EXPLORATION LICENCE 71

FINNISS RIVER, NORTHERN TERRITORY

EXPLORATION FOR BASE METALS

1ST AUGUST, 1973.
## CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>SUMMARY</td>
<td>1</td>
</tr>
<tr>
<td>2.</td>
<td>INTRODUCTION</td>
<td>2</td>
</tr>
<tr>
<td>3.</td>
<td>TITLE</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>WORK COMPLETED</td>
<td>4</td>
</tr>
<tr>
<td>5.</td>
<td>RESULTS</td>
<td>6</td>
</tr>
</tbody>
</table>

### Appendix 1.

- Operational
- I. P. Results
- Soil Sampling Results
- Radiometric Results - Area 1
- Recommended Drill Sites
- Regional Geological Mapping (by M. and V. Diemar)
- Petrological Examinations

### Figure

- Locality
- Title and Areas Covered
- Area 1 - Geophysical and Geochemical Results
- Area 2 - Ground Magnetic Profiles
- Area 3 - Ground Magnetic and Radiometric Profiles.
- Area 4 - Ground Magnetic and Radiometric Profiles.
- Area 5 - Ground Magnetic and Radiometric Profiles.
- Area 1 - Geochemical Ni and Zn Soil Values
- Geological Map (M. and V. Diemar)
1. SUMMARY

This report covers the work carried out over the Company's E.L. 71, Finnis River, between October and December, 1972 and in May to July, 1973. The purpose of the programme was to locate and investigate five aeromagnetic anomalies detected by a B.M.R. airborne survey in 1956. An attempt was also made to locate two radiometric anomalies detected in the same survey.

Ground magnetics located the five aeromagnetic anomalies, two of which appear as multiple anomalies, possibly indicating a layered sequence. Interpreted source depths range from less than 50 metres to 400 metres.

An I.P. survey conducted over the shallowest anomaly indicated a sequence of parallel I.P. zones marginal to the magnetic zones. They are open ended with a minimum strike length of 1000 metres. One of these I.P. zones is centered over a limonitic outcrop which gave up to 840 ppm copper.

Soil samples taken along the I.P. traverses gave a number of high copper values which are associated with I.P. and magnetic anomalies and a small gossanous outcrop.

Drilling commenced on 15th June, 1973 and by the end of July 1 diamond hole had been completed to 70 metres depth and 8 shallow auger holes had been completed.
2. INTRODUCTION

Exploration Licence 71, located 80 kms south west of Darwin (see Figure 1), was selected to test 5 aeromagnetic anomalies, detected by the B.M.R., for massive sulphide mineralization. Similar anomalies in the Daly River area some 35 kms south are thought to reflect massive pyrrhotite bodies which are associated with appreciable base metal concentrations.

The Licence covers an area of the Archaean - Proterozoic Litchfield Complex, mapped by the B.M.R. as granite, granodiorite and tonalite.
Exploration Licence 71, covering 910 square kms was granted to Dampier Mining Company on the 7th September, 1972 for a period of 12 months. A condition of the Licence is that we spend $80,000 in the first 12 months. The northern half of the Licence falls within the Wagait Aboriginal Reserve and as such is covered by special conditions. In particular, the ground within a half-mile radius of the summit of each of the Two Sisters Hills is not to be disturbed in any way.

The title area is shown in Figure 2.
4. WORK COMPLETED

(a) **Ground Magnetics**
Ground magnetics were used to locate the five aeromagnetic anomalies. Readings were taken at 25m intervals along east-west traverses spaced 500 metres apart in each of the areas shown in Figure 2. A total of approximately 48.5 kms were covered.

The traverses were pegged every 50 metres with 0.7m wooden pegs on which the co-ordinates are written. Each traverse has at least three 2m pickets spaced along it.

The magnetometer used was an Askania Torsion Magnetometer with a precision of 2.5-5.0 gammas and a low instrument drift.

(b) **Radiometrics**
Radiometric readings were taken at 50 metre intervals in conjunction with the magnetic traversing. Coverage was incomplete, however, due to repeated instrument failure caused by humidity and rain.

The instrument used was a PUG-1E, a total count scintillometer.

(c) **Induced Polarization**
A brief frequency domain I.P. survey was carried out by McPhar Geophysics along lines 30000N and 31000N in area 1.

2550 metres of 50 metre spreads and 400 metres of 25 metre spreads were completed.

(d) **Soil Sampling**
Hand augered soil sampling was carried out in conjunction with the I.P. survey. A total of 97 samples was taken from B horizon, where recognisable, at depths between 0.15 and 1.9 metres. These samples were sieved to -80 mesh and analysed for Cu, Pb, Zn and Ni.
(e) **Rock Sampling**

Four ferruginous (gossanous) rock samples were taken and analysed for Cu, Pb, Zn and Ni.

(f) **Mapping**

All outcrops along and in the vicinity of the magnetic traverses were recorded.

(g) **Drilling**

Diamond drill hole D1 on Area 1 was completed at a depth of 70 metres. This hole was sited at 31000m N/8580m E and inclined at 45° to the east and was basically designed to test an IP anomaly.

Eight shallow auger holes A1 to A8 were drilled on Area 1 to determine geology and to take rock chip samples for geochemical analysis.
5. RESULTS

(a) Geophysical
The results of the ground magnetic/radiometric traversing and I.P. survey are shown in Figures 3 - 7. The I.P. pseudo cross sections are given in Appendix 2.

The ground magnetics successfully located all five aeromagnetic anomalies while the I.P. survey in Area 1 detected a number of I.P. anomalies.

Ground radiometrics did not locate 2 aeroradiometric anomalies detected in the area by the B.M.R. However, two anomalies were located in area 3.

(b) Geochemical
The results of the soil sampling are given in Appendix 3. Copper profiles are plotted in figure 3, zinc and nickel in Figure 8. Lead values, which differ from the zinc by generally less than 10 ppm have not been plotted.

The results of the four rock analyses are tabulated below.

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Location</th>
<th>Cu</th>
<th>Pb</th>
<th>Zn</th>
<th>N</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AK 0901</td>
<td>30800N/8600E</td>
<td>290</td>
<td>32</td>
<td>36</td>
<td>44</td>
<td>Massive Limonite</td>
</tr>
<tr>
<td>AK 0902</td>
<td>31000N/8600E</td>
<td>22</td>
<td>12</td>
<td>20</td>
<td>12</td>
<td>Limonitic Quartzite</td>
</tr>
<tr>
<td>AK 0903</td>
<td>31000N/8600E</td>
<td>48</td>
<td>16</td>
<td>22</td>
<td>16</td>
<td>&quot;</td>
</tr>
<tr>
<td>AK 0904</td>
<td>31000N/8600E</td>
<td>840</td>
<td>38</td>
<td>260</td>
<td>50</td>
<td>Massive Limonite</td>
</tr>
</tbody>
</table>

(c) Geological
Outcrop was very poor. All outcrops located have been shown in Figures 3-7. The main rock types recorded include granodiorite, microdiorite, dolerite, quartz and quartzite.

Also see Appendices 6 and 7, and Figure 9.
(d) **Drilling**

No analysis results have yet been received from the drilling; D1 intersected fine black schist containing approximately 8% of pyrite over the interval 40m to 60m.
APPENDIX I

OPERATIONAL

Access
Access to E.L. 71 is by 56 kms of sealed road and 97 kms of
good graded dirt road. The unsealed portion is subjected to
frequent flooding during the wet season.

Within E.L. 71 numerous tracks exist outside the Aboriginal
Reserve and access is good while the country is relatively
dry. Inside the Reserve a few tracks exist but much of the
country, being flat and open, is suitable for cross country driv-
ing.

Camp
A camp was established near a small billabong at approximately
26500N/15500E. This site was centrally located and well served
by access tracks. Initially one caravan and one tent were used.
However, deteriorating road conditions caused by the approaching
wet made it necessary to return the caravan to Darwin prior to
the end of the field season. After this, and during the I.P.
survey the camp consisted of 4 tents.

Tents proved to be very troublesome in the severe squalls and
heavy rain associated with the approaching monsoonal season.

Water Supply
In general, water from the nearby homestead, La Belle Downs,
and from Darwin was used for drinking. Water from the local
rivers and billabongs was badly polluted by Water Buffalo.

Vehicles
Two rented Nissan Patrol vehicles were used. These were fitted
with winches and oversized tyres, both of which were necessary
over the swampy ground. Camping equipment and fuel was
carried to and from the area in the Company's International Truck.

**Radios**
Radio contact with Darwin Office proved to be worthwhile. If necessary, purchase of a suitable two way radio is recommended for the coming season.

