

# The Canning Basin, W.A. — An Introduction

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## Abstract

The onshore Canning Basin in north Western Australia covers an area of over 400,000 sq. km and contains over 10,000 m of mainly Palaeozoic sediments. The main basin elements trend NW/SE and extend into the offshore area where they are buried beneath seaward thickening Mesozoic and younger sediments. The main physiographic provinces in the basin are the spectacular limestone ranges along the northern rim, the Fitzroy River valley and the vast desert plain.

The region was settled by man c.30,000 years ago. Major changes in the local culture occurred, c.5000 and c.100 years ago, caused by the migration of new peoples and technology into the area. The pattern of conflict over control of the land and its resources persists today in the "land rights" dispute. There are approximately 30,000 people resident in the area today, concentrated in Broome, Derby and Fitzroy Crossing and spread across the river valleys and coastal regions on pastoral stations and Aboriginal settlements.

The Geological Survey of Western Australia and the Bureau of Mineral Resources have played a leading role in the geological exploration of the basin since the first survey in 1884. Oil indications in the basin were first noted in 1919. Exploration since then involves two main cycles, named for the leading companies, Freney (1920-53) and Wapet (1953-1974). The current round involving many Australian and international companies commenced in 1976.

The Blina and Sundown discoveries proved the presence of commercial oil deposits but these small fields are considered only a hint of the basin's petroleum potential. Good source and reservoir rocks are present and major accumulations may occur in structural and/or stratigraphic traps.

## Introduction

The prospect of giant "Kimberley Oil Fields" first seized the Australian imagination in the years after World War 1. Oil had been a vital factor in the Allied victory and future supplies were essential for empire and industry. Even before the war it was clear that petroleum would fuel the 20th Century and its discovery would bring development to the nation and fortune to the finder. Oil fever swept the world and Australians, who knew about the American oil fields and the discoveries in other countries, were not immune.

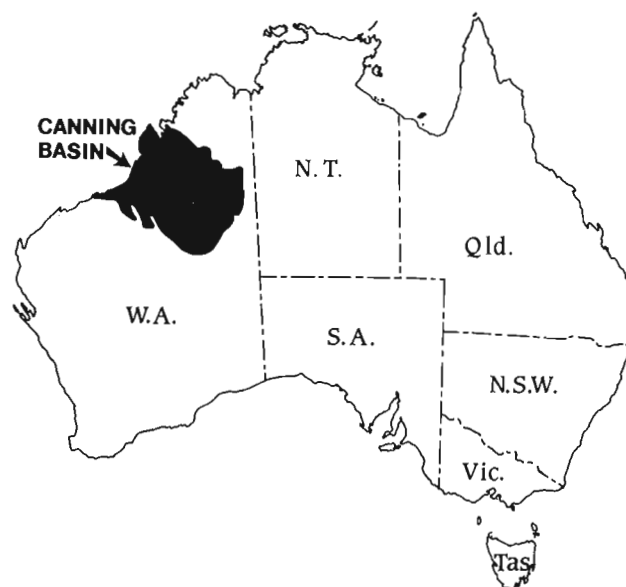


Figure 1: Location map, Canning Basin.

One young Australian, Walter Okes, had heard the story first hand from the American soldiers he fought beside in France: find a seep and you'd found an oil field. Back home in 1919, Okes went prospecting in the eastern Kimberleys and found his seep, near the junction of the Ord and Negri rivers — on a station called Texas! A few months later a water driller, Harry Price, encountered traces of oil in a water well in the Fitzroy Valley. So it began.

The dreams of Kimberley fields have come and gone

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many times since then. There were high hopes at Mt. Wynne in the early 1920's and then Poole Range in the 1930's. Both had well published shows of oil. So too did Sisters 1 and Meda 1 in the mid-late 1950's. Finally, in 1981, the Home Oil group discovered oil in commercial quantities at Blina. In 1982 they found another small field called Sundown.

The dream persists. Almost the entire Canning Basin is currently held under exploration permit with over 50 Australian and international companies involved in the search for those legendary "Kimberley fields". Many believe the basin will prove to be one of Australia's major onshore petroleum provinces.

This paper provides a general introduction to the Canning Basin with a brief description of the geography and physiography of the region, a summary of the history of settlement and petroleum exploration, and a figure summary of the stratigraphy and structure of the basin. A comprehensive suite of references is incorporated as a guide for further reading.

### Basin Name

The term "Canning Basin" was first used for the "vast Permian basin" in north Western Australia by Gentili and Fairbridge (1951) in their "Physiographic Regions of Australia", a diagram and notes accompanying Gentili's (1951) newly completed "Geomorphological Map of Australia".

Earlier names, still partly in use, also had a physiographic basis. Exploration along the Fitzroy River valley in the 1920's sponsored the term, Fitzroy Basin which, in various forms such as Fitzroy Trough, is still used to describe this distinct sub-basinal province. Exploration, mainly isolated geological traverses, also commenced during this period in the vast desert region south of the Fitzroy Valley and the term "Desert Basin" became popular. Clapp (1926a, b) did much for the term's popularity and very little for the basin's reputation!

Jutson (1934) used the term "Desert Basin" for the entire physiographic depression between the Kimberley Block in the north and the Nullagine Platform (now, more commonly, the Pilbara Block) in the southwest. This classification of the Fitzroy Basin as a sub-province of the broader Desert Basin was not accepted immediately by geologists: Bremner (1940) mixed the terms into "Fitzroy Desert Basin" while Findlay (1942) opted for "North-western Basin".

During preparation of their "Physiographic Regions of Australia", part of a world wide compilation, Gentili and Fairbridge (1951) decided that the term "Desert Basin" was too general, especially for a basin extending into the Australian interior. They adopted the term Canning Basin from the Canning Stock Route, established across the basin in 1906 by, and named for, the pioneer surveyor, A.W. Canning. This term was accepted by the BMR (Casey & Nelligan, 1956) and by Wapet, who commenced work in the basin in 1953.

## Basin Definition and Geology

The large Phanerozoic province, now termed the Canning Basin, covers both onshore and offshore regions. In most current, popular usage however, the term "Canning Basin" refers to the onshore, intracratonic basin between the Precambrian Kimberley and Pilbara blocks. The basin covers over 400,000 sq. km and contains at least 10,000 m of Palaeozoic sediments (Figure 2), beneath thin Mesozoic and Cainozoic rocks. It is bound-

