COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

PETROLEUM SEARCH SUBSIDY ACTS

Publication No. 15

QUEENSLAND AMERICAN THE OVERFLOW No. 1, QUEENSLAND

OF

QUEENSLAND AMERICAN OIL COMPANY

Issued under the Authority of Senator the Hon. Sir William Spooner,
Minister for National Development
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COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

Minister: SENATOR THE HON. SIR WILLIAM SPOONER, K.C.M.G., M.M.

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

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

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FOREWORD

In 1959 the Commonwealth Government enacted the Petroleum Search Subsidy Act 1959. This Act enables companies that drill for new stratigraphic information, or carry out geophysical or bore-hole surveys in search of petroleum, to be subsidized for the cost of the operation, provided the operation is approved by the Minister for National Development.

The Bureau of Mineral Resources, Geology and Geophysics is required, on behalf of the Department of National Development, to examine the applications, maintain surveillance of the operations and in due course publish the results.

The drilling of Queensland American The Overflow No. 1 was carried out under the Petroleum Search Subsidy Act 1959, on Authority to Prospect 71P, south-east Queensland, (Lat. 27° 48'30" S., Long. 152° 51'04" E.) by Queensland American Oil Company. This Publication deals with the results of this drilling operation and contains information furnished by Queensland American Oil Company, and edited in the Geological Branch of the Bureau of Mineral Resources. The final report was written by Mr. C.W. Siller, Vice-President, Queensland American Oil Company. The methods employed in the drilling operation and the results obtained are presented in detail.

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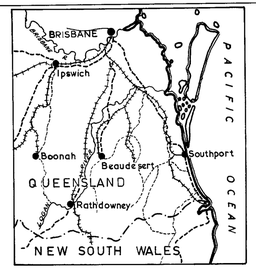

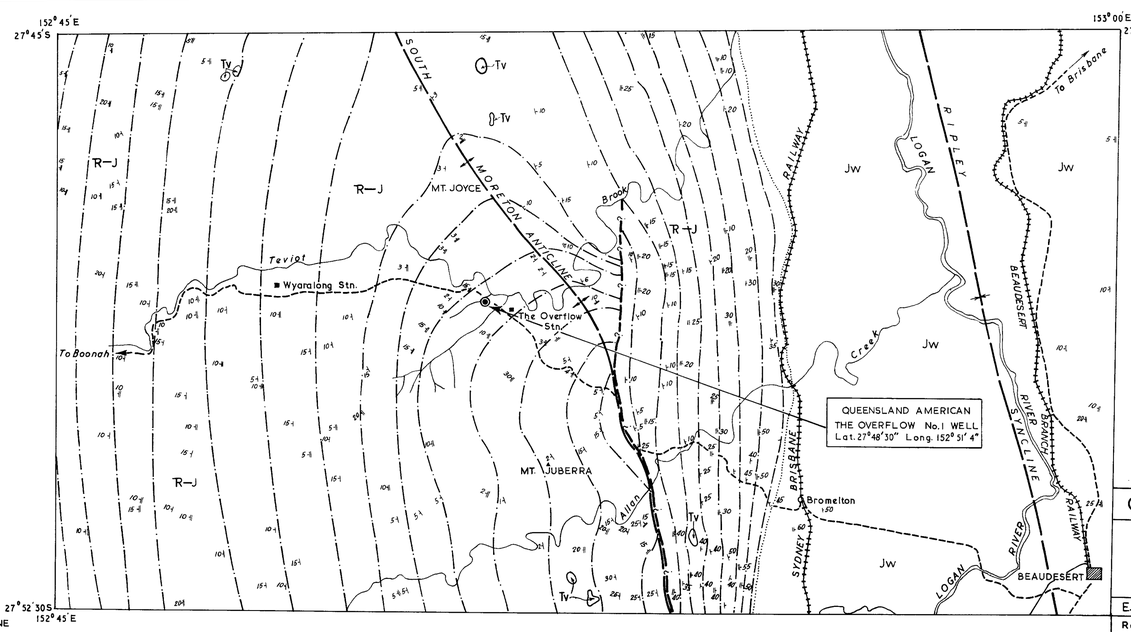

LEGEND

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TRIASSIC	R-J	Bundamba Sandstone

NOTE Form lines on this plan represent a possible interpretation of the structure. They are unrelated to any datum and have been established from photogeological studies. Information has also been obtained from a geological map which was produced by Oil Search Limited

SCALE IN FEET
2000 0 2000 4000 6000

QUEENSLAND AMERICAN OIL CO.

LOCALITY PLAN
THE OVERFLOW No. 1 WELL, QLD

E. A. WEBB — CONSULTING GEOLOGIST

Revised: E A WEBB	
Drawn: I. R	
Date: 22 10 1962	

SUMMARY

The Overflow No. 1 Well was drilled on the South Moreton Anticline in Authority to Prospect 71P, south-east Queensland, to a total depth of 2993 feet. The well drilled in Bundamba Sandstone to 310 feet, Ipswich Coal Measures from 310 feet to 1605 feet, and volcanic rocks of probable early Triassic or Upper Palaeozoic age from 1605 feet to total depth.

Drilling operations commenced on 8th April, 1960, and the well was abandoned as a dry hole on 18th May, 1960. The drilling contractor was Mines Administration Pty Limited, Brisbane, and the rig used was a National Ideal 55. The operation provided for a programme of electric and mud logging, testing and coring.

The well was abandoned short of the target depth of 6500 feet because of the hard drilling and poor petroleum prospects in the thick volcanic sequence. Minor oil and gas showings in the well were closely associated with coal seams.

INTRODUCTION

Queensland American The Overflow No. 1 Well was drilled to determine the stratigraphic succession and to test the oil and gas prospects of the South Moreton or Mt Jubbera Anticline, a large faulted anticlinal structure in south-east Queensland.

The well was located on "The Overflow" Station, 50 yards south of the Beaudesert - Boonah road at Latitude 27°48'30" S., Longitude 152°51'04" E. (Fig. 1).

Drilling operations commenced on 8th April, 1960. Below horizontal freshwater Mesozoic sediments, volcanic rocks with moderate to steep dips were encountered at 1605 feet and operations were suspended on 26th April, at a depth of 1753 feet. Because of doubts as to whether the volcanic rocks below 1605 feet constituted effective basement in the area, drilling was resumed on 29th April, and the well was finally abandoned as a dry hole on 18th May, at a depth of 2993 feet after penetrating an entirely volcanic section below 1605 feet. Rigging up and rigging down operations occupied seven and three days respectively.

The well was drilled on Authority to Prospect 71P, held jointly by Queensland American Oil Company (50%), Phillips Petroleum Company (25%) and Sunray Mid-Continent Oil Company (25%).

