# PLUTONIC OPERATIONS LIMITED

**ACN 004 680 997**



**EXPLORATION LICENCES 4/92 AND 7/92**

**SORELL PENINSULA**

**Annual and Final Relinquishment Report**

**to September 1997**

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ANNUAL & FINAL RELINQUISHMENT
REPORT-SORELL PENIN.-EL 4/92
AND 7/92 - PLUTONIC OPS.

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November 1997

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# 1.0 SUMMARY

This report summarises exploration conducted by Plutonic Operations Limited on EL's 4/92 and 7/92 within the Sorell Peninsula during a five year period up to relinquishment of these tenements on the 11th September 1996. A summary of recent developments stemming from academic study of the Thomas Creek Prospect is also presented.

Relinquishment of EL's 4/92 and 7/92 has been made for corporate reasons, related to a change in focus of basemetal exploration in Australia. The essential grassroots nature of ongoing exploration required to find major new targets on these tenements was perceived as relatively high risk and expensive compared to other regions being explored by Plutonic. Therefore a joint venture partner was sought in early 1997 to share the risk. Unfortunately this did not eventuate and Plutonic withdrew from these tenements at the end of the fifth year.

# 2.0 INTRODUCTION

## 2.1 Tenure

EL's 4/92 "Muddy Cove Creek" (243 km$^2$) and 7/92 "High Rocky Point" (183 km$^2$) were granted to Plutonic Operations Limited on 11 September 1992. The EL's are located in south-west Tasmania within the Sorell Peninsula as shown in Figures 1, 2 and 4.

Following Plutonic's initial assessment of the Sorell Peninsula tenements in 1993 it was evident that substantial exploration over a number of years would be required to bring any prospect to the development stage. Given that the Wilderness Society has proposed the Sorell Peninsula be added to the Tasmanian Wilderness World Heritage Area (TWWHA), it was therefore decided to quantify the sovereign risk perceived to be posed by conservation interests in inhibiting mining development within the South-West Conservation Area.

Assessment of this risk was achieved by presenting a hypothetical mining proposal for the Sorell Peninsula to the Tasmanian Department of Resources and Energy for its evaluation of environmental and conservation issues and the likelihood of approval for development. The Department responded in July 1994 with a document entitled "Issues for Consideration" which outlined the approval process and the requirement of any development to be declared a project of State Significance. In consideration of the fact the area has been declared a Strategic Prospectivity Zone and the strong support the Tasmanian Government has declared for any significant development in the area, Plutonic subsequently decided to proceed with the exploration of these tenements.

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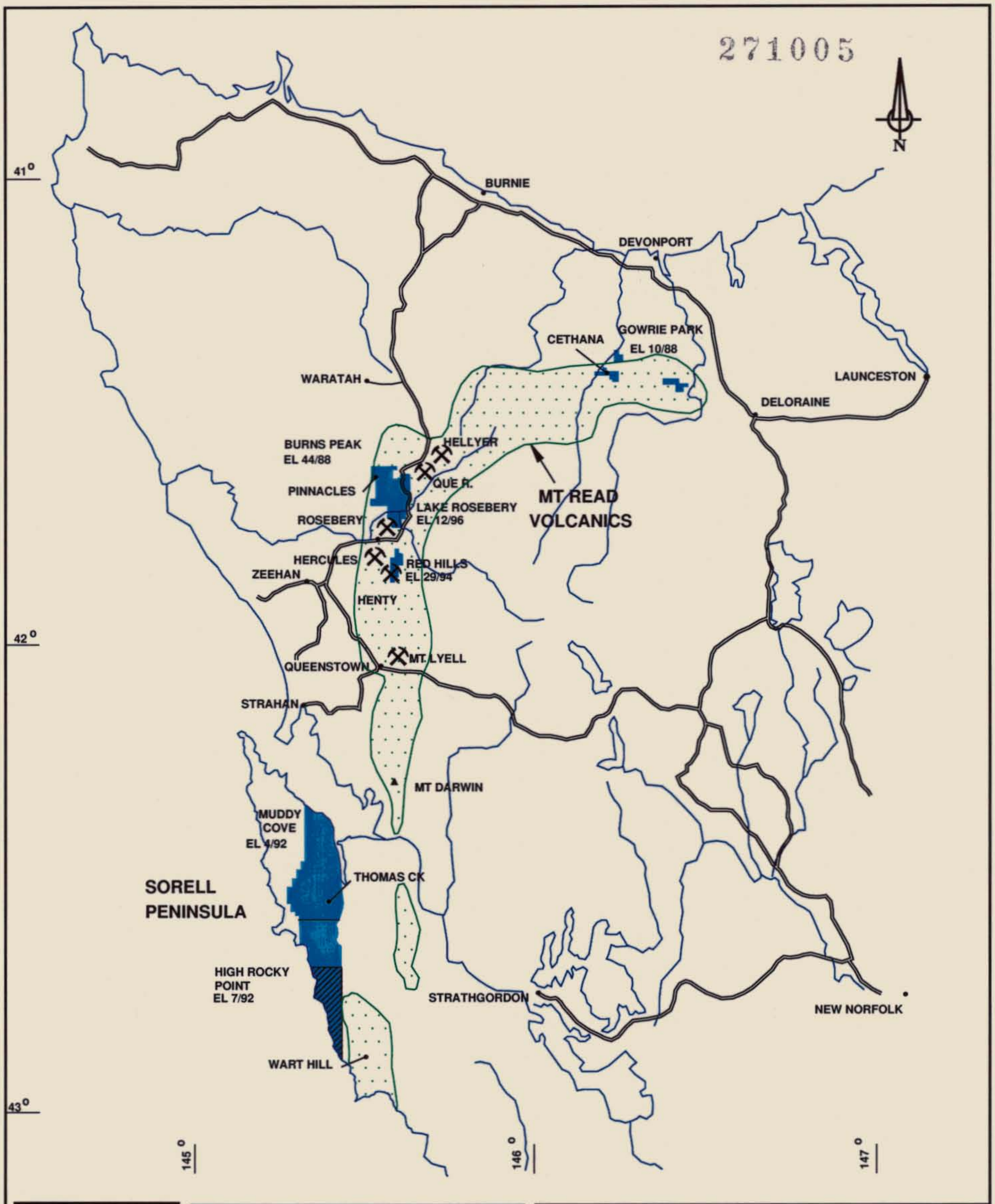



LEGEND

TO BE RELINQUISHED

15Km 0 30 60km

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FIGURE 1

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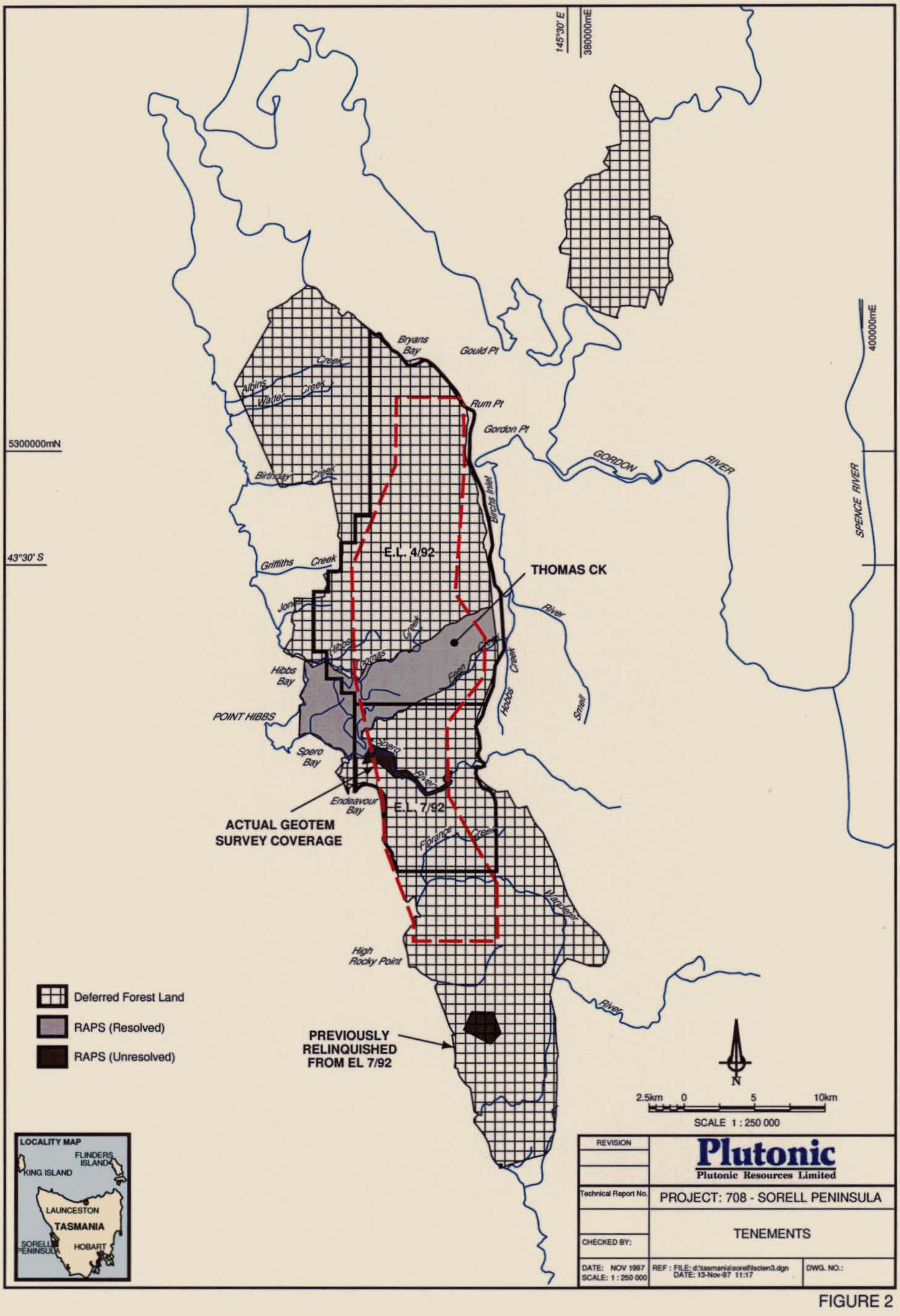



FIGURE 2

### 2.2 Access and Land Usage

The Sorell Peninsula along the south-west coast, receives the full brunt of the roaring forties so that exploration in the winter months is not advisable and the field season is generally November to April.

All of the area is included in the South-West Conservation Area. This means that although exploration is allowed, there are more stringent guidelines than in Crown Land elsewhere. This applies in particular to three Recommended Areas for Protection (RAPS) covering flora habitats within the tenement areas. Refer Figure 2. Given due care to minimise environmental disturbance and adherence to approved and safe exploration practice, work programmes in these areas such as at Thomas Creek Prospect, can be conducted satisfactorily.

