BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

RECORD

Record 1978/80

AN APPRAISAL OF PETROLEUM EXPLORATION TITLE AREAS - OFFSHORE NORTHERN AND CENTRAL QUEENSLAND MAY 1974

Q/1P, 2P, 3P, 4P, 5P, 6P, 7P, 8P, 9P, 10P, 11P, 12P

by

W.J. McAvoy and P.R. Temple

CANCELLED IN CONFIDENCE

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SUMMARY

This record is the result of a brief examination of data relevant to the titles areas. All available data have been used in its preparation, including confidential company reports, but no original interpretation has been made.

Summaries are given of the regional geology, hydrocarbon potential, geophysical activity and drilling results. Assessments have been made of the prospectivity of the title areas, and recommendations are made for further exploration.

Because of the moratorium on exploration on the Great Barrier Reef, only scientific surveys have been carried out since 1969 and no wells have been drilled.

Aeromagnetic and the small amount of reconnaissance seismic work carried out prior to the moratorium indicate the continental shelf is covered by a thin veneer of sediments with several ill-defined basinal depressions. These sediments are generally thought to be of Tertiary and Mesozoic age. Prospects for hydrocarbon accumulations within the existing title areas are rated as low.

An area in the southeastern part of the Gulf of Papua outside the present title areas is considered to have the best prospects.

INTRODUCTION

For the purpose of reporting, the offshore Queensland area has been divided into a northern area and a central area. The northern area includes title areas Q/1P, 2P, 3P, 8P, 9P, 10P, and 11P, and the central area, title areas Q/4P, 5P, 6P, 7P and 12P.

The following reports and maps give a reconnaissance review of the title areas under consideration. Only one month was allotted to examine all available data from the whole area; no time was allowed for interpretative work, and thus all interpretations presented are those of the respective title holders or contractors.

"All available data" were those received in the Petroleum Exploration Branch under the Petroleum Search Subsidy Act and the Petroleum (Submerged Lands) Act. As applications for subsidy, as well as confidential company reports and files, have been used in this assessment, this report must be regarded as confidential.

PART 1

Offshore northern Queensland

Q/1P, 2P, 3P, 8P, 9P, 10P, 11P

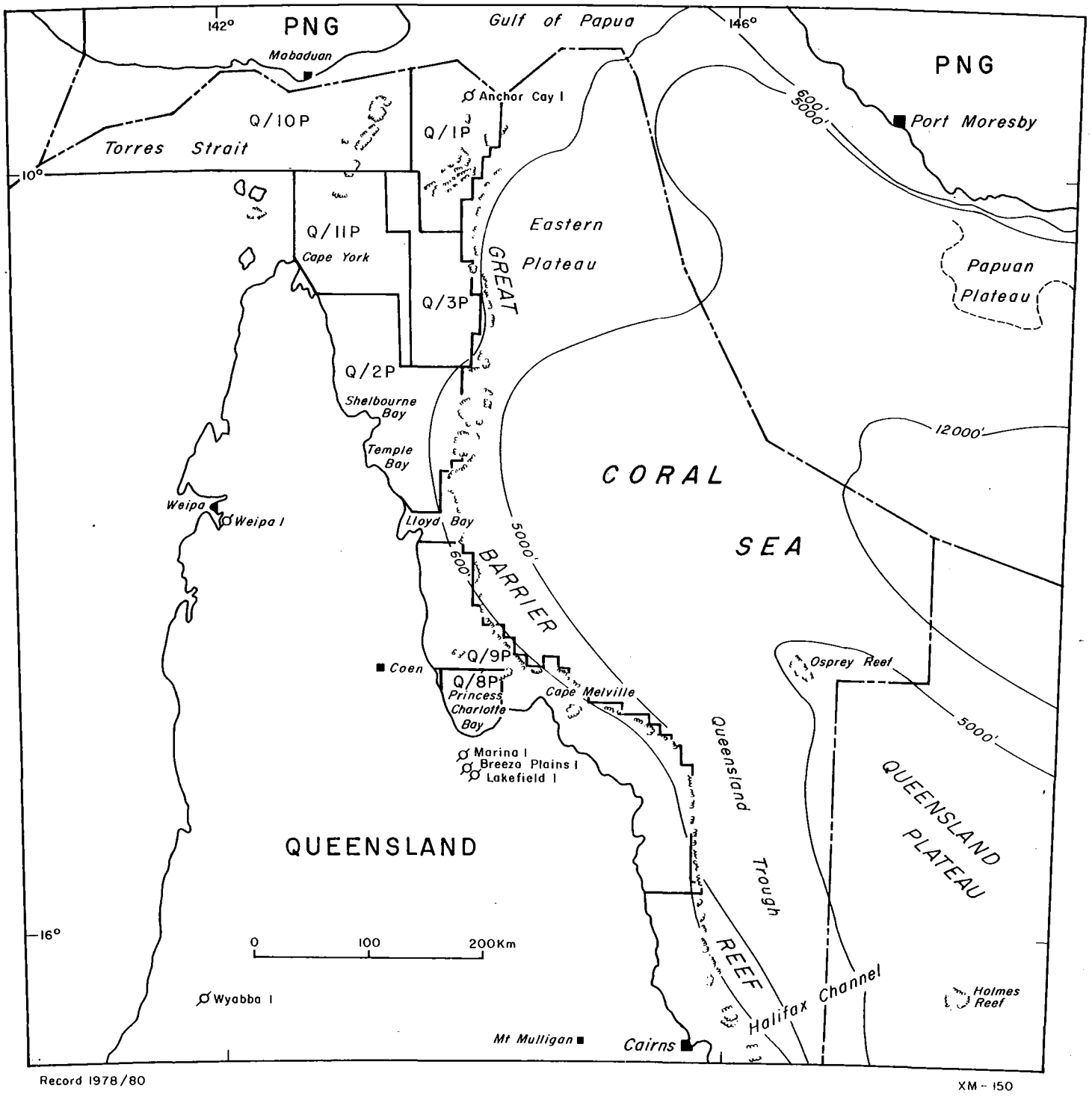


Fig. 1 Offshore Northern Queensland Petroleum Exploration Title Areas

REGIONAL SETTING

The area under consideration comprises the Torres Strait region and the eastward extension of this area to the eastern and northern limits of the Great Barrier Reef, and the Great Barrier Reef areas as far south as the town of Cooktown.

This portion of the Continental Shelf consists of a shallow marine area, the 200 metres water depth contour closely follows the Great Barrier Reef and the eastern extremity of the title areas under consideration. The area is studded with a mass of coral reefs and shoals and a number of small islands.

REGIONAL GEOLOGY

The geology in the area under consideration is only known from broad regional geophysical surveys and extrapolation from the reasonably well known surface geology of the adjoining land areas. To date only one offshore well, Anchor Cay-1, has been drilled in the title areas.

The dominant feature in the Torres Strait is the Cape York-Oriomo basement ridge, which trends north from Cape York across the Torres Strait to the vicinity of Mabaduan on the southern coast of Papua. The sedimentary section thickens both east and west off the ridge: to the west into a relatively unexplored area, which has been referred to as the "Carpentaria-Morehead Basinal area", and to the east into a thick sedimentary depression, regarded as part of the Papuan Basin. The Peninsula Trough extends offshore between the Cape York-Oriomo High and a basement ridge which extends offshore from the Great Dividing Range.

The sedimentary section south of Torres Strait area and to the east of Cape York Peninsula is largely unknown, but a thickening wedge of sediments extends offshore with a few minor depressions where thicker sedimentation is apparent.

The Laura Basin, an intracratonic open syncline plunging gently to the northwest extends beneath Princess Charlotte Bay to approximately east of Lloyd Bay. South of the Laura Basin, the sedimentary section gently onlaps the basement rocks of the Great Dividing Range.

Each of these distinct areas will be discussed in more detail.

Torres Strait area

It seems likely that the area now occupied by the Cape York Peninsula of northeastern Queensland and the Oriomo Spur of extreme southern New Guinea were positive during most of geologic time and geosyncline belts periodically developed eastwards of this "platform". Probably the Mesozoic depocentre lies closer to the Cape York Peninsula than does the Tertiary depocentre axis.

The islands of the Torres Strait are mostly composed of acid pyroclastic rocks. Granite plutons and stocks of Permian age intrude the pyroclastics and any original Palaeozoic sedimentary rocks of the present Papuan Basin have been metamorphosed.

The Cape York-Oriomo High conveniently divides the Torres Strait area into an eastern and western region.

Western Region

The offshore area west of the Cape York-Oriomo High has been little explored. Apart from broad aeromagnetic and gravity coverage, there has been but one reconnaissance seismic survey. These surveys have outlined a basinal area referred to as the Carpentaria and Morehead Basins. The eastern margin of these basins is defined by an outer geosynclinal belt (Palaeozoic Tasman Geosyncline), and the northern margin is the Papuan Basin and southern stable shelf areas.

Drilling in the Morehead Basin, onshore at Morehead-1 well, has proved a thickness of at least 2400 m of Mesozoic and Tertiary sediments overlying basement. It seems reasonable to assume that these sediments also occur offshore, although it is possible that only a Tertiary section overlies basement.

Seismic interpretation indicates a westerly thickening wedge of sediments. These sediments lap onto the Cape York-Oriomo High. It is likely that about 1200-1500 m of sediments occurs at the western extremities of Q/10P. The area appears to have been little affected by regional tectonic movements other than progressive sag between the basement regions. This downwarping may be associated with faulting.

In general, the area is characterised by gentle warping and subhorizontal beds; local structure appears to be related to differential vertical movements of the basement rocks.

Hydrocarbon potential. No wells have been drilled in the offshore area west of the Cape York-Oriomo Ridge. The nearest well control is the onshore well Morehead-1, which drilled Tertiary to 1036 m, Cretaceous to 2324 m, and Jurassic to TD 2465 m. Only slight gas shows were encountered in the Mesozoic section.

It is possible that only a Tertiary section overlies basement in the offshore area. This is likely to be Miocene shoal limestone, sandstone, and shales conformably overlain by a thin sequence of Pliocene/Pleistocene fine clastics and occasional interbeds of limestone. Should a Mesozoic section be proven in the area, the hydrocarbon potential will be greatly enhanced.

Geophysics. Geophysical coverage in this area includes aeromagnetic profiles flown from Horne Island to the Morehead locality in Western Papua. These were flown in 1962 by Aero Service for Delhi Australian Petroleum Limited in the subsidized Gulf of Carpentaria Aeromagnetic Survey (62/1719), and showed magnetic basement increasing from zero at Horne Island to 2100-2700 m along a short NE profile near Morehead.

The only seismic coverage in the area was recorded for Marathon Petroleum Australia Ltd by Western Geophysical Corporation in November 1964. 928 m of 200% and 61 km of 300% reconnaissance were completed on a 16 km grid. Data obtained were of fair quality and indicated generally thin sediments thickening to 1200 m at the western end of the tenement.

Eastern region

This is the area to the east of the Cape York-Oriomo High and includes the northern part of the Great Barrier Reef. Geologically, it is regarded as part of the Papuan Basin.

The area contains Tertiary and Mesozoic sediments deposited on a stable shelf of Palaeozoic and Proterozoic rocks. These sediments thin and wedge out against the Cape York-Oriomo high to the west and thicken to 4200 m at the eastern extremities of Q/1P.

The stratigraphy of the area is based primarily on the only well, Anchor Cay-1, drilled in this area. The well penetrated 3623 m of Tertiary and Mesozoic sediments. No hydrocarbon shows were encountered, and the well was plugged and abandoned.