WELL HISTORY

General Data

Well Name and Number:	Queensland American The Overflow No. 1
Location:	South-east Queensland. Lat. 27°48'30" S., Long. 152°51'04" E.
Tenement Holder:	Queensland American Oil Company, Brisbane, Queensland.
Details of Petroleum Tenement:	Authority to Prospect No. 71P covering 29,500 square miles and valid until 31st March, 1964.
District: (Landowner)	B. Joyce, The Overflow, Beaudesert, Queensland.
Total depth:	2993 feet
Date drilling commenced:	8th April, 1960
Date drilling completed:	17th May, 1960
Date well abandoned:	18th May, 1960
Date rig released:	20th May, 1960
Drilling time to total depth:	36 days
Elevation (a.s.l.):	Ground 183 feet; Kelly Bushing 194 feet (Datum 11-mile peg, Beaudesert-Boonah road)
Status:	Abandoned

Drilling Data

Drilling Contractor: Mines Administration Pty Ltd,
31 Charlotte Street,
Brisbane, Queensland.

Drilling Plant:

Make:	National
Type:	Ideal 55
Rated capacity with 4 1/2" drill pipe:	9000 feet
Rated capacity with 3 1/2" drill pipe:	11,000 feet
Motors:	3 General Motors Diesel, Series 71, 320 BHP each.

Mast:

Make:	Lee C. Moore
Type:	131-foot cantilever
Rated capacity:	550,000 lb.

Pumps:

Make:	National - Ideal
Type:	C - 350
Size:	7 3/4" x 18"
Number:	Two

Blowout Preventer equipment:

Make:	Hydril	Shaffer
Model:	GK	Type B Hydraulic
Size:	12"	12"
Series: (A.P.I.)	900	900

Hole Sizes and Depths:

Surface to 185 feet	-	17 1/2"
185 feet to 214 feet	-	12 1/2"
214 feet to 2990 feet	-	8 1/2"
2990 feet to 2993 feet	-	7 5/8"

Casing details:

Only one string run.

Size:	13 3/8"
Weight:	54 lb/ft.
Grade:	J-55
Range:	2
Setting depth:	174 feet

Casing cementing details:

13 3/8" casing run to 174 feet and cemented to surface with 130 sacks of construction cement mixed to an S.G. of 1.79.

Drilling Fluid:

Mud properties at various depths were -

Depth (feet)	500	1000	1500	2000	2500	2900
Weight (S.G.)	1.08	1.12	1.13	1.12	1.09	1.09
Viscosity (Marsh) (secs)	35	33	35	35	35	41
Filtrate (cc.)	20	17	10	11	16	9
Filter cake (mm.)	2.0	3.0	2.0	1.0	1.0	2.0
pH	8.0	11.0	7.6	12.0	10.5	7.2
Sand content (%)	0.75	1.5	0.75	0.12	0.3	1.0

Materials used -

Bentonite	41,000 lb.	Q.-Broxin	700 lb.
Nymcel	1320 lb.	Myrtan	450 lb.
Caustic Soda	190 lb.	Mica Flakes	317 lb.
Sawdust	34 bags		

Water Supply:

Water was supplied to the site through a pipeline laid from Teviot Brook, approximately one mile away. A pump was installed at the stream by the contractor.

Perforation and Shooting Record:

No perforation or shooting was carried out.

Plugging back and squeeze cementation jobs:

A cement plug was installed at the shoe of the 13 3/8" casing at 174 feet using 28 sacks of cement.

Fishing Operations:

Only one fishing operation was carried out. A twist-off occurred at 2958 feet leaving 11 drill collars (6 1/4" OD x 2 3/4" ID) in the hole. The fish was recovered using an overshot.

Side-tracked Hole:

No side-tracking operations were carried out.

Deviation:

The deviation from vertical in the horizontal sediments above 1605 feet was 1^{o} or less. Below 1605 feet, in hard volcanics, the deviation gradually increased to a maximum of 5 degrees at 2875 feet. The final deviation reading was 4 1/2 degrees at 2930 feet.

Abandonment Programme:

On completion of drilling operations
(a) a 50-foot column of cement was set at the casing shoe;
(b) the casing was filled with anticorrosive mud;
(c) a 20-foot column of cement was set in the top 20 feet of the casing;
(d) the well was sealed with a steel cap detailing the name and number of the well and commencement and completion dates.

Logging and Testing

Sampling and Coring:

Rock cuttings were collected from the shale shaker at 5-foot intervals. A copy of the detailed lithological log may be inspected at the Bureau of Mineral Resources, Canberra, and at the Geological Survey of Queensland, Brisbane.

The following cores were cut with a Hughes core barrel using 7 5/8" Type J hard formation coreheads:

TRIASSIC SEDIMENTS			VOLCANICS		
Core No.	Interval (feet)	Recovery	Core No.	Interval (feet)	Recovery
1	212-214	1'10"	10	1635-1645	9'
2	430-440	10'	11	1738-1753	12'
3	647-657	10'	12	1855-1867	3'
4	657-667	10'	13	2285-2288	2' 2"
5	667-677	7'	14	2653-2659	4' 9"
6	860-870	9' 9"	15	2800-2805	4' 7"
7	1053-1055 1/2	2' 6"	16	2990-2993	2' 7"
8	1265-1275	10'		54' 0"	38' 1"
9	1473-1477	3' 6"			
	68' 6"	64' 7"			

A total footage of 122'6" was cored, with a recovery of 102'8".

The original coring programme included:
(a) Cores at formation changes;

(b) Cores at indications of oil or gas;
(c) Cores at indications of porosity or permeability;
(d) Cores at intervals not exceeding 200 feet except in thick uniform sections where by agreement the interval could be extended to 500 feet;
(e) Core runs to be at least 10 feet.

Within the Triassic sediments, the programme was altered as follows:-

Core No. 1 - Two feet instead of ten feet were cored in hard sandstone to avoid possible deviation at such a shallow depth, using 7 5/8" corehead in 12 1/2" hole.

Core No. 7 - Two and one half feet instead of 10 feet were cored because of the extreme hardness of the cherty conglomerate.

Core No. 9 - Four feet instead of 10 feet were cored because of the extreme hardness of the conglomerate.

Cores 13 to 16 in the underlying volcanics were reduced in length to three to six feet because of the hardness of the volcanic rocks. Additional stratigraphic information would not have been obtained by wasting time and money on full length cores. The intervals between Cores 12 and 13, and 13 and 14 were extended over 200 feet because of the monotonous nature of the volcanic section. However, the average interval between cores in the volcanic rocks was slightly less than 200 feet.

The sample cuttings and cores were described by Messrs P.E. Power and M.J. Mahoney, well-site geologists. The abbreviated descriptions in the Composite Log were compiled from these descriptions.

Electrical Logs:

The following spontaneous potential, resistivity and micro-logs were run by Schlumberger:

Electrical Survey	No. 1	175 - 1755 feet
" "	" 2	1655 - 2931 feet
Microlog	No. 1	176 - 1753 feet

Copies of these logs (scale 1 inch : 50 feet) are available for inspection at the Bureau of Mineral Resources, Canberra, and at the Geological Survey of Queensland, Brisbane.

