorium with superimposed anticlines. Convergence of the axial planes on the surface suggests that these anticlines have closure which was estimated to be between 50 and 200 feet. Faults including thrust faults are developed especially in the south-eastern portion of the Devonian outcrop.

(3) Stratigraphic Table

The formations encountered in Milton No.1 are shown in Table 1. Palaeontological examination of samples by A.E. Cockbain (Appendix 2) has not resulted in any new data on the age of the formations. Formation tops were picked on the basis of lithology and electric logs.

TABLE 1

Age	Formation	Depth R.T.	Depth Subsea	Thickness	
Middle Devonian (Couvinian)	Taravale Formation				
	Unit A	10	+757	1520	+234
	Unit B	1530	-763	1133	-233
	Buchan Caves Limestone				
	Limestone Member	2663	-1896	807	-578
	Dolomite Member	3470	-2703	510	-824
	Spring Creek Member	3920	-3153	110	-961
Lower Devonian	Snowy River Volcanics	4030	-3263	68+	-995
	T.D.	4098	-3331		

(4) Stratigraphy

Middle Devonian (Couvinian)

Taravale Formation (10 - 2663')

The Taravale Formation consists predominantly of dark grey CALCILUTITE and argillaceous LIMESTONE. It is subdivided into two units on the basis of predominance of limestone or calcilutite. The formation is 3653 feet thick in Milton 1 as compared with a maximum outcrop thickness of 1340 feet; faulting may account for some of the increase in thickness in the borehole.

Unit A (10 - 1530')

Medium to dark grey CALCILUTITE is the dominant lithology. The rock is dense, non-fissile, fine to very finely crystalline with crystalline calcite filling veins and fractures. Lenses and nodules of medium to dark brown finely crystalline LIMESTONE become more common below 1000 feet. Rare pyrite grains are scattered throughout the unit. A trace of coal occurred at 203 feet. Tentaculites is rare throughout the section, as are ostracods; bactritids occur at 470 - 480 feet and 500 - 510 feet.

Unit B (1530 - 2663')

Tan to greyish brown argillaceous LIMESTONE with disseminated pyrites predominates in the unit. The limestone is very finely crystalline to microcrystalline and contains scattered carbonaceous material. Rarely it is mottled and stylolites are present throughout the unit. In places it is highly fractured, with cream and white crystalline calcite filling the fractures. It is slightly dolomitic at 2070 feet. The unit is sparsely fossiliferous with Tentaculites, ostracods and shell fragments scattered throughout.

Buchan Caves Limestone (2663 - 4030')

The formation consists of an upper medium to light brown LIMESTONE member, a middle DOLOMITE member and a basal transitional DOLOMITE - TUFFS member. It was not possible to recognize the algal pisolith member in the borehole although the algal overgrowths in core 4 (3420 - 3430' see Appendix 2) may represent this unit. The Buchan Caves Limestone is 1427 feet thick in Milton No. 1; in outcrop up to 700 feet of this formation has been measured.

Limestone Member (2663 - 3470')

This member consists of tan to medium greyish brown LIMESTONE which is finely crystalline, mottled in part and highly fossiliferous. The commonest fossils are brachiopods and corals with minor gastropods, and ostracods. Pyrite and crystalline calcite are scattered throughout the member. At 3210 - 3220 feet there is a trace of clayey volcanic material and oolites are recorded between 3220 and 3420 feet. A few minor gas shows were recorded in the ditch mud gas in this member, the maximum reading being 10 units.

Dolomite Member (3470 - 3920')

Medium dark brown DOLOMITE comprises the bulk of this unit. The rock is very finely crystalline to microcrystalline, argillaceous in part with scattered pyrite and traces of carbonaceous material. Fractures filled with white crystalline calcite are present.

The member is 510 feet thick. The thickest measured sequence of dolomite in outcrop is 140 feet. However Talent (1956) shows that the dolomite member thickens to the south and the section in Milton No.1 shows that this thickening continues southwards beneath the Taravale Formation.

Spring Creek Member (3920 - 4030')

At the base of the Buchan Caves Limestone a transitional zone of medium brown DOLOMITE and bluish green chloritic TUFF occurs which is correlated with the impersistent Spring Creek Member. Traces of disseminated pyrite and abundant white crystalline calcite and anhydrite are present in the unit.

Lower Devonian

Snowy River Volcanics (4030 - 4098' T.D.)

Below the carbonate volcanics transition zone there is a light to medium grey brown to bluish green TUFF containing scattered disseminated pyrite and galena with traces of ? graphite. The tuff is chloritic in part. The gradation between the volcanics and overlying dolomite suggests that there is no unconformity between the two formations.

Palaeontological evidence does not help in placing the Lower-Middle Devonian boundary in Milton No.1 although Talent (1967) suggests it is within the Buchan Caves Limestone.

(5) Structure

Milton No.1 was drilled on the crest of a narrow north trending anticline (Buchan anticline). The continuous dipmeter log (summarised in Table 2) shows that two faults were encountered in the well, at 2130 feet and 2750 feet. Both faults strike north-south and both are interpreted as reverse faults. Despite the large thickness of beds showing random dips below the deeper fault neither is considered to have a large throw because there is no evidence of repetition of strata in the logs or cuttings. Since the fold axis and fault planes are parallel, folding and faulting are closely related as they are in the structurally complex "East Buchan Triangle" (Teichert and Talent 1958).

