

BARKLEY OIL COMPANY PTY. LTD.

COMPLETION REPORT

FREWENA NO. 1 WELL

OIL PERMIT 73 (2)

NORTHERN TERRITORY

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NORTHERN T
GEOLOGICAL

S U M M A R Y

FREWENA NO. 1 WELL

The Frewena No. 1 well was drilled in the Georgina Basin as a stratigraphic test of Cambrian sediments, and to determine the thickness of stratigraphic section. It is the first well drilled by Barkley Oil Company Pty. Ltd. on Oil Permit No. 73 covering an area of 9,553 square miles in eastern central Northern Territory. The well was located seven miles north-west of the Frewena Road house, two miles north of the Barkley Highway. The well was spudded in on December 15th, 1964 and reached total depth of 1,024 feet on January 19th, 1965 after being shut down 10½ days during Christmas holidays waiting on an oilfield air booster. Drilling contractor was W.L. Sides and Son using a Failing 1500 rotary rig.

The well encountered 250 feet of interbedded chert, sandstone, shale, limestone and dolomite and 774 feet of variably vuggy, often gypsiferous dolomite and limestone. Drilling was terminated when effective rig capacity was reached, and the well was left as a stock bore with a standing water level of 133 feet.

RESUMÉ OF DRILLING OPERATIONS

The hole was drilled from surface to total depth with air.

Drilled 8½" hole from surface to 22 feet with conventional bit, from 22 feet to 152 feet with hammer-drill and from 152 feet to 182 feet with a conventional bit. Air circulation was lost while drilling 152 feet to 155 feet. Water was injected and circulation restored. Ran 7" casing and cemented at 172'. Rig shut down 10 days 15 hours waiting on air compressor booster. Drilled 6½" hole 182' - 233' with conventional bit and 233' - 495' with hammer-drill. Cut Core No. 1, 495' - 511', recovered 3'6". Drilled 6½" hole ahead with conventional bit to 576', and from 576' to 852' with hammer-drill. Below 852' hammer-drill would not function because of water in hole. Drilled 6" hole ahead with conventional bit to 955'. Cut Core No. 2, 955' - 961', recovered 1'6". Drilled 6" hole to 1,024'. Drilling terminated at 1,024' when excessive rig time spent on repairs made it uneconomical to continue.

INTRODUCTION

The Frewena No. 1 well is the first well drilled by Barkley Oil Company Pty. Ltd. in the Georgina Basin. The well was drilled on Oil Permit 73 issued by the Administrator of the Northern Territory of Australia.

The well was drilled as a stratigraphic test to evaluate the reservoir and petroleum source potential of Cambrian rocks, and to determine the thickness of prospective sediments in the area.

WELL HISTORY

Well Name and Number: Frewena No. 1.

Location: 19°22'S; 135°30'E.

Name and Address of Tenement Holder:

Barkley Oil Company Pty. Ltd.
2nd Floor, T. & G. Building,
137 Queen Street,
Brisbane. Queensland.

Details of Petroleum Tenement:

Oil Permit No. 73, Northern Territory.

Area: 9,553 square miles

District: Tennant Creek.

Total Depth: 1,024 feet.

Date Drilling Commenced: December 15th, 1964

Date Well Completed: January 19th, 1965. (Shut
down 10½ days).

Drilling Time in days to
total depth: 23

Status: Water well.

Name and Address of Drilling Contractor:

W.L. Sides & Son Pty. Ltd.,
422 Collins Street,
Melbourne. Victoria.

Drilling Plant: Failing 1500 rotary rig.

Hole Size and Depths: 8¼" hole from surface to 182'
6¼" hole from 182' to 852'
6" hole from 852' to 1,024'.

Casing and Cementing Details: Size: 7"
Weight: 20 lb.
Grade: J-55
Setting Depth: 172'
Cemented to: Surface.
Cement used: 70 sacks

Drilling Fluid:

The well was drilled with air because extreme lost circulation problems were expected in the cavernous carbonate section. Water in the hole at 180 feet prevented deeper drilling with the two 600 c.f.m. 100 p.s.i. air compressors on site and drilling was suspended until a booster hired from Oilfield Air Drilling Services arrived.