A number of wells have been drilled by Phillips in the offshore Papuan Basin within the PNG title areas, and the geological history of the area can be constructed using this information.

Mesozoic sediments were deposited in an intracratonic depression bounded by basement ridges (Cape York-Oriomo and Pasca-Kapau ridges). Except for the northeastern flank of the Papuan Basin, the Early Cretaceous was a period of non-deposition and/or erosion. The hiatus is widespread and represented in the area about Anchor Cay by regional emergence and perhaps the local uplift of the several northeast-trending platforms that project into the deeper portion of the basin.

Eocene sediments are restricted to the nadir of the basin and regionally thin to a feather edge towards the shelves. The calcareous nature of these sediments indicates that the basin was not in as deep water or sinking as rapidly as it did during the Miocene and Pliocene.

During the Oligocene, the southwest flank of the basin received little to no sedimentation, although the structural attitudes of the Eocene and Miocene rocks are conformable.

Reef development began in the Papuan Basin and along the Great Barrier Reef during the early Miocene. The Papuan Basin was separated into basin and shelf areas by a system of more or less continuous barrier reefs. Those areas behind the reefs received carbonate sedimentation, with intermittent patch reefs developing in preferential bathymetric positions. In the basinal areas, mudstones and greywackes were deposited, except on northeast-trending platform areas, which maintained their relatively bathymetric positive attitude from former times. Along the crests of these structurally controlled platforms, pinnacle reefs grew vigorously, some attaining thousands of feet of vertical build up. These pinnacle reefs, sheathed in mudstones, have proved to be hydrocarbon-bearing in the Papuan Basin.

After a period of crustal instability and emergence of the basin fringes during late Miocene time, a flood of clastics overwhelmed the rapidly sinking Papuan Basin during Pliocene, Pleistocene and Recent times. The sediment was derived from the rapidly rising highlands of PNG, encompassing the eastern, northern and northwestern margins of the basin. The rapid northern structural subsidence of the Papuan Basin north of the east-west hinge line just north of Anchor Cay-1 well lead to the termination of reef growth, subsidence being too rapid to permit continuous reef growth north of this hinge line. South of this hinge line the substructure of the modern reef is Miocene in age, and probably much of the reef volume is Miocene, at least in the northern portion of the Great Barrier Reef.

Subsidence of the Papuan Basin was accompanied by vulcanism, and several present-day islands in the southwest portion of the basin are composed of Pleistocene basalts. Barrier reef development continued through Pliocene to Recent.

Anchor Cay-1 well penetrated a section of Pliocene reefs, and reefal growth to the present day is locally evident on seismic sections.

Hydrocarbon potential. Anchor Cay-1 well provides the only lithologic and palaeontologic control in this area. Although no shows of oil or gas were found in this well, a number of potential reservoir horizons were proven.

Of particular interest in Anchor Cay-1 was the presence of a Pliocene reefal complex. Unfortunately, it was not adequately sealed, but has indicated the presence of such reservoir rocks in this region. If such reefs can be located in this area, and if they are sheathed in shales, they should prove extremely attractive drilling targets.

Clean, well-sorted sandstones of Early Cretaceous age appear to be extremely attractive objectives. Older Cretaceous and Jurassic sediments appear to have been deposited in a deep water environment as evidenced by the massive shale sections and a great deal of chalcopyrite and pyrites. In the immediate vicinity of Anchor Cay-1 this tends to rule this section out as a drilling target, however, a more favourable section may be between this well and the Cape York-Oriomo Ridge, where coarser, more clastic sediments can be anticipated.

The Mesozoic section thins by truncation to the south and west of Anchor Cay-1 and, thus, otherwise attractive structures in these areas may only represent Tertiary sediments overlying basement. These, however, warrant further investigation. Several prospective features still to be tested, have already been delineated on the western upthrown side of the Komewu fault.

Geophysics. Aeromagnetic coverage of the area was flown in October 1962 for Gulf Interstate Overseas (Cape York Peninsula A/M). The results show that magnetic basement depth increases eastwards off the Oriomo High to a maximum of 4300 m subsea near Anchor Cay.

Seismic coverage has been concentrated in this trough, the Peninsula Trough. The early reconnaissance coverage was carried out for Gulf Interstate Overseas in 1965 and for Tenneco Australia Incorporated in 1966. Results were fair to poor. Tenneco carried out detailing in the Triangle Reef vicinity in 1968 and most recent exploration has been carried out for Amoseas and Texaco in the waters around Warrior Reef.

Northern Great Barrier Reef - Cape York to Lloyd Bay

Little is known of the geology of this area. The outer margin of the Great Barrier Reef is characterised by a well-aligned, although by no means continuous, outer barrier chain of reef islands at the edge of an abrupt continental slope.

Broad aeromagnetic surveys and scattered seismic coverage indicate that the sedimentary section occurs as a thickening offshore wedge of probably only Tertiary sediments. The section thins southwards from the Papuan Basin.

A prominent basement ridge extends offshore from the Great Dividing Range, and the Peninsula Trough extends offshore between this ridge and the Cape York-Oriomo Ridge. In some cases aeromagnetic results indicate a thickness of up to 2100 m of sediments. Offshore at the eastern extremity of the title areas the sedimentary section is believed to be 1800-2500 m thick.

Hydrocarbon potential. No wells have been drilled in this area. Sparse geophysical coverage indicates that probably only Tertiary sediments occur in this area. A sedimentary depression, an offshore extension of the Peninsula Trough, is worthy of more attention.

The substructure of the modern reef is Miocene, and probably much of the reef volume is also. For this reason the actual modern reef trends may provide further leads for petroleum exploration, although the lack on adequate seals would tend to downgrade the prospects.

Geophysics. Geophysical coverage of this area is sparse. Basement depth estimates are based on reconnaissance traverses from the Cape York Peninsula aeromagnetic survey and magnetometer observations made on seismic traverses recorded for Tenneco during the Northern Great Barrier Reef seismic and magnetic survey (66/11086). Basement depth ranges from zero at the coast line to 2400 m at the Barrier Reef. Major structural features delineated are the Oriomo High, the Peninsula Trough and the Peninsula Ridge.

Seismic coverage in this area consists of a few reconnaissance traverses recorded in the Torres Strait-Princess Charlotte Bay survey (65/4599) and in the Northern Great Barrier Reef survey (66/11086). Data, quality ranging from poor to fair, confirmed aeromagnetic basement depth estimates and indicated several structural features.

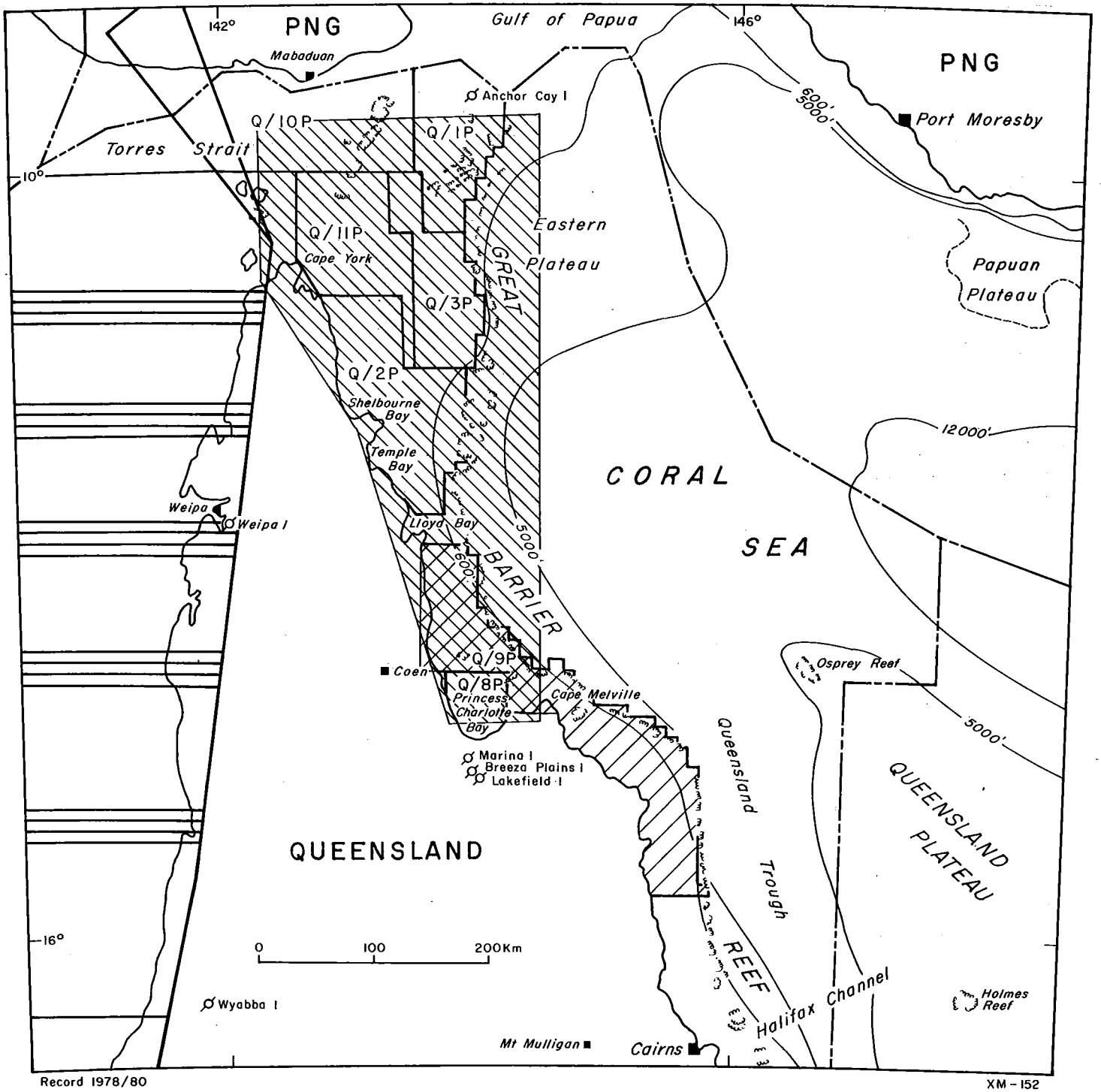


Fig. 2 Offshore Northern Queensland Title Areas

AEROMAGNETIC SURVEYS

Gulf of Carpentaria Aeromagnetic 62/1719

Cooktown Aeromagnetic 68/3010

Cape York Peninsula Aeromagnetic 62/1725

Laura Basin

The Laura Basin is a Cretaceous/Jurassic intracratonic feature extending from approximately 160 km south of Princess Charlotte Bay to approximately east of Lloyd Bay, although the northern limit is not well defined. Structurally the basin is a large graben forming a broad north-trending synclinal depression. The western boundary is controlled by the Palmerville fault complex, although the Mesozoic sediments of the Laura Basin are relatively flat-lying and continue across the fault with very little displacement. The eastern boundary is fault controlled by large, down-to-the-basin, normal faults. To the south, the basin onlaps the late Palaeozoic metamorphosed and indurated sediments of the Hodgkinson Basin, which also, in the main, is the floor of the Laura Basin.

No wells have been drilled in the offshore part of the Laura Basin, and the stratigraphy of this area is extrapolated from seismic coverage and three wells, Marina-1, Lakefield-1 and Breeza Plains-1, drilled in the onshore portion of the basin.

Marina-1 drilled a Cretaceous/Jurassic section to 1087 m before encountering basalt; Lakefield-1 drilled Cretaceous/Jurassic to 921 m before encountering granite and Breeza Plains-1 encountered Permian sandstones at 923 m, having penetrated a Cretaceous/Jurassic section.