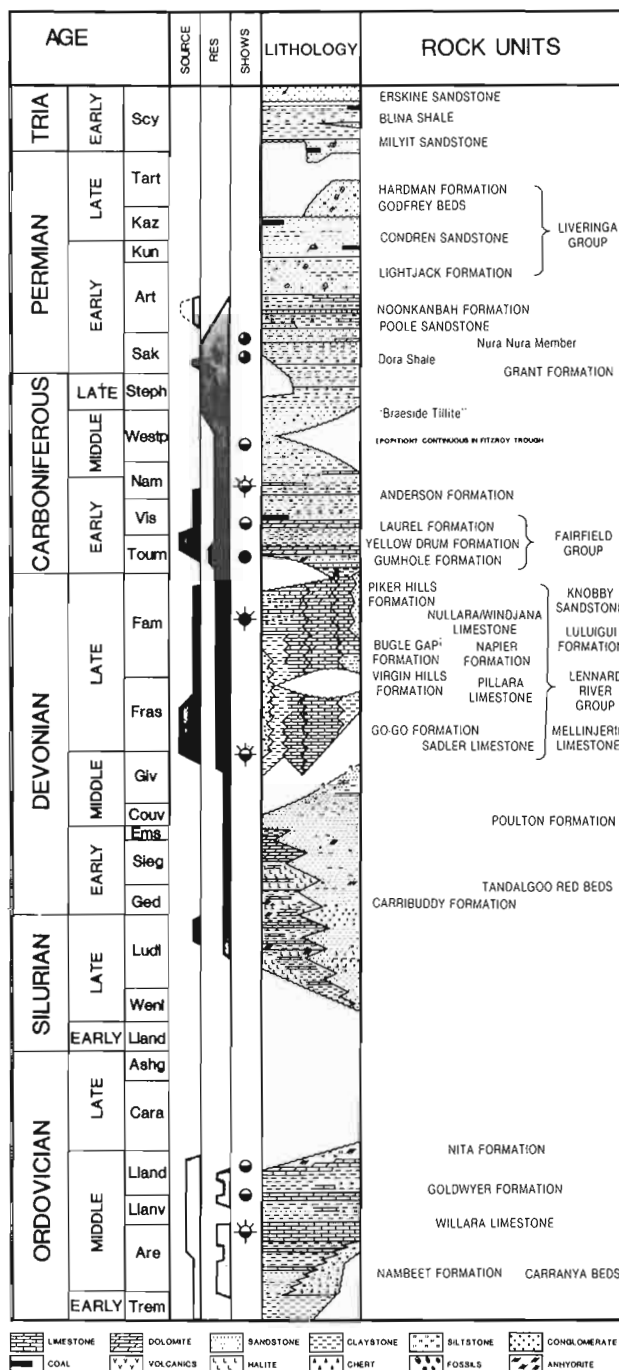


Figure 2: Generalized Stratigraphic Column, Canning Basin (from Poll, 1983).

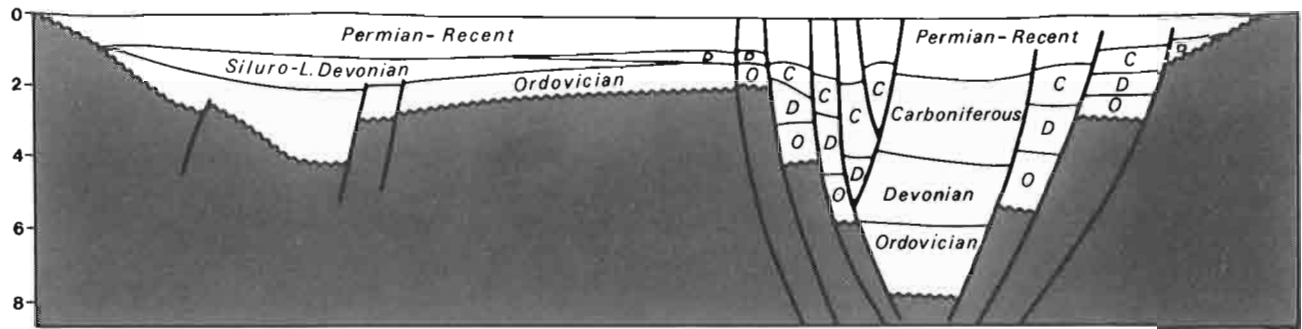


Figure 3: Generalized north/south geological cross-section, Canning Basin.

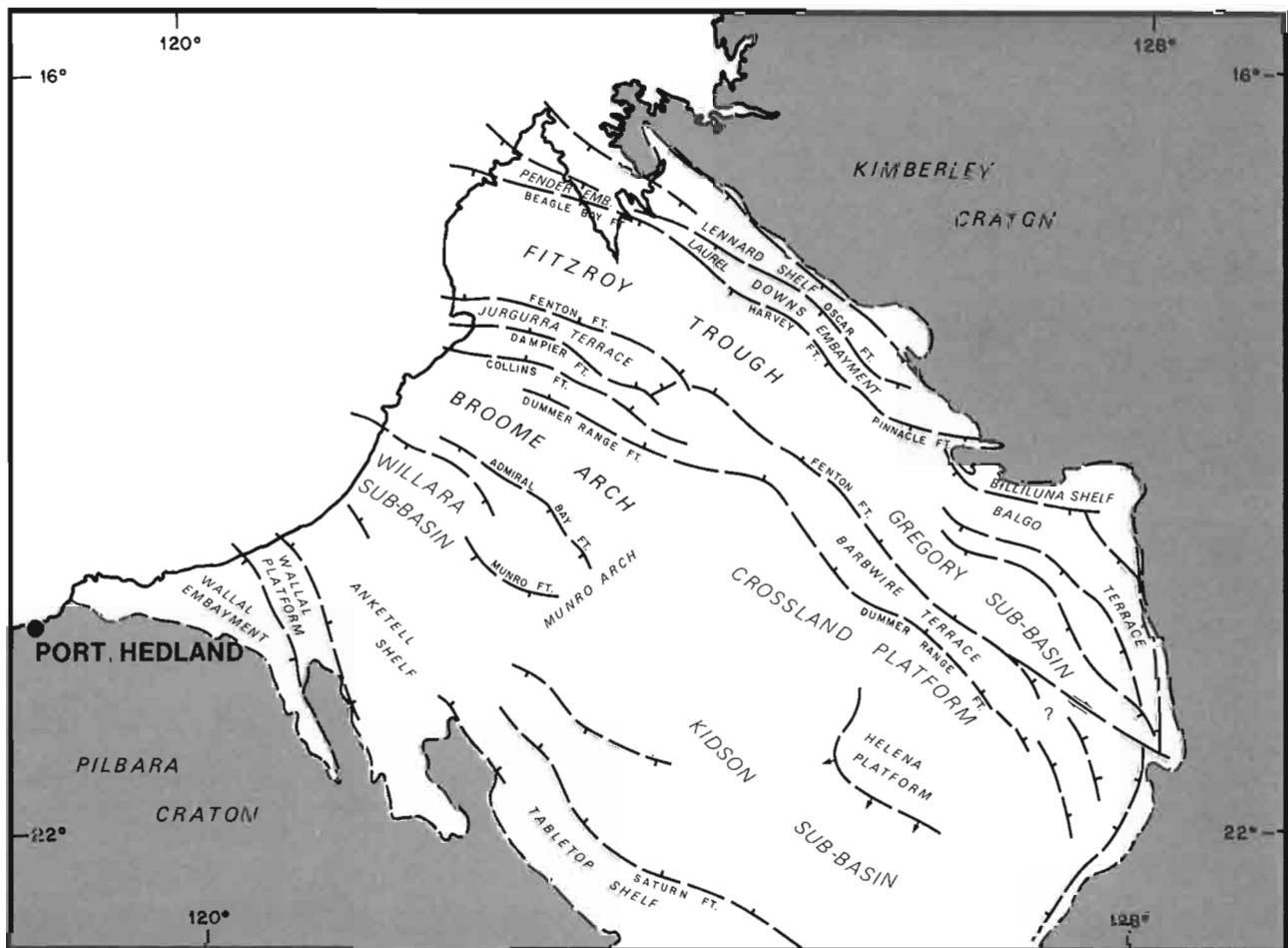


Figure 4: Main Tectonic Elements, Canning Basin.

ed to the east, north and southwest by outcrops of Precambrian basement rocks; the southern boundary with the Officer Basin is generally taken as the Anketell Regional Gravity Ridge, considered to be a basement ridge. A more recent, detailed description of the basin limits is given in Towner & Gibson (1983).

