FINAL REPORT FOR E.L. 1753

BYNOE PROJECT, NORTHERN TERRITORY

LICENSEE : AUSTRALIAN COAL AND GOLD HOLDINGS LTD.

OPERATOR : AUSTRALIAN COAL AND GOLD HOLDINGS LTD.

TERM OF LICENCE : 12TH APRIL, 1979 TO 11TH APRIL, 1985

1:250,000 AREA : DARWIN

COMPiled BY : D.J. PORTER

DATE OF SUBMISSION : 3RD MARCH, 1986

NORTHERN TERRITORY
GEOLOGICAL SURVEY

CR86/112A
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SUMMARY

Bynoe Harbour, E.L. 1753, was explored by Australian Coal and Gold Holdings (AC Gold) for basemetal, uranium and gold mineralisations, in lower Proterozoic rocks of the Pine Creek Geosyncline. The E.L., in its final year of tenure, covered an area of 48 square kilometres over high grade metamorphic rocks of the Litchfield Province. This suite of rocks consists of recrystallised, massive carbonates, calc-silicate rocks, amphibolite, biotite quartzofeldspathic gneiss, graphitic schist/gneiss, quartzite, sideritic iron formation and ultramafic rock. Similar lithologies are found both within rocks of the South Alligator and Mount Partridge Groups.

Exploration by AC Gold commenced in November 1982 to initially test airborne magnetic and radiometric anomalies delineated on NTDME 1:100,000 maps. Programmes completed included 129.5 kilometres of ground magnetic data, 144.4 kilometres of ground radiometric data (U, Th, K and total count channels), geological mapping at a scale of 1:5,000, 5,353.0 metres of shallow RAB drilling, radiometric down hole logging of RAB holes, and 763.9 metres of diamond drilling. Total expenditure amounted to $355,238.

Numerous RAB geochemical anomalies were generated and four were tested by diamond drilling, with generally non-conclusive results:

MHD 01/8N, 8+35W

This hole intersected a maximum of 360 ppm U with 14 ppm Th, over the interval from 84.20 - 85.90 m. The uranium value may reflect trace uranium mineralisation in a brecciated gneiss zone.

MHD 02/13N, 16+95W

Narrow intervals of Ni-Cu sulphide mineralisation (eg. 0.95% Cu and 1.2% Ni from 93.60 - 93.70 m; and 0.21% Cu and 0.23% Ni) were intersected in olivine - tremolite rock. Anomalous palladium values of 0.5 ppm were also associated with the sulphide mineralisation.
Elevated Pb (1400 ppm) and Zn (2350 ppm), over the interval from 145.45 - 147.10 metres, may indicate trace lead and zinc sulphide mineralisation.

MHD 03/ 22N< 2+26E. Weak copper (760 ppm) and nickel (2500 ppm) values are associated with pyritic mineralisation, over the interval from 143.6 - 144.1 metres.

MHD 04/ 60+80N, 5+80E No significant mineralisation was intersected by this diamond drill hole.

The anomalous uranium values intersected in the weathered zone in MHD 01 are encouraging, and because of structural complexity, are only partially tested. Additional testing of uranium anomalies is warranted in the 4N/9W-16N/5W; 7-9N, 13W; and 11-16N, 16W areas.

Another encouraging feature of the diamond drilling is the anomalous Pd values in Ni-Cu sulphides encountered in MHD02. The most obvious area for further testing is the strong Ni-Cu RAB geochemical anomaly and associated magnetic anomaly at 22N, 4+40-5E.
1.0 **INTRODUCTION**

Exploration Licence (E.L.) No. 1753 was granted to Arafura Sand and Aggregate Pty Ltd on the 12.04.79, and under an agreement was transferred to Australian Coal and Gold Holdings Ltd (AC Gold) in the latter half of 1981. AC Gold explored the area for basemetal, uranium and gold until the Licence expired in April 1985.

Originally AC Gold was attracted to the area by an untested series of airborne magnetic and radiometric anomalies outlined on Northern Territory Department of Mines and Energy (NTDME) geophysical maps. These airborne anomalies were delineated on the ground, and extensively tested by RAB and diamond drilling programmes during the three years of exploration. Minor uranium and basemetal mineralisation was outlined.

The results of the three years have previously been presented to the NTDME as annual reports. This final report, required under Section 32 (1) of the Mining Act, presents relevent data from these reports.

2.0 **LOCATION**

E.L. 1753 is situated on the south side of Bynoe Harbour, to the north of Finniss Station, some 70 kilometres southwest of Darwin.

Originally, E.L. 1753 covered an area of 77.13 square kilometres when AC Gold commenced exploration (Fig. 1), but this was reduced to 48 square kilometres by year 6 of the Licence (Fig. 2).
Fig. 2 Location Map, E.L. 1753,
Bynce Project.
Scale 1 : 250,000.
3.0 **PREVIOUS WORK**

Exploration work completed prior to 1982 has been reported to the NTDME by Brown (1982).

The data outlined in this final report have previously been comprehensively covered in three annual reports submitted to the NTDME (Porter; 1983, 1984 and 1985).

4.0 **GEOLOGY**

4.1 Regional Geology

The Litchfield Province is generally regarded as a basement block on the western side of the Pine Creek Geosyncline. It extends for several hundred kilometres in a north-south direction, with a width exceeding 60 kilometres. Recent work has shown diverse elements in the Province, which included Lower Proterozoic gneisses (Wwell Tree Metamorphics), syn-orogenic lower Proterozoic granitoids and post-orogenic Carpentarian granitoids. Archean rocks have not been recognised. Contrary to an earlier expressed opinion (Cotton *et.al.*, 1982) the Province does not appear to form part of the Hall's Creek Mobile Belt.

