Editor
H. WOPFNER

Otway Basin Study-previous history

Rept.Bk.No. 748
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DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY

PETROLEUM EXPLORATION DIVISION

OTWAY BASIN STUDY

PREVIOUS WORK AND EXPLORATION HISTORY

BY

K. ROCHOW
ASSISTANT SENIOR GEOLOGIST
PETROLEUM SECTION

S.R. 11/5/123

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SURFACE GEOLOGY

The earliest geological investigations in the area were carried out by Woods (1862, 1866) who investigated the fauna of the Gambier Limestone in the Mt. Gambier area, and recognised the stranded coastlines and extinct volcanoes. However, it was not until 1951 that the area of the Otway Basin in South Australia was systematically mapped (Penola 4-mile sheet by Sprigg, R.C., Cochrane, G.W. and Solomon, M.). In the intervening period local and regional investigations of the surface geology were undertaken by Howchin (1901) who described the extinct volcanoes at Mt. Gambier and Mt. Schank, Tindale (1933) who related the coastal terraces in the South East to Pleistocene coastal terraces in eastern U.S.A., and Crocker (1941) who related the siliceous sand sheets and dunes to an arid phase which post dates the youngest stranded coastline. Crocker also used this concept as a basis for separating the older volcanics of the Mt. Burr region from the younger, post arid phase volcanic activity at Mt. Gambier and Mt. Schank.

More regional studies of the stranded beach dune ridges were undertaken by Hossfeld (1950) who postulated a series of marine regressions and transgressions, based primarily on the relative erosion of the dune ridges.

The most intensive survey of the surface geology was undertaken by Sprigg (1952) who recognised the complex genesis of the dune ridges which may have marine lenses separating more than one aeolianite sequence, and also locally recorded the succession of marine to non-marine sediments in the interdunal areas.

Between 1952 and 1964 no systematic surface geological mapping was carried out. However, since 1964 the surface geology of the Naracoorte 4-mile sheet area has been progressively mapped so that at this stage the whole of the Otway Basin in South Australia and the southern part of the Padthaway Ridge has been mapped.

SUBSURFACE GEOLOGY AND PETROLEUM EXPLORATION

Probably the first well to explore specifically for oil in Australia was drilled adjacent to the Otway Basin near Salt Creek in 1892 by the Salt Creek Petroleum Company. Interest in the possibility of finding hydrocarbons in commercial quantities in the South East was first aroused by the discovery of a rubber-like material known as coorongite in lagoons in the Coorong area. At that time coorongite was regarded as being derived from petroleum by some process of inspissation, but is known now to form by the decomposition of microscopic algae which secrete oily substances in the cell walls. Reports of coorongite go as far back as 1852.

Even though bedrock proved to be at a depth of only 365ft. in the initial well, several wells were later drilled in the same area between 1922 and 1933 by the Coorong Oil Company and Enterprise Oil Prospecting Company. Six holes were drilled to depths of 931, 650, 656, 701, 606, and 450 feet. Shallow bedrock was encountered below Tertiary sediments in each of these wells except the deepest which passed through 421 feet of (?)Permian glacial sediments before entering bedrock at 924 feet.

It was some years later however, before exploration began in the Otway Basin, stimulated no doubt by strandings of bitumen along that part of the coast.

The first oil exploration well within the presently defined limits of the Otway Basin in South Australia, was commenced in 1915 for the South Australian Oil Wells Company on a

site 7¾ miles east of Robe. The Robe Bore was situated on a Pleistocene aeolianite dune ridge in the belief that it represented an anticline. This well reached a total depth of 4,504 feet and provided substantial information on the sedimentary section of the basin, indicating for the first time a considerable thickness of Lower Cretaceous sediments beneath the Tertiary.

Between 1915 and World War II, wells were drilled in the Otway Basin by several companies as shown in Appendix I. Most of these are relatively shallow and all were abandoned within Tertiary Knight Group sediments without encountering satisfactory showings of hydrocarbons. However, many of the wells were sited on mapped, or at least inferred surface structures in an area of thick sediments. The same cannot be said for several wells drilled in the Kingston area during the same period, one of which was taken to 2,660 feet, after entering basement at 484 feet.

The unsatisfactory nature of many of the well-sites may be a reflection of the scarcity of significant outcrops with the resultant limited knowledge of sub-surface structure and stratigraphy. In the absence of surface information, more sophisticated methods are required to determine the subsurface geology. The first of these was an airborne magnetometer survey flown in 1949 for the Zinc Corporation Ltd. This survey delineated the shallow basement area of the northern margin of the basin.

