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

RECORDS 1953 No. 65

ELECTRICAL LOGGING OF No. 2 BORE, ASSOCIATED AUSTRALIAN OILFIELDS N.L., ROMA, QUEENSLAND

by

WILLIAM. A. WIEBENGA

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A B S T R A C T

The features of the single-point resistance log, obtained in A.A.O. No.2 Bore, Roma, are described. Single-point resistance, self-potential and geological logs of the lower section of the bore hole are shown. The results indicate that electrical logging can be effectively used for correlation problems and that salt water sands in the reservoir rocks can be detected with reasonable certainty.

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ELECTRICAL LOGGING OF NO.2 BORE, ASSOCIATED AUSTRALIAN OILFIELDS N.L., ROMA, QUEENSLAND.

I. INTRODUCTION

In 1952 Associated Australian Oilfields N.L. started their second exploratory bore north of Roma, Queensland, in a lease referred to as Block 16, not far from the old bores R.B.O.1 and R.B.O.4. The approximate co-ordinates of the bore are : latitude 26° 29'.5 S., longitude 148° 50'E. On the Roma four-mile map of the Australian Survey Corps series the co-ordinates are 163800 or, more exactly, 163680 yards east and 708160 yards north. The expected depth was 3,600 feet to basement. The Company's Superintendent, Mr. H. J. Evans, requested the Bureau of Mineral Resources, Geophysical Section, to undertake well logging mainly to facilitate correlation between formations encountered in different bore holes. It was hoped that the use of well logging would avoid the necessity for coring in any future bores drilled in the same area. The Bureau had available a 500-feet single-point "Wideo" logger. It was thought that with a few alterations this instrument could be used in the logging of the 3,600 feet bore. Therefore, a geophysicist with the 500-feet "Widco" logger and some additional equipment was sent to Roma to do the well logging when the bore was expected to reach basement in January, 1953.

This short report is only meant as a commentary on the well logs which were recorded in the A.A.O. No.2 bore and which are reproduced in the accompanying plates. Neither the geology nor the theory of well logging will be explained.

II. APPARATUS AND METHODS

A "Wideo" shot hole logging unit, built by the Well Instrument Developing Co., P.O. Box 2406, Houston, Texas, was used.

The specifications of this logger are :-

Weight :	100 lbs.
Graphs :	Single-point resistance log only.
Recorder :	Fully automatic Esterline-Angus milliammeter.
Batteries :	One Burgess 4F 4H, 6 volt. Three " 5308, 45 "
Cable real :	Hand cranked, 500 feet cable. Logging speed not critical; about one foot per second.
Logging cable :	Stranded steel, neoprene-covered; tensile strength 600 lbs.; O.D. 0.143 inch.
Dimensions :	25" long x 14" wide x 25" high.
Resistance scale :	5, 10, 25, 50 and 100 ohms per inch deflection (approximately).
Electrodes :	Two of 6 lbs. each; 10" long, 1¼" O.D. One to be put in the mudpit at the surface and one for the actual logging.
Scale of records :	20 feet per inch with an adaptation to give 10 feet per inch.

The unit has been designed for use in relatively shallow holes less than 500 feet deep. In order to adapt the equipment for logging the deep A.A.O. No.2 Bore, the following modifications were made :-

The electrode was suspended on 4,000 feet of double insulated telephone wire, wound on a drum. For the electrical connection of the electrode with the logger, 4,000 feet of plastiflex wire was used. The drill rig served as a ground electrode. This arrangement was used to obtain self-potential and single-point resistance logs. For a self-potential log, the current was fed into a D.C. amplifier. The output of the D.C. amplifier went directly to the Esterline-Angus milliammeter recorder.

The well logs were made to a depth of 3,552 feet. A blockage in the hole and the small weight of the electrode made it impossible to extend the log to the bottom of the hole (3,610 ft.).

III. SUMMARY OF RESULTS

The Single-Point Correlation Log.

On Plate 1 the single-point resistance log and [The company's] a ditch sample log are shown side by side. The ditch sample log is made from an examination of rock cuttings as they come up from the hole with the drilling mud. Consequently, the depths shown in the ditch sample log for the changes in formation character are, on an average, about 30 feet too great, whereas the resistance log is shown on the correct depth scale. When this is taken into account the agreement between the two logs is quite fair.

