METALS EXPLORATION N. L.
FREEPORT OF AUSTRALIA INC.

ANTRIM COPPER PROJECT

PROGRESS REPORT NO. 1

by

Allan McGain
December, 1968

Report No. 374
Copy No. 16

R. Hare & Associates,
20 Little Collins Street,
Melbourne.
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by P. R. Donovan of McPhar Geophysics Pty. Ltd.

Accompanying Plans:

1. X Regional Geology showing Titles
   1" = 40 miles

2. Regional Stream Sediment Geochemistry results:
   (1) X Delamere 1:250,000
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   (4) X Waterloo 1:250,000
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SUMMARY.

Copper as native metal and sulphides can be found in amygdaloids and breccia zones in many widely separated occurrences in the Antrim Volcanic rocks of Northern Australia.

A regional stream sediment geochemical survey has been carried out in which 3,852 samples were collected over an area of some 20,000 square miles.

Nine major anomalies and about 35 minor copper anomalies have been located.

Further exploration involving aerial mapping, geological mapping, further geochemistry, extensive geophysics and drilling is recommended. The work will take three years and cost $272,000 in the first year, $241,000 second year and $500,000 third year.
INTRODUCTION.

This copper prospect is based on an analogy between the Antrim Volcanic rocks of the Northern Territory and Western Australia, the rocks of the copper belt of Northern Michigan in the U.S., and the similar Coppermine River Area, North West Territories, Canada. In all cases the rocks are basalts, agglomerates and interbedded sediments, and copper occurs as native metal and sulphides filling vesicles in basalt; in breccia zones associated with flow tops and faults; and in the Michigan case replacing sedimentary rock units.

Antrim Volcanic rocks outcrop over an area of some 20,000 square miles. Access is by well maintained gravelled roads and a net-work of bush tracks. A regular light aircraft service to the larger cattle properties is in effect. The country is generally open and undulating with a well developed drainage system suited to stream sediment geochemistry.

Metals Exploration N. L. and Freeport of Australia Inc. have carried out a programme of stream sediment geochemistry aimed at locating copper provinces within the vast area of out-crop of the Antrim rocks.

This report sets out the results of the geochemistry and recommends further work.

TITLES.

Prospecting Authority - Northern Territory.

Prospecting Authority number 2068 containing an area of 13,988 square miles was granted to Metals Exploration N. L. on the 24th October, 1968, for a period of 6 months.

Temporary Reserve - Western Australia.

Two Temporary Reserves numbers 4754H and 5015H containing areas of 533 and 619 square miles respectively were granted to Metals Exploration N. L. on the 29th November, 1968. An amended application for four smaller areas has been made.

Other holdings.

Brian Crowson of Montejinni homestead, who had A. P. No. 1884 containing 35 square miles under option to Gunn Rural Development, is now willing to negotiate an option with Metals Exploration N. L. Crowson has been approached in this respect.
GEOLOGY

Rock Types and Structure.

Basement rocks are a structural complex of Upper Proterozoic sediments and metamorphics. Dominant strike is north-east.

Antrim Volcanics unconformably overlie the Upper Proterozoic and outcrop over some 20,000 square miles and are known or presumed to sub-crop over a further 15,000 square miles.

The Volcanics are predominantly basalt with inter-bedded sandstone, chert, limestone, conglomerate and pyroclastics. The basalt is usually compact, very fine grained, and well crystallised and varies petrologically from plateau basalt to sanidine trachyte.

Amygdaloidal lavas are common, the cavities often being filled with agate and quartz. The quartz often has inclusions and coatings of native copper and the amygdales are commonly coated with greenish copper carbonate stains. Xenoliths of indurated sandstone are occasionally found.

The presence of sedimentary interbeds in the Volcanics was first recognised in 1965. Since then, interbeds have been recorded from fourteen bores and have been mapped at several localities, particularly in the Delamere-Victoria River Downs areas. The thickest unit recorded is in the vicinity of Victoria River Downs Bores 5 and 7 where some 120 feet of sandstone and shale is known. Lithology of the interbeds is variable. Quartz sandstones appear most common. They are often current bedded and contain rock fragments of siltstone and basalt. Limestones and cherts have been noted with the chert apparently replacing the limestone. A fifty feet thick conglomerate band occurs six miles east of Delamere homestead where basalt blocks up to 18 inches across can be seen in a sandstone matrix. The conglomerate grades upwards into a fine sandstone which is overlain by basalt. Tuffs and agglomerates are known near Wave Hill Bore No. 3.