At about the same time the South Australian Department of Mines undertook a regional gravity survey of the Otway Basin. This survey delineated areas of deeper basement of the Robe-Penola Trough and areas of shallower basement from Kalangadoo to Beachport.

Between 1949 and 1953, the Otway Basin was the object of a joint study between officers of the South Australian and Victorian Geological Surveys. This resulted in publication of a report on the petroleum potential of the Gambier

Sunklands (Sprigg and Boutakoff, 1953) which summarised the surface and subsurface geological information available at that time.

In a previous publication (Sprigg, 1952) the approximate northern boundary of the Otway Basin was defined by an inferred fault along the southern side of the Padthaway Ridge, thus severing the "Gambier Sunklands" (Otway Basin) from the Murray Basin, especially with reference to the pre Tertiary sediments.

Subsequently a more detailed account of the subsurface geological information of the Otway Basin area was included in the Hydrology of the Murray Basin by O'Driscoll (1960). Later a comprehensive account of the stratigraphy was published (Ludbrook, 1961).

At about the time of the above publications, when the overall geology of the Otway Basin was becoming better known, activ e exploration for hydrocarbons resumed. General Exploration Co. of Australia ob ained a lease on all of the onshore area of the basin in 1959. The first well was commenced in 1961 by Oil Development N.L. under a farmout agreement with the lessee. At about the same time, the South-East Oil Syndicate drilled a well in the Beachport Farmout. Subsequently, in 1963, Beach Petroleum N.L. completed Geltwood Beach No. 1 in the Mayurra Farmout. During this phase of exploration, which is continuing at the present time, the wells were sited on structures determined sometimes by shallow structural drilling or by seismic and gravity surveys, rather than on surface geology. At the same time the emphasis shifted from Tertiary sediments to deeper targets in the Upper and Lower Cretaceous Sediments. The total footage of the wells drilled between 1960 and 1967 (See Appendix I), is 77,189 feet which considerably exceeds the total footage drilled in the previous 68 years. No significant showing of hydrocarbons has been encountered, but two wells (AODANL Kalangadoo No. 1 and AODANL Caroline No. 1) each

yielded flows of several million cubic feet per day of carbon dioxide. Kalangadoo No. 1 produced from fractured pre-Mesozoic sediments, whereas Caroline produced from depths between 8,200 and 9,200 feet in Lower Cretaceous sediments which are referable to the Waarre Formation. A further impetus to exploration was the discovery in 1962 of marine Upper Cretaceous sediments in ODNL Mt. Salt No. 1.

Also during the period since 1960, extensive seismic surveys have been carried out onshore, principally by the South Australian Mines Department and Alliance Oil Development. Further local gravity surveys have been completed for Alliance Oil Development also.

Offshore, the continental shelf has been comprehensively covered by aeromagnetic and seismic surveys by Haematite Explorations and Esso Australia. Consequently a considerable amount of new data is available. Under a farmout agreement with Haematite, Esso Australia plan to commence drilling an offshore well during the second half of 1967.

Concurrently with the present upsurge of activity a further joint appraisal of the Otway Basin by the South Australian and Victorian Geological Surveys began in 1964. In South Australia those contributing to the study include Dr. N.H. Ludbrook, Dr. H. Wopfner, W. Harris, W. Kendall and K. Rochow.