The bulk of filed-exploration in the Sorell Peninsula was conducted at the Thomas Creek Prospect which lies approximately 48km south east of Strahan. This area has no existing road infrastructure. Although a network of now overgrown vehicle tracks constructed by BHP in the late 1960's extends to within 5km to the north of this prospect. Similarly a limited number of cut but overgrown cut walking tracks exist, one of which passes through the Thomas Creek campsite.

A new emergency "exit" walking track was cut during 1996 from the to the button grass plains to the east terminating outside the World Heritage Area and within several kilometres of the southern end of Birch's Inlet. Huts for emergency shelter exists at both the BHP landing and near the Birch's River at the southern end of Birch's Inlet.

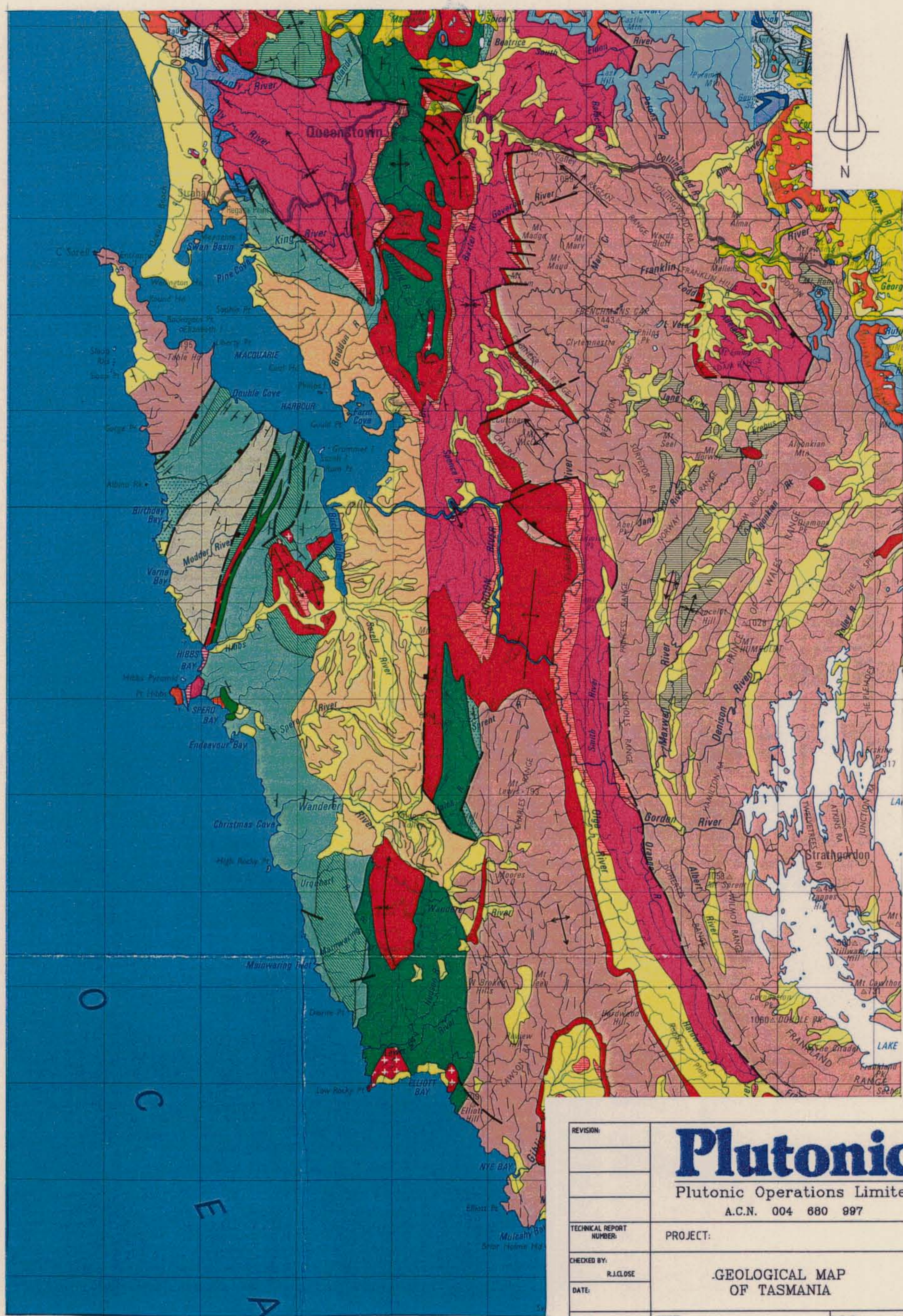
Considering the difficulty of access, any exploration in this area becomes a costly exercise demanding careful planning. For example, access to the Thomas Creek Prospect for the 1996 drilling program required a full day of mobilisation and another for demobilisation. Mobilisation from Strahan involved utilising a barge and helicopter with 3 to 4 hours travel time to the helicopter rendezvous at the BHP landing in Birch's Inlet. All loads were slung directly from the barge using a Helicopter Resources "Squirrel" having lift capacity of approximately 600kg.

## 3.0 REGIONAL GEOLOGY

### 3.1 Introduction

Due to the difficulty of access, limited outcrop and minimal exploration the geology of Sorell Peninsula (Figure 3) remains relatively poorly understood.

The main belt of Cambrian Mt Read Volcanics extends for 170 km south from Hellyer, through Queenstown, along the West Coast Range to South Darwin Peak where it disappears under a Tertiary graben, to re-appear along the D'Aguillar Range and further south to the coast at Elliott Bay.

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| CHECKED BY: R.J.CLOSE<br>DATE: | GEOLOGICAL MAP<br>OF TASMANIA |
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FIGURE 3

To the west of the D'Aguillar Range in the Sorell Peninsula, the Noddy Creek Volcanics have been correlated with the Mt Reads on the basis of their petrology and calc-alkaline geochemical characteristics by a number of workers. However, it is difficult to structurally relate these volcanics with the main belt and it is possible that they represent a slice of a separate, possibly earlier island arc province which has been dismembered and thrust into the present position.

From regional scale magnetics and gravity it is clear that there is a major structure running north-south through Birch's Inlet on the east side of the Sorell Peninsula and a second north-westerly trending structure along the north side of Macquarie Harbour. The whole Sorell Peninsula may thus have been displaced south from a position west of Zeehan and is now in faulted contact with the Mt Read Volcanics along the Copper Creek Fault Zone.

## 3.2 Stratigraphy

The geology of the Sorell Peninsula and the volcanics in particular has been described in company reports for BHP and Amoco/Cyprus, in White's PhD thesis and in recent Mines Department mapping by A Brown, D Seymour, M McClenaghan and D Findlay.

The first regional mapping of the area was completed by BHP in the late 1960s, however, it was based upon coastal and a few inland traverses and relied to a large degree on photo interpretation with the Cambrian and Precambrian left largely undifferentiated. Nevertheless Amoco/Cyprus (Ferris, 1984) relied heavily upon this mapping in their exploration and produced no map of their own other than the rough maps of their areas of interest.

In order to rectify this situation the Tasmanian Mines Department instituted a 1:50,000 regional geological survey in the late 1980s, however due to funding restrictions this programme remains uncompleted. The area north of Varna Bay is covered by the Macquarie Harbour (1989) sheet and the area south of High Rocky Point covered by the Montgomery (1988) sheet. Unfortunately the central Point Hibbs sheet area covering the major area of interpreted Noddy Creek Volcanics and related intrusives has not been mapped apart from a few reconnaissance traverses.

The significant differences between the Mines Department mapping and the earlier BHP/Amoco/Cyprus mapping is the extension of the prospective Noddy Creek Volcanics south to the coast at High Rocky Point and the associated sediments down to Veridian Point. Noddy Creek Volcanics in the Point Hibbs quadrangle were interpreted by Close and Reid (1995) mainly from aeromagnetics as well as limited reconnaissance mapping.

The structure of the Sorell Peninsula is discussed in Brown *et al.* (1991), Carey and Berry (1988) McClenaghan and Corbett (1989) and McClenaghan and Findlay (1989). Two thrust fault bounded belts of Cambrian rocks separated by Precambrian sedimentary sequences occur on the northern part of the Sorell Peninsula. The western-most belt contains the tholeiitic mafic to intermediate

Lucas Creek Volcanics and associated carbonate and greywacke-mudstone sequences. The eastern belt, however contains a complex sequence of volcanic suites and associated volcanic derived sediments, cut by fault bounded blocks containing mafic-ultramafic bodies and intruded by felsic to intermediate plutons. Refer Figure 3 and Plate 1.

The Cambrian-Ordovician sequences are confined by major north-north-east trending and easterly dipping thrust faults of probable Devonian age, along which late transcurrent movement is indicated by McClenaghan and Findlay (1989). This faulting together with limited mapping, poor exposure and the presence of isoclinal folding in sediment-dominant sequences, has combined to reduce the overall understanding of the relationships between major stratigraphic packages in this region.

However, Brown *et al* (1991) and McClenaghan and Findlay (1989) recognise the following Cambrian associations in the tenement areas:-

1. Calc-alkaline Noddy Creek Volcanics;
2. Boninitic Timbertops Volcanics;
3. Tholeiitic basalt Mainwaring-Birch's Inlet Volcanics;
4. Point Hibbs Melange Belt - mafic-ultramafic intrusives.

### 3.2.1 Noddy Creek Volcanics

The Noddy Creek Volcanics differ from the other volcanics on the Sorell Peninsula by the fact that they are a calc-alkaline island arc suite of rocks as opposed to the more exotic alkaline, tholeiitic and picritic basalts and boninitic andesites and ultramafics elsewhere on the peninsula.

It appears almost certain that the Noddy Creek Volcanics are a correlate of the VHMS mineralised Mt Read Volcanics in the Queenstown to Hellyer region. Based upon correlations with the other volcanic suites on the Peninsula, Brown (pers.comm.) feels that they may have been faulted south from around Zeehan. An alternative explanation suggested by McClenaghan and Corbett (1989) is that they are a separate sub-arc.

The Noddy Creek Volcanics and associated sediments were originally mapped by BHP in the 1960's, however they concentrated on the Timbertops area and the Point Hibbs ultramafic intrusives which are faulted against the western side of the Cambrian volcanics and sediments. (Close 1972.) Amoco/Cyprus gave a few localities some attention but not to the degree warranted by the prospectivity of the rocks.

Rocks considered by Brown (1988), McClenaghan and Findlay (1989), Brown *et al.* (1991), Brown (pers. comm.) and Seymour (pers. comm.) to be part of the Noddy Creek volcano-sedimentary association have been previously described in Hall *et al* (1969), White (1975), McClenaghan and Corbett (1989). BHP and Amoco/Cyprus considered most of the sediments associated with these volcanics, from Macquarie Harbour to south of High Rocky Point, to be part of the Dundas Group.

