RECORDS 1957/7

SUMMARY OF OIL-SEARCH ACTIVITIES IN AUSTRALIA AND NEW GUINEA TO THE END OF 1956

Original Report by H. G. Raggatt & Irene Crespin

Revised 1957 by M. A. Condon, H. S. Taylor-Rogers & N. H. Fisher.

SUMMARY OF OIL-SEARCH ACTIVITIES IN AUSTRALIA AND NEW GUINEA

TO THE END OF 1956

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Illustrations

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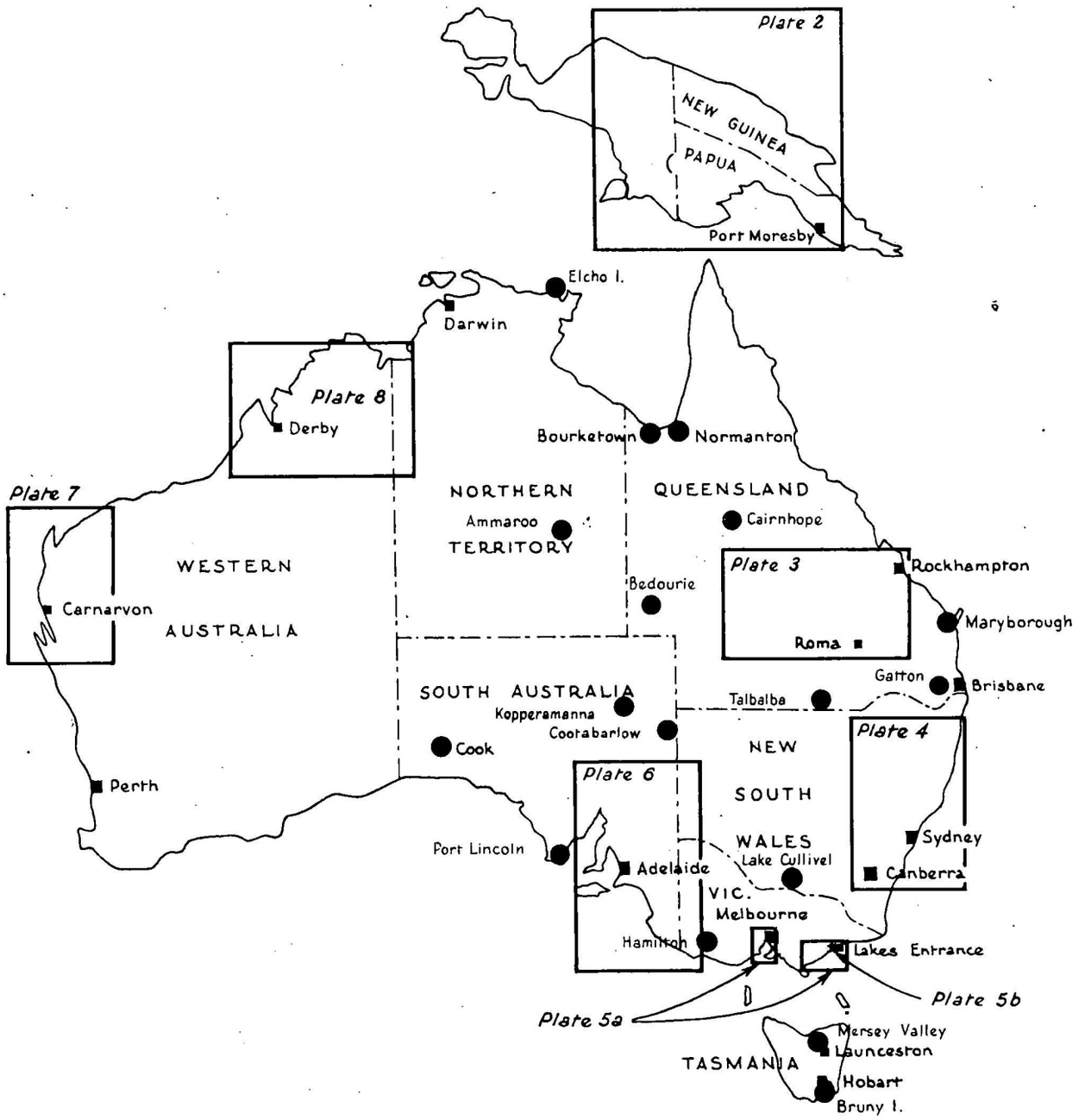

● BORES FOR OIL

AUSTRALIA AND NEW GUINEA

Scale approx. 1:30,000,000

Bureau of Mineral Resources, Geology & Geophysics Feb. '57

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SUMMARY OF OIL-SEARCH ACTIVITIES IN AUSTRALIA AND NEW GUINEA TO THE END OF 1956

INTRODUCTION

This summary is a revision and enlargement of Records 1943/63 by H. G. Raggatt and Irene Crespin - "Summary of Oil-Drilling Activities in Australia and New Guinea". Most of the information relating to the period before 1944 was compiled by Raggatt and Crespin. The geological and geophysical information was compiled by Condon and the drilling and expenditure data by Taylor-Rogers, and the whole report has been revised by Fisher.

A summary of the whole of the activities that have contributed towards the exploration for petroleum is presented; although this is believed to be comprehensive, it is likely that some data are not available or not complete.

In this report "petroleum" is used to refer to hydrocarbons in general, "gas" for gaseous hydrocarbons, "oil" for crude oil (liquid hydrocarbons) and "wax" or "bitumen" for the solid hydrocarbons; "dry gas" is used for inflammable gas without ethane or higher hydrocarbons.

Papua-New Guinea is treated first and then the states in clock-wise order. The drilling activity and expenditure is strictly by states.

Australia and Papua-New Guinea may be regarded for the purpose of exploration for oil as being made up of three main groups of rocks: the crystalline rocks (granite, gneiss and schist) which are unlikely to have oil accumulations except at a contact with sedimentary rocks; strongly indurated and distorted sedimentary rocks which are unlikely to contain commercial accumulations of oil although they may have supplied oil to adjoining undisturbed sedimentary rocks; and sedimentary rocks not strongly indurated or deformed. Only this last group occupy the sedimentary basins which are referred to in this report.

The main basins are as follows: Northern New Guinea Basin, Papuan Basin, Great Artesian Basin, Bowen Basin, Sydney Basin, Gippsland Basin, Murray Basin, Eucla Basin, Perth Basin, Carnarvon Basin, Canning Basin (including the Fitzroy Basin), Bonaparte Gulf Basin, Georgina Basin, and Amadeus Basin. Minor basins include the Aitape-Toricelli and the Sepik-Finisterre subdivisions of the Northern New Guinea Basin, Cape Vogel Basin, Carpentaria Basin, Laura Basin, Maryborough Basin, Clarence Basin, Tasmania Basin, Otway Basin, Adelaide Basin, Pirie-Torrens Basin, Ord Basin, Daly Basin and Barkly Basin. The basin nomenclature used in this report follows mainly that of Condon (1956) and has been checked to give due regard to priority of usage.

PAPUA-NEW GUINEA

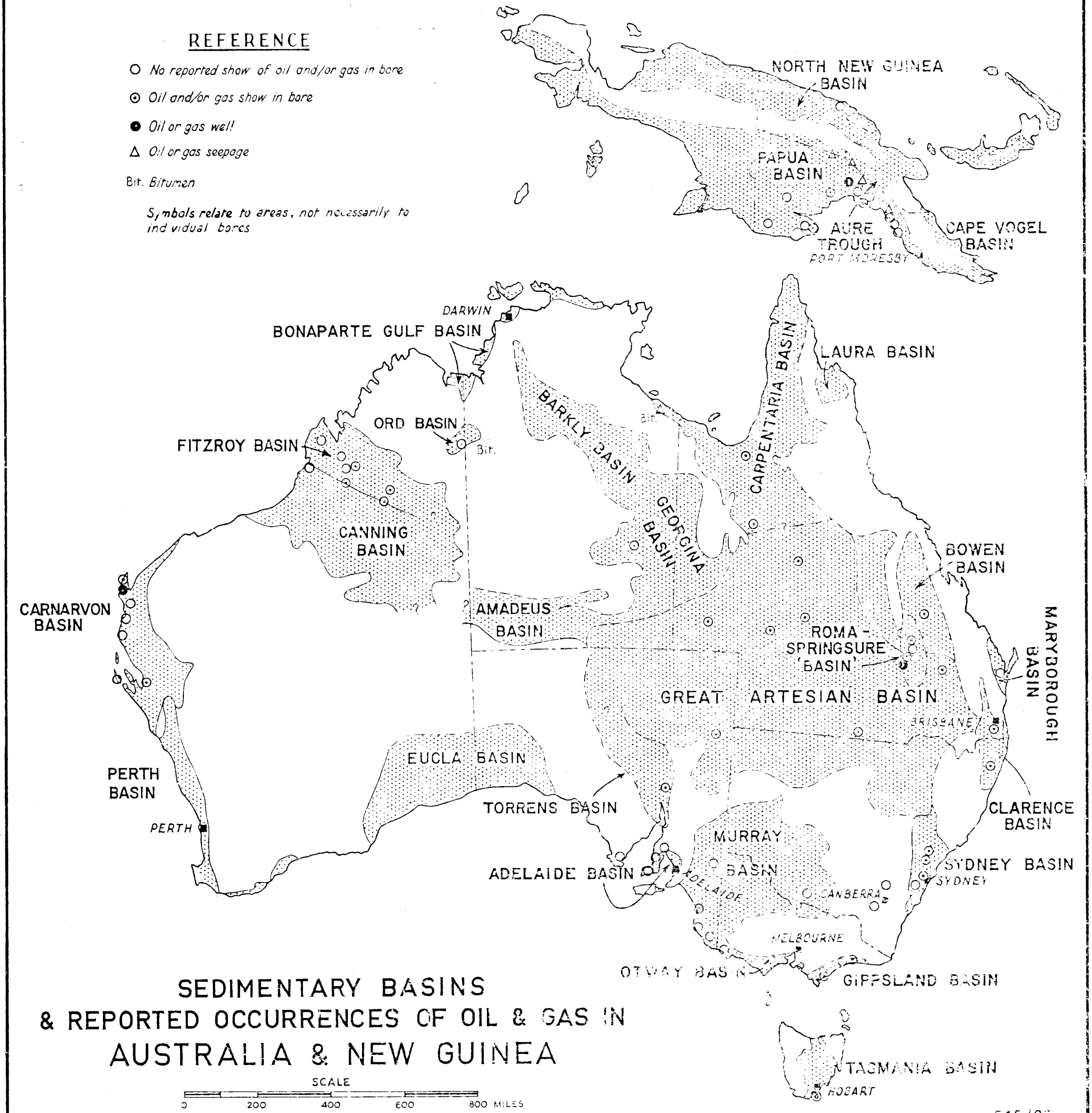
HISTORY OF INVESTIGATIONS

The following account is based partly on the report of the Anglo-Persian Oil Company on the operations it conducted for the Commonwealth Government during 1920-1929 (A.P.O.C.1930), on notes supplied by private companies and information available from official files. Because many of the investigations have been made concurrently in Papua and New Guinea and it is

REFERENCE

- ○ *No reported show of oil and/or gas in bore*
- ⊙ *Oil and/or gas show in bore*
- ● *Oil or gas well!*
- △ *Oil or gas seepage*
- Bit. *Bitumen*

Symbols relate to areas, not necessarily to individual bores



SEDIMENTARY BASINS & REPORTED OCCURRENCES OF OIL & GAS IN AUSTRALIA & NEW GUINEA

SCALE

0 200 400 600 800 MILES

Bureau of Mineral Resources, Geology & Geophysics, Feb '57

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therefore difficult to apportion costs between these territories, no attempt has been made to give separate accounts for each. It may be noted, however, that by far the greatest amount of work has been done in Papua. The drilling done in the Territory of New Guinea has been limited to shallow wells at Matapau and Marienberg.

Commonwealth Government and Anglo-Persian Oil Company

1912-1919. The existence of oil seepages near the Vailala River in Papua was first reported in 1911 and soon afterwards the British New Guinea Development Company commenced drilling at Upoia with a hand-drilling rig. From 1912 onward exploration work was conducted by the Commonwealth Government as a national undertaking (Wade, 1914). Nine bores, the deepest of which was 1,770 feet, were drilled at Upoia. Oil shows were reported in some of these. It is estimated that during this period a sum of £141,534 was spent.

1919-1929. The Anglo-Persian Oil Company became associated with this enterprise in July 1919, when an agreement was signed whereby the Australian and British Governments undertook each to provide a sum of £50,000, and the Company to supply and direct, as agents for the two Governments, the technical staff necessary for geological exploration, selection of sites for test-drilling and the conduct of boring operations.

Field work under this agreement commenced in March, 1920. The site of a test well was selected at Popo and drilling commenced in March, 1922. This well was carried to a depth of 1,775 feet without much difficulty, but after many attempts to deepen it had failed because of running muds, it was abandoned at 1,825 feet. The second well, 1,100 feet from the first, was also abandoned because of drilling troubles, at a depth of 880 feet, and a third hole commenced alongside it. This bore likewise was abandoned at a depth of 2,707 feet owing to failure to handle the swelling and caving formations encountered.

The demands of geological exploration, and the necessity for purchasing and installing new drilling equipment and engaging new personnel for the Popo test well had, by the end of 1921, exhausted the £100,000 provided by the agreement of 1919. The British Government thereupon announced its withdrawal from the enterprise. After a good deal of discussion the Australian Government took over the British Government's share for the sum of £25,000, and the Anglo-Persian Oil Company was authorised to continue operations as agents of the Australian Government alone, by a succession of temporary arrangements, more or less based on the general terms of the original agreements.

In July, 1923, the Australian Government approved an arrangement whereby the boring operations were to be continued on the Government's behalf, subject to certain conditions. This arrangement persisted until the middle of 1926, when operations at Popo were suspended owing to the failure of No. 3 well to reach the depth that was regarded as necessary.

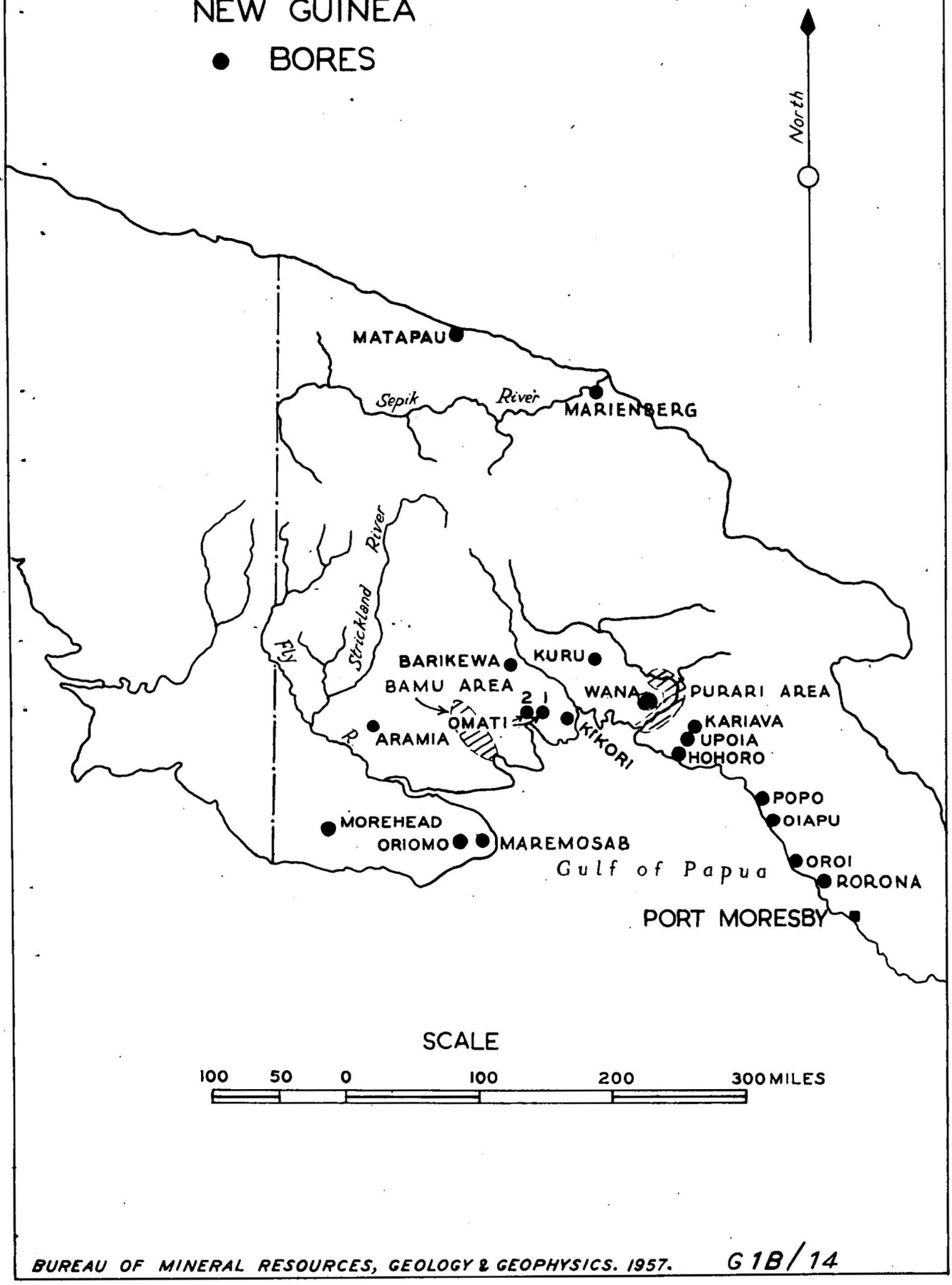
Expenditure under the join agreement had at this time, reached a total of £227/256.

The position then was that the Australian Government had thrown open most of Papua and New Guinea to private enterprise, retaining only a block of country from Popo to Yule Island as a Government reserve. Three test wells had been drilled at Popo, but in spite of the most persistent effort,

PLATE 2

NEW GUINEA

● BORES



BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS. 1957. G1B/14

had not attained the depths required by the geological report. The Company's drilling and geological staffs were of the opinion that a further attempt was justified; and a fourth location, where, it was hoped, some of the drilling difficulties would be eliminated, was suggested. At the request of the Australian Government, Dr. Arthur Wade's opinion was solicited. He agreed with the recommendation of the Anglo-Persian Oil Company; the Australian Government accepted the recommendation and No. 4 Test Well was started at Popo.

After a further consideration of the oil problem by the Australian Government, the Anglo-Persian Oil Company was requested to arrange for extended geological work in the area and, as a result, field work was commenced again towards the end of 1927, and continued until October, 1929.

No. 4 Well at Popo, drilling of which commenced in August, 1927, was abandoned at a depth of 895 feet. No. 5 well was commenced 1,000 feet away from it in February, 1928, and was abandoned at 1,394 feet. Considerable difficulty had been experienced in drilling this well, similar to that experienced with the other holes, but, owing to the termination of the agreement by the Australian Government, operations ceased before further remedial measures proposed by the Company's most experienced drilling engineer could be tried.

Expenditure for the period 1926-1929 amounted to £121,526 making a total of £490,316 for the period 1912-1929. It should be noted also, that all the technical direction and advice provided by the Anglo-Persian Oil Company under these agreements was given without fee.

Relatively Small Private Companies

From 1923 to date private companies have spent considerable sums of money in New Guinea on geological and geophysical work, and scout boring. A limited amount of test drilling has also been done.

Amongst the smaller companies, the Ormildah Oil Development Company and New Guinea Oil Company did some drilling in 1923-1926. The former company, in 1926, drilled a well at Marienberg in New Guinea to a depth of 2,705 feet, and the New Guinea Oil Co. Ltd. sank 7 scout bores near Hohoro in Papua during the years 1923 to 1926, and in 1926 drilled a deeper hole to the depth of 1,157 feet in which gas and oil were reported. Geological reconnaissances were made by Pacific Island Investment Company, and Mandated Development Limited.

At Matapau, New Guinea, the Mandated Development Co. Ltd. drilled six shallow bores between 1924 and 1926: No. 1, 70 feet; No. 2, 661 feet; No.3, 594 feet; No. 4, 137 feet; No. 5, 303 feet and No. 6, 765 feet. From 1929 to 1932, this company drilled three more bores in the same area: No. 7, 1331 feet; No. 8, 60 feet; and No. 9, 510 feet.

It is probable that the four companies mentioned above spent approximately £100,000 in their search for oil.

In 1927-28, the Vogel (Papua) Oil Co. Ltd. drilled two bores, to 180 and 1018 feet, at Kukuia, Cape Vogel area.

Of the other smaller companies, Oriomo Development, Oil Search Limited, and Papuan Apinaipi Petroleum Co. Limited may be specially mentioned. Between them, the first two spent £180,000 on geological work in Papua and New Guinea, and Oil Search Limited carried their investigations to a stage where two of the major oil companies became interested (see below).

Oriomo Oil Limited operated in the Western Division, Papua, where it drilled six bores. The Maremosab Bore reached a depth of 1,595 feet; No. 1 Bore Wohomul, 1,260 feet; No. 2 Bore, Wohomul, 1,890 feet; a bore at Oriomo, 873 feet; and two bores at Wonia, 785 and 665 feet. Gas, bitumen and paraffin wax were reported from the Maremosab and Wohomul bores.

Papuan Apinaipi Petroleum Co. Ltd. which was formed in April, 1937, carried out geological work in the Oiapu district and put down five scout and two deeper holes on a well-defined structure. The footage of scout drilling done was 5,418 feet and of deeper drilling, Oiapu No. 1, 2,769 feet and Oiapu No. 2, 2,086 feet. Work ceased in the area when staff was evacuated in early 1942. Some geological mapping was carried out by Bureau of Mineral Resources geologists during 1947, 1948 and 1949 (Guppy, 1947; Condon, 1949) but the company lost its permit in 1950 through inability to carry out the terms of the Permit. The Company was re-constituted and in 1954, was granted a Permit, No. 22, over a bigger area, including the area of Permit 6 and much of Permit 7, which had been surrendered by Australasian Petroleum Co. Pty. Ltd. It has since carried out revision geological surveys in the Permit area.

The company has expended about £227,500, including £29,608 by way of subsidy from the Commonwealth.

Papua Oil Development Company Ltd., a subsidiary of the Shell Company, operated during 1936 to 1939, on ten permit areas in the Western, Delta and Central Divisions of Papua. These permits covered an area of 22,700 square miles and extended along a narrow coastal strip of the Gulf of Papua, the Bamu River and the lower sections of the Fly and Strickland Rivers. Extensive investigations were carried out including aerial, geological and geophysical surveys, and core drilling. Fifteen scout holes were drilled with a total footage of 20,167 feet, but no test well was put down. Of the scout holes, four were in the Bamu area, one at Kikori, nine in the Purari and one at Rorona. The details of the depths of these holes are as follows:

	Well	Depth (in feet)
Bamu	1	2,138
	2	1,228
	3	1,901
	4	1,140
Kikori	5	2,502
Purari	6	2,551
	7	1,012
	8	1,037
	9	909
	10	778
	11	1,035
	12	797
	13	876
	13A	1,050
Rorono	1	1,222
Total	15	20,176 feet

The total expenditure by this Company amounted to £411,000.

Enterprise of New Guinea Gold and Petroleum Development was granted a permit, No. 21, over an area along the Border of Dutch New Guinea, in the upper part of the Sepik River Valley, in 1954. Since then a geological reconnaissance has been completed, (Perry 1956) and a gravity survey and core-drilling programme started.

The Island Exploration Company Pty. Ltd.

This Company was formed in 1936 by D'Arcy Exploration Company Ltd. and Vacuum Oil Company Pty. Ltd. and was engaged in exploration in New Guinea, from January, 1937, to December, 1939, and in Papua from November, 1936, to the present.

In New Guinea, the Company's permit was in the Madang Area, between the Ramu and Markham Rivers and the coast. Geological reconnaissance was carried out over approximately 8,000 square miles, and aerial survey over 2,370 square miles. No test well was drilled. The Company surrendered its New Guinea Permit No. 2 in December, 1939, after a total expenditure in respect of the Permit of £117,615.

The Company's activities in Papua have extended from the Turama and Kikori rivers in mid-western Papua to the Dutch Border in Western Papua and have included geological reconnaissance over 11,300 square miles, aerial survey of 8,900 square miles and geophysical survey of 15,000 square miles. In addition to test boring shallow holes were put down for geological information. The company has drilled two exploratory test-wells on the Omati river in its Permit No. 2. Omati No. 1 to 14352 feet and Omati No. 2 to 10880 feet. A strong gas show was encountered in Omati No. 1 at 13,743 feet. A well drilled at Aramia to a depth of 6,628 feet, reached granitic basement. A well at Barikewa had been drilled to 1581 feet at the end of 1956.

At this date the Company held Papuan Permits Nos. 2, 15 and 18.

The Australasian Petroleum Company Pty. Ltd.

In 1938, Oil Search Limited united with D'Arcy Exploration Company Ltd. and Vacuum Oil Company Pty. Ltd. to form the Australasian Petroleum Company Pty. Ltd. This Company, which operates jointly with Island Exploration Company, took over the areas previously held by Oil Search Limited.

In New Guinea, the Company operated in portion of the Sepik District. Approximately 6,500 square miles were covered by geological reconnaissance and 7,422 square miles by aerial survey. No test well was drilled.

In Papua operations commenced in October 1938 and except for a period from February 1942, when operations were suspended for security reasons until late 1945, have continued ever since. The Company's activities included geological reconnaissance over 9,500 square miles, aerial survey of 10,315 square miles, and geophysical survey of 3,000 square miles, operations extending from the Gulf to the Delta and Western Divisions. A few scout bores were drilled on Yule Island for geological information only. The Company was engaged in drilling a deep test well at Kariava on the Vailala River in Papua when operations were suspended in January, 1942, at a depth of 5,400 feet.

Company headquarters were re-established in Papua towards the end of 1945 and drilling was resumed at Kariava on 6th November, 1946. The well was deepened to 12,621 feet, when drilling operations were suspended on 25th March, 1948, without encountering any indications of petroleum.

The Company continued to carry out a vigorous programme of exploration drilling. Hohoro No. 1 Well was drilled to 4,721 feet; Hohoro No. 2 to 10,642 feet; Oroi No. 1 to 5,516 feet; Upoia No. 1 was drilled to 5,356 feet; showings of oil were obtained in the Hohoro and Upoia bores; Wana No. 1 was drilled to total depth of 9,866 feet; Kuru No. 1 was drilled to 998 feet when a strong gas blow was struck; Kuru 1A was drilled to kill the gas blow. Kuru No. 2 was drilled to 5,838 feet but had to be plugged back to 4,420 feet and side-tracked; at the end of 1956 the sidetracked hole had been drilled to 4,564 feet. Morehead Bore No.1 was drilled to 7,782 feet at the end of 1956.

In addition to the drilling mentioned above the Company has carried out a comprehensive programme of exploration since 1946 with geological parties operating in both New Guinea and Papua, but mainly in Papua, while geophysical surveys - gravitymeter, magnetometer and seismic - have been carried out in mid-western Papua.

The New Guinea Permits and Papuan Permits Nos. 7 and 13 were subsequently surrendered. Permits in force in Papua at the end of 1956 were Nos. 1, 5, 12, 14, 16, 17 and 19 (Plate 3).

EXPENDITURE

Since the start of oil exploration in Papua-New Guinea in 1912 about 25 test bores for oil have been drilled, totalling about 107,500 feet of drilling.

The total expenditure on oil exploration in the Territory of Papua-New Guinea up to the end of 1956, is shown in Table I.

TABLE 1.

	British Govt. £	Commonwealth Govt. £	Companies £
1. By Commonwealth Government			
(a) on its own account - 1912-1919		141,534	
(b) Under Anglo-Persian agreement			
i. 1919-1926		227,256	
ii. 1927-1929		121,526	
2. By British Government 1919-1926	25,000		
3. By Companies.			
(a) Sundry small companies 1923-1926		9,062(x)	100,000
(b) 1946-1956 (estimate)			30,000
(c) Oil Search Limited and Oriomo Limited			180,000
(d) Papuan Apinaipi Petroleum Company Ltd.		29,608(y)	197,960
(e) Papua Oil Development Company Limited			411,000
(f) Island Exploration Company Pty. Ltd.			7,476,936

(g) Australasian Petroleum Company Pty. Ltd.			14,986,477
(h) Enterprise of New Guinea Gold and Petroleum Development			80,483
4. Total Expenditure amounts to £24,016,842 made up as follows:	25,000	528,986	23,462,856

(x) Subsidy to New Guinea Oil Co. Ltd.
(y) Subsidy.

GEOLOGY

In Papua-New Guinea, unmetamorphosed sedimentary rocks ranging in age from Permian to Recent are known.

Permian

The Permian deposits (Glaessner, Llewellyn and Stanley, 1950; Rickwood, 1955) are known only in the Western Highlands where Permian calcareous arkose and marine limestone, with a maximum total exposed thickness of 800 feet, unconformably overlie granite and metamorphic rocks. No strata referable to the Permian have been met in drilling.

Mesozoic

The New Guinea Mesozoic basin - of Jurassic to Cretaceous age - is part of the Australo-Pacific geosyncline (Schuppli 1946) which developed between the opposed stable areas of the Australian and Melanesian continents.

Outcrops of Mesozoic strata occur mainly in the central mountain ranges, to the west of the Aure Trough. Small outcrops occur in the Port Moresby district and in the Owen Stanley Range.

Much of the outcrop area of Mesozoic rocks has been examined in reconnaissance surveys by geologists of Australasian Petroleum Company and Island Exploration Company. Published reports include those of Osborne (1945), Carey (1944) and Glaessner (1945) on earlier work, and Rickwood (1955) and Osborne (1956).