The bottom 62 feet of the hole (2931 - 2993 feet) was not logged. A final core confirmed that the well bottomed in volcanic material. The logs indicate, as do the sample cuttings and cores, a non-porous, impermeable section.

GEOLOGY

Previous Work

Queensland American The Overflow No. 1 was drilled on the South Moreton or Mt Jubbera Anticline. This anticline and its environs have been reported on by a number of

geologists. However, the basic work relevant to this report appears to have been carried out by J.H. Reid (1922), C.C. Morton (1923) and F. Reeves (1936). With the aid of the excellent geological map accompanying Reeves' report, Geosurveys of Australia Ltd (1959) prepared photo-interpretation maps of the anticline for the Queensland American Oil Company.

This work demonstrated a large faulted asymmetric anticline extending for approximately 40 miles from near Ipswich in the north to near Rathdowney in the south (Fig. 1). Outcrops in the crestal area are massive current-bedded sandstones - the Bundamba Sandstone of Triassic-Jurassic age - flanked in the synclinal areas by outcrops of the Jurassic Walloon Coal Measures.

A considerable amount of volcanic activity occurred in the Moreton Basin during Tertiary time; vast outpourings of plateau basalts presumably flowed over large portions of the anticline from sources to the west and south. These basalts are now represented by isolated remnants (Fig. 1). Associated basaltic dykes occur in the Ipswich Coal Measures, Bundamba Sandstone and Walloon Coal Measures. Denmead (1955) reports that in the Ipswich coal field "the metamorphic effect of the dykes on the invaded strata is usually insignificant ..... . The coal is usually coked for a distance of one to three feet from the contact ...." Trachytic plugs occur along the South Moreton Anticline to both the north and south of the area covered by Figure 1.

Prior to drilling, the section beneath the Bundamba Sandstone, which crops out in the crestal area, was unknown. Reid, on the basis of the large thickness of this formation eroded off the anticline in "The Overflow" area, and the presence of the fossil plant Thinnfeldia, which he considered indicative of the proximity of Ipswich Coal Measure strata, considered that the Ipswich Coal Measures, of Triassic age, would be encountered at shallow depth in an exploratory well. These coal measures in the Ipswich area are approximately 4000 feet thick, and consist of freshwater sandstone, shale, and conglomerate with commercially important coal seams and minor tuffs and lavas in the basal section (Denmead, 1955).

The section below the Ipswich Coal Measures could not be predicted with confidence. However, marine Carboniferous sediments crop out in a disturbed belt near Mount Barney, (Stephenson, 1953) some 30 miles south-south-west of The Overflow No. 1, and it was considered that they might underlie the Ipswich Coal Measures.

Geological Section in The Overflow No. 1

The section obtained in the well, particularly below 1605 feet, was quite different from the predicted section. A tight, monotonous, sandstone-siltstone section was penetrated to 630 feet, the upper 310 feet of which on lithological grounds can be confidently correlated with the outcropping Bundamba Sandstone. Below 630 feet horizontal sandstone, siltstone, and conglomerate, with minor shale and coal seams, extended to 1605 feet where an entirely unexpected sequence of altered volcanic rocks was encountered.

Palynological work (de Jersey, Appendix 4) has shown that the sediments below 1170 feet are definitely of Triassic age. Unfortunately, "basic knowledge of the sequence of microfloras" is, as yet, inadequate and correlation with individual formations (or stages) of the Ipswich Coal Measures in the type area or separation of the microfloras of these measures from those of the overlying Bundamba Sandstone is not, at the present time, practicable.

The coal-bearing section between 630 feet and 1605 feet can be confidently correlated with the Ipswich Coal Measures. The top 310 feet of strata in the well clearly belong to the Bundamba Sandstone. At least part (possibly all) of the interval between 310 feet and 630 feet most probably belongs to the Ipswich Coal Measures and has been shown as Ipswich Coal Measures on the Composite Well Log (Pl. 1).

Until the basic palynological work has been completed it will not be possible to determine whether:

(a) All formations (or stages) of the Ipswich Coal Measures are present, but thinner, over the crest of the anticline; or

(b) whether one or more formations were not deposited on the anticlinal high; or

(c) whether a combination of (a) and (b) is reponsible for the greatly reduced thickness of the Ipswich Coal Measures from approximately 4000 feet in the type area to not more than 1300 feet on the crest of the South Moreton Anticline.

The altered volcanic sequence below 1605 feet was quite unexpected. Cores cut in the overlying Coal Measures indicated horizontal or nearly horizontal bedding. In contrast, Cores 10 (1635-1645 feet) and 11 (1738-1753 feet) in the volcanics showed "dips" of 10 and 20 degrees respectively. In addition the top of the volcanics is multicoloured indicating a period of weathering and a probable unconformity between the sediments and the volcanics.

The absence of sediments in the volcanics between 1605 and 2993 feet (total depth) prevents an age determination. The volcanics are clearly older than the Ipswich Coal Measures (Middle Triassic, Hill, 1930); they could be early Triassic or Upper Palaeozoic. There is no way, except possibly by radio-active methods, to find out which is correct.

OIL AND GAS INDICATIONS

Below 630 feet very tight sandstones and conglomerates associated with coal seams fluoresced and yielded positive cuts with carbon tetrachloride. These "showings" were supported by minor activity on the gas log. Parts of the conglomeratic grit cored between 647 and 677 feet had a distinct oily smell. The lack of porosity and permeability in these coarse sediments due to poor sorting and a kaolinitic matrix was remarkable. The kaolinitic matrix presumably accounts for the lack of a "shale" line on the spontaneous potential curve. The combined evidence from cuttings, cores, gas detector and electric logs clearly indicated that drill stem testing was unwarranted.

The "zones of fluorescence" are shown on the Composite Log. It would be difficult to imagine source material in the section penetrated other than the coal seams with which the zones are associated. Since basaltic dykes are known to occur in the area, the fluorescence may well be due to distillates from the coal seams, heated and coked by nearby dykes. The gas detector indicated that the coal in the section between 1305 and 1350 feet was of a gassy type.

CONCLUSIONS

The following conclusions may be drawn from the information obtained in this well:

(1) The Ipswich Coal Measures, approximately 4000 feet thick in the type area, have thinned to 1300 feet at The Overflow No. 1.

(2) Despite the presence of coarse sandstone, grit and conglomerate, the coal measures do not contain beds with significant porosity and permeability.

(3) The coal measures are more arenaceous than in the type area.

(4) Apart from ash content, etc., the coal seams in the area are non-commercial because of their depth.

(5) The Ipswich Coal Measures are unconformably underlain by altered volcanic rocks of unknown, but presumably early Triassic or Upper Palaeozoic age.

(6) Whether the marine Carboniferous sediments which crop out at Mount Barney occur in this area or the synclinal area to the west is conjectural. If these beds are present in The Overflow No. 1 area, they are covered by a thick volcanic sequence.

