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RECORD 1975/109

HISTORY OF PETROLEUM SEARCH IN THE CANNING BASIN, WESTERN AUSTRALIA, To 31 DECEMBER 1974

by

S.J. MAYNE

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CONTENTS

SUMMARY

Three distinct periods designated 'Freney', 'WAPET', and 'multi-company', can be distinguished in the history of oil exploration in the Canning Basin.

The earliest period began in 1919 when the first signs of oil were discovered, and is dominated by the rather haphazard activities of the Freney companies, particularly at sites in the mid-Fitzroy River Valley. Several wide-ranging reports were made on the Canning Basin, some mildly optimistic, others downright condemnatory.

After the hiatus in activity caused by World War II the Freney companies, disillusioned by constant failure, finally withdrew from the Canning Basin in 1957. A newly-formed consortium, West Australian Petroleum Pty Ltd (WAPET), had already begun operations in the basin, and, under the incentive of youthful enthusiasm and funds provided under the PSSA, embarked on a decade of considerable activity both in geophysical surveying and in well-drilling over the whole basin and not only in the Fitzroy Valley.

The third stage began in 1964 and is characterized by the activities of many companies both onshore and offshore, although Wapet remained as the biggest single operator. Most of the offshore area had recently been taken up by Woodside-Burmah (BOC) as a part of their giant Northwest Shelf holdings.

With the end of government subsidies in 1974 petroleum search in the Canning Basin has all but petered out. Over half a century's effort had produced virtually no reward, and all wells have been plugged and abandoned.

The Bureau of Mineral Resources has played an important role in petroleum exploration in the basin, where it has carried out geological surveys and stratigraphic drilling onshore and geophysical surveys both onshore and offshore.

INTRODUCTION

The Ordovician to Cainozoic Canning Basin is situated between the Kimberley and Pilbara Precambrian blocks in Western Australia. It trends southeast from the continental edge beneath the Indian Ocean to central Australia The present coastline is an approximate boundary between an onshore Palaeozoic potential petroleum province, and an offshore Mesozoic potential petroleum province formed on the edge of the Australian part of the sundered Gondwanaland continent.

The history of oil exploration in the Canning Basin is a long record of the chase of a will-o'-the-wisp. In the first two decades of the twentieth century northern Australia was very much a frontier land, and the geology of 'The Kimberley' and the 'Desert Basin' was known only through brief accounts given by exploring expeditions (Hardman, 1884, 1885; Basedow, 1918). As far as petroleum was concerned, Australians were keenly aware of the glamorous developments taking place in the United States and had strong hopes of doing likewise themselves. Although naive notions concerning the occurrence of petroleum were generally current, it was accepted that the artesian Desert Basin was an area that called for investigation.

Although a great deal of geological surveying has been done not only by petroleum companies in their own permits but by the Geological Survey of Western Australia (GSWA) and the Bureau of Mineral Resources (BMR), most geological data have been obtained from the logs of petroleum exploration wells. The broad structure of the basin has been largely worked out from geophysical surveys, which have also been widely used in well-siting.

Seventy petroleum wells have been drilled (Figs 1 & 2) and of these more than half are located in the area extending up to 300 km northeast to southeast of Broome, where the prime target for drilling has been the Devonian limestones. The prime offshore target has been the Jurassic sandstones. So far only the smallest quantities of petroleum have been found and all wells apart from a few later used as water wells, have been plugged and abandoned. Even the offshore Jurassic sandstones, which might have been expected to form commercial reservoirs, as do similar sandstones on the Rankin Trend to the south and the Browse Basin to the north, seem to be barren.

Phase 1 - THE FRENEY PERIOD

Indications of oil were noticed in 1919 by a Mr Harry Price who was in charge of a boring party searching for water in the Rough Range (now renamed Pillara Range and not to be confused with Rough Range at Exmouth Gulf, the site of Australia's first oil flow). This was the first instance of mineral oil to be departmentally recorded in Western Australia. Samples

of a black scum on the water were shown on analysis to contain traces of mineral oil. A second bore was put down by a Mr M. Freney, who took a second series of samples. A third bore was sunk between the other two in 1921 under the surveillance of the Mines Department geologist T. Blatchford. Ten samples from this bore were analysed: they all contained petroleum but the richest, from the bottom at 27.4 m, had only 0.25 percent petroleum. The presence of mineral oil was also detected in a seepage in the same general area.

A syndicate was formed known as the Freney Oil Company Ltd, which thereupon proceeded on 5 September 1922 to drill Prices Creek No. 1 well with a portable percussion rig. It was sited near the original bore, and penetrated to 307.4 m, the limit of the rig's capacity. The rocks consisted mainly of massive limestone, thought at the time to be of Lower Carboniferous age, but now known to be Ordovician. Traces of mineral oil were found between 69.8 m and 228.6 m, but the richest of six analysed samples contained only 0.01 percent of a pale yellow oil, smelling of petrol.

Prices Creek No. 2 well was drilled in 1922 about 1.5 km east-southeast of the No. 1 well. It reached 103.6 m in hard limestone and was reported by Blatchford (1922) as showing traces of 'mineral oil' from top to bottom.

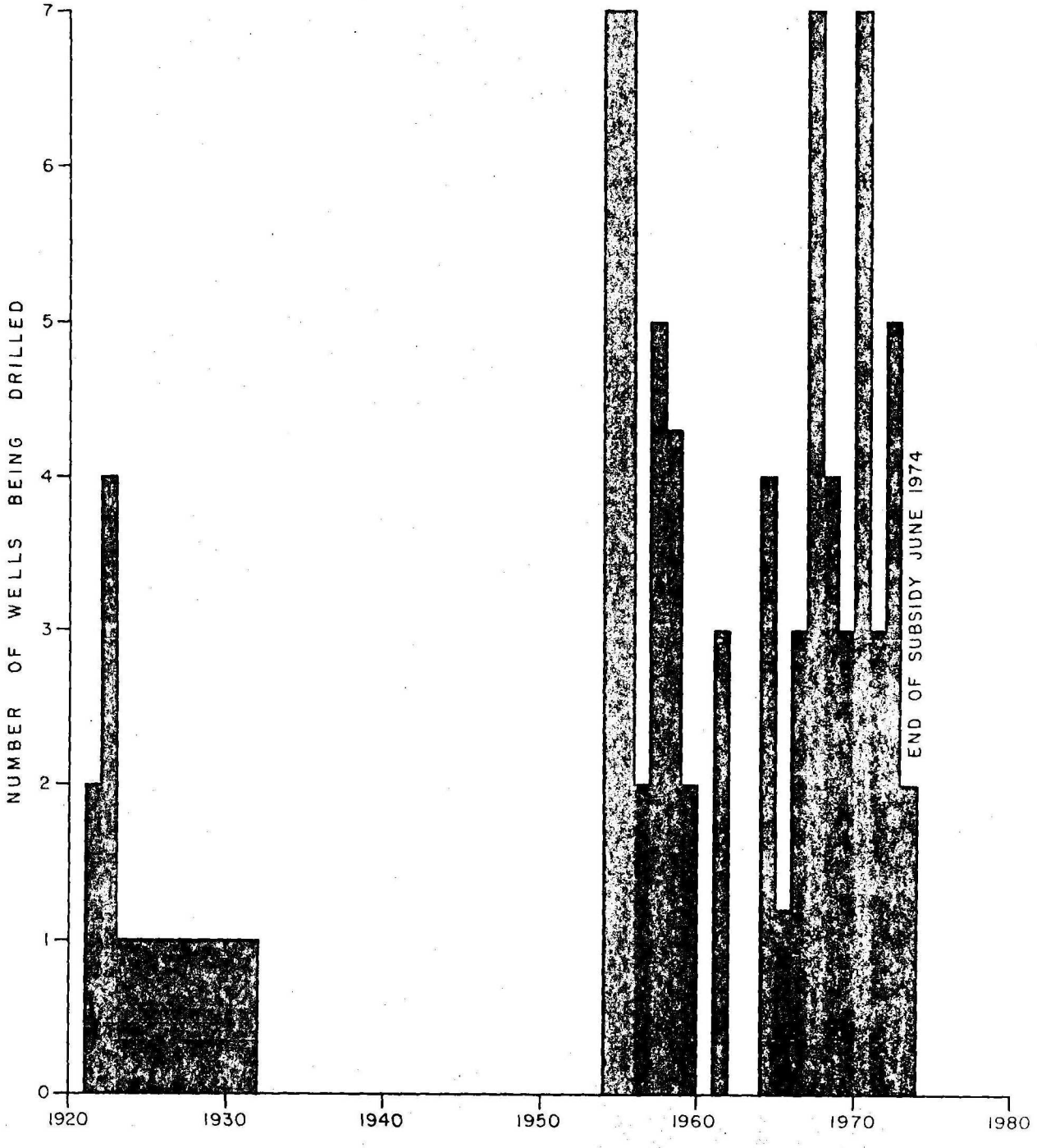
Prices Creek No. 3 well was drilled in 1923 about 1.5 km south of No. 1. It penetrated 246.6 m of calcareous shale and limestone, whence petrol-smelling odours emanated at intervals from 44.8 m to the bottom. There were traces of oil in the bottom 5.5 m.

Prices Creek No. 4 well was drilled in 1923 about 3.5 km WSW of well no. 1, passing through sandstones, shales, and limestones to finish in hard limestone at 135.3 m. Fresh water in quantity was struck in a sandstone at 14 m, but there is no record of any trace of oil.

L.J. Jones (1922a, b) made a reconnaissance survey over a large area of the southern portion of the Desert Basin in 1922 comprising O.P.A. 23H and O.P.A. 25H (Fig. 3). He noted the occurrence of various supposedly Carboniferous beds and considered the 'lower Limestone Series' a likely source of petroleum. He recommended a test hole near to Godfreys Tank on a 'well defined dome', and another about 3.5 km west of No. 50 Well, Canning Stock Route, on a 'structural terrace'. No drilling was undertaken, however.

Meanwhile Blatchford, with W.H.B. Talbot, field manager of the Freney Oil Company, had been continuing geological surveys in the valley of the Fitzroy River (later to be known as the Fitzroy Basin) and a drilling site was chosen at Mount Wynne, in rocks now classified as belonging to the Permian Grant Formation. The Freney Oil Company drilled Mount Wynne No. 1 from June 1922 to June 1923, using a Calyx plant which enabled cores to be taken. The

FIG. 1

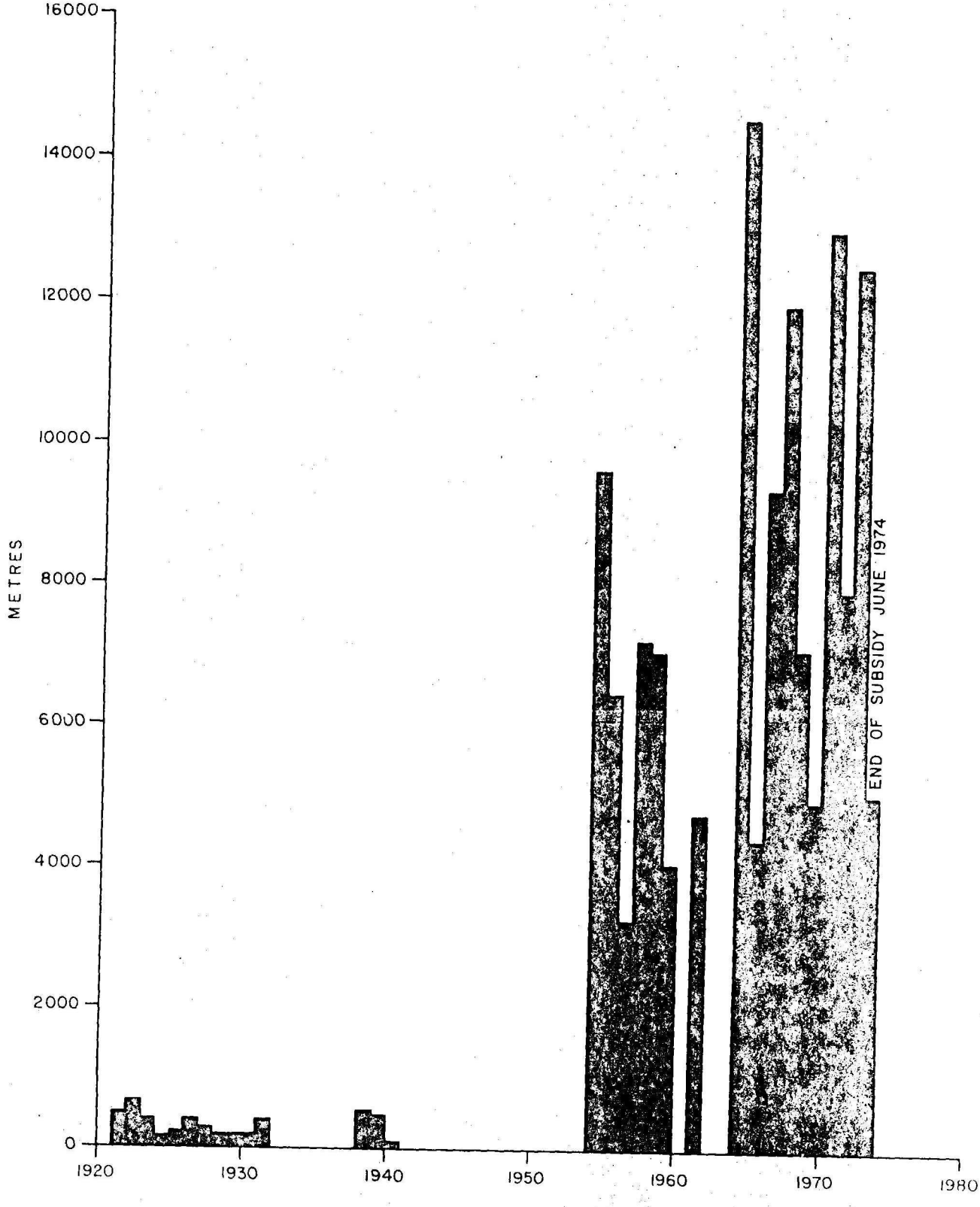


PETROLEUM EXPLORATION DRILLING ACTIVITY, CANNING BASIN

Record No. 1975/109

XM - 180

FIG 2

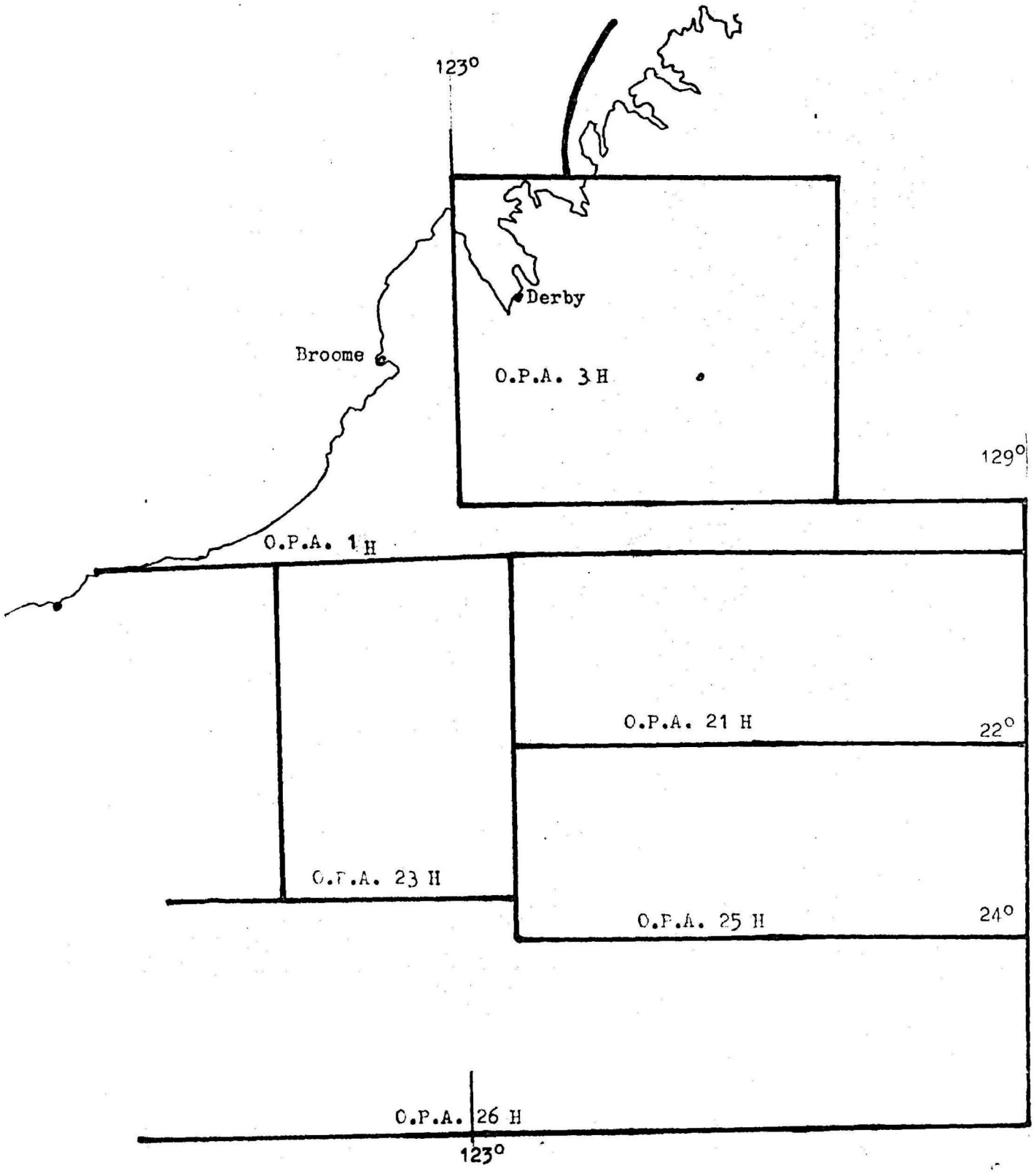


ANNUAL TOTAL OF
DEPTHS DRILLED IN PETROLEUM EXPLORATION WELLS, CANNING BASIN

Record No. 1975/109

XM-181

Fig. 3 PETROLEUM TITLES, 1921



OIL PROSPECTING AREAS

O.P.A. 1H	J.L. Strevens
O.P.A. 3H	M.R. Freney
O.P.A. 21H	W.A. Carcary
O.P.A. 23H	A.D. Baird
O.P.A. 25H	Locke & Thompson
C.P.A. 26H	A.J. Mellor

well reached 273.1 m, but most of the cores were left to weather away around the site. However, 'asphaltum' was reported at 33.2 m and 36.6 m and 'bitumen' at 68.6 m. Excitement ran high and the cores containing these substances were delivered in a sealed case to the Government Chemical Laboratory in Perth, where the seals were broken by the Premier of the State in the presence of the Minister for Mines and members of the Freney Oil Company. Analysis of the black material gave: Petrolene 86.45%; asphaltene 12.93%; non-bituminous amic matter 0.62%. It was described as a true petroleum of the 'soft asphaltum type'. The brown material gave: petrolene 18.15%; asphaltene 16.59%; non-bituminous organic matter 65.26%. It was thought to be an 'older oxidized asphaltum'. The company decided to deepen the well with cable-tools, but the well was too badly deflected for this.

Mount Wynne No. 2 was drilled a few metres away, but the tools broke at 18.3 m. In this connection it is interesting to note that such misadventures which befell any drilling operation in these early days were ascribed in popular fancy to the machinations of the big American petroleum companies.

Mount Wynne No. 3 began drilling in November 1923 and closed down in September 1925. It was sited only a few metres from the other two wells and eventually reached 656.6 m, passing through a dominantly arenaceous sequence of sandstone and shale. 'Globules of oil and bitumen' were reported at several hard sandstone horizons between 76.2 m and 574.8 m. 'Between 1640 feet (499.9 m) and 1674 feet (510.2 m)' Talbot reported in 1924 (Reeves, 1949), 'oil globules came up in the sludge and if there were no water in the bore (with a pressure of 550 lbs to the square inch) it is possible that there might be an appreciable seepage between these levels.'

In an effort to bring rhyme and reason into an understanding of the geology of northern Australia Dr A. Wade was commissioned by the Commonwealth Government to undertake field work between Derby and Darwin in 1924, and presented his report on the petroleum prospects of the Kimberley District of Western Australia and of the Northern Territory to the Senate of the Commonwealth Parliament in October of that year. Wade was in the Fitzroy Valley during April 1924, accompanied by Blatchford (GSWA), and Talbot.

Wade appears to have considered the rocks of the Desert Basin to consist of 'Upper Carboniferous (which might pass upward into Permian)' sandstones, shales, limestones, and till, lying unconformably on 'Lower Carboniferous (which might pass downward into Devonian)' limestones. These were unconformable on the Proterozoic rocks of the Kimberley block, but probably overlay Cambrian formations in the deeper parts of the basin. From Derby to the Gulf of Carpentaria there was an absence of strata of Ordovician, Silurian, and Devonian ages, unless the lower limestones at Mount Pierre represented an

Upper Devonian facies. The only other rocks that Wade recognized were of Jurassic and Recent age near the coast.

Wade envisaged the sagging of the 'Lower and Upper Carboniferous' rocks to form one of the great artesian basins of Australia, and their folding along the northern abutments as due to the resistance offered by the Precambrian shield. The basin contained fresh water at depth in its central parts, and this became brackish towards the margins, where any oil that might have existed in the basin would now rest. Wade considered that suitable structures in the marginal areas were the most favourable for oil accumulation that he had yet examined in Australia. He abandoned the idea of the 'Lower Carboniferous' limestones being the source of any considerable body of oil and thought the most likely source-rocks were postulated Cambrian strata.

Wade found it necessary to draw attention in his report to the importance of fossils in any attempts to elucidate the stratigraphy.

The Wade expedition found a series of folds running en echelon and parallel to the general course of the Fitzroy River for about 350 km. Four anticlines were studied and named: Grant Range, Mount Wynne, Poole Range, and Rough (now Pillara) Range/Prices Creek. He advocated the immediate drilling of three test holes, one on the upthrow side of the fault at Prices Creek and one on the downthrow side, and one on the axis of a more distant fold such as occurred in the Poole Range or in the well currently being drilled at Mount Wynne (Mount Wynne No. 3).

Also in 1924, Dr F.G. Clapp, a consulting geologist from New York, made a reconnaissance trip through various parts of Western Australia. In a paper printed in the Bulletin of the Association of American Petroleum Geologists in 1926 he wrote: 'Desert Basin is not merely a topographic and stratigraphic unit, but also a structural one. Dipping southwest.... the Permo-Carboniferous....strata pass under.... the Fitzroy River and thence to the centre of the basin, where they are buried under an immense thickness of sandstones'. Summarizing, he wrote: 'The insignificant nature of the oil indications in the several wells drilled, the apparent total absence of natural gas, uncertainty as to actual existence of any surface "indications", lack of shale cover, intense faulting and possible metamorphism of the marginal parts, prohibitive thickness of sandstone throughout enormous areas, and somewhat unsatisfactory source of origin are collectively considered unfavourable to the commercial occurrence of oil in the Desert Basin." In Economic Geology, he wrote that 'expenditure in drilling for oil in that State is useless and should be discouraged'. These reports (Clapp, 1926a, b; see also Clapp, 1925) did indeed discourage further investigations for a decade.

In 1925 Talbot conducted a detailed geological survey on the eastern flank of the Poole Range, and reported an anticline which he considered more favourable than those at Prices Creek or Mount Wynne. He advised the Freney Oil Company to drill near Mount Millard on the axis of the anticline and to the west of a fault (later surveys by Wade showed that the axis of the Poole Range structure lay a considerable distance to the northwest of the selected site). Poole Range No. 1 was drilled as a water bore to 121.9 m in July-August 1926. Poole Range No. 2 was drilled a few metres away in 1926-1927. It reached 320.3 m, encountered sub-artesian fresh water, but neither oil nor gas. Poole Range No. 3 well was begun in 1927 and finished three and a half years later at 994.9 m. The rocks consisted of shale and sandstone. Some of the sandstones were aquifers. A show of heavy crude oil, which had a mixed paraffin and asphalt base, was obtained from a fine sandstone between 635.5 m and 644.8 m. The oil yielded only a trace of petrol, 4.3 percent of kerosene, about 75 percent of lubricating oil, and the rest was asphalt and wax. This was the most promising discovery yet made, but, as with the Mount Wynne occurrence, was not adequately tested.