Brown (1988), McClenaghan and Findlay (1989), Brown *et al* (1991) and Seymour (pers. comm.) mapped the Noddy Creek volcano-sedimentary association as predominantly intermediate-acidic, calc-alkaline Cambrian volcanics comprising lavas with associated volcaniclastics and epiclastics derived from these volcanics. Where the association is dominated by the sedimentary component the volcanic units occur as pillowed and sheet lavas, breccia flows and porphyritic flows with volcanic xenoliths, interbedded with vitric tuff or volcaniclastic siltstone and volcanicwacke beds.

Within the sediment dominated part of the section south of the Wanderer River, the sedimentary rocks form a flyschoid sequence with includes channellised sandstone and pebble-cobble conglomerate, suggesting a proximal submarine fan origin. The main clastic component is derived from a quartz-rich acid volcanic terrain with a minor component of metamorphic rock, exotic volcanic clasts and quartz fragments showing graphic intergrowths with feldspar.

In the Timbertops area and to the north two distinct groups of volcanics have been recognised. The first group consists of pyroxene/plagioclase phyric andesite lavas, while the second group consists of quartz/feldspar phyric rhyolitic lavas.

In the south, around High Rocky Point, three groups of pyroxene/plagioclase basaltic-andesite to andesitic rocks, and a later group of hornblende-bearing andesite-dacite dykes have been recognised by Brown *et al* (1991). These define a chemically evolving suite of volcanic rocks consistent with the generally east facing nature of the sequence.

Geochemically the basaltic andesite and andesitic rocks have similarities with the Que-Hellyer Volcanics whilst the andesitic-dacite dykes from the southern part and the rhyolitic rocks from the northern part have geochemical similarities with the bulk of the acid to intermediate rocks of the Mt Read Volcanics. (Brown et al 1991.)

The northern exposures of Noddy Creek Volcanics from Muddy Cove Creek to Timbertops the Noddy Creek Volcanics were petrologically described by White (1975), Ferris (1984), Kary (1985) and McClenaghan and Findlay (1989).

White (1975) described weakly deformed and altered quartz-albite phyric acid lavas, welded quartz-rich lithic tuffs, non-porphyritic, and augite-albite phyric andesites, breccias and crystal lithic-vitric tuffs from sequences north of Timbertops. Whereas Ferris (1984) studying volcanics in the Timbertops area included augite $\pm$ orthopyroxene-phyric basalts, basaltic andesitic tuffs and lavas, rhyodacites and siliceous andesites to trachyandesites as well as quartz microdiorites in the sequence. Rocks from the northern-most part of the Muddy Cove Creek area are described in Kay (1985) as acid tuffs, dacites, andesites as well as basalts, dolerite, gabbro, gabbro/norite and sediments including cherts (Brown et al 1991).

The Timbertops area to Muddy Cove Creek, McClenaghan and Findlay (1989) have broadly differentiated sequences of rhyolitic and andesitic composition, which in the Timbertops area are intruded by probable co-magmatic felsic and intermediate-gabbro bodies. These may represent sub-volcanic intrusives into a former volcanic centre. They also recognise a separate group of boninitic lavas, referred to as the Timbertops Volcanics, which extend to the west and south of Timbertops.

South of Timbertops in the vicinity of Hibbs River and Thomas Creek, basaltic-andesitic tuffs, andesite, dacites and trachyandesites have been correlated with the Noddy Creek Volcanics. In the eastern part of this area adjacent to and probably underlying Ordovician sediments in the Timbertops Syncline, the volcanics are associated with a major intermediate intrusive centre referred to informally as the Thomas Creek diorite complex. The limits of this intrusive system are unknown but on the basis of aeromagnetic interpretation could cover 10 $km^2$. Mapped intrusives vary from medium to coarse grained augite-plagioclase phyritic diorite to microdiorite with locally strong chlorite-pyrite-magnetite-tourmaline alteration as at the Thomas Creek Prospect (528,6000N, 370,000E).

### 3.2.2 Timbertops Volcanics

In the Timbertops region outcrops of boninitic (high-Mg andesitic) lavas, breccias and crystal lithic tuffs, with interbedded mudstones and siltstones (McClenaghan and Findlay 1993), are juxtaposed against the calc-alkaline Noddy Creek volcanics with the unexposed contact possibly a low angle thrust. These rocks are invariably altered with relatively pristine rocks consisting of talc and chlorite pseudomorphs of pyroxene in a matrix of talc, chlorite and spinel.

Microprobe analysis of spinels correlates these rocks with boninitic lavas around Zeehan. Boninitic volcanics were reported along the western side of the Timbertops Syncline as well as along the eastern flank of the ultramafics at the southern end of the Macquarie Harbour sheet.

BHP (McGregor and Bumstead, 1969) described the volcanics in the area mapped as Timbertops Volcanics by Brown *et al,* as being andesitic lavas with very minor basalt and gabbro bodies. They also noted the presence of talc and chlorite alteration of the andesites near contacts with intrusive diorite bodies.

White (1975) refers to these rocks as altered ultramafics, probably pyroxenites, and considered they may be interbedded with the Noddy Creek Volcanics.

Amoco (Ferris, 1984) noted a strong correlation between nickel in soils and chrome in sediments and volcanics west and south of the Timbertops region, as corresponding to the boninitic rocks of McClenaghan and Findlay (1989). This correlation suggests that soil geochemistry for Ni and stream geochemistry for Cr may be a useful mapping tool in delineating the boundary of the calc-alkaline Noddy Creek Volcanics from the Timbertops Volcanics.

### 3.2.3 Birch's Inlet-Mainwaring River Volcanics

Brown *et al.* (1991) consider that the mafic volcanics and associated sediments south of Urquhart River and those outcropping immediately to the west of Birch's Inlet but east of the Noddy Creek Volcanics, are from the same north-south trending belt with the central part hidden by Tertiary cover. Previous workers have considered the two mafic groups separately with the Mainwaring River Volcanics receiving by far the most attention because of their copper anomalous signature.

The two volcanic areas are correlated as a single belt on the basis of geochemical affinities, similar stratigraphy and the presence of a broad aeromagnetic high joining the two areas of outcrops separated by Tertiary sediments.

Brown *et al* (1991) refer to this belt as being a picritic basalt-basalt association with intra-plate and island-arc affinities. The sequence is described as consisting of vesicular, pillow and sheet flows of pyroxene phyric and/or plagioclase phyric basaltic rocks interlayered with hyaloclastite and basalt breccia.

The proportion of sedimentary rocks in the sequence increases to the south. These consist of interbedded mudstones and chert, volcaniclastics siltstone, lithicwacke, carbonates, siliceous pebbly conglomerates and lithicwackes. Brown (1988) noted the northern sequence was east facing whilst in the south isoclinally folded sediments predominate.

Two groups of lavas have been identified in both volcanic areas, with the lower group generally picritic and the upper group tholeiitic. The lower group resembles lavas from the Miners Ridge basalt further north at Queenstown which are considered to represent the base of the Mt Read Volcanic sequences.

This is in contrast to Ferris (1984) who, tentatively correlated the volcanics with the calc-alkaline basic-intermediate Que-Hellyer Volcanics from the uppermost part of the Mt Read Volcanics.

In the Birch's Inlet area, McGregory and Bumstead (1969) on behalf of BHP described a sequence of spilitic basalts and laminated siltstone, whereas White (1975) refers to the Birch's Inlet Volcanics as spilite with thin bands of basaltic tuff, volcanic greywacke and serpentinite. The lack of significant drainage anomalism over these volcanics and their tholeiitic mafic composition has not encouraged any detailed exploration of their economic potential.

In contrast, the volcanics in the Mainwaring River area to the south have received considerable attention, and they were perhaps the main focus of early

BHP and late Amoco/Cyprus exploration because of their copper anomalous character.

Amoco/Cyprus (Ferris 1984) considered the Mainwaring Volcanics occurred within a discrete vent area due to the abnormal amount of explosive mafic volcanic rocks "agglomerates and breccias" interbedded with tuffaceous sediments. Only a minor acid volcanic component was recognised.

BHP (Hall et al., 1969) describe the lower (western) part of the Mainwaring Group as consisting of argillites, phyllites and greywackes cross-cut by diorite and gabbro bodies and intruded by andesitic sills. The upper part described as consisting predominantly of thick basaltic to andesitic tuffs with minor conglomerate also cut by small sill-like gabbro and diorite intrusives, corresponds to the Mainwaring River Volcanics of Brown *et al.*(1991). They consider the western sediment-dominated package is definitely not related to these mafic volcanics and is probably a distal correlate of the Noddy Creek Volcanics, faulted against the Mainwaring River Volcanics.

### 3.2.4 Point Hibbs Melange Belt

A major thrust bound sequence across the Sorell Peninsula consists variously of massive to highly sheared, talcose and/or serpentinised peridotite with minor layered pyroxenite, intruded by gabbro-norite bodies and late lamprophyric dykes. West of the Timbertops area, the ultramafics are apparently associated with sheared, talc-rich boninitic andesite lavas (McClenaghan and Findlay, 1989). A similar association in the Dundas Trough near Zeehan may indicate an original spatial relationship between these two areas.

### 3.2.5 Post Cambrian Stratigraphy

Ordovician sequences in the Sorell Peninsula are restricted to isolated fault slivers on the western side of the Point Hibbs Melange Belt and the major north-west trending Timbertops Syncline. The Ordovician sequence at Timbertops unconformably overlies Cambrian strata, and consists of basal quartz sandstone with conglomerate interbeds and fossiliferous micaceous siltstone-sandstone correlated with the Denison Group. In the core of the syncline recessive outcrops of Gordon Limestone have been recognised (McClenaghan and Findlay, 1989).

Mid to Upper Palaeozoic sedimentary sequences and Jurassic dolerite are restricted to faulted zones between Hibbs Bay and Point Hibbs. Apart from thick unconsolidated quartzose Tertiary sediment cover in the Birch's Inlet to Wanderer River area, no other significant Palaeozoic or younger sequences exists on the Sorell Peninsula.

# 4.0 EXPLORATION HISTORY

## 4.1 Previous Explorers Work

Apart from minor copper workings at Birthday Bay on the West Coast of the northern part of the Sorell Peninsula and a small asbestos quarry at Asbestos Point, no significant mining has ever been conducted.

Earliest exploration by Lyell-EZ Exploration (LEE) from 1956 to 1962, concentrated on the volcanic sequences west of Birch's Inlet in search for VHMS mineralisation. They conducted airborne magnetics and a restricted EM survey which defined a series of anomalies mainly associated with the Point Hibbs Melange Belt. These anomalies were field checked with negative results and no further work was conducted.