Numerous small shows of hydrocarbons were encountered in the Jurassic section at Marina-1. Breeza Plains-1 and Lakefield-1 encountered good reservoir sands in the Jurassic and Cretaceous, but only fresh water was recovered.

Seismic work in the offshore areas indicates that the Mesozoic strata do not thicken significantly from the onshore portion of the basin. It also seems likely that the Mesozoic strata are truncated along the edge of the continental shelf.

Hydrocarbon potential. No wells have been drilled in the offshore Laura Basin. The onshore wells do not give much encouragement for petroleum exploration; however, marine sediments with potential source rocks may be present offshore. Suitable reservoir rocks have been proven within the Jurassic/Cretaceous sequence in the onshore wells. However, these have all proven to be fresh water flushed. Petroleum potential for the basin lies in the possibility that there is an increase of shale offshore, which could have protected potential reservoirs from flushing.

Geophysics. Aeromagnetic coverage consists of traverses flown for Gulf Interstate Overseas Ltd in the Cape York Peninsula survey (62/1725), and in the Cooktown Aeromagnetic survey, flown for Corbett Reef Ltd in 1968 (68/3010). This work confirmed the northerly offshore extension of the basin as a graben containing an estimated 2500 m of sediments.

The area was traversed by marine seismic reconnaissance traverses in the Torres Strait-Princess Charlotte Bay survey (65/4599). Subsequently, the offshore Laura Basin (69/3041) and the Princess Charlotte Bay (69/3047) marine seismic surveys were recorded for Endeavour Oil and Flinders Petroleum, respectively. No reliable seismic horizons were mappable below 900 m b.s.l., and it apppears probable that the magnetic basement depths are based on a horizon deep in the Palaeozoic.

Offshore Great Barrier Reef - Princess Charlotte Bay to Endeavour Reefs

Little is known of the geology of this offshore part of the Great Barrier Reef. No drilling or seismic operations have been carried out in the area.

Lower Palaeozoic geosyncline deposits crop out along the coast, with some limestones and dolomites.

Aeromagnetic data indicate a uniformly seaward-thickening wedge of sediments (probably only Tertiary) with as much as 2400-3000 m at the continental slope. However the validity of the data seems a little suspect (?).

Hydrocarbon potential. This area is unexplored and the hydrocarbon potential and stratigraphy are unknown.

Geophysics. The only geophysical data in this area are E-W traverses from the Cooktown aeromagnetic survey flown for Corbett Reef in 1968. The results show sedimentary thickness increasing rapidly offshore to approximately 2400-3000 m in a depression approximately 65 km E of Cooktown.

TITLE ASSESSMENT Q/1P

Title holder: Tenneco Australia Inc.
Signal (Australia) Petroleum Company

No. of blocks: 115 blocks

Expiry date: 1.9.74

Farmout negotiations: W.J. Steeger has a 5% overriding royalty interest

Previous six-year conditions $A

First, Second	$1,600,000
Third, Fourth	$1,120,000
Fifth, Sixth	$1,120,000
	$3,840,000

Regional setting:

Q/1P includes the eastern part of the Torres Strait and the northern part of the modern Great Barrier Reef. The northern boundary is the boundary between Queensland and Papua New Guinea. Q/1P lies in water depth less than 200 metres, the 200-metre bathymetric contour skirting the southeastern part of the title area.

Wells drilled:

Only one well, Anchor Cay-1, has been drilled within Q/1P. This well, located in the Bligh Entrance between the Gulf of Papua and the Torres Strait, was spudded on 26 February 1969, drilled to a depth of 3623 m, and was plugged and abandoned on 6 May 1969.

The well drilled Pliocene, Miocene and Eocene carbonate sediments to 2118 m. Beneath a major unconformity at that depth, clastic sediments of Early Cretaceous and Jurassic age were penetrated to T.D. 3623 m. No shows of oil or gas were encountered.

Of special importance was the Pliocene reef section encountered by this well. Previous wells in this offshore portion of the Papuan Basin have found mudstone exclusively in the Pliocene. Unfortunately, this porous reefal section was unsealed in this well. Other porous and potential reservoir horizons were found in Miocene and Eocene limestones and sandstones at the top of the pre-Tertiary section.

Geophysical coverage:

Refer to seismic line density maps, table of geophysical surveys, and basin notes.

Prospectivity:

The prospective sections are considered to be Tertiary carbonates (possibly reefs) and coarse clastics of the Upper Mesozoic. These have been proven in Anchor Cay-1 well.

Although the Anchor Cay-1 section contains good reservoir rocks, the prospects are downgraded by the lack of effective seals. Prospects for reefal development are better to the north and east outside the title area, although the presence of seals may also be a problem in this area.

The most prospective part of Q/1P appears to be in the northeast section around Anchor Cay-1 well. A number of large structures have been indicated in this area.

The Mesozoic section thins to the west and south, and is probably truncated within the title area south of Anchor Cay-1.

Recommendations:

Geophysical coverage of the area is sparse and inadequate, and no exploration has been carried out since 1969. Modern high effort marine seismic techniques could provide better definition of structures within the northern part of the title area and provide reconnaissance coverage over the southern unexplored part of the title area.

An evaluation of the vacant area east of Q/1P out to the 200-metre water depth contour would be advisable to assess possibilities of reefal development on the southern extension of the Pasca Ridge. A thicker unexplored Mesozoic section can also be expected in this area.

TITLE ASSESSMENT Q/2P

Title holder: Tenneco Australia Inc.
Signal (Australia) Petroleum Company

No. of blocks: 186 blocks

Expiry date: 1.9.74

Farmout negotiations: W.J. Steeger has a 5% overriding royalty interest

Previous six-year conditions: $A

First	$ 75,000
Second	$ 100,000
Third, Fourth	$1,100,000
Fifth, Sixth	$1,120,000
	$2,395,000

Regional setting:

Q/2P is situated on the eastern offshore margin of the Cape York Peninsula between Tern Island and Lloyd Bay. The eastern margin of the title area, in the north, borders Q/3P and in the south extends as far as the outer limits of the Great Barrier Reef. Water depths vary from zero at the coast to 200 metres at the eastern extremity. Bathymetric re-entrants at Wreck Bay and a minor re-entrant farther south are the only portions of the title area in water depths in excess of 200 metres.

Wells drilled:

No wells have been drilled in Q/2P.

Geophysical coverage:

Refer to seismic line density maps, table of geophysical surveys and basin notes.

Prospectivity:

It seems probable that only Tertiary sediments occur in Q/2P. The title can be conveniently divided into three areas: western, central and eastern.

Western area: This area has only been covered by a reconnaissance aeromagnetic survey, which indicates a depression, a possible offshore extension of the Peninsula Trough, containing up to 1830 m of sediments.

Recommendation: Seismic reconnaissance to confirm aeromagnetic basement depth estimates and assess structural prospects.

Central area: This is an area which aeromagnetic coverage has indicated to be underlain by shallow basement, 300-600 m, the probable offshore extension of the Great Dividing Range. Prospects are poor.

Recommendation: No further work at this stage.

Eastern area: Aeromagnetic and reconnaissance seismic data indicate a thickening wedge of sediments up to 2400 m, extending eastwards from the Great Dividing Range.

Recommendation: Further seismic work is necessary to evaluate structural prospects.

TITLE ASSESSMENT Q/3P

Title holder: Tenneco Australia Inc.
Signal (Australia) Petroleum Company

No. of blocks: 97 blocks

Expiry date: 1.9.74

Farmout negotiations: Nil

Previous six-year conditions: $A

First	$ 75,000
Second	$ 100,000
Third)	$1,100,000
Fourth)	
Fifth)	$1,120,000
Sixth)	
	$2,395,000

Regional setting:

Q/3P is located in the eastern Torres Strait and the northern part of the Great Barrier Reef south of Q/1P. The 200-metre bathymetric contour flanks the eastern margins of the title area.

Wells drilled:

No wells have been drilled in Q/3P.

Geophysical coverage:

Refer to seismic line density maps, table of geophysical surveys, and basin notes.

Prospectivity:

It seems probable that only Tertiary sediments occur in Q/3P, although nothing definite is known about the stratigraphy and hydrocarbon potential.

Q/3P can be conveniently divided into northern and southern areas.

Northern area: This area appears to be underlain by an extension of the Peninsula Ridge (aeromagnetic data), with a sedimentary section of the order of 600 m.

Recommendation: No further work is considered necessary in this area at this stage.

Southern area: Aeromagnetic and reconnaissance seismic data show this area to be underlain by a wedge of sediments thickening to 2400 m at the continental margin.

Recommendation: Reconnaissance seismic work to evaluate structural prospects.

TITLE ASSESSMENT Q/8P

Title holder: Exoil N.L. (70%)
Transoil N.L. (30%)

No. of blocks: 35 blocks

Expiry date: 1.9.74

Farmout negotiations: Nil

Previous six-year conditions: $A

First	$ 10,000
Second	$ 30,000
Third	$ 40,000
Fourth	$ 750,000
Fifth	$ 200,000
Sixth	$ 750,000
	$1,780,000

Regional setting:

Q/8P is located in Princess Charlotte Bay. Water depth is shallow over the entire title area.

Wells drilled:

No wells have been drilled in Q/8P.

Geophysical coverage:

Refer to seismic line density maps, table of geophysical surveys, and basin notes.

Prospectivity:

Prospective horizons are sands within the Cretaceous/Jurassic which have been penetrated in the onshore Laura Basin wells. The Laura Basin is bounded on east and west by large down to the basin faults. The sedimentary

section on the upthrown side of these faults is not regarded as prospective within Q/8P. A detailed seismic grid has delineated two large structures which warrant further investigation. The petroleum potential of the offshore part of the basin must be dependent upon an increase in shale forming protective barriers against flushing.

Recommendations:

Further seismic detailing may be necessary to upgrade these leads into drillable prospects. If sufficient encouragement results from the drilling of a test well, more seismic work would be desirable.

TITLE ASSESSMENT Q/9P

Title holder: Corbett Reef Ltd

No. of blocks: 252 blocks

Expiry date: 1.10.74

Farmout negotiations: W.J. Steeger has a 5% overriding royalty interest

Previous six-year conditions: $A

First	$ 75,000
Second	$ 100,000
Third)	$1,100,000
Fourth)	
Fifth)	$1,120,000
Sixth)	
	$2,395,000

Regional setting:

Q/9P extends from Lloyd Bay to Endeavour Reefs. It includes the area between the coast and the Great Barrier Reef except for Princess Charlotte Bay which is in Q/8P. The 200-metre water depth contour coincides with the eastern margin of Q/9P.

Wells drilled:

No wells have been drilled in Q/9P.

Geophysical coverage:

Refer to seismic line density maps, table of geophysical surveys, and basin notes.

Prospectivity:

The area may conveniently be broken up into the Laura Basin and an area extending from Cape Melville to Endeavour Reef.

Laura Basin: Prospective horizons are porous sands within the Cretaceous - Jurassic section which have been intersected in the onshore Laura Basin wells. As the prospective section was water flushed in the onshore tests, the petroleum potential of the offshore part of the basin must be dependent upon an increase of shale forming protective barriers against flushing. The stratigraphy of the offshore area is unknown. Seismic data indicate that the Mesozoic section does not thicken appreciably offshore. Two structural leads have been defined.

Recommendation: Further seismic work may be required to upgrade the structural leads into drilling locations. Should exploratory drilling yield encouraging results additional seismic work is recommended to further define the area.

