COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Petroleum Search Subsidy Acts

PUBLICATION No. 22

A.A.O. Pickanjinnie No. 1, Queensland

OF

ASSOCIATED AUSTRALIAN OILFIELDS N.L.

Issued under the Authority of the Hon. David Fairbairn
Minister for National Development
1964

COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

MINISTER: THE HON. DAVID FAIRBAIRN, D.F.C., M.P.

SECRETARY: SIR HAROLD 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.

A.A.O. Pickanjinnie No. 1 was drilled under the Petroleum Search Subsidy Act 1959, in Authority to Prospect 55P, Queensland. The well was located at latitude 26°35'42"S., longitude 149°07'18"E., about 20 miles east of Roma, and was drilled for Associated Australian Oilfields N.L., by Mines Administration Pty Ltd of Brisbane, using a National T-32 drilling rig.

This Publication deals with the results of this drilling operation, and contains information furnished by Associated Australian Oilfields N.L., and edited in the Geological Branch of the Bureau of Mineral Resources. The final report was written by S.S. Derrington of Mines Administration Pty Ltd. The methods employed in the drilling operation and the results obtained are presented in detail.

J. M. RAYNER
DIRECTOR

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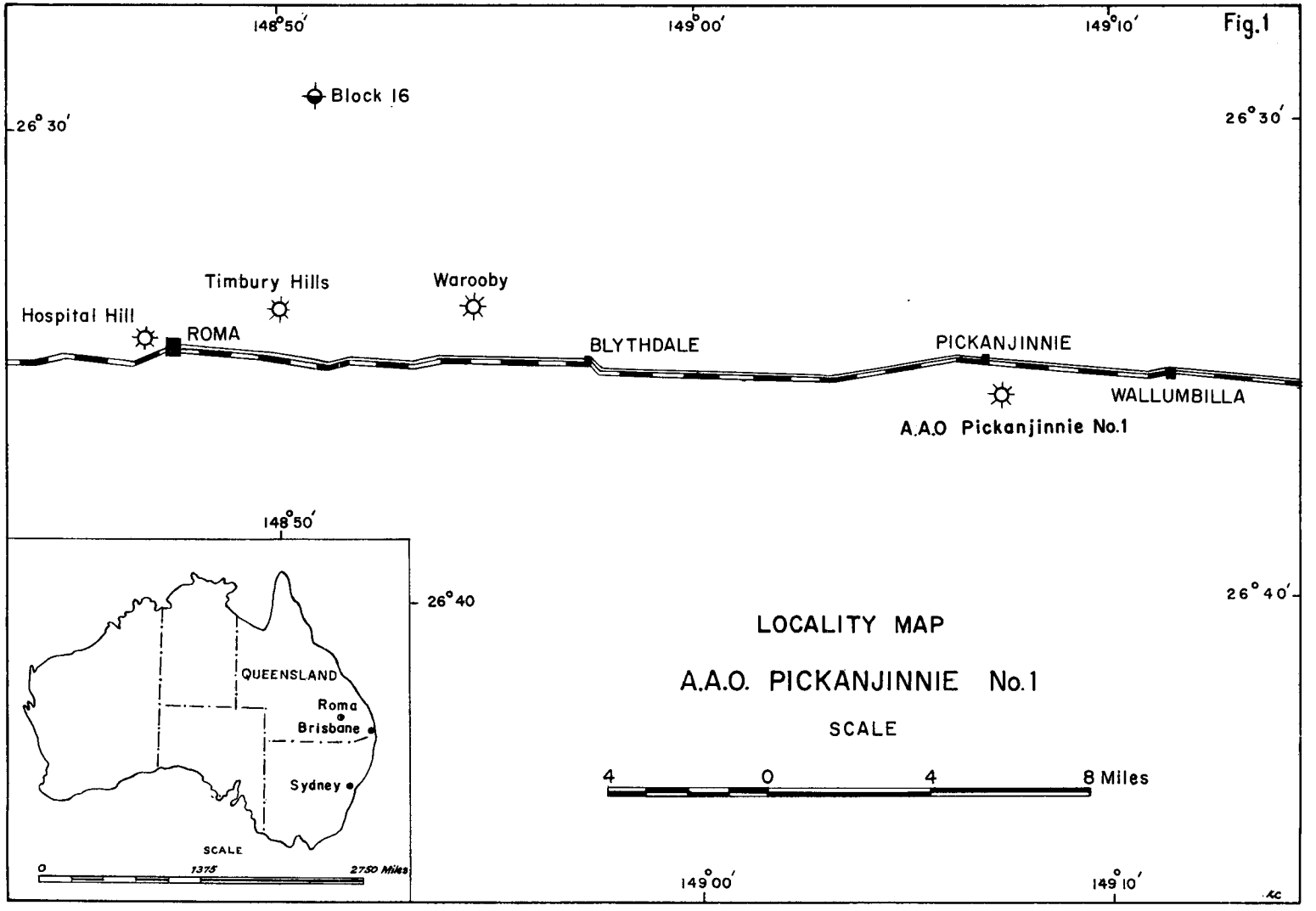
Fig.1


148°50'
149°00'
149°10'
Block 16
26°30'
26°30'
Timbury Hills
Warooby
Hospital Hill
ROMA
BLYTHDALE
PICKANJINNIE
WALLUMBILLA
A.A.O Pickanjinnie No.1
148°50'
26°40
26°40'
QUEENSLAND
Roma
Brisbane
Sydney
SCALE
0
1375
2750 Miles
LOCALITY MAP
A.A.O. PICKANJINNIE No.1
SCALE
4
0
4
8 Miles
149°00'
149°10'
Ac

SUMMARY

A.A.O. Pickanjinnie No. 1 was drilled by Associated Australian Oilfields N.L. on a seismic "high" near Pickanjinnie, approximately 20 miles east of Roma. Drilling was commenced on 27th May, 1960, and was completed on 12th July, 1960, at a total depth of 5213 feet. The drilling contractor was Mines Administration Pty Limited, and the rig used was a National T-32. A full programme of logging, testing and coring was undertaken.

The well was drilled in Mesozoic sediments to 4490 feet; the Roma, Blythesdale, Walloon, Bundamba, Moolayember and Pickanjinnie Formations were penetrated in this section. The Permian Latemore Formation was then encountered beneath a slight unconformity separating this formation from the overlying Mesozoic rocks. The Timbury Hills Formation, (?) Devonian, taken as local basement, was penetrated at 4835 feet and continued to total depth.

Eight formation tests were run, the results of which are summarized in Appendix 7. During the test of the interval 3976 - 4368 feet, over a period of 45 hours, gas flowed at a rate of 6.5 MMcf/D on one inch surface bean. The well was plugged from 4520 feet to total depth, filled with mud and capped, and completed as a gas producer on 29th July, 1960.

The results of the velocity survey of Pickanjinnie No. 1, made on 12th July, 1960, have modified the interpretation of an extensive seismic programme carried out in the region.

INTRODUCTION

The objectives of A.A.O. Pickanjinnie No. 1 Well were:

(i) To determine the hydrocarbon content of three sandstone units in the basal Mesozoic;
(ii) To determine the hydrocarbon content of a predicted Permian section; and
(iii) To obtain lithologic and palaeontological information on the Permian section.

The well was sited on the most easterly of the closed seismic "highs" located by the completed seismic survey, in the hope of penetrating the maximum thickness of the Permian section. The site selected was also designed to provide the best chance of the well being completed as a producer in the basal Mesozoic sands.

WELL HISTORY

General Data

Well name and number:	A.A.O. Pickanjinnie No. 1
Location (co-ordinates):	Latitude 26° 35' 42" S. Longitude 149° 07' 18" E.
(map reference):	195697, No. 1509, Roma 4-mile Sheet
Name and address of Tenement Holder:	Associated Australian Oilfields N.L., 31 Charlotte Street, Brisbane, Queensland
Details of Petroleum Tenement:	Authority to Prospect 55P, Queensland
District:	Roma, Queensland
Total Depth:	5213 feet
Date drilling commenced:	27th May, 1960
Date drilling completed:	12th July, 1960
Date well completed:	29th July, 1960
Date rig released:	4th August, 1960
Drilling time in days to Total Depth:	47
Elevation (ground): Elevation (rotary table):	1059 feet 1069 feet
Status of well:	Secured; filled with mud, and christmas tree installed. Cement plug from 5213 - 4520 feet; 6 5/8" casing cemented at 4497 feet (cement behind casing to 2830 feet). Perforated 6 5/8" casing with four - 1/2" Schlumberger jets per foot at 4053 - 4044 feet, and 4028 - 4009 feet.

Drilling Data

Name and address of drilling contractor:	Mines Administration Pty Ltd, 31 Charlotte Street, Brisbane, Queensland

Drilling Plant:

Make:	National-Ideal
Type:	T-32
Rated capacity with 4 1/2" drill pipe:	5500 feet
Rated capacity with 3 1/2" drill pipe:	6500 feet

Motors:

Make:	General Motors Diesel
Type:	12107
B.H.P.:	320

Mast:

Make:	Lee C. Moore
Type:	94-foot trailer mounted
Rated capacity:	300,000 lb.

Pumps:

Make:	Ideal	Gardner-Denver
Type:	C-250	FX-FXO
Size:	7 1/4" x 15"	7 1/4" x 10"

Motors:

Make:	G.M. Diesel	International
Type:	12107	UD14 (2)
B.H.P.:	320	150

Blowout preventer equipment:

Make:	Hydril M.S.	Cameron S.S.
Size:	10"	10"
Series A.P.I.:	600	900

Hole sizes and depths: 12 1/4" to 184 feet
8 1/2" to 5213 feet

Casing and Liner details:

Size (in.)	Weight (lb./ft)	Grade	Range	Setting Depth (feet)
9 5/8	40	J-55	2	178
6 5/8	28	N-80	2	4497

Casing and Liner cementing details:

Size (in.)	Setting Depth (feet)	No. of Sacks Cement	Cemented to	Method
9 5/8	178	54	Surface	Plug
6 5/8	4497	300	2830'	Plug

Copies of the Cementation Logs are available for inspection at the Bureau of Mineral Resources, Canberra.

Drilling fluid:

Type:	Bentonite/water		
Average weight (S.G.):	1.25		
Treatment:	Initial weight and viscosity control by water. Later viscosity and fluid loss control by caustic/myrtan		
Average weekly analysis:	S.G.	1.25	
	Viscosity	45 sec.	(API)
	Filtrate	6 cc	(API)
	Cake	1.5 mm	(API)
	pH	9	
	Sand	1%	
	Gel (int)	0g	(API)
	Gel (10m)	5g	(API)
	Cl	150 ppm.	

Water supply:

Water was pumped from a sub-artesian bore 2 1/2 miles from site.

Cl - 150 ppm.

Casing perforation and shooting record:

Intervals (feet)	4009 - 4028	4044 - 4053
Numbers of holes per foot:	4	4
Size of holes:	1/2"	1/2"
Method used:	Schlumberger Jet Perforating	

Plugging back jobs:

Length and type of plug:	5213 - 4500 feet - neat cement
Number of sacks used:	234
Method:	Conventional displacement
Tested:	No

Fishing operations:

Depth:	4999 feet	5133 1/2 feet
Nature of job:	Magnetic	Magnetic
Equipment left in hole:	Bit cone bearings	Core bit cone
	Both fishing operations were successful	

Side-tracked hole: None

Logging and Testing

Ditch cuttings:

Method of sampling: Grab samples from shaker - washed, dried, stored in labelled polythene bags.

Interval: 10 feet from 0 to 3500 feet
5 feet from 3505 to T.D.

Coring:

Original programme - One core in the Roma Formation, one core in the Blythesdale Formation, then cores at 400-foot intervals to 3500 feet and at 200-foot intervals from 3500 feet to T.D. cores of any formation change, any oil or gas horizon or any change of rate of penetration.

