ALLIANCE PETROLEUM AUSTRALIA N.T.

ALLIANCE MULGA NO. 1
WELL COMPLETION REPORT

Q.P.63, NORTHERN TERRITORY

BY: A.C.M. Laing


OPEN FILE

NORTHERN TERRITORY GEOLOGICAL SURVEY
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I. SUMMARY

The Alliance Hulga No. 1 Well was drilled to a total depth of 3,003 feet in the Georgina Basin, Northern Territory in the period 5 to 29 August, 1965. The well was located on a geologically closed anticline in the northeast corner of O.P. 63. It was drilled on behalf of Alliance Petroleum Australia N.L., Alliance Oil Development Australia N.L., and Amalgamated Petroleum N.L., with a T-20 rig supplied by Oil Drilling and Exploration Ltd. The well was abandoned on 31 August, 1965.

The well passed through Wimmera Formation (Lower Ordovician) to 190 feet, Arrinthurra Formation (Upper Cambrian) to 1,714 feet, Marqua Beds (Middle Cambrian) to 1,974 feet and Upper Proterozoic Beds to total depth (3,003 feet). The Marqua Beds are only 260 feet thick and have thinned considerably from the wells to the south. In Netting Fence No. 1, 80 miles to the south-southeast, the Middle Cambrian is 2,135 feet thick and in B.M.R. No. 12 (Cockroach), 75 miles to the southwest, the Middle Cambrian is over 1,279 feet thick. The thinning probably takes place to the south only, as in Lake Nash No. 1, 60 miles to the north, the Middle Cambrian is almost the same thickness as in Hulga No. 1. The thinning of the Middle Cambrian is thus largely regional and is not confined to the Hulga Anticline.

The well was drilled throughout using air, despite large flows of fresh water encountered in the Cambrian dolomites penetrated. Flows of fresh water of up to 1,800 barrels per hour were being lifted out of the hole by air by the time total depth had been reached. This water had a standing level of 330 feet (the level where water was first encountered), although the well was cased with 10½ inch casing to 826 feet. This may, possibly, indicate that there are connected fractures up to 330 feet below the surface away from the hole behind the casing.

After cutting a core at 3,003 feet, it was not possible to clean the hole below 2,620 feet, due to severe caving of a section of Upper Proterozoic shale and limestone between 2,620 and 3,003 feet. Consequently, it was decided to abandon the well at that depth.
II. INTRODUCTION

The Alliance Mulga No. 1 Well was drilled, primarily, to investigate the nature of the sediments present in the northeast corner of O.P. 63, Northern Territory and the southeast corner of O.P. 53, Northern Territory; and secondly, to test the Mulga Anticline for the presence of hydrocarbons.

The Mulga Anticline is an anticline with gently dipping flanks (2-3 degrees) and small closure 35 feet over 6 square miles, which was proved by field mapping and photogeology.

The well was located close to the culmination of the anticline, as near as it could be judged. The final wellsite is about ½ mile west of that given in the application to the Bureau of Mineral Resources for subsidy. Amalgamated Petroleum N.L., the operator of the adjoining tenement to the north, contributed 50% of the cost of the well.

The wells site geologist for the drilling of the well was Mr. G.G. Campl of Cundill, Meyers and Associates and the core and cuttings descriptions are his work. The engineering section of the completion report and the composite log were prepared by Cundill, Meyers and Associates.
III. WELL HISTORY

(1) GENERAL DATA:

(a) Well Name and Number:
Alliance Malga No. 1 Well.

(b) Name and Address of Operator:
Alliance Petroleum Australia N.L.,
100 Collins Street,
MELBOURNE ... C.I.
VICTORIA.

(c) Tenement Holder:
Alliance Petroleum Australia N.L.

(d) Details of Petroleum Tenement:
Oil Permit No. 63, Northern Territory.

(e) District:
National Mapping Sheet F53-8 Sandover
River, Northern Territory.

(f) Location:
21° 42' 0.3" South Latitude
137° 38' 18.6" East Longitude.

(Please note that the final wellsite is about
1/2 mile west of that specified in the subsidy
application).

(g) Elevation:
Kelly Bushing 855' ASL
Ground 844' ASL

(h) Total Depth:
3,003 feet.

(i) Date Drilling Commenced:
5 August, 1965.

(j) Date Drilling Completed:
29 August, 1965.

(k) Date Well Abandoned:
31 August, 1965.

(l) Date Rig Released:
1 September, 1965.

(m) Drilling time in days:
25 days.

(n) Status:
Abandoned - Dry Hole. To be converted to water
well for Lake Nash Station.
(2) **Drilling Data:**

(a) **Drilling Contractor:**
Oil Drilling & Exploration Ltd.,
93 York Street,
SYDNEY ... N.S.W.

(b) **Drilling Plant:**

<table>
<thead>
<tr>
<th>Make</th>
<th>National</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>T-20</td>
</tr>
<tr>
<td>Rated Capacity</td>
<td>4,000' with 4(\frac{1}{2})&quot;  D.P.</td>
</tr>
<tr>
<td>Motor</td>
<td>One G.M., Type 12107 (Twin 6, Series 71), 300 R.P., Diesel.</td>
</tr>
</tbody>
</table>

(c) **Mast:**

<table>
<thead>
<tr>
<th>Make</th>
<th>Lee C. Moore 94'</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Cantilever</td>
</tr>
<tr>
<td>Rated Capacity</td>
<td>300,000 pounds.</td>
</tr>
</tbody>
</table>

(d) **Pumps & Compressors:**

**Main Pumps:**

Ideco HBE, 700F 7\(\frac{1}{4}\)" x 16" (one) with GM Quad 6, Series 71 Diesel.

**Standby Pumps:**

Ideco-Clark, T-360-A Triplex 7\(\frac{1}{4}\)" x 12" (one) with GM 12107 Twin 6 Series, 71 Diesel.

**Primary Air Compressor:**

Ingersoll Rand Type HBE, Capacity 1500 cfm with Waukesha LRDCS 405 HP Diesel motor.

**Compressor Booster:**

Ingersoll Rand Boosting from 300 psi to 1500 psi with Waukesha 520 HP Diesel motor.

**Injection Pump:**

Aldrich Type HS-3B Size 1" x 2\(\frac{1}{4}\)" with a Wisconsin VH4D 30 HP motor.

(e) **Bigrout Preventor:**

<table>
<thead>
<tr>
<th>Make</th>
<th>Shaffer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>B, Hydraulic double gate 900 series</td>
</tr>
<tr>
<td>Size</td>
<td>12&quot;</td>
</tr>
<tr>
<td>Working Pressure</td>
<td>3,000 psig.</td>
</tr>
<tr>
<td>Accumulator</td>
<td>60 gallon Hydri.</td>
</tr>
</tbody>
</table>

**Secondary Unit:**

<table>
<thead>
<tr>
<th>Make</th>
<th>Shaffer with Cameron 6&quot; CHR 900 series Hydraulic gate valve.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>900 series</td>
</tr>
<tr>
<td>Size</td>
<td>12&quot;</td>
</tr>
<tr>
<td>Working Pressure</td>
<td>3,000 psig.</td>
</tr>
</tbody>
</table>
(r) Hole Sizes and Depths:

17%"  Surface to 51'
13%"  51' to 892'
8%"  892' to 3002'
7%"  3002' to 3003'

(g) Casing Details:

Size:  10%"  Setting Depth: 826'
Sacks Cement Used: 400
Rise of cement behind casing. Not to surface.
Pumped additional 75 sacks down annulus,
plugged annulus with bags to 20' and
cemented casing to surface with further
15 sacks.

(h) Drilling Fluid:

The hole was air drilled to 330' where water
was encountered at the rate of about one pint
per hour. Mist drilling was commenced at
this point, using Comprox foamer. At 460',
the hole began making additional water at
an estimated rate of 7 barrels per hour,
increasing to 20 barrels per hour at 610',
25 barrels to 660', 33 barrels per hour at
710' and 45 barrels per hour at 750'.
Comprox Dichromate and Caustic were added
to facilitate mist drilling during this
period.

After casing was set at 826', the hole
again began making water on reaching a
depth of 970'. This increased to 200
barrels per hour at 1070'. A compressor
booster was used on the hole from 1200'.
The section of the hole from 970' to
total depth was mist drilled using Atlasol
Comprox, Dichromate and Caustic Soda.
While attempting to clean out the hole
below 2620' prior to running final logs,
the water flow increased to 1800 barrels
per hour. Drilling mud and chemicals were
added during the course of the logging runs
at the end of the hole. These chemicals
included Supercol, P.E.8, and Caustic Soda,
as well as 22 sacks of Sawdust.

(i) Water Supply:

The hole was air or mist drilled, no external
supply of water being required for drilling
operations.

(j) Perforating and Shooting Record:

Nil.

(k) Plugging-back and squeeze cementation jobs:

The only plug set was part of the abandonment
programme.

<table>
<thead>
<tr>
<th>Interval</th>
<th>Length</th>
<th>Sacks of Cement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1710'–1810'</td>
<td>100'</td>
<td>150</td>
</tr>
</tbody>
</table>
(1) **Fishing Jobs:**
Nil.

(2) **Side Tracked Hole:**
Nil.

(3) **LOGGING AND TESTING:**

(a) **Cuttings:**
Cuttings were obtained throughout the drilling of the well and cuts were distributed to Alliance Petroleum Australia N.L., Amalgamated Petroleum N.L. and the Bureau of Mineral Resources.

(b) **Coring:**
A total of six cores were cut as follows, the coring programme being as specified in the subsidy application.

<table>
<thead>
<tr>
<th>Core No.</th>
<th>Interval</th>
<th>Cut</th>
<th>Recovery</th>
<th>% Recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>472' - 484'</td>
<td>12'</td>
<td>7'</td>
<td>58</td>
</tr>
<tr>
<td>2</td>
<td>988' - 998'</td>
<td>10'</td>
<td>2'3&quot;</td>
<td>23</td>
</tr>
<tr>
<td>3</td>
<td>1495' - 1505'</td>
<td>10'</td>
<td>2'6&quot;</td>
<td>25</td>
</tr>
<tr>
<td>4</td>
<td>1980' - 1981'3&quot;</td>
<td>1'3&quot;</td>
<td>1'3&quot;</td>
<td>100</td>
</tr>
<tr>
<td>5</td>
<td>2492' - 2503'</td>
<td>11'</td>
<td>6'3&quot;</td>
<td>57</td>
</tr>
<tr>
<td>6</td>
<td>3002' - 3003'7&quot;</td>
<td>1'7&quot;</td>
<td>0'4&quot;</td>
<td>20</td>
</tr>
</tbody>
</table>

All cores were cut using Hughes hard formation conventional core heads. The entire cores were shipped to the Bureau of Mineral Resources.

(c) **Side Wall Samples:**
Nil.

(d) **Logging:**
The hole was logged by Welex as follows:

- **Induction Electric Logs:** 823' - 2605'
- **Acoustic Velocity Log with Caliper Log:** 823' - 2565'
- **Gamma-Neutron Log:** 50' - 2590'

Because of severe caving, the hole could not be cleaned out to be logged to total depth.

(e) **Drilling time:**
A Geolograph drilling rate recorder was used on the hole.
(f) **Gas Log:**
No gas detector was employed, but a flare was kept burning on the blooey line.

(g) **Formation Testing:**
No formation tests were run on the hole as air drilling effectively provides a continuous formation test. Water encountered in the course of drilling has been discussed under "drilling fluid".

(h) **Deviation Surveys:**
The following deviation surveys were run:

<table>
<thead>
<tr>
<th>Depth</th>
<th>Deviation from Vertical</th>
</tr>
</thead>
<tbody>
<tr>
<td>80'</td>
<td>1°</td>
</tr>
<tr>
<td>200'</td>
<td>1°</td>
</tr>
<tr>
<td>295'</td>
<td>1°</td>
</tr>
<tr>
<td>440'</td>
<td>1°</td>
</tr>
<tr>
<td>890'</td>
<td>1°</td>
</tr>
<tr>
<td>1200'</td>
<td>2°</td>
</tr>
<tr>
<td>1570'</td>
<td>2°</td>
</tr>
<tr>
<td>1700'</td>
<td>2°</td>
</tr>
<tr>
<td>1970'</td>
<td>2°</td>
</tr>
<tr>
<td>2350'</td>
<td>2°</td>
</tr>
<tr>
<td>3000'</td>
<td>2°</td>
</tr>
</tbody>
</table>

(i) **Temperature Surveys:**
The hole temperature recorded by Welex in the course of logging was 105°F at 2605'.

(j) **Velocity Surveys:**
No velocity survey was run in the well. An unsuccessful request was made to get the B.M.R. Georgina Basin seismic crew, then working in the vicinity, to carry out a velocity survey.

(k) **Other Surveys:**
Nil.

(l) **Production Testing:**
Nil.
IV. GEOLOGY

1. SUMMARY OF PREVIOUS WORK:

(a) Geological: The earliest systematic work in the Georgina Basin was that of Whitehouse (1936-39) who concentrated mainly on the Cambro-Ordovician fossils. Similar work was done by Opik (1956). These workers both divided the Cambro-Ordovician beds into 'formations' which were actually stages being recognised on their fossil content rather than their lithology.

Opik's work was followed by a large amount of systematic geological mapping by geologists of the Bureau of Mineral Resources.

Noakes et al (1959) mapped the Urundangi 1:250,000 sheets, which adjoins to the east the Sandover River sheet, in which the Mulga No. 1 Well is located.

Smith et al (1960) mapped Tobermory 1:250,000 sheet which adjoins the Sandover River sheet to the south.

Casey, Reynolds and Pritchard mapped the 1:250,000 sheets, Boulia and Glenormiston, in the southeastern part of the Georgina Basin (Casey et al 1960, Opik and Pritchard 1960, Reynolds and Pritchard 1964).

The Sandover River 1:250,000 sheet was mapped by Nichols (1964) for the B.M.R.

However, the most detailed geological work carried out over the area around Mulga No. 1 Well was done by Wilson (1964) during his examination of O.P.63 for Alliance Petroleum Australia N.L. Besides the detailed geological map of the Mulga Anticline made by Wilson (1964) a structure contour map of the Mulga Anticline was prepared independently for Alliance Petroleum Australia N.L. by Geophoto Resources Consultants from air photographs using a Keish Plotter. Both these maps show closure on the Mulga Anticline.

(b) Geophysical: In 1960-61, the B.M.R. carried out a helicopter gravity survey over the Georgina Basin, including the Sandover River and Tobermory 1:250,000 sheets (Barlow 1965).

The gravity work covering the two latter sheets, which include the whole of O.P.63, was recalculated and interpreted by Starkey (1964) for Alliance Petroleum Australia N.L.
A more detailed gravity survey (Tarlton Downs Gravity Survey) was carried out by Wogela Geophysical Pty. Ltd. (Lonsdale & Ingall 1964) for Alliance Petroleum Australia N.L. This survey included detailed gravity coverage of the Mulga Anticline. This detailed gravity coverage did not, however, confirm closure in the Mulga Anticline, although it shows a residual gravity negative anomaly which coincides with the geological closure.

The B.M.R. also carried out an aeromagnetic survey (Wells and Wilson 1964) over the Georgina Basin which was reinterpreted for Alliance Petroleum Australia N.L. by Starkey (1964). The survey indicated magnetic basement was about 7,000 feet under the Mulga Anticline.

(c) Drilling: In 1962 the B.M.R. conducted a core drilling programme in the Georgina Basin (Milligan 1962). Nineteen holes were drilled with a maximum depth of 750 feet and a total footage of 8,030 feet. The nearest hole to Mulga No. 1 was GRG14, about 14 miles to the northwest, which penetrated Quaternary and Tertiary sediments to 118 feet then pelletoidal dolarenite and dolilutite with minor siltstone to total depth at 720 feet. Aspilatic material was encountered between 562 and 680 feet.

In 1964 two wells, B.M.R. 13 (Sandover) and B.M.R. 12 (Cockroach), were drilled for the B.M.R. Formation tops for B.M.R.13 (Sandover) are as follows (see Lloyd and Bell 1964):

<table>
<thead>
<tr>
<th>Age</th>
<th>Formation</th>
<th>Formation Top</th>
</tr>
</thead>
<tbody>
<tr>
<td>QUATERNARY</td>
<td></td>
<td>0'</td>
</tr>
<tr>
<td>UPPER CAMBRIAN</td>
<td>Arrinthuranga</td>
<td>40'</td>
</tr>
<tr>
<td>MIDDLE CAMBRIAN</td>
<td>Arthur Creek</td>
<td>2235'</td>
</tr>
<tr>
<td>LOWER CAMBRIAN</td>
<td>Mount Baldwin</td>
<td>3097'</td>
</tr>
<tr>
<td>ARCHAEN</td>
<td>Arunta Complex</td>
<td>3328'</td>
</tr>
<tr>
<td></td>
<td>Granite</td>
<td>3328'</td>
</tr>
<tr>
<td><strong>TOTAL DEPTH</strong></td>
<td></td>
<td><strong>3331'</strong></td>
</tr>
</tbody>
</table>

A show of oil and gas was obtained from a calcareous, argillaceous and bituminous dolomite between 2,952 and 2,975 feet in this well, which is located 150 miles west of Mulga No. 1.
Formation tops for B.M.R. 12 (Cockroach) are as follows (see Nichols and Bell 1965):

<table>
<thead>
<tr>
<th>Age</th>
<th>Formation</th>
<th>Formation Top</th>
</tr>
</thead>
<tbody>
<tr>
<td>QUATERNARY</td>
<td></td>
<td>0'</td>
</tr>
<tr>
<td>LOWER ODOVICIAN</td>
<td>Ninmaroo</td>
<td>25'</td>
</tr>
<tr>
<td>UPPER CAMBRIAN</td>
<td>Arrinthurunga</td>
<td>485'</td>
</tr>
<tr>
<td></td>
<td>Marqua Beds</td>
<td>2721'</td>
</tr>
<tr>
<td>TOTAL DEPTH</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The well, which is located 75 miles southwest of Mulga No. 1 was still in Marqua Beds at total depth. No shows were reported.

In 1963 the Lake Nash No. 1 Well was drilled to a total depth of 1,315 feet for Amalgamated Petroleum.

Formation tops for Lake Nash No. 1 were as follows (see Wolf 1963):

<table>
<thead>
<tr>
<th>Age</th>
<th>Formation</th>
<th>Formation Top</th>
</tr>
</thead>
<tbody>
<tr>
<td>UPPER? CAMBRIAN</td>
<td>Unit A (dolomite)</td>
<td>0'</td>
</tr>
<tr>
<td></td>
<td>(Heseta Beds?)</td>
<td></td>
</tr>
<tr>
<td>MIDDLE CAMBRIAN</td>
<td>(Unit B (limestone)</td>
<td>586'</td>
</tr>
<tr>
<td></td>
<td>(Unit C (dolomite)</td>
<td>790'</td>
</tr>
<tr>
<td>UPPER PROTEROZOIC</td>
<td>Unit D (Mulga Beds)</td>
<td>995'</td>
</tr>
</tbody>
</table>

Some viscous tar material was obtained in vugs in dolomite in Unit C, in this well which is located 60 miles north of Mulga No. 1.

In 1964 the Netting Fence No. 1 Well was drilled to a total depth of 6,664 feet for Papuan Apinapi Petroleum Company Ltd. The well is on a closed structure located by surface geological mapping (Laing 1960) and reflection seismic (Hier 1961).

Formation tops for Netting Fence No. 1 are as follows (Kempton 1965):
<table>
<thead>
<tr>
<th>Age</th>
<th>Formation</th>
<th>Formation Top</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORDOVICIAN</td>
<td>Toko Group</td>
<td>0'</td>
</tr>
<tr>
<td></td>
<td>Minmaroo Formation</td>
<td>1261'</td>
</tr>
<tr>
<td>UPPER CAMBRIAN</td>
<td>Georgina Limestone</td>
<td>2361'</td>
</tr>
<tr>
<td>MIDDLE - UPPER CAMBRIAN</td>
<td>Mungerebar Limestone</td>
<td>4090'</td>
</tr>
<tr>
<td>MIDDLE CAMBRIAN</td>
<td>Steamboat Sandstone</td>
<td>4355'</td>
</tr>
<tr>
<td></td>
<td>Netting Fence Formation</td>
<td>5080'</td>
</tr>
<tr>
<td></td>
<td>Thorntonia Limestone</td>
<td>6428'</td>
</tr>
<tr>
<td>PRE-CAMBRIAN</td>
<td>Granite</td>
<td>6590'</td>
</tr>
<tr>
<td></td>
<td>Total depth</td>
<td>6664'</td>
</tr>
</tbody>
</table>

Many shows of bitumen and gas were observed during the drilling of this well, which is located about 80 miles SSE of Mulga No. 1 Well. Gas was noted at 3,550, 3,620, 3,900 and 6,414 feet. Bitumen was observed in the Toko Group, Minmaroo Formation, Steamboat Sandstone and Netting Fence Formation. Bitumen with oil stains were observed in the Georgina Limestone.