Cape Melville to Endeavour Reef: Little is known of this offshore area. Regional geological mapping indicates that the area is underlain by shallow basement whereas aeromagnetic coverage indicates a seaward thickening wedge of sediments increasing to 3000-3700 m at the eastern boundary of the title area. There is a possibility that the aeromagnetic "basement" is within the Palaeozoic, which is regarded as economic basement in this area.

Recommendation: A reconnaissance seismic line including refraction depth probes to establish sedimentary thickness.

TITLE ASSESSMENT Q/10P

Title holder: California Asiatic Oil Company (50%)
Texaco Overseas Petroleum Company (50%)

No. of blocks: 278 blocks

Expiry date: 1.10.74

Farmout negotiations: Nil

Previous six-year conditions: $A

First	$ 100,000
Second	$ 150,000
Third	$ 800,000
Fourth	$ 250,000
Fifth	$1,000,000
Sixth	$ 160,000
	$2,460,000

Regional setting:

Q/10P is located in Torres Strait and extends westwards into the northeastern part of the Gulf of Carpentaria. The northern boundary is the state boundary between Queensland and Papua New Guinea. The Title area lies on the continental shelf and water depths do not exceed 200 metres.

Wells drilled:

No wells have been drilled in Q/10P.

Geophysical coverage:

Refer to seismic line density maps, table of geophysical surveys, and basin notes.

Prospectivity:

The area can be coneniently divided into three separate regions. The western region, the central Cape York-Oriomo basement high region, and the eastern region.

Western Region: The sedimentary section gently onlaps the Cape York-Oriomo Ridge and increases to a thickness of 1200 m at the western margin of Q/10P. The nature of the sedimentary section is unknown; the nearest control being too far away to be of great use (Morehead-1). It seems likely that only Tertiary sediments overlie basement. However, if Mesozoic sediments are proven, then the hydrocarbon potential of this area will be enhanced.

Only one seismic survey has been carried out in this area, with good to fair results. Two significant structural leads were mapped.

Recommendation: Further detailing of the structural leads with a view to the drilling of a test well.

Cape York-Oriomo Ridge: This area includes the basement ridge cropping out between Cape York and Mabaduan and its flanks where the sedimentary section is indicated to be less than 600 m thick. The prospectivity is regarded as poor.

Recommendation: No further work is recommended.

Eastern Region: The sedimentary section increases in thickness to the east off the flanks of the Cape York-Oriomo Ridge, reaching a maximum of 3000 m near the boundary with Q/1P. Several structural leads have been delineated. Prospects of encountering Mesozoic sediments increases to the east.

Recommendation: Further detailing of known structural leads with a view to drilling a test well.

TITLE ASSESSMENT Q/11P

Title holder: Gulf Interstate Overseas Ltd

No. of blocks: 126 blocks

Expiry date: 1.10.74

Farmout negotiations: Nil

Previous six-year conditions: $A

First	$ 45,000
Second	$ 66,000
Third, Fourth	$1,100,000
Fifth, Sixth	$1,120,000
	$2,331,000

Regional setting:

Q/11P is located in the Torres Strait on the eastern side of the Cape York-Oriomo High and adjacent to Cape York. Water depths do not exceed 200 metres.

Wells drilled:

No wells have been drilled in Q/11P.

Geophysical coverage:

Refer to seismic line density maps, table of geophysical surveys, and basin notes.

Prospectivity:

Q/11P is situated between the offshore extension of the Peninsula Ridge and the Cape York-Oriomo Ridge, where aeromagnetic and reconnaissance seismic results indicate that a sedimentary trough has developed. This depression is

regarded as having the best prospects within Q/11P although it seems likely that only a Tertiary section is present. Prospects over the Cape York-Oriomo Ridge and the Peninsula Ridge are regarded as poor.

Recommendation:

Reconnaissance seismic to confirm sedimentary thickness and to delineate any structural leads.

PART 2

Offshore central Queensland

Q/4P, 5P, 6P, 7P, 12P

REGIONAL SETTING

The central and southern portions of the Queensland Continental Shelf increase in width southward from 56 km east of Cairns to 176 km near Mackay, and reach a maximum width of 288 km near Swain Reefs at the southern limit of the Great Barrier Reef system (Fig. 3). Farther south, the shelf edge trends shoreward across the Capricorn Embayment, until it approaches the Capricorn-Barrier Reef Chain, where it parallels the shore line and is about 100 km wide. The title areas under consideration cover the Great Barrier Reef area from Cairns to Fraser Island.

Water depths at the edge of the shelf-slope break vary from 60 metres in the north to slightly over 90 metres in the south. The 200-metre water-depth contour borders the eastern edge of the title areas except in Q/4P where the Capricorn Embayment, a re-entrant of deeper bathymetry, extends into the southern part of the title area, and water depths are in excess of 540 metres.

The area is studded with coral reefs, which do not form solid barriers and a number of navigable passages occur through the reef. In the south the reefs are separated from the continental islands - drowned remnants of shore topography - by a channel free of reefs, whereas in the north near Cairns the zone of reefing merges with the shore line. The reefs mainly develop in water depths of less than 60 metres, and their distribution is controlled partly by Pleistocene depositional features and geological structure.

GEOPHYSICS

Aeromagnetic coverage of the offshore permits was completed in the Barrier Reef A - magnetic survey (62/1714) flown for A.O.G. in 1962, the Swain Reefs A - magnetic survey (63/1712) flown for Australian Gulf Oil in 1964, and the Townsville A - magnetic survey (69/3012), flown for the same operator in 1969.

Marine seismic exploration has been restricted to the southern permits, with the exception of a scientific survey carried out for Gulf Research and Development Company in 1973. A series of traverses ranging from Cairns to Fraser Island produced data of good quality.

The BMR Continental Margins geophysical survey provides broad control of a regional nature from the Barrier Reef eastwards.

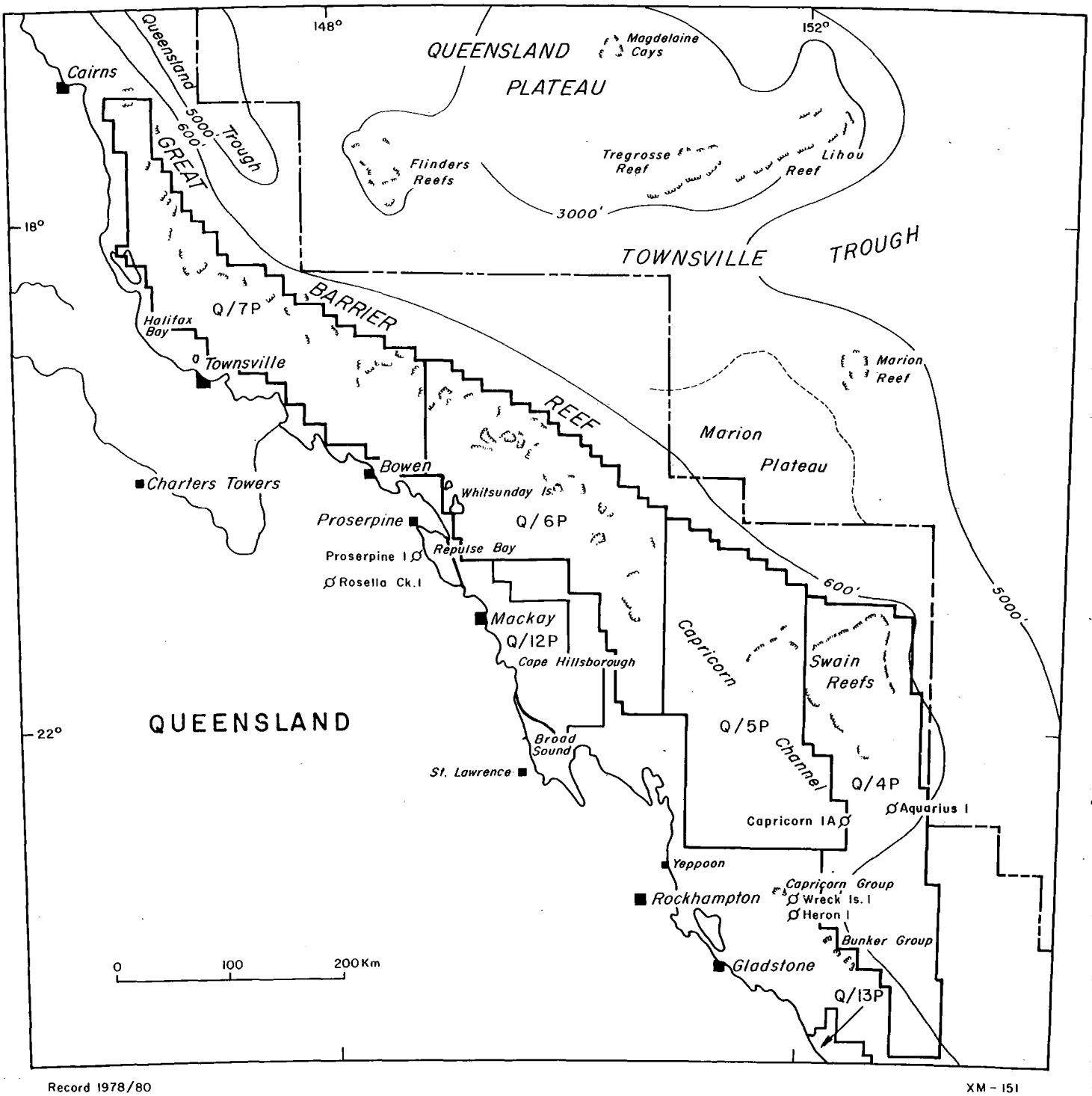
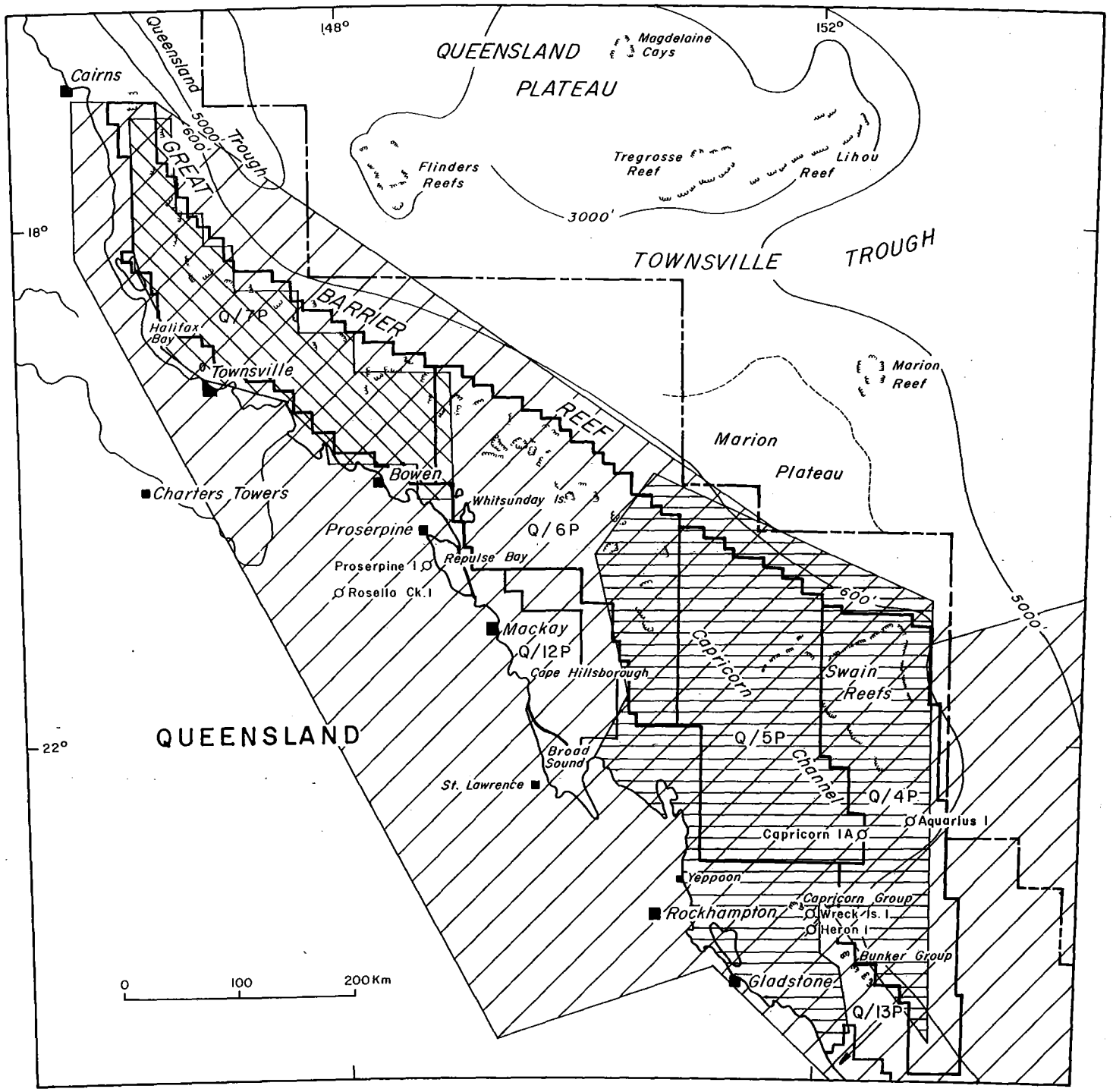