Offshore, the basin covers an area of c.165,000 sq. km. The northern limit has been set at 16°N with the southwestern edge marked by the crest of the Turtle

Arch extending north from the Pilbara basement block. In the offshore area the NW/SE trending structures of the Palaeozoic Canning Basin *proper*, are buried beneath Mesozoic and Tertiary sediments which thicken seaward. These sediments were deposited in the NE/SW basin system along the rifted, subsiding northwestern Australian continental margin.

The basin geology is documented in detail in the many BMR and GSWA publications as well as the extensive

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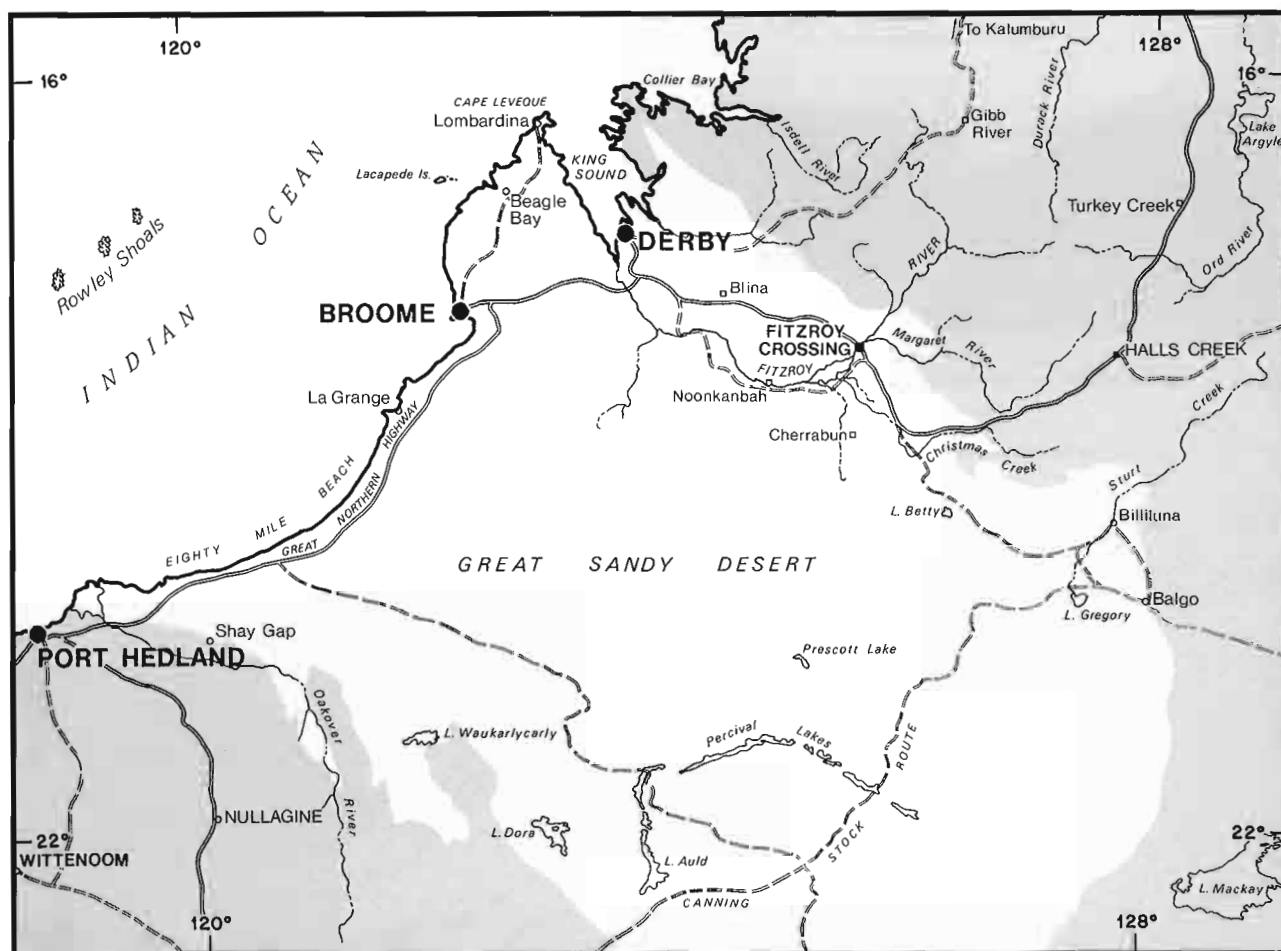


Figure 5: Geography, Canning Basin region.

unpublished company reports on open file with both institutions. Horstman et al (1973) presented a useful summary of the basin at that time. The recent BMR compilation (Towner and Gibson, 1983) is an invaluable reference because of the detailed tabulation of post geophysical and drilling activity.

In general terms the basin is sub-divided into the northern deep Fitzroy Graben system and a shallower southern basin by the Broome Arch (Figure 3). The main tectonic elements of the basin are shown on Figure 4.

### Geography (Figure 5)

The Canning Basin is about 500 kms wide (NE/SW) and 800 kms long (NW/SE), comparable in area to e.g. Texas (Figure 6) or France. It lies within the Kimberley, Eastern and Northwestern Divisions of the State. Local Government shires of Marble Bar, Broome and West Kimberley cover most of the basin but small areas extend into the Halls Creek and Nullagine shires.

There are two main towns in the area, Derby and Broome, both situated on the coast. Broome, the centre of the Broome Shire, is situated beside Roebuck Bay



Figure 6: Size comparison, Canning Basin and Texas U.S.A.

and is well known for its role in the Australian pearl industry. Derby was established as an administrative centre for the Fitzroy Valley. Located near the mouth of the Fitzroy River at the southern end of King Sound, the town site is separated from the ocean by the extensive mud flats which occur along this portion of the coast. It is the administrative centre for the West Kimberley Shire. The small town of Fitzroy Crossing is also located in the basin.

Broome and Derby have daily air services from Perth as well as connections to Darwin and eastern Australia via Alice Springs. There is a local service to Fitzroy Crossing and air charter services are available in both centres. Both towns are also established ports but only Broome enjoys relatively deep water. Tides along the Kimberley coast exceed 12 metres, creating extensive muddy tidal flats in areas, such as King Sound. At the Derby pier, ships rest on the mud at low tide; a deeper water port north of the town is planned for the future.

The access road to the basin from Perth is the Great Northern Highway which runs north from Port Hedland, along the coast to near Broome and then inland, passing near Derby to Fitzroy Crossing. It continues to Halls Creek and, near Kununurra, meets the Victoria Highway en route to Darwin. Graded roads extending from the highway to pastoral stations provide reasonable access to most of the Fitzroy Valley and to the coast. South of the Fitzroy Valley there is only very restricted access, mainly on tracks and survey lines cut by exploration companies. The main access road into the southern Great Sandy Desert is the Kidson track established by Wapet. Like the Canning Stock Route it is locally very rough with deep sand in stretches, and should be used only with caution.