Deviations from programme - When an increase in rate of penetration was noted, drilling was suspended and cuttings circulated out. Mud was checked on gas monitor. Apart from the first gas horizon detected in this manner, subsequent ones were not cored, as it was found that the Microlog tool would not enter the rat-hole.

Schlumberger stated it was desirable to run Microlog as soon as possible after formation penetrated.

Twenty-two cores were cut for a total footage of 194.5 feet, of which 151.1 feet were recovered, giving a percentage recovery of 78% as shown in the following table:

Core No.	Interval (feet)	Recovery (feet)	Percentage
1	200 - 210	10.0	100
2	1322 - 1332	2.5	25
3	1332 - 1342	2.5	25
4	1808 - 1818	9.6	96
5	2148 - 2158	8.0	80
6	2550 - 2555)		
7	2555 - 2565)	15.0	100
8	2950 - 2960	10.0	100
9	3280 - 3290	10.0	100
10	3670 - 3679	0.0	0
11	3679 - 3689	3.2	32
12	3901 - 3909)		
13	3909 - 3911)	17.0	100
14	3911 - 3918)		
15	4010 - 4030	18.0	90
16	4220 - 4230.5	10.5	100
17	4420 - 4430	10.0	100
18	4607 - 4615.5	5.3	62
19	4795 - 4805	5.0	50
20	4945 - 4955	10.0	100
21	5130 - 5133.5	3.5	100
22	5212 - 5213	1.0	100
	Cored 194.5 feet	151.1	78

Coring equipment used: Reed K-500 barrel, 5 5/8" O.D., cutting a 2 3/8" O.D. core.

Sidewall sampling: Nil

Electric logging, etc:

Electric Log	180 feet - T.D.	8 runs
Microlog	3910-4945 feet	5 runs (not continuous)
Section Gauge	150 feet - T.D.	1 run

Drilling time and gas log:

Drilling time log: Computed from time to drill sample interval (10 or 5 feet) and expressed as "minutes per foot" for that interval.

Hydrocarbon analysis log: Made by Rotary Engineering Company, from 2500 feet to T.D.

Copies of all logs listed above are available for inspection at the Bureau of Mineral Resources, Canberra.

Formation testing: Eight formation tests were made of sands in the Moolayember and Pickanjinnie Formations. Details of the tests are given in Appendix 7.

Deviation surveys: Seven drift readings were recorded using Totco Drift Indicator.

Depth (feet)	Deviation from Vertical (degrees)
1770	1 1/2
2527	1
2932	1/2
3260	1/2
3646	1/2
4180	3/4
4965	2

Temperature surveys: 497 to 4369 feet - one run to locate cement top behind casing. This was located at 2830 feet.

Other well surveys: Velocity survey, upwards from T.D. (See Appendix 6).

GEOLOGY

Summary of Previous Work

Geological:

Detailed surface geological mapping was carried out in the area in the late 1920's and early 1930's. Rock exposure is so poor that conclusive results could not be obtained. A detailed pit sinking and shallow core drilling programme carried out in the early 1930's was likewise of little practical use.

Subsurface correlation has been attempted, but results are of doubtful value because of the poor logging of the older wells.

Geophysical:

An extensive programme of gravimetric, magnetic and seismic mapping was carried out in the general Roma area by the Bureau of Mineral Resources in the late 1940's and early 1950's.

A further reflection seismograph survey was carried out in late 1959 and early 1960 by Austral Geo Prospectors Pty Ltd, and it is on the results of this operation that the present drilling programme was based.

Geophysical logging has been used in wells drilled in recent years, and precise subsurface correlation can now be made.

Drilling:

Approximately sixty wells have been drilled in the Roma area. Only five have been completed as gas producers or potential gas producers. Seismic work has shown the majority to be off-structure.

It is suspected that in several instances drilling and completion difficulties were responsible for the poor results obtained in some "on-structure" wells.

Stratigraphy

The table below shows the depth intervals (datum R.T. 10 feet above ground level) of the stratigraphic units encountered in A.A.O. Pickanjinnie No. 1.

Age	Formation		Depth Intervals (feet)	Thickness (feet)
Lower Cretaceous	Roma Formation		10- 365	355+
Lower Cretaceous - Jurassic	Blythesdale Formation	(Transition Member	365- 475	110
		(Mooga Member	475- 750	275
		(Fossil wood Member	750- 937	187
		(Gubberamunda Member	937-1428	491
Jurassic	Walloon Coal Measures		1428-2898	1470
Jurassic	Bundamba Group		2898-3448	550
Triassic	Moolayember Formation		3448-4185	737
Triassic	Pickanjinnie Formation		4185-4490	305
Permian	Latemore Formation		4490-4835	345
(?) Devonian	Timbury Hills Formation		4835-5213	378+

The targets for the drilling operation were the basal sandstone members of the Moolayember Formation.(1) They were encountered at the following depths:

Member	Depth Intervals (feet)	Thickness (feet)
Hospital Hill Sandstone	4009 - 4028	19
Links Sandstone	4044 - 4054	10
Showground Sandstone	4178 - 4185	7

General:

The Roma, Blythesdale, Walloon, Bundamba and Moolayember formations encountered in the drilling of this well did not differ significantly from their normal character in the Roma region. The Moolayember Formation thickens to some extent, and the Bundamba Group thins slightly when compared with their respective thicknesses at Roma. However, lithologies and general characteristics are similar.

Roma Formation (Lower Cretaceous): 10 to 365 feet (355 feet+)

Lithology: This unit is made up of dark grey, partly carbonaceous and micaceous shale; sandy shale grading to siltstone; and minor interbeds of grey, fine-grained, calcareous quartzose sandstone.

Palaeontology: No macrofossils were found in this unit, but microfossils have been found in the cuttings.

Electrical Characteristics: No electrical logs were run above 178 feet, the depth of the surface casing shoe. Below this depth, the S.P. and resistivity curves show the generally interbedded nature of the unit. The sharp break at 365 feet in all curves is considered to be the base of the unit.

Petroleum Manifestations: None

Blythesdale Formation (Lower Cretaceous - Jurassic): 365 to 1428 feet (1063 feet)

The Blythesdale Formation may be subdivided into four members:

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(1) Footnote by Bureau of Mineral Resources:

The names Showground Sandstone, Links Sandstone and Hospital Hill Sandstone have been published on several occasions, but have never been formally defined as required by the Australian Code of Stratigraphic Nomenclature. These units are zones of economic interest within the Moolayember Formation. Their present status is covered by article 4 (f) of the American Code of Stratigraphic Nomenclature: "Aquifers, oil sands, coal beds, and quarry layers are examples of informal units even though named". Future work may show that these units can, in fact, be formally defined as members of the Moolayember Formation, in the sense of the Australian Code of Stratigraphic Nomenclature.

Member	Thickness (feet)
Transition Member	110
Mooga Member	275
Fossil wood Member	187
Gubberamunda Member	491

This subdivision has been possible from a study of the electric logs, but owing to the normal bad contamination resulting from fast drilling it cannot be made from the cuttings. Similarly, it is not possible to distinguish the base of the overlying Roma Formation from cuttings examination. Hence only a blanket lithological description of the Blythesdale Formation can be given.

Lithology: The formation is composed mainly of light grey to white, fine, medium and coarse-grained, partly calcareous and kaolinitic, but mainly friable and porous quartz sandstone. There are minor interbeds of grey, carbonaceous, micaceous, quartz siltstone and dark grey to black, in part carbonaceous, shale grading to coal.

Palaeontology: No macrofossils were found in this unit, but microfossils have been found in the cuttings.

Electrical Characteristics: The Transition Member (365 - 475 feet) is marked by almost featureless curves. The Mooga Member (475 - 750 feet) is mainly sandy with some shale interbeds, and this feature is reflected in the general fluctuatory nature of all curves. Porosity in the sands is generally good, although it would appear that they are not wholly water saturated. All curves in the Fossil wood Member (750 - 937 feet) are of low amplitude, and indicate that the member is composed of shale or sandy shale. In the Gubberamunda Member (937 - 1428 feet) the S.P. curve indicates a dominantly sandy section with variable porosity to about 1270 feet.

The resistivity curves indicate low fluid saturations. The section 1270 - 1428 feet has good porosity and the resistivity curves indicate a high water saturation below 1320 feet. This is the main sub-artesian aquifer in the region.

Petroleum Manifestations: None

Walloon Coal Measures (Jurassic): 1428 to 2898 feet (1470 feet)

Lithology: This formation is mainly argillaceous. It comprises light, medium and dark grey, rarely brown, partly sandy and silty, mainly micaceous and carbonaceous shale with interbeds of grey, grey-green, buff to medium brown, micaceous, calcareous, kaolinitic, slightly carbonaceous, quartz sandstone and coal.

Palaeontology: No macrofossils were found in this unit, but microfossils have been found in the cuttings.

Electrical Characteristics: The S.P. curve is of low amplitude for the whole unit except between 1630 and 1650 feet and between 1942 and 1970 feet where there are deflections of the order of 20 m.v. Apart from corresponding deflections at these two intervals, both the short and long normal curves are of low amplitude. The lateral curve has generally low values, but in this formation is characterized by numerous narrow high deflections caused by thin coal seams.

Petroleum Manifestations: None

Bundamba Group (Jurassic): 2898 to 3448 feet (550 feet)

Lithology: The formation comprises white, and white to light grey, fine, medium and coarse-grained, variably porous, in part micaceous, kaolinitic and calcareous quartz sandstone, with minor interbeds of grey, dark grey, and grey-brown, sandy, micaceous, carbonaceous shale.

Palaeonotology: No macrofossils were found in this unit, but microfossils have been found in the cuttings.

Electrical Characteristics: All curves have fairly high values. The S.P. deflections indicate fair porosity in the sandstone bands and the resistivity curves indicate that in certain intervals the fluid saturation is fairly high.

Petroleum Manifestations: None

Moolayember Formation (Triassic): 3448 to 4185 feet (737 feet)

The top of this formation is placed at 3448 feet, even though there is some sand development between 3495 and 3545 feet. The main reasons for so placing the boundary are the penetration and temperature logs which show a distinct break coinciding with the E. log break at 3448 feet.

Lithology: The formation is dominantly argillaceous, although there are sandstone members near its base which will be described separately as they have economic significance. The formation consists of dark grey-brown, dark grey and black, silty, carbonaceous, micaceous shale; grey, grey-green and dark grey, tight, calcareous, micaceous, kaolinitic siltstone, with minor interbeds of grey and grey-green, very fine-grained, silty, calcareous, micaceous, kaolinitic, quartz sandstone; light grey to white, fine-grained, tight, silty, calcareous quartz sandstone; very minor interbeds of coal.

Three sandstone members are present in the basal part of the section:

(i) Hospital Hill Sandstone: 4009 to 4028 feet (19 feet)

Light grey, fine to coarse-grained, friable, variably calcareous, kaolinitic quartz sandstone, with minor interbeds of dark grey, micaceous shale and grey-green, fine-grained, tight quartz siltstone.

(ii) Links Sandstone: 4044 to 4054 feet (10 feet)

White to light grey, medium-grained, friable, slightly calcareous quartz sandstone.

(iii) Showground Sandstone: 4178 to 4185 feet (7 feet)

White, medium to coarse-grained, friable quartz sandstone.

Palaeontology: Abundant spores have been found in this formation. Results of studies of the microflora are contained in Appendix 2.

Electrical Characteristics: Apart from the sand development between 3495 and 3545 feet, where all curves have fairly high values, the curves are mainly of low amplitude to the top of the Hospital Hill Sandstone at 4009 feet. All curves show large increments across the Hospital Hill, Links and Showground Sandstones. The interpretation of the electric and micrologs across these three members is given in Appendix 5. The interval between the Links and Showground Sandstones is mainly shaly and, consequently, all curves are of lower magnitude with little variation. It should be noted, however, that all resistivity curves have a higher mean value for this interval than they have in the remainder of the formation.

Petroleum Manifestations: Gas with some high gravity condensate was produced from the three sandstone units, and the well was completed as a producer from the Hospital Hill and Links Sandstones.

