COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Petroleum Search Subsidy Acts

PUBLICATION No. 45

U-K-A. Moonie No. 1, Queensland

OF

UNION OIL DEVELOPMENT CORPORATION

KERN COUNTY LAND COMPANY

AND

AUSTRALIAN OIL AND GAS CORPORATION LIMITED

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

Union-Kern-A.O.G. Moonie No. 1 was drilled under the Petroleum Search Subsidy Act 1959, in Authority to Prospect 57P, Queensland. The well was located at latitude 27°44'54"S, longitude 150°15'25"E., (about 35 miles south-south-west of Tara), and was drilled for Union Oil Development Corporation, Kern County Land Company, and Australian Oil and Gas Corporation Limited by Oil Drilling and Exploration Limited of Sydney, using a National 80-B drilling rig.

This Publication deals with the results of this drilling operation, and contains information furnished by Union Oil Development Corporation and edited in the Petroleum Exploration Branch of the Bureau of Mineral Resources. The final report was written by the staff of Union Oil Development Corporation. The methods employed in the drilling operation and the results obtained are presented in detail.

J.M. RAYNER
DIRECTOR

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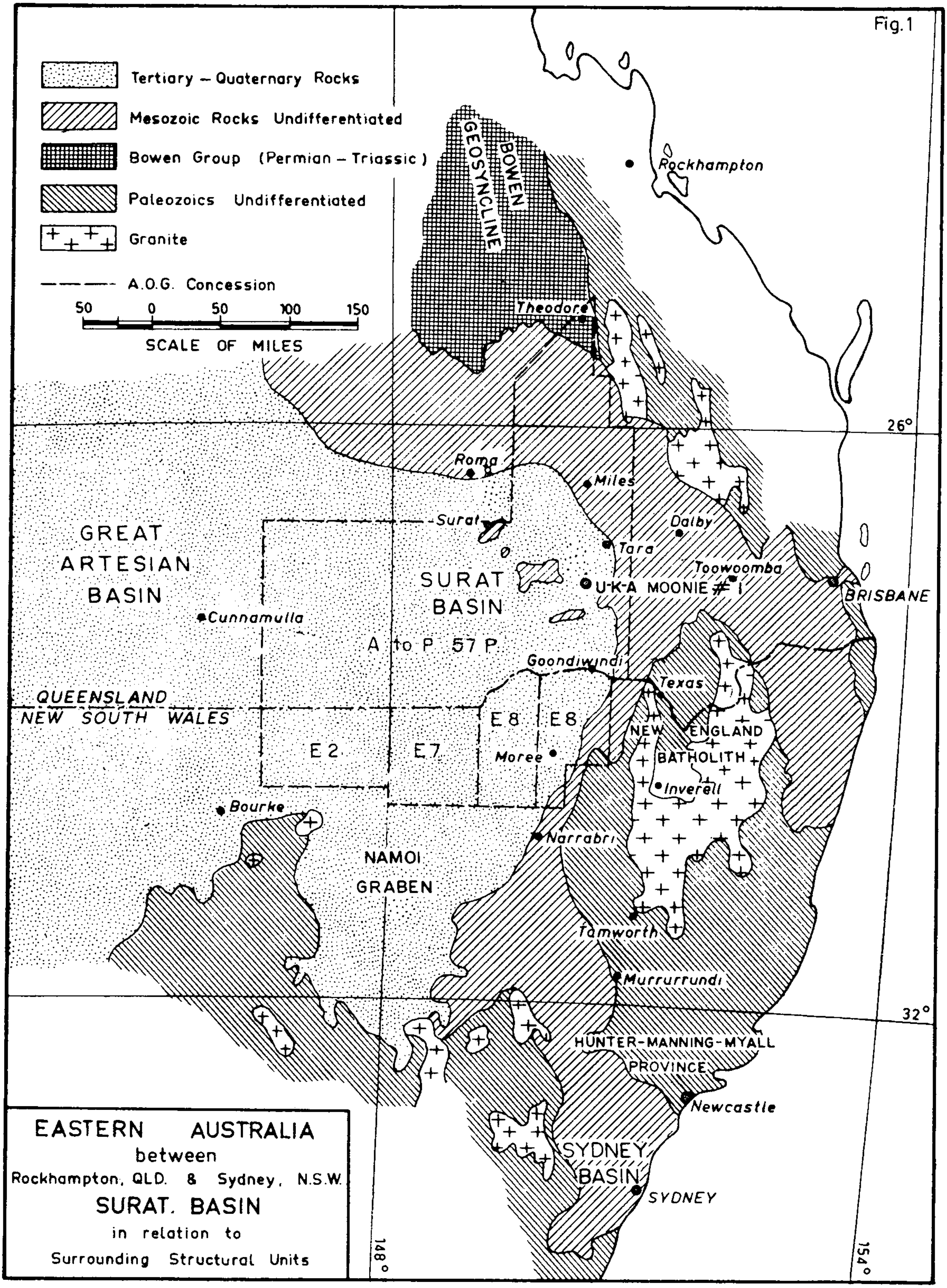
Fig. 1
Tertiary – Quaternary Rocks
Mesozoic Rocks Undifferentiated
Bowen Group (Permian – Triassic)
Paleozoics Undifferentiated
Granite
A.O.G. Concession
50 0 50 100 150
SCALE OF MILES
BOWEN GEOSYNCLINE
Rockhampton
Theodore
26°
Roma
Miles
Surat
Dalby
Tara
Toowoomba
GREAT ARTESIAN BASIN
SURAT BASIN
U-K-A MOONIE #1
BRISBANE
Cunnamulla
A to P 57 P
Goondiwindi
Texas
QUEENSLAND
NEW SOUTH WALES
E8
E8
E2
E7
Moree
NEW ENGLAND BATHOLITH
Inverell
Bourke
Narrabri
NAMOI GRABEN
Tamworth
Murrurrundi
32°
HUNTER-MANNING-MYALL PROVINCE
Newcastle
SYDNEY BASIN
SYDNEY
148°
154°
EASTERN AUSTRALIA
between
Rockhampton, QLD. & Sydney, N.S.W.
SURAT. BASIN
in relation to
Surrounding Structural Units

SUMMARY

Union-Kern-A.O.G. Moonie No. 1 was the third wildcat drilled by Union Oil Development Corporation in its current exploratory effort in the Surat Basin in Queensland. The drilling of the initial test in the Basin, Union-Kern-A.O.G. Cabawin No. 1, resulted in a sub-commercial discovery of oil in an eight-foot sand body (9928-9936 feet) in the Permian Kianga Formation. The second test, Union-Kern-A.O.G. Cabawin East No. 1, was programmed on a distinct closure separated from the domal closure of Cabawin No. 1 by a major transverse fault. The test was designed to evaluate the thesis that the oil bearing sandstone encountered in the first well might thicken appreciably eastward. Cabawin East was dry; the Permian oil bearing sandstone was not developed at the second location.

After additional geophysical work, Union-Kern-A.O.G. Moonie No. 1 was programmed approximately 20 miles south of Cabawin East as a structural test of the petroleum potential of the Triassic lower Bundamba sandstones. At the location of the test, sands of the lower member of the Bundamba Formation in domal closure overlie a truncated and faulted Permian section. The desirability of the test was suggested from information gained in the Cabawin area where permeable lower Bundamba sands were indicated to be the most favourable reservoir rocks, and where the Permian section was indicated to be the probable source of the oil encountered. At the location of the test a maximum of 150 feet of vertical closure over ten square miles was indicated in the Bundamba section. No closure could be postulated for the steeply dipping Permo-Carboniferous sequence unconformably present beneath the Bundamba. The test was based on the thesis that oil generated in the Permian section would migrate up dip, and be trapped in the porous sands of the Bundamba closure. To enhance the prospect further, seismic work indicated that a portion of the lower Bundamba which consisted of a less permeable section in the Cabawin wells, had been overlapped at the proposed location and that porous and permeable sands of the unit might rest directly on the unconformity.

The well was spudded in on 12th November, 1961; 13 3/8" casing was cemented at 1636 feet, and drilling and coring was continued to a depth of 5925 feet. At that depth a 74-minute open-hole formation test of the interval 5816-5925 feet yielded black 48^{o} API gravity oil flowing at an estimated rate of 250 barrels per day and water (29 grains/gallon), at an estimated rate of 250 barrels per day. Gas accompanying the flow was estimated at 200 Mcf/D.

The well was drilled and cored ahead to a total depth of 6106 feet. Casing (5 1/2") was cemented at 5950 feet, and the well was completed through perforations of the interval 5798-5840 feet. A sustained testing programme was conducted from 23rd December, 1961 to 18th February, 1962. At the end of this period the well was producing 666 barrels per day of 45^{o} API gravity oil with 124 Mcf/D of gas through 18/64" choke, with casing and tubing well-head pressures at 600 p.s.i. and 560 p.s.i. respectively. A total of 7445 barrels of crude oil and 1320 Mcf of gas were produced during the testing period. The well was shut in on 18th February, 1962 for final pressure and temperature surveys and was suspended on 21st February, 1962, retained in a condition for production at any future time.

INTRODUCTION

Union Oil Development Corporation, a wholly owned subsidiary of Union Oil Company of California, and the Kern County Land Company, also of California, entered into an Agreement in late 1959 with the Australian Oil and Gas Corporation Limited, holder of Authority to Prospect 57P, Queensland, whereby Union Oil Development Corporation as Operator for Union and Kern would conduct an exploration programme on lands of Authority to Prospect 57P in the Surat Basin of Queensland.

Union Oil commenced exploratory operations in November, 1959, with an aeromagnetic survey and surface geological studies, followed by an intensive reflection seismograph programme. The seismic work was initiated in the area near Cabawin, Queensland, where a major north-south trending structural feature was first disclosed on a seismic reconnaissance line surveyed by the Geophysical Branch of the Bureau of Mineral Resources late in 1959. The primary objective of Union's continuing seismic programme has been to develop structurally closed drillable prospects suitable for testing the petroleum potential of the section in the Surat Basin. Two exploratory tests were drilled by October, 1961 : Union-Kern-A.O.G. Cabawin No. 1, and Cabawin East No. 1. Moonie No. 1 was located about 35 miles south-south-west of Tara.

WELL HISTORY

General Data

Well name and number:	Union-Kern-A.O.G. Moonie No. 1.
Location:	2172 feet south-westerly along property line and thence 2227 feet north-westerly at a right angle to said property line from most southerly corner of Portion 27, Parish of Dilbong, County of Pring. Latitude 27°44'54"S. Longitude 150°15'25"E.
Name and address of Tenement Holder:	Australian Oil and Gas Corporation Limited, 261 George Street, Sydney, New South Wales.
Details of Petroleum Tenement:	Authority to Prospect 57P, Queensland.
District:	Portion 27, Parish of Dilbong, County of Pring, State of Queensland.
Total Depth:	6106 feet
Date drilling commenced:	12th November, 1961
Date drilling completed:	6th December, 1961
Date well suspended:	21st February, 1962

Date rig released:	28th December, 1961
Drilling time in days to Total Depth:	25
Elevations (a.m.s.l.):	Ground- 875.3 feet Kelly Bushing-892.6 feet
Status of well:	Shut in and suspended as oil and gas producer.
Initial production:	252 barrels oil per day, 48° API gravity; 23 Mcf gas in 2.75 hours; 1" choke; 10.6% cut; tubing pressure 50-150 p.s.i.; casing pressure 0; 23rd December, 1961.
Last 24 hours production:	523 barrels oil per day; 45° API gravity; % cut-trace; 97 Mcf gas in 20.2 hours; tubing pressure 575 p.s.i.; casing pressure 645 p.s.i.; 18/64" choke; 20.2 hour gauge; 18th February, 1962.
Producing Formation:	Lower Bundamba.
Casing:	20" cemented at 25 feet 13 3/8" cemented at 1636 feet 5 1/2" cemented at 5950 feet
Perforations:	Jet Perforations; (5614 feet WSO, squeeze cemented) (5650 feet, squeeze cemented) 5798-5840 feet 5808-5814 feet 5818-5839 feet
Tubing:	2 3/8" tubing hung at 5779 feet (open ended)

Drilling Data

Name and address of drilling contractor:	Oil Drilling and Exploration Limited, 93 York Street, Sydney, New South Wales.
Drilling Plant:	
Make:	National - Ideal
Type:	80-B
Rated capacity with 4 1/2" drill pipe:	12,000 feet
Rated capacity with 3 1/2" drill pipe:	14,000 feet

Motors:

Make:	3 Caterpillar
Type:	D-375
H.P.:	335

Derrick:

Make:	Muskogee
Type:	Standard 136' x 30'
Capacity:	800,000 lb.

Pumps:

Make:	2 Gardner-Denver
Type:	GR-GXP
Size:	7 3/4" x 16"
Make:	1 Gardner-Denver
Type:	FG-FXG
Size:	4 1/2" x 6"

Blowout preventer equipment:

Make:	2 Cameron QRC
Size:	12"
Series:	S-900
Make:	1 G.K. Hydril
Size:	12"
Series:	S-900
	Powered by Hydril 80-gallon accumulator

Hole sizes and depths:

30"	to	30 feet
17 1/2"	to	1651 feet
12 1/4"	to	2851 feet
9 7/8"	to	6106 feet T.D.

Casing and Liner details:

Depth (feet)	Size (in.)	Grade Sch.	Weight (lb./ft)	New Used	Seamless Lap	Make
25	20	10	52	N	L	-
1636	13 3/8	H-40	48	N&U	S	Sumitomo
5950	5 1/2	N-80	17-20	N	S	Spang Sumitomo

Casing and Liner cementing details:

Date	Casing (in.)	Depth Cemented (feet)	Cemented Through	Number of Sacks	Cement MSC
16.11.1961	13 3/8	1636	Shoe	1000	Surface
10.12.1961	5 1/2	5950	Shoe	1100	2600'

Drilling Fluid: Fresh water gel base, low pH, low water loss mud used to depth of 5925 feet.

At 5925 feet the drilling fluid was converted to 5 percent oil emulsion fresh water gel base, low water loss, low pH mud using diesel oil. This type mud was maintained until reaching total depth of 6106 feet. Materials and chemicals used included: Bentonite, barytes, caustic soda, Driscose, diesel oil and Spersene.

Drilling Fluid History:

Days	Weight (lb./cu.ft)	Viscosity (sec.-Marsh)	Filtrate (cc)	Wall Cake (in.)	Sand (%)	pH	Remarks
1- 7	68-76	45-52	15-20	2/32	1-6	8	
8-14	72-75	40-65	8-11	2/32-3/32	1-3	7.5-9.0	
15-21	74-77	43-78	9-11	2/32-3/32	1-2.5	8.5-9.0	
21-25	75.5-78	45-110	6.6-13	2/32	1-3	8.0-9.0	Added 5% diesel oil

Water Supply: Fresh water for use in drilling operations was obtained from the Moonie River, which is located in a north-westerly direction from the well site. The water was pumped from the river to the drilling operation through 3 1/2 miles of 4" pipeline using Gardner-Denver FXG 4 1/2" x 6" pump.

Perforation and Shooting Record:

Casing (in.)	Interval (feet)	No. Holes per foot	Size Holes (in.)	Method	Status
5 1/2	5614	4	1/2	Schlumberger Jet Perforator	Squeeze Cemented
5 1/2	5840	4	1/2	"	Open
5 1/2	5808-5814	4	1/2	"	"
5 1/2	5818-5839	4	1/2	"	"
5 1/2	5650	4	1/2	"	Squeeze Cemented
5 1/2	5798-5840	4	1/2	"	Open

Plugging Back and Squeeze Cement Jobs:

Date	Depth Cemented (feet)	Cemented Through	No. of Sacks	Method	Remarks
18.12.1961	5650	4-1/2"perfs.	25	Squeeze	Squeezed 18 sacks to formation. Final pressure of 3400 p.s.i.
20.12.1961	5614 and 5650	4-1/2"perfs.	14	Squeeze	Squeezed 9 sacks to formation. Final pressure of 5000 p.s.i.

Fishing Jobs:

Date	Depth (feet)	Remarks
19.11.1961	3201	Twisted off at top of bit sub., leaving 9 7/8" bit and bit sub. in hole. Recovered fish with Bowen overshot.
30.11.1961	5657	Twisted off leaving bit, bit sub., and 6 - 6 1/2" drill collars in hole. Recovered fish with Bowen overshot.

Coring and Sampling

Ditch Samples:

Ditch samples were collected at 10-foot intervals from surface to total depth. While coring, the interval was reduced to five feet.
Washed sample cuts were made for the Bureau of Mineral Resources, Queensland Department of Mines, and Union Oil Development Corporation.
Full descriptions of cuttings are available for reference at the Bureau of Mineral Resources, Canberra.

Coring:

The original coring programme is set out below:

(i) Cores shall be taken immediately following any showings of hydrocarbons.
(ii) Cores shall be taken at 500-foot intervals after reaching the top of the Bundamba Formation.

Seven (7) conventional cores were cut using Hughes Type "J" core barrel and hard formation core heads. A total of 42 feet of formation was cored and 20.8 feet (49.6%) recovered. (Cores are described in Appendix 1). Fully representative cuts of cores were reserved for the Bureau of Mineral Resources and Queensland Department of Mines.

Sidewall Cores:

In addition to conventional cores, 41 sidewall samples were recovered using Schlumberger Chronologic sample taker. (Descriptions of sidewall cores are given in Appendix 1). The results of core analyses are tabulated in Appendix 6.

Drilling Summary

Union-Kern-A.O.G. Moonie No. 1 was spudded on 12th November, 1961. A 12 1/4" hole was drilled to 1951 feet. The hole was then opened to 17 1/2" to 1651 feet. 13 3/8" casing was run and cemented at 1636 feet with 1000 sacks of Darra construction cement.

After cementing 13 3/8" casing and installing blowout preventer equipment, a 12 1/4" hole was drilled to 2851 feet after which the hole size was reduced to 9 7/8". A 9 7/8" hole was drilled and cored to 5918 feet. An 8 3/4" core was cut from 5918 to 5925 feet. (For descriptions of cores see Appendix 1).

A Schlumberger Electric log was run over the interval from 5917 to 1630 feet and a Microlog was run over the interval 5921 to 3600 feet. Sidewall samples were also obtained in the logged interval.

An open hole formation test was conducted on the interval from 5816 to 5925 feet. The tested interval flowed at a rate of 500 barrels per day gross fluid : 250 B/D 48° API gravity crude, 250 B/D 29 g/g water and 200 Mcf/D dry gas for a period of 74 minutes through a 1/2" choke in the test tool and an adjustable choke at the surface.

A 9 7/8" hole was drilled and cored from 5925 feet to a total depth of 6106 feet.

Copies of weekly drilling reports are available for inspection at the Bureau of Mineral Resources, Canberra.

At total depth the following logs were run over the intervals shown:

Electric Log	5750 - 6105 feet
Microlog	5800 - 6046 feet
Velocity Survey	1650 - 6096 feet
Sonic Log	1630 - 6092 feet
Laterolog	4500 - 6104 feet
Continuous Dipmeter Survey	1630 - 6078 feet
Gamma Ray Log	0 - 5905 feet

The hole was then conditioned and 5 1/2" casing was run and cemented at 5950 feet with 1100 sacks of Darra construction cement.

After cementing 5 1/2" casing, a series of production tests were conducted. The results of these tests are tabulated in Appendix 4.

GEOLOGY

Regional Geology

Surface geological studies have been made by Union Oil Development Corporation over most of the Surat and Bowen Basins and adjoining areas. The structural and stratigraphic relationships have been mapped, described, and correlated with subsurface information from seismic and well studies. All work has been integrated into one regional report. For details of the nomenclature, stratigraphy, or structure, reference is made to "Reconnaissance Geology of the Surat Basin, Queensland and New South Wales", by J.E. Mack Jr., 1963. In the present report only a synthesis of this work is included.

Authority to Prospect 57P lies within the south-eastern part of the Surat Basin, an eastern lobe of the Great Artesian Basin, a major Mesozoic downwarp that had its inception in Triassic time (Fig. 1). The northern edge of the Mesozoic Surat Basin overlaps the southern extension of the Bowen Basin, a major structure that warped downward in varying degrees from Permian time into early Triassic time.

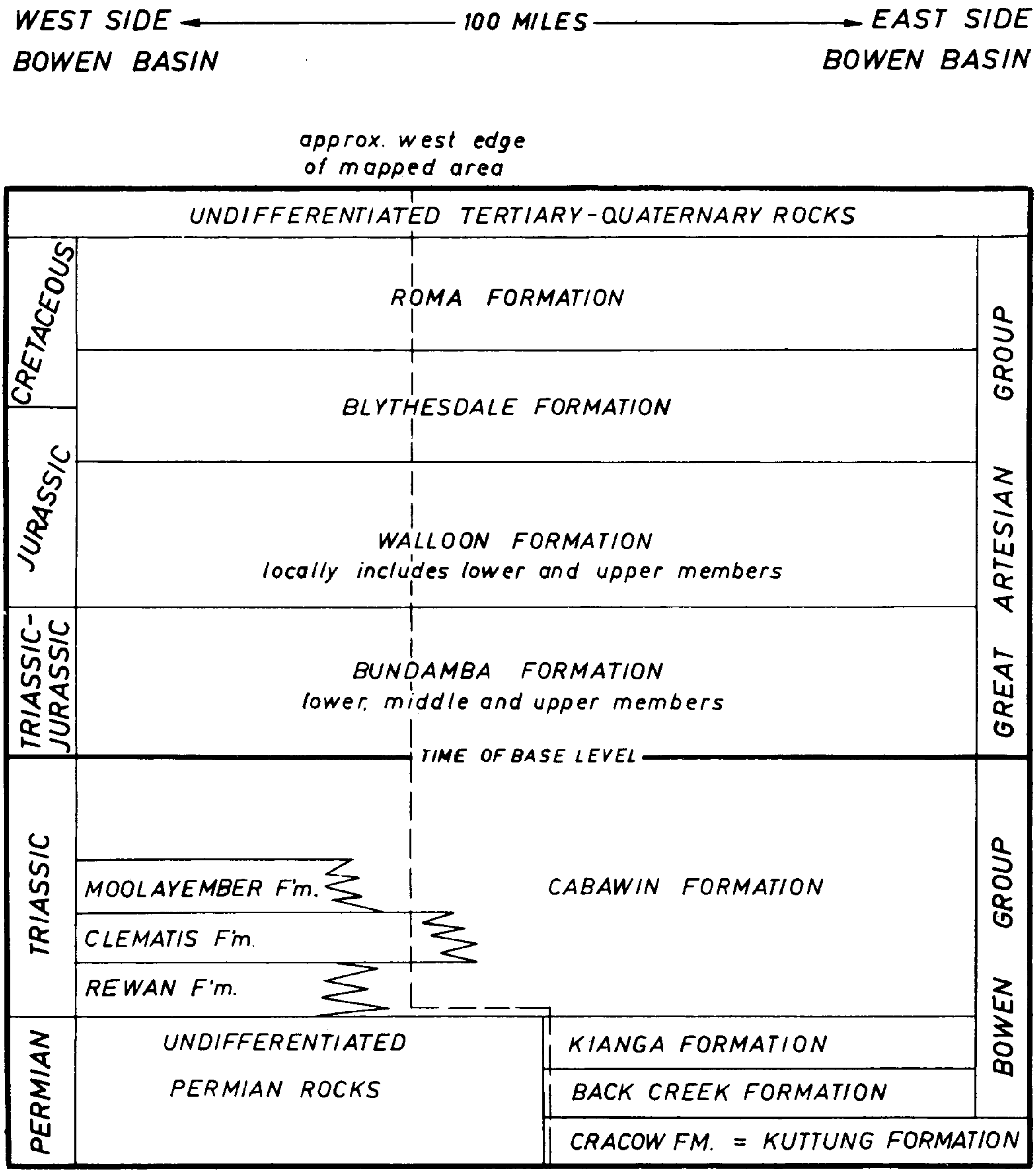

Fig. 2

REVISED STRATIGRAPHIC NOMENCLATURE

BOWEN AND SURAT BASINS

Two major phases of sedimentation have been recognized, one related to the development of the Bowen Basin (Bowen Group) and the other related to the development of the Great Artesian Basin (Great Artesian Group) (see Fig. 2). The Permian rocks of the Bowen Group grade upward from shallow marine tuffaceous clastics (Back Creek Formation) to non-marine tuffaceous clastics and coal (Kianga Formation). The Triassic rocks of this Group (Cabawin Formation) are tuffaceous coarse clastic fill deposits. A period of base level within Triassic time preceded the blanket deposition of the rocks of the Great Artesian Group. Rocks of the Great Artesian Group are predominantly continental clastics deposited in shallow inland seas and swamps (Bundamba, Walloon, and Blythesdale Formations). At the top of the Group a marine transgression is represented by rocks of the Roma Formation.