The logs show the following characteristics which possibly could be used in future correlation work :-

(a) A high resistivity bed between 920 and 1,050 feet, interpreted as a garnet sandstone. Geological evidence indicates that it is a main fresh water horizon in the area. Salinity of the water is less than 10 grains per gallon.

(b) The boundary between Upper Walloon and Middle Walloon may possibly be indicated by a few resistivity peaks at about 1,250 feet. These resistivity peaks may indicate carbonaceous shales or coal bands.

(c) The whole Lower Walloon Coal measures zone between 1,250 and 2,260 is characterized by numerous high resistivity peaks which can be interpreted as coal seams or carbonaceous shales. A very conspicuous anomaly between 1,465 and 1,485 feet probably represents a 20 feet coal seam or carbonaceous shales.

(d) The Bundamba Sandstones between 2,260 and 3,100 feet are characterized by numerous anomalies, completely different in character from the sharply peaked anomalies of the Lower Walloon Coal measures.

(e) The boundary between the Bundamba Sandstones and the Moolayember Shales is characterized by a sudden drop in the general resistivity trend.

(f) The Moolayember Shales do not show much character on the log. The resistivity is about the lowest of the whole section, indicating a higher salinity of the pore solution of the shale.

(g) Below 3,370 feet the zone with economical possibilities is marked by alternating high and low resistivities, interpreted as alternating beds of shales and sandstones containing saltwater, gas and oil traces.

A blockage in the hole at 3,552 feet prevented logging to a lower level.

The Logs of the Lower Part of the Bore.

On Plate 2 geological, self-potential and single-point resistance logs of the sections between 3,410 and 3,552 feet are shown. The amplitudes of the anomalies on the self-potential log are relatively small, no doubt because the log was made more than a week after this part of the section had been drilled and considerable mud infiltration had taken place. Nevertheless, the results suggest the following interpretation rules :-

(a) Sands or sandstones containing gas and/or oil or oil traces are characterized by moderate negative self-potentials and moderate to high resistivities.

(b) Sands or sandstones containing salt water are characterized by high negative self-potentials and low to moderate resistivities.

(c) Shales are characterized by the absence of negative self-potential kicks and usually show low resistivities. The self-potential of the shales is normally taken as the zero reference line in well-logging practice.

The occurrence of gas and oil in what is called, on the geological log, fine-grained sandstone at 3,480 feet and well-cemented sandstone at 3,520 feet suggests that the presence of oil in the sandstones is largely controlled by the pore size. Konecki (1953, p.5.) points out that there are no impervious bands in the oil-sand section penetrated by the bore and suggests that "Fluid saturation is probably controlled by the size and shape of pores (in other words, by permeabilities)."

It was unfortunate that the electrical logging could not be continued below 3,552 feet so as to include the lowest oil sand.

IV. CONCLUSIONS

1. Single-point resistance logs, if possible combined with self-potential logs, probably can be effectively used for correlation problems in the Roma area.

2. Single-point resistance and self-potential logs can be used as a tool in detecting salt water horizons in the zone of oil-bearing reservoir rocks.

3. It appears likely, but this has not been definitely established, that the occurrence of gas and oil in the zone of oil-bearing reservoir rocks is largely controlled by the pore size (permeability).

V. REFERENCE

Konecki, M.C., 1953 - Testing of Cores from Associated Australian Oilfields N.L. Well No.2, Roma, Queensland, Bur. Miner. Res. Geol. & Geophys. Records No.1953/52.

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Melbourne.
9th July, 1953.

Distribution :

Original - Geophysical Library.
1st copy - Chief Geologist, Canberra.
2nd " - Associated Australian Oilfields N.L., Roma.
3rd " - Under Secretary, Department of Mines, Queensland.
4th " - Geophysical Library.
5th " - " "
6th " - " "

PLATE I.

