COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

PETROLEUM SEARCH SUBSIDY ACTS

Publication No. 3

KARUMBA A.A.O. No. 8 BORE, NORTHERN QUEENSLAND

OF

ASSOCIATED AUSTRALIAN OILFIELDS N.L.

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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

Deputy Director : H. TEMPLE WATTS

This Report was prepared for publication in the Geological Section

Chief Geologist : N. H. FISHER

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 Mines Administration Pty Ltd for Associated Australian Oilfields N.L. at Karumba on the Gulf coast of Queensland. 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. Comments by the Bureau are attached as footnotes.

(J.M. RAYNER)
Director.

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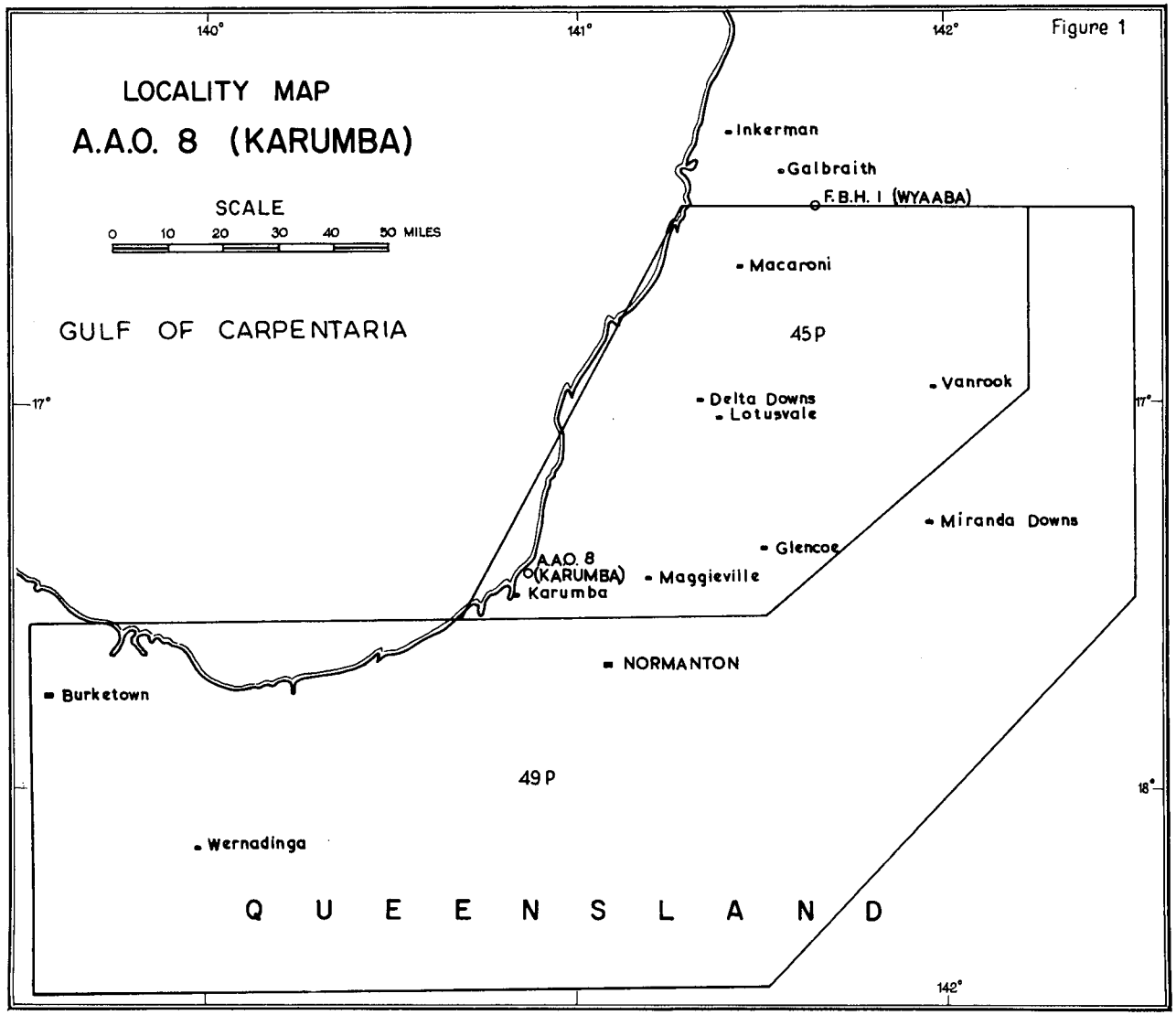
Figure 1
LOCALITY MAP
A.A.O. 8 (KARUMBA)
SCALE
0 10 20 30 40 50 MILES
GULF OF CARPENTARIA
140°
141°
142°
17°
18°
Inkerman
Galbraith
F.B.H. 1 (WYAABA)
Macaroni
45P
Vanrook
Delta Downs
Lotusvale
Miranda Downs
Glencoe
A.A.O. 8
(KARUMBA)
Karumba
Maggieville
NORMANTON
Burketown
49 P
Wernadinga
Q U E E N S L A N D

INTRODUCTION.

The completion report of A.A.O. No. 8, (Karumba) has been written by A.C.M. Laing* and contributions on Petrology by N.C. Stevens,*** Micropalaeontology by I. Crespin,** and Electrical Logging by D.F. Dyson** are appended. The report is one of a series of reports published on bores subsidized under the Petroleum Search Subsidy Act, 1957-58.

The hole was put down to determine the stratigraphical sequence of the south-eastern part of the Carpentaria Basin, an extension of the Great Artesian Basin, and to evaluate the significance of a gravity high.

The significance of the bore is that the stratigraphical sequence of the area and the depth of basement are now actually known from drilling evidence. It is the third test bore recently drilled in the Gulf of Carpentaria, on geophysical indications. The other two are Wyaaba No. 1 (Frome-Broken Hill Co. Pty Ltd), and Weipa No. 1 (Zinc Corporation Ltd). The stratigraphy encountered in these bores is shown on the correlation chart, Plate 2.

A composite well log of A.A.O. No. 8 is attached (Plate I). It is surprising to note from the log that no separate tests were made of the intervals 760-900 feet and 1540-1630 feet. The electrical log for both intervals suggests possibilities of oil, gas, or salt water; a small gas show was actually observed at 1595 feet.

* Mines Administration Pty Ltd, Brisbane.
** Bureau of Mineral Resources, Canberra.
*** University of Queensland.

COMPLETION REPORT ON A.A.O. 8, KARUMBA, QUEENSLAND

by

A.C.M. Laing. *

SUMMARY.

Quartzite basement was encountered at 2360 feet. Four permeable sandstone members separated by shale were penetrated above basement; the upper two of these showed oil fluorescence. A formation test in the Wrotham Park Sandstone brought in only artesian water high in fluorine. The bore was abandoned.

BORE HISTORY.

General Data.

Name and number	:	A.A.O. No. 8 (Karumba).
Location	:	Latitude 17°24'36.4" South.
	:	Longitude 140°52'21.9" East.
Permit Holder	:	Associated Australian Oilfields N.L., 360 Collins Street, Melbourne.
Authority to Prospect No.	:	45
District	:	Karumba, Northern Queensland.
Total Depth	:	2,364 feet.
Date Spudded	:	6th February 1958.
Date completed	:	3rd March 1958.
Actual drilling time	:	14 days.
Elevation (rotary table)	:	20 feet a.s.l.
Status	:	Abandoned, by placing cement plugs from 2,280 to 2,260 feet, from 198 to 98 feet, and from surface to 20 feet.

Drilling Data.

Drilled by	:	Mines Administration Pty Ltd, 31 Charlotte Street, Brisbane.

* Geologist, Mines Administration Pty Ltd, Brisbane.