Structure of the Moonie Anticline

The Moonie Anticline occupies a position on the south-eastern margin of the Bowen Basin. In this region there is a general swing in strike of structural elements from an essentially north-south to a northeast-southwest alignment. Field work by Union Oil Development Corporation has indicated that this anomalous condition may be the result of three factors: (i) a compressional force originating along the eastern side of the Bowen Basin in early Triassic time, (ii) buttressing of the compressional force by a positive element to the south (New England Batholith), and (iii) drape of Mesozoic sediments over a structural complex produced as a result of factors (i) and (ii).

Geophysical work by Union Oil Development Corporation along the eastern side of the basin, south of Tara has confirmed the conclusions based on the field work. In this region, the seismic work has defined a series of north-east trending fault blocks developed in rocks of Permian age. This complex structure is reflected in a series of south-west plunging folds in the younger rocks of the Great Artesian Group. Moonie No. 1 was programmed as a test of a Mesozoic closure on the flank of one of these plunging folds that overlies a faulted steep dipping and truncated Permo-Carboniferous sequence of rocks (see Pl. 2).

Plate 3. Structure Map "L" Horizon - The "L" horizon map is based on a continuous reflection from beds near the top of the Permian Kianga Formation. This horizon approximately marks the position of the Upper Permian oil sand encountered in the drilling of Union-Kern-A.O.G. Cabawin No. 1. As indicated by the map, the structure of the Permian in the Moonie River area consists of a complex fault system. At the location of the Moonie No. 1 test steep dipping (30^{o}) Permian rocks have been truncated and overlapped by the Bundamba Formation (see also Pl. 2). The seismic sections suggest an eroded and faulted anticlinal feature in the Permo-Carboniferous sequence at the location of the test.

Plate 4. Structure Map "G" Horizon - The "G" horizon map represents the approximate top of the lower member of the Bundamba Formation, the oldest stratigraphic unit of the Great Artesian Group, and the primary target of the drilling test. At the location of Moonie No. 1, a maximum of 150 feet of vertical closure is present on the Bundamba horizon covering an areal extent of about 10 square miles. The general configuration of the feature is a south-west plunging fold with a critical north-east reversal present at its lower extremity.

Stratigraphy of Moonie No. 1

As discussed earlier, two major phases of sedimentation have been recognized in the Surat Basin, one phase related to the development of the Bowen Basin, and the other related to the development of the Great Artesian Basin. The Bowen Group includes rocks of both Permian and early Triassic age. The Permian rocks consist of shallow water marine clastics (Back Creek Formation) overlain by a coal bearing sequence (Kianga Formation). The Triassic rocks (Cabawin Formation) are highly tuffaceous conglomeratic fill deposits.

The overlying rocks of the Great Artesian Group were deposited as blanket units. These rocks range in age from Triassic to Cretaceous, and are subdivided into four formational units, from oldest to youngest, the Bundamba, Walloon, Blythesdale, and Roma. All formations of the group show marked intertonguing tendencies, although the gross character of the units is clearly recognizable everywhere that they have been penetrated by the drill.

Ditch samples and cores of the Moonie test are being assessed by palynologists of both the Geological Survey of Queensland (N.J. de Jersey) (see Appendix 2), and the Bureau of Mineral Resources in Canberra (P.R. Evans). Final results are not yet available, but it is reported by P.R. Evans (1962) that hystrichospheres and arenaceous foraminifera occur at 5354 feet in the middle shale member of the Bundamba Formation. Details of spore analysis of correlative units drilled in the Cabawin area are available in Union Oil Development Corporation Well Completion Reports on Cabawin No. 1 and Cabawin East No. 1.

Union-Kern-A.O.G. Moonie No. 1 was spudded in surficial rocks of Tertiary-Quaternary age. Below a thin veneer of these sediments the drill penetrated the Roma, Blythesdale, Walloon and Bundamba Formations of the Great Artesian Group. The test entered a basement complex of agglomerates and flows of the Permo-Carboniferous Kuttung Formation directly beneath the unconformity. Tabled below is the stratigraphic sequence encountered in the well. Datum is the kelly bushing, 17 feet above ground level.

Age	Formation	Depth Intervals (feet)	Thickness (feet)
Cainozoic		17- 200	183
Lower Cretaceous	Roma	200-2398	2198
L. Cret.-Jurassic	Blythesdale	2398-3538	1140
Jurassic	Walloon	3538-4557	1019
Jurassic-Triassic	Bundamba	4557-5933	1376
Permo-Carboniferous	Kuttung	5933-6106(T.D.)	173+

Cainozoic sediments: 17-200 feet (183 feet)

White, yellow, and red sands interbedded with yellow and grey sandy clays.

Great Artesian Group

Roma Formation (Lower Cretaceous): 200 to 2398 feet (2198 feet)

The Roma Formation consists of 2198 feet of interbedded shallow water marine shale, sandstone, siltstone, and coal. Shale predominates to a depth of about 1000 feet. From

1000-1290 feet the section becomes more arenaceous and locally conglomeratic. Shale and siltstone again predominate between 1290 and 2090 feet with the section becoming more sandy below that depth. There is a gradual transition into the sand facies of the underlying Blythesdale Formation with the contact picked on the Electrical log at 2398 feet.

Detailed description, Roma Formation

200-1000 feet (800 ft)

SHALE, grey, dark grey, bluish-grey, silty in part, grading to SILTSTONE between 750 and 890 feet with several very thin, fine-grained, grey SANDSTONES between 700 and 1000 feet.

1000-1290 feet (290 ft)

SANDSTONE, grey, fine to medium-grained, moderately well-sorted subangular and subrounded clear quartz, dark grey and black lithic grains in light grey gummy clay matrix. Few small milky and yellow quartz pebbles. Interbeds of grey and dark grey silty SHALE, containing macerated carbonaceous material.

1290-1580 feet (290 ft)

SHALE, grey and dark grey, silty in part, and interlaminated with grey and brownish-grey SILTSTONE. Thin black, dull COAL at 1390 and 1510 feet and several thin medium-grained porous SANDSTONES interbedded in interval 1430-1460 feet.

1580-2090 feet (510 ft)

SHALE, grey and dark grey, silty, with interbedded and interlaminated grey SILTSTONE, as for Unit 3, but with more thin interbeds of moderately porous grey medium-grained SANDSTONE; poorly sorted subangular and subrounded clear and milky quartz with some cream and black lithic grains; gummy clay matrix loosely cemented. Macerated carbonaceous material and black COAL streaks.

2090-2398 feet (308 ft)

SANDSTONE, grey to light grey, grading from fine to coarse-grained, poorly sorted subrounded and subangular clear quartz, some grey chert, cream tuff grains; white clay matrix, loosely cemented. Thin grey SHALE and SILTSTONE laminae. Distinct SHALE, and silty shale interbeds between 2149 and 2217 feet, 2240 and 2252 feet, and 2377 and 2398 feet. Carbonaceous material throughout.

Blythesdale Formation (Lower Cretaceous - Jurassic): 2398 to 3538 feet (1140 feet)

The Blythesdale Formation consists of 1140 feet of predominantly arenaceous material. The formation consists principally of light grey quartzose porous sandstone with lesser conglomerate, shale and siltstone members. The sandstones predominate to a depth of 2900 feet, are poorly to moderately well-sorted and range from very fine to very coarse-grained. The grains are subangular to rounded and consist primarily of quartz with lesser lithic and carbonaceous material. Below 2900 feet the sands are less porous and there is a proportionally greater percentage of shale and siltstone members.

Detailed description, Blythesdale Formation

2398-2645 feet (247 ft)

SANDSTONE, light grey to white, mainly coarse-grained, some medium-grained with few granules and small pebbles of poorly sorted subrounded and subangular quartz loosely cemented in white clay matrix. Moderate to good porosity with thin laminae of grey and tan SILTSTONE and some grey SHALE. Thin interbeds of SILTSTONE between 2552 and 2610 feet. Macerated carbonaceous material and few coal streaks.

2645-2654 feet (9 ft)

MUDSTONE, light grey to grey.

2654-2898 feet (244 ft)

SANDSTONE, light grey and grey, mainly coarse-grained tending to GRIT in part; content as for Unit 1. Moderate porosity with few thin brownish-grey and grey silty SHALE laminae at 2760 feet and between 2883 and 2887 feet. Carbonaceous material and coaly streaks throughout.

2898-2948 feet (50 ft)

SHALE, grey and light brownish-grey, slightly silty in part with carbonaceous remains.

2948-3178 feet (230 ft)

SANDSTONE, light grey, fine-grained, dominantly clear quartz, some milky quartz, green chert and black lithic grains; clay matrix, loosely cemented. Interbeds of grey to brownish-grey silty SHALE and SILTSTONE. Macerated carbonaceous material in finer grained beds.

3178-3223 feet (45 ft)

SHALE, brownish-grey and grey with carbonaceous streaks.

3223-3352 feet (129 ft)

SANDSTONE, light grey, mainly fine-grained but grading to coarse in part, poorly sorted, subangular some subrounded, mainly clear quartz, some green chert, cream and black lithic grains, some fine sand in white clay matrix, loosely cemented. Thin brownish-grey SILTSTONE laminae particularly towards the base. Scattered carbonaceous material and one thin black COAL seam at 3269 feet.

3352-3417 feet (65 ft)

SHALE, grey, some light grey, silty, grading to brownish-grey SILTSTONE and sandier around 3390 feet. Coaly streaks and carbonaceous remains.

3417-3538 feet (121 ft)

SANDSTONE, light grey, mainly coarse-grained grading to GRIT in part but also fine and medium-grained in part. Poorly sorted, rounded, subrounded some subangular clear quartz, few coloured grains. Loosely cemented in part but mainly tight firm cement. Moderate porosity in part. Black COAL streaks and carbonaceous remains evident.

Walloon Formation (Jurassic): 3538 to 4557 feet (1019 feet)

The Walloon Formation consists of 1019 feet of interbedded shale and coal with minor sand and siltstone members. The sandstones are quartzose, yellow-buff coloured, hard, calcareously cemented, and contain abundant finely macerated carbonaceous matter. The shales are brown to black and carbonaceous; the coals are thin bedded (up to about 10 feet thick) and are most prominent in the interval 3538-4299 feet. Below that depth there is a progressive increase in the sand content.

Detailed description, Walloon Formation

3538-4299 feet (761 ft)

SHALE, light grey, grey, brownish-grey, some dark grey and black, carbonaceous, dense, with much macerated carbonaceous material scattered throughout and with thin brownish-grey SILTSTONE interlaminated and interbedded with many dull and bright black COAL seams up to 10 feet thick. A few thin, grey, fine to medium-grained SANDSTONE beds evident, particularly at 3845 and 3990 feet.

4299-4557 feet (258 ft)

SHALE, light grey, light brown, dark grey and black, dense, silty in part with scattered carbonaceous remains grading to grey and brownish-grey SILTSTONE in part. Thin black coaly streaks evident with one thin seam at 4508 feet. Thin beds of fine to medium-grained grey SANDSTONE, with slightly calcareous cement in the intervals 4353-4359 feet, 4362-4370 feet, and 4458-4473 feet.

Bundamba Formation (Jurassic-Triassic): 4557 to 5933 feet (1376 feet)

The Bundamba Formation consists principally of three members all of which intertongue: an upper interbedded sandstone, siltstone and shale sequence, a middle shale and minor sand sequence, and a lower predominantly sand member. The upper unit occupies the interval 4557-5151 feet in the well; the middle unit, the interval 5151-5628 feet; and the lower member, the interval 5628-5933 feet. The lower member was the primary target of the drilling test.

Detailed description, Bundamba Formation

4557-4831 feet (274 ft)

SANDSTONE, light grey, medium to coarse-grained, conglomeratic, quartzose tending to GRIT in part and fine CONGLOMERATE light grey to grey, small rounded pebbles and granules of clear, milky and pale yellow quartz, set in poorly sorted medium-grained, subrounded to rounded sandstone of same composition. White clayey matrix in part but loosely cemented. Moderate to good porosity with laminae of buff, grey and dark grey silty SHALE and thin interbeds of SHALE between 4571-4588 feet, 4650-4662 feet, 4732-4739 feet, 4779-4782 feet, 4790-4796 feet, and 4802-4806 feet.

4831-5081 feet (250 ft)

SHALE, grey, light brownish-grey, silty in part and interlaminated and thinly bedded grey SILTSTONE with very thin slightly porous grey, fine to medium-grained, quartz SANDSTONES distributed throughout. Carbonaceous material and coaly streaks. Pale blue fluorescence between 4960 and 4980 feet.

5081-5151 feet (70 ft)

SANDSTONE, light grey, pale greenish-grey grading from fine to coarse-grained, quartzose with rare lithic grains; poorly sorted, subrounded and subangular. White to light brown tuffaceous clay matrix. Moderate to good porosity between 5083 and 5118 feet. Thinly interbedded brown and grey SHALE and SILTSTONE near base.

5151-5331 feet (180 ft)

SHALE, brown, tan, greenish-grey and interbedded similarly coloured SILTSTONE with COAL streaks and carbonaceous remains. A few thin black COAL seams up to 5 feet thick. Pale blue fluorescence between 5160 and 5190 feet.

5331-5347 feet (16 ft)

SANDSTONE, light grey, fine to medium-grained; poorly sorted subangular clear and light grey quartz, few greenish and white tuffaceous grains. White clay matrix but moderate porosity. Thin SHALE laminae at 5343 feet. Pale blue fluorescence.

5347-5628 feet (281 ft)

SHALE, brownish-grey and grey with coaly laminations with interbedded brownish-grey SILTSTONE tending to fine-grained light grey and grey SANDSTONE in part. Several thin black shaly COAL seams evident at 5382, 5508, and 5606 feet. Blue fluorescence between 5400 and 5460 feet. Hystrichospheres and foraminifera at 5354 feet.(1)

5628-5690 feet (62 ft)

SANDSTONE, light grey, fine to medium-grained with occasional coarse grains and granules, poorly sorted subangular and subrounded clear quartz, grey, cream and black lithic grains; white clay matrix, moderate cementing. Thin laminae of grey and light grey SHALE particularly evident at 5654, 5665, and 5670 feet. Good to moderate porosity with bright blue and milky fluorescence.

5690-5750 feet (60 ft)

SHALE, grey, light grey, some buff coloured, with plant fragments and thin black COAL laminae, thinly interlaminated with grey and brownish-grey SILTSTONE and minor fine-grained SANDSTONE. Trace very poor blue fluorescence.

5750-5800 feet (50 ft)

SILTSTONE, light grey, dense. Thin shale interbed in the interval 5793-5797 feet.

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(1) Footnote by Bureau of Mineral Resources :

The existence of hystrichospheres and foraminifera at 5354 feet in Moonie No. 1, was reported by P.R. Evans in B.M.R. Record 1962/115 - Microfossils associated with the "Bundamba Group" of the Surat Basin, Queensland.

5800-5850 feet (50 ft)

SANDSTONE, light grey, primarily medium-grained locally coarse-grained to grit size, porous and permeable. Grains consist mainly of clear to milky quartz, subrounded to rounded, minor grey chert and dark grey lithic grains. Loosely to moderately well cemented. Pale to light blue fluorescence. Light straw cut in carbon tetrachloride.

5850-5852 feet (2 ft)

SHALE, grey.

5852-5895 feet (43 ft)

SANDSTONE, as in Unit 9, locally pebbly. Thin shaly interbeds. Trace to weak blue fluorescence.

5895-5933 feet (38 ft)

CONGLOMERATE, grey, mottled salmon, brown, white and cream with multicoloured granules and pebbles. Few cobbles, but mostly very small pebbles and granules. Cobbles up to 80 mm. The pebbles and grains represent a multiplicity of rock types chiefly those of "basement" origin. They include a salmon coloured, unweathered, acid to intermediate igneous rock with much feldspar, clear quartz and biotite, grey and dark grey hypabyssal or volcanic igneous rock in part weathered, and light grey weathered porphyry. They also include hard dark grey, bluish-grey and grey siliceous argillite, soft weathered white tuffaceous shale and grey shale. Matrix is made up of grains and granules of same composition as pebbles. Hard, tight. Thin calcite veins.

Kuttung Formation

The Kuttung Formation was penetrated in the well from 5933 feet to total depth of 6106 feet. Basically the section penetrated consists of two units, a siltstone, shale and conglomerate section from 5933 to 6046 feet, and from 6046 to 6106 feet, a sequence of volcanic flows. Potassium-argon age determination on the volcanics places the age at 300 $\pm$ 10 million years or Carboniferous (probably early Pennsylvanian), confirming correlations to the Kuttung Formation section that crops out in New South Wales west of the Ashford Spur of the New England Batholith. In previous wells (Cabawin No. 1) equivalent lithology was referred to the Cracow Formation.

On first appraisal the tendency would be to place the basement contact at the top of the volcanics and assign the overlying unit to the basal part of the Mesozoic sequence. The character of the section would tend to confirm this age assignment. However the results of dipmeter (see interpretive log and composite well sheets) suggest the opposite. Tentatively therefore the unit has been placed in the Kuttung Formation pending results of additional drilling in the area.

Detailed description, Kuttung Formation

5933-6046 feet (113 ft)

SILTSTONE, grey to dark grey, grading to thin beds of fine-grained tuffaceous SANDSTONE; quartz, feldspar, and mica evident in tight grey matrix, slightly calcareous. Thin beds of grey soft slightly calcareous SHALE and medium-grained mottled red and white SANDSTONE. Pebbles of conglomerate.

6046-6106 feet (60 ft)

DACITE, grey, fractured, weathered, with soft red iron material on joints masking overall colour particularly at top. Rock shows some crystalline form, and carries feldspar, quartz, biotite and other ferromagnesians. Probably tuffaceous in part.

Oil and Gas Indications and Potential Including Discussion of Porosity and Permeability of Sediments

The drilling of Union-Kern-A.O.G. Moonie No. 1 has confirmed the presence of significant accumulations of hydrocarbons in the Surat Basin. The producing section is the lower member of the Bundamba Formation which is by far the best reservoir encountered in the well. Shows in the form of fluorescence began at a depth of 4960 feet and increased progressively downward towards the oil zone. Only one open hole formation test was made in the well between 5816 feet and 5925 feet. On a 74-minute test the formation yielded black 48° API gravity oil at an estimated rate of 250 barrels a day and fresh water (29 gr/gl) at an equal rate. Gas accompanying the flow was estimated at 200 Mcf/D. The well was cased and completed from the perforated interval 5798-5840 feet. At the end of a sustained testing period from 23rd December, 1961 to 18th February, 1962, the well was producing 666 barrels per day of 45° API gravity oil with 124 Mcf/D of gas through 18/64" choke with casing and tubing well head pressures at 600 p.s.i. and 560 p.s.i. respectively.

Porosities in the oil zone range from 12.8 to 24.6 percent; permeabilities up to 133 md. However these determinations are based on analyses of sidewall cores, and the permeability figures cannot be considered to be definitive.

Contribution to Geological Concepts Resulting from Drilling

The Moonie prospect was primarily a Bundamba play where lower Bundamba sands in domal closure overlie a truncated and faulted Permian to Upper Carboniferous sequence of rocks. The desirability of the test was suggested from information gained by studies in the Surat Basin, which indicated that the lower Bundamba sands were the best reservoir rocks and that the Permian section (Back Creek Formation) was the probable source of oil previously encountered in the drilling. The play was based on the thesis that oil generated in the Permian section would migrate up dip and be trapped in the porous sands of the Bundamba Formation in domal closure above the unconformity. The suggested confirmation of this thesis must be considered to be the major contribution to geological concepts resulting from the drilling of the well.

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APPENDIX 1

CORE DESCRIPTIONS

UNION-KERN-A.O.G. MOONIE NO. 1

Core No. 1

Depth Cored:	4795-4805 feet
Interval Cored:	10'0"
Total Recovery:	9'4"
Angle of Hole:	1^{o}
Apparent Dip of Core:	Flat - (Silty laminae in shale range in dip from 1^{o}-5^{o})
Barrel Type and Size:	Hughes 8 3/4" Conventional Type "J" Hard Formation Cutter Head.

From	To	Recovery	Description
4795'0"	4799'3"	3'11"	SHALE, grey slightly waxy lustre in part, thin silty laminae particularly near base and several very thin "bungs" of medium-grained silty sand. Few black COAL laminae.
4799'3"	4801'4"	2'1"	SANDSTONE, grey, fine to medium-grained ill-sorted subangular and subrounded, dominantly clear quartz, some white and grey quartz. Few pale green, yellow and black grains evident with mica forming on some bedding planes. Matrix is very fine quartz sand with some white clay, friable, very loosely cemented and becoming siltier towards the base.
4801'4"	4802'0"	0'8"	SHALE, grey thin silty laminae in part with scattered carbonaceous plant remains along bedding.
4802'0"	4805'0"	2'8"	SANDSTONE, grey to pale greenish-grey, medium-grained, some fine-grained and silty near the top, ill-sorted, subangular some subrounded. Mainly clear quartz, some grey and pale green quartz. Few white lithic and black lithic grains with sparse very fine quartz sand and some white clay matrix. Friable in part, loosely cemented. Some mica and fine macerated carbonaceous material on some bedding planes.

Core No. 2

Depth Cored:	5254-5258 feet
Interval Cored:	4'0"
Total Recovery:	Nil
Angle of Hole:	1 1/2^{o}
Barrel Type and Size:	Hughes 8 3/4" Conventional Type "J" Hard Formation Cutter Head.

Core No. 3

Depth Cored:	5258-5263 feet
Interval Cored:	5'0"
Total Recovery:	Nil
Angle of Hole:	1 1/2^{o}
Barrel Type and Size:	Hughes 8 3/4" Conventional Type "J" Hard Formation Cutter Head.

Core No. 4

Depth Cored:	5351-5356 feet
Interval Cored:	5'0"
Total Recovery:	4'2"
Angle of Hole:	1^{o}
Apparent Dip of Core:	Flat
Barrel Type and Size:	Hughes 8 3/4" Conventional Type "J" Hard Formation Cutter Head.

Recovery	Description
0'6"	SHALE, dark brown with thin, grey siltstone stringers and abundant finely macerated plant fragments and carbonaceous matter.
1'3"	SANDSTONE, light grey, fine to very coarse-grained with trace granule sizes, subangular to subrounded; micro cross-bedded; hard, tight, siliceous cement with thin lenses of coal and plant fragments.
1'2"	SHALE, dark brown interlaminated with grey siltstone and thin coal breaks, hydroplastic slump structures, current-bedding, finely disseminated carbonaceous matter.
1'3"	SILTSTONE, to very fine sandstone, light grey with carbonaceous laminae and minor, thin, dark brown shale bands. Hydroplastic slump structures and current-bedding.