During subsequent drilling to total depth, sufficient air was available to clean the hole.

During drilling the hole produced an estimated 1000 gal./hour of water.

Cutting Sampling:

Ditch cuttings were caught at ten foot intervals from surface to total depth. Two cuts of samples were made, one for the Northern Territory Administration and one for the operator.

Coring:

The programme called for cores to be cut at five hundred foot intervals. Accordingly, two cores were cut. No. 1 at 495' to 511', recovered 3'6" and No. 2 at 955' to 961', recovered 1'6".

Coring equipment consisted of a 20' Reed "Korking" barrel and $5\frac{5}{8}$ " O.D. Reed Hard Formation Core Heads cutting a $2\frac{3}{8}$ " diameter core.

Recovered portions of the cores were delivered to the Resident Geologist Alice Springs, for the Northern Territory Administration.

Electrical Logging No logging was done

Formation Testing:

No formation tests were run, but the use of air for drilling would have provided production of any hydrocarbons encountered.

GEOLOGY

The following summary of the regional geology is taken from B.F. Fitzpatrick "A Review of the Geology of O.P. 73 (1), (2) and (3), Northern Territory", an unpublished report for the Barkley Oil Company:

"On the Brunette Downs Sheet, immediately north of O.P. 73 (2), medium grained current-bedding quartz sandstones outcrop as east-west strike ridges. They occur in the north-east section of the sheet (i.e. south east of O.P. 73 (1)), and dip flatly towards the south. They are considered to be Upper Proterozoic in age, the equivalent of the Mittiebah Sandstone. In the north-western and central parts of the Brunette Downs sheet, outcrops of the Anthony Lagoon Beds are found. No diagnostic fossils have been found in these beds. They do contain algal remains south of Anthony Lagoon. West of Brunette Downs homestead, cross-sections of trilobites have been found. It is important to note that leaching and silicification often makes it difficult to differentiate between Cambrian and Mesozoic rocks.

"Outcrops of the Brunette Limestone (Tertiary) widespread, often as blocks and boulders in black

"Fossiliferous Middle Cambrian sediments outcrop in the south eastern part of the Alroy four mile sheet. They include silicified limestones, siltstones, chert, silicified shale and quartz sandstone. The Wonarah Beds occur as rubble-strewn low rises. They contain fossils of Mid-Cambrian age and continue towards the west as low-scattered outcrops to the vicinity of Gum Ridge, east of Tennent Creek. Here the Gum Ridge Formation is seen to rest directly on Proterozoic rocks that have been mined nearby for gold. Middle Cambrian trilobites have been collected by the writer in the Gum Formation at Gum Ridge. The outcrop occurs as low, rounded, rubble-strewn mounds, with the maximum stratigraphic thickness exposed of the order of 40 feet. It is the opinion of the B.M.R. and the Gum Ridge Formation is contemporaneous, having been deposited in a continuous Mid-Cambrian sea.

"Outcrops of the Tertiary Brunette Downs Limestone occur in the central and northern parts of the Alroy four mile sheet. Travertine is common towards the south margins of the area. While this travertine is apparently similar to the Brunette Downs Limestone, differences in lithology and topographic expression are sufficient to exclude it from the formal unit.

"In O.P. 73 (2) the maximum development of sediments is not expected to exceed 1,000 feet. Of this, up to 100 feet stratigraphic is Tertiary in age.

"There has been a considerable amount of airborne magnetometer work carried out in the vicinity of Tennent Creek. One line, flown across the permit, indicates a maximum depth of 800 feet of magnetic basement. A regional gravity profile has been run along the Barkley Highway but the results of this are not known to the writer.

"The logs of 250 water bores, located on the Brunette Downs, Alroy, Wallhallow and Mt. Drummond four mile sheets, are available from the B.M.R. The bores are generally shallow, the deepest being 600 feet still in Cambrian limestone.

"It is worth reporting that the aquifer normally sought throughout a large area of the Georgina Basin is the Mid-Cambrian limestone. Water is produced from fractures and supplies are normally good. The dark bituminous members of the Mid-Cambrian limestone produce petroliferous odours when freshly broken. It can reasonably be expected that considerable flushing has taken place.