2. REGIONAL GEOLOGY:

The Georgina Basin is a sedimentary basin in the eastern Northern Territory and north-western Queensland with an area of 108,000 sq. miles, containing up to 6,000 feet of sediments. The sediments are mainly flat-lying Cambrian and Ordovician carbonates, with interbedded clastic sediments increasing in percentage to the south-west.

Except along monoclines and other structures in the southern and eastern part of the basin, surface outcrop is poor.

Geologists working on different edges of the basin have defined a number of separate formations equivalent in age and differing little in lithology. In this report the formations defined in the southern part of O.P.63 are used following Wilson (1964).
The regional stratigraphy is outlined in the table below:

<table>
<thead>
<tr>
<th>Age and Formation Name</th>
<th>Lithology</th>
<th>Thickness (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>QUATERNARY</td>
<td>Alluvium and sand</td>
<td></td>
</tr>
<tr>
<td>TERTIARY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Austral Downs Limestone</td>
<td>Silicified limestone</td>
<td>50'</td>
</tr>
<tr>
<td>MESOZOIC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tarlton Formation</td>
<td>Conglomerate and sandstone</td>
<td>70'</td>
</tr>
<tr>
<td>ORDOVICIAN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mithaka Formation</td>
<td>Fossiliferous shales, minor sandstone</td>
<td>400'</td>
</tr>
<tr>
<td>Carlo Sandstone</td>
<td>Medium grained sandstone</td>
<td>100' - 400'</td>
</tr>
<tr>
<td>Nora Formation</td>
<td>Siltstone and shale, minor sandstone and lime-</td>
<td>200' - 400'</td>
</tr>
<tr>
<td></td>
<td>stone</td>
<td></td>
</tr>
<tr>
<td>Coolibah Formation</td>
<td>Limestone and marl</td>
<td>50'</td>
</tr>
<tr>
<td>KELLY CREEK</td>
<td>Sandstone, limestone, dolomite</td>
<td>200' - 500'</td>
</tr>
<tr>
<td>LOWER</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ORDOVICIAN-UPPER CAMBRIAN</td>
<td>Limestone and dolomite with basal</td>
<td>300' - 1000'</td>
</tr>
<tr>
<td>Nimmaroo Formation</td>
<td>glauconite sandstone</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Tumahawk Beds)</td>
<td></td>
</tr>
<tr>
<td>UPPER CAMBRIAN</td>
<td>Limestone, dolomite, marl, calcareous sandstone</td>
<td>1000' - 2500'</td>
</tr>
<tr>
<td>Arrinbrunga Formation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MIDDLE CAMBRIAN</td>
<td>Blue limestone and light grey shales, 70 feet</td>
<td>550' - 2200'</td>
</tr>
<tr>
<td>Marqua Beds</td>
<td>of sandstone at top of unit</td>
<td></td>
</tr>
<tr>
<td>UPPER PROTEROZOIC</td>
<td>Greenish sandstone and siltstone</td>
<td>1500'</td>
</tr>
<tr>
<td>Grant Bluff Formation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The Middle Cambrian Marqua Beds, which outcrop on the Marqua Monocline on the southern edge of O.P.63, are equivalent in age to the Arthurs Creek Formation to the west and to the sequence, in descending order, of Hungerebar Limestone, Steamboat Sandstone, Netting Fence Formation, Thorntonia Limestone found in Netting Fence No. 1 to the east. However, in Netting Fence No. 1 the percentage of sandstone and other clastics were much higher in these formations than in the equivalent Marqua Beds at outcrop. Part of the Marqua Beds are also equivalent in age to Unit C of the Lake Nash No. 1 Well to the north.

The essentially Lower Ordovician Nimmaroo Formation is a predominantly carbonate unit with a basal glauconitic sandstone in O.P.63. The Nimmaroo Formation grades westward into the predominantly clastic Tomahawk Beds. The basal glauconitic sandstone is absent from the type area of the Nimmaroo Formation at Black Mountain 150 miles east of O.P.63.

The main structural features of the area surrounding O.P.63 are:

(1) Pre-Cambrian Structure: There is an Archaean ridge running east-west under B.H.R.13 (Cockroack) according to the results of the Georgina Basin Aeromagnetic Survey (see Starkey 1964). This Archaean ridge separates an area with Upper Proterozoic sediments to the south from another area of Upper Proterozoic sediments in the north. The Upper Proterozoic sediments in the southern area outcrop around the Field River and extend northwards under the Georgina Basin. The Upper Proterozoic sediments in the northern area outcrop partly west of Mt. Isa on the northeast edge of the Georgina Basin and extends westward on the subsurface to Lake Nash No. 1 and Mulga No. 1 Wells.
(2) **Middle and Upper Cambrian Structure**: The main boundaries of the Georgina Basin are structural highs dating from Middle Cambrian times. These structural highs include the Narqua Monocline, a prominent structural feature running east–west through the southern part of 0.P.63 and forming the southern boundary of the Georgina Basin; and the Jervois Range, Warramunga and Mt. Isa basement highs forming the southwest, northwest and northeast boundaries respectively. In addition, there is possibly an isolated high, within the basin in 0.P.63, perhaps formed by faulting, under the Mulga Structure with the Cambrian thickening north and south off the structure.

(3) **Ordovician and younger Structure**: The Toko and Tarlton Synclines, which trend south–east are the main post-Ordovician structural features of 0.P.63. In between these two synclines there is a regional high, the Cockroach High.

In addition, the Mulga Structure developed as an anticline of shallow amplitude in the Ordovician, possibly by compaction. (Refer to 4. Detailed Structure below).

3. **DETAILED STRATIGRAPHY OF ALLIANCE MULGA NO. 1 WELL**: The well stratigraphy is outlined in Table 1 below and then discussed in more detail. The complete core and cutting descriptions made by Mr. G.C. Campe, the wellsite geologist, are given in Appendices 1 and 2. The system of carbonate rock description used is given in Appendix 3, and is written by M.C. LeBlanc.

**TABLE 1.**

**OUTLINE OF MULGA NO. 1 WELL STRATIGRAPHY**

<table>
<thead>
<tr>
<th>Age</th>
<th>Formation</th>
<th>Top (feet) below K.B.</th>
<th>Top (feet) subssea</th>
<th>Thickness (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>QUATERNARY</td>
<td>Unnamed</td>
<td>11</td>
<td>+844</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Unconformity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LOWER ORDOVICIAN</td>
<td>Ninmaroo</td>
<td>16</td>
<td>+839</td>
<td>174</td>
</tr>
<tr>
<td></td>
<td>Formation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unconformity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UPPER CAMBRIAN</td>
<td>Arrinthurunga Formation</td>
<td>190</td>
<td>+665</td>
<td>870</td>
</tr>
<tr>
<td></td>
<td>Unit I</td>
<td>1060</td>
<td>-205</td>
<td>654</td>
</tr>
<tr>
<td></td>
<td>Unit II</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MIDDLE CAMBRIAN</td>
<td>Marqua Beds</td>
<td>1714</td>
<td>-859</td>
<td>260</td>
</tr>
<tr>
<td></td>
<td>Unconformity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>Formation</td>
<td>Tops (feet below K.B.)</td>
<td>Tops (feet) (subsea)</td>
<td>Thickness (feet)</td>
</tr>
<tr>
<td>----------------</td>
<td>--------------------</td>
<td>------------------------</td>
<td>----------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>UPPER PROTEROZOIC Beds</td>
<td>Mulga</td>
<td>1974</td>
<td>-11:9</td>
<td>646</td>
</tr>
<tr>
<td>Unit I</td>
<td></td>
<td>2620</td>
<td>-17:5</td>
<td>383</td>
</tr>
<tr>
<td>Total Depth</td>
<td></td>
<td>3003</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

11-16 feet QUATERNARY - Unnamed: A thin layer of orange to brown, clayey, calcareous sand, consisting of very fine to medium grains of quartz with clay, extends from surface down to 5 feet at the wellsites.

16-190 feet LOWER ORDOVICIAN - Nimmaroo Formation: This unit consists predominantly of dolomite, yellowish in colour down to 149 feet, but red-brown below 149 feet. There are traces of oolites and some dolomitic. The dolomite is interbedded with about 10% green and purple dolomitic shales and siltstones. There are some fine to coarse grained dolomitic sandstone beds in the bottom 20 feet of the unit. These sandstone beds are light grey, silty, poorly sorted and tight.

This unit has been correlated with the Nimmaroo Formation which was mapped outcropping on the surface by Wilson (1964), who considered, however, the possibility that the underlying Arrinbrunga Formation outcrops in the centre of the Mulga Structure.

The base of the unit has been picked on:

(a) A reduction in the amplitude of the Gamma ray log peaks, which correlates well with the base of the Nimmaroo Formation in B.M.R. 12 (Cockroach) and Netting Fence No. 1, and

(b) The presence of a basal sandstone unit overlying beds with a high percentage of chert, possibly indicative of an unconformity. In the southeast of O.P. 63, the Nimmaroo transgressed across and is therefore unconformable on the underlying Georgina Limestone of Upper Cambrian age. This unconformity might extend northwards to the Mulga Anticline.

190-1714 feet UPPER CAMBRIAN - Arrinbrunga Formation: This formation has been distinguished on the basis of the gamma ray log which shows a number of peaks of lesser amplitude through this formation than those measured through the Nimmaroo Formation. At the base of the unit the fluctuations of the gamma
ray give way to an almost flat curve with no distinct peaks.

100-1060 feet - Unit I: Unit I of the Arrinthurunga Formation consists predominantly of dolomite, light grey, white or yellow in colour, generally finely crystalline with minor vugs. The dolomite is slightly argillaceous in part. There are short lenses in the upper part of the unit, possibly associated with a Lower Ordovician weathering surface. Interbedded with the crystalline dolomite are minor amounts of dolomitic, green-grey shale, grading to dolilutite and dolominate and to sandstone. The dolarenite is light yellow-green to grey in colour with fine to coarse quartz grains in a dolomitic, calcareous and argillaceous matrix. Two foot sandstone beds make up 10% of the interval 1048-1060 feet.

No great porosity or permeability is apparent in the cuttings, but the flows of fresh water obtained indicate there must be a large amount of fracture porosity and permeability in the formation.

The base of Unit I of the Arrinthurunga Formation has been places where the resistivity, neutron and acoustic logs increase sharply at 1050 feet, which coincides with the base of an interbedded quartz, sandstone and dolomitic member.

1060-1714 feet - Unit II: Like Unit I, this unit consists predominantly of dolomite, white, yellow, buff and grey in colour, crystalline with traces of vugs and poor intercrystalline porosity. The dolomite grades into and is interbedded with minor amounts of medium to dark grey dolilutite. The base of Unit II is places at a prominent gamma ray log break. Above this break the gamma ray log shows many small peaks; below is a smooth curve. This gamma log break can be picked in B.H.R. 12 (Cockroach) and B.H.R. 13 (Sandover) and coincides with the base of the Upper Cambrian as picked in those two wells.

1714-1974 feet MIDDLE CAMBRIAN - Marqua Beds: This unit consists almost entirely of dolomite with very minor dolilutite interbedded.

The dolomite which makes up about 99% of the unit is white-grey and yellow in colour, crystalline or microcrystalline, with traces of vugs and some poor intercrystalline porosity. There is good fracture porosity. Also, there are traces of pyrite, argillaceous matter and oolites. The dolilutite is mid to dark grey in colour and grades into slightly arenaceous dolomitic shale. The base of the Middle Cambrian Marqua Beds is a distinct lithological change to the underlying quartz sandstone, which is considered to be Upper Proterozoic in age. This change can also be distinguished on the neutron log as a slight curve without sharp peaks, but it is not distinctive on any of the other logs.
1974-3001 feet UPPER PROTEROZOIC - Mulga Beds:
The name Mulga Beds is used informally here for the section of indurated quartz sandstone with a thin dolomite bed overlying a shale carbonate section. This section was penetrated in Mulga No. 1 Well below 1974 feet. The Mulga Beds are probably Upper Proterozoic in age and the upper part (Unit I) is probably equivalent to Unit D of the Lake Mashi No. 1 Well and also to the Makhat and Pilpah Sandstones at outcrop to the east on the western flank of the Makhat-Mt. Isa basement high. Carter (1969) describes the Makhat Sandstone as a poorly sorted, feldspathic, iron-stained sandstone with some quartzite; and the Pilpah Sandstone as fine to medium grained, well sorted and well bedded sandstone with some coarse sandstone and conglomerate.

1974-2620 feet - Unit I: Unit I consists of red-brown, silicified sandstone with one dolomite bed from 2525-2530 feet. The sandstone consists of medium to coarse sized, well rounded grains of quartz with secondary silification obscuring the original grain boundaries.

The sandstone, when it is broken, breaks through the grain boundaries. Besides the siliceous cement there is also traces of chloritic, kaolinitic and argillaceous cement and chlorite fillings in fractures. The sandstone is generally tight, though there are traces of cavities and poor inter-granular porosity.

A bed of dolomite, white to light grey to yellow in colour, microcrystalline with a trace of vugs and slightly argillaceous, was penetrated from 2525-2530 feet.

The base of this unit is the base of the sandstone.

2620-3003 feet - Unit II: Unit II consisted of interbedded reddish shales and slightly argillaceous, siliceous limestones. The shales were reddish-brown to green in colour and graded through argillaceous siltstone to a very fine grained, argillaceous sandstone. The shales are slightly calcareous. The shales break up rapidly without swelling in water and, as a result, the hole caved badly.

Limestone is interbedded with the shale and makes up about 30% of the unit. The limestone is white to orange in colour, dolomitic, siliceous, microcrystalline.

4. DETAILED STRUCTURE:

The Mulga Anticline is one of a number of gentle structures discovered and mapped in the northeast of O.P.63 by Wilson (1964). Wilson established closure by mapping two marker horizons within the Ninmaroo Formation. One of these horizons is a calcareous sandstone, the other a bedded chert. As mapped by Wilson the anticline has closure but with a number of minor structural complications, possibly due to slumping.
The structure contour map (see Plate 8) prepared by Geophoto Resources Consultants using a Kelsh plotter also shows closure, the amount of closure being about 35 feet over an area 6 square miles. This result is substantially in agreement with Wilson (1964) and the Mulga No. 1 wells site was located within this closure.

The almost continuous sequence of fractured dolomite obtained in the well may indicate crestal faulting on the anticline as water bore information indicates that it is not typical of the general area.

The detailed gravity work, Lonsdale and Ingall (1964) carried out by Mongeia Geophysical Pty. Ltd. over the Mulga Anticline shows no sign of structure only a northeast gravity gradient with a residual negative anomaly around Station 717. Station 717 is close to the Mulga No. 1 wells site, although the station is on the eastern side of the creek, not on the west as shown on the detailed gravity map. The residual negative anomaly map reflects either local development of fractured dolomite or local thinning of the Paleozoic carbonate section.

5. **RELEVANCE TO OCCURRENCE OF PETROLEUM**

No shows of hydrocarbons were obtained in the Mulga No. 1 Well. However, during the drilling of most of the well large quantities of detergent laden fresh water were being lifted from the hole by air. It is considered that this water would have been very effective in washing any oil staining from the cuttings and would have obscured any minor shows of oil or gas.

The Cambrian and Lower Ordovician section penetrated was considerably thinner than expected, the Middle Cambrian Marqua Beds being only 260 feet thick, whereas they are over 1,900 feet thick in R.M.R.12 (Cockrach). Most of the section missing is Middle Cambrian in age and the thinning has probably taken place by the cullap northward of the lower part of the Marqua Beds onto basement from the south. This cullap might be expected to provide a stratigraphic trap to the south of Mulga No. 1 and will do so if there are impermeable beds present in the lower part of the Marqua Beds or if the highly permeable dolomites found in Mulga No. 1 are merely a local development, perhaps related to faulting along the crest of the Mulga Anticline.

The Upper Proterozoic section penetrated is not metamorphosed, but the sandstones present are largely converted to tight quartzites and this feature of extreme induration is thought to indicate that the Upper Proterozoic in this area is generally unprospective.
6. POROSITY AND PERMEABILITY OF SEDIMENTS PENETRATED:

The Arrinthuranga Formation and Marqua Beds were found to consist of dolomites which were highly porous and permeable, probably because of fracturing and jointing.

Large flows of fresh water (up to 1,800 barrels per hour) were obtained during air drilling. A small flow of water was first struck at 330 feet and this increased to 45 barrels per hour at 750 feet. The flow was cased off, but water was struck again at 970 feet and reached a flow of 200 barrels per hour at 1070 feet. The water obtained below 970 feet was found to have a standing water level of 330 feet, suggesting continuous vertical connection. Confirmation of this is the regular increase of flow of water obtained from 330 to below 1070 feet. The vertical connection may either be in the hole, behind the casing or within the formation, the latter being more likely. There is, however, an alternative possibility that the aquifer at 970-1070 feet and below is separate from that from 330-750 feet, but with a subartesian head. This latter alternative is rendered less likely through the apparent absence of an aquiclude between 750 and 1070 feet.

7. CONTRIBUTIONS TO GEOLOGICAL CONCEPTS RESULTING FROM DRILLING:

The Mulga No. 1 Well has shown that the main thickness of the Cambrian and Lower Ordovician sediments, particularly the Middle Cambrian, are restricted to an area south of the Mulga No. 1 Well.

The reason for the residual gravity negative anomaly at Mulga No. 1 appears to be the thinned Paleozoic carbonate section (see Starkey 1964). If this is correct, it suggests, firstly, that the thinning is local; secondly, that gravity can be used as a tool to predict anticlines with thinned crestal sections elsewhere in the Georgina Basin.

The development of a section with continuous porosity in the Upper and Middle Cambrian is surprising, but is probably a local feature perhaps relating to crestal faulting on the Mulga Anticline.

The Upper Proterozoic section penetrated included indurated shale and dolomite as well as sandstone and this section is considered to be well indurated and, therefore, can be regarded as economic basement for the purposes of petroleum prospecting.
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D.O.
30.11.1965.
LITHOLOGICAL DESCRIPTION

ALLIANCE MULGA NO. 1, WELL

CORE NO. 1.

472' - 484' Cut 12' Recovered 7'
Hughes 8 1/2" HF Core Head cutting 3 3/4' Core 58%

MACRO DESCRIPTION:
Interbedded green DOLILUTITE, with occasional crystal filled geodes and rare zones rich in geodes, black to grey SHALE, slightly micaceous, very thinly bedded and DOLOMITE, yellow, green, brownish-grey, buff, grey, in part 40% geodes up to 4 cms across with possible permeability. Except for DOLOMITES, generally well and thinly bedded, especially SHALE, undulatory bedding with DOLILUTITE: SHALE greater than 1:1, occasional lensing. Generally tight, with some vug porosity (to 40%) overall approx. 5%; no permeability except in DOLOMITES. Rare calcite veins. Rare fractures - iron stained, as are some vugs in DOLOMITE.

MICRO DESCRIPTION:

Top 1'
DOLILUTITE, green, rare trace micas, generally massive with trace bedding, occasional geodes - to 2 cms - lined partly or filled with clear rhombatedral, occasional intergrown dolomite crystals and rare, fine, cubic, striated pyrite crystals, vug porosity less than 5%, no permeability and thin (3 mm) interbeds, SHALE, black, slightly calcareous, very slightly silty, well and thinly bedded, slightly micaceous with MUSCOVITE. Undulatory bedding - amplitude of undulations approx. ½ cm and rare lensing.

Next 6"
DOLOMITE, light grey, microcrystalline, with approx. 10 to 20% finely crystalline, massive, rare styloclites? in part extremely vuggy - to 40% with vugs to 4 cms across, larger vugs are geods with a lining of imperfect DOLOMITE and a film of very fine, brown to orange iron or iron stained mineral (not soluble in con H Cl) several geodes also with an infilling of black, non florescent mineral or SHALE, vug porosity to 40% with possibly some permeability and very thin interbeds of black SHALE, as above.

Next 2' 6"
DOLILUTITE, green, as above, occasional fractures, iron stained, vug porosity less than 5%, as above, and thin interbeds black SHALE, as above.
DOLOMITE, buff to greenish yellow, generally microcrystalline with from 10 to 20% finely crystalline, hard, massive, 'ghost' aremitic texture, and rare thin interbeds SHALE, black, as above, tight.