Copper mineralisation is widespread in the Antrim Volcanics and known occurrences are described in detail under the following sub-heading "Copper Mineralisation".

The Antrim Volcanics are unconformably overlain by limestones of Middle Cambrian age.
Copper Mineralisation.

Copper mineralisation is known in the Antrim Volcanics and in the overlying Middle Cambrian limestones, indicating that some, if not all, of the mineralisation is post Antrim Volcanics.

The known copper occurrences in the area are described:

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<th>Occurrence</th>
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<tr>
<td></td>
<td>Located by Metals Exploration N.L. during 1968 survey.</td>
<td>14 - 18</td>
</tr>
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</table>

1. Bore Hole DWH 1 Latitude 15° 32' Longitude 131° 39' Elevation 850'

- 0 - 105' SAND and SILTSTONE.
- 105 - 144' BASALT - weathered with green cupferous staining.
- 144 - 415' BASALT.
- 415 - 448' BASALT - amygdaloidal - geodes of quartz with native copper and iron pyrites.

2. Bore Hole DWH 4 Latitude 15° 38' Longitude 131° 41' Elevation 875'

- 0 - 95' SANDSTONE.
- 95 - 153' BASALT and sandstone.
- 153 - 164' BASALT - weathered, copper stained.
- 164 - 411' BASALT.

3. Bore Hole DWH 5 Latitude 15° 46' Longitude 131° 48' Elevation 755'

- 0 - 90' SANDSTONE and CLAYSTONE.
- 90 - 128' BASALT - altered.
- 128 - 135' BASALT - copper carbonate stains.
- 135 - 327' BASALT.

4. Shoeing Tool Replacement Bore Latitude 16° 24' Longitude 131° 34' Elevation 505'

- 0 - 48' BASALT and SOIL.
- 46 - 51' BASALT - vuggy and amygdaloidal with quartz and native copper.
- 51 - 68' BASALT.
- 66 - 226' BASALT - copper staining.
- 226 - 255' BASALT.
- 255 - 275' BASALT - copper staining.
- 275 - 590' BASALT - occasionally with vesicles, filled with green mineral.
Copper Mineralisation (contd.)

5. Native Copper, Denham Station

Latitude 16°37' Longitude 128°22'.

Just to the east of the Northern Highway at a point about two miles north of the Denham River crossing, boulders of prehnite containing small pieces of native copper occur on several low hills of flat lying Antrim Plateau Volcanics. The boulders were not observed in situ, but are believed to have weathered out of the basalt, where they occurred as fillings of steam-holes by late magmatic volatiles during solidification of the lavas. The boulders are up to several feet in maximum diameter, and are more resistant to weathering than the enclosing basalt. During 1955 most of the boulders were gathered, knapped and put into three 44-gallon drums preparatory to shipping; the author is not aware of the person who produced this ore, nor of the grade of the parcel. The small amounts of native copper present in the rock indicate that the grade would not exceed 5% Cu, and might be considerably less.

(The position does not agree with the geographical description; Simpson (ref. 16) lists native copper at 16°15'S, 128°20'E, a position which fits this locality).

6. Native Copper, Rosewood Station

Latitude 16°23' Longitude 129°04'.

Prehnite boulders containing native copper occur on the slopes of a hill about two and half miles east of the six-mile (or No. 6) bore which is situated north-north-east of Rosewood station. The boulders are lighter in colour than the dark brown-grey basalt developed in the area, and show a cellular surface; they can be traced around the hill for about five chains, but do not occur at the summit. Some boulders are up to two feet in diameter, but the average is about six inches and none were found in situ; their copper content varied from plentiful filiform pieces of native copper to rare pinhead sized pieces, and a small specimen of moderate to low grade rock assayed 0.33% Cu.

The distribution of the boulders is consistent with that which would be expected if they were formed as steam hole fillings in a flow top of the flat lying basalt, although the latter is not markedly vesicular in this area. However, a small cherty vesicle filling, occurring in situ in grey fine-grained dense dolerite basalt, was found to contain a small piece of native copper, and this suggests that the larger prehnite boulders have a similar origin.
GEOLOGY (contd.)

Copper Mineralisation (contd.)

7. Sundry Native Copper Occurrences.

Native copper has been reported from Bluehole Yard (Limbunya Station) Turner Station and R-B Creek, but these occurrences could not be verified.

8. 43-mile Copper Deposit.