TABLE 2

Formation	Depth	Dip
Taravale Formation (10-2663')	450-1350'	random
	1350-2130'	30-40° easterly
Buchan Caves Limestone (2663-4030')	Fault	
	2130-2750'	30-60° south-westerly
	Fault	
Snowy River Volcanics (4030-4098' T.D.)	2750-3150'	random
	3150-3600'	20-40° westerly
	3600-T.D.	random

(6) Relevance to Occurrence of Petroleum

1. All the formations are dense and tight with no primary porosity. Fractures are infilled with crystalline calcite and the hoped for secondary porosity is therefore not developed.
2. No reef development on the Taravale Formation and Buchan Caves Limestone can be recognized.
3. The Buchan anticline is faulted along the crest and this raises the issue whether other narrow anticlines in the Buchan synclinorium may not be similarly faulted.
4. Whilst the dark marine muddy limestones of the Devonian section are good potential source rocks, no suitable reservoir rock would seem to exist at depth.

(7) Contributions to Geological Knowledge

Milton No.1 penetrated a thicker sequence of Devonian carbonates than is known in outcrop, although the same formations can be recognized. In particular the Spring Creek Member is much thicker than previously recorded and the dolomite member (510 feet thick) is almost four times thicker than the thickest section measured by Talent (1956). Whether a thicker Devonian section is present south of Milton No.1 is conjectural since the Buchan Group is not present at Nowa Nowa to the south and the southern boundary of the Buchan synclitorium is probably covered by Tertiary gravels. The presence of steep dips and the faulting of the Buchan anticline show that the structural complexities of the eastern part of the synclitorium extend at least as far west as Milton No.1.

(8) Porosity and Permeability

Porosity determinations from the gamma ray logs are given in Appendix 5. No core analyses were carried out. In general porosities are extremely low (less than 5%) throughout the well and there is little or no formation water in the sediments.

V REFERENCES

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- Johnson, W., 1968. Oil and Gas prospects, P.E.P. 65, Buchan District, Victoria, Australia. Unpub. rept., William Johnson & Associates for G. Milton.
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- McCoy, F. 1867. On the recent zoology and palaeontology of Victoria. Ann. Mag. Nat. Hist., ser. 3, vol. 20, pp. 175-202.

- McQueen, A.F., 1958. Summary of drilling by Dome Oil and Mineral Syndicate on Frome Lake Petroleum Prospecting Licence No. 161, Gippsland. Unpub. rept., Frome Broken Hill Pty. Ltd., No. 7100-9-63.
- Philip, G.M., 1966. Lower Devonian conodonts from the Buchan Group, eastern Victoria. *Micropaleontology* vol. 12, pp. 441-460.
- Talent, J.A., 1956. Devonian brachiopods and pelecypods of the Buchan Caves Limestone, Victoria. *Proc. Roy. Soc. Victoria*, vol. 68, pp. 1 - 56.
- Talent, J.A., 1967. Victoria; in *Devonian of Victoria and Tasmania* by J.A. Talent and M.R. Banks; *Int. Symp. on the Devonian System*, Calgary 1967, ed. by D.H. Oswald, Alberta Soc. Petr. Geol., Calgary, Alberta, Vol II, pp. 147-163.
- Teichert, C. & Talent, J.A., 1968. *Geology of the Buchan Area, East Gippsland*. Geol. Surv. Victoria, Mem.21.

APPENDIX 1

PETROLOGICAL REPORT ON SAMPLE FROM MILTON NO. 1

by

I.D. MARTIN,
Mineral Investigators

Milton No.1, Core 6, 4088-4098 feet. Snowy River Volcanics.

Fine grained acid volcanic tuff. The only recognizable mineral is high temperature quartz which sometimes shows development of pyramidal faces. Some grains are coated with fine grained sericitic mica. Calcium carbonate pseudomorphs after another mineral, possibly plagioclase feldspar, are present. A few angular to sub-rounded particles of the same rock are enclosed in the groundmass. These are small lapilli. The groundmass is composed of glass shards and fine grained material which is largely devitrified.

17th April, 1970.

APPENDIX 2

PALAEONTOLOGICAL REPORT ON SAMPLES FROM MILTON NO. 1

by

A.E. COCKBAIN

The following samples were submitted for palaeontological determination:

1. 90- 100 ft: cuttings; dark grey calcareous mudstone
2. 470- 480 ft: cuttings; dark grey calcareous mudstone
3. 500- 510 ft: cuttings; dark grey calcareous mudstone
4. 846- 856 ft: Core 1: dark grey calcareous mudstone
5. 1855-1864 ft: Core 2: brown limestone
6. 2921-2931 ft: Core 3; dark brown limestone
7. 3420-2430 ft: Core 4; dark brown limestone
8. 3877-3882 ft: Core 5; dark brown dolomite

1. 90- 100 ft: Tentaculites sp.

The genus is common throughout the Taravale Formation

2. 470- 480 ft: bactritid
3. 500- 510 ft: bactritid

Bactritids have been recorded from the Murrindal Limestone and Taravale Formation (Teichert and Talent 1958) within the lowest 600 feet of these formations. The present specimen must come from a hitherto unrecorded level high in the Taravale Formation and are generically indeterminate.

4. 846- 856 ft: unfossiliferous
5. 1855-1864 ft: brachiopod fragments (?Spinella sp.)
? Thamnopora sp.
nautiloid fragment (? Pectinoceras)

Nautiloids are fairly common in the lower part of the Taravale Formation (Teichert and Talent 1958)

6. 2921-2931 ft: very fossiliferous
Aulopora cf. conglomerata Goldfuss
Breviphyllum recessum (Hill)
Spinella buchanensis Talent
Loxonema sp.
ostracods

This assemblage is typical of the Buchan Caves Limestone.
Hill (1950) regards this fauna as of Couvinian age.

