COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Petroleum Search Subsidy Acts

PUBLICATION No. 54

SUMMARY OF DATA AND RESULTS PERTH BASIN, WESTERN AUSTRALIA

Eneabba No. 1
Hill River Stratigraphic Wells
Woolmulla No. 1

OF

WEST AUSTRALIAN PETROLEUM PTY LIMITED

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

COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

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

SECRETARY: SIR HAROLD RAGGATT, C.B.E.

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

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Canberra A.C.T.

FOREWORD

Under the Petroleum Search Subsidy Act 1959-1961, agreements relating to subsidized operations provide that the information obtained may be published by the Commonwealth Government six months after the completion of field work.

The growth of the exploration effort has greatly increased the number of subsidized projects and this increase has led to delays in publishing the results of operations.

The detailed results of subsidized operations may be examined at the offices of the Bureau of Mineral Resources in Canberra and Melbourne (after the agreed period) and copies of the reports may be purchased.

In order to make the main results of operations available early, short summaries are being prepared for publication. These will be grouped by area and date of completion as far as practicable. Drilling projects and geophysical projects will be grouped separately. In due course, full reports will be published concerning those operations which have produced the more important new data.

This Publication contains summaries of data and results of three drilling operations undertaken in the Perth Basin, Western Australia: Eneabba No. 1, Hill River Stratigraphic Wells, and Woolmulla No. 1. The information has been abstracted by the Petroleum Exploration Branch of the Bureau of Mineral Resources from well completion reports furnished by West Australian Petroleum Pty Limited.

J.M. RAYNER
DIRECTOR

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ENEABBA NO. 1

of

WEST AUSTRALIAN PETROLEUM PTY LIMITED

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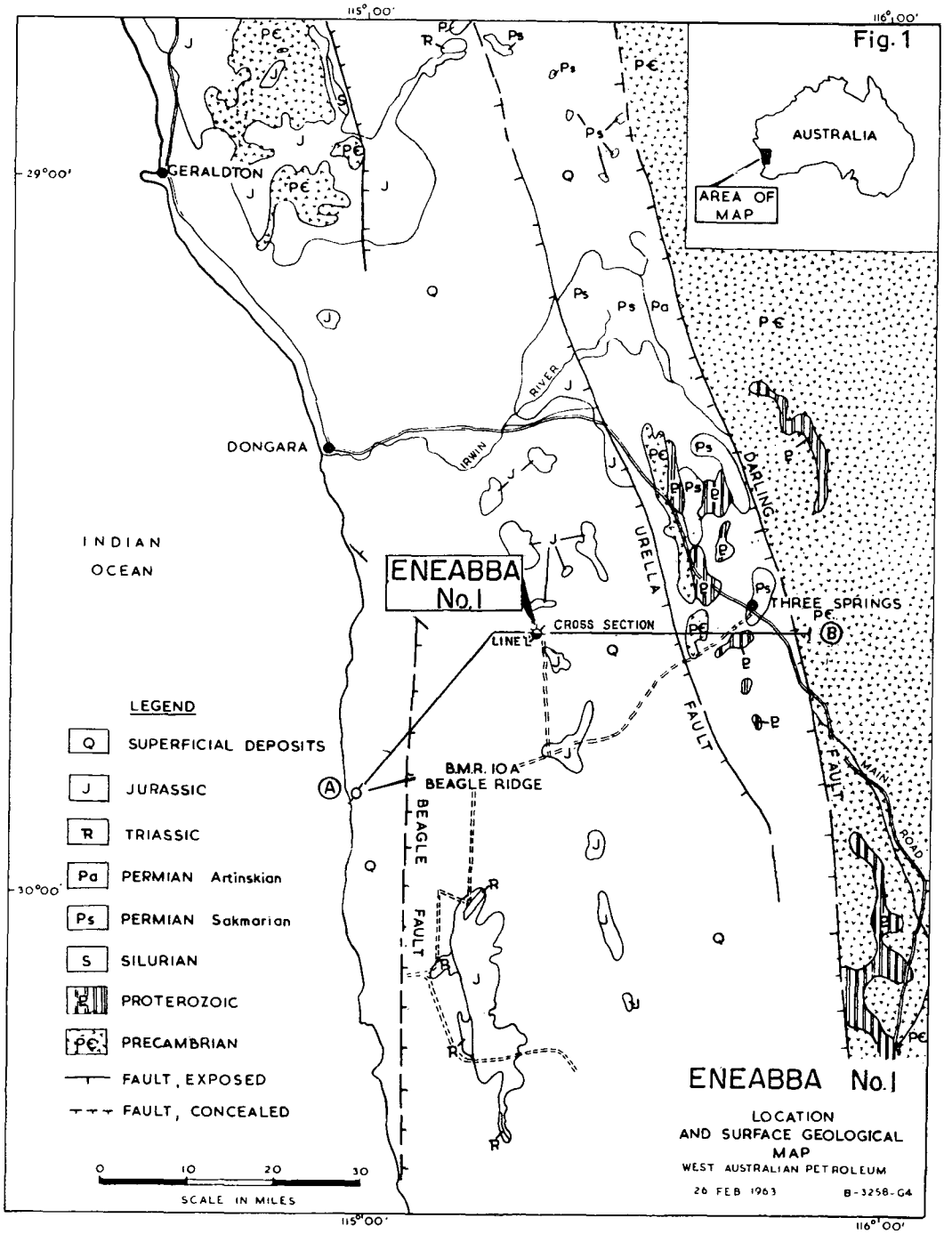
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SCALE IN MILES
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26 FEB 1963
B-3258-G4

ENEABBA NO. 1

SUMMARY OF DATA AND RESULTS*

SUMMARY

Eneabba No. 1 Well was located in the northern part of the Perth Basin, Western Australia, approximately 32 miles south-east of Dongara. The well was drilled by Oil Drilling and Exploration (W.A.) Pty Limited for West Australian Petroleum Pty Limited, to a total depth of 13,712 feet. Drilling commenced on 12th June, 1961 and was completed on 25th November, 1961. A full programme of logging and coring was undertaken.

After drilling through 28 feet of Quaternary alluvium, the well penetrated 5558 feet of Lower Cretaceous to Middle Jurassic Yarragadee Formation, 276 feet of Middle Jurassic probable Cadda Formation equivalent, 3894 feet of Lower Jurassic to Upper Triassic Cockleshell Gully Formation, 960 feet of Upper Triassic Lesueur Sandstone, 436 feet of Middle to Lower Triassic Woodada Formation, and 2548 feet of Lower Triassic Kockatea Shale. The pipe stuck at 5275 feet when starting to pull out at 13,712 feet, and eventually the well was abandoned leaving 9200 feet of drill string in the hole.

The well was drilled to investigate the petroleum potential and stratigraphy of the Mesozoic and Palaeozoic sediments in the northern part of the Perth Basin. The Mesozoic section was much thicker than expected at the well which had not reached the Palaeozoic when abandoned at 13,712 feet because of mechanical difficulties.

Many oil shows and one strong gas show (from a fracture zone between 12,795 and 12,800 feet) were recorded in the Kockatea Shale but no formation tests were carried out because of the impervious nature of the formation.

The stratigraphic drilling operation at Eneabba No. 1 was subsidized under the Petroleum Search Subsidy Act 1959, from surface to total depth.

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* Abstracted from: Well Completion Report Eneabba No. 1, by V. Pudovskis, West Australian Petroleum Pty Limited, February, 1962.

WELL HISTORY

General Data

Well name and number:	Eneabba No. 1
Location:	Latitude 29°34'14"S.
	Longitude 115°19'56"E.
Name and address of Tenement Holder:	West Australian Petroleum Pty Limited, 251 Adelaide Terrace, Perth. W.A.
Details of Petroleum Tenement:	Licence to Prospect No. 95H, Permit to Explore 27H
Total Depth:	13,712 feet
Date drilling commenced:	12th June, 1961
Date drilling completed:	25th November, 1961
Date well abandoned:	26th November, 1961
Date rig released:	26th November, 1961
Elevation (ground):	404 feet
Elevation (derrick floor):	416 feet (datum for depths)
Status:	Dry hole; plugged and abandoned
Cost:	£284,986

Drilling Data

Drilling Plant:

Make:	National
Type:	100

Hole sizes and depths:

20"	to 432 feet
13 3/4"	to 3833 feet
9 7/8"	to 13712 feet

Casing details:

Size (in.):	22	16	10 3/4
Weight (lb./ft):	-	65	40.5
Grade:	H.40	H.40	J.55
Setting depth (ft):	15	426	3812

Logging and Testing

Ditch Cuttings:

Interval:	Ten feet from surface to 11,200 feet, and five feet from 11,200 feet to total depth.
Coring:	Nineteen cores were cut using a Hughes "J" Type core barrel with 7 7/8" core heads (soft formation - 11, hard formation - 8) and one core was cut with a Triefus diamond core head (7 7/8"). 252 feet of formation were cored and 209 feet (83%) recovered.
Sidewall Cores:	On three separate runs 36 sidewall cores were recovered by the Schlumberger core sample taker, between 4107 and 10,480 feet.

Electric and other logging (Schlumberger):

Electrical Log:	426- 8729 feet (4 runs)
Induction - Electrical Log:	5500-13409 feet (9 runs)
Microlog-Caliper:	7000-13380 feet (7 runs)
Sonic Log:	427-11104 feet (5 runs)
Gamma Ray - Neutron Log:	410-13380 feet (7 runs)
Continuous Dipmeter:	427- 8552 feet (2 runs)
Section Gauge:	426-10748 feet (6 runs)
Temperature Log:	426-13440 feet (3 runs)
Deviation Log and Directional Survey:	3812- 5410 feet (2 runs)
Velocity Survey:	A survey with 29 shots was run from surface to 13,500 feet by Geophysical Service International.

GEOLOGY

Stratigraphy

General:

The subsurface geology of the Eneabba area prior to drilling was practically unknown. This part of the Perth Basin was covered by the Company's seismic refraction and reflection surveys, which indicated the presence of several fault-blocks, formed by normal faults, which run approximately in a northerly direction. Refraction, gravity, and magnetic data indicated that the depth to Precambrian basement at Eneabba No. 1 is 24,000 feet.

The age of the formations drilled was established on palaeontological and palynological data supplied by B.E. Balme, P.R. Evans, M.E. White, and J.M. Dickins. The formation boundaries were chosen on lithological breaks and the Induction-Electrical and Gamma Ray-Neutron log interpretation.

The stratigraphic sequence encountered in Eneabba No. 1 is shown in the following Table:

Age	Formation	Depth Intervals (feet)	Thickness (feet)
Quaternary	Alluvium	12- 40	28
	UNCONFORMITY		
Lower Cretaceous-Middle Jurassic	Yarragadee Formation	40- 5598	5558
	? DISCONFORMITY		
Middle Jurassic	Cadda Formation Equivalent?	5598- 5874	276
Lower Jurassic-Upper Triassic	Cockleshell Gully Formation	5874- 9768	3894
Upper Triassic	Lesueur Sandstone*	9768-10728	960
Middle-Lower Triassic	Woodada Formation*	10728-11164	436
Lower Triassic	Kockatea Shale	11164-13712 (T.D.)	2548+

* Lesueur Sandstone and Woodada Formation are new units which are defined by S.P. Willmott in Appendix 1.

Detailed:

Alluvium (Quaternary) : 12 to 40 feet (28 feet)

Lateritic pebbles and loose to poorly cemented coarse quartz sand with clay matrix in parts.

Yarragadee Formation (Lower Cretaceous to Middle Jurassic): 40 to 5598 feet (5558 feet)

Coarse sandstone and conglomerate with interbedded claystone, siltstone, and carbonaceous material. The sandstone ranges from white to brown, and from coarse to very coarse. It is poorly sorted quartzose rock of continental origin. The siltstone is grey to brown and contains abundant plant microfossils. The claystone is grey to brown, micaceous, pyritic, and carbonaceous. In places the carbonaceous material is concentrated in coal seams up to three feet thick. Electrical logs indicate that fresh water is present throughout the formation.

Cadda Formation Equivalent? (Middle Jurassic): 5598 to 5874 feet (276 feet)

Thinly interbedded, fine-grained, grey to grey-brown sandstone, micaceous, sandy siltstone and grey-brown claystone grading into shale. The water in the lower part of the formation contains 45,000 ppm. sodium chloride.

Correlation of this formation with the Cadda Formation outcrop section is not certain and the formation may be the top unit of the Cockleshell Gully Formation.

Cockleshell Gully Formation (Lower Jurassic to Upper Triassic): 5874 to 9768 feet (3894 feet)

Interbedded, coarse sandstone, claystone, siltstone, and coal. No marine fossils were observed in the formation. It can be subdivided in Eneabba No. 1 into an upper unit (5874 to 7553 feet) and a lower unit (7553 to 9768 feet). Coal is most abundant in the upper part of the upper unit (6378 to 6441 feet) and the lower unit consists of coarse and fine sandstone, claystone, and siltstone. However, this subdivision of the formation into two units cannot be followed with certainity in other parts of the Basin.

Because of the preponderance of coal in the interval 6378 to 6441 feet, and since this unit, which has a distinctive microflora, can also be recognized in Hill River No. 2A and at least seven other shallow holes in the Hill River area, it has been named by S.P. Willmott the Cattamarra Coal Member. The formal definition of this new name is given in Appendix 1.

The formation waters within the Cockleshell Gully Formation, especially in the lower parts of the unit, contain 85,000 ppm. sodium chloride.

Lesueur Sandstone (Upper Triassic): 9768 to 10,728 feet (960 feet)

Sandstone, light grey to white, coarse-grained to conglomeratic, with some fine to medium-grained beds; kaolinitic and feldspathic. No marine fossils were noted in the formation.

its age has been based on a rather more diverse "Pteruchipollenites" assemblage than that developed in the lower part of the Cockleshell Gully Formation.

The formal definition of the Lesueur Sandstone is contained in Appendix 1.

Woodada Formation (Middle to Lower Triassic): 10,728 to 11,164 feet (436 feet)

White, grey, and green, chloritic, graphitic, fine to medium-grained sandstone interbedded with brown-grey, graphitic siltstone and sideritic claystone.

The formal definition of this formation is given in Appendix 1.

Kockatea Shale (Lower Triassic): 11,164 to 13,712 feet (2548 feet +)

Thinly interbedded, tight sandstones and shales in the upper part grading downwards into interbedded shale and siltstone. The sandstone is light to medium brown-grey, micaceous and fine-grained, with a siliceous cement, calcareous in places. The siltstone is a medium to dark brown-grey, micaceous rock. The shale is dark grey to black and micaceous. On the evidence of lithology and the Induction Electrical logs, four lithological units were recognized within the Kockatea Shale section.

Oil shows were recorded throughout the formation and a strong flow of gas was recorded from a fracture zone between 12,795 and 12,800 feet.

A few thin beds of limestone were noted below 12,700 feet and marine fossils were recorded.

Structure

Eneabba No. 1 Well was sited in east dipping sediments on the east side of a normal fault downthrown to the west. A Continuous Dipmeter survey was conducted in the well down to 8552 feet. The survey indicated formation dips predominantly from about 8^{o} to 17^{o}. The direction of dips varies from north-easterly, to easterly, to south-easterly. The northerly component is prevalent in the Yarragadee Formation, but the southerly in the Cockleshell Gully Formation section. Both these formations are in parts strongly crossbedded.

Oil and Gas Indications and Potential

Gas shows were observed in three separate zones:

(i) 8,400 to 9,650 feet;

(ii) 11,530 to 11,785 feet; and

(iii) 12,785 to 13,712 feet.

Zone (i) comprises the lower part of the lower unit of the Cockleshell Gully Formation. It is evident that the amount of gas present in the formation is very small. The origin of the gas is uncertain; it could have originated in the interbedded claystone beds, but it also could have originated from the deeper-lying Kockatea Shale.

Zone (ii) is confined to the second unit (11,402-12,020 feet) of the Kockatea Shale. The presence of gas in this unit was indicated by the J.W. gas detector, which gave a maximum reading of 30 units at 11,580 feet. It is evident that the amount of gas which could be produced by the formation is negligible, because of the very poor permeability of the section.

In Zone (iii), a strong gas flow was encountered while drilling at 12,785 feet and it continued to total depth. A temperature survey showed that the main gas producing zone is from 12,800 to 12,795 feet. It appears that the main gas flow is associated with a fracture zone, which could represent a fault plane.

Traces of oil were present in the following intervals:

(i) 10,480 to 10,500 feet;

(ii) 10,750 to 10,760 feet; and

(iii) 11,200 to 11,800 feet.

Ditch samples from interval (i) contained about one percent of sandstone showing brown oil stain and some yellow waxy residue in interstices. This sandstone showed bright, greenish-yellow fluorescence and gave a positive cut with carbon tetrachloride. Subsequent logs and sidewall samples failed to locate the petroliferous beds in this section. Very probably this show represents a residual oil which migrated from the Kockatea Shale and was trapped in a sandstone bed of poor permeability.

Only a negligible amount of fluorescent sandstone chips was observed in interval (ii).

Signs of oil were present throughout interval (iii), of the Kockatea Shale. The best shows were in the upper part of the formation, while only traces of fluorescence were observed in the lower part of the interval. Cores and Electrical logs indicated that the formation is non-porous and impermeable. Thus, no attempt was made to run a formation test. It seems evident that the source rocks of the oil are shale beds in the Kockatea Shale.

REFERENCES

BALME, B.E., 1961: Palynological Report No. 100. Palynology of Eneabba No. 1 Well and other bores in the northern Perth Basin. Unpubl. report to West Australian Petroleum Pty Limited.

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McTAVISH, R.A., 1960b: Completion report on Bore BMR 10A, Beagle Ridge, Western Australia. Bur. Min. Resour. Aust. Rec. 1960/127 (Unpubl.).

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PUDOVSKIS, V., 1960: Subsurface geology of the Perth Metropolitan area. Unpubl. report for West Australian Petroleum Pty Limited.

WEST AUSTRALIAN PETROLEUM PTY LIMITED, 1962: Eneabba No. 1 Well Completion Report (Unpubl.).

WHITE, MARY E., 1962: Plant fossils in Eneabba No. 1 Well. Bur. Min. Resour. Aust. Rec. 1962/131 (Unpubl.).

WILLMOTT, S.P., 1961: Bureau of Mineral Resources Stratigraphic Bore No. 10A (Beagle Ridge). Geological completion report. Unpubl. report for West Australian Petroleum Pty Limited.

ADDITIONAL DATA FILED IN THE BUREAU OF MINERAL RESOURCES

The following additional data relating to Eneabba No. 1 Well have been filed in the Bureau of Mineral Resources, Canberra, and are available for reference:

(i)	Well Completion Report, by V. Pudovskis	26 pp.
	Appendix 1: Palaeontological reports by BMR	7 pp.
	Appendix 2: Petrographic report by J. Glover	1 p.
	Appendix 3: Core and coal analyses by BMR	4 pp.
	Appendix 4: Coal analyses by Government Chemical Laboratories, Perth	8 pp.
	Appendix 5: Gas analyses by B.P. Refinery (Kwinana) Limited	3 pp.
	Appendix 6: Sandstone cuttings analysis by S.R. Silverman and D.W. Levardowski	1 p.
	Appendix 7: Core descriptions and specific gravities	3 pp.

Appendix 8:	List of Schlumberger Logs	2 pp.
Appendix 9:	Deviation records	1 p.
Appendix 10:	Water analysis from Eneabba No. 2 Water Well, by Government Chemical Laboratories, Perth	2 pp.
Appendix 11:	Electric log interpretations	17 pp.
Appendix 12:	Well Velocity Survey by G.S.I.	8 pp.

