ANNUAL REPORT

MLN 16

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GREENEX
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1. **INTRODUCTION**

This report describes the results of the 1987/88 exploration programme for cassiterite - tantalite mineralisation on MLN 16 at Bynoe Project on Cox Peninsula. The programme was implemented by Greenex a division of Greenbushes Ltd on behalf of Greenbushes Ltd and Barbara Mining Corporation, a subsidiary of Bayer (Australia) Ltd.

The exploration programme was aimed at expanding the "soft rock" both alluvial and pegmatite hosted Sn-Ta deposits. It included :-

* 1977 m of backhoe and excavator trenching of pegmatite deposits.
* 2199 m of auger drilling.
* 3025 m of excavator trenching of alluvial deposits.

This work increased the projects reserves.

MLN 16 is located approximately 30 km south west of Darwin (Figure 1). The area has a tropical monsoonal climate. It consists of broad flat uplands which slope gently into broad alluvial flats which may be up to 300 m wide. The pegmatites are usually found on the upland plains or the surrounding transitional areas. The alluvial deposits occur in the mature drainage systems, generally conforming with the present streams.

2. **PREVIOUS MINING AND EXPLORATION**

Greenbushes Ltd has been active in exploring the Finniss River Pegmatite Belt (including MLN 16 area) since 1977.

2.1 **History**

Tin mining commenced on the field in 1886 and although many attempts were made over the years, invariably the projects closed down within a couple of years. Within the last 10 years, associated with an improvement in the tantalum price, there has been a resurgence in mining activity. Mining operations with small plants have worked Hang Gong, Mt Finniss, Wiggs, Picketts and Welcome Extended pegmatite deposits.
2.2 Greenbushes Ltd Exploration

The following work was carried out by Greenbushes Ltd:

1979 -
33 line km of survey grid
900 holes and 2,593 m of auger drilling
490 m of trenching
140 individual pegmatites mapped
1,815 samples collected and processed

1980 -
57 line km of survey grid
2,560 holes and 6,950 m of auger drilling
955 m of trenching
5,249 samples collected and processed

2.3 Bynoe Joint Venture

2.3.1 During 1984 the Bynoe Joint Venture carried out:
59.44 line km of surveying; drilled 18,113.3 m of auger drill holes; cut 306 backhoe trenches totalling 1,825 m;
and processed 5,321 exploration samples

In 1984 a water storage dam was constructed to supply process water for the project.

2.3.2 In 1985 the Bynoe Joint Venture carried out a pilot mining and processing programme. A 100 tonnes per hour pilot plant was constructed with feed bin, trommel, three stage jig for concentration of coarse mineral and two stage spiral for concentration of fine mineral. A total of 80,000 tonnes of ore from nine pegmatite and two alluvial areas was processed to produce 27 tonnes of jig concentrate assaying 43% Sn, 18% Ta₂O₅ and 3.4 tonnes of spiral concentrate assaying 9% Sn and 6.6% Ta₂O₅. During 1985 a total of 20 pegmatites were mapped, 4,150.6 m of backhoe trenching, and 832 m of excavator trenching were carried out. A total of 446.5 m of auger drilling was carried out. This work was carried out for grade control purposes, not to increase ore reserves.

2.3.3 During 1986/1987 the Bynoe Joint Venture carried out the following:

* A total of 14 pegmatite areas were gridded
* A total of 14 pegmatite deposits were mapped
A total of 4,718.5 m of backhoe trenching of 17 pegmatites was carried out.
12 pegmatite deposits were drilled for a total of 3,679 m.
4 alluvial channels were gridded.
A total of 3,675 m of excavator trenching was carried out. These trenches were 3 - 6 m deep.

3. 1987/88 EXPLORATION PROGRAMME

The work carried out in the 1987/88 exploration programme is summarised in Table 1.

A total of 8 pegmatite prospects were gridded.
A total of 8 pegmatite prospects were mapped.
A total of 1,977 m of trenching (1,595 m of backhoe trenching and 382 m of excavator trenching) was carried out on pegmatite deposits.
2 pegmatite deposits were drilled for a total of 2,199 m.
10 alluvial channels were gridded.
A total of 3,025 m of excavator trenching was carried out in exploration of alluvial channels.

3.1 Pegmatite Exploration

3.1.1 Booths South Pegmatite

Location:
This prospect is located in MLN 16, approximately 600 m south east of the Observation Hill Project Camp and plantsite (Figure 2). The prospect lies west of the road leading to the main water storage dam.

Topography:
The prospect is located on two prominent, approximately parallel ridges of shale and siltstone. The shale and narrow pegmatite veins are restricted to the ridge and the wider vein to the western slope.
History:

Numerous small workings are scattered along the crest and slopes of the ridges and a number of shafts have been sunk. Eluvial workings have been found at the base of the western ridge. There is no record of production from this area.

1987 Work:

Following on from earlier work and field reconnaissance areas in the western and southern parts of the prospect were gridded and mapped. A total of 557 m of trenching was carried out adjacent to old workings and to follow up an area of quartz scree in the extreme south of the prospect. A total of 26 samples were taken from trenches and processed. Pegmatite veins uncovered in 1987 were too narrow for auger drilling.

Number, Dimensions and Attitude of Pegmatites:

Booths South Pegmatite is made up of two sub-parallel pegmatite swarms which are 100 m apart. The western swarm consists of possibly as many as 10 narrow veins which show great variation in thickness and orientation; the widest intersection is 11 m. The eastern pegmatite consists of a single main body having several smaller offshoots; maximum exposed width is 30 m. The main body strikes north-west and dips are variable and occasionally show a reversal of direction or are vertical. Proven strike length is approximately 150 m (Figures 3 and 4).