Latitude 16° 26'  Longitude 129° 24'.

About 43 miles south of Mistake Creek Station on the Inverway road, the author found a small chalcolite-quartz veinlet in agglomerate (or a brecciated flow top). Costeaming revealed an ill-defined lode of quartz crystals, cherty quartz, and chalcolite enclosing pieces of agglomerate; the "lode", up to eighteen inches wide, could be traced for only about forty feet, and appeared to cease in depth on a more massive flow or section of flow. The agglomerate or basalt in this area is characterised by cherty quartz encrustations and large vughs filled with quartz crystals and oölites; the vugh fillings become separated by weathering, and occur scattered on the surface as rounded or elliptical "boulders"; they are frequently covered by a coating of green and blue chlorite minerals, which sometimes resemble copper carbonates; these blue minerals also occur disseminated in the basalt or agglomerate. Certain of the vesicles contain fillings of banded chert which sometimes show a small core of chalcopryte.

9. Byrnes Hill - Behn Gorge

Latitude 16° 27'  Longitude 128° 52'.
Latitude 16° 24'  Longitude 129° 6'.

Disseminated copper carbonates were found in a shear zone, and in vesicular basalt, near Byrnes Hill and in the Behn Gorge. The copper is associated with calcite and cherty quartz; the amount of copper present is very small.

10. Denham Station

Latitude 16° 15'  Longitude 128° 22'.

About ten miles north-north-east of Denham Station, just west of Conglomerate Range, traces of copper minerals occur in agglomerate and silicified agglomerate.

11. Wild Dog

Latitude 16° 29'  Longitude 128° 53'.

West of Wild Dog spring on the Rosewood-Spring Creek
GEOLOGY (contd.)

Copper Mineralisation (contd.)

11. Wild Dog (contd.)

road, chalcopyrite grains occur as the cores of banded chert fillings of vesicles; the fillings are coated with blue and green chloritic minerals.

12. Rosewood Wall

Latitude 16°29' Longitude 128°58'.

A sample cut across the top six feet of the Volcanics at the Rosewood Wall assayed 0.6% Cu. The material sampled contained red and blue chloritic minerals, but no visible copper minerals. Samples cut from the same horizon half a mile to the south assayed 0.1% Cu over nine feet, the upper three feet of this assaying 0.53% Cu. Samples cut over twelve feet below the previously quoted top six feet contained no copper.

Assays of the top agglomerate horizon of the Antrim Plateau Volcanics in other areas failed to show any significant copper content; from the presumed mode of origin of the copper minerals in the Volcanics, large concentrated lodes are not to be expected, and the disseminated copper mineralisation appears to be too low grade and restricted to be of economic interest.

13. Campbell's Spring

18 miles south-west of Willeroo homestead.

Two occurrences within ½ mile of each other have been reported by Thompson. Native copper slugs of several pounds weight have been found at the surface apparently weathered out of joints in basalt. No disseminated copper was noted.

14. Montejinni

Near Montejinni homestead.

Quartz-cuprite-malachite veins occur in interlayered fine-grained or vesicular basalt. Large specimens of native copper have been found in this area.

15. Caves

Latitude 17°31' Longitude 129°14'.

Malachite and cuprite occur in an agglomerate layer immediately under the Headley's Limestone. Mineralisation can be seen over an area of 300 feet by 600 feet but the extent of the deposit is obscured by limestone and soil cover. The thickness of mineralised agglomerate is probably about 10 feet and a chip sample taken across the outcrop assayed 20% Cu.
Copper Mineralisation (contd.)

16. Matilda Creek
   16°13'S, 129°12'E.

Native copper flakes, chalcopyrite and occasional malachite staining was found in boulders in the bed of Matilda Creek.

17. Spring Hill
   16°53'S, 128°50'E.

A 1" vein of native Cu and chalcopyrite specks in calcite was found in a stream bed, 4 miles west of Spring Hill, near Spring Creek station.

18. Panton River
   17°50'S, 128°12'E.

One small occurrence of native Cu in calcite was located near the junction of the Panton and Elvira Rivers.

It can be seen from these descriptions that there are four main types of occurrence:-

1. Native copper and sulphides filling amygdaloids in basalt. Prehnite and other zeolite minerals commonly occur along with the copper.

