EXOIL OIL CO. PTY. LTD.

WELL COMPLETION REPORT

HUCKITTA NO. 1

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R. L. Pemberton

OFENELLE

ONSHORE

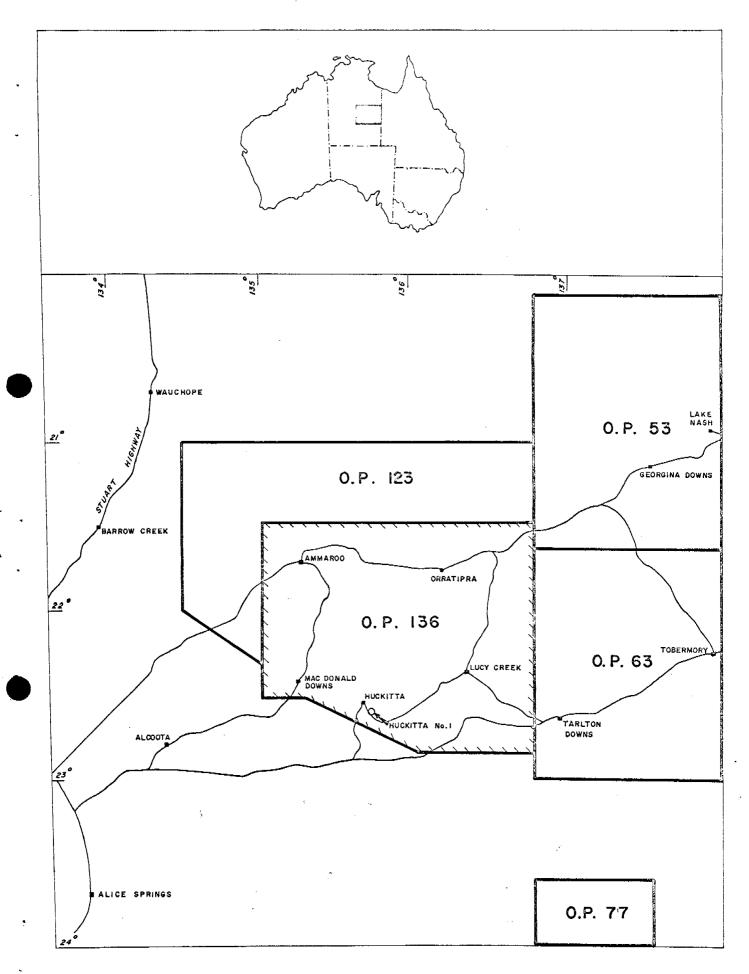
NORTHERN TERRITORY, GEOLOGICAL SURVEY



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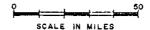
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EXOIL OIL CO. PTY. LTD.

LOCALITY MAP

HUCKITTA No. I WELL



SUMMARY

Huckitta No. 1 well was drilled by Exoil Oil Co.

Ltd. and Transoil (Qld.) Pty. Ltd. as a stratigraphic and structural test of a prominent surface anticline near the southern margin of the south-western lobe of the Georgina Basin in the Northern Territory. Drilling was carried out by Oil Drilling and Exploration Ltd. with a National T-32 rig using air, mist and aerated water as circulating fluids.

The well was spudded in on 15th February, 1966 and abandoned as a dry hole at 4012 feet on 17th March, 1966.

A normal Georgina Basin section was penetrated, consisting of 1475 feet of Upper Cambrian Arrinthrunga Formation, 790 feet of Middle Cambrian Arthur Creek Beds, 415 feet of Lower Cambrian Mt. Baldwin Formation and a total of 970 feet of Upper Proterozoic Grant Bluff and Elyuah Formations, before entering granite at 3665 feet. The basal stratigraphic unit, the Mt. Cornish Formation was absent.

The only evidence of hydrocarbons encountered in the well was residual oil staining in the top Arthur Creek Beds.

RESUME OF DRILLING OPERATIONS

Drilled 9%" surface hole with hammerdril from surface to 270 feet with air and to 330 feet with mist. Opened hole to 13%, ran and cemented 10%" casing to 330 feet. Mist drilled 9%" hole ahead to 1711'. Stuck bit while running in hole at 1711', wor'ed free, mist drilled 9%" hole ahead to 1958'. Logged hole, ran and cemented 8%" casing at 1958'. Ran in, found casing tight for 7%" bit, reamed out casing collars with button bit, mist drilled 7%" hole ahead to 3470', then drilled ahead with aerated water to 4012 feet. Ran Welex logs, ran two cement plugs, backed off and recovered 320 feet of 8%" casing, ran final cement plug to surface, abandoned well.

INTRODUCTION

The Huckitta No. 1 well is the first exploratory well to be drilled by Exoil Oil Co. Ltd. and Transoil (Qld.) Pty. Ltd. in Oil Permit 136 in the Georgina Basin of the Northern Territory. The well, situated 200 miles by road north-east of Alice Springs was drilled to evaluate the reservoir and source potential and to establish the subsurface stratigraphy of the Palaeozoic and Proterozoic section in this area of the south-western Georgina Basin. The well was sited on the crest of the Huckitta Anticline, a prominent surface structure.

WELL HISTORY

GENERAL DATA:

Well Name and Number: Huckitta No. 1

Name and Address of Operator: Exoil Oil Co. Pty. Ltd.,

lst Floor, Perry House, Elizabeth and Albert Streets,

BRISBANE. QUEENSLAND.

Name and Address of Tenement Holder:

Exoil Oil Co. Pty. Ltd., lst Floor, Perry House, Elizabeth and Albert Streets, BRISBANE. QUEENSLAND.

Oil Permit 136 Petroleum Tenement:

Northern Territory of Australia

Area: 9,280 square miles

Huckitta District:

22⁰36'53"S: 135⁰37'00"E Location:

Map Reference F.53-11

Elevation: Ground 1775' a.s.l.

Kelly Bushing: 1790' a.s.l.

4012 feet Total Depth:

Date Drilling Commenced: 15th February, 1966

Date Drilling Completed: 15th March, 1966

Date Well Abandoned: 17th March, 1966

17th March, 1966 Date Rig Released:

Drilling Time in Days to Total Depth: 29

Status: Dry and abandoned

Total Cost:

Subsidy Paid:

DRILLING DATA:

Name and Address of Drilling Contractor:

Oil Drilling and Exploration Limited, 93 York Street, SYDNEY. N.S.W.

Drilling Plant:

Make:

National

Type:

T - 32

Motors (2):

G.M.C. Twin Model 471, 225 h.p

Drilling Plant (cont.):

Mast:

Make:

Emsco

Type:

Serial 12

Rated Capacity: 416,000 lbs.

Pumps (2):

Make:

National

Emsco

Type:

C-250

D-300

Size:

71" x 15"

 $74" \times 14"$

Motors:

1 Twin G.M.C. 671

1 Twin G.M.C. 671

1 Twin G.M.C. 471

Blowout Preventor Equipment:

Make:

Shaffer

Hydril

Shaffer

Model:

"B"

G.K.

Rotating

Size:

12,"

12"

12"

Series:

900

900

900

Working

Pressure: 3000 p.s.i.

3000 p.s.i.. 3000 p.s.i.

Air Drilling Equipment:

Unit

Make

Туре

<u>Size</u>

Motors

300 p.s.i. 405 h.p.

Compressor Ingersoll-Rand HHE-3 Stage

1500 c.f.m. Waukesha

Booster Compressor

Ingersoll-Rand HHE-2 Stage

3000 c.f.m. Waukesha 1500 p.s.i. 405 h.p.

Injection

Pump

Aldrich

Triplex HS-3B

l" x 21"

Wisconsin 30 h.p.

Hole Sizes and Depths:

171" hole from surface to 20 feet

134" hole from 20 feet to 332 feet

 $9\frac{7}{8}$ " hole from 332 feet to 1958 feet

7층" hole from 1958 feet to 4012 feet

Casing and Cementing Details:

Size:

104"

85"

Weight (lbs./ft):

40.5

32

Grade:

H-40

F. J. Hydril

Range:

2

2

Setting Depth:

330

1958

Casing and Cementing Details (cont'd.):

Type and location of collar, shoe, etc.:

Guide shoe and float collar on bottom

Guide shoe on bottom; float collar 30' up.

Cement Used:

120 sacks

50 sacks

Cemented to:

surface

Method Used:

Displaced down pipe and down annulus

rig pumps;plug

Drilling Fluid:

Huckitta No. 1 was air drilled from surface to 270 feet, mist drilled from 270 feet to 3470 feet, and drilled with aerated water from 3470 feet to total depth.

While mist drilling and aerated water drilling a solution in water of foaming agent and corrosion inhibitor was continually injected at the rate of 5 to 10 barrels per hour.

Logging runs were made with a natural fill-up of formation water in the hole.

The following is a table of additives used.

Tolfoam

57 gls.

Comprox

630 gls.

Sodium Bichromate 2077 lbs.

Caustic Soda '

630 lbs.

Water Supply:

Water for the drilling operation and camp was hauled by truck from a stock bore $2\frac{1}{2}$ miles from the wellsite, an adequate supply at all times being maintained. While mist drilling below surface casing, the mud tanks were kept filled with fresh water produced from the well in the event that mudding-up was required.

Perforation and Shooting Record:

No perforation or shooting was required in this well.

Plugging Back and Squeeze Cementation Jobs:

No squeeze cementation jobs were required.

In abandoning the well the following plugs were set:-

Plug

Interval

Cement

1

2100' - 2300'

50 sacks

Plugging Back and Squeeze Cementation Jobs (cont'd.):

Plug	Interval	Cement	
2	1800' - 2000'	60 sacks	
3	326' - surface	55 sacks	

Fishing Operations:

While running in with a new bit at 1711 feet, the bit became stuck at 1472 feet. The bit was successfully worked free, hoisted and checked, the entire operation requiring $6\frac{1}{2}$ hours, i.e. 0.9% of total rig time.

Side Tracked Hole:

No side-tracking was necessary.

LOGGING AND TESTING:

Drill Cuttings:

Drill cuttings were caught using a 2' diameter sample-taker fitted into the blooey line while air, mist and aerated water drilling. Samples were caught at 10 foot intervals while drilling and 5 foot intervals while coring. Cuttings were washed and dried, where required, before packaging. Sample contamination was minimal; as seen on the composite log, changes in lithology are sharp and not masked by cavings.

Cuttings, particularly from intervals drilled with tungsten-carbide "button" bits were often finely divided, at times making only general descriptions possible. However, frequent cores provided good detailed lithological information.

