COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

*Petroleum Search Subsidy Acts*

PUBLICATION No. 44



# U-K-A. Cabawin East 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*

1964

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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

DIRECTOR: J. M. RAYNER

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THIS REPORT WAS PREPARED FOR PUBLICATION IN THE PETROLEUM EXPLORATION BRANCH

ASSISTANT DIRECTOR: M. A. CONDON

*Published by the Bureau of Mineral Resources, Geology and Geophysics*

*Canberra A.C.T.*

## 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. Cabawin East No. 1 was drilled under the Petroleum Search Subsidy Act 1959, in Authority to Prospect 57P, Queensland. The well was located at latitude 27°29'10"S, longitude 150°15'06"E. (4.8 miles on a bearing 080° from Cabawin No. 1 Well), 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 by 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

CONTENTS

CONTENTS (Cont'd)



ILLUSTRATIONS

FIGURES



PLATE

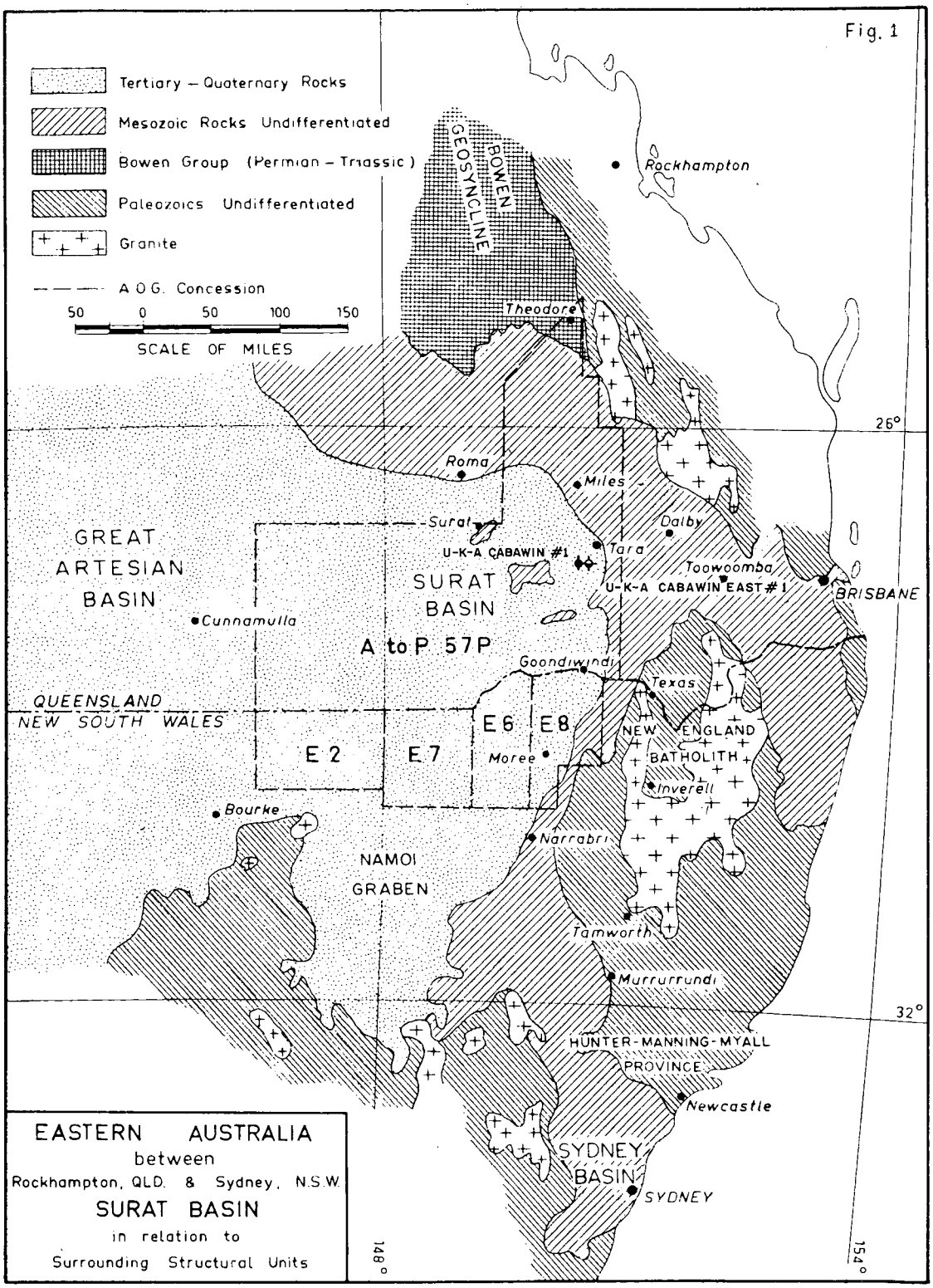


Fig. 1
Tertiary – Quaternary Rocks
Mesozoic Rocks Undifferentiated
Bowen Group (Permian – Triassic)
Paleozoics Undifferentiated
Granite
A.O.G. Concession
50 0 50 100 150
SCALE OF MILES
BOWEN GEOSYNCLINE
Rockhampton
Theodore
26°
Roma
Miles
Surat
Dalby
Tara
U-K-A CABAWIN #1
Toowoomba
U-K-A CABAWIN EAST #1
BRISBANE
GREAT ARTESIAN BASIN
SURAT BASIN
Cunnamulla
A to P 57P
Goondiwindi
Texas
QUEENSLAND
NEW SOUTH WALES
E 2
E 7
E 6
E 8
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. Cabawin East No. 1 was drilled by Union Oil Development Corporation, Kern County Land Company, and Australian Oil and Gas Corporation Limited in the Surat Basin, Queensland, 4.8 miles on a bearing 080° from Cabawin No. 1 Well. The test was undertaken to investigate the possibility that the sub-commercial oil-bearing sand in Cabawin No. 1 might have a thicker development towards the east.

The well was spudded in on 18th July, 1961, and penetrated a veneer of Tertiary; the Roma, Blythesdale, Walloon and Bundamba Formations of the Great Artesian Group; and the Cabawin, Kianga, and Back Creek Formations of the Bowen Group. Minor gas shows were encountered in coaly strata in the Blythesdale and Walloon Formations. Several small methane gas shows were indicated in sandstones of the Blythesdale, Walloon, and Bundamba Formations. Some very small gas showings were obtained through the Cabawin, Kianga and Back Creek Formations. Scattered oil fluorescence was noted from 6370 feet to total depth at 12,091 feet, but there were no important shows. The well indicated that the producing Kianga sand of Cabawin No. 1 was too silty in the Cabawin East location to be a reservoir. Cabawin East No. 1 was abandoned on 17th October, 1961.

## 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.

The drilling of the initial test in the Basin, Union-Kern-A.O.G. Cabawin No. 1, resulted in the discovery of a sub-commercial oil zone in Permian rocks of the Kianga Formation at a depth of 9928-9936 feet. After completion of Cabawin No. 1, seismic surveys conducted to the east of the Cabawin domal closure revealed a separate structurally closed feature occupying a flank position on the "Cabawin Trend". It was postulated that such a flank position might afford opportunity for the development of additional sands in the Permian sequence, thereby providing a more attractive potential reservoir.

Cabawin East No. 1 was therefore programmed primarily as a structural test of the oil bearing Permian section encountered in Cabawin No. 1 The site was located along the Cabawin structural trend east of a fault zone on a structural feature with indicated closure of 200 feet over an area of about 12 square miles. The test was also designed to evaluate the petroleum potential of various permeable horizons in the Lower Triassic Cabawin Formation (7640-9835 feet) in Cabawin No. 1. In addition, although structural closure was limited to 50 feet over approximately five square miles, the porous and permeable lower Bundamba (Triassic) section was considered a potential target for this test.

## WELL HISTORY

### General Data

| | |
|---|---|
| Well name and number: | Union-Kern-A.O.G. Cabawin East No. 1 |
| Location: | Latitude 27°29'10"S. Longitude 150°15'06"E. |
| Map Reference: | Dalby |
| Name and address of Tenement Holder: | Australian Oil and Gas Corporation Limited, 44 Martin Place, Sydney, N.S.W. |

| | |
|---|---|
| Details of Petroleum Tenement: | Authority to Prospect 57P, Queensland. (approximately 47,000 sq. miles). |
| District: | Portion 58, Parish of South Glen, County of Rogers, Queensland |
| Total Depth: | 12,091 feet |
| Date drilling commenced: | 18th July, 1961 |
| Date drilling completed: | 14th October, 1961 |
| Date well abandoned: | 17th October, 1961 |
| Drilling time in days to total depth: | 88 |
| Elevations (a.s.l.): | Ground: 993 feet |
| | Kelly Bushing: 1010 feet (datum for all measurements) |
| Status of well: | Plugged and leased to G.A. Henry for conversion to water well |

Drilling Data

| | |
|---|---|
| Name and address of drilling contractor: | Oil Drilling and Exploration Limited, 93 York Street, Sydney, N.S.W. |
| 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' |
| Rated 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 GK Hydril |
| Size: | 12" |
| Series: | S-900 |
| | Powered by Hydril 80-gallon accumulator |

Hole sizes and depths:

30" to 29 feet
17 1/2" to 1990 feet
12 1/4" to 2565 feet
8 3/4" to 12091 feet

Casing and Liner details:

| Size (in.) | Weight lb./ft | Grade (Sch) | Range | Setting Depth (feet) |
|---|---|---|---|---|
| 20 | 52 | 10 | 2 | 29 |
| 13 3/8 | 48 | H-40 | 2 | 1972 |

Casing and Liner cementing details:

| Size (in.) | Setting Depth (feet) | No. of sacks | Cemented to | Method |
|---|---|---|---|---|
| 20 | 29 | 100 | Surface | Grouted |
| 13 3/8 | 1972 | 1000 | Surface | Plug |

Drilling Fluid:

Fresh water gel-base, low water loss, low pH mud was used to 7120 feet. At 7120 feet, converted to 5 percent oil emulsion fresh water, gel-base, low water loss, low pH mud, using diesel oil.

From 9720 feet to 12,091 feet, oil emulsion mud was used as above except weight was increased with barytes.

Materials and chemicals used included: bentonite, barytes, caustic soda, myrtan, and quebracho.

Table Showing Variation of Mud Properties

| Days | Depth (feet) at end period | Weight (lb./ft) | Viscosity (secs) | Filtrate (cc) | Cake (in.) | Sand (%) | pH |
|---|---|---|---|---|---|---|---|
| 1- 5 | 1990 | 65-73 | 43-50 | 8 | 2/32 | 2 | 8-10 |
| 6-12 | 4196 | 75 | 43-53 | 8 | 2/32 | 2 | 8-10 |
| 13-19 | 6373 | 74-76 | 42-70 | 6.0-8.5 | 3/32 | 1.5-2.5 | 8-10 |
| 20-26 | 7120 | 74-75 | 51-61 | 7.7-10 | 2/32 | 1-4 | 8-9.5 |
| 27-33 | 7608 | 73-77 | 47-63 | 5.0-7.3 | 2/32-3/32 | 0.25-2.5 | 9-10 |
| 34-40 | 8435 | 76-77 | 51-100 | 5.4-6.6 | 2/32 | 1-3 | 9.5 |
| 41-47 | 8462 | 75-76 | 54-100 | 6.0-7.8 | 2/32 | 1-2 | 10 |
| 48-54 | 9056 | 74-77 | 44-100 | 7 | 2/32 | 1-2 | 9.5 |
| 55-60 | 9720 | 75-86 | 45-77 | 6.2-7.2 | 2/32 | 1-2.5 | 9-9.5 |
| 61-67 | 10,289 | 90-91.5 | 45-60 | 6.0-7.0 | 2/32 | 1-2.5 | 8-9.5 |
| 68-74 | 10,678 | 91 | 50-70 | 5.2-6.8 | 2/32 | 1-2 | 9 |
| 75-81 | 11,184 | 91-92 | 48-70 | 5.4-6.6 | 2/32 | 1-2 | 9 |
| 82-88 | 12,091 | 90-92 | 50-70 | 5.2-6.0 | 2/32 | 1-1.5 | 9 |

Water supply:

Fresh water for use during the drilling operation was obtained from a well registered with the Queensland Water and Irrigation Commissioner as No. 12447, located 4.7 miles north of Latitude 27°30' S. and 13 miles east of Longitude 150°E. The well was 2000 feet deep and flowed from 1850 feet at 70 gallons per hour rate. A Southern Cross HD-6 pump jack and pump was used to supply water requirements.

Perforation and Shooting Record: None

Plugging Back and Squeeze Cement Jobs:

| Date | Length Plug (feet) | No. of sacks | Method | Remarks |
|---|---|---|---|---|
| 16.10.61 | 9968-9768 | 70 | Open end D.P. | |
| " " " | 4985-4785 | 70 | " " " | |
| " " " | 2435-2295 | 75 | " " " | Tested with 10,000lb. wt on top plug |

Fishing Jobs:

| Date | Depth (feet) | Remarks |
|---|---|---|
| 28.7.61 | 2440 | Twisted off drill collars at pin. Fish, 8 3/4" bit and 328' 6 1/2" D.C. Recovered with Bowen overshot and grapple. |

| | | |
|---|---|---|
| 5.8.61 | 6373 | Twisted off drill collar at pin. Fish, 8 3/4" bit and 180' 6 1/2" D.C. Recovered with Bowen overshot and grapple. |
| 10.8.61 | 7120 | While taking survey at 7085 feet, stuck drill pipe. Spotted oil, unable work loose. Backed off at 6759 feet. Fish, 8 3/4" bit and 325' 6 1/2" D.C. Screwed into fish, jarred, unable work loose. Ran in with wash pipe, washed over fish 6759 feet, 7119 feet. Ran in with 4 1/2" I.F. sub on Baash-Ross bumper sub on McCullough Jars, screwed into fish, pulled out and recovered fish. |
| 27.8.61 | 8435 | While running in with 8 3/4" bit on 21-6 1/2" D.C. cross-over sub parted 30 feet below table when checking 4 1/2" F.H. collars. Dropped 8 3/4" bit on 21-6 1/2" D.C. Fish 7818-8435 feet. Ran 7 7/8" Bowen overshot with 6 3/8" grapple on McCullough Jars on 110' 6 1/2" D.C. on 4 1/2" D.P. Worked over top fish, jarred 2 1/2 hours, pulled out and recovered fish leaving 3 cones from bit in hole. Ran 8 1/2" Servco Mills, Reed Junk subs, Bowen magnet and Bowen Junk Basket, recovering all cones. |
| 8.9.61 | 8987 | Twisted off. Fish, 8 3/4" bit, 514' 6 1/2" D.C. 4 1/2" x 30' single, and 4 1/2"x 27' stub. Top fish 8417'. Ran 7 5/8" Bowen overshot with 4 1/2" grapple on McCullough Jars. Worked over top fish, recovered. |
| 7.10.61 | 11184 | Twisted off leaving 8 3/4" bit and 12-6 1/2" D.C. (360 feet) in hole. Recovered with 7 7/8" Bowen overshot with 6 3/8" grapple on McCullough Jars. |

Logging and Testing

Ditch samples: Ditch samples were collected at 10-foot intervals from 4900 feet to total depth. Check samples of some strata breaks were taken above 4900 feet. While coring, samples were collected at five-foot intervals. 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 appropriate intervals below the top of the Kianga Coal Measures, by agreement with the Bureau of Mineral Resources.

The original programme was followed with only minor exceptions.

Six conventional cores were cut using Hughes Type "J" core barrel and hard formation coreheads, and one core was cut using D & S 8 5/8" diamond corehead. A total of 66.5 feet of formation was cored and 56.5 feet (85%) recovered. Cores are described in Appendix 1.

Sidewall Cores:

In addition to conventional cores, 47 sidewall samples were taken between 12,085 and 6762 feet, and these are described in Appendix 1.

Electrical Logging: The following Schlumberger logs were run: Electric Log, and Sonic Log. A complete list is given in Appendix 3. A velocity survey was conducted and details are contained in Appendix 3. Copies of logs have been filed in the Bureau of Mineral Resources, Canberra, and are available for reference.

Drilling Rate, Oil and Gas Log: Five-foot drilling time was recorded during drilling, and penetration rates have been plotted on the Composite Log. Showings of hydrocarbons are also noted in this log. Copies of the Hydrocarbon Analysis Log are available for reference at the Bureau of Mineral Resources, Canberra.

Formation Testing: No formation tests were conducted.

Deviation Surveys: Eighteen drift readings were recorded using TOTCO Drift Indicator. Maximum deviation was $1^{o}30'$; surveys have been plotted on the Composite Log.

Drilling Summary

Cabawin East No. 1 was spudded on 18th July, 1961. A 12 1/4" hole was drilled to 1990 feet, then opened to 17 1/2", and 13 3/8" casing was run and cemented at 1972 feet with 1000 sacks.

A 12 1/4" hole was then drilled to 2565 feet at which point the hole size was reduced to 8 3/4" and drilling proceeded to a depth of 6715 feet, where a conventional core was cut (6715 to 6721 feet) recovering 5'8" of grey shale and siltstone (lower Bundamba). Drilling was continued to a depth of 6890 feet, where an electric log and sonic log were run.

The hole was then drilled to a depth of 10,527 feet where a diamond core head was used to core 10,527 to 10,537 feet, recovering 9' 3" of tuffaceous conglomerate (Cabawin Formation). A conventional corehead was then run and a core was taken between 10,537 and 10,547 feet 6 inches recovering 6'6" of tuffaceous conglomerate. An electric log was then run and drilling continued to a depth of 10,663 feet.

A conventional 8 3/4" corehead was run and cored from 10,659 to 10,670 feet, but the core was not recovered. Another corehead was run and the interval 10,670 to 10,678 feet cored, recovering 14'9" of tuff and coal (Kianga Formation). The previous core had been picked up and recovered in the core barrel. From 10,678 to 10,699 feet two cores were taken, recovering tuff, coal and shale.

Drilling then continued to a depth of 10,762 feet where an electric log and sonic log were run. The hole was then drilled to a total depth of 12,091 feet at which point an electric log, sonic log, and velocity survey were conducted. Sidewall samples were also taken.

The hole was then plugged in three stages, 9968 to 9768 feet with 70 sacks cement, 4985 to 4785 feet with 70 sacks cement, and 2435 to 2295 feet with 75 sacks cement.

The top plug was located at 2295 feet and the rig released on 17th October, 1961.