2. Native copper and sulphides in breccia zones associated with flow tops and fault zones.

3. Native copper and sulphides with calcite or quartz in narrow veins along joints in basalt.

4. Copper replacement in the top agglomerate member of the volcanics immediately beneath the limestone.

Our knowledge of the area to date suggests that there may be two important geological features controlling the mineralisation:

1. The Volcanics-Limestone contact.

   Several widely scattered copper occurrences are located at the top of the basalt sequence, suggesting either -

   (i) The youngest flows are a favourable rock type, or

   (ii) The overlying limestone acts as a stratigraphic trap.
GEOLOGY (contd.)

Copper Mineralisation (contd.)


Several copper occurrences and geochemical anomalies appear associated with major structures and these appear to trend north-east, paralleling the regional basement strike.

REGIONAL STREAM SEDIMENT GEOCHEMICAL SURVEY.

Technique.

The sampling was a joint McPhar Geophysics Pty. Ltd. - R. Hare & Associates effort and was completed in the three months August to October, 1968. The ground crews worked through most of the period and collected 1,951 samples, while one helicopter crew worked for the last two weeks and collected 1,901 samples, making a total of 3,852. Sampling density varied from 0.26 to 0.48 per square mile.

All analyses were carried out by McPhar Geophysics Pty. Ltd. and any samples returning over 50 ppm were re-analysed.

Plotting and drafting the results was carried out by McPhar Geophysics Pty. Ltd.

Dr. P. Donovan of McPhar was consulted on the survey and reported on results (see Appendix).

DISCUSSION OF RESULTS.

Copper values in parts per million (ppm) varied from 2 ppm to 160 ppm. Background was calculated at 20 ppm and the threshold was 45 ppm.

Nine major areas of high copper anomalies extending over several square miles were found on the Delamere, Limbunya and Waterloo 4-mile sheets in the Northern Territory and on the Lissadell, Dixon Range and Gordon Downs sheets in Western Australia. Eight of these anomalies are located on either side of the Western Australia-Northern Territory border. One is located on the Delamere sheet in the north east of the Northern Territory.

Several low order anomalies extending over several square miles occur in the Northern Territory and Western Australian Authorities to Prospect. Throughout the whole of the area surveyed there are approximately 35 isolated anomalies of small areal extent indicated by only one or two samples.
DISCUSSION OF RESULTS (contd.)

Features of Major Anomalies

(a) **GUMTREE WELL ANOMALY.**

**Location and access:** Waterloo 4 mile sheet - N. T.

A road and track from Rosewood station cross the southern half of the area. Virtually all of the area is accessible by 4 wheel drive vehicle.

**Area and physiography:**

Approximately 150 square miles.

Undulating hills, rocky in places, with numerous rocky cliffs at the heads of gullies.

**Number of anomalous samples:** (+ 50 ppm) - 28.

**Geology:**

Rocks in the area are predominantly basalts which are probably near the middle of the Antrim Volcanics section.

Strong north-east - south-west lineaments are evident on the photo mosaics of this area and some of the anomalous stream patterns appear to be associated with the lineaments.

No known mineralisation occurs within the anomaly, but one isolated occurrence of native copper and malachite staining was located to the west of the northern end of the anomaly.

(b) **BYRNES HILL ANOMALY.**

**Location and access:** Waterloo 4 mile sheet - N. T.

The area lies immediately north of Rosewood station, and all parts are accessible by 4 wheel drive vehicles.

**Area and physiography:** Approximately 35 sq. miles.

Undulating hills with rocky sections around gullies and hill tops.

**Number of anomalous samples:** (+50 ppm) - 4.

**Geology:**

Rock types are predominantly basalts occurring near the top of the volcanics sequence.
DISCUSSION OF RESULTS (contd.)

Features of Major Anomalies (contd.)

(b) **BYRNES HILL ANOMALY** (contd.)

Prehnite boulders containing native copper have been found within the anomalous area. Disseminated copper carbonates occur in a shear zone and in vesicular basalt near Byrnes Hill.

(c) **KANGAROO CREEK ANOMALY.**

**Location and Access:** Waterloo 4 mile sheet - N.T.

The area lies 5 miles south-east of Rosewood station. No tracks run through the area, but all of it is accessible by 4 wheel drive vehicles.

**Area and physiography:** Approximately 30 sq. miles.

Low undulating hills cover most of the area.

**Number of anomalous samples:** (+ 50 ppm) - 4.

**Geology:**

Rock types are predominantly basalts occurring near the top of the volcanics sequence.

No copper mineralisation is known in the area.

The north-east - south-west lineament which crosses the Gumtree Well anomaly appears to extend into the Kangaroo Creek anomaly.