Rig type and Rating	:	Sullivan 300A mounted on an A.E.C. 6 x 6 truck powered by two International U.D. 14A diesel 75 h.p. motors, using a welded seamless steel tubing, hydraulically raised, 65 feet mast. Rated capacity 3,500 feet.
Hole size and casing	:	11" hole to 203 feet. 8-5/8" 36lb. casing to 198 feet cemented to surface, 5-5/8" hole from 203-2364 feet
Drill pipe and collars	:	2-7/8" Internal Flush, Range 1 Grade D Drill pipe, with four to six 2-7/8" I.F. by 4-1/2" O.D. 30 feet National drill collars.
Pump	:	Gardner Denver trailer-mounted FX/FXO (7-1/4" by 10") pump with vee-belt drive from two International U.D. 14A diesels, 150 h.p.
Drilling mud and water supply	:	See Appendix A.

Ditch Cuttings.

Ditch cuttings were taken at regular intervals of ten feet.

Coring.

Three cores were taken: 1303-1323 feet, 2191-2195 feet, and 2363-2364 feet. For details see Appendix B.

Electric logging.

Electric logging was carried out by the Bureau of Mineral Resources, Geology and Geophysics. The hole was logged to a depth of 2360 feet by self potential and single point resistivity methods. For details see p.25ff.

Drilling time.

See Composite Log, Plate 3.

Formation test.

One test was carried out on the Wrotham Park sandstone. With the hole at total depth the packer was set at 2279 feet. Water flowed from the drill pipe, which was 8 feet above the rotary table, after 28 minutes. For details see Appendix C.

GEOLOGY.

Previous work.

Before drilling A.A.O. No. 8 Bore the Company carried out a gravity survey over the area of ite permit, locating a gravity high at Karumba. The bore was drilled 5,000 feet to the west of the crest of this gravity high, just inside the 14 milligal contour. The Karumba gravity high is one of the gravity

closures along the north-north-east extension of the Boomarra Ridge. The bore was located in the coastal dunes $4\frac{1}{2}$ miles north of the Karumba Pilot Station, Gulf of Carpentaria. It is situated 10 miles north of the southern boundary between Associated Australian Oilfields N.L. Authority to Prospect No. 45 and Associated Freney Oil Fields N.L. Authority to Prospect No. 49.* The bore was sited on the west side of the gravity high not only for all-weather access to the Karumba airstrip during the wet season, but also in case artesian water, if present, had pushed any oil to the west of the structure, and in case permeable beds were lacking right on top of the structure.

If the calculations of basement depth from the gravity calculations continue to be correct, then it is likely that where the bore was drilled the basement is about 50 feet lower than at the top of the gravity high.

No drilling had been carried out previously in the near vicinity of the Karumba Bore.

Stratigraphy.

The following stratigraphical sequence** was encountered in the bore (datum level 5 feet above ground):

AGE	FORMATION	DEPTHS
QUATERNARY		5 - 70 feet
TERTIARY	Lynd Formation	70 - 129 "
UPPER ALBIAN	Normanton Formation	129 - 1246 feet
	Kamileroi Limestone	1246 - 1300 "
LOWER APTIAN	Blackdown Formation	1300 - 2279 "
LOWER CRETACEOUS TO UPPER JURASSIC	Wrotham Park Sandstone	2279 - 2360 "
PALAEOZOIC OR PROTEROZOIC	Basement	2360 - 2364 "

Quaternary: 5 - 70 feet.

A recent deposit, consisting mainly of shells and shell fragments and minor sand with hard bands of coquinite. Drilling was generally easy in the formation, though some thin hard bands slowed down drilling. There were no signs of oil or gas.

Lynd Formation: 70 - 129 feet.

A coarse to gritty sandstone consisting mainly of quartz grains with minor muscovite, shell fragments, laterite pebbles, metamorphic pebbles and dark mineral (ilmenite?). This unit is included in the Lynd Formation mainly because of the presence of derived laterite pebbles. Drilling was easy in this formation. There were no signs of oil or gas.

* The Authorities to Prospect Nos. 45 and 49 referred to and indicated on Figure I, are no longer in force as such: the boundaries have been considerably altered and the holdings re-numbered.

** For details of definition of the stratigraphical units see Australasian Oil and Gas Journal, Vol.5 No. 8, p.35, and Vol.5 No.9, p.28.

Normanton Formation: 129 - 1246 feet.

The Normanton Formation as encountered in the well can be subdivided into three units, the upper two being parts of the Tertiary weathering surface.

The units are as follows :-

(a) Laterite: 129 - 260 feet. Red and white sandy laterite and red shale. The beds are closely similar to the laterite cropping out at Normanton, which can be traced on the surface to the south bank of the Norman River, about 4 miles upstream from Karumba, and about 6 miles in a straight line from the wellsite. Drilling was very hard in the laterite.

(b) Weathered Normanton Formation: 60 - 304 feet. Clay, yellow and green shale, and sandstone. Drilling was very easy in this part of the formation. The electric log showed variable self-potential but uniform resistivity.

(c) Normanton Formation, unweathered: 304 - 1246 feet. Fine grey lithic sandstone* in thin bands and partings and dark grey shale and siltstone; some gypsum plates and fairly abundant pyrite nodules. These beds can be identified lithologically with the Normanton Formation as exposed at the Little Bynoe Crossing. The resistivity curve shows several high peaks, linked with drops in self-potential. Most notable ones are at 350 and 420 feet. These are thought to represent concretionary bands in the formation, a feature which is commonly seen in surface outcrop. Another resistivity high at 775 feet is linked with a sharp rise in self-potential. No distinctive change was noted in the cuttings at this point, and no explanation can be given for it.**

The irregularities in the self-potential log through the Normanton Formation are thought to be largely due to the presence of pyrite in the section. No oil or gas or permeable sandstones were noted.

Drilling was very easy in this formation when a drag bit was used, about 200 feet for eight hours straight drilling being the rule.

The sandstone/shale percentages shown on the composite log are correct only for the cuttings. Much of the shale in the section was comminuted into new mud remaining in suspension in the drilling fluid.

There were no oil or gas traces in this formation.

Kamileroi Limestone: 1246 - 1300 feet.

The beds from 1246 - 1300 feet, which have been included in Kamileroi Limestone, contain less than 50% of limestone. The beds consist of dark grey shale and siltstone with minor grey fine sandstone (20%) and limestone (20%). The limestone is mainly grey, fine, and argillaceous, but includes some crystalline white cone-in-cone limestone, the presence of which is the reason for including these beds in the Kamileroi Limestone. The beds show no distinctive electrical characteristics.

The drilling rate through these beds was slightly slower than through the Normanton Formation. There were no oil or gas traces in this formation.

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* Quartz greywacke in B.M.R. usage.

** The feature may represent a permeable sandstone.

Blackdown Formation: 1300 - 2279 feet.

From 1300 to 1728 feet, dark grey shale with minor fine-grained lithic sandstone and concretionary bands was encountered. Macrofossils and concretionary bands occur at different horizons. From 1728 to 1747 feet minor green, fine-grained glauconitic sandstone was found together with the dark grey shale. From 1747 to 1800 feet the section contained 15% of grey calcilutite. From 1800 to 2279 feet predominantly dark grey fine shale with green and white glauconitic fine sandstone was penetrated.

A gas smell was noted in the mud return pipe and in the cuttings at 1599 feet. The cuttings gave a positive acetone test, and slight golden fluorescence was noted on fibrous calcite. Another positive acetone test was obtained in shales in the cuttings from 1828 to 1838 feet.

The resistivity curve in this formation is generally uniform, apart from sharp peaks, due probably to concretionary bands. However, the zone 1560 - 1635 feet shows a disturbed curve with two peaks. The self-potential curve is flat and uniform except for the zone 1560 - 1635 feet, which shows a slight rise. This may indicate sandstone with very poor permeability and slight oil and gas (or fresh-water) saturation.

The drilling rate was generally very fast with the drag bit; but two high-carbonate zones from 1590 to 1610 feet and 1790 to 1800 feet slowed up drilling considerably.

Wrotham Park Sandstone: 2279 - 2360 feet.

The Wrotham Park Sandstone consists of medium quartz sandstone and dark grey shale with marine fossils. Four sandstone units were recognised on the cuttings log: (1) 2279 to 2281 feet; (2) 2301 to 2303 feet; (3) 2333 to 2339 feet; and (4) 2355 to 2360 feet.

