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DEPARTMENT OF NATIONAL DEVELOPMENT.  
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COMPLETION REPORT, B.M.R. 11 WELL. CATTLE CREEK. N.T.

by

N.E.A. Johnson, R.A.H. Nichols,  
and M.D. Bell.

The information contained in this report has been obtained by the Department of National Development, as part of the policy of the Commonwealth Government, to assist in the exploration and development of mineral resources. It may not be published in any form or used in a company prospectus without the permission in writing of the Director, Bureau of Mineral Resources, Geology and Geophysics.

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BMR No.11 WELL, CATTLE CREEK, NORTHERN TERRITORY

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2. Core descriptions. by N.E.A. Johnson and R.A.H. Nichols.

~~3. Detailed Bit Record. by M.D. Bell. under prep by Pet. Tech.~~

ATTACHMENTS AND ENCLOSURES

Fig. 1. Locality Map.

Fig. 2. Stratigraphic Column for BMR No.11.

Composite Well Log

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## COMPLETION REPORT

### BMR No.11 WELL, CATTLE CREEK, NORTHERN TERRITORY

by

N.E.A. Johnson, R.A.H. Nichols and M.D. Bell

Records 1964/45

### SUMMARY

The Bureau of Mineral Resources stratigraphic well B.M.R. 11 (Cattle Creek) was drilled on the Barkly Tableland, Northern Territory, at a site about twenty miles west-south-west from the Queensland township of Camooweal. The object of the well was to assist petroleum search in the Georgina Basin by determining depth to economic basement, and lithologies, ages and thickness of sedimentary units beneath the Camooweal Dolomite, which has been mapped in the vicinity of the well-site.

The well spudded on 8th July, 1963, and reached total depth (1,501 feet) on 14th November, 1963. A Mayhew 1,000 rig, equipped with air hammer, was used to drill from surface to 210 feet; a Failing 2,500 Holemaster rig, equipped to drill with both air and mud, was used to ream the hole to 210 feet, and then drilled to total depth. The Failing rig was operated by air from surface to 525 feet, and from 525 feet to 900 feet, conventional rotary methods with mud were used. Complete loss of circulation was experienced below 900 feet, and from this depth to total depth, the well was drilled without returns, using water as drilling fluid, but cores were cut at intervals of approximately 50 feet. From surface to 900 feet, progress was very slow because of the necessity to cement aquifers and numerous zones where circulation was lost in fractured, vuggy and cavernous carbonate rocks.

The well penetrated Quaternary soil and gravel from surface to twenty feet, a Cambrian carbonate sequence from 20 to 1412 feet, and Upper Proterozoic or Lower Cambrian sandstone from 1412 feet to total depth. The carbonate sequence has been divided into five units, with tops at 20, 635, 740, 1195 and 1275 feet. Fragmentary fossils were obtained at several levels between 557 and 1257 feet, but none of them is diagnostic, although all are probably Middle Cambrian in age.

No oil shows were detected in the cores and cuttings from B.M.R. 11. The well produced large volumes of water and was secured as a potential water well. During air-drilling operations from surface to 525 feet, tests were made on the aquifers, and yields ranging from 1800 to 6,000 g.p.h. were recorded by air lifting the water. Each test was of short duration, and no measurements of draw-down are available. A static water level of 192 feet below R.T. was measured and checked on several occasions.

### INTRODUCTION

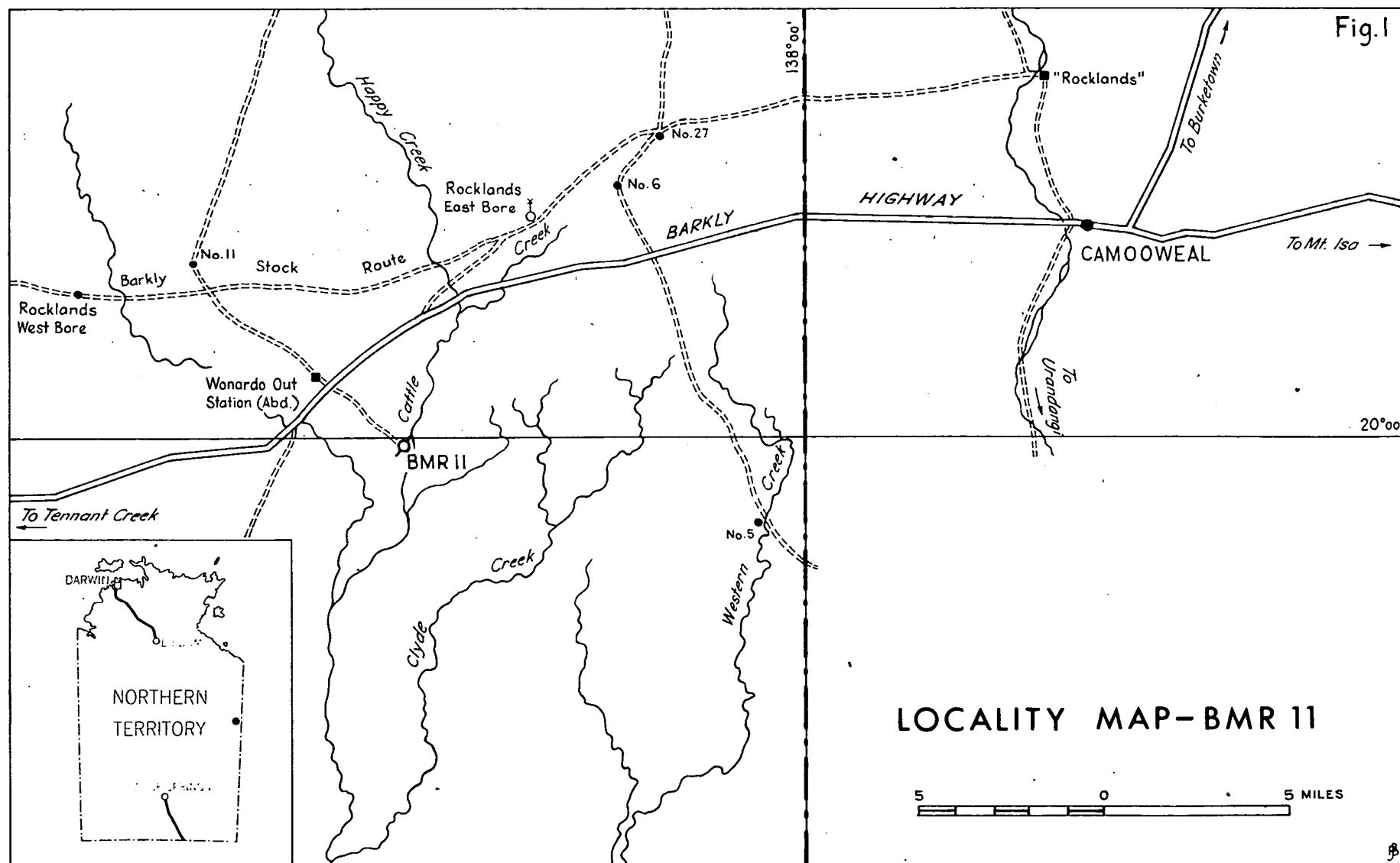
BMR No.11 is situated on Cattle Creek, Northern Territory, 20 miles west-south-west of Camooweal, north-west Queensland. It is the first of three stratigraphic wells programmed by the Bureau of Mineral Resources in the Georgina Basin to increase the stratigraphic knowledge of the basin.

The objectives of BMR No.11 were

1. to determine the thickness of the Camooweal Dolomite.
2. to examine the formations, if any, lying between the Camooweal Dolomite and the top of the Precambrian units.
3. to determine the depth to the base of the Cambrian.
4. to gain information on the permeability and porosity of the rocks penetrated in the well.

Drilling was started by Southern Cross Development Pty.Ltd. under sub-contract to the main contractor, W.L. Sides & Son Pty.Ltd. This sub-contract was negotiated in order to drill hard carbonate rocks in the upper part of the well by means of air-hammer techniques.

Southern Cross Development Pty.Ltd. used a Mayhew 1000 rig equipment for air-hammer operation. A  $6\frac{3}{4}$ " diameter hole was drilled to 75 feet but loss of air in caverns forced abandonment. The rig was then moved 45 yards to the south and a second hole was drilled to a depth of 210 feet. At this stage, Sides & Son's Failing 2500 rig replaced the Mayhew 1000; the  $6\frac{3}{4}$ " hole was opened to  $8\frac{1}{2}$ " before drilling ahead in  $8\frac{1}{2}$ " hole to  $411\frac{1}{2}$  feet. Bits Nos. 1 to 7 were used in reaming and hole opening operations and in drilling the rat hole.