General Geology:

Lithologies at Booths South tend to be homogeneous kaolin-quartz-muscovite, frequently ferruginised and sometimes showing quartz-muscovite enrichment at the contacts. Host rocks are shales and siltstones.

Follow up trenching of the western ridge did not intersect major pegmatites. The western most vein exposed in 1987, was a lenticular, discontinuous segregated body having an established strike length of approximately 15 m. In the north-west of the prospect in dissected parts of the western ridge trenching uncovered two discontinuous, narrow complexly veined pegmatites generally striking NW-N, with contacts which diverge in dip. Strike length did not exceed 25 m and widths varied from 1 - 3 m.
Two additional, narrow 1-2.5 m pegmatite veins were located immediately to the south and south east of these latter veins. The westernmost of these is segregated into a quartz core with an associated kaolin rich rim.

In the extreme south of the prospect trenching exposed two further pegmatite veins varying in width from 0.5 - 5 m and strike length from 50 - 60 m. Both show segregation into a quartz core and associated weathered pegmatite in their northern exposures.

Massive milky (buck) quartz dykes outcrop in the north west of the western ridge. In places these dykes intrude the pegmatite contacts with veins up to 400 mm in width.

Cassiterite and Tantalite Mineralisation:

The cassiterite and tantalite grades from the 1987 work vary greatly within individual pegmatites, with the average SnO₂ :Ta₂O₅ ratio from the 26 samples collected being 1:2.5, with a range from 2.7:1, through 1:1 to 1:21.3. Channel sample grades are shown in Figures 5 and 6.
<table>
<thead>
<tr>
<th>PROSPECT</th>
<th>GRIDDING</th>
<th>MAPPING</th>
<th>TRENCHING (m)</th>
<th>DRILLING (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. PEGMATITE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Booths South</td>
<td>X</td>
<td>X</td>
<td>557</td>
<td>-</td>
</tr>
<tr>
<td>Hang Gong</td>
<td>X</td>
<td>X</td>
<td>431</td>
<td>2081</td>
</tr>
<tr>
<td>Hornet</td>
<td>-</td>
<td>X</td>
<td>25</td>
<td>-</td>
</tr>
<tr>
<td>Lees/Lees West</td>
<td>X</td>
<td>X</td>
<td>382</td>
<td>118</td>
</tr>
<tr>
<td>Litchfield &amp; Luggs</td>
<td>X</td>
<td>X</td>
<td>440</td>
<td>-</td>
</tr>
<tr>
<td>Short Cut</td>
<td>-</td>
<td>X</td>
<td>37</td>
<td>-</td>
</tr>
<tr>
<td>Solomons Reef</td>
<td>X</td>
<td>X</td>
<td>45</td>
<td>-</td>
</tr>
<tr>
<td>Wild Pig</td>
<td>-</td>
<td>X</td>
<td>60</td>
<td>-</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td>1977</td>
<td>2199</td>
</tr>
</tbody>
</table>

| **B. ALLUVIAL**        |          |         |               |              |
| Booths                 | X        | X       | 160           | -            |
| Bush Bull              | X        | X       | 120           | -            |
| Far West               | X        | X       | 125           | -            |
| Hang Gong              | X        | X       | 895           | -            |
| Johnstones             | X        | X       | 740           | -            |
| Jubilee                | X        | X       | 130           | -            |
| Mammoth                | X        | X       | 100           | -            |
| Shireleys              | X        | X       | 185           | -            |
| Siberia                | X        | X       | 140           | -            |
| Vickmans               | X        | X       | 430           | -            |
| **TOTAL**              |          |         | 3025          |              |

==---------------------------------------------------------------------==
3.1.2 **Hang Gong Pegmatite**

**Location:**

This prospect is located in MLN 16, on the northern side of the Mandorah Road approximately 44 km from the Stuart Highway turnoff (Figure 2). During 1987 the Mandorah Road was upgraded and sealed to 200 m NW of Hang Gong Pegmatite so the prospect is accessible via an all weather road. Hang Gong Pegmatite is approximately 2 km in a direct line from the Observation Hill Project Camp and plant site.

**Topography:**

The main Hang Gong Pegmatite forms a prominent ridge adjacent to the Hang Gong alluvial flats. Outcrop is good as mining has removed the top 1 m to 2 m, but dumps and waste material obscure detail. The pegmatite strikes north under the alluvial and scree cover. Here there is no outcrop. In the north west there is a partial laterite cover.

**History:**

Originally known as the Hang Gong Wheel of Fortune, production was first recorded in 1903. In 1903-04, 189.45 tonnes of cassiterite concentrate was produced, but the mine was closed down when the pegmatites lensed out at depth (see later). In 1956, the prospect was repegged and in the late 1970’s local prospector, Snow Casey, again worked the Hang Gong Mine. In the period April 1981 to October 1982 a total of 11.06 tonnes of concentrate with an average grade of 57.9% SnO₂ and 9.3% Ta₂O₅ was produced. The Ta₂O₅ : Nb₂O₅ ratio was 2:1.

**1987 Work:**

Following on from earlier work and field reconnaissance the grid in the Hang Gong West area was expanded and a total of 431 m of trenching was carried out to follow-up old drill lines, quartz scree and a few old workings. A total of 80 samples were taken from trenches and processed.

This work was followed up with a total of 187 holes and 2,081 m of auger drilling. A total of 506 auger drill samples were processed.
Number, Dimensions and Attitude of Pegmatites:

Four separate pegmatites have been outlined in the Hang Gong area (Figure 7; Figure 123, 1984 Annual Report). The Hang Gong Pegmatite is approximately 390 m long and a maximum of 60 m wide. In the south the pegmatite is a horizontal sill, which plunges at a shallow angle to the north. This would explain the lensing out of the pegmatite at depth discovered by early miners. Auger drilling was able to trace the Hang Gong Pegmatite north under alluvial and scree covered flats where it adopted an inclined attitude (maximum dip approximately 45 degrees east). The Hang Gong Pegmatite strikes 350 degrees.

