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WELL COMPLETION REPORT

NORTH SEASPRAY NO. 1

by
Frank T. Ingram

ARCO LIMITED / WOODSIDE (LAKES ENTRANCE)
OIL CO. N. L.

NORTH SEASPRAY NO. 1 WELL

FINAL WELL REPORT

by

FRANK T. INGRAM
ARCO LIMITED.

C O N T E N T S

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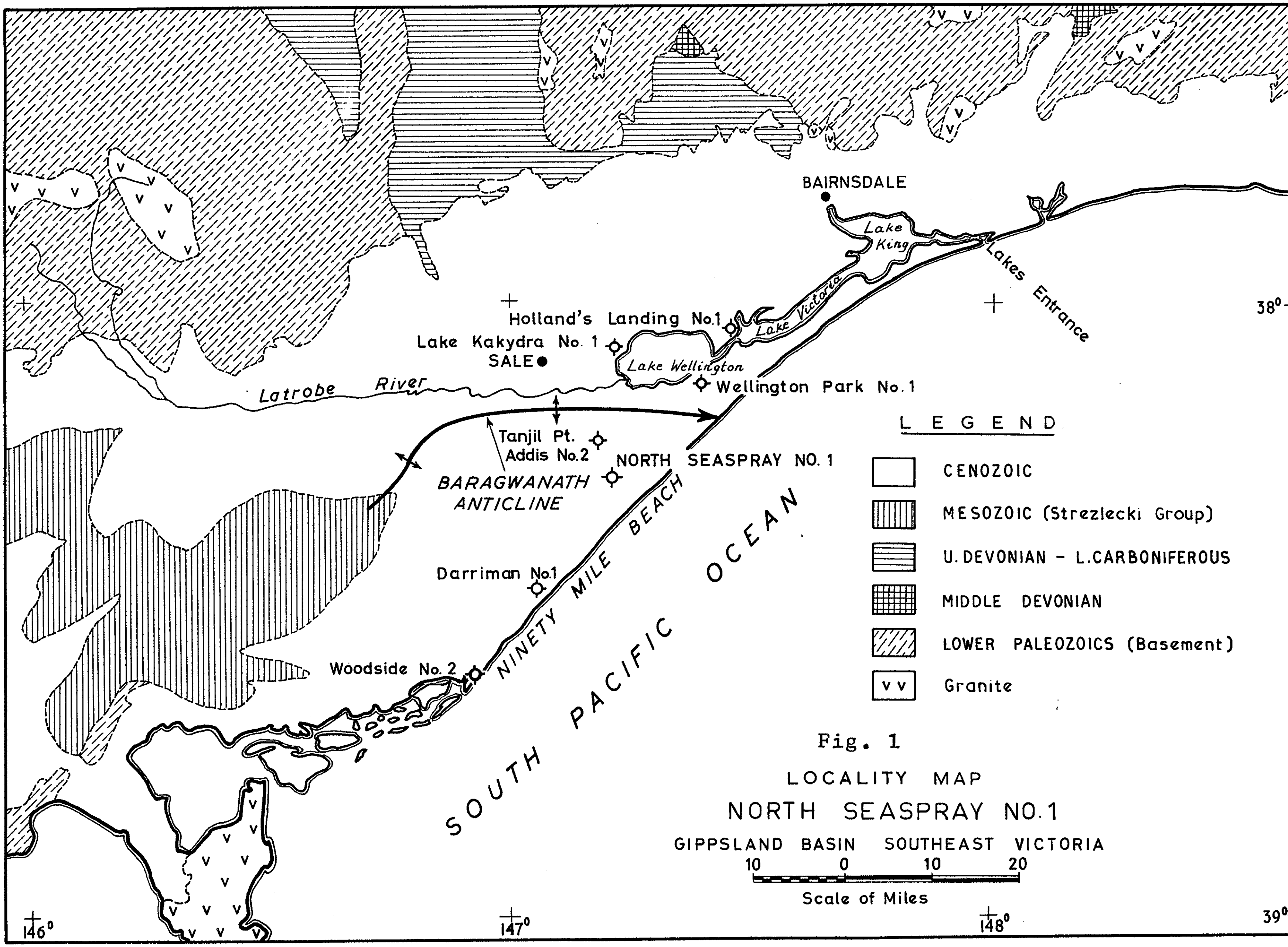


Fig. 1

LOCALITY MAP

NORTH SEASPRAY NO.1

GIPPSLAND BASIN SOUTHEAST VICTORIA

SUMMARY

The North Seaspray No. 1. well was drilled in the Gippsland Basin by Arco Limited as Operator in partnership with Woodside (Lakes Entrance) Oil Co. N.L. to the projected depth of 4500 feet, and then deepened to 5000 feet. The well was spudded on November 21, 1962, and temporarily abandoned on December 21, 1962. The well encountered Tertiary and Mesozoic strata typical of the western part of the basin.

Several gas shows were detected between 3700 and 3800 feet by the mud logging unit. These shows were tested in open hole and through perforations in 7 inch casing. Petroliferous gas was produced from a sandstone in the interval 3768 - 3772 feet at the estimated rate of 50 to 100 MCF/D. The flow from this zone was slightly less when produced through perforations than in open hole.

The gas shows were found in the upper part of the Strzelecki group. Mud filtrate invasion may have reduced the permeability of the kaolinitic sandstones in this section.

INTRODUCTION

During the early part of 1962 a seismic reflection survey located an east-west trending anticline approximately 5-1/2 miles north of Seaspray in the Gippsland Basin of Victoria. A normal fault cuts this structure on the north flank. Closure against the fault was determined to be approximately 300 feet.

A location was staked near the structural high of the anticline. The well was projected to 4500 feet in order to test the sands of the Latrobe Valley Coal Measures and the sandstones and graywackes of the Strzelecki Group.

Shows of oil in the Woodside No. 1 and 2 wells, and in the Lakes Entrance area, indicate a source of petroleum in the basin, probably in the area south of the coast line. The possibility of a marine facies of the Latrobe Valley Coal Measures beneath Bass Strait is one postulated source. Another postulated source is a marine Cretaceous wedge south of the coast line similar to that found in the Otway Basin in south-western Victoria.

It was hoped that oil or gas had migrated north from the source beds and become trapped in the anticlinal structure. In the North Seaspray structure highly porous sands overlain by the impervious shales of the Lakes Entrance Formation are structurally situated to form an excellent trap for any oil or gas migrating from the south.

The well was drilled as a joint operation between Arco Limited and Woodside (Lakes Entrance) Oil Co. N.L. with Arco being the Operator.

WELL HISTORY.

GENERAL DATA

Well Name and Number	:	NORTH SEASPRAY NO. 1.
Location	:	Latitude 37°52'6" South Longitude 147°21' 58" East 5½ miles northeast of Seaspray. Gippsland Basin, Victoria (See locality map)
Name and Address of Tenement Holder	:	Lakes Oil Limited, 792 Elizabeth Street, Melbourne, Victoria.
Details of Petroleum Tenement	:	Petroleum Prospecting Licence No. 160, Victoria.
District	:	Gippsland, Victoria.
Total Depth	:	5,000 feet Driller 4,999 feet Schlumberger
Date Drilling Commenced	:	November 21, 1962
Date Drilling Completed	:	December 13, 1962
Date Well Temporarily Abandoned	:	December 21, 1962
Date Rig Released	:	December 21, 1962
Drilling Time in Days to Total Depth	:	26
Elevation (above M.S.L.)	:	Ground 77 feet Kelly Bushing 88 feet
Status	:	Temporarily abandoned, cement plug in 7" casing 4310' - 4498', Baker bridge plug in 7" casing at 3700 feet, cement plug from 20 to 40 feet (reference kelly bushing) and steel plate with 2 inch valve welded above Braden head
Cost	:	Not available

DRILLING DATA

Name and Address of Drilling Contractor	:	Reading and Bates (Australia) Pty. Ltd. 2 City Road Melbourne, S.C.4., Victoria

Drilling Plant :	Make	National
	Type	50
	Rated capacity	7500 feet with 4-1/2 inch drill pipe
	Rated capacity	10,000 ft. with 3-1/2 inch drill pipe
	Motors	(2) General Motors 6-71 twin model diesel, 504 BHP each
Mast :	Make	Lee C. Moore
	Type	131 feet Cantilever
	Rated capacity	550,000 pounds
:	Make	National
	Type	1 - C250 1 - C150-B
	Size	7-1/4" x 12"
	Pump Motors	Make General Motors Type 6-71 twin diesel BHP 312
Blowout Preventer Equipment :	Make	Cameron (2)
	Size	12"
	Series	900
	Make	Hydril
	Size	12"
	Series	900
Hole Sizes and Depths :	17-1/2"	0 - 30 feet
	12-1/4"	30 - 512 feet
	8-3/4"	512 - 5000 feet
Casing and Liner Details :	Size	13-3/8"
	Weight	48 pound/foot
	Grade	H-40
	Range	2
	Setting Depth	30 feet
	Size	9-5/8"
	Weight	36 pounds/foot
	Grade	J-55
	Range	2
	Setting Depth	512 feet
	Size	7"
	Weight	26 pounds/foot
	Grade	N-80
	Range	2
	Setting Depth	4535 feet

Casing Cementing Details:	Size	13-3/8"
	Setting depth	30 feet
	Quantity cement used	30 sacks
	Cemented to	surface
	Method used	mixed and poured by hand.
	Size	9-5/8"
	Setting depth	512 feet
	Quantity cement used	210 sacks
	Cemented to	surface
	Method used	plug
	Size	7"
	Setting depth	4535 feet
	Quantity cement used	340 sacks
	Cemented to	2900 feet
	Method used	plug

Drilling Fluid: Type — Water base, bentonite, low pH

Average weight:	Depth	Weight
	30 - 512 feet	8.8 lbs/gal.
	512 - 1000 "	9.2 " "
	1000 - 2000 "	9.4 " "
	2000 - 3000 "	9.5 " "
	3000 - 4000 "	10.2 " "
	4000 - 5000 "	10.1 " "

The spud mud used to drill the surface hole was a low weight, low viscosity fresh water bentonite mud. After drilling out below the surface casing at 512 feet the viscosity was gradually built up to about 50 seconds/quart, and the water loss was decreased to about 6 cc/30 min. The viscosity and water loss were controlled by the use of bentonite, Lo-Vis and CMC (Tylose B77). The pH of the mud system was maintained by the use of caustic soda.

Cement contamination was controlled by soda ash and bicarbonate of soda. Lost circulation was encountered while drilling at 3773 feet, and this was successfull controlled by additions of sawdust obtained locally.

Except for minor lost circulation no unusual conditions or difficulties were encountered.

The average weekly analysis of the drilling mud is listed below:

Week ending	Viscosity Sec/qt.	Weight lbs/gal.	W.L. cc/30 min.	pH	F.C.
27/11/62	47	9.4	6.6	9.1	2/32"
4/12/62	50	10.3	10.2	8.5	2/32"
11/12/62	68	9.7	6.4	10.5	2/32"
18/12/62	75	9.8	6.3	10.6	2/32"

Water Supply:

A water well was drilled on the edge of the well site to a depth of 110 feet with a percussion type rig. Six inch casing was set at 90 feet, and 20 feet of plastic screen was set below the base of the casing. A Pomona Pump assembly powered by a Southern Cross diesel engine was installed in the well. The well was tested at the rate of 600 barrels per day, and there was no shortage of water during the operations.

Perforating and Shooting Record:

	Intervals	
7" Casing -	3630' - 3636'	4 shaped charges per foot
	3735' - 3741'	" " " "
	3752' - 3758'	" " " "
	3768' - 3774'	" " " "
	4407' - 4419'	" " " "

Plugging Back:

After reaching 4500 feet a cement plug was set at 3840 to 3940 feet using 47 sacks of construction cement. The top of this plug was found at 3782 feet and then drilled out to 3810 feet in order to retest the gas bearing sandstone at 3758 to 3772 feet. A drill stem test in the interval 3755 - 3810 feet, 24 hours after the plug was spotted, failed because soft cement plugged the perforations in the tail pipe.

After the test a bit was run in the hole to drill off the top of the plug for a second attempt at testing the gas zone, but the plug was not set-up and the bit went through the plug without finding any firm cement. It was decided not to attempt any more cement plugs but to set 7 inch casing to test through perforations.

After testing at 4407 - 4419 feet a cement plug was set at 4310 - 4498 feet in order to test above the plug.

After test No. 10 a Baker bridge plug was set at 3700 feet in order to test above the plug.

Fishing Operations :

No fishing operations were conducged.

Side Tracked Hole :

The plug was not side-tracked.

LOGGING AND TESTING

Ditch cuttings :

Cuttings were collected after passing over the shale shaker, then washed and placed in sample bags. Cuttings were collected at intervals of 10 feet while drilling and 5 feet while coring.

Coring:

A total of 6 cores were taken comprising a footage of 93 feet. A total of 46.5 feet were recovered for a recovery of 50%.

The original coring program was for four cores, two in the Latrobe Valley Coal Measures and two in the top of the Strzelecki Group. The cores were planned so as to determine the presence, or absence, of hydrocarbons in porous zones.

The cored intervals were as follows : 1954-1973 feet, 2020-2038 feet, 2737-2757 feet, 3213-3223 feet, 3484-3504 feet, 3765-3771 feet. Core number 1 was taken at the top of the coal measures, but recovered only coal. Core number 2 was taken a few feet below number 1 and recovered sand and coal. Core number 1 was designed to investigate the first sand at the top of the coal measures, but when no sand was recovered in this core a second one had to be taken.

Cores Nos. 3, 4 and 5 were taken at depths approximately the same as shown on the original coring program. Core number 6 was taken in order to investigate the presence of hydrocarbons indicated when a gas show was encountered. The description of these cores can be found in appendix 5.

Side-Wall Sampling :

A total of 34 side-wall cores were taken in three runs using the Schlumberger side-wall coring gun. Recovery was fair to good. These cores are described in appendix 5.

Electrical and Other Logging

The well was logged from 517 feet to the total depth of 5,000 feet by a Schlumberger truck-mounted logging unit. The electrical log, microlog with microcaliper and sonic log were run over the above interval. In addition the continuous dip-meter log was run in the interval 1700' to 5000', the gamma ray log with collar locator in the interval 2900 to 4440 feet and the temperature log in the interval 2000 to 4444 feet.

A mud logging caravan, leased from Oil Development N.L., was in operation while drilling from 30 feet to total depth. The logging unit was operated by two geologists - Frank Ingram and Nelson Meyers - working 12 hour shifts. Details of the logging are given in appendix 1.

Drilling Time and Gas Log :

The drilling time was recorded by a geolograph located on the rig floor, and also by an Esterline Angus drilling rate recorder located inside the mud logging caravan.

The gas content of the drilling mud was logged continuously from 30 feet to the total depth of 5000 feet using a Johnson Williams gas detector in conjunction with a Minneapolis Honeywell "Brown" recorder. The gas curve on the composite log is the result of this logging.

Formation Testing :

A total of 5 open hole drill stem tests were made, 3 of which were successful. The remaining two failed because of poor hole conditions. A Johnston type "E" testing tool with a 7-1/4 inch packer for testing in 8-3/4" hole was used for all open hole tests.