As a result of the passing of the Petroleum Prospecting Act of 1926, an amount of £60,000 was provided for advances to persons or companies searching for oil. In 1927 the appropriation was increased to £160,000 and an additional sum of £50,000 was voted in 1928. Another result was the establishing of the Geological Branch of the Department of Home and Territories. This unit was the forerunner of the Bureau of Mineral Resources (BMR). The first report of Mr F. Chapman, appointed Commonwealth Palaeontologist in 1927, was on samples from the Freney bore at Poole Range, and maybe regarded as the beginning of an association of Commonwealth geologists with the Canning Basin that has persisted ever since.

In 1931 the geological adviser to the Commonwealth Government, Dr W.G. Woolnough, issued a report on oil-fields in America and oil prospects in Australia. This salutary document (Woolnough, 1931) drew attention to the whole problem of petroleum production and the lack of sophistication in the approach of Australians to it. One of his examples was the treatment of Poole Range No. 3.

Poole Range No. 4 was drilled in 1931 as a water bore 3.5 km east-north-east of Nos. 1, 2 and 3, and Poole Range No. 5 was drilled a few metres away from it in 1932-33. However, while No. 5 was being drilled, the Freney Oil Company went into voluntary liquidation, and Freney Kimberley Oil Company 1932 N.L. was formed. This new company closed down operations at Poole Range when

the No. 5 well had reached 1545 feet, (470.91 m) and commissioned Dr Wade to examine its concessions 146H and 186H, which covered an area of 242,520 square kilometres.

Wade, assisted by L.M. Waterford (surveyor) and E.P. O'Driscoll and R.K. Weatherburn (geologists), covered over 50,000 square kilometres in 1934-1935, and presented a final Report in 1936 (Wade, 1936). Aeroplane reconnaissances were used for the first time, and special attention was paid to the collecting of fossils. The Commonwealth Government undertook to prepare the maps at a scale of 4 miles to one inch.

In his report Wade recognized strata of Middle to Upper Devonian age (possibly grading into Lower Carboniferous), and Permian and Jurassic age. He also examined in some detail the faulting, fracturing and shearing developed in the basin sequence and described the more pronounced structures:

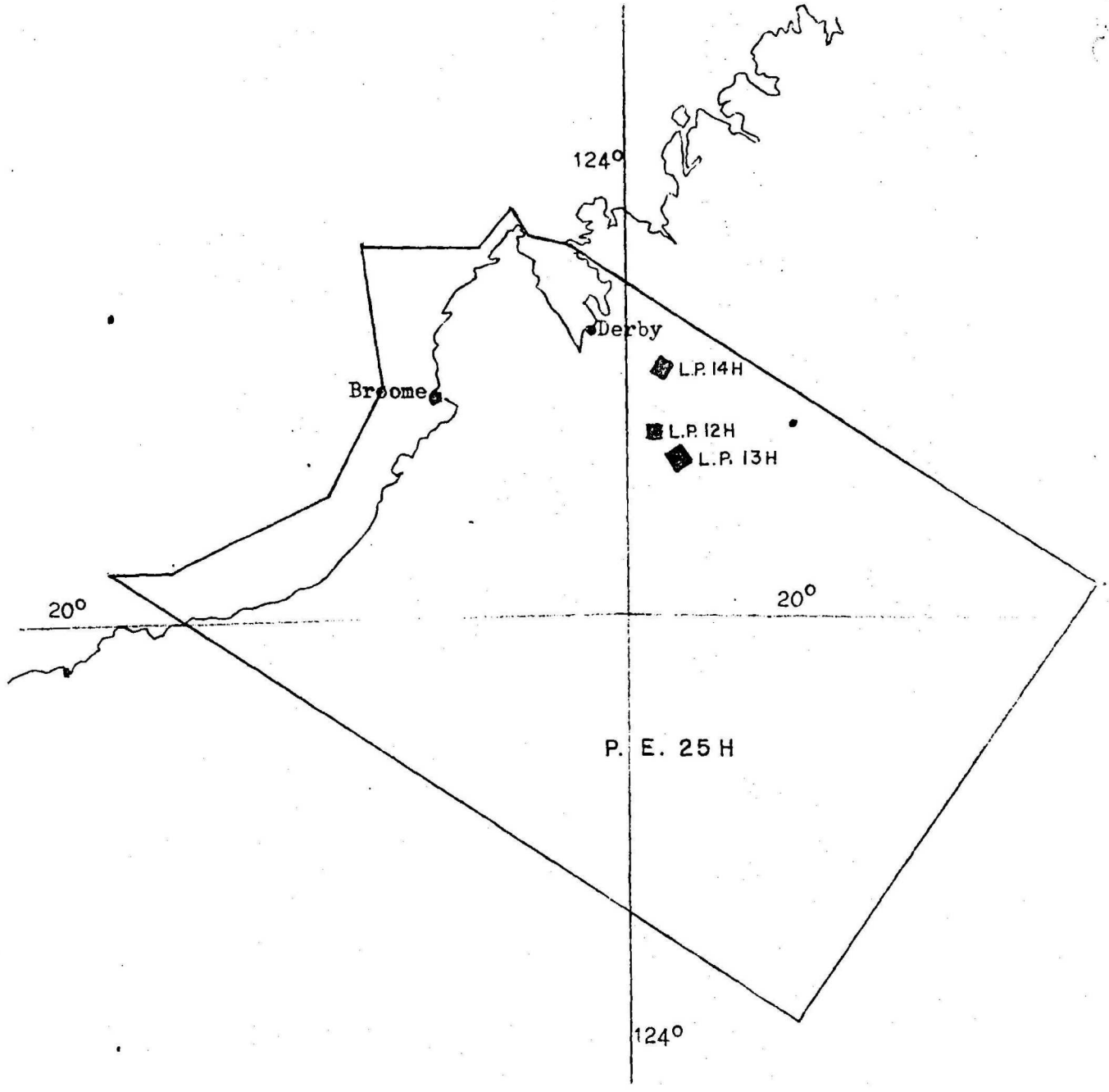
1. Grant Range area
2. Mount Wynne area
3. St George Range area
4. Poole Range area
5. Mount Jabbot Fold
6. Kalsida structure
7. Camelgoorda Hill
8. Mount Arthur structure
9. Edgar Ranges
10. Nerrima Dome
11. Tu-Tu Dome
12. Sisters Terrace
13. Ellindale Structure
14. Myroodah Structure

He emphasized the importance of considering all the factors relevant to oil occurrence, instead of merely structures. All oil indications in the Desert Basin were in lower beds of the sequence, and Wade favoured the Devonian limestones. The small showings of oil found to date were of no especial importance apart from showing that conditions favourable to oil formation had existed somewhere within the basin sequence. Wade concluded that the evidence called for neither undue optimism nor pessimism, and recommended the drilling of two test bores, one to 5,000 feet (1524 m) on the Nerrima Dome, and one to 4,000 feet (1219.2 m) south of the Sisters, thus testing favourable structures in both Permian and Devonian strata.

In 1936 two Petroleum Oil Search Acts were passed, by which £250,000 was appropriated to encourage drilling and to buy suitable drilling equipment (Crespin 1967).

In 1937 the Oil Advisory Committee which had been appointed in 1936, recommended that the Fitzroy River area should be further tested by boring, but not by the newly-developed geophysical methods that had been proposed by a Mr Mitstein of Melbourne, and also by Mr J.M. Rayner, Consultant Geophysicist to

Fig. 4 PETROLEUM TITLES 1939-1952



Permits to Explore

25H CALTEX (1939)
AMPOL Petroleum Ltd
(1947-1952)

Licenses to Prospect

12H)
13H) Freney Kimberley Oil
14H)

Record No. 1975/109

the recently formed Northern Australia Survey.

The Freney Kimberley Oil Company began drilling Nerrima No. 1 well in September 1939, using a rotary rig provided by the Commonwealth. By late 1941 the well was 1301.8 m deep, with slight gas showings reported at 635.5 m and 977.2 m, but the Devonian limestone target had not been reached. Although the area was regarded as the most promising for oil in Australia, the war-time emergency prevented more equipment from being made available to the company, which was forced to suspend operations in February 1942, and the well was never deepened further.

During the early years of the war Dr C. Teichert was responsible for the first detailed biostratigraphic work in the basin (Teichert 1946).

In 1939 Caltex (Aust.) Pty Ltd acquired prospecting permits (PE 25H) over all the Desert Basin, except the few areas still held by Freney (Fig. 4). The company's geologists C. St J. Bremner (1940, 1942), W.A. Findlay (1942), and P.S. Kraus (1941) made detailed surveys in the northern part of the Fitzroy Basin in 1940 and 1941, and an aerial survey over the southern part of the basin. This work advanced considerably the knowledge of the basin, and established that Devonian rocks do not crop out in the south of the basin. In 1941, Caltex reconnoitred the northeastern part of the Fitzroy Basin (Maddox, 1941). After the war, however, Caltex gave up its prospecting permits (1946).

In 1947 the Zinc Corporation took up prospecting permits in the basin, and formed the Bonaparte Gulf Company with Vacuum Oil and D'Arcy Exploration Company. Dr F. Reeves of the United States Department of the Interior was engaged to make a geological survey of the Desert Basin (as the Canning Basin was still called). His report (Reeves, 1949), was the most detailed and valuable yet produced. In particular however, he postulated that the Grant Formation was a facies equivalent of the Devonian limestones. The RAAF took air photographs of that part of the basin lying between the eighteenth and nineteenth parallels and this greatly facilitated the survey.

In 1948 the first BMR field party to work in the basin examined Dampierland (now called Dampier Peninsula), the Mount Ramsay area, and the Nerrima Structure (also called the Nerrima Dome or Anticline). The party considered that the petroleum prospects of Dampierland were considerably enhanced by their discovery that all the outcrops there were of Jurassic or Cretaceous age. A low domal structure was also indicated in the Fraser River/Mount Jowlaenga area. At Nerrima it was suggested that drilling be extended to the Devonian limestone or to basement (Guppy & Lindner, 1949; Guppy et al., 1950).

In 1949 Freney Kimberley Oil resumed work at the Nerrima No. 1 well-site, but abandoned it in 1950 without having deepened the hole. The 1949

BMR field party discovered Ordovician limestone and dolomite at Prices Creek beneath the Devonian strata. By thus extending the time-range of known stratigraphy down into the Lower Palaeozoic the petroleum potential of the Canning Basin was notably increased (Guppy & Opik, 1950). Also in 1949, Ampol Petroleum Ltd acquired prospecting permits over coastal areas of the basin (Fig. 5).

In 1951 Reeves wrote in the Bulletin of the Association of American Petroleum Geologists that the prospects of finding oil south of the Fenton Fault were practically nil because the rocks probably consisted of a thin Permian sequence on Precambrian basement. He concluded that only the coastal parts of the Fitzroy Basin merited further investigation, but nevertheless included the basin in the four Australian basins (all in W.A.) that he considered had 'moderate oil prospects'.

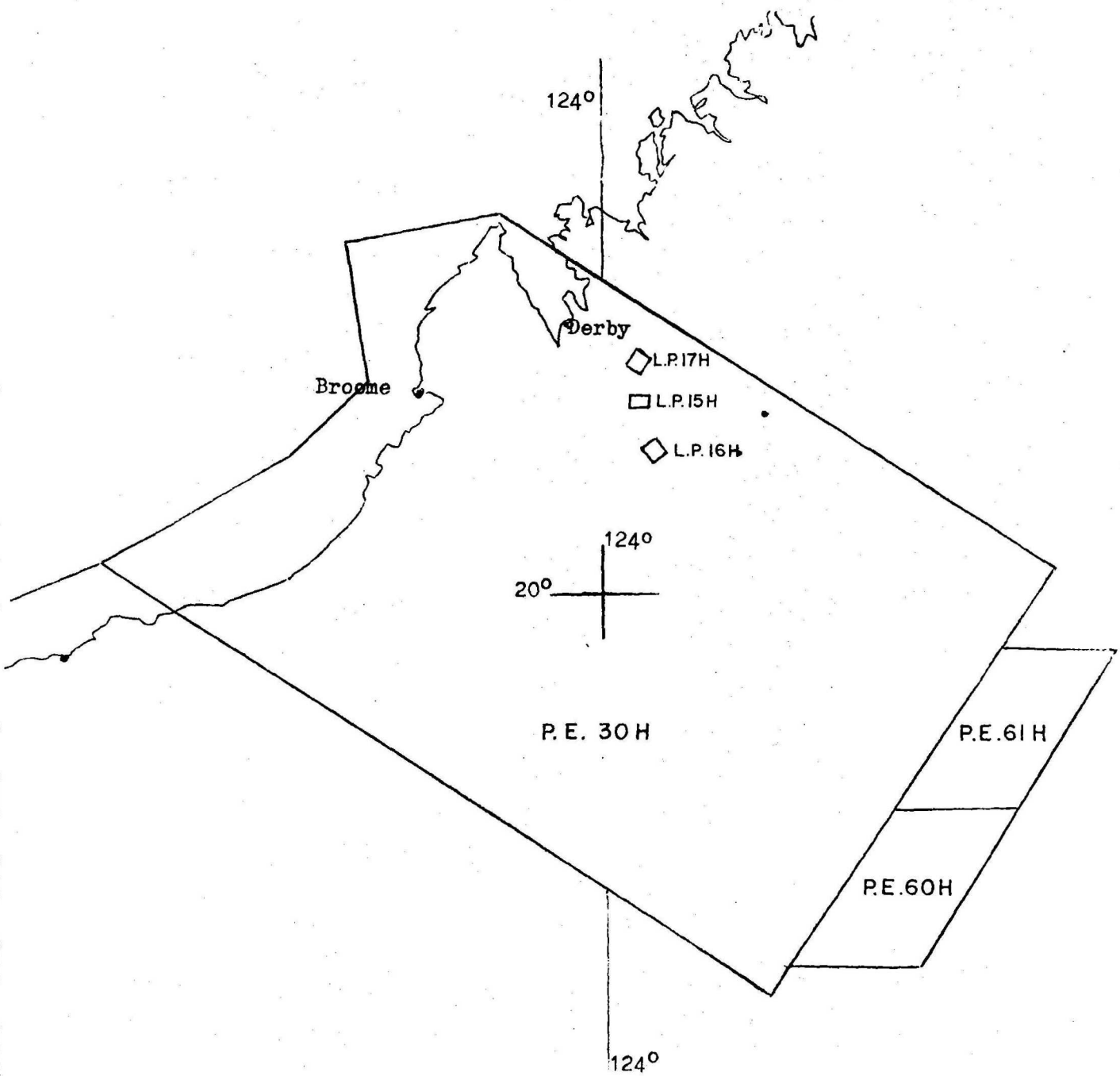
During 1951 and 1952 negotiations took place for the resumption of drilling on the Nerrima structure, the cost to be shared equally by the Commonwealth and Western Australian Governments and Freney Kimberley Oil. It was decided, following a report by Schneeberger (1952), to make gravity and seismic surveys over the anticlinal structure to determine if it persisted in depth and to choose a site for a second bore. These were the first geophysical surveys in the Canning Basin. The results showed that a deep basin existed at depth, rather than a dome, and further geophysical surveys were recommended. (Wiebenga & van der Linden, 1953; Everingham, 1962).

Phase II - THE WAPET PERIOD

As a result of the encouraging stratigraphic and structural information obtained by BMR, Caltex decided to renew its search in the basin. An operating company was formed called West Australian Petroleum Pty Ltd (WAPET), in which Caltex held 80 percent of the shares and Ampol Petroleum Ltd 20 percent. In forming WAPET, Caltex, assisted by Ampol, brought together the greatest concentration of petroleum exploration talent and financial resources yet to appear on the Australian scene. An active drilling campaign was begun in 1953, supported by extensive geological and geophysical surveys, and was rewarded by the discovery of flowing oil in the Rough Range of the Carnarvon (Northwest) Basin in 1953.

In the Canning Basin WAPET, by taking up the large PE 30H became and has remained ever since, the largest explorer in the onshore part of the basin. Freney Kimberley Oil retained a few small permits (Fig. 6), and Hackathorn Oils, Frome Broken Hill, and Cable-Douglas held some basin-margin prospects.

Fig. 5 PETROLEUM TITLES 1953



Permits to Explore

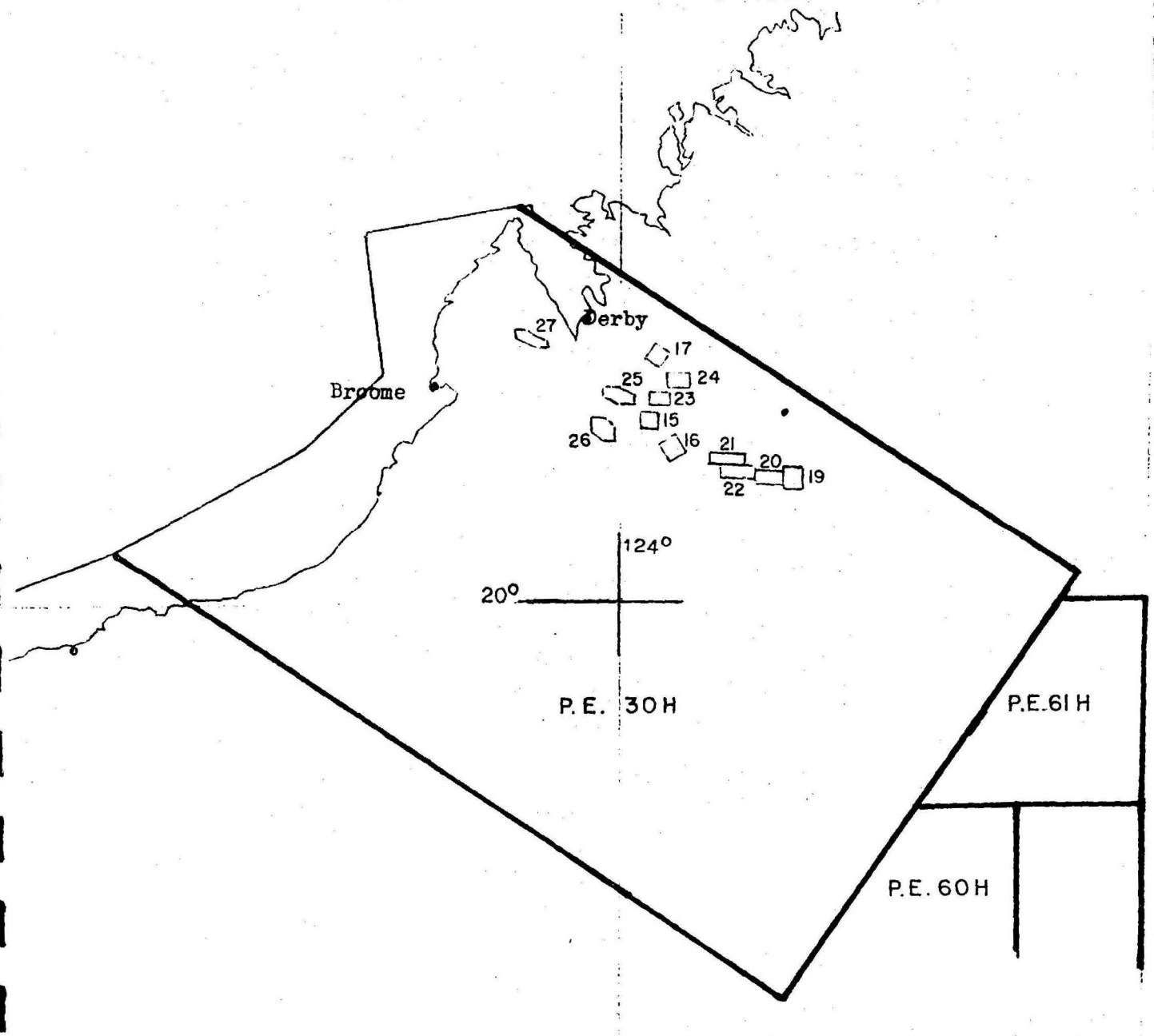
30H WAPET
60, 61 H Carnegie Syndicate

Licences to Prospect

15H, 16H, 17H Freney Kimberley Oil

Record No.1975/109

Fig. 6 PETROLEUM TITLES early 1954



Permits to Explore

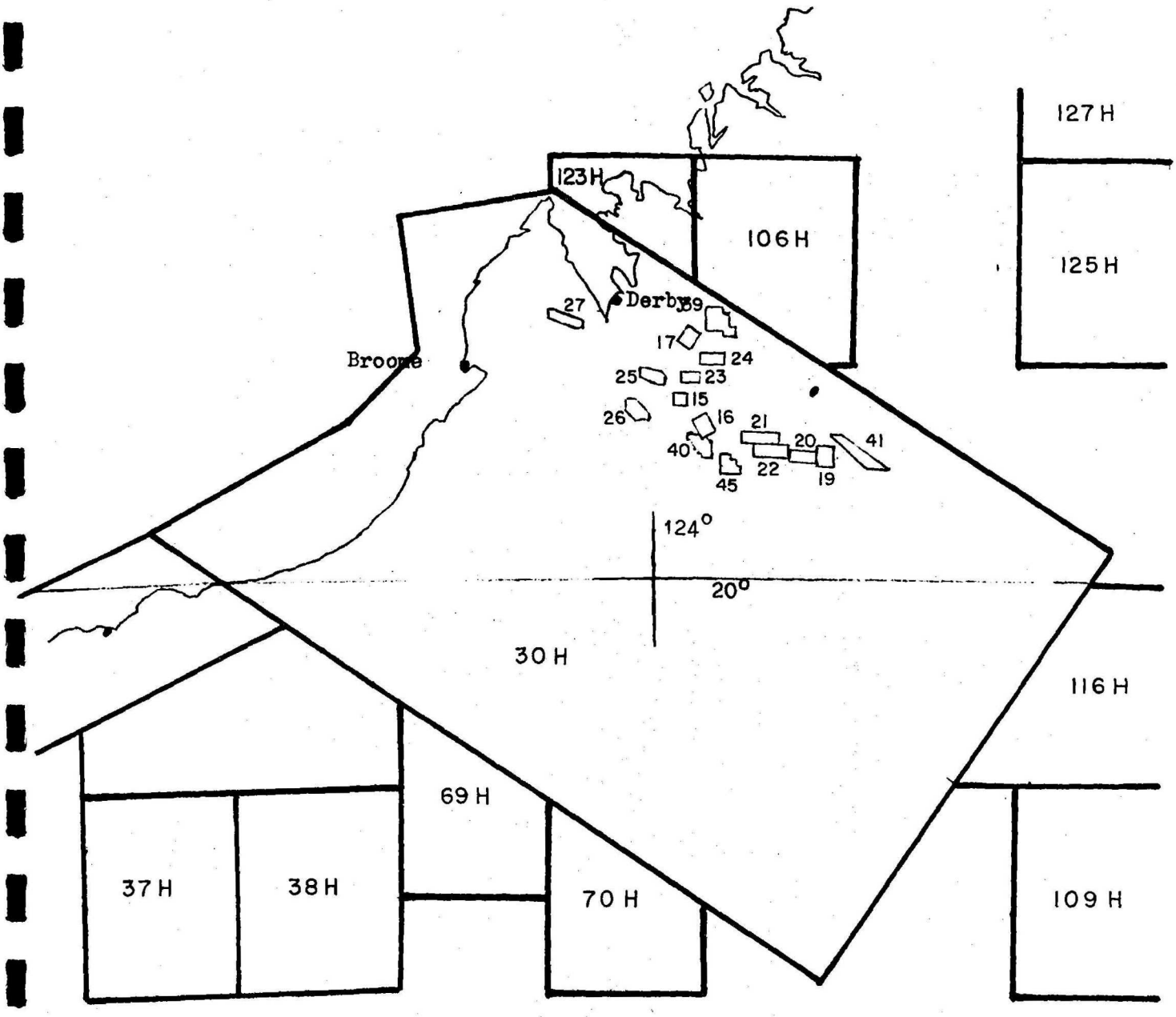
30H WAPET
61H)
60H) Carnegie Syndicate

Licences to Prospect

15H)
16H) Freney Kimberley Oil
17H)
19H–27H WAPET

Record No. 1975/109

Fig. 7 PETROLEUM TITLES, DECEMBER 1954



Permits to Explore

30H	WAPET
106H	Westralian Oil
109H	Atom Minerals & Oil
114H	West Coast Oilfields
123H	Northwest Oil

Licences to Prospect

19H-27H	WAPET
39H-41H	"
45H,	"
17H	Associated Frency Oilfields N.L.

