K. FOX AND ASSOCIATES

METANA MINERALS N.L. / ROEBUCK RESOURCES N.L.

TENNANT CREEK JOINT VENTURE

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PETER PAN PROSPECT

Mineral Lease - C 547

1989 EXPLORATION PROGRESS REPORT

by

K. Fox

February 1990

Report 1990/108

OPEN FILE
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<td>1 : 1,000</td>
</tr>
<tr>
<td>9</td>
<td>Contoured Bedrock Geochemical Results - copper</td>
<td>1 : 1,000</td>
</tr>
<tr>
<td>10</td>
<td>Contoured Bedrock Geochemical Results - lead</td>
<td>1 : 1,000</td>
</tr>
<tr>
<td>11</td>
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<td>1 : 1,000</td>
</tr>
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<td>1 : 1,000</td>
</tr>
<tr>
<td>13</td>
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<td>1 : 500</td>
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APPENDICES

APPENDIX 1 - Total Magnetic Intensity - Stacked Profiles and Contours - July 1989 - 1 : 1,000

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- a -

Summary

The Peter Pan prospect comprises one mineral lease C 547 with a total area of 9 hectares which is due for expiry on 31st December, 1999.

Tenure is held by Roebuck Resources N.L. In 1988, Metana Minerals N.L. entered into a joint venture on all the Roebuck prospects in the Tennant Creek goldfield, whereby it has the right to earn a 60% interest in the Tenements by spending $450,000 on exploration and/or mining over a period ending on the 4th of November, 1991. Metana also made a commitment to spend at least $100,000 before any decision could be made to withdraw from the Joint Venture.

Apart from summarising and reinterpreting all information collected during exploration activities prior to September, 1989; this report presents the detailed results of an exploration programme commenced in September, 1989 and completed in January, 1990.

The above-mentioned programme involved additional detailed geological mapping and a bedrock geochemical vacuum drilling programme. Bottom of hole samples were analysed for gold, bismuth, copper, lead and zinc.

The results of this work indicate the presence of seven target geochemical anomalies. These occur in structurally favourable areas and five of them are believed to be of potential economic significance (see sections 8.2. and 8.3. of this report). The anomalies are plotted on Figure 12, which is a composite anomaly plan.

It has been recommended that four of the above-mentioned anomalies be tested by preliminary percussion drilling, the proposed drill hole locations are indicated in section 8.4. of this report.
1. INTRODUCTION

The Peter Pan prospect comprises a single Mineral Lease C 547 which covers a total area of 9 hectares. It is located about 1.5 kilometres west of the Tennant Creek townsite and lies immediately north of a sealed road - see Figure 1.

Minor intermittent exploration work has been done on the lease area since the 1930s. No intensive work was done until 1987, when the lease was acquired by Roebuck Exploration N.L., and a programme of detailed geological mapping, and scout drilling was completed. In 1988, Metana Minerals N.L. entered into a joint venture on all the Roebuck Tennant Creek tenements. The terms of this agreement are outlined in the Summary above.

An old shack located in the south eastern corner of the lease is occupied by "squatters". Although this makeshift accommodation lacks power, water, or sewage disposal facilities, continuous occupation has been allowed by the local town council. Although the Lease holder can demand removal of this dwelling at any time, this has not been done because its presence did not significantly affect the proposed 1989 exploration programme.

The 1989 programme comprised reappraisal of previous exploration data, additional geological mapping, and detailed bedrock geochemical vacuum drilling. The objectives were: to locate and delineate areas of significantly anomalous gold, bismuth, copper, lead, and zinc; and, to design appropriate follow up exploration programmes if they are warranted.

The conclusions and recommendations presented in this report are those of the writer.
2. PREVIOUS MINING

Ivanac (1954) reported that total production from the Peter Pan Lease had been 235.49 tonnes of ore with an average grade of 10.95 grams of gold per tonne. Recovery was about 89.5 percent with resultant production being 2.27 kilograms of fine gold.

Ivanac’s field investigations were carried out during the years 1948 to 1950. During 1948 and 1949, Ivanac was assisted by geologist N.H. Krasenstein and detailed investigations were confined to “several of the more important mines”. In 1950, he was assisted by geologists E.K. Carter, B.P. Walpole, and E.M. Bennett.

Bulletin 22 (Ivanac, 1954) states that in 1948 a 24.38 tonnes parcel of ore assaying 13.84 grams per tonne was treated. From the geological description it is clear that this ore was mined from the pits and costeans located on the low mesa centred at about 30 metres north, 150 metres west on the present grid (see Outcrop Geology plan - Fig. 2) although some tonnage may have been contributed from several pits and costeans located along strike to the west.

It is also clear that Ivanac assumed that the previously mined 211.11 tonnes were derived from the same location. Ground observations indicate that this is impossible and the only working with mullock dumps of sufficient size is a now obliterated shaft located at 90 metres north, 65 metres west.

The implications of this conclusion are discussed elsewhere in this report.
3. EXPLORATION PRIOR TO 1987

In 1937 (Daly, 1957) a ground magnetic survey was completed over the Peter Pan lease together with the adjoining Wheal Doria and Big Ben leases to the east and west respectively. This survey located an apparent magnetic anomaly centred on a dense ironstone outcrop at 95 metres north, 65 metres west on the present grid. Interpretation of this anomaly suggested that it modelled best as a sphere centred at a vertical depth of 163 metres.