Six formation tests were made inside 7" casing with a Halliburton RTTS hydro-spring test tool run on 2-7/8" tubing. These tests were all successful. Petroliferous gas was produced during one open hole test and during 4 tests through perforations in 7" casing. The gas on all these tests originated from the same zone at 3768-3772 feet (microlog depth).

In brief the formation tests were as follows :

DST. No. 1. 2021' - 2041' - packer failed, recovered 1000 feet of drilling mud.

DST. No. 2 3727' - 3771', rec. 28 ft. of drilling mud, no oil or gas.

DST. No. 3. 3765' - 3795' - petroliferous gas to surface in 13 min., approx. flow 50 -100 MCF/D. recovered 3285 feet of drilling mud (retaining valve failed while coming out of hole), no oil or water.

DST. No. 4 4415' - 4501', recovered 295 feet of drilling mud, no oil, gas or water.

DST. No. 5 3755' - 3810', tail pipe set on cement plug at 3810 feet, cement plug failed to hold, perforations plugged.

TEST NO. 6 4407' - 4419' through perforations in 7" casing. recovered 140 feet of slightly gas cut mud, no free gas, oil or water.

TEST NO. 7 3768' - 3774' through perforations in 7" casing. petroliferous gas to surface in 1 hour and 15 minutes, flow less than 100 MCF/D. recovered 150 feet of slightly gas cut mud.

TEST NO. 8 3768' - 3774' through perforations in 7" casing after acidizing formation, petroliferous gas to surface in 35 minutes, flow less than 100 MCF/D, no recovery of fluid.

TEST NO. 9 3768' - 3774' through perforations in 7" casing. weak blow diminishing to no blow in 10 minutes. No gas to surface, no recovery of fluid.

TEST NO. 10 3752' - 3758', 3735' - 3741' and 3768' - 3774' through perforations in 7" casing, petroliferous gas to surface in 1 hour 45 minutes. flow less than 100 MCF/D. Recovered 360 feet drilling mud.

TEST NO. 11 3630' - 3636', perforations in 7" casing, no gas to surface, recovered 240 drilling mud slightly gas cut in bottom 40 feet.

See appendix 2 for detailed description of formation tests.

Deviation Surveys :

Deviation surveys to determine the hole deviation from vertical were made by running the standard Totco instrument on a wire line, or by dropping the instrument down the drill pipe before making a trip for a new bit.

The vertical deviation gradually increased to 1-1/2° from surface to the top of the Mesozoic section at 3623 feet. From 3623 feet the deviation increased to 3° at 4228 feet, and below this depth varied from 1-1/4° to 3°. No crooked hole problems were encountered.

The direction of deviation from the surface to 3623 feet was to the east, and from 3623 feet to 5000 feet to the southwest.

Temperature Surveys :

A temperature survey was made after setting 7 inch casing at 4535 feet. The top of the cement was found at 2900 feet on the temperature log.

See appendix 3 for a plot showing temperatures versus depth.

Other temperatures determined by Schlumberger are listed below:

Depth	Temperature
4500 feet	108°F
4998 "	118°F

These temperatures were taken by a thermometer in the microlog sonde approximately 6 hours after circulation was stopped.

Other Well Surveys :

No well surveys were made other than those listed above.

GEOLOGY

SUMMARY OF PREVIOUS WORK :

Geological and Drilling :

Before the drilling of the North Seaspray No. 1 well was begun, logs, cores and cuttings of wells in the area were studied in order to anticipate the thickness and lithology of the sediments in the Seaspray area. The most significant of these wells are : Tanjil-Point Addis No. 1, Darriman No. 1, Wellington Park No. 1, Hollands Landing and Wurruk Wurruk. All of these wells penetrated the Tertiary section and part of the thick Lower Cretaceous Strzelecki Group.

The deepest well (12,011) feet in the area, the Arco-Woodside Wellington Park No. 1, penetrated a total of 8,226 feet of the Strzelecki Group, without reaching the base of the unit. This well, completed early in 1962, holds the record as the deepest well in the State of Victoria.

No field geological work was done in the Seaspray area as the surface is covered with late Pliocene and Quaternary sand, gravel and clay which do not sufficiently reflect the subsurface structural conditions to warrant surface mapping.

Various reports on the geology of the Tertiary sediments and the Strzelecki Group, as exposed in the Carrajung uplift, were used to better understand the regional geology of the Gippsland Basin.

Because of the numerous wells and reliability of seismic reflections in the Tertiary section, the structural and stratigraphic conditions of the Tertiary sequence in the basic can usually be predicted with a fair to good degree of accuracy.

Geophysical :

In 1962 a seismic reflection survey consisting of 191 miles of traverse was made from the Lake Wellington area south-west to the Woodside No. 2 well. This survey was conducted by Austral Geo Prospectors Pty. Ltd. and tied into a previous survey by the same company in the Lake Wellington area.

During this survey the North Seaspray structure was located, and several lines were shot across the structure to definitely establish closure along this east-west trending anticline.

Seismic methods yield reliable results in the Tertiary section; but, because of the lack of good reflecting horizons in the thick homogenous Strzelecki Group, the pre-Tertiary structural framework is still not well known. The only source of positive information in this section is from well logs and outcrops. See appendix 1 for velocity survey of the North Seaspray No. 1

SUMMARY OF THE REGIONAL GEOLOGY.

The Gippsland Basin is one of several small basins along the south coast of Australia. The basin is defined and delineated by the presence of Tertiary coal measures and marine sediments. The basin proper can be considered as that area west of the Lakes Entrance granite high, south of the Tertiary - Paleozoic contact on the north side of the basin and east of a line between the Wilson's Promontory granite and the town of Warragul. The position of the south Boundary of the basin is not known as it lies in the area of Bass Strait.

The Paleozoic subsurface is probably very much like the area of Paleozoic outcrops on the north side of the basin. Ordovician and Silurian sediments, altered by dynamic metamorphism and intruded by granite, probably underlie Mesozoic strata over most of the basin. Preserved, highly folded marine strata of Middle Devonian age occur as erosional remnants, or down-faulted blocks, north of the eastern half of the basin. Isolated occurrences of Middle Devonian rocks could be expected in the subsurface in the eastern half of the basin. Overlying these altered and highly folded older Paleozoic rocks on the northern side of the basin is a thick continental sequence of red shales, sandstones, conglomerates and volcanics of Upper Devonian - Lower Carboniferous age. These beds are slightly to moderately folded and probably extend south at least as far as the Lake Wellington area.

No Permian sediments are known in the subsurface of the basin. However, conglomerate, exposed along a major fault on the south side of the Carrajung uplift, is thought to be glacial tillite of Permian age.

The major structural trend in the Tasman geosyncline is north-south, and as the Paleozoic rocks in the sub-surface of the Gippsland Basin are an extension of this geosyncline, then the same trend is thought to persist.

No sediments of Triassic age are know in the Gippsland Basin.

The Upper Jurassic and Lower Cretaceous times are represented by the Strzelecki Group, a thick sequence of non-marine sediments deposited in an east-west trending trough, or graben. The thickness of this sequence is not known, but the Wellington Park No. 1 well penetrated 8,226 feet with no indication of reaching the base. Estimates of the thickness in the outcrop area of the Strzelecki Ranges varies from 5,000 to 20,000 feet.

During Eocene time, when the Latrobe Valley Coal Measures was deposited, the Gippsland Basin acquired, in general, its present size and shape. In the Latrobe Valley and coastal area, between Seaspray and Welshpool, swampy conditions resulted in very thick accumulations of brown coal. Towards the east coal becomes a minor constituent and clastic material predominates. East of Sale several bores have found thin fossiliferous lenses within the coal measures.

In the North Seaspray No. 1 well area brown coal accounts for 32% of the total thickness of the coal measures.

In Oligocene time the first widespread marine invasion occurred in the Gippsland basin resulting in the deposition of the Lakes Entrance Formation.

In Miocene time, as the sea gradually encroached over the basin, limestone and marl was deposited over a large area. This sequence of sediments consists of several members, but usually is referred to as the Gippsland Limestone.

A marine environment continued into Pliocene time, but then gradual retreat of the sea ended marine deposition in the Gippsland area of the Gippsland basin. From Upper Pliocene to recent time non-marine conditions prevailed, and a cover of sand, gravel and clay was deposited over most of the basin.

STRATIGRAPHIC TABLE

The following is the stratigraphic sequence penetrated in the North Seaspray No. 1 :

TABLE 1

	Age	Name	Depth	Thickness	Lithology
TERTIARY	U.Pliocene	Lake Wellington and/or Haunted Hill Gravels	Ref.K.B. 270'	240'	Sand, Gravel and Clay
	L.Pliocene	Jemmy's Point Formation	512'	240'	Sand, Shells and Marl
	U.Miocene	Tambo River Formation	620'	108'	Marl and Limestone
	Miocene	Gippsland Limestone	1700'	1080'	Marl and Limestone
	Oligocene	Lakes Entrance Formation	1922'	222'	Calcareous Shale Marl and minor Limestone, glauc.
	L. Oligocene to U. Eocene	Latrobe Valley Coal Measures	3623'	1701'	Sand, Coal and Clay
					Unconformity
MESOZOIC	U. JUR. - L. CRET.	Strzelecki	T.D. 5000'	1377'	Graywacke, Subgraywacke, Shale, Siltstone, Sandstone and Claystone, carbonaceous, non-marine.

STRATIGRAPHY

0- 40 feet

Quaternary (?)

Sand, white, yellow and red, medium - coarse grained, sub-angular to sub-rounded.

40 - 270 feet

Lake Wellington and/or Haunted Hills Gravels

Upper Pliocene

Sand, white to yellow, fine to medium grained with occasional coarse grains, mostly quartz with jasper and gray rock fragments common, slightly micaceous. sub-angular to sub-rounded; and Clay, red, yellow and gray, non-fossiliferous.

270 - 345 feet

Jemmy's Point Formation

Lower Pliocene

Sand, light gray to yellow, fine to coarse grained, with very abundant shell fragments.

345 - 512 feet

Jemmy's Point Formation

Lower Pliocene

Marl, light gray and light gray green, slightly sandy and silty, soft to friable, abundant bryozoa, with traces of glauconite.

512 - 620 feet

Tambo River Formation

Upper Miocene

Marl, light to medium gray, slightly sandy, fossiliferous, friable; and Limestone, cream - light gray, fine grained, friable.

The Jemmy's Point and the Tambo River Formations are variable in lithology, and their boundaries are determined by the presence of characteristic microfossils.

Typically the Jemmy's Point Formation consists of shelly sand in the upper part and sandy or silty marl in the lower part. The Tambo River Formation consists of interbedded limestone and marl. The percentage of limestone increases toward the southern part of the basin.

620 - 1700 feet

Gippsland Limestone

Miocene

Marl, medium gray, gray green and gray brown, fine grained, friable to gummy, abundant fossils, slightly sandy in part, becoming more shaly downward, slightly to moderately glauconitic; and Limestone, light gray, cream and light brown, fine grained, friable, occasional sand grains, slightly glauconitic, very fossiliferous.

The Gippsland Limestone is composed of three sub-stages which are, from top to bottom, the Bairnsdale, Batesford and Longford. But, since these substages cannot be recognized lithologically, and their boundaries can only be determined by microfossils in cuttings which are usually badly contaminated, the sub-stage nomenclature has not been placed on the composite log.

The limestone is found mostly in the upper 400 feet of the Gippsland Limestone. Below this the limestone occurs mostly in lenses intercalated in soft marl.

1700 - 1922 feet

Lakes Entrance Formation

Oligocene

Shale, green, gray green, light gray and light brown, calcareous, soft and gummy to slightly firm, glauconitic throughout, very glauconitic in bottom 30 feet, partly pyritic, foraminifera common; with minor Marl, light gray to gray green, soft, slightly silty, glauconitic.

The glauconitic sand at the base of the Lakes Entrance Formation in the Lakes Entrance area is not present in the North Seaspray No. 1 well. The lithological change at the base of this formation, where marine fossiliferous marl overlies brown coal, is very abrupt.

A minor unconformity, or hiatus, probably is present between the Lakes Entrance Formation and the underlying Latrobe Valley Coal Measures. In the Woodside No. 2 well (see locality map) a core was cut which exhibited dessiccation cracks in the top of the coal measures filled with marl of the Lakes Entrance Formation.

1922 - 3623 feet

Latrobe Valley Coal Measures

Upper Eocene to Lower Oligocene

Sand, white, light to dark brown and light to medium gray, firm to coarse-grained, occasionally pebbly, clean to very ligneous and argillaceous, unconsolidated to friable, predominantly angular to sub-angular quartz, poor to very good porosity, usually poorly sorted;

Coal, brown to black, soft to brittle, often shaly and earthy; Claystone - Mudstone, light gray to light brown, silty, micaceous, plant fossils common, occasional floating sand grains, irregular bedding and Siltstone, gray to brown, friable, argillaceous, and usually ligneous.

A light brown silty dolomite occurs in the interval 2590 - 2595 feet which is easily seen in the cuttings and on the electrical and sonic logs. This horizon, and the major coal seam at 2708 - 2780 feet, are the only two beds in the North Seaspray No. 1 that can be accurately correlated within the coal measures with the Wellington Park No. 1 well.

The coal measures thicken rapidly in a southwesterly direction. In the Hollands Landing well (see locality map) the thickness of the coal measures was 763 feet; in the Wellington Park No. 1 the thickness was 1400 feet, and in the North Seaspray it reached 1701 feet. The thickening from the Wellington Park No. 1 to the North Seaspray No. 1 is confined to the interval beneath the major coal seam and the top of the Mesozoic section.

No marine fossils were found in cuttings or cores in the Latrobe Valley Coal Measures.

The percentage of coal in the complete coal measure sequence amounts to 32% in the North Seaspray No. 1, or a total of 535 feet. This compares with a percentage of 21% in the Wellington Park No. 1 and 9% in the Hollands Landing well.

3625 - 3800 feet

Strzelecki Group

Lower Cretaceous

Sandstone, light to medium gray, very fine to fine grained and silty, partly calcareous, friable to slightly hard, very kaolinitic, feldspathic, carbonaceous; and Shale, gray green, gray and brown, often mottled, firm, slightly carbonaceous.

This is the unit in which several gas shows were detected by the mud logging equipment. The contact of this unit with the overlying Tertiary sediments is a pronounced unconformity. The sediments immediately above and below the unconformity are of equal consolidation, thus no drilling "break" occurs upon entering the Mesozoic section.

The top of the Strzelecki Group is not easily recognised from cuttings as the diagnostic lithologic feature of the sequence is the presence of consolidated gray green, chloritic graywacke which occurs deeper in the section. The sandstones in the top of the Strzelecki Group are gray to gray brown, slightly consolidated and disintegrate in the drilling mud, which properties make the upper part of the Strzelecki Group difficult to distinguish from the overlying Latrobe Valley Coal Measures.

The first gray green graywacke appeared between 4000 and 4100 feet, and this interval marks the depth in which the drilling rate began to decrease. Thus, approximately 400 feet of the Strzelecki Group was penetrated before it could be definitely recognized on the basis of cuttings alone.

The Tertiary - Mesozoic unconformity can most easily be recognized on the electrical log. The formation water in the coal measures is very fresh (300 - 500 ppm NaCl), resulting in a very high resistivity in the sands of this sequence. The formation water in the Strzelecki Group sediments is brackish (approx. 15,000 ppm NaCl) and the resistivities in this section are moderate to low. Because of the difference in formation water therefore, the Tertiary-Mesozoic unconformity is marked by a strong contrast in resistivities.

