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BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS.

RECORDS

1958 NO. 97.

ELECTRICAL LOGGING OF ASSOCIATED AUSTRALIAN OILFIELDS N.L., NO.8 BORE, KARUMBA, QUEENSLAND.

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ABSTRACT.

Associated Australian Oilfields N.L., No. 8 Bore at Karumba, was logged to a total depth of 2,360 feet, by self potential and single point resistivity methods. Logging was done on a scale of 1 inch equals 50 feet to a depth of 2,347 feet and the section from 2,008 feet to 2,360 feet was logged at 1 inch equals 20 feet.

The electrical log is discussed in relation to the lithology, and although abrupt changes in electrical properties are not obvious at formation boundaries, the character of the electrical properties recorded reveal differences in sediment types.

The most important features of the log are within the sections 1,560 feet to 1,632 feet and 2,285 feet to 2,297 feet. These features correspond to places where traces of gas and/or oil were recorded during drilling operations. The electric log offers precise depth control for these sections.

1. 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 co-ordinates of the bore site are:-

Longitude	140°	52'	21.9"	East
Latitude	17°	24'	36.4"	South

The ground surface elevation at the site is 15 feet above sea level and the rotary table from which all measurements were taken, was 20 feet above sea level.

The hole was cased to a depth of 203 feet with $8\frac{5}{8}$" casing below which the hole was drilled with $5\frac{5}{8}$" bits. Basement rock was encountered at 2,360 feet and the hole was terminated at 2,364 feet.

The log at 1 inch equals 50 feet was run on 23rd. February to a depth of 2,347 feet. Due to a fault in that side of the recorder which normally records the resistivity it was necessary to record both the S.P., and the resistivity logs on the one side in separate operations.

The hole was then extended into the basement and further logging attempted, but this was unsuccessful due 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 equals 20 feet was obtained but jamming of the probe at 2,340 feet during a 1 inch equals 50 feet run 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.

2. 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. The instrument uses a single point electrode and records continuously, and when working correctly, simultaneously, the variations of self-potential (S.P.) and resistance.

3. 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.

Reference to the self-potential is in a negative sense i.e. a high S.P. reads a high negative value. The resistivity depends mainly upon the porosity of the formation and the salinity of the pore solutions.

4. DISCUSSION OF RESULTS.

Due to the instrument fault, it was only possible to record either the S.P. or the resistivity at each logging operation. Plate 1 therefore is from a composite tracing of the logs obtained at the scale of 1 inch equals 50 feet to a depth of 2,347 feet, and Plate 2 from a composite tracing of the logs at a scale of 1 inch equals 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 EQUALS 50 FT. (PLATE 1).

The drift exhibited by the resistance log is attributed to the increasing self-induction during the re-winding of the cable not being fully compensated, while the small drift in the S.P. curve may be caused by a decrease in the permeability at depth caused by the increased compression of deeper sediments of a similar type.

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) Below 235 feet to 467 feet the less abrupt variations in the S.P. and relatively small variation in resistivity is indicative of mixed clays and sands with occasional bands of non-permeable high resistance material i.e. at 351 and 423 feet.

(4) From 467 feet to 580 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, also a greater percentage of sand is indicated by the higher average S.P. value.

590 feet to 1,560 feet.

(1) Below 590 feet to 765 feet the electric log conforms with the lithological data which indicates a predominance of low permeability material with reasonable porosity as may be expected from shales or siltstones. The interval from 695 feet to 740 feet is characterised by what appears 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) Below 915 feet to 995 feet the electrical indication of less permeable beds is attributed to a more argillaceous sequence of sedimentation. 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 from 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 beds more arenaceous in character. 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 characterised 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 relatively more variable. These features indicate a predominantly shale sequence with occasional beds more arenaceous in character as from 2,005 to 2,023 feet and from 2,145 to 2,205 feet. Bands of relatively nonporous, 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 predominantly 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 the section to be predominantly arenaceous.

THE LOG ON A SCALE OF ONE INCH EQUALS 20 FEET (PLATE 2).