KR:CM
9.1.1968

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APPENDIX I

WELL SUMMARY TABLE OF ALL OIL WELLS WITHIN OR IMMEDIATELY ADJACENT TO THE PRESENT AREA OF O.E.L. 22

Well Name	Company	Hundred	Section	Log	Year
Bore A	Salt Creek Petroleum Co.	Messent	22	0' - 365' Tert.-Rec. seds. 365' - 922' Slate bedrock and ended in red chrystalline limestone	1892
	Adelaide Oil Exploration Co.	Riddoch	9	0' - 1045' Knight Gp. basalt between 319'- 459'	? 1915
Robe Bore	South Australian Oil Wells Co.	Waterhouse	714	0' - 145' Pleist.-Rec. 145' - 510' Gambier Limestone 510' - 1400' Knight Gp. 1400' - 4504' Otway Gp.	1915/16
	South Australian Oil Wells Co.	Hindmarsh	195	0' - 392' Gambier Ls. 392' - 420' ? 420' - 1532' Knight Gp.	? 1918/19
	South Australian Oil Wells Co.	Caroline	598	0' - 818' Gambier Ls. 818' - 839' Knight Group	? 1920
	South Australian Oil Wells Co.	Caroline	337	0' - 575' Gambier Ls. 575' - 1226' Knight Group	C. 1920
	South Australian Oil Wells Co.	Caroline	336	0' - 510' Gambier Ls. 510' - 1824' Knight Group	C. 1921
	Southern Ocean Oil Co.	Lacepede	42	0' - 775' Tertiary 775' - 1170' ?	Pre 1922
	South Australian Oil Wells Co.	Caroline	543	0' - 527' Gambier Ls. 527' - 1561' Knight Group	C. 1922
Bore N.	Coorong Oil Coy.	Messent	1	0' - 503' Tert.-& Rec. seds. 503' - 924' Tillite (Perm-Carboniferous) 924' - 931' Slate (Pre-Cambrian)	1922

Well Name	Company	Hundred	Section	Log	Year
Bore No. 1	Coorong Oil Coy.	Santo	B	0' - 190' Rec. & Tert. seds. 190' - 650' Phyllitic Slate T.D. 650'	1924
Bore No. 2	Coorong Oil Coy.	Santo	B	Rec. & Tert. Seds. T.D. 625'	1924
Bore No. 3	Coorong Oil Coy.	Santo	B	Rec. & Tert. Seds. T.D. 701'	1924
Bore No. 1(B)	Enterprise Oil Coy.	Messent	22	0' - 120' Sand 120' - 200' Repetition of sandstone gravel limestone and oyster bed. 200' - 400' Carbonaceous clay 400' - 440' Lignite 440' - 518' White Clay 518' - 620' Slate bedrock	1932
Bore No. 2(A)	Enterprise Oil Coy.	McNamara	9	0' - 36' Sand (Sub Rec. to Pleistocene) 36' - 200' Sand and clay (Upper Pliocene-Werrikooian) 200' - 234' Polyzoal limestone (Miocene) 234' - 244' Glauconitic marl with foraminifera 244' - 400' Lignite beds with clay and sand 400' - 450' Schist Bedrock T.D. 450'	1933
	Associated Oil Co.	Blanche	301	0' - 142' Gambier Ls. 142' - 2110' Knight Gp.	1923/26
	Southern Ocean Oil Co.	Lacepede	507	0' - 215' ?Gambier Ls. 215' - 484' Knight Group 484' - 2660' Precambrian	1925
Comaum Bore	Pt. Addis Oil Wells N.L.	Comaum	½ mile E of 307	0' - 344' Gambier Ls. 344' - 509' Knight Group 509' - 1170' Otway Gp.	1926

Well Name	Company	Hundred	Section	Log	Year
Knight Dome Bore No. 2	Oil Search Limited	Blanche	170	0' - 68' Gambier Ls. 68' - 2013' Knight Group	1930
	Amalgamated Oil Wells	Murrabinna	10B	0' - 160' Recent-Pleistocene 160' - 170' Gambier Ls. 171' - 281' Knight Group 281' - 1365' Bedrock (slate)	?
	Enterprise Oil Prospecting Co.	Lacepede	446N	0' - 186' Pleistocene 186' - 204' ? Compton Cong.	1933
	Enterprise Oil Prospecting Co.	Lacepede	442NE	0' - 103' Pleistocene-Recent 103' - 142' Compton Cong. 142' - 336' Knight Gp. 336' - 466' Bedrock	1934
				[illegible]	
	South Australian Producers Oil Bore	Blanche	150	0' - 210' Gambier Ls. 210' - 1220' Knight Group TOTAL FOOTAGE DRILLED PRE 1960 =	1940-?1944
Tarpeena Bore	Kaniva Syndicate	approx. 5 mls. E of Nangwarry		0' - 400' Gambier Ls. 400' - 2040' Knight Group	1960
ODNL Penola No. 1	Oil Development N.L.	Penola	500	0' - 35' Pleistocene 35' - 250' Gambier Ls. 250' - 300' Compton Cong. 300' - 1040' Knight Group 1040' - 3380' Otway Group 3380' - 4200' " 4200' - 4985' Upper Jurassic	1961
SEOS Beachport No. 1	South-East Oil Syndicate Ltd.	Lake George 37°26'55"S 140°02'15"E	20	0' - ?280 Pleistocene - Recent 280' - 840' Gambier Ls. 840' - 900' Lacepede Fm. 900' - 1820' Knight Group 1820' - 1910' Sherbrook Group 1910' - 3963' Otway Group	1961