E.L. 1753 covers a small area of about 48 square kilometres in the northern part of the Litchfield Province, and an interpretative geological map has been prepared at a scale of 1:100,000 (Fig. 3). RAB drilling and sparse outcrop in the poorly exposed area, has indicated a centrally located, syn-orogenic,
presumed lower Proterozoic granitoid enveloped by a suite of recrystallised carbonate rocks, calc-silicate rocks, amphibolite, biotite quartzofeldspathic gneiss, graphitic schist/gneiss, quartzite, sideritic iron formation and ultramafic rock. This suite of rocks is correlated with the Sweet's unit of the Well Tree Metamorphics and corresponds with pronounced aeromagnetic and radiometric anomalies. Where intersected by diamond drill holes, it is separated from feldspathic gneiss of the Well Tree Metamorphics and syn-orogenic granitoid, by moderate angle (60 - 75 degrees), west dipping breccia zones and silicified faults. The Sweet's unit is isoclinal folds about north-south trending axes, with axial surfaces to the folds dipping consistently at 60 degrees to the west. Further structural complication includes both faulting and cross folding along east-west axes, which produces reversals in the plunges of the isoclinal folds.

The area between the Point Ceylon and Tom Turner Faults consists largely of coarse-grained, highly kaolinized leucogranite with narrow rafts of feldspathic gneiss, mica schist and quartzite.

4.2 Detailed Geology

The gridded area has been mapped at a scale of 1:5,000 and geological maps are included as Plans 9 to 13.

Detailed logging of the four diamond drill holes together with petrographic work has led to a revision and more detailed description of the stratigraphy. However the stratigraphic column, outlined below, is rather tentative because of the structural complexity
and non-penetration of the entire width of Sweet's unit by the drill holes. The description of the stratigraphy and lithologies is drawn from data in the Diamond Drill Logs, Diamond Drill Hole Log Maps, Diamond Drill Hole Cross-sections and List of Thin Section Descriptions which are included in the 1985 Annual Report.

A tentative stratigraphic column, based upon MHD 01-4 (Figs. 4, 5, 6 and 7), and considering the reservations expressed above, is as follows:

**Biotite - feldspar - quartz gneiss unit**

This unit considered to represent the uppermost unit in the sequence was intersected in the upper parts of MHD 01 and possibly MHD 02. Major areas underlain by biotite-quartz-feldspar gneiss are to the west of the Pt Ceylon Fault, and to east of the Sweet's unit which trends north through Toss Point. The gneiss is deeply oxidized and was not thin sectioned.

It is separated from the Calc-silicate Gneiss and Ultramafic units by west dipping breccia and silicified fault zones.

**Ultramafic Unit**

The Ultramafic unit was intersected in MHD 02, from 17 to 110 metres. Other similar rock types occur at 40N, 15+20W; 86N 2+10E; 8N, 29W; and possibly 22N, 5E.

It consists of an upper sub-unit of green, clayey tremolite - actinolite rock, and medium-grained
amphibolite. The lower sub-unit, from 48 to 110 metres, consists of monotonous dark green to black, fine to coarse-grained, serpentinized tremolite-olivine rock. Olivine-content is generally in the range from 40 - 60%. Minor chlorite, phlogopite, garnet, hematite and calcite are other constituents.

The origin of the ultramafic rock is problematical - it may either represent a metamorphosed, massive dolomite or alternatively, an intrusive rock of pyroxenitic to peridotitic composition. The latter explanation is favoured.

Calc-silicate Gneiss unit

The Calc-silicate Gneiss unit consists predominantly of diopside-rich calc-silicate rocks, with subordinate para-amphibolite, pelitic schist, feldspar-quartz-biotite gneiss and graphitic, pelitic schist. It was intersected in MHD 01/48-200m, MHD 02/109.65-164.15m (?), MHD 03/0-47.5m and MHD 04/180-200m. The lower boundary of the unit is defined as the last amphibolite band before a predominant sequence of graphitic pyritic schist, banded calc-silicate gneiss, pelitic schist and recrystallised carbonate rock (Pyritic, Graphitic Schist/Carbonate Rock unit).

The calc-silicate gneisses are thinly banded rocks, which consist of alternating diopside - and biotite/phlogopite-rich layers. Recorded mineral assemblages are diopside-termolite-phlogopite-plagioclase + graphite, diopside-biotite-plagioclase-microcline,diopside-biotite-quartz-microcline, and the rare assemblage, cummingtonite-biotite-plagioclase-vesuvianite-graphite-quartz.
Para-amphibolite may comprise up to 50% of the unit, as bands up to 10 metres, alternating with the calc-silicate gneisses. There appears in places, to be a gradation from amphibolites with hornblende-plagioclase, through amphibolites with colourless amphibole-plagioclase-quartz-biotite to diopside-bearing gneiss. The amphibolites are dark green to grey and white, fine to coarse-grained, lepidoblastic, nematoblastic rocks with the following recorded mineral assemblages:

hornblende-plagioclase + quartz + biotite, plagioclase-cummingtonite-quartz-biotite and feldspar-tremolite-quartz-biotite-diopside.

Commonly the amphibolites are retrograded to assemblages of sericite-chlorite-albite, with introduction of late stage, transgressive veinlets of pyrite.