The features of this log, which extends to 2,360 feet depth from 2,008 feet, are essentially similar to those shown by the earlier one inch equals 50 feet log. Some small variations occur mainly in the S.P. log which may be as a result of the reconditioning of the hole which took place between the running of the two logs. An example of these variations is 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 1 inch equals 20 feet 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 were noted in the lithological log between 1,560 feet and 1,632 feet and this suggests that 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.

5. CONCLUSIONS.

The electrical logging at the Karumba bore was successful in that a reasonable correlation between the lithological log and the electrical log occurs and those 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 sediment types are indicated by the differences in the electrical properties recorded. These are more apparent on the self-potential trace than on the resistivity trace.

6. REFERENCES.

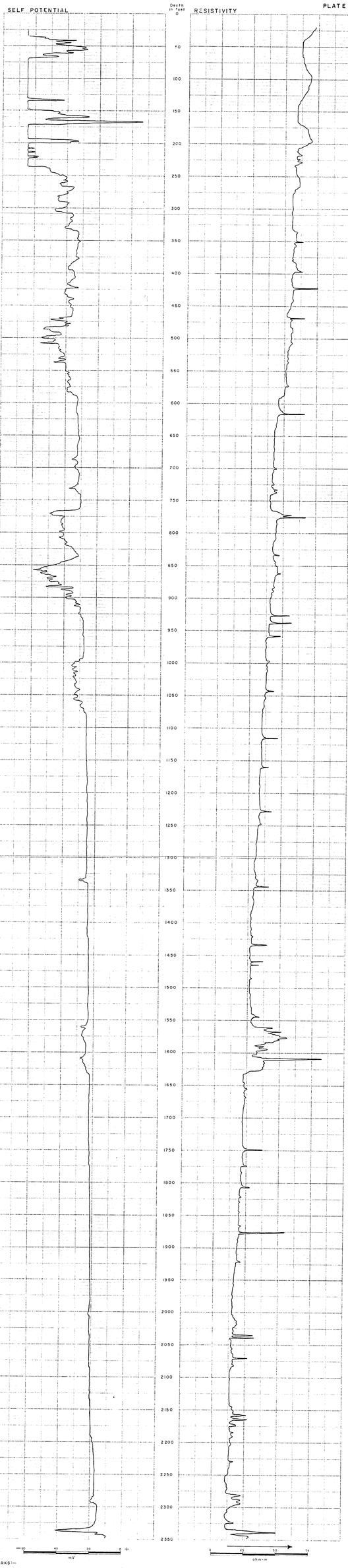
Guyod, Hubert, 1952 - Electrical well logging Fundamentals - a series of Articles, original and reprint prepared by the author for Well Instrument Developing Co., Houston, Texas.

Jakosky, J.J., 1950 - Exploration Geophysics, Trija Publ. Co., Los Angeles.

Schlumberger Well Surveying Corporation, 1949 - Review of Schlumberger Well Logging Auxiliary Methods.

Wiebenga, W.A., 1956 - Electrical Logging of No. 3 Bore, Associated Australian Oilfields, N.L., Roma, Queensland. Bur.Min.Res. Geology and Geophysics. Records 1956 No. 3.

PLATE I



REMARKS:—

Depths with reference to rotary table.
Rotary table 5' above ground.