**Personnel**
The programme required one Geologist and an average of two field assistants. During the I.P. programme the number of field assistants rose to four.
APPENDIX 2

I.P. Pseudo Cross Sections.
### APPENDIX 3 - SOIL SAMPLE RESULTS

<table>
<thead>
<tr>
<th>Coordinates</th>
<th>Sample No.</th>
<th>Cu (ppm)</th>
<th>Ni (ppm)</th>
<th>Zn (ppm)</th>
<th>Pb (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30000N/7600E</td>
<td>AK 0954</td>
<td>70</td>
<td>48</td>
<td>64</td>
<td>72</td>
</tr>
<tr>
<td>7625</td>
<td>0955</td>
<td>22</td>
<td>22</td>
<td>28</td>
<td>24</td>
</tr>
<tr>
<td>7650</td>
<td>0956</td>
<td>14</td>
<td>14</td>
<td>20</td>
<td>16</td>
</tr>
<tr>
<td>7675</td>
<td>0957</td>
<td>220</td>
<td>30</td>
<td>260</td>
<td>34</td>
</tr>
<tr>
<td>7700</td>
<td>0958</td>
<td>54</td>
<td>60</td>
<td>50</td>
<td>44</td>
</tr>
<tr>
<td>7725</td>
<td>0959</td>
<td>78</td>
<td>50</td>
<td>30</td>
<td>44</td>
</tr>
<tr>
<td>7750</td>
<td>0960</td>
<td>58</td>
<td>38</td>
<td>38</td>
<td>36</td>
</tr>
<tr>
<td>7775</td>
<td>0961</td>
<td>140</td>
<td>34</td>
<td>120</td>
<td>46</td>
</tr>
<tr>
<td>7800</td>
<td>0962</td>
<td>76</td>
<td>54</td>
<td>36</td>
<td>42</td>
</tr>
<tr>
<td>7825</td>
<td>0963</td>
<td>56</td>
<td>42</td>
<td>32</td>
<td>32</td>
</tr>
<tr>
<td>7850</td>
<td>0964</td>
<td>72</td>
<td>60</td>
<td>34</td>
<td>30</td>
</tr>
<tr>
<td>7875</td>
<td>0965</td>
<td>54</td>
<td>36</td>
<td>26</td>
<td>30</td>
</tr>
<tr>
<td>7900</td>
<td>0966</td>
<td>54</td>
<td>26</td>
<td>12</td>
<td>28</td>
</tr>
<tr>
<td>7925</td>
<td>0967</td>
<td>68</td>
<td>44</td>
<td>20</td>
<td>34</td>
</tr>
<tr>
<td>7950</td>
<td>0968</td>
<td>104</td>
<td>62</td>
<td>32</td>
<td>46</td>
</tr>
<tr>
<td>7975</td>
<td>0969</td>
<td>72</td>
<td>44</td>
<td>28</td>
<td>42</td>
</tr>
<tr>
<td>8000</td>
<td>0970</td>
<td>86</td>
<td>52</td>
<td>32</td>
<td>34</td>
</tr>
<tr>
<td>8025</td>
<td>0971</td>
<td>102</td>
<td>54</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>8050</td>
<td>0972</td>
<td>100</td>
<td>64</td>
<td>34</td>
<td>32</td>
</tr>
<tr>
<td>8075</td>
<td>0973</td>
<td>80</td>
<td>42</td>
<td>42</td>
<td>34</td>
</tr>
<tr>
<td>8100</td>
<td>0974</td>
<td>90</td>
<td>60</td>
<td>28</td>
<td>32</td>
</tr>
<tr>
<td>8125</td>
<td>0975</td>
<td>140</td>
<td>78</td>
<td>24</td>
<td>40</td>
</tr>
<tr>
<td>8150</td>
<td>0976</td>
<td>150</td>
<td>36</td>
<td>36</td>
<td>52</td>
</tr>
<tr>
<td>8175</td>
<td>0977</td>
<td>200</td>
<td>76</td>
<td>44</td>
<td>32</td>
</tr>
<tr>
<td>8200</td>
<td>0978</td>
<td>130</td>
<td>68</td>
<td>22</td>
<td>26</td>
</tr>
<tr>
<td>8225</td>
<td>0979</td>
<td>120</td>
<td>62</td>
<td>20</td>
<td>26</td>
</tr>
<tr>
<td>8250</td>
<td>0980</td>
<td>66</td>
<td>24</td>
<td>14</td>
<td>22</td>
</tr>
<tr>
<td>8275</td>
<td>0981</td>
<td>140</td>
<td>52</td>
<td>26</td>
<td>32</td>
</tr>
<tr>
<td>8300</td>
<td>0982</td>
<td>150</td>
<td>48</td>
<td>28</td>
<td>30</td>
</tr>
<tr>
<td>8325</td>
<td>0983</td>
<td>80</td>
<td>38</td>
<td>38</td>
<td>26</td>
</tr>
<tr>
<td>8350</td>
<td>0984</td>
<td>150</td>
<td>52</td>
<td>22</td>
<td>26</td>
</tr>
<tr>
<td>8375</td>
<td>0985</td>
<td>200</td>
<td>64</td>
<td>24</td>
<td>30</td>
</tr>
<tr>
<td>8400</td>
<td>0986</td>
<td>150</td>
<td>60</td>
<td>22</td>
<td>26</td>
</tr>
<tr>
<td>8425</td>
<td>0987</td>
<td>380</td>
<td>86</td>
<td>28</td>
<td>34</td>
</tr>
<tr>
<td>8450</td>
<td>0988</td>
<td>140</td>
<td>46</td>
<td>20</td>
<td>26</td>
</tr>
<tr>
<td>8475</td>
<td>0989</td>
<td>170</td>
<td>72</td>
<td>26</td>
<td>32</td>
</tr>
<tr>
<td>Coordinates</td>
<td>Sample No.</td>
<td>Cu(ppm)</td>
<td>Ni(ppm)</td>
<td>Zn(ppm)</td>
<td>Pb(ppm)</td>
</tr>
<tr>
<td>-----------------</td>
<td>------------</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>30000N/8500E</td>
<td>AK 0990</td>
<td>230</td>
<td>88</td>
<td>28</td>
<td>36</td>
</tr>
<tr>
<td>8525</td>
<td>0991</td>
<td>140</td>
<td>64</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>8550</td>
<td>0992</td>
<td>120</td>
<td>56</td>
<td>18</td>
<td>30</td>
</tr>
<tr>
<td>8575</td>
<td>0993</td>
<td>108</td>
<td>58</td>
<td>22</td>
<td>28</td>
</tr>
<tr>
<td>8600</td>
<td>0994</td>
<td>140</td>
<td>46</td>
<td>30</td>
<td>32</td>
</tr>
<tr>
<td>8625</td>
<td>0995</td>
<td>210</td>
<td>68</td>
<td>34</td>
<td>36</td>
</tr>
<tr>
<td>8650</td>
<td>0996</td>
<td>140</td>
<td>48</td>
<td>20</td>
<td>28</td>
</tr>
<tr>
<td>8675</td>
<td>0997</td>
<td>150</td>
<td>48</td>
<td>32</td>
<td>26</td>
</tr>
<tr>
<td>8700</td>
<td>0998</td>
<td>140</td>
<td>46</td>
<td>32</td>
<td>28</td>
</tr>
<tr>
<td>8750</td>
<td>0999</td>
<td>160</td>
<td>50</td>
<td>26</td>
<td>32</td>
</tr>
<tr>
<td>31000N/7500</td>
<td>1000</td>
<td>88</td>
<td>56</td>
<td>28</td>
<td>38</td>
</tr>
<tr>
<td>7525</td>
<td>0906</td>
<td>78</td>
<td>58</td>
<td>26</td>
<td>30</td>
</tr>
<tr>
<td>7550</td>
<td>0907</td>
<td>74</td>
<td>52</td>
<td>22</td>
<td>30</td>
</tr>
<tr>
<td>7575</td>
<td>0908</td>
<td>88</td>
<td>66</td>
<td>34</td>
<td>30</td>
</tr>
<tr>
<td>7600</td>
<td>0909</td>
<td>78</td>
<td>58</td>
<td>22</td>
<td>32</td>
</tr>
<tr>
<td>7625</td>
<td>1001</td>
<td>64</td>
<td>54</td>
<td>28</td>
<td>26</td>
</tr>
<tr>
<td>7650</td>
<td>0910</td>
<td>60</td>
<td>46</td>
<td>22</td>
<td>20</td>
</tr>
<tr>
<td>7675</td>
<td>0911</td>
<td>54</td>
<td>40</td>
<td>16</td>
<td>22</td>
</tr>
<tr>
<td>7700</td>
<td>0912</td>
<td>108</td>
<td>74</td>
<td>36</td>
<td>36</td>
</tr>
<tr>
<td>7725</td>
<td>0913</td>
<td>78</td>
<td>58</td>
<td>24</td>
<td>30</td>
</tr>
<tr>
<td>7750</td>
<td>0914</td>
<td>82</td>
<td>62</td>
<td>22</td>
<td>28</td>
</tr>
<tr>
<td>7775</td>
<td>0915</td>
<td>68</td>
<td>52</td>
<td>28</td>
<td>26</td>
</tr>
<tr>
<td>7800</td>
<td>0916</td>
<td>70</td>
<td>56</td>
<td>26</td>
<td>24</td>
</tr>
<tr>
<td>7825</td>
<td>1002</td>
<td>64</td>
<td>52</td>
<td>24</td>
<td>26</td>
</tr>
<tr>
<td>7850</td>
<td>0917</td>
<td>68</td>
<td>56</td>
<td>30</td>
<td>24</td>
</tr>
<tr>
<td>7875</td>
<td>0918</td>
<td>78</td>
<td>58</td>
<td>24</td>
<td>22</td>
</tr>
<tr>
<td>7900</td>
<td>0919</td>
<td>76</td>
<td>60</td>
<td>26</td>
<td>22</td>
</tr>
<tr>
<td>7925</td>
<td>0920</td>
<td>86</td>
<td>68</td>
<td>28</td>
<td>24</td>
</tr>
<tr>
<td>7950</td>
<td>0921</td>
<td>88</td>
<td>66</td>
<td>24</td>
<td>20</td>
</tr>
<tr>
<td>7975</td>
<td>0922</td>
<td>94</td>
<td>64</td>
<td>34</td>
<td>24</td>
</tr>
<tr>
<td>8000</td>
<td>0923</td>
<td>94</td>
<td>66</td>
<td>26</td>
<td>22</td>
</tr>
<tr>
<td>8025</td>
<td>0924</td>
<td>100</td>
<td>70</td>
<td>28</td>
<td>24</td>
</tr>
<tr>
<td>8075</td>
<td>0925</td>
<td>120</td>
<td>76</td>
<td>30</td>
<td>28</td>
</tr>
<tr>
<td>8100</td>
<td>0926</td>
<td>108</td>
<td>74</td>
<td>28</td>
<td>38</td>
</tr>
<tr>
<td>8100</td>
<td>0927</td>
<td>170</td>
<td>80</td>
<td>30</td>
<td>32</td>
</tr>
<tr>
<td>8125</td>
<td>0928</td>
<td>96</td>
<td>58</td>
<td>28</td>
<td>28</td>
</tr>
<tr>
<td>8150</td>
<td>0929</td>
<td>108</td>
<td>74</td>
<td>40</td>
<td>26</td>
</tr>
<tr>
<td>8175</td>
<td>0930</td>
<td>82</td>
<td>56</td>
<td>26</td>
<td>24</td>
</tr>
<tr>
<td>Coordinates</td>
<td>Sample No.</td>
<td>Cu (ppm)</td>
<td>Ni (ppm)</td>
<td>Zn (ppm)</td>
<td>Pb (PPM)</td>
</tr>
<tr>
<td>-------------</td>
<td>------------</td>
<td>----------</td>
<td>----------</td>
<td>----------</td>
<td>----------</td>
</tr>
<tr>
<td>31000N/8200</td>
<td>AK 0931</td>
<td>84</td>
<td>58</td>
<td>26</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>0932</td>
<td>120</td>
<td>70</td>
<td>52</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>0933</td>
<td>98</td>
<td>58</td>
<td>32</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>0934</td>
<td>110</td>
<td>64</td>
<td>34</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>0935</td>
<td>220</td>
<td>94</td>
<td>36</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>0936</td>
<td>130</td>
<td>72</td>
<td>30</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>0937</td>
<td>170</td>
<td>78</td>
<td>30</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>0938</td>
<td>130</td>
<td>70</td>
<td>38</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>0939</td>
<td>210</td>
<td>82</td>
<td>46</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>0940</td>
<td>120</td>
<td>56</td>
<td>28</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>0941</td>
<td>120</td>
<td>60</td>
<td>30</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>0942</td>
<td>360</td>
<td>72</td>
<td>36</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>0943</td>
<td>760</td>
<td>74</td>
<td>56</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>0944</td>
<td>140</td>
<td>48</td>
<td>24</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>0945</td>
<td>150</td>
<td>44</td>
<td>32</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>0946</td>
<td>210</td>
<td>54</td>
<td>32</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>0947</td>
<td>270</td>
<td>34</td>
<td>56</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>0948</td>
<td>160</td>
<td>34</td>
<td>50</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>0949</td>
<td>80</td>
<td>42</td>
<td>42</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>0950</td>
<td>26</td>
<td>28</td>
<td>68</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>0951</td>
<td>200</td>
<td>26</td>
<td>66</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>0952</td>
<td>48</td>
<td>28</td>
<td>26</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>0953</td>
<td>48</td>
<td>28</td>
<td>40</td>
<td>42</td>
</tr>
</tbody>
</table>
## APPENDIX 4