Core No. 5

Depth Cored:	5918-5925 feet
Interval Cored:	7'0"
Total Recovery:	6'10"
Remarks on Recovery:	Pulled off on first run. Ran in with new catchers and bit passed over and recovered full core.
Angle of Hole:	1^{o}
Apparent Dip of Core:	Flat (?)
Barrel Type and Size:	Hughes 8 3/4" Conventional Type "J" Hard Formation Cutter Head.

From	To	Recovery	Description
5918'0"	5925'0"	6'10"	CONGLOMERATE, grey, mottled salmon, brown, white and cream with multi-coloured granules and pebbles. Very poorly sorted, mainly rounded and subrounded with some fine grains and granules subangular. Few cobbles, many pebbles but mostly very small pebbles and granules around 4-6 mm. Maximum cobble size 80 mm. The pebbles and grains represent a multiplicity of rock types chiefly those of "basement" origin. They include salmon coloured unweathered granite with much salmon coloured feldspar; clear quartz and biotite, grey and dark grey hypabyssal igneous rocks, in part weathered and light grey weathered porphyry. They also include hard, dark grey, bluish-grey and grey siliceous argillite, soft weathered white tuffaceous shale and grey shale. The softer rock types are dominant at the top and the "basement" type rocks mainly granite dominant at the bottom. Much of the grains and granules are partly reworked crystals from the granite and other volcanic rocks although shale fragments are also evident. These granules and grains are often subangular, but mainly subrounded. Biotite is also evident in the matrix. The matrix is made up from granules and grains grading down to silt and having content as just described. The rock is tight, hard, with strong very slightly calcareous cement. A thin sub-vertical vein of calcite is evident.

Core No. 6

Depth Cored:	6095-6100 feet
Interval Cored:	5'0"
Total Recovery:	0'6"
Remarks on Recovery:	Nil on coring run then ranback in with new catchers and recovered 6" in fragments.
Angle of Hole:	1^{o}
Apparent Dip of Core:	Not evident
Barrel Type and Size:	Hughes 8 3/4" Conventional Type "J" Hard Formation Cutter Head.

From	To	Recovery	Description
6095'0"	6100'0"	0'6"	IGNEOUS ROCK, grey, jointed with red weathered material on joints masking in part the overall colour. The rock is weathered but showing some crystalline form. Crystals averaging 2 mm, some smaller, predominantly grey, pink-salmon and cream, soft feldspars (?). Approximately 10% clear quartz and 5% biotite. Trace of brownish-black ferromagnesian. The biotite and ferromagnesian also reach 2 mm. This rock is acidic, may be flow or perhaps hypabyssal.

Core No. 7

Depth Cored:	6100-6106 feet
Interval Cored:	6'0"
Total Recovery:	Nil
Remarks on Recovery:	Jointed and weathered igneous rock either ground away in rough coring run, or lost in jointed fragments through catchers.
Angle of Hole:	1^{o}
Barrel Type and Size:	Hughes 8 3/4" Conventional Type "J" Hard Formation Cutter Head.

SCHLUMBERGER SIDEWALL CORE DESCRIPTIONS

UNION-KERN-A.O.G. MOONIE NO. 1

Date Cores Taken: 2nd December, 1961

Coring Gun: 30-Shot Gun - Hard Formation Sample Takers

Depth (feet)	Recovery (in.)	Description
5648	1 1/2	SANDSTONE, light grey, quartzose, poorly sorted, fine to medium-grained, few coarse subangular some subrounded predominantly clear quartz, some light grey quartz, white tuff grains and few dark grey lithic grains. Fine sand and some white clay matrix loosely cemented. Strong blue fluorescence. Immediate good straw cut with CCl_4. Oil odour.
5809	1 1/2	SANDSTONE, light grey, quartzose, mainly medium-grained, some coarse, some fine-grained, poorly sorted subrounded, subangular, clear, some light grey, quartz. Few grey chert grains. Fine sand and white clay matrix, loosely cemented. Bluish-white fluorescence. Straw cut with CCl_4.
5825	1 1/4	SANDSTONE, light grey, quartzose medium to coarse-grained, poorly sorted subrounded, rounded some subangular mainly clear quartz, some light grey and grey translucent quartz. White clay matrix, loosely cemented. Blue fluorescence. Weak straw cut with CCl_4.
5840	1 3/4	SANDSTONE, light grey to grey, quartzose, poorly sorted mainly fine-grained, some medium-grained, few coarse grains subangular, clear quartz, some light grey and grey quartz, fine quartz sand, trace white clay matrix loosely cemented. Bright blue fluorescence. Trace cut with CCl_4. Oil odour.
5855	1 3/4	SANDSTONE, light grey to grey, very coarse-grained tending to GRIT. Coarse grains rounded, fine grains subrounded and ill-sorted. Mainly clear and some light grey quartz granules and small pebbles up to 10 mm. Matrix fine quartz sand with some white clay. Loosely cemented. Bright blue fluorescence, faint oil odour. Trace cut with CCl_4.
5880	1 1/2	SANDSTONE, light grey, medium-grained, with a few subrounded and rounded granules and small pebbles up to 15 mm. Grains mainly subangular, subrounded ill-sorted, dominantly clear quartz, some light yellow, light grey and milky. Some white clay matrix loosely cemented. Trace weak blue fluorescence.

Date Cores Taken: 6th December, 1961

Coring Gun: 30-Shot Gun - Hard Formation Sample Takers

Depth (feet)	Recovery (in.)	Description
4188	1 1/2	COAL, black, dull.
4247	3	SHALE, grey, soft, greasy.
4300	2	COAL, black, bright.
4600	2	SANDSTONE, light grey, grading fine to medium-grained, mainly fine. Poorly sorted, subangular, some subrounded clear quartz, some light grey, white and light blue quartz, soft white clayey matrix, poorly cemented. Tight. Trace deep blue fluorescence.
4612	1 1/2	SANDSTONE, light grey, quartzose, coarse-grained but grading back to fine, poorly sorted subrounded to rounded clear quartz, few coloured quartz grains, white clayey matrix, poorly cemented. Trace blue fluorescence.
4680	1 1/2	SANDSTONE, light grey, fine to medium-grained, poorly sorted, subangular some subrounded, clear and grey quartz. Few dark grey to black lithic grains, white clay matrix loosely cemented. Trace deep blue fluorescence.
4698	1 1/4	SANDSTONE, grey to buff, fine-grained, some grains medium size, quartzose, subangular some subrounded, clear quartz, few dark brown lithic grains. White clayey cement. Trace blue fluorescence, slight odour.
4750	1 1/2	SANDSTONE, grey to buff, fine to medium-grained (as for 4698 feet above). Trace blue fluorescence.
4820	1 1/2	SANDSTONE, grey, quartzose, grading fine to medium-grained, few coarse-grained, ill-sorted clear and light grey quartz, fine sand matrix loosely cemented. Trace poor blue fluorescence.
5100	3/4	SANDSTONE, light brown, medium to coarse-grained, subrounded and subangular poorly sorted with white to light brown clayey tuffaceous matrix. Grains clear quartz, some grey quartz, cream and brown lithic grains. Tight, well cemented. Deep blue fluorescence.
5108	1 1/4	SANDSTONE, light grey, quartzose, grading fine to medium-grained, poorly sorted, subangular some subrounded clear quartz, some light grey quartz, trace muscovite. Fine quartz sand and white clay matrix. Tight. Poorly cemented.
5260	1 1/2	SANDSTONE, brown, very fine-grained tending to SILTSTONE, clear quartz, grey chert and brownish chert in soft brownish matrix, tight.
5263	1 1/4	SILTSTONE, light brownish-grey tending to very fine-grained SANDSTONE, as for 5260 feet above.

Depth (feet)	Recovery (in.)	Description
5333	2	SANDSTONE, light grey, fine to medium-grained poorly sorted subangular clear and light grey quartz, some white clayey matrix, soft cement. Deep blue fluorescence.
5335	-	Recovery only of mud cake.
5337	2 1/4	SANDSTONE, grey, fine to medium-grained, poorly sorted subangular and subrounded clear and grey quartz in light grey clayey matrix firmly cemented. Deep blue fluorescence.
5604	3/4	SILTSTONE, grey tuffaceous. Trace poor blue fluorescence.
5641	1	SANDSTONE, light grey, fine to medium-grained poorly sorted, subrounded some rounded, clear, light grey quartz, few dark lithic grains, light grey clay matrix, poorly cemented. Good blue fluorescence, poor straw cut with CCl_4. Slight odour.
5660	1 3/4	SANDSTONE, light grey, medium-grained, quartzose, fairly well sorted, subangular some subrounded, clear quartz, some dark grey lithic grains, very fine quartz sand matrix loosely cemented. 80% patchy bright blue fluorescence. Trace straw cut with CCl_4. Odour evident.
5828	1	SANDSTONE, light grey, medium-grained, fairly well sorted, subrounded and subangular clear quartz few dark grey lithic grains. Trace straw cut with CCl_4. Odour and stain.
5832	1 1/2	SANDSTONE, grey, grading medium to coarse-grained, few granules poorly sorted rounded and subrounded, clear and grey quartz, some grey chert and dark grey lithic grains. 80% patchy bright blue fluorescence. Straw cut with CCl_4. Odour and light brown stain evident.
5846	1 1/4	SANDSTONE, grey, coarse-grained with granules and one small rounded pebble evident, ill-sorted rounded and subrounded, clear light grey quartz, few pale yellow quartz and grey and dark grey lithic grains. Some white clayey matrix fairly firmly cemented. Good 80% patchy bright blue fluorescence. Trace cut. Odour evident.
5860	1 1/2	SANDSTONE, light grey, medium-grained but carry-out rounded granules, quartzose, ill-sorted, subangular some subrounded, clear quartz with fine quartz sand matrix loosely cemented. Good blue fluorescence. Trace cut with CCl_4. Odour evident.
5868	1	SANDSTONE, light grey, medium-grained, few coarse grains, ill-sorted, subrounded some rounded, clear and light grey quartz, some white clay matrix, tight. 5% weak blue fluorescence. Slight odour.

Depth (feet)	Recovery (in.)	Description
5799	1 1/2	SANDSTONE, light grey, quartzose, medium-grained but with granules, subrounded, rounded, subangular clear quartz, fine sand matrix, loosely cemented. 80% patchy bright blue fluorescence. Trace straw cut. Slight odour.
5761	3/4	SILTSTONE, grey, clear and grey quartz, some greenish-grey grains, tends to very fine-grained sandstone.
5712	1	SANDSTONE, grey, fine-grained, ill-sorted, subrounded and subangular clear and grey quartz, grey chert. Few dark grey lithic grains, fine sand and grey clay matrix. Trace very poor blue fluorescence, slight odour.

Date Cores Taken: 7th December, 1961

Coring Gun: 30-Shot Gun - Hard Formation Sample Takers.

Depth (feet)	Recovery (in.)	Description
4822	1 1/4	SANDSTONE, grey, fine-grained, quartzose, poorly sorted, subangular and subrounded clear and grey quartz, some grey chert. Clay matrix loosely cemented. Trace blue fluorescence.
5265	1	SANDSTONE, grey to dark grey, very fine-grained, subangular clear quartz with darker grey clay matrix.
5360	2	SHALE, grey, with thin band lighter grey quartzose siltstone.
5751	-	LOST IN HOLE
5940	-	LOST IN HOLE
5964	1	SANDSTONE, grey, fine-grained, tuffaceous, soft, showing platy fracturing, may be soft pebble in a conglomerate.
5990	1 1/4	SILTSTONE, grey to dark grey tending to very fine-grained SANDSTONE, quartz, feldspar and mica evident with grey matrix; tight, gives slightly calcareous reaction.
6010	-	LOST IN HOLE
6027	1	SANDSTONE, grey and mottled red and white, medium-grained, angular and subangular quartz, feldspar and some mica in finer sand matrix. The grains are weathered igneous debris. Tight.
6035	1 1/2	SHALE, grey, soft, slightly calcareous with thin white calcite vein.

Depth (feet)	Recovered (in.)	Description
6055	1 1/4	IGNEOUS ROCK, red, strongly weathered, some crystalline outline evident, clear quartz, salmon, light brown feldspar, mica, some trace of ferromagnesian.
6070	-	EMPTY
6090	1/4	IGNEOUS ROCK, grey in part, weathered reddish, crystalline outline evident almost throughout, size 2 mm, clear quartz, cream, light brown-salmon feldspar, biotite and some ferromagnesian. This is probably volcanic, may be hypabyssal and is intermediate to acid.

APPENDIX 2

PALYNOLOGY OF SAMPLES FROM

UNION-KERN-A.O.G. MOONIE NOS 1 AND 3 WELLS

by

N.J. de Jersey and R.J. Paten *

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* Geological Survey of Queensland, February, 1963.

PALYNOLOGY OF SAMPLES FROM

UNION-KERN-A.O.G. MOONIE NOS 1 AND 3 WELLS

by

N.J. de Jersey and R.J. Paten *

INTRODUCTION

Union-Kern-A.O.G. Moonie No. 1 Well was located at latitude 27°44'54" South, longitude 150°15'25" East, about 35 miles south-south-west of Tara township in southern Queensland. The well was drilled to test the petroleum potential of a domal structure in the Jurassic rocks of the Surat Basin. Drilling began on 12th November, 1961 in a thin veneer of Tertiary sediments overlying the Mesozoic section, and ceased on 6th December, 1961 at 6106 feet in volcanic basement rocks of the Carboniferous Kuttung Formation. Following the completion of this well as a producing oil well, additional wells were drilled to establish the extent of the Moonie field; at the date of writing developmental drilling is continuing.

This palynological investigation was initiated on samples from Moonie No. 1 with additional material being studied from Moonie No. 3, one of the development wells, located approximately 1 1/2 miles north-east of Moonie No. 1. The Surat Basin probably contains the thickest conformable Jurassic succession in Queensland. Support for this assumption has been provided by the Moonie wells which penetrated almost 5000 feet of Jurassic strata. In addition to providing age determination data for use by the Company, the palynologic investigation has established a microfloral sequence throughout this thick succession and has thus provided a reference section for the Jurassic microfloras of Queensland.

The microfloral data have been summarized in two diagrams. Figure 3 indicates the detailed ranges of most of the forms present whereas Figure 4 illustrates the abundance of forms which show significant variation throughout their ranges.

SAMPLES

Nature of Samples

All samples examined are listed in Appendix A. They consist of conventional cores, sidewall cores, and cuttings. Extensive coring in the basal section of Moonie No. 3 Well enabled a close study to be made of this section, all favourable lithologies being examined. As cores from other sections of the wells were widely spaced, additional sidewall cores were requested to provide information on the uncored sections below the Walloon Formation. Information obtained from these sidewall cores has provided a more complete microfloral succession over this part of the section.

It is evident from Figure 3 that the conventional and sidewall cores have provided a fair to excellent coverage of the succession up to the base of the Walloon Formation. Above this level the investigation was based on coal and shale cuttings. Four samples of coal cuttings were examined from the Walloon Formation. These samples were subjected to S.G. separation which removed associated shale cuttings, and because of poor development of coals in the overlying section, contamination from higher coal seams appears unlikely. Because of the high proportion of coals within the Walloon Formation, some contamination of the lower samples seems likely from higher seams in that section. The available evidence indicates relative

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uniformity of the microflora throughout the Walloon Formation in these wells so that such contamination is not a serious problem. The other sample of coal cuttings (2410-2440 feet) examined from the Blythesdale Formation is overlain by a section containing negligible amounts of coal and so there is little possibility of its contamination in this way.

Four samples of shale cuttings were examined from the top 1400 feet of the section assigned to the Roma Formation by the Company. Of these, the upper two samples came from a section giving a very low spore yield. The two lower ones were highly carbonaceous and gave very large spore yields so that contamination would tend to be overshadowed. By examining coal and shale cuttings as indicated, general information has been obtained on the microflora of the Walloon and younger formations even though no cores or sidewall cores were available. While contamination by caving from overlying sediments is often apparent in samples of cuttings, this has been minimized by selecting the samples as indicated above.

Composite Sequence of Samples

The two wells considered are less than 1 1/2 miles apart and excellent electric log correlation is possible between them. By study of these logs, the composite sequence of samples shown in Figures 3 and 4 has been established. Previous work has suggested that the microfloral assemblages are relatively persistent laterally in the Surat Basin. Because of this it is considered unlikely that lateral changes in microfloral content occur over the short distance between Moonie No. 1 and Moonie No. 3 Wells.

STRATIGRAPHIC DISCUSSION

The stratigraphic sequence and division into formations is basically that adopted by the Company (see p.10). The following amendments have been incorporated following discussions with Mr. S. Keller, Resident Geologist, Union Oil Development Corporation.

(i) The names Precipice Sandstone, Evergreen Shale and Hutton Sandstone have been substituted for lower, middle and upper Bundamba respectively. The correlation of these subsurface units with the outcrops in the type areas of these formations is not completely substantiated. However, the subsurface units are so persistent throughout the Surat Basin, and so similar lithologically to the outcropping formations, that the names have been tentatively adopted for the subsurface units. This nomenclature is considered preferable to the continuing use of "Bundamba" which in the type area is based on a sequence of Triassic sediments, probably not co-extensive with this section in the Surat Basin.

(ii) In the Moonie No. 1 Well, Union Oil Development Corporation has placed the junction between the Roma and Blythesdale Formations at 2398 feet. The boundary was placed at this and equivalent horizons in this and subsequent wells although it was recognized by the Company that the junction was gradational. It was further recognized that the subsurface Roma Formation included in its basal part, sediments equivalent to the upper part of the Blythesdale Formation as it outcrops in the Roma area. Supporting evidence for this was provided by the presence of an Upper Jurassic microflora in the sample from 1390-1400 feet. Accordingly, the subdivision shown in Figures 3 and 4 has been suggested by the Company (S. Keller, verb. comm.) whereby the Blythesdale Formation is retained for the thick sandstone unit immediately above the Walloon Formation and the section between the top of the Blythesdale Formation and 1400 feet (in Moonie No. 1) is referred to as "Transition Beds". This is an informal name and it is not inferred that these beds correlate precisely with the Transition Beds - the upper unit of the Blythesdale Group - of the Roma area (Whitehouse, 1955). This problem of lithologic correlation of the subsurface with outcrop in the upper part of the succession is persistent in this region and it is evident that some facies variation has taken place. Such variation should be taken into consideration in all lithologic correlations involving this part of the succession.

DETAILED PALYNOLOGY

Samples of Palaeozoic Age

Kuttung Formation:

The section in Moonie No. 1 Well from 5933-6106 feet is assigned to the Kuttung Formation. This formation is regarded as Carboniferous in age based on a potassium-argon determination. The section consists of an upper sedimentary and lower volcanic section. Three samples examined from the sedimentary section proved barren of spores and pollens so that no further evidence of age is forthcoming.

Permian Sediments:

In all the wells of the Moonie group drilled to date, with the exception of No. 6, the Jurassic succession rests directly on the Kuttung Formation. In Moonie No. 6, however, examination of cuttings suggests the presence of a Permian section between the Jurassic sediments and basement. Two samples 6120-6160 feet and 5960-5970 feet - were examined from this well. The shale cuttings were obtained as sinks in carbon tetrachloride from each sample, the coal floats proving to consist entirely of cavings from overlying Jurassic seams. This is indicated by the presence in the coal of forms such as Callialasporites spp. which appeared appreciably above the base of the Mesozoic sediments in this region. In view of this proof of the presence of cavings in the cuttings of this section, the occurrence of a mixed assemblage of Jurassic and Permian species in the shales has been taken to indicate the presence of a Permian sequence in the well. It is realized that re-working of Permian microfossils into the base of the Jurassic section occurs, however the proportion of Permian species in the cuttings appears far too high in this case to be accounted for by the presence of reworked Permian forms. The following Permian species were recorded:

Shale cuttings 6120-6160 feet

cf. Florinites sp.
Striatites amplus
Nuskoisporites sp.
N. sp. nov.
N. rotatus
N. triangularis (abundant)
Vestigisporites spp.

Shale cuttings 5960-5970 feet

Florinites sp.
cf. F. eremus

Illinites sp.
Nuskoisporites sp.) common
N. triangularis)
Striatites sp.
Vesicaspora cf. maxima
Vestigisporites sp.
V. cf. methoris

The dominance of Nuskoisporites in these assemblages favours a Lower Permian age. This is supported by the presence of Vesicaspora cf. maxima and Vestigisporites cf. methoris, (V. maxima and V. methoris have been described from the Lower Permian of East Africa). In addition, the genus Illinites has previously been found in the Lower Permian of Queensland in cores from A.O.E. No. 1 (Reid's Dome) Well and also in the Lower Permian of Western Australia.

Palynological evidence from the two samples examined thus suggests the presence of approximately 200 feet of Lower Permian strata from about 5960 to 6160 feet in Moonie No. 6 Well. As this evidence is based on cuttings contaminated by caving from the overlying Mesozoics, it is suggested that a conventional or sidewall core be taken to provide confirmation, should an equivalent section be encountered in one of the future wells in the area.

Samples of Mesozoic Age

Precipice Sandstone:

This unit contains the producing oil sands and so was extensively cored. All shale intervals cored in Moonie No. 3 Well were studied, thus providing a detailed coverage of the microfloral sequence. The following assemblages were obtained :

Moonie No. 3 Well, Core No. 11, 5896 feet

Acanthotriletes sp.
sp. nov. aff. Annulispora
Annulispora densata
A. microannulata
Araucariacites sp.
Granulatisporites sp.
Leiotriletes directus
Lycopodiumsporites sp.
Osmundacidites sp.
Pityosporites sp.
Sphagnumsporites sp.
Taurocusporites sp. nov. 1
cf. Todisporites sp.
Vitreisporites subtilis
V. contectus

Moonie No. 3 Well, Core No. 11, 5884 feet

Alisporites sp.	2%
Annulispora microannulata	<1%

Araucariacites sp.	<1%
A. sp. (Ipswich type)	<1%
Baculatisporites sp.	2%
Classopollis sp.	1%
Concavisporites mortoni	<1%
Ginkgocycadophytus sp.	<1%
Granulatisporites sp.	<1%
Laricoidites sp.	<1%
Leiotriletes sp.	4%
Leptolepidites sp.	<1%
Lycopodiumsporites sp.	1%
L. rosewoodensis	<1%
Osmundacidites sp.	25%
Pityosporites sp.	2%
Sphagnumsporites sp.	11%
cf. Todisporites sp.	1%
Vitreisporites subtilis	41%

Moonie No. 3 Well, Core No. 10, 5875 feet

Alisporites sp.	2%
sp. nov. aff. Annulispora	3%
Annulispora microannulata	1%
Araucariacites sp. (Ipswich type)	<1%
A. sp.	<1%
Classopollis sp.	1%
Ginkgocycadophytus nitidus	<1%
Laricoidites reidi	<1%
Leiotriletes directus	2%
Lycopodiumsporites spp.	1%
L. rosewoodensis	1%
Osmundacidites spp.	14%
Pityosporites sp.	17%
Sphagnumsporites sp.	9%
Vitreisporites subtilis	43%

Moonie No. 3 Well, Core No. 9, 5868 feet

Acanthotriletes sp.	<1%
Alisporites sp.	2%
sp. nov. aff. Annulispora	2%
Annulispora folliculosa	<1%
Araucariacites sp.	1%
Classopollis sp.	1%
Ginkgocycadophytus nitidus	<1%
Granulatisporites sp.	<1%
Laricoidites sp.	2%
Leiotriletes sp.	2%
Lycopodiumsporites cf. austroclavatidites tenuis	<1%

Monolites sp.	<1%
Osmundacidites sp.	17%
O. cf. wellmanii	4%
Pilosisporites sp.	<1%
Pityosporites spp.	33%
Sphagnumsporites spp.	13%
S. clavus	<1%
Taurocusporites sp. nov. 1	<1%
Todisporites sp.	4%
Verrucosisporites spp.	2%
Reworked Permian :	
Nuskoisporites triangularis	1%

Moonie No. 3 Well, Core No. 7, 5839 feet

Alisporites spp.	1%
sp. nov. aff. Annulispora	4%
Annulispora microannulata	5%
Baculatisporites sp.	2%
Classopollis sp.	4%
Ginkgocycadophytus sp.	1%
Leiotriletes sp.	<1%
Lycopodiumsporites sp.	3%
L. cf. austroclavatidites tenuis	<1%
L. rosewoodensis	2%
Osmundacidites spp.	30%
O. cf. wellmanii	<1%
Pityosporites spp.	10%
Sphagnumsporites sp.	19%
Taurocusporites sp. nov. 1	<1%
T. cf. triangularis	<1%
Todisporites sp.	1%
Verrucosisporites sp.	<1%
Vitreisporites subtilis	7%
Reworked Permian :	
Striatites limpidus	1%

Moonie No. 3 Well, Core No. 7, 5824 feet

Alisporites sp.	2%
sp. nov. aff. Annulispora sp.	6%
Annulispora microannulata	2%
Araucariacites sp.	<1%
Baculatisporites sp.	1%
Classopollis sp.	2%
Ginkgocycadophytus spp.	2%
Leiotriletes sp.	6%
Lycopodiumsporites sp.	1%
L. cf. austroclavatidites	<1%
L. rosewoodensis	1%
Microreticulatisporites sp.	<1%

Osmundacidites sp.	26%
O. cf. wellmanii	<1%
Pilosisporites sp.	<1%
Pityosporites sp.	15%
Sphagnumsporites spp.	20%
S. clavus	<1%
Taurocusporites sp. nov. 1	<1%
T. cf. reduncus	<1%
Todisporites sp.	2%
Verrucosisporites sp. nov. 2	<1%
Vitreisporites subtilis	5%

Moonie No. 3 Well, Core No. 6, 5818 feet

Alisporites australis
sp. nov. aff. Annulispora
Annulispora microannulata
Ginkgocycadophytus sp.
Granulatisporites sp.
Lycopodiumsporites sp.
Osmundacidites sp.
Pityosporites sp.
Sphagnumsporites sp.
cf. Todisporites sp.
Taurocusporites cf. triangularis
Verrucosisporites sp. nov. 2
Vitreisporites sp.