Trenching and auger drilling has outlined 3 additional pegmatites west of and approximately parallel to the Hang Gong Pegmatite.

Hang Gong West No. 1 (immediately west of Hang Gong) is 15 m wide and 150 m long and in the north dips at 40 degrees east. The pegmatite dyke strikes 355 degrees and in some sections the pegmatite veining is complex.

Hang Gong West No. 2 is 250 m long and up to 60 m wide and dips at up to 42 degrees east in the south, but appears to be horizontal in the north.

Hang Gong West No. 3 is 75 m long and up to 45 m wide. The body appears to be sill like, but may be multi-veined and strikes 350 degrees. This pegmatite is open to the north, but due to the likely continuation being under the Mandorah Road further work to follow up this latter pegmatite is not possible.

General Geology:

Weathering in the Hang Gong area extends to at least 20 m. The Hang Gong Pegmatite is conformable with the strike of the enclosing country rock, but discordant with its near vertical dip. The contacts with the pegmatite are sharp and the schists adjacent to the contact are biotite rich often containing oriented 1 cm x 1 mm to 2 mm tourmaline. In addition to massive 10 cm to 20 cm wide quartz segregations within the pegmatite there are several large quartz zones, the largest being 15 m x 5 m. Although these segregations often restrict auger drill penetration they are not expected to present a problem during mining. The pegmatite has various muscovite and kaolin rich zones, the former often associated with high tantalum grades.

The eluvial zone has been removed by mining in the south, but forms a 1 m thick quartz rich scree in the north of the area.
Hang Gong West No's. 1 and 3 are kaolin-muscovite-quartz rich pegmatites, while Hang Gong West No. 2 is kaolin rich. There is some evidence of segregation in Hang Gong West No. 2 with an increase in the cassiterite-tantalite grade towards the footwall.

Approximately 100 m south of Hang Gong pegmatite is a 60 m long sub-outcrop of milky quartz surrounded with alluvium and tailings. The strike of the quartz outcrop is parallel with the Hang Gong Pegmatite. This outcrop may be the quartz core zone of an unexposed pegmatite.

Cassiterite and Tantalite Mineralisation:

The distribution of cassiterite and tantalite mineralisation within Hang Gong Pegmatite was irregular (Figure 8 and 9). The cassiterite content was relatively low except for a pod on section 325S. Overall the SnO₂:Ta₂O₅ ratio of 1:2 contrasts with that of Snow Casey's production figures 6.2:1. However, the estimated Ta₂O₅ :Nb₂O₅ ratio of 2:1 is identical with the production figures. The tantalum content within and between sections was variable.

The reserve calculation includes some areas which are lower than cut-off grade (1984 Annual Report). Average grade of this deposit may be increased if these areas can be recognised and separated during mining.

Hang Gong West No. 1 has a higher SnO₂ :Ta₂O₅ ratio of 2.16:1 and a lower Ta₂O₅ :Nb₂O₅ ratio of 1.29:1 compared with the Hang Gong Pegmatite.

Hang Gong West No. 2 has generally low levels of cassiterite and tantalite. There is a footwall enrichment with a cassiterite content much higher than other pegmatites in the Hang Gong Prospect, that is 4.8:1. The estimated Ta₂O₅ :Nb₂O₅ ratio is 1:1. From east to west within the Hang Gong prospect there is a trend towards increased SnO₂ and Nb₂O₅ relative to Ta₂O₅.

Hang Gong West No. 3 has an SnO₂ :Ta₂O₅ ratio of 21:1 which is well above average for the Hang Gong Prospect and markedly exceeds Snow Casey's production figures at 6.2:1. The Ta₂O₅ :Nb₂O₅ ratio is approximately 1:1.
3.1.3 *Hornet Pegmatite*

**Location:**

This prospect is located in MLN 16, approximately 700 m north of the Mandorah Road and 1.1 km SE of Observation Hill (Figure 2). The Mandorah Road was upgraded and sealed in late 1987 so provides all weather access but the 700 m to the prospect is on bush track accessible only in the dry season. *Hornet Pegmatite* is 700 m in a direct line from the Project Camp and plantsite.

**Topography:**

Hornet pegmatite is located on the western slope of a prominent ridge. Outcropping shales and associated scree predominate in the country around the prospect. The country is wooded by an open cover of eucalypt forest.

**History:**

There is no recorded production from the prospect nor is there any known record of its location. The limited number of workings suggests a low grade deposit.

There is no evidence of mining since the turn of the century, and Mines Department plans do not record the deposit.

**1987 Work:**

The prospect was rediscovered in 1987. A total of 25 m of trenching was carried out adjacent to the old workings. The open pits were inspected and the prospect mapped. One sample was obtained from the trench and processed.

**Number, Dimensions and Attitude of Pegmatites:**

There is one prominent direction of pegmatite intrusion, comprised of an unconformable vein striking 352 degrees with contacts which dip at a high angle. The vein is from 1.5 - 2 m wide and is at least 10 m in length.
General Geology:
Exposure of this pegmatite on the slope of the ridge is confined the partially caved-in open pit and the trench across the pegmatite. The pegmatite is kaolinised with kaolin dominant over an equal concentration of mica and quartz.

Pegmatite contacts are sharp with the adjacent host rock which consists of yellow brown metasiltstones. The main foliation strikes 342 degrees with a dip of generally high angle. A second foliation parallel to the pegmatite intrusion direction was observed at the east end of the trench (Figure 10).