<table>
<thead>
<tr>
<th>COORDINATE</th>
<th>AREA 1</th>
<th>VALUES IN COUNTS/MIN.</th>
</tr>
</thead>
<tbody>
<tr>
<td>7300E</td>
<td>31500N</td>
<td>31000</td>
</tr>
<tr>
<td>7350</td>
<td>900</td>
<td>1000</td>
</tr>
<tr>
<td>7400</td>
<td>1100</td>
<td>1000</td>
</tr>
<tr>
<td>7450</td>
<td>1200</td>
<td>800</td>
</tr>
<tr>
<td>7500</td>
<td>1300</td>
<td>1000</td>
</tr>
<tr>
<td>7550</td>
<td>1400</td>
<td>900</td>
</tr>
<tr>
<td>7600</td>
<td>900</td>
<td>900</td>
</tr>
<tr>
<td>7650</td>
<td>800</td>
<td>1000</td>
</tr>
<tr>
<td>7700</td>
<td>900</td>
<td>1100</td>
</tr>
<tr>
<td>7750</td>
<td>800</td>
<td>1100</td>
</tr>
<tr>
<td>7800</td>
<td>900</td>
<td>1000</td>
</tr>
<tr>
<td>7850</td>
<td>700</td>
<td>900</td>
</tr>
<tr>
<td>7900</td>
<td>700</td>
<td>800</td>
</tr>
<tr>
<td>7950</td>
<td>700</td>
<td>700</td>
</tr>
<tr>
<td>8000</td>
<td>600</td>
<td>600</td>
</tr>
<tr>
<td>8050</td>
<td>650</td>
<td>500</td>
</tr>
<tr>
<td>8100</td>
<td>600</td>
<td>600</td>
</tr>
<tr>
<td>8150</td>
<td>600</td>
<td>800</td>
</tr>
<tr>
<td>8200</td>
<td>600</td>
<td>1000</td>
</tr>
<tr>
<td>8250</td>
<td>600</td>
<td>800</td>
</tr>
<tr>
<td>8300</td>
<td>600</td>
<td>600</td>
</tr>
<tr>
<td>8350</td>
<td>600</td>
<td>600</td>
</tr>
<tr>
<td>8400</td>
<td>700</td>
<td>700</td>
</tr>
<tr>
<td>8450</td>
<td>700</td>
<td>700</td>
</tr>
<tr>
<td>8500</td>
<td>1100</td>
<td>800</td>
</tr>
<tr>
<td>8550</td>
<td>700</td>
<td>900</td>
</tr>
<tr>
<td>8600</td>
<td>700</td>
<td>900</td>
</tr>
<tr>
<td>8650</td>
<td>900</td>
<td>1000</td>
</tr>
<tr>
<td>8700</td>
<td>1000</td>
<td>900</td>
</tr>
<tr>
<td>8750</td>
<td>1000</td>
<td>1000</td>
</tr>
<tr>
<td>8800</td>
<td>1400</td>
<td>1200</td>
</tr>
<tr>
<td>8850</td>
<td>1000</td>
<td>1100</td>
</tr>
<tr>
<td>8900</td>
<td>1000</td>
<td>900</td>
</tr>
<tr>
<td>31500N</td>
<td>31000N</td>
<td>30000N</td>
</tr>
<tr>
<td>--------</td>
<td>--------</td>
<td>--------</td>
</tr>
<tr>
<td>8900</td>
<td>800</td>
<td>1200</td>
</tr>
<tr>
<td>8950</td>
<td>900</td>
<td>900</td>
</tr>
<tr>
<td>9000</td>
<td>1000</td>
<td>900</td>
</tr>
<tr>
<td>9050</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>9100</td>
<td>800</td>
<td></td>
</tr>
<tr>
<td>9150</td>
<td>600</td>
<td></td>
</tr>
<tr>
<td>9200</td>
<td>1100</td>
<td></td>
</tr>
<tr>
<td>9250</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>9300</td>
<td>1200</td>
<td></td>
</tr>
<tr>
<td>9350</td>
<td>800</td>
<td></td>
</tr>
<tr>
<td>9400</td>
<td>1400</td>
<td></td>
</tr>
<tr>
<td>9450</td>
<td>1200</td>
<td></td>
</tr>
<tr>
<td>9500</td>
<td>1400</td>
<td></td>
</tr>
</tbody>
</table>
## APPENDIX 5