Sandstone (1) showed slight yellow fluorescence, brown staining, and a positive acetone test; (2) showed strong yellow fluorescence (of a slightly different colour from the plant lubricating oils), brown staining right through many fragments, and a positive acetone test. Sandstone (3) was white but showed slight bluish fluorescence; and (4) was white and had the appearance of a water-washed sandstone. Plate 1 illustrates the electrical characteristics of the formation.

Sandstone (1) gave a high self-potential and high resistivity on the first run of the electric log (with bottom at 2340 feet). On the second run (bottom at total depth), carried out days later than the first, the self-potential was reversed, as shown in plate 1; the sandstone was probably flooded. Sandstone (2) gave no sign on the self-potential log; it was probably too thin to record.*

Sandstone (3) registered high self-potential and resistivity. The drilling-mud fluid had a chloride content of 300 p.p.m. during drilling; the formation water obtained during the test of the four sandstones had a chloride content of 1000 p.p.m. This feature therefore indicates a permeable sandstone with formation water of greater salinity than the drilling fluid, possibly containing some gas or oil.

Sandstone (4) apparently shows low resistivity and reverse self-potential, and may be the source bed for artesian water. The low resistivity indicates a highly porous formation.

Drilling was easy through this formation.

Basement: 2360 - 2364 feet.

At 2360 feet drilling was very hard and slow, and cuttings of rock crystal and quartzite were brought up. Drilling rate even with a hard-formation bit was about one inch an hour. The core obtained

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* Or the salinity of the formation water was the same as that of the drilling fluid.

from 2363 to 2364 feet was examined by Dr. N.C. Stevens of Queensland University. He concluded that it was a granitized quartzite, with the composition of granite but showing relict bedding with a dip of about 25°. His report is attached (p. 17).

Oil and Gas Indications.

Positive acetone tests were obtained at 1599, 1828-1838, 2279-2281 and 2301-2303 feet. Fluorescence was seen at 2279-2281, 2301-2302 and 2333-2339 feet.

CORRELATION* BETWEEN A.A.O. 8 KARUMBA, F.B.H. 1 WYAABA, AND Z.C.1. WEIPA.

Plate 2 shows the writer's correlation between the Karumba, Wyaaba, and Weipa bores. In each of these bores are well defined marker horizons which also occur in the surface sections at the edge of the basin. The units used were established in the Associated Australian Oilfields N.L. Carpentaria, 1956, report. For the present report the Wyaaba log was completely re-divided into units, taking no account of the doubtful Albian micropalaeontological determinations from 1600 to 2200 feet. The stratigraphical divisions of the artesian basin are based on macropalaeontological work by Whitehouse. In particular, Whitehouse determined the Tambo Formation and Normanton Formation as Upper Albian. It seems unlikely that Whitehouse's Upper Albian and Belford's Albian (determined in the Wyaaba bore) represent the same period of time. Also, there is no certainty that the foraminifera determined as Albian were not from cavings. Weipa was only changed in that the top of the Blythesdale Group was changed to a lower marker horizon and the Rolling Downs Formation was tentatively subdivided in harmony with the divisions made at Karumba and Wyaaba. The marker horizons used for correlation are :

(a) Basement.

(b) The top of the Wrotham Park Sandstone - the first appearance of sandstone with quartz and feldspar grains underlying glauconitic lithic fine sandstone. In outcrop the Wrotham Park Sandstone (Gilbert River Formation) is characterized at Croydon by fossil wood and plants with a conglomeratic horizon (Croydon Felsite) and marine fossils near the top.

At Karumba this horizon was put at the first appearance of medium quartz sandstone with shale below green glauconitic fine sandstone with shale (2277 feet); at Wyaaba, it is put at the first appearance of conglomeratic sandstone with plant stems (2627 feet); and at Weipa, it is put at the conglomeratic horizon at the top of the highest water-bearing sandstone and below the transition to glauconitic beds (2290 feet).

(c) The highest green glauconitic fine sandstone bands in the Blackdown Formation form a convenient marker in the three wells. Glauconitic sandstone outcrops are found just above the belt of loose sand at the top of the Wrotham Park Sandstone, at Bellevue Gorge on the Wrotham Park - Bellevue road.

(d) The cone-in-cone limestone horizon. Bands of crystalline cone-in-cone limestone up to 100 feet thick are found round Kamileroi; according to Whitehouse they belong to the base of the Tambo Formation. An horizon with a high percentage of limestone separating the more shaly lower beds (Blackdown Formation) from the more sandy Normanton Formation is recognisable in the three wells.

(e) In the Wyaaba well shale lacking foraminifera - and therefore apparently non-marine - was separated by Derrington (unpublished report to Mines Administration Pty Ltd), as equivalent to the Winton Formation.

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* The correlation is the author's, and not necessarily that of Frome Broken Hill or Zinc Corporation.

Similar shale and sandstone with coal are separated in the generalized Weipa log (Plate 2).

(f) The top of the Cretaceous beds and the surface of unconformity with the Tertiary are distinguishable easily on all three logs. This is the main laterite horizon (red beds), in most places about 50 feet thick and representing a Tertiary weathering surface.

(g) The top horizon correlated between the Wyaaba and Karumba wells is the boundary between the known Quaternary surface sediments and the Tertiary (Lynd Formation) gravel and sand, traced through from Wrotham Park, where the Lynd Formation overlies the Cretaceous shales unconformably in isolated hills. The correlation of this top horizon in the three wells is very tentative.

APPENDICES.

A. Drilling Fluid.

During drilling for the surface casing a bentonite-water mix of 4 lb Volclay per cubic foot was used; this mud was retained only until the cement plug had been drilled out. It was then discarded and a new mud was made up of 4 lb Volclay per cubic foot of water, which was used for the rest of the hole and became increasingly a natural mud-bentonite water mix as drilling proceeded. The average properties of this mud were as follows :-

S.G.	-	1.10
Viscosity	-	45 seconds (Marsh Funnel)
Water loss	-	22 c.c.
Filter cake	-	2/32 inch
pH	-	9.0
Sand	-	1/4%
Chloride	-	300 p.p.m.

The water loss was rather high. However, the rig was continually short of water and only enough water could be carted to dilute the new mud continually made in the hole and prevent the viscosity and sand content from rising too high. If bentonite had been added still more water would have been required. The high water loss was obviously responsible for the shale sloughing which caused the dirty hole conditions experienced during coring and electric logging.

B. Coring.

Three cores were cut with a Reed K437 5-3/8" "Kor King" core barrel, and both hard and soft formation heads. The lithological description of the cores is as follows:

Core No. 1.

Interval	-	1303 - 1323 feet.
Length of core obtained	-	8 feet 0.4 inches.
Recovery	-	40%.

All dark grey shale with macrofossils and fine lithic sandstone partings. The upper 12 feet, which was stuck in the core barrel and eventually drilled out, was similar.

Core No. 2.

Interval	-	2191 - 2195 feet
Length of core obtained	-	3 feet 9 inches
Recovery	-	94%

4.8 inches fine argillaceous glauconitic feldspathic sandstone. 2.4 inches dark grey shale with irregular contact with overlying glauconitic sandstone and containing one sandstone lens 1" x 1/2" and irregular sandstone bands. 37.8 inches hard dark grey shales with macrofossils. Beds in core were flat dipping.

Core No. 3.

Interval	-	2363 - 2364 feet (15 ins.)
Length of core obtained	-	10 inches
Recovery	-	66%

Core all hard compact quartzite, possibly containing some feldspar; non-permeable and non-porous. Dip may be about 10°.

C. Formation Test.

A formation test was carried out on the Wrotham Park Sandstone. With the hole at total depth the packer was set at 2279 feet in open hole. After 28 minutes water flowed from the drill pipe, the top of which was 8 feet above the rotary table.

Details of the formation test are as follows :-

Type of tester:	Johnston
Type size packer:	E4 1/2 inch diameter
Choke:	1/4-inch choke at bottom
Well depth:	2364 feet
Pack off at:	2279 feet
Sump:	85 feet
Diameter of well:	5-5/8 inches
Specific gravity of drilling fluid:	1.10

Operation.