Pickanjinnie Formation (Triassic): 4185 to 4490 feet (305 feet)

Lithology: This unit is made up of interbedded sandstone, siltstone, and shale, with minor mudstone and coal. The sandstone is white to pale grey-green, medium to coarse-grained, fairly friable, mainly tight, feldspathic, lithic and quartzose, grading to a grit locally, and is slightly calcareous and pyritic in part; there is also sandstone, white to pale grey-green, very fine to fine-grained, tight, slightly kaolinitic, and mainly quartzose, grading to a siltstone; and minor sandstone, white to brown, very fine to fine-grained, hard, tight kaolinitic, very slightly calcareous, lithic, quartzose, with some erratic coarse quartz grains. The siltstone is light grey-green and tan, hard, compact, slightly calcareous in part, micaceous, argillaceous, quartzose and sandy, grading to a sandstone above. The shale is brown and grey, in part carbonaceous, micaceous, silty, and in part sandy. The mudstone is pale grey-green and compact.

Palaeontology: No macrofossils were found within this formation. A fairly well preserved microflora has been found, which enables its age to be determined as post-Artinskian. The unit can be equated in time with the Newcastle and Tomago Coal Measures of New South Wales.

Electrical Characteristics: All curves on the Electric Log are fairly flat, with little indication of permeability. Micrologs run over most of the section also indicate low permeability.

Petroleum Manifestations: Brown staining in some of the sandstone beds in this section may be due to dead oil. However, this staining does not fluoresce, and gives only a very slow cut.

A drill stem test on the interval 4392 - 4470 feet produced gas at the rate of approximately 15 Mcf/D. This gas was petroliferous.

Latemore Formation (Permian): 4490 to 4835 feet (345 feet)

Lithology: This unit is made up of interbeds of sandstone, siltstone, shale, and mudstone, and contains a number of coal seams.

The sandstone is mainly grey-green to white, fine, medium, and coarse-grained, tight, slightly calcareous and kaolinitic, lithic and quartzose, grading in part to siltstone. Relatively minor beds of grey-green and tan, medium to coarse-grained, tight, variably friable, slightly pyritic, quartzose sandstone also occur. The siltstone is grey-green to tan, tight, compact, argillaceous, slightly calcareous, and siliceous, in part quartzose. The shale is grey-brown and tan, silty, in part very carbonaceous, and grades into a siltstone. There is also a fair proportion of black and dark grey highly carbonaceous shale which is locally micaceous and pyritic and which grades to coal. There are minor interbeds of buff to tan, very slightly sandy mudstone containing some coaly inclusions and off-white, buff and tan sideritic mudstone which grades to siltstone.

Palaeontology: No macrofossils were found in this unit. The microflora was similar to that found in the overlying Pickanjinnie Formation.

Electrical Characteristics: The S.P. log of this unit shows lower negative values than that of the Pickanjinnie Formation. These lower values are probably attributable to the lower sand content of the Latemore Formation.

A number of thin resistive bands appearing on the normal resistivity curves are attributed to coal seams. These seams are also responsible for the numerous peaks in the lateral curve; they are most common in sub-unit B. Porosity appears to be low over the whole section; this is verified by the microlog. It appears from the electric logs that the Latemore Formation could be split into five sub-units, which may be useful at a later stage for short-distance correlation. The unnamed sub-units are:

A	4490 - 4552	:	62 feet
B	4552 - 4678	:	126 feet
C	4678 - 4755	:	77 feet
D	4755 - 4779	:	24 feet
E	4779 - 4835	:	56 feet

Petroleum Manifestations: Fluorescence was fairly widespread throughout this unit. Much of this was due to non-cutting mineral fluorescence, primarily from a mudstone. There was, however, some genuine hydrocarbon fluorescence which gave a fluorescing cut. Minor gas and oil bleeding occurred in Core No. 19 (4795 - 4805 ft) from a tight fine-grained sandstone and a grey siltstone. The oil was a medium brown colour and fluoresced a bright blue-white. A careful examination of micrologs revealed no porosity, and no drill stem test was attempted.

General: This unit appeared, in this well, to be overlain conformably by the Pickanjinnie Formation. Cross sections suggest a slight angular unconformity between it and the underlying Timbury Hills Formation.

Timbury Hills Formation (?Devonian): 4835 to 5213 feet (378 feet +)

Lithology: This unit is made up of a light to medium green, fine to very fine-grained, hard, tight, quartzose sandstone, grading in part to a siltstone.

It is variably calcareous near its top and siliceous towards the bottom of the well, where it grades to a quartzite. A petrological determination of this rock as a slightly metamorphosed, argillaceous quartz sandstone has been made by Miss B. Houston (Appendix 1).

There is a small amount of shale and mudstone shown in this unit on the composite log, but this is probably caving from uphole.

Palaeontology: No organic remains were found in this unit, and its age is unknown.

Electrical Characteristics: The S.P. curve is relatively featureless, and all resistivity curves register extremely high values.

Petroleum Manifestations: None. This unit is local basement.

General: Although the lithology of the unit here is different from that at the type area, the name has been extended as in both localities there is some comparison in electrical characteristics, and in seismic velocity. The high angle dips at Timbury Hills appear to be absent at Pickanjinnie; the only dip noted at the latter locality was almost flat.

Structure

The seismic survey that preceded drilling showed a rather complex structural pattern.

The structure drilled at Pickanjinnie is a north-west trending elongate fold, with a certain closure of at least 100 feet on an area of 864 acres. The fold is roughly uniform to basement, and appears in part to be controlled by the erosion surface of the basement. It was the most easterly fold located in the seismic programme.

Relevance to Occurrence of Petroleum

The well was situated high on the structure, but not on the crest. Petroleum, in the form of petroliferous gas, was encountered. On the basis of this one well, it does not necessarily follow that this structural control has been the only control or even has had any effect on the accumulation.

Porosity and Permeability of Sediments Penetrated

Porosity and permeability determinations were not carried out in the section above the Hospital Hill Sandstone. Estimations of porosity at various intervals were made from Schlumberger electric logs and micrologs. The summarized results are:

Depth (feet)	Porosity (%)
4009 - 4028	16
4044 - 4054	25
4178 - 4185	30

Physical measurements of porosity and permeability were carried out on samples at 2-foot intervals from the Hospital Hill Sandstone, by the Bureau of Mineral Resources. The results are shown in Appendix 4. Overall porosity is comparable with the Schlumberger estimation, but it is difficult to reconcile a steady flow rate of 5.5 MMcf/D with the low permeabilities measured.(2)

Contribution to Geological Concepts Resulting from Drilling

No new basic concepts have resulted from the information obtained from this well; it has, however, provided a wealth of confirmatory information and has modified some pre-existing ideas.

A comparison of the predicted section with the section encountered in A.A.O. Pickanjinnie No. 1, is tabulated below:

Age	Formation Top	Depth Predicted (feet)	Depth Encountered (feet)
Lower Cretaceous	Roma Formation	0	0
Lower Cretaceous - Jurassic	Blythesdale Formation	245	365
Jurassic	Walloon Coal Measures	1440	1428
Jurassic	Bundamba Group	2640	2898
Triassic	Moolayember Formation	3430	3448
Triassic	Pickanjinnie Formation	3980	4185
Permian	Latemore Formation	-	4490
(?) Devonian	Timbury Hills Formation	4270	4835

The lithologic characteristics of the units penetrated were substantially as predicted.

A Permian section was encountered below the Mesozoic as expected. It had previously been thought that the Moolayember Formation was Lower Triassic, but spore examination of the unit in this well points to either an Upper Triassic or Lower Jurassic age. If this is correct, it means either that the time break was greater than previously thought or that correlation with surface Moolayember has been incorrect. Further to this concept, it

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(2) Footnote by Bureau of Mineral Resources:

Laboratory determinations of porosity and permeability were made on samples which did not show secondary porosity or permeability.

has always been tacitly assumed, on the basis of an intraformational conglomerate at the base of the Bundamba, and on field observation, that a major time break occurred between the Bundamba Group and the Moolayember Formation. It would now appear this is not the case at Roma, and that the two are conformable.

Spore analysis of A.R.O. No. 19 (Wallumbilla) has placed the top of the Permian at 4016 feet, whilst the top of the Permian at Pickanjinnie No. 1 has been placed at 4490 feet. This would indicate a westerly dipping surface of the Permian. However, seismic reflections on the top of the Hospital Hill Sandstone are at 4009 and 4210 feet in Pickanjinnie and Wallumbilla respectively; this indicates a pronounced easterly dip near the base of the Mesozoic. The palynological and seismic evidence appear contradictory, and more information is needed to resolve the problem.

A velocity survey carried out in Pickanjinnie No. 1 together with information from an earlier velocity survey in another well, has shown that:

(i) A reflector previously thought to have been the top of the Moolayember Formation is more likely to be the top of the Hospital Hill Sandstone;

(ii) An upper phantom horizon in the Walloon Coal Measures ties to a sandstone member, about 550 feet from its top; and

(iii) The top of the Latemore Formation ties to a reflector previously mapped as the top of the Timbury Hills Formation.

APPENDIX 1

PETROLOGICAL REPORT ON SPECIMEN FROM CORE NO. 21, A.A.O. PICKANJINNIE NO. 1

by

B.R. Houston*

The specimen, from Core No. 21 (5131'6" to 5131'9") is a massive, very fine-grained, dark grey rock, traversed by a fine quartz vein.

Microslide GSQ.1170

In thin section, this sediment is composed of an estimated 65-70 percent quartz, about 20 percent rock fragments, less than 5 percent feldspar grains, and about 10 percent argillaceous matrix.

The sorting is poor and the quartz grains occur as three distinct grain sizes - 0.2 mm, 0.09 mm, and 0.03 mm. The intermediate grain size is the dominant one and more than 50 percent of the grains are in the fine sand range.

The quartz and feldspar grains are strained, have a low sphericity and appear to have been fairly angular. Now, however, the margins of these grains are very slightly embayed to produce a finely serrated effect. The rock fragments have a similar grain size, and are of labile material. The argillaceous matrix has been almost totally recrystallized to produce fine-grained green sericite, muscovite flakes and minor amounts of chlorite.

About 2 to 3 percent opaque material is present, some of which could possibly be carbonaceous remains. Random grains of zircon and spinel are present together with some fine, brownish-green hornblende subhedra.

Name: Argillaceous quartz SANDSTONE.

This rock has undergone extremely low grade metamorphism, probably from the load of overlying sediment.

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*Geological Survey of Queensland

APPENDIX 2

PALAEONTOLOGICAL REPORTS

PALYNOLOGY OF SAMPLES FROM A.A.O. PICKANJINNIE NO. 1 (3681 - 4027 feet) AND A.A.O. NO. 1 (TIMBURY HILLS) (3530 - 3857 feet)

by

N.J. de Jersey*

The samples recorded here came from the lower part of the Mesozoic succession in these wells, overlying Permian sediments in Pickanjinnie No. 1, and overlying basement rocks in the Timbury Hills well. Their spore and pollen content has been examined by P.R. Evans, of the Bureau of Mineral Resources. Dr Evans observed that some of these samples contained the genus Classopollis, in relatively large numbers, and tentatively suggested that the containing beds were younger than the Ipswich Coal Measures. In view of the writer's knowledge of the microflora of the Ipswich Coal Measures in the type area, slides prepared from the samples in question were forwarded for comparison of the microfloras. The slides are as follows:

A.A.O. Pickanjinnie No. 1

Core No. 11	3681 ft 10 in.	-	3682 ft	2 slides
Core No. 12	3901 ft	-	3901 ft 4 in.	2 slides
Core No. 13	3909 ft	-	3909 ft 4 in.	2 slides
Core No. 15	4027 ft	-	4027 ft 5 in.	2 slides

A.A.O. No. 1 (Timbury Hills)

Core at 3530 feet	2 slides
Core at 3749 feet	2 slides
Core at 3857 feet	2 slides

Investigation of these slides indicates a general similarity between the assemblages from the two wells. The microfloras are lacking in forms such as Zonalapollenites, Inaperturopollenites reidi and Lycopodiumsporites rosewoodensis which characterize the Walloon Coal Measures in the type area.