From 1964 to 1972 BHP held title over most of South Western Tasmania which they regionally mapped and explored for various base metal mineralisation styles. On the Sorell Peninsula, BHP exploration involved follow-up of LEE geophysical anomalies as well as reconnaissance mapping and drainage surveys which were concentrated in the Cypress Creek area south of the Mainwaring River, and the Hibbs River-Noddy Creek area.

Copper mineralisation with associated Zn and Ni anomalism was outlined in several areas of Mainwaring River Volcanics with native copper and chalcopyrite identified in sheared or brecciated chlorite-epidote altered intermediate tuffs and gabbro in the Cypress Creek area. Semi-detailed grid surveys failed to locate a source for the copper mineralisation and because the mineralisation was not considered of VMS character no drilling or further work was undertaken.

Subsequent exploration during 1983-1988 by a joint venture involving Placer, Poseidon and Amoco (Cyprus) as managers, initially comprised a detailed airborne aeromagnetic and radiometric survey of the whole Sorell Peninsula with selected volcanic areas covered with DIGHEM surveys. Exploration targets were volcanic-hosted massive sulphides and gold mineralisation.

No significant primary DIGHEM anomalies were recognised, although a number of second class anomalies and other aeromagnetic anomalies were recommended for follow-up. In 1983-84 Amoco conducted reconnaissance mapping and sampling of the Noddy Creek Volcanics around Timbertops north to Briggs Creek and south to Thomas Creek to assess various aeromagnetic anomalies.

No mineralisation directly related to felsic or intermediate volcanics was discovered. However, some weak base metal veining was reported adjacent to diorite at Timbertops, and more significantly a Cu-As (Ba) association with diorites and intermediate volcanics was recognised in the "Warrens to Thomas Creek" area of EL 4/92.

Elsewhere Amoco evaluated the Lucas Creek Volcanics and Mainwaring River Volcanics for gold without success and no significant fieldwork was undertaken after a full interpretation of DIGHEM surveys by Bishop in 1986.

No other company exploration was conducted in the Sorell Peninsula until Plutonic Operations was granted the current licences in 1992.

### 4.2 Plutonic Work

Plutonic's preferred exploration strategy in the rugged Sorell Peninsula was to search for a major VHMS or intrusive related deposit using the most environmentally as well as technically sensitive airborne and ground exploration methods. This necessitated considerable delays in regional exploration assessment before a suitable time domain electromagnetic system could be mobilized to fly the terrain in 1996. During this period data from 1984 aeromagnetic-radiometric survey over this region conducted by Amoco Minerals was reprocessed and interpreted to provide the basis for an updated regional geological map of the tenement areas (Plate 1.).

In 1993, Plutonic conducted detailed geochemical and ground EM surveys in the Briggs Creek area over DIGHEM anomalies recommended by Bishop (1986) within the Noddy Creek Volcanics. These surveys failed to locate any significant EM or geochemical response and the airborne survey data or interpretation was considered questionable.

A gold drainage and reconnaissance mapping survey in the Wanderer River following up Huminex anomalies was also unsuccessful.

At the Thomas Creek prospect however, mapping, sampling and petrology confirmed Amoco's results and indicated a significant zone of alteration with porphyry Cu-Au - like characteristics.

In 1994-95 exploration concentrated on the Thomas Creek prospect where detailed mapping, bedrock geochemistry and IP surveys defined disseminated and vein hosted copper-(gold) mineralisation within an altered multiphase intermediate to mafic intrusive suite (Figs. 4 and 5). The style of mineralisation was recognised as possibly being unique in Tasmania, but little was known about the age, tectonic setting or relationship between the host Thomas Creek Intrusive Complex and the surrounding volcano-sedimentary sequences. The latter were interpreted to belong to the Noddy Creek Volcanics of probable Early Cambrian age and based on limited petrology and inadequate geochemistry these volcanics could be co-magmatic with the Thomas Creek intrusions.

During 1995-96, Geotem surveys and drilling of the Thomas Creek Prospect. were undertaken. No summer field work occurred because of the delayed commencement (March 1996) of the airborne TEM survey (Fig 6 and Plate 2).

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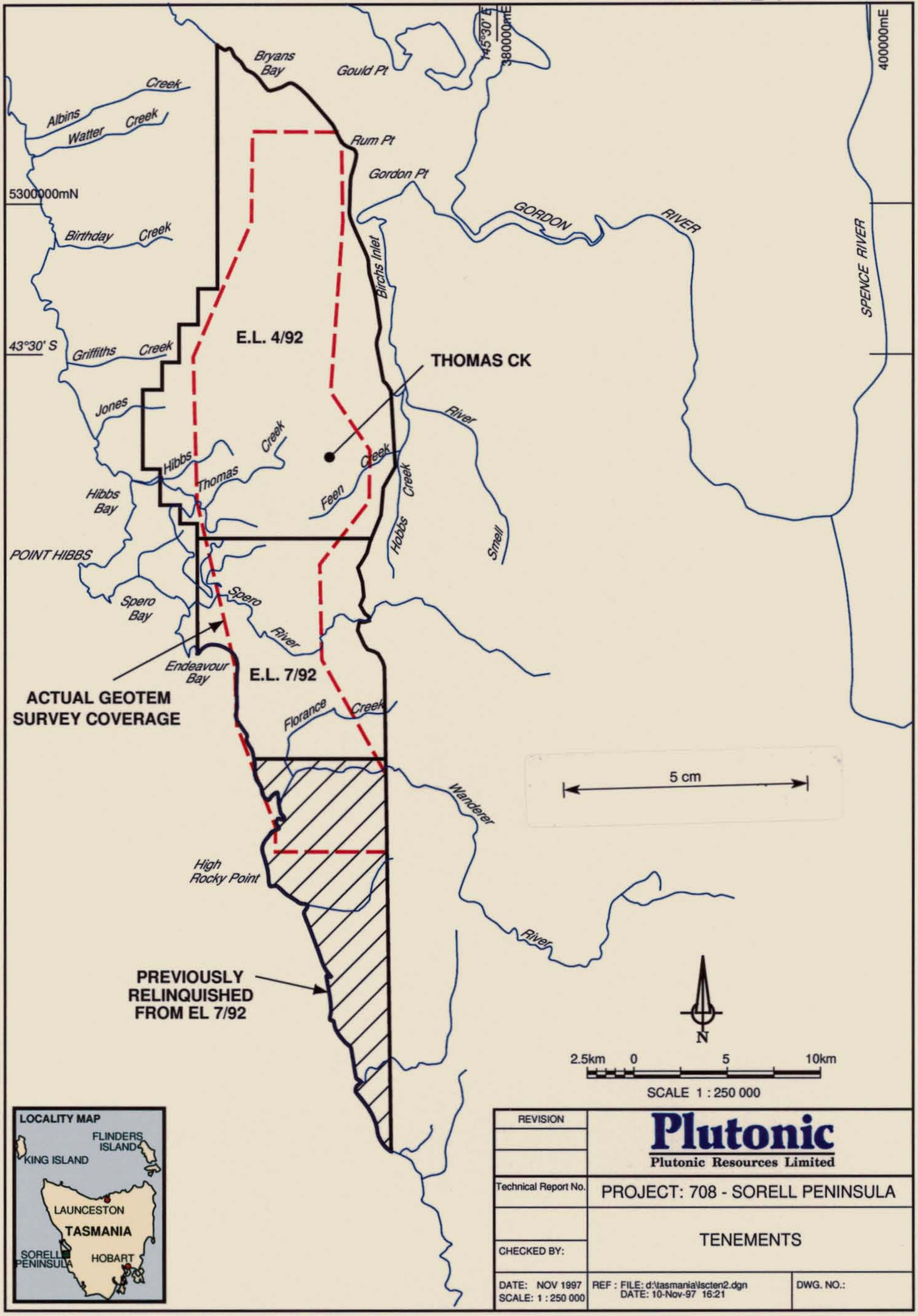


FIGURE 4

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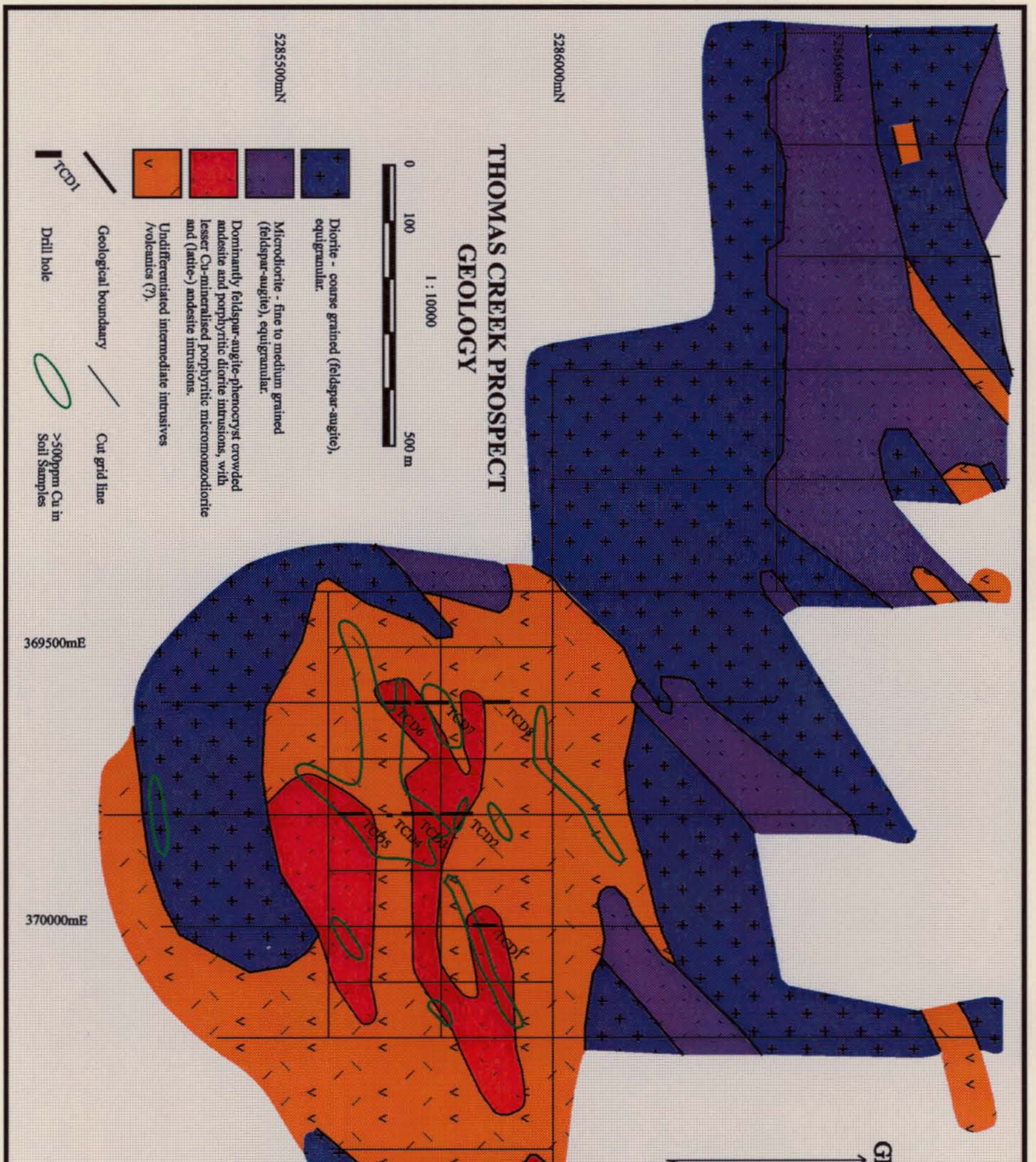


Figure 5: Geological Mapp of the Thomas Creek Prospect. (largelly based on soil sample logging and Ti/Zr soil geochemistry, after Reid, 1997).