WELL HISTORYGeneral

Well name and number:	B.M.R. No.11 (Cattle Creek)		
Location:	Lat. 20°00'33" S. Long. 137°50'06" E.		
Tenement holder:	Australian Oil Corporation, Midland Savings Building, Midland. Texas. U.S.A.		
Petroleum Tenement:	Oil Permit 61, 9720 sq. miles.		
Area:	Georgina Basin, N.T.		
Total Depth:	Driller	1501½ feet	
	Schlumberger	1501 feet	
Date drilling commenced:	8th July, 1963.		
Date drilling completed:	14th November, 1963.		
Date well secured:	16th November, 1963.		
Date rig released:	16th November, 1963.		
Drilling time to total depth:	131 days.		
Elevations:	rotary table 742 feet ground level 736 feet		
Status:	Secured pending completion as a water well.		
Total cost:	Drilling cost	£29,835. 6.6.	
	Consumables(bits etc.)	5,918.10.7.	
		<u>£35,753.17.1.</u>	

Drilling Data

Drilling Contractor:	W.L. Sides and Son Pty.Ltd., 422 Collins Street, Melbourne. C1, Victoria.		
Drilling plant:	make:	Failing 2500	
	type:	Holemaster	
	rated		
	capacity:	4000' with 3½"	
		drill tubing.	
	motors:	2 x 4/71 G.M.	
		110 H.P.	
Mast:	make:	Failing 58'	
	type:	tubular	
	rated		
	capacity:	60,000 lbs.	
Pumps:	make:	Gardner-Denver	Wheatley
	type:	FOFXO	WBD
	size:	7¼" x 10"	5" x 10"
	motors:	6/71 G.M.	rig
Compressors:	make:	Consolidated-	Holman-Howden
		Pneumatic	
	type:	Reciprocating	Rotary
	model:		Rotair 600
	motors:	Lincoln-Ruston	Rolls-Royce

B.O.P.: make: Baash-Ross  
size and model: 6 $\frac{1}{4}$ " Autolock.  
working pressure: 3000 p.s.i.

Hole sizes: sfc. to 28' - 12 $\frac{1}{4}$ "  
28' to 411 $\frac{1}{2}$ ' - 8 $\frac{1}{2}$ "  
411 $\frac{1}{2}$ ' to 903' - 6 $\frac{1}{4}$ "  
903' to T.D. - 6"

Casing Strings: size: 9 $\frac{5}{8}$ " 7"  
grade: J-55 J-55  
weight: 36 lbs. 20 lbs.  
set at: 27 $\frac{1}{2}$ ' 410'

Casing Cement: size: 9 $\frac{5}{8}$ " 7"  
sacks cmt.: 8 60  
cmt.rise: to sfc. est. 50' (R.T.)  
method: single stage, single stage,  
plug. plug.

Drilling Fluid: interval: 0-525' 525'-900' 900'-T.D.  
type: air mud water  
Note: the hole was drilled with air  
from surface to 525' using both air-hammer  
technique and conventional tricone bits.  
At 525' the volume and height of the  
column of formation water in the hole  
was too great to continue drilling  
satisfactorily with air, and drilling  
resumed using fresh water bentonite muds.  
Lost circulation impeded progress to such  
an extent that drilling and coring from  
900' to total depth was continued without  
returns, using water from the nearby  
waterhole as drilling fluid.

Water Supply:drilling: from nearby semi-permanent waterhole on  
Cattle Creek.  
domestic: from Camooweal town water bore.

Perforation and  
Shooting Record: nil  
Plugging Back and  
Squeeze Cement Jobs: nil  
Side-tracked Hole: nil

Fishing Operations:

<u>Date:</u>	<u>Hole depth</u>	<u>Hours lost</u>	<u>Fishing job</u>	<u>How recovered</u>
6. 8.63	216'	14 $\frac{3}{4}$	Hammer bit stuck	Worked free
4.10.63	637'	39 $\frac{1}{2}$	Stuck string	Unloaded water column
19.10.63	885'	42 $\frac{1}{4}$	Stuck string	Unloaded water column
21.10.63	886 $\frac{1}{2}$ '	15 $\frac{3}{4}$	Outer diamond bbl. and bit matrix	Fished and milled out
30.10.63	903'	$\frac{1}{2}$	Stuck string	Worked free

Logging and TestingDitch cuttings:

Samples were collected at five-foot intervals when returns were obtainable. Cuts were distributed to the Geological Branch, B.M.R. Canberra; the Resident Geologist, B.M.R. Alice Springs and the tenement holder, Australian Oil Corporation.

Coring:

The original programme called for routine cores to be cut at convenient bit changes to give a coring interval of approximately 300 feet. Cores were also to have been cut, if required by the well-site geologist, for additional lithological or palaeontological information. This programme was maintained to 900 feet, below which drilling and coring continued, without returns, as attempts to control lost circulation had been hindering progress. As a result, cores were cut at intervals of about 50 feet from 900 feet to 1501 $\frac{1}{2}$  feet (T.D.).

Fifteen of the eighteen cores cut were taken with a 6 inch Reed K-500 barrel using hard-formation coreheads. Core Nos. 4, 5 and 6 were cut with a 3 $\frac{13}{16}$  inch J.K. Smit Dowdco diamond barrel; the outer barrel "twisted off" whilst cutting core No.6 and the tool was not used again. All eighteen cores have a diameter of 2 $\frac{3}{8}$  inches.

The following table shows details of the cores cut:-



Core No.	Interval		Footage	Recovery		
	From (feet)	To (feet)		Feet	ins.	%
1	220	229	9	3	0	33
2	547	560	13	1	0	8
3	701	720	19	1	0	5
4	782	783	1	10	$\frac{1}{2}$	87
5	784	788 $\frac{1}{2}$	4 $\frac{1}{2}$	3	0	67
6	885	886 $\frac{1}{2}$	1 $\frac{1}{2}$	1	2	78
7	940	947 $\frac{1}{2}$	7 $\frac{1}{2}$	4	$\frac{1}{2}$	5
8	947 $\frac{1}{2}$	951	3 $\frac{1}{2}$	4		10
9	1006	1016	10	1	0	10
10	1075	1085	10	1	6	15
11	1136	1139	3	1	3	42
12	1202	1205	3	1	5	47
13	1255 $\frac{1}{2}$	1256 $\frac{1}{2}$	1	7		58
14	1308	1318	10	1	6	15
15	1390	1400	10	7	6	75
16	1450	1451 $\frac{1}{2}$	1 $\frac{1}{2}$	11		61
17	1495	1500	5	3	6	70
18	1500	1501 $\frac{1}{2}$	1 $\frac{1}{2}$	1	3 $\frac{1}{2}$	86

Total footage cored was 114; of this 31'2 $\frac{1}{2}$ " or 28% was recovered.

Side-wall Sampling: nil

Well Logging:

The well was logged by a Failing Logmaster unit of the B.M.R. and by Schlumberger. The logs are summarized below.

Schlumberger

Log type	Run No.	Depth interval	Curves	Scale Vertical
Electric	1	408 - 1499	S.P. Short Normal Long Normal Lateral	2" = 100' and 5" = 100'
Gamma Ray	1	100 - 1500	Gamma Ray	2" = 100' and 5" = 100'
-Neutron			Neutron	
Micro-Caliper	1	408 - 470	Microlog  Caliper	2" = 100' and 5" = 100'
Temperature	1	360 - 1120	Temperature	2" = 100' and 5" = 100'
	2	208 - 800	Temperature	

No microlog was obtainable as the pad was damaged in the borehole; the sonde required a hole with a minimum diameter of  $6\frac{1}{2}$ " whereas a  $6\frac{1}{4}$ " hole was drilled to 903' and a 6" hole from 903' to T.D. The tool would not go below 780', and no record was obtained below 470'.

The two temperature logs were incomplete as the probe was "hanging up" in the hole. In view of the operational requirements of drilling, the well did not have a sufficient waiting period for the temperature to reach equilibrium. As a result, the value of the log is limited. In addition, as in the case of the microcaliper tool, it would appear that the temperature tool was not functioning below 780'.

Bureau of Mineral Resources

Electric	1	410'-1498'	S.P.	1" = 100'
	1	410'-1498'	Short Normal	1" = 100'
	1	410'-1185'	Long Normal	1" = 100'
	2	410'- 800'	Long Normal	1" = 100'
Gamma Ray	1	170'-1355'	Gamma Ray	1" = 100'

Drilling Time and Gas Log:

There was no automatic device on site to detect the presence of gas, but the minutes taken to drill every five feet were recorded by the drillers. These formed the basis of the rate of penetration log on the Composite Well Log attached to this report.

Formation Testing: NilDeviation Surveys:

All deviation surveys were taken with a Totco Double Recorder tool. For the most part readings were taken at intervals of approximately 40 feet; they are listed below and have been plotted on the Composite Well Log:

Depth	Deviation	Depth	Deviation	Depth	Deviation	Depth	Deviation
100'	$\frac{1}{4}^{\circ}$	400'	$2\frac{1}{2}^{\circ}$	650'	$5\frac{3}{4}^{\circ}$	1100'	$6\frac{1}{2}^{\circ}$
150'	$\frac{1}{2}^{\circ}$	450'	$3^{\circ}$	710'	$5\frac{1}{2}^{\circ}$	1170'	$6\frac{1}{4}^{\circ}$
175'	$\frac{3}{4}^{\circ}$	485'	$3\frac{1}{2}^{\circ}$	750'	$5\frac{1}{2}^{\circ}$	1240'	$7^{\circ}$
201'	$1^{\circ}$	500'	$3\frac{1}{4}^{\circ}$	805'	$5^{\circ}$	1275'	$7^{\circ}$
240'	$1^{\circ}$	535'	$3\frac{3}{4}^{\circ}$	840'	$5\frac{1}{2}^{\circ}$	1310'	$5\frac{1}{2}^{\circ}$
275'	$1\frac{1}{2}^{\circ}$	545'	$4\frac{1}{2}^{\circ}$	900'	$6^{\circ}$	1325'	$5\frac{1}{2}^{\circ}$
310'	$2^{\circ}$	590'	$5\frac{1}{2}^{\circ}$	1035'	$6^{\circ}$	1380'	$5^{\circ}$
350'	$2\frac{1}{2}^{\circ}$					1455'	$5^{\circ}$

Other Well Surveys: Nil.