"The Jurassic sequence of New Guinea is well known palaeontologically although Jurassic rocks have only rarely been seen in situ". (Glaessner, 1943).

Jurassic strata of New Guinea as far as known consist of shales with hard siliceous fossiliferous nodules and some sandy limestones.

Oldest Mesozoic fossils from New Guinea are Upper Lias - Goeloceras moermanni Kruizinga which were found at Etna Bay (Western New Guinea).

A faunal gap occurs in the Upper Oxfordian-Kimmeridgian stages - apparently corresponding with a like gap in the classical section of the Spiti shales of the Himalayas (Uhlig 1910). Osborne (1945) attributes this gap to faulting but also mentions a conglomerate at the base of the upper beds - indicating the possibility of an erosion interval. A thickness of 4,000 feet of shales and sandstones (the Kuabgen Group) was mapped in the headwaters of the Fly River. The age of the lowest beds of this group is probably

Callovian. In the Chimbu area (Noakes, 1939) granite underlies the Upper Jurassic sediments in places but elsewhere in the Western Highlands the Upper Jurassic rests on Permian sediments (Rickwood, 1955). The absence of Mesozoic strata in the coastal ranges of Northern New Guinea and in the foothills of Papua, wherever the base of the Tertiary is exposed, indicates that the Mesozoic basin was relatively narrow.

Between the Jurassic and the Cretaceous strata a period of non-deposition apparently intervenes although as far as is known there is no angular unconformity. The Cretaceous strata, of Aptian to Cenomanian age, consist dominantly of sandstones in the lower part and mudstones in the upper part. The Upper Cretaceous beds are upwards of 7,000 feet thick.

The outcrop areas show gentle to moderate folding in the Mesozoic sediments.

Between the Upper Cretaceous and the Tertiary is another large faunal gap which Osborne (1945) believes may be due to deep submergence of the area.

Tertiary

The Northern New Guinea Basin. This Tertiary basin extends from the Huon Peninsula to the Netherlands New Guinea border and beyond.

Miocene marine shale, sandstone and thick limestone, 12,000 feet thick, rest unconformably on Eocene limestone and chert, on Mesozoic sediments, or on the schist and granite of the basement. More or less unconformably overlying the Miocene are Pliocene marine and fresh-water shale, sandstone and conglomerate, with some minor lignites, ranging in thickness from 7,000 to 15,000 feet. This range in thickness is due to the initiation of folding in the late Miocene with erosional truncation of the Miocene strata, and development of more or less detached basins in which Pliocene sediments were deposited. The coastal ranges were probably rising during the Pliocene but the main movement occurred at the end of the Pliocene. This gave rise to three main structural units - the narrow coastal belt, the geanticlinal coastal ranges, and the Sepik-Markham fault-trough or synclinal-trough.

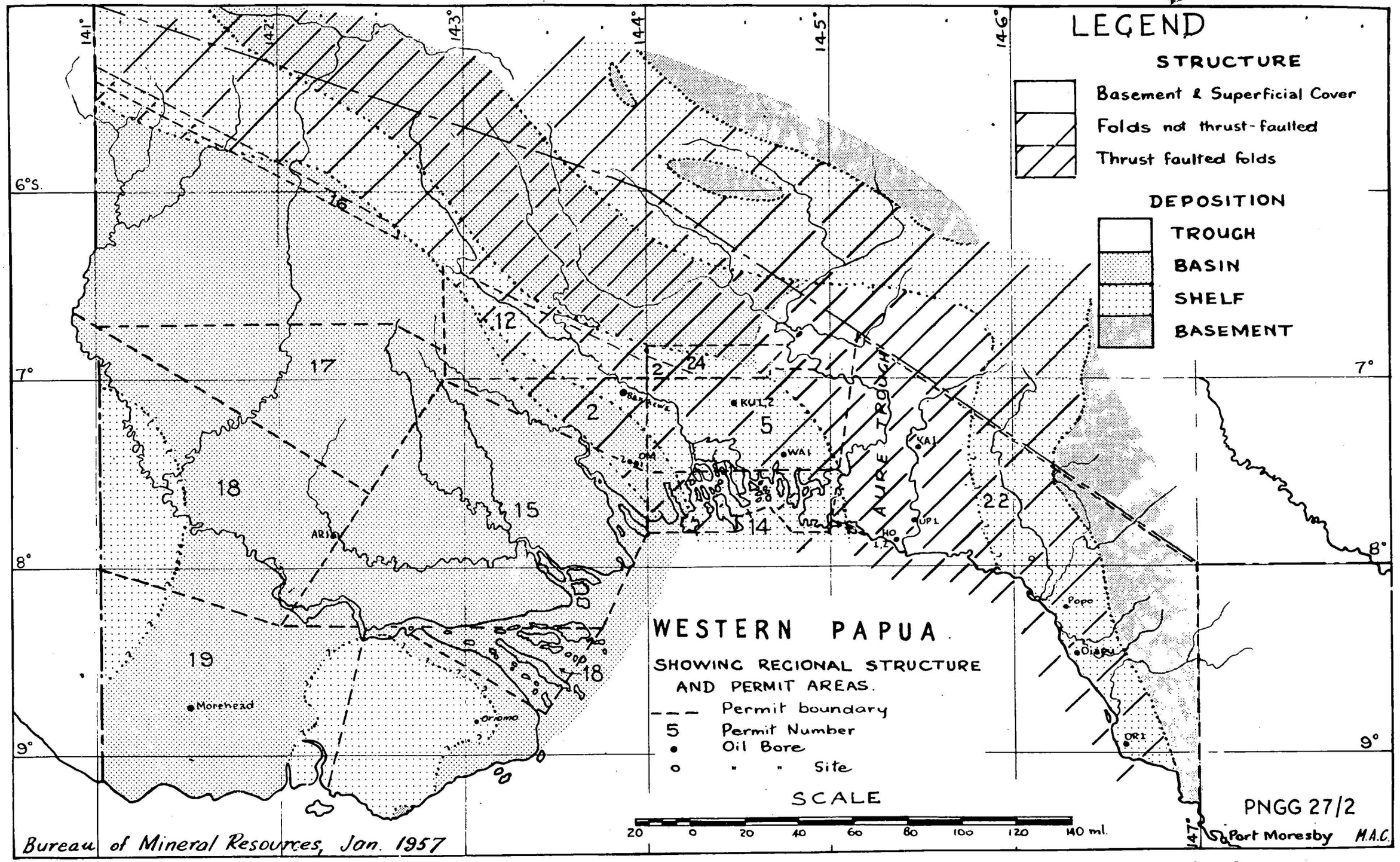
The coastal lowlands are essentially only the flank of the geanticline except in the western part where they widen out in the Bewani geosyncline.

The geanticlinal coastal ranges comprise the Finisterre and Saruwaged Ranges east of Madang, the Adelbert Range west of Madang and the Torricelli and Bewani Mountains west of the mouths of the Sepik and Ramu rivers. Miocene strata form the central parts of the eastern geanticlines, with Pliocene strata, folded and faulted, on the flanks. The Torricelli-Bewani uplift exposes the pre-Tertiary metamorphic and igneous rocks in the core of the ranges, with Miocene and Pliocene strata on the flanks of this uplift.

The great Sepik-Ramu-Markham Trough, which extends into Netherlands New Guinea as the valleys of the Idenberg and Rouffaer Rivers, is either a fault trough or a synclinal trough.

Tertiary sediments on the south side of the trough are very much thinner and folding is more gentle than on the northern side.

The Southern Basin (Papua). The Tertiary Basin in Papua is an asymmetric basin of deposition (ideo-geosyncline) with gently-folded strata on the south-western side where the basin is hinged on the Australian Shield, and very thick


LEGEND
STRUCTURE
Basement & Superficial Cover
Folds not thrust-faulted
Thrust faulted folds
DEPOSITION
TROUGH
BASIN
SHELF
BASEMENT
AURE TROUGH
WESTERN PAPUA
SHOWING REGIONAL STRUCTURE AND PERMIT AREAS.
Permit boundary
5 Permit Number
Oil Bore
Site
SCALE
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PNGG 27/2
Port Moresby M.A.C.
Bureau of Mineral Resources, Jan. 1957
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9°

steeply-folded strata against the Central Ranges of New Guinea. In the Aure Trough, there are at least 15,000 feet of Miocene marine sediments - greywacke, tuffaceous sandstone, mudstone and shale. To the south-east Miocene limestone and mudstone rest unconformably on Eocene limestone, siliceous shale and chert, on Mesozoic strata, or on metamorphic and igneous rocks of the basement complex. The Pliocene strata include marine and terrestrial sediments - sandstone, siltstone, conglomerate, agglomerate and tuff.

Disconformities occur between the Lower and Middle Miocene and between the Miocene and Pliocene in some places. This basin is marked by the large amount of volcanic material in the Upper Tertiary sediments.

Petroleum Indications

Many seepages of oil and gas are known from the Vailala-Purari area and from the western foothills area of Mesozoic outcrop. The seepages appear to come from the Cretaceous, Middle Miocene and Lower Miocene although in many places they are close to faults, and may have moved along the faults. Oil shows were obtained in bores at Upoia and Hohoro and a gas show in the Omati No. 1 Bore. Gas blew wild from Kuru Bore No. 1 before being brought under control.

PRESENT STATUS OF EXPLORATION

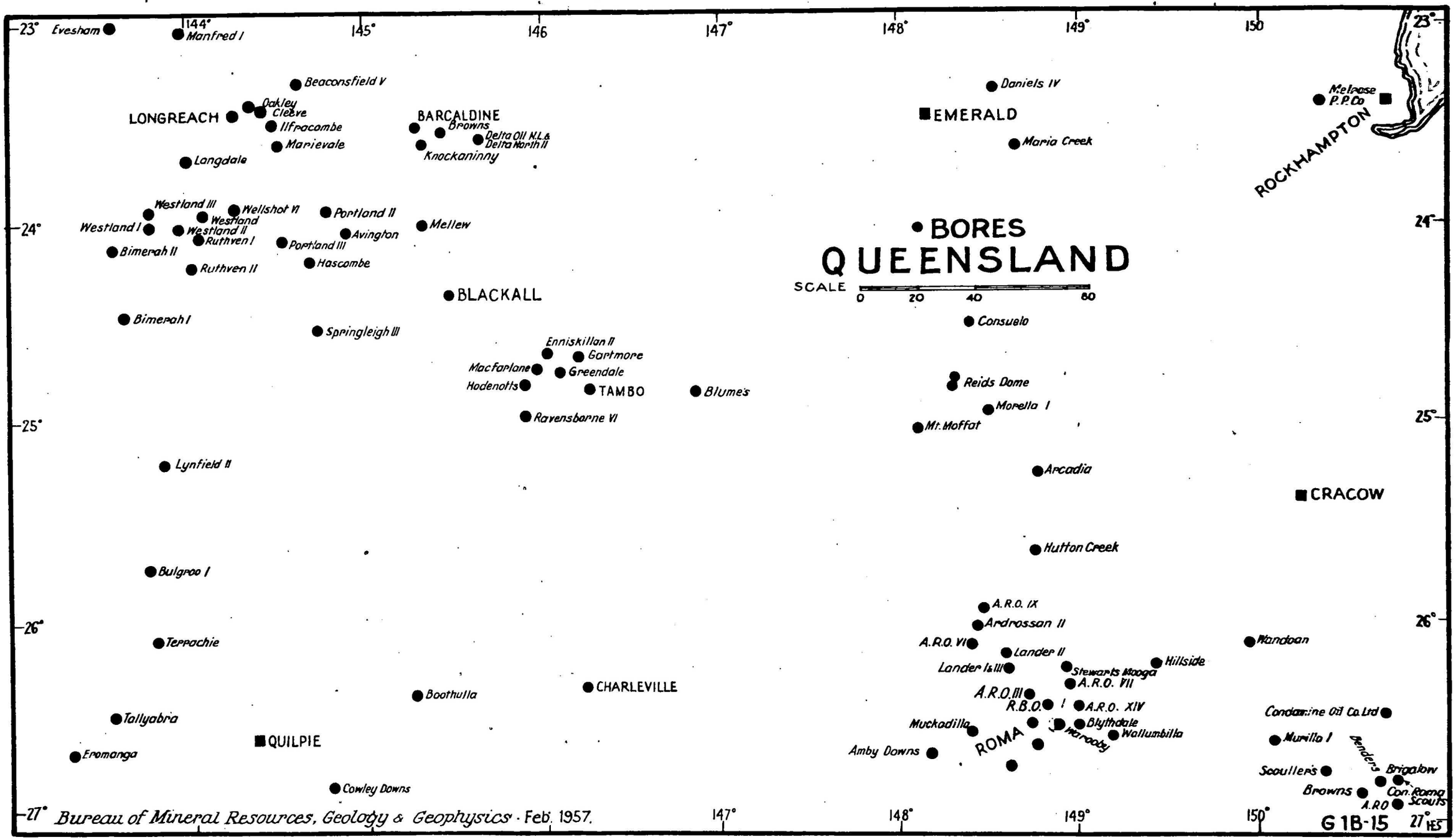
At the end of 1956, Australasian Petroleum Co. Pty. Ltd. and Island Exploration Co. Pty. Ltd. (undertaking a joint operation), Papuan Apinaipi Petroleum Co. Ltd., and Enterprise of New Guinea Gold and Petroleum Development N.L. held permits to explore for oil, the first three in Papua, the other in New Guinea.

Almost the whole of these areas and much of the area of sedimentary rocks outside these areas have been geologically examined at least by reconnaissance surveys. Geophysical surveys have been carried out over large areas of western Papua. Thirteen widely separated localities have been test drilled.

The stratigraphical succession and its regional variations, and the regional structure are moderately well established although, of course, much remains to be done in filling in the details on which successful drilling often depends.

On the accompanying plan (Plate 2a), the regional structure, tectonic and depositional, is indicated diagrammatically. Geologically, the order of importance of the various zones for oil accumulation is as follows:

1. (Most important). The zones of moderate folding without dominant thrust faulting, in the shelf area of deposition. (Parts of Permits 16, 12, 2, 24, 5 and 14).
2. The zones of moderate folding within the basins of deposition (in Permits 16, 12, 2, 5 and 14).
3. The basins with mainly depositional folding (in Permits 17, 18, 19 and 15).
4. Shelf areas marginal to the basins (in Permits 18 and 19).
5. The strongly folded and thrust faulted basin sediments (possibly in Permit 24).
6. The strongly folded and thrust faulted sediments deposited in a trough (in Permits 22, 24 and 5).


BORES
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Oakley
Cleeve
LONGREACH
Ilfracombe
Marievale
Langdale
BARCALDINE
Browns
Delta Oil N.L.&
Delta North II
Knockaninny
Daniels IV
EMERALD
Maria Creek
Melrose
P.P.Co
ROCKHAMPTON
Westland III
Wellshot VI
Portland II
Westland I
Westland
Westland II
Ruthven I
Avington
Mellew
Portland III
Bimerah II
Hascombe
Ruthven II
BLACKALL
Bimerah I
Springleigh III
Enniskillan II
Gartmore
Macfarlane
Greendale
Hodenotts
TAMBO
Blumes
Ravensbarne VI
Consuelo
Reids Dome
Morella I
Mt. Moffat
Arcadia
CRACOW
Lynfield II
Hutton Creek
Bulgroo I
A.R.O. IX
Ardrossan II
A.R.O. VI
Terrachie
Lander II
Lander I & III
Stewarts Mooga
Hillside
A.R.O. VII
A.R.O. III
R.B.O. I
A.R.O. XIV
Blythdale
Wallumbilla
Muckadilla
ROMA
Warrooby
Amby Downs
Wandoan
Condamine Oil Co. Ltd
Murilla I
Benders
Scoullers
Brigalow
Browns
Con. Roma
Scouts
A.R.O
Boothulla
CHARLEVILLE
Tallyabra
QUILPIE
Eromanga
Cowley Downs
23°
24°
25°
26°
27°
144°
145°
146
147°
148°
149°
150
Bureau of Mineral Resources, Geology & Geophysics · Feb. 1957.
G1B-15

Insufficient use at present is made of seismic surveys to map subsurface structure prior to drilling, particularly on structures that are well exposed at the surface. Where a good petroleum show is encountered, absence of seismic survey can effectively prevent reasoned location of a second bore.

In three of the thirteen localities test-drilled, namely Hohoro, Omati and Kuru, good shows of petroleum have been encountered. Only on Kuru was the structural position of the shows known with reasonable certainty.

Many surface anticlines have been geologically mapped in sufficient detail to locate test-drilling sites; few of these have been seismic-surveyed to establish subsurface structure and its relation to surface structure. Unless this is done, the first test well cannot be located in the position where the whole sequence can best be tested and, where petroleum shows are encountered, subsequent wells cannot be placed to best advantage relative to the first well.

QUEENSLAND

(See Plate 3 for locality map)

HISTORY OF INVESTIGATIONS

The greater part of the information given concerning drilling activities in Queensland has been obtained from Queensland Geological Survey Publication No. 247 (Cameron, 1915), the Annual Reports of the Under-Secretary for Mines, Queensland, 1914-1955, and the Queensland Government Mining Journal for 1914-1956, especially Ball (1927 and 1934). Information from Departmental files and from reports supplied by some of the companies including Oil Search Limited, Roma Blocks Limited and Shell (Queensland) Development Pty. Limited has also been used.

Roma

In 1900 the Roma town water bore No. 2 was being deepened to increase its artesian flow, and at 3,683 feet (about 2,000 feet below the principal artesian aquifer), a flow of natural gas measured as 39,400 cubic feet per day was struck. This gas blew off freely for 4 years. In 1904 the flow of gas was measured at 70,000 cubic feet per day. In 1906 a gasometer was erected to collect the gas from the bore, the town was reticulated, and the streets were lit for 10 days. The gas flow then suddenly diminished and the lighting scheme had to be abandoned. In 1907 the Roma Mineral Oil Co., with Government assistance, drilled a new bore known as Roma No. 3, 250 feet south of No. 2. In 1908 gas was struck in this bore at 3,702 feet and caught fire. The fire was extinguished with great difficulty after it had been burning for six weeks. The bore was abandoned at a depth of 3,713 feet with 3 sets of tools in the hole.

At this stage the Queensland Government sought the advice of a number of petroleum technologists in Great Britain and the United States and after considering their advice decided to drill further bores.

A Californian Standard Percussion drilling rig was brought from the United States and an American driller, Mr. Whaley, began, in January 1916, to drill the bore known as Roma No. 4 for the Queensland Government, on a site chosen by W. E. Cameron of the Queensland Geological Survey, 400 feet west-south-west of the Roma Mineral Oil Company's bore (Roma No. 3). The chief purpose of the bore was to test beds below the gas sands for oil.

Many mechanical difficulties were experienced in drilling this hole and progress was slow. The total depth reached was 3,709 feet in 1919. The hole was finally abandoned in 1922. Gas was met with below 3,610 feet. A test made in an oil absorption apparatus in 1920 gave a yield of 1.22 pints of petrol per 1,000 cubic feet of gas.

In 1923 new petroleum legislation, providing for the issue of prospecting permits up to 10,000 acres and leases up to a like amount, was introduced, but a rectangular area of 3,600 square miles around the Roma bores was withheld as a Government Oil Reservation. A licence was, however, granted to Lander Oilfields of Australia, near the centre of the Reservation at Orallo.

Between 1923 and 1929 this Company drilled three holes near Orallo to depths of 2,840, 2,625, and 2,670 feet and one near Roma to a depth of 4,158 feet. Small oil and gas shows were reported from the first three and gas from the fourth was tested to yield about 2.5 pints of gasoline per 1,000 cubic feet of gas.

In September, 1927, Roma Oil Corporation Limited No. 1 Bore, drilled with a rotary plant, struck a flow of 600,000 cubic feet of gas per day at 3,703 feet, and in October, 1928, a Braun gas absorption plant was installed to recover the petrol content of the gas which ranged from 1.2 to 1.6 pints per thousand cubic feet.

This Bore was deepened in 1929 and light oil was found at 3,704 feet. This well is said to have produced 3,100 gallons of natural oil of dark to light colour, in the first 15 months. The gas yield at this time was estimated at 1,277,000 cubic feet per day, and was accompanied by some water. The absorption plant continued in operation for several years, treating the gas from Roma Oil Corporation Limited No. 1 Bore. The total amount of petrol thus extracted until 1932, when the supply of gas failed, was approximately 30,000 gallons.

Roma Oil Corporation No. 2 Bore was commenced in March, 1928, on a site west of earlier activities on Hospital Hill. "Edge" conditions were found to exist and basement was encountered without any notable discovery of gas or oil.

Builders Limited was registered in December, 1927, to correlate the geological information from the various deep bores and to carry out subsurface prospecting by scount drilling and pit sinking in the vicinity of Roma. Between June 1928 and July 1929 this company put down 158 scout bores with an average depth of 240 feet.

Roma Oil Corporation Limited No. 3 Bore was drilled on the eastern side of Hospital Hill and yielded considerable water and only moderate amounts of gas. It was abandoned.

Between 1927 and 1932 several deep bores were drilled in the surrounding district but the only bores with noteworthy indications of petroleum or gas were those at Blythesdale and the one at Mount Bassett (Roma Blocks Oil Co. No. 1 on Block 16) where the gas will still burn at the casing head. The latter bore was drilled to 3,447 feet and gave a yield of light oil of 10 gallons per day. This bore was later carried to granite bedrock at 3,561 feet. A bailing test in 1937 confirmed the original yield. The Roma Blocks Oil Company later (1938-1941) drilled three other wells in the Mount Bassett area in all of which petroliferous gas and/or oil were obtained.

In 1934 the deepest well in the district was drilled at Wallumbilla to a depth of 4,908 feet without reaching bedrock.

From June 1933 to September, 1934, Oil Search Limited drilled 78 scout bores in the vicinity of Roma. Based on the data so obtained a deep test was commenced in March 1934 at Warooby Creek six and one-half miles east of Roma. This struck basement rock at 3,764 feet in August of the same year, and was continued to 3,794 feet. Gas was encountered at two or three horizons. The main flow from a depth of 3,629 feet to 3,660 feet was tested and estimated at 650,000 cubic feet per day. The well was subsequently plugged, pending the results of further activities to the north by the same company.

Roma Blocks Oil Company N.L. became associated after World War 2 with Kalimna Oil Company N.L., Australian Oil Development Company N.L. and Roma North Oil Company N.L., to form Associated Australian Oilfields N.L., and continued to collect information on bores previously drilled in the Roma district. In 1948 the Company was granted Authority to Prospect for Petroleum over 10,000 square miles around the north of Roma. A topographic survey of the area, and geophysical surveys, gravity, magnetic and seismic, conducted by parties from the Bureau of Mineral Resources, were completed, and aerial photographs taken by the Royal Australian Air Force of the area held by the Company.

In 1952 Associated Australian Oilfields N.L. commenced drilling, and 5 holes were drilled, two on Block 16 and 3 on Hospital Hill in Roma. Those on Block 16, No. 2 and 3, were drilled to 3,616 and 3,605 feet respectively and found traces of oil in thin sands in the lowermost part of the Moolayember Shale. No. 4, in the Showgrounds on Hospital Hill, was drilled to 3,891 feet and entered metamorphic rock at this depth. A flow of wet gas of more than 870,000 cu. ft. per day was tested between 3,700 and 3,716 feet. No. 5, north-east of No. 4, was drilled to 4,079 feet and No. 6, south-east of No. 4 to 4,285 feet; in these the gas flow was not economic.

Arcadia

After making geological surveys of the district, in August and September, 1935, Oil Search Limited put down a scout bore to a depth of 442 feet on Arcadia Dome, 85 miles north of Roma. Traces of oil and gas were met between 195 and 300 feet. At the beginning of 1936, Drillers Limited, a subsidiary of Oil Search Limited, commenced a deep test on this structure. Drilling was suspended in September 1939 when the bore was 6,036 feet deep. A normal type of natural gas was met with at 1,187 feet which tested at 250,000 cubic feet per day, and between the depths of 2,487 and 2,900 feet other gas horizons were cut. The gas from the lower horizon gave a flow test over a period of several months of about 3,000,000 cubic feet per day. This gas contains about 70 per cent carbon dioxide.

Drillers Ltd. started a test well on Hutton Creek Dome, 60 miles north of Roma, in October 1935. The bore entered steeply dipping and sheared sediments at a depth of

about 4,080 feet and was abandoned at a depth of 4,688 feet. Opinion has been divided as to whether the high-dipping beds represent pre-Permian bedrock or a fault zone in the Permian. To the authors the evidence seems conclusive in favour of the fault hypothesis.

Springsure Area

From 1939 to April 1944 and from 1947 to 1952 a subsidiary of the Shell Company, Shell (Queensland) Development Pty. Ltd., was engaged in a geological, aerial and geophysical survey of Central, South-western and Western Queensland. Approximately 32,200 square miles were covered by geological mapping and reconnaissance, 192,000 square miles by geophysical survey (mostly reconnaissance gravimeter) and 10,000 square miles by aerial photography. Two Authorities to Prospect to search for Petroleum were held, over areas aggregating 59,000 square miles, as well as three Prospecting Petroleum Permits embracing 525 square miles near Roma. Geological surveys and scout boring were carried out in the Rolleston area about 262 miles west of Rockhampton and 38 scout bores with an average depth of 800 feet were drilled in the district. A promising geological structure was delineated at Warrinilla and the Company drilled a test-well (Morella No. 1).

From 1st April, 1940, to close of operations, the Company expended £920,000 in investigating the possibilities of petroleum occurrence on its areas in Queensland.

During 1954-55 Australasian Oil Exploration Company drilled two bores on Reids Dome, a structure mapped in 1930 by J. H. Reid, who was then a geologist of the Queensland Geological Survey. Small shows of gas were reported. One test bore was drilled on the Consuelo Anticline (Webb 1956).

Southern Queensland

Other Companies including Commonwealth Oil Refineries and Superior Oil Company have made geological reconnaissances in Southern Queensland. The Australian Mining and Smelting Company Ltd. was granted an Authority to Prospect for Petroleum over an area of approximately 25,200 square miles in the south-west portion of Queensland, for a term of one year commencing on 1st March, 1947. The authority was later transferred to the Frome-Broken Hill Company Pty. Ltd., an organization formed by D'Arcy Exploration Company Ltd., Vacuum Oil Company Pty. Ltd., and Zinc Corporation Limited. The Frome-Broken Hill Company carried out aerial and geophysical surveys - gravity and magnetic - over that part of the Great Artesian Basin lying within the boundaries of the Permit. On completion of the surveys, the Company abandoned the area.

A small Queensland company known as the Condamine Oil Limited holds a permit covering 100 square miles in the Speculation District about 22 miles north of Chinchilla. The first exploratory bore was started by this Company in April 1948. At the end of 1956 this bore, being drilled by percussion plant, had reached a depth of 2,287 feet and was in a conglomerate, composed largely of igneous materials, and thought to be pre-Mesozoic. Oil and gas shows have been reported.

During 1955 a hole was drilled at Wellington Point (Winnellls) to a depth of 3,748 feet, passing through basalt and Mesozoic fresh water sediments into Palaeozoic schists.

Maryborough Basin

In 1954, the Lucky Strike Drilling Company drilled two bores. Cherwell No. 1 and Susan Creek No. 1 in the

Maryborough Basin, after only very rapid geological reconnaissance.

Longreach

At Longreach, small quantities of an impure paraffin wax have been flowing for some years from a bore which supplies the town with water. Similar material was met with in a neighbouring bore, drilled by Longreach Oil Wells Limited for oil. Petroliferous gas is known to occur in the same district.

Since 1955, Longreach Oil N.L. has drilled four bores in the vicinity of Longreach. Westland Oil Co. carried out a gravity survey of a large area south of Longreach and drilled three bores.

EXPENDITURE

An estimate of the expenditure by individual companies is not easy to compile. Table 2 sets out the available information.

Table 2.

	£.
1. To 1931 inclusive:	
Geological	5,000
Geophysical	20,000
Scout Boring	20,000
Drilling (59,000 feet percussion, 50,000 feet rotary)	750,000
	795,000
2. 1932-1945:	
(a) Oil Search Ltd. and subsidiary (Drillers Limited).	
Geological and Administrative	43,543
Drilling (incl. plant, £31,088 and Commonwealth Subsidy £31,485)	98,223
	141,766
(b) Roma Blocks Oil Company Drilling (incl. Commonwealth Subsidy £10,142)	35,000
Exploration	65,000
(c) Shell (Queensland) Development Pty.Ltd. Geological geophysical and aerial surveys	219,400
	461,166
3. 1946 to end of 1956:	
(a) Roma Blocks and associated companies	39,064
(b) Associated Australian Oilfields N.L. (Including expenditure on surveys in Northern Territory)	589,820
(c) Westland Oil Co. Ltd.	483,405
(d) Australasian Oil Expl. Ltd.	1,267,015
(e) Winneill's Pty. Ltd.	51,871
(f) Lucky Strike Drilling Co. Pty. Ltd.	264,217
(g) Longreach Oil Ltd.	171,365
(h) Shell (Qld) Development Pty. Ltd.	701,000
(i) Sundry, estimated	200,000
	£3,767,757
TOTAL	£5,023,923

GEOLOGY

Before World War II, subsurface investigation was concentrated on Roma largely because of the chance striking of gas in a water bore there, in 1900. Since the war investigations have been carried out over a wide area.

