

COMMONWEALTH OF AUSTRALIA
DEPARTMENT OF NATIONAL DEVELOPMENT
BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

PETROLEUM SEARCH SUBSIDY ACTS

Publication No. 2

WOOMERA No. 1 BORE, SOUTH AUSTRALIA
OF
CLARENCE RIVER BASIN OIL EXPLORATION CO N.L.

Issued under the Authority of Senator the Hon. W. H. Spooner,
Minister for National Development
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COMMONWEALTH OF AUSTRALIA
DEPARTMENT OF NATIONAL DEVELOPMENT

Minister : SENATOR THE HON. W. H. SPOONER, M.M.

Secretary : H. G. RAGGATT, C.B.E.

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Director : J. M. RAYNER

This Report was prepared for publication in the Geological Branch

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FOREWORD.

In 1957, the Commonwealth Government enacted the Petroleum Search Subsidy Act, under which companies proposing to drill for new stratigraphic information could apply for and be granted subsidies in respect of the cost of drilling operations approved by the Minister for National Development.

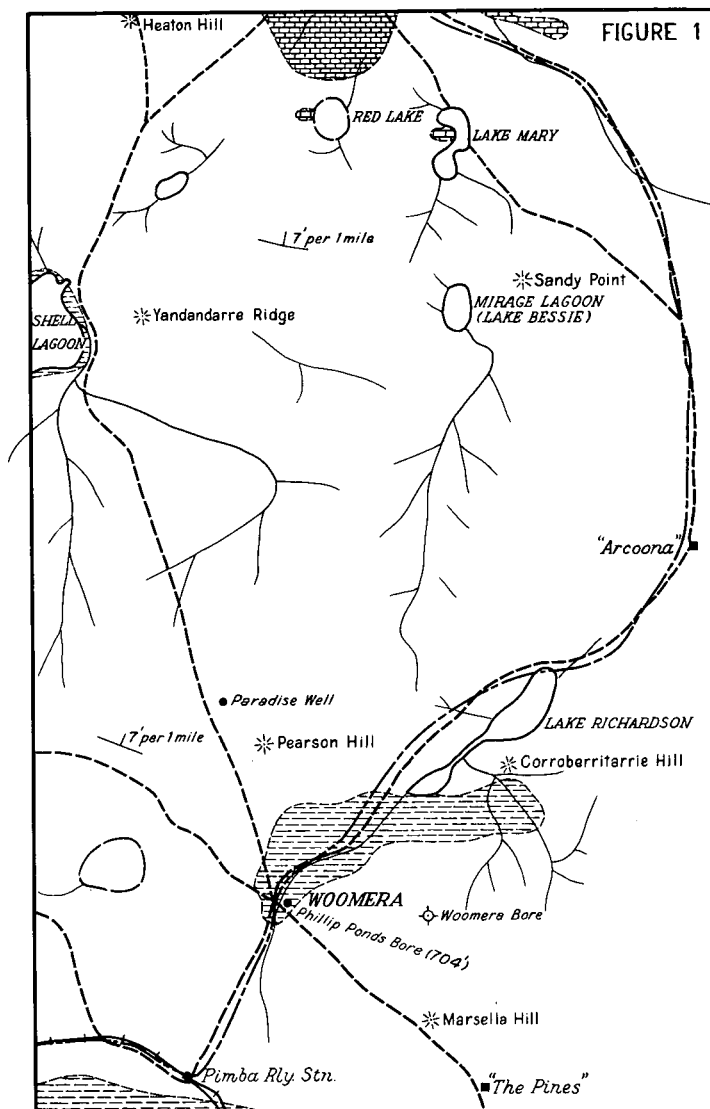
The Bureau of Mineral Resources, Geology and Geophysics was required on behalf of the Department of National Development, to examine the applications, maintain general oversight of the operations, receive the samples and information, and in due course publish the results of the drilling.