GEOLOGYSummary of previous work.

Geological. Regional geological mapping was carried out by the Bureau of Mineral Resources field parties prior to the drilling of BMR No. 11. The information is contained in reports by Opik (1957), Randal & Brown (1962 a, b, c), and Brown (1962) all of which contain references to earlier work.

In 1963, Doeringsfeld, Amuedo and Ivey prepared photogeological evaluations for the permittees of O.P. 53 (United Australian Oil, inc. and Amalgamated Petroleum N.L.) and O.P. 61 (Australian Oil Corporation) in the Northern Territory.

Geophysical. An aeromagnetic traverse was flown by the Bureau of Mineral Resources in 1958 from Tennant Creek to Mount Isa (Jewell, 1960).

Drilling. Two exploratory wells have been drilled in the region - Lake Nash No. 1 in 1962 and Morstone No. 1 in 1963, (Amalgamated Petroleum, N.L., 1963, a and b.).

A number of water bores have been drilled in the region. However, the little geological information obtained from the driller's logs is limited in value for any lithological or stratigraphic evaluation.

During the drilling of BMR No. 11, three water bores were drilled on Rocklands Station (Nos. 32, 33, 34). Samples were collected from each one, but No. 33 was more important geologically as it passed through the base of the surface dolomite unit and into a silty, argillaceous dolomite, and limestone.

Summary of regional geology.

The site of BMR No. 11, Cattle Creek, N.T., was chosen as part of a stratigraphic drilling programme to investigate the subsurface regional geology of the Georgina Basin with particular reference to the Camooweal Dolomite on the Barkly Tableland.

The surface geology of the Ranken and Avon Downs sheet areas which surround the well-site, was mapped by members of the Bureau of Mineral Resources in 1961 (Randal & Brown, 1962a & b). The authors state that a lack of outcrops and few exposed contacts make stratigraphic mapping difficult and results conjectural. Data from most of the water bores does not add useful information.

Large areas are covered by grey soil, and accumulations of chert gravel and residual boulders. "Pavements" of dolomite occasionally form outcrops.

The most important units which crop out on the sheet areas surrounding the well-site are the Camooweal Dolomite, Ranken Limestone and Wonarah Beds. The Ranken Limestone and Wonarah Beds are fossiliferous Middle Cambrian units, but the age of the Camooweal Dolomite is in doubt. Different workers have assigned it to various ages from Upper Proterozoic to the Middle Cambrian (Randal & Brown 1962 a p. 5; Opik, Carter, & Noakes, 1961).

The dolomite on the Ranken Sheet area, north of the well site, is a white crystalline dolomite with nodules and bands of chert, similar to the dolomite near Camooweal, i.e., the Camooweal Dolomite (Randal & Brown, 1962a). The Camooweal Dolomite varies from a white and cream, to buff and light brown crystalline rock with chert bands and nodules. Pellet dolomite and intraformational conglomerate occur near the James River, but have not been found elsewhere.

On the Avon Downs Sheet area, south of the well-site, white, crystalline dolomite with bands and nodules of chert crop out as far south as Lake Nash Station. This dolomite is similar to the Camooweal Dolomite, and the best exposures occur near Happy and Cattle Creeks (the well-site) and Lake Nash. Similar dolomites crop out on adjacent sheet areas, Camooweal (Randal & Brown, 1962c) and Mount Isa (Opik, Carter & Noakes, 1961). Thus, the well-site is surrounded by dolomite similar to the Camooweal Dolomite.

The age of the Camooweal Dolomite is unknown, and is possibly confused because several separate dolomite units may have been called the Camooweal Dolomite. Chert and limestone boulders with Middle and Upper Cambrian fossils were found on the surface of the Camooweal Dolomite, suggesting that the unit is older. In the Ranken River area, Ranken Limestone is of Middle Cambrian age and "there is some evidence that outcrops of dolomite may be lateral equivalents of Ranken Limestone" (Randal & Brown, 1962a). In the north-western part of the Avon Downs Sheet area, and the south-western part of the Ranken Sheet area, the Wonarah Beds crop out and are of lower Middle Cambrian age; they may be equivalent to part of the Camooweal Dolomite. However, although some parts of the Camooweal Dolomite are Middle Cambrian and younger, the question of some pre-Middle Cambrian age Camooweal Dolomite is still unresolved.

The Ranken Limestone is a richly fossiliferous, oolitic and crystalline limestone, partly silicified, and includes dolomite and chert nodules. The Ranken Limestone is of Middle Cambrian age, and may overlies the Camooweal Dolomite and occur as a lens within the Wonarah Beds (Opik, 1957). Condon (1961) considers the Ranken Limestone grades upwards into the dolomite east of the Ranken River. Randal and Brown (1962a) think that the Ranken Limestone may be a lateral equivalent of the dolomite to the east.

The Wonarah Beds consist of fossiliferous siltstone, chert, silicified shale and silicified oolitic limestone. The age is lower Middle Cambrian, and Condon (1961) considers the Wonarah Beds underlie the Ranken Limestone. On a "Probable Rock Relationship" diagram (Randal & Brown 1962a) the Wonarah Beds are shown to be a possible lateral equivalent of the Camooweal Dolomite.

Undifferentiated Cambrian-Ordovician(?) rocks, consisting of finely crystalline, grey to white dolomites, crop out in the south west and southern parts of the Avon Downs Sheet area (Randal & Brown, 1962b). Their exact relationship with the rocks further north is unknown.

Thus, the relationships of the rock units described above are still uncertain, but lithological logs, available from No.33 water bore (Rocklands) and Lake Nash No.1 well (30 miles north-east and 64 miles south of the well-site respectively) indicate a change from dolomite to grey, fossiliferous limestone between 500 ft. - 600 ft. below surface. In Lake Nash No.1 well, the fossiliferous limestone is of early Middle Cambrian age (Opik, pers. comm.); the age of the similar limestone in No.33 water bore is not known, but may be Middle Cambrian. The fossiliferous limestone in both the water bore and Lake Nash well may be equivalent to parts of the Ranken Limestone or the Wonarah Beds.

Mesozoic(?) rocks overlies some of the dolomite on the Ranken and Avon Downs Sheet areas. They form a thin cover and consist of sandstones and pebble-conglomerates.

Cainozoic, possibly Tertiary limestone, crops out on both sheet areas, and is named the Austral Downs Limestone (Noakes, 1959). The Austral Downs Limestone comprises nodular, siliceous calcilutite, with nodules and bands of chalcedonic silica. Bedding is poorly developed and some outcrops may represent intraformational conglomerates. It has not been seen overlying Mesozoic rocks. Fossils have not been found in the Austral Downs Limestone on the Ranken and Avon Downs Sheet areas,

but Paten (1961) recorded foraminifera south east of the well-site near Urandangi, Western Queensland, and considers the unit to be late Tertiary. Noakes, (1951) considers it to be Miocene in age.

Stratigraphic table.

Unit No.	Lithology	Depth (feet)		Interval (feet)	Age
		Drilled (R.T.)	Subsea		
Unit 1	Dolomite	20	+722	615	?Cambrian
Unit 2	Argillaceous dolomite	635	+107	105	?Cambrian
Unit 3	Dolomite	740	+2	455	?Cambrian
Unit 4	Limestone	1195	-453	80	?Cambrian
Unit 5	Dolomite	1275	-533	137	?Cambrian
Unit 6	Sandstone	1412	-670	89½+	?Proterozoic

Stratigraphy.

Unit 1 20 to 635 feet. (615 feet).

Lithology: Dolomite; 95%, white, grey, yellow, brown, microcrystalline, but with some cryptocrystalline to medium crystalline, slightly calcareous in places, alternating porous and tight horizons, vuggy, some vugs lined with drusy growth. Several horizons of pelletal and oolitic dolarenite, pellets of microcrystalline dolomite, up to 0.6 mm. in diameter, rounded. One interval contains numerous, loose, rounded, transparent quartz grains. Chert; 5%, occurs throughout, grey to brown, cryptocrystalline aphanitic, nodular and lens-shaped. Traces of glauconite and manganese.