As a follow up to this survey a vertical diamond drill hole - DDH 4A - was collared near the anomaly centre and was completed to a vertical depth of 136.5 metres (the original hole, DDH 4, was collared 0.6 metres further north but collapsed and was abandoned). The location of this hole is plotted on the Outcrop Geology plan - Fig. 2.

The geological log of DDH 4A is as follows:

<table>
<thead>
<tr>
<th>INTERSECTION -metres</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>From</td>
<td>To</td>
</tr>
<tr>
<td>0</td>
<td>36.58</td>
</tr>
<tr>
<td>36.58</td>
<td>39.62</td>
</tr>
<tr>
<td>39.62</td>
<td>47.85</td>
</tr>
<tr>
<td>47.85</td>
<td>50.60</td>
</tr>
<tr>
<td>50.60</td>
<td>52.43</td>
</tr>
<tr>
<td>52.43</td>
<td>61.26</td>
</tr>
<tr>
<td>61.26</td>
<td>136.55</td>
</tr>
</tbody>
</table>

END OF HOLE

Assaying appears to have been confined to the interval between 50.90 metres and 52.54 metres vertical depth with results as follows:

<table>
<thead>
<tr>
<th>INTERSECTION - metres</th>
<th>ASSAY - grams per tonne</th>
</tr>
</thead>
<tbody>
<tr>
<td>From</td>
<td>To</td>
</tr>
<tr>
<td>50.90</td>
<td>51.82</td>
</tr>
<tr>
<td>51.82</td>
<td>52.43</td>
</tr>
<tr>
<td>52.43</td>
<td>53.04</td>
</tr>
<tr>
<td>53.04</td>
<td>54.25</td>
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</tbody>
</table>
Research of available literature has revealed that one other diamond drill hole has been drilled on the Peter Pan lease. The date on which this hole was collared is unknown; however, it was logged and assayed by the BMR in 1964 (Dunn and Yeaman, 1964). It is recorded that all core was assayed for gold and that there were no significantly anomalous values. No copper analyses were done.

This hole was designated DDH 1, it was inclined at 60° on an azimuth of 340° true, and had a total length of 79.86 metres. The collar location is described as being 134.1 metres west, and 70.1 metres south of the Peter Pan main shaft. This main shaft must be the shaft located at 90 metres north, 65 metres west on the present grid. The location of DDH 1 is plotted on the Outcrop Geology plan - Fig 2, and its geological log is as follows:

<table>
<thead>
<tr>
<th>INTERSECTION - metres</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>From</td>
<td>To</td>
</tr>
<tr>
<td>0</td>
<td>1.68</td>
</tr>
<tr>
<td>1.68</td>
<td>12.01</td>
</tr>
<tr>
<td>12.01</td>
<td>25.54</td>
</tr>
<tr>
<td>25.54</td>
<td>40.54</td>
</tr>
<tr>
<td>40.54</td>
<td>41.75</td>
</tr>
<tr>
<td>41.75</td>
<td>44.20</td>
</tr>
<tr>
<td>44.20</td>
<td>49.90</td>
</tr>
<tr>
<td>49.90</td>
<td>52.46</td>
</tr>
<tr>
<td>52.46</td>
<td>68.37</td>
</tr>
<tr>
<td>68.37</td>
<td>73.00</td>
</tr>
<tr>
<td>73.00</td>
<td>74.07</td>
</tr>
<tr>
<td>74.07</td>
<td>75.29</td>
</tr>
<tr>
<td>75.29</td>
<td>79.86</td>
</tr>
</tbody>
</table>

END OF HOLE

Note: it appears that this hole bottomed either within the target horizon, or in the chloritic halo on its southern margin. Very poor recoveries suggest that any assaying may be suspect.
4. ROEBUCK RESOURCES N.L. EXPLORATION IN 1987

In July 1987, after a brief ground examination, six scout reverse circulation drill holes were completed on the Peter Pan prospect. These holes totalling 392 metres were all collared at 60° inclinations on azimuths of about 175° (true). The holes were sited and logged by geologist S. Carthew.

The locations of the above mentioned holes are plotted on the Outcrop Geology plan - Fig. 2. Significant (greater than 1.0 grams per tonne) gold values were confined to:

<table>
<thead>
<tr>
<th>HOLE NO.</th>
<th>INTERSECTION - metres</th>
<th>GOLD ASSAY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>From</td>
<td>To</td>
</tr>
<tr>
<td>PPRC 4</td>
<td>25.0</td>
<td>26.0</td>
</tr>
<tr>
<td>PPRC 5</td>
<td>27.0</td>
<td>29.0</td>
</tr>
<tr>
<td>PPRC 6</td>
<td>84.0</td>
<td>85.0</td>
</tr>
</tbody>
</table>

Following construction of a grid with an east - west base line with north south cross lines spaced at 25 metres, a programme of detailed geological outcrop mapping at a scale of 1 : 1 000 was completed by K. R. Warne in October 1987. This work resulted in preparation of an excellent and accurate Outcrop Geology plan which, with minor additions and alterations, appears as Fig. 2 of this report.