Record No. 1975/109

Also in 1953, a BMR WAPET field party found fossils near the Twelve-Mile Bore on Brooking Station, which Thomas (1955) determined to be of Lower Carboniferous age. This was the first proof of the existence of Carboniferous rocks in the Canning Basin, although many had been erroneously described as such.

D.J. Guppy of BMR, prepared a preliminary report (Guppy, 1953) on the geology of the Fitzroy Trough wherein he presented a less gloomy picture than had Reeves on the basin's petroleum potential. He refuted Reeves' hypothesis on the age of the Grant Formation, and showed that the deep wells at Mount Wynne, Poole Range and Nerrima probably never reached the base of the Grant. He recommended drilling sites on the anticlinal structures at Grant Range, St George Range, Poole Range, Deep Well, Nerrima, Warrawadda, and Mount Wynne.

In 1954 Associated Australian Oilfields N.L. and Freney Kimberley Oil combined to form Associated Freney Oilfields N.L. (AFO). WAPET spudded in Grant Range No. 1 well, using an up-to-date National 100 rig bought from the Commonwealth Government. After a year's drilling the well was abandoned at 3936.5 m, without having reached the prospective Devonian sediments. The last 1500 m were in an unexpectedly thick Carboniferous sequence of silt and fine sandstone. This was the first really deep well to be sunk in the Canning Basin. In 1954 a BMR party was the first to take conventional two-wheel-drive vehicles into the desert country with success. It mapped a large area in the southwestern part of the basin and a WAPET party penetrated to the McLarty Hills. By the end of 1954, additional explorers were becoming interested in the basin (Figs. 7, 8).

AFO also carried out geological and geophysical surveys, and in 1955 drilled a second well (also called Nerrima No. 1) on the Nerrima Anticline. It reached a depth of 2765.1 m in the Carboniferous, and oil-stained sandstone was encountered at 823 m near the top of the Grant Formation. In 1955 and 1956 the Company drilled on the Myroodah Anticline after BMR carried out gravity and seismic surveys over the area. The well was abandoned at 1829.1 m in the Grant Formation, having encountered no shows of hydrocarbons. WAPET'S second hole was Fraser River No. 1, drilled on the Fraser River structure. It also had a Devonian objective but it was abandoned in 1956 at 3091.9 m in basic igneous rock, after having penetrated 1681 m of Carboniferous sediments. This well is notable as the first drilled throughout the wet season, owing to the provision of an all-weather airstrip.

A stage had now been reached when additional information to guide the search for oil had to be sought by stratigraphic drilling at critical localities. From October 1955 to June 1956 BMR sank three stratigraphic holes in the Fitzroy Basin. The bores were drilled by WAPET under contract, using a Failing 2500

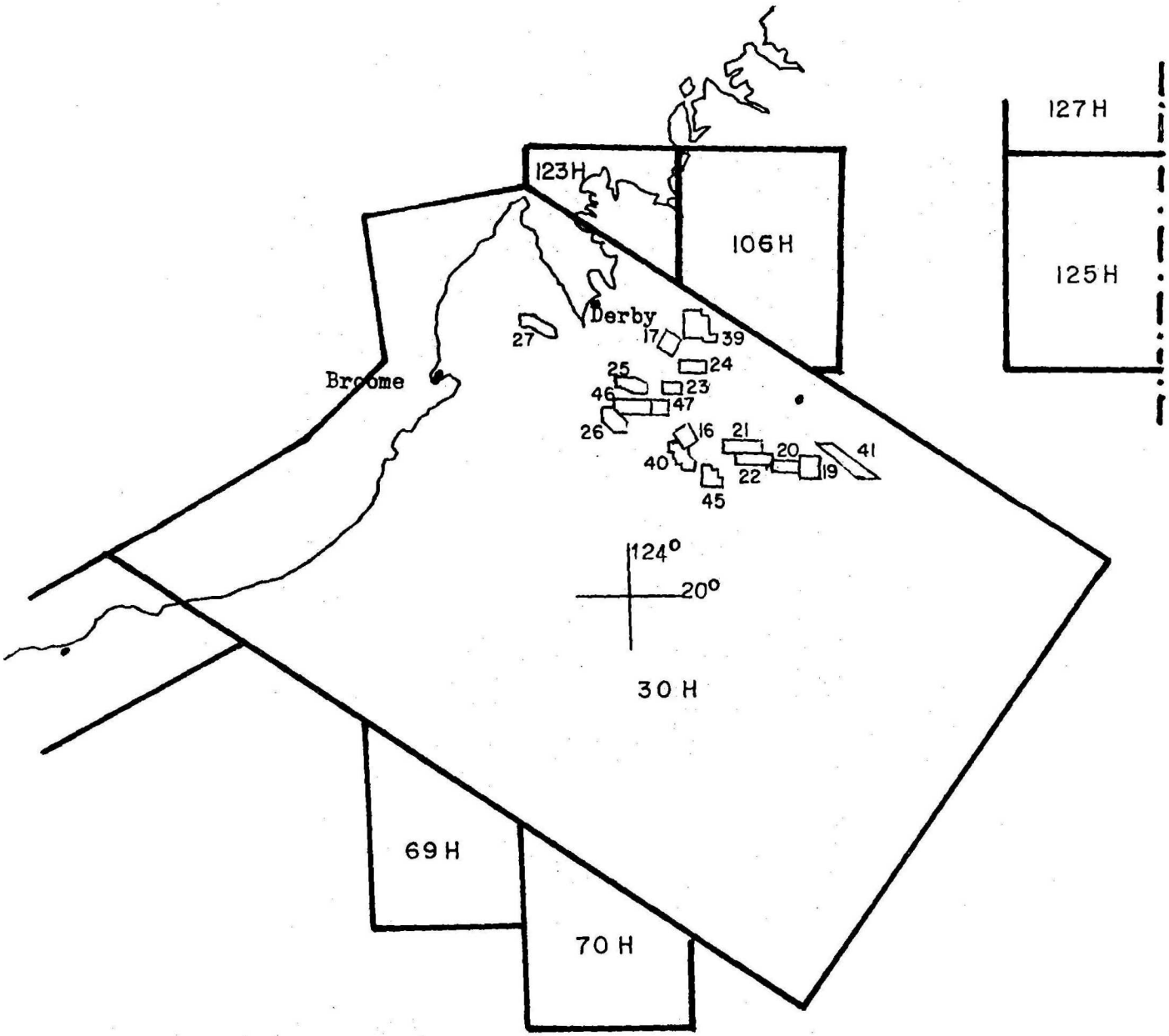
Holemaster drill. BMR Jurgurra Creek No. 1 was sited near the Fenton Fault, BMR Prices Creek No. 3 near the Pinnacle Fault, and BMR Laurel Downs No. 2 farther out in the basin to investigate facies changes in the Devonian sediments and to examine the Carboniferous sequence. When the Government's programme was completed, WAPET arranged to rent the mobile Failing rig, and drilled two stratigraphic bores south of the Fitzroy River. Dampier Downs No. 1 and Roebuck Bay No. 1 were completed in 1956, and for the first time Devonian limestones, so it was thought, were reached at depth. The limestone is now interpreted to be of Ordovician age.

AFO surveyed the Sisters Plateau, discovering the Ryan Anticline whereon Sisters No. 1 was drilled in 1956 and 1957. The well was abandoned at 2995.60 m in the Upper Devonian. A small vug containing oil was found in it, and also some 'tar'. This was, in effect, the end of the Freney story in the Canning Basin, after thirty-six years of unrewarding search. In 1957 the first Petroleum Search Subsidy Act was brought in to encourage the search for petroleum, interest in which had subsided since Rough Range No. 1 was drilled in 1954. In 1957 WAPET drilled the Wallal Corehole to 309.1 m and began Samphire Marsh No. 1, the first Canning Basin well to be subsidized under the Petroleum Search Subsidy Act 1957-58. It hit Precambrian gneissic granite at 2014.7 m. Both these wells are near the coast, in the western part of the basin.

In April and May 1958 the two stratigraphic holes BMR Wallal Nos. 4 and 4A were drilled. An inflow of artesian water forced the abandonment of No. 4, and No. 4A reached granitic gneiss at 677.9 m. Data from this well, when added to those from Samphire Marsh and from seismic surveys, established a structural framework for the western part of the basin.

In June 1958 WAPET started drilling Meda No. 1 to test a prognosticated Devonian reef-complex, and in August of the same year began drilling Goldwyer No. 1 on the Broome Platform. This well penetrated granitic basement at 1432.6 m and was abandoned. Some oil-staining was detected in Ordovician limestone. Meda No. 1 provided some encouragement when oil staining and visible oil saturation were found in sands of Lower Carboniferous age at a depth of about 1560 m. A formation-test of the interval 1557.5 m - 1564.5 m, yielded a few gallons of excellent quality crude oil along with salty water. An extended period of testing followed, but the ratio of oil to salt water never improved and it was concluded that the oil showing was non-commercial. Drilling was continued and the Devonian reef was met at about 2000 m, but was found to be

Fig. 8 PETROLEUM TITLES, 1955-56



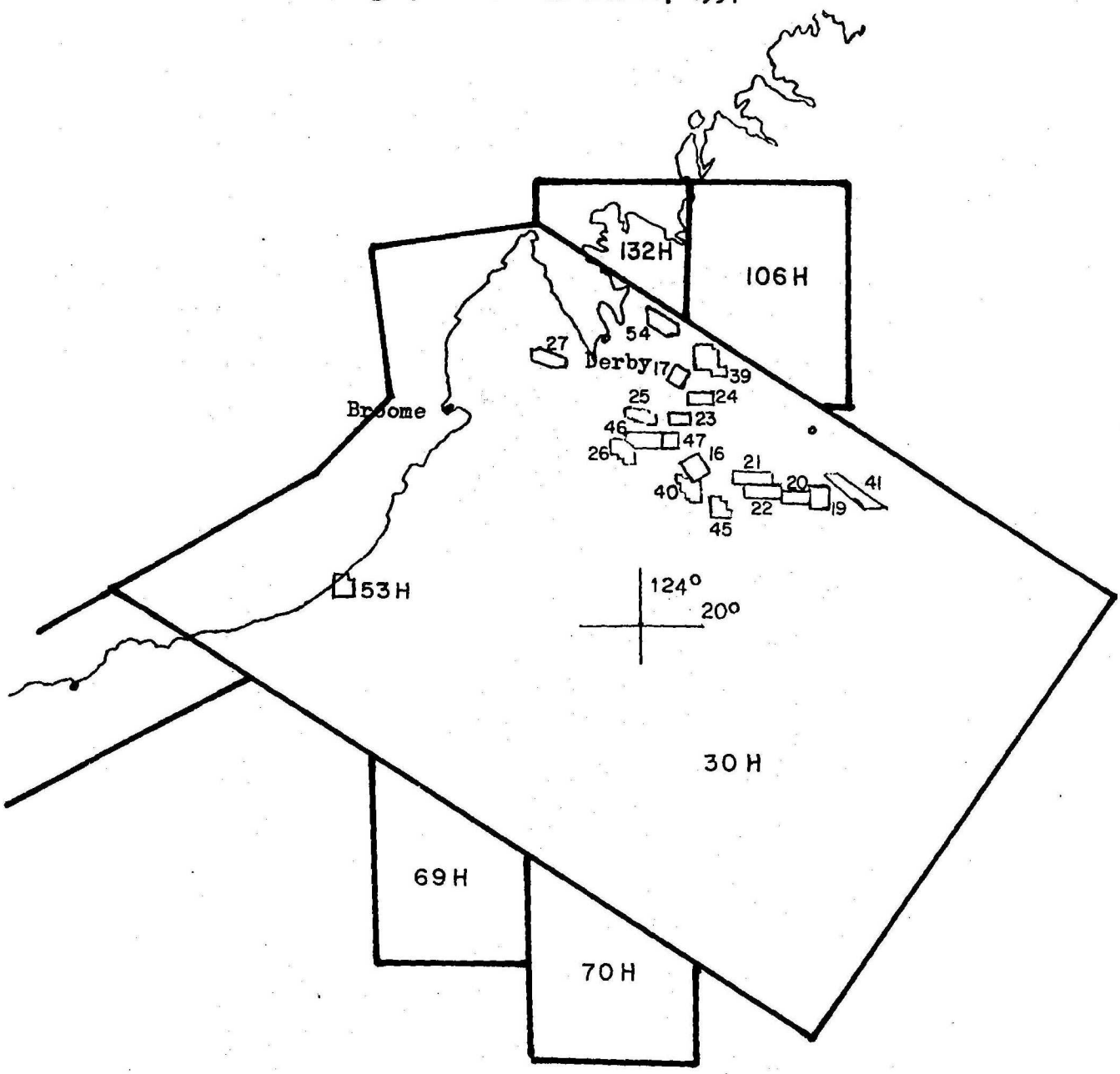
Permits to Explore

PE 29H	WAPET
30	"
69	Westralian Oil
70	" "
106	"
123	Northwest Oil

Licences to Prospect

LP 16H	AFO
17	"
19-27	WAPET
39-46	"

Fig. 9 PETROLEUM TITLES, 1957



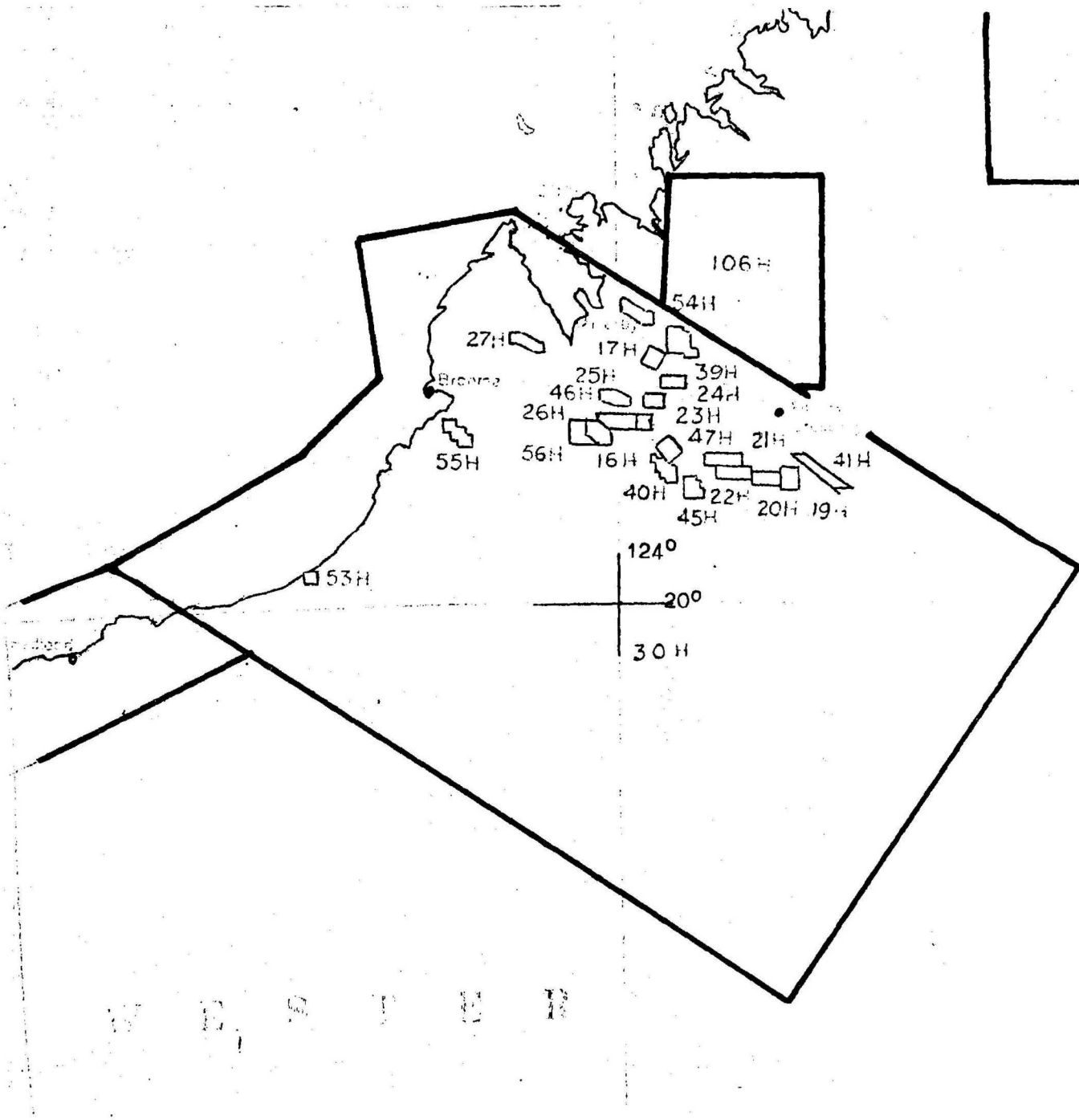
Permits to Explore

29	WAPET
30	"
39	?
69	Westralian Oil
70	" "
106	" "
132	Owen Neave John

Licences to Prospect

16, 17	AFO
19–27	WAPET
39–41	"
45, 46	"
47	AFO
53, 54	WAPET

Fig. 10 PETROLEUM TITLES, 1958



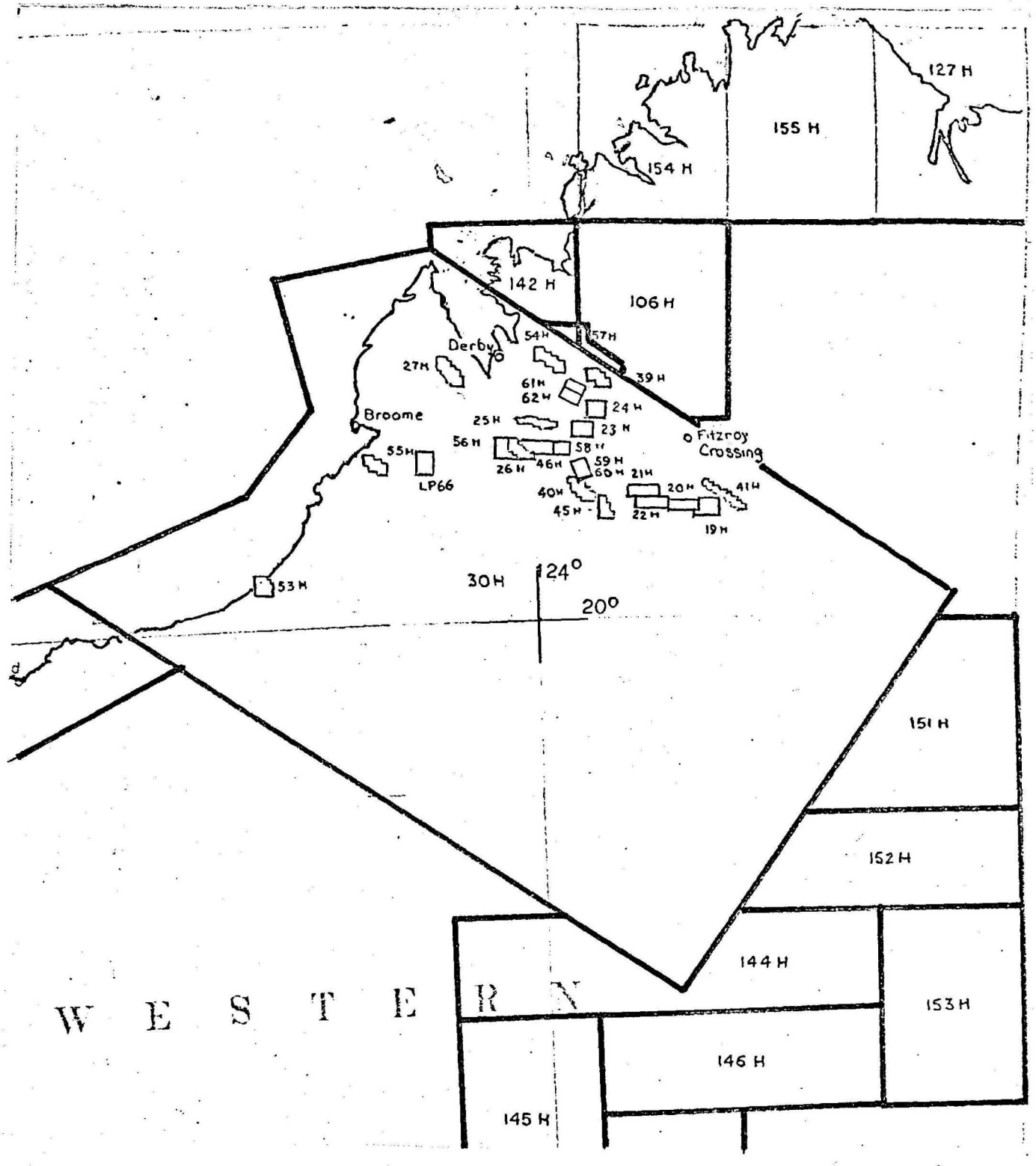
Permits to Explore

29 H WAPET
30 H "
106 H Westralian Oil

Licences to Prospect

16H Oil Drilling & Exploration
17H
19-27 WAPET
39-41 "
45 "
53-56 "
46 "

Fig. 11 PETROLEUM TITLES, 1959



Permits to Explore

30 H WAPET
106 H Westralian Oil
142 H Hawkestone Oil
144 -
146 Frome Broken Hill
151 -
152 -
153 -

Licences to Prospect

19-27
39-41
45
46 WAPET
53-56
66
57 Westralian Oil
58-62 A.F.O.

Record No.1975/109

dense and devoid of oil. The well was abandoned at 2685 m, in basement rocks.

In October 1958, Shell (Queensland) Development Pty Ltd acquired a two-sevenths interest in the WAPET consortium, leaving Caltex holding four-sevenths and Ampol one-seventh.

At this stage WAPET decided to force the pace of operations, and the next two wells were drilled during the 'wet', which was a formidable logistical undertaking. Meda No. 2, located 1200 m south of No. 1, was abandoned in April 1959 at 2325 m. The other well was at Frome Rocks on the Jurgurra Terrace.

The Frome Rocks prospect was found by gravity and seismic surveys. Frome Rocks No. 1 was spudded in February 1959 to test the Permian sequence. It proved to be unique in Australia in that it encountered a salt dome; this was at 688.8 m and the well was abandoned at 1219.2 m, still in salt. A new site was chosen, 7 km south of No. 1 with Ordovician beds as the target. Frome Rocks No. 2 missed the salt but was abandoned at 7504 feet (2287.2 m) in Devonian sediments in which a slight oil staining and fluorescence were noted at several levels. The absence of salt in No. 2 well was taken to indicate that its presence in No. 1 was due to its having migrated up the Fenton Fault zone from a deeper source in the Fitzroy Trough.

General interest in WAPET's work had so increased that when Thangoo No. 1 well was spudded in November 1959, townsfolk from Broome and pastoralists from stations as far as 150 km away came to the event. The well was located on a seismic culmination between Dampier Downs No. 1 and Goldwyer No. 1 and its objective was the porous Ordovician limestone intersected in those wells. Collapse of the hole led to abandonment of the well at 1059.2 m in the Grant Formation. Thangoo No. 1A was drilled through the Ordovician Thangoo Limestone, which was the target, into Precambrian basement. Although traces of oil were met with throughout the Ordovician section, as well as in the Grant Formation, the results from Thangoo No. 1A were held to downgrade the Ordovician in the southern part of the basin. About this time Hackathorn Oil Company obtained tenements on the eastern edge of the Canning Basin (Fig.).

The existence of a salt dome at Frome Rocks suggested that a structure detected by BMR seismic and WAPET aeromagnetic surveys in the Barlee area might also be due to a salt intrusion. Although a WAPET gravity survey in 1959 showed that no salt dome was present, a site for a well was chosen, with a target set as Upper Devonian limestones. Barlee No. 1 was drilled in 1960 to a depth of 2469.2 m, when it was abandoned in an intrusive dolerite in the Anderson Formation, wherein slight gas traces were detected. The unexpectedly thick Carboniferous sequence showed that the well was not on the Jurgurra Terrace as had been suggested, but in the Fitzroy Trough, which extended south to the Dampier Fault.