Cassiterite and Tantalite Mineralisation:
Although the cassiterite grade is relatively low, the tantalite grade from this pegmatite is quite high. On the basis of the sample collected the returned grades gave an SnO₂:Ta₂O₅ ratio of approximately 1.4:1. The Ta₂O₅:Nb₂O₅ ratio was 0.67:1.

7.1.17 Lees Pegmatite Swarm

Location:
The Lees Pegmatite Swarm covers an area approximately 600 m x 400 m and consists of a complex of pegmatite dyke and sill intrusions. The swarm includes Lees Pegmatite, a sill like structure, Lees Extended, Lees South, Lees East and Lees West. The swarm is the main feeder for Lees Drainage alluvial deposits and is located in MLN 16. The area is accessible via the Observation Hill turnoff, on the Mandorah Road (Figure 2), and is approximately 0.75 km from the Observation Hill Project Camp and plantsite.

Lees Pegmatite:
Details of the main Lees Pegmatite are included in the 1984 Annual Report (pp 77 – 9). Pertinent details relating to the 1987 work programme are included here.

Lees pegmatite is interpreted as a relatively flat lying sill plunging at 20 degrees to 30 degrees to the north (Figure 14). The sill is approximately 150 m wide and up to 20 m thick and has been intersected by auger drilling over 80 m in the direction of plunge. Further exploration of the sill was restricted by the hard schist overlying the pegmatite. Auger drilling failed to penetrate the schist.
1987 Work:

Five holes were drilled using a down-hole hammer (HDH) drill rig operated by Grant Unstead of Bynoe drilling. A total depth of 100 m was drilled with the deepest of the 5 holes reaching 35 m (Figure 14). The positions and depths of holes were chosen to intercept the main Lees Pegmatite sill on its downward plunge of 20 - 30 degrees to the north. A total of 3 samples were obtained from a quartz/pegmatite contact intersection in 28520N, 10975E at 15 - 19 m and processed.

General Geology:

The HDH drill generally penetrated hard to very hard weathered micaceous shales. In three of the 4 holes the upper reaches of the country rock was lateritised (28540N, 10925E and 28540N, 10975E). A soft metasandstone or greywacke was intersected at 7 - 11.5 m in 28540N, 10975E and rare quartz grains were brought up with micaceous shales at 10 - 12 m in 28540N, 11040E. Only hole 28520N, 10975E penetrated any material resembling pegmatite. This material comprised a mixture of quartz grains of gravel/pebble size interspersed with unidentified black minerals and was assumed to be a quartz/pegmatite contact with an abundance of tourmaline. The hole was stopped at 19 m due to excessive volumes of water.

From the lack of success in 4 out of 5 drill holes north of Lees Pegmatite, it may be concluded that this orebody; either plunges steeply between 28520N and 28540N, east of 10905E, or terminates completely in the same area. If the latter hypothesis is correct then the Lees pegmatite sill was probably intruded from the west.

Cassiterite and Tantalite Mineralisation:

The cassiterite and tantalite grades from the 3 samples collected were exceptionally low compared to average grades obtained in Lees Pegmatite. And, it is assumed that virtually no mineralisation is present in the material intersected at 15 - 19 m in 28520N, 10975E.

**Lees West Pegmatite**

**Location:**

This pegmatite is located immediately to the west of the Lees Pegmatite sill and is the most northern of the pegmatite swarm (Figure 2).
Topography:

This pegmatite is on the northern upland slope of Lees Drainage. Eluvium is deep, but there is minor outcrop of laterite caprock, and laterised country rock. The eluvium is comprised of ferruginous quartz shale gravel, 0.5 - 1.5 m deep, with the thickest development downslope from the pegmatite.

History:

Much of the work on the Lees Pegmatite Swarm was undertaken in 1984. An open cut, shafts and eluvial workings indicate the extent of earlier work.

Some drilling of Lees West was undertaken in 1984 and is included with the 1984 results for Lees Pegmatite. Trial mining of Lees Pegmatite was undertaken during 1985 (see 1985 Intermediate Report). Earthmoving during 1987 uncovered pegmatite in Lees West which was not reached previously due to the failure of auger drilling to penetrate the schist/micaceous shale country rock in part of the area.

1987 Work:

Six excavator trenches totalling 382 m were dug to attempt to define the near surface extent of pegmatite in the Lees West area (Figure 11). A total of 5 samples were taken over 10 m of the 14 m of pegmatite exposed in the trench along 28540N; 4 m could not be sampled due to flooding. An additional 8.5 m of pegmatite was also exposed along 28520N, but was not sampled again due to flooding and cave in of the trench.

Three auger drill holes totalling 18 m were drilled to investigate the depth extent of the mineralised pegmatite exposed in the trench along 28540N. Further drilling could not be undertaken due to the failure of the drill to penetrate the country rock. Ten auger drill samples were taken and processed.

Number, Dimensions and Attitude of Pegmatites:

One additional pegmatite vein was exposed during trenching of Lees West. The vein strikes 320 degrees and dips approximately 56 degrees west (measured western contact). Trenching exposed a 14 m width of pegmatite along 28540N widening from 10.5 m along 28520N (Figure 11).
Another narrow 3 m wide pegmatite exposed along 28500N at 10849-52E (Figure 11) may also continue to the NNW, however, wet conditions prevented further trenching to determine if it was present along 28520N and 28540N.

General Geology:

Exposure of the pegmatite veins discussed above is restricted to the trenches cut to expose them. There is no outcrop. The pegmatites vary from the more common kaolin-mica-quartz variety to the uncommon mica-kaolin-quartz variety. It has a hard character like the adjacent country rock within which it has intruded, making sampling difficult. The country rock is comprised of grey laminated micaceous shales, with occasional schistose bands and the near surface material is frequently lateritised to various degrees.

Pegmatite contacts are sharp, and the veining rather complex such that in some places veins parallel the foliation and others truncate it. The foliation generally strikes 345 degrees and has a high angle dip.