### RECOMMENDED DRILL SITES

<table>
<thead>
<tr>
<th>CO-ORDINATES</th>
<th>INCLINATION</th>
<th>DEPTH</th>
<th>PURPOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Area 1</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3100N/8140E</td>
<td>$45^0E$</td>
<td>60m</td>
<td>Tests I.P. anomaly and possibly magnetic anomaly.</td>
</tr>
<tr>
<td>3100N/8450E</td>
<td>$45^0E$</td>
<td>150m</td>
<td>Tests magnetic and geochemical anomalies.</td>
</tr>
<tr>
<td>3100N/8580E</td>
<td>$45^0E$</td>
<td>50m</td>
<td>Tests I.P., geochemical anomalies and gossan.</td>
</tr>
<tr>
<td>3000N/7650E</td>
<td>$45^0E$</td>
<td>100m</td>
<td>Tests I.P., geochemical and magnetic anomalies.</td>
</tr>
<tr>
<td>3000N/8090E</td>
<td>$50^0$</td>
<td>130m</td>
<td>Tests magnetic and geochemical anomalies.</td>
</tr>
<tr>
<td>3000N/8160E</td>
<td>$50^0$</td>
<td>130m</td>
<td></td>
</tr>
<tr>
<td>3000N/8690E</td>
<td>$45^0$</td>
<td>70m</td>
<td>Tests I.P. anomaly.</td>
</tr>
</tbody>
</table>

Total for Area 1 : 690 metres.

### Area 2

<table>
<thead>
<tr>
<th>CO-ORDINATES</th>
<th>INCLINATION</th>
<th>DEPTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>4000N/5500E</td>
<td>$60^0$</td>
<td>150m</td>
</tr>
<tr>
<td>4000N/5550E</td>
<td>$60^0$</td>
<td>150m</td>
</tr>
<tr>
<td>3850N/5190E</td>
<td>$90^0$</td>
<td>150m</td>
</tr>
</tbody>
</table>

Tests magnetic anomaly.

Total for Area 2 : 450 metres.

### Area 3

<table>
<thead>
<tr>
<th>CO-ORDINATES</th>
<th>INCLINATION</th>
<th>DEPTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>24000N/14925E</td>
<td>$90^0$</td>
<td>170m</td>
</tr>
<tr>
<td>24000N/15000E</td>
<td>$90^0$</td>
<td>170m</td>
</tr>
<tr>
<td>24000N/15100E</td>
<td>$90^0$</td>
<td>170m</td>
</tr>
<tr>
<td>22000N/14850E</td>
<td>$90^0$</td>
<td>150m</td>
</tr>
<tr>
<td>22000N/14900E</td>
<td>$90^0$</td>
<td>150m</td>
</tr>
<tr>
<td>22000N/14975E</td>
<td>$90^0$</td>
<td>150m</td>
</tr>
</tbody>
</table>

Tests magnetic anomaly.

Total for Area 3 : 960 metres,

---

Note: The table lists recommended drill sites with their coordinates, inclination, depth, and purpose. The total for each area is calculated based on the sum of the depths.
<table>
<thead>
<tr>
<th>CO-ORDINATES</th>
<th>INCLINATION</th>
<th>DEPTH</th>
<th>PURPOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area 4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34000N/1750E</td>
<td>60°</td>
<td>130m</td>
<td></td>
</tr>
<tr>
<td>34000N/1800E</td>
<td>60°</td>
<td>130m</td>
<td></td>
</tr>
<tr>
<td>34000N/1850E</td>
<td>60°</td>
<td>130m</td>
<td></td>
</tr>
</tbody>
</table>

Tests magnetic anomaly.

Total for Area 4 : 390 metres.

Area 5

- None recommended.

Total Drilling 2490 metres.
APPENDIX 6 - REGIONAL GEOLOGICAL MAPPING
(by M. and V. Diemar)

A. Introduction
EL 71 covers an area containing a series of aeromagnetic anomalies similar to those which occur to the south near Daly River. Some of the Daly River anomalies cover zones mineralised in Cu, Pb and Zn and were thought to be in a geological environment similar to the EL 71 anomalies.

A short program of surface mapping was carried out in December and January 1972/73 by geologists M. and V. Diemar based at Darwin office.

B. Geology
1. General
According to the published maps the EL area falls within a sequence of rocks of the ? Archean Litchfield Complex generally described as containing granite, granodiorite, tonalite and garnetiferous granite. In this area, the complex is shown on geological maps to be an upthrown block, fault bounded to the east and west against the Lower Proterozoic Finniss River Group which forms part of the Pine Creek Geosyncline.

Unfortunately no detailed conclusions can be drawn from this mapping due to the scarcity of outcrop. Over 40% of the EL is swampland and most of the remaining area is covered by a veneer of alluvium or laterite.

The geological map accompanying this report (Fig 9) shows all outcrops discovered and it may be noted that some large areas (eg. south of the Reynolds River) are almost totally devoid of any outcrop.

Very little attention has been paid to the Litchfield
Complex by government agencies in the past and so, little information is available. The mapping indicated that this unit is a complex sequence of chert and quartz breccias, siltstones, quartzites, schists, gneisses, gabbros and minor ultramafics (altered peridotites or pyroxenites). Metamorphism, silicification, faulting, laterisation and granite intrusion with associated pegmatites and quartz veining has complicated the picture to some extent. Brief descriptions of the various rock types appear below, and petrological results of samples studied appear in Appendix 7.

Detailed mapping will be necessary to establish genetic and boundary relationship between these rock types.

2. **Rock Types and Descriptions**

   a) **Quartz Veins**  Ridges of quartz outcrop at a number of locations in the area. These generally strike in a north east - south west direction. Most are isolated ridges but in one location near anomaly 3, a series occurs together and are believed to parallel a fault zone in this vicinity.

   The quartz veins have a thickness up to about 8 metres and vary from massive vein quartz to recemented vein quartz breccias. At Pig Hill (samples AK 1023, 1024 and 1025), north north west of Bald Hill (sample AK 1031) and near the BHP camp site (sample AK 1026), sulphides were found in the quartz. Petrographic studies carried out on these samples indicated that the following sulphides were present :-

   AK 1023 - pyrite
   AK 1024 - This showed no actual sulphides, but
small pseudomorphs of fine hematite scattered through the rock are believed to be after pyrite.

AK 1025 - hematite after pyrite and pyrite cavities.

AK 1026 - mainly pyrite; minor pyrrhotite and arsenopyrite;

AK 1031 - mainly pyrite; some covellite & chalcopyrite

b) **Quartzite** Quartzite occurs in the vicinity of anomaly 1 where it varies in texture and composition from hard pure quartzites to being soft and ferruginous.

It appears that minor gossanous material is associated with the ferruginous quartzites in this area. Petrographic study suggested that one sample (AK 1003) was an orthoquartzite while there was some confusion over the origin of sample AK 0902.

c) **Chert and Quartz Breccias** These rock types generally occur together, although varying slightly in composition and appearance, and in EL 71 are found at the Two Sisters and Bald Hill. Both of these locations are prominent hills due to the resistance to erosion shown by these rock types.

The amount of silicification varies considerably and irregularly. Their mode of origin is largely uncertain at this stage:

For example, at Bald Hill, petrological study suggests that outcrops of tectonically formed quartz mica breccia (AK 1007), ? sedimentary chert breccia (AK 1011) and sedimentary quartz breccia (AK 1012) all occur within a distance of 50 metres; while at the Two Sisters, a
Chert breccia (AK 1015) of ? sedimentary origin and a chert/quartz rock of unknown origin (AK 1016) occur in close proximity. Apart from AK 1007 the samples had a siliceous matrix. No signs of pyroclastic rocks were found within the area of interest and no mineralization was noticed within the breccias.

d) **Granite/Granodiorite** Small outcrops of granite rocks are found throughout the central and north eastern portion of EL 71 (see Figure 9). Composition is shown from petrological study to vary from biotite granite to biotite granodiorite which is not considered unusual for a body of this size. At this stage, a normal intrusive origin is postulated. The age of these intrusives from K/Ar measurements is suggested to be 1630 m years.

The granite is not thought to have any influence on the aeromagnetic anomalies or possible mineralization within these anomalies, however its visible affect is great due to the area it covers and the presence of pegmatites and widespread quartz veins. These quartz veins which are found both within and outside the granite in some cases are mineralised as described above.