A plan of Interpreted Geology was also prepared. The lease was interpreted as being mainly underlain by siltstones and sandstones which had been intruded by large mass of rhyolitic quartz-felspar-porphry. This body was interpreted as occupying most of the Northern half of the lease. The main target was interpreted as being a shear zone approximately coincident with the southern contact of the "porphyry" - tested by holes PPRC 2, 3, 5, and 6 (and previous DDH 1). Secondary targets were interpreted as being: an east south easterly trending spur from the main shear, originating at about grid 15 metres north, 175 metres west - tested by hole PPRC 1; and, a small massive ironstone outcrop located on the north eastern contact of the porphyry - tested by hole PPRC 4.

The results of the Roebuck Resources N.L. exploration were fully presented in reports by K. R. Warne - October, 1987, and S. B. Warne - November, 1987. In the latter report it was recommended that the magnetic anomaly (Daly, 1957) centred near the massive ironstone outcrop in the north eastern part of the lease be tested by deeper drilling. No other work was recommended.
Prior to March 1989, Metana's completed an aeromagnetic interpretation (Pearson, 1989), which resulted in a recommendation that:

"In view of the significant aeromagnetic anomaly in the eastern part of the lease, future work should include a detailed ground magnetic survey and modelling of the data prior to drilling of the anomaly if it is warranted."

In July, 1989 a detailed ground magnetic survey, with readings taken at intervals of 5 metres along the existing 25 metres spaced grid cross lines, was completed by TESLA - 10 Pty. Ltd.

It was concluded (by S. H. D. Howard, geophysicist for Metana Minerals N. L.) that the bullseye anomaly detected by the larger station spacing of the 1937 ground magnetic survey and subsequent aeromagnetic surveys was probably the result of aliasing (the combined effect) of the very strong narrow anomalies that occur in the east of the grid.

Plans presenting total magnetic intensity stacked profiles and contours are included as Appendix 1 of this report.

During 1988 the writer was retained by Metana Minerals N.L. to undertake regional studies of the Tennant Creek field. This work comprised photogeological mapping, using 1:25 000 colour aerial photography, and considerable field checking. The area which incorporates and surrounds the Peter Pan prospect was included in this study, but the presence of numerous roads, tracks, fences, power lines, and other cultural features rendered it difficult, if not impossible to distinguish between geological and cultural lineaments.

The writer first visited the prospect in September 1989 and during the period September to December 1989 a programme comprising check and additional geological mapping, grid reconstruction and the drilling of 156 bedrock geochemical vacuum holes totalling 312 metres was completed. The 156 bedrock samples were analysed for gold (ppb), bismuth, copper, lead and zinc. One rock chip sample was also taken and analysed.

The results of the above programme are presented below, and their possible significance when integrated with those from previous work is discussed in some detail.
6. GEOLOGY

Initial checking confirmed that the previous geological mapping by K. R. Warne (1987) was accurate in its delineation of outcrop boundaries and essentially correct in rock type identifications. For these reasons additional geological mapping was conducted with specific objectives in mind:

a) to more accurately distinguish between sedimentary rock types and between dips of bedding and cleavage planes;

b) to locate sedimentary structures which would give clear indications of facings and thus establish the presence or absence of any major fold axes on the lease;

c) to establish the true nature and distribution of the quartz-felspar porphyries; and if possible,

d) to establish the dip directions of the mineralised shear structures.

The sedimentary rocks are all poorly sorted with dominant grain sizes varying from fine to coarse. These fine to coarse grained siltstones and greywackes are typical turbidites with rapid along strike grain size variation making it impossible to identify any persistent stratigraphic horizons.

True bedding was identified in numerous places with dips almost invariably being between 45° and 65° to the north. Steeper apparent dips measured in previous mapping were cleavage and not bedding planes.

Sedimentary structures are particularly well preserved in the south western and north eastern parts of the prospect. Graded bedding and cross bedding indicate that the whole sedimentary sequence on this prospect faces in a northerly direction. It is believed that a major anticlinal axis may be located along the southern boundary of the lease.

Despite an exhaustive search no outcropping quartz-felspar-porphyry/sedimentary rocks contact with a measurable dip could be found. At 105 metres north, 130 metres west, a quartz-felspar-porphyry outcrop lies adjacent to a siltstone outcrop. The contact between these rock types has a west north westerly trend and the siltstone beds have an anomalous local dip of 40° to the south south east. It is believed that this anomalous feature is the result of drag folding adjacent to a porphyry/sediment contact shear.

Reverse circulation holes PPRC 2 and PPRC 3 were drilled on southerly azimuths on a section line at 140 metres west on the present grid. The cross-section of these holes presented in the report of November, 1987 by S. B. Warne (Plan No. 4) indicates that the porphyry (to the north) / sediment contact dips at about 55° to the north. Both of these holes intersected minor zones of anomalous gold values; up to 0.74 grams per
tonne; but these were not considered to be correlatable on this section.