7. 3420-3430 ft: The core is fossiliferous between
3423'6" and 3427'3".

Spinella buchanensis Talent
Loxonema sp.
ostracods

Most of the brachiopods are finely comminuted; corals
are very rare. An occasional brachiopod is coated with
calcareous algae. Spinella buchanensis is found
throughout the Buchan Caves Limestone and the lower
part of the Taravale Formation

8. 3877-3882 ft: unfossiliferous

The only fauna which can be firmly dated comes from Core 3 and
is of Couvinian (early Middle Devonian) age. It is not
possible to fix the Lower-Middle Devonian boundary on the
faunal evidence available.

References

- Hill, D., 1950. Middle Devonian corals from the Buchan District,
Victoria. Proc. Roy. Soc. Victoria, vol. 62, pp. 137-164.
Teichert, C., and Talent, J.A., 1958. Geology of the Buchan
Area, East Gippsland. Geol. Surv. Victoria, Mem. 21.

7th April, 1970.

APPENDIX 3

ASHBURTON MILTON NO. 1

Permit: P.E.P. 65 State: Victoria
 Location: 37° 31' 31" S. Lat., 148° 10' 34" E. Long.
 Measurements) R.T. elev. 767' Described By: Robert J. Berven
 Taken From) Title: Consulting Geologist

Depth to Top	Bottom	Thickness (feet)	Drilled or Cored	Description
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SPUD IN TARAVALÉ FORMATION

UNIT A

0	20'	20'	Drilled	No sample
20'	180'	160'	Drilled	<u>Mudstone</u> grading to argillaceous <u>Calcilutite</u> , medium grey, earthy non fissile blocky and firm, very calcareous with rare nodular dark brown limestone, abundant light brown-white crystalline calcite infilling fractures, dense with poor porosity and permeability, rare <u>Tentaculites</u> , no shows.
180'	300'	120'	Drilled	<u>Mudstone</u> and nodular <u>Limestone</u> as described above with rare traces of black vitreous anthracite? <u>Coal</u> , dense and tight, no shows.
300'	780'	480'	Drilled	<u>Mudstone</u> grading to argillaceous <u>Calcilutité</u> , medium-dark grey, very calcareous, earthy and dense, non fissile and blocky with scattered tan-medium brown, nodular Limestone, microcrystalline and dense, rare pyrite and chalcopyrite?, scattered white crystalline calcite from veins and fractures, rare silty zones, poor porosity and permeability, tight, no shows.

780'	820'	40'	Drilled	<u>Mudstone</u> or <u>Claystone</u> , grading to <u>Siltstone</u> in part, dark grey to black, very calcareous and Micaceous with minor disseminated pyrite and traces of black carbonaceous material, rare, black shiny spherical microfossils?, trace white crystalline calcite from fractures, poor porosity and permeability, dense and hard, no shows.
820'	830'	10'	Drilled	No Sample
830'	846'	16'	Drilled	<u>Mudstone</u> and <u>Claystone</u> as described above with minor <u>Limestone</u> , dark greyish brown, very finely crystalline to microcrystalline, very argillaceous and silty in part, poor porosity and permeability, dense and hard, no shows.
<u>CORE NO.1</u>				
846'	856'	10'	Cored	See Appendix 4
856'	1000'	144'	Drilled	<u>Mudstone</u> or <u>Claystone</u> as described above with irregular lenses and interbeds of Limestone increasing near base; limestone is medium to dark brown as described previously with minor light grey to tan, mottled zones, fine to very finely crystalline and tight with minor clear to white crystalline calcite in veins and fractures. No shows.

1000'	1200'	200'	Drilled	<p><u>Limestone</u> with minor <u>Mudstone</u> and <u>Claystone</u>; limestone, medium to dark brown, occasionally light brown to tan, very finely crystalline to microcrystalline, argillaceous with scattered disseminated pyrite, rare traces of fossiliferous material with molds of brachiopods, possible crinoidal debris, small ostracods and <u>Tentaculites</u> identifiable, poor porosity and permeability, dense and hard with minor <u>Mudstone</u>, dark grey to black, very calcareous and micaceous, scattered pyrite and black carbonaceous material, dense and tight, no shows. Rare traces of <u>sandstone</u> from 1120' to 1130', medium brown, very fine grained and unconsolidated with traces of oil staining? and white fluorescence, no cut with chlorothene, no gas kick.</p>
1200'	1530'	330'	Drilled	<p><u>Mudstone</u> or <u>Claystone</u> with minor interbeds and lenses of <u>Limestone</u>; mudstone, dark grey to black, very calcareous and micaceous with scattered nodular pyrite and black carbonaceous material, minor white crystalline calcite from veins and fractures, dense and hard with limestone, dark greyish brown, very finely crystalline to microcrystalline, argillaceous with rare ostracods, <u>Tentaculites</u> and molds of brachiopod? shells in isolated zones, poor porosity and permeability, dense and hard, tight, no shows.</p>

UNIT B 1530' (-763')

1530'	1855'	325'	Drilled	<u>Limestone</u> , tan-greyish brown, occasionally dark greyish brown, mottled in part, very finely crystalline to microcrystalline, very argillaceous with scattered disseminated pyrite throughout, sparsely fossiliferous with ostracods and <u>Tentaculites</u> identifiable, minor stylolites and scattered fractures with white crystalline calcite healing, poor porosity and permeability, dense and firm. No shows.
<u>CORE 2</u>				
1855'	1864'	9'	Cored	See Appendix 4
1864'	2030'	166'	Drilled	<u>Limestone</u> , medium-dark brown, occasionally dark greyish brown very finely crystalline to microcrystalline, argillaceous and pyritic with traces of black carbonaceous material, poor porosity and permeability, dense and firm, no shows.
2030'	2050'	20'	Drilled	Limestone, light grey to greyish brown occasionally white mottled in part, very finely crystalline to coarsely crystalline, argillaceous with disseminated pyrite, fossiliferous? and highly fractured with abundant cream-white coarsely crystalline calcite healing fractures, rare stylolites, dense and hard, poor porosity and permeability. No shows.