Fig. 3 Offshore Central Queensland Petroleum Exploration Title Areas



Record 1978/80

XM-153

Fig. 4 Offshore Central Queensland Title Areas

AEROMAGNETIC SURVEYS

Townsville Aeromagnetic 69/3012

Barrier Reef Aeromagnetic 62/1714

Swain Reefs Aeromagnetic 63/1712

The sparse geophysical coverage suggests that basement is shallow over most of the shelf except in three depressions where 1500-4500 m of sediments are indicated. From north to south these basins are the Halifax, the Whitsunday and the Capricorn Basins. The Gulf scientific survey provides the best available data on the extent and sedimentary configuration of the Halifax and Whitsunday Basins, but remains only broad reconnaissance, and definition of the margins is incomplete. In the northern portion of the Capricorn Basin detailing was carried out for Australian Gulf Oil in the Swain Reefs (65/11022) and Capricorn Channel (66/11093) marine seismic surveys in 1965/66. Record quality ranged from poor to fair. Several structural prospects were delineated, of which two were tested with the drill - Capricorn-1A and Aquarius-1. It seems likely that the later was sited on a velocity rather than a structural anomaly.

Other marine seismic investigations have been carried out in the Proserpine (Hillsborough) Basin and in the Styx Basin in the Broad Sound north of Rockhampton. In the former, 504 km of 200% CDP coverage were recorded by Western for Ampol in 1964. Results of fair quality indicate the presence of up to 2100 m of Tertiary sediments in a narrow SE-trending graben.

The Styx Basin was investigated in 1966 by a sparker survey in which 240 km of single-fold data were recorded by United for Ampol. A small graben containing approximately 500 m of Mesozoic sediments, faulted at its western margin and closing to the north and east, was delineated.

REGIONAL GEOLOGY

The Queensland hinterland adjacent to the area under consideration contains exposures of igneous, metamorphic and sedimentary rocks of Precambrian, Palaeozoic, Mesozoic and Cainozoic age in a complex structural framework that extends seawards under the Continental Shelf platform. The Palaeozoic section is generally regarded as economic basement, and Mesozoic and Tertiary, predominantly non-marine sediments, are localised in small structural basins along the shoreward edge of the shelf. Offshore, the depth to magnetic basement increases from 600 m or less in the north near Cairns to 4500 m in the Capricorn Basin to the south.

A number of regional geophysical surveys and limited drilling results have outlined this offshore part of Queensland. Three basins peripheral to the continental margin are partly defined. The Capricorn, Whitsunday and Halifax Basins contain 1500 m to 4500 m of sedimentary section. Their location suggests their development is related to rifting between the continental land mass and

submerged segments of continental crust. The Maryborough Basin occurs offshore west of the Capricorn Basin, and is separated from it by the Bunker Ridge. However, most of this basin lies outside the title areas under consideration. Parts of two other basins, the Styx and Proserpine (Hillsborough) Basins occur along the coastal margins.

Each of these basins will be discussed in further detail.

Halifax Basin

The Halifax Basin is a wholly offshore feature 130 km northeast of Townsville and extending north of Cairns. The basin is elongate with a northwest trend and closes to the northwest and southeast. It lies beneath the bathymetric feature, the Queensland Trough, which separates the mainland shelf from the Coral Sea Plateau. The axis of the basin appears to be slightly west of the present bathymetric trough. The thickest section occurs under the edge of the continental shelf and the continental slope. The sedimentary fill is thinner under the floor of the trough to the east.

Early geophysics indicated that the basin is a graben bound to the east and west by large down-to-the-basin faults. Recent seismic work did not confirm faulting on the western flanks, however, some deep-seismic faulting disturbs the deeper section.

It is suggested that the basin was part of the mainland shelf and the Coral Sea Plateau until it subsided. The time of subsidence will not be resolved until a well is drilled; however, it has been tentatively suggested as late Tertiary to Pleistocene or even as early as Eocene.

The basin is presumed to contain Mesozoic, Tertiary and Quaternary sediments. Swarbrick (1972) of the Queensland Mines Department has suggested a sedimentary thickness of about 5000 m. Regional trends indicate that the basin may contain Permian and early Triassic sediments, possibly overlying an older Palaeozoic basin floor. Other sediments may consist of non-marine Jurassic, Aptian, and Albian marine shallow water clastics, and Tertiary to Quaternary biogenic deposits.

Hydrocarbon potential

There is no drilling or outcrop information application to this basin. Based on reflection characteristics (Gulfrex Survey), the sedimentary section is similar to that shown in the Capricorn Basin. However, until a well is drilled,

the stratigraphy and hydrocarbon potential of the Halifax Basin must be regarded as rather speculative.

Whitsunday Basin

The name Whitsunday Basin was proposed for the undefined area east of the Whitsunday Islands, where folded water-laid volcanic and volcanoclastic deposits of Middle Cretaceous age are exposed. Recent reconnaissance seismic work has outlined a thickening wedge of sediments between the Whitsunday Islands and the Marion Plateau. The basin trends northwest and may open up into the Townsville Trough. It could be contiguous with the Halifax Basin farther north or occupy a separate sub-basin in the Queensland Trough. The eastern boundary is not defined, but appears to be limited by the Marion Plateau. Recent reconnaissance seismic work has not noted any flanking faults. The shallow beds are sub-horizontal; however, there is evidence of moderate deformation in the deeper section.

The general character of the sedimentary section is similar to that of the Capricorn Basin. Refraction profiles indicate high velocity material (17 960 f.p.s.) at approximately 1 second (2WT), which could correspond to volcanics possibly equivalent to the Whitsunday formation. A sedimentary section with a thickness of 0.8-1.6 seconds (2WT) is indicated.

The stratigraphy and hydrocarbon potential remain unknown and must be regarded as speculative until a well is drilled.

Hydrocarbon potential

No wells have been drilled in the Whitsunday Basin. The only outcrops are mapped as "Whitsunday Volcanics" - Albian dacites to andesitic pyroclastics, which form most of the Whitsunday and Cumberland Islands. It is likely that these volcanics extend under the Whitsunday Basin. Reflection characteristics (Gulfrex Survey) indicate a similar sedimentary section to that shown in the Capricorn Basin. However, until a well is drilled, the stratigraphy and hydrocarbon potential of this largely unexplored basin must be regarded as speculative.

Capricorn Basin

The Capricorn Basin is defined as an area of deposition containing early Cretaceous and Tertiary sediments, located about 190 km east of Gladstone. The basin is bordered to the east by the Swain Ridge (Swains Reef High), a Palaeozoic high, and to the west by the Bunker Ridge, which represents a boundary of basal Cretaceous volcanics against which early Cretaceous sediments were deposited. To the north, in the early Cretaceous, the basin was shallow and overlapped possible late Palaeozoic rocks. During the Middle and Late Cretaceous, uplift and erosion with some northwest-trending folding took place. The basin was rejuvenated with a larger areal extent in the early Tertiary, with the Swain Ridge forming the eastern margin of the basin.

The Capricorn Basin occupies the depressed region of the shelf, known as the Capricorn Channel, and the deeper region of the shelf to the south.

Three wells have been drilled to economic basement in the Capricorn Basin, indicating that the basin contains at least 2500 m of early Cretaceous and Tertiary sediments (maximum thickness of sediments drilled in Aquarius-1 (2568 m). These wells were drilled in the shallower water portion of the basin (Capricorn Channel), which seismic work indicates as being on the northern flank of the basin. No shows of hydrocarbons were encountered in the wells. Sediments penetrated in Wreck Island-1 well, on the western margin of the basin (Bunker Ridge), exhibit good porosity and permeability. The section below the base Tertiary unconformity in Capricorn-1A is more consolidated than the "loose" overlying Tertiary sequence, but no values for porosity and permeability were determined.

The bulk of the section penetrated in Aquarius-1 indicates good porosities, but all zones were found to be water bearing. An anhydrite and shale section towards the base of the well could act as effective seals for hydrocarbons in the area. Possible source rocks are transgressive limestones and marls.

Hydrocarbon potential

Three wells have tested the sedimentary section in the northwestern sector of the Capricorn Basin. Sands of Oligocene age indicate that reservoir potential is present, although no indications of hydrocarbons were discovered. However, these wells may not have tested reservoir beds in optimum structural or stratigraphic locations.

The main potential of the basin is regarded as the deeper section south of Aquarius-1. In this area there are several highs which could possibly represent folds in the Cretaceous section. Reefal growth possibly took place during the Tertiary over and around these highs, which may be sealed by Miocene shales. Unfortunately, this area is part of the present-day Capricorn re-entrant, and water depths are in excess of 300 metres.

Proserpine (Hillsborough) Basin

The Proserpine Basin is an isolated, narrow northwest trending graben bound to the northeast and southwest by Palaeozoic volcanic rocks. It extends southeast from the town of Proserpine and through Repulse Bay.

The stratigraphy of the offshore area is known from seismic work and extrapolation from the onshore well, Proserpine-1, drilled within the graben. The graben itself is a simple down-faulted block, which probably originated from adjustments in the basement during the early Tertiary orogeny. This trough has filled with material derived from surrounding scarps and deposited under non-marine conditions. Proserpine-1 penetrated 1200 m of early Tertiary interbedded shales, siltstones, and sandstones. Two minor shows of "bitumen" were recorded in the well at 1173 m and 1258 m in a series of interbedded shales, siltstones, and volcanic conglomerates. Formation tests were carried out over three intervals; however, these all proved tight.

In 1969 Japex, under farmout agreement with Ampol Exploration, prepared to drill a well in Repulse Bay. The announcement of this well led to the ban of offshore exploration in Queensland and instigation of the Barrier Reef Commission. The well has not been drilled, and no further work has been carried out since the announcement in May 1970.

