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Northern Territory 0800

AMALGAMATED PETROLEUM LAKE NASH No.1 - OIL PERMIT 53,
NORTHERN TERRITORY.

WELL COMPLETION REPORT.

By:
MINES ADMINISTRATION PTY. LTD.

31 Charlotte Street,
Brisbane.

NORTHERN TERRITORY
GEOLICAL SURVEY
PR63/018B
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<td>1</td>
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<td>2</td>
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<td>3</td>
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<td>There were no palaeontological examinations carried out.</td>
<td>3</td>
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<td></td>
<td>There were no gas or water analyses carried out.</td>
<td>3</td>
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<td>3</td>
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<td>3</td>
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Enclosure 1.
A.P. Lake Nash No.1 was drilled by Forasol S.A. for Amalgamated Petroleum N.L.

Overall supervision of the drilling was by H.W.J. Stewart, Field Superintendent of Amalgamated Petroleum. Wellsite geology was by K.H. Wolf. Core Laboratories Inc. was responsible for the detection of hydrocarbons. The final well report has been compiled by K.H. Wolf and Mines Administration Pty. Limited under the supervision of D.M. Traves, Exploration Manager, Mines Administration Pty. Limited.

I. Summary.

A.P. Lake Nash No.1, east of the Georgina River, between Cidya Creek and Lake Nash Homestead, Northern Territory, was drilled to a total depth of 1315 feet. It penetrated 995 feet of Cambrian carbonate rocks and 320 feet of probable Proterozoic sedimentary rocks. These last were considered as basement in this well. The dolomite unit from 790 feet to 995 feet contained viscous tar or asphalt, but no drill stem tests were carried out on this interval.

The well was subsidised on a cost basis for a stratigraphic drilling operation by the Commonwealth Government.

II. Introduction.

The well was drilled for the following reasons:

1. To test the Lake Nash Anticline.

2. To examine the lithology and total thickness of the sediments.

3. To provide information for future exploration.

The location was selected by Doeringfeld, Amendo and Ivey, Consulting Photogeologists, Denver, Colorado.
III. Well History.

(1) General data.

(a) Well name and number - A.P. Lake Nash No.1.

(b) Location (co-ordinates) - 20° 54'18"S; 137° 53'20"E. 614385. Avon Downs 3 Mile Military Map.

(c) Name and address of tenement holder - Amalgamated Petroleum N.L., 127-29 William Street, Melbourne, Victoria.

(d) Details of petroleum tenement - O.P.53 Northern Territory. Tenable over an area of 8897 square miles until 12/7/63, with the right of renewal.

(e) District - Lake Nash, Northern Territory.

(f) Total depth - 1315 feet.

(g) Date drilling commenced - 25th November, 1962.

(h) Date drilling completed - 23th December, 1962.

(i) Date well abandoned - 29th December, 1962.

(j) Date rig released - 29th December, 1962.

(k) Drilling time in days to total depth - 34

(l) Elevation - ground - 740 feet.

(m) Status - Plugged and abandoned.

(n) Cost - As per audited statement to be submitted separately.

(2) Drilling data.

(a) Name and address of drilling contractor - Forasol S.A., 10 Rue Pergolise, Paris XVI, France.

(b) Drilling plant -

<table>
<thead>
<tr>
<th>make</th>
<th>type</th>
<th>rated capacity with 4½&quot; drillpipe</th>
<th>rated capacity with 3½&quot; drillpipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESSCO.</td>
<td>GB-160-TS.</td>
<td>4000 feet.</td>
<td>5000 feet.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>motors</th>
</tr>
</thead>
<tbody>
<tr>
<td>make : General Motors.</td>
</tr>
<tr>
<td>type : 12103</td>
</tr>
<tr>
<td>B.H.P. : 320</td>
</tr>
</tbody>
</table>

(c) Mast -

<table>
<thead>
<tr>
<th>make</th>
<th>type</th>
<th>rated capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>S. &amp; R.</td>
<td>Double pole telescopic.</td>
<td>120,000 lbs.</td>
</tr>
</tbody>
</table>
III. Well History (contd.)

(2) Drilling data (contd.)

