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MOBIL-SUTTONS JOINT VENTURE

EXPLORATION LICENCES 2762 AND 2763
CHILLING CREEK

FINAL REPORT

TO

THE NORTHERN TERRITORY
DEPARTMENT OF MINES AND ENERGY

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P.J. O'Shea
July, 1982
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SUMMARY

Prior to the granting of EL's 2762 and 2763 on February 17, 1981 to the Suttons Group, the licence areas were part of EL 1597 also held by the Suttons Group since 1977.

Mobil Energy Minerals Australia Inc. (MEMA), in a joint venture with Suttons, has been operator in the area since 1979.

Exploration by MEMA in 1979 and 1980 consisted of regional geological mapping, an airborne radiometric/magnetic survey and a regional stream sediment geochemical survey. A follow-up programme of geological mapping and geochemical sampling was completed over the licences during 1981. The sampling failed to substantiate uranium anomaly U6B and base metal anomaly area BM2 identified during the 1980 geochemical survey.

A gravel sampling programme over the area failed to locate any indicator minerals indicative of kimberlite/diamonds, but two stream sediment samples collected during this programme gave anomalous arsenic and strontium values which may be derived from vein type mineralisation related to non-outcropping Allia Creek/Soldiers Creek type granites emplaced along the Giants Reef Fault zone.

A photogeological study carried out over the Licence areas indicated a possible correlation between the graphitic schist/spilitic volcanic sequence at Buffalo Fly in adjacent EL 1597, and the Berinka Volcanics.

Results to date indicate that the potential for an economic uranium or base metal deposit in the licence areas is minimal, and consequently the licences have been relinquished.
1. INTRODUCTION

Exploration Licences 2762 and 2763 were granted to the Suttons Group on February 17, 1981. The Licences cover areas relinquished from EL 1597 (Chilling Creek), also held by the Suttons Group (Fig. 1). Mobil Energy Minerals Australia Inc. (MEMA), in a joint venture agreement with Suttons, has been operator in the area since 1979.

Prior to granting of EL's 2762 and 2763, exploration by MEMA in the area (as part of EL 1597) consisted of regional geological mapping, an airborne radiometric/magnetic survey and a regional stream sediment geochemical survey.

Exploration has been aimed at defining economic uranium deposits and any associated metals.

This report summarises work carried out on EL's 2762 and 2763 since MEMA first began operating in the area in 1979. Work in the area, since granting EL's 2762 and 2763 in February 1981, has consisted of geological mapping, photogeological interpretation, stream sediment sampling and analysis of stream gravel samples. As part of a larger study of the West Pine Creek area as a whole, compilation of all open file and published geological, and geochemical data relating to the Licence areas was completed.
2. PROPERTY

Exploration Licence 1597 (Chilling Creek) was first granted on August 8, 1977 to Autopool Pty. Ltd., a member of the Suttons Group of Companies. Suttons subsequently entered into a joint venture agreement with MEMA on August 25, 1978.

Exploration Licence 2762 and 2763 were applied for to cover areas relinquished from EL 1597 in August, 1980, and were granted to the Suttons Group on February 17, 1981. EL 2762 covers an area of 46.45 square kilometres and EL 2763 an area of 16.58 square kilometres (see Fig. 1).

3. LOCATION AND ACCESS

The Licence areas are located on the Moyle and Wingate Mountains 1:100,000 map sheets. EL 2763 lies between longitudes 130°25' E and 130°35' E and latitudes 14°10' S and 14°12' S, and EL 2762 lies between longitudes 130°28' E and 130°31' E and latitudes 14°13' S and 14°15' S. They cover part of the southern plains of the Daly River basin and their abutment with the highly dissected northern margin of the Chilling Plateau which rises some 300 metres above the plains.

Access to the area, which lies approximately 200 km south of Darwin, is limited to 4 wheel drive vehicles in the dry season via the Daly River crossing and the Port Keats road.
4. GEOLOGY

The geology of the Licence areas is shown on Plate 1. The geological interpretation was derived from the work of contract structural geologist, Dr. B.W. Nisbet, and Monash University post-graduate student, R. Hammond, who carried out geological mapping in the area (Nisbet, 1981). A photogeological interpretation of the area was carried out as part of a regional photogeological interpretation of the West Pine Creek as a whole, and the results of this study are shown on Plate 2.