"The stratigraphic section to be expected in the above permit is as follows:-

<u>Cainozoic</u>	Black soil, sand travertine laterite Brunette Limestone
<u>Mesozoic</u>	Undifferentiated due to leaching etc.
<u>Palaeozoic</u>	Wonarah Beds Anthony Lagoon Beds Top Springs Beds
<u>Proterozoic</u>	Mittiebah Sandstone"

Stratigraphy:

Thicknesses of the various units described are approximate as no logs were run, and variations in the rate of penetration are as apt to be due to varying mechanical conditions as to changes in lithology, in this type of operation.

Except for the surface mantle, the Frewena No. 1 section is believed to belong to the Middle Cambrian Anthony Lagoon Beds.

0 feet - 25 feet (thickness 25 feet)

Grey, sandy and limy surface soil; grey and rusty, porous, sandy hardpan and claystone; and varicoloured, speckled and banded chert.

25 feet - 150 feet (thickness 125 feet)

Limestone, white, buff and rusty, sandy and silty, earthy to very fine crystalline; sandstone, white, fine grained, calcareous and siliceous, clean; and chert, varicoloured, often speckled: the interval 105 feet to 125 feet is rusty red, silty, calcareous soft shale.

150 feet to 190 feet (thickness 40 feet)

No samples

190 feet to 360 feet (thickness 170 feet)

Dolomite with gradational limestone and interbedded shale. Dolomite is predominantly light buff to brown coloured, partly sandy, fine to medium crystalline, slightly vuggy. Minor dolomite is green, argillaceous, crypto-crystalline, dense. Limestone appears to grade with dolomite and is buff, fine crystalline, vuggy.

Two shale zones are present between 200 feet and 250 feet; and from 340 feet to 360 feet. Shale is rusty red and purple, sandy, silty and micaceous, and contains fine sand streaks. A small amount of chert is present in the interval.

360 feet to 490 feet (thickness 130 feet)

Limestone, very light buff, crypto-crystalline to fine crystalline, partly chalky, partly dolomite and argillaceous with thin cherty streaks and scattered vugs. Gypsum is very abundant in this interval as white sparry beds and vug encrustations within the limestone.

490 feet to 1,024 feet (penetrated thickness 534 feet)

Dolomite, buff, medium brown and white, very fine to medium crystalline, gypsiferous in the upper half of the interval, vuggy throughout, rarely containing black carbonaceous(?) partings. Minor green dense argillaceous dolomite.

Structure:

Two cores cut in the well show beds are flat-lying. This agrees with regional information indicating that the area has enjoyed very stable conditions since the time of deposition of the sediments.

Porosity and Permeability of Sediments:

Porosity and permeability of vuggy carbonates and sandstones in the section penetrated was confirmed. Complete loss of air returns was experienced before surface casing was set, and, below casing, a flow of water estimated at 1000 g.p.h was continuously produced while air drilling.

Relevance to Occurrence of Petroleum:

No evidence of hydrocarbon accumulation was encountered in the well. No fossil material was observed in samples. However, algal remains have been reported in the Anthony Lagoon beds south of Anthony Lagoon. These indicate deposition in an environment favourable for hydrocarbon generation. It is stressed, however, that these beds are thought to outcrop over most of O.P. 73 (2) without significant cover and, if this is the case, the possibility of finding accumulations of hydrocarbons in them in O.P. 73 (2) is remote.

Contribution to Geological Concepts:

The well section showed the excellent reservoir potential of vuggy carbonates in the area.

The well established that basement lies deeper than 1,024 feet at the site.

Carbonates in the section, with known algal buildup south of Anthony Lagoon suggest that significant reef development is possible within the Georgina Basin. Further work in the basin should have good prospects of locating such areas, with possibilities of adjacent stratigraphic or reef-type traps. However, within O.P. 73 (2) it is most unlikely that the carbonates cut in the well can be found beneath cover in an environment conducive to the entrapment of hydrocarbons.