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* Geological Survey of Queensland

This suggests a pre-Walloon age for the sediments. On the other hand, while Pteruchipollenites (a common genus in the Ipswich Coal Measures) is present, it is not as abundant or as diversified specifically as in the Ipswich strata; in addition, two other genera which are present often in great abundance in all the Ipswich samples so far examined, are missing from the assemblage. The features confirm Dr Evans' suggestion that the sediments are younger than the Ipswich Coal Measures. Consequently an age intermediate between the Ipswich and Walloon Coal Measures is indicated for the sediments containing this microflora, and this conclusion is supported by the presence of Classopollis in relative abundance in several of the samples. (This genus has not been recorded from either the Ipswich or Walloon Coal Measures).

As the Ipswich Coal Measures are regarded as Middle Triassic (Jones & de Jersey, 1947, p. 82) and the Walloon Coal Measures as Lower Jurassic (de Jersey, 1959, p. 356), the palynological evidence suggests that the sediments examined are near the Triassic-Jurassic boundary (i.e. Upper Triassic to Lower Jurassic). They may be equivalent to some portion of the succession in the Bundamba Group, but this cannot be determined until the microflora of this Group in the type area is studied in detail. An alternative possibility is that these sediments in the Roma area were deposited in the time interval represented by the disconformity between the Ipswich Coal Measures and the Bundamba Group, so that sediments of equivalent age would be missing from the sequence in the Moreton district.

REFERENCES

de JERSEY, N.J., 1959: Jurassic spores and pollen grains from the Rosewood Coalfield. Qld Govt Min. J. 60, (691), (May, 1959).

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PALYNOLOGICAL EXAMINATION OF SAMPLES FROM A.A.O. PICKANJINNIE NO. 1

by

P.R. Evans*

Eight samples from cuttings taken between 4050 and 4400 feet in A.A.O. Pickanjinnie No. 1 have been examined palynologically in an attempt to determine more precisely the position of the Mesozoic-Permian boundary in the well, based on the information already obtained from cores from the well and from A.R.O. No. 19 (Wallumbilla) in which the boundary already has been defined.

It is tentatively considered that in Pickanjinnie No. 1 the boundary lies between 4350 feet and 4400 feet.

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* Bureau of Mineral Resources

The samples were chosen from the following depths:

4050 feet	4250 feet	
4100 feet	4300 feet	MESOZOIC
4150 feet	4350 feet	
4200 feet		
4400 feet		PERMIAN

An interval between samples of fifty feet was chosen as it corresponds approximately to the interval within which the boundary had been defined in the Wallumbilla well.

Bad contamination of all the samples by material from higher levels made it difficult to decide with certainty whether the boundary is to be found within the interval stated or at a higher level. However, rare specimens of Florinites ovatus Balme and Hennelly, and Nuskoisporites sp. occur in the preparation from 4400 feet and therefore the Permian is considered to persist at least as far up as this level. There is no sign of the abundant Permian microflora seen in Core No. 17 at 4422 feet.

All samples from 4350 feet and above yielded varied assemblages of Mesozoic spores but, because of contamination, it is impossible at this stage to state whether the distinct microflora seen in the Wallumbilla well between 3862 and 3956 feet, that is immediately above the Permian section, is present in Pickanjinnie No. 1. Species from that assemblage are present in the Pickanjinnie samples but only more detailed logging of the palynology of both wells will prove the point.(3)

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(3)Footnote by Bureau of Mineral Resources:

Later palynological evidence shows that the Bundamba Group and Moolayember Formation down to the base of the Links Sandstone, are Jurassic in age, and the shales below the Links Sandstone, including probably the Showground Sandstone, are Triassic (approximately Middle and a portion of the Upper Triassic) in age. At least part of the Pickanjinnie Formation ranges into the Triassic. A portion of the Lower Triassic (equivalent to the middle of the Narrabeen Group of the Sydney Basin) seems to be missing between the Pickanjinnie Formation and the overlying Middle-Upper Triassic shales.

APPENDIX 3

GAS ANALYSIS OF TWO SAMPLES OF GAS FROM DRILL STEM TESTS NOS 7 AND 8, A.A.O. PICKANJINNIE NO. 1 WELL

by

Queensland Government Analyst

	D.S.T. No. 7 (percent)	D.S.T. No. 8 (percent)
Carbon Dioxide	1.1	0.9
Oxygen	0.4	0.3
Methane	83.9	86.8
Ethane	12.4	9.4
Inert	2.2	2.6
	100.0	100.0

CONDENSATE ANALYSES

by

Australian Mineral Development Laboratories

The results of analyses of two samples of condensate collected by the Chief Petroleum Technologist, Bureau of Mineral Resources, from the intervals indicated during Drill Stem Tests Nos 7 and 8, A.A.O. Pickanjinnie No. 1, are summarized below:

Distillation Range of Hydrocarbon Fraction	D.S.T. No. 7 4009 - 4028'	D.S.T. No. 8 4009 - 4028' 4044 - 4053'
Initial boiling point	50°C	50°C
10% distilled	102°	109°
20%	112°	120°
30%	119°	129°
40%	126°	139°
50%	135°	149°
60%	145°	160°
70%	157°	173°
80%	175°	190°
90%	210°	220°
Final boiling point	235°	245°
Recovery	95%	95.5%
Residue	3.4%	3.3%
Loss	1.6%	1.2%
Water content, Vol/Vol, of whole sample	0.45%	1.35%
Chloride content of water (as Cl)	0.11 gm/litre (110 ppm.)	0.20 gm/litre (200 ppm.)

These analyses were made with apparatus that was not strictly in accordance with I.P. Standards. However, it is thought that no material difference would be found with analyses made with the standard glassware.

APPENDIX 4

POROSITY AND PERMEABILITY DETERMINATIONS

A.A.O. PICKANJINNIE NO. 1

by

Petroleum Technology Laboratory
Bureau of Mineral Resources

Porosity and permeability tests were made on samples from Core No. 15 from A.A.O. Pickanjinnie No. 1. The samples on which tests were made did not show secondary porosity or permeability. Ruska field porometer and permeameter, using nitrogen as flowing medium, were employed in making these tests.

Depth	Rock Type	Porosity (%)	Permeability (md) Horiz.	Vertical
4010 - 4010'5"	Fine-grained sandstone	20	4.2	4
4012 - 4012'4"	Fine-grained sandstone	15	0	0
4014 - 4014'4"	Fine-grained sandstone	18	0	13
4016 - 4016'6"	Fine-grained sandstone	20	3	2.3
4018 - 4018'5"	Medium-grained sandstone	19	30	27.5
4020 - 4020'4"	Medium-grained sandstone	21	500	475
4022 - 4022'4"	Fine-grained sandstone	8	0	0
4024 - 4024'5"	Siltstone	6.5	0	0
4026 - 4026'4"	Siltstone	6	0	0
4027'11" - 4028'4"	Fine-grained sandstone	10.5	0	0

APPENDIX 5

TABLE OF LOGS FROM A.A.O. PICKANJINNIE NO. 1

Log	Run	Date	Depth Interval (feet)
Lithology and Gas Log (Rotary Engineering Company)		7.6.60 - 12.7.60	2500 - 5213
Electric Log (Schlumberger)	1	5.6.60	180 - 2148
	2	14.6.60	2070 - 3680
	3	19.6.60	3568 - 4033
	4	21.6.60	3930 - 4058
	5	23.6.60	3956 - 4293
	6	26.6.60	4191 - 4473
	7	3.7.60	4373 - 4949
	8	12.7.60	4849 - 5213
Microlog/Caliper (Schlumberger)	1	19.6.60	3910 - 4031
	2	21.6.60	3940 - 4056
	3	23.6.60	4130 - 4291
	4	26.6.60	4191 - 4472
	5	4.7.60	4372 - 4945
Section Gauge (Schlumberger)	1	12.7.60	150 - 5213
Temperature Log (Schlumberger)	1	16.7.60	497 - 4368

Copies of the above logs are available for inspection at the Bureau of Mineral Resources, Canberra.

Summary of Logging Operations

A.A.O. Pickanjinnie No. 1

Type of Survey	Elect.	Elect.	Elect.	Elect.	Elect.	Elect.	Elect.	Elect.	Microlog	Microlog	Microlog	Microlog	Microlog	Section
Run No.	1	2	3	4	5	6	7	8	1	2	3	4	5	1
Date	5.6.60	14.6.60	19.6.60	21.6.60	23.6.60	26.6.60	3.7.60	12.7.60	19.6.60	21.6.60	23.6.60	26.6.60	4.7.60	12.7.60
Logged from	2148	3680	4033	4058	4293	4473	4949	5213	4031	4056	4291	4472	4945	5213
Logged to	180	2070	3568	3930	3956	4191	4373	4849	3910	3940	4130	4191	4372	150
Depth reached	2149	3681	4034	4059	4294	4474	4950	5213	4034	4059	4294	4474	4950	5213
Bottom (driller)	2148	3679	4030	4055	4290	4470	4945	5213	4030	4055	4290	4470	4945	5213
Casing (log)	179	179	179	179	179	179	179	179	179	179	179	179	179	179
Casing (driller)	178	178	178	178	178	178	178	178	178	178	178	178	178	178
Bit size	8 1/2"	8 1/2"	8 1/2"-4010 5 5/8"-4030	8 1/2"	8 1/2"	8 1/2"	8 1/2"	8 1/2"	8 1/2"	8 1/2"	8 1/2"	8 1/2"	8 1/2"	8 1/2"
Mud Properties														
Type	Bent.	Bent.	Bent.	Bent.	Bent.	Bent.	Bent.	Bent.	Bent.	Bent.	Bent.	Bent.	Bent.	Bent.
Density (S.G.)	1.23	1.21	1.23	1.19	1.24	1.23	1.27	1.28	1.21	1.19	1.24	1.23	1.27	1.28
Visc. (Marsh)	43	41	59	49	46	41	43	48	51	49	46	41	43	48
Water loss (cc/30')	5.5	14.0	7.0	8.0	6.0	7.0	7.9	8.6	5.0	8.0	6.0	7.0	7.9	8.6
Resistivity	7.5 at 48°F.	5.5 at 83°F.	5.7 at 53°F.	4.2 at 67°F.	3.5 at 74°F.	4.7 at 68°F.	4.2 at 67°F.	3.6 at 69°F.	4.2 at 72°F.	4.2 at 67°F.	3.5 at 74°F.	4.7 at 68°F.	4.2 at 67°F.	3.6 at 69°F.
Resistivity B.H.T.	3.9 at 103°F.	3.6 at 121°F.	2.4 at 130°F.	2.1 at 131°F.	2.1 at 132°F.	2.4 at 139°F.	1.8 at 149°F.	1.6 at 164°F.	2.4 at 130°F.	2.1 at 131°F.	2.1 at 132°F.	2.4 at 139°F.	1.8 at 149°F.	1.6 at 164°F.
pH	6.9 at 60°F.	7.6 at 60°F.	8.0 at 60°F.	8.0 at 60°F.	8.5 at 60°F.	8.5 at 70°F.	8.5 at 70°F.	8.0 at 70°F.	8.5 at 70°F.	8.0 at 60°F.	8.5 at 60°F.	8.5 at 70°F.	8.5 at 70°F.	8.0 at 70°F.

LOG INTERPRETATION OF A.A.O. PICKANJINNIE NO. 1 WELL

by

P. Lehmann*

GENERAL INFORMATION

Mud:	Bentonite
Bit size:	d = 8 1/2"
Water samples:	None taken in this well. A water analysis of a sample from A.A.O. No. 5 (Hospital Hill) drilled in the same area was available.
Logs used for interpretation:	Electrical Logs Nos 4 and 5; Microlog/Caliper Nos 1, 2, and 3.