Langoora No. 1 on the Lennard Shelf, was drilled in 1962 in a structural position up-dip from the Devonian reef in Meda Nos. 1 and 2. No

hydrocarbons were detected, and the Precambrian was met at 1697.1 m. Hawkestone No. 1 was drilled in the same year to test the southern flank of a better-documented anomaly, but the results were similar.

In 1962 BMR issued an unpublished report (Flavelle & Goodspeed, 1962) incorporating all gravity results available, and presenting important conclusions about the broad structure of the basin. WAPET did an aeromagnetic survey over 270,000 square kilometres of PE 30H which established the existence of four sub-basins within the Canning Basin. The Kidson sub-basin was named and was estimated to contain over 6000 m of sediment.

In June 1962 Fitzroy Oil N.L. acquired PE 142H and LP 88H from Hawkestone Oil Company Ltd, (which had the same directors), and Westralian Oil farmed out its oil exploration activities to Oil Development N.L. (Fig. 15).

Also in 1962, BMR commissioned the Compagnie Generale de Geophysique to do a seismic survey in the Poole Range which had been recommended by the Institut Francais du Petrole to find out if rocks in the Poole Range were of the same age and type as the Ordovician limestones in the Prices Creek area.

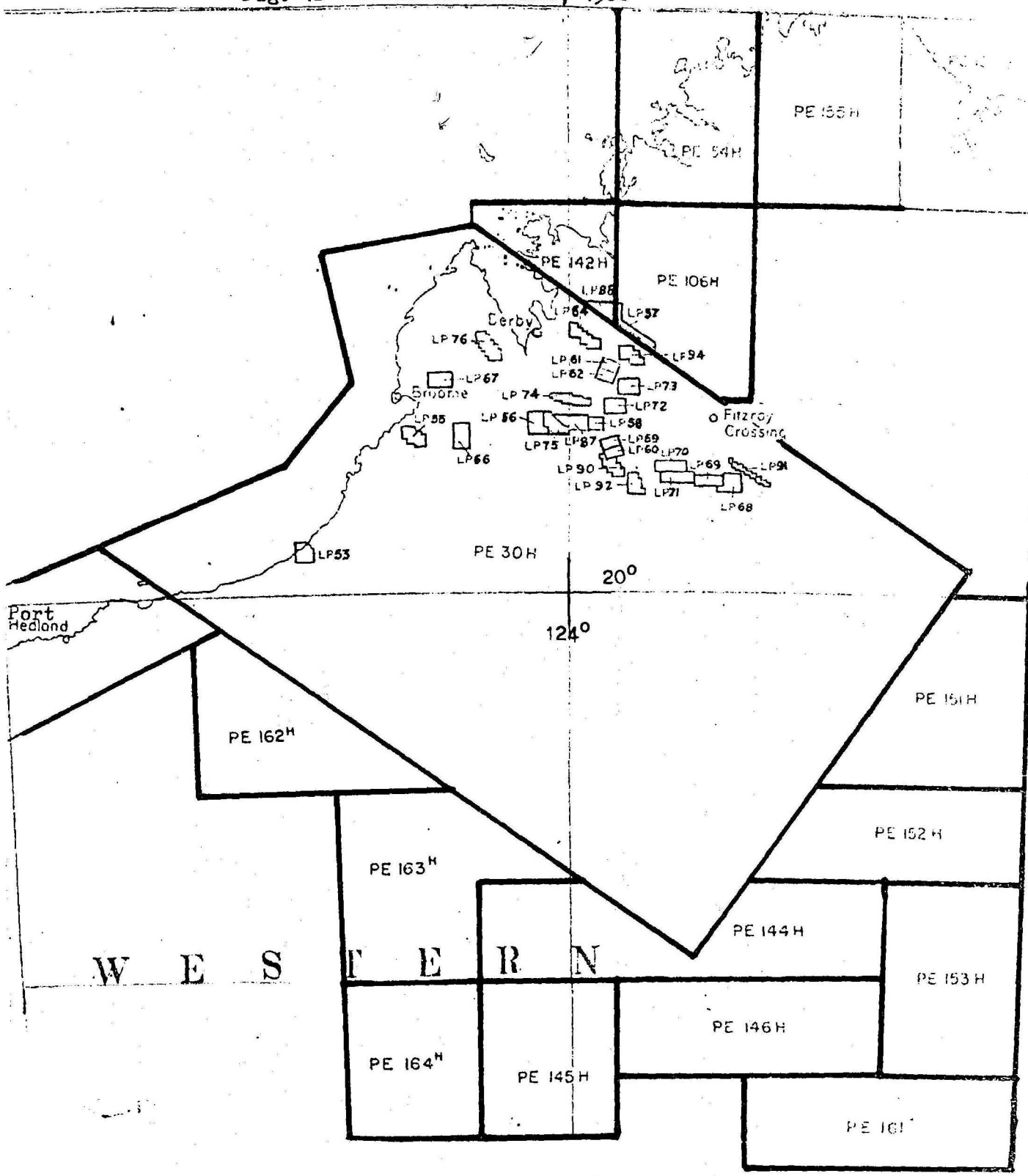
In 1962 Woodside (Lakes Entrance) Oil Company N.L. began negotiations which were completed in May 1963, to acquire a permit over all the continental shelf of northwest Western Australia (Figs. 15, 16) except the inshore areas already held by WAPET, and planned a limited aeromagnetic survey to confirm whether or not the sediments were thick enough for the area to be considered prospective for petroleum. By the end of 1963 Shell Development (Aust.) Pty Ltd and Burmah Oil Company of Australia (BOC) agreed in principle to take up a participating interest in Woodside's offshore areas, Woodside thus gaining access to the resources and know-how of the larger overseas companies. In February 1964 the consortium was formed of three equal partners, with BOC as operator.

Phase III - THE MULTI-COMPANY PERIOD

Three events in 1964 combined to arouse greater company interest in the petroleum prospects of Australia. WAPET struck commercial oil on Barrow Island, Esso-BHP began the first offshore well in Australia, and the Petroleum Search Subsidy Act was altered to include, among other things, specific mention of the continental shelf. That year may therefore be taken as initiating the period of multi-company activity in the Canning Basin.

A farmout agreement was made between WAPET and a partnership of Continental Oil Company of Australia Ltd and Sun Oil Company. The area involved was PE 227H (Fig. 17), and Continental was the operator. Geological and seismic (including vibroseis) surveys were conducted during the year. Alliance Petroleum Australia N.L., after a prolonged photogeologic study of PEs 205, 206, 207 in

Fig. 12 PETROLEUM TITLES, 1960



Permits to Explore

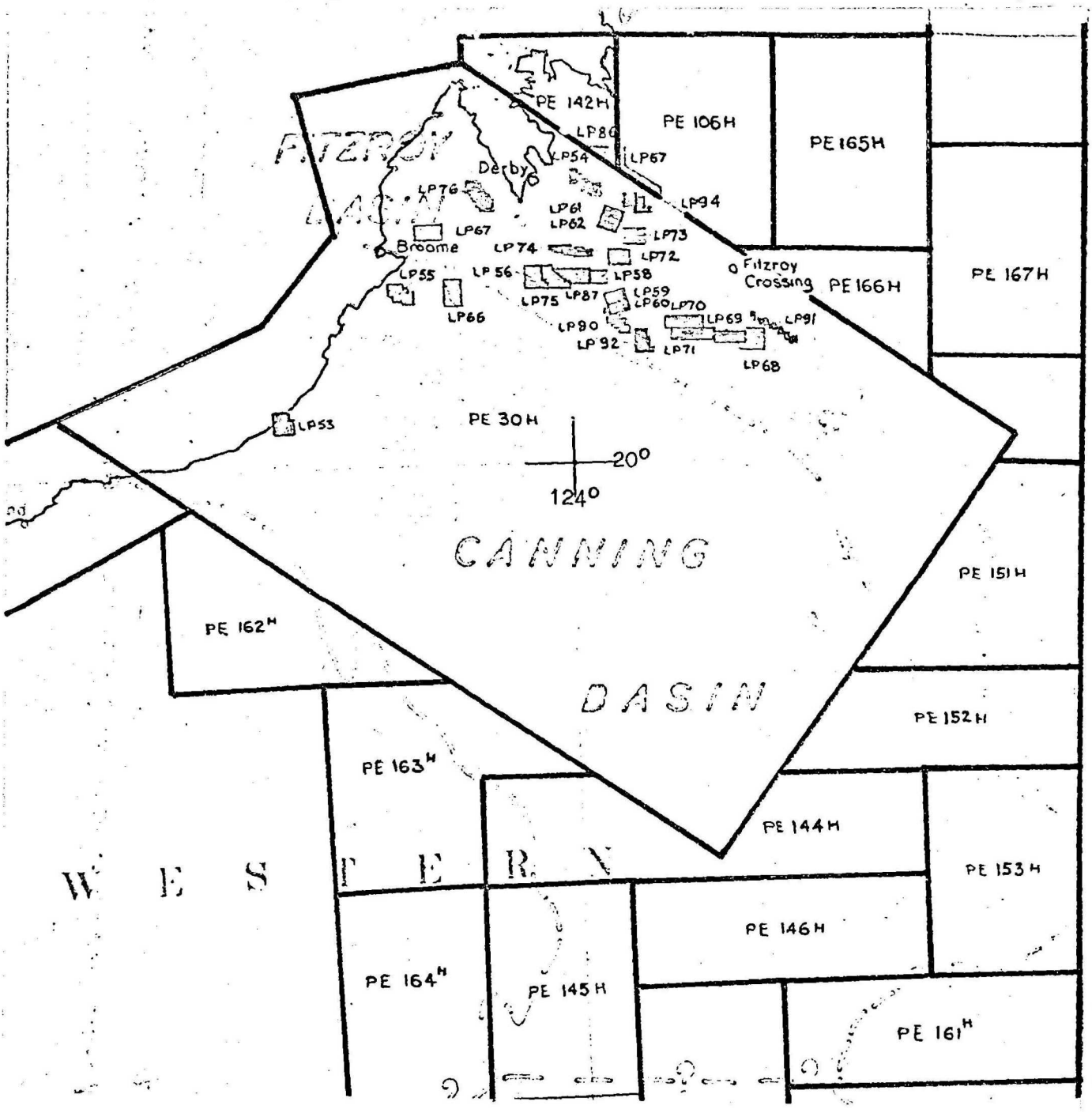
30 H	WAPET
106	Westralian Oil
142	Hawkestone Oil
144, 145, 146	Frome-Broken Hill
151, 152, 153	Hackathorn Oils Pty Ltd
161	Hunt Oil and Placid Oil
162	Australian Oil Industries

Licences to Prospect

53-56	WAPET
57	Westralian Oil
58-62	A.F.O.
68-76	WAPET
88	Hawkestone Oil
90	WAPET
91	"
92	"
94	"

Record No. 1975/109

Fig. 13 PETROLEUM TITLES, 1961



Permits to Explore

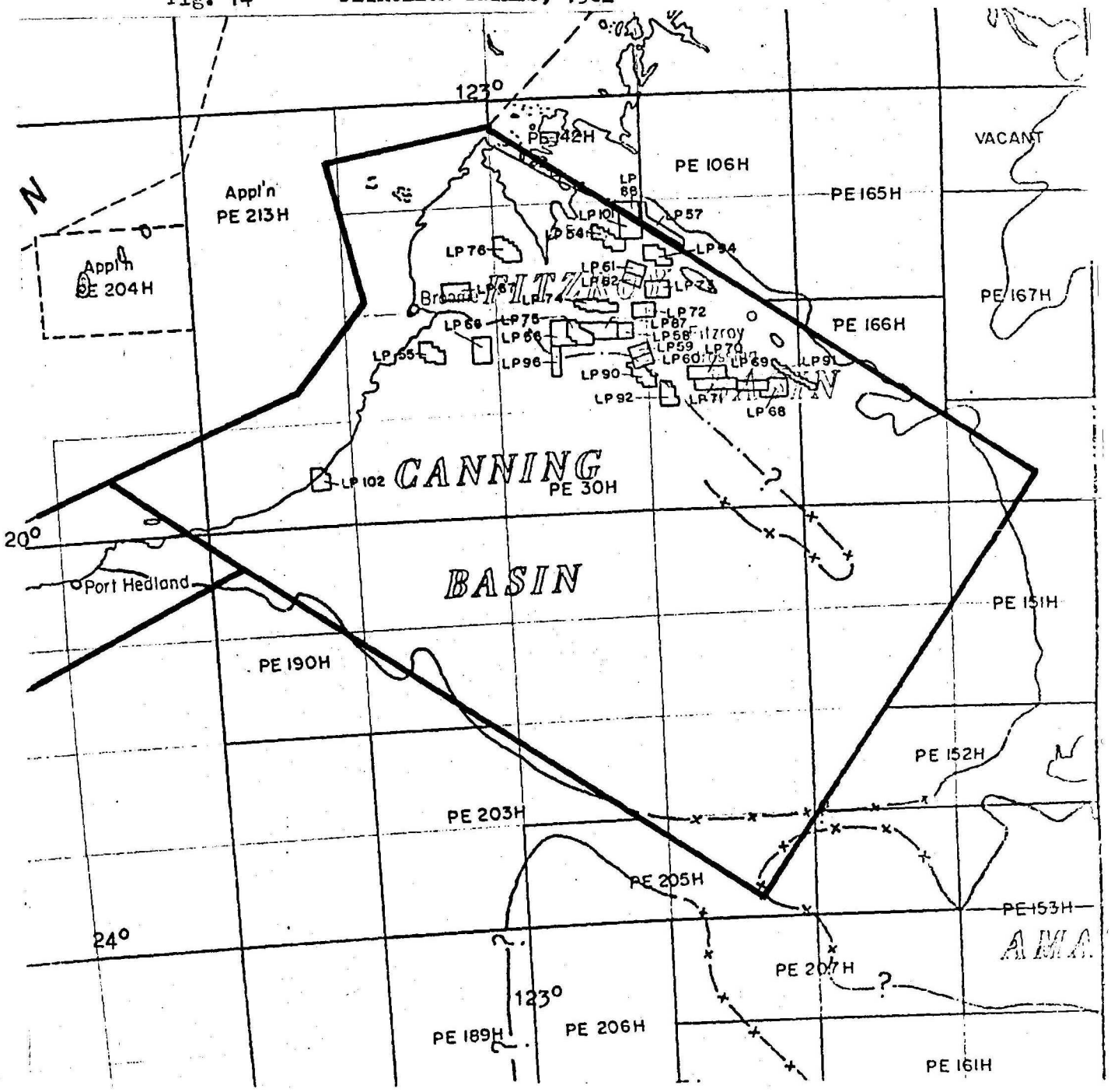
30 H WAPET
106 H Westralian Oil
142 H Hawkestone Oil
144 H Frome-Broken Hill
151 H, 152 H, 153 H Hackathorn Oils Pty Ltd
162 H, 163 H Australian Oil Industries
165, 166 Vickers, Victor

Licences to Prospect

53, 54, 55 WAPET
57 Westralian Oil
58-62 AFO
66-76 WAPET
87 "
88 Hawkestone Oil
90, 91, 92 WAPET

Record No. 1975/109

Fig. 14 PETROLEUM TITLES, 1962



Permits to Explore

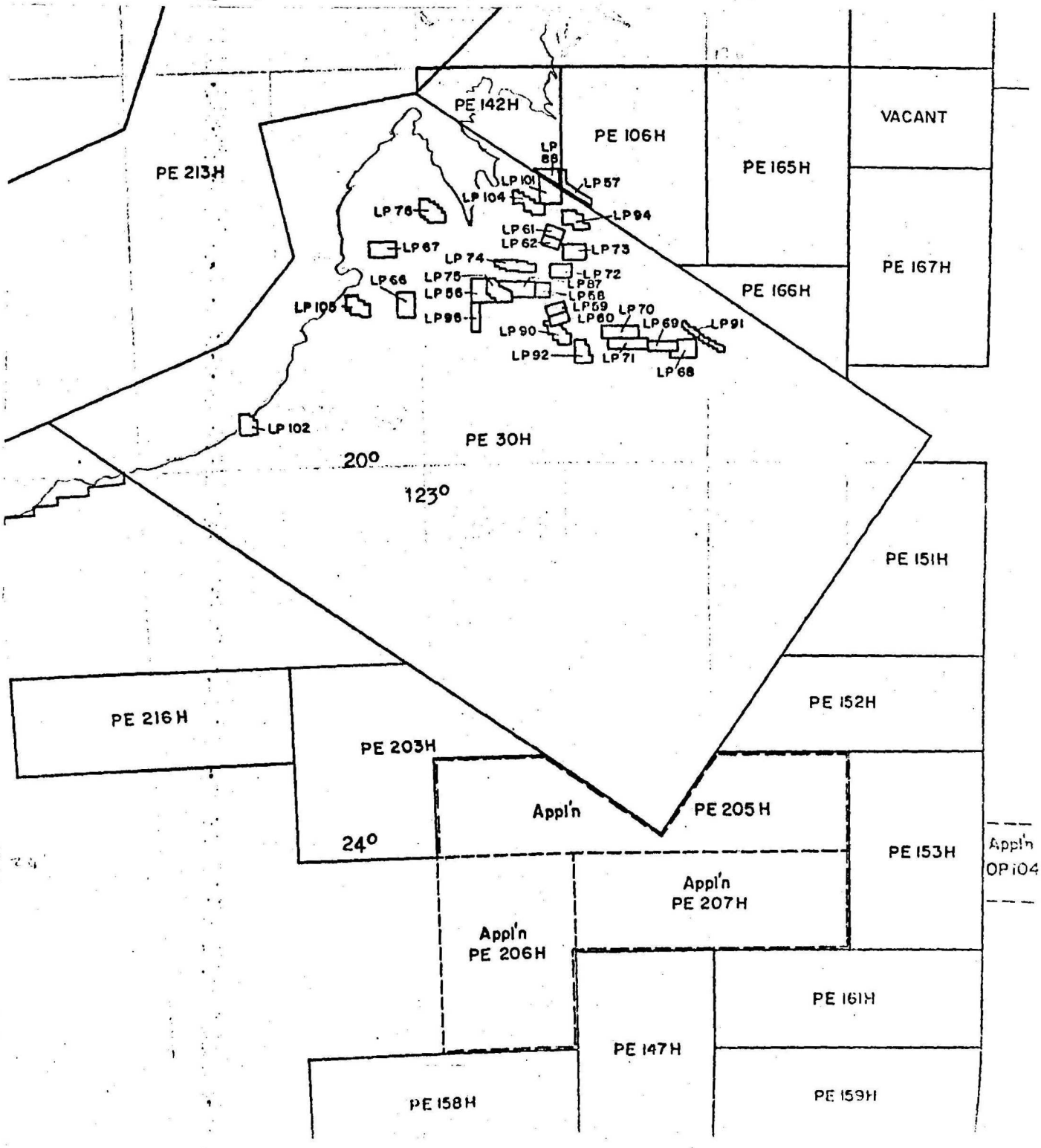
30 H	WAPET
106 H	Westralian Oil
142 H	Hawkstone Oil
151 H	Hackathorn Oils
152 H	"
153 H	"
166 H	Vickers, Victor Ivor
190 H	Textralian Oil
203 H	Australian Oil

Licences to Prospect

54)		90-92	WAPET
55)	WAPET	94	"
56)		96	"
57	Westralian Oil	101	"
58-62	A.F.O.	102	"
60-67	WAPET		
88	Hawkestone		

Record No. 1975/109

Fig. 15 PETROLEUM TITLES, 1963



Permits to Explore

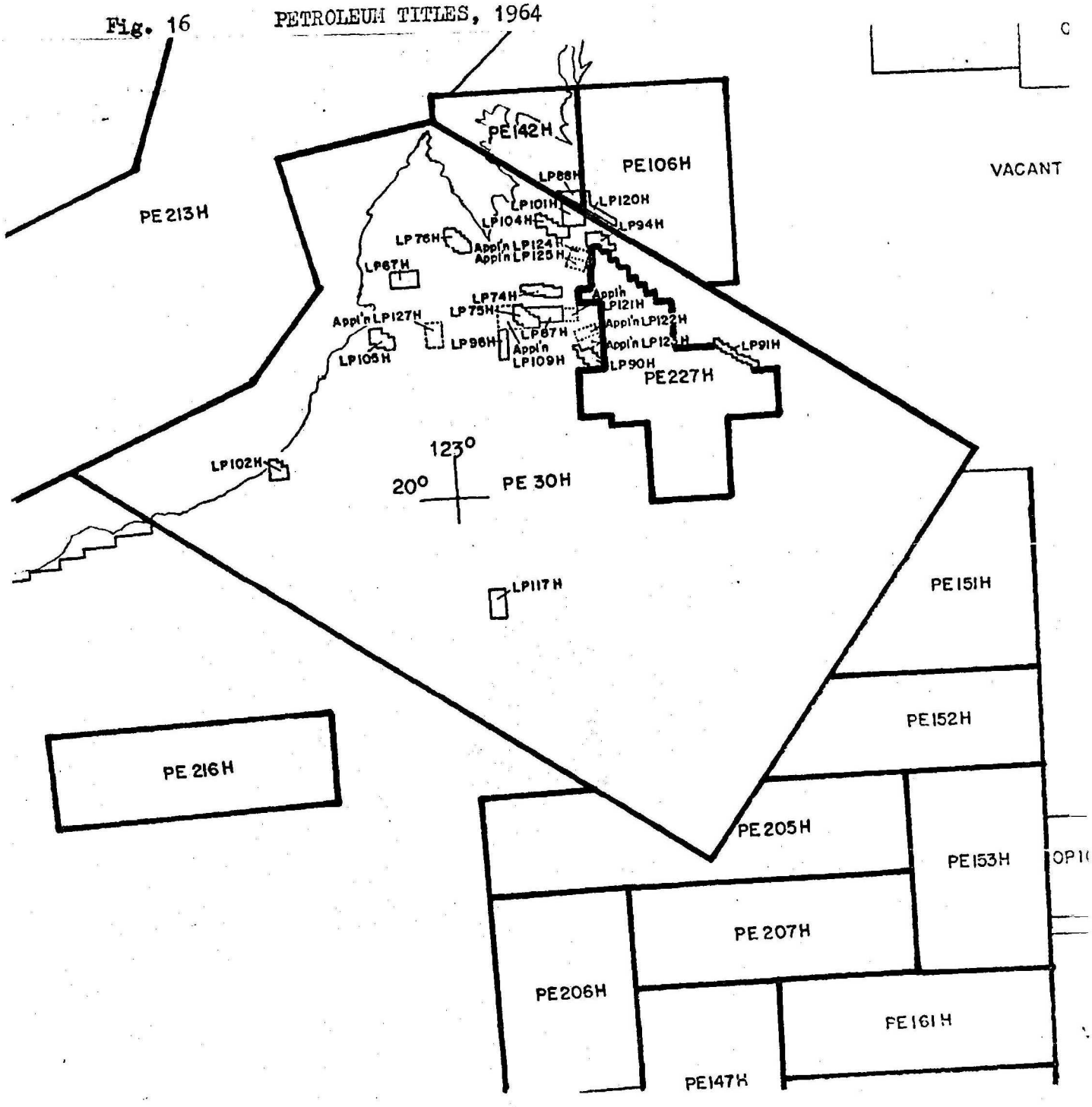
30 H	WAPET
106 H	Westralian Oil
142 H	Hawkestone Oil
151 H, 152 H	Hackathorn Oils
165 H, 166 H	Vickers, Victor Ivor
203 H	Australian Oil Corp.
205 H	Alliance Petr. Aust.
213 H	Woodside (Lakes Entrance) Co. N.L. 104,000

Licences to Prospect

56	West Australian Petr. Pty.
57, 58, 59, 60, 61, 62	Westralian Oil / A.F.O.
66-76, 87	WAPET
88, 90, 92, 94, 96, 101, 102	Hawkestone / WAPET

Record No. 1975/109

Fig. 16 PETROLEUM TITLES, 1964



Permits to Explore

30 H WAPET
106 H Westralian Oil
142 H Hawkestone Oil
151 H, 152 H Hackathorn Oils
205 H Alliance Petroleum Aust.
213 H Woodside (Lakes Entrance) Oil, B.O.C. of Aust. Shell Development (Aust.)