The bore to be described in the following pages was put down under the Petroleum Search Subsidy Act 1957-58 by Clarence River Basin Oil Exploration Co. N.L. at Woomera in South Australia. This publication was prepared from reports furnished by the Company and by specialists employed on certain phases of the operation, and presents in detail the method of carrying out the drilling operation and the results obtained.

(J.M. RAYNER)
Director.







ERRATA

- Page 10 Column two, Fifth description should read 14' 0" not 15' 0" as shown.
- Page 11 Column two, Twenty sixth description should read 88' 0" not 80' 0" as shown.



GENERALIZED GEOLOGICAL MAP WOOMERA AREA

4 0 4 8 MILES

- | | | | |
|---|-----------|---|--|
|  | Limestone |  | Boundary-Oil Exploration Licence No 12 |
|  | Shale |  | Oil bore (Dry) |
|  | Sandstone |  | 704' Water bore |
- PROT.-?CAMB. ?CRET.

SUMMARY.

Woomera Bore 1 was drilled to a depth of 2,005 feet. Four formations were penetrated, believed to be of Cambrian and/or Proterozoic age. The nature of these beds suggests that the area has no petroleum prospects. The age of the strata penetrated is uncertain, as no fossils have been observed. No results were obtained from a formation test carried out with the packer set at 1,445 feet.

INTRODUCTION.

This completion report is one of a series of reports published on bores subsidized under the Petroleum Search Subsidy Act 1957-1958. The Woomera Bore is one of the earlier wells subsidized and at the time of approval of the agreements no stipulation was made for the providing by the company concerned of a detailed completion report. The present report is written by officers of the Bureau of Mineral Resources, guided by information from the Department of Mines of South Australia, received in reports by Stanley Ablamowicz, M.Aust.I.M.M., A.M.I.P.E.Gr.Brt., and by F.N. Betheras, Assistant Chief Mechanical and Boring Engineer; and from geological reports by F.N. Hanlon, B.Sc., M.Aust.I.M.M., Consulting Geologist for the Clarence River Basin Oil Exploration Co. N.L., and Keith R. Miles, D.Sc., F.G.S., M.Aust.I.M.M., South Australia.

The object of drilling the hole was to ascertain the nature of the sediments in an area of little outcrop, where it was thought possible that the petroliferous Cambrian of the Wilkatana area might be present.

BORE HISTORY.

General Data.

Bore name and number:	Woomera Bore 1.
Location:	Latitude: 31° 11' south. Longitude: 136° 51' east.
Permit holder:	Clarence River Basin Oil Exploration Co. N.L.
Permit:	Oil Exploration Licence No. 12.
District:	Pimba Phillip Ponds, Woomera, South Australia.
Total Depth:	2,005 feet.
Date Spudded:	7th February, 1958.
Date Completed:	30th May, 1958.
Actual drilling time:	66 days.
Elevation:	370 feet above sea level.
Status:	Dry and abandoned. A wood plug was placed and bricked over.

Drilling Data.

Name and address of drilling contractor: Department of Mines, South Australia. Driller: R. Stempel.

Rig type and rating: Mindrill E.2000', Rating 2000 feet with N.X. and 3000 feet with A.X. drill rods.

Hole size: 4" size hole to 102'8"
3" size hole to 1003 feet
2-3/8" size hole to 2005 feet

Casing: N.X. casing at 102'8"
B.X. casing at 1033 feet.

Water Supply: The water used was salt and obtained from a nearby waterbore 750 feet deep.

Drilling Fluid: Water was used for drilling except between 915 and 1030 feet, when 2 tons of mud were used. During logging no mud was present. The bore was filled with water to the static level of 20 feet.

Pumps: Two pumps, Mindrill type 750 were used.

Drilling bits: Diamond bits as made by Mindrill with 71 Mintung matrix.

Equipment left in hole: 672 feet B.X. casing was left in the hole.

Coring.