The possibility of this granite being a source of uranium mineralization cannot be ignored particularly due to the area's proximity to Rum Jungle and the presence of untested aerial radiometric anomalies within aeromagnetic anomalies 2 and 4.

e) **Gneiss** An area of gneiss was mapped and sampled some 5 Km NE of anomaly 3. These gneisses are medium to well foliated and petrological examination suggests that they are of sedimentary origin and vary little in composition. They are thought to be formed tectogenically rather than being granitised sediment.
f) **Mafic and Ultramafic Rocks** Three outcrops of mafic to ultramafic rocks were found and have been described in some detail below in sections B.5.a. and B.5.c.

g) **Schists** Two biotite muscovite quartz schists were located; one in anomaly 1 (AK 1017) and one under water at the southern end of Batch Batch Lagoon. The foliation in the second case was vertical striking NW towards AK 1017 although no relationship is suggested to exist at this stage. AK 1017 was sampled by field assistants during the magnetometer survey and no direction of foliation is known. Petrographic study of this sample shows it to be a metasediment.

h) **Siltstone** Two small outcrops of siltstone were mapped within the EL. Both have been altered to some extent by agencies other than metamorphism— the outcrop of micaceous ferruginous siltstone on the southern edge of anomaly 5 (AK 1018) has been strongly leached and that 2 Km east of the BHP camp has been silicified.

3. **Metamorphism**
There is evidence over the area for variable metamorphism ranging from greenschist facies (AK 1017 - biotite muscovite quartz schist in anomaly 1), paragneisses on the central east side of the EL and garnetiferous quartzites (AK 0902 and 1003) within the area of anomaly 1.

4. **Structure**
A suspected fault or shear zone may exist as indicated by the series of NE - SW trending quartz veins to the north of anomaly 3. This feature appears to have modified the shape of the anomaly.
Such features as numerous heavily fractured quartz veins and tectonically formed chert and quartz breccias may indicate the presence of faulting within the central and northern portions of the EL.

5. **Description of Outcrops Within the Magnetic Anomalies (Including Mineralised Samples)**

Outcrop has been found within three of the five aeromagnetic anomalies.

a) **Anomaly 1**: The dominant rock type here is hematite-rich quartzite. Minor outcrops of quartz/hornblende rock and schist occur. One boulder with an earthy gossanous appearance was sampled (AK 0904) and gave reasonable metal values.

Petrological examination suggested that this rock was derived from a rhombohedral carbonate.

Study of another sample (AK 0901) suggested that it was an altered ultramafic, originally a porphyritic microperidotite. This evidence together with that from anomaly 3, might suggest that the copper is present in the ultramafic rocks - possibly intrusive within the iron rich quartzites. Only one deposit of this type is known in the Daly River Area. This is the unworked Marion Hill prospect described as mineralization within an extensive area of 'dolerite'.

Sample AK 0904 might suggest an alternative origin as it fits in with information from Western Nuclear's Daly River Area where "mineralization is an intimate association of sulphides and carbonate." Unfortunately no further details on this area are known to the writers.

b) **Anomaly 2**: The area contains only one known outcrop.
This outcrop forming Pig Hill has been shown by petrological examination to be a fractured quartz vein containing minor pyrite. The relationship between this outcrop and the aeromagnetic anomaly is not known but it is suggested that no relationship exists.

c) Anomaly 3: Due to access problems, the area covered by this anomaly was not mapped to any great extent. In the northern section (see Fig. 9) a north east trending quartz vein exists. This vein is thought to be barren of sulphides. Adjacent to this vein was found an outcrop of uralitised micro gabbro containing minor pyrrhotite and chalcopyrite.

Within 100m of the gabbro was sampled an outcrop of tremolite/talc which a petrological examination suggested originated from either pyroxenite or peridotite. Further work is warranted here.

The Daly River and Ag/Pb deposits, most of which are situated on two sub-parallel NNE trending shear zones are thought to be formed within the Lower Proterozoic Burrel Creek Formation of the Finniss River Group. The rocks within EL 71 have previously been mapped as ? Archean Litchfield Complex. There is not sufficient evidence from the present mapping to prove or disprove this theory.

To the east of this area in the Finniss River Group high grade metamorphism in the vicinity of shear zones has been mapped and it is possible that the metamorphism within the EL is of a similar type rather than being regional. Certainly some outcrops within the EL do not show any metamorphism eg. the siltstone at the southern end of anomaly 5 (AK 1018) and apart from strain
within quartz crystals, the granites appear to be unchanged.

It may be of some importance to resolve the question regarding shear zones as, if they exist, they may have considerable control over mineralization.

C) Conclusions
Lack of outcrop prevented sufficiently comprehensive mapping to be carried out to obtain a clear picture of the geology of the region.

The presence of ultramafics within the aeromagnetic anomaly areas may indicate a relationship to mineralization.

Lack of geological evidence prevents any theories on the origin and possible environment of mineralization - if it exists.

It is likely that shear zones may play an important part in the localization of mineralization.

Petrological evidence indicates that none of the rocktypes found to date are pyroclastics and therefore the possibility of a Noranda type deposit is diminished.

D) Recommendations
The following recommendations are concerned only with geological considerations.
1. **Additional Regional Mapping**
   
a) The southern half of aeromagnetic anomaly 3 as shown on the geological plan (Fig. 9)

b) The area immediately south and south east of the anomaly 1 southern boundary.

c) The strip of high country running south east from anomaly 4 to the western boundary of the EL and to the southern boundary of the Wagait Reserve.

d) The high country within and adjacent to the eastern side of anomaly 2.

2. **Detailed Mapping**
   
a) All the area within the boundaries of anomaly 1 and particularly the area of main interest as shown by soil sampling, 1P and ground magnetometer work. It is suggested that geological information gained should be plotted on a base map of small scale with the grid accurately plotted. It is further suggested that this work be carried out prior to drilling to assist in the correlation of information between lines containing ground magnetometer 1P and soil line anomalies.

   Accurate correlation is necessary before bores can be confidently stepped out from grid lines.

   b) In the immediate vicinity of the quartz vein/gabbro/tremolite outcrops in anomaly 3.

   c) Any areas of suspected shearing and where areas of strong metamorphism are known, should be mapped to establish if in fact these structures are present, what their relationship to metamorphism
is and what the field parameters are which may
be used to recognize them in other parts of the
area.

3. Geochemical Soil Sampling
No soil sampling other than that which may
be planned by Mr. D. Price in aeromagnetic
anomalies is recommended at this stage.
Dr. H. C. Meyer,
The Broken Hill Proprietary Co. Ltd.,
Melbourne Research Labs. - Petrology Dept.,
245-273 Wellington Rd.,
CLAYTON, Vic. 3168

REPORT CMS 73/2/14 - PART 2

YOUR REFERENCE: Letter dated 27-2-73
DATE RECEIVED: 20-2-73
SAMPLES: AK0901, 0902, 0904; AK1003-1009;
AK1011-1018; 1028-1031
SUBMITTED BY: Dr. H. C. Meyer
WORK REQUESTED: Petrology.

H. W. Fander, M.Sc.
CENTRAL MINERALOGICAL SERVICES

SAMPLE REPORT (Mineralogy, Petrology, Ore Microscopy)

Job No. CMS 73/2/14 - Part 2 Date Received: 20-2-73
Reference 0/N NT0501
Sample No. AK0901
Nature of Sample: Hand specimen

DESCRIPTION SECTION No. 10987

a. Hand Specimen:

Porous, leached, ferruginous carbonate rock with hematite and quartz veins.

b. Microscopic:

The mineralogy of this rock is quite simple, but the relict textures are more complex; the rock is believed to be a completely altered ultramafic, and may have been in the nature of a porphyritic microperidotite.

The components are quartz and goethite. The goethite forms small networks (often seen in ferruginised serpentinites) and also larger skeletal patches. These various fine and coarse networks and structures are filled with fine mosaic quartz.

Veins of fine quartz and irregular patches of goethite also occur. As a general rule, even severely altered ultramafics contain relict primary magnetite/chromite; these are absent however, in this rock. The goethite might represent oxidised sulphides.

Thus it is thought that the original rock was a medium-grained, porphyritic peridotite, possibly serpentinitised before alteration to the present quartz - goethite assemblage.

H. W. Fander, M.Sc.
CENTRAL MINERALOGICAL SERVICES

SAMPLE REPORT (Mineralogy, Petrology, Ore Microscopy)

Job No. CMS 73/2/14 - Part 2 Date Received: 20-2-73
Reference NT0504
Sample No. AK0902
Nature of Sample: Hand specimen

DESCRIPTION SECTION No. 10988

a. Hand Specimen:

Quartzite - metaquartzite with porous goethite patches and streaks.

b. Microscopic:

There is evidence in this metaquartzite of two metamorphic episodes.

The rock was probably a sediment, and was a coarse-grained orthoquartzite. It was apparently quartz-veined, then metamorphosed and recrystallized to form an interlocking aggregate of quartz patches. Traces of original grain outlines and of quartz veins are still preserved.

Subsequently the rock was stressed or dynamically metamorphosed. This was accompanied by the introduction of fine hematite. However, no boxworks are recognisable; the porous, fibrous appearance of the hematite-goethite patches in the hand specimen may be due to the bladed to micaceous habit of the hematite.