Started and installed B.H.P. gauge at:	14.30 hours
Started run in at:	14.45 hours
Completed run in:	16.40 hours
Standing for static pressure:	5 mins.
Fluid cushion:	Nil.
Packer set at:	16.45 hours
Weight to set packer:	13,000 lbs.
Trip valve opened:	16.47 hours
Retaining valve closed:	17.17 hours
Flow period:	30 minutes
Unseated packer at:	17.17 hours
Pull to free packer:	30,000 lbs.
Fluid level in drill stem:	Pipe full
Quantity:	57.5 cubic feet
Nature of fluid:	Artesian water

A sample of the water in the drill-collars was sent to the Government Analyst for Queensland, who supplied an analysis as follows :-

Total solids	106.3 grains/gall.
Calcium sulphate	1.3 "
Magnesium sulphate	0.7 "
Sodium sulphate	1.8 "
Sodium carbonate	30.3 "
Sodium chloride	70.5 "
Fluorine	8.0 p.p.m.
Hardness	1.6 "
pH	7.2 "

Sludge from sample bottle:

Light mineral oil	Nil.
Chloroform extract	0.8 per cent.

The chloroform extract consisted of a brown mineral oil, which had a consistency similar to that of a lubricating oil, and showed a bluish-white fluorescence when exposed to ultra-violet light.

The extract was obtained from the dried sludge.

PETROLOGICAL REPORT

by

N.C. Stevens,

University of Queensland

Megascopically, the specimen from Core No. 3 (2363-2364 feet) is a light grey quartz-feldspar rock, resembling a feldspathic quartzite. It shows (after grinding) a distinct planar structure, possibly original sedimentary bedding marked by elongated angular quartz grains, at approximately 165° to the axis of the core.

A microslide shows that the rock consists mainly of feldspar and quartz, with the former in slight excess. Magnetite, tourmaline, biotite, and muscovite are accessories. The texture is allotriomorphic granular, and the grainsize is medium and somewhat variable. The feldspar is mostly microcline, with oligoclase and some microcline-microperthite. The oligoclase (Ab70) is slightly kaolinized, but the microcline is quite fresh. Microcline appears to be replacing plagioclase, and possibly quartz. Quartz occurs as separate grains, aggregates of grains, and rounded grains in feldspar, and has an irregular outline. Magnetite fills cracks in shattered quartz grains, and has been introduced at a late stage.

The texture and mineralogy of the rock, as seen under the microscope, are similar to those of an acid granite, but it is probably a felsdpathized quartzite.

MICROPALAEONTOLOGY.

by

Irene Crespin,

Bureau of Mineral Resources.

Cuttings were taken from every ten feet down to 2,360 feet, and cores at the following depths: 1,315'7"-1,316'7", 1,318'6"-1,319', 2,194'-2,194'5", and 2,363 feet (bottom of the bore). Foraminifera of Pleistocene to Recent age were found in calcareous sandstone down to 100 feet. Lower Cretaceous species were present in grey siltstone from 1,321 feet to 2,272 feet. The assemblage from 1,321 feet to 1,668 feet is dominated by the planktonic form Globigerina planispira Tappan; it has been found in only one surface sample in the Lower Cretaceous of Queensland. The assemblage below 1,668 feet is represented in sediments referable to or equivalent to the Roma Formation.

DETAILED DESCRIPTION OF SAMPLES.

Except where indicated all descriptions relate to cuttings.

50 feet	Cream, shelly calcareous sandstone with a few foraminifera.
	Elphidium craticulatum (F. and M.) Rotalia schroeteriana Parker and Jones
100 feet	Yellowish sandstone with a few foraminifera.
	Rotalia schroeteriana Parker and Jones
200 - 205 feet	Hematitic material - ?laterite.
205 - 283 feet	Friable creamish siltstone. No fossils.
283 - 299 feet	Friable ochreous to whitish siltstone. No fossils.
299 - 1193 feet	Grey siltstone and carbonaceous glauconitic siltstone.
1193 - 1300 feet	Grey siltstone with gypsum. Inoceramus prisms, and fragments of fish remains.
CORE. 1315'7"-1316'7"	Dark greenish-grey very fine-grained siltstone with a few fish remains and carbonaceous fragments.
CORE. 1318'6"-1319'	Dark greenish-grey very fine-grained siltstone with a few fish remains.
CORE 1319'5"-1319'9-3/4"	Dark greenish-grey very fine-grained siltstone with a few fish remains.
CORE. 1321'1"-1321'8-1/2"	Very fine-grained siltstone, with rare foraminifera and fish fragments.
	Globigerina planispira Tappan
1330 - 1396 feet	Dark grey fine-grained siltstone with some gypsum.
1396 - 1404 feet	Dark grey fine-grained siltstone with rare foraminifera and some gypsum.
	Globigerina planispira Tappan
1404 - 1495 feet	Dark grey fine-grained siltstone. No foraminifera.
1495 - 1504 feet	Dark grey siltstone with small foraminifera and fragments of fish remains.

Globigerina planispira Tappan

1504 - 1548 feet — Dark grey siltstone with small foraminifera and Inoceramus prisms.

Globigerina planispira Tappan

1548 - 1557 feet — Dark grey siltstone with small foraminifera, indeterminate radiolaria, and Inoceramus prisms.

Globigerina planispira Tappan

1557 - 1577 feet — Dark grey siltstone with small foraminifera and Inoceramus prisms.

Globigerina planispira Tappan

1577 - 1587 feet — Dark grey siltstone with small foraminifera and Inoceramus prisms.

Globigerina planispira Tappan
Robulus sp.

1587 - 1599 feet — Dark grey siltstone with abundant Inoceramus prisms.

1599 - 1668 feet — Dark grey siltstone with small foraminifera, pyritic replacements of radiolaria, and Inoceramus prisms

Foraminifera: Globigerina planispira Tappan
Neobulimina minima Tappan

Radiolaria: Cenosphaera sp.
Porodiscus sp.

1668 - 1698 feet — Dark grey siltstone with small foraminifera, chiefly calcareous tests, arenaceous forms crushed.

Globigerina planispira Tappan
Haplophragmoides spp.
Lagena laevis (Mont.)
Lenticulina spp.
Pseudoglandulina sp.
Valvulinera infracretacea Crespin

1698 - 1707 feet — Dark grey siltstone with numerous foraminifera, chiefly arenaceous tests, indeterminate radiolaria, and Inoceramus prisms (possibly caving).

Ammobaculites fisheri Crespin
Ammobaculites minimus Crespin
Anomalina mawsoni Crespin
Globigerina planispira Tappan
Haplophragmoides dickinsoni Crespin
Haplophragmoides sp.
Pelosina sp.
Spiroplectammina edgelli Crespin
Spiroplectammina cf. cushmani Crespin
Trochammina raggatti Crespin
Verneuilina howchini Crespin

1707 - 1788 feet — Dark grey siltstone with some glauconite, a few crushed tests of arenaceous formanifera, and indeterminate shell fragments. No prisms of Inoceramus were present.

1788 - 1800 feet — Dark grey siltstone with foraminifera, chiefly arenaceous forms, indeterminate radiolaria, but Inoceramus prisms absent.

Ammobaculites fisheri Crespin
Ammobaculites sp.
Haplophragmoides raggatti Crespin
Globigerina planispira Tappan (rare)

1800 - 1895 feet — Dark grey siltstone with a few arenaceous foraminifera.

1895 - 1907 feet — Dark grey siltstone with foraminifera.

