EXOIL (N.T.) PTY. LTD.

WELL COMPLETION REPORT

OCHRE HILL NO. 1 WELL

by

N. R. McTaggart and D. D. Benbow

CONTENTS

APPENDICES

ILLUSTRATIONS.

Frontispiece

Photograph showing banded Limestone
Core No. 3 at 2666 feet

SUMMARY

Ochre Hill No. 1 well was drilled by Exoil (N.T.) Pty. Ltd. and partners as a stratigraphic and structural test of the Ochre Hill Anticline. The well was located 160 miles west of Alice Springs and south of the Mereenie Oil and Gas Field in the Northern Territory of Australia.

The well was air, mist and aerated water drilled to a total depth of 3,761 feet by Oil Drilling and Exploration Ltd. using a T-32 rig. After spudding on 29th May, 1965 the well was abandoned as a dry hole on 17th June, 1965.

A total of 2,637 feet of Cambrian Pertaoorrta Group was found to overlie steeply dipping Proterozoic Bitter Springs Formation. The basal Pertaoorrta is missing, apparently due to onlap, indicating that the anticline is an extremely "bald headed" feature.

No significant shows of oil or gas were encountered in the well.

RESUME OF DRILLING OPERATIONS

Air drilled 13¾" hole to 48 feet. Reamed 13¾" hole to 20" to depth of 48 feet. Ran 16"casing to 48 feet and cemented to surface. Air drilled 13¾" hole to 487 feet. Added hammerdril to string and air drilled 13¾" hole ahead to 618 feet. Removed hammerdril and air drilled 9⅞" pilot hole to 673 feet. Ran 10¾" casing to 618 feet and cemented to surface. Air drilled 9⅞" hole ahead to 1056 feet. Mist drilled 9⅞" hole to 1288 feet. Mist drilled 7⅞" hole to 2855 feet.. Aerated water drilled 7⅞" hole to 3755 feet. Partially mudded up hole and logged. Cut bottom hole core 3755' - 3761', reran Dipmeter log; plugged and abandoned well.

INTRODUCTION

Ochre Hill No. 1 well was drilled on a farmout to Exoil (N.T.) Pty. Ltd. in O.P. 43, held by Magellan Petroleum Corporation. Exoil's partners in the operation were Transoil (N.T.) Pty. Ltd. and Farmout Drillers No Liability. The well was the ninth wildcat to be drilled in the Amadeus Basin, and the eighth by the Exoil Group.

The well was designed to test, on structure, the petroleum potential of the Cambrian section in a region where it was known to have changed to a sand facies.

WELL HISTORY

GENERAL DATA:

Well Name and Number: Ochre Hill No. 1

Location: 24°07'58"S; 131°23'49"E

Name and Address of Operator:

Exoil (N.T.) Pty. Ltd.,
Perry House,
Elizabeth Street,
BRISBANE. QUEENSLAND.

Name and Address of Tenement Holder:

Magellan Petroleum (N.T.) Pty. Ltd.,
276 Edward Street,
BRISBANE. QUEENSLAND.

Details of Petroleum Tenement:

Oil Permit 43, Northern Territory of Australia

Area: 9,918 square miles

District: Lake Amadeus

Total Depth: 3761 feet

Date Drilling Commenced: 29th May, 1965

Date Drilling Completed: 16th June, 1965

Date Well Abandoned: 17th June, 1965

Date Rig Released: 17th June, 1965

Drilling Time to Total Depth: 19 days

Elevation: Kelly Bushing 2300 feet a.s.l. (approx.)

Status: Dry and Abandoned

Cost:

DRILLING DATA:

Name and Address of Drilling Contractor:

Oil Drilling & Exploration Ltd.,
93 York Street,
SYDNEY. N.S.W.

Drilling Plant:

Make: National Ideal

Type: Rotary T-32

Motors (2): G.M.C. Twin Model 471, 225 h.p.

Mast: Make: Emsco

Type: Serial 12

Rated Capacity: 416,000 lbs.

Pumps:

Make:	National (1)	Emsco (1)
Type:	C-250	D-300
Size:	7¼" x 15"	7¼" x 14"
Motors:	Twin G.M.C. 671 (1)	Twin G.M.C. 671 (1)
	Twin G.M.C. 471 (1)	

Air Drilling Equipment:

Unit	Make	Type	Size	Motors
Compressor	Ingersoll-Rand	HHE 3 stage	1500 c.f.m. 300 p.s.i.	Waukesha 405 h.p.
Booster Compressor	Ingersoll-Rand	HHE 2 stage	3000 c.f.m. 1500 p.s.i.	Waukesha 405 h.p.
Injection Pump	Aldrich	Triplex H.S. 3B	1" x 2½"	Wisconsin 30 h.p.

Blow-out Preventor Equipment:

Make:	Shaffer	Hydril	Shaffer
Type:	"B"	GK	Rotating
Size:	12"	12"	12"
Series:	900	900	900
Working Pressure:	3000 p.s.i.	3000 p.s.i.	3000 p.s.i.

Hole Sizes and Depths:

20" from surface to 48 feet

13¾" from 48 feet to 618 feet

9⅞" from 618 feet to 1288 feet

7⅞" from 1288 feet to 3755 feet

$7\frac{13}{16}$" from 3755 feet to 3761 feet

Casing and Cementing Details:

Size:	16"	10¾"
Weight:	32.25 lb.	40.5 lb.
Grade:	Conductor	J55
Setting Depth:	48 feet	618 feet
Cement Used:	40 sacks	220 sacks
Cemented To:	Surface	Surface
Method Used:	Rig pumps - plug	Rig pumps - plug

Drilling Fluid:

Ochre Hill No. 1 was air drilled from surface to 1056 feet, mist drilled from 1056 feet to 2855 feet and aerated water drilled from 2855 feet to 3761 feet. For the mist drilling operation a solution of foaming agent and corrosion inhibitor in water was injected into the air stream at rates of 7-10 barrels per hour. During aerated water drilling, water treated with corrosion inhibitor was circulated at the rate of 170 gallons per minute. The hole was partially mudded up for the single logging run at total depth.

The following mud and additives were used:-

Gel	7,500 lbs.
Caustic	4,772 lbs.
Bichromate	2,702 lbs.
Lime	800 lbs.
Spersene	400 lbs.
XP20	200 lbs.
Lost circulation material	8 lbs.
Comprox	116¾ gallons
Teepol	60½ gallons

Water Supply:

Water for the camp was trucked 20 miles from the East Johnny's Creek No. 1 water bore. Water for drilling operations was recirculated from the well.