Hydrocarbon potential

One well, Proserpine-1, has been drilled in the onshore portion of the Proserpine Basin. Although no significant hydrocarbon shows or porous sandstones were encountered in this well, sandstone beds were penetrated which could develop porosity elsewhere in the area. The existence has been established of a Tertiary sedimentary trough which could contain marine sediments in the untested offshore areas.

Styx Basin

The Styx Basin is situated near St Lawrence covering the Broad Sound area north of Rockhampton. The basin, 8 km wide and 104 km long, trends north-south, 40 km onshore and about 64 km offshore.

The basin contains approximately 500 km of sediments in a narrow graben. Indurated Palaeozoic sediments form the margins and floor of the basin. These Palaeozoics are intensely folded and faulted in the east, but less so in the west. The Mesozoic strata have been highly disturbed within the basin.

The onshore part of the basin has been extensively explored for coal, which has been mined since 1919. Drilling for coal between 1948 and 1951 supplied detailed knowledge of the subsurface stratigraphy. The stratigraphic section comprises the Styx Coal Measures, approximately 400 m of fine grained sandstone and shale with interbedded coal seams. It is predominantly non-marine, but there is one horizon with possible marine affinities.

Hydrocarbon potential

No wells have been drilled in the offshore part of the Styx Basin. Shallow basement and lack of prospective section give little encouragement for petroleum exploration.

Maryborough Basin

Only a minor part of the Maryborough Basin occurs in the area under consideration.

The Maryborough Basin is a depositional trough which began its history in late Palaeozoic time and ceased to be active at the end of the Mesozoic. During the basin's long depositional history more than 6000 m of sediments were laid down, ranging in age from early Permian to early Tertiary. The western boundary is fault bounded and the eastern boundary is the Bunker Ridge, which forms the outer zone of the continental shelf in that region.

The offshore part of the basin, despite a thick sedimentary section, is largely featureless without any major structural closures.

Hydrocarbon potential

The portion of the Maryborough Basin within the title areas under consideration comprises the southern portion of the Bunker Ridge. One well, Wreck Island-1 was drilled on the western flank of this ridge. It penetrated 540 m of Tertiary sedimentary section overlying basement. No shows were encountered, although the section did exhibit good porosity and permeability. However, because of the shallow section, the area cannot be regarded very favourably as a petroleum province.

TITLE ASSESSMENT Q/4P

Title holder: Australian Gulf Oil Co.

No. of blocks: 397 blocks

Expiry date: 1.9.74

Farmout negotiations: Australian Oil and Gas Corporation Ltd retains a 2½% overriding royalty on crude oil in kind, together with the remainder of a cash payment amounting to $900,000 to be made at 5 cents per barrel on crude production.

Previous six-year conditions: $A

First	$ 25,000
Second	$ 75,000
Third)	$1,500,000
Fourth)	
Fifth	$1,000,000
Sixth	$1,000,000
	$3,600,000

Regional setting: Q/4P lies entirely offshore on the outer margin of Queensland territorial waters between Swain Reefs and Fraser Island. About one-third of the title area lies in water deeper than 200 metres in the Capricorn re-entrant.

Wells drilled: One well, Aquarius-1 has been drilled in Q/4P, Aquarius-1 drilled Recent hard reef limestone to 83 m, Pleistocene to 314 m, Pliocene to 609 m, Miocene to 1245 m, lower Tertiary to 1702, pre-Tertiary (?) to 2643 m, and slightly metamorphosed Palaeozoic shales and sandstones to T.D. 2650 m. No hydrocarbons were encountered and the well was plugged and abandoned.

With the exception of the uppermost 8 m of reef limestone, the section from the sea bed to 1725 m consists of marls, mainly limestone, claystone, sandstone, and pebbly conglomerate. Porosities are generally good, however, the porous sections are salt-water saturated. From 1725 m to 2643 m the section consists of non-marine claystones and minor pebbly conglomerates, and is not considered prospective for hydrocarbons. The slightly metamorphosed section from 2643 m to T.D. is considered to be economic basement.

Although the section does not appear to be extremely prospective in Aquarius-1, it should be pointed out that the well was sited on a velocity anomaly rather than a structural anomaly.

Geophysical coverage: Refer to seismic line density map, table of geophysical surveys and basin notes.

Prospectivity: Much of the section encountered in Aquarius-1 contains excellent reservoir rocks. Both source and cap rocks are known to occur in the area. The area may be divided into four regions: northern - shallow basement; northern flank of the Capricorn Basin; Capricorn Basin proper with water deeper than 200 m; and the southwestern margins of the Capricorn Basin (including the Bunker Ridge).

Northern area: Includes the NW extension of the Swain Reefs high. This is an uplifted area of basement and Palaeozoic rocks, covered by sediments and probable shallow volcanics. Part of this lies in water deeper than 200 m. The margin of the Capricorn Basin is defined as the 0.4 sec. two-way time thickness of sediment contour.

Recommendation: Should the Capricorn Basin prove petroliferous, this area should be looked at more closely for the possibility of up-dip accumulation of hydrocarbons. At this stage however, the shallow basement and the likelihood of only a thin veneer of sediments being present make this area unattractive.

Northern flank of the Capricorn Basin: Although Aquarius-1 constituted a valid test of the stratigraphy to basement, it seems it was not located on a structural high, but on a velocity anomaly resulting from shallow reefing. A number of structural leads have been delinated and will require further seismic detailing to upgrade them into drillable prospects.

Recommendation: Further detailing of structural leads to mature a drill site. Depending on the results of a valid structural test well, further work may be recommended.

Capricorn Basin: All of this area is in water deeper than 200 m. Sedimentary thickness increases in a southeasterly direction to the depo-centre outside of the title area. Seismic work has indicated several highs which are thought to

represent Mesozoic structure. Tertiary reefs may have developed on or around these highs and be possibly sheathed in upper Tertiary shales. There are indications of a possible deltaic to marine transitional sequence in the Upper Mesozoic in this area.

Recommendation: To further investigate by seismic methods the unconformable Mesozoic surface for possible reefing. High effort seismic work is recommended to assess the possibilities of Upper Mesozoic deltaic sedimentation. If the latter is established, i.e. the deltaic section overlapped by rapidly deposited Tertiary section, this would constitute an attractive play.

Southwest Margin Capricorn Basin: This area is one of shallow basement outside the Capricorn Basin proper. More than half of the area is in water depths in excess of 200 metres. It covers the Bunker Ridge, an uplifted area of shallow basement separating the Capricorn and Maryborough Basins.

Recommendation: Should the Capricorn Basin prove petroliferous, further work may be advisable in this area to assess possibilities of up-dip accumulation.

TITLE ASSESSMENT Q/5P

Title holder: Australian Gulf Oil Co.

No. of blocks: 400 blocks

Expiry date: 1.9.74

Farmout negotiations: Australian Oil and Gas Corporation Ltd retains a 2½% overriding royalty on crude oil in kind, together with the remainder of a cash payment amounting to $900,000 to be made at 5 cents per barrel on crude production.

Previous six-year conditions: $A

First	$ 25,000
Second	$ 75,000
Third)	$1,500,000
)	
Fourth)	
Fifth	$1,000,000
Sixth	$1,000,000
	$3,600,000

Regional setting: Q/5P is located inshore from Q/4P and extends from Proserpine to Water Park Point. The 200 m bathymetric contour closely follows the northern margin of Q/5P.

Wells drilled: One well, Capricorn-1A, has been drilled in the title area.

Capricorn-1A was drilled 52 m from Capricorn-1, which was abandoned because of mechanical difficulties.

Capricorn-1A was drilled on a seismically defined closed anticline.

The well penetrated Recent/Pleistocene to 274 m, Pliocene to 722 m, Miocene to 949 m, lower Tertiary (?) to 1600 m and Cretaceous (?) Graham's Creek Volcanics to TD 1710 m.

The section from sea bed to 1228 m consisted of marls, mainly limestone, claystone, and sandstone. Excellent porosity was observed; however, the section was not capped. From 1228 m to 1600 m a conglomerate section with good porosities was encountered - once again, that section was not capped. The volcanic section from 1600 m to TD is considered to be economic basement.

No shows of hydrocarbons were encountered, and the well was plugged and abandoned.

Geophysical coverage: Refer to seismic line density maps, table of geophysical surveys, and basin notes.

Prospectivity: The area can be conveniently divided into three parts: the south eastern flank of the Whitsunday Basin; the northwestern flank of the Capricorn Basin, and the area of shallow basement between these basins.

Southeastern flank of the Whitsunday Basin: The outlines of this basin have been partially defined by recent reconnaissance seismic work. The margin shown on the prospectivity map is arbitrarily indicated as 0.4 sec. two way time contour of the sedimentary thickness. No wells have been drilled in this area, and the sedimentary section remains unknown. However, it is thought likely to be similar to that encountered in the Capricorn Basin.

Recommendation: Reconnaissance seismic with a view to locating drillable structures.

Northwestern flank of the Capricorn Basin: The 0.4 sec. two way time countour is used to outline the basin margin. The drilling of Capricorn-1A in this area has demonstrated the presence of reservoir and source rocks.

Recommendation: Further seismic work is necessary to delineate the configuration of the sediments.

Central area of shallow basement: This area is shaded brown on the prospectivity map. Reconnaissance seismic work indicates that is is an area of shallow basement between the Whitsunday and Capricorn Basins. Prospects are not highly regarded.

Recommendation: This area is not regarded as a high priority area. However, should drilling in either the Whitsunday or Capricorn Basins prove a petroliferous province, then this up-dip region should be further examined.

TITLE ASSESSMENT Q/6P

Title holder: Australian Gulf Oil Co.

No. of blocks: 397 blocks

Expiry date: 1.9.74

Farmout negotiations: Australian Oil and Gas Corporation Ltd retains a 2½% overriding royalty on crude oil in kind, together with the remainder of a cash payment amounting to $900,000 to be made at 5 cents per barrel on crude production.

Previous six-year consitions: $A

First)	$ 200,000
Second)	
Third)	$1,500,000
Fourth)	
Fifth	$1,000,000
Sixth	$1,000,000
	$3,700,000

Regional setting: Q/6P is situated in offshore Queensland between Townsville and the Northumberland Islands. All of the title area lies within the 200 metres bathymetric contour.

Wells drilled: No wells have been drilled in Q/6P.

Geophysical coverage: Refer to the seismic line density map, the table of geophysical surveys and basin notes.

Prospectivity: The area can be conveniently broken into two parts: the Whisunday Basin, and the area of shallow basement marginal to the coast.

Whitsunday Basin: The outlines of this basin have been partially defined by recent reconnaissance seismic work. The margin shown on the prospectivity map is arbitrarily indicated as the 0.4 sec. two-way time contour of the sedimentary

thickness. No wells have been drilled in this area, and the sedimentary section remains unknown. However, it is thought likely to be similar to that encountered in the Capricorn Basin.

Recommendation: Reconnaissance seismic to determine the extent of the basin, the character of sedimentary section, and the presence of suitable targets for drilling.

Shallow basement area marginal to the coast: Reconnaissance seismic work shows this to be an area of shallow basement (< 0.4 sec. two-way time). Prospects are not highly regarded.

Recommendation: Should the Whitsunday Basin prove to be petroliferous, further investigation of this updip province would be justified.

TITLE ASSESSMENT Q/7P

Title holder: Australian Gulf Oil Co.

Nol of blocks: 356 blocks

Expiry date: 1.9.74

Farmout negotiations: Australian Oil and Gas Corporation Ltd retains a 2½% overriding royalty on crude oil in kind, together with the remainder of a cash payment amounting to $900,000 to be made at 5 cents per barrel on crude production.