(ii) Daily drilling reports for period 28th May, 1961 to 5th December, 1961

(iii) Well logs including the following:

(a) Electrical Log

Run 1, 426- 3833 feet (2" = 100 ft)
Run 2, 3812- 5944 feet (2" = 100 ft)
Run 3, 5500- 7806 feet (2" = 100 ft)
Run 4, 7706- 8729 feet (2" = 100 ft)

(b) Induction - Electrical Log

Run 1, 5500- 7800 feet (2" = 100 ft)
Run 2, 7700- 8725 feet (2" = 100 ft)
Run 3, 8600- 9204 feet (2" = 100 ft)
Run 4, 9104-10402 feet (2" = 100 ft)
Run 5, 10302-10524 feet (2" = 100 ft)
Run 6, 10418-11108 feet (2" = 100 ft)
Run 7, 11020-11304 feet (2" = 100 ft)
Run 8, 11020-12467 feet (2" = 100 ft)
Run 9, 12370-13409 feet (2" = 100 ft)

(c) Microlog-Caliper

Run 1, 7000- 8726 feet (2" = 100 ft)
Run 2, 5550- 9273 feet (2" = 100 ft)
Run 3, 9173-10415 feet (2" = 100 ft)
Run 4, 10316-10524 feet (2" = 100 ft)
Run 5, 10424-11116 feet (2" = 100 ft)
Run 6, 11028-11299 feet (2" = 100 ft)
Run 7, 11200-13380 feet (2" = 100 ft)

(d) Sonic Log

Run 1, 427- 3806 feet (2" = 100 ft)
Run 2, 3790- 5900 feet (2" = 100 ft)
Run 3, 5800- 7735 feet (2" = 100 ft)

Run 4, 5600- 9243 feet (2" = 100 ft)
Run 5, 9150-11104 feet (2" = 100 ft)

(e) Gamma Ray - Neutron Log

Run 1, 410- 3840 feet (2" = 100 ft)
Run 2, 3802- 5945 feet (2" = 100 ft)
Run 3, 5850- 9200 feet (2" = 100 ft)
Run 4, 9100-10394 feet (2" = 100 ft)
Run 5, 10294-11114 feet (2" = 100 ft)
Run 6, 11017-11305 feet (2" = 100 ft)
Run 7, 11200-13380 feet (2" = 100 ft)

(f) Continuous Dipmeter

Run 1, 427- 3814 feet (2" = 100 ft)
Run 2, 3812- 8552 feet (2" = 100 ft)
Final plotted log, Runs 1 and 2

(g) Section Gauge

Run 1, 426- 3814 feet (2" = 100 ft)
Run 2, 3800- 4914 feet (2" = 100 ft)
Run 3, 3812- 5794 feet (2" = 100 ft)
Run 4, 5800- 8727 feet (2" = 100 ft)
Run 5, 3812- 7790 feet (2" = 100 ft)
Run 6, 3812-10748 feet (2" = 100 ft)

(h) Temperature Log

Run 1, 426- 3684 feet (2" = 100 ft)
Run 2, 3812- 8727 feet (2" = 100 ft)
Run 3, 11000-13440 feet (2" = 100 ft)

(i) Deviation Log and Directional Survey

Run 1, 3812- 4895 feet (2" = 100 ft)
Run 2, 4797- 5410 feet (2" = 100 ft)

(j) Drilling rate, oil and gas log (2" = 100 ft)

(k) Graphic Log, Eneabba No. 1 Well
(Predicted Section)

(iv) Velocity Survey determinations, Eneabba No. 1 Well.

APPENDIX 1

REVISIONS TO THE MESOZOIC STRATIGRAPHY OF THE PERTH BASIN

by

S.P. Willmott*

The drilling of Eneabba No. 1 Well revealed a thick sequence of arenaceous rocks, ranging in age from Middle Triassic to Lower Jurassic, which had been correlated with the outcropping Cockleshell Gully Sandstone. A series of stratigraphic holes was drilled subsequently in the Hill River area in order to clarify the stratigraphic succession. An informal stratigraphic usage has evolved in reports circulated within West Australian Petroleum Pty Limited, and it is considered, at this stage, that although the stratigraphic succession is not completely understood it should be formalized within the limits of our present knowledge. It has been decided therefore, to clarify and formalize the Jurassic-Triassic stratigraphic nomenclature of the Perth Basin.

The stratigraphic succession at present in formal usage is listed below together with the existing informal usage:

Age	Formal Nomenclature	Informal Nomenclature
Lower Cretaceous-Middle Jurassic	Yarragadee Formation	Yarragadee Formation
Middle Jurassic	Cadda Formation	Cadda Formation
M. - L. Jurassic-Upper Triassic	Cockleshell Gully Sandstone	Cockleshell Gully Sandstone "Lesueur Sandstone" or "Basal Member" "Triassic Unit A" "Triassic Unit B"
Lower Triassic	Kockatea Shale	Kockatea Shale

The revised nomenclature is listed below:

Age	Formal Nomenclature
Middle Jurassic	Cadda Formation
Lower Jurassic-Upper Triassic	Cockleshell Gully Formation (amended) with Cattamarra Coal Member (new name)
Upper Triassic	Lesueur Sandstone (new name)
Middle-Lower Triassic	Woodada Formation (new name)
Lower Triassic	Kockatea Shale

* West Australian Petroleum Pty Limited.

Formal descriptions of the revised nomenclature follow:

Cockleshell Gully Formation (P.E. Playford, S.P. Willmott, and McKellar, in McWhae et al., 1958, amended S.P. Willmott). The name "Cockleshell Gully Sandstone" has been amended to Cockleshell Gully Formation because a higher proportion of argillaceous rocks are now known to be present within the formation than was earlier recognized. In addition, drilling in the Perth Basin has permitted the definition of the lower boundary for the first time.

Definition: The Cockleshell Gully Formation is defined as a succession of sandstones, siltstones, and claystones with some coal beds in the upper part, which are overlain by the Cadda Formation and underlain by the Lesueur Sandstone. The upper boundary of the amended formation is placed at the base of the thick dark shales of the Cadda Formation. The lower boundary is placed at the top of the first massively bedded coarse sandstone of the Lesueur Sandstone.

Type Section: The type section of the formation is located along Cockleshell Gully at latitude 30°07'45"S, longitude 114°40'15"E. This section is faulted at both top and bottom. A reference section of the uppermost part of the formation with its contact with the overlying Cadda Formation is located at latitude 30°15'55"S, longitude 115°17'30"E. The base of the formation is not seen in outcrop and has only been established in Eneabba No. 1 Well (29°34'14"S, 115°19'56"E). The formation occurs between 5874 feet and 9768 feet in this well.

Derivation of Name: The formation name is derived from Cockleshell Gully which drains the main outcrop area of the formation.

Lithology: In outcrop the upper part of the Cockleshell Gully Formation consists of very fine sandstones and sandy siltstones interbedded with medium-grained and coarse-grained sandstones underlain by a lower section dominated by coarse-grained and medium-grained sandstones with lesser thicknesses of siltstones and claystones. In general the sand/shale ratio increases gradually towards the lowest part of the formation.

In Eneabba No. 1 Well, the only complete section encountered so far consists of coarse sandstone and claystone with beds of coal and minor fine to very fine-grained sandstones and some siltstones. Deeper in the section the coal beds are not present. The lower part of the Cockleshell Gully Formation in the Eneabba No. 1 Well consists of coarse to very coarse sandstone, sometimes conglomeratic, interbedded with mottled and multicoloured (red-brown, yellow, green, purple) claystones with some fine-grained sandstones and mottled siltstones.

The formation is mainly continental but with a few marine horizons in the Hill River outcrop section.

Stratigraphic Relations: The Cockleshell Gully Formation is overlain by the Cadda Formation with apparent conformity, and is underlain by the Lesueur Sandstone with a transitional contact. Evidence suggests that the lower part of the formation becomes more sandy from Eneabba No. 1 to Woolmulla No. 1 wells and becomes lithologically more like the underlying Lesueur Sandstone with the result that the base of the Cockleshell Gully Formation in different localities may not represent the same stratigraphic horizon. The lower boundary of the formation has no structural significance.

Fossils and Age: The Cockleshell Gully Formation ranges in age from Lower Jurassic to Upper Triassic, based on palynological determinations by B.E. Balme. A characteristic "Exesipollenites" flora has been found to be associated with the upper part of the Cockleshell Gully Formation. Microplankton have been recorded in some shothole samples drilled within the formation.

Distribution and Thickness: The Cockleshell Gully Formation crops out in the Hill River area. Surface sections in excess of 2200 feet have been measured. The only complete section drilled to date is 3894 feet thick, encountered in Eneabba No. 1. The formation is apparently widespread over the Perth Basin. A seismic reflecting horizon thought to be associated with the Cattamarra Coal Member within the formation in Eneabba No. 1 can be followed over large distances from south of Mingenew to west of Coorow and west of Eneabba.

The formation is believed to be a basin equivalent of the upper part of the Chapman Group of the Geraldton area.

Repository of Samples and Electric Logs: Representative samples and the cores of the best documented section (that of Eneabba No. 1) are stored in West Australian Petroleum Pty Limited's core house at Norma Road, Myaree, W.A. Representative samples are also stored by the Bureau of Mineral Resources in Canberra and by the Geological Survey of W.A. in Perth. Copies of all electric and lithologic logs are held by the Bureau in Canberra.

Cattamarra Coal Member (new name, S.P. Willmott).

Definition: The Cattamarra Coal Member is defined as a thin persistent unit of coal and claystone which occurs within the Cockleshell Gully Formation. Its top and bottom are picked at the appearance and disappearance of a distinctive suite of thick coal seams. The member has a distinctive microflora which can be correlated on spores from Eneabba No. 1 to Hill River No. 2A. The member gives rise to a distinctive seismic reflection which can be followed over wide areas.

Type Section: The type section is selected in the Eneabba No. 1 Well between 6378 feet and 6441 feet. The member has also been penetrated in Hill River No. 2A and a seismic shothole at Hill River Line X, shotpoint 383.

Derivation of Name: The name is taken from Cattamarra Homestead in the Hill River area.

Lithology: The lithology consists of black, banded coal with thin beds of claystone, medium to dark grey, and dark brown-grey.

Stratigraphic Relations: The Cattamarra Coal Member lies some five hundred feet below the top of the Cockleshell Gully Formation in Eneabba No. 1. The member appears to be very lenticular on the western side of the Perth Basin, where it loses its character as a seismic reflection. On the eastern side of the basin it appears to be almost continuous from just south of Mingenew to just west of Coorow.

Fossils and Age: The age of the member is Lower to early Middle Jurassic based on spore and pollen grain determinations by B.E. Balme. The microflora is very distinctive and has been correlated over great distances.

Distribution and Thickness: The Cattamarra Coal Member is 63 feet thick in its type section. In Hill River No. 2A it is 34 feet thick. It is apparently almost continuous over the Perth Basin east of Eneabba No. 1, but is very lenticular over the western side of the Basin.

Repository of Samples and Electric Logs: Representative samples of the type section are stored in West Australian Petroleum Pty Limited's core house at Norma Road, Myaree, W.A. Representative samples are also stored by the Bureau of Mineral Resources in Canberra and by the Geological Survey of W.A. in Perth. Copies of all electric logs are held by the Bureau in Canberra.

Lesueur Sandstone (new name, S.P. Willmott, M.H. Johnstone, J.W. Burdett).

Definition: The Lesueur Sandstone is defined as a unit of uniform sandstones and conglomerates with a few siltstone beds, underlying the Cockleshell Gully Formation and overlying disconformably the Woodada Formation (new name). The upper boundary is placed at the appearance of the massively bedded sandstones below the multicoloured claystones and sandstones of the Cockleshell Gully Formation. The lower boundary is placed at the break from the coarse sandstones of the Lesueur Sandstone to the fine sandstones of the Woodada Formation.

Type Section: The type section of the formation has been selected in the Woolmulla No. 1 Well (latitude 30°01'24"S, longitude 115°11'28"E) between 1408 feet and 3319 feet. An additional reference section is selected at the Eneabba No. 1 Well between 9768 feet and 10,728 feet. The formation is believed to crop out in the Hill River area west of Cadda Spring.

Derivation of Name: The name is taken from Mt Lesueur, the highest hill in the Hill River area.

Lithology: The Lesueur Sandstone consists of sandstones, light grey and white, coarse-grained to conglomeratic, with some fine to medium-grained beds, kaolinitic, feldspathic, slightly pyritic with micaceous partings, often with a green clay matrix. Throughout the section the rock is strongly crossbedded. The unit contains several thin beds of siltstones, medium to dark brownish-grey, and grey-green, micaceous, carbonaceous, thinly bedded. Traces of black, vitreous-lustred carbonaceous material were noted in Woolmulla No. 1 and well-preserved plant fossils were recorded in Eneabba No. 1.

Stratigraphic Relations: The Lesueur Sandstone is overlain by the Cockleshell Gully Formation with a transitional contact. It is underlain by the Woodada Formation with an apparent disconformity. Existing electric log correlations suggest that about 900 feet of additional section is present at the base of the formation in Woolmulla No. 1, as compared with Eneabba No. 1.

Fossils and Age: The age of the formation is Middle to Upper Triassic based on a few spore determinations by B.E. Balme. Spores are rare to absent in the entire section of Woolmulla No. 1. A rather more diverse "Pteruchipollenites" assemblage than in the lower Cockleshell Gully Formation seems to be the palynological feature of the Lesueur Sandstone, although the lithology of the formation precludes closely spaced palynological determinations.

Distribution and Thickness: The Lesueur Sandstone occurs in the Woolmulla No. 1 and Eneabba No. 1 wells. The section encountered in Hill River No. 4 down to 720 feet can be correlated with the formation. The section between 510 and 1097 feet in BMR.10 (Beagle Ridge) can be readily correlated with the Lesueur Sandstone while the section from 101 to 510 feet can be correlated on present data to either the Lesueur Sandstone or the basal Cockleshell Gully Formation.

Specific correlations of surface exposures with the Lesueur Sandstone have not been made, although massive, strongly crossbedded, coarse sandstones of a distinctive appearance in the lowest parts of the exposed section in Cockleshell Gully are believed to correlate with the Lesueur Sandstone.

Repository of Samples and Electric Logs: Representative sample splits and the bulk of the cores of the type section in Woolmulla No. 1 and the main reference section at Eneabba No. 1 are stored in West Australian Petroleum Pty Limited's core house at Norma Road, Myaree, W.A. Representative samples of both sections are also stored by the Bureau of Mineral Resources in Canberra, and by the Geological Survey of W.A. in Perth. Copies of all electric and lithologic logs are held by the Bureau in Canberra.

Woodada Formation (new name, S.P. Willmott, R.A. McTavish).

Definition: The Woodada Formation is defined as a section of fine-grained sandstone with subordinate siltstone underlying the Lesueur Sandstone with an apparent disconformity and overlying the Kockatea

Shale with a transitional contact.

The upper boundary is placed at the appearance of fine-grained sandstones below the coarse-grained sandstones of the Lesueur Sandstone. The lower boundary is placed where the sandstone-siltstone section passes transitionally into a siltstone-shale section. In several wells the lower boundary is too transitional to pick on lithology and electric log markers are used to pick the boundary. Essentially the Woodada Formation is the regressive phase of the marine Kockatea Shale.

Type Section:

The type section of the formation has been selected in the BMR.10 (Beagle Ridge) Well (latitude 29°49'38"S, longitude 114°58'30"E) between 1097 feet and 2002 feet. This section is the most frequently cored section encountered so far and provides the best lithologic section although cuttings samples in the upper part of the section are poor. However, electric logs of this section are rather inadequate, so the section in the Woolmulla No. 1 Well between 3319 feet and 4040 feet is selected as a reference section.

Derivation of Name:

The name is taken from Woodada Hill about eight miles north-east of BMR.10 (Beagle Ridge).

Lithology:

The lithology of the formation in its type section can best be described in two sections. The upper section from 1097 feet to 1462 feet (formerly referred to as "Triassic Unit A") consists of sandstone, fine-grained, light-grey, kaolinitic, thin bedded and crossbedded, interbedded and interlaminated with siltstone, dark grey, carbonaceous, micaceous and rarely pyritic; laminae are generally sharply defined.

The lower unit (formerly referred to as "Triassic Unit B") is composed of interbedded, fine-grained sandstones and interlaminated siltstone-sandstone with a bed of intraformational shale-breccia near the base. The basic lithologies are as for the upper unit but the sand/shale ratio is much lower.

In Woolmulla No. 1 the sandstone lithology is similar, but the siltstones are more common in the upper part of the formation.

Stratigraphic Relations:

The Woodada Formation is overlain by the Lesueur Sandstone with an apparent disconformity. It is underlain by the Kockatea Shale with a transitional boundary. The lower boundary is picked in BMR.10 (Beagle Ridge) where the interbedded sandstone-siltstone section gives way to a greywacke-siltstone unit at the top of the Kockatea Shale. The pick is apparent on Electric and Gamma Ray logs at BMR. 10. In Woolmulla No. 1 the lithologic break cannot be picked and the boundary is picked from Gamma Ray and Electric logs. Similarly in Eneabba No. 1 the Woodada Formation - Kockatea Shale boundary is more apparent on the electric logs than on lithology alone.

Fossils and Age: B.E. Balme determined the age of the formation as Middle Triassic from spores and pollen grains. Because of its transitional contact with the Lower Triassic Kockatea Shale, a Lower to Middle Triassic age is ascribed to the formation. Plant fragments were observed in the section encountered in Eneabba No. 1.

Distribution and Thickness: The Woodada Formation has been encountered in BMR.10 and 10A (Beagle Ridge) where it is 905 feet thick, also in Woolmulla No. 1 (721 feet thick) and Eneabba No. 1 (436 feet thick). It may have been encountered in Hill River No. 4 below 720 feet, but this correlation is not definite. The formation is not believed to crop out in the Hill River area.

Repository of Samples and Electric logs: Samples and cores from BMR.10 (Beagle Ridge) are held by the Bureau of Mineral Resources in Canberra. Electric and lithologic logs are also held by the Bureau. Representative sample splits and the bulk of the cores of the reference section in Woolmulla No. 1 are stored in West Australian Petroleum Pty Limited's core house at Norma Road, Myaree, W.A. Representative samples are also stored by the Bureau in Canberra and by the Geological Survey of W.A. in Perth. Copies of all electric and lithologic logs are held by the Bureau in Canberra.

HILL RIVER STRATIGRAPHIC WELLS

of

WEST AUSTRALIAN PETROLEUM PTY LIMITED

SUMMARY OF DATA AND RESULTS

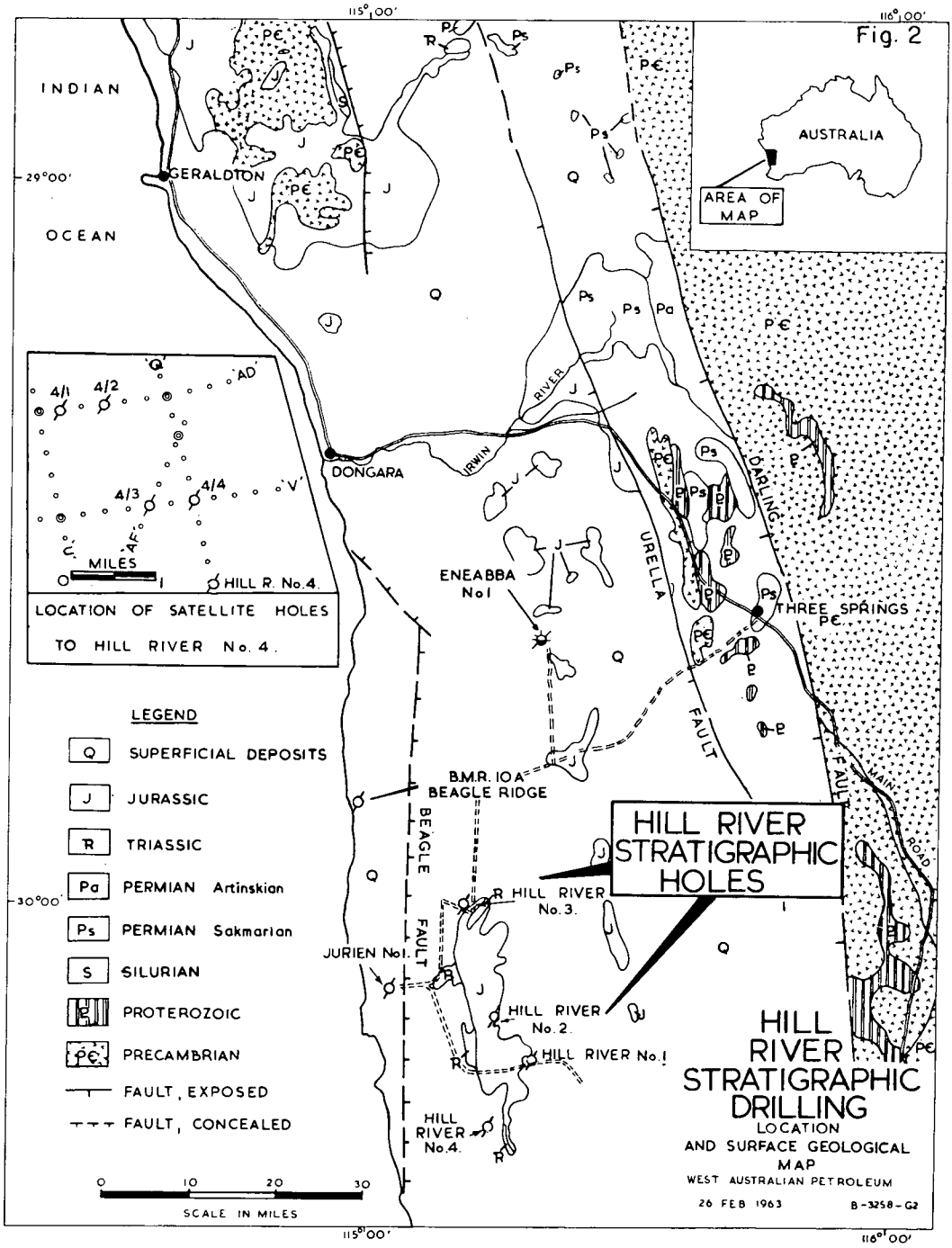
Fig. 2
AUSTRALIA
AREA OF MAP
INDIAN
OCEAN
GERALDTON
29°00'
30°00'
115°00'
116°00'
DONGARA
IRWIN RIVER
DARLING FAULT
URELLA FAULT
ENEABBA No1
THREE SPRINGS
B.M.R. 10A BEAGLE RIDGE
BEAGLE FAULT
HILL RIVER No.3.
HILL RIVER No.2.
HILL RIVER No.1
HILL RIVER No.4.
JURIEN No1.
MAIN ROAD
HILL RIVER STRATIGRAPHIC HOLES
4/1
4/2
4/3
4/4
AD
V
MILES
HILL R. No.4.
LOCATION OF SATELLITE HOLES TO HILL RIVER No. 4.
LEGEND
Q SUPERFICIAL DEPOSITS
J JURASSIC
R TRIASSIC
Pa PERMIAN Artinskian
Ps PERMIAN Sakmarian
S SILURIAN
PROTEROZOIC
PC PRECAMBRIAN
FAULT, EXPOSED
FAULT, CONCEALED
0 10 20 30
SCALE IN MILES
HILL RIVER STRATIGRAPHIC DRILLING
LOCATION AND SURFACE GEOLOGICAL MAP
WEST AUSTRALIAN PETROLEUM
26 FEB 1963
B-3258-G2

HILL RIVER STRATIGRAPHIC WELLS

SUMMARY OF DATA AND RESULTS*

SUMMARY

The Hill River stratigraphic drilling project involved the drilling of nine holes in the various blocks of the Hill River Fault Complex in the western coastal part of the Perth Basin, Western Australia, about 125 miles north of Perth. Drilling commenced on 2nd April, 1962 and was completed on 27th August, 1962; the total footage drilled was 7805 feet made up as follows:

Well	Depth (feet)
Hill River No. 1	1900
Hill River No. 2	1620
Hill River No. 2A	380
Hill River No. 3	865
Hill River No. 4	1010
Hill River No. 4/1	500
Hill River No. 4/2	510
Hill River No. 4/3	510
Hill River No. 4/4	510

Hill River Nos 1, 2, 3, 4, 4/1 and 4/4 were drilled by Geophysical Service International, S.A., with a Mayhew 2000 rig specially designed for stratigraphic drilling. Hill River Nos 2A, 4/2 and 4/3 were drilled with a Mayhew 1000 rig borrowed from one of the Geophysical Service International seismograph parties working nearby. The total cost of the Hill River stratigraphic drilling project was £38,906.