(a) Pumps (Z) -

<table>
<thead>
<tr>
<th>make</th>
<th>type</th>
<th>size</th>
<th>pump motors -</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oilwell</td>
<td>14 P.H.O.</td>
<td>7 1/2&quot; x 14&quot;.</td>
<td>General Motors.</td>
</tr>
<tr>
<td>Oilwell</td>
<td>14 P.</td>
<td>7 1/2&quot; x 14&quot;.</td>
<td></td>
</tr>
</tbody>
</table>

(b) Blowout preventer equipment -

<table>
<thead>
<tr>
<th>make</th>
<th>size</th>
<th>series</th>
</tr>
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<tbody>
<tr>
<td>Shaffer</td>
<td>8&quot;</td>
<td>900</td>
</tr>
<tr>
<td>Hydrol</td>
<td>8&quot;</td>
<td>900</td>
</tr>
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</table>

(c) Hole sizes and depths -

<table>
<thead>
<tr>
<th>size</th>
<th>weight</th>
<th>grade</th>
<th>range</th>
<th>setting depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 1/2&quot;</td>
<td>40 lbs./ft.</td>
<td>J.55.</td>
<td>2.</td>
<td>304 feet.</td>
</tr>
</tbody>
</table>

(d) Casing details -

<table>
<thead>
<tr>
<th>size</th>
<th>weight</th>
<th>grade</th>
<th>range</th>
<th>setting depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 1/2&quot;</td>
<td>40 lbs./ft.</td>
<td>J.55.</td>
<td>2.</td>
<td>304 feet.</td>
</tr>
</tbody>
</table>

(e) Casing cementing details -

<table>
<thead>
<tr>
<th>size</th>
<th>setting depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 1/2&quot;</td>
<td>304 feet.</td>
</tr>
</tbody>
</table>

(f) Drilling fluid -

<table>
<thead>
<tr>
<th>type</th>
<th>average S.G.</th>
<th>treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clay base.</td>
<td>1.11.</td>
<td>Weight control by water; fluid loss control by caustic/tan bark and C.M.C.; viscosity control by caustic/tan bark; cement contamination control by Q-Broxin.</td>
</tr>
</tbody>
</table>

(g) average weekly analysis :

<table>
<thead>
<tr>
<th>S.G.</th>
<th>Visc.</th>
<th>F.L.</th>
<th>Sand</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.11.</td>
<td>41 secs.</td>
<td>15.4 ml.</td>
<td>1%</td>
</tr>
</tbody>
</table>

(h) Water supply -

Water was pulled from the Lake Nash waterhole and carted approximately 5 miles to the site.

(i) Perforation record -

Nil.

(j) Plugging and cementation jobs -

(i) length and type of plug:

<table>
<thead>
<tr>
<th>number of sacks</th>
<th>method</th>
</tr>
</thead>
</table>

(ii) length and type of plug:

<table>
<thead>
<tr>
<th>number of sacks</th>
<th>method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lost circulation (997 feet).</td>
<td>90. Squeezed to formation.</td>
</tr>
</tbody>
</table>
III. Well History (contd.)

(2) Drilling data (contd.)

(1) Plugging and cementation jobs (contd.)

(iii) length and type of plug:
number of sacks:
method:

Lost circulation (1030 feet).
25.
Squeezed to formation.

(iv) length and type of plug:
number of sacks:
method:
tested:

100 ft. (895 to 995 feet).
24.
Conventional displacement.
No.

(v) length and type of plug:
number of sacks:
method:
tested:

100 ft. (250 to 350 feet).
24.
Conventional displacement.
No.

(vi) length and type of plug:
number of sacks:
method:
tested:

100 ft. (0 to 100 feet).
24.
Conventional displacement.
Yes.

(m) Fishing operations -
Nil.

(n) Side tracked hole -
None.

(3) Logging and testing.

(a) Ditch cuttings -
method of sampling:
interval:
Grab samples from the shaker;

washed, air dried and stored in

labelled cloth bags.

10 feet (0 to 1315 feet).

(b) Coring -
original programme:
programme carried out:

One core to be cut approximately
every 300 feet and/or where lith-

ology changes.
The original programme was
executed.

total number of cores cut:
footage cored:
recovery:
equipment:
4.
45.
100%.

44 O.D. 28'' I.D. Series
250F Core Barrel.
39'' O.D. Diamond Corahedr
Series 19050P.

<table>
<thead>
<tr>
<th>CORE NO.</th>
<th>INTERVAL CORED</th>
<th>RECOVERY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>298 to 308</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>586 to 596</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td>801 to 811</td>
<td>100</td>
</tr>
<tr>
<td>4</td>
<td>1012 to 1027</td>
<td>100</td>
</tr>
</tbody>
</table>

(c) Sidewall sampling -
None.

(d) Electric and other logging -

Guard Log:
Radioactivity Log:

300 to 1200 feet - Run 1.
40 to 1199 feet - Run 1.
III. Well History (contd.)

(3) Logging and testing (contd.)

(e) Drilling time and gas log -

- drilling time log:
  Computed from the time to drill 10 feet, the average being plotted as minutes per 5 feet for that interval.
- gas log:
  Core Laboratories Inc. trailer mounted, hot wire, gas detector was used to log the interval 870 to 1315 feet.

(f) Formation testing -
No drill stem tests were carried out.