The well was subsequently leased to the property owner for use as an artesian water well from the interval below the shoe of the 13 3/8" casing (1972 feet) to the top of the plug at 2295 feet.

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

## GEOLOGY

### Regional Geology

Surface geologic 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. In the present report only a synthesis of this work is included. 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.

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 which 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.

Two major phases of sedimentation have been recognized; one related to the development of the Bowen Basin (Bowen Group), and one related to the development of the Great Artesian Basin (Great Artesian Group). 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 was reached in the Bowen Basin within Triassic time. This period marked the end of "Bowen" sedimentation and set the stage for the deposition of the sediments 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.

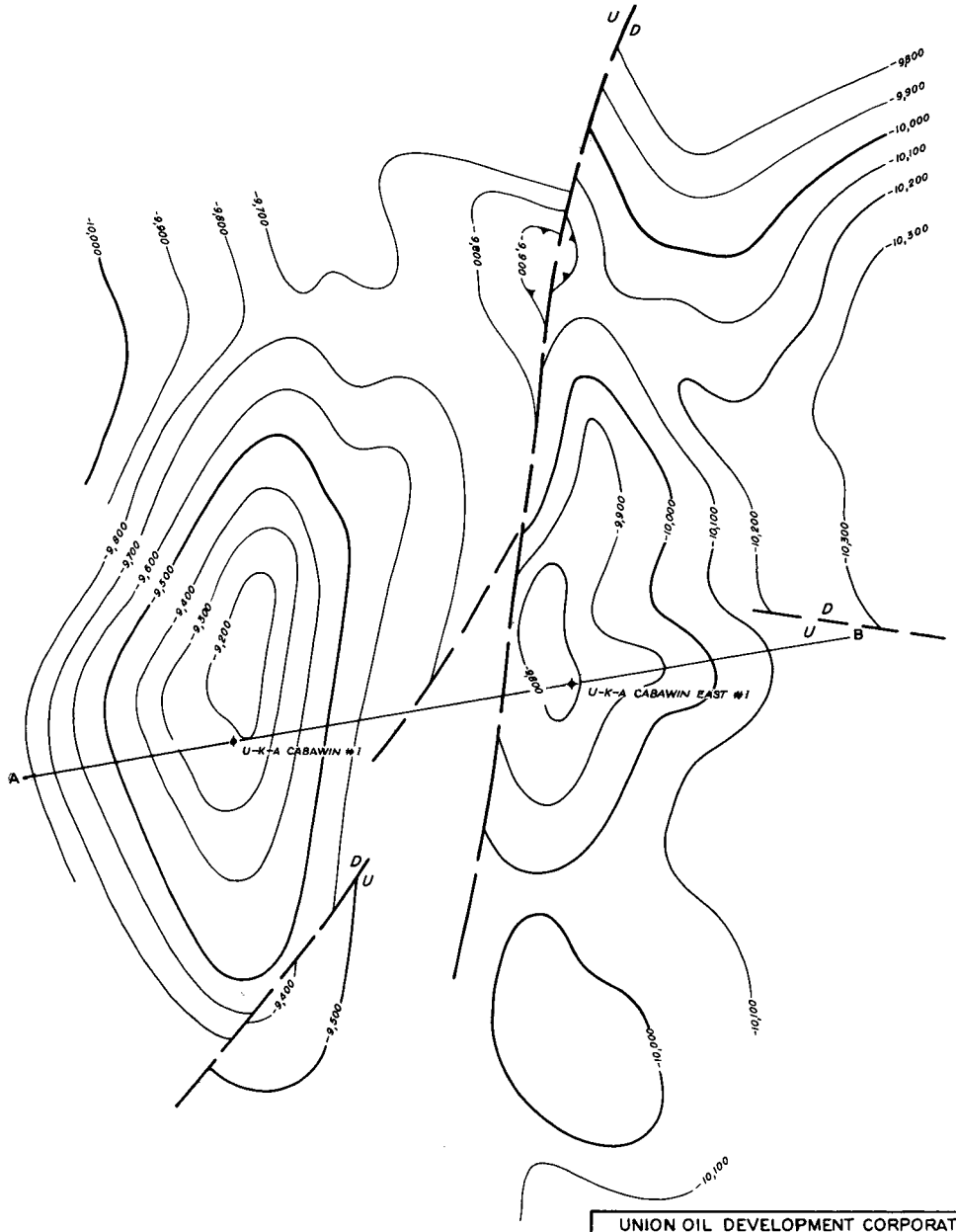
### Structure of the Cabawin Prospect

The Cabawin structure occupies a position on the southern plunge of the "Cabawin Trend", a major north-south trending, faulted, compressional fold that had its inception before the sedimentation related to the sag of the Great Artesian Basin. The compressional forces originated east of the prospect and are genetically related to the forces that were active along the eastern side of the Bowen Basin in late Permian (?) and early Triassic time. Rejuvenation of structure is indicated to some extent in the younger Mesozoic beds.

Figures 2 and 3 are structure maps of the Cabawin prospect as interpreted from the seismic work. Figure 4 is a cross-section along a seismic line showing structural and stratigraphic relationships through the location of Cabawin No. 1 and Cabawin East No. 1.

Figure 2. 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 Cabawin No. 1. As indicated by the contours of the "L" horizon, the Cabawin No. 1 domal structure has a maximum closure of 500 feet over an area of approximately 20 square miles. The Cabawin East No. 1 structure has a minimum closure of 200 feet over an area of approximately 12 square miles. A major fault zone separates the East Cabawin feature from the domal closure of the West Cabawin anticline. The fault appears to be downthrown on the east side, with a throw varying between 200 and 300 feet. The general configuration of the fault, and local irregularities in the amount and direction of the throw, suggest that the movement was primarily lateral.

Fig. 2




UNION OIL DEVELOPMENT CORPORATION

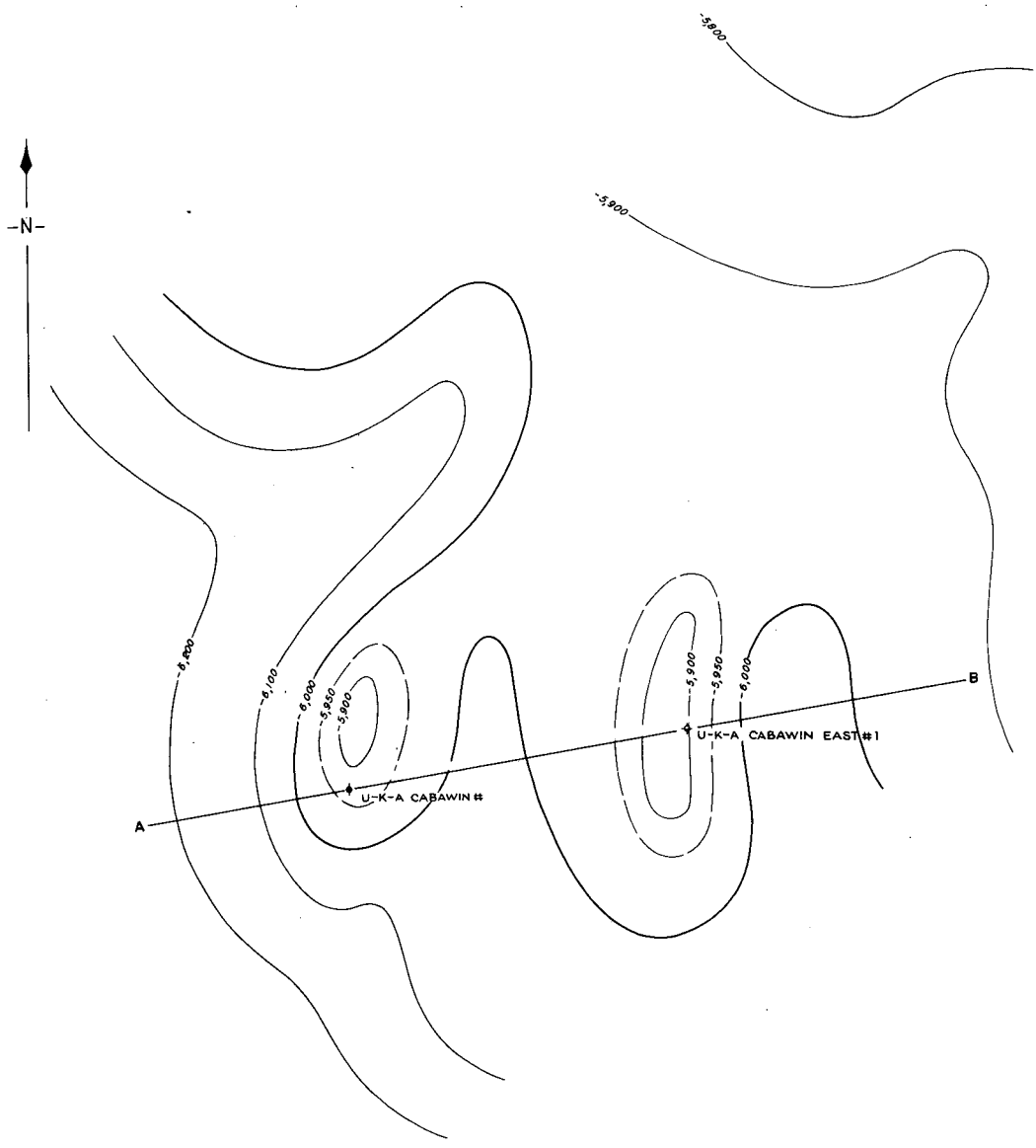
CABAWIN PROSPECT

STRUCTURAL CONTOURS—"L" HORIZON

(NEAR TOP KIANGA FORMATION)

INTERPRETATION: S.KAHANOFF

Fig. 3




1 0 1 2 3

SCALE OF MILES

UNION OIL DEVELOPMENT CORPORATION

CABAWIN PROSPECT

STRUCTURAL CONTOURS – "G" HORIZON

(NEAR TOP LOWER BUNDAMBA FORMATION)

INTERPRETATION: S. KAHANOFF

Fig. 4

U.K.A. CABAWIN #1

U.K.A. CABAWIN EAST #1

A

B

-3000

-4000

-5000

-6000

-7000

-8000

-9000

-10000

-11000

-12000

1 5 466 474 418 422 427 432 438 373 376

FORMATION

WALLOON

FORMATION

BUNDAMBA

LOWER BUNDAMBA SAND ("G" HORIZON)

CABAWIN

FORMATION

PRODUCING ZONE

KIANGA

FORM'N.

FAULT

UPPER PERMIAN SAND ('L' HORIZON)

BACK CREEK

FORMATION

ZONE

T.D. 12035'

T.D. 12091'

CRACOW

VOLCANICS

UNION OIL DEVELOPMENT CORPORATION

# CABAWIN PROSPECT

## CROSS-SECTION A-B

0 1 2

MILES

| | |
|---|---|
| | DATE : JUNE, 1961 |
| VERTICAL SCALE : 1" = 1000 Ft. | DATUM: Sea Level |

Figure 3. 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. Although the structure of the older rocks is reflected in the Bundamba sediments, the amount and areal extent of closure are considerably less. Approximately 50 feet of closure over about 2 square miles is indicated on the Cabawin No. 1 feature, and approximately 50 feet of closure over an area of 5 square miles on the Cabawin East structure.

Stratigraphy of Cabawin East No. 1

Union-Kern-A.O.G. Cabawin East No. 1 was spudded in thin Tertiary sediments and penetrated the Roma, Blythesdale, Walloon and Bundamba Formations of the Great Artesian Group and the Cabawin, Kianga and Back Creek Formations of the Bowen Group. The well was abandoned before cutting a complete section of the Back Creek Formation.

The table below shows the depth intervals of the formations (datum K.B., 17 feet above ground level) penetrated in the well.

| Age | Formation | Depth Interval (feet) | Thickness (feet) |
|---|---|---|---|
| Cainozoic | | 17- 90 | 73 |
| Lower Cretaceous | Roma Formation | 90- 2823 | 2733 |
| L. Cret. - Jurassic | Blythesdale Formation | 2823- 4160 | 1337 |
| Jurassic | Walloon Formation | 4160- 5294 | 1134 |
| Jurassic-Triassic | Bundamba Formation | 5294- 7850 | 2556 |
| Triassic | Cabawin Formation | 7850-10600 | 2750 |
| Permian | Kianga Formation | 10600-11197 | 597 |
| Permian | Back Creek Formation | 11197-12091 | 894+ |

During the drilling of the well a log of the ditch cuttings was kept only for that part of the well below 5000 feet. Detailed descriptions of the cuttings are therefore only recorded below that depth.

Cainozoic Sediments, 17-90 feet (73 feet):

Yellow and tan sandstones and silty sands of fluviatile origin occupy the interval in the well from 17-90 feet.

## Great Artesian Group

Roma Formation, 90-2823 feet (2733 feet):

The Roma Formation consists dominantly of grey shale with lesser coal and sandstone interbeds. In part the shales are slightly calcareous. The sandstones increase

in abundance downward and the formation grades transitionally into the underlying Blythesdale Formation. The base of the unit is arbitrarily chosen on an electric log pick on correlation with a similar point in Cabawin No. 1. An examination of the two logs clearly point out the intertonguing relationship between the Roma and Blythesdale units.

Age, Roma Formation - No samples of the Roma Formation were taken during the drilling of the well. The age of the unit is based on extrapolation of data gained in the drilling of Cabawin No. 1 (P.S.S.A. Publ. No. 43). In that well foraminifera and radiolaria suggested that the unit was at least in part Cretaceous (Aptian-Albian stage). de Jersey, on the basis of spore data, inferred that the lower part of the unit might range into the Jurassic.

Blythesdale Formation, 2823-4160 feet (1337 feet):

This unit is predominantly grey and light grey quartzose sandstone in part conglomeratic with subordinate grey shale and coal. The sandstones grade from fine to coarse-grained and are fairly well sorted, the grains being subangular to subrounded. Quartz is dominant with some lithic and carbonaceous material evident; the matrix is rewashed, light grey, tuffaceous clay. Some porosity is evident, particularly in the basal member below 4065 feet.

Age, Blythesdale Formation - Examination of spores from equivalent section drilled in Cabawin No. 1 indicates that the Blythesdale Formation may range from Jurassic to Cretaceous in age (see Evans, and de Jersey, Appendix 1, P.S.S.A. Publ. No. 43).

Walloon Formation, 4160-5294 feet (1134 feet):

The Walloon Formation consists of interbedded coal, coaly shale, siltstone and sandstone with the coaly sequence dominant. The break with the overlying Blythesdale is clearly marked on the Electric Log. The base of the formational unit intertongues the upper member of the Bundamba Formation and is picked at the top of the first major sandstone below the dominantly coaly sequence.

Detailed description, Walloon Formation

4990-5294 feet (304 feet)

SHALE, grey, light grey and tan, mainly silty and carrying macerated carbonaceous material with interbedded grey and brownish-grey SILTSTONE, minor thin light grey, fine to medium-grained SANDSTONE, poorly sorted subangular clear quartz grains, tight, slightly calcareous cement. Black shaly COAL seams evident throughout.

Age, Walloon Formation - Palynological investigations of material from this formation in Cabawin No. 1 by Evans and de Jersey indicated a Jurassic age.

Bundamba Formation, 5294-7850 feet (2556 feet):

The formation consists of three recognizable units; an upper sandstone member, a middle shale member and a lower sandstone member, although intertonguing of units is evident. The upper member occupies the interval 5294-6112 feet and consists of white, coarse-grained quartzose sandstone with interbedded grey siltstone, grey and dark grey shales and thin coaly shales. The sandstones are in part porous and permeable. The middle member occupies the interval 6112-6560 feet and consists of interbedded grey and dark grey shale, coal and siltstone with a few thin sandstone beds. The lower member of the Bundamba Formation was cut between 6560 and 7850 feet. This unit is principally sandstone, but the sequence is interrupted by 250 feet of interbedded light grey sandstone, grey shale and coaly shale.

The upper part of the lower member is a massive porous and permeable quartz sandstone, grading fine to very coarse-grained, subangular to subrounded and containing rounded quartz pebbles throughout. The sand is 95 percent clear and light grey quartz with some white and black lithic grains and traces of grey chert. The matrix is a white clayey tuffaceous material.

The basal sand body of the formation contains more grey and other coloured quartz and grey chert but otherwise is similar in content and texture to higher sandstones. The unit becomes more conglomeratic downward. The base of the Bundamba Formation appears to be gradational downward into the underlying Cabawin Formation at this location. The pick has been made where best indicated by E-Log and where ditch samples indicate first occurrences of definite greenish rewashed tuffaceous matrix. At around 7850 feet the grains and pebbles also show a marked increase of coloured chert and lithic fragments.

Detailed description, Bundamba Formation

5294-5498 feet (204 feet)

SHALE, grey, some light grey and light brownish-grey silty with some interbedded grey and brownish-grey SILTSTONE. Carbonaceous fragments throughout. Thin beds of porous SANDSTONE, light grey quartzose coarse-grained tending to GRIT, with few small rounded pebbles, loosely cemented in the intervals 5294-5328 feet, 5413-5429 feet, and 5467-5478 feet.

5498-5769 feet (271 feet)

SANDSTONE, grey, coarse-grained, tending to GRIT, with few small rounded clear quartz pebbles. Poorly sorted subrounded and subangular clear quartz, some coloured translucent quartz; white clay matrix loosely cemented, moderate to good porosity with thin grey SHALE laminae throughout and interbeds in the intervals 5539-5556 feet, 5573-5580 feet, 5622-5628 feet, and 5681-5691 feet.

5769-6112 feet (343 feet)

SHALE, grey, brownish-grey, some dark grey silty and grading to grey and brownish-grey SILTSTONE with interbedded thin grey quartz SANDSTONES throughout. These sandstones grade fine to coarse-grained with poorly sorted subangular and subrounded clear quartz, few coloured grains, clay and silty matrix in part strongly cemented but more loosely towards the base of the unit. Carbonaceous material scattered throughout with few thin COAL laminae.

6112-6286 feet (174 feet)

SHALE, grey, dark grey, carbonaceous, some light grey silty with few thin black COAL seams.

6286-6294 feet (8 feet)

SANDSTONE, grey, medium-grained, few coarse grains poorly sorted, subangular to subrounded, some rounded clear quartz grains, matrix fine sand loosely cemented, slight porosity.

6294-6318 feet (24 feet)

SHALE, grey, some dark grey, carbonaceous.