The sediments penetrated in the nine holes ranged in age from the Lower Cretaceous to Middle Jurassic Yarragadee Formation in Hill River No. 1 to the Upper Triassic Lesueur Sandstone in Hill River Nos 3 and 4, and almost a complete succession was covered. The only breaks were possible stratigraphical gaps between the bottom of Hill River No. 1, in the Lower Jurassic Cockleshell Gully Formation, and the top of Hill River No. 2A, in the same formation; and between the base of Hill River No. 2 and the top of Hill River No. 3, a monotonous sequence containing a sparse undiagnostic microflora.

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*Abstracted from Completion Report: Hill River Stratigraphic Bores, Perth Basin, Western Australia, by J.W. Burdett, West Australian Petroleum Pty Limited, 1963.

The main objective was to drill in each of the major blocks of the Hill River Fault Complex in order to establish the complete stratigraphic succession of the near-surface sediments in an area of sparse outcrops. The operation was almost completely successful and provided valuable information to control structural evaluation of the area.

The detailed structure drilling operation at Hill River, Western Australia, was subsidized under the Petroleum Search Subsidy Act 1959-1961.

HILL RIVER NO. 1

General Data

Location:	Latitude 30°16'S. Longitude 115°18'E.
Name and address of Tenement Holder:	West Australian Petroleum Pty Limited, 251 Adelaide Terrace, Perth, W.A.
Details of Petroleum Tenement:	Permit to Explore 27H
Total Depth:	1900 feet
Date drilling commenced:	2nd April, 1962
Date drilling completed:	25th April, 1962
Elevation (K.B. reference):	368 feet (datum for depths)
Status:	Released as a water well at 1900 feet, with 5-sack plug at 232 feet.

Drilling Data

Drilling Plant:	
Make:	Mayhew
Type:	2000
Hole sizes and depths:	6" pilot hole to 70 feet opened to 8 3/8"; 5 5/8" to 1490 feet 5 1/8" to 1625 feet 4 3/4" to 1900 feet (T.D.)
Casing details:	Ran casing from surface to 67 feet; cemented to the surface with 14 sacks cement using a bottom plug.

Logging and Testing

Ditch Cuttings:	
Interval:	Ten feet from 20 to 1900 feet
Coring:	Five cores were cut using a Mayhew core barrel. Fifty feet of formation were cored and 32 feet (64%) recovered.

Electric Logging:	Three logging runs were made, using the Widco logger, Model XMVA-12.
Electrical Survey:	67-1371 feet (2 runs)
Gamma Ray Log:	67-1728 feet (3 runs)
Point Resistivity Log:	67-1728 feet (2 runs)
Velocity Survey:	A velocity survey was carried out by Geophysical Service International, Party 622. Eleven shots were fired, with recordings from 1600 to 230 feet.

Stratigraphy

General:

The formations drilled in the Hill River No. 1 Well are listed in the following Table:

Age	Formation	Depth Intervals (feet)	Thickness (feet)
Lower Cretaceous - Middle Jurassic	Yarragadee Formation	10- 230	220+
	DISCONFORMITY		
Middle Jurassic	Cadda Formation	230- 495	265
Lower Jurassic	Cockleshell Gully Formation	495-1900	1405+

Detailed:

Yarragadee Formation (Lower Cretaceous to Middle Jurassic): 10 to 230 feet (220 feet+)

Greyish-white, fine-grained, quartz sandstone with interbeds of siltstone and ferruginized sandstone.

Cadda Formation (Middle Jurassic): 230 to 495 feet (265 feet)

Dark grey to black siltstone with interbeds and lenses of medium-grained, shelly sandstone containing Ostrea tholliformis.

Cockleshell Gully Formation (Lower Jurassic): 495 to 1900 feet (1405 feet+)

Dark brown to black, micaceous and partly kaolinitic shale and siltstone with interbeds of greyish-white to brown, glauconitic, lignitic, and pyritic quartz sandstone and minor coal seams.

The odour of gas was noted at 1560 to 1580 feet and at 1660 to 1670 feet. In both cases it may have been due to small pockets of coal gas.

HILL RIVER NO. 2

General Data

Location:	Latitude 30°11'S. Longitude 115°14'E.
Name and address of Tenement Holder:	West Australian Petroleum Pty Limited, 251 Adelaide Terrace, Perth, W.A.
Details of Petroleum Tenement:	Permit to Explore 27H
Total Depth:	1620 feet
Date drilling commenced:	6th May, 1962
Date drilling completed:	24th May, 1962
Elevation (K.B. reference):	625 feet (datum for depths)
Status:	Abandoned at 1620 feet, with 6-sack plug set at 65 feet.

Drilling Data

Drilling Plant:	
Make :	Mayhew
Type :	2000
Hole sizes and depths:	6" pilot hole to 68 feet opened to 8-3/8"; 5-5/8" to 1620 feet (T.D.)
Casing details:	Ran casing from one foot above ground to 68 feet (K.B.); cemented to the surface with 14 sacks construction cement using a bottom plug.

Logging and Testing

Ditch Cuttings:	
Interval:	Ten feet from 60 to 1620 feet
Coring:	Five cores were cut using a Mayhew core barrel. Fifty feet of formation were cored and 41 feet (82%) recovered.
Electric Logging:	Two logging runs were made, using the Widco logger, Model XMVA-12.

Electrical Survey:	68-1620 feet (2 runs)
Gamma Ray Log:	68-1620 feet (2 runs)
Point Resistivity Log:	68-1620 feet (2 runs)
Velocity Survey:	A velocity survey was carried out by Geophysical Service International, Party 622. Records were taken between 1000 and 400 feet.

Stratigraphy

General:

The Hill River No. 2 Well spudded in the middle part of the Cockleshell Gully Formation, and terminated while still in Lower Jurassic rocks. The age shown in the following Table is based on palynological data supplied by B.E. Balme:

Age	Formation	Depth Interval (feet)	Thickness (feet)
Lower Jurassic	Cockleshell Gully Formation	5-1620	1615+

Detailed:

Cockleshell Gully Formation (Lower Jurassic): 5 to 1620 feet (1615 feet+)

5 to 1080 feet: An upper unit consisting of interbedded, dark grey and brown, micaceous shale and puggy, sandy claystone, with minor amounts of dark grey, micaceous siltstone and brownish-white, fine-grained, pyritized sandstone.

1080 to 1620 feet: A lower unit consisting of dark grey, brownish-grey, and chocolate coloured, massive claystone grading into brownish-white, greenish-grey, grey, and brownish-grey, puggy claystone interbedded with dark grey, micaceous shale. Minor beds of grey, micaceous siltstone and thin beds of lignite are present.

Small amounts of gas were noted between 300 and 1300 feet. It is likely that the well drilled through some isolated pockets of marsh gas.

HILL RIVER NO. 2A

General Data

Location:	1000 feet East of Hill River No. 2
Total Depth:	380 feet
Date drilling commenced:	24th May, 1962
Date drilling completed:	25th May, 1962
Elevation (K.B.):	603 feet (datum for depths)
Status:	Abandoned at 380 feet

Drilling Data

Drilling Plant:	Mayhew 1000 rig from G.S.I. Party 621

Logging and Testing

Ditch Cuttings:

Interval:	Fifteen feet from surface to 380 feet
Electric Logging:	A Point Resistivity Log was run at the completion of the hole, using the Widco logger, Model XMVA-12.

Stratigraphy

Cockleshell Gully Formation (Lower Jurassic): Surface to 380 feet

A sequence consisting of interbedded, grey to brown, micaceous claystone and sandy, micaceous, grey to white, lignitic siltstone, with some coal beds, most of which occur in the zone 160 to 200 feet. The zone between 164 and 198 feet can be correlated with the coal - bearing zone in Eneabba No. 1 (the Cattamarra Coal Member).

HILL RIVER NO. 3

General Data

Location:	Latitude 30°00'30"S. Longitude 115°11'15"E.
Name and address of Tenement Holder:	West Australian Petroleum Pty Limited, 251 Adelaide Terrace, Perth, W.A.
Details of Petroleum Tenement:	Permit to Explore 27H
Total Depth:	865 feet
Date drilling commenced:	12th August, 1962
Date drilling completed:	27th August, 1962
Elevation (K.B. reference):	413 feet (datum for depths)
Status:	Abandoned, with 8-sack cement plug set at 140 feet.

Drilling Data

Drilling Plant:	
Make:	Mayhew
Type:	2000
Hole sizes and depths:	8 1/2" to 45 feet; 5 5/8" to 865 feet (T.D.)
Casing details:	Ran 6" casing to 45 feet (K.B.); cemented with 12 sacks of construction cement.

Logging and Testing

Ditch Cuttings:	
Interval:	Ten feet from surface to 865 feet
Coring:	Three cores were cut using a Mayhew core barrel. Twenty-five feet of formation were cored and nine feet (36%) recovered.
Electric Logging:	The Widco logger, Model XMVA-12, was used to record the following logs:

Electrical Survey:	170-745 feet (1 run)
Gamma Ray Log:	0-750 feet (1 run)
Point Resistivity Log:	50-740 feet (1 run)

Stratigraphy

General:

The Hill River No. 3 Well was drilled in the Lesueur Sandstone, a poorly sorted, kaolinitic sandstone containing occasional beds of multicoloured claystone and shale. The age of this formation is thought to be Upper Triassic, but no palynological confirmation of this was obtained in this well.

Detailed:

Lesueur Sandstone (?Upper Triassic): Surface to 865 feet

Dominantly white, kaolinitic, very coarse to very fine-grained, friable quartz sandstone with interbeds of green, grey, and black, massive claystone. The claystone grades into shale in places and is regularly interbedded with the sandstone from 500 to 865 feet.

Several lost circulation zones were encountered during the drilling of Hill River No. 3, and some of these contained subartesian water of good quality. The zones were at 100 feet, 520 feet, and 770 to 865 feet; the good porosity appeared to be of the intergranular type.

HILL RIVER NO. 4

Introduction

Hill River No. 4 stratigraphic well and the associated structure holes were located on the south-west flank of the Cadda Structure, situated in the southern part of the Hill River area in the vicinity of Cadda Spring.

Three of the four satellite wells were drilled in sediments similar in age and general lithology to the section in Hill River No. 4. The fourth of the shallow structure holes, Hill River No. 4/1, yielded a spore and pollen assemblage of Lower Jurassic age, comparable with the microfossils in the lower unit of the Cockleshell Gully Formation in Eneabba No. 1 (7553' to 9768 feet).

Electric logs were run in all the wells, but no correlations could be made. No structural information on the area could be added to existing data.

General Data

Location:	Latitude 30°23'24"S. Longitude 115°13'49"E.
Name and address of Tenement Holder:	West Australian Petroleum Pty Limited, 251 Adelaide Terrace, Perth, W.A.
Details of Petroleum Tenement:	Permit to Explore 27H
Total Depth:	1010 feet
Date drilling commenced:	19th June, 1962
Date drilling completed:	30th June, 1962
Elevation (K.B. reference):	309 feet (datum for depths)
Status:	Abandoned

Drilling Data

Drilling Plant:	
Make:	Mayhew
Type:	2000
Hole sizes and depths:	8 1/2" to 67 feet 5 5/8" to 1000 feet 4 1/2" to 1010 feet
Casing details:	Ran 6" I.D. casing from surface to 66 feet and cemented with eight sacks of cement.

Logging and Testing

Ditch Cuttings:

Interval:	Ten feet from surface to 1010 feet
Coring:	Four cores were cut using a Mayhew core barrel. Forty feet of formation were cored and 21 feet (52.5%) recovered.
Electric Logging:	The Widco logger, Model XMVA-12, was used to record the following logs:
Gamma Ray Log:	60-990 feet (1 run)
Point Resistivity Log:	65-995 feet (2 runs)

Stratigraphy

General:

The Hill River No. 4 stratigraphic well was drilled in a sequence of mainly medium-grained sandstones, with minor claystones and siltstones. A satisfactory assemblage of plant microfossils was obtained from Core No. 2 (725-735 feet). Spores and pollen grains were not abundant, but were extremely well-preserved. There is no doubt that the microflora is Triassic, although at this stage it is difficult to determine where it should be placed in that System.

Detailed:

Lesueur Sandstone (?Upper Triassic): Surface to 1010 feet

Mainly coarse-grained, friable sandstone with a kaolinitic matrix and minor interbeds of fine sandstone, siltstone, and claystone. From 370 feet, the sandstone becomes finer grained and poorly sorted and from 720 feet the claystone interbeds become more abundant. The claystones are grey, brown, green, and purple, and the siltstones are brownish-white, grey, green, and purple. It is probable that the section between 720 and 1010 feet is actually the Woodada Formation.

STRUCTURE WELLS DRILLED NEAR

HILL RIVER NO. 4

Introduction

Four shallow structure holes were drilled north and north-west of Hill River No. 4, in an attempt to clarify the near-surface structure of the south-west flank of the Cadda Structure. Hill River No. 4/1 was drilled to a depth of 500 feet in the Lower Jurassic Cockleshell Gully Formation, on the west side of a major fault. Holes Nos 4/2, 4/3, 4/4 were drilled to 510 feet in the Lesueur Sandstone, on the east side of the fault and stratigraphically 3000 feet lower than Hole No. 4/1.

General Data

Details are listed in the Table below:

Name of Well:	HR.4/1	HR.4/2	HR.4/3	HR.4/4
Location:				
Latitude (S):	30°21'39"	30°21'35"	30°22'37"	30°22'32"
Longitude (E):	115°12'03"	115°12'34"	115°13'03"	115°13'34"
Total Depth:	500 feet	510 feet	510 feet	510 feet
Date drilling commenced:	7.7.1962	21.6.1962	3.7.1962	2.7.1962
Date drilling completed:	9.7.1962	29.6.1962	7.7.1962	6.7.1962
Elevation (K.B. reference):	224 feet	237 feet	244 feet	286 feet
Status:	Abandoned	Abandoned	Abandoned	Abandoned
Drilling Plant:	Mayhew 2000	Mayhew 1000	Mayhew 1000	Mayhew 2000
Hole sizes and depths:	5 5/8" to 490 feet 4 1/2" to 500 feet	5 5/8" to 120 feet 5 1/8" to 500 feet 4 1/2" to 510 feet	5 5/8" to 500 feet 4 1/2" to 510 feet	8 3/8" to 24 feet 5 5/8" to 500 feet 4 1/2" to 510 feet
Casing details:	-	-	-	Ran casing from surface to 24 feet (K.B.).

Logging and Testing

Ditch Cuttings:

Interval: Ten feet from surface to total depths

Coring: A Mayhew core barrel was used to cut the following cores:

Well	Core Depth (feet)	Recovery (feet)
HR.4/1	490-500	3
HR.4/2	500-510	8
HR.4/3	500-510	9
HR.4/4	500-510	8

Electric Logging: The Widco logger, Model XMVA-12, was used to record the following logs:

Well	Log	Depth Interval (feet)	Runs
HR.4/1	Gamma Ray	60-500	1
	Point Resistivity	60-500	1
HR.4/2	Point Resistivity	10-430	1
HR.4/3	Gamma Ray	55-498	1
	Point Resistivity	40-498	1
HR.4/4	Point Resistivity	25-490	1

Stratigraphy

Hill River No. 4/1

Cockleshell Gully Formation (Lower Jurassic): Surface to 500 feet

Mainly multicoloured claystone with minor interbeds of fine to medium-grained sandstone. Lower 250 feet is mainly fine to medium-grained, silty sandstone with interbedded, green-grey, and brownish-white claystone.

Hill River No. 4/2

Lesueur Sandstone (Upper Triassic): Surface to 510 feet

Interbedded, multicoloured claystone, friable, coarse-grained sandstone, and silty, fine-grained sandstone. From 265 feet, the section is made up of interbedded, fine-grained sandstone and siltstone.

Hill River No. 4/3

Lesueur Sandstone (Upper Triassic): Surface to 510 feet

Interbedded, medium and fine-grained sandstone grading into siltstone.

Hill River No. 4/4

Lesueur Sandstone (Upper Triassic): Surface to 510 feet

Upper 160 feet consists mainly of multicoloured claystone, with interbedded, medium-grained sandstone; below 160 feet, interbedded, clayey siltstone and fine to medium-grained sandstone.

STRUCTURE OF HILL RIVER AREA

The Hill River area consists of a series of blocks, separated by faults, which step down to the east into the main Perth Basin. The faults, named from west to east, the Beagle, Lesueur, and Warradarge Faults are normal. The pattern is complicated by a second series of faults, downthrown to the west, associated with the Darling Fault.

Two anticlines have been mapped. One is between the Lesueur and Warradarge Faults and the other is east of the Warradarge Fault in the Hill River valley. Both anticlines are faulted.

CONCLUSIONS

The stratigraphic drilling project achieved its objective of investigating the lithology and age of the formations in each of the major fault blocks in the Hill River district. The programme did not drill completely through the whole stratigraphic succession in the area. There is apparently a small gap between the base of Hill River No. 1 and the top of Hill River No. 2A. The main part of the section not drilled is that between the base of Hill River No. 2 and the top of Hill River No. 3; this consists of a monotonous siltstone sequence containing a sparse, undiagnostic microflora.

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ADDITIONAL DATA FILED IN THE

BUREAU OF MINERAL RESOURCES

The following additional data relating to the Hill River stratigraphic drilling project have been filed in the Bureau of Mineral Resources, Canberra, and are available for reference:

Hill River No. 1

(i) Well Completion Report, by J.W. Burdett 8 pp.

Appendix A: Sample descriptions 21 pp.

Appendix B: Coal analyses, by Government Chemical Laboratories, Perth 2 pp.

Appendix C: Palynological report by B.E. Balme 6 pp.

(ii) Daily drilling reports for period 30th March, 1962 to 3rd May, 1962

(iii) Widco Well Logs including the following:

(a) Electrical Survey

Run 1, 67- 526 feet (2" = 100 ft)
Run 2, 67-1371 feet (2" = 100 ft)

(b) Gamma Ray Log

Run 1, 67- 526 feet (2" = 100 ft)
Run 2, 67-1371 feet (2" = 100 ft)
Run 3, 1100-1728 feet (2" = 100 ft)

(c) Point Resistivity Log

Run 1, 67-1371 feet (2" = 100 ft)
Run 2, 1100-1728 feet (2" = 100 ft)

(iv) Composite Well Log (2" = 100 ft)

(v) Velocity Survey determinations, Hill River No. 1

Hill River No. 2

(i) Well Completion Report, by J.W. Burdett 6 pp.

Appendix A: Sample descriptions 26 pp.

Appendix B: Palynological report by B.E. Balme 3 pp.

(ii) Daily drilling reports for period 4th May, 1962 to 26th May, 1962

(iii) Widco Well Logs including the following:

(a) Electrical Survey

Run 1, 68-1518 feet (2" = 100 ft)
Run 2, 1455-1620 feet (2" = 100 ft)

(b) Gamma Ray Log

Run 1, 68-1518 feet (2" = 100 ft)
Run 2, 1460-1620 feet (2" = 100 ft)

(c) Point Resistivity Log

Run 1, 68-1518 feet (2" = 100 ft)
Run 2, 1460-1620 feet (2" = 100 ft)

(iv) Composite Well Log (2" = 100 ft)

Hill River No. 2A

(i)	Well Completion Report, by J.W. Burdett	3 pp.
	Appendix A: Sample descriptions	4 pp.
	Appendix B: Palynological report by B.E. Balme	3 pp.
	Appendix C: Palynological report by B.E. Balme	5 pp.
	Appendix D: Coal analyses, by Government Chemical Laboratories, Perth	1 p.