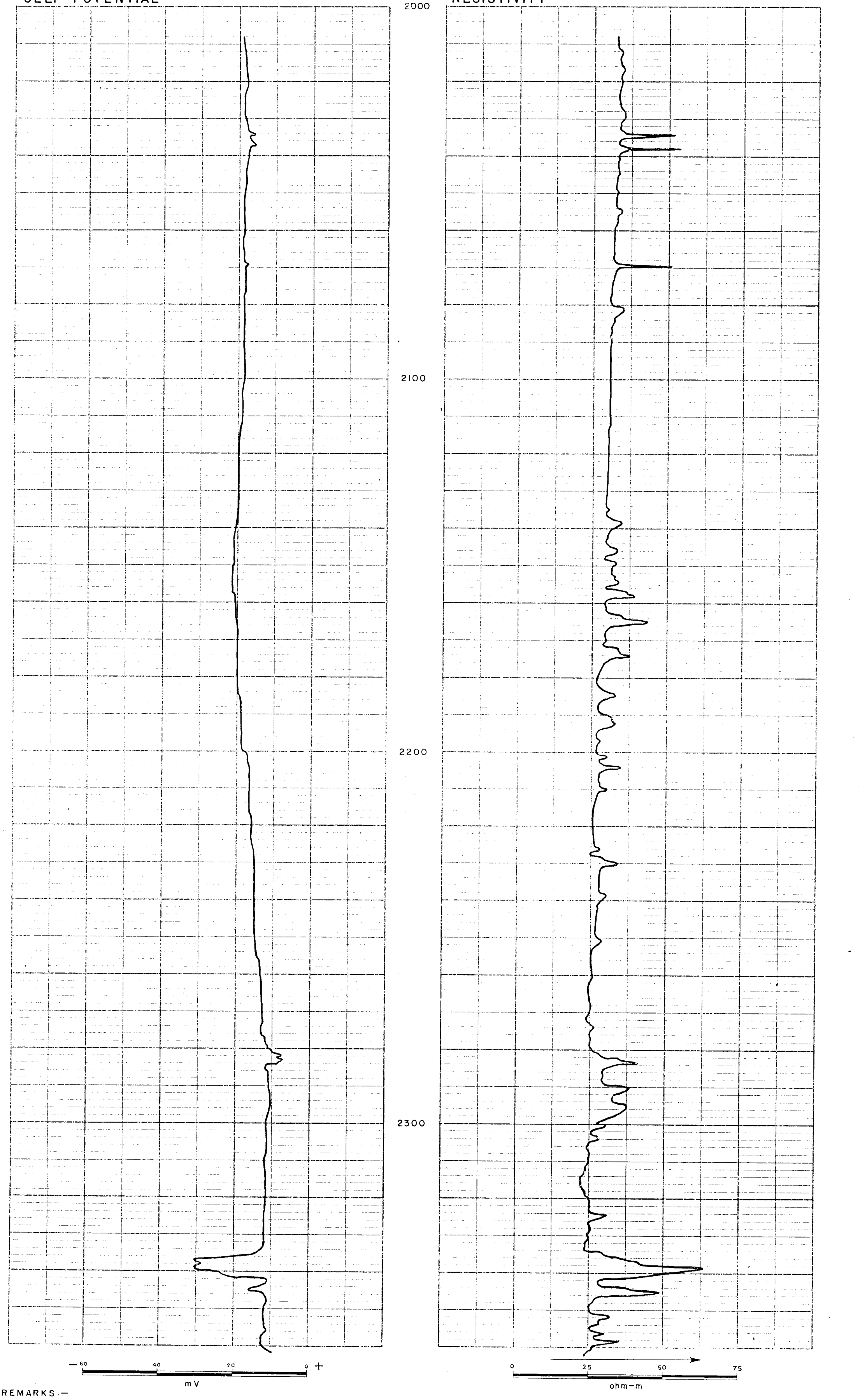
BORE LOG
ASSOCIATED AUSTRALIAN OILFIELDS, N.L. N°8
KARUMBA, QUEENSLAND

COORDINATES	17° 24' 36·4" S 140° 9'5" 21·9" E
ELEVATION	K.B. ... G.L. ...

Instrument	4000' WIDCO
Logged by	N. JACKSON

Date	23-X-1958
First reading	2342
Last reading	20
Footage logged	2327
Bottom (driller)	2394
Casing (from Log)	
Casing (Driller)	128
Casing Size	8⅝" JCC 36 lbs.
Bit Size	5¾"
Bit Size	
Cable Stretch	Corrections made

Mud	
Nature	
Density	
Viscosity	
Resistivity	5·23 ohm-m at 34°C
Resistivity Reading at	
pH	
Circ. Temp.	
Mud Temp.	
Water Loss	



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Depths with reference to rotary table.

Rotary table 5' above ground.

BORE 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	