Aberfoyle Resources Limited

EXPLORATION DIVISION

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EXPLORATION LICENCE 106/87

LAKE MACKINTOSH

TASMANIA

Relinquishment Report

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VOLUME 1 OF 1

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1.0 SUMMARY

This report summarises the results of exploration for volcanic-hosted base metal and gold mineralisation on EL 106/87, Lake Mackintosh, for the period February 1988 to February 1998. Results of some earlier exploration, from the period 1970-1988, are also included as background to the more recent exploration.

The majority of EL 106/87 is underlain by the Que-Hellyer Volcanics (QHV), which host the Que River (discovered in 1975), Hellyer (discovered in 1983) base metal deposits. The presence of this mineralisation has led to sustained and extensive exploration that has included:

- Nineteen diamond drill holes, for 13,460m of drilling.
- Heli-borne magnetics and radiometrics.
- Experimental seismic traverses.
- Research projects into the structure, stratigraphy and geochemistry of the Que-Hellyer Volcanics.
- Small scale frequency-domain EM surveys.
- A total of 244 line km of track cutting to allow access for:
    - Reading of 149.6 line km of ground time-domain EM.
    - Collection of 4057 'b' and 'c' horizon soil samples for analysis by total digest and 1031 samples for analysis by partial digest techniques.
    - Collection of 254 stream sediment samples (-80# and BCL).
    - Collection of 48 line km of ground magnetic data.
    - 1:2500 scale geological mapping and rock-chip sampling (218 samples).
    - Collection of gravity data from 530 infill stations.

During the final year of EL 106/87 work focussed on diamond drill testing at Mayday which comprises a structural / stratigraphic target associated with a partial digest soil anomaly. The targeted Que Hellyer Volcanics were not intersected and the hole was terminated in the Southwell Subgroup at 1504.8m. No source for the soil geochemical anomaly is evident.

2.0 INTRODUCTION

The Lake Mackintosh Exploration Licence (EL106/87) was granted to Aberfoyle Resources Limited on 5 February 1988 under the provisions of the Hellyer Mine Agreement Ratification Act 1987. The licence comprised 135 sq. km. previously covered by EL's 2/70 (Mackintosh) and 15/73 (Hatfield) and encloses CML's 68M/84 (Que River) and 103M/87 (Hellyer) which have an area of 20.2 sq. km; Figure 1.

Under the terms of the act the licence was issued for ten years with mandatory partial relinquishments on the second and fifth anniversaries. The first partial relinquishment was effected in February 1990 when the licence was reduced from 135 to 95 sq. km. (McNeill 1990, TCR 90-3073; Fig. 2). The second partial relinquishment, from 95 to 54 sq. km, was effected in February 1992 (Wallace 1992, TCR 93-3410; Fig. 3). Current tenure and the location of a proposed retention licence over the Mt. Charter mineralisation are shown on Figure 4.

This report details exploration completed in the twelve months to 5 February 1998 and summarises previous exploration by referencing the relevant reports from the previous nine years.

As EL 2/70 (Mackintosh), granted on 1 January 1970, and EL 15/73 (Hatfield), granted on 5 May 1973, were never relinquished, as such, a comprehensive summary of exploration completed on these licences prior to 5 February 1988 has not been prepared. However, exploration of the "Mackintosh District" (EL's 2/70, 15/73, and 5/74) for the period 1969-December 1985 is summarised by Anon (1986; TCR 86-2521) and a list of reports relating to the two licences that were combined to form EL 106/87 are presented in Appendix I. Additionally some results form EL 15/73 and 2/70 are summarised in this report as background to exploration completed during the life of EL 106/87.

3.0 EXPLORATION PHILOSOPHY

Exploration by Aberfoyle Resources Ltd. on EL 106/87 has been aimed at the discovery of a >10 m.t. polymetallic VHMS deposit to replace the Hellyer resource when it is exhausted in mid-2000. A secondary target has been volcanic-hosted or structurally related gold mineralisation.

After the discovery of Hellyer, in 1983, exploration was largely led by the application of ground TDEM techniques for direct target definition to depths of 200-300m. However, by 1988 TDEM surveys had largely covered the outcropping QHV and Que River Shale (QRS) and the only targets defined by these surveys were down-graded as artefacts or false anomalies (lithological conductors).

Exploration recorded in this report was largely designed to test deep targets (>300m and <1500m depth) in the QHV or shallower targets in the less well explored dominantly sedimentary and felsic volcanic sequences (the Southwell Subgroup) or Tertiary basalt covered areas north and east of Hellyer.

Since 1993 in particular, target generation has focussed on defining deep targets through integrating geological, geophysical and geochemical data and developing a three dimensional structural model of the QHV basin. This approach was based upon recognition of the close association of both Hellyer and Que River orebodies with district scale structures and the more general observation that VHMS deposits are always associated with co-active faults. Targets generated by this process and tested (usually by diamond drilling) have been described in the relevant annual reports. Several targets remain untested on both EL 106/87 and ML 103M/87. Those remaining on the EL are shown on Figure 5 and summarised in Appendix II.

4.0 PREVIOUS EXPLORATION

4.1 Introduction

Exploration completed at each prospect on EL 106/87 is summarised on Table 1 (see Figure 6 for prospect locations). Note that the "Regional" prospect generally refers to data collection and compilation over the outcropping QHV on EL 106/87, and may include some data from the Hellyer and Que River CML's. Background information, including details of surveys completed on EL's 2/70 and 15/73, and a more detailed summary of results, divided by work type, is included in the following sections.

4.2 Geology

Several generations of geological mapping has been completed over EL 106/87 by both Mineral Resources Tasmania and Aberfoyle Resources Ltd.

4.2.1 Mineral Resources Tasmania

Three generations of regional mapping have covered the area of EL106/87:

1.The Mackintosh 1: 63,360 sheet (Barton et al., 1966); little detail shown in volcanics on this sheet.

2. More detailed, 1: 36, 680, mapping by P.L.F. Collins that was incorporated into the explanatory notes for the Mackintosh sheet (Collins et al., 1981).

3. Mapping, compiled at 1:25,000, as part of the Mount Read Volcanics Project. Map sheets 1 (Komyshan, 1986), 2 (Corbett and McNeill, 1986), and 7 (Vicary and Pemberton, 1988) cover the area of EL 106/87. Explanatory notes for these map sheets have also been published as Corbett and Komyshan (1989), McNeill and Corbett (1989), and Pemberton et al. (1991).

4.2.2 Aberfoyle Resources Mapping

Outcrop maps

Outcrop mapping has been completed at scales of 1:1,000 (detailed costean mapping), 1:2,500 (standard outcrop mapping) and 1:10,000 (reconnaissance mapping). Prior to 1983 outcrop mapping was compiled on the 1:2,500 QR81 series of plans. However, with the discovery of the Hellyer deposit, and revisions in geological concepts and terminology, a new geological legend (plate MAC114) and map series (MAC89 plans; see plate MAC355 for plan locations) was commenced (Hespe, 1986a). The pre-1983 mapping was included on the MAC89 series

TABLE 1: SUMMARY OF WORK COMPLETED

REPORTING PERIOD/REF	PROSPECT	DETAILS
Feb.1988-Feb.1989. McNeill TCR 89-2948	Southwell River / Leven River	Mapping, stream sediment sampling (108), rock chip sampling (54), VLF EM (2 lines), SIROTEM & EM37 depth sounding, drilling (MAC20, MAC22), down hole EM37.
	North Hatfield	Mapping and rock chip sampling (8).
	Henty Fault Zone	Mapping, rock chip sampling (24), stream sediment sampling (59 BCL & -80#).
	South Hatfield	Mapping, BCL & -80# stream sediment sampling (55), infill soil sampling (92), rock chip sampling (15), infill ground magnetics, drilling (MAC16) & down hole SIROTEM.
	I Zone	Gridding (20 km), mapping, infill soil sampling (652), rock chip sampling (21), follow up UTEM (3.5 km).
	Mt. Charter	Mapping, reassay of DDH's MC1-4, rock chip sampling (41), infill soil sampling.
Feb.1989-Apr.1990. McNeill, Rand, Henham TCR90-3128	Regional	Compilation of regional cross sections and level plans, lineament study, gridding (67.7 km covering EL106/87 and CML103M/87), C horizon soil sampling (2011 over new gridding), compilation and processing of all soil data, reassay of 522 core grinds from 26 holes for lithological discriminator elements.
	Baryte Creek	Mapping, gridding (6 km), follow up EM survey (MAX-MIN 5.1 line km) over 2 airborne EM anomalies
	Tailings Dam	Mapping
	Golden Triangle	Mapping, Rock chip sampling
	N.W. Mt. Charter	Costean channel sampling (19)
	Charter Dolerite	Gridding (3.8 km), UTEM survey (3.1 line km)
	Medway	Gridding (23.6 km), Mapping, UTEM survey (4 loops, 30.4 line km).
	Link Road	Channel sampling, Gridding (4 km), UTEM (2 lines of the north Hellyer survey on CML 103M/87)
	Southwell Valley	EM (MAX-MIN 3 lines) over airborne EM anomaly 4/75.
	Leven River	DHEM (EM37) completed on MAC22.
	North Hatfield	Mapping (50 sq km).
	Black Harry Road	Mapping, costeaning (2) and subsequent channel sampling. Drilling by DOM DDH BLHY-1 (MAC24), down hole EM37.
	I Zone	Mapping, follow up UTEM (1 loop, 3.8 line km)
	Mt. Charter	Mapping, costeaning and subsequent sampling, reprocessing soil data, rock chip and pit sampling, drilling (MAC23), down hole EM37.
	S.W. Mt. Charter	Drilling (MAC25), down hole EM (SIROTEM).
	Henty Fault Zone	Gridding (7.2 line km), mapping, rock chip sampling (7), reassay of earlier soils for Au, stream sediment sampling (32 BCL, -72# & -200#).
	South Mackintosh	Mapping, rock chip sampling (51), ground magnetics (10 line km)
May 1990-Apr.1991. McNeill, Wallace TCR91-3268	Regional	Reprocessing of all soil geochemistry & expansion of lineament study to cover the imaged data.
	Southwell Valley	Gridding (14.05 km), Mapping, rock chip sampling (12), UTEM survey (1 loop, 3.6 line km), ground magnetics (13.1 line km).
	I Zone / South Que River	Mapping, rock chip sampling (21), drilling (MAC28).