Three cuts of all samples were made, one for Exoil
Oil Co. Ltd., one for the Bureau of Mineral Resources, Canberra,
and one for the Northern Territory Administration, Alice Springs
Coring:

The subsidy programme called for cores to be cut for stratigraphic information, at major changes of lithology and where porosity/permeability and oil/gas indications were indicated. This programme was followed throughout the operation. Core No. 5 was cut to evaluate a drilling break and yellow fluorescence in samples. All other cores were

cut for normal stratigraphic information. A bottom hole core was not required as no change in basement lithology was encountered below Core No. 13. Available coring equipment consisted of a Hughes Tool Co. 20 foot type "J" conventiona. core barrel with $7\frac{2}{3}$ " and $8\frac{1}{4}$ " hard formation core heads; and a 60' x $6\frac{1}{4}$ " Christensen diamond core barrel with $7\frac{13}{16}$ " diamond coreheads. All cores were cut with the conventional core barrel.

The following table lists cored intervals and recoveries:-

Core No.	<u>Interval</u>	Cored	Recovered	% Recovered
1	330' - 340'	10:	712"	72
2	611' - 621'	101	5'9"	58
3	892' - 902'	10	5'2"	52
4	1211' -1221'	10'	5'	50
5	1512' -1520'	81	6'	75
6	1779' -1782'	31	1'6"	50
7	2105' -2112'	· 7 '	5'7"	79
8	2377' -2387'	10'	8'6"	85
. 9	2704' -2707'	31	2'6"	83
10	3011' -3016'	5 '	31	60
11	3314' - 3324'	10'	2'6"	25
12	3615' - 3621'	6'	5'	83
13	3872¹ - 3873¹	1,	<i>∮</i>	66
	Total footage	cored:	93 fee	t
	Total footage	recove	red: 58 fee	t 4 inches

A four-inch sample from each two feet of core recovery has been sent to the Bureau of Mineral Resources, Canberra. The remainder of the core is held by Exoil in Alice Springs.

Percentage recovery: 63%

Core descriptions are found in Appendices 2 and 3.

Side Wall Sampling:

No side-wall cores were taken.

<u>Electrical and Other Logging:</u>

Two logging runs were made by Welex, the first prior to running $8\frac{5}{8}$ " casing, the second at total depth. Hole fluid in both cases consisted of a natural water fill-up. Logs were run on 2" = 100' and 5" = 100' scales.

These logs were run:-

Induction Electric Log Run 1 330' - 1952' Run 2 1958' - 4008'

Acoustic-Velocity Log Run 1 1958' - 4010'

Gamma-Ray Log Run 1 Surface - 3983'

Both logging runs were hampered by faulty equipment. Trouble was experienced with Induction Electric log and Acoustic sondes, and the Welex recording camera. A total of 25½ hours, or 3.4% of rig time was used logging.

Drilling Time and Gas Log:

Rate of penetration was recorded on a geolograph recorder and is plotted on the composite log as minutes per five-foot interval.

Hydrocarbon detection was provided by a pilot light burning continuously at the end of the blooey line while air, mist and aerated water drilling and coring. In addition a Corelab hot-wire gas detector, with gas trap fitted to the blooey line, was used when large flows of water were encountered. It was thereby hoped to record small gas shows which might otherwise have been masked by the large volumes of water being produced. However, no gas show was recorded.

Formation Testing:

No conventional drill-stem test was required.

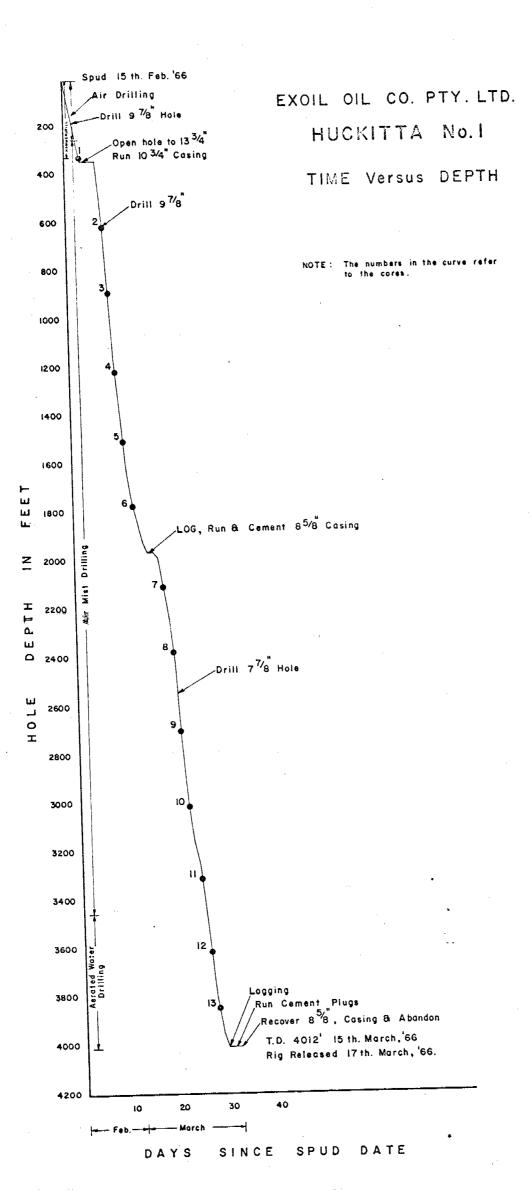
Drilling with air, mist and aerated water provided a continuous open hole test of formations penetrated.

Deviation Surveys:

Deviation surveys were run with a Lane Wells "Sure-shot" instrument run inside the drill pipe on a wire line.

The following table lists all surveys taken:-

64' - misrun		970' - 1 0	•	1693 ' - 2 ⁰
149 ' - ½º		1110' - 10°	••	1718' - 1 2 °
180' - ²⁰		1241' - ‡°	*	1742' - 2°
200 ' - ‡ ⁰	, w	1380'. - ‡ ⁰		1778' - 240
301' - 1 0		1512' - 1 ⁰		1800' - 2 ⁰
425' - 1 ⁰		1560' - 1 2 °		1838' - 20
475' - 1 ⁰		1590' - 1 1 º		1890' - 2 ⁰
710' - ½°		1632' - 1 ²⁰	•	1915' - 2 1 0
820' - 1 0		1662' - 2 ⁰		1975' - 2 ² °



Deviation Surveys (cont'd.):

2015' - 2°	2340' - 4 ⁰	3165' - misrun
2045' - 2 1 0	2400' - 5°	3275' - 7°
2065' - 2°	2427' - 4°	3424' - 7°
2095' - 2 1 °	2488' - 3 ²⁰	3100' - 41°
2160' - 3 ¹ ⁰	2548' - 4 1 0	3586' - 4 ⁰
2180' - 3 ⁰	2640' - 4 1 °	3635' - 2 1 0
2215' - 3 1 °	2760' - 44 ⁰	3845' - 3 1 0
2276' - 3 1 0	3000' - 4 ⁰	

Temperature Surveys:

No temperature survey was run in the well.

Velocity Surveys:

No velocity survey was run.

Drilling Observations:

Figure 2 shows rig time plotted against depth.

A total of 742 hours of rig time was required to drill the well from spudding-in to rig release. The table below gives a breakdown of rig operations:-

<u>Operation</u>	Hours	% of Total Hours
Drilling (a) on bottom (b) trips	363 ≩ 57	48.9 7.8
Coring (a) on bottom (b) trips	20 1 37 1	2.7 5.0
Conditioning Hole	22‡	3. 0
Deviation Surveys	16 1	2.2
Rig Service	41/2	0.6
Breakdown	2 1	0.3
Fishing	6 1	0.9
Logging	25 1	3.4
Casing, W.O.C. etc.	59 1	8.1
Opening Hole for Casing	47 2	6.5
Abandoning	33 4	4.5
Other	45 1	6.1
Total	742	100.0
	·	

Seventeen rock bits (including 9 "button" bits) were used to drill 3903 feet of hole in 3634 hours.

Average footage per bit: 230 feet

Average drilling rate: 10.7 feet per hour

No major drilling problem was encountered while drilling Huckitta No. 1. Extremely hard rocks on surface required spudding-in with a tungsten-carbide "button" bit, and 13 hours were required to drill the mouse hole. The use of air and mist and a Mission Hammerdril to drill and ream surface hole to 330 feet minimized the time required for this operation.

The advantages of aerated water drilling, where large volumes of water are encountered and where caving hole presents no problem, were dramatically seen at Huckitta, where unweathered granite basement was drilled at 5 to 6 minutes per foot with a "button" bit.

GEOLOGY

Summary of Previous Work:

Geological:

Prior to 1957 geological investigations in area were of a reconnaissance nature. Several workers have visited parts of the area, notably Whitehouse (1936), Madigan (1937), Opik (1946), Hossefeld (1954) and Noakes (1956).

Since 1957, the Bureau of Mineral Resources has carried out extensive mapping of the Georgina Basin. In 1957 and 1958, Smith, Woolley, Pulley, Vine, Gough and Robertson mapped the Huckitta Sheet and the area was revisited in 1960 by Smith, Vine, Jones and Milligan. In 1958, 1959, 1960, Casey, Prichard, Smith, Woolley, Vine, Forman and Jensen mapped the Tobermory and Hay River Sheets. In 1960 and 1961, the Elkedra Sheet was mapped by Smith, Vine and Milligan, and the Sandover Sheet was mapped in 1963 by Smith, Milligan, Nichols and Morton.

In addition to work by the B.M.R., some surface mapping and photogeological interpretation has been done by private companies.

Geophysical:

Geophysical work in O.P. 136 is limited to regional surveys by the B.M.R. These are reconnaissance helicopter gravity surveys of the Georgina and Amadeus Basins from 1957

to 1965 with stations spaced every 50 square miles; and regional airborne magnetometer surveys of the Georgina Basin in 1963 and 1964 in which east-west line were flown two miles apart.

Drilling:

Drilling in the area of O.P. 136 has previously been carried out by both private interests and the B.M.R. In 1956 a small flow of gas was encountered in a bore being drilled for water on Ammaroo Station, 70 miles N.N.W. of Huckitta.

In 1962 Farmout Drillers N.L. drilled two wells, Ammaroo Nos. 1 and 2 to 612 feet and 842 feet respectively, to evaluate this show. Both wells encountered minor hydrocarbon shows in Middle Cambrian Sandover Beds, and bottomed in basement.

In 1962 - 1963 the B.M.R. drilled a series of shallow stratigraphic holes to augment their surface mapping in areas of poor outcrop. One of the wells, GRG. 6, approximately 40 miles east north-east of Huckitta encountered strong petroliferous odour in Middle Cambrian Arthur Creek Beds.

In 1964, the B.M.R. drilled a stratigraphic well, B.M.R. No. 13 Sandover, on Orratippra Station, 65 miles northeast of Huckitta. This hole went to 3333 feet in granite basement, and encountered small hydrocarbon shows in Middle and Upper Cambrian sediments.

Regional Stratigraphy:

O.P. 136 is located within south-western lobe of the Georgina Basin, bounded on the south by an Archaean to Lower Proterozoic complex and on the north by a south-east trending out-cropping high of Lower Proterozoic metasediments and irneous rocks of the Davenport geosyncline.