The parentage of the calc-silicate gneisses, based upon petrographic evidence only, appears to be thinly bedded, carbonate-bearing pelites; the absence of calcite in the parageneses suggests either low, initial carbonate content, or deviation from dolomitic, siliceous pelites by decarbonatization during progressive metamorphism. The sedimentary origin of the amphibolites is confirmed by their gradational contacts with calc-silicate gneisses, and in places (eg. MHD 01/168.0-179.0m), their interlayering on a micro-scale with calc-silicate gneiss. Their mineralogy indicates a high chemical component, suggesting periodic influx into the unit of volcanoclastic material.
Pyritic, Graphitic Schist/Carbonate Rock unit

This unit underlies and may be conformable with the Calc-silicate Gneiss unit. It is distinguished by the more abundant black, graphitic, pyritic schist, together with finely banded, graphitic calc-silicate rocks and thin bands of recrystallised dolomitic limestone. Minor rock types include para-amphibolite and pelitic schist. Possibly three drill holes, MHD 02/115.6-164.2m, MHD 03/47.5-116.3m and MHD 04/180.0-121.6m intersected the unit.

The graphitic schist generally contains less than 20% but up to 70% graphite which imparts a dark grey or black colour to the rock. Other minerals include quartz, biotite, sericite, diopside and microcline. Pyrite is ubiquitous, and occurs as coarse, granular aggregates and thin conformable bands, in amounts up to 5%.

Finely banded, graphitic calc-silicate gneiss is a grey and white rock, which consists of alternating layers of graphite-biotite-quartz, diopside-quartz and calcite. There is considerable range in carbonate content, from traces up to 20%. The banding which is generally less than 1 mm wide appears to palimpsest bedding lamination.

Recrystallised white and pale green carbonate rocks form bands generally less than 0.5 metre, but up to 3.0 metres wide. Their dolomitic parentage is indicated by the presence of abundant, subrounded serpentinized olivine grains intergrown with coarse, xenomorphic calcite. The carbonate-content is generally from 50-70%. Textures range from massive to foliated, where lepidoblastic phlogopite and graphite impart a schistosity to the rocks.
The pelitic schists are pale green to grey rocks which predominate in the lower and upper parts of the unit. They are commonly porphyroblastic rocks, with lenticular, coarse porphyroblasts of pinitized cordierite and less commonly garnet. Recorded parageneses are microcline-cordierite-biotite-quartz + plagioclase, quartz-feldspar-garnet-biotite-graphite and quartz-microcline-biotite-sillimanite-graphite + plagioclase.

Limonitic, Graphitic Schist/Quartzite unit

This thin unit was intersected in MHD 03/116.4-130.0m and MHD 04/68.5-121.2m, where it may be isoclinally folded. It presumably lies below the Pyritic, Graphitic Schist/Carbonate Rock unit, and the boundary is defined as the uppermost quartzite band.

Three quartzite bands are present in MHD 03, where there are seven bands in MHD 04. The width of the quartzites range from 0.2 to 3.0 metres. They are pale blue, fine-to medium-grained rocks, generally with less than 5% lepidoblastic biotite and chlorite. In one unit (MHD 04/118.8-121.2m) there appears to be a transition from massive quartzite to thinly (50-100mm) interlayered quartzite and pelitic schist.

Underlying and interbanded with the quartzites is a distinctive reddish brown, limonitic graphitic schist, with 10-50% secondary limonite derived from the oxidation of siderite and staurolite. Biotite, sericite, fibrolitic sillimanite, cordierite, quartz and microcline are other common minerals.
The unit represents a metamorphosed sequence of iron and carbonate rich black shale, and quartzite, derived from either chert or quartz arenite members.

**Amphibolite/Pelitic Schist unit**

The Amphibolite/Pelitic Schist unit was intersected in MHD 03/130.0-200.0m and represents the lowermost unit intersected by the Bynoe diamond drill holes.

It is a composite unit which consists predominantly of fine-grained, massive to foliated, grey and white, biotite amphibolite with subordinate quartzofeldspathic biotite and banded graphitic gneisses. The amphibolite bands have a maximum width in MHD 03 of 14 metres, with a common width of about 5 metres.

**Massive Carbonate Rock unit**

Massive carbonate rock was not intersected by the diamond drilling, but may occur in an antiformal closure in the northern part of the area from 55N, 5E to 60N, 8E. Greasy oxidized talc-carbonate schists were logged in R.A.B. drill holes.

**Coarse-grained Leuco-adamellite**

Pink and white, coarse-grained, graphitic-textured to porphyritic leucocratic adamellite was intersected in all four diamond drill holes. Garnet and biotite are the only mafic minerals and their abundance rarely exceeds 5%.
Leuco-adamellite intrudes the sequence as wide (up to 25m) to very narrow (less than 0.2m) dykes, which are structurally conformable with the foliations in the gneisses and schists. Near the margins of the dykes the igneous textures are overprinted by a foliation (eg. flattened quartz grains, and lepidoblastic biotite), again subparallel to the structures. Marginal silicification of dykes is common, and invariably, contacts with gneisses and schists are marked by a sharp tectonic break. Contact metamorphic effects were not noted.

The upper parts of MHD 01 and MHD 04 also intersected the marginal phase of the large granitic dome, which forms the central core to the gneisses and schists. Petrographically this granitoid is identical to the leuco-adamellite dykes, and in places has a gneissose structure.

Field relationships suggest that the leuco-adamellite dome and dykes are syn-orogenic with the gneisses and schists, and hence are likely to at least be of lower Proterozoic age. It is easy to speculate, based upon limited field relationships, that the dome may represent reactivated basement complex.
Oxidized and brecciated leuco-granite.

Oxidized and brecciated quartzofelspathic gneiss.

Quartz vein.

Calc-silicate gneiss.

Brecciated leuco-granite and quartz.

Biotite-quartz-felspar and calc-silicate gneisses. Minor graphitic schist.

Leuco-adamellite.

Biotite-quartz-felspar and calc-silicate gneisses. Minor graphitic schist.

Leuco-adamellite.

Paro-amphibolite and calc-silicate gneiss.

Leuco-adamellite.

Calc-silicate and graphitic gneisses.
Quartzofelspathic gneiss.
Pelite/shale.