Ammobaculites sp. (large and crushed)
Ammobaculites fisheri Crespin
Epistomina australiensis Crespin
Globigerina planispira Tappan
Robulus gunderbookaensis (Crespin)
Robulus sp.
Spiroplectammina cushmani Crespin
Spiroplectammina edgelli Crespin
Valvulineria infracretacea Crespin

1907 - 1953 feet — Grey to dark grey siltstone with arenaceous and calcareous foraminifera and ostracoda (rare)

Ammobaculites fisheri Crespin
Involutina cretacea (Reuss)
Bathysiphon sp.
Bigenerina loeblichi Crespin
Haplophragmoides sp.
Haplophragmoides concavus (Chapman)
Globigerina planispira (Tappan)
Robulus warregoensis (Crespin)
Spiroplectammina edgelli Crespin
Valvulineria infracretacea Crespin

1953 - 1997 feet — Dark grey siltstone with minute foraminifera

Ammobaculoides romaensis Crespin
Ammobaculites fisheri Crespin
Anomalina mawsoni Crespin
Globigerina planispira Tappan
Haplophragmoides sp.
Neobulimina minima Tappan
Valvulineria infracretacea Crespin

1997 - 2027 feet — Dark grey siltstone with foraminifera.

Ammobaculites fisheri Crespin
Ammobaculoides romaensis Crespin
Epistomina australiensis Crespin
Haplophragmoides sp.
Lenticulina australiensis Crespin
Robulus sp.
Spiroplectammina edgelli Crespin

2027 - 2087 feet — Dark grey siltstone with numerous foraminifera and indeterminate radiolaria.

Involutina cf. cretacea (Reuss)
Ammobaculites fisheri Crespin
Anomalina mawsoni Crespin
Ammobaculoides romaensis Crespin
Haplophragmoides sp.
Hyperammina sp.
Lenticulina sp.
Marginulinopsis sp.
Pelosina lagenoides Crespin
Robulus cf. warregoensis (Crespin)
Siphotextularia sp.
Spiroplectammina cushmani Crespin
Textularia cf. annacooraensis Crespin
Trochammina raggatti Crespin
Valvulineria infracretacea Crespin

2087 - 2105 feet — Dark grey siltstone with foraminifera

Bigenerina loeblichi Crespin
Haplophragmoides globosa Lozo
Spiroplectammina cushmani Crespin
Verneulinidoes cf. schizea (Cushman and Alexander)

2105 - 2193 feet — Dark grey siltstone with small foraminifera, chiefly arenaceous tests.

Ammobaculites minimus Crespin
Haplophragmoides sp.
Hyperammina sp.
Neobulimina minima Tappan
Pelosina lagenoides Crespin
Spiroplectammina cushmani Crespin
Robulus sp.
Textularia sp.

CORE. 2191'-2191'7" — Hard dense dark-grey fine-grained siltstone with bands of glauconitic sandstone and abundant minute foraminifera, the arenaceous tests chiefly crushed.

Globigerina planispira Tappan (abundant)
Neobulimina minima Tappan (few)
Patellina sp. (rare)
Pelesina cf. lagenoides Crespin (rare)
Robulus warregoensis (Crespin)(rare)

CORE. 2194'-2194'5" Hard dark-grey fine-grained siltstone with numerous foraminifera, especially calcareous forms, indeterminate ostracoda, and fragments of thin-shelled pelecypoda.

Buliminella nannina Tappan (common)
Globulina exserta (Berthlin)
Lagena laevis (Mont.)
Lenticulina australiensis Crespin
Lenticulina spp. (common)
Neobulimina minima Tappan (common)
Robulus sp. (common)
Saracenaria sp.
Trochammina raggatti Crespin
Trochammina parvula Crespin

2193 - 2203 feet Dark grey siltstone with small foraminifera and fragments of fish remains.

Ammobaculites minimus Crespin
Buliminella nannina Tappan
Globigerina planispira Tappan
Lenticulina sp.
Pseudoglandulina aff. scotti Tappan
Valvulineria infracretacea Crespin

2203 - 2272 feet Grey to dark grey siltstone with foraminifera, chiefly calcareous with some tests minute, and ostracoda.

Ammobaculites fisheri Crespin
cf. Ammobaculites
Ammobaculoides pitmani Crespin
Anomalina mawsoni Crespin
Epistomina australiensis Crespin
Haplophragmoides spp.
Marginulinopsis australis (Crespin)
Robulus warregoensis (Crespin)
Spiroplectammina cushmani Crespin
Spiroplectammina edgelli Crespin
Verneuilina howchini Crespin

2272 - 2360 feet Grey siltstone and glauconite sandstone. No foraminifera.

2363 feet Basement rock.

STRATIGRAPHICAL AND FAUNAL NOTES.

A summary of the age, limiting depths, and lithology of the cores and cuttings is as follows :

Age	Limiting depths in feet	Lithology
Pleistocene to Regent	50- 200	Calcareous sandstone with foraminifera and indeterminate mollusca
? Tertiary	200- 205	Hematitic material, ?laterite
? Cretaceous	205- 299	Ochreous to whitish siltstone, unfossiliferous
Lower Cretaceous	299-1193	Grey siltstone with some carbonaceous material and occasional fish remains
	1193-1300	Grey siltstone with gypsum, and Inoceramus prisms
	1300-1668	Dark grey siltstone with Globigerina planispira and other small foraminifera; Inoceramus prisms abundant at 1587-1599 feet.
	1668-2272	Grey to dark grey siltstone with arenaceous and many minute calcareous foraminifera. No Inoceramus. Thin-shelled indeterminate pelecypoda in core at 2191'-2191'7". G.planispira also common in this core.
	2272-2360	Grey siltstone and glauconitic sandstone. No foraminifera.
Palaeozoic	2363	Basement rock

The calcareous sandstone from 50 to 200 feet contained typical Pleistocene to Recent warm shallow-water foraminifera, Rotalia schroeteriana and Elphidium craticulatum, which are found in tropical waters around the northern coast of Australia and in the coastal deposits in that region.

The sample from 200-205 feet probably represents laterite and may be of Tertiary age.

The ochreous to whitish siltstone from 205-299 feet is unfossiliferous; the age is uncertain. It probably represents the leached lower part of the laterite profile.

The bore entered the typical Lower Cretaceous sediments of the Great Artesian Basin at 299 feet, which persisted with little lithological change down to 2,360 feet. They consisted of grey to dark grey siltstone down to 2,272 feet, the majority of the samples containing foraminifera. From 2,272 feet down to 2,360 feet, the grey siltstones were interbedded with glauconitic sandstone and were unfossiliferous.

The bore reached basement at 2,360 feet.

Many of the foraminifera listed above are widely distributed in the Lower Cretaceous sediments of the Great Artesian Basin. Arenaceous species such as Ammobaculites fisheri, A. minimus, Ammobaculoides pitmani, A. romaensis, Bigenerina loeblichi, Pelosina lagenoides, Spiroplectammina cushmani, S. edgelli, Trochammina raggatti, and Verneuilina howchini, and the calcareous species Anomalina mawsoni, Epistomina australiensis, Marginulinopsis australis, Lenticulina australiensis, Robulus warregoensis, and Valvulineria infracretacea were described by the writer from either surface sediments in the Roma area, where they were associated with ammonites of Aptian age, or subsurface rocks throughout the Great Artesian Basin as far west of Roma as Marree, South Australia (Crespin, 1953, 1955). Globigerina

planispira, Neobulimina minima, and Buliminella nannina were described by Tappan from the Lower Cretaceous Grayson Formation in Texas, which is the equivalent of the Upper Albian (Tappan, 1940, 1943; Loeblich & Tappan, 1949). All three species are known to range throughout the Albian in America.

The most striking feature of the Lower Cretaceous microfauna of the siltstones in the Karumba Bore is the persistent occurrence of the planktonic foraminifer, Globigerina planispira, which is present in nearly all samples from 1,321 feet to 2,223 feet, with numerous tests in a core taken at 2,191 feet to 2,191 feet 7 inches. From its first appearance in a core at 1,321 feet 1" 8½ inches to 1,668 feet, where one other calcareous species, Neobulimina minima, was recognised, G. planispira is associated with numerous prisms of Inoceramus. Globigerina is indicative of open sea conditions and Inoceramus occurs very abundantly in sediments rich in planktonic foraminifera of Upper Cretaceous age in Western Australia, which were laid down in an epi-continental sea. The association of G.planispira and Inoceramus down to 1,668 feet in the Karumba Bore suggests that the beds in the northern part of the Great Artesian Basin were deposited under epi-continental conditions.

