OPEN FILE

A.O. (Australia) Pty. Ltd.,
131 Elizabeth Street,
BRISBANE.

July, 1980
# CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.00</td>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>2.00</td>
<td>TENURE AND JOINT VENTURE AGREEMENTS</td>
<td>2</td>
</tr>
<tr>
<td>2.10</td>
<td>Title</td>
<td>2</td>
</tr>
<tr>
<td>2.20</td>
<td>Bauhinia Joint Venture</td>
<td>2</td>
</tr>
<tr>
<td>3.00</td>
<td>GEOGRAPHY</td>
<td>4</td>
</tr>
<tr>
<td>3.10</td>
<td>Location and Access</td>
<td>4</td>
</tr>
<tr>
<td>3.20</td>
<td>Physiography</td>
<td>4</td>
</tr>
<tr>
<td>4.00</td>
<td>REGIONAL GEOLOGY</td>
<td>6</td>
</tr>
<tr>
<td>5.00</td>
<td>PREVIOUS EXPLORATION</td>
<td>9</td>
</tr>
<tr>
<td>5.10</td>
<td>C.R.A. Exploration Pty. Ltd.</td>
<td>9</td>
</tr>
<tr>
<td>5.20</td>
<td>Carpentaria Exploration Co. Pty. Ltd.</td>
<td>10</td>
</tr>
<tr>
<td>6.00</td>
<td>POTENTIAL FOR STRATABOUND COPPER IN THE MCArTHUR BASIN</td>
<td>12</td>
</tr>
<tr>
<td>6.10</td>
<td>Introduction</td>
<td>12</td>
</tr>
<tr>
<td>6.20</td>
<td>Characteristics of Stratabound Sedimentary Copper Deposits</td>
<td>12</td>
</tr>
<tr>
<td>6.21</td>
<td>Regional Geological Parameters</td>
<td>12</td>
</tr>
<tr>
<td>6.22</td>
<td>Local Geological Parameters</td>
<td>13</td>
</tr>
<tr>
<td>6.23</td>
<td>Chemical and Mineralogical Parameters</td>
<td>13</td>
</tr>
<tr>
<td>6.24</td>
<td>Environmental Parameters</td>
<td>14</td>
</tr>
<tr>
<td>6.30</td>
<td>McArthur Basin Succession</td>
<td>14</td>
</tr>
<tr>
<td>6.31</td>
<td>Regional Setting</td>
<td>14</td>
</tr>
<tr>
<td>6.32</td>
<td>Stratigraphy and Geochronology</td>
<td>15</td>
</tr>
<tr>
<td>6.33</td>
<td>Known Copper Mineralization</td>
<td>15</td>
</tr>
<tr>
<td>6.40</td>
<td>The Potential of McArthur Basin Strata</td>
<td>16</td>
</tr>
<tr>
<td>6.41</td>
<td>General</td>
<td>16</td>
</tr>
<tr>
<td>6.42</td>
<td>Application of Selection Criteria</td>
<td>16</td>
</tr>
<tr>
<td>6.421</td>
<td>Tawallah Group</td>
<td>16</td>
</tr>
<tr>
<td>6.422</td>
<td>Umbolooga Sub-Group</td>
<td>16</td>
</tr>
<tr>
<td>6.423</td>
<td>Batten Sub-Group and Equivalents</td>
<td>18</td>
</tr>
<tr>
<td>6.424</td>
<td>&quot;Upper&quot; McArthur Group</td>
<td>18</td>
</tr>
<tr>
<td>6.425</td>
<td>Roper Group</td>
<td>19</td>
</tr>
<tr>
<td>6.50</td>
<td>Conclusions</td>
<td>19</td>
</tr>
<tr>
<td>Time</td>
<td>Section</td>
<td>Page</td>
</tr>
<tr>
<td>-------</td>
<td>----------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>7.00</td>
<td>MAPPING</td>
<td>20</td>
</tr>
<tr>
<td>7.10</td>
<td>Introduction</td>
<td>20</td>
</tr>
<tr>
<td>7.20</td>
<td>Mara and Mitchell Yard Dolomites</td>
<td>20</td>
</tr>
<tr>
<td>7.30</td>
<td>Teena Formation</td>
<td>21</td>
</tr>
<tr>
<td>7.40</td>
<td>Barney Creek Formation</td>
<td>21</td>
</tr>
<tr>
<td>7.50</td>
<td>Reward Formation</td>
<td>23</td>
</tr>
<tr>
<td>7.60</td>
<td>Lynott Formation</td>
<td>24</td>
</tr>
<tr>
<td>7.70</td>
<td>Mount Birch Sandstone and Balbirini Dolomite</td>
<td>25</td>
</tr>
<tr>
<td>7.80</td>
<td>Roper Group</td>
<td>25</td>
</tr>
<tr>
<td>7.90</td>
<td>Geological Structure</td>
<td>25</td>
</tr>
<tr>
<td>8.00</td>
<td>GEOCHEMISTRY</td>
<td>27</td>
</tr>
<tr>
<td>9.00</td>
<td>I.P. SURVEY</td>
<td>29</td>
</tr>
<tr>
<td>9.10</td>
<td>Introduction</td>
<td>29</td>
</tr>
<tr>
<td>9.20</td>
<td>Results</td>
<td>29</td>
</tr>
<tr>
<td>10.00</td>
<td>GRAVITY SURVEY</td>
<td>31</td>
</tr>
<tr>
<td>10.10</td>
<td>Introduction</td>
<td>31</td>
</tr>
<tr>
<td>10.20</td>
<td>Survey Instrumentation</td>
<td>31</td>
</tr>
<tr>
<td>10.30</td>
<td>Results</td>
<td>32</td>
</tr>
<tr>
<td>11.00</td>
<td>CONCLUSION</td>
<td>33</td>
</tr>
</tbody>
</table>

REFERENCES
LIST OF PLANS

Plan 1: Geology and Sample Locations

Plan 2: Bauhinia Downs - Line 2N

Plan 3: I.P. Profile - Line 1S

Plan 4: I.P. Profile - Line 2N

Plan 5: I.P. Profile - Line 1N
LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure No.</th>
<th>Opposite Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Exploration Licence 1439</td>
</tr>
<tr>
<td>2</td>
<td>Location and Physiography</td>
</tr>
<tr>
<td>3</td>
<td>Major Tectonic Elements, McArthur River</td>
</tr>
<tr>
<td>4</td>
<td>Correlation Chart for Tawallah and McArthur Groups</td>
</tr>
<tr>
<td>5</td>
<td>Geology and I.P. Lines</td>
</tr>
<tr>
<td>6</td>
<td>Comparison of Stratigraphic Nomenclature</td>
</tr>
<tr>
<td>7</td>
<td>Bouguer Anomaly and Elevation Profiles</td>
</tr>
</tbody>
</table>