Moonie No. 3 Well, Core No. 5, 5724 feet

Classopollis sp.	70%
Laricoidites reidi	1%
Leiotriletes directus	<1%
Lycopodiumsporites sp.	<1%
Osmundacidites sp.	4%
Pityosporites spp.	14%
Sphagnumsporites sp.	7%
Vetreisporites subtilis	1%

Moonie No. 3 Well, Core No. 5, 5714 feet

Classopollis sp. (abundant)
Osmundacidites sp.
Pityosporites sp.
Sphagnumsporites sp.
Taurocusporites cf. triangularis
Reworked Permian:
Nuskoisporites triangularis

Moonie No. 3 Well, Core No. 5, 5702 feet

sp. nov. aff. Annulispora	1%
Annulispora folliculosa	<1%

A. microannulata	1%
Classopollis sp.	41%
Ginkgocycadophytus sp.	<1%
Laricoidites reidi	<1%
Leiotriletes sp.	1%
Lycopodiumsporites sp.	1%
cf. Microreticulatisporites sp.	2%
Osmundacidites sp.	2%
Pityosporites sp.	6%
Sphagnumsporites sp.	38%
Vitreisporites subtilis	1%

The microflora of the Precipice Sandstone is dominated by long ranging forms such as Pityosporites, Osmundacidites and Sphagnumsporites. Short ranging and diagnostic forms are rare and include Taurocusporites sp. nov. 1, Alisporites sp. (Pteruchus type) and Araucariacites sp. (Ipswich type (de Jersey, 1962)) which are present in the lowest samples but do not range beyond the top of the formation. Verrucosisporites sp. nov. 2, Taurocusporites cf. reduncus are confined to the formation. Other characteristic but longer ranging types include Taurocusporites cf. triangularis, Annulispora microannulata and sp. nov. aff. Annulispora.

The most striking feature of the microflora is the presence of Classopollis sp. in low proportions in the lower samples and its marked increase to dominance in the upper levels of the formation (see Fig. 4). This rise in abundance of Classopollis sp. is paralleled by a corresponding decrease in the proportion of Pityosporites sp., Sphagnumsporites sp., and Osmundacidites sp., and Vitreisporites subtilis which are dominant in the basal part of the sampled section. Laricoidites reidi, Lycopodiumsporites rosewoodensis and Annulispora folliculosa which are prominent at higher levels in the Jurassic succession are rare throughout the Precipice Sandstone.

The evidence of these assemblages indicates that the Precipice Sandstone is no older than basal Jurassic since the genera Classopollis (Corollina) (Klaus, 1960, p. 160) and Taurocusporites (Stover, 1962, p. 56) are not known to range below the base of the Jurassic elsewhere.

Evergreen Shale:

Samples processed from the Evergreen Shale yielded the following assemblages :

Moonie No. 3 Well, Core No. 4, 5696 feet

sp. nov. aff. Annulispora	11%
Annulispora folliculosa	2%
A. microannulata	4%
Classopollis sp.	54%
Laricoidites reidi	<1%
Leiotriletes sp.	<1%
Lycopodiumsporites sp.	1%
Pityosporites sp.	5%
Rugulatisporites sp.	<1%
Sphagnumsporites sp.	20%

Moonie No. 3 Well, Core No. 2, 5654 feet

Annulispora microannulata	1%
Baculatisporites sp.	1%
Classopollis sp.	55%
Ginkgocycadophytus sp.	<1%
Laricoidites sp.	2%
L. reidi	1%
Leiotriletes sp.	1%
Lycopodiumsporites cf. austroclavatidites	1%
L. rosewoodensis	3%
Osmundacidites sp.	7%
O. cf. wellmanii	1%
Pityosporites sp.	13%
P. parvisaccatus	2%
Sphagnumsporites sp.	8%
cf. Tsugaepollenites sp.	1%
Vitreisporites subtilis	1%

Moonie No. 3 Well, Sidewall Core, 5603 feet

Annulispora folliculosa
Baculatisporites sp.
Classopollis sp. (abundant)
Leiotriletes directus
L. sp. nov. 1
Osmundacidites sp.
Pityosporites sp.
P. parvisaccatus
Podosporites sp.
Sphagnumsporites sp.
S. sp. nov. 1 (common)
gen. nov. conifer pollen

Moonie No. 3 Well, Sidewall Core, 5592 feet

sp. nov. aff. Annulispora	<1%
Annulispora microannulata	<1%
Araucariacites sp.	<1%
Baculatisporites sp.	<1%
Classopollis sp.	58%
Cyathidites sp.	1%
Ginkgocycadophytus nitidus	<1%
Laricoidites reidi	1%
Leiotriletes sp. nov. 1	<1%
L. directus	2%
Lycopodiumsporites rosewood-ensis	1%
Osmundacidites sp.	3%
Pityosporites spp.	11%

P. parvisaccatus	3%
Podosporites sp.	1%
Sphagnumsporites spp.	8%
S. clavus	<1%
S. sp. nov. 1	<1%
Taurocusporites sp.	<1%
Vitreisporites subtilis	<1%
gen. nov. conifer pollen	1%

Moonie No. 3 Well, Sidewall Core, 5450 feet

Classopollis sp. (abundant)
Laricoidites turbatus
Lycopodiumsporites sp.
Osmundacidites sp.
Pityosporites sp.
Sphagnumsporites sp.
S. sp. nov. 1

Moonie No. 1 Well, Core No. 4, 5355 feet

Acanthotriletes pallidus	<1%
Araucariacites sp.	3%
Callialasporites segmentatus	<1%
Classopollis sp.	62%
Concavisporites mortoni	<1%
Divisporites sp.	<1%
Ginkgocycadophytus sp.	2%
Gleicheniidites sp.	3%
Ischyosporites sp.	2%
Laricoidites reidi	6%
L. turbatus	3%
Leiotriletes sp.	1%
aff. Marsupipollenites sp. (Balme, 1957)	<1%
Osmundacidites sp.	4%
Pityosporites sp.	2%
Sphagnumsporites sp.	1%
Vitreisporites subtilis	<1%
undertermined microplankton	2%

Moonie No. 3 Well, Sidewall Core, 5233 feet

Araucariacites sp.	<1%
Baculatisporites sp.	<1%
Classopollis sp.	3%
Ginkgocycadophytus nitidus	<1%
Granulatisporites sp. nov. 3	1%
Ischyosporites sp.	<1%
Laricoidites reidi	<1%

Leiotriletes sp.	1%
L. sp. nov. 1	1%
Lycopodiumsporites rosewoodensis	2%
sp. nov. aff. Lycopodiumsporites	<1%
Osmundacidites sp.	10%
O. cf. wellmanii	<1%
Perotriletes sp.	3%
Pityosporites sp.	5%
P. sp. nov. 1	65%
Sphagnumsporites sp.	2%
S. sp. nov. 1	<1%

The Evergreen Shale is marked by the first appearance of Pityosporites parvisaccatus, trisaccate pollens, Ischyosporites sp., Sphagnumsporites sp. nov. 1, Leiotriletes sp. nov. 1, gen. nov. conifer pollen, Laricoidites turbatus, Gleicheniidites sp., Callialasporites segmentatus, Acanthotriletes pallidus, Granulatisporites sp. nov. 3, sp. nov. aff. Lycopodiumsporites, Perotriletes sp. nov., and Pityosporites sp. nov. 1. Of these, gen. nov. conifer pollen is confined to the formation. Granulatisporites sp. nov. 3, sp. nov. aff. Lycopodiumsporites, Perotriletes sp. nov., and Pityosporites sp. nov. 1 although observed only in the top sample (5233 ft), may range into the basal part of the Hutton Sandstone as there is a gap of about 400 feet in the sampling above this point. Annulispora microannulata and sp. nov. aff. Annulispora which were characteristic forms of the underlying Precipice Sandstone die out in the basal part of the Evergreen Shale. Although the evidence of stratigraphic ranges is considered of correlative value, the most distinctive feature of the microflora is the dominance of Classopollis sp. in most assemblages. This genus became dominant in the upper part of the Precipice Sandstone, continued to dominate the assemblages throughout most of the Evergreen Shale and then declined abruptly in abundance to scant proportions near the top of the formation and in the succeeding Hutton Sandstone.

Associated with the decline in abundance of Classopollis sp. at the top of the formation, another distinctive conifer pollen, Pityosporites sp. nov. 1, attained dominant proportions (Sidewall Core 5233 ft). This pollen apparently declined abruptly in importance since it was not observed in the microflora of the succeeding sample (4802 ft) about 400 feet higher in the sequence.

Core No. 4 of Moonie No. 1 Well yielded a low proportion of microplankton in addition to abundant spores and pollen grains. The presence of microplankton may suggest a marine or brackish water depositional environment at this horizon in contrast to the non-marine character of the remainder of the Jurassic sequence.

Microfloras similar in general character to those from this formation, particularly as regards the abundance of Classopollis sp. have been recorded elsewhere in the Surat Basin from Cabawin No. 1, Cabawin East No. 1, C.O.L. Speculation No. 1 and other wells. In the Cabawin No. 1 and Cabawin East No. 1 Wells, such assemblages came from sections correlated with the Evergreen Shale suggesting that this abundance of Classopollis sp. persists laterally in this formation. In Cothalow No. 1 Well in the Eromanga Basin the abundance of Classopollis sp. in samples near the base of the Jurassic sequence suggests that time equivalents of the Evergreen Shale may also be present in that region.

Hutton Sandstone:

Only one sample was available for study from the Hutton Sandstone. This yielded the following :

Moonie No. 1 Well, Core No. 1, 4802 feet

Acanthotriletes pallidus	<1%
Annulispora folliculosa	6%
Araucariacites sp.	3%
Callialasporites cf. dampieri	<1%
C. segmentatus	<1%
Cingulatisporites granulatus	6%
Classopollis sp.	3%
Cyathidites parvus	<1%
Ginkgocycadophytus sp.	2%
G. nitidus	2%
Gleicheniidites sp.	<1%
Granulatisporites minor	1%
Ischyosporites sp.	<1%
Laricoidites sp.	3%
L. reidi	2%
L. turbatus	<1%
Leiotriletes sp.	3%
Leptolepidites sp.	3%
L. verrucatus	1%
Lycopodiumsporites sp.	3%
L. sp. nov. 3	1%
L. cf. austroclavatidites	<1%
L. rosewoodensis	12%
Microreticulatisporites sp.	<1%
Monolites sp.	<1%
Osmundacidites sp.	11%
Pityosporites sp.	5%
Rugulatisporites ramosus	2%
Sphagnumsporites sp.	6%
S. clavus	1%
Taurocusporites cf. triangularis	<1%
Verrucosisporites sp. nov. 1	2%
V. triangularis	<1%
V. walloonensis	1%
Vitreisporites subtilis	1%

No detailed study of the variation of the microflora within the Hutton Sandstone was possible. The following species appeared within the section:

Granulatisporites minor, Verrucosisporites walloonensis, V. triangularis, V. sp. nov. 1, Rugulatisporites ramosus, Leptolepidites verrucatus, Cingulatisporites granulatus, Cyathidites parvus and Lycopodiumsporites sp. nov. 3.

Of these, Lycopodiumsporites sp. nov. 1, and Verrucosisporites sp. nov. 1 did not range as high as the basal sample of the overlying Walloon Formation.

Although the microflora has many features in common with those of the Walloon Formation of the Surat Basin and the Walloon Coal Measures of the type area (de Jersey, 1960a and b), certain features in the Hutton Sandstone microflora distinguish it from that of these younger formations. These are the presence of Classopollis sp. in low proportions, a significantly higher proportion of Cingulatisporites granulatus and a lower proportion of Laricoidites reidi. In addition C. granulatus exhibits a diversity of form not observed elsewhere.

Walloon Formation:

Moonie No. 1 Well, Sidewall Core, 4300 feet

Acanthotriletes sp.	1%
Annulispora densata	<1%
A. folliculosa	4%
Araucariacites sp.	2%
Baculatisporites sp.	<1%
Callialasporites dampieri	1%
C. segmentatus	6%
Cingulatisporites sp.	<1%
Cyathidites sp.	<1%
Ginkgocycadophytus nitidus	12%
Granulatisporites minor	1%
Laricoidites reidi	34%
Leiotriletes directus	1%
Leptolepidites verrucatus	3%
Lycopodiumsporites rosewood-ensis	6%
Osmundacidites sp.	1%
Pityosporites sp.	3%
P. parvisaccatus	<1%
P. psilatus	<1%
Rugulatisporites ramosus	<1%
Sphagnumsporites sp.	6%
Todisporites minor	<1%
Verrucosisporites sp.	3%
V. triangularis	<1%
V. walloonensis	4%

Moonie No. 3 Well, Sidewall Core, 4256 feet

Araucariacites sp.
Callialasporites segmentatus
Ginkgocycadophytus crassimarginis
G. nitidus
Laricoidites reidi
Leiotriletes directus
L. magnus
Lycopodiumsporites rosewoodensis

Microreticulatisporites sp.
Osmundacidites sp.
O. cf. wellmanii
Pityosporites sp.
Podosporites sp.
Sphagnumsporites sp.
Vitreisporites contectus
V. subtilis

Moonie No. 1 Well, Coal fraction 4190-4200 feet

Annulispora folliculosa	<1%
Araucariacites sp.	3%
Callialasporites dampieri	1%
C. segmentatus	1%
Cingulatisporites granulatus	<1%
Cyathidites parvus	1%
Ginkgocycadophytus nitidus	4%
Gleicheniidites sp.	8%
Granulatisporites minor	2%
Laricoidites reidi	30%
L. turbatus	<1%
Leiotriletes directus	6%
L. magnus	1%
Leptolepidites verrucatus	<1%
Lycopodiumsporites rosewood-ensis	3%
Microreticulatisporites sp.	<1%
Osmundacidites sp.	9%
Pityosporites sp.	11%
P. parvisaccatus	<1%
P. psilatus	<1%
Sphagnumsporites sp.	4%
Verrucosisporites triangularis	<1%
Vitreisporites subtilis	1%

Moonie No. 1 Well, Coal fraction 3930-3940 feet

Callialasporites dampieri	1%
Cyathidites sp.	<1%
Ginkgocycadophytus sp.	2%
G. crassimarginis	<1%
G. nitidus	3%
Granulatisporites sp.	1%
G. minor	4%
Laricoidites reidi	45%
Leiotriletes directus	7%
L. magnus	1%
Leptolepidites verrucatus	<1%
Lycopodiumsporites sp.	3%

L. rosewoodensis	8%
L. triangularis	1%
Osmundacidites sp.	4%
Pityosporites sp.	10%
P. parvisaccatus	<1%
P. psilatus	<1%
Rugulatisporites sp.	<1%
Sphagnumsporites sp.	4%
Vitreisporites subtilis	<1%

Moonie No. 1 Well, Coal fraction 3730-3740 feet

Araucariacites sp.	1%
Baculatisporites sp.	<1%
Callialasporites dampieri	3%
C. segmentatus	5%
Cyathidites sp.	<1%
Ginkgocycadophytus nitidus	5%
Gleicheniidites sp.	<1%
Granulatisporites minor	6%
Laricoidites reidi	37%
L. cf. *turbatus*	<1%
Leiotriletes directus	2%
L. magnus	1%
Lycopodiumsporites rosewoodensis	16%
Marsupipollenites psilatus	<1%
Osmundacidites sp.	2%
Pityosporites sp.	6%
P. parvisaccatus	<1%
P. psilatus	1%
Rugulatisporites ramosus	<1%
Sphagnumsporites sp.	3%
Verrucosisporites walloonensis	1%

Moonie No. 1 Well, Coal fraction 3600-3610 feet

Baculatisporites sp.	3%
Callialasporites dampieri	<1%
C. segmentatus	2%
C. cf. *trilobatus*	<1%
Concavisporites mortoni	<1%
Ginkgocycadophytus crassimarginis	1%
G. nitidus	8%
Granulatisporites minor	2%
Laricoidites reidi	25%
Leiotriletes directus	6%
Leptolepidites verrucatus	3%
Lycopodiumsporites rosewoodensis	14%

Monolites sp.	1%
Osmundacidites sp.	3%
Pityosporites sp.	9%
P. parvisaccatus	<1%
Rugulatisporites ramosus	2%
Sphagnumsporites sp.	6%
Verrucosisporites sp.	5%
V. walloonensis	2%

Species first obseved in samples from the Walloon Formation include Callialasporites dampieri, Pityosporites psilatus, Ginkgocycadophytus crassimarginis, Leiotriletes magnus, Lycopodiumsporites triangularis and Marsupipollenites psilatus. All these forms, with the exception of C. dampieri were confined to samples from the formation. Vitreisporites contectus, Annulispora densata, Annulispora folliculosa, Osmundacidites cf. wellmanii, Concavisporites mortoni, Pityosporites parvisaccatus, Verrucosisporites walloonensis, V. triangularis, Rugulatisporites ramosus, Leptolepidites verrucatus, Cingulatisporites granulatus and Cyathidites parvus which appeared in lower formations died out within the Walloon Formation. Because of the large gap in the sequence of samples above and below the Walloon Formation, it can be expected that sampling within these gaps would extend the range of many of the species beyond the limits indicated. From the aspect of abundance, the microflora remains monotonously uniform throughout the formation with Laricoidites reidi the dominant species. Callialasporites segmentatus and Granulatisporites minor are more abundant than in older formations. Classopollis sp. was not observed in the Walloon assemblages.

In general features, the microflora of the Walloon Formation showed no marked differences from that of the Walloon Coal Measures of the type area (de Jersey, 1960a and b). This suggests that the coal measures of the two areas are approximate time equivalents and subsurface investigation of the intervening areas may well prove them co-extensive.

Blythesdale Formation:

No cores or sidewall cores were available from this section so that coal cuttings from 2410-2440 feet were selected. The following assemblage was recovered from the sample:

Moonie No. 1 Well, Coal fraction 2410-2440 feet

Araucariacites sp.	<1%
Callialasporites dampieri	1%
C. segmentatus	2%
Classopollis sp.	2%
Cyathidites sp.	2%
C. sp. nov. 1	5%
C. australis/minor group	1%
Ginkgocycadophytus sp.	17%
Gleicheniidites sp.	5%
Granulatisporites minor	1%
Ischyosporites sp.	<1%
Laricoidites reidi	31%
L. turbatus	<1%

Leiotriletes sp.	3%
sp. nov. 1 aff. Leptolepidites	<1%
Leptolepidites sp.	<1%
Lycopodiumsporites rosewoodensis	5%
cf. Microcachrydites antarcticus	<1%
Osmundacidites sp.	2%
Pityosporites sp.	10%
Sphagnumsporites sp.	5%
Todisporites sp.	<1%
Vitreisporites subtilis	<1%

A pre-Cretaceous age is indicated by the presence of sp. nov. 1 aff. Leptolepidites, which was confined to the Upper Jurassic section of the Cothalow No. 1 Well, and by the abundance of Laricoidites reidi and Lycopodiumsporites rosewoodensis. It differs from the Walloon microflora in the presence of Classopollis sp., Cyathidites sp. nov. 1, Ischyosporites sp., and sp. nov. 1 aff. Leptolepidites. The evidence thus favours an Upper Jurassic age and a correlation with some part of the Blythesdale Formation of the Roma area. In addition, the general character of the microflora suggests that this horizon is appreciably below the Jurassic/Cretaceous boundary and so probably well below the top of the Blythesdale Formation of the Roma outcrop.

Roma Formation:

In the absence of cores and sidewall cores four samples of shale cuttings were selected to assist in locating the Jurassic-Cretaceous boundary. The upper two proved almost barren of spores or pollen grains with abundant yields being obtained from the lower two. The following assemblages were recorded :

Moonie No. 1 Well, Cuttings 1390-1400 feet

Acanthotriletes cf. levidensis	<1%
Baculatisporites sp.	1%
Callialasporites segmentatus	<1%
Cicatricosisporites cooksonii	<1%
aff. Concavisporites sp.	<1%
Cyathidites sp.	8%
C. sp. nov. 1	3%
C. australis/minor group	25%
aff. Dacrydiumites sp.	<1%
Ginkgocycadophytus sp.	7%
Gleicheniidites sp.	<1%
Ischyosporites punctatus	2%
Leiotriletes sp.	1%
Lycopodiumsporites sp.	2%
L. rosewoodensis	<1%
Microcachrydites antarcticus	1%
Microreticulatisporites sp. nov. 1	1%

Osmundacidites sp.)	26%
O. comaumensis)	
Pityosporites sp.	10%
Sphagnumsporites sp.	6%

Moonie No. 1 Well, Cuttings 820-830 feet

Acanthotriletes sp.	<1%
cf. Annulispora densata	<1%
Araucariacites sp.	<1%
Callialasporites dampieri	<1%
Cicatricosisporites australiensis	<1%
C. cooksonii	<1%
Classopollis sp.	2%
Cyathidites sp. nov. 1	3%
C. sp. nov. 2	<1%
C. australis/minor group	5%
Cyclosporites hughesi	1%
aff. Dacrydiumites sp.	1%
Ginkgocycadophytus sp.	11%
Gleicheniidites sp.	1%
Ischyosporites sp.	<1%
Laricoidites reidi	2%
Leiotriletes sp.	3%
Leptolepidites sp.	1%
Lycopodiumsporites sp.	4%
L. austroclavatidites	1%
Microcachrydites antarcticus	5%
Monolites sp.	<1%
Murospora sp.	<1%
Osmundacidites sp.)	4%
O. comaumensis)	
Pityosporites sp.	32%
Podosporites microsaccatus	<1%
Polypodiidites sp.	<1%
Sphagnumsporites sp.	16%
S. clavus	<1%
aff. Todisporites sp.	1%
undetermined microplankton	6%

Moonie No. 1 Well, Cuttings 350-360 feet

Cicatricosisporites cooksonii
Cyathidites australis/minor group
Gleicheniidites sp.
Osmundacidites sp.
Pityosporites sp.
Podosporites sp.
Sphagnumsporites sp.
undetermined microplankton

Moonie No. 1 Well, Cuttings 250-260 feet

Baculatisporites cf. truncatus
Cicatricosisporites australiensis
C. cooksonii
Cyathidites sp.
Ginkgocycadophytus sp.
Gleicheniidites sp.
Ischyosporites sp.
Leiotriletes sp.
Lycopodiumsporites sp.
L. cf. austroclavatidites
Microcachrydites antarcticus
Osmundacidites sp.
Pityosporites sp.
Podosporites sp.
Sphagnumsporites sp.