(d) **BLACKFELLA ROCKHOLE ANOMALY.**

**Location and Access:** Limbunya 4 mile sheet - N.T.

The area lies 20 miles east of Ord River station. No tracks occur in the area and access to some parts of the area by 4 wheel drive is very difficult.

**Area and physiography:** Approximately 6 sq. miles.

Steep cliffs and rocky slopes are common.

**Number of anomalous samples** (+ 50 ppm) - 4.

**Geology:**

Basalts from the upper section of the Antrim Volcanic sequence are overlain by the Headley's Limestone which forms steep resistant cliffs in the area.

No mineralisation is known in the area.
DISCUSSION OF RESULTS (contd.)

Features of Major Anomalies (contd.)

(d) **BLACKFELLA ROCKHOLE ANOMALY** (contd.)

**Geology** (contd.)

The close proximity (12 miles) and similar geological environment to the Caves Prospect suggests that the anomalous copper has been derived from the rocks at the Antrim Volcanics-Headley's Limestone contact.

(e) **DELAMERE ANOMALY.**

**Location and Access:** (Delamere 4 mile sheet - N. T.

The area lies 15 miles south of Delamere Station and is wholly accessible by 4 wheel drive vehicle. A track from Delamere station traverses the area.

**Area and physiography:** Approximately 28 sq. miles.

Low undulating hills and broad valleys are typical of the area.

**Number of anomalous samples:** (+ 50 ppm) - 7.

**Geology:**

The predominant rock types are basalts which occur in the middle of the volcanics sequence.

No mineralisation is known to occur in the area.

(f) **FORREST CREEK ANOMALY.**

**Location and Access:** Dixon Range 4 mile sheet - W. A.

The area is 20 miles south of the Ord River Station and most of the area is accessible by 4 wheel drive from the main Wyndham-Nicholson road which traverses the area from north to south.

**Area and physiography:** Approximately 60 sq. miles.

Low undulating hills typify most of the area. Rough stoney areas are common over basalt outcrops and small cliffs or scree slopes occur at the Headley's Limestone-Antrim Volcanics contact.

**Number of anomalous samples** (+ 50 ppm) - 16.

**Geology:**

Predominant rock types are basalts which are overlain
DISCUSSION OF RESULTS (contd.)

Features of Major Anomalies (contd.)

(f) FORREST CREEK ANOMALY (contd.)

by the Middle Cambrian Headley's Limestone and Nelson Shale. The basalts are from the upper section in the Volcanics sequence and dip gently north west under the middle Cambrian sediments.

A regional system of north-west - south-east striking faults near the limestone-Volcanics contact coincides with the area of highest copper anomalies.

No mineralisation is known to occur in the area.

(g) EMU SPRING ANOMALY.

Location and Access: Gordon Downs 4 mile sheet - W. A.

The area lies 20 miles west of Nicholson homestead and is accessible by a track to Turner station. Most of the area can be reached by 4 wheel drive vehicle.

Area and physiography: Approximately 4 sq. miles.

Low undulating hills typify the area with rough rocky areas over basalt outcrops.

Number of anomalous samples (+ 50 ppm) - 9.

Geology:

Predominant rock types are basalts occurring near the middle of the Volcanics sequence. Tertiary and Cenozoic gravels and silts are common.

No known mineralisation occurs in the area.

(h) SPRING CREEK ANOMALY.

Location and Access: Lissadell 4 mile sheet - W. A.

The area lies immediately north-west of Spring Creek station and is wholly accessible by 4 wheel drive vehicles.

Area and Physiography: Approximately 16 sq. miles.

Low undulating hills typify the area but rocky scree slopes are common at the Limestone-Volcanics contact.

Number of Anomalous Samples (+50 ppm) - 4.

Geology:

Basalts and the overlying Headley's Limestone are the common rocks in the area.
DISCUSSION OF RESULTS (contd.)

(h) SPRING CREEK ANOMALY (contd.)

Geology (contd.)

No known mineralisation in the area.

(i) TEXAS DOWNS ANOMALY.

Location and Access: Lissadell and Dixon Range 4 mile sheets - W. A.

The area lies immediately east of the Texas Downs station and is accessible by 4 wheel drive vehicles.

Area and physiography: Approximately 15 sq. miles.

Low undulating hills, rocky in places, typify the area.

Number of anomalous samples: (+50 ppm) - 1.