Ultramafic rock.
Tremolite rock to olivine-tremolite rock.
Probable intrusive, igneous rock.

Para-amphibolite.
Graphitic and pelitic gneisses - carbonaceous and grey shales.

Leuco-granite.
Para-amphibolite, graphitic and calc-silicate gneiss.
Greywacke or mafic tuff ??, black shale, laminated calcareous black shale and carbonaceous dolomitic limestone.

Fig. 5

AUSTRALIA COAL & GOLD HOLDINGS LTD

BYNOE - EL 1753

GENERALIZED DIAMOND DRILL LOG, MHD 02
Calc-silicate gneiss.
Carbonate-bearing pelites.

Para-amphibolite. Mafic tuff or greywacke.

Graphitic schist and calc-silicate rocks. Thinly interbedded calcareous black shale, laminated black shale/carbonate, massive dolomitic limestone with minor tuff(?) and grey shale.

Graphitic schist, pelitic gneiss and quartzite. Thinly interbedded carbonaceous and grey shale, with minor chert or quartz arenite.
Limonitic graphitic schist.
Sideritic black shale.

Para-amphibolite and quartzofelspathic gneiss.
Interbedded mafic tuff or greywacke, with minor shale/siltstone.

Graphitic and pelitic schists.
Black carbonaceous and grey interbedded shales.
Oxidized & brecciated leuco-adamellite.

Silicified contact zone or quartzite.

Limonitic graphitic schist - sideritic black shale, with minor black shale (pyritic) and para-amphibolite.

Quartzite and pelitic schist - Chest and shale?

Para-amphibolite - greywacke or mafic tuff?

Calcereous, graphitic, pelitic schist and recrystallized carbonates - calcereous black shale (massive and finely laminated) and dolomitic limestone.

Pelitic and calc-silicate schists and gneissses with para-amphibolite - shale/siltstone with minor carbonaceous material, and greywacke or mafic tuff?
### TABLE 1
**DRILL HOLE SUMMARY MHD 01**

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>INTERVAL (m)</th>
<th>DESCRIPTION</th>
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</table>
| 0.0 - 24.85 | 24.85       | OXIDIZED AND BRECCIATED LEUCOGRAINITE  
White, kaolinitic clay with 20-40% angular quartz grains, from 0.5 - 20.0 mm. Quartz breccia horizons from 1.6 - 3.8 metres wide. |
| 24.85 - 40.20 | 15.35      | OXIDIZED AND BRECCIATED QUARTZOFELDSPARTIC GNEISS  
White and orange kaolinitic, limonitic clay. Prominent banding of limonite after oxidized mica (?). Quartz-rich breccia zones, from 0.3 - 5.8 metres wide. |
| 40.20 - 47.90 | 7.70        | QUARTZ VEIN  
Massive white quartz vein, fractured and brecciated in part. |
| 47.90 - 64.15 | 16.25       | OXIDIZED CALC-SILICATE GNEISS  
Pale green, orange and white, greasy limonitic clay. Minor biotite, graphite and fine grained quartz. Limonite, up to 50% as thin subparallel bands. Minor narrow intervals of black graphite schist, and common breccia horizons, up to 3.9 metres wide. |
| 64.15 - 83.75 | 19.60       | OXIDIZED/BRECCIATED GRANITE AND QUARTZ  
White, kaolinized quartz-rich (30-50%) granite, extensively brecciated. Quartz breccia fragments (with fine quartz-mica matrix) in zones from 0.4 - 7.3 metres wide, comprise 75% of the unit. Minor, massive quartz veins. |
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<tr>
<th>DEPTH</th>
<th>INTERVAL (m)</th>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>83.75 – 108.80</td>
<td>25.15</td>
<td>OXIDIZED CALC-SILICATE GNEISS, QUARTZOFELDSPATHIC GNEISS AND GRAPHITIC SCHIST. Green and orange clay, with irregular biotite and graphite laminae. Abundant limonite. Green clay from oxidation of retrograde sericite-chlorite. Minor grey and white pyritic biotite quartzofeldspathic gneiss, and black graphitic schist (generally &lt;0.3 metres wide).</td>
</tr>
<tr>
<td>108.80 – 125.00</td>
<td>16.20</td>
<td>OXIDIZED LEUCOGRAINITE. White kaolinitic granite, with coarse graphic texture, commonly overprinted by a metamorphic foliation. &lt;5% chloritized biotite.</td>
</tr>
<tr>
<td>125.00 – 133.60</td>
<td>8.60</td>
<td>BIOTITE QUARTZOFELDSPATHIC AND CALC- SILICATE GNEISSES. Well banded, grey and white feldspar-quartz-biotite gneiss; and green/orange/black oxidized and retrograded calcisilicate gneiss? (sericite-chlorite-clinozoisite graphite-quartz-K-feldspar). Interbanded units from 0.2 – 2.7 metres wide.</td>
</tr>
<tr>
<td>133.60 – 146.60</td>
<td>13.00</td>
<td>LEUCO-ADAMELLITE. Pink and white, coarse grained, graphic textured leuco-adamellite. &lt;5% biotite and garnet.</td>
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<td>Tr – 1% Py. Grain size variation from 2-10 mm, with development of flattened, lepidoblastic quartz near the contacts with gneisses.</td>
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<tr>
<td>DEPTH</td>
<td>INTERVAL (m)</td>
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<tr>
<td>146.60 - 163.00</td>
<td>16.40</td>
<td>PARA-AMPHIBOLITE AND CALC-SILICATE GNEISS</td>
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<tr>
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<td>Banded to massive horn blende-plagioclase + biotite</td>
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<td></td>
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<td>quartz amphibolite, and pale</td>
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<td>green diopside quartz + graphite + biotite + tremolite</td>
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<td>calc-silicate gneisses. Thinly interbanded units from 0.05-1.5 metres.</td>
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<td>163.00 - 168.05</td>
<td>5.05</td>
<td>LEUCO-ADAMELLITE</td>
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<td>Pink and white, coarse-grained (5-20mm) leuco-adamellite, with minor biotite</td>
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<td>garnet.</td>
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<td>168.05 - 179.90</td>
<td>11.85</td>
<td>CALC-SILICATE AND GRAPHITIC GNEISSES</td>
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<td>Grey, brown and pale green interbanded (1-20 cm wide)</td>
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<td>graphite-feldspar-quartz and quartz-biotite-cummingtonite.</td>
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<td>Prominant bands of calc-silicate gneiss (diopside-quartz-feldspar +</td>
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<td>cummingtonite + biotite +-vesuvianite + graphite), and rare para-amphibolite</td>
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<tr>
<td>179.90 - 200.15</td>
<td>20.25</td>
<td>LEUCO-ADAMELLITE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pink and white leuco-adamellite.</td>
</tr>
</tbody>
</table>
TABLE 2
DRILL HOLE SUMMARY MHD 02