4.1 STRATIGRAPHY

4.1.1 Burrell Creek Formation

Metasediments belonging to the Lower Proterozoic Burrell Creek Formation crop out in the central part of EL 2763 in the Giants Reef Fault zone, and represent the oldest rocks in the Licence areas.

Lithologies include quartzite and quartz muscovite metaarenite with conglomerate horizons which form prominent ridges interlayered with phyllite. The coarser grained rocks are generally poorly sorted with angular to rounded grains. Abundant sedimentary structures indicate that the rocks are part of a turbidite sequence. The Burrell Creek Formation in this area has been subjected to a regional prograde metamorphism to lower greenschist facies.
4.1.2 Litchfield Granite

Litchfield Granite crops out in the western corner of EL 2763, and is a collective term previously used to describe a number of syntectonic granitoid intrusions produced by anatexis of the Lower Proterozoic Hermit Creek Metamorphics which crop out to the south of EL 2763 (see Plate 1).

The granite in this area is a coarse grained quartz porphyritic biotite granodiorite containing minor garnet, condierite and metasedimentary xenoliths. Occasional coarse quartz veins occur, but the contact zone generally lacks a pegmatitic phase although quartz-tourmaline veins have been noted near the contact with quartz muscovite schist to the south in EL 1597. The granitoid is generally unlayered but commonly possesses a weak to strong cleavage. To the east, the granitoid is unconformably overlain by Middle Proterozoic Berinka Volcanics and Chilling Sandstone.

4.1.3 Berinka Volcanics

The Middle Proterozoic Berinka Volcanics are predominantly porphyritic acid volcanics and appear to be interlayered with the Chilling Sandstone as flows and sills. The most commonly occurring lithology is a red-brown to green porphyritic rhyolite containing phenocrysts of feldspar and quartz up to a few millimetres in diameter in a fine-grained altered groundmass. Minor fine-grained purple to dark green shales are interlayered with the porphyries.
4.1.4 **Chilling Sandstone**

The Chilling Sandstone crops out in the eastern half of EL 2763 and throughout EL 2762. It is a clean quartz sandstone of fluviatile origin, commonly ripple-marked and cross-bedded. Rare quartz-pebble conglomerates and tuffaceous sandstones occur.

4.1.5 **Dolerite Sills**

A number of dolerite sills occur interlayered with well-sorted quartzites of the Chilling Sandstone in both Licences. Not all have been mapped and they are more extensive than has been shown (Nisbet, 1981). The rock is composed of altered plagioclase ophitically enclosing light green amphibole pseudomorphs after pyroxene.

4.1.6 **Ti-Tree Granophyre**

Massive medium grained granophyre (Ti-Tree Granophyre) containing up to 15% altered hornblende intrudes the Chilling Sandstone in EL 2763.

4.2 **STRUCTURE**

The earliest structural event affecting the Burrell Creek Formation produced a strong phyllitic cleavage in the pelitic rocks and moderate to weakly developed anastomosing foliation in the quartz-rich lithologies.
Bedding and S1 were subsequently folded into tight to isoclinal F2 folds having steeply dipping axial surfaces and weak or absent axial surface foliation.

Unlike the older rocks, those of the Carpentarian sequence are much less deformed. However, south plunging mesoscopic tight folds occur which have been correlated with the F2 generation folds in the Burrell Creek Formation.

Faulting is a very important aspect of the deformation in the area and a number of fault generations with differing displacements have been recognised. The most significant appears to have been the final episode which is characterised by right lateral displacement causing the Hermit Creek Metamorphics to move up and to the north east relative to the Burrell Creek Formation. Displacement is considered to have been large. Faults are generally manifest as zones of quartz breccia up to 30 m thick with associated abundant recrystallisation of quartz and quartz veining.

Deformation associated with the faults is extensive and can consist of drag folds or mesoscopic kinks as well as chevron folds or be reflected by development of foliation in zones up to one kilometre wide adjacent to the fault.

Faulting post-dates the penetrative deformation in the Hermit Creek Metamorphics, F1 and F2 folding in the Burrell Creek Formation and F2 folding in the Chilling sequence.
5. EXPLORATION PROGRAMME - 1977 TO 1980

Exploration carried out over the Licence areas prior to 1981, when they constituted part of EL 1597, has been directed towards the discovery of economic uranium deposits.

In 1977, an airborne geophysical survey was flown on behalf of Autopool Pty. Ltd. Flight lines were spaced at 1 km intervals, technical control was poor, and interpretation indicated that the survey could not provide a reliable data base for uranium exploration.