The Georgina Basin has been defined as an area of Middle Cambrian to Ordovician sedimentation. However, there is some evidence for including sediments of Lower Cambrian and to a degree Upper Proterozoic age, particularly in the permit area. On the Huckitta sheet, after a minor break in sedimentation at the close of a glacial epoch in the Upper

Proterozoic, sedimentation was continuous at least into Lower Cambrian time and, on the basis of present knowledge, quite possibly into Ordovician time.

Sediments of Upper Proterozoic age outcrop in the ranges occupying the southern margin of the Permit, possibly in the Davenport Range north of the Permit, directly east in the Tarlton Range and approximately 50 miles east south-east of the Permit along the faulted southern margin of the Toko Syncline.

In the Huckitta area, the basal unit, the Mt. Cornish Formation, with a maximum thickness of 1250 feet, rests unconformably on Archaean or Lower Proterozoic basement. formation consists primarily of blue-green tillitic boulder beds and laminated cyclic siltstones and sandstones of presumed fluvio-glacial origin, and has been correlated with the Areyonga Formation of the Amadeus Basin. In the Davenport Range to the north of the Permit a glacial epoch, possibly equivalent to 'Mt. Cornish' time, is expressed as a sequence of boulder beds, siltstones and sandstones 150 feet thick lying unconformably in topographic lows on the Lower Proterozoic Hatches Creek Group. To the east and south of the Permit, on the Tobermory and Hay River Sheets, a maximum thickness of 1175 feet of green tillitic siltstones, boulder beds and laminated siltstones comprising the basal unit of the Field River Beds are a probable correlate of the Mt. Cornish Formation.

Following a period of erosion at the close of the Upper Proterozoic glacial epoch, there followed a continuous period of deposition into Lower Cambrian time. In the southern Huckitta area the Mopunga Group was laid down as a sequence of three formations, the Upper Proterozoic Elyuah and Grant Bluff Formations and the Lower Cambrian Mt. Baldwin Formation.

The basal unit, the <u>Elyuah Formation</u> includes the lower Oorabra Arkose Member, which reached its maximum development in the Mopunga Range where 3600 feet of arkose was deposited, followed by 150 to 350 feet of green and red

shales. East of the Permit area in the Keepera Ridges, 1000 feet of arkoses and siltstones included in the Field River Beds and resting with presumed disconformity on boulder and tillitic beds have been equated provisionally with the Elyuah Formation.

Conformably overlying the Elyuah Formation is the Grant Bluff Formation, a distinctive sequence of alternating grey quartz sandstones, quartz greywacke, siltstones, shales and thin algal dolomite bands. In the Elyuah Range, in the extreme southern part of Permit 136, the Formation is 530 feet in thickness which increases eastward to a maximum of 1500 feet on the Tobermory and Hay River Sheets.

On the Huckitta Sheet, the Mount Baldwin Formation, containing Archaeocyathids of Lower Cambrian age, conformably and gradationally overlies the Grant Bluff. The formation outcrops in the Mopunga, Elyuah and Jervois Ranges, and comprises a maximum of 1367 feet of dominantly red sediments sandstone, greywacke, siltstone, dolomite and shale.

recognised south and west of the Huckitta area. On the
Tobermory and Hay River Sheets there is evidence that Middle
Cambrian sediments rest unconformably on various units of the
Field River Beds. Therefore the Mount Baldwin Formation may
have been deposited and eroded completely before Middle
Cambrian sedimentation, or deposition of Grant Bluff type
sediments may have continued into 'Mount Baldwin' time.

In the northern part of the Permit no Upper Proterozoic - Lower Cambrian section is present. However, it is
likely that these beds extend northward from their outcrop
areas in the Mopunga, Elyuah and Jervois Ranges for a
considerable distance under Palaeozoic sediments in the central
Permit area.

Georgina Basin sedimentation, as stated by most writers, began in Middle Cambrian time. In south central O.P. 136, the Mt. Baldwin Formation is succeeded conformably by a maximum thickness of 755 feet of Arthur Creek Beds,

consisting of sparsely fossiliferous dolomite, chert, limestone and minor sandstone in outcrop south and west of the Huckitta Homestead. In the south-eastern portion of O.P. 136, the Arthur Creek Beds thicken to 1010 feet, become less arenaceous and consist of 600 feet of white to buff shale and siltstone with a rich fauna of trilobites and brachiopods, 250 feet of blue-grey fossiliferous flaggy limestone, and 160 feet of white and brown sandstones grading and lensing into brown dolomite and blue limestone.

In the extreme north of the Permit area, where the Mopunga Group is missing apparently due to onlap, the Middle Cambrian Sandover Beds dip south and east unconformably off the Lower Proterozoic Hatches Creek Group and in turn are overlapped by Upper Cambrian. The beds are approximately 850 feet thick and comprise in ascending order; 30 to 120 feet of poorly sorted pebble conglomerates and sandstones, approximately 500 feet of very uniform fossiliferous lutites, approximately 175 feet of bioclastic, sublithographic and algal limestones, and 50 feet of white barren siltstone.

South and east of the Permit area, lower to upper Middle Cambrian rocks of the Marqua Beds lie unconformably on Upper Proterozoic sediments on the Tobermory and Hay River Sheet areas. The Marqua Beds bear many similarities to the Arthur Creek Beds and Sandover Beds, both in fossil content and lithology, and comprise at least 675 feet of limestones, cherts, shales and sandstones.

Upper Cambrian Sediments of the Arrinthrunga Formation and its equivalents. Around the margins of the basin this formation overlaps the Middle Cambrian and consequently lies unconformably on older formations. On the eastern side of the Permit area, the formation is about 1000 feet thick and consists of abundantly algal dolomite, limestone and dolomitic limestone with interbedded sandstone and green siltstone.

In the upper quarter of the formation a sandstone occurs which outcrops over a wide area north and north-east of Arthur Creek.

This is the Eurowie Sandstone Member which attains a maximum thickness of 100 feet and is predominantly a medium grained quartz sandstone with fine grained sandstone and siltstone near the base. Halite pseudomorphs, ripple marks, crossbedding, mud cracks and mud pellets indicate a shallow water depositional environment for this potential reservoir. In the south central portion of O.P. 136, the Arrinthrunga thickens to 3,000 feet but the Eurowie Sandstone is missing and the boundary with the underlying Arthur Creek Beds is difficult to define. The lower Arrinthrunga to the east, consists of limestones, dolomites and minor siltstones.

East of the Permit area, on the Tobermory Sheet the Arrinthrunga Formation and its probable equivalent on the Sandover River Sheet, the <u>Meeta Beds</u>, outcrop sporadically over large areas largely covered with sand and alluvium. Complete sections are rare owing to this cover, but it is known that thickness of 1,000 to 1,300 feet of lithographic, oolitic, algal and clastic limestones and dolomites and minor sandstones are developed.

Conformably overlying the Arrinthrunga Formation are the Tomahawk Beds containing a rich fauna of Upper Cambrian to Lower Ordovician age. In the central Huckitta area these beds are exposed on both flanks of the Dulcie Syncline and reach a maximum thickness of 740 feet of interbedded sandstone, and minor pipe-rock, siltstone, dolomite and limestone. On the south-western flank of the Dulcie Range, the Tomahawk Beds are followed conformably by the Ordovician Nora Formation.

On the north-eastern flank of the range, the Nora Formation is not present, and the Tomahawk Beds are overlain unconformably by the Upper Devonian Dulcie Sandstone.

In the eastern part of the Permit area where its base is not exposed, a thickness of 250 feet of Tomahawk Beds is present, consisting of quartz sandstone and minor carbonate rocks with rapid lateral gradations between the two. East of the Permit area, the Tomahawk Beds gradually change eastward from a fossiliferous sandy facies to the less fossiliferous

carbonate facies of the Ninmaroo and overlying Kelly Creek Formations.

Along the south-eastern margins of the Dulcie Range, the Tomahawk Beds are succeeded conformably by the lithologically distinctive Nora Formation which here reaches a maximum thick-ness of 370 feet. A strong erosional unconformity which follows the unit gives rise to much variation in its thickness, and on the north-western flank of the Dulcie Range, its complete absence. The formation consists of interbedded green foss-iliferous mudstones and claystones, ferruginous sandstones, oolitic ironstone and minor fossiliferous carbonates. The sequence is also recognised in separate outcrops east of the Permit area in the Tarlton and Toko Ranges.

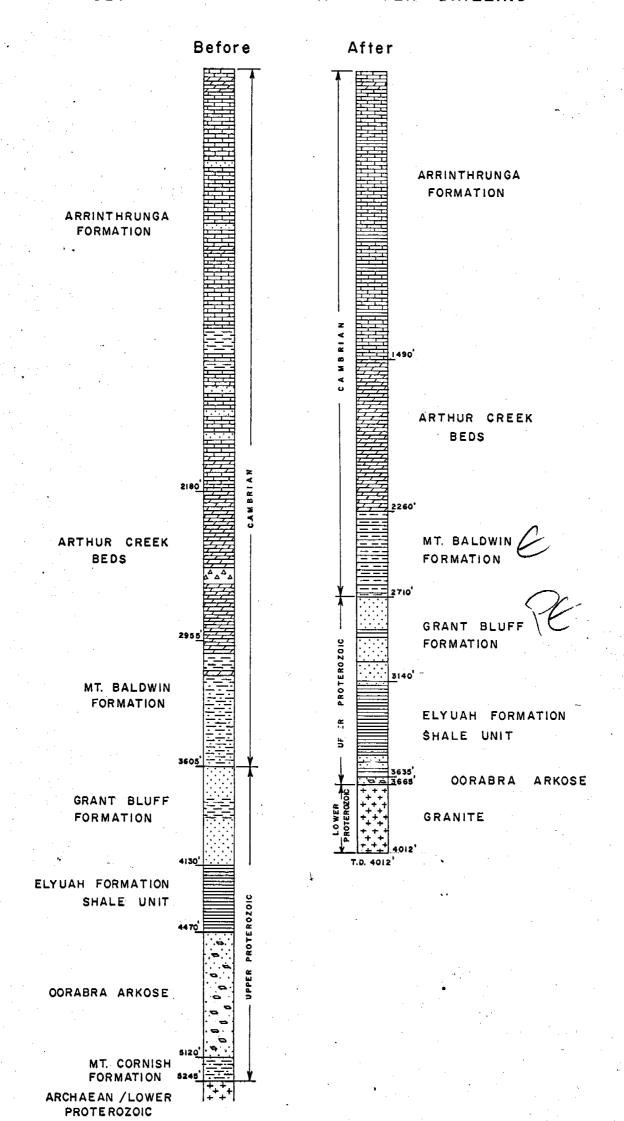
Uplight and slight folding took place in post-Middle Ordovician times and a prolonged period of erosion then preceded the deposition of the Upper Devonian <u>Dulcie Sandstone</u>. This formation consists of a maximum measured thickness of 2,138 feet of strongly crossbedded clean to silty quartz sandstone with sporadic beds of pebble conglomerate. The Dulcie Sandstone occurs as the surface truncated deposit of the Dulcie Syncline in the south-eastern portion of the Permit area and extends north-westwards beyond the boundary. Since this formation is not capped, and because of its restricted area, the Dulcie Sandstone is not thought to be significant in the search for oil.