Plugging Back:

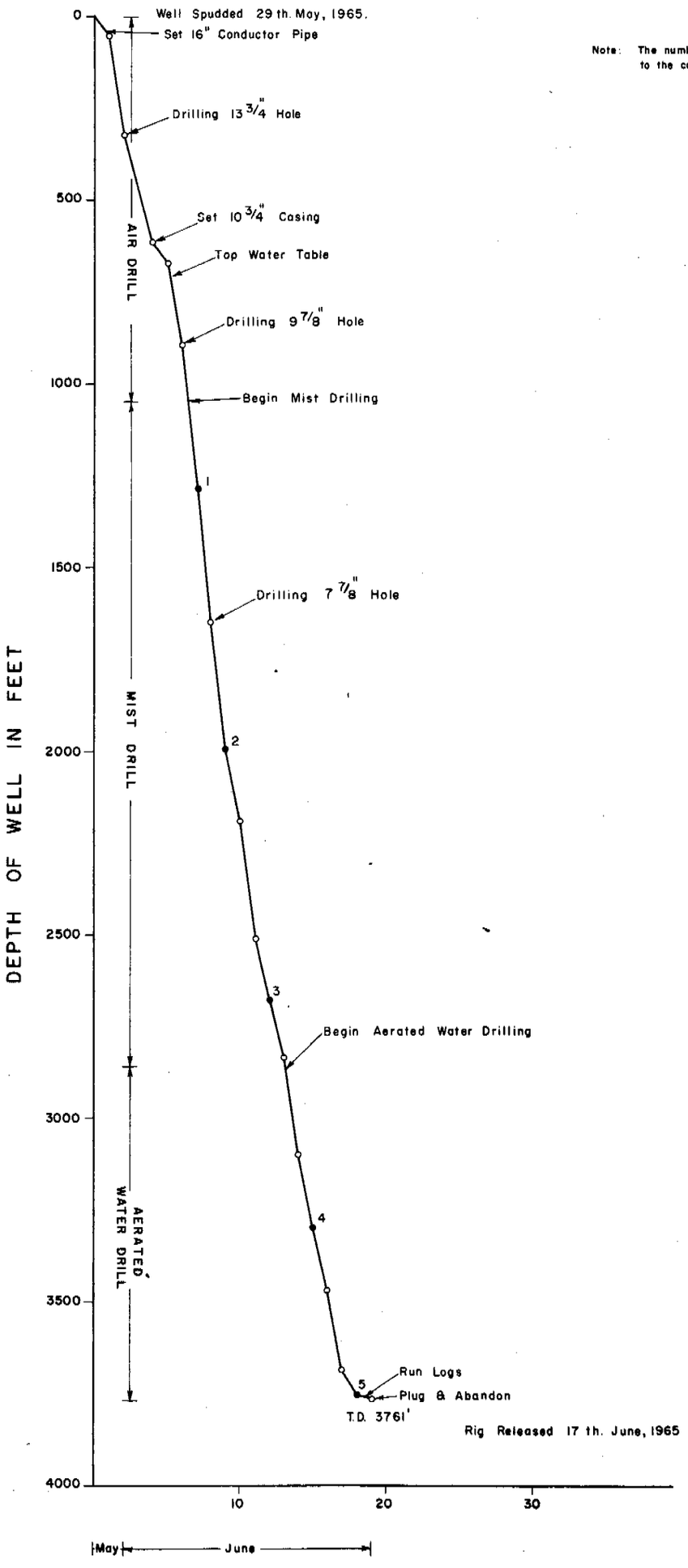
In abandonment the following plugs were run with the rig pumps.

Plug No.	Spotted At	Cement	Felt At
1	2550'	90 sacks	-
2	2000'	90 sacks	-
3	600'	70 sacks	-
4	Surface	20 sacks	-

EXOIL (N.T.) PTY. LTD.

OCHRE HILL No. 1

TIME VERSUS DEPTH GRAPH



Drilling Time and Gas Log:

A Geolograph was used to record the drilling penetration which is plotted on the composite log as minutes per five foot interval.

A pilot light was kept burning continuously at the end of the blooey line; the absence of flare indicated a lack of hydrocarbon flows.

A Corelab hot-wire gas detector was kept on location for use, if mud drilling became necessary.

Formation Testing:

No drill stem test was made.

Deviation Surveys:

Surveys were made with a Lane-Wells instrument run on a wire line inside the drill pipe. Frequent readings were taken except between 1805 feet and 3290 feet when the instrument was damaged after being dropped.

The following surveys were made:-

70' - 0°	480' - 1½°	1805' - 2¼°
185' - ¾°	730' - 1¾°	3290' - 5¼°
245' - 1°	1030' - 1¾°	3690' - 4¼°
307' - ¾°	1480' - 2¼°	
360' - 1¾°	1600' - 2¼°	

Drilling Observations:

A total of 456 hours were required to drill Ochre Hill No. 1 well. Total rotating hours on bottom (excluding coring) were 283½ or approximately 62% of total time. Thirteen bits, 9 Conventional and 4 Button, drilled 3712 feet of hole, an average of 286 feet/bit. In addition one reamer was used on surface hole. Average penetration rate was 13.1 feet/hour.

Breakdown of Drilling Operations:

	Footage	Hours Required	Feet/ Hour	No.of Bits	Bit Footage
Surface Hole	28	6	4.7	1	28
Air Drill 13¾" hole	570	52¼	10.9	4	143
Air Drill 9⅞" hole	438	27	16.2	2	219
Air/Mist Drill 7⅞" hole	1,771	117¾	15.0	3	590
Aerated Water Drill 7⅞" hole	885	80½	11.0	3	295

G E O L O G Y

SUMMARY OF PREVIOUS WORK:

Geological - Several geologists and expeditions have made reconnaissance or semi-detailed stratigraphic surveys of the central part of the Amadeus Basin. The most notable workers who have made cursory examinations of the area are Chewings, Brown, Tate (of the Horn Expedition), Ward, Mawson and Madigan.

In 1956 the Bureau of Mineral Resources commenced regional mapping of the Amadeus Basin, and Prichard and Quinlan (1962) incorporating previous nomenclature, defined a set of type stratigraphic units in the northern part of the basin. Frome-Broken Hill Pty. Ltd. undertook regional reconnaissance mapping of the whole of the basin (inter alia Leslie 1960) and since 1960 Magellan geologists have carried out extensive and locally detailed surveys in the basin, especially in the vicinity of anticlinal features. (Stelk and Hopkins, 1962; McNaughton, 1962). Continuing their mapping programme, the Bureau of Mineral Resources covered the southern, western and central areas of the basin and instituted local nomenclature for south-western and central facies variants in the Proterozoic and Cambrian sequence (Wells, Ranford and Cook, 1963). They made a provisional correlation between these and the northern facies of Prichard and Quinlan.

Geophysical - The Bureau of Mineral Resources carried out a reconnaissance helicopter gravity survey of the central Amadeus area in 1961 and in general anticlinal features were shown to underlie areas of gravity maxima. No other geophysical work has been carried out in the vicinity of Ochre Hill.

Drilling - Johnny's Creek No. 1, a shallow test to 877 feet, and East Johnny's Creek No. 1 were drilled six and 15 miles, respectively, east of the Ochre Hill site. The Mereenie gas field with four wells completed, lies twelve miles north of the site.