6318-6432 feet (114 feet)

SANDSTONE, grey medium-grained, poorly sorted subrounded clear quartz, few lithic grains, fine silt and white clay matrix, loosely cemented, slight porosity with some bright blue fluorescence and with thin interbedded grey SILTSTONE and grey to dark grey SHALE.

6432-6560 feet (128 feet)

SHALE, grey and dark grey, carbonaceous, silty in part with several thin black COAL seams.

6560-6672 feet (112 feet)

SANDSTONE, grey, grading fine to medium-grained with few rounded coarse grains, mainly subrounded clear quartz grains, tight clayey matrix, trace poor blue fluorescence. The sandstone carries interbedded thin grey SHALE and SILTSTONE..

6672-6738 feet (66 feet)

SHALE, grey, dark grey with carbonaceous fragments. Thin black COAL seam at 6700 feet.

6738-7336 feet (598 feet)

SANDSTONE, light grey to grey, coarse to very coarse-grained, grading to GRIT in part and carrying rounded clear and milky quartz pebbles up to 20 mm, particularly from 6950 feet down. Grains poorly sorted, angular through to subrounded, mainly clear quartz, few black lithic, and some muscovite. Matrix fine quartz sand, loosely cemented. Good porosity and permeability evident throughout with some blue fluorescence between 7030-7140 feet. Thin CONGLOMERATIC bands and grey SHALE laminae evident throughout. Thin grey SHALE interbeds near base.

7336-7597 feet (261 feet)

SHALE, grey and dark grey, silty, carrying plant fragments with interbedded grey quartzose SILTSTONE and thin light grey, fine to medium-grained quartzose SANDSTONES. These thin sandstones have slight porosity particularly at the following depths, 7370-7390 feet, 7410 feet, 7472 feet, and 7487 feet. SHALE, grey and dark grey, silty in part at the base (between 7556 and 7597 feet).

7597-7850 feet (253 feet)

SANDSTONE, white to light grey grading fine to coarse-grained near top and tending to greenish-grey GRIT and small pebble CONGLOMERATE with depth. The sandstone and sand matrix of the conglomerate is fine to medium-grained poorly sorted subangular quartz and grey and green lithic grains with some white tuffaceous clay matrix, strongly cemented. Granules and small pebbles are composed of multicoloured subrounded quartz, chert and lithic fragments. Moderate to good porosity particularly near top with few silty SHALE laminae near base. Trace blue fluorescence at 7610 feet.

Age, Bundamba Formation - The age of the Bundamba Formation is considered on palynological evidence to range from Jurassic to Triassic.

## Bowen Group

### Cabawin Formation, 7850-10,600 feet (2750 feet)

The Cabawin Formation is a coarse clastic conglomeratic fill composed almost entirely of volcanic detritus with lesser red shale interbeds. At this location the upper part of the formation appears to grade upward transitionally into the overlying Bundamba Formation. Tongues of coal of the underlying Kianga Formation are present near the base of the unit. In Cabawin No. 1, a thin low resistivity siltstone and shale unit (9835-9865 ft) was included as part of the Kianga Formation. In Cabawin East the equivalent section (10,560-10,600 ft) consists of conglomerate, and has therefore been included as part of the Cabawin Formation.

#### Detailed description, Cabawin Formation

7850-8355 feet (505 feet)

SANDSTONE, grey to greenish-grey, medium-grained, some fine and coarse-grained tending to GRIT in part and carrying few small pebbles, content as for sands above but with much more tuffaceous debris and clay as matrix. Very tight, but with trace weak blue fluorescence. Some very thin grey SHALE interbeds.

8355-8985 feet (630 feet)

SANDSTONE, brownish-grey and reddish-brown, coarse-grained grading to grit, and CONGLOMERATE. Content as for Unit 1 but with red shale and brown chert pebbles and grains dominant. Distinct interbeds of chocolate coloured and grey SHALE evident particularly around 8470 feet, 8600 feet, 8710 feet and 8930 feet. The whole unit is tight though trace of weak blue fluorescence noted at 8690 feet, 8830 feet, and 8880 feet.

8985-9023 feet (38 feet)

SILTSTONE, grey to greenish-grey, with macerated carbonaceous fragments and grading into grey and dark grey silty SHALE in part.

9023-10,230 feet (1207 feet)

SANDSTONE, grey and brownish-grey, in part medium and coarse-grained, in part CONGLOMERATIC, but with few thin beds of slight porosity, the most important of which occur in the intervals 9916-9924 feet, 9963-9973 feet, and 10,021-10,036 feet. Trace poor blue fluorescence at 9560 feet, 9780 feet, and 9830 feet. The interbeds of grey-brown and dark grey SHALE and grey, green-grey, and brownish-grey SILTSTONE occur particularly near top.

10,230-10,600 feet (370 feet)

CONGLOMERATE, whitish-grey, pebbles to cobbles, poorly sorted, subrounded, some rounded, some flattened, ranging from 1/2" to 4" with few granules less than 1/2". Pebbles are dominantly white tuffaceous ash, grey shale and grey chert. Other light brown sub-crystalline dark grey and black lithic fragments. Matrix is medium-grained sand, subrounded and subangular, poorly sorted, grey chert, grey quartz, white ash, with trace mica and white to light grey waxy clayey ash filling matrix. Fairly strong cementing. The conglomerate grades

down to thin sandstones. Weak yellow, milky and blue fluorescence from 10,510 to 10,590 feet. Black coal seams in intervals 10,452 to 10,457 feet and at 10,466 feet and 10,480 feet.

Age, Cabawin Formation - The Cabawin Formation has been dated as Triassic on the basis of palynological evidence, although Permian elements are indicated near the base where the units intertongue the Kianga Formation.

Kianga Formation, 10,600-11,197 feet (597 feet):

The Kianga Formation is an interbedded coal and tuff sequence with minor silty and sandy tuff. Much more coal was present at Cabawin East No. 1 than at Cabawin No. 1 and the thin sandstone that produced oil in the Cabawin No. 1 Well appeared to be much more silty at this location. The Kianga tongues downward into the upper part of the marine Back Creek Formation.

Detailed description, Kianga Formation

10,600-10,711 feet (111 feet)

TUFF, white, light grey, some pale brown dense, siliceous, some hard with subconchoidal fracture, some soft fissile with waxy lustre. Some rewashed silty and fine sand sections, with gold and biotite mica flakes scattered throughout. Thinly interbedded shaly black COAL throughout as are plant fragments. Dull shaly black COAL seams prominent in intervals 10,600-10,608 feet, 10,613-10,620 feet, 10,671-10,676 feet, and 10,690-10,698 feet.

10,711-10,828 feet (117 feet)

TUFF, white, light grey, pale brown as for Unit 1, but interbedded with SANDSTONE, white to light grey, medium-grained, poorly sorted, subangular and subrounded clear quartz, some grey chert with fine sand matrix and strong siliceous cement, hard, slight porosity. A few thin shaly black COAL seams also present.

10,828-11,197 feet (369 feet)

TUFF, white, light grey, brown, as for Unit 1, with interbedded rewashed tuffaceous SILTSTONE, light brown, and pale bluish-grey, and a few very thin re-washed SANDSTONE beds. Thin black COAL seams interbedded throughout in proportion of 20 percent to the other strata.

Age, Kianga Formation - Palynologists have dated the Kianga as Upper Permian.

Back Creek Formation, 11,197-12,091 feet (894 feet):

The Back Creek Formation consists of an interbedded sequence of fossiliferous shallow water marine shales, siltstone, light coloured tuff and coal seams. Only the upper part of the formation was drilled at this locality and this part of the section contained considerably more coal than the equivalent section at Cabawin No. 1.

Detailed description, Back Creek Formation

11,197-11,413 feet (216 feet)

SILTSTONE, bluish-grey, some grey, dark grey, slightly calcareous in part, carrying few sub-rounded to subangular coarse grains of multicoloured chert, quartz and grading to silty SHALE in part. Shelly brachiopoda fragments evident from 11,260 to 11,413 feet. A few thin light grey tuffaceous SHALE and black shaly COALS, interbedded near top and base.

11,413-11,519 feet (106 feet)

COAL, black mainly dull and shaly, some bright with thinly interbedded cream to light brown TUFF and light grey tuffaceous SILTSTONE.

11,519-12,091 feet (572 feet)

SHALE, light to dark grey, slightly calcareous and carrying shelly remains in part but largely carbonaceous grading to grey SILTSTONE in part. A few thin black COAL seams throughout. The beds are sandy and carry grey and green chert pebbles near top of sequence. Thin interlaminated white shaly TUFFS throughout. Yellow fluorescence (possibly mineral) scattered through the unit.

Age, Back Creek Formation - Examination of macrofossils from this unit in Cabawin No. 1 has indicated that the age of the Back Creek Formation is Permian.

Relevance to Occurrence of Petroleum

No significant oil or gas shows were encountered during drilling of the well and consequently no tests were made. Notes on gas shows and fluorescence are given below.

Blythesdale Formation :

Several very small methane gas kicks were noted throughout the unit in the more porous sandstones. A small methane gas show was evident in the basal sandstone of the unit at approximately 4112 feet.

Walloon Formation:

Numerous coal gas shows were encountered through the sequence. These are indicated on the hydrocarbon gas log (held at the Bureau of Mineral Resources, Canberra).

Bundamba Formation:

Several very small coal gas and methane kicks were noted throughout the section. Some scattered blue fluorescence was also noted near the base of the middle member and in the sandstones of the lower member.

Cabawin Formation:

The Electric Log indicates this unit is impermeable throughout. A few very small gas kicks and traces of scattered blue fluorescence were noted (core analyses of Cores 2 and 3 indicated no permeability, porosities of 3 percent to 5 percent and fluid saturation of 100 percent water with trace of oil).

Kianga Formation:

Very small coal gas kicks were noted in this unit along with some scattered weak blue and yellow fluorescence. The yellow fluorescence was associated with tuffs and may be mineral.

Back Creek Formation:

Very small coal gas kicks were evident in this sequence. A yellow fluorescence, sometimes very bright, was noted on cream to light brown tuffs. This fluorescence turned white-blue and then completely disappeared with progressive heating. The tuff locally gave a faint cut. However, fluorescence was never noted in the siltstones or sandstones with which the tuff was interbedded. It is considered that this may be mineral fluorescence, but data are not conclusive.

Porosity and Permeability of Sediments Penetrated

In general the sediments are markedly less porous and permeable than in Cabawin No. 1. This applies to the lower Bundamba section (more silty), the Cabawin Formation (more dense), and the Kianga (Permian) sand which in the first well produced oil, but in Cabawin East, is too silty to be a reservoir.

Contribution to Geological Concepts resulting from Drilling

Cabawin East No. 1 was drilled to determine the hydrocarbon potential of zones of interest encountered in Cabawin No. 1. The test was located on a distinctive fault and domal closure only four miles distant from the productive Cabawin No. 1 Well. The closure occupied a flank position on a large feature and it was postulated that opportunity for increased sand development in the zones of interest would be available. The original concept was proved invalid with observed decrease in sand development with lower porosities and permeability indicated, although the Bundamba, Cabawin and Kianga Formations were thicker than in Cabawin No. 1, possibly as a result of sedimentation on the flanks of a growing structure.

Although negative results were obtained as regards hydrocarbon accumulation, the drilling of Cabawin East No. 1 contributed significantly to the knowledge of stratigraphic characteristics of the various formation units.

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## APPENDIX 1

## CORE DESCRIPTIONS

by

D.J. McGarry *

### Core No. 1

| | |
|---|---|
| Depth Cored : | 6715-6721 feet |
| Interval Cored : | 6'0" |
| Total Recovery : | 5'8" |
| Remarks on Recovery : | Small loss at top through grinding |
| Angle of Hole : | $0^{o}30'$ |
| Apparent Dip of Core : | Flat |
| Barrel Type and Size : | Hughes 8 3/4" Conventional Type "J" Hard Formation Core Head. |

| Recovery | Description |
|---|---|
| 1'5" | SHALE, grey, heavy, dense, subconchoidal fracture in part, scattered carbonaceous and plant fragments. |
| 1'2" | SHALE, grey as above with interlaminated lighter grey SILTSTONE, carrying some scattered macerated carbonaceous material. |
| 3'1" | SHALE, grey to dark grey, heavy, dense, more bedding indicated than for top of core, and with scattered carbonaceous material including fossil plant remains. Thin vertical silty vein in bottom 1'6" filling possible root crack. |

### Core No. 2

| | |
|---|---|
| Depth Cored : | 10,527-10,537 feet |
| Interval Cored : | 10'0" |
| Total Recovery : | 9'3" |
| Remarks on Recovery : | Core lost at bottom |
| Angle of Hole : | $1^{o}$ |
| Apparent Dip of Core : | Flat |
| Barrel Type and Size : | D & S 8 5/8", Diamond Core Head. |

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* Union Oil Development Corporation.

| From | To | Recovery | Description |
|---|---|---|---|
| 10,527'0" | 10,537'0" | 9'3" | CONGLOMERATE, grey to whitish-grey in part, subrounded and flattened, some rounded, ill-sorted pebbles ranging from 1/2" up to 4" with few granules less than 1/2". Pebbles are dominantly white tuffaceous ash, grey chert and grey shale. Other light brown sub-crystalline dark grey and black lithic fragments also evident. Matrix is medium-grained sand subrounded and subangular, ill-sorted, grey chert, white ash, some grey quartz, grey lithic and trace mica with white to light waxy grey clayey ash cement which becomes more apparent towards the base where fills interstitial space between pebbles with less sand matrix. One sandy band between 10,527'6" and 10,527'11". Very weak blue fluorescence at 10,531 feet becoming stronger towards base with blue, milky and yellow fluorescence from 10,533'6" down to bottom of core. Light brown waxy grey clay shows yellow mineral fluorescence and gives slight effervescence with dilute HCl. Tight and hard throughout. |

Core No. 3

Depth Cored : 10,537'0"-10,547'6"

Interval Cored : 10'6"

Total Recovery : 6'6"

Remarks on Recovery : Core ground away top and bottom

Angle of Hole : 1°

Apparent Dip of Core : Flat

Barrel Type and Size : Hughes 8 3/4" Conventional Type "J" Hard Formation Core Head.

| From | To | Recovery | Description |
|---|---|---|---|
| 10,537'0" | 10,547'6" | 6'6" | CONGLOMERATE, grey to whitish-grey in part, subrounded and flattened, some rounded, ill-sorted pebbles ranging from 1/2" up to 4" with few granules less than 1/2". The pebbles are mainly white tuffaceous shale and grey chert with some grey shale, black lithic and other volcanic pebbles. Matrix is medium to coarse, subrounded sand with white and cream clayey ash. Hard and tight. |

Core No. 4

Depth Cored : 10,659-10,670 feet

Interval Cored : 11'0"

Total Recovery : Nil

Remarks on Recovery: Catchers broken, barrel slipped off core

Angle of Hole : $1^{o}$

Dip in Core: -

Barrel Type and Size : Hughes 8 3/4" Conventional Type "J" Hard Formation Core Head.

Core No. 5

Depth Cored : 10,670-10,678 feet

Interval Cored : 8'0"

Total Recovery : 14'9"

Remarks on Recovery : Approximately 9'6" of Core No. 4 run over and picked up, 3' of bottom of Core No. 5, probably coal, left in hole.

Angle of Hole : $1^{o}$

Apparent Dip of Core : Flat ranging $0^{o}$ - $4^{o}$

Barrel Type and Size : Hughes 8 3/4" Conventional Type "J" Hard Formation Core Head.

| From | To | Recovery | Description |
|---|---|---|---|
| 10,659'0" | 10,675'0" | 14'0" | TUFF, white with pale blue-grey and pale brown sections, volcanic ash shale, waxy lustre with few thin soft and brittle sections. One thin siltier part in mid-section carrying 30 percent gold and light brown mica and with slightly calcareous reaction with dilute HCl. Thin carbonaceous laminae near base. |
| 10,675'0" | 10,677'3" | 0'9" | COAL, black, shaly with one thin silty tuffaceous shale band. |

Core No. 6

Depth Cored : 10,678-10,686 feet

Interval Cored : 8'0"

Total Recovery : 8'9"

Remarks on Recovery : 9" gained from bottom of Core No. 5 left in hole

Angle of Hole : $1^{o}$

Apparent Dip of Core : Flat ranging $0^{o}$ - $4^{o}$

Barrel Type and Size : Hughes 8 3/4" Conventional Type "J" Hard Formation Core Head.

| From | To | Recovery | Description |
|---|---|---|---|
| 10,677'3" | 10,682'3" | 5'0" | SHALE, grey, tuffaceous, colouration due to finely disseminated carbonaceous material, carrying plant fragments, some subconchoidal fracture. |
| 10,682'3" | 10,683'11" | 1'8" | COAL, black, shaly, with thin interbedded bands of grey to light grey tuffaceous shale. |
| 10,683'11" | 10,685'9" | 1'10" | TUFF, light grey to white, volcanic ash, traces macerated carbonaceous material. |
| 10,685'9" | 10,686'0" | 0'3" | COAL, black, shaly, with thin laminae grey tuffaceous shale. |

Core No. 7

Depth Cored : 10,686-10,699 feet

Interval Cored : 13'0"

Total Recovery : 11'6"

Remarks on Recovery : A little coal ground away but main loss in tuff pulled off bottom

Angle of Hole : $1^{o}$

Apparent Dip of Core : Flat ranging $0^{o}$ - $4^{o}$

Barrel Type and Size : Hughes 8 3/4" Conventional Type "J" Hard Formation Core Head.

| From | To | Recovery | Description |
|---|---|---|---|
| 10,686'0" | 10,687'5" | 1'5" | TUFF, light brownish-grey, shaly, waxy lustre in part carrying disseminated carbonaceous material with scattered plant remains on bedding. |
| 10,687'5" | 10,688'7" | 1'2" | COAL, black, shaly, with thin bands light grey tuffaceous shale and with much tuffaceous material in coal. |
| 10,688'7" | 10,690'2" | 1'7" | TUFF, light brownish-grey, shaly, waxy lustre with scattered plant remains. |
| 10,690'2" | 10,690'4" | 0'2" | COAL, black, shaly. |
| 10,690'4" | 10,691'1" | 0'9" | TUFF, light brownish-grey as above. |
| 10,691'1" | 10,692'2" | 1'1" | COAL, black, shaly, carrying much tuffaceous material as well as thin bands tuff. |

| From | To | Recovery | Description |
|---|---|---|---|
| 10,692'2" | 10,692'6" | 0'4" | TUFF, light brownish-grey, carrying plant remains. |
| 10,692'6" | 10,697'2" | 4'8" | COAL, black, few thin bright bands mainly shaly, some parts with much admixed tuffaceous material. Few thin bands grey tuff. |
| 10,697'2" | 10,699'0" | 0'4" | TUFF, grey, shaly, some disseminated carbonaceous material and plant remains. |