Quartz veins related to the pegmatite intrusion may emanate from the pegmatite. A small exposure of quartz-kaolin-mica pegmatite in the trench along 28580N (Figure 11) may be representative of this quartz veining.

Cassiterite and Tantalite Mineralisation:

Where the newly exposed pegmatite veins were sampled, cassiterite and tantalite grades were high (Figure 12 and 13). On the basis of the trench and drill samples collected the average SnO₂:Ta₂O₅ ratio was approximately 4.3:1. The Ta₂O₅:Nb₂O₅ ratio was approximately 1.36:1.

3.1.5 Litchfield & Luggs Pegmatite

Location:

This prospect is located in MLN 16, approximately 3.1 km WSW of Observation Hill and approximately 3.5 km SW of the Hang Gong Mine on the Mandorah Road (Figure 2). The area is accessible via the Observation Hill turnoff on the Mandorah Road thence via the Lees Haul Road past Lees Pegmatite and then via the same track along Lees Drainage. Litchfield and Luggs Pegmatite is 3.3 km in a direct line from the Project Camp and plantsite.
Topography:

Litchfield and Luggs pegmatite is located on the northern bank of Lees Creek and on an adjacent laterite capped ridge. The majority of workings lie on extensive alluvial flats immediately abutting the creek. To the north, west and east are further laterite capped ridges separated by drainages of various width, but generally having a broad, shallow (mature) character.

History:

Since initial mining the prospect has been examined at various times over the years and was mapped by B.M.R. in 1956. The workings are partly or substantially collapsed and would appear not to have been worked for a number of years. Considerable work was carried out, so the prospect is virtually worked out suggesting consistently high grades were obtained. There is no recorded production from the prospect. Three old trenches totalling 47 m were located in the south of the prospect.

1987 Work:

The prospect was relocated in 1987. A total of 440 m of trenching was carried out adjacent to the old workings. The open pits and costeans were entered and examined and the trenches (old and new) sampled. A total of 18 samples were taken from trenches and processed.

Number, Dimensions and Attitude of Pegmatites:

There are two separate conformable pegmatites. The westernmost strikes 020 degrees with contacts which dip at a high to medium angle towards the west. This vein is narrow 1.25 - 8 m, and is exposed over a strikelength of 75 m. South east of the westernmost pegmatite is a more complex vein or set of veins striking approximately 030 degrees and exposed over a strikelength of 125 m, with contacts which dip from 20 - 30 degrees west to 86 degrees east. Maximum width exposed in trenches was 6 m.

General Geology:

The pegmatite is very coarse and extensive tourmalinisation is evident (Figure 15). Mineralisation can be found on dumps. Both veins are kaolinised with a harder quartz muscovite greisen zone preserved in the large eastern open cut.
The westernmost body is segregated into a quartz core and associated generally mica rich pegmatite, and is exploited by old workings over 57 m of its length. Many of the dumps are comprised of greisen boulders.

Pegmatite contacts where observed were sharp. Host rocks are micaceous shales, partly ferruginised and partly lateritised, generally to a red-brown colouration. The main foliation strikes NNE with dips of high angle. A rare, second subvertical foliation was apparent adjacent to some pegmatite contacts. In the north of the prospect the foliation appears to attain a more westerly strike.

Rare quartz veining was exposed in the prospect with which minor mica and kaolin were associated.

Cassiterite and Tantalite Mineralisation:

The geological distinction between the western and eastern pegmatites in this prospect is also seen in the cassiterite and tantalite grades (Figure 16). Both have higher levels of tantalite relative to cassiterite with SnO₂:Ta₂O₅ ratios of approximately 1:2.12 and 1:10, respectively. Ta₂O₅:Nb₂O₅ ratios are respectively 1.57:1 and 1:1.07. The western pegmatite contains economic levels of mineralisation.

3.1.6 Short Cut Pegmatite

Location:

This prospect is located in MLN 16, approximately 75 km north of the newly upgraded and sealed section of the Mandorah Road and 500 m NE of Yan Yams prospect (Figure 2). The 75 m to the prospect from the Mandorah Road is on bush track accessible only in the dry season. Short Cut Pegmatite is 750 m NNE of the Project Camp and plantsite.

Topography:

The workings comprise 2 shallow shafts and 2 smaller trenches on the SW slope of a low rounded hill. Low undulating country surrounds the prospect.
History:

There is no known record of the prospect's location nor any recorded production. The limited amount of work carried out, the largest working being 3 m x 5 m and 1 m deep, suggests that tin grades were unacceptable so the prospect was abandoned.

There is no evidence of mining since the turn of the century and Mines Department plans do not record the deposit.

1987 Work:

The prospect was rediscovered in 1987. A total of 37 m of trenching was carried out adjacent to the old workings. Workings and trenches were entered and sampled and the prospect mapped. Two samples were taken from trenches and old workings and processed.

Number, Dimensions and Attitude of Pegmatites:

The direction of pegmatite intrusion appears to be ENE based on contact orientation of the quartz core. There is also a slight elongation of exposures in that direction. The pegmatite body appears to be broad and sill-like, dips to the SW and north and is about 12 m wide as exposed at the surface. It appears to be open in all directions and may comprise a significant part of the low hill upon which it is situated.

It does not, however extend beyond the low hill in a NE direction at least near surface. This is inferred as a borrow pit dug by CIVDEC constructions in this area during upgrading of the Mandorah Road in late 1987, did not expose further pegmatite.

General Geology:

Exposures of this pegmatite are restricted to the old workings and the 2 trenches (Figure 17). The pegmatite is kaolinised and segregated to a quartz core. To the SE of the quartz core it is a quartz-muscovite-kaolin pegmatite and to the NW a kaolin-muscovite-quartz pegmatite.