ZONES ANALYSED

Zone 1 : 4027 - 4009 feet, thickness e=18 feet, e/d = 25, formation temperature 130°F.

Zone 2 : 4054 - 4044 feet, thickness e=10 feet, e/d = 14, formation temperature 130°F.

Zone 3 : 4185 - 4178 feet, thickness e= 7 feet, e/d = 10, formation temperature 130°F.

Zone 1

(i) Porosity determination from Microlog

The Micrologs were used to obtain the porosity since they are more accurate for this purpose than the Electrical Logs. It will be shown below that the Electrical Logs give a value in good agreement with that derived from the Micrologs.

Microlog No. 1: It can be seen from this Microlog that the porosity (ϕ) is not the same in each part of the zone. The value of ϕ was computed for a few sub-zones and an average value for the whole bed then taken.

From the mud log: Rm = 2.7 (Resistivities will always be given in ohm - metres). From Chart A-4 (ref. 1), Rmf = 2.4, Rmc = 2.25, Rmc/Rmf = 0.94.

Sub-zone a: 4027 - 4020 feet, e=7 feet
R1" x 1" = 8.2, R1" x 1"/Rmc = 3.65
R2" =13.5, R2"/Rmc = 6.00

From Chart C-10, with a hole diameter of 8",
Rxo/Rmc = 90 and Fa = Rxo/Rmf = Rxo/Rmc x Rmc/Rmf = 85

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* Schlumberger Seaco Inc.

Since there is gas in the formation, it can be assumed that ROS is not greater than 10 percent.

From Chart C-12, ϕ = 11.3%, F = 68

Sub-zone b: 4020 - 4016 feet, e=4 feet
R1" x 1" = 9.6, R1" x 1"/Rmc = 4.26
R2" = 14.0, R2"/Rmc = 6.20

In the same way as before: Rxo/Rmc = 34, Fa = 32, and ϕ = 17.6%, F = 26

Sub-zone c: 4016 - 4009 feet, e = 7 feet
R1" x 1" = 8.7, R1" x 1"/Rmc = 3.85
R2" = 12.6, R2"/Rmc = 5.60

From these values: Rxo/Rmc = 26, Fa = 24.5, and ϕ = 19.8%, F = 20

Taking an average over the full zone:

$$\bar{\phi} = \frac{(\phi_a \times e_a) + (\phi_b \times e_b) + (\phi_c \times e_c)}{e_a + e_b + e_c}$$

then $\bar{\phi}$ = 16%, $\bar{F}$ = 32

Microlog No. 2: Because of the presence of thicker mud cake (see Caliper Log) the readings are smaller for this Microlog than for the first one. Another consequence is that the differentiation of the sub-zones is less obvious. Average readings have been taken for the whole bed. The mud log gives the same value for Rm as before and hence the same values for Rm, Rmf, and Rmc.

The readings are:

R1" x 1" = 6.8, R1" x 1"/Rmc = 3.02
R2" = 11.2, R2"/Rmc = 5.00

Proceeding as before: Rxo/Rmc = 42, Fa = 39.5 and ϕ = 16%, F = 32

The results from both Micrologs therefore, are in close agreement.

(ii) Water saturation from Electrical Log

Formation water resistivity: The same value is used for Rm as for the Micrologs since the Electrical Log and the Microlog were run within a period of a few hours.

For the S.P., the values from the curves obtained without current are taken. Both logs show the same S.P. deflection: SSP = -33mV.

From Chart A-10 (ref. 1), Rmf/Rwe = 2.6, and Rwe = 2.4/2.6 = 0.92.
It is believed that no correction is required for bivalent ions. Water analyses of samples taken in wells drilled in the same area show that the most common cation is Na, the anions being Cl as well as CO_3. The bivalent ions Ca and Mg occur in very small proportions and are probably of no consequence for the resistivity.

From an analysis of a sample taken in A.A.O. No. 5 (Hospital Hill) at 3700 feet, by converting each salt content to equivalent NaCl, it is found that the concentration is 3600 ppm. eq. NaCl. At 130°F, this concentration gives a resistivity of 0.9 (Chart A-6), which is in good agreement with the value derived above from the S.P.

The value Rw = 0.9, will be used in subsequent determinations.

True resistivity of the formation: Since the bed is not very thick corrections have to be made to the readings of the lateral device for the bed thickness. From the curves given in ref. 3 (Lateral curves for thin non-invaded beds), for the case e/d = 20; Rs/Rm = 10, which is the closest value to Zone 1 figures, (e/d = 25; Rs/Rm = 5), it is seen that the correction to be made to the lateral reading is very large. The ratio of true resistivity to lateral reading will be between say 3 and 9. This wide range therefore, makes all other corrections such as borehole effect and invasion of little importance (Rmf and Rw are not very different). On the other hand, since the normal devices are giving apparent readings of the same order as the lateral and are much less influenced by bed thickness, they are of no interest for computing the true resistivity Rt. However, to be complete, all readings are taken and corrected for borehole effect and bed thickness. Using the short normal device a value for the resistivity of the invaded zone Ri and an approximate value of F are obtained; it is seen that the Electrical Log and Microlog are in good agreement.

E Log No. 4:

	16" Normal	64" Normal	18'8" Lateral
AO/d	1.9	7.5	26.5
Apparent resistivity Ra	100	100	100
Ra/Rm (Rm = 2.7)	37	37	37
Corrected for borehole and bed thickness (ref.2, p.83 and ref.3)	42	60	> 100

E Log No. 5:

Ra	75	85	110
Ra/Rm (Rm = 2.7)	28	31.5	41
Corrected as above	33	50	> 120

It is emphasized that the above corrected values are not to be considered as true resistivities. They are the values that would be obtained if there were no borehole, infinite bed thickness and no invasion. The values given for the lateral are in no way accurate; they are given to show that the deeper the investigation of the device the higher the corrected value of Ra/Rm.

It is concluded that in E Log No. 5, invasion was deeper, the resistivity of the

invaded zone Ri being smaller than the true resistivity Rt. Using document No. 3 (ref.2, pp. 93 and 95) it seems that the invasion diameter is probably of the order of Di = 2d for E Log No. 4 and Di = 5d for E Log No.5.

Assuming $F \doteq Ri/Rm \doteq R16"/Rm$ corrected, then $F \doteq 33$.

This is to be considered as a maximum value and is in good agreement with the value F = 32 derived from the Microlog.

To obtain a figure for Rt, it is necessary to use the lateral curve. From the document "Lateral curves for thin non-invaded beds" (ref.3), using the curves for Rs/Rm = 10, e/d = 20, and Rs/Rm = 1, e/d = 20, it is concluded that the ratio Rt/Ra must be of the order of 6. But this is a very rough approximation since two interpolations have been made between quite different values. Here too, a Laterolog would be helpful in determining a better value for Rt.

Using the figure $Rt/Ra = 6 \pm 2$, then

$$Rt/Rm = 240 \pm 80, \quad Rt = 650 \pm 200$$

The water saturation Sw can now be computed, since $Sw^2 = \frac{F \times Rw}{Rt}$

Using the values F = 32, Rw = 0.9, $Rt = 650 \pm 200$, then

$$Sw = 21 \pm 3\%$$

Because of the wide range of Rt, it is concluded that

$$Sw < 24\%$$

Zone 2

(i) Porosity determination from Microlog

The procedure followed is the same as above.

There is only one Microlog for this zone; Rm, Rmf, Rmc are the same as before. The readings are:

R1" x 1" = 6.2, R1" x 1"/Rmc = 2.75
R2" = 9.2, R2"/Rmc = 4.10

Hence, Rxo/Rmc = 16, Fa = 15 and ϕ = 25%, F = 12

(ii) Water saturation from Electrical Log

Since the S.P. deflection is the same, the value Rw = 0.9 is used. The resistivities for E Log No. 4 are:

	16" Normal	64" Normal	18'8" Lateral
AO/d	1.9	7.5	26.5
Ra	38	32	38
Ra/Rm	14	11.5	14
Corrected as above (Ref.2, p.97: ref.3)	17	24	> 40

The differences between E Logs 4 and 5 are negligible and a second computation is not necessary.

From the above results it is concluded that $F < 17$, which agrees with the result from the Microlog.

To obtain a figure for the true resistivity Rt, the lateral curve is again used and the reading corrected by means of ref. 3. The curves to be used are those for e/d = 20, Rs/Rm = 10, and e/d = 10, Rs/Rm = 10.

It is concluded from the curves that the value of Rt/Ra must be of the order of 5. Using the figure $Rt/Ra = 5 \pm 1.5$, then $Rt/Rm = 70 \pm 20$, $Rt = 190 \pm 60$, and finally with F = 12, and Rw = 0.9,

$$Sw = 24 \pm 3\ \%$$ and it is concluded that $Sw < 27\%$

Zone 3

(i) Porosity determination from Microlog

The mud log seems influenced by the formations. It is believed that the value Rm = 2.7 can still be used and therefore Rmf and Rmc have the same values as before.

R1" x 1" = 6, R1" x 1"/Rmc = 2.65
R2" = 10, R2"/Rmc = 3.70

Hence, Rxo/Rmc = 10.2, Fa = 9.6 and ϕ = 30%, F = 8.2

(ii) Water saturation from Electrical Log

Formation water resistivity: The S.P. deflection is smaller than for Zones 1 and 2. This may be due to the fact that the sand is not clean (no core was taken in this zone) or to the fact that the connate water has effectively a higher resistivity than in the two upper zones. The interpretation is made on the assumption that the sand is clean, i.e. that the second hypothesis is correct, giving SSP = -20 mV.

From Chart A-10 (ref 1), Rmf/Rwe = 1.85. This value will be used to obtain Rw, without making any correction for bivalent ions. Hence, Rw = 1.3.

The resistivities from E Log No. 5 are:

	16" Normal	64" Normal	18'8" Lateral
AO/d	1.9	7.5	26.5
Ra	60	40	50
Ra/Rm	22	14.8	18.5
Corrected as above (Ref 2, p. 109: ref.3)	32	78	70

In this zone the invasion is probably not very deep. (This is to be expected, on the other hand, since the porosity is high).

From $F \doteq Ri/Rm$, then $F \doteq < 32$.

This value agrees with the Microlog result. However, in this case the E Log alone would be of little help in the porosity determination.

To determine Rt approximately, the lateral reading is again used in conjunction with ref.3. The curves to be considered are those for e/d = 10, Rs/Rm = 10. A reasonable value for Rt/Ra would be $Rt/Ra = 4 \pm 1$ and $Rt/Rm = 74 \pm 20$, $Rt = 200 \pm 60$.

With this value and F = 8.2, Rw = 1.3, the water saturation is

$Sw = 23 \pm 4\%$ leading to the conclusion $Sw < 27\%$.

Note that the interpretation has been made assuming a sand without shales which makes this result less reliable than the results for Zones 1 and 2.

SUMMARY OF RESULTS

Zone No.	Porosity (%)	Water saturation (%)
1	16	< 24
2	25	< 27
3	30	< 27

EXPERIMENTAL RESULTS

The results of drill stem tests of these three zones are given in Appendix 7.