Previous six-year conditions: $A

First) Second)	$ 200,000
Third) Fourth)	$1,500,000
Fifth	$1,000,000
Sixth	$1,000,000
	$3,700,000

Regional setting: Q/7P is situated along the coastal strip from Cairns to Bowen. All of the title area lies in water shallower than 200 m.

Wells drilled: No wells have been drilled in Q/7P.

Geophysical coverage: Refer to the seismic line density map, the table of geophysical surveys, and basin notes.

Prospectivity: The area can be conveniently broken into two parts: the Halifax Basin, and the shallow basement coastal strip.

Halifax Basin: Reconnaissance seismic work indicates that the Halifax Basin extends into Q/7P. The boundary between the Halifax Basin and the Whitsunday Basin is not well defined, and the two basins are possibly continuous. Only the western flank of the Halifax Basin occurs within Q/7P. The western margin is defined as the 0.4 sec. two-way time sedimentary thickness contour. No wells

have been drilled in the basin and the sedimentary section remains unknown. It seems likely that a Tertiary section similar to that in the Capricorn Basin exists in this area.

Recommendations: Reconnaissance seismic work to determine the extent of the basin, the character of the sedimentary section, and the presence of suitable targets for drilling.

Shallow basement coastal strip: Reconnaissance seismic work shows this to be an area of shallow basement (< 0.4 sec. two-way time). The prospectivity is not rated very highly.

Recommendations: Should the Halifax Basin prove to be petroliferous, further investigation of this up-dip province would be justified.

TITLE ASSESSMENT Q/12P

Title holder: Ampol Exploration (Qld) Pty Ltd

No. of blocks: 150

Expiry date: 1.12.74

Farmout negotiations: Nil

Previous six-year conditions: $A

First)	$ 625,000
)	
Second)	
Third)	$ 200,000
)	
Fourth)	
Fifth)	$ 725,000
)	
Sixth)	
	$1,550,000

Regional setting: Q/12P lies between Proserpine and the Broad Sound Channel. Water depth is shallow throughout the title area.

Well drilled: No wells have been drilled in Q/12P.

Geophysical coverage: Refer to the seismic line density map, the table of geophysical surveys, and the basin notes.

Prospectivity: Q/12P can conveniently be divided into three parts: the Proserpine Basin, the offshore extension of the Styx Basin, and an area of shallow basement between them.

The Proserpine Basin: The prospective section must be regarded as sands within the Tertiary sequence which have been proven in the only well drilled in the basin so far, Proserpine-1. The stratigraphy of the offshore part of the Proserpine Basin is unknown. The petroleum potential of the offshore area could be enhanced by the presence of marine sediments. Seismic work has detailed a few minor structures.

Recommendations: A firm recommendation can be made after the drilling of the largest structure in the area, Mackay-1 in the inland waters part of the title area (162P Schedule B).

The offshore extension of the Styx Basin: The prospective section probably consists of sand bodies within the Cretaceous coal measures. Onshore stratigraphy gives little encouragement for further exploration in the offshore.

Recommendation: Because of the shallowness of the basin and lack of prospective section, no further evaluation is considered necessary at this stage.

Shallow basement area: Reconnaissance aeromagnetic work indicates this to be an area of shallow basement with only poor prospects.

Recommendation: No further exploration is indicated at this stage.

TABLE 1 - Exploration wells - offshore and onshore Queensland

Well	No.	Title	Rig	Rig Release	K.B./S.L.	Basin	T.D.	Reached basement	Deepest Sed. horizon penetrated	Cost MM$	
*Anchor Cay No. 1	69/2000.	Q/1P	Conception	6.5.69	10m/63m 34'/206'	Papuan	3623 m 11,888'	No	Mesozoic undiff.	1.73	p/a p/a
*Aquarius No. 1	67/4276	Q/4P	EW Thornton	27.3.68	10m/65m 32'/213'	Capricorn	2650 m 86095'	Yes	Early Cret. (Aptian)	1.101	"apparent drape over reef" after drilling no structur Recent reef in sea floor.
*Capricorn No. 1A	67/4269	Q/5P	EW Thornton	15.1.68	10m/106m 32'/347'	Capricorn	1710 m	Yes	Aprian	.99	p/a closed anticline.
Marina No. 1	62/1214	onshore	-	12.8.62	24m RT + 80'	Laura	1166 m 3829'	No	Permian (basalt)	.196	p/a Stratigraphic test - on small positive gravity anomaly.
Breeza Plains No. 1	70/650	onshore	-	14.8.70	19m KB + 61.8'	Laura	987 m 3238'	Yes	Permian	.288	p/a East flank of anticline.
Lakefield No. 1	70/650	onshore	-	29.8.70	32m KB +105.4'	Laura	930 m 3052'	Yes	Jurassic		p/a East flank of anticline.
Wreck Island No. 1	62/1021	onshore	-	14.6.59	7m RT + 22'	Maryborough	579 m 1898'	Yes	Miocene	.169	p/a Gravity high.
Proserpine No. 1	65/4149	onshore	-	28.7.65	7m RT + 23'	Proserpine	1295 m 4250'	Yes	L. Carb(?)	.108	p/a
Mackay No. 1	69/2022	Q/12P	Navigator	Proposed spud 1.3.1970. Est. duration 40 days	23 m RT + 77'	Proserpine	6600'	?	?	.82	Proposed well - never drill located in inland waters 162P of Q/12P. Anticline.

*Denotes offshore well

TABLE 2 - GEOPHYSICAL SURVEYS - OFFSHORE QUEENSLAND

SURVEY			COMPANY	CONTRACTOR	TENEMENTS	SEISMIC SOURCE	CABLE	RECORDER
Bunker Group S.	64/4505	4.2.64 - 7.2.64	Shell Dev.	Western Geo.	ATP 70P (Q/13P)	Expl.	600 m - 600 m 1200 m - 1200 m	FA-32
Mackay S.	64/4507	11.2.64 -19.2.64	Ampol Exp.	"	ATP 93, 94P (Q/12P)	"	7876 ft 3940 ft	West FA-32
ATP 104 P West S.	64/4554	1.11.64 -28.11.64	Marathon	Western	ATP 104P (Q/10P)	"	2400 m	WGC 24FA-40A
Hervey Bay S.	64/4569	8.3.65 -15.4.65	Shell Dev.	G. S. I.	ATP 70P (Q/13P)	"	1500 m	Shell QL-107 T.I. Exp. 8000-2
Torres St. - Pr. Charlotte	65/4599	14.5.65 - 5.7.65	Gulf Interstate O/S	Western	ATP 88P (Q/10P, 11P 1P, 2P, 3P)	"	600 m - 600 m	West FA-40
Swain Reefs S.	65/11022	17.7.65 -24.8.65	Aust. Gulf Oil	Western Geo.	ATP 90P (Q/4, 5P, 3P)	"	600 m - 600 m 1200 m - 1200 m	"
Northern Gt. Barrier R.S+M	66/11086	23.7.66 -17.9.66	Tenneco	Independent S G.A.I. M	ATP 88P (Q/1P, Q/10P) ATP 111P Q/11P, 2P	"	streamer 5400'	TIDFS 10000 Varian V4937
Capricorn Channel (Swain Reefs Phase 11)	66/11093	20.8.66 -24.11.66	Aust. Gulf Oil	United G.C.	ATP 90P (Q/4, 5, 6, 13P)	Spkr.	8040 ft	SIE PDR 70 (dig.).
Broad Sound S.	66/11134	17/11.66-19.11.66	Ampol Exp.	U.G.C.	Q12P	Spkr.	180 ft	
Triangle Reef S.	68/3008	23.3.68 -23.4.68	Tenneco	Western Geo.	ATP 88P (Q/1P) ATP 134P	Expl.	1200 m	SDS 1010
Warrior Reef S.	68/3011	25.4.68 -29.4.68	Amoseas	Western	ATP 133P (Q/10P 11P)	"	1200 m	SDS 1010
Hervey Bay S.	69/3002	19.1.69 -23.9.69	Shell	B.I.P.M.	Q13P	A/G	2700 m	Leach DS 1021
Pearce Cay S.	69/3024	23.9.69 -28.9.69	Texaco	Western	Q/10P	Aquapulse	5290 ft	SDS 1010
Offshore Laura Basin S.	69/3041	31.7.69 -22.8.69	Endeavour	U.G.C.	Q/9P	A/G	3940 ft	SIE DFS
Princess Charlotte Bay S.	69/3047	25.8.69 -31.8.69	Exoil-Flinders	"	Q/8P	"	3940 ft	EG & G 146
Gulf R & D Scientific Survey	73/21	22.2.73 -25.3.73	Gulf R & D	Gulf R & D	Q/4P, 5P, 6P, & 7P	Aquapulse	48 ch	GUS HDDR 4000
Barrier Reef A/M	62/1714	7.3.62 - 4.4.62	A.O.G.	Aero Serv. Ltd	(Q/4P,5P,6P,7P,13P)			
Gulf of Carpentaria A/M	62/1719	29.7.62 -16.8.62	Delhi	"	ATP-58P (Q/10P)			
C. York Peninsula A/M	62/1725	3.10.62 -16.10.62	Gulf Interstate O/A	"	ATP-88P (Q/1P,2P,3P,8P,9P,10P,11P)			
Swain Reefs A/M	63/1712	14.5.64 -20.9.64	Aust. Gulf Oil	"	ATP-90P (Q/4P,5P,6P)			
Cooktown A/M	68/3010	18.5.68 -18.6.68	Corbett Reef	"	ATP-127P (Q/8P, Q/9P)			
Townsville A/M	69/3012	6.3.69 -19.4.69	Aust. Gulf Oil	"	Q6P, Q7P			

TABLE 2 - Continued

SURVEY	COVERAGE	MILEAGE	REFR.	GRAV.	MAG.	QUALITY	REMARKS
Bunker Group S.	100% 200%	183.4 m (293 km)	-	-	-	P	Shallow platform N of Fraser Is. No thickening of Tert. s. of Wreck Island.
Mackay S.	100% 200%	315 (504 km)	-	-	-	P - F	Trough 7000 (2134 m). No large structures.
ATP 104 P West S.	200% 300%	580 (928 km) 38 (61 km)				F	5000 ft (1525 m) of T? in west.
Hervey Bay S.	100% 400%	689 (1102 km)				P	Confirmed basement ridge Sandy C to Bunker Gp.
Torres St. - Pr. Charlotte	600%	567 (907 km)				F	7500 ft (2286 km) Pr. Charlotte B.
Swain Reefs S.	400%	519 (830 km)				P	Record quality poor, up to 8000' (2428 m) seds. in E
Northern Gt. Barrier R.S+M	300%	764 (1222 km)	-	-		F	Detailed two structures
Capricorn Channel (Swain Reefs Phase 11)	400% & 600%	1839 expl. (1942 km) 305 spkr. (488 km)		-	-	P	Maryborough, Capricorn Basins - little structures 5-8000 ft (1525-2438 m) sediments.
Broad Sound S.	100%	150 (240 km)				F	N/S Trough (narrow) faulted on W side.
Triangle Reef S.	600%	240 (384 km) 56 (896 km)	-	-	-	F	10000' (3050ft) in NE AP 88P Section thinning to W.
Warrior Reef S.	300% 600%	45 (72 km) 55 (88 km)		-	-	P - F	Section thins N, W & S from low 10000 ft (3050 m)
Hervey Bay S.	2400%	128 (205 km)	-			F	Thick section in Maryborough Basin. Faulting and folding
Pearce Cay S.	2400%	118 (189 km)				P	2 Major structural trends. Moderately thick section 3 basement features.
Offshore Laura Basin S.	600%	330 (528 km)				P	3150 ft (960 m) of sediments
Princess Charlotte Bay S.	600%	462 (739 km)				P - F	Trench 7500 ft (2286 m)
Gulf R & D Scientific Survey	2400%	1374 (2199 km)				P - G	Reconnaissance Halifex, Whitsunday and Capricorn Basins.
Barrier Reef A/M		5545					5000' sediments except in Maryborough Basin
Gulf of Carpentaria A/M		9756					0 (Horne Is) - 7000-8000 ft (2134-2438 m) (Morehead)
C. York Peninsula A/M		3294					Basement depth 0-8000 ft (2438 m) (Laura Basin)
Swain Reefs A/M		17668					5000-15000 ft (1525-4572 m) of sediments
Cooktown A/M		4844					Up to 8000 ft (2438 m) in Laura Basin
Townsville A/M		11879					Shallow Basement (L 5000 ft) (1525 m)