DOILILUTITE, green, as above, vug porosity, and thin interbeds black to grey SHALE; minor, thin interbeds and lenses of DOLOMITE, brownish grey to grey, microcrystalline to finely crystalline, hard, massive, tight. Undulatory bedding, as above.

SHALE, grey to black, slightly greenish, firm, in part very slightly silty, micaceous with MUSCOVITE, slightly calcareous, well and thinly bedded with rare, very thin quartzose beds, occasionally small (2 mms), inclusions, black SHALE, rare calcite filled veins, rare pyrite coated mud balls?, rare concentrations along bedding of green mineral, crystalline, nitreous; and interbedding of DOILILUTITE, as above. Bedding undulatory, occasional lensing, occasional flat bedding. No shows in Core No. 1. Overall Core dip 0° to 2°.
988' - 998' Cut 10' Recovered 2'3" 23% diam. 3½"  
Bit HTC HF Core Head. Rate 21m/ft.  
N.B. Core heavily fractured and not considered essential to cut a further one.

MACRO DESCRIPTION: Interbedded yellow to buff and dark grey, massive DOLOMITES; in turn, these are very finely (1 mm) interlaminated with alternating light and dark laminations. The core is fractured and tends to break along these fractures. Most fractures are vertical and iron (rustcoloured) stained. Bedding is flat, approx. 0 - 1. The grey DOLOMITE has a few geodes, to 1 cm, whilst the yellow DOLOMITE has numerous geodes, the largest being 5 - 6 cms vertical. No shows.

MICRO DESCRIPTION:

Top 1'2"
DOLOMITE, yellow to buff, generally very fine to micro crystalline with common geodes, the smaller ones filled with clear rhombohedral crystal intergrowths of DOLOMITE and the larger ones lined with DOLOMITE RHOMBS, fine to very fine grained, or with a drusy like surface of DOLOMITE. In part slightly, to 10%, arenitic, with fine grained, subrounded, clear quartz grains. Fine laminations appear to be pre dolomitisation and, in part, are marked by coarse DOLOMITE CRYSTALS. Geodes, in part, show the thin bedded matrix of the rock with parallel lines of crystal growth. No shows, poor porosity, flat bedded 0-1" dip.  
N.B. Pipe dope in some geodes.

Next 3'6"
DOLOMITE, mid grey, slightly arenaceous, in part arenaceous to 20%, very finely crystalline, trace argillaceous matter to 5%, laminations pre dolomitisation, trace dolomitic lined geodes, with occasional interbeds and pockets of argillaceous, slightly silty DOLLILUTITE, slightly micaceous, dark green-grey. Tight no shows.

Bottom 10"
DOLOMITE, yellow to buff, as above, but with fewer geodes (to 2cms) and trace porosity, no shows. Core dips 8-1°.
ALLIANCE MULGA NO. 1 WELL

CORE NO. 3. 1495' - 1505' Recovered 2' 6" 25% Rate 21 m/ft. Head 7½" HTC/HFCH 3½" diam. core. Time 3½ H Condit. 3-2-1.

N.B. Core heavily contaminated with pipe dope.

MACRO DESCRIPTION:

Top 1' 6"

DOLOMITE, white to cream, occasionally orange mottling, microcrystalline, in part fractured with vertical fractures, occasional geodes elongated parallel to bedding, lined with DOLOMITE CRYSTALS, occasionally to complete width of core (traces on core indicate a very large geode), two sets of fractures, one main strong set vertical, secondary set associated with formation of main set vertical, at 30° to main set, only 1-2 inches horizontally - tear joints, red iron staining on fractures, trace relict bedding with dip 0-3°. Trace to poor vug porosity, no shows.

Bottom 9"

DOLOMITE, mid to light grey, microcrystalline, to trace PYRITE and argillaceous specks, fractured, as above with 2 sets, trace DOLOMITE lined, flat geodes (to 2 cms). Possible "solid solution" type texture with minor clear DOLOMITE in the grey DOLOMITE. Clear DOLOMITE shows a general elongation approx. 45° to vertical, possibly along sets of minor fractures. Rare trace relict bedding 0-3° dip, tight N.S.

MICRO DESCRIPTION:

N.B. Core heavily contaminated with pipe dope.

Top 1' 6"

DOLOMITE, white to cream with occasional orange mottling, hard, generally microcrystalline, grading to very finely crystalline, rare argillaceous specks, usually in localised concentrations, common vugs with black, argillaceous lining or geodes with fine DOLOMITE CRYSTALS, occasionally drusy like. Common fractures vertical to subvertical, pink-brown stained DOLOMITE, with occasional purpule-brown crystals of ?GARNET?, usually with an associated hals of microcrystals, occasionally LIMONITE stained. Trace bedding with dips 0-3°, trace poor porosity. No shows.

Bottom 9"

DOLOMITE, light grey, micro to occasionally very finely crystalline, common - to 5% - trace scattered argillaceous matter, rare trace green argillaceous mineral, rare arenitic grains, common geodes usually crystal filled with trace porosity. These give rise to "solid sob" texture above, trace bedding 0-3°, trace fractures, vertical. No shows.
ALLIANCE MULGA NO. 1 WELL

CORE NO. 4, 1980 - 1981'3". Cut 1'3", Recovered 1'3" 100%
HTCJ H.F. C.H. 7⅞ cutting 3⅛" hole. Rate approx. 90m.
Condite bit 3-3-0 Bald.

MACRO DESCRIPTION:

SANDSTONE, purple brown, silicified, glassy, fine to coarse grained, occasional granules, fair to poor sorting, well rounded, clear QUARTZ GRAINS with occasionally 30% clear, siliceous cement masking grains, 60% fine, white, medium soft, microcrystalline cement and rare emerald green, argillaceous (chloritic?) cement, brown ferruginous cement or pyritic cement, trace bedding outlined in part by PYRITE, dip approx. 10° to core axis, common PYRITE, occasionally along bedding, common fractures, vertical inclined (up to 45°) and possibly horizontal with an emerald green argillaceous (chloritic?) soft mineral covering; tight, no shows.

MICRO DESCRIPTION:

Whole Core:

SANDSTONE, brownish-purple, glassy, generally silicified, breaks through QUARTZ GRAINS, occasionally around the QUARTZ GRAINS, fine to coarse grained, with occasional granules and pebbles, fair to poorly sorted, clear and purple-brown, well rounded QUARTZ GRAINS, occasionally brown, very fine grained QUARTZITE, with crystal faces (secondary silification) cemented with various cements, trace brown ferruginous cement, emerald green, argillaceous (chloritic?), soft, soapy cement, common white, micro to silt sized crystalline, non calcareous, possibly siliceous and common silica, which tends to obscure the QUARTZ GRAINS, common trace PYRITE as finely disseminated cubes, occasionally in local concentration and occasionally along bedding. Common fractures with green, argillaceous mineral (as above) lining them, occasional bedding with 10-15° dip and rare apparent lensing (could be caused by variations in cement) tight, no shows.
ALLIANCE MULGA NO.1 — CORE DESCRIPTION

Core No. 5 2492-2503 Cut 11 Rcv. 6'5"
Core Head 7'5" HTCJ H.F. cutting 2'4" core. Rate 15 m/ft.

Macro Description:

6'3"
SANDSTONE, slightly pinkish white, grading to red brown and occasionally purple brown, after 1st foot, in part conglomeratic, medium to very coarse grained and occasional pebbles to 3 cms. and granules, in part with common granules and pebbles, fair to poor sorting, consists of quartz grains, generally rounded, occasional shale pebbles in a white, kaolinitic (?) matrix and occasionally a green chloritic matrix, scattered siliceous zones except in top 1 foot, causing quartz grains to break, common sub-vertical fractures lined with yellow crystalline mineral, non-calcareous, occasionally to bedding, cross-bedding with dips 2° - 15°. Porous, no shows. N.B. Pipe dope on core.

Micro Description:

6'3"
SANDSTONE, light pink to red or purple brown, medium to very coarse grained with common granules and pebbles of well rounded to sub-angular, reddish brown, occasionally pink to white and occasionally clear quartz grains, occasional pebbles of shale, poorly, in part fairly, sorted. A variety of cements exist even in small fragments of core. Overall the core, except for the top foot, is silicified to slightly silicified whilst there is abundant white soft kaolinitic ? cement ? filling intergranular spaces, occasional light green, chloritic cement ? However there is a suggestion of a primary siliceous cement binding the rock grains together with a filling of intergranular pore space. Occasional dark purple, shaly matrix. Common fractures, generally sub-vertical in many directions, lined with a yellow, medium hard (approximately 3-4) slightly sandy, fine to micro crystalline mineral. Trace bedding 0-10° dips - possible cross bedding. Occasional poor porosity and occasional cavities to 1 cm. across. No shows.
ALLIANCE MULGA NO.1 WELL — CORE DESCRIPTION

Core No. 6 3002-3003'7" Rec. 4' 20%
Core Head HTCJ H.F. 7'/3" 3'/1" core diam. Condit. 4-3-1
Rate 60 m/ft.

N.B. Core barrel plugged with savings - to 5' x 3" x 2" of mainly red brown shales - (2620-2860') - and purple shales, thinly interbedded, firm, crumby on exposure, fissile, in part micaceous to very micaceous, to minor scours, flute casts - shallow water deposition, occasional light green, firm, fissile and rare light green chloritic soft with interbeds (+ mm. or so) purple brown, soft to firm, slightly micaceous.

Macro Description:

4'
SHALE, dark green-grey to yellow-brown, thinly bedded, in part slightly micaceous, dense, in part undulatory bedding and lensing, often slightly dolomitic or calcareous and grades from dark green grey shale to yellow-brown chert. Dips 0-2'.

N.B. Overall density of core greater than that of shales, 2620'-2860' which suggests a density change at 2860'. This could correspond with the B.K.R. seismic reflection horizon in the vicinity of 2800'.

Micro Description:

SHALE dark green-grey, occasionally black to dark green, chloritic with trace slickensides, to grey-green, grading from non calcareous (or dolomitic) to slightly calcareous or dolomitic and to argillaceous, slightly dolomitic cherts and siliceous shales, dense, hard, fissile, in part very micaceous to slightly micaceous, undulatory bedding with occasional scour marks in the dark green variety, grading through brown-yellow, massive to micro crystalline chert, concordal fracture, in part banded. No shows.
ALLIANCE MULGA NO. 1 WELL

11'-20'
20% SAND, orange, brown, clayey, calcareous, composed of fine to medium and very fine QUARTZ GRAINS, 50%, and CLAY 50%.
80% DOLOMITE, yellow, micro to finely crystalline with 30% orange, micro, occasionally very finely crystalline, tight.

20'-30'
80% DOLOMITE, slightly calcareous, yellow, as above, and 30% orange, as above.
20% QUARTZ GRAINS, very fine to fine grained, (possibly savings).

30'-40'
100% DOLOMITE, slightly calcareous, yellow to white, very fine to microcrystalline, occasionally arenitic with fine, clear, sub to well rounded QUARTZ GRAINS with approx. 80% yellow to occasionally orange, 20% white, no porosity, no shows. White very calcareous LIMESTONE, dolomitic.

40'-50'
100% DOLOMITE, buff to light yellow, fine to very finely crystalline, in part iron stained, in part slightly arenaceous, granular texture, light yellow clayey mineral along crystal boundaries, occasionally slightly calcareous.

50'-60'
100% DOLOMITE, buff, yellow, white, generally fine to very finely crystalline, occasionally microcrystalline, as above.
Trace calcareous SILTSTONE, bentonitic.

60'-70'
100% DOLOMITE, buff, yellow, 70% very fine to finely crystalline with yellow intergranular cement, possible a DOLARENITE, tight, 30% very fine to microcrystalline, mainly yellow to white, tight, no shows, rarely slightly calcareous.

70'-80'
100% DOLOMITE, 80% buff, yellow, light grey, fine to very finely crystalline, arenaceous, as above - DOLARENITE - or possible cement (a weathering effect) Rare trace possible geode. 20% white, yellow, occasionally buff, micro to occasionally very finely crystalline, no show, tight, rare "oolitic" relict texture.

80'-90'
90% DOLOMITE, yellow to buff, 80% arenaceous with fine to very fine crystals to DOLOMITE, with yellow to white carbonate cement around crystal edges and with rare very fine QUARTZ GRAINS, trace vugs, trace porosity, 20% yellow to buff, white, micro to finely crystalline, tight, no shows, Trace "oolitic" relict texture.

... B.
80’ - 90’
(Cont)
10% SHALE, green, slightly dolomitic, slightly bentonic, soft, silty with rare DOLOMITE CRYSTALS, fine grained, well and thinly bedded.

90’ - 100’
Approx. 40% sample as well rounded pebbles - to 5mm., of DOLOMITE and DOLARENITE, in part with QUARTZ GRAINS.
80% DOLOMITE, yellow to white, occasionally buff, grey, 20% white, coarsely crystalline, trace vugs, trace porosity, 30% microcrystalline to occasionally very finely crystalline, tight, 50% very fine to finely crystalline, arenaceous, as above, with occasional QUARTZ GRAINS, tight, no show.
20% SHALE, green, silty, as above.

100’ - 110’
20% SHALE, green, in part silty, dolomitic, well and thinly bedded, soft to firm,
20% SHALE, green, grading to green, argillaceous, slightly silty DOLOMITE.
60% DOLOMITE, white, yellow, micro crystalline, trace occasionally very finely crystalline, in part very arenaceous, rare trace vugs, trace porosity, 50% as rounded pebbles of finely crystalline.

110’ - 120’
40% SHALE, green, as above.
60% DOLOMITE, white, buff, yellow, light green, arenaceous, 10% generally micro to very finely crystalline with 50% occurring as well rounded cuttings (pebbles?), tight, no show.

120’ - 130’
100% DOLOMITE, white to slightly greenish or yellowish-white, generally microcrystalline, occasionally very fine to finely crystalline, 20% as pebbles, as above, in part slightly arenaceous to arenaceous (10-15%), tight, no show, slightly calcareous, rare "oolitic" relict texture.
Trace SHALE, green, as above.

130’ - 140’
50% DOLARENITE, white, yellow, buff, fawn, generally micro to very finely crystalline, occasionally finely crystalline, very rare trace porosity, 10% as pebbles (?) with dark grey, microcrystalline, arenaceous (15%).
10% SHALE, green, dolomitic, soft, very slightly silty, well to thinly bedded.
40% SHALE, grey, in part silty, slightly dolomitic, occasionally sandy to 10% firm, well and thinly bedded, semi-fissile.
Trace "oolitic" LIMESTONE, dolomitic.
Trace SANDSTONE, medium grained, well rounded QUARTZ in a dolomitic clear matrix.
140' - 149'

80% DOLomite, white, yellow, light grey, generally very finely crystalline; 70% white variety, sugary texture (N.B. indistinguishable from DOLomite at approx. 1600'). Light grey, occasionally slightly arenaceous and occasionally medium crystalline with carbonate matrix; rare trace porosity, no show; rarely slightly argillaceous (light grey variety).

10% SHALE, green, as above, and occasionally purple-brown, dolomitic, slightly silty.

10% SILTSTONE, red-brown to purple-brown, dolomitic, grading to DOLILUTITE, slightly sandy in part, argillaceous to very argillaceous, firm, well bedded, fissile, in part.

Colour Change.

149' - 160'

60% DOLomite, red-brown to occasionally purple-brown, very argillaceous 20-30% to slightly argillaceous, microcrystalline, to occasionally a very finely crystalline mosaic type texture, occasionally mottled, red-brown to white, tight, no show.

20% DOLomite, yellow to white and occasionally light green, as above.

10% SHALE, green and grey, as above.

10% SILTSTONE, purple-brown, as above.

160' - 170'

30% DOLomite, white to yellow, generally micocrystalline, occasionally very finely crystalline, occasionally arenaceous, trace fracture, geode porosity.

20% DOLomite, argillaceous, purple to purple brown, very finely crystalline, tight.

50% SHALE, dolomitic, purple to purple-brown, trace green, occasionally slightly silty, firm, blocky, occasionally fissile, grades to argillaceous DOLomite.
**REDESCRIPTION OF SAMPLE**

**ALLIANCE MULGA NO. 1, WELL.**

170' - 180'

10% **DOLOMITE**, white, pink, yellow, microcrystalline, tight.
30% **SANDSTONE**, dolomitic, in part silty to very silty, light grey, tight, trace **PYRITE**, argillaceous, very fine grained, in part poorly sorted, very fine to coarse grained.
60% **SHELLE**, grey, grey-green, slightly purplish-grey, in part silty with rare patches very fine to medium, sandy, firm, blocky, occasionally green, dolomitic, well bedded, soft, in part fissile and well bedded.

180' - 190'

10% **DOLOMITE**, white, microcrystalline, tight, no show.
50% **SHELLE**, mid grey, occasionally purple, brown or grey-green, as above, in part sandy.
40% **SANDSTONE**, as above, light grey to light brown-grey, generally very fine grained with occasional medium and coarse grains, occasionally silty, argillaceous, dolomitic, tight, no show, massive.

190' - 200'

30% **DOLOMITE**, white, occasionally buff, light grey, microcrystalline, occasionally very finely crystalline, tight, no show.
40% **SHELLE**, grey, green-grey, as above.
30% **SANDSTONE**, grey, light brown-grey, white, dolomitic, as above, in part very poorly sorted, tight.
Trace **CHERT**, amber, orange, conchondal fracture, microcrystalline.

200' - 210'

80% **DOLOMITE**, greyish-white, grades occasionally to light grey, argillaceous, microcrystalline with rarely, very finely crystalline patches, rare trace vugs, rare trace porosity, no show.
20% **SHELLE**, mid to dark grey, dolomitic to very dolomitic, in part very arenitic, trace bedding, blocky, firm.

210' - 220'

10% **CHERT**, amber, light grey, finely banded, microcrystalline, conchondal fracture.
70% **DOLOMITE**, light grey to white, generally dirty whitish grey, microcrystalline, occasionally very finely crystalline, trace argillaceous matter, tight, no show.
20% **SHELLE**, as above, grades to **DOLILUTITE**, occasionally arenitic.

220' - 230'

10% **CHERT**, as above and yellow-green.
10% **DOLOMITE**, light grey, argillaceous to 5%, as above.
80% **SHELLE**, as above.
230'-240'

- 20% CHERT, grey, buff, white, milky, microcrystalline, conchoidal fracture, trace banding, trace argillaceous? matter.
- 20% SANDSTONE, white, calcareous, medium to fine grained, occasionally coarse grains, fairly sorted, calcareous cement, tight, no show.
- 10% DOLOMITE, dirty grey to greyish-white, microcrystalline, tight, no show.
- 50% SHALE, mid to dark grey and black, occasionally slightly greenish, dolomitic to very dolomitic, occasionally arenitic grains, thinly and occasionally well bedded, slightly calcareous, grades to DOLILUTITE.

240'-250'

- 10% CHERT, as above.
- 10% SANDSTONE, as above.
- 30% SHALE to DOLILUTITE, as above, occasionally breaks up on contact with water, especially dark grey to black variety.
- 50% DOLOMITE, dark grey to occasionally white, generally slightly argillaceous, with occasional gradation to DOLILUTITE, rare trace geode, rare trace porosity, vugular type, microcrystalline with occasional arenitic, very fine to fine QUARTZ GRAINS, no show.

250'-260'

- 20% CHERT, as above, white, light grey and pink.
- 80% DOLOMITE, light grey to dirty grey, to white, platy, microcrystalline, tight, no show.
- Trace SANDSTONE, SHALE, as above.

260'-270'

- 30% DOLOMITE, as above, microcrystalline, tight, no show.
- 10% CHERT, as above.
- 20% CALCARENITE, grades to white, calcareous SANDSTONE, as above, light green, grey, white, light grey with fine to medium QUARTZ GRAINS in a calcareous, slightly dolomitic matrix, argillaceous to 20%, tight, no show.
- 40% SHALE, light grey to grey, rare purple-grey, dolomitic, slightly calcareous to occasionally calcareous, fissile, well and thinly bedded, grades to a DOLILUTITE, trace MICA, trace arenitic grains.

270'-280'

- 20% SANDSTONE, pinkish-grey to buff, fine to medium grains quartz in a dense, slightly dolomitic matrix, tight, no show. Trace pebble fragment in cuttings.
- 50% DOLOARENITE, light yellow-green, with very fine to coarse, well rounded, clear QUARTZ GRAINS, occasionally well sorted, grading to a dolomitic SANDSTONE, tight, no show, occasionally grey.
- 30% DOLOMITE, white to light grey and buff, microcrystalline, occasionally very finely crystalline, tight, no show.
280' - 290'
100% DOLOMITE, grey, buff, dirty grey, occasionally white, micro to very finely crystalline, rarely finely crystalline, occasionally slightly argillaceous or arenitic, tight, no show.
Trace calcareous SANDSTONE, DOLARENITE, SHALE, as above. CHERT, as above.