Following Mobil's entry as a joint venture partner, a detailed airborne radiometric/magnetic survey was flown on 250 metre line spacing by Scintrex in 1979. Interpretation delineated 24 anomalies considered to warrant ground inspection, and subsequent computer processing of digital data yielded a further 6 low-order uranium anomalies. No uranium mineralisation was located on follow-up, but several minor superficial uranium occurrences were noted.

During 1980, a regional stream sediment geochemical survey was conducted along the western margins of the Chilling Plateau to check for uranium mineralisation possibly masked from the airborne geophysical surveys by the rugged terrain of the Giants Reef Fault zone.

The stream sediment survey was completed in June, 1980 and resulted in the identification of one uranium and one base metal anomaly in the area presently covered by EL 2763 (see Fig. 2).
6. EXPLORATION PROGRAMME - 1981 TO 1982

6.1 GEOCHEMISTRY

Following the 1980 regional stream sediment geochemical survey and subsequent follow-up work, doubt was cast on the validity of some analytical results. As a result, a check sampling programme was carried out during July 1981, and eleven stream sediment samples were collected in EL 2763 (see Figure 2).

Original (1980) sites were resampled wherever possible. When permatag or flagging were not located, sites were identified from aerial photographs.

The survey parameters are listed below:

(a) Samples were sieved to minus 200 mesh in the field: approximately one kg of sample yielded 2-5 gm of minus 200 mesh material.

(b) 10% of the samples collected were duplicated (identical splits) and submitted at the same time as a check on analytical methods.

(c) Samples were analysed by Pilbara Laboratories for:

\[
\begin{aligned}
&\text{Cu, Pb, Zn, Mo, Ni} \quad \text{by AAS} \\
&\text{U} \quad \text{by fluorimetry} \\
&\text{Fe} \quad \text{by AAS (for selected samples)}
\end{aligned}
\]
Figure 2

MOBIL ENERGY MINERALS AUSTRALIA
PROJECT
SUTTONS PROJECT
CHILLING CREEK
(ELs 2762 & 2763)
REGIONAL STREAM SEDIMENT SURVEY
LOCATION OF ANOMALIES

SCALE 1:250,000

BM2 ANOMALY AREA
AREA OF SURVEY
E.L. BOUNDARY

SCALE 1:250,000

P:\gb savings\gb global\gb mining\gb project documents\gb data\gb images\gb survey images
The check survey did not substantiate the base metal anomaly (BM2) found by the 1980 survey. Laboratory analytical results are shown in Table 1.

**TABLE 1.**

<table>
<thead>
<tr>
<th>Sample</th>
<th>Cu</th>
<th>Pb</th>
<th>Zn</th>
<th>Mo</th>
<th>Ni</th>
<th>U</th>
<th>Fe %</th>
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<td>8031</td>
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<td>11</td>
<td>5</td>
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<td>1.29</td>
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<tr>
<td>8032</td>
<td>10</td>
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<td>8033</td>
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<td>2</td>
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<td>3.25</td>
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<td>5</td>
<td>12</td>
<td>2</td>
<td>3.51</td>
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Uranium anomaly U6B, detected as a single point stream sediment anomaly (sample 3428 - 8 ppm U) in the 1980 survey, was tested in October, 1981 by stream sediment sampling and scintillometer traversing.
The 1980 anomalous value is located in a relatively flat terrain of extensive soil development over granitic rock similar in composition to the Buffalo Fly Hill granodiorite which crops out to the south in EL 1597. The soil cover is in places broken by an occasional granite outcrop. The anomaly area is a topographic depression which is fed by a broad stream. Vegetation is confined to Pandanus palms with the development of black to brown soils.

The 1981 follow-up work was aimed at substantiating the anomalous value and to observe whether there were any extensions to the anomalism. The original 8 ppm U was not substantiated (see Table 2) and further sampling also returned low values (3–4 ppm). The area has been interpreted as exhibiting minor retention of U associated with the localised humus development.

**TABLE 2.**

<table>
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<tr>
<th>Sample</th>
<th>U (ppm)</th>
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<td>G1057</td>
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<tr>
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<td>3</td>
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<td>G1059</td>
<td>4</td>
</tr>
<tr>
<td>G1060</td>
<td>3</td>
</tr>
</tbody>
</table>

As part of a joint venture between Mobil, Suttons and Gem Exploration, a number of bulk gravel samples and stream sediment samples were collected in EL's 2762 and 2763 (see Fig. 3)
The gravel samples were processed to provide a non-magnetic heavy mineral concentrate for binocular microscope scanning and identification of anomalous mineral grains.