(ii) Widco Well Log

(a) Point Resistivity Log

Run 1, 12- 294 feet (2" = 100 ft)

(iii) Composite Well Log (2" = 100 ft)

Hill River No. 3

(i)	Well Completion Report, by J.W. Burdett	5 pp.
	Appendix A: Sample descriptions	11 pp.
	Appendix B: Palynological report by E.M. Fowler	1 p.

(ii) Daily drilling reports for period 10th August, 1962 to 27th August, 1962

(iii) Widco Well Logs including the following:

(a) Electrical Survey

Run 1, 170-745 feet (2" = 100 ft)

(b) Gamma Ray Log

Run 1, 0-750 feet (2" = 100 ft)

(c) Point Resistivity Log

Run 1, 50-740 feet (2" = 100 ft)

(iv) Composite Well Log (2" = 100 ft)

Hill River No. 4 and Associated Structure Wells

(i) Well Completion Report, by J.W. Burdett 9 pp.

Appendix A: Sample descriptions 31 pp.

Appendix B: Palynological reports by B.E. Balme 7 pp.

(ii) Daily drilling reports for period 27th May, 1962 to 23rd July, 1962

(iii) Widco Well Logs including the following:

Well No. H.R.4, Gamma Ray Log

Run 1, 60-990 feet (2" = 100 ft)

Well No. H.R. 4, Point Resistivity Log

Run 1, 104-735 feet (2" = 100 ft)

Run 2, 65-995 feet (2" = 100 ft)

Well No. H.R. 4/1, Gamma Ray Log

Run 1, 60-500 feet (2" = 100 ft)

Well No. H.R. 4/1, Point Resistivity Log

Run 1, 60-500 feet (2" = 100 ft)

Well No. H.R. 4/2, Point Resistivity Log

Run 1, 10-430 feet (2" = 100 ft)

Well No. H.R. 4/3, Gamma Ray Log

Run 1, 55-498 feet (2" = 100 ft)

Well No. H.R. 4/3, Point Resistivity Log

Run 1, 40-498 feet (2" = 100 ft)

Well No. H.R. 4/4, Point Resistivity Log

Run 1, 25-490 feet (2" = 100 ft)

(iv) Composite Well Log, Hill River No. 4 (2" = 100 ft)

(v) Composite Electrical Logs of Hill River No. 4 and all associated wells

(vi) Locality and geological map (1 inch =1 mile)

Hill River Stratigraphic Wells

(i)	Consolidated report, by J.W. Burdett	34 pp.
	Appendix A: Core analyses, Hill River Nos 1 and 2, by BMR	3 pp.
	Appendix B: Coal analyses, by Government Chemical Laboratories, Perth	3 pp.
	Appendix C: Palynological reports by B.E. Balme	21 pp.
	Appendix D: Coring programme	1 p.
	Appendix E: Summary of logging operations	2 pp.
	Appendix F: Notes on the nomenclature of the Jurassic-Triassic sediments of the Perth Basin, by M.H. Johnstone.	1 p.

WOOLMULLA NO. 1

of

WEST AUSTRALIAN PETROLEUM PTY LIMITED

SUMMARY OF DATA AND RESULTS

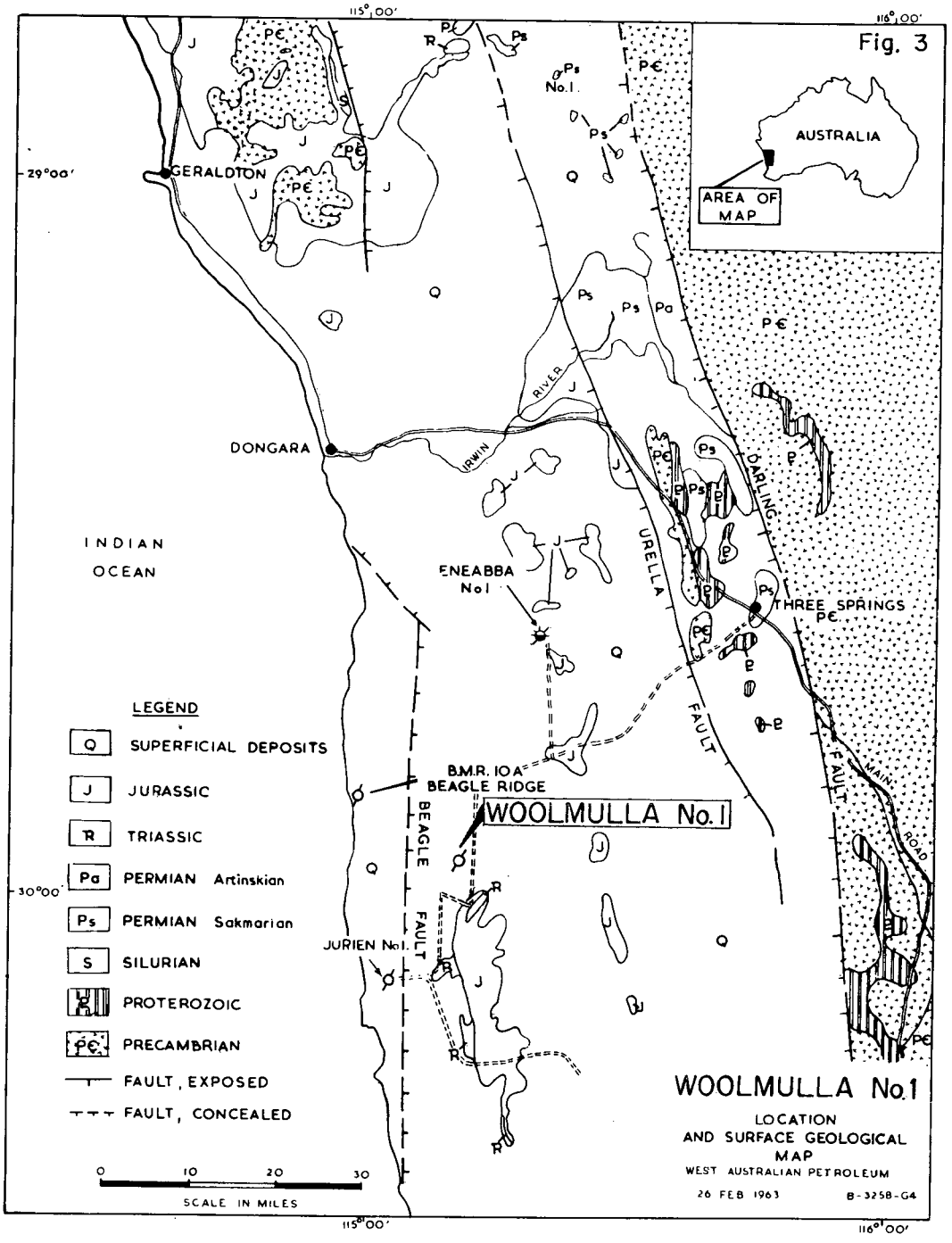
Fig. 3
AUSTRALIA
AREA OF MAP
115°00'
116°00'
29°00'
30°00'
GERALDTON
DONGARA
IRWIN RIVER
INDIAN OCEAN
ENEABBA No.1
Ps No.1
BEAGLE RIDGE
B.M.R. 10A
WOOLMULLA No.1
JURIEN No.1
BEAGLE FAULT
URELLA FAULT
DARLING FAULT
MAIN ROAD
THREE SPRINGS
LEGEND
Q SUPERFICIAL DEPOSITS
J JURASSIC
R TRIASSIC
Pa PERMIAN Artinskian
Ps PERMIAN Sakmarian
S SILURIAN
PROTEROZOIC
PC PRECAMBRIAN
FAULT, EXPOSED
FAULT, CONCEALED
0 10 20 30
SCALE IN MILES
WOOLMULLA No.1
LOCATION AND SURFACE GEOLOGICAL MAP
WEST AUSTRALIAN PETROLEUM
26 FEB 1963
B-3258-G4

WOOLMULLA NO. 1

SUMMARY OF DATA AND RESULTS*

SUMMARY

Woolmulla No. 1 Well was located in the Perth Basin, Western Australia, approximately 100 miles south-south-east of Dongara. The well was drilled by Oil Drilling and Exploration (W.A.) Pty Limited for West Australian Petroleum Pty Limited, to a total depth of 9224 feet. Drilling commenced on 3rd November, 1962 and was completed on 8th March, 1963. A full programme of logging, testing, and coring was undertaken.

The well was spudded in the lower part of the Cockleshell Gully Formation, and penetrated 7508 feet of Upper to Lower Triassic sandstone, siltstone, and claystone; 1577 feet of Permian (Artinskian) sandstone, siltstone, limestone, shale, and coal measures; and 127 feet of Precambrian metamorphic basement. The Permian-Precambrian junction was not clearly defined because of faulting.

The objective of the well was to evaluate the hydrocarbon potential of the Triassic and Permian sediments in the Woolmulla Anticline. The well was drilled on the eastern flank of this anticline which is situated between the Beagle Ridge on the west and the deep trough of the Perth Basin on the east. Because of the faulting out of the lower section of Permian sediments, the objective of the well was only partly achieved.

Traces of petroleum gas and oil were noted throughout the Kockatea Shale but formation tests were non-productive because of low porosity and permeability. A drillstem test over the interval 9030 to 9224 feet yielded gas-cut mud and salty formation water from a fault zone in the Irwin River Coal Measures and basement. The petroleum gas was possibly from deeper Permian strata faulted out at the well.

The stratigraphic drilling operation at Woolmulla No. 1 was subsidized under the Petroleum Search Subsidy Act 1959-1961, from surface to total depth.

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* Abstracted from: Well Completion Report Woolmulla No. 1, by V. Pudovskis, West Australian Petroleum Pty Limited, July, 1963.

WELL HISTORY

General Data

Well name and number:	Woolmulla No. 1
Location:	Latitude 30°01'24"S. Longitude 115°11'28"E.
Name and address of Tenement Holder:	West Australian Petroleum Pty Limited, 251 Adelaide Terrace, Perth, W.A.
Details of Petroleum Tenement:	Licence to Prospect No. 100H, Permit to Explore No. 27H
Total Depth:	9224 feet
Date drilling commenced:	3rd November, 1962
Date drilling completed:	8th March, 1963
Date well abandoned:	15th March, 1963
Date rig released:	15th March, 1963
Elevation (ground):	382 feet
Elevation (derrick floor):	394 feet (datum for depths)
Status:	Dry hole; plugged and abandoned
Cost:	£274,110

Drilling Data

Drilling Plant:

Make:	National	
Type:	100	
Hole sizes and depths:	20"	to 496 feet
	13 3/4"	to 4184 feet
	9 7/8"	to 9224 feet

Casing details:

Size (in.):	16	10 3/4
Weight (lb./ft):	65	40.5
Grade:	H.40	J.55
Setting depth (ft):	492	4182

Logging and Testing

Ditch Cuttings:

Interval:	Ten feet from surface to total depth
Coring:	Twenty conventional cores were cut. Cores Nos 1 to 9 were cut with Hughes soft formation core heads, Nos 10 to 15 with Hughes hard formation core heads, Nos 16 and 17 with Triefus diamond core heads and Nos 18 to 20 with home made core heads. The size of all the core heads was 7-7/8". A total of 199 feet of formation was cored and 141 feet (70.5%) recovered.
Sidewell Cores:	Fifty-one sidewall cores were recovered by the Schlumberger core sample taker between 3745 and 8231 feet.

Electric and other logging (Schlumberger):

Electrical Log:	70- 527 feet (1 run)
Induction-Electrical Log:	496-9230 feet (9 runs)
Microlog:	3200-9200 feet (5 runs)
Sonic-Gamma Ray - Caliper Log:	4350-9225 feet (4 runs)
Sonic Log:	496-4450 feet (1 run)
Gamma Ray Log:	15-4454 feet (4 runs)
Laterolog:	496-9226 feet (2 runs)
Section Gauge:	495-8700 feet (3 runs)
Continuous Dipmeter:	496-4454 feet (1 run)
Cement Bond Log:	2450-4186 feet (1 run)
Velocity Survey:	Measurements were made at six depths in the well between 4200 and 9220 feet.

GEOLOGY

Stratigraphy

General:

The palynological material in the Woolmulla No. 1 Well is very poorly preserved and could not be used for correlation purposes. The formation boundaries were established on the interpretation of the Induction-Electrical and Gamma Ray logs and on the lithological breaks.

The formations penetrated in Woolmulla No. 1 are listed in the Table below:

Age	Formation	Depth Intervals (feet)	Thickness (feet)
Upper Triassic	Cockleshell Gully Formation	12-1408	1396+
Upper Triassic	Lesueur Sandstone	1408-3319	1911
	DISCONFORMITY		
Middle-Lower Triassic	Woodada Formation	3319-4040	721
Lower Triassic	Kockatea Shale	4040-7520	3480
	UNCONFORMITY		
Permian (Artinskian)	Carynginia Formation	7520-8628	1108
Permian (Artinskian)	Irwin River Coal Measures	8628-9097	469
	PROBABLE FAULT		
Precambrian	Metamorphic Basement	9097-9224	127+

Detailed:

Cockleshell Gully Formation (Upper Triassic): 12 to 1408 feet (1396 feet+)

The Cockleshell Gully Formation consists of interbedded, coarse, yellow sandstone; mottled, multicoloured, yellow, purple-red, and green claystone; and thin beds and lenses of grey, micaceous, laminated siltstone. The only fossils observed were plant remains and a few poorly preserved pollens.

Lesueur Sandstone (Upper Triassic): 1408 to 3319 feet (1911 feet)

The Lesueur Sandstone consists of light grey to white, coarse-grained sandstone which is strongly crossbedded and is kaolinitic, feldspathic, pyritic and micaceous, with a green clay matrix. Thin beds of grey, micaceous, carbonaceous siltstone occur near the top and bottom of the formation.

Woodada Formation (Middle to Lower Triassic): 3319 to 4040 feet (721 feet)

The Woodada Formation is disconformable beneath the Lesueur Sandstone and consists of fine-grained, well-sorted, micaceous sandstone with kaolinitic and siliceous cement, interbedded with brownish-grey, carbonaceous, micaceous siltstone and reddish brown, mottled, micaceous claystone. The sandstone is usually white to grey-green, but red-brown and pink calcareous varieties occur.

Kockatea Shale (Lower Triassic): 4040 to 7520 feet (3480 feet)

This formation consists of thinly interbedded sandstone, limestone, siltstone, and shale. The fauna include pelecypod "Posydonia" sp. and ammonite cf. Subinyoites kashmiricus (Diener) 1913. The sandstone members are fine-grained, micaceous, and range from white to brown-grey. The limestones are grey-brown to brown and finely crystalline. The siltstones are brown-grey, siliceous, calcareous in part, and micaceous. The shales are grey-brown, thinly laminated, micaceous, carbonaceous, and graphitic. The formation can be divided into six units based on the distribution of the various lithological types.

Carynginia Formation (Permian-Artinskian): 7520 to 8628 feet (1108 feet)

The formation has been subdivided into four units:

Unit A (7520 to 7688 feet) - grey to black, micaceous, pyritic, laminated shale interbedded with grey to black, sandy, pyritic siltstone, and grey-brown, silty, sandy, crystalline limestone.

Unit B (7688 to 8058 feet) - mostly dark grey, pyritic shale with a few thin beds of siltstone and limestone as above. Some pelecypods and ostracods are present.

Unit C (8058 to 8400 feet) - this is the sandiest part of the formation and consists of interbedded siltstone and shale as above, with grey, mostly fine-grained, silty, pyritic, micaceous sandstone. No macrofossils were observed.

Unit D (8400 to 8628 feet) - interbedded, grey, silty, micaceous shale, grey to black, sandy, pyritic siltstone, and sandstone as above.

Irwin River Coal Measures (Permian-Artinskian): 8628 to 9097 feet (469 feet)

The Irwin River Coal Measures can be divided into an upper member (8628 to 8873 feet) containing no coal, and a lower member (8873 to 9097 feet) in which black vitreous coal is present. Both members consist of interbedded, white to grey, fine-grained, moderately sorted, pyritic sandstone, dark brown-grey to black, micaceous, pyritic shale, and dark grey to black, micaceous, pyritic, sandy siltstone. Traces of brown-grey, coarse crystalline limestone were observed in the upper part of the upper member. Most of the lower part of the lower member has been replaced by vuggy, pyritic, vein quartz. Some petroliferous gas was recovered from the basal part of the formation. The formation is faulted against the metamorphic Precambrian basement.

Metamorphic Basement (Precambrian): 9097 to 9224 feet (127 feet+)

The boundary between the Irwin River Coal Measures and the basement is uncertain. It has been chosen arbitrarily on the Laterolog break, which approximately coincides with the first appearance of mica-bearing quartz. The dominant basement rock is pyritic, quartz-muscovite gneiss.

Structure

The well was drilled on the southern part of the eastern flank of the Woolmulla Anticline, which is situated between the Beagle Ridge on the west and the deep trough of the Perth Basin on the east, and is bounded by the Peron Fault on the west and the Lesueur Fault on the east. Measured reliable dips range from 6^{o} to 18^{o} and vary from south to east. However, the amount and the direction of the dip in the drilled section could be influenced by the proximity of a fault. The presence of a fault is well indicated by the abundant quartz veins which are present in the Irwin River Coal Measures. It is evident that a normal fault (the Peron Fault) plane was penetrated at 9097 feet where the Precambrian basement was encountered.

Oil and Gas Indications and Potential

Traces of petroliferous gas were observed in the well throughout the Kockatea Shale and Carynginia Formation sections. Only traces of methane were recorded on the gas

detector (average reading less than five units) throughout most of the Irwin River Coal Measures. However, while drilling the interval 9040 to 9045 feet a reading of 120 units methane was recorded.

At the total depth a drill stem test was run to test the lower part of the hole. The test included also the interval of high gas reading mentioned above.

Results of the test were surprising: the recovered rat hole mud and salty formation water were strongly gas cut; the gas chromatograph analysis suggested that this was a petroleum gas, containing hydrocarbons at least up to butane. The tested formation consists mostly of fractured and vuggy vein quartz and is probably not the source rock of the gas. Very probably the petroliferous gas migrated into the tested zone from deeper Permian strata, which are faulted out in the Woolmulla No. 1 Well.

Slight traces of oil were present in the upper part of the Kockatea Shale from 4200 to 4400 feet. These traces appear as staining in thin sandstone lenses, which show blue and yellow fluorescence and give a fluorescent cut with carbon tetrachloride. Compared with Eneabba No. 1, traces of oil in Woolmulla No. 1 are on a considerably smaller scale. The same could be said also of the gas shows.

Sandstone beds of the Cockleshell Gully Formation and the Lesueur Sandstone represent the most porous and most permeable section in the hole. Porosities of these beds vary from 11 to 29 percent, and permeabilities from 400 to 43,000 millidarcys.

Measured porosities of sandstones in the prospective Woodada Formation are from 9 to 14 percent.

All cores from the Kockatea Shale show no permeability. Porosities of their sandy parts vary from 1 to 4 percent with one sample showing 8.5 percent.

Measured porosities in the Permian rocks do not exceed 1.5 percent. Prospective sandstones of the Irwin River Coal Measures lay in the fault zone and thus are completely silicified. However, numerous fractures in the Permian section form some permeable zones. Some porosity and permeability also exist in numerous vuggy quartz veins, which form a major part of the Irwin River Coal Measures.

REFERENCES

BARDSLEY, S.R., and ALGERMISSEN, S.T., 1963: Evaluating oil shale by log analysis. J. Petrol. Tech., January, 1963.

PLAYFORD, P.E., and WILLMOTT, S.P., 1958: Stratigraphy and structure of the Perth Basin, Western Australia. Unpubl. report for West Australian Petroleum Pty Limited.

PUDOVSKIS, V., 1962: Jurien No. 1 Well Completion Report. Unpubl. report for West Australian Petroleum Pty Limited.

PUDOVSKIS, V., 1963: Woolmulla No. 1 Well Completion Report. Unpubl. report for West Australian Petroleum Pty Limited.

ADDITIONAL DATA FILED IN THE

BUREAU OF MINERAL RESOURCES

The following additional data relating to Woolmulla No. 1 Well have been filed in the Bureau of Mineral Resources, Canberra, and are available for reference:

(i)	Well Completion Report, by V. Pudovskis	24 pp.
	Appendix 1: Palaeontological report by J. M. Dickins	2 pp.
	Appendix 2: Gas analyses by B.P. Refinery (Kwinana) Limited	2 pp.
	Appendix 3: Water analyses by Government Chemical Laboratories, Perth	5 pp.
	Appendix 4: Drill stem test reports	5 pp.
	Appendix 5: Core analysis and S.G. data	5 pp.
	Appendix 6: List of Schlumberger logs	1 p.
	Appendix 7: Deviation records	1 p.
	Appendix 8: Petrological report by R.T. Prider	1 p.
	Appendix 9: Velocity Survey by R.G. Dennison	1 p.