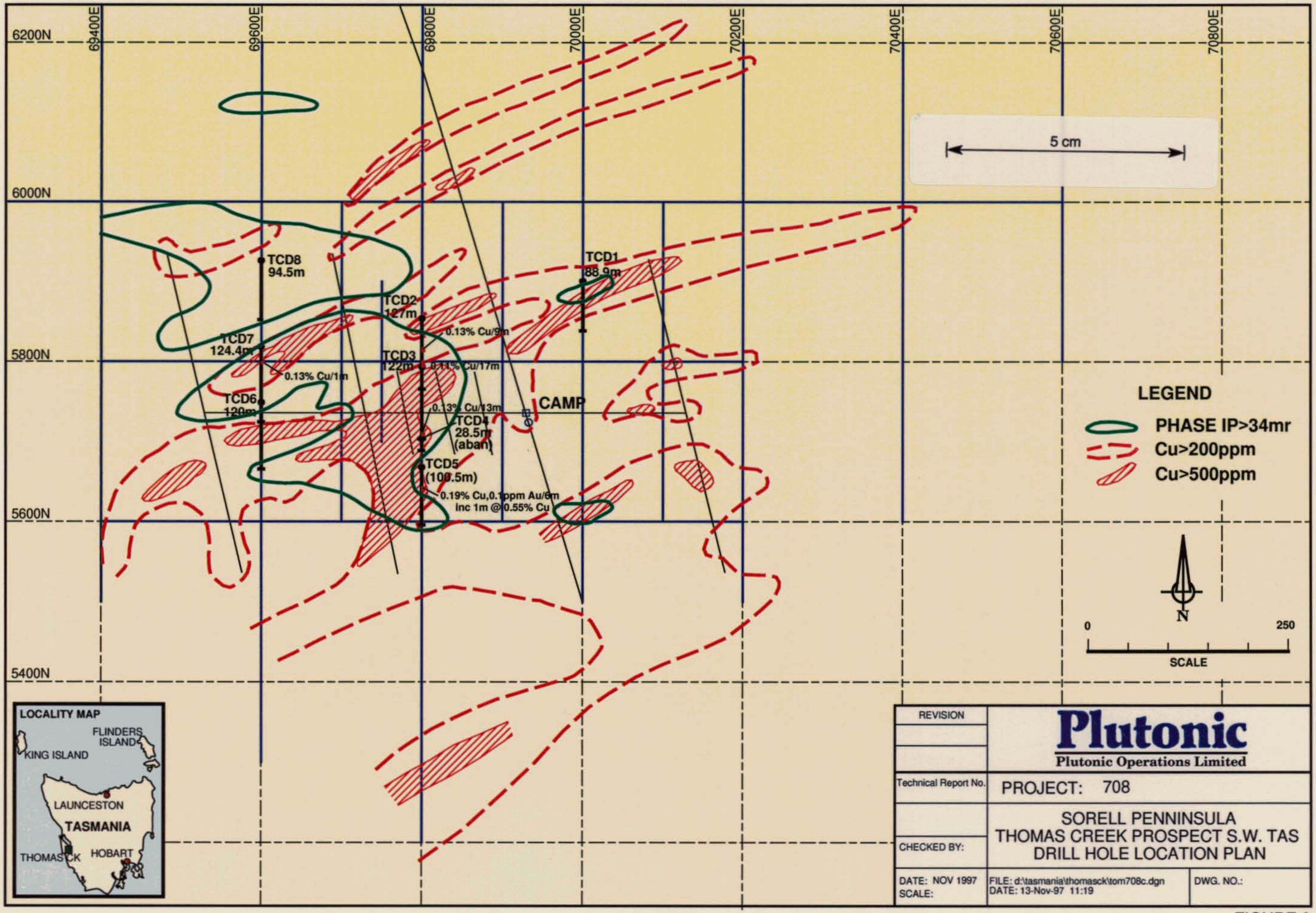


FIGURE 6

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The Geotem survey was expected to define mineralised targets worthy of detailed evaluation. The prominent AEM anomalies discovered were found to correlate with faults/shears within ultramafics of the Point Hibbs Melange Belt. Whereas, none of the thirteen anomalies (Plate 2) located within the Noddy Creek Volcanics gave unequivocal late time responses that could be attributed to conductive sulphide mineralisation. Subsequently, no detailed follow up exploration was undertaken.

In the absence of any other significant prospects, diamond drill testing of the porphyry Cu - like mineralisation at the Thomas Creek Prospect occurred during May-June 1996. An eight hole programme totalling 806.6 metres was successfully conducted using a lightweight "Gopher Rig" operated by All Terrain Exploration. The drilling which was targetted at peak zones of copper geochemistry and IP chargeability confirmed the porphyry-like character of mineralisation, but grades were less than expected with better intersections assaying 0.1 to 0.2 % Cu and <0.1 g/t Au.

Limited regional geological reconnaissance involving geological mapping and collection of stream sediment and soil samples resulted in the discovery of moderately pyritic mineralisation in creek systems to the northeast and east of the Thomas Creek grid. Panned concentrate samples from these areas returned anomalous values of 3.1 and 1.02 ppm Au, respectively. Ground magnetics coverage over the entire grid system was also completed.

## 6.0 WORK CONDUCTED IN 1997

### 6.1 Introduction

No field work was undertaken during the year preceeding September 1997. However, petrological, geochemical, sulphur isotope and alteration features of the Thomas Creek Prospect were evaluated by Robert Reid during preparation of his Masters of Economic Geology thesis at CODES. The following section is largely a summary of the geology, mineralisation and alteration features of the Thomas Creek Prospect detailed in Reid (1997). Revised drill sections are presented as Plates 3 to 7.

### 6.2 The Thomas Creek Prospect

Thomas Creek appears to be a Cambrian intrusive complex comprising diorites, andesite intrusions and late-formed mineralised monzodioritic intrusions. Extrusive volcanic products are not observed in the prospect vicinity. This is unlike the bulk of the lava-rich MRV, which is dominantly submarine in character, although accompanying synvolcanic intrusions are common (Corbett, 1992; McPhie and Allen, 1992).

Geochemical discrimination diagrams developed by Crawford et al. (1992) for classification of MRV suites show a consistent correlation of the Thomas Creek Prospect intrusions with MRV suite III. This suite includes basaltic and andesitic lavas from the Lynch Creek basalts and shallow intrusive rocks in the

Howard Plains area (both part of the Yolande River sequence), and the hanging wall sequence of the Que-Hellyer Volcanics (Mt Charter Group).

Widespread (600 by 400 m), but low grade copper mineralisation and associated magnetite and feldspar-silicate alteration assemblages are hosted by diorites and feldspar-augite porphyritic andesite intrusions, which have been intruded by chalcopyrite-bearing porphyritic micromonzodiorites (Fig. 4). Early disseminated magnetite, pyrite and chalcopyrite formed prior to and synchronous with pervasive feldspar-silicate alteration. Various chalcopyrite-bearing vein generations (actinolite, tourmaline, K-feldspar - smectite, epidote and carbonate) have overprinted the early-formed magnetite and feldspar-silicate alteration assemblages.

Bivariant comparison of the "immobile" elements reveals two data sets, one showing coherent geochemical behaviour indicating that the diorites and porphyritic micromonzodiorites form a co-magmatic fractionation series, and a second set in which mobility of Zr and Nb and to a lesser extent Y and Ti is evident. The "immobile" elements were apparently mostly mobilised during the formation of pervasive K-feldspar hydrothermal alteration at Thomas Creek. Fe, S, P and Cu appear to have been contributed to the hydrothermal system as a result of fractionation and devolatilisation of the micromonzodiorite magmas. Coherent behaviour of Ba, Rb, Sr and $K_2O$ has been recognised for the igneous suite and both primary and secondary K-feldspar appear to be intrusion-related

Sulphides at Thomas Creek have sulphur isotope values which are consistent with their formation in response to igneous fractionation and devolatilisation of $^{32}S$ rich hydrothermal fluids, resulting in isotopically lighter signatures (-4.9 to 7.7‰) in veins related to the intrusions. Sulphur isotope geothermometry, utilising co-existing pyrite-chalcopyrite pairs, indicates mineralisation temperatures in veins ranged from 254 to 611°C.

Four stages of mineralisation have been recognised at Thomas Creek:

1:- Early magnetite and feldspar-silica alteration.
2:- Emplacement of Cu-bearing micromonzodiorite intrusions and precipitation of coeval actinolite and tourmaline veins.
3:- K-feldspar - smectite vein formation, which may also be related to micromonzodiorite intrusion.
4:- Epidote and carbonate veining.

Phases 1 and 2 represent periods of magma emplacement with some mixing of magmatic-hydrothermal water with seawater-derived fluid. Phase 3 veins appear to be of magmatic character, with minimal seawater influence. Phase 4: probably represents final incursion of seawater-derived fluids as the magmatic system waned.

Mineralisation at Thomas Creek can be related to Mt Lyell copper-gold-type mineralisation, based on similarity of sulphur isotope distribution and ore mineralogy. At Thomas Creek mineralisation is believed to represent the root zone of a Mt Lyell-type hydrothermal system (Fig. 7). There are also some similarities with the alkaline porphyry Cu-Au deposits of British Columbia, with Thomas Creek possibly being the submarine analogue of a porphyry system.