FORMATIONS PENETRATED Stratigraphic Table

Age	Formation	<u>Tor</u> <u>Depth</u>	Subsea	Thickness
Upper Cambrian	Arrinthrunga Fm.	Surface	+1775'	1475 °
Middle Cambrian	Arthur Creek Beds	1490'	+300 1	790
Lower Cambrian	Mt. Baldwin Fm.	2280'	-4 90'	415
Upper Proterozoic	(Grant Bluff Fm. (Elyuah Fm. shale	2695	- 905 '	495
Mopunga Group	member (Oorabra Arkose	3190 ' 3635 '	-1400' -1845'	445' 30'
Lower Proterozoic	Granite	3665 ¹	-1875	347 +

EXOIL OIL CO. PTY. LTD. HUCKITTA No. I

SECTIONS BEFORE AND AFTER DRILLING



Detailed Stratigraphy:

Arrinthrunga Formation surface - 1490' (thickness 1475')

Age: Upper Cambrian

Limestone, buff, light to dark grey and brown crypto-crystalline to coarse crystalline, partly granular, with few oolitic beds, often with fine sandy intercalations; interbedded with approximately 20% red, green, grey and black micaceous shales and siltstones. Top of interval contains several thin beds of grey and brown fine grained sandstone. Top 300 feet and bottom 100 feet of interval includes much brown, buff and grey variably sandy and silty, very fine to coarsely crystalline and granular dolomite. Base of interval is picked at bottom of a lone thin grey very fine sandstone. Traces of crystalline gypsum are present at 500'.

Arthur Creek Beds 1490' - 2280' (thickness 790')

Age: Middle Cambrian

Top:Picked at base of single sand bed at base of Arrinthrunga, in a zone of transition to dolomite predominating over limestone. Formation consists almost entirely of dolomite (grading at times to limestone) light to dark grey and brown, crypto-crystalline to coarsely crystalline and granular, occasionally silty and finely sandy, with scattered dark grey shaly partings.

Between 1506' and 1517' several thin light brown limestone beds are finely crystalline with excellent fine vuggy porosity and residual oil staining. Traces of blue chert are present at 1800 feet.

645 - 821 Mt. Baldwin Formation 2280' - 2695' (thickness 415')

Age: Lower Cambrian

Top: Picked at pronounced break to shale lithology on Gamma and Acoustic logs.

A monotonous sequence of interbedded and gradational red shale and siltstone, rarely green, with sparse sandy and dolomitic zones to 2650'. Below 2650' a 45 foot "transition zone" to the Grant Bluff Formation below is composed of interbedded green siltstone, black micaceous shale, very fine grey silty sandstone, dark grey siliceous poorly sorted greywacke and

grey-brown dense dolomite. As the Mount Baldwin - Grant Bluff contact is imperfectly known, the pick here is purely arbitrary.

Grant Bluff Formation 2695' - 3190' (thickness 495')

Age: Upper Proterozoic

Top: Picked on Gamma and Acoustic logs at a pronounced shift to low gamma count and increased velocity, at the top of a distinctive limestone bed.

Top 20 feet of formation is dark brown, pelletoid, arkosic limestone (see Appendix 3). Formation is principally composed of sandstone, light to dark grey, generally fine grained, locally coarse, often slightly glauconitic, silty and dolomitic, grading locally to grey siltstone; interbedded with grey, green and black platy micaceous shale. Minor thin dolomite beds, partly oblitic, are present in top 50 feet of interval. Elyuah Formation

Shale member 3190' - 3635' (thickness 445')

Age: Upper Proterozoic

Top: Picked on Gamma and Acoustic logs at top of thick shale sequence.

Shale, red, green, minor dark grey, micromicaceous, well indurated, often pyritic and occasionally gypsiferous with sandy laminae. A few sandstone beds are grey, very fine grained, silty and siliceous.

Oorabra Arkose 3635' - 3665' (thickness 30')

Age: Lower Proterozoic

Alkaline granite detritus composed of quartz, microcline and minor plagioclase, muscovite and dark ferromagnesian minerals. Cuttings samples over this interval were very finely crushed.

Granite 3665' - 4012' (thickness 347'+).

Age: Lower Proterozoic

Top: Samples over arkose and granite intervals are identical. Top is picked on a sharp break on the Gamma Ray log, and on the Acoustic log at a shift to a section of uniform high velocity, differing from the rapidly oscillating curve in the Oorabra Arkose. Rock type is microcline granite (see Appendix 3).

STRUCTURE

Huckitta No. 1 was sited on the crest of a surface anticline within O.P. 136. The structure extends for approximately 15 miles, has a maximum width of over 2 miles and has been interpretated to have three separate culminations and vertical closure of at least 1500 feet.

The well passed through horizontal beds within the Arrinthrunga Formation. Below the top of the Arthur Creek Beds dips averaged 10° to 15° probably due to divergence from the vertical of the axial plane of the structure. An anomalous dip of 35° and a marked increase in hole deviation in the Elyuah shale member suggests minor faulting in incompetent beds at depth. This would explain an increase in the thickness of shale penetrated over that prognosticated.

The sedimentary section encountered is 1595 feet thinner than was expected, due mainly to a reduced Arrinthrunga section and marked thinning in the Oorobra Arkose. Large variations in thickness of the Oorabra Arkose are presumed to be largely controlled by relief on the pre-Upper Proterozoic depositional surface (Smith 1964, P. 24). The Huckitta structure was therefore probably a positive feature before sedimentation commenced. Minor rejuvinations during deposition of the section may have occurred in Cambrian times resulting in stratigraphic thinning of the Mt. Baldwin and Arrinthrunga Formations over the structure.

There is strong evidence to suggest that the Huckitta structure reached its present configuration during a strong orogeny between Upper Devonian and Triassic time which severely folded and faulted the sedimentary sequence in the south eastern part of the Dulcie Range.

RELEVANCE TO OCCURRENCE OF PETROLEUM

No significant hydrocarbon occurrence was encountered in Huckitta No. 1. A thin flushed zone was encountered in the top of the Middle Cambrian Arthur Creek beds. Thin limestone beds between 1506 feet and 1520 feet contained excellent fine vuggy porosity with bright, patchy yellow fluorescence giving

a faint blue cut. Sample cuttings from 1520 feet to 1580 feet contained yellow fluorescence. No oil or gas was produced from the interval. No other shows were recorded in the well.

POROSITY AND PERMEABILITY OF SEDIMENTS PENETRATED

The only significant permeability in Huckitta No. 1 was encountered in the Arrinthrunga Formation and the Arthur Creek beds, as indicated by water produced while drilling. Above 1220 feet a maximum of 20 barrels per day of fresh water was produced, indicating poor permeability. Below 1220 feet the flow increased steadily to 200 barrels per day indicating good permeability in the lower Arrinthrunga and Upper Arthur Creek.

Below casing at 1958 feet to the top of the Grant Bluff Formation, the lower Arthur Creek produced fresh water at the rate of 90 barrels per day.

No increase in water production or visual porosity was noted below the Arthur Creek Beds, showing the Upper Proterozoic - Lower Cambrian section to be tight at depth.

CONTRIBUTIONS TO GEOLOGICAL CONCEPTS

The drilling of Huckitta No. 1 provided valuable new stratigraphic information in an area where a complete stratigraphic sequence is not present at the surface. Lithologic detail of formations was provided by the thirteen cores cut.

A normal stratigraphic succession, much as anticipated, was penetrated. The absence of the Mt. Cornish Formation and a very thin Oorabra Arkose were unexpected, but this is not surprising as the Mt. Cornish is often missing in outcrop due to a slight erosional hiatus at the close of Mt. Cornish time; and the thickness of the Oorabra Arkose is very inconsistent in the area.

The Mt. Baldwin Formation is unusual in that, except for a transition zone from arenaceous Grant Bluff Formation below, it is much finer grained than sections in outcrop.

It is postulated that the Huckitta section represents a change, sea-word from the more arenaceous, in-shore sediments outcropping along the southern margins of the basin.

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HUCKITTA NO. 1

CORE DESCRIPTIONS

Core No. 1: 330' - 340' recovered 7'2"

Coring Times: 2, 3, 8, 10, 14, 10, 6, 13, 11, 12 mins./ft.

Arrinthrunga Formation

<u>ll" Dolomite</u> patchy light green crypto-crystalline and brown fine crystalline with irregular flesh-coloured weathered streaks throughout - scattered pocked appearance suggests leached disseminated pyrite. Scattered zones of floating sub-rounded fine sand grains and fine dark argillaceous streaks.

2'3" Interbedded Limestone and Minor Shale beds &" to 2" thick, wavy, often gradational. Limestone is dark brown medium crystalline dense, featureless - becomes argillaceous. Shale partings are dark grey to red, with very micaceous zones on bedding planes. Mud cracks and worm tubes visible on some bedding planes. One 4" zone of brown ferruginous, calcareous, tough sandy Siltstone.

4 Limestone dark brown to partly grey, uniformly cryptocrystalline. Dark grey to black wavy shaly partings and few well developed stylolites. No bedding visible in limestone. Wavy, often sub-circular patterns suggest algal colonies.

Scattered open vugs to 1" lined with calcite crystals. Rare openings lined with fine crystalline pyrite.

Slight evidence of contemporaneous deformation. Dip of core generally flat - often wavy. No oil or gas indications.

Core No. 2: 611' - 621' recovered 5'9"

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

Arrinthrunga Formation

1'3" Limestone dark brown fine crystalline, scattered brown mica flakes, dense. Rare dark grey argillaceous wavy partings.

Many open vugs to 1" lined with calcite crystals.

1'8" Limestone and Shale - Thinly bedded (boundaries gradational) Limestone as above and Shale very dark grey, silty, limy, hard. Beds irregular, gradational 4" to 1" thick.

1'8" <u>Limestone</u> dark grey, slightly argillaceous, very finely crystalline, massive.

1'2" Limestone and Shale - thin bedded to laminated <u>Limestone</u>, dark grey as above, grading to dark grey <u>Shale</u> (80% Limestone, 20% Shale).

Several fine irregular laminae of white, fine crystalline, slightly micaceous Limestone.

Core contains several open fractures - surfaces have brown oxide staining.

Dip of core slightly wavy - flat. No oil or gas indications.

Core No. 3: 892' - 902' recovered 5'2"

Coring Times: 6, 8, 7, 9, 9, 8, 8, 11, 14, 9 mins./ft.

