

PETROLEUM EXPLORATION IN WESTERN AUSTRALIA IN 1981

by K. A. Crank and A. Janssens

ABSTRACT

The increase in petroleum exploration in Western Australia, noted in 1980, continued in 1981, although metres drilled decreased slightly. In 1981, 42 exploration wells were completed, compared with 32 in 1980, and eight were drilling ahead at the end of 1981 for a total penetration of 86 268 m, compared with 91 733 m in 1980. The decrease of 6% in metres drilled was caused by the drilling of a number of relatively shallow onshore wells in 1981. The average depth of wells spudded and drilled to total depth in 1980 and 1981 was 2 388 m and 1 796 m respectively. There was virtually no change in the number of rig months in 1980 (71.1 versus 73.2). Two development wells were drilled in the Barrow Island oilfield and four (including one water-disposal well) in the Dongara gasfield in 1981.

Highlights of the year included the oil discovery at Blina 1, the first commercial oil to be found in the Canning Basin; a major offshore gas discovery at Gorgon 1; and small gas discoveries in the Wyloo and Tubridgi wells in the onshore Carnarvon Basin.

Land seismic surveys increased by 144%, from 4 898 km in 1980 to 11 932 km in 1981, and marine seismic surveys increased by 14%, from 19 089 km in 1980 to 21 732 km in 1981.

INTRODUCTION

Exploratory drilling for petroleum in Western Australia over the past two years is illustrated in the following tables:

Type of well	Wells completed		Wells drilling on 31 December	
	1980	1981	1980	1981
New-field wildcats .....	21	19	4	2
New-pool wildcats.....	11	2	0	1
Extension tests .....	0	14	2	5
Stratigraphic tests.....	0	4	0	0
Shallower-pool tests.....	0	3	0	0
Total	32	42	6	8

One oil discovery was made in 1981, at Blina 1 in the northern Canning Basin. Gas discoveries were made in the offshore Carnarvon Basin, in Gorgon 1, and onshore in the same basin near Onslow, in the shallow Wyloo 1 and Tubridgi 1 wells.

Figure 1 summarizes seismic activity since 1969. Geophysical survey activity in 1980 and 1981 is shown below.

Type of survey	Line km	
	1980	1981
Land seismic.....	4 898	11 932
Marine seismic.....	19 089	21 732
Land gravity.....	226	1 350
Marine gravity .....	1 328	1 645
Marine magnetic.....	3 587	1 289
Aeromagnetic.....	0	2 400

Basin	Metres drilled—by Basin			
	1980 Onshore	1980 Offshore	1981 Onshore	1981 Offshore
Bonaparte Gulf.....	0	3 589	0	2 956
Browse.....	—	13 058	—	0
Canning.....	5 447	4 880	16 568	0
Carnarvon .....	11 554	11 845	14 209	17 191
“Exmouth Plateau”.....	—	16 284	—	926
Perth .....	18 383	0	32 572	1 770
Eucla.....	0	2 573	0	0
Officer.....	4 120	—	76	—
Totals	39 504	52 229	63 425	22 843
	91 733		86 268	

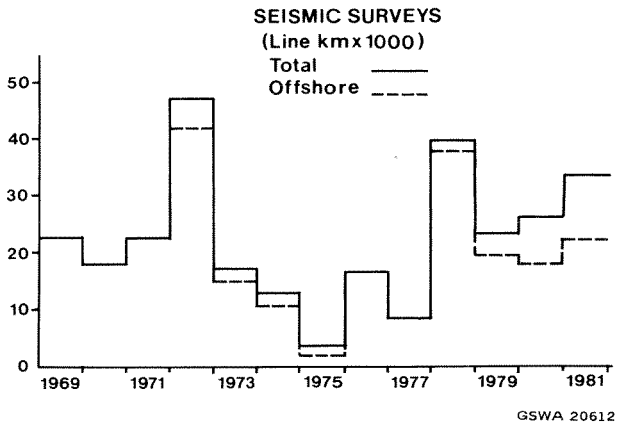


Figure 1. Seismic Surveys since 1969.

## OFFSHORE

CONTRACTOR	RIG	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
ATTWOOD OCEANICS	REGIONAL ENDEAVOUR	North Rankin 6					Fisher 1			Goodwin 6				
PETRO MARINE	PETROMAR NORTH SEA	Lawley1 → <div></div>												
SOUTHSEAS DRILLING CO.	SOUTHERN CROSS	Gorgon 1			Parmelia1									
GLOBAL MARINE AUSTRALIA	GLOMAR GRAND ISLE												Tern 2	
ODECO	OCEAN PROSPECTOR											West Tryal Rocks 3		
INTERNATIONAL CHANDLERS	SEDCO 471	Saturn1												

## ONSHORE

RICHTER DRILLING	NATIONAL 80 B	Woodada 3	Woodada 4	Blina 1	Yarrada 1	Blina 2	Beekeeper 1
RICHTER DRILLING	T 32	Dongara 23	Dongara WDW 24	Dongara 25	Great Sandy 1	Blina 3	
RICHTER DRILLING	RR 550	Point Louise 1 → <div></div> North Yarradino 1 ↓ Yardie East 1 ↓					
O.D.&E	H 1700	Yowalga 3	Warradong 1	Ejarno 1	<div></div>	Bootine 1	<div></div>
O.D.&E	IDECO H35	Tubridgi 1 → <div></div> Wyloo 1 → <div></div> Barrow Island Wells					
MUNGAROO DEVELOPMENT	NATIONAL T12	Tubridgi 2,3,4,5,6					
PACIFIC BASIN	CARDWELL KM 250	Mt.Horner 4	Mt.Horner 5	Georgina 1			
INTAIRDRILL	WILSON SUPER 38	Orange Pool 1 → <div></div>					
WESTERN RESOURCES	EMSCO 350	Casuarinas 1 → <div></div>					
P.D.S AUSTRALIA	OILWELL 840 E	Whicher Range 3					
ROCKDRILL	LONGYEAR 550	Abutilon 1 Acacia 1 Boab 1 Cassia 1					

GSWA 20613

Figure 2. Rig Utilization, 1981.