## SCHLUMBERGER SIDEWALL CORE DESCRIPTIONS

by

D.J. McGarry *

Date Cores Taken: 15th October, 1961

Coring Gun : 30 Shot Gun - Hard Formation Sample Takers

| Depth (feet) | Recovery (in.) | Description |
|---|---|---|
| 7120 | - | LOST IN HOLE |
| 7236 | - | LOST IN HOLE |
| 7617 | 1 1/4 | SANDSTONE, grey, medium-sized subangular clear and grey quartz, finely CONGLOMERATIC pebbles rounded to subrounded, grey quartz and chert ill-sorted up to 12 mm. Light grey clayey matrix, soft. |
| 7700 | 1 | SILTSTONE, grey, with thin white bedding lamina. |
| 7830 | 1 | SANDSTONE, greenish-grey, medium-grained, ill-sorted, subangular, clear, grey and greenish-grey quartz, light grey chert and some cream and black lithic fragments in soft cream tuffaceous matrix. |
| 8098 | 1 | SANDSTONE, reddish-brown, ill-sorted, medium to coarse, subangular some subrounded, clear and grey quartz and chert, few cream coloured tuffaceous grains, few granule size set in fine sand and soft red tuffaceous clay matrix, local rewash sediment. |
| 8177 | 1 1/4 | SANDSTONE, reddish-brown as for 8098 feet but with much more chocolate clay matrix. |
| 9920 | - | EMPTY |
| 9922 | - | EMPTY |
| 9969 | - | LOST IN HOLE |
| 9971 | - | EMPTY |
| 10028 | - | EMPTY |
| 10030 | 1 | SHALE, chocolate coloured, with flecks greenish-grey silty material. |

* Union Oil Development Corporation.

| Depth (feet) | Recovery (in.) | Description |
|---|---|---|
| 10,285 | - | MISFIRE |
| 10,455 | - | EMPTY |
| 10,475 | 1 | COAL, black, bright. |
| 10,477 | 1 1/4 | COAL, black, bright. |
| 10,625 | - | LOST IN HOLE |
| 10,744 | - | EMPTY |
| 11,495 | 1 | COAL, black, bright. |
| 11,504 | 1 | SANDSTONE, grey, coarse-grained, ill-sorted rounded and subrounded, black, light grey chert and lithic grains set in grey silty clay tuffaceous soft matrix. |
| 11,511 | 1/4 | TUFF, dark brown, waxy lustre, primary volcanic ash with admixed finely disseminated carbonaceous material. |
| 11,524 | 1 | SANDSTONE, grey, tuffaceous, ill-sorted, medium-grained, light grey tuff grains some clear and light grey quartz, subangular, soft light grey, tuffaceous clay matrix. |
| 11,533 | 1 | SANDSTONE, grey, tuffaceous, fine to medium-grained, subangular, light grey, some clear quartz with some subrounded grey quartz and chert in soft light grey tuffaceous matrix. |
| 11,796 | 1 1/2 | COAL, black, shaly. |
| 11,935 | 1 | SHALE, blue-grey, with few coarse grains grey chert. |
| 11,961 | 1/2 | SHALE, dark grey, silty. |
| 12,085 | 1 | SHALE, dark bluish-grey, silty. |
| 6762 | 1 | SILTSTONE, grey, quartzose but with fine sand matrix, few fine-grained size clear quartz grains evident. |
| 6762 | 1 | SILTSTONE, grey as for 6762 feet above, (extra sample taken for B.M.R.). |
| 6803 | 3/4 | SILTSTONE, grey, shaly, micromicaceous. |

| Depth (feet) | Recovery (in.) | Description |
|---|---|---|
| 6900 | 3/4 | SANDSTONE, light grey, fine to medium-grained, quartzose, subangular clear quartz grains with few larger light grey translucent subrounded quartz grains. Matrix is very fine quartz sand, loosely cemented, tight, bright blue fluorescence, trace cut. |
| 6901 | 3/4 | SANDSTONE, white, fine to medium-grained as for 6900 feet above, bright blue fluorescence, trace cut. |
| 7020 | 3/4 | SANDSTONE, grey, medium-grained, fair sorting, subrounded, some subangular clear quartz, few light grey quartz grains. A little white silt matrix, porous. |
| 7020 | 3/4 | SANDSTONE, grey, medium-grained as for 7020 feet above but tighter with white silt matrix and containing one black carbonaceous lamina. |
| 7121 | 1/2 | SANDSTONE, grey, coarse-grained, ill-sorted, subrounded, some subangular clear quartz and hard cream lithic grains, few grey grains in soft loose cream tuffaceous matrix. |
| 7208 | 1 | SANDSTONE, light grey, medium-grained, ill-sorted, subrounded and subangular clear and grey quartz, few coarse grains, few cream coloured lithic grains, white silt matrix, tight. |
| 7235 | 1 1/4 | SANDSTONE, light grey, tuffaceous, fine-grained, subangular clear and light grey quartz set in light grey tuffaceous matrix, micromicaceous, tight. |
| 7235 | 1 1/4 | SANDSTONE, light grey, medium-grained, subrounded and subangular clear and grey quartz, few black lithic grains, white tuffaceous matrix, tight. |
| 9920 | - | EMPTY |
| 9923 | - | EMPTY |
| 9968 | 1 | SANDSTONE, grey, medium-grained, finely CONGLOMERATIC ill-sorted multicoloured chert, some quartz, subangular and subrounded, subrounded small grey lithic pebble evident, tight, tuffaceous matrix. Trace weak blue fluorescence. No cut. |
| 10027 | 3/4 | GRIT, greenish-grey, ill-sorted, subrounded and subangular multicoloured chert, quartz and lithic grains set in grey tuffaceous clay matrix, tight. |

| Depth (feet) | Recovery (in.) | Description |
|---|---|---|
| 10,605 | 2 | COAL, black, thinly laminated bright and shaly bands. |
| 10,640 | 1 | SHALE, black, carbonaceous, primary tuff with finely admixed carbonaceous material, and thin black coal laminae. |
| 10,650 | - | LOST IN HOLE |
| 10,749 | 3/4 | TUFF, white, with few grey lithic medium-sized grains evident. |

## APPENDIX 2

## PALAEONTOLOGICAL REPORTS

## PALYNOLOGY OF SAMPLES FROM UNION-KERN-A.O.G. CABAWIN EAST NO. 1

by

N.J. de Jersey, M. Hamilton, and R.J. Paten *

### INTRODUCTION

The palynological investigation was based on conventional cores, sidewall cores and cuttings. Attention was concentrated on the Permian section of the well in order to carry out a comparison of the microfloral succession with that in the previous well, Union-Kern-A.O.G. Cabawin No. 1, drilled approximately four miles to the west. By such a comparison it was hoped to obtain evidence on the lateral persistence of microfloral assemblages within the Permian sequence. From the economic aspect, itwas also hoped detailed study of the microfloral succession within the Permian might provide evidence on correlation between the two wells near the level of the sandstone from which oil was produced in Cabawin No. 1.

In addition some samples from the Mesozoic section of the well have been examined in order to enable comparison with assemblages from the previous well. With the exception of a sample from Core No. 1, which was examined by R.J. Paten, the investigation was carried out by N.J. de Jersey and M. Hamilton.

### DETAILED PALYNOLOGY OF SAMPLES

#### Samples of Permian Age

As in the previous well, the Permian section at Cabawin East No. 1 consists of marine strata with interbedded coal seams towards the top, overlain by coal measures which have been correlated with the Kianga coal measures. These Permian coal measures are in turn overlain by a large thickness of coarse sandstone and conglomerate (the Cabawin Formation) which is regarded as largely Triassic in age. The material available for study from this section of the well consisted of conventional Cores 5, 6, and 7 from the top portion of the Permian coal measures, some sidewall cores, two of which (from 10,605 feet and 11,495 feet) were examined, and cuttings taken at 10-foot intervals. Contamination of the cuttings was minimized by selecting samples from some of the thick coal seams within the section. The coal cuttings were separated from the accompanying shale as the floats in carbon tetrachloride (S.G. 1.58), possible contamination from shale cuttings thus being eliminated. In addition, possible contamination from coal seams higher in the sequence was reduced by selecting samples from the top of each coaly sequence, immediately below sections of shale and sandstone.

##### Coal seams interbedded within the marine Permian:

The presence of a thick coal seam interbedded in the marine sediments is indicated by the lithological log in which sections containing 80 to 100 percent coal are recorded from 11,420 to 11,520 feet. The top of this thick seam is about 150 feet below the top of the marine strata. The sample examined from this section was a sidewall core taken at 11,495 feet. To reduce possible contamination from drilling mud this was subjected to

* Geological Survey of Queensland, February, 1962.

specific gravity separation in carbon tetrachloride. It is to be expected, however, that difficulties due to contamination of sidewall cores which were previously experienced in the case of shale cores from the Combarngo No. 1 Well would be much less in evidence in the case of sidewall cores of coal, as the high spore yield from the coal would overshadow any contamination from the adhering drilling mud.

The following spores were identified :

| | | |
|---|---|---|
| Acanthotriletes sp. | ) | 8% |
| A. ericianus - | ) | |
| Calamospora sp. | ) | 3.5% |
| C. diversiformis | ) | |
| Cirratriradites sp. | ) | |
| Dulhuntyispora parvitholus | | 44.5% |
| Ginkgocycadophytus sp. | ) | |
| Granulatisporites sp. | ) | |
| G. aff. micronodosus | ) | 7% |
| G. trisinus - | ) | |
| Inaperturopollenites sp. | ) | 19.5% |
| Pilasporites sp. - | ) | |
| Leiotriletes sp. | ) | 11.5% |
| L. directus - | ) | |
| Lunatisporites sp. | ) | |
| L. limpidus - | ) | 3.5% |
| Marsupipollenites triradiatus | | |
| Striatites cancellatus | | |
| Verrucosisporites sp. | | |

The characteristic feature of this assemblage is the dominance of Dulhuntyispora parvitholus (44.5%). The dominance of this species (previously recorded as Tholosporites parvitholus) is similarly a feature of the assemblage from a thick section interbedded in the marine Permian in Cabawin No. 1. In the latter sample (from 10,570 to 10,620 feet) the proportion of D. parvitholus was 45 percent. In addition the remaining species from the two samples are generally comparable in distribution and the close similarity in the assemblages, in conjunction with their similar positions in the sequence (near the top of the marine section) indicates a correlation of these two sections.

As D. parvitholus is restricted to the Uppper Coal Measures of New South Wales (Upper Permian), the evidence of this assemblage indicates an Upper Permian age for the sample.

Samples from the Permian coal measures:

The samples described here came from the Permian coal measures which are about 650 feet thick in this well, overlying the marine beds at a depth of 11,270 feet and being in turn overlain by coarse sandstone and conglomerate of the Cabawin Formation. This portion of the sequence was studied in some detail and the assemblages recorded are listed below in ascending stratigraphic order.

(i) Coal Cuttings, 11,190-11,200 feet

| | |
|---|---|
| Acanthotriletes sp. | ) |
| A. ericianus | ) 12% |
| A. tereteangulatus - | ) |
| Apiculatisporites filiformis | ) 7% |
| A. cf. levis | ) |
| Bascanisporites undosus | 1% |
| Calamospora diversiformis | 6.5% |
| Dulhuntyispora parvitholus | 1.5% |
| Ginkgocycadophytus sp. | ) 2% |
| G. vetus - | ) |
| Granulatisporites sp. | ) |
| G. micronodosus | ) 5.0% |
| G. trisinus - | ) |
| Inaperturopollenites sp. | ) 17.5% |
| Pilasporites sp. - | ) |
| Laevigatosporites sp. | ) 1% |
| L. vulgaris forma colliensis - | ) |
| Leiotriletes sp. | ) 10% |
| L. directus | ) |
| Limitisporites sp. | |
| Lunatisporites sp. | ) |
| L. amplus | ) 26.5% |
| L. limpidus - | ) |
| Marsupipollenites sp. | ) |
| M. sinuosus | ) 3.0% |
| M. triradiatus | ) |
| Protosacculina multistriatus | |
| Punctatisporites aff. gretensis | |
| Striatites cancellatus | 3.0% |
| Type 25A de Jersey (1946) | |
| Indeterminate Bisaccate Spores | |
| Striate Bisaccate Spore | |

(ii) Coal Cuttings, 11,090-11,100 feet

| | |
|---|---|
| Acanthotriletes sp. | ) |
| A. ericianus | ) 13.5% |
| A. tereteangulatus | ) |
| Apiculatisporites cf. levis | 1.5% |
| Bascanisporites undosus | 1.0% |
| Calamospora sp. | ) |
| C. diversiformis | ) 1.5% |
| Dulhuntyispora parvitholus | 0.5% |
| Granulatisporites micronodosus | ) 5.0% |
| G. cf. trisinus - | ) |
| Inaperturopollenites sp. | ) 38% |
| Pilasporites sp. - | ) |

| | | |
|---|---|---|
| Leiotriletes sp. | ) | 21% |
| L. directus | ) | |
| Lunatisporites amplus | ) | 8.5% |
| L. limpidus | ) | |
| Marsupipollenites sp. | | |
| Protosacculina multistriatus | | |
| Pteruchipollenites sp. | | |
| Striatites cancellatus | ) | 4.5% |
| Striatopodocarpites fusus | ) | |
| Verrucosisporites trisecatus | | |
| Verrucososporites sp. | ) | 1.5% |
| V. leopardus | ) | |
| Indeterminate Bisaccate Spores | | |

(iii) Coal Cuttings, 10,900-10,920 feet

| | | |
|---|---|---|
| Acanthotriletes sp. | ) | 6.5% |
| A. ericianus | ) | |
| A. tereteangulatus | ) | |
| Apiculatisporites filiformis | ) | 1.5% |
| A. cf. levis | ) | |
| Calamospora sp. | ) | 2.5% |
| C. diversiformis | ) | |
| Dulhuntyispora parvitholus | | 0.5% |
| Ginkgocycadophytus sp. | | |
| Granulatisporites sp. | ) | |
| G. micronodosus | ) | 7.5% |
| G. cf. trisinus | ) | |
| Inaperturopollenites sp. | ) | 35% |
| Pilasporites sp. | ) | |
| Leiotriletes sp. | ) | 25.5% |
| L. directus | ) | |
| Limitisporites sp. | | |
| Lunatisporites amplus | ) | 12.5% |
| L. limpidus | ) | |
| cf. Marsupipollenites fasciolatus | ) | 1.5% |
| M. triradiatus | ) | |
| Striatites cancellatus | ) | 2.5% |
| Striatopodocarpites fusus | ) | |
| Verrucosisporites sp. | | |
| Vestigisporites sp. | | |
| Indeterminate Bisaccate Spores | | |

(iv) Coal Cuttings, 10,780-10,790 feet

| | | |
|---|---|---|
| Acanthotriletes sp. | ) | 3.0% |
| A. ericianus | ) | |
| A. tereteangulatus | ) | |
| cf. Annulispora sp. | | 1.0% |
| Apiculatisporites sp. | | 1.0% |

| | | |
|---|---|---|
| Araucariacites sp. | | |
| Bascanisporites undosus | | 0.5% |
| Calamospora sp. | ) | 3.5% |
| C. diversiformis | ) | |
| Dulhuntyispora parvitholus | | 2.0% |
| Ginkgocycadophytus spp. | ) | |
| G. cf. cymbatus | ) | 5.5% |
| G. vetus | - ) | |
| Granulatisporites sp. | ) | 3.5% |
| G. micronodosus | - ) | |
| Inaperturopollenites sp. | ) | 39% |
| Pilasporites sp. | - ) | |
| Laevigatosporites sp. | ) | 1.0% |
| L. scissus | - ) | |
| Leiotriletes sp. | ) | 18.5% |
| L. directus | ) | |
| Lunatisporites limpidus | | 5.0% |
| Marsupipollenities sp. | ) | |
| M. fasciolatus | ) | 2.0% |
| M. triradiatus | ) | |
| Nuskoisporites gondwanensis | | 1.0% |
| Protosacculina multistriatus | | |
| Pteruchipollenites sp. | | |
| Striatites sp. | ) | 2.5% |
| S. cancellatus | ) | |
| Striatopodocarpites fusus | ) | |
| Tuberculatosporites modicus | | 1.0% |
| Indeterminate Bisaccate Forms | | |

(v) Coal Cuttings, 10,730-10,740 feet

| | | |
|---|---|---|
| Acanthotriletes sp. | ) | |
| A. ericianus | ) | 3.0% |
| A. tereteangulatus | ) | |
| Bascanisporites undosus | | |
| Dulhuntyispora parvitholus | | 6.0% |
| Ginkgocycadophytus sp. | | 2.5% |
| Granulatisporites sp. | ) | 6.5% |
| G. micronodosus | - ) | |
| Inaperturopollenites sp. | ) | 46.5% |
| Pilasporites sp. | - ) | |
| Leiotriletes sp. | ) | 26% |
| L. directus | ) | |
| Lunatisporites limpidus | | 2.5% |
| Marsupipollenites triradiatus | ) | 3.5% |
| M. triradiatus forma striatus | ) | |
| aff. Nuskoisporites sp. | | |
| Striatites cancellatus | ) | 1.0% |
| Striatopodocarpites fusus | ) | |
| Indeterminate Bisaccate Pollen | | |
| Striate Bisaccate Pollens | | |

(vi) Core No. 7, 10,697 feet - 10,697 feet 4 inches

| | |
|---|---|
| Acanthotriletes sp. | ) 5.5% |
| A. ericianus | ) |
| A. tereteangulatus - | ) |
| Calamospora sp. | ) 1.5% |
| C. diversiformis | ) |
| Dulhuntyispora parvitholus | 0.5% |
| Ginkgocycadophytus sp. | 2.0% |
| Granulatisporites sp. | ) |
| G. micronodosus | ) 10.0% |
| G. trisinus - | ) |
| Inaperturopollenites sp. | ) 18.5% |
| Pilasporites sp. | ) |
| Leiotriletes directus | 42% |
| Lunatisporites sp. | ) |
| L. amplus | ) 9.0% |
| L. limpidus | ) |
| Marsupipollenites triradiatus | 3.5% |
| Nuskoisporites cf. gondwanensis | |
| Pteruchipollenites sp. | |
| Striatites cancellatus | ) 2.5% |
| Striatopodocarpites fusus | ) |
| Vestigisporites sp. | 1.0% |
| Indeterminate Bisaccate Type | |