(g) Deviation surveys -

- equipment:
- results:
  TOTCO.
  203 feet - 3°
  230 feet - 2°
  306 feet - 3°
  678 feet - 4°
  801 feet - 4°

(h) Temperature survey -
None.

(i) Other well surveys -
None.
From Proof Copy of
AVON DOWNS
1:250,000 Sheet
Probable relationships of units - Avon Downs sheet area

Diagrammatic, not to scale
IV. Geology. (by K.H. Wolf, Amalgamated Petroleum N.L.)

(1) Summary of previous work.

(a) Geological.

Randall and Brown (1962) made a geological reconnaissance of the area while engaged in regional mapping of the Ranken - Camooweal—Avon Downs - Mt. Isa area.

Surface outcrops are very poor and the immediate vicinity of the well is confined to the Cambrian Camoolweal Dolomite and residual chert accumulations.

(b) Geophysical.

As far as is known, no geophysical surveys have been carried out in the immediate area.

(c) Drilling.

No deep hole drilling has been done in the near vicinity of the well. The little geological information obtained from a number of water bores is too unreliable for any lithologic or stratigraphic evaluations. During the recent few months the Bureau of Mineral Resources has done some shallow hole stratigraphic drilling. This has helped in mapping the area.

(2) Summary of the regional geology.

Despite some work done by the Bureau of Mineral Resources, the stratigraphic information available at the present time is uncertain and even contradictory due to the poor outcrops and absence of exposed contacts. Large areas are covered by soil containing residual accumulations of chert, etc., pebbles. The data from water bores affords little information.

The general stratigraphic picture as visualised by Randall and Brown (1962) is given on Enclosure 3.

The Wonarah siltstone, shale and limestone beds outcrop on the western part of the Avon Downs sheet whereas the Camooweal Dolomite forms the major surface exposures to the east where A.P. Lake Nash No.1 is located.

The lithology of various subdivisions is as follows:

PALAEOZOIC:

Camooweal Dolomite: Cavernous, white, crystalline; with chert bands and nodules; no fossils have been found in situ, but Middle and Upper Cambrian, fossiliferous chert and limestone fragments are scattered over the surface. The age of the dolomite is not clear. The dolomite outcrops in the northern and eastern parts of the Avon Downs sheet area and
IV. Geology (contd.)

(2) Summary of the regional geology (contd.)

Camooweal Dolomite (contd.) continues north onto the Ranken and Camooweal sheets, eastwards onto the Mt. Isa sheet and south-east onto the Urandangi sheet. The dolomite outcrops near Lake Nash on the south-eastern part of the Avon Downs sheet and extends south onto the Sandover River sheet. All of these outcrops are tentatively regarded as Camooweal Dolomite until further information is available.

Outcrops are very few in the Avon Downs sheet area.

The outcrop of the Lake Nash Anticline is composed of crystalline dolomite. It is laminated with chert bands and nodules, in part vuggy and cavernous and variable in colour — white, creamy-brown, buff.

The structure of the Camooweal Dolomite is unknown, in most cases the bedding is horizontal or nearly so and except for the Lake Nash Anticline, even moderate folding appears to be absent.

The anticline near Lake Nash is approximately 8 miles east-west and 4 miles north-south and forms a group of low hills up to 220 feet high.

The western part outcrops on the banks of the Georgina River. The trend of the anticline is easier to recognise on aerial photographs than on the ground.

As yet, the exact age of the Camooweal Dolomite is unknown. It is believed that it is Middle Cambrian but the possibility of pre-Middle Cambrian age is still unresolved. The stratigraphic relationship with overlying, underlying and interfingering beds in widely spaced areas sometimes leads to contradictory results in regard to the age, probably because different dolomite units have been grouped together to form the so-called Camooweal Dolomite.

Thickness is not known but it is at least 800 feet.

The limestone is very fossiliferous (trilobites, etc.), and appears to intertongue with the Wonarah Beds to the west. However, the relationship with the Camooweal Dolomite in the east is not clear. The thickness is
IV. Geology (contd.)

(2) Summary of the regional geology (contd.)

Ranken Limestone (contd.)

uncertain but is probably less than a few hundred feet.

The Ranken Limestone contains oolitic, fragmental and crystalline limestone, silicified limestone, chert and some dolomite. Bedding is often poorly developed and ranges from thin to medium.

Age of the limestone is lower Middle Cambrian.

Wonarah Beds

They consist of fossiliferous siltstone, chert, silicified shale and silicified oolitic limestone. The rocks are lateritised locally.

The Wonarah Beds crop out on the western part of the Avon Downs sheet and they are largely covered by sandy soil.

They are of lower Middle Cambrian age. The thickness is not known but is at least 500 feet.

