Natural Resources and Environment

AGRICULTURE • RESOURCES • CONSERVATION • LAND MANAGEMENT

WCR

Pretty Hill-1

(W469)

1 Folio No	2 Referred to	3 Date	4 Clearing Officer's Initials	1 Folio No.	2 Referred to	3 Date	Cle Offi Ini
	Otway Onshore						
	P.EP/5						

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LOCATION

WCR
PRETTY HILL-1
(W469)

Contents.....

SECTION.....

1.0 Well Card

W469

WELL PRETTY HILL No 1. TYPE N.F.W. BASIN W.D 77

TEN. HOLDER Frome-Broken Hill Co. Pty Ltd. lat. 38° 13 ~~[illegible]~~ 24

OPERATOR " " " LOCATION. Long. 142° 07 ~~[illegible]~~ 24 ~~[illegible]~~ Velocity Surv Rpt.

TENEMENT P.E.P. 5. Military Map. Hawkesdale 1 m/l. 077 868.

ELEVATION 189 G.L. 202 R.T. (Datum) T.D. 8129 STATUS. D. & A.

SPUD. 7 Sept. 1962 COMPL. 13 Oct. 1962 ABD. 22 Oct. 1962

CASING 20" Cond. @ 39' 13 3/8" @ 1257'. C. to S. 9 5/8" @ 6690 C to 5600 (est.)

STRATIGRAPHY.

AGE.	FORMATION	DEPTH		THICKNESS
Oligocene	Glenelg Grp (≡ Heytesbury Grp).	13	+189	1243
Eocene – U. Cret.	Knight. Grp. (≡ Wangerrip Grp.)	1256.	-1054.	1114
	Dartmoor Fm	1256	(-1054)	
	Bahgallah Fm	1800	(-1598)	
U. Cretaceous	Paaratte Fm.	2370	-2168.	228
U. Cretaceous	Belfast. Mdst. ? (equivilant)	2598	-2396	172
U.-L. Cretaceous	Flaxmans Beds.	2770	-2568	152
L. Cret. – Jur.	Merino Grp (≡ Otway Grp.)	2922	-2720	3042
L. Cret – Jur ?	Basal Sandstone. (marine - brackish ?)	5964	-5762	1910 (4952)
Cambrian.	Basement Complex (Diabase)	7874	-7672	255+.

FORMATION TESTS.

D.S.T. No 1. 6690 – 6732. – Misrun

D.S.T. No 1a. 6690 – 6732. Basal Ss. 7/8" B.H.C. 2" T.H.C.

Set packer 6590'. Tool open 11 min. Good.

Strong immed. blow, continued. Rec. 5760'

muddy salt water. Salinity 14,000 ppm. Rw = 0.36 ohm m²/m @ 55°F.

IHP. 3310 FHP. 3310

IFP. 2660 FFP 2830 increasing.

No. S.I.P.

LOG SUMMARY and INTERPRETATION

Type	Run	Interval	Date	Type	Run	Interval	Date	Interval	φ	Sw
E log.	1	1282 – 100	10 Sept 62	Laterolog	1	2928 – 1256	19 Sept. '62			
"	2	2930 – 1256	18 " "	"	2	6702 – 4450	2 Oct '62			
"	3	4692 – 2700	24 " "	C.D.M.	1	6696 – 5700	3-4 Oct.			
"	4	6705 – 4450	2 Oct. 62	"		3200 – 2200	'62			
"	5	8128 – 6692	14 " "	"	2.	8126 – 6692	14 Oct. 62			
				C.W.L	1	1278 – 67	10 Sept. '62			
Microlog	1	2930 – 1256	18 Sep 62	(Sonic)	2	2928 – 1256	18 " "			
"	2	4692 – 2700	24 " "	"	3	4690 – 2700	24 " "			
"	3	6705 – 4450	3 Oct 62	"	4	6690 – 4450	3 Oct. '62			
"	4	8128 – 6692	14 " "	"	5	8120 – 6692	14 " "	Velocity Survey	conducted	

Frome-Broken Hill
PRETTY HILL No 1.

CORES

No	Interval	Rec	No	Interval	Rec	No	Interval	Rec	No	Interval	Rec.
1	1282-1302	12'0"	9 to 1	3810-3830	13'0"	17	6070-6080	6'0"			
2	1816-1836	6'0"	10	4315-4328	13'0"	18	6376-6388	4'0"			
3	2373-2383	Nil.	11	4625-4640	7'0"	19	6690-6702	7'6"			
4	2383-2403	15'0"	12	4640-4655	15'0"	20	7200-7214	14'0"			
5	2716-2726	Nil	13	4940-4960	5'0"	21	7585-7597	12'0"			
6	2726-2734	6'0"	14	5400-5420	20'0"	22	7883-7895	6'0"			
7	2928-2940	12'0"	15	5420-5424	2'0"	23	8112-8129	16'0"			
8	3340-3360	15'0"	16	5935-5947	12'0"						

CHEMICAL ANALYSES (OIL, WATER, GAS.)

Analyses by B.M.R. on core samples.

		WATER	OIL. % pore space
WATER & OIL.	(7) 2928-2940	17.350 ppm.	N.I.
	(13) 4940-4961	21.100 ppm.	1
	(14) 5400-5420	19.900 ppm.	Not measureable
	(16) 5935-5947	21.600 ppm.	3.
	(17) 6070-6080.	18,400 ppm.	N.M
	(18) 6376-6388.	6.250 ppm.	Nil.
	(19) 6690-6702	3.140 ppm	Nil
	(20) 7200-7214.	2990 ppm	Nil
	(21) 7585-7597.	3.200 ppm	Nil.

GENERAL (Conclusions, structure, abandonment programme, etc)

located on crest of structure interpreted for deep seismic reflector which turned out to be basement. Sections above this had their culmination offset slightly to the south of the wellsite & some slight North component of dip could be expected. On the north side of a regional E-W. normal fault downthrown to the S.

The age of the new sandstone unit is uncertain but on lithological comparison & doubtful spore content it has been assigned as L. Cret - Jurassic age. This basal SS evidenced porosities up to 25% and permeabilities to 2700 md. but was completely devoid of hydrocarbons. High salinity of its formation water suggests marine conditions of deposition.

References:
Edwarthy, K.S. 1964 "A Petrological Study of the Sediments from the Frome Broken Hill Pretty Hill Well No 1 Otway Basin, Victoria."
B.M.R. Record No 1964/185.

2.0 WCR

2.0 WCR

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FROME-BROKEN HILL COMPANY PTY. LTD.

Report No. 7200-G-94

WELL COMPLETION REPORT

PRETTY HILL NO. 1, SOUTHWEST VICTORIA

by

J. S. Bain

Melbourne

November, 1962

CONTENTS

ILLUSTRATIONS

Pretty Hill. 3

I SUMMARY

Pretty Hill No. 1 well was drilled to a total depth of 8,129 feet within the southwestern part of the Otway Basin.

The well bottomed in igneous rock correlated with the Cambrian basement complex to the north, having penetrated Tertiary and Mesozoic rocks. A new basal sandstone unit was found directly above the basement complex. The age of this new sandstone unit is uncertain but, on lithological comparisons and doubtful spore content, it has been assigned a Lower Cretaceous-Jurassic age. No Waarre Formation, as determined in the Port Campbell area, was evident in this well.

There was some evidence for angularity between the basal sandstone unit and the overlying Merino Group, and the presence of the Flaxmans Beds suggests an erosional period during this time and before the marine Belfast Mudstone was deposited. There is a third unconformity between the basal sandstone and the Cambrian basement complex.

Below the Paaratte Formation, apart from the basal sandstone, reservoirs were poorly developed, porosities being low and permeabilities zero. The basal sandstone evidenced porosities up to 25% and permeabilities to 2700 millidarcies, but was completely devoid of hydrocarbons. Formation water within this unit suggested marine conditions of deposition. The only gas shows in the well appeared to be wholly related to carbonaceous sections.

SEE ALSO: "LITHOFACIES DATA SHEET B" PREPARED BY CUNDILL MEYERS & ASSOC. FOR SHELL DEV. 1967.

4.

II INTRODUCTION

Pretty Hill No. 1 was drilled by Frome-Broken Hill Company Pty. Ltd. to further evaluate the petroleum possibilities of the Otway Basin.

The well was located by seismic methods to the north of a regional east-west normal fault downthrown to the south. Regional south dip is present in the area, but in the vicinity of Pretty Hill, on the upthrown side of this major fault, north dip is indicated in the deeper target horizons. In the shallower horizons this dip reversal is confined to the immediate culmination of the structure and south dip is prevalent across the structure and is independent of faulting.

The Commonwealth Government agreed to contribute to the cost of drilling the well to total depth.

Pretty Hill

5.

III WELL HISTORY

1. General Data

(a) Well Name and Number:

Pretty Hill No. 1

(b) Location:

Parish of Boothapool, County of Villiers, Shire of Belfast.
Reference on 1 mile military map of Hawkesdale: 077868.
Latitude: 38° 13' ~~30~~ 24" S; Longitude: 142° 07' ~~30~~ 24" E.

(c) Name and Address of Tenement Holder:

Frome-Broken Hill Co. Pty. Ltd.,
95 Collins Street,
Melbourne, C.1.

(d) Details of Petroleum Tenement:

Petroleum Exploration Permit No. 5 issued by the State of Victoria.

(e) District:

Southwest Victoria

(f) Total Depth:

8129 feet

(g) Date Drilling Commenced:

September 7, 1962

(h) Date Drilling Completed:

October 13, 1962

(i) Date Well Abandoned:

October 22, 1962

(j) Date Rig Released:

Rig not released - transferred to Eumeralla No. 1.

Pretty Hill

(k) Drilling Time in Days to Total Depth:

37 days

(l) Elevation:

Ground Level	189 feet	
Derrick Floor	201 "	
Rotary Table	202 "	(datum for drilling)
Kelly Bushing	203 "	

(m) Status:

Well abandoned. Recovered $9\frac{5}{8}$" casing to 1218 feet. Set cement plugs between 6690 and 6560 feet, 1116 and 1052 feet, and from 10 feet to surface.

2. Drilling Data

(a) Name and Address of Drilling Contractor:

Drilling Contractors (Australia) Pty. Ltd.,
383 George Street,
SYDNEY, N.S.W.

(b) Drilling Plant:

Make:	National
Type:	Ideal 80-B
Rated Capacity with $4\frac{1}{2}$" drill pipe:	12,000 feet

Motors -

Make:	Waukesha
Type:	Model LRDBSU
B.H.P.:	526
Number:	3

(c) Mast/Derrick:

Make:	Lee C. Moore
Type:	136 feet
Rated Capacity:	700,000 lbs.

(d) Pumps:

Make:	Emsco	National
Type:	D850	G700
Size:	$8\frac{1}{4}$" x 18"	8" x 14"

(e) Blowout Preventor Equipment:

Make:	Cameron	Hydril	Hydril
Type:	SS	GK	Accumulator
Size:	12"	12" flanged	
Series:	900	900	

(f) Hole Sizes and Depths:

(1) (i) 24" hole to 39 feet.
(ii) Set 20" conductor pipe at 39 feet.

(2) (i) Drilled $12\frac{1}{4}$" hole to 1282 feet.
(ii) Reamed $12\frac{1}{4}$" hole to $17\frac{1}{2}$" to 1282 feet.
(iii) Set $13\frac{3}{8}$" casing at 1257 feet.

(3) (i) Drilled $12\frac{1}{4}$" hole to 6702 feet.
(ii) Set $9\frac{5}{8}$" casing at 6690 feet.

(4) (i) Drilled $8\frac{5}{8}$" hole to 8129 feet T.D.

(g) Casing Details:

Size:	$13\frac{3}{8}$"
Weight:	48 lb/foot
Grade:	H.40
Range:	2
Setting Depth:	1257 feet

Size:	$9\frac{5}{8}$"	
Weight:	40 lb/foot	
Grade:	N.80 and J.55	
Range:	2	
Setting Depth:	6690 feet	(0 - 205 feet - N.80
		(205 - 4115 " - J.55
		(4115 - 6690 " - N.80

(h) Casing Cementing Details:

(i)

Size:	$13\frac{3}{8}$"
Setting Depth:	1257 feet
Quantity Cement Used:	1100 sacks
Cemented to:	Surface
Method Used:	Single stage cementing with plugs, by Halliburton cementing truck.

(ii)

Size:	$9\frac{5}{8}$"
Setting Depth:	6690 feet
Quantity Cement Used:	400 sacks
Cemented to:	5600 feet (estimated)
Method Used:	Single stage cementing with plugs by Halliburton cementing truck.

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(i) Drilling Fluids: by W. D. Wood,
Drilling Engineer, Mobil Petroleum Company

A freshwater native mud was used to drill the hole to depth of running the $13\frac{3}{8}$" surface casing. After setting the surface casing a freshwater-bentonite system was employed to a depth of approximately 3200 feet where it was converted to a bentonite-Spersene system. This system was then used to the setting depth of the $9\frac{5}{8}$" intermediate casing string.

Properties of the bentonite-Spersene system were as follows:

Weight	Ranged from 10.0 to 11.0 lb/gal. The weight increase experienced was due mainly to the mud carrying a high sand and solid content.
Viscosity	37 to 60 seconds. No difficulty was experienced in maintaining the viscosity below 60 seconds.
Water Loss	8.0 to 10.0 cc.
Filter Cake	2/32" to 3/32"
pH	9.0 to 10.0
Sand Content	2.5 to 10%

After setting of the $9\frac{5}{8}$" intermediate casing string the bentonite-Spersene system was converted to a gypsum-Spersene system which was then used to total depth. Properties of this system had the following characteristics:

Weight	9.8 to 10.0 lb/gal.
Viscosity	35 to 40 seconds
Water Loss	5.2 to 7.8 cc
Filter Cake	2/32" to 3/32"
pH	9.0 to 10.0
Sand Content	$\frac{1}{4}$ to $\frac{1}{2}$%

Both the bentonite-Spersene and gypsum-Spersene systems performed very satisfactorily during the drilling of the well. While drilling the intermediate hole, tight spots along with minor bridging were encountered, this condition being the result of maintaining a too low annular velocity of 90 ft./min. When the annular velocity was increased to 160 ft./min. these problems were overcome.

(j) Water Supply:

A water well was drilled to 101 feet and a 2-stage Model 6K11A K.L. Berkeley vertical turbine pump installed. Salinity of this water was 600 ppm. chlorides.

(k) Perforation and Shooting Record:

No perforating was carried out.

(l) Plugging Back and Squeeze Cementation Jobs: (See Plate No. 6)

(a) Spotted 50 sack plug from 6690 to 6560 feet.
(b) Spotted 50 sack plug from 1116 to 1052 feet.
(c) Spotted 5 sack plug from 10 feet to surface.

(m) Fishing Operations:

None

(n) Side-tracked Hole:

None

3. Logging and Testing

(a) Ditch Cuttings:

Cuttings were taken over a normal shale shaker. Interval sampled was every 10 feet to total depth, with bottom hole samples circulated at various depths.

(b) Coring: (See Appendix 4 for Core Description)

Original coring program outlined cores to be taken on the occurrence of hydrocarbon shows, indications of prospective reservoirs, at formation changes and drilling breaks, and at fossiliferous marker beds. In addition, Commonwealth Government subsidy agreement stipulated routine cores to be taken at 300 foot intervals, these intervals being extended to 500 feet for drilling within a section of uniform lithology.

Twentythree cores were cut for a total footage of 328 feet. Recovery was 218 feet 6 inches, or 66.6%.

Nine cores were cut with a Hughes Type 'J' barrel with soft and hard formation coreheads, and fourteen cores were cut by Reed Korking barrel with hard formation coreheads. Core diameters were $3\frac{1}{2}$".

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(c) Sidewall Sampling:

No sidewall cores were attempted.

(d) Electrical and Other Logging:

Logging was carried out by Schlumberger Seaco Inc., the engineer being M. G. Guigues. Logs were run as follows:

Electric Log I.E.S.	Microlog	Laterolog
100 to 1282 feet	1256 to 2930 feet	1250 to 2928 feet
1256 to 2930 "	2700 to 4692 "	4450 to 6702 "
2700 to 4692 "	4450 to 6705 "	
4450 to 6705 "	6692 to 8128 "	
6692 to 8128 "		

Sonic Log	Continuous Dipmeter
67 to 1278 feet	2200 to 3200 feet
1256 to 2928 "	5700 to 6696 "
2700 to 4890 "	6690 to 8128 "
4450 to 6690 "	
6692 to 8120 "	

Scales of all the logs run except the Continuous Dipmeter were 1" = 100 feet and 5" = 100 feet. The Continuous Dipmeter run was recorded at scales 2" = 100 feet and 1" = 2 feet.

(e) Drilling Time:

A Geolograph continuous time-depth recorder was used during the drilling of Pretty Hill No. 1, which recorded the time taken for each foot penetrated. A drilling time log was drawn up from the Geolograph charts and is included in the composite log.

(f) Formation Testing:

Testing was carried out by Halliburton Ltd. The following tests were run with a $9\frac{5}{8}$" R.T.T.S. tool adapted as a hookwall packer, and regular Hydrospring Tester.

D.S.T. NO. 1 — 6690 to 6732 feet
Mis-run. Closed in pressure valve became shut while running in the hole. The tester failed to open.

Pretty Hill

D.S.T. No. 1a — 6690 to 6732 feet. Basal sandstone section. Bottom choke $\frac{3}{8}$", top choke 2". Set packer at 6590 feet. Tool open for 11 minutes. Good strong immediate blow continued throughout flow period. Water cushion 90 feet. Recovered 5360 feet of muddy salt water contaminated at the top by mud and water cushion. Salinity of salt water 14,000 ppm. Cl. Rw = 0.36 ohm m^2/m at 55°F.

I.H.P. 3310 psi F.H.P. 3310 psi
I.F.P. 2660 " F.F.P. 2830 " increasing
No S.I.P.

(g) Deviation Surveys: (See Appendix No. 5 for details)

Deviation surveys were carried out with Totco instrument and in conjunction with the Schlumberger Continuous Dipmeter runs.

In general, under 1° deviation was maintained up to 4000 feet, between 1° and 2° to 6500 feet, and this angle increased to maximum of 4° 15' at 7585 feet, and decreased to 4° at total depth.

(h) Other Well Surveys:

A well geophone velocity survey was run in conjunction with Namco International to total depth in the well.

Check shots were taken at some of the formation breaks and also at 500 and 1000 feet intervals as selected from data obtained from the Sonic Log.

IV GEOLOGY

1. Summary of Previous Work

(a) Geological

The surface of the Otway Basin has extensive basalt and Quaternary cover, and in the Tyrendarra area nothing of subsurface value can be learned from outcrop work. Detailed photogeological and geomorphic studies of the area with field checks have shown some surface anomalies in both drainage and linear features. Some of these anomalies are attributable to the influence of intrusive rocks, while others are believed to be related to folding and faulting of the sedimentary section.

(b) Geophysical

The Pretty Hill No. 1 location was selected from the results of a seismic survey carried out by Ray Geophysics (Aust.) Pty. Ltd. for the Company.

The seismic results in this area indicate that all horizons dip to the south with a general east-west strike. This south dip is interrupted by a regional east-west normal fault, downthrown to the south. In the vicinity of Pretty Hill, on the upthrown side of this fault, north dip is indicated in the deeper horizons. However, at the seismic horizon correlated with the top of Paaratte Formation, the northerly dip is confined to the immediate culmination of the structure and south dip is prevalent elsewhere. East-west closure on the Pretty Hill location is independent of faulting.

(c) Drilling

Two water wells were recently drilled in the general area by the Victorian Mines Department. The first one was the Belfast No. 4 bore in the neighbourhood of Port Fairy, approximately 12.5 miles southeast from Pretty Hill No. 1. This well reached 5522 feet and penetrated 1650 feet of Glenelg Group, 1925 feet of Knight Group, 975 feet of Paaratte Formation, 435 feet of Belfast Mudstone and 537 feet of the Merino or equivalent Otway Group.

The other well was Yangery No. 1 in the vicinity of Koroit township, approximately 14.5 miles east-southeast from Pretty Hill No. 1. This well was drilled to 4330 feet and penetrated 1786 feet of Glenelg Group, 764 feet of Knight Group, 395 feet of Paaratte Formation and 385 feet of Merino or equivalent Otway Group.

2. Summary of the Regional Geology

The Otway Basin, which extends across southwest Victoria and southeastern South Australia, contains Mesozoic and Tertiary sediments. The Pretty Hill No. 1 well was the first well within the deeper parts of the basin to reach basement.

To the north, Palaeozoic rocks ranging from Cambrian to Permian age and comprising conglomerates, shales, mudstones, glacial deposits, volcanic rocks, metamorphics and large igneous bodies crop out. In the western part of the basin in South Australia, some granites are present along the margin but the southern and eastern limits of the basin are not defined. Mesozoic rocks crop out in the Otway Ranges in the east part and also around Casterton and Merino in the northwestern part of the basin. Many of the recognised subsurface units are not known in outcrop. The basin is largely covered by Tertiary and younger volcanic flows and Quaternary deposits with considerable onlap and overlapping of the older section.

The area, as a whole, contains non-marine and marine ?Jurassic to Upper Tertiary strata having an aggregate thickness in excess of 12,000 feet. As far as is known, the lower part of the succession was laid down under predominantly freshwater conditions. Upward through the Mesozoic succession, conditions changed to a shallow water, brackish environment through a definite marine phase and then back to shallow water, brackish conditions. In the wells drilled to date these latter conditions graded vertically upwards into predominantly paralic conditions during the Lower Tertiary, which was transitional to the open marine conditions of the Middle Tertiary.

It appears that the major structural features within the basin are closely related to normal faulting rather than primary compressional forces. The faulting appears to have been active during sedimentation, resulting in radical thickness changes, and the development of local unconformities. This contemporaneous faulting dies out in the uppermost Cretaceous after which stable conditions existed until uplift began in the late Tertiary. This latter uplift resulted in some post-depositional normal faulting in restricted areas and was responsible for the formation of some very shallow broad folds in the younger Tertiary strata.

3. Stratigraphic Table - Pretty Hill No. 1

Unit	Age	Subsurface Top (Feet)	Thickness (Feet)
Glenelg Group (≡ Heytesbury Group)	Oligocene	-	1243
Knight Group (≡ Wangerrip Group)	Eocene-Upper Cretaceous	1256(-1054)	1114
Paaratte Formation	Upper Cretaceous	2370(-2168)	228
Belfast Mudstone	Upper Cretaceous	2598(-2396)	172
Flaxmans Beds	Upper-Lower Cretaceous	2770(-2568)	152
Merino Group (≡ ?Otway Group)	Lower Cretaceous-?Jurassic	2922(-2720)	3042
Basal Sandstone	?Lower Cretaceous-?Jurassic	5964(-5762)	1910
Basement Complex	Cambrian	7874(-7672)	255 +

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Note: Figures in brackets refer to depth below sea level of the various horizons.

4. Stratigraphy

The section cut in Pretty Hill No. 1 can be correlated to some extent with wells in the Port Campbell Embayment, and general descriptions of the lithology are as follows:

Surface to 1256 feet — Glenelg Group ≡ Heytesbury Group

Surface to 420 feet: Limestone, light grey, fossiliferous, slightly glauconitic, with some silty limestones. Freshwater bearing. Equivalent to the Portland Limestone member of the Gambier Limestone Formation.

420 to 1120 feet: Marl, grey, blue-grey, fossiliferous, soft, puggy.

1120 to 1256 feet: Limestone, light brown, fossiliferous with grey-brown, grey silty marls. The interval 420 to 1256 feet is equivalent to the Heywood Marl member of the Gambier Limestone Formation.

1256 to 2370 " — Knight Group ≡ Wangerrip Group

Sandstone. Dominantly medium to coarse grained, light grey with interbedded medium to dark grey and brown micaceous siltstones. Pyrite and limonite present and fossiliferous in parts. Dolomite band towards base.

2370 to 2598 " — Paaratte Formation

Siltstone and sandstones. Interbedded dark grey to brown-grey, micaceous, carbonaceous and pyritic siltstones and fine to coarse, clear quartz sandstones. Few dolomite bands.

2598 to 2770 " — Belfast Mudstone

Sandy siltstones. Dark grey to greenish grey, micaceous, fossiliferous, glauconitic.

2770 to 2922 " — Flaxmans Beds

Sandstone. Dirty brown, very limonitic medium to very coarse grained sandstones interbedded with dark grey glauconitic sandstone.

2922 to 5964 " — Merino Group ≡ Otway Group

Sandstones, siltstones and mudstones. Interbedded light to medium grey and green-grey, fine to coarse sandstones and subgreywackes with siltstones and mudstones. Composition is quartz, feldspar, dark rock fragments, chlorite, mica and some clays.

5964 to 7874 feet — Basal sandstone

Sandstone. Light grey, very porous, made up almost entirely of clear quartz, fine to coarse, angular to subrounded and containing distinctive orange-red to pink grains (?garnet). Matrix when present is mainly siliceous but some clay and ?gypsum is present. Sandstone is generally non-calcareous but bands of thin chocolate brown dolomite and dolomitic cement are present. A few mudstone bands are interbedded with the sandstone. Carbonaceous matter and coal are present.

7874 to 8129 " — Basement Complex

Diabase. Dark grey and greenish-grey ultra-basic igneous rock, originally olivine dolerite and altered to a diabase. Very fractured and slickensided and with ferro-calcite veining.

The Glenelg Group in Pretty Hill No. 1 had a lithology similar to the equivalent **Heytesbury** Group in the Port Campbell Embayment. However, the basal Nelson Formation was not present in this well and possibly there is some basis for a local depositional break between the Knight Group and the Glenelg Group.

The Knight Group has been subdivided on fossil content into the Dartmoor Formation from 1256 to 1800 feet and the Bahgallah Formation from 1800 to 2370 feet. There is no unconformity between these two units and, for purposes of this report, they are grouped together as the Knight Group which is lithologically similar to the Wangerrip Group of the Port Campbell Embayment, and ranges downward from Eocene to Upper Cretaceous age.

The transitional Paaratte Formation in this well has not as well developed separate sand and siltstone-mudstone sections as in the Port Campbell wells, and it tends to remain more like the basal Knight Group here than the Belfast Mudstone below it.

The Belfast Mudstone in this well is more sandy than equivalent sections further to the east. It also has a type of glauconite which turns browny-orange when heated dry which is characteristic of equivalent sections in the Heywood No. 10 and Yangery No. 1 bores but is distinct from wells east of the Warrnambool High where the glauconite remains unchanged on heating. This is probably evidence of a slight change of marine depositional environment. Foraminifera also are sparse and indicate anaerobic conditions.

The section from 2770 to 2922 feet is placed within the Flaxmans Beds on lithological comparisons and the top of the Merino Group is taken as 2922 feet. Apart from a finer grain size in the top part, the Merino Group appears to be similar in composition to the Otway Group. No attempt has been made to sub-divide the Merino Group into the Runnymede and Mocamboro members as defined from outcrop.

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The basal sandstone cut from 5964 to 7874 feet was not recognised in previous wells, and is made up almost entirely of quartz sandstones with obvious high porosity throughout. These sandstones were thought at first to be possibly equivalent to the Grampian Series of western Victoria, but it is now thought that they are younger than this unit and are tentatively assigned a Mesozoic age, possibly Lower Cretaceous-Jurassic. This unit is lithologically very similar to the Waarre Formation within the Port Campbell Embayment, although the Waarre Formation has more clay matrix probably derived from weathered feldspar. The nature of the formation water tends to suggest marine or at least brackish conditions of sedimentation. Cross bedding appears to be present but true dip is hard to estimate. The Continuous Dipmeter did not give very usable results through this section, but possibly some of the low dips measured towards the northwest are representative of true dip. Hole deviation and seismic sections support the view that north dip is present at this location.