The above mentioned cross-section acknowledges that it was prepared after "logs by S. Carthew, 15 July 1987". This section indicates that hole PPRC 2 intersected quartz-felspar-porphyry from the surface to 14 metres, possible sediments from 14 to 17.5 metres, quartz-felspar-porphyry between 17.5 and 26 metres, and then sediments to 51 metres depth, with the hole terminating in quartz-felspar-porphyry at 60 metres (see Figure 3).

This does not conform with Carthew's log of this hole (Warne, S.B., 1987), or with the writer's checking of sample material remaining on the ground.

Carthew's log identifies the rocks from surface to 17 metres as sediments (siltstones), with massive quartz-felspar porphyry between 17 and 26 metres and the remainder of the hole in agreement with the above mentioned cross-section except for the final metre - 59 to 60 metres which is greywacke.

If this cross-section is reconstructed using Carthew's logs two alternative interpretations can be made:

Alternative A - Figure 4 - assumes that the geochemically anomalous zones in both holes correlate with each other and with the surface target zone outcrop. This suggests that the target shear zone dips at 80° to 85° to the north, and that the quartz-felspar-porphyries are lenses, sub-parallel to the shear zone and cleavage planes, having been intruded as dyke-like bodies.

Alternative B - Figure 5 - assumes better correlation between the bodies of quartz-felspar-porphyry and observed surface geology (i.e. a porphyry lense outcrops about 8 metres south of, and greywacke and some siltstone float occurs in the immediate vicinity of the PPRC 2 hole collar.

This suggests that the porphyry lenses are sub-parallel to the mineralised shear which dips at about 70° to the south; and, that the geochemically anomalous zones in the two holes do not correlate.

Holes PPRC 5 and PPRC 6 are approximately located on north - south section line 225 metres west. The cross-section presented as Plan No. 6 of the November 1987 report by S.B. Warne accurately presents Carthew's logging of these holes and has been redrawn as Figure 6 of this report. This indicates a quartz-felspar-porphyry/sediment contact with sub-parallel vertical to 85° northerly dipping shear zone hosted mineralisation.

Diamond hole DDH 1 (see Figure 2 for location) was collared in sediments some 20 metres south of the sediment/porphyry contact. It was drilled to a depth of 79.86 metres, at 60° inclination, on an azimuth of 340° true. No
REFERENCE

V  V  Quartz felspar porphyry
I  I  Greywacke and siltstones
b   b  Blotite schist - possible biotite lamprophyre.

TENNANT CREEK PROJECT
PETER PAN PROSPECT
CROSS-SECTION
PPRC 2 AND PPRC 3

REFERENCE

VV Quartz felspar porphyry

IVIV Greywacke and siltstones

BB Biotite schist - possible biotite lamprophyre.
possible dilational shear fractures
- apparent dip

coarse turbidites -sandstones and greywackes

sandstones

65°

silicified
talc - magnetite

quartz felspar porphries & siltstones

PPRC 2

PPRC 3

anomalous
gold values

greywackes
and siltstones

anomalous
- gold values

POSSIBLE SHEAR ZONE

60m

(Flatening of hole
assumed to be as in
PPRC 3 surveys)

REFERENCE

Metamorphosed sediments

V V Quartz felspar porphyry dykes

b b Biotite schist.

Figure No. 5.

TENNANT CREEK PROJECT

PETER PAN PROSPECT
CROSS-SECTION 125 W
PPRC 2 AND PPRC 3
ALTERNATIVE B

Scale: 1:500 Date: March 90 Dwg.No: M107-54

METANA MINERALS N.L.
TENNANT CREEK PROJECT
PETER PAN PROSPECT
CROSS-SECTION
PPRC 5 AND PPRC 6

Redrawn from original by S.B.Warne, 1987

scale: 1:500 date: March '90 Dwg. No.: M107-58
METANA MINERALS N.L.
quartz-felspar porphyry was encountered.

The BMR diamond drill hole 4 A, also plotted on Figure 2, was drilled vertically to 136.55 metres. In the November, 1987 report, S. B. Warne states that the brown soft 'wacke intersected between surface and 36.58 metres vertical depth is now known to be weathered porphyry.

The collar position of this hole is plotted on Figure 2 with an accuracy of + or - 5 metres. The location is surrounded by sediment outcrops and the sediment / porphyry contact is located about 10 metres to the south west. The hole was cored and the writer believes that the BMR geologist responsible would have been able to distinguish between weathered greywacke core and weathered porphyry core. Assuming this to be the case no porphyry was encountered in this hole, and the porphyry / sediment contact in this area must be either vertical or south west dipping.

It is concluded that the porphyry intrusives are irregular masses which together with peripheral dykes are preferentially orientated parallel to the dominantly east west cleavage and associated shearing.

The log of the cored hole DDH 1 indicates that some biotite lamprophyre (minette) dykes are present.
Figure No. 13

TENNANT CREEK PROJECT

PETER PAN PROSPECT
CROSS-SECTION
PPRC 4 AND DDH 4A
SECTION ON 57 METRES WEST

Scale: 1:500 Date: March '90 Dwg. No.: M 107-57

METANA MINERALS N.L.
7. MINERALISATION AND GEOCHEMICAL EXPLORATION RESULTS.