Roma District (Reeves, 1947)

Stratigraphy: The Roma district is at the eastern edge of the Great Artesian Basin, which generally contains Triassic, Jurassic and Cretaceous sediments. Permian sediments outcrop to the north of Roma. These consist in descending order of up to 2,800 feet of clay shale, 400 feet of arkosic calcareous sandstone with beds of coal, 1,200 feet of dark marine shale and sandy limestone, 600 feet of dark sandy marine shale, 1,700 feet of coarse sandstone and more than 300 feet of marine shale.

Unconformably overlying the Permian are Lower and Middle Triassic non-marine fine-grained sandstone and tuffaceous shale which are up to 1,400 feet thick. These are separated by an unconformity from Upper Triassic non-marine sandstone (coarse to fine grained) and clay shale, about 1,000 feet thick.

Conformable above the Upper Jurassic beds is a series of non-marine sandstone, sandy shale and coal beds of Jurassic age, about 2,500 feet thick. Conformably above this again is a thickness of about 200 feet of dark marine Cretaceous shale with friable porous sandstone at the base, which forms the basal part of the Roma Group outcropping to the north of Roma.

Structure: Around Roma itself the Cretaceous and Jurassic strata dip gently southwards at between 45 and 100 feet to the mile. Farther north anticlinal structures occur in the Triassic and Permian strata. There is some suggestion of an east-west fault just north of Injune.

Oil and Gas Indications: Most of the gas and many of the oil showings in the Roma wells came from gritty and coarse sandstone 2 to 5 feet thick near the base of the Triassic Moolayember Shale. In the Arcadia Well the gas came from Permian Middle Bowen Aldebaran Sandstone.

Springsure Area (Hill, 1957)

The Springsure Area, to the north of the Roma area, has been investigated mainly since the war, although some earlier work on regional geology had been done (Reid, 1930).

Stratigraphy: Devonian sediments rest unconformably on schist and granite west of Springsure. Carboniferous sediments overlie the Devonian there and Permian sediments overlie the Carboniferous and outcrop over large areas to the west and south-east of Springsure. Triassic and Triassic-Jurassic sediments overlap the Palaeozoic.

The lower beds in the Devonian consist of 3,500 feet of arenaceous sediments with minor shales; the upper part of the Devonian consists of 4,000 feet of conglomeratic sandstone, unconformable on the lower formation, with minor mudstone, and 3,000 feet of sandstone and claystone with thin limestone beds.

The lowermost conglomerate and sandstone of the Carboniferous (200 to 1,100 feet thick) is unconformable on the Devonian. Above this is flaggy sandstone 1,100 feet thick followed by 8,500 feet of felspathic sandstone and siltstone with lenses of algal limestone.

The Permian deposits west of Springsure are mainly continental and comprise lowermost glacial sediments 2,400 feet thick, sandstone 4,500 feet thick, fossiliferous marine limestone 50 feet thick and sandstone 1,300 feet thick.

South-east of Springsure the Permian sequence exposed consists of 2,000 feet of sandstone, shale and sandy limestone with some glacial sediments and marine fossils; 500 feet dark shale and thin marly limestone with marine fossils; in some places andesitic volcanic rocks at least 300 feet thick; 2,500 feet of sandstone; 500 feet of shale, marl, sandstone and limestone with abundant marine fossils; 200 feet of sandstone; 100 feet of limestone, marl and shale with rich marine fauna; 300 feet of carbonaceous shale; and 700 feet of sandstone, shale and coal seams.

Triassic and later sediments are discussed under "Great Artesian Basin".

Structure: There are several well-expressed anticlines in the area, three of which (Morella, Reids Dome, and Consuelo) have had bores drilled on them.

Great Artesian Basin (Whitehouse, 1955).

Small shows of petroleum have been reported from many artesian water bores in the Great Artesian Basin (Mott, 1952). Several bores have been drilled (as at Longreach) apart from the numerous bores put down for artesian water.

Stratigraphy: Sediments ranging in age from Triassic to Cretaceous occupy the Basin. Underlying these are Palaeozoic sediments and metamorphic and granitic rocks. Little is known of the geology or distribution of Palaeozoic sedimentary rocks under the Artesian Basin although these may be of importance in the search for oil.

The Triassic sediments of the Great Artesian Basin consist of sandstone, siltstone and shale ranging in thickness from about 800 feet to 2,700 feet. They crop out only in the central part of the eastern margin of the basin. They are known as far west as Middleton in the subsurface and consist of continental sediments containing plant fossils.

Jurassic sediments from 1,000 to 2,850 feet thick crop out along the eastern margin of the Basin from near Aramac to near Moree (N.S.W.) and have been recognized in subsurface west of Longreach and Wyandra. Interbedded siltstone and sandstone predominate, with one sandstone formation near the top. The Jurassic is continental with plant fossils.

The Cretaceous sediments consist of siltstone, shale, thin sandstone and one sandstone formation at base. Part of the sequence is marine in origin. The thickness ranges from about 900 to about 4,500 feet. The area of outcrop is the main central part of the Basin - outcrop generally is very poor because of soil development over the siltstone.

Structure: The Great Artesian Basin is a very large but relatively shallow downwarp which is divided into several subsidiary but large basins by basement ridges. Much of the structural relief in the Mesozoic sediments is possibly caused by deposition over a surface of marked relief, perhaps increased by differential sagging and compaction.

Maryborough Basin

In a small basin north and south of Maryborough, Mesozoic sediments rest on indurated Permian sediments.

Stratigraphy: Permian marine sandstone, shale, limestone and tuff intruded by granite, and containing in places, as at Gympie, gold-bearing quartz reefs, probably form the floor of the Basin. Shale, sandy shale, sandstone and conglomerate of Triassic age unconformably overlie the Permian. Little is known of their thickness.

Lacustrine shale and sandstone with coal seams of Jurassic age have suffered intrusion. Little work has been done on this sequence.

The Cretaceous marine sediments previously reported as 600 feet thick (Bryan and Jones, 1945, p.63) were found to be at least 8,000 feet thick in Cherwell Bore No. I. Lacustrine sandstone and siltstone with coal seams total about 5,000 feet in thickness.

Structure: The generally synclinal shape of the basin is broken by several large anticlines only parts of which remain above sea level. Insufficient work has been done to indicate the details of the anticlinal structures.

PRESENT STATUS OF EXPLORATION

The following companies, at the end of 1956, held oil exploration tenements in Queensland:

Lucky Strike Drilling Co.; Associated Australian Oilfields N.L.; Australasian Oil Exploration Ltd.; Frome Broken Hill Pty. Ltd.; J. P. McCosh; Winniells Pty. Ltd.; Longreach Oil Ltd. and Oil Drilling & Exploration Ltd.; Oil Structure Surveys Ltd.; Kimberley Oil Exploration Syndicate Ltd.; Ozark Royalty Co.; South Queensland Petroleum Pty. Ltd.; E. Evans and J. Bjelke-Petersen; Longreach Oil Ltd.; Australian Mining and Smelting Co. Ltd.; Australian Oil and Gas Corporation Ltd.; Central Queensland Petroleum Pty. Ltd. and the Catawba Corporation; Condamine Oil Co.; Tallyabra Oil Pty. Ltd.; and W. C. Walz, H. T. Walz and A. E. Zurker.

No drilling was in progress except the Chinchilla Bore of Condamine Oil Co., but during 1957 bores have been started at Arcadia and near Tambo.

After a typical burst of drilling activity following the discovery of oil at Rough Range (Western Australia) in 1953, the tempo of the search for oil in Queensland has markedly decreased.

Although Oil Search Ltd. and Shell (Queensland) Development Pty. Ltd. carried out geological and geophysical investigations that led to drilling, nowhere in Queensland has there been the combined geological, geophysical and drilling exploration over large areas required to indicate the areas where oil may have been formed and is most likely to have accumulated. Almost all exploration in Queensland has resulted from chance encounters in water bores of shows of petroleum or from structural mapping without regard for the geological history of the area concerned.

On the basis of the rather poor stratigraphical, structural and palaeogeographic evidence available, it is thought by Condon that the following areas roughly in order of attractiveness, should be thoroughly investigated to determine the stratigraphic sequence and its variations, the structure and geological history. Drilling may be necessary to help in this investigation but, apart from this, random drilling may serve only to discourage investment in the

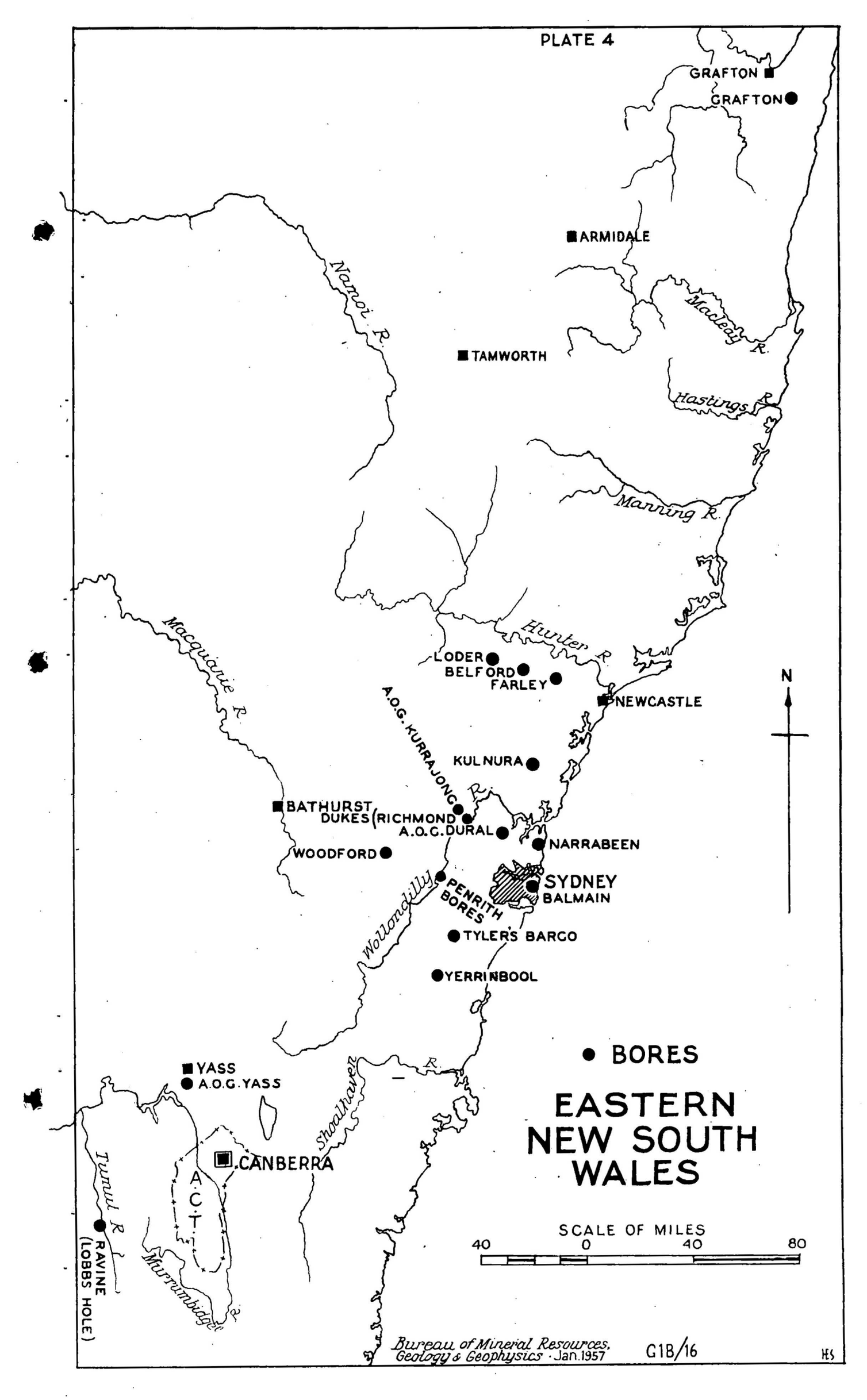
PLATE 4
GRAFTON
GRAFTON
ARMIDALE
Namoi R.
Macleay R.
TAMWORTH
Hastings R.
Manning R.
Macquarie R.
Hunter R.
LODER
BELFORD
FARLEY
NEWCASTLE
A.O.G. KURRAJONG
KULNURA
BATHURST
DUKES
RICHMOND
A.O.C. DURAL
NARRABEEN
WOODFORD
SYDNEY
BALMAIN
PENRITH BORES
Wollondilly R.
TYLER'S BARCO
YERRINBOOL
YASS
A.O.G. YASS
Shoalhaven R.
CANBERRA
A.C.T.
Tumut R.
RAVINE (LOBBS HOLE)
Murrumbidgee R.
N
BORES
EASTERN NEW SOUTH WALES
SCALE OF MILES
40 0 40 80
Bureau of Mineral Resources, Geology & Geophysics · Jan. 1957
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search for oil in an area where there is no lack of minor indications of its presence. The areas are Boulia, Carpentaria, Bowen, Maryborough, eastern margin of Artesian Basin, and Palmer River. Even the Springsure area and the central area of the Basin may repay adequate investigation.

NEW SOUTH WALES

(See Plate 4 for locality map)

HISTORY OF INVESTIGATIONS

Leo J. Jones (1921) reviewed the history of prospecting for oil in New South Wales up to 1921 in Mineral Resources No. 31, Geological Survey, N.S.W., and additional notes prepared by H. G. Raggatt were published in 1932. These reports have been drawn upon but it has also been necessary to abstract information from official files and company records (chiefly Oil Search Limited) to bring this account up to date.

Attention has been paid mainly to the Permo-Triassic rocks of central-eastern New South Wales.

Grafton District

A water bore drilled on the Grafton Racecourse between 1897 and 1902 encountered a show of dry gas.

About 1933, the Clarence River Oil Prospecting Company put down a bore for gas and oil, 2½ miles south of Halfway Creek, which is about 18 miles south-east of Grafton on the main Grafton-Woolgoolga road. The bore was drilled to 2,580 feet, was cased throughout and cored in part. No mapping or field investigation of any kind was done. No gas was noted during drilling, but it was found later that if the holes were plugged for a few days, gas containing 5% ethane would accumulate and burn for two minutes.

During 1955, a bore was drilled near Grafton by Clarence River Basin Oil Exploration Co. N.L. This was abandoned at a depth of 4,583 feet. No information is available on petroleum shows. (Press reports state some gas was encountered).

Hunter River District

The Hunter River district has been geologically mapped by the Geological Survey of New South Wales and several anticlinal structures are known. (Morrison 1925; Raggatt 1938; Booker 1953).

Loder Dome: Oil and Gas Investigations Ltd., put down a bore to a depth of 2,391 feet in 1926-1927 on a well-defined structure in the Upper Marine series of the Permian. The bore was discontinued after penetrating 352 feet into the Lower Marine series. Only slight gas shows were noted. It is estimated that expenditure in this venture amounted to approximately £200,000 including a Commonwealth subsidy of £2,260.

Belford Dome: In 1927-1928 Belford Dome Limited drilled two core holes to depths to 1,550 and 1,664 feet respectively and carried a test well to a depth of 1,498 feet using a cable tool rig. The structure had been adequately defined by geological mapping. The sequence proved is much the same as at the Loder Dome. Small gas showings were reported. This Company spent about £48,000 of which approximately half represents the cost of actual drilling.

Farley Bore: The Farley Bore, drilled by W. J. Maskell, was suspended at a depth of 5,364 feet in 1936. The site was not well chosen and the bore was in steeply dipping Lower Marine sediments throughout. Small gas showings were reported. A sum of about £12,000 was spent on drilling at this site.

Sydney-Gosford Districts

The bores drilled in this district in the search for oil are listed below. These all commenced in the Triassic and penetrated to or through the Upper Coal measures in the Permian.

Kulnura Bore: The Kulnura Bore was drilled by the Kamilaroi Oil Co. Ltd., a subsidiary of Oil Search Limited, in 1935-1938, to a depth of 6,293 feet. Small gas shows were logged. It is estimated that the expenditure on this enterprise was £50,000, including £17,000 Commonwealth Government subsidy.

Richmond Bores: Three bores were put down at Redbank, near Richmond, in 1910-1916, the deepest of which reached a depth of 877 feet. A trace of crude oil of paraffin base was reported from No. 3 Bore.

Penrith Bore: This bore was drilled to a depth of about 2,700 feet in 1918-1920. Gas was met, but owing to the poor technique employed in drilling, the flow could not be adequately tested.

Mulgoa Bore: This bore was put down by Gas Drillers Ltd., a subsidiary of Oil Search Limited, on a sharply folded structure* with a faulted and jointed crest. The bore reached a depth of 3,125 feet. Numerous gas showings were encountered over a wide vertical range. Estimated expenditure was £27,000 including £2,800 Commonwealth subsidy.

Narrabeen Bores Two bores were sunk at Narrabeen to a depth of 1,200 feet and 2,015 feet, both of which struck gas flows at 700 feet.

Balmain Bore (Raggatt, 1941): A bore drilled in 1932-1937 by Natural Gas and Oil Corporation Limited from the bottom of the Balmain Coal Shaft (itself 2,937 feet deep) reached a total depth of 4,937 feet. A small yield of gas was obtained between the depths of 4,180 and 4,530 feet. Gas was drawn off from the sealed colliery workings for a time during the war at the rate of 120,000 cubic feet per week and used in cylinders and bags as a petrol substitute in motor vehicles.

Yerrinbool Bore: In 1921-1922 the Yerrinbool Oil Prospecting Syndicate drilled a hole to a depth of 2,238 feet. There is no record indicating whether or not any oil or gas showings were encountered.

Tyler's Bargo Bore: Few details are known concerning the bore put down by Mr. Tyler, a few miles west of Bargo. It had reached a depth of 3,550 feet when operations were suspended in 1935. Some gas was noted during drilling.

Kurrajong and Dural: In 1954, Australian Oil and Gas Corporation started a geological, geophysical and drilling investigation of the Sydney district. In 1954 a bore was started at Kurrajong Heights and suspended later in the same year. In 1956 a bore was started at Dural and was still drilling at the end of 1956. Shows of inflammable gas were reported from the Dural Bore.

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* Five miles south-west of Penrith.

Other Localities

Most of the exploration that has been done outside the central-eastern Permo-Triassic basin and the Grafton District has little economic significance. In 1917 a bore was drilled to a depth of 763 feet at Ravine in the vicinity of the Lobb's Hole copper mine, Yarrangobilly district. This bore was drilled because inflammable gas had been observed issuing in the workings of the copper mine. Some drilling has also been done in the Tamworth and Scone district but the total footage involved in both localities is small.

Two oil bores were sunk in the vicinity of Jerilderie to depths of 1,150 and 800 feet respectively.

In 1956, Australian Oil and Gas Corporation Ltd. drilled a core-hole near Yass.

EXPENDITURE

An estimate of expenditure incurred in the search for oil in New South Wales is given in Table 3 below:

Table 3

	£	
To the end of 1945:		
Loder Bore (including Commonwealth Government subsidy of £2,260)	20,000	
Belford Bores	48,000	
Farley Bore (estimated)	12,000	
Kulnura Bore (including Commonwealth Govt. Subsidy of £17,000)(estimated)	50,000	
Richmond Bore (estimated)	5,000	
Penrith Bore (estimated)	7,000	
Mulgoa Bore (including Commonwealth Government subsidy of £2,800)	27,000	
Narrabeen	10,000	
Balmain Bore (excluding colliery experiment, estimated)	6,000	
Yerrinbool Bore (estimated)	7,000	
Tyler's Bargo Bore (estimated)	7,000	
All others (estimated)	30,000	£229,000
1946-1956:		
Australian Oil and Gas Corporation (includes survey costs in South Australia)	348,900	
Clarence River Basin Oil Exploration N.L. (includes survey costs in South Australia)	92,100	
Sundry unrecorded (estimated)	100,000	£541,000
TOTAL		£770,000

GEOLOGY

There are four sedimentary basins in New South Wales which have not suffered severe deformation - the Permian-Triassic Basin of east-central New South Wales (the Sydney Basin); the Mesozoic basin of north-western New South Wales (the southern part of the Great Artesian Basin);

the Mesozoic - mainly freshwater - basin of north-eastern New South Wales and southern Queensland, the Clarence-Ipswich Basin; and the Tertiary basin of south-western New South Wales (part of the Murray Basin). Most of the drilling has been done in the Sydney Basin.

The Sydney Basin:

This basin stretches from near Murrurundi in the north to near Bateman's Bay in the south and westerly from the coast to a few miles beyond Lithgow and Rylstone. An unknown but probably large part of the original basin is covered by the Pacific Ocean.

Stratigraphy: Table 4 shows the stratigraphic succession in this basin. The thicknesses given refer to the type areas and tend to be greater than the average. This applies especially to the Permian, for which thicknesses are from the Hunter Valley. The formations listed are not present everywhere throughout the Sydney Basin. The sequence was laid down in a large gulf in which periods of free access to the sea alternated with periods of restricted access.

TABLE 4

"Series"		"Stage"	Thickness Feet	Lithology
TRIASSIC	Wianamatta		800	Shale, calcareous flaggy sandstone.
	Hawkesbury		1,000	Cross-bedded glistening white sandstone, fossiliferous shale.
	Narrabeen	Upper	560	Sandstone with shaly sandstone and shale.
		Middle	850	Red and green shale; sandstone and fine conglomerate.
		Lower	880	Red and green shale; sandstone and fine conglomerate.
PERMIAN	Upper Coal Measures	Newcastle	1,200	Conglomerate, sandstone, shale coal seams.
		Tomago	1,860	Shale and sandstone, coal seams.
	Upper Marine	Mulbring	1,200	Shales and shaly mudstones
		Muree	200	Sandstone, sandy mudstone, calcareous in part.
		Branxton	1,400	Sandy shale and mudstone
			1,500	Sandstone.
	Greta Coal		200	Fine conglomerate, sandstone shale and coal seams.
	Lower Marine	Farley	1,200	Sandy shale and mudstone Ravensfield sandstone (200') at base.
		Allandale	800	Calcareous mudstone, conglomerate (250') at base.
		Lochinvar	2,600	Shale, mudstone, sandstone, amygdaloidal basalt. Red brown shale at base.

The "Lower Marine" series is restricted in area (occurring around the Newcastle district only) but is quite thick. The "Upper Marine" rocks were deposited in a basin which in area was the biggest in the Permian-Triassic sedimentary episode in this area. The thickest deposit (about 5,000 feet) was laid down in the Newcastle area.

Between these two marine deposits are the Greta Coal Measures, up to 600 feet thick. Above the Upper Marine rocks is a thickness of up to 3,000' of Upper Coal Measures.

The marine sediments offer possible source beds of petroleum, the coal measures possibly source beds of dry gas and there are sufficient pervious sandstones and conglomerates to act as reservoir beds.

Structure: The regional structure of the Permian-Triassic sediments is synclinal. The low point of the basin is considered to occur in the Newcastle district, although the low point of the syncline in the Triassic sediments is in the Sydney area.

This structural basin is the original basin of deposition which has been altered but little. On the north-east the Hunter Thrust Fault modified that side of the basin bringing Kuttung (Carboniferous) Tillites over the Permian sediments.(Osborne,1949).

In the Permian rocks of the Hunter Valley there are many small anticlinal structures - the domes of the Singleton area and the faulted Muswellbrook and Lochinvar domes. The latter are eroded into the Lower Marine sediments while the smaller domes - the Loder, Belford, Sedgefield and Darlington Domes - have been eroded down to the Branxton Stage of the Upper Marine series. In the Triassic rocks one large domed anticline - the Kulnura Dome - has been mapped. One bore has been drilled on this dome. The anticline on which the Loder Dome is developed continues to the south and has a minor expression in the Triassic rocks. A small sharp anticline has been drilled at Mulgoa.

Oil Indications: Gas has been reported in small amounts from bores at Loder, Belford, Kulnura, Mulgoa, Farley, Penrith, Narrabeen, Balmain, Bargo and Dural. Oil shows have been reported from a bore at Richmond (probably in Narrabeen sediments). Reported gas appears to have come from Lower Marine, Greta, Upper Marine, Upper Coal and Narrabeen rocks. Only the bores at Loder, Belford, Kulnura, Mulgoa and Dural were located on domes.

PRESENT STATUS OF EXPLORATION

Almost all exploration before 1954 was by drilling, mainly without geological guidance in site selection. The exploration at present being carried out in the Sydney area by Australian Oil and Gas Corporation is well organized and directed and is more likely to obtain results which will continue to be useful in the search for petroleum or dry gas.

At the end of 1956, tenements for petroleum exploration were held by: Australian Oil and Gas Corporation; Clarence River Basin Exploration Company N.L.; Oil Search Limited; and Messrs. R. W. Addison and J. E. Gulliver.

Available geological and geophysical information is not suited to the requirements of oil exploration. In only one area - the Hunter River District - does the geological information have the precision necessary for planning oil exploration programmes. This deficiency is being overcome

VICTORIA.

(See plates 5a, 5b, and 6 for locality maps)

HISTORY OF INVESTIGATIONS

Drilling for oil in Victoria dates from 1914, but the principal activity has been since 1924, when a bore put down at Lake Bunga by the Lakes Entrance Development Co. (No. 50 on Plate 5b) on a site recommended by the Director of the Victorian Geological Survey, struck a flow of artesian water with traces of petroleum and a flow of natural gas at 1,070 feet. Since that date many companies have been formed to carry on operations in various parts of the State.

The East Gippsland area has continued to receive most attention. Before World War II, most exploration activity was restricted to wildcat drilling without geological or geophysical help in selecting sites. After the war, the Geological Survey of Victoria carried out geological surveys to help in the assessment of the oil potential and to locate drilling areas. The Bureau of Mineral Resources has carried out gravity, aeromagnetic and seismic surveys to indicate the regional shape of the Gippsland Basin and to indicate structural targets for drilling. The Bureau has also carried out gravity surveys in western Victoria and seismic test shooting over the basalt near Heywood.

Since the war, the investigation has not been restricted to the Tertiary sequence but has included the pre-Tertiary sediments. Shows of petroleum have been found in bores into the Jurassic of Gippsland at Woodside. Drilling is continuing there.

East Gippsland (Baragwanath, 1937).

Lakes Entrance (refer to Plate 5b). Fifty-two bores have been put down in the search for oil in the Lakes Entrance area. Of these three were drilled by the Victorian Mines Department, nine jointly by the Victorian and Commonwealth Governments and the remainder by the following companies:

Lakes Entrance Development Company;
Point Addis Oil Wells Company;
Tanjil No. 1 Company;
Tanjil No. 2 Company;
Cobden's Lakes Entrance Oil Trust;
Kalimna Oil Company;
Lake View Oil Company;
Mac's Lakes Entrance Oil Wells Ltd.;
Texland (Houghton's) Oil Company;
Gippsland Oil Company;
Midfield Oil Company;
Mid West Oil Company;
South Australia Oil Company;
Oil Search Limited; and
Austral Oil Drilling Syndicate.

Particulars concerning these bores are set out in Table 5 of this report. (The co-operation of the State Mines Department in compiling this statement is gratefully acknowledged).

TABLE 5

OIL BORES, LAKES ENTRANCE, VICTORIA

(Note: See Plate 5a for locations of bores 1-8 and 52; and Plate 5b for bores 9-52)

No.	Bore	Surface Level	Depth	Glauconitic Sandstone	Basement at	Basement Rock	Bottom Water	Oil	Reference and Notes
1.	No. 1, Ph.Bumberrah	5	1226'6"	32'6" @ 1194'	-	-	1500 gal/hr. at 1180'.	Nil	(9, p.7) Not checked against driller's log.
2.	No. 2, Pt.Addis Co.	5	949'	Absent	934?	Schist	1440 gal/hr. at ? 803' increasing 2800 at 933'.	See "notes" column.	(8, p.135) Driller reports traces of oil 850' to 864' in fine white sand.
3.	No. 2, Gippsland Oil Co.	225	1106'						(7, p.163)Drilling suspended in micaceous beds. W.G.
4.	No. 3, Gippsland Oil Co.	220	1461'	43' @ 1380'					
5.	No. 1, Gippsland Oil Co.	255	1766'	16' @ 1446'	1484'	Shale	Small sub-artesian flow at 1462'	Trace	(7, p.161) W.G.
6.	No. 1, Pt.Addis Co.	2	1474'	36' @ 1396'			120 gal/hr.at 1354; 20,000 gal/hr. at 1432'	Nil	(8, p.116) (4) W.G.
7.	No. 3, Ph.Colquhoun	5	1454'	≠20' @ 1434'				Nil	(10) (7) p.159-160.
8.	No. 1, Ph.Colquhoun North.	100	660'	Absent				Nil	(8) p.117 (4)
9.	No. 5, Ph.Colquhoun	10	1255'	≠1228-1249'				Nil	(10) (7) p.161 W.
10.	No. 2, Ph.Colquhoun	60	974'3"		974?'	Granite	Artesian flow @ 700', 967' and 974'.	? See "Notes" column.	(8, p.136) Driller reports traces of oil at 835'.
11.	No. 1, S.A. Oil Co.	187	1250'	29' @ 1150'?	1250'?	? Granite		Present	°Records unreliable
12.	No. 6, Ph.Colquhoun	175	1458'	23' @ 1401'	1457'	Granite		Nil	(10)
13.	No. 1, Kalimna Oil Co.	4	1474'	31'@ 1387'6"	1472'	Schist	Between 1414' and 1418'6"	Nil	(8, p.117) (5)
14.	No. 5, S.A. Oil Co.	139	1320'	?58' @ 1261'	?1320'	? Granite		Nil	Depth records doubtful.
15.	No. 2, Kalimna Oil Co.	163	1406'	34' @ 1370'	1406?'	? Slate		Nil	W.
16.	No. 3, S.A. Oil Co.	165	1350'	35' @ 1313'				10 gal/day. short tests. Over 3 gal/day for 216 days. Both bailing.	
17.	No. 1, Ph.Colquhoun	9	1404'6"	41½ @ 1331'	1404'	Granite	1800 gal/hr. @ 1358' increasing to 10,000.	1 pint/day	(8, p.89) (4) (2, p.646) W.C.
18.	No. 8, Ph.Colquhoun	6	1165'	44' @ 1050'	1155'	Granite	100-300 gal/hr. 1056-1104' 1300 gal/hr @ 1122'.	Up to 13 gal/day.	W.G.
19.	No. 1, Oil Search Ltd.	132	1276'	42' @ 1232'			Small quantity at 1271.	Very small amount.	
20.	No. 2, Oil Search Ltd.	142	1319'	≠36' @ 1283'				Pumping test 2 barrels/day = 70 gal/day. (Co's figures).	
21.	No. 4, Ph.Colquhoun	15	1509'9"	23' @ 1421'	1508'	Granite	At 1455'	Trace	(10) (7,p.160-161).