Seismic work also shows evidence of some angularity between the basal sandstone unit and the overlying Merino Group. The random nature of the dips from the dipmeter survey between 5800 and 6000 feet, as well as the fractured nature of Core No. 16 from 5935 to 5947 feet, tend to support the presence of an hiatus between these units.

From 7874 to total depth of the well at 8129 feet, basement was cut. This consists of a dark grey, very fine grained rock, determined petrologically to be an olivine dolerite altered to diabase, with ferro-calcite veining. A similar rock type is encountered within the Cambrian basement complex to the north of Pretty Hill.

5. Structure

The well was located on the crest of the structure interpreted for the deep seismic reflector which turned out to be basement. Sections above this had their culmination offset slightly to the south of the wellsite and some slight north component of dip could be expected within these limits.

Cross bedding was apparent in some of the Merino Group and basal sandstone cores. Apparent dip through these sections varied between 10^{o} and 30^{o}. Results from the dipmeter survey confirm that the dip is generally towards the northern quadrant down into the top of the Otway Group, but quite disturbed at the Merino Group-basal sandstone contact. Below this contact dips vary, probably as a result of cross bedding. Regional dip through the basal sandstone section is probably less than 15^{o} towards the northwest.

6. Relevance to Occurrence of Petroleum

Pretty Hill No. 1 was unusual compared with the Port Campbell and Flaxmans No. 1 wells in that there were virtually no shows of hydrocarbons. Small gas readings and trip gas recorded on the gas detector were probably all methane and related to the coal sections within the Merino Group and basal sandstone sections. This probability is supported by the presence of one or two gas bubbles emanating from a thin coal stringer in Core No. 20 cut from 7200 to 7214 feet.

A test within part of the basal sandstone section yielded a strong flow of salt water which did not show any evidence of solution gas. Resistivities recorded on electric logs confirmed the water-bearing nature of this sand as well as sands within the Merino Group.

7. Porosity and Permeability of Sediments Penetrated

Porosity and permeability were estimated qualitatively at the wellsite from cuttings and cores, and quantitatively on log analysis from the Microlog and Sonic Log and by core analysis.

Sediments down to the Merino Group had similar porosities to their counterparts in the Port Campbell Embayment. Merino Group sediments, although in general finer grained than their counterparts from the Otway succession, showed porosities ranging from less than 10% up to 27% from log analysis. These are confirmed by core analyses. Permeabilities, however, are low to nil which has generally been typical of the Otway Group in the Port Campbell Embayment.

The basal sandstone section is characterised by high porosity and permeability throughout, and porosities from log analysis are nearly all over 20%. Core analyses show porosities ranging from 20% to 25% and permeabilities ranging from 197 to 2756 m.d. and, in this respect, these properties are similar to those of the Waarre Formation in the Port Campbell area. These high permeabilities were confirmed in drill stem test No. 1(a) run in a part of this basal sandstone.

8. Contribution of Geological Concepts Resulting from Drilling

Pretty Hill No. 1 well added considerably to our knowledge of the area.

This well was the first in the deeper part of the Otway Basin to drill to economic basement, which was found to be similar to the Cambrian basement complex which occurs in western Victoria. It is still conjecture, however, as to the areal extent of this type of basement complex beneath other parts of the basin.

A sandstone section with very obvious reservoir characteristics was found to lie between the basement complex and the overlying sediments of the Merino Group. The age and depositional nature of this sand section are not well defined, but the sand is thought to be of possibly

marine or at least brackish depositional origin by reason of the high salinity of the formation water. An age determination based on spore content is suggested to be Lower Cretaceous. It is not known to what extent it occurs in other parts of the basin.

The Merino Group has been proved to have a thickness of 3042 feet in this area and is barren of hydrocarbons. There is no Waarre Formation developed at Pretty Hill unless the basal sand is Waarre equivalent which seems unlikely. Sediments above the Merino Group are somewhat different from their equivalents east of Warrnambool. These features point to a somewhat different geological history in this area. Possibly, the Waarre Formation was never laid down in this area, its equivalent time interval being represented by the Flaxmans Beds which exhibit some characteristics of an unconformity.

There is also some evidence, from the seismic mapping, of angularity between the basal sandstone and the Merino Group. The presence of this hiatus is not apparent from cores or cuttings, but is indicated by the dipmeter survey. The geological history of this area is further complicated by the presence of a large normal fault down to the south just south of the well. As this faulting appears to have been contemporaneous with Cretaceous deposition, conditions are probably different in other parts of the Tyrendarra area and only further drilling will help elucidate these problems.

November, 1962

J. S. BAIN

Pretty Hill

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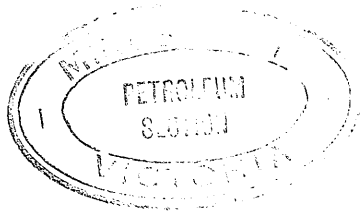

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2. Glenie, R. C. and Reed, K. J. — Bores 2 and 3, Portland, Victoria - Subsurface Geology and Engineering Data. Mining & Geol. Journal (Victoria) Vol. 6, No. 4, 1959-1960.

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Appendix 1. . . .

Petrological Reports

Pretty Hill

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APPENDIX 1.

PETROLOGICAL REPORTS

Pretty Hill

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PETROGRAPHIC EXAMINATION OF CORE FROM 7883 TO 7895 FEET

The rock is igneous, and shows no traces of metamorphism. It is very fine-grained, holocrystalline, and porphyritic.

The phenocrysts are predominantly subhedral pale green chloritic alterations of olivine and hornblende. The former is also quite strongly serpentinised. Serpentine is characteristic of ultrabasic rocks, and indicates weathering. In one large phenocryst calcite occurs, derived probably from the release of Ca from the hornblende.

Augite is quite common, sometimes as fresh pale-brown subhedral phenocrysts; larger ones may show an inner core with a higher extinction angle. Pyroxene phenocrysts more commonly are pseudomorphs; many of these are rhomb-shaped (representing a particular cross-section), suggesting a preferred orientation.

Brown calcite, probably ferro-calcite, occurs along fractures.

Anhedral magnetite is an abundant accessory, both in the groundmass, and as coarser grains. It has no specific association with any other mineral, but is probably a product of the generation of iron from the olivine during the process of serpentinisation.

Accessory epidote also occurs in traces.

The groundmass is very fine-grained, and other than magnetite it contains plagioclase felspar, which is not very abundant, and laths of a fresh pyroxene (probably a second generation of augite). The felspar occurs as very small (commonly only 0.03 mm. long) thin laths. Its refractive index is approximately that of Canada Balsam; and it shows (although it is usually too obscure) an Albite twinning with an extinction angle of approximately 12°. This suggests that the felspar is albite. It was necessary to study the groundmass under a magnification of 400x; with such power, the groundmass appeared (apart from magnetite) to be isotropic in parts, suggesting the possible occurrence of ? analcite. This is a very indefinite observation, however.

The groundmass has a trachytic texture in parts, but not so much as to call the rock a trachyte.

Conclusions

The rock appears to have originally been an olivine dolerite which has since been strongly weathered. This weathering involves extensive chloritisation, also serpentinisation, probable albitisation, introduction of abundant iron ore, possible analcite, and also accessories such as epidote. Some calcite is also introduced. It is thus an ultrabasic igneous rock which is very rich in ferromagnesian minerals. A local name for such a rock would be a "diabase".

Pretty Hill

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Dolerites are typically hypabyssal, that is, intrusive rocks, commonly occurring as dykes and sills. The latter can be extremely thick (for example, the Mt. Wellington dolerite sill exceeds 1,000 feet thickness).

Mineralogically and texturally the rock has many similarities to Victorian Cambrian greenstones. If Cambrian, the most likely associated outcrop would be in the Glenelg River area, at Wando Vale, where mainly amphibolites and serpentines occur. The trend here is northwest-southeast.

However, it cannot be said definitely that the rock does belong to the Cambrian complex, or even that it is an intrusive rock. (Some dolerites in the Cambrian at Heathcote are undoubtedly lava flows).

It is hoped that examination of a deeper core of similar rock may throw more light on the problem.

J. B. HOCKING

Pretty Hill

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PETROGRAPHIC EXAMINATION OF CORE FROM 8112 TO 8129 FEET

The hand specimen is a dense, dark green rock, very fine-grained. White (and occasionally brown) calcite commonly occurs as fracture fillings.

The rock has been subjected to some stress, as it shows polished slickenside surfaces. It also crumbles freely upon soaking in water. It is somewhat softer than the sample from Core 22, and is readily scratched by the latter. The thin section shows little evidence of any shearing forces, however.

Petrographic Determination

It is a pale green igneous rock which is holocrystalline, fine-grained, and porphyritic. However, it is less porphyritic than the sample from Core 22: the phenocrysts are commonly not as large, while the groundmass is somewhat coarser-grained than that of the Core 22 sample.

Phenocrysts are occasionally of olivine, sometimes retaining one of its pyramidal terminations. Although it occurs invariably as chloritic pseudomorphs, it shows no serpentinisation.

The majority of the phenocrysts are augite pseudomorphs. These augites have been completely chloritised, and are normally anhedral. They show secondary cleavage, and straight extinction on this cleavage. Fresh augite phenocrysts are relatively common, occurring as subhedral to euhedral elongated prisms, approx. 0.3 mm. long. The augites are often fractured; one prism, roughly 0.7 mm. long, is bent at one end and shows wavy extinction; this is the only evidence of stress in the rock.

Chlorite sometimes occurs as spherulitic growths. Another interesting feature is the occurrence of an amygdule containing secondary albite and chlorite. (Whether the amygdule itself is primary or secondary is doubtful). The albite and chlorite are intergrown; the former occurs as laths up to 0.1 mm. long, while the chlorite has a coarse aggregate growth, spherulitic in parts.

Calcite fills both amygdules and fractures, and may show good twin lamallae. Another colourless mineral filling small fractures is presumably a zeolite (its optical properties are as follows: biaxial negative, medium 2V, about 40°; one good cleavage, with straight extinction, otherwise extinction of separate wedge-shaped aggregates; low birefringes, first order grey and yellow; R.I. low: α < 1.485, γ approx. 1.485).

Magnetite is a common accessory, but is coarser-grained and less abundant than that in the Core 22 samples.

The "groundmass"* consists almost entirely of high refractive index minerals, most of which are fresh augite prisms, randomly orientated. No other minerals could be positively identified.

Pretty Hill

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(*The groundmass is not a typical one in that there is somewhat of a gradation in size up to grains of phenocryst size, instead of the two clear-cut size ranges of the Core 22 sample.)

Conclusions

This rock is very rich in pyroxene, and is rather typical of limburgites, it could almost be called an augitite, because of the abundance of augite. It has been considerably altered, however, and is now chlorite-rich. As with the Core 22 sample, a broad field term would be "diabase". It is most certainly an ultrabasic rock.

There seems little doubt now that this rock is part of a Cambrian basement complex. The Cambrian rocks of Victoria are typically augite-rich; other mineralogical characteristics of well-studied Cambrian rocks at Heathcote-Romsey are similar to those here. (However, the writer still believes that, structurally, these rocks are associated with the Glenelg River Cambrian outcrop).

The change in original rock type, i.e. from dolerite to limburgite, from Core 22 to Core 23, seems to rule out the possibility of this rock being part of a dyke or sill.

J. B. HOCKING

FROME-BROKEN HILL CO. PTY. LTD.: PRETTY HILL No.1

PETROGRAPHIC DETERMINATION OF SAMPLE FROM FT. : CORE 22.

The rock is igneous, and shows no traces of metamorphism. It is very fine-grained, holocrystalline, and porphyritic.

The phenocrysts are predominantly subhedral pale green chloritic alterations of olivine and hornblende. The former is also quite strongly serpentinised. Serpentine is characteristic of ultrabasic rocks, and indicates weathering. In one large phenocryst calcite occurs, derived probably from the release of Ca from the hornblende.

Augite is quite common, sometimes as fresh pale-brown subhedral phenocrysts; larger ones may show an inner core with a higher extinction angle. Pyroxene phenocrysts more commonly are pseudomorphs; many of these are rhomb-shaped (representing a particular cross-section), suggesting a preferred orientation.

Brown calcite, probably ferro-calcite, occurs along fractures.

Anhedral magnetite is an abundant accessory, both in the groundmass, and as coarser grains. It has no specific association with any other mineral, but is probably a product of the generation of iron from the olivine during the process of serpentinisation.

Accessory epidote also occurs in traces.

The groundmass is very fine-grained, and other than megnetite it contains plagioclase felspar, which is not very abundant, and laths of a fresh pyroxene (probably a second generation of augite). The felspar occurs as very small (commonly only 0.03 mm. long) thin laths. Its refractive index is approximately that of Canada Balsam; and it shows (although it is usually too obscure) an Albite twinning with an extinction angle of approximately 12°. This suggests that the felspar is albite. It was necessary to study the groundmass under a magnification of 400x; with such power, the groundmass appeared (apart from magnetite) to be isotropic in parts, suggesting the possible occurrence of ? analcite. This is a very indefinite observation, however.

The groundmass has a trachytic texture in parts, but not so much as to call the rock a trachyte.

Conclusions

The rock appears to have originally been an olivine dolerite which has since been strongly weathered. This weathering involves extensive chloritisation, also serpentinisation, probable albitisation, introduction of abundant iron ore, possible analcite, and also accessories such as epidote. Some calcite is also introduced.

It is thus an ultrabasic igneous rock, which is very rich in ferromagnesian minerals. A local name for such a rock would be a "diabase".

Dolerites are typically hypabyssal, that is, intrusive rocks, commonly occurring as dykes and sills. The latter can be extremely thick (for example, the Mt. Wellington dolerite sill exceeds 1,000 ft. thickness).

Mineralogically and texturally the rock has many similarities to Victorian Cambrian greenstones. If Cambrian, the most likely associated outcrop would be in the Glenelg River area, at Wando Vale, where mainly amphibolites and serpentines occur. The trend here is N.W. - S.E.

However, it cannot be said definitely that the rock does belong to the Cambrian complex, or even that it is an intrusive rock. (Some dolerites in the Cambrian at Heathcote are undoubtedly lava flows.)

It is hoped that examination of a deeper core of similar rock may throw more light on the problem.

J.B. HOCKING, B.Sc.

FROME-BROKEN HILL CO. PTY. LTD.

CORE 23: 8107-8124 ft.

The hand specimen is a dense, dark green rock, very fine-grained. White (and occasionally brown) calcite commonly occurs as fracture fillings.

The rock has been subjected to some stress, as it shows polished slickenside surfaces. It also crumbles freely upon soaking in water. It is somewhat softer than the sample from Core 22, and is readily scratched by the latter. The thin section shows little evidence of any shearing forces, however.

Petrographic Determination

It is a pale green igneous rock which is holocrystalline, fine-grained, and porphyritic. However, it is less porphyritic than the sample from Core 22 : the phenocrysts are commonly not as large, while the groundmass is somewhat coarser-grained than that of the Core 22 sample.

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Chorite sometimes occurs as spherulitic growths. Another interesting feature is the occurrence of an amygdule containing secondary albite and chlorite. (Whether the amygdule itself is primary or secondary is doubtful). The albite and chlorite are intergrown; the former occurs as laths up to 0.1 mm. long, while the chlorite has a coarse aggregate growth, spherulitic in parts.

Calcite fills both amydules and fractures, and may show good twin lamellae. Another colourless mineral filling small fractures is presumably a zeolite (its optical properties are as follows: biaxial negative, medium 2V, about 40°; one good clearage, with straight extinction, otherwise extinction of separate wedge-shaped aggregates; low birefringence, first order grey and yellow; R.I. low: 1.485, approx. 1.485).

Magnetite is a common accessory, but is coarser-grained and less abundant than that in the Core 22 sample.

The "groundmass"* consists almost entirely of high refractive index minerals, most of which are fresh augite prisms, randomly

orientated. No other minerals could be positively identified.

(* The groundmass is not a typical one in that there is somewhat of a gradation in size up to grains of phenocryst size, instead of the two clear-cut size ranges of the Core 22 sample.)

Conclusions

This rock is very rich in pyroxene, and is rather typical of limburgites; it could almost be called an augitite, because of the abundance of augite. It has been considerably altered, however, and is now chlorite-rich. As with the Core 22 sample, a broad field term would be "diabase". It is most certainly an ultrabasic rock.

There seems little doubt now that this rock is part of a Cambrian basement complex. The Cambrian rocks of Victoria are typically augite-rich; other mineralogical characteristics of well-studied Cambrian rocks at Heathcote-Romsey are similar to those here. (However, the writer still believes that, structurally, these rocks are associated with the Glenelg River Cambrian outcrop.)

The change in original rock type, i.e. from dolerite to limburgite, from Core 22 to Core 23, seems to rule out the possibility of this rock being part of a dyke or sill.

J. B. HOCKING.

BORE NAME : PRETTY HILL 1.

DEPTH OF SAMPLE	TYPE	DETERMINATION	REFERENCES
1816-36 ft. 553·5-559·6m	CORE 2	D. ORTHOTEICHUS	HARRIS (1965) DETTMANN (1970, 63, 6468)
2383-403 ft 726·3-732·4m	CORE 4	NOTHOFAGIDITES OR T. PACHYEXIMUS	DETTMANN 1970, 63b, 64i, 68d.
2726-39 ft. 830·8-834·8m	CORE 6	T. PACHYEXIMUS	DETTMANN 1970, 1969 1963b, 64i, 68d.
2928-40 ft. 892·4-896·1m	CORE 7	T. PANNOSUS	"
3340-60 ft. 1018-1024·1m	CORE 8	C. PARADOXA (UNNAMED UNIT)	DETTMANN 1969 63b, 64i, 68d
3810-30 ft. 1161·2-1167·3m	CORE 9	"	"
4315-28 ft. 1315·1-1319·1m	CORE 10	"	"
4625-40 ft. 1409·6-1414·2m	CORE 11	"	"
4640-55 ft 1414·2-1418·8m	CORE 12	"	"
4940-60 ft. 1505·6-1511·7m	CORE 13	C. PARADOXA (?D. FILOSUS)	"
5400-20 ft. 1645·8-1651·9m	CORE 14	NOT DETERMINABLE.	"
5420-24 ft. 1651·9-1653·1m	CORE 15	D. SPECIOSUS (SUBZONE NOT DETERMINED)	"
5935-47 ft. 1808·9-1812·6m	CORE 16	F. ASYMMETRICUS	"
6070-80 ft. 1850-1853·1m	CORE 17	C. HUGHESI (UNIT NOT DETERMINED)	"
6376-88 ft. 1943·3-1947m	CORE 18	"	"
6690-702 ft. 2039-2042·7m	CORE 19	C. STYLOSUS	"

SOURCE :

BORE NAME : PRETTY HILL 1

DEPTH OF SAMPLE	TYPE	DETERMINATION	REFERENCES
7200 - 14ft. 2194·4 - 2198·7 m	CORE 20	C. STYLOSUS	DETTMANN 1969 636, 64i 68d
7585 - 97ft. 2311·8 - 2315·4 m	CORE 21	NOT DETERMINABLE.	"

SOURCE :- DETTMANN·M·E (1969) PALYNOLOGICAL ZONATION OF L. CRETACEOUS SEDIMENTS OF THE OTWAY BASIN, VICTORIA. S.D.A FILING NO R181?

- DETTMANN (1970) PALYNOLOGICAL ZONATION OF U. CRETACEOU. SEDIMENTS OF THE OTWAY BASIN, VICTORIA. S.D.A FILING..
- DETTMANN (1963b) PALYNOLOGICAL REPORT ON NON-MARINE L.CRET SEDS. INTERSECTED IN EUMERALLA 1 & PRETTY HILL 1 WELLS. UNP. REPORT SUBM. TO FBH COPTY LTD 14/11/63.
- DETTMANN (1964i) FURTHER PALYNOLOGICAL OBSERVATIONS ON EUMERA 1 & PRETTY HILL 1, WELLS IBID 23/11/64.

DETTMANN (1968d) PALYNOGICAL REPORT ON INTER./SHELL PURRUMBETE 1 & 1602 - 5426 ft. UNP. REP. SUBM. TO SHELL DEVEL. (AUSTRALIA) PTY·LTD 14/11/68

Appendix 2 . . . .

Paleontological Reports

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APPENDIX 2

PALAEONTOLOGICAL REPORTS

by

M. F. Glaessner
University of Adelaide

R. C. Glenie and D. J. Taylor; J. Douglas
Department of Mines of Victoria

and

P. R. Evans
Bureau of Mineral Resources
Geology and Geophysics

Pretty Hill

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REPORT ON CORE NO. 6, 2726 to 2734 feet

PRETTY HILL NO. 1

by

M.F.Glaessner

I have examined the sample from Pretty Hill No. 1, Core No. 6, 2726 to 2734 feet which consists of glauconitic sandy mudstone. It contains:

Ammodiscus sp.

Hyperammina? sp.

Haplophragmoides sp.

Trochammina sp.

Textularia sp. ind.

Coral (1 specimen of a solitary coral)

Inoceramus (shell fragments)

Ammonite (1 minute shell fragment with partial suture)

Fish remains

This is closely comparable to the glauconitic Belfast Mudstone with poorer foraminiferal faunas. I have at present insufficient information to place it into any particular zone of this unit. I note that corals have not been previously reported from the Belfast Mudstone and I shall try to identify the only specimen found. The age of this rock is Upper Cretaceous.

Pretty Hill

PALAEONTOLOGICAL REPORTS

COMMENTS ON THE ROCK STRATIGRAPHY IN PRETTY HILL NO. 1 WELL

After an examination of the lithology and faunal content of the cores and cuttings from Frome-Broken Hill's Pretty Hill No. 1 well, we wish to make the following suggestions regarding the rock stratigraphic units intersected in the bore. The depth intervals mentioned are only approximate as they can be more accurately delineated by Frome-Broken Hill geologists who have the electric logs and continuous sample logs at their disposal.

One of the difficulties in assigning rock units to this well is the fact that it is in the centre of the Otway Basin whilst the rock units have been defined on either side of it; Mt. Gambier-Glenelg in the west and Pebble Point to Port Campbell in the east. Also the Otway Basin can be subdivided into three sub-basins (or sunklands) namely, the Gambier, Portland and Port Campbell sub-basins. The Pretty Hill well is within the Portland sub-basin, being west of the Warrnambool high.

The suggested rock units are as follows:
- 1220 feet: The Heywood Marl Member of Glenie and Reed (1960) would include the grey marls and pinky rubbly limestone of this interval.

1220-1800 feet: The Dartmoor Formation as outlined by Boutakoff and Sprigg (1953) is lithologically equivalent to the sands, silty sands, dolomitic sands and siltstones of this interval. By definition the Dartmoor Formation comprises the upper part of the Knight Group. It is noted that Ludbrook (1961) records an upper Eocene fauna (including Globigerina linaperta) from the top of the Knight Group in the Gambier sub-basin. G. linaperta occurs at 1286 feet in the Pretty Hill well.

1800-2150 feet: The Bahgallah Formation as defined by Kenley (1951) appears equivalent to the sediment in this interval. The top of the formation at 1800 feet is chosen on fossil content, as the Bahgallah Formation passes up into the Dartmoor Formation without any definite lithological break. The iron stained sands at the base of the interval are unfossiliferous but are typical of the Bahgallah Formation. The Pebble Point Formation is the equivalent of this formation in the east. It should be noted that beds containing marine fossils do not occur at the base of either formation in their type sections.

2150-2600 feet: The top of Cretaceous sedimentation of marginal marine origin. Equivalent of the Paaratte Formation of the Port Campbell wells. Similar sediments are present in the Heywood No. 10, Belfast No. 4, Yangery No. 1 and Wangoom No. 2 and No. 6 bores which were drilled by the Victorian Department of Mines. All these bores are considered to be within the Portland sub-basin. At present it is feasible to use the term Paaratte Formation in all these bores (including Pretty Hill).

2600-2850 feet: The marine dark grey glauconitic mudstones of this interval are similar to that present at the bottom of the Heywood No. 10 bore and Yangery No. 1, but its development was very thin in the latter bore.

These similar sediments in all three bores are characterised by a foraminiferal fauna indicative of anaerobic conditions and by a glauconite which turns browny-orange when heated dry. The typical glauconite of the Belfast Mudstone of the Port Campbell wells retains its green colour when heated dry. This interval may be the equivalent of the Belfast Mudstone. It is of the same age as the top of the Belfast Mudstone in the Port Campbell and Belfast bores but is not of the same facies as the top of the Belfast Mudstone.

2850 to 2922 feet: The presence of limonitic pellets is reminiscent of the Flaxmans Beds of Flaxmans No. 1 well.

2922- feet: Otway Group equivalents.

Foraminiferal studies suggest that there is a depositional break between the Heywood Marls and the Dartmoor Formation. The Nelson Formation is present between these two units in the Portland bores (Glenie and Reed, 1960) but is not lithologically identifiable in the Pretty Hill well.

The use of the term Knight Group is considered synonymous to the term Wangerrip Group which is used in the Port Campbell sub-basin.

R.C. Glenie and D.J. Taylor

Melbourne
October 17, 1962

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Glenie, R.C. and Reed, K.J.	1960	Bores 2 and 3, Portland, Victoria - subsurface geology and engineering data. Vict. Min. & Geol. J., 6 (4), 37-43.
Kenley, P.R.	1951	Marine Eocene sediments near Casterton, Victoria. Aust. J. Sci., 14 (3). 91-92.

Pretty Hill

STRATIGRAPHIC SUMMARY FOR PRETTY HILL NO. 1 WELL

DEPTH	STRATIGRAPHIC UNITS		AGE
to 1220 feet	Heywood Marl	?HEYTESBURY GROUP?	to Upper Oligocene
	(probable depositional break)		
1220 feet to	Dartmoor Formation	KNIGHT or WANGERRIP GROUP	Upper Eocene to Palaeocene
1800 feet to 2150 feet	Bahgallah Formation		
2150 feet to	Paaratte Formation		Upper Cretaceous
2600 feet to 2850 feet	?Belfast Mudstone		
	(probable depositional break)		
2850 feet to 2922 feet to ?	Flaxmans Beds	OTWAY or MERINO GROUP	Lower Cretaceous

17.10.62

R.C. Glenie and D.J. Taylor
Geologists

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COMMENTS ON FAUNA IN PRETTY HILL NO. 1 WELL

A detailed examination has been made of cores and cuttings below 1000 feet in Frome-Broken Hill's Pretty Hill No. 1 well.

1000 to 1160 feet: The cuttings at the base of the marl (1160 feet approx.) contain a fauna indicative of the Longfordian Stage. The diagnostic Foraminifera include (Globoquadrina dehiscens, Globigerinoides triloba, Elphidium crespinae, Eponides repandus, Stomatorbina concentrica.

1160 to 1220 feet: The pinky rubbly limestone contains bryozoa, mollusca and Foraminifera. Identification of the Foraminifera was difficult because of encrusting by calcium carbonate. The fauna is similar to that above 1160 feet, although planktonic forms are rarer and most specimens are larger in size. There is no evidence to suggest that this interval represents a stage older than basal Longfordian (Upper Oligocene).

1220 to 1800 feet: This interval comprises sands, siltstones and some dolomitic siltstones. Foraminifera are rare and are mainly arenaceous forms including Cyclammina spp. However, Core No. 1 (sample 1286 - 1288 ft.) contains several specimens of Globigerina linaperta which is restricted to the first three faunal units outlined by Carter (1958). This sample is probably upper Eocene in age.

1800 to 2150 feet: This interval comprises siltstones, silty sandstones and the sands near the base are iron stained. Core 2 (1816 - 1836 feet) contains mollusca, corals and Foraminifera. The only molluscan species identifiable was the pelecypod Nuculana paucigradata Singleton. This species is typical of the Pebble Point and Bahgallah Formations (Singleton 1943 and Kenley 1951). The Foraminifera are also typical of the Pebble Point Formation and the faunas from the King's Park Bore, Perth, Western Australia, as described by Parr (1939). The Foraminifera include Globorotalia chapmani, Globigerina orbiformis, Alabamina westraliensis, Discorbis assulatus, Lenticulina (Robulus) warmani. Such a fauna (both molluscan and foraminiferal) is now believed to be typical of the Palaeocene. Fossils were not found in the iron stained sands at the base of this interval.