Undifferentiated Cambrian and Ordovician

Finely crystalline, grey-white, dolomites outcrop in the south-west and southern parts of the Avon Downs sheet area. Their exact relationship is unknown.

Rocks of this age form a thin veneer over the Palaeozoic rocks in the northern part of the Avon Downs sheet area. They consist of quartz sandstone and pebble conglomerate. Poorly preserved plant remains have been recorded.

MESOZOIC.

CAINozoIC.

Austral Downs Limestone

Tertiary nodular limestone crops out in the central and south-eastern parts of the Avon Downs sheet area.

It is a skeletal, white, crystalline or amorphous nodular limestone. Chalcedonic nodules and bands are common and frequently have textures similar to the limestones. Intrabreccias and sedimentary conglomerates are common. Bedding is poorly developed.

The Austral Downs Limestone forms a thin veneer over the older rocks, which frequently protrude as inliers. It is believed that the Cainozoic lime and silica was deposited in a lacustrine environment and was derived by leaching of the older rocks.

No fossils were found in the Avon Downs sheet.
IV. Geology (contd.)

(2) Summary of the regional geology (contd.)

Austral Downs Limestone (contd.)

area but south of it, the forams *Rotula* and *Globigerina*, calcareous algae (charophyte
stems), *syracornes* and *ostracods* were
reported. The maximum thickness is probably
55 feet.

(3) Stratigraphic table.

<table>
<thead>
<tr>
<th>AGE</th>
<th>FORMATION</th>
<th>DEPTH INTERVAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAMBRIAN</td>
<td>Dolomite Unit-A</td>
<td>0 - 586 feet</td>
</tr>
<tr>
<td>&quot;</td>
<td>Limestone Unit-B</td>
<td>586 - 790 feet</td>
</tr>
<tr>
<td>&quot;</td>
<td>Dolomite Unit-C</td>
<td>790 - 995 feet</td>
</tr>
<tr>
<td>PROTERozoic</td>
<td>Quartzite Unit-D (with dolomite bed)</td>
<td>995 - T.D. (320 feet)</td>
</tr>
</tbody>
</table>

(4) Stratigraphy.

UNIT-A

Lithology: Dolomite, medium crystalline, varicoloured from light yellow-brown to light grey,
porous and tight horizons alternating, the porosity (see photo in appendix) consists of
mainly geode-like vugs lined with cuboidal dolomite crystals (see photo in appendix),
occasional stylolites traces of "ghost" textures have been preserved. Sometimes well
preserved "Gelite - Sparite - Dolarenite" are recognisable, local trace of quartz grains
and pyrite. No trace of hydrocarbons.

UNIT-B

Lithology: Limestone, finely crystalline, mainly very
argillaceous, *calcilutite* (=marl) with a
number of fairly pure calcilutite beds;
patches of light grey material in medium grey
"matrix" results in a settled and wavy struct-
ure (see photo in appendix), some of the tub-
ular patches resemble locally "worm burrows",
the limestone on the whole is varicoloured;
Medium to dark grey, various shades of brown,
and light grey to white; minute skeletal frag-
ments of thin shelled organisms are present
and only one complete pectenoid or brachiopod
shell (no determination has been made up to
the time of this report). Pyrite replacing
fossils. No porosity and no hydrocarbons.
Structures suggest shallow water deposition.
IV. Geology (cont'd.)
(4) Stratigraphy (cont'd.)

UNIT-C -

Lithology:

790 to 955 feet (205 feet).

Dolomite, medium crystalline, light to medium grey, trace of glauconite and pyrite, tight and vuggy horizons alternating, some vague "ghost" textures present. Viscous tar or asphalt with occasional small oil drops occur throughout, however, a particularly large quantity occurs from 790 to 800 feet. The asphalt is non-fluorescent whereas the minute specks of thick oil gives a very faint, straw coloured fluorescence. No gas was recorded.

UNIT-D -

995 to 1093 Quartzite.
1093 to 1159 Dolomite (see remarks below).
1159 to 1315 Sandstone and quartzite
(Total 320 feet).

Lithology:

Quartzite, ferruginous, light reddish-brown, very hard, trace of glauconite, specks of white, clayey material apparently filling intergranular spaces, pyrite and marcasite (the latter occur in dodecahedrons (?) and not as simple cubes) as disseminations and fracture fillings, mineralisation of a white, kaolinitic (?) and a greenish, chloritic (?) substance in combination with marcasite occurs, especially in fractures at 1026 to 1027 feet (= hydro-thermal alteration ??).

Dolomite, medium crystalline, light grey to buff-brown, vuggy porosity with specks of asphalt, occasional "ghost" textures, trace of glauconite. (In all respects this dolomite appears to be similar to the one just above the quartzite, (see remarks below).