REPORTING PERIOD/REF	PROSPECT	DETAILS
May 1990-Apr.1991. (cont.)	Mt. Charter	Drilling (MAC26), down hole EM (Zonge GDP-16)
	Mt. Charter Dolerite	Drilling (MAC27), down hole EM (Zonge GDP-16)
	South Mackintosh	Mapping, review of UTEM data
Apr.1991-Apr.1992. Richardson TCR92-3355	Regional	Structural/stratigraphic reinterpretation of Que-Hellyer volcanics commenced by Etheridge & Henley.
	South Que River	Drilling (MAC29, MAC30), down hole EM (MAC28, MAC29).
Apr.1992-Apr.1993. Richardson TCR93-3441	Regional	Completion of Etheridge & Henley structural project, reinterpretation of all existing 1:2500 scale mapping, helicopter borne aeromagnetic and radiometric survey.
	South Que River	Down hole EM (MAC30), reinterpretation of all DHEM data for this area.
	Mt. Charter	Geological reinterpretation, drilling (MAC32, MAC33).
	Murchison Highway	Drilling (MAC34, MAC35).
Apr.1993-Feb.1994. Richardson. TCR94-3537	Regional	Interpretation of previous years helimag data, infill gravity survey (530 stations).
	South Que River	Resurvey MAC28 with down hole UTEM.
	Mt. Charter	Down hole UTEM (MAC33).
	Murchison Highway	Down hole UTEM (MAC35).
	South Mt. Charter	Drilling (MAC36).
	Baryte Creek	Drilling (MAC37).
Feb.1994-Feb.1995. Richardson TCR95-3719	Regional	Gridding commenced for EM and soil programmes north of Hellyer (70 line km to date).
	South Mt. Charter	Down hole EM (MAC36).
	Baryte Creek	Down hole EM (MAC37).
Feb.1995-Feb.1996 Richardson TCR96-3839	Regional	Complete gridding (124 km total), Zonge GDP-16 TDEM survey (20 loop, 103 line km) north of Hellyer.
	Mt. Charter	Drilling (MAC40), down hole EM (Zonge & Crone).
	Leven River	Ground EM survey, drilling (MAC41), down hole EM.
Feb.1996-Feb.1997. NcNeill, Hicks TCR97-3991	Regional	Update of Etheridge & Henley structural study, mag sus readings on selected holes, AGSO seismic traverse north of Hellyer, TMI soil sampling programme (1031) & EM depth soundings north of Hellyer.
	Murrays Road	Soil sampling (271).
	Link Road	Gridding (2.75 km), Wacker soil sampling (87).
Feb. 1997-Feb. 1998 This report	Mayday (Southwell River)	Drilling (MAC43), down hole EM.

plans where no more recent mapping was available and is distinguished by italic lettering. 1:10,000 scale outcrop mapping is recorded on the MAC193 series of plans and covers areas peripheral to the QHV where gridding was not undertaken. Outcrop plans were continuously updated during the life of the licence. Outcrop descriptions are based on field descriptions which may be supported by analyses of rock-chip samples (see section 4.3.4) and petrographic description of thin sections (some 350 of which have been prepared; locations are available digitally).

Interpretive maps

Interpretive plans and cross sections have been compiled from all available data sources; outcrop mapping, airphoto interpretation, drilling, rock-chip and soil geochemistry, open file reports on adjacent tenements and magnetic and gravity surveys. Plans have been produced at scales of 1:2,500 (MAC148 plan series; now out of date), 1:10,000 (MAC161 series in McNeill and Wallace, 1991; plate MAC380 in Richardson, 1993) and 1:25,000 (plate MAC412 in Richardson, 1994). Regional cross sections (at 1:10,000 scale) were presented in McNeill (1989b; plates MAC97A-D) and were updated in McNeill et al. (1990; plates MAC269A-D). Interpretive level plans (plates MAC284 and 285), largely derived from the regional cross sections were also included in McNeill et al. (1990).

4.2.3 Geological interpretation

The Current geological understanding of EL 106/87 is summarised on plate MAC 412 (Richardson, 1994) and on Figure 7. In the northern and eastern parts of the EL outcropping lithologies are the Tertiary flood basalts and Cambro-Ordovician to Devonian clastic and carbonate sediments that overly prospective Middle-Late Cambrian Mount Read Volcanics. The volcanics in this area comprise the Central Volcanic Complex overlain by the Mt. Charter Group (as defined by Corbett, 1992; Figure 5). The economically significant unit of the Mt Charter Group is the Que-Hellyer Volcanics (QHV) which host the Hellyer, Que River and Mt. Charter VHMS bodies. Published descriptions of the volcanology, stratigraphy and primary lithogeochemistry of the QHV include Waters and Wallace (1992), Corbett (1992) and Crawford et al (1992).

The QHV are a sequence of marine calc - alkaline mafic to felsic volcanics and volcaniclastics deposited / erupted into an extensional basin interpreted to develop as a result of movement on regional synvolcanic faults such as the Henty, Mt. Charter and Mt. Cripps Faults. The QHV can be broadly subdivided into a lower sequence of basalt and feldspar phyric andesite lava and volcaniclastic (geochemical suite 1 of Crawford et al. (1992))

separated from an upper sequence of dominantly basaltic rocks (geochemical suite 3) by a complex interval known as the Mixed Sequence. The Mixed Sequence marks a relatively quiescent period dominated by polymict epiclastics and numerous small volume dacitic lava / breccia bodies. Thickness of the Mixed Sequence varies from a few centimetres to more than 300m whilst the total thickness of the QHV can vary from around 20m (in the NW) to more than 1.5 kilometres in the vicinity of the orebodies.

A strong Cambrian structural control is recognised for the formation and morphology of the QHV basin and associated VHMS mineralisation. A network of syndepositional NE (mine grid) trending normal faults linked by NW trending transfer faults has been interpreted from facies and thickness variations, magnetics, gravity etc. In addition, a major NNE half graben like structure extends at least from Que River to Hellyer, hosting the two orebodies and localising strong footwall alteration. This structural zone is interpreted to relate to oblique extensional reactivation of a deep tapping, basement structure.

Compressional structures are thought to largely reflect reactivation of these syndepositional structures during the ?Late Cambrian, Devonian and Mesozoic events.

Southwell Subgroup (SSG) rocks outcrop or lie beneath Tertiary basalt over much of the northern half of EL 106/87. A distinctive quartz phyric volcaniclastic near the base of the SSG has been correlated by McPhie and Allen (1992) with hangingwall volcaniclastics overlying the Rosebery orebody. One interpretation of this correlation is that Rosebery mineralisation may be younger than Hellyer and that potential exists for mineralisation near the base of the SSG north of Hellyer.

4.2.4 Mineralisation / alteration

Although there is evidence of base metal mineralisation higher and lower in the QHV, at present all known major occurrences occur within the Mixed Sequence. VHMS mineralisation occurs where hydrothermal fluids have been focussed into dilatant areas near the intersection of synvolcanic faults, possibly during a regional stress pulse at Mixed Sequence time (Windh and Etheridge, 1992).

The three stratiform and stratabound VHMS bodies discovered to date are (from north to south):

Hellyer: Mineralisation is described by McArthur and Dronseika (1990) and McArthur (1996). Hydrothermal alteration of the footwall and hangingwall are described by Gemmell and Large (1992) and Jack (1989) respectively. The structure of the orebody has been discussed by Drown and Downs (1990) and Downs (1993).