7.1. Surface and drill hole evidence.

Geological mapping (Fig. 2) has suggested the presence of three zones of mineralisation:

A) an approximately east-west trending zone extending from 20 metres North, 00 metres West through 15 metres North, 375 metres West. Outcrop evidence suggests that this is the most persistent and possibly most important zone;

B) a spur to the above structure, extending from about 15 metres North, 200 metres West, in an east south east direction through 40 metres South, 40 metres West; and,

C) a zone of indeterminate orientation centred on the small massive quartz-magnetite-haematite outcrop at about 90 metres North, 60 metres West.

Zone "A", referred to by Warne, 1987, as "Peter Pan's main lode" appears from outcrop evidence to be a shear zone which varies between about 5 metres and 15 metres in width. The Roebuck reverse circulation drill holes PPRC 5 and PPRC 6, and probably also PPRC 2 and PPRC 3 appear to have intersected this zone. Alteration within the shear zone has produced a chloritic schist which is haematitic and contains variable quantities of talc, up to 10 percent magnetite, and some apparent chert/jasper bands (in the oxide zone). A chloritic halo is present in the wall rocks.

A grab rock chip sample taken over a 3 metres radius from silicified talc-chlorite-magnetite rock at 10 metres North, 163 metres West gave analyses of 22.19 ppb gold, 1.047 ppm bismuth, 357 ppm copper, 342 ppm lead, and 182 ppm zinc. Details of significant gold values recorded in the Roebuck drill holes appear in Section 4 of this report.

Zone "B" is less well exposed, and the most obvious target, a small massive magnetite outcrop located at 25 metres South, 85 metres West, was tested by the Roebuck hole PPRC - 1; no anomalous gold values were recorded. Silicified talc-chlorite schist peripheral to the ironstone outcrop, in a costean 50 metres to the east south east (where it is manganese stained), and the drill hole log (Warne, S. B., 1987) suggest a shear zone similar to Zone "A".

The old mullock dumps around the collapsed shaft on the south side of the Zone "C" ironstone suggest that this was the main working on this prospect. The Roebuck reverse circulation hole PPRC - 4, collared about 20 metres north of the ironstone and drilled on a southerly azimuth failed to encounter any major alteration zone although a significant gold assay of 2.5 grams per tonne was recorded between 25.0 and 26.0 metres down hole depth.
7.2. **Results of bedrock geochemistry.**

The programme comprised 156 vacuum holes totalling 312 metres drilled 15 metres apart on grid lines spaced 25 metres apart. The holes were drilled through the soil cover and bedrock samples averaging about 2 kilograms were collected and despatched to the Metana Minerals N.L. Perth laboratory for gold, bismuth, copper, lead, and zinc analyses.

All results are presented as "Appendix 2" of this report and gold, bismuth, copper, lead, and zinc values are separately plotted in Figures 7, 8, 9, 10, and 11 respectively.

Although there appears to be a fairly widespread distribution of mineralisation on this prospect and the total sample population is only 156, the calculations of mean values, and standard deviations have been used as guides in establishing the local threshold values for each element.

**GOLD in ppb - see Figure 7.**

Four samples, with values of 99 ppb or more, were treated as spurious highs and were excluded from calculations with the following results:

mean background (m) = 7.6 ppb

standard deviation (s) = 11.5 ppb

local threshold value = m + 2s = 30.6 ppb - say 30 ppb.

Contour intervals selected for Figure 7 are 15, 30, 60, and 120 ppb.

**BISMUTH in ppm - see Figure 8.**

Four samples, with values of 70 ppm or more, were treated as spurious highs and were excluded from calculations with the following results:

mean background (m) = 2.9 ppm

standard deviation (s) = 4.9 ppm

local threshold value = m + 2s = 12.7 ppm - say 12.5 ppm.

Contour intervals selected for Figure 8 are 6, 12, 24, and 48 ppm.
COPPER in ppm - see Figure 9.

Five samples, with values of 1 000 ppm or more, were treated as spurious highs and were excluded from calculations with the following results:

- mean background \( (m) \) = 99.20 ppm
- standard deviation \( (s) \) = 124.60 ppm
- local threshold value = \( m + 2s = 348.40 \) ppm - say 350 ppm.

Contour intervals selected for Figure 9 are 175, 350, and 700 ppm.

LEAD in ppm - see Figure 10.

Five samples, with values of more than 90 ppm, were treated as spurious highs and were excluded from calculations with the following results:

- mean background \( (m) \) = 8.20 ppm
- standard deviation \( (s) \) = 13.50 ppm
- local threshold value = \( m + 2s = 35.20 \) ppm say 35 ppm.

Although the above calculations were taken into account the contour intervals of 20, 40, and 80 ppm used in Figure 10 were mainly selected for reasons explained in section 8.2.4. of this report.

ZINC in ppm - see Figure 11.

Three samples, with values of more than 500 ppm, were treated as spurious highs and were excluded from calculations with the following results:

- mean background \( (m) \) = 51.80 ppm
- standard deviation \( (s) \) = 66.50 ppm
- local threshold value = \( m + 2s = 184.80 \) - say 200 ppm.

Contour intervals selected for Figure 11 are 100, 200, 400 and 800 ppm.