Arrinthrunga Formation

5'2" Shale red, silty, calcareous - scattered thin (lamellar to 2") bands light grey dense <u>Limestone and Dolomite</u>. Scattered thin sandy and silty streaks - rare pockets of crystalline calcite - some open. Worm tubes? on bedding planes. Dip - flat. No oil or gas indications.

Core No. 4: 1211' - 1221' recovered 5'

Coring Times: 6, 6, 6, 6, 6, 7, 6, 6, 6, 7 mins./ft.

Arrinthrunga Formation

- l' <u>Limestone</u> medium brown, crypto to very fine crystalline hard and dense. Several fine black argillaceous partings, some slickensiding evident. Interval badly broken up (fractured?).
- l' Limestone light grey, crypto to very fine crystalline hard, dense, massive bedding. Rare black thin argillaceous partings.
- <u>3' Shale</u> red, slightly silty, slightly calcareous. Top 6" gradational in bands with Limestone above. Scattered thin light bands gradational to Limestone. One thin zone contains angular limestone and rare chert fragments and sand grains. Dip flat. No visible fossil content. No oil or gas indications.

Core No. 5: 1512' - 1520' recovered 6'

Coring Times: 8, 10, 9, 10, 8, 7, 9, 9 mins./ft.

Arthur Creek Beds

4'2" Dolomite very silty, light grey, crypto to very fine crystalline, massive. Rare dark argillaceous streaks. Rare stylolites. Few fine fractures in bottom 2' of interval have bright yellow and minor blue fluorescence, good blue cut, traces of brown residual oil-staining.

4" Limestone light grey brown, very fine crystalline, extremely silty - many small vugs - lined with fine quartz and calcite euhedra. Patchy strong yellow fluorescence giving blue fluorescent cut. Traces brown residual oil stain. No cuttings gas or petroliferous odour.

1'6" Dolomite as above, often banded with dark argillaceous streaks. Good yellow fluorescence in top 6" of interval. Dip of bedding 15°. Core thoroughly flushed.

Core No. 6: 1779' - 1782' recovered 1'6"

Coring Times: 8, 12, 27 mins./ft.

Arthur Creek Beds

1'2" Dolomite medium grey very silty and very fine sandy (almost Siltstone) micro-crystalline dense; fine dark grey argillaceous partings and rare thin coarse sandy streaks, very hard and tight. 4" Dolomite medium brown, very siliceous, crypto-crystalline, very hard, tight, broken into small pieces. Dip 10 to 15°. No oil or gas indications.

Core No. 7: 2105' 2112' recovered 5'7"

Coring Times: 9, 9, 8, 14, 27, 13, 19 mins./ft.

Arthur Creek Beds

1'8" Dolomite and Shale interlaminated and gradational (finely ground sample under microscope is brown) Dolomite is very dark grey, argillaceous, silty very fine crystalline, hard dense and tight - gradational with Shale, dark grey, dolomitic, silty, finely micaceous, brittle and platy; scattered light grey silty laminations.

3'll" Dolomite as above, very dark grey, silty, argillaceous very finely crystalline, hard dense and tight with several fine black Shale partings and light grey silty streaks. Rare high-angle fractures (to ½" wide) healed with white crystalline calcite. Dip of bedding 10°. No oil or gas indications.

<u>Core No. 8:</u> 2377! recovered 8' 6"

Coring Times: 9, 10, 7, 6, 9, 12, 14, 10, 8, 7 mins./ft.

Mt. Baldwin Formation

8'6" Shale/Siltstone gradational, rusty red, micro-micaceous, scattered large flakes brown (secondary?) mica, tough, brittle and platy. Rare brownish to greenish, hard, dense, dirty, fine sandy and dolomitic streaks minor open fracturing at high angles. One fracture shows poorly developed slickensiding. Dip - 10°. No oil or gas indications.

Core No. 9: 2704' - 2707' recovered 2'6"

Coring Times: 29, 36, 24 mins./ft.

Mt. Baldwin Formation

Quartz Greywacke (for lack of a better name) - very dark grey, massive, crystalline appearance on fresh surface. Matrix is dark grey brown crystalline quartz and dolomite, argillaceous-trace clear crystalline gypsum. Poorly sorted, mostly very coarse quartz, minor chert, and lithic grains, often rounded. Side of core has pelletoid appearance, due to rounded quartz grains. Rock is possibly phosphatic. Recrystallization of some grains is evident. Bottom 2" of core grades to dolomite, siliceous, very dark brown, crystalline, dense - rare argillaceous partings. Dip is indistinct but appears to be flat no oil or gas indications. Note: This core has subsequently been identified as an arkosic Limestone (see appendix 3).

Core No. 10: 3011' - 3016' recovered 3'

Coring Times: 5, 4, 3, 14, 13 mins./ft.

Grant Bluff Formation

2' Shale dark green-grey, slightly micro-micaceous brittle and platy, rarely slightly silty, traces fine disseminated pyrite. Rare small cylindrical pyrite inclusions (%" X 2") appear to be pyritized organic remains.

1' Shale as above with several thin (to 2") Sandstone beds. Sandstone is dark grey, vitreous, poorly sorted, fine to very coarse grained, sub-angular to rounded quartz in very hard siliceous, silty matrix. Rounded glauconite grains common. Very hard, dense and tight. Dip - 0°. No oil or gas indications.

Core No. 11: 3314' - 3324' recovered 2'6"

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

Elyuah Formation - Shale Member

Shale, red, micromicaceous brittle and platy - core broken into small biscuits and chunks. Dip apparently 10° - fine laminations seen by colour banding. No oil or gas indications.

Core No. 12: 3615' - 3621' recovered 5'

Coring Times: 8, 16, 16, 21, 15, 28 mins./ft.

Elyuah Formation - Shale Member

5' Shale very dark greenish grey, very brittle and platy, common very fine laminations of hard, very fine to fine grained Sandstone, rare pyrite laminae to 1" thick. Dip of bedding 35°. Much of core sheared and fractured, some well developed slickensiding. No oil or gas indications.

Core No. 13: 3872' - 3873' recovered 8"

Coring Time: 60 mins./ft.

Proterozoic Granite Basement

A granitic rock composed of coarse crystalline orthoclase feldspar and quartz, with massive interlocking crystal texture. Minor muscovite and biotite are present. Some quartz appears rounded suggesting a sedimentary classification (Arkose). Fine crystalline calcite is present in tight fractures. Identification of this core must await thin-section study. It may be a true granite, an Arunta metamorphic or an altered arkose.

Note: This core has subsequently been identified as a microcline Granite. (See Appendix No. 3).

HUCKITTA NO. 1

SAMPLE DESCRIPTIONS

- 20 30 feet 80% Sandstone yellow-brown, very fine to medium grained, dolomitic, argillaceous hard, tight, slightly friable. 20% Shale dark grey, calcareous, very silty, micromicaceous, tough.
- 30 40 feet 90% <u>Limestone</u>, dolomitic, yellow-brown, minor grey, purple, partly sandy, finely crystalline, dense. 10% <u>Sandstone</u> as above.
- 40 50 feet 70% <u>Limestone</u>, dolomitic, partly siliceous, as above. 20% <u>Shale</u> medium grey calcareous. 10% Sandstone.
- 50 60 feet 70% Sandstone, calcareous, siliceous very fine grained to medium grained, ochre-brown, reddish, purplish, etc., hard and tight, argillaceous.

 20% Shale.

 10% Limestone.
- 60 70 feet 100% Dolomite greenish grey, also light brown, argillaceous and silty, very fine crystalline, dense-shaly partings.
- 70 80 feet 60% Shale, green, minor brown, platy, soft, crumbles when wet.
 40% Dolomite.
- 80 90 feet 90% <u>Dolomite</u> buff brown, very fine sandy, siliceous? fine crystalline, very hard, tight. 10% <u>Shale</u>, green.
- 90 100 feet 100% Dolomite, varicoloured, variably sandy and silty, very fine crystalline tight.
- 100 110 feet 100% <u>Limestone</u>, medium brown, cryptocrystalline dense; micaceous shaly partings.
- 110 120 feet 100% <u>Limestone</u>, mottled purple, red, white, brown, fine to medium crystalline.
- 120 130 feet 100% <u>Limestone</u>, buff brown, fine crystalline to granular, dense.
- 130 140 feet 100% <u>Limestone</u> as above, partly light medium grey, fine crystalline and fine sucrosic.
- 140 150 feet 70% Limestone.
 20% Siltstone grey, sandy, argillaceous, friable.
 10% Shale, soapy, green to grey.
- 150 160 feet 60% Limestone, white, brown, grey, pink crypto-to medium crystalline dense.

 20% Siltstone.
 20% Shale, dark grey, and green, micromicaceous platy, fissile.
- 160 170 feet 80% Dolomite, orange-brown, yellowish brown, generally very sandy (very fine sand grains), dense, tight.

 10% Limestone, brown crystalline.

 10% Shale, green, fissile.
- 170 180 feet 100% Dolomite 50% light buff-orange-brown,

- fine to medium crystalline. 50% dark grey fine crystalline, sandy, argillaceous.
- 180 200 feet 100% <u>Dolomite</u>, light grey-buff, sandy, very fine crystalline dense, minor yellowish brown.
- 200 210 feet 100% <u>Dolomite</u> medium brown, very sandy and silty (sand grains very fine to coarse, subangular) grades partly to <u>Sandstone</u>, dense.
- 210 220 feet 80% <u>Dolomite</u> grading to <u>Limestone</u>, as above, sandy.
 20% Shale, red and green micaceous, silty.
- 220 230 feet 40% <u>Dolomite/Limestone</u>, sandy as above.
 60% <u>Shale</u> dark grey very silty and micaceous, dolomitic, tough, grades to argillaceous <u>Dolomite</u>.
- 230 240 feet 100% <u>Dolomite</u> medium orange-brown, very sandy, calcareous, crypto-to micro-crystalline dense grades to very fine dolomitic <u>Sandstone</u>.
- 240 250 feet 80% <u>Limestone</u> grey to pink finely mottled, dense crypto-to micro-crystalline.
 20% <u>Shale</u> red and green micaceous as above.
- 250 260 feet 20% <u>Limestone</u>.
 80% <u>Shale</u> red, micromicaceous firm tough, slightly calcareous.
- 260 270 feet 90% <u>Limestone</u>, predominately brown, fine crystalline, slightly sandy, argillaceous, dense, partly granular appearance.

 10% <u>Shale</u> dark grey calcareous, micromicaceous.
- 270 290 feet 100% Dolomite buff to brown, appears finely granular to crystalline (samples finely divided); trace Shale.
- 290 300 feet 70% Limestone light brown fine crystalline, scattered well developed colites, dense. Platy (thin bedded?)
 30% Shale red and grey micaceous, calcareous, tough platy.
 NOTE: This sample consists of extremely large chips whereas samples both before and after are all very finely divided.
- 300 310 feet 90% <u>Limestone</u> as above. 10% <u>Shale</u> as above.
- 310 320 feet 80% <u>Limestone</u> as before and <u>Limestone</u>, red to brown, sandy ferruginous, weathered appearance, grades to Dolomite.