(vii) Core No. 5, 10,676 feet - 10,676 feet 2 inches

| | |
|---|---|
| Acanthotriletes sp. | ) |
| A. ericianus | ) 12% |
| A. cf. tereteangulatus | ) |
| A. cf. uncinatus - | ) |
| Apiculatisporites sp. | ) 1.5% |
| A. filiformis | ) |
| cf. Araucariacites sp. | 1% |
| Calamospora sp. | ) 2.5% |
| C. diversiformis - | ) |
| Ginkgocyadophytus sp. | ) 4.5% |
| G. vetus | ) |
| Granulatisporites micronodosus | 7% |
| Inaperturopollenites sp. | ) 32% |
| Pilasporites sp. | ) |
| Laevigatosporites vulgaris | |
| Leiotriletes sp. | ) 31% |
| L. directus | ) |
| Lunatisporites limpidus | 2.5% |
| Marsupipollenites triradiatus | 1% |
| Striatites cancellatus | |
| Verrucosisporites sp. | 2.5% |
| Indeterminate Bisaccate Forms | |

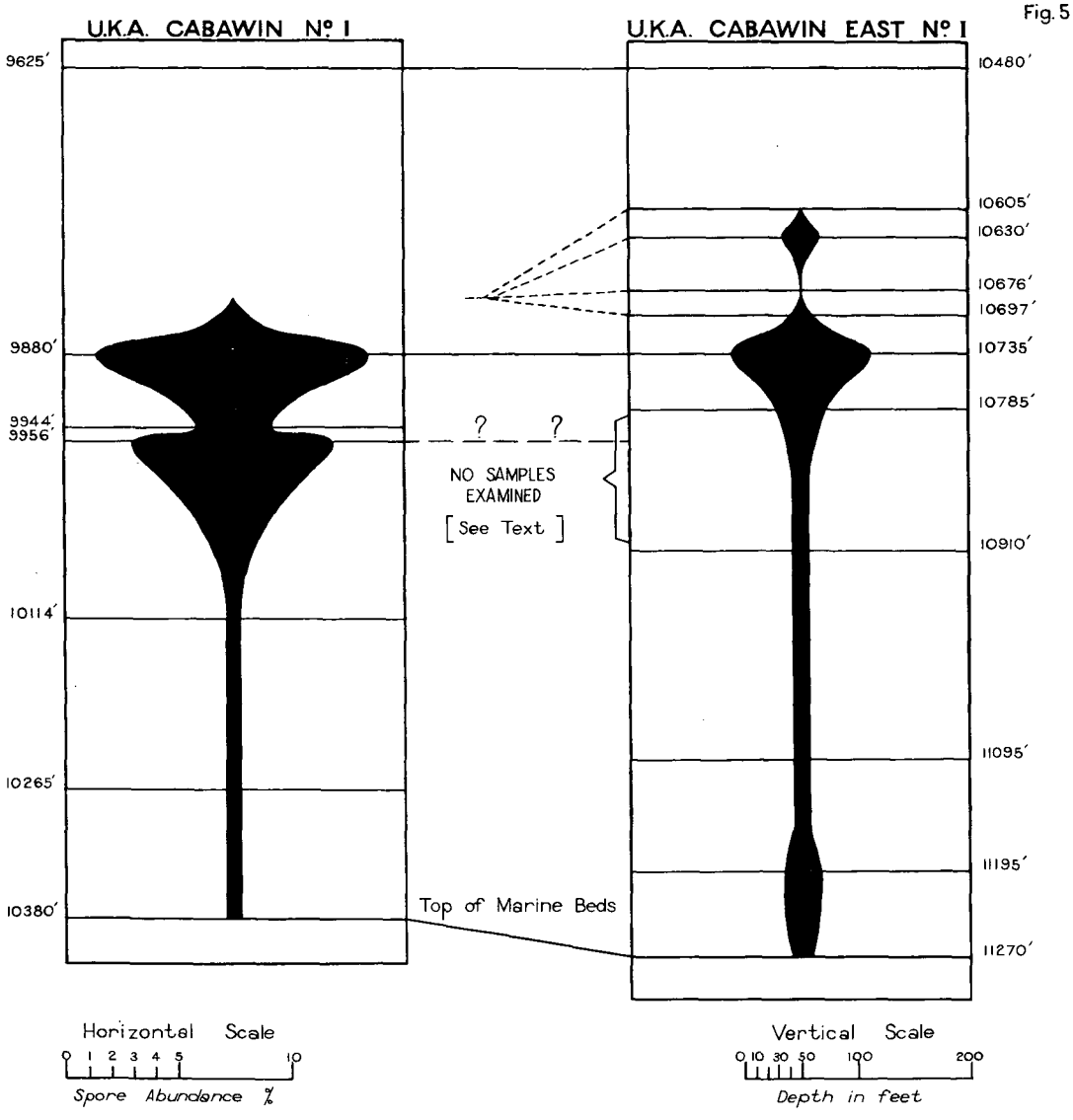
(viii) Coal Cuttings, 10,620-10,640 feet

| | |
|---|---|
| Acanthotriletes sp. | ) |
| A. ericianus | ) 9.5% |
| A. tereteangulatus - | ) |
| Apiculatisporites filiformis | ) |
| A. cf. levis | ) 1% |
| cf. Araucariacites sp. | |
| Calamospora diversiformis | |
| cf. Cirratriradites sp. | |
| Cirratriradites cf. splendens | |
| Dulhuntyispora parvitholus | 1.5% |
| Ginkgocycadophytus spp. | ) 3.5% |
| G. vetus - | ) |
| Granulatisporites sp. | ) |
| G. micronodosus | ) 6% |
| G. trisinus - | ) |
| Inaperturopollenites sp. | ) 33% |
| Pilasporites sp. | ) |
| Laevigatosporites scissus | |
| Leiotriletes sp. | ) 27% |
| L. directus - | ) |
| Lunatisporites sp. | ) |
| L. cf. amplus | ) 6% |
| L. limpidus - | ) |
| Striatites cancellatus | ) |
| Striatopodocarpites cf. fusus | ) 1% |
| Verrucosisporites sp. | |
| Verrucososporites sp. | 1.5% |
| Type 25A de Jersey (1946) | |
| Indeterminate Bisaccate Forms | |

(ix) Sidewall Core at 10,605 feet

| | |
|---|---|
| Acanthotriletes sp. | ) |
| A. ericianus | ) 11% |
| A. tereteangulatus - | ) |
| Apiculatisporites sp. | ) 3% |
| A. cf. levis | ) |
| Ginkgocycadophytus sp. | |
| Granulatisporites sp. | ) 5% |
| G. micronodosus - | ) |
| Inaperturopollenites sp. | ) 29% |
| Pilasporites sp. - | ) |
| Leiotriletes sp. | ) 42% |
| L. directus - | ) |
| Lunatisporites cf. limpidus | ) 4% |
| Striatites cancellatus | ) |
| Striatopodocarpites fusus | ) |
| Verrucosisporites sp. | |
| Indeterminate Bisaccate Forms | |

Fig. 5




DISTRIBUTION DIAGRAMS FOR DULHUNTYISPORA SHOWING CORRELATION OF PORTIONS OF U.K.A. CABAWIN Nº I AND U.K.A. CABAWIN EAST Nº I WELLS

During the investigation of the Permian assemblages from the Cabawin No. 1 Well, attention was concentrated on distinctive features of vertical distribution of the species which might be of stratigraphic value for recognition of horizons within this part of the sequence. The most promising species from this aspect was found to be D. parvitholus. This species was found to be fairly common (12%, 9%) in two samples from near the top of the Permian coal measures and much less abundant in samples from the lower part of the section.

Study of the percentage distribution of D. parvitholus in the Cabawin East No. 1 Well, as recorded above, shows that it exhibits a similar general pattern to that in Cabawin No. 1. The species is comparatively rare (usually less than 2%) in samples from the lower part of the coal measures and reaches a maximum of 6 percent in the sample from 10,730 to 10,740 feet. Thus this maximum of D. parvitholus may be correlated with the maximum of the species in the sample from 9870 to 9890 feet in the Cabawin No. 1 Well. This correlation is illustrated in Figure 5 by lines joining corresponding maxima of the distribution diagrams.

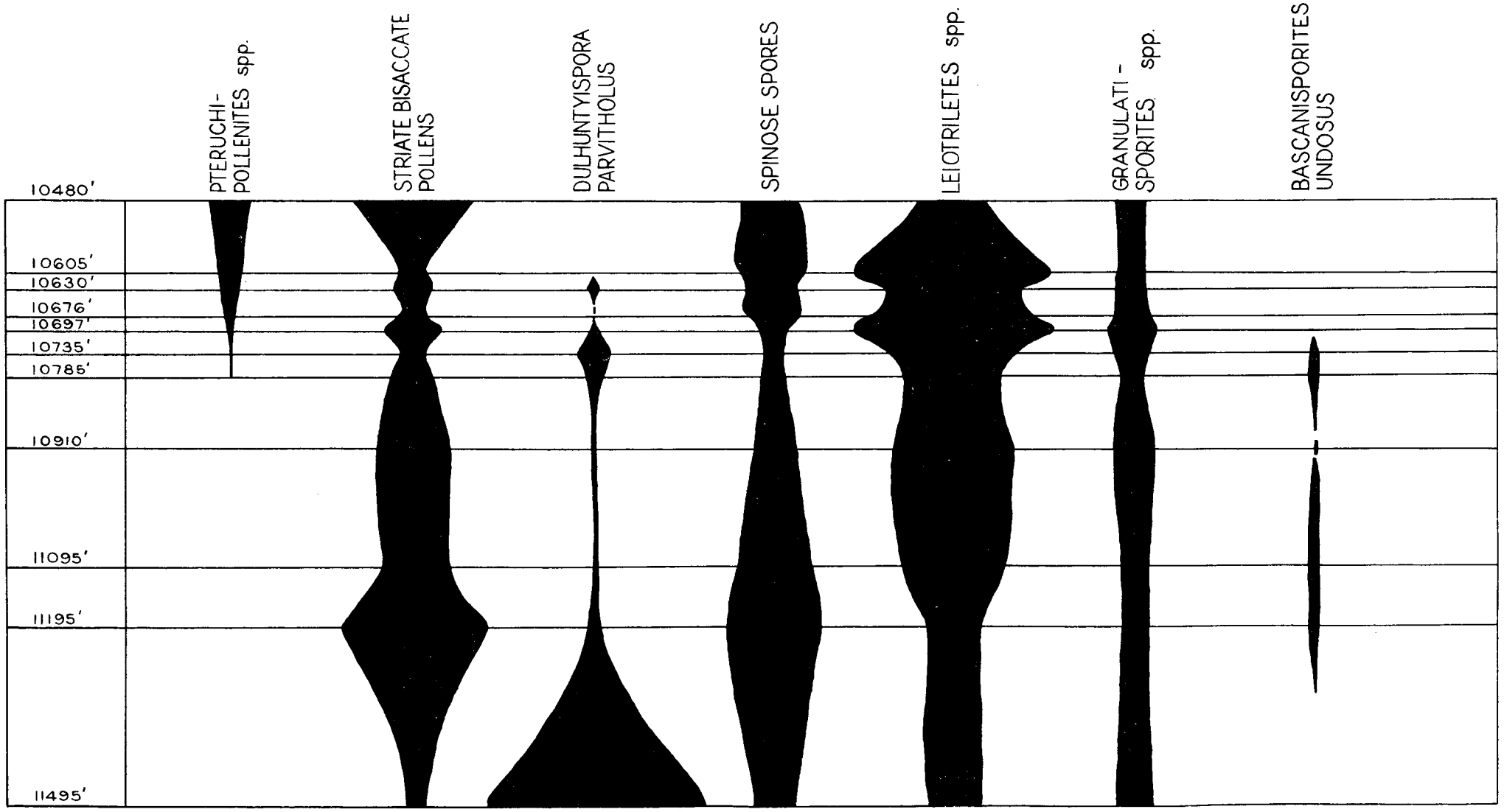
In Cabawin No. 1, a secondary peak in the distribution curve was observed in a sample from Core No. 33 (9955'9"). The presence of this secondary peak could not be definitely demonstrated in the Cabawin East sequence because no core samples nor cuttings of high coal content were available from the equivalent portion of the succession. Cuttings, predominantly shale, which were the only samples available, were considered too prone to contamination to warrant detailed study in this part of the sequence.

In the Cabawin No. 1 Well, the coal seam which yielded the assemblage with the maximum of D. parvitholus (9870 to 9890 feet) was almost directly overlain by the sandstone and conglomerates of the Cabawin Formation. In the Cabawin East succession, however, the assemblage with a maximum of D. parvitholus came from a sample (10,730 to 10,740 feet) which was overlain by a section of over 100 feet of coal measure strata which was in turn succeeded by the Cabawin Formation. The correlation suggested above thus indicates that this section at the top of the coal measures in Cabawin East No. 1, is missing from the sequence at Cabawin No. 1.

The correlation outlined above also provides evidence bearing on the possible extension of the sandstone, which was the oil reservoir intersected in Cabawin No. 1, to the Cabawin East No. 1 Well. In the former well this sandstone was about 40 feet below the horizon yielding a maximum of D. parvitholus. At Cabawin East there is a sandstone section about 25 feet below the coal seam (10,730 to 10,740 feet) yielding this maximum of D. parvitholus and consequently it is suggested that this latter sandstone is on an horizon approximately equivalent to that of the oil sand in the Cabawin No. 1 Well.

The distribution of Dulhuntyispora and other genera and groups of genera of possible stratigraphic significance is indicated in Figure 6. This diagram shows the distribution of Dulhuntyispora as described above. It also indicates the appearance of Pteruchipollenites spp. towards the top of the sequence and the persistence of genera such as Leiotriletes and Granulatisporites, and also of spinose spores and striated bisaccate pollens throughout the succession. With the possible exception of Leiotriletes, the distribution patterns of these genera and groups of genera do not appear to be of stratigraphic significance. The genus was appreciably more abundant in the section at the top of the coal measures where its proportion reached 42 percent. This distribution may, however, be of ecological rather than stratigraphic significance, as the samples examined were derived from thin coal seams which might be expected to have a less diversified flora than the thicker coal sections. The distinctive species Bascanisporites undosus was confined to four samples in the section 10,730 to 11,190 feet.

Fig. 6




# DIAGRAM TO ILLUSTRATE THE VERTICAL DISTRIBUTION OF SOME SIGNIFICANT SPORE TYPES

Although only present in small proportions (average 1%) it is such a distinctive species that it may be of stratigraphic value in recognition of this part of the sequence, particularly as it was recorded from a sample of cuttings (10,260 to 10,270 feet) in Cabawin No. 1, which would be stratigraphically equivalent to an horizon within this part of the sequence.

The assemblages recorded above are in general typical of the Upper Permian as exemplified by the Upper Coal Measures of New South Wales. D. parvitholus, which is regarded as being significant in fixing the Permian - Triassic boundary, is present throughout, with the exception of the sidewall core from 10,605 feet. The absence of D. parvitholus from this sample, however, is not considered highly significant as the species was present in a sample only 15 feet farther down, and also because the upper sample yielded a rather specialized assemblage, dominated by Leiotriletes sp. Consequently the whole of the section of coal measures examined from 10,605 feet downwards, is regarded as Upper Permian in age.

Coal Sample of (?) Lower Triassic Age:

A sample which is regarded as probably Triassic in age has been examined from a coal seam interbedded within the Cabawin Formation. It consisted of coal cuttings recovered from the ditch sample from 10,480 to 10,482 feet as the floats in carbon tetrachloride. The following species have been identified :

| | |
|---|---|
| Acanthotriletes ericianus - A. tereteangulatus | 12% |
| Apiculatisporites filiformis - A. levis | 2.5% |
| Araucariacites sp. | 5.5% |
| Caytonipollenites sp. | 2% |
| Ginkgocycadophytus sp. | 2% |
| Granulatisporites sp. - G. micronodosus | 5.5% |
| Inaperturopollenites sp. | |
| Pilasporites sp. - P. crassus | 22.5% |
| Leiotriletes sp. - L. directus | 13.5% |
| Lunatisporites amplus - L. limpidus - L. cf. phaleratus | 18.5% |
| Marsupipollenites sp. | |
| Pteruchipollenites sp. | 7.5% |
| Striatites cancellatus - Striatopodocarpites fusus | 7% |
| Verrucososporites sp. Type 25A de Jersey (1946) | |

This assemblage contains a mixture of Permian species, of genera such as Acanthotriletes, Apiculatisporites, Lunatisporites, Striatites, and Striatopodocarpites with genera of Mesozoic aspect such as Araucariacites, Caytonipollenites, and Pteruchipollenites. Such a "mixed" microflora has been recorded from the Lower Triassic Narrabeen Group of New South Wales by Hennelly (1958a), and consequently the age of this sample is regarded as

probable Lower Triassic. D. parvitholus, a distinctive Permian species has not been identified in a count of 200 specimens and there is thus a marked difference from the coal measures lower down where it was persistently present. In view of the distance between the sections at Cabawin and in the Sydney Basin, too detailed a comparison may be inadvisable, and it may be difficult to locate precisely the Permian-Triassic boundary in the Surat Basin. Consequently, on present knowledge, the coal measures from 10,605 feet downwards, containing a microflora closely comparable with that of the Upper Coal Measures of New South Wales, are regarded as representing the highest Permian horizons in the well.

The general character of the assemblage from this sample is similar to that of an assemblage previously recorded from 9620 to 9630 feet (coal cuttings) in Cabawin No. 1. On the basis of this similarity and the similar stratigraphic position of these coal sections (representing in each case the only coal seam interbedded in a large thickness of coarse sediments), they are regarded either as co-extensive or as on closely similar horizons.