227 H WAPET
Farmounts:- 227 H, WAPET to Continental Oil of Aust. and Australian Sun Oil

213 H Woodside to B.O.C., Shell Development, California Asiatic Oil , and Mid-Eastern Oil

Licences to Prospect

67, 74, 75, 76, 87, 88 WAPET Hawkestone

90, 91, 96, 101, 102 WAPET

104, 105, 109, 117, 120 Westralian Oil

121, 122, 123, 124, 125 A.F.O.

1963, carried out a field survey in the area in 1964 (Figs. 16, 17), paying especial attention to possible salt-dome structures. A farmout was made with Union Oil Development Corporation, by which Union undertook a work programme for 3 to 4 years. Beach Petroleum N.L., under a 66 2/3-percent farmout from Hackathorn, carried out a geological and helicopter gravity survey over PEs 151 and 152 (Figs. 17, 18). In August 1964 California Asiatic Oil Company took over 50 percent of Shell's one-third interest in the Woodside-Burmah-Shell consortium.

1965 saw a recrudescence of drilling activity in the Canning Basin. In January, WAPET spudded in Sahara No. 1 well on a location defined by seismic surveying, as a stratigraphic test in the unexplored Kidson Sub-basin. It was intended to drill the well to 3048 m (10 000 feet), but repeated difficulties finally caused its suspension in March at 2120.2 m. Although it has never been deepened it nevertheless provided invaluable stratigraphic data. Three new informal formations were described below the Permian strata.

WAPET drilled two more wells, both unsuccessful, in 1965. Parda No. 1 was drilled on the southern margin of the Broome Platform, in a regionally favourable position between the shaly source rocks of the Parda Sub-basin to the south and petroliferous Ordovician limestones encountered in wells on the Broome Platform. Willara No. 1 was drilled farther out in the Parda Sub-basin. Both wells were drilled on seismically-defined structures.

In mid-1965 Hackathorn's interests (Fig. 18) were acquired by the General Exploration Company of California. Beach Petroleum (which had held a two-thirds interest in PE 151 and PE 152 by farmout from Hackathorn) combined with General Exploration to make a new farmout arrangement with Australian Aquitaine, such that Beach had 60 percent interest, General Exploration 40 percent, and Australian Aquitaine, in return for work, could earn a 55 percent interest. Australian Aquitaine drilled Point Moody No. 1 in the last quarter of the year, on the Point Moody anticline. Its objective was to test the stratigraphic sequence within the 'Stansmore Gravity Trough' wherein sediments about 6000 m thick had been suggested. Three drill-stem tests from the Grant Formation were either dry or produced salt water, although traces of gas had been detected during drilling.

Continental Oil (as operator) and its partner Sun Oil began drilling St George Range No. 1 in September 1965 on LP 132H (Figs. 18, 19) by farmout agreement from WAPET. It was planned as the deepest well so far in Australia 4876.8 m (16 000 ft), surpassing WAPET's Cape Range No. 2, but was stopped at 4437.3 m. The objective was to evaluate the petroleum potential and stratigraphy of the St George Range Anticline, which had been mapped by Continental in 1964. Some gas shows of no significance were met with, mainly in fracture-zones in

non-porous Laurel Formation beds.

Another well to carry over from 1965 into 1966 was WAPET's Kidson No. 1. It was a part of the company's project, involving also extensive seismic surveys, to determine the structure and stratigraphy of the previously untested southeastern part of the Kidson Sub-basin in PE 30H.

In July 1966 WAPET completed a farmout agreement with Gewerkschaft Elwerath of Germany. This company was to explore a block of 10 800 square kilometres (PE 251 H) (Fig. 19), and at once contracted for a seismic survey.

Towards the end of 1966 BP Petroleum Development gained a half share in BOC's interest off the coast of W.A., and early in 1967 French Petroleum Co (Aust) Pty Ltd obtained PE 259 H by farmout from WAPET (Fig. 20). Two wells were to be drilled in the next eighteen months, forming part of a stipulated total of 15240 m (50 000 ft) of hole to be drilled in four years. French Petroleum immediately undertook a seismic survey of their area just as Gewerkschaft was finishing theirs in 251 H.

In May 1967 WAPET drilled May River No. 1 down-dip from the basement high encountered in Langoora No. 1. It was hoped to strike a Devonian reef-complex around the flanks of this high, but only shallow basement was encountered. Also in May 1967 Gewerkschaft spudded in Yulleroo No. 1 on the southeastern flank of the seismically-defined Yulleroo Anticline. It was plugged and abandoned in December at 4574.7 m (15 009 ft) the deepest in the Canning Basin - after having passed through an unexpectedly thick Carboniferous sequence with only a few insignificant shows of gas. Gewerkschaft thereupon withdrew from the West Australian scene.

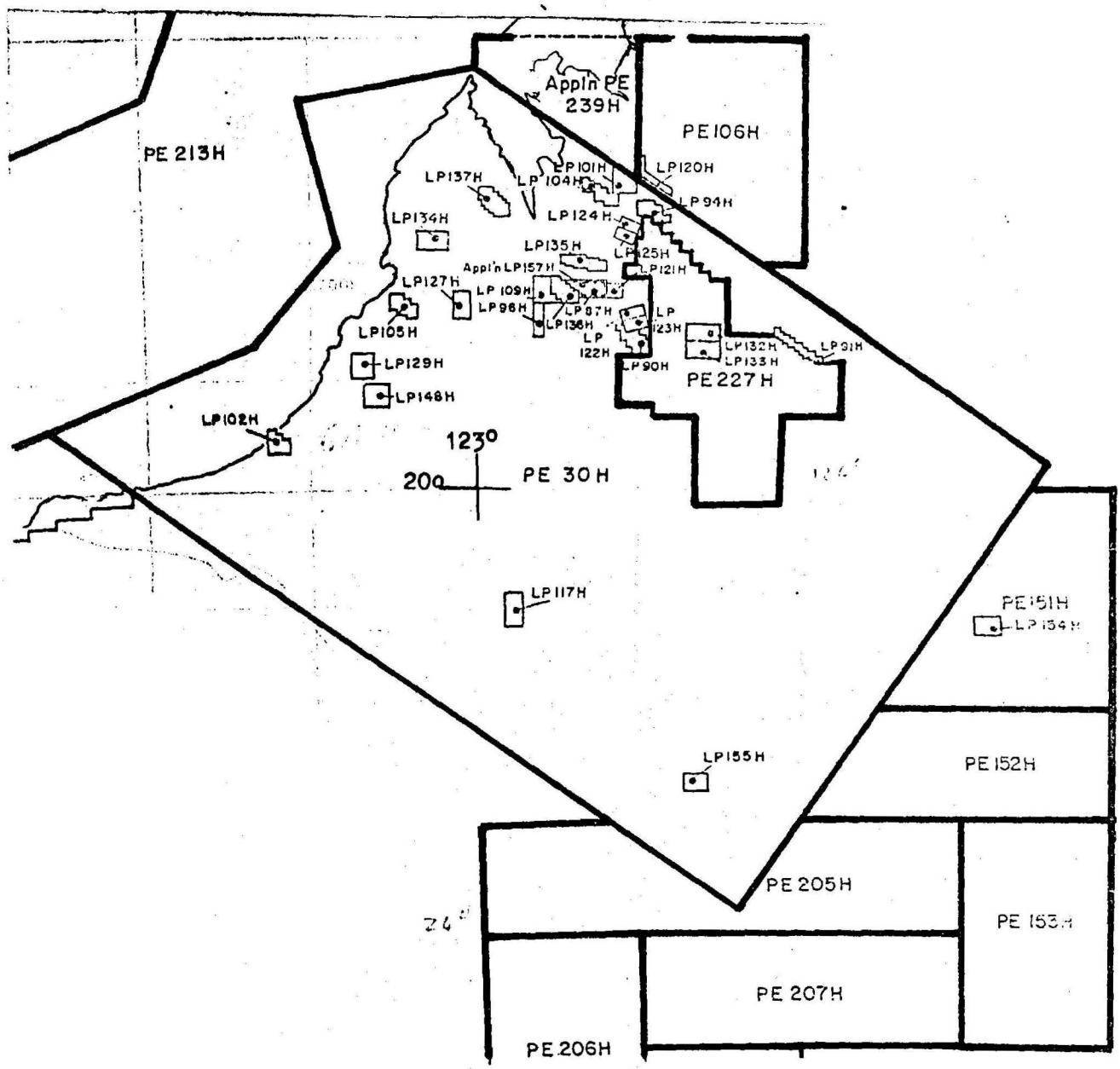
In July WAPET made another attempt on the elusive Devonian reef facies of the Lennard Shelf when it began drilling Blackstone No. 1. Although the limestones were encountered, they were hard and dense and contained only traces of bitumen. The well was deepened as a stratigraphic well into the underlying Ordovician beds, to a total depth of 3050 m.

There was considerable activity in the Canning Basin in 1967. Seismic and gravity surveys were carried out by Gewerkschaft, Australian Aquitaine, French Petroleum and WAPET. On 16 October BOC began drilling the consortium's first offshore well from the barge 'Investigator' at Ashmore Reef.

Towards the end of 1967 and in 1968 the Commonwealth and State parliaments passed the Petroleum (Submerged Lands) Acts. As a result, the old Permits-to-Explore, both offshore and onshore, were rearranged into usually smaller graticular Exploration Permits.

The most notable event in 1968 was the start of a drilling programme of five wells by Total Exploration Australia Pty Ltd, the name by which French Petroleum Company was known after May of that year. These holes were the outcome

Fig. 17. PETROLEUM TITLES - 1965



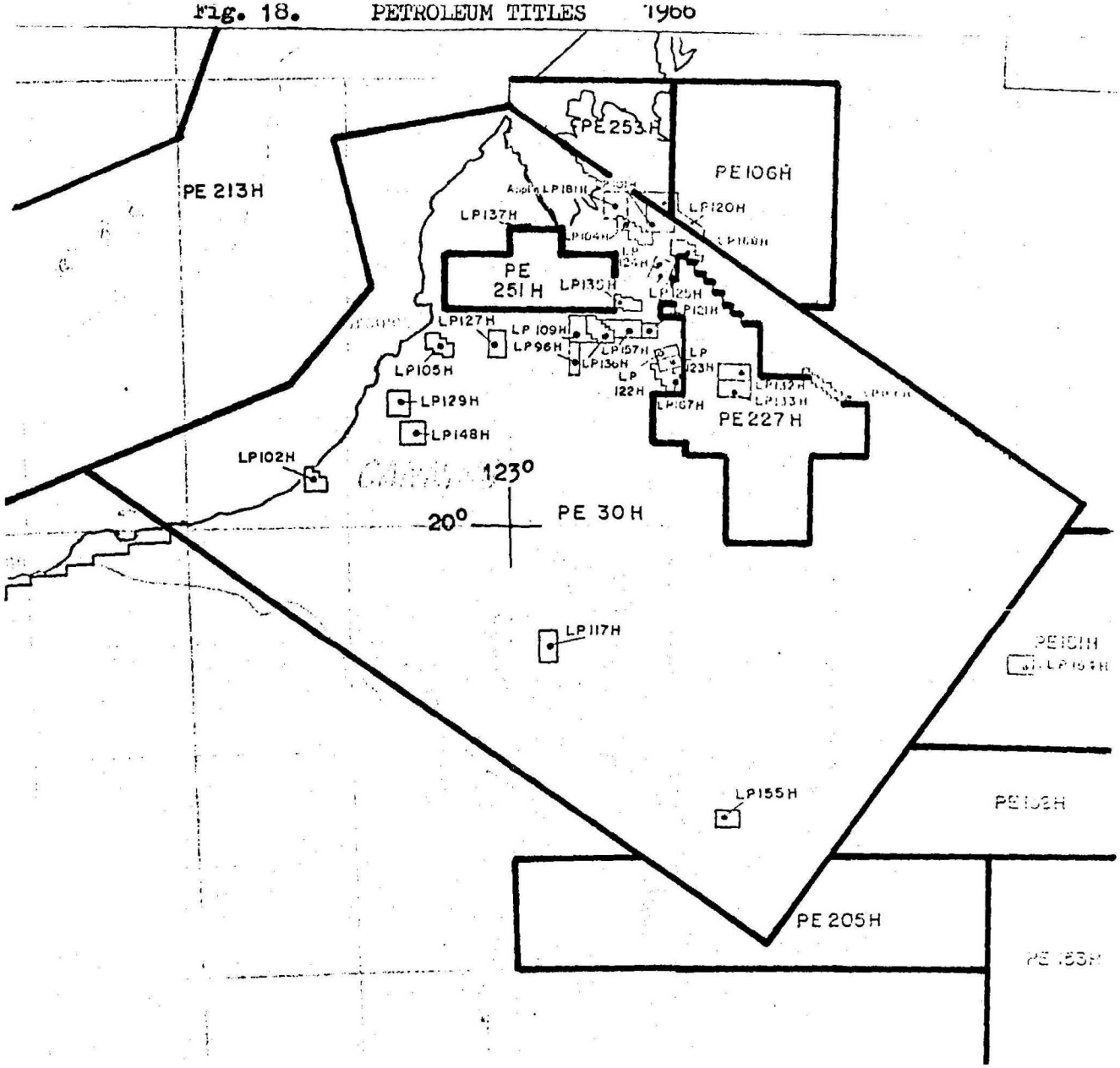
Permits to Explore

30 H	WAPET	205 H	Alliance Petroleum
106 H	Westralian Oil	207 H	" "
151 H	Beach General Exploration	213 H	Woodside, B.O.C., Shell
152 H	" " "	227 H	WAPET
		239 H	Abrolhos Oil

Licences to Prospect

87)		120	Westralian Oil
90)		121-125	A.F.O.
91)		127)	
94)		132-137)	WAPET
96)		148)	
101)	WAPET	155)	
102)			
104)			
105)			
109)			
117)			

Fig. 18. PETROLEUM TITLES 1966



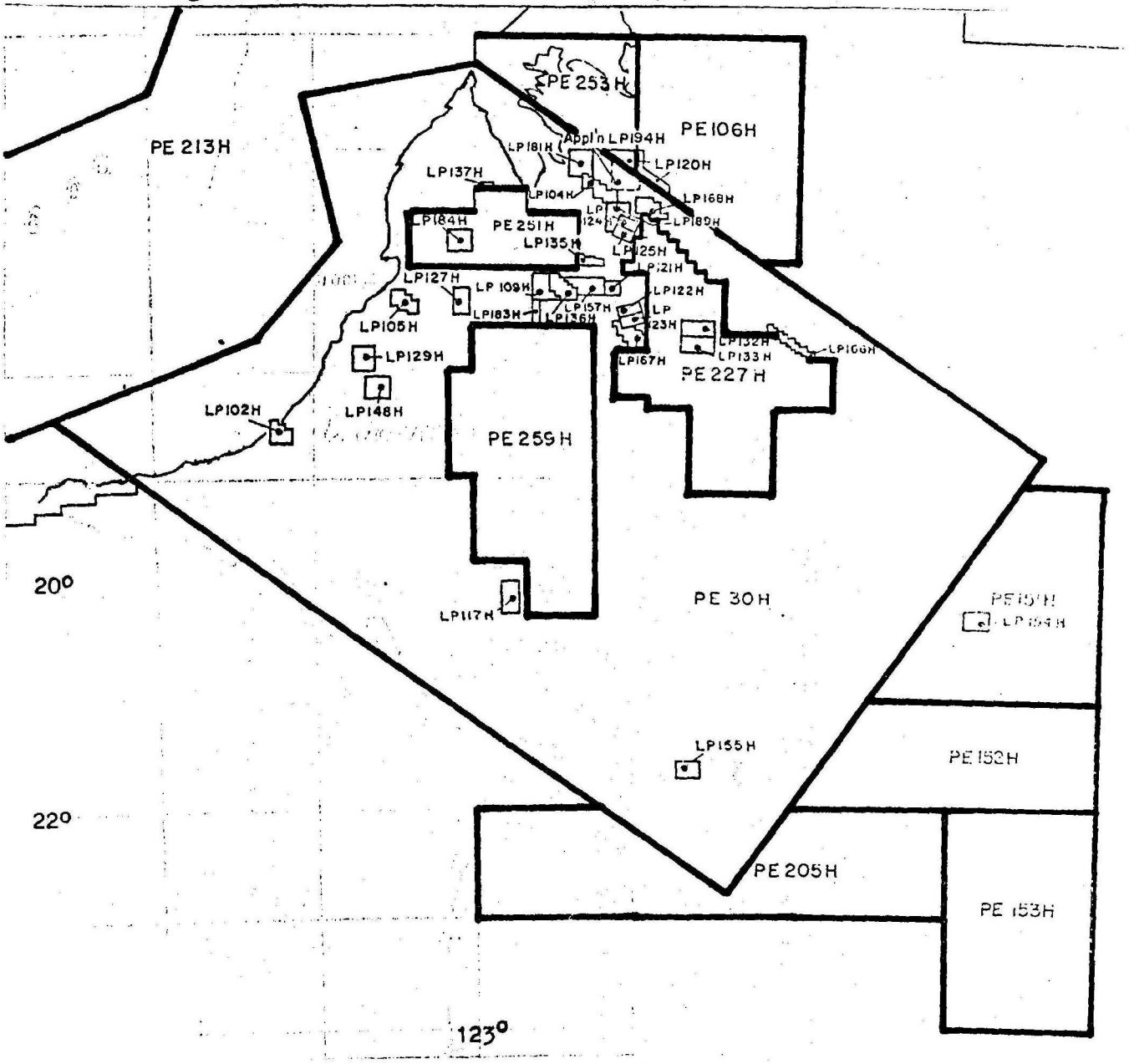
Permits to Explore

30 H	WAPET	213 H	Woodside, (Lakes Entrance) B.O.C., Shell
106 H	Westralian Oil	227	WAPET
151 H) 152 H)	Beach General Ex.	251	WAPET
205 H	Alliance Petroleum Aust.	253	Westralian Oil

Licences to Prospect

96	WAPET	127	WAPET
101	"	129	"
102	"	132	"
104	"	135	"
105	"	136	"
109	"	137	"
117	"	148	"
120	Westralian	155	"
121-) 125)	A.F.O.	157	"
		166	"
		167	"
		181	"

Fig. 19. PETROLEUM TITLES - 1967



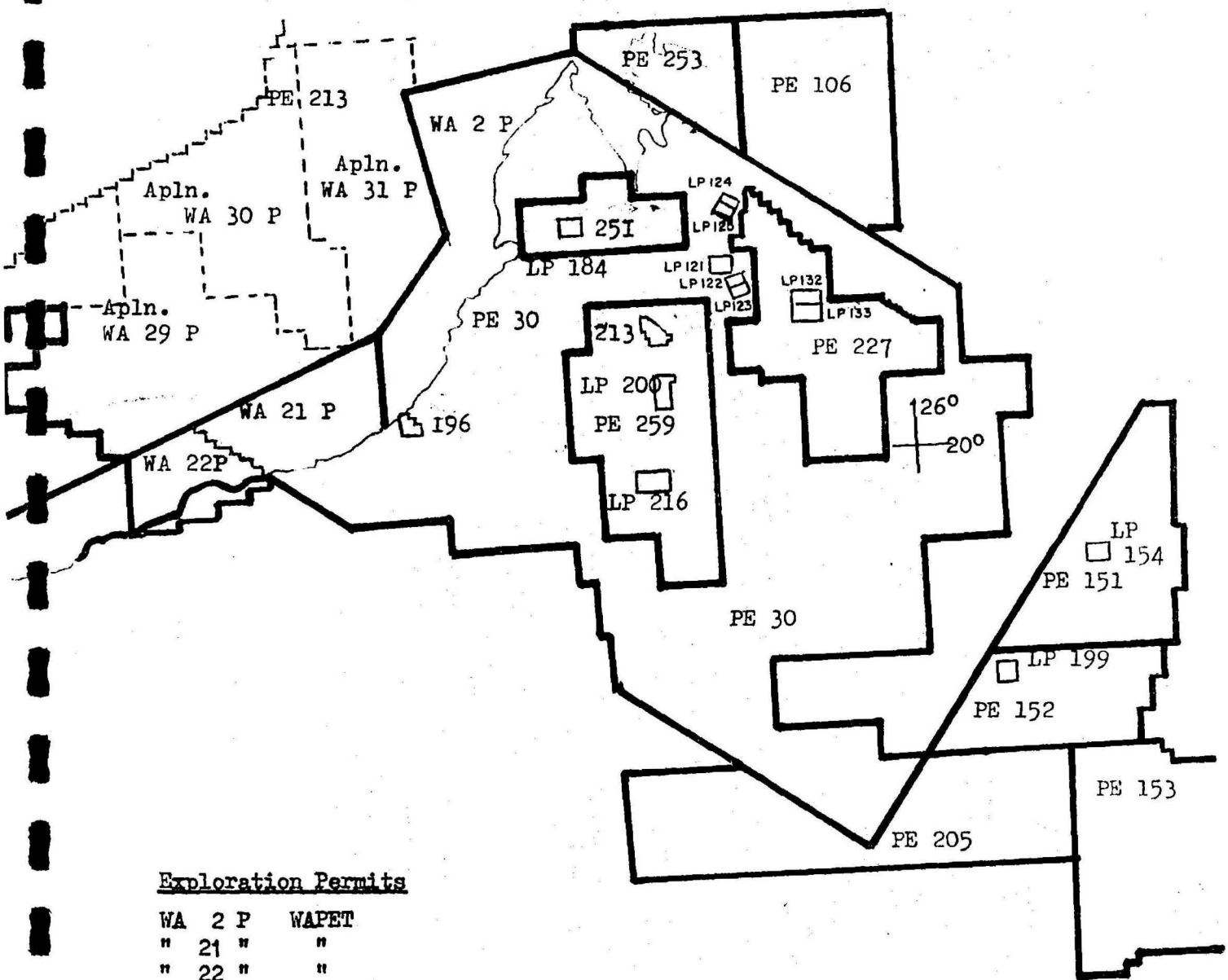
Permits to Explore

30 H	WAPET	213 H	Woodside, BOC, Shell
106 H	Westralian Oil	227 H	WAPET
151 H)		251 H	WAPET
152 H)	Beach-General Explor.	253 H	Westralian Oil
153 H)		259 H	WAPET
205 H	Alliance Petroleum Aust.		

Licences to Prospect

102)		154	Beach-General Explor.
105)	WAPET	155	WAPET
109)		157	"
117	"	164	"
120	Westralian Oil	166	"
121-)		181	"
125)	WAPET	183	"
127	"	184	"
129	"	194	"
132, 133,	"		
135-137	"		
148	"		

Fig. 20. PETROLEUM TITLES 1968



Exploration Permits

WA	2 P	WAPET
"	21 "	"
"	22 "	"
"		Woodside/Shell/B.O.C. 28-32P

Permits to Explore

30	H	WAPET
106	H	Westralian Sands Ltd
151	H	Beach-General Explor.
152	H	" " "
153	H	" " "
205	H	Alliance Petr.
213	H	Woodside/Burmah/Shell
227	H	WAPET
251	H	"
259	H	"

Licences to Prospect

121-125	WAPET
132,133	"
154	Beach-General Explor.
184	WAPET
196	"
199	Beach-General "
200	WAPET
213	"
216	"

of the intensive survey work carried out by the Company in PE 259 (Fig. 21), and were all located on seismically-determined structures on or near the Broome Platform. The wells were McLarty No. 1 (May-July 1968) Edgar Range No. 1, Kemp Field No. 1, Matches Springs No. 1, and Mowla No. 1 drilled at the end of 1969. All except Mowla No. 1 penetrated deep into the Ordovician strata. All were disappointingly barren, and Total withdrew from the Canning Basin.

The other French-linked company, Australian Aquitaine, drilled Wilson Cliffs No. 1 in the latter half of 1968 as the sequel to the surveys it had been carrying out over PE 151, PE 152 and PE 153 (Fig. 21).

WAPET drilled three rather shallow wells in 1968. Doran No. 1 was drilled on one of a series of en-echelon asymmetric domes on the Jurgurra Terrace. Willara Hill No. 1, located on the northern margin of the Willara Sub-basin, was drilled in the anticipation that hydrocarbons encountered in the Grant Formation in Willara No. 1 could have accumulated up-dip in a seismically-determined structural high. Chirup No. 1, located in the Wallal Embayment (Which had also been defined by seismic surveys), was the only unsubisdized WAPET hole in the Canning Basin. None of the three wells had more than a trace of hydrocarbons.