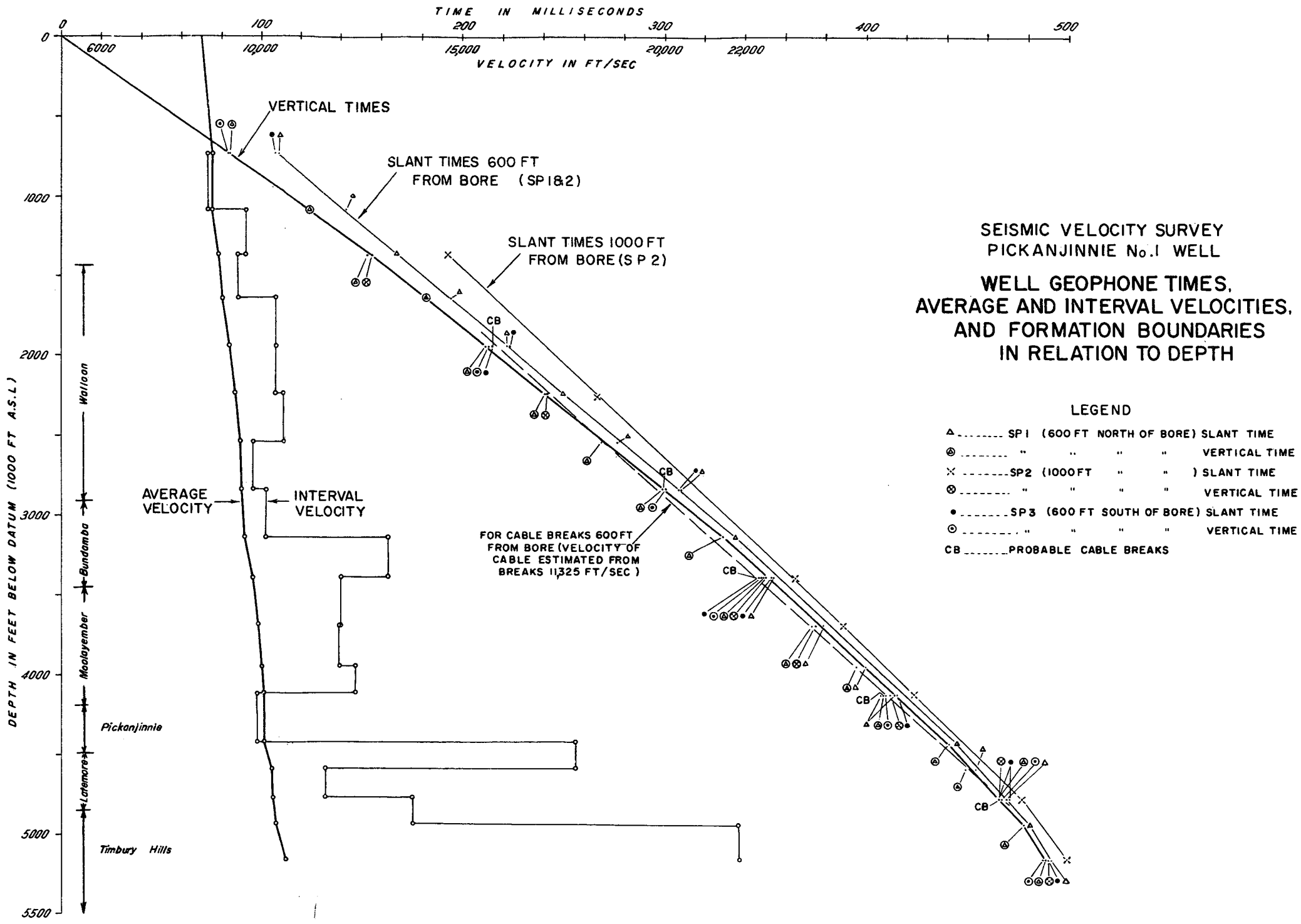
REFERENCES

(1) Schlumberger Log Interpretation Chart Book.

(2) Resistivity Departures Curves, Document No. 3.

(3) Lateral Curves for thin non-invaded Beds (AO = 18'8").

Fig. 2



SEISMIC VELOCITY SURVEY
PICKANJINNIE No. 1 WELL

WELL GEOPHONE TIMES, AVERAGE AND INTERVAL VELOCITIES, AND FORMATION BOUNDARIES IN RELATION TO DEPTH

LEGEND

- △ ..... SP 1 (600 FT NORTH OF BORE) SLANT TIME
- ⊙ ..... " " " " VERTICAL TIME
- × ..... SP 2 (1000 FT " ") SLANT TIME
- ⊗ ..... " " " " VERTICAL TIME
- • ..... SP 3 (600 FT SOUTH OF BORE) SLANT TIME
- ⊙ ..... " " " " VERTICAL TIME
- CB ..... PROBABLE CABLE BREAKS

Bureau of Mineral Resources, Geology and Geophysics G 38-82-1

APPENDIX 6

SEISMIC VELOCITY SURVEY IN A.A.O. PICKANJINNIE NO. 1

by

Geophysical Branch

Bureau of Mineral Resources

On 12th July, 1960 a velocity survey of Pickanjinnie No. 1 Well was made by a seismic party from the Bureau of Mineral Resources. The Bureau provided the necessary staff and seismic equipment, including the well geophone. Schlumberger (contractor to A.A.O.) provided the cable truck and winch and requisite personnel.

Three shot-points were used during the survey. These were located 600 feet and 1000 feet north of the well and 600 feet south of the well. Well-geophone times from only the first of these shot-points were used for the computation of velocities, the data from the other two shot-points being used for confirmation of the results from the first shot-point and to assist in recognition of cable breaks. Good-quality first breaks were recorded on the well geophone. This was a three-element geophone which permitted a vertical component and two horizontal components of ground movement to be recorded simultaneously. Cable breaks were sometimes recorded but it was possible to recognize these.

The well-geophone times, average velocities, interval velocities, and formation boundaries in relation to depth are all shown on Figure 2. The interval velocities recorded are geologically acceptable. However, the interval velocities measured in the formations below the base of the Mesozoic may be inaccurate because of the small time intervals which had to be measured. If the velocities are calculated over the full intervals of Permian strata and Timbury Hills Formation, then 13,800 ft/sec. is obtained for the Permian and 17,400 ft/sec. for the Timbury Hills Formation. These are more reasonable values.

The average velocities of the main stratigraphic divisions are:

Mesozoic	10,050 ft/sec.
Permian	13,800 ft/sec.
Timbury Hills Formation	17,400 ft/sec.

A more detailed record of the conduct of the survey and interpretation of results are given by E.R. Smith and K.B. Lodwick in B.M.R. Record 1962/52 - Pickanjinnie No. 1 Seismic Velocity Survey, Queensland, 1960, (Unpubl.).

APPENDIX 7

FORMATION TESTS

A.A.O. PICKANJINNIE NO. 1.

Six short open-hole formation tests (four mechanically successful) and two long tests of production through perforated casing, were undertaken in the well. Results of the tests are summarized in the Table below:

Test No.	Interval (feet)	Period hrs.	mins	Flow	Rate (Mcf/D)	Method	Remarks
1	3952-4030	0	40	Gas	2414	Johnston open hole packer	
2	4030-4055	1	03	Gas	990	Johnston open hole packer	
3	4137-4290	0	44	Gas	24	Johnston open hole packer	
4	4397-4470	0	45	Nil	-	Johnston open hole packer	Tester clogged
5	4395-4470	1	03	Nil	-	Johnston open hole packer	Trip valve unopened
6	4392-4470	1	02	Gas	15	Johnston open hole packer	
7	3976-4368	70	00	Gas	5603	Lane Wells casing packer	Perf. 4009-4028'
8	3976-4368	45	00	Gas	6541	Lane Wells casing packer	Perf. 4009-4028'; 4044-4053'

Details of the production tests are shown in the following tables:

A.A.O. PICKANJINNIE NO. 1

DRILL STEM TEST NO. 1

General

Date:	20th June, 1960
Object:	To test sand encountered between 4007 and 4024 feet
Type of Tester:	Johnston
Type Size Packer:	X, 6 5/8"
Choke:	1/4"
Well Depth:	4030 feet
Pack off at:	3952 feet
Diameter of Well:	8 1/2"
Specific Gravity of Drilling Fluid:	1.21

Operation

Standing for Static Pressure:	15 minutes
Fluid Cushion:	Nil
Packer set:	0905 hrs
Weight to set Packer:	30,000 lb.
Trip Valve opened:	0908 hrs
Retaining Valve closed:	1026 hrs
Flow Period:	40 minutes
Shut-in Period:	39 minutes
Unseated Packer:	1027 hrs
Pull to free Packer:	40,000 lb.
Fluid level in Drill Stem at 6th stand; quantity:	45 cu.ft
Nature of Fluid:	Gas-cut drilling mud, chloride content 150 ppm.
Bottom Hole Temperature:	170 ^{o}F.

Comments

(i) It was not possible to set either Foxboro gauges in operation;

(ii) At 1020 hours with orifice of 1 1/4", differential pressure was 55 p.s.i. and temperature 72 ^{o}F.

Conclusions

(i) Petroliferous gas was produced at the rate of 2414 Mcf/D;

(ii) Closed in pressure was 1800 p.s.i;

(iii) Flowing pressure was 1680 p.s.i.;

(iv) There appeared to be no water produced with the gas.

A.A.O. PICKANJINNIE NO. 1

DRILL STEM TEST NO. 2

General

Date:	21st June, 1960
Object:	To test sand encountered between 4041 and 4051 feet
Type of Tester:	Johnston
Type Size Packer:	X, 6 5/8"
Choke:	1/4"
Well Depth:	4055 feet
Pack off at:	4030 feet
Diameter of Well:	8 1/2"
Specific Gravity of Drilling Fluid:	1.21

Operation

Standing for Static Pressure:	60 minutes
Fluid Cushion:	Nil
Packer set:	1310 hrs
Weight to set Packer:	30,000 lb.
Trip Valve opened:	1314 hrs
Retaining Valve closed:	1417 hrs
Flow Period:	63 minutes
Shut-in Period:	9 minutes
Unseated Packer:	1426 hrs
Pull to free Packer:	80,000 lb.

Fluid level in Drill Stem at 2 feet above R.V.

Nature of Fluid:	Highly gas-cut drilling mud
Bottom Hole Temperature:	145 ^{o}F.

Comments

(i) When R.V. shut for C.I.P. it was suspected that it did not seat efficiently, and that C.I.P. quoted is erroneous.

Conclusions

(i) Flow rate was 990 Mcf/D of petroliferous gas;

(ii) Closed in pressure was 550 p.s.i.;

(iii) Flowing pressure was 500 p.s.i.;

(iv) The gas under test was water free.

A.A.O. PICKANJINNIE NO. 1

DRILL STEM TEST NO. 3

General

Date:	24th June, 1960
Object:	To test sands in interval 4137 - 4290 feet
Type of Tester:	Johnston
Type Size Packer:	X, 6 5/8"
Choke:	1/4"
Well Depth:	4290 feet
Pack off at:	4137 feet
Diameter of Well:	8 1/2"
Specific Gravity of Drilling Fluid:	1.24

Operation

Standing for Static Pressure:	85 minutes
Fluid Cushion:	Nil
Packer set:	0830 hrs
Weight to set Packer:	32,000 lb.
Trip Valve opened:	0832 hrs
Retaining Valve closed:	0916 hrs
Flow Period:	44 minutes
Shut-in Period:	16 minutes
Unseated Packer:	0932 hrs
Pull to free Packer:	23,000 lb.
Fluid level in Drill Stem at top 8th D/C; quantity:	12 cu.ft
Nature of Fluid:	Gas-cut drilling mud, chloride content 275 ppm.
Bottom Hole Temperature:	151^{o}F.

Conclusions

(i) Gas flow was estimated at 24 Mcf/D;

(ii) There was little if any water pressure in the gas;

(iii) In spite of high porosity, production was low - this indicates permeability was of a low order.

A.A.O. PICKANJINNIE NO. 1

DRILL STEM TEST NO. 4

General

Date:	26th - 27th June, 1960
Object:	To retest interval 4397 - 4470 feet
Type of Tester:	Johnston
Type Size Packer:	X, 6 5/8"
Choke:	1/4"
Well Depth:	4470 feet
Pack off at:	4397 feet
Diameter of Well:	8 1/2"
Specific Gravity of Drilling Fluid:	1.23

Operation

Standing for Static Pressure:	102 minutes
Fluid Cushion:	Nil
Packer set:	0457 hrs
Weight to set Packer:	30,000 lb.
Trip Valve opened:	0500 hrs
Retaining Valve closed:	0545 hrs
Flow Period:	45 minutes
Shut-in Period:	Nil
Unseated Packer:	0545 hrs
Pull to free Packer:	5000 lb.
Fluid level in Drill Stem at top 8th D/C.; quantity:	12 cu.ft
Nature of Fluid:	Gas-cut drilling mud, chloride content 150 ppm.
Bottom Hole Temperature:	157°F.