Que River: Mineralisation is described in McArthur and Dronseika (1990) and McGoldrick and Large (1992). Structure is described in Large et al (1988) and Young (1980) and alteration in Whitford et al (1989) and Offler and Whitford (1992).

Mt Charter: The geology of the Mt. Charter mineralisation is described in Rand (1988).

4.3 Geochemistry

4.3.1 Stream sediments

Two generations of stream sediment sampling have been completed over the area of EL 106/87:

1. Pre-1983.

An initial regional -20# stream sediment sampling program covering EL 2/70 (Krummei, 1972) located an anomaly that was later found to be adjacent to AEM anomaly 8, leading to the discovery of the Que River deposit (Webster and Skey, 1979). An orientation survey, covering three streams draining the Que River deposit, was completed (ibid) and the -40# fraction selected as being a suitable medium for an expanded survey which covered the area of outcropping QHV's on EL's 2/70 and 15/73 (Skey, 1975; Skey and Webster, 1976a and 1976b). Results are shown on plates DT60A and B (Skey and Webster 1976a). Some stream humus and water samples were also collected (ibid).

2. Post-1988.

Stream sediment sampling was as a major component, in conjunction with mapping and rock-chip sampling, of initial base metal and Au exploration in poorly-explored areas outside the QHV. The felsic volcanics and sediments north and east of Hellyer (Southwell River prospect), the Henty Fault Zone, and the Central Volcanic Complex (South Hatfield prospect) were all sampled (McNeill, 1989; McNeill et al., 1990). Sample locations and results are shown on plates MAC203 and 204 (in McNeill et al., 1990). Sample media were the -72#, -200#, and -7mm (used for bulk cyanide leach analysis) size fractions, although not all fractions were analysed at each site.

4.3.2 Soils

Total digest

A total of 15, 577 nominal ‘C’ horizon soil samples were collected on EL’s 15/73, 2/70 and 106/87. As these samples were collected over a long time period a range of collection and analytical procedures were used:

•**Sample collection:** The majority of samples were nominal “C” horizon collected using a hand auger from < 1.0m depth (but up to 1.5m in some surveys). “A” horizon samples (e.g., the Hg orientation survey described in McNeill, 1989a) and “B” horizon samples (collected in conjunction with partial digest samples; see below and McNeill and Hicks, 1997) were collected as part of some surveys. Sampling density was variable, with sample spacings of 10m to 50m (but generally 25m), on 50m to 500m spaced lines.

•**Analysis:** Prior to analysis the majority of soil samples were dried and sieved to -80#, exceptions being some early (pre 1975; e.g., Skey, 1975) samples which were sieved to -40#, and samples from the partial digest sampling (McNeill and Hicks, 1997) which were sieved to -6mm prior to analysis. Pre- 1985 soils were analysed for Cu, Pb, and Zn with scattered Fe, Ba, and As results. Post -1985 the majority of samples were analysed for Cu, Pb, Zn, Ba, As, Ag, Cr, Ti, and Zr. The latter three elements were analysed as they are relatively immobile and were used to differentiate basalts, andesites and dacites in areas of poor outcrop (Hespe, 1986; Ni was also used in some surveys, but as it provides no more information than Cr it was not analysed in more recent surveys). Ba, As, and Ag were analysed as pathfinder elements, as they were cheap to assay, gave good anomaly contrast and are relatively immobile in the secondary environment. Gold assays were done on specific prospects, i.e., Mt. Charter and South Hatfield (McNeill, 1989c), Boundary (McNeill, 1989b), Henty Fault Zone (McNeill et al, 1990) and Murrays Road (McNeill and Hicks, 1997). A mercury and antimony orientation survey was also completed (Hespe in McNeill, 1989b) and some samples were analysed for mercury in the Tailings dam area (McNeill, 1989b).

Problems with quality control in some surveys led to the inclusion of at least one standard sample (prepared by homogenising 20kg of “C” horizon soil material from EL’s 15/73 and 2/70; see Appendix 4 of McNeill, 1989a for composition) with every batch of soil samples submitted for analysis since early 1986.

•**Results:** Data indicates widespread dispersion of base metals throughout the QHV. Zones anomalous in base metals occur throughout the outcropping QHV, both areally and stratigraphically. They indicate hydrothermal activity was continuous throughout development of the basin, continuously pervading superposed volcanic sequences as subsidence of the basin progressed. Highest values are found within the footwall alteration zones outcropping between the Que River and Hellyer mines. In contrast footwall alteration exposed in the sub parallel Amoeba zone is almost barren.

In broad terms:
Copper is elevated within outcropping footwall alteration but also defines outcropping basalt.
Lead anomalies define -

- footwall alteration between Hellyer and Que River and at Mt. Charter
- Mixed Sequence containing clastic base metal sulphides
- evolved Upper basalt containing veins and disseminations of sphalerite and galena E and NE of Mt Charter
- weakly mineralised footwall epiclastic breccias on top of the Lower basalt, 1.5 km south of Que River mine
- Upper basalt overlying a thin intersection of base metal sulphides at the Hellyer ore position, 500m south of Mt. Charter
- a poorly understood zone within Upper basalt in the core of a syncline north of the Que Fault but not associated with any visible mineralisation.

Zinc anomalies reflect the same features as lead but are often broader due to greater mobility. Barium anomalies indicate hydrothermal alteration; particularly in the Mt. Charter area. Arsenic also has a strong correlation with known areas of hydrothermal alteration whilst silver is only consistently anomalous in soils at Mt. Charter.

Partial Digest

Partial digest, or transported metal ion (TMI), soil sampling has been shown to detect blind mineralisation and alteration zones in the Que-Hellyer Volcanics. A total of 1031 samples from within EL 106/87 (over the Murrays Road, Medway and Leven River prospects) were collected as part of a larger geochemical sampling program covering CML 103M/87 and EL’s 3/95 Hatfield River (McNeill, 1997) and 13/94 Mt. Cattley (Hicks, 1997). Samples were collected from the “B” horizon at a nominal 50 metres spacing on a 200-600 metre spaced grid, from dominantly residual soils. Duplicate and standard samples were added to the sample set which was assayed for Cu, Pb, Zn, Ba, As, Cd, Co, Ni, and Sb by both partial and total digest methods. Results of this survey are discussed in McNeill and Hicks (1997).

A single coherent multi-line Cu, Pb, Zn, and Cd anomaly, the Mayday anomaly, was selected for diamond drill testing (see section 5 for results).

Wacker

Two deep geochemical sampling (Wacker) programs were completed in areas of cover or poor outcrop;

The Cripps Fault prospect (McNeill, 1989a): Sampling in an area of deep, up to >29m thick, glacial cover was designed to provide information on the location of the Que-Cripps fault. Some geochemical anomalism (up to 925 ppm Zn, 6000 ppm Ba and 210 ppm As) is associated with the fault.

The Link Road prospect (McNeill and Hicks, 1997): Sampling around a zone of fuchsite alteration and barite veining (hangingwall style alteration?) in Southwell Subgroup volcaniclastics indicated that the alteration had a restricted distribution and was not associated with anomalous base metals.

4.3.3 Drill core

Drill holes in the QHV have routinely been sampled over their entire length by continuous core grinds. Samples are selected on lithological, alteration or mineralisation boundaries, or over 10-15m intervals where lithologies are uniform. Short intervals (<1-2m) are often cut. Prior to 1986 samples were routinely analysed for Cu, Pb and Zn, ± Ag and Au, however, as a result of the work of Hespe (1986), lithogeochemical (Cr, Ti and Zr) and pathfinder elements (Ba, As) indicator elements have been routinely analysed. Sample preparation and analytical methods are summarised in Hespe (1986). As with soil samples, a standard (prepared from drill core) has been routinely included in all batches of core-grinds submitted for analysis since 1985.

During the life of EL 106/87 many older drillholes (pre-1985) were re-ground and(or) existing pulps of grinds were re-analysed for lithogeochemical and pathfinder elements to complete the core geochemical dataset (see McNeill (1989) and McNeill et al. (1990) for details). The new lithogeochemical data was compared with lithological descriptions, from drill logs, and discrepancies noted. The differences between visual and chemical classifications were then resolved by re-description of thin sections and(or) re-examination of core (McNeill et al, 1990; McNeill and Wallace, 1991) and any significant changes to the geological interpretation incorporated into the regional cross sections and interpreted geology plans.

Core grinds of any QHV intersected in drillholes more recent than MAC32 (and including MAC29) have been analysed for whole-rock, and sulphur, in addition to the suite discussed above. Whole-rock analyses are used to:

- Help define alteration zones. Studies in the Que-Hellyer Volcanics (Jack, 1989; Gemmell, 1990, McNeill et al., 1990, and Henley, in McNeill and Wallace, 1991) indicated several potential vectors to alteration and mineralisation, particularly the alteration index of Ishikawa et al. (1976) which indicates Ca and Na mobility.
- Aid in rock classification and correlation as discussed by Crawford (1991) and Crawford et al. (1992).