3800 - 5000 feet

<u>Strzelecki Group</u>

Lower Cretaceous

Shale, gray, gray green and light brown, firm to soft, slightly carbonaceous, partly silty; Sandstone, medium gray speckled with white kaolin, very fine to fine grained, feldspathic, friable to slightly hard, carbonaceous flakes common, grading downward into Subgraywacke and Graywacke, gray green, very fine to fine grained, consisting of quartz, white and pink feldspar, green and gray rock fragments with a matrix of kaolin, chlorite, silt size rock detritus and calcite; and Claystone, light brown to light gray, soft, slightly silty.

At 4700 to 4810 feet a light brown to light gray bentonitic Claystone is present. This is similar to a bentonitic claystone present in the Wellington Park No. 1 in the interval 5090 - 5215 feet.

This unit exhibits the monotonous lithology typical to the Strzelecki Group in the Gippsland Basin. The term graywacke is applied to the sandstones as defined by Pettijohn (1949), that is, a dark sandstone composed of angular detrital grains of quartz, feldspar and rock fragments with a matrix of chlorite, sericite and carbonate. Subgraywacke, as used in this report, refers to a sandstone similar to graywacke, but richer in quartz and having a scarcity of feldspar.

The sediments of the Strzelecki Group are thought to be completely non-marine in origin as no fossils, other than plant remains, are known to exist. Fragments of carbonized wood resembling charcoal are common in the graywackes. These charcoal fragments were possibly washed from burned off wooded areas and deposited along with classic material being eroded from the same area.

Plant fossils, mostly flattened stems with occasional leaf impressions, are common in the shale and claystone layers. Coal is also common in the top 800 feet of the Strzelecki Group, but only as thin laminations.

STRUCTURE

The North Seaspray No. 1 was drilled near the structural high of an east-west trending anticline. This anticline was located by a seismic reflection survey in 1962. The reflecting horizon used for mapping was the top of the Latrobe Valley Coal Measures and what was believed to be the base of the Tertiary section. No continuous reflecting horizons were found below the Tertiary, as is true for the entire Gippsland Basin.

The north flank of the anticline is cut by an east-west normal fault with the north side being the down-faulted block. The throw on this fault varies from 200 to 500 feet, the maximum being near the structural high. Closure is controlled by the fault, although there is a small area of north, or reverse, dip near the structural high. The amount of closure against the fault is approximately 300 feet on the top of the coal measures and about 350 feet on the base of the Tertiary.

It was assumed before drilling that the Mesozoic section below the Tertiary would have approximately the same structural character as the Tertiary section. After drilling the well and making a continuous dipmeter survey it was learned thatthe Mesozoic section has an average dip direction of N 11°E and an average dip magnitude of 15°. Dips in the Tertiary as determined by the continuous dipmeter are somewhat erratic. In general the dip direction in the Lakes Entrance formation is N 25°W with an average magnitude of 5°; in the Latrobe Valley Coal Measures the average dip direction is S 35° W, and the average magnitude is 6°.

From the above directions of dip it is now assumed that the well was drilled on the west side of a structural high in the Tertiary section. The structure in the underlying Mesozoic rocks is not well known. The direction of dip in the rocks suggests that the well was drilled on the north flank of an east-west trending anticline or nose.

A detailed plot of dip magnitude versus depth in the Mesozoic section indicates that the dip magnitude decreases downward at the rate of about 3 to 4° per 1000 feet. This decrease or "flattening out", with depth can be the result of one, or both, of two things. If the well is situated on the north flank of an assymetrical anticline with the axis inclined and migrating towards the south with depth, then the dip would decrease downward at a rate dependent upon the degree of folding. The second explanation is that the dip magnitude is a result of drag folding along an east-west fault, and with depth the magnitude of folding decreases with the increasing distance of the well from the fault plane.

If the dips in the underlying Mesozoic section are due solely to folding, then the structural high in this section is to the south of the well site. The sands that contained gas in the North Seaspray No. 1. would then terminate at the Tertiary-Mesozoic unconformity a short distance south of the well, if the dip rate is maintained. If the dip rate and strike are maintained north of the well then a substantial amount of additional section should be present in that direction.

The closed structure mapped in the Tertiary section is due partly to the draping effect of sediments deposited over a Mesozoic high, or stable block, which allowed more rapid deposition around the high than over it. Contemporaneous faulting occurred during deposition, possibly because of the unequal amounts of sediment being deposited throughout the basin. Uplift, accompanied by mild warping and faulting, occurred during late Miocene and early Pliocene time and accentuated the existing structures. Thus, the structures present in the Tertiary section are due to differences in rates of deposition and vertical crustal movements, and do not necessarily reflect the Pre-Tertiary structural environment.

RELEVANCE TO OCCURENCE OF PETROLEUM.

The North Seaspray No. 1 was drilled with the hope of finding oil or gas in the Latrobe Valley Coal Measures, or in the upper part of the Strzelecki Group.

No shows of hydrocarbons were found in the Latrobe Valley Coal Measures, and the sands in this section contained only fresh water. One formation test was made in the top sand of the coal measures in order to obtain a water sample and investigate the possible presence of undetected hydrocarbons, but due to an enlarged hole the packer would not seat. However, all the sands in the coal measures have a water saturation calculated at 100% from the electrical logs, and no indications of hydrocarbons were found in the cuttings or in the drilling mud.

Gas shows were recorded by the gas detector in each of the following intervals : 3732' - 3742' (46 units of gas); 3750' - 3760' (50 units of gas) and 3774' - 3780' (37 units of gas). Tests of the upper two zones in open hole, and through perforations in 7 inch casing, produced no hydrocarbons.

A formation test in the interval 3765' - 3795' produced wet gas at the rate of 50 to 100 MCF/D. This gas originated from the sandstone indicated at 3768' - 3774' on the electric logs. Three analyses of the gas by Mr. Jack C. Kennedy of the Victorian Department of Mines are given in Table 2 below :

ANALYSES OF HYDROCARBONS

TABLE 2

DST. NO. 3 -	3765' - 3795'(Open hole)	
	Methane	66.9%
	Ethane	20.6%
	Propane	8.3%
	Isobutane	1.2%
	N-Butane	2.0%
	Isopentane	0.4%
	N-Pentane	0.5%
DST. NO. 7 -	3768' - 3774' (perforations in 7" casing)	
	Methane	97.2%
	Ethane	1.6%
	Propane	0.8%
	Isobutane	0.11%
	N-Butane	0.19%
	Isopentane	0.04%
	N-Pentane	0.02%

DST. NO. 8 - 3768' - 3774' (perforations in 7" casing after acidizing)

Air	1.9%
CO_2	7.8%
Methane	86.7%
Ethane	1.8%
Propane	1.1%
Isobutane	0.28%
N-Butane	0.33%
Isopentane	0.08%
N-Pentane	0.09%

After the well reached a total depth of 5000 feet 7" casing was set at 4535 feet, and cemented back to 2900 feet, in order to thoroughly test the sands which had yielded shows of hydrocarbons. The zone at 3768 - 3774 feet was perforated and tested, but the gas flow was the same, or slightly less, than when tested in open hole.

Because of the kaolinitic matrix of the sandstone it was feared that invasion of mud filtrate had reduced the reservoir permeability by causin the swelling of the kaolinitic matrix. In order to remedy this loss of permeability around the bore hole the zone was acidized with 500 gallons of -15% hydrochloric acid, but in spite of the slightly calcareous matrix, the flow, instead of increasing, slightly decreased.

Perforations in the 7" casing were made in the intervals 3752 - 3758 feet and 3737 - 3741 feet, and these two zones were tested jointly with the zone at 3768 -3774 feet, but no additional gas was produced. Sidewall cores in these three zones were barren of fluorescence and appeared to have poor porosity and permeability.

In the interval 4406 to 4500 feet good porosity was indicated by the microlog and microcaliper. A drill stem test of the interval 4415 - 4501 feet recovered only 295 feet of drilling mud. The zone was tested again through perforations in 7" casing at 4407 - 4419 feet, but the recovery was only 140 feet of slightly gas cut drilling mud.

The peculiar SP deflection at the Tertiary - Mesozoic unconformity was tested through perforations at 3630 - 3636 feet in 7" casing, but the recovery was only 240 feet of drilling mud, slightly gas cut in the bottom 40 feet.

Thus, the only significant show of hydrocarbons in the North Seaspray No. 1 occurred in a sandstone 4 feet thick with poor porosity and permeability, and produced petroliferous gas at the estimated rate of 50 to 100 MCF/D. The origin of this gas is unknown as it occurs in a thick non-marine section and is overlain by 1700 feet of non-marine coal measures.

POROSITY AND PERMEABILITY OF SEDIMENTS PENETRATED.

Sands, clean and porous for the most part, are present from the surface down to 345 feet. A water well drilled at the well site to a depth of 110 feet produced water at the estimated rate of 600 barrels per day. A well drilled to 345 feet would probably produce several times this amount of water.

In the marine Tertiary sequence, from 345 feet to 1922 feet, the only indications of porosity are in the limestones of the Gippsland Limestone in the interval 912 feet to 1282 feet. Several zones within the limestone sequence have porosities of 25 to 30% calculated from the microlog, but the true porosities are believed to be 20 to 30% less than this. No cores or drill stem tests were taken in this section so that the permeability of the porous zones is unknown.

In the Latrobe Valley Coal Measures numerous unconsolidated sands are present with porosities ranging from 15 to 35%, as calculated from the microlog and sonic log. The majority of these sands are clean, coarse-grained and angular. One formation test was attempted in the top sand of the coal measures, but was unsuccessful due to packer failure. However, the sands are well known for their good permeability and large artesian flows of fresh water in the Gippsland Basin, and the sands encountered in the well appear to have this same high permeability.

Several porous zones were encountered in sandstones, subgraywackes and graywackes of the Strzelecki Group. Some of these zones have well developed mud cake, good separation on the microlog, and indicated porosity on the sonic log. In Table 3 below are porosity values determined from the sonic and micrologs, and porosity and permeability values determined by Core Laboratories [illegible]

POROSITY AND PERMEABILITY DETERMINATIONS

TABLE 3.

DEPTH	POROSITY			PERMEABILITY
	Microlog	Sonic log	Side-wall cores	Side-wall cores
919' - 1282'	25 - 30%	Not reliable	Not determined	Not determined
2083' - 2126'	35 - 40%	30 - 40%	"	"
2282' - 2368'	33 - 40%	32%	"	"
2778' - 2812"	24 - 33%	27%	"	"
2950' - 2993'	24 - 32%	30 - 33%	"	"
3460' - 3483'	21 - 30%	15 - 35%	"	"
3573' - 3625'	17 - 23%	16 - 28%	--	--
3595' -	20.5%	23%	29.0%	0.7 md
3629'	23%	21%	26.6%	0.8 md
3635'	20.0%	19%	14.1%	0.9 md
3737' - 3741'	18 - 28%	13%	--	--
3738'	23.5%	13%	20%	1.6 md
3752' - 3758'	30%	13 - 23%	--	--
3753'	26%	23%	28.3%	0.9 md
3768' - 3772'	34%	13 - 30%		
3770'	34%	27%	29.5%	1.7 md
3773'	No separation	27%	28.3%	5.7 md
4090' - 4105'	29 - 34%	20 - 23%	--	--
4410'	26%	19%	26.3%	8.0
4456' - 4480'	15 - 20%	14 - 24%	--	--
4461'	19%	17%	22.9%	6.9
4604' - 4660'	18 - 19%	13 - 17%	Not determined	Not determined

In the table above porosity values from the sonic log have been corrected for shaliness and compaction where necessary. A shaliness factor ($\mathcal{L}$) of 0.7 has been used for all determinations in the Strzelecki Group to remove the effect of the kaolinitic matrix.

In general the side-wall core analyses indicate a porosity slightly higher than the sonic log and approximately the same as the microlog. The permeability measurements on side-wall cores indicate that the formation tests in the intervals 4415 - 4501 feet (open hole) and 4407 - 4419 feet (perforations in 7" casing) should have recovered some fluid. However, these two tests recovered only drilling mud and the flowing pressures were very low.

One conclusion to draw from this lack of fluid recovery during formation tests is that mud filtrate invasion has caused the kaolinite in the matrix to swell, thereby reducing the permeability and blocking the flow of formation fluids into the bore hole. The depth of invasion can often be estimated from the three resistivity curves on the electrical log, but in this case all three curves read approximately the same. Thus, the invasion is either very shallow (less than 6 inches) or very deep (greater than 3 feet).

The side-wall cores from 3629 - 3773 feet indicate poor flow properties for the sandstones in this interval, and possibly the permeabilities have been damaged by deep mud filtrate invasion. However, the fact that the gas zone at 3768 - 3772 feet was tested in open hole within 8 hours after drilling through it, and that the water loss of the drilling mud at the time was only 10 cc per 30 minutes, suggests that formation damage by invasion did not substantially decrease the gas flow. Also, the gas flow from the same zone was only slightly less when tested through perforations, after the zone had been exposed to drilling mud for 14 days.

From 4660 feet to total depth porosities are mostly below 10% and generally tight, and no formation tests were made in this interval.

CONTRIBUTION TO GEOLOGICAL CONCEPTS RESULTING FROM DRILLING.

1. The Latrobe Valley Coal Measures are now known to thicken rapidly to the southwest. From the Hollands Landing well to the North Seaspray No. 1 well the coal measures thicken by 938 feet.

2. Although favorably situated structurally the porous sands of the Latrobe Valley Coal Measures are barren of oil or gas. These sands have been flushed by meteoric waters entering the sands where they outcrop around the eastern end of the Carrajung uplift (western end of the Baragwanath anticline on the locality map).

3. The sandstones and graywackes of the upper part of the Strzelecki Group were found to be porous, but with low permeabilities. In the Wellington Park No. 1 well there was very little porosity in the Strzelecki Group. It is reasonable to assume

that the sandstones and graywackes become "cleaner" towards the south or southwest and that better porosities can be expected in this direction.

4. Petroliferous gas was present in the upper part of the Strzelecki Group only 145 feet below the Tertiary - Mesozoic unconformity. The gas probably migrated up dip from the low area to the north or north-east of the well site and became trapped by low permeability before reaching the unconformity. The origin of the gas is unknown.

5. The structural nature of the Strzelecki Group is more complex than formerly believed. Folding, and probably erosion also, on a moderate scale preceded the deposition of the Latrobe Valley Coal Measures. Seismic methods have thus far been unable to map continuous reflections below the coal measures.

REFERENCES

DUDLEY, Paul H. 1959 Oil possibilities of the petroleum prospecting licence 212, in the South Gippsland Highlands, unpublished report for Victorian Oil N.L.

INGRAM, Frank T. 1962 Wellington Park No. 1 well, final well report, unpublished report for Arco Limited and Woodside (Lakes Entrance) Oil Co. N.L.

APPENDIX NO. 1.