Comments

(i) B.H. C.I.P. was not obtained as the packer was inadvertently unseated when closing the retaining valve.

Conclusions

(i) Gas was produced in very minor quantities at 1/2" water head;

(ii) B.H.P. gauge chart showed tester was clogged;

(iii) A re-run is necessary.

A.A.O. PICKANJINNIE NO. 1

DRILL STEM TEST NO. 5

General

Date:	26th June, 1960
Object:	To retest interval 4395 - 4470 feet
Type of Tester:	Johnston
Type Size Packer:	X, 6 5/8"
Choke:	1/4"
Well Depth:	4470 feet
Pack off at:	4395 feet
Diameter of Well:	8 1/2"
Specific Gravity of Drilling Fluid:	1.23

Operation

Standing for Static Pressure:	32 minutes
Fluid Cushion:	Nil
Packer set:	1352 hrs
Weight to set Packer:	40,000 lb.
Trip Valve opened:	1354 hrs
Retaining Valve closed:	1457 hrs
Flow Period:	63 minutes
Shut-in Period:	9 minutes
Unseated Packer:	1506 hrs
Pull to free Packer:	20,000 lb.
Fluid level in Drill Stem at 3 feet above R.V.; quantity:	1/5 cu. ft
Nature of fluid:	Drilling mud, chloride content 150 ppm.
Bottom Hole Temperature:	157 ^{o}F.

Comments

(i) There was a very weakly surging flow for about 30 seconds - after that, flow was nil.

Conclusions

(i) The trip valve was not opened during test. It was slightly fractured - thus allowing mud head to be relieved to some extent and allowing full formation pressure to be registered;

(ii) B.H. C.I.P. was 2000 p.s.i.;

(iii) A re-test is necessary.

A.A.O. PICKANJINNIE NO. 1

DRILL STEM TEST NO. 6

General

Date:	28th June, 1960
Object:	To retest interval 4392 - 4470 feet
Type of Tester:	Johnston
Type Size Packer:	X, 6 5/8"
Choke:	1/4"
Well Depth:	4470 feet
Pack off at:	4392 feet
Diameter of Well:	8 1/2"
Specific Gravity of Drilling Fluid:	1.22

Operation

Standing for Static Pressure:	74 minutes
Fluid Cushion:	Nil
Packer set:	0842 hrs
Weight to set Packer:	40,000 lb.
Trip Valve opened:	0843 hrs
Retaining Valve closed:	0945 hrs
Flow Period:	62 minutes
Shut-in Period:	Nil
Unseated Packer:	0945 hrs
Pull to free Packer:	23,000 lb. (Xs)
Fluid level in Drill Stem at 300 feet above R.V.; quantity:	15 cu.ft
Nature of Fluid:	Drilling mud, chloride content 150 ppm.
Bottom Hole Temperature:	157°F.

Comments

(i) A B.H. C.I.P. was not measured, as it had already been determined from a previous test (D.S.T. No. 5).

Conclusions

(i) Petroliferous gas was produced at an estimated rate of 15 Mcf/D;

(ii) Maximum B.H. F.P. is 200 p.s.i.

A.A.O. PICKANJINNIE NO . 1, D.S.T. NO. 7

INTERVAL 4009 - 4028 FEET

Date	Time (hrs)	Surface Bean (in.)	Flow Tester Orifice (in.)	Orifice Factor	Temp. °F	Temp. Factor	Orifice Press.	Adjust O.P.	Sp.Gr.	Sp.Gr. Factor	Rate of Flow MMcf/D	Time from Start (Hrs. Mins)
22.7.60	2025	1	1 1/4	34.3	72	0.9887	116	130	0.608	0.9942	4.3830	5.00
23.7.60	0107	1	1 1/4	34.3	72	0.9887	125	139	0.608	0.9942	4.6864	9.42
	1010	1	1 1/4	34.3	77	0.9840	135	149	0.608	0.9942	4.9997	18.45
	1513	1	1 1/4	34.3	77	0.9840	141	155	0.608	0.9942	5.2011	23.48
	2107	1	1 1/4	34.3	71	0.9896	143	157	0.608	0.9942	5.2981	29.42
24.7.60	0120	1	1 1/4	34.3	71	0.9896	144	158	0.608	0.9942	5.3319	33.55
	0935	1	1 1/4	34.3	75	0.9859	150	164	0.608	0.9942	5.5137	42.10
	1445	1	1 1/4	34.3	79	0.9822	153	167	0.608	0.9942	5.5935	47.20
	2030	1	1 1/4	34.3	73	0.9877	153	167	0.608	0.9942	5.6248	53.05
25.7.60	0015	1	1 1/4	34.3	70	0.9905	153	167	0.608	0.9942	5.6407	56.50
	0100	1/2	1 1/4	34.3	67	0.9933	145	159	0.608	0.9942	5.3857	57.35
	0150	3/8	1 1/4	34.3	51	1.0088	121	135	0.608	0.9942	4.6441	58.25
	0315	1/4	1 1/4	34.3	46	1.0137	86	100	0.608	0.9942	3.4568	59.50
	0550	1/4	1 1/4	34.3	36	1.0239	86	100	0.608	0.9942	3.5134	62.25
	1140	1	1 1/4	34.3	83	0.9786	158	172	0.608	0.9942	5.7398	68.15

A.A.O. PICKANJINNIE NO. 1, D.S.T. NO. 8

INTERVALS 4009 - 4028 FEET; 4044 - 4053 FEET

Date	Time (hrs)	Surface Bean (in.)	Flow Tester Orifice (in.)	Orifice Factor	Temp. °F	Temp. Factor	Orifice Press.	Adjust O.P.	Sp.Gr.	Sp.Gr. Factor	Rate of Flow MMcf/D	Time from Start (Hrs. Mins)
26.7.60	1605	1	1 1/4	34.3	77	0.9840	160	174	0.579	1.018	5.9784	1.05
	1705	1	1 1/4	34.3	75	0.9859	161	175	0.579	1.018	6.0243	2.05
	2210	1	1 1/4	34.3	75	0.9859	170	184	0.579	1.018	6.3342	7.10
27.7.60	0320	1	1 1/4	34.3	75	0.9859	171	185	0.579	1.018	6.3686	12.20
	0830	1	1 1/4	34.3	75	0.9859	174	188	0.579	1.018	6.4719	17.30
	0900	1	1 1/2	49.2	75	0.9859	117	131	0.579	1.018	6.4687	18.00
	1030	1	1 1/2	49.2	77	0.9840	118	132	0.579	1.018	6.5055	19.30
	1530	1	1 1/2	49.2	75	0.9859	120	134	0.579	1.018	6.6168	24.30
	1940	1	1 1/2	49.2	73	0.9877	120	134	0.579	1.018	6.6289	28.40
28.7.60	0130	1	1 1/2	49.2	70	0.9905	120	134	0.579	1.018	6.6477	34.30
	0250	0.5	1 1/2	49.2	67	0.9933	115	129	0.579	1.018	6.4177	35.50
	0405	0.4	1 1/2	49.2	62	0.9981	110	124	0.579	1.018	6.1988	37.05
	0530	0.3	1 1/2	49.2	55	1.0043	100	114	0.579	1.018	5.7343	38.30
	0715	0.2	1 1/2	49.2	44	1.0167	73	87	0.579	1.018	4.4315	40.15

Plate 1
Sheet 1

ASSOCIATED AUSTRALIAN OILFIELDS N.L.
AUTHORITY TO PROSPECT 55P.

COMPOSITE LOG.

PICKANJINNIE No1

CLAY SILTSTONE. COAL
SHALE SANDSTONE

LOCATION 26° 35' 42"S
149° 07' 18"E

ELEVATION, R.T. 1069 FEET
ELEVATION, G.L. 1059 FEET
TOTAL DEPTH 5213 FEET

DATE SPUDDED : 27 MAY 1960
DATE COMPLETED : 12 JULY 1960.

ELECTRIC LOGGING : SCHLUMBERGER.
LITHOLOGIC LOGGING : S.S.DERRINGTON. M.J.MAHONEY
GAS LOGGING : ROTARY

BITS.
1 OWS 12¼hr.
2 OSC-3J.
1 Reed HF 2hr
2 OSC-3J 40hr.
2 Reed HF 6½hr
3 OSC-1J 40¼hr.
2 Reed HF 4¾hr.
3 OSC-1J
2 Reed HF 3¾hr.
4 OSC-1J 25¼hr

RATE OF PENETRATION (minutes per foot) (averaged for each ten foot interval)
5 10 15

HOLE SIZE AND CASING DATA TEMPERATURE LOG
Hole Size 5 10 15 inches
12¼" Surface hole.
Cement Job #1
9⅝" J 55.
89°
104°
Bit Size 8½"
6⅝" N 80
104°
114°

SPONTANEOUS POTENTIAL. (millivolts).
Run 1
4

DEPTH STRAT.
CRETACEOUS
ROMA FORMATION
BLYTHESDALE FORMATION
TRANSITION MEMBER
MOOGA MEMBER
FOSSIL WOOD MEMBER
GUBBERAMUNDA MEMBER
JURASSIC
WALLOON COAL MEASURES

LITHOLOGY.
100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000 2100 2200 2300 2400 2500

CORES D.S.T DEVIATION.
1. 100%.
2 25%
3 25%
4 96%.
5 80%.

RESISTIVITY (Ohms m²/m)
AM 1. = 16" 50 500
AM 2. = 64" 50 500
AO = 18' 8" 50 500

DESCRIPTIVE LITHOLOGY

0-10	Rotary table to ground surface
10-20	Surface soil and clay
20-40	SHALE, dark grey, with some clay
40-130	SHALE, dark grey, grading to SILTSTONE, in part
130-200	INTERBEDS SANDSTONE, grey, fine grained calcareous, quartzose, (grains sub-angular to subrounded) and SHALE, dark grey
200-210	CORE 1 30" SHALE, dark grey, carbonaceous, micaceous, 30" SHALE with sandy interbeds, 42" SANDY SHALE. 18" SHALE, with sandy interbeds.
210-280	INTERBEDS SANDSTONE, grey, fine grained, calcareous quartzose and SHALE, dark grey
280-480	SANDSTONE, grey, fine grained, well sorted, quartzose, with minor interbeds of SILTSTONE, grey, quartzose.
480-1322	SANDSTONE, light grey to white, medium to coarse grained, friable, mainly porous, quartzose. The grains are mainly of quartz and are sub angular to sub rounded, and clear to cloudy. There are some rare grains of chert. There are minor interbeds of SHALE, dark grey to black, partly carbonaceous - grading to low grade COAL, and SILTSTONE, grey, quartzose.
1322-1332	CORE 2. SANDSTONE, grey, medium grained, very calcareous quartzose. Quartz grains clear and sub-angular to sub-rounded
1332-1342	CORE 3. SANDSTONE, grey, medium grained, well sorted, friable, porous slightly calcareous garnetiferous, quartzose
1342-1410	SANDSTONE, grey, mainly fine grained, calcareous, in part kaolinitic, quartzose with minor interbeds of SILTSTONE, grey, carbonaceous, micaceous, quartzose and SHALE, dark grey.
1410-1680	INTERBEDS SHALE, medium to dark grey, micaceous in part carbonaceous SILTSTONE grey, carbonaceous, micaceous, quartzose, and SANDSTONE, grey, fine grained, calcareous, in part kaolinitic quartzose
1680-1808	INTERBEDS SHALE and SANDSTONE generally as above the shale becomes more carbonaceous. Minor thin seams COAL
1808-1818	CORE 4. 12" INTERBEDS grey carbonaceous sandy SHALE and SANDSTONE, light grey, medium grained, carbonaceous, slightly calcareous, micaceous, kaolinitic quartzose, Generally tight, 108" SANDSTONE, as above.
1818-1970	SANDSTONE as for CORE 4, with minor interbeds decreasing basally, of SHALE, grey micaceous and carbonaceous, and SILTSTONE grey green siliceous.
1970-2000	COAL
2000-2090	INTERBEDS SANDSTONE and SHALE, as for 1818 to 1970.
2090-2110	COAL
2110-2148	INTERBEDS SANDSTONE and SHALE, generally as for 2000 to 2090.
2148-2158	CORE 5. 96' INTERBEDS SHALE medium to to dark grey, carbonaceous slightly micaceous and SANDSTONE, medium grey, fine grained, tight carbonaceous, slightly calcareous, in part kaolinitic, quartzose
2158-2410	INTERBEDS SANDSTONE and SHALE generally as for CORE 5
2410-2550	INTERBEDS SANDSTONE and SHALE as above, and SILTSTONE buff to medium brown, hard compact, calcareous, in part siliceous, quartzose

PROGRESS LOG (days.)
10 20
Ran 9⅝" J.55 to 178'. Cement Job #1
Core#1 Mud change
Core # 2,3.
Core #4
5 10 15
1 1 1
Run1 Schlumberger - hole dirty - had to be re-run
Core # 5

Plate 1
Sheet 2.