4.3.4 Rock-chip / channel sampling

Rock chip and channel sampling have been carried out in conjunction with geological mapping throughout the life of EL's 2/70, 15/73 and 106/87. In total 638 rock chip samples and 695 channel samples have been collected. Channel samples, normally over 10m intervals, were often taken when new access tracks and costeans were cut through areas of geological interest. Samples were generally analysed for Cu, Pb, Zn, Ag, Au, and (post 1985) Ba, As, Cr, Zr and Ti. Results are included in relevant annual reports.

4.3.5 Pb-isotopes

Pb-isotopes have been demonstrated to be useful discriminants between economic Cambrian massive sulphide systems (Que River, Hellyer and Rosebery) and Devonian vein systems (Gulson and Porritt, 1987). During the life of EL 106/87 two samples; from the Henty Fault Zone and Black Harrys Road, were analysed by SIROTOPE. Results are included in McNeill et al. (1990).

4.4 Geophysics

4.4.1 Ground EM

Time-domain

Given that EM surveys were instrumental in the discovery of the Que River and Hellyer ore deposits (Webster and Skey, 1979; Eadie et al., 1985), ground EM became a key technique in the exploration of the Que-Hellyer Volcanics (QHV). As stated in section 3, by the time of granting of EL 106/87 most of the outcropping QHV had been covered by fixed loop time-domain EM (see plates MAC113B and C in McNeill, 1989a for reading line locations). EM surveys completed in the reporting period were therefore designed to:

1. Complete coverage of potential buried extensions to the QHV (Hellyer north survey, in McNeill et al., 1990).

2. Infill holes in the previous coverage of the QHV (Charter Dolerite survey, in McNeill et al., 1990).

3. Test poorly understood responses located in previous surveys (I-Zone surveys, in McNeill, 1989a and McNeill et al., 1990).

4. Explore exposed felsic volcanic sequences of the Southwell Subgroup (Medway survey, in McNeill et al., 1990, and the Southwell valley survey, in McNeill and Wallace, 1991).

5. Explore beneath largely Tertiary Basalt covered areas for both Southwell Subgroup and Mt.Cripps Subgroup volcanics (Mackintosh North survey, in Richardson, 1996. Note that this survey also covered parts of ELs 3/95 Hatfield River [McNeill, 1997] and 13/94 Mt. Cattley [Hicks, 1997]).

Only one anomaly considered worthy of drill testing was located by these surveys; a response in the Mackintosh North area (Leven River prospect) between 17000N and 18000N and centred at 9900E. This response was tested by DDH MAC41 with negative results (Richardson, 1996; see section 4.5 for details). The area of EL106/87 is now considered to be adequately tested for conductive targets of greater than Que River size, to within approximately 150m of surface, where ground EM coverage is effective (i.e., outside the powerline corridor).

Test work at Hellyer and Que River has demonstrated that downhole EM (DHEM) is effective in locating mineralisation at >150m from drillholes, provided loop designs allow effective coupling with the target (Eadie, 1987; Silic and Eadie, 1989). As a result DHEM became a routine procedure in drilling programs on EL 106/87. A range of systems have been used including SIROTEM, EM-37, UTEM, Crone PEM and the Zonge GDP-16. Results of surveys are summarised in section 4.5. No off-hole conductors attributable to massive sulphide mineralisation were detected and the only two non-lithology related anomalies (in MAC28 and MAC40) were instrumental effects.

In addition to its direct ore-finding role, ground time-domain EM has been used, in an “in-loop sounding” mode to infer two types of stratigraphic information:

1. To estimate the thickness of Tertiary basalt cover at Middlesex Road, prior to drilling MAC20 and 22 (McNeill, 1989), and at the Leven River prospect, prior to drilling MAC41 (Richardson, 1996).

2. To estimate the depth to top of the Que River Shale over the AGSO seismic line and at the Mayday structural / geochemical target area (McNeill and Hicks, 1997).

Frequency-domain

Frequency-domain EM techniques have not been widely applied on EL 106/87. However, limited Max-Min and VLF surveys were used a first pass technique over previously un-checked DIGHEM anomalies, from the 1975 (Webster, 1975) survey, at the Barite Creek and Southwell Valley prospects (McNeill et al., 1990; Appendix 5). None of the anomalies were considered worthy of follow-up with time-domain EM.

4.4.2 <u>Seismic</u>

Three seismic surveys have been conducted:

1. A two line (10800N and 10950N) reflection survey conducted by the University of Tasmania over the immediate environs of the Hellyer orebody (Read, 1986 and 1989).

2. The results from lines 10800N and 10950N encouraged Aberfoyle to collect two further lines of reflection data; a regional section on 10600N from the Murchison highway to Hellyer, and a section on 11800N north of Hellyer. Survey specifications and results are included in McNeill (1989b; Appendix 7). Data quality was poor, due to ground roll and air blast effects. Results suggest that the Hellyer orebody would not have been located by seismic reflection alone, but that stratigraphic variations could be resolved.

3. As part of the TASGO project, AGSO completed a seismic reflection line along the Cradle Mt. Link Road. A segment of this line (6300E to 7300E) was shot with closer spaced (10m) stations than the regional traverse. An initial interpretation of the partially processed and un-migrated data indicated that the survey may have mapped the top of the Que-Hellyer Volcanics. Two further lines, totalling 3.0 km, with a north-south orientation, were collected on CML 103M/87 and EL 106/87 in April 1995. This survey was tied in to a deep drill hole (HL469) north of Hellyer to provide geological control. Survey specifications are included in McNeill and Hicks (1997). Bends in the traverse have made a comprehensive interpretation difficult. However, some conclusions are presented in McNeill and Hicks (1997) and have been published by Yeates et al. (1997).

4.4.3 Magnetics

Ground

During the life of EL 106/87 a total of 48 line km of ground magnetic data was collected from the Mt. Charter dolerite and South Hatfield (McNeill, 1989a), the South Mackintosh (McNeill et al., 1990) and the Southwell River (McNeill and Wallace, 1991) prospects. Data was collected at 10m spacing using an OMNI EDA4 proton precession magnetometer. This data was then dumped to a porta-pak computer and combined with data from a second OMNI magnetometer used in base station mode. Corrected data were then combined with previous surveys (see McNeill, 1989b). However, problems with levelling these different surveys and with data quality, meant the data sets could not be integrated without producing severe striping in both N-S and E-W orientations, that masked any subtle structural trends that otherwise may be evident in the data.

Although the QHV are relatively magnetically quiet, the ground data did show some prominent geological features. Sufficient magnetic susceptibility contrast appeared to exist for geological features to be clearly defined if a high quality aeromagnetic survey were to be undertaken.

Airborne

During march 1993 Geoterrex conducted a 1087 line km helicopter borne magnetic survey over EL 106/87 and CMLs 103M/87 and 68M/84. The survey was designed to confirm geological trends and more accurately locate structures inferred from geological and geochemical data. Survey specifications and the processing of results are summarised in Richardson (1993, and 1994).

The QHV are generally magnetically quiet with only a few weakly magnetic dacite bodies. Most sources and breaks are shallow features reflected in the high frequency part of the data. Therefore, spatially persistent breaks that are inferred to reflect faults are probably Devonian or younger in age. However, many shallow aeromagnetic breaks mark major faults with geological evidence such rapid stratigraphic thickness and facies changes or localisation of hydrothermal alteration, indicating they must have been active during the Cambrian. A general fall in magnetic intensity from south to north is interpreted to reflect progressive deepening of the magnetic Central Volcanic Complex to the north. The regional gradient is terminated on a major NW trending structure through Hellyer that coincides approximately with a major regional gravity discontinuity of the same orientation.

Magnetic susceptibility measurements

Magnetic susceptibility data have been collected from drill core to assist in interpreting magnetic surveys, assist with stratigraphic subdivision, and to determine if magnetite is responsible for spurious EM responses in some drill holes. Results and techniques are discussed in McNeill (1989b; Appendix 12) and McNeill and Hicks (1997).

4.4.4 Radiometrics

Radiometric data (total count, U, Th and K) were collected during the 1993 helicopter borne aeromagnetic survey (see Richardson (1993) for survey specifications). Results have proved to be of little use. Tertiary basalt, Cambrian dolerite and cultural features such as roads and powerlines are the most prominent features and are best seen in the total count data (Richardson, 1994).

4.4.5 Gravity

Gravity measurements were seen as a method of supporting the syn-volcanic fault model derived from geological and magnetic data, and in conjunction with magnetics could be used in 2-D modelling to refine cross sections through the Que-Hellyer Volcanic basin.