Well Name	Company	Hundred	Section & Coords.	Log	Year
ODNL Mt. Salt No.1 Structure Holes	Oil Development N.L. Aust. N.L.	McDonnell	37°78'07"S 37°57'25"S 140°37'43"E	0' - 480' Gambier L.s. 480' - 590' Buccleuch Group 590' - ?3260' Knight Group ?3260' - 10044' Sherbrook Group	1962
ODNL Mt. Salt No.1 Structure Holes	Oil Development N.L. Aust. N.L.	McDonnell	37°58'07"S 140°38'24"E	No. 1 Structural Hole 0-640 Gamb. L.s. 640-690 Buccleuch Gp. 690-1007 Knight Gp.	1962
		"	37°57'22"S 140°37'41"E	No. 2 " " 0-390 Gamb. L.s. 390-460 " 460-998 Knight Gp.	
		"	37°56'35"S 140°36'54"E	No. 3 " " 0-610 Gamb. L.s. 610-710 " 710-997 Knight Gp.	
		"	37°57'03"S 140°38'24"E	No. 4 " " 0-500 Gamb. L.s. 500-530 " 530-997 Knight Gp.	
		"	37°57'39"S 140°37'04"E	No. 5 " " 0-660 Gamb. L.s. 660-710 " 710-997 Knight Gp.	
B.P. Geltwood Beach No.1	Beach Petroleum N.L.	Mayurra	37°39'44"S 140°14'35"E	0' - 910' Gambier Ls. 910' - 930' Lacepede Fm. 930' - 970' Kongorong Sand 970' - 1920' Knight Group 1920' - 3680' Sherbrook Group 3680' - 12301' Otway Group	1963
B.P.N.L. Geltwood Beach No. 1 Structure Holes	Beach Petroleum N.L.	Mayurra	37°40'14"S 140°15'08"E	No. 1 Structural Hole 0- 59 Plst.-Rcnt. 1104-1111 Buccleuch Group 59-1104 Gambier L.s. 1111-1150 Knight Gp.	1962-63
			37°39'51"S 140°14'00"E	No. 2 " " 0- 66 Plst.-Rcnt. 890-902 " 66 890 Gambier L.s. 902-1210 Knight Gp.	
			37°38'56"S 140°12'57"E	No. 3 " " 0- 58 Plst.-Rcnt. ?899- 909 " 58- 899 Gambier L.s. 909-1210 Knight Gp.	
			37°39'02"S 140°14'58"E	No. 4 " " 0- 66 Plst.-Rcnt. 900- 919 66- 900 Gambier Ls. 919-1210 Knight Gp.	

Well Name	Company	Hundred	Section & Co-ords.	Log	Year
B.P.N.L. Geltwood Beach No. 1 Structure Hole (contd.)	Beach Petroleum N.L.	Mayurra	37°48'39"S 140°15'36"E	No. 5 Structural Hole: 0- 80 Pleistocene 80-900? Gambier L.s. 900- 904 Buccleuch Gp. 904-1210 Knight Gp	1962-63
			37°38'33"S 140°14'00"E	No. 6 " " : 0- 45 Pleistocene 45-1358 Gambier L.s. ?1358-1368 Buccleuch Gp. 1368-1415 Knight Gp.	
			37°37'20"S 140°14'30"E	No. 7 " " : 0- 105 Plst.-Rcnt. 105-1245 Gambier L.s. 1245-1256 Buccleuch Gp. 1256-1610 Knight Gp.	
			37°37'04"S 140°12'57"E	No. 8 " " : 0- 50 Plst.-Rcnt. 50-990 Gambier L.s. 990-1009 Buccleuch Gp. 1009-1353 Knight Gp.	
			37°36'38"S 140°09'52"E	No. 9 " " : 0- 68 Plst.-Rcnt. 68-940 Gambier L.s. 940-960 Buccleuch Gp. 960-1390 Knight Gp.	
AOD Kalangadoo No. 1	Alliance Oil Develop. Aust. N.L.	Grey	Allot 95 37°34'40"S 140°41'40"E	16' - 465'? Gambier Limestone 465' - 1992' Knight Group 1992' - 2494' Sherbrook Group 2494' - 2836' Waarre Fm. Equiv. 2836' - 6765' Otway Group 6765' - 9049'? Palaeozoic	1965
AODANL Caroline No. 1	Alliance Oil Devel. Aust. N.L.	Caroline	Allot. 573 37°56'30"S 140°54'30"E	16' - 26' Quaternary 26' - 640' Gambier Fm. 640' - 682' Nelson Fm. Equiv. 682' - 3040' Dilwyn Fm. 3040' - 3123' Pebble Pt. Fm. 3123' - 3970' Curdies Fm. 3970' - 7072' Paaratte Fm. 7072' - 8080' Belfast Fm. 8080' - 8179' Transition Unit 8179' - 9320' Waarre Fm. 9320' - 9490' Transition Unit 9490' - 11061' Eumeralla Fm.	1967 21.2.67