From 1,668 feet down to 2,272 feet, arenaceous tests are associated with G.planispira and other small calcareous foraminifera; Inoceramus prisms disappear. The micro-fauna of the beds in the vicinity of Roma and in the southern and western parts of the Great Artesian Basin is dominated by arenacous foraminifera, which suggests that the sediments were laid down not very far off shore in a bay or gulf in moderately shallow and possibly cool water. The association of these forms with the planktonic G. planispira and other small calcareous species suggests that the beds in the Karumba Bore from 1,668 feet to 2,272 feet were deposited in a bay not very far off shore.

Until recently few tests of G. planispira had been found in the Lower Cretaceous sediments of the Great Artesian Basin. Of these only one occurrence was from surface outcrop; this was at a locality 34 miles from Barcaldine on the Barcaldine-Aramac road, Central Queensland. However, during recent investigations in the northern part of the Basin, in the Cape York Peninsula, the species has been found in some abundance in the FBH Wyaaba No. 1 Bore, Core 2 at 1,694 feet and cuttings at 2,000 feet. It was also present in ZCL Weipa No. 1 Bore, Core 2 at 998-1005 feet.

Carbonaceous fragments, so common in surface and subsurface sediments in the vicinity of Roma and elsewhere in the Great Artesian Basin, were seldom noted in sediments in the Karumba Bore.

G. planispira has been found so rarely in surface sediments in the Lower Cretaceous of Queensland that correlation of the subsurface assemblages in which it is prominent is difficult. Only field work can prove whether these opensea deposits are a facies change of the Aptian Roma beds of the central and southern part of the Great Artesian Basin or whether they are stratigraphically higher in the Lower Cretaceous and equivalent to the Albian.

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ELECTRICAL LOGGING.

by

D.F. Dyson,

Bureau of Mineral Resources

INTRODUCTION.

Upon a request from Associated Australian Oilfields N.L., the Geophysical Section of the Bureau recorded a single-electrode electrical log of the Company's No. 8 exploratory drill hole at Karumba, Queensland, on 23rd and 26th February 1958.

The log at 1 inch to 50 feet was run on 23rd February to a depth of 2,347 feet. Owing to a fault in the side of the recorder that normally records the resistivity, both the S.P. and the resistivity logs had to be recorded on the same side in separate operations.

The hole was then extended into the basement and further logging attempted; but this was unsuccessful owing to caving within the hole. The hole was reconditioned and mud circulated prior to a final attempt at logging on the 26th February. A log of the bottom of the hole between 2,360 feet and 2,008 feet at 1 inch to 20 feet was obtained, but jamming of the probe at 2,340 feet during a run at 1 inch to 50 feet caused failure of the winch and abandonment of further logging attempts. The electric log can be interpreted readily in terms of the lithologic log, and two zones where oil traces were obtained can be recognised on the log.

EQUIPMENT.

A Widco two channel logger (Model ZDE) was used. This instrument is manufactured by the Well Instrument Developing Company, Bellaire, Texas, U.S.A.; it uses a single point electrode and records continuously, and, when working correctly, simultaneously, the variations of self-potential (S.P.) and resistance.

METHODS.

The technique and principles of interpretation are readily available in the appropriate literature (Jakosky, 1950; Schlumberger, 1949; Guyod, 1952; Wiebenga, 1956).

Very briefly, the magnitude of the self-potential depends upon the permeability of the formation and the salinity contrast between the pore solutions and the drilling mud.

DISCUSSION OF RESULTS.

Because the instrument was faulty the S.P. and the resistivity could not both be recorded at each logging operation. Plate 3 therefore is from a composite tracing of the logs obtained at the scale of 1 inch to 50 feet to a depth of 2,347 feet, and Plate 4 from a composite tracing of the logs at a scale of 1 inch to 20 feet from 2,008 to 2,360 feet. An estimated correction for cable stretch has been made on each tracing.

THE LOG ON A SCALE OF ONE INCH TO 100 FT. (Plate 3).

The drift exhibited by the resistance log is attributed to inadequate compensation of the increasing self-induction during the re-winding of the cable; the small drift in the S.P. curve may be caused by a decrease in the permeability due to increased compression at depth.

Surface to 590 feet.

(1) The casing to 203 feet masks any features to this depth. The large variations in the S.P. readings may be caused primarily by electro-chemical currents due to corrosion or electrolytic action of the casing.

(2) From the bottom of the casing to 235 feet the S.P. is high and the resistance variable; this section is within the lithologically identified lateritic zone.

(3) From 235 feet to 467 feet the less abrupt variations in the S.P. and relatively small variation in resistivity indicate mixed clays and sands, with bands of non-permeable high-resistance material at 351 and 423 feet.

(4) From 467 feet the variations in the S.P., accompanied by only small changes in the resistance, indicate a more pronounced separation of the clays and sands over this section than the one immediately overlying it; the higher average S.P. value indicates a greater proportion of sand.

590 feet to 1,560 feet.

(1) From 590 feet to 765 feet the electric log conforms with the lithological data, which indicate a predominance of low-permeability material with reasonable porosity, as may be expected from shale or siltstone. The interval from 695 feet to 740 feet is characterized by what appear to be thin sandstone bands, as indicated by the higher and more variable S.P. and the more variable resistivity.

(2) The interval between 765 feet and 915 feet is indicative of the predominance of sandstone. This is verified by the lithological log, particularly below 840 feet.

(3) From 915 feet to 995 feet the electrical indication of less permeable beds is attributed to a more argillaceous sequence. The high resistance peaks at 927, 938, and 958 feet may identify the precise positions of the calcilutite bands recorded in the lithological log within this section.

(4) From 995 to 1,560 feet the sediments are mainly argillaceous, except between 995 and 1,077 feet and 1,332 to 1,339 feet, where the variations recorded on the S.P. trace and small fluctuations in resistivity values indicate a sequence of more arenaceous beds. The high resistivity peaks, with or without corresponding small changes in the S.P., at such positions as 1,115, 1,160, 1,228, 1,344, 1,434, 1,460, and 1,465 feet are most probably caused by impervious bands identified in the lithological log as limestone and siliceous shale.

1,560 feet to 1,632 feet.

The electrical log between these limits is characterized by the relatively high resistivity and moderate S.P. values. This indicates a permeable zone containing salt water and possibly oil and gas. Gas and fluorescence were also indicated in the lithological log.

1,632 feet to 2,280 feet.

The S.P. log over this section exhibits only minor variations, although the resistivity curve is more variable. These features indicate a predominantly shale sequence, with occasional beds more arenaceous, as from 2,005 to 2,023 feet and from 2,145 to 2,205 feet. Bands of relatively non-porous, non-permeable material are also present at various depths, those at 1,749, 1,877, 2,035, 2,039, 2,070, 2,157 and 2,165 feet being the most obvious.

2,280 feet to 2,297 feet.

The character of the combined S.P. and resistivity logs below 2,284 feet is similar to that in the log from 1,560 feet to 1,632 feet, where gas and fluorescence were noted in the lithological log.

2,297 feet to 2,320 feet.

A sequence of beds with low permeability and high porosity may be identified as mainly shale.

2,320 feet to 2,347 feet.

The variations in permeability and porosity which are indicated by the logs may be correlated with the lithological log, which indicates that the section is predominantly arenaceous.

THE LOG ON A SCALE OF ONE INCH TO 20 FEET (PLATE 4).

The features of this log, which extends from 2,008 feet to 2,360 feet, are essentially similar to those shown by the earlier log. Some small variations occur, mainly in the S.P. log, which may be as a result of the reconditioning of the hole after the first log was run. Examples of these variations are the lower S.P. recorded between 2,280 and 2,284 feet and the absence on the later log of the higher S.P. between 2,284 and 2,296 feet; also the gradual increase in S.P. indicated from 2,320 to 2,332 feet is not indicated in the later log.