(ii) Daily drilling reports for period 31st October, 1962 to 15th March, 1963

(iii) Well logs including the following:

(a) Electrical Log

Run 1,	70- 527 feet	(2" = 100 ft)

(b) Induction - Electrical Log

Run 1,	496-2200 feet	(2",5" = 100 ft)
Run 2,	2100-2591 feet	(2",5" = 100 ft)
Run 3,	2490-3376 feet	(2",5" = 100 ft)
Run 4,	3250-3834 feet	(2",5" = 100 ft)
Run 5,	496-4420 feet	(1" = 100 ft)
Run 5,	3700-4457 feet	(2",5" = 100 ft)
Run 6,	4186-6555 feet	(2",5" = 100 ft)
Run 7,	4186-8062 feet	(1" = 100 ft)
Run 7,	6400-8062 feet	(2",5" = 100 ft)
Run 8,	7880-8793 feet	(1",2",5" = 100 ft)
Run 9,	8700-9230 feet	(1",2",5" = 100 ft)

(c) Microlog

Run 1,	3200-3834 feet	(2",5" = 100 ft)
Run 2,	3700-4457 feet	(2",5" = 100 ft)
Run 3,	4350-4750 feet	(2",5" = 100 ft)
Run 4,	8100-8794 feet	(2",5" = 100 ft)
Run 5,	8700-9200 feet	(2",5" = 100 ft)

(d) Sonic-Gamma Ray-Caliper Log

Run 1,	4350-6552 feet	(2",5" = 100 ft)
Run 2,	6450-8059 feet	(2",5" = 100 ft)
Run 3,	7950-8789 feet	(2",5" = 100 ft)
Run 4,	8700-9225 feet	(2",5" = 100 ft)

(e) Sonic Log

Run 1,	496-4450 feet	(2",5" = 100 ft)

(f) Gamma Ray Log

Run 1,	15-2196 feet	(2",5" = 100 ft)
Run 2,	2100-2588 feet	(2",5" = 100 ft)
Run 3,	2480-3374 feet	(2",5" = 100 ft)
Run 4,	3240-4454 feet	(2",5" = 100 ft)

(g) Laterolog

Run 1,	496-4454 feet	(2",5" = 100 ft)
Run 2,	7500-9226 feet	(2",5" = 100 ft)

(h) Section Gauge

Run 1,	495-2725 feet	(2",5" = 100 ft)
Run 2,	4186-5000 feet	(2", = 100 ft)
Run 3,	4900-8700 feet	(2" = 100 ft)

(i) Continuous Dipmeter

Run 1,	496-4454 feet	(2" = 100 ft)
Final plotted log, Run 1,		(1" = 100 ft)

(j) Cement Bond Log

Run 1,	2450-4186 feet	(2" = 100 ft)

(k) Graphic Log, Woolmulla No. 1 (Predicted Section)

(iv) Velocity Survey determinations, Woolmulla No. 1 Well.

PLATE 1
SHEET 1

COMPOSITE WELL LOG

WEST AUSTRALIAN PETROLEUM PTY LIMITED

FNEABBA No.1

PERMIT TO EXPLORE 27H

LICENCE TO PROSPECT 95H

STATE: WESTERN AUSTRALIA 4 MILE SHEET: DONGARA BASIN: PERTH

WELL STATUS: ABANDONED

LOCATION LAT 29°34'14"S. LONG. 115°19'56"E.
ELEVATION GROUND LEVEL 404'
DERRICK FLOOR 416'

DATE SPUDDED: 12th JUNE 1961
DATE DRILLING STOPPED: 25th NOVEMBER 1961
TOTAL DEPTH D.F. 13712'

HOLE SIZE.

IN.	FROM	TO
20	0	432'
13½	432'	3833'
9⅞	3833'	13712'

CASING.

SIZE	WT	G R	DEPTH	CMT.	CMT. TO
22"	—	H-40	15	20	SURFACE
16"	65	H-40	426	400	"
10¾"	40.5	J-55	3812	500	2160

CEMENT PLUGS

FROM	TO	TOP	SACKS
SURFACE	SURFACE	SURFACE	2
3560	3830	3560	150
12235	12508	12235	100
12788	13298	12788	25

PERFORATIONS: NIL

WELL HEAD FITTINGS: M S PLATE WELDED OVER CASING
DRILLED BY: OIL DRILLING & EXPLORATION LTD.
DRILLING METHOD: ROTARY

STANDARD E. LOGS → ← INDUCTION E. LOGS

RUN No.	1	2	3	4	1	2	3	4	5	6	7	8	9
DATE	24·6·61	20:7:61	2:8:61	8:8:61	3·8:61	8:8:61	30:8:61	14:9:61	17·9:61	7:10.61	17:10:61	4:11:61	16·11:61
FOOTAGE LOGGED	3407	2132	2306	1023	2300	1025	604	1298	222	690	284	1447	1039
TOTAL DEPTH ELECTRIC LOG	3833	5944	7806	8729	7800	8725	9204	10402	10524	11108	11304	12467	13409
TOTAL DEPTH DRILLER	3833	5947	7815	8730	7815	8730	9763	10406	10528	11118	11308	12469	13415
CASING SHOE, ELECTRIC LOG	426	3812	3812	3812	3812	3812	3812	3812	3812	3812	3812	3812	3812
CASING SHOE, DRILLER	426	3812	3812	3812	3812	3812	3812	3812	3812	3812	3812	3812	3812
BIT SIZE	13¾	9⅞	9⅞	9⅞	9⅞	9⅞	9⅞	9⅞	9⅞	9⅞	9⅞	9⅞	9⅞
MUD DATA – TYPE	CLAY BASE	DIESEL EMULSION											
TREATMENT	GEL	GEL, DIESEL											
WATER LOSS 30 MIN.	72	3	5 6	3.4	5 6	3.4	3 4	5 2	4 8	4.4	4.2	5.6	5.2
WEIGHT	82 5	67.5	72	79	72	79	76 5	77	75	73	73	74	81
VISCOSITY	45	47	49	48	49	48	56	62	70	54	43	50	68
P.H.	10	12	12	10 5	12	10.5	11	11	11	10.5	10.5	10. 5	10.5
RESISTIVITY & TEMP.													
RM	10.2 @ 59°F	3.8 @ 72°F	1.6 @ 76°F	25 @ 52°F	1·6 @ 76°F	2.5 @ 52°F	2.25 @ 65°F	2.2 @ 71°F	2.0 @ 73°F	2.0 @ 83°F	2.5 @ 67°F	2.5 @ 73°F	1.8 @ 89°F
RMF					0.45 @ 186°F	1.19 @ 35°F	1.51 @ 55°F	1.31 @ 60°F	1.6 @ 50°F	1.27 @ 85°F	1.54 @ 75°F	2.0 @ 73°F	1.12 @ 72°F
RMC					0.75 @ 186°F	2.08 @ 35°F	1.81 @ 55°F	1.45 @ 60°F	1.7 @ 50°F	1.17 @ 85°F	1.58 @ 75°F	2.05 @ 73°F	1.15 @ 72°F
MAXIMUM RECORDED TEMP.	124°F	168°F	186°F	200°F	186°F	200°F	208°F	219°F	221°F	225°F	225°F	235°F	270°F
ELECTRODE SPACING													
AM 1 AM	16"	16"	16"	16"		16"	16"	16"	16"	16"	16"	16"	16"
AM 2 IND	64"	64"	64"	64"	40"	40"	40"	40"	40"	40"	40"	40"	40"
AO SO.	18'18"	18'8"	18'8"	18'8"		1½"	1½"	1½"	1½"	1½"	1½"	1½"	1½"
RECORDED BY	METENIER												

RADIOMETRIC LOG DATA

TYPE OF LOG	GRN	GRN	GRN	GRN	GRN	GRN	GRN
RUN NUMBER	1	2	3	4	5	6	7
DATE IN 1961	JUNE 26	JULY 20	AUG. 31	SEPT. 15	OCT 8	OCT. 17	NOV. 17
TOTAL DEPTH DRILLER	3833	5947	9763	10406	11118	11308	13415'
TOP OF LOGGED INTERVAL	410	3802	5850	9100	10294	11017	11200'
BOTTOM LOGGED INTERVAL	3830	5945	9200	10394	11114	11305	13380'
TYPE OF FLUID IN HOLE	MUD						
FLUID LEVEL	FULL						
MAXIMUM RECORDED TEMP.	124°F	168°F	208°F	219°F	225°F	225°F	270°F
SONDE SIZE & TYPE	GNAM 2	GNAM 2	GNAM 5	GNAM 5	GNAM 5	GNAM 5	GNAM 5
TIME CONSTANT SECONDS	5	4	4	4	4	4	4
LOGGING SPEED FT/HR	1000	2000	2500	2500	2400	2400	1600
SENSITIVITY REFERENCE	200	200	200/300	200/300	200/300	200/300	300

OTHER ELECTRICAL LOGS —

TEMPERATURE	426 TO 13440	RUN 1 TO 3
SONIC	196 TO 11104	RUN 1 TO 5
SECTION GAUGE	426 TO 10748	RUN 1 TO 6
MICROLOG – CALIPER	3812 TO 13380	RUN 1 TO 7
DEVIATION LOG & DIRECTIONAL SURVEY	3812 TO 5410	RUN 1 TO 2

LITHOLOGY BY. V. PUDOVSKIS, S.P. WILLMOTT, R.M.L. ELLIOTT
COMPILED BY: V. PUDOVSKIS
LOGGED BY: SCHLUMBERGER

LITHOLOGIC REFERENCE & WELL SYMBOLS

CONGLOMERATE
CLAYSTONE
SANDSTONE, COARSE
SANDSTONE, FINE
SILTSTONE
CALCILUTITE
SHALE
PYRITIC
COAL
CARBONACEOUS MATTER
PEBBLY
CALCARENITE
CALCAREOUS
FOSSILIFEROUS
OIL SHOW
GAS SHOW
CORE (Recovery black) SPECIFIC GRAVITY
SIDE WALL CORE
CASING SHOE

NEW BIT / CORE BIT
DRILLING RATE FEET PER HOUR 150 100 50 0
DEPTH
LITHOLOGY SANDST. SILTST SHALE COAL
OIL SHOWS TRACE FAIR GOOD SHOW
GAS LOG FREE GAS OFF SCALE 0 2 6 10 20 30 40 50
DEVIATION
CASING & PLUGS
(V) VISUAL DIPS MEASURED
SPONTANEOUS POTENTIAL — MILLIVOLTS — 10
DETAILED LITHOLOGY
RESISTIVITY — ohms m²/m — 16" SHORT NORMAL 0 20/200
64" LONG NORMAL 0 200
RESISTIVITY — ohms m²/m — 19'8" LATERAL 0 20 200
GAMMA RAY Mg Ra EQUIV/TON 0 10
1"/100
NEUTRON C.P.S. 58 158 258
STRATIGRAPHIC COLUMN

REED L.T.3 9⅞" #1

LEGEND OF MUD PROPERTIES

Mud Wt.	lbs/c.ft
Vis.	Secs. Marsh Funnel
Water loss	c.c/30 min.
Filter Cake	Inches
pH	
Sand	percent
An. Vel.	ft/min
Oil	percent

S.F.C.H. 7⅞" #2
#3 O.S.C.-3 13⅜"
RECORDS START
NO SAMPLE
16" CASING SET AT 426'
E.S. RUN 1.
G.R.N. RUN 1.
GAP DUE TO SLIPPAGE
GAP DUE TO SLIPPAGE
#2 R.R.
#3 R.R.
950'
Mud Wt. 75
Vis 41
Water Loss 14
Filter Cake 2/32
pH 12
Sand 9
An. Vel. --
#4 S.F.C.H. 7⅞"
#5 O.S.C.-3 13⅜"
#4 R.R.
#5 R.R.
1600'
Mud Wt. 76-81
Vis. 42-48
Water Loss 11-13
Filter Cake 2/32
pH 11
Sand 9-14
An. Vel. 95
#6 O.S.C. 13⅜"
J.W. IN OPERATION

YARRAGADEE FORMATION
LOWER CRETACEOUS

PLATE 1
SHEET 2

COMPOSITE WELL LOG — SHEET 2

WEST AUSTRALIAN PETROLEUM PTY. LIMITED

ENEABBA No.1.

LOCATION: LAT. 29°34'14"S. LONG. 115° 19'56" E. STATE: WESTERN AUSTRALIA 4-MILE SHEET: DONGARA BASIN: PERTH
ELEVATION: GROUND LEVEL 404'. DERRICK FLOOR 416'.

NEW BIT
CORE BIT
DRILLING RATE FEET PER HOUR
150 100 50 0
DEPTH
LITHOLOGY
SANDST.
SILTST.
SHALE
COAL
OIL
TRACE SHOW GOOD
GAS LOG
FREE GAS
OFF SCALE
0 2 6 10 20 30 40 50
DEVIATION
CASING & PLUGS
(V) VISUAL MEASURED DIPS
SPONTANEOUS POTENTIAL
— MILLIVOLTS —
10
DETAILED LITHOLOGY
RESISTIVITY -ohms m2/m
16" SHORT NORMAL 20
200
64" LONG NORMAL 20
200
RESISTIVITY -ohms m2/m
18'8" LATERAL
GAMMA RAY Mg Ra. EQUIV/TON
0 10
NEUTRON C.P.S.
58 158 258
STRATIGRAPHIC COLUMN
E.S. RUN 1
G.R.N. RUN 1
2150'
Mud Wt. 80
Vis. 40
Water Loss 12-14
Filter Cake 2/32
pH 11
Sand 8-12
An Vel. 95
#4 R.R.
#7 OSC-3 13¾"
NO SAMPLE
5° N51E
9° N55E
15° N37E
3° 4
4° N68E
8° S74E
10° S58E
10° N8E
18° N1W
3° S70W
Scale Change
90 60 30 0
2500'
Mud Wt. 75
Vis. 40
Water Loss 12
Filter Cake 2/32
pH 10 5
Sand 2.5
An. Vel. 96
#8 SFCH 7⅞"
#9 OSC 13¾"
1° 4
LOW(V)
11° N18E
2800'
Mud Wt 79
Vis. 42
Water Loss 9.6
Filter Cake 2/32
pH 10.5
Sand 6
An.Vel 92
#10 OSC 13¾"
11° N88E
1°
13° N74E
#8 RR 7⅞"
#11 OSC 3 13¾"
13° N57E
3200'
Mud Wt 78
Vis. 42
Water Loss 7.6
Filter Cake 3/32
pH 10.5
Sand 3
An. Vel. 81
14° N24E
14° N67E
1⅛°
#12 SFCH 7⅞"
#13 OSC 13¾"
8° N59E
3500'
Mud Wt. 78
Vis. 45
Water Loss 8.2
pH 10
Filter Cake --
Sand 1½
An. Vel. 88
PLUG 3A
4° SOUTH
10 3/4" casing set at 3812'
3800'
Mud Wt 79
Vis 42
Water Loss 8.0
pH 10.5
Filter Cake 3/32
Sand 4
An Vel. 81
#12 RR. 7⅞"
#14 SFCH 7⅞"
#15 OSC 13¾"
#16 REED
L T-3 9⅞"
PLUG 3
3833' Logging
Mud Wt 82.5
Vis. 45
Water Loss 7.2
pH 10
Filter Cake 2/32
Sand 3
MECHANICAL SHIFT
E S RUN 2
SCALE CHANGE 200 0
500 0
SCALE CHANGE 0 5
58 SCALE 158 CHANGE 258
127.5 277.5 427.5
G.R.N. RUN 2
#17 REED LT-3 9⅞"
3° 4
9° N42E
4200'
Mud Wt 71
Vis 38
Water Loss 23
pH 12
Filter Cake 3/32
Sand 1
An Vel. 145'/min
#18 REED T 9⅞"
2½°
12° S22E
4500'
YARRAGADEE FORMATION
LOWER CRETACEOUS
UPPER JURASSIC

PLATE 1
SHEET 3

COMPOSITE WELL LOG — SHEET 3

WEST AUSTRALIAN PETROLEUM PTY. LIMITED

ENEABBA No. 1

LOCATION: LAT. 29°34′14″S. LONG. 115°19′56″E. STATE: WESTERN AUSTRALIA 4-MILE SHEET: DONGARA BASIN: PERTH
ELEVATION: GROUND LEVEL 404′ DERRICK FLOOR 416′

NEW BIT / CORE BIT

DRILLING RATE FEET PER HOUR (90 60 30 0)

DEPTH

LITHOLOGY: SANDST. SILTST. SHALE COAL

OIL: TRACE SHOW COAL

GAS LOG: FREE GAS; OFF SCALE (0 2 6 10 20 30 40 50)

DEVIATION

CASING & PLUGS: FISH; TOP

(V) VISUAL MEASURED DIPS

SPONTANEOUS POTENTIAL — MILLIVOLTS — (10)

DETAILED LITHOLOGY

RESISTIVITY — ohms m²/m — 16″ SHORT NORMAL 50 / 500; 64″ LONG NORMAL 50 / 500

RESISTIVITY — ohms m²/m — 18′8″ LATERAL 50 / 500

GAMMA RAY Mg. Ra EQUIV/TON (0 5)

NEUTRON C P S (127.5 277.5 427.5)

STRATIGRAPHIC COLUMN

Mud Wt 73
Vis 54
Water Loss 16.6
pH 12
Filter Cake 2/32
Sand 2.
An. Vel. 145

#19 SEC 5-4 9⅞"

4800′
Mud Wt 73
Vis. 46
Water Loss 18
pH 12
Filter Cake 2/32
Sand 2.5
An. Vel. 135

#20 SEC 5-4 9⅞"

#21 OSC-J

5250′
Mud Wt. 76
Vis 55
Water Loss 10
pH 12
Filter Cake 2/32
Sand 3
An. Vel. 152

#22 SEC M4L 9⅞"

5450′
Mud Wt. 75
Vis. 48
Water Loss 8.2
pH 11.5
Filter Cake 2/32
Sand 4.5
An. Vel. 152

#23 OWV 9⅞"

#24 SEC 5-6 9⅞"

90 60 30 0
Scale Change
60 40 20 0

5700′
Mud Wt. 77
Vis. 60
Water Loss 6.2
pH 11.5
Filter Cake 2/32
Sand 4.5
An. Vel 132

#25 SFCH 7⅞"
#26 SEC 5-6 9⅞"

5900′
Mud Wt. 77
Vis. 53
Water Loss 4.8
pH 12
Filter Cake 2/32

#27 SEC 5-6 9⅞"
#29 SEC M4L 9⅞"

Sand 4
An. Vel 137

#30 OWV 9⅞"

JUNK IN HOLE

RAN MAGNET

#31 SEC 5-6 9⅞"

JUNK IN HOLE

RAN MAGNET

#32 5-6

#33 5-6

#34 5-6

6560′
Mud Wt 70
Vis 50
Water Loss 3.4
pH 12
Filter Cake 1/32
Sand 1.5
An. Vel
Oil ?10-15

#35 5-6

#36 5-6

#37 5-6

6918′
Mud Wt 71
Vis. 45
Water Loss 4.2
Filter Cake 1/32
pH 12
Sand 0.50
An. Vel.
Oil ?10-15

#38 5-6

#39 OWV

Oil emulsion mud used below 5946′

E.S RUN 2

AMPLIFIED 16″ NORMAL 0-10

AMPLIFIED 16″ NORMAL 0-10

10 SCALE CHANGE 15

RESISTIVITY 0 0

RESISTIVITY 50 0 50 500 1000

RESISTIVITY CONDUCTIVITY 50 0 0 500

SCALE CHANGE 5 9·7

I E S RUN 1

INDUCTION RESISTIVITY 0-50

G.R.N RUN 2

27·5 58·5 SCALE 277·5 208·5 CHANGE 427·5 358·5

G R N RUN 3

DEPTH	DEVIATION	DIPS
4500	1°	
4600		12° S79E
4700		
4800	2 1/2°	
4900		14° S80E
5000		7° S86E
5100	3°	
5200		16° N73E
5300		
5400	5°	
5500		11° N74E
5600	4 1/4°	
5700	4°	8°(V)
5800		11° S70E
5900	5°	16° S61E
6000	5°	7° S59E
6100	4 3/4°	17° S84E
6200		7° S47E
6300	4°	
6400	3 1/2°	12° N68E
6500		9° N82E
6600	4°	0° EAST
6700		
6800	5°	
6900	6°	
7000	6°	

CADDA FORMATION
EQUIVALENT(?)
MIDDLE JURASSIC

YARRAGADEE FORMATION
UPPER JURASSIC

COCKLESHELL GULLY FORMATION
CATTAMARRA COAL MEMBER
LOWER JURASSIC

PLATE I
SHEET 4

COMPOSITE WELL LOG — SHEET 4

WEST AUSTRALIAN PETROLEUM PTY. LIMITED

ENEABBA No.1

LOCATION: LAT. 29°34'14"S. LONG. 115°19'56"E. STATE: WESTERN AUSTRALIA 4-MILE SHEET: DONGARA BASIN: PERTH
ELEVATION: GROUND LEVEL 404' DERRICK FLOOR 416'