The first appearance of Cicatricosisporites australiensis has been generally accepted in Australia as marking the Jurassic-Cretaceous boundary. On this basis, it would be placed between 830 and 1390 feet. This is supported by the presence of Cyclosporites hughesi in the sample 820-830 feet which is confined to the Neocomian-Aptian (Cookson & Dettmann, 1958, p. 104).

Microplankton were observed in samples 820-830 feet and 350-360 feet suggesting a marine depositional environment for the sediments at least above 830 feet. The absence of microplankton from 250-260 feet is not considered significant since a very low yield of microfossils was obtained from this sample. In view of the known wide-spread marine transgression in Lower Cretaceous times in the Great Artesian Basin, the presence of microplankton would thus support the evidence of the Lower Cretaceous age furnished by the microflora. The Upper Jurassic age of the microflora from the sample 1390-1400 feet indicates that the base of the Roma Formation as defined in the Moonie area on lithologic grounds by the Company is somewhat older than the base of the Roma Formation of the type area.

CONCLUSIONS

General Results of Investigation

The principal interest of the investigation is in the Jurassic portion of the sequence. In the Surat Basin this attains an approximate thickness of 5000 feet, and is probably the thickest Jurassic sedimentary development in Queensland. Study of the microflora succession throughout the sequence has provided a succession of assemblages which can serve as a reference section for the Jurassic of the Great Artesian Basin. Thus, Figures 3 and 4 provide a basis for future correlation studies. From these figures it will be clear that the samples have provided excellent coverage of the Precipice Sandstone and Evergreen Shale and a general picture of the remainder of the section. Additional samples from other wells should provide more detailed information on the poorly sampled sections. From the aspect of correlation, certain evidence obtained on percentage distribution appears highly significant and likely to provide a promising means of correlation.

Age of the Microfloras

Microfloral evidence on the age of the formations of the Surat Basin is based almost entirely on a comparison with the microfloral succession in the Jurassic rocks of Western Australia (Balme, 1957). This is because the latter succession is the only Jurassic microfloral succession as yet described in Australia. In addition, the age of Balme's microfloras are well established, being derived from marine faunas as a consequence of the intercalation of marine and non-marine sediments in Western Australia.

Comparison of the Queensland microfloras with those of Western Australia indicates that while certain species are restricted to each area, other forms regarded as being of stratigraphic significance are common to both successions.

Balme's lowest microflora (Microflora I) came from the Cockleshell Gully Sandstone of Liassic age. One of its characteristic features was the abundance of Classopollis sp. and also the presence of Laricoidites (Inaperturopollenites) turbatus and Callialasporites (Zonalapollenites) segmentatus. In these features it is comparable with the assemblage from the upper part of the Evergreen Shale and accordingly, a Liassic age is suggested for this section of its Queensland succession. The absence of L. turbatus and C. segmentatus from the lower part of the Evergreen Shale and the Precipice Sandstone suggests that this basal part of the Queensland succession is older than Balme's Microflora I. However, the persistence of Classopollis sp. in the lower samples from the Precipice Sandstone indicates that this formation is also no older than Liassic.

Higher in the sequence, the appearance of Callialasporites (Zonalapollenites) dampieri is regarded as of stratigraphic significance. This species appears in the Bajocian of Western Australia, no definite specimens being recorded from the Liassic. In the Moonie sequence, it was first recorded from near the base of the Walloon Formation although, because of the wide spacing of samples below this in the underlying Hutton Sandstone, its range could well extend down into that formation. This downwards extension of the range of this species is supported by evidence from other areas which suggests that C. dampieri first appeared within the sequence of the Hutton Sandstone.

On the basis of the first appearance of this species, the upper part of the Hutton Sandstone and the Walloon Formation are assigned to the Bajocian.

Some support is given to this correlation by the absence of Cicatricosisporites cooksonii from the Walloon Formation of the Moonie wells which by comparison with the Western Australian section would indicate a pre-Oxfordian age (i.e. Middle or Lower Jurassic). Owing to poor sampling no detailed discussion of the age of the post-Walloon sequence is attempted at this stage.

These conclusions are summarized in the Table below:

<table>
<tr><td rowspan="4">MIDDLE JURASSIC</td><td>CALLOVIAN</td><td rowspan="2"></td></tr>
<tr><td>BATHONIAN
? ? ?</td></tr>
<tr><td rowspan="2">BAJOCIAN</td><td>WALLOON FORMATION</td></tr>
<tr><td rowspan="2">HUTTON SANDSTONE</td></tr>
<tr><td rowspan="3">LOWER JURASSIC</td><td rowspan="3">LIAS</td></tr>
<tr><td>EVERGREEN SHALE</td></tr>
<tr><td>PRECIPICE SANDSTONE</td></tr>
</table>

ACKNOWLEDGEMENTS

The authors wish to acknowledge the assistance of Miss M. Hamilton in examining the two samples of cuttings of Permian shale from Moonie No. 6 Well. The assistance of Union Oil Development Corporation in providing sidewall cores from Moonie Nos 1 and 3 Wells is also appreciated.

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APPENDIX A

Summary of Samples Studied

Moonie No. 1 Well

Depth (feet)	Sample	Lithology	Relative Spore Yield
6035	Sidewall Core	shale	barren
6027	"	sandstone	"
5964	"	sandstone	"
5918-5925	Core No. 5	conglomerate	"
5828	Sidewall Core	sandstone	"
5712	"	sandstone	"
5351-5356	Core No. 4	shale	abundant
5333	Sidewall Core	sandstone	barren
5260	"	sandstone	"
5108	"	sandstone	"
4795-4805	Core No. 1	shale	abundant
4698	Sidewall Core	sandstone	barren
4600	"	sandstone	"
4300	"	coal	abundant
4247	"	shale	barren
4190-4200	Coal Fraction	coal	abundant
3930-3940	"	coal	"
3730-3740	"	coal	"
3600-3610	"	coal	"
2410-2440	"	coal	"
1390-1400	Cuttings	carb. shale	"
820- 830	"	carb. shale	"
350- 360	"	shale	poor
250- 260	"	shale	poor

Moonie No. 3 Well

Depth (feet)	Sample	Lithology	Relative Spore Yield
5896	Core No. 11	shale	poor
5884	"	shale	abundant
5875	Core No. 10	shale	"
5868	Core No. 9	shale	"
5839	Core No. 7	carb. sandstone	"
5824	"	shale	"
5818	Core No. 6	shale	poor
5724	Core No. 5	carb. sandstone	abundant

Depth (feet)	Sample	Lithology	Relative Spore Yield	Remarks
5718	Core No. 5	sandstone	barren	
5714	"	sandstone	poor	
5702	"	shale	abundant	
5696	Core No. 4	coal	"	
5690	"	sandstone	barren	
5654	Core No. 2	shale	abundant	
5603	Sidewall Core	shale	poor	
5592	"	shale	abundant	
5450	"	shale	poor	
5252	"	sandstone	barren	
5233	"	shale	abundant	
4318	"	shale	-	badly contaminated
4256	"	coal	abundant	
4227	"	shale	-	badly contaminated

<u>Relative Spore Yield (five slides systematically traversed)</u>

Very poor	0 - 10	spores
Poor	10 - 100	"
Good	100 - 200	"
Abundant	200 +	"

APPENDIX B

Alphabetic List of Spores and Pollens listed in Figure 3

	No.
Acanthotriletes pallidus	36
Alisporites spp.	17
sp. nov. aff. Annulispora	11
Annulispora densata	9
A. folliculosa	21
A. microannulata	10
Araucariacites spp.	6
A. sp. (Ipswich type)	18
Callialasporites dampieri	51
C. segmentatus	35
Cicatricosisporites australiensis	65
C. cooksonii	60
Cingulatisporites granulatus	46
Classopollis sp.	14
Concavisporites mortoni	16
Cyathidites sp. nov. 1	58
C. sp. nov. 2	66
C. australis/minor group	57
C. parvus	47
Cyclosporites hughesi	67
Ginkgocycadophytus spp.	13
G. crassimarginis	53
Gleicheniidites sp.	33
Granulatisporites sp. nov. 3	37
G. minor	42
Ischyosporites spp.	28
I. punctatus	63
Laricoidites reidi	19
L. turbatus	32
Leiotriletes spp.	4
L. sp. nov. 1	30
L. magnus	54
sp. nov. 1 aff. Leptolepidites	59
Leptolepidites verrucatus	45
sp. nov. aff. Lycopodiumsporites	38
Lycopodiumsporites spp.	5
L. sp. nov. 3	49
L. rosewoodensis	15
L. triangularis	55
Marsupipollenites psilatus	56
Microcachrydites antarcticus	61
Microreticulatisporites sp. nov. 1	64
Murospora sp.	68
Osmundacidites spp.	3

	No.
O. comaumensis	62
O. cf. wellmanii	22
Perotriletes sp. nov. 1	39
Pityosporites spp.	1
P. sp. nov. 1	40
P. parvisaccatus	26
P. psilatus	52
Podosporites sp.	27
P. microsaccatus	69
Rugulatisporites ramosus	44
Sphagnumsporites spp.	2
S. sp. nov. 1	29
S. clavus	20
Taurocusporites sp. nov. 1	12
T. cf. reduncus	25
T. cf. triangularis	23
Verrucosisporites sp. nov. 1	50
V. sp. nov. 2	24
V. triangularis	48
V. walloonensis	43
Vitreisporites contectus	8
V. subtilis	7
gen. nov. conifer pollen	31
microplankton	34

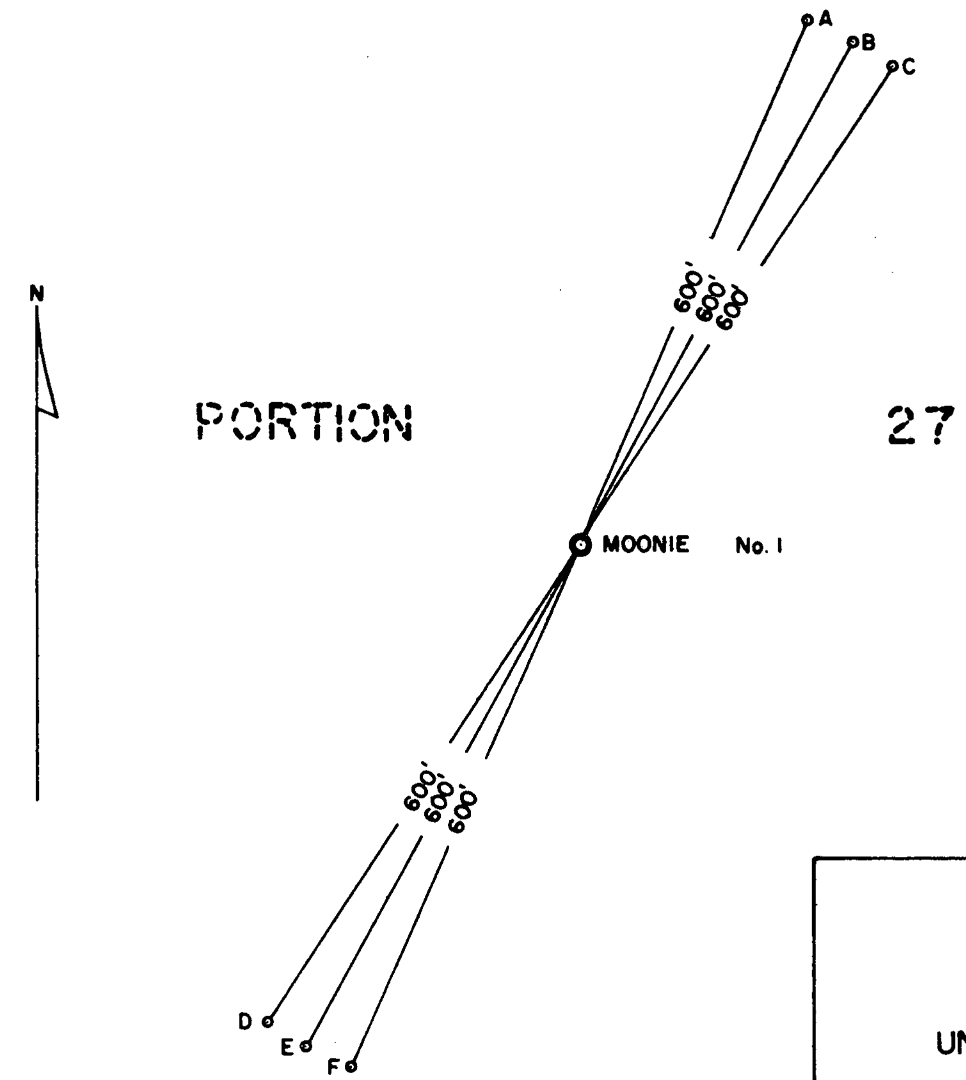
APPENDIX 3

WELL LOGGING

UNION-KERN-A.O.G. MOONIE NO. 1

CONTENTS

Fig. 5



o U. G. C. SHOT POINTS

SURVEY PLAT

VELOCITY SURVEY

for

UNION – KERN – A.O.G. MOONIE No. 1

By

PARTY 126, UNITED GEOPHYSICAL CO. S.A.

200 0 200 400

FEET

SCALE: 1 inch = 200 feet	
DATE: DEC. 7, 1961	

Fig. 6

COMPANY	WELL	LOCATION
U.K.A.	MOONIE NO.1	PORTION 27 PARISH OF DILBONG COUNTY OF PRING STATE OF QUEENSLAND.

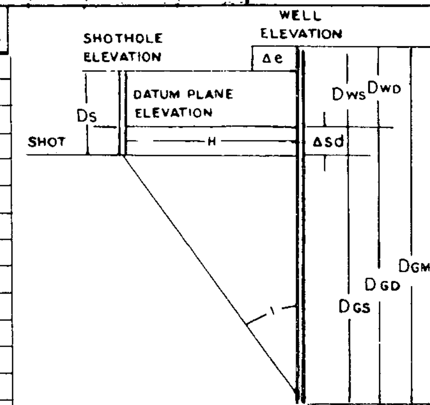
SHOT HOLE	ELEVATION	DISTANCE	SHOT HOLE	ELEVATION	DISTANCE
A	870′		D	869′	
B	870′		E	869′	
C	870′		F	869′	

ELEVATION	
KELLY BUSH	887′
ROTARY TBL	
DERRICK FL	
GROUND	869′

REF. GEO.	RECORD NO.	SHOT HOLE NO	DGM	TUS	TC	DS	ΔE	DWS	ΔS	DGS	H	Cot I	Cos I	T	GRADE	TGS	ΔSD/V	TGD	DGD
.090	B	16	1650	.040	NE	148	+17	165	78	1485	600	2.4750	.9272	.195	G	.1808	.0117	.1925	1563
.094	F	17	1650	.040	SW	146	+18	164	77	1486	"	2.4767	.9272	.195	G	.1808	.0116	.1924	1563
.094	B	15	2256	.040	NE	148	+17	165	78	2091	"	3.4850	.9612	.252	G	.2422	.0117	.2539	2169
.094	F	14	2256	.040	SW	148	+18	166	79	2090	"	3.4833	.9612	.250	F	.2403	.0119	.2522	2169
.092	E	1	2900	.040	SW	148	+18	166	79	2734	"	4.5567	.9768	.317	P	.3096	.0119	.3215	2813
.088	A	13	3540	.039	NE	148	+17	165	78	3375	"	5.6250	.9846	.379	F	.3732	.0117	.3849	3453
.092	D	12	3540	.040	SW	150	+18	168	81	3372	"	5.6200	.9846	.379	F	.3732	.0122	.3854	3453
.089	B	11	4050	.040	NE	148	+17	165	78	3885	"	6.4750	.9883	.432	F	.4269	.0117	.4386	3963
.090	D	10	4595	.041	SW	150	+18	168	81	4427	"	7.3783	.9909	.482	F	.4776	.0122	.4898	4508
.088	B	9	4595	.041	NE	148	+17	165	78	4430	"	7.3833	.9909	.481	F	.4766	.0117	.4883	4508
.090	D	8	5150	.040	SW	147	+18	165	78	4985	"	8.3083	.9928	.527	F	.5232	.0117	.5349	5063
.089	B	7	5630	.039	NE	148	+17	165	78	5465	"	9.1083	.9940	.568	F	.5646	.0117	.5763	5543
.090	D	6	5630	.043	SW	148	+18	166	79	5464	"	9.1067	.9940	.567	P	.5640	.0119	.5759	5543
.091	E	5	5925	.040	SW	148	+18	166	79	5759	"	9.5983	.9946	.588	P	.5848	.0119	.5967	5838
.090	C	4	6096	.034	NE	112	+17	129	42	5967	"	9.9450	.9950	.607	P	.6040	.0063	.6103	6009
.093	E	3	6096	.041	SW	148	+18	166	79	5930	"	9.8833	.9949	.601	?	.5979	.0119	.6098	6009
.087	C	2	6096	.035	NE	122	+17	139	52	5957	"	9.9283	.9950	.606	?	.6030	.0078	.6108	6009

ΔDGD	ΔTGD	VI INTERVAL VELOCITY
1563	.192	8141
606	.0606	10,000
644	.0685	9,401
640	.0637	10,047
510	.0534	9,551
545	.0504	10,813
555	.0459	12,091
480	.0412	11,650
295	.0206	14,320
171	.0136	12,573

VA AVERAGE VELOCITY
8124
8573
8750
8964
9036
9219
9465
9622
9784
9846

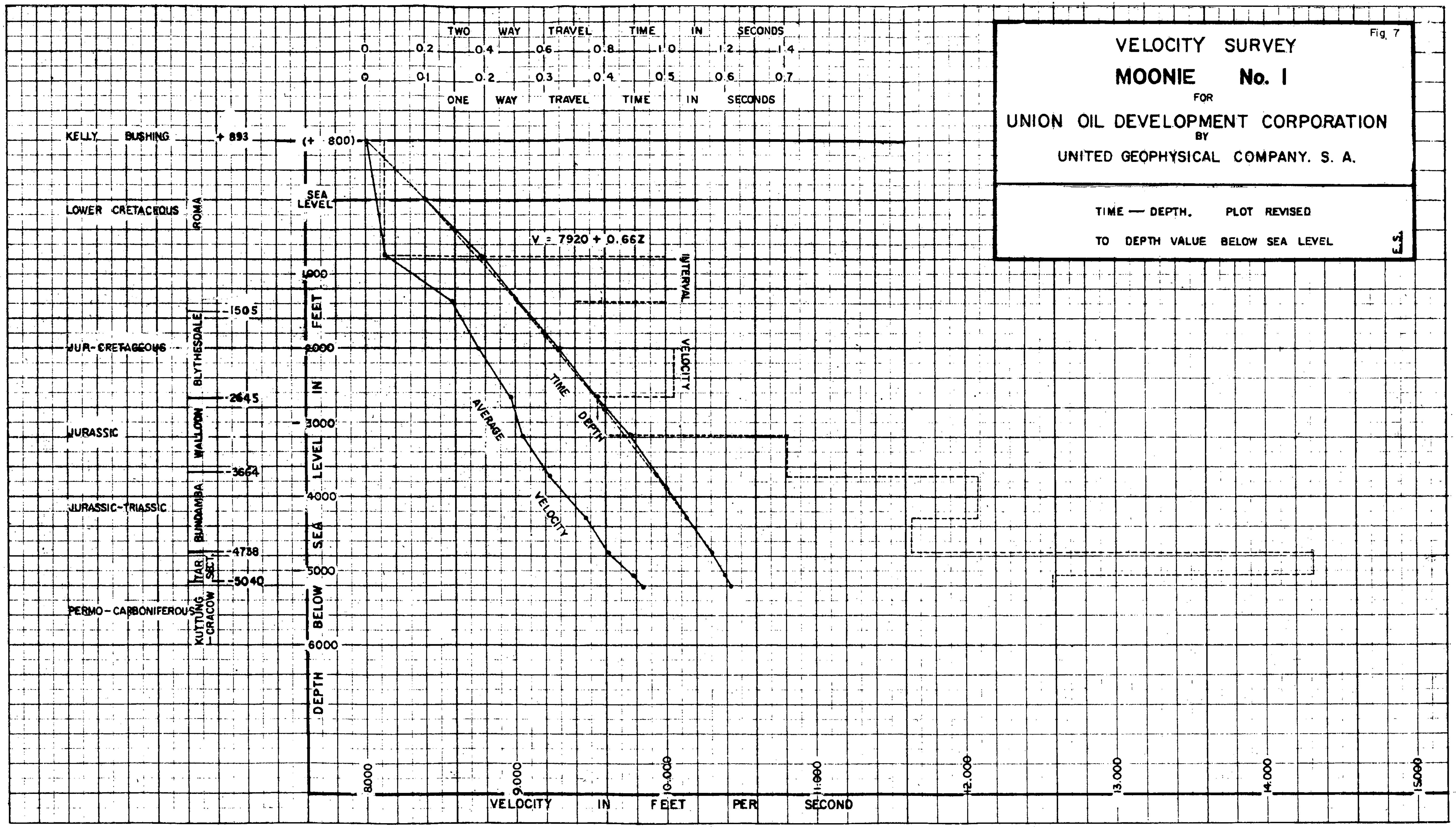


DWD = KELLY ELEVATION MINUS DATUM ELEVATION
DGM = SEISMOMETER DEPTH BELOW KELLY ELEVATION
TUS = UPHOLE TIME OF SHOT
TC = TIME CORRECTION (FROM REFLECTION, REFRACTION, OR UPHOLE TIME)
DS = DEPTH OF SHOT
ΔE = KELLY ELEVATION MINUS SHOTHOLE ELEVATION
DWS = DS + ΔE
ΔSD = DWS − DWD
DGS = DGM − DWS
H = HORIZONTAL DISTANCE, WELL TO SHOTHOLE
COT I = DGS / H
T = WELL SEISMOMETER TIME FROM TIME BREAK
TGS = T COS I
TGD = TGS + ΔSD/VI = VERTICAL TRAVEL TIME, WELL SEISMOMETER TO DATUM PLANE.
DGD = DGM − DWD = VERTICAL DISTANCE, WELL SEISMOMETER TO DATUM PLANE
VI = INTERVAL VELOCITY = ΔDGD/ΔTGD
VA = AVERAGE VELOCITY = DGD/TGD

SURVEYED FOR:
SURVEYED BY:
COMPUTED BY:
DATE SURVEYED:

CASING:

WEATHERING: Datum. elev: 800′a.s.l.
Datum veloc. 6666 f/s.