Sandstone, ferruginous, dark red-brown, medium to coarse grained, medium sorted, mostly angular, iron oxide forms the matrix and therefore less quartz-cement is present; occasional layers of hard quartzite.

Reasons for distinguishing units:

The basis for the above division is based wholly on the lithology. No palaeontological information was available.

According to the published information available the uppermost dolomite (Unit-A) is the Camooweal Dolomite. The diagrammatic section of Randal and Brown (1962) suggests that the limestone Unit-B may be the Ranken Limestone below which the Camooweal dolomite reoccurs as Unit-C.
IV. Geology (contd.)

Reasons for distinguishing units (contd.)

Dolomite beds in the Proterozoic are abundant and so the dolomite bed within the ferruginous sandstone has been included in Unit-D.

It seems certain that, based on the published geological information, the carbonate section above the quartzite is Cambrian. However, the age of the quartzite with its dolomite bed is not definitely established, but it is most probably Proterozoic.

(5) Structure.

The well was situated on the crest of the Lake Nash Anticline which, according to aerial photographic interpretations, is approximately 8 miles east-west and 4 miles north-south.

(6) Relevance to occurrence of petroleum.

The only hydrocarbon encountered was viscous tar or asphaltic material with occasional specks of viscous oil (see photograph in appendix). Only the oil showed slight, straw coloured fluorescence. No gas was recorded.

The occurrence of the asphaltic and slightly oily material just below the limestone is not coincidental. It would seem that within the whole section penetrated the only good cap rock is the tight, marly limestone. Any hydrocarbons, either passing through or which previously had accumulated in the porous dolomite above this limestone, were not able to remain in situ and must have escaped for want of a cap rock.

(7) Porosity and permeability of sediments penetrated.

No accurate determinations were made. Most of the dolomite has good to excellent vuggy porosity and may have some intercrystalline porosity. The visible permeability appears to be fairly low. Some horizons of the dolomites appear to be tight. The argillaceous finely crystalline limestone and the quartzite are tight (see photographs of porosity in appendix). Porosity and permeability determinations on the vuggy dolomite could not be carried out with the equipment available.

(8) Contribution to geological concepts.

The genesis of the dolomite appears to be by diageneric to epigenetic replacement of limestone. The evidence is as follows:

(i) Fragments of "Calcite - Sparite - Dolomarenite" and of other dolomitised fragmental or detrital carbonates.

(ii) Presence of dolomitised fossil fragments.

(iii) Occurrence of all stages or gradations from well preserved syngenetic sedimentary textures (as those mentioned in (i) through vague "ghost" textures to completely destroyed textures.

(iv) Predominance of large geode-like vugs or cavities in the dolomite - never characteristic of primary dolomite.
IV. Geology (contd.)

(8) Contribution to geological concepts (contd.)

(v) Medium to coarsely crystalline dolomite predominates suggesting that the mineral is of secondary origin.

(vi) Complete absence of laminations, bedding planes or any depositional structures.

Fragmental carbonates are often porous and permeable and solutions responsible for dolomitization can pass through the whole rock.

This is not possible in case of the tight, impenetrable, argillaceous calcilutite limestone and consequently remains unaffected.

This may be the reason why the argillaceous limestone bed had not been replaced to form a dolomite.

This interpretation is very significant in stratigraphic work as it seems self evident that the limestone indicates a slight change of environment from the deposition of oolites to argillaceous calcilutite. Both types can accumulate in shallow water - one under turbulent, the other under quieter conditions. Therefore, the mere lithologic change from dolomite to limestone need not indicate an unconformity - the whole carbonate section may be of similar age (unless palaeontological studies prove otherwise).

V. References.


VI. Enclosures.

(1) Locality Map (frontispiece).

(2) Map Showing Relation to Regional Geology. (Opp. page 5).


(4) Stratigraphic Column. (Opp. page 8).

(5) Composite Log (Back of report).

(6) Logs - Guard Log

- Run 1, Scale 50' = 1".
- Run 1, Scale 20' = 1".

- Radioactivity Log

- Run 1, Scale 50' = 1".
- Run 1, Scale 20' = 1".
APPENDICES.

APPENDIX 1. - Petrological Reports.

(a) Petrographic report on specimens from Amalgamated Petroleum Lake Nash No.1 well (Northern Territory) by S. M. Tucker, Geological Survey of Queensland, 2/1/63.

(b) Petrographic report on core samples from A.P. Lake Nash No.1, by J. M. Rhodes, Bureau of Mineral Resources, 10/1/63.

APPENDIX 2. - Palaeontological Reports.

There were no palaeontological examinations carried out.

APPENDIX 3. - Gas and Water Analyses.

There were no gas or water analyses carried out.

APPENDIX 4. - Core Descriptions and Analyses.