## DRILLING

### DRILLING OPERATIONS

Expressed in rig months, there was a slight decrease in overall exploration operations from 73.2 in 1980 to 71.7 in 1981. Offshore operations decreased by 57% to 20.0 rig months in 1981 compared to 47.3 rig months in 1980. However, onshore there was an increase of 100% from 25.9 to 51.7 rig months.

These changes in rig utilization reflect a severe shortage of offshore drilling rigs and the interest generated by recent onshore discoveries at Blina, Tubridgi and Woodada. Three of the offshore rigs used in 1981 were only available for part of the year. After drilling Lawley 1 and Parmelia 1, respectively, the Petromar North Sea and the Southern Cross left Western Australian waters for Victoria, and, after drilling Saturn 1, the Sedco 471 left for the Ivory Coast. Towards the end of the year the Ocean Prospector arrived from Singapore and the Glomar Grand Isle from California.

A total of 17 rigs, six offshore and eleven onshore, operated in Western Australia. Details of rig utilization are shown in Figure 2. Two tropical cyclones interrupted drilling operations offshore in January and February, and caused a loss of 30 rig days in the drilling of Saturn 1, Gorgon 1, and North Rankin 6.

Figure 3 is a summary comparison of drilling operations for the 14-year period 1968-1981.

#### WELLS COMPLETED IN 1981

The location of wells drilled for petroleum exploration in Western Australia during 1981 is shown in Figure 4. Details relating to wells drilled during the year are given in Table 1. All petroleum wells drilled in Western Australia up to the end of 1981 are listed in Janssens (1982). A summary follows of the principal results of drilling in each basin during 1981.

#### Bonaparte Gulf Basin

The only well spudded in the (offshore) Bonaparte Gulf Basin in 1981 was Tern 2, drilled by Australian Aquitaine Petroleum Pty Ltd. It is located approximately 10 km southeast of Tern 1, which was drilled by ARCO in 1971 and abandoned after testing up to  $215.2 \times 10^3 \text{ m}^3$  of gas per day from Upper Permian sandstones. Tern 2 at the end of the year was drilling ahead at 2 496 m.

#### Canning Basin

During 1981, four new-field wildcats, two extension tests, and four stratigraphic tests were

drilled in the onshore Canning Basin; no drilling took place offshore. One of the wildcats discovered a probably commercial oil-pool.

Home Oil Australia Ltd drilled the new-field wildcat, Blina 1, as a structural test of the Devonian reefal section on the Lennard Shelf. On test, the reefal limestone section between 1 402 m and 1 478 m produced oil at a rate of 143.9 kL/day (906 bopd) with no gas. A dolomite section above the reef also produced an oil flow (6 kL/day; 37.6 bopd). The well has since been placed on a long-term production testing programme. Home Oil subsequently drilled two successful extension tests, Blina 2 and Blina 3. Previous to Blina 1, 95 wells (including six offshore) with a total penetration of 185 504 m had been