BITS

RATE OF PENETRATION (minutes per foot) (averaged for each ten foot interval) 5 10 15

HOLE SIZE AND CASING DATA TEMPERATURE LOG

Hole Size 5 10 15 inches

SPONTANEOUS POTENTIAL (millivolts)

DEPTH STRAT.

LITHOLOGY

CORES D.S.T DEVIATION

RESISTIVITY (Ohms m $^2/_m$)

DESCRIPTIVE LITHOLOGY

PROGRESS LOG (days)

4. Reed HF. 6¼hr.

5 OSC-1J 20¾hr.

5. Reed HF 1hr.

6 OSC 31¾hr

6 Reed HF. 3 hr.

7 OSC-1J 36½hr

7. Reed HF. 8 hr.

8. Reed HF. 2½hr.

8. OSC-1J. 19½hr

9. Reed HF. 4 hr.

10 Reed H.F. 7 hr.

9 OSC-1J 9hr.

11. Reed H.F. 8 hr.

10 OSC-1J. 17½hr

12. Reed H.F. 5½hr.

11. OSC-1J 20½hr

13. Reed H.F 6½hr.

12 OSC-1J 22½hr

14 Reed H.F. 10 hr.

13. OSC-2J. 30hr

15 Reed H.F. 7hr

14. OSC-2J 24½hr

16. Reed H.F. 7½ hr.

15 OSC-2J 14¾hr

16 W7R. 12 hr

17 W7R. 14hr

18 W7R. 17 hr

19 W7R. 18 hr

20 W7R 15 hr

119° 134° 149° F

134° 149° 164° F

Cement Job #3

Casing Shoe 4497'

Cement Job #2

Run 2 / Run 3 10 − + +

Run 3 / Run 5 10 − + +

Run 5 / Run 6 10 − + +

Run 6 / Run 7 4 − + +

Run 7 / Run 8 4 − + +

JURASSIC GROUP

BUNDAMBA FORMATION

MOOLAYEMBER FORMATION

TRIASSIC

Hospital Hill Sandstone

Links Sandstone

Showground Sandstone

PICKANJINNIE FORMATION

PERMIAN

LATEMORE FORMATION

(?) DEVONIAN

TIMBURY HILLS FORMATION

2500 2600 2700 2800 2900 3000 3100 3200 3300 3400 3500 3600 3700 3800 3900 4000 4100 4200 4300 4400 4500 4600 4700 4800 4900 5000 5100 5200

6,7 100%.

8 100%.

9 100%.

10 NIL
11 32%.

12 100%.

15 90%.

16 100%.

17 100%.

18 62%.

19 50%.

20 100%.

21 100%.

22 100%.

D.S.T 1 24¼ MCF

D.S.T 2 980

D.S.T 3 25 MCF 560 MCF 641 MCF

D.S.T 7 D.S.T 8

D.S.T 4 56 MCF

Scale change to 200/2000

Scale change to 200/2000

2550 – 2565 CORE 6+7. (core 6 2550 – 2555 nil recovery, core 7 2555 – 2565 recovered 15') 11½' SANDSTONE, grey, medium grained, tight carbonaceous, kaolinitic, slightly calcareous, quartzose, 2' SANDSTONE, as above, very calcareous, 1½' SANDSTONE, as above, only slightly calcareous.

2565 – 2900 SHALE, light grey, medium grey, dark brown, mainly carbonaceous, in part sandy and micaceous, with interbeds (becoming more frequent basally) of SANDSTONE, white, medium to coarse grained, tight quartzose.

2900 – 2950 SANDSTONE, white to light grey, medium to coarse grained, mainly tight, quartzose, with minor interbeds SHALE, grey micaceous and in part carbonaceous

2950 – 2960 CORE 8. 10' SANDSTONE, grey, fine to medium grained, slightly carbonaceous and kaolinitic, quartzose, with some SANDSTONE, white, coarse grained, kaolinitic quartzose

2960 – 3000 SANDSTONE generally as for Core 8

3000 – 3280 INTERBEDS SANDSTONE white, coarse grained, mainly tight, quartzose (quartz grains subrounded and clear) and SHALE, dark grey brown, carbonaceous, and SHALE dark grey, sandy and micaceous.

3280 – 3290 CORE 9. 10' INTERBEDS SANDSTONE light grey, fine grained, kaolinitic, carbonaceous, micaceous, quartzose, containing shale, coal and mudstone pebbles, and SHALE dark grey carbonaceous sandy micaceous, in part coaly

3290 – 3450 SANDSTONE, light grey, fine to medium grained, calcareous, micaceous, kaolinitic quartzose (grains subangular to subrounded and clear) With minor beds SHALE, dark grey and brown, carbonaceous, micaceous and sandy.

3450 – 3590 INTERBEDS SHALE, generally as above, with minor SANDSTONE, generally as above. Minor COAL SEAMS

3590 – 3670 INTERBEDS SHALE and SANDSTONE and SILTSTONE, light to medium grey, compact, tight quartzose

3670 – 3679 CORE 10 NIL

3679 – 3689 CORE 11. 40" INTERBEDS SILTSTONE grey and grey green, tight, calcareous, micaceous, kaolinitic, quartzose, SHALE dark grey brown, silty, carbonaceous, micaceous, SANDSTONE grey and grey green, very fine grained, silty calcareous, micaceous, kaolinitic quartzose.

3689 – 3901 INTERBEDS SHALE, SILTSTONE, SANDSTONE, as for Core 11

3901 – 3918 CORE 12,13,14 (Core 12 3901-3909 NIL Core 13 3909-3911 NIL Core 14 3911-3918 Rec 17') 14' SHALE, dark grey, slightly micaceous, carbonaceous silty, minor partings of light grey, siltstone and fine white tight quartz sandstone. 5½" SILTSTONE, grey and grey green, very fine grained, tight, with minor partings of carbonaceous shale. 42" SHALE, as above 83" SANDSTONE, light grey, fine to medium grained, silty kaolinitic calcareous quartzose

3918 – 3995 INTERBEDS SHALE SILTSTONE SANDSTONE as for

3995 – 4010 SANDSTONE, white, fine grained tight, friable, kaolinitic, calcareous, quartzose, minor shale

4010 – 4030 CORE 15. 13' SANDSTONE, and silty partings light grey, fine to coarse grained, calcareous, kaolinitic, quartzose. 14" SHALE dark grey, micaceous carbonaceous 50" INTERBEDS SHALE and SILTSTONE

4030 – 4055 SANDSTONE, grey green fine grained, light quartzose

4055 – 4090 light grey to white, fine to medium grained, friable INTERBEDS slightly calcareous, quartzose Minor SHALE SANDSTONE, grey white, fine-medium grained, tight kaolinitic quartzose, SILTSTONE, light to dark grey, argillaceous, grading in part to SANDSTONE, SHALE, dark grey brown

4090 – 4180 INTERBEDS SHALE, SILTSTONE SANDSTONE.

4180 – 4220 SANDSTONE, white to light grey, fine to medium grained, slightly calcareous, kaolinitic quartzose, lithic Minor thin SHALE bands

4220 – 4230½ CORE 16. 22" SILTSTONE, light grey green, hard compact, sandy calcareous. 10" SANDSTONE pale grey-green, medium to coarse grained, slightly calcareous. pyritic, felspathic lithic, quartzose

4230½ – 4420 INTERBEDS SANDSTONE, SILTSTONE SHALE, generally as above.

4420 – 4430 CORE 17 20" SILTSTONE, light grey green, slightly sandy 17" SHALE dark grey to black, minor partings siltstone and sandstone. 83" SANDSTONE, light grey green, fine grained,

4430 – 4475 SANDSTONE, as light, lithic, quartzose, for Core 17, with minor interbeds SHALE, grey brown silty micaceous.

4470 – 4607 INTERBEDS SANDSTONE light grey green fine medium and coarse grained partly friable mainly tight, slightly calcareous and argillaceous lithic quartzose SANDSTONE grey and tan slightly argillaceous and calcareous in part tight quartzose. SHALE grey brown and black fairly silty with many carbonaceous and coaly inclusions MUDSTONE pale tan soft COAL

4607 – 4615½ CORE 18 7½" SHALE black very carbonaceous grading to COAL. 27" MUDSTONE buff to tan rarely sandy with carbonaceous streaks and inclusions 7" SHALE 21½" MUDSTONE as above

4615½ – 4710 INTERBEDS SHALE, very dark grey to black, carbonaceous grading to COAL, MUDSTONE, soft, buff to tan, with minor SANDSTONE, grey, medium to coarse grained, friable, lithic quartzose, and SILTSTONE, grey, tan, argillaceous.

4710 – 4755 SILTSTONE grey brown hard tight calcareous argillaceous in part silicious. Minor dark SHALE and tan MUDSTONE

4755 – 4780 SHALE, dark grey to black, very carbonaceous, grading to COAL

4780 – 4795 INTERBEDS, SANDSTONE, fine grained, tight, SILTSTONE, dark grey, brown SHALE dark grey,

4795 – 4805 CORE 19 7" SAND- and MUDSTONE, tan. STONE, light green, fine to medium grained, hard, tight, slightly calcareous, lithic, quartzose 10" MUDSTONE tan 25" SANDSTONE as above 10" SILTSTONE as above. Minor gas and oil bleeding

4805 – 4835 INTERBEDS from core + FL + cut SANDSTONE SILTSTONE MUDSTONE SHALE as for Core 19

4835 – 4945 SANDSTONE medium grey-tinged green very fine grained grading in part to a siltstone slightly calcareous, quartzose.

4945 – 4955 CORE 20 SANDSTONE medium grey green very fine grained, grading in part to silt, hard tight in part siliceous, quartzose

4955 – 5130 SANDSTONE, as for Core 20.

5130 – 5133½ CORE 21 SANDSTONE, medium grey green, very fine grained, hard, tight, silicious, quartzose, appears to approach a quartzite

5133½ – 5212 SANDSTONE, as for Core 21.

5212 – 5213 TD CORE 22. 12" SANDSTONE, as for Core 21

Core #6&7

Core #8

Core #9

Core 10 Run 2. Electric log.

20 30 40
Core #11,

Core # 12
Core #13,14.

Core #15 D.S.T #1
Electr Log No 3 Micrelog #1
D.S.T #2
Electr Log #4 Micrelog #2

Electr Log #5 Micrelog # 3
Core #16.
D.S.T. #3

Electric Log #6 Micrelog # 4
Core #17
D.S.T. #4,5,6

25 30 35

Core #18

Core # 19

Electric Log #7 Micrelog #5
Core # 20

40 50 60

Ran magnet to recover fish (bit bearings)

Core #21 Ran magnet to recover core head cutter cone

Core #22 TD reached 47 days after spud in
E.Log #8