No.	Bore	Surface Level	Depth	Glauconitic Sandstone	Basement at	Basement Rock	Bottom Water	Oil	Reference and Notes
32.	No. 2, Tanjil No.1 Co.	177	1264' (see notes)	36' @ 1228'		? Granite		10 gal/day.	Co. records 1271. Oil Search Ltd.
23.	No. 4, Pt. Addis Co.	201	1348'6"	≠38' @ 1310'6"				106 gals. bailed in 18 days = 5.8 gals per day.	(9, p.7)
24.	No. 3, Mac's Oil Wells	30	1310'	At 1250'			Artesian	Present	
25.	No. 2, Mac's Oil Wells	50	1297'	≠35' @ 1262'			Artesian	110 gal/day bailing (Oil Search Ltd.)	Well still flowing Water & oil yield can be measured.O
26.	No. 1, Mac's Oil Wells	41	1308'	≠48' @ 1260'				Present	
27.	No. 1, Midwest Co.	183	1320'	30' @ 1280'				Present	
28.	No. 3, Lake View Co.	85	1285'	≠30' @ 1255'				?20 gal/day	
29.	No. 2, Midwest Co.	131	3400'	28' @ 1227'		Granite		Company's bailing test 1937, 114 days average 18.3 gal/day.	(11) W.
30.	Imray Bore, Austral Oil Syndicate	135	1274'	≠21' @ 1253'				5 gal/day over extended period	(6) (7,p.163) W.
31.	No. 11, Ph.Colquhoun	200	1238'	84½ @ 1149'	1238'	Granite		Present No test Hole water flooded.	
32.	No.4, S.A. Oil Co.	140	1255'	≠33' @ 1222'				7 months pumping average 6½ gal/day (Co's figures)	
33.	No. 6, S.A. Oil Co.	97	1255'	34' @ 1186'	?1255'	?Granite		Present	
34.	No. 7, S.A. Oil Co.	88	1255'	29' @ 1193'				7 months pumping average 15 gal/day. (Co's figures).	
35.	No. 1, Tanjil No. 1 Co.	196	1269'	≠31' @ 1238'				10 gal/day (Co's figures)	Oil Search Lt
36.	Houghton's Bore, Texland Co.	164	1274'	≠29' @ 1245'				Present	0.
37.	No. 2, S.A. Oil Co.	151	1305'	38' @ 1245'				Present	(3) W.O.
38.	No. 8, S.A. Oil Co.	144	1278'	≠28' @ 1250'				Co.'s figures: pumping Dec. 1932 to May 1934, average about 2 gal. dry oil/hr.	
39.	Foster's Bore, Austral Oil Syndicate.	93	1260'	≠31' @ 1229'			Fair quantity	100 gal/day (pumping).	(7) p.163.
40.	No. 10, Ph.Colquhoun	140	1382'	44' @ 1255'	1362'	Granite	Small quantity @ 1294'+	7.6 gal/day.	W.
41.	No. 3, Pt. Addis Co.	28	1241'	38' @ 1202'			1' water sand @ 1239'6" (in glauconitic bed) approx. 23 gal/day bailed.	686 gal.bailed in 88 days = 7.8 gal/day.	(8, p.137) (15, p.7)
42.	No. 1, Tanjil No. 2 Co.	231	1360'	31' @ 1290'		Granite		Present	
43.	No. 1, Midfield Co.	199	1305'	≠33' @ 1272'				Present	
44.	No. 2, Midfield Co.	173	1308'	≠28' @ 1280'				Present	

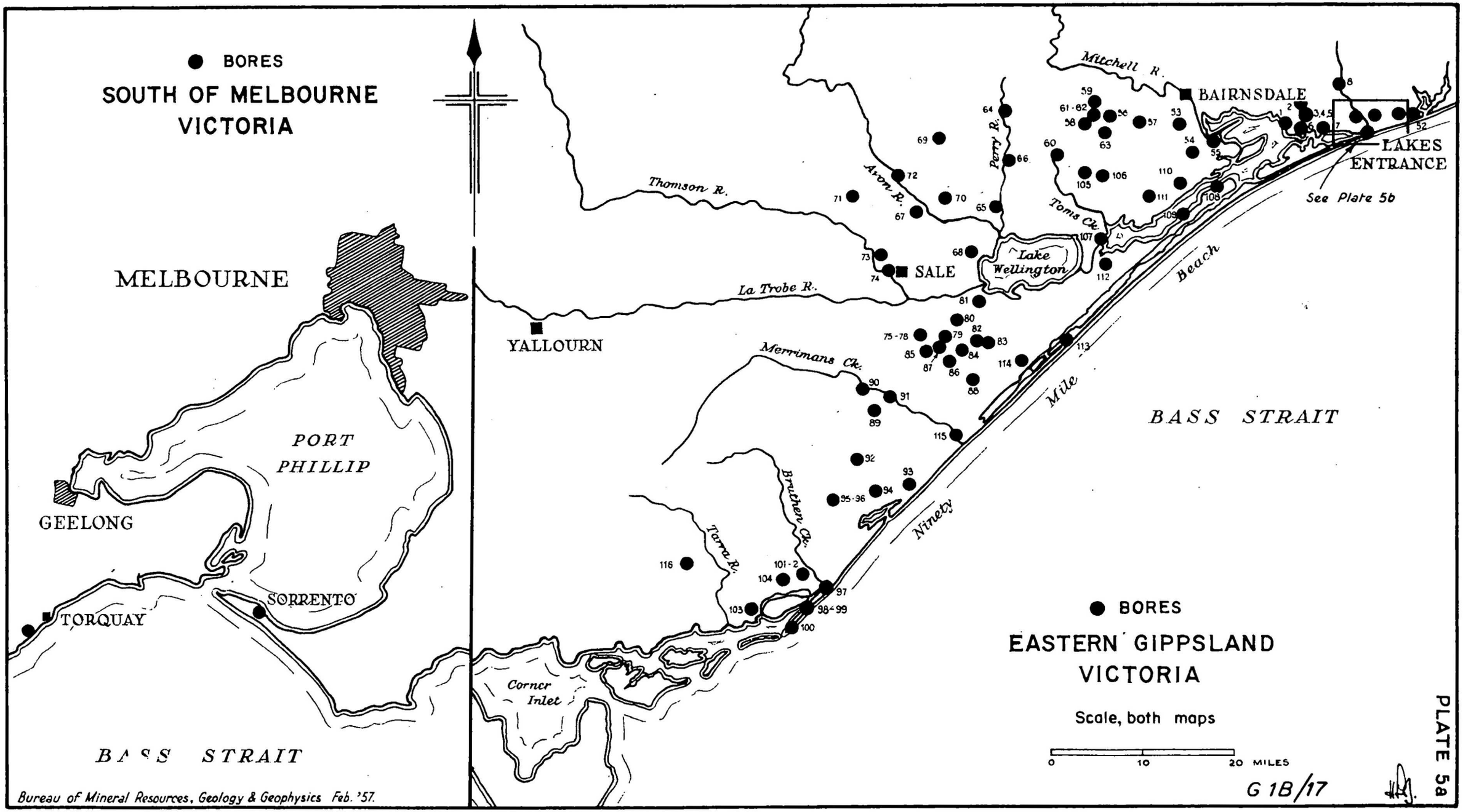
No.	Bore	Surface Level	Depth	Glauconitic Sandstone	Basement at	Basement Rock	Bottom Water	Oil	Reference and Notes
[illegible]	No. 2, Lake View Co.	177	1341'	¤39' @ 1302'				Present	
[illegible]	No. 3, Oil Search Ltd.	117	1310'6"	34' @ 1276'			Pumping 128 gal/hr.	Pumping test 2 gal/hr.= 48 gal/day. (Co. figures)	Oil at base of reservoir bed. 1308'-1310'. Water sand 1310'-1310'6".
[illegible]7.	No. 2, Lakes Entrance Development Co.	31	1275'	61' @ 1209'	1270'	Granite	60 gal/hr.	1 pint/day	W.G.O. (8, p.69) (1, p.56; 2, p.646).
[illegible]8.	No. 1, Lake View Co.	141	1207'	37' @ 1170'	?	? Slate		Present	
49.	No. 9, Ph.Colquhcun	7	1244'	40'6" @ 1186'	1242'	Hornfels	Artesian 93 ga/hr. at 700'.	Nil	
50.	No. 1, Lakes Entrance Development Co.	9	1215'	(4) 16' at 1084' (8) 31'6" at 1080'.	1210'	Slate	1200 gal/hr.	Trace	W.G.O. (8, p.24)
51.	No. 7, Ph.Colquhoun	5	1221'6"	35' @ 1185'	1221'	Slate		Nil	(10) W.
52.	Cobden's Bore	20	1507'	Absent	?	? Granite	1354'-1480'; water rising to 10' from surface.	Nil	Log does not specify granite as bedrock.

W = Water analyses made at Mines Department Laboratory
G = Gas " " " " " "
O = Oil " " " " " "
¤ = Full thickness of glauconitic sandstone not penetrated.

- - - - - - - - - -

The numbers in the last column refer to the following publications:

1. Baragwanath, 1937a;:
2. Baragwanath, 1937b;
3. Binney, 1937;
4. Chapman and Crespin, 1932;
5. Chapman and Crespin, 1935;
6. Croll, 1939;
7. Croll, 1940;
8. Records of Boring Operations, Mines Department of Victoria, 1923-1930;
9. Ibid., 1931-37;
10. Annual Report, Secretary for Mines, Mines Department, Victoria, 1940;
11. Thomas, 1937;
12. Crespin, 1943.


BORES
SOUTH OF MELBOURNE
VICTORIA
MELBOURNE
PORT
PHILLIP
GEELONG
TORQUAY
SORRENTO
BASS STRAIT
Bureau of Mineral Resources, Geology & Geophysics Feb. '57.
Thomson R.
Avon R.
Perry R.
Mitchell R.
BAIRNSDALE
LAKES
ENTRANCE
See Plate 5b
Toms Ck.
Lake
Wellington
SALE
La Trobe R.
YALLOURN
Merrimans Ck.
Brucher Ck.
Tarra R.
Corner
Inlet
Ninety
Mile
Beach
BASS STRAIT
BORES
EASTERN GIPPSLAND
VICTORIA
Scale, both maps
0
10
20 MILES
G 1B/17
PLATE 5a

The total footage drilled in the area amounts to 68,106 feet. The drilling has served to delineate an area of at least eight square miles within which oil occurs in a glauconitic sandstone of ~~Middle Miocene~~ Eocene age at an average depth of about 1,200 feet. The Companies engaged in the area have reported to the Victorian Mines Department a production of 107,129 gallons of oil for the period 1930 to July 1941, and Messrs. Ramsay and Treganowan state that they have purchased approximately "100,000 gallons of dehydrated crude oil" from producers at Lakes Entrance.

It was proposed to develop this area by horizontal drilling from a circular shaft which was put down at Lakes Entrance during the war under the joint direction of the Commonwealth and State Governments. The shaft is a circular concrete one, 10 feet inside diameter, and was sunk to a depth of 1,156 feet , approximately 40 feet above the top of the oil-bearing glauconitic sandstone. In June, 1945, a diamond drill hole was drilled from the shaft bottom to 1,220 feet. Further tests made at shaft bottom indicated that production on a commercial scale was not likely to result, and the project was abandoned by the Governments on 9th May, 1946. Later work was done in the area by Lakes Oil Limited. A pilot bore was drilled to 1,310 feet and passed into the glauconitic sandstone at about 1,190 feet. The Company then did some drilling from a work chamber at the base of the shaft, in an attempt to secure commercial production of oil, but the attempt was unsuccessful.

Bairnsdale-Sale Area. (Refer to Plate 5a)
Of the 50 bores listed in Table 6, fifteen were put down by private companies. These companies includes:

Oil Search Limited;
Texland Oil Company;
Lake Wellington Oil Wells;
Amalgamated Oil Syndicates;
Signal Hill Oil Exploration Company;
Valve Oil Wells;
Tanjil-Pt. Addis Company; and
Midfield Oil Company.

In the table, the numbers of the bores refer to Government bores, unless otherwise stated.

(To accompany Plate 5b, G1B/18)

Bores for Oil, Lakes Entrance, Victoria.

9. Colquhoun Parish No. 5
10. Colquhoun Parish No. 2
11. S.A. Oil Co. No. 1
12. Colquhoun Parish No. 6
13. Kalimna Oil Co. No. 1
14. S.A. Oil Co. No. 5
15. Kalimna Oil Co. No. 2
16. S.A. Oil Co. No. 3
17. Colquhoun Parish No. 1
18. Colquhoun Parish No. 8
19. Oil Search No. 2
20. Oil Search No. 3
21. Colquhoun Parish No. 4
22. Tanjil No. 1 Co., No. 2
23. Pt. Addis Co. No. 4
24. Mac's Oil Wells No. 3
25. Mac's Oil Wells No. 2
26. Mac's Oil Wells No. 1
27. Midwest Co. No. 1
28. Lake View Co. No. 3
29. Midwest Co. No. 2
30. Austral Oil, Imray Bore
31. Colquhoun Parish No. 11
32. S.A. Oil Co. No. 4
33. S.A. Oil Co. No. 6
34. S.A. Oil Co. No. 7
35. Tanjil No. 1 Co., No. 1
36. Texland Co., Houghton's Bore
37. S.A. Oil Co. No. 2
38. S.A. Oil Co. No. 8
39. Austral Oil, Foster's Bore
40. Colquhoun Parish No. 10
41. Pt. Addis Co., No. 3
42. Tanjil No. 2 Co., No. 1
43. Midfield Co., No. 1
44. Midfield Co., No. 2
45. Lake View Co., No. 2
46. Oil Search No. 1
47. Lakes Entrance Development, No. 2
48. Lake View Co., No. 1
49. Colquhoun Parish, No. 9
50. Lakes Entrance Development, No. 1
51. Colquhoun Parish No. 7

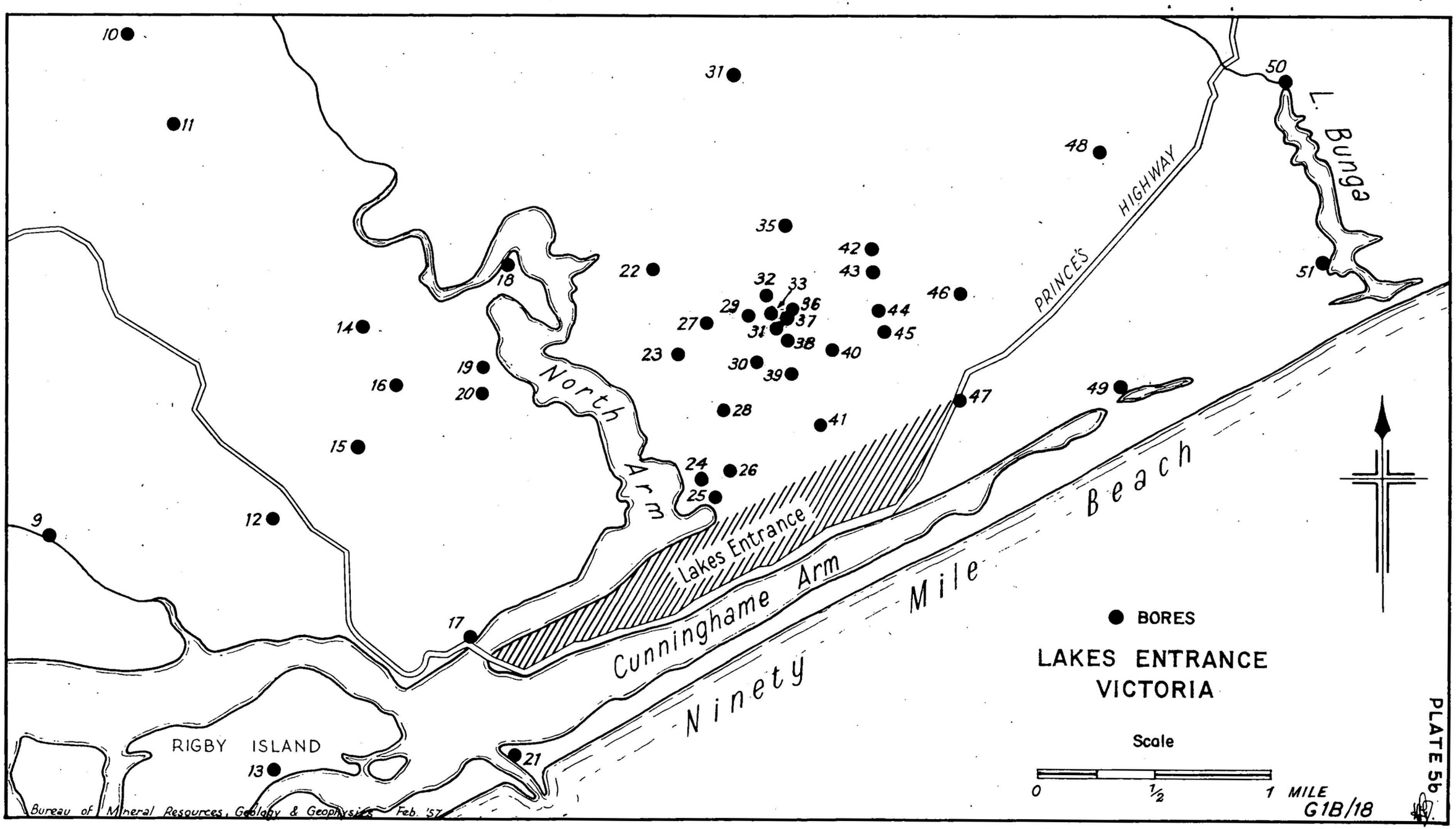

North Arm
Lakes Entrance
Cunninghame Arm
Ninety Mile Beach
PRINCES HIGHWAY
L. Bunga
RIGBY ISLAND
BORES
LAKES ENTRANCE
VICTORIA
Scale
0
1/2
1 MILE
Bureau of Mineral Resources, Geology & Geophysics Feb. '57
G1B/18
PLATE 5b

Table 6.

Bores in the Bairnsdale-Sale District

Parish	Name or Number	Depth (in feet)	Number on Plate 5a
Bairnsdale	3 (Cobbler's Creek)	866	53
	4 (Forge Creek)	1,410	54
	5 (Eagle Point)	1,541	55
Moormurng	1	1,021	56
Frome Lakes Pty. Ltd.	5 (Gippsland)	1,550	57
Coongulmerang	1	945	58
	2	640	59
	3 (Tom's Creek)	1,200	60
Oil Search Ltd.	1 (Bravo Plant)	282	61
	2 (Bravo Plant)	306	62
	3 (Steam Drill)	1,446	63
Nindoo	1	530	64
Yeerung	1	1,340	65
Meerlieu	1	1,200	66
Nuntin	1	1,452	67
	2 (Lake Kakydra)	3,560	68
Stratford	1	561	69
Frome Lakes Pty. Ltd.	4 (Gippsland)	1,815	70
Bundalaguah	1	575	71
	2	650	72
	3	552	73
Wurruk Wurruk	1 (Sale)	3,214	74
Glencoe	2	947	75
	3	214	76
	4	340	77
	5	532	78
	6	605	79
	7	1,380	80
	8	1,406	81
Texland Oil Co.	1	1,085	82
Lake Wellington Oil Wells	1	2,217	83
Glencoe South	2	927	84
Tanjil - Pt. Addis Co.	1	1,400	85
	2	2,760	86
Midfield Oil Co.	1	960	87
Wulla Wullock	2	1,420	88
Stradbroke	14 (Monkey Creek)	1,505	89
	15	640	90
	16 (Merriman's Creek)	1,476	91
Darriman	3	1,207	92
	4	1,245	93
Frome Lakes Pty. Ltd.	1 (Darriman)	4,730	94

(Table 6 Cont'd.)

Parish	Name or Number	Depth (in feet)	Number on Plate 5a
Woodside	5	312	95
	6	137	96
Woodside (Lakes Entrance N.L.)	1	6,008	97
	2	8,862	98
	3	5,985	99
	4	(Drilling)	100
Frome Lakes Pty. Ltd.	1 (Gippsland)	790	101
	1a (Gippsland)	1,962	102
	2 (Gippsland)	1,552	103
	3 (Gippsland)	1,876	104
Bengworden Oil Search Ltd.	1	924	105
	2	1,087	106
Bengworden South	1 (Holland's Landing)	4,004	107
Boole Poole	1 (Sperm Whale Head)	3,110	108
Valve Oil Wells	1 (Pelican Point)	2,309	109
Goon Nure	1 (Romawi)	3,244	110
Amalgamated Oil Syndicate	1	2,890	111
Seacombe	1	1,616	112
Dulungalong	1	1,616	113
Signal Hill Exploration	1	2,295	114
Giffard	14	1,600	115
Devon Westralian Oil Ltd.	1 (Yarram)	1,875	116
		107,706	(without Woodside - Lakes Entrance 4)

Port Phillip (Refer to Plate No. 5a).

The drilling done on both sides of Port Phillip is summarised hereunder:

	Feet
Sorrento Bore (Gov't)	1,696
Torquay Bores (Pt. Addis Co.)	
No. 6	842
No. 7	922
Torquay Oil Wells (five bores)	4,552
	8,012

Western Victoria (refer to Plate 6).

The following bores have been put down:

	Feet
Hamilton, Ph. Yulecart (Gov't)	252
Comaum Bore (Pt. Addis Co.)	1,171
Ph. Dartmoor (24 Govt. bores)	3,096
Mumbannar No. 1 Bore (Mersey Valley Oil Co.)	1,100
Portland (Producing Oilfields)	2,835
Nelson, Ph. Glenelg (Gov't)	7,305
(Western Petroleum)	1,000
Ph. Palpara (Pt. Addis Co.)	850)
	17,609

The Commonwealth and State Governments jointly drilled the Nelson Bore, which was put down to prove the Tertiary sequence in the area. Drilling was suspended on 28th November, 1945, at a depth of 7,305 feet. The bore finished in sediments which may be of lowest Eocene or Cretaceous age, without encountering any indications of petroleum. The thickness of Tertiary sediments proved - more than 5,300 feet - was much greater than was expected.

EXPENDITURE

Table 7 sets out the estimated expenditure on oil exploration in Victoria to the end of 1956.

Table 7

To the end of 1945:	£	
Victorian Government (1924-32 and 1935-41)	35,000	
Nelson Bore	36,385	
Commonwealth Government (1935-41)	19,000	
Nelson Bore	36,385	
Oil Search Limited		
Test Wells	9,700	
Geology, geophysics and scout drilling	11,000	
Austral Oil Drilling Syndicate	40,000	
Other Oil Companies (including Sth. Australian Oil Wells)	105,000	
	292,470	292,470

Table 7 (Cont'd.)

1946-1956:		
Frome-Broken Hill Pty. Ltd.	£362,600	
Woodside (Lakes Entrance) Oil Co. N.L.	379,658	
Sundry unrecorded, excluding expenditure by Lakes Oil Ltd. on horizontal drilling from Lakes Entrance S Shaft	150,000	
		892,258
Total		£1,184,728

GEOLOGY (Boutakoff, 1956).

Sedimentary basins which have not suffered severe deformation comprise the Carboniferous basins of the Mansfield district and the Grampians, the Jurassic basin of South Gippsland and the Otway Ranges, and the Tertiary basins of Gippsland, Port Phillip Bay, Western Victoria and North-Western Victoria (part of the Murray Basin).

Mansfield Area

In the Mansfield district, about 150 miles north-east of Melbourne, is a deposit of sandstone, shale, limestone and conglomerate, with Carboniferous fish remains near the top. These rocks dip at low angles to the west and are bounded on the west by a major fault. The rocks were deposited in an estuarine environment. No anticlinal structures are known but minor faults and stratigraphic traps would provide closure in these rocks so that while not as favourable for oil accumulation as some other basins it should not be entirely disregarded.

The Grampians

Of probably the same age as the Mansfield Beds are the marine (estuarine) sandstones and shales of the Grampians area (200 miles west from Melbourne). Here the sediments are faulted and gently folded so that the nature and origin of the rocks and their structure are not unfavourable for oil accumulation.

Jurassic Sediments

Outcropping in South Gippsland and in the Otway Ranges is a deposit of fresh-water to estuarine greywacke, arkose, and coal, generally block-faulted and with some small folds. These rocks are thought to be unlikely as source rocks for oil but the coal measures may give rise to natural gas. It is possible that these pass eastward into marine sediments.

Gippsland

The Lakes Entrance area is part of a Tertiary marine basin of deposition which probably has not been deformed at all.

Stratigraphy: Up to 250 feet of Pleistocene to Upper Pliocene sand and clay rest on up to 250 feet of Lower Pliocene shelly marl. This rests on about 700 feet of Miocene bryozoal limestone and marl, about 300 feet of Oligocene &/or U. Eocene micaceous marl and glauconitic sandstone and up to 30 feet of Eocene ferruginous sandstone.

Structure: As far as is known the only structures are those due to conditions of deposition and to later compaction. There is a dip of up to 3 degrees southerly but little evidence of tilting, folding or faulting.

Oil Indications: Small oil and gas shows occur in the Miocene polyzoal limestone and in the Eocene glauconitic sand. Suitable structures are generally absent and the low permeability of the glauconitic sandstone makes this area a poor prospect.

Port Phillip Bay

In the Tertiary sedimentary basin in the Port Phillip Bay district, the beds range in age from Miocene to Pliocene and include marine, estuarine, and freshwater deposits. Sandstone, clay, limestone and lignite are included in these sediments. Some folding and faulting have occurred (e.g. at Beaumaris and Torquay). No oil indications have been reported.

Western Victoria and S.E. South Australia

On either side of the Victoria-South Australia border is a Tertiary basin of marine sediments. Little has been reported on the stratigraphy and structure of this basin but the presence of more than 7,000 feet of marine sediments justifies a search for structures in this basin. (Ward, 1941 and 1946; Sprigg and Boutakoff, 1953).

Murray Basin

The Murray Basin of Tertiary sediments extends from Murray Bridge to Corowa and from Wilcannia on the Darling to Nelson on the Glenelg.

Stratigraphy: Up to 350 feet of post Lower Pliocene sands rest on 150 feet of Lower Pliocene clays which overlie about 550 feet of Miocene limestones, over up to 500 feet of Eocene ligneous clays and sands. Near Corowa marine and glacial Permian sediments underlie the Tertiary.

Structure: A broad uplift in the South Australian portion of the Murray Basin south of the Murray River, extends into Victoria near Murrayville. Boring has revealed the presence of many gentle anticlinal structures in the Tertiary strata of the basin. Some of these are depositional structures but some at least are due to faulting in the pre-Tertiary bedrock (Gloe, 1947, p.116.

Oil Indications: Most of the bores put down in this basin have been water bores and in the logs of these bores no mention is made of gas or oil. In the southern part of the basin, in south-eastern South Australia and in Western Victoria, some oil bores have been drilled, not on defined structures.