2150 to 2600 feet: This interval comprises clean sands with carbonaceous siltstones near the base. Core No. 4 (2382 to 2403 feet) contained a sparse arenaceous foraminiferal fauna which includes species of Haplophragmoides which occur in the Cretaceous sediments of the Port Campbell wells.

2600 to 2850 feet: This interval comprises dark grey glauconitic siltstones with some pyrite and quartz. Foraminifera are sparsely distributed (even in Core 6) and arenaceous forms predominate although there are a few Lenticulina spp. The fauna also includes ammonite fragments, a belemnite fragment, fragments of Inoceramus sp. and fish remains. The foraminiferal fauna is Ammobaculites cf. fragmentaria, A. goodlandensis Bathysiphon sp., Dorothea filiformis, Haplophragmoides sp. A, H.sp.B, H.sp.C, Lenticulina (Marginulinopsis) curvisepta, Lenticulina (Robulus) navarroensis extruatus, Reophax sp., and Textularia anceps. All of these species occur in the upper

Pretty Hill

part of the Cretaceous sequence in the Port Campbell wells (Taylor, 1962). Characteristic species of the lower part of the Port Campbell Cretaceous sequence were not found in Pretty Hill. The predominantly arenaceous fauna and the abundance of glauconite suggests anaerobic conditions.

2850 to 2922 feet: The cuttings in this interval contain limonitic pellets. No fauna was found.

2922 to feet: Regarded as Otway Group equivalent. No fauna found apart from obvious contamination from higher in the well.

17.10.62

D. J. Taylor - Geologist

References

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Kenley, P. R. 1951 Marine Eocene Sediments near Casterton, Victoria, Aust. J. Sci., 14 (3), 91-92.

Parr, W. J. 1938 Upper Eocene Foraminifera from deep borings, Perth, Western Australia. J. Roy. Soc. West. Aust., 24, 69-101.

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Pretty Hill

PLANT REMAINS - PRETTY HILL NO. 1 BORE

A thin (four inches) band of coalfield plant material was included in Core No. 7 Pretty Hill No. 1 bore, 2928-2940 feet. Among stem and leaf remains recognisable were Conifer leaves of Araucarian type, (cf. Pagiophyllum sp.) and fragments of Angiosperm leaves. Cuticular tissues have been isolated from both types, and identification is proceeding. Angiosperm leaves have previously been identified from the Mesozoic Merino Group sediments of southwest Victoria from Killara Bluff (Medwell, 1954) but the stratigraphic position and geological age of this outcrop has not been evaluated since recent additional data on Western Victorian Mesozoic sediments have been available. Angiosperm leaves, however, have also been found in the Yangery No. 1 bore at 4320-4330 feet (Douglas, 1963) and are regarded as Lower Cretaceous in age. These Yangery 4320-4330 feet and Pretty Hill 2928-2940 feet beds may directly correlate, but on the basis of microfloral comparisons (Douglas, J. G., Unpublished Report 1962/72) it would seem that the Pretty Hill bed is higher up in the non-marine Mesozoic sequence than the Yangery bed.

It is difficult to assess the value for correlation of macroscopic plant remains found in bore core as portion only of a larger flora is available. For example, liverwort (Hepatic) thallus impressions found in the Yangery bed under discussion (4320-4330 feet), Belfast No. 4 bore at 5353 feet and Wangoom No. 6 bore at 3314 feet indicate that these beds may correlate, but may also represent only fortuitous coring of a form prevalent throughout much of the non-marine sequence.

5th December, 1962

J. Douglas - Geologist

References:

Douglas, J. G.	1962	Pretty Hill No. 1 Bore - Preliminary Examination for acid insoluble microfossils. Vic. Mines Dept. Unpub. Rept. 1962/72.
————	1963 In press	A Mesozoic dicotyledonous leaf from the Yangery No. 1 bore, Koroit, Vic. Min. Geol. Jour. 6, 5.
Medwell, Lorna M.	1954	Fossil Plants from Killara near Casterton, Victoria. Proc. Roy. Soc. Vict. 66, 17-23.

Pretty Hill

PRETTY HILL NO. 1 BORE - PRELIMINARY EXAMINATION FOR ACID INSOLUBLE MICROFOSSILS

Core from the Pretty Hill No. 1 bore was treated by the Hydrofluoric acid - Schulze's solution method, and the residues obtained examined under the microscope for acid insoluble microfossils.

Core No.	Depth	Microfossils
1.	1292-6 feet	Deflandrea sp.1 Proteacidites pollens
2.	1820-22 "	Proteacidites, Myrteacidites pollens
4.	2385-98 "	Proteacidites pollens Nelsoniella aceras Deflandrea sp.2 Deflandrea sp.3 Cf. Membranilarnax sp. Hystrichosphaeridium heteracanthum
6.	2726-32 "	Deflandrea tripartita Hystrichosphaera ramosa Hexagonifera vermiculata Odontochitina cf. O. cribropoda
7.	2928-40 "	Barren
8.	3340-55 "	Cicatricosisporites australiensis Lycopodiumsporites austroclavatidites Gymnosperm pollens etc.
9.	3812-4 "	Largely barren
10.	4318-28 "	Largely barren

Discussion:

Core 1 (1292-6 feet) Deflandrea sp.1 compares closely to Deflandrea sp. described from the Princetown Member of the Dilwyn Clay by Deflandre and Cookson (1955) and recorded as Lower Eocene.

Core 2 (1820-2 feet) Preparations from this core were unsatisfactory, poorly preserved microfossils indicating a Tertiary marine environment. The Mesozoic-Tertiary boundary appears to be between this and

Core 4 (2385-98 feet) which contains Upper Cretaceous microplankton. Xenikoon australis, common at the top of the Western Victorian marine Upper Cretaceous section (Evans, 1962) is absent. This and the presence of Nelsoniella aceras indicates that this core is somewhat below the uppermost portion of the Upper Cretaceous and probable correlation within the zone 2 of the sequence as described by myself (see Douglas 1959/60). The closest comparable Port Fairy (Belfast No. 4) microflora is that from 4285-4286 feet which also contains N.aceras and H.heteracanthum.

Rietty Hill

Core 6 (2726-32 feet) falls within my zone 3 with the characteristic D. tripartita prominent. Of Belfast No. 4 microfloras, that from 4652 feet (Belfast Mudstones) would probably compare most closely.

Core 7 (2928-40 feet) Samplings contained no recognisable marine microfossils, but a microflora including the types listed above indicate the presence of Lower Cretaceous Otway Group sediments.

Core 9 (3812-4 feet) and Core 10 (4318-28 feet) The barren preparations from these cores indicates further sampling from relatively unfossiliferous non-marine sections.

(Signed) J. Douglas
Geologist

30th October, 1962

References:

Douglas, J. G.	1959/60	Microplankton of the Deflandreidae group in Western District sediments. Min. & Geol. Jour. 6, 4, p. 17-32.
Deflandre, G. and Cookson, Isobel C.	1955	Fossil Microplankton from Australian late Mesozoic and Tertiary sediments. Aust. Jour. Mar & Freshw. Res. 6, 2, p. 242-313.
Evans, P. R.	1962	Palynological observations on Frome Broken Hill Flaxman's Hill No. 1 Well. Bureau Min. Res. Records 1962/57.

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Interim Note on F.B.H. Pretty Hill No. 1 Well
Otway Basin, Victoria

1. F.B.H. Pretty Hill No. 1 Well passed from the Otway Group at 5990 feet to a sandstone with minor coals that persisted to 7874 feet; this sandstone section has been referred to the (?)Grampian Series of Upper Devonian-Lower Carboniferous age by the well-site geologist.

2. Cores 17 (6070-6080 feet) to 21 (7585-7597 feet) were cut from this interval. They have been examined for their spore content to determine their age. Only samples from cores 19(6690-6702 feet) and 20 (7200-7214 feet) were processed; cuts available from the other three cores were of porous sandstone that would have a very low spore content and that in any case might have been invaded by contaminated drilling mud.

3. Core 19 (6696-6697 ft. 6 in.) included a thin ($\frac{1}{4}$ in.) lamination of coaly matter. Maceration of this material yielded vegetable tissue and extremely few spores, none diagnostic.

4. Core 20 (7200-7214 feet: precise interval not determinable) was also of sandstone, but included a very thin lamination of grey silty sandstone. This lamination yielded a moderate number of well preserved spores. They included:

Cyathidites spp. incl. *C. australis rimalis*	1 specimen of each
Dictyotosporites speciosus	
Lycopodiumsporites circolumenus	
Aequitriradites tilchaensis	
Disaccites spp. (common)	
"*Inaperturopollenites*" spp. (fairly common).	

This a Mesozoic, probably Lower Cretaceous assemblage, although, depending on definitions, it could be in the Upper Jurassic. The association of *D. speciosus* and *L. circolumenus* is a characteristic of a basal Cretaceous zone in the Great Artesian Basin that includes a lower portion of the Roma Formation and the Transition Beds of the Blythesdale Group. Unfortunately the apparent absence of other key fossils used to define stratigraphic position in that basin precludes further discussion.

5. Pretty Hill No. 1, core 20 differs from the Otway Group of Flaxman's Hill No. 1 (Evans, 1962) by the lack of *Cicatricosisporites australiensis* and the presence of *D. speciosus* and *L. circolumenus*. Apart from the lithological sequence this sandstone unit may thus be older than the Otway Group of Flaxman's Hill No. 1. A comparable assemblage was observed in cores 15 - 19 (3917-4400 feet) in Penola No. 1 (Evans, 1961) to which Pretty Hill No. 1 core 20 might be compared.

Pretty Hill

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6. The section 5990-7874 feet in Pretty Hill No. 1 is therefore not a correlate of the U. Devonian - L. Carboniferous "Grampian Series" or Group (Jones, 1958).

References:

EVANS, P.R., 1961 — A palynological report on Oil Development N.L. Penola No. 1 Well, South Australia. Bur.Min.Resour.Aust.Rec. 1961/76 (unpubl.)

EVANS, P.R. 1962 — Palynological observations on F.B.H. Flaxman's Hill No. 1 Well. Ibid. 1962/57 (unpubl.).

JONES, D.S. 1958 — Humicite in the Grampians Sandstones at McKenzie Creek, Western Victoria. Min.Geol.J.Vic. 6(2), 42-45.

16th November, 1962.

(Signed) P.R. EVANS
GEOLOGIST

Pretty Hill

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INTERIM NOTE NO. 2 ON F.B.H. PRETTY HILL NO. 1 WELL,
OTWAY BASIN, VICTORIA

1. Samples of the cores listed below from F.B.H. Pretty Hill No. 1 Well have now been examined for their content of spores and microplankton.

Depth of Core Sample	Probable Age
c.1, 1286-1288 feet	Tertiary
c.2, 1816-1818 "	"
c.4, 2391-2393 "	Upper Cretaceous, marine.
c.6, 2728-2730 "	" " "
c.7, 2938-2940 "	Cretaceous undiff.?non-marine
c.16, 5954-5957 "	Lower Cretaceous, non-marine
c.19, 6696-6697½ "	" " "
c.20, 7200-7214 "	" " "

2. Cores 1 and 2 contained few pollens and very rare microplankton (hystrichospheres only).

Core 4 contained fairly common marine micro-organisms, but none of the marker microfossils located at Port Campbell and Flaxman's Hill were observed. Two specimens of Deflandrea aff. serratula were present. If the specific identification is correct, this is the first time D. serratula has been recorded from the Otway Basin. Uncertainty of identification of the specimens arises from their fairly close relationship to Deflandrea minor. However, what appear to be serrated borders to the shell and the size and shape of the capsule suggest D. serratula rather than D. minor. The distinction is significant stratigraphically as D. serratula appeared in a younger horizon than Xenikoon australis in Western Australia (Cookson & Eisenack, 1960 Micropalaeontology, 6(1); in consequence, Pretty Hill No. 1, c.4 may be somewhat younger than Flaxman's Hill No. 1, c.3 (4126-4134 feet). Triorites edwardsii was observed among the content of pollen.

Core 6 contained abundant microspores and microplankton, and included common Hexagonifera glabra with Delfandrea tripartita and Odontochitina cribropoda. They indicate that the c.6 is a correlate of an horizon within the Belfast Mudstone of Flaxman's Hill No. 1

Core 7 yielded few spores and no microplankton. The sample from core 16 contained abundant microspores and no microplankton. The spores included:

Sphagnumsporites australiensis
Cyathidites spp.
Baculatisporites comaumensis
Cicatriocosisporites australiensis
Lycopodiumsporites spp.
Dictyotosporites speciosus
Inaperturate spp.

Pretty Hill

Comments on core 19 and 20 were made in Interim Note No. 1 (16th November). The appearance of D. speciosus in c.16 suggests that the sandstones of c.20 are not much older than c.16. The association of D. speciosus and C. australiensis in c.16, above the D. speciosus, L. circolumenus combination of c.20, is a repetition of the sequence in Penola No. 1. It might suggest that the base of the Otway Group in Pretty Hill No. 1 (5990 feet) may correlate with an horizon in the region of 3524-3715 feet in Penola No. 1. However, evidence from other species is desirable before such a correlation is affirmed.

(Signed) P.R. EVANS
Geologist

26th November, 1962.

PALYNOLOGICAL ZONATION OF UPPER CRETACEOUS SEDIMENTS OF THE OTWAY BASIN

1. INTRODUCTION

This report includes a summarized account of the distribution of the Upper Cretaceous spore-pollen zones defined by Dettmann and Playford (1969) in subsurface sections of the Otway Basin. The report thus represents an extension to previous accounts on the palynological zonation of Lower and early Upper Cretaceous strata of the Otway Basin (Dettmann 1969a,b). The well sections and sampling depths studied have been assessed in terms of the spore-pollen zones of Dettmann and Playford (1969); this publication should be consulted for criteria upon which the zones are based, and age relationships of the zones.

2. SOUTH AUSTRALIA

South Australian sediments of Upper Cretaceous age that have been examined by the author occur in Esso Crayfish A-1 and Alliance Kalangadoo No.1. Information of the spore-pollen zones represented in the material studied is documented by Dettmann (1969b).

3. VICTORIA

3.1 Oil Exploration Wells

Planet Heathfield No.1

SAMPLE	DEPTH (ft.)	SPORE-POLLEN ZONE
core 1	960-75	Triorites edwardsii Zone of Harris 1965
" 2	1378-93	Nothofagidites or Tricolpites pachyexinus
" 3	1858-63	?Tricolpites pannosus

Reference: Dettmann 1965b,d.

F.B.H. Pretty Hill No.1

SAMPLE	DEPTH (ft.)	SPORE-POLLEN ZONE
core 2	1816-36	Duplopollis orthoteichus Zone of Harris 1965
" 4	2383-403	Nothofagidites or Tricolpites pachyexinus
" 6	2726-39	Tricolpites pachyexinus

SAMPLE	DEPTH (ft.)	SPORE-POLLEN ZONE
core 7	2928-40	Tricolpites pannosus

Reference: Dettmann 1963b; 1964i; 1968d.

3 F.B.H. Eumeralla No.1

SAMPLE	DEPTH (ft.)	SPORE-POLLEN ZONE
core 3	2108-21	Duplopollis orthoteidhus Zone of Harris 1965 or younger
" 4	2835-49	Tricolpites pachyexinus
" 5	3311-21	Tricolpites pannosus

Reference: Dettmann 1963b; 1964i; 1968d.

4 F.B.H. Flaxmans No.1

SAMPLE	DEPTH (ft.)	SPORE-POLLEN ZONE
core 2	3561-73	Triorites edwardsii Zone of Harris 1965
" 3	4126-34	Nothofagidites
" 4	4309-16	"
" 5	4479-96	"
" 6	4687-95	"
" 7	4695-714	"
" 8	4974-83	Tricolpites pachyexinus
" 9	4983-93	"
" 10	5330-36	"
" 11	5358-76	"
" 12	5376-96	"
" 13	5458-63	"
" 14	5531-39	"
" 15	5543-46	"
" 16	5950-70	"
" 17	6375-91	Clavifera triplex
" 18	6606-16	"
" 19	6616-26	"
" 20	6626-36	"
" 21	6832-72	"
" 24	6882-902	not determinable
" 25	6902-13	"
" 26	6982-7000	"
" 27	7200-20	Appendicisporites distocarinatus

REF ID: 751

(47)

PALYNOLOGICAL REPORT ON NON-MARINE LOWER CRETACEOUS SEDIMENTS INTERSECTED IN F.B.H. EUMERALLA NO.1 AND F.B.H. PRETTY HILL NO.1 WELLS

INTRODUCTION

The present report incorporates preliminary results of microfloral analyses of cores from F.B.H. Eumeralla No.1 Well between 3311 and 10,308 ft. and from F.B.H. Pretty Hill No.1 Well between 2928 and 7597 ft. The Lower Cretaceous microfloras obtained from these non-marine horizons provide a means by which the sequences may be subdivided and correlated with other bore sections and outcrops in the Otway Basin. Correlation of the sediments is based entirely on the presence of certain microfloral species possessing restricted vertical distribution. The stratigraphical use of quantitative changes in the microfloras will be evaluated at a later date.

Microfloras contained in samples from Eumeralla No.1 Well between 941 and 2849 ft. and from Pretty Hill No.1 Well between 1282 and 2739 ft. are of post-Lower Cretaceous age and will be considered in a subsequent report.

GENERAL OBSERVATIONS

With the exception of those obtained from cores 17, 21, and 22, the microfloras from Eumeralla No.1 Well are diverse and well-preserved. Cores 18, 20, and 21 in Pretty Hill No.1 Well yielded well-preserved spores and pollen in extremely low concentrations, whereas the more abundant microfloras contained in cores 10-14, 16, 17, and 19 from the same well are poorly preserved. The other cores (7-10 and 15) examined from Pretty Hill No.1 Well contain diverse and well-preserved microfloras.

Organisms of definite marine origin have not been observed in any of the residues. Remanié microspores and pollen grains of Permian and Triassic age were obtained from many of the samples, and were more commonly found in the upper interval (3311-5309 ft.) of Eumeralla No.1 Well.

It is relevant to add that sediment from the inner part only of each core sample was processed for microfloral examination. This procedure was adopted to minimize the risk of incorporating drilling mud in the preparations.

MICROFLORAL ASSEMBLAGES AND CORRELATIONS

The microfloras occurring in the non-marine horizons between 3311 and 10,308 ft. in Eumeralla No.1 Well and between 2928 and 7597 ft. in Pretty Hill No.1 Well are comparable to the Lower Cretaceous microfloral assemblages that were described by Cookson and Dettmann (1958a,b) and Dettmann (1963) from south-eastern Australia. Two of the three assemblages delineated by Dettmann occur successively in both the Eumeralla and Pretty Hill sequences (see Table 1). On this basis the non-marine bore sections are subdivided and correlated with sediments of equivalent age in ODNL Penola No.1 Well and South Aust. Oil Wells Robe Bore No.1 (Table 2). The microfloral evidence recorded below indicates that the lowest Mesozoic horizons examined from Eumeralla No.1 Well and the sediments at and above 7214 ft. in Pretty Hill No.1 Well are younger in age than core 21 (4766-76 ft.) in Penola No.1 Well. The basal sample (at 7585-97 ft.) from Pretty Hill No.1 Well contains a sparse microflora and cannot be precisely correlated on microfloral evidence with the Penola and Eumeralla sequences.

An outline of the stratigraphical occurrence of the three, distinct, Lower Cretaceous microfloral assemblages (the Stylosus, Speciosus, and Paradoxa

Assemblages) in Eumeralla No.1 and Pretty Hill No.1 Wells and in other Otway Basin sediments is presented below.

The Stylosus Assemblage: This assemblage, which is of lowermost Cretaceous (Valanginian or older) age has been recorded from Penola No.1 Well at 4766-76 ft. Strata immediately succeeding this interval contain the Speciosus Assemblage of Valanginian-Aptian age.

The Speciosus Assemblage: Microfloras recognizably conformable with the Speciosus Assemblage occur in Eumeralla No.1 Well between 6034 and 10,308 ft., Pretty Hill No.1 Well between 5420 and 7214 ft., Penola No.1 Well between 2990 and 4619 ft., Robe Bore No.1 between 3150 and 4300 ft., Comaum Bore No.2 between 781 and 651 ft., and in an outcrop sample from the Barrabool Sandstone (for locality, see Dettmann 1963). Pretty Hill No.1 Well, core 21 (7585-97 ft.) contains a sparse microflora not definitely assignable to either the Stylosus or Speciosus Assemblage.

Two, distinct microfloral categories of the Speciosus Assemblage have been recognized. The older category is characterized by the association of Dictyotosporites speciosus Cookson & Dettmann and Cyclosporites hughesi (Cookson & Dettmann), and the younger category is diagnosed by the combined occurrence of D. speciosus and Crybelosporites striatus (Cookson & Dettmann). 1) Assemblages in which D. speciosus and C. hughesi are present have been extracted from the following deposits: Eumeralla No.1 Well between 7225 and 10,308 ft., Penola No.1 Well between 3363 and 4619 ft., and Robe Bore No.1 between 3860 and 4300 ft. Comparable microfloras were recovered from cores 19 and 20 (6690-7214 ft.) in Pretty Hill No.1 Well. The succeeding cores (16-18) in this well contain poorly preserved or sparse microfloras in which C. hughesi and/or D. speciosus were not recognized.

Certain horizons which contain the older microfloral category of the

Speciosus Assemblage have also yielded Cooksonites variabilis Pocock which is of considerable stratigraphical value both in south-eastern Australia (Dettmann 1963) and Canada (Pocock 1962). The presence of C. variabilis in Eumeralla No.1 Well between 8459 and 8924 ft., Pretty Hill No.1 Well between 5935 and 5947 ft., Penola No.1 Well between 3715 and 3721 ft., and Robe Bore No.1 at 3860 ft. indicates that these deposits are correlatives.

2) The younger microfloral category containing D. speciosus and C. striatus has been identified in the following strata which are considered to be of contemporaneous age: Eumeralla No.1 Well between 6034 and 6720 ft., Penola No.1 Well between 2790 and 3000 ft., Robe Bore No.1 between 3150 and 3500 ft., Comaum Bore No.2 at 651 ft., and in the outcrop sample from the Barrabool Hills (see above). It should be noted that Cyclosporites hughesi is entirely absent or only doubtfully representated in these horizons. The only Otway Basin deposit from which undoubted examples of D. speciosus, C. hughesi, and C. striatus occur together is from Comaum Bore No.2 from 781 ft; this horizon underlies strata (at 651 ft.) which contain D. speciosus and C. striatus and apparently lack C. hughesi. D. speciosus and C. striatus have not been found in association in microfloras recovered from Pretty Hill No.1 Well.

The Paradoxa Assemblage: Microfloras conformable with the Aptian-Albian Paradoxa Assemblage occur in the following bore deposits: Eumeralla No.1 Well between 3311 and 5816 ft., Pretty Hill No.1 Well between 3340 and 4960 ft., Penola No.1 Well between 1200 and 2790 ft., Robe Bore No.1 between 1400 and 2630 ft., Dergholm Bore No.1 at 532 ft., and Birregurra Bore No.1 between 1079 and 1102 ft. The Paradoxa Assemblage has also been identified in outcrop samples from Barongarook Creek (west branch); Devil's Kitchen, Gellibrand River; and on the Bellarine Peninsula (see Dettmann 1963).

Core 7 (2928-40 ft.) from Pretty Hill No.1 Well contains a microflora which apparently lacks diagnostic components of the Paradoxa Assemblage and in which angiosperm grains (Tricolpites sp.) make their first appearance. Identical grains first appear in Eumeralla No.1 Well in the 3311-21 ft. interval which is probably similar in age to core 7 in Pretty Hill No.1 Well. The age of these horizons is estimated to be Upper Albian-?Cenomanian since, in the Great Artesian Basin (South Australia), identical grains first appear in Upper Albian horizons of the Tambo Formation and extend into the ?Cenomanian Winton Formation. Angiosperm grains have not been encountered by the writer in other non-marine Mesozoic samples from the Otway Basin.

RECOMMENDATIONS FOR FURTHER INVESTIGATIONS

An examination of cuttings (taken at 30-40 ft. intervals) from the following depths in Eumeralla No.1 Well and Pretty Hill No.1 Well may provide information concerning the precise vertical distribution of the microfloral assemblages in these wells:

Eumeralla No.1 Well between cores 10 and 11 (5799-6054 ft.)

" " " " " 4 and 5 (2835-3321 ft.)

Pretty Hill No.1 Well below core 21 (7597 ft.).

" " " " between cores 13 and 15 (4960-5420 ft.)

" " 6 and 7 (2739-2940 ft.)

The envelope containing core 8, Eumeralla No.1 Well is incorrectly (?) labelled 4296-4814 ft. instead of 4812-14 ft.

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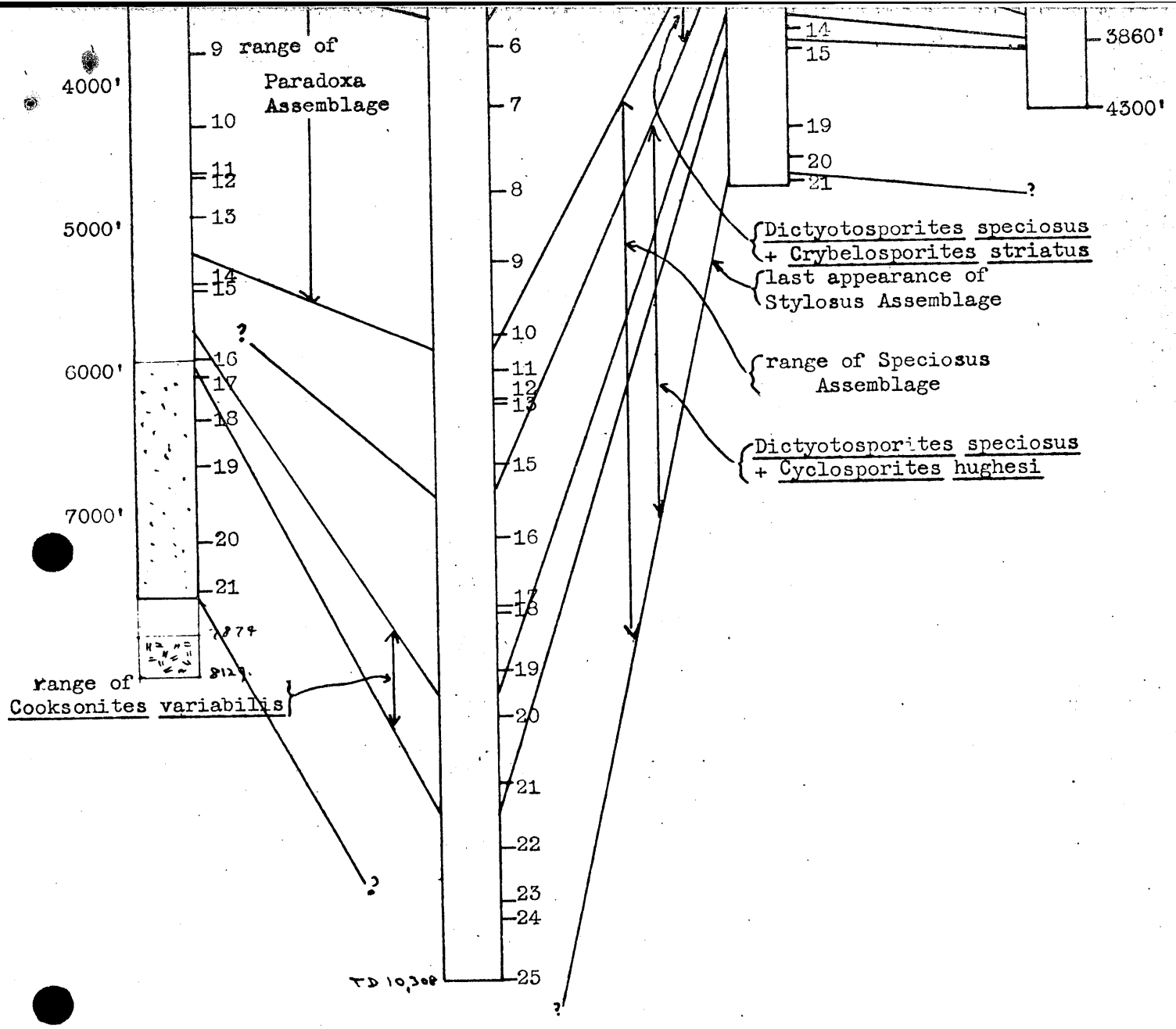
14th November, 1963.