0-10	SURFACE SOIL AND BROWN CLAY
10-60	SANDSTONE, SOFT BROWN AND GREY CLAY
60-190	SILTY SANDSTONE, GREY SOFT WITH THIN COAL BANDS GREY SHALE
190-210	SANDSTONE, GREY SOFT CARBONACEOUS SOME COAL AND BROWN SANDY COAL
210-270	SHALE, GREY, SANDY, SANDSTONE, CARBONACEOUS, GREY SANDSTONE BUFF COLOURED, SOME COAL
270-385	SILTY SANDSTONE AND SANDSTONE, CARBONACEOUS. GREY, FINE TO MEDIUM. SOME SHALE AND COAL IRREGULAR QUARTZ FRAGMENTS
385-400	SANDSTONE AND GRIT, FINE TO COARSE WITH QUARTZ FRAGMENTS. SOME SHALE AND SILTSTONE
400-445	CARBONACEOUS SHALE AND COAL GREY SILTSTONE AND BROWN CLAY, AND SANDSTONE MEDIUM TO COARSE
445-465	SANDSTONE, MEDIUM GRAIN, CARBONACEOUS, SILTSTONE GREY.
465-475	CARBONACEOUS SHALE AND COAL SANDSTONE, MEDIUM, CARB.
475-510	SILTSTONE AND SHALE, GREY, CARBONACEOUS SOME SANDSTONE AND SILTY SANDSTONE, MEDIUM TO FINE.
510-520	SANDSTONE, FINE GRAIN AND GREY SILTSTONE
520-695	SANDSTONE, MEDIUM GRAIN, CARBONACEOUS SOME SHALE AND GREY SILTSTONE. SOME GREEN SILTSTONE AT 610'
695-710	SANDSTONE, MEDIUM GRAIN, SHALE, GREY BROWN AND TAN SOME QUARTZ FRAGMENTS
710-780	SANDSTONE. MEDIUM GRAIN, SOME SHALE SLIGHTLY CARBONACEOUS.
780-800	SANDSTONE, MEDIUM AND GREY SHALE.
800-820	SHALE, GREY AND SANDSTONE, WITH QUARTZ FRAGMENTS
820-835	SANDSTONE, SILTY SANDSTONE AND GREY SHALE.
835-865	SANDSTONE, FINE GRAIN. SOME GREY SHALE.
865-980	SANDSTONE, FINE TO MEDIUM, SOME SHALE.
980-1025	SANDSTONE, FINE GRAIN, MANY REDGARNETS.
1025-1100	SANDSTONE, FINE GRAIN, SOME SHALE.
1100-1110	SANDSTONE, MEDIUM TO COURSE AND GREY SHA
1110-1125	SHALE, GREY, SANDY AND SANDSTONE MEDIUM GRAIN
1125-1155	SANDSTONE, FINE GRAIN AND GREY SHALE
1155-1185	SHALE AND SANDSTONE, FINE GRAIN AND SLIGHTLY SILTY
1185-1240	SANDSTONE, FINE GRAIN AND SHALE.
1240-1285	SHALE AND SANDY SHALE, SANDSTONE. SOME GREEN CLAYSTONE.
1285-1310	SANDSTONE, FINE GRAIN, SHALE AND CARBONACEOUS SHALE, AND GREEN CLAYSTONE
1310-1320	COAL CARBONACEOUS SHALE AND SANDSTONE.
1320-1340	SANDSTONE, SHALE AND CARBONACEOUS SHALE SOME GREEN PYRITES NODULES
1340-1400	SHALE AND CARBONACEOUS SHALE WITH SOME SANDSTONE. OCCASIONAL COAL BANDS
1400-1430	SANDSTONE WITH SOME SHALE.
1430-1460	SILTY SANDSTONE AND SHALE
1460-1500	SANDSTONE AND SHALE, SOME CARBONACEOUS SHALE
1515-1605	SANDSTONE, SILTY IN PLACES GREY SHALE AND CARBONACEOUS SHALE. OCCASIONAL COAL BANDS.
1605-1625	SHALE AND CARBONACEOUS SHALE, SOME SAND
1625-1685	SANDSTONE, MEDIUM GRAIN SOME SHALE
1685-1700	SANDSTONE AND SHALE WITH COAL BAND
1700-1755	SHALE AND CARBONACEOUS SHALE. SOME SILTY SANDSTONE. COAL BAND
1755-1765	SANDSTONE SOME SHALE
1765-1810	SHALE AND SANDSTONE