NEW BIT
CORE BIT
DRILLING RATE FEET PER HOUR
60 40 20 0
DEPTH
LITHOLOGY SANDST. SILTST. SHALE COAL
OIL TRACE SHOW GOOD
GAS LOG FREE GAS OFF SCALE
DEVIATION
CASING & PLUGS
DIPS (V) VISUAL MEASURED
SPONTANEOUS POTENTIAL — MILLIVOLTS — 10
DETAILED LITHOLOGY
RESISTIVITY — ohms m²/m
16" SHORT NORMAL
INDUCTION
500 CONDUCTIVITY 0
1000 mmhos-m²/m 500
GAMMA RAY Mg. Ra. EQUIV./TON
0 9.7
1"/100
NEUTRON C. P. S.
58·5 208·5 358·5
STRATIGRAPHIC COLUMN
#40 S-6
#41 S-6
#42 S-6
#43 SEC S-6 9⅞"
#44 SEC S-6 9⅞"
#45 HTC OWV 9⅞"
#46 OWV 9⅞"
#47 OWV 9⅞"
#48 OWV 9⅞"
#49 OWV 9⅞"
#50 OWV 9⅞"
#51 OWV 9⅞"
#52 W7R 9⅞"
#53 M4L 9⅞"
#54 OWV 9⅞"
#55 OWV 9⅞"
#56 OWV 9⅞"
#57 OWV 9⅞"
#58 OWV 9⅞"
#59 OWV 9⅞"
7100 7200 7300 7400 7500 7600 7700 7800 7900 8000 8100 8200 8300 8400 8500 8600 8700 8800 8900 9000 9100 9200 9300 9400 9500 9600
IES RUN 1
INDUCTION RESISTIVITY 0-50
INDUCTION CODUCTIVITY
GRN RUN 3
14° N63E
CAVINGS
CLEARED SAMPLE LINE
IES RUN 2
SCALE CHANGE
SN
IND
12° S34E
8° N78E
10° S65E
15° S61E
7° N59E
7° S85E
8730' (Logging point)
Mud Wt 79
Vis. 48
pH 10.5
Water Loss 3.4
Filter Cake 1/32"
Sand 3.0
IES RUN 3
8900'
Mud Wt 79
Vis 53
pH 10.6
Water Loss 4.0
Filter Cake 1/32
Sand 4.0
Shear 0/0
Oil 10
NaCl 3000 p.p.m.
J.W. OPERATING AT 1·3 VOLTS ONLY BELOW 9000'
IES RUN 4
SCALE CHANGE 9.7 9.8
GRN RUN 4
9250
Mud Wt 78
Viscosity 50
Water Loss 4
pH 11
Filter Cake 1/32
Oil 9
An. Vel. 120
Sand 5
Change Filament. Operating 2.1V
COCKLESHELL GULLY FORMATION
UPPER TRIASSIC

PLATE 1
SHEET 5

COMPOSITE WELL LOG — SHEET 5

WEST AUSTRALIAN PETROLEUM PTY. LIMITED

ENEABBA No. 1

LOCATION: LAT. 29°34'14"S. LONG. 115°19'56" E. STATE: WESTERN AUSTRALIA 4-MILE SHEET: DONGARA BASIN: PERTH
ELEVATION: GROUND LEVEL 404' DERRICK FLOOR 416'

NEW BIT
CORE BIT
DRILLING RATE FEET PER HOUR
DEPTH
LITHOLOGY SANDST. SILTST. SHALE COAL
OIL TRACE SHOW GOOD
GAS LOG FREE GAS OFF SCALE
DEVIATION
CASING & PLUGS
(V) VISUAL MEASURED DIPS
SPONTANEOUS POTENTIAL — MILLIVOLTS —
DETAILED LITHOLOGY
RESISTIVITY –ohms m²/m 16" SHORT NORMAL INDUCTION
CONDUCTIVITY mmhos m²/m
GAMMA RAY Mg. Ra. EQUIV/TON
NEUTRON C.P.S.
STRATIGRAPHIC COLUMN
9800' Mud Wt. 74 Vis. 65 pH 10.5 W.L. 4.8 Filter C. 2/32 Sand 4 Oil 10
10100 Mud Wt 75 Vis. 58 pH 11 W.L. 5.2 Filter C. 2/32 Sand 4 Oil 8 An. Vel. 120
10500' Mud Wt 75 Vis. 65 pH 11 W.L. 4.8 Filter C. 2/32 Sand 6 Oil 9
10961' Mud Wt 72 Vis 60 W.L. 4 pH 11 Filter Cake 2/32 Sand 2½ Oil 12%
11306' Mud Wt 73 Vis 48 pH 10.5 W.L. 4 F.C. 2/32
11452' Mud Wt 73 Vis. 48 pH 11 W.L. 3.6 F.C 2/32 Sand 1.5 Solids 19 Oil 11
11707 Mud Wt 73 Vis 47 pH 11 W.L. 4.4 Oil 12.5 Solids 15
12122' Mud Wt 75 Vis. 55 pH 11 W.L. 5
Milling on iron
adjusted depth +16'
SCALE CHANGE
MISSING
MIDDAY MAXIMUM
M.D. MAX.
RECIRCULATED GAS
I.E.S RUN 4
IES RUN 5
IES RUN 6
IES RUN 7
IES RUN 8
MECH. SHIFT
INDUCTION RESISTIVITY 0-20
GRN RUN 4
GRN RUN 5
GRN RUN 6
GRN RUN 7
LOW(V)
8°(V)
LESUEUR SANDSTONE
UPPER TRIASSIC
WOODADA FORMATION
LOWER TO MIDDLE TRIASSIC
KOCKATEA SHALE
LOWER TRIASSIC

PLATE 1
SHEET 6

COMPOSITE WELL LOG — SHEET 6

WEST AUSTRALIAN PETROLEUM PTY. LIMITED

ENEABBA No.1

LOCATION: LAT. 29°34'14"S. LONG. 115°19'56"E. STATE: WESTERN AUSTRALIA 4-MILE SHEET: DONGARA BASIN: PERTH
ELEVATION: GROUND LEVEL 404' DERRICK FLOOR 416'

NEW BIT / CORE BIT

DRILLING RATE FEET PER HOUR 15 10 5 0

DEPTH

LITHOLOGY SANDST. SILTST. SHALE COAL

OIL

GAS LOG FREE GAS OFF SCALE 0 2 6 10 20 30 40 50

DEVIATION

CASING & PLUGS

(V) VISUAL MEASURED DIPS

SPONTANEOUS POTENTIAL — MILLIVOLTS — 10

DETAILED LITHOLOGY

RESISTIVITY — ohms m^2/m — 16" SHORT NORMAL 20 100 INDUCTION 100

180 CONDUCTIVITY mmhos m^2/m

GAMMA RAY Mg. Ra. EQUIV/TON 0 10

NEUTRON C.P.S. 58 158 258

STRATIGRAPHIC COLUMN

#101 Sec M 5 9⅞"

#102 Sec M5

#103 Sec M 5 9⅞"
12469
Mud Wt. 74
Vis 60
pH
W.L. 5.6

#104 Sec M 5 9⅞"

#105 HFCH 7⅞"

#106 Sec M 5

#107 Sec M 5
12933'
Mud Wt. 71
Vis. 115
pH 10.5
W.L. 5.8
Oil 2%

#108 Sec M 5

#109 Sec M 5
13218'
M.Wt. 74.5
Vis. 51
pH 10.5
W.L. 5.6

#110 HFCH 7⅞"
13419
M. Wt. 79
Vis. 158
pH 10.6
W.L. 4.8

#109 RR

#111 Sec M 5

#112 Sec M 5 9⅞"
13602
M Wt. 85
Vis. 53
pH 10.5
W.L. 4.8

12200 12300 12400 12500 12600 12700 12800 12900 13000 13100 13200 13300 13400 13500 13600 13700 T.D. 13712

CAVING

NOT COLLECTED

MISSING

MISSING

$3\frac{1}{2}°$ $3\frac{1}{4}°$ $3\frac{1}{8}°$ $3°$ $4°$ $4\frac{1}{2}°$ $4\frac{3}{4}°$ $4\frac{1}{4}°$

PLUG No1 OUTSIDE DRILL PIPE.

PLUG No2 INSIDE DRILL PIPE

5°(V)

I.E.S. RUN 8

MECHANICAL SHIFT

I.E.S. RUN 9

G R N RUN 7

NO ELECTRIC LOGS BELOW 13430' DUE TO FISH IN HOLE AT TIME OF ABANDONMENT

FORMATION TESTS: NIL
GAS SAMPLES COLLECTED AT J.W GAS DETECTOR PUMP EXHAUST: AT 8500'
" 8520'
" 8730'
" 9000'
" 12795'- 12810'

BOTTOM FISH

T.D 13712'

KOCKATEA SHALE
LOWER TRIASSIC

COMPOSITE WELL LOG

WEST AUSTRALIAN PETROLEUM PTY LIMITED

HILL RIVER No.1

STATE WESTERN AUSTRALIA 4 MILE SHEET HILL RIVER BASIN PERTH WELL STATUS. ABANDONED

PERMIT TO EXPLORE 27H

LOCATION LAT 30° 16'00"S LONG 115° 18'00"E
ELEVATION GROUND LEVEL 363'
KELLY BUSHING 368'

DATE SPUDDED; ..... 2 APR. 1962
DATE DRILLING COMPLETED .. 25 APR 1962
TOTAL DEPTH K B ..... 1900' (DRILLER)

HOLE SIZE	IN.	FROM	TO
	8½	0'	67'
	5⅝	67'	1900'

CASING SIZE: 6"
DEPTH: 67'
CMT: 67'
CMT TO: SURFACE

CEMENT PLUGS FROM 230
TO 200
SACKS 65

PERFORATIONS NIL

WELL HEAD FITTINGS: NIL
DRILLED BY: GEOPHYSICAL SERVICE INTERNATIONAL
DRILLING METHOD ROTARY

E. LOG DATA

RUN NUMBER	1	2
DATE IN 1962	7 APRIL	18 APRIL
FOOTAGE LOGGED	526'-67'	1371-67'
TOTAL DEPTH (LOG)	526'	1304'
TOTAL DEPTH (DRILLER)	520'	1490'
CASING SHOE (LOG)	67'	67'
CASING SHOE (DRILLER)	67'	67'
BIT SIZE	8½ 0'-67'	8½ 0'-67'
	5⅝ 67'-526'	5⅝ 67'-1490'
MUD DATA-TYPE	LOWPH, C.B.	LOWPH, C.B.
TREATMENT	GEL	GEL
WATER LOSS 30 MIN	—	—
WEIGHT	76 lbs/c.ft.	78 lbs/c.ft.
VISCOSITY	42@75°F	39@75°F
RESISTIVITY Rm	1·25@75°F	3·78@75°F
ELECTRODE SPACING AM 1	16"	16"
AM 2	64"	64"
RECORDED BY	D.N. SMITH	M. HUGHNSTONE

RADIOMETRIC LOG DATA

TYPE OF LOG	GR	GR
RUN NUMBER	2	3
DATE IN 1962	18 APRIL	24 APRIL
TOTAL DEPTH (DRILLER)	1490'	1900'
TOP OF LOGGED INTERVAL	67'	1100'
BOTTOM LOGGED INTERVAL	1371'	1728'
TYPE OF FLUID IN HOLE	MUD	MUD
SONDE TYPE	RG-7A	RG-7A
TIME CONSTANT (SECONDS)	5	5
LOGGING SPEED FT/HR	600	600

OTHER ELECTRICAL LOGS —

POINT RESISTIVITY

526' TO 67' RUN 1
1371' TO 67 RUN 2
1728' TO 1100' RUN 3

LITHOLOGIC REFERENCE & WELL SYMBOLS

CONGLOMERATE
CLAYSTONE
SANDSTONE, COARSE
SANDSTONE FINE
SILTSTONE
CALCILUTITE
SHALE
PYRITIC
COAL
CARBONACEOUS MATTER
PEBBLY
CALCARENITE
CALCAREOUS
FOSSILIFEROUS
OIL SHOW
GAS SHOW
CORE (Recovery black)
SIDE WALL CORE
CASING SHOE

LITHOLOGY BY. J.W. BURDETT
COMPILED BY: J.W. BURDETT

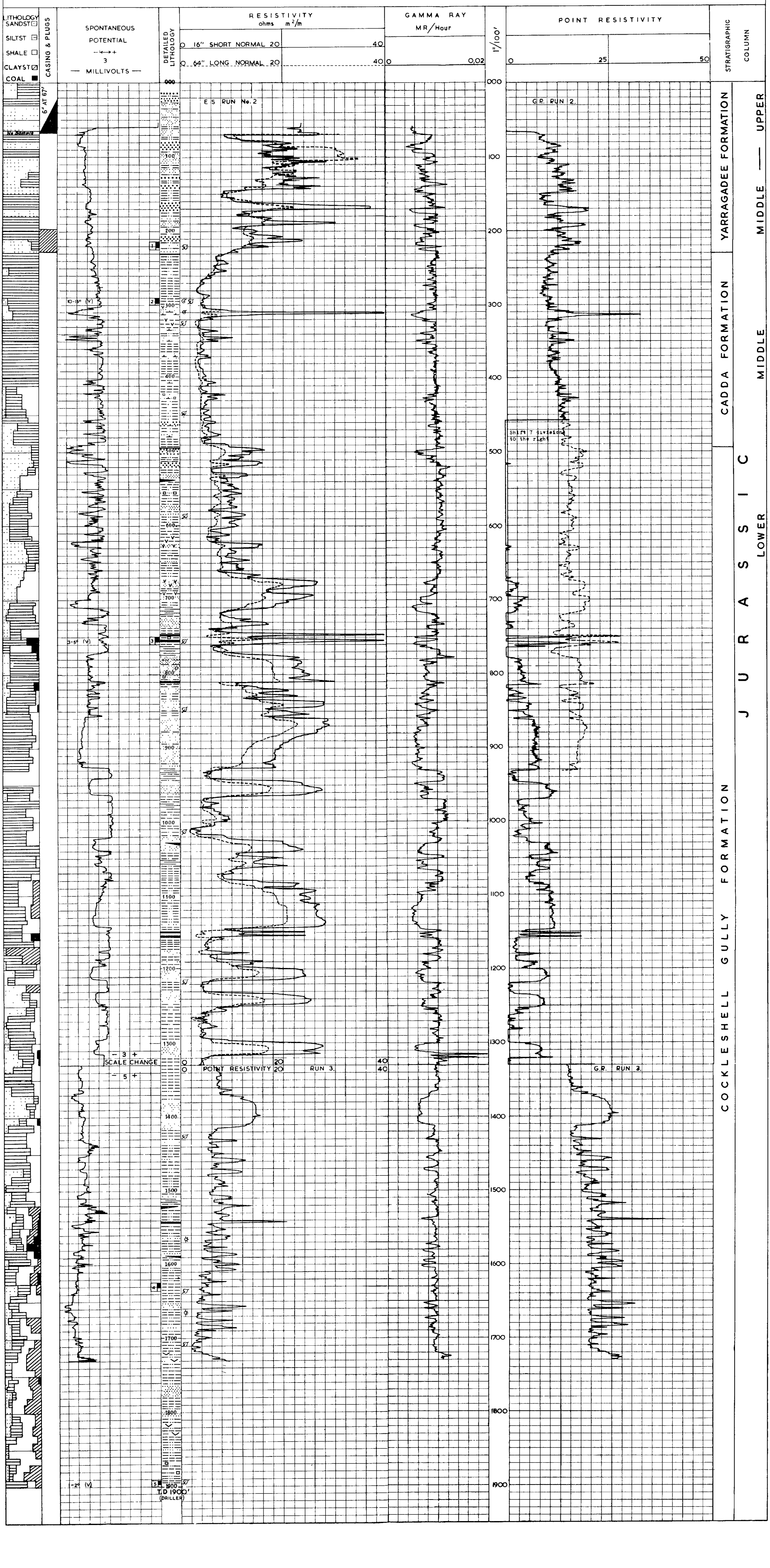


PLATE 3

COMPOSITE WELL LOG

WEST AUSTRALIAN PETROLEUM PTY LIMITED

HILL RIVER No.2

STATE: WESTERN AUSTRALIA 4 MILE SHEET: HILL RIVER BASIN: PERTH WELL STATUS: ABANDONED

PERMIT TO EXPLORE 27H

LOCATION LAT 30°11' 00"S. LONG 115°14' 00"E
ELEVATION GROUND LEVEL: 620'
KELLY BUSHING 625'

DATE SPUDDED. 6 MAY 1962
DATE DRILLING COMPLETED 24 MAY 1962
TOTAL DEPTH K B: 1620'

HOLE SIZE:	IN.	FROM	TO
	8 3/8	0	68
	5 5/8	68	1620

CASING. SIZE 6"
DEPTH. 68'
CMT 68'
CMT. TO SURFACE

CEMENT PLUGS FROM 65'
TO 10'
SACKS 6

PERFORATIONS: NIL

WELL HEAD FITTINGS. NIL
DRILLED BY: GEOPHYSICAL SERVICE INTERNATIONAL
DRILLING METHOD: ROTARY

E. LOG DATA

RUN NUMBER	1	2
DATE IN 1962	22 MAY	25 MAY
FOOTAGE LOGGED	1450	165
TOTAL DEPTH (LOG)	1518	1620
TOTAL DEPTH (DRILLER)	1520	1620
CASING SHOE (LOG)	68	
CASING SHOE (DRILLER)	68	68
BIT SIZE	8 3/8 0-68	8 3/8 0-68
	5 5/8 68-1520	5 5/8 68-1620
MUD DATA – TYPE	LOWPH, C.B.	LOWPH, C.B.
TREATMENT	GEL	GEL
WATER LOSS 30 MIN	—	—
WEIGHT	80	80
VISCOSITY	32 @ 60°F	39 @ 65°F
RESISTIVITY Rm	3.95@60°F	3.60@65°F
ELECTRODE SPACING AM 1	16"	16"
AM 2	64"	64"
RECORDED BY:	M.H.JOHNSTONE	J.W.BURDETT

RADIOMETRIC LOG DATA

TYPE OF LOG	GR	GR
RUN NUMBER	1	2
DATE IN 1962	22 MAY	25 MAY
TOTAL DEPTH (DRILLER)	1520	1620
TOP OF LOGGED INTERVAL	68	1460
BOTTOM LOGGED INTERVAL	1518	1620
TYPE OF FLUID IN HOLE	MUD	MUD
SONDE TYPE	RG-7A	RG-7A
TIME CONSTANT (SECONDS)	5	5
LOGGING SPEED FT/HR	900	900

OTHER ELECTRICAL LOGS —

POINT RESISTIVITY
1518' TO 68' RUN 1
1620' TO 1460' RUN 2

LITHOLOGIC REFERENCE & WELL SYMBOLS

CONGLOMERATE
CLAYSTONE
SANDSTONE, COARSE
SANDSTONE, FINE
SILTSTONE
CALCILUTITE
SHALE
PYRITIC
COAL
CARBONACEOUS MATTER
PEBBLY
CALCARENITE
CALCAREOUS
FOSSILIFEROUS
OIL SHOW
GAS SHOW
CORE (Recovery block)
SIDE WALL CORE
CASING SHOE

LITHOLOGY BY: J.W. BURDETT
COMPILED BY: J.W. BURDETT

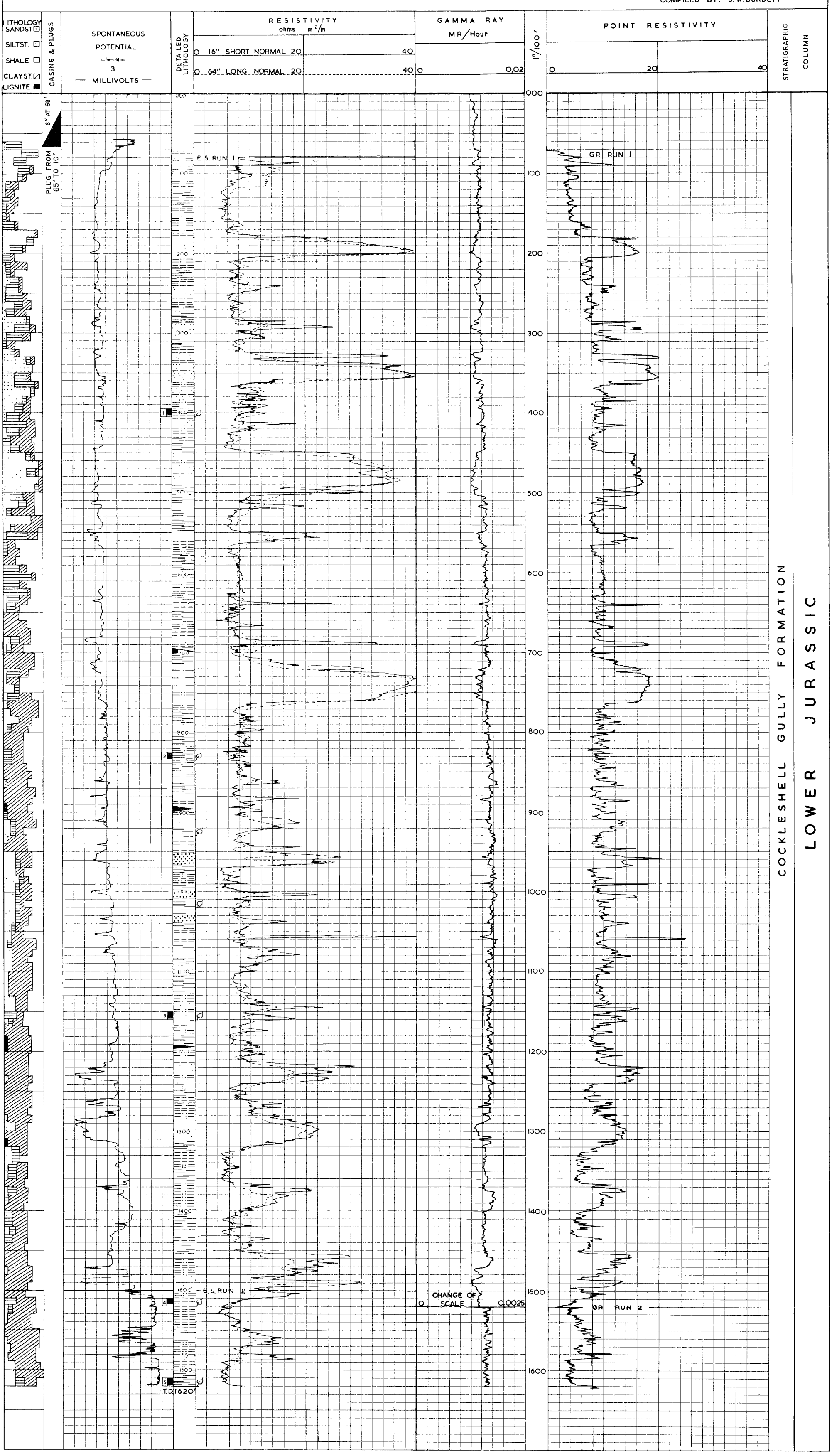


PLATE 4

COMPOSITE WELL LOG

WEST AUSTRALIAN PETROLEUM PTY LIMITED

HILL RIVER No. 2A.