(7) The South Moreton Anticline, because of the lack of porosity and permeability in the Ipswich Coal Measures, and the presence of a thick sequence of altered volcanic rocks of unknown age, does not warrant further exploration at this stage.

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APPENDIX 1

CORE DESCRIPTIONS

THE OVERFLOW NO. 1

by

P.E. Power and M.J. Mahoney

Mines Administration Pty Ltd

Core No. 1: Cored interval 212 - 214 feet. Recovery 22", (92%).
Sandstone, light grey, coarse-grained, in places grading to grit (2-4 mm), patchily calcareous, partly kaolinitic, quartzose. Grains more than 95% quartz, mainly subangular to angular, clear; less than 5% grains black, angular, dominantly siltstone. The sandstone contains two thin (5 mm) irregular coaly partings at its base. Dip 5^{o} - 7^{o} (may be current-bedding in part).*
No show of oil or gas.

Core No. 2: Cored interval 430 - 440 feet. Recovery 10 feet, (100%).

9" Sandstone, white to light grey, fine quartz grains subangular to subrounded, kaolinitic, very calcareous, minor current-bedding, thin coaly bands 1 - 2 mm which have considerable mica; some lithic grains; slightly porous, fairly hard and well cemented;

6'3" Sandstone, grey and light grey, quartzose, fine-grained, grading into siltstone, few silty lenses; thinly bedded, thin interbeds of micaceous carbonaceous shale (1-2 mm), minor coal; minor current-bedding, non-porous, hard, compact; plant remains, white to grey;

1'8" Sandstone, white to light grey, coarse, poorly sorted, grades into grit; mainly quartz grains subangular to subrounded, a few fragments of metamorphic rocks; kaolinitic, slightly porous, calcareous; minor interbeds of thinly bedded micaceous carbonaceous siltstone; minor coal;

4" Coal, dull black, brittle, micaceous, shaly;

1'0" Grit, white to light grey, poorly sorted; quartz grains clear and glassy, also grains of grey quartzite, some coal fragments, other rock fragments rare; kaolinitic, calcareous, slightly porous; massive to poorly bedded. Dip horizontal. Flame test negative. No sign of oil or gas.

Core No. 3: Cored interval 647 - 657 feet. Recovery 10 feet, (100%).

3" Grit, white to grey, speckled black to grey, coarse to conglomeratic, friable, apparently porous; grains, angular to subrounded, of clear quartz, grey quartzite, coal, ironstone and chert; very slightly calcareous, minor matrix appears kaolinitic. Strong bright golden-yellow "powdery" fluorescence, faint brown stain;

1" Siltstone, dark brown, fine, grades into shale; quartzose, micaceous, carbonaceous, contains plant impressions. No fluorescence;

* Description of Core No. 1 by S.S. Derrington. The author of the completion report considers that the dip in this core is due to current-bedding.

3" Grit, as above;

5'0" Siltstone, dark grey-brown to black, fine-grained, well sorted, carbonaceous, minor coal, micaceous, plant fossils; contains one main grit lens, with golden fluorescence. The siltstone is interbedded (4" beds) and interlaminated with sandstone, grey to light grey-brown, fine-grained, well sorted, hard, non-porous, micaceous, carbonaceous;

10" Sandstone, white to light grey-brown, fine to medium-grained, poorly to moderately sorted, quartzose, minor mica, kaolinitic; minor grit, few specks of coal, carbonaceous streaks patchy; light brown to yellow fluorescence;

3'7" Grit, conglomeratic, white to light grey-brown, coarse-grained, poorly sorted, friable, some porosity, quartzose, grains predominantly subangular to subrounded quartz and quartzite, a few lithic, some clastic coal; pebbles up to 2 1/2", average 1", banded and grey quartzite; minor carbonaceous silty and shaly interbands, coaly plant remains, patchy fluorescence, brown and bright golden, spotty yellow and blue. Dip horizontal.

Core No. 4: Cored interval 657 - 667 feet. Recovery 10 feet, (100%).

10' Grit, white to light and medium grey, quartzose, feldspathic, kaolinitic; some grains of quartzite; conglomeratic, poorly sorted, low porosity; pebbles of grey quartzite up to 2", averaging about 5/8" diameter, some pebbles of coal; massive to poorly bedded, a few thin siltstone interbeds are carbonaceous and micaceous; positive spotty golden-yellow fluorescence quite strong, smell of oil, slight brown staining. Dip horizontal. Slight show of oil and gas (on detector).

Core No. 5: Cored interval 657 - 667 feet. Recovery 7 feet, (70%).

7' Conglomerate, dappled black, grey and white, fine-grained, grades into coarse grit, moderately sorted; pebbles of quartz, quartzite, coal and carbonaceous shale, feldspathic and kaolinitic, in part friable; low porosity; few coaly interbeds and streaks, minor grit and sandstone interbeds with same mineral composition; some evidence of depositional deformation; pebbles subrounded, smaller grains subangular. Positive patchy golden-yellow fluorescence, minor faint brown staining. Dip horizontal. Slight show of oil and gas.

Core No. 6: Cored interval 860 - 870 feet. Recovery 9'9", (97%).

7'3" Sandstone, white to light grey and fawn, medium to coarse-grained, grades into grit, rarely conglomeratic; subangular grains of clear and frosted quartz, few of grey and green quartzite, minor coal fragments; kaolinitic; blue quartzite pebbles up to 2" diameter, massive to poorly bedded, poor porosity. Dip apparently horizontal. Faint dull brown to yellow fluorescence, positive cut with carbon tetrachloride;

2'6" Sandstone, light brown-grey, fine to medium-grained, quartzose, subrounded grains of clear quartz, and dark grey, grey, white, fawn, some green and red quartzite, minor coal; micaceous, very minor kaolin, hard, light, little matrix; well cemented beds 1/4" to 9" thick, interbedded with shale, dark brown-grey to black, silty, which grades into siltstone, micaceous, carbonaceous, semi-fissile, quartzose. Dip horizontal.

Core No. 7: Cored interval 1053 - 1055' 6". Recovery 2'6", (100%).

2'6" Conglomerate, predominantly cherty. Pebbles range up to 1 1/2" diameter.

Quartz pebbles white to light grey, other pebbles red, black, grey, green. The conglomerate becomes coarser basally. Porosity practically nil. At 1053' 6" there is 1 1/2" band of sandstone, grey, fine to medium-grained, quartzose; grains clear to cloudy, subangular to subrounded, set in kaolin cement. Evidence of layering in the conglomerate can be seen in slightly carbonaceous layers. Dip horizontal. At the base a few grains and pebbles of black shale can be seen. Slight petroliferous smell about the core - no gas evident. Fluorescence very slight.

Core No. 8: Cored interval 1265 - 1275 feet. Recovery 10 feet, (100%).
Interbeds of carbonaceous sandstone, shale and a thin band of coal. The sandstone coarsens basally with bands of finer material at irregular intervals.