Geology:

Basalts occurring near the base of the volcanics sequence are the predominant rock types.

No mineralisation is known in the area.

Although only one sample of 50 ppm occurs in the anomaly, background samples of 40 and 45 ppm are common.

FUTURE EXPLORATION.

Technique.

The anomalous areas located by the geochemical survey are very large and are separated by long distances. An exploration programme to cover these separate areas can take various forms depending on the time and money one is willing to spend. In any case, the work can be considered in six separate phases.

1. **Aerial Photo Mapping.**

The best available base plans (1:250,000) are nowhere near adequate for detail geochemistry and geology. All the areas of interest should be flown and photographed and base plans prepared at 1" = ¼ mile and 1" = ½ mile.

Stereo-photography, preferably in colour, is necessary for geological mapping.
FUTURE EXPLORATION (contd.)


Very little is known about the detailed geology of the volcanic units. Reconnaissance mapping to establish section columns should be carried out in critical areas and all geochemically anomalous areas should be mapped at 1\" = \frac{1}{4} \text{ mile}.

3. Detailed Geochemistry.

This should be carried out concurrently with the geology and would involve increasing the sample density over the broad anomalous areas to 10 samples per square mile.

4. Trial Geophysics.

Geophysics will no doubt play an important part in locating drill targets and it is anticipated that an extensive amount will be carried out. There is no data available on rock resistivities and it is difficult to plan a programme without some trial information. A six weeks trial survey should be carried out over known mineralisation with the following techniques:

(1) Magnetics.
(2) Electro Magnetics.
(3) Induced Polarisation.
(4) Afmag.

5. Geophysics.

The extent to which geophysics can be used will naturally depend on the trials. It is anticipated however that an extensive programme will be necessary.

6. Drilling.

Both airblast and diamond drilling will be required to test anomalies and drill out any potentially economic mineralisation. The extent of the drilling programme will, of course, depend on the results of the previous phases.
FUTURE EXPLORATION (Contd.)

Programme and Budget

The programme presented here breaks the exploration into three seasons of work:

Year 1
- Base Map Preparation
- Camp Establishment
- Detail Stream Sediment Geochemistry
- Geological Mapping
- Trial Geophysics

Year 2
- Detail Geophysics
- Geological Mapping
- Limited Geochemistry

Year 3
- Further Geophysics
- Airblast and Diamond Drilling

The cost of this work is estimated as follows:

1. CAPITAL ITEMS

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Laboratory

- 22,000

2. CONTRACTORS

(i) Base Map Preparation $21,000
(ii) Trial Geophysics 8,500
(iii) Helicopter and Air Charter 20,000
(iv) Sample Analyses 15,000

- $64,500 $64,500

(v) Colour air photography and maps
(vi) Detailed Geophysics
(vii) Drilling (airblast and diamond)

- 40,000
- 65,000 32,000
- 300,000

C/forward

- $140,000
- 120,000
- 359,000
3. PERSONNEL

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<td>Project Manager (12 mths.)</td>
<td>27</td>
<td>$2,160</td>
<td>$57,120</td>
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<td>Camp Supervisor (8 mths.)</td>
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<td>2 Geologists (8 months)</td>
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<td>2,700</td>
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<tr>
<td>Chemist and Assistant (year 3 only)</td>
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<tr>
<td>Draftsman (8 months)</td>
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<td>Consultants (12 months)</td>
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<tr>
<td>Field Assistants &amp; Samplers (8 months)</td>
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<td>Cook and off-sider (8 mths.)</td>
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4. OPERATING COSTS.

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<td>Fuel and Lubricants</td>
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<td>Communications</td>
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<td>Travelling</td>
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<td>Freight</td>
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5. HEAD OFFICE OVERHEADS.

<table>
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<th>Description</th>
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<tbody>
<tr>
<td>10% of costs less capital &amp; contractors</td>
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<td>TOTAL FOR EACH YEAR</td>
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<tr>
<td>PROGRESSIVE TOTALS</td>
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<td>513,000</td>
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<td>1,013,000</td>
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</table>

Allan McGain
13th November, 1968,

MEMORANDUM TO: METALS EXPLORATION N.L.

MEMORANDUM FROM: Dr. P. R. DONOVAN AND
Mr. R. W. FIDLER,
McPHAR GEOPHYSICS PTY. LTD.

SUBJECT: PRELIMINARY SUMMARY OF RESULTS
OF RECONNAISSANCE GEOCHEMICAL
PROGRAMME, ANTRIM VOLCANICS
COPPER PROJECT.