Very occasional small (<0.1 mm.) grains of garnet are seen; they are observed by the hematite-goethite and it is not known whether they are of detrital or metamorphic origin (the latter alternative is suspected).

H. W. Fander, M.Sc.
CENTRAL MINERALOGICAL SERVICES

SAMPLE REPORT (Mineralogy, Petrology, Ore Microscopy)

Job No. CMS 73/2/14 - Part 2 Date Received: 20-2-73
Reference NT0904
Sample No. AK0904
Nature of Sample: Hand specimen

DESCRIPTION SECTION No. 10569

a. Hand Specimen:

   Soft, porous, ferruginous, manganiferous rock.

b. Microscopic:

   The dominant mineral in this rock is goethite, with minor quartz.

   Prismatic-radiating relict textures are dominant, and represent a fibrous to prismatic mineral. Cross sections of these features suggest derivation from a carbonate (i.e., a rhombohedral carbonate). On the other hand, the mineral could have been an amphibole, though it is likely that some (e.g., actinolite) would have been preserved. On the whole, derivation from a fibrous, rhombohedral carbonate is favoured. There is no tangible evidence for the former presence of sulphides, nor is the source of the Fe known.

   MnO₂ occurs as patches and rather diffuse veins, cutting the rock. The actual mineral species would need to be determined in polished section, but is probably not warranted.

H. W. Fander, M.Sc.
CENTRAL MINERALOGICAL SERVICES

SAMPLE REPORT (Mineralogy, Petrology, Ore Microscopy)

Job No. CMS 73/2/14 - Part 2 Date Received: 20-2-73
Reference NT0501
Sample No. AK1003
Nature of Sample: Hand specimen

DESCRIPTION SECTION No. 10990

a. Hand Specimen:

Quartzose rock, slightly ferruginous.

b. Microscopic:

This is a garnetiferous metaquartzite, and closely resembles AK0902.

It consists of strongly stressed, coarse, interlocking mosaics of quartz, and occasional small, subhedral crystals of garnet (probably almandine).

The rock was evidently fractured and cut by quartz veins. Recrystallization has occurred, whereby the vein-quartz has been incorporated into the host quartz and is often optically continuous with it, but the outlines of the veins are preserved due to fine Fe oxides.

Subsequently the rock was stressed and fractured, with the introduction of small amounts of bladed hematite.

The garnet occurs as small isolated crystals and occasional clusters. It appears to be of metamorphic origin, tending to confirm this suggestion in AK0902. The original rock was most probably an orthoquartzite.

H. W. Fander, M.Sc.
CENTRAL MINERALOGICAL SERVICES

SAMPLE REPORT (Mineralogy, Petrology, Ore Microscopy)

Job No. CMS 73/2/14 - Part 2 Date Received: 20-2-73
Reference NT0501
Sample No. AK1004
Nature of Sample: Hand specimen

DESCRIPTION SECTION No. 10991

a. Hand Specimen:

Biotitic granite gneiss. K feldspar stain test negative.

b. Microscopic:

This is a relatively fine-grained hornblende - biotite - quartz - plagioclase gneiss. Its composition corresponds to that of a trondhjemite, since it contains no alkali feldspar. Its fabric, and the presence of rounded zircon grains, suggests a tectogenic or synkinematic formation, originally from a sediment.

The rock is foliated on a small scale; the hornblende and biotite are fairly well segregated, with poikiloblasts of hornblende associated and intergrown with brown biotite flakes; these show subparallel orientation, and contain small grains of sphene.

The quartz - plagioclase layers consist of anhedral patches of stressed quartz, and laths of calcic oligoclase/sodic endosome.

Small apatite crystals are relatively common. Detritally rounded zircon grains were detected.

The rock is quite fresh and unaltered. Whilst the evidence of the detritally-rounded zircons is a bit meagre, experience with similar rocks indicates a sedimentary origin.

H. W. Fender, M.Sc.
CENTRAL MINERALOGICAL SERVICES

SAMPLE REPORT (Mineralogy, Petrology, Ore Microscopy)

Job No.CMS 73/2/14 - Part 2 Date Received: 20-2-73
Reference NT0501
Sample No. AK1005
Nature of Sample: Hand specimen

DESCRIPTION

SECTION No. 10992

a. Hand Specimen:

Biotitic granite-gneiss. K-feldspar stain test positive.

b. Microscopic:

Compositionally this rock is a biotite - adamellite, but its fabric is gneissose although foliation is not marked. The rock is a biotite - microcline - oligoclase - quartz gneiss.

The biotite (3%) occurs as small, dark-brown, subparallel flakes, in discontinuous layers, with occasional muscovite flakes. The quartz (50%) is present as stressed, interlocking patches. The K-feldspar (25%) sometimes shows poorly-developed microcline twinning, possibly due to stress. Oligoclase (20%) is poorly twinned or untwinned, but fresh. A few patches of myrmekite occur.

Clusters of small muscovite flakes partly replace occasional feldspar patches, and fine sericite is present in traces.

The fabric is gneissose, and grain size very variable. Detrital heavy mineral grains were not detected, but it is thought that this rock had a similar (tectogenic) origin as AK1004, derived from a sediment.

H. W. Gander, M.Sc.
CENTRAL MINERALOGICAL SERVICES

SAMPLE REPORT (Mineralogy, Petrology, Ore Microscopy)

Job No. CMS-93/2/14 = Part 2
Reference: NT0501
Sample No. AK1006
Nature of Sample: Hand specimen

DESCRIPTION

SECTION No. 10993

a. Hand Specimen:

Biotitic granite-gneiss. K-feldspar stain test positive in patches.

b. Microscopic:

This gneiss greatly resembles AK1005; both are characterised by a dominance of quartz, which is not typical of magmatic rocks.

The quartz (50%), occurs as stressed, interlocking grains and occasional larger patches or eyes. Microcline (20%) also tends to occur as poikiloblastic patches, as well as being intergrown on a finer scale with quartz and plagioclase (20%). The biotite (10%) is the same dark-brown variety as in AK1005.

The plagioclase is very poorly twinned and is extensively argillised; it is intermediate oligoclase.

D detrital zircon grains are present and suggest a sedimentary origin for the rock; it is regarded as flctogenic formation, rather than being a granitised rock.

The fabric is gneissose on a fairly fine scale, with "augen" of quartz and microcline.

H. W. Fander, M.Sc.
CENTRAL MINERALOGICAL SERVICES

SAMPLE REPORT (Mineralogy, Petrology, Ore Microscopy)

Job No. OMS 73/2/14 - Part 2  Date Received: 20-2-73
Reference NT 0901
Sample No. AK1007

Nature of Sample: Hand specimen

DESCRIPTION

SECTION No. 10994

a. Hand Specimen:

Brecciated quartz – muscovite rock.

b. Microscopic:

This is a quartz – mica breccia and is thought to be of tectonic (not sedimentary) origin.

It consists mainly of angular, stressed fragments of quartz, of all sizes from 0.1 mm. to 3 mm. or more. The quartz occurs as single crystals, mosaics (interlocking patches), and sheaves of prismatic vein-quartz crystals with cavities.

Muscovite and occasional biotite flakes occur throughout, generally bent and contorted, and obviously fragmentary. The muscovite is also intergrown with quartz.

Interstitial areas consist of fine colourless and iron-stained kaolinite.

The rock is believed to be a brecciated pegmatite or quartz-mica vein material. Whilst it may have been transported and redeposited, it would not be far from its source.

H. W. Fander, M.Sc.
CENTRAL MINERALOGICAL SERVICES

SAMPLE REPORT (Mineralogy, Petrology, Ore Microscopy)

Job No. CMS 73/4/14 - Part 2 Date Received: 20-2-73
Reference NT 0501
Sample No. AK1008
Nature of Sample: Hand specimen

DESCRIPTION SECTION No. 10995
a. Hand Specimen:

Even-grained microgranitic rock with biotite and muscovite. K-feldspar
stain test positive.

b. Microscopic:

A slightly stressed microgranite, with muscovite and biotite.

The main constituents are quartz (30%), microcline (40%), oligoclase (20%) and
micas (10%). The microcline occasionally occurs as phenocrysts, but on the whole the rock is hypidiomorphic-granular, with an average grain size range of 0.5 mm. to 1.0 mm.

The plagioclase (intermediate oligoclase, An_{20}) tends to be subhedral and
is always partly sericitised and argillised. The microcline and quartz are
anhedral and intergrown, the quartz showing stress. Biotite is a dark-brown
variety (cp AK1005 - 1006), as small random flakes. Muscovite occurs as large
poikilitic (or poikiloblastic) flakes.

No heavy-mineral grains were detected. Whilst the rock is granitic in
composition and microgranitic in fabric, it may not be of magmatic origin,
but rather of tectogenic origin as proposed for AK1005 and 1006.