1810-1925	SHALE LIGHT TO DARK GREY SLIGHTLY CARBONACEOUS SOME SAND.
1925-1955	SANDSTONE, FINE GRAIN SOME SHALE.
1955-2010	SHALE, SOME CARBONACEOUS SHALE AND COAL SOME SANDSTONE AND GREEN CLAYSTONE
2010-2020	SANDSTONE FINE GRAIN SOME SHALE
2020-2095	SHALE WITH COAL AND CARBONACEOUS SHALE BANDS. SANDSTONE AND SILTY SANDSTONE.
2095-2265	SHALE AND SANDY SHALE WITH CARBONACEOUS SHALE AND COAL BANDS SOME SANDSTONE.
2265-2295	SANDSTONE, FINE AND VERY FINE GRAIN. SOME SHALE.
2295-2355	SANDSTONE FINE TO MEDIUM GRAIN SOME SHALE.
2355-2385	SHALE, CARBONACEOUS SHALE AND COAL WITH SANDSTONE BANDS.
2385-2410	SANDSTONE, FINE GRAIN WITH COARSE GRAIN BAND AT 2425'. SOME SHALE
2410-2490	SHALE, CARBONACEOUS SHALE AND COAL. SOME SANDSTONE, VERY FINE GRAIN.
2490-2555	SHALE WITH SOME CARBONACEOUS SHALE AND COAL SANDSTONE, FINE GRAIN WITH COARSE GRAINED BAND
2555-2705	SANDSTONE, FINE TO MEDIUM. SOME SHALE AND CARBONACEOUS SHALE.
2705-2725	SANDSTONE, VERY FINE GRAIN.
2725-2790	SHALE, SOME CARBONACEOUS SHALE AND COAL. SOME SANDSTONE.
2790-2905	SANDSTONE, FINE GRAIN SHALE, SOME CARBONACEOUS SHALE.
2905-2955	SANDSTONE, VERY FINE GRAIN SOME SHALE.
2955-2980	SHALE, SOME CARBONACEOUS SHALE AND COAL SOME SANDSTONE
2980-3016	SANDSTONE WITH SHALE CONGLOMERATE.
3016-3040	SHALE, CARBONACEOUS SHALE. SOME PIPE CLAY SOME FINE SANDSTONE
3040-3075	SANDSTONE, FINE GRAIN WITH SHALE, CARBONACEOUS SHALE AND PIPE CLAY. SOME COAL.
3075-3100	SHALE, CARBONACEOUS SHALE AND PIPE CLAY. WITH SOME FINE GRAIN SANDSTONE
3100-3120	SANDSTONE, FINE GRAIN WITH ANGULAR SHALE CONGLOMERATE.
3120-3142	SANDSTONE, FINE GRAIN. OCCASIONAL BEDS OF SANDSTONE AND SHALE CONGLOMERATE.
3142-3161	SHALE WITH SANDSTONE BAND.
3161-3180	SANDSTONE WITH SOME SHALE.
3180-3240	SHALE AND SANDY SHALE. SOME SANDSTONE.
3240-3297	SANDSTONE AND SHALE.
3297-3410	ALTERNATING THIN BANDS OF SANDSTONE AND LEACHED SHALE, CARBONACEOUS AND MICACEOUS WITH RUST COLOURED PLANT MATTER. SOME SANDSTONE AND SHALE CONGLOMERATE IN Nº8 CORE.
3410-3451	SANDSTONE, FINE TO MEDIUM WITH SOME COARSE GRAIN LIGHT GREY WITH SOME THIN SHALE BANDS. GAS SHOW 3423'-3438'
3451-3476	SHALE AND SANDSTONE
3476-3489	SANDSTONE, LIGHT GREY, FINE TO MEDIUM SOME THIN SHALE BANDS AND ONE FOOT OF SHALE ON BOTTOM. GAS SHOW
3489-3545	SANDSTONE, LIGHT GREY, FINE TO MEDIUM. SLIGHTLY SILTY. SOME THIN SHALE BANDS. OIL SHOW 3517'5" TO 3521'6".
3545-3547	SHALE
3547-3559	SANDSTONE FINE TO MEDIUM. OIL SHOW 3549'4" TO 3553'10".
3559-3569	SHALE WITH SILICIFIED SANDSTONE BANDS CONTAINING OIL
3569-3578	SILTY SANDSTONE WITH GRIT BANDS.
3578-3590	SHALE, BLACK COMPACT, MICACEOUS.
3590-3598	SANDSTONE, WHITE, FINE GRAIN WITH SIDERITE NODULES.
3598-3616	GRANITE