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>INTERVAL (m)</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 - 17.10</td>
<td>17.1</td>
<td>OXIDIZED QUARTZOFELDSPATHIC GNEISS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Brown and white, ferruginous, clayey gneiss. Minor graphite.</td>
</tr>
<tr>
<td>17.10 - 37.90</td>
<td>20.8</td>
<td>OXIDIZED ULTRAMAFIC ROCK</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lime to pale green, greasy clay, and minor partly oxidized tremolite-actinolite rock. Minor thin amphibolite units.</td>
</tr>
<tr>
<td>37.90 - 42.00</td>
<td>4.1</td>
<td>APLITE DYKE/BRECCIA ZONE</td>
</tr>
<tr>
<td>42.00 - 109.65</td>
<td>67.65</td>
<td>ULTRAMAFIC ROCK</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bluish green, well foliated olivine-termolite rock. Partly retrograded to</td>
</tr>
<tr>
<td></td>
<td></td>
<td>serpentine-chlorite. Uniform composition, with little mineralogical variation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Adamellite dykes from 104.0 - 105.05 metres, 108.45 - 108.90 metres and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>109.10 - 109.65 metres.</td>
</tr>
<tr>
<td>109.65 - 115.65</td>
<td>6.0</td>
<td>PARA AMPHIBOLITE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Grey and white, massive to foliated amphibolite.</td>
</tr>
<tr>
<td>115.65 - 131.25</td>
<td>15.60</td>
<td>GRAPHITIC AND PELITIC GNEISSES</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Predominantly graphite-quartz + biotite + K-feldspar gneiss with subordinate interbanded, greyish green K-feldspar - quartz - biotite - cordierite - sillimanite gneiss. Lithologic units 0.5 - 1.0 metres wide. Abundant pyrite, generally 1-5%.</td>
</tr>
<tr>
<td>131.25 - 138.70</td>
<td>7.45</td>
<td>LEUCO-ADAMELLITE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pink and white, coarse-grained adamellite, with 70% microcline-plagioclase, 25% quartz and 5% biotite-garnet.</td>
</tr>
<tr>
<td>138.70 - 140.80</td>
<td>2.10</td>
<td>GRAPHITIC AND PELITIC GNEISS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Similar to 115.65 - 131.25 metres.</td>
</tr>
<tr>
<td>DEPTH</td>
<td>INTERVAL (m)</td>
<td>DESCRIPTION</td>
</tr>
<tr>
<td>---------</td>
<td>--------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>140.80 - 164.15</td>
<td>23.35</td>
<td>PARA-AMPHIBOLITE, GRAPHITIC AND CALC-SILICATE GNEISSES</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Interbanded grey and white biotite amphibolite (units 0.5-4.0m); grey graphite-quartz feldspar gneiss, with rare carbonate bands; banded white and grey carbonate-graphite-quartz gneiss; and massive, white carbonate-minor graphite rock) maximum width 1.6 metres).</td>
</tr>
<tr>
<td>DEPTH</td>
<td>INTERVAL (m)</td>
<td>DESCRIPTION</td>
</tr>
<tr>
<td>------------</td>
<td>--------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| 0.0 - 32.95| 32.95        | OXIDIZED CALC-SILICATE GNEISS  
Pale green, grey and orange clay - green clay from oxidized sericite - diopside; up to 50% grey graphite (generally 10%), and abundant limonite. |
| 32.95 - 47.45 | 14.50       | PARA-AMPHIBOLITE  
Greenish grey and white, foliated rocks containing hornblende, plagioclase, cummingtonite, quartz and biotite. Rare graphitic units (<1 metres wide). |
| 47.45 - 96.35 | 48.90       | GRAPHITIC SCHIST/GNEISS AND CALC-SILICATE ROCKS  
Predominantly grey graphite-mica + feldspar + quartz + carbonate schist and gneiss with abundant pyrite; and laminated to massive, recrystallized calcareous units, up to 8 metres thick. Calc-silicate rocks include massive carbonate-olivine, laminated graphite-quartz-carbonate, and diopside-quartz graphite schists. Rare para-amphibolite and pelitic gneiss. |
| 96.35 - 119.70 | 23.35       | GRAPHITIC SCHIST/GNEISS, PELITIC GNEISS AND QUARTZITE  