The population of the Canning Basin area is approximately 16,000. These people are concentrated in the northern and coastal areas and the vast desert area is virtually uninhabited. Derby and Broome have 3500 and 4500 inhabitants respectively, Fitzroy Crossing, 1000; the remainder of the population is concentrated at pastoral stations or Aboriginal settlements.

The climate is monsoonal with normally well defined wet and dry periods. The annual rainfall ranges from about 600 mm near Derby to an irregular 250 mm annual average in the desert area. Some of the rainfall in the desert occurs as major falls during cyclone activity and areas may not experience rain for years on end. Normally the bulk of the annual rainfall occurs between December and March. During abnormal years however, very heavy falls can be recorded during the dry season particularly in May and June. The rainfall during the wet season and the abnormal dry periods cause extensive flooding and severely disrupts access and communications.

The temperature in the region has its highest monthly maximum in November (38°C in Derby). The lowest monthly maximum (31° in Derby) occurs in June. Minimum values in the desert area and in the ranges can approach zero overnight.

## Physiography

The *King Leopold Ranges* along the northern boundary of the basin consist of a series of rugged strike ranges and valleys, reaching a maximum altitude at 900 m at Mt. Ord. The topography is closely related to the Precambrian geology: the ranges are the more resistant folded quartzites, while the valleys are normally in doleritic bedrock. Further northeast, flatly bedded, Upper Proterozoic rocks unconformably overlie the strongly folded quartzites and comprise the Kimberley Plateau with an average altitude of about 500 m (Casey & Wells, 1961, Figures 142, 143).

The major rivers of the Fitzroy Valley originate in the Kimberley Plateau and flow through the ranges. The valleys are commonly geologically controlled but the Fitzroy and Barker rivers cut across the geologic grain. The ranges are separated from the *Limestone Ranges* province by the broad Richenda Valley (Figure 7).

The *Limestone Ranges* are the most distinctive features of the southern Kimberley landscape, extending



**Figure 7: Aerial view across the northern edge of Napier Range and Richenda Valley towards the King Leopold Ranges. (Photograph courtesy of the Department of Lands and Surveys.)**

from Bugle Gap near Christmas Creek homestead in the southeast to Limestone Spring in the northwest, a distance of about 300 km. South of the Fitzroy River a series of limestone ranges and intervening valleys occur across a 20 km expanse (Figure 9). North of the Fitzroy River the ranges stretch unbroken to the north, 16 km wide in the Oscar Range area and narrowing to a few hundred metres in the Napier Range (Figure 10). Playford and Lowry (1966) provided a detailed summary of the physiography of the ranges which are comprehensively described by Jennings and Sweeting (1963).

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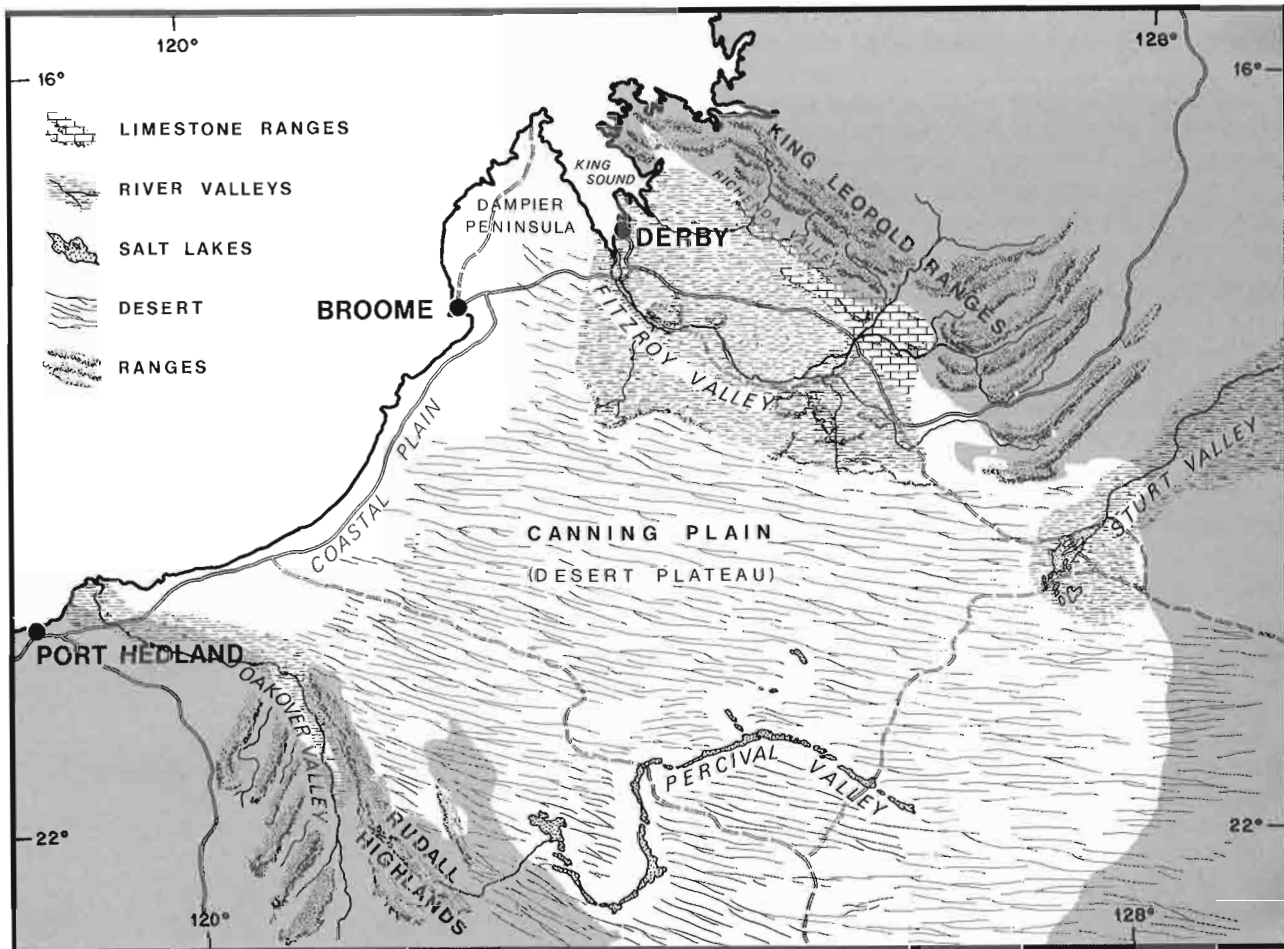


Figure 8: Physiography of the Canning Basin region.

The erosional remnant of Upper Devonian reef complexes, the ranges often rise quite abruptly out of the plain, especially where the front of a range is the massive reef facies. The relief is often visually accentuated by the linear front to the ranges, resulting from breakdown along major jointing planes in the limestone. The southern face of the Napier Range near Windjana Gorge and the Morown Cliffs in the Oscar Range are well known examples. Windjana Gorge, cut by the Lennard River through the Napier Ranges is the most famous feature in the ranges, both geologically and scenically (Figure 11). Other spectacular gorges are Geikie Gorge, where the Fitzroy River cuts through the Geikie Range, and Brooking Gorge, cut by Brooking Creek through the Oscar Range.