(a) Core descriptions, by K. L. Wolf on behalf of Amalgamated Petroleum N.L.

(b) Mud and cuttings analyses for Amalgamated Petroleum N.L. Lake Nash No.1 by Core Laboratories Australia Ltd., 7/1/63.

APPENDIX 5. - List and Interpretation of Electric and Other Logs.

Logs - Guard Log  Run 1, Scale 50' = 1".
Run 1, Scale 20' = 1".

Radioactivity Log  Run 1, Scale 50' = 1".
Run 1, Scale 20' = 1".

APPENDIX 6. - Testing Reports.

No testing was carried out.

APPENDIX 7. - Photos on Cores from Lake Nash No.1.
APPENDIX 1.

Petrological Reports.

(a) Petrographic report on specimens from Amalgamated Petroleum Lake Nest No.1 well (Northern Territory), by R.M. Tucker, Geological Survey of Queensland, 2/1/63.

**DEPTH**: 1013 1/2 feet.


**MICRO**: Fine grained, clastic sedimentary rock, composed essentially of quartz, with minor chert and low grade metamorphic rock fragments. The rock has been strongly cemented by overgrowths of quartz on the original clastic grains.

- **Crystal Fragments**: Quartz, up to 0.5 mm. Usually strained, and "dusty" with inclusions. Overgrowths almost invariably present. 95%.

- **Lithic Fragments**: Chert or quartzite, and quartz-biotite schist. 5%.

The original sedimentary grains were of moderate sphericity and roundness, with porosity up to 5%.

**NAME**: Cemented, medium grained, quartz sandstone.

**DEPTH**: 1022 feet.

The material is identical in all respects to the material from 1013 1/2 feet.

The complete filling of pore spaces, and the presence of pyrite in joints would indicate that the rocks are not favourable as reservoir-rocks for petroleum.
(b) Petrographic report on core samples from A.P. Lake
Nash No.1, by J.N. Rhodes, Bureau of Mineral Resources,
10/1/63.

Several pieces of core were submitted for petrographic exami-
nation by K.A. Wolf of Amalgamated Petroleum N.L. on the 24th December.
The sample was obtained from the Lake Nash No.1 well, Queensland, at a
depth of 1012 - 1027 feet.

The purpose of the examination was to determine if the rock
has been subjected to metamorphism or hydrothermal alteration, and whether
it may form part of the local basement.

Petrography.

Fine to coarse grained, unsorted, silicified, quartz sand-
stone, with rounded to subangular grains ranging from about 0.1 to 0.6 mm.
in diameter. The rock consists predominantly of quartz grains, with some
siltstone fragments, kaolin, pyrite, sericite and hydrated iron oxide.

Thin, straight veins of a sulphide mineral, identified by
W.M.B. Roberts as pyrite, kaolin and fine grained siliceous material fill
fractures in the rock.

Quartz - rounded to subangular grains, 0.1 to 0.6 mm. in diameter,
forming about 80-90% of the rock. Most grains are surrounded and cemented
by well developed secondary silica rims in optical continuity with the
grain. This silica cement is responsible for the hardness of the rock,
the fracturing across grains, and the recrystallised appearance in hand
specimen. Strain effects and recrystallisation textures other than those
present in the grains prior to sedimentation are lacking.

Siltstone Fragments - rounded fragments of very fine grained siltstone
composed of kaolin and sericite. Many of these siltstone fragments contain
abundant small euhedral pyrite crystals, and accumulation of pyrite.

Kaolin - occurs both in the siltstone fragments and in irregular, disso-
cinated patches between quartz grains. The irregular patches may have formed
from the weathering of either siltstone fragments or feldspar grains.

Sericite - occurs mostly within the siltstone fragments, but a few small
flakes occur between quartz grains.

Pyrite - the bulk of the disseminated pyrite in the rock occurs as small
euhedral grains and accumulations within the siltstone fragments. Pyrite
grains not included in siltstone fragments have probably been derived from
the siltstone during sedimentation.

Hydrated iron oxide - occurs as thin seams around some of the grains and
is probably formed by oxidation of pyrite.

Conclusions - The rock is a silicified quartz sandstone. There is no text-
ural evidence of strain or recrystallisation due to either regional or
thermal metamorphism. Formation of secondary silica rims around detrital
grains is usually indicative of ground water circulation.

Kaolin is indicative of hydrothermal activity, very low grade metamorphism
or diag enesis. In this case the kaolin appears to have formed diagnostically
from siltstone fragments and to have been redistributed throughout the
rock, notably along fractures by solution, during silicification.

The bulk of the disseminated pyrite in the rock occurs within the siltstone
fragments and is therefore unlikely to be of hydrothermal origin. The
pyrite found along fractures, together with kaolin has probably formed by
redistribution of pyrite within the rock during silicification.