Coal Sample of Upper Triassic Age:

This sample consisted of coal cuttings separated from the ditch sample (7400 to 7410 feet) as the floats in carbon tetrachloride. It yielded abundant spores and pollens, the following being identified :

| | |
|---|---|
| cf. Annulispora sp. | |
| Araucariacites sp. | 2.5% |
| Concavisporites sp. | 9% |
| Ginkgocycadophytus sp. ) | |
| G. cf. crassimarginis ) | 15% |
| G. nitidus ) | |
| G. magna ) | |
| Granulatisporites sp. | |
| Inaperturopollenites spp. ) | |
| I. reidi ) | 14% |
| Pilasporites crassus ) | |
| P. minutus ) | |
| Leiotriletes sp. ) | |
| L. directus ) | |
| L. magnus ) | 19% |
| L. mortoni ) | |
| Leptolepidites sp. | |
| Lycopodiumsporites rosewoodensis ) | 2% |
| L. triangularis ) | |
| Pteruchipollenites spp. | 22.5% |
| Punctatosporites sp. | 6.5% |
| cf. Todisporites sp. | |
| Tsugaepollenites sp. ) | 1% |
| Tsugaepollenites cf. segmentatus ) | |
| Verrucosisporites spp. | 3% |
| Verrucososporites sp. | 1.5% |

This assemblage is characterized by an abundance of Pteruchipollenites spp. (22.5%). This is a distinctive feature in the Triassic of Queensland, there being a marked

difference from the succeeding microflora of the basal Jurassic which is distinguished by the appearance in great abundance of Corollina and the rarity of Pteruchipollenites. There is also a marked difference from the Lower Triassic microflora recorded from the previous sample and this is to be expected from the lithological evidence of an unconformity between the Cabawin Formation and the overlying Upper Triassic.

From the evidence of work currently in progress on the microfloras of the Ipswich Basin it is clear that assemblages with abundant Pteruchipollenites extend through the upper 3000 feet of the Ipswich Coal Measures and then into the lower part of the overlying Bundamba Group. To distinguish zones within this sequence it is clear that detailed study of assemblages will be necessary in order to discover features, possibly based on the distribution of other genera and species, which may enable subdivision of this sequence. On present knowledge, the presence of species such as Lycopodiumsporites rosewoodensis, Leptolepidites sp. and Tsugaepollenites cf. segmentatus, which have not been found in any of the seams of the Ipswich Coal Measures, suggests that this Cabawin East sample comes from a somewhat higher horizon, possibly equivalent to some part of the Bundamba Group in the type area.

Assemblages similar in general character to that in this Cabawin East No. 1 sample occur in the Cabawin No. 1 Well over the approximate interval 7000 to 7600 feet (de Jersey and Dearne, 1961a). The present sample can thus be correlated with this section in the former well.

Sample of Lower Jurassic Age:

The sample examined consisted of dark carbonaceous shale, taken from Core No. 1 between the depths of 6715 feet 8 inches and 6716 feet. It yielded abundant spores and pollens, the following being identified :

| | | |
|---|---|---|
| Corollina sp. | ) | 78% |
| C. cf. torosus | ) | |
| Araucariacites sp. | ) | 10% |
| A. cf. australis | ) | |
| Cingulatisporites sp. | | |
| Cyathidites sp. | | |
| Inaperturopollenites sp. | | |
| Leiotriletes sp. | | |
| Lycopodiumsporites sp. | ) | 2% |
| L. rosewoodensis | ) | |
| L. cf. austroclavatidites | ) | |
| Osmundacidites sp. | ) | 2% |
| O. cf. wellmanii | ) | |
| Pteruchipollenites sp. | | 2% |
| Sphagnumsporites adnatus | | |
| S. australis | | |
| Verrucosisporites sp. | | |

This assemblage, being characterized by the dominance of Corollina and the presence of Lycopodiumsporites, Osmundacidites, and Araucariacites, with a minor proportion

of Pteruchipollenites, indicates an horizon near the base of the Jurassic. (The name Corollina is used to record the pollens previously identified as Classopollis, recent research having shown that the generic name Corollina Maljawkina (1949) has priority over the name Classopollis Pflug (1953)).

In the Cabawin No. 1 Well, assemblages with abundant Corollina were recorded from Cores 17, 18 and 19 (within the interval 6250 to 6750 ft) and correlation with an horizon within this approximate interval is indicated. The abundance of Corollina is the distinguishing feature of "Zone 2", a unit recognized by P.R. Evans from the subsurface of the Roma District. In that area it comprises sediments including the Hospital Hill and Links gas sands.

An interesting feature of the assemblage recorded here is the extremely high proportion of Corollina (78%). This is much higher than in any sample previously examined in the Geological Survey, and suggests that the genus may well have reached its acme of abundance at this horizon.

## CONCLUSIONS

The investigation recorded here has been undertaken to enable comparison of microfloral assemblages from this well with those from Cabawin No. 1, drilled approximately four miles to the west. It has shown that assemblages from approximately equivalent horizons in the two wells display close similarities and this evidence of lateral persistence of assemblages should thus find application in future palynological studies in the Surat Basin.

Attention has been concentrated on the Permian microfloras and frequency distribution studies have shown that a section characterized by a significant proportion of Dulhuntyispora can be recognized in each well and can be used as a marker bed near the top of the Permian sequence. These studies have further indicated that a section over 100 feet in thickness at the top of the Permian coal measures in Cabawin East No. 1 is missing from the sequence in the Cabawin No. 1 Well. Another aspect of the discovery of this Dulhuntyispora marker bed is that it overlies the oil sand in Cabawin No. 1. Below this marker bed in the Cabawin East sequence there is a sandstone bed at about the same stratigraphic level, which, it is suggested, may be on an equivalent horizon to the Cabawin oil sand.

The Permian assemblages have also been explored for other species likely to have stratigraphic significance for correlation within the sequence and the results from this aspect are recorded above. Bascanisporites undosus, a distinctive species which appears to be confined to a portion of the sequence, seems to be the most promising from this aspect.

In addition three samples of Mesozoic age have been examined. They have yielded assemblages closely comparable with equivalent horizons in the Cabawin No. 1 Well and have thus provided evidence on the lateral persistence of these Mesozoic microfloras.

The results of the investigation from the aspect of age determination and correlation with equivalent formations are summarized, for the samples examined, in the Table below.

Summary of Age Determinations and Correlations

| Depth | Nature of Sample | Lithology | Relative Spore Yield* | Age | Equivalent Formation or Group |
|---|---|---|---|---|---|
| 6715'8" - 6716'0" | Core No. 1 | Carbonaceous shale | Abundant | Basal Jurassic | |
| 7400' - 7410' | Cuttings | Coal composite | Abundant | Upper Triassic | ?Bundamba Group (of type area) |
| 10,480' - 10,482' | Cuttings | Coal composite | Abundant | Lower Triassic | Narrabeen Group |
| 10,605' | Sidewall Core | Coal | Abundant ⊕ | Upper Permian | Upper Coal Measures of New South Wales; Bandanna Formation; Kianga coal measures |
| 10,620' - 10,640' | Cuttings | Coal composite | Abundant | | |
| 10,676' - 10,676'2" | Core No. 5 | Coal | Abundant | | |
| 10,697' - 10,697'4" | Core No. 7 | Coal | Abundant | | |
| 10,730' - 10,740' | Cuttings | Coal composite | Abundant | | |
| 10,780' - 10,790' | Cuttings | Coal composite | Abundant | | |
| 10,900' - 10,920' | Cuttings | Coal composite | Abundant | | |
| 11,090' - 11,100' | Cuttings | Coal composite | Abundant | | |
| 11,190' - 11,200' | Cuttings | Coal composite | Abundant | | |
| 11,495' | Sidewall Core | Coal | Abundant | | |

* Relative spore yield based on number of spores examined

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

⊕ Only 100 spores counted owing to the more diverse microflora in the sample 15 feet lower (10,620-10,640 ft).

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# PALYNOLOGICAL OBSERVATIONS ON UNION-KERN-A.O.G. CABAWIN EAST NO. 1 WELL

by

P.R. Evans*

## INTRODUCTION

The following report is an enlargement on the notes written concerning the palynological examination of cores from Cabawin East No. 1 Well, in November-December, 1961. Some of the findings discussed below were not available at the time that the company report was written.

## OBSERVATIONS

Core No. 1, 6717 feet 6 inches to 6718 feet

Shale containing:

Cyathidites sp.
Baculatisporites sp.
Apiculati spp. incl. "Apiculati sp. nov."
Lycopodiumsporites spp.
Perinotriliti sp. nov.
Podocarpidites sp.
Vitrepollenites cf. V. pallidus
Classopollis torosus (common)

SWC 6762 feet. Light grey sandstone. The core could not be readily cleaned and very few spores were obtained.

Baculatisporites sp.
Classopollis torosus

were observed.

SWC 6803 feet. Sandstone, adequately cleaned. A moderate yield of spores was obtained including :

Todisporites sp.
Baculatisporites sp.
Lycopodiumsporites sp.
Podocarpidites sp.
Klausipollenites sp.

SWC 6900 feet. Incompetent sandstone which could not be cleaned.

Granulatisporites sp.
Perinomonoliti sp.
cf. Alisporites sp.

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were observed, but their stratigraphic significance cannot be evaluated owing to the original broken state of the core.

SWC 7020 feet. Sandstone with carbonaceous siltstone, adequately cleaned. A low spore yield was obtained with

Baculatisporites sp.
Perinotriliti sp.
Classopollis torosus (relatively common).

SWC 7121 feet. Sandstone which could not be cleaned. A few fragmentary spores were obtained, none of which was identifiable.

SWC 7208 feet. Sandstone with pebbles, but no spores.

SWC 7235 feet. Green and cream clayey sandstone; no spores.

SWC 7700 feet. Green-grey shale and siltstone; cleaned. A moderate yield of spores was extracted including a high proportion of Alisporites spp. plus rare Azonomonoliti sp. and "Nuskoisporites" sp. nov.

SWC 7830 feet. Green sandstone; no spores.

SWC 8098 feet. Red and green pebbly sandstone; no spores.

Cuttings 8460-8470 feet. Grey shale. A good yield of spores was obtained including :

Cyathidites sp.
"Apiculati sp. nov."
Classopollis torosus
Alisporites spp. (fairly common)
Callialasporites dampieri

SWC 9968 feet. Green-grey shale; no spores.

SWC 10,030 feet. Red-green shale; no spores.

Cuttings 10,270-10,273 feet. Shale, with a good spore content including :

Leiotriletes directus
Cyathidites sp.
Lycopodiumsporites spp.
Alisporites spp.
Callialasporites dampieri

Cuttings 10,480-10,482 feet. Coal which contained abundant microspores including :

Lunatisporites amplus )
L. limpidus ) very common
Apiculati spp.
Kraeuselisporites apiculatus
Dulhuntyispora parvitholus

Alisporites spp.

SWC 10,640 feet. Carbonaceous shale containing :

Leiotriletes directus
Granulatisporites micronodosus
G. cf. trisinus
Acanthotriletes tereteangulatus
Lunatisporites amplus
L. limpidus
Striatites cancellatus
Vesicaspora ovata
Nuskoisporites triangularis
Succinctisporites sp.
Marsupipollenites sinuosus

Core No. 7, 10,690 feet 2 inches - 10,690 feet 6 inches. Barren

## COMMENTS

The stratigraphy of Cabawin East No. 1 may be compared with that of Cabawin No. 1 and the many wells drilled to the east of Roma. A.A.O. Pickanjinnie No. 1 Well is chosen to represent the Roma sections in the following discussion. A correlation of the Cabawin wells and Pickanjinnie No. 1, based on palynological and electric log data, is presented in Figure 7. The formational nomenclature and boundaries are those used by the authors of the well completion reports. Reference should be made to Table 1 (p.49) for a correlation of these interpretations. Certain facts, such as the character of "Zone 1", were not apparent initially in Pickanjinnie No. 1 but were discovered and studied in neighbouring wells such as A.A.O. Latemore East No. 1 and A.A.O. Combarngo No. 1. Electric Log and lithological correlations have been used to identify this zone in Pickanjinnie No. 1. The terms "Zone 1" and "Zone 2" were initially used to distinguish the Triassic - Jurassic boundary in the Pickanjinnie area before their relationships to outcrop geology were understood. More detailed definitions of these zones are still required, but the names are retained for the present as they have been frequently used in unpublished reports to denote what are now easily recognized palynological units.

1. Abundant Classopollis torosus and "Apiculati sp. nov." (in Core No. 1 (6717 ft)) mark "Zone 2" of the Pickanjinnie area; they were present with the associate "Zone 2" species in Cabawin No. 1, Core No. 19, 6716 ft 5 in. - 6716 ft 9 in. and Core No. 20, 6767 ft 6 in. - 6767 ft 10 in.

2. The sidewall cores between 6762 and 7235 feet were taken from an enlarged hole section through sandstone so that the core recovery was poor and the spore content of the strata sampled was low. However, they have demonstrated that the Classopollis assemblage of "Zone 2" persists down to 7020 feet (although many of the typical associate species were missing at that level). The change between "Zone 1" and "Zone 2" occurs just below the Links Sandstone of Pickanjinnie No. 1 and, in that area, is very abrupt, most probably due to the existence of a disconformity or unconformity. "Zone 1", as at present defined on the abundance of species of Alisporites, expands in thickness from Pickanjinnie through Combarngo to Cabawin, but the closest approximation to the gross assemblage of the Pickanjinnie area "Zone 1" that has been seen in Cabawin No. 1 occurred in Core No. 23, 7404 ft 3 in. - 7404 ft 7 in. It seems likely that an upwards extension of the typical "Zone 1" and downwards development of "Zone 2" are present in the Cabawin area.

3. The coal at 9620 - 9630 feet in Cabawin No. 1 contained a mixture of Lunatisporites, Striatites (al. Lueckisporites) and Alisporites (al. Pteruchipollenites). A similar mixture exists in the coal in Cabawin East No. 1 at 10,480-10,482 feet so that these horizons are closely associated. Previously this spore assemblage had been compared with the association of striate and pteruchid pollens from the Lower Triassic Pickanjinnie Formation of Pickanjinnie No. 1 (Evans, and de Jersey and Dearne, Appendix 1, P.S.S.A. 43, 1963). Subsequent analysis and comparison of the various horizons does not support that view. The striate pollens and associate pteridophyte spores of the Pickanjinnie Formation include species not represented at Cabawin and which seem to commence their existence at a younger horizon than the coal at 9620 feet in Cabawin No. 1. It is better to regard that coal as Permian in age and as part of a very distinctive horizon, since closely related microfloras occur in the highest coal of A.A.O. No. 7 (Arcadia) and O.S.L. No. 3 (Arcadia), where they are overlain by Pickanjinnie Formation assemblages, and since they are to be found in the highest outcropping coals of the Bandanna Formation.

4. The coals at 9620 feet in Cabawin No. 1 occur towards the base of the Cabawin Formation (Union Oil Development Corporation, 1963). Only sidewall core 7700 feet in Cabawin East No. 1 provides additional evidence of the age of that unit. (The cuttings at 8460 - 8470 feet and 10,270 - 10,273 feet in Cabawin East No. 1 contain species such as Callialasporites dampieri, Lycopodiumsportes spp. which elsewhere only appear later than "Zone 1" and are considered in this instance to be the product of caving). In order to determine the age of the Pickanjinnie Formation and the subsurface Cabawin Formation, the continuously cored J. Strevens Enterprises Terrigal No. 1 Well, which penetrated the Narrabeen Group of the Sydney Basin, has been analysed in detail. Comparison between assemblages and species from the Surat and Sydney Basins is close and it can be shown that the Pickanjinnie Formation has its equivalent in approximately the Munmorah Conglomerate and that "Zone 1" commences at the base of the Gosford Formation. ("Zone 2" is younger than any beds in the Sydney Basin). The presence of "Nuskoisporites" sp. nov. in both the Tuggerah Formation and the Munmorah Conglomerate and at 7700 feet in Cabawin East No. 1 would suggest that that horizon is older than "Zone 1" and that it could be part of the Cabawin Formation. These relationships are demonstrated in Table 1.

## RELATIONSHIP OF SURFACE AND SUBSURFACE BUNDAMBA AND CABAWIN FORMATIONS

The development of "red beds" in the Lower Triassic of both the Sydney and Surat Basins is very striking and leads to a consideration of the outcrop equivalents of the subsurface Cabawin Formation. Mack (1963) included the Moolayember Shale, Clematis Sandstone and Rewan Formation in the outcrop Cabawin Formation. Of these units, only the Rewan Formation contains "red beds". The Clematis Sandstone is stained red from weathered ochre bands and contains carbonaceous matter towards the top, while the Moolayember Shale is typically carbonaceous. The Clematis Sandstone of the Carnarvon Gorge, the Moolayember Shale of the type area, and shot point samples from the Cabawin Formation, stratigraphically higher than the type Clematis Sandstone east of Bauhinia Downs, have yielded "Zone 1" assemblages. None of these localities is older than the Gosford Formation of the Narrabeen Group of the Sydney Basin. The pattern in eastern Australia then emerges of Permian coal measures overlain by Lower Triassic "red bed" facies that in turn are covered by Middle - Upper Triassic beds, namely the Clematis Sandstone and Moolayember Shale in Queensland, and the Gosford Formation to Wianamatta Group in New South Wales, in which reducing conditions of sedimentation reappear. As "Zone 1" occurs above the subsurface Cabawin Formation

only a correlate of the Rewan Formation is present in the Cabawin wells (see Table 1). "Zone 1" of Cabawin No. 1 is placed in the Bundamba Formation by Union Oil Development Corporation (1963), but, as explained above, this section correlates with the Clematis Sandstone and the Moolayember Shale. The hiatus below the outcropping Bundamba Formation (or Group) could thus be equal to the break between "Zone 1" and "Zone 2" (confirmed in A.A.O. Glentulloch No. 1 subsequent to the drilling of Cabawin East No. 1). However, this break occurs within the "lower Bundamba Formation" of Cabawin No. 1 (Fig. 7). The subsurface base of the Bundamba Formation should therefore be redefined. Taking into account the evidence from spores, electric logs (Tissot, pers. comm.), and lithology (Fehr & Bastian, 1962), the base should be taken close to 7025 feet in Cabawin No. 1, (a point that accords with the revised definitions of the subsurface Bundamba Formation supplied by Union Oil Development Corporation (1962), after drilling Wandoan No. 1).

Fig. 7.