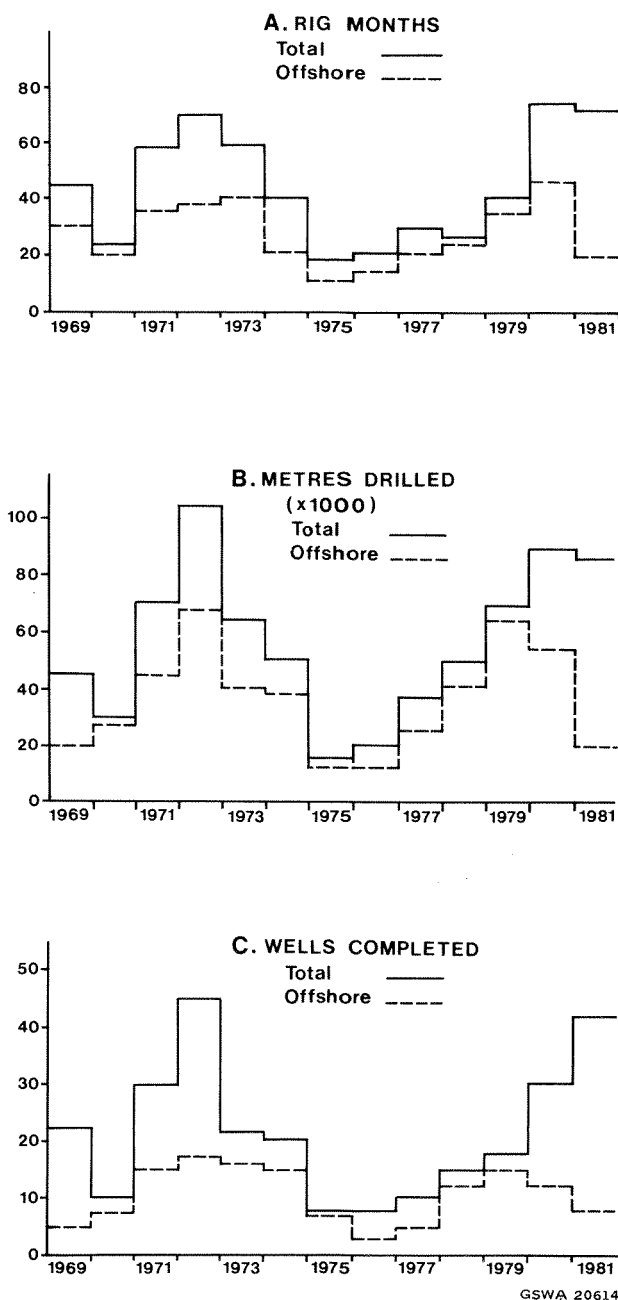


Figure 3. Drilling operations since 1968.

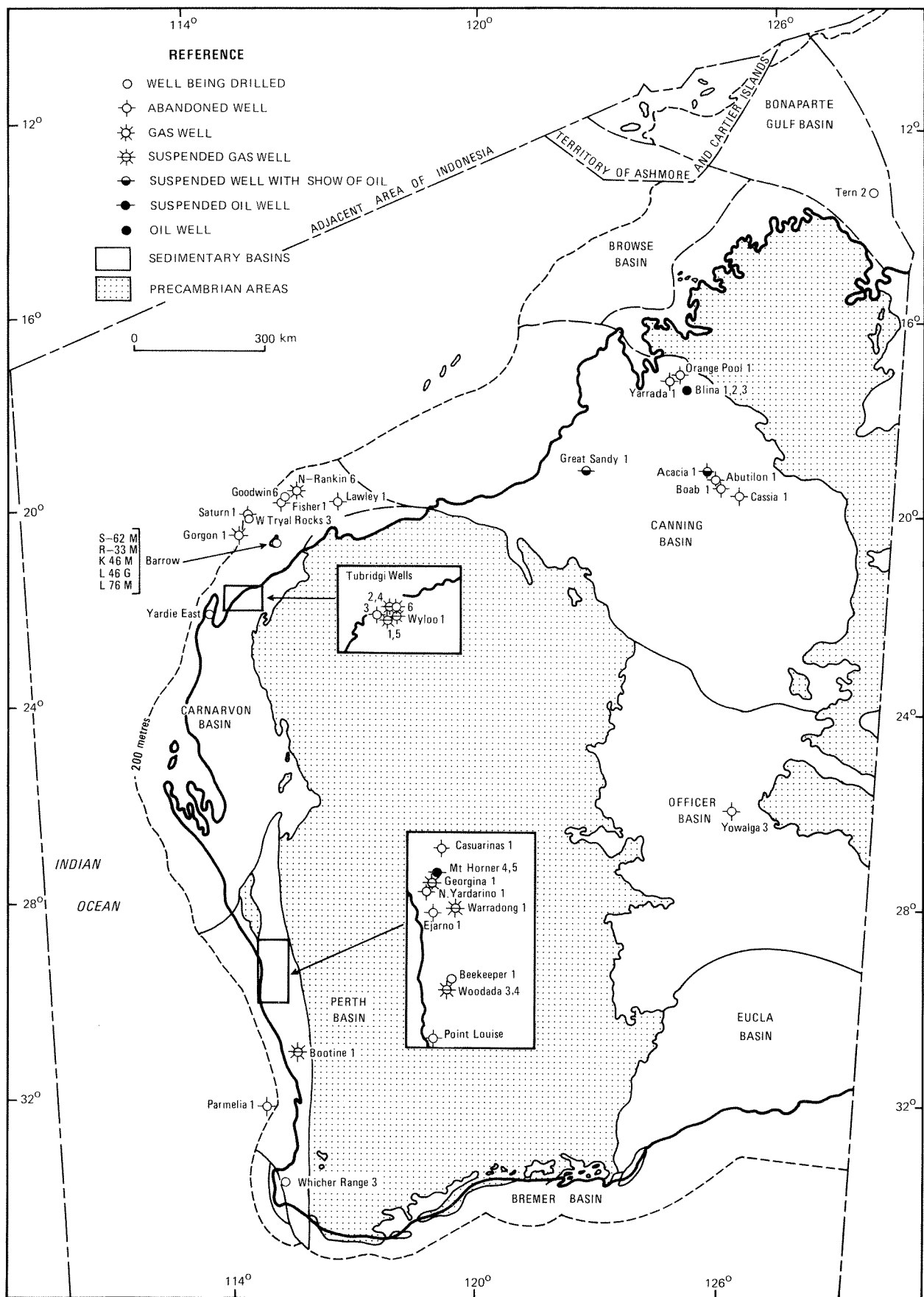


Figure 4. Map showing wells drilled for petroleum in Western Australia during 1981.