LIST OF TABLES

<table>
<thead>
<tr>
<th>Table No.</th>
<th>Opposite Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Summary of Stratigraphy McArthur River Basin</td>
</tr>
<tr>
<td>2</td>
<td>Selection Criteria for Determining Target Horizons</td>
</tr>
<tr>
<td>3</td>
<td>Rock Geochemistry E.L. 1439</td>
</tr>
</tbody>
</table>
ABSTRACT

During the period 7th November, 1977 to 31st April, 1980, the Bauhinia Joint Venture undertook a program of literature studies, reconnaissance mapping and concomitant geochemical rock chip sampling in addition to the implementation of geophysical surveys including I.P./resistivity and gravity. Some areas of geochemically anomalous Barney Creek Formation were defined but follow-up I.P. and gravity work failed to locate drilling targets.
1.00 INTRODUCTION

Exploration Licence 1439, located near Bauhinia Downs Homestead in the McArthur River region initially covered 48 square miles and was granted to A.O. (Australia) Pty. Ltd. on 7th November, 1977. The licence was reduced to 23 square miles in November, 1979, and surrendered on 22nd April, 1980. Exploration Licence 1439 was one of a number of licences subject of a Joint Venture Agreement known as the Bauhinia Joint Venture.

During the first year of tenure of the licence, a review of previous exploration, a literature study to assess strata-bound sedimentary copper potential, airphoto interpretation studies, reconnaissance mapping and geochemical sampling were undertaken. The program of regional mapping continued during the 1979 field season. In addition an induced polarization/resistivity survey was implemented and a gravity traverse completed over a possible basinal structure containing Barney Creek Formation.

The contents of this report detail the investigations undertaken and the expenditure incurred in E.L. 1439 during the period 7th November, 1977 to 21st April, 1980.

The report is submitted in compliance with section 38.0(1) of the Mining Act.
EXPLORATION LICENCE 1439

(16°00',135°25')

(16°00',135°30')

To Bauhinia Downs & Homestead - approx.
12 km.

(16°06',135°25')

(16°06',135°28')

(16°10',135°28')

(16°10',135°30')

BOUNDARY DURING PERIOD
7.11.77 - 6.11.79

BOUNDARY DURING PERIOD
7.11.79 - 21.04.80

SCALE: 1:100,000

FIGURE 1

BAUHINIA JOINT VENTURE

JULY, 1980
2.

2.00 TENURE AND JOINT VENTURE AGREEMENTS

2.10 Title

Exploration Licence 1439, covering an area of 48.22 square miles was initially granted to A.O. (Australia) Pty. Ltd. on 7th November, 1977 for a period of twelve months and renewed for a further twelve months in November, 1978. An outline of the area of the licence effective during the first two years of tenure is given in Figure 1 and the area fully described below:

Commencing at the intersection of latitude 16 degrees 00 minutes with longitude 135 degrees 25 minutes thence proceeding to the intersection of latitude 16 degrees 00 minutes with longitude 135 degrees 30 minutes thence proceeding to the intersection of latitude 16 degrees 10 minutes with longitude 135 degrees 30 minutes thence proceeding to the intersection of latitude 16 degrees 10 minutes with longitude 135 degrees 28 minutes thence proceeding to the intersection of latitude 16 degrees 06 minutes with longitude 135 degrees 28 minutes thence proceeding to the intersection of latitude 16 degrees 06 minutes with longitude 135 degrees 25 minutes thence proceeding to the intersection of latitude 16 degrees 00 minutes with longitude 135 degrees 25 minutes.

In accordance with the provisions of section 38B(11) of the Mining Act, the licence was reduced to 22.84 square miles following its second year term. An outline of the reduced area is given in Figure 1.

Exploration Licence 1439 was surrendered on the 22nd April, 1980.

2.20 Bauhinia Joint Venture

Exploration Licence 1439 is one of a number of licences in the McArthur River region which are the subject of the
3.

Bauhinia Joint Venture in which the following companies are participants:

A.O. (Australia) Pty. Ltd.
Electrolytic Zinc Company of Australia Ltd.
Penarroya (Australia) Pty. Ltd.
Preussag Australia Pty. Ltd.

The Joint Venture was formed in November 1976 with the aim of locating economic lead-zinc mineralization of the H.Y.C.-type within the McArthur River region. The Agreement was approved and registered under the Northern Territory Mining Ordinance on the 28th January, 1977 with A.O. (Australia) Pty. Ltd. as Manager. On 9th July, 1979, Shell Company of Australia Ltd. entered into an agreement with the four abovementioned companies by which it can earn a fifty percent interest in the Bauhinia Joint Venture.

During various stages, the Joint Venture has held and investigated in excess of 3,000 square miles. A wide range of techniques have been employed including -

1. INPUT Surveys
2. photogeological and ERTS studies
3. induced polarization/resistivity surveys
4. gravity surveys
5. ground magnetic traversing
6. diamond drilling
7. geological reconnaissance
8. detailed geological mapping
9. geochemical programs - rock and soil
10. literature reviews

To date a total of more than one million dollars had been expended by the Bauhinia Joint Venture on the McArthur River Project.
LOCATION AND PHYSIOGRAPHY

E.L. 1439

To Bauhinia Downs & Homestead - approx. 12 km.

PHYSIOGRAPHICAL SKETCH MAP BAUHINIA DOWNS 1:250,000 SHEET

APPROXIMATE POSITION OF E.L. 1439

FIGURE 2

BAUHINIA JOINT VENTURE

JULY, 1980
3.00 GEOGRAPHY

3.10 Location and Access

E.L. 1439 is located approximately 12 kilometres north of Bauhinia Downs Homestead. The licence occurs within the northeast corner of the Bauhinia Downs 1:100,000 topographic sheet and in the far north of the Bauhinia Downs 1:250,000 sheet.

Access to the licence is made by way of the Borroloola - Bauhinia Downs Homestead road passing south of the area. Vehicular tracks from the Bauhinia Downs Homestead enter the licence and continue in northerly directions toward Nathan River Homestead. In the vicinity of the intersection of the western track with Tawallah Creek an east-west vehicular track traverses the licence (refer to Figure 2).

3.20 Physiography

Topographically the licence occurs within a physiographic unit known as the Gulf Fall, the Fall being defined as the hill country surrounding the Gulf of Carpentaria in which the drainage is toward the Gulf. The region is predominantly a lowland area west of the Tawallah Range. The Range is one of a number of isolated ranges which occur within the area of the Bauhinia Downs sheet. Generally, however, land is undulating with low rounded hills up to fifteen metres high with occasional beds of Yalco Formation and parts of Lynott Formation forming strike ridges up to sixty metres in elevation. Ranges in the vicinity of the licence are composed of rocks of the Tawallah Group and consist of resistant sandstone ridges above steep-sided valleys formed by erosion of softer beds.
5.
The maximum elevation within the licence is of the order of one hundred and ten metres. Two prominent ridges occur west of the licence trending in a northwest-southeast direction. Further south in the vicinity of Bauhinia Downs Homestead the ridges trend north-south. A number of minor ridges occur within E.L. 1439, the most continuous of which trends north-north-east to south-south-west and passes through the centre of the western portion of the licence.