6'7" Sandstone, mid-grey, fine-grained, very dirty, containing quartz grains, subangular to subrounded, cloudy to clear. Kaolin cement. Particles of coal and carbonaceous shale and ordinary dark shale are present. There is a large proportion of probable weathered mica and there are also minor finer bands of this material. Porosity low. A trace of fluorescence;

11" Sandstone, as above, but medium-grained and having some calcareous material. Different to the above in that there is less weathered mica and more red, green and dark grey chert fragments. The porosity is less than in the overlying sandstone;

2'6" Sandstone overlying carbonaceous shale. The sandstone very similar to sandstone above but becoming much coarser basally - grains up to 5 mm. Minor bands of coal and shaly coal and coal fragments present. The basal 2" passes sharply from the dirty coarse sandstone into a carbonaceous shale.

Core No. 9: Cored interval 1473 - 1477 feet. Recovery 3'6", (88%).

1'9" Sandstone, pebbly, grey, fine to medium-grained, quartzose; quartz grains are subangular to subrounded, clear to cloudy with kaolin cement, calcareous. Also grains of chert, mainly dark grey. Pebbles, up to 1 1/2" diameter, of quartz, chert, shale, and a finer sandstone occur irregularly throughout. This section has very little porosity or permeability. Small amounts of carbonaceous material can be seen;

1'9" Conglomerate, pebbles of shale, sandstone, chert and quartz set in a fine carbonaceous sandstone; also an occasional pebble of kaolin. The conglomerate coarsens basally until pebbles of fine sandstone are up to 2 1/2" diameter. Basally, sandstone pebbles become more common at the expense of the chert pebbles. This conglomerate has very little porosity or permeability.

Core No. 10: Cored interval 1635 - 1645 feet. Recovery 9 feet, (90%).

9' Andesite or andesitic tuff (siltstone size), green, green-grey, green-brown, finely crystalline, hematitic, and with orange-red stained quartz, and minor calcite veins filling fractures; two sets of fractures, one sub-parallel to bedding or flow dips 5^{o}, the other at 75^{o} - 80^{o}, no evidence of movement along fractures; rock does not appear metamorphosed; some glassy and ochreous shards just visible at X35 magnification.

Core No. 11: Cored interval 1738 - 1753 feet. Recovery 12 feet, (80%).

12' Andesite, dark green and green with grey, green, brown, white and red fracture filling; hard, fine, compact, hematitic, pyritic?, some ?zeolites; flow structure

not obvious, some banding in one piece of core, dipping 20^{o}; inclusions rounded, ?pyroclastic vitreous shards visible at X35 magnification; very fractured, straight clean breaks, also some slickensiding on other irregular fractures. No show of oil or gas.

Core No. 12: Cored interval 1855 - 1867 feet. Recovery 3 feet, (25%).

3' Andesite, dark green and green-grey, red in patches, hard, fine, compact, crystalline, glassy shards visible under X35 magnification; very fractured, some fractures almost vertical, some filled with white ? quartz (harder than zeolite, no HCl reaction). Core recovered as fragments.

Core No. 13: Cored interval 2285 - 2288 feet. Recovery 2'2", (72%).

2'2" Andesite, dark green, grey-green, and brownish; extremely hard, finely crystalline. Rock fractured almost vertically and fracture is filled with ? quartz. Rock not completely uniform but grades from grey-green to dark green, etc. It could possibly be slightly tuffaceous as different coloured fragments (of grey in dark green) occur sparsely scattered throughout. Top 9" possibly basalt.

Core No. 14: Cored interval 2653 - 2659 feet. Recovery 4'9", (80%).

4'9" Extremely compact microcrystalline buff-coloured rock, traversed by numerous fine to large veins of calcite, and with evenly distributed phenocrysts of a red-brown mineral and light green to dark green mineral. A mottled effect is given by aggregations of fine white material closely but evenly distributed. The rock is of volcanic or intrusive origin.

Core No. 15: Cored interval 2800 - 2805 feet. Recovery 4'7", (92%).

4'7" Andesite, dark grey, altered, in part traversed by a network of calcite veins up to 1/2" in width.

Core No. 16: Cored interval 2990 - 2993 feet. Recovery 2'7", (86%).

2'7" Grey-green, finely crystalline igneous rock, having very fine phenocrysts of a dark mineral. Also inclusions of (?) chlorite which seem to be roughly orientated. The rock has calcite-filled fractures.

APPENDIX 2

PETROGRAPHIC REPORT ON SPECIMENS OF CORES FROM THE OVERFLOW No. 1*

by

B.R. Houston

Geological Survey of Queensland

Core No. 10 (1635 - 1645 feet): Microslides GSQ 815, 816

A fine, dark greenish-grey rock traversed by fine roughly parallel white "streaks" (dip approximately 10°); it also contains parallel elongate fragments (about 0.5 mm x 3 mm) of dark red material. The specimen is cut by a fine vein of white calcite.

In thin section the rock is very fine and fairly even-grained. The texture is intersertal. The dominant constituent is plagioclase, which occurs as lath-shaped crystals averaging about 0.09 mm in length. Very fine (about 0.02 mm) granular pyroxene and flakes of green chlorite are quite abundant. The interstices appear to be filled with glassy material (mostly devitrified), formless chlorite, and calcite (?). Euhedral to anhedral cubic opaque material (magnetite?) is widespread. The white "streaks" appear to be areas in which there is a much greater abundance of feldspar crystals and much less glassy material in the interstices than elsewhere in the specimen.

The "elongate fragments" are very heavily stained with hematite. It is doubtful whether these areas were discrete fragments originally.

Name: Altered fluidal BASALT

Core No. 11 (1738 - 1753 feet): Microslides GSQ 817 - 821

A fine-grained, greenish-grey and white mottled rock containing numerous irregular fragments of very fine dark red or black material. Fine veins of white calcite or pinkish-red zeolite are common; in the coarser veins green fibrous chlorite is associated with either or both of these minerals. The average size of these fragments is 1 to 2 mm.

In thin section the overall texture is typical of a tuff and individual minerals are difficult to distinguish. Some fine needlelike crystals of feldspar are present; in the matrix argillaceous material including chlorite and sericite are present; fine ragged crystals of calcite (?) are fairly evenly distributed throughout the rock. Euhedral to anhedral cubic opaque material (magnetite?) is abundant.

The "black" fragments are really very pale green in thin-section and seem to represent totally or partially devitrified shards which are surrounded by a narrow zone of radiating fibres of green chlorite. Fragments of fluidal (?) volcanic rock may be present but

* Publication authorized by Chief Government Geologist, Geological Survey of Queensland Brisbane.

the outlines are very difficult to distinguish.

The dark red inclusions are very heavily hematite-stained fragments of volcanic rock (?).

The pinkish-red veins are of zeolite, coated with hematite about the margins.

Name: Altered TUFF (probably basic or intermediate).

Core No. 11 (1738 - 1753 feet): Microslides GSQ 822, 823

This rock is very fine-grained, greenish-grey and contains numerous fragments of dark red, fine-grained material.