TABLE 1. WELLS DRILLED FOR PETROLEUM EXPLORATION IN WESTERN AUSTRALIA DURING 1981

Basin	Well	Concession	Operating Company	Type	Position		Elevation and water depth (m)			Dates			Total depth (or depth reached) (m)	Bottomed in	Status on 31 Dec.
					Latitude South	Longitude East	GL	RT	WD	Commenced	Reached TD	Rig Released			
Bonaparte Gulf	Tern 2	WA-18-P	Aquitaine	EXT	13°16'44"	128°07'58"	—	10	86	16/11/81	—	—	2 956	—	Drilling
Canning	Blina 1	EP129	Home	NFW	17°37'26"	124°30'02"	58	64	—	18/04/81	08/06/81	27/06/81	2 496	Devonian	Oil well
	Orange Pool 1	EP129	Home	NFW	17°18'18"	124°12'34"	29	34	—	21/06/81	14/07/81	22/07/81	1 171	Precambrian	Water well
	Yarrada 1	EP129	Home	NFW	17°22'00"	124°06'09"	21	26	—	29/06/81	20/09/81	23/09/81	3 295	Devonian	Dry, P & A
	Abutlon 1	EP143	WMC	STRAT	19°27'18"	125°07'00"	230	232	—	30/06/81	13/08/81	17/08/81	850	Devonian	P & A
	Acacia 1	EP143	WMC	STRAT	19°19'54"	124°59'42"	226	228	—	19/08/81	16/09/81	22/09/81	1 209	M. Ordovician	Oil shows, P & A
	Boab 1	EP143	WMC	STRAT	19°34'42"	125°08'45"	202	204	—	24/09/81	20/10/81	28/10/81	1 033	Silurian/Ordovician	P & A
	Great Sandy 1	EP164	Meridian	NFW	19°12'51"	122°21'11"	87	91	—	27/09/81	09/11/81	13/11/81	1 769	Ordovician	Oil shows, suspended
	Blina 2	EP129	Home	EXT	17°37'10"	124°29'46"	55	60	—	01/10/81	23/10/81	27/10/81	1 588	Devonian	Oil well
	Cassia 1	EP143	WMC	STRAT	19°44'12"	125°30'48"	194	196	—	02/11/81	14/12/81	15/12/81	1 577	U. Devonian	P & A
	Blina 3	EP129	Home	EXT	17°37'23"	124°29'48"	56	61	—	21/11/81	17/12/81	04/01/82	1 580	Devonian	Oil well
Carnarvon	Gorgon 1	WA-25-P	WAPET	NFW	20°34'43"	114°46'22"	—	21	259	11/10/80	11/01/81	19/04/81	4 401	Triassic	Gas well
	North Rankin 6	WA-1-L	Woodside	EXT	19°32'46"	116°08'27"	—	8	124	24/12/80	05/04/81	20/04/81	3 900	Triassic	Gas well, suspended
	Tubridgi 1	EP110	Otter	NFW	21°48'30"	114°48'55"	5	8	—	04/06/81	11/06/81	16/06/81	611	Triassic	Gas well, suspended
	Fisher 1	WA-28-P	Woodside	NFW	19°49'25"	115°42'32"	—	8	88	25/06/81	18/08/81	27/08/81	3 762	Triassic	Gas shows, P & A
	Wylloo 1	EP110	Otter	NFW	21°47'36"	114°51'16"	5	8	—	18/06/81	25/06/81	28/06/81	732	Triassic	Gas well, suspended
	Lawley 1	WA-58-P	Hudbay	NFW	19°54'21"	117°00'32"	—	10	60	10/08/81	24/08/81	29/08/81	1 120	Precambrian	Dry, P & A
	Barrow S-62M	PL1H	WAPET	NPW	20°45'43"	115°21'39"	9	12	—	29/08/81	09/09/81	01/10/81	1 094	Cretaceous	Suspended
	Goodwyn 6	WA-5-L	Woodside	EXT	19°43'24"	115°51'12"	—	8	124	28/09/81	—	—	4 664	—	Drilling
	Barrow R18	PL1H	WAPET	EXT	20°46'26"	115°22'08"	48	51	—	15/09/81	21/09/81	22/09/81	811	Cretaceous	Oil well
	Tubridgi 2	EP110	Otter	EXT	21°46'55"	114°50'48"	3	6	—	28/09/81	15/10/81	16/10/81	592	Triassic	Gas well, suspended
	West Tryal	WA-25-P	WAPET	EXT	20°09'18"	115°02'57"	—	25	162	02/10/81	01/12/81	—	4 035	Triassic	Testing
	Rocks 3	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Barrow R33M	PL1H	WAPET	NPW	20°46'56"	115°20'59"	18	22	—	03/10/81	16/10/81	18/10/81	1 080	Cretaceous	Suspended
	Tubridgi 3	EP110	Otter	EXT	21°47'22"	114°48'19"	5	8	—	20/10/81	30/10/81	04/11/81	597	Triassic	Dry, P & A
	Barrow R63	PL1H	WAPET	EXT	20°47'35"	115°21'01"	41	44	—	29/10/81	30/10/81	30/10/81	814	Cretaceous	Oil well
	Tubridgi 4	EP110	Otter	EXT	21°45'31"	114°50'00"	5	8	—	06/11/81	13/11/81	20/11/81	595	Triassic	Gas well, suspended
	Barrow L46G	PL1H	WAPET	SPT	20°48'48"	115°23'28"	49	53	—	07/11/81	10/11/81	11/11/81	585	Cretaceous	Suspended
	Barrow R43	PL1H	WAPET	EXT	20°47'03"	115°20'58"	11	14	—	12/11/81	17/11/81	17/11/81	829	Cretaceous	Suspended
	Barrow Q56M	PL1H	WAPET	SPT	20°47'18"	115°23'33"	50	54	—	19/11/81	07/12/81	07/12/81	1 052	Cretaceous	Suspended
	Tubridgi 5	EP110	Otter	EXT	21°48'37"	114°47'55"	5	8	—	22/11/81	28/11/81	04/12/81	593	Triassic	Gas well, suspended
	Tubridgi 6	EP110	Otter	EXT	21°44'41"	114°52'26"	0	3	—	05/12/81	12/12/81	—	594	Triassic	Testing
	Barrow K46M	PL1H	WAPET	SPT	20°48'43"	115°21'35"	57	60	—	09/12/81	24/12/81	25/12/81	1 004	Cretaceous	Suspended
	Yardie East 1	WA-24-P	WAPET	NFW	22°00'28"	113°55'34"	4	11	—	15/12/81	—	—	1 080	—	Drilling
	Barrow L76M	PL1H	WAPET	NPW	20°49'29"	115°23'31"	57	61	—	25/12/81	—	—	763	—	Drilling
"Exmouth Plateau"	Saturn 1	WA-84-P	Phillips	NFW	19°54'36"	114°56'41"	—	11	1 178	01/12/80	28/01/81	05/02/81	4 000	Triassic	Dry, P & A
Perth	Mt Horner 4	EP96	XLX	EXT	29°07'49"	115°05'24"	215	219	—	29/11/80	07/01/81	09/02/81	1 816	Permian	Oil shows, suspended
	Woodada 3	EP100	Hughes	EXT	29°45'17"	115°09'21"	42	47	—	10/12/80	11/01/81	08/02/81	2 540	Permian	Gas well, suspended
	Warradong 1	EP105	Mesa	NFW	29°18'05"	115°10'17"	97	103	—	04/02/81	15/03/81	14/04/81	3 717	Permian	Gas shows, P & A
	Woodada 4	EP100	Hughes	EXT	29°50'06"	115°08'33"	41	46	—	16/02/81	22/03/81	05/04/81	2 271	Permian	Gas well, suspended
	Mt Horner 5	EP96	XLX	EXT	29°07'37"	115°05'17"	213	216	—	24/02/81	05/04/81	22/04/81	1 819	Permian	Oil shows, suspended
	Ejarno 1	PL1	WAPET	NFW	29°18'54"	115°04'33"	73	80	—	21/04/81	20/05/81	24/06/81	2 868	Permian	Dry, P & A
	Georgina 1	EP96	XLX	NFW	29°08'41"	115°04'25"	143	146	—	28/04/81	11/06/81	12/07/81	1 831	Permian	Oil shows, suspended
	Parmelia 1	WA-13-P	WAPET	NFW	32°17'57"	115°04'32"	—	21	242	29/04/81	25/05/81	10/06/81	1 770	Cretaceous	Dry, P & A
	North Yardarino 1	PL2	WAPET	NFW	29°11'24"	115°02'24"	56	63	—	03/07/81	26/07/81	28/07/81	2 207	Permian	Dry, P & A
	Boothie 1	EP24	WAPET	NFW	31°10'39"	115°49'32"	166	173	—	10/08/81	06/11/81	22/11/81	4 306*	Jurassic	Suspended
	Point Louise 1	EP100	Mesa	NFW	30°02'22"	115°03'51"	36	39	—	28/08/81	16/09/81	17/09/81	950	Permian	Dry, P & A
	Whichee Range 3	EP130	BP	EXT	33°52'19"	115°23'33"	131	137	—	21/09/81	—	—	3 136	—	Drilling
	Casuarinas 1	EP111	Jervois	NFW	28°55'32"	115°09'06"	240	244	—	22/10/81	24/11/81	26/11/81	1 478	Permian	Water well
	Beckeeper 1	EP174	Aquitaine	NFW	29°42'52"	115°11'07"	48	53	—	09/11/81	23/12/81	—	3 012	Permian	Testing
Officer	Yowalga 3	EP178	Shell	NFW	26°09'03"	125°54'56"	476	483	—	19/08/80	09/01/81	17/01/81	4 197	Proterozoic	Dry, P & A