 20% <u>Shale</u>, black, micaceous.
- 320 330 feet 50% <u>Dolomite</u>, white, grey, buff, greenish crypto-to micro-crystalline.
 50% <u>Limestone</u>, buff to brown mottled, crystalline, slightly oolitic.
- 330 340 feet Core No. 1
- 340 360 feet 80% Shale very dark grey, calcareous, slightly micaceous, platy.
 20% Limestone brown, argillaceous, fine crystalline dense, slightly oolitic.

- 360 380 feet 90% <u>Limestone</u> brown very fine crystalline (samples very fine).
 10% Shale as above.
- 380 390 feet 90% <u>Limestone</u> as above ochre and red sandy, silty weathered streaks.

 10% <u>Shale</u>.
- 390 410 feet No sample.
- 410 430 feet 100% <u>Limestone</u> 70% very light grey, fine sandy, fine granular and crystalline, 30% dark brown, very fine crystalline, dense. Trace pyrite.
- 430 440 feet 30% Shale red, silty and partly slightly sandy, micaceous grades to Siltstone also minor green micaceous Shale.

 70% Limestone as above with sandy streaks.
- 440 450 feet 80% Shale as above red and minor green. 20% Limestone.
- 450 460 feet 30% Shale.
 70% Limestone brown, minor pink, green, red sandy streaks, very fine crystalline.
- 460 470 feet 100% <u>Limestone</u>, light grey to light brown mottled, fine crystalline to granular, slightly oolitic.
- 470 480 feet 100% <u>Limestone</u> becoming partly mottled pink, orange, brown, mottled, oolitic, very fine to fine crystalline, partly very fine granular.
- 480 490 feet 100% Limestone light grey to brown clean, as above.
- 490 500 feet 90% Limestone, as above, sandy streaks, scattered varicoloured weathering, traces clear gypsum.

 10% Shale, red, green, etc., dirty, silty, micaceous.
- 500 510 feet 100% Limestone as above, trace gypsum.
- 510 530 feet 90% Limestone, brown, very fine to fine crystalline to granular, black shaly partings, trace sand, dense.

 10% Shale, grey and green, calcareous, micaceous.
- 530 550 feet 100% Limestone as above.
- 550 560 feet 90% Limestone as above, trace colitic, trace glauconite (?)
 10% Shale, red, micaceous.
- 560 570 feet 80% <u>Limestone</u>.
 20% <u>Shale</u>, trace pyrite.
- 570 580 feet 100% <u>Limestone</u> becoming light grey-brown trace algal (*) structures, trace disseminated pyrite, fine sandy streaks, dark grey argill-aceous partings.

- 580 590 feet 70% Limestone partly red stained, mottled. 30% Shale red, partly silty, very micaceous.
- 590 600 feet 80% <u>Limestone</u> grey to dark grey, argillaceous, crypto-crystalline, dense, grading to Shale. 20% Shale very dark grey, calcareous.
- 600 611 feet 80% <u>Limestone</u> light brown, partly rusty. 20% <u>Shale</u> rusty, very micaceous.
- 611 621 feet Core No. 2
- 621 630 feet 80% <u>Limestone</u>, grey and brown, fine crystalline, dense.
 20% <u>Shale</u> red and dark grey micaceous, calcareous, silty?
- 630 640 feet 80% <u>Limestone</u>, partly red stained.

 20% <u>Shale</u> mostly red, micaceous.
- 640 660 feet 90% <u>Limestone</u> medium to dark brown and grey, fine crystalline, black shaly partings, scattered coarse mica flakes.

 10% <u>Shale</u> very dark grey to black micaceous.
- 660 670 feet 90% <u>Limestone</u> predominately brown as above, trace disseminated pyrite.

 10% Shale as above.
- 670 680 feet 80% <u>Limestone</u>. 20% <u>Shale</u>.
- 680 700 feet 30% Limestone.

 50% Shale red, silty micaceous.

 20% Siltstone, argillaceous, micaceous very dark grey minor red, partly light grey, calcareous.
- 700 710 feet 50% Limestone as above. 30% Shale. 20% Siltstone.
- 710 720 feet 90% <u>Limestone</u>. 10% <u>Shale</u>.
- 720 730 feet 80% <u>Limestone</u>.
 20% <u>Shale</u> very dark grey, very silty, micaceous, calcareous.
- 730 740 feet 60% <u>Limestone</u> partly light brown, granular. 40% Shale red, micaceous.
- 740 750 feet 80% <u>Limestone</u>. 20% <u>Shale</u>.
- 750 760 feet 100% <u>Limestone</u> light grey to buff, partly dolomitic, fine crystalline to granular and slightly earthy, partly fine sandy.
- 760 770 feet 100% Limestone becoming darker grey and brown, dense; very dark micaceous shaly partings.
- 770 810 feet 90% Limestone.
 10% Shale, black micaceous.
- 810 820 feet 70% <u>Limestone</u>. 30% <u>Shale</u>.
- 820 840 feet 60% <u>Limestone</u>, partly reddish grading with Shale.

 40% <u>Shale</u> red micaceous, silty grades partly to <u>Siltstone</u>.

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840 - 850 feet 80% <u>Limestone</u>. 20% <u>Shale</u>.
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850 - 860 feet 50% <u>Limestone</u>. 50% <u>Shale</u>.

860 - 870 feet 80% <u>Limestone</u>. 20% <u>Shale</u>.

870 - 880 feet 90% <u>Limestone</u>. 10% <u>Shale</u>.

880 - 892 feet 80% <u>Limestone</u>. 20% <u>Shale</u>.

892 - 902 feet Core No. 3

902 - 920 feet 80% Limestone light blue-grey and brown fine to very fine crystalline and partly granular, scattered loose fine to medium sand grains. 20% Shale, red, silty, micaceous (samples very fine).

920 - 930 feet 70% <u>Limestone</u>. 30% <u>Shale</u>.

930 - 940 feet 90% <u>Limestone</u>.

940 - 950 feet 60% Shale red, minor green, silty micaceous grades to Siltstone.

40% Limestone.

950 - 960 feet 60% <u>Limestone</u> as above partly stained pink. 40% <u>Shale</u>, red, as above grading to <u>Siltstone</u>.

960 - 970 feet 80% <u>Limestone</u> mostly light grey, crypto to fine crystalline, some pink staining, dense. 20% Shale, red, silty, micaceous.

970 - 990 feet 90% <u>Limestone</u>, with grey silty streaks. 10% <u>Shale</u>.

990 - 1000 feet 80% <u>Limestone</u>, brown finely granular, silty. 20% Shale.

1000-1010 feet 70% <u>Limestone</u>.
30% <u>Shale red gicaceous</u>.

1010-1030 feet 80% <u>Limestone</u>, light grey (blue) crypto to very fine crystalline.
20% Shale.

1030-1040 feet 90% <u>Limestone</u>, rare sand grains. 10% <u>Shale</u>.

1040-1050 feet 60% <u>Limestone</u>.

20% <u>Shale red</u>, micaceous, slightly calcareous.

20% <u>Siltstone</u> red micaceous, slightly calcareous.

1050-1070 feet 90% <u>Limestone</u> light blue-grey as above. 10% <u>Shale</u>.

1070-1080 feet 70% <u>Limestone</u>.
30% <u>Shale</u>, red, as above.

- 1080-1100 feet 70% Shale.
 30% Limestone; scattered sand loose grains.
- 1100-1110 feet 50% Shale.
 50% Limestone, fine sandy streaks developing.
- 1110-1120 feet 60% Shale, grades to Siltstone.
 40% Limestone.
- 1120-1130 feet 80% Limestone as before. 20% Shale.
- 1130-1140 feet 60% <u>Limestone</u>. 40% <u>Shale.</u>
- 1140-1150 feet 40% Limestone. 30% $\frac{\text{Shale.}}{\text{Siltstone.}}$
- 1150-1160 feet 100% <u>Limestone</u> light grey crypto-to very fine crystalline, partly granular; grey argillaceous silty streaks.
- 1160-1180 feet 90% Limestone.
 10% Siltstone, red, micaceous.
- 1180-1190 feet 100% <u>Limestone</u> light grey, very fine crystalline, tight; trace Shale.
- 1190-1200 feet 50% <u>Limestone</u>, red.
- 1200-1211 feet 60% Limestone, sandy streaks.
 40% Siltatone.
- 1211-1221 feet Core No. 4
- 1221-1240 feet 50% Shale, red, grading to Siltstone.
 50% Limestone brown to grey, very fine crystalline as in Core No. 4.
- 1240-1250 feet 80% <u>Limestone</u>. 20% Shale.
- 1250-1270 feet 80% Shale red, silty, micaceous. 20% Limestone.
- 1270-1280 feet 70% <u>Limestone</u> as above partly fine granular, partly red stained.

 30% <u>Shale</u>.
- 1280-1290 feet 80% <u>Limestone</u>, appears to grade partly to Dolomite (samples very fine).
 20% <u>Shale</u>.
- 1290-1300 feet 70% Shale very dark grey, very micaceous and calcareous, silty.

 30% Limestone brown and grey, crypto-crystalline to very fine crystalline.
- 1300-1310 feet 90% Limestone, trace disseminated pyrite. 10% Shale, dark grey and red, micaceous.
- 1310-1320 feet 70% <u>Limestone</u>.
 30% <u>Shale</u> red silty, micaceous.
- 1320-1330 feet 50% <u>Limestone</u>.
 50% <u>Shale red</u>, micaceous, silty, grades to Siltstone.
- 1330-1340 feet 80% <u>Limestone</u>. 20% <u>Shale/Siltstone</u>.

1340-1360 feet 80% Limestone, becoming partly dark grey, argillaceous, fine crystalline. 20% Shale, becoming partly dark grey.

1360-1370 feet 80% Limestone brown and grey, very fine crystalling 20% Shale dark grey and red.

1370-1380 feet 90% Shale red, micaceous, silty. 10% Limestone.

1380-1390 feet 50% Shale, red as above, grades to Siltstone. 50% Limestone - partly red stained, silty.

1390-1400 feet 60% Siltstone, light grey, micaceous, dolomitic.

Trace pyrite.

20% Limestone.

20% Shale, red.

1400-1410 feet 60% <u>Limestone</u> - brown to salmon coloured, very fine crystalline.
40% Siltstone light to medium grey as above.

1410-1420 feet 50% Limestone.
50% Dolomite dark grey, very silty, very fine crystalline to granular.

1420-1430 feet 70% Limestone.
20% Siltstone grey as above.
10% Shale red.

1430-1440 feet 70% Shale.
30% <u>Limestone</u> brown to reddish, dolomitic, very fine crystalline.