Prior to 1993 existing gravity data was restricted to detailed surveys over the Hellyer and Que River orebodies (Leaman and Richardson, 1981; Hudspeth and Richardson, 1985), wide (1-2 km) spaced data collected as part of the Mount Read Volcanics project, and a close spaced traverse over the Mt. Charter Dolerite (Hespe, 1986). To complete coverage a total of 530 infill stations, on available access throughout the EL, were read during 1993/94. All stations were then surveyed and levelled and data reduction undertaken by Leaman Geophysics.
The new data was then merged with the existing surveys on EL 106/87 and CMLs 68M/84 and 103M/87 (summarised above) and with open-file data from the adjacent ELs 39/85 (Placer; Leaman, 1988) and 37/89 (Pasminco). Station locations, numbering and reduced gravity values are shown on Plates MAC413A, B, and C (Richardson, 1995).

4.5 **Diamond drilling**

Nineteen diamond drill holes, for a total of 13,460 m, were completed by Aberfoyle Resources on EL 106/87 (see Figure 8 for collar locations). In addition three holes were drilled on EL 106/87 by the Tasmanian Department of Mines.

The Department of Mines holes are:

MAC24 (488.8m) at Black Harrys Road. Details in McNeill et al. (1990) and Pemberton et al. (1991).

SBDP10 (321m) on Beecroft Road (Leven River prospect; Pemberton et al., 1991).

SBDP6 (316m) on Racecourse Road (North Hatfield prospect). Details in McNeill (1990) and Baillie and Green (1988).

The aims and results of holes drilled by Aberfoyle Resources are summarised below:

MAC16 (367.4m) Boundary Prospect (South Hatfield) - (McNeill, 1989)

Designed to test a zone of ?hangingwall style (K-feldspar - sericite - quartz) alteration associated with barite-pyrite veining in rhyolitic volcanics of the Central Volcanic Complex. Alteration and barite veining were intersected to approximately 12m depth. Native Cu, malachite and chalcocite were recorded deeper in the hole, and may be associated with a thick zone of intense quartz veining. Base metal values were low, maximum 0.2% Cu, 700 ppm Zn, and no off-hole EM conductors were located.

MAC20 (397.5m) Middlesex Road (Leven River) - (McNeill, 1989)

Designed to test for QHV beneath Tertiary basalt cover south west of the Pancontinental drilling on EL 14/85. Hole intersected volcaniclastics and sediments of the Southwell Sub-group beneath 51m of Tertiary basalt cover. No significant mineralisation, anomalous geochemistry or EM conductors were located. Trilobite fossils from limestone clasts from this hole have been described by Jago and McNeill (1997).

MAC22 (424.3m) Middlesex Road (Leven River) - (McNeill, 1989)

Following the failure of DDH MAC20 to intersect QHV correlates a step out of 900m to the north was made for MAC22. Assuming the southwesterly dips determined in MAC20 remained constant then this hole should have tested deeper in the stratigraphy. The hole intersected volcaniclastics, sediments and rhyolitic lava of the Southwell Subgroup beneath 144m of younger cover rocks. Only minor syngenetic sphalerite was intersected (18m @ 0.1%Zn, 0.07%Pb from 259-277.3m) and no off-hole conductors were detected. See Van Kerkvoort (1995) and reports by Lees (in McNeill and Wallace, 1991; and Richardson, 1992) for detailed logs and discussion of the volcanology of this hole.

MAC23 (280m) Mt. Charter - (McNeill et al., 1990)

DDH MAC23 was designed to test variations in Au grade in the Mt. Charter alteration zone beneath the outcropping massive barite and most intense alteration. The hole failed to intersect the massive barite, the position of which is occupied by a polymict volcaniclastic, but stayed in stringer core type alteration for its entire length. The entire length of this hole was anomalous in Au (>0.1 g/t) with best intersections of 6m@ 2.3 g/t Au and 12 g/t Ag (135-141m) and 6m@ 2.9 g/t Au, 2.8 g/t Ag (216-222m). Base metals were also anomalous with best intersections of 0.25% Cu, 1.2% Pb, and 2.4% Zn (62-64m) and 1m@ 1.9% Pb, 3.74% Zn (197-198m).

MAC25 (530.3m) S.W. Mt. Charter - (McNeill et al., 1990)

This hole was designed to test the Que River ore position, at the base of the Mt. Charter dacite, beneath effective UTEM and adjacent to the co-active Mt. Charter fault. A thicker than interpreted Hellyer basalt sequence and a shallower dip on the Mt. Charter fault, meant that the fault was intersected before the Que River ore position. Mineralisation was restricted to “inter-pillow” stringers of pyrite and sphalerite (1.89m@ 0.1% Pb, 2.6% Zn, 5 g/t Ag from 123.6-125.4m). No off-hole conductors were detected.

MAC26 (850.7m) Mt. Charter - (McNeill and Wallace 1991)

DDH MAC26 was designed to drill down the core of the steeply north plunging Mt Charter alteration system to test for 1. Au mineralisation and 2. Base metal mineralisation at the Que River ore position below effective ground EM. The hole intersected 447m of stringer core alteration before passing into stringer envelope alteration and a barren ore position at 691.7-731.4m. Intersections include 58.4m@ 0.7% Pb, 1.15% Zn, 32 g/t Ag, 1.75 g/t Au (0-58.4m) and 1.3m@ 3.8% Pb, 7.4% Zn, 29.5g/t Ag and 0.68 g/t Au (245.7-247m). No off-hole conductors were detected.

MAC27 (883.8m) Charter Dolerite - (McNeill and Wallace 1991)

This hole was designed to test the Que-Hellyer host horizon below effective EM, in an area of known hangingwall style alteration and unusual sphalerite-rich mineralisation adjacent to the co-active Mt. Charter Fault. A thicker Que River Shale and Hangingwall Basalt package coupled with fault complications meant that the hole failed to intersect the target ore-positions. Intersections include: 85m@0.1% Pb, 0.3% Zn (249.8-335m) and 1.7m@ 1.23% Zn (759.3-761m). No off-hole conductors were detected. Mineralisation and alteration in this hole are described in detail by Hine (1995; see section 4.6.1).

MAC28 (907.5m) South Que River - (McNeill and Wallace 1991)

DDH MAC28 was designed to test the interpreted south plunging blind extension of the Que River alteration system beneath effective EM and to provide stratigraphic information in a poorly drilled area. The hole intersected a zone of stringer envelope (SEZ) type alteration below 716m, which although base metal-poor was anomalous in As (to 56 ppm), a feature typical of outcropping SEZ alteration (e.g., Amoeba Zone). A four loop DHEM survey located a complex off-hole conductor that was recommended for drilling.

MAC29 (762m) South Que River - (Richardson 1992)

This hole was designed to test the DHEM response above and to the east of DDH MAC28. A 100m wide fault bounded zone of SEZ alteration was intersected but no obvious source for the DHEM anomaly was seen. Drilling problems meant that the rod string was cemented in the hole from 463-709m and this resulted in the loss of critical DHEM data required to resolve the MAC28 anomaly.

MAC30 (185m) South Que River - (Richardson 1992)

MAC30A (785.1m) South Que River - (Richardson 1992)

Following the inconclusive test of the MAC28 conductor by MAC29 it was decided to step 100m south for a final attempt to test the target. No well defined alteration zone, ore position or source for the conductor was intersected. However, a response was still evident in the DHEM data. Experimentation with different DHEM systems led to the conclusion that the anomalous responses in MAC28 and MAC30 were due to a previously unrecognised “ferrite core” effect and thus an instrumental artefact resulting from the design of the Zonge SIROTEM and CRONE systems (Richardson, 1994; Appendix 1).

MAC32 (278.4m) Mt. Charter - (Richardson 1993)

This hole was designed to test the Que-Hellyer ore position, at the base of the Mt. Charter dacite, in the Mt. Charter alteration zone near the intersection of the interpreted co-active Murchison Highway and Barite Creek structures. The hole was abandoned after strong azimuthal deviation, a result of drilling at 45° to the cleaved Mt. Charter alteration zone. The entire length of the hole was in the Mt. Charter alteration system and was anomalous in Au, with a best intersection of 32.2m@ 0.4 g/t Au (0-32.2m).

MAC33 (910.7m) Mt. Charter - (Richardson 1993)

This hole was designed to test the same target as MAC32, but was drilled from the opposite direction in an attempt to minimise deviation. A complete QHV sequence was intersected, from the Que River Shale to the Animal Creek Greywacke. Disseminated sphalerite (125m@ 0.2% Zn) was present in Hellyer basalt correlates but the hole did not intersect the Murchison Highway structure and therefore remained in the less prospective footwall block. However, a DHEM survey coupled with DHEM in DDH MAC26 indicate that no large conductive bodies are present in the target position.

MAC34 (31m) Murchison Highway Zone - (Richardson 1993)

MAC35 (1189.6m) Murchison Highway Zone - (Richardson 1993)

These holes were designed to test the Que-Hellyer ore position in the core of the Old Mill site syncline near the intersection of four interpreted syn-volcanic structures. MAC34 was abandoned due to strong azimuthal deviation but MAC35 was successful in testing the target zone. Although the hole intersected a thick polymict volcaniclastic package with minor lava, considered to be the Mixed Sequence, there was no mineralisation or significant footwall style alteration. Once again disseminated sphalerite mineralisation in pillow lava sequence equivalents yielded 71m@ 0.2% Zn. No off-hole conductors were detected. The mineralisation and alteration in DDH MAC35 are also described by Hine (1995).