# LOWER MESOZOIC SECTIONS IN THE SURAT BASIN

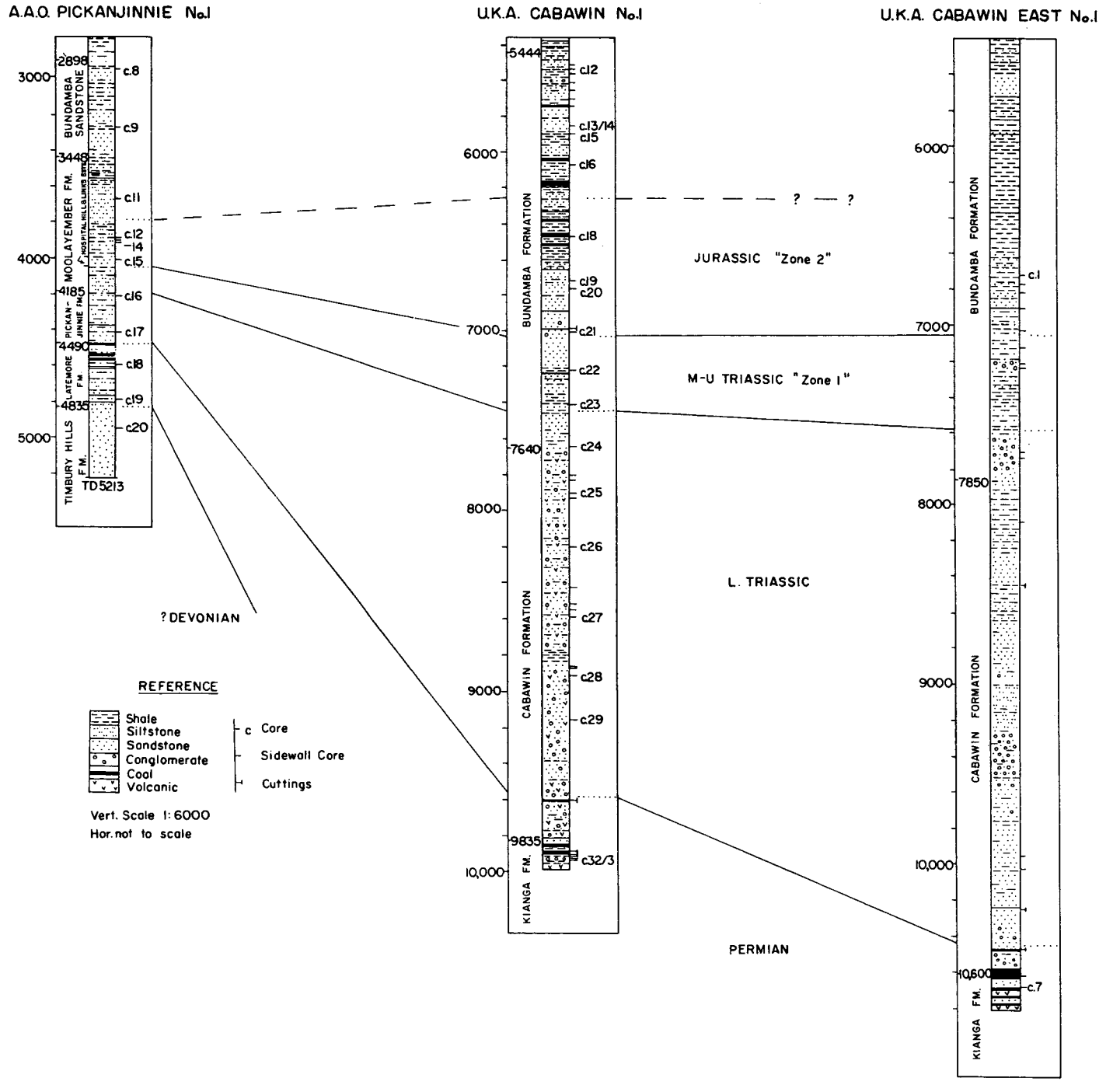

TABLE 1: CORRELATION OF PERMIAN, TRIASSIC AND JURASSIC UNITS

of the

BOWEN, SURAT AND SYDNEY BASINS

| OUTCROP | | | SUBSURFACE | | SPORE UNITS and AGE | SYDNEY BASIN (Terrigal No. 1, etc.) |
|---|---|---|---|---|---|---|
| Reeves, 1947; Whitehouse, 1955; Hill, 1957. | | Mack, 1963 | Cabawin No. 1 Union Oil Dev. Corp. 1963 | Pickanjinnie No. 1 Derrington, 1960 | | |
| Hutton Sandstone | | Bundamba Fm. upper | Bundamba Formation upper | Bundamba Sandstone | JURASSIC | |
| Bundamba Gp | Boxvale Sandstone | | | | | |
| | Evergreen Shale | middle | middle | Moolayember Formation | "Zone 2" | |
| | Precipice Sandstone | lower | | Hospital Hill and Links Sandstones | | |
| Moolayember Shale | | Cabawin Formation | lower | | "Zone 1" | Wianamatta Group |
| Clematis Sandstone | | | | | M. - U. TRIASSIC | Hawkesbury Sandstone |
| | | | | | | Narrabeen Gp: Gosford Formation |
| Rewan Formation | | | Cabawin Formation | | L. TRIASSIC | Collaroy Claystone; Tuggerah Formation |
| | | | | Pickanjinnie Formation | | Munmorah Conglomerate |
| Bandanna Formation | | Kianga Formation | Kianga Formation | Latemore Formation | PERMIAN | Newcastle Coal Measures |

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FIGURE 8

COMPANY: U.K.A. CABAWIN EAST NO. 1.

WELL:

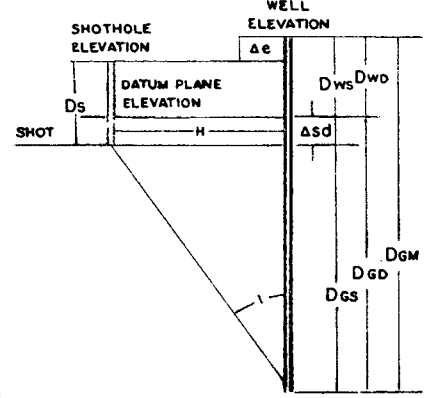
LOCATION: 9310' FROM SW CORNER OF PORTION 5B IN THE PARISH SOUTH GLEN COUNTY OF ROGERS.

| SHOT HOLE | ELEVATION | DISTANCE | SHOT HOLE | ELEVATION | DISTANCE | SHOT HOLE | ELEVATION | DISTANCE | SHOT HOLE | ELEVATION | DISTANCE | SHOT HOLE | ELEVATION | DISTANCE | SHOT HOLE | ELEVATION | DISTANCE | SHOT HOLE | ELEVATION | DISTANCE | SHOT HOLE | ELEVATION | DISTANCE | SHOT HOLE | ELEVATION | DISTANCE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 995 | 600' | C | 988 | 600' | G. | 988 | 600' | | | | | | | | | | | | | | | | | | |
| B | 997 | 600' | D | 987 | 600' | | | | | | | | | | | | | | | | | | | | | |
| | | | E | 988 | 600' | | | | | | | | | | | | | | | | | | | | | |
| | | | F | 988 | 600' | | | | | | | | | | | | | | | | | | | | | |

ELEVATION

| | |
|---|---|
| KELLY BUSH | 1010 |
| ROTARY TBL | |
| DERRICK FL | 1009 |
| GROUND | 993 |

| 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 | ΔDGD | ΔTGD | VI INTERVAL VELOCITY | VA AVERAGE VELOCITY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| .122 | 23 | D | 2000 | 054 | W | 172 | +23 | 195 | -15 | 1805 | 600 | 3.00833 | .9489 | 216 | G | 2050 | -.0023 | 2027 | 1790 | | | | 8831 |
| .095 | 2 | A | 2000 | 055 | E | 174 | +15 | 189 | -21 | 1811 | | 3.01833 | .9492 | 226 | F | 2145 | -.0032 | 2113 | 1790 | 1790 | 207 | 8,647 | 8471 |
| .122 | 22 | D. | 2825 | 055 | W | 172 | +23 | 195 | -15 | 2630 | | 4.38333 | .9750 | 287 | G | 2798 | -.0023 | 2775 | 2615 | 825 | 071 | 11,620 | 9423 |
| .123 | 19 | E | 4165 | NIL | W | 112 | +22 | 134 | -76 | 4031 | | 6.71833 | .9891 | 442 | G | 4372 | -.0114 | 4258 | 3955 | 1340 | 149 | 8,993 | 9288 |
| .093 | 20 | B | 4165 | 055 | E | 170 | +13 | 183 | -27 | 3982 | | 6.63667 | .9888 | 436 | F | 4311 | -.0041 | 4270 | 3955 | | | | 9262 |
| .122 | 21 | D | 4165 | 053 | W | 174 | +23 | 197 | -13 | 3968 | | 6.61333 | .9888 | 435 | G | 4301 | -.0019 | 4282 | 3955 | | | | 9236 |
| .092 | 18 | B | 5295 | 057 | E | 170 | +13 | 183 | -27 | 5112 | | 8.52000 | .9932 | 541 | G | 5373 | -.0041 | 5332 | 5085 | 1130 | 106 | 10,660 | 9537 |
| .095 | 14 | A | 6738 | 055 | E | 162 | +15 | 177 | -33 | 6561 | | 10.9350 | .9958 | 661 | F | 6582 | -.0050 | 6532 | 6528 | 1443 | 121 | 11,926 | 9994 |
| .128 | 17 | E | 6738 | 057 | W | 159 | +22 | 181 | -29 | 6557 | | 10.9283 | .9958 | 662 | F | 6592 | -.0044 | 6548 | 6528 | | | | 9969 |
| .130 | 13 | F | 7850 | 059 | W | 174 | +22 | 196 | -14 | 7654 | | 12.7567 | .9969 | 737 | F | 7347 | -.0021 | 7326 | 7640 | 1112 | 079 | 14,076 | 10429 |
| .121 | 11 | F | 9400 | 054 | W | 174 | +22 | 196 | -14 | 9204 | | 15.3400 | .9979 | 845 | G | 8432 | -.0021 | 8411 | 9190 | 1550 | 108 | 14,352 | 10926 |
| .094 | 8 | B | 10600 | 054 | E | 172 | +13 | 185 | -25 | 10415 | | 17.3583 | .9983 | 928 | F | 9264 | -.0038 | 9226 | 10390 | 1200 | 082 | 14,634 | 11262 |
| .127 | 7 | E | 10600 | 056 | W | 157 | +22 | 179 | -31 | 10421 | | 17.3683 | .9983 | 929 | G | 9274 | -.0047 | 9227 | 10390 | | | | 11260 |
| .093 | 6 | B | 12092 | 054 | E | 174 | +13 | 187 | -23 | 11073 | | 18.4550 | .9985 | 989 | F | 9875 | -.0035 | 9840 | 11050 | 660 | 061 | 10,820 | 11230 |
| .096 | 4 | A | 12092 | 054 | E | 174 | +15 | 189 | -21 | 11903 | | 19.8383 | .9987 | 1057 | P | 1.0556 | -.0032 | 1.0524 | 11882 | 832 | 068 | 12,235 | 11290 |
| .121 | 9 | F | 12092 | 054 | W | 174 | +22 | 196 | -14 | 11896 | | 19.8267 | .9987 | 1055 | P | 1.0536 | -.0021 | 1.0515 | 11882 | | | | 11300 |
| .095 | 10 | A | 12092 | NIL | E | 170 | +15 | 185 | -25 | 11907 | | 19.8450 | .9987 | 1056 | P | 1.0546 | -.0038 | 1.0508 | 11882 | | | | 11308 |




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
TGS = TGS + ΔSD/VI = VERTICAL TRAVEL TIME, WELL SEISMOMETER TO DATUM PLANE.
DGD = DGM − DWD = VERTICAL DISTANCE, WELL SEISMOMETER TO DATUM PLANE
VI = INTERVAL VELOCITY = Δ DGD / Δ TGD
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.

Fig. 9

# VELOCITY SURVEY
# U.K.A. CABAWIN EAST No.1
FOR
## UNION OIL DEVELOPMENT CORPORATION
BY
## UNITED GEOPHYSICAL COMPANY, S.A.

TRAVEL TIME IN SECONDS
ONE WAY TIME IN SECONDS
DATUM + 800
SEA LEVEL
KELLY BUSHING +1010
LOWER CRETACEOUS
ROMA
-1813
JUR-CRETACEOUS
BLYTHESDALE
-3150
JURASSIC
WALLOON
-4284
JURASSIC - TRIASSIC
BUNDAMBA
-6840
TRIASSIC
CABAWIN
-9590
PERMIAN
KIANGA
-10187
PERMIAN
BACK CREEK
-11081
DEPTH BELOW SEA LEVEL IN FEET
2000
4000
6000
8000
10,000
12,000
Vz = 7830 + .74z
TIME - DEPTH AVERAGE VELOCITY
INTERVAL VELOCITY
VELOCITY IN FEET PER SECOND
8,000
9,000
10,000
11,000
12,000
13,000
14,000
15,000

## APPENDIX 3

## WELL LOGGING

## VELOCITY SURVEY

by

S. Kahanoff *

A survey was conducted by United Geophysical Party 126, on 15th October, 1961, to determine the subsurface velocities as well as to provide a series of check shots for the calibration of the sonic log which had been taken earlier. A pressure type well geophone was used for the survey.

Ten horizons were checked at depths ranging from 2000 feet sub kelly bushing, the approximate base of the surface pipe, to 12,091 feet. The velocity distribution $V_z = 7830 + 0.74Z$ feet per second was determined by using Miller's method (Seismic Prospecting for Oil by Dix) and checked by the formula $T = \frac{Z}{k} \log_e (1 + \frac{kZ}{Vo})$, where Vo = 7830 feet per second and k = 0.74. This compared very closely with the velocity distribution $V_z = 7850 + 0.73Z$ feet per second which was determined in Union-Kern-A.O.G. Cabawin No. 1.

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* Union Oil Development Corporation.

## WELL LOGGING

## SCHLUMBERGER ELECTRIC LOG

| Run No. - Depth Scale | 1 - 5"/100' | 2 - 5"/100' | 3 - 5"/100' | 4 - 5"/100' |
|---|---|---|---|---|
| Date | 8. 8. 61 | 28. 9. 61 | 2.10. 61 | 15.10. 61 |
| First Reading | 6889 | 10536 | 10762 | 12096 |
| Last Reading | 1972 | 6789 | 6789 | 10662 |
| Interval Measured | 4917 | 3747 | 3973 | 1434 |
| Casing Schlumberger | 1972 | 1972 | 1972 | 1972 |
| Casing Driller | 1972 | 1972 | 1972 | 1972 |
| Depth Reached | 6890 | 10537 | 10763 | 12097 |
| Bottom Driller | 6890 | 10547 | 10762 | 12091 |
| Mud Nature | Bentonite | Oil Emulsion | Oil Emulsion | Oil Emulsion |
| Density (Viscosity) | 75 (60) | 92.5 (70) | 92 (50) | 90 (60) |
| Mud Resistivity | 4.0 at 67°F | 2.6 at 102°F | 2.3 at 101°F | 3.5 at 89°F |
| Mud Resist. B.H.T. | 1.8 at 152°F | 1.3 at 188°F | 1.2 at 200°F | 1.4 at 215°F |
| pH. (Fluid Loss) | 9 (8cc/30 min.) | 9 (5.7cc/30 min.) | 9 (6cc/30 min.) | 9 (6cc/30 min.) |
| Origin of Sample | Pit | Shaker | Shaker | Shaker |
| Rmf | 3.8 at 67°F | | | 2.7 at 89°F |
| Rmc | 3.2 at 67°F | | | |
| Bit Size 1 | 12 1/4" to 2565 | 12 1/4" to 2565 | 12 1/4" to 2565 | 12 1/4" to 2565 |
| 2 | 8 3/4" to 6890 | 8 3/4" to T.D. | 8 3/4" to T.D. | 8 3/4" to T.D. |
| Casing Size | 13 3/8" | 13 3/8" | 13 3/8" | 13 3/8" |
| Opr. Rig Time | 2.00 hrs | 4.00 hrs | 3.00 hrs | 4.30 hrs |
| Truck No. | 325 | 325 | 325 | 325 |
| Recorded by | A. Baudot | A. Baudot | A. Baudot | A. Baudot |
| Witness | A.S. Keller | D.E. Pyle | D.E. Pyle | D.J. McGarry |
| Spacing AM1 | 16" | 16" | 16" | 16" |
| Spacing AM2 | 64" | 64" | 64" | 64" |
| Spacing AO | 18'8" | 18'8" | 18'8" | 18'8" |
| Weight Used | no | no | | no |
| Equipment Type & No. | | | | |
| Sonde | S57. 133 | S57. 133 | S57. 133 | S57. 133 |
| Pulsator | PCC.C. 970 | PCC.C. 970 | PCC.C. 970 | PCC.C. 970 |
| Panel | ESP.C. 410 | ESP.C. 410 | ESP.C. 410 | ESP.C. 410 |

## SCHLUMBERGER SONIC LOG

| Run No. - Depth scale | 1 - 2"/100' | 2 - 2"/100' | 3 - 2"/100' |
|---|---|---|---|
| Date | 8. 8. 61 | 2.10. 61 | 16.10. 61 |
| First Reading | 6875 | 10749 | 12086 |
| Last Reading | 1972 | 6775 | 10649 |
| Interval Measured | 4903 | 3974 | 1437 |
| Casing Schlumberger | 1972 | 1972 | 1972 |
| Casing Driller | 1972 | 1972 | 1972 |
| Depth Reached | 6881 | 10756 | 12093 |
| Bottom Driller | 6890 | 10762 | 12091 |
| Mud Nature | Bentonite | Oil Emulsion | Oil Emulsion |
| Density (Viscosity) | 75 (60) | 92 (50) | 90 (60) |
| Mud Resistivity | 4.0 at 67°F | 2.3 at 101°F | 3.5 at 89°F |
| Mud Resist. B.H.T. | 1.8 at 152°F | 1.2 at 200°F | 1.4 at 215°F |
| pH. (Fluid Loss) | 9 (8cc/30 min.) | 9 (6cc/30 min.) | 9 (6cc/30 min.) |
| Origin of Sample | Pit | Shaker | Shaker |
| Rmf | 3.8 at 67°F | | 2.7 at 89°F |
| Rmc | 3.2 at 67°F | | |
| Bit size 1 | 12 1/4" to 2565 | 12 1/4" to 2565 | 12 1/4" to 2565 |
| 2 | 8 3/4" to 6890 | 8 3/4" to T.D. | 8 3/4" to T.D. |
| Casing Size | 13 3/8" | 13 3/8" | 13 3/8" |
| Opr. Rig Time | 3.30 hrs | 4.00 hrs | 4.00 hrs |
| Truck No. | 325 | 325 | 325 |
| Recorded by | A. Baudot | A. Baudot | A. Baudot |
| | P. Lehmann | | |
| Witness | A.S. Keller | D.E. Pyle | D.J. McGarry |
| Spacing | 3' | 3' | 3' |
| Centralizer | Yes | 2 spring type | Yes |
| Bias | 95v to 110v | 105v | 105v |
| Record Speed | 4000 ft/hr | 4000 ft/hr | 4000 ft/hr |
| Equipment Type & No. | | | |
| Panel | VLP - 8.P20B | VLP - 8.P20B | VLP - 8.P20B |
| Integrator | VIP - A.P14C | VIP - A.P14C | VIP - A.P14C |
| Cartridge | VAC - C.12 | VAC - C.12 | VAC - C.12 |
| Housing | VLH - A.19P | VLH - A.19P | VLH - A.19P |
| Sonde | VLS - G.21PE | VLS - G.21PE | VLS - G.21PE |

## APPENDIX 4

## CORE ANALYSIS

by

Union Oil Personnel

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

Type Cores : Conventional - 3 1/2" diameter

| Depth (feet) | Porosity (%) | Permeability (md. Air) | Oil-Water Ratio | %total pores full of | | |
|---|---|---|---|---|---|---|
| | | | | Oil | Water | Tot. Liq. |
| 10528 | 3.2 | 0 | - | - | 100 | 100 |
| 10534 | 1.1 | 0 | tr. | tr. | 100 | 100 |
| 10537 | 3.3 | 0 | - | - | 100 | 100 |
| 10547 | 3.1 | 0 | - | - | 100 | 100 |

## CORE ANALYSIS

by

Bureau of Mineral Resources

Equipment :

Ruska Field Porometer and Permeameter using air and nitrogen as saturating and flowing media. Extractions were made by the Dean and Stark method using toluene as solvent.