H. W. Fander, M.Sc.
CENTRAL MINERALOGICAL SERVICES

SAMPLE REPORT (Mineralogy, Petrology, Ore Microscopy)

Job No. CMB 73/2/14 - Part 2
Reference NT0501
Sample No. AK1009
Nature of Sample: Hand specimen

DESCRIPTION

SECTION No. 10996

a. Hand Specimen:


b. Microscopic:

This rock is quite similar to AK1009, though oligoclase dominates over K-feldspar and thus the rock is a granodiorite. It is also slightly more coarsely-crystalline, with grain sizes generally over 1 mm. (the division between "medium" and "coarse" according to Hatch, Wells & Wells).

The main constituents are about 40% oligoclase, 30% quartz, 20% microcline, and 10% micas. The constituents are even-grained, with a tendency for the oligoclase (An_{20}) to be subhedral, quartz and microcline anhedral. The biotite is extensively chloritised and contains many small pleochroic haloes. Muscovite is less common but occurs as larger "books" or thick flakes. Quartz shows strain-extinction.

The oligoclase is partly sericitised and argillised, and often zoned. Small patches of zoisite/clinozoisite occur within the oligoclase.

There is no direct evidence regarding the origin of this rock. Compositionally and texturally it appears to be a normal granodiorite.

H. W. Fander, M.Sc.
CENTRAL MINERALOGICAL SERVICES

SAMPLE REPORT (Mineralogy, Petrology, Ore Microscopy)

Job NoCMS 73/2/14 - Part 2 Date Received: 20-2-73
Reference NTO501
Sample No. AK1011
Nature of Sample: Hand specimen

DESCRIPTION SECTION No. 10997

a. Hand Specimen:

Pals grey-green, fine-grained siliceous rock with quartz veins. K-feldspar
stain test negative.

b. Microscopic:

This is a fractured, quartz-veined chert. In common with the great majority
of cherts, it is recrystallized and consists of microcrystalline, interlocking
quartz patches.

Many fine, almost submicroscopic impurities are present; these are probably
clay, possibly leucocene (a common mineral in cherts).

The chart was brecciated after lithification, and veined by coarse quartz,
some of which occurs as crystals lining cavities.

There are no indications of fossils, and the rock lacks distinctive
features of any kind, though there is a very vague indication of bedding.
No evidence of pyroclastic components could be found.

H. W. Fander, M.Sc.
Sample Report (Mineralogy, Petrology, Ore Microscopy)

Job No. CMS 73/2/14 - Part 2  Date Received: 20-2-73
Reference: NTD 501
Sample No.: AK1012
Nature of Sample: Hand specimen

Description

SECTION No. 10998

a. Hand Specimen:

Brown, porous siliceous, micaceous rock with small, quartz-lined cavities.

b. Microscopic:

This is a quartz-breccia in the sedimentary sense of the term, i.e., composed essentially of angular detrital fragments. However, the rock shows affinities with AK1007, and may be a clastic equivalent of that rock.

It consists of a framework of stressed, angular to splintery grains of quartz, ranging in size from 0.1 mm. to 1.5 mm., and occasional muscovite flakes. The matrix/cement is porous in places (cavities are lined with quartz crystals), and is composed of ferruginous quartz, and some fine argillaceous matter obscured by iron-staining. The original matrix may have been ferruginous chert, now recrystallised.

Occasional detrital grains of zircon, tourmaline, and goethite are seen. The goethite may have been derived from pyrite; there is a suggestion of a goethite pseudomorph after a pyrite crystal ("devils dice").

H. W. Fender M.Sc.
CENTRAL MINERALOGICAL SERVICES

SAMPLE REPORT (Mineralogy, Petrology, Ore Microscopy)

Job No. CMS 73/2/14 - Part 2  Date Received: 20-2-73
Reference NT0501
Sample No. AK1013
Nature of Sample: Hand specimen

DESCRIPTION  SECTION No.  10999

a. Hand Specimen:

Massive quartz rock with quartz-goethite veins.

b. Microscopic:

A vein-quartz breccia of tectonic origin. The rock is virtually monomineralic, consisting of small and large fragments of typical vein-quartz, cemented with further quartz and cut by small quartz veins.

A larger quartz vein, of a younger generation, cuts the rock and consists of coarse, prismatic-radiating crystals, with fibrous goethite lining cavities and coating quartz crystal faces. Fine, diffuse goethite also occurs elsewhere in the rock.

Very small clusters of minute (<20μ) crystals of ? anatase, and associated leucoxene, are scattered through the rock.

No other features of interest or significance occur.

H. W. Fander, M.Sc.
CENTRAL MINERALOGICAL SERVICES

SAMPLE REPORT (Mineralogy, Petrology, Ore Microscopy)

Job No. CMS 73/2/14 - Part 2  Date Received: 20-2-73

Reference NTD01

Sample No. AK1014

Nature of Sample: Hand specimen

DESCRIPTION  SECTION No.  11000

a. Hand Specimen:

Quartz breccia with goethite veins and patches.

b. Microscopic:

This quartz-breccia resembles AK1013, but there are distinctive features.

Evidently the vein-quartz was deposited in open spaces, and shows some layering or stratification in addition to the normal vein-quartz features.

Much of the quartz is massive, well-crystallized, zoned crystal material growing inwards into cavities. There are also areas of finer, brecciated, stressed quartz veined by further quartz and by goethite.

The banded or stratified quartz is quite fine, and consists of crystals and quartz mosaics alternating with thin layers of earthy goethite. Apparently this feature represents a form of rhythmic deposition of the two minerals, and is similar to the situation at Beltane (willemite) and elsewhere.

H. W. Fender, M.Sc.
CENTRAL MINERALOGICAL SERVICES

SAMPLE REPORT (Mineralogy, Petrology, Ore Microscopy)

Job No. CMS 73/2/14 - Part 2 Date Received: 20-2-73
Reference NT0501
Sample No. AK1017
Nature of Sample: Hand specimen

DESCRIPTION SECTION No. 11003

a. Hand Specimen:

Fine-grained, biotite-rich quartzofeldspathic schist or microgneiss.
K-feldspar test positive in small patches.

b. Microscopic:

This rock is best termed a quartz - biotite - muscovite schist with minor feldspar, though its fabric is not markedly schistose; this is because of the dominance of granular quartz. However, it as a schist rather than, say, a hornfels, and is a product of regional metamorphism (greenschist-facies).

Biotite and muscovite occur as small, subparallel flakes in approximately equal amounts (7-10% each), but the biotite is coarser and more conspicuous.

The main constituent is even-grained quartz (0.1 - 0.2 mm. average size), with interspersed patches of orthoclase and oligoclase comprising 5 to 10% of the rock.

Occasional small, euhedral crystals of green tourmaline are present, as well as small apatite grains. Both minerals are metamorphic. Detrital zircon grains are also seen.

There is little doubt that this is a metasediment.

H. W. Fander, M.Sc.
CENTRAL MINERALOGICAL SERVICES

SAMPLE REPORT (Mineralogy, Petrology, Ore Microscopy)

Job No. CM3 73/2/14 - Part 2 Date Received: 20-2-73
Reference NT0504
Sample No. AK1018
Nature of Sample: Hand specimen

DESCRIPTION

SECTION No. 11004

a. Hand Specimen:

Friable, porous siltstone or fine sandstone.

b. Microscopic:

In its present state, this rock is a micaeous, ferruginous siltstone. However, it has evidently been thoroughly leached, and is believed originally to have contained substantial amounts (20-30%) of carbonate.

Subangular grains of quartz, with an average grain size of 0.04 - 0.05 mm., constitute the dominant component. Small flakes of muscovite, and occasional biotite (= vermiculite), are common and show parallel orientation due to bedding. Interstitial secondary quartz and fine goethite form the cement.

There are many small cavities, usually goethite-tinned; some show vague rhombohedral outlines and appear to represent leached carbonate.

Detrital grains of green tourmaline, opaques, zircon, and possibly xenotime, are scattered through the rock. Occasional small, ovoid pellets of a glauconite-like mineral also occur; this component is too sparse to be identified with certainty.

H. W. Fander, M.Sc.
CENTRAL MINERALOGICAL SERVICES

SAMPLE REPORT (Mineralogy, Petrology, Ore Microscopy)

Job No. CMS 73/2/14 - Part 2  Date Received: 20-2-73
Reference: NT0501
Sample No. AK1023
Nature of Sample: Hand specimen

DESCRIPTION  SECTION No.  11005

a. Hand Specimen:

Massive quartz with pyrite and leached cavities.

b. Microscopic:

The specimen consists of vein-quartz with pyrite.

The quartz occurs as small, matted or interlocking prismatic crystals; some areas contain impurities of fine clay and earthy hematite or goethite, and occasional small muscovite flakes. Other areas, and veins, consist of fairly pure, uncontaminated quartz, generally coarsely-crystalline.