The geochemical samples, of -80 mesh material, were analysed by AAS for Cu, Pb, Zn, Co, Ni, Cr, Ag, Au and by XRF for Nb, La, Sr, Ta, As, W, Sn, U. Results are tabulated in MEMA Tech. Record 3.3965.1.043 (O'Shea, 1982).

In EL 2762 21 ppm As was recorded from stream sediment sample no. 11 and 113 ppm Sr from stream sediment sample no. 12. These values may be derived from vein type (pegmatite or quartz) mineralisation related to non-outcropping Allia Creek/Soldiers Creek type granites emplaced along the Giants Reek Fault zone. No indicator minerals indicative of kimberlites were noted in the gravel samples from this area.

6.2 PHOTOGEOLOGY

Results of the photogeological study carried out by Robertson Research Australia Pty. Ltd. over the Licence areas are depicted on Plate 2 and in Robertson Research Technical Report No. 901. The study indicates a possible correlation between the graphitic schist/spilitic volcanic sequence at the Buffalo Fly Prospect in adjacent EL 1597 and the Berinka Volcanics which crop out in EL 2763.

Nisbet correlates the Buffalo Fly sequence with the Hermit Creek Metamorphics - his mapping suggests that the Berinka Volcanics unconformably overlie this sequence.
6.3 REGIONAL STUDIES

In addition to the field work and photogeological interpretation carried out during the year, the area was subjected to an intense literature search/compilation of open file data phase as part of a regional study of the whole West Pine Creek Region. This study indicated that non-outcropping equivalents of the Allia Creek Granite to the east (a high radiometric background granite) may be present in the area and that the Giants Reef Fault could act as a pathway and/or a structural trap for uranium and base metal rich hydrothermal fluids.

As part of a regional granite sampling programme in the West Pine Creek area carried out by the C.S.I.R.O. on behalf of Mobil, a number of samples were collected from the Litchfield Granite 5 km to the west of the Licences and also 15 km to the north-east. These samples were collected in order to determine the fertility of the Litchfield Granite as a uranium source rock in the general area - results of zircon analyses from the samples indicate that the Litchfield Granite is not prospective as a uranium source rock.

7. CONCLUSIONS

The results of airborne geophysical surveys conducted over the Licence areas, together with the geochemical sampling carried out in 1980 and 1981, has downgraded the uranium and base metal potential of the Licence areas.
Regional geological studies indicate that there remains some potential in the area of the Giants Reef Fault zone for replacement uranium and base metal deposits, and that the Berinka Volcanics could host a syngenic base metal deposit.

Recent assessment of exploration conducted over these Licence areas indicates that the potential for a uranium or base metal deposit considered to be economic by MEMA is minimal, and consequently the licences have been relinquished.

8. REFERENCES


COTTON, R.E. AND HILL, K.G.

**Mobil Energy Minerals Australia Inc.**

(INCORPORATED IN DELAWARE, U.S.A.; LIMITED LIABILITY)

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**STATEMENT OF EXPENDITURE FOR PERIOD**

**FEBRUARY 17, 1981 TO JULY 8, 1982**

**EXPLORATION LICENCE 2762 NT - CHILLING CREEK NO.3**

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<th>Description</th>
<th>Amount</th>
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H.G. Milton  
*Accounting Manager*
Mobil Energy Minerals Australia Inc.

STATEMENT OF EXPENDITURE FOR PERIOD
FEBRUARY 17, 1981 TO JULY 8, 1982
EXPLORATION LICENCE 2763 NT - CHILLING CREEK NO.2

Professional Fees of Geologists and Consultants 11,833.14
Travel and Accommodation 2,371.66
Freight 607.91
Field Supplies 336.42
Equipment and Facilities 94.13
Hire of Field Equipment 85.79
Hire of Motor Vehicles 678.44
Vehicle Operations 347.28
Ground Surveys 895.29
Air Photographs/Photogeological Study 587.46
Laboratory Services 632.43
Other Contract Services 953.52
Maintenance and Repairs 30.93
Motor Registration 5.04
Direct Overheads 713.15

20,172.59

Head Office Overheads at 15% of Total Direct Costs 3,025.89
$ 23,198.48

H.G. Milton
Accounting Manager