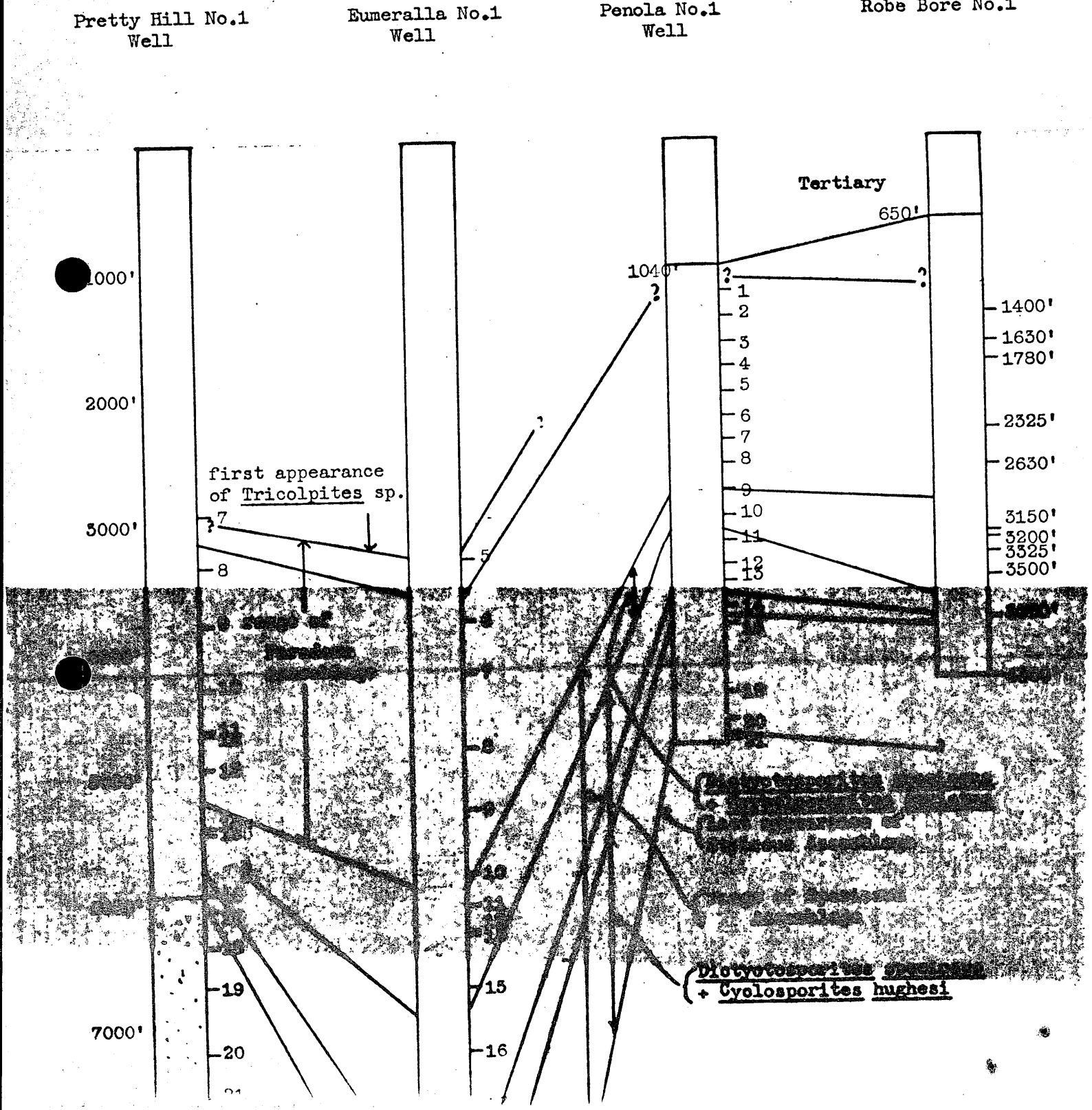
Mary E. Dettmann,
Department of Geology,
University of Queensland,
St. Lucia, Queensland.



core number or palynological sampling depth.

Vertical scale 1" = 1000!
No horizontal scale.
Correlation lines join the centres of intervals in which microfloral changes apparently take place.

TABLE 2. Microfloral correlation of non-marine Lower Cretaceous sequences in wells at Pretty Hill, Eumeralla, Penola, and Robe in the Otway Basin.


Pretty Hill No.1 Well
Eumeralla No.1 Well
Penola No.1 Well
Robe Bore No.1
Tertiary
650'
1040'
1000'
2000'
3000'
7000'
1400'
1630'
1780'
2325'
2630'
3150'
3200'
3325'
3500'
first appearance of Tricolpites sp.
Dictyotosporites
+ Cyclosporites hughesi

PRETTY HILL No.1 | EUME…

c.17 6070-80'	c.16 5935-47'	c.15 5420-24'	c.14 5400-20'	c.13 4940-60'	c.12 4640-55'	c.11 4625-40'	c.10 4315-28'	c.9 3810-30'	c.8 3340-60'	c.7 2928-40'		c.25 10300-08'	c.24 9881-90'	c.23 9767-74'	c.22 9373-85'	c.21 8914-24'	c.20 8459-65'	c.19 8143-56'	c.18
— cf											1.								
											2.	+							
											3.								
											4.			+		+	+		
											5.	+	+	+		+	+		
	+	+									6.	+	+	+	+	+	+		+
											7.	+		+		+			+
								+			8.			+	+				
											9.								
	+	+		+	+	+	+	+	+		10.	+	+			+	+	+	+
	+						+	+	+		11.	+	+	+		+			
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											13.	+	+						
	+		+	+	+			+	+		14.		+	+					
	+										15.					+	+		
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				+			+		+		19.								
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							+				29.								
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										+	31.								
					+				+		32.								
							+				33.								
											34.								
										+	35.								

S ASSEMBLAGE | PARADOXA ASSEMBLAGE | III | SPECIOSU…

See P.C. 1-3 Pages

C. hughe…

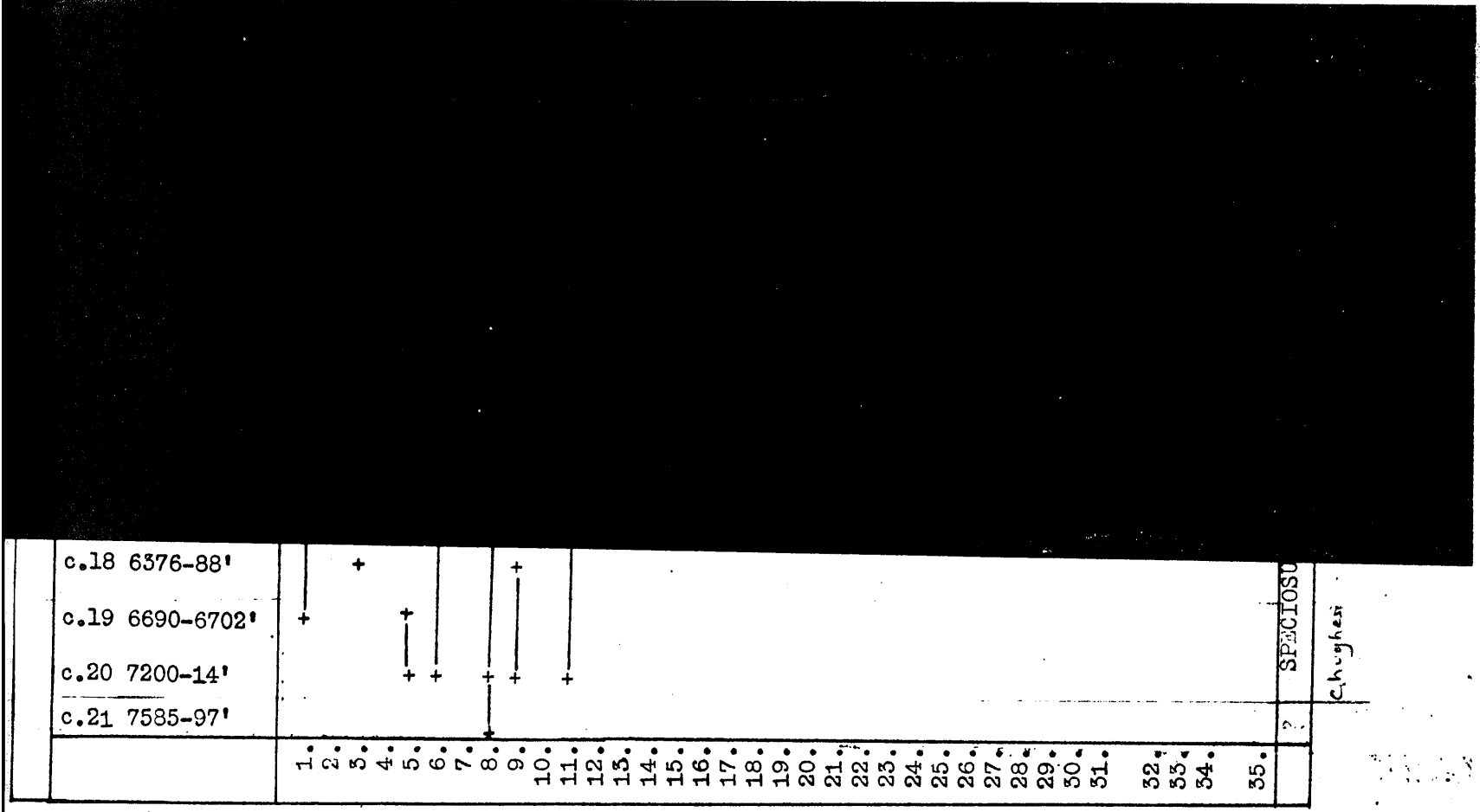
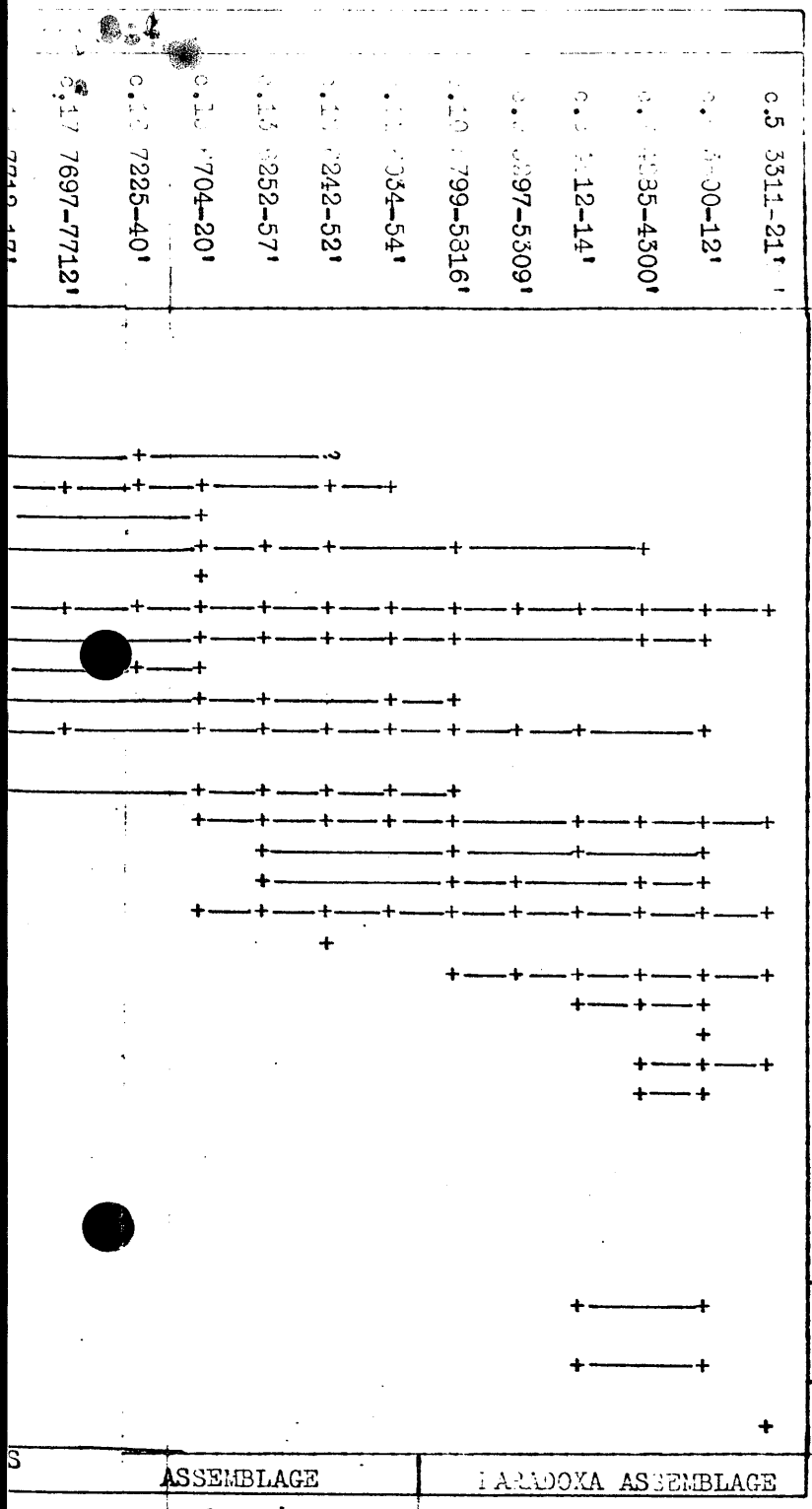


TABLE 1. Distribution of selected spore and pollen species in non-marine Lower Cretaceous sequences in F.B.H. Eumeralla No.1 and F.B.H. Pretty Hill No.1 Wells.

\+ - species present
cf - specimens similar to, but not identical with, a particular species
? - doubtful representatives of a species

14 Nov '63



Microspores

1. Coronatispora perforata
2. Contignisporites cooksonii
3. Biretisporites spectabilis
4. Kraeuselisporites linearis
5. Cyclosporites hughesi
6. Dictyotosporites speciosus
7. Cicatricosisporites ludbrooki
8. Ischyosporites punctatus
9. Couperisporites tabulatus
10. Cicatricosisporites australiensis
11. Aequitriradites spinulosus
12. Pilosisporites notensis
13. Januasporites spinulosus
14. Rouseisporites reticulatus
15. Cooksonites variabilis
16. Pilosisporites parvispinosus
17. Foraminisporis asymmetricus
18. Rouseisporites radiatus
19. Rouseisporites simplex
20. Crybelosporites striatus
21. Dictyotosporites filosus
22. Coptospora paradoxa
23. Trilites cf. T. tuberculiformis
24. Coptospora striata
25. Cicatricosisporites hughesi
26. Kraeuselisporites majus
27. Trilobosporites trioreticulosus
28. Pilosisporites grandis
29. Concavissimisporites penolaensis
30. Cicatricosisporites pseudotripartitus
31. cf. Gleicheniidites sp.

Megaspores

32. Balmeisporites holodictyus
33. Balmeisporites tridictyus
34. Pyrobolospora reticulata

Pollen

35. Tricolpites sp.

S ASSEMBLAGE | PARADOXA ASSEMBLAGE

C. striatus,

PRETTY HILL 1

PRETTY HILL NO. 1 BORE - PRELIMINARY EXAMINATION FOR ACID INSOLUBLE MICROFOSSILS

Core from the Pretty Hill No. 1 bore was treated by the Hydrofluoric acid - Schulze's solution method, and the residues obtained examined under the microscope for acid insoluble microfossils.

Core No.	Depth	Microfossils
1.	1292-6 feet	Deflandrea sp.1 Proteacidites pollens
2.	1820-22 "	Proteacidites, Myrteacidites pollens
4.	2385-98 "	Proteacidites pollens Nelsoniella aceras Deflandrea sp.2 Deflandrea sp.3 Cf. Membranilarnax sp. Hystrichosphaeridium heteracanthum
6.	2726-32 "	Deflandrea tripartita Hystrichosphaera ramosa Hexagonifera vermiculata Odontochitina cf. O. cribropoda
7.	2928-40 "	Barren
8.	3340-55 "	Cicatricosisporites australiensis Lycopodiumsporites austroclavatidites Gymnosperm pollens etc.
9.	3812-4 "	Largely barren
10.	4318-28 "	Largely barren

Discussion:

Core 1 (1292-6 feet) Deflandrea sp.1 compares closely to Deflandrea sp. described from the Princetown Member of the Dilwyn Clay by Deflandre and Cookson (1955) and recorded as Lower Eocene.

Core 2 (1820-2 feet) Preparations from this core were unsatisfactory, poorly preserved microfossils indicating a Tertiary marine environment. The Mesozoic-Tertiary boundary appears to be between this and

Core 4 (2385-98 feet) which contains Upper Cretaceous microplankton. Xenikoon australis, common at the top of the Western Victorian marine Upper Cretaceous section (Evans, 1962) is absent. This and the presence of Nelsoniella aceras indicates that this core is somewhat below the uppermost portion of the Upper Cretaceous and probable correlation within the zone 2 of the sequence as described by myself (see Douglas 1959/60). The closest comparable Port Fairy (Belfast No. 4) microflora is that from 4285-4286 feet which also contains N.aceras and H.heteracanthum.

Core 6 (2726-32 feet) falls within my zone 3 with the characteristic D. tripartita prominent. Of Belfast No. 4 microfloras, that from 4652 feet (Belfast Mudstones) would probably compare most closely.

Core 7 (2928-40 feet) Samplings contained no recognisable marine microfossils, but a microflora including the types listed above indicate the presence of Lower Cretaceous Otway Group sediments.

Core 9 (3812-4 feet) and Core 10 (4318-28 feet) The barren preparations from these cores indicates further sampling from relatively unfossiliferous non-marine sections.

(Signed) J. Douglas
Geologist

30th October, 1962

References:

Douglas, J. G.	1959/60	Microplankton of the Deflandreidae group in Western District sediments. Min. & Geol. Jour. 6, 4, p. 17-32.
Deflandre, G. and Cookson, Isobel C.	1955	Fossil Microplankton from Australian late Mesozoic and Tertiary sediments. Aust. Jour. Mar & Freshw. Res. 6, 2, p. 242-313.
Evans, P. R.	1962	Palynological observations on Frome Broken Hill Flaxman's Hill No. 1 Well. Bureau Min. Res. Records 1962/57.

Interim Note on F.B.H. Pretty Hill No. 1 Well
Otway Basin, Victoria

1. F.B.H. Pretty Hill No. 1 Well passed from the Otway Group at 5990 feet to a sandstone with minor coals that persisted to 7874 feet; this sandstone section has been referred to the (?)Grampian Series of Upper Devonian-Lower Carboniferous age by the well-site geologist.

2. Cores 17 (6070-6080 feet) to 21 (7585-7597 feet) were cut from this interval. They have been examined for their spore content to determine their age. Only samples from cores 19(6690-6702 feet) and 20 (7200-7214 feet) were processed; cuts available from the other three cores were of porous sandstone that would have a very low spore content and that in any case might have been invaded by contaminated drilling mud.

3. Core 19 (6696-6697 ft. 6 in.) included a thin ($\frac{1}{4}$ in.) lamination of coaly matter. Maceration of this material yielded vegetable tissue and extremely few spores, none diagnostic.

4. Core 20 (7200-7214 feet: precise interval not determinable) was also of sandstone, but included a very thin lamination of grey silty sandstone. This lamination yielded a moderate number of well preserved spores. They included:

Cyathidites spp. incl. *C. australis rimalis*	1 specimen of each
Dictyotosporites speciosus	
Lycopodiumsporites circolumenus	
Aequitriradites tilchaensis	
Disaccites spp. (common)	
"*Inaperturopollenites*" spp. (fairly common).	

This a Mesozoic, probably Lower Cretaceous assemblage, although, depending on definitions, it could be in the Upper Jurassic. The association of *D. speciosus* and *L. circolumenus* is a characteristic of a basal Cretaceous zone in the Great Artesian Basin that includes a lower portion of the Roma Formation and the Transition Beds of the Blythesdale Group. Unfortunately the apparent absence of other key fossils used to define stratigraphic position in that basin precludes further discussion.

5. Pretty Hill No. 1, core 20 differs from the Otway Group of Flaxman's Hill No. 1 (Evans, 1962) by the lack of *Cicatricosisporites australiensis* and the presence of *D. speciosus* and *L. circolumenus*. Apart from the lithological sequence this sandstone unit may thus be older than the Otway Group of Flaxman's Hill No. 1. A comparable assemblage was observed in cores 15 - 19 (3917-4400 feet) in Penola No. 1 (Evans, 1961) to which Pretty Hill No. 1 core 20 might be compared.

6. The section 5990-7874 feet in Pretty Hill No. 1 is therefore not a correlate of the U. Devonian - L. Carboniferous "Grampian Series" or Group (Jones, 1958).

References:

EVANS, P.R., 1961 — A palynological report on Oil Development N.L. Penola No. 1 Well, South Australia. Bur.Min.Resour.Aust.Rec. 1961/76 (unpubl.)

EVANS, P.R. 1962 — Palynological observations on F.B.H. Flaxman's Hill No. 1 Well. Ibid. 1962/57 (unpubl.).

JONES, D.S. 1958 — Humicite in the Grampians Sandstones at McKenzie Creek, Western Victoria. Min.Geol.J.Vic. 6(2), 42-45.

16th November, 1962.

(Signed) P.R. EVANS
GEOLOGIST

INTERIM NOTE NO. 2 ON F.B.H. PRETTY HILL NO. 1 WELL,

OTWAY BASIN, VICTORIA

1. Samples of the cores listed below from F.B.H. Pretty Hill No. 1 Well have now been examined for their content of spores and microplankton.

Depth of Core Sample	Probable Age
c.1, 1286-1288 feet	Tertiary
c.2, 1816-1818 "	"
c.4, 2391-2393 "	Upper Cretaceous, marine.
c.6, 2728-2730 "	" " "
c.7, 2938-2940 "	Cretaceous undiff.?non-marine
c.16, 5954-5957 "	Lower Cretaceous, non-marine
c.19, 6696-6697½ "	" " "
c.20, 7200-7214 "	" " "

2. Cores 1 and 2 contained few pollens and very rare microplankton (hystrichospheres only).

Core 4 contained fairly common marine micro-organisms, but none of the marker microfossils located at Port Campbell and Flaxman's Hill were observed. Two specimens of Deflandrea aff. serratula were present. If the specific identification is correct, this is the first time D. serratula has been recorded from the Otway Basin. Uncertainty of identification of the specimens arises from their fairly close relationship to Deflandrea minor. However, what appear to be serrated borders to the shell and the size and shape of the capsule suggest D. serratula rather than D. minor. The distinction is significant stratigraphically as D. serratula appeared in a younger horizon than Xenikoon australis in Western Australia (Cookson & Eisenack, 1960 Micropalaeontology, 6(1); in consequence, Pretty Hill No. 1, c.4 may be somewhat younger than Flaxman's Hill No. 1, c.3 (4126-4134 feet). Triorites edwardsii was observed among the content of pollen.

Core 6 contained abundant microspores and microplankton, and included common Hexagonifera glabra with Delfandrea tripartita and Odontochitina cribropoda. They indicate that the c.6 is a correlate of an horizon within the Belfast Mudstone of Flaxman's Hill No. 1

Core 7 yielded few spores and no microplankton. The sample from core 16 contained abundant microspores and no microplankton. The spores included:

Sphagnumsporites australiensis
Cyathidites spp.
Baculatisporites comaumensis
Cicatriocosisporites australiensis
Lycopodiumsporites spp.
Dictyotosporites speciosus
Inaperturate spp.

Dettmann
23 NOV 1964

		Microspores											Pollen			Microplankton							
		Ciatricosisporites australiensis	Foraminisporis asymmetricus	Crybelosporites striatus	Coptospora paradoxa	Cicatricosisporites hughesi	Cicatricosisporites pseudotripartitus	Trilites cf. T. tuberculiformis	Laevigatosporites ovatus	Microfoveolatosporis canaliculatus	cf. Gleicheniidites sp.		Amosopollis cruciformis ?	Tricolpites sp. ?	triporate sp.A	triporate sp.B	Hystrichosphaeridium heteracanthum	Odontochitina striatoperforata	Deflandrea cretacea	Deflandrea victoriensis	Amphidiadema denticulata	Hexagonifera vermiculata		
Eumeralla No.1	c.4 2835-42 ft.	+	+	+	+	+	+	+	+	+	+												III
	c.5 3311-21 ft.	+	+	+	+	+	+	+	+	+	+			+									Paradoxa/II
Pretty Hill No.1	c.4 2383-2403 ft.													+	+	+	+						III
	c.6 2726-39 ft.													+	+	+	+	+	+	+	+	+	
	c.7 2928-40 ft.	+		+	+						C				+								Paradoxa/II

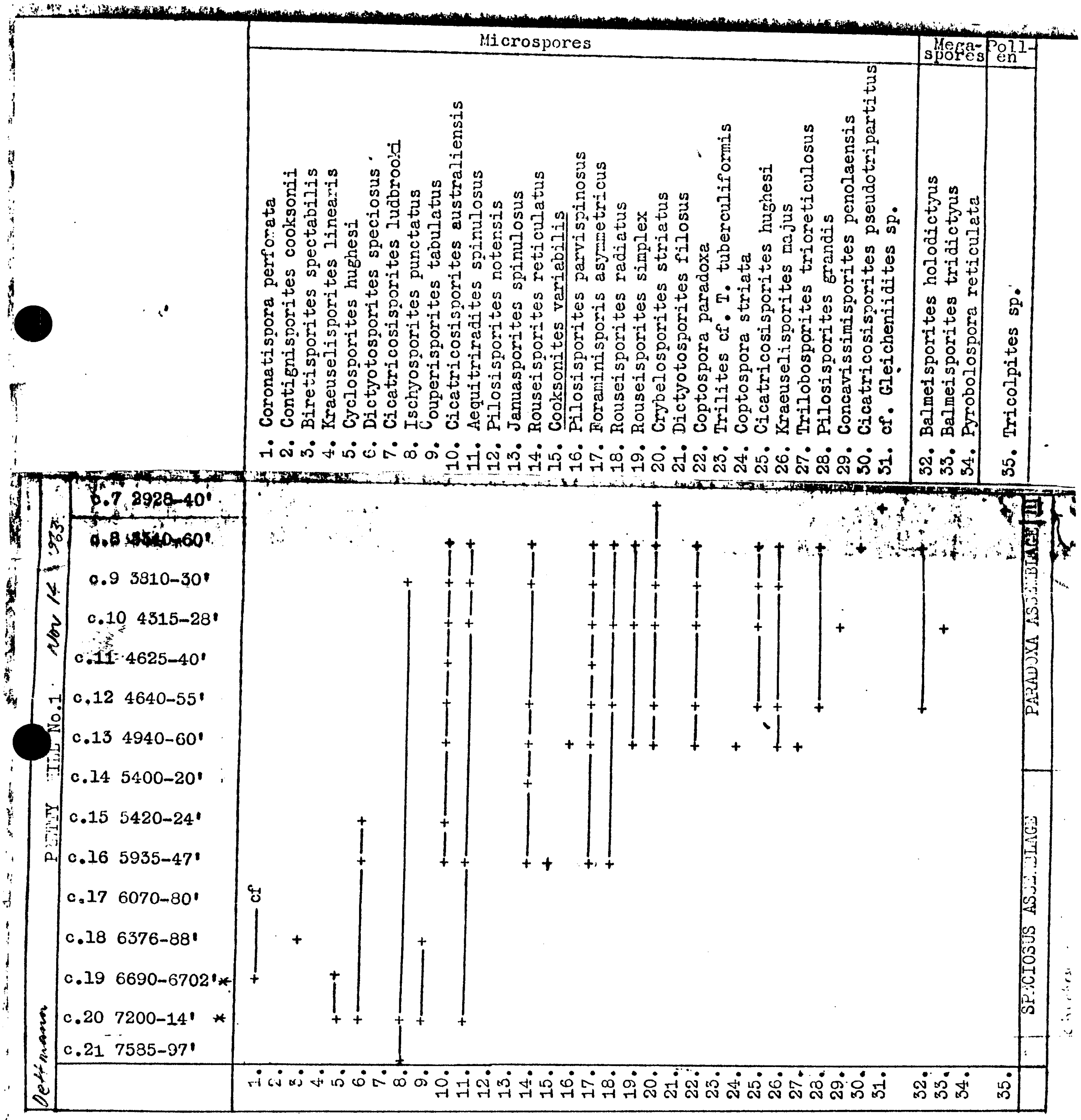
Table 1. Distribution of selected spore, pollen, and microplankton species in samples from Eumeralla No.1 and Pretty Hill No.1 wells.