The surface of the limestone is generally very rough and in some areas the ranges are virtually impenetrable because of the severe karsting. Despite this local relief, the top of the ranges forms a remarkably planar surface, varying from about 170-260 m above sea level and probably the exhumed Permian erosional surface. Cave systems are not extensively developed in the limestone ranges; the only known major system occurs in the Lawford Range (Figure 9) behind Cave Spring, the outlet for a subterranean river and a permanent source

of water in the area. Tunnel Creek in the Napier Range is another well-known example of subterranean drainage. There are many springs in the ranges, mostly



Figure 9: Looking south across the Lawford Range. This hill is a rolled block of the reef complex. Photograph courtesy of E. Horstman.





**Figure 10:** Aerial view across Windjana Gorge and the Napier Range, looking northwest. Photograph courtesy of P.E. Playford.



**Figure 11:** Aerial view of the entrance of Windjana Gorge in the Napier Range. King Leopold Ranges in the background. Photograph from the Wapet/Canning set, courtesy of the Geological Survey of Western Australia.

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intermittent but several permanent springs, such as Bulluloo in the Oscar Range, are well-known.

The *Fitzroy Valley* province (Figure 12) occurs between the Limestone Ranges to the edge of the desert in the southeast. Approximately 120 km wide and 300 km long, it extends from Christmas Creek in the southeast to King Sound in the northwest, and includes the valleys of the Fitzroy, Lennard, Barker and Margaret rivers, as well as Christmas and Jurgurra creeks. The Fitzroy, Lennard, Barker and Margaret rivers all rise in the Precambrian Ranges and enter the valley through gorges cut in the Limestone Ranges. The Jurgurra Creek drains northward into the Fitzroy Valley from headwaters in the Edgar Ranges along the edge of the desert plateau.

The Fitzroy Valley is a relatively flat plain with recent alluvium overlying Permian and Mesozoic sediments. A series of major anticlines occur on the valley floor as sharply dissected to extensively eroded swells. Grant Range (Figure 12) and St. George Ranges are the largest of these structures. There are also scattered buttes or mesas throughout the area. The Erskine Ranges near Derby are a well known example but these hills are more common to the southeast (Figure 13).

A series of hills, erosional remnants of Mesozoic folding and volcanism, occur along the Fenton Fault

which is generally coincident with a topographic incline between the desert plateau and the valley. In places, as at Edgar Range, the desert and valley are separated by an abrupt scarp.

The *Sturt Valley* is an internal drainage system which drains south into Lake Gregory. It is probable that this system once continued across the basin, reaching the sea near Mandora Flats on the Eighty Mile Beach (Beard, 1973).

The *Canning Plain* of the Great Sandy Desert region consists of a series of plains which merge imperceptibly or are separated by erosional scarps or breakaways. The region is often called the Desert Plateau (Guppy et al, 1958), in recognition of the relief of the peneplain above the Fitzroy Valley. Beyond the Fitzroy Valley "escarpment" the elevation rises gradually to over 300 m in the interior (Figure 14). The plains are underlain by flat lying Mesozoic and Permian rocks covered by sand or duricrust.

Most of the region is covered with WNW-ESE trending sand dunes which vary to 20 m in height and 50-500 m in width (Figure 15). Most of the ridges have spinifex and other sparse scrub with some stunted trees. The ridges, aligned with the prevailing easterly winds, are part of a continent wide system thought to date from the last glacial age c20-15,000 years ago.



Figure 12: Aerial view of the Fitzroy Valley looking south across Liveringa Station towards Grant Range.





**Figure 13: Eroded Permian hills in southeast Fitzroy Valley. These two hills are known in local aboriginal mythology as Gunya Gudjara, the Two Dogs.**



**Figure 14: Aerial view looking south in the Edgar Range area at the escarpment between the Fitzroy Valley and the "Desert Plateau". Photograph courtesy of J. Moore.**

In the southwest the surface becomes less sandy and is covered by ironstone and siliceous rubble (Veevers and Wells, 1961). Isolated mesas occur in the desert, e.g. McLarty Hills, Ryan Buttes.

The *Percival Valley* is a palaeodrainage system now marked by a chain of salt lakes including Percival Lakes and Lakes Auld Dora and Waukarlycarly (Figure 15). Elevation of the lakes decreases towards the coast, being 350 m at the eastern end of Percival Lakes and decreasing to 200 m at Lake Dora.

The *Rudall Highlands* consist of a series of strike ridges of Precambrian rocks that mark the edge of the Percival Valley in particular and the Canning Basin geologic province in general. The Paterson and Gregory ranges are prominent in the region, reaching to 400 m elevation and rising 100 m above the plain.

The *Oakover Valley* contains the Oakover, Nullagine and DeGrey rivers and appears to be located in a faulted inlier, containing Permian and younger sediments, in the Pilbara craton.

The *Coastal Plain* extends along the entire coast, approximately 16 kms wide except at Roebuck Plains and Samphire Marsh where it reaches inland over 60 kms. The plain is covered by coastal dunes and samphire marsh, lying generally less than 10 m above sealevel and prone to extensive flooding during the wet season.



**Figure 15: Aerial view of the Percival Lakes area showing the encrusted playas of this relict palaeo-drainage system as well as the adjacent dune fields. Photograph courtesy of E. Horstman.**

## Human Settlement

There is no direct archaeological evidence of the early occupation of the Canning region but radio-carbon dates in the Pilbara and Ord River Valley (Dortch, 1977) suggest the area was occupied 30-40,000 years ago. A major change in the stone tool culture occurred 3-5,000 years ago, contemporaneous with the arrival of the dingo, and can be interpreted in terms of migration from the (then) drowning Sundaland (Flood, 1983). The passage of people across the region is well expressed in a mythology of wandering clans, such as the Wandjina of the Kimberley ranges (Crawford, 1968) or the "Dingari mob" of the desert (Berndt, 1970). The passage, of ideas at least, is also expressed in the layered structuring of traditional Kimberley beliefs (Capell, 1939) and in the layering of art work in the caves: Wandjina artists whitewashed (sic) over the delicate giro-giro drawing of an earlier culture before painting their own rain-gods. The conflicts between these different groups are remembered in mythic tales of great battles and genocidal wars (Crawford, 1968; Worms, 1955).

The Fitzroy River Valley was both a physiographic and a cultural divide between the Desert clans to the south and the more tribal Kimberley groups in the ranges. Material culture, language and social structure all changed quite abruptly across the valley. It was also the main trade route between the coast and the interior, with secular and sacred objects traded back and forth:

Kimberley pearl shells were prized ritual items across Australia. This exchange route remains dynamic today with the Woagaia and Djuluru cults being traded from community to community (Ackerman, 1979).

The control of the Fitzroy Valley and its resources was often fiercely contested, an historic pattern of conflict that persists today in the land rights dispute. Noonkanbah, for its parade of peoples, is an appropriate, if ironic, symbol of this conflict: Nygena



**Figure 16: Distribution of Aboriginal Tribes, Canning Basin region (from Tindale, 1974).**

clans took over the area from Djaba people late last century (Capell, 1952) but lost control soon after to white pastoralists who finally sold it, via Government funds, to a dominantly Desert aboriginal community!

The distribution of "tribes" in the Canning and Kimberley region early this century is shown on Figure 16 (Tindale, 1974). This tribal subdivision of Aboriginal society is disputed, especially for the Desert groups (Berndt, 1959; Kolig, 1977), but is now accepted by Aboriginals and the concept of tribal land is an emotional and real force in contemporary politics.