\*Does not include sidetracked hole

Aquitaine: Australian Aquitaine Petroleum Pty Ltd

Home: Home Oil Australia Ltd

WMC: Western Mining Corp. Ltd

Meridian: Meridian Oil N.L.

Woodside: Woodside Petroleum Development Pty Ltd

Oter: Oter Exploration N.L.

Hudbay: Hudbay Oil (Aust.) Ltd

WAPET: West Australian Petroleum Pty Ltd

Phillips: Phillips Australian Oil Co

XLX: XLX N.L.

Hughes: Hughes &amp; Hughes

Mesa: Mesa Australia Ltd

BP: BP Petroleum Development Aust. Pty Ltd

Jervois: Jervois Sulphates (N.T.) Ltd

Shell: The Shell Co. of Australia Ltd

NFW: New-field wildcard well

NPW: New-pool wildcard well

EXT: Extension test well

STRAT: Stratigraphic test well

SPT: Shallower-pool test well

P &amp; A: Plugged and abandoned

GL: Ground level

RT: Rotary table

WD: Water depth

drilled without finding commercial hydrocarbons. It is considered to be the most important oil discovery in Western Australia since the Barrow Island field in 1964.

Following Blina 1, Orange Pool 1 and Yarrada 1 were drilled as new-field wildcats by Home Oil. Orange Pool 1 was drilled to test a seismic anomaly in a Devonian reef section about 50 km northwest of Blina 1, and Yarrada 1 was a similar test located on the southern margin of the Lennard Shelf. No hydrocarbons were found in the two tests, and Orange Pool 1 was abandoned and Yarrada 1 was left as a water well.