STATE : WESTERN AUSTRALIA

BASIN : PERTH

4 MILE SHEET : HILL RIVER

WELL STATUS : ABANDONED

PERMIT TO EXPLORE 27H.

LOCATION: LAT. 30°11'12" S. LONG. 115°14'00".

ELEVATION: GROUND LEVEL 599'
KELLY BUSHING 603'

DATE SPUDDED : 24 MAY 1962.
DATE DRILLING COMPLETED : 25 MAY 1962.
TOTAL DEPTH K.B. : 380' (DRILLER)

HOLE SIZE :

IN.	FROM	TO
4¼	0'	380'

DRILLED BY : GEOPHYSICAL SERVICE INTERNATIONAL
DRILLING METHOD : ROTARY.
LITHOLOGY BY : J.W. BURDETT.
COMPILED BY : J.W. BURDETT.

POINT RESISTIVITY LOG

RUN NUMBER	1
DATE (IN 1962)	26th MAY
FOOTAGE LOGGED	294'–12'
TOTAL DEPTH (DRILLER)	380'
RECORDED BY	J.W.BURDETT.

LITHOLOGIC REFERENCE

SILTSTONE
SHALE
CLAYSTONE
COAL
FOSSILIFEROUS (SPORES)

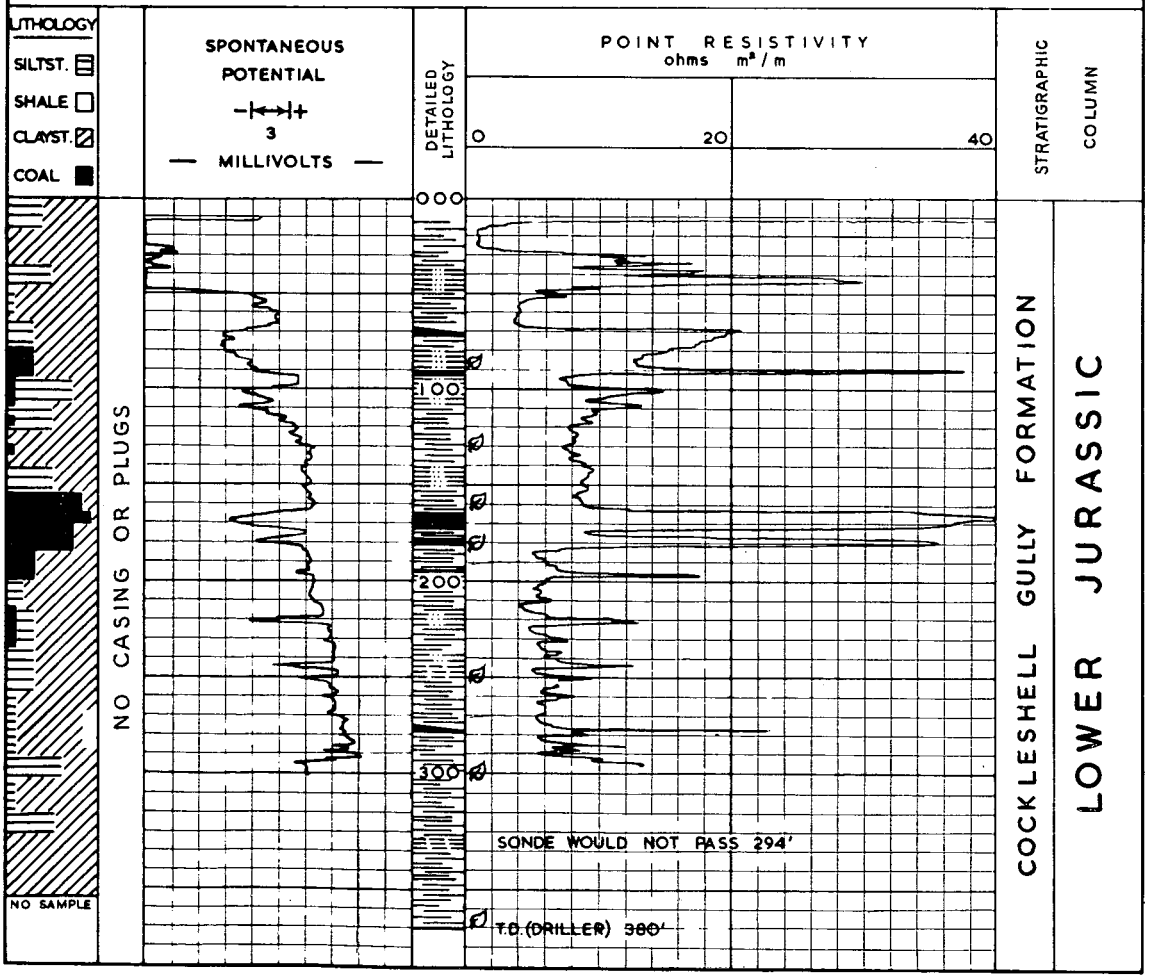


PLATE 5

COMPOSITE WELL LOG

WEST AUSTRALIAN PETROLEUM PTY LIMITED

HILL RIVER No.3

STATE: WESTERN AUSTRALIA 4 MILE SHEET: HILL RIVER BASIN: PERTH WELL STATUS: ABANDONED

PERMIT TO EXPLORE 27H

LOCATION LAT 30°00'30"S. LONG 115°11' 15"E

ELEVATION GROUND LEVEL: 408'
KELLY BUSHING: 413'

DATE SPUDDED: 12 AUGUST 1962
DATE DRILLING COMPLETED 27 AUGUST 1962
TOTAL DEPTH K B: 865'

HOLE SIZE:	IN.	FROM	TO
	8½	0'	45'
	5⅝	45'	865'

CASING SIZE 6"
DEPTH 45'
CMT 45'
CMT TO SURFACE

CEMENT PLUGS FROM 140'
TO 100'
SACKS 8

PERFORATIONS: NIL

WELL HEAD FITTINGS. MARKER PLATE
DRILLED BY. GEOPHYSICAL SERVICE INTERNATIONAL
DRILLING METHOD: ROTARY

E. LOG DATA

RUN NUMBER	1
DATE IN 1962	27 AUGUST
FOOTAGE LOGGED	575
TOTAL DEPTH (LOG)	—
TOTAL DEPTH (DRILLER)	865
CASING SHOE (LOG)	—
CASING SHOE (DRILLER)	45
BIT SIZE	8½ 0–45
	5⅝ 45–865
MUD DATA–TYPE	LOW PH. C.B.
TREATMENT	GEL
WATER LOSS 30 MIN	—
WEIGHT	—
VISCOSITY	—
RESISTIVITY Rm	3.60 @ 70°F
ELECTRODE SPACING AM 1	16"
AM 2	64"
RECORDED BY	J W. BURDETT

RADIOMETRIC LOG DATA

TYPE OF LOG	GR
RUN NUMBER	1
DATE IN 1962	26 AUGUST
TOTAL DEPTH (DRILLER)	865
TOP OF LOGGED INTERVAL	0
BOTTOM LOGGED INTERVAL	750
TYPE OF FLUID IN HOLE	MUD
SONDE TYPE	RG-7A
TIME CONSTANT (SECONDS)	5
LOGGING SPEED FT/HR	600

OTHER ELECTRICAL LOGS —

POINT RESISTIVITY 740' TO 50'

LITHOLOGIC REFERENCE & WELL SYMBOLS

- CONGLOMERATE
- CLAYSTONE
- SANDSTONE, COARSE
- SANDSTONE, FINE
- SILTSTONE
- CALCILUTITE
- SHALE
- PYRITIC
- COAL
- CARBONACEOUS MATTER
- PEBBLY
- CALCARENITE
- CALCAREOUS
- FOSSILIFEROUS
- OIL SHOW
- GAS SHOW
- CORE (Recovery black)
- SIDE WALL CORE
- CASING SHOE

LITHOLOGY BY: J.W. BURDETT
COMPILED BY: J W BURDETT

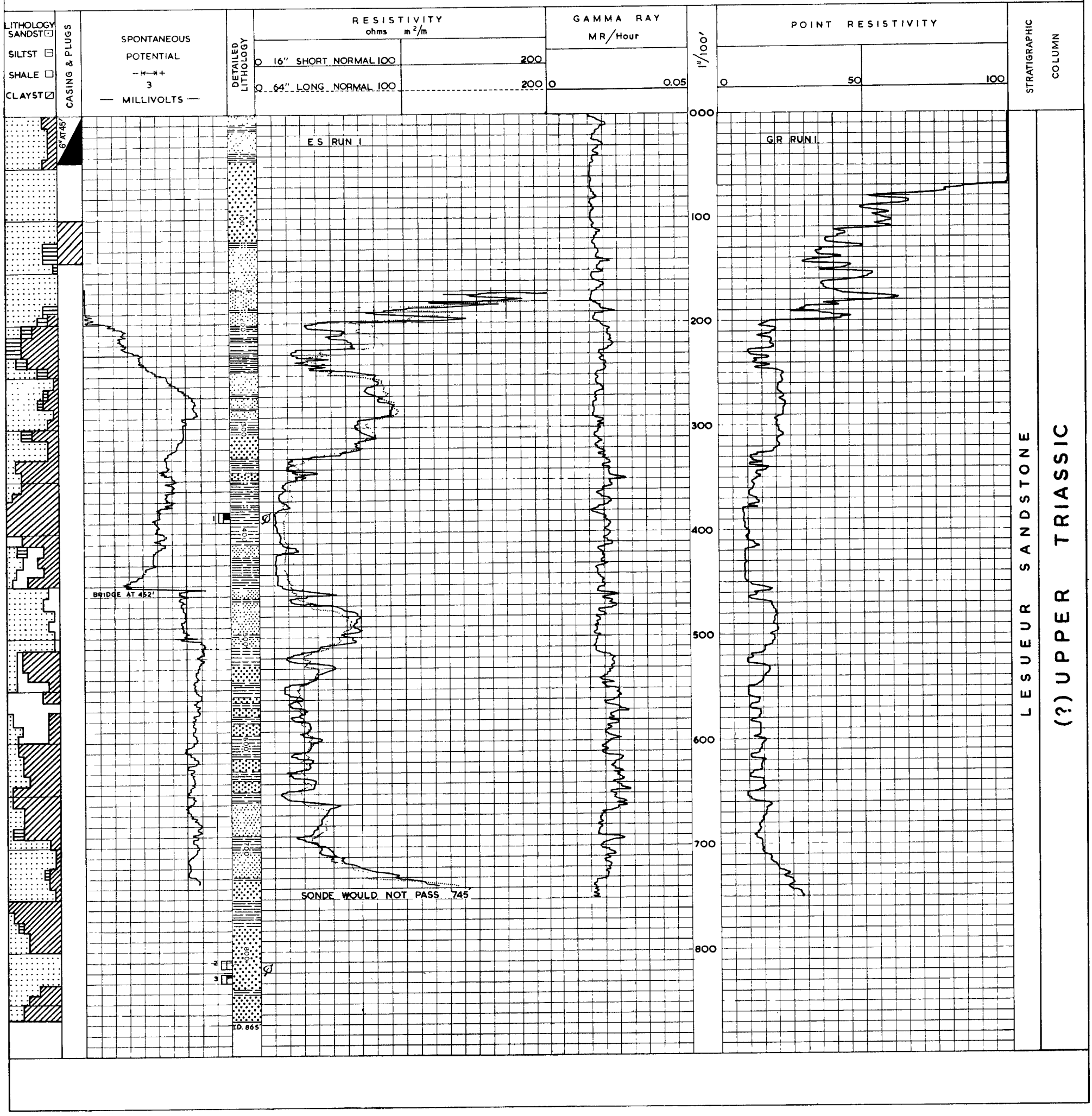


PLATE 6

COMPOSITE WELL LOG

WEST AUSTRALIAN PETROLEUM PTY LIMITED

HILL RIVER No.4

STATE: WESTERN AUSTRALIA 4 MILE SHEET: HILL RIVER BASIN: PERTH WELL STATUS: ABANDONED

PERMIT TO EXPLORE 27H

LOCATION LAT 30°23'24"S LONG 115°13'49" E
ELEVATION GROUND LEVEL 305'
KELLY BUSHING 309'

DATE SPUDDED 19 JUNE 1962
DATE DRILLING COMPLETED 30 JUNE 1962
TOTAL DEPTH K.B. 1010'

HOLE SIZE	IN.	FROM	TO
	8½	0'	67'
	5⅝	67'	1010'

CASING		
	SIZE	6"
	DEPTH.	66'
	CMT.	66'
	CMT. TO.	SURFACE

CEMENT PLUGS: NIL

PERFORATIONS: NIL

WELL HEAD FITTINGS: NIL
DRILLED BY: GEOPHYSICAL SERVICE INTERNATIONAL
DRILLING METHOD: ROTARY

POINT RESISTIVITY LOG DATA

RUN NUMBER	1	2
DATE IN 1962	28 JUNE	10 JULY
FOOTAGE LOGGED	735'-104'	995'-65'
TOTAL DEPTH (LOG)	735'	–
TOTAL DEPTH (DRILLER)	735'	1010
CASING SHOE (LOG)	–	–
CASING SHOE (DRILLER)	66	66
BIT SIZE	5⅝ 0-725	5⅝ 0-990
	4½ 725-736	4½ 990-1010
MUD DATA – TYPE	LOW pH, C.B	LOW pH, C.B
TREATMENT	GEL	GEL
WATER LOSS 30 MIN	–	–
WEIGHT	77	–
VISCOSITY	53@60°F	–
RESISTIVITY Rm	–	10·5@60°F
RECORDED BY:	J.W. BURDETT	J.W. BURDETT

RADIOMETRIC LOG DATA

TYPE OF LOG	GR
RUN NUMBER	1
DATE IN 1962	10 JULY
TOTAL DEPTH (DRILLER)	1010
TOP OF LOGGED INTERVAL	60
BOTTOM LOGGED INTERVAL	990
TYPE OF FLUID IN HOLE	MUD
SONDE TYPE	RG-7A
TIME CONSTANT (SECONDS)	5
LOGGING SPEED FT/HR	840

LITHOLOGIC REFERENCE & WELL SYMBOLS

CONGLOMERATE
CLAYSTONE
SANDSTONE, COARSE
SANDSTONE, FINE
SILTSTONE
CALCILUTITE
SHALE
PYRITIC
COAL
CARBONACEOUS MATTER
PEBBLY
CALCARENITE
CALCAREOUS
FOSSILIFEROUS
OIL SHOW
GAS SHOW
CORE (Recovery black)
SIDE WALL CORE
CASING SHOE

LITHOLOGY BY: J.W. BURDETT
COMPILED BY: J.W. BURDETT

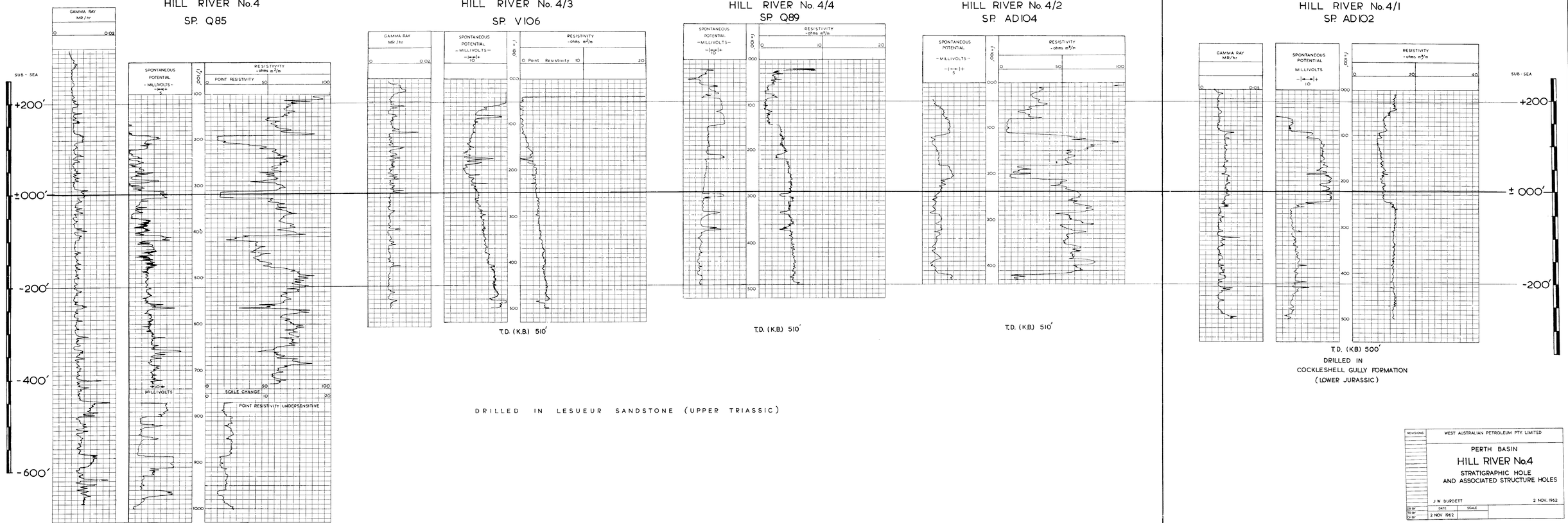
HILL RIVER No.4
SP. Q85

HILL RIVER No. 4/3
SP. V106

HILL RIVER No. 4/4
SP. Q89

HILL RIVER No. 4/2
SP. AD104

HILL RIVER No. 4/1
SP. AD102



DRILLED IN LESUEUR SANDSTONE (UPPER TRIASSIC)

REVISIONS	WEST AUSTRALIAN PETROLEUM PTY. LIMITED
	PERTH BASIN
	HILL RIVER No.4
	STRATIGRAPHIC HOLE AND ASSOCIATED STRUCTURE HOLES
	J.W. BURDETT — 2 NOV. 1962
DD BY / TR BY / CH BY	DATE: 2 NOV 1962 — SCALE:

COMPOSITE WELL LOG

WEST AUSTRALIAN PETROLEUM PTY LIMITED

WOOLMULLA No.1

PERMIT TO EXPLORE 27 H

LICENCE TO PROSPECT 100H

LOCATION LAT: 30° 01' 24"S. LONG: 115° 11' 28"E.
ELEVATION GROUND LEVEL 382'
DERRICK FLOOR 394'

DATE SPUDDED: 3 NOV. 1962
DATE DRILLING STOPPED: 15 MARCH 1963
TOTAL DEPTH D.F. 9224'

HOLE SIZE

IN.	FROM	TO
20'	0'	496'
13¾"	496'	4184'
9⅞"	4184'	9224'

CASING:

SIZE	WT	G R.	DEPTH	CMT.	CMT. TO
16"	65lb/ft	H-40	492'	500sx	SURFACE
10¾"	40·5 lb/ft	J-55	4182'	550sx	2800'

CEMENT PLUGS:

FROM	TO	TOP	SACKS
SURFACE	—	SURFACE	5
4140'	4300'	4140'	200
5180'	5500'	5180'	150

PERFORATIONS: 15 HOLES 4522' TO 4529'
15 HOLES 4618' TO 4625'
BOTH SETS OF HOLES IN OPEN HOLE FOR D.S.T. No4.