MAC36 (814.4m) Mt. Charter - (Richardson 1994)

This Hole was designed to test the base of the Mt. Charter dacites overlying the interpreted Que-Hellyer structure, along strike from the Mt Charter alteration zone, on section 4500N. The hole intersected dacite then footwall andesites before passing into Animal Creek greywacke, a sequence similar to that intersected by MAC33 and MAC37 (see below). There was no obvious ore position at the base of the dacite but a 48m thick epiclastic dominated unit immediately above the greywacke is variably silica-sericite-pyrite (up to 5% Py) altered. Base metal values are generally low and no off-hole conductors were detected.

MAC37 (835.2m) Mt. Charter - (Richardson 1994)

This hole was designed to test polymict volcaniclastics at the base of a dacite wedge overlying the Barite Creek structure and associated with an As soil anomaly. A sequence of dacite and silicic andesite with minor volcaniclastic (similar to lithologies in MAC33, 35 and 36) overlying the lower Basalt. No significant mineralisation or off-hole conductors were located. Silica-sericite-pyrite (up to 10-15% pyrite) alteration is locally intense, particularly from 270-300m but base metal values are low.

MAC40 (1168.7m) Mt. Charter - (Richardson 1996)

DDH MAC40 was designed to test two targets; the Mt.Charter position (?Hellyer ore position) down dip and plunge of the barite outcrops and the base of the Mt Charter dacite (the Que River ore position). The hole intersected these potential ore positions but both were un-mineralised and the lack of strong alteration suggests that the Mt Charter alteration zone does not focus on the Murchison Highway structure on this section. As with many other holes in the Charter area disseminated sphalerite mineralisation on the Hellyer basalt yielded assays of 88.9m@ 0.22% Zn. No other significant assays were reported. An anomaly was recorded in the initial DHEM survey, but, was recognised as a "ferrite core" artefact by comparing data from air- and metal-cored probes.

MAC41 (353.5m) Mackintosh North (Leven River) - (Richardson 1996)

This hole was designed to test a TDEM anomaly, in an area of Tertiary Basalt cover, located during the Mackintosh North EM survey. The anomaly was interpreted to be flat lying, with a width of 200m, a depth to top of 250m, and an approximate strike length of 1500m, extending onto the adjacent EL 3/95 (McNeill, 1996). The anomaly was tested by a vertical hole which intersected Tertiary basalt (to 281m) overlying Tertiary sediments (including porous organic-rich material - the interpreted source of the anomaly) and calcareous sandstone and limestone (Ordovician Gordon Group?). No mineralisation was intersected.

4.6 Research

4.6.1 Theses

Post-graduate research projects into aspects of the geology, alteration, and mineralisation of EL 106/87 are:

Rand (1988); The Geology and Mineralisation of the Mount Charter Prospect. B.Sc. (Hons.) thesis, University of Tasmania, Hobart. Some of the results of this study were published in Huston et al. (1992).

Hine (1995); Mafic -hosted zinc mineralisation, High Point, Western Tasmania. B.Sc. (Hons) thesis, University of Tasmania, Hobart.

Van Kerkvoort (1995); The geology of the Mt. Cattley-Two Hummocks area, Western Tasmania. B.Sc. (Hons) thesis. University of Tasmania, Hobart. This project largely dealt with EL 14/91 Mt. Tor, but includes drill logs and discussion of DDHs MAC-20 and 22 on EL 106/87.

Waters (1995); Volcanology and sedimentology of the host succession to VHMS style mineralisation within the Cambrian Que-Hellyer Volcanics, northwestern Tasmania. PhD. Thesis, Monash University, Melbourne. Progress reports were included in McNeill (1990, 1991) and Richardson (1992, 1993) and part of this study has been published as Waters and Wallace (1992).

Glenn Lees; The eruptive and depositional history of the Cambrian Upper Rhyolitic Sequence, Hellyer region, Mt. Read Volcanic belt, western Tasmania. This M.Sc. project at Monash University was not completed but progress reports are included in McNeill and Wallace (1991) and Richardson (1992).

4.6.2 Consultants reports

Structural study of the Hellyer Que-River area by A. Cooke, World geoscience Corp. Ltd. (in McNeill and Wallace, 1991).

Exploration research in the Mount Read Volcanics, Tasmania by R.J. Henley, Epithermex International. A two part report on structural models and lithogeochemistry (in McNeill and Wallace, 1991).

Structural setting of the Mackintosh block and its mineralisation by J. Windh and M. Etheridge, Etheridge and Henley, Geoscience consultants (in Richardson, 1993).

Review of drill targets and update of structural model of the Mackintosh Basin, NW Tasmania by R. Sliwa, Etheridge, Henley and Williams (in McNeill and Hicks, 1997).

4.7 Access

4.7.1 Line cutting

During the life of EL 106/87 a total of 244 line km (including some cutting on CML 103M/87 but, excluding DHEM and ground EM loop lines) of gridding was completed. Gridding completed each year (since 1973) is shown on the MAC153 series of plans, at 1:10,000 scale. Gridding had largely been re-cutting or extending the Mackintosh grid (“mine grid”), initially established prior to the discovery of the Que River deposit. Mine grid has its origin at AMG coordinates 5 388 687.4 mN, 383 972.8 mE (mine grid 000 mN, 000 mE) and with mine grid north oriented at 22° 07' 22" east of AMG (i.e., approximately 10° east of magnetic north).

4.7.2 Vehicular tracks /costeans

Early exploration, during the lives of EL 2/70 and 15/73, led to the establishment of a network of 4WD access tracks and costeans over the area of EL 106/87 (these are shown on the MAC89 outcrop mapping series of plans; see reports in Appendix I for details). This access was used during the life of EL 106/87 and additional track construction and costeaning has been minimal. Many drillholes have been sited on, or within 50m, of existing access tracks. Exceptions were:

- DDH's MAC-36, and 37 on the east flank of Mt. Charter required construction of 900m of access from the Barite Creek track (see plate MAC89-DD).
- DDH's MAC-28, 29 and 30 required construction of a 620m access track from the 6000N costean at I-Zone (see plate MAC89-BB).
- DDH's MAC-32 and 33, north and west of Mt. Charter respectively, required the construction of 150m long access tracks (see plate MAC89-CC).

Similarly only four new costeans have been dug; the 4350E and 4500E costeans at Mt. Charter (plate MAC89-CC McNeill et al., 1990) and the 1615E and 1645E costeans at Black Harrys Road (plate MAC89-3; McNeill et al., 1990). Rehabilitation of these tracks and costeans is discussed in section 6.0.

5.0 WORK COMPLETED IN THE FINAL YEAR

5.1 Introduction

Work during the current reporting period has focussed on drill testing of the Mayday target. During 1996 a partial digest soil geochemical survey was conducted over a corridor along strike from the Hellyer and Que River orebodies; from Hellyer mine, ten kilometres NNE to the boundary of EL 106/87. The aim of the survey was to detect massive sulphide mineralisation, overlain by barren hangingwall rocks below the penetration depth of surface EM. Results of this survey have been presented in McNeill and Hicks (1997). Only one area of relatively coherent anomalous partial digest geochemistry was detected. This coincided with a previously recognised structural / stratigraphic target, known as the Mayday target due to its proximity to the Mayday fault. An 1800 metre vertical hole was proposed to test the Hellyer ore position beneath the anomalous geochemistry.

DDH MAC 43 was collared on 5-3-97 and completed on 15-11-97 at 1504.8 metres. Collar location is at AMG 5399317.8N 396471.8E (Mine Grid 14558.3N 7577.7E).