About 50:50 grey graphite-quartz + mica + feldspar schists and gneisses, and pale green quartz-biotite-feldspar + cordierite-sillimanite gneiss. Three prominent quartzite units, from 0.25 - 0.70 metres wide, towards the base of the unit. |
<table>
<thead>
<tr>
<th>DEPTH</th>
<th>INTERVAL (m)</th>
<th>DESCRIPTION</th>
</tr>
</thead>
</table>
| 119.70 - 129.25 | 9.55         | LIMONITIC GRAPHITIC SCHIST
Reddish brown and grey, limonitic graphite-quartz-biotite schist. Distinctive red colouration caused by limonite-quartz grains (up to 60% limonite) possibly pseudomorphous after siderite? |
| 129.25 - 144.10 | 14.85        | PARA-AMPHIBOLITE
Bluish grey, foliated and banded hornblende - plagioclase + quartz + biotite + diopside rock. Narrow sulphide intervals. |
| 144.10 - 169.55 | 25.45        | LEUCO-ADAMELLITE
Pink and white, coarse-grained (3-30mm) graphic textured adamellite. <5% biotite and garnet. |
| 169.55 - 185.00 | 15.45        | PARA AMPHIBOLITE AND QUARTZOFELDSPATHIC GNEISS
Bluish grey para-amphibolite, with narrow intervals (<1.5m wide) of K-feldspar-plagioclase-biotite-quartz-garnet gneiss. |
| 185.00 - 200.05 | 15.05        | GRAPHITIC SCHIST/GNEISS AND PELITIC GNEISS
Grey graphite-biotite-quartz schist/gneiss, and brown/white K-feldspar-plagioclase-biotite-quartz + cordierite + garnet + sillimanite gneiss. |
<table>
<thead>
<tr>
<th>DEPTH</th>
<th>INTERVAL (m)</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 - 61.90</td>
<td>61.90</td>
<td>OXIDIZED AND BRECCIATED LEUCO-ADAMELLITE White to pink and white, coarse-grained (2-50mm) leuco-adamellite. &lt;5% biotite and garnet. Silicified and brecciated zones, from 0.30 to 6.0 metres wide.</td>
</tr>
<tr>
<td>61.90 - 68.65</td>
<td>6.75</td>
<td>SILICIFIED CONTACT ZONE White and pale yellow, fine-grained (1mm diameter) quartzite, and minor biotite-quartz-feldspar gneiss.</td>
</tr>
<tr>
<td>68.65 - 107.10</td>
<td>38.55</td>
<td>LIMONITIC, GRAPHITIC SCHIST, WITH MINOR PARA-AMPHIBOLITE AND GRAPHITIC SCHIST Reddish brown, pale green and grey limonite (10-50%) - graphite (10-20%) - biotite-quartz-feldspar-sericite schist. Limonite-quartz pseudomorphs after siderite (?). Minor biotite-quartz-feldspar + graphite gneiss and para-amphibolite. Altered granite dykes at 83.85 - 85.15 metres and 93.60-95.15 metres.</td>
</tr>
<tr>
<td>107.10 - 121.60</td>
<td>14.50</td>
<td>QUARTZITE AND PELITIC SCHIST Pale blue, fine grained quartzite (7 bands from 0.25 - 3.10 metres wide) interlayered with grey and white biotite-quartz feldspar gneiss and sericite-graphite-quartz schist.</td>
</tr>
<tr>
<td>DEPTH</td>
<td>INTERVAL (m)</td>
<td>DESCRIPTION</td>
</tr>
<tr>
<td>---------</td>
<td>--------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>121.60</td>
<td>8.90</td>
<td>PARA AMPHIBOLITE AND MINOR GRAPHITIC GNEISS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dark grey, massive, fine-grained amphibolite with minor banded, graphicite schist. Coarse-grained leuco-adamellite from 126.40 - 129.00 metres.</td>
</tr>
<tr>
<td>130.50</td>
<td>43.80</td>
<td>CALCAREOUS, GRAPHITIC, PELITIC SCHIST, AND RECRYSTALLISED CARBONATE ROCKS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Grey and white, finely banded graphite carbonate-quartz schist; white and pale green recrystallised dolomitic limestone (with about 50-70% calcite and 30-50% altered olivine); dark grey graphite schist; and grey graphite-quartz-feldspar-biotite gneiss. Thirteen prominent carbonate bands from 0.15-2.00 metres wide.</td>
</tr>
<tr>
<td>174.199.50</td>
<td>25.20</td>
<td>PELITIC SCHISTS AND GNEISSES WITH PARA-AMPHIBOLITE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Grey and white, banded biotite-quartz-feldspar + graphite (&lt;5%) schists and gneisses, with thin units (3.50-4.35 metres wide) of para-amphibolite.</td>
</tr>
</tbody>
</table>
5.0 **EXPLORATION PROGRAMMES**