The specimen is comparable with that described from Core No. 10, but is much finer-grained. The fluidal texture is very strongly marked; flow about some of the fragments is clearly marked.

Name: Altered fluidal BASALT

Note: The specimens from Cores 10 and 11 were compared with thin sections of volcanics of the Mt Barney Beds (Middle Carboniferous) and Middle Triassic (?) volcanics of the Mount Barney area (P.J. Stephenson, Uni. Qld Honours thesis, 1953) and of the Basalt (Middle Triassic?) of the Mount Crosby area (R.J. Allen, 1959, Aust. Oil & Gas J., 5 (11), 32-35). There are no points of similarity other than those which might reasonably be expected between any intermediate to basic volcanics of this type. Similarly, there is no evidence to show that these rocks are definitely not related.

Core No. 12 (1855 - 1867 feet): Microslides GSQ 824, 825

A fine-grained, massive, dark-grey rock. Macroscopically, the thin section displays a parallel banding with irregular white bands, averaging 0.05 mm across, 2 to 3 mm apart.

In thin section, the texture is typical of a porphyritic fluidal basalt. The phenocrysts are stout lath-shaped crystals of labradorite, averaging about 0.02 mm in length.

The white bands are composed of parallel acicular crystals of plagioclase (0.05 to 0.15 mm) and fine prismatic ferromagnesian minerals in a glassy groundmass. The mafic minerals include colourless pyroxene (augite?) and a yellow to green pleochroic fibrous mineral which appears to be replacing the pyroxene. This mineral cannot be positively identified but is probably chlorite or uralite.

The remainder of the rock is very cloudy, probably due to devitrification of the glassy portion. Anhedral to euhedral (cubic) opaque material is relatively abundant.

Name: Altered BASALT, probably extrusive

Core No. 13 (2285 - 2288 feet): Microslides GSQ 826, 827

A very fine-grained, massive, dark-grey rock, mottled with red.

In thin section this rock is very cloudy due to alteration but appears to be similar to the above rock, though more altered. The red mottling is due to concentrations of hematite.

Name: Altered BASALT

Core No. 14 (2653 - 2659 feet): Microslides GSQ 294, 295

A pale greenish-grey, very fine-grained massive rock.

In thin section, a very fine (0.05 to 0.03 mm), fairly even-grained, leucocratic rock of which feldspar is the dominant constituent.

The feldspar has undergone considerable alteration, the chief product being clay minerals. It occurs as unoriented, subhedral to anhedral lath-shaped crystals. Most of these crystals have embayed margins. The interstices of the rock are occupied by pale green chlorite and devitrified glass (?) and minor (less than 10%) quartz. Formless chlorite is irregularly distributed throughout the rock, and in general is intimately associated with clay minerals. Apatite is present in accessory amounts.

At least 50% of the feldspar is potash feldspar. The remainder of it may be albite but this could not be proved.

Name: Altered TRACHYTE

Core No. 15 (2800 - 2805 feet): Microslides GSQ 421, 422

A very fine-grained, dark grey rock traversed by a network of very fine calcite veins. Some fine pyrite can be identified on the surface.

Macroscopically, the thin section displays an irregular banding of light and dark grey bands.

The rock is very fine-grained, porphyritic and the dominant constituent is plagioclase. The phenocrysts are subhedral to anhedral lath-shaped crystals of plagioclase, partially altered to sericite; they have no preferred orientation; the average length is about 0.2 mm.

The groundmass is cloudy but anhedral lath-shaped crystals of plagioclase (0.05 to 0.07 mm) can be distinguished. Sericite is abundant and formless green chlorite, which rarely bears a crudely sub-ophitic relationship to the feldspar crystals, is very widespread. The chlorite is hematite-stained to varying degrees. Opaque material, magnetite and pyrite, anhedral or cubic, about 0.04 mm, is abundant. Accessory apatite is present. The darker bands appear to coincide with areas in which there is a marked concentration of chlorite and hematite. A number of small irregular areas of chlorite, slightly hematite-stained, probably represents amygdaloidal filling of vesicles.

Determination of the feldspar is almost impossible because of the cloudy, altered

nature of the rocks. However, at least some of the phenocrysts and groundmass feldspar are albite; potash feldspar is present in the groundmass in small amounts (less than 3%).

Name: ALBITE ANDESITE

Note: The alteration of the specimens from Cores 14 and 15 is considerable; the albite is believed to be secondary in origin. Secondary albitization of basic volcanics commonly occurs in a geosynclinal environment. It is currently believed that the alteration takes place either by direct metasomatism by sea water or by autometasomatism, that is, chemical alteration of an igneous rock by residual aqueous fluids derived from its own magma, under the influence of a geosynclinal environment. There is no proof, however, that albitization of basic volcanics does necessarily indicate a geosynclinal environment.

Devitrification of glass can take place under almost any conditions; it is generally believed to be an autometamorphic process.

APPENDIX 3

PETROLOGICAL DESCRIPTION OF SAMPLES

FROM THE OVERFLOW NO. 1

by

N. C. Stevens

University of Queensland

Core No. 11 (1738 - 1753 feet)

A dark greenish-grey fragmental rock with irregular veins and areas of soft white minerals and some slickensided surfaces. Effervescence with acid indicated the presence of carbonate.

The fragment size is very variable; in some parts of the core the rock is sufficiently fine-grained to be called a tuff but, considering the average grain-size, it is better termed a breccia.

Thin sections show angular fragments of basaltic rocks tightly packed in a matrix consisting largely of a zeolite, probably laumontite. The basaltic fragments are fine-grained, non-porphyritic, have well marked flow structure by alignment of plagioclase laths, and are mostly amygdaloidal, with green chlorite in the amygdules. The fragments contain varying amounts of magnetite; they are variously weathered to green and red colours.

The rock is a basaltic breccia, a pyroclastic rock.

Core No. 14 (2653 - 2659 feet)

The rock is light-grey to brown, massive, and very fine-grained. Aggregates of a soft green mineral are present and the rock is traversed by minute carbonate veins. Under a binocular microscope the grain-size is very even. A single grain of galena was noticed.

Two thin sections were made of rocks of slightly different grain-size; texture and mineral composition were the same in both sections.

The main constituent of the rock is alkali feldspar, albite with some K-feldspar. This occurs chiefly in equant grains with diameter about 0.02 mm. A few larger crystals (0.15 mm long) were present. Albite twinning was noted in some of the small grains and Carlsbad twinning in the larger crystals.

Quartz, in very small grains or aggregates of grains, is generally associated with areas of green chlorite, brownish carbonate, and opaque mineral. There are some fine-grained quartz-feldspar intergrowths.

A feature of the rock is the large amount of carbonate (probably calcite) disseminated through it. The rock has been affected by deuteric or hydrothermal alteration.

Assuming that some, at least of the quartz is primary this rock may be named a quartz-trachyte. Similar rocks from the Mount Alford district, west of Beaudesert, have been described as Tertiary intrusives.