The target implications of the anomalies defined by the bedrock geochemical sampling programme, and indicated on Figures 7 to 11 inclusive, are discussed in section 8 of this report.
8. DISCUSSION

8.1. 1989 exploration objectives.

Although briefly summarised in section 1. INTRODUCTION of this report, the aims of the 1989 exploration programme can be more clearly stated.

Following the failure of the detailed ground magnetic survey to identify any magnetic targets two conclusions could be drawn: either, no potential existed for significant ore discovery, in which case no further work was justified; or potential existed for discovery of non-magnetic ore, and exploration should continue.

It was judged that additional data needed to be acquired before an informed decision could be made. The detailed bedrock vacuum drilling programme was then completed to provide a geochemical data base which could be integrated with the results of all previous exploration, and would enable the following specific objectives to be achieved:

i ) to identify bedrock geochemical anomalies with possible ore discovery potential, and if they occur;

ii ) to identify the geological structures which control and host mineralisation;

iii ) to determine the attitude of such structures;

iv ) to establish (if possible) the probable geometry of potential "ore bodies" within the favourable structures i.e. strike length and direction, width, dip, and plunge;

v ) to assign target priorities; and,

vi ) to design an appropriate follow up exploration programme.

8.2. Interpretation of bedrock geochemical results.

The surface and near surface geochemical characteristics of numerous known areas of mineralisation in the Tennant Creek gold field have been recorded and appear to have certain characteristics in common.

8.2.1. GOLD

Outcropping ore bodies exhibit leaching and secondary enrichment of gold.

Significant evidence of gold mineralisation at, or within a few metres
of, the surface is generally confined to outcrops of quartz-haematite or chlorite-magnetite ironstones, and talc-chlorite schists which have been subjected to surface silicification.

Elsewhere the gold has been almost completely leached from the near surface rocks.

The zone of secondary gold enrichment commences at 10 to 15 metres vertical depth and continues to the base of oxidation at between 80 and 120 metres vertical depth. Within this zone gold grades are often high although erratic with the gold frequently being coarse and easily visible to the naked eye.

Note - During recent bedrock geochemical surveys, Western Mining Corporation drilled all vacuum holes to 15 metres vertical depth with bottom of hole samples being taken at that depth. No samples were taken above this depth since WMC considered that reliable gold in bedrock distribution could only be determined by sampling at the same level as the top of the zone of secondary enrichment.

With the above observations in mind it is concluded that, while the Peter Pan gold in bedrock results provide an excellent guide to the locations of areas of significant near surface gold mineralisation, they may not provide a reliable indication of target orientation or dimensions.

Using the 30 ppb local threshold level calculated above a total of 7 gold anomalies were indicated - See Figures 7 and 12.

8.2.2. BISMUTH

All of the available evidence suggests that bismuth is substantially leached from the zone of oxidation; no bismuth has been produced from any oxide zone ore body. Although anomalous levels of bismuth clearly remain in areas of oxidised mineralisation, the almost complete leaching of the element from the zone of oxidation suggests it to be highly mobile. Regional ironstone sampling also indicates that, unlike gold, ore grades are not preserved in silicified ore body outcrops.

It is concluded that bismuth and gold anomalies have similar levels of importance in indicating target locations.

Using the 12.5 ppm local threshold value calculated above, 8 bismuth anomalies are indicated, 6 of which approximately coincide with anomalous gold - see Figures 8 and 12.
8.2.3. COPPER

All of the primary zone ore deposits in the Tennant Creek gold field contain significant amounts of copper; with averages varying between 0.33% at Juno and 4.01% at Peko. Sporadic copper carbonates are often visible at the surface, in silicified ironstone or talc-chlorite schist outcrops and in gold deposits within the zone of oxidation.

Notwithstanding the above-mentioned oxide zone occurrences it is clear that most of the copper content of the mineralised zones has been leached. Although the copper appears to be very mobile, and oxidation depths are considerable, there are no recorded occurrences of high grade supergene copper deposits. The reasons for the absence of such REDOX boundary controlled chalcocite dominated deposits are unknown.

It appears possible that rather than having been leached downwards the copper may have been diffused laterally to produce a large halo in the surrounding wallrocks.

This suggestion is supported by the general observation that, in non-mineralised areas e.g. E.L. 5330 (Fox, 1989) the bedrock copper values are generally within the 0 to 10 ppm range. On a regional basis values of 30 ppm or more would be considered anomalous. On the Peter Pan prospect more than 60% of the values exceed 30 ppm, and over 50% exceed 50 ppm. The presence of this large anomalous halo is responsible for the high local mean background and threshold values of 99 ppm and 350 ppm respectively.

Using the 350 ppm threshold, 6 copper anomalies are indicated on this prospect. All of these are approximately coincident with anomalous gold and bismuth - see Figures 9 and 12.

8.2.4. LEAD

In a paper entitled "Application of Ironstone Trace Element Studies to the Exploration for Gold at Tennant Creek", Large and Robinson (1987) proposed the following principal criteria.

a) There is a consistent positive relationship between gold and lead in all ironstones. Truely barren ironstones always contain less than 100 ppb gold and less than 20 ppm lead.

b) Ironstones with greater than 20 ppm lead ( and zinc in the range 0 to 10 ppm ) have high gold potential.