REGIONAL STRATIGRAPHY:

The Amadeus Basin, in its present form, occurs as an elongate, downwarped region between the Musgrave (southern) and Arunta (northern) metamorphic-igneous complexes. However, the sediments of the basin are considered to be merely shelf deposit remnants of a former depositional basin which extended considerably further to the north and east over the Arunta Block. The section covers strata from Upper Proterozoic to Devonian and embraces an aggregate thickness of some 20,000 feet.

In the northern part of the basin the Upper Proterozoic comprises a group of four conformable formations each of which shows evidence of deposition under marine shallow water conditions. The basal Amadeus unit is the Heavitree Quartzite, a transgressive sandstone - siltstone sequence up to 1,400 feet thick which shows bold outcrop along the truncated northern rim of the basin. The conformably overlying Bitter Springs Limestone consists mainly of algal bearing dolomitic limestone some 3,000 feet in thickness but varying minor amounts of shale and sandstone also occur and in places the carbonate rock has a high clastic content. The Areyonga Formation, which

follows with transitional contact, mainly, comprises a mixed unit of siltstones, sandstones and conglomerates of glacial aspect with limestone concentrated at the top and bottom of its sequence. Its thickness is 1,400 feet in the north central part of the basin but it thins markedly to the east and west, suggesting a deltaic accumulation of outwash material. Conformably following this unit the unfossiliferous Pertatataka Formation comprises up to 2,000 feet of black to vari-coloured shales and siltstones with thin interbeds of glauconitic sandstones and oolitic limestones.

Along the south western margin of the basin the Dean Quartzite and the Pinyinna, the Inindia and the Winnall Beds have been respectively equated with the above four formations. A total thickness of some 1,4000 feet has been estimated for these beds and each unit shows an appreciable thickening in comparison with its northern counterpart. In further contrast, local unconformity is suggested between the Inindia and the Winnall Beds in the former's type area and the latter is a distinctly sandy facies variant of the Pertatataka.

The Cambrian deposits of the Amadeus Basin are included under the composite name Pertaoorrta Group, a 5 - 6,000 feet marine sequence which shows an interesting clastic to carbonate facies change. The better known central facies comprises the predominantly sandy Arumbera Formation, the abundantly fossiliferous Hugh River Shale and the sandy Goyder Formation. Eastward, the uppermost two units become more carbonate rich through an increasing abundance of limestone tongues until, east of Alice Springs, this facies, the Jay Creek Limestone, occupies the entire lithological interval of the two formations.

To the west the Hugh River Shale becomes sandier, particularly in its second and uppermost quarters, whereby it is divisible into the Tempe Member, the Illara Sandstone, the Deception Member and the Petermann Sandstone. The Tempe overlies the Eninta Sandstone which is equivalent to the upper part, at least, of the Arumbera Formation. Further west the Deception Member also changes to sand and the pre-Goyder, Pertaoorrta sequence is mapped as the 3,000 feet thick Cleland Sandstone which overlies the Winnall Beds with unconformity. (The Tempe and Illara have been described under the names Mission and Gardner formations by McNaughton).

To the south of the James Ranges the Chandler Limestone, occurring between the Eninta and the Tempe, comprises up to 300 feet of contorted cherty limestone, dolomite and minor clastics. However, the detailed stratigraphic relationship of the Chandler to the Tempe and the limits of the former's geographical distribution have not, as yet, been established.

Conformably following the Pertaoorta is the Larapinta Group of fossiliferous marine strata. The basal unit is the Cambro-Ordovician Pacoota Sandstone up to 2,500 feet thick composed predominantly of clean quartz sandstone. The overlying Horn Valley Siltstone is 400 feet thick in the north west but it thins and pinches out completely eastward and southward. The phosphatic Stairway Sandstone conformably overlies the Horn Valley but is more transgressive, overlapping the lower Larapintine units to the south and east where it unconformably rests upon Pertaoorrta. The formation is almost 900 feet thick in the north and central parts of the basin but it thins eastward and southward in harmony with its contiguous formations. The top Larapinta unit is the Upper Ordovician Stokes Formation comprising up to 2,000 feet of vari-coloured siltstones

with limestones in the lower part and some transitional sands at the base.

The Mereenie Sandstone overlies the Stokes Formation conformably in the central part of the Amadeus Basin but elsewhere laps unconformably onto lower Larapintine units. Where conformity exists a basal 450 foot brown sand is always present which contains fossils of Ordovician aspect. The upper part of the Mereenie consists of some 2,000 feet of white to varicoloured unfossiliferous, possibly continental sandstone, usually assigned to the Silurian on a residual basis. As with the underlying Larapinta units, the Mereenie Sandstone shows thinning to the east and south, the latter being the more marked.

The Pertnjara Formation, at least 10,000 feet of continental clastics, overlies the Mereenie with angular unconformity. It comprises a lower siltstone section and an upper unit of red-brown to white silty and pebbly sandstone. Plant and fish remains of Devonian aspect have been found in both sections. The Pertnjara Formation is the topmost Amadeus unit and it occurs as an obscuring fill type deposit over the northern and central regions of the trough.

FORMATIONS PENETRATED

Stratigraphic Table:

Age	Lithological Unit	Tops Depth	Tops Subsea	Thickness
Cambrian	Goyder	Surface	2300'	428'+
Cambrian	Cleland	428'	1872'	2209'
Upper Proterozoic	Bitter Springs	2637'	-337'	1124'+

Detailed Stratigraphy:

Goyder Formation

0 - 428' (Thickness 428'+)

Entirely white, clean, very fine to coarse grained, argillaceous, slightly calcareous sandstone. Grains are well sorted quartz, angular to subrounded with minor traces of black lithic flecks.

Cleland Sandstone -

428' - 2637' (Thickness 2209')

Upper Sandstone -

428' - 2190' (Thickness 1762')

Almost entirely white, pink, orange and brown, clean, fine to medium grained, slightly calcareous sandstone. Green, grey and red-brown, micaceous siltstone and shale occur in the intervals 700' - 750', 1070' - 1100' and 1860' - 2190' and also in minor quantities throughout the section. Sandstone grains are well to medium sorted quartz with slight traces of black flecks and brown interstitial staining and below 2060' some glauconite inclusions. The sandstone is cleaner and more porous below 2055' and shows good resemblance to the Illara sand of East Johnny's Creek No. 1.

Tempe Member -

2190' - 2637' (Thickness 447')

Slightly glauconitic, mainly very fine to very fine grained silty sandstone in approximately equal ratio to red brown, minor green and grey, micaceous, dolomitic shale and lesser siltstone. At 2575' - 2595' and 2626' - 2637' bands of white, pink and grey vuggy dolomite are correlatable with a dual dolomite near the base of the Tempe in East Johnny's Creek No. 1. At 2637' Cambrian dolomite rests upon Bitter Springs dolomitic limestone with unconformable, possibly faulted contact.