The bore was continuously cored. Core recovery was very good except from 886-1017 feet. Core barrels used are stationary inner tube and single tube barrels. For core description see Appendix I.

Electrical logging.

- (a) Radioactivity log from 0-2005 feet.
- (b) Resistivity log (short normal) from 0-1900 feet.
- (c) Resistivity log (long normal) from 0-1900 feet.
- (d) Resistivity lateral log from 0-1900 feet.
- (e) Self-potential log from 0-1900 feet.

For details see Appendix II and Plate 2.

Temperature records.

Temperature log °C. from 0-2005 feet (see Plates 1 and 2).

Formation Tests.

A formation test carried out with the packer at 1,445 feet gave no results. Surging of the bore for a period of 1½ hours resulted in the drawing of approximately 2,000 gallons of water. For details see Appendix III.

GEOLOGY AND STRATIGRAPHY.

The amount of actual rock exposed within the area is very small, probably less than 1%. The bulk of the underlying rock is masked by sand, clay soil, tertiary gravel, and gibber. A broad description of the geology of the area is given in the Journal of the Geological Society of Australia, Vol. 5, Part 2, pp. 74-77.

Rock units identified in the area are probably of two ages: Mesozoic (?Cretaceous) and ?early Palaeozoic/Late Proterozoic (?Cambrian).

The Mesozoic (?Cretaceous) rocks comprise siliceous shale, sandy shale and white sand or sandstone, usually highly decomposed and silicified to a white crustal deposit at the surface, which occupies the higher ground in the Mt. Eba-Millere Creek areas. The deposits are non-marine and have no known organic remains to determine their age.

The Palaeozoic/late Proterozoic sediments consist of a sequence of limestone, greywacke, and shale, and are covered in the eastern half of the Licence area by the gibber tableland of the Woomera region and adjoining mulga plains and sand dune country. They are believed to belong to the same general stratigraphical formations as are exposed in the Tent Hills and other plateau country near Port Augusta, and are thought to be part of a continuous succession of sediments of very early Cambrian or very late Precambrian age.

The bore commenced in the lowermost outcropping shale of the Palaeozoic-Proterozoic sequence, and penetrated a sequence which is not exposed in the vicinity. It has been hoped that the base would have penetrated Cambrian limestone; the absence of such beds decreases the prospects of oil from the older rocks in the area in general.

The sequence encountered in the bore consists essentially of two shale-siltstone formations alternating with two greywacke formations.

The topmost shale-siltstone formation (from 0-784 feet) is generally reddish-brown and greenish-grey. Its uppermost 263 feet contains some greywacke beds. This formation is underlain by 333 feet (784' - 1117') of medium-grained to coarse-grained pinkish greywacke. Underlying the greywacke (from 1117'-1490') there is 373 feet of grey shale and siltstone containing some veins of gypsum and anhydrite. The interval becomes more silty towards its base. From 1490 to 2005 feet (total depth) the bore passed through greywacke and quartz greywacke, medium-grained to coarse-grained, predominantly reddish-brown, with, in parts, pebbles ranging from $\frac{1}{2}$ to 1 inch. Parts of the beds are arkosic and micaceous.

Cores at 1189, 1300, 1398, and 1489 feet were examined by Dr. P.R. Evans for microplankton. They proved to be barren. Since no macrofossils were observed either, the age of the sediments could not be determined.

RELEVANCE TO OCCURRENCE OF PETROLEUM.

No results were obtained from the formation test. The greasy material collected from the first surge test is considered to have come from the preservative grease on the rods and casing, which had probably collected in the settling pit.

Negative results were obtained from the second surge test, which was the more reliable one.

APPENDIX I.Core Descriptions.

The following are the lithological core descriptions made by the Mines Department of South Australia, with some amendments made on examination of core samples received by the Bureau of Mineral Resources.