5.2 DDH MAC 43 - Geology

A detailed log and list of logging codes is attached as Appendix III, whilst a cross section is included as Plate MAC 479. A summary log is as follows:

0	-	40.4m	Sandstone and conglomerate - Denison Group
40.4	-	112.1	Polymict rhyolitic lapilli to breccia epiclastics - Mt. Cripps Subgroup
112.1	-	120.5	Mudstone - Mt. Cripps Subgroup (MCSG)
120.5	-	256.8	Quartz - feldspar crystal rich polymict lapilli to breccia epiclastics - MCSG
256.8	-	277.8	Mudstone - MCSG
277.8	-	321.8	Quartz rich volcanogenic sandstone - MCSG
321.8	-	329.1	Mudstone - MCSG
329.1	-	341.5	Quartz rich volcanogenic sandstone - MCSG
341.5	-	363.6	Polymict pumiceous breccia - Southwell Subgroup (SSG)?
363.6	-	523	Rhyolite lava and breccia - SSG
523	-	527.5	Fault Zone
527.5	-	538.6	Sericite altered volcanogenic sandstone - SSG
538.6	-	571.4	Grey micaceous siltstone with bands of siliciclastic

			granule conglomerate - SSG
571.4	-	577.6	Polymict pumiceous breccia - SSG
577.6	-	642.5	Grey micaceous siltstone with bands of siliciclastic granule conglomerate - SSG
642.5	-	699	Polymict ash to breccia pumiceous volcaniclastic - SSG
699	-	735.4	Ash volcaniclastic interbedded with siltstone - SSG
735.4	-	799	Polymict crystal rich volcaniclastic - SSG
799	-	962.2	Polymict pumiceous rhyolitic breccia to coarse lapilli and minor ash volcaniclastic - SSG
962.2	-	1043.7	Quartz - feldspar crystal volcaniclastic - SSG
1043.7	-	1069.9	Shale - SSG
1069.9	-	1084.3	Dacitic? Lava and ash volcaniclastic - SSG
1084.3	-	1096.6	Interbedded black shale and quartz phyric volcaniclastics - SSG
1096.6	-	1174.3	Black shale - SSG
1174.3	-	1185.1	Polymict rhyolitic ash to lapilli volcaniclastics - SSG
1185.1	-	1214.2	Black shale - SSG
1214.2	-	1307.2	Quartz - feldspar crystal volcaniclastic - SSG
1307.2	-	1502.9	Polymict pumiceous lapilli to breccia volcaniclastic - SSG
1502.9	-	1504.8	Dacite? Lava - SSG

MAC 43 was collared in Upper Owen sandstone and siliciclastic conglomerate. The entire hole was drilled in rhyolitic volcaniclastics with minor lava and sediments of the Mt Cripps and Southwell Subgroups (MCSG and SSG). The base of the Southwell Subgroup was not reached.

The sequence intersected by MAC43 bears only broad resemblance to that exposed in the Cradle Mountain Link road. On the link road the boundary between the MCSG and SSG is placed at the base of a sequence of siltstone and siliciclastic granule conglomerate that separates SSG felsic lava from a MCSG crystal tuff sequence. In MAC 43 the boundary is tentatively placed at the gradational contact between overlying quartz rich volcanogenic sandstone and underlying pumice bearing breccia at 341.5m. About 20m below this contact a flow banded quartz ± feldspar phyric rhyolite lava was intersected. A felsic lava is also exposed in the Cradle Mountain Link road at the top of the SSG. In MAC 43 the felsic lava is underlain by 80m of siltstone and siliciclastic granule conglomerate which under the current interpretation would presumably represent a very thin Murrays Road greywacke. Alternatively this interval of sediment may represent the basal unit of the MCSG.

The remainder of MAC43 intersected an alternating sequence of polymict pumiceous epiclastics and grey to black siltstone and shale, correlated with the SSG. Minor unfossiliferous? limestone clasts were recorded from some SSG breccias similar to MAC 20 and MAC 22 to the north.

Core to bedding angles in the sediments indicate stratigraphy to be shallow dipping above the rhyolite lava body but to steepen with depth until dips around 80° dominate. Core orientation was not possible until the hole flattened sufficiently to allow an orientation device to be used. Successful orientations are consistent with stratigraphy generally dipping to the ESE but below around 1100m becoming steeply overturned to the NW. Overturning is supported by a general mirror image repetition of lithological units around 1100m.

Given the interpretation that below 1100m MAC 43 was drilling overturned stratigraphy it was decided to stop and complete downhole EM in order to provide encouragement to continue drilling. As no DHEM response was obtained and no stratigraphic indication of proximity to the Que - Hellyer volcanics was evident it was decided to terminate the hole. The source of the partial digest soil anomaly therefore remains unresolved.

Trace disseminated pyrite occurred throughout the hole and only very weak local galena ± sphalerite ± chalcopyrite veining was intersected. Narrow intervals were reported from 733.2 - 733.3m, 905.8 - 905.9m, 1043.7 - 1067.9m, 1077 - 1079.6m. Minor massive pyrite and variably Si+Py±Se±Cl altered volcanic clasts, with 15-30% Py, were intersected between 646.85 and 681.6m. These are not known elsewhere in the SSG and their significance, other than indicating hydrothermal activity, is unclear.

No PVC casing was used for DHEM in MAC43 and the HW casing was left in the hole to allow for possible extension by future explorers.

5.3 DDH MAC 43 - Geochemistry

Only local assays were carried out on MAC43. Core grinds were taken of weakly pyritic felsic volcaniclastic between 60 and 100m. Ten metre samples were assayed for whole rock and Zr, Cr, Ba, As, Cu, Pb, Zn, Ag and Au. Results are included in Appendix IV. Base and precious metal values are uniformly low.

Core grind and split core samples were also taken over several intervals containing weak base metal veining between 733 and 1130m. These samples were analysed for Cu, Pb, Zn, Ag, Au, Ba and As. Sample intervals and results are included in Appendix IV. A summary of mineralised intervals is as follows:

- 733.2-733.3m, 0.1m@ 0.14% Cu, 1.76% Zn, 5.52% Pb, 27 g/t Ag. (strongly Gn+Sp veined shale).
- 1043.7-1050.3m, 6.6m@ 990 ppm Pb, 0.34% Zn , 6 g/t Ag (?Devonian veins in shale and volcaniclastics).
- 1075.3-1079.6m, 4.3m@ 0.27% Pb, 6 g/t Ag (?Devonian veins in volcaniclastic).
- 1106.1-1116.1m, 10m@ 500 ppm Pb, 0.12% Zn, 2 g/t Ag (?Devonian veins in shale).

In order to confirm the origin of lead in galena bearing veinlets, a sample from 733.2m was submitted to the CSIRO for lead isotope analysis. The sample returned a clear Hellyer signature. Results are included in Appendix V.

5.4 DDH MAC 43 - Geophysics

5.4.1 Downhole EM

At the time of casing off to NQ at around 500m it was proposed to carry out in-hole depth soundings. The aim was to refine the estimate of depth to the top of the Que River shale that had been obtained from surface soundings and was a basis for the expected depth to the Que Hellyer Volcanics in the target area. Equipment failures caused the sounding to be delayed until 570m. Unfortunately, after carrying out both downhole and surface tests (at 570m and 740m) it appears that no available downhole probe is capable of measuring, with suitable quality, the extremely low signal from deep, poorly conductive stratigraphy. Consequently, meaningful results could not be obtained and the original surface based estimate of 900-1500m to the top of the Que River Shale could not be improved.

A two loop downhole EM survey (Zonge GDP-16) was undertaken in an open hole from 1504.8m back to the HQ casing at 525m. Loop locations and survey results are shown in Appendix VI. No off-hole conductors were located and the only response is due to the shale unit intersected below 1050m.

5.4.2 Magnetic Susceptibility

Magnetic susceptibility measurements of drill core from MAC 43 were taken at one metre intervals over the full length of the hole. Results are included in Appendix VII.
Mt. Cripps Subgroup volcaniclastics are variably magnetic until a lithological boundary at 227.4m. From this contact to what is interpreted as the base of the Mt. Cripps Subgroup, susceptibilities are low. They remain low within the Southwell Subgroup except for two intervals of volcaniclastic (710.4 - 724.3 and 758.6 - 782m) which have distinctive pink and green mottled and banded alteration typical of the Tyndall Group. One other zone of moderately elevated values is associated with a red siliceous Fe rich interval of volcaniclastic breccia between 1442 and 1477m.

6.0 ENVIRONMENTAL DISTURBANCE AND REHABILITATION

6.1 Introduction

Exploration over the life of EL 106/87 and preceding EL's 2/70 and 15/73 resulted in the establishment of several kilometres of 4WD tracks and associated diamond drill pads. A survey of all drill sites and tracks was undertaken and a preliminary plan of proposed rehabilitation formulated. This was discussed with Mineral Resources Tasmania resulting in agreement on the final scope of work. Work to be completed over the summer of 1997 / 1998 is shown on Plate MAC 478 and summarised below.

6.2 To be left open

The following tracks will not be rehabilitated as they are considered to provide key access into remote or prospective areas. Barriers will be constructed at their junction with the HEC transmission line to prevent casual access but will allow for re-opening by future explorers if required.

- The main track accessing Mt. Charter (excluding tracks and drill sites near the summit).
- The Barite Creek track (excluding the MAC36/37 access tracks and drill sites).
- The South Charter track.

6.3 To be rehabilitated

Rehabilitation will be carried out using an excavator to drag stockpiled soil back onto tracks from the verges. Some older tracks have not been used for several years and consequently now have well established regrowth. These will not be disturbed. Several drill holes in the vicinity of Mt. Charter are making water. These will be re-entered and sealed prior to track and pad rehabilitation. The following tracks and drill sites will be rehabilitated:

- MAC43 drill site and access track (north of Plate MAC 478).
- MAC28/29/30 drill sites and access track from the HEC line to MAC30.
- MAC34/35 drill sites and access track from the HEC line to MAC35.
- The first 200m of the MC14 access track off the High Point track.
- The disused lower portion of the Mt. Charter track accessing MAC33.
- The top section of the Mt. Charter track accessing MAC23/26.
- MAC36/37 drill sites and access track back to the junction with the Barite Creek track.
- The disused portion of the South Charter track adjacent to the HEC line.