Bitter Springs Limestone -

2637' - 3761' (Thickness 1124'+)

Interbedded white and minor grey, pink and black, dense, finely crystalline, occasionally silty, dolomitic limestone and red-brown with minor green micaceous, calcareous, silty shale to 3300'. White, grey and minor pink, brown, purple,

dense, fine to coarse crystalline, silty to sandy, banded dolomitic limestone below this. At 3680' shale, as above, increases in occurrence till below 3720' limestone is a minor constituent.

STRUCTURE

Ochre Hill No. 1 was drilled on the Ochre Hill Anticline, a well defined feature, aligned regionally W.N.W. - E.S.E. and showing dips up to 20° on both the northern and southern flanks.

Ochre Hill lies to the south of an anticlinal hinge line which extends from the Gardner Range in the west, through the James Ranges structures then eastward through the Mt. Burrell anticlinorium to the Hale River Metamorphic 'inlier'. North of this line the Amadeus Basin shows considerable downwarp of strata, a thick fill of Pertnjara Formation, gentle fold elements and fair conformity between formations. In contrast, the area to the south of this alignment is characterised by faulting, major unconformities and hiati, and appreciable post-depositional folding. Over this latter block the Gardner Range, Parana Hill and Petermann Creek anticlines show Pertaoorrta resting with marked angular unconformity on truncated Proterozoic units indicating considerable uplift and erosion prior to deposition of the Pertaoorrta. Posthumous uplift of the Palaeozoic strata produced typical 'bald headed' anticlinal features. The Ochre Hill structure proved to be 'bald headed' to the extent of basally truncated Tempe overlying Bitter Springs.

RELEVANCE TO OCCURRENCE OF PETROLEUM

Ochre Hill No. 1 gave no significant indications of hydrocarbons. Traces of brown material, possibly residual hydrocarbon, occurred in the upper Cleland and black residual hydrocarbon was observed throughout the upper 260 feet of

the Bitter Springs.

At 2150' - 2170' golden fluorescence was noted in association with residual hydrocarbon. Over the basal fifty feet of the Tempe dolomite fluoresced yellow. Yellow fluorescence occurred in limestone throughout the whole of the upper part of the Bitter Springs (2628' - 3300'), golden fluorescence was associated with all the occurrences of black residual hydrocarbon. The lower section of the formation to total depth showed blue and yellow fluorescence in limestone at several horizons.

POROSITY AND PERMEABILITY OF SEDIMENTS PENETRATED

Porous sands were noted throughout the Goyder and Upper Cleland and there was a steady increase in fresh water output through the unit. All these zones have indicated permeability associated with mud cake build up on the Contact Caliper log.

In the Bitter Springs vugular porosity in limestone was noted in Core No. 3 (2665' - 2673'), at 2900' in the interval 3110' - 3150' and in Core No. 4 (3297' - 3312'). A small increase in water was associated with an increase in the measured chloride content near the Tempe-Bitter Springs contact. This, together with the failure of mud to return to surface, suggests that a brackish aquifer occurs in this vicinity which acted as a lost circulation zone. A salt water aquifer is indicated on the Induction Electric log by a strong S.P. kick allied with high conductivity in the interval 2630' - 2640' which embraces the Tempe-Bitter Springs contact. No measurement of water yield could be made from the lower porous zones in the formation since aerated water was injected for drilling below 2855'.

OCHRE HILL NO. 1 WELL

CORE DESCRIPTIONS

Core No. 1: 1288' - 1298' recovered 8'4"

Coring Times: 5, 4, 3, 4, 4, 3, 4, 4, 3, 3 mins./ft.

Top 1': Interbedded Sandstone and Shale.

Shale is red, brown, very micaceous, soft, slightly platy, occasionally white, light brown, soft, clay-like. Sandstone is white, orange, very fine to medium grained, medium sorted, quartz is clear, frosted, angular to sub-rounded. Sandstone is very friable, soft, porous, breaks around quartz grains, much soft white, yellowish, clay cement (kaolin) through Sandstone, some very minor black scattered argillaceous inclusions.

Bottom 7'4": Sandstone, white, orange, brown, very fine to coarse grained, medium sorting, quartz as above, very slightly micaceous, much white, yellow clay cement, scattered porosity, friable, fairly soft, scattered haematite nodules (up to 1" across) through interval, some nodules circular, others elliptical (with long axis generally parallel to bedding). Core breaks horizontally into thin (4") pieces. Core generally is white, friable Sandstone with some thin ($\frac{1}{4}$") brown sandstone (haematite) interbeds. Scattered black argillaceous flakes and inclusions through interval.

Very slight scattered pinpoint blue mineral fluorescence (probably due clay). Scattered porosity up to 8% through interval.

Dip 0°- 3°.

Core No. 2: 2005' - 2015' recovered 6'7"

Coring Times: 5, 5, 6, 8, 9, 9, 11, 8, 7, 6 mins./ft.

6'7" Interbedded poorly sorted red brown Sandstone, red brown Shale and Siltstone. Sandstone is red brown in colour overall, though individual sand grains are white, brown, pink and orange; is very fine to coarse grained, poorly sorted, much clay cement (mainly haematite, possibly some kaolinite) micaceous (white mica) very slightly dolomitic. Quartz is clear, frosted, pinkish, brownish, angular to sub-rounded, some pink grains may be felspar (orthoclase). Scattered through sand are pits. Inclusions and patches of Shale, mainly red brown, micaceous, slightly silty, some green, micaceous (possibly slightly glauconitic?). These patches are up to $\frac{3}{4}$" across (circular to elliptical in shape, long axis parallel to bedding). Scattered through interval are minor (up to 4") interbeds red brown Shale (clay-like) micaceous, grades to Siltstone in part. Overall appearance of core is that of "dump" deposit (very little evidence of bedding) each interval grades into the adjoining intervals. Slight porosity and permeability (soaks up water). Very slight porosity scattered through interval. Overall tight. No fluorescence.

Dip 0°.

Core No. 3: 2665' - 2673' recovered 3'6"

Coring Times: 18, 23, 25, 21, 20, 30, 21, 16 mins./ft.

3'6" white calcareous Siltstone (some white clay material near top) with ¼" veins (bands) pure calcite cutting across Siltstone at approximately 70° angle. Veins of calcite have coarse, clear well developed crystal structure and contain black asphaltic material at crystal interfaces (which flakes off with acetone) scattered pyrite throughout calcite. Section could be called a white banded Limestone with dense, fine to clear, coarse, well developed calcite crystals scattered stylolites through interval rarely dip more than 5°. Section has slightly vuggy porosity is slightly dolomitic in part. Some solution cavities up to ½" across contain well developed coarse calcite crystals. There is no easily determined bedding (bedding probably roughly parallel to stylolites). Banding in Limestone is alternately coarsely crystalline to fine silty (marl like). Core breaks along banding planes, i.e. at 70°. Minor blue yellow fluorescence in Limestone. Golden fluorescence with residual hydrocarbon. Scattered solutions cavities in Limestone. Minor vuggy porosity in Limestone, no apparent permeability.