Because of its stability in the oxidised zone, it is believed that the 20 ppm lead threshold may retain its significance in weathered rocks. Assuming this to be so, values for lead could represent the most valuable, and main definitive geochemical tool for target selection.
Evidence from the Warrego deposit (Wedekind and Love, 1987) indicates that the gold-bismuth-copper mineralisation (+ associated lead etc.) was introduced at a later date, and higher temperature, than the ironstone emplacement. This relationship is believed to apply throughout the gold field.

The writer believes that lead in bedrock geochemistry could be a valid tool for major target identification and delineation in areas in which ironstones are absent or of small and apparently insignificant size.

Using the 20 ppm threshold value identified by Large and Robinson, 1987, the 6 anomalies plotted on Figures 10 and 12 are indicated. These are all to some degree coincident with anomalous values for other elements.

8.2.5. ZINC

Large and Robinson, 1987 stated that ironstones with zinc values between 0 and 10 ppm were characteristic of ironstones with high gold potential. This statement was based on analytical data for fresh ironstones.

Zinc is known to be highly mobile in all, or almost all weathering environments and it must be considered to have doubtful value as a tool in bedrock geochemistry.

The results are plotted and contoured on Figure 11. Using the 200 ppm threshold value calculated in section 7.1 above, five anomalies are indicated, three of which are coincident with anomalous gold, bismuth, copper and lead (see Figure 12).

8.2.6. BEDROCK GEOCHEMICAL TARGETS.

Figure 12 - Composite Anomaly Plan, presents threshold value contours for gold, bismuth, copper, lead and zinc, together with geological data relevant to target selection and the planning of future drilling.

Seven anomalies (PPA 1. TO PPA 7.) are indicated, with varying degrees of coincidence. Target priorities and recommended follow up drilling are discussed in section 8.4. of this report.

ANOMALY PPA 1.

This anomaly located in the central part of "Zone A" (section 7.1. of this report) exhibits excellent coincidence between all five elements. The 20 ppm lead contour suggests a potential strike length
of 60 to 70 metres.

**ANOMALY PPA 2.**

Good coincidence of anomalous gold, bismuth, copper and lead characterise this anomaly at the western end of "Zone A" (see section 7.1.) although some complexity appears to be caused by interference from anomaly PPA 4.

The 20 ppm lead contour suggests a target strike length of about 80 metres, open ended to the west where it passes into the adjacent Big Ben mining lease.

**ANOMALY PPA 3.**

Anomalous lead, with coincident copper and partly coincident bismuth anomalies define this target on "Zone C" (see section 7.1. of this report). Weakly anomalous gold, up to 13 ppb (and zinc, up to 200 ppm?) values reinforce its significance.

The 20 ppm lead contour suggests a target strike length of about 80 metres.

**ANOMALY PPA 4.**

This is a strong coincident lead - copper anomaly with anomalous bismuth being coincident with its west south western end. The potential target strike length, based on the 20 ppm lead contour, appears to be about 150 metres.

Anomalous bismuth, copper, and gold values on the east north easterly trend extension of this anomaly have been assumed to be associated with anomaly PPA 6.

**ANOMALY PPA 5**

This is a strong coincident anomaly on the south eastern edge of the explored area and on "Zone B" described in section 7.1. of this report. It is open to the east. The target strike length cannot be established without further work but could be 60 to 80 metres.

**ANOMALY PPA 6**

This anomaly owes its identity to a single station lead in bedrock value of 269 ppm - the highest recorded in the bedrock geochemical programme. A strong gold anomaly (up to 200 ppb) occurs on its south side, which is overlapped by anomalies in bismuth (up to 22 ppm) and copper (up to 2758 ppm) to the south and south east respectively.

If the lead anomaly had not been indicated, it would have been assumed that the anomalous values in the other elements were associated with anomaly PPA 4.
The assumed target strike length, based on a single station lead value, is only 25 metres, but is possible that this feature could be a structurally integral part of anomaly PPA 4.

ANOMALY PPA 7

This "Zone C" (see section 7.1.) anomaly, with an apparent strike length of about 40 metres, is characterised by approximately coincident anomalous lead and gold values.

8.3. Possible target zone geometry and exploration priorities.

The observations of previous workers have established that most primary ore deposits at Tennant Creek are zoned: bismuth and copper may be present in discrete or overlapping zones above the gold. Although these zones may not be well preserved in oxidised rocks, it is possible that copper - lead - ?bismuth anomalies with little or no coincident gold may indicate deposits in which the erosional surface plane is sufficiently higher above the gold mineralisation for little or no geochemical leakage to exist.

Production from the Wheal Doria lease was all derived from the workings located 80 metres east of the boundary with the Peter Pan prospect (see Figures 2, and 12). These workings were surveyed and the longitudinal section indicates that the ore shoot had a strike length of about 15 metres and plunged at 70° to the west. This plunge was confirmed by Peko holes DDH 1 and DDH 2. DDH 2 intersected the "ore horizon" east of the anticipated down-plunge location of the ore shoot and recorded about 3 metres hole length averaging about 1.5 grams of gold per tonne. DDH 1 encountered the ore shoot between 89 and 96 metres down hole depths and the 7 metres intersection averaged 40.47 grams of gold per tonne.