VELOCITY SURVEY
MOONIE No. I
FOR
UNION OIL DEVELOPMENT CORPORATION
BY
UNITED GEOPHYSICAL COMPANY. S. A.
Fig. 7
TIME — DEPTH. PLOT REVISED
TO DEPTH VALUE BELOW SEA LEVEL
E.S.
TWO WAY TRAVEL TIME IN SECONDS
0 0.2 0.4 0.6 0.8 1.0 1.2 1.4
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7
ONE WAY TRAVEL TIME IN SECONDS
KELLY BUSHING
+ 893
(+ 800)
SEA LEVEL
LOWER CRETACEOUS
ROMA
V = 7920 + 0.66Z
INTERVAL
VELOCITY
1000
FEET
1505
BLYTHESDALE
JUR-CRETACEOUS
2000
IN
2645
TIME
TRAVEL
DEPTH
AVERAGE
VELOCITY
WALLOON
JURASSIC
3000
LEVEL
3664
BUNDAMBA
JURASSIC-TRIASSIC
4000
SEA
4738
TAR SECT.
5000
5040
BELOW
PERMO-CARBONIFEROUS
KUTTUNG-CRACOW
6000
DEPTH
8000
9.000
10.000
11.000
12.000
13.000
14.000
15.000
VELOCITY IN FEET PER SECOND

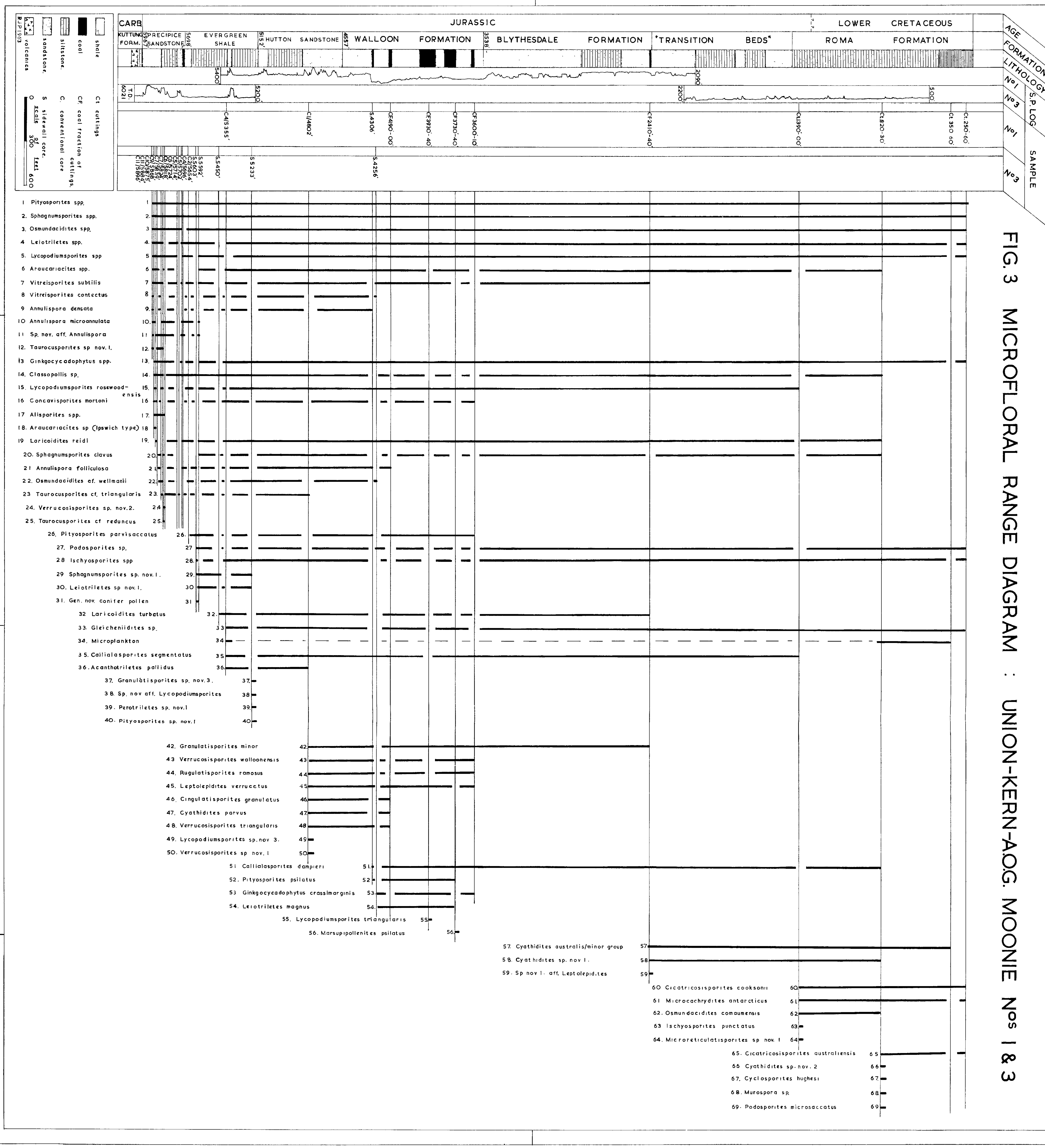


FIG. 3 MICROFLORAL RANGE DIAGRAM : UNION-KERN-A.O.G. MOONIE Nos 1 & 3

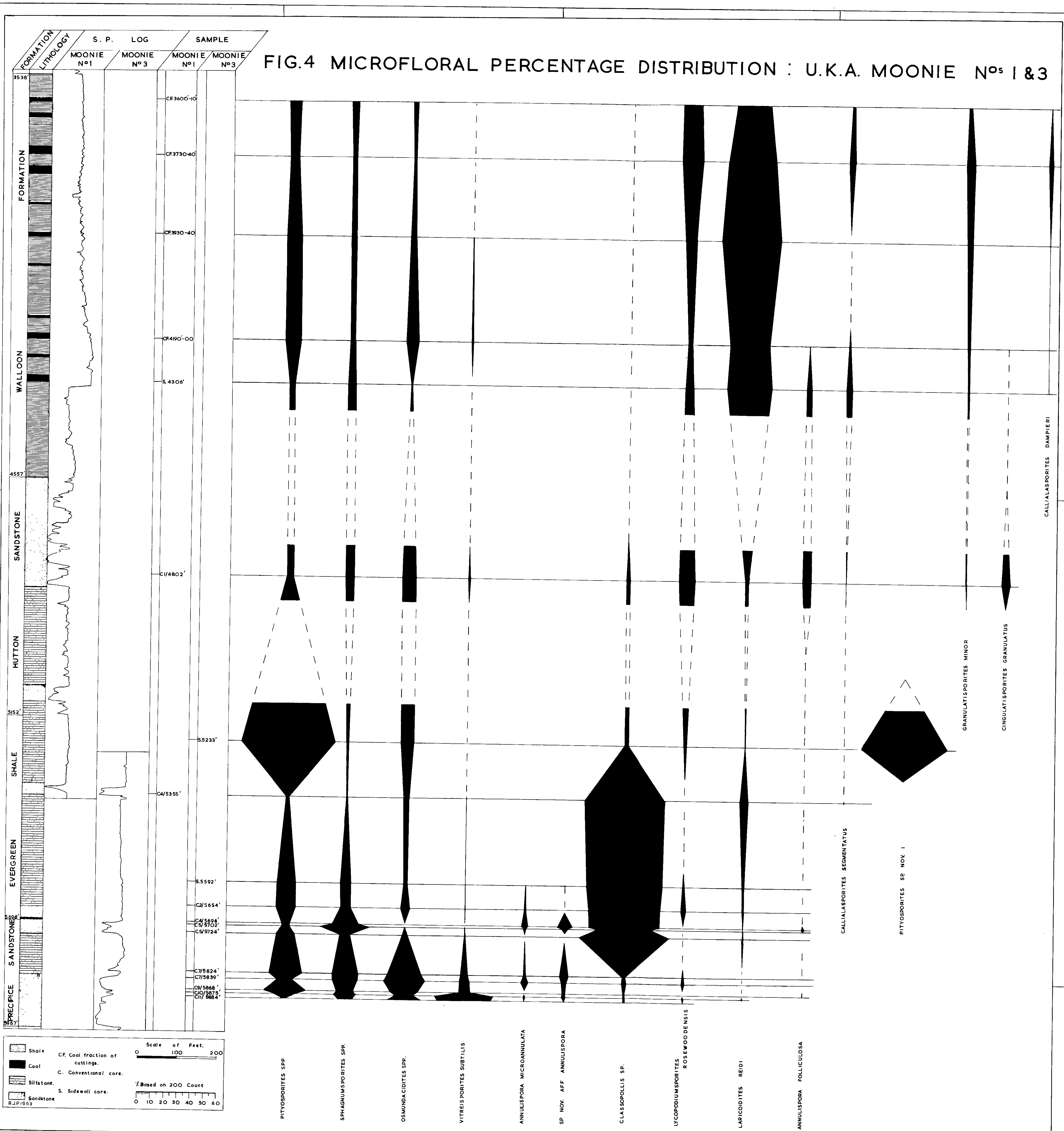


FIG.4 MICROFLORAL PERCENTAGE DISTRIBUTION : U.K.A. MOONIE Nºs 1 & 3

UNION-KERN-A.O.G. MOONIE NO. 1.

VELOCITY SURVEY

by

D.L. Olson*

A survey was conducted on 7th December, 1961, to determine the subsurface velocities at Union-Kern-A.O.G. Moonie No. 1. The survey was conducted by United Geophysical Company Party 126 which was based in a tent camp in the Moonie Area, Queensland. The well at the time of the survey had been drilled to a depth of 6106 feet sub-kelly bushing.

Well depths were measured with a Schlumberger cable with reference to the kelly bushing: the elevation was 887 feet above sea level.

A total of ten horizons was tested at depths ranging from 1650 feet, the approximate base of the surface pipe, to 6096 feet sub-kelly bushing. Horizons of geological significance were chosen where possible and at these horizons, shots were taken at opposite sides of the well.

The velocity distribution $V_z = 7920 + 0.66z$ feet per second was determined by using Miller's method (Seismic Prospecting for Oil by Dix) and checked by the formula

$$T = \frac{2}{k} \log_e \left(1 + \frac{kz}{Vo}\right) \text{ where } Vo = 7920 \text{ feet per second and } k = 0.66.$$

* Union Oil Development Corporation.

WELL LOGGING

SCHLUMBERGER ELECTRIC LOG

Run No.	1	2
Date	1.12.1961	6.12.1961
First Reading	5917	6105
Last Reading	1630	5750
Feet Measured	4287	355
Casing Schlumberger	1630	1630
Casing Driller	1636	1636
Depth Reached	5918	6106
Bottom Driller	5925	6106
Depth Datum	K.B.	K.B.
Mud Nature	Gel.	Gel.
Mud Density	75	77
Mud Viscosity	55	53
Mud Resistivity	5.3 at 84°F	4.7 at 87°F
Mud Resist. B.H.T.	3.1 at 144°F	2.7 at 145°F
Mud pH	9	9
Mud Water Loss	10 cc/30 min.	7 cc/30 min.
Max. Temp.	144°F	145°F
Bit Size	9 7/8"	9 7/8"
Spacings - AM1	16"	16"
AM2	64"	64"
AO	18' 8"	18' 8"
Operator Rig Time	2:00 hr	1:30 hr
Truck No.	325	324
Recorded By	A. Baudot	A. Baudot
Witness	D.J. McGarry	D.J. McGarry

SCHLUMBERGER CONTINUOUS DIPMETER

Run No.	1
Date	9.12.1961
Casing Schlumberger	1630
Casing Driller	1636
Total Depth Schlumberger	6106
Total Depth Driller	6106
Total Depth Reached	6078
Bit Size	9 7/8" to T.D.
Mud Nature	Gel.
Mud Density	77
Mud Viscosity	53
Mud Resistivity	4.7 at 86^{o}F
B.H.T.	145^{o}F
Mud Water Loss	7 cc/30 min.
Logging Speed	2000 ft/hr
First Reading	6078
Last Reading	1630
Feet Measured	4448
Truck No.	325
Observer	A. Baudot
Witness	D. Pyle
Computer	R.D. ED. BA.
Magnetic Declination	8^{o} East
Levels	1 to 90

SCHLUMBERGER LATEROLOG

Run No.	1
Date	8.12.1961
First Reading	6104
Last Reading	4500
Feet Measured	1604
Casing Schlumberger	1630
Casing Driller	1636
Depth Reached	6107
Bottom Driller	6106
Mud Nature	Gel.
Mud Density	77
Mud Viscosity	53
Mud Resistivity	4.7 at 86°F
Mud Resist. B.H.T.	2.7 at 145°F
Mud pH	9
Mud Water Loss	7 cc/30 min.
Rmf	5.2 at 86°F
Bit Size	9 7/8"
Operator Rig Time	2:00 hr
Truck No.	325
Recorded By	A. Baudot
Witness	D. Pyle

SCHLUMBERGER SONIC LOG

Run No.	1
Date	8.12.1961
First Reading	6092
Last Reading	1630
Feet Measured	4462
Casing Schlumberger	1630
Casing Driller	1636
Depth Reached	6099
Bottom Driller	6106
Mud Nature	Gel.
Mud Density	77
Mud Viscosity	53
Mud Resistivity	4.7 at 86°F
Mud Resist. B.H.T.	2.7 at 145°F
Mud pH	9
Mud Water Loss	7 cc/30 min.
Origin of Sample	Flow Line
Rmf	5.2 at 86°F
Bit Size	9 7/8" to T.D.
Casing Size	13 3/8"
Operator Rig Time	5:00 hr
Truck No.	325
Recorded By	A. Baudot
Witness	D. Pyle

SCHLUMBERGER MICROLOG

Run No.	1	2
Date	2.12.1961	6.12.1961
First Reading	5921	6046
Last Reading	3600	5800
Feet Measured	2321	246
Depth Reached	5924	6107
Bottom Driller	5925	6106
Depth Datum	K.B.	K.B.
Mud Nature	Gel.	Gel.
Mud Density	75	77
Mud Viscosity	55	53
Mud Resistivity	5.3 at 84°F	4.7 at 86°F
Mud Resist. B.H.T.	3.1 at 144°F	2.7 at 145°F
Mud pH	9	9
Mud Water Loss	10 cc/30 min.	7 cc/30 min.
Rmf	7.2 at 69°F	5.2 at 86°F
Mud Log Rm	3.5	2.7
Depth	5800	6000
Bit Size	9 7/8"	9 7/8"
Sonde Type	WRS-T	WRS-T
Pad Type	Hydraulic Type 1	Hydraulic Type 1
Operator Rig Time	4:00 hr	2:00 hr
Truck No.	325	325
Recorded by	A. Baudot	A. Baudot
Witness	D.J. McGarry	D.J. McGarry

SCHLUMBERGER GAMMA RAY LOG

Run No.	1
Date	14.12.1961
Depth Reference	K.B.
First Reading	5905
Last Reading	0
Feet Measured	5905
Max. Depth Reached	5906
Bottom Driller	5910
Maximum Temp.	145°F
Mud Nature	Gel.
Mud Density	76
Mud Viscosity	64
Mud Resistivity	4.7 at 86°F
Casing Size	5 1/2"
Casing Weight	17 lb./ft
Open Hole	9 7/8" to T.D.
Fluid Level	Surface
Recording Speed	850 ft/hr
Sensitivity Tap	200
Time Constant	4
Panel	GNP-C
Operator Rig Time	11:00 hr
Sonde Type and Size	3 3/8" GNAM-5
Truck No.	325
Observer	A. Baudot

HYDROCARBON ANALYSIS LOG

Depth Logged	From 25 to 6106 feet
Date Logged	From 12th November, 1961 to 6th December, 1961
Total Depth	6106 feet
Depth Datum	K.B.
Supervising Engineer	D.J. McGarry
Company Geologist	D.J. McGarry

SCHLUMBERGER ELECTRIC LOG INTERPRETATION

UNION-KERN-A.O.G. MOONIE NO. 1

1. UPPER SAND

ES depth 5643 - 5690 feet

This sand can be split into three parts:

(i) 5643 - 5652 feet

(ii) 5658 - 5662 feet

(iii) 5674 - 5690 feet

Rm = 3.1 at B.H.T. (144°F)

Rmf = 2.8 at B.H.T. (144°F) Rxo = F x Rmf for average F = 20 to 55

(a) Formation Water

From the SP reading at 5680 feet, SP = -53 mv

From Chart A10, $\frac{Rmf}{Rwc} = 4.5$. Hence $Rwc = \frac{Rmf}{4.5} = \frac{2.8}{4.5} = 0.62$ ohm-m

From Chart A12, Rw = 1.6 at 144°F

Check : Rw = 3.3 at 70°F against 3.9 from DST in lower sand.

(b) Rt

Depth	Rsn	Rln	R11	Rsn/Rm	Rln/Rm	d	16"/d	64"/d	Di	Rt/Rm	Rt (ES)	Rt (L)
5680	27	34	27.5	9	11	15"	1.1	4.5	d	9	27.3	27.5
5660	55	too thin	60	17.5	-	11"	1.5					60
5648	65	60	58	21	19.5	9 1/2"	1.7	6.7	<2d	18	55.8	58
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(c) Porosity - Formation factor

From ML, Rmc = 2.5 at B.H.T.

Depth	R2"	R1" x 1"	R2"/Rmc	R1" x 1"/Rmc	Rxo/Rmc	Rxo	F assuming ROS = 0%	ROS = 10%
5680	8	5	3.2	2	15	37.5	13.5	
5648	9	5.5	3.6	2.2	20	50	18	14.5

From Sonic Log

Depth	Δ t	tm	%	F	(Rw= 1.6) FRw	Rt	Sw%
5680	83	54	22	17	26	27	100
5660	79	54	19	23	36.5	60	77
5648	83	54	22	17	26	58	67

SCHLUMBERGER ELECTRIC LOG INTERPRETATION

UNION-KERN-A.O.G. MOONIE NO. 1

2. LOWER SAND

ES depth 5798 - 5896 feet

Rm = 3.1 at B.H.T. (144°F)

Rmf = 2.8 at B.H.T. (144°F)

Rmc = 2.5 at B.H.T. (144°F)

(a) Formation Water

DST (i) From analysis: Equivalent 1550 ppm.

Rw = 3.9 at 65°F

Rw = 1.7 at 144°F (B.H.T.)

(ii) From surface measurement:

Rw = 3.9 at 65°F

Rw = 1.7 at 144°F

(iii) From Chart A10: SP = -48 mv at 5880 feet

$\frac{Rmf}{Rwc} = 4.0$

$Rwc = \frac{2.8}{4.0} = 0.7$ ohm-m

From Chart A12: Rw = 1.8 at 144°F

(b) Rt

Depth	R11	Rsn	Rln	d	16"/d	64"/d	Rsn/Rm	Rln/Rm	Di	Rt/Rm	Rt
5870 -											
5890	65	65	75	9"	1.75	7	21	24	<2d	19	65
5860	80	75	100	9"	1.75	7	24	32	d	26	80
5840 -											
5850	85	75	110	9"	1.75	7	24	36	d	28	85
5824	115	100	thin	9"	1.75	7	32				115
5814	110	100	thin	9"	1.75	7	32				110

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(c) Porosity Sonic Log and Saturation

Depth	Δt	%	F	FRw	Rt	Sw%
5870 -						
5890	73	15	23	39	65	77
5860	74	15.5	23	39	80	70
5840 -						
5850	78	18	21.5	36.5	85	63
5824	77	17.5	22	37.5	115	57
5814	75	16	22.5	38	110	59

APPENDIX 4

RESERVOIR ENGINEERING

UNION-KERN-A.O.G. MOONIE NO. 1

CONTENTS

UNION-KERN-A.O.G. MOONIE NO. 1

PRODUCTION AND FORMATION TESTS

Formation Lower Bundamba

Perforated Intervals 5798 - 5840 feet. 4-1/2" Jet Shots per foot.

Date	Oil bbl.	Gravity °API	Cut %	Water bbl.	Gas Mcf	Tbg. p.s.i.	Csg. p.s.i.	Bean /64"	Hours
23.12.61	252	48	10.6	30	23	50-150	0	64	2.75
27.12.61	195	47	4.9	10	21	0- 50	240-350	64	2.5
28.12.61	330	47	2.9	10	36	220-560	220-756	64-10	18.75
29.12.61	76	47	11.6	10	7	0	600	64	1.0
1. 2.62	590	46	tr.	-	96	600	400	64-12	24
2. 2.62	240	46	tr.	-	41	600	700	12	24
3. 2.62	236	45	tr.	-	36	600	700	12	24
4. 2.62	207	45	tr.	-	38	600	700	12	24
5. 2.62	185	45	tr.	-	36	600	700	12	24
6. 2.62	121	45	tr.	-	32	610	700	12	24
7. 2.62	87	45	tr.	-	14	625	700	12	10.5
8. 2.62	Shut in					666	750		
9. 2.62	Shut in					666	700		
10. 2.62	505	45	tr.	-	131	540	600	64-17	13.2
11. 2.62	504	45	tr.	-	95	586	650	17-14	24
12. 2.62	461	45	tr.	-	83	590	650	14	24
13. 2.62	464	45	tr.	-	83	590	650	14	24
14. 2.62	402	45	tr.	-	73	620	700	14	24
15. 2.62	547	45	tr.	-	105	550	600	17-18	24
16. 2.62	685	45	tr.	-	126	550	630	18	24
17. 2.62	666	45	tr.	-	124	560	600	18	24
18. 2.62	523	45	tr.	-	97	575	645	18	20.2
19. 2.62	Shut in								
Cumulative	Production:								
	7445				1320				

Open Hole Formation Tests

Date	Tester	Interval (feet)	Packer (feet)	Water Cushion (feet)	Open	Results
3.12.1961	Howco	5816-5925	5816	300	1 hour 38 mins	Opened test tool with good blow on 1/2" choke in tool. Water cushion to surface in 19 mins. Formation fluid to surface in total of 24 minutes. Flowed 74 minutes on a rate of 500 B/D gross fluid, 250 B/D 48° API gravity crude, 250 B/D 29 g/g water, and 200 Mcf/D gas. Closed tool and took 34-minute final shut-in pressure. Initial Hydrostatic 3115 p.s.i. Initial Flow 2020 p.s.i. Final Flow 2515 p.s.i. Final Shut-in 2800 p.s.i. Final Hydrostatic 3065 p.s.i.

Interval (feet)	Formation	Hole Condition	Packer (feet)	Water Cushion	Open	Remarks
5840	Bundamba	Plug 5910' WSO 5614'	5821	None	2 hours 5 mins	Opened tool with medium blow steadily increasing to strong blow. Fluid to surface in 40 minutes. Flowed 1440 B/D 48° API crude with trace cut and 100 Mcf/D gas through 5/8" choke in tester. After 85-minute flow test, shut tool in for one hour. Initial Hydrostatic 3175 p.s.i. Initial Flow 450 p.s.i. Final Flow 1670 p.s.i. Final Shut-in 2412 p.s.i. Final Hydrostatic 3175 p.s.i.
5808-5814 5818-5840	Bundamba	Plug 5910' WSO 5614'	5791	360'	50 mins	Tool plugged.
5808-5814 5818-5840	Bundamba	Plug 5910' WSO 5614'	5791	360'	1 hour 16 mins	Opened tool with strong blow. Fluid cushion to surface in 8 minutes. Formation fluid to surface in 11 mins. Well flowed at rate of 1765 B/D 47° API crude with trace mud and water and 175 Mcf/D gas through a 5/8" choke in tool. Inside Initial Hydrostatic 3020 p.s.i. Initial Flow 820 p.s.i. Final Flow - Final Shut-in - Final Hydrostatic 3005 p.s.i. Outside Initial Hydrostatic 3005 p.s.i. Initial Flow 1650 p.s.i. Final Flow 2165 p.s.i. Final Shut-in 2480 p.s.i. Final Hydrostatic 3040 p.s.i.
5650	Bundamba	Plug 5702' WSO 5614'	5634	360'	60 mins	Opened tool with slight blow, tool open 60 minutes with slight blow throughout. No gas to surface. Pulled tool and recovered 1775 feet gross fluid rise as follows : 360 feet fluid cushion, 135 feet gas-cut mud, 360 feet clean 54° oil, 460 feet gas and oil-cut mud, 270 feet oil and water emulsion, 110 feet clean oil, 80 feet emulsion with 25% free water.