Pegmatite contacts are sharp. The host rocks are yellow-green laminated siltstones. They strike approximately ENE and have dips of generally high angle.
Cassiterite and Tantalite Mineralisation:

The cassiterite grades are low, but the tantalite grades are high from this pegmatite. On the basis of the 2 samples collected the average SnO₂:Ta₂O₅ ratio was approximately 1:13. The Ta₂O₅:Nb₂O₅ ratio was 1:1.13.

3.1.7 Solomons Reef Pegmatite

Location:

This prospect is located in MLN 16, approximately 2.5 km WSW of Observation Hill and 3.0 km SW of the old Hang Gong mine on the Mandorah Road (Figure 2). Access is via the Observation Hill turnoff to the Bynoe Joint Venture camp and plantsite on the Mandorah Road, thence via Lees Haul Road to Lees Drainage after which Lees Drainage track is followed to the prospect.

Solomons Reef Pegmatite is 2.75 km in a direct line from the Project Camp and plantsite.

Topography:

Solomons Reef pegmatite is on the slope of a laterite capped ridge on the western side of Far West Drainage. Extensive alluvial flats lie to the east of the prospect. Mineralisation from the prospect is likely to have been shed into Far West Drainage and thence into Lees Drainage during the areas depositional history.

History:

There is no recorded production from the prospect nor is there any known record of its location. Workings are limited in size suggesting low grades in general, but, probably also due to the nature of the country rock, which is hard lateritised material, and the pegmatite, which is greisenised.

There is no evidence of mining since the turn of the century, and Mines Department plans do not record the deposit.
1987 Work:

The prospect was rediscovered in 1987, while trenching alluvials in Far West Drainage. A total of 45 m of trenching was carried out adjacent to the old workings. The open pits and trenches were entered and sampled. A total of 5 samples were taken from the prospect and processed.

Number, Dimensions and Attitude of Pegmatite:

There is one prominent direction of pegmatite intrusion. It is comprised of a single narrow 0.5 - 0.75 m vein striking 017 degrees with contacts which dip from 56 - 77 degrees east is and exposed over a striklength of 25 m.

An additional pegmatite vein was exposed in an alluvial trench along 29000N, 8785-7E in Far West Alluvial 200 m NE of Solomons Reef pegmatite. Additional veins may therefore be present in the subsurface in this area.

General Geology:

Exposures of this pegmatite are restricted to old workings and the 2 trenches cut to expose the pegmatite (Figure 18). The pegmatite is partly kaolinised, but is mostly comprised of a hard quartz muscovite kaolin (greisen) material with occasional variations to quartz kaolin muscovite pegmatite in some parts of the prospect.

Pegmatite contacts are sharp. Host rocks are laminated to massive micaceous shales which are lateritised and therefore of red colouration. The main foliation strikes approximately north-south, but varies to 350 degrees in the northern trench and dips from 71 degrees east to vertical. A second foliation, parallel to the pegmatite intrusion direction, was also apparent in the northern trench.

East of the pegmatite vein a quartz dyke 0.1 - 1 m wide has intruded the country rock. This dyke has the same strike as the pegmatite vein, but showed no signs of mineralisation.
Cassiterite and Tantalite Mineralisation:

Cassiterite and tantalite grades from the prospect are generally low, however, one sample from an open pit in the south of the prospect came partly from a wall carrying coarse mineralisation and so the average grade for the prospect was enhanced (Figure 18). On the basis of the 5 samples collected the average $\text{SnO}_2 : \text{Ta}_2\text{O}_5$ ratio was 52:1. The $\text{Ta}_2\text{O}_5 : \text{Nb}_2\text{O}_5$ ratio was 1:1.33.

3.1.8 Wild Pig Prospect

Location:

This prospect is located in MLN 16, approximately 1.0 km SE of the Hang Gong Mine on the recently upgraded all weather Mandorah Road (Figure 2). Access to the prospect from the Mandorah Road is via bush track accessible only in the dry season. Wild Pig Prospect is 1.6 km in a direct line from the Project Camp and plantsite.

Topography:

Wild Pig prospect is located on low sloping rises on the eastern margin of Hang Gong Drainage. To the east are dissected uplands with broad interveining drainages. In the north and south is undulating country carrying occasional pegmatites, and to the west are the extensive alluvial flats of Hang Gong Drainage.

History:

A number of quartz outcrops are known on the Cox Peninsula. Some of these are the quartz cores of otherwise unexposed pegmatites, while others carry minor pegmatite veining. Others still are barren, showing no visible signs of muscovite or other mineralisation. All types of quartz outcrop are potential exploration targets being directly associated with mineralised pegmatites or possible indicators thereof. Wild Pig prospect is of the middle category - being a quartz outcrop that carried minor pegmatite veining.
1987 Work:

The prospect was located during ground reconnaissance of MLN 16 during 1987. A total of 60 m of trenching was carried out on the prospect, and the prospect mapped. No additional pegmatite other than minor mica content was located. The prospect was therefore abandoned.

Number, Dimensions and Attitude of Pegmatite:

The prospect is comprised of unconformable north-south striking massive milky quartz dykes within which minor pegmatite veining, mainly as trails of mica, is evident. These quartz veins appear to have contacts with a sub-vertical dip.

General Geology:

There are three quartz veins in evidence, of which two are aligned in the west of the prospect and the third appears to have been intruded in the east (Figure 19). Another interpretation is that the veins were dislocated due to some structural movement. A single western vein was then eroded to form two aligned veins. There is a large amount of quartz cobble scree on the adjacent drainage and also in the underlying alluvial sediments, which is thought to have been shed largely from this source. Host rocks are micaceous shales which strike approximately 350 degrees with dips of a high angle.