Core No. 15 (2800 - 2805 feet)

The rock is dark, greenish and fine-grained. It has amygdules, irregular areas and veinlets of hematite, small amygdules of dark green chlorite, and veinlets (chiefly vertical) of calcite.

Thin sections show flow-oriented plagioclase, largely andesine, in laths about 0.15 mm long, with some larger crystals to 0.6 mm. There is much chlorite and opaque mineral present, both in amygdules and replacing ferromagnesian minerals, and some albite, probably of deuteric origin. Calcite is confined to the veinlets.

The rock is an andesite or andesitic basalt, which has been deuterically altered but not metamorphosed.

APPENDIX 4

PALYNOLOGY OF SAMPLES FROM THE OVERFLOW No. 1*

by

N. J. de Jersey

Geological Survey of Queensland

Three samples from this well were examined for spores and pollen grains. They comprised (1) Core from 212-214 feet, (2) Cuttings from 1170-1175 feet, and (3) Cuttings from 1510 - 1515 feet.

(1) Core from 212-214 feet

The specimen submitted from this core consisted of coaly fragments embedded in a sandstone matrix. A portion of the coal was separated by hand-picking and subjected to maceration. The maceration residue consisted of humic material and mineral matter, and no spores or pollens were observed. The coal lenticles were evidently derived entirely from wood fragments incorporated in the sandstone during deposition.

(2) Cuttings from 1170-1175 feet

A sample of the cuttings was subjected to specific gravity separation with carbon tetrachloride (S.G. 1.58) and the coal (floats) macerated with Schultz solution. The following species were identified in the maceration residue:-

Species	Known Stratigraphic Range
Leiotriletes directus	Permian to Lower Jurassic
Entylissa nitidus	Triassic to Lower Cretaceous
Araucariacites sp.	Triassic to Lower Cretaceous
Caytonipollenites sp.	Triassic to Lower Cretaceous
Inaperturopollenites sp.	Triassic to Lower Jurassic
Pteruchipollenites sp. nov. A.	Triassic
Pteruchipollenites sp. nov. B.	Triassic
Concavisporites sp. nov.	Triassic
Gen. et sp. nov. A.	Triassic
Gen. et sp. nov. B.	Triassic

* Publication authorised by Chief Government Geologist, Geological Survey of Queensland, Brisbane.

The sample contains five species which so far have been found only in the Triassic (in the Ipswich Coal Measures), together with five longer-ranged forms. Its Triassic age is thus well established, and this conclusion is supported by the absence of species of the genera Lycopodiumsporites, Gleicheniidites and Zonalapollenites which characterize the Lower Jurassic Walloon Coal Measures.

(3) Cuttings from 1510 - 1515 feet

Spores and pollens were relatively rare in the maceration residue of a sample of cuttings from this depth. The following species were identified:-

Species	Known Stratigraphic Range
Leiotriletes directus	Permian to Lower Jurassic
Entylissa nitidus	Triassic to Lower Cretaceous
Araucariacites sp.	Triassic to Lower Cretaceous
Inaperturopollenites sp.	Triassic to Lower Jurassic
Pteruchipollenites sp. nov. A.	Triassic
Gen. et sp. nov. B.	Triassic
Annulispora sp. nov.	Triassic

The three Triassic species have previously been found in samples from the Ipswich Coal Measures. The Triassic age indicated agrees with that determined for the sample from 1170 - 1175 feet.

The new genera and species listed above are among those observed in samples from the seams of the Ipswich Coal Measures in an investigation in progress. They are as yet unnamed as this work is incomplete. It is hoped eventually to extend this investigation, which so far has been restricted to samples from the Blackstone Formation, at the top of the Ipswich Coal Measures, to the Cooneana and Tivoli Formations, and also to the overlying Bundamba Group. When basic knowledge of the sequence of microfloras in this established succession is available, it will be possible to attempt a closer correlation of the present sample with one of the formations in this succession.

COMPOSITE WELL LOG

COMPANY QUEENSLAND AMERICAN OIL CO.

PETROLEUM TENEMENT Authority to Prospect 71P

WELL NUMBER "THE OVERFLOW" No.1

STATE: QUEENSLAND 4 MILE-SHEET: IPSWICH BASIN: MORETON WELL STATUS: ABANDONED

LOCATION — Lat. 27° 48' 30"S
Long. 152° 31' 06"E

ELEVATION — Reference Pt.- K.B. 194' A.S.L.
Ground 185' A.S.L.

Date Spudded: 8th April, 1960
Date Drilling Stopped 17th May, 1960
Date Rig Off: 20th May, 1960

Total Depth Driller: 2993
E.Log

Hole Size	In	From	To
	17½	0'	185'
	12¼	185'	214'
	8¼	214'	2990'
	7⅞	2990'	2993'

Casing	In	Wt	Gr	Depth	Cmt	Cmt'd to
	13⅜	54 lbs	J 55	174'	130 sax	Surface

Cement Plugs Cemented 0'-20' 50' column of cement at casing shoe

Well Head Fittings: Sealed with steel cap detailing name of well, commencement and completion dates.
Drilled by: Mines Administration Pty. Ltd.
Logged by: Schlumberger
Drilling Method: Rotary
Cemented by: Minad
Mud Logging by: Rotary Engineering Co. Midland, Texas

ELECTRIC LOG DATA

RUN NUMBER	1	2
DATE	25-4-60	15-5-60
FOOTAGE LOGGED	1580'	1276'
LOGGED FROM	1755'	2931'
LOGGED TO	175'	1655'
TOTAL DEPTH-ELECTRIC LOG	1755'	2932'
TOTAL DEPTH-DRILLER	1755'	2932'
CASING SHOE-ELETRIC LOG	173'	
CASING SHOE-DRILLER	174'	
BIT SIZE	8¼"	6¼"
MUD KIND	Bentonite	Bentonite
TREATMENT		
WATER LOSS ccs/30min	12	13
WEIGHT lbs/cu ft.	71	67
VISCOSITY (Marsh) sec	36	35
PH	6·8	11
Resistivity Ω m²/m & TEMP	3.43@ 70°F 2.7@ 93°F	3.0@ 69°F 2.1@100°F
MAX. RECORDED TEMPERATURE	95°F	100°F
ELECTRODE SPACING	16"	16"
SYMMETRICAL	64"	64"
NON-SYMMETRICAL	18'8"	18'8"
RECORDED BY	G. Metenier	G. Metenier

LITHOLOGIC REFERENCE

Conglomerate — Shale
Sandstone — Coal
Siltstone — Volcanic rocks

Lithology by: P. Power
M. Mahoney

WELL SYMBOLS

Core, interval, number, and recovery
Plugged interval
Casing shoe
Fluorescence

QUEENSLAND AMERICAN OIL CO.