Strata	Thickness	Depth
Broken surface material, gibbers and alluvium	12' 10"	0 - 12'10"
Shale and siltstone, pinkish-grey in upper sections becoming more reddish-brown in lower part. Slump structures at 63 feet	79' 2"	12'10" - 92'0"
Shale, reddish-brown & grey, becoming silty and grading to siltstone.	10' 4"	92' 0" -102'4"
Shale & siltstone, grey & reddish-brown, rhythmically interbedded, current-bedded; in parts some shale breccia; becoming more silty towards base.	35' 8"	102' 4" -138'0"
Greywacke, medium-grained with quartz, interbedded with shale & siltstone, grey & reddish brown; shale breccia in central portion.	15' 0"	138' 0" -152'0"
Greywacke, fine-grained to medium-grained, reddish-brown & grey; few shale fragments.	1' 0"	152' 0" -153'0"
Shale, grey & reddish brown, inter bedded with siltstone in part.	7' 6"	153' 0" -160'6"
Greywacke, medium-grained, shale pebbles and lenses.	2' 0"	160' 6" -162'6"
Greywacke, medium-grained to coarse-grained, reddish-brown & grey, with shale lenses, and pebbles.	16' 9"	162' 6" -179'3"
Shale, reddish-brown & grey, interbedded with siltstone.	5' 9"	179' 3" -185'0"
Siltstone & shale with bands of medium-grained to coarse-grained greywacke.	11' 0"	185' 0" -196'0"
Greywacke, fine-grained thinly bedded.	7' 3"	196' 0" -203'3"
Greywacke, medium-grained to fine-grained, reddish-brown and grey, thinly bedded in part.	23' 9"	203' 3" -227'0"
Shale and greywacke, reddish-brown and grey.	7' 0"	227' 6" -234'0"
Greywacke, fine-grained, reddish-brown.	6' 0"	234' 0" -240'0"

Strata.	Thickness.	Depth.
Shale, reddish-brown, with bands of greywacke.	3' 9"	240' 0" - 243' 9"
Greywacke, and laminated hematitic siltstone interbedded with shale.	19' 3"	243' 9" - 263' 0"
Shale, reddish-brown with greenish grey bands, tending to hematitic siltstone; in places some current bedding.	521' 6"	263' 0" - 784' 6"
Greywacke, coarse-grained with quartz, pinkish, top 3 feet finer grained.	58' 6"	784' 6" - 843' 0"
Greywacke, coarse-grained to medium-grained with few thin finer-grained bands.	42' 0"	843' 0" - 885' 0"
Clayey silty material, reddish-brown.	1' 0"	885' 0" - 886' 0"
No core.	20' 0"	886' 0" - 906' 0"
Quartz greywacke, coarse-grained, pinkish; only 4" of core recovered.	4' 0"	906' 0" - 910' 0"
Greywacke, coarse-grained to medium-grained, pinkish, porous, friable, current-bedded in part; half of core lost.	94' 0"	910' 0" - 1004' 0"
Clayey-silty material; large part of core lost.	16' 0"	1004' 0" - 1020' 0"
Quartz-greywacke, hematitic, coarse-grained to medium-grained, pinkish; some finer bands towards base.	80' 0"	1020' 0" - 1108' 0"
Greywacke, fine-grained to medium-grained.	3' 0"	1108' 0" - 1111' 0"
Shale, grey, slickensided, probably large pebble.	6"	1111' 0" - 1111' 6"
Greywacke, coarse-grained, pebbly, pebbles up to 1/4".	6' 0"	1111' 6" - 1117' 6"
Shale breccia.	1' 0"	1117' 6" - 1118' 6"
Shale, grey, some veins of gypsum and anhydrite, with bands of siltstone becoming more frequent towards base.	371' 0"	1118' 6" - 1489' 6"
Calcareous greywacke, dark grey, coarse-grained, "tuffaceous"; medium grained hard thin bed with interbedded laminae of greywacke siltstone.	6"	1489' 6" - 1490' 0"

Strata.	Thickness.	Depth.
Quartz greywacke, medium-grained to coarse-grained with finer bands, pebbly in part with pebbles up to $\frac{1}{2}$ " and odd ones up to 1", purple to reddish-brown colour predominating over lighter colours. Generally finer grained in lower part; some beds arkosic and micaceous.	515' 0"	1490' 0" -2005' 0"

ERRATA

Page 13 First paragraph, the last sentence should read. "The top 1033 feet were cased and water stood at 10 feet below the surface" not "The top 1090 feet were cased and water stood at 10 feet below the surface."