The first European to land on the Kimberley shores was William Dampier in 1688. By that time, sailors from Makassar (Celebes) were visiting the area to harvest pearl shells and the sea slug, beche-de-mer. The Makassans did not establish permanent settlement and Aboriginal folklore remembers contact between the two peoples as hostile (Crawford, 1968).

In 1838, Captain John Stokes aboard the "Beagle" discovered the mouth of the Fitzroy River and Lt. George Grey penetrated into the Kimberley region. In the 1860's explorers reached the interior Pilbara and pastoralists settled the Roebourne region, many turning almost immediately to pearl shell farming. Within a few years many ships were working along the coast

with Roebuck Bay, the site of Broome, a favoured anchorage for rest, repair and trading (Bain, 1982). In 1866 Cowle explored the coastal region, including the Dampier Peninsula but it was Alexander Forrest's 1879 expedition to the Fitzroy Valley, and his reports of good pastoral and agricultural land, that attracted settlers to the region.

Pastoral leases covered most of the Fitzroy, Meda and Lennard river valleys by 1883 when the town site of Derby was declared. These stations were predominantly settled by sheep farmers from southwestern W.A.; by contrast the eastern Kimberley was settled by cattlement such as the McDonalds and Duracks from eastern Australia, and who drove their herds overland in epic journeys (Durack, 1956).

This migration of white pastoralists into the region quickly destabilized the prevailing life style and culture in the region. As ever, there were accommodations and there were conflicts, this time recorded not only in Aboriginal oral traditions but in police records and history books, albeit with vastly differing perspectives.

Gold was discovered at Halls Creek in 1885 but it was the distant gold-fields of Kalgoorlie and elsewhere in the south that doubled the state's population and provided the market for Kimberley meat. The early history

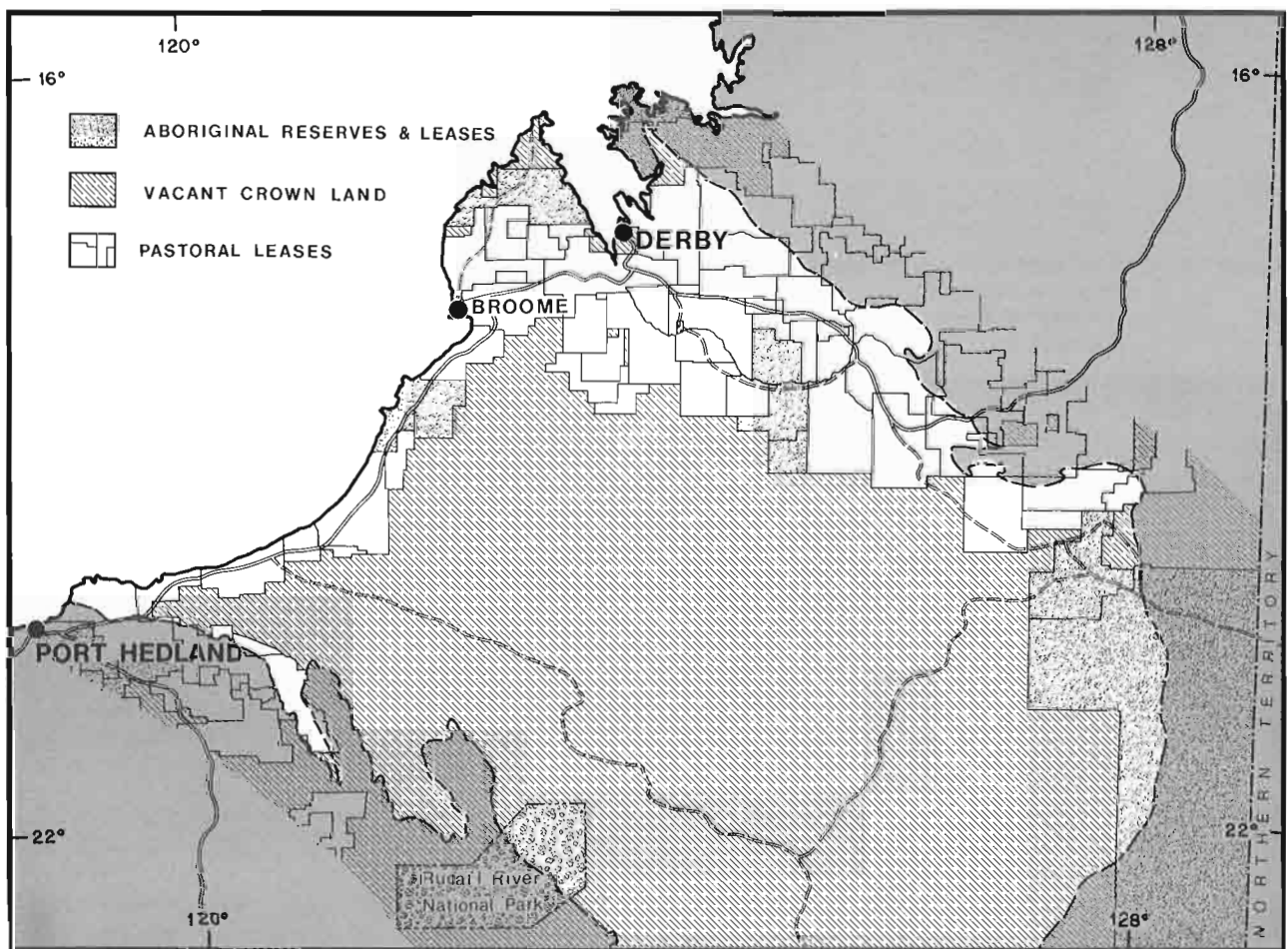


Figure 17: Land Tenure Map, Canning Basin region.

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of the pastoral industry in the southern Kimberley region and its development through the 1950's is documented by Bolton (1953).

The pattern of land tenure in the region today is shown on Figure 17. All land is owned by the Crown, i.e. the State of Western Australia (except for minor Commonwealth land for defence and other purposes). Individuals, communities or corporations utilize the land under various leasehold conditions.

Pastoral stations cover the Fitzroy Valley and line the coast. Almost the entire desert region is unused and unpopulated. Aboriginal Reserve land is held by the Aboriginal Land Trust which also has control of several pastoral leases purchased for aboriginal communities. The map does not show small residential areas, also vested in the ALT, excised from pastoral stations for resident aboriginal groups.

### Geological Exploration

The first geological investigation of the Canning Basin area was by E.T. Hardman (1884), the Government Geologist of Western Australia. In the century since, many geologists in the Geological Survey of Western Australia and the Bureau of Mineral Resources (BMR) have played important roles in the exploration of the region and have contributed significantly to the search for petroleum and mineral deposits (Figure 18). Wade (1924) made the first systematic stratigraphic study in the basin, essentially on the Permian sediments of the Fitzroy Trough. The first report by the Geological Branch of the Department of Home and Territories, later the BMR, was F. Champman's palaeontological analysis of samples from Freney's Poole Range well (Mayne, 1975).



Figure 18 (a): Joint GSWA/Freney geological survey party bogged in Fitzroy River c. 1923. Photograph courtesy of Geological Survey of Western Australia.



Figure 18 (b): A. Wells (BMR) at Well 23, Canning Stock Route, 1956. Photograph K. Powenall, courtesy of A. Wells.



Figure 18 (c): W.G. Woolnough and crew ready for Canning Basin aerial reconnaissance 1932. Reproduced with the permission of Mitchell Library, Sydney.