The Tawallah and Bauhinia Creeks flow through the licence area in a general northwest-southeast direction. The intersection of Tawallah and Mulholland Creeks occurs in the central eastern portion of the licence. Ridges throughout E.L. 1439 are drained by streams flowing into these creeks and perennial lakes occur within the vicinity. Forest and scrub are of medium density throughout E.L. 1439.

FIGURE 3

BAUHINIA JOINT VENTURE

JULY, 1980
4.00 REGIONAL GEOLOGY

Exploration Licence 1439 occurs within the McArthur River Basin. The Basin is the largest of several mid-Proterozoic mildly deformed platform covers which compose the North Australian Platform Cover and which unconformably overlie highly deformed basement complexes forming the North Australian Orogenic Province. The McArthur Basin lies near the eastern edge of the craton, adjacent to the penecontemporaneous mobile belt of the Mount Isa Orogen. Following cratonisation of the Mount Isa Orogen, it and the North Australian Platform Cover were unconformably overlain by Adelaidean and Palaeozoic basins belonging to the Central Australian Platform Cover.

The McArthur Basin is a relatively undeformed structure within which the Carpentarian Tawallah, McArthur and Roper Groups and their stratigraphic equivalents were deposited. The basin, containing up to 12,000 metres of Carpentarian sediments, is bounded by and unconformably overlies the Lower Proterozoic Pine Creek Inlier in the northwest, the Murphy Inlier in the southeast, and the Arnhem Inlier in the northeast (refer to Figure 3). In the north, south and east the basin extends beneath the unconformably overlying covers of the Palaeozoic Arafura Basin, the early Palaeozoic Georgina and Daly River Basins, and the Mesozoic Carpentaria Basin respectively.

In its present form the McArthur Basin is essentially a structural basin and the B.M.R. have indicated that broad trends in the basins succession would suggest basin margins
# SUMMARY OF STRATIGRAPHY
## McARTHUR BASIN

*(after Plumb & Derrick, 1975)*

<table>
<thead>
<tr>
<th>Unit and locality</th>
<th>Main rock types. Thickness in m</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dolerite sills</td>
<td></td>
<td>Intrude Roper, Mt Rigg, &amp; Malay Road Gyms</td>
</tr>
<tr>
<td><strong>ROPER GROUP</strong> (Throughout basin)</td>
<td></td>
<td>Pe (Roper P) in Sheering Ironstone Mbr of McMinn Fm. Overlies McArthur &amp; Mt Rigg Gyms with regional unconformity</td>
</tr>
<tr>
<td>Quarts sandstone, minor ferruginous sandstone, shale (Limmerin, Amber, Basset Cr Sills); micaceous silstones (McKellar Fm); micaceous glauconitic sandstones (Crawford Fm); interbedded micaceous fine sandstone, siltstone, &amp; shale (Coroner, Cobramino Fm, Mallow Sub-gp). 300-5 000</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>MALAY ROAD GROUP</strong> (Caledon Shelf)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quarts sandstone (Malloin, Asstell Sills); micaceous siltstone, quartz greywacke (Wigram, Pobabane Fms); black shale (Wigram Fm); glauconitic sandstone (Pobabane Fm). 1 550+</td>
<td></td>
<td>Unconformably overlies Wilberforce Beds. Correlated with Roper Gy</td>
</tr>
<tr>
<td>Dominantly carbonate rocks. 0-3 500</td>
<td></td>
<td>Locally unconformable on Roper Sub-Gp</td>
</tr>
<tr>
<td>Chert-quartz sandstone, conglomerate (Smoyne Silt); dolomite, siltstone, shale, chert on dolomites, doloulite, lenticular dolomites (Baillieu Dol). 1 250</td>
<td></td>
<td>Locally unconformable on Umboloosa Sub-Gp</td>
</tr>
<tr>
<td><strong>Batten Sub-Group</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dolomitic siltstone, sandstone, shale (Lyallton Fm); interlaminated siltstone-chert (Vallool Fm); quartz sandstone (Stretton Silt); chert, cherty siltstone (Looking Glass Fm). 1 000</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Billumgarrah Formation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chert, sandstone, dolomite, shale. 1 000</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Umboolagoa Sub-Group</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ferruginous &amp; dolomitic sandstone &amp; siltstone, dolomites (Mallapuyah Fm); dolomite, dololite, abundant siltstones (Amelia, Emmerunga, Tena, Reward Dol); flaggy sandstones (Tahalina Silt); alternated dolomites (stromatolites), dolomitic siltstone &amp; sandstone (Teggnindine Fm); dolomite, luteous, bluish, vesicular, &amp; pyritic shale (Barney Creek Fm). basic to intermediate volcanics (Teggnindine Dol). Up to 1 230</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Batten Trough-Blue Mud Bay area</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Siltstone, shale, dolomite (Koolango Silt); chert breccia (Strawbridge Breccia); black shale, dolomitic siltstone &amp; shale (Tuff) (Vaughn Dol); siliceous siltstone, chert (Cowboy Fm, Zamia Cr Sirt); dolomitic siltstone, chert-quartz sandstone, conglomerate (Yarrapart Fm); interlaminated siltstone-chert, feldspathic fine-grained sandstone (Bukirr Fm); feldspathic felsic breccia, chert, laminated siltstone-chert, dolomitic siltstone (Bukirr Dol). 1 000</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Turrarina Tectonic Ridge</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dolomitic &amp; cherty siltstone; dolomite, siltstones; dolomitic dolomites; dolomites, feldspatic, &amp; quartz sandstones (Vizard, Koopaburra Cr Fm); feldspathic chert-quartz sandstone, conglomerate (Mt Birr Sirt); chert (Koopaburra Cr Fm); basic to intermediate volcanics (Yalpara Volc Mbr of Koopaburra Cr Fm). 1 000</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TAWALLAH GROUP</strong> (Wearyan Shelf, Batten Trough-McArthur River area)**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quarts and feldspathic sandstones, conglomerate (Yarrapart, Sij Creek, Mulhalland Silt, Westmoreland Fm, Marmetan Fm). Subordinate basic to intermediate volcanics (Peters Cr, Settlement Cr Volc, Gold Cr Volc Mbr of Marmetan Fm); acid volcanics (Hobblestone Rhyolite &amp; Taunambin Volc, Mbr of Marmetan Fm); dolomites, dolomitic siltstone &amp; sandstone (Wallerangp, Moomertan Fm). 1 000-5 000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 1**

**BAUHINIA JOINT VENTURE**

**JULY, 1980**
near the present limits of preservation of many sequences.

Table 1 summarizes the stratigraphy of the McArthur Basin. The succession comprises three major subdivisions, the Tawallah and McArthur Groups and their equivalents and, unconformably overlying the latter, the Roper Group.