+ - species present; C - species represented as contaminant

Comments on core 19 and 20 were made in Interim Note No. 1 (16th November). The appearance of D. speciosus in c.16 suggests that the sandstones of c.20 are not much older than c.16. The association of D. speciosus and C. australiensis in c.16, above the D. speciosus, L. circolumenus combination of c.20, is a repetition of the sequence in Penola No. 1. It might suggest that the base of the Otway Group in Pretty Hill No. 1 (5990 feet) may correlate with an horizon in the region of 3524-3715 feet in Penola No. 1. However, evidence from other species is desirable before such a correlation is affirmed.

(Signed) P.R. EVANS
Geologist

26th November, 1962.



* See also Evans in Rec. 1963/33

TABLE 1. Distribution of selected spore and pollen species in non-marine Lower Cretaceous sequences in F.B.H. Eumeralla No.1 and F.B.H. Pretty Hill No.1 Wells.

OTWAY BASIN

PALYNOLOGICAL & PALEONTOLOGICAL ZONATION

PALYNOLOGICAL ZONATION (DETTMAN 1969; HARRIS 1971)	AGE			FORAM. ZONATION (TAYLOR 1966-71)
	TERTIARY	Pliocene	TERTIARY	A
		U. Miocene		B
		M. Miocene		C, D, E, F
		L. Miocene		G, H
		U, M, L Oligocene		I-1, I-2, J
		U. Eocene		K, L, M
Proteacidites confragosus (P.c.Z.)		M. Eocene		N
Cupanieidites orthoteichus (C.o.Z.)		U. Paleocene		Q, R
Myrtaceidites eugeniioides (M.e.Z.)		U-M. Paleocene		S, T
Gambierina edwardsii (G.e.Z.)		M. Paleocene		U, V
Nothofagidites Microflora (N.M.)	UPPER CRETACEOUS	Uppermost Cretaceous-Santonian	UPPER CRETACEOUS	Z
Tricolpites pachyexinus (T.pa.Z)		Santonian-Coniacian		X A
Clavifera triplex (C.t.Z.)		?Coniacian-Turonian		X B
Appendicisporites distocarinatus (A.d.Z)		Turonian-?Cenomanian		X C, "X D" ?—?—?
Tricolpites pannosus (T.p.Z)	LOWER CRETACEOUS	?Cenomanian-U. Albian	LOWER CRETACEOUS	
Coptospora paradoxa (C.p.Z)		U-M. Albian		

REFERENCES:

1. DETTMAN, M.E. — 1969 — in S.D.A. Report 96.
2. HARRIS, W.K. — 1971 — in Spec. Bull. Geol. Survs. S. Aust. Vic. (in press).
3. TAYLOR, D.J. — 1966 — Publs. Petrol. Search Subsidy Acts Aust. No. 76.
   — 1971 — in spec. Bull. Geol. Survs. S. Aust. Vic. (in press.)

Inset A

PE605022

This is an enclosure indicator page.
The enclosure PE605022 is enclosed within the container PE907073 at this location in this document.

The enclosure PE605022 has the following characteristics:

ITEM_BARCODE	= PE605022
CONTAINER_BARCODE	= PE907073
NAME	= Well Log
BASIN	= OTWAY
PERMIT	= PEP/5
TYPE	= WELL
SUBTYPE	= WELL_LOG
DESCRIPTION	= Well Log (enclosure from Appendix 2 of WCR--Paleontology) for Pretty Hill-1
REMARKS	=
DATE_CREATED	=
DATE_RECEIVED	=
W_NO	= W469
WELL_NAME	= PRETTY HILL-1
CONTRACTOR	=
CLIENT_OP_CO	= FROME-BROKEN HILL CO PTY LTD

(Inserted by DNRE - Vic Govt Mines Dept)

REF ID: 19501

John Douglas

COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS

RECORDS

1963/53

THE MICROFLORA OF F.B.H. PRETTY HILL NO.1 AND F.B.H. EUMERALLA NO.1 WELLS, VICTORIA

by

P.R. Evans

THE MICROFLORA OF F.B.H. PRETTY HILL NO.1 AND F.B.H. EUMERALLA NO.1 WELLS, VICTORIA

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RECORDS 1963/53

CONTENTS

THE MICROFLORA OF F.B.H. PRETTY HILL NO.1 AND F.B.H. EUMERALLA NO.1 WELLS, VICTORIA

by

P.R. Evans

SUMMARY

The microflora from Lower Cretaceous horizons in F.B.H. Pretty Hill No.1 and F.B.H. Eumeralla No.1 are recorded and used to correlate these sections with others in South Australia and western Victoria. A tentative subdivision of the Lower Cretaceous, modified from that initially suggested by Cookson & Dettmann (1958) is employed. A tendency towards brackish, if not marine conditions of sedimentation is recognized in late Lower Cretaceous times.

INTRODUCTION

F.B.H. Pretty Hill No.1 Well was drilled by Frome-Broken Hill Co. Pty Ltd into the Tyrendarra Embayment of the Otway Basin at Long. 142° 07' 30" E; Lat. 38° 13' 30" S. to a total depth of 8124 feet during the period September - October 1962 (Bain, 1962). The well entered (?) Cambrian diabase at 7874 feet after penetrating a Tertiary and Cretaceous section. It entered a "basal sandstone" at 5964 feet with porosity and permeability values such as to warrant consideration of the formation as a potential reservoir. The company then drilled F.B.H. Eumeralla No.1 about 10 miles to the west of the Pretty Hill No.1 to test the extend of the "basal sandstone". Eumeralla No.1 was sited at Long. 141° 56' 01" E; Lat. 38° 12' 43" S. and was drilled to a total depth of 10,308 feet without encountering basement.

Palynological observations were made in the Bureau of Mineral Resources on Pretty Hill No.1 in November 1962, initially to determine the age of the "basal sandstone". Observations were later made on cores from the Tertiary and Upper Cretaceous horizons of the well. The results of this examination appear in Appendix 2 of Bain (1962).

Samples of thirteen cores from Eumeralla No.1 were examined in March 1963 to compare the Eumeralla section with that encountered in Pretty Hill No.1. Results of that examination will appear in the Eumeralla No.1 Well Completion Report.

The object of this paper is to compile the data on the Lower Cretaceous sections of these wells and to compare them with ones obtained from the Lower Cretaceous of other sections in the Otway Basin. Comments on the Upper Cretaceous of Pretty Hill No.1 are not included. The author's conclusions on that horizon presented in Bain (1962) should be considered in the light of evidence recorded by Douglas in the same report.

MATERIAL EXAMINED

Pretty Hill No.1

Merino Group.	Core 16,	5954 - 5957 feet.
"Basal sandstone".	*Core 19,	6696 - 6697½ feet.
" "	*Core 20,	7200 - 7214 feet.

Cores 17 (6070 - 6080 feet) to 21 (7585 - 7597 feet) were cut from the "basal sandstone". Only samples from cores 19 and 20 were processed as the available cuts from the other three cores were of porous sandstone that probably contains a very low spore content and that in any case might have been invaded by contaminating drilling mud. The sample taken from core 19 included a thin lamination of coaly matter. That from core 20 consisted of a very thin lamination of grey silty sandstone.

Eumeralla No.1

The company's subdivision of the well section into formations is not yet available.*

Core samples were taken from the following depths.

Core	5,	3313 - 3315 feet.
Core	6,	3806 - 3808 feet.
Core	8,	4812 - 4814 feet.
Core	10,	5803 - 5805 feet.
Core	13,	6254 - 6257 feet.
Core	15,	6716 - 6718 feet.
Core	18,	7712 - 7714 feet.
Core	19,	8151 - 8152½ feet.
Core	20,	8458 - 8461 feet.
Core	21,	8916 - 8918 feet.
Core	22,	9397 - 9381 feet.
Core	23,	9767 - 9769 feet.
Core	25,	10302 -10305 feet.

OBSERVATIONS

The microspores, pollens and microplankton encountered in Eumeralla No.1 are listed in Table I: those from Pretty Hill No.1 are in Table II.

The fossils were generally well preserved even to total depth in Eumeralla No.1.

Neither of the samples from Pretty Hill contained microplankton. Likewise the samples below core 10 in Eumeralla No.1 lacked these fossils. However, the hystrichosphere Micrhystridium sp. and the pterospermopsid Cymatiosphaera sp. between cores 5 and 10 in Eumeralla No.1 indicate possible marine or brackish water conditions of deposition over the interval 3313 - 5805 feet in the well.

AGE DETERMINATIONS

Observed forms such as Cyathidites australis, Sphagnumsporites spp., Baculatisporites comaumensis, Leptolepidites verrucatus, Cicatricosisporites cooksonii, Lycopodiumsporites austroclavatidites, "Ginkocycadophytus" nitidus, and Vitreisporites pallidus commenced their life ranges in Jurassic or earlier times and they have no bearing on stratigraphical sub-divisions of Eumeralla No.1. The presence of Cicatricosisporites dorogensis (al. australiensis) and Aequitriradites verrucosus at total depth in that well indicates that it finished in beds of Lower Cretaceous age.

The association of Dictyosporites speciosus and Lycopodiumsporites circolumenus with C. dorogensis (in Eumeralla No.1, c.19 and below) may be taken to indicate the Aptian.

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* See Addendum.

Porotrilites striatus, Balmeisporites holodictyus and Cingulatisporites euskirchensoides in core 8 of Eumeralla No.1 signify an Albian age for the core. The species observed between core 8 and core 19 have no meaning in terms of the accepted stage divisions of the Lower Cretaceous, partly because the Eumeralla section modifies knowledge of the ranges of certain species, and partly because there are variations in assemblage from one sample to another that have no stratigraphic significance when the ranges of their component species elsewhere are considered. Core 19 of Eumeralla, for example, contains an assemblage that was not repeated elsewhere in the well but which is composed of species that range through thick sections at Robe and Penola. Until more work is done on the palynological meaning of the Aptian and the Albian any use of these terms will bear little precision. However, at least certain locally recognizable units are becoming apparent within the Lower Cretaceous, indications of which are demonstrated in the following discussion.

CORRELATION OF LOWER CRETACEOUS SECTIONS IN THE OTWAY BASIN WITH THE PRETTY HILL AND EUMERALLA WELLS

F.B.H. Pretty Hill No.1 is the nearest deep well to Eumeralla No.1. Pretty Hill No.1 core 20 contained fairly common Cythathiids and L. circolumenus, D. speciosus and Cyclosporites hughesi (Table II). L. circolumenus was also present in core 19. These species imply a correlation of the Pretty Hill samples with horizons somewhere between core 19 and core 21 of Eumeralla No.1 (see figure 1). However, all these species occur as low as the base of the marine Cretaceous of the Great Artesian Basin (Cookson & Dettmann, 1958), i.e. very close to the level at which C. dorogensis first appears. Thus it is feasible, on the basis of comparable points of first appearance, that Pretty Hill No.1 core 20 could be as old or older than the bottom of Eumeralla No.1. Palynological data from the wells is insufficient for a determination of which of these alternatives is correct.

F.B.H. Flaxman's No.1 Well, drilled into the eastern part of the Otway Basin, penetrated an horizon (core 41 (10801 - 10817 feet)) that contains relatively abundant C. dorogensis (Evans, 1962). As this epibole was not repeated at any other horizon in Flaxman's No.1 and as it appeared at only one horizon in Eumeralla No.1, in core 13 (6254 - 6257 feet), it is possible that these horizons may be correlated. A similar abundance of C. dorogensis was observed in outcrop sample W - 37 from the Merino Group at Merino (Evans, 1961b).

O.D.N.L. Penola No.1 was drilled to the west of the outcropping Merino Group through a sequence that is directly comparable with that in Eumeralla No.1. A twofold division of the Lower Cretaceous of Penola was possible (Evans, 1961a), based on the change occurring between core 8 (2586 - 2596 feet) and core 12 (3363 - 3373 feet). Unfortunately inconclusive results from the intervening cores (9 - 11) prevented any attempt at refining the limits of this change. The same change occurs between core 8 and core 18 (4814 - 7712 feet) of Eumeralla No.1 if the range of D. speciosus is taken as a common denominator in the lower division.

Correlation between Penola and Eumeralla may also be expressed in terms of the observed limits of ranges of species as in figure 1. It is perhaps significant that this correlation places Eumeralla No.1 core 5 and core 8 and Penola No 1, core 8 that all contained hystrichospheres into the same unit. It also links Eumeralla No.1 core 10 and Penola No.1 core 9 - 11, none of which yielded spores in abundance. The significance of the hystrichospheres may be heightened by their presence in Flaxman's No.1, core 34 (8470 - 8484 feet), appropriately above the epibole of C. dorogensis.

REFERENCES

BAIN, J.S., 1962 - Well completion report, Pretty Hill No.1, South West Victoria. Frome-Broken Hill Co.Pty Ltd Rep.No. 7200-G-94 (unpubl.).

COOKSON, I.C., & DETTMANN, M.E., 1958 - Some trilete spores from Upper Mesozoic deposits in the eastern Australian region. Proc.Roy.Soc. Vic. 70(2), 95-128.

EVANS, P.R., 1961a - A palynological report on Oil Development N.L. Penola No.1 Well, South Australia. Bur.Min.Resour.Aust.Rec. 1961/76 (unpubl.).

EVANS, P.R., 1961b - A palynological examination of samples from the Merino Group, Victoria. Ibid. 1961/155 (unpubl.).

EVANS, P.R., 1962 - Palynological observations on F.B.H. Flaxman's Hill No.1 Well. Ibid. 1962/57 (unpubl.).

ADDENDUM

The well completion report for Eumeralla No.1 (Bain, 1963) was received after the preceding notes had been compiled. Bain divided the section as follows:

0 - 1268 feet	Glenelg Group (= Heytesbury Group)
1268 - 2740 feet	Knight Group (= Wangerrip Group)
2740 - 2960 feet	Paaratte Formation
2960 - 3108 feet	Belfast Mudstone
3108 -10308 feet	Merino Group.

Below 9100 feet it contains sandstones similar to the basal sandstone of Pretty Hill No.1.

Reference

BAIN, J.S., 1963 - Well completion report, Eumeralla No.1, South West Victoria. Frome-Broken Hill Co. Pty Ltd Rep. No. 7200-W-21 (unpubl.).

PE907108

This is an enclosure indicator page.
The enclosure PE907108 is enclosed within the container PE907073 at this location in this document.

The enclosure PE907108 has the following characteristics:

ITEM_BARCODE	= PE907108
CONTAINER_BARCODE	= PE907073
NAME	= Microfloral Distribution Chart
BASIN	= OTWAY
PERMIT	= PEP/5
TYPE	= WELL
SUBTYPE	= DIAGRAM
DESCRIPTION	= Distribution of Selected Microfloral Species in FBH Eumeralla-1 (enclosure from WCR) for Pretty Hill-1
REMARKS	=
DATE_CREATED	=
DATE_RECEIVED	=
W_NO	= W469
WELL_NAME	= PRETTY HILL-1
CONTRACTOR	=
CLIENT_OP_CO	= FROME BROKEN HILL CO PTY LTD

(Inserted by DNRE - Vic Govt Mines Dept)

PE907109

This is an enclosure indicator page.
The enclosure PE907109 is enclosed within the container PE907073 at this location in this document.

The enclosure PE907109 has the following characteristics:

ITEM_BARCODE	= PE907109
CONTAINER_BARCODE	= PE907073
NAME	= Microfloral Correlation Chart
BASIN	= OTWAY
PERMIT	= PEP/5
TYPE	= WELL
SUBTYPE	= DIAGRAM
DESCRIPTION	= Microfloral Correlation of 3 Sections Through the Merino Group of the Otway Basin (enclosure from WCR) for Pretty Hill-1
REMARKS	=
DATE_CREATED	=
DATE_RECEIVED	=
W_NO	= W469
WELL_NAME	= PRETTY HILL-1
CONTRACTOR	=
CLIENT_OP_CO	= FROME BROKEN HILL CO PTY LTD

(Inserted by DNRE - Vic Govt Mines Dept)

TABLE II THE MICROFLORA OF CORES 19, 20 FROM F.B.H. PRETTY HILL NO.1

Core 19 (6696 - 6697 ft. 6 in.) included a thin ($\frac{1}{4}$ inch) lamination of coaly matter. Maceration of this material yielded vegetable tissue and extremely few spores. Lycopodiumsporites circolumenus and Leptolepidites verrucatus were recognized among them.

Core 20 (7200 - 7214 feet: precise interval not determinable) was also of sandstone, but included a very thin lamination of grey silty sandstone. This lamination yielded a moderate number of well preserved spores. They included:

Cyathidites spp. incl. C. australis rimalis
Dictyotosporites speciosus
Lycopodiumsporites circolumenus
Cyclosporites hughesi
Aequitriradites tilchaensis
} 1 specimen of each
Disaccites spp. (common)
"Inaperturopollenites" spp. (fairly common).

PE907074

This is an enclosure indicator page.
The enclosure PE907074 is enclosed within the container PE907073 at this location in this document.

The enclosure PE907074 has the following characteristics:

ITEM_BARCODE	= PE907074
CONTAINER_BARCODE	= PE907073
NAME	= Stratigraphic Column
BASIN	= OTWAY
PERMIT	= PEP/5
TYPE	= WELL
SUBTYPE	= STRAT_COLUMN
DESCRIPTION	= Stratigraphic Column Prior to Drilling (enclosure from WCR) for Pretty Hill-1
REMARKS	=
DATE_CREATED	= 30/11/62
DATE_RECEIVED	=
W_NO	= W469
WELL_NAME	= PRETTY HILL-1
CONTRACTOR	=
CLIENT_OP_CO	= FROME-BROKEN HILL CO PTY LTD

(Inserted by DNRE - Vic Govt Mines Dept)

Petroleum Technology Laboratory, Bureau of Mineral Resources, Geology and Geophysics, Canberra.

Date: 15th October, 1962

CORE ANALYSIS RESULTS

Notes: (i) Unless otherwise stated, the porosities and permeabilities were determined on two small plugs (V & H) cut at right angles from the core or sample. Ruska field porometer and permeameter were used, with air and dry nitrogen, respectively, as the saturating and flowing media. (ii) Oil and water saturations were determined using Soxhlet type extraction apparatus. (iii) Acid solubilities were determined using 15% commercial hydrochloric acid. (iv) N.D. means Not Determined.

Well or Area	Core or Sample Number	Depth in ft. From: To:	Effective Porosity % by Vol.		Absolute Permeability Millidarcies		Avg. density in gms/cc.		Fluid Saturation			Acid solubility % by vol.	Oil Characteristics			Virgin Bulk Dens. gms/cc	Salinity of core water P.P.M. Na Cl.
			V.	H.	V.	H.	Dry Bulk	Grain	Water: % pore space	Oil: % pore space	Oil: Metric tons/ acre ft.		Fluorescence in solvent	Colour of extracted oil	Fluorescence of extracted oil		
Pretty Hill No. 1	7	2928' 2940'	N.D.	38	N.D.	70	1.65	2.66	82	Nil	Nil	Nil	N.D.	Nil Oil	N.D.	1.96	17,350
"	13	4940' 4961'	25	24	Nil	Nil	2.04	2.71	80	1	3	25	Bluish-white	Yellow-Brown	Whitish-yellow	2.24	21,100
"	14	5400' 5420'	20	18	Nil	Nil	2.20	2.71	95	Not Measurable		30	Bluish-white	N.D.	N.D.	2.38	19,900
"	16	5935' 5947'	19	18	Pencil split	Nil	2.29	2.80	77	3	6	21	Strong bluish White; green-yellow bloom	Yellow-brown	Greenish-yellow	2.44	21,600
"	17	6070' 6080'	24	22	2	No Pencil	2.07	2.65	80	Not Measurable		9	Faint bluish-white	N.D.	N.D.	2.26	18,400
"	18	6376' 6388'	22	22	2,097	2,756	2.07	2.64	70	Nil	Nil	13	Nil	Nil Oil	N.D.	2.22	6,250

General File No. 62/399

Well File No. 62/1115

Additional information: Acetone Tests:

Core No. 7 - Negative
" " 13 - Faint positive
" " 14 - Negative

Core No. 16 - Positive
" " 17 - Faint positive
" "" 18 - Negative

Petroleum Technology Laboratory, Bureau of Mineral Resources, Geology and Geophysics, Canberra

Date: 13th November, 1962.

CORE ANALYSIS RESULTS

Notes (i) Unless otherwise stated, the porosities and permeabilities were determined on two small plugs (V & H) cut at right angles from the core or sample. Ruska field porometer and permeameter were used, with air and dry nitrogen, respectively, as the saturating and flowing media. (ii) Oil and water saturations were determined using Soxhlet type extraction apparatus. (iii) Acid solubilities were determined using 15% commercial hydrochloric acid (iv) N.D. means Not Determined.

Well or Area	Core or sample number	Depth in ft. from: To:	Effective porosity % by Vol.		Absolute permeability millidarcys.		Avg. density in gms/cc.		Fluid saturation			Acid solubility % by vol.	Oil Characteristics			Core Water Salinity P.P.M. Na Cl.
			V.	H.	V.	H.	Dry Bulk	Grain	Water: % pore space	Oil: % pore space	Oil: Metric tons/ acre ft.		Fluorescence in solvent	Colour of extracted oil.	Fluorescence of extracted oil.	
Pretty Hill No. 1	19	6690' 6702'	25	21	967	363	2.11	2.73	79	Nil	Nil	N.D.	Nil	Nil Oil	N.D.	3,140
"	20	7200' 7214'	23	22	198	197	2.15	2.77	81	"	"	"	"	" "	"	2,990
"	21	7585' 7597'	20	19	525	865	2.19	2.72	74	"	"	"	"	" "	"	3,200

Additional information: Acetone tests carried out on all samples gave negative results

General file no. 62/399

Well file no. 62/1115

J.

Petroleum Technology Laboratory, Bureau of Mineral Resources Geology and Geophysics Canberra.

Date: 4th December, 1964

CORE ANALYSIS RESULTS

Notes:- (i) Unless otherwise stated, the porosities and permeabilities were determined on two small plugs (V & H) cut at right angles from the core or sample. Ruska porosimeter and permeameter were used, with air at 350 p.s.i.g. and dry nitrogen, respectively, as the saturating and flowing media. (ii) Residual oil and water saturations were determined using Sozhlet type apparatus. (iii) Acetone test precipitates and fluorescence of solvent after extraction are recorded as, nil, trace, fair, strong or very strong.

Well or Area	Core or Sample No.	Depth in ft. From:- To:-	Lithology	Effective Porosity in % by Vol		Absolute Permeability in Millidarcys		Avg. density in gms./cc		Fluid Saturation in % Pore Space.		Acetone Test		Solvent after Extraction.		Remarks.
				V	H	V	H	Dry Bulk	Apparent Grain	Water	Oil	Colour	Precipitate	Colour	Fluor	
Pretty Hill No. 1	1	1284' 1286'	Siltstone and shale	35	35	3	4	2.00	3.08	27	Trace	Orange	Very strong	Trace	Trace	
	2	1816' 1818'	Siltstone and sandstone	40		N.D.		1.84	3.03	48	Nil	Pale yellow	Nil	Trace	Fair	Pieces only; insufficient for plugs.
	3	NIL CORE RECOVERY														
	4	2389' 2391'	Siltstone and sandstone	36	37	Nil	33	1.91	3.08	21	Trace	Pale yellow	Very strong	Trace	Trace	Pyrites obvious
	5	NIL CORE RECOVERY														
	6	2728' 2730'	Siltstone and sandstone	N.D.	42	N.D.	39	1.95	3.39	30	Nil	Trace	Nil	Nil	Trace	All vertical plugs crumbled
	CORE NO.	7 REPORTED OCTOBER 1962														
	8	3342' 3344'	Siltstone	32	32	Nil	Nil	2.00	2.93	31	Nil	Pale yellow	Nil	Pale yellow	Fair	

Additional Information:

General File No. 62/399
Well File No. 62/1115

Petroleum Technology Laboratory, Bureau of Mineral Resources Geology and Geophysics Canberra.

Date: 4th December, 1964

CORE ANALYSIS RESULTS

Notes:- (i) Unless otherwise stated, the porosities and permeabilities were determined on two small plugs (V & H) cut at right angles from the core or sample. Ruska porosimeter and permeameter were used, with air at 30 p.s.i.g. and dry nitrogen, respectively, as the saturating and flowing media. (ii) Residual oil and water saturations were determined using Sozhlet type apparatus. (iii) Acetone test precipitates and fluorescence of solvent after extraction are recorded as, nil, trace, fair, strong or very strong.

Well or Area	Core or Sample No.	Depth in ft. From:- To:-	Lithology	Effective Porosity in % by Vol.		Absolute Permeability in Millidarcys		Avg. density in gms./cc		Fluid Saturation in % Pore Space.		Acetone Test		Solvent after Extraction.		Remarks.
				V	H	V	H	Dry Bulk	Apparent Grain	Water	Oil	Colour	Precipitate	Colour	Fluor	
Pretty Hill No1	9	3812' 3814'	Sandstone	26	27	Nil	3	2.09	2.83	11	Nil	Faint trace	Nil	Nil	Trace	Pyrites obvious.
	10	4317' 4319'	Siltstone and shale	25	25	Nil	Nil	2.13	2.88	17	"	Pale yellow	Trace	Pale yellow	Fair	Pyrites obvious.
	11	4635' 4640'	Siltstone and shale	22	22	"	"	2.23	2.84	16	"	Pale yellow	Trace	Pale yellow	Fair	Pyrites obvious.
	12	4640' 4642'	Shale	22	22	"	"	2.25	2.89	23	"	Trace	Nil	Trace	Trace	
	CORES		NOS. 13 AND	14		REPORTED		OCTOBER		1962						
	15	5420' 5424'	Sandstone	N.D.	21	N.D.	Nil	2.18	2.74	21	Nil	Trace	Nil	Nil	Trace	Small pieces only. No "V" plug.
	CORES		NOS. 16 TO	21		REPORTED		OCTOBER		1962						
	22	7885' 7887'	Dolerite	6	3	Nil	Nil	2.74	2.85	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	Pyrites obvious.