5.1 Gridding Programmes

Gridding was commenced in November, 1982 to provide ground control for geophysical surveys. Initially the gridding was spaced at 400 metres cross lines, but this was infilled to 100 and 200 metres in anomalous areas.

A total of 153.1 kilometres of line clearing and gridding was completed, together with 20.5 kilometres of flagged lines. Plan 1 shows the locations of all surveyed grid lines.

5.2 Ground Magnetic Survey

A ground magnetic survey using a Scintrex MP-2 portable proton precession magnetometer was conducted over the gridded area, with readings at 20 metres spacings along the lines.

A total of 86.1 kilometres of readings were recorded in 1982/1983 and an additional 43.4 kilometres in 1983/1984. Plans 2, 3 and 4 present significant magnetic data at a scale of 1:5,000.

5.3 Ground Radiometric Survey

A ground radiometric survey, using a Scintrex GAD-6 portable, digital four channel gamma-ray spectrometer coupled with GSP-3S gamma-ray sensor was conducted over the gridded area.

The survey differentiated the airborne total count radiometrics into U, Th, K and total count channels, at 20 metres station intervals. A total of 80.0 kilometres of readings were recorded in 1982/1983 and an additional 64.4 kilometres in 1983/1984.
Plans 5, 6, 7 and 8 present the significant uranium radiometric data at a scale of 1:5,000.

5.4 Geological Mapping/RAB Drilling Programmes

The E.L. area, which has sparse outcrop, was geologically mapped at a scale of 1:5,000. Two RAB drilling programmes were also used to interpret the geology.

The first RAB drill programme, conducted in October, 1983, consisted of 478 holes for a total depth of 2936.5 metres. It tested ground radiometric and magnetic anomalies, generally on a 400 x 20 metres drill pattern. A second RAB drill programme, conducted in July, 1984 consisted of 262 holes with a total depth of 2416.5 metres. The anomalous areas were infilled to 100 metres line spacing.

Plans 9, 10, 11, 12 and 13 present geological interpretations based upon outcrop and RAB drilling results, with all RAB drill hole locations shown.

The two volumes of RAB drill logs can be obtained from the 1984 and 1985 Annual Reports, together with geochemical data.

5.5 Drill Hole Radiometric Probing

The 1984/1985 and anomalous RAB holes were radiometrically logged using a Scintrex downhole logging system which consisted of a GAD-6 spectrometer, GSD-4S/22 sensor, CDI-2 controller and TR-2 cassette recorder.
All results of this survey are included in the 1985 Annual Report.

5.6 Diamond Drilling Programme

The diamond drilling programme conducted from the 27th August, 1984 to 30th November, 1984 consisted of 4 holes with a total depth of 763.85 metres. It was designed to test anomalous geochemistry in geological environments favourable for mineralisation.

5.7 Petrology

Fifty thin sections were prepared and described for samples from diamond drill holes MHD 01-04. Brief descriptions are included in the 1985 Annual Report.

6.0 RESULTS

The diamond drilling programme, the culmination of the gridding, ground geophysical and RAB drilling programmes intersected minor mineralisation. Briefly the results of the drill programme is, as follows:

(i) MHD 01; 8N, 8+35W

Anomalous uranium values were returned from three separate intervals in MHD 01. An assay of 85 ppm U was returned over the interval from 40.20 to 48.90m. Basemetal values were also slightly anomalous with 220 ppm Pb, 860 ppm Zn, 170 ppm Ni, 300 ppm Co, and also 18 ppm Bi. Thorium was low (26 ppm). Core recovery
over the sampled interval was poor, and averaged only 20%, with no core recovery from 42.0 to 45.0 metres. The recovered core consists of quartz fragments, probably derived from veins and breccia. This zone must be considered untested, because of the poor core recovery.

A further anomalous uranium value of 95 ppm, with 18 ppm Th, 550 ppm Zn, 185 ppm Ni and 135 ppm Co was returned over the interval from 60.05 - 63.40 metres. The interval was split further, into 2 samples (insufficient sample for 60.05 - 61.0 metres) and reassayed. Uranium values were low from 61.0 - 63.4 m and ranged from 18 to 22 ppm, with anomalous Zn (620 - 680 ppm) and Ni (130-140 ppm). The lithology over the interval is an orange and green, limonitic clay, with black sooty graphite along slickensides.

The highest uranium values of 260 ppm with 290 ppm Zn, 125 ppm Ni and 14 ppm Th occurs over the interval from 84.20 - 85.90 metres. The host rock is a grey and white, clayey biotite quartzofeldspathic gneiss, with a trace to 5% fresh pyrite. Although uranium minerals were not identified, the elevated uranium value may reflect trace mineralisation possibly as fracture and grain coatings on the pyrite.

(ii) MHD 02 ; 13N, 16+95W

Diamond hole MHD 02 was drilled to test anomalous basemetal values in a RAB hole, and a down hole radiometric U anomaly.

The anomalous basemetal values are explained by narrow
intervals of pyritic nickel - copper mineralisation: 0.95% Cu and 1.2% Ni from 93.60 - 93.70 metres and 0.21% Cu and 0.23% Ni from 107.45 - 108.45 metres. The narrow 10cm interval consists of banded, massive pyrite with interstitial iron oxides and chalcopyrite, while the 1.0 metres interval consists of 1-5% disseminated coarse pyrite. The host rock to the sulphides is a grey green to bluish grey, massive tremolite - olivine rock, partially retrograded to assemblages with serpentine and chlorite. Platinoid group analyses were conducted on the sulphide samples and anomalous palladium values (0.5 ppm) were returned for both samples.

Anomalous lead and zinc values were returned from 3 samples over the intervals 10.0 - 12.0, 18.0 - 20.0 and 26.0 - 28.0 metres. The values range to a maximum of 710 ppm Pb, and 1400 ppm Zn. Rock types are highly oxidized in these upper intervals, and consist predominantly of pale green and orange limonitic clays derived from the oxidation of either a calc-silicate or quartzofeldspathic gneiss. Further anomalous Pb - Zn values occur along strike from these values, in RAB holes at 12N, 16+40 and 16+60W and 14N, 16+60W.

Additional anomalous lead and zinc also occur over the interval from 145.45 to 147.10 metres. Values of 1400 ppm Pb and 2350 ppm Zn in a graphitic schist unit with 1-5% disseminated pyrite may represent trace lead and zinc sulphide mineralisation, but this has not been verified by mineragraphic studies.

(iii) MHD 03 ; 22N, 2+26E

Diamond hole MHD 03 was collared to undercut anomalous zinc (1000 ppm) and uranium (32 ppm) values in a RAB hole at 22N, 2+80E, as well as gaining stratigraphic information.
An anomalous zinc value of 1100 ppm in chlorite schist with 10% limonite after oxidized sulphide, was intersected near the target depth, but associated uranium was negligible.