In early 1969 a new oil prospecting company, Lennard Oil N.L. (Fig. 22) entered the search and bought the oil exploration titles in the Fitzroy Trough that were held by Western Sands (formerly Westralian Oil). Lennard Oil continued with the geophysical surveys of PE 106 and PE 253 and then in July 1969 began drilling a series of four wells on the Lennard Shelf. The Devonian limestones were the major target. Napier No. 1 was commenced in July 1969 and Napier No. 5 was finished in October 1970 (Napier No. 3 was cancelled). Only traces of hydrocarbons were found. The first three wells were freshwater-flushed and the fourth was dry.

The PSSA was amended in 1969 such that, among other things, the granting of subsidy for offshore operations was restricted to companies with Australian equity.

WAPET drilled no wells in 1969 and 1970 but continued with an extensive geophysical (mainly seismic) programme.

1970 was perhaps chiefly noteworthy in that it was in this year that BOC drilled its first well in the Canning Basin. This was Lacepede No. 1, drilled on a seismically-delineated anticline on the offshore extension of the Fitzroy Trough, in about 60 m of water. Although only traces of methane and ethane were recorded, the well did confirm the presence in the offshore part of the basin of thick porous and permeable sandstones in the Lower Cretaceous and Jurassic sections, and of thick shales which could be source rocks. It also demonstrated the existence of an important unconformity cutting out the Triassic. By now geological thought had become influenced by the plate-tectonic theory and

the thick Mesozoic wedges on the Northwest Shelf were now seen as having been deposited over a sial-sima contact at the edge of the recently severed Australian Gondwanaland plate.

BOC continued its offshore programme by drilling Bedout No. 1 in 1971 in about 90 m of water from the Glomar Tasman on a dome on the offshore extension of the Broome Swell. The results however were similar of those from Lacepede No. 1. Meanwhile important discoveries of gas were being made in wells in basins to the north and south.

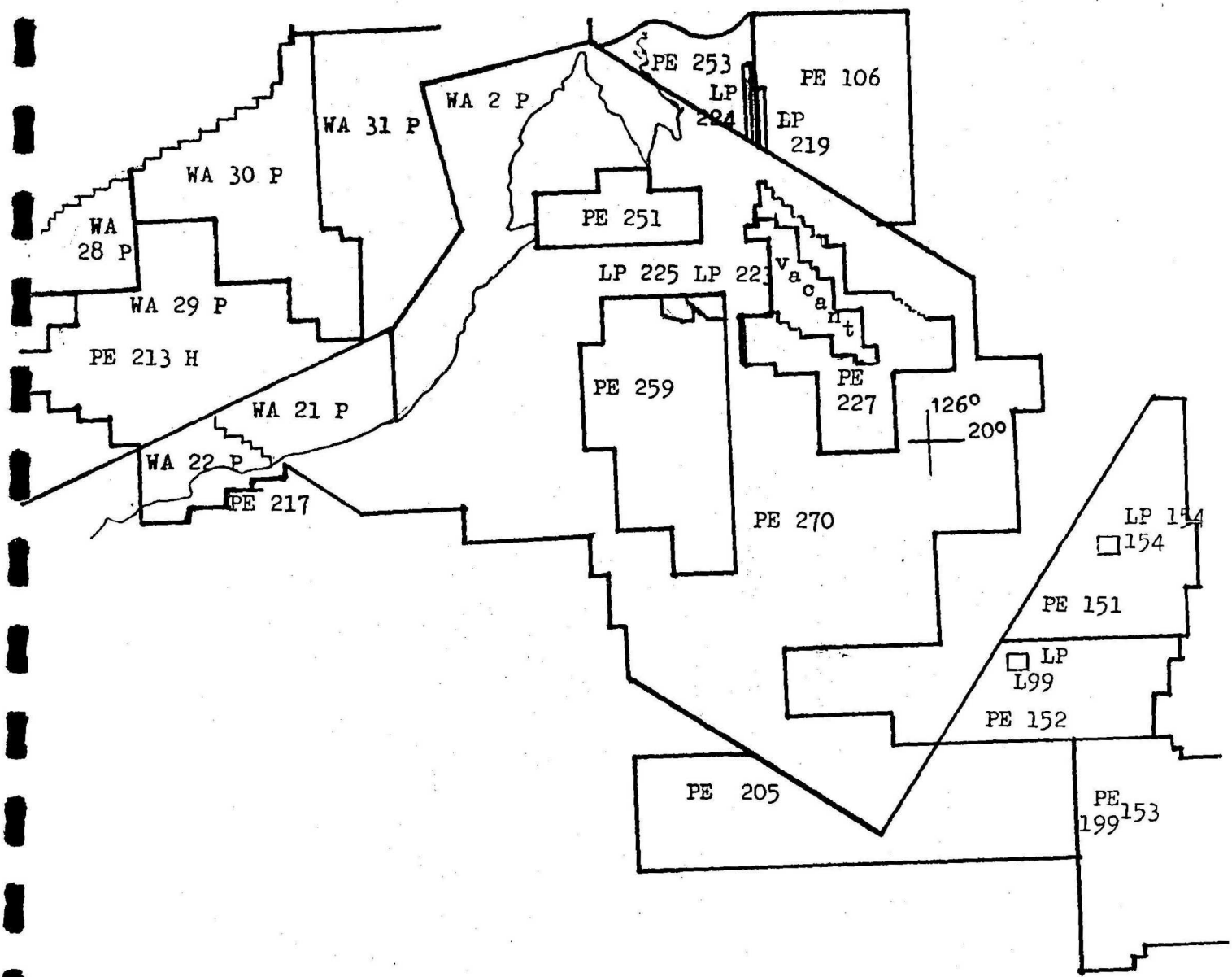
WAPET resumed its drilling programme in 1971 with the spudding of Tappers Inlet No. 1. It contained only traces of hydrocarbons but did suggest that the southern boundary of the Lennard Shelf was far more complex than the simple fault-line previously proposed.

Far to the east WAPET drilled three coreholes, Crossland Nos 1, 2 and 3 on the Crossland Platform and Barbwire Terrace. Their main objective was to obtain data in a desert area remote from well-control.

The Lake Betty Structure on the southern edge of the Lennard Shelf had been mapped geologically in the 1950s and by geophysics in the 1960s. WAPET drilled Lake Betty No. 1 towards the end of 1971 only to discover that the principal objective, the Devonian Pillara Formation, had been cut out by faulting. WAPET also drilled Munda No. 1 at about the same time, as a stratigraphic hole to test several unusual ('turtle-style) salt-cored structural features observed in the Munro Arch seismic survey.

In Spetember 1971 BOC announced it would spend $57 million in the next five years exploring and proving its Northwest Shelf and Cooper Basin leases, thus raising the company's cumulative expenditure in Australia to $120 million. If the discoveries on the Shelf (Carnarvon and Browse Basins) proved to be economically viable, Burmah estimated that $1 000 million would be spent over a 10-year period. A director of the BOC group said the Shelf was one of the prime oil exploration areas of the world. In March 1972 representatives from the member companies of the Northwest Shelf consortium met in London to discuss the future development of the gas and condensate finds, and in April BOC as operator for the consortium farmed out four areas on the Shelf (Fig. 25). In Area 1, about one-third of Block 30P went to Shell Development Aust. Pty Ltd as partner. Similarly, in Areas 2 and 4 about one-third of 30P and half of 29P went to a group consisting of Hematite Petroleum Pty Ltd, Mitsui & Co. Ltd, Bridgestone Liquefied Gas Co. Pty Ltd, and C. Itch & Co. (Aust) Pty Ltd. In Area 3 about one third of 31P, the new partners were a group consisting of Amax Petroleum (Aust) Inc., Mitsui & Co. Ltd, Sumitomo Shoji Kaisha Ltd, and Beaver Exploration Australia N.L. Shell farmed-in on the unusually stiff terms of earning only one third interest.

Fig. 21. PETROLEUM TITLES, 31 December 1969



Permits to Explore

106 H Lennard Oil
151 H) Beach-General
152 H) Explor.
153 H) Australian Aquitaine
205 H Aust. Aquitaine
213 H Woodside, Shell, BOC
227 H WAPET
251 H "
253 H Lennard Oil
259 H WAPET
270 H "

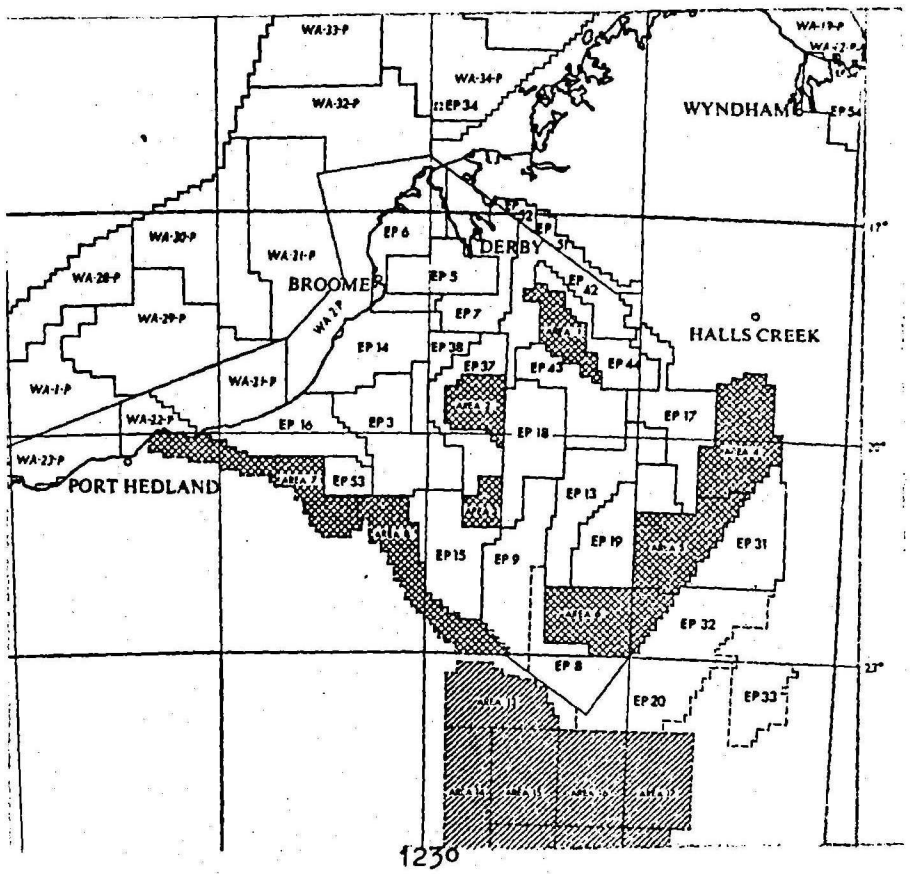
Exploration Permits

WA 2 P WAPET
" 21 " "
" 22 " "
28-32 Woodside/Shell/BOC

Licences to Prospect

154 Beach-General Explor. Aust. Aquitaine
199 " " "
219 Lennard Oil
223 WAPET
224 Lennard Oil
225 WAPET

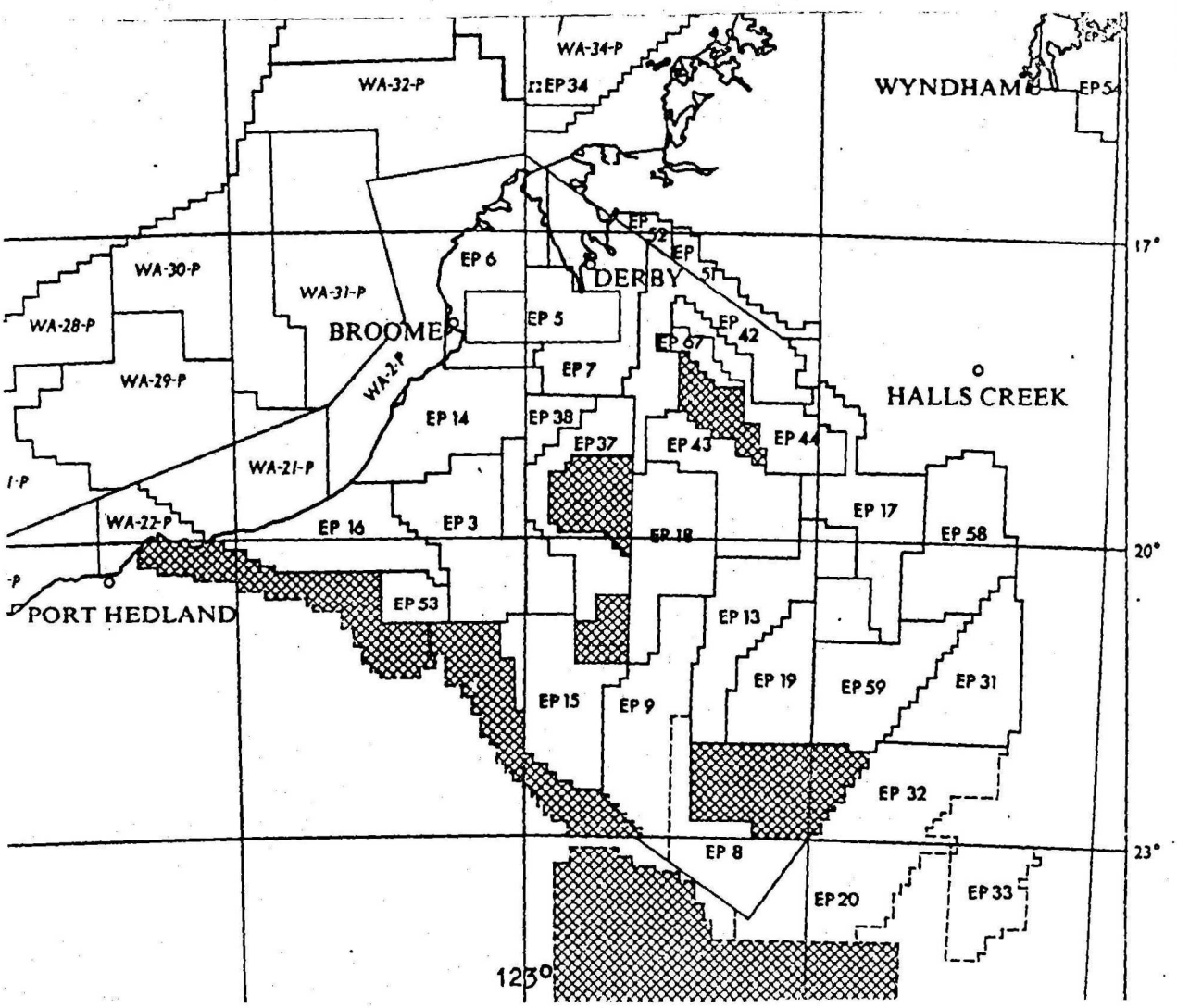
Fig. 22. PETROLEUM TITLES 1970



Exploration Permits

EP	3,5-9,13-19	WAPET
	20	Australian Aquitaine
	31,32	Beach General Explor. Aust. Aquitaine
	33,37,38	WAPET
	42,43,44	"
	51,52	Lennard Oil
	53	WAPET
WA	2P	WAPET
	21	"
	22	"
	28-32	Woodside/Shell/BOC

Fig. 23. PETROLEUM TITLES, 1971

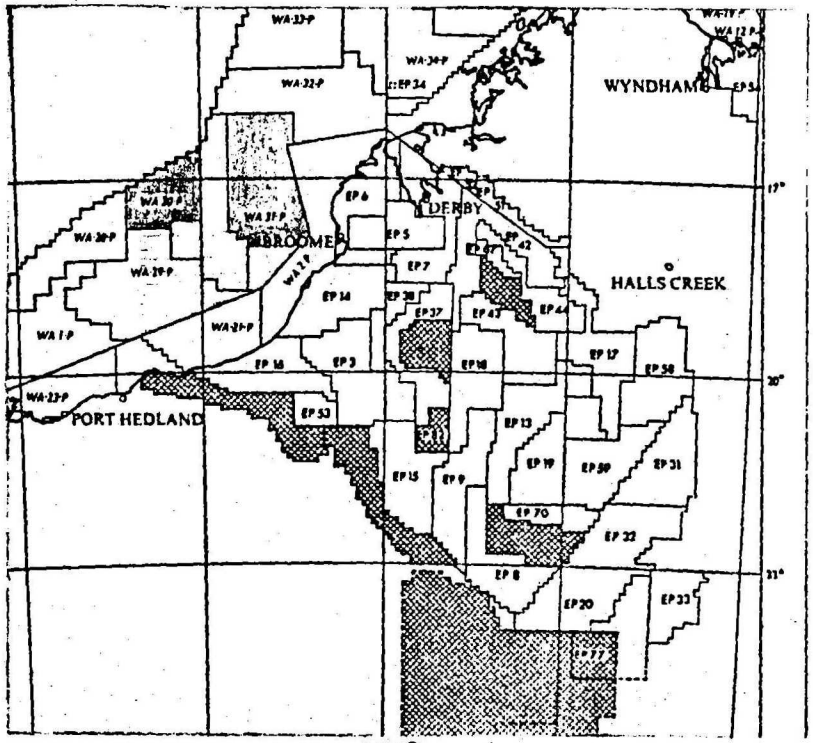


Exploration Permits

EP	3,5-9,13-19	WAPET
	20	Australian Aquitaine
	31,32	Beach General Explor. Aust. Aquitaine
	33,37,38	WAPET
	42,43,44	"
	51,52	Lennard Oil
	53	WAPET
	58,59	Associated Australian Oilfields Australian Aquitaine Petroleum Abrolhos Oil Ashburton Oil Flinders Petroleum Longreach Oil Pursuit Oil
	67	WAPET
WA	2P	WAPET
	21	"
	22	"
	28-32	Woodside/Shell/BOC

Record No.1975/109

Fig. 24. PETROLEUM TITLES, 1972



EP	3,5-9, 12-18	WAPET
	19,20	AAP
	21-25	WAPET
	31-33	Beach-General Exploration-AAP
	34	BOC, Woodside, Shell
	37,38,42-44	WAPET
	51,52	Lennard Oil
	58,59,70	AAO,AAP,Abrolhos,Ashburton,Flinders, Longreach Pursuit
	53,67	WAPET
	77	Stannon Engineering
WA - 2 - P		WAPET
	21	WAPET
	29-32	BOC, Woodside, Shell

WAPET continued with its drilling programme in 1972 by sinking five wells. Pender No. 1 was drilled as a shallow stratigraphic hole at the western end of the Lennard Shelf but potential reservoirs were found to be water-flushed as the Napier wells had been. Palm Springs No. 1 was a stratigraphic hole in a potentially productive area where all seismic data were poor. Barbwire No. 1 was drilled into an anticline poorly defined on seismic data at the culmination of the Jurgurra and Barbwire Terraces. Although Barbwire No. 1 well contained no hydrocarbons it did show that Devonian and Ordovician carbonate units are continuous along the terraces. Munro No. 1 was located on a basement-controlled structure southeast of the Willara Sub-basin in which it was theorized that carbonate rocks could form traps generated by draping over basement-controlled faulting. Logue No. 1 was drilled on the Jurgurra Terrace in an optimum position to entrap any hydrocarbons migrating from postulated source rocks deep within the Fitzroy Trough.

BMR returned to the Canning Basin in 1972 when a test-drilling programme was undertaken, and Billiluna, Stansmore and Lucas 1:250 000 Sheet areas were surveyed as part of a program for remapping the entire basin. Further drilling was done in 1973, and Crossland, Mount Bannerman, Dummer, Cornish, Helena and Webb 1:250 000 Sheet areas were mapped. WAPET drilled three more holes in 1973. Thangoo No. 2 was drilled on an anticlinal structure near the crest of the Broome Platform. Ordovician carbonates were the main objective, but the only indication of hydrocarbons was a minor oil shale in a sandstone of the Grant Formation. Mimosa No. 1 was drilled on a seismically-defined anticline on the southern edge of the Lennard Shelf near the margin of the Fitzroy Trough. The primary objective, the Devonian limestones, was found to be missing, but thick Late Devonian source rocks were found that upgraded the hydrocarbon prospects of that part of the Lennard Shelf. Mount Hardman No. 1 tested a fault-line structure in an optimum regional position for any hydrocarbons generated in the Fitzroy Trough to the south to have accumulated in the Laurel Formation on the Devonian carbonates. Sandstones in the Laurel Formation were the primary objective, but no hydrocarbons of any importance were found.

Australian Aquitaine, after several years of geophysical surveying, drilled Contention Heights No. 1 in 1973 on a structure defined by seismic surveys in the Kidson Sub-basin. The target was the Ordovician strata, but the well was abandoned some 450 m short after unsuccessful fishing operations, and no significant shows of oil or gas were recorded.

The three consortia that obtained offshore farmouts from Woodside-Burmah in 1971 were active during 1973. Hematite, after making a seismic and magnetic survey in 1972, drilled Keraudren No. 1 on a structure with combined fold and fault closure near the centre of the Bedout Sub-basin. The prime target was the Triassic

beds, which were expected to be almost 2000 m thick. After penetrating more than 1000 m of Middle Triassic sediments, mechanical difficulties forced the hole to be abandoned prematurely.

The deepwater drillship Sedco 445, which had been brought to Australia by Shell to drill Lynedoch No. 1 in the Arafura Sea, drilled East Mermaid No. 1 in 397 m of water in the Rowley Shoals at the offshore limits of the basin. Jurassic sandstones were the target but East Mermaid was plugged and abandoned as a dry hole, whereupon Shell withdrew from operative exploration in Western Australia, having spent a total of $11 000 000 on this well and Lynedoch No. 1.

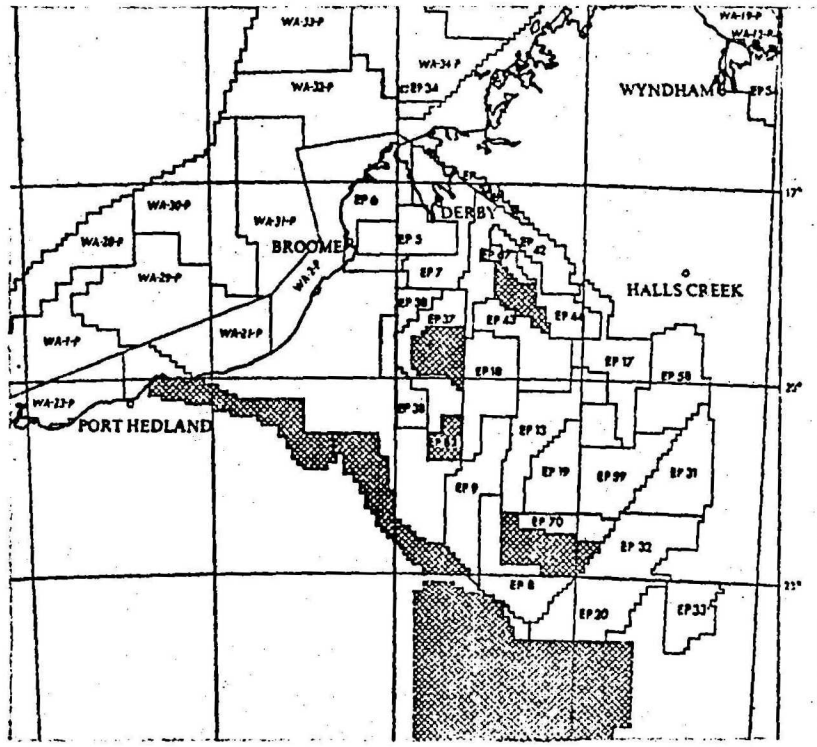
Amax drilled Wamac No. 1 in the WA31-P farmout to evaluate the Palaeozoic rocks in the offshore extension of the Fitzroy Trough. It was abandoned because of drilling difficulties about 900 m short of target depth. The presence of igneous intrusions in the Wamac structure showed the need to re-appraise other Palaeozoic structures in the area.

In 1974 B.O.C. drilled Minilya No. 1 from the "Ocean Digger" on a seismically delineated structure in WA29-P, on the boundary between the Bedout Sub-basin and the Beagle Sub-basin. The objective was Jurassic sandstones.

WAPET drilled Jones Range No. 1 in 1974, an anticline on the Jones Arch separating the Fitzroy Trough from the Gregory Sub-basin. The objective was the Devonian carbonates, but the well proved to be dry.

The last subsidized operation in the Canning Basin was Hematite's North Marine Seismic and Magnetic survey in WA29-P on the Bedout Structure.