Dip 0° - 5°.

Core No. 4: 3297' - 3312' recovered 15'

Coring Times: 22, 24, 17, 17, 21, 18, 19, 19, 16, 17, 18, 20, 20, 18,20 mins./ft.

15' interbedded Limestone, calcareous Siltstone. Minor Dolomitic Limestone is white, pink, grey, fine to coarsely crystalline, dense in part, slightly silty in part. Scattered interbeds grey, white, calcareous Siltstone (Siltstone beds rarely more than 6" thick). Upper section of core mainly massive Limestone with scattered solution cavities (aligned parallel to bedding) through Limestone dipping at approximately 70°. 3' from top of core is large solution cavity containing 1" calcite crystals and numerous small (⅛") cubic crystals calcite, which appear to be pseudomorphs of calcite replacing salt (cubic halite crystals). Bottom section of core consists of thinly bedded Limestone and calcareous Siltstone with patchy Dolomite. Scattered solution vugs occur through this interval (usually elongate with long axis roughly parallel to bedding). Little or no effective permeability can be seen between the solution cavities and vugs in this core.

No apparent permeability except porosity through large cavities. Scattered solution cavities. Minor vuggy porosity. Scattered yellow mineral fluorescence.

Dip 70°.

Core No. 5: 3755' - 3761' recovered 6'

Coring Times: 43, 32, 35, 30, 33, 36 mins./ft.

6' red, brown Shale with scattered stringers and spots, green, white Shale and Limestone. Shale is hard, massive, calcareous, very slightly micaceous. Scattered through core are vari-coloured patches, dense, white, finely crystalline Limestone. Dip on core is indeterminate but minor fracturing occurs along green Shale contacts (slickensides) which dip approximately 40°. Section is patchy, slightly dolomitic throughout. Red, brown Shale is slightly splintery and very hard. Appears as massive unit in core. Green Shale and Limestone rarely greater than 1" in thickness.

Interval tight, scattered blue, yellow mineral fluorescence.

Dip indeterminate.

Ochre Hill No. 1

Core 1 1290' Arkose

Quartz makes up an estimated 65-70% of the rock. The other important clastic mineral is feldspar, which includes orthoclase and some plagioclase with the predominant microcline. Scattered flakes of muscovite and some biotite are common. Tourmaline pleochroic in pale yellow and blue is a common accessory mineral, and there are a few rounded grains of zircon. There is about 10% clay as intergranular matrix and also as an alteration product of feldspar. Geothite cement is locally concentrated along bedding planes and also forms small concretionary masses.

Grains are poorly rounded or angular with sutured boundaries. Sorting is only fair, with average grain diameter about 0.1 mm. Porosity appears low, with grains tightly compacted and intergrown, and clay fills most of the intergranular spaces.

Core 3 2666' Dolomite with calcite veins

The core fragment supplied consists of fine-grained cream-colored rock traversed by parallel fractures 2-3 mm. wide filled with coarse carbonate. A stained thin section shows that the cream colored rock is composed of dolomite grains averaging less than 0.05 mm. in diameter but ranging up to 1.0 mm. in diameter along the margins of the fractures. The larger grains also tend to be euhedral, with good rhombohedral outlines. Very large calcite crystals fill the fractures and are often optically uniform across the fractures and for 3-4 mm. along the length of the fractures. Calcite also fills porous zones in the dolomite, where it is associated with relatively coarse euhedral dolomite crystals and with patches of fine quartz (recrystallized chert?) 0.5-1.0 mm. in diameter. Some of the calcite is optically continuous with euhedral dolomite crystals and appears to be replacing the dolomite.

There does not appear to be any organic material or clastic grains in this sample. A suggestion of layering in the rock parallels the fractures and probably represents incipient shear zones rather than bedding.

W. B. Bryan
Sept. 20, 1965

Ochre Hill No. 1

Core 2 2012' Feldspathic glauconite sandstone

About 90% of the rock is quartz and chert, with conspicuous amounts of microcline. Pellets of cryptocrystalline green glauconite may total 2-3% of the rock. Hematite is present as thin coatings on the original grain boundaries. Zircon, apatite and blue tourmaline are present in very minor amounts. Scattered opaque granules are metallic in reflected light and are probably magnetite or pyrolusite.

The original grain boundaries as indicated by hematite coatings were well rounded with a high degree of sphericity. Overgrowths on quartz and feldspar have filled most of the original pore space and have created a secondary mosaic texture. The sample is massive, with no obvious bedding.

Core 4 3300' Limestone

The sample is composed almost entirely of cryptocrystalline calcite, with traces of quartz as tiny grains .01-.02 mm. in diameter. A network of incipient fractures traverses the sample. These fractures are filled with coarser calcite averaging 0.1-0.2 mm. in diameter. Boundaries between fracture fillings and cryptocrystalline limestone are generally diffuse. Most of the fractures are irregular in trend and width; a few are straight and are about 0.2 mm. wide. Vuggy cavities observed in the hand specimen are probably related to these fractures. The texture suggests slow brecciation and recrystallization in response to deforming stresses.

W. B. Bryan
Sept 20, 1965

Ochre Hill No. 1

Core 5 3757' Dolomitic shale

The sample is composed of fine ferruginous clay with an abundance of silt sized platy crystals (illite?) and angular silt-sized quartz with possibly some feldspar; An estimate of mineral proportions is difficult due to the fine grain size, but the silt-sized material may total 30% or more of the rock.

Distinct carbonate rhombs appear in the sample and are locally concentrated into carbonate-rich areas 2-3 mm. in diameter. Individual crystals may be as large as .1 mm. but most are much smaller. They are unaffected by dilute acid and this, with the characteristic crystal form, indicates that they are dolomite.

Light-colored areas 2-3 mm. in diameter appear in the thin section and hand specimen. They differ from the rest of the rock mainly in the absence of ferruginous pigment, but may also contain slightly more dolomite.

The fine grain size and wide distribution of the dolomite crystals suggests that these are a primary precipitate and may indicate deposition in a restricted basin.

W. B. Bryan

Sept. 20, 1965

APPENDIX 3

RESEARCH FOR INDUSTRY

THE AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES

CONYNGHAM STREET · PARKSIDE · SOUTH AUSTRALIA
TELEPHONE 791662 · TELEGRAMS 'AMDEL' ADELAIDE

Please quote this reference in your reply:

MP 3/162/0

22nd October, 1965

Your reference:

Mr. D. Bembow,
Exoil N.L.,
Perry House,
Elizabeth Street,
BRISBANE QLD.

REPORT MP2643-65

YOUR REFERENCE:	Letter dated 21/6/65 (Fitzpatrick, Johnson and Associates)
MATERIAL:	Core samples
IDENTIFICATION:	East Johnny Creek No.1, Core 7 Ochre Hill No.1, Core 4
DATE RECEIVED:	23/6/65
WORK REQUIRED:	x-radiography of vertical sections

Investigation and Report by: N.A. Trueman

Officer in Charge, Mineralogy Section: H.W. Fander

H.W. Fander

P.A. Young
Director

c.c. to
Messrs Fitzpatrick, Johnson & Associates,
77 Grenfell Street,
ADELAIDE S.A.