290' - 300'
100% DOLOMITE, as above, micro to very finely crystalline, tight, no show.
Trace SHALE, DOLARENITE, as above.

300' - 310'
40% DOLOMITE, as above and yellow-green, microcrystalline, occasionally very finely crystalline, in part slightly argillaceous, tight, no show.
50% SHALE, grading (30%) to DOLILUTITE, light to dark grey, in part (light grey) slightly calcareous and arenitic, slightly micaceous, well and thinly bedded, generally fissile, occasionally very arenitic.
10% SANDSTONE, white, fine to medium grained, well rounded QUARTZ, in a white, carbonate cement; tight, no show.
Trace CHERT, DOLARENITE, as above.

310' - 320'
100% DOLOMITE, white to buff, slightly calcareous, very finely crystalline, occasionally finely crystalline or microcrystalline, trace geodes, trace porosity, no show.

320' - 330'
100% DOLOMITE, as above, but made of an OCHRE, micro to occasionally very finely crystalline, trace fractures, trace fair porosity, no show.

330' - 340'
100% DOLOMITE, light yellow to white, slightly greenish, microcrystalline, occasionally very finely crystalline, trace fracture, trace arenitic grains, occasional trace argillaceous matter, in part calcareous.

340' - 350'
100% DOLOMITE, white to cream, as above, micro to very finely crystalline (60-40%), rare trace argillaceous matter, occasionally calcareous, tight, no show.

350' - 360'
100% DOLOMITE, white, occasionally cream to light yellow-green, sample as mainly very fine DOLOMITE GRAINS and is probably a very finely crystalline DOLOMITE, with possible trace porosity, no show.

360' - 370'
100% DOLOMITE, white to whitish-grey, occasionally light yellow-green, very fine to microcrystalline, sugary texture, in very fine crystalline fragments, tight, no show, rare trace argillaceous material.
Trace QUARTZ GRAINS, clear, fragmental to rounded, fine to very coarse grained.
Sample smaller than silt size.
Smaller than -
80% DOLOMITE, white to cream, very finely crystalline to microcrystalline, no show, tight.
Larger than -
20% QUARTZ GRAINS, occasionally fine grained, clear, well rounded, trace argillaceous grains, DOLILUTITE, SHALE.
Trace argillaceous matter.

80% DOLOMITE, as above,
20% QUARTZ GRAINS, as above.

80% DOLOMITE, white to cream, grey and occasionally yellow-green, very finely crystalline, tight, no show.
20% QUARTZ GRAINS, very fine to fine grained, occasionally silt sized, clear, well rounded.
A DOLOMITE, in part, slightly arenaceous.

80% DOLOMITE, as above,
20% QUARTZ GRAINS, as above.
Trace argillaceous fragments.

As above, samples still smaller than silt size.
Smaller than -
70% DOLOMITE, white to cream, generally greyish, and cream to yellow-green, very finely crystalline, with occasional microcrystalline grains, generally transparent to translucent, no shows.
10% QUARTZ GRAINS, very fine grained, range silt to fine grained, well rounded, clear.
Larger than -
20% SHALE or DOLILUTITE FRAGMENTS, grey-green.

Smaller than -
70% DOLOMITE, as above, no show.
Larger than -
10% QUARTZ GRAINS, as above.
20% SHALE, as above.

60% DOLOMITE, white to slightly new greenish-grey, cream, very fine to microcrystalline, greenish-grey variety argillaceous, grading to DOLILUTITE, tight, rare trace porosity, no show.
10% QUARTZ GRAINS, as above.
30% DOLILUTITE, grey-green, trace grey, possibly grades to SHALE.

40% DOLOMITE, white to light grey, argillaceous and cream, very fine to microcrystalline.
60% DOLILUTITE, possibly grading to SHALE, mainly light grey, to dark grey and black, occasionally slightly arenaceous, possibly slightly calcareous.
Trace QUARTZ GRAINS, as above.
80% DOLOMITE, white, occasionally greyish, occasionally yellow to yellow-green, occasionally green-grey, very finely crystalline, occasionally micro-crystalline, trace argillaceous matter, no show.

20% DOLILUTITE, green-grey to dark grey, as above.
Trace QUARTZ GRAINS.

60% DOLOMITE, white to occasionally greyish or cream.
20% DOLILUTITE, as above.
20% QUARTZ GRAINS, very fine to silt size, as above.
Trace PYRITE CUBES.

30% DOLOMITE, white to grey, cream, and occasionally yellow to orange, very finely crystalline to micro-crystalline, occasionally finely crystalline, suggary texture, tight, no show, in part slightly arenitic. Trace SANDSTONE, white, very fine to fine grained, clear, well rounded QUARTZ GRAINS with ?calcareous cement.

60% DOLILUTITE, grey to dark grey and occasionally black, argillaceous, in part very argillaceous, a dolomitic SHALE, in part arenaceous.

10% SHALE, dolomitic, grey-green to blue-grey, blocky.
Trace PYRITE.

CORE NO. 1 - Recovered 7 feet.
8⅝" HTCO HIGH
See Core Description.

Smaller than -
50% DOLOMITE, white to light grey, slightly argillaceous, as above, micro to very finely crystalline. Sample to very fine grained, no show.
30% DOLILUTITE, as above.
10% SHALE, as above.
Larger than -
10% QUARTZ GRAINS - very fine to silty, clear.

80% DOLOMITE, white, cream, light grey, slightly argillaceous, as above, no show, occasionally grey-brown, very finely crystalline.

10% DOLILUTITE, as above.
10% QUARTZ GRAINS, as above.

Samples of good size - possibly contaminated.
30% DOLOMITE, white, occasionally slightly greenish, light green, light grey, in part slightly argillaceous, very fine to finely microcrystalline, tight, no show, rarely arenaceous (light green).

70% DOLILUTITE, mid grey to occasionally dark grey, argillaceous to very argillaceous, light yellow-green, slightly arenitic to arenitic.
510° - 520°
90% DOLOMITE, yellow to white, occasionally light grey, very finely crystalline, occasionally fine or microcrystalline, rare trace intergranular porosity, no show.
10% DOLILUTITE, as above.

520° - 530°
90% DOLOMITE, yellow to white, micro to very finely crystalline, occasionally finely crystalline, occasionally slightly arenitic, occasionally slightly argillaceous.
10% DOLILUTITE, as above, QUARTZ GRAINS, as above.

530° - 540°
80% DOLOMITE, very fine to finely crystalline, as above.
20% DOLILUTITE, mid-grey, yellow-green, slightly arenitic, in part slightly calcareous, cavities?
Trace QUARTZ GRAINS.

540° - 550°
100% DOLOMITE, as above, in part green-yellow, microcrystalline, no show.
Trace QUARTZ GRAINS, DOLILUTITE.

550° - 560°
Sample good size but ?cavities,
10% DOLOMITE, as above, very fine grains.
70% DOLOMITE, white, yellowish and green-yellow, very fine to fine and occasionally medium crystalline, occasionally microcrystalline, rare trace geodes, occasionally slightly arenitic, trace porosity, no show.
10% DOLARENITE, slightly calcareous, white, greenish and yellow-green, 20-30% arenaceous QUARTZ GRAINS, occasionally greenish is a dolomitic, slightly calcareous matrix, generally micro to very finely crystalline, slightly argillaceous, tight, no show.
10%DOLILUTITE, grey, green-grey, yellow-green, occasionally well and thinly bedded, in part slightly calcareous.

560° - 570°
70% DOLOMITE, white, cream, occasionally greenish, trace grey-brown, very fine to finely crystalline, occasionally microcrystalline, in part slightly argillaceous, trace geodes, trace porosity, no show.
30% DOLILUTITE, as above.

570° - 580°
Very fine grained sample.
80% DOLOMITE, 60% white to light grey, slightly argillaceous, 40% white to yellow, generally micro to very finely crystalline, no show.
20% DOLILUTITE, grey, green-grey, in part very argillaceous, slightly calcareous.
Trace QUARTZ GRAINS.
580' - 590'

Fine grained sample.
Poor sample.
70% DOLOMITE, white, occasionally slightly arenitic, grades to yellow, very fine to microcrystalline, no show. 50% light grey, slight argillaceous, generally microcrystalline, no show.
30% DOILITITE, mid grey, to occasionally dark grey and black, generally slightly to very argillaceous, in part very arenaceous, grading to a DOLEARNITE, occasionally well and thinly bedded, slightly micaceous.

590' - 600'

50% DOLOMITE, as above, slightly calcareous, tight, no show.
50% DOILITITE in part dolomitic SHALE, as above.

600' - 610'

50% DOLOMITE, as above.
50% DOILITITE, as above.

610' - 620'

Cavings - trip sample.
40% DOLOMITE, in part very calcareous, a dolomitic LIMESTONE, as above, in part fine to medium crystalline, trace geodes, trace vugular porosity, no show.
60% DOILITITE, as above, grades to dolomitic SHALE.

620' - 630'

30% DOLOMITE, as above, with generally very fine grains, occasionally finely crystalline with trace intergranular porosity, no show, slightly calcareous to calcareous.
50% DOILITITE, as above, generally mid-grey to blue-grey, in part very argillaceous, in part micaceous.
20% SHALE, dolomitic, blue-grey to black, in part fissile, slightly micaceous, well and thinly bedded.

D.D.
50% DOLOMITE, white to grey, very slightly calcareous, microcrystalline with 20% finely crystalline, tight with trace vugs, trace PYRITE, with 40% of sample medium to fine grained fragments and DOLOMITE CRYSTALS which could possibly constitute a medium to fine grained crystalline DOLOMITE with porosity or a dolomitic SANDSTONE, fine to medium grained, possibly porous.

10% DOLOMITE, brown, slightly calcareous, fine to medium crystalline, trace argillaceous matter (2-5%), relict arenitic texture, tight.

40% DOLLILUTITE, grey to dark grey, occasionally green-grey, slightly calcareous, argillaceous approx. 5%, grading to microcrystalline DOLOMITE, trace fine grained DOLOMITE CRYSTALS.

Trace in sample of DOLARENITE?, light grey, composed of medium grained, occasionally fine grained DOLOMITE CRYSTALS, enahedral, in a silty to argillaceous, slightly calcareous matrix, tight, relict arenaceous texture.

60% DOLOMITE, white to buff, light grey and minor brown, 30% massive, 40% microcrystalline, 30% finely to very finely crystalline, trace PYRITE CRYSTALS, trace geodes, rare relict vug? with earthy black mineral - or rock - lining, trace porosity.

40% DOLLILUTITE, light to dark grey, slightly calcareous, argillaceous - to 25% - occasionally scattered PYRITE CRYSTALS, rarely concreted along bedding?, grades to microcrystalline and occasionally very finely, slightly argillaceous DOLOMITE.

Check on water flow approx 25 bbls/hr.

80% DOLOMITE, white to buff, and grey, as above; 20% massive, 40% microcrystalline, 40% finely to silty crystalline, occasional vugs, trace porosity.

20% DOLLILUTITE, as above, trace thin bedding. Trace DOLARENITE, white, consists of fine to medium, anhedral to enahedral DOLOMITE GRAINS and CRYSTALS. Trace to poor porosity.

90% DOLOMITE, white to light grey, microcrystalline with approx. 20% very finely crystalline with trace porosity; slightly calcareous, very slightly trace of argillaceous matter.

10% DOLLILUTITE, grey to dark grey, slightly calcareous, argillaceous, massive with rare trace bedding.

90% DOLOMITE, as above, with 30% very fine to finely crystalline.

10% DOLLILUTITE, as above, approx. 5-10% argillaceous matter.

Rare iron staining on several DOLOMITE CHIPS.
70% DOLOMITE, white to occasionally buff and light grey, very finely crystalline with 20% finely crystalline, 10% micro-crystalline, composed of subhedral to anhedral DOLOMITE CRYSTALS, sugary type texture, common vugs and geodes, trace to poor porosity, trace PYRITE CRYSTALS, rare iron staining, rare argillaceous specks, rare pseudo, oolitic, relict texture; a vuggy, white, crystalline DOLOMITE.

30% DOLILUTITE, grey to green-grey, slightly argillaceous, approx 5%, massive with occasional trace bedding, grades in part to microcrystalline DOLOMITE, slightly micaceous, rare trace PYRITE CRYSTALS, rare vugs.

50% DOLOMITE, white to light grey, micro-crystalline, rarely (5%) very finely crystalline, trace porosity, trace argillaceous matter.

50% DOLILUTITE, 30% white, 20% light grey to occasionally green-grey, as above, massive.

60% DOLOMITE, mainly white, some light grey, microcrystalline, with 30% very finely crystalline, slight trace porosity, occasional vugs.

40% DOLILUTITE, 50% white, 50% light grey to green grey, as above, white, very slightly argillaceous, massive, light grey, slightly argillaceous, rare MICAX, massive with occasional trace thin bedding, rare vugs

Making water at approx. 33 barrels/hour.
Making water at approx. 45 barrels/hour.

80% DOLOMITE, 30% white, 20% light brown, 50% light to mid grey, white, micro to finely crystalline, sugary texture, trace geodes, trace porosity, rarely coarsely arenaceous, light brown, fine to medium crystalline, trace porosity, trace geodes, trace argillaceous matter, grey, micro-crystalline, rarely very finely crystalline, 5% argillaceous matter, occasionally to 10%, rare trace MICAX FLAKES, generally tight.

20% DOLILUTITE, mid to dark grey, grades to microcrystalline DOLOMITE, argillaceous (to 20%), occasionally well and thinly bedded.
Trace SHALE, black, thinly bedded, micaceous.

90% DOLOMITE, 40% white, micro to finely crystalline, mainly very finely crystalline, trace PYRITE CRYSTALS, trace geodes, trace porosity grades to 40% light brown to light yellow brown, finely crystalline, occasionally to 30% very finely to micro-crystalline, trace poor porosity, sugary texture, common geodes, 20% light to mid grey, as above.

10% DOLILUTITE, as above.
90% DOLOMITE, 60% white, as above, trace porosity, 20% light brown to brown-yellow, finely crystalline, occasionally microcrystalline or very finely crystalline, rarely arenaceous, trace porosity, 20% light grey, as above.
10% DOLLILUTITE, as above.

90% DOLOMITE, 60% white, grading to light grey, 90% microcrystalline, 10% very fine to finely crystalline, trace PYRITE, rare trace porosity, 10% yellow-brown, as above, 30% mid grey, microcrystalline, argillaceous to 5%.
10% DOLLILUTITE, mid to dark grey, argillaceous, thinly and well bedded, trace MICA.

90% DOLOMITE, in part slightly calcareous, 70% white, grading to light grey, 20% finely crystalline, 40% very finely crystalline, 40% microcrystalline, sugary texture, trace geodes, trace porosity, 20% yellow-brown, mainly finely crystalline, rare geodes, slight trace porosity, 10% mid grey, microcrystalline, tight, trace argillaceous matter.
10% DOLLILUTITE, grading to SHALE, mid to dark grey, in part very argillaceous, micaceous.

100% DOLOMITE, 70% white to light grey, 70% micro crystalline, 30% very finely crystalline to occasionally crystalline, trace geode, trace CALCITE VEINS (or STYOLETES), rarely slightly argillaceous, slight trace porosity, 30% light yellow-brown to light green-yellow, fine to very finely crystalline, rarely microcrystalline, sugary texture, rare geodes, trace porosity, in part appears slightly arenaceous with microcrystalline white cement; trace coarse DOLOMITE CRYSTALS, euhedral to subhedral, possibly from geodes.
Trace brown, red, finely crystalline, slightly calcareous DOLOMITE.
Trace DOLLILUTITE, dark grey, argillaceous, micaceous, thinly bedded.

100% DOLOMITE, as above, white to light grey, 30% yellow-brown, as above, with common geodes, trace porosity.
Trace DOLLILUTITE, as above; yellow, very finely crystalline, DOLOMITE, slightly calcareous.

Cuttings approx. 4mm in size average.
80% DOLOMITE, 30% white to light grey, very fine to finely crystalline with 40% micro crystalline, occasionally slightly calcareous, sugary texture, common geodes, trace porosity, occasionally slightly argillaceous, 15% yellow, finely to very finely crystalline, sugary texture, in part with crystals ranging from medium to very fine, common geodes, trace to poor porosity, interbedded (or interlaminated) with white variety above, in part calcareous to very calcareous, 5% grey brown finely crystalline, trace porosity, occasionally mottled, white and yellow, with gradations from white to yellow. ... 4.
20% DOLLUTITE, mid to dark grey, rarely grey-brown, argillaceous, slightly calcareous, micaceous, in part well and thinly bedded. Water flow still increasing. Hole still caving, but not as much as above. Running 13th hole to approx 900 and then casing.

Cuttings average 2-3 mms.

90% DOLOMITE, 70% white to light grey, mainly micocrystalline. 30% very fine to finely crystalline, common geodes, trace to poor porosity, rare PYRITE CRYSTALS, 30% yellow grading to white and occasionally to brown, very finely crystalline, 30% microcrystalline, sugary texture, common trace geodes, trace porosity, slightly to moderately calcareous.

10% DOLLUTITE, as above.

DOLOMITE GRAINS in sample larger than 1 mm.

90% DOLOMITE, 50% white, very finely crystalline with 20% microcrystalline and 20% finely to medium crystalline (crystals from geodes?), possible common geodes, slightly calcareous, 50% yellow, very finely crystalline, 10% finely crystalline, 30% microcrystalline, rare argillaceous specks and possible iron staining, slightly calcareous. Trace grey, finely crystalline, trace porosity, trace argillaceous matter.

10% DOLLUTITE, mid to dark grey, slightly calcareous, argillaceous (to 20%), trace PYRITE CUBES, trace MICA.

Trace massive PYRITE.

As 800-810' larger than 1 mm.

100% DOLOMITE, 60% white, consisting mainly of crystals, very fine to medium grained, possibly from vugs or rock, a crystalline, vuggy DOLOMITE. Otherwise, as above, 40% yellow, as above.

Trace light blueish grey, microcrystalline, rare trace argillaceous matter.

DOLOMITE as 30% crystals or 70% fragments to 1 mm. DOLLUTITE, as cutting to 2 mm.

70% DOLOMITE, white, occasionally with slight brown SHALE, very finely crystalline, with 20% finely crystalline, trace PYRITE, trace porosity.

30% DOLLUTITE, grey, grades to DOLOMITE, argillaceous up to 30%, slightly micaceous, trace bedding.

One large fragment caving - a dolomitic SANDSTONE, consisting of white to clear and with patches of DOLOMITE CRYSTALS, in a white, earthy, slightly calcic DOLOMITE matrix, good porosity, moderately hard. Also a fragment of fine to medium crystalline, trace porosity, yellow DOLOMITE. Possibly hard drilling - massive DOLOMITE, soft dolomitic SANDSTONE.

90% DOLOMITE, white to light grey, 50% sample as very fine to silty crystals, 50% as very finely crystalline, occasionally finely crystalline or microcrystalline, trace geodes, trace PYRITE, trace yellow, as above.
830'- 837'
(cont) 10% QUARTZ GRAINS, iron stained, 5% medium
grains, 5% very fine to silt size with
occasionally very coarse grains, well to
subrounded.
Trace PYRITE, MAGNETITE(?) PELLETS.

837'
D11 HTC W.7. 13\$".

837'- 850'
100% DOLOMITE, white to light grey, 50%
sample as very fine to silt size single
crystals of white to clear DOLOMITE,
enhedral to subhedral, 50% very finely
crystalline, occasionally finely or
microcrystalline, sugary texture, trace
gedes, trace porosity, trace PYRITE CUBES,
rare argillaceous specks, trace yellow
DOLOMITE, very finely crystalline.
Trace QUARTZ GRAINS, iron stained, fine to very
fine grained, well to subrounded.

850'- 860'
Sample cuttings less than 2mm.
100% DOLOMITE, 80% white to grey, grading to
yellow, as above, 20% yellow, very
slightly calcareous, generally very finely
crystalline, occasionally microcrystalline;
Trace yellow, green, dolomitic SHALE,
argillaceous.

860'- 870'
100% DOLOMITE, 40% white to light grey, very
fine to microcrystalline, trace relitio,
oolitic texture, silty, slight trace
porosity, 60% yellow, mainly very finely
crystalline, occasionally microcrystalline,
sugary texture, slightly calcarious.
Trace possible cavings, especially yellow
DOLOMITE, composed of yellow stained, semi-
transparent DOLOMITE CRYSTALS, in a yellow
matrix; Crystals: matrix approx. 20:1,
moderately soft as yellow, as above.
There could be soft bands with matrix
being washed out by mist and water.