LEGEND

- SANDSTONE
- SHALE
- COAL BANDS
- CARBONACEOUS
- CONGLOMERATE

REMARKS: BORE HOLE DIAMETER : 8¼"
MUD RESISTIVITY : 1-2 OHM METER
MUD INFILTRATION : HIGH
GEOLOGY FROM H.J. EVANS & J. TONKIN.
DATE: FEB. 1953.

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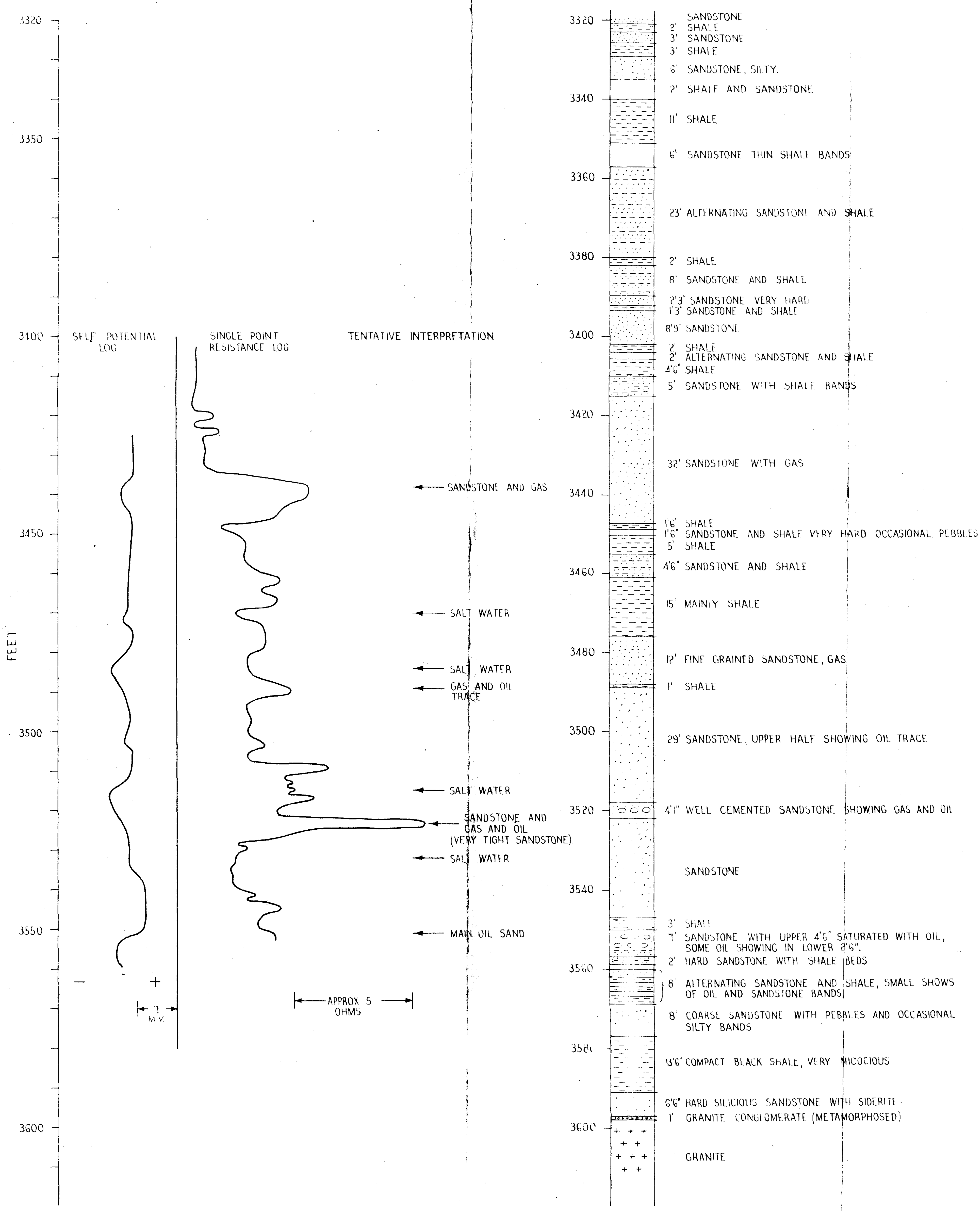
WELL LOGGING. ROMA.

ASSOCIATED AUSTRALIAN OIL FIELDS N.L. Nº2 BORE
SINGLE POINT RESISTANCE AND DITCH SAMPLE LOG

Geophysical Section, Bureau of Mineral Resources, Geology and Geophysics.

G38-53

PLATE. 2



WELL LOGGING. ROMA.

ASSOCIATED AUSTRALIAN OIL FIELDS N.L. Nº2 BORE

GEOLOGIC, SELF POTENTIAL AND SINGLE POINT RESISTANCE LOGS OF LOWER PART OF BORE

William A Wiebenga GEOPHYSICIST