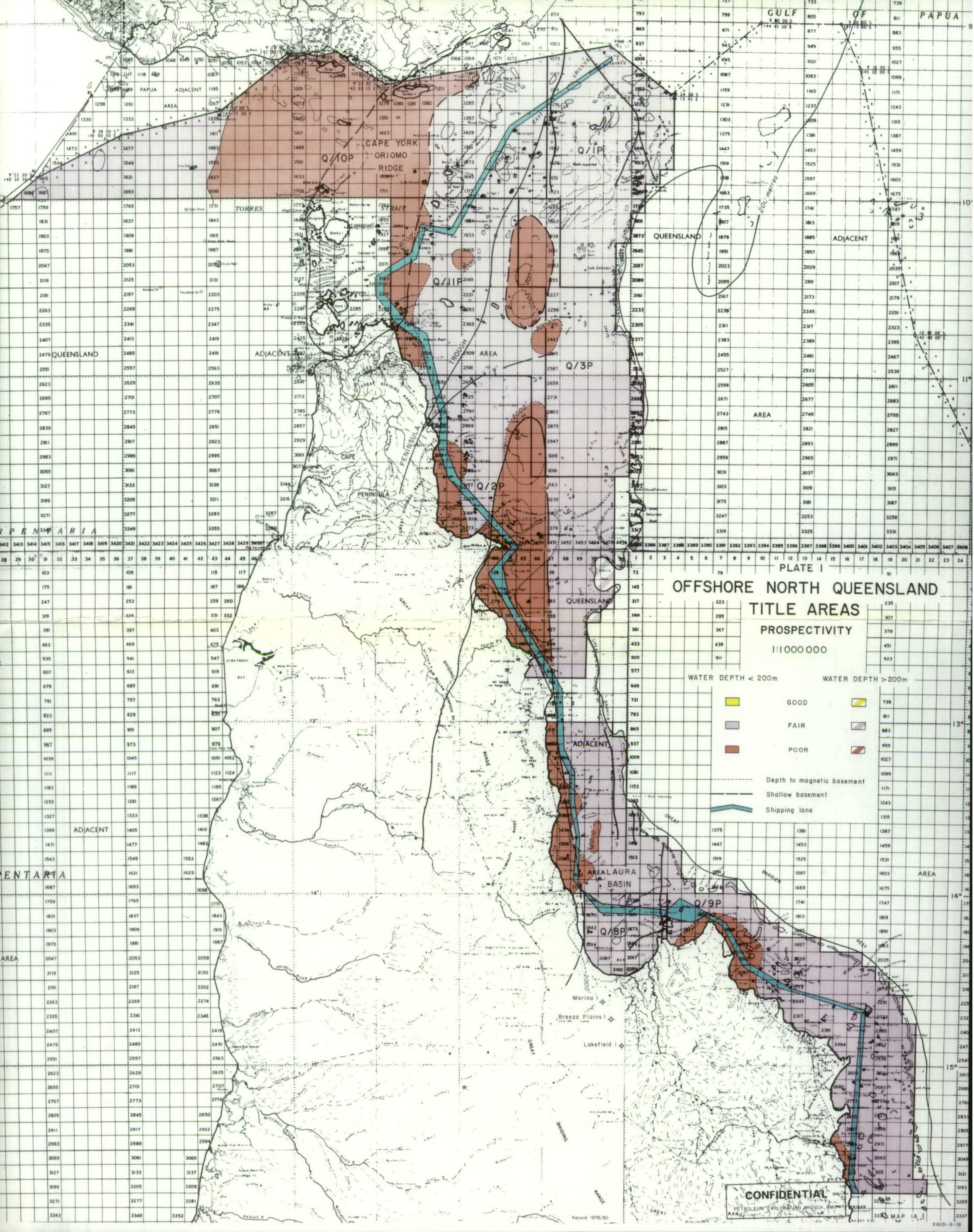


PLATE 1
OFFSHORE NORTH QUEENSLAND
TITLE AREAS
PROSPECTIVITY
1:1 000 000
WATER DEPTH < 200m
WATER DEPTH > 200m
GOOD
FAIR
POOR
Depth to magnetic basement
Shallow basement
Shipping lane
GULF OF PAPUA
PAPUA ADJACENT AREA
QUEENSLAND ADJACENT AREA
TORRES STRAIT
CAPE YORK ORIOMO RIDGE
Q/10P
Q/1P
Q/11P
Q/3P
Q/2P
Q/9P
Q/8P
PENINSULA TROUGH
CAPE PENINSULA
LAURA BASIN
GREAT DIVIDING RANGE
GREAT BARRIER REEF
200 metres
Marina I
Breeza Plains I
Lakefield I
CONFIDENTIAL
PETROLEUM EXPLORATION BRANCH, BMR
MAP IA 1
Record 1978/80
XAUS-6-19

PLATE 2

OFFSHORE NORTH QUEENSLAND TITLE AREAS

SEISMIC LINES

1 : 1000000

1964
1965
1966
1968
1969

CONFIDENTIAL

PETROLEUM EXPLORATION BRANCH, BMR

MAP 2A

Record 1978/80

XAUS-6-20

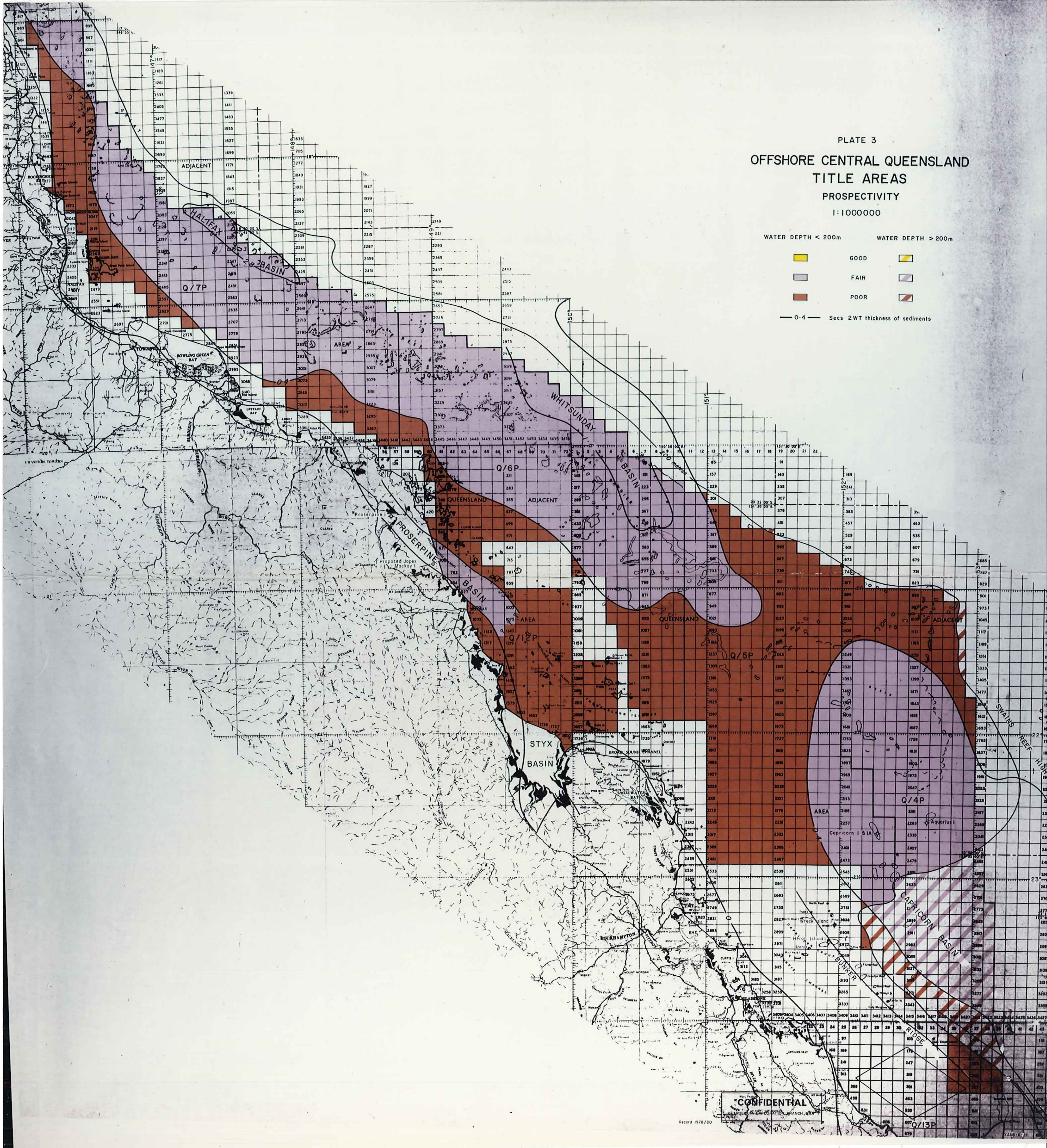


PLATE 3
OFFSHORE CENTRAL QUEENSLAND
TITLE AREAS
PROSPECTIVITY
1:1000000
WATER DEPTH < 200m
WATER DEPTH > 200m
GOOD
FAIR
POOR
0·4 Secs 2WT thickness of sediments
HALIFAX BASIN
Q/7P
ADJACENT
AREA
WHITSUNDAY BASIN
Q/6P
QUEENSLAND
ADJACENT
PROSERPINE BASIN
Q/12P
AREA
Q/5P
QUEENSLAND
ADJACENT
STYX BASIN
Q/4P
AREA
Aquarius I
Capricorn I & IA
CAPRICORN BASIN
BUNKER RIDGE
SWAINS REEF HIGH
Q/13P
BOWLING GREEN BAY
TOWNSVILLE
Proserpine
Proposed Japex Mackay I
ROCKHAMPTON
BROAD SOUND CHANNEL
SHOALWATER BAY
Wreck Island
Heron Island
CHARTERS TOWERS
CONFIDENTIAL
Record 1978/80

PLATE 4

OFFSHORE CENTRAL QUEENSLAND TITLE AREAS

SEISMIC LINES

1:1000000

1964

1965

1966

1973

B.M.R.

ADJACENT AREA

Q/7P

Q/6P

Q/12P

Q/5P

Q/4P

Q/13P

ADJACENT AREA

QUEENSLAND

ADJACENT AREA

Capricorn B.I.A.

CONFIDENTIAL

PETROLEUM EXPLORATION BRANCH, BMR.

Record 1978/80

MAP 28