In the following resume, the number of square miles following the sheet
title refers to the area of outcrop of the basalts, and not to the area of the
lease.

A value of 50 ppm Cu has been selected as a threshold value.

WESTERN AUSTRALIA

LISSADELL. (769 square miles - 198 samples - 0.26 per square mile).

At the beginning of the survey there were two known occurrences, 9 and 12.

No. 9 (Behn Gorge) was not located, and there are no Cu anomalies in the
area.

No. 12 (Rosewood Wall) was not located, but sample 1521 is anomalous
in this area.

A piece of malachite-stained flint was located at 16° 44'S, 128° 53'E.
There are no associated geochemical anomalies.

Another Cu occurrence, consisting of 1" vein of native Cu and chalcopyrite
in calcite, was found in a stream bed 4 miles west of Spring Hill (16° 53'S,
128° 50'E). Again, there are no associated geochemical anomalies.
There are two main anomalous areas:

(a) In the south-west corner of the area.
(b) On the south side of Spring Creek.

There are also 5 one- and two-sample anomalies.

There appears to be some relationship between the anomalous Cu values and the contact between the top of the basalts and the base of Headley's Limestone.

**DIXON RANGE.** (404 square miles - 197 samples - 0.48 per square mile).

There were no known Cu occurrences within the area at the beginning of the survey.

One small occurrence of native Cu in calcite was located near the junction of the Panton and Elvira Rivers (17° 50'S, 128° 12'E).

No samples were collected below this due to the width of the Panton River.

In the northern area there was one one-sample anomaly (2808).

In the southern area there is a belt of anomalous values in the northwest corner. These may be related to a zone of NW - SE faulting. The highest value obtained during the present survey (130 ppm) was obtained in this area.

**GORDON DOWNS.** (559 square miles - 175 samples - 0.31 per square mile).

There were no known occurrences within the area at the beginning of the survey and no occurrences were located during the survey.

There is one belt of anomalous samples in the north with two one-sample anomalies in the south.

**NORTHERN TERRITORY.**

**WATERLOO.**

There were two known occurrences at the beginning of the survey.
WATERLOO (contd.)

No. 9 (Byrnes Hill) was not located, but there was an associated geochemical anomaly (1216).

No. 6 (Rosewood Station) was not located but there is a sizeable group of anomalous Cu values in this area.

Another occurrence was located consisting of native Cu and chalcopryite in boulders in a creek but no anomalous values showed up in this area (16° 13'S, 129° 12'E).

There is an extensive scattering of anomalous Cu values spreading for twenty miles north of Brolga Creek to the northern boundary of the area. There is also a group of anomalous values south of Kangaroo Creek.

There are two isolated one-sample anomalies in the central part of the area (1260 and 1741) and one in the north (1400).

LIMBUNYA.

There is no published geological map available for this sheet at this stage. There is an estimated 2540 square miles and approximately 1138 samples, giving a density of 0.45 samples per square mile.

There were no known Cu occurrences in this area at the beginning of the survey.

Two occurrences were located:

(a) The Caves Prospect (17° 31'S, 129° 14'E). Here malachite and chalcocite occurs over a distance of at least 300' in an agglomerate layer near the base of the Headley's Limestone. (See R. W. F's letter to K. F.). No sampling was carried out in this area, because the limestone is the principal outcropping rock in the area.

(b) Copper was reported at Nelson Springs but was not located. Nelson Springs is considered to be out of position on the topographic map.

There is one main group of anomalous values near "Blackfella Rockhole".

There is one three-sample anomaly east of Uindait Spring.

There are two two-sample anomalies in the western half of the map (2533-2867, 1684-1685).
LIMBUNYA (contd.)

There are six other anomalous values (882, 917, 2624, 2829, 2835, 2836) which still require checking by re-analysis.

DELAMERE.

There were four known occurrences within this sheet.

1, 2 and 3 were in boreholes, and 13 was not located.

Another small occurrence of azurite was found in volcanics below limestone near Stubb Yard. This is outside the western boundary of the area. There were no associated anomalous Cu values.

There is a major group of anomalous values near No. 5 bore.

There are also six one-sample anomalies, one of which (81) is just east of the eastern boundary.

VICTORIA RIVER DOWNS.

There was one known occurrence in this area, No. 4, in a bore.

No additional occurrences were located.

There are five one-sample and one two-sample anomalies within the sheet, but no major groupings.