The fourth new-field wildcat, Great Sandy 1, was drilled by Meridian Oil N.L. on the Broome Platform; it found a good show of oil in Ordovician carbonates and a show of gas in the Poole Sandstone (Permian). A drillstem test of the interval 1 445-1 525 m in the Ordovician yielded less than 1 barrel of oil-cut mud. The well has been suspended and awaits further testing.

Four stratigraphic diamond-cored holes to test various types of seismic anomalies noted on the lines shot by the previous permit holder were drilled by Western Mining Corporation. One of these, Acacia 1, encountered excellent shows of oil in Ordovician carbonates, but it and the others (Boab 1, Abutilon 1, and Cassia 1) were plugged and abandoned because it was not possible to carry out extensive testing or logging in the narrow-diameter corehole. Western Mining intends to return to the Acacia location with a larger drilling rig in 1982 to evaluate the Ordovician section.

### *Carnarvon Basin*

Two New-field wildcats, seven extension tests, two new-pool wildcats and three shallower pool tests were drilled in the onshore carnarvon Basin in 1981; offshore, three new-field wildcats and one extension test were drilled. In addition, drilling ahead or logging/testing at year end were two extension tests in the offshore, and one new-field wildcat, one extension and one new-pool wildcat in the onshore part of the basin.

Onshore, a shallow gasfield was discovered near Onslow by Otter Exploration N.L., which drilled the new-field wildcats, Wyloo 1 and Tubridgi 1, on anomalies located by a seismic survey, and found gas in the Birdrong Sandstone and a greensand within the Muderong Shale (Cretaceous). Wyloo 1 is located 4 km south-southwest of Onslow 1, drilled in 1966 by WAPET and abandoned with shows of oil and gas in the Birdrong Sandstone. Wyloo 1 tested  $120 \times 10^3 \text{ m}^3/\text{day}$ , and Tubridgi 1,  $79 \times 10^3 \text{ m}^3/\text{day}$ , both on 13 mm choke. Three successful Tubridgi extension wells and one dry hole were subsequently

drilled, and the fifth extension well was being tested at the end of the year.

WAPET drilled two new-pool wildcat wells, three extension tests and three shallower-pool tests on Barrow Island, all of which are awaiting testing; one new-pool wildcat was drilling on Barrow Island at year end. The results of these wells are discussed in the Report of the Director of the Petroleum Division, in the Annual Report of the Department of Mines, 1981.

Offshore, WAPET drilled Gorgon 1 as a new-field wildcat on a horst-block closure on the southern extension of the Rankin trend. Seven drillstem tests were run over five different zones, six of which produced gas at rates up to a maximum of  $770\,000 \text{ m}^3$  per day. Most of the production is from the Mungaroo Formation (Triassic) but one zone in the Barrow Formation (Jurassic) also produced a gas flow ( $260\,000 \text{ m}^3$  per day).

The testing indicates the discovery of a major gas field with reserves estimated at over  $84 \times 10^9 \text{ m}^3$ . The well is situated approximately 50 km southwest of West Tryal Rocks. At the end of the year WAPET had just reached total depth at West Tryal Rocks 3 which was drilled to further delineate the West Tryal field.

Woodside Petroleum Development Pty Ltd drilled North Rankin 6 in 124 m of water, approximately 2.1 km northwest of North Rankin 2, as an extension test to resolve structural and sedimentological uncertainties in the northwest area of the field. The well was temporarily suspended in April and re-entered to production test in September. On test, North Rankin 6 flowed at an aggregate rate of  $1.586 \times 10^6 \text{ m}^3$  of gas per day.

Woodside's Fisher 1, an offshore wildcat, was drilled to test Triassic sands in a fault block down-thrown from the Rankin Platform. Although gas shows were encountered, no commercial reservoirs were found and the well was plugged and abandoned. Hudebay Oil Australia's Lawley 1 was drilled on a postulated horst of thin Triassic rocks resting on Precambrian basement with post-Middle Jurassic Sandstones draped over the horst. The objective sandstones proved to be water-wet and the well was abandoned as a dry hole.

At the end of the year Woodside was drilling an extension test, Goodwyn 6, in the southern part of the Goodwyn "main block" to evaluate the potential of deeper Triassic Sandstone reservoirs below the present pay section.

### *Barrow Island development wells*

During 1981 only two wells (cumulative depth 2 529 m), classified as development wells, were

completed by WAPET within the Barrow Island Oil Field. The status of these wells at year end is shown in Table 2.

TABLE 2 STATUS OF BARROW ISLAND DEVELOPMENT WELLS

Well Name	Total Depth	Status	Completed on
Y14-M.....	1 273	Suspended	11/8/81
Y34-M.....	1 256	Suspended	20/8/81

*Exmouth Plateau area*

The only well drilled on the Exmouth Plateau in 1981 was Phillips Australia Oil Company's Saturn 1. Spudded in 1980, the new-field wildcat had a Late Triassic sandstone objective on a tilted fault-block closure on the east flank of the Kangaroo Syncline. It was plugged and abandoned as a dry hole after no significant hydrocarbon shows were encountered.

*Perth Basin*

In 1981, seven new-field wildcats and four extension tests were drilled in the onshore Perth Basin; offshore, one new-field wildcat was drilled. In addition, one new-field wildcat and one extension test were drilling ahead onshore at year end.