Interval (feet)	Formation	Hole Condition	Packer (feet)	Water Cushion	Open	Remarks
5650	Bundamba	Plug 5702' WSO 5614'	5634	360'	60 mins	Initial Hydrostatic 2930 p.s.i. Initial Flow 260 p.s.i. Final Flow 540 p.s.i. Final Hydrostatic 2865 p.s.i.

The perforations at 5614 feet and 5650 feet were squeeze cemented. The cement plug and cast iron bridge plug at 5702 feet were drilled out. The zone from 5798 to 5840 feet was perforated with 4-1/2" jet shots per foot. Tubing was then run into the well and hung open ended at 5779 feet. After installation of wellhead equipment the well was returned to production from this zone. (See initial production).

The well was produced for a short period of time during which pressure and temperature surveys were conducted on 21st February, 1962. The well was shut-in and suspended, but retained in a condition to be produced at any future time.

UNION-KERN-A.O.G. MOONIE NO. 1

SUBSURFACE PRESSURE AND TEMPERATURE SURVEYS

Subsurface Pressure Survey, 27th December, 1961

Casing:	5 1/2" C.5950'	
Elevation:	893' K.B.	
J.P. 5614' W.S.O.	J.P. 5650' sq. Cmtd.	J.P. 5798-5840'
Cement Plug:	5910'	
Tubing Detail:	2 3/8" H. 5779'	
Zero Point:	K.B.	
Zone:	58-0 Sand	
Top of Swab Valve:	12' below K.B.	
Purpose:	Static Pressure Survey and Gradient	
Remarks:	Lubricator leaked oil and found tubing pressure at 810 p.s.i. after finish of survey	
Pick up at:	5827'	
Maximum Temperature:	154 ^{o}F	

Depth (feet)	Pressure (p.s.i.)	Gradient		
0	711	0.300	Stabilization Period	30 days
1000	1032	0.305	Gross Oil Rate B/D	-
2000	1368	0.310	Net Oil Rate B/D	-
3000	1684	0.330	Formation Gas Mcf/D	-
4000	2008	0.340	GOR cu. ft/bbl.	-
5000	2336	0.360	Circulated Gas Mcf/D	-
5500	2510	0.360	Oil Dry Gravity ^{o}API	-
5700	2579	0.380	Bean Size	-
5826	2660	0.635	Casing Pressure	555 p.s.i.g.
			Tubing Pressure	1005-810 p.s.i.g.

Subsurface Pressure Survey, 31st January, 1962

Casing:	5 1/2" C. 5950'
Elevation:	893' K.B.
J.P. 5614' W.S.O.	J.P. 5798-5840'
Cement Plug:	5910'
Tubing Detail:	2 3/8" H. 5779'
Zero Point:	K.B.
Zone:	58-0 Sand
Purpose:	Static Pressure Survey
Pick up at:	-
Maximum Temperature:	154 ^{o}F at 5821'

Depth (feet)	Pressure (p.s.i.)	Gradient		
5821	2336	0.322	Stabilization Period	32 days
5700	2299	0.320	Gross Oil Rate B/D	-
5000	2077	0.318	Net Oil Rate B/D	-
2500	1280	0.322	Formation Gas Mcf/D	-
1000	783	0.278	GOR cu. ft/bbl.	-
0	505		Circulated Gas Mcf/D	-
			Oil Dry Gravity ^{o}API	-
			Bean Size	-
			Casing Pressure	730 p.s.i.
			Tubing Pressure	505 p.s.i.

Subsurface Temperature Survey, 5th February, 1962

Casing:	5 1/2" C. 5950'
Elevation:	893' K.B.
J.P. 5798-5840'	
Cement Plug:	5910'
Tubing Detail:	2 3/8" H. 5779'
Zero Point:	K.B.
Zone:	58-0 Sand
Purpose:	Flowing Temperature Survey
Remarks:	Combined results of two runs

Depth (feet)	*Temperature (°F)	Gradient		
0	90		Stabilization Period	4 days
500	95		Gross Oil Rate B/D	185
1000	101		Net Oil Rate B/D	185
1500	107		Formation Gas Mcf/D	36
2000	113		GOR cu. ft/bbl.	194
2500	118		Circulated Gas Mcf/D	-
3000	124	1.13°	Oil Dry Gravity °API	45
3500	129	per	Bean Size	12/64"
4000	135	100 ft	Casing Pressure	735 p.s.i.
4500	141		Tubing Pressure	628 p.s.i.
5000	146			
5500	152			
5700	154			
5830	156			

* Temperatures obtained from straight line graph. For observed temperatures, see field Work Sheet.

Subsurface Pressure Survey, 5th February, 1962

Casing:	5 1/2" C. 5950'
Elevation:	893' K.B.
J.P. 5798-5840'	
Cement Plug:	5910'
Tubing Detail:	2 3/8" H. 5779'
Zero Point :	K.B.
Depth:	5821'
Zone:	58-0 Sand
Purpose:	Flowing Pressure Survey
Pick up at:	-
Maximum Temperature:	155°F at 5821'

Depth (feet)	Pressure (p.s.i.)	Gradient		
0	651	0.300	Stabilization Period	-
1000	938	0.323	Gross Oil Rate B/D	185
2000	1266	0.323	Net Oil Rate B/D	185
3000	1600	0.323	Formation Gas Mcf/D	36
4000	1908	0.323	GOR cu. ft/bbl.	195
5000	2230	0.323	Circulated Gas Mcf/D	-
5500	2400	0.323	Oil Dry Gravity °API	45
5700	2451	0.323	Bean Size	12/64"
5821	2492	0.323	Casing Pressure	735 p.s.i.
			Tubing Pressure	625 p.s.i.

Subsurface Pressure Survey, 7th-10th February, 1962

Casing:	5 1/2" C. 5950'
Elevation:	893' K.B.
J.P. 5798-5840'.	J.P. 5614' W.S.O.
Cement Plug:	5910'
Tubing Detail:	2 3/8" H. 5779'
Zero Point:	K.B.
Depth:	5821'
Zone:	58-0 Sand
Purpose:	Static Pressure Build-up
Remarks:	Instrument hung at 5821' then shut in 20 minutes later for 66 hour static pressure build-up curve.
Pick up at:	-

Depth (feet)	Pressure (p.s.i.)	Hrs S.I.		
5821	2283	0		Flowing 5 days
	2324	1	Stabilization Period	Shut in 66 hrs.
	2326	2	Gross Oil Rate B/D	190
	2327	6	Net Oil Rate B/D	190
	2328	12	Formation Gas Mcf/D	32
	2329	24	GOR cu. ft/bbl.	169
	2330	36	Circulated Gas Mcf/D	-
	2331	48	Oil Dry Gravity °API	45
	2332	66	Bean Size	12/64"
			Casing Pressure	625 F. 663 S.I.
			Tubing Pressure	700 F. 750 S.I.

Instrument hung at 5821'

$$P.I. = \frac{190}{2332-2283} = 3.9$$

Subsurface Pressure Survey, 14th February, 1962

Casing:	5 1/2" C. 5950'
Elevation:	893' K.B.
J.P. 5798-5840'	
Cement Plug:	5910'
Tubing Detail:	2 3/8" H. 5779'
Zero Point:	K.B.
Depth:	5830'
Zone:	58-0 Sand
Purpose:	Flowing Pressure Survey
Pick up at:	-
Maximum Temperature:	156^{o}F at 5830'

Depth (feet)	Pressure (p.s.i.)	Gradient		
0	460	0.282	Stabilization Period	-
1000	743	0.282	Gross Oil Rate B/D	402
2000	1052	0.317	Net Oil Rate B/D	402
3000	1372	0.317	Formation Gas Mcf/D	73
4000	1696	0.317	GOR cu. ft/bbl.	182
5000	2004	0.317	Circulated Gas Mcf/D	-
5500	2163	0.317	Oil Dry Gravity ^{o}API	45
5700	2222	0.317	Bean Size	14/64"
5830	2262	0.317	Casing Pressure	670 p.s.i.
			Tubing Pressure	626 p.s.i.

Subsurface Pressure Survey, 18th February, 1962

Casing:	5 1/2" C. 5950'
Elevation:	893' K.B.
J.P. 5798-5840'	
Cement Plug:	5910'
Tubing Detail:	2 3/8" H. 5779'
Zero Point:	K.B.
Depth:	5830'
Zone:	58-0 Sand
Purpose:	Flowing Pressure Gradient
Pick up at:	-
Maximum Temperature:	156°F at 5830'

Depth (feet)	Pressure (p.s.i.)	Gradient		
0	405	0.261	Stabilization Period	-
1000	666	0.261	Gross Oil Rate B/D	666
2000	980	0.318	Net Oil Rate B/D	666
3000	1300	0.318	Formation Gas Mcf/D	97
4000	1620	0.318	GOR cu. ft/bbl.	185
5000	1940	0.318	Circulated Gas Mcf/D	-
5500	2100	0.318	Oil Dry Gravity °API	45
5700	2160	0.318	Bean Size	18/64"
5830	2198	0.318	Casing Pressure	635 p.s.i.
			Tubing Pressure	571 p.s.i.

Subsurface Pressure Survey, 20th February, 1962

Casing:	5 1/2" C. 5950'
Elevation:	893' K.B.
J.P. 5798-5840'	
Cement Plug:	5910'
Tubing Detail:	2 3/8" H. 5779'
Zero Point:	K.B.
Depth:	5821'
Zone:	58-0 Sand
Purpose:	Pressure Build-up after Shut-in
Remarks:	Well shut in at 8:15 p.m., 18th February, 1962.
Pick up at:	-
Maximum Temperature:	156°F at 5821'

Depth (feet)	Pressure (p.s.i.)	Hrs. S.I.		
5821	2250	0	Stabilization Period	Nil
	2287	1/4	Gross Oil Rate B/D	666
	2327	1/2	Net Oil Rate B/D	666
	2335	1	Formation Gas Mcf/D	124
	2340	2	GOR cu. ft/bbl.	186
	2344	3	Circulated Gas Mcf/D	-
	2348	12	Oil Dry Gravity °API	45
	2348	24	Bean Size	18/64"
	2348	36	Casing Pressure (p.s.i.)	643 F. 730 S.I.
			Tubing Pressure (p.s.i.)	588 F. 667 S.I.

Instrument hung at 5821'

$$P.I. = \frac{666}{2348-2250} = 6.55$$

Subsurface Temperature Survey, 21st February, 1962

Casing: 5 1/2" C. 5950'
Elevation: 893' K.B.
J.P. 5798-5840'
Cement Plug: 5910'
Tubing Detail: 2 3/8" H. 5779'
Zero Point: K.B.
Zone: 58-0 Sand
Purpose: Static Temperature Survey

Depth (feet)	* Temperature (°F)	Gradient		
0	87		Stabilization Period	2 days
500	93		Gross Oil Rate B/D	-
1000	98		Net Oil Rate B/D	-
1500	104		Formation Gas Mcf/D	-
2000	110		GOR cu. ft/bbl.	-
2500	115		Circulated Gas Mcf/D	-
3000	121		Oil Dry Gravity °API	-
3500	127	1.15°	Bean Size	-
4000	134	per	Casing Pressure	668 p.s.i.
4500	138	100 ft	Tubing Pressure	755 p.s.i.
5000	144			
5500	150			
5700	152			
5830	154			

* Temperatures taken from straight line graph. For observed temperatures, see Field Work Sheet.

APPENDIX 5

EVALUATION OF OIL AND WATER

UNION-KERN-A.O.G. MOONIE NO. 1

CONTENTS

EVALUATION OF MOONIE NO. 1

CRUDE OIL

by

E.E. Zinser

Union Oil Company of California

The results of a series of tests performed to evaluate the character of the gas and crude oil from Moonie No. 1, Queensland, have been tabulated. Only selected tests were run rather than the complete evaluation programme as outlined in the Crude Oil Data Book.

The crude oil as received had a gravity of 44.4°API and contained 0.002 wt-% sulphur. The crude was fractionated into six fractions as listed below:

	Cut, °F	Vol-%	Gravity °API
Light Ends	X- 120	2.3	-
Light Gasoline	120- 240	14.6	66.6
Heavy Gasoline	240- 430	29.3	53.1
Light Gas Oil	430- 650*	26.4	38.8
Heavy Gas Oil	650-1050**	21.7	34.6
Residuum		5.7	23.7

The knock rating, Research, of the light gasoline fraction was 63.0 clear, and 82.5 with 3 ml of TEL. The cetane index, calculated, of the light gas oil fraction was 58.3. These high ratings are similar to those found for the Cabawin No. 1 crude oil evaluation. The PONA analysis of the heavy gasoline indicated 46% paraffins, 49% naphthenes, and 5% aromatics. Thus, this fraction is slightly more napthenic and less aromatic than the similar cut from Cabawin No. 1 crude oil.

Additional data concerning individual fractions are in the appended tables.

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* Estimated atmospheric distillation temperature; distillation actually carried out at a pressure of 10 mm Hg.

** Estimated atmospheric distillation temperature; distillation actually carried out at a pressure of 1 mm Hg.

TEST DATA ON MOONIE NO. 1 CRUDE OIL

	Crude Oil	Light Ends X-120°F	Light Gasoline 120-240°F	Heavy Gasoline 240-430°F	Light Gas Oil 430-650°F	Heavy Gas Oil 650-1050°F	Light Gas Oil Free Resid.	Heavy Gas Oil Free Resid.
Vol. %	100.0	2.3	14.6	29.3	26.4	21.7	27.4	5.7
Gravity, °API at 60°F	44.4	--	66.6	53.1	38.8	34.6	31.8	23.7
S, Wt. %	0.002							
Doctor Test			H_2S Swt Mercap Swt					
Knock Rating Res, Cl.			63.0					
+ 3 ml			82.5					
Cetane Index Calc.					58.3			
ASTM Dist., °F			(D86)	(D86)	(D86 Gp4)	(D1160T)		
Init.			162	270	464	665		
5%			179	277	480	705		
10%			182	284	486	715		
20%			185	292	494	725		
30%			189	298	503	740		
40%			193	305	512	770		
50%			195	314	524	810		
60%			200	325	534	855		
70%			204	338	546	925		
80%			208	353	561	1050		
90%			212	374	578			
95%			217	386	590			
Dry			231	400	598			
Max			236	404	600			
% Recovery			99.0	99.0	98.0	79.0		
Cut Point, °F		120	240	430	650	1050		
SSU at 210°F							54.1	753.3
PONA, V% P		99	65	46				
O		1	--	--				
N		--	35	49				
A		--	0	5				
Pour Point, °F					+10	+100		
Chromatographic Analysis		Appended	Appended					

Sample: 939-C1 (Light Ends)

Chemist: MGM

Serial No.: B620095

MOONIE NO. 1

UNION OIL COMPANY OF CALIFORNIA

Research Department

C_5-C_6 GAS CHROMATOGRAPHY ANALYSIS

Component	Liquid Vol. %	Component	Liquid Vol. %	Component	Liquid Vol. %	Component	Liquid Vol. %	Component	Liqu Vol.
C_2H_6 / C_3H_8	-- / 0.32	*	--	n-C_6	0.40	1, 1 DMCP	--	2,2,4 TMP	1.01
i-C_4	5.26	2,2 DMB	2.61	MCP	0.29	2,3 DMP	--	Benz	--
n-C_4	4.83	CP	0.14	2,2 DMP + 2,2,3 TMB	--	2-MH	2.09	n-C_7	--
Butenes	1.24	2, 3 DMB	1.89	2, 4, DMP	--	1, cis 3 DMCP	--	MCH	--
i-C_5	51.06	2-MP	5.06	CH	--	3 MH + 1,t3 DMCP	0.69		
n-C_5	21.57	3-MP	1.56	3,3 DMP	--	3 EP + 1, t2 DMCP	--		

* Observable pentenes

Sample: 939-C2 (Light Gaso)

Chemist: MGM

Serial No.: B620094

MOONIE NO. 1

UNION OIL COMPANY OF CALIFORNIA

Research Department

C_5-C_6 GAS CHROMATOGRAPHY ANALYSIS

Component	Liquid Vol. %	Component	Liquid Vol. %	Component	Liquid Vol. %	Component	Liquid Vol. %	Component	Liquid Vol. %
C_2H_6 / C_3H_8	-- / 0.05	*	--	n-C_6	10.45	1,1DMCP	1.05	2,2,4 TMP	--
i-C_4	0.13	2,2 DMB	0.52	MCP	3.00	2,3 DMP	1.94	Benz	--
n-C_4	0.10	CP	--	2,2 DMP + 2,2,3 TMB	1.10	2-MH	7.57	n-C_7	12.94
Butenes	0.02	2, 3 DMB	1.43	2, 4 DMP	1.38	1, cis 3 DMCP	--	MCH	27.12
i-C_5	1.08	2-MP	6.37	CH	4.38	3 MH + 1, t3 DMCP	8.43		
n-C_5	0.86	3-MP	5.29	3,3 DMP	0.83	3 EP + 1, t2 DMCP	3.96		

* Observable pentenes

REPORT OF FRACTIONAL ANALYSIS

Production Service Laboratory - Brea Research Center

Date of Sample:	January, 1962	Report No.:	SP-3
Sample:	Wet Gas		
Well:	Moonie No. 1	District:	Australia
Sample as Received:	20 LB. GA., 80°F		
Sample After Heating:	35 LB. GA., 260°F		
Col. No:	Chrmo.		

	Gas (MCL) Volume %
Nitrogen	0.95
Water Vapour	-
Air	0.00
Carbon Dioxide	0.00
Methane	95.50
Ethane	0.53
Propane	0.17
Iso-Butane	0.28
N-Butane	0.15
Iso-Pentane	0.55
N-Pentane	0.22
Butenes	0.02
Residue (Hexane & Heav.)	1.64*

	Mol. %
* 2,2 Dimethylbutane	0.03
2,3 Dimethylbutane)	
2 Methylpentane)	0.24
Cyclopentane)	
3 Methylpentane	0.12
N-Hexane	0.22
Heptanes	0.39
Octanes	0.40
Nonanes	0.19
Decanes	0.05
	1.64

REPORT OF FRACTIONAL ANALYSIS

Production Service Laboratory - Brea Research Center

Date of Sample:	January, 1962.	Report No. :	SP-4
Sample:	Crude Oil		
Well:	Moonie No. 1	District:	Australia
Sample as Received:	15 LB. GA., 80 ^{o}F		
Col. No.:	1A		

	Liquid Volume%
Methane	0.41
Ethane	0.01
Propane	0.02
Iso-Butane	0.08
N-Butane	0.09
Iso-Pentane	0.79
N-Pentane	0.34
Residue (Hexane & Heav.)	98.26
Gravity of Residue ^{o}API	44.1

UNION-KERN-A.O.G. MOONIE NO. 1

OIL ANALYSIS

by

Bureau of Mineral Resources

The results of an analysis of a sample of crude oil recovered from the interval 5816 to 5925 feet during the open hole formation test run on 3rd December, 1961, are recorded below. The analysis was carried out in accordance with the Institute of Petroleum (London) Standards.

Water content (IP 74/57)	0.07%
Sediments (IP 75/57)	0.30%
Ash (IP 4/60) Less than	0.005%
Open Flash Point (IP 75/42))	$35^{o}C$
Fire Point (IP 75/42))	
Aniline Point (IP 2/56A)	$80-83^{o}F$
Pour Point (IP 15/60A)	$4^{o}C$
Cloud Point (IP 15/60A)	absent
Density of crude at $15.5^{o}C$ (IP 59/57E)	$0.8036\ gm/cm^3$
Distillation (IP 78/51T)	
Distillate : Over - point (I.B.P.)	$90^{o}C$
1 ml	$100^{o}C$
6 ml	$124^{o}C$
22 ml	$150^{o}C$
31 ml	$174^{o}C$
37 ml	$200^{o}C$
43 ml	$227^{o}C$
49 ml	$250^{o}C$
56 ml	$275^{o}C$
64 ml	$300^{o}C$

Residue : 36 ml

Loss: Nil

Density of combined distillate at $15.5^{o}C$ $0.7730\ gm/cm^3$

Density of residue estimated as 0.85 at $15^{o}C$, (it is semi-solid below $25^{o}C$)

The crude may be classified as naphthenic - paraffinic, low in the light front ends, low in sulphur, ash, waxes and residue and high in gasoline, kerosene and gas oils. The distillation curve has a sharp discontinuity in the gasoline/kerosene region. The composition of gasoline fraction is well outlined as being highly naphthenic, but a more detailed characterization of kerosene and gas oil fractions is required for the economic evaluation of the crude. All water (0.07%) is in emulsion, and the very low ash content (0.005%) indicates that the "sediment" is of organic nature rather than clay.

UNION-KERN-A.O.G. MOONIE NO. 1

WATER ANALYSIS

by

Queensland Government Chemical Laboratory

The results of an analysis of a water sample obtained on 3rd December, 1961, from an open hole formation test from the interval 5816 to 5925 feet (lower Bundamba sand), are tabulated below :

Grains per gallon :	
Total Solids	104.0
Calcium Sulphate	1.8
Calcium Carbonate	1.2
Magnesium Carbonate	0.3
Sodium Carbonate	81.3
Sodium Chloride	11.5
Hardness	2.8
Organic Matter	Present
pH	7.8

APPENDIX 6

CORE ANALYSES

UNION-KERN-A.O.G. MOONIE NO. 1

CONTENTS

UNION-KERN-A.O.G. MOONIE NO. 1

CORE ANALYSIS

by

Union Oil Personnel

Depth	Porosity (%)	Permeability (md.)	Oil/Water Ratio	% Liquid in Pores		
				Oil	Water	Total Liquid
Schlumberger Sidewall Samples, 2nd December, 1961						
5648	23.0	50	0.13	8.7	68.0	76.7
5809	17.0	40	0.08	6.2	77.8	84.0
5825	24.6	110	0.08	5.1	66.9	72.0
5840	12.8	37	0.20	16.5	83.5	100.0
5855	23.0	21	0.04	1.9	46.4	48.3
5880	22.8	-	0.00	0.0	74.0	74.0
Schlumberger Sidewall Samples, 6th December, 1961						
4612	23.0	271	0.0	0.0	84.1	84.1
4680	23.8	76	0.0	0.0	82.0	82.0
4750	18.1	18	0.0	0.0	100.0	100.0
4820	18.3	18	0.0	0.0	90.0	90.0
5337	21.8	46	0.11	4.1	32.7	36.8
5641	19.8	91	0.13	8.9	71.4	80.3
5660	14.0	27	0.10	8.8	91.2	100.0
5799	13.8	41	0.08	6.1	78.6	84.7
5832	15.1	-	0.19	13.9	72.8	86.7
5846	21.4	133	0.06	5.7	90.3	96.0
5860	15.1	23	0.05	3.5	68.7	72.2
5868	20.2	24	0.08	7.4	89.6	97.0

NOTE: Only 18 cores recovered were of sufficient size to analyse.

UNION-KERN-A.O.G. MOONIE NO. 1

CORE ANALYSIS

by

Bureau of Mineral Resources

Equipment

Ruska Field Porometer and Permeameter using dry air and nitrogen as saturating and flowing media.

Oil and water saturations were obtained using Soxhlet extraction apparatus with toluene as solvent.

Acid solubilities were determined using 15 percent commercial hydrochloric acid.

All samples were received in unsealed condition.

Results

Results are summarized in the Table below. Note that the Bulk Density is the density of the whole rock, including void space, measured after extraction and drying. The Grain Density is the actual density of the grains alone.