## 7.0 CONCLUSIONS

Plutonic aquired the Sorell Peninsula tenements to explore for VHMS mineralisation following the recognition that the Cambrian Noddy Creek Volcanics are correlates of thc well mineralised Mt Read Volcanics. Limited geological reconnaissance together with regional scale airborne geophysical surveys failed to locate any VHMS mineralisation but led to the recognition of Cu-Au intrusion-related mineralisation at Thomas Creek.

Detailed surveys in 1995 including grid based mapping, geochemistry, magnetics and IP outlined a sizeable mineralised target which was tested in 1996 by 8 shallow diamond drill holes. The low grade mineralisation encountered could represent the root zone of a Mt Lyell-type hydrothermal system or an upper part of a porphyry-style system, the first recognised in Tasmania.

This mineralisation however was not considered sufficiently attractive by Plutonic to warrant further detailed evaluation, and since all other targets were of a grassroots nature, Plutonic decided not to fund any further exploration. Subsequent attempts to joint venture this property in 1996-1997 were unsuccessful and the property was eventually relinquished in September 1997.

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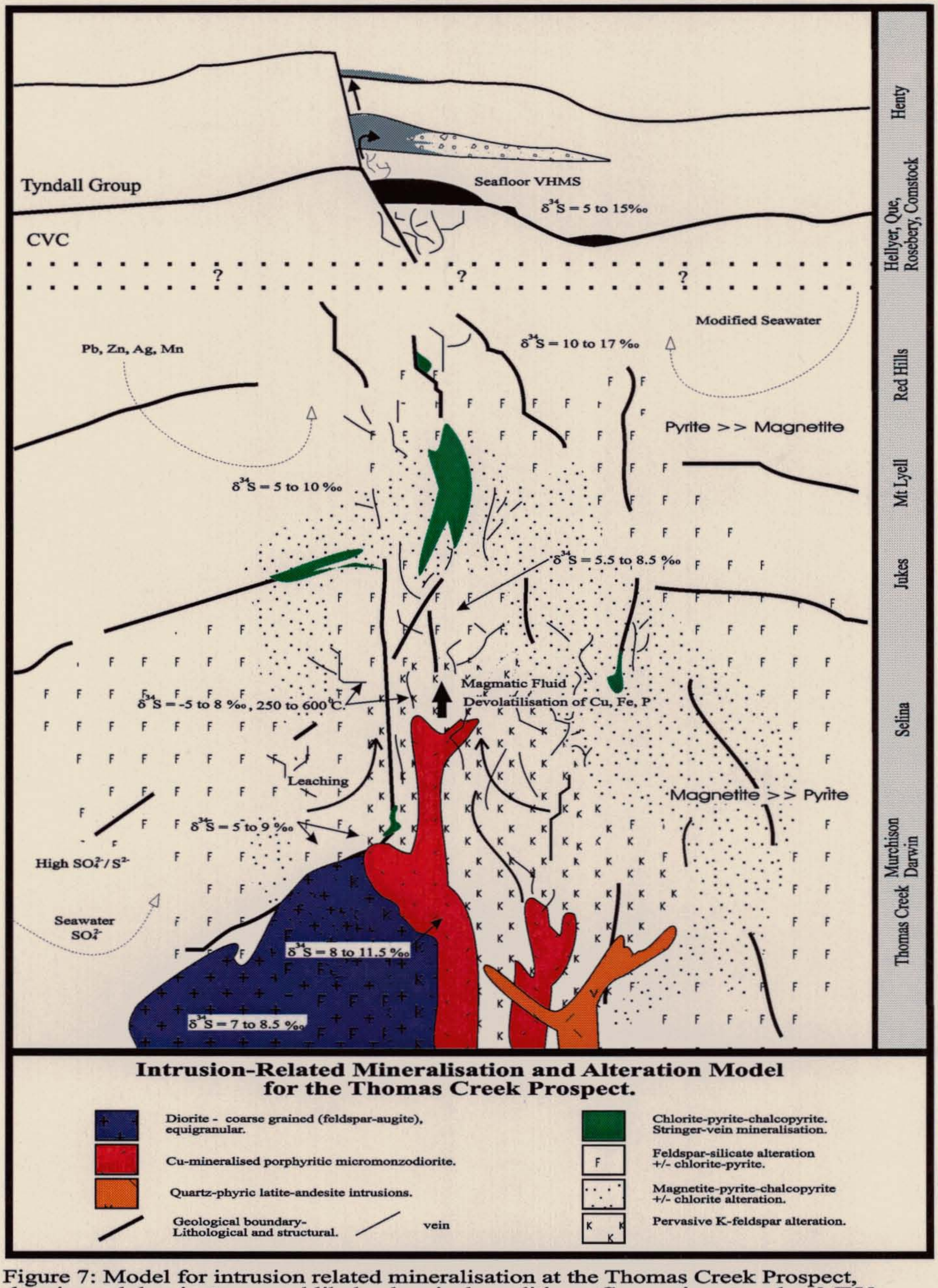


Figure 7: Model for intrusion related mineralisation at the Thomas Creek Prospect, showing sulphur isotopes and likely chemical conditions. Comparison to other MRV-hosted Cu-Au mineralisation occurrences is shown. (After Reid, 1997).

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MACQUARIE HARBOR
SOUTHERN OCEAN
LIBERTY POINT
Liberty Bay
Betsys Bay
Sloop Point
GORGE POINT
Pelias Cove
Hogan Point
Bryans Bay
Steadman Point
Richardsons Beach
Sarah Island
Grummet Island
Halliday Island
RUM POINT
Philips Island
Cool Head
Dingy Point
Soldiers Island
Farm Cove
Pine Point
Kelly Basin
St Leger Point
Brisbanes Bay
Charcoal Burners Bluff
Gordon Point
Grubbys Point
Wrights Bay
Albina Rock
Birthday Bay
Varna Bay
BIRCHS INLET
Sorell River
Hibbs Bay
Hibbs Pyramid
HIBBS
Spero Bay
Endeavour Bay
EL 4/92
EL 7/92
EL 53/94
HIGH ROCK POINT
Montgomery Rocks
Mainwaring
Acaria Rocks
Diorite Point
Verdina Point
Moores Valley
Osmaria
Wart Hill
42°30'S
40'
50'
20'
145°30'E
5250000 N AMG
Legend
TERTIARY – QUATERNARY
Gravel, alluvium — Ts–Qs
JURASSIC
Dolerite — D 67
PERMIAN
Undifferentiated sediments — P 38
DEVONIAN
Spero Bay Group — Dol 35, Ds 41, Dr 45, Dw 48
Dol = dolomite
ORDOVICIAN
Gordon Limestone — Og 39
Owen Conglomerate (Oo)
Caroline Creek Sandstone (Crotty Equivalent) — Oc/Oo 64
CAMBRIAN – Dundas Group
Undifferentiated (S–Sediments) I = ironstone — €d(s) 70, I 14
Greywacke, conglomerate — €ds 69
Argillite, siltstone, minor carbonates — €da 68
Igneous Rocks associated with Dundas Group
Quartz – biotite granite (Stoney CK GT)
Timbertops Microgranite (MGT) — MGT / GT 19
Hornblende diorite (Di) Qtz diorite QDi
Microdiorite (MDI) — MDI / Di–Q Di 22
Gabbro — €g 10
Pyroxenite serpentinite, Dunite — €vm 46
Lucas Creek Volcanics, Basalts, breccias, tuffs — €vl 6
Noddy Creek Volcanics, Andesites, dacites, tuffs (€vn) basalts (Vnb), felsic tuffs (Vnt) — €vn, Vnb, Vnt 8
Mainwaring Volcanics (€vm) Basalts, andesites & tuffs
Birch's inlet Volcanics (€vb) — €vm / €vb 5
Elliot Bay Volcanics, felsic lava tuffs & volcaniclastics — €ve 2
Timbertops Volcanics – andesite, basalt — €vt
Undifferentiated Volcanics — €dv
Albina Creek Group
Argillite – Mudstone, lithicwacke, phyllite, basalt — €am 63, €bb 43
Dolomite, (€ad) calcareous siltstone (€ac) He – haematitic — €ac, He, €ad 29
Tyndall Group
Waterloo CK formation — €w
PROTEROZOIC
Nielson River Group
Meta quartzwacke, siltstone (Pnq)
Meta impure dolomite, siltstone — Pnq / Pnd 30
Liberty point Group
Meta orthoquartzite, siltstone, conglomerate — Pl 66
Geology modified from BHP and Mines Department 1 : 50 000 geology sheets
Inferred fault
Geological contact
Geological contact Inferred
Unconformity
Location
NORTHERN TERRITORY
QUEENSLAND
WESTERN AUSTRALIA
SOUTH AUSTRALIA
NEW SOUTH WALES
VICTORIA
TASMANIA
Project Area
TN
MN
12.75°
5 cm
1:50000
0 1 2 3
Kilom
Basemap compiled from provisional 1:50000 sheets ac
from the Tasmanian Lands Department
Plutonic
Plutonic Operations Limited
A.C.N. 004 680 997
97-4084
ANNUAL & FINAL RELINQUISHMENT
REPORT-SORELL PENIN.-EL 4/92
AND 7/92 - PLUTONIC OPS.
271026
Project SORELL PENINSULA № 708
Project Partner
ELs 4/92, 7/92, 53/94
REGIONAL
GEOLOGY
Map Ref. ANG K-55-5 Latitude 42°30'S Longitude 145°30'E
Surveyed R. J. Close Date Aug 1995 Scale 1:50000
Drawn Date Drawing №M84-2248
6087

PLATE 1


AIRBORNE SURVEY SPECIFICATIONS

| | |
|---|---|
| EM SYSTEM : | GEOTEM III 25 Hz<br>Pulse width : 4108 microseconds<br>Components : X and Z<br>Channel centres : 501,658,814,1048,1361 1751,2220,2767,3470,4330,5345,6517,7923 9642,11830,14486 microseconds after transmitter turn off<br>Inpulse channel centres : 469,781,1094,1406 microseconds after transmitter turn on |
| RECORDING INTERVAL : | 0.25 sec (approx 16 m sampling) at mean ground speed of 235 km/hour |
| MAGNETOMETER : | Cesium Vapour optical absorption<br>Sensitivity : 0.01 nT |
| RECORDING INTERVAL : | 1.0 sec (approx 65 m sampling) at mean ground speed of 235 km/hour |
| DIGITAL RECORDING : | Geoterrex GEODAS acquisition system |
| NOMINAL TERRAIN CLEARANCE : | Magnetometer sensor in aircraft at 105 m<br>EM transmitter in aircraft at 105 m<br>EM receiver in towed bird at 62 m |
| NOMINAL LINE SPACING : | Traverse lines 200 m<br>Tie lines peripheral |
| NOMINAL LINE DIRECTION : | Traverse lines 090/270 degrees<br>Tie lines various |
| FLIGHT PATH NAVIGATION : | SERCEL NR103 GPS navigation system and a SINGER KEARFOTT AN/ASN 128 Doppler system with SPERRY C12 compass and VG14 vertical gyro |
| FLIGHT PATH RECORD : | GPS positioning corrected for selected availability integrated with Doppler track |