2050' 2160' 110' Drilled Limestone, tan-greyish brown mottled in part, very finely crystalline to microcrystalline argillaceous with abundant disseminated pyrite, dense and firm with occasional soft, tan chalky zones, rare ostracods and fossil fragments, dolomite in part, poor porosity and permeability, rare stylolites, fractured with white coarsely crystalline calcite healing, no shows.

2160' 2780' 620' Drilled Limestone, dark grey-dark greyish brown, occasional tan very finely crystalline to microcrystalline, very argillaceous grading to calcareous mudstone in part, scattered disseminated pyrite and black carbonaceous material, rare unidentifiable fossil fragments, scattered white crystalline calcite from fractures, poor porosity and permeability, dense and firm. No shows.

BUCHAN CAVES LIMESTONE 2780' (-2013')

LIMESTONE MEMBER

2780' 2921' 141' Drilled Limestone, tan-medium greyish brown, mottled, very finely crystalline, argillaceous and very fossiliferous in parts with scattered ostracods and unidentifiable fossil debris, scattered black carbonaceous partings poor porosity and permeability, dense and fractured with white crystalline calcite healing, no shows.

CORE NO. 3

2921'	2931'	10'	Cored	See Appendix 4
2931'	3210'	279'	Drilled	<u>Limestone</u> , tan-medium brown, mottled very finely crystalline, slightly argillaceous and very fossiliferous with scattered black carbonaceous material, dense and fractured with white crystalline calcite healing, poor porosity and permeability, tight, no shows.
3210'	3220'	10'	Drilled	<u>Limestone</u> , as in interval above and minor traces of pinkish red, slightly calcareous clayey volcanic? material, dense and firm, no shows.
3220'	3420'	200'	Drilled	<u>Limestone</u> , tan-medium greyish brown, mottled fine to very finely crystalline, slightly argillaceous with scattered dark grey shaly partings and lenses, very fossiliferous with ostracods and oolitic? material common, rare black carbonaceous partings, dense and fractured with white crystalline calcite healing, poor porosity and permeability, tight, no shows.

CORE NO. 4

3420'	3430'	10'	Cored	See Appendix 4
3430'	3470'	50'	Drilled	<u>Limestone</u> , tan-medium brown, very finely crystalline to microcrystalline argillaceous and very fossiliferous in parts, scattered black shaly partings and traces of pyrite, dolomitic in part, dense & fractured with white crystalline calcite healing, poor porosity and permeability, tight, no shows.

DOLOMITE MEMBER

3470'	3770'	300'	Drilled	<u>Dolomite</u> and minor dolomitic <u>Limestone</u> , tan-dark brown mottled in part, fine-very finely crystalline, sucrosic in part, argillaceous with scattered black fissile shaly lenses and carbonaceous parting traces of nodular pyrite, dense and fractured with white crystalline calcite healing, poor porosity & permeability, rare ostracods and traces of fossiliferous material, tight, no shows.
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3770' 3877' 107' Drilled Dolomite, medium-dark brown, fine very finely crystalline, argillaceous and dense with abundant nodular and disseminated pyrite throughout, traces of black carbonaceous material and fossil fragments, fractured with white crystalline calcite healing, poor porosity and permeability, tight, no shows.

CORE NO. 5

3877' 3882' 2½' Cored See Appendix 4

3882' 3920' 38' Drilled Dolomite, light-medium brown-greyish brown mottled in part, very finely crystalline-microcrystalline slightly argillaceous with scattered pyrite and black carbonaceous material, dense and fractured with white crystalline calcite healing, poor porosity and permeability, tight, no shows.

SPRING CREEK MEMBER

3920' 4030' 110' Drilled Minor Dolomite, medium brown and microcrystalline with abundant white to clear crystalline anhydrite, traces of disseminated pyrite, highly fractured and dense, traces of bluish-green chloritic tuff, no shows.

SNOWY RIVER VOLCANICS

4030' 4060' 30' Drilled Volcanic Tuff, light-medium greyish brown soft and bentonitic with scattered finely disseminated pyrite and galena with traces of graphite? traces of bluish green chloritic tuff with tiny dark green phenocrysts, poor porosity and permeability, tight, no shows.

4060' 4088' 28' Drilled Chloritic Tuff, bluish green, mottled, non calcareous and soft with scattered dark green angular, phenocrysts, minor disseminated pyrite and galena fissile in part and fractured, dense and tight, no shows.