Additional Information:

General File No. 62/399
Well File No.

Petroleum Technology Laboratory, Bureau of Mineral Resources Geology and Geophysics Canberra.

Date: 4th December, 1964

CORE ANALYSIS RESULTS

Notes:- (i) Unless otherwise stated, the porosities and permeabilities were determined on two small plugs (V & H) cut at right angles from the core or sample. Ruska porosimeter and permeameter were used, with ~~air~~ at ~~130~~ p.s.i.g. and dry nitrogen, respectively, as the saturating and flowing media. (ii) Residual oil and water saturations were determined using Sozhlet type apparatus. (iii) Acetone test precipitates and fluorescence of solvent after extraction are recorded as, nil, trace, fair, strong or very strong.

Well or Area	Core or Sample No.	Depth in ft. From:- To:-	Lithology	Effective Porosity in % by Vol		Absolute Permeability in Millidarcys		Avg. density in gms./cc		Fluid Saturation in % Pore Space.		Acetone Test		Solvent after Extraction.		Remarks.
				V	H	V	H	Dry Bulk	Apparent Grain	Water	Oil	Colour	Precipitate	Colour	Fluor	
Pretty Hill No. 1	23*	8115' 8117'	Dolerite	37		Nil		2.44	3.81	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	

* NOTE increase in porosity and grain density compared with core No. 22.
Because of this the above characteristics were checked and confirmed
by three different methods (1) Air injection (2) Gas expansion (3) Washburn Bunting.

Additional Information:

General File No. 62/399
Well File No.

Appendix 3....

Water Analysis

Pretty Hill

APPENDIX 3

WATER ANALYSES

Pretty Hill 40

WATER ANALYSIS

(Analysis by Mobil Oil Company - Melbourne)

D.S.T. No. 1a	6690 to 6732 feet dated 8.10.62	
	Steam Distillable Oil	Nil
	Hexane Extract	.0025%
	Explosive Gases	Present (small extent only)
	Chloride Content as Cl	13.5 gms/litre
	" " as Na Cl	22.1 " "

Appendix 4....

Lithological Descriptions

Pretty Hill

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APPENDIX 4

DETAILED LITHOLOGICAL DESCRIPTION

AND

CORE DESCRIPTIONS

AND ANALYSES

Pretty Hill

CORE DESCRIPTIONS

Core No. 1 — 1282 to 1302 feet. Recovered 12 feet.
2 feet sandstone; dirty, dark brown, limonitic. Fine to very coarse grained with some granules; subangular to well rounded, poorly sorted quartz grains set in a dirty brown limonitic matrix. Tight, fairly hard, non-calcareous and non-fossiliferous.

10 feet siltstone and mudstone; light brown, chocolate brown to dark brown, micaceous, pyritic, laminated.

No apparent dip. Ultra violet: negative.

Core No. 2 — 1816 to 1836 feet. Recovered 6 feet
Siltstone and mudstone; dark brown, laminated, micaceous, pyritic, with interbedded clear, loose, very fine to fine sand and shell fragments in places. Tight, dense but soft. No apparent dip.

Core No. 3 — 2373 to 2383 feet. Recovery nil.

Core No. 4 — 2383 to 2403 feet. Recovered 15 feet.
2" dolomite-ankerite; brown, tight, dense and hard. The rest of the core is siltstone to very fine sandstone; light to dark grey, brownish, laminated, very micaceous, pyritic and tight. No apparent dip.

Core No. 5 — 2716 to 2726 feet. Recovery nil.

Core No. 6 — 2726 to 2734 feet. Recovered 6 feet.
Sandy siltstone; dark grey, greenish, very glauconitic and micaceous, fossiliferous and non-calcareous. Tight, dense, and soft. Quartz grains are coarse to very coarse, angular to subrounded, poorly sorted and occur in patches throughout the core. Some coal is present in places.

No apparent bedding. Ultra violet: negative.

Core No. 7 — 2928 to 2940 feet. Recovered 12 feet.
Sandstone; light grey-green, fairly porous, made up of clear to light grey, fine to coarse (mainly medium) grained, angular to subround, fairly well sorted quartz grains, some dark rock fragments, feldspar, siltstone fragments, odd clay pellets, some pink grains, probably feldspar, with chlorite and a few pebbles. Few calcareous concretions.

One foot from the top of the core there is a 3" thick poorly sorted pebble (quartz) conglomerate.

No apparent bedding. Ultra violet: negative.

Core No. 8 — 3340 to 3360 feet. Recovered 15 feet.
1 foot siltstone; light grey-green, compact, composed of clear quartz, some feldspar and silty, clayey, micaceous, chloritic matrix.

2 feet sandstone; light grey-green, very fine subgreywacke with same constituents as the top of the core and somewhat coaly in the bottom foot.

12 feet siltstone and mudstone; light to medium grey-greenish, fairly hard, compact.

No apparent dip. Ultra violet: negative.

Core No. 9 — 3810 to 3830 feet. Recovered 13 feet.
Siltstone; light grey-green, micaceous, carbonaceous, compact, tight and uniform except in the second foot from the top when it becomes very fine to fine sandstone, fairly tight and made up of quartz approximately 60%, feldspar, dark rock fragments, chlorite and silty matrix. Siltstone is sandy in places and dense. Cross bedding and apparent dip of 28°. Ultra violet: negative.

Core No. 10 — 4315 to 4328 feet. Recovered 13 feet.
Siltstone; light to medium to dark grey, sandy in part, micaceous, carbonaceous, tight, compact and uniform except for several bands of light grey-green, very fine to fine, calcareous, compact sandstone up to 4" thick, mineral composition of which is quartz, feldspar, biotite, few dark rock fragments and chlorite.

Cross bedding and apparent dip of 15°.

No evidence of oil or gas.

Core No. 11 — 4625 to 4640 feet. Recovered 7 feet.
Note: Seven feet of Core No. 11 was picked up when cutting Core No. 12 and the lithology is uniform for the two cores. Description is as for Core No. 12.

Core No. 12 — 4640 to 4655 feet. Recovered 15 feet.
Siltstone; light green-grey, medium to dark grey, tight, dense with odd green clay fragments and carbonaceous matter. In places grades into a very fine sandstone. Mineral composition is quartz, about 50% to 60%, mica, feldspar and few dark rock fragments.

Apparent dip of 15° to 20°. Density: 2.41.

Ultra violet: negative. No evidence of oil or gas.

Pretty Hill

Core No. 13 4940 to 4960 feet. Recovered 5 feet.
2 feet siltstone and very fine sandstone; dark grey, micaceous, laminated, tight and dense, non-calcareous.

3 feet sandstone-subgreywacke; light to medium grey, mottled, tight, with fine to medium grained quartz, feldspar, dark rock fragments, chlorite and mica.

Apparent dip in siltstone 15° to 20°.
" " " sandstone up to 30°.

Density siltstone: 2.49.
" sandstone: 2.3.

No evidence of oil or gas.

Core No. 14 5400 to 5420 feet. Recovered 20 feet.
Sandstone-subgreywacke; grey-green to blue-green, mottled, slightly calcareous, tight, compact, made up of fine to coarse but nearly all medium grained, well sorted quartz, 40% to 50%, feldspar 20%, dark rock fragments 20%, and the rest mica, silt and clay, carbonaceous matter and few pink mineral fragments.

One apparent dip on a carbonaceous bed: 10°.
Density: 2.35. Ultra violet: negative.

No evidence of oil or gas.

Core No. 15 5420 to 5424 feet. Recovered 2 feet.
First foot sandstone as for Core No. 14.
One foot intraformational breccia, made up of pebble sized bodies of light grey, dark grey and black siltstone fragments, quartz and coal set in a sandstone matrix. Core is tight and some of the brecciated fragments show a slickensided surface. No evidence of oil or gas. Density: 2.38. Ultra violet: negative.

Core No. 16 5935 to 5947 feet. Recovered 12 feet.
Siltstone and mudstone; dark grey, fissile, fractured, dense, slickensided and brecciated in few places. Fractures are filled with white, soft, slickensided non-calcareous material slightly resembling talculm.

Fourth and fifth feet grade into very fine sandstone made up of quartz, feldspar, mica, dark rock fragments and carbonaceous matter.

Apparent dip of 25°

Density: 2.46. No evidence of oil or gas.

Pretty Hill 45

Core No. 17 6070 to 6080 feet. Recovered 6 feet.
Sandstone; white, friable, uniform and slightly cross bedded, made up of clear, mainly medium to very coarse, angular to subround, subhedral quartz with some distinctive light orange to pink garnets and possibly some feldspar, set in a white, siliceous, kaolinitic, non-calcareous matrix. Some mica fragments and thin coal streaks appear near the base of the core. Four inches from the base a large, grey mudstone fragment occurred.

No apparent dip. Density: 2.5.

No evidence of oil or gas. Ultra violet: negative.

Core No. 18 6376 to 6388 feet. Recovered 4 feet.
Sandstone; white to light grey, made up of clear, medium to granule, angular, subhedral, poorly sorted quartz with orange and pink garnet, (about 5%) and few black, hard, mineral grains, possibly ilmenite, set in a siliceous, clayey matrix which is not as abundant as in Core No. 17. A few thin streaks of carbonaceous matter appear near the bottom of the core.

No bedding apparent. Density: 2.3.

No evidence of oil or gas. Ultra violet: negative.

Core No. 19 6690 to 6702 feet. Recovered 7 feet, 6 inches.
1 foot sandstone; light brown, compact, slightly dolomitic and ankeritic, made up of clear to light grey, fine to very coarse angular and subhedral quartz, sometimes nearly euhedral with fresh, nicely developed faces probably resulting from secondary crystallisation. Matrix is light brown, siliceous, clayey, slightly dolomitic or ankeritic. The rest of the core is light grey, highly porous, cross bedded sandstone differing from the top by the absence of dolomitic-ankeritic matrix and porosity only. As accessories, light violet, pink or blood red garnets, black, heavy and hard possible ilmenite and some odd soft black graphite occur.

Apparent dip of 10° to 25°. Density: 2.33

No evidence of oil or gas. Ultra violet: negative.

Core No. 20 7200 to 7214 feet. Recovered 14 feet.
Sandstone; light grey, white, friable, made up of light grey, clear, fine to very coarse, angular to subround, poorly sorted quartz with evidence of secondary crystallisation, and white, siliceous, silty, clayey matrix.

One foot in the centre of the core is sandstone, brown, slightly calcareous or dolomitic. Few coal streaks with evidence of cross bedding appear in the bottom part with one or two gas bubbles emanating from this coal only.

No apparent dip. Acetone test: negative.

No other evidence of oil or gas. Ultra violet: negative.

Core No. 21 7585 to 7597 feet. Recovered 12 feet
Sandstone; light grey, consisting of clear to light grey and white, fine to coarse and some very coarse, angular to subround poorly sorted quartz and nearly entirely with a siliceous matrix (cf. Waarre Formation, Port Campbell No. 2). Not as porous as Cores Nos. 18 to 20 and is harder. Few coaly bands and prominent quartz veining.

Apparent dip: 10^{o}. Density: 2.42.

No evidence of oil or gas. Ultra violet: negative.

Core No. 22 7883 to 7895 feet. Recovered 6 feet.
Diabase; dark grey to dark green, dense, veined, porphyritic, metamorphosed basic rock. Phenocrysts, medium to dark green in some sections, translucent to transparent exhibiting monoclinic to rhombic sections and occasional poor prismatic cleavage and basal parting, very soft, often with yellow marginal alterations. Could be monoclinic proxene ?augite and olivine altered to uralite, serpentine and even to chlorite. The phenocrysts are set in a microcrystalline, dense, ash-like, glittering matrix with tiny lath-like ?feldspar crystals showing ophitic structure in places and some sulphide crystals - ?pyrite. Veins and fractures are filled with secondary calcite usually stained red with iron oxide, and ?chlorite. Rock is slightly magnetic.

Density: 2.8.

Core No. 23 8112 to 8129 feet. Recovered 16 feet.
Diabase; dark grey, dark green, porphyritic, altered igneous rock with veins and fractures. Phenocrysts of green, usually granular, stubby, prisms of olivine with pyramid terminations. Common aggregations within olivine grains probably alterations to ?serpentine, ?pyroxene, ?amphybole and chlorite. In the middle part of the core some olivine is replaced by clear ?quartz and chlorite. Elongated prismatic green phenocrysts are possibly pyroxene. Small lath-like, vitreous, not very conspicuous feldspars apparently fairly fresh are set in a fine crystalline ash-like matrix with numerous milk-white granular minerals possibly primary zeolites or kaolin and CaMg carbonates. Numerous fractures are filled with chlorite, zeolite or carbonates possibly magnesite, sometimes stained by iron oxide.

Pretty Hill

DETAILED LITHOLOGICAL DESCRIPTION

Glenelg Group = Heytesbury Group

Surface to 420 feet	Limestone; light grey, fossiliferous, slightly glauconitic, porous, with some thin bands of silty limestone and glauconitic, calcareous siltstone.
420 to 1120 "	Marl; grey to blue-grey, puggy, fossiliferous.
1120 to 1256 "	Limestone; light brown, fossiliferous, limonitic with some scattered glauconite fragments, interbedded with grey to brown grey, fossiliferous, puggy, silty marl.

Knight Group = Wangerrip Group

1256 to 1770 feet	Sandstone; yellow-brown, dirty, fine to granule, unsorted, set in limonitic matrix, interbedded with light to dark brown, micaceous, pyritic, laminated siltstone-mudstone.
1770 to 1905 "	Siltstone-mudstone; dark brown to dark grey, laminated, micaceous, interbedded with thin beds of very fine to fine, clear, loose sand. Pyrite abundant, fossiliferous.
1905 to 2370 "	Sandstone; yellow to clear, dirty, medium to coarse, unsorted, set in limonitic matrix, interbedded with brown laminated, micaceous, pyritic siltstone. Dolomite bands in places.

Paaratte Formation

2370 to 2598 feet	Siltstone; dark grey to brown-grey, micaceous, pyritic, with dolomite bands interbedded with sandstone, yellow to clear, fine to coarse.

Belfast Mudstone

2598 to 2770 feet	Siltstone; sandy, dark grey to greenish-grey, micaceous, glauconitic, fossiliferous, pyritic and carbonaceous.

Flaxmans Beds

2770 to 2922 feet		Sandstone; clear to brown, dirty, limonitic, medium to very coarse, pyritic, interbedded with dark grey glauconitic sandstone.

Merino Group

2922 to 3005 feet		Sandstone; light green-grey, fine to coarse, mainly medium grained, quartz, dark rock fragments, feldspar, chlorite, and some pink grains.
3005 to 3150	"	Siltstone; sandy, light grey, micaceous.
3150 to 3200	"	Sandstone; light grey to light greenish-grey, fine to coarse.
3200 to 3485	"	Siltstone-mudstone; light to medium grey to greenish-grey, composed of clear quartz grains, feldspar, mica, in silty clayey matrix, interbedded with light greenish-grey, very fine sandstone to subgreywacke with the same constituents.
3485 to 3522	"	Sandstone; light greenish-grey with quartz, feldspar and dark rock fragments; slightly calcareous in parts.
3522 to 3565	"	Siltstone; light grey to greenish-grey, interbedded with sandstone.
3565 to 3618	"	Sandstone; light greenish-grey.
3618 to 3705	"	Siltstone; light grey to greenish-grey, interbedded with sandstone.
3705 to 3745	"	Sandstone; light grey to greenish-grey.
3745 to 3835	"	Siltstone; light grey to greenish-grey, micaceous, carbonaceous, interbedded with sandstone, light grey to greenish-grey. Fine grained, made up of quartz, feldspar, dark rock fragments and chlorite in silty matrix.
3835 to 3882	"	Sandstone; light grey to greenish-grey.
3882 to 4004	"	Sandstone; light grey to greenish-grey, interbedded with siltstone, light grey to greenish-grey, few coal seams.

Merino Group (Cont'd)

4004 to 4890 feet	Siltstone; grey to greenish-grey, composed of quartz, feldspar, dark rock fragments, micaceous, interbedded with sandstone of the same composition. Several coal bands.
4890 to 5102 "	Sandstone to subgreywacke; light to medium grey, mottled, fine to medium, made up of quartz, feldspar, dark rock fragments, chlorite, mica. Interbedded with siltstone, grey, micaceous, laminated and several coal bands.
5102 to 5400 "	Siltstone; grey, micaceous, laminated with coal bands, interbedded with sandstone to subgreywacke, light to medium grey, mottled.
5400 to 5550 "	Sandstone to subgreywacke; grey-green to blue-green, fine to coarse but mainly medium grained, very well sorted, made up from quartz, feldspar, dark rock fragments, mica, slightly calcareous. Interbedded with siltstone, grey to green-grey, micaceous and several coal bands.
5550 to 5935 "	Siltstone; light to medium grey to green-grey, sandy to clayey in places, calcareous. Interbedded with sandstone to subgreywacke, grey to green-grey.
5935 to 5964 "	Siltstone to mudstone; dark grey, fissile, very fractured, slickensided, interbedded with sandstone, made up of quartz, feldspar, mica, dark rock fragments and carbonaceous material.

Basal Sandstone

5964 to 7874 feet	Sandstone; made up of white to clear quartz, fine to very coarse, angular to subrounded with some well developed secondary crystal facies, contains very distinctive, translucent, orange-red to pink ?garnet fragments. The matrix is white, very fine, siliceous material. Generally noncalcareous but bands of dolomite and dolomitic cement appear. Interbedded with a few beds of light to medium grey mudstones and coal.

Pretty Hill

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Cambrian Basement Complex

7874 to 8129 feet

Dark grey to greenish-grey, ultrabasic igneous rock which appears to have originally been an olivine dolerite and has since been strongly weathered and altered to diabase. Very fractured and slickensided with ferro-calcite along fractures.

Appendix 5....

Hole Deviation

Pretty Hill

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APPENDIX 5

HOLE DEVIATION

Pretty Hill

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HOLE DEVIATION

TOTCO READINGS

Depth (feet)	Deviation (Degrees)	Depth (feet)	Deviation (Degrees)
120	$\frac{1}{8}$	2900	$1\frac{1}{2}$
195	0	3342	$\frac{1}{2}$
280	$\frac{3}{4}$	3810	$\frac{7}{8}$
340	$\frac{1}{4}$	4315	1
430	$\frac{1}{2}$	4625	2
525	$\frac{1}{4}$	4940	$1\frac{1}{4}$
618	1	5400	$1\frac{1}{2}$
649	$\frac{1}{2}$	5722	$1\frac{3}{4}$
713	$\frac{3}{4}$	5935	Mis-run
805	$\frac{1}{4}$	6070	$1\frac{1}{2}$
900	$\frac{1}{4}$	6376	$\frac{3}{4}$
990	$\frac{1}{8}$	6690	Mis-run
1090	$\frac{1}{4}$	6700	$2\frac{1}{4}$
1185	$\frac{1}{4}$	7200	$4\frac{1}{4}$
1280	$\frac{1}{2}$	7585	$4\frac{1}{4}$
1800	1	7860	4
2345	$\frac{1}{2}$	8100	Mis-run
2686	$1\frac{1}{2}$		

Pretty Hill

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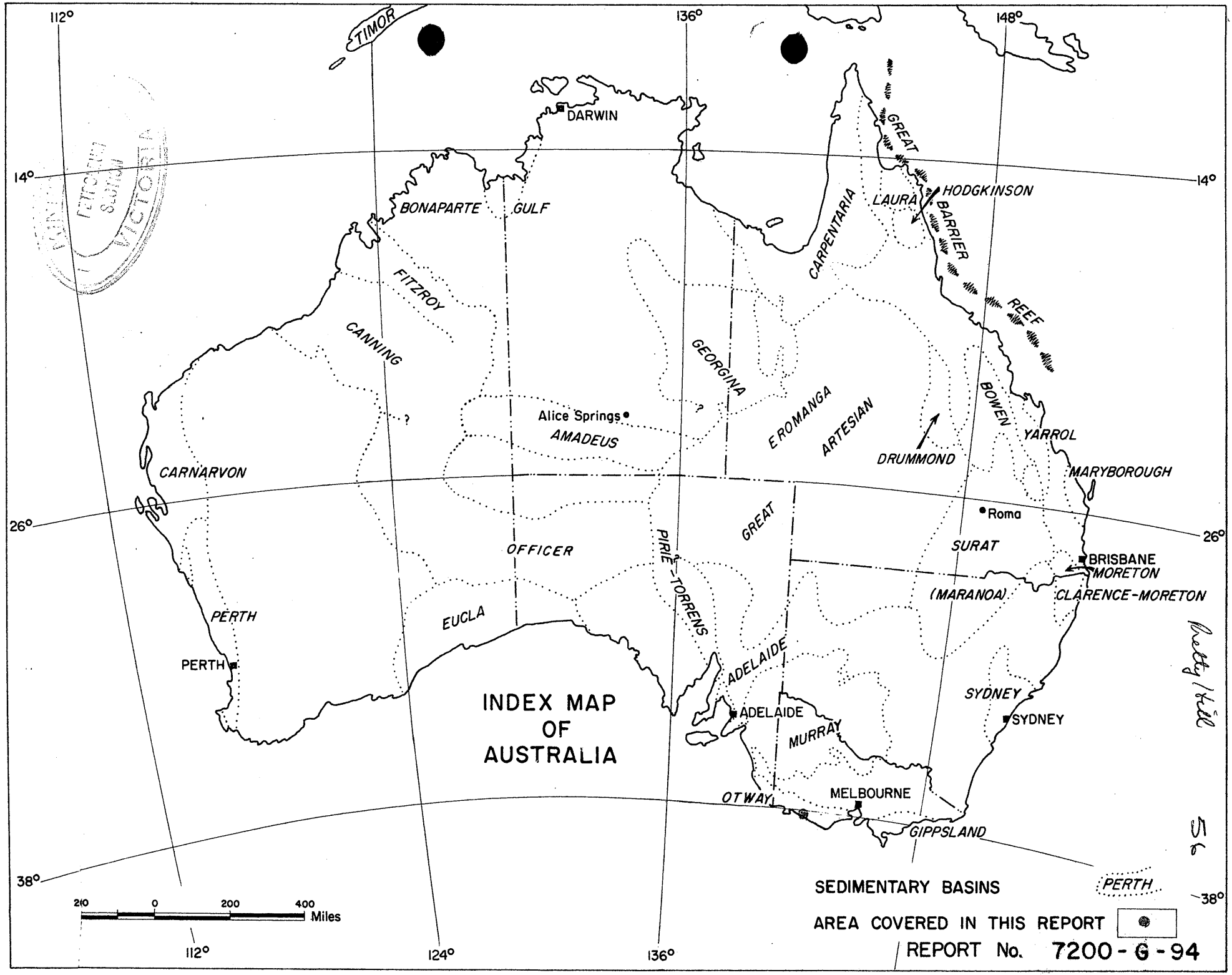
SCHLUMBERGER READINGS

Depth (feet)	Deviation (Degrees)	Azimuth (Rel. to Mag. N)	Depth (feet)	Deviation (Degrees)	Azimuth (Rel. to Mag. N)
2229	0		3198	0.45	130
2295	0		5732	1	270
2326	0		5769	1	240
2368	0.45	115	5823	1.30	300
2463	1	130	5845	1.15	295
2489	1	155	5888	1.15	300
2513	1	130	5902	1.30	290
2590	1	170	5910	1.30	280
2778	1.15	170	5958	2	260
2848	1	175	6005	1.30	250
2863	1	190	6016	1.30	250
2957	1	150	6100	1.15	230
2983	0.30	160	6147	0.30	205
3003	0.30	165	6300	0.30	180
3050	0.15		6463	0.15	180
3065	0.30	150	6649	1.30	175
3085	1	170			


112°
136°
148°
14°
26°
38°
TIMOR
DARWIN
BONAPARTE GULF
FITZROY
CANNING
CARPENTARIA
LAURA
HODGKINSON
GREAT BARRIER REEF
GEORGINA
Alice Springs
AMADEUS
EROMANGA
ARTESIAN
DRUMMOND
BOWEN
YARROL
MARYBOROUGH
CARNARVON
Roma
GREAT
SURAT
BRISBANE
MORETON
(MARANOA)
CLARENCE-MORETON
OFFICER
PIRIE-TORRENS
PERTH
EUCLA
PERTH
ADELAIDE
SYDNEY
ADELAIDE
MURRAY
SYDNEY
OTWAY
MELBOURNE
GIPPSLAND
PERTH
INDEX MAP
OF
AUSTRALIA
240 0 200 400 Miles
112°
124°
136°
SEDIMENTARY BASINS
AREA COVERED IN THIS REPORT
REPORT No. 7200-G-94

Pretty Hill

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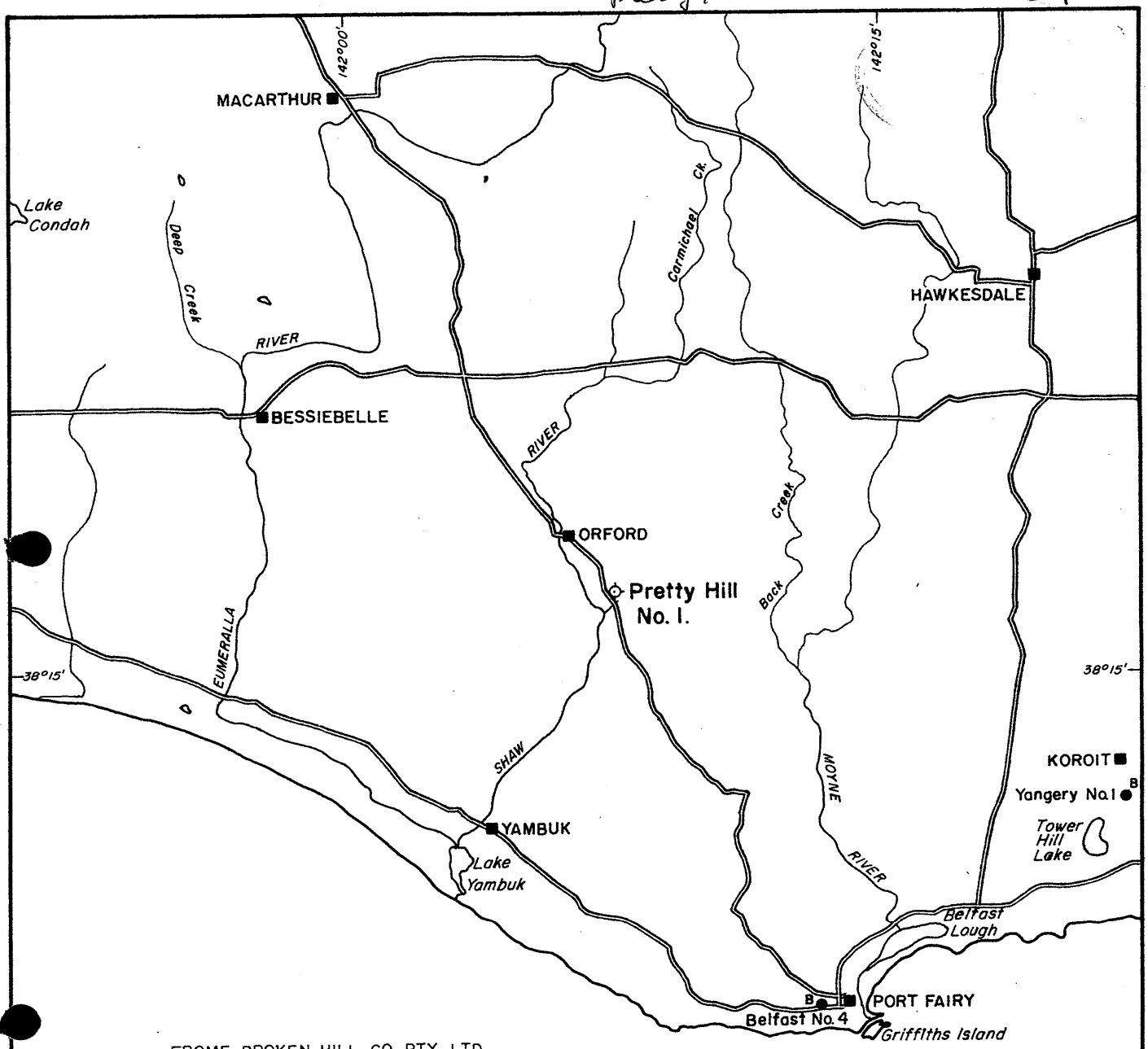


FROME-BROKEN HILL CO. PTY. LTD.