LOGGING AND TESTING:

Ditch Cuttings:

Drill cuttings were collected from the blooey line at ten foot intervals except during coring when five foot samples were taken. Three cuts of samples were made, one for each of the Northern Territory Administration (Alice Springs), Magellan Petroleum (N.T.) Pty. Ltd. and Exoil (N.T.) Pty. Ltd.

Coring:

Five cores were cut to evaluate lithology and hydrocarbon shows as indicated in the cuttings.

The following table lists cored intervals and recoveries:-

Core No.	Interval	Cored	Recovered	% Recovered
1	1288' - 1298'	10'	8'4"	83
2	2005' - 2015'	10'	6'7"	66
3	2665' - 2673'	8'	3'6"	44
4	3297' - 3312'	15'	15'	100
5	3759' - 3761'	6'	6'	100
		49'	39'5"	80

(See Appendix 1 for core descriptions)

Electrical and Other Logging:

A single logging run was made by Welex before cutting a bottom hole core. However, the Dipmeter log was unsuccessful and a successful rerun was made at total depth. The hole was mudded up just prior to logging but was flushed with aerated water before the Dipmeter was rerun.

The following logs were run at 2" and 5" scales.

Induction-Electric	618' - 3749'
Gamma Ray	0' - 3748'
Contact-Caliper	618' - 3752'
Acoustic Velocity	618' - 3748'

THE AUSTRALIAN MINERAL DEVELOPMENT LABORATORIES

X-RADIOGRAPHY OF CORE SAMPLES

Both samples are of carbonate sediments.

The core 7, East Johnny Creek No.1 well (6020 ft) shows irregular, plastically deformed bedding, the general direction of which is approximately 80° to the axis of the core (10° to the horizontal). Some rafting of the sediment is evident.

Core 4, Ochre Hill No.1 well (3311 ft) shows bedding approximately 10° to the axis of the core (or 80° to the horizontal). Rafting of the sediment is also evident in this section and the rock is recrystallized. Assuming the axis of the core to be vertical the sediments would appear to be overturned approximately 10°.

ws:1

NORTHERN TERRITORY ADMINISTRATION—ANIMAL INDUSTRY BRANCH

WATER ANALYSIS

Origin of water OCHRE HILL NO. 1 EXOIL OIL TEST

Reference Sn 66 / 21

Specimen Advice Note No. 9355

Date sampled ?

Date received 16/7/65

* Results in milligrams per litre of filtered sample.

	Sample	Recommended Maximums (see over page). Domestic	Stock	Agriculture
HARDNESS (calculated as $CaCO_3$)—				
" Total	410	500	—	—
" Carbonate	102	—	—	—
" Non-Carbonate	308	—	—	—
ALKALINITY IN EXCESS OF TOTAL HARDNESS	Nil	—	—	—
CHLORIDE	180	500	—	—
SULPHATE	398	250	2,000	—
BICARBONATE	125	—	—	—
NITRATE	Not Determined	Child 20 Adult 120	—	—
FLUORIDE	" "	1.5	5.0	—
CARBONATE	Nil	—	—	—
SODIUM	160	—	—	—
POTASSIUM	27	—	—	—
CALCIUM	116	100	—	—
MAGNESIUM	29	100	300	—
TOTAL-DISSOLVED SALTS	-	3,000	8,000	1,000
RESIDUE ON EVAPORATION	1,100	3,000	8,000	1,000

pH 7.6

General remarks of Analysing Officer with particular reference to suitability of the water for the purpose for which it is stated to be required.

The above results are forwarded for your information.

Signature [signature]

Date 12-8-65.

* 14.3 milligrams per litre equals 1 grain per gallon. 437.5 grains equals 1oz.

APPENDIX 5

WELEX

DIP LOG CALCULATIONS

COMPANY EXOIL (N.T.) PTY. LTD.
WELL ORBE HILL #1
FIELD WILDCAT
County State N.T.

Log Measured From KELLY BUSHING
Drilling Measured From KELLY BUSHING

Elev.: K.B. D.F. G.L.

Run No.	Date	Depth-Driller	Depth-Welex	Btm. Log Interval	Top Log Interval	Casing-Driller	Casing-Welex	Bit Size	Type Fluid in Hole
ONE		3755	3754						[illegible]

Fold Here

REMARKS

DIP LOG DATA PROCESSED THROUGH 1620 IBM COMPUTER SYSTEM.

Magnetic Declination 5degrees East

TABLE OF CONSTANTS FOR DETERMINING VERTICAL DIFFERENCE AT VARIOUS DIP ANGLES

DIP ANGLES Degrees	CONSTANT	DIP ANGLES Degrees	CONSTANT	DIP ANGLES Degrees	CONSTANT	DIP ANGLES Degrees	CONSTANT
1	.0175	11	.194	21	.384	35	.700
2	.035	12	.213	22	.404	40	.839
3	.052	13	.231	23	.425	45	1.000
4	.070	14	.249	24	.445	50	1.192
5	.088	15	.268	25	.466	55	1.428
6	.105	16	.287	26	.487	60	1.732
7	.123	17	.306	27	.509	65	2.144
8	.141	18	.325	28	.531	70	2.748
9	.158	19	.344	29	.554	75	3.732
10	.176	20	.364	30	.577	80	5.671

Vertical difference in feet is obtained by multiplying the constant for any given dip angle by the horizontal distance in feet.

Example: Dip angle 10°, Horizontal distance 440 ft.
Vertical difference = .176 x 440 = 77.44

DIPMETER EVALUATION

AN EVALUATION OF THE DATA PRESENTED ON THIS SURVEY MUST BE INFLUENCED TO A DEGREE BY THE QUALITY OF THE CORRELATIONS ON EACH LEVEL OR INTERVAL.