Fig. 25. PETROLEUM TITLES, 1973 and 1974



EP	5-9,13,17-20 37,38,42-44, 67	WAPET
	31-33	Beach-General Exploration AAP
	51	Lennard Oil
	52	" " "
	58,59;70	Associated Australian Resources Aust. Aquitaine Petroleum Abrolhos Oil Ashburton Oil Flinders Petroleum Longreach Oil Pursuit Oil
WA - 1 - P		BOC, Woodside, Shell
WA - 28 to 34 - P		BOC, Woodside, Shell
WA - 2 - P 21 & 23- P		WAPET

TABLE 1. SUMMARY OF DRILLING OPERATIONS IN THE CANNING BASIN

AAO = Associated Australian Oilfields N.L.

AAP = Australian Aquitaine Petroleum Pty Ltd

BMR = Bureau of Mineral Resources, Geology and Geophysics

BOC = Burmah Oil Company

PE = Permit to Explore

LP = Licence to Prospect

PSSA = Petroleum Search Subsidy Acts

WADM = Western Australian Department of Mines

WAPET = West Australian Petroleum Pty Ltd

BEFORE PETROLEUM SEARCH SUBSIDY ACTS

Operator	Name of well. Reference	Location	Date drilled	Total depth (metres)	Hydrocarbons	Stratigraphy (depths to formation tops in metres)
Freney Oil	Prices Creek 1 Ann.Rep.Dep.Min. W.Aust. 1921	18°42'00"S 125°55'30"E	1922	392.2	Traces of oil	Emmanuel Fm
Freney Oil	Prices Creek 2 Ann.Rep.Dep.Min. W.Aust. 1927	see text	1922	103.6	" " "	Emmanuel Fm
Freney Oil	Prices Creek 3 Ann.Rep.Dep.Min. W.Aust. 1928	see text	1923	271.3	" " "	Emmanuel Fm
Freney Oil	Prices Creek 4 Ann.Rep.Dep.Min. W.Aust. 1929	see text	1923	121.9	No record	Grant Fm
Freney Oil	Mt Wynne 1	18°06'00"S 124°27'00"E	1922-23	273.1	Slight asphalt	Grant Fm

Freney Oil	Mt Wynne 2	see text	1923	21.3	None	Grant Fm	
Freney Oil	Mt Wynne 3 Ann.Rep.Dep.Min. W.Aust. 1935 BMR Bull. 60	see text	1923-25	656.5	Globules of oil	Grant Fm	
Freney Oil	Poole Range 1 BMR Bull. 36 " " 60	18°52'00"S 125°48'00"E	1926	121.9	None	Grant Fm	
Freney Oil	Poole Range 2	see text	1926-27	320.3	None	Grant Fm	
Freney Oil	Poole Range 3	see text	1927-30	994.9	Thick oil at about 640 m	Grant Fm	
Freney Oil	Poole Range 4	see text	1931		None	Grant Fm	
Freney Oil/ Freney Kimberley Oil	Poole Range 5 Ann.Rep.Dep.Min. W.Aust. 1935	see text	1933	470.9	None	Grant Fm	
Freney Kimberley Oil	Nerrima 1 BMR Bull. 36 " " 60	18°27'00"S 124°24'00"E	1939-41	1301.6		Noonkanbah Fm Poole Ss Nura Nura Member Grant Fm	1.5 243.8 310.9 378-T.D.
WAPET	Grant Range 1 Company files	18°01'00"S 124°00'30"E	1955-56	3936.5		Quaternary Grant Fm Anderson Fm	0 9.1 1856.2-T.D.
Associated Freney Oilfields	Nerrima 1 Company files	18°27'00"S 124°22'00"E	1955	2765.1	Traces of oil in Binda Member of Grant Fm	Noonkanbah Fm Poole Ss Nura Nura Member Grant Fm Anderson Fm	13.7 307.9 579 658.4 2441-T.D.

BMR	Jurgurra Creek 1 BMR Rep. 60	18°20'04"S 123°43'05"E LP 26 H	1955	512.1	None	Noonkanbah Poole Sst Grant Fm	0 318.5 379.5-T.D.
BMR	Laurel Downs 1 BMR Rep. 60	18°07'24"S 125°19'58"E PE 30 H	1955-56	1219.2	None	Quaternary Grant Fm Laurel Fm Fairfield Virgin Hills Lst Gogo Fm	0 .9.1 76.2 432.8 566.9 1031.7-T.D.
BMR	Prices Creek 1 BMR Rep. 60	18°39'44"S 125°54'00"E LP 41 H	1956	211.5	None	Lr. Ordovician Precambrian	0 180.7 - T.D.
WAPET	Fraser River Corehole Company files	17°29'00"S 123°12'30"E	1955	366.4		Quaternary Jarlemai Sltst Alexander Fm Wallal Sst	0 7.6 80.2 105.8-T.D.
WAPET	Fraser River 1 Company files	17°25'04"S 123°09'39"E	1955	3091.9		Quaternary Jarlemai Sltst Alexander Fm Wallal Sst Grant Fm Anderson Fm Laurel Fm Intr. dol.	0 12.2 71.6 88.4 423.7 1380.7 2436.9 3061.7-T.D.
WAPET	Dampier Downs 1 Company files	18°00"S 123°06'00"E	1956	922.9		Quaternary Jarlemai Sltst Alexander Fm Wallal Sst Poole Sst Nura Nura Mbr Upper Grant Thangoo Lst	0 4.6 92.4 147.4 316.1 468.8 482.9 800.1-T.D.

TABLE 1 (cont'd), p.4

WAPET	Roebuck Bay 1 Company files	18°09'34"S 122°27'28"E PE 30 H	1956	1219.2		Quaternary Broome Sst Jarlemai Sltst Alexander Fm Wallal Sst Poole Sst Nura Nura Mbr Upper Grant Thangoo Lst	0 9.1 148.4 240.5 295.7 477.6 606.3 624.2 1022.3-T.D.
Associated Freney Oilfields	Myroodah 1 Company files	18°16'30"S 124°12'00"E	1955-56	1829.1		Liveringa Gr Noonkanbah Fm Poole Sst Nura Nura Mbr Upper Grant Lower Grant	0 434.6 804.7 1151.5 1161.3 1787.7-T.D.
Associated Freney Oilfields	Sisters 1 Company files	17°43'31"S 124°25'09"E	1956-57	2995.4		Liveringa Gr Noonkanbah Fm Poole Sst Nura Nura Mbr Grant Fm Laurel Fm Devonian Lst Clanmeyer Sltst	0 158.5 565.4 582.2 618.7 1580.4 1975.1 2575.6-T.D.
WAPET	Wallal Corehole Company files	19°51'46"S 120°37'00"E	1957	309		Cainozoic Broome Sst Jarlemai Sltst Alexander Fm Wallal Sst	0 12.2 85.3 125 213.4-T.D.
	Wallal 4	19°44'12"S 120°44'28"E	1958	429.8		Tertiary Cretaceous	0 22.9
BMR	Wallal 4A BMR Rep. 60	19°44'12"S	1958	679.1	None	Jurassic Triassic Liveringa Gr Grant Fm Precambrian	114.9 587.3 612.6 643.7 677.9-T.D.

AFTER PETROLEUM SEARCH SUBSIDY ACTS

Operator (amount of subsidy)	Name of well. Reference	Location	Date drilled	Total depth (metres)	Hydrocarbons	Stratigraphy (depths to formation tops in metres)	
WAPET ($159 086)	Samphire Marsh 1 PSSA Rep. No. 5	19°31'07"S 121°10'51"E LP 53H	1958	2031.2	None	Quaternary Broome Sst Jarlemai Alexander Fm Wallal Sst Grant Fm Lr Ordovician Precambrian	0 8.2 170.4 262.1 354.2 688.2 1240.2 2014.1
WAPET ($244 346)	Meda 1 PSSA Rep. No. 7	17°24'36"S 124°11'30"E PE 30H LP 54H	1958	2685	A few gallons of oil from Laurel Fm; several small gas shows from Devonian	Quaternary Blina Sh Liveringa Gr Noonkanbah Fm Poole Sst Grant Fm Anderson Fm Laurel Fm Fairfield Dev Reef Precambrian	0 18.3 217.6 397.2 678.2 739.4 1280.5 1504.2 1671.2 2017.8 2640.5
WAPET (unsubsidized)	Meda 2 Company files	17°24'36"S 124°11'23"E PE 30H LP 54H	1959	2325	Minor gas in Devonian	Quaternary Blina Sh Noonkanbah Fm Poole Sst U. Grant Anderson Fm Laurel Fm Fairfield Gr Dev. Reef	0 21.3 253.6 435.3 787.3 1261.9 1550.5 1371 2017.8-T.D.

WAPET (unsubsidized)	Goldwyer 1 Company files	18°22'47"S 122°22'58"E	1958	1438.7	Traces of oil in Goldwyer & Thangoo	Quaternary Broome Sst Jarlemai Sltst Alexander Fm Wallal Sst Poole Sst Grant Fm Goldwyer Fm Thangoo Limestone Precambrian	0 12.2 161.5 258.8 317.6 533.4 619.4 848.3 1077.5 1420.4
WAPET ($108 898)	Frome Rocks 1 PSSA No. 8	18°11'48"S 123°38'42"E PE 30H LP 56H	1959	1219.2	None	Quaternary Jarlemai Sltst Alexander Fm Wallal Sst Dolomite Salt	0 12.2 93.6 166.7 223.7 687.6-T.D.
WAPET ($105 282)	Frome Rocks 2 PSSA Rep. No. 8	18°15'15"S 123°39'35"E PE 30H LP 56H	1959	2287.2	Globules of oil in Devonian	Quaternary Wallal Sst Liveringa Gr Noonkanbah Fm Poole Sst Nura Nura Mbr Grant Fm Devonian	0 9.1 62.8 110.6 440.7 635.2 642.8 1084.2-T.D.
WAPET ($105 668)	Thangoo 1 PSSA Rep. No. 14	18°22'06"S 122°53'22"E PE 30H LP 66H	1959	1059.2	Traces in Thangoo Lst	Quaternary Cretaceous Jurassic Permian Goldwyer Fm Thangoo Lst	0 11.9 74.4 420.6 852.5 1028.7-T.D.
	Thangoo 1A PSSA Rep. No. 14	18°21'52"S 122°53'09"E PE 30H LP 66H	1959-60	1655.4	None	Quaternary Cretaceous Jurassic Permian Goldwyer Fm Thangoo Lst Precambrian	0 11.9 71.6 428.2 848 1059.8 1554.5

APET (810 046)	Barlee 1 PSSA Rep. No. 16	17°48'25"S 122°42'40"E LP 67H	1960	2469.1	Gas traces 1213.1-1341.1m; 1575.8-1630.7m; 2374.4-2438.4m Bitumen in sst 1706.9-1767.8m	Quaternary Broome Sst Jarlemai Sltst Alexander Fm Wallal Sst Anderson Fm	0 9.8 43.6 302.7 323.7 485.9 - T.D.
APET $156 808)	Babrongan 1 PSSA Rep. No. 48	18°23'23"S 123°35'37"E PE 30H LP 96H	1962	1949.2	Gas 464.8-472.4m Bitumen 1834.9-1841m	Quaternary Mesozoic Permian Sst Nura Nura Mbr Grant Fm Luluigui Fm Clanmeyer Fm Virgin Hills Lst	0 9.1 79.2 260.9 266.4 669 713.2 1736.4-T.D.
APET $77 232)	Langoora 1 PSSA Rep. No. 48	17°18'07"S 124°06'48"E PE 30H LP 54H	1962	1615	None	Quaternary Blina Sh Liveringa Gr Noonkanbah Fm Poole Sst Grant Fm Anderson Fm Laurel Fm Fairfield Gr Precambrian	0 31.7 127.4 275.8 539.5 594.4 1264 1307.6 1484.4 1597.2-T.D.
APET $67 352)	Hawkestone Peak 1 PSSA Rep. No. 48	17°14'45"S 124°24'26"E	1962	1187.8	None	Quaternary Grant Fm Laurel Fm Fairfield Gr D Reef Precambrian	0 15.2 244.1 359.7 590.7 1175-T.D.

WAPET ($229 456)	Sahara 1 PSSA Rep. No. 80	21°04'40"S 123°23'30"E PE 30H LP 117H	1965	2120.2	None	Recent Mesozoic Noonkanbah Fm Poole Sst Grant Fm Dora Sh Cuncudgerie Braeside Tillite Melinjerie Lst Tandalgoo Red Beds Carribuddy Fm	0 12.2 59.4 286.5 361.8 361.8 687.3 871.3 931.2 1127.8 1726.7-T.D.
WAPET ($114 336)	Parda 1 BMR File 65/4137	18°56'08"S 122°00'34"E LP 129H	1965	1806.8	Slight traces in Goldwyer Fm	Broome Sst Jarlemai Sltst Alexander Fm Wallal Sst Poole Sst Nura Nura Mbr Grant Fm R/G Goldwyer Fm Thangoo Lst Precambrian	0 209.4 303 382.5 611.7 662.6 673.6 980.2 1183.8 1495.3 1777-T.D.
WAPET ($126 061)	Willara 1 BMR File 65/4158	19°10'48"S 122°04'14"E PE 30H LP 148H	1965	3903.3	Gas and oil traces 804.7-853.4m	Quaternary Broome Sst Jarlemai Alexander Fm Wallal Sst Grant Fm Carribuddy Fm Goldwyer Fm Thangoo Lst Nambeer Fm	0 21.3 152.4 215.2 295.1 513.3 1255.2 1873.9 2610 3141.9-T.D.
Continental ($688 397)	St George Range 1 BMR File 65/4170	18°41'30"S 125° 8'11"E LP 132H	1965-66	4437.3	Bituminous shale at 3441.2m; several small gas shows (2800 m^3 day) from 3154.1 to 3254.7m	Grant Fm St George Fm Anderson Fm Laurel Fm	0 1517.9 2487.2 2883.4-T.D.

TABLE 1 (cont'd), p.9

Australian Aquitaine ($180 428)	Point Moody 1 BMR File 65/4174	21°15'34"S 127°48'22"E PE 151H	1965	2133.6	Gas traces max. at 1112.5m	Quaternary Noonkanbah Fm Poole Sst Grant Fm Anderson Fm	0 12.2 347.5 659.3 1972-T.D.
WAPET ($510 754)	Kidson 1 BMR File 65/4177	22°37'00"S 125°00'22"E PE 30H LP 155H	1965-66	4431.5	None	Quaternary Cretaceous Liveringa Gr Noonkanbah Fm Poole Sst Grant Fm Dora Sh Cuncudgerie Fm Braeside Tillite Melinjerie Lst Tandalgoo Carribuddy Fm Goldwyer Fm Thangoo Lst	0 1.8 212.4 289.6 600.5 735.5 735.5 1069.2 1477.7 1570.6 1837 2570.1 4279.4 4412.9-T.D.
WAPET ($74 302)	May River 1 BMR File 67/4252	17°14'50"S 124°05'01"E PE 30H LP 181H	1967	1677.9	Staining in dolomitic sands at 1193.9m	Recent Blina Sh Liveringa Gr Noonkanbah Fm Poole Sst Grant Fm Anderson Fm Fairfield Gr Pre Fairfield	0 19.8 36.6 163.1 439.2 488.9 969.3 1171.7 1642-T.D.
WAPET ($160 922)	Blackstone 1 BMR File 67/4262	17°35'14"S 124°21'01"E PE 30H LP 124H	1967	3049.5	Gas traces in Carboniferous, bitumen traces in Devonian	Recent Erskine Sst Blina Sh Liveringa Gr Noonkanbah Fm Poole Sst Grant Fm Laurel Fm Fairfield Gr Blackstone Fm Ordovician	0 4.9 9.1 319.4 510.5 750.7 798.6 1486.2 1578.3 1914.1 2220.5-T.D.

Gewerkschaft-Elwerath ($458 757)	Yulleroo 1 BMR File 67/4249	17°51'16"S 122°54'25"E PE 251H LP 184H	1967	4574.7	$12m^3$/hour gas 3342-3347m; $57m^3$/hour gas 3395-3408m	Quaternary Broome Sst Jarlemai Sltst Alexander Fm Wallal Sst Grant Fm Carb. U. Dev.	0 6.1 69.8 266.7 286.9 443 621 3849.6-T.D.
Total ($249 127)	McLarty 1 BMR File 68/2009	19°23'45"S 123°39'30"E PE 259H	1968	2590.8	Faint traces	Recent Alexander Fm Wallal Sst Grant Fm Carribuddy Fm Goldwyer Fm Thangoo Lst Unnamed Sst	0 4.3 23.5 125.6 452 1687.4 2060.5 2341-T.D.
Total ($103 508)	Edgar Range 1 BMR File 68/2041	18°45'26"S 123°35'33"E PE 259H	1968	1968.1	Oil trace in Caribuddy	Alexander Fm Jur. Sst Grant Fm Carribuddy Fm Goldwyer Fm Thangoo Lst	0 9.1 113 571.5 888.2 1352.7-T.D.
Total ($102 549)	Kemp Field 1 BMR File 68/2048	20°19'10"S 123°27'58"E PE 259H	1968	1181.1	Faintest trace	Recent Alexander Fm Wallal Sst Noonkanbah Fm Poole Sst Grant Fm Melinjerie Lst Tandalgoo Red Beds Carribuddy Fm	0 16.8 52.7 103.3 157.9 179.2 563 720.5 1115.3-T.D.

TABLE 1 (cont'd), p. 11

Australian Aquitaine ($539 037)	Wilson Cliffs 1 BMR File 68/2011	22°16'39"S 126°46'55"E PE 152H LP 199H	1968	3722.2	A few slight traces	Quaternary Mesozoic Noonkanbah Fm Poole Sst Grant Fm Carribuddy Fm Goldwyer Fm Mid fm Lower fm Cam/Prot.	0 12.2 181.4 373.4 579.1 966.8 2532.9 2847.4 2963.3 3503.4-T.D.
WAPET ($18 049)	Doran 1 BMR File 68/2033	18°10'56"S 123°29'06"E LP 210H	1968	763.2	Some solid bitumen in lowermost Grant	Recent Jarlemai Sltst Alexander Fm Wallal Sst U. Grant Luluigui Fm	0 19.2 30.5 105.2 181.4 741.3-T.D.
WAPET ($12 516)	Willara Hill 1 BMR File 68/2044	19°03'31"S 121°52'45"E PE 30H LP 211H	1968	861.1	None	Quaternary Broome Sst Jarlemai Sltst Alexander Fm Wallal Sst Grant Fm	0 18 208.2 285.3 365.8 630.3-T.D.
WAPET (unsubsidized)	Chirup 1	19°51'S 120°26'E	1968	762.6			
Total ($139 196)	Matches Springs 1 BMR File 69/2023	18°41'28"S 124°04'11"E PE 259H	1969	2834.6	Fluorescence in Carribuddy	Recent Alexander Fm Wallal Sst Grant Fm un. formn. Tandalgoo Red Beds Carribuddy Fm un. formn. Goldwyer Fm	0 9.1 22.3 104.2 547 1706.3 1779.4 2108 2277.2-T.D.

Total ($52 220)	Mowla 1 BMR File 69/2039	18°43'50"S 123°42'35"E PE 259H	1969	762		Recent Wallal Sst Grant Fm Devonian	0 10.4 28.3 473.4-T.D.
Lennard Oil ($144 622)	Napier 1 BMR File 69/2015	17°12'20"S 124°31'36"E PE 253H	1969	1801.4	Traces of bitumen in Devonian lst. Freshwater-flushed	Lr Carb. Fairfield Gr Napier Fm Van Emmerick Cong. Mid. Dev. Precambrian	0 202.4 883 1140.6 1296.3 1772.7-T.D.
Lennard Oil ($104 415)	Napier 2 BMR File 69/2031	17°04'55"S 124°21'20"E	1969	1606.9	Traces of gas and bitumen in Devonian lst. Freshwater-flushed	Lr.Carb. "A" Carb/Dev "B" U. Dev "C" M. Dev "E" Precambrian	0 146.9 848.9 1195.4 1587.7-T.D.
Lennard Oil ($94 088)	Napier 4 BMR File 70/589	16°55'00"S 124°05'35"E	1970	965	Freshwater-flushed	Quaternary Permian L. Carb Devonian Proterozoic	0 14.3 68 169.2 943.1-T.D.
Lennard Oil ($108 784)	Napier 5 BMR File 70/750	17°06'30"S 124°28'06"E	1970	1657.1	Faint gas traces	Anderson or Laurel Fairfield Gr Napier Fm Van Emmerick Cong. Stony Creek Cong. Proterozoic	0 82.6 461.8 918.1 1179.6 1649.6-T.D.
BOC ($156 065)	Lacepede 1, 1a BMR File 70/426	17°05'19"S 121°26'42"E WA 31P	1970	2286	Traces of gas	Tertiary U. Cretaceous L. Cretaceous Jurassic Permian	57.9 302.7 382.5 1204 1998-T.D.

BOC ($111 591)	Bedout 1 BMR File 71/435	18°14'40"S 119°23'22"E WA 29P	1971	3073	None	Tertiary Cretaceous Jurassic Triassic uncert.	0 794 1716 2910 3020.9-T.D.
WAPET ($211 361)	Tappers Inlet 1 BMR File 71/301	16°51'33"S 122°35'20"E EP 6	1971	2856.2	Slight traces of oil and gas	Alexander Fm Wallal Sst Noonkanbah Fm U. Grant Pillara Lst Poulton Fm unnamed Nambeet Fm Precambrian	0 414.5 641 1030.2 1531.6 1963.2 2015.9 2202.5 2834.6-T.D.
WAPET (unsubsidized)	Crosslands 1 BMR File 71/465	19°43'10"S 125°14'50"E EP 43	1971	913.2	None	Recent Grant Dev./Carb.	0 9.1 301.4-T.D.
WAPET (unsubsidized)	Crosslands 2 BMR File 71/465	20°00'45"S 124°59'36"E EP 18	1971	914.4	None	Recent Tert./Perm. Poole Sst Grant Fm Carb.	0 9.1 143.9 207.9 659.6-T.D.
WAPET ($91 477)	Crosslands 3 BMR File 71/465	20°12'12"S 125°45'39"E EP 13	1971	915.3	None	Recent Noonkanbah/Poole Grant Fm Napier Fm	0 6.1 102.4 477.3-T.D.
WAPET ($310 342)	Lake Betty 1 BMR File 71/441	19°34'08"S 126°19'45"E EP 17	1971	3145.8	None	Liveringa Gr Noonkanbah Fm Poole Sst Grant Fm Laurel Fm Luluigui Fm Poulton Fm	0 378 678.2 764.4 1656.9 2579.5 3078.5-T.D.

WAPET ($39 361)	Munda 1 BMR File 71/475	19°28'27"S 122°17'32"E EP 3	1971	1066.8	None	Broome Sst Jarlemai/Alexander Wallal Sst Grant Fm Carribuddy A. Carribuddy B.	0 110 243.8 410.9 800.4 1012.5-T.D.
WAPET ($35 669)	Pender 1 BMR File 72/2000	16°40'48"S 122°50'06"E EP 6	1972	911.7	None. Completely water-flushed	Quatern./Tert. L. Cretaceous Jurassic L.Perm/U.Carb. Precambrian	0 62.2 181.7 441.4 904.3-T.D.
WAPET ($31 456)	Palm Springs 1 BMR File 72/2002	17°48'56"S 124°53'08"E EP 42	1972	1066.8	None	Quaternary Permian Luluigui Fm	0 6.1 462.1-T.D.
WAPET ($49 522)	Barbwire 1 BMR File 72/2001	19°10'39"S 125°00'59"E EP 43	1972	1071.4	None	Grant Fm Pillara Lst Tandalgoo Red Beds Carribuddy Fm Nita Fm Goldwyer Fm carbonate	0 143.3 363.6 457.8 730.3 782.4 822.4-T.D.
AAP ($132 493)	Contention Heights 1 BMR File 73/230	22°25'36"S 127°13'31"E EP 32	1973	1790.7	No significant hydrocarbons. Potential reservoirs water-saturated	Recent Mesozoic Noonkanbah Fm Poole Sst Grant Fm Mbr 1 " 2 Mellinjerie Lst Tandalgoo Red Beds Carribuddy Fm Goldwyer Fm Ordovician	0 4.6 13.7 87.8 174.7 397.2 475.5 832.7 850.4 1342.7 1580.4-T.D.