PRETTY HILL NO. 1

LOCALITY MAP

PLATE 1

By J. S. BAIN

SCALE: 1 INCH = 4 MILES

4 2 0 4 8 Miles

NOV. 1962

7200-G-94

PE907075

This is an enclosure indicator page.
The enclosure PE907075 is enclosed within the container PE907073 at this location in this document.

The enclosure PE907075 has the following characteristics:

ITEM_BARCODE	= PE907075
CONTAINER_BARCODE	= PE907073
NAME	= Geological Cross Section
BASIN	= OTWAY
PERMIT	= PEP/5
TYPE	= WELL
SUBTYPE	= CROSS_SECTION
DESCRIPTION	= Geological Cross Section showing the proposed Pretty Hill-1, Plate 3, (enclosure from WCR) for Pretty Hill-1
REMARKS	=
DATE_CREATED	= 30/11/62
DATE_RECEIVED	=
W_NO	= W469
WELL_NAME	= PRETTY HILL-1
CONTRACTOR	=
CLIENT_OP_CO	= FROME-BROKEN HILL CO PTY LTD

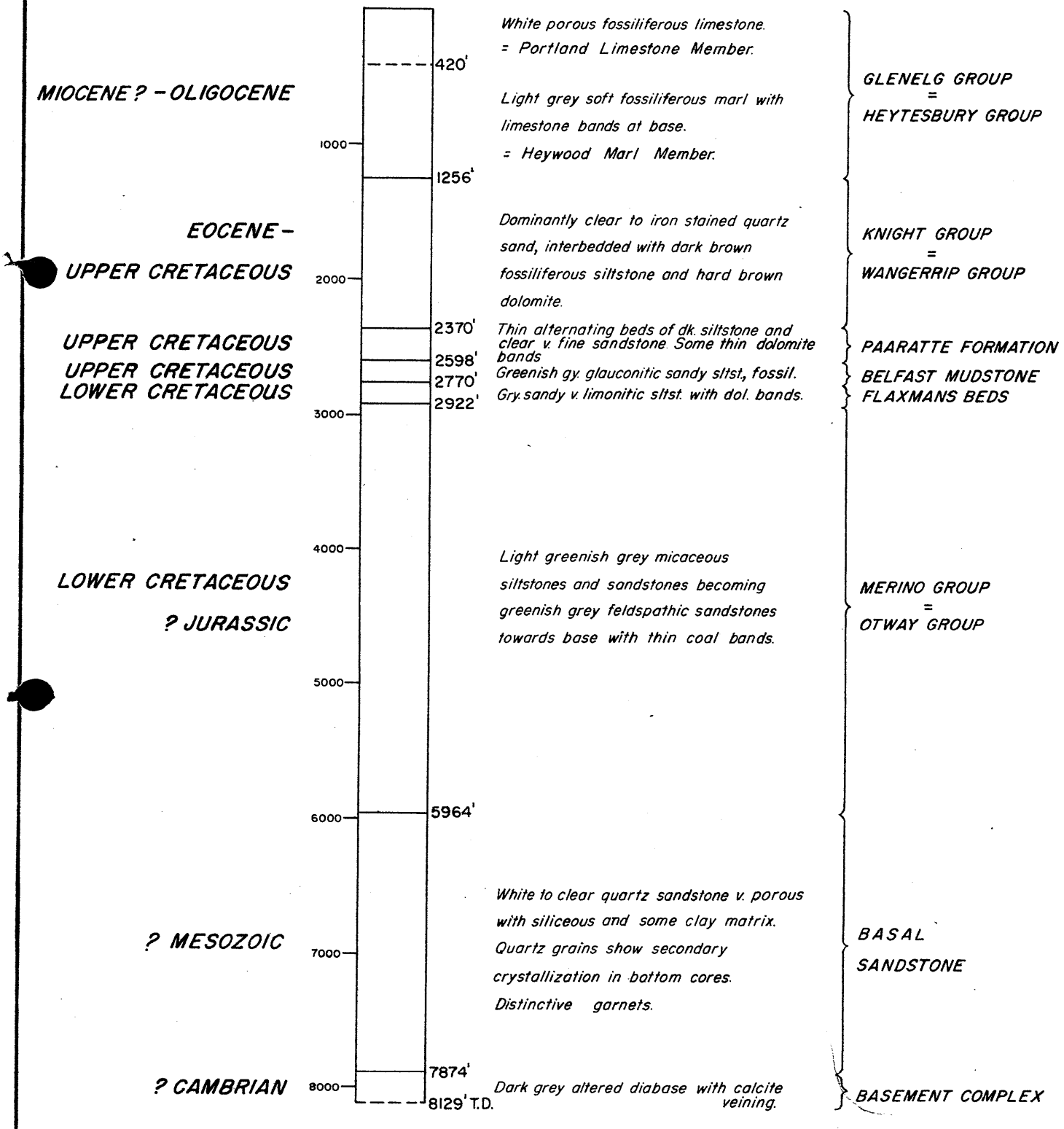
(Inserted by DNRE - Vic Govt Mines Dept)

FROME-BROKEN HILL CO. PTY. LTD.

PRETTY HILL NO. 1

STRATIGRAPHIC COLUMN AFTER DRILLING

SCALE: 1 INCH = 1000 FEET



By J.S. BAIN and S. BENEDEK
NOV. 1962

PLATE 4

7200-G-94

PE907076

This is an enclosure indicator page.
The enclosure PE907076 is enclosed within the container PE907073 at this location in this document.

The enclosure PE907076 has the following characteristics:

ITEM_BARCODE	= PE907076
CONTAINER_BARCODE	= PE907073
NAME	= Geological Cross Section
BASIN	= OTWAY
PERMIT	= PEP/5
TYPE	= WELL
SUBTYPE	= CROSS_SECTION
DESCRIPTION	= Geological Cross Section, Plate 5, (enclosure from WCR) for Pretty Hill-1
REMARKS	=
DATE_CREATED	= 30/11/62
DATE_RECEIVED	=
W_NO	= W469
WELL_NAME	= PRETTY HILL-1
CONTRACTOR	=
CLIENT_OP_CO	= FROME-BROKEN HILL CO PTY LTD

(Inserted by DNRE - Vic Govt Mines Dept)

Pretty Hill

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FROME-BROKEN HILL COMPANY PTY. LTD

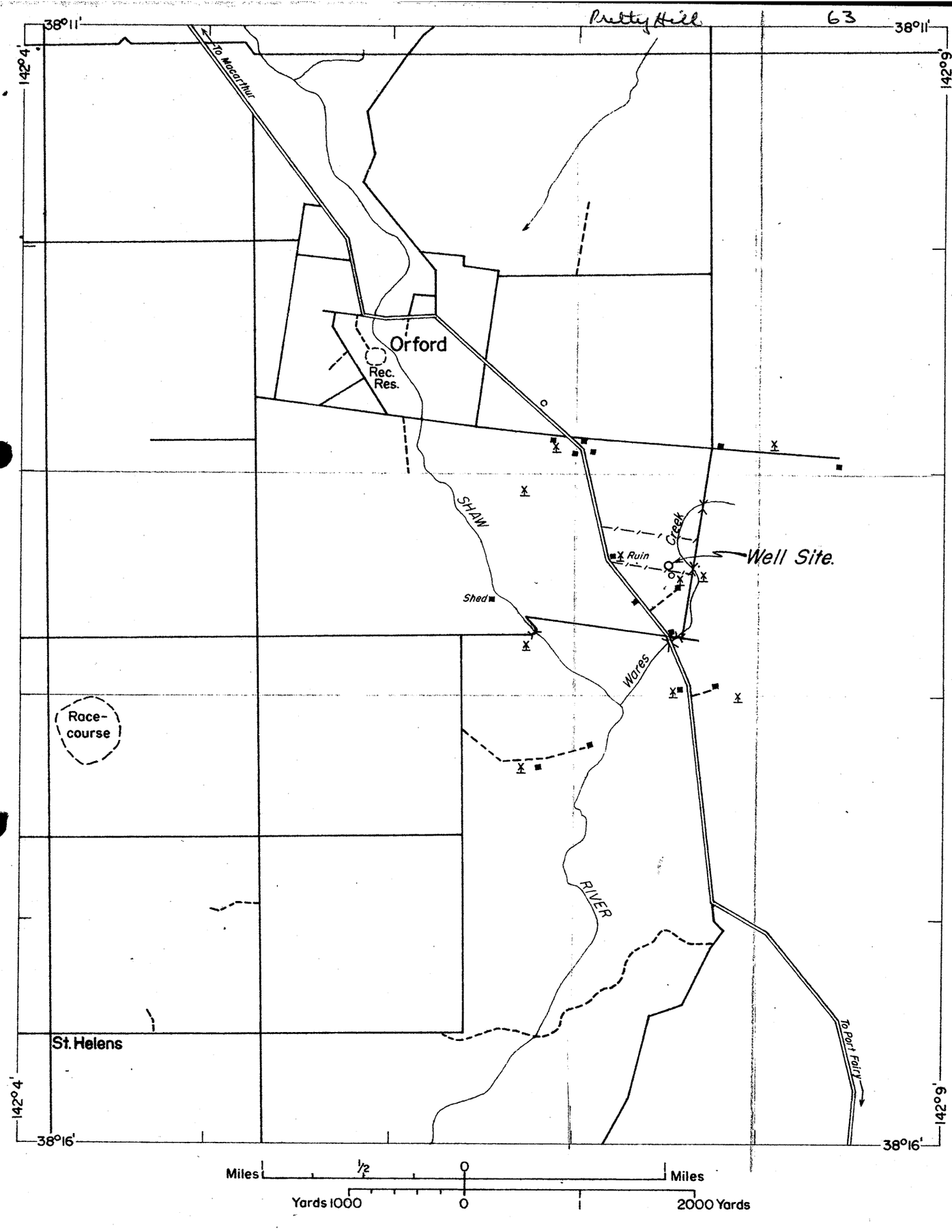
REPORT NO. 7200-P-49

VELOCITY SURVEY OF PRETTY HILL NO. 1.

by

K. A. RICHARDS

Melbourne
October 1962.



Major Road.

Minor Road.

Track.

Fence.

Water Hole.

House.

Wind Pump.

FROME BROKEN HILL CO. PTY. LTD.

LOCALITY MAP

PRETTY HILL NO. 1 WELL

JUNE 1962

CONTENTS

2. Discussion of Survey

Since no seismic crew was working for Frome at the time of drilling Pretty Hill No. 1 the velocity survey had to be organised on a rather disjointed basis. The shot holes were drilled and cased prior to the survey and no rig was available when the survey was actually being carried out. An unanticipated early caving of two of the shot holes forced the number of shots to be reduced and for this reason not every level was shot from both sides of the well. Also difficulty with landowners resulted in the holes having to be placed along the adjacent roads. This is the reason for the slightly unconventional layout as shown in the layout diagram.

Namco International agreed to supply a set of recording instruments, shooting truck plus an observer, two shooters and a computer to record the data. A T.I.C. standard 24l W well geophone serial No. 113 was supplied by the Bureau of Mineral Resources. A reflection spread was not shot across the location. It was hoped that records from the nearby lines 127 and 105 would suffice for comparison purposes.

Shot hole charges varied from 5 to 15 lb. of dynamite in single holes at depths from 70 to 30 feet. Larger charges would have been used, especially for the deeper shots if it had not been for the fear of caving the holes. However, most of the breaks are readily apparent even though some are not as sharp as might be expected. It would appear that at least two levels, (1200 ft, 5500 ft.) have been affected by casing or cable kicks and an endeavour has been made to distinguish between them and the true geophone break when picking the records. Also the 8100 ft. level may have been subject to bottom hole effect.

The unusually wide variance at most of the levels between shots from shot points 1 and 2 is put down mainly to the holes not being diametrically opposite one another. The plot of the check shots illustrates, however, that this variance is consistent in that shots from SP1 always took less time than the shots from SP2.

Comparison Sonic Log and Check Shot Data

Depth Below Datum Floor	Average Vertical Time	△ T Check Shots	△ T Sonic	Difference	Interval Depth	Microsec per foot error.
700	.126					
1200	.204	.078	.079	-.001	500	-2.0 Microsec/
1800	.284	.080	.080	0	600	0 " ft.
2500	.371	.087	.088	-.001	700	-1.4 "
3000	.427	.056	.061	-.005	500	-10.0 "
3800	.529*	.102	.093	+.009	800	+11.3 "
4500	.588*	.059	.071	-.012	700	-17.1 "
5500	.680	.092	.091	+.001	1000	+1.0 "
6500	.778	.098	.084	+.014	1000	+14.0 "
7000	.813	.035	.041	-.006	500	-12.0 "
7874	.878*	.065	.070	-.005	874	-5.7 "
8100	.903	.025	.027	-.002	226	-8.8 "
		.767 Total	.785 Total	-.018 Total	7400 Total	-2.5 " Average

*These times are the check times from SP1 with 0.010 sec. added - (0.020 is the average amt. by which check shots from SP1 and 2 differed at each level.)

Due to the unreliability of the assumed average vertical times for 3800, 4500 and 7874 the errors, do not appear significantly large, i.e. consider the interval 3000 ft. to 5500 ft.

△ T check shots = 0.680 - 0.427 = 0.253 sec.

△ T sonic = 0.102 + 0.059 + 0.092 = 0.253 sec.

It would appear certain that the assumed average vertical time of 0.529 sec. at 3800 ft. is too high and that here the time from SP1 of 0.519 sec. is close to being correct.

The 5500 ft. level may also be questionable though this is fairly obvious from the calculations sheet due to the 0.043 sec. difference in the shots from SP1 and 2. It appears possible that the break from SP1 on record No. 10 has been affected by cable or casing kicks and that the reading is too small by about 0.020 sec.

Our plot of the integrated data from the sonic log indicates a reasonable fit to the check shots. There is probably as much inherant error in the velocity survey results as in the integrated sonic data, especially since the hole was in good condition when the sonic was run. For this reason we have not made corrections to any of the sonic runs, and fitted the integrated time depth curve directly to the check shots.

KAR:ET

K. A. RICHARDS

PE904002

This is an enclosure indicator page.
The enclosure PE904002 is enclosed within the container PE907073 at this location in this document.

The enclosure PE904002 has the following characteristics:

ITEM_BARCODE	= PE904002
CONTAINER_BARCODE	= PE907073
NAME	= Layout Diagram of Velocity Survey
BASIN	= OTWAY
PERMIT	= PEP/5
TYPE	= WELL
SUBTYPE	= VELOCITY_CHART
DESCRIPTION	= Layout Diagram of Velocity Survey (enclosure from WCR) Pretty Hill No 1
REMARKS	=
DATE_CREATED	= 31/12/62
DATE_RECEIVED	=
W_NO	= W469
WELL_NAME	= Pretty Hill-1
CONTRACTOR	= Frome Broken Hill Co P/L
CLIENT_OP_CO	= Frome Broken Hill Co P/L

(Inserted by DNRE - Vic Govt Mines Dept)

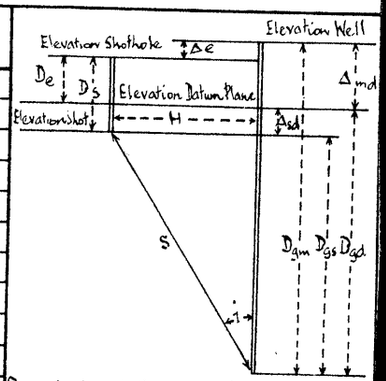
Shothole information Elevation Dist & Dirn from Well

Group 1 — 186' Av 1128' ESE
" 2 — 193' Av 1125' NW
" 3 — 188' 750' WNW

Company: FROME-BROKEN HILL CO. PTY. LTD.
Well: PRETTY HILL No1.
Elevation (Derrick Floor): 202
Total Depth: 8124

LOCATION
Coordinates: Lat. 38°13' S, Long. 142° 07' E
Section Township Range County Area or field: Southwest Victoria. Australia.

Record Number	Shot no Number	Formation	Dgm	Ds	tus	tr	T Reading	T Polarity	T Error	Dgs	H	tmt	cos i	Tgs	Δsd	Δsd/V	Tgd	Tgd Average	Dgd	ΔDgd	ΔTgd	Vi Interval Velocity	Va Average Velocity
20	3A		700	54	·031	·148	·178			632	750			·115	68	·011	·126		700				
19	3A		1200	56	·035	·153	·231			1130	750			·193	70	·011	·204		1200				
18	2B		1800	58	·039	·218	·337			1733	1125			·283	67	·010	·293	·284	1800				
17	1B		1800	43	·022	·195	·313			1741	1128			·263	59	·009	·272						
16	2B		2500	54	·035	·219	·408			2437	1125			·370	63	·010	·380	·371	2500				
1	1A		2500	46	·018	·195	·387			2458	1128			·352	62	·010	·362						
14	2B		3000	52	·033	·218	·450			2939	1125			·420	61	·010	·430	·427	3000				
15	1B		3000	46	·022	·194	·443			2938	1128			·414	62	·010	·424						
13	1B		3800	46	·022	·194	·532			3738	1128			·509	62	·010	·519		3800				
12	1B		4500	56	·023	·192	·585			4428	1128			·567	72	·011	·578		4500				
11	2A		5500	61	·037	·218	·706			5430	1125			·691	70	·011	·702	·680?	5500				
10	1B		5500	56	·022	·192	·660			5428	1128			·646	72	·011	·657						
9	2A		6500	57	·035	·218	·788			6434	1125			·776	66	·010	·786	·778	6500				
2	1A		6500	52	·021	·193	·769			6432	1128			·758	68	·011	·769						
7	2A		7000	58	·038	·221	·829			6933	1125			·818	67	·010	·828	·813	7000				
8	1B		7000	56	·022	·191	·796			6928	1128			·786	72	·011	·797						
5	1B		7874	49	·020	·192	·867			7809	1128			·858	65	·010	·868		7874				
4	2A		8100	66	·034	·214	·913			8025	1125			·904	75	·012	·916	·903	8100				
3	1A		8100	31	·018	·195	·890			8053	1128			·881	53	·008	·889						

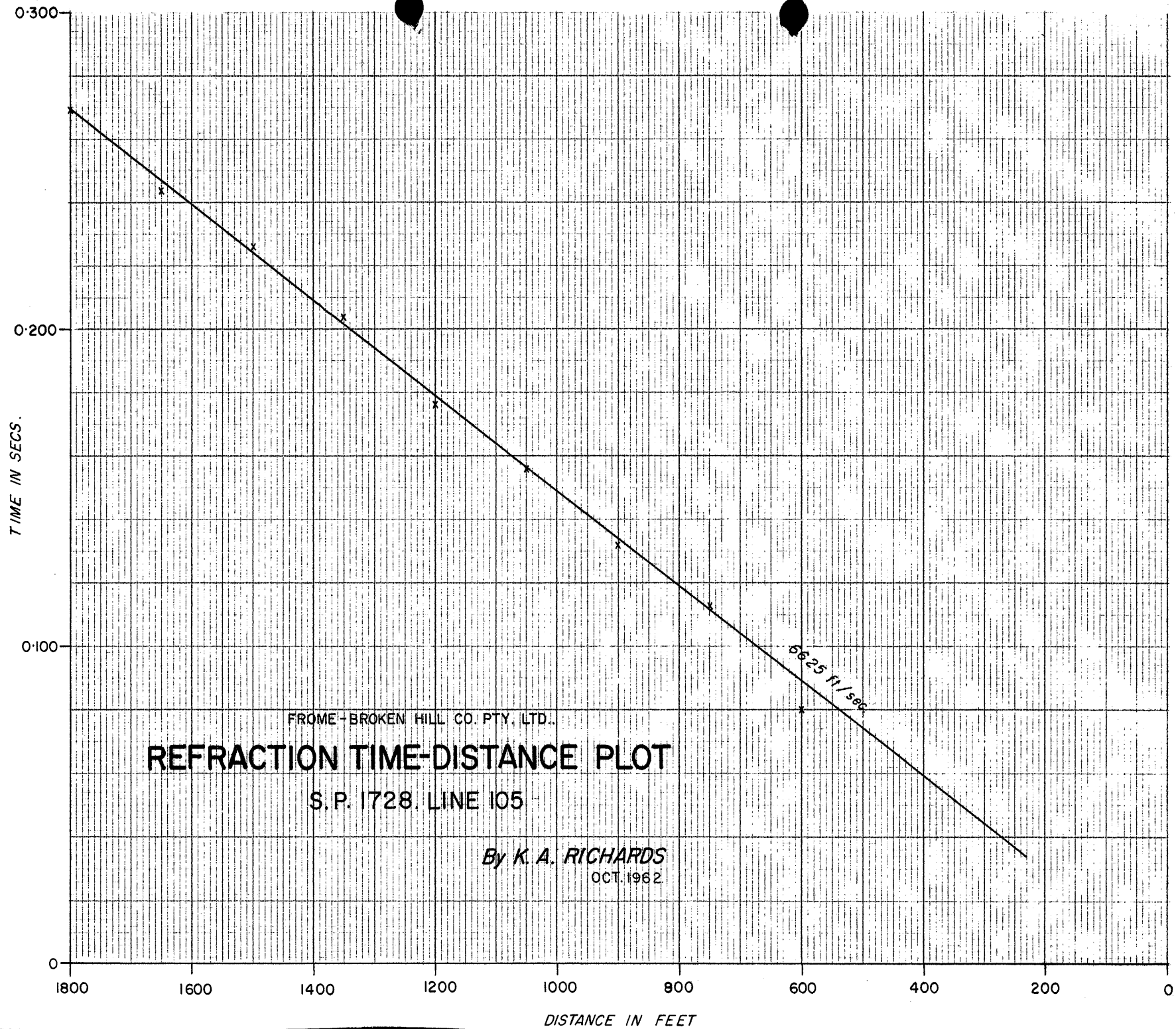


Dgm = Geophone depth measured from well elevation
Dgs = " " " " shot "
Dgd = " " " " datum "
Ds = Depth of shot
De = Shothole elevation to datum plane
H = Horiz. dist. from well to shotpoint
S = Straight line travel path from shot to well geophone
tus = Uphole time at shotpoint
T = Obsd time from shotpoint to well geophone
tr = " " to reference geophone
Δe = Diff in elev. between mouth of shothole & datum plane
Δsd = " " " " shot & datum plane
Δsd = Ds − De
Dgs = Dgm − Dg ± Δe, tan i = H / Dgs
Tgs = cos i T = Vert trav time from shot to elev. geophone
Tgd = Tgs ± Δsd/V = " " " " datum plane "
Dgd = Dgm − Δmd
Vi = Interval velocity = ΔDgd / ΔTgd
Va = Average = Dgd / Tgd

Surveyed by
Date

Weathering Data
V = 6500 ft/sec
Datum + 202 ft.

Casing Record
9⅝" to 6690'



Britty Hill

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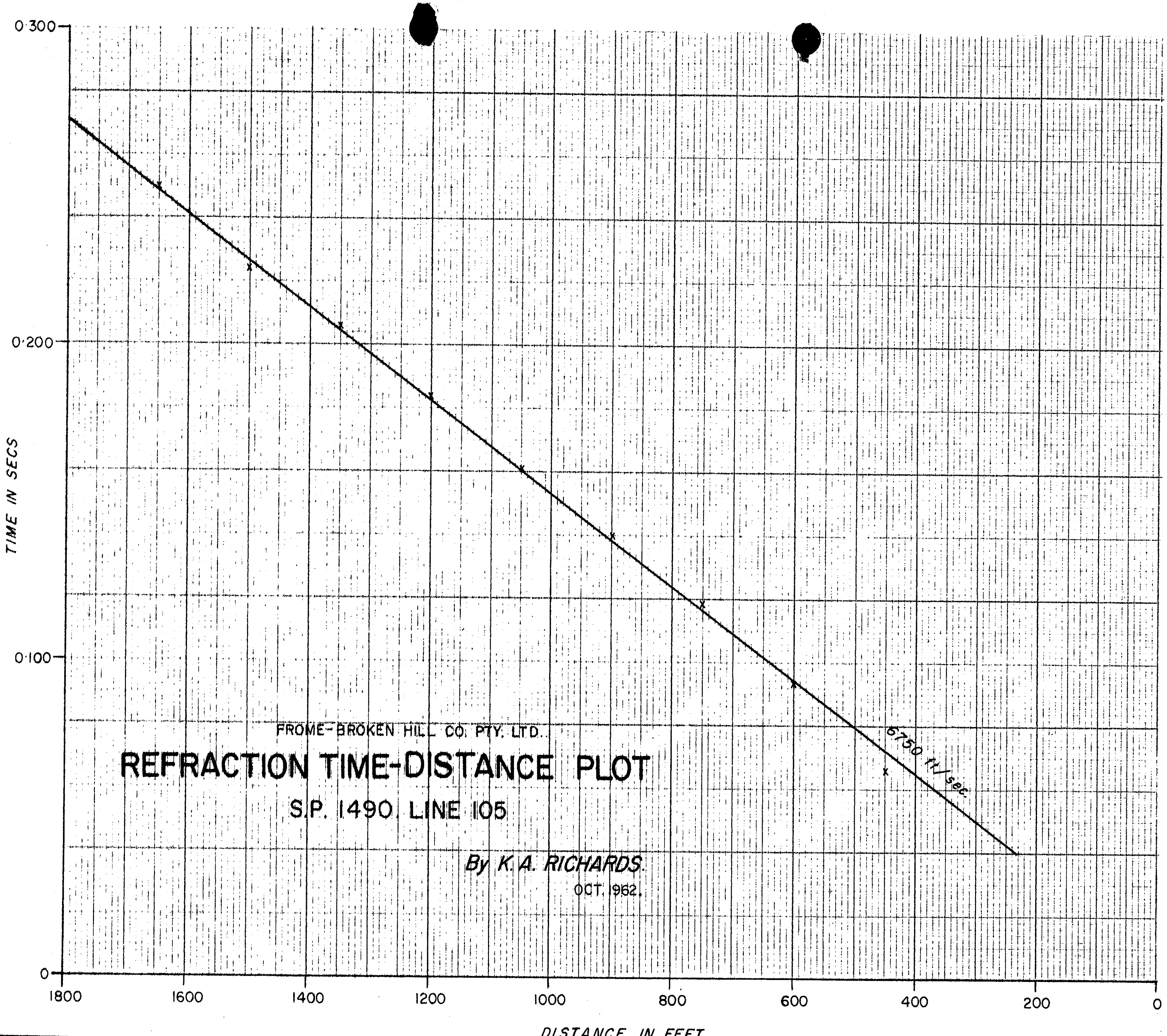

Pretty Hill

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PE907078

This is an enclosure indicator page.
The enclosure PE907078 is enclosed within the container PE907073 at this location in this document.

The enclosure PE907078 has the following characteristics:

ITEM_BARCODE = PE907078
CONTAINER_BARCODE = PE907073
NAME = Velocity Summary Data Sheet
BASIN = OTWAY
PERMIT = PEP/5
TYPE = WELL
SUBTYPE = VELOCITY_CHART
DESCRIPTION = Well Velocity Survey Summary Sheet (enclosure from WCR) for Pretty Hill-1
REMARKS =
DATE_CREATED = 15/10/62
DATE_RECEIVED =
W_NO = W469
WELL_NAME = PRETTY HILL-1
CONTRACTOR = NAMCO INTERNATIONAL
CLIENT_OP_CO = FROME-BROKEN HILL CO PTY LTD

(Inserted by DNRE - Vic Govt Mines Dept)

3.0 Weekly Drilling Report

MINES DEPARTMENT
VICTORIA

PETROLEUM ACT 1958 (SECTION 45).