THESE CORRELATIONS, WHICH, OF COURSE, ARE THE BASIS FOR ALL DIPMETER COMPUTATIONS, ARE COMPLICATED BY VARIOUS FACTORS SUCH AS WASHED OUT HOLE, MUD INVASION (I.E. MUD CAKE THICKNESS), TOOL ROTATION, ETC. THE FOLLOWING IS A GUIDE TO THE CORRELATION GRADING SYSTEM USED IN COMPUTING THIS RECORD:

- "A" EXCELLENT (AN ALMOST EXACT DUPLICATION OF ANOMALIES ON ALL THREE PROFILES)
- "B" GOOD (GOOD REPETITION OF CHARACTER AND MAGNITUDE OF ANOMALIES ESPECIALLY AT TOPS AND BASES OF RESISTIVE BEDS)
- "C" FAIR (GENERAL CHARACTER OF MAJOR ANOMALIES ESSENTIALLY SAME WITH DIFFERENCE IN MAGNITUDE AND/OR MINOR CHANGES IN APPARENT LITHOLOGICAL FEATURES)
- "D" POOR (POOR DEFINITION OF BED BOUNDARIES AND/OR VERY LITTLE CHANGE IN LITHOLOGY)

DEPTH INTERVAL REFERENCE NUMBER AND CORRELATION GRADE				COMPUTED DIP FROM TRUE NORTH		MEASURED DATA FROM MAGNETIC NORTH			DIA. AND DISPLACEMENTS			
Depth		Ref. No.	Corr. Grade	Dip Angle	Dip Azimuth	Drift Angle	Drift Azimuth	Azimuth No. 1	DIA.	No. 1	No. 2	No. 3
[illegible]												

DIP LOG

TRUE NORTH

ARROWS DENOTE DIRECTION OF DIP

1" 100'

POTENTIAL MILLIVOLTS	RESISTIVITY OHMS M^2/M	CONDUCTIVITY M MHOS/M

18" Normal 100 / 1000

CORRELATED INTERVAL & CORRELATION GRADE
- "A" CORRELATION
- "B" CORRELATION
- "C" CORRELATION
- "D" CORRELATION

Magnitude of Dip angle
0 5 10 15 20 30 40 50 70 90

Magnitude of Dip angle
0 5 10 15 20 30 40 50 70 90

CORRELATED INTERVAL & CORRELATION GRADE

18" Normal 100 / 1000

POTENTIAL MILLIVOLTS	RESISTIVITY OHMS M^2/M	CONDUCTIVITY M MHOS/M

EXOIL (N.T.) PTY. LTD.
ORBE HILL #1
WILDCAT
NORTHERN TERRITORY (AUSTRALIA)

T.D. LOGGED 3757'
T.D. DRILLER 3755'
T.D. WELEX 3754'

PR65/12.B

COMPOSITE WELL LOG
EXOIL (N.T.) PTY. LTD.
OCHRE HILL No. 1

PETROLEUM TENEMENT: O.P. 43 STATE: NORTHERN TERRITORY 4-MILE SHEET: LAKE AMADEUS BASIN: AMADEUS

WELL STATUS: DRY & ABANDONED

LOCATION: Lat 24° 07' 58" S, Long 131° 23' 49" E

ELEVATION: Ground K.B. 2300' est (approx.)

Date Spudded: 29 - 5 - '65
Date Drilling Stopped: 16 - 6 - '65
Date Rig off: 17 - 6 - '65

Total Depth: Driller 3761', E. Log 3754' (before 6' bottom hole core cut)

Hole Size	Inches	From	To
	20	Surface	46'
	13 3/4	46'	618'
	9 7/8	618'	1288'
	7 7/8	1288'	3755'
	7 13/16	3755'	3761'

Casing Size	Inches	Wt	Gr	Depth	Cmt	Cmt'd to
	16	52.25	Cond	46'	40 sacks	Surface
	10 3/4	40.5	J-55	618'	220 sacks	Surface

Cement Plugs	From	Sacks
1	2550'	90
2	2000'	90
3	600'	70
4	Surface	20

Well Head Fitting: Welded steel plate
Drilled by: Oil Drilling and Exploration
Logged by: Welex
Drilling Method: Rotary — Air, mist, aerated water
Cemented by: Oil Drilling and Exploration
Mud Logging by: Exoil
Lithology by: D. Benbow

INDUCTION - ELECTRICAL LOG DATA

Run No.		1		
Date		16-6-'65		
First Reading		3744'		
Last Reading		618'		
Interval Recorded		3126'		
Casing Meter		618'		
Casing Driller		618'		
Depth Reached		3744		
Bottom Driller		3755		
Hole Nature		DEL		
Density / Viscosity				
Mud Resistivity				
Mud Resistivity @ oF				
pH/Fluid Loss cc/30min.				
Origin of Samples				
Run				
Rec.				
Bit Size		9 7/8" - 7 7/8"		
Casing Size		10 3/4"		
Opr. Rig Time				
Truck No.				
Recorded by		E. MYERS		
Witness		J. MOORE		

RADIOMETRIC LOG DATA

Type of Log	GAMMA RAY
Run No.	1
Date	16 - 6 - '65
Total Depth Driller	3755'
Top Logged Interval	0
Bottom of Logged Interval	3752
Type of Fluid in Hole	GEL. MUD
Fluid Level	IN CASING
Maximum Recorded Temperature	124° F
Neutron Source, Strength and Type	
Source Spacing — in.	
Length of Measuring Device	26"
O.D. of Instrument — in.	3 5/8"
Time Constant — Secs.	3/4
Logging Speed — Ft./Min	72
Circulation Cessation	2 HR
Sensitivity Reference	80 API UNITS/in.
Recorded by	E. MYERS

CASING RECORD				OPEN HOLE RECORD		
Run No.	Size in	Wt. Lbs. per ft.	Interval in Ft.	Bit Size in	Interval in Ft.	
1	16	52.25	Surface	24	9 7/8	618 - 1288
2	10 3/4	40.5	Surface	618	7 7/8	1288 - 3755
					7 13/16	3755 - 3761

OTHER LOGS

Contact Caliper: 618' - 3752'
Acoustic Velocity 618' - 3748'
Continuous Diameter: 618' - 3752'

LITHOLOGIC REFERENCE

- Sandstone
- Siltstone
- Shale
- py Pyrite
- gl Glauconite
- ▲ Chert
- Limestone
- Dolomite
- Dolomitic Limey
- gy Gypsum
- 0 Fluorescence
- h/c Residual hydrocarbon