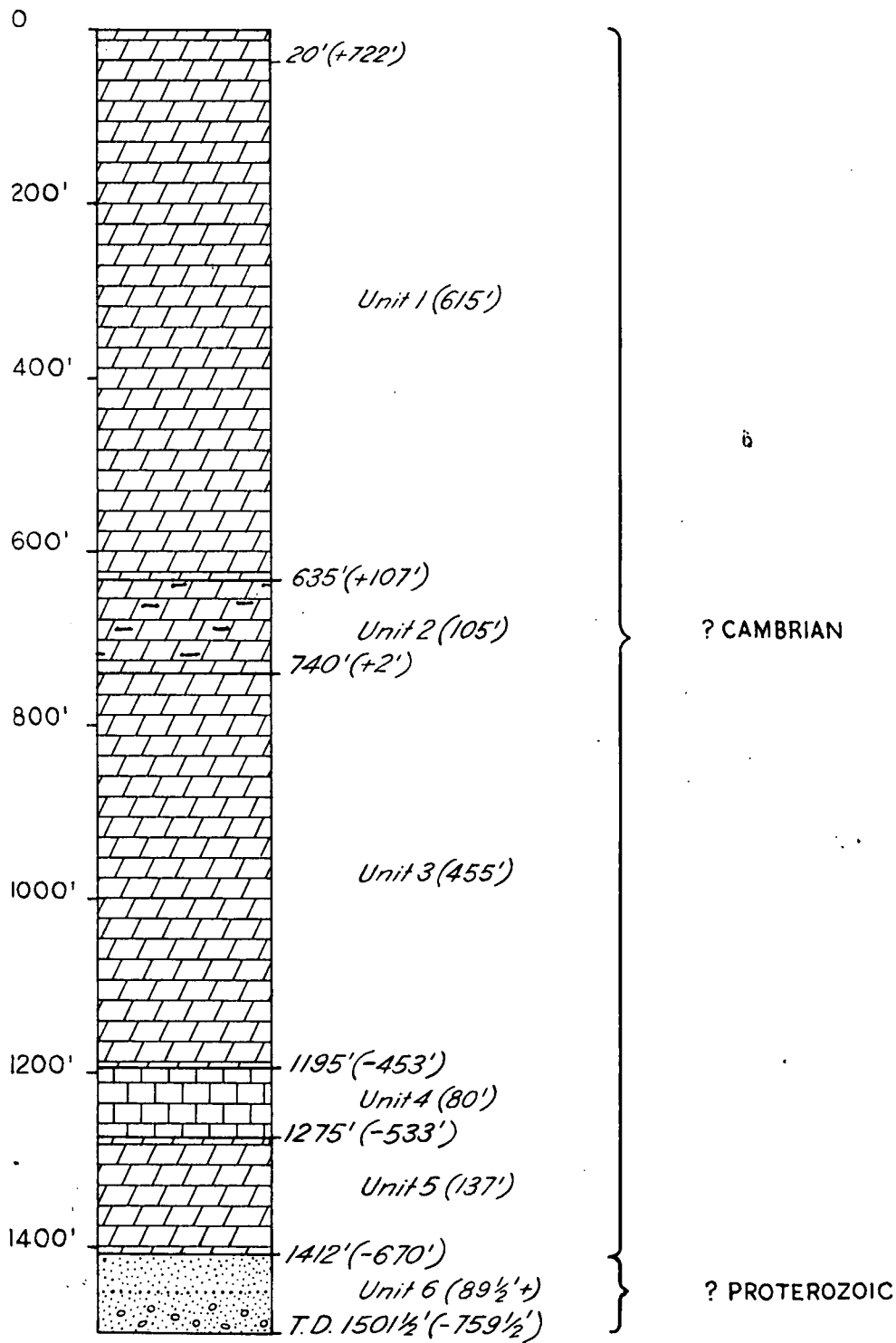
Unit 2 635 to 740 feet (105 feet).

Lithology: Argillaceous dolomite; grey, greenish grey, grey-brown, microcrystalline, micaceous (?clay minerals), slightly calcareous, platy fracture (?fissile), slightly porous (10%). Dolomite interbeds at the base, white, microcrystalline, rare vugs, traces of glauconite and pyrite. Rare chert.

Fig.2

STRATIGRAPHIC COLUMN

BMR No. II



To accompany Record 1964/45



Unit 3 740 to 1195 feet (455 feet).

Lithology: Dolomite; 95%, white, light to medium grey, grey-brown, light brown, microcrystalline to medium crystalline, slightly calcareous intervals, moderately vuggy, many vugs lined with drusy growths of euhedral dolomite and some calcite crystals. One horizon of pelletal and oolitic dolarenite. Low to medium amplitude stylolites, some fine fractures. Irregular veins and patches of medium crystalline dolomite near the base. Traces of glauconite and manganese. Minute shell fragments unidentifiable. Chert; < 5%, grey, cryptocrystalline, nodular, fractured; in Core No.5 it replaces pelletal and oolitic dolomite.

Unit 4 1195 to 1275 feet (80 feet).

Core

Lithology: Limestone; 90%, medium grey and brown, cryptocrystalline to microcrystalline, vague granular texture. Thin (0.5 mm.) laminae with small grey-black, vague ?pellets, slightly calcareous. Traces of pyrite. One Lingula sp. Chert, 10%, medium blue-grey to brown, cryptocrystalline, aphanitic, nodular.

Unit 5 1275 to 1412 feet (137 feet).

Core

Lithology: Dolomite; 100% light grey-brown, cryptocrystalline to microcrystalline, vuggy, vugs with drusy growths interconnected. Porosity, 20-60%. Probable shell fragments.

A marked change occurs at 1385 feet, the dolomite becomes mottled light brown to grey-brown, cryptocrystalline to microcrystalline, calcareous; intergranular porosity, pores lined with carbonate crystals. Thin, dark grey, ?carbonaceous, iron-stained laminae present.

Unit 6 1412 to 1501½ feet (89½ feet +)

Core

Lithology: Sandstone; white to grey to medium dark red brown, medium-grained quartz sandstone. Quartz grains are colourless, translucent to transparent, sub-rounded, moderately sorted and partly bound by siliceous cement, some ferruginous matrix.

Probable cross-stratification. Pebbly quartz sandstone, pebbles, rounded, average diameter 1 cm., composed of quartz and lithic fragments (mainly quartzite). Minor green-grey, micaceous siltstone and ferruginous siltstone.

Reasons for distinguishing the above units. The basis of the subdivision into six units is wholly on lithological grounds as no palaeontological information is available.

Available information (Randal & Brown, 1962a) indicates that Unit 1 consists of dolomite similar to Camooweal Dolomite possibly of Middle Cambrian age. The carbonate sequence comprising Units 2, 3, 4 and 5, is most probably Cambrian in age. A problem arises with the age of the underlying sandstones. The non-ferruginous sandstone from the upper part of Unit 6 could be Cambrian in age, as it is lithologically different from the ferruginous pebbly quartz sandstone at the base of Unit 6. The sandstones may be part of an alternating sequence or represent two units of different ages. However, the sandstones of Unit 6 are lithologically similar to ferruginous sandstones of probable Proterozoic age, e.g. the Pilpah Sandstone described by Opik, Carter & Noakes (1961) and the Mittiebah Sandstone described by Smith & Roberts (1960), and are therefore tentatively assigned to the Proterozoic.

Structure. B.M.R. No.11 was not sited on a surface structural feature. Dip measurements were not readily available from the cores. However, the general impression gained from the cores is that the whole sequence is sub-horizontal.

Porosity and permeability. Laboratory tests to obtain accurate information on the porosity and permeability of the units were not conducted.

The porosity of the carbonates is variable, with alternating porous and tight horizons. The porous horizons contain a variable number of vugs; some appear to be inter-connecting. In rare instances intergranular porosity was noted, and is particularly common in Unit 5.

The sandstones are hard and non-porous due to the development of quartz overgrowths filling most of the pore spaces.

### Hydrology

The hydrology of the region has been investigated by Randal (1962) who used information from bores surrounding BMR No.11 to plot topographic, piezometric and main aquifer contours.

In BMR No.11, aquifers were penetrated at 220-230'; 280-290'; 320-370'; 415-425'; 515-525'. The flows were estimated to be 1800 to 6000 gph by means of air lifting the water. Below 525' mud was used as a drilling fluid and further records of aquifers could not be obtained. Preliminary analyses indicate that the water is fit for general consumption.

The aquifers appear to comprise cavernous horizons with loose deposits of dolomite, pebbles and crystals, and vuggy horizons.

### CONCLUSIONS

The thickness of the Camooweal Dolomite is not precisely known as the upper and lower limits have not been defined. It is assumed to be 615 feet + if the first dolomite unit is equivalent to the Camooweal Dolomite.

The formations between the possible Camooweal Dolomite and total depth (1501½ feet) were examined, but it is not known if the well is in or near the top of the Precambrian units at total depth.

It is not known if the well penetrated Precambrian units. Fossils were not found at or near total depth. The ferruginous quartz sandstones at the bottom of the well can be tentatively correlated with Upper Proterozoic rock units 45 miles to the south-east (Pilpah Sandstone) and 90 miles to the north-west (Mittiebah Sandstone) on the basis of lithological similarities and stratigraphic position.

A detailed palaeontological examination of the core material will assist in clarifying the stratigraphy of the well in relation to regional stratigraphy.