1440-1450 feet 70% <u>Limestone</u> brown to grey, very fine to fine crystalline, dense.

30% <u>Dolomite</u> dark grey argillaceous, cryptocrystalline, dense.

1450-1460 feet 60% Limestone.
40% Dolomite, as above, calcareous.

1460-1480 feet

60% Limestone gradational, dark grey and brown, very fine crystalline, argillaceous, tight, light chalky streaks.

40% Dolomite gradational, dark grey and brown, very fine crystalline, argillaceous, tight, light chalky streaks.

1480-1490 feet 10% Sandstone light grey, silty, calcareous, very fine grained, tight, grades to Siltstone.

20% Limestone.

70% Dolomite, dark grey, very silty, very fine crystalline to granular, grades to Siltstone.

1490-1500 feet 20% <u>Limestone</u> brown, fine crystalline, dolomitic. 80% <u>Dolomite</u> brown to dark grey, very silty, fine crystalline to granular, grades to <u>Siltstone</u>.

1500-1512 feet

20% Limestone light grey, very silty, slightly very fine sandy, medium crystalline, good microvuggy porosity, strong yellow fluorescence, no cut with CCl_h, probably dead oil stain (drilling indicates interval 1506' - 1509').

50% Limestone light grey and brown, fine crystalling Siltstone, light grey, very finely sandy, calcareous, friable.

- 1512-1520 feet Core No. 5.
- 1520-1530 feet 100% Dolomite light grey, minor brown, very silty, very fine crystalline to granular, 80% bright yellow fluorescence, slight blue cut.

 NOTE: SAMPLES BELOW THIS DEPTH ARE VERY FINE, HENCE LITTLE DETAIL IS POSSIBLE.
- 1530-1540 feet 100% Dolomite, medium brown, very silty and partly very fine sandy, 30% yellow fluorescence, blue cut.
- 1540-1560 feet 100% <u>Dolomite</u> as above, scattered coarse sand grains 5% yellow and blue fluorescence.
- 1560-1580 feet 100% $\underline{\text{Dolomite}}$ very silty and sandy as above. $\underline{\text{Traces yellow fluorescence.}}$
- 1580-1610 feet 100% <u>Dolomite</u> as above, grades partly to <u>Limestone</u>, traces yellow fluorescence, up to 5 10% of sample.
- 1610-1710 feet 100% <u>Dolomite/Limestone</u> with <u>fluorescence as above</u>-dull <u>yellow</u>, <u>very silty and fine sandy through</u>-out sample.
- 1710-1760 feet 50% Dolomite light grey, very silty, fine sandy, crypto to micro-crystalline (samples very fine) very faint yellow fluorescence (mineral?).

 50% Limestone light grey, very silty, fine sandy, crypto to micro-crystallines (samples very fine) very faint yellow fluorescence (mineral?).
- 1760-1779 feet 100% <u>Dolomite</u> as above distinction between Dolomite and <u>Limestone</u> difficult due to fine samples. Very faint yellow fluorescence.
- 1779-1782 feet Core No. 6.
- 1782-1910 feet 100% <u>Dolomite</u>, light grey, and brown, very silty, very fine sandy, crypto to micro-crystalline, partly very siliceous, traces blue chert. Faint yellow fluorescence.
- 1910-1940 feet 100% <u>Dolomite</u> light grey, sandy, silty cryptocrystalline to fine crystalline and granular, light grey sand streaks, yellow mineral fluorescence.
- 1940-1950 feet 100% <u>Dolomite</u> as above, 10% medium to dark brown calcareous, very fine crystalline.
- 1950-2060 feet 100% <u>Dolomite</u>, calcareous, medium to dark brown, very fine to fine crystalline, dense, scattered pyrite.
- 2060-2105 feet 90% Dolomite. 10% Shale, black, silty, micaceous.
- 2105-2112 feet Core No. 7.
- 2112-2120 feet 90% <u>Dolomite</u> dark grey, silty, argillaceous, fine crystalline to granular. 10% <u>Shale</u>, black, silty.
- 2120-2150 feet 100% Dolomite as above dark grey brown, lighter silty streaks, traces black Shale rare sandy streaks.

- 2150-2160 feet 100% <u>Dolomite</u>, partly light grey sucrosic 5% white crystalline calcite.
- 2160-2170 feet 100% <u>Dolomite</u> light grey-brown silty, very fine crystalline and sucrosic, trace glauconite.

 Trace calcite.
- 2170-2180 feet 100% Dolomite, becoming medium brown.
- 2180-2210 feet 100% Dolomite, becomes very dark grey argillaceous.
- 2210-2230 feet 100% Dolomite, very light grey, fine sugary to crystalline, silty.
- 2230-2240 feet 100% Dolomite, light grey, silty, very fine crystalline to sugary.
- 2240-2250 feet 100% <u>Dolomite</u>, medium-dark brown, silty, partly fine sandy, very fine crystalline and sugary.
- 2250-2260 feet 100% Dolomite medium brown, crypto to micro-crystalline, dense and tight. Trace white crystalline calcite.
- 2260-2270 feet 100% Dolomite as above rare sandy streaks, trace calcite.
- 2270-2280 feet 80% Siltstone/Shale gradational, red, slightly dolomitic, Shale is micaceous, silty.
 20% Dolomite thin streaks in Shale, brown to reddish, partly mottled, argillaceous, microcrystalline.
- 2280-2300 feet 100% Siltstone/Shale as above, scattered large flakes of (secondary?) biotite, all micromicaceous, rare dolomitic and sandy streaks, colour predominately rusty red, partly purplish.
- 2300-2320 feet 100% <u>Siltstone/Shale</u> as above rare green shale, sandy and dolomitic streaks as above.
- 2320-2377 feet 100% <u>Siltstone/Shale</u> as above (samples become very finely divided) variable small amount very fine loose sand grains, appears to decrease with lepth.
- 2377-2387 feet Core No. 8
- 2387-2620 feet 100% Shale/Siltstone as above with minor dolomitic streaks, and rare green Shale and Siltstone.
- 2620-2630 feet 100% Shale/Siltstone as above, 20% green minor grey green sandy, micaceous stringers.
- 2630-2640 feet 100% Shale/Siltstone 50% red, 50% green.
- 2640-2650 feet 40% <u>Siltstone</u>, green and grey, very micaceous.
 60% <u>Sandstone</u>, grey (loose in sample) very fine grained, micaceous, silty, well sorted, apparently argillaceous.
- 2650-2660 feet 30% Shale black, micaceous and silty, poker-chip.
 40% Sandstone as above.
 30% Siltstone as above.
- 2660-2670 feet 10% Dolomite grey brown, fine crystalline, dense, yellow mineral fluorescence.

 30% Siltstone dark grey to black, argillaceous, siliceous, abundant coarse dark brown mica gives greasy appearance.

 60% Sandstone (quartz greywacke?) grey to dark grey, clear quartz and dark brown and grey silty, argillaceous matrix, also matrix of brown

crystalline carbonate material. Very coarse to coarse quartz and chert grains, predominately angular (suggests conglomerate pebbles?) some grains sub-rounded, frosted trace glauconite grains. Some clear quartz grains appear re-crystallized.

2670-2680 feet 40% Shale dark grey - black micaceous, silty, poker-chip.

50% Siltstone as above.

10% Greywacke as above.

2680-2690 feet 40% <u>Siltstone</u>. 40% <u>Shale</u>. 20% <u>Greywacke</u>.

2690-2704 feet 80% Greywacke (much loose coarse quartz). 20% Siltstone.

2704-2707 feet Core No. 9.

2707-2730 feet (samples pulverized - very fine) 80% Sandstone grey, very fine to slight coarse grained dolomitic silty.
20% Shale, grey silty, micaceous.

2730-2740 feet 100% <u>Sandstone</u> grey-brown, silty micaceous matrix, predominately fine grained, rarely coarse, rounded to angular.

2740-2750 feet 20% <u>Dolomite</u> brown, sandy trace colitic, fine sucrosic, grading with Sandstone.

80% <u>Sandstone</u> with silty streaks as above.

2750-2810 feet 100% Sandstone (greywacke?) dark grey, siliceous, silty, slightly dolomitic matrix, extreme poor sorting, very fine to very coarse angular to rounded. Some quartz grains re-crystallized, minor coarse muscovite flakes, rare chert grains.

2810-2820 feet 70% (samples very fine) <u>Sandstone</u>, grey-brown, slightly dolomitic, very fine to fine grained, grading to 30% <u>Siltstone</u> (?) grey, finely divided trace coarse mica.

2820-2830 feet 80% Sandstone fine to very coarse as before. 20% Shale, black, micaceous, greasy appearance.

2830-2840 feet 90% <u>Sandstone</u>, very fine to fine as in 2820' to 2830' sample - minor coarse muscovite flakes. 10% <u>Shale</u>, black, as above.

2840-2850 feet 80% <u>Sandstone</u>. 20% <u>Shale</u>.

2850-2860 feet 60% <u>Sandstone</u>.

40% <u>Shale</u>, green to grey, silty, platy.

2860-2870 feet 70% Shale green-grey as above. Trace pyrite. 30% Sandstone.

2870-2900 feet 90% Shale, green as above. 10% Sandstone.

2900-2920 feet 80% Shale.
20% Sandstone very fine grained, grey.

2920-2940 feet 100% Shale, green, minor grey, trace Sandstone.

2940-2950 feet 50% Shale.
50% Sandstone (loose in samples) grey, very fine to fine grained, rare coarse grains, rounded to angular, few glauconite grains.

2950-3011 feet 90% Sandstone as above, trace glauconite, very fine grained, 10% Shale as above.

3011-3016 feet Core No. 10.

3016-3020 feet 30% Shale green.
70% Sandstone (loose in samples) very fine to medium, rarely coarse, angular to rounded, silty, trace glauconite.

3020-3050 feet 90% Sandstone very fine grading to Siltstone, trace glauconite, rare coarse grains.

10% Shale.

3050-3060 feet 40% Shale green and grey. 60% Sandstone.

3060-3070 feet 10% Shale.
90% Sandstone, very fine to fine as above siliceous, trace glauconite and coarse muscovite flakes.

3070-3090 feet 80% <u>Sandstone</u>. 20% <u>Shale</u>.

3090-3100 feet 90% <u>Sandstone</u>. 10% <u>Shale</u>.

3100-3110 feet 20% Shale green and grey, micaceous, slightly pyritic.
80% Sandstone grey, vitreous, very fine, siliceous cement, scattered glauconite grains.

3110-3120 feet 10% Shale.
20% Siltstone dark grey, siliceous, grading with Sandstone.
70% Sandstone glauconite, very fine, as above.

3120-3130 feet 20% Shale, becoming black, very micaceous. 20% Siltstone as above. 60% Sandstone as above.