Figure 18 (d): Rupert Crowe sampling Anketell Sandstone, South Canning Basin, 1975. Photograph courtesy of R. Towner.

The BMR commenced systematic geological and geophysical exploration in the Canning Basin in 1947 and continued field work until 1958. The initial work on the Fitzroy Basin was presented in BMR Bulletin No. 36 (Guppy et al, 1958); work over central and southern regions was summarized by Traves et al (1957) and formally presented in Bulletin No. 60 (Veevers and Wells, 1961). These surveys and compilations also used the sparse sub-surface and geophysical control available from early petroleum exploration work.

The Geological Survey of Western Australia (GSWA) began detailed investigations of the Devonian Reef Complexes along the northern basin margin in the 1960's. The GSWA Bulletin No. 118 (Playford and Lowry, 1966), summarizing the first stage of this project, deservedly stands beside the early BMR Bulletins as "classics" in the Canning Basin literature. The reports all summarize the early exploration and present detailed structural and stratigraphic information.

In the early 1970's the GSWA and the BMR both commenced major projects in the Canning Basin. The GSWA continued its study of the reef complexes and, in co-operation with the BMR, initiated a basin wide, detailed mapping project to upgrade the 1/250,000 geology series. At the same time the BMR commenced

a major review and compilation of the available geological and geophysical information in published and company reports. The field work led to a series of publications on the reef complexes (Playford, 1976, 1980), numerous upgraded 1/250,000 Geology Sheets and several BMR Bulletins, notably No. 215, the "Geology of the Onshore Canning Basin, Western Australia" (Towner and Gibson, 1983). The BMR's compilation project was presented informally as Record 1979/32 (Gorter et al, 1979) and formalized in part in both Bulletin No. 215 and Bulletin No. 210, "Geological Evolution of the Canning Basin, Western Australia" (Forman & Wales, 1981).

### Petroleum Exploration

The history of the exploration for petroleum in the Canning Basin has been compiled in BMR record 1975/109 (Mayne, 1975) and summarized and updated by Poll (1983). Both recognized a three-fold subdivision of the exploration activity:

- the Freney period,
- the Wapet period, and
- the multi-company period,



Figure 19: The Mt. Wynne No. 3 bore. Photograph by W.G. Woolnough. Reproduced with the permission of Mitchell Library, Sydney.



but differed in their perception of the end of the Wapet period and the timing of the multi-company period.

### The Freney Period (1920-1953)

This period commenced in 1920 when M. Freney drilled a shallow bore near Prices Creek to investigate oil.

## OIL IN THE KIMBERLEYS

### IMPORTANT AND ENCOURAGING REPORTS

#### PITCH AT OAKES' FIND.

*Daily News 13/10/21*

### OIL, OUR SALVATOR

Are we going to get oil in West Australia? We are certainly going to have an oil boom, and it is just as well to warn the public to be cautious . . .

One thing is certain — it is now agreed that all the geological and stratified conditions exist in the far North-West for the existence of pool oil, and Profesor David, reasoning on Mr. Blatchford's data and his own surface examinations, save that "if payable oil is struck it will probably be found to extend over a considerable area."

*Sunday Times 16/10/21*

### AN OIL EXPERT

#### Freney's New Superintendent.

'S far 's your Kimberley field's concerned, why, you've got oil there: that's proved. I haven't been there yet, but I have seen the reports, and you can bet you last dollar it's there. I happen to know, too, that Dr. Wade thinks they've only struck the top stratum there, and from what I've seen elsewhere I'm game to bet there's good an' plenty way down under."

*West Australian 9/1/29*

shows which had been found in Harry Price's water bore. The Freney Kimberley Oil Company Limited was formed soon after and the drilling programme began, first at Prices Creek, then at Mt. Wynne (Figure 19) and later at Poole Range (Waterford, 1941).

It is difficult now to appreciate the great excitement and expectation that surrounded those early wells. Newspapers carried reports on the "Kimberley Oil Fields" and editorials speculated on the size of the finds and fortunes to come; experts from the American fields were interviewed eagerly and contributed to the expectations (Figure 20). There was never any doubt that the oil would be found, and with it would come the development of the Kimberley and the State of Western Australia. Dame Mary Durack, whose father was a director of the Freney company, remembers (pers. comm.) being kept back from the rig drilling Poole Range No. 3 because of the danger of a "gusher". The strike was ever imminent.

This period deservedly carries the Freney name but other activity in the basin, which was entirely under permit, in the early 1920's, is undeservedly forgotten. The Locke Oil Expedition, for example, crossed the basin by camel train from Wiluna to Fitzroy Crossing and Broome (Jones, 1922a). A member of the party was speared to death by aborigines near Well 30 on the Canning Stock Route.

Caltex (Aust.) Pty. Ltd., a subsidiary of Texaco and Standard Oil of California, took a prospecting permit over most of the basin in 1939 and conducted pioneering geological surveys and aerial reconnaissance (Bremmer, 1940; Kraus, 1941; Findlay, 1942) before relinquishing in 1946. Vacuum Oil and D'Arcy, later Mobil and BP respectively, also looked at the (then) Desert Basin (Reeves, 1949) and dismissed it as unprospective, thin Permian rocks. Despite this activity, Freney's drilling activity, as sporadic as it was, held the exploration spotlight. The company struggled along for decades, plagued by inadequate funding and, perhaps, dismal luck. It was restructured several times, lastly into Associated Freney Oil Company N.L. for the drilling of the Sisters 1 well in 1956. As ever, Freney found



Figure 21: Visitors from Derby and nearby stations at the spudding-in of Grant Range No. 1, October, 1954. Photograph courtesy of A. Lindner.

Figure 20: Selected extracts from W.A. Newspapers in the 1920's.

shows of oil that made headlines and amounted to nothing more. By then, Wapet had entered the basin and the Freney period was over.

### The Wapet Period (1953-1974)

Ampol Petroleum Ltd., took up PE 25H in 1947 and, in 1951, were joined by Caltex, lured back by the results of BMR work in the late 1940's, demonstrating a thick ?Lower Palaeozoic sedimentary sequence in the basin. The final agreements were made in 1952, the permit was retitled PE 30, and the Wapet era began in the Canning Basin — and in W.A. generally.

PE 30 covered almost the entire basin and dominated permit maps until 1969 when the Petroleum Act 1967 was proclaimed and onshore permits were redesignated. This early work again attracted great public interest and Government support. The size and international stature of these companies fit the mood of the early 1950's and their programme was watched with great expectations, especially after the oil flow at Rough Range. The spudding of each new well was a social event (Figure 21) as the dreams of Kimberley fields soared again.

The Wapet story in the Canning Basin has not yet been told and this comment is no more than summary acknowledgement. The tracks that are cut in the desert

and the sections, seismic and geological, that stimulate new explorers still, are Wapet made. Many senior geologists and geophysicists in Australian and international oil companies today, as well as senior officials in State and Commonwealth surveys, served an apprenticeship with Wapet. The facts and the figures of the period are presented in detail by Mayne (1975); perhaps someone, in the near future, will write the romance and the rumour of it all.

Ironically, Wapet's last permit covered the current EP 129; one of the main prospects was a buried reef anomaly called Erskine (Playford, 1983). The proposed location was less than 1 km from Home's Blina 1 discovery well!