CORE NO. 6

4088'

4098'

10'

Cored

See Appendix 4

APPENDIX 4

MILTON NO. 1
CORE DESCRIPTION

by

R.J. BERVEN

CORE DESCRIPTION AND ANALYSIS

WELL.....	MILTON No. 1	CORE No.....	1
COMPANY.....	ASHBURTON OIL N.L.	CORE INTERVAL.....	846'—856'
DATE.....	DECEMBER 9, 1969	CUT.....	10 FEET
GEOLOGIST.....	R. J. BERVEN	RECOVERED.....	10 FEET 100 %
MUD LOGGING CO.....		BIT TYPE.....	SMITH DIAMOND C.B.
		DIAMETER.....	4 3/4"

CORE ANALYSIS					SHOWS	LITHOLOGY	DEPTH	DESCRIPTION AND REMARKS
DENSITY	FLUIDS		PERM. MD	POROSITY				
	OIL	H ₂ O						
	NIL		NIL	NIL	NIL		846	<p>846'—856'. MUDSTONE or CLAYSTONE with thin interbeds and lenses of LIMESTONE; mudstone, dark grey to black very calcareous and micaceous with scattered nodular pyrite and traces of black carbonaceous material, highly indurated, dense and hard, grading to siltstone in parts, poor porosity and permeability with irregular lenses and interbeds of LIMESTONE, medium to dark greyish brown, very finely crystalline to microcrystalline, very argillaceous and silty, dolomitic in part, poor porosity and permeability, dense and hard, minor compaction structures with mudstone stringers squeezed into limestone lenses. Estimated dips: 45°. No shows.</p>
							847	
							848	
							849	
							850	
							851	
							852	
							853	
							854	
							855	
							856	

- | | | |
|------------------------|--------------------------|---------------|
| CONGLOMERATE | CALCILUTITE | CALCARENITE |
| CALCITE | MUDSTONE/SHALE | CALCAREOUS |
| SANDSTONE | PYRITIC | FOSSILIFEROUS |
| MARL | COAL | COQUINITE |
| SILTSTONE | CARBONACEOUS | TILLITE |
| ARGILLACEOUS LIMESTONE | VOLCANICS CHLORITIC TUFF | MICACEOUS |
| DOLOMITE | CHERT | DOLOMITIC |
| KAOLINITE | PEBBLY | ANHYDRITIC |
| STYLOLITE | | GYPSEOUS |

Cartography by Western Mapping Pty. Ltd.

CORE DESCRIPTION AND ANALYSIS

WELL.....	MILTON No. 1	CORE No.....	2
COMPANY.....	ASHBURTON OIL N.L.	CORE INTERVAL.....	1855'—1864'
DATE.....	DECEMBER 16, 1969	CUT.....	9 FEET
GEOLOGIST.....	R. J. BERVEN	RECOVERED.....	9 FEET 100 %
MUD LOGGING CO.....		BIT TYPE.....	SMITH DIAMOND C.B.
		DIAMETER.....	4 3/4"

CORE ANALYSIS					SHOWS	LITHOLOGY	DEPTH	DESCRIPTION AND REMARKS
DENSITY	FLUIDS		PERM. MD	POROSITY				
	OIL	H ₂ O						
							1855	1855'—1864'. LIMESTONE medium to dark brown to dark greyish brown, mottled in part, very finely crystalline to microcrystalline, very argillaceous in parts with rare irregular shaly partings and lenses, sparsely fossiliferous with scattered brachiopods (<i>Spinella?</i>), tabulate corals (<i>Favosites?</i>), ostracods, scattered sub-horizontal to vertical stylolites with black clayey infilling, numerous oblique to vertical fractures with white crystalline calcite and pyrite infilling, scattered disseminated pyrite, poor porosity and permeability, dense and hard, rare geopetal structures. No shows. Estimated dips: 45°.
							1856	
							1857	
							1858	
							1859	
							1860	
							1861	
							1862	
							1863	
							1864	
	NIL		NIL	NIL	NIL			

- | | | |
|------------------------|--------------------------|---------------|
| CONGLOMERATE | CALCILUTITE | CALCARENITE |
| CALCITE | MUDSTONE/SHALE | CALCAREOUS |
| SANDSTONE | PYRITIC | FOSSILIFEROUS |
| MARL | COAL | COQUINITE |
| SILTSTONE | CARBONACEOUS | TILLITE |
| ARGILLACEOUS LIMESTONE | VOLCANICS CHLORITIC TUFF | MICACEOUS |
| DOLOMITE | CHERT | DOLOMITIC |
| KAOLINITE | PEBBLY | ANHYDRITIC |
| STYLOLITE | | GYPSEOUS |

Cartography by Western Mapping Pty. Ltd.

CORE DESCRIPTION AND ANALYSIS

WELL..... MILTON No. 1
 COMPANY..... ASHBURTON OIL N.L.
 DATE..... DECEMBER 27, 1969
 GEOLOGIST..... R. J. BERVEN
 MUD LOGGING CO.....

CORE No..... 3
 CORE INTERVAL..... 2921'—2931'
 CUT..... 10 FEET
 RECOVERED..... 8 FEET 80 %
 BIT TYPE..... SMITH DIAMOND C.B.
 DIAMETER..... 4 3/4"

CORE ANALYSIS					SHOWS	LITHOLOGY	DEPTH	DESCRIPTION AND REMARKS
DENSITY	FLUIDS		PERM. MD	POROSITY				
	OIL	H ₂ O						
	NIL		NIL	NIL	NIL		2921'—2929'. LIMESTONE medium to dark greyish brown, mottled, very finely crystalline and very argillaceous with scattered irregular black shaly lenses and partings, very fossiliferous with abundant brachiopods, corals, ostracods and gastropods, poor porosity and permeability, rare stylolites throughout, dense and fractured with white crystalline calcite healing, tight. No shows. Estimated dips: 40°.	
						2929'—2931'. No recovery.		