- MC17 drill site and access track off the South Charter track.

7.0 CONCLUSIONS

The focus of the final years work on Mackintosh EL 106/87 was diamond drill testing of the highest ranked partial leach soil geochemical anomaly, identified during the 1996 TMI survey. This anomaly coincides with a structural / stratigraphic target identified in 1994. Targeted Que - Hellyer Volcanics were not reached as they occur at greater than anticipated depth. No source for the geochemical anomaly is evident.

EL 106/87 has been the focus of Aberfoyle's' Tasmanian exploration effort for the past ten years but no new massive sulphide mineralisation has been discovered since the Hellyer orebody in 1983. Many targets with varying geological, geochemical and geophysical support were drill tested during that time. Other, lower ranked targets remain to be tested.

8.0 EXPENDITURE

The following expenditure was incurred on EL 106/87 Lake Mackintosh for the period February 1997 to the time of writing (1st January 1998). Final expenditure will be forwarded to Mineral Resources Tasmania upon completion of rehabilitation work.

GEOLOGY	$125,099
SURVEY	$3,446
GEOPHYSICS	$76,015
GEOCHEMISTRY	$3,297
DIAMOND DRILLING	$284,019
ACCESS	$24,104
REHABILITATION	$10,829
OTHER SERVICES	$13,975
ADMINISTRATION	$55,366
TOTAL	**$596,150**

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Appendix I.

Chronological listing of open file reports for EL 2/70, Mackintosh, and 15/73, Hatfield.

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Appendix II.

Summary of untested identified structural / stratigraphic targets on EL 106/87

TARGET NAME: MAYDAY 1

TARGET BACKGROUND:

Lower Mt. Cripps Subgroup volcanogenic sandstones are restricted to S side of Mayday Fault. Mayday Fault is inferred Cambrian transfer which when extrapolated to the E also controls Back Peak Beds (Lower Mt. Read Volcs.) and location of anomaly 13 and Anio Ck. gold mineralisation. Magnetic interpretation suggests Que-Hellyer Structure may extend to NE of Hellyer and cross Mayday transfer at Mayday 1.

Sructure: Target lies at intersection of inferred Que-Hellyer Corridor and Mayday Fault transfer.

Stratigraphy: QHV at great depth

Structural activity: Localisation of units against Mayday Fault indicates Cambrian activity.

Alteration and geochemistry: Massive pyrite clasts at Murrays Road associated with minor fuchsite.

Indicators: Murrays road massive pyrite clasts at base of Mt. Cripps Subgroup.

DRILLING: MAC43 to 1505m failed to reach the QHV

TARGET NAME: QUE SOUTH

TARGET BACKGROUND:

In MAC29and MAC30 Se+Si+Py altered clasts occur in epiclastcs and breccias in the transition zone between Feldspar Phyric Andesite and Lower Basalt. These can be geochemically anomalous eg. MAC29 157.5-162.2 0.18% Zn.

Structure: Target defined by inferred Que - Hellyer Structure near its intersection with the Barite Creek Structure.

Stratigraphy: Target is at the Lower Basalt - Feldspar Phyric Andesite contact.

Structural activity: Rapid thinning of the Lower Basalt is infered across the Que - Hellyer Structure toward the east. No direct evidence of activity.

Alteration and geochemistry: Anomalous base metals in soils and in drill core around LB / Afp contact. Hydrothermally altered clasts in epiclastics around this boundary.

Indicators: Anomalous geochemistry and altered clasts.

DRILLING: 1* 800metre inclined hole required.

TARGET NAME: AMOEBA ZONE

TARGET BACKGROUND:

Altered dacite outcrops along Amoeba Zone. This hole proposes to test the base of the dacite where the alteration zone crosses a possible NW transfer (Brambles Yard Structure). Only one very shallow hole (HAT3) has been drilled in this area.

Structure:Target defined by intersection of NNE Que-Hellyer style Amoeba Zone and NW Brambles Yard transfer.

Stratigraphy: Target is at base of dacite sequence / top of Feldspar Phyric Andesite.

Structural activity: Hydrothermal alteration indicates activity of Amoeba Zone. No other evidence known.

Alteration and geochemistry: Amoeba Zone alteration is pervasive sericite+silica+ pyrite. It is base metal poor but generally anomalous in arsenic.

Indicators: Amoeba Zone alteration.

DRILLING: 1* 600 metre inclined hole required.

TARGET NAME: MURCHISON HIGHWAY

TARGET BACKGROUND:

This target has a setting analogous to Hellyer. Amoeba Zone alteration could be interpreted to plunge S along the axial plane of anticlinaly folded Upper Basalt / dacite. This hole proposes to test the base of dacite in the core of the anticline as the Hellyer ore position is probably within surface EM range. DHEM from MAC 35 and Paminco DDH BHD3 restrict the size of target that can be accommodated.

Structure: Many inferred coactive structures appear to converge in this area. These are 1) Amoeba Zone
2) Que Fault
3) High Point

Stratigraphy: Target is at base of dacite sequence.

Structural activity: Upper Basalt appears to thicken in nose of anticline possibly reflecting thicker stratigraphy above an active structure, as at Hellyer.

Alteration and geochemistry: Minor lead anomaly in soil hangingwall to target.

Indicators: None known.

DRILLING: 1* 900 metre inclined hole required.

TARGET NAME: AMOEBA SOUTH

TARGET BACKGROUND:

Altered dacite outcrops along Amoeba Zone. This hole proposes to test the base of the dacite beneath the best developed alteration and an associated gravity anomaly at the southern end of the outcropping alteration zone.

Structure: Target defined by NNE Que-Hellyer style Amoeba Zone.

Stratigraphy: Target is at base of dacite sequence / top of Feldspar Phyric Andesite.

Structural activity: Hydrothermal alteration indicates activity of Amoeba Zone. No other evidence known.

Alteration and geochemistry: Amoeba Zone alteration is pervasive sericite+silica+pyrite. It is base metal poor but generally anomalous in arsenic.

Indicators: Amoeba Zone alteration. Gravity anomaly.

DRILLING: 1* 700 metre inclined hole required.

TARGET NAME: BRONCO

TARGET BACKGROUND:

This target is defined by the intersection of two inferred Cambrian structures interpreted from magnetics. The proposed hole would test the base of the Upper Basalt and underlying dacite adjacent to the intersection of the two structures. The target would be in the SW quadrant of the intersection where soil geochemistry is elevated and Cambrian subsidence is interpreted to have occurred .

Structure: Target defined by intersection of NNE High Point Structure (potentially analogous to Que-Hellyer Structure) and NW Brambles Yard transfer.

Stratigraphy: Target is at base of Upper Basalt and at contact of dacite sequence / top of Feldspar Phyric Andesite.

Structural activity: Que River Shale thickens to west (across High Point Structure ?) in holes on 7700N.

Alteration and geochemistry: No alteration known but moderate lithology normalised Pb soil anomaly adjacent to target in hangingwall Upper Rhyolite Sequence and Que River Shale.

Indicators: Hangingwall Pb soil anomaly.

DRILLING: 1*800 metre inclined hole required.

TARGET NAME: MAVERICK

TARGET BACKGROUND:

Target is lower Upper Rhyolite Sequence (URS) and QHV along strike from Hellyer mine in an area of strong fuchsite alteration and minor barite veining.

Structure: Target not well defined by structures identified to date. Possible NE trending (Que Fault trend) magnetic break.

Stratigraphy: Target is basal Southwell Subgroup and / or Hellyer ore position.

Structural activity: None known.

Alteration and geochemistry: Strong pervasive fuchsite alteration of epiclastics well up in the SSG. Rhyolite lava adjacent to the altered epiclastics hosts massive barite veins.

Indicators: The hanging wall fuchsite alteration and barite veining. Wacker sampling indicated limited extent of alteration and associated weak Pb anomalism. TMI sampling indicated sporadic elevated Cu Zn and Pb values.

TARGET NAME: MEDWAY

TARGET BACKGROUND:

Area has been covered by EM and no conductors identified.
Outcrop is Upper Southwell Subgroup so attractive stratigraphy is inferred to lie at great depth.
Several potentially prospective structures are inferred to intersect in this area and a deep magnetic source is interpreted to lie at depth.

Structure: NNE trending extension of Que-Hellyer Structure intersects a regional E-W gravity linear. A NNW fault also is interpreted to pass through the area.

Stratigraphy: Target would be Lower Southwell Subgroup (Rosebery host equivalent??) or QHV but these are interpreted to lie at considerable depth.

Structural activity: No evidence known.

Alteration and geochemistry: Sporadic anomalous TMI Cu, Co, As geochemistry.

Indicators: None known.