APPENDIX II.Notes on Geophysical Logging of Diamond Drill Hole Woomera No. 1.

by K.R. Seedsman *

The following logs were obtained in the Woomera Bore No. 1:

- (1) short normal probe resistivity, electrode spacing MA = 18 ins.;
- (2) long normal probe resistivity, electrode spacing MA = 66 ins.;
- (3) lateral probe resistivity, electrode spacings MA = 234 ins., AB = 18 ins.
- (4) spontaneous potential;
- (5) radioactivity;
- (6) temperature;

and are shown on Plate 2. Logs (1) and (2) were run concurrently down the hole, (3) and (4) concurrently up the hole, (5) alone, upwards, and (6), alone, downwards. The depth reached in each trip down the hole was about 40 feet short of the drilled depth, 2005 feet, possibly owing to the accumulation of cuttings in the bottom. The top 1090 feet were cased and water stood at 10 feet below the surface.

The short normal, the long normal, and part of the lateral probe resistivities were measured with a constant applied current of 0.1 amp. While the lateral was being run the applied current was increased to 0.5 amp. at the point indicated. The logs have not been interpreted quantitatively, and the horizontal scales of the resistivity curves have not been converted to resistivity units but left in terms of the measured potential.

A thermistor in the top of the probe was used to measure the temperature of the water in the hole after it had lain undisturbed for several days. The radioactivity within the hole was detected with a 10-inch Geiger tube and recorded as shown with a full scale deflection of 20 counts per minute.

The general principles of electric log interpretation have been stated in "Geophysical Prospecting for Oil", by L.L. Nettleton, as follows :-

- "1. A high resistivity means either
 - a. A non-porous formation containing relatively little conducting fluid (i.e. salt water).
 - b. A porous formation containing a non-conducting fluid such as oil or gas.
2. A low resistivity means a porous formation containing a conducting fluid (i.e. salt water).
3. A high self-potential value means a permeable formation."

As a rule clays and shales have lower resistivities than sands. An increase in radioactivity is probably caused by an increase in potassium content, the potassium being present in feldspathic or clayey material, or to increase in carbon or hydrocarbon which commonly absorbs radioactive particles.

Between 770 feet and 1100 feet, and below 1370 feet, the general level of radioactivity is low. These areas may be sandstone and the higher radioactivity areas may be predominantly shale. A change in the general temperature gradient near 800 feet suggests a change in rock type.

From the number of peaks on the resistivity logs the succession below the casing must consist of thin, alternating beds of non-porous rock (peaks) and either shale or porous rock saturated with salt water (low resistivities).

*Geophysicist, Department of Mines, South Australia.

APPENDIX III.Formation Tests in Woomera No. 1 Bore.

by F.N. Betheras *

The following tests were carried out on 9th and 10th June, 1958.

(a) Formation Test.

A formation tester that could be used in a BX hole was designed and manufactured by the Mechanical and Boring Branch of the Department of Mines.

This equipment was lowered down the hole and the packer expanded to seal the hole at a depth of 1445 feet. It had been intended to expand the packer at a depth of 1485 feet, but an obstruction in the hole 40 ft. above bottom would not allow the tail rods to go right to the bottom of the hole. Examination of the core shows that at a depth of 1445 feet the walls of the hole should have been smooth and suitable for the packer to make a good seal.