LIST AND INTERPRETATION OF ELECTRICAL AND OTHER LOGS

	Run No.	Interval
Electrical log	1	517' - 4500'
	2	4314' - 4998'
Microlog with Microcaliper	1	517' - 4500'
	2	4350' - 4998'
Sonic log	1	517' - 4497'
	2	4280' - 4995'
Dipmeter	1	1700' - 4498'
	2	4500' - 4996'
Gamma Ray with Collar Locator	1	2900' - 4440'
Temperature Log	1	2000' - 4444'

For the most part the logs are self explanatory. The electrical log has a reversed SP through the Latrobe Valley Coal Measures because of fresh formation waters. A peculiar SP deflection is present at the Tertiary - Mesozoic unconformity. The large deflection here is the result of fresh water coming in contact with brackish water, and is not caused by a permeable sand as it would first appear. This same peculiar SP deflection was noted at the unconformity in the Wellington Park No. 1 well.

A mud logging caravan was leased from Oil Development N.L. for the duration of the drilling operation. This caravan housed the gas detection device and various other equipment used by the geologists while logging the well.

A Johnson-Williams hot wire gas detector was in continuous operation from 512 feet to total depth. During normal operations this detector operated on a voltage high enough to burn methane, plus all other combustible gases, but could be switched to a lower voltage whereby only hydrocarbons heavier than methane would ignite. By this arrangement the percentage methane in any gas "show" could be estimated. The values shown by the gas curve in the composite log are for total gas.

VELOCITY SURVEY

NORTH SEASPRAY NO. 1

by

VICTOR BYCHOK - ARCO LIMITED.

A velocity survey of Arco-Woodside NORTH SEASPRAY NO. 1, a Mesozoic exploratory test, was conducted in two stages using the Schlumberger Sonic Log. The well is located approximately 5½ miles north of the village of Seaspray, Victoria. The co-ordinates of the well are Latitude 38°17'38"S and Longitude 147°12'13"E.

The first stage of the survey was run on 5th December, 1962, when the well had reached its projected depth of 4500 feet. At this time the interval measured for the velocity survey was from 517 feet to 4497 feet. The second stage was run on 13th December, 1962, after the well had been deepened to 5,000 feet. The interval surveyed at this time was 4280 feet to 4995 feet.

As surface casing had been set to a depth of 512 feet, the velocity used in the computations for the interval from the datum plane of sea level to a well depth of 520 feet (-432 ft.) was based on the average velocity at this depth interval measured in the Arco-Woodside, Wellington Park No. 1, a deep Mesozoic exploratory test located approximately 15 miles northeast of the North Seaspray No. 1 well. No check shots were taken by a conventional seismic crew; therefore, the reliabilith of the survey is that of a Sonic Log velocity measurement.

GEOLOGIC DATA

Geologic formation tops as reported are as follows :

Elevation - KB -	88 ft. above sea level.
0' to 40'	Quaternary
40' to 270'	Haunted Hills Gravel
270' to 512'	Jemmy's Pt. Fm.

512'	to 620'	Tambo River Fm.
620'	to 1700'	Gippsland Limestone
1700'	to 1922'	Lakes Entrance Fm.
1922'	to 3623'	Latrobe Valley Coal Measures
3623'	to 4999'	Strzelecki Group (Mesozoic)

VELOCITY DATA

Company
Arco Limited - Woodside (Lakes Entrance) Oil Co. N.L.

Well
NORTH SEASPRAY NO. 1

Latitude 38°17'38" South

Longitude 147°12'13" East

KB Elevation 88 ft. above sea level

Total Depth (driller) 5000 ft.

Dgd	Tgd	ΔDgd	ΔTgd	Vi	Vav
		432*	0.0755*	5720*	
432*	0.0755*				5720*
		205	0.0299	6856	
637	0.1054				6044
		475	0.0652	7285	
1112	0.1706				6517
		460	0.0617	7456	
1572	0.2323				6767
		262	0.0398	6583	
1834	0.2721				6744
		278	0.0422	6588	
2112	0.3143				6720
		580	0.0848	6840	
2692	0.3991				6782
		420	0.0526	7985	
3112	0.4517				6889
		423	0.0453	9338	
3535	0.4970				7113
		477	0.0491	9715	
4012	0.5461				7346
		395	0.0364	10852	
4407	0.5825				7565
		481	0.0401	11995	
4980	0.6226				7880

EXPLANATION OF ABBERVIATIONS

Dgd = measured depth of sonde from datum elevation

Tgd = measured vertical time from datum elevation

Δ Dgd = difference in depth between interval depths

Δ Tgd = difference in vertical time between interval times

Vi = Interval velocity - ft/sec = $\frac{\Delta \text{ Dgd}}{\Delta \text{ Tgd}}$

Vav = average velocity - ft/sec = $\frac{\text{Dgd}}{\text{Tgd}}$

* = data from Arco-Woodside Wellington Park No. 1 well

CASING RECORD at the time of survey = 512 ft. - 9-5/8"

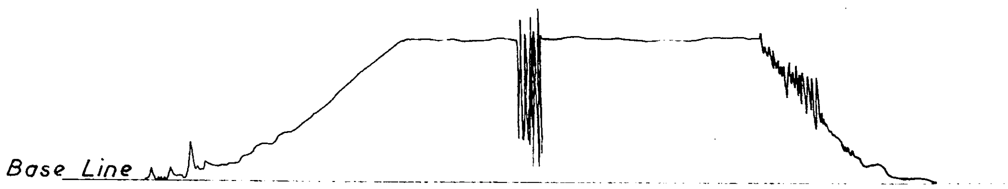
TOTAL RIG TIME

First stage	=	3 hrs.
Second stage	=	2 "
TOTAL		5 hrs.

DATUM ELEVATION = Sea level

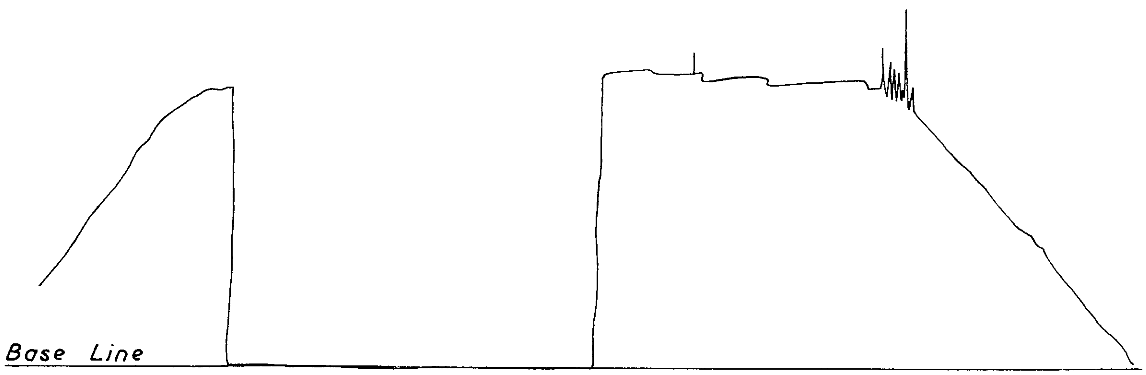
FORMATION TESTING DETAILS

D. S. T. No. 1



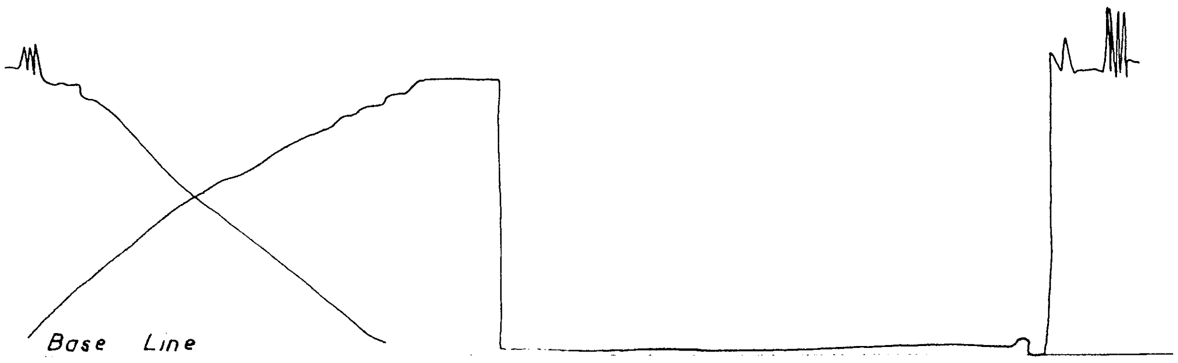
2021′ - 2041′, open hole, packer failed, enlarged hole, recovered 1000 feet of drilling mud, IHP 1030 psi, FHP 1020 psi.

D. S. T No. 2



3727′ - 3771′ open hole, Tool Open 1 hour, moderate blow for 5 min. becoming weak and dying in 45 min., no gas to surface, recovered 28 feet of drilling mud. IHP 2000 psi, IFP 0, FFP 0, FHP 2000 psi. No shut-in pressures, Johnston tool not equipped with independent shut - in valve.

D.S.T. No 3



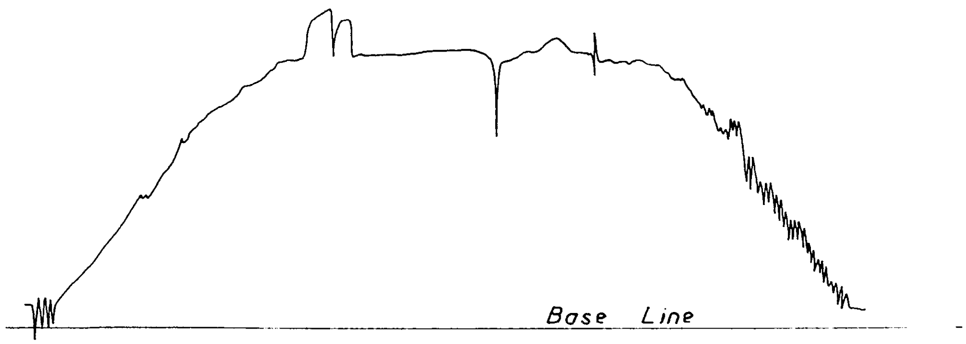
3765' - 3795', open hole, Tool Open 2 hours, immediate strong blow which lasted throughout test, gas to surface in 13 min., flowing pressure on bubble hose 15 psi, 5 - 10 flare at end of 2" line, estimated flow 50 to 100 MCF/D, petroliferous odor, recovered 3285' of drilling mud (retaining valve failed to close), no trace of water or oil. IHP 2000 psi, IFP 0, FFP 0, FHP 2000 psi.

D.S.T. No 4

(No chart for this test)

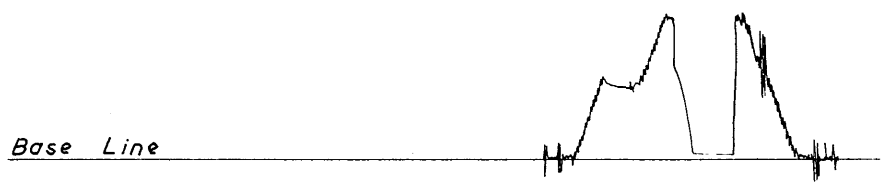
4415 - 4501, open hole, initial shut in 20 min., Tool open 1 hour, weak blow which became intermittent after 20 min, reset packer after 1 hour, weak blow for 3 min., recovered 295 of drilling mud, no gas or water, pressure recorder chart failed to rotate, maximum recorded pressure 2535 psi, hydrostatic, pressure calculated at 2550 psi

D.S.T. No. 5



3755′ - 3810′, (plugged back to 3810′) open hole, initial shut in 20 min., tool opened and packer seat failed, reset and tool remained open for 30 min., fair blow lasting for 3 min., reset packer, no blow, tool open total of 35 min., recovered 250′ drilling mud, tool plugged with mud and cement.
IHP 1910 psi, FHP 1910 psi. No flowing pressures.

D.S.T. No. 6



4407′ - 4419′, perforations in 7″ casing, 4 shots per foot, packer set at 4392′, 5/8″ bottom choke, no top choke, tool open 1 hour, shut in 30 min., immediate slight blow which continued throughout test, recovered 140′ of slightly gas cut drilling mud and filtrate, no free gas or water.
IHP 2075 psi, IFP 20 psi, FFP 110 psi, FSIP 1320 psi.

D. S. T. No. 7

3768′ - 3774′, perforations in 7″ casing, cement plug at 4310′- 4498′, packer set at 3750′, 5/8″ bottom choke, no top choke, tool open 2 hours, gas to surface in 1 hour and 13 min., 5′ flare at end of 2″ line, recovered 150′ of very slightly gas cut drilling mud. IHP 1815 psi, IFP 60 psi, FFP 115 psi, FSIP 1440 psi, FHP 1815 psi.

Note. Went in with Howco packer and circulating sub, set packer at 3740′ and acidized through perforations at 3768′ - 3774′ with 500 gallons of 15 % HCI with inhibitor injection rate 2 bbls. per minute at 1500 psi.

D. S. T. No. 8

(No chart for this test)

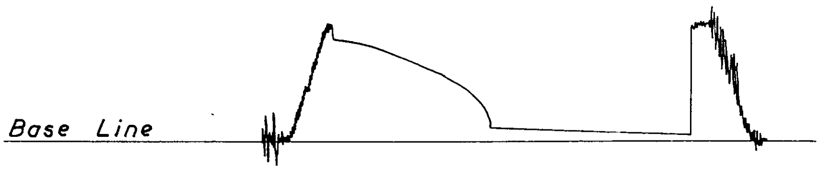
3768′ - 3774′, perforations in 7″ casing as in test No. 7, 5/8″ bottom choke, 1/2″ top choke, no pressure recorders or retaining valve because of acid in hole, tool open 1 hour and 30 min., gas to surface in 35 min., 1 - 2′ flare at end of 2″ line, diminished to no blow, no recovery, no pressure recorded.

D.S.T. No.9

(No chart for this test)

3768′- 3774′, perforations in 7″ casing, as in tests No. 6 and No.7, tool open 1 hour, weak blow diminishing to no blow in 10 min., no pressure recorder or retaining valve used because of acid in hole.