Hematite-aggregates are pseudomorphous after pyrite, and sometimes have associated microgranular jarosite (as would be expected from the oxidation of sulphides).

In polished section, pyrite was the only sulphide mineral detected. It occurs as generally euhedral crystals from 0.05 mm. to several millimetres in size. Some crystals show partial to almost complete oxidation to goethite.

H. W. Fander, M.Sc.
CENTRAL MINERALOGICAL SERVICES

SAMPLE REPORT (Mineralogy, Petrology, Ore Microscopy)

Job No. CMS 73/2/14 - Part 2  Date Received: 20-2-73
Reference: AT0201
Sample No.: AK1024
Nature of Sample: Hand specimen

DESCRIPTION

SECTION No. 11006

a. Hand Specimen:

Massive, brecciated quartz with occasional cavities (?after pyrite).

b. Microscopic:

Consisting of vein-quartz with occasional muscovite flakes, this rock shows several phases of quartz growth but is otherwise devoid of interesting features.

The coarsely-crystalline quartz is generally stressed and shows overgrowths of finer quartz. Interstitial areas and angular patches contain fine, matted quartz crystals.

The muscovite flakes are generally small and wispy, occasionally larger, and appear to be located near fractures.

Small pseudomorphs of fine hematite after pyrite are scattered through the rock, but there is no more definite evidence of the former presence of sulphides.

H. F. Fander, M.Sc.
CENTRAL MINERALOGICAL SERVICES

SAMPLE REPORT (Mineralogy, Petrology, Ore Microscopy)

Job No. CMG 73/2/14 - Part 2 Date Received: 20-2-73
Reference NT0501
Sample No. AK1025
Nature of Sample: Hand specimen

DESCRIPTION SECTION No. 11007

a. Hand Specimen:

Massive quartz with occasional small, pyrite-shaped cavities.

b. Microscopic:

As in the previous specimen, the vein-quartz shows several phases of growth.

The coarsely-crystalline quartz is cut by thin quartz veins which show the same optical orientation as the host quartz. The coarse material is embedded in finer quartz, with patches containing fine hematite.

Very occasional small aggregates of hydromuscovite are present, but otherwise the rock shows no noteworthy features. Small cavities, some of them hem tite-filled, are probably representative of former pyrite.

H. W. Fander, M.Sc.
CENTRAL MINERALOGICAL SERVICES

SAMPLE REPORT (Mineralogy, Petrology, Ore Microscopy)

Job No. SMB 73/2/14 - Part 2  Date Received: 20-2-73
Reference NT 0501
Sample No. AK1026
Nature of Sample: Hand specimen

DESCRIPTION  SECTION No.  11008

a. Hand Specimen:

Milky, massive quartz with minor pyrite.

b. Microscopic:

This specimen consists of very coarsely-crystalline vein-quartz. In fact, the whole thin section is a single crystal, stressed by fracture-zones in which the fragments have been stressed and rotated.

The fracture-zones contain minor interstitial goethite, but there are also later (younger) goethite veinlets cutting these. The goethite veins carry the pyrite elsewhere in the specimen, and the pyrite is thus young.

The polished section shows rather porous, decomposed sulphides, dominantly pyrite, with isolated patches of pyrrhotite and arsenopyrite. A small inclusion (<0.1 mm.) of mackinawite was seen in the pyrite.

H. W. Fander, M.Sc.
**CENTRAL MINERALOGICAL SERVICES**

**SAMPLE REPORT (Mineralogy, Petrology, Ore Microscopy)**

Job No. CMS 73/2/14 - P.r.t 2  Date Received: 20-2-73

Reference: NT0501

Sample No. AK1028

Nature of Sample: Hand specimen

**DESCRIPTION**

**SECTION No.** 11009

a. Hand Specimen:


b. Microscopic:

While this rock consists mainly of hornblende, it is not appropriate to term it an amphibolite, because it lacks the orientated fabric usually associated with this group of rocks.

The major mineral hornblends, occurs as random to radiating groups of acicular to prismatic crystals. Interstitial areas are composed mainly of mosaic quartz, with minor, virtually untwinned polygonal grains of andesine or labradorite. Small clusters of small ilmenite crystals are fairly common, usually with rims of sphene.

Although the mineralogy is quite straightforward, the question of origin is not. There are no recognizable relict igneous textures, but relict sedimentary features are also absent. It seems more likely, in view of the mineral assemblage, that the rock was ultimately of igneous origin but has been thoroughly recrystallized, i.e., thermally metamorphosed. Alternatively, it could have had a metasomatic origin (cp. skarn). Field relationships may assist.

H. W. Fander, M.Sc.
CENTRAL MINERALOGICAL SERVICES

SAMPLE REPORT (Mineralogy, Petrology, Ore Microscopy)

Job No. CMS 73/2/14 - Part 2 Date Received: 20-2-73
Reference NT 0501
Sample No. AK 1029
Nature of Sample: Hand specimen

DESCRIPTION

SECTION No. 11010

a. Hand Specimen:


b. Microscopic:

This rock is a uraltised microgabbro. The interesting feature is the freshness of the plagioclase, compared with the total conversion of pyroxene to amphibole.

The amphibole is a pale yellowish-green, weakly pleochroic variety (possibly magesiochastingsite) which has completely replaced pyroxene and has a rather fibrous habit, which is characteristic of this type of alteration. The plagioclase is intermediate labradorite (An$_{50}$) and occurs as small, fresh, randomly orientated laths. Small crystals of oxide opaques are scattered through the rock.

The fabric of the rock is more typical of a microgabbro than a dolerite. The pyroxene must have had an ophitic texture.

The malitisation was probably a late magmatic re-adjustment rather than a deuteric phenomenon.

Opaque minerals include primary ilmenite, and small, subrounded grains of pyrrhotite, also possibly primary (10 - 100µ in size). Traces of chalcopyrite are associated with the pyrrhotite and also as isolated small grains (<50µ).

H. W. Fander, M.Sc.
CENTRAL MINERALOGICAL SERVICES

SAMPLE REPORT (Mineralogy, Petrology, Ore Microscopy)

Job No. CMS 73/2/14 - Part 2 Date Received: 20-2-73
Reference NT 0501
Sample No. AK 1030
Nature of Sample: Hand specimen

DESCRIPTION SECTION No. 11011

a. Hand Specimen:

Fibrous, crystalline pale rock. K-feldspar stain negative.

b. Microscopic:

This is a tremolite-talc-chlorite rock, believed to represent a totally altered, metasomatized ultramafic type. Similar rocks occur in W.A., where their origin is clear.

It consists mainly of large, fibrous, randomly orientated tremolite crystals forming a framework. Small, stubby flakes of talc are scattered through the rock and appear to be replacing the tremolite. Angular interstitial areas contain aggregates of colourless, magnesian chlorite (or antigorite).

Small euhedral crystals of oxide opaques are relatively conspicuous throughout the rock. They are believed to be primary (i.e. relict crystals) and to consist of zoned chromite/magnetite crystals. Often, rocks of this type are completely altered except for the chromite/magnetite, and this phase therefore provides supporting evidence for the ultramafic origin of the rock.

Thus the original rock was an Mg-rich ultramafic (? pyroxenite-peridotite) with chromite/magnetite crystals. It may have been serpentinised prior to tremolitisation - steatitisation.

H. W. Fander, M.Sc.
CENTRAL MINERALOGICAL SERVICES

SAMPLE REPORT (Mineralogy, Petrology, Ore Microscopy)

Job No. CMS 73/2/14 - Part 2 Date Received: 20-2-73
Reference NT 0601
Sample No. AK 1031
Nature of Sample: Hand specimen

DESCRIPTION SECTION No. 11012

a. Hand Specimen:

Massive quartz with fine, disseminated sulphides.

b. Microscopic:

Massive, fractured, strongly-stressed vein-quartz is the dominant constituent of this specimen. It occurs as coarse and fine aggregates of subhedral crystals and mosaics with interstitial, recrystallized quartz. Healed fractures and recrystallized quartz veins occur. There are also late, goethite-filled fractures. Small jarosite aggregates are pseudomorphous after a sulphide, and sulphide crystals are scattered through the quartz. They appear to be of relatively early formation, and are fractured and cut by later quartz veinlets.

In polished section, the major sulphide is seen to be pyrite, as generally small, porous, single crystals and occasional irregular patches up to 1 mm. across. There are also small (0.1 mm.) covellite patches, and larger composite areas (up to 0.5 x 1.0 mm.) of chalcopyrite - covellite.

H. W. Fender, M.Sc.
Ground magnetic profiles (2 cm = 2500 gammas)

Total count scintillometer profiles (1 cm = 1000 counts/min)

Interpreted magnetic body & recommended drill sites
FIG. 8

Ni soil profile (1 cm = 100 ppm)

Zn soil profile (1 cm = 100 ppm)

SCALE OF METRES