Thus the only possible additional evidence revealed by the later log is that the resistivity high between 2,281 and 2,284 feet would seem to be a non-permeable low-porosity band and the possible petroliferous evidence immediately underlying this and encountered initially was lost after the reconditioning of the hole.

PERMEABLE ZONES.

Below 1,100 feet there are only three zones - from 1,560 feet to 1,632 feet, 2,280 feet to 2,297 feet and 2,330 feet to 2,347 feet - where the rocks are likely to be sufficiently permeable to yield significant quantities of fluid under test. The presence of gas and fluorescence was noted in the lithological log between 1,560 feet and 1,632 feet; so fluids from this zone may contain oil or gas. Whether or not further testing of this zone is warranted depends on other factors which are outside the scope of this report.

CONCLUSIONS.

The electrical logging at the Karumba bore was successful in that the lithological log and the electrical log correlate reasonably well, and the sections where oil traces were noticed are readily recognisable on the electric log.

The abrupt changes in electrical properties often associated with formation boundaries are not prominent in the log, although the various types of sediment are indicated by the differences in the electrical properties recorded. These are more apparent on the self-potential trace than on the resistivity trace.

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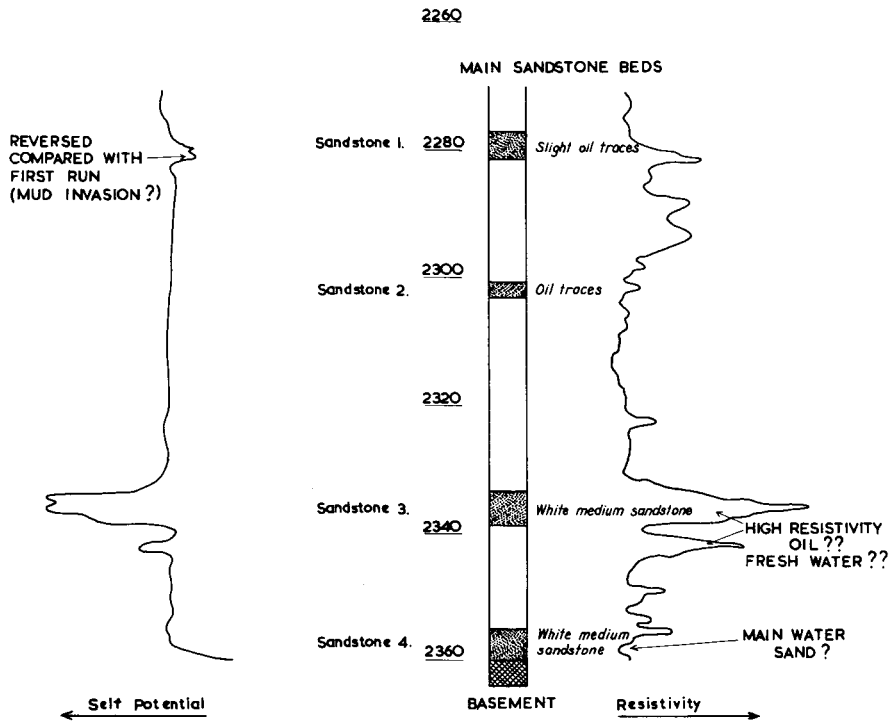


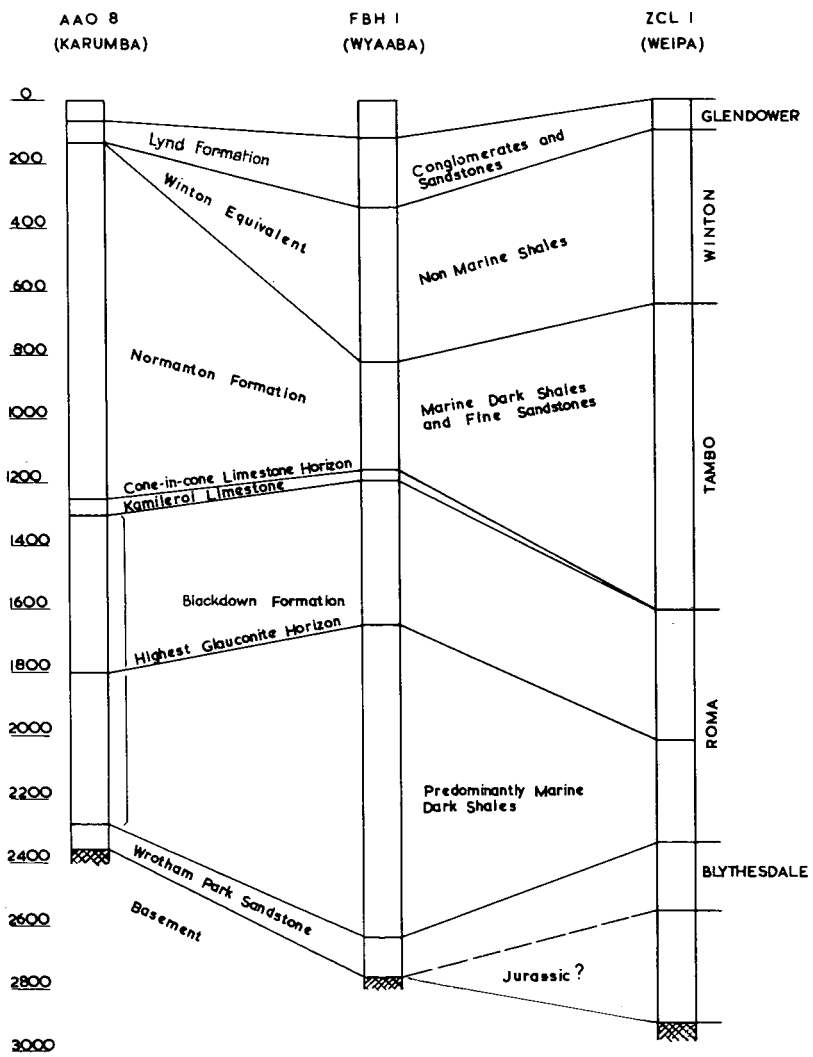
PROVISIONAL ELECTRIC LOGS IN WROTHAM PARK SANDSTONE

AAO 8 (KARUMBA)

LOGGING BY BMR WIDCO SINGLE ELECTRODE
N. JACKSON OPERATOR

COMPILED AND INTERPRETED A.C.M. LAING
MINES ADMINISTRATION PTY. LTD.
Report Q/45P/44

Plate 2



LITHOLOGICAL CORRELATION CHART FOR OIL BORES GULF OF CARPENTARIA

A.C.M. LAING
MINES ADMINISTRATION PTY. LTD.

Report Q/45P/44.

PLATE 3

ASSOCIATED AUSTRALIAN OILFIELDS N.L.

WELL No8 (KARUMBA)

TOTAL DEPTH 2364 FT

COMPOSITE LOG

LOCATION: 17°24'36.4"S - 140°52'21.9" E

DATE SPUDDED: 4th FEBRUARY 1958

DATE COMPLETED: 3rd MARCH 1958

ROTARY TABLE ELEVATION: 20 FT

ELECTRIC LOGGING B.M.R. WIDCO SINGLE ELECTRODE UNIT
(N. Jackson - operator)

LITHOLOGIC LOG and COMPILATION: A.C.M. LAING
MINES ADMINISTRATION PTY. LTD.