All samples were received in unsealed condition.

Results :

Results are summarized in the Table below.

## CORE RESULTS SUMMARY SHEET

| Core No. | Depth | Effective Porosity % by vol. | | Absolute Permeability Millidarcys | | Density (Gms/cc.) | | 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 | |
| 2 | 10,533' 7" to 10,534' 0" | 13 | 11 | less than 1 | less than 1 | 2.45 | 2.78 | 24 | Nil | No colour in toluene | 1 |
| 5 | 10,659' 3" to 10,659' 7" | 10 | 8 | as above | | 2.37 | 2.60 | 36 | Nil | as above | 2 |
| 6 | 10,684' 11" to 10,685' 3" | 6 | 6 | as above | | 2.39 | 2.55 | 100 | Nil | as above | 2 |
| 7 | 10,686' 0" to 10,686' 5" | 5 | 8 | as above | | 2.40 | 2.58 | 100 | Nil | as above | 1 |

## APPENDIX 5

### ADDITIONAL DATA FILED IN THE BUREAU OF MINERAL RESOURCES

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

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

(ii) Weekly drilling reports for period 2nd July, 1961 to 25th October, 1961.

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

Composite Electrical log (2" = 100')

Composite Sonic log (2" = 100')

Interpretive log (2" = 100')

Hydrocarbon analysis log

Expanded scales (5" = 100')

Electrical log, Runs 1, 2, 3, 4,

Sonic log, Runs 1, 2, 3

U.O.D.C. WELL COMPLETION REPORT NO. 2

# COMPANY: UNION OIL DEVELOPMENT CORPORATION

PETROLEUM TENEMENT: A. to P 57P

MILITARY 4-MILE SHEET: DALBY.

WELL No.: UNION-KERN-A.O.G. CABAWIN EAST No.1.

BASIN: BOWEN—SURAT

STATE: QUEENSLAND

WELL STATUS: PLUGGED AND LEASED TO G.A. HENRY FOR CONVERSION TO WATER WELL.

## ELECTRIC LOG DATA

DATUM: K.B.

| RUN Nº | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| DATE | 8 Aug. 1961 | 28 Sept. 1961 | 2 Oct. 1961 | 15 Oct. 1961 |
| FIRST READING | 6889' | 10536' | 10762' | 12096' |
| LAST READING | 1972' | 6789' | 6789' | 10662' |
| INTERVAL MEASURED | 4917' | 3747' | 3973' | 1434' |
| Csg., Schlumberger | 1972' | 1972' | 1972' | 1972' |
| Csg., DRILLER | 1972' | 1972' | 1972' | 1972' |
| DEPTH REACHED | 6890' | 10537' | 10763' | 12097' |
| BOTTOM, DRILLER | 6890' | 10547' | 10762' | 12091' |
| MUD NATURE | Bentonite | Oil emulsion | Oil emulsion | Oil emulsion |
| DENSITY— VISCOSITY | 75 60 | 92·5 70 | 92 50 | 90 60 |
| MUD RESISTIVITY | 4·0 @ 67°F | 2·6 @ 102°F | 2·3 @ 101°F | 3·5 @ 89°F |
| MUD RESIST. B.H.T. | 1·8 @ 152°F | 1·3 @ 188°F | 1·2 @ 200°F | 1·4 @ 215°F |
| pH FLUID LOSS | 9/8cc/30 min. | 9/5·7cc/30 min. | 9/6cc/30 min. | 9/6cc/30 min. |
| ORIGIN OF SAMPLE | Pit | Shaker | Shaker | Shaker |
| R.M.F. | 3·8 @ 67°F | | | 2·7 @ 89 |
| R.M.C. | 3·2 @ 67°F | | | |
| BIT SIZE ..... 1 | 12¼" to 2565' | 12¼" to 2565' | 12¼" to 2565' | 12¼" to 2565' |
| 2 | 8¾" to 6890' | 8¾" to T.D. | 8¾" to T.D. | 8¾" to 12091' |
| Csg. SIZE | 13⅜" | 13⅜" | 13⅜" | 13⅜" |
| OPR. RIG TIME | 2·00 | 4·00 | 3·00 | 4·30 |
| TRUCK Nº | 325 | 325 | 325 | 325 |
| RECORDED BY | A. Baudot | A. Baudot | A. Baudot | A. Baudot |
| WITNESS | S. Keller | D.E. Pyle | D.E. Pyle | D.J. McGarry |

NAME OF WELL: Union-Kern-A.O.G. Cabawin East No.1
STATE: Queensland
COUNTRY: Australia
COUNTY: Rogers
PARISH: South Glen
PORTION: 58
LATITUDE: 27°29'10"S.
LONGITUDE: 150°15'06"E.
ELEVATION: K.B. 1010' (datum)
G.L. 993'
T.D. .....: 12091'
DATE SPUDDED: 18 July, 1961
DATE T.D.: 14 October, 1961
DATE RIG RELEASED: 17 October, 1961
STATUS OF WELL: Plugged and leased to G.A. Henry for conversion to water well
DRILLED BY: Oil Drilling and Exploration Ltd.
DRILLING METHOD: Rotary National 80 B
LOGGING: Schlumberger
CEMENTING: Halliburton
MUD LOGGING: Operator

### OTHER ELECTRICAL LOGS

SONIC LOG: 1972'- 12086'
VELOCITY SURVEY: 2000'- T.D.

### 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

Lithology by
D.J. McGarry and J.E. Mack Jr.

SYSTEM OR SERIES: CRETACEOUS
FORMATION: ROMA FORMATION
DEPTH, IN FEET

SPONTANEOUS POTENTIAL 100 millivolts 10

LITHOLOGY Percentage cuttings: NOT SAMPLED

RESISTIVITY 50 ohms. m²/m: AM₁ = 16" 50 | 0 500; AM₂ = 64" 50 | 0 500

RESISTIVITY 50 ohms m²/m: AO = 18'8" 50 | 0 500

CORE BITS

DRILLING BITS
1 12¼" Reed B-2
2 12¼" Reed B-2
3 12¼" Hughes OSC 3J
4 12¼" Sec. S3
5 12¼" Sec. S3

RATE of PENETRATION ft/hour
Dashed on bit change and core interval.
150 ..... 50 | 50 0

MUD GAS DETECTION
0 ..... 500 | 0 100

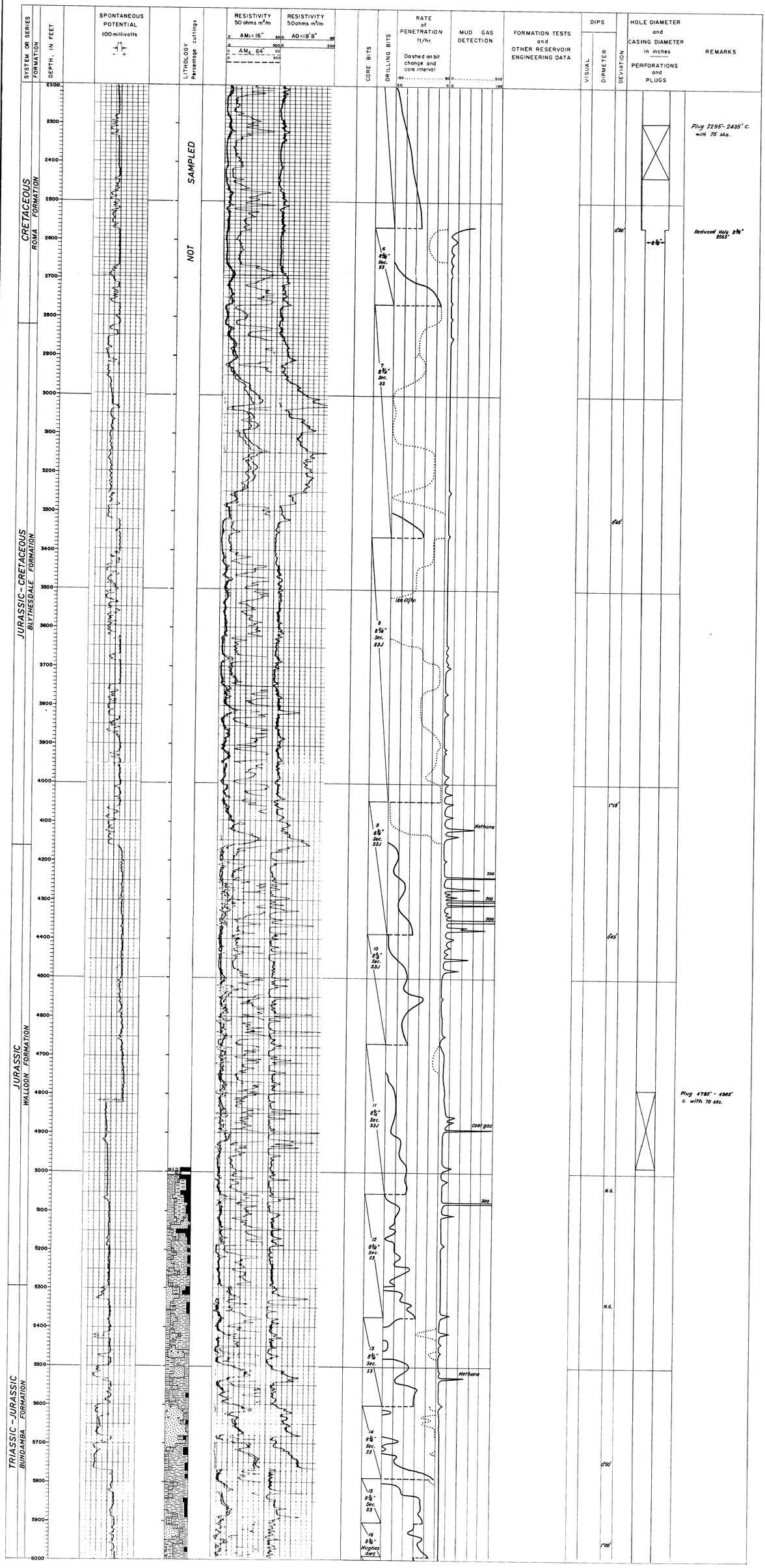
FORMATION TESTS and OTHER RESERVOIR ENGINEERING DATA.

DIPS: VISUAL; DIPMETER

DEVIATION
0°15'
0°45'
0°30'

HOLE DIAMETER and CASING DIAMETER in Inches
PERFORATIONS and PLUGS
17½"
13⅜"
12¼"

REMARKS
13⅜" H-40 48# C. 1972' 1000 SKS.
Reduced Hole 12¼" 1990'


SYSTEM OR SERIES
FORMATION
DEPTH, IN FEET
SPONTANEOUS POTENTIAL 100 millivolts
LITHOLOGY Percentage cuttings
RESISTIVITY 50 ohms m²/m
AM1=16"
AM2 64"
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
CRETACEOUS
ROMA FORMATION
JURASSIC-CRETACEOUS
BLYTHESDALE FORMATION
JURASSIC
WALLOON FORMATION
TRIASSIC-JURASSIC
BUNDAMBA FORMATION
NOT SAMPLED
6 8⅝" Sec. 53
7 8¼" Sec. 53
8 8¼" Sec. 53J
9 8¼" Sec. 53J
10 8¼" Sec. 53J
11 8¼" Sec. 53J
12 8¼" Sec. 53
13 8¼" Sec. 53
14 8½" Sec. 53
15 8½" Sec. 53
16 8½" Hughes duro
186 ft/hr.
Methane
200
200
200
coal gas
200
Methane
Plug 2295'-2435' c. with 75 sks.
Reduced Hole 8¾" 2565'
0°30'
0°45'
1°15'
0°45'
N.G.
N.G.
0°30'
1°00'
Plug 4785'-4988' c. with 70 sks.

TRIASSIC
CABAWIN FORMATION

TRIASSIC - JURASSIC
BUNDAMBA FORMATION

SYSTEM OR SERIES
FORMATION
DEPTH, IN FEET
9100 9000 8900 8800 8700 8600 8500 8400 8300 8200 8100 8000 7900 7800 7700 7600 7500 7400 7300 7200 7100 7000 6900 6800 6700 6600 6500 6400 6300 6200 6100 6000

SPONTANEOUS POTENTIAL
100 millivolts

LITHOLOGY
Percentage cuttings

RESISTIVITY
50 ohms m²/m
AM = 16"
AM = 64"
0 50 500

RESISTIVITY
50 ohms m²/m
AO = 18'6"
0 50 500

CORE BITS

DRILLING BITS

RATE of PENETRATION
f./hr.
Dashed on bit change and core interval
0 50 100

MUD GAS DETECTION
Methane
Methane
Methane
Coal gas
0 100 500

FORMATION TESTS and OTHER RESERVOIR ENGINEERING DATA

DIPS
VISUAL
DIPMETER
0°
0°
0°
0°
0°
0°

DEVIATION
0°45'
1°15'
1°30'
0°15'
0°30'
0°30'

HOLE DIAMETER and CASING DIAMETER in inches
PERFORATIONS and PLUGS

REMARKS

PLATE I
SHEET 3

PLATE I
SHEET 4

SYSTEM OR SERIES: PERMIAN | TRIASSIC

FORMATION: BACK CREEK FORMATION | KIANGA FORMATION | CABAWIN FORMATION

DEPTH, IN FEET: 9100 9200 9300 9400 9500 9600 9700 9800 9900 10000 10100 10200 10300 10400 10500 10600 10700 10800 10900 11000 11100 11200 11300 11400 11500 11600 11700 11800 11900 12000 12100

LITHOLOGY — Percentage cuttings — N.S.

SPONTANEOUS POTENTIAL — 100 millivolts

RESISTIVITY 50 ohms m²/m — AO=18'8" — AM=16" — AM=64"

RESISTIVITY 50 ohms m²/m

DRILLING BITS

| Bit | Size | Type |
|---|---|---|
| 62 | 8¾" | Hughes W7K |
| 63 | 8¾" | Hughes DWG |
| 64 | 8¾" | Hughes W7K |
| 65 | 8¾" | Sec. M4L |
| 66 | 8¾" | Hughes W7K |
| 67 | 8¾" | Hughes W7K |
| 68 | 8¾" | Sec. M7 |
| 69 | 8¾" | Hughes W7K |
| 70 | 8¾" | Hughes W7K |
| 71 | 8¾" | Sec. M4L |
| 72 | 8¾" | Hughes W7K |
| 73 | 8¾" | Hughes W7K |
| 74 | 8¾" | Hughes W7K |
| 75 | 8¾" | Hughes W7K |
| 76 | 8¾" | Hughes W7K |
| 77 | 8¾" | Hughes W7K |
| 78 | 8¾" | Hughes W7K |
| 79 | 8¾" | Hughes DWG |
| 80 | 8¾" | Hughes W7K |
| 81 | 8¾" | Sec. M4L |
| 82 | 8¾" | Hughes W7K |
| 83 | 8¾" | Hughes W7K |
| 84 | 8¾" | Sec. M4L |
| 85 | 8¾" | Hughes W7K |
| 86 | 8¾" | Hughes W7K |
| 87 | 8¾" | Sec. M7 |
| 88 | 8¾" | Sec. M4L |
| 89 | 8¾" | Hughes W7K |
| 100 | 8¾" | Sec. M7 |
| 101 | 8¾" | Sec. M4L |
| 103 | 8¾" | Sec. M4L |
| 104 | 8¾" | Sec. M5 |
| 105 | 8¾" | Sec. M4L |
| 106 | 8¾" | Hughes OW |
| 107 | 8¾" | Sec. M5 |
| 108 | 8¾" | Sec. M5 |

CORE BITS

| Bit | Size | Type |
|---|---|---|
| CC-1 | 8¾" | Christensen |
| CC-2 | 8¾" | Christensen |
| CC-3 | 8¾" | Christensen |
| CC-4 | 8¾" | Hughes JAF |
| CC-5 | 8¾" | Hughes JAF |

DIPS — VISUAL — DIPMETER

DEVIATION: 1°00' | 1° | 1° | 0°45' | 0°45' | 0°45'

HOLE DIAMETER and CASING DIAMETER in inches — PERFORATIONS and PLUGS

REMARKS

Plug 9768'-8868' Cm't'd with 70 sks.

FORMATION TESTS and OTHER RESERVOIR ENGINEERING DATA

Core Analysis:

| Depth | Perm. | Ø% | O/I |
|---|---|---|---|
| 10328' | 3.2% | 0 | 100% Tr. |
| 10334' | 3.1% | 0 | 100% |
| 10337' | 3.1% | 0 | 100% |
| 10347' | 3.1% | 0 | 100% |

Average rate

Average rate

RATE OF PENETRATION ft./hr. — Dashed on bit change and core interval

MUD GAS DETECTION

T.D. 12091'

Compiled by: A. S. Keller.....
Drafted by: M. Bradshaw, NOV. 1961