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## APPENDIX 1 - SAMPLE DESCRIPTIONS

0-10 feet	<p><u>Soil</u>; 80%, grey, cream to white, with clay and rounded grains of white, yellow and red quartz.</p> <p><u>Chert</u>; 20%, gravel, red, grey, yellow, brown cryptocrystalline, banded, with spherulitic (kidney) structure, pelletal (.25 mm diameter).</p>
10-20 "	<p><u>Chert</u>; 95%, brown, red, grey, yellow, cryptocrystalline banded.</p> <p><u>Soil</u>; 5%, red, grey, with quartz grains.</p>
20-30 "	<p><u>Chert</u>; 50%, red, grey, cryptocrystalline.</p> <p><u>Dolomite</u>; 45%, grey, light brown, yellow, microcrystalline, uniform texture, rare Fe dolomite, hard, 10% of sample with intergranular porosity, some dendritic manganese.</p> <p><u>Limestone</u>; 5%, white to light grey, fine to medium crystalline, porous, friable; 2% of limestone, pelletal, red, brown, sandy. Quartz grains rounded, 20% in specimen, diameter .25 mm. Some red, brown clay with quartz grains.</p>
30-40 "	<p><u>Dolomite</u>; 90%, white, grey, brown, microcrystalline to medium crystalline, aphanitic, uniform texture. Some yellow, white calcareous dolomite.</p> <p><u>Limestone</u>; 5%, red-brown, pelletal, sandy, soft, friable, quartz grains .25 mm.</p> <p><u>Chert</u>; 5%, grey, yellow, brown, cryptocrystalline, aphanitic.</p>
40-50 "	<p><u>Dolomite</u>; 95%, white to light grey, brown, microcrystalline to medium crystalline, uniform texture, porous, friable. 10% intergranular porosity. Cavernous 42-44 ft.</p> <p><u>Chert</u>; 5%, grey, yellow, brown, cryptocrystalline, aphanitic</p>
50-60 "	<p><u>Dolomite</u>; 95%, light grey, white, yellow, brown, microcrystalline to medium crystalline, uniform texture, calcareous in parts, porous and friable.</p> <p><u>Chert</u>; 5%, grey, red, cryptocrystalline, aphanitic.</p>
60-70 "	<p><u>Dolomite</u>; 90%, calcareous, light grey, brown, microcrystalline, uniform texture; 5% inter granular porosity.</p> <p><u>Limestone</u>; 5% pelletal, red, brown with dolomite pellets and quartz in calcareous groundmass.</p> <p><u>Chert</u>; 5%, brown, white, grey, cryptocrystalline, aphanitic. Some clay and quartz grains.</p>
70-80 "	<p><u>Dolomite</u>; 90%, white, yellow, brown, microcrystalline, calcareous, coarse crystalline patches in some samples, 10% intergranular porosity, some manganese.</p> <p><u>Chert</u>; 10%, light grey to grey, cryptocrystalline, mottled and some banding. Some clay and quartz grains.</p>
80-90 "	<p><u>Dolomite</u>; 90%, white, yellow, brown, grey, mottled, microcrystalline to medium crystalline, aphanitic, hard, 5% porosity, some manganese dendrites.</p> <p><u>Chert</u>; 10%, grey, cryptocrystalline, aphanitic.</p>
90-100 "	<p><u>Dolomite</u>; 95%; white, yellow, brown, microcrystalline, uniform texture, slightly calcareous, no porosity; 5% silty, yellow microcrystalline dolomite with 10% quartz.</p> <p><u>Chert</u>; 5%, grey, cryptocrystalline, aphanitic.</p>

- 100-110 feet. Dolomite; 95%, yellow, white, light brown micro-crystalline, slightly calcareous, 1% porosity, small vugs, 1 mm. in diameter.  
Chert; 5%, grey, white, brown, aphanitic, hard.
- 110-120 " Dolomite; 95%, yellow, white, light brown, micro-crystalline, uniform texture.  
Chert; 5%, grey, white and brown, cryptocrystalline, aphanitic. Some clay.
- 120-130 " Dolomite; 95%, white, yellow, light brown, mottled, microcrystalline to medium crystalline, slightly calcareous, and ferruginous. Some well rounded, white loose dolomite pellets, part of unconsolidated deposit in cavity(?). Some silty dolomite, vugs.  
Chert; 5% grey, brown, white, cryptocrystalline, aphanitic.
- 130-140 " Dolomite; 90%, white, yellow, brown, mottled. Micro-crystalline, hard, 10% porosity. Some loose rounded pellets.  
Chert; 5%, white, light grey, aphanitic, cryptocrystalline.  
Sand; 5%, rounded quartz grains .25 mm in diameter.
- 140-150 " Dolomite; 90%; white, yellow, brown, mottled, slightly calcareous; microcrystalline, 70%; pelletal 10%; silty 10%; Some loose rounded pellets of dolomite.  
Chert; 10%, silicified pellet dolomite/limestone, and grey, cryptocrystalline, aphanitic.
- 150-160 " Dolomite; 90%; white, yellow, brown, microcrystalline sandy dolomite, 5%, with 15% angular quartz.  
Chert; 10%, grey, cryptocrystalline, aphanitic. Some clay and quartz grains.
- 160-170 " Dolomite; 90%; calcareous, white, yellow, brown, micro-crystalline, uniform texture, tight; 50% loose rounded pellets of dolomite;  
Chert; 10%, silicified oolitic dolomite/limestone; white, light grey, cryptocrystalline, aphanitic. Some clay and quartz.
- 170-180 " Dolomite; 90%, white, brown, yellow, microcrystalline, uniform texture, tight; slightly calcareous 10% of sample contains 15% silt and rounded quartz sand; some loose rounded dolomite pellets up to 4 mms long.  
Chert; 10%, grey, cryptocrystalline, aphanitic.
- 180-190 " Dolomite; 90%; white, brown, yellow, microcrystalline, tight, uniform texture; 5% silty dolomite with 10%-15% quartz silt and fine sand; 20% loose, rounded dolomite pellets up to 1 cm. long.  
Chert; 10%, grey, brown, cryptocrystalline, aphanitic. Some clay and quartz grains.
- 190-200 " Dolomite; 90%; white, yellow, brown, micro-crystalline, uniform texture, tight; 5% silty dolomite; slightly calcareous; 20% loose, rounded dolomite pellets.  
Chert; 10%, grey, brown, cryptocrystalline, aphanitic; some clay and quartz grains.
- 200'-210 " Dolomite; 90%; white, yellow, brown, microcrystalline, uniform texture, tight; 40% loose, rounded dolomite pellets. 20% silty dolomite with 10% angular quartz grains. Some calcareous dolomite.  
Chert; 10%, grey, cryptocrystalline, aphanitic.

- 210-220 feet. Dolomite; 90%; white, yellow, microcrystalline, ferruginous, tight; 60% loose rounded dolomite pellets 1.25 mm-9mm long. Large cobbles show thin laminae 0.6 mm thick, vugs from 1 mm high to 2.5 cms long.  
Chert; 10%, grey cryptocrystalline, thin lenses up to 3 mms thick, High porosity.
- 220-230 " Dolomite; 95%, white, brown, microcrystalline, uniform texture, little intergranular porosity.  
Chert; 5%, grey, cryptocrystalline, aphanitic.
- 230-240 " Dolomite; 90%; white, yellow, brown, microcrystalline, tight; 20% loose dolomite sand of rhombs.  
Chert; 5%, grey, brown, cryptocrystalline, aphanitic.  
Sand; 5% quartz grains, angular to sub-rounded, clear.
- 240-250 " Dolomite; 90%; white, light grey, microcrystalline, tight, possibly pellet "ghosts"; 5% silty dolomite. Some intergranular porosity.  
Chert; 10%, grey, cryptocrystalline, aphanitic.
- 250-260 " Dolomite; 85%; white, yellow, mottled, microcrystalline, uniform, tight; 5% pelletal dolomite, pellets rounded, of sand size.  
Chert; 15%, grey, cryptocrystalline, aphanitic.
- 260-270 " Dolomite; 90%; white, yellow, brown, microcrystalline to medium crystalline, uniform texture, tight; 5% pelletal dolomite.  
Chert; 10%, grey, cryptocrystalline, aphanitic.
- 270-280 " Dolomite; 95%; white, microcrystalline, uniform texture, tight; 40% pelletal dolomite, yellow, pellets rounded, of sand size.  
Chert; 5%, grey, yellow, cryptocrystalline, mottled and aphanitic.
- 280-290 " Dolomite; 95%; 70% pellet and oolitic dolarenite, pellets of microcrystalline dolomite; pellets and ooliths, white, yellow, well-rounded, oval and spherical 0.5 mm. diameter, 50-60% packing in medium crystalline dolomite groundmass; 30% white, yellow, microcrystalline dolomite, some intergranular porosity.  
Chert; 5%, grey, cryptocrystalline, aphanitic.
- 290-300 " Dolomite; 100%; 80-90% oolitic and pelletal dolarenite; pellets of microcrystalline dolomite, pellets and ooliths, rounded, oval and spherical, 0.3 mm. diameter, 50% packing in medium crystalline dolomite groundmass. Oolitic coats superficial; 10-20% white, microcrystalline dolomite.  
Chert; 5%, grey, cryptocrystalline, aphanitic.
- 300-310 " Dolomite; 90%; 70% pelletal and oolitic, white dolarenite with microcrystalline dolomite, vuggy, iron stained, 20% porous; 30% microcrystalline, light brown, vuggy. 10% hard.  
Chert; 10%, grey, cryptocrystalline, aphanitic.
- 310-320 " Dolomite; 95%; 50% light brown, white, yellow, brown, microcrystalline, hard, iron stained, 20% vuggy, tight; 50% white, pelletal dolarenite, microcrystalline matrix, vuggy, iron stained, some intergranular porosity.  
Chert; 5%, brown, cryptocrystalline, aphanitic.