Deposition of the basal arenites of the Tawallah Group was followed by widespread flood basalt volcanism. These early volcanics are succeeded by sandstone alternating with siltstone, carbonates and later volcanics.

Provisional interpretation by the B.M.R. (Plumb 1978) depicts the greater part of the McArthur Group deposited in very shallow seas or lakes (a large proportion intertidal and supratidal) with only the Barney Creek Formation (host to the H.Y.C. deposit), parts of the Reward Dolomite, "Lower Lynott Formation", and perhaps Amos Formation showing evidence of relatively deeper water conditions. Walker et al (1977) concluded, after a study of evaporitic relicts, that significant parts of the group were deposited in a marginal sabkha environment.

The widespread erosional unconformity below the Roper Group is believed to be of the same age as the folding and metamorphism in the Mount Isa Orogen. The group is characterised by mica-rich siltstone and quartz greywacke alternating with clean quartz sandstone, typical of an
unstable shelf association. Muir and Plumb (1976) interpret
the shales and siltstones of the Roper Group as representing
shallow-water conditions, with fluviatile and deltaic channel
open-marine areas and occasional stagnant lagoons.
PREVIOUS EXPLORATION

C.R.A. Exploration Pty. Ltd.

In 1974, C.R.A. Exploration Pty. Ltd. held E.L. 879, an area of 485 square kilometres in the Bauhinia Downs Homestead region. The area covered by E.L. 1439 lies wholly within the former C.R.A. licence.

C.R.A. geologists were aware of remapping by the B.M.R. of the Billengarrah Formation as Barney Creek Formation and Reward Dolomite and they undertook to investigate the former of these two units.

The maximum development of Barney Creek Formation was found to occur in the south of the licence near Four Mile Creek where the formation comprised 80 metres of dark grey, carbonaceous, dolomitic siltstones with thin interbeds of dololutite and pink tuffaceous shales. In this area beds were recorded as dipping at 8-10° to the west and the formation thinning gradually along strike to the north.

As the Barney Creek Formation outcrops poorly, a power auger was employed to obtain bedrock samples. Twenty-nine samples were collected at one kilometre spacing during the initial reconnaissance. All samples were assayed for Pb, Zn, Cu, Ni, Co, Cr, Mn and Ag.

Most samples assayed in the range 11-170 ppm Pb and 9-560 ppm Zn. One sample assayed 1480 ppm Pb and 900 ppm Zn (its approximate location in relation to Bauhinia Joint Venture mapping is given in Plan 1). At this locality an additional
eighteen samples were collected on a 500 metre grid. Assays for the second group of samples had an overall range of 34-640 ppm Pb and 9-360 ppm Zn. Most fall in the range of 60-240 ppm Pb and 21-57 ppm Zn.

C.R.A. concluded that results indicated that although Barney Creek Formation within the grid area is anomalous in lead and zinc, significant values are only sporadically distributed.

C.R.A.'s work demonstrated that the Barney Creek Formation can carry significant anomalous values of lead and zinc at sizable distances removed from the H.Y.C. area.

5.20 Carpentaria Exploration Co. Pty. Ltd.

C.E.C. began exploration in the McArthur River region in 1955. The last area within E.L. 1439 held by that company was the southern portion in 1972.

During the period 1968-1971, the majority of the licence area was included in a regional stream sediment sampling program at a density of 3 samples per square mile conducted west of the Tawallah Fault. An anomalous lead value of 140 ppm was detected in a stream draining Scrutton Creek in the western portion of E.L. 1439; its approximate location being given in Plan 1.

Regional soil traverses were undertaken in conjunction with
the stream sediment sampling program. These produced some minor copper anomalies over the Amelia Dolomite that were further investigated using induced polarization/resistivity surveys, which apparently failed to define percussion drilling targets.

In 1966, C.E.C. decided that helicopter-supported, reconnaissance geological traversing should be undertaken west of the Tawallah Fault in order that the development of H.Y.C. Pyritic Shale, at the appropriate stratigraphic level between the Emmerugga Dolomite and Billengarrah Formation as formerly mapped by the B.M.R., could be evaluated. Within the bounds of E.L. 1439, five such helicopter-supported traverses were undertaken along the western edge of the licence. Of these, C.E.C. considered that the rocks above the Laminated Dolomite (a stratigraphic unit used by C.E.C. - refer to Figure 6, page 21) resemble the McArthur Group sequence east of the Tawallah Fault. They were assessed as probable equivalents of the middle Batten Sub-Group or parts of the Roper Group.
6.00 POTENTIAL FOR STRATABOUND COPPER IN THE McARTHUR BASIN

6.10 Introduction

This section gives a brief resume of an office research study into the potential for development of stratabound sedimentary copper deposits within the Bauhinia Joint Venture Exploration area of the McArthur Basin. The characteristics of stratabound sedimentary copper deposits were studied in detail with extensive use being made of two review papers - Pelissonier (1972) and Bowen and Gunatilaka (1977). The stratigraphic nomenclature used is that of the B.M.R. (Plumb and Derrick, 1975 - see Figure 4).

For the purpose of this report, the term "stratabound sedimentary copper deposits" is used to include both the so-called red-bed type and the Mansfield-type deposits.

6.20 Characteristics of Stratabound Sedimentary Copper Deposits

6.21 Regional Geological Parameters

Bowen and Gunatilaka (1977) have divided the time of formation of these types of copper deposits into two main periods. The earliest period is between 1300 m.y. and 840 m.y., with a maximum development at circa 1000 m.y., in the Central African Copperbelt of Zambia and Zaire. The second great period of copper accumulation was mainly during the Middle Devonian to Permian (circa 380 m.y. to 250 m.y. ago) in the northern continents.

Pelissonier (1972) summarizes other regional parameters. The sediments which enclose the copper mineralization are
part of a sequence of layered sediments deposited in continental basins or on continental platforms. The deposits have a terrestrial provenance and are of a post-orogenic or epeirogenic nature. The substratum often shows an eroded, irregular surface. The distance, therefore, between the mineralized horizon and true basement is very variable and there may be no apparent association. The deposits are generally associated with transgressive and cyclic sedimentary sequences of intraplate environments.

The sediments have not usually been subjected to folding after deposition but patterns of fractures and faults are always present. In the majority of cases regional metamorphism is very weak or absent.

6.22 Local Geological Parameters
The host rocks to mineralization are diverse; conglomeratic arkoses, sandstones, clays, marls and dolomites. In the metallogenic unit the mineralization usually prefers a single lithological facies which may occur cyclically through the series. The enclosing rocks are usually characterized by the presence, often abundance, of organic debris (often bituminous or carbonaceous material).

6.23 Chemical and Mineralogical Parameters
Pelissonier (1972) characterizes stratabound sedimentary copper deposits by the relative lack of sulphur and iron in the ore minerals; primary ores being chalcocite and bornite with minor chalcopyrite and pyrite.
Apart from copper, cobalt occurs in several of the deposits as carrollite-linnaeite. Sphalerite, galena and uranium minerals are often associated. Silver is contained within most deposits but is generally less than 10 ppm.