WAVE HILL.

There were no known occurrences within this sheet and none were found.

There are five one-sample anomalies within the area and no major groupings were found.
CONCLUSIONS.

Major Cu anomalies extending over areas of several square miles were found on the Delamere, Limbunya, Waterloo (3) sheets in the Northern Territory; and Lissadell (2), Dixon Range, and Gordon Downs sheets in Western Australia.

Visible Cu mineralisation was located at seven previously unrecorded locations.

There are approximately one hundred one-or-two sample anomalies occurring on all the sheets surveyed.

The programme will be reviewed in Melbourne with MENL on November 14th-15th and recommendations for follow-up drawn up.

Yours sincerely,

McPHAR GEOPHYSICS PTY. LTD.

P. R. DONOVAN.
MEMORANDUM TO: METALS EXPLORATION N.L.

MEMORANDUM FROM: DR. P. R. DONOVAN,
McPHAR GEOPHYSICS PTY. LTD.

SUBJECT: STREAM SEDIMENT RECONNAISSANCE
GEOCHEMICAL PROGRAMME,
ANTRIM VOLCANICS PROJECT.

DATE: 22nd NOVEMBER, 1968.

INTRODUCTION

Following the preliminary summary dated 13th
November, this memorandum deals with points arising from
the discussions in Melbourne with Messrs. Fletcher and
McGain on 14th November.

ANALYSIS

All Cu analysis was performed by AAS following
a hot 25% HNO₃ leach for 1 hour on 0.25 gm sample of minus
80-mesh material.

An early orientation study indicated that this
mesh size was as suitable as any other on the Delamere sheet.
However, it is possible that a coarser or finer fraction may
have been more suitable on other sheets over such a wide area.
All anomalous samples, i.e. 50 ppm Cu or above, were checked by reanalysis at no cost to MENL. A sheet of corrected values is attached to this report and it is recommended that the incorrect values on the original sheets be altered immediately to prevent possible future errors. Approximately half of these are amended background values.

All the corrected values have been plotted on the Cu maps.

All samples from this project will be stored indefinitely in Adelaide.

MAPS

Transparencies showing sample locations and Cu values for each of the sheets have been sent to MENL today under separate cover.

LISSADELL

It should be noted that there are no values over 50 ppm Cu in the southwestern anomaly. However, it is considered that this high background area is worth following up. The anomalous sample (2808) in the northern part of the Dixon Range sheet forms part of this zone.

VICTORIA RIVER DOWNS

The previous memorandum omitted to mention the Montejinni occurrence (14) which has now been plotted on the maps.

LIMBUNYA

The six values (892, 917, 2624, 2629, 2635 and 2636) mentioned in the previous memorandum were reanalysed and found to be background.

/page 3.
FOLLOW-UP

The following is a suggested geochemical follow-up programme.

(1) Aerial photographs, preferably in colour, should be obtained at a scale of 2" = 1 mile of all the major anomalies.

(2) Geological photo-interpretation should be carried out prior to any field work.

(3) Detailed base maps showing all drainages should be prepared for each.

(4) Initial follow-up should consist of stream sediment sampling at a density of 10 samples per square mile.

(5) By the time the crews are on the last of the major anomalies, the results for the first areas will be ready and a visit should be made to assess the merits of soil sampling vs bedrock sampling on grids. Each area will have to be visited separately.

It should be noted that the Caves area on the Limbunya sheet should be treated as a major anomaly, although no geochemical sampling has been carried out in this area yet.

Apart from the major anomalies there are approximately 35 one and two-sample anomalies that should be resampled in more detail.

Yours sincerely,
McPHAR GEOPHYSICS PTY. LTD.

P. R. DONOVAN

Distribution:
K. Fletcher (2)
Toronto
Files
Cu by AAS following
hot 25% HNO₃ leach for 1 hour
on 0.25 gm sample
of minus 60-mesh.
Cu by AAS following
hot 25% HNO₃ leach for 1 hour
on 0.25 gm sample
of minus 80 - mesh.
MC PHAR GEOPHYSICS PTY LTD
METALS EXPLORATION N.L.
ANTRIM VOLCANICS COPPER PROSPECT
W.A.
DIXON RANGE
STREAM SEDIMENT RECONNAISSANCE
COPPER RESULTS ppm

SCALE 1:250,000 DRAWN BY CHECKED BY

u by AAS followed by
35% HNO₃ leach for hour
on 0.25 gm samp