RECORD OF WORK AT .....PRETTY HILL NO. 1..... bore on
*Petroleum Exploration Permit)
*~~Petroleum Prospecting Licence~~) Number ...5.....during week
*~~Mineral Lease~~)

ending ..September 9th.. 19..62....

* Strike out words not applicable.

DEPTH	DESCRIPTION OF STRATA
Surface to 570 feet.	~~Light~~ grey fossiliferous, slightly glauconitic limestone with minor amounts silty fossiliferous grey marl. Few interbeds calcareous clay.
570 to 1120'	Blue-grey and grey marl. Soft, very fossiliferous.
1120 to 1222'	Light brown to pink limonitic, fossiliferous limestone. Tight and dense with some brown marl interbeds.

NOTES BY DRILLER IN CHARGE: (State in notes whether water, gas or petroleum has been met with, and, if so, give depth and nature of occurrence, also depth to which casing has been inserted and cemented.)

Well spudden September 7th, 1 962.

20" conductor pipe was set at 39 feet.

Elevations: Ground Level - 189 Feet.

Rotary Table - 202 feet.

All well measurements will be referred to rotary table as datum.

(Signed) L. B. Robertson.

Legal Manager, ~~From~~ Broken Hill Company Pty. Ltd.

Date ..13.../..9../.1962..

N.B. The Act also requires the Minister to be notified immediately water, gas or petroleum is encountered.

Analyses of water, gas and oil should be submitted if available.

Dr Thomas
17.9.62

MINES DEPARTMENT
VICTORIA

2/8

PETROLEUM ACT 1958 (SECTION 45).

RECORD OF WORK AT ....PRETTY HILL NO.1..... bore on
*Petroleum Exploration Permit)
*Petroleum Prospecting Licence) Number .....5.....during week
*Petroleum Mineral Lease)
ending ...September.16.. 19.62....
* Strike out words not applicable.

DEPTH	DESCRIPTION OF STRATA
1222 to 1256 feet	Limestone, light brown, fossiliferous, limonitic with rare glauconite.
1256 to 2383 "	Interbedded sandstone, sand and siltstone with some mudstone. Dolomite and ankerite in parts. Pyrite and mica common, glauconite rare.

NOTES BY DRILLER IN CHARGE: (State in notes whether water, gas or petroleum has been met with, and, if so, give depth and nature of occurrence, also depth to which casing has been inserted and cemented.)

Ran 13⅜" casing to 1257 feet and cemented to surface.
Cut cores at 1282 to 1302 feet, 1816 to 1836 feet and 2373 to 2383 feet.
No evidence of dip in cores.
Water, gas or petroleum have not been met with.

Signed ..L.B. ROBERTSON.....
Legal Manager, FROME-BROKEN HILL CO.PTY.LTD. Co.
Date ..September 20, 1962..

N.B. The Act also requires the Minister to be notified immediately water, gas or petroleum is encountered.

Analyses of water, gas and oil should be submitted if available.

Dr. Thomas.
21.9.62.

MINES DEPARTMENT
VICTORIA

PETROLEUM ACT 1958 (SECTION 45).

RECORD OF WORK AT .... Pretty Hill No. 1 ..... bore on
*Petroleum Exploration Permit)
~~*Petroleum Prospecting Licence~~) Number .....5.....during week
~~*Petroleum Mining Lease~~)
ending . September 23,... 19.62.....
* Strike out words not applicable.

DEPTH	DESCRIPTION OF STRATA
2383 to 2598 feet	Interbedded sand, sandstone and siltstone, very dolomitic towards the base, with some glauconite, pyrite and mica.
2598 to 2770 "	Silty sandstone and sandy siltstone, dark grey, fossiliferous, glauconitic, some pyrite and coal.
2770 to 2922 "	Sandy siltstone-mudstone, abundant glauconite and limonite pellets.
2922 to 4777 "	Interbedded and intergrading siltstone-sandstone, dark grey to green-grey, some thin beds coal. Sandstone composed of quartz, feldspar and dark rock grains. Formation calcareous in parts. Mica and Chlorite in parts.

NOTES BY DRILLER IN CHARGE: (State in notes whether water, gas or petroleum has been met with, and, if so, give depth and nature of occurrence, also depth to which casing has been inserted and cemented.)

Cores were cut in the following intervals: 2383 to 2403 feet, 2716 to 2726 feet, 2726 to 2734 feet, 2928 to 2940 feet, 3340 to 3360 feet, 3810 to 3830 feet, 4315 to 4328 feet, and 4624 to 4655 feet. Hole deviation was recorded as follows: 2686' - $1\frac{1}{2}^{o}$, 2900' - $1\frac{1}{2}^{o}$, 3340' - $\frac{1}{2}^{o}$, 3810' - 1^{o}, 4315' - 1^{o}, 4625' - 2^{o}. No visible shows of oil or gas were noted, but the gas detector ~~was~~ indicated the presence of hydrocarbon gas in the drilling mud while drilling was in progress between 4280 and 4650 feet. No flows of water were encountered.

Signed .L..B..Robertson.....

General ~~Manager~~ Manager, .Frome-Broken..Hill.. Co.Pty Ltd.

Date ...2.../..10./.1962..

N.B. The Act also requires the Minister to be notified immediately water, gas or petroleum is encountered.

Analyses of water, gas and oil should be submitted if available.

Dr Thomas.
4.10.62

MINES DEPARTMENT
VICTORIA

4/8

PETROLEUM ACT 1958 (SECTION 45).

RECORD OF WORK AT ...PRETTY HILL NO. 1..... bore on
*Petroleum Exploration Permit)
*~~Petroleum Prospecting Licence~~) Number ....5.....during week
*~~Petroleum Mining Lease~~)
ending .September 30,... 19.62....
* Strike out words not applicable.

DEPTH	DESCRIPTION OF STRATA
4777 to 5990 feet	Interbedded and intergrading siltstone-sandstone, dark grey and green-grey, some dark grey siltstone-mudstone. Coal band 5630 to 5650 feet. Formation calcareous in parts. Mica, chlorite and carbonaceous material in parts.
5990 to 6388 feet	Quartz sandstone and sand, light grey, friable, calcareous and gypsiferous cement in parts. Thin carbonaceous bands in part.

NOTES BY DRILLER IN CHARGE: (State in notes whether water, gas or petroleum has been met with, and, if so, give depth and nature of occurrence, also depth to which casing has been inserted and cemented.)

Cores were cut in the following intervals: 4940 to 4960 feet, 5400 to 5420 feet, 5420 to 5424 feet, 5935 to 5947 feet, 6070 to 6080 feet and 6376 to 6388 feet.

Electric, Sonic and Micrologs were run to 4692 feet.

No visible shows of oil or gas, or flows of water were noted while drilling the above interval, but a slight positive acetone reaction was obtained in cuttings from 5190 to 5200 feet and 5290 to 5300 feet.

Signed ....L.E.Robertson..

General ~~Legal~~ Manager, ..Frome-Broken Hill.. Co.Pty;Ltd.

Date ....4../..10./.1962..

N.B. The Act also requires the Minister to be notified immediately water, gas or petroleum is encountered.

Analyses of water, gas and oil should be submitted if available.

K. Thomas
8.10.62.

MINES DEPARTMENT
VICTORIA

5/8

PETROLEUM ACT 1958 (SECTION 45).

RECORD OF WORK AT .....Pretty.Hill.No..1..... bore on
*Petroleum Exploration Permit)
*~~Prospecting Reserve~~) Number ...5.....during week
*~~Prospecting Area~~)

ending ....October.7th.. 19.62....

* Strike out words not applicable.

DEPTH	DESCRIPTION OF STRATA
6388 to 6732 feet	Sandstone, light grey, fine to coarse grained, composed of clear quartz, some clay-like cement, few thin stringers of coal.

NOTES BY DRILLER IN CHARGE: (State in notes whether water, gas or petroleum has been met with, and, if so, give depth and nature of occurrence, also depth to which casing has been inserted and cemented.)

A core was cut in the interval 6690 to 6702 feet. Electric logs were run to 6705 feet and 9⅝" casing run to 6690 feet and cemented with 400 sacks of cement.

At the end of the period attempts were being made to obtain a drill stem test of the formation exposed below the casing shoe.

No visible shows of oil or gas were noted during drilling and no flows of water were encountered.

Signed .L..B..ROBERTSON.....

~~Engineer~~ General Manager, FROME-BROKEN.HILL..... Co. PTY.LTD

Date Oct..../.11../.1962..

N.B. The Act also requires the Minister to be notified immediately water, gas or petroleum is encountered.

Analyses of water, gas and oil should be submitted if available.

A/g. for Dr. Thomas

12.10.62.

MINES DEPARTMENT
VICTORIA

6/8

PETROLEUM ACT 1958 (SECTION 45).

RECORD OF WORK AT ....PRETTY.HILL.NO.1..... bore on
*Petroleum Exploration Permit)
~~XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX~~) Number .....5.....during week
~~XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX~~)
ending ..October.14..... 19.62....
* Strike out words not applicable.

DEPTH	DESCRIPTION OF STRATA
6732 to 7874 feet	Sandstone, quartzose, fine to coarse grained.
	Traces dolomite, coal. Siliceous or clayey
	matrix in parts.
7874 to 8124 "	Dark grey to black diabase, serpentinised in
	parts.

NOTES BY DRILLER IN CHARGE: (State in notes whether water, gas or petroleum has been met with, and, if so, give depth and nature of occurrence, also depth to which casing has been inserted and cemented.)

Cores were cut of the intervals 7200 to 7214 feet, 7585 to 7597 feet, 7883 to 7895 feet, and 8107 to 8124 feet.

A drill stem test of the interval 6690 to 6732 feet yielded 5360 feet of muddy water with chloride content of 14,000 ppm.

Electric logs were run in the interval 6692 to 8124 feet.

No oil or gas zones were found during the week.

Signed .L. B. ROBERTSON.....

General ~~XXXXX~~ Manager, .ROME-BROKEN.HILL.... Co. PTY.LTD.

Date .Oct.../..17./.1962..

N.B. The Act also requires the Minister to be notified immediately water, gas or petroleum is encountered.

Analyses of water, gas and oil should be submitted if available.

Dr Thomas
19.10.62.

MINES DEPARTMENT
VICTORIA

7/8

PETROLEUM ACT 1958 (SECTION 45).

RECORD OF WORK AT ...PRETTY HILL NO. 1..... bore on
*Petroleum Exploration Permit)
*~~Petroleum Prospecting Licence~~) Number .5.....during week
*~~Petroleum Mining Lease~~)
ending ...October, ~~21st~~ 19..62.....
* Strike out words not applicable.

DEPTH	DESCRIPTION OF STRATA
	T.D. 8124 feet.

NOTES BY DRILLER IN CHARGE: (State in notes whether water, gas or petroleum has been met with, and, if so, give depth and nature of occurrence, also depth to which casing has been inserted and cemented.)

Velocity log was run in hole to T.D.

$9\frac{5}{8}$"casing was cut at 1218 feet and 31 joints recovered.

A cement plug was laid from 6690 to 6560 feet, using 50 sacks cement.

Signed L. B. Robertson
General ~~Legal~~ Manager, FROME-BROKEN HILL CO.PTY.LTD. Co.

Date ...25./.10.../.62.....

N.B. The Act also requires the Minister to be notified immediately water, gas or petroleum is encountered.

Analyses of water, gas and oil should be submitted if available.

Dr Thomas. for
26.10.62.

MINES DEPARTMENT
VICTORIA

8/8

PETROLEUM ACT 1958 (SECTION 45).

RECORD OF WORK AT ...PRETTY.HILL.NO..1..... bore on
*Petroleum Exploration Permit)
~~XPXXXXXXXXXXXXXXXXXXXXXXXXXXXX~~ Number .....5.....during week
~~XPXXXXXXXXXXXXXXXXXXXXXXXXXX~~)
ending ...October.28.... 19.62....

* Strike out words not applicable.

DEPTH	DESCRIPTION OF STRATA
	T.D. 8129 feet
	(Corrected from Electric Log Depth)

NOTES BY DRILLER IN CHARGE: (State in notes whether water, gas or petroleum has been met with, and, if so, give depth and nature of occurrence, also depth to which casing has been inserted and cemented.)

A cement plug was placed in the 13⅜" casing from 1052 to 1116 feet and a cement plug set at surface of the 13⅜" casing. A steel plate was also welded over the top of the 13⅜" casing.

The well was abandoned October 22, 1962.

This is the final progress report for the Pretty Hill No. 1 well.

Signed ...L..B..Robertson..

General ~~Manager~~ Manager, Frome-Broken Hill..... Co. PtyLtd.

Date ..30.../.10./1962...

N.B. The Act also requires the Minister to be notified immediately water, gas or petroleum is encountered.

Analyses of water, gas and oil should be submitted if available.

Dr. Thomas 31.10.62
DLI

AMERICAN OVERSEAS PETROLEUM LIMITED

1ST FLOOR, "GLEN CRAG"
119-123 LEICHHARDT STREET, BRISBANE
QUEENSLAND

PHONE: 23327
BOX 1086N, G.P.O., BRISBANE

June 27, 1967.

EXPLORATION GEOLOGY

Source Rock Analysis

The General Manager,
Frome-Broken Hill Company Pty. Ltd.
31 Queen Street,
MELBOURNE, C.1., Victoria

Dear Sir:

We have received the following source rock analyses from the Chevron Research Company, for samples from your Eumeralla 1, Pretty Hill 1 and Port Campbell 1 wells in the Otway basin.

Well	Core No.	Depth Feet	Weight Percent of Bitumen Carbon	Weight Percent of Bitumen-free organic carbon	Total Organ. content Vol %	Petroleum Source Index
Eumeralla	22	9384	0.01	0.19	0.60	0.32
Pretty Hill 1	6	2825-32	0.01	1.04	3.15	0.90
Pretty Hill 1	12	4640-57	0.02	0.54	1.68	0.89
Port Campbell	8	2915-33	0.09	1.92	6.05	0.95
Port Campbell	15	4293	0.02	2.07	2.27	0.98
Port Campbell	21	5223-33	0.02	1.13	3.45	0.95
Port Campbell	23	5700-18	0.05	2.85	8.71	0.98

An evaluation of the source potential of a sample can be made by referring to the attached chart. For example, a shale containing 3.15% organic matter with a source index of 0.90 would rate very highly as opposed to one with 0.60% organic matter and an index of 0.32.

We wish to thank you for permission to sample the wells and hope the above information will be of value.

Yours very truly,

AMERICAN OVERSEAS PETROLEUM LIMITED.

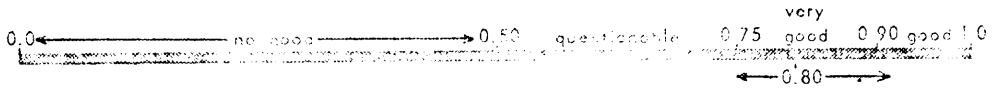
E.R. LOCKE,
Manager

NWH:CDS.
cc. Victoria Dept. of Mines
Encl.1

SOURCE ROCK POTENTIAL

Quantity – Volume of Organic Matter in Rock (to be included in future CRC reports)
(See Table I and II in text)

Source Potential
or Index*
(0 to 10)



*Needs consistency in several samples to be rated

Source Potential results from the volume of organic matter (quantity) and its relation to the potential or index (quality).

ENCLOSURES. . . .

Enclosures

PE605013

This is an enclosure indicator page.
The enclosure PE605013 is enclosed within the container PE907073 at this location in this document.

The enclosure PE605013 has the following characteristics:

ITEM_BARCODE	= PE605013
CONTAINER_BARCODE	= PE907073
NAME	= Composite Well Log
BASIN	= OTWAY
PERMIT	= PEP/5
TYPE	= WELL
SUBTYPE	= COMPOSITE_LOG
DESCRIPTION	= Well Composite Log (enclosure from WCR) for Pretty Hill-1
REMARKS	=
DATE_CREATED	= 28/10/62
DATE_RECEIVED	=
W_NO	= W469
WELL_NAME	= PRETTY HILL-1
CONTRACTOR	=
CLIENT_OP_CO	= FROME-BROKEN HILL CO PTY LTD

(Inserted by DNRE - Vic Govt Mines Dept)

PE907080

This is an enclosure indicator page.
The enclosure PE907080 is enclosed within the container PE907073 at this location in this document.

The enclosure PE907080 has the following characteristics:

ITEM_BARCODE	= PE907080
CONTAINER_BARCODE	= PE907073
NAME	= Velocity-Depth Curves
BASIN	= OTWAY
PERMIT	= PEP/5
TYPE	= WELL
SUBTYPE	= VELOCITY_CHART
DESCRIPTION	= Velocity-Depth Curves, Computed from Corrected Time-Depth Curves, (enclosure from WCR) for Pretty Hill-1
REMARKS	=
DATE_CREATED	= 31/10/62
DATE_RECEIVED	=
W_NO	= W469
WELL_NAME	= PRETTY HILL-1
CONTRACTOR	=
CLIENT_OP_CO	= FROME-BROKEN HILL CO PTY LTD

(Inserted by DNRE - Vic Govt Mines Dept)

PE907081

This is an enclosure indicator page.
The enclosure PE907081 is enclosed within the container PE907073 at this location in this document.

The enclosure PE907081 has the following characteristics:

ITEM_BARCODE	= PE907081
CONTAINER_BARCODE	= PE907073
NAME	= Corrected Time-Depth Curve
BASIN	= OTWAY
PERMIT	= PEP/5
TYPE	= WELL
SUBTYPE	= VELOCITY_CHART
DESCRIPTION	= Corrected Time-Depth Curve (enclosure from WCR) for Pretty Hill-1
REMARKS	=
DATE_CREATED	=
DATE_RECEIVED	=
W_NO	= W469
WELL_NAME	= PRETTY HILL-1
CONTRACTOR	=
CLIENT_OP_CO	= FROME-BROKEN HILL CO PTY LTD

(Inserted by DNRE - Vic Govt Mines Dept)

PE605011

This is an enclosure indicator page.
The enclosure PE605011 is enclosed within the container PE907073 at this location in this document.

The enclosure PE605011 has the following characteristics:

ITEM_BARCODE	= PE605011
CONTAINER_BARCODE	= PE907073
NAME	= Electric Log
BASIN	= OTWAY
PERMIT	= PEP/5
TYPE	= WELL
SUBTYPE	= WELL_LOG
DESCRIPTION	= Electric Well Log, 1" = 100', (enclosure from WCR) for Pretty Hill-1
REMARKS	=
DATE_CREATED	= 2/10/62
DATE_RECEIVED	=
W_NO	= W469
WELL_NAME	= PRETTY HILL-1
CONTRACTOR	= SCHLUMBERGER
CLIENT_OP_CO	= FROME-BROKEN HILL CO PTY LTD

(Inserted by DNRE - Vic Govt Mines Dept)

PE605012

This is an enclosure indicator page.
The enclosure PE605012 is enclosed within the container PE907073 at this location in this document.

The enclosure PE605012 has the following characteristics:

ITEM_BARCODE	= PE605012
CONTAINER_BARCODE	= PE907073
NAME	= Electric Log
BASIN	= OTWAY
PERMIT	= PEP/5
TYPE	= WELL
SUBTYPE	= WELL_LOG
DESCRIPTION	= Electric Well Log, 5" = 100', (enclosure from WCR) for Pretty Hill-1
REMARKS	=
DATE_CREATED	= 2/10/62
DATE_RECEIVED	=
W_NO	= W469
WELL_NAME	= PRETTY HILL-1
CONTRACTOR	= SCHLUMBERGER
CLIENT_OP_CO	= FROME-BROKEN HILL CO PTY LTD

(Inserted by DNRE - Vic Govt Mines Dept)

PE907084

This is an enclosure indicator page.
The enclosure PE907084 is enclosed within the container PE907073 at this location in this document.

The enclosure PE907084 has the following characteristics:

ITEM_BARCODE	= PE907084
CONTAINER_BARCODE	= PE907073
NAME	= Seismic Section
BASIN	= OTWAY
PERMIT	= PEP/5
TYPE	= SEISMIC
SUBTYPE	= SECTION
DESCRIPTION	= Seismic Section along Line OPP-85A-11 (enclosure from WCR) for Pretty Hill-1
REMARKS	=
DATE_CREATED	= 28/02/85
DATE_RECEIVED	=
W_NO	= W469
WELL_NAME	= PRETTY HILL-1
CONTRACTOR	= GEO-SYSTEMS
CLIENT_OP_CO	= FROME-BROKEN HILL CO PTY LTD

(Inserted by DNRE - Vic Govt Mines Dept)

PE605014

This is an enclosure indicator page.
The enclosure PE605014 is enclosed within the container PE907073 at this location in this document.

The enclosure PE605014 has the following characteristics:

ITEM_BARCODE	= PE605014
CONTAINER_BARCODE	= PE907073
NAME	= Well Log
BASIN	= OTWAY
PERMIT	= PEP/5
TYPE	= WELL
SUBTYPE	= WELL_LOG
DESCRIPTION	= Well Log, LLS, LLD & SP, 1cm = 25m, (enclosure from WCR) for Pretty Hill-1
REMARKS	=
DATE_CREATED	=
DATE_RECEIVED	=
W_NO	= W469
WELL_NAME	= PRETTY HILL-1
CONTRACTOR	=
CLIENT_OP_CO	= FROME-BROKEN HILL CO PTY LTD

(Inserted by DNRE - Vic Govt Mines Dept)

PE605015

This is an enclosure indicator page.
The enclosure PE605015 is enclosed within the container PE907073 at this location in this document.

The enclosure PE605015 has the following characteristics:

ITEM_BARCODE	= PE605015
CONTAINER_BARCODE	= PE907073
NAME	= Well Log
BASIN	= OTWAY
PERMIT	= PEP/5
TYPE	= WELL
SUBTYPE	= WELL_LOG
DESCRIPTION	= Well Log, 1cm = 10m, (enclosure from WCR) for Pretty Hill-1
REMARKS	=
DATE_CREATED	=
DATE_RECEIVED	=
W_NO	= W469
WELL_NAME	= PRETTY HILL-1
CONTRACTOR	=
CLIENT_OP_CO	= FROME-BROKEN HILL CO PTY LTD

(Inserted by DNRE - Vic Govt Mines Dept)

PE605016

This is an enclosure indicator page.
The enclosure PE605016 is enclosed within the container PE907073 at this location in this document.

The enclosure PE605016 has the following characteristics:

ITEM_BARCODE	= PE605016
CONTAINER_BARCODE	= PE907073
NAME	= Well Log
BASIN	= OTWAY
PERMIT	= PEP/5
TYPE	= WELL
SUBTYPE	= WELL_LOG
DESCRIPTION	= Well Log, 1cm = 25m, (enclosure from WCR) for Pretty Hill-1
REMARKS	= This Log has interpretation and has been coloured
DATE_CREATED	=
DATE_RECEIVED	=
W_NO	= W469
WELL_NAME	= PRETTY HILL-1
CONTRACTOR	=
CLIENT_OP_CO	= FROME-BROKEN HILL CO PTY LTD

(Inserted by DNRE - Vic Govt Mines Dept)

PE907103

This is an enclosure indicator page.
The enclosure PE907103 is enclosed within the container PE907073 at this location in this document.

The enclosure PE907103 has the following characteristics:

ITEM_BARCODE	= PE907103
CONTAINER_BARCODE	= PE907073
NAME	= Seismic Section
BASIN	= OTWAY
PERMIT	= PEP/5
TYPE	= SEISMIC
SUBTYPE	= SECTION
DESCRIPTION	= Seismic Section (enclosure from WCR) for Pretty Hill-1
REMARKS	= This Item has coloured interpretation
DATE_CREATED	=
DATE_RECEIVED	=
W_NO	= W469
WELL_NAME	= PRETTY HILL-1
CONTRACTOR	=
CLIENT_OP_CO	= FROME-BROKEN HILL CO PTY LTD

(Inserted by DNRE - Vic Govt Mines Dept)

PE907104

This is an enclosure indicator page.
The enclosure PE907104 is enclosed within the container PE907073 at this location in this document.

The enclosure PE907104 has the following characteristics:

ITEM_BARCODE	= PE907104
CONTAINER_BARCODE	= PE907073
NAME	= Seismic Survey Map
BASIN	= OTWAY
PERMIT	= PEP/5
TYPE	= SEISMIC
SUBTYPE	= LOCATION_MAP
DESCRIPTION	= Seismic Survey Location Map (enclosure from WCR) for Pretty Hill-1
REMARKS	=
DATE_CREATED	=
DATE_RECEIVED	=
W_NO	= W469
WELL_NAME	= PRETTY HILL-1
CONTRACTOR	=
CLIENT_OP_CO	= FROME-BROKEN HILL CO PTY LTD

(Inserted by DNRE - Vic Govt Mines Dept)

PE605021

This is an enclosure indicator page.
The enclosure PE605021 is enclosed within the container PE907073 at this location in this document.

The enclosure PE605021 has the following characteristics:

ITEM_BARCODE	= PE605021
CONTAINER_BARCODE	= PE907073
NAME	= Lithologic Log
BASIN	= OTWAY
PERMIT	= PEP/5
TYPE	= WELL
SUBTYPE	= WELL_LOG
DESCRIPTION	= Lithologic Log (enclosure from WCR) for Pretty Hill-1
REMARKS	=
DATE_CREATED	=
DATE_RECEIVED	=
W_NO	= W469
WELL_NAME	= PRETTY HILL-1
CONTRACTOR	=
CLIENT_OP_CO	= FROME-BROKEN HILL CO PTY LTD

(Inserted by DNRE - Vic Govt Mines Dept)

PE907105

This is an enclosure indicator page.
The enclosure PE907105 is enclosed within the container PE907073 at this location in this document.

The enclosure PE907105 has the following characteristics:

ITEM_BARCODE	= PE907105
CONTAINER_BARCODE	= PE907073
NAME	= Correlation Section
BASIN	= OTWAY
PERMIT	= PEP/5
TYPE	= WELL
SUBTYPE	= WELL_CORRELATION
DESCRIPTION	= Correlation Section, Pretty Hill-1 to Woolsthorpe-1, Structure and Stratigraphy Based on Seismic and Well Data, (enclosure from WCR) for Pretty Hill-1
REMARKS	=
DATE_CREATED	=
DATE_RECEIVED	=
W_NO	= W469
WELL_NAME	= PRETTY HILL-1
CONTRACTOR	= INTERSTATE OIL LTD
CLIENT_OP_CO	= FROME-BROKEN HILL CO PTY LTD

(Inserted by DNRE - Vic Govt Mines Dept)

PE907107

This is an enclosure indicator page.
The enclosure PE907107 is enclosed within the container PE907073 at this location in this document.

The enclosure PE907107 has the following characteristics:

ITEM_BARCODE	= PE907107
CONTAINER_BARCODE	= PE907073
NAME	= Stratigraphic Cross Section A-A'
BASIN	= OTWAY
PERMIT	= PEP/5
TYPE	= WELL
SUBTYPE	= CROSS_SECTION
DESCRIPTION	= Stratigraphic Cross Section A-A' (enclosure from WCR) for Pretty Hill-1
REMARKS	=
DATE_CREATED	= 31/10/71
DATE_RECEIVED	=
W_NO	= W469
WELL_NAME	= PRETTY HILL-1
CONTRACTOR	=
CLIENT_OP_CO	= SHELL DEVELOPMENT (AUSTRALIA) PTY LTD

(Inserted by DNRE - Vic Govt Mines Dept)