Mesa Australia Ltd drilled Point Louise 1 and Warradong 1 to test Triassic and Permian rocks in the northern Perth Basin. Point Louise 1 was drilled on the west flank of the Beagle Ridge although no closed structure had been mapped. The main targets were limestones of the Carynginia Formation, which produced gas at Woodada, and the Irwin River Coal Measures. Only minor shows of gas and oil were reported and the well was abandoned as a dry hole. Warradong 1 was drilled near the Mondarra field on a small closure at the Lower Triassic level with the objectives the basal Triassic and Wagina Sandstones. Some gas shows were encountered but only minor gas flows were achieved on testing and the well was plugged and abandoned.

WAPET drilled Ejarno 1 in Production Licence No. 1, about 4 km southeast of the Dongara gasfield, with the principal objective being Permo-Triassic sandstones in a fault trap on the downthrown side of, and adjacent to, the Mountain Bridge Fault. The target sandstones were 700 m deeper than at Dongara but slightly higher than in Mondarra. Log data suggested some gas pay but testing showed it was not recoverable and the well was abandoned.

As farminee-operator, Mesa drilled Bootine 1 south of Gingin 1 in WAPET's permit EP 24. The objective was to test the Cattamarra Coal Measures Member, which had produced gas at Gingin 1, on the northern end of the Gingin anticline, which is on the west flank of the central part of the Perth Basin.

After reaching 3 658 m the well had to be sidetracked around a fish, from 3 390 m to total depth (4 306 m). Several zones of interest were tested but mechanical problems forced a suspension of operations. A workover rig returned to the location in December and testing was proceeding at the end of the year.

Also in the northern Perth Basin, WAPET drilled North Yardarino 1 as a structural test of Triassic and Permian rocks. The location was on the downthrown side, and at the junction, of the Allanooka and Mountain Bridge Faults, 5 km north of the Dongara Field. The objective sandstones were not developed and the well bottomed in granitic gneiss at 2 199 m and was abandoned as a dry hole.

Hughes & Hughes drilled two extension tests (Woodada 3 and 4) as follow-ups to the gas discovery in fractured limestone in the Carynginia Formation (Permian) in Woodada 1 and 2; both extensions have been left as suspended gas wells pending further evaluation.

XLX N.L. drilled Mount Horner 4 and 5 and Georgina 1 as follow-ups to Mount Horner 3, which produced oil on test from Early Triassic sandstone and shale in 1980. All three wells have been left suspended for testing after reported oil shows. Georgina 1 is only 2 km south of Mount Horner but is separated from the main field by a fault.

Jervois Sulphates drilled Casuarinas 1, about 15 km north-northeast of the Dongara gas field, to test Permian and Triassic Sandstones on a faulted structural nose. No shows of hydrocarbons were encountered and the well was completed as a water well in the Yarragadee Formation.

At the end of the year two wells were operating in the onshore Perth Basin; Whicher Range 3, drilled by BP Petroleum Development Australia Pty. Ltd., and Beekeeper 1, operated by Australian Aquitaine. Whicher Range 3, in the southern Perth Basin, is a follow up to Whicher Range 1 which found gas in tight Permian sandstones on a faulted dome. Beekeeper 1 is located approximately 9 km north-northeast of Woodada 1 and was being tested at the end of the year.

The only offshore well drilled in the Perth Basin in 1981 was WAPET's Parmelia 1, located approximately 90 km southwest of Perth in 242 m of water. It tested Early Cretaceous sandstones on a palaeogeographic high but failed to find hydrocarbons, and was plugged and abandoned at a total depth of 1 770 m.

*Dongara Field development wells.*

Within the Dongara Field four development wells (including one water-disposal well), were drilled in

1981 for a total of 4 290 m of drilling. Details are shown below.

STATUS OF DONGARA FIELD DEVELOPMENT WELLS			
Well Name	Total depth (m)	Status	Completed on
Dongara 23	1 765	drilled in 1980;	10/1/81
Dongara WDW 1	652	gas well shut in	23/2/81
Dongara 24	1 808	gas well	09/4/81
Dongara 25	1 830	gas well	05/8/81

*Officer Basin*

The Shell Company of Australia Ltd, in 1981, drilled the first petroleum exploration well in the Officer Basin since 1966. Shell's Yowalga 3 was a structural test of Early Palaeozoic and Proterozoic sediments and was drilled on a WNW-ESE trending anticline thought to be salt induced. The earlier wells, Yowalga 1 and 2, had only penetrated part of the section—although the No. 2 well penetrated a short way into the Proterozoic. No hydrocarbon-bearing reservoirs were encountered.

**GEOPHYSICAL SURVEYS**

Geophysical surveys carried out in 1981 consisted mostly of seismic work. Line-kilometres of seismic surveys increased by 40% on the 1980 figure; onshore seismic work increased by about 144% and offshore seismic work, by about 14%.

Other geophysical activities included marine gravity and marine magnetic surveys carried out in conjunction with marine seismic surveys. A land-based aeromagnetic survey of 2 400 km was completed by Carr Boyd Minerals Ltd in the Eucla Basin (EP192), and Whim Creek Consolidated N.L. completed a 1 350 km land gravity survey in the Canning Basin (EP205).