The rock has not been metamorphosed or hydrothermally altered, but whether
it forms part of the basement in the area, must be evaluated in light of
the knowledge of local stratigraphy.
APPENDIX 2.

Palaeontological Reports.

There were no palaeontological examinations carried out.

APPENDIX 3.

Gas and Water Analyses.

There were no gas or water analyses carried out.

APPENDIX 4.

Core Descriptions and Analyses.

(a) Core descriptions, by K.H. Wolf on behalf of Amalgamated Petroleum N.L.

CORE No.1.

Interval: 298 to 308 feet.
Recovery: 100%.

Dolomite, medium crystalline, good (approx. 5 - 10%), vuggy porosity, occasional band with excellent (up to 30%) vuggy porosity, especially from 299 to 302 feet, some horizons appear to be fairly tight. The vugs are lined by euhedral dolomite crystals giving rise to geode-like cavities. In most cases, the vugs are concentrated along certain horizons and are usually elongate horizontally. Their size ranges from microscopic dimension to 40 - 50 mm, with an average size of approximately 5 - 10 mm. The vugs are stained yellowish-brown. Occasional stylolites are present.

Oil and/or gas signs: None.

CORE No.2.

Interval: 586 to 596 feet.
Recovery: 100%.

Micro: (from spot samples).

At 586 feet: Very argillaceous, finely crystalline limestone, medium dark grey, slightly micaceous, irregular and plate-like patches of pyrite, medium grey patches within darker grey "matrix", some patches resemble tubular "worm burrows" (?).

At 588 feet: As above; the pyrite frequently forms a rim around a round patch of sparite (replaced fossil ?).

At 589 feet: Finely crystalline limestone, light - medium buff-brown, trace of thin skeletal shell fragments, trace of pyrite which occurs as patches rather than disseminated, trace of argillaceous material; more finely crystalline than above; occasional patches of sparite. The rock is
CORE No.2 (contd.)

sometimes mottled due to irregular patches of medium brown components within light buff-brown "matrix".

At 589½ and 590 feet: As above.

At 592½ feet: Calcilutite limestone, with patches of sparite filling geode-like cavities which have euhedral calcite crystals radiating to the centre of the cavity; trace of pyrite. The calcite is cryptocrystalline; there is no sign of recrystallisation (as seen under X10 power).

At 594½ feet: Identical to rock described at 589 feet.

Oil and/or gas signs: None.

CORE No.3.

Interval: 801 to 811 feet.
Recovery: 100%.

Medium crystalline dolomite, poor vuggy porosity which increases locally to good or excellent porosity. Vugs are from a fraction of an mm. to 40 mm. in some instances. Only from 809 to 810 feet are the vugs filled with the asphaltic component; trace of glauconite; stylolitic in places; trace of pyrite. The vugs are lined with euhedral dolomite crystals — occasional vertical fracture show the same lining. Some vugs "ghost" textures can be seen at about 804 feet. The tar did not fluoresce or cut despite containing drops of fairly fluid oily material. The tar was mainly solid to very viscous.

NOTE: No drill stem test was thought to be necessary because there were no hydrocarbons of a higher A.P.I. and the porosity and permeability was rather low. Also, in general, it is well known that no commercial hydrocarbons are associated with viscous or "dead" asphalt. However, their possible environmental significance is discussed elsewhere in this report.

CORE No.4.

Interval: 1012 to 1027 feet.
Recovery: 100%.

Quartzite, ferruginous, light salmon pink to reddish-brown, slightly argillaceous, very finely cemented; white specks well disseminated throughout the rock — their nature is not recognisable; a fair percentage of green specks occur as disseminations as well as fracture fillings — these resemble glauconite or chlorite. The rock is thinly bedded or laminated — usually horizontal with slight local dips of 5° - 10° (cross bedding ?). Disseminated pyrite or marcasite occurs as well as fracture filling marcasite. The latter porous euhedral crystals up to 3 mm. in diameter and they are not simple cubes so characteristic of pyrite, but are, it seems, a modification of the cubic system-dodecahedron (?). The fracture fillings occur especially from about 1026 feet onwards. With the marcasite there is also a large amount of soft, white, clayey material that may be kaolin and a very light green crystalline to amorphous unidentifiable (under X10 power) mineral (chlorite ?, zeolite ?, fluorite ?, copper mineral ?).
A Core Laboratories Australia combination drill cuttings and gas detection unit was present at the site of the subject well during drilling operations from 870 feet to the total depth of 1315 feet. Using standard equipment, the drilling fluid was monitored continuously for hydrocarbon content and the lagged drill cuttings were checked at regular intervals for gas and oil content and lithology. Unlagged cuttings samples from the first 870 feet were also described and recorded. The results of this operation are shown on the accompanying Grapholog.