- 320-330 feet: Dolomite; 95%, white, light brown, microcrystalline pelletal dolarenite, vuggy (70%), tight, hard, iron-stained.  
Chert; 5%, brown, cryptocrystalline, aphanitic.
- 330-340 " Dolomite; 95%, light brown, grey, white, hard, microcrystalline, slightly calcareous, vuggy, iron-stained.  
Chert; 5%, brown, cryptocrystalline, aphanitic.
- 340-350 " Dolomite; 95%; 55% pelletal dolarenite, brown, white, grey, microcrystalline, hard, porous; 45% light brown, white, microcrystalline, slightly calcareous, hard, iron-stained. 5%.  
Chert; 5%.
- 350-360 " Dolomite; 90%; 65% pellet dolarenite, white, brown, grey, microcrystalline, tight, hard, laminated(?), iron stained; 35%, brown microcrystalline, hard.  
Chert; 10%, brown, cryptocrystalline, aphanitic. Iron oxide, and red clay(?).
- 360-370 " Dolomite; 95%, brown, blue-grey, white, pelletal dolarenite, microcrystalline matrix and pellets, some porosity (10%) intergranular, hard, iron stained, ferruginous.  
Chert; 5%, partly replacing pelletal dolarenite.
- 370-380 " Dolomite; 98%, white, light brown, pelletal and finely pelletal dolarenite, microcrystalline platy, tight, hard, porosity (20%), iron staining, iron stained joints.  
Chert; rare .2%.
- 380-390 " Dolomite; 98%; 92% white, microcrystalline, fine to coarse-grained, pelletal dolarenite, vuggy (10%), intergranular porosity, iron stained; 8% brown, microcrystalline, vuggy.  
Chert; 2%, grey, cryptocrystalline, aphanitic.
- 390-400 " Dolomite; 100%, white, pelletal dolarenite, microcrystalline, slightly calcareous, iron-stained along joints, vuggy (20%).
- 400-410 " Dolomite; 90%, white, brown, light brown, pelletal dolarenite, microcrystalline, hard, iron stained, slight intergranular porosity.  
Silt; 10%, dark brown, soft, no samples - driller's report.
- 410-420 " Dolomite; 100%; 85% white, grey, pelletal dolarenite, microcrystalline, hard, iron-stained, vuggy (20%); 15% light to medium brown, microcrystalline, tight, hard, slightly calcareous.
- 420-430 " Dolomite; 100%; 90% grey, white, brown, pelletal and oolitic(?) dolarenite, microcrystalline, tight, hard, iron-stained, vuggy (20%), large platy chips.
- 430-440 " Dolomite; 95%; 50%, white, grey, medium brown, pelletal dolarenite, microcrystalline, vuggy(10%) iron-stained, hard, fractured, some intergranular porosity. 50% brown, microcrystalline, fractured, hard, some intergranular porosity, some manganese.  
Chert; 5%, medium brown, cryptocrystalline, aphanitic, and red, oolitic, pelletal(?) chert.

- 440-450 feet. Dolomite; 96%; 50% white, grey, medium brown, pelletal dolarenite, microcrystalline, slightly calcareous, vuggy, iron-stained, hard, some manganese; 47% grey, white, medium brown, microcrystalline, slightly calcareous, hard, iron-stained, some manganese. Some rounded dolomite pebbles, 6 mms in diameter.  
Chert; 4%, red, brown, cryptocrystalline, aphanitic.
- 450-460 " Dolomite; 95%; 68% white brown, microcrystalline, hard, iron-stained; 32% white, pelletal, oolitic(?) dolarenite, microcrystalline, vuggy(10%).  
Chert; 5%, red, brown, cryptocrystalline, aphanitic.
- 460-470 " Dolomite; 100%, light brown, white, microcrystalline, partly calcareous, iron stained.
- 470-480 " Dolomite; 97%; 95% light brown, white, dark brown, microcrystalline, slightly calcareous, iron stained; 5% white, pelletal, microcrystalline, iron stained.  
Ironstone; 3%.
- 480-490 " Dolomite; 98% light brown, white, microcrystalline, many loose grains, possibly pellets?, slightly calcareous, iron stained; numerous white, transparent grains, ?quartz;  
Ironstone; 2%.
- 490-500 " Dolomite; 98%, very light brown, cream, cryptocrystalline to microcrystalline, numerous transparent (quartz) and white (dolomite) grains, possibly derived from dolomitic quartz sandstone, some manganese, pyrite.  
Ironstone; 2%
- 500-510 " Dolomite; 98%; very light brown, cryptocrystalline, microcrystalline, very porous, loose, possibly friable, 90% transparent quartz grains, derived from above or interbedded sandstone.  
Ironstone; 2%.
- 510-520 " Dolomite; 98%; 40% white, microcrystalline, ? friable, very porous, iron staining; 60% transparent, rounded quartz grains;  
Ironstone; 2%.
- 520-530 " Dolomite; 100%; 80% white, pale brown, cryptocrystalline, microcrystalline, slightly calcareous, some vugs with drusy growth, slight to very porous, some transparent quartz grains.
- 530-540 " Dolomite; 100%; white, pale yellow-brown, cryptocrystalline, slightly calcareous, vuggy, some vugs with drusy growth, porosity 10%, iron staining, ? manganese grains.
- 540-547 " Dolomite; 100%; white, pale brown, cryptocrystalline, microcrystalline, rare pellets, few vugs, iron-stained, porosity 10%, rare manganese and glauconite grains.
- 547-552 " No sample. r. . . . .
- 552-560 " Dolomite; 100%; white, cryptocrystalline, microcrystalline, pelletal, vuggy with drusy growths in some vugs, porosity 10-15%, one shell fragment.
- 560-570 " Dolomite; 100%; white, very pale brown, cryptocrystalline, microcrystalline, slighty pelletal, moderately hard, vugs with drusy growths, porosity 15%, rare glauconite and manganese grains.

- 570-580 feet. Dolomite; 100%; white, pale brown, cryptocrystalline, microcrystalline, rare to moderately vuggy, some vugs lined with drusy growth, porosity 10%, very light iron staining, rare glauconite grains.
- 580-590 " Dolomite; 100%; white, pale brown, cryprocrystalline, microcrystalline, medium crystalline patches, slightly calcareous, moderately vuggy, some vugs with drusy growths, porosity 10-20%, rare iron staining, rare glauconite and blue-black manganese grains.
- 590-600 " Dolomite; 100%; white, cryptocrystalline, microcrystalline, slightly calcareous, vuggy, some vugs with drusy growths and iron staining, porosity 15-20%, no manganese or glauconite grains.
- 605-610 " Dolomite; 100%; white, microcrystalline, slightly calcareous, very vuggy, many vugs lined with drusy growths, porosity 10-20%, iron staining.
- 610-620 " Dolomite; 100%; white, light yellowish brown, cryptocrystalline, microcrystalline, very vuggy, many vugs lined with drusy growths, porosity 25-30%.
- 620-630 " Dolomite; 100%; white, very pale green, white, cryptocrystalline, microcrystalline, very vuggy and porous, rare pellets.
- 630-640 " Dolomite; 99%; <sup>90%</sup> grey, yellow-brown, brown, microcrystalline, micaceous (possible clay minerals), argillaceous, calcareous, manganese present, porosity 10%, iron staining.  
Dolomite; 9%; white, microcrystalline, medium crystalline, pelletal, vuggy with 15% porosity.  
Ironstone; 1%.
- 640-650 " Dolomite; <sup>100%</sup> 99%; grey, yellow-brown, grey-brown, microcrystalline, micaceous (? clay minerals) slightly calcareous, weak platy fracture, porosity 10%, iron staining ?manganese grains, rare glauconite.  
Dolomite; 1%; white, microcrystalline.
- 650-660 " Dolomite; 100%; light grey, grey-brown, argillaceous, micaceous (? clay minerals), slightly calcareous, some manganese grains, several glauconite pellets, moderately porous 20-30%, iron staining.
- 660-670 " Dolomite; 100%; light grey, microcrystalline, argillaceous, slightly calcareous, moderately porous, chips rare may indicate a dolomitic (claystone).
- 670-680 " Dolomite; 100%; light grey, microcrystalline, , micaceous (? clay minerals), weak fissile fracture, variable porosity <sup>eg.</sup> weathered chips, 40%, unweathered 10%. Possible dolomitic claystone in interval.
- 680-690 " Dolomite; 95%; light grey, grey-brown, argillaceous, microcrystalline. Some microcrystalline dolomite.  
Chert; 5%; grey, cryptocrystalline.
- 690-700 " Dolomite; <sup>90%</sup> 92%; grey, greenish grey, microcrystalline, , possibly silty, micaceous (? clay minerals), slightly calcareous.  
Dolomite; 2%; white, microcrystalline.  
Chert; 8%; grey, cryptocrystalline.