PRESENT STATUS OF EXPLORATION

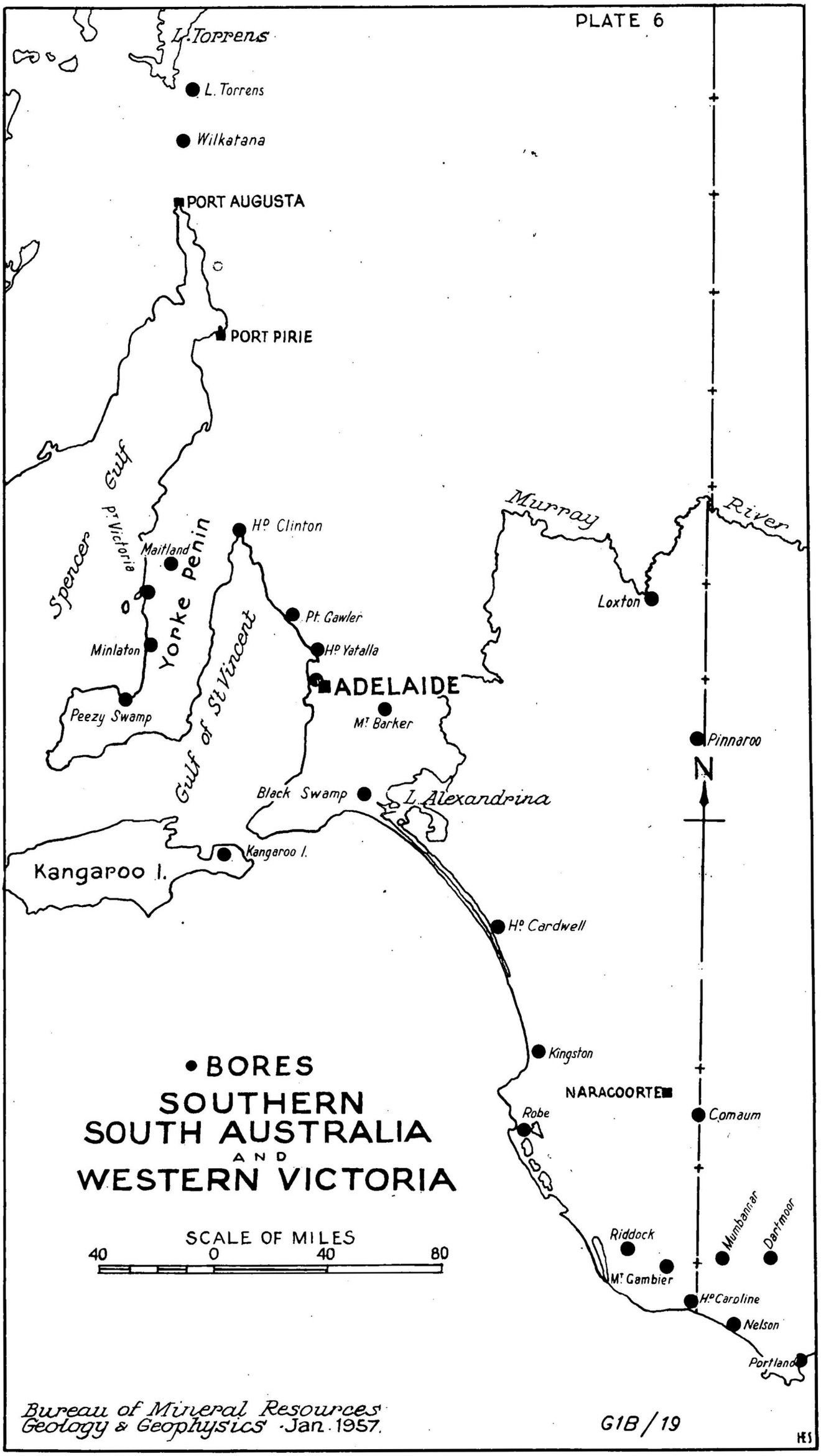
The following companies at the end of 1956 held petroleum tenements in Victoria (see Appendix 6):

Frome Broken Hill Pty. Ltd.; Lochiel Oil Search and Prospecting Co. Ltd.; Frome Lakes Pty. Ltd.; Frome Austral Pty. Ltd.; Mineral Ventures, N.L.; Woodside (Lakes Entrance) Oil Co. N.L.; Gippsland Oil Co. Ltd.; Oil and Minerals Quest N.L.; J. P. McCosh; Australian Paper Manufacturers Ltd.; G. D. Lindholm; A. E. Ekberg; and Pacific Mining Ltd.

Woodside (Lakes Entrance) Oil Company was drilling two bores, No. 2 and 4 at Woodside. Frome-Lakes Pty. Ltd. was drilling its Gippsland No. 5 six miles south west of Bairnsdale.

Woodside Bore No. 2 is notable as it is the first oil bore in Victoria to have drilled beyond the base of the Tertiary sediments. It is reported to be in marine Jurassic

PLATE 6



Bureau of Mineral Resources
Geology & Geophysics · Jan. 1957.

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sediments and to have encountered shows of light oil over a range of 1,000 feet (from 5120 to 6100 feet depth).

An aero-magnetic survey of the Gippsland Basin was carried out in 1956 by the Bureau of Mineral Resources. This should show the regional shape of the basin. Compilation of this work is progressing.

Trial seismic surveys over the basalt near Heywood in western Victoria have shown that reflections can be obtained through the basalt. This will open up the Mesozoic Tertiary basin under the basalt to seismic survey.

There has been no significant activity in western Victoria following the drilling of the Nelson Bore although the indication of thick marine sediments should have directed attention to the area. The Mines Departments of Victoria and South Australia carried out geological and gravity surveys and the area is held under permit by Frome Broken Hill Pty. Ltd.

TASMANIA

(See Plate 1 for locality map)

Sediments older than Permian in Tasmania are too strongly indurated and deformed to offer any possibility of petroleum accumulation. The east-central area of Tasmania contains marine and terrestrial sediments of Permian and Triassic age intruded by dolerite sills. The limits of the basin of deposition are poorly defined but, roughly, the western edge of the basin runs from Devonport to near Dover and the eastern edge from near Launceston to near St. Marys.

The only locality where any extensive amount of drilling has been done is the Mersey Valley district (MacIntosh Reid, 1924), where two companies have between them drilled 21 holes at an estimated cost of £60,000. The Mersey Valley Oil Co. Ltd. drilled 9 holes totalling 5,781 feet, and the Adelaide Oil Exploration Co. drilled 12 holes with an aggregate depth of 8,507 feet.

A hole has also been drilled to a depth of 430 feet (in 1915) on Bruny Island, and some shallow drilling has been done elsewhere.

The total expenditure on oil drilling in Tasmania is about £100,000.

SOUTH AUSTRALIA

(See Plate 6 for locality map)

HISTORY OF INVESTIGATIONS

The presence of coorongite, known since 1852, early directed attention to the Coorong area where the first bore for oil was drilled in 1892. A total of seven bores of an aggregate depth of 4,916 feet have been drilled in this area.

From 1915 to 1919 six bores were drilled in the Robe area. From 1925 to 1930, seven bores were drilled in the Mount Gambier district.

Up to 1930, no geological or geophysical mapping had been attempted. In 1930 a geological survey indicated an anticlinal structure about five miles west-north-west of Mount Gambier. A magnetometer survey was carried out on this structure, which was then drilled. Only one bore was put down and only one bore has since been drilled in this district.

In 1954, following geological surveys by state geologists in both South Australia and Victoria (Sprigg and Boutakoff, 1953) the Mines Department of South Australia conducted a gravity survey of the south-eastern part of South Australia, and the Bureau of Mineral Resources did a gravity survey of the adjoining area of Victoria.

Before World War II, bores had been drilled, mainly near supposed petroleum indications, in Yorke Peninsula, Eyre Peninsula, the Adelaide Plains and Kangaroo Island. Stratigraphic boring now being carried out by the South Australian Mines Department on Yorke Peninsula has found grease and slicks of oil in Permian tillite and underlying Cambrian beds.

Several artesian water bores in the area north and east of Lake Frome encountered inflammable gas. These bores were drilled in the south-western margin of the Great Artesian Basin.

In 1946-7, Frome-Broken Hill Pty. Ltd. carried out extensive geological and geophysical surveys in the area north-east of Lake Frome and drilled a bore at Kopperamanna, and two at Lake Cootarbarlow.

From 1955 to the present, South Australia and Northern Territory Oil Search (Santos) Ltd. have drilled several bores at Wilkatana where oil was reported in a water bore in 1934.

Clarence River Basin Oil Exploration N.L. carried out a geological survey of an area north of Woomera, in 1956.

Australian Oil and Gas Corporation drilled a bore at Loxton during 1956.

Murray Basin Oil Syndicate carried out an aeromagnetic survey of a large area between the Murray River and the Victorian border in 1955 and drilled a bore at Pinnaroo during 1956.

Very small traces of free oil were recorded by Cosmo Newbery from the No. 2 bore hole put down to test the coal measures at Leigh Creek (R.M.S.A., 1908, p.345). The Director of Mines has commented, also, that "possibly some oil was found in the 180 foot bore hole south of Lake Torrens, but, after the early report, attempts to collect even a few drops of oil were unsuccessful".

The Bureau of Mineral Resources carried out reconnaissance profile flying with the aero-magnetometer in the Eucla Basin in South Australia and Western Australia in 1954.

In 1955, gravity traverses were made along the Trans-continental Railway from Ooldea to Kalgoorlie and thence to Perth, along the Eyre Highway from Ceduna to Norseman, and from Mundrabilla on the highway to Forrest on the railway.

Table 8 hereunder lists bores drilled for oil in South Australia and gives their depths. Most of them call for little comment as they were put down at locations which even the most optimistic geologist would regard as hopeless. The main interest, as stated above, has attached to the south-east corner of South Australia and particularly the Mount Gambier district. The depth to bedrock in the Mount Gambier district has never been

determined but as sedimentation in that area was continuous with adjoining areas across the border in Victoria, the Nelson Bore, which was drilled to a depth of 7,305 feet by the State and the Commonwealth Governments, served to outline the geological section for both States.

Table 8

Wells bored for oil in South Australia

Locality	No. of Bores	Depth in Feet
Coorong, Hd. Cardwell	7	922 931 650 656 701 606 450
Kingston Amalgamated Oil Wells	1	1,365
Enterprise Oil Co.	2	466 204
Southern Ocean Oil Co.	2	1,170 2,660
Robe, Hd. Waterhouse. (South Australian Oil Wells)	1	4,504
Mt. McIntyre, Hd. Riddoch (Adelaide Oil Exploration)	1	1,045
Hd. Hindmarsh (South Australian Oil Wells)	1	1,532
Mt. Gambier, Hd. Blanche (Associated Oil Corporation) (Producers Oil Wells) (Oil Search Ltd.)	3	 2,110 1,220 2,013
Hd. Caroline (South Australian Oil Wells)	4	1,226 1,824 1,561 839
Maitland, Yorke Peninsula (Adelaide Oil Exploration Co.)	2	404 1,549
Minlaton, Yorke Peninsula (Minlaton Oil Prospecting Syndicate) (Peninsula Oil Syndicate) (Adelaide Oil Exploration Co.)	3	 1,800 315 1,942
Peezy Swamp, Yorke Peninsula (Peninsula Oil Syndicate)	1	1,132
Hd. Wanilla (Eyre Peninsula Oil Co.)	1	150
Hd. Yatala (Co-op. Oil Co.) (Largs Bay Oil Co.)	2	 1,354 305
Pt. Gawler (Hallion's)	1	603
N.E. of Pt. Gawler	1	543
Hd. Clinton	1	133
Mount Barker	1	407
Black Swamp	1	352
Kangaroo Island	1	961
Kopperamanna (Frome-Broken Hill)	1	3,256
Lake Cootarbarlow (Frome Broken Hill)	2	1,343 1,615

Table 8 (Cont'd).

Wilkatana (SANTOS)	10	2,199 1,025 1,100 1,194 398 476 430 530 1,025 568
Loxton (Aust. Oil and Gas Corp.)	1	1,602
Pinnaroo (Murray Basin Oil Syndicate)	1	950

EXPENDITURE

It is difficult to give an estimate of the money which has been expended on drilling in South Australia. (Ward, 1944). Dr. L. Keith Ward, then Director of Mines, suggested in 1942 that the amount was not less than £200,000. In 1932 he had reported that the South Australian Oil Wells Company had spent approximately £100,000 on drilling in South Australia. Oil Search Limited had incurred an expenditure of £8,714 on drilling at Knight's Dome, and other operations are believed to have cost over £90,000.

An estimate of expenditure on oil search in South Australia is set out below:

Prior to 1942 (estimated)	£200,000
1942 to 1956:	
SANTOS Ltd.	167,421
Enterprise Oil Exploration Ltd.	92,463
South Aust. Mines Department	25,000
Sundry	50,000
	£534,884

GEOLOGY

There are four main sedimentary basins in South Australia the south-western part of the Great Artesian Basin, the south-western part of the Murray Basin, the eastern part of the Eucla Basin, and the Adelaide Basin.

Great Artesian Basin

The portion of this basin in South Australia covers the north-east part of the State east from longitude 134° east and north from latitude 30° south.

Stratigraphy: Up to 300 feet of argillaceous sandstone and sandy shale comprise the Tertiary Eyrian series which occupies much of the surface of this part of the Artesian Basin. Underlying this is the Winton series comprising up to 2,500 feet of shale, sandy shale and green sandstone with some lignitic matter. This series is overlapped around the margin of the basin by the Eyrian series. Conformably under the Winton series is the Rolling Downs series of up to 2,500 feet of shale with thin beds of limestone. This rests conformably on Jurassic sandstone up to at least 1,000 feet thick. This in places conformably overlies at least 500 feet of Triassic carbonaceous shales with beds

of sub-bituminous coal. Up to 3,000 feet of Permian shales and tillites occur under the Triassic coal measures on the western edge of the basin.

Structure: Boring for water has shown that although the general structure of the basin in synclinal there are many large anticlinal structures and fault structures, some related to high points and faults in the basement, others depositional structures.

Oil Indications: Inflammable gas was reported in the Quinyambie New Homestead Bore (completed 1945) at the south edge of the basin near the South Australian-N.S.W. border (Ward, 1946, p.216). This bore apparently reached the Jurassic sandstone. Few bores have reached the Triassic or Permian strata. More recently grease and oil slicks have been reported from Water bores in the Oodnadatta district.

Murray Basin

The part of this basin in South Australia covers the south-eastern part of the State east from 139° East longitude and south from about latitude 33° South.

Stratigraphy: 1,500 feet of Tertiary limestone, clay, sand, and lignite has been proved by boring near Renmark. Over 7,000 feet of Miocene limestone and Eocene (?) sandstone occurs at Nelson (in Victoria). Near Lake Cooee (Victoria) a bore went through 509 feet of Tertiary limestone and 662 feet of Jurassic Coal Measures - thin-bedded greenish shale and argillaceous sandstone with a few thin beds of limestone and some thin coal seams. The Jurassic coal measures are also reported from the Robe Bore (4,504 feet). Inliers of basement rock occur in the area north-west of Kingston.

Structure: As in Victoria, there are large arches (as at Penola) and smaller anticlinal and fault structures (e.g. the Tartwaup Fault).

Oil Indications: Inflammable gas was reported at 950 feet in the Blackford bore (about 12 miles east of Kingston). (Ward, 1946, p.261).

Eucla Basin

The portion of this basin in South Australia extends from the border with Western Australia easterly to longitude 132° East and from the coast north to latitude 30° South. The surface of this basin forms the Nullabor Plain.

Stratigraphy: A thickness of up to 1,100 feet of Tertiary limestone, clay, sand, and lignite lies in a gentle depositional synclinal basin.

Structure: Bore information shows no evidence of anti-clinal or fault structures though these probably exist.

Oil Indications: Gas was reported at 220 feet in the Muddaugana Bore (31°20'S, 130°45'E).

Adelaide Basin

This is a small Tertiary basin on the eastern shore of St. Vincents Gulf.

Stratigraphy: At the south end of the basin, marine and sandy limestone and sandstone totalling over 2,000 feet occur. These range in age from Cretaceous to Recent with an unconformity above the Lower Cretaceous sandstone, another above the Eocene

Sandstone and a disconformity between the Middle Miocene and the Pliocene.

Towards the north end of the basin estuarine and fresh water sediments including lignite occur.

Structure: The Adelaide Basin is a depositional syncline. There is good evidence in bores of faulting so that fault structures almost certainly occur.

Oil Indications: No oil or gas has been reported from the many bores drilled for water, but very few of these penetrate the full thickness of sedimentary rocks.

Pirie-Torrens Basin

In the area north and west of Port Pirie, there is a poorly defined area of Lower Palaeozoic and probably Upper Proterozoic sediments, covered in part by Tertiary sediments. Little is known of the details of the stratigraphy and structure.

Oil Indications: Oil was reported from a water bore at Wilkatana Station in 1934. SANTOS have drilled several holes in which they report shows of oil and gas in both Tertiary and Cambrian sediments.

PRESENT STATUS OF EXPLORATION

Five companies - SANTOS Ltd., Australian Oil and Gas Corporation, Murray Basin Oil Syndicate, Clarence River Basin Oil Exploration N.L., and Frome Broken Hill Pty. Ltd. - hold exploration permits in South Australia.

SANTOS Ltd. is continuing drilling in the Wilkatana area.

The discovery of shows of oil and gas in the Tertiary sandstone and in the Cambrian limestone of the Wilkatana area has directed attention to the Torrens Basin and to the Cambrian sediments which probably cover a large area around Lake Torrens, under Tertiary cover in most parts.

SANTOS Ltd. and Clarence River Basin Oil Exploration N.L. are carrying out geological surveys in this area.

The Loxton Bore of Australian Oil and Gas Corporation Ltd. was drilled through a thin but fairly complete sequence of marine Tertiary sediments and finished in Lower Cretaceous marine shale.

In the Murray Basin, geophysical work - gravity followed by seismic surveys - is required to indicate the regional shape of the basin and to help in the selection of drilling sites in structurally suitable locations. More information is required about the structure and stratigraphy of the rocks underlying the Tertiary in this Basin. The marine Cretaceous is of petroleum source-rock type and adequate reservoir rocks overlie it at the base of the Tertiary sequence. Good palaeontological and lithological markers are present in the Tertiary at depths less than 600 feet to enable structural core drilling to be carried out successfully.

In the Torrens Basin, much additional work is required on the stratigraphy and structure of both the Tertiary and pre-Tertiary sediments.

In the Artesian Basin, much additional work is required both on the Mesozoic rocks of the basin and on the older rocks underlying the basin. Field work in progress in the area around and east of Oodnadatta is revealing encouraging information.

WESTERN AUSTRALIA

HISTORY OF INVESTIGATIONS (Hobson, 1936).

Kimberley Area

In 1919 Walter Oakes reported the finding of glance pitch in basalt near the junction of the Negri and Ord Rivers. The discovery was confirmed by Blatchford (1922). The Oakes-Durack Company was formed and the area was geologically examined by D. J. Mahoney (1922). Following Mahoney's work, a bore was drilled to a depth of 1196 feet on the east side of the Ord River about 30 miles south of the Negri-Ord junction. From 788 feet onwards this bore passed through basalt. Gas of petroliferous and sulphurous odour was reported to be noticeable when the bore was 788 feet deep.

In 1919, Harry Price reported that he had obtained traces of oil in a water bore being sunk on Gogo Station, West Kimberley Division. This discovery was confirmed by Blatchford (1922). Freney-Kimberley Oil Company was formed and geological work was started. Four bores ranging in depth from 340 to 1008 feet were drilled in the vicinity of Prices water bore between September, 1922 and late 1923: Number 1, drilled September-December 1922 (1,008 feet), No. 2 drilled December 1922 (340 feet) and No. 3 drilled January to May 1923 (809 feet) sunk in the vicinity of Price's original bore, all showed traces of oil but Number 4 (444 feet), two miles to the west, showed no indications. Numbers 1, 2 and 3 all penetrated limestones, now known to be of Ordovician age, throughout their entire depths; number 4 started in Permian Grant Formation and passed into Devonian limestone at 444 feet depth.

Blatchford and Talbot continued geological surveys throughout the Fitzroy Basin; a drilling site was selected at Mt. Wynne. Drilling commenced, using a Calyx drill, about the middle of 1922. The first hole was carried to a depth of 896 feet, when it was decided to change to percussion drilling. It was found that the hole was crooked, and it was abandoned. Asphaltum was recorded at several depths, 109 feet, 118 feet 6 inches, 121 feet 6 inches, 225 feet, and 274 feet (?). Samples obtained at a depth of 120 feet were examined by Simpson (1922) and were considered to be true petroleum residues.

A second hole, beginning also near the top of the Grant Formation, was carried to a depth of 2,154 feet. The log of this bore is given in Bulletin 93 of the Geological Survey of Western Australia (Blatchford, 1927). The log shows that globules of oil were noted at various depths between 524 feet and 1,886 feet. Bitumen was also recorded between these depths and also shallower. A water-shut-off was attempted at 2,084 feet but failed owing to the shale band being thin and underlain by a friable sand containing water. Drilling was stopped in September, 1925, at a depth of 2,154 feet.

Following Dr. Wade's visit of inspection in 1924 and work by Blatchford and Talbot at the Poole Range, drilling was commenced on the Poole Range structure, about 100 feet below the top of the Grant Formation. A pilot hole was drilled to a depth of 1,051 feet.

In the main hole 10-inch casing was carried to 1,683 feet (Blatchford 192) and all top waters were cemented off at this point. Soon after continuing drilling in an 8 inch hole, water entered the hole and rose to within 127 feet of the surface. It is not certain where this came from - whether

the cement had failed or a water sand had been struck below 1,683 feet. Drilling was continued in a wet hole. At 2,085 feet to 2,115 feet and at 2,117 feet to 2,131 feet, shows of oil were obtained. Oil was noticed coating the cable and floating on the water. Drilling was suspended at 2,131 feet and the hole mudded up.

An attempt was made to shut off the water at 2,078 feet and test for the oil which had showed from 2,085 feet to 2,131 feet. After drilling through the cement bridge, water entered the hole and rose to within 242 feet of the surface. Blatchford (19) considered that this water was coming from the oil sands which had been partly flooded.

Drilling was continued in a six inch hole to 2,605 feet, when a brown shale band was struck. It was decided to attempt to cement off the 5 inch casing at 2,616 feet still in the brown shale. This was only partly successful, water was reduced to 300-400 gallons per hour.

Drilling was again continued, using 4 inch casing. At 3,138 feet a showing of gas was encountered with minor quantities of a light oil. Cementing was again attempted and this time was successful. The hole remained dry until 3,200 feet was reached, when it was again flooded with water, thought to be coming from another water-bearing stratum.

Drilling was continued to 3,264 feet when the tools were lost owing to the rope breaking and the hole was subsequently abandoned.

It is considered that the best showings of oil were obtained at 2,085 feet to 2,115 feet. Following further considerations of the original mapping of the area, a change in drilling site was proposed. The drawing of structure contours disclosed an apparently suitable structure east of the original site.

Drilling was undertaken on a new site to a depth of 1,545 feet and then suspended.

After geological mapping by Wade on behalf of the Freney-Kimberley Oil Co. had defined an anticlinal structure at Nerrima, the Nerrima Bore was commenced on 22nd September, 1939. The bore had reached a depth of 4,271 feet when operations were suspended (because of the war) in February 1942. Slight gas showings have been reported at 2,085 feet and 3,206 feet. The Company resumed operations on the well on 22nd March, 1949, but abandoned the well in 1950 without having achieved any additional footage.

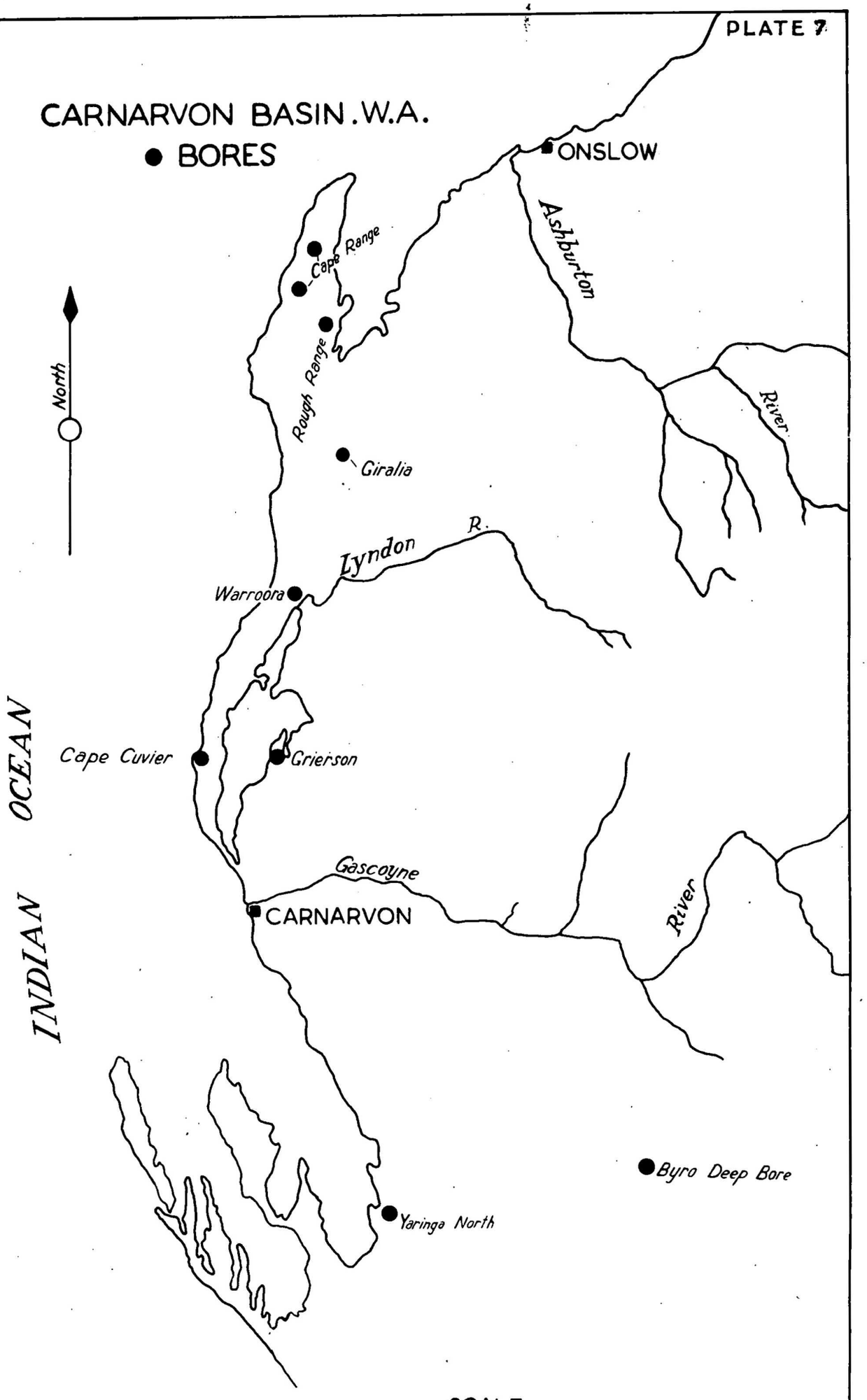
After the discovery of oil at Rough Range in November 1953, Freney Kimberley Oil Company joined Associated Anstralian Oilfields N.L. in a new company, Associated Freney Oilfields N.L., which carried out geological and geophysical surveys and in 1955 drilled a second bore No. AFO-1 on the Nerrima Anticline to a depth of 9072 feet. Permian Noonkanbah Formation was encountered from the surface to 990 feet, Poole Sandstone from 990 to 2165 feet and Grant Formation from 2165 feet to the bottom, 9072 feet.

Associated Freney Oil Company drilled a bore on Myroodah Anticline during 1955 and 1956, after the Bureau of Mineral Resources had carried out gravity and seismic surveys over the area. The total depth reached was 6,001 feet. The bore passed through the Noonkanbah Formation from 825 to 2,700 feet and finished in Grant Formation.

PLATE 7

CARNARVON BASIN. W.A.

● BORES



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Bureau of Mineral Resources, Geology & Geophysics. 1957.

The same company did geological and geophysical work over a poorly exposed structure on the Sisters Plateau. An anticline was discovered and a bore, Sisters No. 1, was started late in 1956 and was being drilled at the end of the year.

In 1940 and 1941 Caltex Oil Development Pty. Ltd. carried out geological reconnaissance in the Fitzroy valley and in the Carnarvon and Perth Basins, but no drilling was done.

From 1946 to 1949, the Fitzroy Basin was surveyed, geologically and aerially, by geologists of Bonaparte Gulf Company Ltd., a company formed by D'Arcy Exploration, Vacuum Oil and Zinc Corporation.

From 1947 in the Fitzroy Basin and from 1948 in the Carnarvon Basin, geologists and geophysicists of the Bureau of Mineral Resources have been carrying out detailed regional and some detailed surveys. The Bureau also drilled three stratigraphic bores in the Fitzroy Basin (Henderson, 1956).

Partly as a result of the early work of the Bureau geologists, the company holding the Permits to Explore for Petroleum, both in the Kimberley area and in the North West Division (Ampol Petroleum Ltd.) was able to form an operating company with Caltex, known as West Australian Petroleum Pty. Ltd. This company has carried out geological and geophysical surveys in the Fitzroy, Canning, Carnarvon and Perth Basins and has drilled several test wells and stratigraphic holes in the first three Basins. One bore was drilled on the crest of the Grant Range anticline, after geological and geophysical surveys had been carried out. This bore, Grant Range No. I, was drilled to 12,915 feet, passing through Permian Grant Formation from surface to about 7,800 feet, Upper Carboniferous carbonaceous siltstone from about 7,800 to 9,550 feet; evaporites from 9,550 to 10,150 feet and hard sandstone from 10,150 to total depth. No oil or gas shows were reported.