D.S.T. No.10



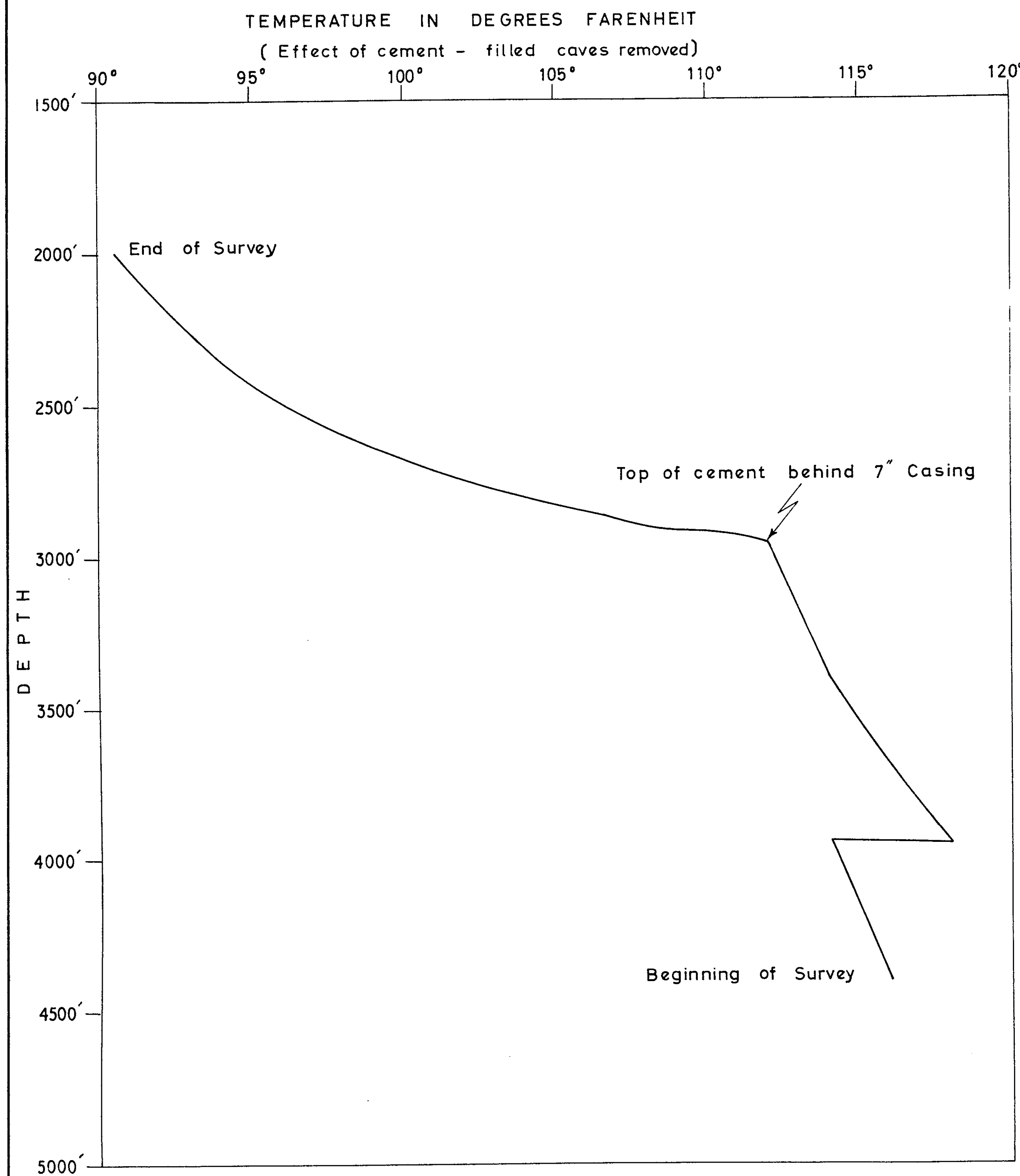
3768′- 3774′, 3752′- 3758′ and 3735′- 3741′, perforations in 7″ casing, 4 shots per foot, 5/8″ bottom choke, 1/2″ top choke, packer set at 3718′, tool open 5 hours, shut in 4 hours, gas to surface in 1 hour and 45 min., 1 1/2′ flare at end of 2″ line, recovered 360′ drilling mud cut with spent acid, no oil or water.

IHP 1730 psi, IFP 60 psi, FFP 175 psi, FSIP 1500 psi, FHP 1730 psi.

D.S.T. No.11

3630′ - 3636′, perforations in 7″ casing, 4 shots per foot, Baker bridge plug set at 3700′, 5/8″ bottom choke, 1/2″ top choke, packer set at 3602′, tool open 2 1/2 hours, shut in 2 1/2 hours, good blow for 25 minutes, weak intermittent blow for 2 hours, decreasing to no blow, recovered 240′ drilling mud, bottom 40′ slightly gas cut, no water.

IHP 1670 psi, IFP 70 psi, FFP 130 psi, FSIP 580 psi, FHP 1620 psi.



NORTH SEASPRAY No. 1

PLOT OF TEMPERATURE SURVEY

(After setting 7″ Casing)

Drafting by GEODRAFTING SERVICES

Date 17 · 5 · 63

APPENDIX NO. 4.

PALEONTOLOGICAL REPORTS

REPORT ON FAUNA FROM NORTH SEASPRAY NO. 1.

by

D. J. TAYLOR
Department of Mines,
Victoria.

Cores 1 to 5 (3504 feet), and rotary cutting samples to 2700 feet have been examined from Arco-Woodside's North Seaspray No. 1 Well.

The stratigraphy, based on foraminiferal content, is outlined below in drilled order. All lithological units and stage names are those used and defined by Carter (1962).

0 - 270 feet : This interval comprised mainly sand. No Foraminifera or other marine fossils were found. These sands are probably Pliocene - Pleistocene in age and may represent the Lake Wellington Formation and/or the Haunted Hill gravels.

270 - 620 feet: From 270 feet to 512 feet the Foraminifera are abundant and specimens are large in size. The species present include *Elphidium imperatrix*, *E. crassatum*, *E. parri*, *Rotalia beccarri*, *Valvulineria kalimnensis*, *Globigerinoides conglobata* and *Triloculina tricultrata*. This fauna is typical of the Jemmy's Point Formation which represents the Kalimnan Stage of Pliocene age.

From 512 to 590 feet the fauna is smaller and contains no diagnostic species. This may represent the Mitchelian Stage and thus the sediment is the equivalent of the Tambo River Formation. However, Carter (loc. cit.) states it is difficult to separate the Jemmy's Point Formation from the Tambo River Formation in drilled sections.

From 590 to 620 feet coarse sand was present which contained no fauna.

620 - 850 feet : This interval comprises the top of the

calcareous section which contained abundant benthonic and planktonic Foraminifera. The individual specimens were small in size. Orbulina universa was present. This interval contains the Bairnsdalian Stage (middle Miocene) and represents the Bairnsdale Limestone which is the highest member of the Gippsland Limestone.

850 - 1000 feet : The first appearances of Notorotalia mioclathra, Amphistigina lessonii, and Operculina victoriensis. N.miaoclathra does not occur above the Balcombian Stage whilst the other two species are typical of the Wuk Wuk Marls (Balcombian Stage).

1000 - 1400 feet : Contains abundant larger foraminiferal fauna including Lepidocyclina howchini, Gypsina howchini, Cycloclypeus victoriensis, Amphistigena lessonii and Operculina victoriensis which is typical of the Batesfordian Stage. Thus this interval probably represents the Glencoe Limestone. But the boundary between the Glencoe Limestone and the Wuk Wuk Limestone cannot be accurately designated on rotary cuttings.

1400 - 1700 feet : The first appearance of Astrononion centroplax was noted at 1400 feet. This species does not range above the Longfordian Stage. This interval is the equivalent of the Longford Limestone although it contains mainly silts.

1700 - 1940 feet : Lithologically similar to the preceding interval but contains Victoriella conoidea (Victoriella "plecte") which is the characteristic species of the Janjukian Stage. Therefore the sediment is the equivalent of the Lakes Entrance Formation.

1940 - 3504 feet : Brown coal fragments were first noted at 1940 feet. No new species of Foraminifera were present in rotary cutting samples and specimens which were isolated are believed to be contamination. Cores Nos. 1 to 5 are within this interval and no fossils were found in the samples examined.

Comments on Stratigraphy :

Nothing can be said regarding the basal Tertiary and pre-Tertiary portion of the section because of absence of fauna. The marine Tertiary sequence commenced with the Lakes Entrance formation. The greensand member of this Formation is absent in this section, but it is also absent in other sections from the central part of the basin. In this well the thickness of the Lakes Entrance Formation is consistent with that of other sections in the central part of the basin (e.g. Wellington Park No. 1). The boundary between the Lakes Entrance Formation and the Longford Limestone is not lithologically finite, as the basal part of the Longford Limestone is represented by a silt facies in the central part of the basin as well as to the west in the Woodside area. Thus the boundary placed at 1700 feet is a biostratigraphic one and corresponds with the boundary between the Janjukian and Longfordian Stages.

There is no apparent break between the argillaceous sequence (Lakes Entrance Formation and in part the Longford equivalent) and the calcareous sequence (Gippsland Limestone). However, there appears to be a break in marine sedimentation at 620 feet at the top of the Gippsland Limestone (= Bairnsdale Limestone Member). From 620 to 590 feet no samples contain Foraminifera and the sands are believed to be of non marine origin. Also the Mitchellian (represented in the Gippsland area by the Tambo River Formation) is not clearly recognisable between the top of definite Bairnsdalian at 620 feet and the base of typical Kalimnan at 512 feet. Carter (1962) states that the Tambo River Formation is conformable with the top of the underlying Gippsland Limestone in outcrop on the northern bank of the Tambo River near the northern margin of the Gippsland Basin. It is suggested that, as this Well is situated on a structural high, the Tertiary structural movement took place in the late Miocene and early Pliocene; that is after the deposition of the Jemmy's Point Formation. There is no suggestion that this movement took place lower in the Tertiary, before the Tertiary marine transgression) e.g. the Lakes Entrance Formation).

The marine Tertiary sequence in North Seaspray No. 1 is tabulated below. (Depths quoted are drilled depths taken from the kelly bushing which was 88 feet above sea level).

Depth	Faunal Units (Carter 1959)	Australian Stages (Carter, 1959)	Rock Units (Carter, 1962) Formation	Member
to 270'			Lake Wellington or Haunted Hills Gravels	
270' to 512'		Kalimnan	Jemmy's Point	
512' to 620'		? Mitchellian	? Tambo River	
620' to 850'	11	Bairnsdalian		Bairnsdale Limestone
850' to 1000'		Balcombian	GIPPSLAND	Wuk Wuk Marls
1000' to 1400'	9	Batesfordian	LIMESTONE	Glencoe Limestone
1400' to 1700'	8 to 6	Longfordian		Longford Limestone
1700' to 1940'	5	Janjukian	LAKES ENTRANCE	

(Signed) D. J. TAYLOR - Geologist.
18/12/62.

References :

Carter, A.N. 1959 - Guide Foraminifera of the Tertiary Stages in Victoria. Vic. Mining & Geol. J.6. (3). 48-54.

Carter, A.N. 1962 - Tertiary Foraminifera from the Gippsland, Victoria and their stratigraphic significance. Geol. Surv. Vict., Memoir (in press)

COMMENTS ON PRE-MARINE TERTIARY SECTION FROM NORTH SEASPRAY NO. 1

by

D. J. TAYLOR
Department of Mines, Victoria

Micropalaeontological examination of Arco-Woodside's North Seaspray No. 1 Well has now been completed. An earlier report (dated 18.12.62) dealt with cores 1 to 5 (to 3504 feet) and rotary cutting samples to 2700 feet. The base of the marine Tertiary section was placed at 1940 feet. Core No. 6 and representative side wall cores and rotary cutting samples have now been examined between 2700 feet and 4999 feet (total depth).

There is no evidence of marine sediment being present below 1940 feet (the base of the Janjukian in the bore). No Mesozoic faunas were found. Foraminifera were found in side wall core and rotary cutting samples but these were obvious contaminations from higher in the bore. It is believed that at least one side wall core is composed wholly or partially of "mud cake". The side wall core sample from 3192 feet contained planktonic Foraminifera, including Globoquadrina dehiscens. This species would not be present in the sediment below 1700 feet (the base of the Longfordian) in this section.

D. J. Taylor,
GEOLOGIST.

23rd January, 1963.

PRELIMINARY EXAMINATION FOR ACID INSOLUBLE MICROFOSSILS

NORTH SEASPRAY NO. 1 BORE

by

JOHN DOUGLAS
Department of Mines,
Victoria

Core samples from the Arco-Woodside Pty. Ltd. North Seaspray No. 1 bore were treated by the hydrofluoric acid - Schulzes solution method, and the residue examined under the microscope for acid insoluble microfossils.

CORE NO.	DEPTH (feet)	MICROFOSSILS
1.	1956	Plant cellular debris
3.	2739	Dinoflagellates
Sidewall core	2927	Disaccate gymnosperms
		Proteacidites, sp. Triorites sp.
		Nothofagus cf N. Falcata, etc.
Sidewall core	3190	None isolated
4.	3216	Dinoflagellates
5.	3491	Dinoflagellates, Proteacidites sp.
Sidewall core	3663	Disaccate gymnosperm pollen
Sidewall core	3731	Apiculatisporis sp.
		Cirratriradites sp.
		Cicatricosisporites sp.
		Lycopodiumsporites sp. etc.

REMARKS

Tertiary pollens and dinoflagellated organisms persist to Core 5 (3491 feet), but the assemblages are not composed of types sufficiently diagnostic to attempt stage subdivision. The pollens from 2927 - 3491 feet indicate deposition somewhere within the time range Eocene - Lower Miocene.

Mesozoic sediments are first indicated by a depauperate assemblage in a side-wall core at 3663 feet. Slightly below this, at 3731 feet, a large Lower Cretaceous assemblage was isolated from another side-wall core.

JOHN DOUGLAS,

Geologist.

APPENDIX NO. 5

CORE DESCRIPTIONS

NORTH SEASPRAY NO. 1

CORE NO. 1, 1954' - 1973', recovered 7'.

1954' - 1955' <u>Coal</u>, dark brown to black, earthy to lustrous, occasional conchoidal fracture, common patches of yellow-brown silt, firm to slightly brittle.

1955' - 1957' Interbedded <u>Siltstone</u>, dark brown, argillaceous, micaceous, carbonaceous; and <u>Coal</u>, as above, thin-bedded, irregular bedding, dip approximately flat.

1957' - 1961' Mostly <u>Coal</u>, black and dark brown, with some thin beds of dark brown silty clay, crumbly, dip appears flat.

CORE NO. 2, 2020' - 2035', recovered 6'.

2020' - 2022' <u>Coal</u>, brown to black, soft to brittle, pure to argillaceous and silty; interbedded with <u>Clay</u>, yellow-brown, soft and silty, laminated, strong H_2S odor.

2022' - 2025' <u>Sand</u>, light to medium gray, fine to medium grained, unconsolidated, sub-angular, mostly gray quartz, good porosity, looks wet, no show.

2025' - 2026' <u>Sand</u>, dark gray brown, fine to medium grained, very ligneous, fair porosity, sub-angular to sub-rounded, looks wet, strong H_2S odor, no show.

CORE NO. 3, 2737' - 2757', recovered 8'

2737' - 2745' <u>Coal</u>, brown to black, earthy to lustrous, soft to brittle. (Core badly jammed in barrel due to expansion of coal.)

CORE NO. 4, 3213' - 3223', recovered 4.5'

3213' - 3213.5' <u>Sandstone</u>, light brown, fine grained with scattered coarse grains, sub-angular to angular, poorly sorted, very argillaceous, thin laminations of carbonaceous material, poor porosity, no show.

3213.5' - 3214.5' <u>Siltstone</u>, light brown, grading to fine grained sandstone at base, laminations of brown clay and black coal, soft, micaceous, tight, no show.

3214.5' - 3217.5' — Sandstone, brown, medium to coarse grained, angular to sub-angular quartz, fair sorting, trace of clay in matrix, soft and pliable in part, unconsolidated, ligneous coating on grains, good porosity, looks wet.

CORE NO. 5, 3484' - 3504', recovered 19'.

3484' - 3503' — Mudstone, light gray and light brown, silty and micaceous, very carbonaceous throughout, carbonized plant remains common (often vertical in core), floating medium to coarse grained quartz sand grains common, bedding indistinct and irregular, cut and fill structures common, dip appears of low magnitude, soft to firm.