(700-705 feet. No samples recovered)

- 705-710 feet. Dolomite; <sup>90%</sup>75%; green, grey, greyish white, microcrystalline, argillaceous, porosity 10%.  
Dolomite; 15%; grey, white, microcrystalline medium crystalline, vuggy, porosity 30%.  
Chert; 10%; grey, cryptocrystalline.
- 710-720 " Dolomite; <sup>98%</sup>75%; grayish white, microcrystalline, argillaceous, slightly calcareous.  
Dolomite; 23%; white, cryptocrystalline, microcrystalline, hard, rare vugs, rare glauconite grains, ? shell fragments;  
Chert; 2%; grey, cryptocrystalline, aphanitic.
- 720-730 " Dolomite; <sup>100%</sup>65%; grey, microcrystalline, argillaceous, slightly calcareous.  
Dolomite; 35%; white, cryptocrystalline, microcrystalline, slightly pelletal, hard, tight, rare minute vugs, traces of glauconite and pyrite.  
<sup>98%</sup>
- 730-740 " Dolomite; 60%; grey, grey-brown, yellow-brown, microcrystalline, pelletal, micaceous (? clay minerals), slightly porous, iron stained, some manganese.  
Dolomite; 38%; brownish grey, cryptocrystalline, microcrystalline, small vugs, porosity 25%, rare glauconite grains.  
Chert; 2%; grey, cryptocrystalline, aphanitic.
- 740-750 " Dolomite; <sup>100%</sup>75%; white, brownish white, cryptocrystalline, microcrystalline, small vugs, porosity 15%, iron staining, reddish brown encrustations, some clay (? contamination).  
Dolomite; 25%; light grey, reddish brown, yellowish brown, microcrystalline, argillaceous, slightly calcareous, rare glauconite.  
Chert; 1%; grey, cryptocrystalline.
- 750-760 " Dolomite; 93%; white, brown, reddish brown, microcrystalline, moderately vuggy, porosity 10%, very iron stained.  
Chert; 7%; reddish brown (iron stained), cryptocrystalline.
- 760-770 " Dolomite; 88%; white, very light brown, microcrystalline, medium crystalline, some vugs with rare drusy growths, rare ? pyrite, glauconite grains.  
Chert; 12%; grey, bluish grey, cryptocrystalline, some relic pellets.
- 770-780 " Dolomite; 95%; light grey, light brown, microcrystalline, medium crystalline, rare pelletal, vugs with drusy growths, iron staining, glauconite pellets.  
Chert; 7%; grey, bluish grey, cryptocrystalline.
- 780-790 " Dolomite; 98%; grey, white, yellowish, pale brown, pelletal and oolitic, pellets microcrystalline, rounded, set in microcrystalline dolomite matrix, not grain-on-grain packing, rare glauconite pellets.  
Chert; 2%; grey, cryptocrystalline.

- 790-880 feet. <sup>98%;</sup>  
Dolomite; 80%; white, pale yellow brown, pelletal, well rounded, microcrystalline matrix, not grain-on-grain, 20-60% packing, rare vugs, porosity 5%, rare glauconite pellets.  
Dolomite; 18%; white, cryptocrystalline, microcrystalline, hard, tight, rare rugs some with drusy growths.  
Chert; 2%; grey, rare yellow-brown, cryptocrystalline, aphanitic.
- 800-810 " <sup>100%;</sup>  
Dolomite; 95%; white, grey-white, microcrystalline, hard, tight, occasional vugs, 5-10% porosity, large irregular glauconite pellets, rare iron staining.  
Dolomite; 5%; white, pelletal microcrystalline, well rounded set in microcrystalline matrix.  
Chert; < 1%; brown, cryptocrystalline.
- 810-820 " <sup>100%;</sup>  
Dolomite; 98%; grey, white, microcrystalline, cryptocrystalline, rare medium crystalline, hard tight, rare vugs, porosity 5%; creamy-white, white, microcrystalline, pelletal, iron staining.  
 \* rare glauconite pellets. Dolomite; 2%;
- 820-830 " <sup>100%;</sup>  
Dolomite; 100%; white, grey, light brown, microcrystalline, rare yellow-white microcrystalline pellets, hard, tight, rare vugs some with drusy growths, some iron staining.
- 830-840 " <sup>100%;</sup>  
Dolomite; 100%; white, yellow, light brown, cryptocrystalline, slightly calcareous, hard, rare vugs with drusy growths, 5% porosity, some iron staining.
- 840-850 " <sup>100%;</sup>  
Dolomite; 100%; white, yellowish, cryptocrystalline, microcrystalline, slightly calcareous, hard, tight, rare vugs - some drusy growth.  
Chert; < 1%; brown, cryptocrystalline.
- 850-860 " <sup>98%;</sup>  
Dolomite; 98%; white, cryptocrystalline, slightly calcareous, variable hardness, some vugs with drusy growth, porosity 5-10%.  
Chert; 2%; grey, brown, cryptocrystalline aphanitic.  
 (No returns between 852 and 855 feet).
- 860-870 " <sup>99%;</sup>  
Dolomite; 99%; white, microcrystalline, cryptocrystalline, medium crystalline, hard and tight, vugs with drusy growths, some glauconite, possible shell fragments. 40% chips iron-stained.  
Chert; 1%; brown, cryptocrystalline; aphanitic.
- 870-880 " <sup>95%;</sup>  
Dolomite; 95%; white, light brown, microcrystalline, to medium crystalline, only slightly calcareous, hard, tight, rare vugs and iron staining.  
Chert; 5%; grey, brown, red-brown, cryptocrystalline, aphanitic.
- 880-890 " <sup>85%;</sup>  
Dolomite; 85%; white, grey, cryptocrystalline, microcrystalline to medium crystalline, slightly calcareous, very vuggy - drusy growths, iron staining.  
Chert; 15%; grey, colourless, cryptocrystalline, aphanitic.
- 890-900 " <sup>80%;</sup>  
Dolomite; 80%; white, grey, microcrystalline, cryptocrystalline, small vugs, 10% porosity, hard, some iron staining.  
Chert; 20%; grey, white, cryptocrystalline, aphanitic (Cavity between 895 $\frac{1}{2}$ -899 $\frac{1}{2}$  feet).

## APPENDIX II - CORE PRESCRIPTIONS

### Core No. 1

Interval Cored: 220 - 229 ft.

Cut: 9 ft.

Recovered: 3 ft. of broken core.

Description: Dolomite: 100% white, with light brown patches, microcrystalline to medium crystalline, uniform, euhedral rhombs, hard, vuggy, vugs connected, formation of iron carbonate (Sidemite?), and calcareous dolomite within vugs. Some cryptocrystalline dolomite forms tight interbeds. Some thin pelletal dolarenite interbeds, pellets of microcrystalline dolomite, 0.6 mm in diameter, rounded beds tight, hard. Some microcrystalline dolomite with horizontal banding and laminae (algal?) yellow, white, silty, vuggy, some intergranular porosity. Some slightly calcareous, some manganese.

### Core No. 2:

Interval Cored: 547 - 560 ft.

Cut: 13 ft.

Recovered: 12 inches of broken core consisting of 16 pieces.

Description: Dolomite: 100% white, microcrystalline, hard, tight, vuggy; vugs interconnect, porosity (30%). Euhedral crystals occur on vug walls. Some pelletal interbeds, pellets, cream, white, well rounded, rare glauconite pellets. Some iron staining, some manganese dendrites. Fossils: 1 brachiopod shell fragment.

### Core No. 3

Interval Cored: 701 - 720

Cut: 19 ft.

Recovered: 12 inches of broken core

Description: Dolomite: 98%, dark grey, green, microcrystalline argillaceous, platy fracture, fissile?. Chert: 2%, grey, cryptocrystalline, aphanitic, weakly laminated.

### Core No. 4:

Interval Cored: 782 - 783 ft.

Cut: 1 ft.

Recovered: 10½ inches (2 pieces).

Description: Dolomite: 100% grey white, pale brown-grey, microcrystalline densely pelletal and possibly oolitic, tight, hard; crystalline dolomite (1%), vugs (3 mm in diameter), giving porosity of 10%, stylolites and fine fractures. Iron nodule, 0.5 mm wide in fracture. Some manganese dendrites.

### Core No. 5:

Interval Cored: 784 - 788' 6"

Cut: 4' 6"

Recovered: 3 ft. (left last 1½" in hole).

Description: Dolomite: 96%; pelletal and oolitic dolarenite, grey, white, yellow, brown; pellets of microcrystalline dolomite form 20 - 70% of sample, well rounded, not grain-on-grain, set in matrix of microcrystalline dolomite. Small percentage medium crystalline dolomite.