Lateral and vertical zonation of metal content is common where lead and zinc are present. Upwards from the base and seawards away from the margins of the basin the sequence is Cu-Pb-Zn-Fe.

6.24 Environmental Parameters

Bowen and Gunatilaka (1977) indicate that the sedimentary environments for deposition are either:

(a) marine to marginal-marine environments of mainly terrigenous accumulations that are indicative of extensive subtidal to supratidal flats and shallow enclosed embayments.

(b) shallow lagoonal and lacustrine type settings of inferred continental basins with possibly internal drainage.

6.30 McArthur Basin Succession

6.31 Regional Setting

The McArthur Basin is the largest of the several mid-Proterozoic mildly deformed platform covers which compose the North Australian Platform Cover unconformably overlying a highly deformed basement. The basin contains up to 12,000 metres of Carpentarian sediments which are exposed over about 170,000 square kilometres, see Figure 3. The depositional limits, during the various stages of the basin's development, are poorly known.
6.32 Stratigraphy and Geochronology

The McArthur Basin succession has a maximum composite thickness of about 12,000 metres (Figure 3), although 10,500 to 11,000 is more typical in the central belt of maximum thickness. The succession comprises three major subdivisions. In order of deposition they are, respectively: the Tawallah Group and equivalents consisting of quartz-rich arenites, subordinate basic volcanics, carbonates and lutites up to 6,000 metres thick; a dominantly carbonate sequence, the McArthur Group and equivalents, up to 5,500 metres thick; and the Roper Group and equivalents, which consist of alternating quartz arenites and micaceous lutites up to 5,000 metres thick. The succession is illustrated in Table 1.

6.33 Known Copper Mineralization

Plumb (1977) discusses known copper occurrences in sedimentary rocks in the McArthur River region. He notes that:

"The deposits so far known in sedimentary rocks are all small and usually show some structural control. However, all occur in similar facies and probably represent remobilised stratabound deposits. The host rocks are very shallow-water or red-bed carbonate and terrigenous sediments; a preliminary investigation tends to suggest that they occur in the dolomitic silts rather than the nearby carbonates. Recent detailed work by M.D. Muir has revealed very fine-grained disseminated copper in thin sections of otherwise apparently unmineralized rocks. Most deposits at the surface comprise secondary carbonates and oxides. Workings are collapsed and inaccessible. The nature of the deposits at depth is unknown.

There appears to be potential for the discovery of large low-grade bedded copper deposits."
TABLE 2: SELECTION CRITERIA FOR DETERMINING POSSIBLE TARGET HORIZONS

GEOLOGICAL CRITERIA

1. Substratum usually eroded with an irregular surface
2. Substratum —
   either (i) strongly metamorphosed basement predating sedimentation by a large amount of time
   or (ii) consists of sediments with a marked volcanogenic character usually, but not always, predating host formation.
   No apparent association with basement.
3. Forms part of a transgressive series
4. Presence of alternating layers with different granulometric composition (reflecting possible cyclic sedimentation)
5. Presence of a suitable host lithology i.e. reduced sandstones, shales, argillites, dolomites (often stromatolitic) or a combination of these lithologies
6. Presence of, or underlain by, red-beds or other oxidized continental clastic sediments
7. Presence of, or overlain by evaporitic lithologies (dolomite, anhydrite, gypsum)
8. Presence of carbonaceous material, bituminous material or organic debris

CHEMICAL/MINERALOGICAL CRITERION

9. Associated copper mineralization and/or anomalous copper rock or soil geochemistry.

ENVIRONMENTAL CRITERION

10. Part of, or wholly represents, a subtidal - intertidal - supratidal setting similar to Recent sabkhas.
6.40 The Potential of McArthur Basin Strata

6.41 General

Several features of the McArthur Basin succession are in keeping with the regional setting of stratabound sedimentary copper deposits. These features are summarized below:

(a) The succession represents a sequence of layered sediments deposited on a continental platform.

(b) A terrestrial provenance with denudation of continental masses is envisaged.

(c) The succession represents post orogenic accumulation.

(d) Transgressions and regressions are a feature of sedimentation.

(e) Syn-sedimentary faults are the dominant structural feature compared to post depositional folding.

(f) Regional metamorphism is absent.

6.42 Application of Selection Criteria

The criteria used for selecting possible target horizons within the McArthur Basin succession are listed in Table 2.

6.421 Tawallah Group. On present information one formation of the Tawallah Group satisfies a significant number of the selection criteria. This is the Wollogorang Formation. This formation contains suitable host lithologies, bituminous horizons, dolomites, ferruginous horizons and associated stratabound copper (and lead - zinc) mineralization. Volcanics occur at the base of the Group.

6.422 Umbolooga Sub-Group. It is envisaged that two major cycles of transgression-regression occurred during
Umbolooga Sub-Group times: from the top of the Mallapunyah Formation to the Myrtle Shale Member of the Tooganinnie Formation and from the top of the Myrtle Shale Member to the top of the Reward Dolomite. The Umbolooga Sub-Group was deposited in an arid hypersaline environment alternating between supratidal, intertidal and shallow subtidal conditions. Three formations of the Umbolooga Sub-Group fulfil a number of the remaining selection criteria. They are the Mallapunyah Formation, Amelia Dolomite and Tooganinnie Formation. The Mallapunyah Formation has a suitable non-eroded substratum, suitable host lithologies, presence of red beds, evaporites and algal dolomites, a suitable environmental setting and known stratabout bounded copper mineralization. Carbonaceous lithologies have not been located.

The Amelia Dolomite forms part of a transgressive sequence; contains suitable reduced lithologies, evaporitic rocks and local carbonaceous shales; conformably overlies a predominantly red bed sequence (Mallapunyah Formation) as well as containing red siltstone horizons itself; contains known weak Stratabout bounded copper mineralization; and has a suitable environmental setting.

The Tooganinnie Formation has a suitable environmental setting, is part of a transgressive sequence, contains regularly alternating lithologies which include stromatolitic dolomite, reduced and oxidized shales, siltstones and dolomitic sandstone. Evaporite relicts are present and some copper anomalism is associated with the "Slab Top Dolomite" and Leila Sandstone Members. The formation however, is not
known to contain carbonaceous, bituminous lithologies. The substratum is not eroded and does not contain stratigraphically close basic volcanics.

6.423 Batten Sub-Group and Equivalents. The formation which satisfies the largest number of criteria is the Lynott Formation. This has a suitable substratum and contains a variety of lithologies including reduced pyritic units, rocks with evaporite pseudomorphs and dolomite with stromatolites. The environmental setting may be suitable. However, the formation lacks copper mineralization, red beds, known cyclic sedimentation, or carbonaceous and bituminous host lithologies.