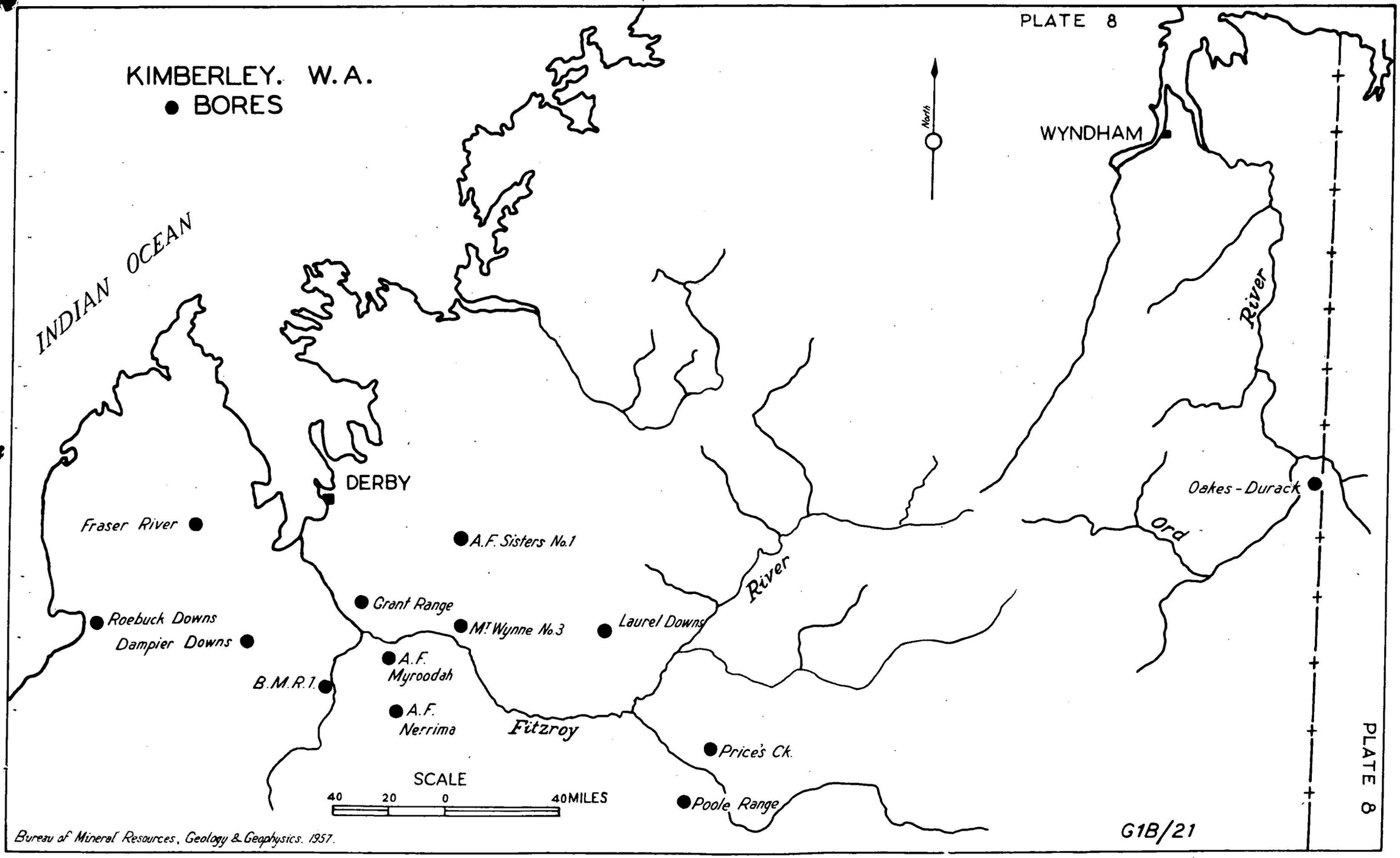
West Australian Petroleum Pty. Ltd. after geophysical surveys and core-drilling, also drilled a test on the Dampier Peninsula. This bore, Fraser River No. 1, was drilled in 1955-56 to 10,144 feet, finishing in gabbro, probably of Precambrian age.

In 1954 and 1955, Westralian Oil Co. Ltd. did some geological work along the northern margin of the Fitzroy Basin.

In 1954 and 1955 several small companies and syndicates held permits to explore, in various parts of Western Australia but did little significant work.

In 1955, the Bureau of Mineral Resources, following gravity survey by their Geophysical Section and a seismic profile by West Australian Petroleum, drilled a stratigraphic bore, B.M.R.1, on Jurgurra Creek south of the "Fenton Fault", to establish stratigraphic and structural relationships across this feature. This bore, which had to be abandoned at 1,680 feet when drill pipe was stuck, started in Permian Noonkanbah Formation, not in Jurassic as had been expected, and passed through Noonkanbah at 770 feet; Poole Sandstone was cut from 770 feet to the bottom. This established that there was little displacement across the "Fenton Fault" and that the Permian formations continued across it at this place without significant change.

In late 1955 and 1956, the Bureau of Mineral Resources drilled a stratigraphic bore, B.M.R.2, to 4,000 feet depth at Laurel Downs to obtain a section of the newly discovered Lower Carboniferous and to examine changes in thickness and lithology of the Carboniferous and Devonian as far out into the basin


KIMBERLEY. W.A.
● BORES
PLATE 8
North
WYNDHAM
INDIAN OCEAN
River
DERBY
Oakes - Durack
Ord
Fraser River
A.F. Sisters No.1
River
Grant Range
Roebuck Downs
Mt Wynne No.3
Laurel Downs
Dampier Downs
A.F. Myroodah
B.M.R.1.
A.F. Nerrima
Fitzroy
Price's Ck.
SCALE
40 20 0 40 MILES
Poole Range
PLATE 8
G1B/21
Bureau of Mineral Resources, Geology & Geophysics. 1957.

from outcrop as practicable. The lithology and thickness are very different from the outcrop only 10 miles away but do indicate a change into petroleum source bed type.

In 1956, the Bureau of Mineral Resources drilled a stratigraphic bore in the Prices Creek area to determine the total thickness of the Ordovician sediments and what rocks were beneath them. This bore, B.M.R.3, was drilled to 694 feet; the lower Ordovician Prices Creek Group probably continues from the surface down to 325 feet; below this is 268 feet of arkose and 60 feet of tuff which may be Ordovician or possibly Cambrian; under this is hard schist and hornfels, probably Precambrian.

Carnarvon (North West) Basin

F. G. Clapp (1925) after a brief reconnaissance, reported unfavourably on the oil prospects of the area. W. G. Woolnough (1933) confirmed the existence of the Cape Range anticline and noted several other anticlinal structures.

Oil Search Ltd. carried out reconnaissance surveys over the northern part of the Carnarvon Basin in 1932 to 1934, and detailed surveys in the Byro Plains area south of the Wooramel River (Condit 1955, Raggatt 1936). They drilled one bore at the south end of Byro Plains.

No further exploration was undertaken until 1948 when the Bureau of Mineral Resources commenced systematic mapping of the basin and established the existence of Devonian and Carboniferous sediments as well as Permian (Teichert 1949).

Subsequently Ampol Petroleum Ltd. took up a petroleum permit over the area and as a result of the Bureau's stratigraphic discoveries, succeeded in interesting Caltex interests in undertaking exploratory work, after Richfield Oil Corporation and Signal Oil and Gas had both examined the area but had not been able to continue with active exploration. As previously stated, an exploration company, West Australian Petroleum Ltd., was formed, with Caltex holding 80 per cent and Ampol Exploration Ltd. 20 per cent of the shares.

Following geological and gravity surveys by the Bureau of Mineral Resources and seismic surveys by the Company, West Australian Petroleum Ltd. drilled a test well, Rough Range 1, on the east flank of an anticline in Miocene limestone, starting in September, 1953. In November, 1953, oil was discovered and tested to flow at 500 bbl/day. After several days testing the "Birdrong" oil sand was cemented off and the test drilling continued to total depth of 14,607 feet where it was abandoned because of a stuck bit. Tertiary limestone was cut from surface to 1300 feet, Cretaceous limestone and marl from 1300 to 1600 feet, Cretaceous shale from 1600 and 3604 feet, sandstone from 3604 to 3990, Lower Cretaceous and possibly Jurassic sandstone and siltstone from 3990 to 6235 feet, Permian Lyons Group from 6235 to about 10,300 feet, Carboniferous and possibly Devonian siltstone and sandstone to total depth.

Rough Range 2 was drilled on the apex of the surface anticline to prove a gas cap in the oil sand but cut the top of the sand below the level of the bottom of the oil in Rough Range 1.

Rough Range 3, 4, 5, 6, 7 and 8 were drilled in an attempted to find an up-dip extension of the oil sand but all met the sand below the level of the oil in No. 1. After a careful seismic reflection survey, Rough Range 9 was drilled but met the sand at the lowest level of all. Six structural holes have since been drilled on Rough Range South. One of these, Rough Range South No. 5 was drilled through the sand

without finding oil.

The Cape Range anticline was surveyed geologically by the Bureau of Mineral Resources, a gravity survey was run around it and several trial seismic lines were surveyed. West Australian Petroleum Ltd. drilled Cape Range 1 on the north-east flank of the anticline to a total depth of 8,019 feet. 2½ miles S.S.W. of Cape Range No. 1, Cape Range 2 was drilled to total depth of 15,170 feet. This cut about 1,560 feet of Tertiary limestone, 1,945 feet of Cretaceous shale, 215 feet of Cretaceous Sandstone (the same as the oil sand in Rough Range 1) about 1100 feet of Lower Cretaceous siltstone, and 10,360 feet of Jurassic siltstone. A gas show was encountered at 10,000 feet; this tested initially at 300,000 cubic feet/day but dropped to 48,000 cubic feet/day.

Cape Range 3A (3,737 feet) and 4 (3,858 feet) were drilled to locate and examine the Birdrong oil sand. Oil and gas shows were reported from the Birdrong oil sand in 3A but the sand was missing in 4.

Exploration holes have been drilled by West Australian Petroleum Ltd. on many of the anticlines exposed at the surface. Giralia No. 1 was drilled to a total depth of 4,087 feet on the east flank of the Giralia Anticline near the apex. Lower Cretaceous shale and Birdrong sand were cut from surface to 370 feet, Permian siltstone and sandstone from 370 to 4035 feet, and Permian Lyons Group from 4035 feet to bottom. No oil indications were reported.

Warroora No. 1 was drilled on the east flank of the Warroora Anticline. Cretaceous sediments including the Birdrong Sand were cut from surface to 1100 feet. Below the Birdrong Sand, Permian Lyons was cut from 1353 to the total depth of 5,989 feet.

Grierson No. 1 (1437 feet), No. 2 (1500 feet) and three (1450 feet) were drilled across the Grierson Anticline. Only a trace of oil was reported from No. 1, at the top of the Birdrong Sand. This well was completed as an artesian well. Cuvier No. 1 was drilled on the Cuvier Anticline to total depth of 1500 feet. Beneath the bottom of the Birdrong Sand at 1337 feet, Devonian calcareous sediments were encountered.

At Dirk Hartog Island, 16 structure holes were drilled to determine structure. A test well was started early in 1957.

The whole of the Carnarvon Basin is held under Permit to explore or Licence by West Australian Petroleum Pty. Ltd.

Other Areas

A small amount of drilling for oil has been done in the South-West Division.

EXPENDITURE

The following figures cover the major expenditure on oil drilling exploration in Western Australia:

Table 9

Estimated Expenditure on Oil Search in Western Australia to the end of 1956

Prior to 1945:		
Freney Kimberley Oil Co.	£138,283	
Commonwealth subsidy to F.K.O.	39,717	
State subsidy to F.K.O.	24,288	
Caltex Oil Development	37,500	
Oil Search Ltd.	12,000	
Minor Companies (estimated)	35,500	
		287,000
1946 to 1956:		
Freney Kimberley Oil Co. (1932) N.L.	110,298	
West Australian Petroleum Pty.Ltd.	10,442,744	
Ampol Exploration Pty. Ltd.	431,420	
Associated Freney Oilfields N.L. (includes survey costs in N.T.)	690,760	
Westralian Oil Ltd. (includes survey costs in W.A., N.T. and Victoria).	130,977	
Sundry minor companies (estimated)	50,000	
		11,856,000
TOTAL		£12,143,000

GEOLOGY

There are seven main sedimentary basins in Western Australia - the Eucla Basin, the Perth Basin, the Carnarvon Basin, the Canning Basin (which includes the Fitzroy Basin) and the Bonaparte Gulf Basin.

Eucla Basin

The western part of the Eucla Basin extends from the South Australian Border west to longitude 123° East and from the coast to about latitude 29° South.

Stratigraphy: About 1,000 feet of Tertiary limestone rests on up to 1,500 feet of Cretaceous.

Structure: The structure in the Eucla Basin is a depositional syncline. No fold or fault structures are known but there are sure to be depositional folds even if tectonic folding has not occurred.

Oil Indications: No oil indications are known from water bores in the basin in Western Australia.

Perth Basin

This basin extends southwards from Geraldton, between the coast and the Precambrian tableland.

Stratigraphy: Very little is known of the stratigraphic detail of this basin but outcrops at the north end and information from water bores suggests that there may be at least

7,000 feet of Tertiary limestone, Cretaceous shale, Jurassic sandstone and Permian sandstone and shale.

Structure: Gravity and seismic surveys indicate that the regional structure is synclinal with at least 30,000 feet thickness of sediments in the deepest part. Several anticlinal structures have been indicated.

Carnarvon Basin (Condon 1954; Condon, Johnstone, Perry and Crespin 1953, Condon, Johnstone, Prichard and Johnstone, 1954).

This basin stretches from Onslow to Murchison River (latitude 22° to 28° south) and from about longitude 116° westward.

Stratigraphy: Along the coast Tertiary limestones up to 1,000 feet thick occur. Conformably beneath these are Cretaceous limestone, shale and sandstone totalling about 4,000 feet thick. In the Cape Range, a bore has drilled through 11,300 feet of Jurassic siltstone, not represented in outcrop anywhere in the basin. Outcropping at the east edge of the basin, unconformably beneath the Cretaceous, is a conformable succession of Permian marine shale, sandstone, limestone and glacial greywacke totalling up to 10,000 feet; Carboniferous arkose and limestone about 2,000 feet thick; and Devonian sandstone, limestone and greywacke about 4,000 feet thick. Possible lower Palaeozoic sediments totalling about 15,000 feet thick are unconformable beneath Cretaceous and Permian sediments.

Structure: The Carnarvon Basin is made up of a number of subsidiary basins separated by ridges of Precambrian basement covered in most places by thinner sedimentary sequences.

Most of the major structures are depositional in character.

Anticlines are known in the Tertiary and Mesozoic in the coastal region and are probably present over some of the basement ridges.

Oil Indications: Gas has been reported from water bore at Yaringa North near the south end of Shark Bay.

No oil or gas seepages are known.

Oil was discovered in November 1953, in a bore on Rough Range; this was tested to flow at about 500 bbl/day. Eight other holes have been drilled on the same surface structure but all have encountered the oil sand at a lower elevation than the bottom of the oil in the discovery hole.

A strong gas show was tested in a bore on Cape Range, but produced only 48,000 cubic feet/day.

Gas was tested deep in the discovery bore on Rough Range.

Traces of oil were reported from Grierson Bore.

Canning (including Fitzroy) Basin (Guppy, Lindner, and Casey, 1957; Traves, Casey and Wells, 1957).

The Canning Basin is the second largest sedimentary basin in Australia, and covers an area of about 140,000 square miles. It extends along the north-west coast from

east of Port Hedland to King Sound and from the coast covers a large U-shaped area extending eastward to longitude 128°30' East and south beyond latitude 24° South.

The large subsidiary basin forming the north-eastern part of the Canning Basin is the Fitzroy Basin.

Stratigraphy: At the outcrop, about 15,000 feet of Ordovician, Devonian, Carboniferous, Triassic and Jurassic marine and fresh water sediments overlie Precambrian rocks.

Ordovician rocks are known only in the outcrop area at Prices Creek where they are about 2,800 feet thick and include petroliferous siltstone. Devonian and Carboniferous sediments of variable thickness outcrop along the north-eastern margin where they are about 5,000 feet thick in mainly calcareous sediments. Devonian calcareous sediments have been encountered by bores 17 miles from the north-eastern margin and at Roebuck Bay. Upper Carboniferous carbonaceous shale and sandstone about 5,000 feet thick were drilled at Grant Range.

Permian formations outcropping in the Fitzroy Basin comprise 5,000 feet of shallow marine and fresh-water sandstone and shale. The Permian sequence thins to the south and east, possibly to about 1,000 feet.

In bores, the lowermost Permian formation, Grant Formation, has been shown to be 8,500 feet thick at Grant Range but only about 1400 feet thick at Roebuck Bay. At Roebuck Bay the entire Permian sequence is only about 2,200 feet thick.

Triassic and Jurassic rocks comprise 1,000 feet of marine and fresh-water sandstone and shale. They unconformably overlie the Permian in the coastal area and in the Derby and Edgar Range synclines. In the Roebuck Bay bore they are about 1100 feet thick.

Structure: The Canning Basin probably is made up of three main subsidiary basins separated by basement ridges. Only the northernmost, the Fitzroy Basin, has been named.

Some evidence exists that the basement ridges have been in existence throughout the history of the Canning Basin and have controlled the sedimentation and the depositional structures. If this is so, they are undoubtedly the most favourable places in which to conduct exploration for oil.

Large anticlinal folds occur in the marginal Devonian sediments and in the Permian sediments of the Fitzroy Basin.

Near the edge of Palaeozoic outcrop of the Fitzroy Basin, is a linear feature which has been named the Fenton Fault. It is possible that this is a monocline and not a fault - a seismic profile across it does not preclude this theory. The feature could have been developed as a depositional structure on the flank of a steep sided basement high. This is probably the north flank of the basement ridge indicated by aero-magnetic and gravity surveys.

Oil Indications: Many of the oil bores in the Fitzroy River area produced small shows of oil, gas and bitumen.

In the Prices Creek Bores, traces of oil were reported in Ordovician limestone.

At Mount Wynne asphaltum was reported from several depths in the first bore, and globules of oil (at 524' and 1,886') and some bitumen in the second bore.

The Poole Range bore obtained oil shows at 2,085 feet and 2,117 feet and gas and light oil at 3,138 feet.

The Nerrima Bore obtained slight showings of gas at 2,280 feet and 3,206 feet.

Ord Basin

This Palaeozoic basin lies between longitudes 128°10' East and 129°30' East and between latitudes 16°00' South and 18°30' South, with an area of about 4,000 square miles. The area is drained by the Ord River and its tributaries.

Stratigraphy: Cambrian shale and sandstone 2,000 feet thick rest on lower Cambrian shale and limestone 1,000 feet thick. This limestone rests on Lower Cambrian(?) basalt and agglomerate about 3,000 feet thick.

Structure: There are two synclinal basins - the Rosewood Basin (Cambrian sediments) and the Hardman Basin (Cambrian sediments and basalt).

Oil Indications: Asphaltum occurs at the top of the basalt near the Negri-Ord River junction.

Bonaparte Gulf Basin

This basin occupies the area east and south of the Bonaparte Gulf and an unknown part of the Gulf itself. Part of the area is in Western Australia and part in Northern Territory.

Stratigraphy: Cambrian, Ordovician, Devonian, Carboniferous and Permian sediments rest unconformably on Precambrian sediments, schists and granite (Traves, 1955).

The Cambrian consists of about 2,000 feet of sandstone, limestone and shale; the Ordovician of 550 feet of glauconitic sandstone; the Devonian of 3,000 feet of sandstone and 4,000 feet of calcareous sediments; the Carboniferous of 3,000 feet of conglomeratic (? glacial) sandstone and calcareous sediments; and the Permian, 1,500 feet of shale and sandstone.

Unconformities are known between the Precambrian and Cambrian, between Lower Ordovician and Devonian and between Lower Carboniferous and Upper Carboniferous.

Structure: The Basin is divided into at least two major subsidiary basins by a meridional ridge of Precambrian rocks. Several anticlines are present in the eastern basin and the structure of the Palaeozoic sediments covering the basement ridge may be anticlinal.

Oil Indications: No petroleum seepages have been reported.

PRESENT STATUS OF EXPLORATION

West Australian Petroleum Pty. Ltd., Associated Freney Oilfields, N.L., Jacksons Explorations, Goldfields Petroleum Discovery Syndicate Ltd., Westralian Oil Ltd., Northwest Oil Pty. Ltd., Kimberley Oil Exploration Syndicate Ltd., and Gulf Oil Syndicate hold Permits or Licences to explore for petroleum in Western Australia.

West Australian Petroleum Pty. Ltd. are actively engaged in geological and geophysical surveys of the Canning Basin, including the Fitzroy Basin, and geophysical surveys in

in the Carnarvon Basin. They are are present drilling only one bore, on Dirk Hartog Island.

Associated Freney Oil Company N.L. is drilling a bore on the Sisters Anticline, and carrying out detailed geological and geophysical work in the Sisters Plateau permit area.

As far as is known the other permittees are not going any significant work.

The Bureau of Mineral Resources is continuing the reconnaissance geological and geophysical survey of the Canning Basin, and compiling the results of field work in the Carnarvon Basin.

After the discovery of oil in the first test well drilled in the Carnarvon Basin, the subsequent drilling has been extremely disappointing. However, good production was tested from Rough Range I, although it was realized that that bore is on the edge of the pool since the oil-water contact was present in the bore. The outlines of this pool have not been determined, nor have the structural controls been resolved. Early geophysical work by the Bureau of Mineral Resources indicates a positive gravity anomaly to the east of the surface anticline; Bureau geophysicists made an analysis of this anomaly and concluded that the anomaly was produced by a feature at 3700 to 4300 feet depth. If this conclusion is correct, it would appear that the anomaly may indicate the structure of the unconformity below the Birdrong Sand; it would seem worthwhile for the company to drill a bore on this anomaly to test the validity of this conclusion and possibly to give significant information on the structural history of the area. Information on the shape of the wedge of Jurassic and Lower Cretaceous sediments below the Birdrong Formation should be obtained by seismic survey supported by core-drilling; this sequence is known to contain abundant traces of petroleum - the pinch-out of this wedge should be an important area for testing. The sediments overlying the basement ridges are practically unknown either stratigraphically or structurally. A line of core holes preferably with accompanying seismic survey, is required particularly across the main Ajana-Wandagee Ridge, and preferably across areas of high gravity anomaly such as west of Winning Pool, at Binthalya Homestead and east of Pimbie Homestead. Much more information is required about the areal geology and structure of the sediments beneath the base of the Birdrong Formation.

In the Perth Basin, gravity and seismic surveys by the Bureau of Mineral Resources and gravity surveys by West Australian Petroleum Pty. Ltd. have indicated a very great thickness of sediments filling a synclinal basin between the Darling scarp and about the edge of the continental shelf. A large anticlinal structure has been proved by seismic survey in the Gin Gin area and large structural relief has been indicated at the southern end of the basin, in the Busselton area. Because this is the main area of settlement in Western Australia, discovery of petroleum or of dry gas would be of relatively greater importance there than elsewhere in the state. If the main reason for not testing the Gin Gin anticline is the presence in outcrop to the east of terrestrial sediments, this is not a valid reason, since the type of lacustrine sediments known in outcrop could produce dry gas which would be of value in the Perth metropolis. Apart from this there is a real possibility of the development of marine or paralic sediments with a good chance of petroleum accumulation. Further seismic surveys are required over irregularities in the generally smooth gravity contours to decide whether these irregularities are produced by structural features or significant sedimentary structures such as sand bars or sand pinch-outs.

Examples of such irregularities are at Coolcalalaya (on the Murchison River), 14 miles west of Mullewa, 25 miles south-south-east of Dongara, 20 miles west of Coorow, 32 miles north-west of Gin Gin, and possibly immediately east of Perth.

In the Canning Basin, additional gravity and possibly aeromagnetic surveys are required to locate adequately the basement ridges separating the major subsidiary basins. Detailed gravity followed by seismic surveys are required over selected areas of these ridges. These surveys may be expected to indicate the shape and depth of the basement ridge; anticlinal structures in the overlying sediments; sedimentary structures such as reefs, sand bars, pinch-outs; and unconformities. On the basis of this information test drilling may be undertaken. In this sort of environment many of the targets will be on the flank of the ridge rather than on its crest although there are also important targets on the crestal area. In the Fitzroy Basin, where reconnaissance and detailed gravity surveys and seismic profiles are available, irregularities in the gravity contours should be examined in detail by gravity and seismic surveys and possibly core-drilling in search of test drilling targets. Adequate source beds are known in the Ordovician, Devonian, Permian and Carboniferous; reservoir beds are known in the Devonian and Permian but have little significance in other areas -- however, the basement ridges are likely to be favourable for development of reservoir rocks.

One of the main geological problems still to be resolved throughout the Western Australian area is the fundamental structural control. One of the authors (Condon) is strongly of the opinion that the main control is the original shape of the Precambrian surface on which the sediments were deposited; the companies appear to be working on the assumption of conventional tectonic control. Until the basic structural control is established all detailed exploration must remain trial-and-error. The results to date appear to confirm the idea of original structures formed by deposition over pre-existing hills but the evidence is not indubitable. An area such as the Rough Range, where there are already a number of bores, should be drilled until the structural evidence is strong enough to be used with confidence. In the Rough Range, also, it is at least possible that such a programme would result in a payable field.

In the Bonaparte Gulf Basin, the outlines of the outcrop stratigraphy and structure are known. The whole basin should be covered by gravity survey and the Gulf part of the basin surveyed by marine gravity meter or aero-magnetometer. Structures indicated in outcrop or by the gravity-magnetometer work should preferably be seismic survey before test drilling. Core drilling is of value in calibrating the seismic and gravity results.

NORTHERN TERRITORY

HISTORY OF INVESTIGATIONS

Bitumen was found by members of the crew of H.M.S. Beagle in the tidal reaches of the Victoria River. As far as is known this seepage has not been re-discovered since.

Some drilling was done on Elcho Island (see Plate 1) in 1924 to 1926.

The Australian Mining and Smelting Company Ltd. held Oil Exploration Licences for about 25,000 square miles in the

Northern Territory in 1947. The Bonaparte Gulf Company carried out geological reconnaissance surveys over this area before the concessions were abandoned.

The Australian Motorists Petrol Company Ltd. held Oil Exploration Licences over 28,000 square miles in the Ord River district of the Bonaparte Gulf area during 1948-51. No significant work was done in the area.

In 1954, following the discovery of oil at Rough Range, W.A., many applications for authorities to explore for petroleum were made. Several permits were granted over areas in the Bonaparte Gulf area and in the Alice Springs area.

Santos Ltd. carried out geological reconnaissance over the area south and west of Alice Springs and abandoned the permit.

Associated Australian Oilfields N.L. carried out geological and gravity surveys in their permit area in the Bonaparte Gulf Basin.

Westralian Oil Ltd. carried out geological surveys in their permit area adjoining that of Associated Australian Oilfields N.L.

The Bureau of Mineral Resources has carried out seismic profiling in the Bonaparte Gulf Basin, in Western Australia and in Northern Territory.

Geologists of Broken Hill Pty. Ltd. in 1954 found a bitumen seepage with Jurassic shells in the Robinson River area. This was analysed and found to be a residual crude oil.

Frome-Broken Hill Pty. Ltd. was granted a permit to explore for petroleum to the south of the Gulf of Carpentaria. They carried out a geological reconnaissance in the permit area and aero-magnetometer profiles across the permit area and the waters of the Gulf.

Inflammable gas was encountered in a water bore on Ammaroo Station on the Sandover River about 160 miles north-east of Alice Springs during 1956. The bore was being drilling through Cambrian limestone. At a depth of 135 feet an explosion occurred in the bore. A geologist reported later that gas was entering the hole between 135 and 173 feet and issuing from the surface at a slow but steady rate. The drillers applied for a petroleum prospecting permit.

Several other permits were applied for in the central and southern part of the Northern Territory.

GEOLOGY

On the basis of present geological knowledge there are two main areas in the Northern Territory which may be regarded as havingsome possibility of commercial accumulations of petroleum: the Bonaparte Gulf Basin and the Carpentaria Basin. Other sedimentary basins with little known prospect of petroleum accumulations are the Georgina Basin, the Barkly Basin, the Daly Basin and Amadeus Basin.

Bonaparte Basin (see Western Australia)

In Northern Territory, only Carboniferous and Permian sediments outcrop but several anticlinal structures are known to exist.

Carpentaria Basin

This basin is the northern extension of the Great Artesian Basin. Little is known of its limits in the Northern Territory. Marine Cretaceous and Tertiary rocks are known on Wellesley Islands and gas was encountered in a water bore at Normanton (Qld.). Jurassic fossils were found with a bitumen seep on Robinson River.

Georgina Basin

Little is known of the detailed stratigraphy and structure of this basin except where it overlaps the Precambrian of the Mt. Isa-Cloncurry area. There, marine Cambrian and Ordovician sediments fill synclinal areas and plunge off the Precambrian geanticline, thickening away from the Precambrian outcrop. Trace petroleum has been reported from these sediments. The Ammaroo Bore is at the western margin of this basin.

Barkly Basin

This is a basin, apparently shallow, containing Proterozoic and Cambrian sediments, probably marine. Little is known of the details of stratigraphy and structure.

Daly Basin

This is a shallow basin of Cambrian marine sediments recently mapped by Bureau geologists. The limestones are reported to contain trace petroleum.

Amadeus Basin

This is a large basin of lower Palaeozoic marine sediments. The sediments have been strongly folded and faulted. Large anticlinal structures exist and sediments not unfavourable for formation and accumulation of petroleum are known but details are lacking. The remoteness of this area from possible markets reduces its attractiveness for petroleum exploration.

PRESENT STATUS OF EXPLORATION

The following petroleum exploration permits were held at the end of 1956:

Permit No. 1 : Associated Freney Oilfields N.L.

Permit No. 2 : Associated Australian Oilfields N.L.

Permit No. 3 : Westralian Oil Limited

Permit No. 8 : Santos Limited

Permit No. 12 : Messrs. Petrick, Mengel and McIntyre

Permit No. 14 : R. C. Sprigg.

Geological and geophysical work is continuing in the Bonaparte Gulf areas. Geological work is planned in the Amadeus area, and to the north-east and south-east of Alice Springs.

The Bureau of Mineral Resources has carried out trial seismic surveys in the Bonaparte Gulf area and has started a regional geological survey of the Amadeus Basin. It is proposed to start the regional geological survey of the Georgina Basin in Queensland, and ultimately to join up the surveys of the Amadeus and Georgina Basins.

In none of these basins is the geological and geophysical work sufficiently advanced to give a reliable

assessment of the petroleum potential. The sequence has been established in the Amadeus Basin only and even there little is known of the variations within the basin. The regional structure of this basin is indicated but not reliably established.

SUMMARY

This summary is intended to give a perspective view of the search for oil throughout Australia and New Guinea.

GEOLOGY

Outcrop geology is known reasonably adequately only in Papua, northern Sydney Basin, Victoria and the Carnarvon and Fitzroy Basins of Western Australia. Subsurface geology is practically unknown.