WELL HEAD FITTINGS. STEEL PLATE WELDED OVER CASING
DRILLED BY: OIL DRILLING AND EXPLORATION (WA) PTY LTD
DRILLING METHOD: ROTARY

STATE: WESTERN AUSTRALIA 4 MILE SHEET. HILL RIVER BASIN: PERTH WELL STATUS: ABANDONED

INDUCTION ELECTRIC LOG DATA

RUN NUMBER	1	2	3	4	5	6	7	8	9	STANDARD ELEC. LOG
DATE IN 1962 /63	25 NOV	27 NOV	8 DEC	11 DEC	17 DEC	12 JAN	6 FEB	20 FEB	9 MAR	7 NOV
FIRST READING	2200	2591	3376	3834	4457	6555	8062	8793	9230	527
LAST READING	496	2100	2490	3250	3700	4186	6400	7880	8700	70
INTERVAL MEASURED	1704	491	886	584	757	2369	1662	913	530	457
CASING SCHLUMBERGER	496	—	—	—	496	4186	4186	4186	4186	—
CASING DRILLER	492	492	492	492	492	4182	4182	4182	4182	—
DEPTH REACHED	2201	2592	3377	3835	4458	6556	8063	8794	9231	528
BOTTOM DRILLER	2199	2590	3380	3861	4463	6552	8185	8789	9224	548
MUD NATURE	BENTONITE		SPERSENE XP 20							BENTONITE
DENSITY lbs/CuFt. VISCOSITY	72 42	72 42	71 40	70·5 38	68·5 38	83·5 40	80·5 40	79 43	71 41	70 60
PH WATER LOSS cc/30Min	10·5 7·4	10·5 7·4	11 5·4	10 5·4	10·5 9	10+ 6	10 7·6	10 6·8	10 7·2	— 7·2
MUD RESISTIVITY	1·5 @ 95°F	1·6 @ 92°F	1·1 @ 82°F	1·3 @ 72°F	1·4 @ 73°F	1·02@75°F	1·04@74°F	·7 @ 88°F	·78@78°F	1·7 @ 82°F
MUD RESISTIVITY BHT.	1·3 @ 110°F	1·4 @ 110°F	·85 @ 110°F	·85 @ 110°F	·83 @ 126°F	45 @ 172°F	·36@206°F	·24@232°F	·25@235°F	—
Rmf Measured	1·3 @ 95°F	1·4 @ 92°F	·92 @ 88°F	·92 @ 88°F	1·5 @ 67°F	1·1 @ 75°F	·63 @ 88°F	·57 @ 88°F	·64 @ 78°F	—
Rmc Measured	1·6 @ 95°F	1·7 @ 92°F	1·4 @ 88°F	1·2 @ 88°F	1·62 @ 67°F	1·66 @ 75°F	—	1·4 @ 88°F	1·04@78°F	—
BIT SIZE	13¾"	13¾" TO 2193 9⅞" TO T.D.	13¾" TO 3293 9⅞" TO T.D.	13¾" TO 3460 9⅞" TO T.D.	13¾" TO 3460 9⅞" TO T.D.	9⅞"	9⅞"	9⅞"	9⅞"	20" TO 480 12¼" TO T.D.
MAXIMUM RECORDED TEMP.	<110°F	<110°F	<110°F	110°F	126°F	172°F	206°F	232°F	235°F	
ELECTRODE SPACING										
AM	16"	16"	16"	16"	16"	16"	16"	16"	16"	16" & 64"
IND	40"	40"	40"	40"	40"	40"	40"	40"	40"	——
S.O.	1½"	1½"	1½"	1½"	1½"	1½"	1½"	1½"	1½"	——
RECORDED BY	S O C K									
WITNESSED BY	P U D O V S K I S						PEARSON	P U D O V S K I S		
REMARKS	6 FF 40 TOOL									A O = 18' 8"

RADIOMETRIC LOG DATA

GAMMA RAY: RUN IN COMBINATION WITH SONIC CALIPER

TYPE OF LOG	G. R.	G. R.	G. R.	G. R.	GR-S-C	GR-S-C	GR-S-C	GR-S-C
RUN NUMBER	1	2	3	4	1	2	3	4
DATE IN 1962 /63	25 NOV	27 NOV	8 DEC	18 DEC	13 JAN	6 FEB	20 FEB	9 MAR
FIRST READING	2196	2588	3374	4454	6552	8059	8789	9225
LAST READING	15	2100	2480	3240	4350	6450	7950	8700
INTERVAL MEASURED	2181	488	894	1214	2202	1609	839	525
DEPTH REACHED	2201	2592	3379	4459	6557	8065	8794	9230
TYPE OF FLUID IN HOLE	FRESH WATER GEL		SPERSENE XP 20					
FLUID LEVEL	FULL							
MAXIMUM RECORDED TEMP.	< 110°F	< 110°F	< 110°F	126°F	172°F	206°F	232°F	235°F
SONDE TYPE	3⅝" 6NT — H							
TIME CONSTANT-SECONDS	2	2	2	2	2	2	2	2
LOGGING SPEED FT/HR.	2100	2100	1800	1800	1500	1800	1500	1800
SENSITIVITY REFERENCE	200	200	200	200	200	200	200	200

OTHER ELECTRICAL LOGS

SONIC	4450'– 496'	1 RUN
SONIC-GAMMA RAY-CALIPER	9225'– 4350'	4 RUNS
LATEROLOG	4454'– 496'	1 RUN
LATEROLOG	9226'–7500'	1 RUN
MICROLOG	4750'–3200'	3 RUNS
MICROLOG	9200'–8100'	2 RUNS
SECTION GAUGE	2725'– 495'	1 RUN
SECTION GAUGE	8700'– 4186'	2 RUNS
CONTINUOUS DIPMETER	4454'– 496'	1 RUN
CEMENT BOND LOG	4186'–2450'	1 RUN

LITHOLOGIC REFERENCE & WELL SYMBOLS

CONGLOMERATE
PEBBLY SANDSTONE
SANDSTONE,
SILTSTONE
CLAYSTONE
SHALE
LIMESTONE
COAL
CARBONACEOUS MATTER
PYRITIC
QUARTZ VEINS
GRANITIC GNEISS
FOSSILIFEROUS
OIL SHOW
GAS SHOW
CORE (Recovery black) SPECIFIC GRAVITY
SIDE WALL CORE
CASING SHOE

LITHOLOGY BY: V. PUDOVSKIS, G.R.PEARSON, W.E.GARDNER
COMPILED BY: V. PUDOVSKIS
LOGGED BY: SCHLUMBERGER (ELECTRIC)
EXPLORATION LOGGING (MUD)

PLATE 8
SHEET 2

PERMIT TO EXPLORE 27 H

LICENCE TO PROSPECT 100H

COMPOSITE WELL LOG

WEST AUSTRALIAN PETROLEUM PTY. LTD.

WOOLMULLA No.1

LOCATION : LAT. 30° 01' 24" S. LONG. 115° 11' 28" E.
ELEVATION: GROUND LEVEL 382' DERRICK FLOOR 394'

STATE: WESTERN AUSTRALIA

4-MILE SHEET: HILL RIVER

BASIN: PERTH

NEW BIT
CORE BIT
EXPLORATION LOGGING
DRILLING RATE FT/HR
DRILLING & BIT DATA
GRAPHIC LITHOLOGY
LEGEND
CLAY, SHALE
SILTSTONE
SANDY SILT
CONGLOM.
SANDSTONE
VEIN QUARTZ
COAL
DEPTH
CORE TEST
MUD ANALYSIS
DITCH MUD GAS
TOTAL DITCH GAS
METHANE
BLENDOR MUD GAS
OIL IN MUD TRX FAIR XX GD.XXX
CHROMATOGRAPHIC GAS ANALYSIS
METHANE —1—
ETHANE —2—
PROPANE —3—
BUTANES —4—
PENTANES —5—
PPM
CUTTING ANALYSIS
OIL
SOLVENT CUT
GAS
TOTAL GAS
METHANE
P.V (ETHANE+)
DEVIATION
CASING & PLUGS
DIPS
(V) VISUAL MEASURED
SPONTANEOUS POTENTIAL
— MILLIVOLTS —
10
PERM.(md)
POROSITY
S.G
DETAILED LITHOLOGY
RESISTIVITY — ohms m²/m
16" SHORT NORMAL 10
500
INDUCTION 50
500
CONDUCTIVITY millimhos m²/m
180 0
GAMMA RAY A.P.I UNITS
0 200
1"/100
SONIC LOG
INTERVAL TRANSIT TIME MICROSECOND PER FOOT
140 90 40
FORMATION TESTS
STRATIGRAPHIC COLUMN
SCALE CHANGE
BIT 10 USED REAMING 1926'-2193'
NO SAMPLE
HIGH GAS READING PROBABLY DUE TO FERMENTING LCM.
TG=30 UNITS
BIT # 26 USED REAMING 2985'-3460'
56 ft/hr
10¾" CASING SET AT 4182'
PLUGS # 2
TOTAL
IES # 2
IES # 3
IES # 4
IES # 5
IES # 6
G.R. RUN 2
G.R. RUN 3
G.R. RUN 4
SL-G.R. RUN 1
D.S.T. # 1. 3797'–3861'
CUSHION: NIL
TEST DURATION: 75 Min.
RECOVERY: 1 bbl. DRILLING MUD
5 bbl FRESH WATER
(493 ppm CHLORIDE IONS
2,740 ppm TOTAL SALTS.
Rw 2·7 ohms at 80° F.)
D.S.T. # 4. 4182'–5180'
TESTED WITH HOOKWALL PACKER SET IN 10¾" CASING AT 4010'
CUSHION: NIL
TEST DURATION: 180 Min.
RECOVERY: 540' (7·5 bbl) OF DRILLING WATER.
NO FORMATION WATER.
INITIAL CLOSED IN PRESS. 1500 p.s.i.
FLOWING PRESSURE 250 p.s.i.
FINAL CLOSED IN PRESS. 1000 p.s.i.
LESUEUR SANDSTONE
UPPER TRIASSIC
WOODADA FORMATION
LOWER TO MIDDLE TRIASSIC
KOCKATEA SHALE
LOWER TRIASSIC

PLATE 8
SHEET 3

PERMIT TO EXPLORE 27 H

LICENCE TO PROSPECT 100H.

COMPOSITE WELL LOG

WEST AUSTRALIAN PETROLEUM PTY. LTD.

WOOLMULLA No.1

LOCATION : LAT. 30° 01' 24" S. LONG. 115° 11' 28" E.

ELEVATION: GROUND LEVEL 382' DERRICK FLOOR 394'

STATE: WESTERN AUSTRALIA

4-MILE SHEET: HILL RIVER

BASIN: PERTH

NEW BIT
CORE BIT
EXPLORATION LOGGING
DRILLING RATE FT/HR
DRILLING & BIT DATA
GRAPHIC LITHOLOGY
LEGEND
CLAY, SHALE
SILTSTONE
SANDY SILT.
CONGLOM
SANDSTONE
VEIN QUARTZ
COAL
DEPTH
CORE
MUD ANALYSIS
DITCH MUD GAS
TOTAL DITCH GAS
METHANE
BLENDOR MUD GAS
OIL IN MUD TRX FAIR XX GD XXX
CHROMATOGRAPHIC GAS ANALYSIS
METHANE — 1 —
ETHANE — 2 —
PROPANE — 3 —
BUTANES — 4 —
PENTANES — 5 —
PPM
CUTTING ANALYSIS
OIL
SOLVENT CUT
GAS
TOTAL GAS
METHANE
PV (ETHANE+)
DEVIATION
CASING & PLUGS
DIPS (V) VISUAL MEASURED
SPONTANEOUS POTENTIAL — MILLIVOLTS
DETAILED LITHOLOGY
RESISTIVITY — ohms m^2/m
AMP. 16" SHORT NORMAL 10
INDUCTION
CONDUCTIVITY millimhos m^2/m
GAMMA RAY A.P.I. UNITS
1"/100
SONIC LOG
INTERVAL TRANSIT TIME MICROSECOND PER FOOT
Spacing 3 ft. 2 Receivers
FORMATION TESTS
STRATIGRAPHIC COLUMN

IES RUN 6

SL G.R. RUN 1

SL-G.R RUN 2

IES RUN 7

#34 HTC OSC 9 7/8"

ALL DRILLING BITS TO T.D. 9 7/8" DIAMETER

#35 HFCH

#36 SEC S-6

#37 SEC S-4

#38 SEC S-4

#39 HTC-OSC

#40 SEC-S-4

#41 HTC-OSC

#42 HFCH

#43 SEC S-4

#44 SEC S-4

#45 SEC S-4

#46 SEC S-4

#47 HTC OSC

#48 HTC OSC

#49 HTC OWV

#50 HFCH

#51 HTC OWV

#52 HTC OWV

#53 SEC M-5

#54 SEC M-5

#55 HTC OWV

TG=10U
TG=7U
CG=5U
CG=9U
CG=26U
CG=5U
TG=30U
CG=8U
CG=11U
CG=14U
CG=10U
TG=64U
CG=9U
CG=8U
CG=48U
CG=15U
TG=10U
CG=12U
CG=11U
CG=13U
CG=12U
CG=9U
TG=150U
TG=46U
TG=51U
TG=25U
TG=38U

PLUG #1

BREAK DUE TO +10 DEPTH CORRECTION — NO SAMPLE

D.S.T. #4

KOCKATEA SHALE

LOWER TRIASSIC

PLATE 8
SHEET 4

PERMIT TO EXPLORE 27 H

LICENCE TO PROSPECT 100H.

COMPOSITE WELL LOG

WEST AUSTRALIAN PETROLEUM PTY. LTD.

WOOLMULLA No.1

LOCATION : LAT. 30° 01' 24" S. LONG. 115° 11' 28" E.

ELEVATION: GROUND LEVEL 382' DERRICK FLOOR 394'

STATE: WESTERN AUSTRALIA

4-MILE SHEET: HILL RIVER

BASIN: PERTH

NEW BIT / CORE BIT

EXPLORATION LOGGING — DRILLING RATE ☒ FT/HR — DRILLING & BIT DATA

GRAPHIC LITHOLOGY — LEGEND: CLAY/SHALE, SILTSTONE, SANDY SILT., CONGLOM., SANDSTONE, VEIN QUARTZ, COAL

MUD ANALYSIS — DITCH MUD GAS: TOTAL DITCH GAS, METHANE, BLENDOR MUD GAS, OIL IN MUD TR/FAIR/XX/GD/XXX — CHROMATOGRAPHIC GAS ANALYSIS: METHANE—1, ETHANE—2, PROPANE—3, BUTANES—4, PENTANES—5 — PPM

CUTTING ANALYSIS — OIL: SHOW, FAIR, GOOD, CUT, FLUOR — SOLVENT CUT — GAS: TOTAL GAS, METHANE, P.V. (ETHANE-)

DEPTH — CORE TEST

DEVIATION

CASING & PLUGS

DIPS (V) VISUAL MEASURED

SPONTANEOUS POTENTIAL — MILLIVOLTS — PERM. (m.d.) — POROSITY — S.G.

DETAILED LITHOLOGY

RESISTIVITY — ohms m^2/m — AMP. 16" SHORT NORMAL — INDUCTION

CONDUCTIVITY millimhos m^2/m

GAMMA RAY A.P.I. UNITS

1"/100

SONIC LOG — INTERVAL TRANSIT TIME MICROSECOND PER FOOT Spacing 3 ft. 2 Receivers

FORMATION TESTS

STRATIGRAPHIC COLUMN

BIT	DRILLING & BIT DATA
* 56 HTC OWV	ALL DRILLING BITS 9⅞" DIAMETER
* 57 HTC OSC	
* 58 HTC OSC	
* 59 HTC OSC	
* 60 SEC S-6	
#61-HFCH	
* 62 SEC M4L	
* 63 SEC M4L	
* 64 HTC OWV	
* 65 SEC M4L	
* 66 SEC M4L	
* 67 SEC M4L	
* 68 SEC M4L	
* 69 SEC M4L	GAP DUE TO A 10' DEPTH CORRECTION — NO SAMPLE
* 70 SEC M5	
#71-HFCH	
* 72 SEC M5	
* 73 SEC M4L	
* 74 HTC W7R	
* 75 HTC W7R	
* 76 SEC M5	
* 77 SEC M5	
* 78 SEC M5	
* 79 SEC M5	
* 80 SEC M5	
* 81 SEC M4L	
* 82 SEC M4L	
* 83 SEC M4L	
* 84 HTC W7R	
* 85 DIAMOND C.H.	
* 86 HTC W7R	
* 87 HTC W7R	
* 88 HTC W7R	BITS #89 & #90 BOTH W7R USED FOR REAMING
#91	#92 DIAMOND C.H.
* 93 HTC R1	
* 94 HTC R1	
RRB * 93 HTC R1	
* 95 HTC W7R	
RRB * 93 HTC R1	
#96 W7R	
#97 W7R	
#98 W7R	
* 100 HTC R1	#99 HFCH USED REAMING
* 102 HTC R1	#101 W7R USED REAMING
#103 W7R	
* 105 HTC R1	#104 W7R USED REAMING
#106 HFCH	
#107 HTC W7R	

TG=15 U; TG=45 U; TG=40 U; TG=55 U; TG=40 U; TG=42 U; TG=43 U; TG=32 U; TG=35 U; TG=30 U; TG=95 U; TG=61 U; TG=118 U; TG=45 U

IES RUN 8 — SCALE CHANGE AMP. S N — SCALE CHANGE — SL-G.R. RUN 3

IES RUN 9 — S.P. VERY DISTURBED BY GROUND CURRENTS — ? FAULT — SONIC + GAMMA RUN 4.

T.D. 9224'

D.S.T. * 2-2D. 8631' — 8789'

TEST REPEATED 5 TIMES, BUT PACKER DID NOT HOLD.
NO PRESSURE DATA.

D.S.T. * 3. 9030' — 9224'

CUSHION: 3000' WATER
TEST DURATION: 60 Min.
RECOVERY: CUSHION WATER: 3000'
MUD, STRONGLY GAS CUT: 900'
SALT WATER, GAS CUT: 900'
COLLECTED 4 Half Gal. Gas
CHROMATOGRAPH AND MASS SPECTROMETER GIVE FOLLOWING COMPOSITION OF GAS

METHANE	300,000 ± 30,000	p.p.m. Volume
ETHANE	4,150 ± 650	,, ,,
PROPANE	4,70 ± 75	,, ,,
ISO BUTANE	40 ± 10	,, ,,
NORM. BUTANE	35 ± 10	,, ,,

INITIAL SHUT IN PRESSURE 4040 p.s.i.
FLOWING PRESSURE 2480 p.s.i.
FINAL SHUT IN PRESSURE 4000 p.s.i.
Rw = 0·2 ohms at 82° F

KOCKATEA SHALE — LOWER TRIASSIC

IRWIN RIVER COAL MEASURES — PERMIAN (ARTINSKIAN)

CARYNGINIA FORMATION — PRECAMBRIAN

HILL RIVER STRATIGRAPHIC WELLS

PERTH BASIN - WESTERN AUSTRALIA

SHOWING STRATIGRAPHIC AND PALYNOLOGICAL CORRELATIONS AND PROPOSED NOMENCLATURE
WITH REFERENCE TO ENEABBA No.1 AND WOOLMULLA No.1

NOMENCLATURE ESTABLISHED IN ENEABBA No.1

YARRAGADEE FORMATION

COCKLESHELL GULLY FORMATION

LESUEUR SANDSTONE

WOODADA FORMATION

KOCKATEA SHALE

HILL RIVER No.1
D.F. 368' T.D. 1900'
SPUDDED 2 APRIL 1962
ABANDONED 25 APRIL 1962

ENEABBA No.1
D.F 416' T.D. 13,712'
SPUDDED 12 JUNE 1961
ABANDONED 26 NOV. 1961

HILL RIVER No.2A
D.F. 603' T.D. 380'
SPUDDED 24 MAY 1962
ABANDONED 25 MAY 1962

HILL RIVER No.2
D.F. 625' T.D. 1620'
SPUDDED 6 MAY 1962
ABANDONED 24 MAY 1962

WOOLMULLA No.1
D.F. 394' T.D. 9224'
SPUDDED 3 NOV 1962
ABANDONED 15 MAR 1963

HILL RIVER No.3
D.F. 413' T.D. 865'
SPUDDED 12 AUG 1962
ABANDONED 27 AUG 1962

HILL RIVER No.4
D.F. 309' T.D. 1010'
SPUDDED 19 JUNE 1962
ABANDONED 30 JUNE 1962

YARRAGADEE FM.

CADDA FM.

COCKLESHELL GULLY FM.
(LOWER JURASSIC – UPPER TRIASSIC)

LESUEUR SANDSTONE
(UPPER TRIASSIC)

WOODADA FORMATION
(LOWER - MIDDLE TRIASSIC)

KOCKATEA SHALE
(LOWER TRIASSIC)

CATTAMARRA COAL MEMBER

PROBABLE CORRELATION ON LITHOLOGY AND PALYNOLOGY

Dampieri

Dampieri – Exesipollenites

Exesipollenites

? Dampieri Exesipollenites

Classopollis abundant

? Pteruchipollenites

Pteruchipollenites

Classopollis Abundant in upper part

Indeterminate Microflora

Taeniaesporites

LEGEND

SANDSTONE

SILTSTONE

CLAYSTONE

SHALE

COAL

LIMESTONE

SPORES

MEGAFOSSILS

SCALE 0' 1000' 2000'

M. H. JOHNSTONE., MAR. 1963