6.424 "Upper" McArthur Group. The units comprise the upper transgressive sequence, namely Smythe Sandstone, Mount Birch Sandstone and the overlying McArthur Group units. Evaluation is hampered by the lack of published data concerning these units. Favourable features include:

(a) part of a transgressive series
(b) unconformity at base
(c) volcanogenic component in the Smythe Sandstone
(d) suitable environment
(e) indication of evaporites
(f) a variety of shallow water lithologies which could host mineralization if reduced facies present
(g) minor associated copper mineralization
6.425 **Roper Group.** The application of selection criteria to this group is difficult due to the lack of detailed studies by the B.M.R. and exploration companies. Based on present, available data, the group satisfies only a few selection criteria; namely:

(a) base marked by an erosional unconformity
(b) presence of reduced siltstones and shales
(c) shallow water marine conditions (although not interpreted as indicative of sabkha development)
(d) copper mineralization reported at one locality.

6.50 **Conclusions**

Within the original ground held as E.L. 1439 the eastern area contained outcrops of the lower Umbolooga Sub-Group units considered to hold potential for the development of strata-bound copper, namely Mallapunyah Formation, Amelia Dolomite and Tooginanie Formation. However the office study covered all licences held by the Bauhinia Joint Venture and although it indicated units with potential in E.L. 1439, these were not specifically designated for field follow-up.
COMPARISON A.G. C.E.C. AND B.M.R. NOMENCLATURE.
East of Tawallah Fault and excluding environs of H.Y.C. deposit.

COMPARISON OF STRATIGRAPHIC NOMENCLATURE

FIGURE 6
7.00 MAPPING

7.10 Introduction

The geology of Exploration Licence 1439 as mapped at 1:50,000 scale during the 1978 field season is given in Plan 1. This plan is based on airphoto interpretation modified by field mapping.

During the 1979 field program ancillary mapping was undertaken along I.P. survey lines which resulted in an update of the geology in the western portion of the licence (see Figure 5) and the construction of a cross section of the "Bauhinia Downs" basin (refer to Plan 2).

The stratigraphic nomenclature used in the mapping is that adopted by A.O. (Australia) Pty. Ltd. during the course of its exploration program in the McArthur River region.

The nomenclature initially arose from detailed mapping of several areas east of the Tawallah Fault, but has been found, during the three years of exploration by the Bauhinia Joint Venture to be applicable over an extensive area covering the Bauhinia Downs and Mount Young 1:250,000 sheets. Figure 6 gives a comparison between the nomenclature used in the mapping of E.L. 1439 by the Bauhinia Joint Venture with that published to date by the B.M.R.

7.20 Mara and Mitchell Yard Dolomites

Exposures of the Mara Dolomite exhibit the normal characteristics of predominantly cherty, grey stromatolotic dolomite
with the exception of recrystallized material occurring in
the non-resistant zone and below the top of the unit.

The Mitchell Yard Dolomite appears to be generally absent
from the area. When it does occur, it is confined to a
few high points below a karsted surface at the base of the
T₂ sub-unit of the Teena Formation.

7.30 Teena Formation
Outcrop of this formation is only sporadic throughout the
area: T₁ and T₂ members are not well developed. Some
outcrop of less resistant stromatolitic dolomite occurs
below the T₃ massive white dolomite in the south of the licence.

Where present in outcrop, the Coxco Dolomite Member (T₃)
of the Teena Dolomite provides an unequivocal base for the
Barney Creek Formation. In areas of soil cover, this
boundary was able to be fixed due to a prominent change in
soil colour from red on the Coxco Dolomite to grey-brown
on the Barney Creek Formation. The boundary is marked by a
chain of dolines (sinkholes) on the air photographs.

The Coxco Dolomite is massive, sugary pink and white dolomite
with acicular gypsum pseudomorphs common. The transitional
T₄ member consists of slabby beds of pink tuff interbedded with
brown weathering dolomite. The T₄ unit is only about 4 metre
thick.

7.40 Barney Creek Formation
The estimated thickness of the Barney Creek Formation to the
Surprise Creek Pyritic Shale Bed, based on mapping along I.P. Line 2N is 200 metres. However it is believed that this may represent an overestimation, with 100 metres being more realistic and an underestimation in the event of basinal thickening where up to 400 metres could be present (refer to Plan 2).

Exposure of the Barney Creek Formation is poor in the western section of the licence area. Investigations of the unit established the sequence near-basal flinty tuffs followed by shales, then dolomitic siltstones and interbedded tuffs from approximately the middle of the formation, with the lenticular Lower Surprise Creek Dolomite being very well developed and occupying up to one-third of this interval.

The H.Y.C. shale equivalent in the area consists of the typical carbonaceous, dolomitic siltstones with some pink tuff beds for most of its thickness. In areas where basal H.Y.C. equivalent was accessible, flinty tuffaceous interbeds were common and samples of this material generally have anomalous geochemistry (refer to Section 8.00). It is thought that this material is the equivalent of the green vitric tuff of the Wickens Hills area. Some anomalous gossan float was also observed in this interval.

The Surprise Creek Dolomite is well developed in the area. Below the pyritic shale marker bed the unit is a uniform flaggy dolomite. This is thickest to the south of E.L. 1439 and becomes thinner in the centre of the licence. The thickness variation reflects the facies boundary with the H.Y.C. Pyritic Shale equivalent.
The Upper Surprise Creek Dolomite is not observed much north of Piggi Piggi Waterhole (situated approximately one kilometre south of the eastern end of I.P. Line 1N) where the unit is up to 30 metres thick. It includes two thick tuffaceous dolomitic siltstone beds developing into tuffs in the centre of the licence, pyritic shale and dolomitic siltstones as well as yellow weathering dolomite. Thickness variations of the unit are evident and caused by variable truncation at the slight unconformity at the base of the Reward Dolomite. One kilometre south of the western end of I.P. Line 2N, silicified Reward Dolomite is apparently resting on Barney Creek Formation rocks that are stratigraphically below the Surprise Creek Pyritic Shale Bed.

7.50 Reward Formation

The Reward Dolomite appears to represent the base of an unusually thick Reward section from which the upper beds have been removed. Silicification is abundant usually as bars aligned along joints and also in certain areas along the base of the formation.

Nearer the H.Y.C. deposit area, the basal thin-bededded and dolomite-nodule-bearing, cherty dolomite is overlain by dolomites with larger chert nodules, dolomite breccia and/or the 'pastel tuff beds' and, in some areas, the dolomitic 'Boko Beds'.

The best developed sections of the Reward, consist wholly of the dolomite-nodule cherty dolomite. Much of the variation in thickness of the Reward occurs through development of chert
breccia at the expense of the dolomite, probably through solution-collapse prior to deposition of the Lynott Formation.

A second type of chert replacement in which the original volume is maintained is also common in the licence. This lithology has been encountered elsewhere in the McArthur River region where it appeared to be a wall rock replacement adjacent to veins and was anomalous in lead. In the case of E.L. 1439 samples obtained from this unit were anomalous in copper only.