870'- 875'
Hard drilling 873-875'
100% DOLOMITE, white to yellow, grading in
part to light pink to white, very finely
crystalline, in part to 10%, finely
crystalline and 5% microcrystalline,
sugary texture, rare trace PYRITE,
trace geodes lined with fine to medium
DOLOMITE CRYSTALS, rare ?red GARNET?
(of Hartz Range), rare MAGNETITE as ?
flakes. Very slight trace porosity.

D.D.
LITHOLOGICAL DESCRIPTION

ALLIANCE MULGA NO.1 WELL

875' - 880'
100% DOLOMITE, 60% white, slightly greyish to light grey, 40% yellow, generally very finely crystalline, occasionally 10% finely crystalline, 20% microcrystalline, sugary texture, rare trace argillaceous matter, pyrite ? magnetite and ??red garnet, trace geodes, trace porosity (vug type).

880' - 890'
100% DOLOMITE, 50% white, slightly greyish, 40% yellow, as above, 10% light grey, microcrystalline to silty crystalline, generally 80% microcrystalline, common trace approx. 2% argillaceous specks (black). Trace CHERT, amber to red, opaque, conchoidal fracture.

890' - 892'
100% DOLOMITE, 20% white, as above, 10% light grey, as above, 70% yellow to light yellow, as above.

892' Pipe Tally = 892.13'
Ran 10 1/2" casing Shoe at 826'
Used 400 sacks cement.
WOC 12 hours.

No returns, possible that mud lost to formation.

17.8.1965 - 12.30 p.m. Pumped 75 sacks from surface down annulus. 300 lbs. CaCl₂.

Stuffed bags 20' down hole. Dumped 15 sacks cement.

Pressured up 1000 psi
Drilled out plug and show with 9 1/2" bit.
Drilled ahead with air to 920 then misted up.

892' - 900'
90% CEMENT.
10% DOLOMITE, white, microcrystalline, occasionally very finely crystalline, tight. Trace yellow DOLOMITE. Trace shoe.

900' - 910'
50% CEMENT.
50% DOLOMITE, white to occasionally yellow or light grey, 30% finely crystalline, 60% microcrystalline, 10% finely crystalline, slight trace argillaceous matter, tight.
Trace Shoe.

910' - 920'
Change white to yellow at 913' approx.
10% CEMENT.
30% DOLOMITE, white to grey, microcrystalline to very finely crystalline, tight.
60% DOLOMITE, yellow to buff, microcrystalline, occasionally very fine to finely crystalline, grades to DOLIOLITE, massive, firm to hard, tight, rare trace geodes. Rare relict "oolitic" textures.
920t - 930t

100% DOLOMITE, yellow to buff, grading to white, microcrystalline, 30% very fine to finely crystalline and 10% finely arenitic with carbonate cement, occasionally slightly lutitic, massive, rare trace geodes, possible trace porosity. No shows.
Trace cement.

930t - 940t

Sample very fine - smaller than 1 mm.
10% CEMENT.
90% DOLOMITE, white to very light grey, very finely crystalline with 30% micro-
crystalline, 10% dolomitic crystals (possible geodes).

940t - 950t

90% DOLOMITE, white to light grey, micro-
crystalline, in part very finely crystalline, in part slightly argillaceous, in part trace PYRITE, 20% arenaceous with fine grained dolomitic grains in a carbonate, argillaceous, matrix. Tight.
10% DOLARENITE, light to mid grey, argillaceous to 10% trace MICA, possibly thinly bedded.
Trace Shoe, cement.

950t - 960t

100% DOLOMITE, white, buff, grey, 90% micro-
crystalline, 10% very finely crystalline, trace PYRITE, in part with trace argillaceous matter, tight.
Trace DOLARENITE, as above. Trace cement, trace DOLILUTITE.

960t - 970t

Samples still very, very fine.
100% DOLOMITE, white to light grey (more white than previous), microcrystalline with possibly 20% very finely crystalline, rare trace PYRITE, argillaceous matter, tight.
Trace DOLILUTITE, mid grey, argillaceous, slightly micaceous. Trace cement.

970t - 980t

100% DOLOMITE, white, slightly calcareous, microcrystalline with 30% very, very finely crystalline, occasionally fine grained plates DOLOMITE (or CALCITE) possible from geodes.
No visible porosity.
Trace black pellets, very, very fine grained, possibly fragments DOLILUTITE. Rare trace shoe. Cement.

980t - 988t

Sample very, very fine and small in volume. 100% DOLOMITE, white to occasionally buff, and occasionally lime green (possible staining from Bichromate), generally very finely crystalline with 10% finely crystalline, smalaremtic, 20% microcrystalline, rare trace geodes, very slight trace porosity.
Core No. 2. 988'-998' Cut 10'. Rec. 2'3". Diam 3\frac{1}{2}" YK 23%

Interbedded yellow to buff, mid-grey, DOLOMITE, yellow, buff, very finely crystalline with vugs and geodes, thinly bedded. Mid-grey, lithic 5% argillaceous, thinly bedded. Fractured, in part heavily and not expected tale, good coring rock. Recovery satisfactory.

N.B. Crystalline DOLOMITES, very, very fine samples. Microcrystalline and massive DOLOMITES, fine to medium samples. Making much water from approx. 970' onwards.

998' - 1010'

100% DOLOMITE, 70% light yellow-green, microcrystalline, occasionally very finely crystalline to medium crystalline, common geodes, generally massive appearance, common iron stained fractures, trace carbonate veins, 30% mid grey to white, microcrystalline, occasionally very finely crystalline (white variety, trace carbonate veins, trace argillaceous matter, rare geodes).

Trace SHALE, black, earthy, slightly micaceous, slightly dolomitic, interbedded with grey DOLOMITE.

1010' - 1020'

100% DOLOMITE, 30% light yellow-green, microcrystalline, occasionally very finely crystalline, trace geodes, in part platy. 40% white to light yellow, buff, finely crystalline, occasionally 30% very coarse crystalline and occasional very coarse crystals (from geodes) poor porosity, occasionally iron stained fracture. 30% mid grey, microcrystalline, 20% very finely crystalline, grades to DOLILUTITE, trace MICA, slightly argillaceous (65%) tight.

1020' - 1030'

80% DOLOMITE, 30% yellow to yellow-orange, very finely crystalline, trace microcrystalline, rare fracture. 70% yellow to yellow-brown, green, brown and grey. 10% microcrystalline 60% very fine to finely crystalline, 30% medium crystalline, grades to DOLILUTITE or dolomitic SHALE, in part very argillaceous to 20%, micaceous with occasional PYRITE rich cuttings, platy, thinly and well bedded.

20% DOLILUTITE, grading to dolomitic SHALE, green yellow-brown, orange-brown, very argillaceous (30-40%) in part very micaceous (30%) thinly and often well bedded.

1030' - 1040'

100% DOLOMITE, 40% white to orange-brown, coarsely to finely crystalline, poor to good porosity, 60% white to light green, yellow and yellow-brown, microcrystalline to very finely crystalline, trace geodes, trace porosity, trace fractures, rare argillaceous specks. Trace DOLILUTITE, very argillaceous, as above.

... 4...
1040'-1050'
70% DOLOMITE, white to yellow, occasionally light grey, 20% finely to medium crystalline, 50% very finely crystalline, 30% microcrystalline. Trace geodes.
20% DOLILUTITE, grey, as above.
10% QUARTZ GRAINS, clear, orange stained (iron?), well rounded, good sphericity, grading from very fine to very coarse, occasional grains, subangular, clear.

1050'-1060'
10% DOLOMITE, white to yellow, micro to finely crystalline with trace geodes, trace porosity.
20% QUARTZ GRAINS, clear to orange (Fe) stained, very fine to very coarse grained, mainly well rounded, occasionally subrounded to subangular. A very porous SANDSTONE.
70% DOLOMITE, slightly calcareous, grey, green-grey, purple, red-brown, very fine to medium crystalline, very argillaceous, in part very pyritic (60%), mostly trace PYRITE, trace MICA, in part platy.

1060'-1065'
90% DOLOMITE, white 50% microcrystalline, 20% very finely crystalline, 30% fine to medium crystalline, trace geodes, trace porosity, rare trace argillaceous specks.
10% QUARTZ GRAINS, as above.

SANDSTONE, occurs as very thin interbeds - up to 2' by geologist.
Flow greater than 100,000 gpd/day fresh.

1065'-1068'
light grey.

1068'-1070'
White.

1065'-1070'
90% DOLOMITE, 40% white, fine to very finely crystalline, as above. 60% light grey to mid grey, microcrystalline, occasionally (to 20%) very finely crystalline, trace argillaceous matter tight.
10% QUARTZ GRAINS, as above.
Trace DOLILUTITE, black, sandy, slightly calcareous.

1070'-1080'
90% DOLOMITE, white, grading to light grey, and light grey, fine to very finely crystalline with 20% microcrystalline, 10% medium crystalline, occasionally slightly to very calcareous (grades to LIMESTONE) trace porosity, trace geodes with poor to good porosity in medium crystalline variety which has argillaceous specks along crystal boundaries. Trace fractures.
10% QUARTZ GRAINS, as above.
Trace CEMENT.
1080' - 1090'

90% DOLOMITE, 60% white, microcrystalline, 30% very fine to fine and microcrystalline, trace PYRITE cubes, trace fractures, grades to 40% light grey, microcrystalline, occasionally very finely crystalline, often slightly argillaceous, rare trace PYRITE, tight.

10% DOLomitE, grey-green to mid-grey, slightly micaceous, slightly calcareous, platy, trace PYRITE.

Trace CEMENT: QUARTZ GRAINS.

1090' - 1100'

DOLOMITE-CALCITE TEST - all DOLOMITE, white, slightly calcareous.

90% DOLOMITE, 70% white to light grey, 50% microcrystalline, 40% very finely crystalline, 10% finely crystalline, trace PYRITE, trace argillaceous matter, in very fine and finely crystalline varieties, trace fracture (iron stained) possible fracture porosity, 30% light to mid-grey, micro to very finely crystalline, argillaceous to 10% with trace mica - trace fractures.

10% QUARTZ GRAINS, very fine to coarse and occasionally very coarse, 70% well rounded, iron stained, 30% angular, clear. Possibly thin SANDSTONE beds, poorly sorted, good porosity, with zones of siliceous cement.

1100' - 1111'

100% DOLOMITE, 60% white to light grey, 40% microcrystalline, 30% very finely crystalline, 30% fine to microcrystalline, generally clean with occasional trace argillaceous matter, trace large geodes with large to 3mm DOLOMITE CRYSTALS, trace fracture, trace poor porosity, 30% light to mid grey, as above, in part very pyritic, 5-10% argillaceous 5-10% white to buff finely to medium, crystalline, possible trace geodes.

Trace QUARTZ GRAINS (5%) trace SANDSTONE, dark brown, rusty, very fine to coarse grained, poorly sorted, soft, friable, consists of brown stained QUARTZ GRAINS, loosely packed in a ferruginous cement, good porosity, no shows.

Trace yellow, firm to hard, composed of DOLOMITE CRYSTALS to medium grained, in lenses in a yellow calcareous, earthy, matrix, common geodes. DOLOMITE occurs with distinct interface with calcareous matrix and also as grains surrounded by it.

An intraformational DOLOMITE?

1111' - 1120'

Trip.

60% DOLOMITE, white, slightly creamish, coarsely to very coarsely crystalline, (occasional pyramidal type crystals) poor to good porosity, no shows.

40% DOLOMITE, white to slightly buff, grey, micro to very finely crystalline, trace argillaceous matter, trace geodes, trace porosity, in part very slightly arenaceous.

Trace QUARTZ GRAINS.
N.B. From reaming - Trace QUARTZ GRAINS, fine, well sorted.

1120' - 1130'

100% DOLOMITE, white, buff, yellow, orange, light grey, light yellow, green, generally very finely crystalline, occasionally micro to coarsely crystalline, occasional geodes, trace to poor porosity.

1130' - 1140'

100% DOLOMITE, white yellow-green, light to mid grey, generally microcrystalline, 40% very finely crystalline, occasionally fine to medium crystalline, occasional geodes, trace porosity, light to mid grey variety often to 10% argillaceous matter and trace PYRITE.

1140' - 1150'

100% DOLOMITE, yellow to slightly orange, occasionally greenish, microcrystalline, 30% very finely crystalline, occasionally slightly arenaceous, trace white to light grey, as above, tight.

1150' - 1160'

90% DOLOMITE, yellow, green-yellow, white, occasionally grey-brown, grey, orange, generally very finely crystalline with 20% fine to microcrystalline 20% microcrystalline, in part slightly argillaceous, trace geodes, trace porosity, rarely slightly arenaceous. 10% DOLILUTITE, mid to dark grey, argillaceous (10-20%) trace MICA, rare trace PYRITE.

Trace CEMENT.

1160' - 1170'

100% DOLOMITE, white to slightly greenish, white, 40% very fine to microcrystalline, 50% coarsely to medium crystalline, 10% finely crystalline, coarse variety with enehadal crystals, trace to poor porosity, very fine and micro, tight, no shows. Trace CEMENT, DOLILUTITE.

D.D.
LITHOLOGICAL DESCRIPTION

Alliance Mulga No.1 Well

1170' - 1180'
60% DOLOMITE, white to yellow and light grey, 60% medium to coarsely crystalline, 20% finely crystalline, 20% micro to very finely crystalline, general granular texture with equant euhedral DOLOMITE CRYSTALS, trace to poor porosity; no shows.

40% DOLILUTITE, mid to dark grey, argillaceous to 30%, common mica, trace PYRITE, in part very slightly arenaceous, poorly bedded, in part slightly calcareous.

1180' - 1190'
20% DOLOMITE, white to occasionally yellowy and light grey, fine to medium crystalline, slight trace porosity.

80% DOLILUTITE, medium to dark grey, in part slightly greenish, grades to grey, fine to medium crystalline DOLOMITE 50% as above, 50% slightly argillaceous and with rare trace MICA (a slightly argillaceous DOLOMITE?).

1190' - 1200'
70% DOLOMITE, mid to light grey, occasionally white, generally micro to very finely crystalline, trace argillaceous matter, tight, rare trace PYRITE and 10% purple, very finely crystalline, argillaceous, tight. No shows.

30% DOLILUTITE, as above. Trace CEMENT.

1200' - 1210'
60% DOLOMITE, white to occasionally light grey, occasionally grey-brown, generally medium to coarsely crystalline, trace porosity. No shows.

40% DOLILUTITE, grey to black, in part very argillaceous, argillaceousness appears to increase with darkness, in part micaceous, rare trace bedding, very slightly calcareous.

1210' - 1220'
20% DOLOMITE, white, finely crystalline, occasionally very fine to medium crystalline, rare trace geode, trace porosity N.S.

20% DOLOMITE, light grey, very fine to microcrystalline, slightly argillaceous, tight.

60% DOLILUTITE, light to dark grey, occasionally greenish, argillaceous to very argillaceous (40%), slightly micaceous, in part slightly calcareous to occasionally calcareous, rare trace PYRITE, occasionally thinly bedded.

1220' - 1230'
40% DOLOMITE, 50% white, finely crystalline, grading from micro to medium crystalline, occasionally sugary or equant granular texture, rare trace geodes, trace porosity, 50% light grey, micro to very finely crystalline, trace argillaceous matter, tight, N.S.
1220' - 1230'
(cont)

60% DOLILUTITE, mid to dark grey, occasionally greenish, very argillaceous, up to 40% slightly micaceous, rare trace PYRITE, occasionally slightly calcareous, occasionally rare trace bedding, occasionally slightly arenaceous.

1230' - 1240'

60% DOLOMITE, 30% white, very finely crystalline, as above, 30% light grey, as above, 40% light brown-grey, argillaceous, microcrystalline, grading occasionally to finely crystalline, tight. No shows. Rarely slightly arenaceous.
40% DOLILUTITE, mid to dark grey and black, firm, argillaceous to 40% slightly micaceous, in part thinly bedded with rare interbeds white, calcareous, silty SHALE, firm with black, argillaceous specks.
Rare trace QUARTZ GRAINS.

1240' - 1250'

100% DOLOMITE, 90% light brown, translucent, coarsely crystalline to very coarsely crystalline, slightly argillaceous with specks along crystal boundaries, granular sub-equant texture, trace to poor porosity, no shows. 10% white, fine to medium, occasionally coarsely crystalline, sugary texture, occasionally granular as light brown above. Trace porosity. 10% savings of mid-grey DOLILUTITE-DOLOMITE.

1250' - 1260'

70% DOLOMITE, 70% white to slightly pinkish white, occasional brown patches, very coarsely crystalline, trace PYRITE, poor porosity, no shows. 30% white to light grey, very fine to microcrystalline, very slightly arenaceous, tight.
10% CHERT, white, translucent, conchoidal fracture bedded or banded.
20% DOLILUTITE, grey-green, argillaceous to 10%, very slightly micaceous, slightly calcareous, occasionally black, very argillaceous, slightly micaceous.
Trace DOLOMITTO SANDSTONE - DOLOMITE CRYSTALS, very fine to medium grained in a silty, carbonate matrix, tight.

1260' - 1270'

50% DOLOMITE, white to slightly yellow-white, coarsely to medium crystalline, consists equant crystals, granular texture, slight to argillaceous material along crystal boundaries, poor porosity, no shows.
20% DOLILUTITE, mid-grey, grades to argillaceous DOLOMITE, argillaceous 10-30% slightly micaceous, trace PYRITE, in part very arenaceous.
30% DOLOMITE, light to mid grey, finely microcrystalline, argillaceous to 10%, rare trace PYRITE, occasionally slightly arenaceous, trace porosity, no shows.
Trace DOLOMITE, reddish purple.
100% DOLOMITE, white to yellow-white and light buff, 70% medium to coarsely crystalline, poor porosity, 30% fine to very finely crystalline, sugary texture, trace porosity. Slight trace argillaceous material along crystal boundaries.

Trace DOLOMITIC SANDSTONE, light green, consists of fine grains QUARTZ, well rounded in a white to green dolomitic, slightly calcareous, silty matrix. Matrix: QUARTZ approx. 31%.

Trace DOLILUTITE, as above.

1280' - 1290'

DOLOMITE TEST - DOLOMITE AND DOLARENITE. 90% DOLOMITE, white, generally medium to coarse and very coarsely crystalline, occasionally fine to very finely crystalline, granular texture, subequant DOLOMITE CRYSTALS, poor to trace porosity, no shows.

10% DOLARENITE, green-grey, consists very fine to fine, well rounded QUARTZ GRAINS, with zones very fine to coarse grains, in an argillaceous dolomitic matrix, tight, no shows.

1290' - 1300'

100% DOLOMITE, white to light yellow, trace to rarely yellow and light brown, 60% coarsely crystalline, 30% fine to medium crystalline, 10% very fine to microcrystalline, as above, trace porosity, no shows.

1300' - 1310'

50% DOLOMITE, white to light grey, occasionally light yellow, generally finely crystalline, occasionally microcrystalline to coarsely crystalline, occasionally slight trace argillaceous matter, trace porosity, no shows, rare geodes, rarely extremely pyritic.

30% DOLARENITE, green-grey, very fine to fine QUARTZ GRAINS, in dolomitic, argillaceous, matrix, occasionally DOLOMITE CRYSTALS, medium to coarse.

20% DOLOMITE, grey, grades to DOLILUTITE, very argillaceous, slightly micaceous, as above.

1310' - 1320'

60% DOLOMITE, white to slightly buff white, fine to medium crystalline, occasionally very fine to micro or rarely coarsely crystalline, rare argillaceous matter, trace geodes, trace to poor porosity, mainly intercrystalline type.

20% DOLARENITE, green-grey, grades from grey DOLOMITE, very fine to fine QUARTZ GRAINS, well rounded in dolomitic, argillaceous matrix, QUARTZ: Matrix approx. 1:3, occasionally fine to medium DOLOMITE CRYSTALS.

20% DOLILUTITE, grey to dark grey, interbedded with DOLARENITE, slightly arenaceous, very argillaceous, approx. 30%, occasionally slightly calcareous.
90% DOLOMITE, white to light grey to light yellow, very fine to finely crystalline, slight trace argillaceous matter, in grey variety, granular texture of equant crystals, trace porosity, no shows.

10% DOLLILUTITE, as above, slightly arenaceous.

180% DOLOMITE, 90% white to light grey, white is slightly calcareous, as above, with 20% micro-crystalline, trace geodes, common geode crystals, trace fractures, trace to poor porosity, 10% light brown, very fine to medium crystalline with trace geodes, trace to poor porosity, no shows.

Trace DOLLILUTITE, as above, DOLARENITE, as above.