- | | | |
|------------------------|--------------------------|---------------|
| CONGLOMERATE | CALCILUTITE | CALCARENITE |
| CALCITE | MUDSTONE/SHALE | CALCAREOUS |
| SANDSTONE | PYRITIC | FOSSILIFEROUS |
| MARL | COAL | COQUINITE |
| SILTSTONE | CARBONACEOUS | TILLITE |
| ARGILLACEOUS LIMESTONE | VOLCANICS CHLORITIC TUFF | MICACEOUS |
| DOLOMITE | CHERT | DOLOMITIC |
| KAOLINITE | PEBBLY | ANHYDRITIC |
| STYLOLITE | | GYPSEOUS |

CORE DESCRIPTION AND ANALYSIS



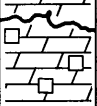
WELL..... MILTON No. 1
 COMPANY..... ASHBURTON OIL N.L.
 DATE..... JANUARY 1, 1970
 GEOLOGIST..... R. J. BERVEN
 MUD LOGGING CO.....



























CORE No..... 4
 CORE INTERVAL..... 3420'—3430'
 CUT..... 10 FEET
 RECOVERED..... 10 FEET 100 %
 BIT TYPE..... SMITH DIAMOND C.B.
 DIAMETER..... 4 3/4"

CORE ANALYSIS					SHOWS	LITHOLOGY	DEPTH	DESCRIPTION AND REMARKS																																																				
DENSITY	FLUIDS		PERM. MD	POROSITY																																																								
	OIL	H ₂ O																																																										
	NIL		NIL	NIL	NIL		<p>3420'—3423.5'. LIMESTONE, medium to dark brown, mottled, very finely crystalline to micro-crystalline, slightly argillaceous with traces of pyrite, rare fossils and scattered stylolitic partings, dense and fractured with white crystalline calcite and minor anhydrite healing, tight throughout. No shows. Grading to:</p> <p>3423.5'—3426.75'. LIMESTONE, medium to dark greyish brown, mottled, very finely crystalline, very fossiliferous with scattered corals, brachiopods, ostracods, gastropods, etc., abundant irregular black shaly partings, dense and fractured with white crystalline calcite and minor anhydrite healing, tight throughout. No shows. Grading to:</p> <p>3426.75'—3430'. LIMESTONE as in upper 3' 6" interval. Estimated dips: 35°.</p>																																																					
						<table border="0"> <tr> <td></td> <td>CONGLOMERATE</td> <td></td> <td>CALCILUTITE</td> <td></td> <td>CALCARENITE</td> </tr> <tr> <td></td> <td>CALCITE</td> <td></td> <td>MUDSTONE/SHALE</td> <td></td> <td>CALCAREOUS</td> </tr> <tr> <td></td> <td>SANDSTONE</td> <td></td> <td>PYRITIC</td> <td></td> <td>FOSSILIFEROUS</td> </tr> <tr> <td></td> <td>MARL</td> <td></td> <td>COAL</td> <td></td> <td>COQUINITE</td> </tr> <tr> <td></td> <td>SILTSTONE</td> <td></td> <td>CARBONACEOUS</td> <td></td> <td>TILLITE</td> </tr> <tr> <td></td> <td>ARGILLACEOUS LIMESTONE</td> <td></td> <td>VOLCANICS CHLORITIC TUFF</td> <td></td> <td>MICACEOUS</td> </tr> <tr> <td></td> <td>DOLOMITE</td> <td></td> <td>CHERT</td> <td></td> <td>DOLOMITIC</td> </tr> <tr> <td></td> <td>KAOLINITE</td> <td></td> <td>PEBBLY</td> <td></td> <td>ANHYDRITIC</td> </tr> <tr> <td></td> <td>STYLOLITE</td> <td></td> <td></td> <td></td> <td>GYPSEOUS</td> </tr> </table>		CONGLOMERATE		CALCILUTITE		CALCARENITE		CALCITE		MUDSTONE/SHALE		CALCAREOUS		SANDSTONE		PYRITIC		FOSSILIFEROUS		MARL		COAL		COQUINITE		SILTSTONE		CARBONACEOUS		TILLITE		ARGILLACEOUS LIMESTONE		VOLCANICS CHLORITIC TUFF		MICACEOUS		DOLOMITE		CHERT		DOLOMITIC		KAOLINITE		PEBBLY		ANHYDRITIC		STYLOLITE				GYPSEOUS
	CONGLOMERATE		CALCILUTITE		CALCARENITE																																																							
	CALCITE		MUDSTONE/SHALE		CALCAREOUS																																																							
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	MARL		COAL		COQUINITE																																																							
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	DOLOMITE		CHERT		DOLOMITIC																																																							
	KAOLINITE		PEBBLY		ANHYDRITIC																																																							
	STYLOLITE				GYPSEOUS																																																							

CORE DESCRIPTION AND ANALYSIS

WELL.....	MILTON No. 1.....	CORE No.....	5.....
COMPANY.....	ASHBURTON OIL N.L.....	CORE INTERVAL.....	3877'—3882'.....
DATE.....	JANUARY 8, 1970.....	CUT.....	5 FEET.....
GEOLOGIST.....	R. J. BERVEN.....	RECOVERED.....	2.5 FEET..... 50 %.....
MUD LOGGING CO.....	BIT TYPE.....	SMITH DIAMOND C.B.....
		DIAMETER.....	4 3/4".....