3.2 ALLUVIAL DEPOSITS

During the 1987 field season sections of Booths, Bush Bull, Far West, Hang Gong, Johnstones, Jubilee, Mammoth, Shirleys, Siberia and Vickmans drainages were tested by costeaming on grid spacings of 100 or 200 m (Figure 2).

The drainages are long, broad, shallow, mature systems varying up to several kilometres in length and 200 m to 300 m in width. At their deepest they rarely contain more than 4 m of alluvium although the southern sections of Booths drainage sometimes exceeded 6 m. In profile the drainages are virtually the same and consist of a surficial black soil horizon 100 mm to 200 mm thick, underlain by a mottled ferruginous clay which grades into a sandy clay to clayey gravel wash containing significant cassiterite and tantalite concentrations.
Within the alluvial sediments at least three sedimentary cycles are recognised, the earliest producing the basal clayey sand or clayey gravel wash which is up to 2.5 m thick and usually contains subangular quartz and siltstone clasts of up to 200 mm in length. This basal, or C horizon, contains the major portion of tin tantalum reserves. Directly overlying the C horizon, and usually combined within it or separated by thin bands of clayey sand is a second minor gravel horizon (B horizon) which is up to 1 m thick. The B horizon contains minor concentrations of cassiterite and tantalite and may be absent due to reworking or unrecognised if it is represented by the A horizon, as a thin, rarely observed band of small 5 - 10 m pebbles which usually occurs about 0.5 m below the organic clay layer. The A horizon is generally no more than 0.5 m thick and is essentially unmineralised.

In places all horizons have been subjected to recent reworking and resultant in-filling with black organic clays.

The underlying bedrock is usually weathered to clay directly beneath the C horizon, weathering becomes less intense towards the margins of the drainage channel which are usually marked by an abrupt increase in bedrock elevation.

Vertical channel samples (6 l) are collected from the B and C horizons (if present) at 5 m intervals, the depth and thickness of individual horizons are noted and the samples processed according to standard practice.

3.2.1 **Booths Drainage**

Location and Topography:

Booths drainage is located in MLN 16 and has its source directly east of the campsite above the main freshwater dam. Trenching was undertaken between 1 - 1.3 km downstream from the headwaters and upstream from trenches cut in 1986. The drainage in this area is somewhat rejuvenated as evidence by the incised nature of the main channel, but its confluence with the broad Shirleys drainage gives it a mature drainage appearance. Seepage from the main storage dam ensures that the alluvials are generally wet, and this caused cave-in difficulties during trenching.
1987 Work:

Costeaming totalled 160 m, along 11,100 and 11,300E respectively (Figure 20), and 31 samples were collected and processed.

3.2.2 Bush Bull Drainage

Location and Topography:

Bush Bull drainage is located in MLN 16 and has its source south of Roadside pegmatite (Figure 2). Trenching was undertaken NW of Two Sisters pegmatite along lines 26,100 and 26,300N across the drainage in an area where it attains a width of 150 - 200 m. The area was previously untested.

1987 Work:

Two costeans totalling 120 m were dug (Figure 21). A total of 24 samples were taken from trenches and processed.

3.2.3 Far West Drainage

Location and Topography:

Far West drainage is located within MLN 16 and has its source immediately east of Far West South pegmatite (Figure 2). Trenching was undertaken across the drainage to the east and north east of Solomons Reef pegmatite along lines 28800 and 29000N in an area where the drainage is up to 150 m wide. The area was previously untested.

1987 Work:

Two costeans totalling 125 m were dug (Figure 22). A total of 24 alluvial samples were taken from trenches and processed. In addition, a sample was taken from a 2 m wide pegmatite exposed in the trench along 29000N and processed.
3.2.4 Hang Gong Drainage

Location and Topography:

This drainage is located in MLN 16 north of the Mandorah Road and the catchment includes the Hang Gong, Hills, Highland, Crawfords, Roses and other pegmatites (Figure 2). At its north-western extremity the drainage joins with Johnstones drainage before continuing north into West Arm.

1987 Work:

Four costeans were dug along 600S, 900S, 1100S (Hang Gong grid) and 30,300N (main area grid), over a total distance of 895 m (Figure 23 - 25). A total of 178 samples were collected from the trenches and processed.

7.2.8 Johnstones Drainage

Location and Topography:

Johnstones drainage is located in MLN 16 (Figure 2). The work detailed in this section was carried out in the northern part of the drainage (Johnstones North) past its confluence with Hang Gong drainage, and in the southern part (Johnstones South) where the drainage has a broad, mature character. In the north the drainage has developed a rejuvenated profile with a well defined channel.

1987 Work:

At Johnstones North three costeans were dug (with a spacing of 100 m) along 32,600, 32,700 and 32,800N over a total distance of 415 m (Figure 26 and 27). A total of 82 samples were collected from trenches and processed. In addition, three narrow pegmatite veins were exposed in trenches along 32700N, one of which was sampled (Figure 27).

At Johnstones South two costeans were dug (with a 200 m spacing) along 30,300 and 30,500N over a total distance of 325 m (Figure 28, 29, 30). A total of 56 samples were collected from trenches and processed. During this work four narrow pegmatite veins were exposed along 30500N (Figure 28), all of which were sampled.
3.2.6 Jubilee Drainage

Location and Topography:

Jubilee drainage is located within MLN 16 and has its source south-west of Shirleys North pegmatite. Trenching commenced in the northern part of the drainage immediately west of B.P. 33 pegmatite. The drainage has a broad, mature profile, and the area was previously untested.

1987 Work:

Two costeans were dug (with a 200 m spacing) along 25,700 and 25,900N over a total distance of 130 m (Figure 31). A total of 38 samples were collected from trenches and processed.