Much additional geological work is required in outcrop areas of sedimentary basins of New Guinea, Queensland, South Australia and Northern Territory and in the Perth, Canning, Bonaparte Gulf and possibly Eucla Basins of Western Australia.

GEOPHYSICS

Gravity and/or magnetic surveys of reasonable reconnaissance standard have been completed of western Papua, central Queensland, central Sydney Basin, Gippsland Basin, western Victoria and south-east South Australia, Frome Embayment in South Australia, Perth, Carnarvon and Fitzroy Basins of Western Australia. Reconnaissance gravity and/or aero-magnetic surveys are required of the remainder of the sedimentary basins of Papua and New Guinea, the Great Artesian Basin and its extension the Carpentaria Basin, some of the smaller areas along the edge of the geosynclinal belt of coastal Queensland, the remainder of the Sydney Basin; the Murray Basin in N.S.W.; the Canning and Bonaparte Gulf Basins and possibly the Eucla Basin; the Amadeus Basin and its continuation into the Georgina Basin.

Seismic surveys are desirable to check subsurface structure before drilling.

DRILLING

Following is a summary of total drilling by states: to the end of 1956:

State or Territory	Number	Footage (feet)
Papua-New Guinea	25	107,500
Queensland	45	213,000
New South Wales	20	53,000
Victoria	129	200,000
Tasmania	21	14,000
South Australia	68	71,000
Western Australia	64	200,000
Northern Territory	-	-
TOTALS	372	858,500

PETROLEUM
PERMITS, LICENCES & LEASES
IN AUSTRALIA AND THE TERRITORY OF PAPUA - NEW GUINEA

AS AT 31·12·1956

SCALE OF MILES
100 0 100 200 300 400 500

Based on information supplied by State and Territorial Departments of Mines.

For further details application should be made direct to the Department of Mines of the State or Territory concerned.

PLATE 9

130° 136° 142° 148°

BEWANI RA
TORRICELLI
AITAPE RA
WEWAK
Sepik R.
P21
NEW GUINEA
Ramu R.
ADELBERT RA
MADANG
FINISTERRE RA
Etna Bay
P16
CHIMBU
P2 P24
P12
P17
P2
P5
P18
P15
Vailala R.
P22
P14
KEREMA
P19
P18
DARU
HUON PEN.
Markham R.
YULE I.
OWEN STANLEY RA.
C. VOGEL
PORT MORESBY
PAPUA

8
DARWIN
JOSEPH BONAPARTE GULF
WYNDHAM
127H
3
1
Victoria R.
123H
KING SOUND
106 H
39 H
125H
DAMPIER PENINSULA
BROOME
DERBY
17H
27H 25H
46H
26H
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41H
Fitzroy R.
FITZROY CROSSING
GULF OF CARPENTARIA
11 P
WELLESLEY IS
Robinson R.
9 P
NORMANTON
CAIRNS
35 P
NORTHERN TERRITORY
QUEENSLAND
30 H
PORT HEDLAND
29 H
69 H
70H
12
ALICE SPRINGS
14
Exmouth Gulf
37H
35H
36H
18H
28H
29H
30H
31H
33H
32H
34H
CARNARVON
28 H
DIRK HARTOG I.
44H
YARINGA
N. R.
WESTERN AUSTRALIA
Murchison R.
37 P
MUTTABURRA
LONGREACH
34 P
CLERMONT
SPRINGSURE
26P
19 P
12P
TAMBO
10P
7P
MACKAY
33 P
ROCKHAMPTON
THEODORE
6P
29P
MARYBOROUGH
PPP696
PPP688
QUILPIE
ROMA
MILES
PPP 685
AREAS 1 to 8
ARE 13P
CHINCHILLA
36 P
Area No.1
Area No.7
Area No.8
Area No.6
Area No.5
Area No.4
Area No.3
32P
BRISBANE
2
7
6
ML 5056
GRAFTON
COFFS HARBOUR
TAMWORTH
PPL 1
3
MURRURUNDI
9
10
11
RYLSTONE
LITHGOW
PPL 2
PPL 3
NEWCASTLE
PEL 787
SYDNEY
1
WOLLONGONG
NOWRA
BATEMANS BAY
GERALDTON
27H
42 H
PERTH
COLLIE
ALBANY
35 H
ESPERANCE
NORSEMAN
KALGOORLIE
NULLARBOR PLAIN
FORREST
MUNDRABILLA
EUCLA
42 H
46H
EYRE
OODNADATTA
L Eyre
COOBER PEDY
O.E.L.7
OOLDEA
O.E.L 12
WOOMERA
"Quinyambie"
L Frome
WILCANNIA
CEDUNA
PORT AUGUSTA
O.P.L 13
WILKATANNA
Excluded
PORT PIRIE
O.E.L 11
RENMARK
BROKEN HILL
NEW SOUTH WALES
EYRE PENINSULA
100 of WANILLA
ADELAIDE
35°S
O.E.L 10
COOKONG
PENOLA
BEACHPORT
O.E.L 9
MCINTYRE
10C of CAROLINE
SEE INSET FOR VICTORIAN DETAILS
VICTORIA
ALBURY
MELBOURNE
MERSEY VALLEY
DEVONPORT
TASMANIA
ST MARYS
HOBART
BRUNY I.
WENTWORTH
MILDURA
P.E.P 1
EUSTON
UNDERBOOL
P.E.P. 2
OUYEN
P.E.P. 3
BIRCHIP
WARRACKNABEAL
P.E.P. 12
KANIVA
P.E.P. Appn 14
THE GRAMPIANS
P.E.P Appn 13
HAMILTON
P.E.P 5
NELSON
PORT FAIRY
PORTLAND
P.E.P 6
QUEENSCLIFF
202
LORNE
PORT CAMPBELL
MELBOURNE
BEAUMAURIS
LEONGATHA
164
WOODSIDE
136
213
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248
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162
181
156
LAKES ENTRANCE
SCALE OF MILES
32 0 32 64
COROWA
VICTORIA

112° 118° 124° 130° 142°
143° 144° 145° 146° 147° 148° 149°
154°
34° 35° 36° 37° 38° 39°

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Almost all drilling undertaken to date in Australia and Papua-New Guinea has been wildcatting in the sense that insufficient was known about the stratigraphy and structure and geological history to drill for expected targets. One exception to this was the Rough Range bore which discovered oil in the first target formation and a gas show in the second target formation. Even in this case the structure and geological history were insufficiently known.

Much of the drilling for oil completed to date has not been technically adequate to discover all indications of petroleum and to test them properly. This was particularly so with much of the percussion drilling before World War II, when it was commonly assumed that oil would make its presence known as a gusher. In general it is probably less likely that a commercial oil pool would be overlooked in a dry percussion bore than in a rotary bore using drilling mud, but even in the percussion bore there is the possibility of the bit and cuttings sealing the sand as it is drilled through. It is most essential that all bores be electrically logged before casing; that a petroleum engineer, geologist of geophysicist experienced in the interpretation of electric logs in terms of petroleum occurrence examine the logs before the bore is abandoned; and that any petroleum occurrence be adequately tested, at least until formation fluid is returned at a rate consistent with the recorded pressure and the permeability indicated by or computed from the electric log.

In cases where an oil show is obtained in a bore, all information should be examined to ascertain whether or not the show may be a pointer to a large accumulation. This can only be done with confidence if the knowledge about the structure, stratigraphy and geological history in the vicinity is reasonably adequate.

No structure in Australia has been "drilled out", that is, drilled sufficiently to establish structure and stratigraphy including variations; and none, except perhaps Roma, has been drilled sufficiently to indicate that a large accumulation is unlikely.

EXPENDITURE

Expenditure which can be accounted for in the search for oil in Australia is divided among the States and Territories as follows:

Papua-New Guinea	£24,017,000
Queensland	5,024,000
New South Wales	770,000
Victoria	1,185,000
Tasmania	125,000
South Australia	535,000
Western Australia	12,143,000
Northern Territory(say)	100,000
	£43,899,000

PRESENT STATUS OF EXPLORATION

Oil exploration companies hold concessions to search for oil in all States and Territories except Tasmania. The areas held at the end of 1956 were as follows:

State or Territory	Number	Area held (sq.miles)
New Guinea	1	1,650
Papua	3	44,181
Queensland	18	266,528
New South Wales	5	37,455
Victoria	14	27,547
Tasmania	-	-
South Australia	5	302,450
Western Australia	9	383,801
Northern Territory	6	42,910
TOTALS	62	1,106,522

One promising oil discovery has been made by West Australian Petroleum Pty. Ltd. at Rough Range, Western Australia; a large gas strike has been made by Australasian Petroleum Company Ltd. at Kuru in Papua. Oil and gas shows have been encountered elsewhere in Papua and Western Australia and in Queensland, Victoria and South Australia. Dry gas has been obtained in New South Wales and a show of wet gas in Northern Territory.

Geological and geophysical information in most of the prospective areas is known only in broadest outline. In very few areas is the geological information sufficiently precise for scientific location of drilling sites or for following indications when found. Regional geological information is reasonably satisfactory only in Papua, Sydney Basin, Carnarvon Basin and Fitzroy Basin. Geological detail is not satisfactory even in these areas. Partly because of requirements of confidence in relation to reports submitted to Government Authorities, partly because in many cases satisfactory reports have not been a requirement for satisfaction of permit conditions, the same sort of exploratory work has been repeated in many areas. This is uneconomical since the same amount of work could extend the sum of knowledge instead of merely confirming it, particularly since the confirmation is inherent in the more precise investigation.

Drilling is continuing in Papua, Western Australia, Victoria, South Australia, New South Wales and Queensland; but only nine bores are being drilled for oil in the whole of Australia and Papua-New Guinea. Only two of these are drilling to an established or expected stratigraphic target although six of them are drilling on established anticlinal structure. No stratigraphic drilling is in progress.

The presently operating companies spent about nine and a half million pounds during 1956.

PROSPECTS

The discovery of oil in Western Australia and gas in Papua confirm the geologists' general opinion that petroleum is likely to occur in significant quantities both in Papua-New Guinea and in Australia. In themselves they are important leads to the targets which in the immediate vicinity may lead to commercial accmulations of petroleum. This sort of lead has not formerly been available.

The operating company in Western Australia has not followed up that lead adequately although it is three years since the oil was discovered. There is still a likelihood of the presence of a significant oil poor at Rough Range. The discovery of a very big wedge of petroliferous sediments under the Cape Range gives promise of accumulations up-dip. The probability of original structural relief in the Western Australian basins adds to the prospect of petroleum accumulations along these ridges. In Papua, the regional geology has been outlined, and largely as a result of this the first successful bore has been drilled at Kuru. It may be expected that continued exploration in the same regional province, in the area between the shelf and the Aure Trough, will produce continuing success.

In Queensland, there is plenty of promise in the large number of petroleum shows in water and oil bores widely spaced over the state. Geological and geophysical exploration, regional in the first place, is required to bring some meaning into the present random occurrences of shows of petroleum. More attention might profitably be paid to the substratum of the Great Artesian Basin which is known to consist of older sediments in some places. In some cases the oil shows in the Mesozoic may have come from older sediments. In the coastal region of Queensland more attention is required to the regional variations in structure and stratigraphy so that the dominantly important "hinge-line" may be recognised.

In the Sydney Basin, the operating company is continuing a sound exploration programme although the use of percussion drilling plant slows the drilling exploration without being likely to change significantly the appreciation of gas shows. It is possible that suitable marine Palaeozoic sediments lie beneath the Tertiary-Mesozoic cover of the New South Wales part of the Murray Basin: investigation of this basin would be difficult and costly, requiring gravity and seismic investigations, and core-drilling.

In Gippsland recent exploration has opened the prospective sequence at least into the Jurassic without appreciably improving the prospects of the Tertiary sequence.

In western Victoria and south-eastern South Australia, a thick sequence of marine Tertiary sediments has been established. In the Torrens Basin, oil shows have been found in Tertiary and Cambrian sediments but no evidence in favour of the possibility of large accumulations is known although they may be present.

No single area in Australia and Papua-New Guinea can be said to have been thoroughly tested although some areas have been shown to be of lithology of structure unlikely to contain large accumulations of petroleum.

The areas which, on available geological and geophysical information, are most likely to contain commercial accumulations of petroleum are listed roughly in the order of present potential (which is very largely the order of knowledge of the areas): west side of Aure Trough, Papua; Rough Range, Carnarvon Basin, W.A.; Cape Range east, Carnarvon Basin; east side of Aure Trough, Papua; Broome ridge, Canning Basin, W.A.; Ajana-Wandagee Ridge, Carnarvon Basin, W.A.; Queensland Coastal area basins; Georgina Basin, Qld.; Great Artesian Basin and Carpentaria Basin; Perth Basin, W.A.; Gippsland Basin, Victoria; Bonaparte Gulf Basin, N.T. and W.A.; Murray Basin in N.S.W.; Torrens Basin, S.A.; Murray Basin, S.A. and Victoria. The Bowen and Maryborough basins, Queensland; Sydney Basin, N.S.W.; Gippsland Basin, Victoria; Perth Basin, W.A.; and the Permian-Triassic basin of Tasmania may produce useful amounts of dry gas.

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APPENDIX (1)

Brief History of the Search for Oil in Australia and New Guinea

Part (A) - Prior to 1946.

QUEENSLAND

The search for oil in Australia may be said to have had its inception at Roma, Queensland, in 1900 when a town water bore - being deepened to increase its artesian flow - struck a flow of natural gas. The gas blew-off freely for about six years and an attempt was then made to use it, through a gasometer and reticulation system, for street lighting. After ten days the gas supply failed and the scheme was abandoned.

A bore drilled by the Queensland Government to discover the source of the gas was started in 1907; it struck a strong flow of gas which caught fire and burned for six weeks before it could be extinguished. In subsequent operations the tools were lost, and the hole finally abandoned.

The Government resumed the search by starting another bore in 1916, intended to penetrate the gas sand in search for oil, but progress was slow and drilling dragged on until 1922 without worthwhile result.

In 1923 private enterprise entered the search; between then and 1930 many bores were put down in south-eastern Queensland. Some got small quantities of crude oil, others struck gas, but most were "dry" holes. Roma Oil Corporation Limited erected an absorption plant to recover condensate from the "wet" gas produced from its Hospital Hill bores, but the gas flow declined and the project was not a commercial success.

After 1930, the search for oil slackened off; the main companies still operating were Oil Search Limited and Roma Blocks Oil Company, and drilling was confined mostly to the Mount Bassett, Jarooby, Hutton Creek, and Arcadia areas. Both companies were assisted by Commonwealth Advances. Some scout boring was also done by Oil Search Limited.

Between 1939 and 1944 a subsidiary of Shell Oil Company undertook extensive geological and geophysical surveys of central, south-western and western Queensland. Operations were then suspended until after the war period.

PAPUA-NEW GUINEA

Chronologically, the next centre for oil investigation was Papua where, following the report of an oil-seepage on the Vailala River in 1911, the Commonwealth Government sponsored an active search between 1912 and 1929. For a time the United Kingdom Government assisted financially, and during the 1919-1929 operations, the Anglo-Persian Oil Company provided technical direction.

After detailed geological surveys had been made, nine bores were put down at UPOIA, on the Vailala River, and five others at POPO, on the Kapuri River; all were abandoned owing to drilling difficulties before reaching target depth. Oil showings were reported in some of the UPOIA bores.

Numerous small companies were active between 1923, when part of the Government Reserve was thrown open, and 1930. Bores were put down in the Oriomo area, near Daru, at Hohoro on the Vailala River, in Papua, and at Marienberg, Cape Vogel and Matapau in northern New Guinea.

Prospecting was stagnant during the early depression years, but resumed in 1936 under more liberal legislation. Two stronger companies entered the field - Papuan Oil Development Pty. Ltd. (a subsidiary of the Shell Company) and Island Exploration Company Pty. Ltd. (a subsidiary of Vacuum Oil Co. Pty. Ltd.). Oil Search Limited of Sydney resumed its search but on an enlarged scale, and Papuan Apinaipi Petroleum Company was formed. All four had active survey programmes.

Late in 1938 a new Act was passed which imposed definite obligations as to surveys, drilling, and the submission of maps and reports, and in return granted preferential concessions over larger areas of land, together with other rights and privileges. Following the passage of this legislation one large company was formed, and another reorganised -

Island Exploration Co. Pty. Ltd.: The Vacuum Oil Company, which had previously held all the shares, now took Anglo-Iranian Oil Company as an equal partner.

Australasian Petroleum Co. Pty. Ltd.: Formed by Anglo-Iranian Oil Co. Ltd. (British Petroleum) Vacuum Oil Co. Pty. Ltd. (which is a subsidiary of Standard-Vacuum Oil Co. Ltd. of New York) and Oil Search Limited of Sydney, each holding one-third of the shares. This company took over the permits previously held by Oil Search Limited.

Papuan Oil Development Company carried out geological and geophysical surveys and put down fifteen scout bores, but withdrew from Papua in 1939, transferring its technical personnel to the Shell subsidiary company prospecting in Queensland.

Australasian Petroleum, Island Exploration and Papuan Apinaipi companies were active until the area was closed, because of the war, early in 1942. The two larger companies had extensive programmes of aerial photography, geological and geophysical surveys in New Guinea as well as in Papua, and one major test had started at KARIAVA and reached 5,400 feet before the area was evacuated. Papuan Apinaipi concentrated on a shallow test drilling programme, completing two bores at less than 3,000 feet and five scout bores.

The New Guinea Oil Co. Ltd. which operated in the late nineteen-twenties, and Papuan Apinaipi Petroleum Co. Ltd. received Commonwealth Government subsidies.

VICTORIA

Although the search in Victoria dates from about 1914, the principal drilling activity has been since 1924 when a flow of artesian water with gas and traces of oil was struck at 1,070 feet in a bore at Lake Bunga.

Early operations were mainly confined to drilling, but were distributed over a considerable area; fifty-two bores were put down in the Lakes Entrance area, fifty-two around Bairnsdale and Sale, eight on Port Phillip Bay and thirty-one (including 24 scout bores) in Western Victoria. More than half of these were drilled by the State Government, in some cases with Commonwealth assistance. No major oil company took part in the search.

Drilling at Lakes Entrance delineated an area of about eight square miles within which oil occurred in a Miocene glauconitic sandstone at a depth of about 1,200 feet. As a war-time measure the Commonwealth and State Governments put down a shaft with the intention of drilling horizontal holes into the glauconite to drain the oil. Tests made at shaft bottom indicated that production on a commercial scale was unlikely to result and the Governments suspended operations. The project was taken over by Lakes Oil Limited and some oil was produced and sold.

The Nelson Bore put down by the State and Commonwealth Governments proved a sedimentary sequence of 7,305 feet, at least 5,300 of which is Tertiary.

NEW SOUTH WALES

The principal search has been made in the Hunter River and Sydney-Gosford districts. Work elsewhere has had little economic significance.

In the Hunter River district, a bore put down on Loder Dome to 2,391 feet encountered only slight gas shows. Two scout bores were drilled on Belford Dome, but a test bore only reached 1,498 feet before the operators ran out of money; small gas showings were reported. Both domes had previously been adequately defined at the surface by geological mapping.

The site of the Farley Bore was badly chosen, and the bore was in steeply dipping Lower Marine Sediments throughout. A depth of 5,364 feet was reached, with only small gas showings.

The principal bores drilled in the Sydney Basin were Kulnura, 6,293 feet; Mulgoa, 3,125 feet; Balmain, 4,937 feet; Tyler's Bargo, 3,550 feet. Shallower bores were drilled at Penrith, Richmond (3), Yerrinbool, Narrabeen (2), and Ravine. All but two struck small shows of gas.

The Grafton Racecourse bore which was drilled in the Clarence Basin for water also encountered gas in small quantity. A bore was drilled at Halfway Creek, south-east of Grafton to a depth of 2,580 feet.

All the drilling was done by private enterprise; the Commonwealth Government subsidised the Loder, Kulnura and Mulgoa bores.

WESTERN AUSTRALIA

The finding of glance pitch in basalt near the junction of the Negro and Ord Rivers in 1919 started the search for oil in Western Australia. After geological examination a bore was drilled which bottomed at 1,196 feet. Traces of gas were reported.

Of five shallow bores drilled between 1919 and 1922 at Prices Creek (four by Freney Kimberley Oil Company), traces of oil were reported from four. A shallow bore was also drilled at Mount Wynne, followed by a second bore which reached 2,154 feet and encountered globules of oil.

Two bores (respectively 3,264 and 1,545 feet) were drilled at Poole Range after geological survey, and traces of oil and gas were reported. Slight traces of gas were also reported from Freney Kimberley Oil Company's bore at Nerrima which had reached 4,271 feet when the area was closed (February, 1942) for security reasons. Extensive geological surveys by

Dr. Arthur Wade preceded the drilling. The operations of Freney Kimberley Oil Company were subsidised by the Commonwealth and State Governments.

In the two years up to the outbreak of war with Japan, Caltex Oil Development Pty. Ltd. carried out geological work in the Kimberley and North-West Cape regions, but abandoned the areas without drilling.

TASMANIA

The search in Tasmania has been concentrated in the Mersey Valley district, where two Australian companies drilled twenty-one shallow holes. Some shallow drilling has also been done on Bruny Island and elsewhere.

SOUTH AUSTRALIA

About thirty-eight bores were drilled in search for oil in South Australia; most of these were shallow, the deepest being 4,504 feet at Robe.

Traces of oil and gas were reported, but not substantiated.

Boring was almost equally divided between the State Department of Mines and private enterprise.

NORTHERN TERRITORY

Very little prospecting for oil had been done in the Northern Territory in the years before the war.

Part (B) - from and including 1946.

QUEENSLAND

After the war period, private enterprise resumed operations. Shell (Queensland) Development Pty. Ltd. carried out geological surveys and scout drilling, and selected a test-drilling site, at Warrinilla, south-east of Springsure. The company expected to have to drill to 10,000 feet and imported a suitable heavy (and costly) plant for the work; the drill ran into volcanics at about 4,000 feet, and was abandoned at 4,634 feet. The drilling of this bore is an excellent example of the necessity to carry out geophysical surveys before test-drilling.

In the Roma area, the Roma Blocks Oil Company and other small Australian companies jointly carried out geological investigations, and then united to form Associated Australian Oil Fields N.L. which, after the Bureau of Mineral Resources had carried out geophysical surveys in the vicinity of the first site, proceeded to put down six test bores between 1952 and 1956, three in the Roma township and three about eight miles north of the town. One of the former struck petroliferous gas.

As a result of the discovery of oil in Western Australia late in 1953, many companies were formed, and during the next three years four bores were drilled at Longreach, three at Warbreccan, three near Springsure, two at Maryborough and one at Wellington Point. Although evidence of oil and/or gas was found in some of these, in no case was either present in commercial quantities. Most of this drilling was done without any survey other than reconnaissance geology. Reconnaissance gravity survey preceded the siting of the Warbreccan bores of Westland Oil Co.

PAPUA

On the resumption of operations after the war, Australasian Petroleum Co. Pty. Ltd. began an active drilling campaign on its renewed permits. Drilling commenced in the area known geologically as the Aure Trough in 1946, and between 1946 and 1950 the Kariava Well was completed at 12,621 feet depth and wells were drilled at Oroi, Upoia, Hohoro and Wana. Some signs of oil and gas were met in most of these. Drilling conditions in this area are extremely difficult, and late in 1950, Island Exploration Co. Pty. Ltd. began drilling in the limestone area, at Omati, to the west of the Aure Trough. At 13,743 feet in Omati No. 1 a high-pressure show of gas was encountered, but the bore was abandoned after sidetracking operations, for the purpose of passing drill pipe and tools lost in the hole, had failed to enter the gas show. Omati No.2 was then drilled as a "dry" hole, and also a well at Aramia on the Fly River which encountered traces of oil and gas.

In January, 1956, drilling contractors employed by Australasian Petroleum Company struck gas at 998 feet in the Kuru test, which blew-out and flowed out of control until an "offset" well was directionally-drilled to intersect the limestone at the base of Kuru No. 1, when water was pumped in and killed the gas flow. Another test was subsequently drilled on the Kuru structure. Drilling is also taking place at Barikewa, and drilling sites are being prepared at KOMEWU and SIRERU. The test well at Morehead in the south-western part of the Territory, was abandoned at 8,087 feet early in February 1957; no oil or gas was encountered there.

Both companies have had a continuing programme of detailed geological, gravity, seismic, and airborne magnetometer surveys.

Papuan Apinaipi Petroleum Co. Ltd. has not yet commenced drilling on its permit area; geological surveys are in progress, and stratigraphic boring is scheduled to commence as soon as landing craft, being built in Sydney, is available to move the drilling plant into the area.

NEW GUINEA

Geological and geophysical exploration is being carried out by Enterprise of New Guinea Gold and Petroleum Development, N.L. on its Sepik River permit area, and scout drilling is expected to commence when plant alterations have been completed.

VICTORIA

Permits to explore for petroleum now cover most of the parts of the State where sedimentary formations are known to occur. Operations since the war have been confined to the Woodside area of Gippsland, where two companies have so far drilled three wells; a fourth is now being drilled. Five scout bores have been drilled for geological information, and a sixth is now in progress.

The deeper wells are reported to have given indications of the presence of oil in Tertiary rocks and in Jurassic sediments of freshwater origin. Drilling has been continued in an effort to reach the marine sediments which, from surface evidence in other parts of Gippsland, may be expected to underlie the freshwater Jurassic rocks, but the Jurassic rocks have been found to be thicker than expected and no marine sediments have been reached so far.

NEW SOUTH WALES

The Sydney and Clarence Basins have been the scene of recent drilling (1955 and 1956). A well at Kurrajong was suspended at 4,755 feet without locating any oil or gas. A well at Grafton in the north-east of the State was drilled to 4,583 feet; it was reported that a small amount of gas was encountered.

A well is at present being drilled by Australian Oil & Gas Corporation Limited at Dural in the Sydney Basin and this had reached 3,501 feet by 31st December, 1956. Several showings of gas have been reported.

WESTERN AUSTRALIA

After the war large areas were taken up by Ampol Limited, and successive attempts made to attract American capital to undertake the exploration. In the meantime the Bureau of Mineral Resources had commenced regional and detailed geological and geophysical investigations in the Carnarvon and Canning Basins.

The stratigraphic and structural information obtained by the Bureau was so encouraging that the Caltex Oil Company, which had examined and rejected the area before the war, decided to renew its search. An operating company was formed called West Australian Petroleum Pty. Ltd. (WAPET), Caltex holding 80 percent of the shares and Ampol 20 percent. WAPET began an active drilling campaign in 1953, supported by extensive geological and geophysical surveys. Oil in commercial quantities was found in the first well drilled at Rough Range. After the completion of flow tests on the sand at 3,605 feet in the discovery well, drilling was continued and the well was taken to a depth of 14,607 feet. Tests were then made on other small indications of oil and gas which had been noted, and a considerable period of time passed before the main oil sand could be re-opened on test. Flow could not be reinduced and an offset well, No. 1A, was drilled and the sand brought into production with the same rate of flow as originally obtained in No. 1.

Subsequent drilling proved the structure to be different from that on the surface and although ten other test wells were drilled, they were all "dry". With only one producing well, the area cannot be operated on a commercial basis.

Drilling also took place on the Cape Range structure, to the north-west of Rough Range, but though gas was found at various depths in the four bores, it was not in commercial quantities.

In all, twenty-one wells have been drilled so far in the Exmouth area.

One well was drilled at Giralia, south-east of Rough Range, but this was a dry hole. One bore has been drilled at Warroora, in the Carnarvon Basin south of Rough Range, three at Grierson, and one at Cuvier; all these were "dry". The one at Warroora and one at Grierson were completed as artesian water bores.

In the Fitzroy Basin, four holes have been drilled, two by WAPET (at Frazer River, and Grant Range) and two by Associated Freney Oilfield N.L. (at Nerrima and Myroodah). This latter company subsequently drilled a third well at Sisters Terrace.

In addition to the above, twenty-five stratigraphic bores have been drilled for geological information - nineteen on Dirk Hartog Island and three in the Canning Basin by by WAPET and three in the Canning Basin by the Bureau of Mineral Resources.

TASMANIA

There appears to have been no post-war activity in oil prospecting.

SOUTH AUSTRALIA

In 1947, Zinc Corporation Limited, Anglo-Iranian Oil Company Limited and Vacuum Oil Company Pty. Ltd. united to form Frome-Broken Hill Pty. Ltd., each holding one-third of the shares. Frome-Broken Hill carried out geological and geophysical investigations, followed by test drilling, in the Frome Embayment. In 1954, Zinc Corporation Ltd. transferred the greater part of its holding to Interstate Oil Limited, to enable the public to have a direct interest in the operations of Frome-Broken Hill Pty. Ltd. and Frome-Lakes Pty. Ltd.

In 1955 Santos Ltd. commenced drilling in the Wilkatana area, north of Port Augusta, and so far nineteen holes have been drilled. Some evidence of the presence of crude oil has been noted. Geological and geophysical surveys are also being carried out.

Three shallow wells have been drilled at Loxton, Pinnaroo and Tailem Bend in the Murray Basin east of Adelaide; no evidence of petroleum has been reported.

The South Australian Department of Mines has a drilling campaign on the Yorke Peninsula, and in December, 1956, bores were being put down on Minlaton and Stansbury; traces of oil were found in the former.

NORTHERN TERRITORY

Six permits were in force at December, 1956; geological and geophysical surveys had been made, but the drilling stage had not been reached in any area.

A showing of gas and oil was reported at shallow depth in a bore drilled for water at Ammaroo.

APPENDIX (2).

Part (a) - Wells Drilled in Search for Oil, 1946-1956.