*SEISMIC*

During 1981, offshore seismic surveys were conducted in the Perth Basin (1 379 km), Carnarvon Basin (9 005 km), Canning Basin (2 624 km), Bonaparte Gulf Basin (3 356 km), Browse Basin (4 660 km), and on the Exmouth Plateau (699 km). Onshore seismic surveys were conducted in the Perth Basin (1 901 km), Carnarvon Basin (115 km), Canning Basin (7 664 km), and the Officer Basin (2 252 km).

Details are as follows:

SEISMIC SURVEYS—OFFSHORE			
Basin	Tenement	Company	Line km
Perth	WA-135-P	Wainoco International Inc.	768
	WA-113-P	Strata Oil N.L.	116
	WA-115-P	Mesa Australia Ltd	13
	WA-144-P	Mesa Australia Ltd	482
Carnarvon	WA-25-P	West Australian Petroleum Pty Ltd	107
	WA-64-P	West Australian Petroleum Pty Ltd	5
	WA-59-P	Magnet Petroleum Pty Ltd	407
	WA-28-P	Woodside Petroleum Development Pty Ltd	472
Carnarvon	WA-149-P	Mesa Australia Ltd	1 908
	WA-93-P	Hudbay Oil (Australia) Ltd	1 038
	WA-59-P	Hudbay Oil (Australia) Ltd	675
	WA-155-P	Esso Exploration & Production Aust. Inc.	4 393
Bonaparte Gulf	WA-18-P	Mesa Australia Ltd	335
	WA-77-P	Magnet Metals Ltd	906
	WA-128-P	CNW Oil (Australia) Pty Ltd	600
	WA-103-P	The Shell Co. of Australia Ltd	1 515
Canning	WA-62-P	BP Petroleum Development Pty Ltd	515
	WA-137-P	BP Petroleum Development Pty Ltd	280
	WA-142-P	BP Petroleum Development Pty Ltd	850
	WA-114-P	ESP Exploration Pty Ltd	358
Browse	WA-134-P	Wainoco International Inc.	621
	WA-136-P	Conex Oil Exploration Pty Ltd	520
	WA-32-P	Woodside Petroleum Development Pty Ltd	366
	WA-33-P	Woodside Petroleum Development Pty Ltd	1 516
	WA-34-P	Woodside Petroleum Development Pty Ltd	745
	WA-35-P	Woodside Petroleum Development Pty Ltd	1 171
	WA-37-P	Woodside Petroleum Development Pty Ltd	185
	WA-104-P	Brunswick Oil N.L.	157
Exmouth Plateau	WA-96-P	Esso Exploration & Production Aust Inc.	222
	WA-97-P	Esso Exploration & Production Aust. Inc.	472
Total			21 732

## SEISMIC SURVEYS—ONSHORE

Basin	Tenement	Company	Line km
Officer	EP186,187	Swan Resources Ltd	106
	EP178-189	The Shell Co. of Australia Ltd	2 146
Perth	EP174	Mesa Australia Ltd	272
	EP224	Phoenix Oil & Gas N.L.	8
	EP204	Phoenix Oil & Gas N.L.	38
	PL-1H	West Australian Petroleum Pty Ltd	188
	EP130	BP Petroleum Development (Aust) Pty Ltd	47
	EP112	Weaver Oil & Gas Corp., Australia	194
	EP201	Lassoc Pty Ltd	67
	EP111	Jervois Sulphates (N.T.) Ltd	384
	EP23	Mesa Australia Ltd	12
	EP105	Mesa Australia Ltd	91
	EP130	Mesa Australia Ltd	388
	EP100	Mesa Australia Ltd	212
Carnarvon	EP41	West Australian Petroleum Pty Ltd	15
	EP110	Otter Exploration N.L.	100
Canning	EP126	Mesa Australia Ltd	211
	EP216	Ranger Oil (Australia) Ltd	1 250
	EP129, 104	Home Oil Australia Ltd	134
	EP239	Weaver Oil & Gas Corp. Australia	50
	EP170	ESP Interior Pty Ltd	407
	EP107	Era South Pacific Pty Ltd	181
	EP142	Wainoco International Inc.	310
	EP97	IEDC	119
	EP101	IEDC	438
	EP102	IEDC	1 328
	EP103	IEDC	804
	EP134	Mobil Oil Australia Ltd	131
	EP219	Mobil Oil Australia Ltd	679
	EP164	Meridian Oil N.L.	45
	EP175	Getty Oil Development Co. Ltd	451
	EP114	Swan Resources Ltd	463
	EP104	Esso Exploration & Production Aust. Inc.	663
Total			11 932

### GRAVITY

Several surveys were carried out in conjunction with offshore marine seismic surveys as follows:

#### GRAVITY SURVEYS—OFFSHORE

Basin	Tenement	Company	Line km
Canning	WA-62-P	BP Petroleum Development (Aust) Pty Ltd	515
	WA-137-P	BP Petroleum Development (Aust) Pty Ltd	280
	WA-142-P	BP Petroleum Development (Aust) Pty Ltd	850
Total			1 645

### MAGNETIC

Magnetic surveys were conducted in conjunction with marine seismic surveys as follows:

#### MAGNETIC SURVEYS—OFFSHORE

Basin	Tenement	Company	Line km
Perth	WA-135-P	Wainoco International Inc.	768
Canning	WA-134-P	Wainoco International Inc.	621
Total			1 389

## REFERENCE

Janssens, A., 1982, Wells drilled for petroleum exploration in W.A. to the end of 1981: West. Australia Geol. Survey Record 1982/3.