While it cannot be assumed that all ore bodies in the general area will have plunges of 70° to the west, the existence of steep westerly or easterly plunges must be anticipated. Extreme care needs to be exercised in planning and interpreting follow up drilling.

Current knowledge of the geometry of Tennant Creek ore bodies indicates that: they tend to be relatively short in plan strike length being generally parallel to the regional approximately east - west cleavage; average thicknesses are usually more than 20% of strike lengths; and, in most cases, the lengths of their down plunge axes are considerably greater than their strike lengths.

For example: in the old workings the Wheal Doria ore body appears to have had an average strike length of about 15 metres; Peko's DDH 1 suggests a true width of about 3 to 4 metres; and, that the ore body extends to at least 60 metres vertical depth. In this case the
long down plunge axis is more than 3 times the strike length.

In order to assess the relative discovery potentials of the anomalies PPA 1 to PPA 7, described in section 8.2. above, the following dimensional assumptions have been made:

a) that the strike lengths indicated by the 20 ppm lead in bedrock contour are the strike lengths of the potentially mineralised bodies;

b) that the bodies have average true widths of 10 metres;

c) that the bodies all have vertical depth dimensions of 100 metres; and,

d) that the average specific gravity is 2.5.

Although it can be assumed that Metana Minerals N.L. requires any ore discovery to have "stand alone" potential with respect to mining and treatment infrastructure costs, such a requirement could be met by one substantial deposit and several satellite deposits. The writer considers that 100,000 ounces of gold is a reasonable minimum discovery objective; and, that expected average gold grade in Tennant Creek oxide zone ore bodies is greater than 0.5 ounces per tonne, thus suggesting a minimum tonnage requirement of 150,000 to 200,000 tonnes depending on grade.

Based on the above assumptions the minimum target strike length requirement is 60 metres (150,000 tonnes potential). In this case anomalies PPA 1 (60 metres), PPA 2 (80 metres), PPA 3 (80 metres), PPA 4 (150 metres), and possibly PPA 5 (uncertain but could be 60 to 80 metres) merit further investigation.

8.4. Proposed drilling programme.

It is recommended that a first pass scout drilling programme totalling 250 metres should be completed to test anomalies PPA 1, PPA 2, PPA 3 and PPA 4.

The proposed method of testing these targets is open hole percussion drilling; with an estimated contract price of $15 per metre. If the costs of analyses, supervision, travel, transport, etc. are taken into account, it is estimated that a budget of about $10,000 is required.

It is recommended that 5 holes, each 50 metres in length, be drilled as follows:
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<th>HOLE NO.</th>
<th>GRID LOCATION (metres)</th>
<th>AZIMUTH</th>
<th>INCLINATION</th>
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<td>To test the central part of anomaly PPA 3.</td>
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In the writer's opinion the results of this programme should assist the Directors of Metana Minerals N.L. in deciding either, to continue exploration, or, to terminate the joint venture on this property. The proposed holes locations minimise the risk of failing to intersect the targets because of unexpected plunges.
9. REFERENCES

Cathew, S., 1987 - Peter Pan Prospect: drill logs for PPRC 1, PPRC 2, and PPRC 3 (Unpublished).


Large, R. R., and Robinson, P., 1987 - The application of ironstone trace element studies to the exploration for gold at Tennant Creek: Geology and Geochemistry of Gold - Copper Iron Oxide Systems, Tennant Creek and Starra Districts, University of Tasmania Workshop Manuals, Vols. 1 and 2, 1987.


### EXPENDITURE STATEMENT

**FOR THE PERIOD 1 JUNE 1989 TO 31 MAY 1990**

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**METANA MINERALS NL**

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APPENDIX 1.

APPENDIX 2.

Vacuum hole data and analyses.
### Peter Pan Prospect - Vacuum Hole Data and Analyses.

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**Explanation of geological abbreviations:**

gw. - greywacke  
sh. - shale or siltstone  
qfp. - quartz-felspar porphyry  
chl. - very chloritic  
talc. - talcose  
fe. - very ferruginous  
he. - hematitic  
ja. - with jasper  
qtz. - with quartz veins or stringers
TENANT CREEK PROJECT

PETER PAN PROSPECT

BEDROCK GEOCHEMISTRY

BISMUTH in ppm

REFERENCE

Threshold - 12.5 ppm

0 10 20 30 40 50 60 70 80 90 100 METRES

0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0 40.0 41.0 42.0 43.0 44.0 45.0 46.0 47.0 48.0 49.0 50.0 51.0 52.0 53.0 54.0 55.0 56.0 57.0 58.0 59.0 60.0 61.0 62.0 63.0 64.0 65.0 66.0 67.0 68.0 69.0 70.0 71.0 72.0 73.0 74.0 75.0 76.0 77.0 78.0 79.0 80.0 81.0 82.0 83.0 84.0 85.0 86.0 87.0 88.0 89.0 90.0 91.0 92.0 93.0 94.0 95.0 96.0 97.0 98.0 99.0 100.0

CR90/527

METANA MINERALS N.L.