CORE ANALYSIS					SHOWS	LITHOLOGY	DEPTH	DESCRIPTION AND REMARKS	
DENSITY	FLUIDS		PERM. MD	POROSITY					
	OIL	H ₂ O							
	↑		↑	↑	↑		3877	3877'—3879.5': DOLOMITE, dark brown, mottled very finely crystalline-microcrystalline highly fractured and brecciated with abundant white calcite and pyrite infilling the fractures, scattered disseminated pyrite throughout, argillaceous with traces of shale in stylolitic partings, dense and tight. No shows. No dips measurable.	
							3878		
							3879		
								3880	3879.5'—3882'. No recovery.
								3881	
								3882	

- | | | |
|---|--|---|
|  CONGLOMERATE |  CALCILUTITE |  CALCARENITE |
|  CALCITE |  MUDSTONE/SHALE |  CALCAREOUS |
|  SANDSTONE |  PYRITIC |  FOSSILIFEROUS |
|  MARL |  COAL |  COQUINITE |
|  SILTSTONE |  CARBONACEOUS |  TILLITE |
|  ARGILLACEOUS LIMESTONE |  VOLCANICS CHLORITIC TUFF |  MICACEOUS |
|  DOLOMITE |  CHERT |  DOLOMITIC |
|  KAOLINITE |  PEBBLY |  ANHYDRITIC |
|  STYLOLITE | |  GYPSEOUS |

CORE DESCRIPTION AND ANALYSIS

WELL.....	MILTON No. 1	CORE No.....	6
COMPANY.....	ASHBURTON OIL N.L.	CORE INTERVAL.....	4088'—4098'
DATE.....	JANUARY 12, 1970	CUT.....	10 FEET
GEOLOGIST.....	R. J. BERVEN	RECOVERED.....	2 FEET 20 %
MUD LOGGING CO.....		BIT TYPE.....	REED H.F.C.B.
		DIAMETER.....	4 3/4"

CORE ANALYSIS					SHOWS	LITHOLOGY	DEPTH	DESCRIPTION AND REMARKS
DENSITY	FLUIDS		PERM. MD	POROSITY				
	OIL	H ₂ O						
	↑		↑	↑	↑	4088'	4088'—4090'. CHLORITIC TUFF, bluish green, mottled, non-calcareous with abundant dark green angular phenocrysts, fractured with greyish-white bentonitic material infilling fractures, soft and rubbly to fissile in part, minor finely disseminated pyrite with traces of galena and graphite(?), dense and tight throughout. No shows.	
	↑		↑	↑	↑	4089'		
	↑		↑	↑	↑	4090'		
	↑		↑	↑	↑	4091'		
	↑		↑	↑	↑	4092'		
	↑		↑	↑	↑	4093'		
	↑		↑	↑	↑	4094'		
	↑		↑	↑	↑	4095'		
	↑		↑	↑	↑	4096'		
	↑		↑	↑	↑	4097'		
	↑		↑	↑	↑	4098'	4090'—4098'. No recovery.	

- | | | |
|------------------------|--------------------------|---------------|
| CONGLOMERATE | CALCILUTITE | CALCARENITE |
| CALCITE | MUDSTONE/SHALE | CALCAREOUS |
| SANDSTONE | PYRITIC | FOSSILIFEROUS |
| MARL | COAL | COQUINITE |
| SILTSTONE | CARBONACEOUS | TILLITE |
| ARGILLACEOUS LIMESTONE | VOLCANICS CHLORITIC TUFF | MICACEOUS |
| DOLOMITE | CHERT | DOLOMITIC |
| KAOLINITE | PEBBLY | ANHYDRITIC |
| STYLOLITE | | GYPSEOUS |

Cartography by Western Mapping Pty. Ltd.

APPENDIX 5

LIST OF SCHLUMBERGER LOGS

MILTON NO. 1

LOG	RUN	DATE	INTERVAL	SCALES
Induction-Electrical (I.E.S.)	1	12-1-70	4080-440'	2", 5"
Borehole compensated Sonic log (with caliper) (BSL)	1	12-1-70	4079-440'	2", 5"
Compensated Formation Density log (FDCGR)	1	12-1-70	3645-440'	2", 5"
Four arm high resolution Continuous Dipmeter (HDT)	1	12-1-70	4080-440'	2"

LOG INTERPRETATION

By

R.J. BERVEN

Mud Properties:

Rm = 7.02@ 69°F

Rmf = 7.32@ 72°F

Rmc = 6.59@ 72°F

Rmf = 5.20@ 98°F

General:

Although the well was drilled to 4098 feet, the bottom 10 feet of hole was not reamed to 8½" following the cutting of a bottom hole core, and the logging tools were only able to reach 4080 feet. The logs therefore cover the interval from the 9⅝" casing shoe at 440 feet to a T.D. of 4080 feet. The gamma ray log was recorded through the casing to a depth of 50 feet.

The lithology consists of calcareous mudstone and claystone, argillaceous limestone, clean fossiliferous limestone, dense argillaceous dolomite and minor volcanic tuffs and breccias. All the sediments drilled in the well with the exception of the volcanics in the bottom 100 feet of hole are extremely dense, tight and highly indurated. The induction log readings are in the order of 100 ohms or greater with only minor shaly intervals where the resistivity drops to 70-80 ohms, except for the softer volcanics from 3980'-4098 feet.

Porosity

The Borehole Compensated Sonic Log and the Compensated Formation Density Log were the only two porosity logs run on the well. Table I gives log porosity values read opposite low gamma ray readings in each formation and/or member (V matrix = 21,000 ft/sec.)