The geological section construction along I.P. Line 2N indicates a thickness of some 200 metres for the formation but that this may represent an overestimation.

7.60 Lynott Formation

A complete Lynott Formation exists southeast of I.P. line 1S, however only the basal pyritic shales have been observed in the vicinity of the I.P. line. No outcrop of the formation is present north of Tawallah Creek.

Southeast of the I.P. line, the Lynott Formation L₁ member was very well developed with abundant pyritic shale.

An unconformity at the base of the L₄ is postulated to account for the rarity of non stromatolitic impure dolomitic rocks assignable to the L₂ and L₃ units. The hard shale marker with mudcracks was not observed (possibly because of erosion at the L₄ unconformity) but dolomitic sandstone beds more characteristic of L₃ and L₂ are common. The
25.

thickest section of L₂ - L₃ was observed in the southern portion of E.L. 1439 (refer Plan 1).

The L₄ member makes up most of the formation, but its base cannot always be determined as the white sandstone marker is not well developed and stromatolitic cherts are less abundant than usual. Pyritic shale was absent.

7.70

**Mount Birch Sandstone and Balbirini Dolomite**

Substantial outcrops of white pebbly sandstone of the Mount Birch Sandstone overlie pyritic shales of the Lynott Formation in the vicinity of I.P. Line 1S. Pipes of the sandstone have developed down into the Reward Dolomite which underlies the Lynott Formation. The thickness of the Mount Birch Sandstone is variable (of the order zero to 100 metres). Cherts and areas of no outcrop overlying the Mount Birch Sandstone are now assigned to the Balbirini Dolomite. No actual dolomite outcrops.

7.80

**Roper Group**

The Limmen Sandstone of the Roper Group outcrops as a conspicuous escarpment west of the licence area with weak rocks of the basal Roper Group underlying the sandstone and extending up to one kilometre from the cliffs.

7.90

**Geological Structure**

A folded sequence of upper Umbolooga Sub-Group units occur within a fault-bounded block in the western portion of the licence. Within this sequence the Barney Creek Formation
outcrops as both an anticline to the west outside the licence and as an anticline-syncline pair within the licence.

The area is marginal to a major basin in the Roper Group and hence the McArthur Group rocks are likely to be tilted to the west relative to their original depositional situation. Flattening off of the Limmen Sandstone north of the area may be a reflection of persistence of local subsidence in the area.

A possibility exists, which has not been indicated on Figure 5 or Plan 2, that a north-south fault is present within the basin, crossing I.P. Line 2N at 1600E with a downthrow to the west. This possibility is based on the absence on the eastern side of the basin of prominently outcropping lithologies in the Balbirini Dolomite present in the west between approximately 600E and 800E. However no supporting evidence of such a fault is present in the gravity data for Line 2N (refer to Section 10.00).

In the southern half of E.L. 1439 pinch-and-swell outcrop patterns represent either apparent thickness variation due to changes in bedding dips, or actual thickness variation caused by oblique sectioning of small basins. It is considered that the latter interpretation is more likely to be correct.
<table>
<thead>
<tr>
<th>Formation</th>
<th>Sample No.</th>
<th>Cu (ppm)</th>
<th>Pb (ppm)</th>
<th>Zn (ppm)</th>
<th>U (ppm)</th>
<th>Ag (ppm)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lynott Formation</td>
<td>7567</td>
<td>20</td>
<td>135</td>
<td>155</td>
<td>3</td>
<td></td>
<td>Carbonaceous pyritic shale</td>
</tr>
<tr>
<td></td>
<td>7569</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Limonite and haematite concretions in shale</td>
</tr>
<tr>
<td>Reward Dolomite</td>
<td>7568</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Flinty tuff and pyritic chert</td>
</tr>
<tr>
<td></td>
<td>7576</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Limonite regolith beneath Reward Dolomite</td>
</tr>
<tr>
<td>Surprise Creek</td>
<td>1943</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td>Float-tuff stringers with dense Fe oxide clots. 30</td>
</tr>
<tr>
<td>Dolomite</td>
<td>7570</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td>2m section showing secondary limonite and pyroclastic with white efflorescence at top of the unit. Carbonaceous shale below sample 7570.</td>
</tr>
<tr>
<td></td>
<td>7571</td>
<td></td>
<td></td>
<td>175</td>
<td>10</td>
<td>4</td>
<td>Ferruginous tuff and tuffaceous shale. Pyrite and limonitic shale.</td>
</tr>
<tr>
<td></td>
<td>7575</td>
<td></td>
<td>30</td>
<td>210</td>
<td>160</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7577</td>
<td></td>
<td>15</td>
<td>350</td>
<td>70</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Barney Creek</td>
<td>7573</td>
<td></td>
<td></td>
<td>40</td>
<td>260</td>
<td>5</td>
<td>Flinty ferruginous tuff at the base of the formation.</td>
</tr>
<tr>
<td>Formation</td>
<td>7579</td>
<td></td>
<td></td>
<td>35</td>
<td>60</td>
<td>7</td>
<td>Flinty tuff in lower part of the formation.</td>
</tr>
<tr>
<td></td>
<td>7580</td>
<td></td>
<td></td>
<td>130</td>
<td>390</td>
<td>5</td>
<td>Limonite and haematite in dolomitic siltstone just below sample 7579.</td>
</tr>
<tr>
<td></td>
<td>7581</td>
<td></td>
<td></td>
<td>60</td>
<td>360</td>
<td>7</td>
<td>Limonite and haematitic shale</td>
</tr>
<tr>
<td></td>
<td>7582</td>
<td></td>
<td></td>
<td>40</td>
<td>180</td>
<td>10</td>
<td>Creamy, flinty tuff; W-Fold equivalent</td>
</tr>
<tr>
<td></td>
<td>7583</td>
<td></td>
<td></td>
<td>35</td>
<td>70</td>
<td>7</td>
<td>Gossan vein in tuff - selective sample</td>
</tr>
<tr>
<td></td>
<td>7584</td>
<td></td>
<td></td>
<td>30</td>
<td>40</td>
<td>4</td>
<td>20m section of the basal part of the formation</td>
</tr>
<tr>
<td></td>
<td>7585</td>
<td></td>
<td></td>
<td>20</td>
<td>20</td>
<td>6</td>
<td>20m section of dolomite above sample 7584</td>
</tr>
<tr>
<td>Teena Dolomite</td>
<td>7572</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Silicified limonitic sandstone and shale at the bottom of the unit T4.</td>
</tr>
<tr>
<td>Mara Dolomite</td>
<td>7574</td>
<td>&lt;2</td>
<td>10</td>
<td>10</td>
<td>1</td>
<td></td>
<td>Recrystallized dolomite at base of unit.</td>
</tr>
<tr>
<td></td>
<td>7578</td>
<td>10</td>
<td>10</td>
<td>220</td>
<td>1</td>
<td></td>
<td>Limonite associated with recrystallized dolomite.</td>
</tr>
</tbody>
</table>
Table 3 presents a summary of the geochemistry of rock chip samples collected in E.L. 1439. Location of the samples is given in Plan 1 and Figure 5.