Well Name	Company	Hundred	Section & Co-ords.	Log	Year
AODANL Robertson No.1	Alliance Oil Devel. Aust. N.L.	Killanoola	408 37°11'23"S	15' - 16' Rec. 16' - 241' Glenelg Gp. 241' - 345'? Lacepede Fm. equivalent 345' - 933' Knight Gp. 933' - 5570' Otway Group 5570' - 5790' Un-named 5790' - 5900' Trachyte unit	1967 14.3.67
AODANL Robertson No.2	Alliance Oil Devel. Aust. N.L.	Robertson	142 37°10'20"S 140°45'40"E	15' - 16' Rec. 16' - 422' Glenelg Gp. 422' - 485' ?Lacepede Fm. 485' - 807' Knight Gp. 807' - 4244' Otway Gp. 4244' - 4760' Un-named 4760' - 4916'? Palaeozoic detrital zone 4916' - 4938'? Palaeozoic	1967

TOTAL FOOTAGE DRILLED SINCE 1960 = 77,189 FEET

Note: The formation names and formation boundaries in the above table are taken directly from the various well completion reports and Department of Mines Files without modification, except that in some instances an effort was made to bring the nomenclature up to date.

OTWAY BASIN

Reduce to inches

LOCALITY MAP SHOWING OIL EXPLORATION WELLS

36° 00 | 140° 00 | 140° 30 | 141° 00

139° 30

36° 30

37° 00

37° 30

38° 00

THE COORONG

ALFRED FLAT

SALT CREEK
656′
701′
650′

Coorong Oil Co.
931′

Salt Creek Petroleum Co.
922′

Enterprise Oil Co.
606′

Enterprise Oil Co.
450′

Coorong Oil Co.

KEITH

Railway

BORDERTOWN

AUSTRALIA

Hd. Peacock
Sect. 30

PADTHAWAY

FRANCES

BLACKFORD
Amalgamated Oil Wells
1365′

Enterprise Oil Co.
466′

Enterprise Oil Co.
204′

KINGSTON

Approximate limit of Lower Cretaceous sediments.

Southern Ocean Oil Co.
2660′

Southern Ocean Oil Co.
1170′

Cape Jaffa

AVENUE

LUCINDALE

NARACOORTE

Railway

STRUAN

A.O.D.A.N.L.
Robertson No.1
4938′
No.2
5900′

ROBE

S. A. Oil Wells Co.
Robe Bore
4504′

O.D.N.L.
Penola No.1
4985′

PENOLA

S.E.O.S.
Beachport No.1
3963′

BEACHPORT

Railway

Adelaide Oil Expl. Co.
1045′

A.O.D.A.N.L.
Kalangadoo No.1
9049′

KALANGADOO

MILLICENT

B.P.N.L.
Geltwood Beach
No.1 12301′

S.A. Oil Wells Co.
1532′

Producers Oil Bore
1220′
1200′

Associated Oil Corp.

2013′
Oil Search Ltd.

MT. GAMBIER

O.D.N.L.
Mt. Salt No.1
10044′

A.O.D.A.N.L.
Caroline No.1
11061′

S.A. Oil Wells Co.
1286′
1824′
1561′
839′
4 Bores

SOUTHERN OCEAN

VICTORIA

SOUTH AUSTRALIA

REFERENCE

Oil Exploration Well
(Location and total depth) ---------- S.A. Oil Wells Co. 1532′

Igneous Outcrops ----------

SCALE

MILES 0 10 20 30 40 MILES

67—804

K. Rochow Assistant Senior Geologist

S.A.Department of Mines