CORE RESULTS SUMMARY

Core No.	Depth	Effective Porosity (% by vol.)		Permeability (md.)		Density gm/cc		Residual Saturation		Oil Character	Acid Solubility (% by vol.)
		V	H	V	H	Dry Bulk Avg.	Grain Avg.	Water % Pore Space	Oil % Pore Space	Extracted fluores. and colour	
1	4801' 2" to 4801' 6"	16	14	Less than 1	Less than 1	2.28	2.70	40	Nil	No colour in Toluene	2
5	5918' 0" to 5918' 5"	5	2	Less than 1	Less than 1	2.55	2.65	78	Nil	As above	5

APPENDIX 7

ADDITIONAL DATA FILED IN THE BUREAU OF MINERAL RESOURCES

The following additional data relating to Union-Kern-A.O.G. Moonie No. 1 have been filed in the Bureau of Mineral Resources, Canberra, and are available for reference :

(i) Descriptions of cuttings, by Union Oil Development Corporation.

(ii) Weekly drilling reports for period 26th October, 1961 to 30th December, 1961.

(iii) Complete set of well logs, including the following :

Composite Electrical log (2" = 100')

Composite Microlog (2" = 100')

Laterolog (2" = 100')

Gamma Ray log (2" = 100')

Hydrocarbon analysis log (2" = 100')

Sonic log (2" = 100')

Interpretive log (2" = 100')

Continuous Dipmeter log

Expanded scales (5" = 100')

Electrical log, Runs 1, 2

Microlog, Runs 1, 2

Laterolog, Run 1

Sonic log, Run 1

PLATE 1
SHEET 1

COMPANY: UNION OIL DEVELOPMENT CORPORATION

PETROLEUM TENEMENT: A. to P 57P
MILITARY 4-MILE SHEET: DALBY

WELL No.: UNION-KERN-A.O.G. MOONIE No. 1
BASIN: BOWEN–SURAT

STATE: QUEENSLAND
WELL STATUS: **Shut in and suspended**

ELECTRIC LOG DATA

DATUM: K.B

RUN Nº	1	2		
DATE	DECEMBER 1,1961	DECEMBER 6,1961		
FIRST READING	5917'	6105'		
LAST READING	1630'	5750'		
INTERVAL MEASURED	4287'	355'		
Csg., Schlumberger	1630'	1630'		
Csg., DRILLER	1636'	1636'		
DEPTH REACHED	5918'	6106'		
BOTTOM, DRILLER	5925'	6106'		
MUD NATURE	Gel	Gel base		
DENSITY– VISCOSITY	75—55	77—53		
MUD RESISTIVITY	5·3 at 84°F	4·7 at 87°F		
MUD RESIST. BHT	3·1 at 144°F	2·7 at 145°F		
pH FLUID LOSS	9–10 cc/30 min	9–7 cc/30 min		
ORIGIN OF SAMPLE	SHAKER	SHAKER		
R.M.F	—	—		
R.M.C.	—	—		
BIT SIZE 1	9⅞"	9⅞" to 6095'		
2		8¾" to 6106'		
Csg. SIZE	13⅜" to 1636'	13⅜ to 1636'		
OPR. RIG TIME	2 hrs.	1 hr. 30 min.		
TRUCK Nº	325	325		
RECORDED BY	A. Baudot	A. Baudot		
WITNESS	D.J. McGarry	D.J. McGarry		

NAME OF WELL: UNION-KERN-A.O.G. MOONIE No. 1
STATE: QUEENSLAND
COUNTRY: AUSTRALIA
COUNTY: PRING
PARISH: DILBONG
PORTION 27
LATITUDE 27° 44' 54" S
LONGITUDE: 150° 15' 25" E
ELEVATION: K.B. 893 ft. a.m.s.l.

T.D. .... 6106'
DATE SPUDDED: November 12, 1961
DATE T D · December 6, 1961
DATE RIG RELEASED: December 28, 1961
STATUS OF WELL: Shut in and temporarily suspended
DRILLED BY · Oil Drilling & Exploration Ltd
DRILLING METHOD: Rotary—National 80B
LOGGING: Schlumberger
CEMENTING: Halliburton
MUD LOGGING: Union Oil Development Corporation
XMAS TREE: O.C.T. tubing head with 2½" S 1500 valves

OTHER ELECTRICAL LOGS

SONIC LOG: 1630'-6092'
VELOCITY SURVEY: 1650'-6096'
MICROLOG: 3600'-6046'
LATEROLOG: 4500'-6104'
GAMMA RAY: 0-5905'
CONTINUOUS DIPMETER: 1630'-6078'

LITHOLOGIC REFERENCE

- *Conglomerate*
- *Sandstone*
- *Limy sandstone*
- *Tuffaceous sandstone*
- *Tuff*
- *Shale or mudstone*
- *Limy shale*
- *Siltstone*
- *Coal or carb. matter*
- *Volcanic flows*

WELL SYMBOLS

- *Gas show slight*
- *Gas show strong*
- *Oil show slight*
- *Oil show strong*
- *Oil and gas show*
- *Fluorescence*
- *Blowout*
- *Macrofossil*
- *Spore, pollen*
- *Core interval, Nº and Recovery*
- *Sidewall core*
- *Perforated interval*
- *Formation test or production test O.H. and in csg.*
- *Plugged interval*

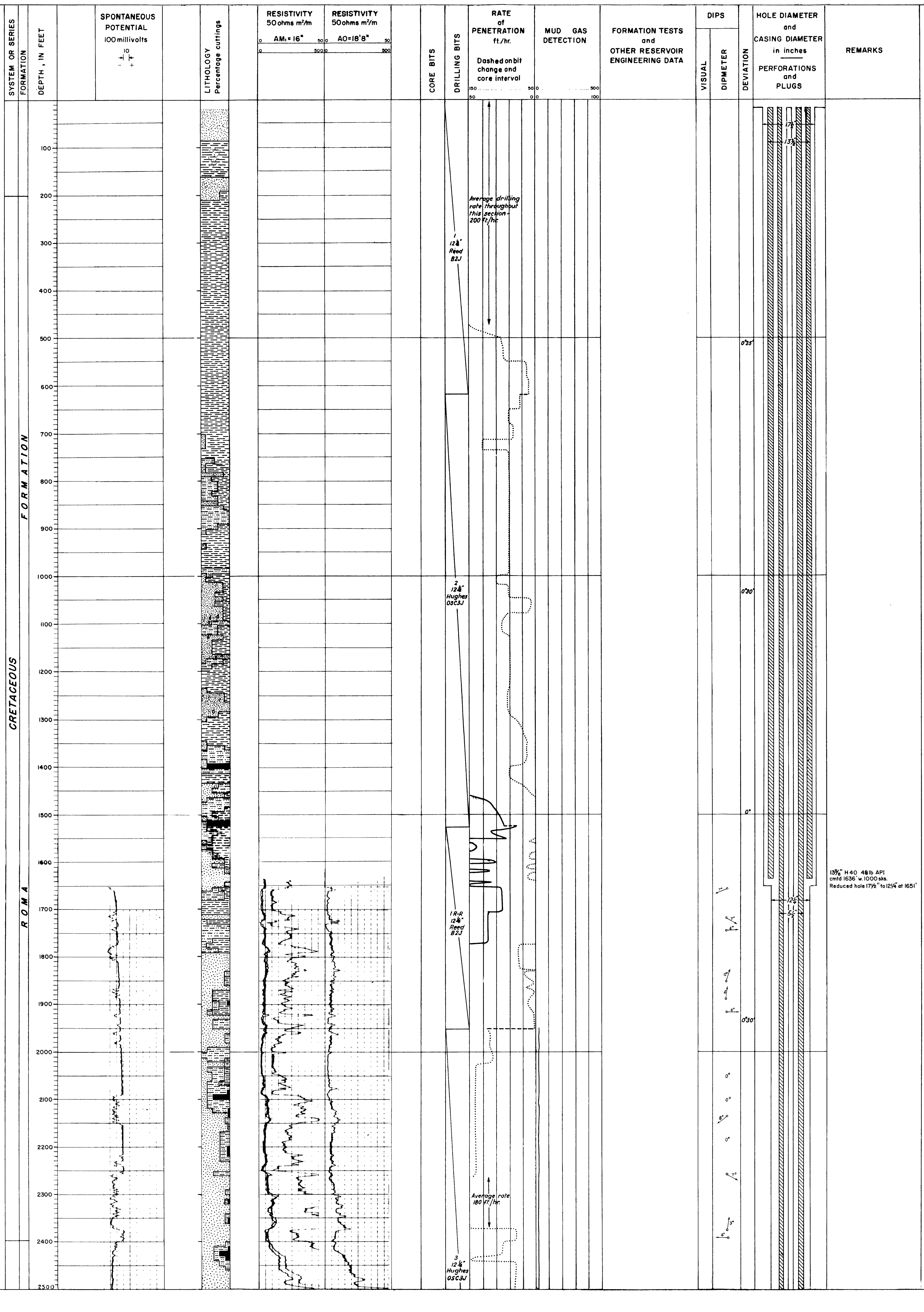



PLATE I
SHEET 2
SYSTEM OR SERIES
FORMATION
DEPTH IN FEET
SPONTANEOUS POTENTIAL
100 millivolts
LITHOLOGY
Percentage cuttings
RESISTIVITY
50 ohms m²/m
AM = 16"
RESISTIVITY
50 ohms m²/m
AO = 18'8"
CORE BITS
DRILLING BITS
RATE of PENETRATION ft/hr
Dashed on bit change and core interval
MUD GAS DETECTION
FORMATION TESTS and OTHER RESERVOIR ENGINEERING DATA
DIPS
VISUAL
DIPMETER
DEVIATION
HOLE DIAMETER and CASING DIAMETER in inches
PERFORATIONS and PLUGS
REMARKS
JURASSIC - CRETACEOUS
BLYTHESDALE FORMATION
JURASSIC
WALLOON FORMATION
TRIASSIC - JURASSIC
BUNDAMBA FORMATION
PERMO - CARBONIFEROUS
KUTTUNG FORMATION
T.D. 6106'
Trip gas
Trip gas
Methane
Trip gas
Methane
Methane
Methane
Trip gas
Trip gas
Recirc. gas
Reduced hole 12¼" to 9⅞" at 2851'
5337' S.W.C.
Por. 51·8 % Perm. 46 md. OW; 0·11
S.W.C. Analyses
Depth Por. Perm. O-W
5641' 19·8% 91md. 0·13
5648' 23% 50md. 0·13
5660' 14% 27md 0·10
Halliburton Production Test
J.P 4 1/2" holes/ft. at 5650'
Packer 5634' with tail to 5648'.
Open 1 hr., 1775' gross rise as follows:
360' mc
135' gas cut mud
360' clean oil
325' gas & oil cut mud
135' gas oil & mud
270' oil & water emulsion
110' oil
80' emulsion with 25% free water
Halliburton Production Test
J.P 4 1/2" holes/ft. 5808'-5814
5818'-5840'
Packer 5791', tail to 5840'
58 min. test
360' wc to surface 8 min
Fm fluid to surface 11 min.
Flowed 1765 b/d 47° oil with
175 McF/d gas
S.W.C. Analyses
Depth Por. Perm. O-W
5809' 17% 40 md 0·08
5825' 24·6% 110 md. 0·08
5832' 15·1% – 0·19
5840' 12·8% 37md. 0·20
5846' 21·4% 133md 0·06
5855' 23·0% 21 md. 0·04
5860' 15·1% 23md. 0·05
5868' 20·2% 24md. 0·08
5880' 22·8% – 0·00
(JP 5614') wso sq. cmt'd
(JP 5650') sq. cmt'd
2" tubing H 5779'
J.P 5798'-5808'
J.P and Re JP 5808'-5814'
J.P 5814'-5818
J.P and Re JP 5818'-5840'
5½" 17# and 20# c.
5950' w. 1100 sks

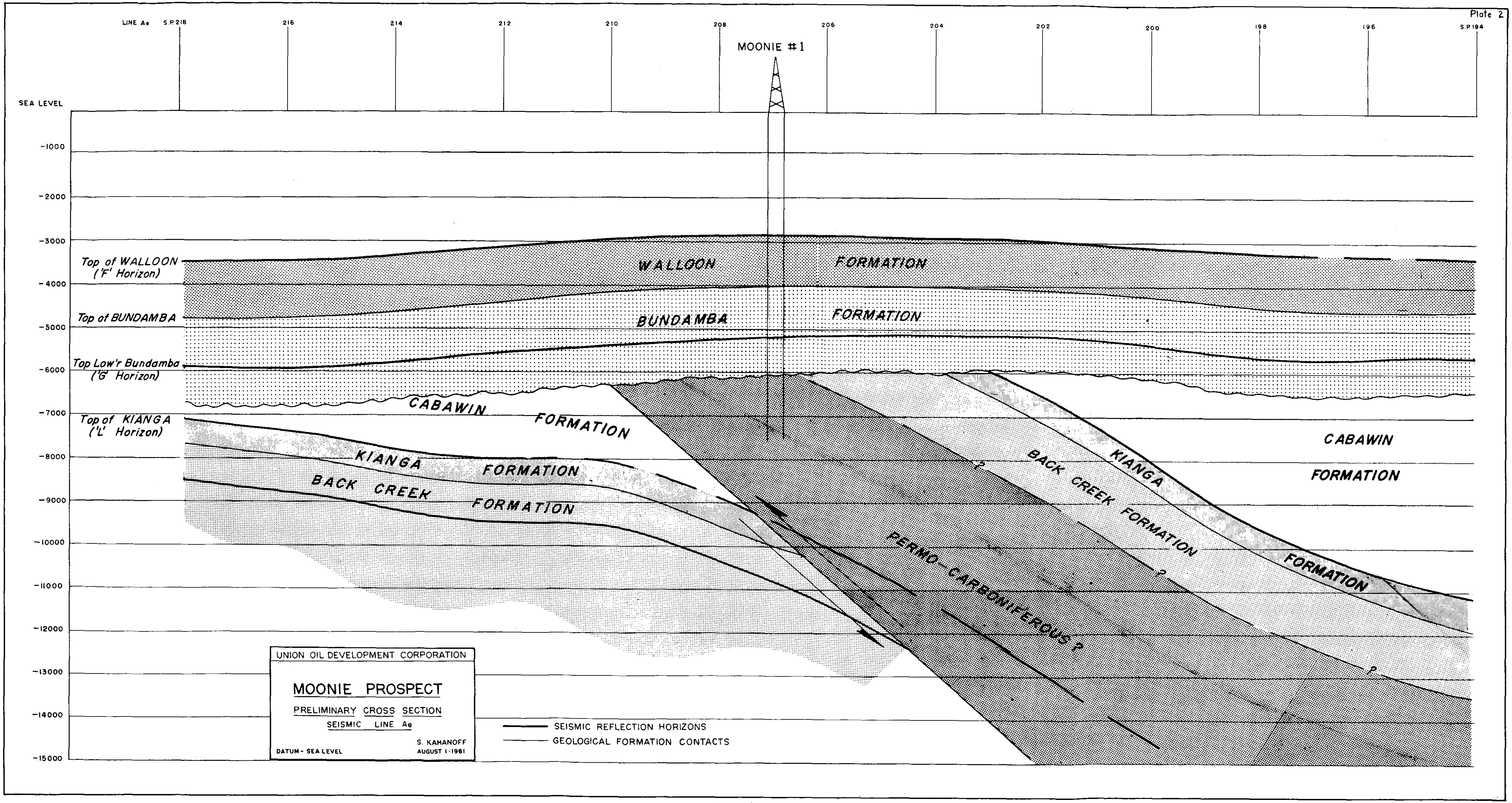


Plate 2
LINE Ae
S.P. 218
216
214
212
210
208
206
204
202
200
198
196
S.P. 194
MOONIE #1
SEA LEVEL
-1000
-2000
-3000
-4000
-5000
-6000
-7000
-8000
-9000
-10000
-11000
-12000
-13000
-14000
-15000
Top of WALLOON ('F' Horizon)
Top of BUNDAMBA
Top Low'r Bundamba ('G' Horizon)
Top of KIANGA ('L' Horizon)
WALLOON FORMATION
BUNDAMBA FORMATION
CABAWIN FORMATION
KIANGA FORMATION
BACK CREEK FORMATION
PERMO-CARBONIFEROUS ?
CABAWIN FORMATION
BACK CREEK FORMATION
KIANGA FORMATION
UNION OIL DEVELOPMENT CORPORATION
MOONIE PROSPECT
PRELIMINARY CROSS SECTION
SEISMIC LINE Ae
S. KAHANOFF
AUGUST 1-1961
DATUM - SEA LEVEL
SEISMIC REFLECTION HORIZONS
GEOLOGICAL FORMATION CONTACTS

HISTORICAL SUMMARY

S3 Designation	Contractor	Crew	Operator	Date	Remarks

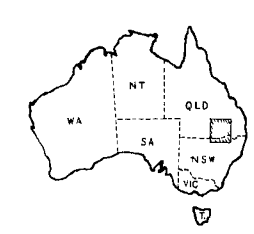
PLANIMETRIC DETAIL

Compiled by
ADASTRA AERIAL SURVEYS
41-45 VICKERS AVENUE
MASCOT N.S.W.

THIS MAP WAS COMPILED FROM AIR PHOTO MOSAICS AND QUEENSLAND 2m SERIES MAPS

MAIN ROAD
MINOR ROAD
RAILWAY
TOWN
STATE BOUNDARY

Scale
1 0 1 2 3 4 5
Miles



LOCALITY SKETCH

99	98	97	96	95	94	93	92	91
89	88	87	86	85	84	83	82	81
79	78	77	76	75	74	73	72	71
69	68	67	66	65	64	63	62	61
59	58	57	56	55	54	53	52	51
49	48	47	46	45	44	43	42	41
39	38	37	36	35	34	33	32	31
29	28	27	26	25	24	23	22	21
19	18	17	16	15	14	13	12	11
9	8	7	6	5	4	3	2	1

SHEET INDEX

REVISIONS	
Date	Draftsman

UNION OIL DEVELOPMENT CORPORATION

MOONIE PROSPECT

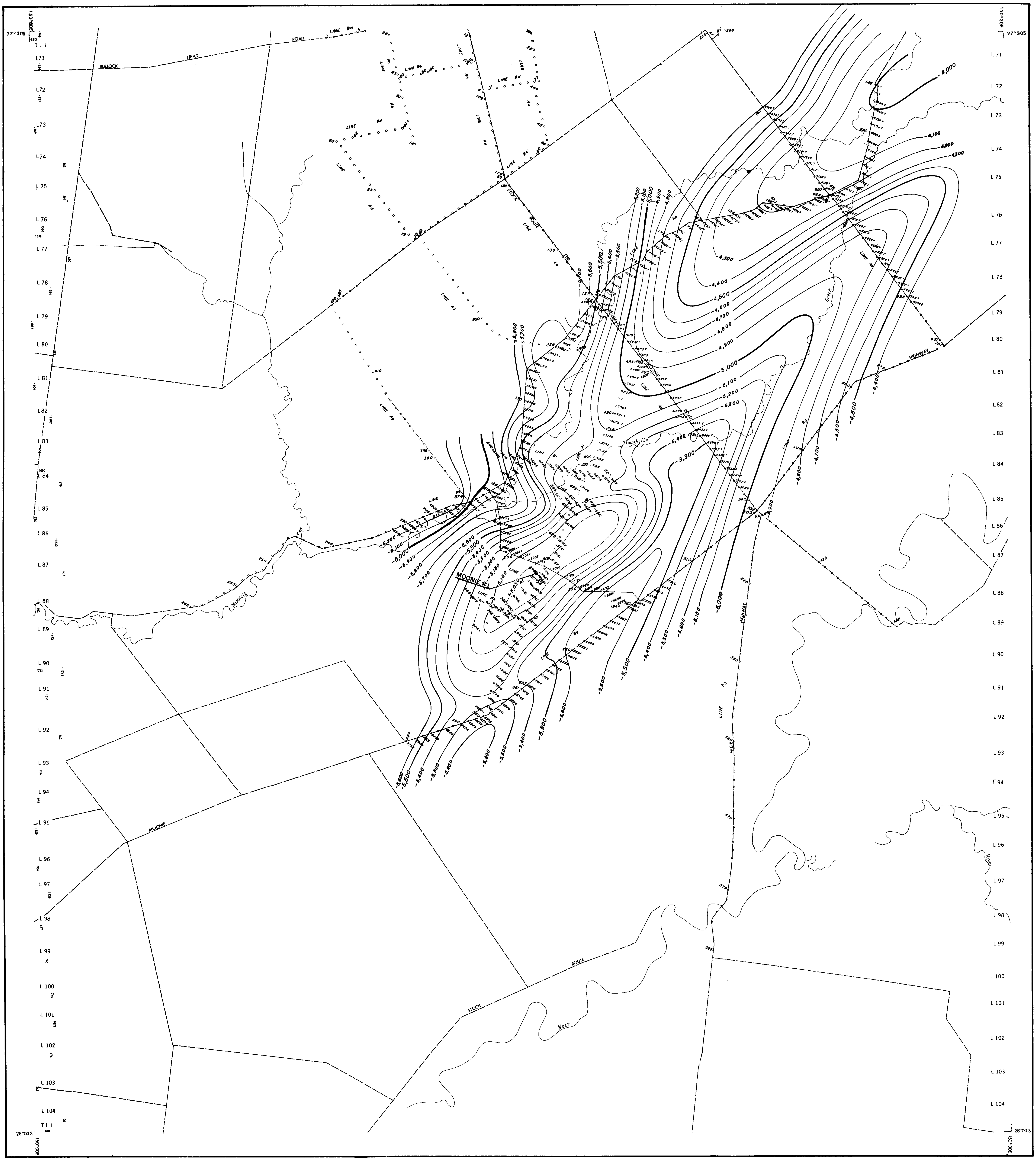
PROGRESS MAP

PERMIAN

"L" Interpretation A S MAUREIRA

PARTY 126 UNITED GEOPHYSICAL CO, S.A.

District	Velocity Function 7850 + .73 Z	Datum 800' Above sea level
	Datum Velocity 6666 ft. / sec.	Contour Interval



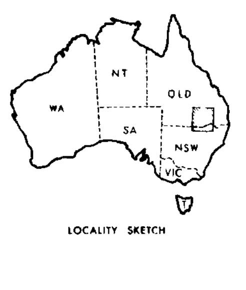
HISTORICAL SUMMARY

S.P. Designation	Contractor	Crew	Operator	Date	Remarks

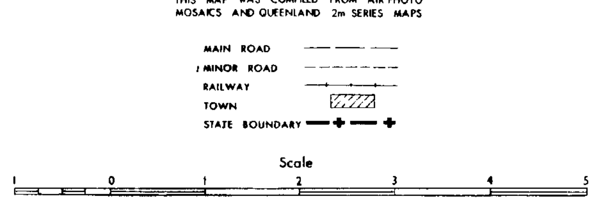
PLANIMETRIC DETAIL

Compiled by
ADASTRA AERIAL SURVEYS
41-45 VICKERS AVENUE
MASCOT N S W

THIS MAP WAS COMPILED FROM AIR PHOTO MOSAICS AND QUEENLAND 2m SERIES MAPS



LOCALITY SKETCH



99	98	97	96	95	94	93	92	91
89	88	87	86	85	84	83	82	81
79	78	77	76	75	74	73	72	71
69	68	67	66	65	64	63	62	61
59	58	57	56	55	54	53	52	51
49	48	47	46	45	44	43	42	41
39	38	37	36	35	34	33	32	31
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19	18	17	16	15	14	13	12	11
9	8	7	6	5	4	3	2	1

SHEET INDEX

REVISIONS	
Date	Draftsman

UNION OIL DEVELOPMENT CORPORATION

MOONIE
PROSPECT

CONTOURS ON
'G' HORIZON
(LOWER BUNDAMBA)

Interpretation S KAHANOFF
Date October 16, 1961

District MOONIE	Velocity Function V=7850+ 73 Z	Datum Sea Level
	Datum Velocity	Contour Interval 100 feet