CORE NO. 6, 3765' - 3771', recovered 2'.

3765' - 3767' — Sandstone, medium gray to medium brown and speckled uniformly with kaolin or weathered feldspar (salt and pepper effect), carbonaceous fragments common in brown parts, moderately micaceous, grains consist of approximately 30% quartz, 30% gray rock fragments, 20% kaolin and weathered feldspar, 10% tan calcite, and 10% carbonaceous fragments, dip of small magnitude, bedding obscure and crossbedded, overall dull yellow fluorescence, probably due to calcite, no cut or smell, poor porosity.

NORTH SEASPRAY NO. 1

SIDE-WALL CORES

Rec.	Depth	Description
2"	2927'	Brown Coal, slightly shaly, soft.
2"	3190'	Claystone, light brown gray, slightly firm, with lamination of brown coal.
1-1/2"	3595'	Clay, gray green, soft, sticky (misfire)
2"	3622'	Sandstone, light brown gray, fine to coarse-grained, poorly sorted, very feldspathic (appears to be rotten feldspar), fair porosity, angular grains, very slightly calcareous, N.S.
1-1/4"	3626'	Sandstone, medium gray, fine grained, very argillaceous, kaolinitic, soft, poor porosity, orange mineral fluorescence, N.S., slightly micaceous.
1-1/2"	3629'	Sandstone, medium gray, fine grained, very argillaceous, exactly like core at 3622', orange mineral fluorescence, N.S.
2"	3631'	Sandstone, medium gray with abundant white specks of kaolin and rotten feldspar, fine grained, very similar to cores at 3622' and 3626', soft, orange mineral fluorescence, poor porosity, N.S., kaolin and argillaceous material in matrix reduce porosity, one thin coal lamination.
1-3/4"	3731'	Shale, medium gray, firm with some dark brown mottling.
1"	3737'	Siltstone, medium gray with slight green tinge argillaceous, friable, poor porosity, no fluorescence, slightly carbonaceous, no cut.
1/2"	3738'	Sandstone, medium gray with slight green tinge very fine grained and silty, argillaceous and kaolinitic, poor porosity, N.S., slightly calcareous.
1-1/2"	3752'	Siltstone, medium gray, friable, slightly argillaceous, fair porosity, N.S.
1-1/4"	3756'	Mudstone, medium gray, silty, laminated, slightly firm, N.S.
2"	3769'	Sandstone, light to medium gray, fine grained, angular to subangular quartz, feldspar (white and pink), green and dark gray minerals common, kaolinitic, fair porosity, soft to friable, well sorted, N.S.

14	2"	3770'	<u>Sandstone</u>, medium gray with white specks (as above), very fine grained, slightly calcareous, fair porosity, brown fracture with brown stain, no fluorescence, slightly argillaceous, friable, no cut.
15	1-1/8"	3984'	<u>Sandstone</u>, gray with white specks, very fine to fine grained (salt and pepper effect), angular, poorly sorted quartz, white-pink feldspar, green and gray minerals, kaolinitic, slightly argillaceous, poor porosity, no fluorescence, slightly micaceous, slightly carbonaceous.
16	1"	4092'	<u>Sandstone</u>, medium gray, very fine grained, angular, quartz, pink and white feldspar, green and dark gray minerals, kaolinitic with gray green shale inclusion, poor porosity, non-calcareous, no fluorescence or cut, friable, slightly biotitic, slightly argillaceous.
17	1-1/2"	4100'	<u>Sandstone</u>, as in core at 4092' but fine grained, more micaceous, flecks of carbonaceous material, poor porosity, N.S.
18	1"	4287'	<u>Sandstone</u>, light gray, very fine to fine grained, same minerals as above, poorly sorted, moderately kaolinitic, very poor porosity, N.S.
19	1/2"	4410'	<u>Siltstone</u>, light gray, same minerals as above, slightly argillaceous, thin laminations of coal, tight, N.S.
20	1/2"	4439'	<u>Sandstone</u>, light gray, very fine grained and silty, feldspathic, quartz, green minerals and gray rock fragments, more argillaceous, very poor porosity, N.S.
21	1"	4461'	<u>Sandstone</u>, light to medium gray, same minerals as above, moderately argillaceous, kaolinitic, very poor to poor porosity, N.S., green gray when wet, non-calcareous.
22	1/4"	2593'	<u>Siltstone</u>, brown, very calcareous and ligneous, thin lenses of brown coal, yellow mineral fluorescence, slightly argillaceous.
23	1/2"	2788'	<u>Sandstone</u>, light gray, fine to very coarse grained, angular, poorly sorted, quartz, slightly calcareous, friable to unconsolidated, good porosity, N.S.
24	1-3/4"	2937'	<u>Coal</u>, brown, brittle, waxy, lustrous. N.S.
25	1/4"	2964'	<u>Sand</u>, dark gray, very coarse, angular quartz grains in gummy matrix (probably mud cake)

26	2"	3190'	Claystone, light tan, soft to firm, silty trace pyrite, carbonized plant stems.
27	2"	3192'	Coal, brown, soft, gummy, very argillaceous, almost brown ligneous mudstone.
28	1/2"	3595'	Sandstone, white, coarse grained, angular, poorly sorted large, white vitreous quartz pebble makes up most of core, good porosity, yellow mineral fluorescence.
29	2"	3635'	Sandstone, light gray, fine grained, angular, feldspar, quartz, biotite, minor green and black minerals, very kaolinitic, and argillaceous, poor porosity, friable, N.S.; yellow mineral fluorescence.
30	1-1/3"	3648'	Shale, light gray, soft to firm, soapy feel.
31	1-1/2"	3663'	Shale, gray, soft to firm, soapy feel, abundant pyrite.
32	1"	3678'	Shale, gray, same as Core No. 31 with occasional carbonaceous material.
33	1"	3773'	Shale, green gray and brown, mottled, firm, waxy.
34	2"	4367'	Sandstone, medium gray, very fine grained, angular, well sorted, quartz, white and pink feldspar, micaceous, green minerals, kaolinitic, slightly argillaceous, poor porosity, friable, N.S.

POST - MESOZOIC STRATIGRAPHY IN NORTH SEASPRAY No. 1 WELL.

Location: Lat. 38°17'38" S, Long. 147° 12' 13"E, Parish of

T.D. : 4,999 feet (Schl.)

Elevation: 77 ft. (Ground), 88 ft. (Kelly B.)

Date commenced: Nov., 1962.

Lithologic Log: [Based largely on sample description]

Depths generally taken to the nearest 10 feet:-

0 - 40 : samples not available.

40 - 190 : yellow, grey and brown fine to coarse grained sands, some clayey; partially gravelly

190 - 270 : fine grey micaceous sand.

270 - 300 : as above, with fragments of mollusca, bryozoa, *Ditrupa*, and echinoid spines.

300 - 340 : grey calcareous sand / sandy marl with abundant shells.

340 - 420 : grey sandy marl / sdy marly limestone, shell material uncommon (? slight greenish tinge).

420 - 480 : yellowish grey ~~slightly~~ slightly sandy limestone with minor glauconite grains, also *Ditrupa*, bryozoa.

480 - 660 : as above, bryozoa more abundant, also some molluscan fragments. ~~[illegible]~~

660 - 780 : yellowish gy calcareous sand, and sandy limestone with minor glauconite grains; e-log indicates tight limestone horizons below 695ft; *Ditrupa* fragments.

780 - 970 : light grey bryozoal limestone, larger forams. more common below 940ft. (NOTE: Fine sand, pros. contamination down to 850ft. in samples)

970 - 1230 : light grey bryozoal marly limestone with traces of glauconite, *Amphistegina lessonii* common.

1230 - 1300 : as above, some narrow hard horizons, also traces (in the samples) of dark grey pyritic marl.

1300 - 1390 : Lt. grey marl, some minor marly limestone.

1390 - 1620 : yellowish grey marly limestone and puggy marl, traces of bryozoa

1620 – 1740 : yellowish grey puggy foraminiferal marl.
1740 – 1850 : lt. grey foraminiferal marly limestone, traces of ~~of~~ glauconite & quartz.
1850 – 1940 : as above, but glauconite v. common, ~~[illegible]~~ particularly at base, pyrite also; brown siderosic sli glauc. dolomite bed @ approx. 1928-25 feet.

1940 –

~~[illegible]~~

Stratigraphy.

0 – 270 feet : Upper Pliocene to Recent.

Haunted Gravels are not present below 40 feet. The beds sampled belong to the Bushy Park Beds.

270 – ? 480 feet : Jemmys Point and Tambo River Formations.

The uppermost beds contain shallow water species such as Elphidium crassatum, E. imperatrix and Triloculina sp.
The calcareous beds below include Massilina lepidigera also, while a residue from 390 feet contains the above together with Valvulineria kalimnensis and Globigerinoides conglobata a typical Kalimnan fauna. It is of interest to note that this sample also contains single worn specimens of Operculina victoriensis and Amphistegina lessonii, indicating that this sediment is derived in part from the erosion of older (possibly Balcombian) beds.

? 480 – 1620 feet : Gippsland Limestone.

An approximate stage subdivision is as follows :-

? 480 – 800 ft. : Bairnsdalian.

The top of this unit is not easily picked, but was chosen on the first appearance (down-hole) of a limestone with abundant bryozoa. The microfauna is limited, and includes Elphidium parri, ...ncris phillipinensis, and Orbulina universa. The last of these does not occur below approximately 800 feet.

800 – 900 ft. Balcombian.

As usual, typical planktonic species are rare, although Orbulina suturalis was noted in some samples. *

900 – 1230 ft : Batesfordian.

This is represented by the range of Lepidocyclina howchini, with which Amphistegina lessonii is generally quite common. Gypsina howchini is also recorded, and Cycloclypeus victoriensis appears in a Lepidocyclina-rich sample at 1000 feet.

.../4

---

* The highest occurrence of both Operculina victoriensis & Amphistegina lessonii is at 850 ft, although traces of the former appear in a sample @ 790-800 ft.

1230 – 1620 ft. (Longfordian)

Astrononion centroplax occurs below 1230ft. It is ~~generally~~ often accompanied by Globigerina apertura, G. woodi, and Globigerinoides triloba (the last at least down to 1510ft, where a sample was taken).

1620 – 1940 feet: Lakes Entrance Formation.

Excellent microfaunas all indicate Faunal Unit 5 of Carter. Species include Globigerina ampliapertura euapertura, G. parva, Cibicides brevoralis, C. perforatus, Astrononion centroplax, Gyroidina zealandica, Elphidium crespinae, Victoriella conoidea (= plecte), together with miliolids and arenaceous species. The latter, particularly "Cyclammina" incisa, are relatively common and assist in differentiating the faunas from those of the overlying basal Gippsland Limestone.

– Shallow water species are particularly noticeable in the basal sample at 1930 – 40 feet.

1940 – feet: Latrobe Valley Coal Measures.

No foraminifera have been isolated from this formation.

Below feet: Strzelecki Group.

No foraminifera have been isolated from this group.

Characteristics of the Lakes Entrance Formation.

At 1620 feet, the following characteristics are observed:

i. the drilling rate increases from approx. 2 min/5 ft. to considerably more than 5 min/5 ft. & then drops back to an average of between 4 and 5 min./5 ft.

ii. the amplified short normal reaches it lowest downhole value of 2 ohms m^2/m.

iii. the nature of the microfaunas changes.

Unfortunately, none of these characteristics is particularly evident.

At 1740 feet the ~~short normal value~~ resistivity value increases, apparently due to a tightening in the sediment which appears to change from a puggy marl to a relatively tight, possibly dolomitic, marly limestone.

Glauconite becomes very common at 1850 feet, and then particularly abundant at 1920 feet, at which depth there is also a thin dolomite bed (giving the characteristic "kick" on the resistivity curves. Pyrite also becomes more prevalent with depth, and is abundant - and intimately associated with the glauconite - in the basal 20-odd feet.

Minor quartz gravel, some of it with a greenish (glauconite) tinge, occurs in the basal 10-odd feet.

Dettmann
14-4-66

North Seaspray No.1 c.6 3765-71'	North Seaspray No.1 c.5 3484-504'	
		Punctatisporites gretensis
		Calamospora diversiformis
		Leiotriletes directus
		Acanthotriletes ramosus
		Cirratriradites splendens
		Laevigatosporites vulgaris
		Nuskoisporites gondwanensis
		Nuskoisporites rotatus
		Vestigisporites rudis
		Aequitriradites spinulosus
		Dictyotosporites speciosus
		Cicatricosisporites australiensis
		Cooksonites variabilis
		Leptolepidites verrucatus
		Klukisporites scaberis
		Reticulatisporites pudens
		Foraminisporis wonthaggiensis
		Foraminisporis asymmetricus
		Rouseisporites reticulatus
		Crybelosporites striatus
		Coptospora paradoxa
+		Laevigatosporites ovatus
+		Trilites tuberculiformis
+		Cyathidites splendens
+		Verrucatosporites speciosus
+		Dacrydiumites ellipticus
+		Phyllocladidites mawsonii
+		Nothofagidites emarcida
+		Proteacidites subscabratus
+		Proteacidites adenanthoides
+		Tricolporites microreticulatus
+		Tricolpites gillii
+		Triorites edwardsii

PERMIAN (handwritten beside the first nine species)

T. balmei – ? T. longus (handwritten vertically in column c.6)

NORTH SEASPRAY - 1 W473

5 ONSHORE GIPPSLAND BASIN WELLS LOG INTERPRETATION

PETROLEUM DIVISION

CONFIDENTIAL

18 DEC 1989

PREPARED FOR

THE DEPATRTMENT OF INDUSTRY, TECHNOLOGY AND RESOURCES

Petroleum Division

BY

P.N. Samson & Associates

October 1989

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1. SUMMARY OF RESULTS

Five wells from onshore Gippsland Basin have been interpreted with the view of identifying the presence of hydrocarbons. The interpretation was carried out using a pattern recognition method which makes heavy use of cross-plotting techniques. Using the information available from wireline and mud logs the wells have been subdivided in discrete intervals according to their petrophysical properties.

The detailed log analysis has shown that North Seaspray and Burong show evidence of hydrocarbons from the logs. None of the anomalies identified appear to be able to produce commercial quantities of hydrocarbons. The summary of the hydrocarbon anomalies are presented in Table 1. below:

WELL	INTERVAL	AVG POROSITY %	WATER SATURATION %
Burong	3896' - 3930'	20	55
	3975' - 4000'	18	77
North	3624' - 3635'	20	45
Seaspray	3645' - 3780'	25	65

Table 1.

The interpretation was hampered by the poor quality of the logs caused by the severe deterioration of the hole conditions. In the great majority of the cases only the Sonic Log and the Dual Laterolog were suitable for quantitative analysis. The interpretation method used has attempted to circumvent the limited basic data available, however it is strongly recommended that future drilling in the area should consider alternative drilling technology to improve hole conditions. It is also recommended that intervals of suspected hydrocarbons be cored and tested.

As far as exploration is concerned it is suggested that the formation water resistivity information derived from the log analysis be incorporated into a wider basin study of the hydrodinamical conditions which have lead to accumulations in locations such as Patricia, Golden Beach and North Seaspray.