TABLE I

No.	Depth (feet)	R _{il} (Ω)	ρ _B	φ _o	Δt (μ sec/ft)	φ _s	φ _e
1	665'	200	2.72	0.0%	58	7.5%	3.0%
2	1132'	110	2.70	0.0%	60	9.0%	4.0%
3	1493'	100	2.72	0.0%	58	7.5%	3.0%
4	1707'	300	2.73	0.0%	53	4.0%	2.0%
5	2281'	320	2.71	0.0%	53	4.0%	2.0%
6	2550'	420	2.73	0.0%	53	4.0%	2.0%
7	2890'		2.70	0.0%	48	0.0%	0.0%
8	3121'	950	2.70	0.0%	51	2.5%	1.0%
9	3292'		2.72	0.0%	48	0.0%	0.0%
10	3453'		2.78	0.0%	47	0.0%	0.0%
11	3677'	600	2.85	0.0%	46	0.0%	0.0%
12	3797'	400	2.85	0.0%	44	0.0%	0.0%
13	3929'	550	2.87	0.0%	45	0.0%	0.0%
14	4015'	220	2.75	0.0%	52	3.0%	1.0%

The log-derived porosities are extremely low to practically zero throughout the well. These facts were supported by the samples and cores taken from the project. An occasional open fracture within the carbonate sequence yielded a trace of methane gas and occasionally caused minor lost circulation problems. The logs are reading close to matrix resistivity, matrix density and matrix sonic velocity throughout the section.

PE902837

This is an enclosure indicator page.
The enclosure PE902837 is enclosed within the
container PE902835 at this location in this
document.

The enclosure PE902837 has the following characteristics:

- ITEM_BARCODE = PE902837
- CONTAINER_BARCODE = PE902835
- NAME = Geological Map of Northern Part of PEP
65
- BASIN = GIPPSLAND
- PERMIT = PEP/65
- TYPE = WELL
- SUBTYPE = GEOL_MAP
- DESCRIPTION = Geological Map of Northern Part of PEP
65 (enclosure 1 of WCR) for Milton-1
- REMARKS =
- DATE_CREATED =
- DATE_RECEIVED =
- W_NO = W564
- WELL_NAME = Milton-1
- CONTRACTOR = Ashburton Oil Co
- CLIENT_OP_CO = Ashburton Oil Co

(Inserted by DNRE - Vic Govt Mines Dept)

PE902836

This is an enclosure indicator page.
The enclosure PE902836 is enclosed within the
container PE902835 at this location in this
document.

The enclosure PE902836 has the following characteristics:

- ITEM_BARCODE = PE902836
- CONTAINER_BARCODE = PE902835
- NAME = Section across Buchan Synclinorium
Before & after drilling
- BASIN = GIPPSLAND
- PERMIT = PEP/65
- TYPE = WELL
- SUBTYPE = CROSS_SECTION
- DESCRIPTION = Section across Buchan Synclinorium
Before & after drilling (enclosure 2 of
WCR) for Milton-1
- REMARKS =
- DATE_CREATED =
- DATE_RECEIVED =
- W_NO = W564
- WELL_NAME = Milton-1
- CONTRACTOR = Ashburton Oil Co
- CLIENT_OP_CO = Ashburton Oil Co

(Inserted by DNRE - Vic Govt Mines Dept)

PE601485

This is an enclosure indicator page.
The enclosure PE601485 is enclosed within the
container PE902835 at this location in this
document.

The enclosure PE601485 has the following characteristics:

ITEM_BARCODE = PE601485
CONTAINER_BARCODE = PE902835
NAME = Composite Well Log
BASIN = GIPPSLAND
PERMIT = PEP/65
TYPE = WELL
SUBTYPE = COMPOSITE_LOG
DESCRIPTION = Composite Well Log, sheet 1 of 2,
(enclosure 3 of WCR) for Milton-1
REMARKS =
DATE_CREATED = 13/01/1970
DATE_RECEIVED =
W_NO = W564
WELL_NAME = Milton-1
CONTRACTOR = Ashburton Oil Co
CLIENT_OP_CO = Ashburton Oil Co

(Inserted by DNRE - Vic Govt Mines Dept)

PE601486

This is an enclosure indicator page.
The enclosure PE601486 is enclosed within the
container PE902835 at this location in this
document.

The enclosure PE601486 has the following characteristics:

ITEM_BARCODE = PE601486
CONTAINER_BARCODE = PE902835
NAME = Composite Well Log
BASIN = GIPPSLAND
PERMIT = PEP/65
TYPE = WELL
SUBTYPE = COMPOSITE_LOG
DESCRIPTION = Composite Well Log, sheet 2 of 2,
(enclosure 3 of WCR) for Milton-1
REMARKS =
DATE_CREATED = 13/01/1970
DATE_RECEIVED =
W_NO = W564
WELL_NAME = Milton-1
CONTRACTOR = Ashburton Oil Co
CLIENT_OP_CO = Ashburton Oil Co

(Inserted by DNRE - Vic Govt Mines Dept)

PE902838

This is an enclosure indicator page.
The enclosure PE902838 is enclosed within the
container PE902835 at this location in this
document.

The enclosure PE902838 has the following characteristics:

ITEM_BARCODE = PE902838
CONTAINER_BARCODE = PE902835
 NAME = Well History Chart
 BASIN = GIPPSLAND
 PERMIT = PEP/65
 TYPE = WELL
 SUBTYPE = DIAGRAM
DESCRIPTION = Well History Chart (enclosure 4 of WCR)
 for Milton-1
REMARKS =
DATE_CREATED =
DATE_RECEIVED =
 W_NO = W564
 WELL_NAME = Milton-1
CONTRACTOR = Ashburton Oil Co
CLIENT_OP_CO = Ashburton Oil Co

(Inserted by DNRE - Vic Govt Mines Dept)