The only other analysis of any significance was 760 ppm Cu, 2500 ppm Ni and 300 ppm Co over the interval from 143.6 to 144.1 metres. Massive pyrite occurs over a 20 cm interval, and narrow cross-cutting veinlets of pyrite (5%) in para-amphibolite over the remaining 30 cm interval. Platinoid group analyses of the sulphide interval showed no anomalous values.

(iv) MHD 04  60+80N, 5+80E

Diamond hole MHD 04 was targeted to test a ground magnetic anomaly, downhole radiometric U anomaly, and weak RAB geochemical values.

No significant geochemical results were obtained from the diamond drill hole. Narrow units of amphibolite are present in the sequence and may explain the magnetic anomaly. The downhole radiometric U anomaly may reflect a weak surface enrichment of uranium near the granite - Sweet's unit contact. Elevated basemetal values may also reflect weak lateritic enrichment from mafic and graphitic schist units.

It may be concluded from these results that further testing of uranium anomalies is warranted in the 4N/9W - 16N/5W, 7-9N, 13W and 11-16N, 16W areas.

Elevated palladium values in Ni-Cu sulphide mineralisation in ultramafic rock (MHD 02) suggests potential for platinoid mineralisation in a similar geological setting in the Sweet's unit. The most obvious area for further testing in the strong Ni-Cu RAB geochemical anomaly and associated magnetic anomaly at 22N, 4+40-5E.
REFERENCES

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Unpublished Report to NTDME.

PORTER, D.J., 1983
Annual Report for E.L. 1753, Bynoe Project, Northern Territory.
Unpublished Report, NTDME.

PORTER, D.J., 1984
Annual Report for E.L. 1753, Bynoe Project, Northern Territory.
Unpublished report, NTDME.

PORTER, D.J., 1985
Annual Report for E.L. 1753, Bynoe Project, Northern Territory.
Unpublished report, NTDME.
LEGEND

- Lateite: Ferrugino in zone.
- Ultramafic rock.
- Granite: Even, coarse-grained, muscovite with minor biotite.
- WWE. Triassic metamorphics, felsiclastic gneiss, gneissite, greenstone, graphitic schist, pelitic-quartz schist, pelitic gneiss, amphibolite, and quartzite.
- Sweets unit: Granite, graphitic gneiss and some, carbonate, mafic rocks, and quartzite.
- R.A.R. hole FF106
- Roads
- Creek
- Breakaway
- Geological contact
- Outcrop boundary
- Fault
- Fault inferred
- Strike and dip of gneissic layering
- Strike and dip of lithologic layering
- Minimum and plunge of minor fold
- Dip line

NORTHERN TERRITORY GEOLOGICAL SURVEY

CB86/112B
AUSTRALIAN COAL AND GOLD HOLDINGS LTD

GEOLOGY SHEET No.3

PROJECT NAME: BYNOE E.L. 1793
COMPILED BY: B.R.F. SCALE: 1:25,000
DRAWN BY: D.F. DRAWING NO. 17
<table>
<thead>
<tr>
<th>Depth</th>
<th>Lithology</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 m</td>
<td>White, limy, pebbly, sand, 60% coarse quartz, 15% chert, 25% clay, 5% siltstone, 1% granite</td>
<td>Located quartzfeldspathic gneiss.</td>
</tr>
<tr>
<td>2 m</td>
<td>Siltstone, orange/orange-white, clay, 25% coarse quartz, 10% chert, minor quartz grains, minor feldspar grains.</td>
<td>Located quartzfeldspathic gneiss.</td>
</tr>
<tr>
<td>4 m</td>
<td>White, clay, 25% coarse quartz, 10% chert, minor feldspar grains.</td>
<td>Located quartzfeldspathic gneiss.</td>
</tr>
<tr>
<td>6 m</td>
<td>Siltstone, orange/orange-white, clay, 25% coarse quartz, 10% chert, minor feldspar grains.</td>
<td>Located quartzfeldspathic gneiss.</td>
</tr>
<tr>
<td>8 m</td>
<td>White, clay, 25% coarse quartz, 10% chert, minor feldspar grains.</td>
<td>Located quartzfeldspathic gneiss.</td>
</tr>
<tr>
<td>10 m</td>
<td>White, clay, 25% coarse quartz, 10% chert, minor feldspar grains.</td>
<td>Located quartzfeldspathic gneiss.</td>
</tr>
<tr>
<td>12 m</td>
<td>White, clay, 25% coarse quartz, 10% chert, minor feldspar grains.</td>
<td>Located quartzfeldspathic gneiss.</td>
</tr>
<tr>
<td>14 m</td>
<td>White, clay, 25% coarse quartz, 10% chert, minor feldspar grains.</td>
<td>Located quartzfeldspathic gneiss.</td>
</tr>
<tr>
<td>16 m</td>
<td>White, clay, 25% coarse quartz, 10% chert, minor feldspar grains.</td>
<td>Located quartzfeldspathic gneiss.</td>
</tr>
<tr>
<td>18 m</td>
<td>White, clay, 25% coarse quartz, 10% chert, minor feldspar grains.</td>
<td>Located quartzfeldspathic gneiss.</td>
</tr>
<tr>
<td>20 m</td>
<td>White, clay, 25% coarse quartz, 10% chert, minor feldspar grains.</td>
<td>Located quartzfeldspathic gneiss.</td>
</tr>
</tbody>
</table>

**Note:** The log indicates a series of rock types with a progression from white, limy, pebbly sandstone to various clays and quartzfeldspathic gneiss throughout the measured depth range. The presence of coarse quartz and chert suggests a sedimentary origin, possibly a river or lake deposit, while the quartzfeldspathic gneiss indicates a metamorphic component.