STATE	COMPANY	AREA	WELL NUMBER	DEPTH	TOTAL FOR AREA	TOTAL FOR STATE	YEAR COMPLETED	
WESTERN AUSTRALIA	West Australian Petroleum Pty. Ltd.	Exmouth Gulf	Rough Range No. 1	14,607			1955	
			Rough Range No. 1A	3,656			1955	
			Rough Range No. 2	4,079			1954	
			Rough Range No. 3	3,915			1954	
			Rough Range No. 4	3,760			1954	
			Rough Range No. 5	3,772			1954	
			Rough Range No. 6	3,692			1955	
			Rough Range No. 7	4,281			1955	
			Rough Range No. 8	3,919			1955	
			Rough Range No. 9	3,884	49,565		1955	
			Rough Range South No.1	2,867			1956	
			Rough Range South No.2	1,523			1956	
			Rough Range South No.3	1,900			1956	
			Rough Range South No.4	2,289			1956	
			Rough Range South No.5	4,760			1956	
			Rough Range South No.6	1,594	14,933		1956	
			Cape Range No. 1	8,005			1955	
			Cape Range No. 2	15,170			1956	
			Cape Range No. 3A	3,737			1956	
			Cape Range No. 4	3,858	30,770		1956	
		Carnarvon	Giralia No. 1	4,087			1955	
			Warroora No. 1	5,989	10,076		1955	
		Fitzroy Basin	Grant Range No. 1	12,915			1955	
			Frazer River No. 1	10,144	23,059		1956	
	Associated Freney Oilfields N.L.	Fitzroy Basin	Nerrima No. 1	9,072			1955	
			Myroodah No. 1	6,001			1956	
			Sisters Terrace No.1	800	15,873			Drilling
						144,276		

STATE	COMPANY	AREA	WELL NUMBER	DEPTH	TOTAL FOR AREA	TOTAL FOR STATE	YEAR COMPLETED	
SOUTH AUSTRALIA	Santos Ltd.	Wilkatana	Wilkatana No. 1	2,199			1956	
			Wilkatana No. 2	1,025			1956	
			Wilkatana No. 3	1,264			1956	
			Wilkatana No. 3A	493			1956	
			Wilkatana No. 4	1,435			1956	
			Wilkatana No. 5	516			1956	
			Wilkatana No. 6	445			1956	
			Wilkatana No. 7	476			1956	
			Wilkatana No. 8	1,065			1956	
			Wilkatana No. 9	1,167			1956	
			Wilkatana No. 10	45			1956	
			Wilkatana No. 10A	267			1956	
			Wilkatana No. 11	1,109			1956	
			Wilkatana No. 12	237			1956	
			Wilkatana No. 13	582			1956	
			Wilkatana No. 14	600			1956	
			Wilkatana No. 15	580			1956	
			Wilkatana No. 16	810			1956	
			Wilkatana No. 17	209			1956	
			Wilkatana No. 18	428	14,952		1956	
	Australian Oil & Gas Corp.	Murray Basin	Loxton No. 1	1,460	1,460			Drilling
	Murray Basin Oil Syndicate	Murray Basin	Pinnaroo No. 1	950			1956	
			Tailem Bend No. 1	260	1,210		1956	
	Enterprise Oil Exploration Pty. Ltd.	Frome Embayment	Tilcha No. 1	2,353			1949	
			Cootabarlow No. 2	1,615			1947	
			Lakeside No. 1	1,076			1950	
			Black Oak	454	5,498		1950	
	South Australian Mines Dept.	Yorke Peninsula	Port Clinton No. 1	518				
			Minlaton No. 1	1,821				Drilling
			Stansbury No. 1	542	2,881	26,001	1956	

STATE	COMPANY	AREA	WELL NUMBER	DEPTH	TOTAL FOR AREA	TOTAL FOR STATE	YEAR COMPLETED	
VICTORIA	Woodside (Lakes Entrance) Oil Co. N.L.	Woodside	Woodside No. 1	6,008			1955	
			Woodside No. 2	7,350				Drilling
			Woodside No. 3	5,985			1956	
	Frome Lakes Pty. Ltd.		Darriman No. 1	4,730	24,073	24,073	1955	
NEW SOUTH WALES	Clarence River Basin Oil Exploration Co. N.L.	Grafton	Grafton No. 1	4,583	4,583		1955	
	Australian Oil & Gas Corp.	Sydney	Kurrajong No. 1	4,755			1955	Suspended
			Dural No. 1	3,501	8,256	12,839		Drilling
QUEENSLAND	Associated Australian Oilfields N.L.	Roma	Roma No. 1	3,892			1952	
			Roma No. 2	3,616			1953	
			Roma No. 3	3,605			1953	
			Roma No. 4	3,891			1954	
			Roma No. 5	4,079			1955	
			Roma No. 6	4,285	23,368		1955	
	Australasian Oil Exploration Ltd.	Springsure	Reid's Dome No. 1	9,060			1955	
			Reid's Dome No. 2	4,060			1955	
			Consuelo No. 1	4,427	17,557		1955	
	Lucky Strike Drilling Co.	Maryborough	Cherwell Creek No. 1	9,773			1955	
			Susan Creek No. 1	8,069	17,842		1955	
	Longreach Oil Ltd.	Longreach	Cleeve No. 1	3,068			1955	
			Longreach No. 2	3,224			1955	
			Longreach No. 3	3,490			1955	
			Longreach No. 4	3,277	13,059		1955	

STATE	COMPANY	AREA	WELL NUMBER	DEPTH	TOTAL FOR AREA	TOTAL FOR STATE	YEAR COMPLETED	
QUEENSLAND (cont'd)	Westland Oil Co.	Longreach	Warbreccan No. 1	5,433			1955	
			Warbreccan No. 2	5,224			1955	
			Warbreccan No. 3	6,054	16,711		1955	
	Winneills Pty. Ltd.	Ipswich Basin	Wellington Point No.1	3,748	3,748		1955	
	Shell (Queensland) Development Pty. Ltd.	Springsure	Morella No. 1	4,634	4,634		1951	
	Murilla Oil Co.	Roma East	Boyanda No. 1	4,782	4,782		1956	
	Condamine Oil Co.	Roma East	Speculation No. 1	2,294	2,294	103,995		Drilling
PAPUA	Island Exploration Co. Pty. Ltd.		Omati No. 1	14,352			1955	
			Omati No. 2	10,880			1955	
			Aramia No. 1	6,628			1955	
			Barikewa No. 1	1,581	33,451			Drilling
	Australasian Petroleum Co. Pty. Ltd.		Kuru No. 1	998			1956	
			Kuru No. 1A	986			1956	
			Kuru No. 2	5,838				Drilling
			Morehead No. 1	8,087	15,909			Drilling
			Kariava No. 1	12,621			1948	Resumed in 1946 at 5,400 feet.
			Oroi No. 1	5,516			1949	
			Upoia No. 1	5,356			1950	
			Wana No. 1	9,866			1951	
			Hohoro No. 1	4,721			1950	
			Hohoro No. 2	10,642	48,722	98,082	1952	
					GRAND TOTAL	409,266		

Part (B) — Bores drilled for Structural and Stratigraphical Information, 1946-1956.

STATE	COMPANY	AREA	BORE NUMBER	DEPTH	TOTAL FOR AREA	TOTAL FOR STATE	YEAR COMPLETED
WESTERN AUSTRALIA	West Australian Petroleum Pty. Ltd.	Carnarvon	Grierson No. 1	1,437			1955
			Grierson No. 2	1,500			1955
			Grierson No. 3	1,450			1955
			Cuvier No. 1	1,500			1955
			Dirk Hartog No. 1	1,100			1955
			Dirk Hartog No. 2	840			1955
			Dirk Hartog No. 3	896			1955
			Dirk Hartog No. 4	1,500			1955
			Dirk Hartog No. 5	924			1956
			Dirk Hartog No. 6	1,400			1956
			Dirk Hartog No. 7	268			1956
			Dirk Hartog No. 7A	900			1956
			Dirk Hartog No. 8	778			1956
			Dirk Hartog No. 8A	1,200			1956
			Dirk Hartog No. 9	180			1956
			Dirk Hartog No. 9A	850			1956
			Dirk Hartog No. 10	876			1956
			Dirk Hartog No. 11	815			1956
			Dirk Hartog No. 12	830			1956
			Dirk Hartog No. 13	975			1956
			Dirk Hartog. No. 14	975			1956
			Dirk Hartog No. 15	1,050			1956
			Dirk Hartog No. 16	850	23,150		1956
		Exmouth Gulf	Exmouth No. 1	1,759			1956
			Exmouth No. 2	2,029	3,788		1956
		Fitzroy Basin	Roebuck Bay No. 1	4,000			1956
			Dampier Downs No. 1	3,028	7,028		1956
	Bureau of Mineral Resources	Fitzroy Basin	BMR 1 Jurgurra Creek	1,680			1955
			BMR2 Lurel Downs	4,000			1956
			BMR3 Prices Creek	694	6,374	40,340	1956

STATE	COMPANY	AREA	BORE NUMBER	DEPTH	TOTAL FOR AREA	TOTAL FOR STATE	YEAR COMPLETED
VICTORIA	Frome Lakes Pty. Ltd.	Gippsland	No. 1	790			1956
			No. 1A	1,962			1956
			No. 2	1,552			1956
			No. 3	1,876			1956
			No. 4	1,815	7,995		1956
	Commonwealth & State	Lakes Entrance	Pilot Bore	1,310	1,310		1945
	Woodside (Lakes Entrance) Oil Co. N.L.	Woodside	Woodside No.4	1,330	1,330	10,635	Drilling
NEW SOUTH WALES	Australian Oil and Gas Corp.	Yass	Yass No. 1	1,107	1,107	1,107	1956
					GRAND TOTAL	51,982	

APPENDIX (3)

EXPENDITURE ON OIL SEARCH

PART (A)

To 31st December, 1945, approximately (taken as the end of the war period during which operations were virtually at a stand-still).

PAPUA/NEW GUINEA

Commonwealth Government including subsidy of £29,608 to Papuan Apinaipi and £9,062 to New Guinea Oil Co.	£528,986
British Government	25,000
Papuan Apinaipi Petroleum Co. Ltd.	101,827
Papua Oil Development Pty. Ltd.	411,000
Island Exploration Co. Pty. Ltd.	376,750
Australasian Petroleum Co. Pty. Ltd.	1,054,563
Oil Search Ltd. and subsidiaries	180,000
Sundry small companies, allow	100,000
	£2,778,126

QUEENSLAND

Estimated to end of 1931 (Geological Survey of Queensland)	£795,000
Oil Search Ltd. and subsidiaries	110,290
Roma Blocks Oil Co. and associates	89,858
Shell (Queensland) Development Pty. Ltd.	219,401
Commonwealth Government (Subsidies of £31,485 to Oil Search Ltd., group and £10,142 to Roma Blocks)	41,627
	£1,256,176

EXPENDITURE (continued)

NEW SOUTH WALES

Loder Bore	£17,740
Belford Bores	48,000
Farley Bore (estimated)	12,000
Kulnura Bore "	33,000
Richmond Bores "	5,000
Penrith Bore "	7,000
Mulgoa Bore	24,200
Narrabean Bores	10,000
Balmain Bore (estimated)	6,000
Yerrinbool Bore "	7,000
Tyler's Bargo Bore "	7,000
Commonwealth Government	22,060
(Subsidies of £2,260 for Loder Bore, £17,000 for Kulnura and £2,800 for Mulgoa)	
All others, estimated	30,000
	£229,000

No record is at present available of expenditure on surveys.

VICTORIA

Victorian Government	
General	£35,000
Nelson Bore	36,385
Commonwealth Government	
General	19,000
Nelson Bore	36,385
Oil Search Ltd.	
Test drilling	9,700
Geology, geophysics and scout drilling	11,000
Austral Oil Drilling Syndicate	40,000
Other oil companies, estimated	105,000
	£292,470

No expenditure figure is included for the Lakes Entrance Shaft.

EXPENDITURE (continued)

WESTERN AUSTRALIA

Freney Kimberley Oil Company	£130,283
Oil Search Limited	12,000
Caltex Oil Development Pty. Ltd.	37,500
Commonwealth Government (S)	39,717
State Government (S)	24,288
(S) Subsidies to Freney Kimberley Oil Company	
Others, estimated	35,500
	£287,288

SOUTH AUSTRALIA

An estimate by the then Director of Mines placed the expenditure on the search for oil at not less than £200,000 prior to 1942. No records are available.

TASMANIA

No records exist, but the expenditure is thought not to have been less than £100,000.

NORTHERN TERRITORY

No record of cost is available, and it is thought that expenditure was negligible.

RECAPITULATION

Papua/New Guinea	£2,778,126
Queensland	1,256,176
New South Wales	229,000
Victoria	292,470
Western Australia	287,288
South Australia	200,000
Tasmania	100,000
	£5,143,060

PART (B)

From 1st January, 1946, approximately.

PAPUA-NEW GUINEA

Australasian Petroleum Co.

1946	£225,032	
1947	554,340	
1948	880,587	
1949	2,311,114	
1950	1,728,160	
1951	964,164	
1952	515,821	
1953	66,495	
1954	1,559,123	
1955	2,522,519	
1956 (estimated)	2,604,559	£13,931,914

Island Exploration Co.

1946	£1,513	
1947	4,342	
1948	61,143	
1949	102,781	
1950		
1951	397,669	
1952	704,798	
1953	1,112,407	
1954	1,376,526	
1955	1,512,386	
1956 (estimated)	1,826,621	£7,100,186

Enterprise of New Guinea Gold & Petroleum Development N.L.

1955	£37,914	
1956	42,569	£80,483

PAPUA--NEW GUINEA (Continued)

Papuan Apinaipi Petroleum Co. Ltd.		
1946/50	£12,817	
1954	13,316	
1955 (estimated)	25,000	
1956	45,000	£96,133
Sundry unrecorded, estimated		30,000
TOTAL PAPUA/NEW GUINEA		£21,238,716

WESTERN AUSTRALIA

West Australian Petroleum Pty. Ltd.			
1953/54	(x)	£2,617,744	
1955	(x)	4,500,000	
1956	(x)	3,325,000	£10,442,744

(x) includes a one-fifth interest by Ampol Exploration Ltd.

Ampol Exploration Pty. Ltd.		
1948/53	£333,452	
1954 (Administration)	23,375	
1955 "	50,352	
1956 "	24,241	£431,420
Associated Freney Oil Co. N.L.		
1955	£447,543	
1956	243,217	£690,760

(Includes survey costs in Northern Territory)

Westralian Oil Ltd.		
1955	£78,103	
1956	52,874	£130,977

(Includes work done in Western Australia, Victoria and the Northern Territory).

WESTERN AUSTRALIA (Continued)

Freney Kimberley Oil Co. (1932) N.L.

1946/47	£10,834	
1948	29,856	
1949	24,321	
1950	15,810	
1951	4,477	
1952 (estimated)	5,000	
1953 "	5,000	
1954 "	5,000	
1955 "	5,000	
1956 "	5,000	£110,298

(Including subsidy of £15,000 from Western Australian Government)

Sundry unrecorded, estimated	£50,000
TOTAL FOR WESTERN AUSTRALIA (approx.)	£11,856,199

QUEENSLAND

Roma Blocks and associated companies:

1946	£3,100	
1947	4,800	
1948	6,464	
1949	6,929	
1950	8,005	
1951	8,366	
1952 (estimated)	1,400	£39,064
1953 LIQUIDATED		

Associated Australian Oilfields N.L.

1952	£102,929	
1953	54,643	
1954	77,203	
1955	250,358	
1956 (estimated)	104,687	£589,820

(Includes expenditure on surveys in Northern Territory).

QUEENSLAND (Continued)

Westland Oil Co. Ltd.		
1955	£352,405	
1956	131,000	£483,405
Since liquidated.		
Australasian Oil Exploration Ltd.		
1955	796,059	
1956	470,956	£1,267,015
Winneill's Pty. Ltd.		
1954	1,102	
1955	48,742	
1956	2,027	£51,871
(Includes expenditure on Wellington Point bore by this company, Oil Drilling & Exploration Ltd., and Longreach Oil Ltd.)		
Lucky Strike Drilling Co. Pty. Ltd.		
1954	£2,888	
1955	144,527	
1956	116,802	£264,217
(Includes expenditure on Cherwell Bores by this company and Oil Drilling & Exploration Ltd.)		
Longreach Oil Ltd.		
1955	£165,039	
1956	6,326	£171,365
(See note under Winneill's Pty. Ltd.)		
Shell (Queensland) Development Pty. Ltd.		£701,000
1947/1951		
(The gross expenditure was about £1,181,000 on post-war work, and disposal of assets realized above £480,000)		
Sundry unrecorded, estimated		£200,000
TOTAL FOR QUEENSLAND (approx.)		£3,767,757

VICTORIA

Frome-Broken Hill Pty. Ltd.		
Frome-Lakes Pty. Ltd.		
1955	£169,600	
1956	193,000	£362,600
(Includes expenditure on surveys in Queensland and the Northern Territory)		
Woodside (Lakes Entrance) Oil Co. N.L.		
1955	£57,236	
1956	322,422	£379,658
Sundry unrecorded, estimated, excluding expenditure by Lakes Oil Ltd. on horizontal boring from base of Lakes Entrance shaft.		£150,000
TOTAL FOR VICTORIA (approx.)		£892,258

NEW SOUTH WALES

Australasian Oil & Gas Corporation Ltd.		
1955	£202,105	
1956	146,748	£348,853
(Includes survey costs in South Australia)		
Clarence River Basin Oil Exploration Co. N.L.		
1955	£15,142	
1956	76,953	£92,095
(Includes survey costs in South Australia)		
Sundry Unrecorded, estimated		£100,000
TOTAL FOR NEW SOUTH WALES (approx.)		£540,948

SOUTH AUSTRALIA

Santos Ltd.		
1955	£31,336	
1956	136,085	£167,421
(Includes survey costs in Northern Territory)		

SOUTH AUSTRALIA (continued)

South Australian Department of Mines (not to hand; provisionally estimated)	£25,000
Enterprise Oil Exploration Pty. Ltd.	92,463
Sundry unrecorded, estimated	50,000
TOTAL FOR SOUTH AUSTRALIA (approx.)	£334,884

TASMANIA

Sundry unrecorded, estimated	£25,000

NORTHERN TERRITORY

Included with company expenditures shown under States above.

RECAPITULATION

Papua-New Guinea	£21,238,716
West Australia	11,856,199
Queensland	3,767,757
Victoria	892,258
New South Wales	540,948
South Australia	334,884
Tasmania	25,000
Northern Territory (Included under States)	
	£38,655,762
Commonwealth Government (through the Bureau of Mineral Resources, Geology and Geophysics) approximately	1,300,000
	£39,955,762
Expenditure to end 1945	£5,143,060
" from 1946	39,955,762
TOTAL EXPENDITURE	£45,098,822

APPENDIX (4)

Census

of

Test Drilling Plants

for

Oil Search

as at 15/2/57

(Scout drilling units excluded).

The ratings shown below are for 4-½" drill pipe weighing 16.60 pounds per foot unless shown otherwise. Higher ratings are permissible using 3-½" 13.30-pound, or 2-⅞" 10.40-pound drill pipe, provided adequate power is available for fluid circulation.

Associated Freney Oil Company

1 - National Type "55" rated for drilling to 7,000 feet. This unit is now drilling at the Sisters permit in the Fitzroy River area; subsequently it will be used by Papuan Apinaipi Petroleum Company in Papua.

Associated Australian Oil Fields N.L.

1 - Sullivan Type "300" rated for drilling to 3000-4000 feet with 2-⅞" drill pipe. Plans have been completed for drilling at Arcadia, Queensland, with this unit.

Papuan Apinaipi Petroleum Co. Ltd.

1 - National Type "T-32" rated for drilling to 5,500 feet with 4-½" drill pipe. This unit was recently purchased from Associated Australian Oilfields N.L., but is still in Queensland. Plans are being made to drill with this unit at Singleton, N.S.W. for Australian Oil & Gas Corporation Ltd.

Woodside (Lakes Entrance) Oil Co. N.L.

1 - Brewster Type "N-4" rated for drilling to 5,500 feet. Now drilling and formation testing in Company's permit area in Gippsland.

Mines Department, Victoria

1 - Emsco Type "GB-250-T" rated for drilling to 5,500 feet. Import Licence issued early January. This unit may be employed, in part, on the search for underground water.

Australian Oil & Gas Corporation Ltd.

1 - Bucyrus-Erie Percussion Drill Type "48-L" rated for drilling to 6,000 feet. Now drilling at Dural, N.S.W.

Australasian Petroleum Co. Pty. Ltd.

(In association with Island Exploration Co. Pty. Ltd.)

1 - National Type "130" rated for 13,000 feet; now drilling at BARIKEWA, Papua.

1 - National Type "100" rated for 10,000 feet; now drilling at KURU, Papua.

1 - National Type "50" rated for 5,000 feet; completed drilling at MOREHEAD, Papua, early February.

2 - National Type "50", converted for use as HELIRIGS (i.e. to be flown to site by helicopter) shortly to be used at KOMEWU and SIRERU, Papua. Depth rating 5,000 feet.

Oil Drilling and Exploration Ltd.

(Drilling Contractors)

1 - National Type "80-B" rated for 10,000 feet. Idle.

1 - National Type "55" rated for 5,500 feet. Idle.

1 - National Type "T-20" rated for 4,000 feet; contract drilling for West Australian Petroleum Pty. Ltd. on Dirk Hartog Island.

1 - Brewster Type "N-55" rated for 8,000 feet with 4-$\frac{1}{2}$" drill pipe. This drill is being sold to an Australian company shortly to be floated in Sydney to search for oil in Timor.

West Australian Petroleum Pty. Ltd. (WAPET)

1 - National Type "130" rated for 13,000 feet. Standing-by, waiting for results of seismic and gravity surveys and the consequent selection of drill sites.

West Australian Petroleum Pty. Ltd. (WAPET) (Continued)

1 - National Type "100" rated for 10,000 feet. Also standing-by as above.

2 - National Type "T-32" rated for 5,500 feet. Also standing-by as above.

APPENDIX 5

LIST OF PERMITS, LICENCES AND LEASES (OR EQUIVALENTS), BY STATES IN FORCE AT 31.12.56

STATE	TYPE OF AUTHORITY	NUMBER OF AUTHORITY	HOLDER	AREA (Sq.miles)	DATE OF EXPIRY
PAPUA	Permit to Explore	15	Island Exploration Co. Pty. Ltd.	8,125	30/6/59
		18		7,850	2/9/57
		2		1,465	31/10/57
		12	Australasian Petroleum Co. Pty. Ltd.	1,704	30/6/59
		5, 14		4,080	30/6/57
		16, 17, 19		11,610	2/9/57
		24		647	25/4/57
		22	Papuan Apinaipi Petroleum Co. Ltd.	8,600	10/8/57
NEW GUINEA	Permit to Explore	21	Enterprise of New Guinea Gold and Petroleum Development N.L.	1,650	30/6/57
QUEENSLAND	Authority to Prospect (P)	6	Lucky Strike Drilling Co.	1,050	31/3/58
		7, 9	Associated Australian Oilfields N.L.	21,750	31/3/58
			Australasian Oil Exploration Ltd.	2,398	31/9/59
		11	Frome Broken Hill Pty. Ltd.	80,000	31/3/58
		12	J. P. McCosh	1,850	31/5/57
		13	Winneills Pty. Ltd., Longreach Oil Ltd. and Oil Drilling & Exploration Ltd.	1,000	30/4/57
		19	Oil Structure Surveys Ltd.	7,000	31/1/57
		26	Kimberley Oil Exploration Syndicate Ltd.	8,000	31/1/58
		29	Ozark Royalty Company	1,180	31/5/58
		32	South Queensland Petroleum Pty. Ltd.	1,900	28/2/59
		33	E. Evans and J. Bjelki-Petersen	22,400	31/12/57
		34	Longreach Oil Ltd.	10,000	31/12/57
		35	Australian Mining & Smelting Co. Ltd.	64,500	30/6/59
		36	Australian Oil & Gas Corporation Ltd.	31,400	30/6/59
		37	Central Queensland Petroleum Co. Pty. Ltd. and the Catawba Corporation.	11,600	31/8/59

STATE	TYPE OF AUTHORITY	NUMBER OF AUTHORITY	HOLDER	AREA (Sq. miles)	DATE OF EXPIRY.
QUEENSLAND (Cont'd.)	Petroleum Prospecting Permits	685	Condamine Oil Co.	100	31/7/57
		688	Tallyabra Oil Pty. Ltd.	200	31/7/57
		696	W. C. Walz, H.J. Walz & A. E. Zurker	200	4/10/58
SOUTH AUSTRALIA	Oil Exploration Licence (O.E.L.)	7	Santos Ltd.	176,650	28/2/57
		9	Frome Broken Hill Pty. Ltd.	4,600	4/2/57
		10	Murray Basin Oil Syndicate	14,000	31/10/57
		11	Australian Oil & Gas Corpn.	18,000	20/12/57
		12	Clarence River Basin Oil Exploration Co. N.L.	8,900	7/5/58
	Oil Prospecting Licence (O.P.L.)	13	Santos Ltd.	200	6/2/60
NORTHERN TERRITORY	Permit to Explore	1	Associated Freney Oilfields N.L.	9,200	23/12/57
		2	Associated Australian Oilfields N.L.	7,600	23/12/57
		3	Westralian Oil Ltd.	7,400	23/12/57
		8	Santos Ltd.	7,450	11/7/57
		12	A. M. Petrick, A. J. Mengel & C. G. McIntyre	9,800	4/11/57
		14	R. C. Sprigg	1,460	9/12/57
WESTERN AUSTRALIA	Permit to Explore	27H, 28H, 29H, 30H,	West Australian Petroleum Pty. Ltd.	282,200	22/10/57
		35H	Jacksons Explorations	15,800	9/2/57
		42H, 46H	Goldfields Petroleum Discovery Syn. Ltd.	19,500	9/2/57
		69H, 70H	Westralian Oil Ltd.	30,150	12/7/57
		106H			28/3/57
		123H	Northwest Oil Pty. Ltd.	4,600	28/3/57
		125H	Kimberley Oil Exploration Syn. Ltd.	13,000	28/3/57
		127H	Gulf Oil Syndicate	13,000	28/3/57

STATE	TYPE OF AUTHORITY	NUMBER OF AUTHORITY	HOLDER	AREA (Sq.miles)	DATE OF EXPIRY
	Licence to Prospect	16H, 17H, 47H	Associated Freney Oilfields N.L.	570	26/6/57
		18H, [illegible]	West Australian Petroleum Pty. Ltd.		17/8/57
		19H, 20H, 21H			
		22H, 23H, 24H			
		25H, 26H, 27H			
		28H, 29H, 30H			
		31H, 32H, 33H			
		34H, 35H, 36H			
		37H.			17/5/58
		39H, 40H, 41H,			
		42H, 44H, 45H			21/12/58
		46H		4,981	17/11/58
NEW SOUTH WALES	Exploration Licence.	1	Australian Oil & Gas Corporation	1,955	22/6/58
		4, 5	" " " "	10,000	27/6/58
		2	" " " "	5,000	27/9/58
		6, 7, 8	" " " "	11,350	9/8/58
		9	" " " "	4,600	30/11/58
		10	Oil Search Ltd. (for A.O.G.)	3,800	30/11/58
		11	R. W. Addison	336	30/11/58
		3	E. Gulliver	2,700	19/11/58
	Prospecting Licences	1,	J. C. Reynolds	14	19/11/58
		2, 3	Australian Oil and Gas Corpn. Ltd.	400	27/6/58
	Mining Lease	5056	J. A. O'Shea	108 acres	22/10/68
	Private Lands Lease	787	Misses M. E. Olarenshaw & A.F.S. Harrison.	4 acres	22/10/68
VICTORIA	Petroleum Exploration Permits (P.E.P.)	1,2,3,5,6.	Frome Broken Hill Pty. Ltd.	21,770	1/6/57
		12	Lochiel Oil Search and Prospecting Co. Ltd.	1,183	30/6/58
	Petroleum Prospecting Licences (P.P.L.)	157	Frome Lakes Pty. Ltd.	200	1/6/57
		161, 162		368	1/4/57
		190		172	1/9/58

STATE	TYPE OF AUTHORITY	NUMBER OF AUTHORITY	HOLDER	AREA (Sq. Miles)	DATE OF EXPIRY.
VICTORIA (Cont'd.)	Petroleum Prospecting Licences (P.P.L.)	158, 159, 160	Frome Austral Pty. Ltd.	531	1/11/57
		181		136	1/4/58
		164	Mineral Ventures N.L.	149	1/2/58
		212		167	1/1/59
		174	Woodside (Lakes Entrance) Oil Co. N.L.	200	1/3/57
		213		158	1/2/59
		247		149	1/7/60.
		196,197,201	Gippsland Oil Co. Ltd.	482	1/10/58
		248		141	31/10/60
		180	Oil and Minerals Quest N.L.	67	1/3/58
		184,185		111	1/5/58
		191	J. P. McCosh	139	1/9/58
		215, 216		370	1/3/59
		192	Australian Paper Manufacturers Ltd.	193	1/1/59
		193		182	1/9/5
		198	G. D. Lindholm	85	1/10/
		199	" " (option granted to Westralian Oil Ltd.)	80	1/10/
		210	" " (option granted to Westralian Oil Ltd.)	191	1/1
		211	" "	126	1/7
		246	A. E. Ekberg	197	1/
		202	Pacific Mining Ltd.	149	3
	Application for Petroleum Exploration Permit.	13	Murray Basin Oil Syndicate		
		14	Woodside (Lakes Entrance) Oil Co. N.L.		