COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS.

RECORDS

1959 NO.59

ELECTRIC LOGGING OF PORT FAIRY BOREHOLE, PARISH OF BELFAST NO. 4, VICTORIA.

APRIL 1959.

by

F. JEWELL

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ABSTRACT

Single point resistivity, self potential and gamma ray logs were run in the new Port Fairy water bore currently being drilled by the Victorian Mines Department. The object of the logging was to assist in determining the best place to set casing in order to seal off aquifers likely to contain saline water. The logs are interpreted as clearly indicating a depth range in which the casing should be set.

1. INTRODUCTION

In response to a request from the Victorian Mines Department, the Bureau's Widco 2,000 ft. logger was despatched to the Port Fairy borehole, Parish of Belfast No.4, on April 27th. It was hoped from information provided by the self-potential, single-point resistance and gamma-ray logs furnished by the logger to reach conclusions as to the quality of the water obtainable from the various formations traversed and thus indicate the best depth to set casing.

2. LOGGING OPERATIONS

Logging commenced at 8.30 p.m. on April 27th but, owing to the thickness of the mud, the lowest depth reached by the electric probe was only 2,000 ft. Operations were therefore suspended at 11.00 p.m. and recommenced at 8.30 a.m. the following day after further conditioning of the mud. The electric log was run to the full available depth of the logger cable i.e. 2,325 ft. but gradual thickening of the mud made it impossible to record the gamma-ray log below 1,935 ft.

Logs were run on two different vertical scales on the paper chart i.e. 20 ft. = 1 inch and 50 ft. = 1 inch. On the gamma-ray log, the sensitivity used was such that 1" of chart in a horizontal direction was equivalent to a dose-rate of 0.005 milliröntgens per hour, corresponding to a gamma-ray flux of 150 quanta per sq.cm. per minute, at an energy of 1.0 MeV. On the self-potential log 1" of chart was equivalent to 20 millivolts and on the resistance log 1" corresponded to a resistance change of 5 ohms.

3. CORRELATION OF ELECTRIC, RADIOACTIVE AND STRATIGRAPHIC LOGS AND INTERPRETATION

The main divisions of the geological succession, as indicated by the borehole samples, produce distinctive phases on the resistance and self-potential logs. Thus:-

Top - 122 ft.	Basalt with claystone bands. The basalt is characterized by high resistance.
122 - 1390 ft.	Marly limestone, becoming more marly towards the base. The marl exhibits low resistance and low (i.e. very little negative) self-potential. Porous zones in the limestone produce negative peaks in the self-potential curve.
1390 - 1458 ft.	Calcarecus sandstone. Characterized by high resistance.
1458 - 1475 ft.	Sandy clay. Low resistance characteristic of clay.
1475 - 1490 ft.	Sand. High resistance; the negative self-potential indicates permeability.
1490 - 1625 ft.	Silty breccia, merging into carbonaceous clay. Low self-potential indicates lack of permeability. Where the breccia is compact, the resistance is high.
1625 - 1660 ft.	Sand. The negative self-potential indicates permeability.
1660 - 2325 ft.	Siltstones, silty sands and sands.

In the portion of the log below 1,660 ft. the sands produce small positive peaks in the self-potential. The inference is that the water in the sands is less saline than the drilling mud. In the upper part of the hole however, the permeable zones exhibit negative peaks of self-potential, indicating that the formation waters are more saline than the mud.

On this basis in order to exclude the more saline water a suitable depth to set casing would appear to be in the region 1700 - 1750 feet.

The gamma-ray log shows a slight increase in radioactivity with depth as far as the base of the limestone, which may be due to increasing marl content.

Thereafter, the radioactivity is rather less, apart from occasional striking increases which correlate well with the self-potential and resistivity logs. Thus:-

1625 - 1660 ft.	Sand. The relatively high radioactivity would indicate that the sand is silty.
1680 - 1690 ft.	Carbonaceous claystone according to sample log.
1800 - 1825 ft.	Presumably silty zone.

(Sands are expected to be less radioactive than silts and clays.)

It is hoped to log the remainder of the hole, below 2,325 feet, with the Failing Logmaster recently acquired by the Bureau. This will provide information on the sands known to be present between 2,325 ft. and 2,660 feet below the rotary table.

PLATE I

ELECTRIC LOG

PORT FAIRY BOREHOLE

PARISH OF BELFAST No. 4

COMPANY : MINES DEPARTMENT OF VICTORIA

DATE : 28th APRIL, 1959

FIRST READING : 12 FEET BELOW TABLE

LAST READING : 2325 FEET BELOW TABLE

BIT SIZE : $12\frac{1}{4}$" (0-1496 FEET)

: 9" (1496-1652 FEET)

: $7\frac{5}{8}$" (1652-BOTTOM)

CASING : NIL

COORDINATES : (MILITARY) 669158

GROUND ELEVATION : 20 FEET ABOVE SEA LEVEL

HEIGHT OF TABLE : 10 FEET ABOVE GROUND

MUD TYPE : BENTONITE

MUD RESISTIVITY : 4·1 OHM-METRES @ 20°C

LOGGED BY : F. JEWELL

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PLATE 2

GAMMA-RAY LOG

PORT FAIRY BOREHOLE

PARISH OF BELFAST No4

COMPANY : MINES DEPARTMENT OF VICTORIA

DATE : 28th APRIL, 1959

FIRST READING : 12 FEET BELOW TABLE

LAST READING : 1935 FEET BELOW TABLE

BIT SIZE : 12¼" (0-1496 FEET)

: 9" (1496-1652 FEET)

: 7⅞" (1652- BOTTOM)

RANGE : 0·05 MILLI-ROENTGENS/HOUR/PER INCH

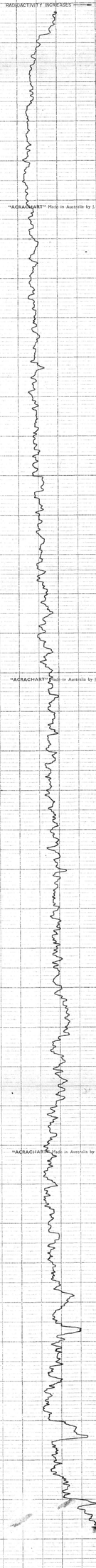
COORDINATES : (MILITARY) 669/58

GROUND ELEVATION : 20 FEET ABOVE SEA LEVEL

HEIGHT OF TABLE : 10 FEET ABOVE GROUND

LOGGED BY : F. JEWELL

RADIOACTIVITY INCREASES ——→



0
100
200
"ACRACHART" Made in Australia by J.J. Miller Printing Co. Pty. Ltd., Melbourne. Brown Type 5840-N Maker's No. 765
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"ACRACHART" Made in Australia by J.J. Miller Printing Co. Pty. Ltd., Melbourne. Brown Type 5840-N Maker's No. 765
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