TOTAL MAGNETIC FIELD CONTOURS

| | |
|---|---|
| Magnetics : | Diurnally levelled |
| Grid mesh size : | 50 x 50 metres |
| Grid filter : | None |
| Contour interval : | 25, 250 and 2500 |

271027

TN GN MN

Grid Convergence = 1.07°
Declination = 11.60°

SCALE 1:50000

1 0 1 2 3 4 km

5 cm

97-4084

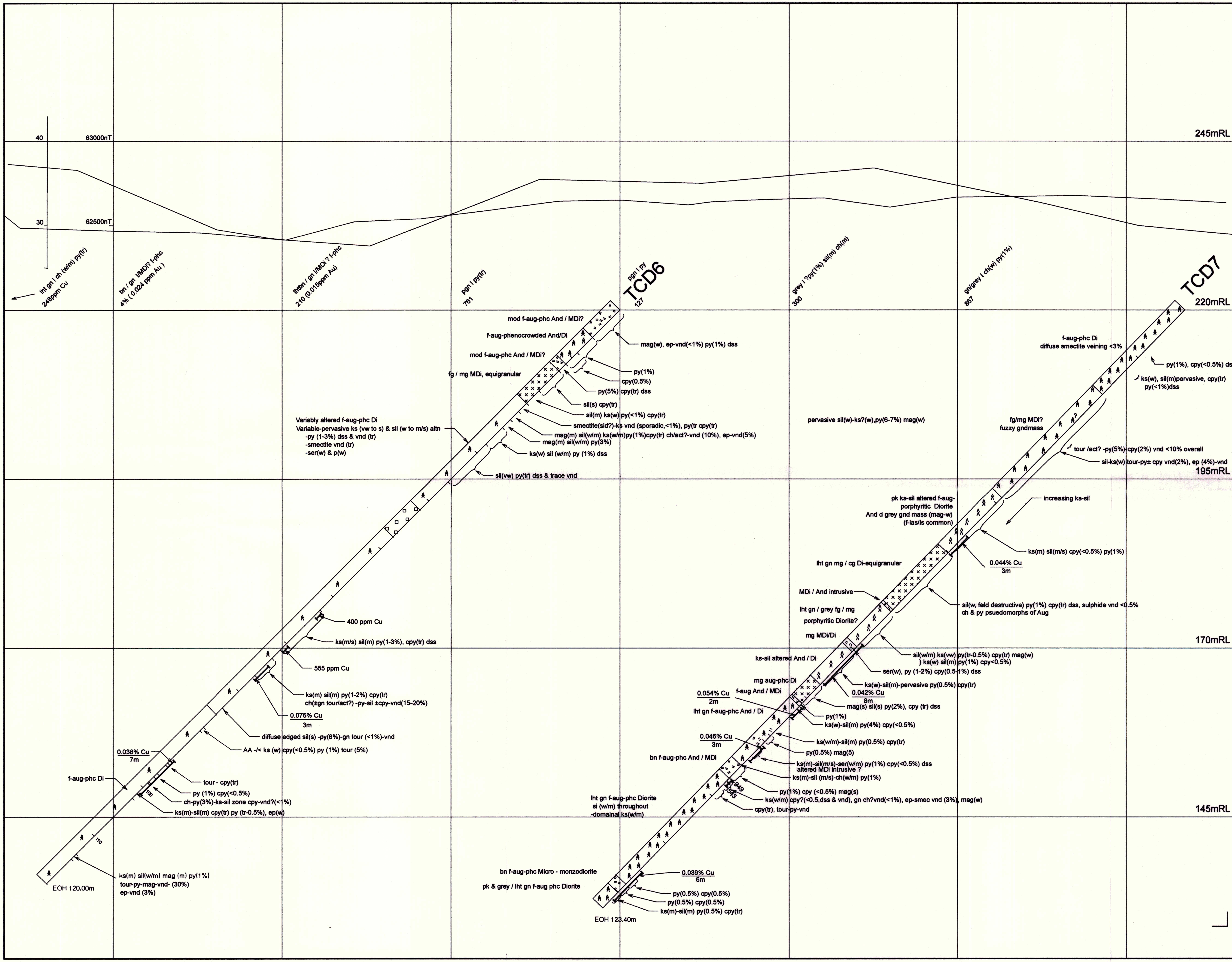
ANNUAL & FINAL RELINQUISHMENT
REPORT-SORELL PENIN.-EL 4/92
AND 7/92 - PLUTONIC OPS.

**PLUTONIC OPERATIONS LIMITED**

**SORELL PENINSULA**

**AIRBORNE (GEOTEM) SURVEY**

**INTERPRETATION 2P PLATE 2**

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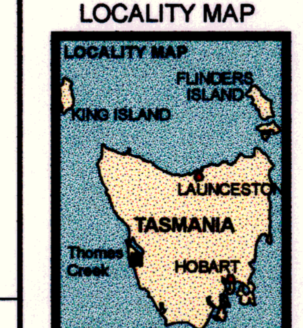
LOCALITY MAP

SHEET INDEX

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REVISION

R. Reid, July 1997

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Technical Report No.

SECTION 369600(a)mE

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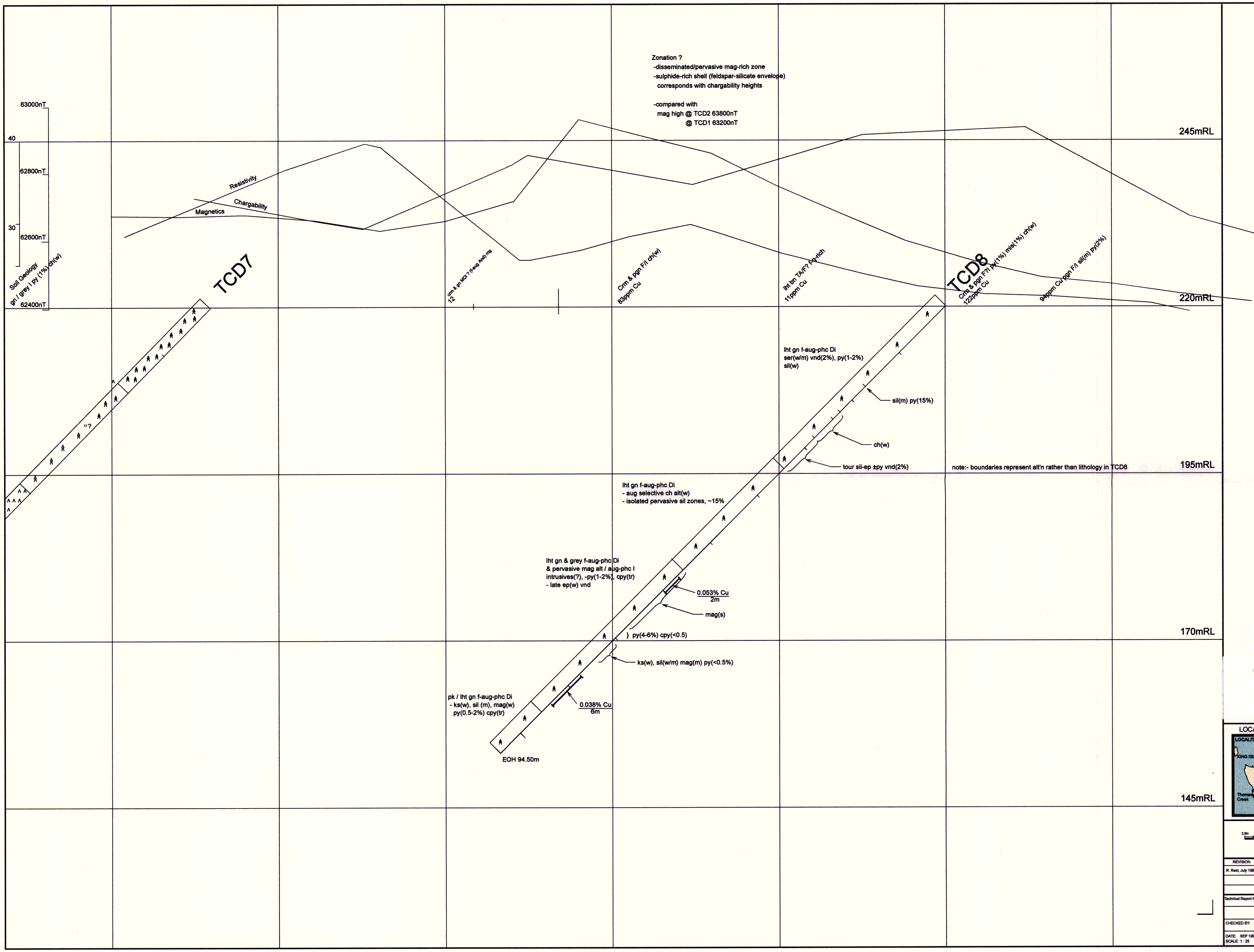


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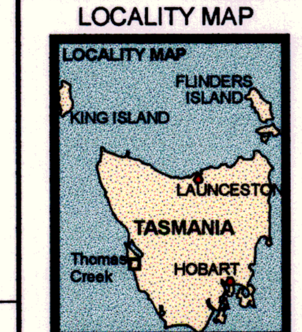