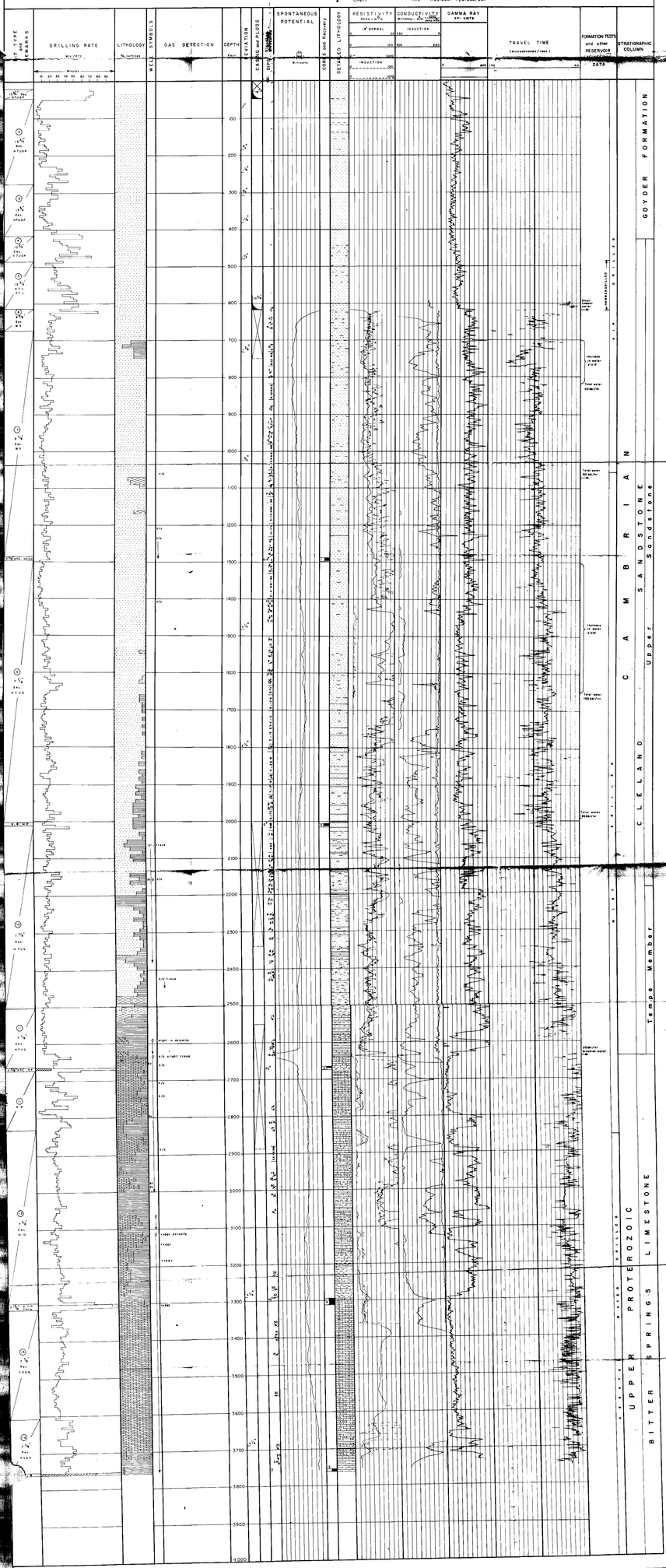


FIGURE 1

131° 15'
131° 30'
131° 45'
24° 00'
24° 15'
24° 30'

A
B
C

MEREENIE GAS FIELD

WEST MEREENIE No. 1
MEREENIE No. 1
EAST MEREENIE No. 1
EAST MEREENIE No. 2
OCHRE HILL No. 1
JOHNNY'S CREEK No. 1
EAST JOHNNY'S CREEK No. 1

Approx. Location
B.M.R. Drill Hole
A.P.4. with oil sand

A — MEREENIE FARMOUT

B — JOHNNY CREEK FARMOUT

C — OCHRE HILL FARMOUT

EXOIL (N.T.) PTY. LTD.

Location Map

OCHRE HILL No 1

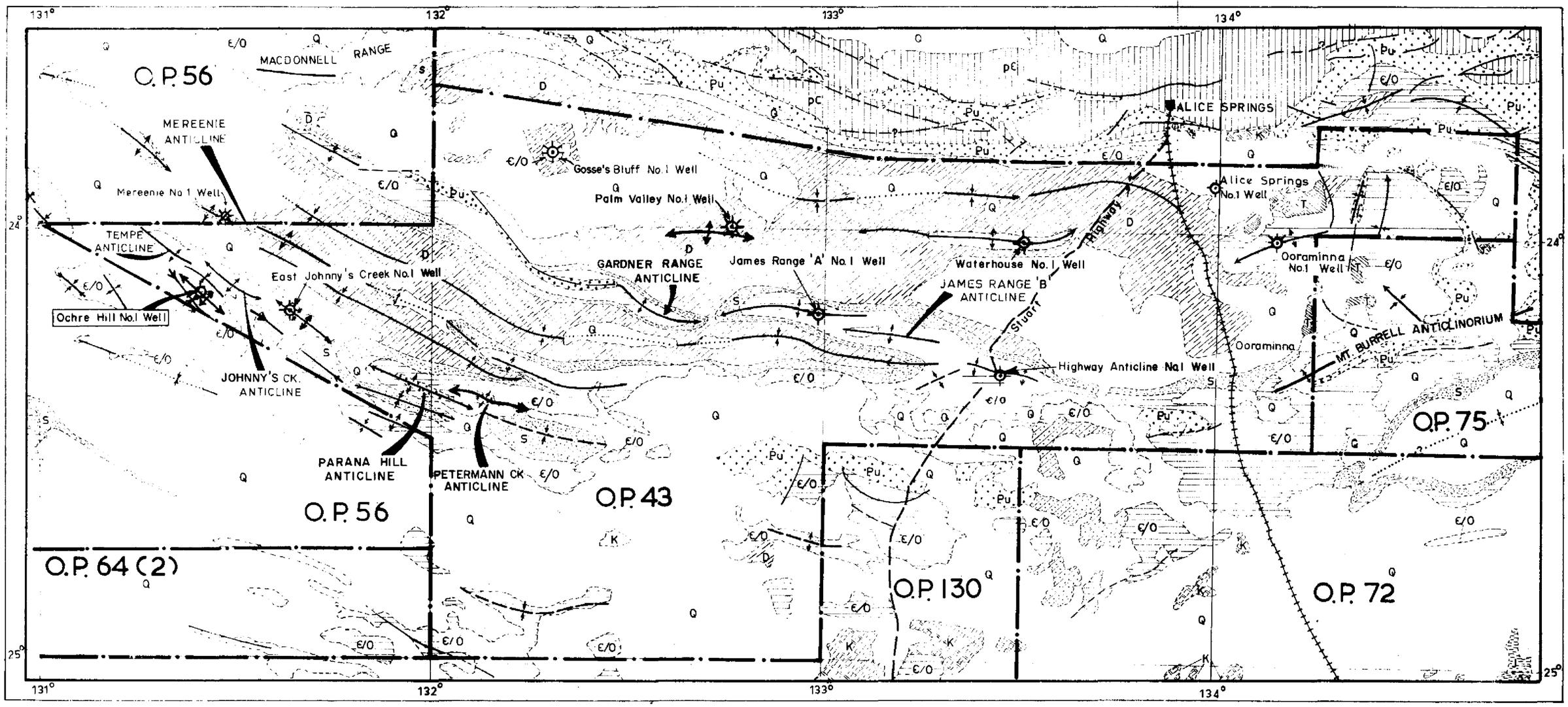
O.P. 43, N.T.

SCALE IN MILES

4 0 4 8

PR65/228

FIGURE 3



LEGEND

- Q — QUATERNARY
- T — TERTIARY — Sediments
- TERTIARY — Grey billy
- K — CRETACEOUS
- ? JURASSIC
- D — DEVONIAN
- S — ? SILURIAN
- €/O — ORDOVICIAN—CAMBRIAN
- Pu — UPPER PROTEROZOIC
- pC — Undifferentiated
- Fault
- Anticline, showing plunge
- Syncline

WELL LOCATION & REGIONAL GEOLOGICAL MAP
OCHRE HILL No. 1

SCALE OF MILES

16 8 0 16 32

Geology after: T. Quinlan, BMR

PR65|22B