COMPOSITE WELL LOG
"THE OVERFLOW" No.1 WELL

E. A. WEBB CONSULTING GEOLOGIST

Revised by: E. A. WEBB
Drawn: I.R.
Date: 4.10.1962

SPONTANEOUS POTENTIAL — Millivolts

RESISTIVITY ohms m²/m — AM 1·16' 0–50 0–500; AM 2·64' 0–50 0–500

RESISTIVITY ohms m²/m — AO 18'8" 0–50 0–500

BIT TYPE REMARKS | DRILLING RATE min/5ft. | LITHOLOGY % of cuttings | MUD GAS DETECTION | DEPTH feet | ELEVATION CASING & PLUGS CORES & SEC.

LITHOLOGIC DESCRIPTION

STRATIGRAPHIC COLUMN (C.W. Siller)

0 — 28'	Soil	
28 — 100'	Sst. grey brown, fine to coarse grained, tight, quartzose, kaolinitic	BUNDAMBA SANDSTONE
100 — 135'	Sst. grey, fine to medium grained, tight, quartzose, kaolinitic	
135 — 160'	Sh., grey, micaceous, silty	
160 — 195'	Sst. as above	
195 — 212'	Sst light grey, white, coarse, quartzose	
212 — 214'	Core No1 Sst. light grey, gritty, kaolinitic, coaly partings at base ?current bedding	
214 — 225'	Sst. as above	
225 — 240'	Siltstone, yellow to grey	
240 — 285'	Sst. white, grey, fine, medium, kaolinitic	
285 — 300'	Siltstone, brown, micaceous	
300 — 310'	Sst. as above	
310 — 430'	Sst. white, fine to medium, quartzose kaolinitic	
430 — 440'	Core No.2 Sst. white to light grey, fine to coarse, grades into siltstone & grit. Minor micaceous sh. dip horizontal	
440 — 530'	Sst. white to light brown, fine to medium, kaolinitic Siltstone, brown, micaceous	
530 — 540'	Sst. white to light brown, fine to medium, kaolinitic, calcareous	
540 — 610'	Sst. as above, medium to coarse Siltstone, brown, micaceous, coaly Siltstone, white to yellow	
610 — 650'	Sh., grey, micaceous, carbonaceous Siltstone, white, brown as above	
650 — 647'	Shaly coal, siltstone as above. Sst., white, fine to coarse	
647 — 657'	Core No.3 Grit, Sst., siltstone	
657 — 667'	Core No.4 Grit No porosity	
667 — 677'	Core No.5 Conglomeratic No porosity	
677 — 725'	Core No. 3 & 5 Intermittent oil Strong smell of oil. Sst. white, grades into grit. Coal, grades into carbonaceous shale Siltstone, white to yellow, brown, micaceous, carbonaceous	
725 — 735'	Grit, conglomeratic, white; siltstone, brown, Sst., white to grey, pebbly; siltstone, brown, coal.	
735 — 745'	Conglomerate, grey	
745 — 765'	Siltstone, brown, micaceous. Conglomerate as above. Sst., fawn, fine and white, grading into conglomeratic Siltstone, brown, micaceous	
765 — 775'	Shale, black, carb. micaceous, micaceous	
775 — 800'	Sst., fawn, fine, siltst ric as above. Sst., white, coarse. Siltstone, brown, grey, white	
800 — 845'	Sst. white, grey fine to medium. Siltstone, brown, micaceous, white. Coal	
845 — 860'	Sst. & conglomerate, white to grey	
860 — 870'	Siltstone, brown, micaceous. Sh. black. Core No.6 Sst., grey, fine to coarse, conglomeratic.	
870 — 950'	Sh. & siltstone interbeds; dip horizontal Sst. fine to coarse, conglomeratic in part. Siltstone, brown micaceous, carbonaceous, grades into Sh. & Coal Also siltstone, white	
950 — 970'	Sandstone as above. Siltstone as above. Sh., black.	
970 — 1020'	Coal, conglomerate, Sst., white to grey, medium, coarse. Siltstone, white, brown Black Sh. Coal. Sst. grey, medium to coarse. Siltstone grey carbonaceous micaceous Sh. grey to black	
1020 — 1035'	Sst., as above, conglomeratic. Siltstone as above, sh as above	
1035'72"	Core No.7 Cherty conglomerate	
1035'72" — 1080'	Conglomerate as above, Coal. Siltstone, brown, micaceous, carbonaceous	
1080 — 1200'	Sst. buff fine to medium Sh. grey, micaceous, carbonaceous Cherty conglomerate Coal	
1200 — 1215'	Sh. grey, carbonaceous, micaceous	
1215 — 1265'	Sst. grey fine Sst. grey pebbly. Sh., grey, micaceous, carbonaceous	
1265 — 1275'	Core No.8 Interbedded Sst.	
1275 — 1305'	Carbonaceous Sh. Sst. grey, fine to medium Sh. grey, carbonaceous, micaceous	
1305 — 1330'	Sst. as above. Coal & very carbonaceous Sh. Sh. dark grey to black	
1330 — 1473'	Sandstone, grey, fine to medium, pebbly in part. Sh., grey carbonaceous	
1473 — 1477'	Core No.9 Sst. grey, pebbly & conglomerate	
1477 — 1525'	Sst. grey pebbly Sh. grey, carbonaceous	
1525 — 1595'	Sst. as above. Coal and carbonaceous sh. Siltstone. Siltstone, brown, grey, carbonaceous Sh. grey, micaceous, stone coal Conglomerate	
1595 — 1605'	Sst. medium, coarse, pebbly	
1605 — 1620'	Sh. grey, brown, micaceous, as above Sh. multicoloured	
1620 — 1635'	Dark green volcanic rock	
1635 — 1645'	Core No.10 Basalt, altered, fluidal	
1645 — 1738'	Altered green volcanics	
1738 — 1755'	Core No11 Altered tuff (dip 20°) & altered fluidal basalt	
1733 — 1855'	Altered green volcanics Red colouration 1820—1825'	
1855 — 1867'	Core No.12 Altered basalt	
1867 — 2285'	Altered green volcanics Multicoloured in part	
2285 — 2288'	Core No.13 Altered basalt	
2288 — 2655'	Altered green volcanics Multicoloured in part	
2655'- 2659'	Core No.14 Altered trachyte	
2659 — 2800'	Altered green volcanics Multicoloured in part	
2800 — 2805'	Core No.15 Albite andesite	
2805 — 2990'	Altered green volcanics Multicoloured in part	
2990 — 2993'	Core No.16 Altered volcanic rock	

FIRST CHANGE OF SCALE

RESISTIVITY ohms m²/m		RESISTIVITY ohms m²/m	
0 AM 1·16' 40		AO 18'8"	
0 200	0	200	
0 2000	0	2000	
0 AM 2·64' 200			
0 2000			

SECOND CHANGE OF SCALE

RESISTIVITY ohms m²/m		RESISTIVITY ohms m²/m	
0 AM 1·16' 80		AO 18'8"	
0 400	0	400	
0 4000	0	4000	
0 AM 2·64' 400			
0 8000			

COAL MEASURES IPSWICH TRIASSIC

VOLCANICS AGE NOT DETERMINED