3130-3140 feet 40% Shale, very dark grey to black, siliceous, micaceous.
60% Sandstone very fine quartzitic, vitreous, partly argillaceous, traces glauconite.

3140-3150 feet 60% Shale dark green and grey, platy, very silty, micaceous.

40% Sandstone grey-green, medium to coarse, rarely very coarse, rounded to sub-angular, siliceous cement.

3150-3170 feet 80% Shale. 20% Sandstone, mostly fine grained vitreous.

3170-3180 feet 60% Shale, green, rare glauconite grains.

40% Sandstone grey, vitreous quartzitic, fine to predominately coarse to very coarse grained, angular to rounded, some chert grains, siliceous cement, clean, trace glauconite.

3180-3190 feet 70% <u>Sandstone</u>. 30% <u>Shale</u>.

3190-3200 feet 90% Shale green platy. 10% Sandstone.

3200-3220 feet 100% Shale green, very minor grey, rare sandy streaks. Trace coarse grained Sandstone.

3220-3230 feet 100% Shale as above, trace red. Trace pyrite.

3230-3240 feet 100% Shale 60% green, 40% red, slightly micaceous trace coarse grained Sandstone.

3240-3250 feet 100% Shale 30% green, 70% red; grey-green siliceous sand streaks.

3250-3314 feet 100% Shale 90% red micro micaceous, platy, 10% green. Trace gypsum spar 3290' - 3310'.

3314-3324 feet Core No. 11.

3324-3330 feet 100% Shale red, minor green, as above.

3330-3340 feet 100% Shale, green, very minor red.

3340-3370 feet 90% Shale green and dark grey, scattered pyrite.

10% Sandstone, loose in sample, fine to very fine grained, siliceous, grey, tight - as fine stringers in Shale.

3370-3380 feet 90% Shale, becoming partly red. Trace pyrite. 10% Sandstone as above.

3380-3430 feet 100% Shale green, as before, trace pyrite. Trace Sandstone (loose in samples).

3430-3480 feet 90% Shale, trace calcareous, trace red.
10% Sandstone very fine siliceous, silty. Trace
gypsum 3470' - 3480'.

3480-3500 feet 80% Shale.
20% Sandstone, grey, very fine siliceous, vitreous, brittle, grades to siliceous Siltstone.

3500-3510 feet 40% <u>Sandstone</u>. 60% <u>Shale</u>.

3510-3540 feet 80% <u>Sandstone</u>. 20% <u>Shale</u>, scattered pyrite.

3540-3550 feet 70% Sandstone.
30% Shale, green, grey, minor red, trace pyrite.

3550-3570 feet 90% Shale green, slightly pyritic. 10% Sandstone.

3570-3590 feet 20% Sandstone, trace glauconite.
80% Shale, gron, minor grey and red, pyritic, trace gypsum spar.

3590-3600 feet 90% Shale. 10% Sandstone, trace glauconite.

3600-3615 feet 80% <u>Shale</u>. 20% <u>Sandstone</u>.

3615-3621 feet Core No. 12.

3621-3630 feet 80% Shale, greenish grey as in Core 12, very minor red shale. 20% Sandstone, generally very fine to fine (finely divided in sample) rare coarse grains, trace pink feldspar.

100% Arkose(?) pink (very fine in samples) quartz and abundant pink orthoclase feldspar, variable minor amounts of muscovite, biotite, and dark 3630-3872 feet ferromagnesian minerals.

Core No. 13.

3872-3873 feet

3873-4012 feet 100% finely divided quartz and orthoclase feldspar (T.D.) and minor light and dark mica, rare dark ferromagnesian mineral grains as in samples below 3630 feet.

PETROGRAPHICAL REPORT CORES 5, 9, & 13

Huckitta No. 1

Core 5 1516' Limestone

Calcite is the predominant mineral. It occurs as subhedral to anhedral crystals averaging about .05 mm. in diameter. Interstitical quartz is present as tiny irregular patches .02-.05 mm. in diameter and may constitute 3-5% of the rock.

Vugs up to 2.0 mm. in diameter are abundant in the sample and are lined with relatively coarse (0.1-0.3 mm. diameter) euhedral calcite crystals.

There are minute opaque crystals tending toward cubic form which have metallic reflectance. These may be pyrite. There are also a few subspherical concentrations of cryptocrystalline calcite which may be remnants of pellets or colites, now largely recrystallized.

Core 9 2705'. Arkosic limestone

The predominant mineral is calcite, ranging from cryptocrystalline aggregates to crystals 0.1-0.2 mm. in diameter. These form a matrix enclosing spherical to moderately well rounded quartz and microcline grains ranging from 0.5-2.0 mm. in diameter. These clastic grains make up 10-15% of the rock. Quartz predominates over microcline. Many quartz grains are slightly enlarged by secondary overgrowths.

Anhydrite is relatively abundant (5-10%?) as porphyroblastic crystals replacing carbonate, and also as a crystalline cement interstitial to pellet-like aggregates of carbonate. These pellets may have cores of microcline, quartz, or fine grained carbonate. They are oval in outline, the outer rim being marked by sudden increase in grain size. It is these pellets, surrounded by anhydrite matrix, that give the sample its granular, or colitic, appearance.

The sample probably represents a partly recrystallized colitic limestone. Dolomite could be expected but was not detected in the thin section.

Core 13 3872' Microcline granite

The principal minerals are microcline and quartz, with traces of muscovite, plagioclase, sphene, and opaque dust (probably hematite). The grain size (major minerals) averages about 0.8-1.0 mm., but many grains are extremely irregular in form. Graphic and myrmekitic intergrowths are common. Small feldspar grains in the groundmass are now heavily sericitized. Many of these show traces of polysynthetic twinning and are probably albite.

The texture is indicative of a plutonic igneous rock. Grain boundaries are complex and interlocking, and there is no obvious foliation developed. Myrmekitic and graphic intergrowths are typical of igneous rock. The almost complete absence of micas and mafic minerals is unusual but not unknown in granites; this sample approaches in composition the pure quartz-potash feldspar variety which is sometimes called 'alaskite'.

W. B. Bry an-1april 1966

CORE LABORATORIES, INC.

Petroleum Reservoir Engineering

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Compan	y EXOIL	(N. T.) PTY. LTD	•	Formation .	. <u>.,</u>		Page 1 of
Well	HUCKIT	ra no. 1		Cores CC	NVEN	LIONYL	File AP-1-106
Field WILDCAT			Drilling Fluid		e nominalisation	Date Report 11 MAR 1966	
XXXXX	NTH. TI	ERRITOR XXXXX A	USTRALI	A Elevation			Analysts JBM
Location	a			Remarks _			
				ORE ANALYS			
SAMPLE NUMBER	DFPTH FEET	PERMEABILITY MILLIDARCYS HORIZONTAL VERTICAL	POROSITY PERCENT	RESIDUAL SATURATIO OIL OIL PORE	N	PROBABLE PRODUCTION	REMARKS
3	•						
1	1 5 16	2.5	12.0	5.9	66.7		LIMESTONE, grey micro-crystalline slightly argilaceous and vuggy, bright gold fluorescence
-							to the control of the

OFF LOCATION ANALYSES-NO INTERPRETATION OF RESULTS.

REFER TO ATTACHED LETTER.

1 NCOMPLETE CORE RECOVERY INTERPRETATION RESERVED

These analyses, opinions or interpretations are based on observations and materials supplied by the client to whom, and for whose exclusive and confidential use, this report is made. The interpretations or opinions expressed represent the best judgment of Core Laboratories, Inc. (all errors and omissions excepted); but Core Laboratories, Inc., and its officers and employees, assume no responsibility and make no whrranty or representations, as to the productivity, proper operation, or profitableness of any oil, gas or other mineral well or sand in connection with which such report is used or relied upon.

NORTHERN TERRITORY ADMINISTRATION—ANIMAL INDUSTRY BRANCH WATER ANALYSIS

Date sampled 26/2/66 Date received of filtered sample. Sample Do HARDNESS (calculated as CaCO ₃)—	11/3/ Recomme (see	No. 9482 /66 ended Maximums over page). Stock Agriculture
*Results in milligrams per litre of filtered sample. Sample Do HARDNESS (calculated as CaCO ₃)—	Recomme (see mestic	ended Maximums over page).
Sample Do HARDNESS (calculated as CaCO ₃)—	(see emestic	over page).
HARDNESS (calculated as CaCO ₃)—	. ·	Stock Agriculture
	500	to-miller garante
44 Total 338	500	g _a -maga
A O blob of the second		
" Carbonate		
" Non-Carbonate H11	, 	
ALKALINITY IN EXCESS OF		
TOTAL HARDNESS	•	<u> </u>
CHLORIDE	500	、 :
SULPHATE 51	250	2,000 —
BICARBONATE 417	 -	
Child	20	. ————————————————————————————————————
NITRATE Not Determined Adult	120	
FLUORIDE	1.5	5.0
CARBONATE		
SODIUM		-
POTASSIUM 9		<u> </u>
CALCIUM 30	100	
MAGNESIUM	100	300 —
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e de perendia de la competit del competit de la competit de la competit de la competit de la com		
TOTAL DISSOLVED SALTS 670 Approx. 3	,000	8,000 1,000
RESIDUE ON EVAPORATION 3	,000	8,000 1,000
pH 8.2		

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 Wearl R. Vacetone

Date 29-3-66

NORTHERN TERRITORY ADMINISTRATION—ANIMAL INDUSTRY BRANCH

WATER ANALYSIS

Origin of water EXOIL HUCKITTA NO. 1	Reference	e Sn 66 / 369				
OIL WELL @ 1480!	Specimer	Specimen Advice Note No. 9462				
Date sampled 26/2/66	Date rec	• • • • • • • • • • • • • • • • • • • •				
* Results in milligrams per litre of filtered sample.		Recommended Maximums (see over page).				
	\mathbf{Sample}	Domestic Stock Agriculture				
# HARDNESS (calculated as CaCO ₈)—						
" Total	328	500				
"Carbonate						
" Non-Carbonate	Nil					
ALKALINITY IN EXCESS OF						
TOTAL HARDNESS	6					
CHLORIDE	40	500				
SULPHATE	56	250 2,000				
BICARBONATE	407					
		Child 20 — — —				
NITRATE Not	Determined	Adult 120 — —				
FLUORIDE	1 t	1.5 5.0 —				
CARBONATE	N11					
SODIUM	45					
POTASSIUM	10					
CALCIUM	29	100				
MAGNESIUM	62	100 300				
		andra (1995) i sa				
	· · · · · · · · · · · · · · · · · · ·					
TOTAL DISSOLVED SALTS6	50 Approx.	3,000 8,000 1,000				
RESIDUE ON EVAPORATION		3, 000 8,000 1,000				
pH8.3	en e					

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 Lean U.R. Marrows.

Date 29-3:66 -

* 14.3 milligrams per litre equals 1 grain per gallon. 437.5 grains equals 10z,