Within the Barney Creek Formation in the northwestern region, anomalous lead-zinc geochemistry has been found in the Surprise Creek Dolomite Member (R7575, 7577, 1943) and associated with basal tuffs, shales and siltstones (R7580-7582). Sample R1943 recorded the maximum lead content of 0.24% with accompanying zinc and silver levels of 660 ppm and 310 ppm respectively. This sample is from float believed to represent strata above the Lower Surprise Creek Dolomite. Regolith material from the base of the Reward Dolomite (R7576) also contained anomalous base metal levels (350 ppm Cu, 640 ppm Pb, 0.12% Zn, 18 ppm U).

In the southern part of the licence, Sample R7573 registered a lead content of 0.15% with 260 ppm zinc. The samples is a flinty, ferruginous tuff at the base of the Barney Creek Formation, equated with the Green Vitric Tuff Member.

Of additional note in Table 3 is the elevated copper value 0.23% from Sample R7568, a flinty tuff and pyritic
chert of the Reward Dolomite and the slightly elevated lead-zinc from carbonaceous, pyritic shales of the Lynott Formation (R7567; 135 ppm Pb, 155 ppm Zn). Both of these samples are from the southern portion of E.L. 1439.
9.00 I.P. SURVEY

9.10 Introduction

The structural setting of the Barney Creek Formation and its associated geochemistry in the northern and central portions of the licence were considered favourable features and this region was subsequently regarded at the conclusion of the 1978 field season as an on-going target. Detailed assessment of the region however was impeded by lack of, and the poorly developed nature of the outcrop. It was therefore decided to implement an induced polarization/resistivity survey during the 1979 field program to aid in mapping the subsurface distribution of any polarizable material similar to the H.Y.C.-style mineralization which may be present in this area.

The survey, which was part of a larger program covering a number of Bauhinia Joint Venture licences was undertaken by Geoterrex Pty. Ltd. during September, 1979. Three lines, totalling 13 kilometres were gridded and surveyed using 200 metre dipoles. The location of these lines are given in Figure 5.

9.20 Results

Investigation of I.P. Line 1S (refer to Plan 3) revealed anomalous chargeabilities between 400E and 2000E. A well defined zone of low chargeabilities between 600E and 1400E influenced the distribution of higher chargeabilities to such an extent that detailed interpretation of the 400E-2000E zone was rendered impossible.
The data on Line 2N indicated a small basinal feature approximately 2.5 kilometres across. The edges occur at 400E and at 2800E. The low resistivities near those edges appeared to be related to the chargeabilities but were not coincident. A massive sulphide as the source of the lower resistivities was regarded as highly unlikely (refer Plans 2 and 4).

Chargeable zones on Line 1N were mapped between 0 and 1200E, 1600E and 2200E and a much weaker zone between 2900E and 2300E (refer to Plan 5). The anomalies on this line were less defined than on Line 2N and may also have originated from a source slightly closer to the surface.
10.00 **GRAVITY SURVEY**

10.10 **Introduction**

A regional gravity survey totalling approximately 457 kilometres was performed in a number of licences held by the Bauhinia Joint Venture during the 1979 field season. A line of 5.2 kilometres was surveyed in E.L. 1439. The survey was positioned over I.P. Line 2N (refer to Figure 5) and was carried out in an attempt to confirm the existence of a basinal structure.

A gravity survey was performed by the B.M.R. in 1978 within the Batten Trough and Wearyan Shelf of the McArthur Basin, including one traverse over the H.Y.C. ore body. A number of anomalous gravity features were delineated and it was found that these could be interpreted in the context of ore bodies and mineralized zones (Antiloff, 1979). The gravity survey, undertaken by A.O. (Australia) Pty. Ltd. on behalf of the Bauhinia Joint Venture, was carried out on the basis of the B.M.R. results in the hope of delineating drilling targets.

10.20 **Survey Instrumentation**

The 1979 regional gravity survey was performed with the use of a Worden Master 806 Gravity Meter. The meter is exceptionally accurate and incorporates a low-powered temperature stabilizer system which maintains a nearly constant internal temperature. The scale value of the meter was 0.0869 milligals per division.
FIGURE 7

BAUHINIA
NORTHERN TERRITORY
BOUGUER ANOMALY and
ELEVATION PROFILES

BAUHINIA JOINT VENTURE

A.O. AUSTRALIA PTY. LTD.

Horizontal Scale: 1:25,000
Vertical Scale: 20 mm = 1 Milligal
10 mm = 10 Metres

DENSITY: 2.5 gm/cm³
DATUM: Arbitrary

Drafted by: WONGELA GEOPHYSICAL PTY. LTD.
JANUARY, 1980
Each line was optically levelled prior to commencement of the survey. Temperature readings were taken at each 200 metre station and, in order to account for drift, base stations were reoccupied and the gravity readings retaken a number of times for each line. The meter drift was very low and it is considered that the quality of the field readings is good.

10.30 Results

The east-west traverse along Line 2N incorporated 27 stations with a station spacing of 200 metres. An arbitrary datum was used.

Computation and interpretation of the data was carried out by Wongela Geophysical Pty. Ltd. Bouger anomaly and elevation profiles at a scale of 1:25,000 were prepared (see Figure 7) and the accuracy of the Bouger anomaly values was considered to be ± 0.02 milligals. A density of 2.5 gm/cm³ was used for the elevation correction.

From the observation of the Bouger anomaly and elevation profiles for Line 2N, Wongela noted that the selected reduction density of 2.5 gm/cm³ was probably too large and that the inverse relationship between anomaly and topography at 3200E and to a lesser extent at 600E suggests that a lower reduction density would have been appropriate. Regardless of this however, the results do not show any anomaly of significance. The small positive anomaly at 200E with an amplitude of about 0.6 milligals was not considered to be diagnostic of any significant mineralization.
BAUHINIA JOINT VENTURE

EXPLORATION LICENCE No. 1439

EXPENDITURE: 7.11.1977 to 21.4.1980 (Relinquishment Date)

Salaries $11,562
Field Expenses $12,774
Miscellaneous $5,642

TOTAL EXPENDITURE $29,978

OES 2.7.1980
11.00 CONCLUSION

Although areas of Barney Creek Formation containing anomalous levels of lead and zinc have been identified in the area, geophysical surveys conducted over the most structurally promising of these proved discouraging. Induced polarization/resistivity and gravity data failed to locate drilling targets.

It was considered that the potential of Exploration Licence 1439 for the development of an ore body was limited and an application for the surrender of the licence was subsequently lodged. The surrender of E.L. 1439 was granted by the Department of Mines and Energy effective from 22nd April, 1980.

A statement of expenditure for the period 7th November, 1977 to 21st April, 1980 inclusive is given on the page opposite.
REFERENCES