LEGEND
- limestone
- fine sandstone
- medium sandstone
- shale and siltstone
- laterite

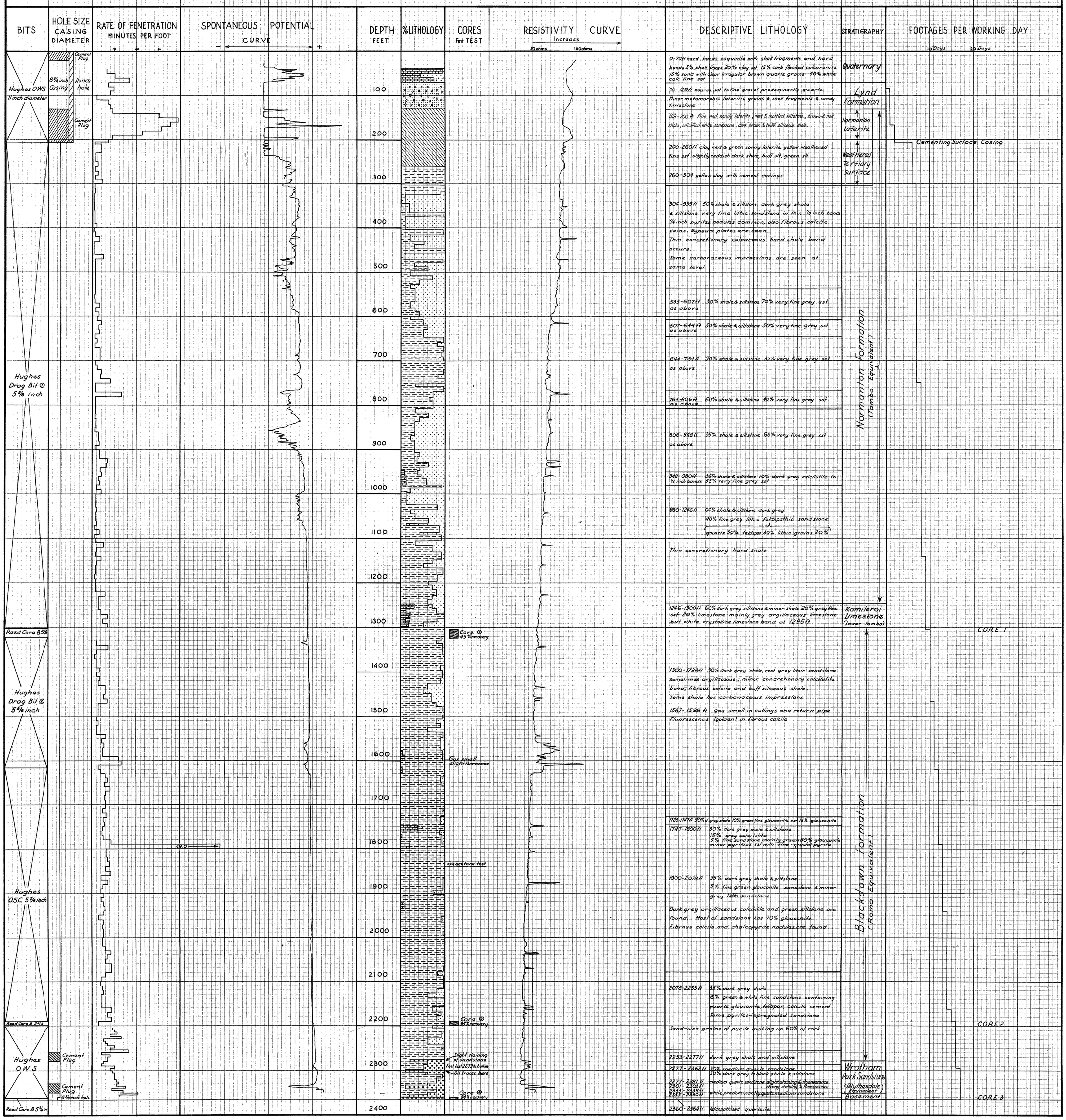
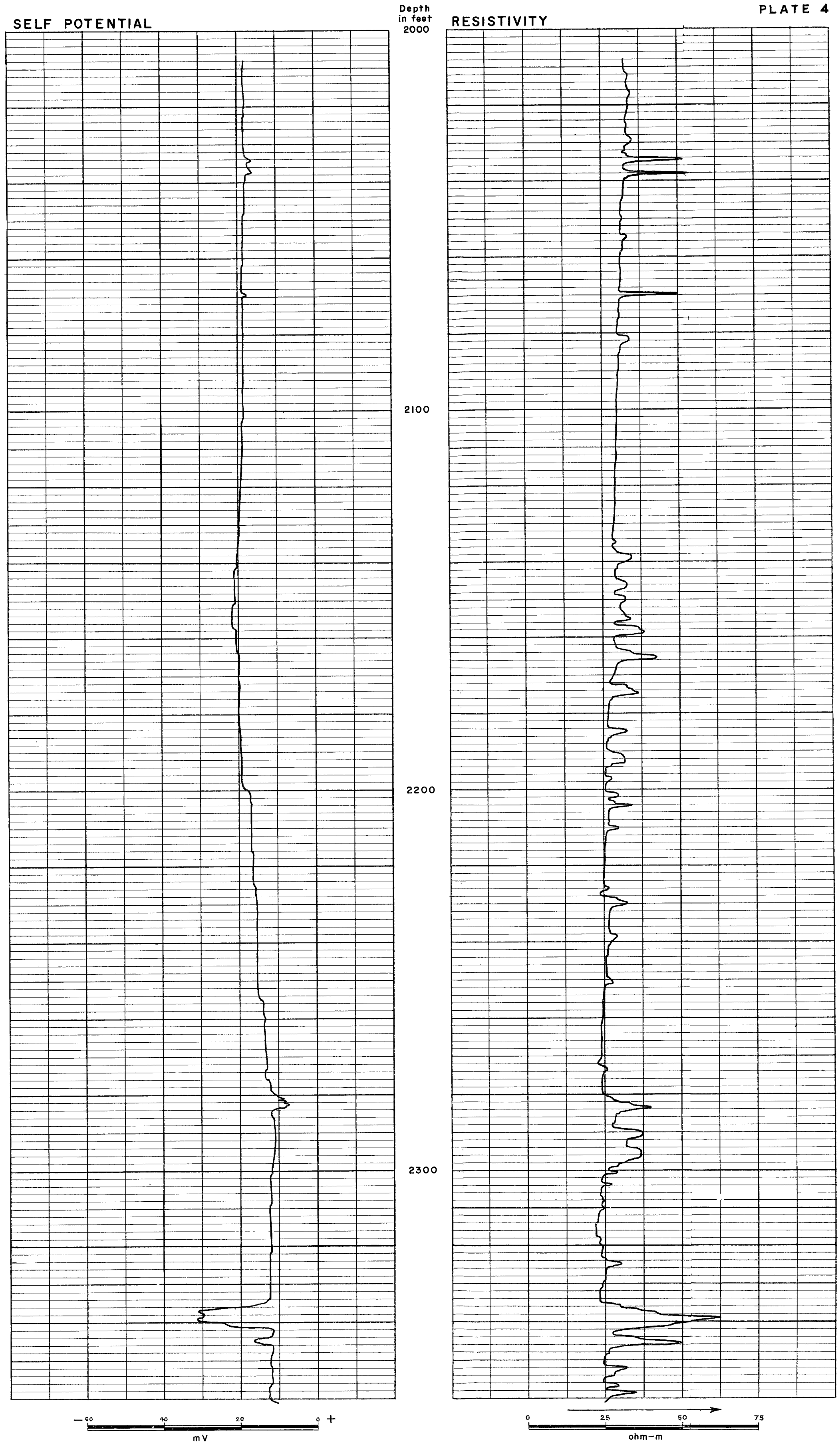


PLATE 4



REMARKS:—

Depths with reference to rotary table.

Rotary table 5′ above ground.

ELECTRICAL LOG
ASSOCIATED AUSTRALIAN OILFIELDS, N.L. N°8
KARUMBA, QUEENSLAND

COORDINATES	17° 24′ 36·4″ S 140° 52′ 21·9″ E
ELEVATION	K.B. G.L.

Instrument	4000′ WIDCO
Logged by	N. JACKSON

Date	26-2-1958
First Reading	2362
Last Reading	2008
Footage Logged	354
Bottom (Driller)	2364
Casing (from Log)	
Casing (Drilling)	
Casing Size	
Bit Size:	5⅝″
Bit Size:	
Cable Stretch	CORRECTIONS MADE

MUD	
Nature	
Density	
Viscosity	
Resistivity	
Res. at BHT	
pH	
Circ. Temp.	
B.H. Temp.	
Water Loss	