The packer was left expanded for a period of one hour. No water was forced to the top of the rods and there was no evidence of any gas. The height to which the water came up the rods could not be determined, but there was no evidence of any pressure developing below the packer.

On withdrawal of the formation tester, the packer showed evidence that it had sealed the hole.

(b) Surging of Bore.

A surger to fit inside BX casing was made and was used at Woomera in an attempt to develop the bore.

On 9th June, 1958, surging was carried out for a period of 1½ hours at an estimated rate of 1200 to 1500 gallons per hour. A total of approximately 2000 gallons of water was drawn from the bore. Samples of water were taken at the beginning and end of the surging.

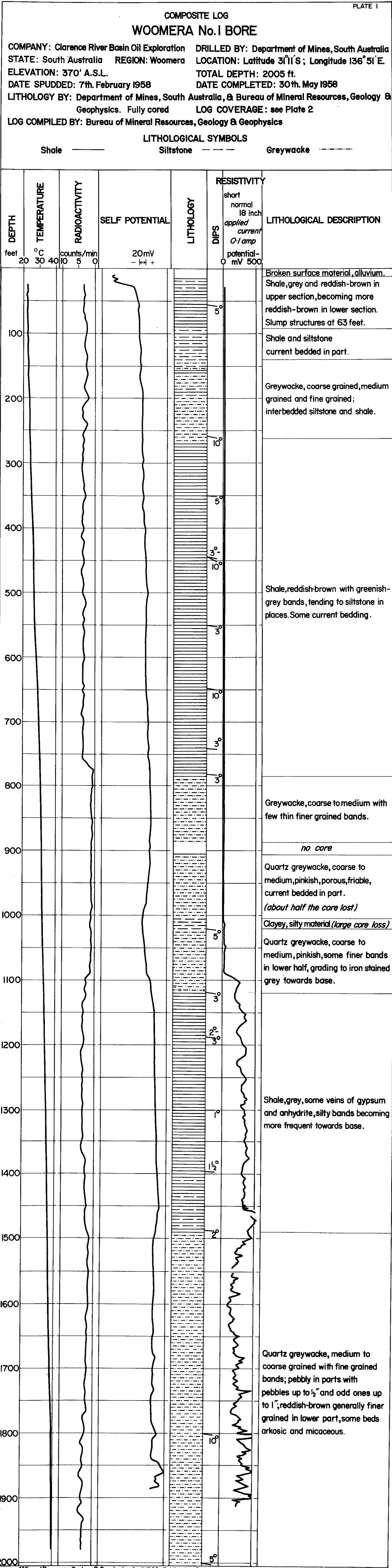
During surging a film of greasy material was noticed on the surface of the settling pit. This was found to be fluorescent and a sample was collected.

It was then learnt from the driller that some of the casing and rods used in the hole was new and still retained the manufacturer's preservative grease. The surger was a close fit in the casing and would have removed any grease that may have still been on the inside of the casing. The sludge in the settling pit appeared to contain a certain amount of grease and a sample of it was collected. This surging was done before the formation test was carried out.

On 10th June, 1958, after the formation test was completed, further surging was done. In this test, in order to prevent contamination from any grease that might be in the drain or settling pit, the water was run direct into a clean tank.

A light scum formed on the surface of the water while surging was in progress, but it did not persist after surging was stopped. It was similar to scum that is normally obtained in surging and was not greasy. There was not sufficient scum to collect a sample.

* Assistant Chief Mechanical and Boring Engineer, Department of Mines, South Australia.



GEOPHYSICAL LOGS BY DEPARTMENT OF MINES, SOUTH AUSTRALIA
WOOMERA No.1 BORE

PLATE 2

Hole Size : 4" to 102'8", 3" to 1033', 2 3/8" to 2005'
Drilling Fluid: salt water (no resistivity reported)

Depths relate to ground level
Mindrill diamond bite, with 71 Mintung matrix