Hydrocarbon Shows:

No live oil fluorescence was noted in any cuttings from this well.

Heavy asphalt was logged from 790 to 910 feet being especially prominent at 790 feet. Asphalt was also noted in Core No.3 from 809 to 810 feet and in the cuttings from 1093 to 1159 feet. All asphalt appeared to be in vuggy dolomite. No gas was detected in the section logged.

Cores:

Four cores were cut during the drilling of this well; their detailed descriptions follow:

<table>
<thead>
<tr>
<th>CORE NO.</th>
<th>DEPTH feet</th>
<th>RECOCIRED foot</th>
<th>LITHOLOGICAL DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>298-308</td>
<td>10.0</td>
<td>DOLOMITE, light, grey, crystalline, with good vuggy porosity. Some portions are devoid of porosity. Vugs filled with euhedral dolomite crystals.</td>
</tr>
<tr>
<td></td>
<td>98.0-99.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>99.5-02.0</td>
<td></td>
<td>DOLOMITE, as above with 10 to 30% vuggy porosity.</td>
</tr>
<tr>
<td></td>
<td>02.0-08.0</td>
<td></td>
<td>DOLOMITE, as in 98.0 to 99.5.</td>
</tr>
<tr>
<td>2</td>
<td>586-596</td>
<td>10.0</td>
<td>LIMESTONE, medium to dark grey, finely crystalline, argillaceous, micaceous, with irregular and elongated pyrite patches. Medium grey, irregular limestone patches are present in the darker coloured limestone matrix. Stylolites are present.</td>
</tr>
<tr>
<td></td>
<td>86.0-89.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>89.0-92.5</td>
<td></td>
<td>LIMESTONE, light to medium buff-brown, finely crystalline with trace of pyrite which occurs in patches rather than disseminated. Some medium brown irregular patches which occur within the predominantly light buff-brown &quot;matrix&quot;. Stylolites are present, trace of argillaceous material noted.</td>
</tr>
<tr>
<td>3</td>
<td>92.5-94.0</td>
<td></td>
<td>LIMESTONE, as above, but argillaceous. Stylolites are present.</td>
</tr>
<tr>
<td></td>
<td>94.0-96.0</td>
<td></td>
<td>LIMESTONE, light to medium buff-brown and finely crystalline.</td>
</tr>
</tbody>
</table>
### APPENDIX 4 (contd.)

<table>
<thead>
<tr>
<th>CORE NO.</th>
<th>DEPTH feet</th>
<th>RECOVERED feet</th>
<th>LITHOLOGICAL DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>801 - 811</td>
<td>10.0</td>
<td>DOLOMITE, grey to buff, medium crystalline with good to excellent porosity. Vugs from less than 1 mm to 40 mm locally. Occasional specks of glauconite. Locally stylolitic. Trace of pyrite in occasional disseminated patches. DOLOMITE, as above with asphalt filled vugs. DOLOMITE, as per 801-09.</td>
</tr>
<tr>
<td></td>
<td>01.0-09.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>09.0-10.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>10.0-11.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>1012 -1027</td>
<td>15</td>
<td>QUARTZITE, light pink to brown, well cemented, very hard, thinly bedded or laminated, horizontal with occasional slight dip of 0 to 4 degrees. Associated kaolin-like mineral in interstices and light green, crystalline to amorphous unidentified mineral. QUARTZITE, as above with fracture filled marcasite.</td>
</tr>
<tr>
<td></td>
<td>12.0-26.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>26.0-27.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX 5.
List and Interpretation of Electric and Other Logs.

Logs - Guard Log       Run 1, Scale 50' = 1".
                     Run 1, Scale 20' = 1".

Radioactivity Log  Run 1, Scale 50' = 1".
                     Run 1, Scale 20' = 1".

APPENDIX 6.
Testing Reports.

No testing was carried out.
APPENDIX 7.
Photos of Cores from Lake Nash No.1.

808 - 809 ft.
Dense and vuggy dolomite, vugs are partly filled with tar and viscous oil.

At 807 ft.
Geode-like vugs in dolomite; with subhedral dolomite crystal lining approx. 1" in diameter.

305 - 306 ft.
Vuggy dolomite.

591 - 592 ft.
Tight, argillaceous limestone with irregular patches of somewhat purer limestone (shallow water deposit?).
APPENDIX 7 (contd.)

305 - 306 ft.
Vuggy dolomite, vugs partly filled with drilling mud.

809 ft.
Dolomite, vugs filled with tar and viscous oil.

592 - 593 ft.
Dense, argillaceous and pure limestone interbedded and in contact along stylolites.

1026 - 1027 ft.
Quartzite, mineralized by marcasite, kaolin (?) and chlorite (?).