Mineralised Reserves:

The trenches were some of the deepest dug to-date with wash levels down to 6.9 m. Only 1 economic grade was returned so a reserve estimate was not made.

3.2.7 Mammoth Drainage

Location and Topography:

Mammoth drainage is located in EL 4183 and MLN 16, with its source south of the Mandorah Road in the Grants pegmatite area. It joins Hang Gong drainage near BP 6 pegmatite.

The drainage has a broad profile, but is quite shallow, and the area was previously untested.

1987 Work:

Two trenches were dug (with a 100 m spacing) along 32700 and 32800N over a total distance of 100 m. A total of 20 samples were taken from trenches and processed (Figure 32 and 33).

Mineralised Reserves:

All grades were sub-economic so no reserve estimate was made. Trenching should, however, be undertaken in this
drainage to the south of the Mandorah Road as there is a likelihood of increased grades from mineralisation shed from Grants, Grants West and Far West North pegmatites.

3.2.8 Shirleys Drainage

Location and Topography:

Shirleys drainage is located in MLN 16 and is locally known as the "airstrip" due to its broad flat profile. The source of this drainage is in the Bradys pegmatite area, and in the south it joins Booths drainage as a tributary. This drainage was previously untested.

1987 Work:

Two trenches were dug (with a spacing of 200 m) along 26,700 and 26,900N over a total distance of 185 m (Figure 34). A total of 37 samples were collected from trenches and processed.

Mineralised Reserves:

Grades from the samples in this drainage were poor and the wash zones were relatively deep. They were also unstable due to the presence of water, particularly in the central parts of the drainage. No reserve estimate was justified. This drainage is somewhat isolated from adjacent pegmatites, however, a costean in the north to determine if mineralisation from Booths south pegmatite has entered its northern extremities may be worthwhile.

3.2.9 Siberia Drainage

Location and Topography:

Siberia drainage is located in MLN 16 with its source region south-west of Observation Hill. The drainage is a tributary of Lees drainage, and has a relatively broad, mature profile. This area was previously untested.
1987 Work:

Two trenches were dug (with a spacing of 100 m) along 9950 and 10050E over a total distance of 140 m. A total of 28 samples were taken from trenches and processed (Figure 35).

3.2.10 Vickmans Drainage

Location and Topography:

Vickmans drainage is located in MLN 16 and has its source north-west of Bradys pegmatite (Figure 2). It is generally a broad, mature drainage, but narrows and deepens in parts due to vagaries in topography caused by quartz reefs or lateritisation. The area was previously untested.

1987 Work:

Five costeans were dug (with a 200 m spacing) along 9200E, 25900, 26100, 26800 and 27000N over a total distance of 430 m. A total of 86 samples were taken from trenches and processed.

Mineralised Reserves:

The work completed to-date represents a good proportion of the northern and southern ends of the drainage (Figures 36 - 39). Results from along 26100N, in particular, are very good and warrants additional costeanning to follow up the mineralisation in this area.

4. ESTIMATED EXPLORATION EXPENDITURE

The Bynoe Joint Venture participants have invested in excess of $4.5 million on their project at Bynoe in the past 4 years. A plant, and water resource has been developed on site and the project has been ready for production from early 1987.

Unfortunately the crash in the tin price and the consistently low tantalum prices has meant the project is on hold until more favourable prices are established. The tin price which fell from A$18,000 to less than A$8,000
has shown a mild improvement to A$9-10,000. Tantalum prices, which reached a high of US$120 per lb in the early 1980's began 1987 at US$16 per lb. This price has improved substantially and in March 1988 had reached US$30 per lb. The project is being re-evaluated in the light of current prices. Investigations into production and consumption trends through the Tantalum Information Centre in Brussels and current market prices are being closely monitored. During 1987/88 the B.J.V. participants continued their evaluation of the tin and tantalum resources within MLN 16, as documented in this report. The following table is an estimate of the expenditure on this area:

<table>
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<th>ITEM</th>
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<td>Surveying</td>
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<tr>
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<td>Pegmatite Trenching</td>
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<td>Drilling</td>
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<td>Alluvial Trenching</td>
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<tr>
<td>Administration Communications</td>
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<tr>
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</tbody>
</table>

TOTAL ESTIMATE

$175,000

5. CONCLUSIONS

The 1987 - 1988 exploration programme for MLN 16 expanded the project reserves. Prices for both tin and tantalum concentrates remain at historically low levels and substantially below the levels required for a profitable operation at Observation Hill. During the early part of 1987 tantalum prices were at record lows of US$16 per lb Ta₂O₅ (record since 1970). However by the early months of 1988 the price had increased to US$25 per lb Ta₂O₅ with reports suggesting price gains in 1988.

There have been reports that the largest single tantalum producer, the Tanco Mine in Canada was going to recommission its underground mine and plant late in 1988. This mine was closed in 1983. The Bynoe Joint Venture partners have completed feasibility study updates and is now closely monitoring the tantalum price and demand.
Observation Hill about 600m

Ridge top track to Jewellers/Kings Table

Makoskitalkure
Shallow Pit
Caved in

Mandurah Road 200m

CR 88/1508

GREENEX
EXPLORATION DIVISION OF GREENBUSHES LTD.

BYNOE JOINT VENTURE — N.T.

HORNET PROSPECT

GEOLOGICAL PLAN

FIGURE No10 DATE 19/8/87
REPORT No ORIGINATOR F.M.
PROJECT No DRAFTSPERSON H.P.M.

DRG No SHEET No PLATE No
GREENEX
EXPLORATION DIVISION OF GREENBUSHES LTD.

BYNOE N.T. — JOINT VENTURE

Vickman's
Alluvial Trenching

FIGURE No 39
DATE OCTOBER, 1987
ORIGINATOR F.M.
DRAFSPERSON H.P.W.

CR 88/1508