2. INTRODUCTION

At your request P.N. Samson & Associates has carried out a detailed log analysis of several intervals in 5 onshore Gippsland Basin wells. The objective of the study was to provide a second independent opinion regarding the possibility of hydrocarbon evidence from logs, their quantity and producibility. The scope of work as described by your letter dated 12 September 1989 was to encompass a number of items extending from log quality control to conclusion and recommendations. The report has been structured to cover the scope of work.

3. DATA AVAILABLE

The subject wells have been drilled between 1964 and 1988 and the type of logs reflect the wireline logging technology at that point in time. Table 2 represents the data available to carry out this study.

WELL	LOGS
Burong # 1	LDL-CNL-GR, SONIC-GR, DLL-MSFL-GR, Mud Log
Wrixondale # 1	LDL-CNL-GR, DLL-MSFL-GR, Mud Log
Macalister # 1	LDL-CNL-EPT-NGS, DLL-MSFL-GR, Mud Log
Seaspray # 1	EL, SONIC
North Seaspray # 1	EL, SONIC

Table 2.

The conclusions of the study had to be qualified because of lack of core analysis and water resistivity results against which the log derived parameters could be calibrated.

4. CALIBRATION AND QUALITY CONTROL

The logs available for the study can be classified in two broad categories:

- analog recording: Seaspray #1, North Seaspray #1
- digital recording: Macalister #1, Burong #1, Wrixondale #1

For the first, analog category has a very limited range of calibration recorded and the only applicable quality control is the repeat section which should be recorded at the bottom of the well. None of the analog logs analysed had repeat section recorded and therefore their validity cannot be verified. The only other quality control, which will be discussed at the interpretation method is the porosity resistivity log-log crossplot.

The modern digital logs record a full set of qualibration parameters both before and after survey in addition to the very useful repeat section. The following minimum calibration verification was carried out for each of the logging tools : 1) the response of the tool to a known standard 2) wellsite tool adjustment to reproduce the measurement made with the known standard, and 3) verification tool drift during the survey was within tolerance. Calibrations however, do not assure that a tool is operating properly, they only adjust the tool response to a known standard. The preferred calibration is that against core measurements which was not available for any of the wells reviewed.

Before and after survey calibration drifts have been found within acceptable tolerances. In some of the examined logs the repeat section does not appear to have been recorded. The examination of repeat section has shown that for pad devices (MSFL, LDL and CNL) the repeatability is poor in the sections with hole enlargement or hole rugosity.

The major log quality problem has been caused by very poor hole conditions over the intervals of interest. The hole enlargement, sometimes beyond the limit of the caliper opening and the severe hole rugosity has made the measurement of the pad devices unusable in most instances. Plots such the M vs N and Density Porosity vs Caliper (described in full in the interpretation section) are clear evidence of the deterioration of the measurement of the tools. Over the intervals where hole conditions were poor the LDL-CNL measurement was only used qualitatively, while for porosity calculations the Sonic log which is least affected was used in porosity calculations. Resistivity measurements of devices such as Laterolog and Induction Log and are less influenced by hole enlargements and hole rugosity but beyond certain hole size the environmental corrections charts do not provide reliable adjustments. This is more so when the MSFL which is badly affected by hole conditions enters into the calculation of the correction.

In conclusion, although for all recent post 1980 wells a full suite of logs was recorded sometimes with more exotic logs such as EPT and NGS, only the Sonic and Dual Laterolog logs can be used for any quantitative evaluation.

5. INTERPRETATION METHOD

The philosophy adopted for this project was to seek interpretive methods which will eliminate or reduce the uncertainties in the conventional methods which inevitably result from measurement quality control problems, uncertainties in in the calibration constants for porosity tools and uncertainties in parameters such as Rw, m, n, etc. It also seeks that method which will best fit the situation and data in hand. This approach makes heavy use of crossplotting and pattern recognition and interrelationships developed from rock typing and past experience with the rocks in question. This philosophy adopts the idea that each evaluation is different, at least in terms of uncertainties, and attempts to tailor an approach to that specific case to minimise the uncertainties in the answers.

5.1. Pattern Recognition

This method starts with a consideration of the basic equation for resistivity: $Rt = Ø^{-m}\, Rw\, I$. By taking the logarithm of both sides of this equation, we can convert it to a linear equation:

$$\text{Log } Rt = -m \text{ Log } Ø + \text{Log } Rw + \text{Log } I$$

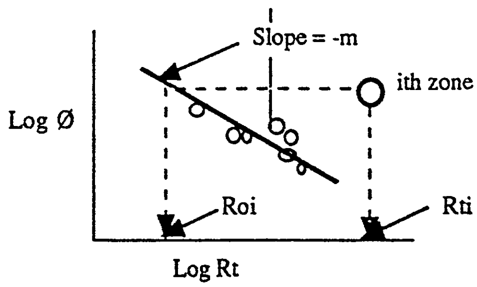
On a log-log plot of Rt vs Ø this is the equation of a family of straight lines with slopes -m and intercepts (at porosity Ø=100%) on the resistivity axis of IRw. If we assume that we have a series of zones, one of which, the i-th zone having a resistivity index of Ii, and the rest of which have a water saturation of 100% (I = 1). The equation for the i-th zone is Log Rti = - m Log Øi + Log Rw + Log Ii while the equation for the water bearing zones are Log Ro = - m Log Ø + Log Rw, since for these zones I = 1 and Log I = 0. The last equation defines (on a log-log plot of Ro vs Ø) a straight line with slope of - m and intercept at 100% Ø of Rw. Along this line, consider the point where Ø = Øi, the porosity of the hydrocarbon bearing zone (i-th zone). The equation of this point is Log Roi = - m Log Øi + Log Rw. If we take the difference of this equation and the equation for the i-th zone point, we get:

Log Rti - Log Roi = Log Ii if the water bearing zones and the hydrocarbon bearing zone have the same m and Rw. Since Log Rti - Log Roi = Log (Rti/Roi) = Log Ii, then Ii = Rti/Roi.

Thus, if the zones on the cross-plot have the same Rw and m's, the Is for the zones of interest can be obtained without knowing m (in fact m is determined by the slope of the water-bearing trend) or Rw. The risk of course is that the zones plotted on the cross-plot do not have the same m's and Rw's and that we can recognize the water-bearing trend.

$$Rt = Ø^{-m}\ Rw\ Sw^{-n} = Ø^{-m}\ Rw\ I$$

$$\text{Log } Rt = -m \text{ Log } Ø + \text{Log } Rw + \text{Log } I$$



$$I = \frac{Rti}{Roi} = Swi^{-n}$$

Figure1

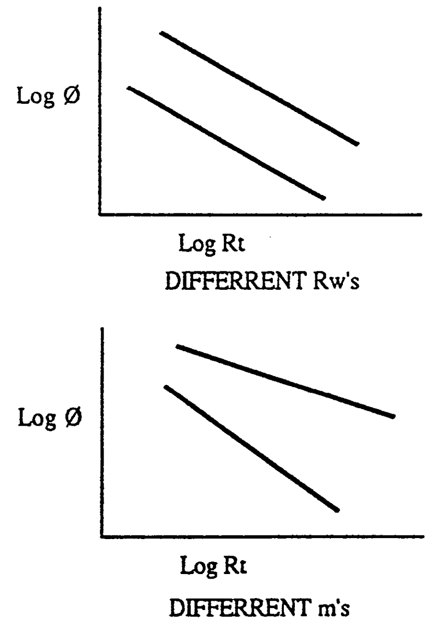


Figure 2

In practice the method illustrated graphically in Figure 1 is used as follows:

Plot Rt versus Porosity

Identify Water-Bearing Trend (Sw=100%)

Interpret "Anomalies" (if any)

Increasing oil or gas ?	*compare with*
Different Rw ?	*water-bearing*
Rock type change ?	*trend*

If Oil or Gas, Calculate Sw for Anomaly

Figure 2 illustrates the effects of rock type and Rw changes on the cross-plots.

The pattern recognition approach is one of the most powerful interpretive techniques yet devised. The basic advantages of this approach are that the resistivity index (a reflection of water saturation) and a number of other potentially useful parameters can be obtained without knowing many of the quantities required for the other approaches such as Rw, m, etc. The limitations are that a statistically significant number of zones are required and a certain unknown parameters must be constant for the zones used in the plot.

5.2. Litho-Porosity

The litho-porosity cross-plot is used for interpretation in formation of complex lithologies. It presents simultaneously the data from at least three of the standard porosity tools: the Compensated Neutron, Compensated Density and Borehole Compensated Sonic logs. From the reading of these logs two porosity independent

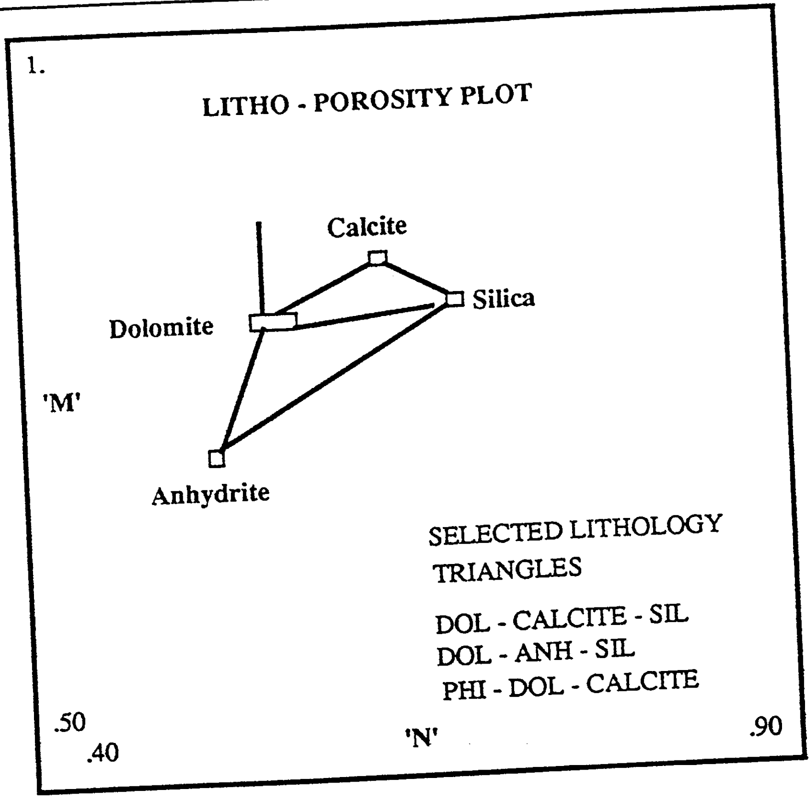


Figure 3

parameters 'M' and 'N', are derived - 'M' from the Sonic and Density and 'N' from the Neutron and Density.

In the plot of of 'M' versus 'N', each pure rock mineral is represented by a unique point regardless of porosity. For a formation of complex lithology, the position of log data points on a the M-N plot relative to the pure mineral points is of great assistance in identifying various minerals in the formation. Lithology information so derived is then used to calculate accurate values of porosity.

The equations for 'M' and 'N' are as follows:

$$M = \frac{tf - t}{pb - pf} \qquad N = \frac{tf - t}{pb - pf}$$

The typical Litho-Porosity cross-plot is illustrated in figure 3. For the present project the litho-porosity method was used primarily for the identification of possible gas effect and hole rugosities. The effect of the gas is to displace any point along a line drawn from the gas point through the point representing the matrix. For a gas of 0.6 specific gravity at 100° and 1300 psi M = 00. and N = -.77. A large scatter in the shale region is caused by hole rugosity.

5.3. Normalised Qv - Shaly Sand Evaluation

In order to evaluate the water saturation of shaly sands from logs using the Waxman-Smits equation the parameter Qv (cation exchange capacity per unit total pore volume) must be known. Qv is normally obtained from a Qv -total porosity ($Ø_T$) relationship defined on the basis of either core data, or log derived Qv and $Ø_T$ values calculated via the Waxman-Smits equation in water-bearing sands.

The constraints of applicability of such approach are obvious:

- either pertinent core data or representative water-bearing sands must be available and, in addition,
- the formation characteristics must be such that a good correlation between Qv and porosity exists.

Juhasz has demonstrated that the above constraints can be largely eliminated by replacing Qv in the Waxman-Smits equation with a dimensionless expression of Qv defined as "normalised Qv": Qvn = Qv/Qvsh. This parameter is equivalent to the "shale-water saturation": $Qvn = Vsh\varnothing_T sh/\varnothing_T$, a parameter which is derived from logs. Qvsh, the Qv value of the shales intimately associated with the sands is also derived from logs as the difference between shale water conductivity and formation water conductivity divided by B, the specific conductance of the clay exchange cations. Qv is thus calculated entirely from logs simply from the equation Qv = Qvn.Qvsh

By using the concept of the normalised Qv the Waxman-Smits equation is converted into a "normalised" form in which all parameters, with the exception of the saturation exponent n*, can be obtained from logs. From this, the water saturation can be expressed in the form of the familiar Archie equation:

$$SWT = \frac{\varnothing_T^{-m}\ Rwe}{Rt}^{1/n^*} \quad \text{where}$$

$$Rwe = \frac{Rw \cdot Rwsh \cdot SWT}{Rwsh(SwT-Qvn)+RwQvn} \quad \text{and} \quad Rwsh = Rsh \cdot \varnothing_T sh\ m^*$$

In a water bearing sand/shale sequence the total porosity $\varnothing_T$ is derived directly from density log which is virtually unaffected by clay content of the formation as since Rho clay(dry) is approximately equal to Rho matrix of the 'clean' sand, i.e. about 2.65 g/cc. In hydrocarbon bearing sand/shale lithologies the porosity has to be corrected for hydrocarbon presence.

6. MACALISTER

6.1. Summary of Results

To allow for the frequent change in petrophysical parameters the interpretation of this well was carried out in 5 discrete intervals. The quality of the basic log data has been severely affected by the hole conditions. Although a full suite of logs has been run in this well only parts of the Dual Laterolog and the Sonic Log are suitable for quantitative interpretation. Using the limited reliable tools available the analysis has shown that the intervals analysed are water bearing. The few anomalies detected which due to the limitations of the methods compute hydrocarbon saturations of around 10% are mostly attributable to changes in lithology and environment and less to residual hydrocarbons.