90% DOLOMITE, 60% white to occasionally dark grey, fine to very finely crystalline, 20% microcrystalline, trace porosity, light grey, slightly argillaceous and rarely slightly arenaceous, no shows, 40% light to mid-brown, medium to coarse crystalline, 30% very fine to finely crystalline, common geodes and geode crystals, poor porosity, trace argillaceous matter.

10% DOLARENITE, grey, slightly greenish with silt sized QUARTZ GRAINS, in a dolomitic matrix, argillaceous to 20%, slightly micaceous.

100% DOLOMITE, 70% white to light brown and occasionally brown, medium to coarse and very coarsely crystalline, equant crystals, granular texture, trace to poor porosity, common vug crystals, 30% white to light grey, very fine to micro-crystalline, slight trace argillaceous matter, rare geodes, tight, in part slightly arenaceous.

Trace DOLARENITE, silty, as above, DOLLILUTITE, as above.

DOLOMITE TEST - DOLOMITE with trace argillaceous residue.

100% DOLOMITE, white, in part slightly calcareous, very fine to finely crystalline, generally even sized crystals, sugary equant texture, trace to poor inter-crystalline porosity, trace vug porosity. Vug crystals, occasionally with yellow CLAY staining - LIMONITE?

Trace white, earthy, rock, very hard (greater than steel), slightly calcareous, trace relict arenaceous grains, siliceous.

90% DOLOMITE, 10% white to grey, very finely crystalline, trace porosity, 80% brown to dark brown, coarse to very finely crystalline, mainly fine to medium microcrystalline, equant granular texture, poor vug porosity, poor intercrystalline porosity, 10% mid grey, very finely crystalline with thin (1 mm) interbeds purple and orange DOLOMITE, crystalline.

10% DOLLILUTITE-DOLARENITE, greenish-grey, argillaceous, silty, in part very silty.
1380° - 1390° 100% DOLomite, white, grades in part to slightly brownish-white, 90% very finely crystalline, 10% fine or microcrystalline, platy, occasional geode and fracture, trace porosity, rare trace bedding, trace brown, as above.

Trace DOLLUTITE.
DOLomite in part slightly silicified, earthy.

1390° - 1400° 100% DOLomite, white to cream, as above, very fine to finely crystalline, sugary texture, trace to poor porosity, no show.

1400° - 1410° 70% DOLomite, white, very fine to finely crystalline, rarely micro to very finely crystalline, rare trace argillaceous matter, trace to poor porosity, no shows.
10% DOLARENITE, light grey, slightly argillaceous, slightly arenaceous, finely crystalline, tight to trace porosity.
20% DOLARENITE, light to mid grey, argillaceous to very argillaceous (to 25%) trace DOLomite CRYSTALS, generally very fine grained to silt sized QUARTZ GRAINS in dolomitic matrix, tight, no shows.

Trace QUARTZ GRAINS, coarse.
Trace PYRITE.

1410° - 1420° 70% DOLomite, white to occasionally light brown or cream, very fine to finely crystalline, common geodes, rare trace argillaceous matter, trace to poor porosity, no shows.
10% DOLARENITE, mid grey, very slightly greenish, argillaceous to 30%, in part very argillaceous to 50% and micaceous to 10%, silt to very fine QUARTZ GRAINS, in a dolomitic matrix, Matrix: QUARTZ approx 4:1: tight.

1420° - 1430° 80% DOLomite, light brown, grading to white, fine to medium crystalline, occasionally very finely crystalline, trace geodes, trace argillaceous matter, trace to poor porosity. Trace purple DOLomite, very finely crystalline, tight.
20% DOLARENITE, DOLLUTITE, mid grey, as above, grading from silty DOLLUTITE to DOLAR-ENITE, tight, no shows.

1430° - 1440° 100% DOLomite, white, very fine to finely crystalline, occasionally microcrystalline, rare trace argillaceous matter, equant granular texture, trace common geodes, porosity - no shows.

Trace DOLLUTITE, as above.

1440° - 1450° 100% DOLomite, white to occasionally cream and light grey, very finely crystalline, occasionally finely crystalline, rarely slightly argillaceous, trace geodes, trace porosity, intergranular and vugular, no shows. Trace DOLLUTITE, as above.
1450' - 1460'
95% DOLOMITE, white to greyish-white, very fine and finely crystalline, trace argillaceous matter, occasionally slightly calcareous, trace to common geodes, trace porosity, intergranular and vugular types, no shows.
5% DOLOMITIC SILTSTONE, earthy, light grey, speckled, possible cavings, trace bedding, in part very slightly sandy.
Trace CHERT, white, conchoidal fracture.

1460' - 1470'
100% DOLOMITE, white to buff and yellowish-white, generally very fine to finely crystalline with 20% coarsely crystalline, greyish white with trace PYRITE, common trace black mineral grains, occasional trace PYRITE CUBES, generally geodes with LIMONITE type staining, poor to trace porosity, intergranular and vugular types, no shows.
Trace DOLOMITIC SANDSTONE - DOLOMITE CRYSTALS fine grained in a white, carbonate matrix around crystal edges. Crystals: Matrix approx 5:1.
Trace SILTSTONE.

1470' - 1480'
100% DOLOMITE, white to occasionally greyish-white, greenish white, yellow and light grey, generally very finely crystalline, occasionally fine or microcrystalline, trace argillaceous matter with occasional common trace (5 - 10%), trace geode crystals, trace porosity, vugular and intergranular, no shows.
Trace DOLILUTITE, slightly arenaceous, light green-grey.

1480' - 1490'
100% DOLOMITE, white to cream and light grey, 10% microcrystalline, 20% very finely crystalline, 50% finely crystalline 20% coarsely to medium crystalline, light grey, in part, slightly arenaceous, slightly argillaceous, generally rare trace argillaceous matter, occasional geodes, trace intergranular and vugular types, no shows.

1490' - 1495'
100% DOLOMITE, very slightly calcareous, white, light grey, slightly orange-white, generally micro to occasionally very finely crystalline, rarely finely to medium crystalline, in part common 10 - 15%, argillaceous matter giving faint bedding delineation, trace very, very fine grained, reddish purple mineral, also along 7 bedding, generally tight, no shows.
Trace CONGLOMERATE, dolomitic, possibly intraformational with range in size from pebbles (5 mm) to coarse grains, tight. Grains probably dolomitic.

End of bft D-14 - Cheers.

1495' - 1505' CORE No. 3. Recovered 2'3" Interbedded micro to very finely crystalline, vuggy DOLOMITE.
D-15 YHWGJ
Trip Sample.
80% DOLOMITE, white to occasionally buff, yellow, brown, light grey, 30% white and light brown, very fine to finely crystalline with crystals in a white carbonate matrix, argillaceous and occasionally with DOLOMITE as matrix, trace porosity. 70% very fine to finely crystalline, occasionally micro to coarsely crystalline, trace geodes, trace argillaceous matter, especially in light grey variety which is commonly arenaceous to slightly arenaceous and very slightly pyritic, trace porosity, trace light green, micro to very finely crystalline, tight.
20% DOLILUTITE, green-grey to black, firm, in part arenaceous, argillaceous to very argillaceous, trace MICA, PYRITE, occasionally very thinly bedded, especially black variety.
Trace DOLOMITE SILTSTONE, IRONSTONE NODULES, black to orange.

DOLOMITE TEST - DOLOMITE.
100% DOLOMITE, white, slightly greyish, very fine to finely crystalline, granular texture, occasionally medium crystalline, trace PYRITE, calcareous, trace geodes and vugs, occasionally a DOLOMITE SANDSTONE with matrix along crystal edges and with rare QUARTZ GRAINS, trace to poor intergranular and vuglar porosity. Rare trace 7 bedding.
Trace DOLILUTITE, as above.

100% DOLOMITE, white to light yellow-brown and occasionally very dark brown, generally fine to medium crystalline, occasionally coarsely or very finely crystalline, rare trace PYRITE, trace geodes and geode crystals, black-brown variety, very fine grained and overall as grain size increases, colour decreases in intensity to yellow brown, trace thin bedding well bedded. Trace to poor intergranular and vuglar porosity.
Trace DOLILUTITE, as above.

80% DOLOMITE, white, slightly greyish-white, grading to yellow, light yellow-brown, finely crystalline, ranging from rarely microcrystalline to medium crystalline, common geode crystals, rare trace PYRITE, trace argillaceous matter, trace porosity intergranular and vuglar, no shows.
20% CHERT, white, light grey, brown, micro-crystalline, rarely with trace PYRITE, conchoidal fracture, translucent.

100% DOLOMITE, white to mid brown and greyish-white, generally fine to very finely crystalline, occasionally medium crystalline, occasional trace argillaceous matter common in light grey, rare trace PYRITE, trace geodes, trace porosity, intergranular and vuglar, no shows.
Trace DOLILUTITE, green-grey; CHERT to 5%.

... 8...
1550 - 1560
100% DOLOMITE, light yellow-brown to dark brown, white and light grey, finely crystalline, ranging from micro to coarsely crystalline, common argillaceous specks in light grey variety, trace in others, trace geodes, trace porosity, no shows.
Trace DOILITUTITE, arenaceous, very argillaceous; CHERT.

1560 - 1570
50% DOLOMITE, white to buff, light yellow-brown, and light grey, as above, very fine to finely crystalline, trace porosity.
50% DOILITUTITE, mid grey to dark grey and grey-green, very argillaceous, up to 30%, micaceous, amount varying from trace to very common, occasionally slightly calcareous, in part well and thinly bedded, grades from DOLOMITE, in part well and thinly bedded, argillaceous, to a DOLOMITIC SHALE, in part arenaceous to slightly arenaceous.

1570 - 1580
100% DOLOMITE, white to light yellow-brown, generally very finely crystalline 20% finely crystalline, 10% microcrystalline, 10% medium to coarsely crystalline, trace argillaceous specks, occasional geodes; trace PYRITE, trace porosity, no show.
Trace silty SHALE, LIMONITE stained and possibly cemented.

1580 - 1590
100% DOLOMITE, white, greyish-white, light yellow, yellow-brown, generally medium crystalline, 40% fine to very finely crystalline, trace argillaceous matter, common geode crystals, trace to poor porosity. Occasionally arenitic and ruditic grains, brown to pink DOLOMITE in very fine grained DOLOMITE, in part ooilitic.

1590 - 1600
20% DOLOMITE, white to light yellow, very fine to fine grained, trace PYRITE, argillaceous material, porosity, no shows.
20% DOILARENITITE, light to dark grey, argillaceous to very argillaceous (to 30%), very slightly micaceous, grading to argillaceous DOLOMITE, slightly arenaceous, occasionally slightly pyritic.
40% DOLOMITE, light grey, very fine grained, consists of DOLOMITE CRYSTALS in a carbonate matrix, slightly argillaceous, rarely slightly arenaceous.
20% DOILITUTITE, mid to dark grey and black, very slightly arenaceous, occasionally well and thinly bedded, generally very argillaceous.

1600 - 1610
90% DOLOMITE, white, occasionally light yellow, light grey, finely crystalline, occasionally micro, finely or medium crystalline, occasional trace argillaceous matter, trace geodes and geode crystals, poor porosity, inter-granular and vugular, no shows.
1600'-1610' (cont)
10% DOLILUTITE and DOLARENITE, as above.

1610'-1620'
90% DOLOMITE, mainly white, occasionally light yellow, light grey, finely crystalline, sugary texture with equant crystals, finely crystalline, as above, poor porosity, no shows.
10% DOLILUTITE and DOLARENITE, as above.

1620'-1630'
100% DOLARENITE, 70% white to greyish-white, very fine to fine grained, sugary texture, trace argillaceous matter, trace reddish stringers, trace poor intergranular and vugular porosity, trace geodes, no show, 30% brown to light yellow brown, very fine to medium crystalline, generally finely crystalline, occasional vein type white to clear DOLOMITE, occasional argillaceous matter, trace porosity, no show.
Trace DOLILUTITE, as above.

1630'-1640'
60% DOLOMITE, white to light yellow, as above, 30% light brown to dark brown, as above, trace to poor porosity, no show and light grey, microcrystalline, rarely arenitic.
40% DOLILUTITE, mid to dark grey, very argillaceous, in part slightly argillaceous, occasionally micaceous, occasionally slightly arenaceous to arenaceous (QUARTZ GRAINS to very coarse size) common to thin bedding.

1640'-1650'
90% DOLOMITE, white, yellow, buff, very fine to fine, occasionally microcrystalline, 20% microcrystalline, granular texture, trace geodes, occasional trace argillaceous matter, very rarely with green (GLAUCONITE?) clay in crystal interstices, poor porosity intergranular and vugular, no shows.
10% DOLILUTITE, grading to DOLOMITE, light to mid grey, slightly argillaceous, occasionally medium argillaceous (to 30%), rare arenaceous grains, occasionally well and thinly bedded.

1650'-1660'
70% DOLOMITE, white to yellow and buff and light grey, very finely crystalline with 20% microcrystalline, 30% fine to coarsely crystalline, rare trace PYRITE, trace argilaceous matter, rare arenaceous grains, trace intergranular porosity, no shows.
30% DOLILUTITE, mid to dark grey, as above, in part very argillaceous (30%), occasional trace PYRITE.

1660'-1670'
60% DOLOMITE, white to yellow, buff, light grey, as above, very fine to finely crystalline, grades micro to coarsely crystalline, trace geodes, trace argilaceous matter, light grey occasionally slightly arenaceous with trace PYRITE, trace to occasional poor porosity vugular and intergranular, no shows.

...10.
1660' - 1670' (cont)
40% DOLILUTITE, grading in part to
DOLOMITIC SHALE, mid grey to black,
as above.

1670' - 1676'
100% DOLOMITE, buff, yellow, grading to
white, occasionally light grey, very
fine to finely crystalline, 10% micro
crystalline, 20% medium to coarsely
crystalline, trace geodes, occasional
trace argillaceous matter, rare trace
thin, relict bedding.
Trace DOLILUTITE, as above, DOLARENITE,
silty.

Bit Change D-16.

1670' - 1680'
90% DOLOMITE, white, greyish-white, brownish-
white, generally medium to coarsely
crystalline, occasionally 20% micro
to finely crystalline, very common
geodes with LIMONITE staining, good
porosity intergranular and vugular;
Trace light grey, argillaceous, micro
to very finely crystalline.
10% DOLILUTITE, mid to dark grey, slightly
arenaceous, trace MICA.

1680' - 1690'
90% DOLOMITE, as above, 50% fine to
coarsely crystalline, 50% micro to very
finely crystalline, poor porosity, no
shows.
10% DOLILUTITE, DOLOMITIC SHALE, grey, as
above, slightly arenaceous, 10%.

1690' - 1700'
90% DOLOMITE, white, cream, light grey,
60% microcrystalline, 10% very fine,
30% fine to coarsely crystalline,
common geodes and geode crystals, poor
porosity, no show, rare trace PYRITE.
10% DOLILUTITE-DOLOMITIC SHALE, mid grey,
slightly arenaceous, occasionally
fissile and well bedded.

1700' - 1710'
100% DOLOMITE, white, cream, light grey,
10% microcrystalline, 30% very fine to
finely crystalline, 10% coarsely
crystalline, common geodes with CHERT,
clear to yellow DOLOMITIC CRYSTALS,
trace PYRITE, trace argillaceous matter,
in light grey DOLOMITE, good to poor
porosity, no shows.

1710' - 1720'
100% DOLOMITE, white to cream and light grey,
10% microcrystalline, 20% very fine to
finely crystalline, 70% medium to
coarsely crystalline, as above, trace
PYRITE, common geodes, poor to good
porosity, no shows.
Trace DOLILUTITE, as above.

Bit Change D-16 button bit.

1720' - 1730'
100% DOLOMITE, 60% white, 20% light grey,
slightly argillaceous, 20% yellow to
mid brown, 60% very finely crystalline,
10% microcrystalline, 20% fine to
coarsely crystalline, common trace
geodes, poor porosity, no show.
Trace DOLILUTITE.
1730'-1740'
100% DOLOMITE, white to cream, occasionally light grey, rare trace felt "calotic" texture, generally finely crystalline with 20% medium to coarsely crystalline, trace argillaceous matter in light grey with occasionally thinly bedded, trace to poor porosity, intergranular and vuglar, trace geodes.

1740'-1750'
100% DOLOMITE, pinkish white, occasionally white, 30% light yellow to cream, smaller than 10% light grey, very fine to finely crystalline, range from micro to medium crystalline, rarely ruditic and arenaceous grains, occasional trace argillaceous matter, trace porosity, intergranular and vuglar, no shows.

1750'-1760'
100% DOLOMITE, white to cream, occasionally pinkish white or yellow, generally very finely crystalline with range micro to fine to medium crystalline, occasionally slightly argillaceous, trace geodes, trace intergranular and vuglar porosity, trace arenaceous grains, trace light grey, slightly argillaceous, thinly bedded, no shows.

1760'-1770'
100% DOLOMITE, white to cream, white, occasionally calcareous, 60% micro to very finely crystalline, 40% fine to occasionally microcrystalline, rarely slightly argillaceous, trace geodes, trace porosity.

1770'-1780'
100% DOLOMITE, white to cream and dirty cream, generally micro to very finely crystalline, rare trace arenaceous grains, trace geodes, trace porosity, occasional trace bedding. Minor yellow to yellow-green, microcrystalline, possibly slightly argillaceous, well bedded.

1780'-1790'
100% DOLOMITE, white to light cream, slightly calcareous, very fine to medium crystalline, generally finely crystalline, trace geodes, occasionally with LIMONITE staining, trace porosity vuglar type, no shows.

1790'-1800'
100% DOLOMITE, white to cream and greyish-white, very finely crystalline, range micro to fine to medium crystalline, trace to common geodes, occasionally solid solution type texture - clear and cream DOLOMITE (geodes?), trace to poor porosity, vuglar type, no shows, rare trace bedding.

1800'-1810'
100% DOLOMITE, white to cream and greyish-white to light grey, generally as above, very finely crystalline, range micro to finely crystalline with occasional medium to coarsely crystalline, trace geodes, rare argillaceous matter, trace porosity, vuglar type, no shows, texture as above, rare trace bedding.

... 12.
1810⁰ - 1820⁰ 100% DOLOMITE, white to cream, with 40% light grey to greyish-white, generally very fine to microcrystalline, ranges to occasionally medium crystalline, common geodes, occasional trace argillaceous matter, especially light grey, rare trace PYRITE, occasional relict scattered oolitic textures or MICROCONGLOMERATE, trace to poor vuggy porosity, no shows.

1820⁰ - 1830⁰ 100% DOLOMITE, cream to white, finely crystalline, range very fine to micro to medium crystalline, common trace geodes, with occasional LIMONITE staining, rare PYRITE, rare argillaceous specks, trace porosity, vugular, no shows.

1830⁰ - 1840⁰ 100% DOLOMITE (similar to 1810-1820⁰), 60% white to cream, very finely crystalline, range fine to medium and occasionally microcrystalline, trace geodes, trace porosity, 40% light grey, microcrystalline, trace argillaceous matter (in part to 5%), rare trace disseminated PYRITE, occasional trace relict oolitic or arenitic textures, general trace thin bedding, tight, no shows.

1840⁰ - 1850⁰ 100% DOLOMITE, white to cream and occasionally light grey, white and light grey slightly calcareous, very fine to fine grained, range micro to fine, occasionally medium grained, trace to common geodes, rare trace argillaceous matter, trace porosity, no shows.

1850⁰ - 1860⁰ 100% DOLOMITE, white to cream, occasionally brownish and light grey, 30% light grey, microcrystalline, slightly argillaceous, in minor part very argillaceous 20%, trace PYRITE, platy, tight, rare relict arenaceous grains, 70% white to cream, 60% very fine to finely crystalline, 30% micro and 10% medium crystalline, rarsly very slightly argillaceous, rare trace PYRITE, trace geodes, trace vugular porosity, white microcrystalline grades to light grey and is platy.

1860⁰ - 1870⁰ 100% DOLOMITE, 50% white to cream, occasion-ally brownish, micro to very finely crystalline, occasionally finely crystalline, trace geodes, trace argillaceous matter (1-4%), occasionally platy, trace porosity, vugular, no shows, 20% light grey, as above, microcrystalline with occasionally very finely crystalline, trace geodes, slight trace porosity, no shows.

1870⁰ - 1880⁰ 100% DOLOMITE, 50% white to yellow-brown, as above, micro to very finely crystalline and occasionally finely crystalline, trace PYRITE, argillaceous matter, rare geodes, slight trace porosity, 50% light grey, as above, microcrystalline trace PYRITE, rare arenaceous grains, tight, no shows.
1880* - 1890*

90% DOLOMITE, 60% light grey, grading to white, very slightly calcarceous, microcrystalline, occasionally very finely crystalline, platy, slightly argillaceous to 5%, trace pyrite, usually disseminated, occasionally very finely in cubes, occasionally arenaceous grains (relic?), tight, no shows. 40% white to occasionally cream, very finely crystalline, 20% microcrystalline, 10% finely crystalline, rare trace argillaceous matter, slight trace PYRITE, in part slightly calcareous, occasionally platy, rare geode crystals, possible trace porosity, no shows.