### The Multi-Company Period

Mayne (1975) defined a multi-company period commencing in 1964, stimulated by discoveries at Barrow Island and Bass Strait. Poll (1983), from a later perspective, rightly saw that the Wapet farmouts and other small permits in the Canning were incidental to Wapet's dominance of the basin exploration activity into the 1970's.

The multi-company period began late in 1976 when Whitestone Petroleum Australia, Ltd. was granted

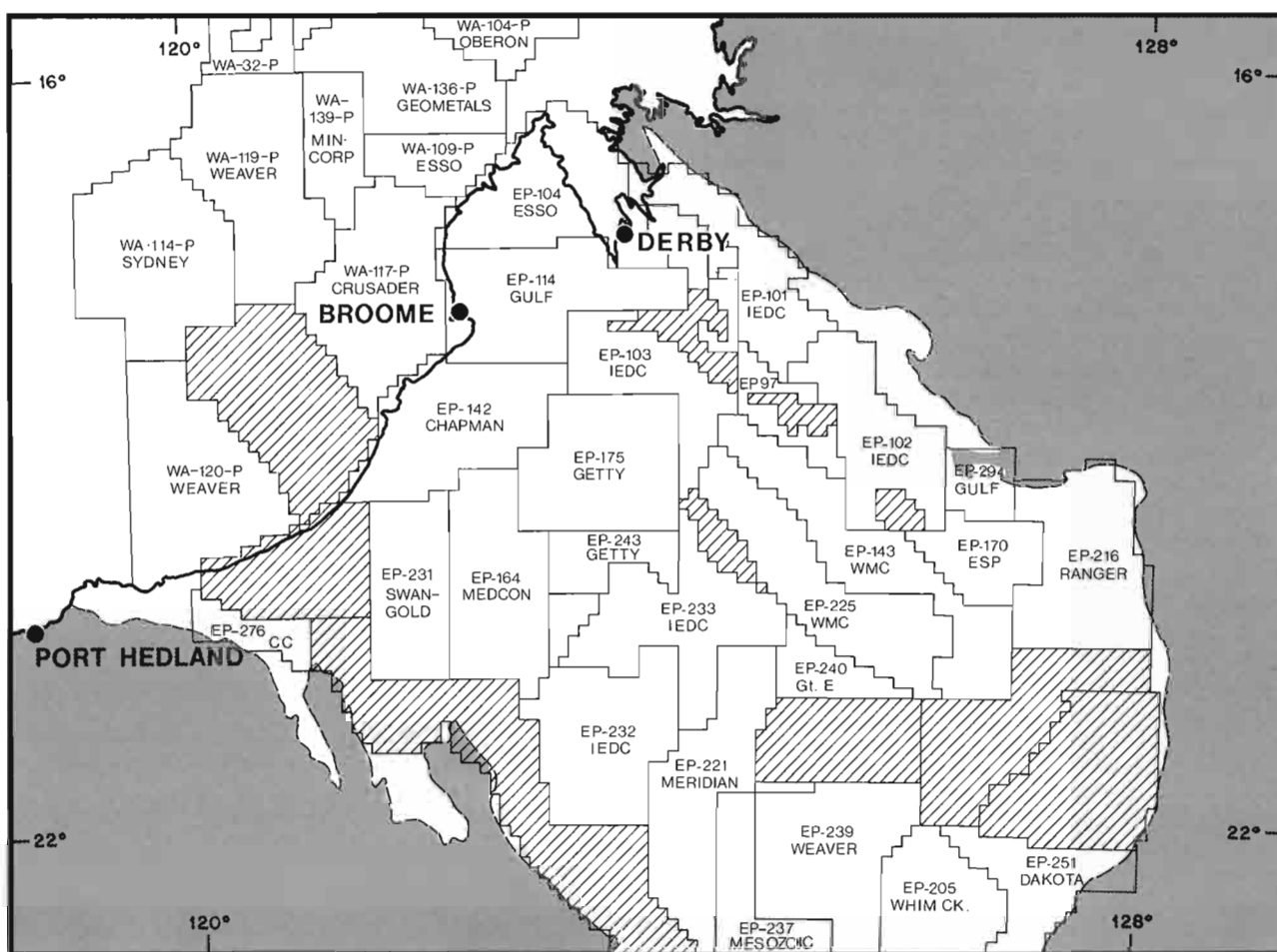


Figure 22: Petroleum Tenement Map, Canning Basin area.

## 18 Canning Basin, Introduction

EP 97 in the central Fitzroy Valley. It is appropriate, in an exploration cycle built so much on past work, that this first new permit should be so based. Whitestone's Exploration Vice-President, W.T. Stille, had been a geophysicist with Conoco in the 1960's and had recognized the possibility, on seismic evidence, of an intra-rift horst-block in the Fitzroy Trough on the northern flank of the St. George Ranges structure. Aware of this interest, the writer advised Whitestone early in 1976 that Exploration Permit 97 over the structure was available. The permit was granted late 1976 and the structure known as the Noonkanbah Prospect, was drilled by the controversial Fitzroy River No. 1 well in 1980. By 1978 the Amax/Whitestone group had acquired three other permits and Esso (Australia) Limited also held a permit.

Since then, many companies have become important players in the current round of exploration (Figure 22). Over 30,000 km of multi-fold seismic reflection profiles have been recorded since 1976. More than 30 wells have been drilled and another thirty are scheduled for 1984/85. The Blina and Sundown fields, though small, prove the presence of commercial oil deposits in the basin, and encourage continued optimism about the basin's potential.

### Concluding Remarks

The search for the "Kimberley Oil Fields" goes on — and deservedly so. The efforts of the past decades may have shown that the oil deposits of the Canning Basin are elusive but they have not discouraged belief in the basin's potential.

The early drilling hinted that there would be no lucky wildcatters in the Canning Basin and the later work by Wapet proved it. These disappointments led to the popular view in the early 1970's that the Canning Basin was not a significant hydrocarbon province. That conclusion was premature: a basin the size of Texas cannot be evaluated with 50 wells; it cannot be properly evaluated with 50 wells a year!

The extensive seismic exploration of recent years has revealed, for the first time in many areas, the complex structure and stratigraphy of the basin. The eastern area is a case in point: Smith (1984) and Jacobsen (1984) document a complex basin system and a variety of exploration plays that were not known (or at least not defined) before 1982. Recent seismic and core hole drilling programmes have led to a similar rewriting of the petroleum prospects of the central Canning region (Porter & Egan, 1983). Exploration of the southern Canning Basin has barely commenced: 200,000 sq. kms with half a dozen wells and a few thousand kilometres of seismic recorded over a decade ago. Most of the work in recent years has concentrated on the Lennard Shelf, Fitzroy Trough and the Broome Arch. There too, the geophysical and drilling data have redefined some exploration concepts.

Geochemical studies have confirmed the presence of

source rocks of both Upper and Lower Palaeozoic age. Drilling has shown the presence of good clastic reservoir rocks such as the Tandalgoo or Grant sandstones as well as the potential of Devonian and Ordovician carbonates.

Exploration in the Canning Basin has progressed beyond the generalities of surface and shallow seismic structure. The detailed data becoming increasingly available through this modern exploration round points to a progressively more focussed approach to exploration in the future.

The discoveries to date in the Canning Basin, Blina and Sundown, are encouraging but they are only a hint of the basin's future and potential. The dream of "Kimberley Oil Fields", long a glint in the explorer's eye, glistens still.

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