3

Chert: 4%, grey, blue, cryptocrystalline, aphanitic, replaced pelletal dolomite. Dolomite slightly calcareous, vuggy, vugs up to 10 cms long, vertical in core; porous parts connected, stylolites, and fine fractures present. Some Manganese grains, and glauconite pellets.

Core No. 6:

Interval Cored: 885' - 886' 6"

Cut: 1' 6"

Recovered: 1' 2"

Description: Dolomite: 75%, grey, white, microcrystalline, medium crystalline, fracturing planes around chert, stylolites, vugs approx. 1.25 cms. in diameter, euhedral crystals lining vugs and stylolites. Chert: 25%, light grey, cryptocrystalline, aphanitic, with conchoidal fractures, some filled with crystalline calcite, nodules.

Core No. 7:

Interval Cored: 940 - 947' 6"

Cut: 7' 6"

Recovered: 4 $\frac{1}{2}$ " (broken core)

Description: Dolomite: grey, white, microcrystalline, clay pellets fine sand size with "spine-like" problematica small, irregular shape, iron staining. Chert: light, medium grey, cryptocrystalline, nodular, fractured.

Core No. 8:

Interval Cored: 947' 6" - 951 ft.

Cut: 3' 6"

Recovered: 4" (broken core)

Description: Dolomite: white, grey, brown-grey, microcrystalline, granular texture, tight, hard. Some euhedral medium crystalline areas, vugs with drusy growth. Dendritic Manganese. Chert: white, grey, cryptocrystalline, aphanitic, nodular, fractured.

Core No. 9:

Interval Cored: 1006 - 1016 ft.

Cut: 10 ft.

Recovered: 12 inches.

Description: Dolomite: 100%, white, grey, slightly calcareous microcrystalline to medium crystalline, fossiliferous (shell fragments), vuggy. Vugs lined with euhedral drusy crystals. Some intergranular porosity in coarser crystalline parts. Some irregular shaped glauconite pellets.

Core No. 10:

Interval Cored: 1075 - 1085 ft.

Cut: 10 ft.

Recovered: 1' 6"

Description: Dolomite: 100%, medium grey, to brown-grey, microcrystalline to medium crystalline; fossiliferous (two shell fragments), vugs, few, large, iron-stained. Irregular areas veins of white coarse crystalline dolomite.

Core No. 11:

Interval Cored: 1136 - 1139 ft.

Cut: 3 ft.

Recovered: 1' 3"

Description: Dolomite: 100%, white, grey, microcrystalline to medium crystalline, with granular texture, tight, hard; white coarse crystalline dolomite, dark grey-black, carbonaceous clay films on fractured planes and stylolite surfaces.

Core No. 12:

Interval Cored: 1202 - 1205 ft.

Cut: 3 feet.

Recovered: 1' 5"

Description: Limestone: 80%, grey, brown microcrystalline, thin (0.5 mm) laminae in limestone with thin, very dark grey-black, carbonaceous vague pellets?, slightly calcareous. Chert: 20% medium blue-grey, nodular, cryptocrystalline, aphanitic with thin, white rims.

Core No. 13:

Interval Cored: 1255' 6" - 1256' 6"

Cut: 1 ft.

Recovered: 7 inches.

Description: Limestone: 98%, medium grey, brown, cryptocrystalline to microcrystalline with vague granular texture, lingula present, (carbonaceous laminae, pyrite, granular, scattered) Veins of coarse crystalline, slightly calcareous dolomite in Chert: 2% fractured, nodular, blue-grey, brown.

Core No. 14:

Interval Cored: 1308 - 1318 ft.

Cut: 10 ft.

Recovered: 1' 6"

Description: Dolomite: 100%, light brown-grey, cryptocrystalline to microcrystalline, vuggy. Vugs, with drusy crystals, interconnected. Porosity variable 20-60%, possible shelly fragments.

Core No. 15:

Interval Cored: 1390 - 1400 ft.

Cut: 10 ft.

Recovered: 7' 6"

Description: Dolomite: 100%, light brown, grey-brown, mottled, cryptocrystalline to microcrystalline, calcareous, appears fragmental in section and mottled in plan. Pores with carbonate crystals. Intergranular porosity (15-50%).



Thin, carbonaceous (?), dark grey and iron stained laminae are present.

Core No.16

Interval Cored: 1450 - 1451'6"

Cut: 1'6"

Recovered: 11"

Description: Sandstone: 100%, white, grey, medium grained, quartz. Quartz grains are colourless, transparent to translucent, subrounded, moderately sorted, and partly bound by siliceous cement, vague laminae. Porosity (20 - 40%): Some white clay? pellets or pore fillings.

Core No.17

Interval Cored: 1495 - 1500 feet.

Cut: 5 feet.

Recovered: 3'6" feet

Description: Sandstone: 100%; 50% grey, medium and dark red-brown, medium grained, quartz. Quartz grains, colourless, translucent to transparent, subrounded, moderately sorted, siliceous cement. 50%, pebbly quartz sandstone; pebbles, rounded, quartz, average diameter 1 cm. Minor, green-grey, micaceous siltstone occurs at 1495'7". Dip, almost horizontal with thin to medium bedding and cross-lamination.

Core 18

Interval Cored: 1500 - 1501'6"

Cut: 1'6"

Recovered: 1'3½"

Description: Sandstone: 100%, grey to medium red-brown, pebbly quartz sandstone grading to a coarse-grained quartz sandstone at 1500'8". Matrix of iron-rich material.

# COMPOSITE WELL LOG

OPERATOR: BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

PETROLEUM TENEMENT: OIL PERMIT 61

WELL NAME AND No: B.M.R. No.11 (CATTLE CREEK)

NORTHERN TERRITORY

4-MILE SHEET: F53-4 AVON DOWNS, BASIN GEORGINA

WELL STATUS SECURED PENDING COMPLETION  
AS WATER WELL FOR PROPERTY

LOCATION - Lat. 20°00'33" S. Long. 137°50'06" E.  
ELEVATION - Reference Datum (R.T.) 742' A.S.L.  
Ground Level 736' A.S.L.

Date Spudded 8.7.63.  
Date Drilling Stopped 14.11.63.  
Date Rig Off 16.11.63.  
Total Depth Driller 1501.5'  
GRN Log 1501'

Hole Size in. from to  
12 1/4 5/8 28'  
8 1/2 28' 411.5'  
6 1/4 411.5' 903'  
6 903' T.D.

Casing in. Wt. Gr. Depth Cmt. Cmt'd To  
9 3/8 36" J-55 27.5' 8x 50'  
20 J-55 410' 60x 50' (est)

Cement Plugs Nil

Perforations Nil

## ELECTRIC LOG DATA

SERVICE	SCHLUMBERGER	BUREAU OF MINERAL RESOURCES
LOG TYPE	Electric	S.P. & 16" N
RUN No & SCALE	1 2" & 5"	1 1" 2 1"
DATE RUN	16.11.63.	16.11.63.
FIRST READING	1497'	1498'
LAST READING	408'	410'
INTERVAL MEASURED	1089'	1088'
CASING: E-LOG	408'	411'
: DRILLER	410'	410'
DEPTH REACHED	1499'	1500'
BOTTOM DRILLER	1501.5'	1501.5'
MUD NATURE	Water	Water
DENSITY	8.33	8.33
RESISTIVITY	12.0 @ 84°F	12.2 @ 90°F
RESIST. B.H.T.	@ 96°F	@ 96°F
STANDING WATER LEVEL	191'	191'
BIT SIZE: 1	6 1/4" to 903'	6 1/4" to 903'
SPACING AM <sub>1</sub>	16"	16"
AM <sub>2</sub>	64"	63"
AO	18" 8"	
WEIGHT USED	No	No
RECORDED BY	P. HUSTEN	A. RADESKI

## RADIOMETRIC LOG DATA

SERVICE	SCHLUMBERGER	B.M.R.
LOG TYPE	GRN	Gamma
RUN No & SCALE	1 2" & 5"	1 1"
DATE RUN	16.11.63.	7.11.63.
FIRST READING	1500'	1355'
LAST READING	100'	170'
INTERVAL MEASURED	1400'	1285'
CASING: GRN-LOG	408'	
: DRILLER	410'	410'
MUD NATURE	Water	Water
MAX. RECORDED TEMP.	96°F	
STANDING WATER LEVEL	190'	191'
TIME CONSTANT SECS	2	5
LOGGING SPEED ft/min.	30	70
STAT. VARIATION ins.	0.3	0.5
RECORDED BY	P. HUSTEN	A. RADESKI

## OTHER BORE-HOLE LOG

Temperature: Schlumberger - incomplete  
Micro-Caliper: Schlumberger - incomplete  
Other: Nil

## LITHOLOGICAL REFERENCE

Drilling Contractor: W.L. Sides & Son Pty. Ltd.  
Well Head Fittings: Welded steel plate  
Cemented by: Drilling Contractor  
Logged by: Schlumberger & B.M.R.  
Drilling Method: Air Hammer & Rotary  
Mud logging by: Nil  
Lithology by: N.E.A. JOHNSON, other by: M. Bell

Chert Quartz sandstone Pebble Quartz sandstone Dolomite Argillaceous Dolomite Limestone Macrofossils