10% DOLILUTITE, mid to dark grey, grades to very argillaceous DOLOMITE, rare arenaceous grains, thinly bedded.

1890* - 1900*

90% DOLOMITE, 70% light grey, grades to white or mid grey, micro, occasionally very finely crystalline, trace geodes (crystal filled), slightly argillaceous with argillaceous content increasing with darkness in colour to 15-20%, platy, possible trace porosity, no show, 30% white to slightly creamy white, very fine to microcrystalline with trace finely crystalline, trace argillaceous matter, trace fractures, iron stained, rare geodes, possible trace porosity, vuglar and intergranular.

10% DOLILUTITE, as above, but more of an argillaceous DOLOMITE, grading from mid grey DOLOMITE, as above.

1900* - 1910*

100% DOLOMITE, 70% white, occasionally creamy or pinkish, very finely crystalline, ranges to microcrystalline to 30% finely crystalline, common geodes, rarely slightly argillaceous, trace porosity, no show, 30% light grey, as above, slightly argillaceous, tight, microcrystalline.

1910* - 1920*

100% DOLOMITE, 70% white to cream, very fine to microcrystalline with 10-15% finely crystalline, trace geodes, trace rare vein DOLOMITE?, very slightly calcareous, slight trace argillaceous matter, trace vugular porosity, 30% light grey, as above, platy, slightly argillaceous microcrystalline.

1920* - 1930*

100% DOLOMITE, 70% cream to white, very finely crystalline, 30% micro, 20% finely crystalline, trace geodes, rare trace PYRITE and argillaceous matter, trace to poor vugular porosity, trace brown to black lining argillaceous material in vugs. 30% light grey, as above.

1930* - 1940*

100% DOLOMITE, 80% white to cream, 30% fine, 40% very fine, 30% microcrystalline, trace PYRITE, common geodes, a vein.
1930⁴ - 1940⁴ (cont)
GARNET?
type of crystals, reddish purple, brown, cubic or hexagonal striated faces, red brown streak; hardness 3⁵ - 5⁷, geodes commonly LIMONITE stained, occasionally with reddish stain or crystals, as above, vugular porosity, with slightly intergranular porosity, no shows, 20% light grey, platy, slightly argillaceous, in part pyritic 5%, rare geodes, tight, no shows.

1940⁴ - 1950⁴ 100% DOLOMITE, rarely slightly calcareous, 80% white to cream and occasionally brown to dark brown, as above, very fine to finely crystalline, common geodes, trace PYRITE, trace solid solution type texture, poor to good porosity, no show, 20% light grey, as above. Common iron and reddish-purple stained geodes.

1950⁴ - 1960⁴ 100% DOLOMITE, 90% white to cream, as above, fine to very finely crystalline, common geodes, iron stained, occasionally reddish purple, very fine crystals in geodes (as above), trace fractures, poor to good porosity, very fine, trace PYRITE, slight trace argillaceous matter, 10% light grey, as above.

1960⁴ - 1970⁴ 100% DOLOMITE, 60% white to slightly light cream and occasionally grey, very fine to microcrystalline, 30% finely crystalline, trace geodes, occasionally argillaceous to 5%, trace PYRITE, poor porosity, very fine, no show, trace fractures, 40% light grey, to occasionally mid and dark grey, microcrystalline, argillaceous to very argillaceous 20-25%, tight, platy, occasional trace PYRITE, arenaceous grains.

SANDSTONE from approx. 1975. 600 m

1970⁴ - 1980⁴ 70% DOLOMITE, light to mid grey, very slightly calcareous, argillaceous to 20%, platy, trace PYRITE.
30% SANDSTONE, grey, green-grey, pink, composed of fine to coarse grained, well rounded, clear QUARTZ GRAINS, poorly sorted, in a siliceous, glauconitic?? (probably not), often deep to mid green (ferrous type green) clayey matrix, or white, slightly dolomitic matrix, slightly pyritic, occasionally with common scattered, very fine cubes, slight trace porosity, no show.

CORE NO. 4 - 1980 - 1981'3'' Recovered 1'3''
Water temp on reaching surface after trip 1800⁴, 35°C = 95°F
1980⁴ approx. 35°C = 97°F
These are not accurate as sample probably not from bottom of the hole
1931' - 1990'
Trip with DOLOMITE cavings.
100% SANDSTONE, redbrown, to occasionally purple-brown, rarely white, composed of red-brown to clear, well rounded, fine to very coarse QUARTZ GRAINS, poorly to fairly sorted, in a variety of cements - all visible occasionally in one fragment - siliceous causing breaking of grains, white microcrystalline, soft, occasionally green, argillaceous (chloritic?), soft, rarely pyritic, rare trace porosity, no shows, scattered PYRITE, occasional quartz crystal faces.

1990' - 2000'
100% SANDSTONE, as above, with abundant white micro to very finely crystalline cement, soft, together with siliceous cement, which causes secondary enlargement of grains.

2000' - 2010'
100% SANDSTONE, as above, red-brown and purple-brown, as above, tight, no shows.

2010' - 2020'
100% SANDSTONE, red brown, very fine to coarse grained, rare green, chloritic cement.

2020' - 2030'
100% SANDSTONE, red-purple-brown, generally medium grained, ranges fine to occasionally very coarse, cement 70% siliceous 10% white ?kaolinitic microcrystalline, tight.

2030' - 2040'
100% SANDSTONE, as above, very rare trace porosity, no show.

2040' - 2050'
100% SANDSTONE, as above, generally medium to coarsely grained, poorly sorted with fine to occasionally very fine grains, well rounded, but silicified, no shows.

2050' - 2060'
100% SANDSTONE, as above, 80% red-brown stained grains, 20% clear, tight, no shows.

2060' - 2070'
100% SANDSTONE, red-purple, brown, medium to coarse grained, occasionally very fine grained or very coarse grained, generally fair to poor sorting, composed of 80-90% red-brown stained (ferruginous?), 20-10% clear, well rounded (originally) good sphericity, QUARTZ GRAINS, in a siliceous cement, with obliterated original grains, causes breakage through grains and gives occasional crystal faces approx 20%, white microcrystalline cement, kaolinitic? possibly siliceous also, trace white, soft cement (kaolinitic) tight, no shows, rare grains of QUARTZITE, very fine crystalline to microcrystalline, trace PYRITE cubes.

... 16...
2070⁴ = 2080⁴ 100% SANDSTONE, as above, occasional trace argillaceous (chloritic?) cement, 30% clear grains, tight, no show.

2080⁴ = 2090⁴ 100% SANDSTONE, as above, with trace rock grains, as above.

2090⁴ = 2100⁴ 100% SANDSTONE, as above, trace black mineral grains (?iron).

2100⁴ = 2110⁴ 100% SANDSTONE, as above, generally medium grained, to very coarse and rarely fine grained, common 10% rock grains - metamorphics? QUARTZITES.

2110⁴ - 2120¹ Samples getting finer but mainly chipped grains with quartz cement % increasin to approx. 90%.
100% SANDSTONE, as above, rare trace iron rock fragments.

2120⁴ - 2130⁴ 100% SANDSTONE, mainly siliceous cement - QUARTZITE.

2130¹ - 2140¹ 100% SANDSTONE, as above, with 10% purple-brown, silty rock, possibly a thin interbed of SILTSTONE, occasionally medium sandy.

2140¹ - 2150¹ 100% SANDSTONE, as above, with 10% silty rock, sandy, as above.

2150¹ - 2160¹ 100% SANDSTONE, as above with 5% silty rock, as above.

2160¹ - 2170¹ Sample lighter in colour.
100% SANDSTONE, light red-purple, very siliceous, possible a QUARTZITE, mainly as chips of grains?, medium to very coarse grained with occasional fine grains, generally iron stained on outside, but fragments are clear, fair sorting, tight, no shows, trace rock grains. Overall slight variation throughout unit 1974.

2170¹ - 2180¹ 100% SANDSTONE, as above.

2180¹ - 2190¹ 100% SANDSTONE, as above, with trace iron mineral fragments.

2190¹ - 2200¹ 100% SANDSTONE, as above, tight, no shows.

2200¹ - 2210¹ 100% SANDSTONE, as above.
N.B. Throughout samples is mostly 1-2% soft, white mineral, possibly amorphous, with occasional QUARTZ GRAINS and red-purple staining - Could be (a) ground up white, kaolin type cement or (b) thin lenses in the SANDSTONE.
2210' - 2220' 100% SANDSTONE, as above.
2220' - 2230' 100% SANDSTONE, as above, slightly more purple and darker.
2230' - 2240' 100% SANDSTONE, as above.
2240' - 2250' 100% SANDSTONE, as above, lighter changes
2250' - 2260' 100% SANDSTONE, as above.
2260' - 2270' 100% SANDSTONE, as above, very slightly darker.
2270' - 2280' 100% SANDSTONE, as above, slightly darker, 80% siliceous cement, 20% very finely crystalline, white (siliceous?) cement, tight, no shows, medium to occasionally very coarse grained.
2280' - 2290' 100% SANDSTONE, reddish-purple, coarse to medium, occasionally very coarse grained, trace granular, fair sorting, generally well rounded, red-purple to red-brown QUARTZ GRAINS, ferruginous?, generally siliceous cement causing secondary enlargement of grains giving occasional crystal faces, minor to 30% in part, generally 10-20%, white very fine to microcrystalline cement, possible siliceous or kaolinitic, occasionally to rare rock fragment grains, trace PYRITE, rare trace limonitic staining, tight, no shows.
Trace white, soft, amorphous mineral with QUARTZ GRAINS, occasional white with red-purple zones.
2290' - 2300' 100% SANDSTONE, as above, slightly lighter, trace rock fragments, tight, no shows.
2300' - 2310' 100% SANDSTONE, as above, tight, no shows.
2310' - 2320' 100% SANDSTONE, as above, trace light green, argillaceous cement or rock fragments, QUARTZ GRAINS, generally red-brown with rock fragments, dark purple, tight, no shows.
2320' - 2330' 100% SANDSTONE, as above, with rare trace PYRITE, very fine cubes, tight, no shows.
2330' - 2340' 100% SANDSTONE, as above, with trace argillaceous rock fragments, tight, no shows.
2340' - 2350' 100% SANDSTONE, as above, with common rock fragments, dark purple, microcrystalline, hard, QUARTZITE?, tight, no shows.

N.B. Samples very fine chips and true grain size relationships or porosity not known—could be pebbles or larger.
2350' - 2360'
100% SANDSTONE, as above, medium to very coarse grained with occasional granules and pebbles, tight, no shows. Trace white mineral, as above.

2360' - 2370'
100% SANDSTONE, as above, slightly darker, medium grained to granules and pebbles, poorly sorted, rare trace porosity, dark purplish variety has more of a purple, silty groundmass, red-brown has white microcrystalline and siliceous matrix, no shows.

2370' - 2380'
Sample fine, therefore lighter.
100% SANDSTONE, deep purple through to red-brown, medium to very coarse grained, with occasional pebbles and granules, poorly to occasionally well sorted, composed of rounded to subrounded (?) red-brown and purple stained QUARTZ GRAINS, in a siliceous cement, a finely crystalline white cement or occasionally a purple, silty crystalline cement?, general absence porosity with rare trace, no shows. Rock fragments included in SANDSTONE as black to dark purple mafic rocks and QUARTZITE. Rare to green chloritic (?) argillaceous fragments, no shows.

2380' - 2390'
100% SANDSTONE, as above, no porosity determination possible.

2390' - 2400'
100% SANDSTONE, as above, with trace green SILTSTONE fragments, no show, with trace pebbles.

2400' - 2410'
100% SANDSTONE, as above, with trace pebbles, no show.

2410' - 2420'
100% SANDSTONE, as above, slightly lighter, more of a rose-purple, no show.

2420' - 2430'
100% SANDSTONE, as above,

2430' - 2435'
100% SANDSTONE, as above, but granules darker, as fragments are larger, 50% medium to very coarse and occasionally granules and pebbles with approx. 50% sample being mainly granules and occasionally pebbles, with occasionally medium to very coarse grains. General two colours, a red to purple-brown and a dark purple, common white microcrystalline cement? with possible secondary, generally well silicified enlargement of grains.

2435' - 2440'
100% SANDSTONE, as above, with trace interbedded white, medium to coarse grained, SANDSTONE, partly silicified with white microcrystalline cement? and white amorphous mineral, as above as cement could be a softer interbed. Tight, no shows.

D.D.
129.1965.
ALLIANCE MULGA NO. 1 WELL

LITHOLOGICAL DESCRIPTION.

2440' - 2450' Sample as fine chips. 100% SANDSTONE, red, purple, trace possible white, siliceous cement, or white, finely crystalline mineral, occasionally, possibly common granules and pebbles. No show.

2450' - 2460' 100% SANDSTONE, siliceous, as above. No show.

2460' - 2470' 100% SANDSTONE, as above, occasionally cuttings as rounded grains, indicating occasional lack of silicification.

2470' - 2480' 100% SANDSTONE, as above, with trace granules, tight, no show.

2480' - 2490' 100% SANDSTONE, as above, with 20% white, medium to coarse grained, slightly siliceous and well rounded QUARTZ GRAINS, clear, in a white, occasionally mottled green, argillaceous, possibly kaolinitic matrix. Tight, no show - white SANDSTONE from drilling break.

2490' - 2492' 100% SANDSTONE, as above, purple, medium to coarse, with occasionally very coarse grains and granules, silicified with common, white, microcrystalline cement and 10% white, as above, medium to coarse grained with common crystal faces on QUARTZ GRAINS, partly silicified, white, argillaceous, soapy cement.

6430 Diamond Core barrel on site 82

2492' CORE NO. 5 - Using HTOJ H/F OH 725
Water temp at surface 36°C = 97°F
Water fresh.
Pipe Tally 2491

CDRE NO. 5 - 2491-2502, Cut 11 feet
Recovered 6 feet 3 inches

2502' - 2510' 100% SANDSTONE, purple-brown, medium to very coarse grained with occasional fine grains, clear and red-brown and purple-brown, well to subrounded QUARTZ GRAINS, partly silicified, partly with white microcrystalline (KAOLIN-FELDSPAR?) cement. Tight, no shows. Trace SANDSTONE, white with clear QUARTZ GRAINS, only slightly silicified, possible trace porosity, no show. Trace CHERT, grey (savings?).

2510' - 2520' 100% SANDSTONE, as above, cuttings as very fine to fine, angular QUARTZ GRAINS, with occasional medium to coarse QUARTZ GRAINS and occasional SANDSTONE FRAGMENTS, tight, no show.
2520' - 2530'
80% SANDSTONE, red-brown and purple-brown, medium to very coarse grained and occasionally granules and pebbles, generally silicified with common, white crystalline cement, occasional ferruginous cement and rare, green, argillaceous, chloritic? cement, tight, no show.
20% DOLOMITE, white, yellow, light to mid grey, white, very fine to finely crystalline, yellow and grey microcrystalline, platy, grey, slightly argillaceous, rare trace geodes in white variety, trace porosity. Possible cavings. Trace CHERT, grey to cream.

2530' - 2540'
60% SANDSTONE, as above and occasionally white, rare trace porosity.
40% DOLOMITE, white, very fine to finely crystalline, trace geodes, trace vugular porosity, grading in part to cream or light grey, micro to very finely crystalline, platy, tight, and light grey, microcrystalline, trace geodes - filled, slightly argillaceous to, in part, very argillaceous and black, in part slightly calcareous, tight, no show.

2540' - 2550'
100% SANDSTONE, cuttings, fine to medium, angular QUARTZ GRAINS, light purple, occasionally very fine to fine, red-brown, subangular QUARTZ GRAINS - ferruginous. Trace SANDSTONE, white with green, chloritic cement, as above, tight, no show.

2550' - 2560'
100% SANDSTONE, fine to medium, angular fragments of QUARTZ, purple overall, but 80% fragments clear, 20% purple-brown and red-brown. Possible fine grained, angular SAND or chipped up, medium to very coarse SANDSTONE, as before.

2560' - 2570'
100% SANDSTONE, as above, no shows.

2570' - 2580'
100% SANDSTONE, as above, no shows.

2580' - 2590'
100% SANDSTONE, as above, with trace SANDSTONE, white, fine grained, sub- angular to subrounded, clear to slightly cloudy QUARTZ GRAINS, in a ?kaolinitic matrix, poor porosity.

2590' - 2600'
100% SANDSTONE, as above, 70% clear fragments and grains, 30% coloured, generally a fine to medium grained with occasional granule SANDSTONE.

2600' - 2610'
100% SANDSTONE, as above, with trace sample with secondary enlargement of QUARTZ GRAINS, trace white SANDSTONE, as above, rest as grains, 70% white, 30% coloured to give overall a light purple.
2610+ - 2620+

100% SANDSTONE, as above. Overall soft drilling break, a fine to coarse grained with occasional granules. SANDSTONE, generally white with occasional red-brown stained QUARTZ GRAINS, cement? probable good porosity, no shows. Trace SHALE, purple.

2620+ - 2630+

60% SANDSTONE, as above, no show.
30% SHALE, purple to red-brown, firm, fissile, in part slightly micaceous, occasionally silty.
10% SHALE, light green, firm, blocky, well bedded, chloritic, soapy feel.

2630+ - 2640+

70% SHALE, 60% red-brown, 40% purple, as above, in part slightly sandy, in part mottled with green variety.
10% SHALE, green, as above, thinly bedded, and as mottling with SHALE above.
10% SHALE, orange to pink and white, slightly siliceous, fissile, firm to hard, thinly bedded.
10% SANDSTONE, very fine grained to fine grained, occasionally fine to medium grained, white with occasional orange, white, kaolinitic cement, tight, no show.

2640+ - 2650+

60% SHALE, 70% purple, 20% red-brown, occasionally calcareous, in part slightly micaceous, grading in part to very fine grained SANDSTONE, thinly bedded, occasionally fissile.
10% light green to very light green, as above, in part occurring in red-brown or purple as a mottling.
20% LIMESTONE, argillaceous, slightly dolomitic, salmon to pink and rose, white, orange, microcrystalline, massive, tight, no show.
10% White to light orange, amorphous SHALE, firm.
Trace SANDSTONE and QUARTZ GRAINS, as above, fine to very coarse.

2650+ - 2660+

80% SHALES, as above, 30% red-brown, 60% purple, thin bedded and fissile, 5% light green, in part slightly silty and sandy, 5% white, amorphous, as above.
10% LIMESTONE, as above, tight, no show, occasionally non-argillaceous.
10% SANDSTONE, white to light green, very fine to fine grained in a white to light green, argillaceous (possibly kaolinitic) matrix, tight, no shows and trace QUARTZ GRAINS.

2660+ - 2670+

80% SHALE, as above.
20% LIMESTONE, as above, microcrystalline, generally argillaceous to slightly argillaceous, tight, no show.
Trace SANDSTONE, as above, tight, no show.
70% SHALE, as above, 50% red-brown, 40% purple, generally slightly silty, calcareous, commonly silty and sandy, fissile, thinly bedded, common mottling with light green as coarse sized spots, 10% light green, as above, grading in part to very fine grained SANDSTONE, slightly calcareous.

20% LIMESTONE, slightly argillaceous, as above, trace bedding, thin, microcrystalline with trace very finely crystalline, tight, no show. Trace partly silicified.

10% SANDSTONE, light green, argillaceous, tight, with occasional SHALE FRAGMENTS, trace light grey, very fine to fine grained with calcareous, argillaceous cement, tight, no show.

2680' - 2690'

70% SHALE, 80% purple to red-brown, in part slightly sandy, occasionally grading to very fine grained SANDSTONE, slightly calcareous to calcareous, occasionally non-calcareous, fissile, thin and well bedded, trace light green mottling and 20% light green to white, yellow, green, firm, occasionally slightly sandy, thin and well bedded, blocky

30% Chloritic (?) LIMESTONE, dolomitic, in part argillaceous, salmon, pink, white, yellow, orange, grey, light green, occasionally well and thinly bedded, microcrystalline, tight, no show.

Trace SANDSTONE, red-brown, very light green, grades from sandy SHALE, tight, no show.

2690' - 2700'

50% SHALE, as above, 30% red-brown, 40% purple to brown-purple, 30% green, slightly calcareous.