10. NORTH SEASPRAY

10.1. Summary of Results

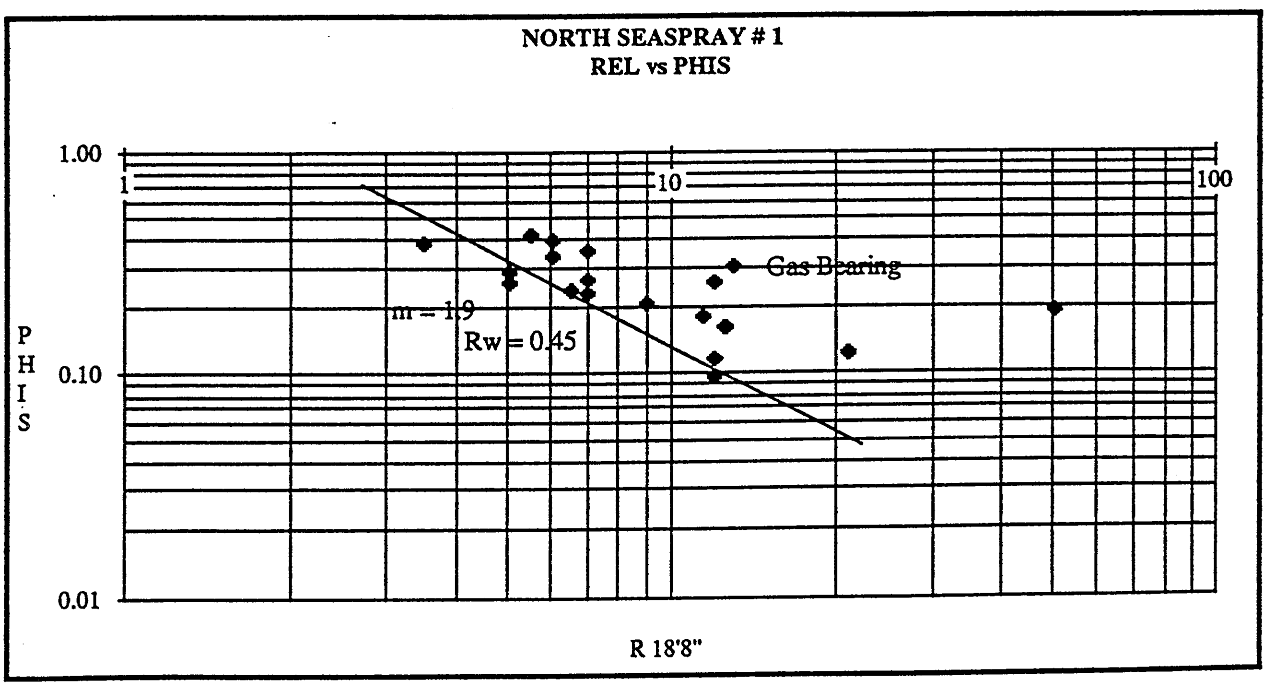
The interval analysed shows clear evidence of gas saturation. Bearing in mind the quality of the very limited logs available it appears that gas is present in a tighter sandstone at the top of the interval(3624'-3635') and also in the the body of the sandstone probably in microfractures extending from 3645' to 3780'. As the tests and log analysis have shown the gas saturation and permeability is low and the gas is not producible in commercial quantities. An important observation is the lower water resistivity(Rw=0.45 ohm-m) derived from the logs which may indicate a less flushed area.

10.2. Interval 3608' - 3798'

Lithologically described as sandstone, partly calcareous friable to hard, very kaolinitic with poor to o fair porosity. Mud log also shows a sequence of small gas kicks between 3730' to 3800'. The 1962 vintage Electric and Sonic Logs allowed only a very limited quantitative analysis.

10.2.1. Electric Log (18'8") vs Sonic Log Porosity Cross Plot

The cross plot using a Sonic derived porosity (Dtm = 70 msec/ft) and the Long Lateral of the Electric Log define a reasonable water bearing trend with Rw=0.45ohm-m and an m=1.9. Anomalies caused by the presence of gas are clear on the plot.



DTM	DTF	CP	M	RW			
70	189	1.3	1.9	0.45			

NO	DEPTH	RLL	DT	PHIS	F	RWA	SW
4	3630	50	100	0.19	22.57	2.22	0.45
5	3650	13	117	0.30	9.62	1.35	0.58
6	3663	3.5	130	0.39	6.05	0.58	0.88
7	3672	12	88	0.12	59.57	0.20	1.49
8	3680	0.3	125	0.36	7.13	0.04	3.27
9	3703	5	110	0.26	13.07	0.38	1.08
10	3715	5.5	136	0.43	5.05	1.09	0.64
11	3719	12.5	95	0.16	31.91	0.39	1.07
12	3732	6	132	0.40	5.68	1.06	0.65
13	3739	21	89	0.12	53.75	0.39	1.07
14	3745	5	114	0.28	10.90	0.46	0.99
15	3756	12	110	0.26	13.07	0.92	0.70
16	3760	6	122	0.34	7.94	0.76	0.77
17	3772	7	125	0.36	7.13	0.98	0.68
18	3798	11.5	98	0.18	25.73	0.45	1.00
19	3810	7	111	0.27	12.47	0.56	0.90
20	3813	12	85	0.10	84.23	0.14	1.78
21	3816	7	106	0.23	15.96	0.44	1.01
22	3820	9	102	0.21	19.96	0.45	1.00
23	3828	6.5	107	0.24	15.15	0.43	1.02

11. CONCLUSIONS

The detailed log analysis of the 5 wells has shown that North Seaspray and Burong show evidence of hydrocarbons from the logs. None of the anomalies identified appear to be able to produce commercial quantities of hydrocarbons.

The interpretation was hampered by the poor quality of the logs caused by the severe deterioration of the hole conditions. In the great majority of the cases only the Sonic Log and the Dual Laterolog were suitable for quantitative analysis. The interpretation method used has attempted to circumvent the limited basic data available, however it is strongly recommended that future drilling in the area should consider alternative drilling technology to improve hole conditions. It is also recommended that intervals of suspected hydrocarbons be cored and tested.

As far as exploration is concerned it is suggested that the formation water resistivity information derived from the log analysis be incorporated into a wider basin study of the hydrodinamical conditions which have lead to accumulations in locations such as Patricia, Golden Beach and North Seaspray.

12. REFERENCES

Juhasz - Normalised Qv - The Key to Shaly Sand Evaluation Using The Waxman-Smits Equation in The Absence of Core Data, SPWLA 22nd Annual Logging Symposium, 1981

Burke et al. - The Litho-Porosity Cross Plot, SPWLA 1969

Pickett - Pattern Recognition As A Means of Formation Evaluation, SPWLA, 1973

Sclumberger - Log Interpretation Charts 1979

Chevron Overseas Petroleum Inc. - Formation Evaluation Course Notes

13. LIST OF SYMBOLS

LLD - Laterolog Deep Resistivity
LLS - Laterolog Shallow Resistivity
MSFL - Micro Spherically Focused Log Resistivity
GR - Gamma Ray
GRCL - Clean formation Gamma Ray
GRSH - Shale GammaRay
PHIN - Neutron Log Porosity
RHOB - Bulk Density
RHOM - Matrix Density
RHOF - Fluid Density
PEF - Litho Density
DT - Travel Time
DTM - Matrix Travel Time
DTF - Fluid Travel Time
PHIS - Sonic Log Porosity
PHID - Density Log Porosity
CAL - Caliper
VSH - Shale Volume
Qv - Concentration of clay counterions per unit pore volume of shaly formation
Qvn - Normalised Qv, Qv/Qvsh
Ro - resistivity of water bearing formation
Rt -resistivity of hydrocarbon bearing formation
Rw - formation water resistivity
Rwsh - equivalent bulk water resistivity of shale

Rwe - equivalent bulk water resistivity of shaly formation

Rwa - apparent bulk water resistivity of a hydrocarbon bearing shaly formation

SWT - Total Water Saturation

SHT - Total Hydrocarbon Saturation

Ø T - Total Porosity, including 'clay-bound' water.

To Mr Henley
[initials] 6-2-63

JCK:PD

16th January, 63.

An.GG,PG,19/12

Report on Samples Nos. 1569,1570/62

Sample : Bore-hole gas
Locality : Seaspray
Sender : Dr. D.F.Thomas,
Director of Geological Survey,
Mines Department.

Two samples of bore-hole gas were received for analysis. The gas was obtained during the drilling of North Seaspray Well No. 1 by ECO-Woodside (Lakes Entrance) Oil Co. N.L.

Sample No. 1569/62

Drill Stem Test	No. 7 (before "acidising")
Date taken	13th December, 1962 (afternoon)
Casing perforated at	3768-3774 feet
Nature of Gas	Inflammable gas with a petroliferous odour.

Remarks: The analysis of the gas, which contained only traces of air and carbon dioxide, is given below:

	%
Methane	97.2
Ethane	1.6
Propane	0.[illegible]
Isobutane	0.11
n-Butane	0.13
Isopentane	0.04
n-Pentane	0.02

Sample No. 1570/62

Drill Stem Test	No. 8 (after "acidising"
Date taken	13th December1962(morning)
Casing perforated at	3768-3774 ft.
Nature of gas	Non-inflammable gas with petroliferous odour

Results: The gas contained air and carbon dioxide.

	%
Air	1.9
Carbon Dioxide	7.8
Methane	86.7
Ethane	1.8
Propane	1.1
Isobutane	0.28

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MELBOURNE, C.2

2/3

n-Butane	0.32
Isopentane	0.08
n-Pentane	0.09

The action of the acid on the calcite present in the strata, liberated carbon dioxide which prevented the ignition of the gas.

Although the percentages of hydrocarbons other than methane are lower than those present in a previous sample (No. 1571/62) the latest samples would still be regarded as natural gas of petroliferous origin.

John G. Kennedy

Senior Chemist,
Mines Department.

North Seaspray No. 1

Arco - Woodside

Gas show 3768 - 3774 (low pressure)

After acidizing porous zone with 18% HCl - 600 gals for 12 hours reacting time - column of spent acid in well prevented satisfactory test or sampling

Gas includes up to   %
hydrocarbons in the range CH_4 to C_5H_{12}

PALYNOLOGICAL CHART PE900797

CONTAINS DATA FROM NORTH SEASPRAY-1.

CHART NOT INCLUDED IN THIS REPORT

PE603558

This is an enclosure indicator page.
The enclosure PE603558 is enclosed within the container PE904011 at this location in this document.

The enclosure PE603558 has the following characteristics:

ITEM_BARCODE =	PE603558
CONTAINER_BARCODE =	PE904011
NAME =	Composite Well Log
BASIN =	GIPPSLAND
PERMIT =	PEP160
TYPE =	WELL
SUBTYPE =	COMPOSITE_LOG
DESCRIPTION =	Composite Well Log (including Mud Log) ,sheet 1 of 2, enclosure from WCR for North Seaspray-1.
REMARKS =	
DATE_CREATED =	21/12/62
DATE_RECEIVED =	17/03/86
W_NO =	W473
WELL_NAME =	NORTH SEASPRAY-1
CONTRACTOR =	
CLIENT_OP_CO =	ARCO LIMITED

(Inserted by DNRE - Vic Govt Mines Dept)

PE604522

This is an enclosure indicator page.
The enclosure PE604522 is enclosed within the container PE904011 at this location in this document.

The enclosure PE604522 has the following characteristics:

ITEM_BARCODE =	PE604522
CONTAINER_BARCODE =	PE904011
NAME =	Composite Well Log
BASIN =	GIPPSLAND
PERMIT =	PPL/160
TYPE =	WELL
SUBTYPE =	COMPOSITE_LOG
DESCRIPTION =	Composite Log, part 2of 2, (enclosure from WCR) for North Seaspray-1
REMARKS =	
DATE_CREATED =	21/12/62
DATE_RECEIVED =	17/03/86
W_NO =	W473
WELL_NAME =	NORTH SEASPRAY-1
CONTRACTOR =	
CLIENT_OP_CO =	ARCO LTD/WOODSIDE (LAKES ENTRANCE) OIL CO. NL

(Inserted by DNRE - Vic Govt Mines Dept)

PE603559

This is an enclosure indicator page.
The enclosure PE603559 is enclosed within the container PE904011 at this location in this document.

The enclosure PE603559 has the following characteristics:

ITEM_BARCODE =	PE603559
CONTAINER_BARCODE =	PE904011
NAME =	Sonic Log
BASIN =	GIPPSLAND
PERMIT =	PEP160
TYPE =	WELL
SUBTYPE =	WELL_LOG
DESCRIPTION =	Sonic Log (enclosure from WCR) for North Seaspray-1
REMARKS =	
DATE_CREATED =	5/12/62
DATE_RECEIVED =	17/03/86
W_NO =	W473
WELL_NAME =	NORTH SEASPRAY-1
CONTRACTOR =	SCHLUMBERGER
CLIENT_OP_CO =	ARCO LIMITED

(Inserted by DNRE - Vic Govt Mines Dept)

PE904012

This is an enclosure indicator page.
The enclosure PE904012 is enclosed within the container PE904011 at this location in this document.

The enclosure PE904012 has the following characteristics:

ITEM_BARCODE =	PE904012
CONTAINER_BARCODE =	PE904011
NAME =	Geological Cross Section
BASIN =	GIPPSLAND
PERMIT =	PPL/160
TYPE =	WELL
SUBTYPE =	CROSS_SECTION
DESCRIPTION =	Geological Cross Section (enclosure from WCR) Nth Seaspray No 1
REMARKS =	
DATE_CREATED =	16/05/63
DATE_RECEIVED =	
W_NO =	W473
WELL_NAME =	North Seaspray-1
CONTRACTOR =	Arco Ltd/Woodside Oil Co
CLIENT_OP_CO =	Arco Ltd/Woodside Oil Co

(Inserted by DNRE - Vic Govt Mines Dept)

PE906834

This is an enclosure indicator page.
The enclosure PE906834 is enclosed within the container PE904011 at this location in this document.

The enclosure PE906834 has the following characteristics:

ITEM_BARCODE =	PE906834
CONTAINER_BARCODE =	PE904011
NAME =	Time Depth Curve
BASIN =	GIPPSLAND
PERMIT =	PPL/160
TYPE =	WELL
SUBTYPE =	VELOCITY_CHART
DESCRIPTION =	Time Depth Curve, including Age and Formation, (enclosure from WCR) for North Seaspray-1
REMARKS =	Also shows Formation and Age
DATE_CREATED =	21/12/62
DATE_RECEIVED =	17/03/86
W_NO =	W473
WELL_NAME =	NORTH SEASPRAY-1
CONTRACTOR =	
CLIENT_OP_CO =	ARCO LTD/WOODSIDE (LAKES ENTRANCE) OIL CO. NL

(Inserted by DNRE - Vic Govt Mines Dept)

PE906178

This is an enclosure indicator page.
The enclosure PE906178 is enclosed within the container PE904011 at this location in this document.

The enclosure PE906178 has the following characteristics:

ITEM_BARCODE =	PE906178
CONTAINER_BARCODE =	PE904011
NAME =	Time-Depth Curve
BASIN =	GIPPSLAND
PERMIT =	PEP160
TYPE =	WELL
SUBTYPE =	VELOCITY_CHART
DESCRIPTION =	Time-Depth Curve (enclosure from WCR) for North Seaspray-1.
REMARKS =	
DATE_CREATED =	20/12/62
DATE_RECEIVED =	17/03/86
W_NO =	W473
WELL_NAME =	NORTH SEASPRAY-1
CONTRACTOR =	
CLIENT_OP_CO =	ARCO LIMITED

(Inserted by DNRE - Vic Govt Mines Dept)

PE906179

This is an enclosure indicator page.
The enclosure PE906179 is enclosed within the container PE904011 at this location in this document.

The enclosure PE906179 has the following characteristics:

ITEM_BARCODE = PE906179
CONTAINER_BARCODE = PE904011
NAME = Abandonment Schematic
BASIN = GIPPSLAND
PERMIT = PEP160
TYPE = WELL
SUBTYPE = DIAGRAM
DESCRIPTION = Abandonment Schematic (enclosure from WCR) for North Seaspray-1.
REMARKS =
DATE_CREATED =
DATE_RECEIVED =
W_NO = W473
WELL_NAME = NORTH SEASPRAY-1
CONTRACTOR =
CLIENT_OP_CO = ARCO LIMITED

(Inserted by DNRE - Vic Govt Mines Dept)