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271028

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|---|---|
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| Technical Report No. | SECTION 369600(b)mE |
| CHECKED BY: | Plate 4 |
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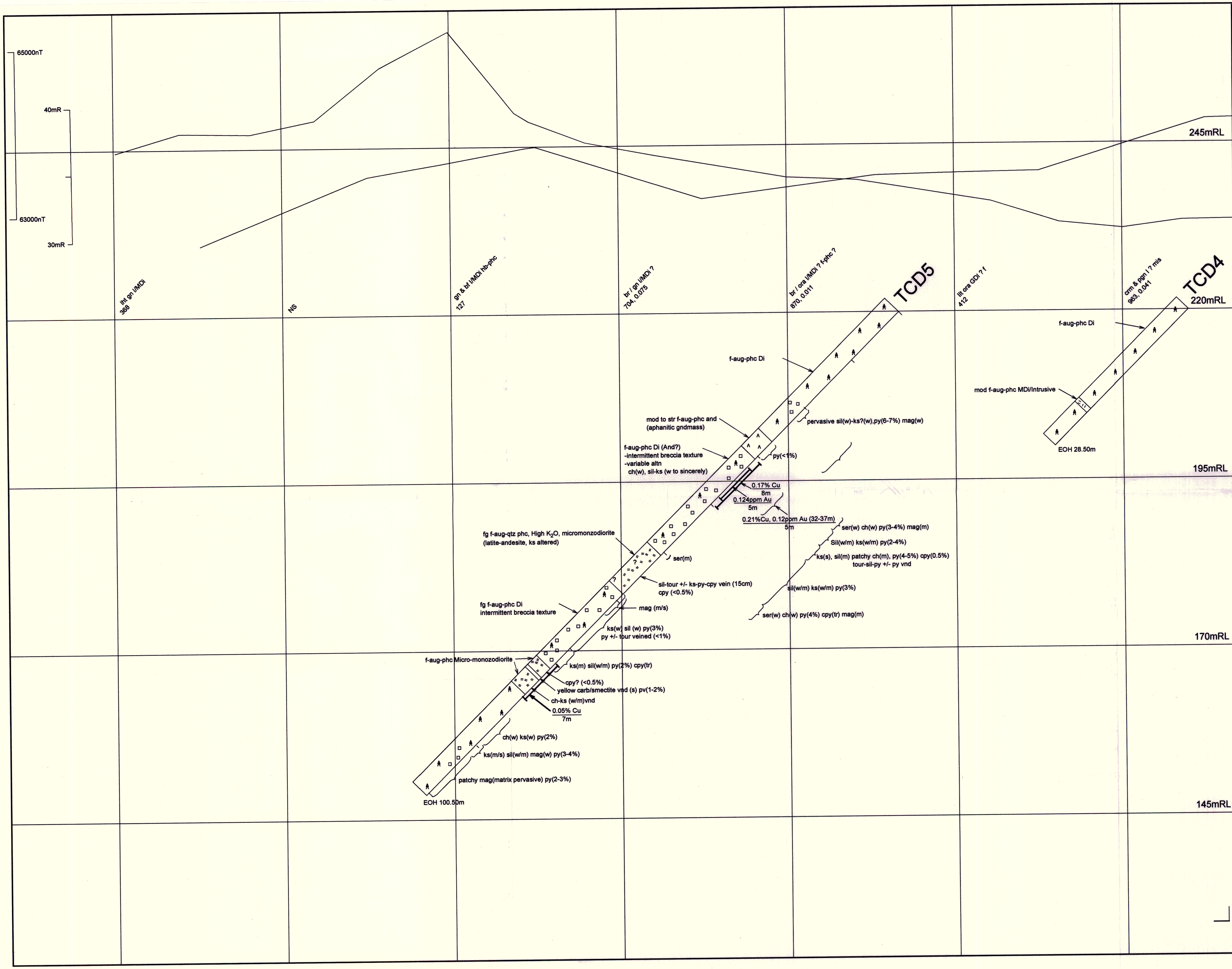


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LOCALITY MAP

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271029

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SECTION 369800(a)mE

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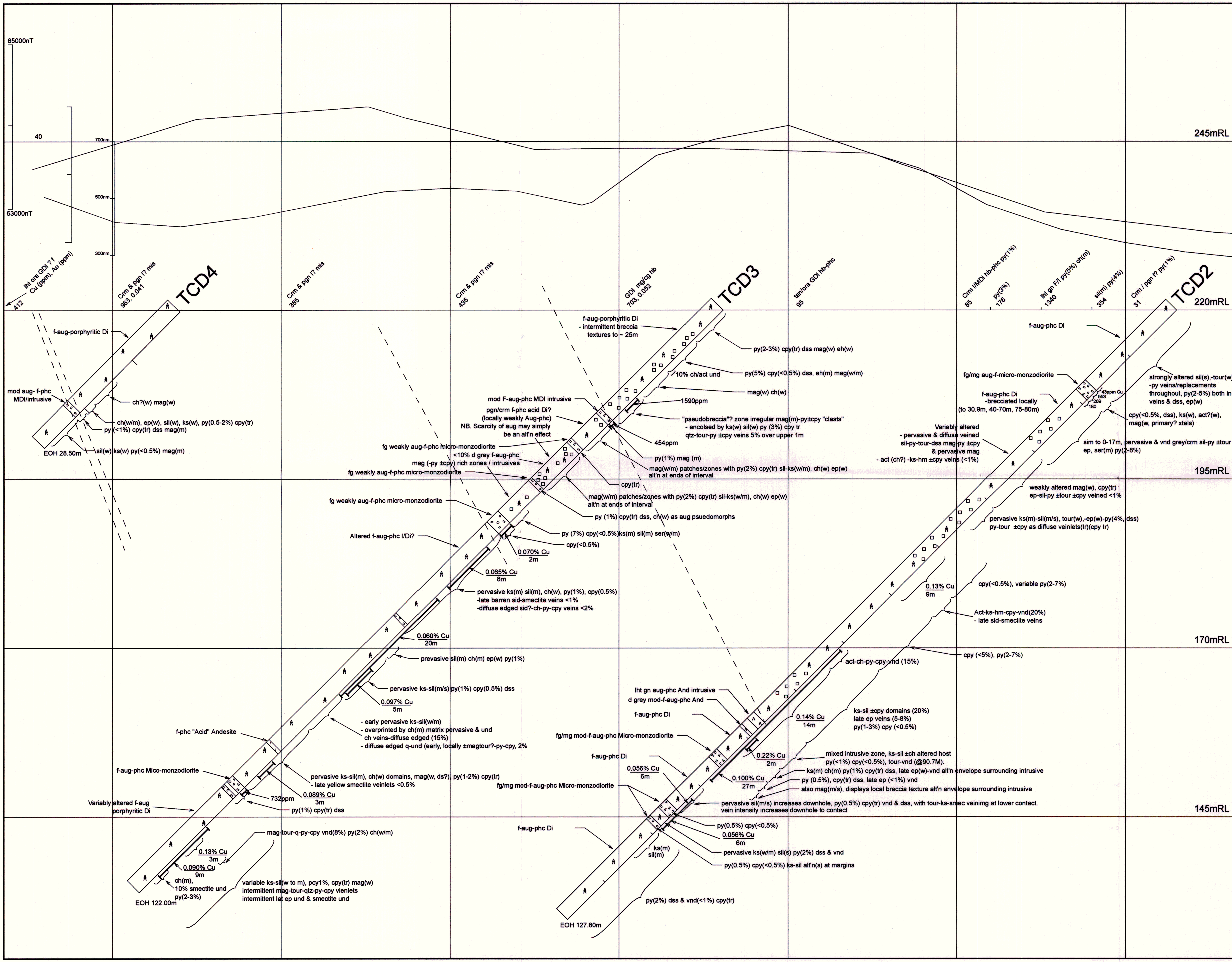


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LOCALITY MAP | SHEET INDEX

271030

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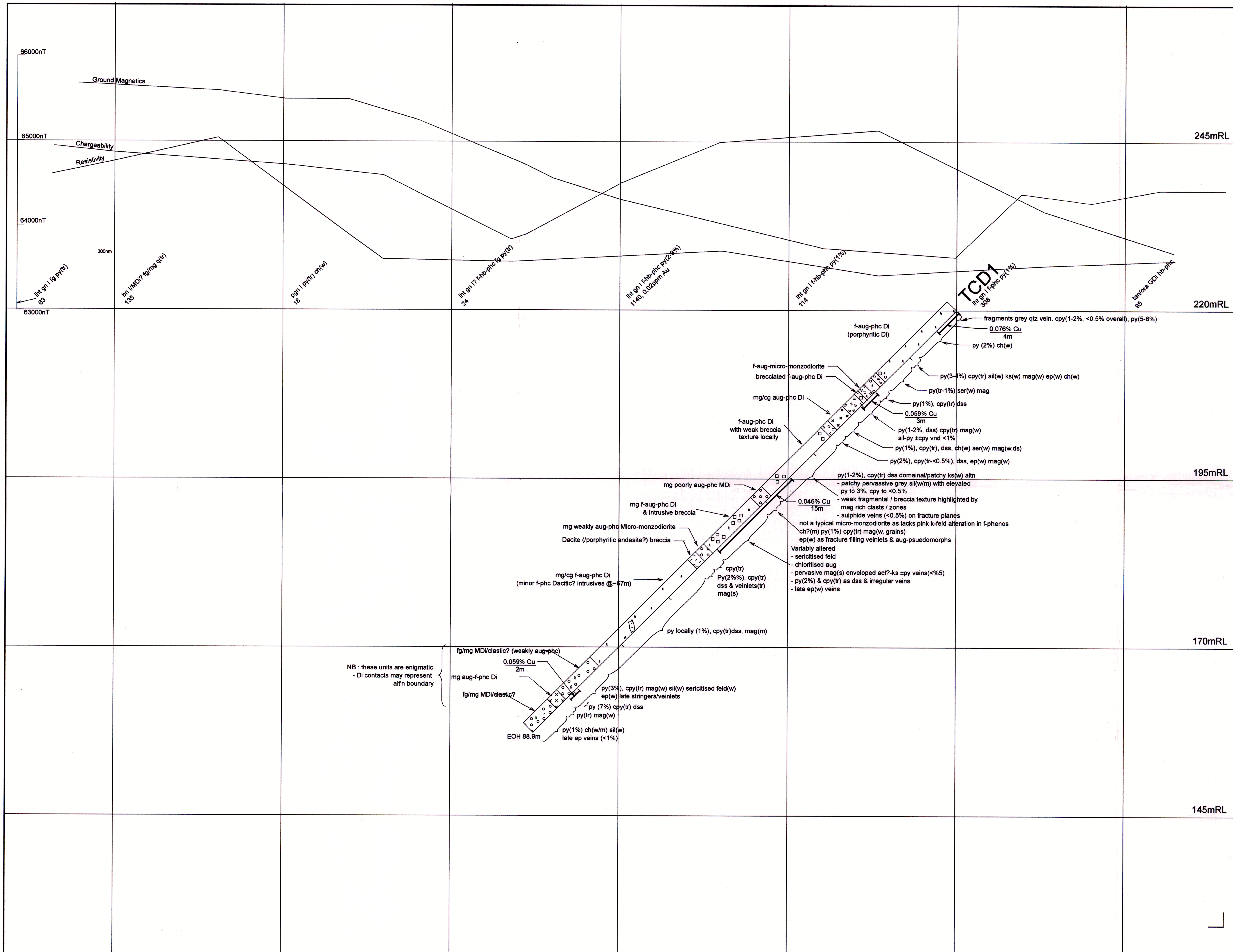
Plate 6

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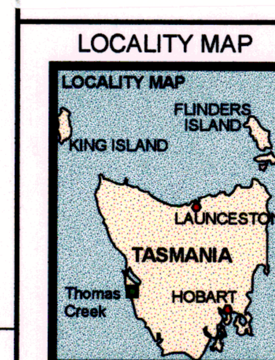
LOCALITY MAP | SHEET INDEX

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