Shell (unsubsidized)	East Mermaid 1	17°10'01"S 119°49'21"E WA 30P	1973	4070	Minor gas readings in Cretaceous and top Jurassic	Pliocene Miocene Oligocene Eocene Palaeocene Maas-Campanian Santonian Con-Cenomanian Lr Ceno/Up Albian Albian Aptian Neocomian Jurassic	518.1 563.8 1261.9 1292.4 1597.2 1627.6 1737.4 1752.6 1767.8 1792.2 1938.5 2301.2-2883.4 2883.4-4070
Amax Petroleum ($158 585)	Wamac 1 BMR File 73/246	17°14'26"S 121°29'28"E WA 31P	1973	2764	Small amounts C, in Palaeozoic	Rec-Miocene U Cretaceous Aptian Tithonian Bath-Bajocian ? U Palaeozoic	 357 405 1072 1604 1964 2071-T.D.
Hematite Petroleum ($570 840)	Keraudren 1 BMR File 73/240	18°54'25"S 119°09'14"E WA 29P	1973	3844	Slight gas in Jurassic and Triassic. Potential reservoirs water-saturated	Lr Tertiary Maas-Santonian Con-Turonian Ceno-Albian Apt-Neocomian Neo-Tithonian Oxf-Callovian Mid Jurassic Lr Jurassic U Triassic Lad-Anisian	527 600 815 843 1065 1237 1539 1543 1650 2460 2801-T.D.
WAPET ($132 274)	Thangoo 2 BMR File 73/218	18°26'32"S 122°54'33"E EP 14	1973	1472	Minor oil-showing in Cuncudgerie	Broome Sst Jarlemai Sltst Alexander Fm Wallal Sst Grant Fm Binda Mbr Dora Mbr Cuncudgerie Mbr Goldwyer Fm Willara Fm Nambeet Fm Precambrian	12 77 195 248 422 458 545 788 913 1267 1436

6

BOC (unsubsidized)	Minilya 1 BMR File 74/116	18°19'28"S 118°43'55"E in 146 m water. 29 P	1974	2400	Tertiary Cretaceous Upper Jurassic
WAPET (unsubsidized)	Jones Range 1	19°21'40"S 125°40'13"E EP 43	1974	2540	to Ordovician

TABLE 2. Summary of Geophysical Surveys in the Canning Basin

OPERATOR (AMOUNT OF SUBSIDY)	TYPE AND/OR NAME OF SURVEY	YEAR	AREA	REFERENCE
BMR	Semi-detailed gravity	1952	Nerrima Dome and Fenton Fault	BMR Record 1953/64
BMR	Seismic refraction	1952	Nerrima Dome	BMR Record 1953/72
BMR	Regional gravity	1953	Onslow-Derby	BMR Record 1963/13
BMR	Detailed gravity along seismic lines	1953	Poole Range	BMR Record 1962/91
BMR	Regional gravity	1953	Kimberley	BMR Reg.Grav.File 5308
BMR	Seismic reflection and refraction	1953	Poole Range/Prices Creek	BMR Record 1955/35
BMR	Detailed gravity	1954	Grant Range, Myroodah, Luluigui	BMR Reg.Grav.File 5407
BMR	Gravity	1954	Halls Creek, Derby, Broome	BMR Reg.Grav.File 5406
BMR	Regional aeromagnetic	1954	Halls Creek	BMR Record 1955/108
BMR	Regional aeromagnetic	1954	Canning Basin	BMR Record 1960/11
BMR	Seismic reflection	1954	Poole Range/Christmas Creek	BMR Record 1956/66
BMR	Seismic reflection	1954	Deep Well Anticline, Myroodah	BMR Record 1955/110
BMR	Seismic reflection	1954	Broome	BMR Record 1955/112
BMR	Regional gravity	1955	Christmas Creek, Derby, Broome, Anna Plains	BMR Grav. 5505
BMR	Seismic reflection	1955	Christmas Creek	BMR Record 1957/37
BMR	Seismic reflection	1955	Langeys Crossing	BMR Record 1956/112
BMR	Seismic reflection	1955	La Grange	BMR Record 1960/49
BMR	Seismic reflection	1955	Barnet Flow/Nerrima	BMR Record 1959/63
BMR	Seismic reflection	1955	Broome	BMR Record 1961/57
BMR	Regional gravity	1956	Billiluna, Anna Plains	BMR Reg.Grav.File 5605
BMR	Gravity	1956	Poole Range	BMR Record 1956/155
WAPET	Gravity	1954-56	Carnarvon Basin and adjacent areas	BMR Reg.Grav.File 5630

WAPET	Seismic refraction	1958	Jurgurra Terrace	C.J. Blum & D.N. Smith "Refraction surveys of the Fenton Project" WAPET company rep. 1959 (unpubl.)
BMR	Helicopter regional gravity	1957	Canning Basin, road traverses	BMR Reg.Grav.File 5707
WAPET ($72 364)	Blue hills/Logue Seismic	1959-60	Jurgurra Terrace. PE 30 et al.	PSSA Publ. No.36
WAPET ($121 144)	Dampier Fault Seismic	1959-60	Jurgurra Terrace, PE 30	BMR File 62/1520
WAPET ($10 046)	Barlee Gravity	1960	Jurgurra Terrace. PE 30	BMR File 62/1903
BMR	Helicopter gravity	1960	Canning Basin	BMR Record 1962/105
BMR	Aeromagnetic recce	1960	Canning Basin	BMR Record 1960/11
BMR	Poole Range Gravity	1962	Poole Range	BMR Record 1962/91
WAPET ($49 854)	Hawkestone Peak Seismic and Gravity	1962	Lennard Shelf. PE 30H	BMR File 62/1608
WAPET	Jurgurra Terrace Gravity	1962	PE 30H	BMR Reg.Grav.File 6237
WAPET ($40 700)	Laurel Downs/Virgin Hills Gravity	1962	PE 30H, LP 91H	BMR File 62/1928
AOD ($9 384)	Napier Downs Gravity	1962	PE 106H	BMR File 62/1931
Hawkestone ($6 858)	Alexander Creek Gravity	1962	PE 142H	BMR File 62/1934
WAPET ($49 918)	South Canning Aeromagnetic	1962	PE 30H	BMR File 62/1728
WAPET ($78 965)	Laurel Downs Seismic	1962	PE 30H	BMR File 62/1620
AFO ($18 242)	The Sisters/Blackstone Seismic	1962	LP 61H, LP 62H, central Fitzroy Graben	BMR File 62/1598
WAPET ($7 162)	Sahara Gravity	1963	Central PE 30H	BMR File 63/1910
WAPET ($20 224)	Lake Betty Gravity	1963	PE 30H, central Fitzroy Graben	BMR File 63/1909
WAPET ($40 092)	Joanna Springs Gravity	Dec 1963 Apr 1964	PE 30H, central Fitzroy Graben	BMR File 63/1908
Hackathorn Oils ($4 862)	Stansmore Range Gravity, Aeromagnetic Seismic	1963	PE 151H, PE 152H	BMR File 63/1700
Woodside ($15 420)	Rowley Shoals/Scott Reef/ Sahul Banks Aeromagnetic	1963	PE 213H	BMR File 63/1709
WAPET ($79 048)	Goorda-Logue Seismic	1963	PE 30H, LP 56H, LP 64H	BMR File 63/1526

TABLE 2 (cont'd), p.3

WAPET ($87 598)	Balgo/Lake Betty Seismic	1963	PE 30H, eastern Fitzroy Graben	BMR File 63/1533
WAPET ($18 310)	Gogo Seismic	1962-63	PE 30H	BMR File 63/1531
WAPET ($127 244)	Sahara Seismic Recce	1963-64	PE 30H	BMR File 63/1539
Beach Petroleum	Stansmore Range Gravity	1964	PE 151H	BMR File 64/4807
WAPET (unsubsidized)	Gravity	1964	PE 30H	Company file
WAPET ($173 739)	Parda Seismic	1964	PE 30H, northwestern part	BMR File 64/4524
Continental ($191 912)	St George Range Seismic	1964-65	PE 227H	BMR File 64/4548
BOC ($127 014)	Northwest Shelf Seismic	1964	PE 213H	BMR File 64/4529
AAP ($19 140)	Pollock Hills Aeromagnetic	1965		BMR File 65/4619
Beach Petroleum	Aeromagnetic	1965	PE 152H, PE 153H	Company File
WAPET ($14 136.88)	Dampier land semi-detailed Gravity	1965	PE 30H	BMR File 65/4816
WAPET ($32 743)	Southeast Kidson Gravity	1965	PE 30H	BMR File 65/4814
WAPET ($165 188)	Southeast Kidson Seismic	1965	PE 30H	BMR File 65/11014
WAPET ($10 843)	West Lennard digital Seismic	1965	PE 30H	BMR File 65/11016
WAPET ($15 469)	Mowla Seismic	1965	PE 30H	BMR File 65/11040
WAPET ($18 333)	Offshore Canning Aeromagnetic	1965	PE 30H	BMR File 65/4614
Continental ($50 749)	Poole Range Detailed Seismic	1965	PE 227H	BMR File 65/11001
Continental ($30 748)	Broome Swell Seismic	1965	PE 227H (SW part)	BMR File 65/11006
Continental ($76 087)	Barbwire Range Seismic	1965	PE 227H	BMR File 65/11041
Continental ($82 344)	Crossland Seismic	1965	PE 227H	BMR File 65/11012
BOC ($328 360.99)	Montebello/Mermaid Shoals Marine Seismic	1965	PE 213H and Northwest Shelf	BMR File 65/11015
WAPET ($10 532)	King Sound Aeromagnetic	1966	PE 30H	BMR File 66/4623
WAPET ($36 968)	Roebuck Seismic	1966	PE 30H	BMR File 66/11115
WAPET ($77 352)	Dampierland Seismic	1966	PE 30H	BMR File 66/11099
WAPET ($5 001)	West Meda Seismic	1966	PE 30H	BMR File 66/11160
WAPET ($15 454)	Marine Vibroseis	1966	PE 30H	BMR File 66/11067
WAPET ($59 953)	Betty Detail Seismic	1966	PE 30H	BMR File 65/11055

WAPET ($12 110.59)	Willara Hills Reflection Seismic	1966	PE 30H	BMR File 66/11081
WAPET (unsubsidized)	Nita-Willara Seismic	1966	PE 30H	BMR File 66/11131
BOC ($148 001)	Rankin-Troubadour Marine Seismic	1966	PE 213H	BMR File 66/11104
Gewerkschaft Elwerath ($247 022)	Lower Fitzroy Reflection Seismic/Magnetic	1966-67	PE 251H	BMR File 66/11111
WAPET ($14 266)	Munro Arch Gravity	1967	PE 30H	BMR File 67/4829
Continental ($10 957)	Noonkanbah Gravity	1967	PE 227H	BMR File 67/4834
French Petroleum ($11 740)	Jarmura Gravity	1967	PE 259H	BMR File 67/4832
French Petroleum ($254 415)	McLarty Gravity and Seismic	1967	PE 259H	BMR File 67/11145
AAP ($147 925)	Dakota Gravity and Seismic	1967	PE 151H, PE 152H, PE 205H	BMR File 67/11161
BMR	Helicopter Gravity	1967	W.A., N.T.	BMR Record 1970/15
WAPET ($11 598)	Wallal Marine Seismic	1967	PE 30H	BMR File 67/11208
BOC ($34 904)	Ashmore Reef Marine Seismic	1967	PE 213H	BMR File 67/11144
BOC ($134 098)	Scott-Cartier Marine Seismic	1967	PE 213H	BMR File 67/11173
AAP ($186 587)	Ryan Gravity and Seismic	1968	PE 151H, PE 152H, PE 205H	BMR File 68/3026
AAP ($41 098)	Terry Range Magneto-telluric	1968	PE 152H	BMR File 68/3016
BMR	Marine gravity, magnetic and seismic	1968	Barrow Island to Ashmore Reef	BMR Record 1969/99
BMR	Helicopter gravity	1968	N.S.W., Qld, W.A.	BMR Record 1969/109
Westralian Oil ($12 300)	Napier Refraction	1968	PE 106H, PE 253H	BMR File 68/3033
WAPET ($26 377)	Lennard Seismic	1968	Lennard Shelf, PE 30 H	BMR File 68/3018
WAPET ($30 241)	Baskerville Seismic	1968	Northwestern Fitzroy Graben PE 30H	BMR File 68/3023
BOC ($243 796)	Canning-Seringapatam Marine Seismic	1968	PE 213H	BMR File 68/3027
BMR	Helicopter gravity, magnetic and seismic	1969	Northwest shelf	BMR Reg.Grav.Files 6911-18
AAP ($90 413)	Contention Heights Seismic Refraction and Gravity	1969	PE 151H, PE 152H	BMR File 69/3036
AAP ($42 596)	Baron Range Seismic and Gravity	1969	PE 205H	BMR File 69/3052

TABLE 2 (cont'd), p. 5

WAPET ($11 530)	Wallal Aeromagnetic	1969	Offshore W.A. 21P; PE 30H	BMR File 69/3037
WAPET ($87 718)	Bedout Marine Seismic	1969	WA 2P; WA 21P; WA 22P; WA 23P	BMR File 69/3013
WAPET ($119 491)	Munro Arch Seismic	1969	PE 30H	BMR File 69/3042
WAPET ($17 903)	Jurgurra Terrace Seismic	1969	PE 30H	BMR File 69/3075
WAPET ($28 706)	Munro R-1 Seismic	1969	PE 30H	BMR File 69/3081
Lennard Oil ($59 205)	Alexander Seismic	1969	PE 253H; PE 106H	BMR File 69/3057
Total ($94 136)	Matches Spring Seismic	1969	PE 259H	BMR File 69/3028
BOC ($469 912)	Legendre-Marie marine Seismic	1969	Northwest Shelf	BMR File 69/3005
BOC ($287 964)	Adele-Scott Marine Seismic	1969	W.A. 30P, W.A. 31P	BMR File 69/3038
AAP ($105 640)	Stretch Range Gravity and Seismic	1970	PE 151H	BMR File 70/600
WAPET ($91 096)	Tabletop Seismic	1970	EP 8; EP15	BMR File 70/392
WAPET	Tabletop Gravity	1970	EP 8, EP 15	BMR Reg.Grav. File 7031
WAPET ($52 940)	Laurel Seismic	1970	EP 42; EP 44	BMR File 70/763
WAPET ($30 160)	Pender Seismic	1970	EP 6; EP7	BMR File 70/817
WAPET ($9046)	King Sound Marine Seismic	1970	PE 30H	BMR File 70/218
WAPET ($118 604)	Oscar Seismic	1970	EP 5; EP 7; EP 42	BMR File 70/765
WAPET ($67 243)	Lake Betty Seismic	1970	EP 17	BMR File 70/657
WAPET ($130 562)	Helena Seismic	1970	EP 9, EP 13, EP 17	BMR File 70/504
WAPET ($41 639)	Crossland Seismic	1970	EP 18, EP 43, EP 44	BMR File 70/687
WAPET ($52 732)	Gogo Trig Seismic	1970	EP 42	BMR File 70/718
WAPET ($12 380)	Canning Marine Seismic	1970	WA 2P, WA 21P	BMR File 70/158
WAPET ($99 182)	Broome-Samphire Seismic	1970	EP 3, EP 6, EP 14, EP 16	BMR File 70/857
WAPET ($70 814)	Anketell Seismic	1970-71	EPs 3, 16, 53	BMR File 70/896
Lennard Oil ($103 146)	Alexander II Seismic	1970	EP 51, EP 52	BMR File 70/449
BOC ($183 878)	Tryall-Evans Marine Seismic	1970	Offshore	BMR File 70/245
WAPET	Gravity	1971	EP's 3,6,7,13,14,15,37,38,42,43, 44, 53	Company file

69

AAO ($22 684)	Billiluna-Helena Aeromagnetic	1971	EP 58, EP 59	BMR File 71/422
AAP ($9281)	White Hills Aeromagnetic	1971	EP 31, EP 32, EP 33	BMR File 71/508
WAPET ($15 743)	Lake Auld Seismic	1971	EP 15	BMR File 70/933
WAPET ($54 783)	Munro detail Seismic	1971	EP 3	BMR File 70/1000
WAPET ($51 113)	Munro D-2 Seismic	1971	EP 3; EP 37; EP 38	BMR File 71/478
WAPET ($191 260)	Crossland Platform Seismic	1971	EP 13; EP 18; EP19; EP 43	BMR File 71/150
WAPET ($60 680)	North Broome Seismic	1971	EP 6; EP 14; EP38	BMR File 71/252
WAPET ($174 809)	Poulton Seismic	1971	EP 7; EP 42; EP 44	BMR File 71/326
BOC ($158 152)	Trimouille-Dillon Seismic	1971	offshore	BMR File 70/976
Hematite ($125 575)	Bedout/Broome Swell Magnetic and Seismic	1972	WA 29P; 30P; 31P	BMR File 72/1616
WAPET ($79 812	Lennard Shelf Aeromagnetic	1972	EPs 5,7,17,42,44,51,52,67	BMR File 72/1019
WAPET ($142 493)	Lennard Shelf Seismic	1972	EPs 5,7,17,42,44,51,52,67	BMR File 72/1065
WAPET ($504 825)	East Canning Seismic	1972	EPs 13, 17, 18, 19, 42, 43, 44	BMR File 72/975
WAPET ($247 368)	Dampier Downs/Collins Seismic	1972	EPs 7, 42, 43, 37, 38	BMR File 72/2545
WAPET ($72 287)	North Broome D-2Seismic	1972	EPs 6, 14	BMR File 72/961
WAPET($ 143 580)	Liveringa Ridge Seismic	1972	EPs 5,6,7	BMR File 72/2938
AAP ($190 332)	Hickey Hills Seismic	1972	WA 20P, WA 33P	BMR File 72/2761
BOC ($10 146)	Naringla Seismic	1972	WA 31P	BMR File 72/2716
BOC ($60 336)	Monte Bello/Turtle Seismic	1972	Northwest Shelf	BMR File 72/509
BOC ($60264)	Steamboat Spit Seismic	1973	WA 1P; WA 29P	BMR File 72/3253
BOC ($38 064)	Mermaid/Cartier Seismic	1973	WA 30P; WA 31P; WA 32P	BMR File 73/204
WAPET ($46 126)	Crossland III Seismic	1973	EP 18	BMR File 73/244
WAPET ($30 024)	Sahara II Seismic	1973	EP 15	BMR File 73/234
Hematite ($4864)	Jaubert WA Seismic and Magnetic	1973	WA 29P	BMR File 73/212
AAO ($23 744)	Thornton Seismic	1973	EP 58, EP 59	BMR File 72/3362
WAPET ($112 310)	Barbwire II Seismic	1973	EPs 13,19,23	BMR File 73/263
WAPET ($48 559)	Collins II Seismic	1973	EP 37	BMR File 73/248
WAPET ($66 084)	Doran Seismic	1973	EP 7	BMR File 73/267

WAPET ($102 385)	Jones Range/Halls Range Seismic	1973	EPs 17, 43, 44	BMR File 73/255
WAPET ($15 712)	Liveringa II Seismic	1973	EP 5	BMR File 73/271
Hematite ($22 314)	Bedout North Marine Seismic and Magnetic	1974	WA 29P	BMR File 74/225

<u>TABLE 3. SUBSIDIES PAID FOR DRILLING UNDER THE PETROLEUM SEARCH SUBSIDY ACTS</u>

Year	WAPET	AAP	BOC	Lennard	Total	Gewerkt	Continental	AMAX	Hematite	Yearly Total	Yearly % of grand total
1958	403 432									403 432	5.56%
1959	214 180									214 180	2.95%
1960	115 714									115 714	1.59%
1961											
1962	301 392									301 392	4.15%
1963											
1964											
1965	469 853	180 428					688 397			1 338 678	18.47%
1966	510 754									510 754	7.04%
1967	235 224					458 757				693 981	9.57%
1968	30 565	539 037			455 184					1 024 786	14.14%
1969				249 037	191 416					440 453	6.07%
1970			156 065	202 872						358 937	4.95%
1971	620 721		111 591							732 312	10.10%
1972	116 647									116 647	1.6%
1973	132 274	132 493						158 585		423 352	5.84%
1974									570 840	570 840	7.87%
Total	3 150 756	851 958	267 656	451 909	646 600	458 757	688 397	158 585	570 840		
% of grand total	43.48%	11.75%	3.69%	6.23%	8.92%	6.33%	9.5%	2.18%	7.87%		
Grand Total to end of 1974	- - - - - - - -									7 245 458	

TABLE 4. SUBSIDIES PAID FOR GEOPHYSICAL SURVEYS UNDER THE PETROLEUM SEARCH SUBSIDY ACTS

Year	WAPET	AAP	BOC	Lennard	Total	Gewerkt	Continental	Hematite	Hackathorn	Westralian	A.F.O.	Beach	Hawkestone	AAO	Yearly Total	Yearly % of grand total
1958																
1959	193 508														193 508	2.03
1960	10 046														10 046	0.1
1961																
1962	253 986.9										18 242		6 858		279 086.9	2.93
1963	252 434		15 420						4 862						272 716	2.86
1964	300 980.2		127 014				191 916.8					17 926			637 837	6.7
1965	354 921.6	19 140	328 361				258 259								960 681.6	10.09
1966	217 370.6		148 001			247 022									612 393.6	6.43
1967	25 864	147 925	169 002		266 155		10 957								619 903	6.51
1968	56 618	227 685	243 796							12 300					540 399	5.67
1969	265 348	133 009	757 876	59 205	94 136										309 574	3.25
1970	705 584	105 640	183 878	103 146											1 098 248	11.53
1971	619 202	31 965	158 152												809 319	8.5
1972	1 190 365	190 332	70 482					125 575							1 576 754	16.56
1973	236 273		98 328					4 864						237 440	576 905	6.06
1974								22 314							22 314	0.23
Total	4 682 501.3	855 696	2300 310	162 351	360 291	247 022	461 132.8	152 753	4 862	12 300	18 242	17 926	6 858	237 440		
% of Grand Total	49.18%	8.98%	24.16%	1.7%	3.78%	2.59%	4.84%	1.6%	0.05%	0.12%	0.19%	0.18%	0.07%	2.49%		
Grand Total to end of 1974	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	9 519 685.1	

TABLE 5. MAIN STRATIGRAPHIC UNITS IN THE CANNING BASIN

AGE	UNIT
Lower Cretaceous	Bejah Clst. Broome & Melligo Ssts
Upper Jurassic	Jarlemai Sltst. Alexander Fm. Wallal Sst.
Lower Triassic	Culvida & Erskine Ssts Blina Sh.; Chilpada & Millyit Ssts
Permian	Hardman Fm.) Liveringa Group Condren Sst.) Lightjack Fm.) Noonkanbah Fm.; Triwhite Sst. Dora Sh. Poole Sst. & Nura Nura Mbr; Cuncudgerie Sst.
Upper Carboniferous	Grant Fm. (Binda Sst. Mbr (Dora Sh. Mbr Braeside (Cuncudgerie Mbr Tillite
Lower Carboniferous	Anderson Fm. = St George Fm.
Upper Devonian	Laurel Fm) Luluigui Fm. Yellowdrum Sst.) Fairfield Gr. Gum Hole Fm.) Clanmeyer Sltst. Bugle Gap) Napier) Van Emmerick) Virgin Hills) Lsts; Gogo) Fms; Bobs Bore)Congloms. Pillara) Sadler) Stony Creek) Babrongan Beds
M. Devonian	Melinjerie Lst; Poulton Fm = Blackstone Fm.
Lr. Devonian	Tandalgoo Red Beds
Silurian ?	Carribuddy Fm. Nita Fm. Goldwyer Fm.
Lower Ordovician	Emmanuel Fm; Willara Lst = Thangoo Lst Carranya Beds Nambeet Fm.

TABLE 6. STRATIGRAPHY OF THE CANNING BASIN, AS KNOWN IN THE EARLY 1920s

Tertiary	recognized in several areas.
'UPPER CARBONIFEROUS', with tillites.	'recognized' at a few places in the Fitzroy Valley.
'LOWER CARBONIFEROUS' with limestones.	'recognized' at a few places in the Fitzroy Valley.
'Desert Sandstones'	of unknown age.
'Upper Cambrian	'recognized' at one place in the Fitzroy Valley.

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