50% LIMESTONE, as above, 70% white to buff and yellow-orange, 30% light green, salmon, pink, argillaceous, microcrystalline, slightly siliceous, occasionally thinly bedded, tight, no show.

2700' - 2710'

70% SHALE, as above, 50% purple-brown-purple, 30% red-brown, 20% green, firm, fissile, occasionally slightly chloritic, cell varieties in part sandy to slightly sandy.

30% LIMESTONE, dolomitic, in part a DOLOMITE, very slightly calcareous, in part well and thinly bedded, in part slightly argillaceous, microcrystalline, rare arenitic grains, in part siliceous to almost completely siliceous; tight, no show.
2710\textsuperscript{1} - 2720\textsuperscript{1}

70\% SHALE, as above, 30\% purple, 20\% red-brown, 30\% green.
30\% LIMESTONE-DOLOMITE, as above, in part 10-20\% very siliceous.

2720\textsuperscript{1} - 2730\textsuperscript{1}

30\% SHALE, as above, 50\% purple, 10\% red-brown, 40\% green.
70\% LIMESTONE, as above, mainly light orange to cream, rare trace vugular porosity (caving?), microcrystalline, no show.

2730\textsuperscript{1} - 2740\textsuperscript{1}

30\% SHALE, as above.
70\% LIMESTONE, slightly dolomitic, as above, mainly white to light orange, tight, no show, in part slightly siliceous.

2740\textsuperscript{1} - 2750\textsuperscript{1}

40\% SHALE, 70\% purple to brown-purple, slightly calcareous, fissile, well and thinly bedded, in part sandy, occasionally mottled with light green, slightly chloritic SHALE occasionally slightly micaceous, 30\% milky green to green, to almost white, firm, in part sandy and grading to a SANDSTONE, occasionally occurs as mottling in SHALE above, in part slightly siliceous, thin and well bedded, possibly slightly chloritic, slightly calcareous; trace red-brown.
60\% LIMESTONE-DOLOMITE, to slightly calcareous DOLOMITE, occasionally slightly to very siliceous, rarely cherty, microcrystalline, mainly white to orange, minor salmon, light green, light grey, slightly argillaceous in part, rare trace arenitic grains of QUARTZ, occasionally well and thinly bedded, tight, no show.

2750\textsuperscript{1} - 2760\textsuperscript{1}

30\% SHALE, as above, 50\% purple, 50\% green.
70\% LIMESTONE, as above, with rare fragments, very fine to finely crystalline with trace geodes, trace porosity, no show.

2760\textsuperscript{1} - 2770\textsuperscript{1}

40\% SHALE, as above.
60\% LIMESTONE, as above, white to orange with minor salmon, light grey, tight, no show.

2770\textsuperscript{2} - 2780\textsuperscript{1}

30\% SHALE, as above, 50\% purple, 50\% green, occasionally blueish green, fissile, slightly calcareous, in part slightly mottled with very fine purple mottling.
70\% LIMESTONE, dolomitic, in part slightly dolomitic (20\%), in part dolomitic, slightly calcareous (10\%) and occasionally to 10\% siliceous, microcrystalline, rarely very finely crystalline, tight, no show.
2780" - 2790" 70% SHALE, as above, 60% purple, 30%
green, bright, 10% red-brown.
30% LIMESTONE, as above, micro,
very rarely finely crystalline,
tight, no show.

2790" - 2800" 50% SHALE, 50% purple to brown-purple,
generally slightly calcareous; in
part silty to sandy, occasional
MICA, trace green mottling, fissile,
well and thinly bedded, 40% green,
brighter than bedrock, slightly
calcareous, firm, slightly chloritic(?)
in part slightly silty and sandy,
well and thinly bedded, occasionally
fissile, 10% red-brown, rarely
slightly silty, occasionally with
green mottling, well and thinly
bedded, fissile, slightly calcareous.
50% LIMESTONE, white to orange and salmon,
oncasionally green, light grey,
grades to DOLOMITE, microcrystalline,
rarely finely crystalline, occasionally
well and thinly bedded, tight, no show.

Still tight hole
with cavities on
connections.

2800" - 2810" 60% SHALE, as above.
40% LIMESTONE, as above, in part fine
to medium crystalline, tight, no
show.

2810" - 2820" 60% SHALE, as above, with 40% red-brown,
20% green, 40% purple.
30% LIMESTONE, as above, occasionally
microcrystalline, arenitic, tight,
no show.
10% SANDSTONE, as thin bands in SHALE,
reddish-brown stained QUARTZ GRAINS,
slightly silicified, tight, no show.

2820" - 2830" 60% SHALE, as above.
30% LIMESTONE, as above, in part slightly
to occasionally argillaceous (5-
15%).
10% SANDSTONE, white, very fine to fine
grained, fair sorted, more of a
dolomitic ARENITE with a dolomitic
centre clear DOLOMITE GRAINS.

2830" - 2840" 60% SHALE, as above, 40% purple, 30%
red-brown, 30% green.
30% LIMESTONE, as above.
10% DOLARENITE, as above, calcareous.

2840" - 2850" 70% SHALE, as above, 30% purple, 30%
red-brown, 40% green.
30% LIMESTONE, as above, in part
slightly to very arenaceous.

2850" - 2860" 70% SHALE, as above, 50% purple, 20%
red-brown, 30% green.
20% LIMESTONE, as above, but more very
fine to finely crystalline (to 30%).
10% CALCARENITE, dolomitic, orange with
occasional green grains, tight, no
show.
Change in fragment size and overall colour, darker and finer.
70% SHALE, purple-brown, occasionally slightly sandy, in part slightly calcareous, firm, fissile, occasionally mottled, well and thinly bedded, light green to grey-green, occasionally slightly sandy (10%) grading to an argillaceous SANDSTONE, slightly calcareous, red-brown, firm, fissile, well and thinly bedded.
30% LIMESTONE, white, light orange to pink, salmon, light green, generally dolomitic to calcareous DOLOMITE, argillaceous, microcrystalline, grading to very finely crystalline and occasionally finely crystalline, trace ARENITE, orange, very fine grained with orange and green grains, in a white matrix, tight, argillaceous.

60% SHALE, as above, 70% green, grey, grey-green, yellow-green, light orange, generally ?chloritic, firm, well and thinly bedded, slightly calcareous, slightly siliceous and grades into argillaceous, calcareous SANDSTONE and argillaceous CALCARENITE.
30% LIMESTONE, as above, tight, no show.
10% Calcarenous SANDSTONE, argillaceous, orange, white to light green, slightly siliceous, grading to CALCARENITE.

Overall sample, slightly calcareous, with occasional very calcareous grains, grey.
Sample gradational from SHALE to argillaceous LIMESTONE to LIMESTONE, except for purple-red-brown SHALE.
20% SHALE, purple and red-brown.
10% CALCARENITE, argillaceous, as above.
40% LIMESTONE, as above, occasionally pure LIMESTONE, micro to occasionally very finely crystalline, argillaceous and occasionally lutitic, tight, no show, generally grey.
30% SHALE, to green-grey.

Sample dark grey, overall a calcareous SHALE, grading to CALCILUTITE.
10% SHALE, purple, red-brown, green, as above.
80% SHALE, dark grey to black, calcareous to CALCILUTITE, hard, massive.
10% LIMESTONE, as above.

10% SHALE, purple, red-brown, green, slightly calcareous, fissile, well and thinly bedded.
10% LIMESTONE, dolomitic, occasionally arenitic, green, light orange, white.
80% SHALE, dark grey to black, calcareous to CALCILUTITE, occasionally silty to arenaceous grains, massive, tight, no show.
2910'-2920'
Common cavings.
30% Cavings SHALE and LIMESTONE, as above.
50% SHALE, black, grey, light grey, calcareous, as above.
20% CALCILUTITE, black, grey, light grey, as above.

2920'-2930'
60% SHALE, black, grey, light grey, in part calcareous, in part thinly and well bedded.
20% CALCILUTITE, as above.
10% SHALE, purple, etc., as above.
10% LIMESTONE and CALCARENITE, as above.

2930'-2940'
10% SHALE, purple, red-brown, as above.
20% LIMESTONE, white, orange, green, in part arenaceous, dolomitic, micro to occasionally very finely crystalline, tight, no show.
50% SHALE, as above, in part very slightly sandy, fissile, well and thinly bedded, in part calcareous.
20% CALCILUTITE, as above, in part almost a CALCARENITE, very argillaceous, tight, no show.
Sample contaminated with diesel fuel.

2940'-2950'
70% SHALE, dark grey, occasionally blueish or greenish, to black, occasionally light grey, in part calcareous, in part slightly micaceous, occasionally silty, fissile, well and thinly bedded.
10% CALCILUTITE, as above.
20% SHALE and LIMESTONE, as above - cavings?

2950'-2960'
60% SHALE, as above, in part siliceous, in part slightly calcareous, fissile.
20% CALCILUTITE, grading to argillaceous LIMESTONE, micro to occasionally finely crystalline, occasionally slightly arenitic.
20% SHALE and LIMESTONE, as above, tight, no show.

2960'-2970'
70% SHALE, dark grey to black, occasionally greenish or blueish, in part slightly calcareous, in part slightly siliceous, occasionally slightly silty and sandy, trace PYRITE VEINING - possible along bedding? - fissile, well and thinly bedded.
10% CALCILUTITE, in part arenaceous, tight, no show.
20% SHALE, purple, red-brown, green, cavings and LIMESTONE, white to light orange, microcrystalline.

2970'-2980'
70% SHALE, as above, with rare PYRITE CUBES in rock.
20% CALCILUTITE, as above, grading to light grey CALCARENITE, argillaceous with CALCITE VEINS.
10% SHALE, LIMESTONE, as above.

2980'-2990'
70% SHALE, as above, slightly calcareous, slightly siliceous, fissile, well and thinly bedded.
20% CALCILUTITE, as above.
10% SHALE and LIMESTONE cavings, as above.

... 9.
2990' - 3002'

60% SHALE, as above, in part with common QUARTZ GRAINS, occasional light khaki, siliceous.

30% CALCILUTITE, dolomitic in part, occasionally with CALCARENITE, also dolomitic in part, tight, no show.

10% SHALE and LIMESTONE, as above.

CORE NO. 6 3002 - 3003' 7'' Recovered 4'' 20%

7½" HT & J HICH 3½'' diam. Rate 60 m/ft.

Hole still caving slightly especially on connections when air shut off.

Hole caved to 100' from bottom - cleared. Cut core 1' in 1½ hours - heaving cavings during coring, cleaned hole and pulled out. String almost stuck but circulation broken and string hoisted out. Continual caving from 2620 down. Caving material larger than 50%, red-brown brown-purple SHALE, smaller than 50% grey SHALE.

D.D.
8.9.1965.
APPENDIX NO. 3.

DESCRIPTION OF CARBONATE ROCKS

The texture of carbonates and the nature of their component particles have often been obscured by alteration of these rocks after lithification. Whether or not carbonates have been altered, their texture and the nature of their constituent particles are readily observable when the rock chips are immersed in oil of cloves.

There is no generally accepted classification of carbonates, although many have been proposed. To ensure that carbonates encountered at wells drilled by this company are described in a uniform manner, it is suggested that the following procedure be employed.

1. CRYSTAL OR FRAGMENT SIZE:

The size classification to be used is that of Wentworth, i.e., :

\[
\begin{align*}
\text{silt} & : 0.004 \text{ (1/256) mm to 0.062 \text{ (1/16) mm}} \\
\text{Very fine} & : 0.062 \text{ (1/16) mm to 0.125 \text{ (1/8) mm}} \\
\text{Fine} & : 0.125 \text{ (1/8) mm to 0.250 \text{ (1/4) mm}} \\
\text{Medium} & : 0.250 \text{ (1/4) mm to 0.500 \text{ (1/2) mm}} \\
\text{Coarse} & : 0.500 \text{ (1/2) mm to 1.00 \text{ (1) mm}} \\
\text{Very coarse} & : 1.00 \text{ (1) mm to 2.00 \text{ (2) mm}}
\end{align*}
\]

A crystalline carbonate with an average crystal size of less than 1/16 mm. would be described as "microcrystalline".

A fragmental carbonate with an average fragment size of less than 1/16 mm. would be classified as a "calcilutite".

Other carbonates can be described in terms of their grain, fragment or crystal size i.e., :

LIMESTONE: 30% coarse oolites in finely crystalline matrix.

DOLOMITE: finely crystalline (medium grained fragmental relic texture).

2. ROCK-BUILDERS:

For non-crystalline carbonates, the nature and percentage of the various rock-building components should be determined and recorded in the lithologic column.
A) "Rock-builders" comprise the following:

(i) **ALGAL.** Algal carbonates can be easily recognised in cores but are very difficult to identify in cuttings samples. The presence of very thin laminae of differing colour and/or texture within a single chip is interpreted by some geologists as indicative of algal origin.

(ii) **BIOCLASTIC OR FRAGMENTAL.** These terms apply to rocks composed predominantly of fossil fragments. If the fossils can be identified, the appropriate rock-builder symbol should be used.

(iii) **PSUEDO-OOLITE OR PELLETS.** These are similar to oolites but without the typical oolite concentric or radial structure. They may have several origins:

- They may be fecal pellets of marine origin.
- They may be formed in a manner similar to the sands found on the Bahams Banks today.
- They may be fragments of ocean floor torn up by waves and subsequently rounded by ocean currents.

Pelletoidal carbonates are typically non-porous and contain few macrofossils.

(iv) **OOLITES.** Pelletoid shapes showing concentric or radial structure. Oolitic carbonates are commonly porous.

(v) **CORAL, STROMATOPORIDS, BRYOZA, FORAMINIFERA, CRINOIDS, MOLLUSCA.** There is a symbol for each of these fossils. If the fossil cannot be identified, a bioclastic symbol is to be used. "F" is a symbol for any fossil which makes up less than 15% of the rocks; the fossil name should be mentioned in the description.

B) "Rock-builder" symbols are as follows:

- Algae
- **B** Bioclastic or fragments
- Pseudo-oolites or pellets
- **A** Oolites
- **C** Coral
- **S** Stromatoporoid
- **B** Bryozoa
C) Use of "Rock-builder" symbols:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0 to 15 percent</td>
</tr>
<tr>
<td>1</td>
<td>15 to 35 percent</td>
</tr>
<tr>
<td>2</td>
<td>35 to 55 percent</td>
</tr>
<tr>
<td>3</td>
<td>55 to 85 percent</td>
</tr>
<tr>
<td>4</td>
<td>85 to 100 percent</td>
</tr>
</tbody>
</table>

3. ACCESSORIES THAT CAN BECOME ROCK TYPES:

A) These should be noted and recorded in the lithologic column. These accessories include the following material: argillaceous, dolomitic, calcareous, anhydritic, gysiferous, silty, sandy; salt and chert.

B) Accessory symbols are as follows:

- argillaceous
- dolomitic
- calcareous
- anhydritic
- gysiferous
- salt
- sand
- silt
- chert
- silica.

C) Use of accessory symbols:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>0 to 5 percent</td>
</tr>
<tr>
<td>1</td>
<td>5 to 20 percent</td>
</tr>
<tr>
<td>2</td>
<td>20 to 40 percent</td>
</tr>
<tr>
<td>3</td>
<td>40 to 50 percent</td>
</tr>
</tbody>
</table>

If a significant amount of accessory, but less than 5%, is present, the pertinent symbol should be recorded in the accessory column (to the right of the "Lithology - percentage of cuttings" column).
D) Identification of accessories:—

Some accessories are readily identifiable on sight, while the identification of others requires various tests.

LIMESTONE: Limeness is determined by applying a drop of acid to the chip with brush or by dropping the chip into acid. A quantitative estimate requires that the sample be left in the acid until the calcium carbonate is completely dissolved. The residual volume is then compared with the original volume.

DOLOMITE: Dolomite is identified by its crystalline habit or by its reaction to acid. In cold acid it will slowly emit bubbles, but if the acid is warmed, the reaction will increase in vigour.

NOTE: Acid reactions are affected by various factors; oil-staining will restrict or retard reactions; the reaction of impure limestone may be slow and similar to that of dolomite. A pure dolomite reacts slowly at first and gradually increases in vigour whereas an impure limestone reacts in the reverse manner; the reaction, initially vigorous, gradually decreases.

ANHYDRITE: At times it may be difficult to differentiate between dolomite and anhydrite. If a drop of acid is applied to a chip and the chip is scratched, a dolomite powder will effervesce, whereas anhydrite will not. A chip dropped into hot acid will react vigorously if composed of dolomite.

To test a chip suspected of being (or containing) anhydrite:—

- place the chips in a watch glass and dissolve (or heat) the chips in hot acid.
- allow the acid to cool slowly. While it is cooling, add another chip of anhydrite or anhydritic material in order to obtain a supersaturated solution.
- if anhydrite is present, it will precipitate slowly as distinctive star-shaped clusters of acicular crystals.

SAND, SILT, SILICA, ARGILLACEOUS MATTER: Siltiness or sandiness can be detected by rubbing the side of the probe over the chips. The arenaceous matter will remove visible fragments of steel from the probe. To obtain quantitative estimates of the sand, silt, argillaceous or silica content, the carbonate should be dissolved completely and the residue examined. Carbonates can be quickly dissolved in acid by the use of watch glasses and a small thermostatically controlled hot plate.
A silt residue will commonly consist of various sized grains of an equant shape. A silica residue will usually be extremely fine and include elongated shapes in the form of clusters or box structures. The distinction between silt and silica may be important in determining environment.

**GYPSUM**: Gypsum is identified by its crystal habit. To test for the presence of gypsum in a carbonate:

- heat the sample vigorously in acid.
- as the acid cools gypsum will precipitate as an agglomerate of "feather-shaped" crystals.
- if the sample contains an abundance of gypsum, the gypsum may precipitate in the form of a mamillary crust.

4. **MINOR ACCESSORIES**:

The presence of significant amounts of accessories, other than those discussed above, should be noted by recording the pertinent symbol in the "Accessory" column to the right of the "Lithology - percentage of cuttings" column.

Symbols for minor accessories are as follows:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Limestone streaks</td>
</tr>
<tr>
<td></td>
<td>Dolomite streaks</td>
</tr>
<tr>
<td>Py</td>
<td>Pyrite</td>
</tr>
<tr>
<td>Ph</td>
<td>Phosphate</td>
</tr>
<tr>
<td>G</td>
<td>Glaucnite</td>
</tr>
<tr>
<td>C</td>
<td>Carbonaceous matter</td>
</tr>
<tr>
<td>B</td>
<td>Bituminous matter</td>
</tr>
<tr>
<td></td>
<td>Concretions</td>
</tr>
<tr>
<td>☯</td>
<td>Vug-grown crystals</td>
</tr>
<tr>
<td>☯</td>
<td>Plant remains</td>
</tr>
</tbody>
</table>

Examples of this method of describing carbonates are given on Page 6.
INTERPRETATION

Medium grained, fragmental limestone, consisting of 55 to 85% crinoid remains, with less than 15% other fossiliferous fragments (including corals) underlain by

Very finely crystalline limestone, with 5 to 20% sand; dolomitic (5 to 20%); with less than 5% silica; pyritic.

Very dolomitic (40 to 50%), very finely crystalline (or fragmental) limestone with 15 to 30% crinoid fragments and 5 to 20% sand grains; grades to very calcareous (20 to 40%), sandy (20 to 40%) dolomite with less than 5% silt content; glauconitic.

Medium grained fragmental limestone, with less than 15% brachiopod and coral fragments underlain by

Coarse grained fragmental limestone consisting of 35 to 55% crinoid fragments and 35 to 55% pellets with less than 15% other rock-builders (including corals and bryozoa).
APPENDIX V.

LOGGING.

Induction Electric, Gamma Ray, Neutron and Acoustic Caliper logs at two inches and five inches to one hundred feet scale were run in the hole by Walex. The hole was full to 230 feet with water when it was logged.

Because of casing problems the hole could not be cleaned out below 2600 feet and the hole was not logged below that depth.

Owing to the rough roads to the wellsite from Alice Springs, the logging operator had trouble getting the logging tools working properly.

The results of the logs are somewhat disappointing in that the main lithologic change in the well, the top of the Upper Proterozoic sandstone at 1,974 feet does not show clearly on any logs and indeed only shows at all on the neutron log.

The main log characteristic is the flat SP curve suggesting the formation waters encountered, and filling the hole, are all of the same salinity.

If this is accepted the resistivity logs probably indicate the positions of fissures in the dolomite section and the resistivity variations should reflect variations in the neutron and sonic porosities. Using this criteria the sonic porosities are surprisingly found to be more accurate than the neutron porosities.

From the resistivity logs alone it appears that the interval 1710-1930 feet is largely tight as the resistivity of this interval is higher and more uniform than in the remainder of the carbonate section.